Our ref: 25-396.01L

F.A.O. Matthew Norris

One 17 Structural Design
The Dyehouse
Armitage Bridge
Huddersfield
West Yorkshire
HD4 7PD

Arc Environmental Ltd
Solum House
Unit 1 Elliott Court
St Johns Road
Meadowfield
Durham
DH7 8PN

02nd June 2025

Dear Matthew,

Re: Coal Mining Risk Assessment (CMRA) – Proposed New Residential Properties, Units 11 - 12 & 13 - 14, Manor Avenue, Savile Town, Dewsbury, West Yorkshire

1.0 Introduction:-

Arc Environmental Limited (ARC) have been requested by One 17 Structural Design, to undertake a Coal Mining Risk Assessment (CMRA) for the construction of four new detached dwellings (Units 11 - 12 and 13 - 14) within the established Manor Avenue residential development off Caledonian Road, Savile Town, Dewsbury.

The National Grid Reference for the central part of the proposed development area is 424456, 420475. The purpose of this CMRA Report is to provide the Local Planning Authority (LPA) with information on historical coal mining activities and workings with a view to assessing the potential impact on land stability in relation to the proposed new development. This CMRA Report has been prepared in accordance with the requirements of the Coal Authority Guidance Document, reference; Risk Based Approach to Development Management, Guidance for Developers (Version 4 – 2017).

The geological and coal mining assessment for this proposed development has been based on records produced by the British Geological Survey (BGS), including publicly available archive borehole records, the Mining Remediation Authority (MRA) formerly the Coal Authority (CA) interactive map viewer and a site specific CA Consultants Coal Mining Report, as well as extensive intrusive site investigation works covering these plots (as part of the wider historical development area) and adjacent areas. The following documents have been reviewed as part of this CMRA;

- BGS Sheet 77, Huddersfield, Solid and Drift Geology, 1:50,000 scale, 2003.
- BGS County Series; Sheet 247 NE, 1:10,560, 1928.
- CA Consultants Coal Mining Report, reference; 51003502404001 (copy attached).
- Archive BGS Borehole Log Record SE22SW960 – Ravenslodge Colliery, Dewsbury.

Re: Coal Mining Risk Assessment (CMRA) – Proposed New Residential Properties, Units 11 - 12 & 13 - 14, Manor Avenue, Savile Town, Dewsbury, West Yorkshire (Cont'd)

1.0 Introduction (Cont'd):-

In addition, reference has been made to the following historical site investigation data, provided by the Client and with relevant extracts attached:

- Dunelm Drilling Company – Job no. C8761 for Robinson Consulting Engineers, November 1996 – 10 no. Trial Pits and 3 no. Rotary Boreholes with location plan (copies also available on the BGS Geology of Britain viewer). This relates to the constructed housing (referred to as The Sidings) to the north of the adjacent Sidings Health Centre.
- Robinson Environmental Limited (REL) Phase 2: Ground Investigation Report (incomplete copy), Ref. RE/002074, March 2001. This relates to the same site as the Dunelm Drilling Company trial pit and borehole logs.
- REL Ground Engineering Interpretative Report, Ref. 05-5648RE, May 2006. This relates to all the land within the ongoing Manor Avenue residential development including the Sidings Health Centre plot and Plots 6/7 & 8/9.
- Robinson Geo Engineering (RGE) Ground Gas & Contamination Assessment, Ref. 06-6184RGE, May 2007. This relates to same area as the REL report from May 2006 with additional investigation for a parcel of land immediately adjacent to Caledonian Road.
- Arc Environmental Ltd. – Letter Report Ref. 11-183.02L, 2nd June 2011. This relates to additional trench excavations completed within the parcel of land immediately adjacent to Caledonian Road.
- Arc Environmental Ltd. – Letter Report Ref. 11-183.04L, 22nd January 2013. This relates to additional intrusive investigation works (cable percussive and rotary boreholes) for the adjacent Sidings Heath Centre development.
- Arc Environmental Ltd. – Letter Report Ref. 11-183.06L, 3rd September 2013. This relates to supplementary intrusive investigation works (cable percussive, rotary and windowless sampling boreholes) for the Manor Avenue residential development.

2.0 Geological Setting & Ground Profile:-

2.1 Made Ground:-

Published BGS data identifies that significant made ground deposits are present across this site, associated with the historical infilling of the former railway cutting and this has been confirmed through the various historical intrusive investigation works completed across this site and adjacent development areas. From the historical borehole and trial pit site investigation data, directly attributable or in close proximity to this site, locally the depth of made ground has been recorded at depths of between c.3.50m and c.6.10m bgl.

2.2 Superficial Deposits/Residual Soils:-

The BGS data identifies that the site lies within an area absent of superifical deposits, with the solid geology present at or close to ground level. From the historical site investigation works, no significant thicknesses of superifical deposits have been recorded.

Re: Coal Mining Risk Assessment (CMRA) – Proposed New Residential Properties, Units 11 - 12 & 13 - 14, Manor Avenue, Savile Town, Dewsbury, West Yorkshire (Cont'd)

2.0 Geological Setting & Ground Profile (Cont'd):-

2.2 Superficial Deposits/Residual Soils (Cont'd):-

However, within some of the investigation positions thin layers of 'residual soils' (completely weathered materials arising from the underlying parent bedrock deposits) have been recorded, typically comprising sandy gravelly clays.

2.3 Solid Geology:-

The solid deposits are shown to comprise the Pennine Lower Coal Measures (PLCM) formation, deposited during a period of the Earth's history known as the Carboniferous, and typically comprising cyclical alternations of shales, mudstones, siltstones, sandstones, productive coal seams and seatearths / fireclays.

The proposed development area is shown to be underlain by the Birstall Rock (BR) sandstone unit, with the shallowest potentially productive named coal seam below the site recorded as the 2nd Brown Metal (2BM) coal seam (formerly known as the 2nd Old Hards / Hards Coal), and is shown to subcrop c.60m to the northwest of the site. Locally, the seam has been recorded with thicknesses of between c.0.30m to c.0.71m and is shown to dip below the proposed development area in a south easterly direction at an angle of c.4°, which in turn indicates that the 2BM seam is potentially present at a shallow depth of <10m below rock head.

The next shallowest recorded coal seam is the 3rd Brown Metal (3BM) seam (formerly 3rd Old Hards / Hards Coal), shown to subcrop c.300m to the northwest, with a seam thickness of up to c.0.76m and is locally recorded as c.15m below the base of the 2BM seam, which indicates that the 3BM seam could also be at a shallow depth, i.e. <30m, below this site.

The 1st Brown Metal (1BM) seam (formerly 1st Old Hards / Hards Coal) is shown to the subcrop c.100m to the southeast of the site, dipping away from this site and therefore this seam will not be present below the proposed development area.

There are no geological faults shown on or across the site and none are shown adjacent. A fault, recorded as the Thornhill Fractures, is inferred c.100m to the east, trending northwest to southeast and with the downthrow to northeast.

3.0 MRA Data & Consultants Coal Mining Report:-

In accordance with the MRA Online Interactive Map Viewer, the site is shown to lie within a coal mining reporting area and the whole of the site is defined as a development high risk area (DHRA). There are no past recorded shallow or deep coal workings present below the site, but with the presence of the 2BM and 3BM coal seams at potentially shallow depths below the site, the area is identified as lying in an area of probable shallow coal mine workings.

3.0 MRA Data & Consultants Coal Mining Report (Cont'd):-

There are no known, recorded or suspected mine entries (shafts or adits) on or within close proximity to the site (100m) and no coal seams are shown to subcrop below the proposed development area.

A Consultants Coal Mining Report (ref. 51003502404001) has been obtained from the MRA to further assess the risks posed to the site with respect to possible instability issues arising in the future as a direct result of past shallow coal mining activities, and this concurs with the online data reviewed.

The CA report confirms that there are no recorded workings or spine roadways at shallow depths below the site, but probable unrecorded shallow workings may be present. There are no mine entries on the site or in close proximity (100m) of the site boundary and no coal seams outcropping below the site.

Similarly, there are no geological faults, fissures or breaklines, opencast mines or CA managed tips on or in close proximity to the site. The CA have received no coal mining subsidence claims for the subject property or for any property within 50m since 31st October 1994, and there are no current Stop Notices applicable to the site nor is the CA aware of any requests for preventative works prior to coal being worked under Section 33 of the Coal Mining Subsidence Act of 1991. There are no mine gas sites or mine water treatment schemes within 500m of the site boundary.

4.0 Historical Site Investigation and Development Data:-

The relevant extracts (primarily borehole and trial pit location plans and logs) from the various historical site investigation works for this site and adjacent areas can be found in Appendices III – VI.

4.1 Dunelm Drilling Company (1996) & REL Site Investigation Records (Appendix III):-

The Dunelm Drilling Company rotary boreholes (to depths of 30.00m bgl) and trial pits, as well as the REL trench excavations, were completed for the now constructed 'The Sidings' housing development to the north of the Sidings Health Centre and was the first phase of the development of the former railway cutting and tracks, heading south from Savile Road. Although the conjectured position of the subcrop for the 2BM (2nd Old Hards/Hards) seam cuts across this site, none of the 1996 trial pits and boreholes encountered this seam with the majority of the investigation positions located north of the anticipated position of the subcrop of the 2BM seam.

As can be seen from two of the three rotary boreholes (RBH's 2 & 3), rockhead was recorded at between 1.00m and 1.50m bgl and a thin (0.20m to 0.30m) coal seam was recorded at depths of between 23.30m and 24.50m bgl, which is taken as being representative of the 3BM seam. There was no evidence of any unrecorded workings, voiding or broken ground/collapsed workings noted in this seam nor in RBH1.

Re: Coal Mining Risk Assessment (CMRA) – Proposed New Residential Properties, Units 11 - 12 & 13 - 14, Manor Avenue, Savile Town, Dewsbury, West Yorkshire (Cont'd)

4.0 Historical Site Investigation and Development Data (Cont'd):-

4.1 Dunelm Drilling Company (1996) & REL Site Investigation Records (Appendix III) (Cont'd):-

As part of the REL 2001 investigation works, a series of three trench excavations were carried out to locate the outcrop of the 2BM seam. Unfortunately, the copy of this report is incomplete and does not contain the log for the first trench, which did not encounter the 2BM seam, nor a location plan showing the positions of each of the trench excavations. However, it is understood that the trench excavations were completed at the southern end of the residential site and potentially extending into the Sidings Health Centre site.

From the trench record sheets for trenches 2 and 3, where the subcrop of the 2BM seam has been located, it has been recorded as thin up to c.0.20m thick and comprising poor to reasonable quality (generally inferior) coal with a seat earth below and no evidence of extraction. The reports concluded that whilst the site was not considered to be at risk from any shallow unrecorded workings in either the deeper 3BM seam noted in RBH's 2 & 3, or within the 2BM seam at subcrop, for those plots affected future foundations would need to be taken down through the subcrop of the 2BM seam and be based in the underlying bedrock materials.

4.2 REL (2006) & RGE (2007) Site Investigation Records (Appendix IV):-

During 2006 REL completed intrusive investigation works across both the Sidings Health Centre site and the Manor Avenue residential development site, comprising two rotary boreholes (RH's 1 & 2), four cable percussive boreholes (BH's 1 – 4) and eight trial pits (TP's 1 – 8) (see Appendix IV), with BH2 and TP3 & TP4 shown to be located within the proposed development area. As anticipated no shallow coal seams were recorded in either the cable percussive boreholes or trial pits during these investigation works.

Thin coal was noted in RH1, at depths of 15.00m (0.40m thick – taken as the 2BM seam) and 21.50m (0.20m thick – thin impersistent unnamed seam), with no coal seams recorded in RH2. Unfortunately, the exploratory borehole plan provided in the 2006 REL report does not show the positions of rotary boreholes RH's 1 & 2, and it is understood that these boreholes were located along the centre line of the site, with RH1 most likely located on the northern portion of the residential development site and to the north of the proposed development area, with RH2 located to the south of the proposed development area.

There was no evidence of any unrecorded workings, voiding or broken ground/collapsed workings noted in the seams recorded in RH1 (29.50m depth) nor in RH2 (25.00m depth). The REL report concludes that there were no economically viable thicknesses of coal seams or evidence of workings underlying the site and the risk from void migration from shallow worked seams to the surface of the site is minimal.

4.0 Historical Site Investigation and Development Data (Cont'd):-

4.2 REL (2006) & RGE (2007) Site Investigation Records (Appendix IV) (Cont'd):-

Supplementary intrusive investigation works were completed by RGE during 2007 on the Sidings Health Centre and Manor Avenue residential sites, as well as across an additional parcel of land immediately adjacent to Caledonian Road where the new access road for Manor Avenue would be constructed along with additional residential properties. These supplementary works comprised an additional fourteen windowless sampling boreholes (WS-01 to WS-08 and WS-A to WS-F), with WS-04 shown to be located to the immediate southeast of the site and WS05 to the immediate northwest of the site.

There was no shallow coal seams identified in any of these supplementary borehole locations, with the exception of WS-A, positioned close to Caledonian Road next to the location of the new access road. In WS-A, as 0.40m thick coal seam, described as weak black thinly laminated coal, was encountered at a depth of 2.50m bgl, just below rockhead (at 1.80m bgl), and this seam correlates with the potential location of the 1BM seam shown to subcrop across this portion of the Manor Avenue residential development.

There was no additional commentary or assessment of this coal seam provided within the supplementary RGE report, which was designed to address potential ground gas and ground contamination issues only.

4.3 Arc Environmental Ltd. Letter Reports (2011 & 2013) - Site Investigation Records (Appendix V):-

The initial intrusive investigation works completed by Arc Environmental Ltd. (Ref. 11-183.02L, June 2011) comprises a series of four trial trench excavations (TT's 01 to 03 & 03A) located next to Caledonian Road, at the southern end of the Manor Avenue residential development and where the new access road and residential properties have been constructed. Trial trench TT03A was not extended beyond a depth of 0.40m bgl due to encountering a service culvert which prevented further excavation.

At the locations of TT01 and TT02 bands of anthracitic black coal, with bands of inter-bedded coal and carbonaceous mudstone, were noted within the initial mudstone deposits, at depths of between 2.50m to 3.50m (TT02) and 5.60m to 6.40m bcgl (TT01). In addition, at the location of TT01 an initial shallow band of very weak black weathered coal was also noted at rock head, from 1.60m to 1.90m bcgl, with this band noted to be tapering in thickness and was no longer evident 2.00m from the site boundary. Similarly, a thin layer of inter-bedded carbonaceous mudstone and extremely weak weathered coal was noted in TT03 at depths of between 1.90m to 2.00m bgl, within the initial mudstone bedrock materials.

There was no evidence of any unrecorded workings, voiding or broken ground/collapsed workings noted in the coal seams identified in TT's 01 to 03.

4.0 Historical Site Investigation and Development Data (Cont'd):-

4.3 Arc Environmental Ltd. Letter Reports (2011 & 2013) - Site Investigation Records (Appendix V) (Cont'd):-

Given the positions of these trial trenches on the southern portion of the site, it can be seen that the recorded seams are associated with the 1BM seam which subcrops across this portion of the residential development site.

Following on from these initial trial trench excavations, and to supplement/update the previous REL and RGE site investigation works from 2006 and 2007, for the Sidings Health Centre site and Manor Avenue residential development, two additional site investigation letter reports (11-183.04L, January 2013 & 11.183.06L, September 2013) were produced for One 17 (Structural Design) Ltd. on behalf of Savile Developments. A series of four cable percussive boreholes (CP's 1 – 4) and one rotary cored borehole (RBH3 – extended from the base of CP3 to 16.50m bgl) were completed across part of the Sidings Health Centre site and extending into the northern end of the Manor Avenue residential site.

These works were followed by an additional four cable percussive boreholes (CP's 5 – 8), one rotary cored borehole (extended from the base of CP6 to 12.00m bgl) and twelve windowless sampling boreholes (WS's A – L) across the Manor Avenue residential site, with WS's G, H & I located close or within the proposed development area.

With the exception of CP3, no shallow coal seams were encountered in any of these additional intrusive investigation works, with no evidence of any unrecorded workings, voiding or broken ground/collapsed workings noted in the boreholes.

In CP3, located within the former railway cutting, an intact coal seam was recorded at rock head, immediately below the made ground, at a depth of c.9.70m bgl before siltstone was noted at a depth of 10.50m bgl, with no evidence of any unrecorded workings, voiding or broken ground/collapsed workings noted in this seam. As can be seen from the CA Consultants Mining Report and BGS Geological Maps, the subcrop pattern of 2BM coal seam has been locally impacted by the railway cutting and given the location of CP3 on the Manor Avenue residential site, the coal seam identified in CP3 is also considered to be part of the subcrop of the 2BM coal seam at this location.

Below a depth of 10.50, CP3 was extended (logged as RBH3), initially using open hole rotary techniques to a depth of 12.00m bgl, before continuing with core recovery to a depth of 16.50m bgl, again with no further shallow coal seams or evidence of unrecorded workings, voiding or broken ground/collapsed workings being noted.

4.0 Historical Site Investigation and Development Data (Cont'd):-

4.4 Sidings Health Centre Construction Photographs – Foundation Excavations (May 2014) (Appendix VI):-

Copies of 6 no. site photographs taken during May 2014 of the foundation excavations for the southern corner of the Sidings Health Centre building have been provided by One 17 Structural Design, copies of which can be seen in Appendix VI. During the foundation excavations for the southern corner of the new health centre building, and as expected from previous intrusive investigation works, the outcrop of the 2BM coal seam was encountered at shallow depths below this portion of the site.

The coal seam was noted to be intact comprising bands of interbedded anthracitic black weak coal, carbonaceous mudstone and weathered mudstone, locally up to c.0.60m in thickness, before being underlain by mudstone bedrock materials within which the new foundations were constructed. There was no evidence of any unrecorded workings, voiding or broken ground/collapsed workings noted in the 2BM seam.

5.0 Conclusions & Recommendations:-

From the results of all the information reviewed, as part of this CMRA for the development of Units 11 - 12 & 13 - 14 with private residential properties, it can be seen that the ground conditions encountered across the various development sites generally concurs with the MRA and BGS coal seam data.

The previous site investigation data and reports covering this site and the adjacent areas have confirmed that the 2BM coal seam subcrops to the northwest of proposed development area, below the southern end of The Sidings residential development and the more recently constructed Sidings Health Centre. The historical site investigation works have also confirmed that the 2BM dips below the site, being identified in RH1 at a depth of 15.00m bgl (0.40m thick) to the north of the proposed development and at >25.00m bgl below the southern portion of the Manor Avenue residential development. During all the historical investigation works there was no evidence of any unrecorded workings, voiding or broken ground/collapsed workings in the 2BM seam.

The 1BM seam has also been identified as subcropping across the southern end of the Manor Avenue residential development, close to Caledonian Road, dipping away from the proposed development area in a southerly direction. Similarly, the 3BM seam has been identified below the northern end of the original The Sidings residential development, at depths of 23.30m to 24.50m with a seam thickness of up to c.0.30m, also dipping below the site area in a south easterly direction. Again, there was no evidence of any unrecorded workings, voiding or broken ground/collapsed workings in either the 1BM of 3BM seams, where encountered during the historical investigation works.

Re: Coal Mining Risk Assessment (CMRA) – Proposed New Residential Properties, Units 11 - 12 & 13 - 14, Manor Avenue, Savile Town, Dewsbury, West Yorkshire (Cont'd)

5.0 Conclusions & Recommendations (Cont'd):-

Consequently, it can be seen that neither the 1BM nor the 3BM coal seams represent a potential risk to the proposed development, with the position of the 1BM subcrop confirming that this seam is not present below the site. Similarly, the thickness of the 3BM seam is locally recorded as 0.30m (in RBH's 2 & 3) confirming that the seam was most likely uneconomic for extraction. In addition, if any unrecorded historical extraction of the 3BM seam has occurred, there will be more that sufficient rock cover (i.e. >10:1 ratio) to arrest any potential void migration, with the anticipated depth to the 3BM seam below the site of >25m below rock head.

When considering the potential risks of ground instability arising from unrecorded workings within the 2BM coal seam, it can be seen from all the intrusive investigation works completed around the proposed development area, where the 2BM seam has been exposed in excavations or recorded in boreholes, there is no evidence of any unrecorded workings, voiding or broken ground/collapsed workings. The most likely reasons for none-extraction of the seam would be, locally, the limited thickness (typically between 0.20m and 0.60m thick) and quality of the coal. In addition, given the close proximity of proposed dwellings to the recorded location of the subcrop of the 2BM seam, the potential risks associated with 'daylighting', due insufficient potential competent rock cover above the seam, will also have contributed to making the seam uneconomically viable for extraction.

Bearing in mind the comments above and all the data reviewed, it can be seen that the proposed development is not considered to be at risk from unrecorded historical coal mining activities and no further investigation, risk assessment or remediation measures will be required for these proposed dwellings.

We trust the information contained within this CMRA Report is of benefit and if you need any further information or clarification please do not hesitate to contact us.

Yours faithfully

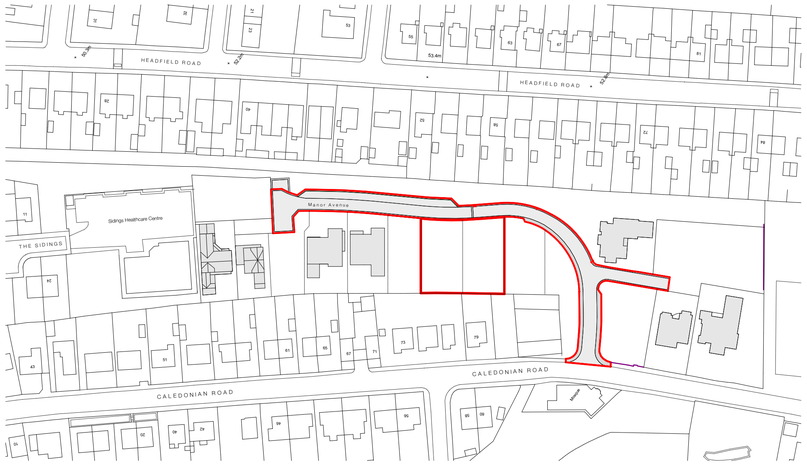
.....

Darren McGrath
MIEnvSc FGS Tech IOSH
Director
For and on behalf of Arc Environmental Limited

Appendix I

Existing Site Location & Development Layout Plans

T: 0191 378 6380
E: admin@arc-environmental.com
W: www.arc-environmental.com
Registered in England No. 05539784



Site Location Plan - 1:1250

Proposed Site Block Plan - 1:500

Existing Site Plan - 1:250

Notes

Do not scale from drawing, use figured dimensions only.

All dimensions must be checked and verified on site prior to commencement of work and Architect to be notified of any discrepancies.

This drawing is intended to permit overall scheme proposals only and cannot be used for construction purposes without further information.

Rev	Description	Drawn	Date
•	Drawing created.	-	-

N

Client
Imran Ismail

Site Address
Units 11-12 & 13-14, Manor Avenue ,
Savile Town , Dewsbury, WF12 9FB

Project Description
4 New Semi-detached dwellings (2 pairs)

Status
Planning

Date	Drawn	Checked
February 2025	MJN	

Drawing
Existing Site Plan

Scale @ A1
1:1250, 1:250, 1:500

Drawing No.
3633 (0-) 01

Revision
-

ONE17 DESIGN
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ONE17DESIGN.COM

Appendix II

The Coal Authority Consultants Coal Mining Report

Archive BGS Borehole Records (SE22SW960)

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W: www.arc-environmental.com
Registered in England No. 05539784

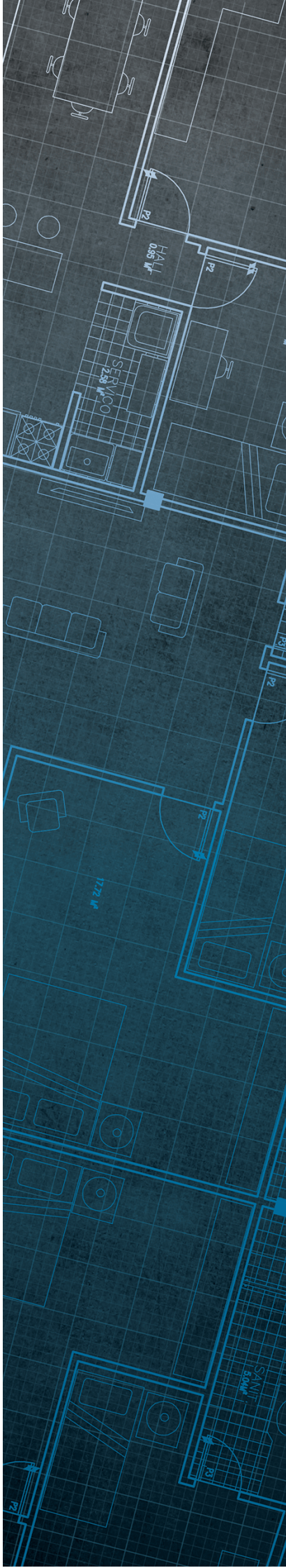
The Coal Authority

Consultants

Coal Mining Report

Units 11-13 & 13-14
Manor Avenue
Savile Town
Dewsbury
Kirklees

Date of enquiry:	**2 June 2025**
Date enquiry received:	**2 June 2025**
Issue date:	**2 June 2025**
Our reference:	**51003502404001**
Your reference:	**25-396**



Consultants

Coal Mining Report

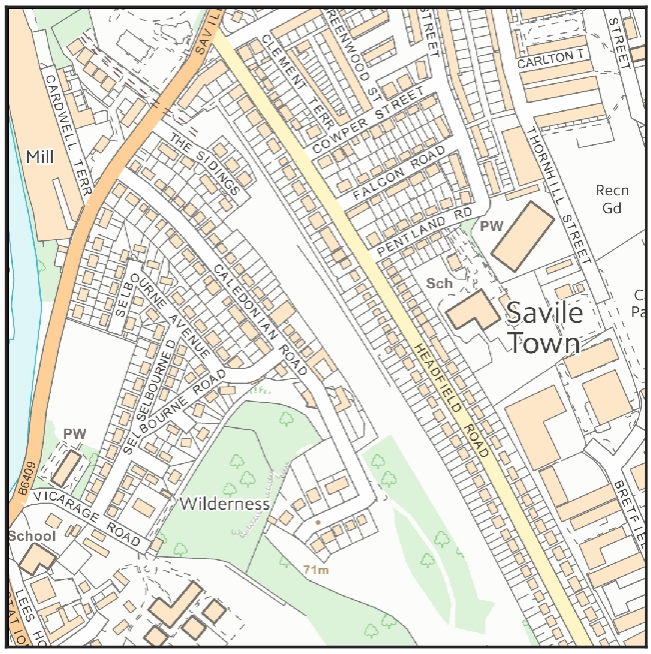
This report is based on and limited to the records held by the Coal Authority at the time the report was produced.

Client name

Arc Environmental Ltd

Enquiry address

Units 11-13 & 13-14
Manor Avenue
Savile Town
Dewsbury
Kirklees



Approximate position of property

Map data

How to contact us

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Nottinghamshire
NG18 4RG

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Section 1 – Mining activity and geology

Past underground mining
No past mining recorded.

Probable unrecorded shallow workings
Yes.

Spine roadways at shallow depth
No spine roadway recorded at shallow depth.

Mine entries
None recorded within 100 metres of the enquiry boundary.

Abandoned mine plan catalogue numbers
The following abandoned mine plan catalogue numbers intersect with some, or all, of the enquiry boundary:

NE108		

Please contact us on 0345 762 6848 to determine the exact abandoned mine plans you require based on your needs.

Outcrops
No outcrops recorded.

Geological faults, fissures and breaklines
No faults, fissures or breaklines recorded.

Opencast mines
None recorded within 500 metres of the enquiry boundary.

Coal Authority managed tips
None recorded within 500 metres of the enquiry boundary.

Section 2 – Investigative or remedial activity

Please refer to the 'Summary of findings' map (on separate sheet) for details of any activity within the area of the site boundary.

Site investigations
None recorded within 50 metres of the enquiry boundary.

Remediated sites
None recorded within 50 metres of the enquiry boundary.

Coal mining subsidence
The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres of the enquiry boundary, since 31 October 1994.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

Mine gas
None recorded within 500 metres of the enquiry boundary.

Mine water treatment schemes
None recorded within 500 metres of the enquiry boundary.

Section 3 – Licensing and future mining activity

Future underground mining
None recorded.

Coal mining licensing
None recorded within 200 metres of the enquiry boundary.

Court orders
None recorded.

Section 46 notices
No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.

Withdrawal of support notices
The property is not in an area where a notice to withdraw support has been given.

The property is not in an area where a notice has been given under section 41 of the Coal Industry Act 1994, cancelling the entitlement to withdraw support.

Payments to owners of former copyhold land
The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

Section 4 – Further information

Based on the responses in this report, no further information has been highlighted.

Future development

If development proposals are being considered, technical advice relating to both the investigation of coal and former coal mines and their treatment should be obtained before beginning work on site. All proposals should apply specialist engineering practice required for former mining areas. No development should be undertaken that intersects, disturbs or interferes with any coal or coal mines without first obtaining the permission of the Coal Authority.

MINE GAS: Please note, if there are no recorded instances of mine gas within 500m of the enquiry boundary, this does not mean that mine gas is not present within the vicinity. The Coal Authority Mine Gas data is limited to only those sites where a Mine Gas incident has been recorded. Developers should be aware that the investigation of coal seams, mine workings or mine entries may have the potential to generate and/or displace underground gases. Associated risks both to the development site and any neighbouring land or properties should be fully considered when undertaking any ground works. The need for effective measures to prevent gases migrating onto any land or into any properties, either during investigation or remediation work, or after development must also be assessed and properly addressed. In these instances, the Coal Authority recommends that a more detailed Gas Risk Assessment is undertaken by a competent assessor.

Section 5 – Data definitions

The datasets used in this report have limitations and assumptions within their results. For more guidance on the data and the results specific to the enquiry boundary, please **call us on 0345 762 6848** or **email us at groundstability@coal.gov.uk.**

Past underground coal mining

Details of all recorded underground mining relative to the enquiry boundary. Only past underground workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination, will be included.

Probable unrecorded shallow workings

Areas where the Coal Authority believes there to be unrecorded coal workings that exist at or close to the surface (less than 30 metres deep).

Spine roadways at shallow depth

Connecting roadways either, working to working, or, surface to working, both in-seam and cross measures that exist at or close to the surface (less than 30 metres deep), either within or within 10 metres of the enquiry boundary.

Mine entries

Details of any shaft or adit either within, or within 100 metres of the enquiry boundary including approximate location, brief treatment details where known, the mineral worked from the mine entry and conveyance details where the mine entry has previously been sold by the Authority or its predecessors British Coal or the National Coal Board.

Abandoned mine plan catalogue numbers

Plan numbers extracted from the abandoned mines catalogue containing details of coal and other mineral abandonment plans deposited via the Mines Inspectorate in accordance with the Coal Mines Regulation Act and Metalliferous Mines Regulation Act 1872. A maximum of 9 plan extents that intersect with the enquiry boundary will be included. This does not infer that the workings and/or mine entries shown on the abandonment plan will be relevant to the site/property boundary.

Outcrops

Details of seam outcrops will be included where the enquiry boundary intersects with a conjectured or actual seam outcrop location (derived by either the British Geological Survey or the Coal Authority) or intersects with a defined 50 metres buffer on the coal (dip) side of the outcrop. An indication of whether the Coal Authority believes the seam to be of sufficient thickness and/or quality to have been worked will also be included.

Geological faults, fissures and breaklines

Geological disturbances or fractures in the bedrock. Surface fault lines (British Geological Survey derived data) and fissures and breaklines (Coal Authority derived data) intersecting with the enquiry boundary will be included. In some circumstances faults, fissures or breaklines have been known to contribute to surface subsidence damage as a consequence of underground coal mining.

Opencast mines
Opencast coal sites from which coal has been removed in the past by opencast (surface) methods and where the enquiry boundary is within 500 metres of either the licence area, site boundary, excavation area (high wall) or coaling area.

Coal Authority managed tips
Locations of disused colliery tip sites owned and managed by the Coal Authority, located within 500 metres of the enquiry boundary.

Site investigations
Details of site investigations within 50 metres of the enquiry boundary where the Coal Authority has received information relating to coal mining risk investigation and/or remediation by third parties.

Remediated sites
Sites where the Coal Authority has undertaken remedial works either within or within 50 metres of the enquiry boundary following report of a hazard relating to coal mining under the Coal Authority's Emergency Surface Hazard Call Out procedures.

Coal mining subsidence
Details of alleged coal mining subsidence claims made since 31 October 1994 either within or within 50 metres of the enquiry boundary. Where the claim relates to the enquiry boundary confirmation of whether the claim was accepted, rejected or whether liability is still being determined will be given. Where the claim has been discharged, whether this was by repair, payment of compensation or a combination of both, the value of the claim, where known, will also be given.

Details of any current 'Stop Notice' deferring remedial works or repairs affecting the property/site, and if so the date of the notice.

Details of any request made to execute preventative works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991. If yes, whether any person withheld consent or failed to comply with any request to execute preventative works.

Mine gas
Reports of alleged mine gas emissions received by the Coal Authority, either within or within 500 metres of the enquiry boundary that subsequently required investigation and action by the Coal Authority to mitigate the effects of the mine gas emission. Please note, if there are no recorded instances of mine gas reported, this does not mean that mine gas is not present within the vicinity. The Coal Authority Mine Gas data is limited to only those sites where a Mine Gas incident has been recorded.

Mine water treatment schemes
Locations where the Coal Authority has constructed or operates assets that remove pollutants from mine water prior to the treated mine water being discharged into the receiving water body.

These schemes are part of the UK's strategy to meet the requirements of the Water Framework Directive. Schemes fall into 2 basic categories: Remedial – mitigating the impact of existing pollution or Preventative – preventing a future pollution incident.

Mine water treatment schemes generally consist of one or more primary settlement lagoons and one or more reed beds for secondary treatment. A small number are more specialised process treatment plants.

Future underground mining
Details of all planned underground mining relative to the enquiry boundary. Only those future workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination will be included.

Coal mining licensing
Details of all licenses issued by the Coal Authority either within or within 200 metres of the enquiry boundary in relation to the under taking of surface coal mining, underground coal mining or underground coal gasification.

Court orders
Orders in respect of the working of coal under the Mines (Working Facilities and Support) Acts of 1923 and 1966 or any statutory modification or amendment thereof.

Section 46 notices
Notice of proposals relating to underground coal mining operations that have been given under section 46 of the Coal Mining Subsidence Act 1991.

Withdrawal of support notices
Published notices of entitlement to withdraw support and the date of the notice. Details of any revocation notice withdrawing the entitlement to withdraw support given under Section 41 of the Coal Industry Act 1994.

Payment to owners of former copyhold land
Relevant notices which may affect the property and any subsequent notice of retained interests in coal and coal mines, acceptance or rejection notices and whether any compensation has been paid to a claimant.

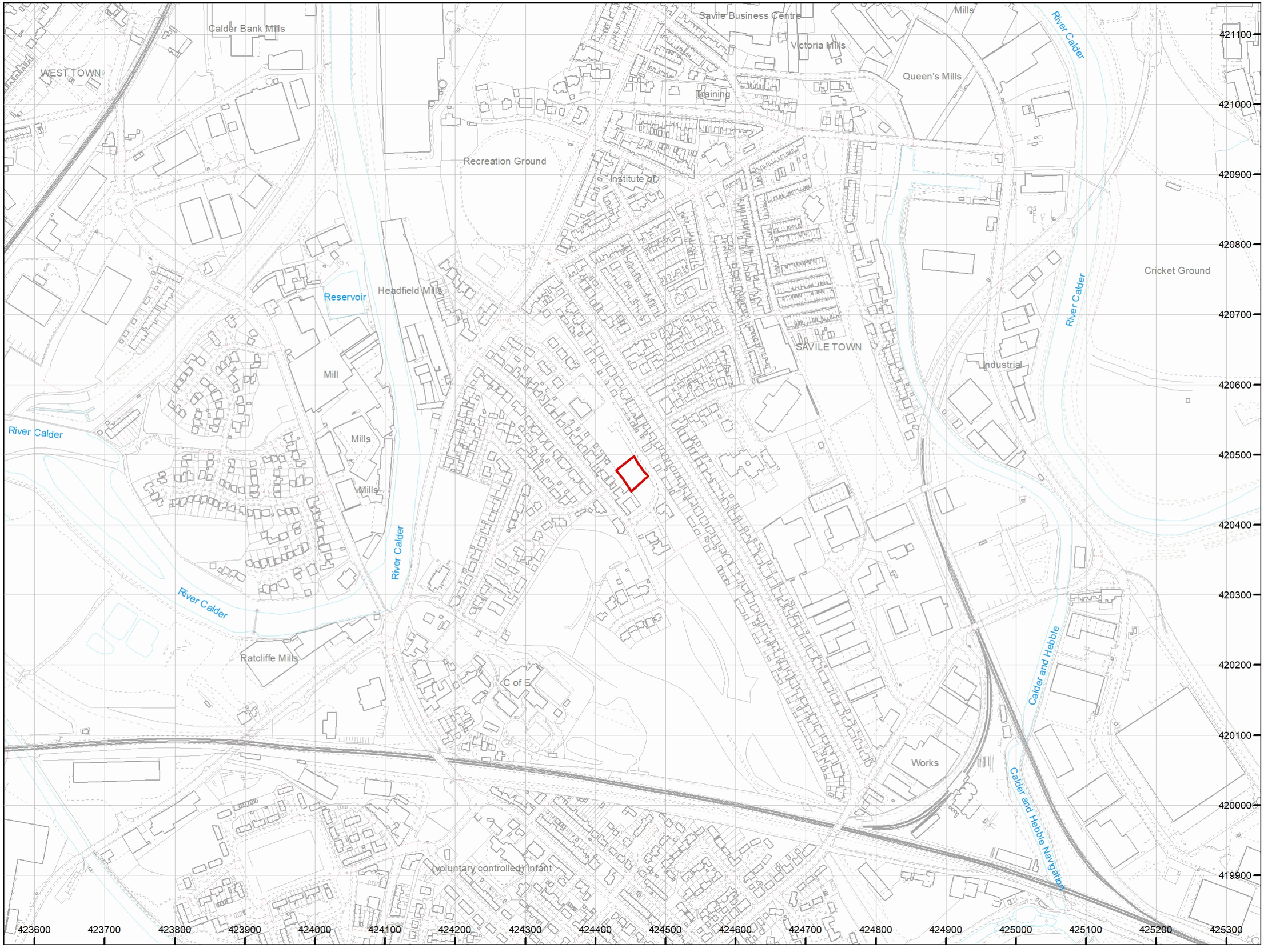
The Coal Authority

Summary of findings

The map highlights any specific surface or subsurface features within or near to the boundary of the site.

Key

Approximate position of the enquiry boundary shown



How to contact us
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+44 (0)1623 637 000 (International)
www.groundstability.com

C.3.—RAVENSLODGE COLLIERY, DEWSBURY.

Date of Sinking, 1889.

Lat. 53° 41′ 0″ N. Long. 1° 38′ 45″ W

Height above O.D., 180 ft. Dip of Strata, 1 in 48 to 1 in 24 S.E.

		YD.	FT.	IN.	YD.	FT.	IN.
1	Clay		2	2	0		
2	Marl		3	0	0		
	[illegible]		2	2	2		
4	Marl		2	2	10		
	[illegible]		3	0	4		
6	**Brown Metal Coal**		0	1	0		
						14	2	4
7	Marl		2	0	8		
8	Blue bind		5	1	4		
9	**Seam of Coal**						
	Lousey Coal	FT. 1	IN. 3				
	Clunch	2	3				
	Coal	0	9	1	1	3	
						23	2	7
10	Clunch		1	0	1		
	[illegible]		1	1	0		
12	Blue bind		10	0	0		
13	**Middleton Little Coal**						
	Coal	FT. 0	IN. 6				
	Dirt	0	4				
	Coal	1	4	0	2	2	
						36	2	10
14	Clunch		0	2	6		
15	Bind		5	1	0		
16	COAL		0	0	8		
						43	1	0
17	Clunch		1	2	2		
	[illegible]		10	2	0		
19	Blue bind		3	0	7		
20	**New Hards Coal**		1	0	1		
						59	2	10
21	Clunch		4	0	6		
22	Rock		0	2	1		
23	Stone clunch		2	0	5		
24	Stone bind with ironstone balls		6	1	0		
	[illegible] with a band of galliard		5	0	5		
26	**Wheatley Lime Coal**		0	2	7		
						79	0	10
27	Clunch		1	2	5		
28	Bind		1	1	4		
29	Clunch		1	1	3		
30	Bind		1	1	10		
31	**Seam of Coal**						
	Dirt and Coal	FT. 0	IN. 6				
	Inferior Coal	2	0	0	2	6	
						87	0	8
32	Stone clunch		1	2	11		
33	Stone bind		5	2	9		
34	Cank		0	1	9		
35	Bind		4	2	10		
36	Black shale		0	1	7		
37	Clunch		1	1	7		
	[illegible]		0	2	5		
39	Stone bind with rock bands		1	2	5		
40	Bind		0	1	9		
41	Clod		0	0	6		
42	**Blocking Coal**		0	1	1		
						105	1	9
43	Clunch		1	0	8		
44	Stone bind		4	1	10		
	[illegible]		1	1	1		
46	Bind with ironstone balls		4	1	3		
47	COAL		0	0	1		
						117	0	8
48	Bind with ironstone balls		5	2	10		
	[illegible]		1	1	11		
50	Bind		6	0	4		
51	**Rock**		3	0	3		
52	Stone bind		4	0	10		
53	Johnnies		0	0	2		
54	COAL		0	0	5		
						138	1	5
55	Stone clunch		0	2	5		
56	COAL		0	0	2		
						139	1	0
57	Stone clunch		1	1	11		
58	Stone bind with rock bands		4	0	7		
59	Black shale		0	1	11		
60	Stone bind		8	2	9		
61	Black shale		0	0	7		
62	Stone clunch with rock bands		2	1	0		
63	Blue bind		3	1	9		
64	COAL		0	0	3		
						161	2	9
65	Soft clunch		1	2	3		
66	**Upper Beeston or Shertcliffe Top Coal**						
	Coal	FT. 1	IN. 1				
	Muck	0	3				
	Coal	0	7	0	1	11	
						164	0	11
67	Stone clunch		2	0	2		
68	Black shale		0	0	3		
69	Clunch		1	1	3		
70	Black shale		0	0	3		
71	Stone clunch		1	1	11		
72	Stone bind		7	2	3		
73	Cank		0	1	7		
	[illegible]		8	2	7		
75	Stone bind		5	1	0		
76	**Rock**		1	0	0		

C.3.—RAVENSLODGE COLLIERY, DEWSBURY.—*Continued.*

		YD.	FT.	IN.	YD.	FT.	IN.
77	**Lower Beeston or Low Shertcliffe Coal**						
	Coal	FT. 1	IN. 4				
	Dirt	0	2	0	1	6	
						193	1	8
78	Strong clunch		1	0	3		
79	Strong bind		0	1	7		
80	**Rock**		2	0	10		
81	Cank		0	2	2		
82	Strong and dark bind with ironstone		10	0	8		
83	Black shale		2	0	0		
84	Dark bind with ironstone		5	2	0		
85	Stone bind		4	0	6		
86	Hard grey stone with cank bands		12	0	6		
87	Stone bind		3	2	10		
88	Blue and dark bind		2	2	9		
89	COAL		0	0	3		
						239	1	0
90	Clunch		1	1	10		
91	Stone bind		3	2	0		
92	**Rock**		7	1	4		
93	**Crow Coal**	FT.	IN.				
	Coal	0	10				
	Scale	0	4	0	1	2	
						252	1	4
94	Clunch		0	2	2		
95	Dark bind with ironstone		4	2	11		
96	COAL smit		0	0	2		
						258	0	7
97	Clunch		0	1	6		
98	**Rock**		2	0	7		
99	Dark bind with ironstone		1	0	0		
100	Seat earth		0	1	4		
101	Stone bind		4	2	1		
102	Soft shale		0	0	2		
103	**Low Moor Black Bed**		0	2	7		
						267	2	10
104	Stone clunch		0	1	1		
105	Hard rock and cank		1	0	11		
106	Bind		5	2	3		
107	**Hard stone** (Thick stone)		12	1	9		
108	Stone bind		2	1	0		
109	Blue bind		2	2	0		
110	Stone bind		4	2	1		
111	**Stone**		7	2	7		
112	Blue bind		6	0	2		
113	**Low Moor Better Bed**		0	1	0½		
						311	2	8½
114	Black shale		0	0	2		
115	Fireclay		0	2	10		
116	Stone		1	2	3½		
						314	2	0

Appendix III

Extracts from Dunelm Drilling Co (1996) & Robinson Environmental Ltd. (2001) Reports

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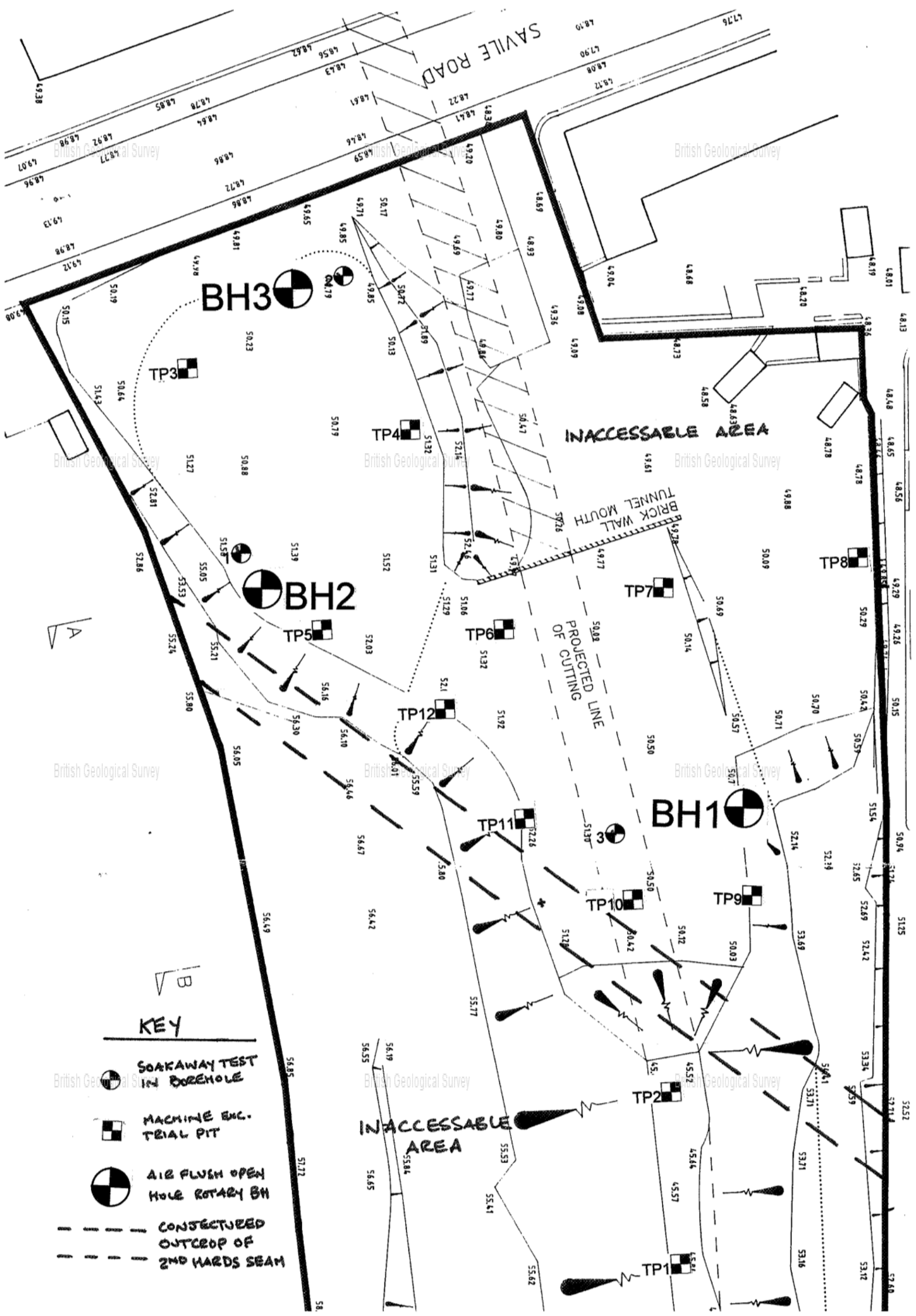
W: www.arc-environmental.com
Registered in England No. 05539784


SAVILE ROAD
BH3
BH2
BH1
TP1
TP2
TP3
TP4
TP5
TP6
TP7
TP8
TP9
TP10
TP11
TP12
INACCESSABLE AREA
BRICK WALL TUNNEL MOUTH
PROJECTED LINE OF CUTTING
INACCESSABLE AREA
A
B
KEY
SOAKAWAY TEST IN BOREHOLE
MACHINE EXC. TRIAL PIT
AIR FLUSH OPEN HOLE ROTARY BH
CONJECTURED OUTCROP OF 2ND HARDS SEAM

CLIENT	JOB NO	LOCATION	BOREHOLE NO
ROBINSON CONSULTING ENGS	C8761	LAND OFF SAVILE ROAD, DEWSBURY	RBH1
DATE: NOVEMBER 1996 — SCALE: 1 to 100	BORING METHOD: OPEN HOLE AIR FLUSH ROTARY		Sheet: 1

Drilling & Casing Progress	SAMPLE/TEST Type & No.	SAMPLE/TEST Depth(M)	SPT N – value or COHESION	DESCRIPTION	O D LEVEL	LEGEND	DEPTH
13TH					50.70		0.0
				MADE GROUND? – Possibly disturbed dark brown and black very "soily" clay.	49.70		1.00
				Very weathered light grey with brown shaly MUDSTONE.	48.70		2.00
13TH				Grey MUDSTONE.			
					46.70		4.00
				Grey SHALE.			
					32.20		18.50
				Grey and brown very muddy SANDSTONE.			

