AG3080-19-AK40

APPLiED GEOLOGY

GROUND INVESTIGATION REPORT FOR BALANCING POND, HOYLAND COMMON, BARNSLEY, M1 JUNCTION 36

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1.0 INTRODUCTION

1.1 Scope and Objective of the Report

An area of land between the M1 motorway and Sheffield Road, to the south of Hoyland Common near Barnsley (the site) is to be developed by Newlands Developments (the Client). The proposals comprise development of a series of agricultural fields to create level development platforms for commercial / industrial end use. Integral to the drainage design of the whole scheme is the creation of a balancing pond located to the south and down topography from the development.

Applied Geology Limited has been appointed by Newlands Developments to undertake a Ground Investigation to provide information to assist in the effective and economical design of the proposed development. This report covers the proposed balancing pond to the south of the main site. Applied Geology have recently completed a separate ground investigation of Plots 1 to 3 (the main site) inclusive of the development area known as 'Hoyland West', as shown on the Masterplan, and this was reported under reference AG3080-19-AK21.

This Ground Investigation Report (GIR) has been prepared in general accordance with guidance set out in British Standard EN 1997-2:2007 Eurocode 7 – Geotechnical Design (BS EN 1997-2, 2007). The report provides full details of the fieldwork and laboratory testing undertaken, presents the factual findings and provides an interpretation of the ground conditions and characteristic material properties of the various strata encountered for use in a Geotechnical Design Report (GDR), which is to be issued under separate cover for the whole development site. The report also includes an assessment of ground contamination and a coal mining risk assessment and should be read in conjunction with the General Notes presented at the end of the report text.

1.2 Description of Project

The main development site to the north comprises creation of level development plateaus via cut/fill earthworks for industrial warehouse end use. The drainage design for the scheme includes a large balancing pond to the south of the main development areas and this report covers the investigation of the pond site, which is an area of existing agricultural fields c. 400m to the south of the main development areas.

A deep excavation is required to form the pond with maximum cut depth of c. 10m to the north of the pond reducing to c. 4m in the south of the pond. Some limited engineered filling is needed on the southern end of the pond where a c. 1m high bund will be added to a limited area in order to maintain the required perimeter levee level. An adoptable drainage route with associated easements will link the main development area to the pond.

The drainage is proposed to enter the pond from the northeast and exit towards the southwest where it will eventually join Harley Dike. Details of the proposals are shown in the Masterplan drawing supplied by the Client (pHp Architects Drawing No. 4400-001 P23 dated 4th June 2020) and the Proposed Levels Drawing (Stafsurv dwg ref. 10940a dated 06.05.2020).

1.3 Geotechnical Category

The proposed pond development has been categorised as Geotechnical Category 2 as defined by British Standard EN 1997-1:2007 Eurocode 7 – Geotechnical Design. This is because it involves conventional types of geotechnical earthworks and activities.

2.0 EXISTING INFORMATION – DESK STUDY REVIEW

A Phase 1 Desk Study and Preliminary/Phase 1 Coal Mining Risk Assessment (CMRA) were carried out for the site by Applied Geology in June 2020 (Report Ref. AG3080-19-AK38, Validated Issue 2). For full details of the coal mining issues and geo-environmental setting of the site, reference should be made to the report detailed above. However, a summary of the key findings is provided below

2.1 Location & Topography

The site is located to the east of Black Lane and to the west of Sheffield Road (A6135), approximately 1km south of the village of Hoyland Common and approximately 7km south of Barnsley, in South Yorkshire. Junction 35a of the M1 is c. 1km south of the site and junction 36 is c. 1.5km to the northwest. The Ordnance Survey grid reference for the centre of the site is approximately 435932 398848, as shown on the Site Location Plan in Appendix A.

The site approximately 'L-shaped' in plan view, with maximum extents of 260m (NE-SW) and 215m (NW-SE), and covers an area of approximately 3.5ha. The north of the site is relatively flat, whereas it slopes down towards the southeast from the centre of the site.

2.2 Published Geological Information

Reference to the published 1:50,000 scale British Geological Survey (BGS) map, Sheet 87 (Barnsley) [Bedrock and Superficial Geology] dated 2008 indicates the site to be underlain by Solid Geology of the Pennine Middle Coal Measures Formation of Carboniferous age. Made Ground is also mapped along the northern portion of the site and is listed as 'infilled ground' by the BGS.

The northern half of the site is anticipated to be underlain by backfill material placed within a historic opencast coal mine. This backfill material likely comprises the overburden formerly present above the extracted coal seam (i.e. reworked natural soil and rock). The in-situ natural Pennine Middle Coal Measures Formation strata will be present beneath the opencast backfill and also from surface towards the south of the site outside of former coal workings. The opencast coal mine is understood to have extracted the Swallow Wood Coal seam, with coal and ironstone seams below worked via deep underground mining. Old shafts are marked along the north western boundary on and off site and these have been identified by historical mapping as probable former bell pits whilst shafts just outside of the pond / offsite to the south are former shafts from the working of ironstone and coal at depth. The possibility of unrecorded workings exists.

The Groundsure Report, which sources information on radon affected areas from the BGS/Public Health England, identifies that the site is within an area where between

1% and 3% of properties are above the Action Level. Therefore, no precautions against ingress of radon into buildings would be necessary if any new buildings were constructed on site in the future.

2.3 History and Former Land Use

The site was previously part of the Tankersley deer park, and was stocked with deer until the mid-nineteenth century. The site has comprised fields since at least 1855, with an ironstone pit and three ponds present in the south and southeast of the site, and Black Lane forming the southwest boundary. An estate plan dated 1840-1841 showed that the field to the northwest of the site, and possibly the northwest part of the site itself, were subject to early mining with a series of bell pits shown covering the area. From the 1855 edition map an ironstone pit with associated buildings was present on the very southern margin of the site together with a shaft, which may have been used to extract both ironstone and coal. The ironstone pit buildings are no longer shown from the 1929 edition map whilst the shaft survives to the present day located just off site to the south and is monitored every three months by the Coal Authority. The immediate surrounding area has been subject to ironstone, sandstone and coal extraction with numerous ironstone pits and bell pits to the north, west and south of the site. In addition, railways lines linking the pits and a sandstone quarry were also present in the surrounding area. During the 1970's, the M1 was constructed c.400m west of the site.

2.4 Mining and Minerals

The site is within a Coal Mining Reporting Area, with much of the site within a Development High Risk Area. A Consultant's Coal Mining Report has been obtained, summarised below and a copy is included in Appendix B of the Phase 1 Desk Study report.

The Groundsure Report identifies two hundred and twenty-five historic underground workings within 1km of the site, predominantly for ironstone and coal. Five mine entries are shown on the site along the northern margins and these relate to former bell pits dating to at least 1840 whilst a further five entries are located within the immediate vicinity of the site, probably related to deep underground coal mining.

Opencast mining of the Swallow Wood Seam has been undertaken across much of the northern half of the site. The thickness of the seam is noted as 0.99m (3' 3"). The depth of the excavation is shown to have ranged between 1.5m below ground level (bgl) and 9.6m bgl. Based on the abandonment plan, opencast mining on site began in June 1956 and the area was 're-soiled' and converted back to agricultural use in September 1957.

The Groundsure Report also notes the site is not located in an area of recorded natural cavity formation, nor is it within area of known brine or gypsum extraction.

2.5 Hydrology and Flooding

It is understood that the site and the surrounding area generally drain to the south and east following the topography. Most of the nearby streams (within 250m) to the southwest, south and east of the site, appear to effectively be tributaries of Harley Dike, which itself meanders east and finally northeast to enter Elsecar Reservoir. Elsecar Reservoir is understood to have been completed in 1785 and was built to

provide water for the nearby canal. It is understood that the proposed outflow from the balancing ponds will connect to Harley Dike located to the south/southeast.

There are no surface water abstractions within 500m of the site.

According to the Groundsure Report, there is one licensed discharge consent with 500m of site, for sewage discharges (final/treated effluent) 185m east of the site into a tributary of Harley Dike.

The site is not within Fluvial Flood Zones 2 or 3. However, this report is not intended to be a full hydrological study and if a flood risk assessment is needed, additional analysis by others is recommended to confirm this aspect of the development.

2.6 Hydrogeology

The Pennine Middle Coal Measures Formation is classified by the Environment Agency as a Secondary A Aquifer. There is one groundwater abstraction licence within 500m of the site, 275m southwest of the site for spray irrigation at Tankersley Park Golf Club. The site is not located within a groundwater Source Protection Zone.

2.7 Conceptual Site Model

As part of the previous Phase 1 Desk Study a Conceptual Site Model (CSM) has been produced and this is summarised below with the source-pathway-receptor linkages and qualitatively assessed levels of risk:

Conceptual Site Model

Source	Pathway	Receptor	Risk*
Backfill material to historic opencast pits (on and off site) and possible spoil from any historic unrecorded workings (on site).	Leaching/migration	Proposed balancing pond and connecting watercourse	Low-medium
		Aquifer	Low-medium
	Downward migration via old shafts	Aquifer	Low-medium
Ground gas from spoil from any historic unrecorded workings and backfill material to historic opencast pits (on and off site)	Migration and inhalation	Neighbours	Low
Mine gas from the Pennine Middle Coal Measures strata (on site)	Migration and inhalation	Neighbours	Low
Potential metals, other inorganic contaminants and hydrocarbons from former land uses (off site)	Migration and leaching	Proposed balancing pond and connecting watercourse	Low-negligible
Elevated sulphates in backfill material, any spoil and natural soils (on site)	Direct contact	Buried concrete	High

*** Definition of Risk Categories**
Negligible - Contaminants that might have unacceptable impact on key receptors, are unl kely to be present, or, no pathway is envisaged.
Low Risk: Contaminants may be present but are unlikely to be at levels to have unacceptable impact on key receptors, or pathways are l kely to be minimal.
Medium Risk: Contaminants are probably present and might have an unacceptable impact on key receptors. Pathways may also be present therefore remedial measures may be necessary to reduce the risks.
High Risk – Contaminants probably or certainly present and pathways are probably also present. Therefore, contaminants are likely to have an unacceptable impact on key receptors and remedial measures are likely to be necessary to reduce the risks to acceptable levels.

2.8 Unexploded Ordnance (UXO) Risk

The Zetica on-line bomb risk map identifies the site to be within a low risk area of unexploded bombs from WWII.

3.0 FIELD AND LABORATORY STUDIES

3.1 Site Description

The site is approximately 'L-shaped' in plan view, with maximum extents of 260m (NE-SW) and 215m (NW-SE) and covers an area of approximately 3.5 Ha.

The site is comprised of an open arable field, bounded by hedges and further arable land. Black Lane, a gravel surfaced track, runs alongside the western boundary and has dual use as a bridleway and also as farm access. The topography is such that the highest point of the site is the north-western corner (c. 114m OD), with levels falling away to the east (c. 103m OD on eastern boundary) at a shallow gradient whilst the gradient to the south is steeper with levels dropping down to c. 101m OD on the southern boundary. At the southern end of the site the ground surface flattens towards the site boundary.

The land to the east of the site is raised to form a mound and anecdotally is formed of colliery spoil. This is supported by historical mapping which suggests the mound is spoil from Lidgett Colliery and has been in place since at least 1891. Semi-mature and mature trees cover the mounded area and a drainage ditch, which contained water at the time of the fieldwork, ran along the north eastern site boundary at the foot of the mound boundary slope. In the south, the Trans Pennine Trail ran parallel to the southern site boundary. In the south western corner of the site a mound was present, covered in trees and overgrown vegetation. This is also where Coal Authority records indicate there to be a capped mineshaft.

3.2 Intrusive Ground Investigation

Fieldwork was generally carried out, in accordance with BS5930 "Code of Practice for Site Investigations", BS10175 Investigation of Potentially Contaminated Sites, the Association of Geotechnical and Geo-environmental Specialist Guidelines for Good Practice in Site Investigations and supervised by an experienced Engineering Geologist.

The locations of the exploratory holes were selected and set out on site by Applied Geology Limited. The statutory plans did not identify any utility services on site and anecdotally the tenant farmer suggested there were no services aside from a drainage run that crossed the far south eastern corner, where no exploratory holes were proposed. The positions of the exploratory holes were levelled and located on

site by specialist contractor (Benchmark Engineering). The locations are presented on the Exploratory Hole Location Plan, Drawing N^{o} AG3080-19-10 in Appendix A.

Descriptions and depths of the various strata recovered are presented on the exploratory hole records, reproduced in Appendix B, together with sample depths, the results of in-situ testing, comments on groundwater inflows, pit stability and any other pertinent information. The soils and rocks encountered have been described in accordance with BS5930:1999 + A2:2010 and BS EN ISO 14688-1:2002 and BS EN ISO 14689-1:2003.

The following scope of fieldwork was undertaken:

- 12 No. machine excavated trial pits (TP1301 to TP1312), two of these were extended into trenches to investigate the opencast boundary and coal seam outcrops (TP1305 and TP1306);
- 4 No. soakaway tests in trial pits (TP1302, TP1303, TP1307 & TP1310);
- 5 No. driven continuous sampling with rotary cored follow-on boreholes (RC4101 to RC4105).

Copies of all the exploratory hole records are presented within Appendix B. Trial Trench sketches and photos are also located in Appendix B, with photographs of rotary core and trial pits located in Appendix C.

3.2.1 Trial Pits & Soakaway Tests

Ten machine dug trial pits were undertaken across the site to provide general spatial coverage of the proposed balancing pond area and these were excavated using a 20 tonne 360 tracked excavator. These provided information on the nature of the backfill material, allowed for sampling for laboratory testing and allowed for observation of ground stability and groundwater seepage/flow.

In-situ trial pit soakaway testing was carried out in TP1302, TP1303, TP1307 and TP1310 with the test strata comprising both opencast backfill and natural materials. The tests were carried out in general accordance with BRE DG 365 with three test fills carried out over successive days where the permeability of the ground allowed for multiple fills. The results of the tests are discussed in Section 5.4.

Two further machine dug trial pits (TP1305 & TP1306) were located in an attempt to locate the opencast high walls and extended as necessary into trial trenches. These were also excavated using the 20 tonne 360 tracked excavator.

3.2.2 Driven Continuous Sampling with Rotary Core Follow-on

Rotary cored boreholes were undertaken across the site using a Beretta T41 to targeted depths of c. 2m below the base of the proposed pond excavation. These allowed the composition of the opencast backfill and natural bedrock to be explored to depths deeper than achievable by trial pitting as well to gain as a better understanding of the shallow coal seams underlying the site. The works were undertaken under a continuation of the previous coal authority permit to enter or disturb Coal Authority interests (ref. 19194).

The soil strength materials such as the weathered Coal Measures and the Made Ground – Opencast Backfill were sampled via Driven Continuous Sampling producing 87mm diameter samples (borehole diameter of 95mm). The rotary drilling was then undertaken either where driven sampling was no longer feasible or where rock strength materials were encountered. Air mist drilling flush was used during rotary drilling and rotary core of 85mm diameter was recovered (borehole diameter of c. 123mm).

Samples from these rotary cored boreholes were taken to allow rock strength testing to be undertaken, along with geotechnical and contamination testing on soil strength materials.

In all boreholes, groundwater and gas monitoring and sampling standpipes were installed with response zones targeting both Made Ground - Opencast Materials and Pennine Middle Coal Measures Formation.

3.2.3 Instrumentation

Summary of Standpipe Installations in Boreholes

Borehole N°	Depth To Base (m)	Nominal Pipe Diameter (mm)	Response Zone (m bgl)	Response Zone Strata
RC4101	6.00	50	2.00-6.00	Made Ground - Opencast Backfill & Pennine Middle Coal Measures Formation
RC4102	3.50	50	0.50-3.50	Made Ground - Opencast Backfill
RC4103	11.00	50	6.00-11.00	Pennine Middle Coal Measures Formation
RC4104	8.00	50	4.00-8.00	Pennine Middle Coal Measures Formation
RC4105	3.00	50	1.00-3.00	Pennine Middle Coal Measures Formation

3.2.4 Monitoring and Groundwater Sampling

Ground gas and groundwater monitoring visits were undertaken on 4 occasions from 1st June to 9th July 2020 including during 2 periods of falling atmospheric pressure. Each monitoring well was monitored for concentrations of carbon dioxide, methane, oxygen, carbon monoxide, hydrogen sulphide together with flow rate, differential pressure and water level.

Groundwater samples were collected from three of the boreholes during the second monitoring visit on the 9th June 2020 via modified volume purge methods (recharge was not quick enough to facilitate three well volumes of purge in all of the standpipes) and using dedicated bailers. Insufficient water was present in the two other standpipes to allow samples to be collected. On the previous visit the standpipes were developed using a submersible pump. The monitoring results are included in Appendix D.

3.2.5 Variable Head Testing

Following completion of the monitoring falling head permeability tests were undertaken in standpipes installed within RC4101, RC4102 and RC4103 in general accordance with BE EN ISO 2282-2. The results and calculated permeabilities are discussed in Section 5 and the results are presented in Appendix D.

3.3 Geotechnical Laboratory Testing

A programme of geotechnical laboratory testing was scheduled on samples selected of soil and rock core by Applied Geology.

The geotechnical testing was carried out generally in accordance with BS 1377:1990 Method of Tests for Soils for Civil Engineering Purposes and ISRM Suggested Methods and was undertaken by specialist laboratories (Professional Soils Ltd and Geolabs Ltd) and comprised:

- 32 No Natural Moisture content tests;
- 22 No Atterberg Limit tests;
- 14 No Particle Size Distribution tests;
- 9 No Compaction tests (5 no. 4.5kg tests & 4 no. 2.5kg tests)
- 6 No Particle density tests;
- 8 No remoulded CBR tests;
- 3 No triaxial permeability tests;
- 1 No shear strength by direct shear (small shear box);
- 6 No Franklin Point Load tests;
- 6 No Laboratory Hand Vane tests;
- 6 No Unconfined Compressive Strength (UCS) tests;
- 7 No BRE “Special Digest 1” suites;
- 6 No Calorific Value tests;
- 6 No Loss on Ignition tests.

In addition, 10 No point load tests were undertaken by Applied Geology on samples of rock core as part of the logging process during the site works.

The geotechnical laboratory test results and ‘field’ point load test results are presented in Appendix E.

3.4 Chemical Laboratory Testing

A programme of chemical laboratory testing was scheduled on samples selected of soil and groundwater by Applied Geology. The tests were carried out by specialist laboratories i2 Analytical and Socotec (float yield and ash content only) comprised:

- 12 No soil suites comprising heavy metals, PAHs, pH and SOM on a combination of topsoil, soil, weathered rock and Made Ground samples;
- 3 No pesticide screening tests on Topsoil samples;
- 3 No asbestos screen tests on Made Ground samples;
- 3 No BRE SD1 tests on soil and weathered rock samples (in addition to those mentioned above);
- 3 No site-specific groundwater suites, comprising heavy metals, PAHs, pH, sulphate, hardness and various water quality parameters;
- 4 No Float Yield and Ash Content tests.

In addition to the above four samples of the Made Ground – Opencast Backfill were submitted to specialist laboratory Socotec for float yield and ash content analysis. The samples chosen for this testing were selected from areas where low specific gravity had been previously measured and / or high coal content was observed.

The test results are presented in Appendix F.

3.5 Specialist Topsoil Testing

Two soil samples were sent to Tim O'Hare Associates to determine the suitability for general landscape purposes (trees, shrubs and amenity grass). In addition, these samples were assessed to determine compliance with the requirements for the British Standard for Topsoil (BS3882:2015 - Specification for Topsoil - Table 1, Multipurpose Topsoil). The specialist report is presented in Appendix G.

4.0 GROUND CONDITIONS

The Swallow Wood Coal seam runs east/west and from published information would formerly have outcropped in the centre of the site prior to the opencast mining. Made Ground - Opencast Backfill was encountered to the north of the inferred coal outcrop and the Made Ground deposits deepened to the northern and eastern boundaries following the dip of the coal seam. To the south of the inferred outcrop natural materials of the Pennine Middle Coal Measures Formation were encountered.

A layer of Topsoil/Made Ground typically less than 0.50m thick was encountered at the surface. The Made Ground - Opencast Backfill typically consisted of reworked natural coal measures material. The in-situ natural coal measures strata consisted of an initial weathered clay horizon where natural materials were present from shallow depth, increasing to rock strength mudstone, siltstone and sandstone with depth and directly below the Opencast Backfill.

