



**ARP GEOTECHNICAL LTD  
CHARTERED CONSULTING ENGINEERS**

**COMBINED STAGE 1 & 2  
DESK STUDY AND GEO-ENVIRONMENTAL REPORT**

**FOR**

**SITES FOUR AND FIVE**

**LAND AT CROSSLEY LANE, DALTON  
HUDDERSFIELD**

**ON BEHALF OF**

**MINERVA WORKS DEVELOPMENTS LTD**

**MARCH 2017**

<b>Report No: MWD/01r2</b>	<b>Name</b>	<b>Date</b>
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# CONTENTS

	Page	
1.0	Executive Summary	3
2.0	Terms of Reference	4 - 5
3.0	Site Description	6 - 10
4.0	Environmental Setting	11 - 14
5.0	Preliminary Risk Assessment and Conceptual Model	15 - 19
6.0	Site Investigation	20 - 21
7.0	Summary of Ground Conditions	22 - 27
8.0	Contamination Analysis	28 - 45
9.0	Geotechnical Testing	46 - 47
10.0	Comments and Conclusions	48 - 55

## APPENDICES

Appendix A	Site Location Plan and Site Plan
Appendix B	Ordnance Survey Archive Maps
Appendix C	Landmark Geology Maps
Appendix D	Landmark Envirocheck Report
Appendix E	Indicative Proposed Site Layout
Appendix F	Borehole and Trial Pit Location Plan and Logs
Appendix G	Laboratory Test Certificates and Screening Values
Appendix H	Gas Monitoring Report
Appendix J	Contamination Remediation Statement

## 1.0 EXECUTIVE SUMMARY

The pertinent conclusions of the report are tabulated below. However, the information below is not exhaustive, and it is recommended the report is read in its entirety.

Proposed Development	Residential dwellings with private gardens.
Existing Site Description	Site comprises "Site 4" & "Site 5" of larger site. Site 4 mainly covered by concrete slabs. Large retaining wall on the north. Site 5 covered mainly by slabs. Vegetation on the south.
Site History	Site 4 - dye and bleach works post 1918. Site 5 - small gas works then dye and bleach works.
Geology	Undifferentiated strata (mudstones, siltstones and minor sandstone). Alluvial deposits are shown to overlie the solid strata on Site 5, and on the southern tip of Site 4. Fault crosses Site 5.
Coal Mining	Site can be considered stable.
Hydrogeology	Secondary A Aquifer. No sensitive abstractions within 1km.
Hydrology	Nearest watercourse is a beck, beyond site boundary to the south of Site 5. No sensitive surface water abstractions within 1km of the site. Flood risk on Site 5.
Radon	Basic protection measures recommended.
Landfill Gas	CS2/Amber 1 Gas protection required.
Ground Conditions	Made ground up to 2.6m thick on Site 4, and at least 3.45m thick on Site 5, over cohesive and granular subsoils.
Contamination	Widespread generally elevated determinands on both sites. Localised hydrocarbons, including volatiles.
Remediation Strategy	Remove localised hydrocarbons from site. Retain rest of made ground below hard areas and/or below 0.6m thick clean soil in soft areas, with 100mm hard break layer or geotextile/geogrid below.
Foundations	Piles are likely to be the favoured solution, with the exception of the northeastern third of Site 4, on which strip/trench fill foundations should be feasible.
Excavations	Liable to localised collapses and water ingress.
Concrete	FND2z designation for unreinforced buried concrete. For reinforced concrete, other design-specific mixes will apply.
Soakaways	Unlikely to be suitable for use on the site.

## **2.0 TERMS OF REFERENCE**

- 2.1 Minerva Works Developments Ltd is considering developing the site at Crossley Lane, Dalton, Huddersfield, with residential properties. The larger site comprises five areas, which are referred to as "Site 1" to "Site 5". This report deals only with Site 4 and Site 5. Site 1, Site 2 and Site 3 have been investigated separately under ARP report reference MWD/01r1, issued on 2<sup>nd</sup> August 2016. It was considered appropriate to implement a desk study and ground investigation to provide information to aid viability assessment and design of any subsequent development.
- 2.2 ARP Geotechnical Ltd was appointed by Minerva Works Developments Ltd to carry out the investigation, which involved a desk study assessment of the geological and coal mining aspects, Ordnance Survey archive maps, radon gas, indicative flood risk, hydrogeology, landfill, and other environmental issues, primarily by assessment of a Landmark Envirocheck Report, but also by assessment of a Geo-environmental Appraisal, by Sirius Geotechnical and Environmental Ltd, dated March 2006, under reference C1273. This report included details of intrusive ground investigations.
- 2.3 In addition, the above information was supplemented by an intrusive investigation by ARP Geotechnical Ltd.
- 2.4 The investigation was implemented generally in accordance with BS 5930 : 1999 "Code of practice for site investigations", NHBC Standard Chapter 4.1 "Land quality - managing ground conditions", Environment Agency CLR 11 "Model Procedures for the Management of Land Contamination" and BS10175 : 2011 + A1 : 2013 "Investigation of potentially contaminated sites - Code of practice". This report is limited to the data obtained as part of this investigation. It should be noted that there is a possibility of variation in ground conditions between test locations and interpretation of strata is given for guidance only. No liability is accepted for changes to site conditions, including groundwater levels, after the preparation of this report.