DUNELM DRILLING COMPANY
TEL 091-526-2534 FAX 091-517-0085

BOREHOLE LOGSHEET

Water Observations, Remarks, Etc

Water struck at 14.00m.
Cased to 3.00m.
Descriptions based purely on drillers interpretation of returned cuttings to surface and drilling rates maintained.

No workings recorded.
No coal noted.
Full air return noted throughout borehole.

CLIENT	JOB NO	LOCATION	BOREHOLE NO
ROBINSON CONSULTING ENGS	C8761	LAND OFF SAVILE ROAD, DEWSBURY	RBH1
DATE: NOVEMBER 1996 / SCALE: 1 to 100	BORING METHOD: OPEN HOLE AIR FLUSH ROTARY		Sheet: 2

Drilling & Casing Progress	SAMPLE/TEST Type & No.	SAMPLE/TEST Depth(M)	SPT N – value or COHESION	DESCRIPTION	O D LEVEL	LEGEND	DEPTH
							20.0
				Grey and brown very muddy SANDSTONE.			
					28.20		22.50
				Grey SHALE.			
13TH					20.70		30.00

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BOREHOLE LOGSHEET

Water Observations, Remarks, Etc

CLIENT	JOB NO	LOCATION	BOREHOLE NO
ROBINSON CONSULTING ENGS	C8761	LAND OFF SAVILE ROAD, DEWSBURY	RBH2
DATE: NOVEMBER 1996 — SCALE: 1 to 100	BORING METHOD: OPEN HOLE AIR FLUSH ROTARY.		Sheet: 1

Drilling & Casing Progress	SAMPLE/TEST Type & No.	SAMPLE/TEST Depth(M)	SPT N – value or COHESION	DESCRIPTION	O D LEVEL	LEGEND	DEPTH
12TH					51.80		0.0
				MADE GROUND? – Possibly disturbed dark brown and grey shaly clay.	50.30		1.50
12TH				Very weathered light grey and rusty brown MUDSTONE, with thin sandy bands.	48.50		3.30
				Grey SHALE.	36.10		15.70
				Rusty brown and grey fine to medium grained muddy SANDSTONE.			

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BOREHOLE LOGSHEET

Water Observations, Remarks, Etc

Water struck at 14.50m.
Cased to 2.00m.
Descriptions based purely on drillers interpetation of returned cuttings to surface and drilling rates maintained.

Coal recorded from 24.50m to 24.70m.
No workings noted.
Full air flush recorded throughout investigation.

CLIENT	JOB NO	LOCATION	BOREHOLE NO
ROBINSON CONSULTING ENGS	C8761	LAND OFF SAVILE ROAD, DEWSBURY	RBH2
DATE: NOVEMBER 1996 / SCALE: 1 to 100	BORING METHOD: OPEN HOLE AIR FLUSH ROTARY.		Sheet: 2

Drilling & Casing Progress	SAMPLE/TEST Type & No.	SAMPLE/TEST Depth(M)	SPT N – value or COHESION	DESCRIPTION	O D LEVEL	LEGEND	DEPTH
							20.0
				Rusty brown and grey fine to medium grained muddy SANDSTONE.			
					27.30		
					27.10		24.50
				COAL.			24.70
				Grey SHALE.			
12TH					21.80		30.00

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BOREHOLE LOGSHEET

Water Observations, Remarks, Etc

CLIENT	JOB NO	LOCATION	BOREHOLE NO
ROBINSON CONSULTING ENGS	C8761	LAND OFF SAVILE ROAD, DEWSBURY	RBH3
DATE: NOVEMBER 1996 — SCALE: 1 to 100	BORING METHOD: OPEN HOLE AIR FLUSH ROTARY.		Sheet: 1

Drilling & Casing Progress	SAMPLE/TEST Type & No.	SAMPLE/TEST Depth(M)	SPT N – value or COHESION	DESCRIPTION	O D LEVEL	LEGEND	DEPTH
14TH					49.80		0.0
				MADE GROUND? – Possibly disturbed medium to dark brown and grey very shaly friable clay.	48.30		1.50
14TH				Very weathered light grey shaly MUDSTONE, with some sandy bands.	46.60		3.20
				Grey SHALE.	34.40		15.40
				Brown and grey muddy SANDSTONE.			

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BOREHOLE LOGSHEET

Water Observations, Remarks, Etc

Water struck at 13.70m.
Cased to 2.00m.
Descriptions based purely on drillers interpretation of returned cuttings to surface and drilling rates maintained.

Coal recorded from 23.30m to 23.60m.
No workings noted.
Full air return recorded throughout borehole.

CLIENT	JOB NO	LOCATION	BOREHOLE NO
ROBINSON CONSULTING ENGS	C8761	LAND OFF SAVILE ROAD, DEWSBURY	RBH3
DATE: NOVEMBER 1996 / SCALE: 1 to 100	BORING METHOD: OPEN HOLE AIR FLUSH ROTARY.		Sheet: 2

Drilling & Casing Progress	SAMPLE/TEST Type & No.	SAMPLE/TEST Depth(M)	SPT N – value or COHESION	DESCRIPTION	O D LEVEL	LEGEND	DEPTH
							20.0
				Brown and grey muddy SANDSTONE.			
					26.50		23.30
				COAL.	26.20		23.60
				Grey SHALE.			
14TH					19.80		30.00

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BOREHOLE LOGSHEET

Water Observations, Remarks, Etc

CLIENT	JOB NO	LOCATION	BOREHOLE NO
ROBINSON CONSULTING ENGS	C8761	LAND OFF SAVILE ROAD, DEWSBURY	TP1
DATE: NOVEMBER 1996 / SCALE: 1 to 50	BORING METHOD: MECHANICAL EXCAVATOR (JCB3X)		Sheet: 1

Drilling & Casing Progress	SAMPLE/TEST Type & No.	SAMPLE/TEST Depth(M)	SPT N – value or COHESION	DESCRIPTION	O D LEVEL	LEGEND	DEPTH
12TH					45.80		0.0
				MADE GROUND – Black ash, soil, coal duff and colliery type waste.	45.50		0.30
				MADE GROUND – Fragmented rock rubble (sandstone and mudstone).	45.30		0.50
12TH				Weathered thin to medium bedded fine grained muddy SANDSTONE, moderately strong with slightly open discontinuities.	44.80		1.00
				Light grey fairly strong moderately weathered shaly MUDSTONE.	44.60		1.20

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BOREHOLE LOGSHEET

Water Observations, Remarks, Etc

No water encountered.

Existing 9" drain encountered in trial pit at approx. 1.00m from current ground level, trending in a E – W direction.

CLIENT	JOB NO	LOCATION	BOREHOLE NO
ROBINSON CONSULTING ENGS	C8761	LAND OFF SAVILE ROAD, DEWSBURY	TP2
DATE: NOVEMBER 1996 — SCALE: 1 to 50	BORING METHOD: MECHANICAL EXCAVATOR (JCB3X)		Sheet: 1

Drilling & Casing Progress	SAMPLE/TEST Type & No.	SAMPLE/TEST Depth(M)	SPT N – value or COHESION	DESCRIPTION	O D LEVEL	LEGEND	DEPTH
12TH					45.50		0.0
				MADE GROUND – Black soil, coke, clinker, coal, timber etc..	45.20		0.30
				MADE GROUND? – Possibly disturbed very weathered rubbly light brown fine to medium grained SANDSTONE.	44.90		0.60
12TH				Moderately weathered and becoming strong, light grey muddy SILTSTONE.	44.50		1.00

DUNELM DRILLING COMPANY
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BOREHOLE LOGSHEET

Water Observations, Remarks, Etc
No water encountered.

CLIENT	JOB NO	LOCATION	BOREHOLE NO
ROBINSON CONSULTING ENGS	C8761	LAND OFF SAVILE ROAD, DEWSBURY	TP3
DATE: NOVEMBER 1996 — SCALE: 1 to 50	BORING METHOD: MECHANICAL EXCAVATOR (JCB3X)		Sheet: 1

Drilling & Casing Progress	SAMPLE/TEST Type & No.	SAMPLE/TEST Depth(M)	SPT N – value or COHESION	DESCRIPTION	O D LEVEL	LEGEND	DEPTH
12TH					50.30		0.0
				Dark brown/black SUBSOIL.	50.20		0.10
				Firm to stiff light orangey brown and grey mottled friable fissured slightly sandy occasionally very silty CLAY.	49.50		0.80
				Upper clays grading into a completely weathered light grey with orangey brown shaly MUDSTONE, with occasional completely weathered thin sandstone lenses.	48.40		1.90
12TH				Very to completely weathered medium to dark brown, grey and black friable SHALE, with frequent ironstained layers and areas, with some thin bands of stiff clay and weathered sandstone.	47.30		3.00

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BOREHOLE LOGSHEET

Water Observations, Remarks, Etc
No water encountered.

CLIENT	JOB NO	LOCATION	BOREHOLE NO
ROBINSON CONSULTING ENGS	C8761	LAND OFF SAVILE ROAD, DEWSBURY	TP4
DATE: NOVEMBER 1996 / SCALE: 1 to 50	BORING METHOD: MECHANICAL EXCAVATOR (JCB3X)		Sheet: 1

Drilling & Casing Progress	SAMPLE/TEST Type & No.	SAMPLE/TEST Depth(M)	SPT N – value or COHESION	DESCRIPTION	O D LEVEL	LEGEND	DEPTH
12TH					51.30		0.0
				MADE GROUND – Dark brown and black subsoil.	51.20		0.10
					51.00		0.30
				MADE GROUND – Disturbed light orangey brown and grey silty sandy fissured clay, occasional silty areas.	50.40		0.90
	U	1.00	85.00				
	U	1.50	125.00	MADE GROUND? – Possibly disturbed dark reddish brown very clayey "soily" fine grained sand.	49.60		1.70
					49.40		1.90
12TH				Firm to stiff to stiff light orangey brown and grey mottled silty fissured CLAY.	48.70		2.60
				Thin transitional layer of stiff and friable/completely weathered light grey CLAY/SHALE.			
				Grading into initially very to completely weathered brown and grey mottled friable SHALE, intercalated with thin bands of sandstone and ironstained areas.			

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BOREHOLE LOGSHEET

Water Observations, Remarks, Etc
No water encountered.

CLIENT	JOB NO	LOCATION	BOREHOLE NO
ROBINSON CONSULTING ENGS	C8761	LAND OFF SAVILE ROAD, DEWSBURY	TP5
DATE: NOVEMBER 1996 — SCALE: 1 to 50	BORING METHOD: MECHANICAL EXCAVATOR (JCB3X)		Sheet: 1

Drilling & Casing Progress	SAMPLE/TEST Type & No.	SAMPLE/TEST Depth(M)	SPT N – value or COHESION	DESCRIPTION	O D LEVEL	LEGEND	DEPTH
12TH					52.00		0.0
				MADE GROUND – Disturbed firm to stiff medium to dark brown and grey clay.	51.80		0.20
				Firm to stiff to stiff fissured very silty light grey with brown CLAY, occasionally poorly laminated with fine sand partings.	51.40		0.60
12TH				Grading into an initially very to completely weathered light grey friable MUDSTONE, with frequent heavily ironstained joints and layers, closely spaced discontinuities.	49.60		2.40

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BOREHOLE LOGSHEET

Water Observations, Remarks, Etc

No water encountered, although ironstained joints recorded as visually damp.

CLIENT	JOB NO	LOCATION	BOREHOLE NO
ROBINSON CONSULTING ENGS	C8761	LAND OFF SAVILE ROAD, DEWSBURY	TP6
DATE: NOVEMBER 1996 — SCALE: 1 to 50	BORING METHOD: MECHANICAL EXCAVATOR (JCB3X)		Sheet: 1

Drilling & Casing Progress	SAMPLE/TEST Type & No.	SAMPLE/TEST Depth(M)	SPT N – value or COHESION	DESCRIPTION	O D LEVEL	LEGEND	DEPTH
12TH					51.30		0.0
					51.20		0.10
				MADE GROUND – Dark brown/black subsoil.			
				MADE GROUND – Fairly compact dark brown and grey claybound shale, mudstone and sandstone rubble, with some stiff clay lumps, occ. small frags of pottery, glass etc and some black "soily" areas.			
12TH					47.10		4.20

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BOREHOLE LOGSHEET

Water Observations, Remarks, Etc
No water encountered.

CLIENT	JOB NO	LOCATION	BOREHOLE NO
ROBINSON CONSULTING ENGS	C8761	LAND OFF SAVILE ROAD, DEWSBURY	TP7
DATE: NOVEMBER 1996 — SCALE: 1 to 50	BORING METHOD: MECHANICAL EXCAVATOR (JCB3X)		Sheet: 1

Drilling & Casing Progress	SAMPLE/TEST Type & No.	SAMPLE/TEST Depth(M)	SPT N – value or COHESION	DESCRIPTION	O D LEVEL	LEGEND	DEPTH
12TH					50.00		0.0
				MADE GROUND – Dark brown and black topsoil and subsoil with much clay.	49.50		0.50
				MADE GROUND? – Black topsoil with many rootlets – possibly indicative of original cutting surface level?	49.20		0.80
				Stiff light grey and yellow very silty fissured CLAY.	48.90		1.10
				Grading into an ititially weathered light grey very friable MUDSTONE.			
12TH					47.10		2.90

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BOREHOLE LOGSHEET

Water Observations, Remarks, Etc
No water encountered.

Northern section of TP7 displaying apparent 20 to 30 degree slope, indicative of top of existing railway cutting slope.

CLIENT	JOB NO	LOCATION	BOREHOLE NO
ROBINSON CONSULTING ENGS	C8761	LAND OFF SAVILE ROAD, DEWSBURY	TP8
DATE: NOVEMBER 1996 — SCALE: 1 to 50	BORING METHOD: MECHANICAL EXCAVATOR (JCB3X)		Sheet: 1

Drilling & Casing Progress	SAMPLE/TEST Type & No.	SAMPLE/TEST Depth(M)	SPT N – value or COHESION	DESCRIPTION	O D LEVEL	LEGEND	DEPTH
12TH					49.80		0.0
				MADE GROUND – Black topsoil.	49.50		0.30
				MADE GROUND – Very stiff (dessicated?) brown and grey mottled fissured clayey subsoil, with many roots.	49.10		0.70
				MADE GROUND? – Possibly disturbed dark brown and grey very dry (dessicated?) very stiff and friable fissured "soily" CLAY.	48.70		1.10
				Very stiff fissured light rusty orangey brown and grey very friable silty slightly sandy CLAY.	47.30		2.50
12TH				Grading into an initially very to completely weathered light grey friable MUDSTONE.	46.60		3.20

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BOREHOLE LOGSHEET

Water Observations, Remarks, Etc
No water encountered.

CLIENT	JOB NO	LOCATION	BOREHOLE NO
ROBINSON CONSULTING ENGS	C8761	LAND OFF SAVILE ROAD, DEWSBURY	TP9
DATE: NOVEMBER 1996 — SCALE: 1 to 50	BORING METHOD: MECHANICAL EXCAVATOR (JCB3X)		Sheet: 1

Drilling & Casing Progress	SAMPLE/TEST Type & No.	SAMPLE/TEST Depth(M)	SPT N – value or COHESION	DESCRIPTION	O D LEVEL	LEGEND	DEPTH
12TH					50.80		0.0
				MADE GROUND – Dark brown and grey claybound mudstone, shale and sandstone rubble.	49.90		0.90
12TH				Initially very weathered and weak light grey very friable MUDSTONE, becoming more competent from around 1.60m, with tight closely spaced ironstained joints.	48.80		2.00

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TEL 091-526-2534 FAX 091-517-0085

BOREHOLE LOGSHEET

Water Observations, Remarks, Etc
No water encountered.

CLIENT	JOB NO	LOCATION	BOREHOLE NO
ROBINSON CONSULTING ENGS	C8761	LAND OFF SAVILE ROAD, DEWSBURY	TP10
DATE: NOVEMBER 1996 — SCALE: 1 to 50	BORING METHOD: MECHANICAL EXCAVATOR (JCB3X)		Sheet: 1

Drilling & Casing Progress	SAMPLE/TEST Type & No.	SAMPLE/TEST Depth(M)	SPT N – value or COHESION	DESCRIPTION	O D LEVEL	LEGEND	DEPTH
12TH				MADE GROUND – Fairly compact dark brown and grey claybound fine to coarse fragmented mudstone, siltstone and sandstone, with small occ. glass, bricks etc, and some black "soily" veins.	50.50		0.0
12TH					47.00		3.50

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BOREHOLE LOGSHEET

Water Observations, Remarks, Etc
No water encountered.

CLIENT	JOB NO	LOCATION	BOREHOLE NO
ROBINSON CONSULTING ENGS	C8761	LAND OFF SAVILE ROAD, DEWSBURY	TP11
DATE: NOVEMBER 1996 — SCALE: 1 to 50	BORING METHOD: MECHANICAL EXCAVATOR (JCB3X)		Sheet: 1

Drilling & Casing Progress	SAMPLE/TEST Type & No.	SAMPLE/TEST Depth(M)	SPT N – value or COHESION	DESCRIPTION	O D LEVEL	LEGEND	DEPTH
12TH					52.30		0.0
				MADE GROUND – Disturbed black subsoil.	52.20		0.10
				MADE GROUND? – Possibly disturbed "rubbly" dark brown and grey ironstained shale.	51.50		0.80
				Grading into an initially very to completely weathered light grey very friable MUDSTONE, becoming hard at 3.00m.			
12TH					49.30		3.00

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TEL 091-526-2534 FAX 091-517-0085

BOREHOLE LOGSHEET

Water Observations, Remarks, Etc
No water encountered.

CLIENT	JOB NO	LOCATION	BOREHOLE NO
ROBINSON CONSULTING ENGS	C8761	LAND OFF SAVILE ROAD, DEWSBURY	TP12
DATE: NOVEMBER 1996 / SCALE: 1 to 50	BORING METHOD: MECHANICAL EXCAVATOR (JCB3X)		Sheet: 1

Drilling & Casing Progress	SAMPLE/TEST Type & No.	SAMPLE/TEST Depth(M)	SPT N – value or COHESION	DESCRIPTION	O D LEVEL	LEGEND	DEPTH
12TH					52.00		0.0
				MADE GROUND? – Possibly disturbed dark grey "rubbly" shaly mudstone.			
					51.15		0.85
				Initially very to completely weathered light grey very friable occasionally ironstained MUDSTONE.			
12TH					49.00		3.00

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TEL 091-526-2534 FAX 091-517-0085

BOREHOLE LOGSHEET

Water Observations, Remarks, Etc
No water encountered.

geo engineering

ROBINSON CONSULTING ENGINEERS

PHASE 2 : GROUND INVESTIGATION REPORT

PROPOSED RESIDENTIAL DEVELOPMENT
SAVILLE ROAD
DEWSBURY
WEST YORKSHIRE

RE/002074

ROBINSON ENVIRONMENTAL

ROBINSON CONSULTING ENGINEERS

PHASE 2: GROUND INVESTIGATION REPORT

PROPOSED RESIDENTIAL DEVELOPMENT

SAVILLE ROAD

DEWSBURY, WEST YORKSHIRE

Document Control Sheet:

Project No. RE/002074

Type	Prepared By	Approved By

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Date: 23/03/01	Initials		Initials	

Revision	Name		Name	
Date	Initials		Initials	

Revision	Name		Name	
Date	Initials		Initials	

This report, the information and/or advice which it contains is based solely on, and is limited to, the data obtained from the boreholes put down and from the subsequent tests carried out. Responsibility cannot be accepted for conditions not revealed by the Investigation or variations in the ground conditions between and around the investigation positions. All, comments, opinions, diagrams or cross sections and sketches contained within the report, and/or any configuration of the findings is conjectural and given for guidance only and confirmation of intermediate ground conditions should be considered if deemed necessary. Agreement for the use of this report by any Third Party must be obtained in writing from Robinson Environmental.

CONTENTS

1.0 Introduction

March 2001

As requested by Robinson Consulting Engineers of Bradford, on behalf of Oakapple Partnerships, a Phase 2: Ground Investigation was carried out, over an area of land off Saville Road, Dewsbury, where is proposed to redevelop the site for new housing.

The investigation comprised a series of mechanically excavated trenches to locate a coal outcrop, as well as a series of dynamic probes (14 no.) to check the consistency of the infilled railway cutting, the locations of which can be seen on the Proposed Site Layout Plan (Figure 1), a reduced extract of which can be seen in Appendix I.

2.0 Site Details

Site Name:	Proposed Residential Development Saville Road
Site Address:	Saville Road, Dewsbury, West Yorkshire
OS Grid Reference:	~
Description of Location:	Previously infilled railway cutting
Site boundaries:	~
Site Setting:	Mainly residential
Adjacent Site Uses:	Mainly residential

* N = north, S = south, E = east, W = west

3.0 Scope of Works

Client:	Oakapple Partnerships
Consultant:	Robinson Consulting Engineers.
Project type:	Residential Development
Site Location plan:	NP
Layout plan (existing):	NP
Layout plan (proposed):	See Appendix I
Intrusive Investigation Works:	Mechanically excavated trenches 14 no. dynamic probes 4 no. hand samples for contamination
Laboratory Testing:	Geotechnical & Ground Contamination
Reporting:	Factual & Interpretative.
Comments:	This report should be read in conjunction with previous desk top study and report for site (Dunelm Drilling Company C8761, November 1996)

NP – not provided. NA – none appointed. NK – not known.

At each trench position, the types and changes of strata were noted, and these are duly recorded on the graphic trench record sheets, copies of which can be found in Appendix II. Also recorded are the depths at which groundwater was encountered, and its final standing levels, where recorded. A series of dynamic probes, generally along the route of the previously infilled railway cutting were also undertaken, the results of which can be seen in the dynamic probe record sheets in Appendix III.

3.0 Scope of Works (Cont'd)

The information contained in this report is limited to the site boundary, as indicated on the plan shown in Appendix I, and the areas accessible during the ground investigation. The depths of strata on the record sheets are recorded from current ground levels. No additional desk top study, topographical or walk over survey was requested or undertaken and therefore when considering the full scope of the development any features and/or issues not specifically mentioned in this report cannot be assumed to have been covered.

4.0 Ground Conditions

For an accurate description of the ground conditions encountered at each investigation positions, reference should be made to the trench record sheets in Appendix II. In addition, a summary of the ground conditions can be found in Table 4.1 below, based on the trenches done to locate the coal seam.

The investigation was carried out over an extended period of time due to the soft surface ground conditions recorded, particularly after prolonged rainfall. An initial site visit was undertaken on 27/11/00, where due to prolonged rainfall, the investigation was abandoned due to health and safety reasons. Monitoring of the site was undertaken periodically to check if conditions were improving, with further field testing (dynamic probes) being able to be carried out from 6 – 7/3/01, and gas spike tests on 20/3/01. Even after the delayed period to allow surface conditions to dry, access was not available to an area of land adjacent to the existing tunnel, as shown in Figure 2 in Appendix I.

Table 4.1

Type of Strata (see descriptions below table)	**Depths Recorded (BGL)**	**General Comments**
MADE GROUND:	From 0.00m up to 0.15m to 0.70m	Made ground appears to comprise mainly clay fill, with occasional soily areas (particularly upper levels), brick fragments etc.
BEDROCK (or completely weathered rock)	From 0.15m to 0.70m up to 1.40m to 2.50m	Comprising very to completely weathered MUDSTONE/CLAY. Coal seam (thin – 0 – 0.20m) noted in trench 2 & 3. Coal seam noted as poor to reasonable quality, with a seat earth below. No evidence of abstraction was noted.

No water was struck, with each trench remaining dry throughout the investigation period.

5.0 Insitu Testing

5.1 Insitu Dynamic Probes

Insitu dynamic probes were carried out across the development area, mainly concentrating in deeper areas of fill, in order to determine the relative density/consistency of the infilled railway cutting and previous earthworks undertaken. In each case a 90-degree solid cone was driven into the ground using a 50kg hammer, over a 500mm drop. The number of blows for each 100mm of penetration was recorded, and this value over 300mm can be site specifically correlated to the SPT 'N' value. These values are shown both graphically and numerically on the dynamic probe record sheets in Appendix III.

Access was not available to the very soft area as shown in Figure 2 in Appendix I. Dynamic probe no. 1 was unable to be undertaken (this was scheduled in this area on original planning of the investigation).

As can be seen from these results, relatively similar, if slightly erratic, resistance profiles were obtained. For the majority of the site however, the mass characteristics of the fill would appear to be at least medium dense to dense. These results indicate that the materials tested appear to have been placed and compacted under relatively controlled conditions.

There was however a high level obstruction at probe 2, which resulted in early termination of this probe. At probe 15 there was an apparent "void" from 0.60m to 0.90m, and this is thought to be indicative of a field drain or similar, rather than indicative of pervasive voiding.

5.2 Insitu Soil Vapour Survey for Landfill Gas

An insitu soil gas/vapour monitoring survey was undertaken at 22 points across the site on 20/3/01, to check the presence or not of any landfill gas emissions from the infilled railway cutting. In each case a small diameter (25mm nominal hole) was formed with an electrically driven auger, to a depth of at least 1m below ground levels. This formed hole was plugged and left for a short period of time to allow soil gasses to equilibrate. Soil vapours were then measured using a Geotechnical Instruments GA2000 infrared gas analyser, to measure insitu levels of methane, oxygen, carbon dioxide, carbon monoxide, hydrogen sulphide, as well as atmospheric pressure.

The results of the testing carried out, and the positions of the "spike" survey can be seen in Appendix IV.

As can be seen from the results of the tests undertaken, no elevated gas levels were noted, with comparably "normal" gas results obtained. These results would suggest that, there is no evidence of landfill gas migration or production below this site.

6.0 Laboratory Testing

All testing was carried out in accordance with BS1377:1990:Parts 1-9 unless otherwise stated.

6.1 Determination of pH & SO_4: –

Representative samples of the soil encountered in the investigation were tested in order to determine their acidic and soluble sulphate levels. The results are shown in Table 6.1 below and are also shown in the laboratory testing summary sheets in Appendix V (ECoS & AES analytical reports).

Table 6.1

TP/BH	Depth(m)	M/C(%)	pH	SO_4(g/l)	% Passing 2.00mm sieve	Class
TR1	0.25	~	7.6	0.182	~	1
TR2	0.40	~	8.8	0.613	~	1
TR2	0.70	~	5.5	0.136	~	1
S1	0.20	~	8.1	0.048	~	1
S2	0.25	~	7.8	0.055	~	1
S3	0.15	~	8.9	0.019	~	1
S4	0.25	~	9.7	0.015	~	1

From these results it can be seen that the samples tested are generally of a slightly acidic to slightly alkaline disposition, and the amount of soluble sulphate present falls within the Class 1 range. Therefore, in accordance with BRE Digest 363:1996, the site can be given a classification of Class 1, and there should be little risk of aggression towards foundation or buried concrete coming into contact with these materials.

6.2 Contamination Screening: -

Representative samples of the upper materials (made ground) in the investigation (both from trenching as well as surface samples by hand) were passed onto ECoS Environmental, and AES, so that contamination screening, generally in accordance current ICRCL Guidance notes (59/83), could be carried out. The results of these tests can be seen in the technical reports no. R20/3763 & ROBDG – 4349, copies of which can be found in Appendix V.

As can be seen from these results, for the majority of analytes screened, the threshold values associated with the proposed end use, i.e. residential development with gardens, have not been exceeded.

There are however, slightly elevated levels of arsenic, which just exceed the 10mg/kg threshold level for domestic gardens, but fall well below the threshold value for parks playing fields and open spaces (ICRCL 59/83). The levels obtained for arsenic are all below optimum/uncontaminated threshold values within the Dutch List criteria/GLC guidelines respectively. There are also two slightly elevated total sulphate levels from TR1 & TR2, but these fall below the 10000mg/kg action level for this analyte, again as given in the ICRCL 59/83 guidelines.

6.0 Laboratory Testing (Cont'd)

6.2 Contamination Screening (Cont'd)

Three of the 7 samples screened also revealed slightly elevated levels of Toluene Extractable Matter (TEM). The TEM test is essentially a "catch all" screen of organic material within a sample. The samples screened which revealed these slightly elevated TEM levels were very "soily" and were noted to contain old rootlets etc, and it is felt that the recorded TEM levels are attributable to the presence of these features, rather than an indication of more harmful organic contamination, such as PAH etc.

7.0 Conclusions & Recommendations

From the information gained in this ground investigation, and from the results of the tests carried out, it would appear that the infill used within the previous railway cutting is relatively compact, and appears to have been placed in a controlled and engineered manner, with the mass characteristics of the fill tested suggesting at least medium dense materials.

There was however an area of atypical backfill, close to the mouth of an existing railway tunnel, the approximate area of which is shown in Figure 2 in Appendix I. It is suggested this material is treated separately from the fill across the remainder of the site, and if to be used as a structural fill it is either removed/replaced or improved to a similar consistency to the remainder of the site.

It is believed that new dwellings within the fill are to be piled and any roadways on the fill are to be subject to "ground Improvement". The results of the dynamic probes can therefore be used to determine parameters for these processes, i.e., likely depths for piling and stiffness of the fill for subsequent improvement.

The investigation also proved the presence of an outcrop of coal, most likely to represent the 2nd Hards coal seam, as intimated from previous desktop study information. This was shown to be thin and generally inferior, with no evidence of extraction. There should be no requirement therefore for structural precautions against shallow coal abstraction below the site. However, due to the presence of coal at outcrop, and as coal has a low bulk density and a propensity for easily crushing under loading, it is felt that it would not prove a suitable foundation media. Foundations should therefore ideally be taken down through this coal, where it is within significant influence of new foundations.

If assuming new foundations close to outcrop are envisaged to be around 0.60m wide and are to be based at a minimum depth of around 0.75m to take account of shrinkage and swelling/frost protection etc, then an approximate "zone of influence" of these new foundations would be around 2.50m. From Figure 1 it can be seen that the southern properties will only be affected, with the northern properties to be piled below the influence of the coal. Based on a shallow coal dip of 3^0 - 4^0, the coal outcrop should be at a depth greater than 2.50m from current ground levels at a distance of around 40m from the outcrop. This therefore would appear to affect plots 4, 5 and 6 as shown on Figure 1 in Appendix I, although this may be less, bearing in mind that the levels are envisaged to be raised on this portion of the site.

There appears to be no direct evidence of shallow groundwater below the site, and no major problems are envisaged with this respect.

7.0 Conclusions & Recommendations (Cont'd)

Bearing in mind the mature of the materials encountered on this site (particularly the made ground), it is likely that adequate lateral trench support will be required for most excavations, in order to prevent trench wall collapse or over excavation, as well as to provide a safe working environment below a depth of 1.20m. In addition it is recommended that excavations remain open for as short a period as possible, since these materials will be susceptible to significant deterioration, if left open to the natural elements for any significant periods of time.

It is recommended that adequate surface drainage should be designed and installed by a competent contractor, in order to prevent surface water 'ponding' or collection, during and post construction, particularly where the existing surface drainage system is disrupted or damaged. In addition, for deeper excavations, drainage, service runs or the like that may pass close to or beneath any existing or proposed new foundations, these should be undertaken with care and completed prior to the preparation of any new foundations, so as not to allow any loose or granular material to move or 'flow', thus causing settlement to occur to any new or adjacent old foundation based at a higher level.

From the data gained, it is recommended that for the size and type of structures envisaged, normal strip or pad type foundations will prove adequate, where thin fill is evident. New foundations based in the mudstone/clay can be designed and constructed to a maximum allowable bearing pressure of at least 200kN/m^2, without the risk of failure or excessive settlements occurring.

From the results of the contamination screening carried out on the samples of made ground, it can be seen that the fill materials may have to be considered as 'slightly contaminated, and dealt with accordingly if they are to be removed as a waste material from site. Due to the low levels of contamination observed, it is felt these materials can remain on site without requiring treatment and do not pose a risk with respect to off-site migration towards any nearby potentially sensitive receptors or the groundwater present in the underlying minor aquifer. Some minor "clean" topsoil cover is however recommended for any garden areas, due to the very slightly elevated arsenic and TEM levels recorded, in order to negate any risk of harm to human health through direct dermal contact or ingestion in the future.

The results of the screening can also be used to enable the appointed Planning Supervisor to formulate an adequate safety plan in accordance with current CDM regulations, and when designing a site Health and Safety Plan.

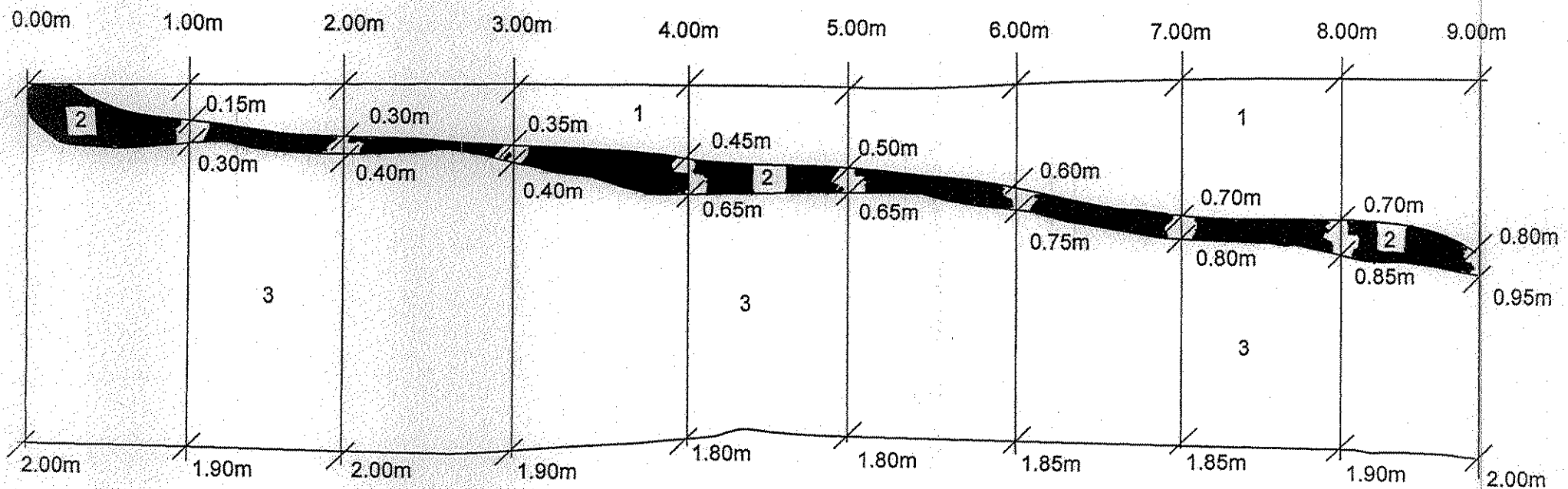
A strict "observational technique" should be applied to design and construction of the new foundations on this site, and where ground conditions seem to vary from that indicated from the conceptual ground model derived from works to date, then advice from a suitably qualified Engineering Geologist/Geotechnical Engineer should be sought.

END OF REPORT

APPENDIX I

Fig 1 - Site Investigation Location Plan
Fig 2 – Extent of recorded "soft area"

TRENCH NO. 2 SAVILLE ROAD



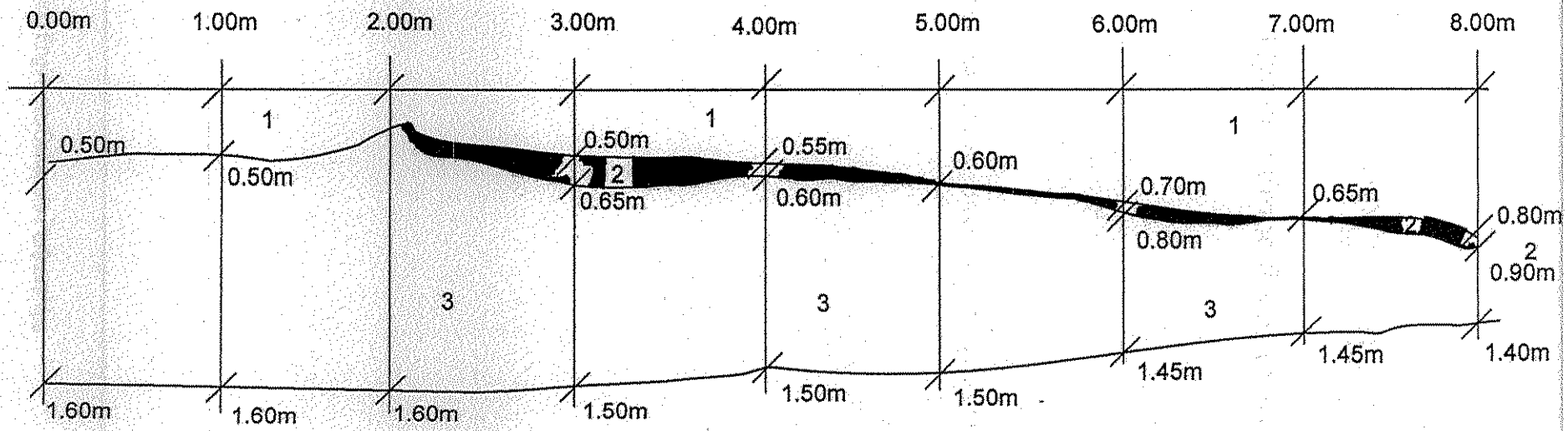
KEY

1 Made Ground / stiff mudstony clay

2 Apparent Coal Seam (including seat earth etc)

3 Mudstone

TRENCH NO. 3 SAVILLE ROAD



KEY

1 Made Ground / stiff mudstony clay

2 Apparent Coal Seam (very poor)

3 Mudstone (occasionally very mudstony clays)

Appendix IV

Extracts from REL (2006) & RGE (2007)Reports

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Savile Town Developments
Savile Road, Dewsbury

Ground Engineering Interpretative Report 05-5648

This report has been prepared for the sole benefit, use and information of Developments Ltd and the liability of Robinson Environmental Limited, its Partners and Employees in respect of the information contained in the report will not extend to any third party.

Author	Steve Hill	Approved	Hakop Mirzabaugian
Signed	S. Hill	Signed	H. Mirzabaugian
Date	May 2006	Date	May 2006

Contents

1 Executive Summary

A former railway cutting site (now backfilled) located off Savile Road, Dewsbury is to be redeveloped with two storey housing and a two storey health centre with associated infrastructure.

Robinson Environmental Ltd (REL) were commissioned by Savile Town Developments Ltd (STDL) to undertake a site investigation at the site.

The findings of this investigation show that the site is underlain by made ground to a maximum depth of 10.20m which is locally underlain by natural superficial deposits comprising firm and stiff clays. Bedrock was encountered at depths between 3.50m bgl and 10.20m bgl and was proven to depths of 29.50m.

No economically workable thicknesses of coal were encountered during the rotary openholes and the risk of void migration from shallow workings to the surface of the site is classed as negligible.

Contamination test results indicate that a 500mm clean cover layer of imported topsoil should be utilised in areas of soft landscaping and private garden areas.

Results of the gas monitoring shows that gas protection measures in accordance with CIRIA Report 149, characteristic situation 2, should be adopted at the site.

In view of the ground conditions a piled foundation solution has been recommended with the consideration of vibro-stone columns.

2 Introduction

Developments Ltd propose to develop a site located off Saville Road, Dewsbury for two storey residential housing and a two storey health centre. Robinson Environmental Ltd (REL) were commissioned by Savile Town Developments Ltd to undertake an intrusive site investigation at the site.

This report presents the findings of the site investigation and makes recommendations on ground related design and construction issues. This report covers both geotechnical and geoenvironmental aspects of the development. A Phase I Desk Study Report was prepared by REL, REL Report No. 05-5648RE, March 2006 and should be read in conjunction with this report.

Factual data for the site investigation together with laboratory and insitu testing results are presented within the appendices, and should be read in conjunction with this report.

3 The Site

3.1 Site Location and Description

The site is located off The Sidings, Savile Road, Dewsbury, West Yorkshire at National Grid Reference 424450, 420490. A site location plan is included within Appendix A.

The site is rectangular in shape and covers an area of approximately 13500m^2. The site is flat and has a level of approximately 52.0m AOD. The site is bounded to the east and west by residential properties of Headfield and Caledonian Road respectively. Residential properties located on The Sidings bound the site to the north. The site remains undeveloped along the southern boundary and comprises grassed land.

3.2 Site History

The historical uses of the site are covered in REL Report No. 05-5648RE March 2006. The following is a summary of the historical features relevant to the development of the site.

The earliest available historical plan of 1855 shows the northern part of the site as open farmland while the southern area contains buildings and trees. Three small quarries are shown 100m to the south of the site.

The plan of 1893 shows Headfield Quarry as disused 50m to the southwest of the site.

The plan of 1907 shows the buildings on site have been demolished and the site is shown as a cutting. A tunnel has been constructed under Savile Road to the north of the site connecting with a similar cutting on the opposite side of the road.

The plan of 1922 shows two railway lines have been constructed on the site. A new quarry is shown 45m to the southeast of the site.

The plan of 1965 shows both railway lines have been dismantled and the railway cuttings backfilled.

3.3 Site Geology

The 1:50,000 BGS Sheet 77 – Huddersfield, Solid and Drift edition indicates the site to be underlain by artificially modified infilled ground. This is inturn underlain at depth by the Westphalian Coal Measures of the Upper Carboniferous.

4 Ground Investigation

4.1 General

The site investigation was designed to gather geotechnical and geoenvironmental information on the materials beneath the site.

The investigation was supervised by an REL Engineer on a full time basis.

4.2 Current Investigation

The intrusive site investigation was carried out on the 5 February 2006, between the 13 and 14 February 2006 and on the 9 April 2006, and briefly comprised:

- The mechanical excavation of eight trial pits, denoted TP1 to TP8, to depths of up to 5.00m bgl.
- The sinking of four cable percussive boreholes, denoted BH1 to BH4, to depths of up to 10.20m bgl.
- The sinking of two rotary openhole boreholes, denoted RH1 to RH2, to depths of up to 29.50m bgl.
- The installation of four gas and groundwater monitoring standpipes within BH1 to BH4, to depths of up to 10.00m bgl.

An exploratory hole location plan is included within Appendix A.

5 Ground Conditions

The following is a summary of the ground conditions encountered during the site investigation and should be read in conjunction with the Exploratory Hole record sheets presented within Appendix B.

5.1 Stratigraphy

The table below summarises the depths of the materials encountered within the exploratory holes.

Strata	Range of Depths Encountered (mbgl)	Maximum Thickness (m)
MADE GROUND:	0.00 to 10.20	10.20 (BH4)
NATURAL CLAY DEPOSITS:	3.50 to 7.20	0.50 (BH1)
BEDROCK:	3.50 to 29.50*	23.8 (RH1)

* denotes the exploratory hole was terminated before the base of the strata was encountered, hence it is considered that the strata extends beyond the depths recorded.

5.2 Groundwater

Groundwater was not encountered during either the sinking of the cable percussive or rotary boreholes. It should be noted however, that the rapid rates of exploratory hole progression may mask minor seepages.

Groundwater seepage was encountered during the excavation of TP4, TP6 and TP8 at depths between 0.80m and 4.10m bgl.

5.3 Made Ground

Made ground was encountered in all exploratory holes and comprised predominantly cohesive deposits with local sand inclusions. The gravel fraction of the made ground comprised brick, sandstone, tarmacadam, concrete, coal and clinker. Decayed organic matter and rootlets were also noted.