Groundwater was recorded at variable levels across the site, with perched localised horizons within the opencast material and deeper groundwater encountered below c. 8m in the Coal Measures strata.

Two geological cross sections have been produced for the proposed pond site and these have been named Section A1-A1, which is oriented NE-SW and Section B1-B1 that is oriented NNW-SSE. Both sections are included in Appendix A as drawing AG3080-19-15.

4.1 Topsoil/Made Ground

A layer of re-worked Topsoil was recorded over the whole site comprising what was likely to have originally been natural Topsoil with rare man-made fragments such as brick and glass etc. This stratum has been labelled as 'Topsoil/Made Ground' and was encountered at all exploratory hole locations from ground level to depths of between 0.20m and 0.55m bgl with a mean average thickness of 0.4m and a mode average of 0.5m. This stratum generally comprised stiff and friable brown slightly gravelly clay with frequent rootlets. Gravel was fine to coarse angular to subrounded of brick, mudstone, coal and occasional ironstone.

4.2 Made Ground – Opencast Backfill

Made Ground - Opencast Backfill was encountered underlying the Topsoil/Made Ground at all exploratory hole locations with the exception of TP1307 to TP1311 and RC4105 all of which were located in the southern half of the site This stratum was proven to depths of between 3.5m and 5.1m bgl in the rotary boreholes (thickest in

RC4103). It was not possible to prove the base of the strata in the trial pits with the exception of TP1305 and TP1306. The opencast stratum generally comprised firm through to very stiff often friable brown and dark grey slightly gravelly to gravelly clay with occasional to frequent subangular cobbles of mudstone, siltstone and locally ironstone. TP1303, TP1306 and RC4102 were all notable for their higher cobble content. Gravel was fine to coarse angular to subangular mudstone, siltstone, coal and ironstone.

There was some indication of a possible clay “capping” layer in the top c.1m of the opencast backfill materials, similar to that encountered on the main site. However, it was only locally present and was less evident/clearly defined.

4.3 Pennine Middle Coal Measures Formation

Strata of the Pennine Middle Coal Measures Formation was encountered across the site. In the south it was encountered underlying the Topsoil/Made Ground (TP1307 to TP1311 and RC4105) and recorded to depths of between 1.7m and 7.0m bgl, with the base not proven. In the north and east it was encountered underlying the opencast material (TP1305, TP1306, RC4101 to RC4104) from depths of between 0.9m and 5.1m bgl and recorded to depths of between 3.8m and 12.0m bgl, again the base was not proven.

In the south of the site (where opencast materials were absent) a weathered upper layer was present, generally comprising firm to stiff becoming very stiff grey and light brown slightly sandy clay with occasional becoming frequent fine to medium gravel lithorelicts of mudstone, siltstone and locally clarain & fusain coal.

Across all areas of the site rock strength materials were encountered either below the opencast in the north and east or below the weathered clay horizons in the south. These materials generally comprised extremely weak increasing to weak mudstone and siltstone, locally with sandstone bands and ironstone nodules.

The ironstone nodules were identified throughout the core at varying depths these caused disturbance in cored samples at times which led to the lack of samples for core strength testing.

5.0 GROUND GAS & GROUNDWATER

5.1 Ground Gas

Due to the presence of underground coal seams being encountered during drilling, personal gas monitors were used to record mine gas concentrations. There were no elevated concentrations of gas recorded during site works by these monitors.

In addition to this, four phases of ground gas monitoring have been undertaken as part of this investigation, the results of which are included in Appendix D. Installations were installed in the Made Ground Opencast Backfill and in the Pennine Middle Coal Measures, both being potential sources of ground/mine gas.

All installations recorded negligible methane concentrations, all below the level of detection (0.1%).

Most installations were measuring some carbon dioxide concentrations with several measuring >5%. Carbon dioxide concentrations from installations within natural coal measures ranged between 0.5% and 8.9%. Installations within the opencast backfill materials recorded carbon dioxide concentration between 1.9% and 7.0%.

Oxygen concentrations were recorded as between 9.9% (depleted) and 20.1% (near atmospheric). Most have negligible carbon monoxide concentrations, below the level of detection (between less than 1ppm and 2ppm). All hydrogen sulphide concentrations can be considered negligible.

Flow rates were generally negligible with a maximum rate of 0.1l/hr recorded.

5.2 Groundwater

Groundwater across the site was locally encountered within the Opencast Backfill, particularly towards the base, and within more permeable horizons within the Pennine Middle Coal Measure Formation.

The groundwater observations during the sitework are detailed in the table below.

Borehole Nº	Depth of Strike (m bgl)	Remarks	Strata
RC4102	7.75	Slight seepage	Pennine Middle Coal Measures Formation
TP1302	2.60	Medium seepage	Made Ground – Opencast Backfill
TP1303	3.60	Slight seepage	Made Ground – Opencast Backfill

Subsequent monitoring of the standpipes installed within selected boreholes was undertaken to record standing groundwater level.

A summary of the recorded standing groundwater levels in standpipes is given in the table below:

Strata	Range of Recorded Groundwater depths (m bgl)	Range of Recorded Groundwater depths (m AOD)	Associated Borehole Installations and base of installation (m)
Made Ground-Opencast Backfill	1.98 - 3.12	104.62 - 102.08	RC4101 (6m bgl) and RC4102 (3.5m bgl)
Shallow Pennine Middle Coal Measures Formation (<8m bgl)	2.80 – 7.81	102.41 - 100.20	RC4104 (8m bgl) and RC4105 (3m bgl)
Deep Pennine Middle Coal Measures Formation (>8m bgl)	10.24- 10.83	99.28 – 98.69	RC4103 (11m bgl)

Groundwater levels within the opencast materials were variable and would likely be responsive to weather conditions, similar to the response recorded in the main site.

Groundwater with the coal measures rock was recorded as a strike during formation of RC4102 at c. 7.75m bgl (97.47m OD) and noted to coincide with fracturing.

Groundwater was also recorded during monitoring of RC4103 at c. 10.50m bgl (99.02m OD). These observations do not indicate clear evidence of sub-artesian characteristics as were encountered within the main site, although this cannot be ruled out. It suggests that perhaps there is likely to be slow seepage of groundwater within the Pennine Middle Coal Measure Formation strata below c.7-8m bgl, although only limited monitoring has been undertaken.

5.3 Variable Head Testing

Variable head tests were undertaken in RC4101 and RC4102 within the Made Ground - Opencast Backfill and in RC4103 within Pennine Middle Coal Measures Formation to give an indication of the permeability of these strata. Up to fifty litres of clean water was used in each test. The results of which are included in Appendix D and summarised below:

Borehole	Strata	Permeability (m/s)
RC4101	Made Ground – Opencast Backfill*	5.3×10^{-8}
RC4102	Made Ground – Opencast Backfill	1.1×10^{-8}
RC4103	Pennine Middle Coal Measures Formation	1.7×10^{-8}

* Base 1.3m response zone of borehole within PMCMF strata.

5.4 Trial Pit Soakaway Testing

Soakaway tests were carried out in four of the twelve trial pits excavated over a period of several days. In the more permeable Made Ground - Opencast Backfill materials up to three fills were carried out, the tests carried out in the Pennine Middle Coal Measures Formation experienced lower rates of infiltration and thus only one or two fills were achievable within the given time period. Infiltration rates were calculated in accordance with BRE 365 methodology. The results of which are included in Appendix D and summarised below:

Test Location	Calculated Soil Infiltration Rate (m/s)		
	Fill 1	Fill 2	Fill 3
TP1302	2.5×10^{-6}	8.1×10^{-7}	*
TP1303	2.3×10^{-6}	1.7×10^{-6}	8.8×10^{-7}
TP1307	Insufficient drop in water level over two days to calculate infiltration rate.		
TP1310	*2	4.5×10^{-7} *3	*

*unable to calculate insufficient drop in water level in time period remaining.
*1 not undertaken due first test left to run over multiple days.
*2spalling in base of pit, unable to calculate infiltration rate.
*3extrapolated value.

6.0 GEOTECHNICAL PROPERTIES

A range of geotechnical properties have been derived for the various strata encountered. These have been drawn from various methods/sources including from laboratory analyses, assessment/engineering judgement of rock core statistics, discontinuity spacing/nature and published correlations. Reference has also been made to the wealth of in-situ testing (SPT and CPTu) carried out in very similar soils as part of the ground investigation for the main site located to the north of the pond area.

6.1 Classification/Index Properties

6.1.1 Moisture Contents

Moisture Content tests were undertaken on 16 no. samples from the Made Ground - Opencast material and 16 no samples from the soil and extremely weak rock strength Pennine Middle Coal Measures Formation. A summary of the results of this testing is presented in the table below:

Stratum	Moisture Content (%)		
	Min	Max	Average
Made Ground - Opencast	10	23	17.1
Pennine Middle Coal Measures Formation	3.9	11.4	25

6 no. Moisture Content tests were undertaken on samples from the rock strength core samples of the Pennine Middle Coal Measures Formation. These have been divided into the material types and results presented in the table below:

Stratum	Moisture Content (%)
Mudstone	14 (one sample)
Siltstone/Mudstone	3.3 and 4.2 (two samples)
Siltstone	3.9 and 4.1 (two samples)
Sandstone	3.1 (one sample)

6.1.2 Atterberg Limits

19 no. Atterberg limit tests were undertaken on soil samples from across the site at a range of depths. The minimum, maximum and average values for Made Ground – Opencast Backfill and Pennine Middle Coal Measures Formation soils are presented below. The results are also presented on a plasticity chart in Appendix A.

Material - Description	w%	% passing 425um	wL	wP	PI	
			uncorrected	*uncorrected*	*uncorrected*	*corrected*
Made Ground - Opencast Backfill (Minimum)	13.0	43.0	39.0	20.0	19.0	8.6
Made Ground - Opencast Backfill (Average)	18.6	72.3	47.8	22.3	25.5	18.9
Made Ground - Opencast Backfill (Maximum)	23	94.0	55.0	25.0	31.0	28.2
Pennine Middle Coal Measures (Minimum)	4.9	30.0	36.0	19.0	16.0	5.1
Pennine Middle Coal Measures (Average)	12.6	77.0	44.3	21.9	22.4	17.85
Pennine Middle Coal Measures (Maximum)	27.3	100.0	57.0	26.0	31.0	28.0

Made Ground - Opencast Backfill

12 no. Atterberg tests were carried out on samples of cohesive materials of Made Ground - Opencast Backfill. Of these 9 indicated intermediate/medium plasticity and 3 indicated high plasticity. The results also indicated the material to be of low to medium shrinkability in the samples tested.

Pennine Middle Coal Measures Formation

10 no. Atterberg tests were carried out on samples of Pennine Middle Coal Measures Formation. Of these 6 indicated intermediate/medium plasticity and 2 indicated high plasticity, and 2 were recorded as being non-plastic. The results also indicated the material to be of low to medium shrinkability in the samples tested.

6.1.3 Organic Content/Loss on Ignition

Soil organic matter testing was carried out as part of the chemical laboratory testing. The results of 4 no. tests on the Topsoil/Made Ground recorded results of 2.6-5.0% (average of 3.0%) and three tests on Made Ground-Opencast Backfill returned results of 0.60-4.0% (average of 2.5%).

Loss on Ignition tests were undertaken on 6 no. samples from the opencast backfill materials with results ranging from 2.3% to 13.35% (average value of 6.5%).

6.1.4 Calorific Value

Calorific Value tests were undertaken on 6no. samples from the opencast backfill materials with recorded values being reported between less than the level of determination (<1 MJ/kg) and 2.7 MJ/kg. The locations recording a value greater than the level of detection include the sample from RC4102 at 1.30m bgl (2.7 MJ/kg) and from TP1301 at 0.80m bgl (2.0 MJ/kg). However, material descriptions from these two samples do not identify a higher coal content than other locations.

6.2 Particle Size Distribution

Nine Particle Size Distribution (PSD) tests were undertaken on samples from the Made Ground - Opencast. The results of this testing and the resultant classification are given in the table below. Combined graphs of the PSD tests per material type are also included in Appendix A.

Location	Depth (m bgl)	Sample Proportion (%)					Classification
		Clay	Silt	Sand	Gravel	Cobbles	
RC4101	2.0	16	21	19	44	0	Slightly sandy gravelly clayey SILT
RC4103	2.1	69		8	23	0	Slightly sandy slightly gravelly CLAY/SILT
RC4104	2.5	41		12	47	0	Slightly sandy gravelly CLAY/SILT
TP1301	4.0	20	25	15	40	0	Slightly sandy very gravelly clayey SILT

Location	Depth (m bgl)	Sample Proportion (%)					Classification
		Clay	Silt	Sand	Gravel	Cobbles	
TP1302	2.0	67		4	29	0	Slightly sandy slightly gravelly silty CLAY
TP1302	2.5	18		3	39	40	Slightly silty slightly sandy very gravelly COBBLES
TP1303	2.0	37	45	4	14	0	Slightly sandy slightly gravelly clayey SILT
TP1304	1.5	65		3	32	0	Slightly sandy gravelly clayey SILT
TP1306	2.5	69		4	27	0	Slightly sandy gravelly clayey SILT

2 no. Particle Size Distribution tests were undertaken on samples from the Pennine Middle Coal Measures Formation. The results of this testing and the resultant classification are given in the table below:

Location	Depth (m bgl)	Sample Proportion (%)					Classification
		Clay	Silt	Sand	Gravel	Cobbles	
TP1305	1.6	47	49	4	0	0	Slightly sandy clayey SILT
TP1310	1.7	17		10	73	0	Slightly sandy clayey GRAVEL

6.3 Bulk Density

One sample of the upper weathered (clay strength) coal measures strata was submitted for bulk density determination as part of the small shear box testing. In addition, as part of the six UCS tests on coal measures rock core bulk density was also determined.

Stratum	Bulk Density (Mg/m^3)
Pennine Middle Coal Measures Formation (Soil Strength)	2.08
Pennine Middle Coal Measures Formation (Rock Strength)	Min 2.51, Max 2.58, Ave 2.64

6.4 Float Yield and Ash Content

Four samples of Made Ground – Opencast Backfill were submitted for float yield and ash content analysis, three being from the main development area to the north and the fourth from the pond area. The results of which are summarised below:

Sample	Float Yield at specific gravity of 1.6		Ash content of floating fraction (%)	Analysis moisture of floating fraction (%)
	Float	Sink		
TP 1035 - 3.5-4.0m	0.5	99.5	15.8	4.8
TP1052 - 2m	3.4	96.6	20.3	4.3
RC4006 - 3-5m	2.9	97.1	10.5	6.6
TP1312 - 1-2m	2.9	97.1	12.7	8.8

6.5 Maximum Dry Density/Optimum Moisture Content

The maximum dry density results from the 4.5kg rammer are as follows:

Strata	Optimum moisture content (%)			Maximum dry density (Mg/m³)		
	Min	Max	Ave	Min	Max	Ave
Made Ground – Opencast Backfill	11	15	12.3	1.82	1.98	1.92
Pennine Middle Coal Measures Formation	6.8	13	-	1.90	2.14	-

The maximum dry density results from the 2.5kg rammer are as follows:

Strata	Optimum moisture content (%)			Maximum dry density (Mg/m³)		
	Min	Max	Ave	Min	Max	Ave
Made Ground – Opencast Backfill	One Test: 21			One Test: 1.63		
Pennine Middle Coal Measures Formation	11	22	17.3	1.65	1.92	1.78

For the Made Ground - Opencast Backfill material of the four comparisons undertaken of natural moisture content and optimum moisture content; three were wet of optimum (> +2%), one was within optimum +/- 2% whilst none of the samples were dry of optimum (< -2%).

For the Pennine Middle Coal Measures Formation material of the five comparisons undertaken of natural moisture content and optimum moisture content; two were wet of optimum (> +2%), 2 were classified as within optimum +/- 2% and 1 was dry of optimum (< -2%).

6.6 Particle Density

Particle Density tests were undertaken on the samples subjected to compaction testing. A summary of the results of this testing is presented in the table below:

Stratum	Particle Density (Mg/m³)
	Range
Made Ground – Opencast Backfill	2.61-2.67
Pennine Middle Coal Measures Formation	2.62-2.72

6.7 CBR

CBR tests were undertaken on materials at optimum moisture content/maximum dry density alongside the compaction tests. These results are summarised below:

Stratum	CBR Value (%)					
	Min		Max		Average	
	Top	Base	Top	Base	Top	Base
Made Ground – Opencast Backfill	59	43	63	61	64	55
Pennine Middle Coal Measures Formation	74	58	110	89	-	-

Using the results of the plasticity index results for the materials inferred by the correlation outlined in Table 5.1 in the Interim Advice Note 73/06 Rev 1(2009), CBR values are indicated to range between 3% and 5% dependant on thick or thin pavement construction.

6.8 Rock Quality

A summary of the rock core quality data for the Pennine Middle Coal Measures Formation is presented below

BH	Range of TCR (%)	Range of SCR (%)	Range of RQD (%)	Range of average If (mm)	Comments
RC4101	33-90	13-72	0-34	20-95	Lowest RQD between 4.70 and 6.20m. SCR improves with depth.
RC4102	83-97	57-97	24-49	85	RQD and SCR improve with depth.
RC4103	65-100	29-100	0-72	40-130	Lowest rock core quality between 8.00m and 9.50m, aside from this a general improvement with depth is observed.
RC4104	93-100	57-90	30-82	90-350	Lowest RQD between 6.50m and 8.00m.
RC4105	85-100	28-100	0-23	55	RQD is recorded as zero between 2.60m and 6.00m with low SCR values between 3.00m and 4.00m as well as between 5.00m and 6.00m.

Key
TCR – total core recovery
SCR – solid core recovery
RQD - Rock Quality Designation
If – Fracture Spacing

6.9 Unconfined Compressive Strength

Unconfined compressive strength (UCS) testing of the rock core samples was undertaken in accordance with ISRM Suggested Methods - Rock Characterization Testing and Monitoring 1974 - 2006. In total 6 samples were tested. The results broadly correlate with the field assessed strengths, due to the sample quality required for this test the lower strength materials (extremely weak) would likely not have been able to be tested. The results are presented in Appendix F and summarised below.

Strata type	UCS Range (MPa)	Strength
Mudstone	1.29 (one result)	Very Weak
Siltstone	20.1 to 21.1	Weak
Mudstone/Siltstone	12.8 to 27.8	Weak to medium strong
Sandstone	29.2 (one result)	Medium Strong

Moisture contents were measured on each UCS sample but there is no apparent correlation between UCS and moisture content or between moisture content and depth of sample.

6.10 Franklin Point Load Test Index

Franklin point load tests were undertaken on samples of the rock core in general accordance with ISRM Suggested Methods - Rock Characterization Testing and Monitoring 1974 - 2006. A summary of the results is presented below.

Strata type	Axial/Diametral	Range of Is(50) Results (MPa)	Average Is (50) (MPa)
Mudstone	Axial	0.05-0.21	0.11
	Diametral	0.0-0.08	0.04
Siltstone	Axial	0.15-2.42	1.15
	Diametral	0.33-2.1	0.87
Sandstone	Axial	0.20-1.36	0.84
	Diametral	0.04-0.89	0.41
Siltstone/Mudstone	Axial	0.56-0.76	0.66
	Diametral	0.30	0.30

$Is_{(50)}$ results for the axial tests have also been plotted against elevation (m AOD) by material type and by depth (m bgl). In a number of cases it was possible to carry out Point Load tests on remnant samples which were still suitable following previous UCS testing. Copies of all these plots are included in Appendix A.

A comparison of these results provides highly variable 'k' values (the relationship between $Is_{(50)}$ and UCS) ranging between 5 and 30 for mudstone and siltstone materials. There were too few results of the sandstone to infer a value for 'k'. Literature values generally range between 10 and 25 for varying rock types, with values of 25 (Cavagnaro, 1980) suggested for Coal Measures strata and 14 (Agustawijaya 2007) suggested for 'soft' argillaceous rocks.

Using a 'k' value of 10 the results would indicate rock strengths of between 0.5MPa (extremely weak) and 24MPa (weak). Using a 'k' value of 14 the results would indicate rock strengths of between 0.7MPa (extremely weak) and 34MPa (medium strong). Using a 'k' value of 25 the results would indicate rock strengths of between 1.25MPa (very weak) and 60MPa (strong). However, due to the significant scatter in point load test results and ranges of values for 'k', extrapolated UCS values derived from point load tests should not be used for design purposes.