The maximum depth of made ground was encountered within BH4 to a depth of 10.20m bgl.

5.4 Natural Deposits

Natural superficial deposits were encountered underlying the made ground within TP2, TP4, BH1 and BH3 only. These deposits comprised firm and stiff sandy gravely clay. The gravel fraction comprised sandstone and mudstone.

5.5 Bedrock

Underlying the made ground or natural superficial deposits bedrock was encountered within RH1, RH2, TP6, TP7, and BH1 to BH4 inclusive. The depths to rockhead varied between 3.50m (TP6) to 10.20m bgl (BH4).

Bedrock comprised alternating sandstone, siltstone, mudstone and thin coal seams and the findings are in agreement with the anticipated Westphalian Coal Measures as highlighted from the geological map for the area.

5.5.1 Coal Mining Risks

The rotary boreholes constructed at the site did not encounter economically viable thicknesses of coal seams or evidence of workings underlying the site. The risk from void migration from shallow worked seams to the surface of the site is minimal.

6 Testing

6.1 Insitu Testing

Insitu Standard Penetration Tests (SPT's) were carried out during the progression of the cable percussive boreholes. The SPT's were taken in order to give an indication of the relative density of granular deposits, the undrained shear strength of the cohesive deposits and the strength of bedrock deposits.

The results and the depths of the SPT's can be found adjacent to the appropriate sample level on the relevant exploratory hole record sheets included in Appendix B.

6.2 Laboratory Testing

6.2.1 General

A representative number of soil samples were scheduled by REL for a range of geotechnical and geoenvironmental testing. The various types of testing undertaken and the results are presented below. Test results as received from the laboratory are presented within Appendix D.

6.2.2 Geotechnical Testing

Geotechnical testing was carried out in compliance to BS1377:1990 and comprised soluble sulphate and pH testing and particle size distribution analysis.

Soluble sulphate testing indicates values between 0.06g/l and 0.36g/l while pH values vary between 7.25 and 10.95.

The particle size distribution analysis indicates that the granular soils below the site comprise slightly clayey to clayey sandy gravel.

6.2.3 Geoenvironmental Testing

Geoenvironmental testing was carried out on 11 soil samples and 2 water samples for the assessment of the risk to human health and groundwater.

The determinants tested include:

Arsenic, Boron, Cadmium, Chromium, Copper, Lead , Mercury, Nickel, Selenium, Zinc, pH, Sulphate, Cyanide, Phenols, Total Organic Carbon, Polyaromatic Hydrocarbon, Total Petroleum Hydrocarbon (C10-C40) and Diesel Range Organics (DRO).

The geoenvironmental testing was sent under subcontract to Chemtech Environmental Ltd and Derwentside Environmental Testing Services Ltd.

7 Contamination

7.1 General

7.2 Background on Guidance

Results from the soil samples have been compared, where possible, to the Department of the Environment, Food and Rural Affairs (DEFRA) / The Environment Agency (EA), Contaminated Land Exposure Assessment (CLEA) Soil Guideline Values (SGV's). The CLEA method is based on a statistical approach to the likelihood of a soil borne contaminant being present on the site above the specified SGV. Currently only the following ten SGV's have been published: Arsenic, Cadmium, Chromium, Lead, Inorganic Mercury, Nickel, Selenium, Phenol, Toluene and Ethyl Benzene. CLEA guidance is concerned with the assessment of risk to human health only.

Where no SGV's are provided, the Dutch intervention values (DIV's) (Ministry of Housing, Spatial Planning and Environment, 1994) have been used. It should be noted that the Dutch guidance is based on a multi use approach, i.e. not end use specific like CLEA and is therefore generally more conservative.

7.3 Comparison with Guidance Levels

7.3.1 Soils

The results have been compared to the available guideline values and indicate that the majority of the determinants tested are below their relevant guideline values and therefore pose no risk to human health.

The exceptions to this are for locally very slightly elevated arsenic and locally elevated PAH and TPH.

The slightly elevated arsenic values are recorded from two samples from BH1 and BH4 at depths between 1.00 and 1.10m bgl. The recorded values were 24mg/kg and 22mg/kg for BH1 and BH4 respectively, compared to a CLEA soil guideline value of 20mg/kg. The results are not considered to pose a risk to human health.

Elevated values of PAH were recorded from BH2, BH3, BH4, TP2, TP5, TP6 and TP7 at shallow depths between 0.50 to 1.50m bgl. Elevated values of PAH were recorded between 50mg/kg and 285mg/kg compared to a DIV of 40mg/kg.

Elevated values of TPH were recorded from BH1, BH3, BH4, TP5, TP6 and TP7 at shallow depths between 0.50 to 1.50m bgl. Elevated values of TPH were recorded between 790mg/kg and 1909mg/kg compared to a DIV of 5000mg/kg.

The locally elevated PAH and TPH results have been speciated and the results are included in Appendix C. The results show that TPH levels are spread over the C10-C40 range and are likely to be attributed to the presence of coal, clinker or tarmacadam within the made ground. The locally elevated PAH's can also be attributed to these materials. In order to break the pathway from the source of contamination to the end users of the site it is recommended a 500mm thick layer of clean topsoil be utilised in areas of soft landscaping or garden areas. The footprint of housing or road infrastructure will also be an effective means of capping the contamination and breaking the pathway from contamination source to the end users of the site.

7.3.2 Groundwater

Ground water samples were taken during the gas and groundwater monitoring period and were scheduled for a range of chemical determinants. The results of the groundwater analysis have been compared to the stringent drinking water guidelines. The majority of the determinants are below the relevant guideline values with the exception of elevated PAH and DRO (C10-C24). A PAH value of 0.00022 mg/l was recorded from BH4 compared to the drinking water guideline value of 0.0001 mg/l. Two elevated DRO values of 0.086 mg/l and 0.27 mg/l were recorded from BH3 and BH4 respectively. The guideline value fro DRO (based on dissolved / emulsified hydrocarbons) is 0.01 mg/l. Based on these results and the fact that the site is underlain by a minor aquifer and the nearest groundwater abstraction is located 135m to the north of the site, the results are considered to pose a low risk to groundwater.

7.3.3 Ground Gas

Ground gas and groundwater monitoring is ongoing at the site. The results available to date show that oxygen concentrations varied between 0.00% and 19.4%, carbon dioxide concentrations between 0.00% and 4.8% and methane concentrations between 0.1% and 4.9%. The atmospheric pressure at the time of the readings was between 1002 and 1005 mb.

8 Risk Assessment

8.1 General

The risk management approach to contaminated land aims to assess the risks on a site from contamination by assessing the Source/Pathway/Target scenarios. This process is described below.

For a risk of harm to receptors such as end users and the environment to exist, there must be a source of 'harm', a 'receptor' to be harmed and a 'pathway' by which the source can reach the receptor. If anyone of these three is absent then the risk is removed.

Chemical testing has been carried out on a total of 11 samples and the results are discussed below.

8.2 Soils

8.2.1 End Users as a Target

Based on the site investigation and the results of the laboratory testing the contamination beneath the site should be capped by either a 500mm thick layer of clean imported topsoil or under the footprint of buildings and road infrastructure and hardstanding. The capping of the contamination will effectively break the pathway from the contamination source to the end users of the site and therefore will remove the risk to the end users of the site.

8.2.2 Groundwater as a Target

Based on the laboratory testing information to date the risk to groundwater as a target is classified as low. This is based on the fact that the underlying site geology is classified as a minor aquifer, the nearest groundwater is located 135m to the north of the sit and that the majority of the test results are below their relevant guideline values.

8.3.3 Construction and Future Maintenance Workers as a Target

There is a potential for the levels of contaminants to impact on construction and future maintenance workers via skin contact, inhalation and ingestion. Standard PPE in the form of gloves and dust masks should be provided as well as washing facilities.

8.3 Groundwater

Based on the fact that limited groundwater was encountered during the site investigation, the majority of the determinants tested are below guideline values, and the majority of the site will be capped by the footprint of buildings, areas of road infrastructure or hardstanding. The risk from groundwater to impact on the end users or construction and maintenance workers is classified as negligible.

8.4 Ground Gas

The results of the ground gas monitoring indicate that the site is classified in accordance with CIRIA Report 149 as a Characteristic Situation 2 and that gas protection measures are required at the site.

9 Proposed Development

9.1 Introduction

It is proposed to redevelop the site with between 18 and 20 two storey detached housing, a two storey health centre and areas of road infrastructure, hardstanding, car parking and private garden areas.

9.2 Constraints on Development

9.2.1 Buried Obstructions

No buried obstructions were encountered during the site investigation works. However, due to the history of the site (infilled railway cutting) it may be possible that buried obstructions exist within the made ground which were not encountered during the investigation.

9.2.2 Contamination

Based on the findings of the site investigation and the laboratory testing on site contamination is locally present and will require capping to break the pathway from source to end users. It is recommended that a 500mm thick clean cover layer of imported topsoils is utilised in areas of soft landscaping and garden areas. The footrprint of buildings or areas of road infrastructure will also break the pathway from the contamination source to the end users of the site.

9.2.3 Ground Gas

The results of the ground gas monitoring to date indicate that the site is classified in accordance with CIRIA Report 149 as a Characteristic Situation 2 and that the following gas protection measures will be required at the site:

- Ventilation of confined spaces within building
- Well constructed ground slab
- Low permeability gas membrane
- Minimum penetration of ground slab by services

9.2.4 Existing Services

Services exist on the site which may require redirection or protection prior to construction.

10 Discussion and Recommendations

10.1 Foundations

Deep foundations in the form of driven and bored cast in place piles will be uneconomic for the type of development proposed fro the site. It is therefore recommended that ground improvement in the form of stone columns should be used. This will then enable the use of shallow foundations.

In view of the ground conditions encountered during the investigation, in particular the significant quantities of made ground, it is recommended that a piled foundation solution or a ground improvement technique such as vibro-replacement stone columns are utilised.

10.2 Buried Concrete

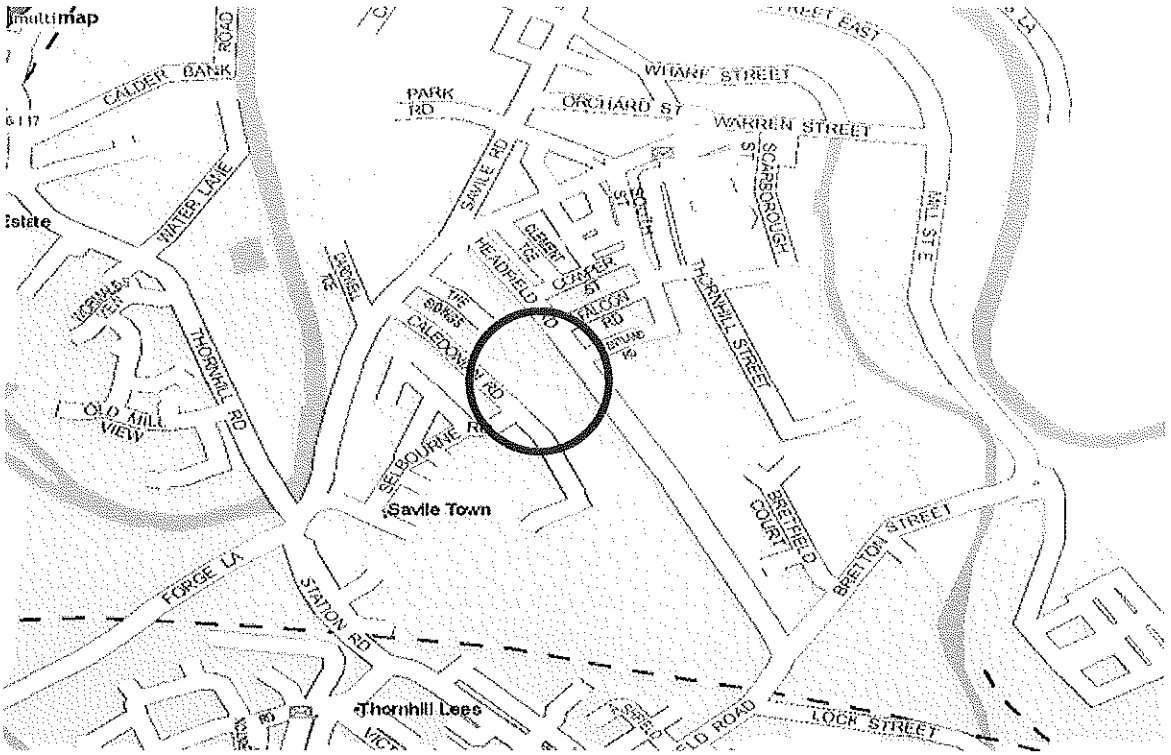
Based on the results of soluble sulphate testing the site Design Sulphate (DS) classification for the site is DS-1 and the Aggresive Chemical Environment for Concrete (ACEC) classification for the site is AC-1s.

10.3 Excavation and Earthworks

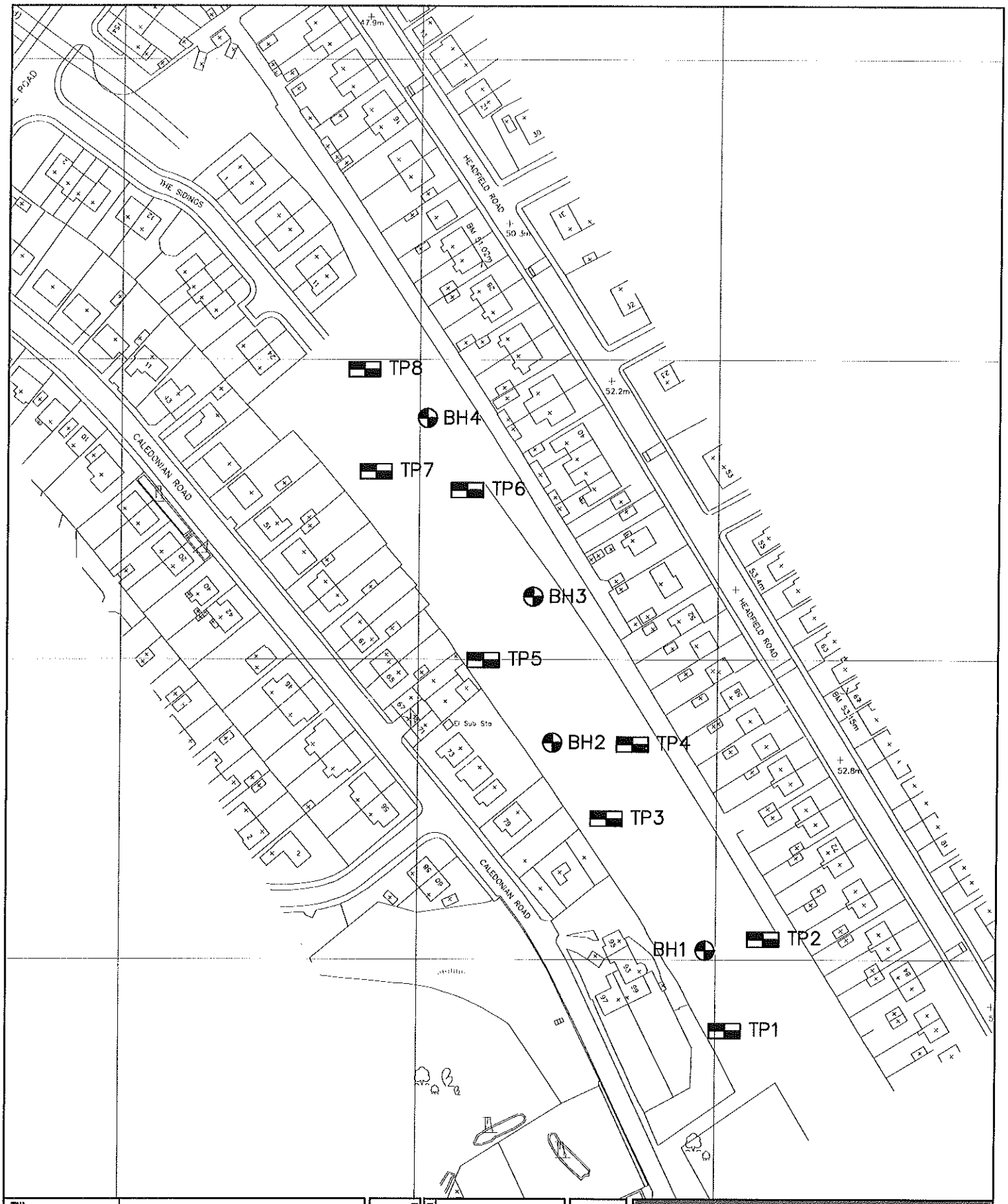
Excavations within the made ground deposits will be achievable by conventional JCB / 3CX type backhoe excavators.

Any surplus material resulting from the piling or ground improvement process should be stockpiled and tested for waste disposal purposes. If any obviously contaminated or ashy material be encountered this should stockpiled separately in order to reduce disposal costs. An experienced geoenvironmental engineer should be present to sample the various stockpiles and schedule the correct Waste Acceptance Criteria (WAC) testing.

Appendix A FIGURES & DRAWINGS



Ground Investigation Report	Appendix A	Site Location Plans and Aerial Photo
ROBINSON ENVIRONMENTAL	Robinson Environmental 1 West Durham Office Park St John's Road Meadowfield Industrial Estate, Durham, DH7 8RD TEL- 0191 378 7480 Fax-0191 378 7481	**SITE NAME: Savile Road Dewsbury** **REF: 05-5648 RE** **CLIENT: Savile Town Developments Ltd** REPRODUCED FROM ORDNANCE SURVEY MAP WITH THE PERMISSION OF THE CONTROLLER OF HER MAJESTY'S STATIONARY OFFICE: © CROWN COPYRIGHT



Title :
SAVILE ROAD, DEWSBURY

APPENDIX A

EXPLORATORY HOLE LOCATION PLAN

Job Reference :	Drawing Number :	Revision :
05-5848 RE	05-5848 RE_A	0

Drawn by :	Date :	Scale at A4 :
GC	APRIL 2006	NTS

Checked by :		Certificate Number FS 40109
SH		

Issued for:

REV	DATE	AMENDMENTS	DRAWN BY	CHKD

notes

All work to be carried out in accordance with Building Regulations and the requirements of the Local Authority.
The Contractor must check all dimensions on site before commencement of work.
No dimensions to be scaled off this drawing.

robinson environmental

1 West Durham Office Pk, St. John's Road
Meadowfield, Durham, DH7 8RD, Co. Durham

Telephone : +44 (0) 191 378 7480
Facsimile : +44 (0) 191 378 7481
email : environmental@robinsongroup.co.uk
web : www.robinsonenvironmental.co.uk

Appendix B EXPLORATORY HOLE RECORDS

ROBINSON
Robinson Environmental
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St Johns Road, Meadowfield Industrial Estate, Durham DH7 8RD
Telephone: 0191 378 7480
Fax: 0191 378 7481

BOREHOLE LOG

Project				BOREHOLE No
Savile Rd Dewsbury				RH1
Job No	Date	Ground Level (m)	Co-Ordinates ()	
05-5648RE	09-04-06 09-04-06			
Contractor				Sheet
Norwest Holst				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
						(2.00)	MADE GROUND - Brown sandy gravelly CLAY. Gravel is of brick and sandstone.		
						2.00			
						(3.70)	MADE GROUND - Brown grey very clayey SAND and GRAVEL. Gravel is of sandstone and brick. Wood fragments noted.		
						5.70			
						(6.00)	YELLOW SANDSTONE.		
						11.70			
						(3.30)	GREY MUDSTONE.		
						15.00			
						15.40	COAL SEAM.		
						15.90	BLACK MUDSTONE.		
						(5.60)	GREY MUDSTONE.		
						21.50			
						21.70	COAL SEAM.		
						22.20	BLACK MUDSTONE.		
						(7.30)	GREY MUDSTONE		
						29.50			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
09-04-06	11.00	29.50	7.00		10.20-11.00						Air Flush.

All dimensions in metres Scale 1:187.5	Client Savile Town Developments Ltd	Method/ Plant Used TRUCK MOUNTER R39	Logged By TW

AGS3 UK BH RHLOGS.GPJ AGS3_ALL.GDT 13/4/06

ROBINSON
Robinson Environmental
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St Johns Road, Meadowfield Industrial Estate, Durham DH7 8RD
Telephone: 0191 378 7480
Fax: 0191 378 7481

BOREHOLE LOG

Project				BOREHOLE No
Savile Rd Dewsbury				RH2
Job No	Date	Ground Level (m)	Co-Ordinates ()	
05-5648RE	09-04-06 09-04-06			
Contractor				Sheet
Norwest Holst				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
						(4.70) 4.70	MADE GROUND - Brown sandy gravelly CLAY. Gravel is of brick and sandstone.		
						(1.80) 6.50	Yellow SANDSTONE.		
						(18.50) 25.00	SILTSTONE/SANDSTONE		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
09-04-06	14.30	25.00	7.00		19.50-22.10						Air Flush.

All dimensions in metres Scale 1:156.25	Client Savile Town Developments Ltd	Method/ Plant Used TRUCK MOUNTED R39	Logged By TW

AGS3 UK BH RHLOGS.GPJ AGS3_ALL.GDT 13/4/06

ROBINSON
Robinson Environmental Ltd
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Fax: 0191 378 7481

BOREHOLE LOG

Project				BOREHOLE No
Savile Road, Dewsbury				BH1
Job No	Date	Ground Level (m)	Co-Ordinates ()	
05-5648 RE	12-01-06 12-01-06			
Contractor				Sheet
M&M				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.40-0.50	B					(1.00) 1.00	MADE GROUND - Mottled brown and grey slightly sandy slightly gravelly CLAY. Sand is fine-coarse. Gravel is angular-sub rounded, fine-coarse of sandstone and brick.		
1.00-1.10	B						MADE GROUND - Grey slightly sandy gravelly CLAY. Sand is fine-coarse. Gravelis angular-sub rounded, fine-coarse of brick and sandstone.		
1.50-1.95	J	1,2,8,11,12,15 N=46				(1.50)			
1.50-1.95	B					2.50			
2.50-2.60	B						MADE GROUND - Very Dence dark grey very clayey very sandy GRAVEL. Sand is fine-coarse. Gravel is angular-sub rounded, fine-coarse of brick, concrete and sandstone.		
3.30-3.75	B								
3.30-3.75	J	4,6,10,14,15,15 N=54							
4.00-4.10	B								
4.50-4.80	B					(4.20)			
4.50-4.80	J	10,19,12,40+ N=104							
5.50-5.60	B								
6.00-6.10	B								
6.50-6.60	B					6.70			
7.00-7.10	B					(0.50) 7.20	Stiff light yellowie brown with mottled greys slightly sandy slightly gravelly CLAY. Sand is fine-coarse. Gravel is angular-sub andular, fine-coarse of sandstone and mudstone. Becomes sandy with depth.		
7.50-7.60	B	5,22,50+ N=200				(0.95)	Very dense brown weathered SANDSTONE interbeded with MUDSTONE.		
8.00-8.15	J					8.15			

Boring Progress and Water Observations					
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

Chiselling			Water Added	
From	To	Hours	From	To
7.2	8	0.5		

GENERAL REMARKS

No groundwater encountered.

All dimensions in metres Scale 1:56.25	Client Savile Town Developments Ltd	Method/ Plant Used DANDO2000	Logged By TW

AGS3 UK BH BH LOGS.GPJ AGS3_ALL.GDT 21/4/06

ROBINSON
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Fax: 0191 378 7481

BOREHOLE LOG

Project				BOREHOLE No
Savile Road, Dewsbury				BH2
Job No	Date	Ground Level (m)	Co-Ordinates ()	
05-5648 RE	12-01-06 12-01-06			
Contractor				Sheet
M&M				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.30-0.40	B					(0.50) 0.50	MADE GROUND - Brown sandy gravelly CLAY. Sand is fine-coarse. Gravel is angular-sub rounded, fine-coarse of sandstone, coal and brick. Cobbles noted. Some wood fragments.		
1.00-1.10	B						MADE GROUND - Dark grey sandy gravelly CLAY. Sand is fine-coarse ashy. Gravel is angular-sub rounded, fine-coarse of sandstone, coal and brick. Wood fragments noted. Lenses of gravely Sand noted.		
1.50-1.60	B								
2.00-2.45	B								
2.00-2.45	J	5,4,4,4,3,2 N=13							
3.00-3.10	B					(5.60)			
3.50-3.60	B								
4.00-4.10	B								
4.50-4.95	B								
4.50-4.95	J	2,3,3,4,4,5 N=16							
5.50-5.60	B								
						6.10			
6.40-6.50	B					(0.70)	Weathered Brown and grey thinly bedded fine SANDSTONE and MUDSTONE.		
6.50-6.65	J	13,23,50+ N=200							
						6.80			
6.50-6.80	B								

Boring Progress and Water Observations					
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

Chiselling			Water Added	
From	To	Hours	From	To
6.1	6.5	1		

GENERAL REMARKS

No groundwater encountered.

All dimensions in metres Scale 1:43.75	Client Savile Town Developments Ltd	Method/ Plant Used DANDO2000	Logged By TW

AGS3 UK BH BH LOGS.GPJ AGS3_ALL.GDT 21/4/06

ROBINSON
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Meadowfield, Durham
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Fax: 0191 378 7481

BOREHOLE LOG

Project				BOREHOLE No
Savile Road, Dewsbury				BH3
Job No	Date	Ground Level (m)	Co-Ordinates ()	
05-5648 RE	13-01-06 13-01-06			
Contractor				Sheet
M&M				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.50-0.60	B					(1.50)	MADE GROUND - Brown clayey very gravelly SAND. Sand is fine-course. Gravel is angular-sub rounded, fine-coarse of sandstone, brick, tarmac and concrete.		
1.00-1.10	B					1.50			
1.50-1.60	B					(0.50)	MADE GROUND - Dark grey very clayey very gravelly SAND. Sand is fine-coarse. Gravel is angular-sub angular fine-coarse of sandstone, brick and clinker.		
2.00-2.45	B					2.00			
2.00-2.45	J	,2,7,6,5,6 N=24				(1.90)	MADE GROUND - Dark grey sandy gravelly CLAY. Sand is fine-coarse. Gravel is angular-sub angular fine-coarse of brick sandstone and clinker.		
3.00-3.10	B								
3.50-3.60	B					3.90			
4.00-4.10	B					(0.60)	Light brown highly weathered Sandstone recovered as slightly sandy gravelly CLAY. Sand is fine-coarse. Gravel is angular-sub angular, fine-coarse of sandstone and mudstone.		
4.50-4.90	J	10,18,11,12,50+ N=97				4.50 (0.50)	Weathered SANDSTONE.		
						5.00			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
						3.9	5	0.5			No groundwater encountered.

All dimensions in metres Scale 1:37.5	Client Savile Town Developments Ltd	Method/ Plant Used DANDO2000	Logged By TW

AGS3 UK BH BH LOGS.GPJ AGS3_ALL.GDT 21/4/06

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BOREHOLE LOG

Project				BOREHOLE No
Savile Road, Dewsbury				BH4
Job No: 05-5648 RE	Date: 13-01-06 13-01-06	Ground Level (m):	Co-Ordinates ():	
Contractor: M&M				Sheet: 1 of 2

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.50-0.60	B					(2.50)	MADE GROUND - Dark brown grey very clayey very gravely SAND. Sand is fine-coarse slightly ashy. Gravel is angular-sub rounded, fine-coarse of sandstone, brick and clinker.		
1.00-1.10	B								
1.50-1.60	B								
2.00-2.10	B					2.50			
2.50-2.60	B					(1.00)	MADE GROUND - Dark grey sandy gravelly CLAY. Sand is fine-coarse. Gravel is angular-sub angular, fine-coarse of brick, clinker and sandstone.		
3.00-3.10	B					3.50			
3.50-3.60	B					4.00	MADE GROUND - Light brown slightly sandy slightly gravelly CLAY. Sand is fine-coarse. Gravel is angular-sub rounded, fine-coarse of sandstone and mudstone.Little black fibrous organic material noted.		
4.00-4.10	B						MADE GRIUND - Mottled grey and light brown slightly sandy gravelly CLAY. Sand is fine-coarse. Gravel is angular-sub rounded, fine-coarse of sandstone, brick, concrete, clinker and tarmac. Some rootlets noted.		
4.50-4.60	B								
5.00-5.10	B								
5.50-5.60	B								
6.00-6.10	B								
6.50-6.60	B								
7.00-7.10	B					(6.20)			
7.50-7.60	B								
8.00-8.10	B								
8.50-8.60	B								
9.00-9.10	B								
9.50-9.60	B								
10.20-10.35	B					10.20			
10.20-	J	27,50+ N=200				10.30	Weathered brown fine SANDSTONE.		

Boring Progress and Water Observations					
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

Chiselling			Water Added	
From	To	Hours	From	To
10.2	10.3	1		

GENERAL REMARKS

No groundwater encountered.

All dimensions in metres Scale 1:68.75	Client: Savile Town Developments Ltd	Method/ Plant Used: DANDO2000	Logged By: TW

AGS3 UK BH BH LOGS.GPJ AGS3_ALL.GDT 21/4/06

ROBINSON
Robinson Environmental Ltd
1 West Durham Office Park, St John's Road,
Meadowfield, Durham
Telephone: 0191 378 7480
Fax: 0191 378 7481

BOREHOLE LOG

Project				BOREHOLE No
Savile Road, Dewsbury				BH4
Job No	Date	Ground Level (m)	Co-Ordinates ()	
05-5648 RE	13-01-06 13-01-06			
Contractor				Sheet
M&M				2 of 2

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
10.35									

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	No groundwater encountered.

All dimensions in metres Scale 1:68.75	Client Savile Town Developments Ltd	Method/ Plant Used DANDO2000	Logged By TW

ROBINSON
Robinson Environmental Ltd
1 West Durham Office Park, St John's Road,
Meadowfield, Durham
Telephone: 0191 378 7480
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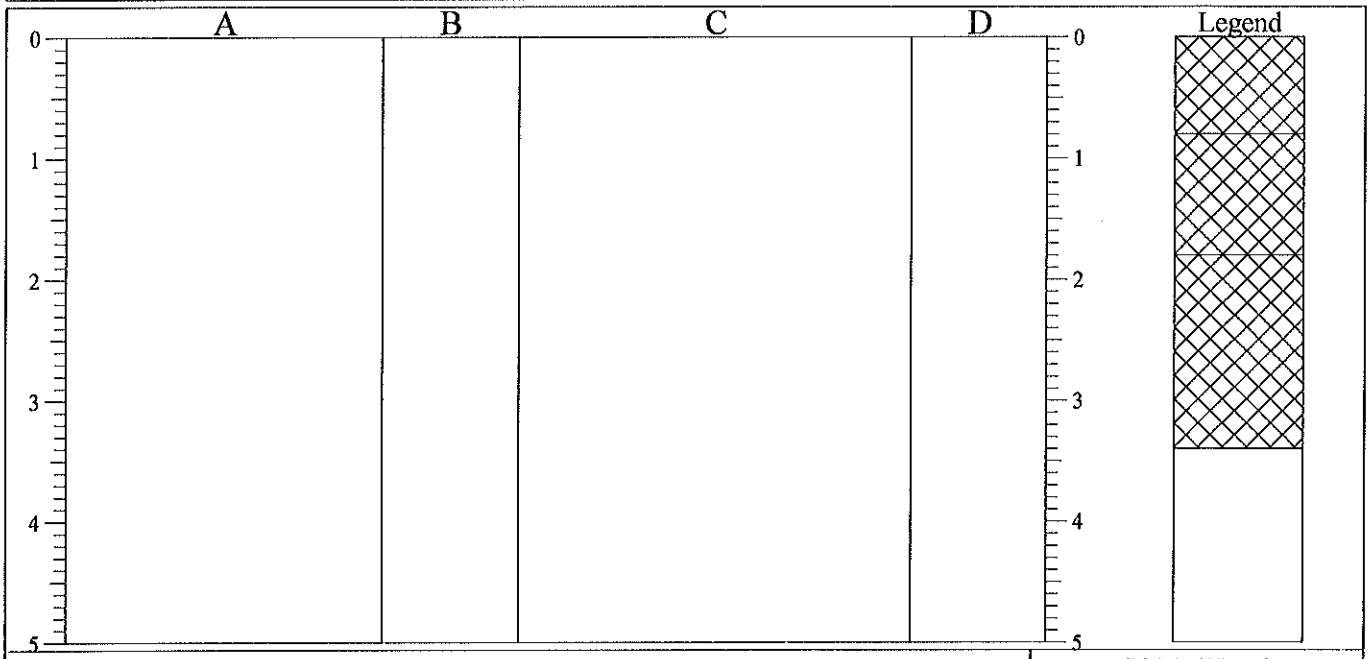
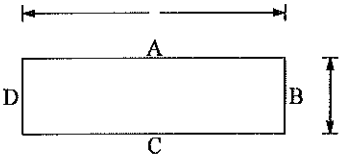
TRIAL PIT LOG

Project				TRIAL PIT No
Savile Road, Dewsbury				TP1
Job No	Date	Ground Level (m)	Co-Ordinates ()	
05-5648RE	05-02-06 05-02-06			
Contractor				Sheet
HEWDEN				1 of 1



STRATA			COMMENTS	
Depth	No	DESCRIPTION	Depth	COMMENTS
0.00-0.80		MADE GROUND - Light grey brown slightly sandy slightly gravely CLAY. Sand is fine-coarse, gravel is angular-sub angular, fine-coarse of Sandstone and Brick. Cobbles noted.	0.30-0.80	B1 Vane 46
0.80-1.80		MADE GROUND - Dark grey very clayey very gravely SAND. Sand is fine-coarse slightly ashy, gravel is angular-sub angular, fine-coarse of Brick, Concrete, Tarmac and Clinker. Cobbles noted. Some wood fragments.	1.00-1.50	B2
1.80-3.40		MADE GROUND - Mottled greys slightly sandy gravely CLAY. Sand is fine-coarse, gravel is angular-sub angular, fine-coarse of Concrete, Brick and Sandstone. Boulders noted. Some fragments of wood and plastic piping noted.	2.00-2.50	B3 Vane 35
			3.00-3.40	B4 Vane 46

Shoring/Support:
Stability:



GENERAL REMARKS

No groundwater encountered.

All dimensions in metres Scale 1:62.5	Client Savile Town Developments Ltd	Method/ Plant Used JCB 3CX	Logged By TW

AGS3 UK TP 04-2180.GPJ AGS3_ALL.GDT 21/4/06

ROBINSON
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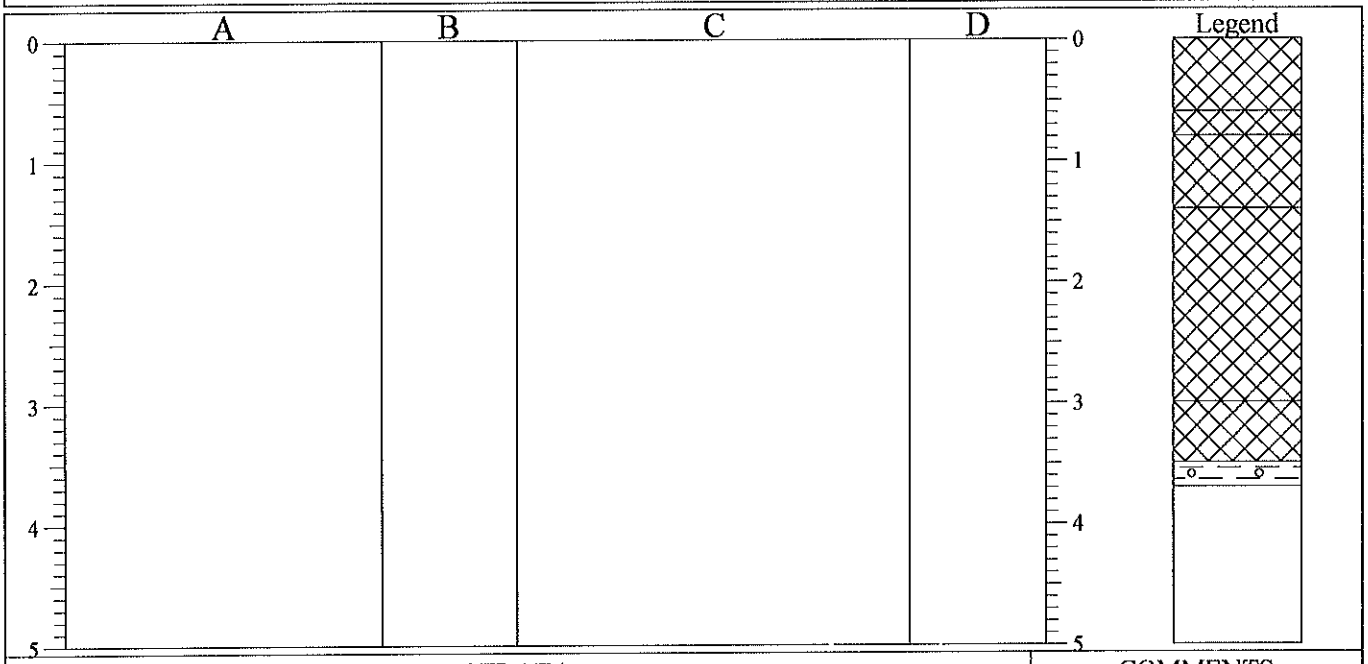
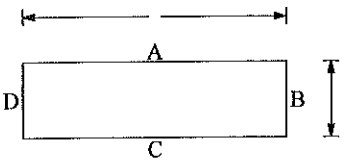
TRIAL PIT LOG

Project				TRIAL PIT No
Savile Road, Dewsbury				TP2
Job No	Date	Ground Level (m)	Co-Ordinates ()	
05-5648RE	05-02-06 05-02-06			
Contractor				Sheet
HEWDEN				1 of 1



STRATA			COMMENTS	
Depth	No	DESCRIPTION	Depth	COMMENTS
0.00-0.60		MADE GROUND - Dark grey very clayey very gravely SAND. Sand is fine-coarse slightly ashy, gravel is angular-sub angular, fine-coarse of Brick, Sandstone and Clinker. Some rootlets noted.		
0.60-0.80		MADE GROUND - Brown slightly sandy slightly gravely CLAY. Sand is fine-coarse, gravel is angular-rounded, fine-medium of Sandstone and Brick.	0.60-0.80	B1 Vane 71
0.80-1.40		MADE GROUND - Grey very clayey very gravely SAND. Sand is fine-coarse ashy, gravel is angular-sub rounded, fine-coarse of Brick, Sandstone and Clinker. Boulders noted.	1.00-1.40	B2
1.40-3.00		MADE GROUND - Dark grey very clayey very gravely SAND. Sand is fine-coarse ashy, gravel is fine-coarse, angular-sub angular of Brick, Concrete and Clinker. Boulders noted. Some wood, plastic piping and metal noted.	2.00-2.50	B3
			2.50-3.00	B4 Vane 38
3.00-3.50		MADE GROUND - Dark mottled greys slightly sandy gravely CLAY. Sand is fine-coarse, gravel is angular-sub angular, fine-coarse of Brick and Concrete. Metal poles noted.		
3.50-3.70		Firm light mottled yellow and greys slightly sandy gravely CLAY. Sand is fine-coarse, gravel is angular-rounded, fine-coarse of Sandstone and Mudstone.	3.50-3.70	B5 Vane 68

Shoring/Support:
Stability:



GENERAL REMARKS

No groundwater encountered.

All dimensions in metres Scale 1:62.5	Client Savile Town Developments Ltd	Method/ Plant Used JCB 3CX	Logged By TW

AGS3 UK TP 04-2180.GPJ AGS3_ALL.GDT 21/4/06

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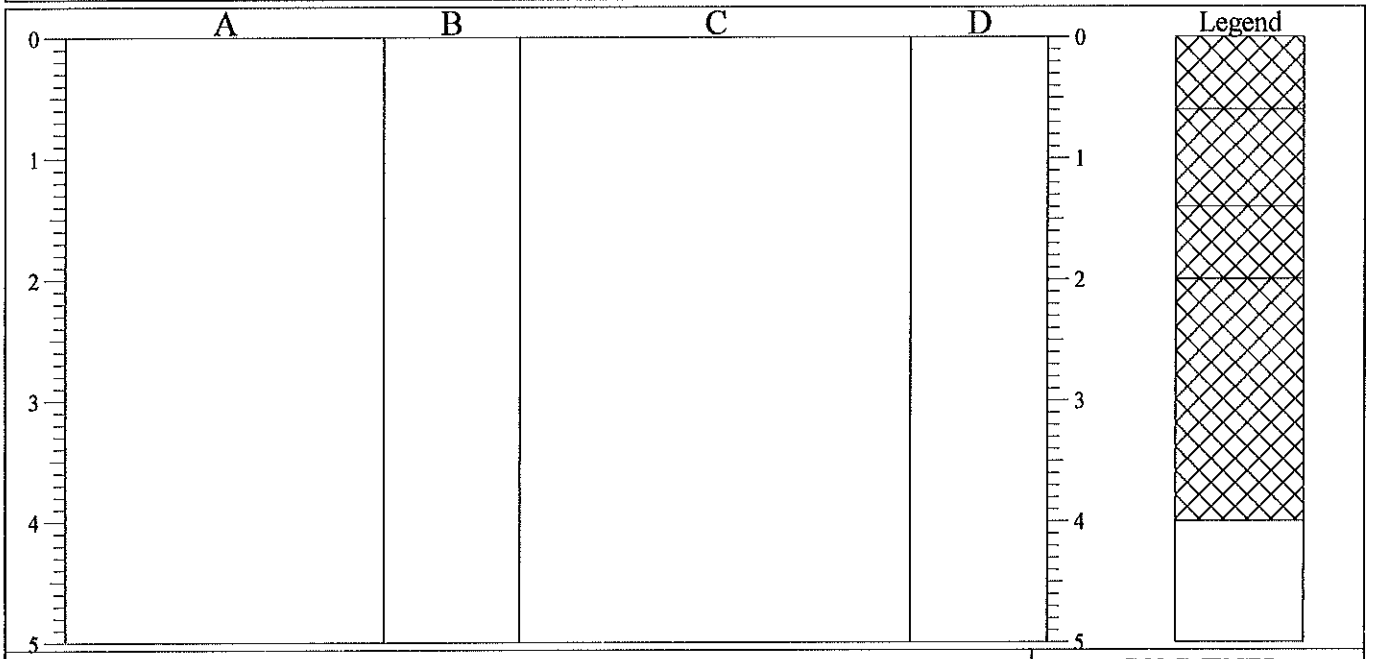
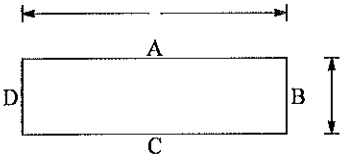
TRIAL PIT LOG

Project				TRIAL PIT No
Savile Road, Dewsbury				TP3
Job No	Date	Ground Level (m)	Co-Ordinates ()	
05-5648RE	05-02-06 05-02-06			
Contractor				Sheet
HEWDEN				1 of 1



STRATA			COMMENTS		
Depth	No	DESCRIPTION	Depth	COMMENTS	
0.00-0.60		MADE GROUND -Brown sandy gravely CLAY. Sand is fine-coarse, gravel is angular-sub rounded, fine-coarse of Sandstone and Brick. Cobbles noted.			
0.60-1.40		MADE GROUND - Dark grey slightly clayey very gravely SAND. Sand is fine-coarse slightly ashy, gravel is angular-sub rounded, fine-coarse of Brick and Sandstone. Boulders noted.	0.50-0.60	B1	Vane 47
			1.00-1.40	B2	
1.40-2.00		MADE GROUND - Dark grey slightly sandy gravely CLAY. Sand is fine-coarse, gravel is angular-sub rounded, fine-coarse of Brick, Tarmac, Coal, Sandstone and Clinker.	1.50-2.00	B3	Vane 35
2.00-4.00		MADE GROUND - Dark grey clayey very gravely SAND. Sand is fine-coarse slightly ashy, gravel is angular-sub rounded, fine-coarse of Sandstone, Brick and Clinker.	2.00-2.50	B4	

Shoring/Support:
Stability:



GENERAL REMARKS

No groundwater encountered.

All dimensions in metres Scale 1:62.5	Client Savile Town Developments Ltd	Method/ Plant Used JCB3CX	Logged By TW

AGS3 UK TP 04-2180.GPJ AGS3_ALL.GDT 21/4/06

ROBINSON
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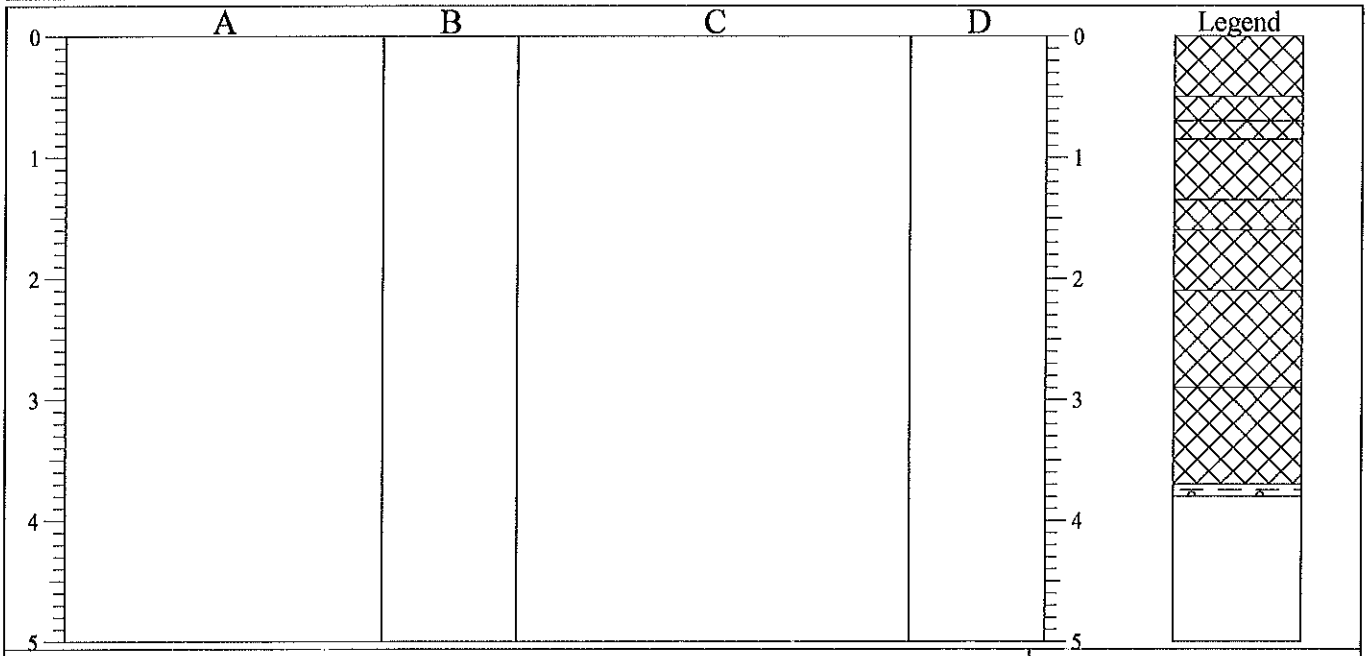
TRIAL PIT LOG

Project				TRIAL PIT No
Savile Road, Dewsbury				TP4
Job No	Date	Ground Level (m)	Co-Ordinates ()	
05-5648RE	05-02-06 05-02-06			
Contractor				Sheet
HEWDEN				1 of 1



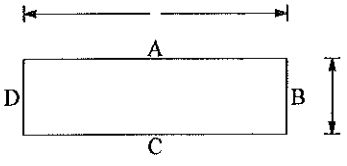
STRATA

Depth	No	DESCRIPTION
0.00-0.50		MADE GROUND - Brown slightly sandy slightly gravely CLAY. Sand is fine-coarse, gravel is angular-sub rounded, fine-coarse of Sandstone and Brick.
0.50-0.70		MADE GROUND - Dark grey slightly sandy slightly gravely CLAY. Sand is fine-coarse,
0.70-0.85		gravel is angular-sub rounded, fine-coarse of Brick, Concrete and Sandstone. Plastic piping,
0.85-1.35		rope and metal noted.
		MADE GROUND - Dark grey very clayey very gravely SAND. Sand is fine-coarse, gravel is angular-sub rounded, fine-coarse of Brick and Sandstone.
1.35-1.60		MADE GROUND - Dark grey slightly sandy slightly gravely CLAY. Sand is fine-coarse,
1.60-2.10		gravel is angular-sub rounded, fine-coarse of Brick and Sandstone.
		MADE GROUND - Dark grey very clayey very gravely SAND. Sand is fine-coarse, gravel is angular-sub rounded, fine-coarse of Brick and Sandstone.
2.10-2.90		MADE GROUND -Dark grey slightly sandy slightly gravely CLAY. Sand is fine-coarse, gravel is angular-sub rounded, fine-coarse of Brick and Sandstone.
		MADE GROUND - Dark grey very clayey very gravely SAND. Sand is fine-coarse, gravel is angular-sub rounded, fine-coarse of Brick and Sandstone.
2.90-3.70		MADE GROUND - Dark grey slightly sandy slightly gravely CLAY. Sand is fine-coarse, gravel is angular-sub rounded, fine-coarse of Brick and Sandstone.
3.70-3.80		Stiff light brown very gravely slightly sandy CLAY. Sand is fine-coarse, gravel is angular-sub angular, fine-coarse of Sandstone. Sandstone showing signs of hematite staining.

COMMENTS

Depth	COMMENTS
0.30-0.50	B1 Vane 53
0.50-0.70	B2
1.50-2.00	B3
3.70-3.80	B4

Shoring/Support:
Stability:



GENERAL REMARKS

Water noted seeping in to hole at 0.80 metres.

All dimensions in metres Scale 1:62.5	Client Savile Town Developments Ltd	Method/ Plant Used JCB 3CX	Logged By TW

AGS3 UK TP 04-2180.GPJ AGS3_ALL.GDT 21/4/06

ROBINSON
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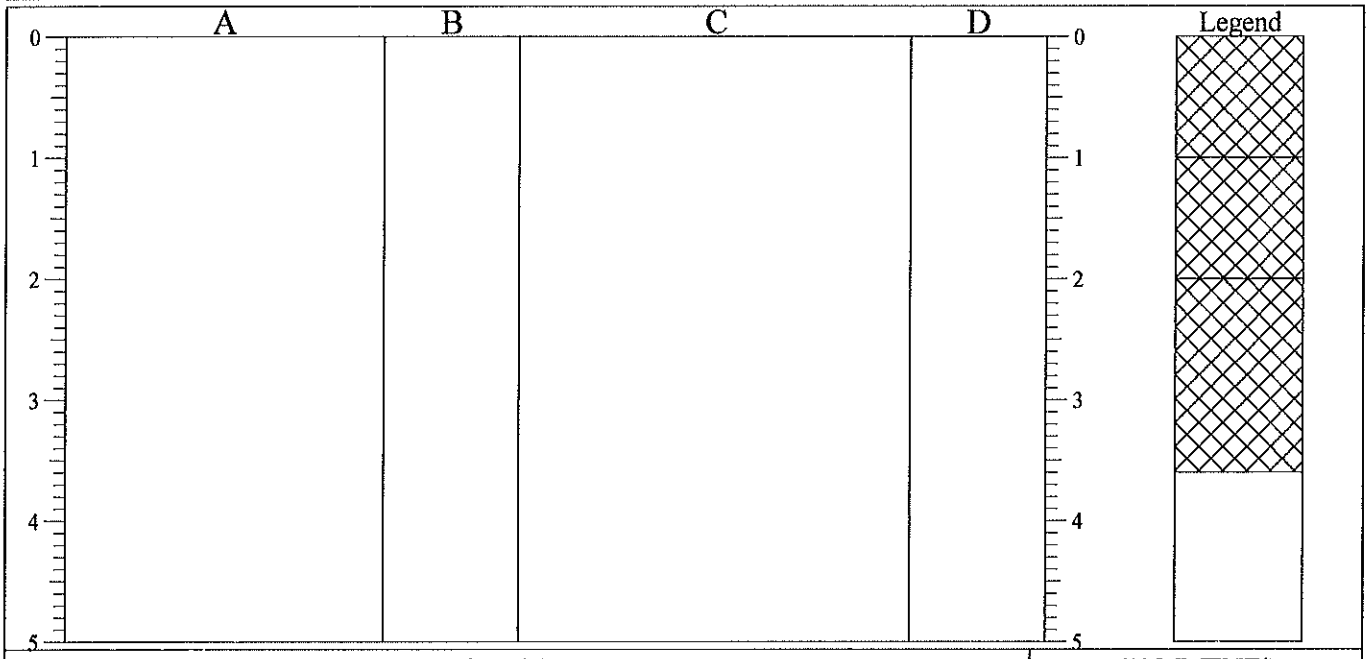
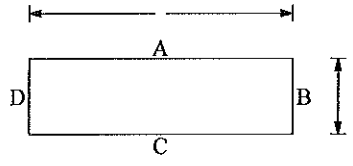
TRIAL PIT LOG

Project				TRIAL PIT No
Savile Road, Dewsbury				TP5
Job No	Date	Ground Level (m)	Co-Ordinates ()	
05-5648RE	05-02-06 05-02-06			
Contractor				Sheet
HEWDEN				1 of 1



STRATA			COMMENTS	
Depth	No	DESCRIPTION	Depth	COMMENTS
0.00-1.00		MADE GROUND - Brown sandy gravely CLAY. Sand is fine-coarse, gravel is angular-sub rounded, fine-coarse of Sandstone, Brick and Concrete. Old plastic piping noted.	0.50-1.00	B1
1.00-2.00		MADE GROUND - Dark grey clayey very gravely SAND. Sand is fine-coarse slightly ashy, gravel is angular-sub rounded, fine-coarse of Brick and Concrete. Wood fragments noted..	1.00-1.50	B2
2.00-3.60		MADE GROUND - Mottled dark greys slightly sandy gravely CLAY. Sand is fine-coarse, gravel is angular-rounded, fine-coarse of Sandstone, Brick, Tarmac, Clinker and Burnt Shale. Wood fragments noted.	2.50-3.00	B3 Vane 53

Shoring/Support:
Stability:



GENERAL REMARKS

No groundwater encountered.

All dimensions in metres Scale 1:62.5	Client Savile Town Developments Ltd	Method/ Plant Used JCB 3CX	Logged By TW

AGS3 UK TP 04-2180.GPJ AGS3_ALL.GDT 21/4/06

ROBINSON
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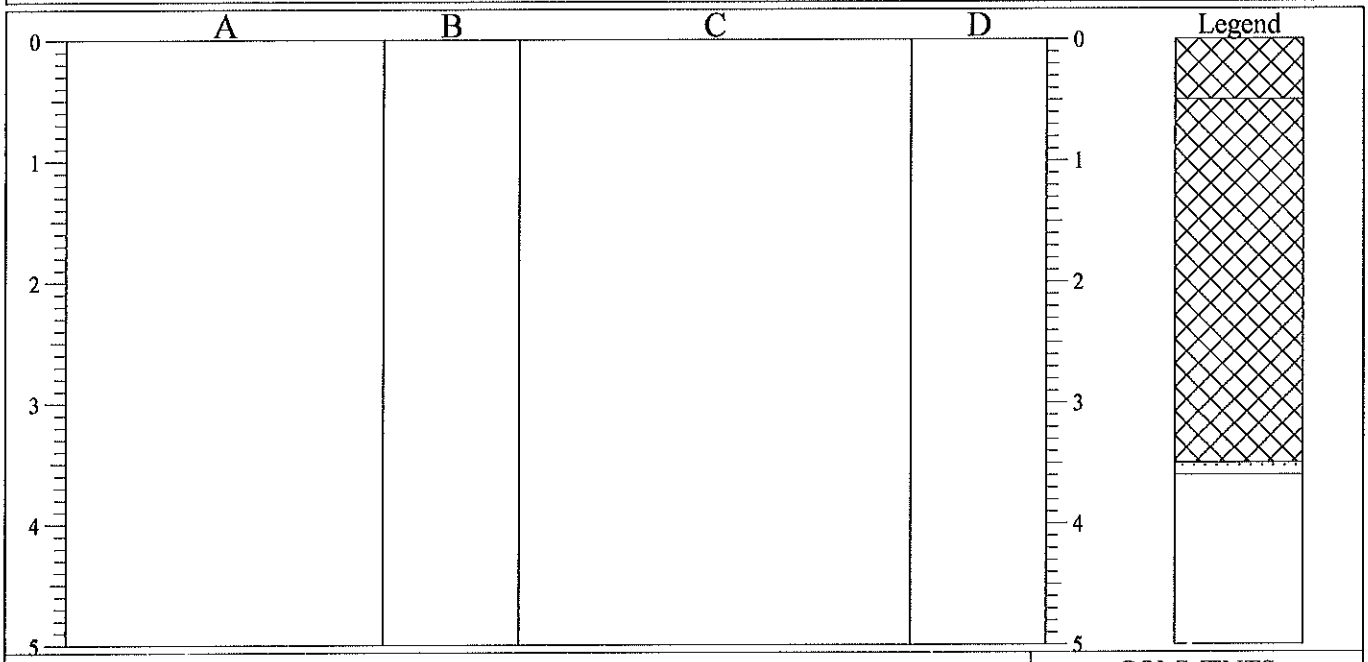
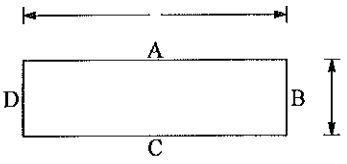
TRIAL PIT LOG

Project				TRIAL PIT No
Savile Road, Dewsbury				TP6
Job No	Date	Ground Level (m)	Co-Ordinates ()	
05-5648RE	05-02-06 05-02-06			
Contractor				Sheet
HEWDEN				1 of 1



STRATA			COMMENTS	
Depth	No	DESCRIPTION	Depth	COMMENTS
0.00-0.50		MADE GROUND -Brown sandy gravely CLAY. Sand is fine-coarse, gravel is angular-sub angular, fine-coarse of Sandstone, Brick and Concrete.		
0.50-3.50		MADE GROUND - Dark brown progressing to dark grey with depth clayey very gravely SAND. Sand is fine-coarse, gravel is angular-sub angular, fine-coarse of Tarmac, Concrete and Brick.	1.00-1.50	B1
			2.00-2.50	B2
			3.00-3.50	B3
3.50-3.60		Weathered Sandstone Bedrock. Recovered as SAND and GRAVEL. Sand is fine-coarse. gravel is angular, fine-coarse of Sandstone. Cobbles noted.		

Shoring/Support:
Stability:



GENERAL REMARKS

Hole becomes damp from 2.40 metres.

All dimensions in metres Scale 1:62.5	Client Savile Town Developments Ltd	Method/ Plant Used JCB 3CX	Logged By TW

AGS3 UK TP 04-2180.GPJ AGS3_ALL.GDT 21/4/06

ROBINSON
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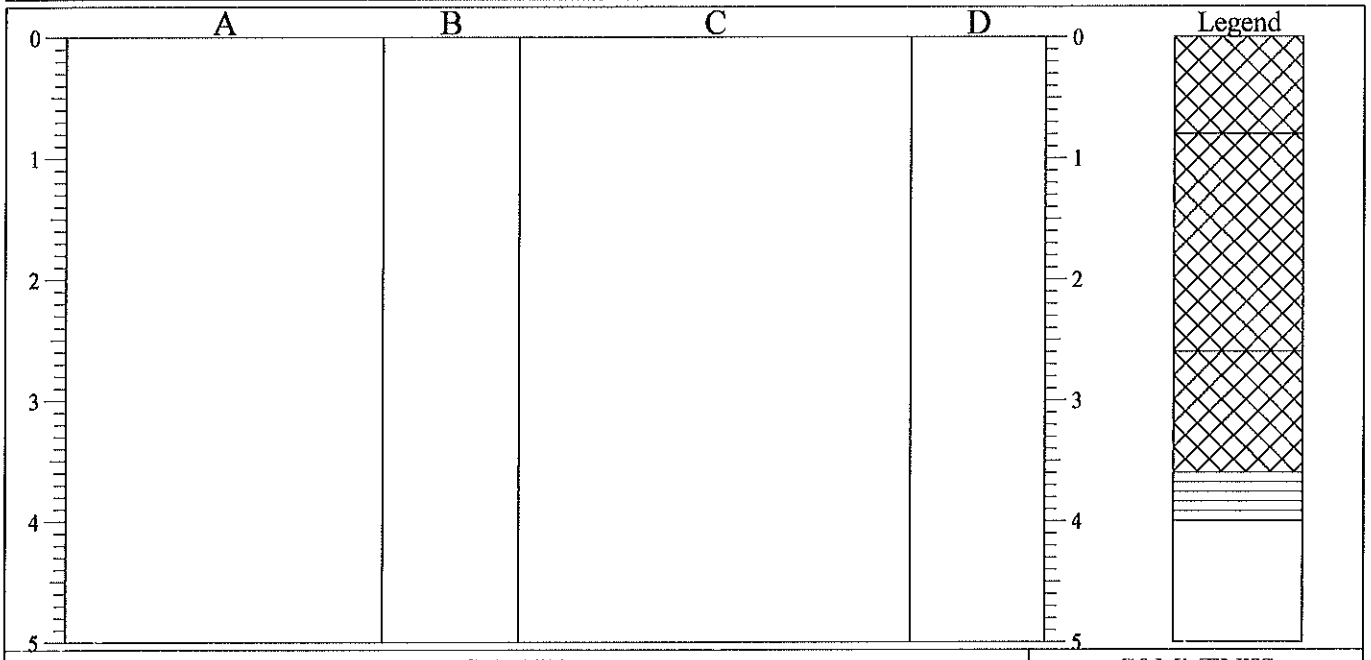
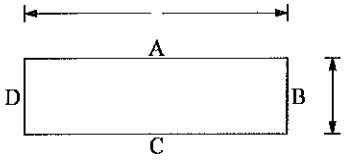
TRIAL PIT LOG

Project				TRIAL PIT No
Savile Road, Dewsbury				TP7
Job No	Date	Ground Level (m)	Co-Ordinates ()	
05-5648RE	05-02-06 05-02-06			
Contractor				Sheet
HEWDEN				1 of 1



STRATA			COMMENTS	
Depth	No	DESCRIPTION	Depth	COMMENTS
0.00-0.80		MADE GROUND - Brown clayey very gravely SAND. Sand is fine-coarse, gravel is angular-sub angular, fine-coarse of Brick, Sandstone, concrete and Pottery. Boulders noted.	0.50-0.80	B1
0.80-2.60		MADE GROUND - Dark grey clayey very gravely SAND. Sand is fine-coarse slightly ashy, gravel is angular-sub rounded, fine-coarse of Brick, Sandstone and Concrete.	1.00-1.50	B2
2.60-3.60		MADE GROUND - Mottled greys sandy gravely CLAY. Sand is fine-coarse, gravel is angular-sub rounded, fine-coarse of Sandstone, Brick, Clinker and Concrete.	3.00-3.50	B3 Vane 15
3.60-4.00		Highly weathered mottled yellow and black Siltstone and coal recovered as sandy GRAVEL. Sand is fine-coarse, gravel is angular, fine-coarse of Siltstone, Mudstone and Coal.	3.80-4.00	B4

Shoring/Support:
Stability:



GENERAL REMARKS

No groundwater encountered.

All dimensions in metres Scale 1:62.5	Client Savile Town Developments Ltd	Method/ Plant Used JCB 3CX	Logged By TW

AGS3 UK TP 04-2180.GPJ AGS3_ALL.GDT 21/4/06

ROBINSON
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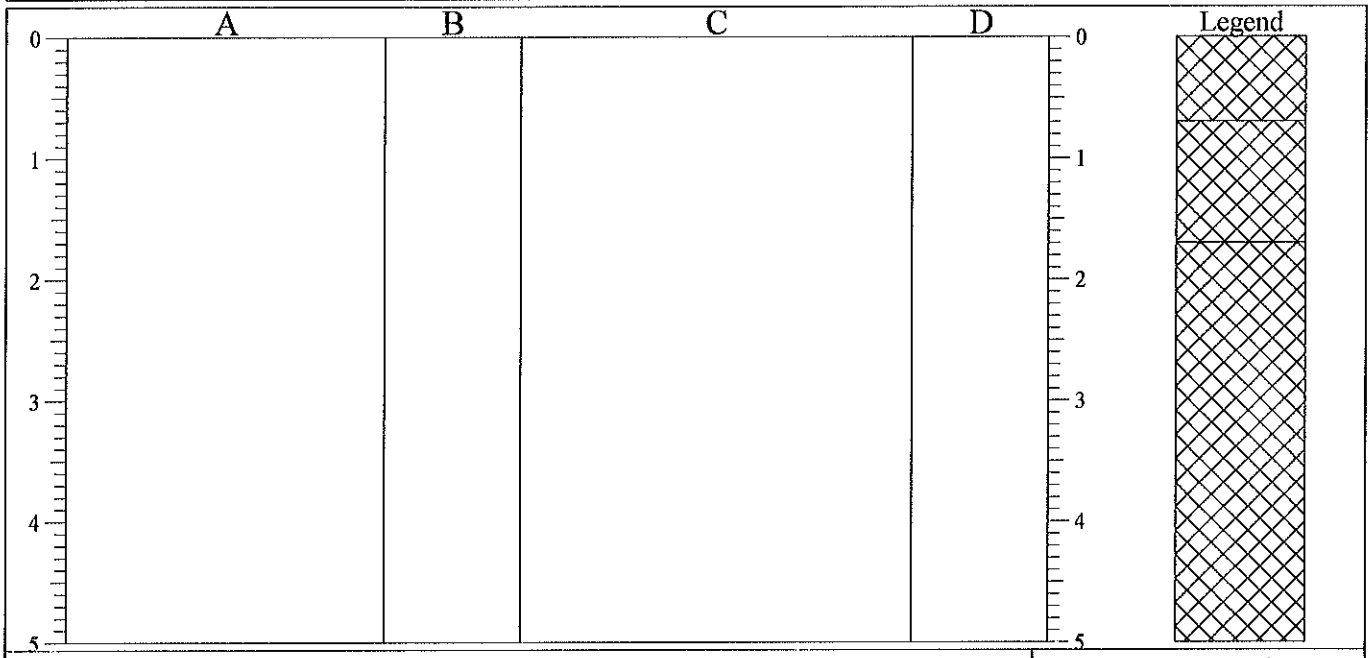
TRIAL PIT LOG

Project				TRIAL PIT No
Savile Road, Dewsbury				TP8
Job No	Date	Ground Level (m)	Co-Ordinates ()	
05-5648RE	05-02-06 05-02-06			
Contractor				Sheet
HEWDEN				1 of 1



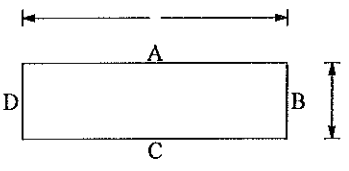
STRATA

Depth	No	DESCRIPTION
0.00-0.70		MADE GROUND -Greyey brown sandy gravely CLAY. Sand is fine-coarse, gravel is angular-sub rounded, fine-coarse of Sandstone and Brick. Boulders noted. Wood fragments and metal wire also noted.
0.70-1.70		MADE GROUND - Brown very clayey very gravely SAND. Sand is fine-coarse, gravel is angular-sub angular, fine-coarse of Brick, Concrete and Sandstone. Cobbles noted.
1.70-5.00		MADE GROUND - Dark grey very clayey very gravely SAND. Sand is fine-coarse, gravel is angular-sub angular, fine-coarse of Brick, Tarmac, Pottery, Clinker and Sandstone. Metal chain, wood and plastic piping also noted.

COMMENTS

Depth	COMMENTS
0.30-0.70	B1 Vane 57
1.00-1.50	B2
2.00-2.50	B3
3.00-3.50	B4
4.50-5.00	B5

Shoring/Support:
Stability:



GENERAL REMARKS

Water noted seeping in at 4.10 metres.

All dimensions in metres Scale 1:62.5	Client Savile Town Developments Ltd	Method/ Plant Used JCB 3CX	Logged By TW

AGS3 UK TP 04-2180.GPJ AGS3_ALL.GDT 21/4/06

06-6184RGE
Savile Road
Savile Road Developments Ltd

Ground Gas and Contamination Assessment

This report has been prepared for the sole benefit, use and information of Saville Road Developments Ltd and the liability of Robinson Geo Engineering, its Directors and Employees in respect of the information contained in the report will not extend to any third party unless prior written permission is granted.

1	**Draft**	**SHC**	**14/05/07**	**HM**
Rev.	**Description**	**Issued by**	**Date**	**Checked**

Author	S. H. Coomber	Approved	Hakop Mirzabaigian
Signed		Signed	
Date	May 2007	Date	May 2007

Contents

1 Executive Summary

Savile Road Developments Limited are proposing to develop a site at Savile Road Dewsbury. The development consists of a medical centre, residential houses and associated infrastructure.

The site is located within residential and a light industrial area, that is bounded to the east and west by residential properties of Headfield and Caledonian Road respectively. Residential properties located on The Sidings bound the site to the north. The site remains undeveloped along the southern boundary and comprises grassed land. Playing fields are located to the southeast of the site.

A desk study report and intrusive ground investigation report have been prepared previously. Based on the findings of these site investigations the site is underlain by varying depths of made ground. Made ground was noted to contain materials such as ash and clinker, materials which are associated with elevated levels of the above contaminants.

Geoenvironmental testing was carried out on a number of representative soil samples identified contamination with some elevated levels.

Ground gas monitoring results during the previous investigation showed high levels of methane and carbon dioxide. Following discussions with the local Authority further boreholes were constructed with gas monitoring installations and a further three months of monitoring has been carried out.

Based on the results of the gas monitoring carried out the site has been characterised and a risk assessment carried out to establish the measures required for gas protection of the site. In carrying out the work the recommendations and guidelines in CIRIA C659 'Assessing Risk Posed by Hazardous Ground Gases to Buildings' and BRE414 ' Protective Measures for Housing on Gas-Contaminated Land' have been taken into account.

This document is in draft for consultation and will form part of the main report which will cover the investigation to be carried out as a result of the recommendations made in this report.

Based on the work carried out and reported in this report it is considered that the site can be developed by using low permeability membranes and appropriate passive gas protection measures.

The monitoring of the installations is being continued and further intrusive investigation is recommended.

2 Introduction

Savile Road Developments Ltd proposes to develop an infilled railway cutting located in Dewsbury. A site location plan and existing site layout plan are presented in Appendix A.

Robinson Geo Engineering (RGE) Ltd has been appointed by Savile Road Developments Ltd to undertake an Intrusive Site Investigation (SI) for the purposes of gas monitoring at the site.

There have been several previous site investigations on this site comprising of the following:

A Phase I Desk Study and a Phase II Site Investigation was carried out by Robinson Environmental Ltd (REL) in May 2006 and should be read in conjunction with this report.

Robinson Consulting Engineers (RCE) carried out a Phase 2 Ground Investigation Report in 2001 on the site and adjacent land.

A desk study and site investigation undertaken by Dunelm Engineering in 1996 consisted of 3 boreholes drilled to a depth of 30m and the excavation of 12 trial pits.

This report makes recommendations on the geoenvironmental aspects of the project, based on information obtained during this Intrusive Site Investigation and the results of previous investigations.

Factual data from the current Site Investigation together with laboratory and in-situ testing results are presented in the Appendices.

3 The Site

3.1 Site Location and Description

The site is located off Savile Road, Dewsbury, at approximate national grid reference NGR 424450, 420490.

The site is rectangular in shape and covers an area of approximately 1.35 hectares, with the long axis trending northwest-southeast. The site is bounded to the east and west by residential properties of Headfield and Caledonian Road respectively. Residential properties located on The Sidings bound the site to the north. The site remains undeveloped along the southern boundary and comprises grassed land. Playing fields are located to the southeast of the site. It is flat and has a level of approximately 52.0m AOD. The site is sloping, with the degree of slope increasing downhill, towards the northeast. The change in vertical height, from southwest to northeast is approximately 4-5m across the site. The site is currently in use as a public rough grass area.

The site has previously been a Railway cutting that was infilled in the mid to late 1990's. It was infilled with waste categorised as "non-hazardous industrial, including small amounts of inert slurry". The waste appears to originate from the Bretton Street Gasworks Site, Dewsbury. By looking at the Environmental Agency Document 'CLR 8 – Potential Contaminants for the Assessment of Land' it can be seen that typical contamination from a gas works site can include Arsenic, Cadmium, Chromium, Lead, Mercury, Nickel, Copper, Sulphates, Cyanides, Asbestos, Phenols, Aromatic Hydrocarbons and Polyaromatic Hydrocarbons.

A site location plan, aerial photograph, current layout and proposed layout are presented in Appendix A.

3.2 Site History

A full site history is available within the REL Phase 1 Desk Study (2006), which should be read in conjunction with this report. Table 1 and 2 below provide a brief summary of the site history and predominant land use of the surrounding area.

Table 1 Site History Summary

Date	Site Use
1855	The site is shown as open fields
1893/4	Small buildings and a few tracks are shown to exist on site
1907	All buildings on site are shown to have been demolished. The site is now indicated to be a cutting.
1922	Two railway lines have been constructed on site
1933-1937	No change have taken place on site, though residential buildings have been constructed along the boundaries
1965/6	Railway lines running across the site are shown to have been dismantled.
1973-2000	No changes to the site are shown.

Although no changes were noted in the desk study from 1973 to 2000, the site was infilled in the mid to late 1990's.

Table 2 Predominant land use of the area surrounding the site

Date	Predominant land use of area surrounding site
1855-date	Residential with some industrial

3.3 Published Site Geology

Published geology is recorded on British Geological Survey Sheet 77, Huddersfield, Soil and Drift Edition, 1:50 000 series. This indicates the site to be underlain by deposits of made ground, noted as artificially raised ground. Solid geology is indicated to comprise of Middle Coal Measures of the Westphalian series of the Upper Carboniferous period.

3.4 Published Site Hydrogeology

Geological Classification

The underlying geology has been classified under the Environment Agency's Policy and Practice for the Protection of Groundwater as a Minor Aquifer with variable permeability.

A minor aquifer is defined as 'fractured or potentially fractured rocks, which do not have a high primary permeability, or other formations of variable permeability including unconsolidated deposits. Although not producing large quantities of water for abstraction they are important for local supplies and in supplying base flow to rivers.'

Soil Classification

Soil underlying the site has been classified as soil with a high leaching potential. That is they are considered to have a high potential for contaminants to be leached from them by the presence of a percolating liquid, i.e. water. A worst case vulnerability classification (H) is reserved for restored mineral workings and urban areas until proven otherwise by site investigation and subsequent laboratory testing.

3.5 Site Hydrology

The closest surface water feature is that of the Calder River which meanders around the site from west to east. At its closest point it is 200m from the western site boundary.

The site is not located within an area at risk from flooding.

A water abstraction point for is located 135 metres to the north of the site and relates to groundwater for domestic use.

3.6 Coal Mining

The site is within 'an area which maybe affected by coal mining'. A mining report was therefore commissioned from David Bellis Consulting Surveyors (DBCS). The report indicates that the following seam is recorded to have been worked adjacent to the site.

- The Black Bed seam 90-120cm thickness at 228 metres depth in 1953

The risk of void migration to the surface of the site from this seam is regarded as Low as there is significant thickness of competent rock overburden.

Historical maps indicate that there are disused quarries located 45 metres to the southwest of the site. These are not shown on the maps post 1990 and may have been infilled.

4 Ground Investigation

4.1 General

The Site Investigation was designed to provide geotechnical and geoenvironmental information on the materials beneath the site, as well as investigate the potential gas contamination issues. The Site Investigation was supervised by an RGE representative on a full time basis and was carried out with reference to and in line with British Standards BS5930:1999 and BS10175:2001.

4.2 Previous Investigations

A number of previous investigations have been undertaken at this site the details of which are presented in the following:

Dunelm Drilling Co. Site Investigation Report, 1996.
Robinson Consulting Engineers (RCE) Phase 2 Ground Investigation Report, 2001.
Robinson Environmental Ltd (REL) Phase 1 Desk Study Report, 2006.
Robinson Environmental Ltd (REL) Phase 2 Ground Engineering Report, 2006.

Investigations undertaken to date have determined the ground to be contaminated, with sources relating to past site uses.

4.3 Current Investigation

The Intrusive Site Investigation was undertaken between 28th February and 2nd March 2007 and comprised:

Eight Window Sample Boreholes (WS-01 to WS-08) were constructed within the site along with six window sample boreholes in the Caledonian Road section of the site. Ground gas monitoring standpipes were installed in the boreholes WS-01 to WS-08 and WS-A to WS-C.

The approximate locations of the exploratory holes are presented in Appendix A.

Gas monitoring has been carried out over a three months period at a fortnightly intervals. The monitoring results for this investigation and previous investigations are presented in Appendix C.

At the exploratory borehole positions, the type and changes of strata were noted and recorded on log sheets, copies of which are presented in Appendix B. Also noted were the depths at which groundwater was encountered and observed levels subsequent to drilling. The depths of strata and groundwater on the log sheets are recorded in metres below ground level (mbgl).

5 Ground Conditions

5.1 Stratigraphy

A summary of the ground conditions encountered during the intrusive investigation is presented below in Table 3 and should be read in conjunction with the exploratory hole log sheets presented in Appendix B. All levels are measured in metres below ground level (m bgl).

Strata	Range of Depths Encountered (mbgl)	Maximum Thickness (m)
MADE GROUND:	0.00m to 6.00m*	6.00m (WS-01 and WS-04)
NATURAL CLAY DEPOSITS:	2.00m to 2.45m	0.45 (WS-08)
NATURAL BEDROCK DEPOSITS:	2.45m to 5.00m*	1.55m (WS-08)

* denotes the exploratory hole was terminated before the base of the strata was encountered, hence it is considered that the strata extends beyond the depths recorded.

In previous investigations the following summery of ground conditions were encountered.

RGE Site Investigation (2006)

Strata	Range of Depths Encountered (mbgl)	Maximum Thickness (m)
MADE GROUND:	0.00 to 10.20	10.20 (BH4)
NATURAL CLAY DEPOSITS:	3.50 to 7.20	0.50 (BH1)
BEDROCK:	3.50 to 29.50*	23.8 (RH1)

* denotes the exploratory hole was terminated before the base of the strata was encountered, hence it is considered that the strata extends beyond the depths recorded.

RCE Site investigation (2001)

Strata	Range of Depths Encountered (mbgl)	Maximum Thickness (m)
MADE GROUND:	0.00m to 0.15m to 0.70m	0.55m (Trench 2)
BEDROCK (or completely weathered rock):	0.15m to 0.70m, 1.40m to 2.50m	1.10m (Trench 3)

5.2 Made Ground

Made ground was encountered in all of the exploratory holes, with a maximum thickness of 6.0 mbgl. The made ground generally comprised sand gravelly CLAY with fine rootlets underlain by made ground comprising sandy gravelly CLAY with varying degrees of sandstone, ash, brick, coal, concrete, granite and wood. Made ground which differs from the general description was recovered as follows:

COBBLES consisting of sandstone, wood, brick or concrete.
Sandy organic CLAY
Clayey GRAVEL or sandy GRAVEL
Sandy clayey GRAVEL or clayey sandy GRAVEL
Gravelly CLAY or gravelly sandy CLAY
Gravelly CLAY with fine rootlets or sandy CLAY with fine rootlets

5.3 Natural Soil Deposits

Natural soil deposits were encountered only in WS5, WS6 and WS8. Both granular and cohesive deposits were encountered. Three distinct layers of natural ground were encountered which are listed below:
Weak highly weathered MUDSTONE recovered as gravelly CLAY.
Stiff orange mottled grey CLAY.
Moderately weak highly weathered SANDSTONE recovered as sandy GRAVEL.

5.4 Groundwater

Groundwater not documented as having been encountered at time of the Intrusive Site Investigation. However it was encountered in all exploratory holes in subsequent monitoring visits except for WS-04 which remained dry.

In previous investigations, the following groundwater conditions were encountered.

RGE Site Investigation (2006)
Groundwater was encountered in TP4 at 0.80m; in TP6 it was noted that the trail pit became damp from 2.40m; and in TP-08 water was encountered at 4.10m.

RCE Site investigation (2001)
Groundwater not documented as having been encountered at time of the Intrusive Site Investigation.

6 Testing

6.1 In-situ Testing

In-situ Standard Penetration Tests (SPTs) were carried out in all Window Sample Boreholes at 1.0m intervals in the natural ground to measure the relative density of the granular soils and give an indication of the undrained shear strength of the cohesive soils.

The results of the SPTs (*N* values) are given on the relevant exploratory borehole log sheets, adjacent to the appropriate test level and are presented in Appendix B. Figure C.1 presents a graph with SPT '*N*' values plotted against depth (mbgl).

6.2 Ground Gas Monitoring

A limited number of ground gas monitoring was carried out in post intrusive investigation in 2006. Further monitoring of the same instrumentations was carried out in late 2006 and early 2007. In February 2007 the current investigation was carried out which consisted of further boreholes and installations. All of the installations have been monitored on a fortnightly basis for a period of three months.

A copy of all monitoring results is presented in Appendix C.

6.3 Laboratory Testing

There were no geo-environmental samples tested for this investigation. The results from Robinson's site investigations in 2006 have been analysed and interpreted. The chemical results are presented in Appendix D.

7 Contamination

7.1 Soil Contamination

The current UK framework (Contaminated Land Exposure Assessment (CLEA)) for the assessment of risk to human health from potentially contaminated land follows a tiered approach and is based on the *Source-Pathway-Receptor* scenario, as set out by the Department of Environment, Food and Rural Affairs (DEFRA). Without the presence of all three elements within the scenario a pollutant linkage cannot be deemed feasible and the site is not considered to pose a risk to receptors. In the case where a risk is not presented a site cannot be legally classified as contaminated under Part IIA of the Environmental Protection Act (1990).

A Tier 1 Preliminary Risk Assessment uses the development of a conceptual site model to identify all elements of the *Source-Pathway-Receptor* scenario and thus any pollutant linkages and consequential risk to receptors. Where risk is identified a further tier of risk assessment is recommended and comprises a Tier 2 Generic Quantitative Risk Assessment or a Tier 3 Detailed Quantitative Risk Assessment.

A Tier 2 risk assessment compares Generic Assessment Criteria (GAC) (for example EA published Soil Guideline Values (SGV)) with an upper bound value based on the 95th percentile (US_{95}) of the soil laboratory test results. Where no EA published SGV are available other published screening criteria may be utilised for comparison, taking account of the justifications and assumptions associated with the values. In this report reference has been made to the Atkin's AtRiskSoil database.

Under the CLEA guidance generic land uses have been published and are divided into the following categories:

Residential with Plant Uptake

Residential without Plant Uptake

Allotments

Commercial/Industrial

Each of these generic land uses has a prescribed set of pathways and assumptions associated with them and which effectively characterise the land in terms of the way it is used. GAC published for a contaminant as a set of values, with each value corresponding to a specific land use category.

Based on the details of the proposed development, 20 properties and a health centre are to be constructed with associated services and landscaping. For the purposes of a Tier 2 Generic Quantitative Risk Assessment the land use category of **Residential with Plant Uptake** best fits the proposed development and as such will be used for the assessment of any potential risks to human health.

The contamination aspects of the site will be discussed in the final report.

7.2 Comparison with Guideline Values

The assessment of risks to human health from exposure to potentially contaminated soil compares geochemical laboratory test results with published GAC such as the EA SGV. For this purpose two types of statistical tests are applied, the Mean Value Tests and the Maximum Value Test.

For the Mean Value Tests the 95% Confidence Limit of the measured mean (the Upper 95th Percentile, US_{95}) is calculated for a sample population (i.e. concentrations of a specific contaminant in soil) and compared with the corresponding GAC. Where the US_{95} value is less than the GAC the Mean Value Test is passed and the site may be considered not to present a significant possibility of significant harm to human health. Where the US_{95} value exceeds GAC the test is failed and the site may be determined as contaminated land under Part 2A of the EPA (1990), where pollutant linkages are identified.

The Maximum Value Test is applied where US_{95} values exceed GAC, in order to determine whether statistical outlier exist within a sample population,

7.3 Statistical Assessment Results

The US_{95} value of geochemical laboratory based test results was calculated for all contaminants listed above in Section 6.2.2 and was used for comparison with the appropriate GAC. EA published SGV were used where available and in their absence reference was made to the Atkin's AtRiskSoil database.

The Mean Value Test identified the US_{95} value for a number of contaminants to exceed published GAC. Those identified are listed below in Table 7 with the minimum and maximum values, the calculated US_{95} value and the published GAC.

Contaminants which did not exceed current guidelines values are not considered further.

Table 7 Contaminants exceeding published guideline values.

Contaminant	Minimum Value mg/kg	Maximum Value mg/kg	Mean Value mg/kg	US_{95} value mg/kg	GAC [1,2] mg/kg
Arsenic	4.0	24.0	15.8	23.0	20.0 [1]
Anthracene	0.5	6.6	3.9	6.4	4.79 [2]
Benzo (a) anthracene	5.1	19.3	12.0	18.5	0.54 [2]
Benzo (a) pyrene	4.2	20.4	12.6	19.7	5.54 [2]
Dibenzo (a.h) anthracene	3.2	5.7	4.5	5.6	0.61 [2]
Indeno (1,2,3-c,d) pyrene	9.8	16	12.9	15.7	6.04 [2]

[1] Environment Agency published Soil Guideline Values (SGV)
[2] Atkin's AtRiskSoil Soil Screening Values

The Maximum Value Test (MVT) is undertaken when the US_{95} value is higher than the GAC and is used along with professional judgement to help determine if the results statistically belong to the same population, i.e. contamination is distributed randomly throughout the site or localised around specific areas. The 10% critical value has been assigned to place a more stringent and therefore protective constraint on the likely distribution.

Elevated levels of Arsenic were encountered in two samples to a maximum value of 24.0 mg/kg. The US_{95} value of 23.0mg/kg is determined for the made ground on site which is above the chosen GAC. The MVT indicates that the results are statistically part of the same population. The contaminant is therefore likely to be distributed throughout the made ground across the site.

Elevated levels of Anthracene were encountered within one sample to a maximum value of 6.6mg/kg. The US_{95} value of 6.4mg/kg is determined for the made ground on site, which is above the chosen GAC. The MVT indicates that the one result is part of different population. Anthracene is therefore considered localised around BH-02.

Elevated levels of Benzo(a)anthracene were encountered within three sample to a maximum value of 19.30mg/kg. The US_{95} value of 18.5mg/kg is determined for the made ground on site, which is above the chosen GAC. The MVT indicates that the results are statistically part of the same population. The contaminant is therefore likely to be distributed throughout the made ground across the site.

Elevated levels of Benzo(a)pyrene were encountered within two samples to a maximum value of 20.4mg/kg. The US_{95} value of 19.7mg/kg is determined for the made ground on site, which is above the chosen GAC. The MVT indicates that the results are statistically part of the same population. The contaminant is therefore likely to be distributed throughout the made ground across the site.

Elevated levels of Dibenzo(ah)anthracene were encountered within two samples to a maximum value of 5.7mg/kg. The US_{95} value of 5.6mg/kg is determined for the made ground on site, which is above the chosen GAC. The MVT indicates that the results are statistically part of the same population. The contaminant is therefore likely to be distributed throughout the made ground across the site.

Elevated levels of Indeno(1,2,3-c,d)pyrene were encountered within two samples to a maximum value of 16mg/kg. The US_{95} value of 15.7mg/kg is determined for the made ground on site, which is above the chosen GAC. The MVT indicates that the results are statistically part of the same population. The contaminant is therefore likely to be distributed throughout the made ground across the site.

All samples showing elevated concentrations of contaminants were taken from areas of made ground. Made ground was noted to contain materials such as ash, and clinker, materials which are associated with elevated levels of the above contaminants.

7.4 Groundwater

Two groundwater samples were analysed for contaminants in the May 2006 site investigation, and the results showed no contamination present.

8 Ground Gas

8.1 General

The redevelopment of brownfield sites for both residential and commercial uses has been encouraged by the recent government policy. The policy also applies to brownfield sites where there is a potential presence of elevated concentrations of hazardous soil gases. Government policy is based upon a "suitable for use approach" which is relevant to both current and proposed future use of land.

The presence of hazardous soil gases could provide the "source" in a "pollutant linkage" resulting is determination that significant harm can be caused to people, buildings or the environment. Under such circumstances a landfill gas risk assessment has to be carried out to demonstrate that the proposals adequately mitigate any potential hazards associated with ground gas.

8.2 Technical Overview

The nature of the ground gases can be very different depending on the previous site use. Gas from former landfills can consist of methane and carbon dioxide, while from former mine workings the problems can be from methane and stythe gas (carbon monoxide and carbon dioxide). Gas can be generated from the process given in CIRIA R152 including the following:

Corrosion of metals or reactions between metals
Reactions of waste with acidic material within the fill
Redox reactions within the waste
Biological decomposition of biodegradable material within the waste

When a new development is proposed, particularly on a brown filed site, there are always concerns about contamination and gas migration. The primary cause of gas entering a building is from the pressure difference that exists between the outside and inside of a building. Soil gases can enter buildings through gaps around service pipes; cracks in walls below ground and floor slabs; construction joints or wall cavities. They can accumulate in any voids created by settlement beneath floor slabs; in drains and soakaways; or in confined spaces within the building such as cupboards, sub floor voids or small rooms such as a bathroom. After several housing explosions associated with ground gas in the 1990's, guidance and regulations were brought in to understand and solve the problems of soil gas migration.

The most current guidance used for this investigation is obtained from the CIRIA document C659 'Assessing the risks posed by hazardous ground gases to buildings' that, using the traffic light system and Gas Screening Values (GSV), indicate on a risk based assessment what actions should be taken to ensure protection to a new development. Certain factors are assumed when these values are calculated e.g. a 150mm floor void, a ground floor area of 64m^2. If a building design is significantly different from the guidance, higher or lower GSV's may be calculated and the gas regime may be adjusted accordingly.

The GSV's are calculated from the results of gas monitoring. The maximum borehole flow rate (Litres per hour) is multiplied by the maximum gas concentration (%). For example, monitoring data has given a maximum flow rate of 3.5 l/hr and a maximum methane concentration of 4.0%. The GSV would be calculated as 3.5 x 0.04 giving a GSV value of 0.14 l/hr. These values can then be compared to guideline values and then compared to the traffic light system that would classify the gas regime of a site as green, amber or red.

The gas regimes are as follows:-

Green – Negligible gas regime identified and gas protection measures are not considered necessary.

Amber 1 – Low to intermediate gas regime identified, which requires low-level gas protection measures, comprising a membrane and ventilated sub-floor void to create a permeability contrast to limit the ingress

of gas into buildings. Gas protection measures should be prescribed in BRE Report 414. Ventilation of the sub-floor should facilitate a minimum of one complete volume change in 24 hours.

Amber 2 – Intermediate to high gas regime identified, which requires high-level gas protection measures, comprising a membrane and ventilated sub-floor void to create a permeability contrast to prevent the ingress of gas into buildings. Gas protection measures should be prescribed in BRE Report 414. Membranes should be fitted by a specialist contractor. As with Amber 1, ventilation of the sub-floor should facilitate a minimum of one complete volume change in 24 hours. Certification that these passive protection measures have been installed correctly should be provided.

Red – High gas regime identified. It is considered that standard residential housing would not normally be accepted without a further Gas Risk Assessment and / or possible remedial mitigation measures to reduce and / or remove the source of gas.

Based on the results of the assessment outlined above various means of passive gas protection, outlined in BRE414, can be used to mitigate the dangers from the presence of the ground gas.

Before a risk assessment can be carried out it is important to establish the likely presence, extent and nature of the potential soil gas source. Based on this information an initial conceptual model can be produced to identify principal pollutant linkages. The information is then used to plan the scope and extent of the intrusive investigation and monitoring regimes.

8.3 Ground Gas Monitoring Results

In previous gas monitoring investigations, there were concerns about gas levels. This site investigation was undertaken to investigate the potential gas sources and any gas issues that could pose problems for future development.

Based on the gathered information from the monitoring of ground gas over along period it is apparent that there is ground gas being generated beneath the site but the concentrations vary significantly across the site. Despite the high concentrations recorded, the flow rates are very low or insignificant. The importance of the flow rate has been recognised by many professionals within the industry as well as publications and guidelines produced in relation with ground gas.

The borehole logs with the details of installations are given in Appendix A. The ground gas monitoring are given in Appendix C

Risk Assessment

The gas monitoring results can be used to characterise the site as recommended in CIRIA C659. This approach uses Gas Screening Values (GSVs) for consideration for situations where Typical Maximum Concentration are exceeded. The calculated GSV values are given in Appendix C.

From the GSV values it is possible to classify the site as Amber 2, (based on a worst case scenario for which the highest GSV is calculated from BH-03). However, if the site is divided into smaller areas, the gas monitoring results can be used to give specific gas regimes. The site has been spilt into four areas. A plan of these areas is presented in Appendix A.

Area 1 – this area is the north of the site, adjacent to The Sidings that will be developed into the health centre from the site boundary down to WS-06.

Area 2 – This consists of the site from the BH-03 down to the WS-03

Area 3 – is the small area of land adjacent to Caledonian Road.

Area 4 – this is the remaining southern end of the site.