6.11 Sulphates

Selected samples of soils were submitted for assessment of sulphate, sulphur and pH concentrations in order to assess classifications for the design of buried concrete. The table below provides a summary of the results.

Stratum	Characteristic Water-Soluble Sulphate (mg/l) *1	Characteristic Total Potential Sulphate (TPS) SO_4 % *2	Characteristic pH	Design Class based on w/s sulphate	Design Class based on TPS
TS	50	N/A	7.0	DS-1	N/A
OCBF	250	0.2	6.7	DS-1	DS-1
PMCMF	100	0.5	5.3	DS-1	DS-2
GW	500	N/A	6.8	DS-2	N/A

TS – Topsoil or Topsoil/Made Ground
OCBF – Opencast Backfill
PMCMF – Pennine Middle Coal Measures Formation
GW – Groundwater
*1: Rounded to nearest 100mg/l (where a significant value i.e. >50mg/l)
*2: Rounded to nearest 0.1%

Of the samples tested for acid soluble sulphate and total sulphur none of the four samples of opencast backfill were potentially pyritic whilst two out of six coal measures samples were potentially pyritic. Therefore, it could be concluded that there is not a sufficient number of potentially pyritic samples to base the Design Sulphate Class on Total Potential Sulphate characteristic values. However, a design class of DS-2 is still recommended due to the soluble sulphate content of the groundwater.

Under BRE SD1, it could be argued that the site can be deemed greenfield as it essentially comprised natural soils or fill derived from natural soils and is unlikely to contain chemical residues produced by or associated with industrial production. Should this be the case, an ACEC Class of AC-2 would generally be appropriate, however, a pH value of 5.3 (as assigned to the natural coal measures strata) would indicate AC-3z conditions.

The sulphate results have also been assessed for consideration of suitability of moisture modification by the addition of lime. In respect of Total Potential Sulphate (TPS) a total of 10no. determinations were made with results ranging between 0.03% and 0.48% with 2no. values (20% of results) at greater than 0.25% both of which were from the natural coal measures strata. The total (acid soluble) sulphate concentrations for all materials tested were of low order and ranged from 0.01 to 0.081%, with an average of 0.034%. Water soluble sulphate in soils and sulphates in groundwater all fall well below the limits set by SHW600 (30000mg/l and 1400mg/l respectively). None of the tests recorded oxidizable sulphides of >0.6% with the highest results being 0.47%. These results generally indicate that the sulphate concentrations of the materials beneath the site would not restrict the use of lime modification and/or stabilisation, if required.

6.12 Triaxial Permeability

Two triaxial permeability tests were undertaken on disturbed samples of Made Ground Opencast Backfill from depths of between 2m and 3m bgl. The samples were remoulded using a 2.5kg rammer at optimum moisture content and permeabilities of $4.9x10^{-10}$ m/s and $2.9x10^{-10}$ m/s were recorded.

A third test was undertaken a sample of Pennine Middle Coal Measures Formation from a depth of 0.70m bgl. The sample was again remoulded using a 2.5kg rammer at optimum moisture content and recorded a permeability of $2.9x10^{-10}$m/s.

6.13 Shear Box Test

One small shear box test was undertaken on a sample of Pennine Middle Coal Measures Formation (clay) from 0.70m bgl. The sample was remoulded at existing moisture content using a 2.5kg rammer and was consolidated for a period of 1 day. The shearing stage for the three remoulded samples lasted a duration of 5 days each. Once the sample had been sheared and peak conditions recorded the apparatus was racked back allowing approximate residual conditions to be estimated. The results of the test are tabulated below.

Location	Peak Condition		Residual Condition	
	Apparent Cohesion (kPa)	Angle of Shearing Resistance (degrees)	Apparent Cohesion (kPa)	Angle of Shearing Resistance (degrees)
TP1311 (PMCMF)	17	24.5	12	19.5

7.0 GEOTECHNICAL RISK REGISTER

The proposed pond development has been categorised as Geotechnical Category 2 as defined by British Standard EN 1997-1:2007 Eurocode 7 – Geotechnical Design. This is because it involves conventional types of geotechnical earthworks and activities.

A Geotechnical Risk Register has been derived for the proposed development and is presented in Appendix H. The aim of the risk register is to identify the geotechnical hazards and risks associated with the proposed development at the time of reporting. Later, as the project progresses with more detailed information in terms of design and mitigation measures, this should be revised and updated.

8.0 CONTAMINATION ASSESSMENT

In the context of the proposed pond development and with reference to the CSM there are no Human Health receptors at the pond site. The chemical testing carried out has been to determine the suitability for re-use at the main site and to assess the risk to Controlled Waters.

8.1 Chemical Suitability for Re-Use

In order to determine whether soils cut from the pond excavation are suitable for re-use as general fill at the main site and whether Topsoil is suitable for re-use at the main site (or others sites) the results of the chemical testing have been assessed as follows:

- Proposed end-use – commercial warehouses with lorry/car parking and minimal perimeter landscaping;
- Screening criteria – commercial/industrial, assuming 6.0% SOM for Topsoil/ Made Ground and 2.5% SOM for other soils;

- Based on the soils encountered on the site and proposed re-development plans, the testing has been split into two data sets:
  - samples from Topsoil/Made Ground;
  - samples from all other soils beneath site (Made Ground-Opencast).

As the development will create a surplus of topsoil it is possible that this will eventually be sent for use on other sites. Therefore, the results of the tests undertaken on Topsoil/Made Ground were also compared to residential with plant update screening criteria. Additionally, two samples were also sent to Tim O'Hare for specialist analysis and this also included a suite of chemical tests, the results of which have also been assessed below.

Spreadsheets summarising the laboratory results for each data set and relevant screening values are presented in Appendix F. From these summary spreadsheets, it can be seen that the majority of the determinants have been found not to exceed their relevant screening values.

Due to the current agricultural land use, a selection of Topsoil/Made Ground samples were analysed for a suite of pesticides (SVOC suite with TICs). No evidence of pesticides was detected.

PAHs were widely tested for across all soil types and all recorded concentrations below relevant screening criteria and many below levels of detection.

Asbestos screening tests did not typically detect the presence of any fibres in any of the Made Ground soils tested.

Based on the currently proposed commercial/industrial end use it is considered that the Made Ground-Opencast Backfill is chemically suitable for use as engineered fill on the main site. It is also considered that the Topsoil/Made Ground would be chemically suitable for use as Topsoil either in landscaping on the main site or potentially for export to other sites (subject to meeting any import criteria from the receiving site).

8.2 Controlled Waters Risk Assessment

All concentrations in groundwater samples tested were below the conservative screening criteria adopted with the exception of nickel and selenium.

The concentrations of selenium were below the screening criteria within the Made Ground - Opencast materials. The exceedance from RC4103, with response zone within the Pennine Middle Coal Measures Formation recorded a concentration of 27 µg/l (compared to the WFD Environmental Standard of 10µg/l) and is considered a marginal exceedance. Concentrations of nickel within the Made Ground - Opencast materials were below the screening criteria. The exceedance from RC4103, with response zone within the Pennine Middle Coal Measures Formation, recorded a concentration of 30 µg/l (WFD Environmental Standard of 20µg/l) and so is again considered marginal. As per the previous report conclusions for the main site it is considered that the concentrations are reflective of background concentrations in the groundwater resident within the natural coal measures strata.

It is therefore considered that the site presents a negligible risk to identified controlled water receptors.

8.3 Conclusions and Recommendations

The above risk assessments have established a negligible risk to Controlled Water receptors and that the soils to be excavated in creation of the pond are considered chemical suitable for re-use. It is therefore considered that further assessment or remedial actions are not warranted for this development.

The results of the chemical testing confirm that the Topsoil and Topsoil/Made Ground is chemically suitable for re-use on site or off-site including for housing. However, topsoil suitability depends on other factors including the nature of the proposed planting and the requirements of a Landscape Architect. Attention is drawn to the specialist Topsoil report included in Appendix H.

As part of the redevelopment a large proportion of the natural and Made Ground Opencast Backfill materials will be excavated, especially from the north and centre of the site, to be re-used as engineered fill placed predominantly in the south of site. The chemical testing undertaken on these soils has indicated that they are chemically suitable for re-use as engineered fill.

Issues regarding the potential impact on buried concrete, water supply pipes and possible lime modification of wet soils is discussed in the Geotechnical Design Report (GDR).

The development is being designed to achieve a cut-fill balance; hence the aim is to re-use all excavated materials on site as engineered fill to create the required development platforms. Should any excavated opencast backfill or natural soils require disposal off site, they should be appropriately tested and classified. On the basis of the test results undertaken as part of the current investigation, it is anticipated that the soils would be classified as inert. However, if the soils could not be recycled, the organic/coal content may preclude disposal at landfill as inert waste.

It is understood that measures will be included in the Earthworks Specification on how to deal with any suspected contamination, should it be uncovered as part of the redevelopment works.

9.0 UPDATED COAL MINING RISK ASSESSMENT

The previously issued Phase 1 report which included a Preliminary Coal Mining Risk Assessment has been updated following the findings of the ground investigation.

The previous report came to a number of conclusions relating to risks based on the information available at that time. These were summarised at the time as follows:

Coal Mining Issues Summary

Coal Mining Issue	Yes/No	Risk Assessment
Recorded underground shallow mine workings	Yes	Low Risk: possibly along the north western edge of the site.
Unrecorded underground shallow mine workings	No	Negligible
Recorded Mine entries (shafts and adits)	Yes	Minor risks along the north western boundary.

Coal Mining Issue	Yes/No	Risk Assessment
Unrecorded Mine entries (shafts and adits)	Yes	Very low risk across the site.
Mining geology (faults and fissures)	No	Negligible
Record of past mine gas emissions	No	Negligible
Recorded mining surface hazard	No	Negligible
Surface mining (opencast workings)	Yes	Low Risk: Uncontrolled backfill

9.1 May/June 2020 Investigation

Since the Phase 1 report was issued, a ground investigation has been undertaken across the site area by Applied Geology. The investigation included 5 no. rotary cored boreholes extended up to 12m bgl together with 12 no. trial pits, laboratory testing and monitoring.

The ground investigation was able to confirm many of the ground conditions and features predicted to be present on site by the Phase 1 CMRA. In particular the Swallow Wood Seam was proven at shallow depths in trial pits close to where it is inferred to outcrop on abandonment plans and geological mapping. A thinner second and unnamed seam 0.35m thick was encountered c.4m below the Swallow Wood Seam in RC4103 only.

Two geological cross sections have been produced for the proposed pond (Drawing AG3080-19-15), which clearly demonstrate the general absence of the Swallow Wood seam in areas of former workings as is expected and that there was no evidence of unrecorded underground workings or voids within the limits of the exploratory holes of the investigation.

9.2 Risk Assessment of Unrecorded Shallow Mine Workings

Shallow underground mine workings (Bell Pits) of the Swallow Wood Coal seam are recorded on mine abandonment plan 10651 along the north western edge of the site, which may just encroach on to the site itself. Given the depth of excavation of the pond in this area, these workings are unlikely to affect the construction. No evidence of shallow workings or voids was encountered during the ground investigation works and it is considered that these features have been removed and replaced with backfill during the opencast mining activities of the 1950s.

Underground mine workings of the Lidgett Coal seam are shown on mine abandonment plan 5843 Part A beneath all parts of the site. However, the depth of working is thought to be more than c.48m beneath the site and so following cut to form the pond, the closest underground workings could be to the base of the pond is in the order of c. 38m or possibly greater. The recorded seam thickness is generally <1.0m and hence the thickness of intact rock above the coal workings is a minimum of 38 times the seam thickness. Hence, it is considered that there is sufficient thickness of solid strata between the workings and the ground surface to mitigate against the risk of upward migration of voids. No further mitigation is required. Recorded workings in coal and ironstone seams below the site are therefore, considered to present a negligible risk to surface instability.

9.3 Risk Assessment of Recorded Mine Shafts

There are eight recorded mine entries within, or very close to the site and a further two within 50m of the site. Five shafts have been identified as being on the site and

five shafts are within the immediate vicinity of the site, all thought to be related to coal workings. However, some appear to relate to shallow bell pits or shallow shafts that were used to extract ironstone and coal and were subsequently encountered and removed during the opencast mining activities, as recorded on the 1950's abandonment plans.

A reassessed summary of known information relating to those within and closest to the site is provided below.

Reassessment of risk posed by Mineshafts and adits

CA Reference	Coordinates	General location	Comments
435398-051	435926,398947	On site (NW)	Bell pit - likely removed following opencast excavation.
435398-052	435894,398915	On site (NW)	Bell pit - likely removed following opencast excavation.
435398-053	435870,398887	On site (NW)	Bell pit - likely removed following opencast excavation.
435398-062	435976,398744	On site (SE)	No treatment records. Likely bell pit - query on shaft type.
435398-106	435924,398740	On site (S)	No treatment records. Likely bell pit.
436399-042	436012,399058	To north of site	No treatment records, not in close proximity to site.
436398-003	436139,398921	To east of site	Filled within 0.4m of ground level with a 4m x 4m concrete cap, not in close proximity to site.
435398-006	435925,398720	To south of site	Capped in November 1989. Water and gas levels are monitored by the Coal Authority every 3 months.
435398-050	435871,398952	To NW of site	Bell pit.
435398-054	435837,398911	To NW of site	Bell pit.

There are two shafts present in the south of the site which were not thought to have been removed during opencast works, Shaft 435398-062 is stated as being for coal in the CA Consultants Report. However, the Interactive map names this shaft as an ironstone shaft and it is in the location of the former ironstone pit, as shown on the historical OS maps (pre-1956). Similarly Shaft 435398-106 correlates with the location of a depressed feature on historical mapping (1893-1931) likely associated with a former shallow ironstone pit. A pond is shown in the approximate location of Shaft 435398-062 on more recent mapping (1956 - 1993), perhaps a settlement feature following backfill of the ironstone pit. This pond is no longer shown on later edition maps and becomes part of agricultural fields as shown on mapping from 1993 onwards. Both are shown to be outside the extents of the current proposed pond excavation.

Given the location of other shafts and the site proposals, it was considered unlikely that their positions will be identified physically during construction of the balancing pond. It is considered that the reliability of the position co-ordinates for these shafts is quite high and probably better than the 8m precision recommended by CIRIA (2019). Several trial pits (TP1301 and TP1304) were undertaken to try and locate/identify former shafts/bell pits within the area of the pond excavation and these did not highlight any ground anomalies associated with shafts. It is likely they were removed during excavation of the opencast mine.

9.4 Unrecorded Mine Entries

The proposed development site's coal mining context is such that there will always be a low risk of unrecorded mine entries being present. During the ground investigation phase, no evidence of any workings related to underground mining was identified. As previously recommended, it is considered that a watching brief should be undertaken during all excavation and ground works within the development. Any anomalous features that may indicate historic mine entries should be investigated and recorded by a competent person.

9.5 Surface Mining (Opencast Workings)

The proposed development area has been subject to historic opencast mining along the northern portion of the site. Opencast operations do not result in a residual risk to ground instability. However, variations in backfilling compaction can result in variable and unpredictable settlement when new loads are applied. This is particularly the case above highwalls, where sudden variations in thickness of Made Ground can occur. However, the plans for this site comprise the creation of a pond, which would not be particularly sensitive to differential settlements and so the risk is deemed to be low.

The Swallow Wood Coal Seam was last worked as part of the opencast mining shown in abandonment plan ref. NE290 in 1956 and 1957. The opencast workings extend approximately from the north western site boundary up to within c. 20m of the coal outcrop which is mapped running roughly east/west through the centre of the site. The depth of the opencast was proven in several locations (RC4101- RC4104) and the southern extent and 'low-wall' profile was investigated by trial trenches (TP1305 and TP1306). The proven extents of the opencast generally align with those of published records and therefore, the risk of encountering unexpected opencast features outside of this area is limited.

9.6 Revised CMRA

Base on the results of the recent site investigation, the CMRA findings can be revised as shown below.

Revised Coal Mining Issues Summary

Coal Mining Issue	Yes/No	Risk Assessment
Recorded underground shallow mine workings (bell pits)	Yes	Low risk: none identified during ground investigation.
Unrecorded underground shallow mine workings	No	Negligible.
Recorded Mine entries (shafts and adits)	Yes	Low risk: 'Shafts' listed on site appear to have been bell pits since removed by opencast.
Unrecorded Mine entries (shafts and adits)	Yes	Very low risk across the site.
Mining geology (faults and fissures)	No	Negligible.
Record of past mine gas emissions	No	Negligible.
Recorded mining surface hazard	No	Negligible.
Surface mining (opencast workings)	Yes	Low Risk: Uncontrolled backfill.

9.7 Conclusions

In summary, it is concluded that there is a low to negligible risk of coal mining related issues affecting the development with the exception of the subsidence risk from the opencast backfill materials. The stability of the opencast backfill materials is also an outstanding risk where such materials form part of cut slopes when the pond is formed. However, sufficient information on ground conditions and materials properties has been gathered by the ground investigation to enable these risks to be mitigated by appropriate design.

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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) The services provided are defined within our proposal and are carried out in line with the terms of appointment between Applied Geology and the Client.

C) 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.

D) 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.

E) 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.

F) 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.

G) 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.

H) 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.

I) 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.

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

K) The works performed are not a comprehensive site characterisation and should not be construed as being such.

L) The findings of the geo-environmental risk assessment are based on information obtained from a variety of sources which Applied Geology believe to be correct. Applied Geology cannot and does not guarantee the authenticity or reliability of the information it has relied upon.

M) The report represents the findings and opinions of experienced geo-environmental consultants. Applied Geology does not provide legal advice and the advice of lawyers may be required.

N) Conditions at the site are subject to change from the time of the site inspection.

O) It is possible that researches carried out by Applied Geology, whilst fully appropriate for a phase 1 desk study, failed to indicate the existence of important information sources. Assuming such indicators actually exist, their information could not have been considered in the formulation of Applied Geology findings and opinions.

P) 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.

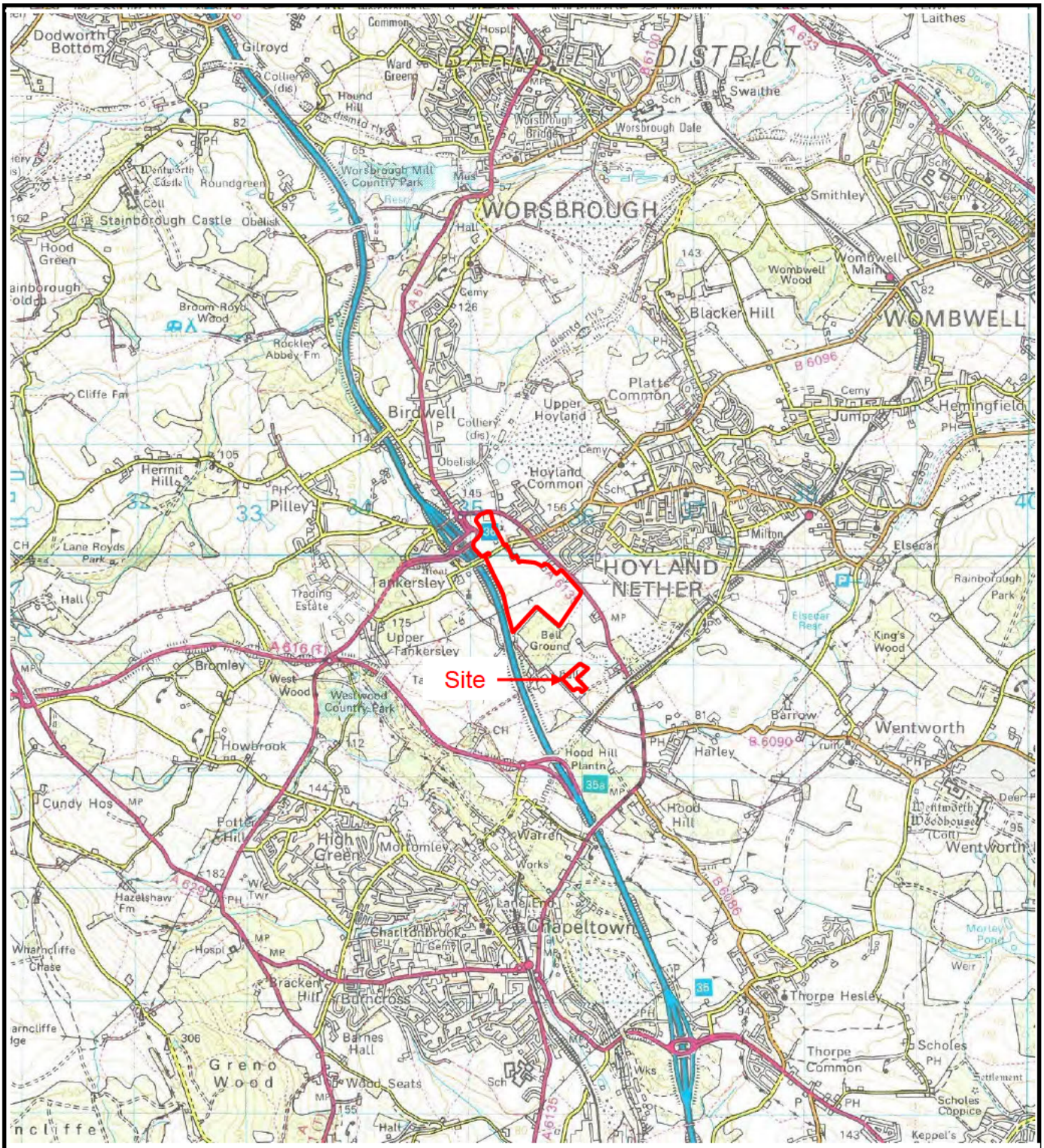
Q) Applied Geology operates as a Consultancy and does not operate it's own laboratory for soil testing, this work being sub contracted to known and respected, generally UKAS accredited, laboratories. Applied Geology can therefore not be held responsible for the testing carried out.