Area 1

The gas monitoring results from BH-04 WS-06, WS-07 and WS-08 give the following results:

Monitoring Position	Description	CH_4 %	CO_2 %
BH-04	Average	2.90	3.16
	Maximum Flow	2.40	2.40
	Maximum gas value	5.00	4.90
	Gas Screening value	**0.12**	**0.1176**
WS-06	Average	1.30	0.20
	Maximum Flow	0.1	0.1
	Maximum gas value	1.70	0.20
	Gas Screening value	**0.0017**	**0.0002**
WS-07	Average	0.19	0.31
	Maximum Flow	<0.1	<0.1
	Maximum gas value	0.60	0.70
	Gas Screening value	**0.00006**	**0.00007**
WS-08	Average	0.77	1.91
	Maximum Flow	0.10	0.10
	Maximum gas value	1.20	2.80
	Gas Screening value	**0.0012**	**0.0028**

The results indicate that Area 1 with gas screening values of 0.12 (worst case scenario), would be characterised as green, that would give a negligible gas regime and no gas protection measures needed.

Area 2

For Area 2 the gas monitoring results for BH-02, BH-03, WS-03, WS-04, and WS-05 are used, as follows.

Monitoring Position	Description	CH_4 %	CO_2 %
BH-02	Average	3.68	5.79
	Maximum Flow	0.20	0.20
	Maximum gas value	5.40	6.80
	Gas Screening value	**0.0108**	**0.0136**
BH-03	Average	0.80	1.91
	Maximum Flow	6.30	6.30
	Maximum gas value	7.00	4.40
	Gas Screening value	**0.4410**	**0.2772**
WS-03	Average	0.19	0.31
	Maximum Flow	<0.1	<0.1
	Maximum gas value	4.60	0.40
	Gas Screening value	**0.00046**	**0.00004**
WS-04	Average	1.17	0.55
	Maximum Flow	0.10	0.10
	Maximum gas value	3.20	0.80
	Gas Screening value	**0.0032**	**0.0008**
WS-05	Average	0.53	2.45
	Maximum Flow	<0.1	<0.1
	Maximum gas value	0.60	3.50
	Gas Screening value	**0.00006**	**0.00035**

The results indicate that Area 2 with gas screening values of 0.44 (worst case scenario), would be characterised as amber 1.

Area 3

For Area 3 the gas monitoring results for WS-A, WS-B and WS-C are used as follows.

Monitoring Position	Description	CH_4 %	CO_2 %
WS-A	Average	0.10	1.05
	Maximum Flow	0.00	0.00
	Maximum gas value	0.10	3.70
	Gas Screening value	**0.0001**	**0.000**
WS-B	Average	0.1	0.57
	Maximum Flow	0.01	0.01
	Maximum gas value	0.10	0.80
	Gas Screening value	**0.0001**	**0.0008**
WS-C	Average	<0.1	1.64
	Maximum Flow	0.01	0.01
	Maximum gas value	<0.1	1.90
	Gas Screening value	**0.00**	**0.0019**

The results indicate that Area 3 with gas screening values of 0.001 (worst case scenario), would be characterised as green.

Area 4

For Area 4 the gas monitoring results for BH-01, WS-01 and WS-02 are used as follows.

Monitoring Position	Description	CH_4 %	CO_2 %
BH-01	Average	3.68	5.79
	Maximum Flow	1.70	1.70
	Maximum gas value	2.90	0.40
	Gas Screening value	**0.05**	**0.01**
WS-01	Average	0.53	2.45
	Maximum Flow	<0.01	<0.01
	Maximum gas value	4.20	5.60
	Gas Screening value	**0.0042**	**0.0056**
WS-02	Average	1.30	0.20
	Maximum Flow	<0.01	<0.01
	Maximum gas value	25.70	<0.01
	Gas Screening value	**0.00257**	**0.0000**

This would indicate that Area 3 with gas screening values of 0.05 (worst case scenario), would be characterised as amber 1. However, the gas levels in WS-02 for methane exceed the maximum value for amber 1 therefore, in this area further investigation is required from either trial pits dug to investigate potential sources of gas generation or additional boreholes drilled and further monitoring undertaken.

9 Gas Protection Measures

The control of gas migration is usually achieved by breaking the migration pathway between the identified gas source and the sensitive receptor(s). The pathway can be broken either at source or at the receptor. Although further investigation is proposed for areas of high concentration which may result in removing the source for majority of the site the pathway will be broken at the receptor.

The details of the gas protection for the various parts of the development have not yet been finalised but will be a combination of low permeability barriers and when necessary the introduction of passive systems.

10 Discussion and Recommendations

10.1 Ground Gas

Using the CLEA risk assessment and Generic Assessment Criterion (GAC) the made ground across the site is identified as a widespread contamination source. Elevated levels of contamination were encountered within the boreholes drilled and trail pits dug during the previous investigations. These elevated levels within the soil include Arsenic, Anthracene, Benzo (a) anthracene, Benzo (a) pyrene, Dibenzo (ah) anthracene and Indeno (1,2,3-c,d) pyrene. From the results there is widespread contamination with particular hotspots of Anthracene identified within the area BH-02. The made ground was noted to contain materials such as ash, slag and clinker to which the above elevated levels of soil contamination can be attributed. Also during the site investigation, small quantities of coal were also noted. CIRIA R152 has stated that ground gas can be generated from a number of processes including the following:

Corrosion of metals or reactions between metals
Reactions of waste with acidic material within the fill
Redox reactions within the waste
Biological decomposition of biodegradable material within the waste

When a gas regime is designed, a number of factors must be taken into account such as the end use buildings, the time scale that a regime will be in place, or any alterations or additions that may take place over the lifetime of the building. If the risk assessment is followed using the Source – Pathway – Receptor view then either the source of gas contamination must be removed or the pathway that leads to the receptors must be removed.

Using the results thus far the site has been divided into areas with specific requirements for gas protection. It is considered that based on the available information the ground gas issues on site can be mitigated by using low permeability membranes with additional passive venting measure when necessary. The monitoring of the installations is being continued.

10.2 Ground Contamination

Elevated levels of contamination were encountered within the boreholes drilled and trail pits dug during the previous investigations. These elevated levels within the soil include Arsenic, Anthracene, Benzo (a) anthracene, Benzo (a) pyrene, Dibenzo (ah) anthracene and Indeno (1,2,3-c,d) pyrene. The made ground was noted to contain materials such as ash, slag and clinker to which the above elevated levels of soil contamination can be attributed. These sources may pose a potential risk to the end users in areas of soft landscaping and gardens and as such represents an identified source and potential pathway.

To remove the risk for end users the installation of a capping system is recommended the design of which is outlined in the section below. Following the installation of a clean cover system the potential pathways associated with the CLEA risk based analysis are removed, and thus the risk to end users is also removed.

Although there were no leachate tests carried out this these investigations, and the water contamination results showed no contamination, the likelihood exists that there could be migration off site of contaminated groundwater. The limited thickness and reduced infiltration rate across the site caused by the proposed development, hard standing and appropriate drainage systems will, in reality reduce the risk significantly.

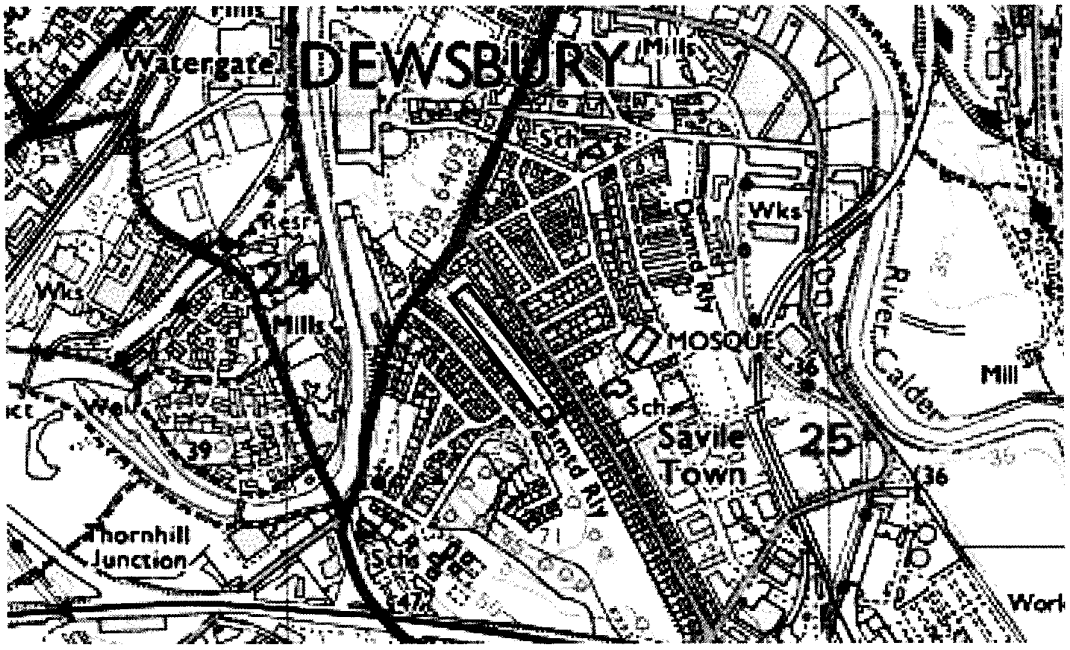
The removal of risk from both end users and groundwater is demonstrated within Appendix E, 'Conceptual Site Model'.

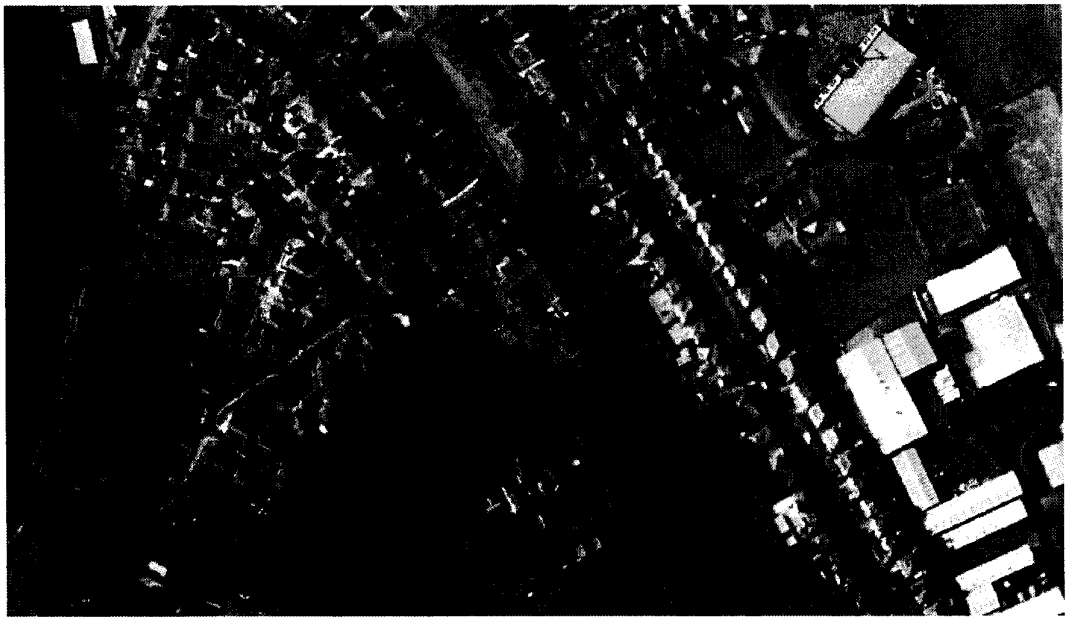
Further investigations in the form of machine dug trail pits is being carried out to recover soil samples for laboratory testing. These samples will be recovered from areas where borehole installations show high gas levels.

10.3 Capping System

To remove the pathways associated with the risk to human health the soft landscaping and garden area will need to be capped with a minimum 250mm of clean backfill and 350mm of topsoil. Following the placement, the system must be validated on site by a suitably qualified consultant, and the validation report presented to the local authorities.

Appendix A Figures





Desk Study Report	Appendix A	Site Location Plan and Aerial Photograph

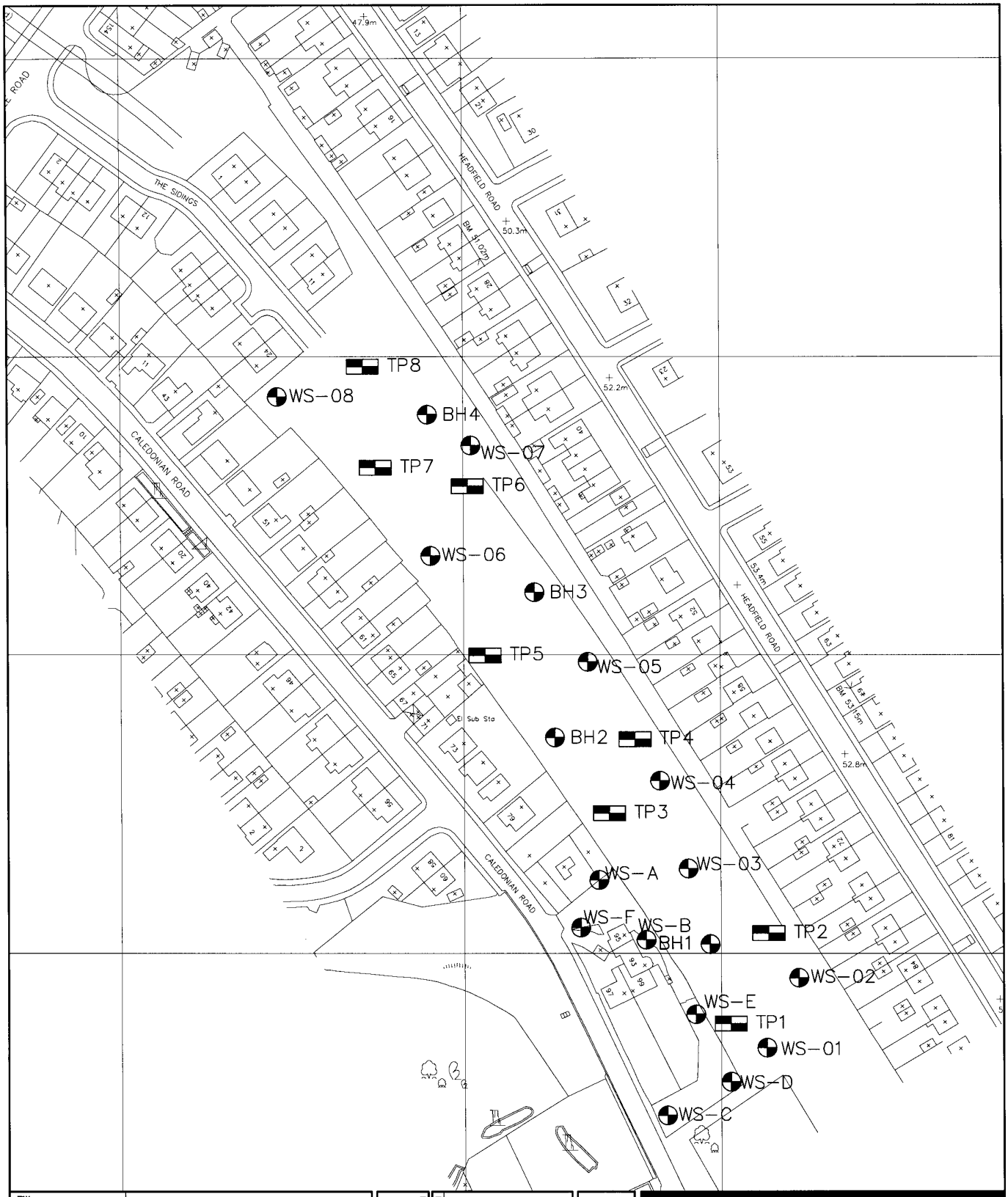
robinson environmental

1 West Durham Office Park
St Johns Road, Meadowfield
Durham, DH7 8RD
TEL: 0191 378 7480 FAX: 0191 378 7481

Project Name: Savile Road, Dewsbury

Project Reference: 06-6148 RE

Client: Savile Town Developments Ltd



Title : SAVILE ROAD, DEWSBURY		
APPENDIX A		
EXPLORATORY HOLE LOCATION PLAN		
Job Reference : 06-6148 RGE	Drawing Number : 06-6148 RGE_A	Revision : 0
Drawn by : SHC	Date : MAY 2007	Scale at A4 : NTS
Checked by : SH	Certificate Number FS 40109	

Residual Risk:

REV	DATE	AMENDMENTS	DRAWN BY	CHKD

notes

All work to be carried out in accordance with Building Regulations and the requirements of the Local Authority.
The Contractor shall check all dimensions on site before commencement of works.
No dimensions to be scaled off this drawing.

robinson environmental

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Appendix B Exploratory Hole Log Sheets

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BOREHOLE LOG

Project				BOREHOLE No
Saville Road				WS-01
Job No	Date	Ground Level (m)	Co-Ordinates ()	
06-6184	01-03-07 01-03-07			
Contractor				Sheet
Global Probing and Sampling				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION		
						0.15	MADE GROUND (Grey brown slightly sandy gravelly Clay with fine rootlets. Gravel is angular to rounded, fine to medium and consist of sandstone and brick.)		
0.50	J					(0.65)			
						0.80	MADE GROUND (Dark brown sandy gravelly Clay. Gravel is angular to rounded, fine to coarse and consist of sandstone ash and brick.)		
1.00		N11				(0.80)	MADE GROUND (Black slightly sandy gravelly Clay. Gravel is angular, fine to coarse and consist of ash.)		
1.20	J					1.60			
2.00		N8				(0.95)	MADE GROUND (Grey brown black mottled orange sandy gravelly Clay. Gravel is angular to subangular, fine to coarse and consist of ash brick concrete coal and sandstone.)		
2.50	J					2.55			
						2.80	MADE GROUND (Black sandy Gravel. Gravel is angular, fine to coarse and consist of ash brick.)		
3.00		N28					MADE GROUND (Dark grey sandy gravelly Clay. Gravel is angular to sub rounded, fine to coarse and consist of ash brick and sandstone.) .....Below 3.60m becomes very gravelly		
3.50	J					(1.90)			
4.00		N33							
4.50	J					4.70			
							MADE GROUND (Black grey green sandy very gravelly Clay. Gravel is angular to sub rounded, fine to coarse and consist of ash brick and sandstone.)		
5.00		N30				(0.70)			
						5.40			
5.50	J					(0.40)	MADE GROUND (Yellow brown cobble. Cobble is angular and consists of sandstone)		
						5.90	MADE GROUND (Grey mottled green sandy very gravelly Clay. Gravel is angular to sub rounded, fine to coarse and consist of wood ash brick and sandstone.)		
6.00		N50/ 0.27				6.00	MADE GROUND (Black sandy organic Clay.)		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	

All dimensions in metres Scale 1:50	Client Saville Developments LTD	Method/ Plant Used Mini-percussive Rig 130	Logged By SHC

AGS3 UK BH WS LOGS.GPJ AGS 3_1.GDT 14/5/07

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BOREHOLE LOG

Project				BOREHOLE No
Saville Road				WS-02
Job No	Date	Ground Level (m)	Co-Ordinates ()	
06-6184	01-03-07 01-03-07			
Contractor				Sheet
Global Probing and Sampling				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION		
						0.10	MADE GROUND (Brown sandy gravelly Clay with fine rootlets. Gravel is angular to rounded, fine to coarse and consist of sandstone and brick.)		
						(0.50)			
0.50	J					0.60	MADE GROUND (Brown sandy very gravelly Clay. Gravel is are angular to rounded, fine to coarse and consist of sandstone and brick.)		
						(0.40)			
						1.00	MADE GROUND (Yellow brown very sandy very gravelly Clay. Gravel is angular, fine to coarse and consist of sandstone.)		
1.00		N34				1.30	MADE GROUND (Red sandy very gravelly Clay. Gravel is angular, fine to coarse and consist of brick and sandstone.)		
1.50	J					1.40	MADE GROUND (Black sandy gravelly Clay. Gravel is angular, fine to coarse and consist of sandstone and brick.)		
						1.60	MADE GROUND (Black mottled yellow sandy gravelly Clay. Gravel is angular, fine to coarse and consist of sandstone ash coal and brick.)		
2.00	J	N14				1.65			
						2.00	MADE GROUND (Yellow cobble. Cobble is angular and consists of wood)		
						(0.60)			
2.50	J					2.60	MADE GROUND (Red brown cobble. Cobble is angular and consists of brick)		
						2.80	MADE GROUND (Grey brown mottled green very sandy gravelly Clay. Gravel is angular to subangular, fine to coarse and consist of sandstone ash concrete coal and brick.)		
3.00		N28				(0.40)			
						3.20	MADE GROUND (Grey brown mottled green very sandy very gravelly Clay. Gravel is angular to subangular, fine to coarse and consist of sandstone and brick.)		
3.50	J					3.25			
						(0.55)	MADE GROUND (Red brown cobble. Cobble is angular and consists of brick)		
3.80						3.80	MADE GROUND (Yellow cobble. Cobble is angular and consists of wood)		
							MADE GROUND (Black mottled grey sandy gravelly Clay. Gravel is angular, fine to coarse and consist of pieces of wire, sandstone, ash, coal and brick.)		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	

All dimensions in metres Scale 1:50	Client Saville Developments LTD	Method/ Plant Used Mini-percussive Rig 130	Logged By SHC

AGS3 UK BH WS LOGS.GPJ AGS 3_1.GDT 14/5/07

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BOREHOLE LOG

Project				BOREHOLE No
Saville Road				WS-03
Job No	Date	Ground Level (m)	Co-Ordinates ()	
06-6184	01-03-07 01-03-07			
Contractor				Sheet
Global Probing and Sampling				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION		
						(0.40) 0.40	MADE GROUND (Brown slightly sandy gravelly Clay with fine rootlets. Gravel is angular to rounded, fine to coarse and consist of sandstone ash and brick.)		
0.50	J					0.50 (0.50) 1.00	MADE GROUND (Yellow slighty slighty clayey Gravel. Gravel is angular coarse and consist of sandstone.)		
1.00		N20					MADE GROUND (Black mottled green and orange sandy gravelly Clay. Gravel is angular, fine to coarse and consist of sandstone, ash and brick.)		
1.50	J					(0.80) 1.80	MADE GROUND (Black sandy very gravelly Clay. Gravel is angular to subangular, fine to coarse and consist of concrete sandstone, ash, granite and brick.)		
2.00		N17				2.00	MADE GROUND (Black sandy clayey Gravel. Gravel is angular to subangular, fine to coarse and consist of concrete sandstone, ash, granite and brick.)		
2.50	J					(1.60)	MADE GROUND (Black slightly sandy slighty gravelly Clay. Gravel is angular to subangular, fine to coarse and consist of concrete sandstone, ash, granite and brick.)		
3.00		N25							
3.50	J					3.60			
3.80		N49				3.70 (0.50) 4.20	MADE GROUND (Black slightly clayey sandy Gravel. Gravel is angular to subangular, fine to coarse and consist of ash.) MADE GROUND (Black very sandy very gravelly Clay. Gravel is angular to subangular, fine to coarse and consist of ash.)		
4.40	J					4.40	MADE GROUND (Black clayey sandy Gravel. Gravel is angular to subangular, fine to coarse and consist of ash.)		
4.60		N66				(0.40) 4.80	MADE GROUND (Black gravelly Clay. Gravel is angular to subangular, fine to coarse and consist of ash.)		
4.80	J								

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	

All dimensions in metres Scale 1:50	Client Saville Developments LTD	Method/ Plant Used Mini-percussive Rig 130	Logged By SHC

AGS3 UK BH WS LOGS.GPJ AGS 3_1.GDT 14/5/07

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BOREHOLE LOG

Project				BOREHOLE No
Saville Road				WS-04
Job No	Date	Ground Level (m)	Co-Ordinates ()	
06-6184	01-03-07 01-03-07			
Contractor				Sheet
Global Probing and Sampling				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION		
						0.20	MADE GROUND (Brown sandy gravelly Clay with fine rootlets. Gravel is angular to rounded, fine to coarse and consist of sandstone and brick.)		
0.50	J					0.50 (0.40) 0.90	MADE GROUND (Yellow brown sandy gravelly Clay. Gravel is angular to rounded, fine to coarse and consist of sandstone and brick.)		
1.00	J	N15				1.20	MADE GROUND (Red brown Cobble. Cobble is angular and consists of brick)		
1.50	J					1.45 (0.40) 1.85	MADE GROUND (Black sandy gravelly Clay. Gravel is angular, fine to coarse and consist of sandstone and ash.)		
2.00	CHJ	N12				1.95	MADE GROUND (Black sandy Gravel. Gravel is angular, fine to coarse and consist of ash.)		
2.50	J					(0.60) 2.70	MADE GROUND (Grey mottled orange sandy gravelly Clay. Gravel is angular to subangular, fine to coarse and consist of ash.)		
3.00		N46				3.00 (0.50) 3.50	MADE GROUND (Yellow brown Cobble. Cobble is angular and consists of sandstone)		
3.50	J						MADE GROUND (Firm black sandy Gravel. Gravel is angular, fine to coarse and consist of ash.)		
3.90		N13				(1.00) 4.50	MADE GROUND (Brown mottled black sandy gravelly Clay. Gravel is angular, fine to coarse and consist of sandstone and ash.)		
4.50	J					4.60	MADE GROUND (Brown sandy gravelly Clay. Gravel is angular, fine to coarse and consist of brick)		
5.00		N19				4.75 (1.20) 5.80	MADE GROUND (Red brown sandy gravel. Gravel is angular, fine to coarse and consist of brick)		
5.50	J					6.00	MADE GROUND (Brown sandy gravelly Clay. Gravel is angular, fine to coarse and consist of brick and ash.)		
6.00		N77/ 0.28					MADE GROUND (Red brown Cobble. Cobble is angular and consists of brick)		
							MADE GROUND (Brown sandy gravelly Clay. Gravel is angular, fine to coarse and consist of brick and ash.)		
							MADE GROUND (Grey Cobble. Cobble is angular and consists of concrete)		
							MADE GROUND (Black sandy gravel Clay. Gravel is angular, fine to coarse and consist of ash.)		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	

All dimensions in metres Scale 1:50	Client Saville Developments LTD	Method/ Plant Used Mini-percussive Rig 130	Logged By SHC

AGS3 UK BH WS LOGS.GPJ AGS 3_1.GDT 14/5/07

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BOREHOLE LOG

Project				BOREHOLE No
Saville Road				WS-05
Job No	Date	Ground Level (m)	Co-Ordinates ()	
06-6184	28-02-07 28-02-07			
Contractor				Sheet
Global Probing and Sampling				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION		
						0.10	MADE GROUND (Brown gravelly Clay with fine rootlets. Gravel is angular to rounded, fine to medium and consist of brick sandstone and coal.)		
0.50	J					(1.40)	MADE GROUND (Brown very sandy very gravelly Clay. Gravel is angular to rounded, fine to medium and consist of brick concrete mudstone and coal.)		
1.00		N28				1.50			
1.50	J					(0.50)	MADE GROUND (Yellow very sandy very gravelly Clay. Gravel is angular to rounded, fine to medium and consist of brick concrete mudstone and coal.)		
2.00		N24				2.00			
						(0.50)	MADE GROUND (Black very sandy very gravelly Clay. Gravel is angular to rounded, fine to medium and consist of brick concrete mudstone and coal.)		
2.50	CHJ					2.50			
2.50	J						MADE GROUND (Grey mottled orange very sandy very gravelly Clay. Gravel is angular to rounded, fine to medium and consist of brick concrete mudstone and coal.)		
3.00		N34				(1.20)			
3.50	J					3.70			
3.80		N50/ 0.16				4.00	MADE GROUND (Red brown Cobble. Cobble is angular and consists of brick)		
						(0.80)	MADE GROUND (Grey brown mottled orange slightly sandy very gravelly Clay. Gravel is angular to rounded, fine to medium and consist of sandstone and mudstone.)		
						4.80			
						5.00	Very weak thinly laminated grey mottled black MUDSTONE		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	

All dimensions in metres Scale 1:50	Client Saville Developments LTD	Method/ Plant Used Mini-percussive Rig 130	Logged By SHC

AGS3 UK BH WS LOGS.GPJ AGS 3_1.GDT 14/5/07

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BOREHOLE LOG

Project				BOREHOLE No
Saville Road				WS-06
Job No	Date	Ground Level (m)	Co-Ordinates ()	
06-6184	28-02-07 28-02-07			
Contractor				Sheet
Global Probing and Sampling				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION		
						0.10	MADE GROUND (Brown sandy gravelly Clay with fine rootlets. Gravel is angular to sub angular, fine and consist of brick and ash.)		
0.50	J					(0.90)	MADE GROUND (Brown slightly sandy gravelly Clay. Gravel is angular to sub angular, fine and consist of brick concrete and ash.)		
1.00		N19				1.00	MADE GROUND (Brown very sandy very gravelly Clay. Gravel is angular to sub angular, fine and consist of brick concrete and ash.)		
1.50	J					(0.50) 1.50	MADE GROUND (Brown sandy gravelly Clay. Gravel is angular to sub angular, fine and consist of brick concrete and ash.)		
2.00		N32				(0.50) 2.00	MADE GROUND (Brown slightly sandy gravelly Clay. Gravel is angular to sub angular, fine and consist of brick concrete and ash.)		
2.50	J					(1.50)			
3.00		N41							
3.50	CHJ					3.50			
3.50	J					3.70	MADE GROUND (Red brown Cobble. Cobble is angular and consists of brick)		
4.00		N58				(1.20)	MADE GROUND (Brown sandy very gravelly Clay. Gravel is angular to sub angular, fine and consist of brick concrete and ash.)		
4.80		N81				4.90			
						5.00	Moderatly weak yellow SANDSTONE.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	

All dimensions in metres Scale 1:50	Client Saville Developments LTD	Method/ Plant Used Mini-percussive Rig 130	Logged By SHC

AGS3 UK BH WS LOGS.GPJ AGS 3_1.GDT 14/5/07

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BOREHOLE LOG

Project				BOREHOLE No
Saville Road				WS-07
Job No	Date	Ground Level (m)	Co-Ordinates ()	
06-6184	28-02-07 28-02-07			
Contractor				Sheet
Global Probing and Sampling				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION		
						0.10	MADE GROUND (Dark brown sandy slightly gravelly Clay with fine rootlets. Gravel is angular to rounded, fine and consist of sandstone and ash.)		
0.50	J					(1.10)	MADE GROUND (Brown very sandy very gravelly Clay. Gravel is angular to rounded, fine to coarse and consist of sandstone brick granite wood a sponge and ash.)		
1.00		N17				1.20			
						(0.40)	MADE GROUND (Brown mottled dark brown very sandy clayey Gravel. Gravel is angular, fine to coarse and consist of sandstone brick wood and ash.)		
1.50	J					1.60			
							MADE GROUND (Brown becoming yellow sandy gravelly Clay. Gravel is angular to sub rounded, fine to coarse and consist of sandstone brick and ash.)		
2.00		N20							
2.50	J					(1.90)			
3.00		N29							
						3.50			
3.50	J						MADE GROUND (Dark grey mottled black very sandy very gravelly Clay. Gravel is angular to sub angular, fine to coarse and consist of sandstone concrete brick and ash.)		
4.00		N24				(1.50)			
						5.00			
5.00									

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	

All dimensions in metres Scale 1:50	Client Saville Developments LTD	Method/ Plant Used Mini-percussive Rig 130	Logged By SHC

AGS3 UK BH WS LOGS.GPJ AGS 3_1.GDT 14/5/07

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BOREHOLE LOG

Project				BOREHOLE No
Saville Road				WS-08
Job No	Date	Ground Level (m)	Co-Ordinates ()	
06-6184	28-02-07 28-02-07			
Contractor				Sheet
Global Probing and Sampling				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION		
0.20-0.30	J					0.10 (0.75) 0.85	MADE GROUND (Dark brown gravelly slightly sandy Clay with fine rootlets. Gravel is angular to sub angular, fine to coarse and consists of ash, brick concrete and sandstone) MADE GROUND (Brown gravelly slightly sandy Clay. Gravel is angular to subangular, fine to coarse and consists of ash, brick concrete and sandstone woodl)		
1.00-1.20	J	N22				(1.00)	MADE GROUND (Black slightly clayey sandy Gravel. Gravel is angular, fine to coarse and consists of ash, concrete and sandstone)		
1.50	CHJ					1.85			
2.00		N26				2.00 (0.45) 2.45	MADE GROUND (Grey mottled orange sandy gravelly Clay. Gravel is angular to sub angular, coarse and consists of sandstone) Stiff orange mottled grey CLAY		
2.40	J					(0.55)	Weak thinly laminated yellow mottled grey MUDSTONE.		
2.80	J					3.00			
3.00		N28				(1.00)	Weak thinly laminated grey mottled black MUDSTONE		
4.00	J	N53				4.00			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	

All dimensions in metres Scale 1:50	Client Saville Developments LTD	Method/ Plant Used Mini-percussive Rig 130	Logged By SHC

AGS3 UK BH WS LOGS.GPJ AGS 3_1.GDT 14/5/07

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BOREHOLE LOG

Project				BOREHOLE No
Saville Road				WS-A
Job No: 06-6184	Date: 02-03-07 02-03-07	Ground Level (m):	Co-Ordinates ():	
Contractor: Global Probing and Sampling				Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION		
						0.20	MADE GROUND (Black very sandy clayey Gravel with fine rootlets. Gravel is angular, fine to coarse and consists of sandstone and brick.)		
						0.40	MADE GROUND (Yellow brown Cobble. Cobble is angular and consists of sandstone)		
0.50	CHJ					0.60	MADE GROUND (Red very sandy gravel. Gravel is angular, fine to coarse and constsis of brick sandstone (hardcore) and ash.) A strong hydrocarbon odour was noted.		
1.00	J	N17/ 0.225				(0.70) 1.30	Stiff dark brown mottled yellow and black CLAY.		
1.50	J					(0.40) 1.70	Stiff yellow sandy gravelly CLAY. Gravel is fine to medium, angular and consists of sandstone.		
						1.80	Medium dense yellow sandy GRAVEL. Gravel is angular and consists of sandstone.		
2.00		N43				(0.30) 2.10	Very weak yellow thinly laminated MUDSTONE		
2.10	J					(0.40) 2.50	Very weak yellow grey thinly laminated MUDSTONE		
2.50	CHJ					(0.40) 2.90	Weak black thinly laminated COAL		
						3.00	Very weak thinly laminated yellow brown MUDSTONE.		
3.00	J	N58							

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	

All dimensions in metres Scale 1:31.25	Client: Saville Developments LTD	Method/ Plant Used: Mini-percussive Rig 130	Logged By: SHC

AGS3 UK BH WS LOGS.GPJ AGS 3_1.GDT 14/5/07

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BOREHOLE LOG

Project				BOREHOLE No
Saville Road				WS-B
Job No	Date	Ground Level (m)	Co-Ordinates ()	
06-6184	02-03-07 02-03-07			
Contractor				Sheet
Global Probing and Sampling				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION		
						0.20	MADE GROUND (Black sandy Clay with fine rootlets.)		
						0.40	MADE GROUND (Brown sandy gravelly Clay. Gravel is angular to rounded, fine to coarse and constists of sandstone and brick.)		
0.50	J					0.60	MADE GROUND (Black sandy clayey Gravel. Gravel is angular, fine to coarse and consists of ash sandstone and brick.)		
						0.80	MADE GROUND (Yellow clayey very gravelly Sand. Gravel is angular, fine to coarse and consists of ash and sandstone.)		
1.00	J	N12				(0.50) 1.30	MADE GROUND (Yellow mottled brown and orange sandy gravelly Clay. Gravel is angular, fine to coarse and consists of sandstone.)		
1.50	J					(0.40) 1.70	MADE GROUND (Brown very gravelly sandy Clay. Gravel is angular, fine to coarse and consists of brick and concrete.)		
2.00		N17				(0.50) 2.20	MADE GROUND (Brown sandy gravelly Clay. Gravel is angular, fine to coarse and consists of brick coal ash and sandstone.)		
2.50	J					(0.80) 3.00	Stiff yellow mottled grey slightly sandy gravelly CLAY. Gravel is angular, fine to coarse and consists of coal and sandstone.		
3.00		N25				3.05	Medium dense yellow sandy GRAVEL. Gravel is angular, fine to coarse and consists of sandstone.		
						3.20	Stiff yellow very sandy very gravelly CLAY. Gravel is angular, fine to coarse and consists of sandstone.		
3.50	J					(0.80) 4.00	Very weak thinly laminated yellow brown MUDSTONE.		
4.00		N50/ 0.19							

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	

All dimensions in metres Scale 1:31.25	Client Saville Developments LTD	Method/ Plant Used Mini-percussive Rig 130	Logged By SHC

AGS3 UK BH WS LOGS.GPJ AGS 3_1.GDT 14/5/07

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BOREHOLE LOG

Project				BOREHOLE No
Saville Road				WS-C
Job No	Date	Ground Level (m)	Co-Ordinates ()	
06-6184	02-03-07 02-03-07			
Contractor				Sheet
Global Probing and Sampling				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION		
						(0.30) 0.30	MADE GROUND (Dark brown sandy gravelly Clay with fine rootlets. Gravel is angular, coarse and constists of brick.)		
0.50	J					(0.50) 0.80	MADE GROUND (Orange brown sandy gravelly Clay. Gravel is angular, fine to coarse and constists of sandstone.)		
1.00		N15				(0.70) 1.50	Medium dense yellow clayey gravelly SAND. Gravel is angular, fine to coarse and constists of sandstone.		
1.50	J					1.60	Medium dense black clayey sandy GRAVEL. Gravel is angular, fine to coarse and constists of coal.		
						1.80	Stiff black mottled orange gravelly sandy CLAY. Gravel is angular, fine to coarse and consists of weathered mudstone.		
2.00		N32					Very weak thinly laminated yellow MUDSTONE.		
2.50	J					(1.40)			
3.00		N41				3.20			
							Very weak thinly laminated grey mottled orange MUDSTONE.		
3.50	J					(0.80)			
4.00		N72				4.00			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	

All dimensions in metres Scale 1:31.25	Client Saville Developments LTD	Method/ Plant Used Mini-percussive Rig 130	Logged By SHC

AGS3 UK BH WS LOGS.GPJ AGS 3_1.GDT 14/5/07

Robinson Geo Engineering
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St Johns Road, Meadowfield, Durham, DH7 8RD
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BOREHOLE LOG

Project				BOREHOLE No
Saville Road				WS-D
Job No	Date	Ground Level (m)	Co-Ordinates ()	
06-6184	02-03-07 02-03-07			
Contractor				Sheet
Global Probing and Sampling				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend		DESCRIPTION		
						(0.40) 0.40	MADE GROUND (Brown sandy Clay with fine rootlets)		
0.50	J					0.60	Orange brown sandy gravelly CLAY. Gravel is angular, fine to coarse and consists of sandstone.		
						0.80	Yellow sandy GRAVEL. Gravel is angular, fine to coarse and consists of sandstone.		
						1.00	Yellow mottled black sandy GRAVEL. Gravel is angular, fine to coarse and consists of sandstone and coal.		
1.00		N31				(0.70) 1.70	Dense black sandy GRAVEL. Gravel is angular, fine to coarse and consists of coal.		
1.50	J								
						(0.30) 2.00	Very weak thinly laminated grey mottled black MUDSTONE		
2.00		N64							
2.50	J								

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	

All dimensions in metres Scale 1:31.25	Client Saville Developments LTD	Method/ Plant Used Mini-percussive Rig 130	Logged By SHC

Robinson Geo Engineering
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BOREHOLE LOG

Project				BOREHOLE No
Saville Road				WS-E
Job No	Date	Ground Level (m)	Co-Ordinates ()	
06-6184	02-03-07 02-03-07			
Contractor				Sheet
Global Probing and Sampling				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION		
						(0.30) 0.30	MADE GROUND (Dark brown sandy slightly gravelly Clay with fine rootlets. Gravel is angular to rounded, fine to medium and consists of sandstone and coal.)		
						0.50	MADE GROUND (Red brown sandy gravelly clay with fine rootlets. Gravel is angular to sub angular, fine to coarse and consists of sandstone brick and coal.		
0.50	J						Medium dense yellow gravelly clayey SAND. Gravel is angular, fine to coarse and consists of sandstone.		
1.00	J	N11				(1.00)			
						1.50			
1.50	J					1.60	Medium dense black gravelly sandy CLAY. Gravel is angular, fine to coarse and consists of coal.		
						(0.30) 1.90	Medium dense orange mottled black gravelly CLAY. Gravel is angular, fine to coarse and consists of mudstone.		
2.00	J	N30				(0.60)	Weak thinly laminated grey mottled brown MUDSTONE		
						2.50			
						(0.50) 3.00	Weak thinly laminated yellow mottled orange MUDSTONE		
3.00	J	N50/ 0.155							

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	

All dimensions in metres Scale 1:31.25	Client Saville Developments LTD	Method/ Plant Used Mini-percussive Rig 130	Logged By SHC

Robinson Geo Engineering
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BOREHOLE LOG

Project				BOREHOLE No
Saville Road				WS-F
Job No	Date	Ground Level (m)	Co-Ordinates ()	
06-6184	02-03-07 02-03-07			
Contractor				Sheet
Global Probing and Sampling				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
						0.05	MADE GROUND (Black sandy gravelly Clay. Gravel is angular, fine to coarse and consists of sandstone, brick and ash.)		
						(0.35)	MADE GROUND (Yellow very sandy slightly clayey Gravel. Gravel is angular, fine to coarse and consists of sandstone.)		
						0.40	MADE GROUND (Black mottled red very sandy clayey Gravel. Gravel is angular, fine to coarse and consists of sandstone, brick and ash.)		
0.50	J					0.50			
						0.70	MADE GROUND (Yellow sandy gravelly Clay. Gravel is angular, fine to coarse and consists of sandstone.)		
						0.80	MADE GROUND (Brown sandy gravelly Clay. Gravel is angular, fine to coarse and consists of sandstone and coal.)		
1.00	J	N15				(0.45)	Medium dense yellow brown slighty clayey gravelly SAND. Gravel is angular, fine to coarse and consists of sandstone.		
						1.25	Firm yellow brown sandy gravelly CLAY. Gravel is angular, fine to coarse and consists of sandstone and coal.		
						(0.25)	Firm black sandy gravelly CLAY. Gravel sized constituent is angular, fine to coarse and consists of coal.		
1.50	J					1.50	Firm yellow mottled black gravelly CLAY. Gravel is angular, medium to coarse and consists of coal and weathered mudstone.		
						1.60	Firm becoming stiff yellow mottled grey gravelly CLAY. Gravel is angular, medium to coarse and consists of weathered mudstone.		
						1.80	Stiff grey mottled orange and yellow gravelly CLAY. Gravel is angular, medium to coarse and consists of weathered mudstone.		
2.00		N30				(0.70)	Very stiff grey gravelly CLAY. Gravel is angular, medium to coarse and consists of weathered mudstone.		
						2.50	Medium dense black sandy GRAVEL. Gravel is angular, fine to coarse and consists of coal.		
2.50	J					(0.50)	Very weak thinly laminated black mottled grey MUDSTONE		
						3.00			
3.00	J	N26							
3.10	J					(0.50)			
						3.50			
3.50	J					(0.30)			
						3.80			
						4.00			
4.00	J	N50/ 0.17							

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	

All dimensions in metres Scale 1:31.25	Client Saville Developments LTD	Method/ Plant Used Mini-percussive Rig 130	Logged By SHC

AGS3 UK BH WS LOGS.GPJ AGS 3_1.GDT 14/5/07

Appendix V

Extracts from Arc Environmental Ltd. (2011 & 2013) Reports

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Registered in England No. 05539784

Our Ref: 10-626.01L
Your Ref:

Savile Developments Limited
8 Royd Wells,
Mirfield,
West Yorkshire,
WF14 9TD

Arc Environmental Ltd
The Rivergreen Centre
Aykley Heads
Durham
DH1 5TS

FAO: Mr. Ismail Adam

2nd June 2011

Dear Ismail,

RE: Land off Caledonian Road, Savile Town, Dewsbury

Further to our recent visit to the above mentioned site, please find attached the following:

- Site Location Plan
- Aerial Photograph
- Trial Trench Location Plan
- Trial Trench Record Sheets & Cross-Sections (including Photographic Record)
- Laboratory Test Results

As requested by Savile Developments Limited, a brief ground investigation has been carried out within the south-western corner of the above mentioned site, where it is proposed to construct a new retaining wall situated immediately adjacent to Caledonian Road.

The intrusive investigation works, undertaken by Arc Environmental Limited, comprised the sinking of 4 no. mechanically excavated trial trenches (TT01, TT02, TT03 & TT03A), the locations of which are shown on the enclosed Trial Trench Location Plan. It should be noted that this plan must be used for orientating purposes only, as the positions shown are approximate, and the plan is not to a standard scale.

To aid in this assessment, each of the above trial trenches were positioned on or within close proximity to the 3 no. retaining wall sections shown on the proposed Retaining Wall Adjacent Highway plan produced by the Consulting Engineer (Robinson Consulting Limited), with TT01 generally corresponding to Section 3-3, TT02 generally corresponding to Section 2-2 & TT03 generally corresponding to Section 1-1.

General site levels were also interpolated for each of the exploratory positions from the Topographical Survey Plan provided by the Consulting Engineer, to aid in correlating the ground conditions identified with Ordnance Datum (mAOD).

1.0 Ground Conditions:

For an accurate description of the ground conditions encountered at each investigation position, reference should be made to the enclosed trial trench record sheets and cross-sections. It should be noted that there is always the possibility of variation in the ground conditions around and between the trial trench locations.

RE: Land off Caledonian Road, Savile Town, Dewsbury (Cont'd)

1.0 Ground Conditions (Cont'd):

During the intrusive works, a shallow service culvert was encountered below the former yard area initially targeted by TT03A, at a depth of c.0.40m bcgl. In order to avoid damage to this feature TT03A was terminated and moved c.1m south. This second trial trench was subsequently labeled as TT03.

1.1 Soil Profile:-

During the intrusive investigation works, an initial layer of topsoil was recorded at the locations of TT01 and TT02 to depths of between c.0.15m and c.0.40m below current ground levels (bcgl), whilst an initial layer of concrete and crushed gravel surfacing was noted at the location of TT03 (associated with historical yard area), to a maximum recorded depth of c.0.30m bcgl.

At the location of TT03 a secondary layer of made ground, comprising disturbed gravelly sand, with sandstone cobbles, intermixed with light grey mudstone, was noted to c.1.10m bcgl.

Underlying the initial made ground materials, a limited thickness of residual soil comprising brown slightly clayey gravelly sand, with many sandstone cobbles and boulders, was noted to depths of between c.1.50m and c.1.60m bcgl, below the area of the proposed retaining wall sections. These depths generally correspond to levels of c.66.34m AOD at the location of TT01 (Section 3-3), c.64.75m AOD at the location of TT02 (Section 2-2) and c.62.01m AOD at the location of TT03 (Section 1-1).

As can be seen from the attached sections, the overall thickness of the residual soil deposits was noted to increase towards the base of the sloped areas targeted by TT01 & TT02, up to a maximum recorded depth of c.2.60m bcgl (TT01).

Solid deposits generally comprising extremely weak to very weak grey mudstone inter-bedded with dark grey carbonaceous mudstone, were noted at the trial trench locations up to a maximum recorded depth of c.6.50m bcgl (TT01) and c.59.91m AOD (TT03). Towards the base of TT03 medium strong sandstone deposits were also recorded up to a maximum recorded depth of c.4.10m bcgl (i.e. 59.49m AOD).

At the locations of TT01 and TT02 bands of anthracitic black coal, with overlying bands of inter-bedded coal and carbonaceous mudstone, were also noted contained within the initial mudstone deposits, at depths of between c.2.50m to c.3.50m (TT02) and c.5.60m to c.6.40m bcgl (TT01).

At the location of TT01 an initial shallow band of very weak black weathered coal was also noted from c.1.60m to c.1.90m bcgl. However this band was noted to be tapering in thickness and was no longer evident c.2.00m from the site boundary.

1.2 Groundwater:-

No significant groundwater ingresses were noted within TT01 and TT02 during the intrusive works. However the solid deposits at the location of TT01 were noted to become damp at c.3.90m, whilst a slight seepage and occasional pockets of standing water were observed from c.4.20m bcgl.

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RE: Land off Caledonian Road, Savile Town, Dewsbury (Cont'd)

1.0 Ground Conditions (Cont'd):

1.2 Groundwater (Cont'd):-

A water strike was also noted at the location of TT03 (sunk across the area of Section 1-1) at a depth of c.3.60m bcgl (i.e. c.59.91m AOD) contained at the boundary between the mudstone and sandstone deposits.

Taking into account the above, it would be considered prudent to allow for the possible introduction of temporary pumping equipment, in order to take care of any future water ingresses, particularly during the wetter periods of the year.

2.0 Laboratory Testing:

Geotechnical testing was carried out in accordance with BS1377:1990:Parts 1-9, by Professional Soils Laboratory Limited (PSL) of Doncaster, South Yorkshire, unless otherwise stated (UKAS certification enclosed), and by Chemtech Environmental Limited of Consett, Co. Durham (UKAS certified).

2.1 Determination of Liquid & Plastic Limits:

Representative samples (3 no.) of the natural mudstone solid deposits, encountered within the trial trenches were tested in order to determine their liquid and plastic limits, so these materials might be classified. The results can be seen in Table 1 below and are also contained in the PSL Report no. PSL11/1095, a copy of which has been enclosed.

Table 1

Position	Depth (m)	M/C (%)	LL	PL	PI	Class	% Passing 425µm Sieve
TT01	3.50-3.70	11	47	22	25	CI	76
TT02	3.60-3.90	18	33	17	16	CL	91
TT03	2.20-2.60	13	35	18	17	CL	86

M/C = Moisture Content, LL = Liquid Limit, PL = Plastic Limit, PI = Plasticity Index, NP = Non plastic.

From the results it can be seen that the samples tested are generally of an inorganic nature, and when plotted on the plasticity chart, fall within the low and intermediate plasticity ranges, and from the resulting plasticity indices, display a low shrinkage and swelling potential when taking into account the amount passing the 425µm sieve.

2.2 Determination of pH & SO_4:-

Representative samples of the residual soil, mudstone and banded coal / carbonaceous mudstone recovered from the trial trenches, were tested in order to determine their acidic (pH) and soluble sulphate (SO_4) levels. The results are shown in Table 2 below and are also contained within the Chemtech Environmental Limited Analytical Report (Ref no: ARC/42468) a copy of which is enclosed.

Table 2

Position	Depth (m)	SO_4(mg/l)	pH value	Design SO_4 Class	ACEC Class
TT01	0.40-0.80	<10	6.6	DS-1	AC-1
TT01	4.60-4.80	20	5.8	DS-1	AC-1
TT03	1.90-2.00	38	5.2	DS-1	AC-2z

ACEC = Aggressive Chemical Environment for Concrete site classification (for natural ground locations).

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RE: Land off Caledonian Road, Savile Town, Dewsbury (Cont'd)

2.0 Laboratory Testing (Cont'd):

2.2 Determination of pH & SO_4 (Cont'd):-

From these results it can be seen that the pH values for the samples tested ranged from 5.2 to 6.6, and the amount of soluble sulphate present falls within the negligible range (<500mg/l). Therefore, in accordance with BRE Special Digest 1: 2005, the site can be given a classification of Class DS-1.

When considering the nature of the materials tested and assuming mobile groundwater the assessment of the Aggressive Chemical Environment for Concrete (ACEC), is AC-2z, due to the occasional acidity of the deposits tested (i.e. banded carbonaceous mudstone and coal).

2.3 Determination of Calorific Value:-

Representative samples of the natural mudstone and anthracitic coal deposits encountered within TT01 were tested to determine their calorific values, which are used to assess their potential for combustibilty. The results obtained are included in the Chemtech Environmental Analytical Test Report No. ARC/42468, a copy of which is enclosed.

The results of the tests undertaken on the sample of mudstone tested from TT01 revealed a calorific value of 103kJ/kg and as such do not represent a risk from combustability.

However, the sample of anthracitic coal tested from TT01 (at a depth of between c.6.00m to c.6.20m bcgl) revealed a calorific value of 25713kJ/kg, and as such represents a high risk of combustability, in accordance with ICRCL 61/84 'Notes on the fire hazards of contaminated land'.

From these results it can be seen that whilst mudstone solid deposits identified within the trial trenches do not represent a potential risk, potentially combustible materials are present at depth below the site, primarily associated with the recorded bands of anthracitic coal.

In accordance with ICRCL 61/84 potentially combustable materials should be overlain by a minimum c.>1m thickness of non-combustible material, in order to isolate these materials from potential ignition at the surface.

In addition, due to the nature of the identified coal deposits, combined with the overall combustability potential, it is also recommended that proposed foundations be either based a minimum of c.1m above the identified combustable materials or sunk down through these deposits, thereby negating any potential risk.

3.0 Conclusions and Recommendations:

When considering the proposed retaining structures, the Retaining Wall Adjacent Highway plan provided by Robinson Consulting Engineers, indicates that the proposed sections are to be based at depths of c.61.50m (Section 1-1, corresponding to TT03), c.62.00m (Section 2-2, corresponding to TT02) and c.62.50m AOD (Section 3-3, corresponding to TT01).

RE: Land off Caledonian Road, Savile Town, Dewsbury (Cont'd)

3.0 Conclusions and Recommendations (Cont'd):

From the findings of the intrusive works, this would result in the formation levels of the proposed retaining structures being based within wholly within mudstone solid deposits at the locations of Section 1-1 (TT03) and Section 2-2 (TT02), where a maximum allowable bearing pressure of 200kN/m² is available at the location of Section 1-1 and 300kN/m² at the location of Section 2-2.

However, at the location Section 3-3 (TT01) the proposed formation level (c.62.50m AOD) would result in footings being based within close proximity to the identified coal deposits at this location (i.e. to within c.0.35m), which were recorded at a depth of c.62.14m AOD, thereby potentially increasing the risk from combustability.

In order to negate against any potential risk it is recommended that the formation level for this section of the proposed retaining wall be extended down through the identified coal deposits, and based wholly within the underlying carbonaceous mudstone deposits, recorded at a depth of c.61.50m AOD, where a maximum allowable bearing pressure of 300kN/m² is available.

For retaining wall design purposes the critical internal angle of friction ($ø'_{crit}$) is typically 28 degrees for weak mudstone, however in this instance it is recommended that a conservative critical internal angle of friction ($ø'_{crit}$) of 27 degrees be utilised, to account for the weathered nature of the deposits encountered (decomposed to clay sized fragments) and the results of the Plasticity Indices. For the initial sand residual soil deposits a critical internal angle of friction ($ø'_{crit}$) value of 32 degrees can be adopted.

I trust the attached information is to your satisfaction. If you require any further information or clarification, please do not hesitate to contact me.

Yours Sincerely

NWatson

……

For and on behalf of Arc Environmental Ltd
Nicola Watson
Geotechnical Engineer

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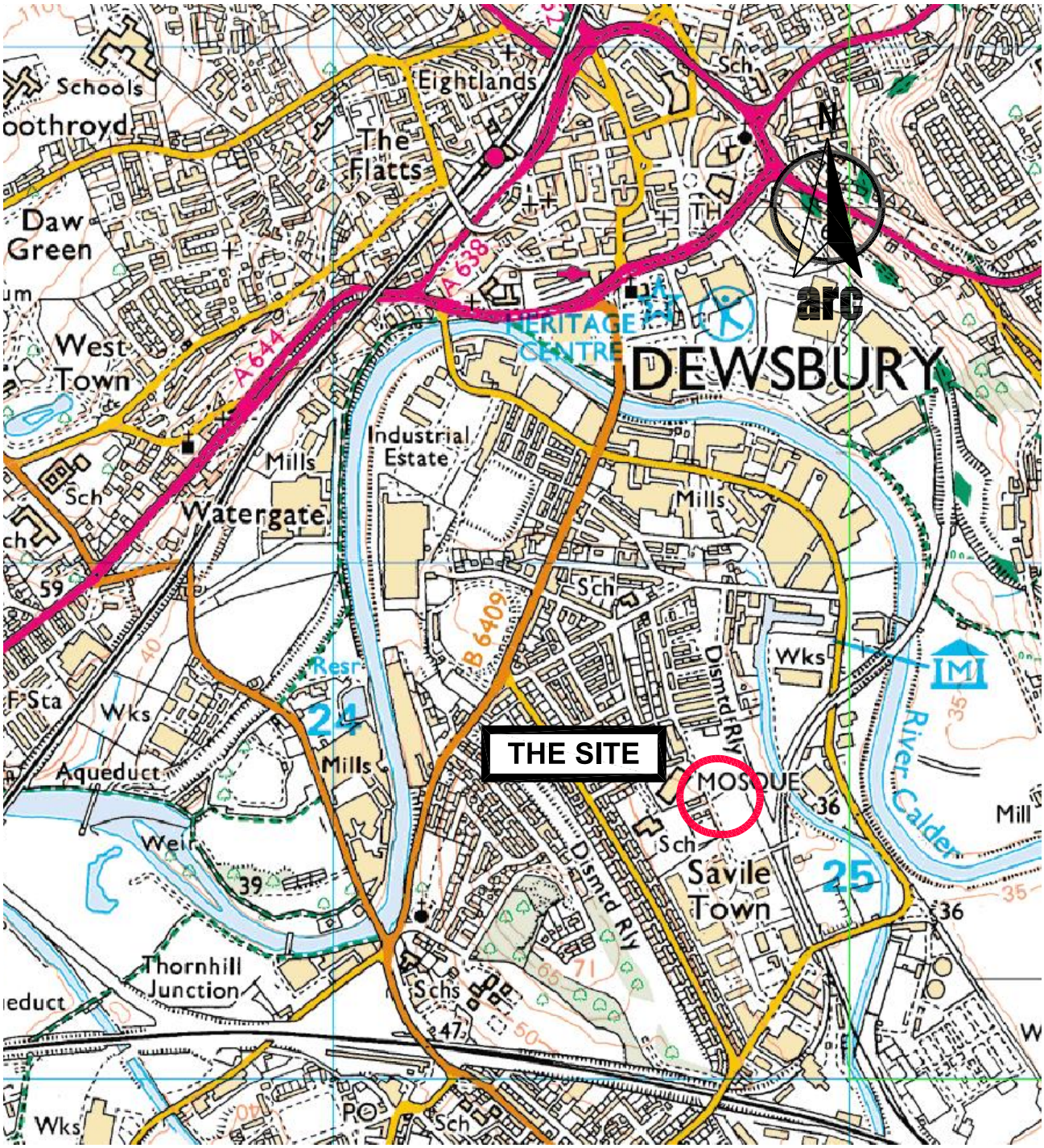

Client:

Savile Developments Ltd

Project Title:	Drawing Title:
Proposed Residential Development The Sidings Savile Road, Dewsbury	Location Plan

rev.	date	amendments	drawn	chckd

Job Reference:	Drawing Number:	Revision:
11-183	-	-

Drawn by:	Date:	Scale at A4:
NJW	02.06.11	NTS @ A4

Checked by:	Approved by:	
~	~	The contractor shall check all dimensions on site before commencement of any works. No dimensions to be scaled off this drawing.

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LEGEND	
———	INVESTIGATION AREA

rev.	date	amendments	drawn	chckd

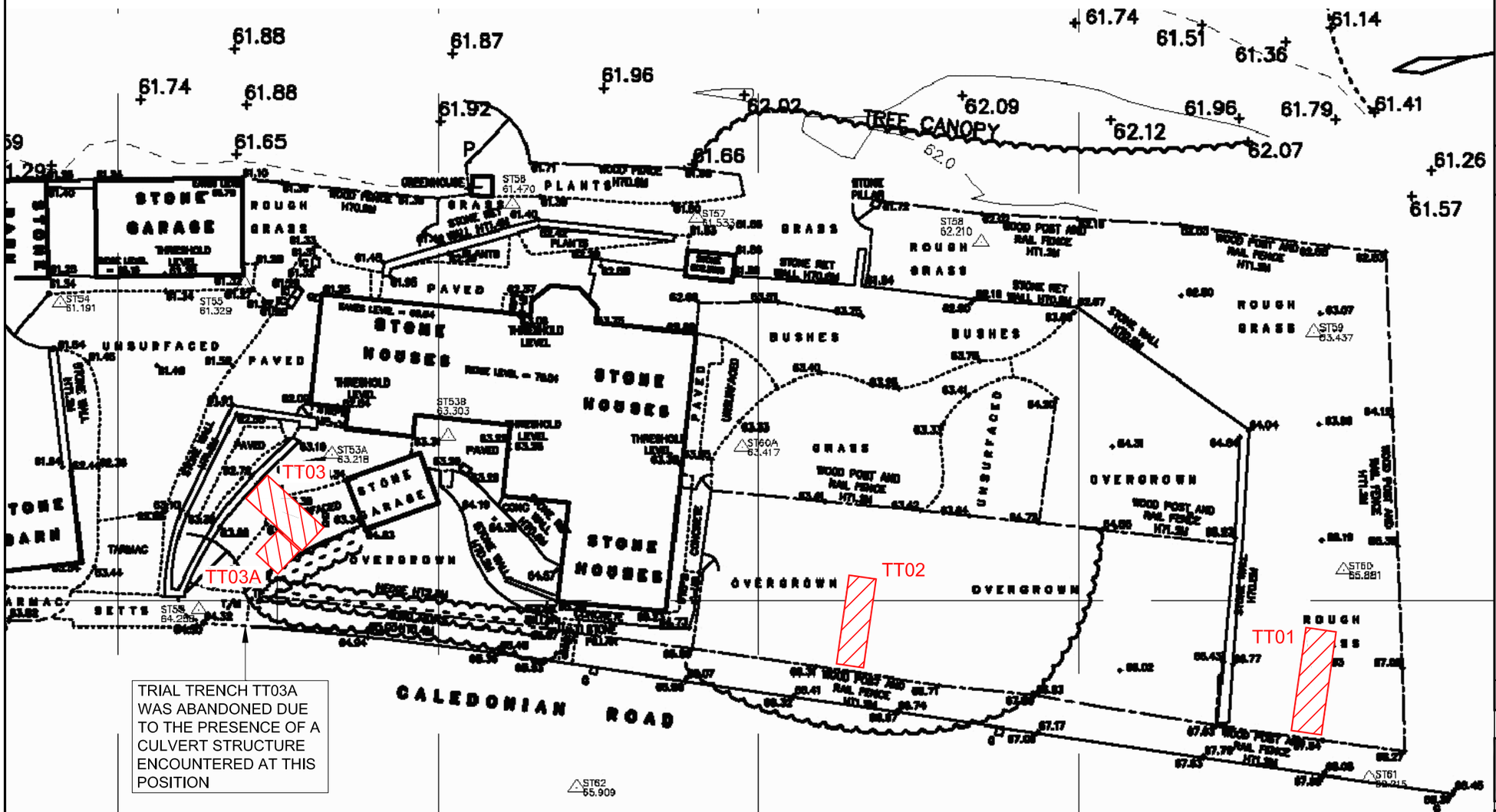
Client:
Savile Developments

Project Title:
Proposed Residential Development
The Sidings
Savile Road, Dewsbury

Drawing Title:
Aerial Photograph

Scale at A3:	Date:	Drawn by:	Approved by:
NTS @ A3	02.06.11	NJW	~

Job Ref:	Drg no:	Rev:
11-183	-	-



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LEGEND

	APPROXIMATE TRIAL TRENCH POSITION

rev.	date	amendments	drawn	chckd

Client:
SAVILE DEVELOPMENTS

Project Title:
Proposed Residential Development
The Sidings
Savile Road, Dewsbury

Drawing Title:
Trial Trench Location Plan

Scale at A3:	Date:	Drawn by:	Approved by:
As Shown	17.05.11	P.D	N.J.W

Job Ref:	Drg no:	Rev:
11-183	-	-

TRIAL TRENCH CROSS SECTION (TT01)

GROUND PROFILE

NOTE: DEPTHS RECORDED IN THE BELOW GROUND PROFILE WERE RECORDED VERTICALLY DOWN THE SOUTHERN FACE OF THE TRENCH EXCAVATION

STRATA 1	DEPTH m (BGL)	STRATA DESCRIPTION
	0.0-0.15	Unmanaged vegetation over topsoil with many roots (TOPSOIL).

STRATA 2	DEPTH m (BGL)	STRATA DESCRIPTION
	0.15-1.6	Brown slightly clayey gravelly fine to medium SAND, with many sandstone cobbles and boulders. Gravel consists of sandstone (RESIDUAL SOIL).

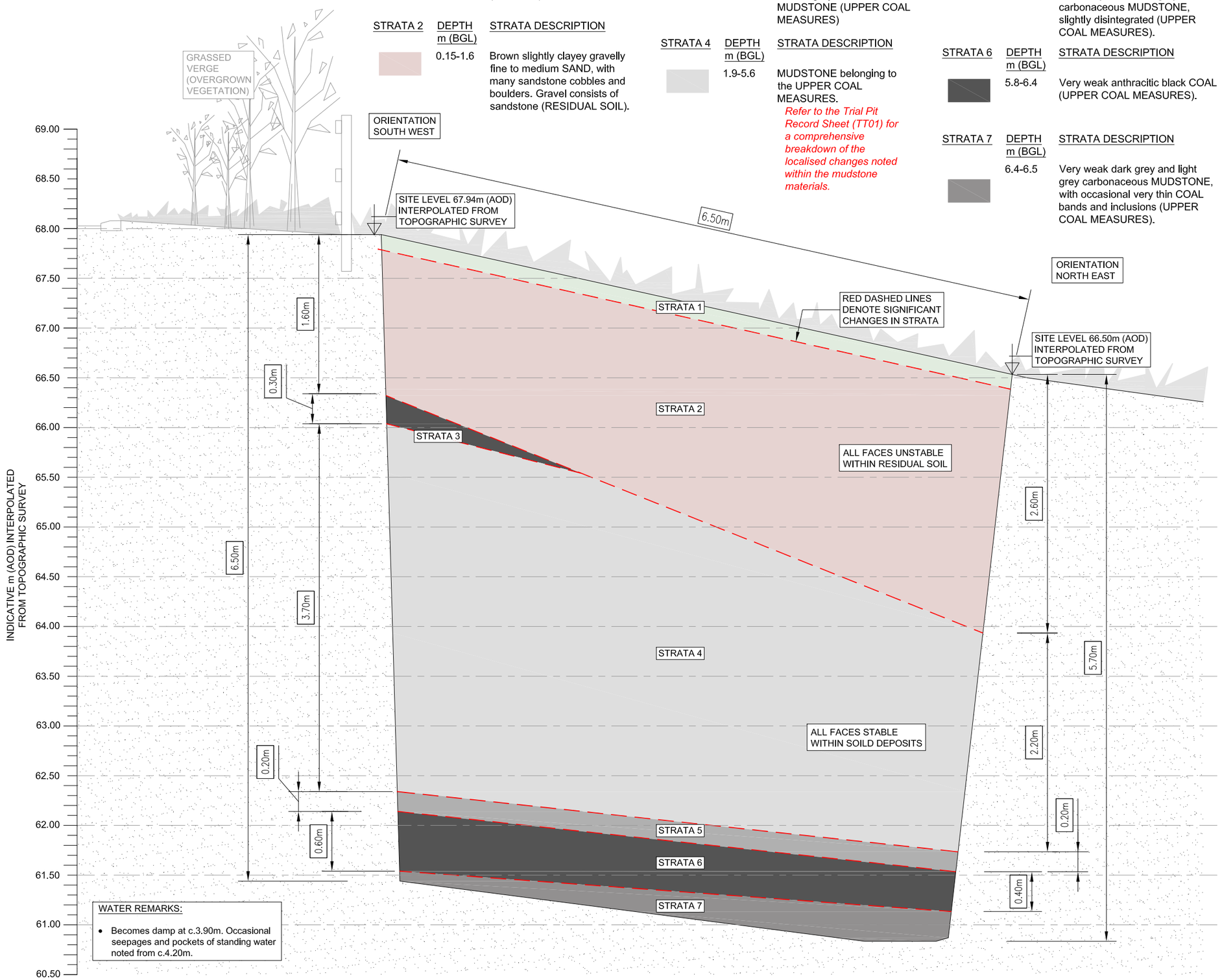
STRATA 3	DEPTH m (BGL)	STRATA DESCRIPTION
	1.6-1.9	Very weak black weathered COAL, with very thin bands of dark grey carbonaceous MUDSTONE (UPPER COAL MEASURES)

STRATA 4	DEPTH m (BGL)	STRATA DESCRIPTION
	1.9-5.6	MUDSTONE belonging to the UPPER COAL MEASURES. *Refer to the Trial Pit Record Sheet (TT01) for a comprehensive breakdown of the localised changes noted within the mudstone materials.*

STRATA 5	DEPTH m (BGL)	STRATA DESCRIPTION
	5.6-5.8	Extremely weak weathered black COAL, thinly interbedded with extremely weak dark grey carbonaceous MUDSTONE, slightly disintegrated (UPPER COAL MEASURES).

STRATA 6	DEPTH m (BGL)	STRATA DESCRIPTION
	5.8-6.4	Very weak anthracitic black COAL (UPPER COAL MEASURES).

STRATA 7	DEPTH m (BGL)	STRATA DESCRIPTION
	6.4-6.5	Very weak dark grey and light grey carbonaceous MUDSTONE, with occasional very thin COAL bands and inclusions (UPPER COAL MEASURES).



WATER REMARKS:

- Becomes damp at c.3.90m. Occasional seepages and pockets of standing water noted from c.4.20m.

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NOTES:

1. SEE DRAWING '*11-183-TRIAL TRENCH CROSS SECTION (TT01) - SHEET 2*' FOR A PHOTOGRAPHIC RECORD OF THE TRIAL TRENCH EXCAVATION

rev.	date	amendments	drawn	chckd

Client:
SAVILE DEVELOPMENTS

Project Title:
Proposed Residential Development
The Sidings
Savile Road, Dewsbury

Drawing Title:
Trial Trench Cross Section (TT01) - Sheet 1

Scale at A3:	Date:	Drawn by:	Approved by:
As Shown	17.05.11	P.D	N.J.W

Job Ref:	Drg no:	Rev:
11-183	-	-

PLATE 1

PLATE 2

PLATE 3

PLATE 4

PLATE 5

PLATE 6

PLATE 7

PLATE 8

PLATE 9

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rev.	date	amendments	drawn	chckd

Client:
SAVILE DEVELOPMENTS

Project Title:
Proposed Residential Development
The Sidings
Savile Road, Dewsbury

Drawing Title:
Trial Trench Cross Section (TT01) - Sheet 2

Scale at A3:	Date:	Drawn by:	Approved by:
N/A	17.05.11	P.D	N.J.W

Job Ref:	Drg no:	Rev:
11-183	-	-

TRIAL TRENCH CROSS SECTION (TT02)

GROUND PROFILE

NOTE: DEPTHS REOCORDED IN THE BELOW GROUND PROFILE KEY WERE RECORDED VERTICALLY DOWN THE SOUTHERN FACE OF THE TRENCH EXCAVATION

STRATA 1	DEPTH m (BGL)	STRATA DESCRIPTION
	0.0-0.4	Unmanaged vegetation over conglomerated mudstone pockets, many roots and occasional plastic fragments (TOPSOIL).

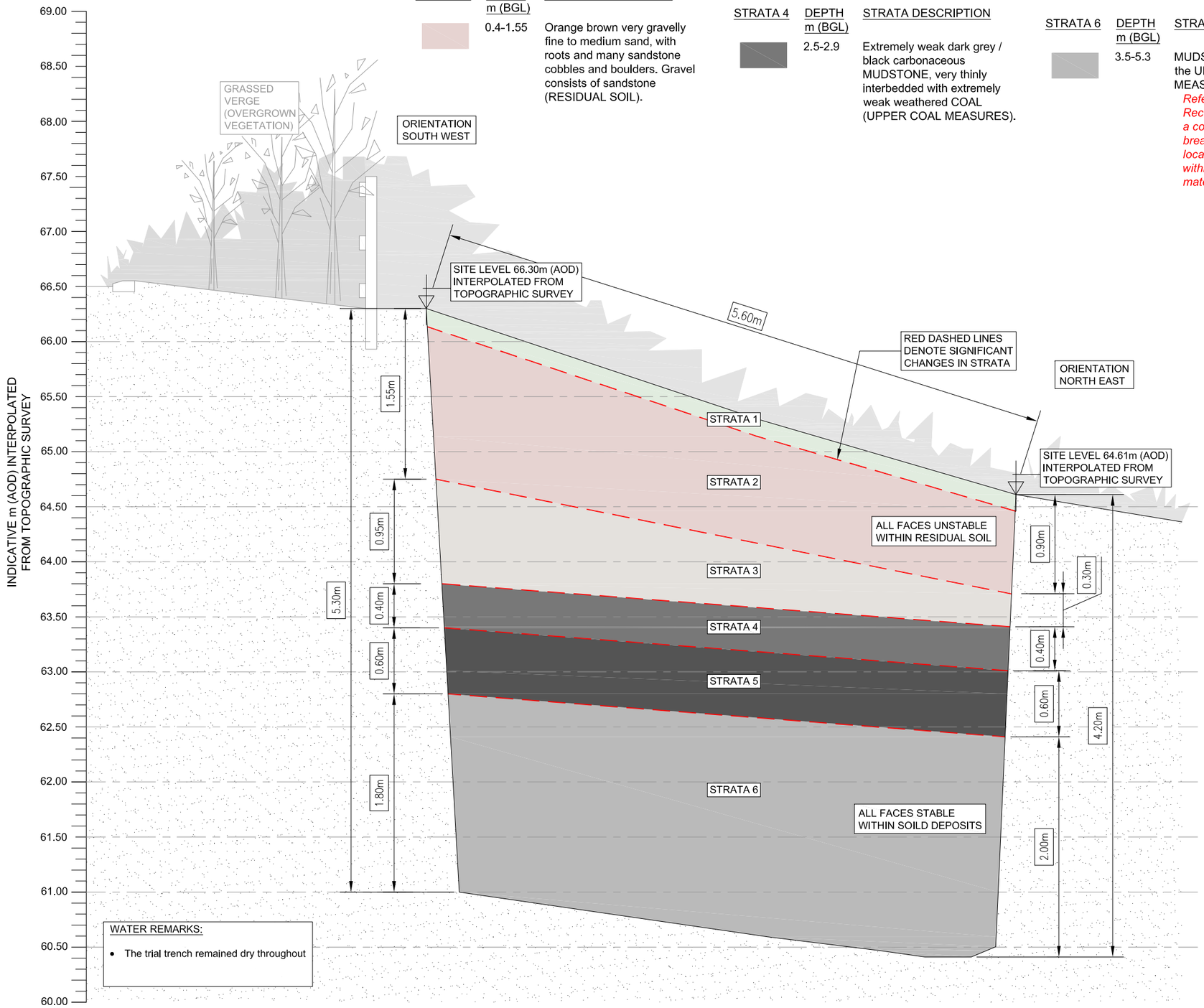
STRATA 2	DEPTH m (BGL)	STRATA DESCRIPTION
	0.4-1.55	Orange brown very gravelly fine to medium sand, with roots and many sandstone cobbles and boulders. Gravel consists of sandstone (RESIDUAL SOIL).

STRATA 3	DEPTH m (BGL)	STRATA DESCRIPTION
	1.55-2.5	Extremely weak light grey and orange silty MUDSTONE, disintegrated (UPPER COAL MEASURES).

STRATA 4	DEPTH m (BGL)	STRATA DESCRIPTION
	2.5-2.9	Extremely weak dark grey / black carbonaceous MUDSTONE, very thinly interbedded with extremely weak weathered COAL (UPPER COAL MEASURES).

STRATA 5	DEPTH m (BGL)	STRATA DESCRIPTION
	2.9-3.5	Very weak anthracitic black COAL, with occasional very thin black carbonaceous MUDSTONE bands (UPPER COAL MEASURES).

STRATA 6	DEPTH m (BGL)	STRATA DESCRIPTION
	3.5-5.3	MUDSTONE belonging to the UPPER COAL MEASURES. *Refer to the Trial Pit Record Sheet (TT02) for a comprehensive breakdown of the localised changes noted within the mudstone materials.*



WATER REMARKS:

- The trial trench remained dry throughout

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NOTES:

1. SEE DRAWING '*11-183-TRIAL TRENCH CROSS SECTION (TT02) - SHEET 2*' FOR A PHOTOGRAPHIC RECORD OF THE TRIAL TRENCH EXCAVATION

rev.	date	amendments	drawn	chckd

Client: SAVILE DEVELOPMENTS

Project Title:
Proposed Residential Development
The Sidings
Savile Road, Dewsbury

Drawing Title:
Trial Trench Cross Section (TT02) - Sheet 1

Scale at A3:	Date:	Drawn by:	Approved by:
As Shown	17.05.11	P.D	N.J.W

Job Ref:	Drg no:	Rev:
11-183	-	-

PLATE 1

PLATE 2

PLATE 3

PLATE 4

PLATE 5

PLATE 6

PLATE 7

PLATE 8

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web: www.arc-environmental.com

rev.	date	amendments	drawn	chckd

Client:
SAVILE DEVELOPMENTS

Project Title:
Proposed Residential Development
The Sidings
Savile Road, Dewsbury

Drawing Title:
Trial Trench Cross Section (TT02) - Sheet 2

Scale at A3:	Date:	Drawn by:	Approved by:
N/A	17.05.11	P.D	N.J.W

Job Ref:	Drg no:	Rev:
11-183	-	-

GROUND PROFILE NOTE: DEPTHS RECORDED IN THE BELOW GROUND PROFILE WERE RECORDED VERTICALLY DOWN THE SOUTH WESTERN FACE OF THE TRENCH EXCAVATION

STRATA 1	DEPTH m (BGL)	STRATA DESCRIPTION
	0.0-0.3	Concrete with underlying gravel sub-base (former access road) and crushed concrete, dolomite and brick surfacing (MADE GROUND).

STRATA 2	DEPTH m (BGL)	STRATA DESCRIPTION
	0.3-0.5	Dark grey / black carbonaceous mudstone gravel (MADE GROUND).

STRATA 3	DEPTH m (BGL)	STRATA DESCRIPTION
	0.5-1.1	Disturbed yellow brown gravelly sand, with sandstone cobbles and boulders, intermixed with light grey and orange mudstone (MADE GROUND). Disused drain encountered at 1.10m.

STRATA 4	DEPTH m (BGL)	STRATA DESCRIPTION
	1.1-1.5	Brown slightly clayey gravelly fine to medium SAND, with many sandstone cobbles and boulders. Gravel consists of sandstone (RESIDUAL SOIL).

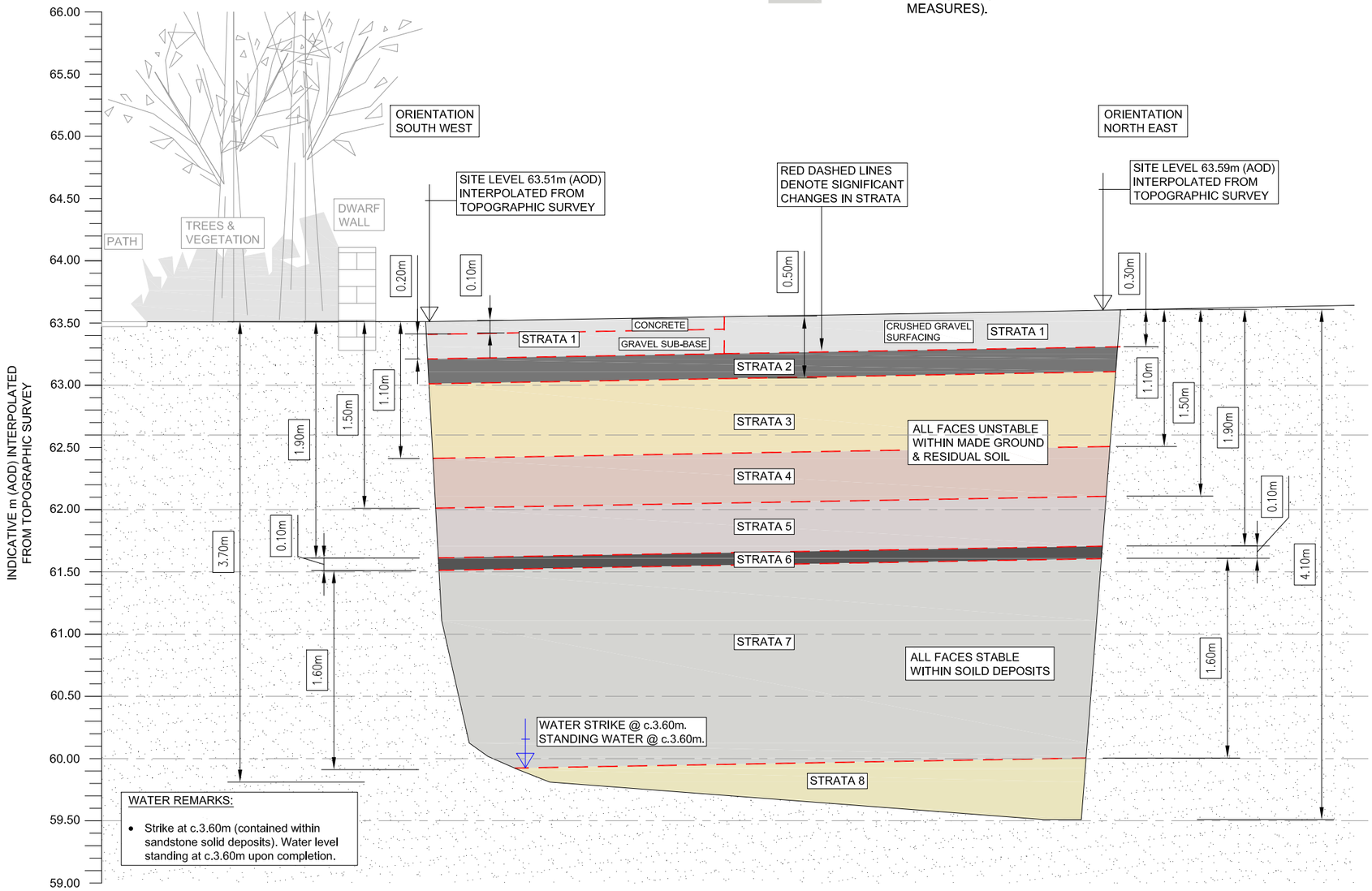
STRATA 5	DEPTH m (BGL)	STRATA DESCRIPTION
	1.5-1.9	Extremely weak light grey and orange slightly disintegrated MUDSTONE (UPPER COAL MEASURES).

STRATA 6	DEPTH m (BGL)	STRATA DESCRIPTION
	1.9-2.0	Extremely weak dark grey / black carbonaceous MUDSTONE, very thinly interbedded with extremely weak weathered COAL (UPPER COAL MEASURES).

STRATA 7	DEPTH m (BGL)	STRATA DESCRIPTION
	2.0-3.6	Extremely weak light yellow and grey MUDSTONE, slightly disintegrated (UPPER COAL MEASURES).

STRATA 8	DEPTH m (BGL)	STRATA DESCRIPTION
	3.6-4.1	Medium strong bedded light yellow micaceous fine to medium SANDSTONE, with orange brown (iron) staining on bedding and fracture surfaces (excavated in tabular blocks) (UPPER COAL MEASURES).

TRIAL TRENCH CROSS SECTION (TT03)



WATER REMARKS:

- Strike at c.3.60m (contained within sandstone solid deposits). Water level standing at c.3.60m upon completion.

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NOTES:

1. SEE DRAWING '*11-183-TRIAL TRENCH CROSS SECTION (TT03) - SHEET 2*' FOR A PHOTOGRAPHIC RECORD OF THE TRIAL TRENCH EXCAVATION

rev.	date	amendments	drawn	chckd

Client:
SAVILE DEVELOPMENTS

Project Title:
Proposed Residential Development
The Sidings
Savile Road, Dewsbury

Drawing Title:
Trial Trench Cross Section (TT03) - Sheet 1

Scale at A3:	Date:	Drawn by:	Approved by:
As Shown	17.05.11	P.D	N.J.W

Job Ref:	Drg no:	Rev:
11-183	-	-


PLATE 1


PLATE 2


PLATE 3


PLATE 4


PLATE 5


PLATE 6


PLATE 7


PLATE 8

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rev.	date	amendments	drawn	chckd

Client:
SAVILE DEVELOPMENTS

Project Title:
Proposed Residential Development
The Sidings
Savile Road, Dewsbury

Drawing Title:
Trial Trench Cross Section (TT03) - Sheet 2

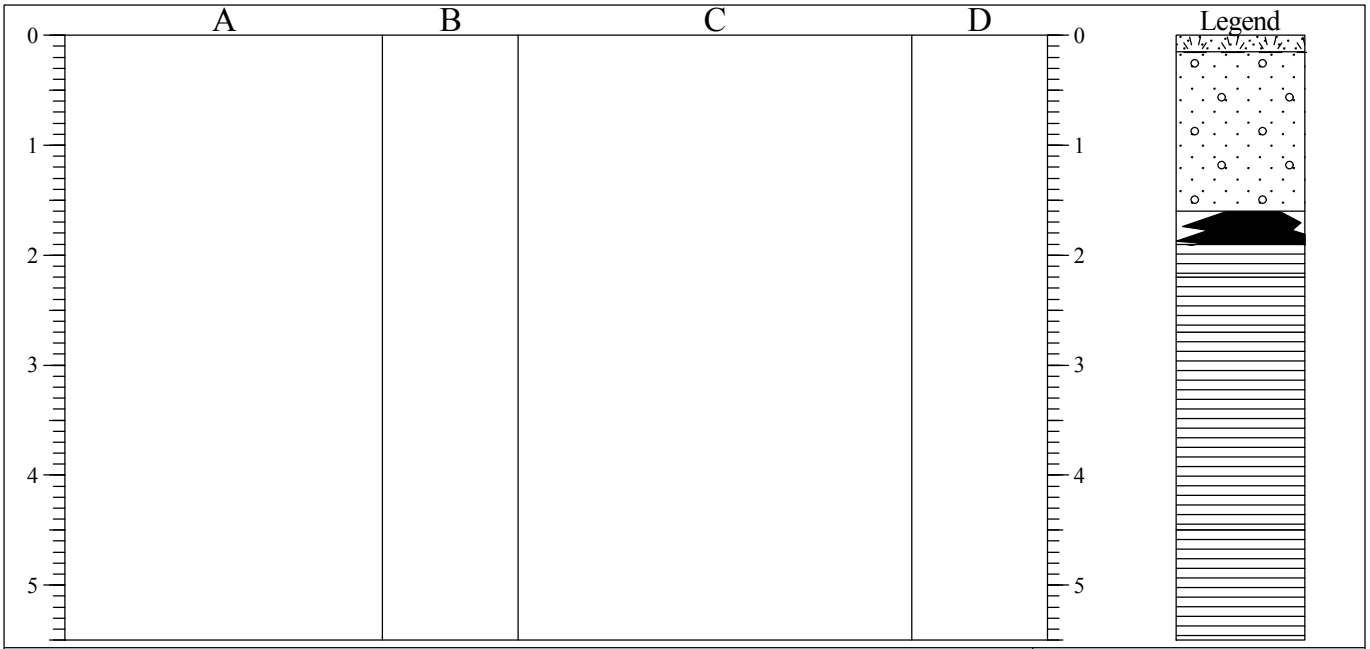
Scale at A3:	Date:	Drawn by:	Approved by:
N/A	17.05.11	P.D	N.J.W

Job Ref:	Drg no:	Rev:
11-183	-	-

Arc Environmental Limited
The Rivergreen Centre
Aykley Heads
Durham
DH1 5TS

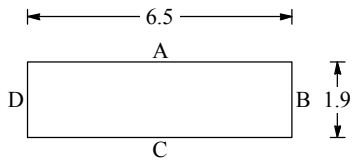
TRIAL PIT LOG

Project				TRIAL PIT No
Land adjacent to Caledonian Road, Savile Town, Dewsbury				TT01
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	05-05-11	67.94		
Contractor				Sheet
Arc Environmental Limited				1 of 2



STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-0.15		Unmanaged vegetation over TOPSOIL, with many roots (TOPSOIL).			
0.15-1.60		Brown slightly clayey gravelly fine to medium SAND, with many sandstone cobbles and boulders. Gravel consists of sandstone (RESIDUAL SOIL).	0.40-0.80	B1	
1.60-1.90		Very weak black weathered COAL, with very thin bands of dark grey carbonaceous MUDSTONE (UPPER COAL MEASURES).	1.70-1.90	B2	
1.90-2.20		Extremely weak light grey silty MUDSTONE, slightly disintegrated (UPPER COAL MEASURES).	1.90-2.20	B3	
2.20-2.70		Extremely weak light grey silty MUDSTONE, very thinly interbedded with very weak black COAL and extremely weak dark grey carbonaceous MUDSTONE (UPPER COAL MEASURES).	2.40-2.60	B4	
2.70-4.50			3.00-3.30	B5	
3.20		Extremely weak light brown MUDSTONE, discoloured and slightly disintegrated (recovered as sandy gravel sized fragments) (UPPER COAL MEASURES). from c.3.20m..becomes very weak.	3.50-3.70	B6	
4.50-5.60		Very weak thinly bedded grey discoloured MUDSTONE, with orange brown (iron) staining on fracture and bedding surfaces (UPPER COAL MEASURES).	4.60-4.80	B7	
4.80		from c.4.80m..becomes thinly interbedded with very weak dark grey carbonaceous MUDSTONE.	5.00-5.20	B8	

Shoring/Support: None
Stability: All faces unstable in residual soil. Stable in solid deposits.



GENERAL REMARKS

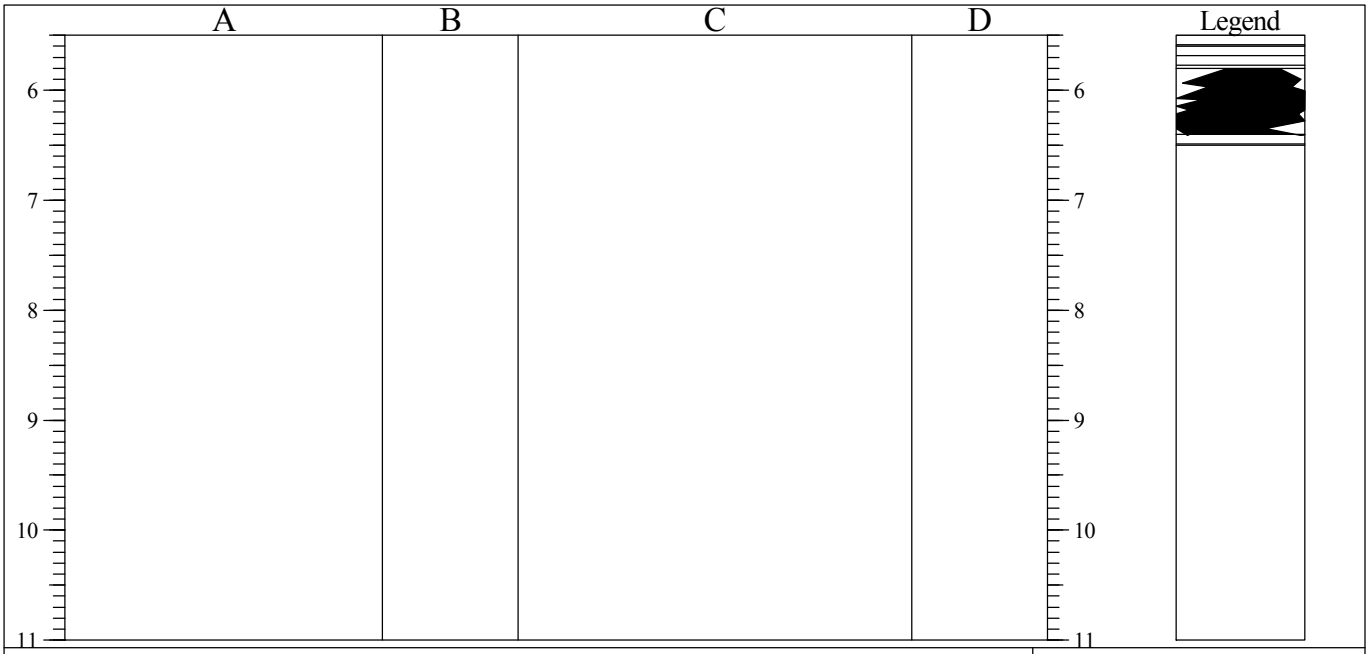
WATER: Becomes damp at 3.90m. Occasional seepages and pockets of standing water noted from c.4.20m.
ORIENTATION: NE-SW.