LIST OF REFERENCES COMMONLY USED BY APPLIED GEOLOGY IN REPORTS

SECTION/TITLE	AUTHOR/PUBLICATION
LABORATORY TESTING	
BS 1377-1:2016 Method of Test for Soils for Civil Engineering Purposes	BSI
SITE WORK	
Guidelines for Combined Geoenvironmental and Geotechnical Investigations. Issue 2. March 2006.	AGS
BS 5930:2015. Code of Practice for Ground Investigations	BSI
BS 10175:2011 & A1:2013 Code of Practice for the Investigation of Potentially Contaminated Sites	BSI
FOUNDATION DESIGN	
BS EN 1997-1 Eurocode 7 – Geotechnical Design, Part 1. 2004.	BSI
BS EN 1997-2 Eurocode 7 – Geotechnical Design, Part 2. 2007.	BSI
Paper by M. A. Stroud 'The Standard Penetration Test – its Application and Interpretation' within Thomas Telford/ICE book 'Penetration Testing in the UK'. 1989.	Stroud
BRE Special Digest 1: 2005 Third Edition. Concrete in Aggressive Ground	BRE
NHBC Standards, Chapter 4.2: Building Near Trees. 2017.	National House Building Council
Engineering in Chalk (C574). 2002.	CIRIA
Engineering in Mercia Mudstone (C570). 2001.	CIRIA
Engineering in Glacial Till (C504). 1999.	CIRIA
GROUND GAS	
BRE 211 Protecting New Buildings from Radon. 2015.	BRE
BS 8485:2015 Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings.	BSI
Guidance on Evaluation of Development Proposals on Sites Where Methane and Carbon Dioxide are Present. 4th Ed, 2007	NHBC & RSK Group
Assessing Risks Posed by Hazardous Ground Gases to Buildings. C665. 2007.	CIRIA
Research Bulletin 17. 2012.	CLAIRE
BS 8576:2015 Guidance on Investigations for Ground Gas. Permanent Gases and Volatile Organic Compounds (VOCs)	BSI
Guidance on the Use of Plastic Membranes as VOC Vapour Barriers. C748. 2014.	CIRIA
Remediating and Mitigating Risks from Volatile Organic Compound (VOC) Vapours from Land Affected by Contamination. C716. 2012.	CIRIA
GROUNDWATER	
BRE DG 365: Soakaway Design. 2016.	BRE
BS EN ISO 22282-2:2012 Geotechnical Investigation and Testing – Geohydraulic Testing, Part 2. 2012.	BSI
CONTAMINATION ASPECTS (Soil & Groundwater)	
Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance. 2012.	DEFRA
Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination - SP1010. 2014.	DEFRA
HPA Contaminated Land Information Sheet – Risk Assessment Approaches for Polycyclic Aromatic Hydrocarbons. Version 3. 2010.	HPA
Cover Systems for Land Regeneration. Thickness of Cover Systems for Contaminated Land. 2004. BR465.	AGS/BRE
Development of Generic Assessment Criteria for Assessing Vapour Risk to Human Health from Volatile Contaminants in Groundwater. Version 1.0. February 2017.	SOBRA
BS 3882:2015 Specification for Topsoil	BSI
The LQM/CIEH S4ULs for Human Health Risk Assessment, 2015. S4UL3159.	Chartered Institute of Environmental Health. Land Quality Management.
Generic Assessment Criteria for Human Health Risk Assessment. 2009.	Chartered Institute of Environmental Health. Land Quality Management.
Model Procedures for the Management of Contaminated Land. Contaminated Land Report. 11 September 2004.	DEFRA / Environment Agency
The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils. February 2005.	Environment Agency
The Environment Agency's Approach to Groundwater Protection, V1. 2017.	Environment Agency
Remedial Targets Methodology. Hydrogeological Risk Assessment for Land Contamination. 2006.	Environment Agency
Guidance for the Safe Development of Housing on Land Affected by Contamination	NHBC
Sampling Strategies for Contaminated Land. Contaminated Land Research Report no.4. 1994.	DoE
NHBC Standards, Chapter 4.1: Land Quality – Managing Ground Conditions. 2017.	National House Building Council
ATRISK^{soil} Soil Screening Values. 2017.	Atkins
CLEA Software (Version 1.071). 2015.	Environment Agency

The Water Supply (Water Quality) Regulations. 2016.	DWI
Prioritisation & Categorisation Procedure for Sites Which May Be Contaminated (CLR Report No6)	Department of the Environment, Contaminated Land Research Report
Code of Practice for the Investigation & Mitigation of Poss ble Petroleum-Based Land Contamination. 1993.	The Institute of Petroleum
Piling & Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention. 2001.	Environment Agency
DISPOSAL OF SOIL	
Guidance on the Classification and Assessment of Waste. Technical Guidance WM3. 1st Ed. 2015.	SEPA, NIEA, Natural Resources Wales & Environment Agency
Waste Sampling and Testing for Disposal to Landfill. 2013.	Environment Agency
BURIED SERVICES	
Guidance for the Selection of Water Supply Pipes to be Used in Brownfield Sites. (10/WM/03/21). 2011.	UK Water Industries Research
PAVEMENT DESIGN	
Interim Advice Note 73/06 Rev 1, 2009. Design Guidance for Road Pavement Foundations (Draft HD25)	Highways Agency
PLANNING	
DCLG:2012 National Planning Policy Framework and Practice Guidance	Department for Communities and Local Government
HEALTH & SAFETY ASPECTS	
A Guide for Safe Working on Contaminated Sites (Report 132)	CIRIA
Protection of Workers and the General Public During the Development of Contaminated Land (HSG66)	Health & Safety Executive
Construction (Design & Management) Regulations 2015 (CDM)	Health & Safety Executive
Control of Substances Hazardous to Health Regulations 2002	Health & Safety Executive
Workplace Exposure Limits. EH40/2005	Health & Safety Executive
Trenching Practice. Guidance on Groundwater Control (Report 97)	CIRIA
Control of Groundwater for Temporary Works (Report 113)	CIRIA
Asbestos in Soil and Made Ground: A Guide to Understanding and Managing Risks. C733. 2014.	CIRIA

APPENDIX A



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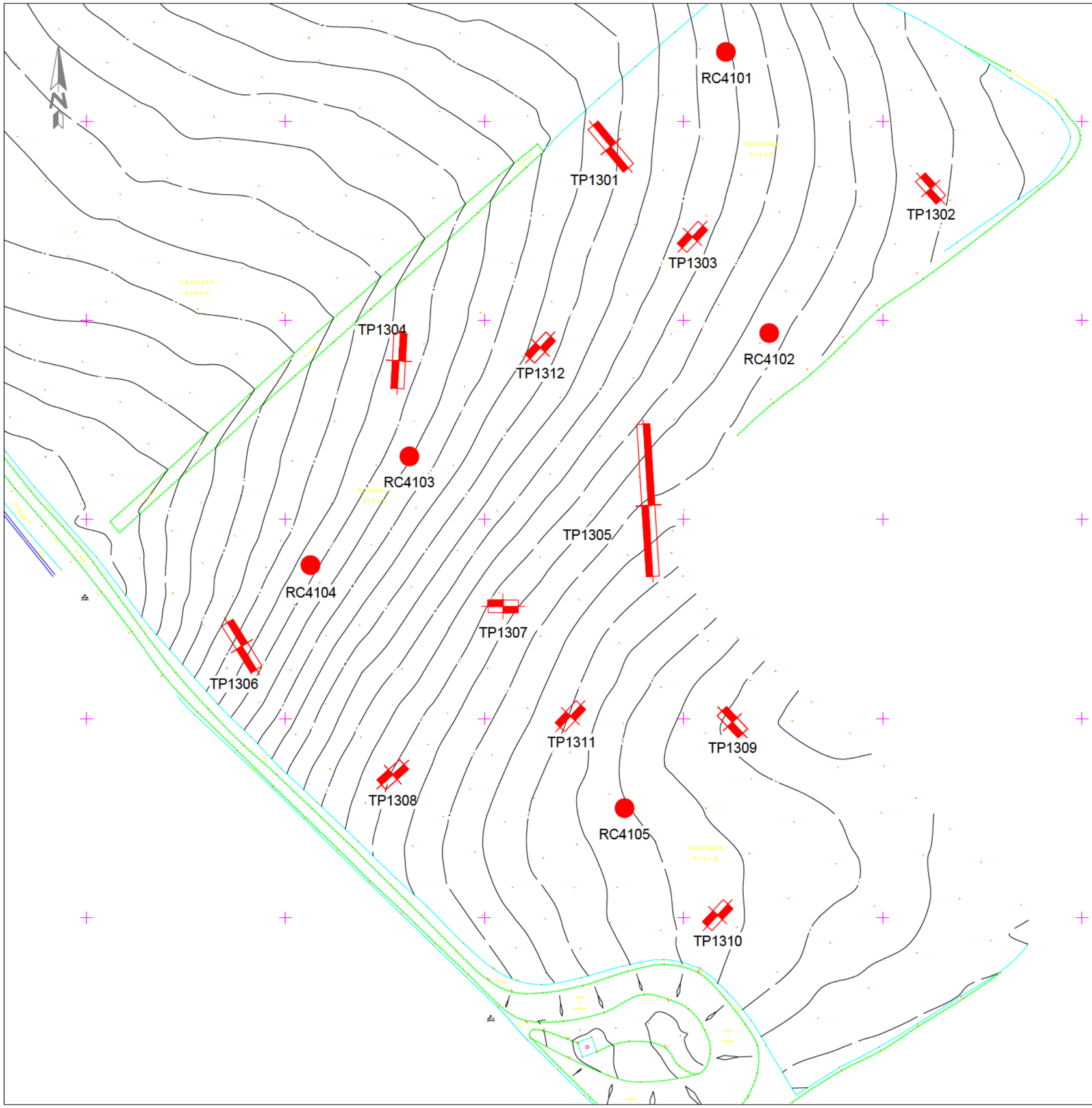
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M1 JUNCTION 36

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JS	SD	A4

Scale:	Date:	NGR:
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Title: SITE LOCATION PLAN

Drawing No:	Revision:
AG3080-19-01B	0



KEY:

TP1301 — Trial Pit

RC4101 — Dynamic / Sample and Rotary Cored Borehole

Drawing based on Ellam Land Surveys, drawing No:7879/1B dated March 2019.

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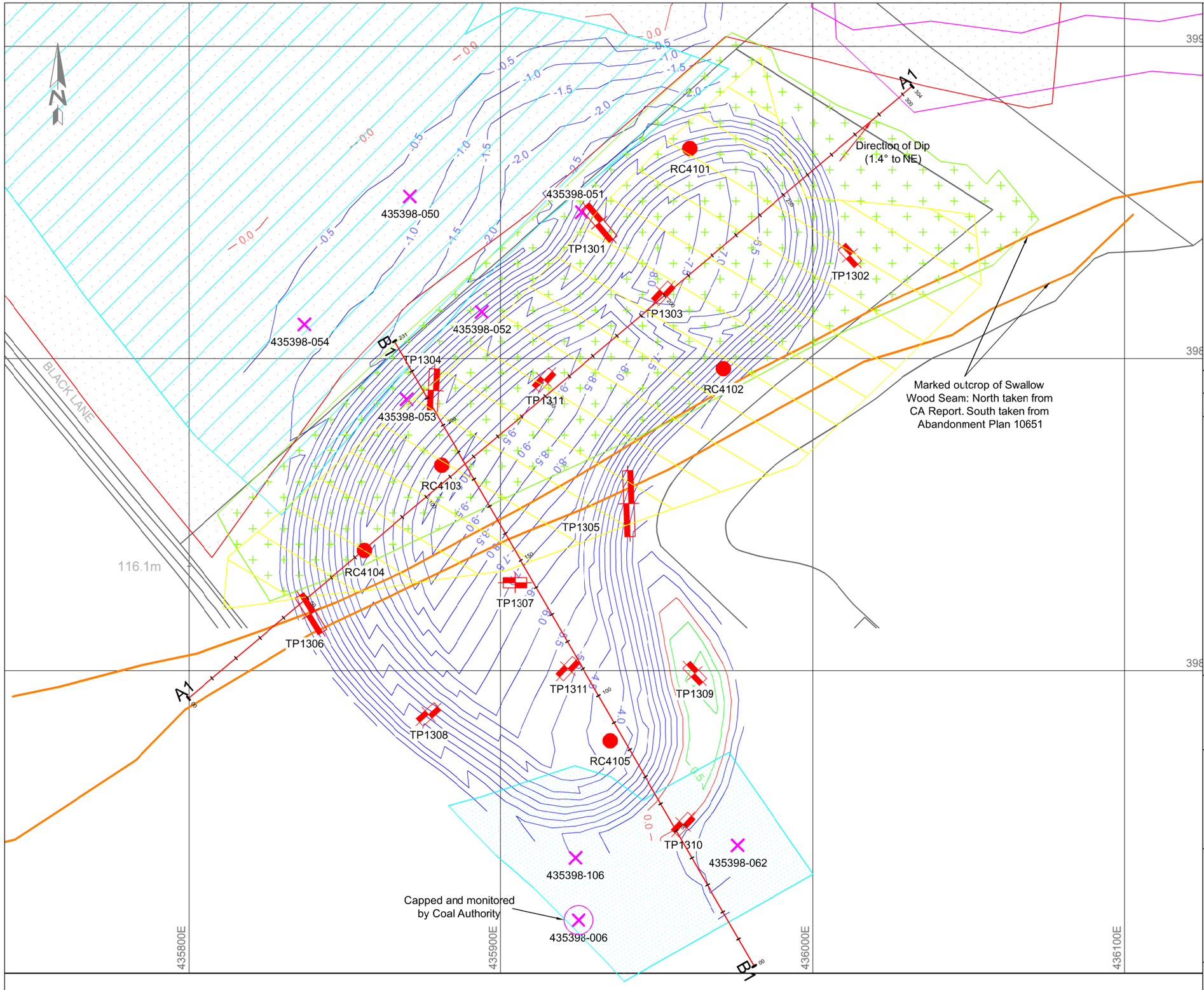
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EXPLORATORY HOLE LOCATION PLAN-
BALANCING POND

Drawn By:	Checked By:	Paper Size:
FD	SD	A3

Scale:	Date:
1:200	08.06.2020

Drawing No:	Revision:
AG3080-19-10	0



Rev	Notes	Date	By
1	Mineshaft numbers amended and section lines added	07.07.2020	AP

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HOYLAND COMMON, BARNSLEY
M1 JUNCTION 36

Title:

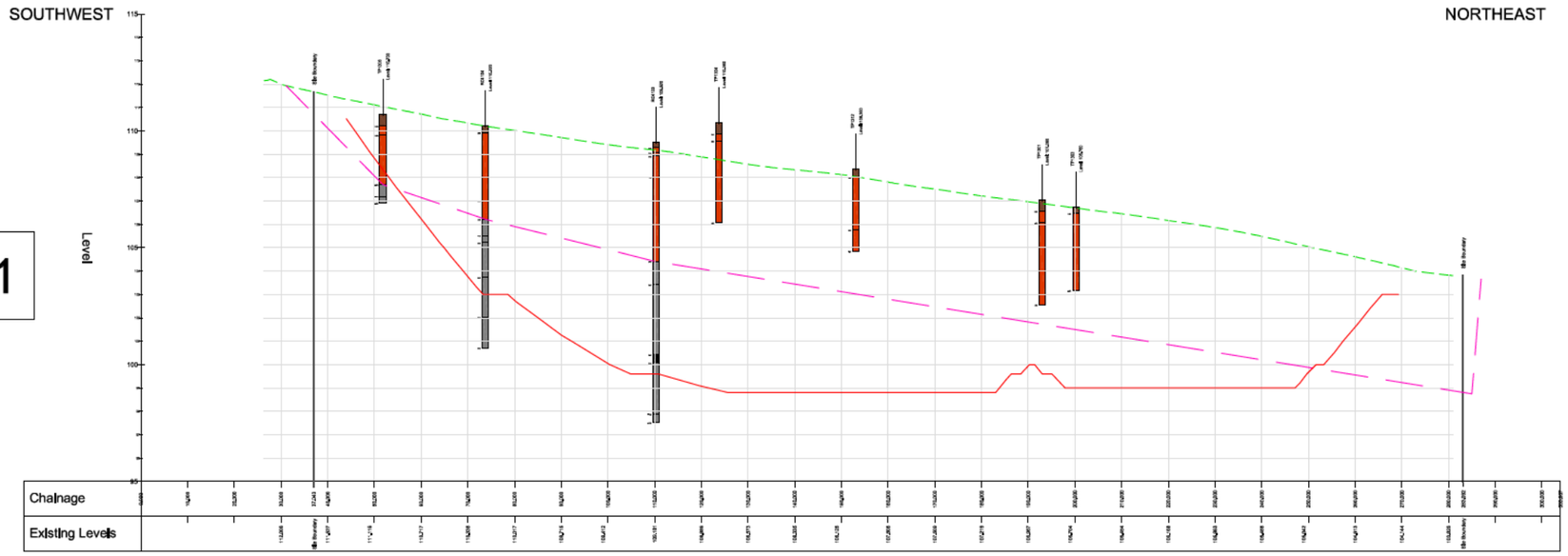
EXPLORATORY HOLE LOCATION PLAN-
BALANCING POND WITH CUT/ FILL LEVELS
& MINING INFORMATION

Drawn By:	Checked By:	Paper Size:
FD	SD	A3

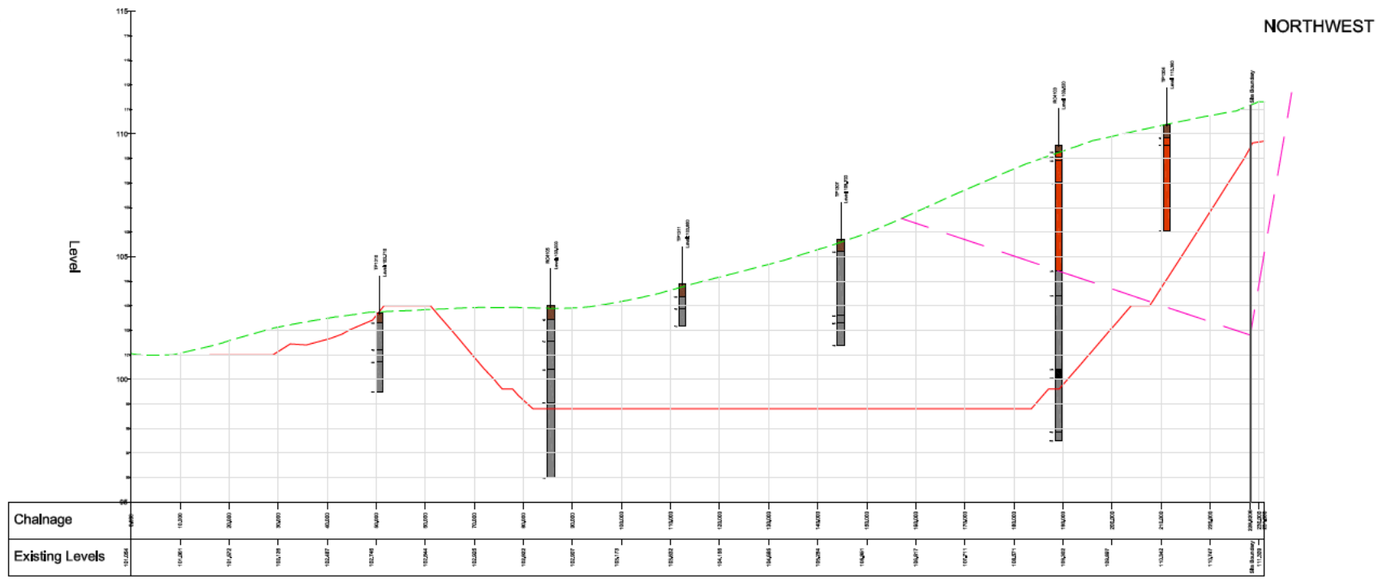
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Drawing No:	Revision:
AG3080-19-11	1