All dimensions in metres Scale 1:68.75	Client Savile Developments Ltd	Method/ Plant Used CAT 320	Logged By NJW

Arc Environmental Limited
The Rivergreen Centre
Aykley Heads
Durham
DH1 5TS

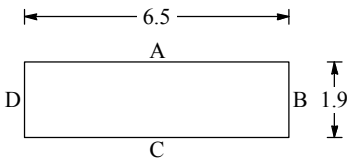
TRIAL PIT LOG

Project				TRIAL PIT No
Land adjacent to Caledonian Road, Savile Town, Dewsbury				TT01
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	05-05-11	67.94		
Contractor				Sheet
Arc Environmental Limited				2 of 2



STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
5.60-5.80		Extremely weak weathered black COAL, thinly interbedded with extremely weak dark grey	5.60-5.80	B9	
5.80-6.40		carbonaceous MUDSTONE, slightly disintegrated (UPPER COAL MEASURES).			
		Very weak anthracitic black COAL (UPPER COAL MEASURES).	6.00-6.20	B10	
6.40-6.50		Very weak dark grey and light grey carbonaceous MUDSTONE, with occasional very thin	6.40-6.50	B11	
6.50		COAL bands and inclusions (UPPER COAL MEASURES).			
		Trial trench complete at 6.50m.			

Shoring/Support: None
Stability: All faces unstable in residual soil. Stable in solid deposits.



GENERAL REMARKS

WATER: Becomes damp at 3.90m. Occasional seepages and pockets of standing water noted from c.4.20m.
ORIENTATION: NE-SW.

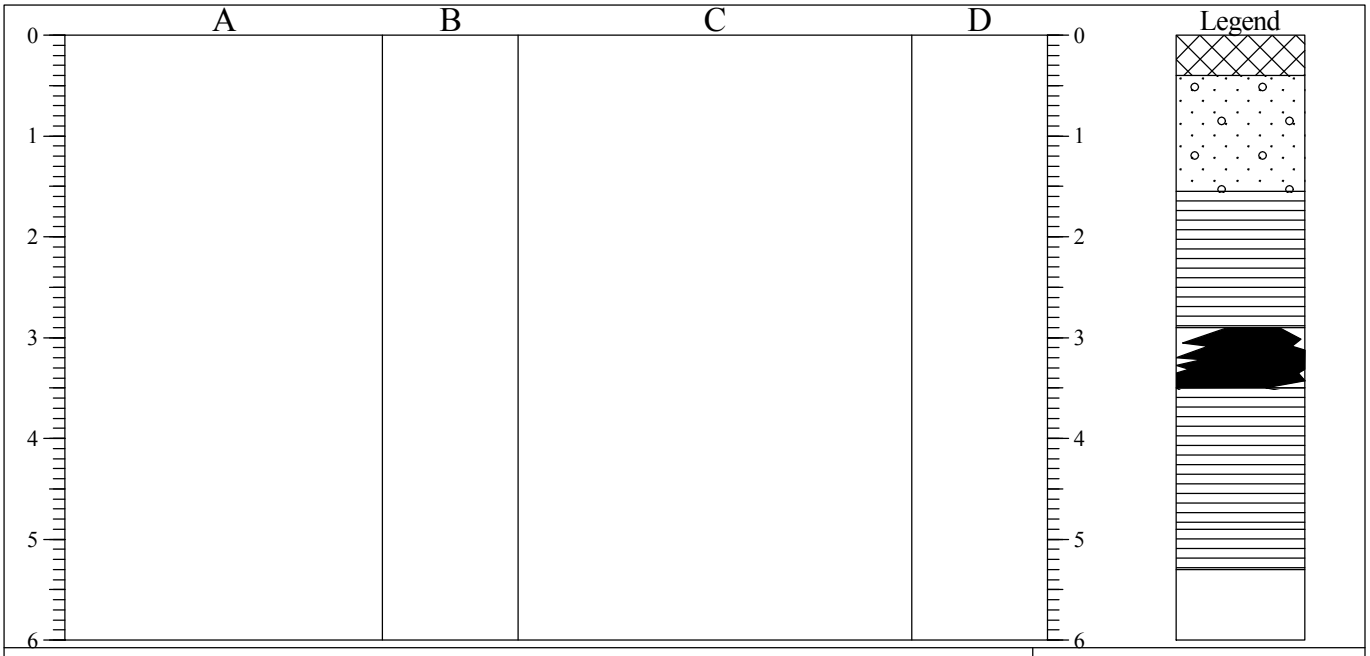
All dimensions in metres Scale 1:68.75	Client Savile Developments Ltd	Method/ Plant Used CAT 320	Logged By NJW

AGS3 UK TP 11-183 TP LOGS.GPJ AGS3_ALL.GDT 2/6/11

Arc Environmental Limited
The Rivergreen Centre
Aykley Heads
Durham
DH1 5TS

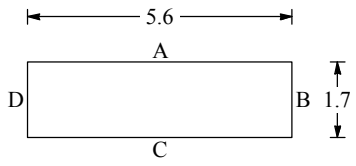
TRIAL PIT LOG

Project				TRIAL PIT No
Land adjacent to Caledonian Road, Savile Town, Dewsbury				**TT02**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	05-05-11	66.31		
Contractor				Sheet
Arc Environmental Limited				1 of 1



STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-0.40		Unmanaged vegetation over topsoil, with conglomerated mudstone pockets, many roots and occasional plastic fragments (MADE GROUND).	0.10-0.30	B1	
0.40-1.55		Orange brown very gravelly fine to medium SAND, with roots and many sandstone cobbles and boulders. Gravel consists of sandstone (RESIDUAL SOIL).	0.80-1.20	B2	
1.55-2.50		Extremely weak light grey and orange silty MUDSTONE, disintegrated (UPPER COAL MEASURES).	1.60-1.80	B3	
2.50-2.90		Extremely weak dark grey / black carbonaceous MUDSTONE, very thinly interbedded with extremely weak weathered COAL (UPPER COAL MEASURES).	2.60-2.80	B4	
2.90-3.50		Very weak anthracitic black COAL, with occasional very thin black carbonaceous MUDSTONE bands (UPPER COAL MEASURES).	3.00-3.30	B5	
3.50-4.90 3.70 4.20		Extremely weak light grey and orange slightly disintegrated MUDSTONE, with occasional thin very weak dark grey carbonaceous MUDSTONE bands (recovered as gravel sized fragments) (UPPER COAL MEASURES). from c.3.70m..no carbonaceous MUDSTONE bands. from c.4.20m..becomes weak and increasingly difficult to excavate using CAT 320.	3.60-3.90	B6	
4.90-5.30		Very weak thinly bedded light grey discoloured MUDSTONE, with orange brown (iron) staining on bedding surfaces (UPPER COAL MEASURES)	5.00-5.30	B7	
5.30		Trial trench complete at 5.30m.			

Shoring/Support: None
Stability: All faces unstable in made ground and residual soil. Stable in solid deposits.



GENERAL REMARKS

WATER: Trial trench remained DRY throughout.
ORIENTATION: NE-SW.

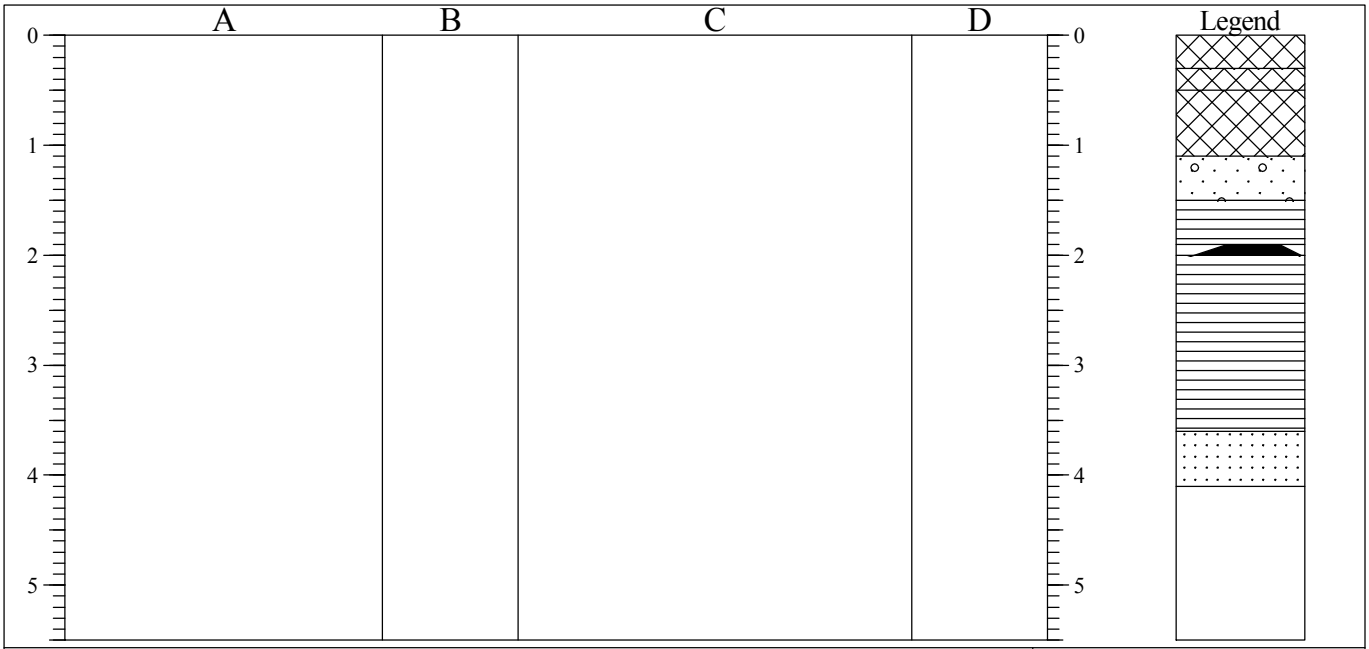
All dimensions in metres Scale 1:75	Client Savile Developments Ltd	Method/ Plant Used CAT 320	Logged By NJW

AGS3 UK TP 11-183 TP LOGS.GPJ AGS3_ALL.GDT 2/6/11

Arc Environmental Limited
The Rivergreen Centre
Aykley Heads
Durham
DH1 5TS

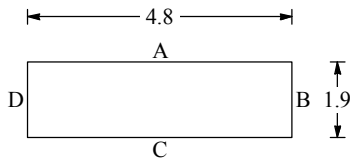
TRIAL PIT LOG

Project				TRIAL PIT No
Land adjacent to Caledonian Road, Savile Town, Dewsbury				TT03
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	05-05-11	63.59		
Contractor				Sheet
Arc Environmental Limited				1 of 1



STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-0.30		Concrete with underlying gravel sub-base (former access road) and crushed concrete, dolomite and brick surfacing (MADE GROUND).			
0.30-0.50		Dark grey / black carbonaceous mudstone gravel (MADE GROUND).	0.30-0.50	B1	
0.50-1.10		Disturbed yellow brown gravelly sand, with sandstone cobbles and boulders, intermixed with light grey and orange mudstone (MADE GROUND). Disused drain encountered at 1.10m.	0.60-0.80	B2	
1.10-1.50		Brown slightly clayey gravelly fine to medium SAND, with many sandstone cobbles and boulders. Gravel consists of sandstone (RESIDUAL SOIL).	1.20-1.40	B3	
1.50-1.90		Extremely weak light grey and orange slightly disintegrated MUDSTONE (UPPER COAL MEASURES).	1.60-1.80	B4	
1.90-2.00		Extremely weak dark grey / black carbonaceous MUDSTONE, very thinly interbedded with extremely weak weathered COAL (UPPER COAL MEASURES).	1.90-2.00	B5	
2.00-3.60		Extremely weak light yellow and grey MUDSTONE, slightly disintegrated (UPPER COAL MEASURES).	2.20-2.60	B6	
3.60-4.10		Medium strong bedded light yellow micaceous fine to medium SANDSTONE, with orange brown (iron) staining on bedding and fracture surfaces (excavated in tabular blocks) (UPPER COAL MEASURES).	3.80-4.10	B7	
4.10		Trial pit complete at 4.10m.			

Shoring/Support: None
Stability: All faces unstable in made ground and residual soil. Stable in solid deposits.



GENERAL REMARKS

WATER: Strike at 3.60m (contained within sandstone solid deposits). Water level standing at 3.60m upon completion.
ORIENTATION: NE-SW.

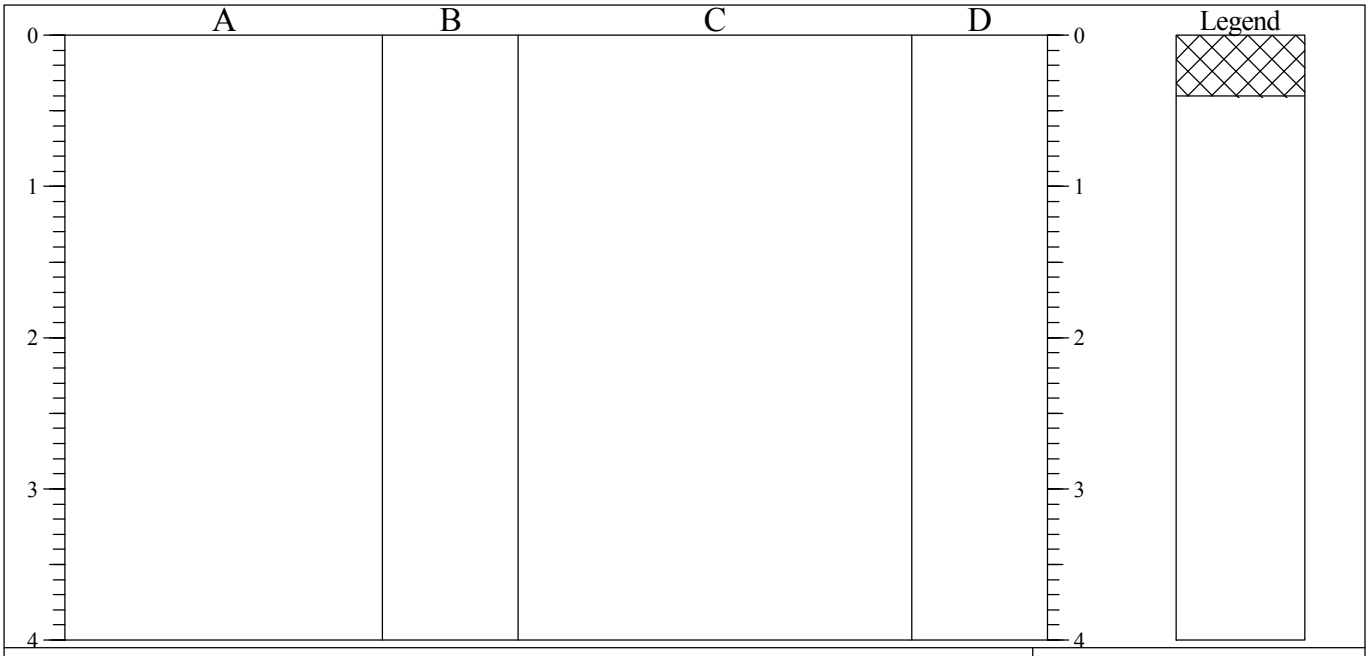
All dimensions in metres Scale 1:68.75	Client Savile Developments Ltd	Method/ Plant Used CAT 320	Logged By NJW

AGS3 UK TP 11-183 TP LOGS.GPJ AGS3_ALL.GDT 2/6/11

Arc Environmental Limited
The Rivergreen Centre
Aykley Heads
Durham
DH1 5TS

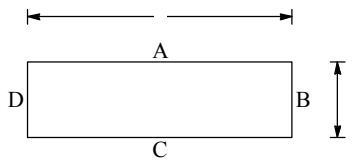
TRIAL PIT LOG

Project				TRIAL PIT No
Land adjacent to Caledonian Road, Savile Town, Dewsbury				**TT03A**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	05-05-11	63.59		
Contractor				Sheet
Arc Environmental Limited				1 of 1



STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-0.40		Concrete with underlying gravel sub-base (former access road) and crushed concrete, dolomite and brick surfacing (MADE GROUND).	0.10-0.30	B1	
0.40		Trial trench terminated at 0.40m as uncovered service culvert within western face of trench (cast iron pipe visible at base of culvert) - noted to trend E-W below the existing yard area and also extend below adjacent Caledonian Road. To avoid potential damage trial trench location moved c.1m south - see TT03A for further detail.			

Shoring/Support: None
Stability: All faces unstable in made ground.



GENERAL REMARKS

ORIENTATION: NE-SW.

All dimensions in metres Scale 1:50	Client Savile Developments Ltd	Method/ Plant Used CAT 320	Logged By NJW

AGS3 UK TP 11-183 TP LOGS.GPJ AGS3_ALL.GDT 2/6/11

By Email & Post

Our ref: 11-183.04L

Michael Naughton
One 17 (Structural Design) Limited
The Dyehouse
Armitage Bridge, Huddersfield
HD4 7PD

Arc Environmental Ltd
Solum House
Unit 1 Elliott Court
St Johns Road
Meadowfield
Durham
DH7 8PN

22nd January 2013

Michael,

Re: Proposed Site Redevelopment, Land adjacent to Caledonian Road / The Sidings, Dewsbury

We have pleasure in providing you with our supplementary geotechnical ground investigation report, to allow you to move forward with the proposed Health Centre development. The information contained within this report should be read in conjunction with documents previously produced for this development site by Robinson Environmental Limited, Robinson Geo Engineering & Arc Environmental Limited.

1.0 Introduction:-

Arc Environmental Limited was commissioned by One 17 (Structural Design) Limited of Armitage Bridge, Huddersfield, West Yorkshire on behalf of their client Savile Developments Limited to undertake a program of supplementary geotechnical ground investigation works over a parcel of undeveloped land located adjacently south-east of The Sidings, and north-east of Caledonian Road located within the Savile Town area of Dewsbury, West Yorkshire. The supplementary geotechnical intrusive investigation works undertaken by Arc Environmental Limited comprised the sinking of 4 no. cable percussive boreholes, labelled CP's 1 – 4, accompanied by the sinking of 1 no. rotary cored borehole, labelled RBH3 which commenced at the basal depth of CP3. Cable percussive boreholes labelled CP1 & CP2 targeted the footprint of the proposed Health Centre development, whilst CP3 & CP4 targeted an infilled railway cutting which crosses the site which lies below proposed car parking bays and access road. All of the exploratory positions can be seen on the borehole location plan attached and this plan should be used for orientating purposes only, as the positions shown are approximate and the plan is not to a standard scale. The positions were marked out from a line of sight off The Sidings at locations determined by One 17 (Structural Design) Limited to target the above features and locations.

2.0 Ground Conditions:-

For an accurate description of the ground conditions encountered at the borehole locations created by Arc Environmental Limited, reference should be made to the borehole record sheets attached. It should be noted that there is always the possibility of variation in the ground conditions around and between the borehole locations. A summary of the soil and groundwater profile for the borehole locations can be seen in Table 1 on the following page.

Re: Proposed Site Redevelopment, Land adjacent to Caledonian Road / The Sidings, Dewsbury (Cont'd)

2.0 Ground Conditions (Cont'd):-

Attendance on site to undertake the cable percussive boreholes occurred on the 18th September 2012. However, due to the sites sloping topography, coupled with the presence of large stockpiles and soft / wet surface conditions a JCB type excavator had to be employed to manoeuvre the drilling equipment to each borehole location. As a result of these difficult conditions the cable percussive drilling works were did not commence until the 19th September 2012. Rotary coring was undertaken at the location of CP3 on the 25th September 2012. Site photographs were taken during our initial visit and these can be seen attached.

Table 1

Type of strata	Depths recorded	Description
MADE GROUND: (Variable)	From 0.00m up to c.1.45m to c.9.70m	Made ground was recorded at all four cable percussive borehole locations and comprised a mixture of dark brown disturbed clay and mudstone containing occasional fragments of brick through to sandstone and brick rubble. Occasional pieces of timber were noted within the upper levels at the location of CP3. CP1 & CP2 which were sunk on the northern extreme of the proposed building footprint recorded made ground to a maximum depth of c.2.10m (CP2). The made ground deposits extended to greater depths while trending towards the infilled railway cutting (within the proposed car parking bays and access road).
BEDROCK DEPOSITS: (Carboniferous Coal Measures)	From c.1.45m to c.9.70m up to c.5.40m to c.16.50m	Below the made ground deposits natural bedrock was recorded comprising mainly of MUDSTONE and SILTSTONE. A thin intact COAL seam (c.0.35m) was recorded towards the basal depth of CP3 at a depth of c.9.70m.

Rotary coring was undertaken from the base of CP3 in order to recover intact rock cores to allow for a more accurate assessment of the underlying geology. The borehole was extended to a maximum depth of c.16.50m.

2.0 Ground Conditions (Cont'd):-

Upon completion of the borehole, the recovered cores were subsequently logged to assess their engineering properties by an experienced Engineering Geologist, with values of Total Core Recovery (TCR), Solid Core Recovery (SCR) and Rock Quality designation (RQD) being calculated. These values are displayed numerically on the borehole record sheet for RBH3 and photographs of the recovered cores were also taken and these can be seen attached. The TCR values recorded within the boreholes varied from 67% up to 85%, whilst the SCR values varied from 19% up to 37%.

In order to obtain the RQD values for the cores recovered, the combined length of all solid core pieces which are greater than 100mm in length are determined and expressed as a percentage against the total length of core run. This gives an indication of the quality of a rock mass, with RQD values greater than 90% being regarded as generally very good, 75% to 90% as good, 50% to 75% as fair, 25% to 50% as poor, and less than 25% as very poor.

RQD values of between 7% up to 25% were recorded for the siltstone deposits encountered at RBH3, generally indicating very poor, bordering a poor rock mass with an overall average RQD value of 14% (poor) being calculated.

3.0 Groundwater:-

A slight ingress of water was recorded at the location of CP3 from a depth of c.2.20m, within sandstone rubble type deposits. The water ingress experienced at this location is likely to be a result of trapped surface water infiltration. The remaining boreholes were noted to be dry during the period of investigation.

Water ingresses may therefore occur within shallow construction related excavations, particularly where made ground deposits are penetrated and as a result it would be prudent to allow for the introduction of temporary groundwater control techniques (i.e. pumping equipment), in order to take care of any localised ingresses of groundwater which may occur during the construction period, especially during the wetter periods of the year.

4.0 Insitu Testing:-

4.1 Insitu Standard Penetration Tests (SPT):-

Standard penetration tests and cone penetration tests were carried out within the cable percussive boreholes with the use of either a normal split spoon sampler, or a 60^{o} solid cone in order to determine the relative strength and density of the variable deposits encountered. The results are shown as uncorrected 'N' values on the graphic borehole record sheets, adjacent to the appropriate sample level. The results are summarised in Table 2 on the following page.

4.0 Insitu Testing (Cont'd):-

4.1 Insitu Standard Penetration Tests (SPT) (Cont'd):-

Table 2

Type of strata	Range of SPT 'N' vales
Made ground	18 up to 75 blows for limited penetration – equates to medium dense, dense and very dense / hard strata
Natural bedrock deposits (mudstone and siltstone)	22 up to 75 blows for limited penetration – equates to medium dense, dense and very dense / hard strata

5.0 Laboratory Testing:-

All geotechnical testing was carried out in accordance with BS1377:1990:Parts 1-9 by Professional Soils Laboratory Limited (PSL) of Doncaster, South Yorkshire and Chemtech Environmental Limited of Consett, Co. Durham.

5.1 Determination of pH & SO_4:-

Eleven representative samples of the variable deposits encountered within the cable percussive boreholes were tested in order to determine their acidic (pH) and soluble sulphate (SO_4) levels. The results are shown in Table 3 below and are also contained in the Chemtech Environmental Analytical Report, ref no: 46200 a copy of which can be seen attached.

Table 3

BH Position	Depth (m)	pH	SO_4(mg/l)	Design SO_4 Class	ACEC Class	Strata Type
CP1	0.50	7.9	201	DS-1	AC-1	Made ground
CP1	1.50-2.50	7.7	81	DS-1	AC-1	Mudstone
CP2	0.50	9.6	278	DS-1	AC-1	Made ground
CP2	2.50-3.00	7.2	32	DS-1	AC-1	Mudstone
CP3	0.30	8.1	191	DS-1	AC-1	Made ground
CP3	2.20	8.6	16	DS-1	AC-1	Made ground
CP3	3.20-5.00	9.9	63	DS-1	AC-1	Made ground
CP3	7.50-9.00	7.8	1754	DS-3	AC-3	Made ground
CP3	9.70-10.00	7.9	356	DS-1	AC-1	Coal
CP4	3.00	8.0	299	DS-1	AC-1	Made ground
CP4	7.60-8.10	8.6	141	DS-1	AC-1	Siltstone

Re: Proposed Site Redevelopment, Land adjacent to Caledonian Road / The Sidings, Dewsbury (Cont'd)

5.0 Laboratory Testing (Cont'd):-

5.1 Determination of pH & SO_4 (Cont'd):-

The pH values obtained for the variable deposits tested range from 7.8 to 9.9 and the amount of soluble sulphate present for the majority of the samples fall below the negligible threshold value of 500mg/l. However, a soluble sulphate level of 1754mg/l has been recorded for a sample of made ground recovered from a depth of c.7.50m – c.9.00m at the location of CP3, which is located within the former infilled railway cutting.

In accordance with BRE Special Digest 1: 2005 (3rd Edition) where foundations are to be constructed outwith the infilled railway cutting a design class of DS-1 AC-1 can be considered. Based on the results of the soils taken from CP1 & CP2 this design class will apply to foundations constructed for the proposed Health Centre development.

Based on the results of the samples taken at depth within CP3 a design class of DS-3 AC-3 should be considered where foundations are to be placed within these deposits.

5.2 Determination of Liquid & Plastic Limits:-

Three representative samples of the natural mudstone deposits encountered within the cable percussive boreholes were tested in order to determine their liquid and plastic limits, so these materials might be classified. The results are shown in Table 4 below and are also contained in the Professional Soils Laboratory Analytical Report, ref no. PSL12/3325 a copy of which can be seen attached. From the results it can be seen that the samples tested are of an inorganic nature and when plotted on the plasticity chart fall within the intermediate plasticity range and from the resulting plasticity indices the samples tested have a low volume change potential when taking into account the amount passing the 425μm sieve.

Therefore, it can be seen that the natural mudstone deposits tested are unlikely to undergo significant changes in volume, if large changes in their natural moisture content were to occur due to seasonal variations or the like, and therefore if new foundations are to be based within these materials, it is recommended that they are taken down to a minimum depth of 0.75m below finished ground levels.

Table 4

BH Position	Depth(m)	M/C (%)	LL	PL	PI	Class	%Passing 425μm Sieve
CP1	1.50-2.50	17	35	17	18	CI	82
CP2	1.50-2.00	21	37	17	20	CI	70
CP3	1.20	20	39	18	21	CI	61

M/C = Moisture Content, LL = Liquid Limit, PL = Plastic Limit, PI = Plasticity Index

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5.0 Laboratory Testing (Cont'd):-

5.2 Determination of Liquid & Plastic Limits (Cont'd):-

An increase in this minimum depth will be required, where made ground is encountered >0.75m in thickness is present and also if the proposed building is within close proximity to existing or envisaged vegetation. Reference should be made to BS5837: 2012, "Trees in Relation to Construction".

5.3 Determination of Unconfined Compressive Strength (UCS):-

Three representative samples of intact rock were forwarded on to the laboratory for subsequent compressive strength testing. The unconfined uniaxial compressive strengths of the siltstone deposits were determined in the laboratory on selected samples of core taken from the rotary cored borehole. A summary of the UCS tests can be seen in Table 5 below and are also contained in the Professional Soils Laboratory Analytical Report, ref no. PSL12/3727 a copy of which can be seen attached.

Table 5

BH Position	Depth (m)	Type of strata	Diameter (mm)	Length (mm)	Load failure (kN)	Maximum compressive strength (MPa)
RBH3	12.80	Siltstone	73.0	199.1	134.0	20.6 (Moderately strong)
RBH3	13.50	Siltstone	73.0	160.8	100.0	19.1 (Moderately strong)
RBH3	15.20	Siltstone	73.0	69.20	113.0	2.6 (Weak)

The results obtained for the natural siltstone deposits range from 2.6MPa up to 20.6MPa equating to weak and moderately strong rock.

6.0 Foundation Options / Recommendations:-

Based on the ground conditions identified at the location of CP1 & CP2 it is anticipated that the location of the footprint of the proposed Health Centre development will be underlain by made ground deposits ranging in type and thickness. The made ground deposits were noted to be medium dense in nature and extended to depths ranging from between c.1.45m (CP1) and c.2.10m (CP2) before encountering natural bedrock deposits.

Due to the presence of made ground, foundations for the proposed Health Centre will need to extend beyond this layer and based wholly within the underlying natural mudstone (bedrock) deposits. This will require the creation of either pad, deep strip or trenchfill foundations which can be designed to a maximum allowable bearing pressure not to exceed 300kN/m^2.

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6.0 Foundation Options / Recommendations (Cont'd):-

Piled foundations will need to be utilised for future developments positioned over the infilled railway cutting where made ground deposits have been identified to a depth of c.9.70m. Due to the numerous types of pile, and methods of installation available, the information contained within this report, should be passed onto specialist piling contractors, so they could design and price a suitable scheme, particularly as a detailed pile design lies outwith the scope of this report.

The proposed car parking area and access road associated with the Health Centre development is situated above the infilled railway cutting. Based on the type and nature of the made ground deposits recorded at the location of CP3 and CP4, the made ground deposits are likely to achieve insitu CBR values of at least 3%. However, this is simply an estimation and therefore we would recommend that once all of the required site preparation works have been completed for both the Health Centre development and the remainder of the site a series of insitu CBR tests are undertaken. This will allow accurate road / pavement designs to be completed.

For future site works, adequate lateral trench support will be required for excavations, in order to prevent trench wall collapse or over excavations, as well as to create a safe working environment below a depth of 1.20m, and any excavations on this site should remain open for as short a period as possible, since some of these materials may be susceptible to deterioration, if left open to the natural elements for any significant period of time. Reference to CIRIA Report 97 1992 'Trenching Practice – Second Edition' would be beneficial to establish a suitable means of support or battering of excavation sides during construction. It is also recommended for any new developments, adequate surface drainage should be designed and installed by a competent contractor, in order to prevent surface water 'ponding' or collection, during and post construction, particularly where the existing surface drainage system is disrupted or damaged. It is also recommended for any new developments, adequate surface drainage should be designed and installed by a competent contractor, in order to prevent surface water 'ponding' or collection, during and post construction, particularly where the existing surface drainage system is disrupted or damaged.

The information contained within this report relates only to those portions of the site where the Health Centre and Plots TH1, TH2 & TH3 are to be constructed. This equates to a small portion of the overall site area and as such the contents of this report should not be used to assist in foundation designs elsewhere on the site.

We trust the contents of this report is to your satisfaction and if you require any further information or clarification please do not hesitate to contact us.

Yours sincerely,

.....

For and on behalf of Arc Environmental Limited
Terry McMenam BSc (Hons) CEnv CSci MIEnvSc FGS MCMI MIoD
Director

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Location Plan

Site Observations – Photographic Record Sheets

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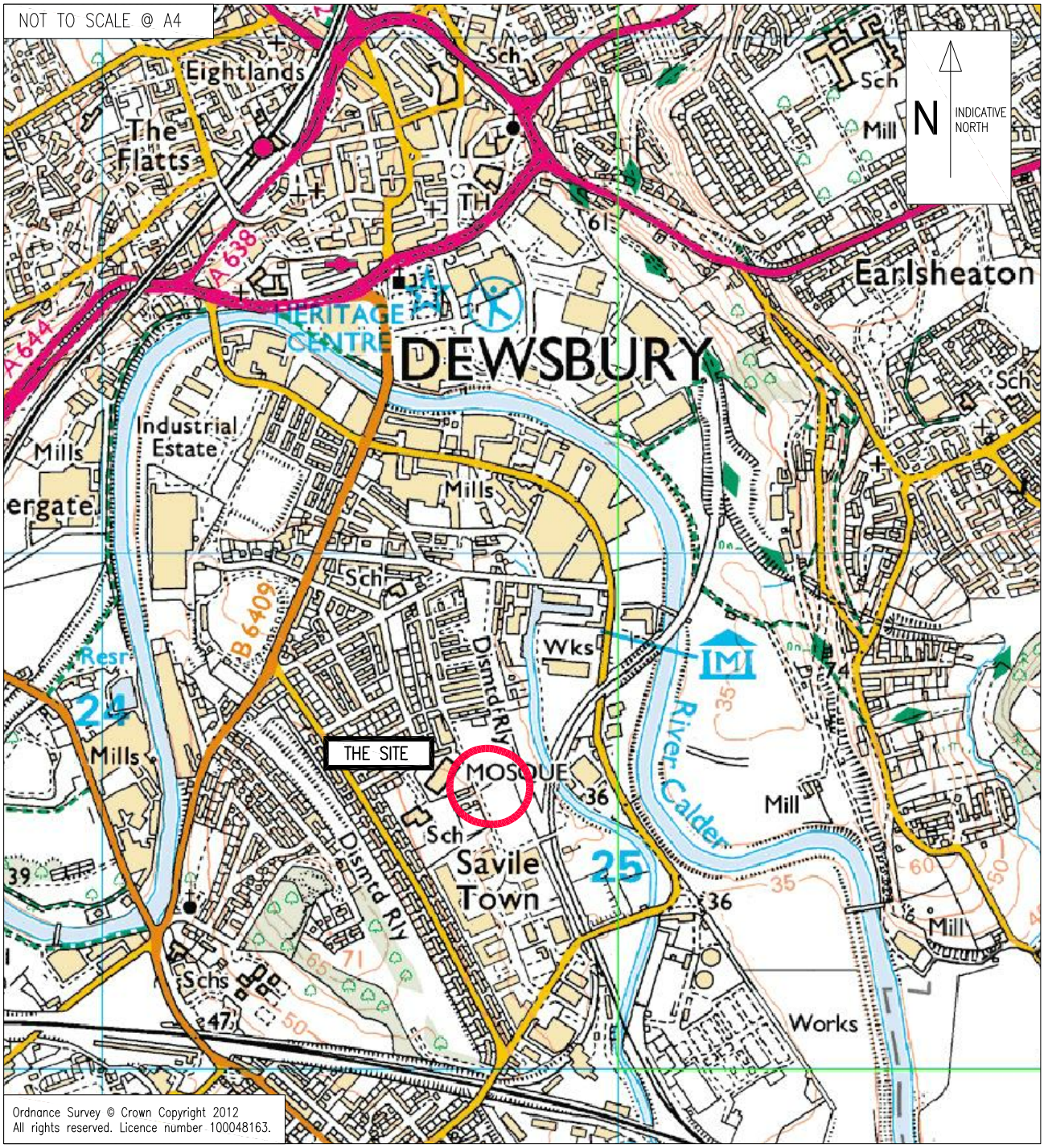
NOT TO SCALE @ A4



Client:
SAVILE DEVELOPMENTS LTD

Project Title:	Drawing Title:
Proposed Health Centre Development Land Adjacent to Caledonian Road / The Sidings, Dewsbury	Location Plan

Job Reference:	Drawing Number:	Revision:
11–183	–	–

Drawn by:	Date:	Scale at A4:
P.D	21.01.13	NTS @ A4

Checked by:	Approved by:	
T.M	T.M	The contractor shall check all dimensions on site before commencement of any works. No dimensions to be scaled off this drawing. © Copyright Reserved

rev.	date	amendments	drawn	chckd

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arc environmental

Borehole Location Plan

Borehole Record Sheets

Rotary Core Photographic Record Sheet

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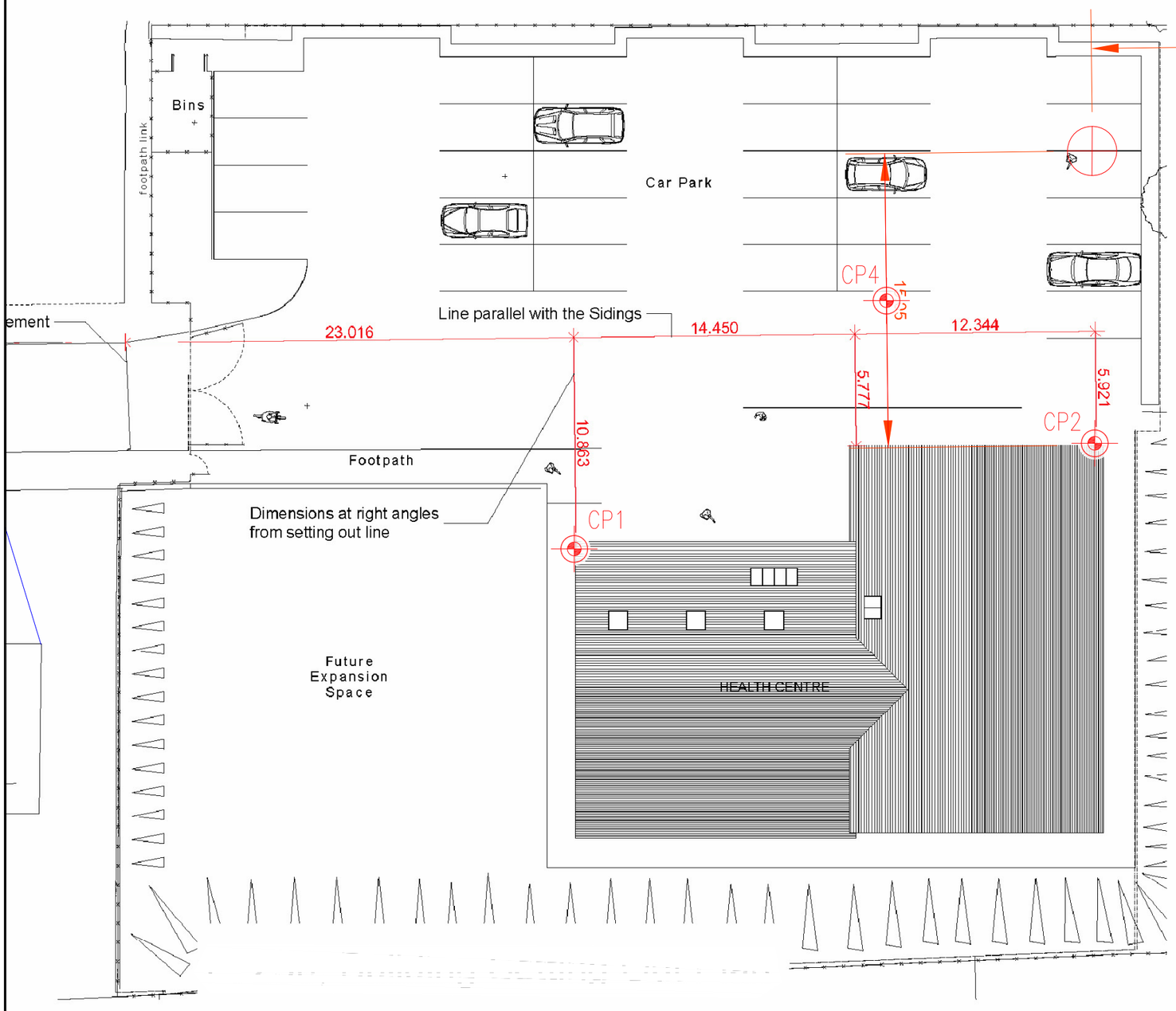
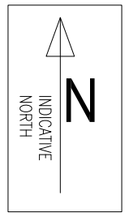


POSITION OF PROPOSED BOREHOLE TARGETED ON THE FORMER INFILLED RAILWAY CUTTING FEATURE. THIS BOREHOLE LIES OUTWITH THE REVISED PROPOSED DEVELOPMENT EXTRACT SUPPLIED TO ARC ENVIRONMENTAL BY CLIENT



SCALE 1:250 @ A3

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rev.	date	amendments	drawn	chckd

Client:
SAVILE DEVELOPMENTS

Project Title:
Proposed Health Centre Development
Land Adjacent to Caledonian Road / The Sidings
Dewsbury

Drawing Title:
Borehole Location Plan

Scale at A3:	Date:	Drawn by:	Approved by:
1:250 @ A3	21.09.12	P.D	T.M

Job Ref:	Drg no:	Rev:
11-183	–	–

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BOREHOLE LOG

Project				BOREHOLE No
Land adjacent to Caledonian Road / The Sidings, Dewsbury				CP1
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	19-09-12			
Contractor				Sheet
Arc Environmental Limited				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.80	D					(1.45) 1.45	Dark brown disturbed clay and mudstone with occasional fragments of brick (MADE GROUND).		
1.45	D						Initially medium dense becoming dense and very dense dark brown and grey weathered MUDSTONE (CARBONIFEROUS COAL MEASURES).		
1.50-2.50	B								
1.50-1.95	SPT	N=22							
2.50-3.00	B								
2.50-2.95	SPT	N=29							
3.50-4.50	B					(3.95)			
3.50-3.95	SPT	N=33							
4.50-4.95	SPT	N=57							
5.20-5.40	SPT	75 blows				5.40			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
19-09-12	00.00	5.40	1.50	150mm		5.2	5.40	0.5hr			WATER: Borehole remained dry during the investigation period.

All dimensions in metres Scale 1:37.5	Client One 17 (Structural Design) Ltd	Method/ Plant Used Cable percussive	Logged By RD

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BOREHOLE LOG

Project				BOREHOLE No
Land adjacent to Caledonian Road / The Sidings, Dewsbury				CP2
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	19-09-12			
Contractor				Sheet
Arc Environmental Limited				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.50	D					(2.10)	Medium dense dark brown disturbed claybound mudstone with occasional fragments of brick (MADE GROUND).		
1.50-2.00	B								
1.50-1.95	SPT	N=27				2.10			
2.10	D						Dense dark grey weathered MUDSTONE (CARBONIFEROUS COAL MEASURES).		
2.50-3.00	B								
3.00-3.45	SPT	N=40				(1.90)			
						4.00			
4.00-4.50	D						Very dense / hard light grey weathered SILTSTONE (CARBONIFEROUS COAL MEASURES).		
4.00-4.45	SPT	N=50				(1.40)			
5.00-5.20	SPT	75 blows							
5.20-5.40	SPT	75 blows				5.40			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
19-09-12	00.00	5.40	3.00	150mm		5.2	5.40	0.5hr			WATER: Borehole remained dry during the investigation period.

All dimensions in metres Scale 1:37.5	Client One 17 (Structural Design) Ltd	Method/ Plant Used Cable percussive	Logged By RD

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BOREHOLE LOG

Project				BOREHOLE No
Land adjacent to Caledonian Road / The Sidings, Dewsbury				CP3
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	19-09-12			
Contractor				Sheet
Arc Environmental Limited				1 of 2

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.30	D					(2.15)	Medium dense dark brown disturbed clay mudstone and sandstone with occasional fragments of brick and pieces of timber (MADE GROUND).		
1.20	B					2.15			
1.20-1.65	SPT	N=18							
2.20-2.65	CPT	N=37				(0.90)	Dense and very dense sandstone rubble (MADE GROUND).		
2.20	D					3.05			
2.90-3.10	CPT	75 blows				(1.75)	Initially dense becoming medium dense brick rubble (MADE GROUND).		
3.20-5.00	B					4.80			
3.20-3.65	CPT	N=32							
4.20-4.65	CPT	N=26					Dense dark brown disturbed claybound mudstone and sandstone with occasional fragments of brick (MADE GROUND).		

Boring Progress and Water Observations					
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

Chiselling			Water Added	
From	To	Hours	From	To

GENERAL REMARKS

WATER: Slight ingress of water recorded at a depth of c.2.20m. Borehole dry upon completion.

All dimensions in metres Scale 1:37.5	Client One 17 (Structural Design) Ltd	Method/ Plant Used Cable percussive	Logged By RD

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BOREHOLE LOG

Project				BOREHOLE No
Land adjacent to Caledonian Road / The Sidings, Dewsbury				CP3
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	19-09-12			
Contractor				Sheet
Arc Environmental Limited				2 of 2

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
6.00-7.50	B						Dense dark brown disturbed claybound mudstone and sandstone with occasional fragments of brick (MADE GROUND). *(continued)*		
6.00-6.45	CPT	N=31							
						(4.45)			
7.50-9.00	B								
7.50-7.95	SPT	N=35							
9.00-9.70	B								
9.00-9.45	SPT	N=32				9.25			
						(0.45)	Dense dark brown and grey disturbed mudstone (MADE GROUND).		
						9.70			
9.70-10.00	B					(0.35)	Black COAL (CARBONIFEROUS COAL MEASURES).		
						10.05			
10.00-10.40	SPT	75 blows			× × × × × × × × × × × ×	(0.45)	Very dense / hard light grey weathered SILTSTONE (CARBONIFEROUS COAL MEASURES).		
10.40-10.50	SPT	75 blows				10.50			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
19-09-12	00.00	10.50	9.00	150mm		10.3	10.50	0.5hr			WATER: Slight ingress of water recorded at a depth of c.2.20m. Borehole dry upon completion.

All dimensions in metres Scale 1:37.5	Client One 17 (Structural Design) Ltd	Method/ Plant Used Cable percussive	Logged By RD

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BOREHOLE LOG

Project				BOREHOLE No
Land adjacent to Caledonian Road / The Sidings, Dewsbury				CP4
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	19-09-12			
Contractor				Sheet
Arc Environmental Limited				1 of 2

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
							Dense dark brown disturbed clay and mudstone with occasional fragments of brick (MADE GROUND).		
1.00	D								
2.00-2.45	CPT	N=17							
3.00	D								
						(7.60)			
4.00-4.45	CPT	N=25							
5.00	D								

Boring Progress and Water Observations					
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

Chiselling			Water Added	
From	To	Hours	From	To

GENERAL REMARKS

WATER: Borehole remained dry during the investigation period.

All dimensions in metres Scale 1:37.5	Client One 17 (Structural Design) Ltd	Method/ Plant Used Cable percussive	Logged By RD

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BOREHOLE LOG

Project				BOREHOLE No
Land adjacent to Caledonian Road / The Sidings, Dewsbury				CP4
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	19-09-12			
Contractor				Sheet
Arc Environmental Limited				2 of 2

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
6.00-6.45	CPT	N=32					Dense dark brown disturbed clay and mudstone with occasional fragments of brick (MADE GROUND). *(continued)*		
7.00	D					7.60			
7.60-8.10	B				× × × ×		Very dense / hard light grey weathered SILTSTONE (CARBONIFEROUS COAL MEASURES).		
7.60-7.90	SPT	75 blows			× × × ×	(0.50)			
8.00-8.10	SPT	75 blows			× × × ×	8.10			

Boring Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt
19-09-12	00.00	8.10	7.50	150mm	

Chiselling

From	To	Hours
8	8.10	0.5hr

Water Added

From	To

GENERAL REMARKS

WATER: Borehole remained dry during the investigation period.

All dimensions in metres Scale 1:37.5	Client One 17 (Structural Design) Ltd	Method/ Plant Used Cable percussive	Logged By RD

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DRILLHOLE LOG

Project				DRILLHOLE No
Land adjacent to Caledonian Road / The Sidings, Dewsbury				**RBH3**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	25-09-12			
Contractor				Sheet
Arc Environmental Limited				1 of 3

RUN DETAILS			STRATA							
Depth / Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION: Discontinuities	Detail	Main	Geology	Instrument/ Backfill
					(10.50)			Rotary coring commenced from the base of CP3 at a depth of c.10.50m. Please refer to borehole record sheet reference CP3 for strata details from ground level to c.10.50m.		