A1-A1



B1-B1



Key:

- Topsoil/ Made Ground
- Made Ground- Opencast Backfill
- Coal Seams
- Pennine Middle Coal Measures Formation
- EXISTING GROUND PROFILE
- PROPOSED POND DESIGN 4400-001-P12-3d
- INFERRED BASE OF OPENCAST WORKINGS

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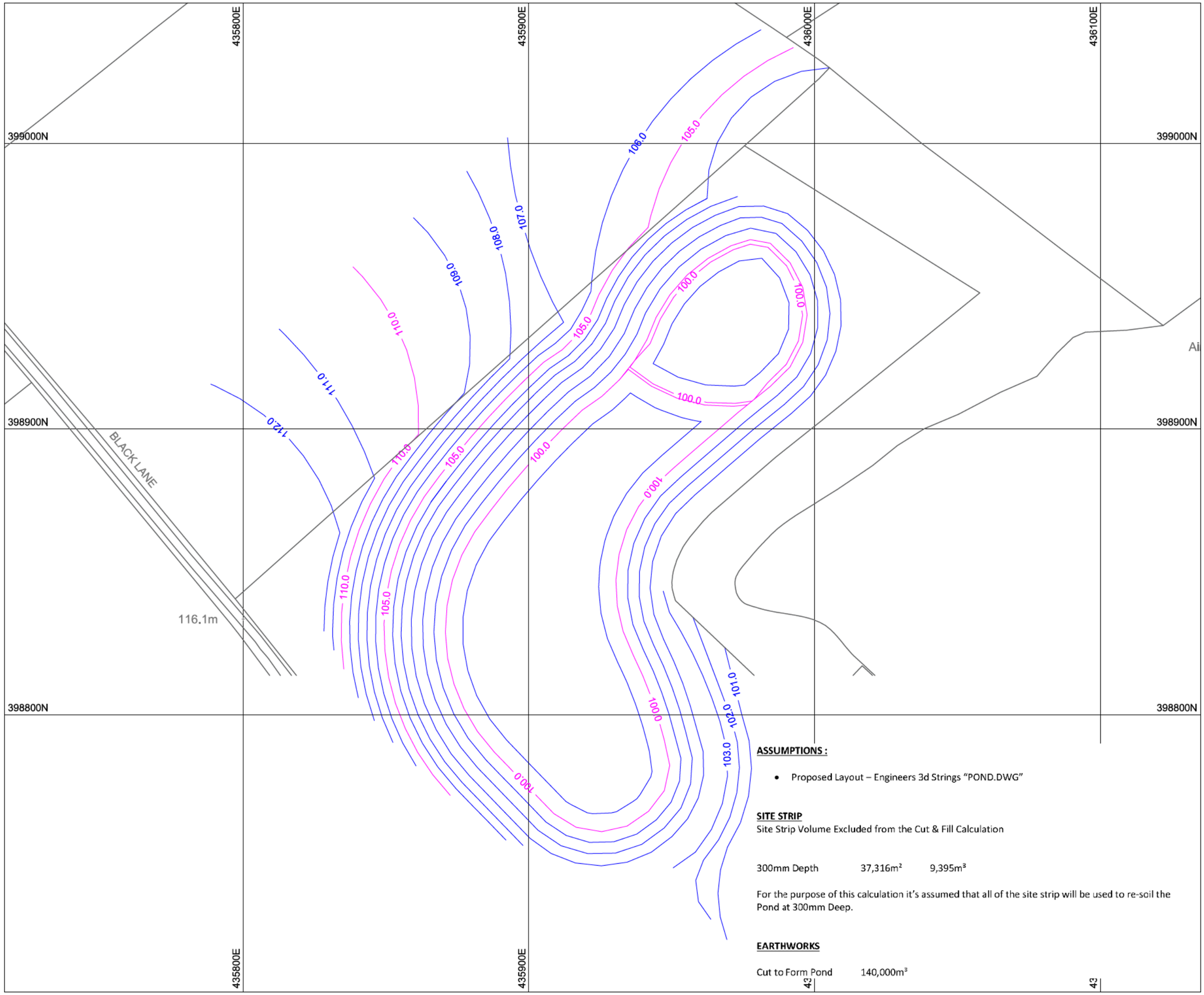
Project: HOYLAND COMMON, BARNSLEY
M1 JUNCTION 36

Title: GEOLOGICAL CROSS SECTIONS- POND

Drawn By	Checked By	Paper Size
SB	SD	A3

Scale	Date
Horizontal 1:1250 Vertical 1:250	15.07.2020

Drawing No	Revision
AG3080-19-15	0



ASSUMPTIONS :

- Proposed Layout – Engineers 3d Strings "POND.DWG"

SITE STRIP

Site Strip Volume Excluded from the Cut & Fill Calculation

300mm Depth 37,316m² 9,395m³

For the purpose of this calculation it's assumed that all of the site strip will be used to re-soil the Pond at 300mm Deep.

EARTHWORKS

Cut to Form Pond 140,000m³

stafsurv LAND SURVEYORS

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Tel 01604 678960
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email mail@winvic.co.uk

SITE

HOYLANDS COMMON
BARNSLEY

PROJECT

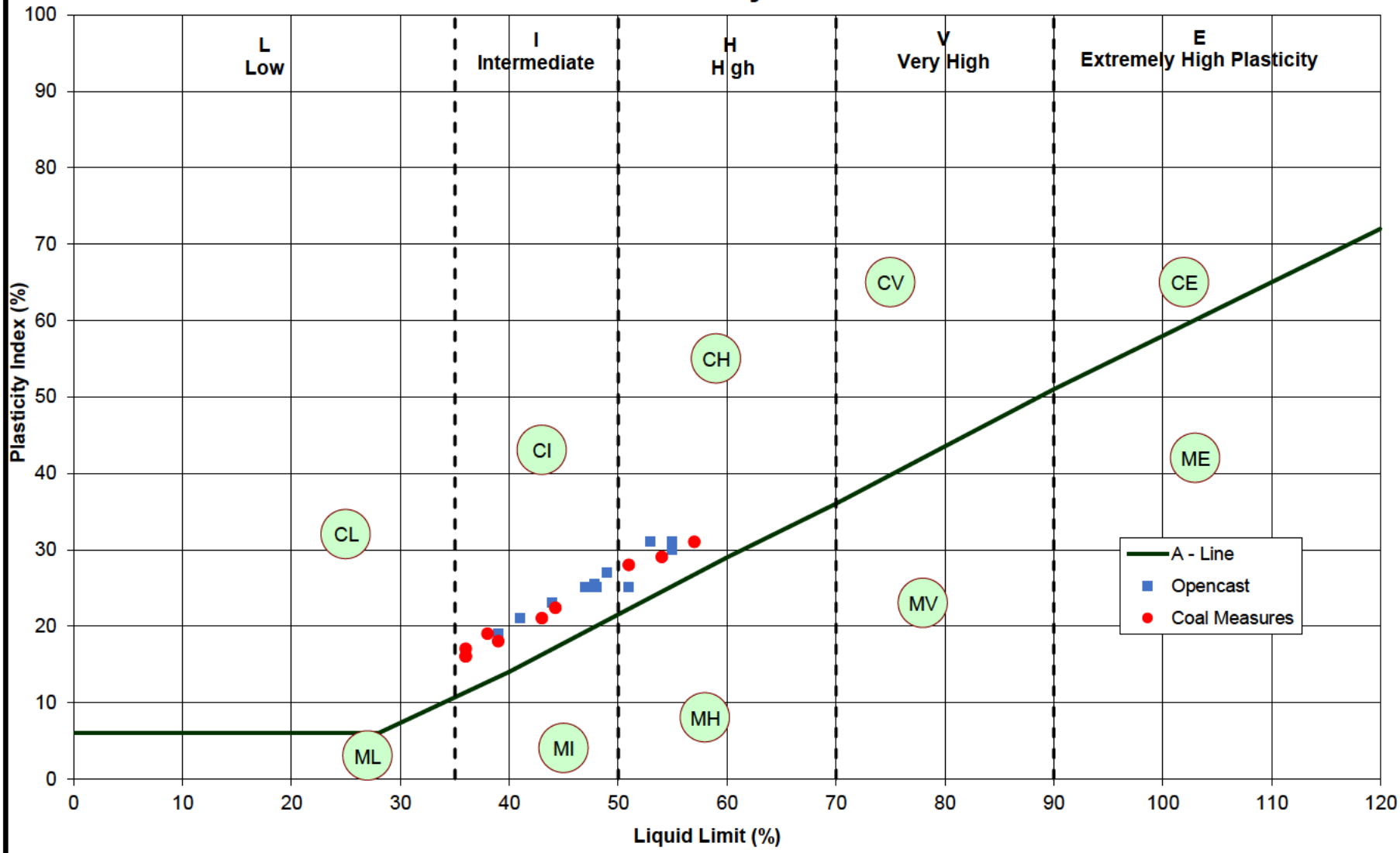
SOUTHERN POND
PROPOSED LEVELS

SCALE	DATE
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DRAWING No.

10940a-POND

Plasticity Chart

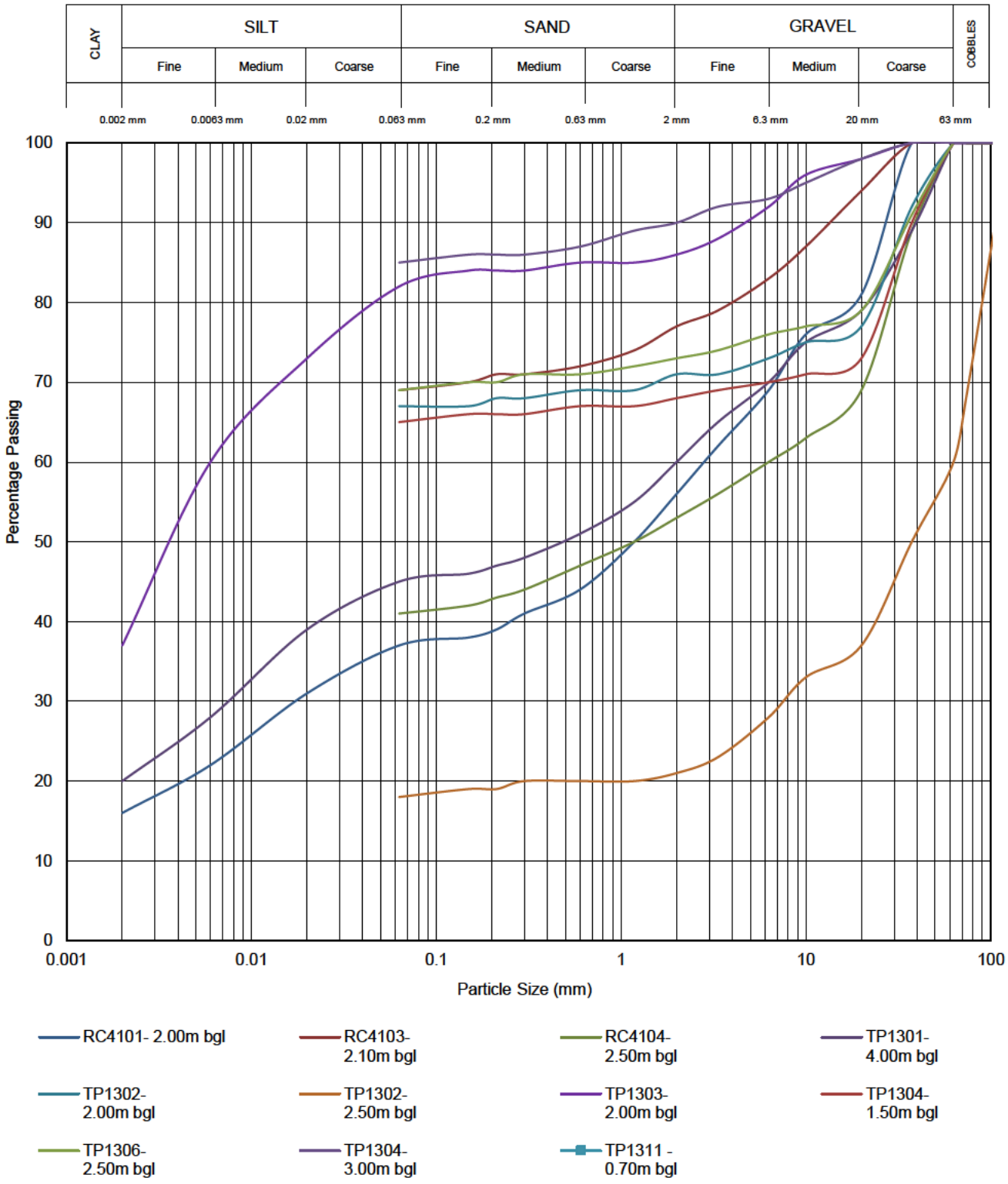


Client:	Newlands Developments
Project:	Hoyland Common, Barnsley, M1 Junction 36
Project No.:	AG3080-19

APPLiED GEOLOGY

Determination of Particle Size Distribution- Made Ground Opencast Backfill

BS1377 : Part 2 : Clause 9.2 : 1990 Wet Sieving Method
BS1377 : Part 2 : Clause 9.3 : 1990 Pipette Sedimentation

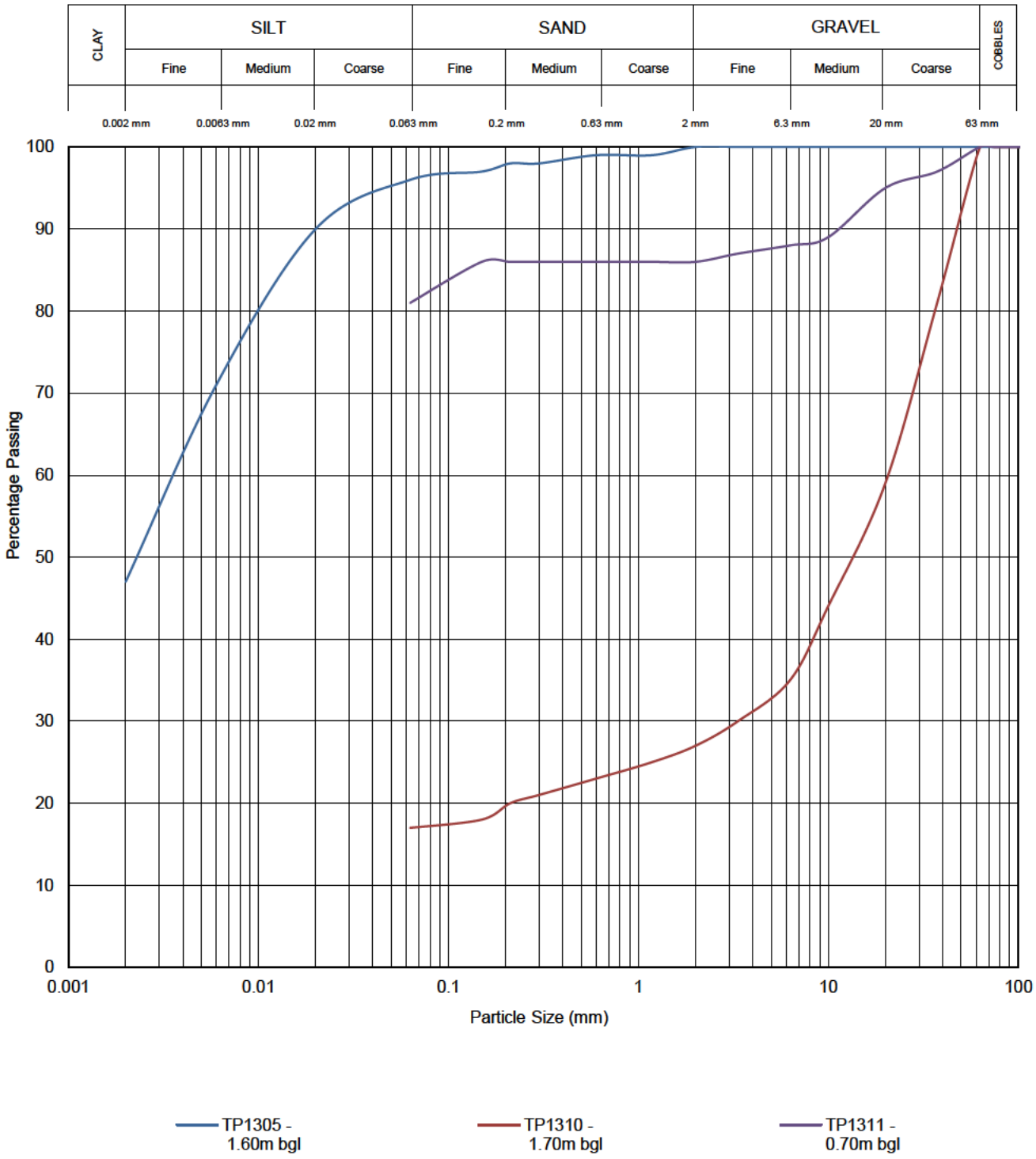


Client:	Newlands Developments
Project:	Hoyland Common, Barnsley, M1 Junction 36
Project No.:	AG3080-19

APPLiED GEOLOGY

Determination of Particle Size Distribution- Pennine Middle Coal Measures Formation

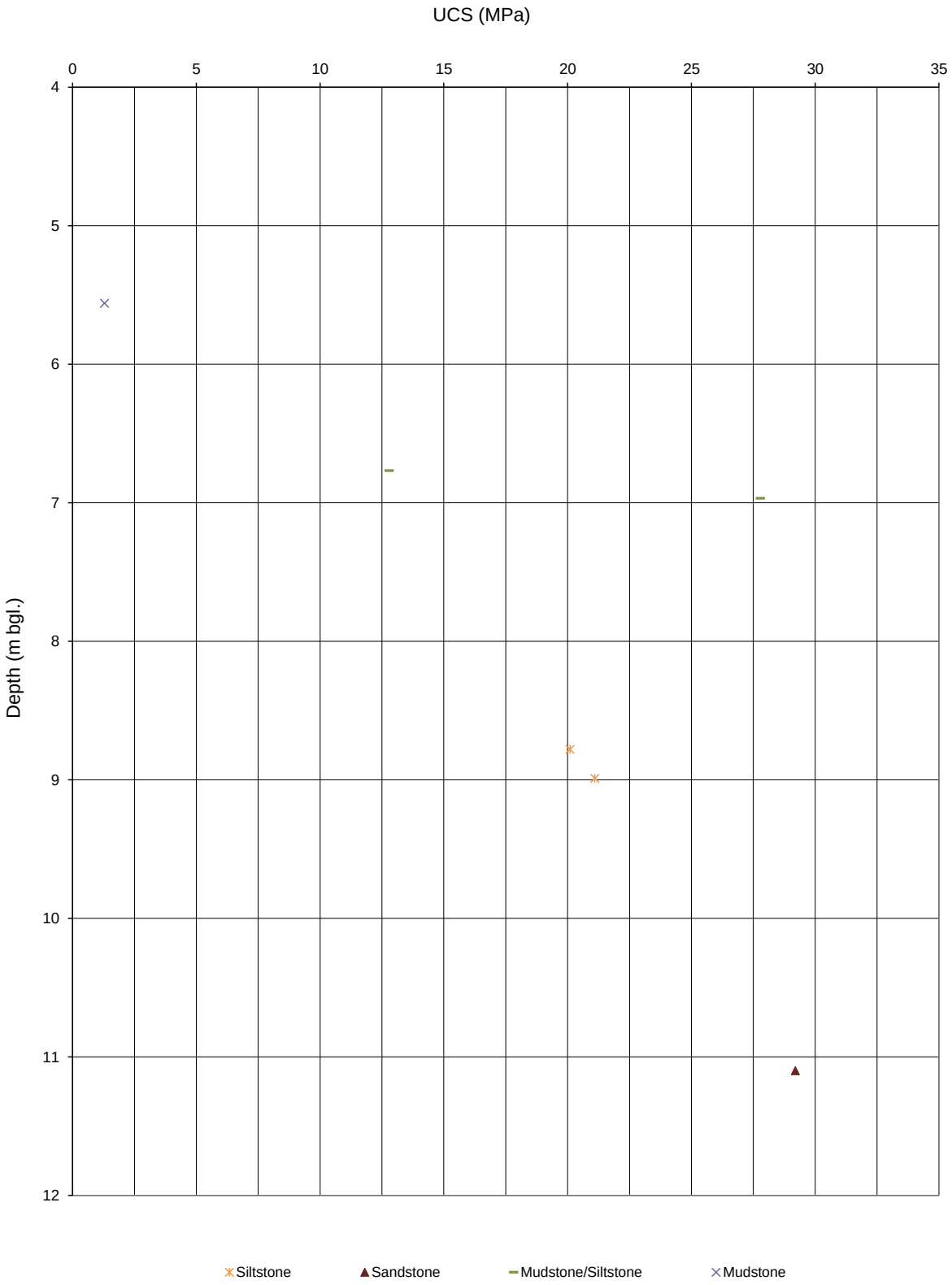
BS1377 : Part 2 : Clause 9.2 : 1990 Wet Sieving Method
BS1377 : Part 2 : Clause 9.3 : 1990 Pipette Sedimentation



Client:	Newlands Developments
Project:	Hoyland Common, Barnsley, M1 Junction 36
Project No.:	AG3080-19

APPLiED GEOLOGY

UCS (MPa) versus depth (by material type)

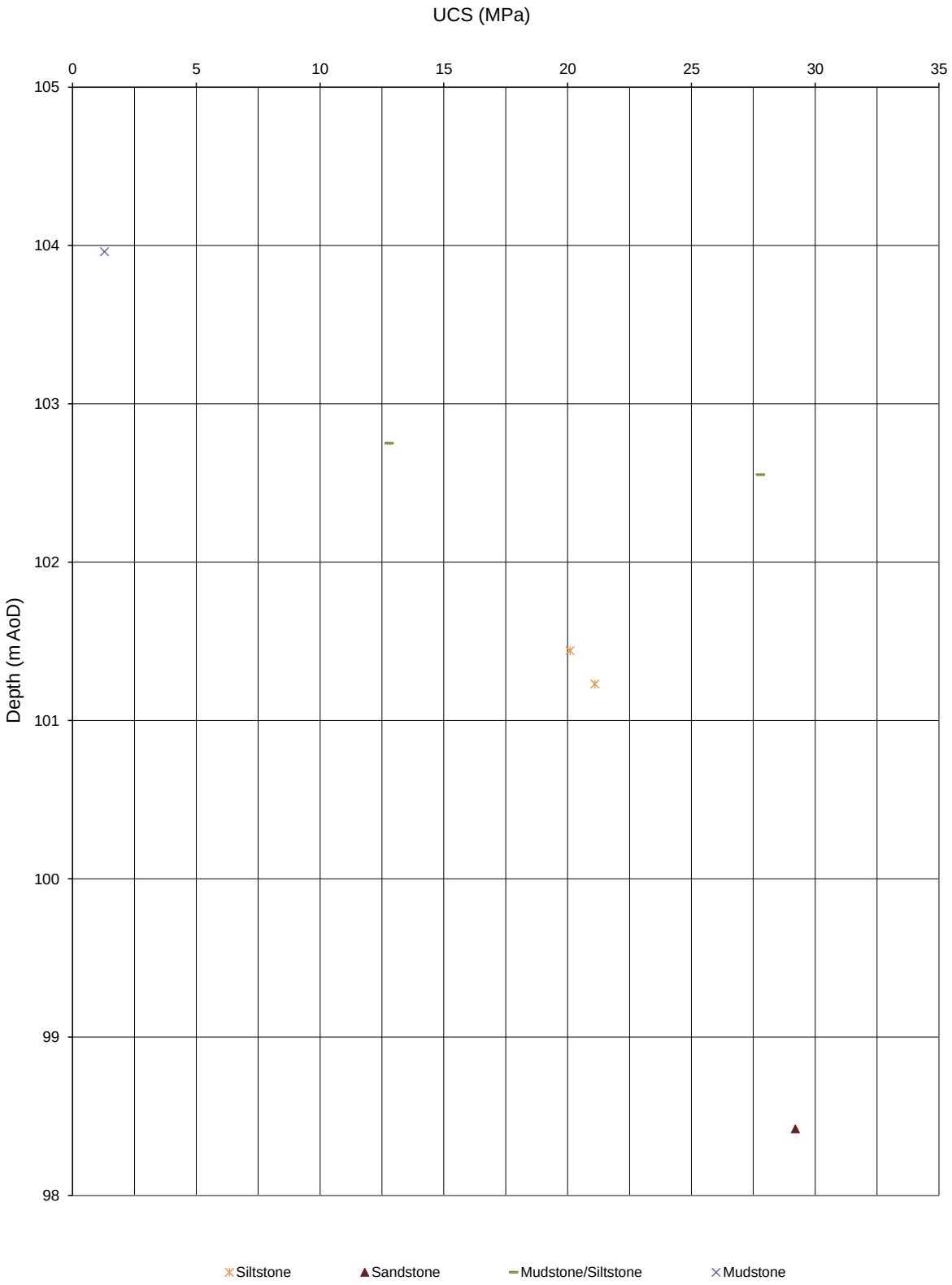


Notes:

Client:	Newlands Developments
Project:	Hoyland Common, Barnsley
Project No.	AG3080-19

APPLiED GEOLOGY

UCS (MPa) versus reduced level (by material type)

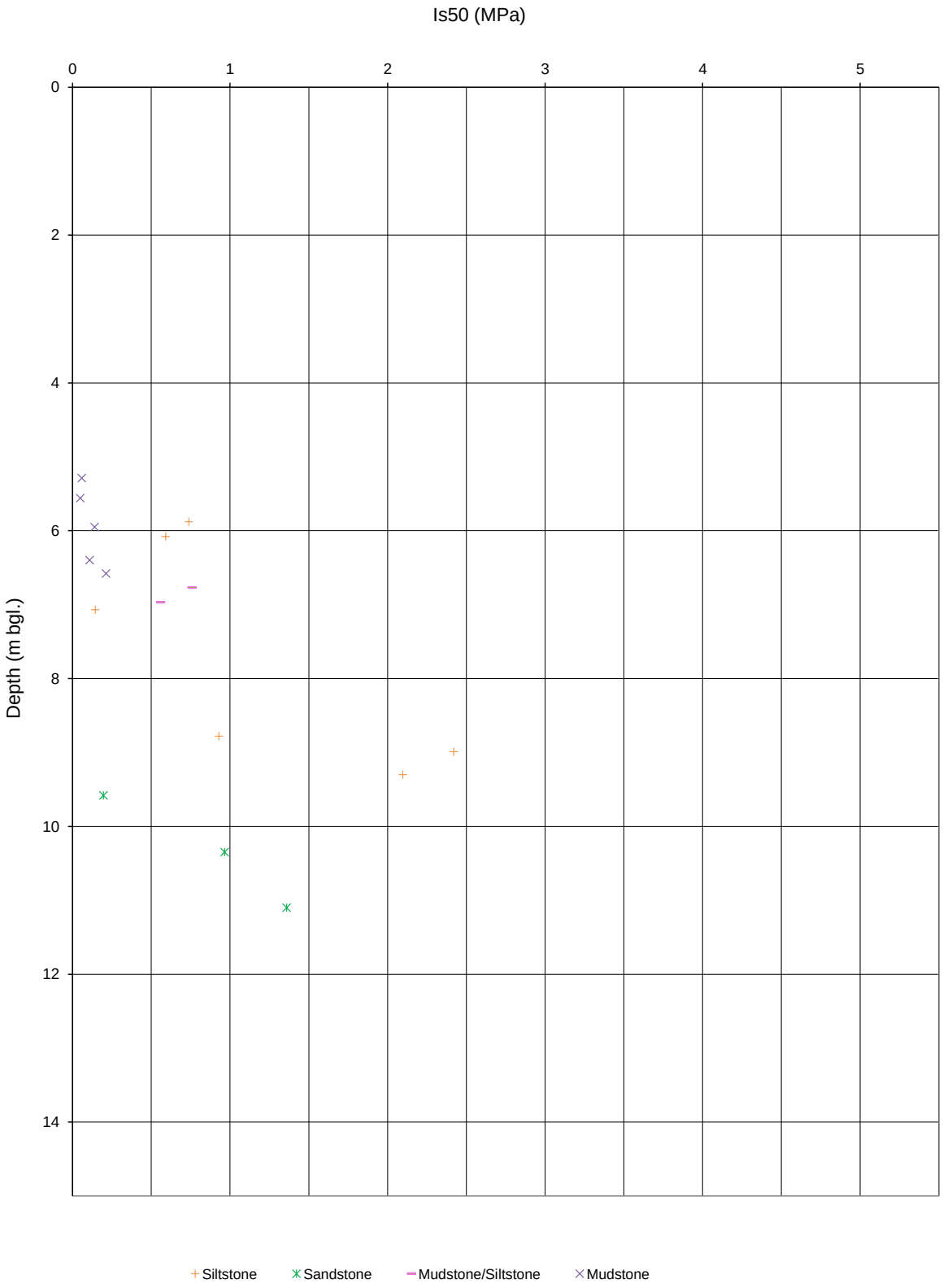


Notes:

Client:	Newlands Developments
Project:	Hoyland Common, Barnsley
Project No.	AG3080-19

APPLiED GEOLOGY

Is50 (MPa) versus depth (by material type)

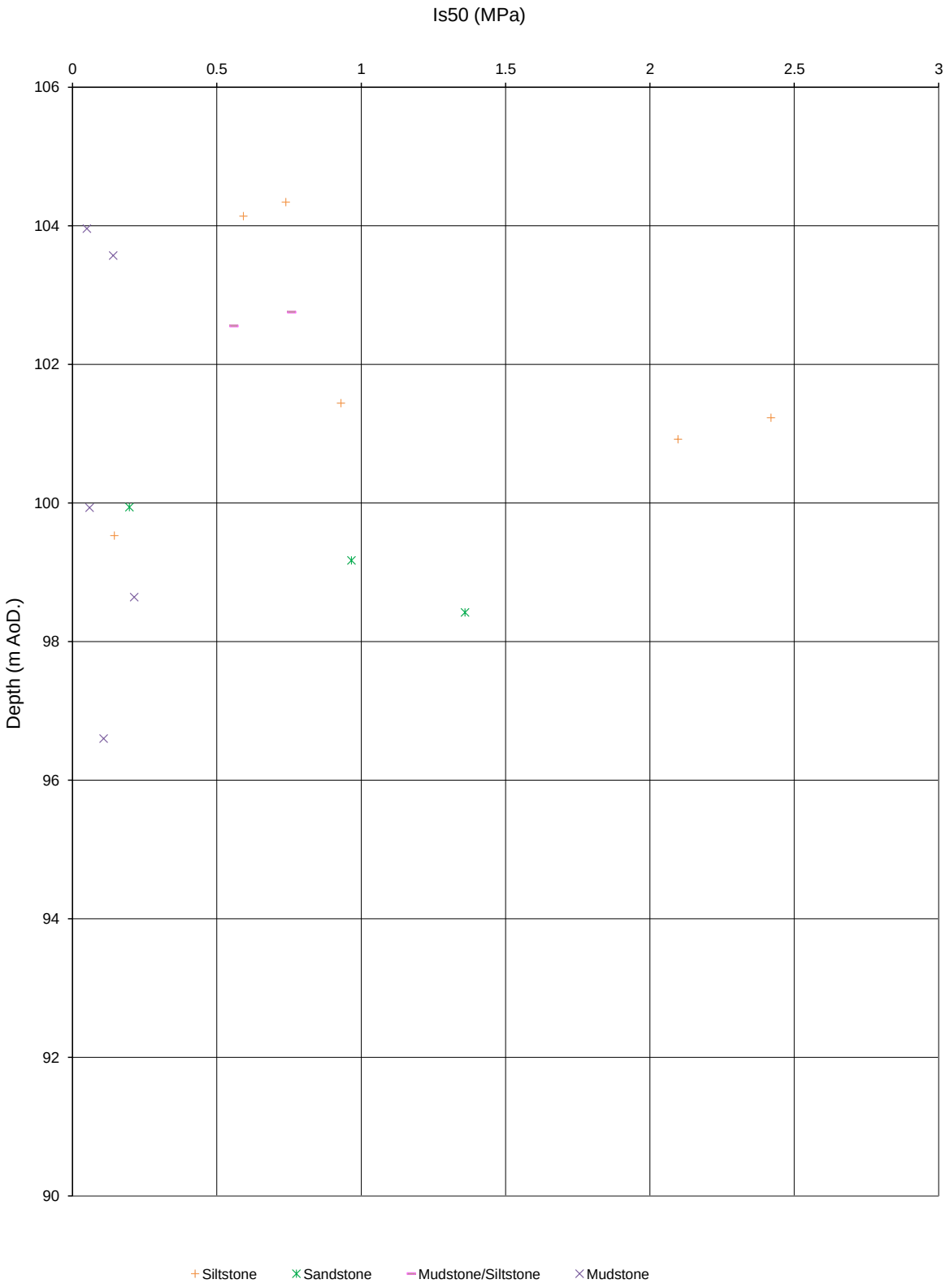


Notes:

Client:	Newlands Developments
Project:	Hoyland Common, Barnsley
Project No.	AG3080-19

APPLiED GEOLOGY

Is50 (MPa) versus reduced level (by material type)



Notes:

Client:	Newlands Developments
Project:	Hoyland Common, Barnsley
Project No.	AG3080-19

APPLiED GEOLOGY

APPENDIX B

TRIAL PIT LOG

TP1301

Project	Hoyland Common, Barnsley	**Project No.**	AG3080-19
Client	Newlands Developments	**Sheet**	1 of 1
Date	27/05/2020	**Scale**	1:25
Ground Level	107.06m AOD **Coordinates** E 435932.09 N 398933.54	**Total Depth**	4.50m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
						Stiff friable brown slightly gravelly CLAY with frequent rootlets. Gravel is fine to coarse subangular to subrounded brick and mudstone. (TOPSOIL/MADE GROUND)		
				(0.50)				
D	0.30							
ES	0.30							
			106.56	0.50	E	Stiff light brown and grey slightly gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone and coal. (MADE GROUND - OPENCAST BACKFILL)		
				(0.50)	E			
D	0.80							
ES	0.80							
ES	0.80							
			106.06	1.00		Stiff to very stiff dark grey gravelly CLAY. Gravel is fine to coarse angular to subangular mudstone and coal. (MADE GROUND - OPENCAST BACKFILL)		
D	1.90							
ES	1.90				M			
				(3.50)				
D	3.00							
ES	3.00							
LB	3.00							
D	4.00							
ES	4.00							
LB	4.00							
			102.56	4.50		End of Trial Pit at 4.50m		

Method: Tracked Excavator

Groundwater: Groundwater not encountered.

Stability: Stable

Remarks: Trial pit backfilled with arisings on completion.

Length:	3.50m
Width:	0.70m
Logged:	JW
Checked:	FC

TRIAL PIT LOG

TP1302

Project	Hoyland Common, Barnsley	**Project No.**	AG3080-19
Client	Newlands Developments	**Sheet**	1 of 1
Date	27/05/2020	**Scale**	1:25
Ground Level	104.27m AOD **Coordinates** E 436012.02 N 39893.07	**Total Depth**	3.00m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
						Stiff friable brown slightly gravelly CLAY with frequent rootlets. Gravel is fine to coarse subangular to subrounded mudstone, coal and brick. (TOPSOIL/MADE GROUND)		
D	0.30			(0.50)	E			
ES	0.30							
			103.77	0.50				
						Stiff light brown and dark grey gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone and coal. (MADE GROUND - OPENCAST BACKFILL)		
D	0.80							
ES	0.80			(0.70)	E			
			103.07	1.20				
					M	Stiff becoming very stiff dark grey and black gravelly CLAY. Gravel is fine to coarse angular to subangular mudstone and coal. (MADE GROUND - OPENCAST BACKFILL)		
				(1.30)				
D	2.00							
ES	2.00							
LB	2.00							
D	2.50		101.77	2.50				
ES	2.50					Dark grey and black sandy GRAVEL of fine to coarse angular to subangular mudstone and coal. (MADE GROUND - OPENCAST BACKFILL)		
LB	2.50			(0.50)	M			
			101.27	3.00		End of Trial Pit at 3.00m		

Method: Tracked Excavator

Groundwater: Seepage from below 2.60m bgl. Water level at 2.70m bgl after 10 minutes.

Stability: Semi-spalling in opencast strata.

Remarks: Trial pit backfilled with arisings on completion. Soakaway test undertaken in this trial pit.

Length:	3.20m
Width:	0.70m
Logged:	JW
Checked:	FC

TRIAL PIT LOG

TP1303

Project	Hoyland Common, Barnsley	**Project No.**	AG3080-19
Client	Newlands Developments	**Sheet**	1 of 1
Date	26/05/2020	**Scale**	1:25
Ground Level	106.76m AOD **Coordinates** E 435952.20 N 398920.95	**Total Depth**	3.60m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
ES	0.10			(0.30)	E	Firm to stiff brown silty slightly gravelly CLAY with rare to occasional rootlets. Gravel is fine to coarse subangular to subrounded brick, siltstone and mudstone. (TOPSOIL/MADE GROUND)		
ES	0.30		106.46	0.30		Firm locally stiff grey mottled yellowish brown and black slightly gravelly to gravelly silty CLAY with occasional cobbles. Gravel is fine to coarse angular to subangular of coal, mudstone and siltstone. Cobbles are subangular siltstone and occasional mudstone. (MADE GROUND - OPENCAST BACKFILL) *Between 0.50m and 0.60m bgl: predominantly black.*		
ES	0.50							
D	0.60							
D	1.20				E			
D	1.60							
LB	2.00			(3.30)		*Below 2.00m bgl: predominantly firm, locally soft.*		
					E			
D	3.60		103.16	3.60		End of Trial Pit at 3.60m		

Method: 20T Tracked Excavator

Groundwater: Slight seepage at 3.60m bgl.

Stability: Stable.

Remarks: Trial pit backfilled with arisings on completion. Soakaway test undertaken in this trial pit.

Length:	3.00m
Width:	0.60m
Logged:	FC
Checked:	SD

TRIAL PIT LOG

TP1304

Project	Hoyland Common, Barnsley	**Project No.**	AG3080-19
Client	Newlands Developments	**Sheet**	1 of 1
Date	27/05/2020	**Scale**	1:25
Ground Level	110.36m AOD **Coordinates** E 435878.49 N 398889.81	**Total Depth**	4.30m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
				(0.50)	E	Stiff friable brown slightly gravelly CLAY with frequent rootlets. Gravel is fine to coarse subangular to subrounded brick, mudstone and coal. (TOPSOIL/MADE GROUND)		
D ES	0.30 0.30							
			109.86	0.50				
				(0.30)	E	Stiff orange and brown slightly sandy slightly gravelly CLAY. Gravel is sine to coarse, angular to subrounded mudstone and coal. (MADE GROUND - OPENCAST BACKFILL)		
D ES	0.70 0.70		109.56	0.80	M	Stiff becoming very stiff grey to dark grey and dark brown gravelly CLAY. Gravel is fine to coarse angular to subangular mudstone, coal and siltstone. (MADE GROUND - OPENCAST BACKFILL)		
D ES LB	1.50 1.50 1.50							
				(3.50)				
D ES LB	3.00 3.00 3.00							
			106.06	4.30		End of Trial Pit at 4.30m		

Method: Tracked Excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial pit backfilled with arisings on completion.