Drilling Progress and Water Observations							Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing	Core Dia mm	Water Strike	Water Standing	From	To	Type	Returns	

All dimensions in metres Scale 1:37.5	Client One 17 (Structural Design) Ltd	Method/ Plant Used Rotary Coring	Logged By MPB

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DRILLHOLE LOG

Project				DRILLHOLE No
Land adjacent to Caledonian Road / The Sidings, Dewsbury				**RBH3**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	25-09-12			
Contractor				Sheet
Arc Environmental Limited				2 of 3

RUN DETAILS			STRATA							
Depth / Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION: Discontinuities	Detail	Main	Geology	Instrument/ Backfill
					10.50			Rotary coring commenced from the base of CP3 at a depth of c.10.50m. Please refer to borehole record sheet reference CP3 for strata details from ground level to c.10.50m. *(continued)*		
					(1.50)			Open hole rotary drilling from c.10.50m to c.12.00m.		
12.00					12.00					

Drilling Progress and Water Observations							Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing	Core Dia mm	Water Strike	Water Standing	From	To	Type	Returns	

All dimensions in metres Scale 1:37.5	Client One 17 (Structural Design) Ltd	Method/ Plant Used Rotary Coring	Logged By MPB

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DRILLHOLE LOG

Project				DRILLHOLE No
Land adjacent to Caledonian Road / The Sidings, Dewsbury				**RBH3**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	25-09-12			
Contractor				Sheet
Arc Environmental Limited				3 of 3

RUN DETAILS			STRATA						
Depth / Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION: Discontinuities / Detail	DESCRIPTION: Main	Geology	Instrument/ Backfill
		Non-intact			(0.30) 12.30	12.00 - 12.30 Non-intact.	Grey highly weathered SILTSTONE. Generally recovered as clayey gravel (CARBONIFEROUS COAL MEASURES).		
		10			(0.30) 12.60	12.30 - 12.60 Fractures are closely spaced sub horizontal undulating rough open to tight with silt sized infill.	Weak to medium strong grey SILTSTONE. Occasional dark grey staining noted on all surfaces (CARBONIFEROUS COAL MEASURES).		
	85 (37) 25	Non-intact			(0.40) 13.00	12.60 - 13.00 Non-intact.			
13.50		6				13.00 - 13.50 Fractures are closely spaced sub horizontal undulating rough and open with silt sized infill.	Grey weathered SILTSTONE. Generally recovered as clayey gravel (CARBONIFEROUS COAL MEASURES).		
	67 (23) 11	8			(3.50)	13.50 - 15.00 Fractures are closely spaced sub horizontal undulating rough and open with silt sized infill. 13.80 - 13.95 1 no. impersistent sub vertical planar rough and tight fracture.	Weak to medium strong grey SILTSTONE with occasional iron brown staining noted on several surfaces (CARBONIFEROUS COAL MEASURES).		
15.00									
	67 (19) 7	Non-intact 5				15.00 - 15.10 1 no. impersistent sub vertical planar rough and tight fracture. 15.00 - 16.50 Fractures are closely spaced sub horizontal undulating rough open to tight with silt sized infill. 15.30 - 15.40 1 no. impersistent sub vertical planar rough and tight with silt sized infill fracture. 15.40 - 15.45 Non-intact.			
16.50					16.50	16.40 - 16.50 1 no. impersistent sub vertical planar rough and tight with silt sized infill fracture.			

Drilling Progress and Water Observations						
Date	Time	Depth	Casing	Core Dia mm	Water Strike	Water Standing

Rotary Flush			
From	To	Type	Returns

GENERAL REMARKS

All dimensions in metres Scale 1:37.5	Client One 17 (Structural Design) Ltd	Method/ Plant Used Rotary Coring	Logged By MPB

AGS3 UK DH SEPT 2012 RBH BOREHOLE.GPJ AGS3_ALL.GDT 22/1/13

ROTARY CORE PHOTOGRAPHIC RECORD

CORE DETAILS	
BOREHOLE REF	BH1
CORE SECTION (DEPTHS)	12.0M to 16.5M
CORE RECOVERY	LESS THAN 100% CORE RECOVERY THROUGH CORE RUN

Client:
SAVILE DEVELOPMENTS

Project Title:
Proposed Health Centre Development
Land Adjacent to Caledonian Road /
The Sidings, Dewsbury

Drawing Title:
Rotary Core
Photographic Record Sheet

rev.	date	amendments	drawn	chckd

Job Reference:	Drawing Number:	Revision:
11-183	-	-

Drawn by:	Date:	Scale at A4:
P.D	21.01.13	NTS @ A4

Checked by:	Approved by:	
T.M	T.M	The contractor shall check all dimensions on site before commencement of any works. No dimensions to be scaled off this drawing.

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Our ref: 11-183.06L

Michael Naughton
One 17 (Structural Design) Limited
The Dyehouse
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3rd September 2013

Dear Michael,

Re: Supplementary Geotechnical Investigation for Land adjacent to Caledonian Road, Dewsbury

Arc Environmental Limited was commissioned by One 17 (Structural Design) Limited of Armitage Bridge, Huddersfield, West Yorkshire on behalf of their client Savile Developments Limited to undertake a program of supplementary geotechnical ground investigation works for a proposed residential development situated off Caledonian Road, Savile Town, Dewsbury. These works were completed following reduction of the site levels as part of the planned enabling works to achieve finished site levels.

Please find enclosed the following:

- Proposed Development Layout Plan Showing Exploratory Hole Positions
- Supplementary Borehole Record Sheets
- Core Photographic Record Sheet (CP6)

The supplementary geotechnical intrusive investigation works undertaken by Arc Environmental Limited comprised 4 no. cable percussive boreholes (CP5 to CP8), 1 no. of which was continued as a cored rotary drill hole (CP6) and 12 no. windowless sampling boreholes (WSA to WSL). The locations of all the exploratory positions can be seen on the Exploratory Hole Location Plan, a copy of which is enclosed.

Each exploratory position was sunk to provide a more detailed assessment of the ground conditions below the areas of the proposed residential properties, following removal of a significant thickness of the made ground/fill materials from across the site as part of the site enabling works.

2.0 Ground Conditions:-

For an accurate description of the ground conditions encountered at the borehole locations reference should be made to the enclosed borehole record sheets. It should be noted that there is always the possibility of variation in the ground conditions around and between the borehole locations. A summary of the soil and groundwater profile for the borehole locations can be seen in Table 1 on the following page.

Re: Supplementary Geotechnical Investigation for Land adjacent to Caledonian Road, Dewsbury (Cont'd)

2.0 Ground Conditions (Cont'd):-

Table 1

Type of strata	Depths recorded (bcgl)	Description
MADE GROUND: (Variable)	From 0.00m up to c.1.00m to c.7.40m	Made ground generally comprising soft to firm (occasionally stiff) sandy gravelly clay, with occasional brick, ash, clinker and sandstone, was recorded below the western site area, to depths of between c.2.40m and c.5.20m. As anticipated, an increased thickness of made ground was identified across the eastern site area, associated with the location of infilled railway cutting. From the cable percussive boreholes, these materials were noted to comprise generally medium dense clay-bound mudstone and brick fill, to depths of between c.6.50m and c.7.40m. Following completion of the site enabling works, generally limited made ground was identified across the south-western site area (encompassing proposed Plots 2 to 4), to depths of between c.1.00m and c.1.10m.
RESIDUAL SOIL:	From c.1.00m to c.3.80m up to c.1.60m to c.4.00m	Residual soil deposits were noted to be generally absent across the site. However, isolated areas of soft to stiff brown clay and medium dense sand were identified at the locations of WSD, WSK & WSL, to depths of between c.1.60m and c.4.00m.
BEDROCK DEPOSITS: (Carboniferous Coal Measures)	From c.1.60m to c.7.40m up to a maximum recorded depth of c.12.00m	Below the made ground deposits natural bedrock was recorded comprising mainly of interbedded MUDSTONE, SILTSTONE and SANDSTONE, to a maximum recorded depth of c.12.00m (CP6).

Rotary coring was undertaken from the base of CP6 in order to recover intact rock cores to allow for a more accurate assessment of the underlying geology. The borehole was extended to a maximum depth of c.12.00m.

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2.0 Ground Conditions (Cont'd):-

Upon completion of the borehole, the recovered cores were subsequently logged to assess their engineering properties by an experienced Engineering Geologist, with values of Total Core Recovery (TCR), Solid Core Recovery (SCR) and Rock Quality designation (RQD) being calculated. These values are displayed numerically on the drillhole record sheet for CP6 and a photograph of the recovered core is also attached. During completion, a loss of core recovery was noted from c.7.50m to c.9.63m due to the highly weathered nature of the bedrock deposits (i.e. the deposits were scrubbed away during coring). Subsequently, the TCR values recorded for CP6 varied from 0% up to 83%, whilst the SCR values varied from 0% up to 34%.

In order to obtain the RQD values for the cores recovered, the combined length of all solid core pieces which are greater than 100mm in length are determined and expressed as a percentage against the total length of core run. This gives an indication of the quality of a rock mass, with RQD values greater than 90% being regarded as generally very good, 75% to 90% as good, 50% to 75% as fair, 25% to 50% as poor, and less than 25% as very poor.

RQD values of between 0% up to 16% were recorded for the interbedded mudstone and sandstone deposits encountered at CP6, generally indicating very poor rock mass which is likely attributable to initial weathering of the solid deposits below the site.

3.0 Groundwater:-

Isolated water strikes and slight ingress of water were recorded at a number of the exploratory hole locations, at depths of between c.1.70m and c.3.10m, generally contained within the made ground materials. The water ingresses experienced at these locations are likely to be a result of trapped surface water infiltration, with the remaining boreholes noted to be dry during intrusive works.

Water ingresses may therefore occur within shallow construction related excavations, particularly where made ground deposits are penetrated and as a result it would be prudent to allow for the introduction of temporary groundwater control techniques (i.e. pumping equipment), in order to take care of any localised ingresses of groundwater which may occur during the construction period, especially during the wetter periods of the year.

4.0 Insitu Testing:-

4.1 Insitu Standard Penetration Tests (SPT):-

Standard penetration tests and cone penetration tests were carried out within the cable percussive boreholes with the use of either a normal split spoon sampler, or a 60^{o} solid cone in order to determine the relative strength and density of the variable deposits encountered. The results are shown as uncorrected 'N' values on the graphic borehole record sheets, adjacent to the appropriate sample level. The results are summarised in Table 2 on the following page.

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Re: Supplementary Geotechnical Investigation for Land adjacent to Caledonian Road, Dewsbury (Cont'd)

4.0 Insitu Testing (Cont'd):-

4.1 Insitu Standard Penetration Tests (SPT) (Cont'd):-

Table 2

Type of strata	Range of SPT 'N' vales
Made ground	5 up to 75 blows for limited penetration – equates to loose, medium dense, dense and very dense strata
Natural bedrock deposits (mudstone/sandstone/siltstone)	27 up to 75 blows for limited penetration – equates to medium dense, dense and very dense strata (i.e. extremely weak to weak)

5.0 Foundation Options / Recommendations:-

When considering the variable ground conditions identified during the supplementary ground investigation works, i.e. deep made ground across the eastern site area associated with the infilled railway cutting, combined with variable made ground across the north-western site area and shallow bedrock deposits across the south-western area, foundation options have been considered for individual groupings of plots, as highlighted below:

Plots 1, 5 and TH1 to TH3 – When considering potential foundation options for these proposed plots, from the findings of the combined intrusive works an increased thickness of made ground/fill is shown to encroach below these areas of the site associated with the historically infilled railway cutting, to depths of between c.6.50m and c.7.40m, where upon natural interbedded mudstone, siltstone and sandstone bedrock deposits were encountered.

Taking into account the nature of these materials (i.e. medium dense to dense clay-bound mudstone and brick fill), at present conventional footings (i.e. strip or pad) or a rafted foundation solution are not considered to represent a potentially viable option for these proposed plots, with the most definitive foundation solution being the utilisation of a piled foundation solution, based within the underlying more competent bedrock deposits. If this option were to be utilised, due to the numerous types of piles and installation methods available, it is recommended that these comments and attached borehole records be passed onto specialist pile design contractors so that they can design a suitable scheme.

Alternatively, the utilisation of ground improvement techniques (i.e. vibro stone columns) could also represent a potentially viable solution for these areas of the site, with this option generally being utilised to increase the density/strength of the made ground/fill below this area and control settlement. However, in order to confirm the suitability of this option it is recommended that these comments and enclosed borehole records be passed onto specialist ground improvement contractors for their comments.

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5.0 Foundation Options / Recommendations (Cont'd):-

When considering proposed Plots 1 & 2, at this stage it is understood that basement features are to be incorporated into these buildings, which will need to be fully tanked to provide an impervious barrier to prevent surface water and damp infiltration (potential foundation options for Plot 2 are discussed below). The incorporation of tanking (i.e. an impervious barrier) into the proposed basements will also act as a permanent gas barrier and as such prevent ground gas migration, resulting in no significant alterations to the gas mitigation measures agreed with Kirklees Borough Council as part of the remedial works for this site.

Plots 2, 3 and 4 – Following completion of the site enabling works, generally limited made ground/fill and residual soil deposits were identified below this area of the site (south-western site area), to depths of between c.1.60m and c.2.40m, where upon natural interbedded mudstone, sandstone and siltstone deposits were encountered. Taking this into account, there is a potential that shallow strip or pad foundations could represent a viable option for Plots 2, 3 & 4, based wholly within the initial interbedded bedrock deposits, at a depth of c.0.90m below finished ground levels, where a maximum allowable bearing pressure of 200kN/m^2 would be available.

However, should an increased thicknesses of made ground be encountered encroaching below this area during future foundation excavations (associated with the adjacent infilled railway cutting), to ensure footings for these plots are based within similarly competent strata, it is recommended that foundation depths be extended to ensure footings are based wholly within the identified bedrock deposits.

Plots TH4 to TH12 and SD1 to SD10 - When considering potential foundation options for Plots TH4 to TH12 & SD1 to SD10, following completion of the site enabling works generally variable thicknesses of made ground/fill have been identified below this area of the site, to depths of between c.2.40m and c.5.20m bcgl.

Taking this into account, the most definitive foundation solution for this area is considered to be the utilisation of a piled foundation solution, based within the underlying interbedded mudstone, sandstone and siltstone bedrock deposits, where a maximum allowable bearing pressure of 200kN/m^2 would be available. However, as previously highlighted, the utilisation of ground improvement techniques (i.e. vibro stone columns) could also represent a potentially viable solution for this area of the site. If these options were to be considered it is recommended that these comments and enclosed borehole records be passed onto specialist ground improvement and/or pile design contractors for their comments.

From the findings of the intrusive works, the overall thickness of the made ground/fill below this area of the site was noted to generally increase in thickness to the south (i.e. towards Plots SD1 to SD10), with made ground/fill being identified to depths of between c.2.40m and c.3.80m below Plots TH4 to TH12.

Taking this into account, there is a potential that strip or pad foundations could represent a viable option for Plots TH4 to TH12, with footings based wholly within the initial bedrock deposits, where a maximum allowable bearing pressure of 200kN/m^2 would be available. However, should this option be considered it should be noted that there is a potential for unidentified increased thicknesses of made ground/fill to occur between borehole locations across this area, which could result in alterations to the overall foundation design during foundation excavation works.

Re: Supplementary Geotechnical Investigation for Land adjacent to Caledonian Road, Dewsbury (Cont'd)

5.0 Foundation Options / Recommendations (Cont'd):-

General Comments – When considering the proposed access road associated with this development, from the proposed development layout plan it can be seen that this feature partially extends onto the location of the infilled railway cutting. However, when considering the nature and general composition of the infill materials (i.e. relatively competent and homogeneous medium dense to dense clay-bound mudstone and brick fill), no increased risk of settlement is anticipated associated with construction of the proposed roadway, providing adequate sub-grade composition and thickness is utilised. At this stage, it is understood that a minimum c.300mm sub-grade thickness is to be utilised for this site. In addition, when considering the nature of the made ground deposits recorded below this area of the site, the made ground deposits below this area are also likely to achieve insitu CBR values of at least 3%.

For any future site works, adequate lateral trench support will be required for excavations, in order to prevent trench wall collapse or over excavations, as well as to create a safe working environment below a depth of 1.20m, and any excavations on this site should remain open for as short a period as possible, since some of these materials may be susceptible to deterioration, if left open to the natural elements for any significant period of time.

It is also recommended for any future redevelopment works, adequate surface drainage should be designed and installed by a competent contractor, in order to prevent surface water 'ponding' or collection, during and post construction, particularly where the existing surface drainage system is disrupted or damaged. In addition, for deeper excavations, drainage, service runs or the like that may pass close to or beneath any existing or proposed foundations, these should be undertaken with care and completed prior to the preparation of any new foundations, so as not to allow any loose or granular material to move or 'flow', thus causing settlement to occur to any new foundations based at a higher level.

An "observational technique" can be applied to future design and construction works on this site, and where ground conditions seem to vary from that indicated from the conceptual ground model derived from works to date, then advice from a suitably qualified Engineering Geologist/Geotechnical Engineer should be sought.

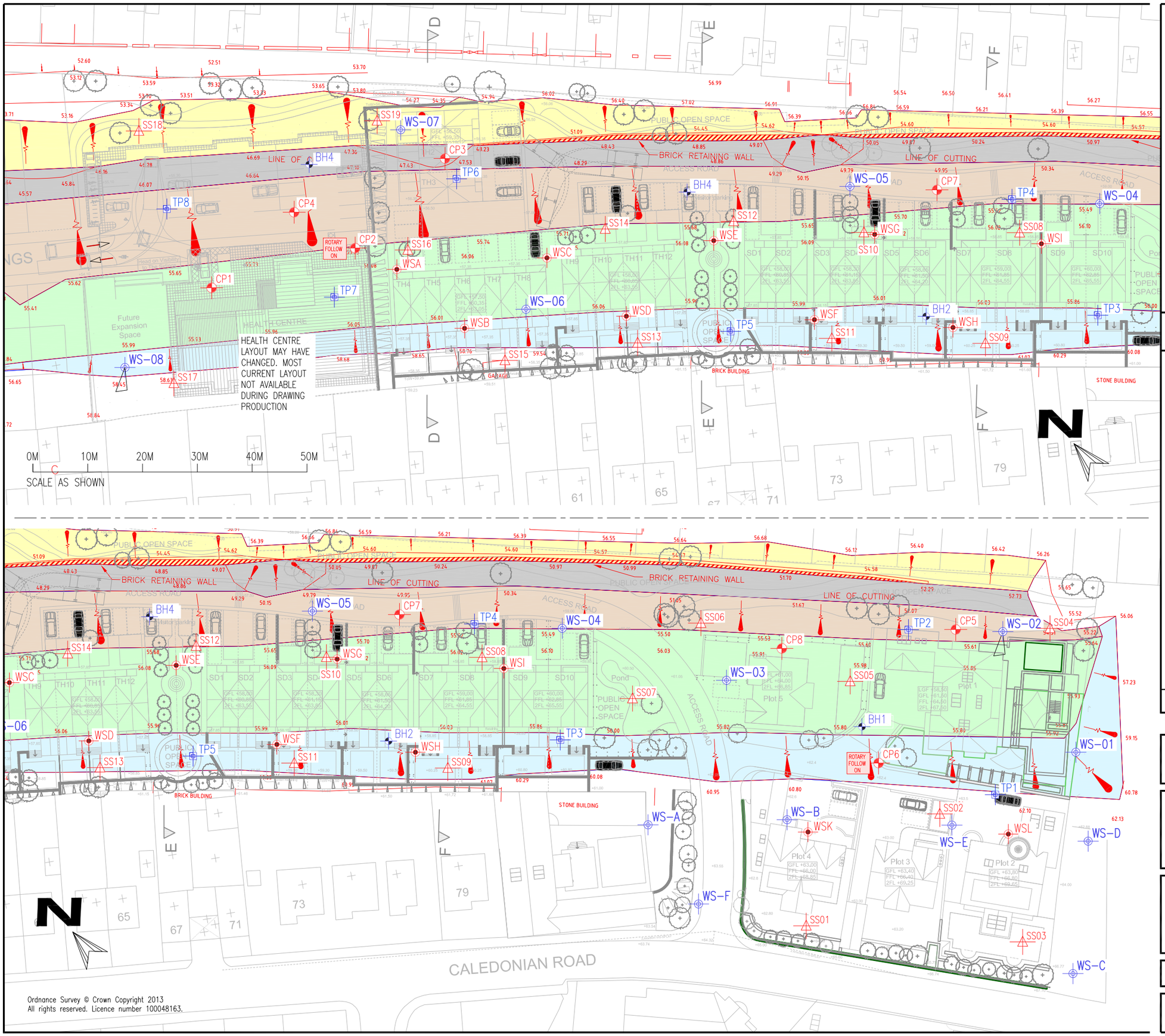
We trust the contents of this report is to your satisfaction and if you require any further information or clarification please do not hesitate to contact us.

Yours Sincerely

NWatson

……

For and on behalf of Arc Environmental Ltd
Nicola Watson BSc (Hons) FGS
Geotechnical Engineer



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LEGEND	
	WINDOWLESS SAMPLING BOREHOLE POSITION (ROBINSONS)
	CABLE PERCUSSIVE BOREHOLE POSITION (ROBINSONS)
	MECHANICALLY EXCAVATED FOUNDATION PIT (ROBINSONS)
	WINDOWLESS SAMPLING BOREHOLE LOCATION (ARC)
	CABLE PERCUSSIVE BOREHOLE LOCATION (ARC)
	MANUALLY EXCAVATED SURFACE SAMPLE POSITIONS (ARC)
ROTARY FOLLOW ON	ARC ROTARY FOLLOW ON FOR WITHIN THE HIGHLIGHTED BOREHOLE POSITION

rev.	date	amendments	drawn	chckd

Client:
SAVILE DEVELOPMENTS

Project Title:
Proposed Site Redevelopment
Land Adjacent to Caledonian Road / The Sidings
Dewsbury

Drawing Title:
Proposed Development Layout Plan
Showing Exploratory Hole Positions and
Former Railway Cutting Detail

Scale at A3:	Date:	Drawn by:	Approved by:
As Shown	03.07.13	P.D	N.J.W

Job Ref:	Drg no:	Rev:
11-183	–	–

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BOREHOLE LOG

Project				BOREHOLE No
Caledonian Road, Savile Town, Dewsbury				CP5
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	19-06-13			
Contractor				Sheet
Arc Environmental Limited				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.30-1.20	B						Medium dense greyish brown clay bound mudstone and brick fill (MADE GROUND).		
1.20-1.65	SPT	N=14							
1.20-1.70	B								
2.20	SPT	N=19							
2.20-2.70	B								
3.20-3.65	SPT	N=20							
3.20-4.00	B					(7.10)			
4.20-4.65	SPT	N=20							
4.20-5.00	B								
5.20-5.65	SPT	N=26							
5.20-6.00	B								
6.20	SPT	N=26							
6.20-7.00	B								
						7.10			
7.20	SPT	75 blows					Weak greyish brown interbedded SILTSTONE and SANDSTONE (CARBONIFEROUS COAL MEASURES).		
7.20-8.00	B					(0.90)			
7.90	SPT	75 blows				8.00			
							Borehole complete at 8.00m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
19-06-13	00.00	8.00	4.50	150	Dry	7.5	8	1hr			WATER: Borehole remained DRY throughout. STANDING TIME: Winching rig onto borehole position - 1hr.

All dimensions in metres Scale 1:62.5	Client One 17 SD	Method/ Plant Used Cable Percussion	Logged By RD

AGS3 UK BH 11-183 BH LOGS.GPJ AGS3_ALL.GDT 14/8/13

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BOREHOLE LOG

Project				BOREHOLE No
Caledonian Road, Savile Town, Dewsbury				CP6
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	19-06-13			
Contractor				Sheet
Arc Environmental Limited				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.30-1.20	B						Medium dense to dense greyish brown clay bound mudstone and brick fill (MADE GROUND).		
1.20-1.65	SPT	N=17							
1.20-2.00	B								
2.20-2.65	SPT	N=16							
2.20-3.00	B								
3.20-3.27	SPT	75 blows				(6.50)			
3.20-4.00	B								
4.20-4.65	SPT	N=23							
4.20-5.00	B								
5.20-5.65	SPT	N=33							
5.20-6.00	B								
6.20-6.65	SPT	N=29							
6.20-7.70	B					6.50			
						(1.00)	Weak greyish brown interbedded SILTSTONE and MUDSTONE (CARBONIFEROUS COAL MEASURES).		
7.20-7.28	SPT	75 blows				7.50			
							Borehole continued as a Cored Drillhole		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
19-06-13	00.00	7.70	4.50	150	Dry	3.2 7.3	3.4 7.7	1hr 1hr			WATER: Borehole remained DRY throughout.

All dimensions in metres Scale 1:62.5	Client One 17 SD	Method/ Plant Used Cable Percussion	Logged By RD

AGS3 UK BH 11-183 BH LOGS.GPJ AGS3_ALL.GDT 14/8/13

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DRILLHOLE LOG

Project				DRILLHOLE No
Caledonian Road, Savile Town, Dewsbury				CP6
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	19-06-13			
Contractor				Sheet
Arc Environmental Limited				1 of 1

RUN DETAILS			STRATA						
Depth / Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION: Discontinuities / Detail	DESCRIPTION: Main	Geology	Instrument/ Backfill
19-06 0.50	0 (0) 0	No Recovery			7.50	7.50 - 9.63 No Recovery - loss of recovery during coring due to highly weathered nature of bedrock deposits.	Weak greyish brown interbedded SILTSTONE and MUDSTONE (CARBONIFEROUS COAL MEASURES).		
9.00					(1.50) 9.00				
19-06	37 (23) 0	17				9.63 - 10.00 Very closely spaced sub-horizontal irregular, rough, open and tight discontinuities.	Weak grey MUDSTONE very thinly interbedded with light grey SANDSTONE, highly weathered (CARBONIFEROUS COAL MEASURES).		
10.00					(1.86)				
19-06	83 (34) 11	No Recovery 17				10.00 - 10.17 No Recovery - loss of recovery during coring due to highly weathered nature of bedrock deposits. 10.17 - 11.00 Very closely spaced sub-horizontal planar and irregular, rough and smooth, open and tight discontinuities. 10.54 - 10.62 Non-intact.			
11.00					10.86				
19-06	73 (25) 16	No Recovery 12			(1.14)	10.62 - 10.81 1 no. impersistent sub-vertical irregular, rough and open discontinuity. 11.00 - 11.27 No Recovery - loss of recovery during coring due to highly weathered nature of bedrock deposits. 11.27 - 12.00 Closely spaced sub-horizontal irregular, rough and open discontinuities.	Medium strong light grey fine to medium SANDSTONE, with occasional very thin dark grey MUDSTONE interbeds (CARBONIFEROUS COAL MEASURES).		
12.00					12.00				
							Borehole complete at 12.00m.		

Drilling Progress and Water Observations						
Date	Time	Depth	Casing	Core Dia mm	Water Strike	Water Standing
19-06-13	00.00	7.70	4.50	150		

Rotary Flush			
From	To	Type	Returns

GENERAL REMARKS

WATER: Borehole remained DRY throughout.

All dimensions in metres Scale 1:31.25	Client One 17 SD	Method/ Plant Used Cable Percussion	Logged By RD

AGS3 UK DH 11-183 BH LOGS.GPJ AGS3_ALL.GDT 14/8/13

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BOREHOLE LOG

Project				BOREHOLE No
Caledonian Road, Savile Town, Dewsbury				CP7
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	20-06-13			
Contractor				Sheet
Arc Environmental Limited				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.10-1.00	B						Medium dense greyish brown clay bound mudstone and brick fill (MADE GROUND).		
1.20-1.65	SPT	N=18							
1.20-1.70	B								
2.20-2.65	SPT	N=20							
2.20-2.70	B								
3.20-3.65	SPT	N=30							
3.20-4.00	B					(6.90)			
4.20-4.65	SPT	N=28							
4.20-5.00	B								
5.20-5.65	SPT	N=28							
5.20-6.00	B								
6.00-6.50	B								
6.20-6.65	SPT	N=27							
						6.90			
7.00-7.27	SPT	75 blows				(0.70)	Weak greyish brown interbedded SILTSTONE and SANDSTONE (CARBONIFEROUS COAL MEASURES).		
7.00-7.60	B					7.60			
7.50-9.63	SPT	75 blows					Borehole complete at 7.60m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
20-06-13	00.00	7.60	6.00	150	Dry	3.7 7.3	3.9 7.6	1hr 1hr			WATER: Borehole remained DRY throughout.

All dimensions in metres Scale 1:62.5	Client One 17 SD	Method/ Plant Used Cable Percussion	Logged By RD

AGS3 UK BH 11-183 BH LOGS.GPJ AGS3_ALL.GDT 14/8/13

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BOREHOLE LOG

Project				BOREHOLE No
Caledonian Road, Savile Town, Dewsbury				CP8
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	19-06-13 20-06-13			
Contractor				Sheet
Arc Environmental Limited				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.10-1.00	B						Medium dense greyish brown clayey mudstone and brick fill (MADE GROUND).		
1.20-1.65	SPT	N=17							
1.20-1.70	B								
2.20-2.65	SPT	N=15							
2.20-3.00	B								
3.20-3.65	SPT	N=16							
3.20-3.70	B					(7.40)			
4.20-4.65	SPT	N=15							
4.20-5.00	B								
5.20-5.65	SPT	N=17							
5.20-6.00	B								
6.20-6.45	SPT	N=18							
6.20-7.00	B								
7.20-7.65	SPT	N=51				7.40			
7.50-8.30	B					(0.90)	Weak grey highly weathered MUDSTONE, interbedded with yellowish brown SANDSTONE (CARBONIFEROUS COAL MEASURES).		
8.20-8.30	SPT	75 blows				8.30			
							Borehole complete at 8.30m.		

Boring Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt
19-06-13	00.00	4.50	4.50	150	Dry
20-06-13	00.00	8.30	4.50	150	Dry

Chiselling

From	To	Hours
8	8.3	1hr

Water Added

From	To

GENERAL REMARKS

WATER: Borehole remained DRY throughout.
STANDING TIME:
Winching rig onto borehole position - 1hr.

All dimensions in metres Scale 1:62.5	Client One 17 SD	Method/ Plant Used Cable Percussion	Logged By RD

AGS3 UK BH 11-183 BH LOGS.GPJ AGS3_ALL.GDT 14/8/13

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BOREHOLE LOG

Project				BOREHOLE No
Caledonian Road, Savile Town, Dewsbury				**WSA**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	19-06-13			
Contractor				Sheet
Arc Environmental Limited				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.50	B					(0.80)	Stiff dark brown sandy gravelly clay, with brick fragments (MADE GROUND).		
0.50-1.00	B					0.80			
1.00-1.45	SPT	N=6					Soft to firm brown gravelly clay, with occasional ash, clinker, sandstone and brick (MADE GROUND).		
1.50	B					(1.60)			
2.00-2.45	SPT	N=16							
2.00	B					2.40			
2.40	B					(0.40)	Greyish brown weathered sandy MUDSTONE (CARBONIFEROUS COAL MEASURES).		
2.80	B					2.80			
3.00-3.45	SPT	N=28					Grey weathered sandy MUDSTONE (CARBONIFEROUS COAL MEASURES).		
3.50	B								
4.00-4.45	SPT	N=27							
4.00	B								
4.60	B					(3.65)			
5.00-5.45	SPT	N=45							
5.00	B								
5.50	B								
6.00-6.45	SPT	N=77							
6.00	B					6.45			
							Borehole complete at 6.45m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	WATER: Borehole remained DRY throughout.

All dimensions in metres Scale 1:43.75	Client One 17 SD	Method/ Plant Used Windowless Sampling	Logged By SW

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BOREHOLE LOG

Project				BOREHOLE No
Caledonian Road, Savile Town, Dewsbury				**WSB**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	19-06-13			
Contractor				Sheet
Arc Environmental Limited				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.30	B					0.30	Compact dark brown sandy slightly clayey brick, concrete and sandstone rubble (MADE GROUND).		
0.30-0.80	B					(0.50) 0.80	Compact black and brown sandy gravelly brick and sandstone rubble (MADE GROUND).		
0.80-1.00	B						Soft to firm brown gravelly clay, with brick, concrete, tarmac and wood fragments (MADE GROUND).		
1.00-1.45	SPT	N=12							
1.50	B					(2.00)			
2.00-2.45	SPT	N=9							
2.00	B								
2.50	B					2.80			
2.80-3.00	B					3.00	Greyish brown weathered sandy MUDSTONE (CARBONIFEROUS COAL MEASURES).		
3.00-3.45	SPT	N=29					Grey weathered MUDSTONE (CARBONIFEROUS COAL MEASURES).		
3.00-3.58	B					(0.87)			
3.58-3.87	SPT	75 blows				3.87			
							Borehole complete at 3.87m.		

Boring Progress and Water Observations					
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

Chiselling			Water Added	
From	To	Hours	From	To

GENERAL REMARKS

WATER: Borehole remained DRY throughout.

All dimensions in metres Scale 1:43.75	Client One 17 SD	Method/ Plant Used Windowless Sampling	Logged By SW

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BOREHOLE LOG

Project				BOREHOLE No
Caledonian Road, Savile Town, Dewsbury				**WSC**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	19-06-13			
Contractor				Sheet
Arc Environmental Limited				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.40	B					(0.40) 0.40	Compact brown sandy gravel, with brick, concrete and sandstone (MADE GROUND).		
0.40-1.00	B						Firm brown sandy gravelly clay, with brick, wood, sandstone and pottery (MADE GROUND).		
1.00-1.45	SPT	N=14				(1.30)			
1.50	B					1.70			
2.00-2.45	SPT	N=9					Soft dark brown sandy silty gravelly clay, with wood, brick, coal, ash and clinker (MADE GROUND).		
2.00	B					(1.05)			
2.50	B					2.75			
2.75-2.95	SPT	75 blows				2.95	Light brown weathered MUDSTONE (CARBONIFEROUS COAL MEASURES).		
							Borehole complete at 2.945m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											WATER: Strike at 1.70m. Borehole DRY upon completion.

All dimensions in metres Scale 1:43.75	Client One 17 SD	Method/ Plant Used Windowless Sampling	Logged By SW

AGS3 UK BH 11-183 BH LOGS.GPJ AGS3_ALL.GDT 14/8/13

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BOREHOLE LOG

Project				BOREHOLE No
Caledonian Road, Savile Town, Dewsbury				**WSD**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	19-06-13			
Contractor				Sheet
Arc Environmental Limited				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.50	B						Compact dark brown sandy gravelly clay, with sandstone cobbles, brick, ash, clinker and sandstone (MADE GROUND).		
0.50-1.00	B					(1.60)			
1.00-1.45	SPT	N=11							
1.50	B					1.60			
1.60-2.00	B						Firm brown sandy gravelly clay, with brick and sandstone (MADE GROUND).		
2.00-2.45	SPT	N=32							
2.50	B					(1.80)			
3.00-3.45	SPT	N=14							
3.00	B					3.40			
3.40-3.80	B					(0.40)	Loose black ash and clinker gravel (MADE GROUND).		
3.80-4.00	B					3.80	Firm brown sandy gravelly CLAY. Gravel consists of mudstone.		
4.00-4.13	SPT	75 blows				4.00			
						4.13	Light brown weathered MUDSTONE (CARBONIFEROUS COAL MEASURES).		
							Borehole complete at 4.13m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											WATER: Slight seepage at 3.10m. Water level standing at 3.75m upon completion.

All dimensions in metres Scale 1:43.75	Client One 17 SD	Method/ Plant Used Windowless Sampling	Logged By SW

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BOREHOLE LOG

Project				BOREHOLE No
Caledonian Road, Savile Town, Dewsbury				**WSE**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	19-06-13			
Contractor				Sheet
Arc Environmental Limited				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.50	B						Stiff dark brown sandy gravelly clay, with mudstone, sandstone, brick, ash, clinker and wood (MADE GROUND).		
0.50-1.00	B								
1.00-1.45	SPT	N=8							
1.50	B								
2.00-2.45	SPT	N=8							
2.00	B					(4.30)			
2.50	B								
3.00-3.45	SPT	N=21							
3.00	B								
3.50	B								
3.80-4.18	SPT	75 blows							
3.80	B								
4.00-4.30	B					4.30			
4.30	B						Light brown and light grey weathered MUDSTONE (CARBONIFEROUS COAL MEASURES).		
						(0.99)			
5.00-5.29	SPT	75 blows							
5.00	B					5.29			
							Borehole complete at 5.285m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											WATER: Slight seepage at 4.30m. Water level standing at 5.175m upon completion.

All dimensions in metres Scale 1:43.75	Client One 17 SD	Method/ Plant Used Windowless Sampling	Logged By SW

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BOREHOLE LOG

Project				BOREHOLE No
Caledonian Road, Savile Town, Dewsbury				**WSF**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	19-06-13			
Contractor				Sheet
Arc Environmental Limited				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.50	B						Stiff brown / black sandy gravelly clay, with brick, sandstone, tarmac, wood, pottery, ash and clinker (MADE GROUND).		
0.50-1.00	B								
1.00-1.45	SPT	N=9							
1.50	B					(3.50)			
2.00-2.45	SPT	N=31							
2.00	B								
2.50-2.95	SPT	N=26							
2.50	B								
3.00	B								
						3.50			
3.50-3.95	SPT	N=13					Soft dark brown sandy gravelly clay, with brick, sandstone and wood (MADE GROUND).		
3.50	B								
4.00	B								
						(1.70)			
4.50-4.95	SPT	N=9							
4.50	B								
						5.20			
5.20-5.26	SPT	75 blows				5.31	Yellowish brown weathered fine SANDSTONE (CARBONIFEROUS COAL MEASURES).		
5.20	B						Borehole complete at 5.305m.		

Boring Progress and Water Observations					
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

Chiselling			Water Added	
From	To	Hours	From	To

GENERAL REMARKS

WATER: Slight seepages at 2.40m and 5.10m. Borehole DRY upon completion.

All dimensions in metres Scale 1:43.75	Client One 17 SD	Method/ Plant Used Windowless Sampling	Logged By SW

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BOREHOLE LOG

Project				BOREHOLE No
Caledonian Road, Savile Town, Dewsbury				**WSG**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	19-06-13			
Contractor				Sheet
Arc Environmental Limited				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.50	B						Firm becoming stiff dark brown sandy gravelly clay, with brick, concrete, wood and metal (MADE GROUND).		
0.50-1.00	B								
1.00-1.45	SPT	N=11							
1.00-2.00	B					(3.00)			
2.00-2.45	SPT	N=21							
2.50	B					3.00			
3.00-3.45	SPT	N=16					Stiff brown sandy gravelly clay, with brick, sandstone and sandstone cobbles (MADE GROUND).		
3.00	B					(0.90)			
3.50	B					3.90			
3.90-4.09	SPT	75 blows				4.09	Light grey weathered fine SANDSTONE (CARBONIFEROUS COAL MEASURES).		
3.90	B						Borehole complete at 4.085m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											WATER: Borehole remained DRY throughout.

All dimensions in metres Scale 1:43.75	Client One 17 SD	Method/ Plant Used Windowless Sampling	Logged By SW

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BOREHOLE LOG

Project				BOREHOLE No
Caledonian Road, Savile Town, Dewsbury				**WSH**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	20-06-13			
Contractor				Sheet
Arc Environmental Limited				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.50	B						Stiff brown sandy gravelly clay, with mudstone, sandstone, brick and wood (MADE GROUND).		
0.50-1.00	B								
1.00-1.45	SPT	N=7				(2.20)			
1.00-2.00	B								
2.00-2.45	SPT	N=5				2.20			
2.00-2.50	B					2.50	Very loose dark brown sandy slightly gravelly soil, with rootlets (possible residual topsoil) (MADE GROUND).		
2.50-2.70	B					(0.43)	Grey and orangish brown weathered interbedded SANDSTONE and SILTSTONE (CARBONIFEROUS COAL MEASURES).		
2.70-2.93	SPT	75 blows				2.93			
							Borehole complete at 2.93m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	WATER: Borehole remained DRY throughout.

All dimensions in metres Scale 1:43.75	Client One 17 SD	Method/ Plant Used Windowless Sampling	Logged By SW

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BOREHOLE LOG

Project				BOREHOLE No
Caledonian Road, Savile Town, Dewsbury				**WSI**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	20-06-13			
Contractor				Sheet
Arc Environmental Limited				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.50	B						Stiff becoming occasionally soft brown and black sandy gravelly clay, with brick, sandstone, wood, coal, ash and clinker (MADE GROUND).		
0.50-1.00	B								
1.00-1.45	SPT	N=30							
1.50	B								
2.00-2.45	SPT	N=5							
2.00	B					(4.90)			
2.50	B								
3.00-3.45	SPT	N=41							
3.00	B								
3.50	B								
4.00-4.45	SPT	N=5							
4.00	B					4.90			
5.00-5.26	SPT	75 blows				(0.36)	Grey and orangish brown weathered interbedded SANDSTONE and SILTSTONE (CARBONIFEROUS COAL MEASURES).		
						5.26	Borehole complete at 5.26m.		

Boring Progress and Water Observations					
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

Chiselling			Water Added	
From	To	Hours	From	To

GENERAL REMARKS

WATER: Slight seepage at 0.60m. Borehole DRY upon completion.

All dimensions in metres Scale 1:43.75	Client One 17 SD	Method/ Plant Used Windowless Sampling	Logged By SW

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BOREHOLE LOG

Project				BOREHOLE No
Caledonian Road, Savile Town, Dewsbury				**WSJ**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	20-06-13			
Contractor				Sheet
Arc Environmental Limited				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.50	B						Stiff brown and black sandy gravelly clay, with brick, sandstone, tarmac, wood and concrete (MADE GROUND).		
0.50-1.00	B								
1.00-1.45	SPT	N=7							
1.50	B								
2.00-2.45	SPT	N=12				(4.00)			
2.00	B								
2.50	B								
3.00-3.45	SPT	N=12							
3.00	B								
3.50	B								
						4.00			
4.00-4.26	SPT	75 blows				4.26	Grey and orangish brown weathered interbedded SANDSTONE and SILTSTONE (CARBONIFEROUS COAL MEASURES).		
4.00	B						Borehole complete at 4.255m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											WATER: Borehole remained DRY throughout.

All dimensions in metres Scale 1:43.75	Client One 17 SD	Method/ Plant Used Windowless Sampling	Logged By SW

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BOREHOLE LOG

Project				BOREHOLE No
Caledonian Road, Savile Town, Dewsbury				**WSK**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	20-06-13			
Contractor				Sheet
Arc Environmental Limited				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.50	B						Compact dark brown sandy brick, concrete and sandstone rubble, with occasional stiff clay pockets (MADE GROUND).		
0.50-1.10	B					(1.10)			
1.00-1.45	SPT	N=10				1.10			
1.10	B					(0.50)	Firm brown slightly sandy slightly gravelly CLAY. Gravel consists of sandstone and mudstone.		
1.60	B					1.60			
						(0.40)	Soft to firm brown very sandy gravelly CLAY. Gravel consists of sandstone.		
2.00-2.45	SPT	N=19				2.00			
2.00	B					(0.40)	Stiff orangish brown with grey mottling gravelly CLAY. Gravel consists of shale and coal (possible completely weathered mudstone).		
2.00-2.40	B					2.40			
2.40	B					(0.60)	Orangish brown and light brown weathered MUDSTONE (CARBONIFEROUS COAL MEASURES).		
						3.00			
3.00-3.18	SPT	75 blows				3.18	Light brown weathered fine SANDSTONE (CARBONIFEROUS COAL MEASURES).		
3.00	B						Borehole complete at 3.175m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											WATER: Borehole remained DRY throughout.

All dimensions in metres Scale 1:43.75	Client One 17 SD	Method/ Plant Used Windowless Sampling	Logged By SW

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BOREHOLE LOG

Project				BOREHOLE No
Caledonian Road, Savile Town, Dewsbury				**WSL**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
11-183	20-06-13			
Contractor				Sheet
Arc Environmental Limited				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.60	B					(0.60) 0.60	Compact brown and grey sandy gravelly clay, with sandstone cobbles (MADE GROUND).		
0.60-1.00	B					(0.40) 1.00	Compact dark brown slightly gravelly sand, with sandstone fragments and rootlets (MADE GROUND).		
1.00-1.45	SPT	N=17				(0.60) 1.60	Medium dense brown slightly gravelly SAND, Gravel consists of sandstone (possible completely weathered bedrock) (RESIDUAL SOIL).		
1.00-1.60	B								
1.60-1.95	B					(0.35) 1.95	Orangish brown and grey weathered sandy MUDSTONE (CARBONIFEROUS COAL MEASURES).		
1.95-2.10	B					(3.10) 5.05	Light brown and orangish brown weathered sandstone MUDSTONE and SILTSTONE (CARBONIFEROUS COAL MEASURES).		
2.00-2.45	SPT	N=19							
3.00-3.45	SPT	N=41							
3.00	B								
3.00-3.70	B								
3.70-4.15	SPT	N=34							
4.20	B								
4.70-5.05	SPT	75 blows							
4.70	B								
							Borehole complete at 5.045m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	WATER: Borehole remained DRY throughout.

All dimensions in metres Scale 1:43.75	Client One 17 SD	Method/ Plant Used Windowless Sampling	Logged By SW

AGS3 UK BH 11-183 BH LOGS.GPJ AGS3_ALL.GDT 14/8/13

ROTARY CORE PHOTOGRAPHIC RECORD

CORE DETAILS	
BOREHOLE REF	CP6
CORE SECTION (DEPTHS)	7.50M to 12.00M
CORE RECOVERY	LESS THAN 100% CORE RECOVERY THROUGH CORE RUN

Client:
SAVILE DEVELOPMENTS

Project Title:	Drawing Title:
Proposed Health Centre Development Land Adjacent to Caledonian Road / The Sidings, Dewsbury	Rotary Core Photographic Record Sheet

Job Reference:	Drawing Number:	Revision:
11-183	-	-

Drawn by:	Date:	Scale at A4:
P.D	03.09.13	NTS @ A4

Checked by:	Approved by:	
T.M	T.M	The contractor shall check all dimensions on site before commencement of any works. No dimensions to be scaled off this drawing.

rev.	date	amendments	drawn	chckd

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Appendix VI

Photographs of Foundation Excavations (May 2014)

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Plate 1

Plate 2

Plate 3

Plate 4

Plate 5

Plate 6