Length:	3.00m
Width:	0.80m
Logged:	JW
Checked:	FC

TRIAL PIT LOG

TP1305

Project	Hoyland Common, Barnsley	**Project No.**	AG3080-19
Client	Newlands Developments	**Sheet**	1 of 1
Date	26/05/2020	**Scale**	1:25
Ground Level	105.01m AOD **Coordinates** E 435941.09 N 398853.53	**Total Depth**	2.00m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
ES	0.20			(0.40)	E	Stiff friable brown slightly gravelly silty CLAY. Gravel is fine to coarse subangular to subrounded brick and rare sandstone. (TOPSOIL/MADE GROUND) *Between 0.00m and 0.10m bgl: rare rootlets present.*		
			104.61	0.40	E	Stiff closely fissured yellowish brown mottled grey silty CLAY with pockets of dark grey and black coal gravel. (MADE GROUND - OPENCAST BACKFILL)		
ES	0.60			(0.50)				
			104.11	0.90		Black and dark grey dull rare semi-bright coal predominantly fusain COAL, recovered as sandy gravel. Gravel is fine and medium occasionally coarse subangular coal and occasional carbonaceous mudstone. (SWALLOW WOOD SEAM) (PENNINE MIDDLE COAL MEASURES FORMATION)		
D	1.00			(0.50)	E			
D	1.30							
			103.61	1.40	E	Firm to stiff yellowish brown mottled light grey silty CLAY. (PENNINE MIDDLE COAL MEASURES FORMATION) *Between 1.50m and 1.60m: Intermittent presence of semi bright vitrain and clarain coal, recovered as slightly sandy gravel.* *Between 1.60m and 2.00m bgl: stiff locally grey to dark grey.*		
D	1.55							
LB	1.60			(0.60)				
D	1.80							
D	2.00		103.01	2.00		End of Trial Pit at 2.00m		

Method: 20T Tracked Excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial pit backfilled with arisings on completion. See trench sketch for further details.

Length:	30.00m
Width:	0.60m
Logged:	FC
Checked:	SD

APPLiED GEOLOGY

TRIAL PIT LOG

TP1306

Project	Hoyland Common, Barnsley	**Project No.**	AG3080-19
Client	Newlands Developments	**Sheet**	1 of 1
Date	28/05/2020	**Scale**	1:25
Ground Level	110.70m AOD **Coordinates** E 435840.05 N 398828.21	**Total Depth**	3.80m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
					E	Stiff friable brown slightly gravelly CLAY with frequent rootlets. Gravel is fine to coarse angular to subangular mudstone, brick and ironstone. (TOPSOIL/MADE GROUND)		
				(0.50)				
D	0.30							
ES	0.30							
			110.20	0.50	E	Stiff to very stiff light brown and grey slightly sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone and coal. (MADE GROUND - OPENCAST BACKFILL)		
				(0.40)				
D	0.80							
ES	0.80		109.80	0.90	M	Very stiff grey and brown slightly sandy gravelly CLAY. Gravel is fine to coarse angular to subangular mudstone, coal and siltstone. Frequent cobbles of angular to subangular mudstone and siltstone. (MADE GROUND - OPENCAST BACKFILL)		
D	1.50							
ES	1.50							
				(2.10)				
D	2.50							
ES	2.50							
LB	2.50							
			107.70	3.00	M	Very stiff grey and orange slightly sandy slightly gravelly CLAY. Gravel is fine to coarse angular to subangular mudstone. (PENNINE MIDDLE COAL MEASURES FORMATION)		
D	3.20			(0.50)				
			107.20	3.50	H	Extremely weak to very weak grey MUDSTONE recovered as fine to coarse gravel and frequent cobbles. (PENNINE MIDDLE COAL MEASURES FORMATION)		
LB	3.60			(0.30)				
			106.90	3.80		End of Trial Pit at 3.80m		

Method: Tracked Excavator.

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial pit backfilled with arisings on completion. See trench sketch for further details.

Length:	12.00m
Width:	0.80m
Logged:	JW
Checked:	FC

TRIAL PIT LOG

TP1307

Project	Hoyland Common, Barnsley	**Project No.**	AG3080-19
Client	Newlands Developments	**Sheet**	1 of 1
Date	27/05/2020	**Scale**	1:25
Ground Level	105.70m AOD **Coordinates** E 435904.66 N 398828.15	**Total Depth**	4.30m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
				(0.50)	E	Stiff friable brown slightly gravelly CLAY with frequent rootlets. Gravel is fine to coarse subangular to subrounded mudstone, sandstone and brick. (TOPSOIL/MADE GROUND)		
D ES	0.30 0.30							
			105.20	0.50	M	Stiff becoming very stiff light grey and light brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded mudstone and coal. (PENNINE MIDDLE COAL MEASURES FORMATION)		
D	1.00							
				(2.60)				
D	2.00							
			102.60	3.10		Black semi-bright clarain COAL recovered as fine to medium occasionally coarse slightly sand gravel. (SWALLOW WOOD SEAM) (PENNINE MIDDLE COAL MEASURES FORMATION)		
B	3.20			(0.30)				
			102.30	3.40		Very weak to weak grey and orange partially weathered SILTSTONE recovered as fine to coarse angular to subangular gravel and frequent cobbles. (PENNINE MIDDLE COAL MEASURES FORMATION)		
				(0.90)	M-H			
B	4.00							
			101.40	4.30		End of Trial Pit at 4.30m		

Method: Tracked Excavator.

Groundwater: Groundwater not encountered.

Stability: Stable

Remarks: Trial pit backfilled with arisings on completion. Soakaway test undertaken in this trial pit.

Length:	3.80m
Width:	0.70m
Logged:	JW
Checked:	FC

TRIAL PIT LOG

TP1308

Project	Hoyland Common, Barnsley	**Project No.**	AG3080-19
Client	Newlands Developments	**Sheet**	1 of 1
Date	26/05/2020	**Scale**	1:25
Ground Level	106.05m AOD **Coordinates** E 435876.95 N 398785.95	**Total Depth**	2.90m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
						Stiff friable brown slightly gravelly CLAY with frequent rootlets. Gravel is fine to coarse subangular to subrounded mudstone and brick. (TOPSOIL/MADE GROUND)		
D ES	0.30 0.30			(0.60)				
			105.45	0.60		Stiff becoming very stiff orange and grey slightly sandy slightly gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone and fusain coal. (PENNINE MIDDLE COAL MEASURES FORMATION)		
D	0.80			(0.50)				
			104.95	1.10		Black semi-bright and dull fusain COAL recovered as slightly sand fine to medium locally coarse gravel. (SWALLOW WOOD SEAM) (PENNINE MIDDLE COAL MEASURES FORMATION)		
D	1.30			(0.30)				
			104.65	1.40		Very stiff light grey slightly gravelly CLAY. Gravel is fine to coarse angular to subrounded fusain coal, mudstone and siltstone. (PENNINE MIDDLE COAL MEASURES FORMATION)		
LB	1.80			(1.00)				
			103.65	2.40		Very weak to weak grey and brown SILTSTONE recovered as fine to coarse angular to subangular gravel and frequent cobbles of siltstone. (PENNINE MIDDLE COAL MEASURES FORMATION)		
LB	2.50			(0.50)				
			103.15	2.90		End of Trial Pit at 2.90m		

Method: Tracked Excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial pit backfilled with arisings on completion.

Length:	2.80m
Width:	0.70m
Logged:	JW
Checked:	FC

TRIAL PIT LOG

TP1309

Project	Hoyland Common, Barnsley	**Project No.**	AG3080-19
Client	Newlands Developments	**Sheet**	1 of 1
Date	26/05/2020	**Scale**	1:25
Ground Level	101.85m AOD **Coordinates** E 435962.21 N 398799.03	**Total Depth**	3.00m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
				(0.50)	E	Stiff friable brown slightly gravelly CLAY with frequent rootlets. Gravel is fine to coarse angular to subangular brick, mudstone and sandstone. (TOPSOIL/MADE GROUND)		
D ES	0.30 0.30							
			101.35	0.50	E	Stiff becoming very stiff light brown and grey slightly gravelly sandy CLAY. Gravel is fine to coarse subangular to subrounded mudstone and sandstone. (PENNINE MIDDLE COAL MEASURES FORMATION)		
D	0.80			(0.80)				
			100.55	1.30	M	Very stiff friable grey CLAY with fine to coarse subangular to subrounded mudstone and fusain coal lithorelicts. (PENNINE MIDDLE COAL MEASURES FORMATION)		
LB	1.50			(1.20)				
LB	2.50		99.35	2.50	H	Very weak to weak grey and brown SILTSTONE and sandstone. Recovered as fine to coarse angular to subangular gravel of siltstone and sandstone and frequent cobbles of angular to subangular siltstone and sandstone. (PENNINE MIDDLE COAL MEASURES FORMATION)		
				(0.50)				
			98.85	3.00		End of Trial Pit at 3.00m		

Method: Tracked Excavator.

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial pit backfilled with arisings on completion.

Length:	2.80m
Width:	0.70m
Logged:	JW
Checked:	FC

TRIAL PIT LOG

TP1310

Project	Hoyland Common, Barnsley	**Project No.**	AG3080-19
Client	Newlands Developments	**Sheet**	1 of 1
Date	26/05/2020	**Scale**	1:25
Ground Level	102.71m AOD **Coordinates** E 435958.52 N 398750.67	**Total Depth**	3.20m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
ES	0.10			(0.40)	E	Firm to stiff dark brown slightly gravelly silty CLAY with rare rootlets and rare cobbles. Gravel is fine to coarse subangular brick and concrete. Cobbles are subangular brick. (TOPSOIL/MADE GROUND)		
ES	0.30		102.31	0.40				
B	0.50					Firm to stiff locally friable with occasional medium spaced fissure light grey mottled light orangish brown silty CLAY. (PENNINE MIDDLE COAL MEASURES FORMATION)		
D	0.50				E			
D	1.00			(1.10)				
			101.21	1.50				
D	1.60					Stiff light grey and orangish brown silty CLAY with frequent fine to coarse mudstone lithorelicts and rare subrounded ironstone nodules. (PENNINE MIDDLE COAL MEASURES FORMATION)		
LB	1.70			(0.50)	E			
			100.71	2.00		Very weak interbedded very closely fissured grey locally dark grey and orangish brown SILTSTONE and mudstone recovered as slightly gravelly tabular cobbles. (PENNINE MIDDLE COAL MEASURES FORMATION)		
				(1.20)	M			
			99.51	3.20	M/H	End of Trial Pit at 3.20m		

Method: 20T Tracked Excavator.

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial pit backfilled with arisings on completion. Soakaway test undertaken in this trial pit.

Length:	3.00m
Width:	0.60m
Logged:	FC
Checked:	SD

TRIAL PIT LOG

TP1311

Project	Hoyland Common, Barnsley	**Project No.**	AG3080-19
Client	Newlands Developments	**Sheet**	1 of 1
Date	01/06/2020	**Scale**	1:25
Ground Level	103.88m AOD **Coordinates** E 435921.57 N 398800.63	**Total Depth**	1.70m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
				(0.50)	E	Stiff friable brown slightly gravelly CLAY with frequent rootlets. Gravel is fine to coarse angular to subrounded mudstone and ironstone. (TOPSOIL/MADE GROUND)		
			103.38	0.50				
LB	0.70				E	Stiff light brownish orange slightly sandy slightly gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone and fusain coal. (PENNINE MIDDLE COAL MEASURES FORMATION)		
LB	0.70			(0.50)				
			102.88	1.00				
					M	Very stiff light grey to grey slightly gravelly CLAY. Gravel is fine to coarse angular to subangular mudstone, siltstone and fusain coal. (PENNINE MIDDLE COAL MEASURES FORMATION)		
				(0.70)				
LB	1.50							
			102.18	1.70		End of Trial Pit at 1.70m		

Method: Tracked Excavator.

Groundwater: Groundwater not encountered.

Stability: Stable

Remarks: Trial pit backfilled with arisings on completion.

Length:	2.50m
Width:	0.70m
Logged:	JW
Checked:	FC

APPLiED GEOLOGY

TRIAL PIT LOG

TP1312

Project	Hoyland Common, Barnsley	**Project No.**	AG3080-19
Client	Newlands Developments	**Sheet**	1 of 1
Date	01/06/2020	**Scale**	1:25
Ground Level	108.36m AOD **Coordinates** E 435913.99 N 398893.17	**Total Depth**	3.50m

Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Ease of Dig	Description of Strata	Legend	GW
				(0.35)	E	Stiff friable brown slightly gravelly CLAY with frequent rootlets. Gravel is fine to coarse angular to subrounded mudstone and brick. (TOPSOIL/MADE GROUND)		
			108.01	0.35	M	Stiff to very stiff dark grey and brown slightly sandy gravelly CLAY. Gravel is fine to coarse angular to subangular mudstone and fusain coal. (MADE GROUND - OPENCAST BACKFILL)		
LB	1.00							
				(2.25)				
			105.76	2.60	M	Stiff to very stiff grey to dark grey gravelly CLAY and light brown slightly gravelly slightly silty sand. Gravel is fine to coarse angular to subangular mudstone and coal. (MADE GROUND - OPENCAST BACKFILL)		
LB	3.00							
				(0.90)				
			104.86	3.50		End of Trial Pit at 3.50m		

Method: Tracked Excavator

Groundwater: Groundwater not encountered.

Stability: Stable.

Remarks: Trial pit backfilled with arisings on completion.

Length:	2.80m
Width:	0.80m
Logged:	JW
Checked:	FC

BOREHOLE LOG - ROTARY

RC4101

Project	Hoyland Common, Barnsley			**Project No.**	AG3080-19
Client	Newlands Developments			**Sheet**	1 of 1
Start	20/05/2020	**Coordinates**	E 435960.61 N 398967.35	**Scale**	1:50
End	20/05/2020	**Ground Level**	106.60m AOD	**Total Depth**	8.60m

Depth (m)	TCR SCR RQD	If	Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
						106.40	(0.20)	Topsoil (Driller description)			
							0.20	(TOPSOIL/MADE GROUND)			
						106.20	(0.20)	Brown CLAY (Driller description)			
						106.00	0.40	(MADE GROUND - OPENCAST BACKFILL)			
							(0.20)	Grey CLAY (Driller description)			
							0.60	(MADE GROUND - OPENCAST BACKFILL)			
							(0.90)	Grey GRAVEL of mudstone (Driller description)			
								(MADE GROUND - OPENCAST BACKFILL)			
1.50			D	1.50		105.10	1.50	Stiff becoming very stiff brown to dark brown and dark grey gravelly CLAY. Gravel is fine to coarse angular to subrounded mudstone, siltstone and coal.			
			ES					(MADE GROUND - OPENCAST BACKFILL)			
	100		B	2.00				*From 1.50m to 1.80m bgl: very gravelly with occasional gravel of brick.*			
	0										
2.50	0										
	100										
	0						(3.20)				
	0										
3.50											
	100										
	0		D	4.00							
	0		ES								
4.30											
	100							*From 4.40m to 4.60m bgl: very gravelly.*			
4.70						101.90	4.70	Very weak to weak thickly bedded light grey SANDSTONE and SILTSTONE. Distinctly weathered from 4.70m to 6.65m bgl. Slightly weathered from 6.65m to 8.60m bgl. Fractures dip > 5 degrees closely to very closely spaced undulating smooth.			
	33							(PENNINE MIDDLE COAL MEASURES FORMATION)			
	13							*From 4.70m to 5.00m bgl: recovered as gravel of fine to coarse angular to subangular siltstone.*			
	12	NI									
		20									
		35	D	6.00							
6.20			D					*From 6.20m to 6.50m bgl: recovered as gravel of fine to coarse angular to subangular siltstone.*			
							(3.90)	*From 6.50m to 6.65m bgl: recovered as stiff light grey slightly gravelly clay. Gravel is fine to coarse angular to subangular silstone.*			
	90										
	50										
	34		C	7.07 - 7.20							
		NI						*At 7.45m bgl: fracture at 75 degrees dip undulating rough.*			
		95									
7.70		260						*From 7.70m to 8.15m bgl: fracture at 90 degrees dip undulating rough.*			
	88										
	72							*At 8.20m bgl: fracture at 75 degrees dip planar smooth.*			
	0										
8.60						98.00	8.60	*From 8.45m to 8.60m bgl: recovered as gravel of fine to coarse angular to subangular siltstone.*			
								End of Borehole at 8.60m			

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

Remarks: Dynamic sampling to 4.70m bgl, rotary cored from 4.70m to 8.60m bgl.

Groundwater Strikes

Depth Strike	Rise	Remarks	Cased	Sealed

Drilled: Ace Drilling Services Ltd

Logged: JW

Checked: FC

Diameter: 140mm to 1.50m
123mm to 8.60m

APPLiED GEOLOGY

BOREHOLE LOG - ROTARY

RC4102

Project	Hoyland Common, Barnsley			**Project No.**	AG3080-19
Client	Newlands Developments			**Sheet**	1 of 1
Start	21/05/2020	**Coordinates**	E 435971.49 N 398896.77	**Scale**	1:50
End	22/05/2020	**Ground Level**	105.22m AOD	**Total Depth**	8.00m

Depth (m)	TCR SCR RQD	If	Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
0.00			D	0.15			(0.25)	Stiff and friable brown slightly gravelly slightly sandy CLAY with frequent rootlets. Gravel is fine to coarse angular to subrounded brick and mudstone. (MADE GROUND/TOPSOIL)			
	100 0 0		ES			104.97	0.25				
			D	0.40		104.77	(0.20)	Stiff brown and grey slightly gravelly CLAY. Gravel is fine to coarse angular to subrounded coal and mudstone. (MADE GROUND - OPENCAST BACKFILL)			
							0.45				
1.30			D	1.30				Stiff becoming very stiff grey to dark grey and brown to dark brown gravelly CLAY. Gravel is fine to coarse angular to subrounded coal, brick and mudstone. (MADE GROUND - OPENCAST BACKFILL)		
	100 0 0		D					*Between 0.80m to 1.30m bgl: mudstone boulder.*			
			ES								
			B	2.00			(3.05)				
			B								
2.50											
	100 0 0										
			D	3.40							
3.50			ES			101.72	3.50	Black semi-bright clarain COAL. (SWALLOW WOOD SEAM) (PENNINE MIDDLE COAL MEASURES FORMATION)			
			D	3.70			(0.50)	*From 3.85m to 3.95m bgl: recovered as gravel of fine to coarse angular to subangular coal.*			
						101.22	4.00	Extremely weak to very weak thinly bedded grey MUDSTONE. Distinctly weathered from 4.00m to 6.50m bgl. Slightly weathered from 6.50m to 8.00m bgl. Fractures dip 5 degrees extremely closely to closely spaced undulating smooth. (PENNINE MIDDLE COAL MEASURES FORMATION)			
	83 57 39		D	4.50				*From 4.40m to 4.60m bgl: recovered as gravel of fine to coarse angular to subangular mudstone.*			
5.00								*From 5.00m to 5.10m bgl: recovered as gravel of fine to coarse angular to subangular mudstone.*			
			C	5.29 - 5.43							
	90 81 49	NI 85 310					(4.00)				
6.50			C	6.58 - 6.72							
			D	7.00							
	97 88 24		D					*From 7.50m to 7.80m bgl: fracture at 90 degree dip planar rough.*			
8.00						97.22	8.00	End of Borehole at 8.00m			

Installation: 50mm diameter standpipe installed to 3.50m bgl.

Remarks: Dynamic sampling to 0.80m bgl. From 0.80m to 1.30m bgl open hole techniques used to progress through boulder. Dynamic sampling from 1.30m bgl. Rotary cored from 3.50m to 8.00m bgl.

Groundwater Strikes

Depth Strike	Rise	Remarks	Cased	Sealed
7.75	0 00	Dip		

Drilled: Ace Drilling Services Ltd

Logged: JW

Checked: FC

Diameter: 140mm to 3.50m
123mm to 8.00m

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

APPLiED GEOLOGY

BOREHOLE LOG - ROTARY

RC4103

Project	Hoyland Common, Barnsley	**Project No.**	AG3080-19
Client	Newlands Developments	**Sheet**	1 of 2
Start	19/05/2020 **Coordinates** E 435881.15 N 398865.80	**Scale**	1:50
End	20/05/2020 **Ground Level** 109.52m AOD	**Total Depth**	12.00m

Depth (m)	TCR SCR RQD	If	Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
							(0.25)	Topsoil (Driller description)			
						109.27	0.25	(TOPSOIL/MADE GROUND)			
						109.07	(0.20)	Brown CLAY (Driller description)			
						108.92	0.45	(MADE GROUND - OPENCAST BACKFILL)			
							(0.15)	Grey CLAY (Driller description)			
							0.60	(MADE GROUND - OPENCAST BACKFILL)			
							(0.90)	Grey GRAVEL of mudstone (Driller description)			
								(MADE GROUND - OPENCAST BACKFILL)			
1.50						108.02	1.50				
	80 0 0		ES	1.80				Stiff becoming very stiff grey and brown very gravelly CLAY. Gravel is fine to coarse angular to subangular mudstone, ironstone, and coal.			
			B	2.10				(MADE GROUND - OPENCAST BACKFILL)			
2.50											
	80 0 0										
			D	3.40			(3.60)				
3.50			ES								
3.70	100							*From 3.70m to 4.70m bgl: gravel of fine to coarse angular to subangular mudstone and ironstone.*			
	20 0 0										
4.70								*From 4.70m to 5.10m bgl: clayey gravel of fine to coarse angular to subangular mudstone and ironstone.*			
	100		D	4.90							
5.10			ES			104.42	5.10	Extremely weak thinly bedded grey MUDSTONE. Distinctly weathered. Fractures dip <5 degrees extremely closely to very closely spaced, undulating smooth.			
			C	5.56 - 5.75			(1.00)	(PENNINE MIDDLE COAL MEASURES FORMATION)			
	94 73 52	NI 90 190	C	5.95 - 6.05				*From 5.10m to 5.20m bgl: recovered as gravel of fine to coarse angular to subangular mudstone.*			
						103.42	6.10	*From 6.05m to 6.10m bgl: recovered as gravel of fine to coarse angular to subangular mudstone.*			
6.50								Very weak interbedded light grey SILTSTONE and grey MUDSTONE. Slightly weathered. Fractures dip <5 degrees very close to close spacing undulating smooth and planar.			
			C	6.77 - 6.97				(PENNINE MIDDLE COAL MEASURES FORMATION)			
	95 90 61	NI 130 350	C	6.97 - 7.25							
							(3.00)	*From 7.60m to 7.70m bgl: fracture at 80 degrees dip undulating smooth.*			
8.00			D	8.00				*From 7.75m to 7.80m bgl: recovered as gravel of fine to coarse angular to subangular mudstone and siltstone.*			
			D					*From 7.90m to 8.00m bgl: several <2mm bands of vitrain coal.*			
	65 29 0	NI 40 85									
						100.42	9.10	Black semi-bright vitrain COAL recovered as slightly sandy subangular fine to coarse gravel.			
							(0.35)	(PENNINE MIDDLE COAL MEASURES FORMATION)			
9.50						100.07	9.45	Weak thickly bedded light grey SANDSTONE. Slightly weathered. Fractures dip <5 degrees close to medium spacing			

Continued next sheet

Installation: 50mm diameter standpipe installed to 11m bgl.
Remarks: Dynamic sampling to 3.70m bgl rotary core drilling from 3.70m to 4.70m bgl, dynamic sampling to 5.10m bgl. Rotary drilling from 5.10m to 12.00m bgl.

Groundwater Strikes

Depth Strike	Rise	Remarks	Cased	Sealed

Drilled: Ace Drilling Services Ltd
Logged: JW
Checked: FC

Diameter: 140mm to 4.50m
123mm to 12.00m

APPLiED GEOLOGY

BOREHOLE LOG - ROTARY

RC4103

Project	Hoyland Common, Barnsley			**Project No.**	AG3080-19
Client	Newlands Developments			**Sheet**	2 of 2
Start	19/05/2020	**Coordinates**	E 435881.15 N 398865.80	**Scale**	1:50
End	20/05/2020	**Ground Level**	109.52m AOD	**Total Depth**	12.00m

Depth (m)	TCR SCR RQD	If	Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
	97 83 68		C	10.35 - 10.50			(2.20)	Weak thickly bedded light grey SANDSTONE. Slightly weathered. Fractures dip <5 degrees close to medium spacing undulating rough. (PENNINE MIDDLE COAL MEASURES FORMATION) *From 9.70m to 9.80m bgl: recovered as gravel of fine to coarse angular to subangular sandstone and siltstone.* *From 10.50m to 10.65m bgl: fracture at 75 degrees dip planar rough. Occasional ironstone nodules <10m size throughout.*			
11.00		NI 130 350	C	11.10 - 11.32							
	100 100 72					97.87	11.65 (0.35)	Very weak thinly bedded grey to dark grey MUDSTONE. Slightly weathered. Fractures dip <5 degrees very closely to closely spaced planar smooth. (PENNINE MIDDLE COAL MEASURES FORMATION) *At 11.65m bgl: fractures at 45 degrees dip planar smooth. Occasional ironstone nodules <10m size throughout.* *At 11.75m bgl: fractures at 45 degrees dip planar smooth. Occasional ironstone nodules <10m size throughout.* *At 11.85m bgl: fractures at 45 degrees dip planar smooth. Occasional ironstone nodules <10m size throughout.*			
12.00						97.52	12.00	End of Borehole at 12.00m			

Installation: 50mm diameter standpipe installed to 11m bgl.
Remarks: Dynamic sampling to 3.70m bgl rotary core drilling from 3.70m to 4.70m bgl, dynamic sampling to 5.10m bgl. Rotary drilling from 5.10m to 12.00m bgl.

Groundwater Strikes

Depth Strike	Rise	Remarks	Cased	Sealed

Drilled: Ace Drilling Services Ltd
Logged: JW
Checked: FC

Diameter: 140mm to 4.50m
123mm to 12.00m

APPLiED GEOLOGY

BOREHOLE LOG - ROTARY

RC4104

Project	Hoyland Common, Barnsley			**Project No.**	AG3080-19
Client	Newlands Developments			**Sheet**	1 of 1
Start	18/05/2020	**Coordinates**	E 435856.31 N 398838.52	**Scale**	1:50
End	18/05/2020	**Ground Level**	110.22m AOD	**Total Depth**	9.50m

Depth (m)	TCR SCR RQD	If	Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
						109.92	(0.30) 0.30	Firm locally stiff friable brown silty, slightly sandy, slightly gravelly CLAY with occasional cobbles. Gravel is fine to coarse subangular to rounded siltstone, sandstone and brick. Cobbles are subangular siltstone, sandstone and brick. (TOPSOIL/MADE GROUND)			
1.50	100 0 0		D	1.70			(2.90)	Firm to stiff friable brownish grey and greyish brown slightly sandy, gravelly, silty CLAY. Gravel is fine to coarse angular to subrounded siltstone, mudstone, coal and ironstone. (MADE GROUND - OPENCAST BACKFILL)			
2.50	100 0 0		D ES D B	2.30 2.40 2.50				*From 2.80m to 3.15m bgl: very gravelly.*			
3.50	100		D	3.40		107.02	3.20	Soft to firm dark grey mottled grey and orangish brown slightly gravelly silty CLAY. Gravel is fine subangular of coal, mudstone. (MADE GROUND - OPENCAST BACKFILL)			
3.70	0 0 0					106.22	(0.80) 4.00	*From 3.40m to 3.70m bgl: firm.* Light grey and grey mudstone (Driller description) (PENNINE MIDDLE COAL MEASURES FORMATION)			
4.70	83					105.52	(0.70) 4.70				
5.00	100 57 30		D	5.50		105.22	(0.30) 5.00	Grey and dark brown MUDSTONE and IRONSTONE, recovered as gravelly cobbles. High drilling disturbance due to presence of ironstone. (PENNINE MIDDLE COAL MEASURES FORMATION)			
5.70	88 65 56		C C	5.88 - 6.08 6.08 - 6.17			(1.50)	Very weak to weak thickly bedded light grey SILTSTONE. Distinctly weathered. Fractures dip <5 degrees very closely to closely spaced undulating rought. (PENNINE MIDDLE COAL MEASURES FORMATION) *From 5.40m to 5.50m bgl: recovered as gravel of fine to coarse angular to subangular siltstone.* *At 6.20m bgl: fracture at 20 degrees dip undulating rough.*			
6.50	93 67 31	NI 90 220	C D	6.95 - 7.07 7.50		103.72	6.50 (1.70)	Extremely weak to very weak thinly bedded grey and dark grey MUDSTONE. Distinctly weathered. Fractures dip <5 degrees very closely spaced planar smooth. (PENNINE MIDDLE COAL MEASURES FORMATION) *From 6.75m to 6.90m bgl: recovered as fine to coarse angular to subangular gravel of mudstone.* *At 6.95m bgl: black bright vitrain in coal bands <15mm thick.* *At 7.28m bgl: black bright vitrain in coal bands <15mm thick.* *At 7.34m bgl: black bright vitrain in coal bands <15mm thick.* *At 7.60m bgl: black bright vitrain in coal bands <15mm thick.* *At 7.71m bgl: black bright vitrain in coal bands <15mm thick.*			
8.00	93 90 82	30 350 680	C C C	8.78 - 8.99 8.99 - 9.36 9.30 - 9.43		102.02	8.20 (1.30)	Weak thickly bedded light grey SILTSTONE. Slightly weathered. Fractures dip <5 degrees closely spaced undulating rough. Subvertical calcite/quartz lenses (up to 50mm length) present throughout. (PENNINE MIDDLE COAL MEASURES FORMATION)			
9.50						100.72	9.50	End of Borehole at 9.50m			

Installation: 50mm diameter standpipe installed to 8.00m bgl.

Remarks: Dynamic sampling to 3.70m bgl, rotary open hole drilling to 4.70m bgl. Rotary core drilling from 4.70m to 9.50m bgl

Groundwater Strikes

Depth Strike	Rise	Remarks	Cased	Sealed

Drilled: Ace Drilling Services Ltd

Logged: FC/JW

Checked: SD

Diameter: 140mm to 1.50m
123mm to 9.50m

APPLiED GEOLOGY

BOREHOLE LOG - ROTARY

RC4105

Project	Hoyland Common, Barnsley			**Project No.**	AG3080-19
Client	Newlands Developments			**Sheet**	1 of 1
Start	22/05/2020	**Coordinates**	E 435935.16 N 398777.52	**Scale**	1:50
End	22/05/2020	**Ground Level**	103.00m AOD	**Total Depth**	7.00m

Depth (m)	TCR SCR RQD	If	Sample / Test Type	Depth (m)	Result	Level (mAoD)	Strata Depth (thickness) (m)	Description of Strata	Legend	GW	Install
0.00	100 0 0		D	0.30			(0.55)	Stiff and friable brown slightly gravelly CLAY with frequent rootlets. Gravel is fine to coarse angular to subrounded mudstone, sandstone and brick. (MADE GROUND/TOPSOIL)			
			ES			102.45	0.55				
			D	0.65				Stiff becoming very stiff grey and light brown slightly gravelly sandy CLAY. Gravel is fine to coarse subangular to subrounded mudstone, sandstone. (PENNINE MIDDLE COAL MEASURES FORMATION)			
0.80	0						(0.90)	*Between 0.80m and 1 20m bgl: sandstone cobble/boulder encountered, open hole techniques used.*			
1.20	100										
1.35						101.55	1.45	Very stiff grey slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded mudstone. (PENNINE MIDDLE COAL MEASURES FORMATION)			
	96 0 0		D	1.70			(1.15)				
2.60						100.40	2.60	*At 2.45m bgl c. 5mm band of black fusain coal.*			
	100		D	2.70				Very weak interbedded grey MUDSTONE and SILTSTONE. Distinctly weathered. Fractures <5 degrees dip, very closely to closely spaced planar smooth and rough. (PENNINE MIDDLE COAL MEASURES FORMATION)			
3.00	100 28 0		D	3.50			(1.35)	*From 3.000m to 3.10m bgl: recovered as gravel of fine to coarse angular to subangular mudstone and siltstone.*			
4.00						99.05	3.95	Very weak thinly bedded grey and dark grey MUDSTONE. Distinctly weathered. Fractures <5 degrees dip, very closely to closely spaced planar smooth. (PENNINE MIDDLE COAL MEASURES FORMATION)			
	85 70 0	NI 55 230	D	4.60				*From 4.05m to 4.10m bgl: recovered as gravel of fine to coarse angular to subangular mudstone. Light brown ironstone nodules (>20mm length) present throughout.*			
			D	4.80				*From 4.55m to 4.60m bgl: recovered as gravel of fine to coarse angular to subangular mudstone. Light brown ironstone nodules (>20mm length) present throughout.*			
5.00	90 40 0		D	5.50			(3.05)	*From 5.40m to 5.55m bgl: recovered as gravel of fine to coarse angular to subangular mudstone. Light brown ironstone nodules (>20mm length) present throughout.*			
6.00											
	90 65 23		C	6.40 - 6.48				*From 6.20m to 6.30m bgl: recovered as gravel of fine to coarse angular to subangular mudstone. Light brown ironstone nodules (>20mm length) present throughout.*			
7.00						96.00	7.00	End of Borehole at 7.00m			

Installation: 50mm diameter standpipe installed to 3.00m bgl.

Remarks: Dynamic sampling to 0.80m bgl rotary open hole drilling from 0.80m to 1.20m bgl, dynamic sampling to 1.35m bgl. Rotary drilling from 1.35m to 7.00m bgl.

Groundwater Strikes

Depth Strike	Rise	Remarks	Cased	Sealed

Drilled: Ace Drilling Services Ltd

Logged: JW

Checked: FC

Diameter: 140mm to 0.80m
123mm to 7.00m

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	-

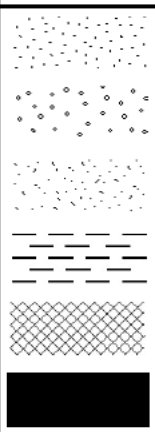
Rotary Core Notation

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

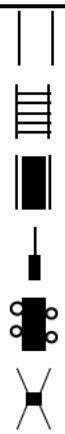
Concrete

Bentonite

Arisings

Grout

Installation Symbols



Plain Standpipe

Slotted Standpipe

Piezometer

Vibrating Wire Piezometer

Inclinometer

Extensometer
(with magnet locations)

Groundwater (GW)



Rise

Groundwater Str ke -
with Recorded Rise

Strike

Groundwater Str ke -
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

NR NR
NR NR

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 C


APPLIED
GEOLOGY
DATE
27/05/2020
JOB REF
Hoyland Common, Barnsley
JOB NO
AG3080-19
TP REF
TP130
DEPTH
FACE




APPLIED GEOLOGY
DATE
JOB REF
JOB NO
TP REF
TP1502
DEPTH
FACE




APPLIED
GEOLOGY
DATE
26/05/2020
JOB REF
JOB NO
TP REF
TP1303
DEPTH
3.50M
FACE




APPLIED
GEOLOGY
DATE
27/05/2020
JOB REF
Hoyland Common, Barnsley
JOB NO
AG3080-19
TP REF
TP130
DEPTH
FACE




PPLIED
EOLOGY
DATE
26/05/2020
JOB REF
Hoyland Common, Barnsley
JOB NO
AG3080-19
TP REF
TP130S
DEPTH
1.50M (bench)
FACE




CASE
APPLIED GEOLOGY
DATE
JOB REF
JOB NO
TP REF
DEPTH
FACE




APPLIED
GEOLOGY
JOB REF
JOB NO
TP REF
DEPTH
FACE
DATE




CASE
CX210D
APPLIED GEOLOGY
DATE
JOB REF
JOB NO
TP REF
DEPTH
FACE




APPLIED
GEOLOGY
DATE
JOB REF
JOB NO
TP REF
TP1309
DEPTH
3.0m
FACE




DATE
TP1S1C
320M




APPLIED
GEOLOGY
DATE
JOB REF
JOB NO
TP REF
DEPTH
FACE



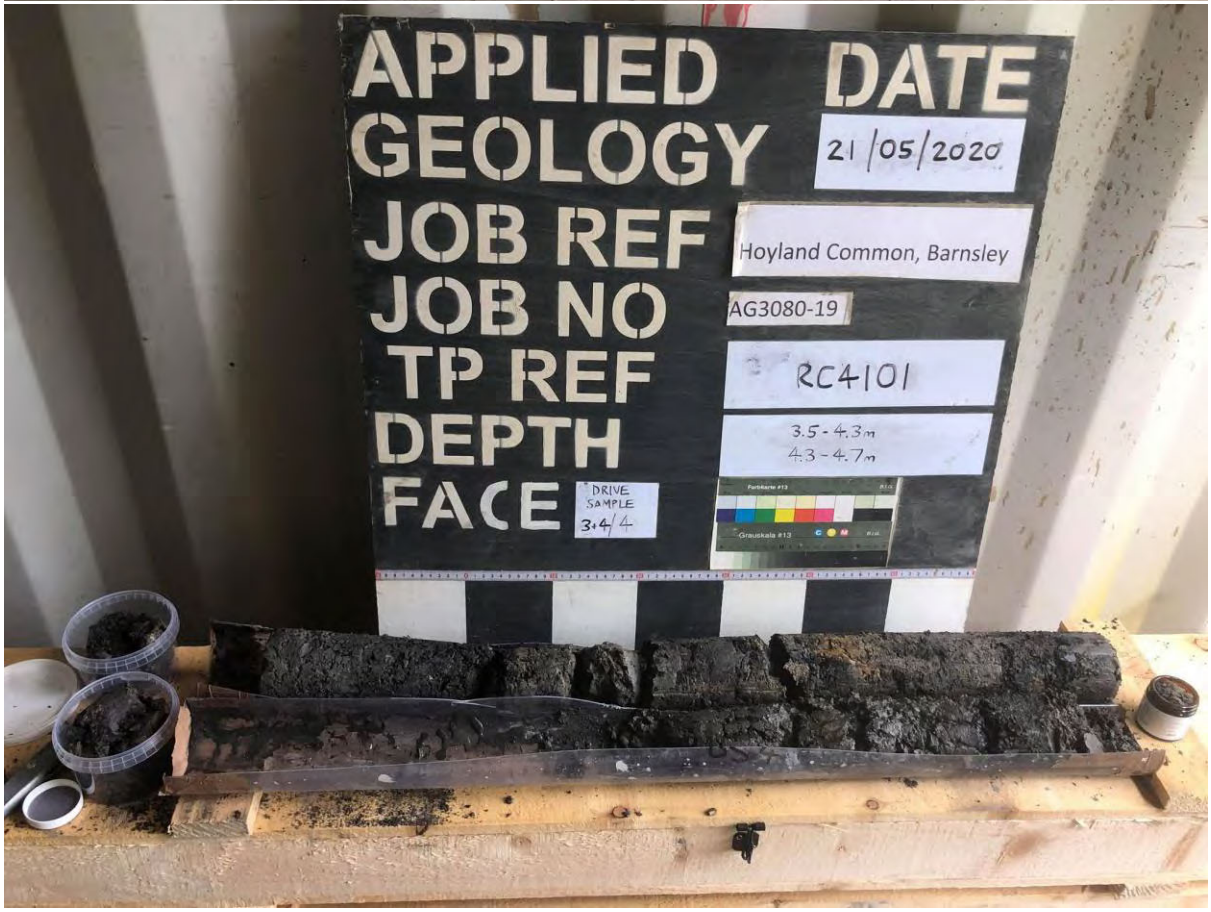

APPLIED
GEOLOGY
DATE
JOB REF
JOB NO
TP REF
DEPTH
FACE




APPLIED GEOLOGY
DATE
21/05/2020
JOB REF
Hoyland Common, Barnsley
JOB NO
AG3080-19
TP REF
RC4101
DEPTH
1.5 - 2.5m
2.5 - 3.5m
FACE
DRIVE SAMPLE 1+2/4


FACE
DRIVE SAMPLE 1+2/4


Grauskala #13
B.I.G.


APPLIED GEOLOGY
DATE
21/05/2020
JOB REF
Hoyland Common, Barnsley
JOB NO
AG3080-19
TP REF
RC4101
DEPTH
3.5-4.3m
4.3-4.7m
FACE
DRIVE SAMPLE
3:4/4


FACE
DRIVE
SAMPLE
3+4/4


Farbkarte #13
B.I.G.
Grauskala #13
B.I.G.