- 2.5 The general observation and assessment of the ground surface, and the identification/classification of vegetation is made in general terms only. It would be prudent for a specialist to undertake a more detailed survey, including for any invasive/harmful weeds.
- 2.6 The assessment of any topsoil is carried out in terms of potential chemical effects on human health only, and no account is taken of aesthetic or horticultural properties. Such considerations should be referred to a horticulturist or landscape architect.
- 2.7 The report has been prepared for the use and reliance of the Client only. The report shall not be relied upon or transferred to any other parties without the written agreement of ARP Geotechnical Ltd. For the avoidance of any doubt, where ARP Geotechnical Ltd enters into a letter of reliance for the benefit of a third party, that third party will be permitted to rely on the report. No responsibility will be accepted where this report is used, either in its entirety or in part, by any other party without ARP Geotechnical Ltd.'s consent.

### **3.0 SITE DESCRIPTION**

#### Site Location

- 3.1 The area covered by this report (“The Site”) comprises Site 4 and Site 5 of a larger area. The site is centred on Ordnance Survey Grid Reference 417360, 417360, and is located to the north and to the south of Crossley Lane, in Dalton, which is located approximately 3km to the east of the town of Huddersfield. Site 4 is located to the north of Crossley Lane and to the east of Cold Royd Lane. Site 5 is located to the south of Crossley Lane and to the north of Ox Field Beck.
- 3.2 A site location plan and site plan are presented in Appendix A.

#### On - Site Features

##### **Site 4**

- 3.3 Site 4 is an almost rectangular piece of land extending to an area of approximately 120m (southwest to northeast) by 100m (northwest to southeast).
- 3.4 Across the majority of the site, the ground is covered with concrete slabs. Until recent demolition, more than 50% of the site was covered by industrial buildings, with the central belt of the site (east to west) having no building cover. All of the industrial buildings have now been demolished.
- 3.5 The majority of the site slopes downwards gently to the south-southwest. On the north of the site is a large concrete retaining wall (east to west, along the northern boundary). There is a 2m to 3m high raised platform area below this retaining wall, also of concrete construction. Below this platform, and centrally on the site, are large stockpiles of demolition waste, including intact and crushed construction materials such as brick, concrete block, metal and wood.

- 3.6 On the southwest of the site, there are two cylindrical tanks approximately 3m in diameter and 4m in height, seated within a bund of concrete block construction, with associated pipework intact, and labelled to have contained ferric chloride. Intersecting the site on the southeast is a bund of crushed construction materials, approximately 2m to 3m high.

### **Site 5**

- 3.7 Site 5 is an irregular shaped piece of land extending to an area of approximately 290m (west northwest to east southeast) by 140m (south southwest to north northeast).
- 3.8 There is only a thin strip of land (maximum width of 20m) along the southern boundary of the site which is not capped with hardstanding. Until their recent demolition, most of the site was occupied by six large adjoined industrial buildings. The buildings have now been demolished, with the concrete ground slabs left intact.
- 3.9 The site slopes gently down to the southwest. However, the majority of the site is currently flat in the area of the former industrial buildings. Therefore, on the southwest of the site, the concrete ground slab of the former buildings is retained 1.5m above ground level. On the northeast of the site, the concrete floor slab of the former buildings is at ground level.
- 3.10 There is a car parking area on the northwest of the site (45m by 30m) and a small, fenced electricity substation is indicated on plans nearby, but this had been removed at the time of the investigation. On the east of the site, three above ground gas tanks (possibly propane) are present, as well as a fuel filling pump (possibly diesel), which is likely to be fed by an underground storage tank (unknown volume). Beyond the hardstanding on the south of the site, the concrete base of a large cylindrical storage container (possibly gas) is present. A main sewer intersects the southwest of the site (east southeast to west northwest). A high pressure gas main (17 bar) crosses the watercourse to the south of the site, enters the site and turns west exiting the site in the southwestern corner.

### Site Boundaries and Surrounding Land Use

- 3.11 Site 4 is bounded to the north by a large concrete retaining wall extending approximately 5m above ground level, which retains a strip of land formerly occupied by the Kirkheaton branch railway, and now occupied by third party private gardens. To the east, the site is open onto the larger derelict site (Site 3). To the south, Site 4 is bounded by a metal rail fence, beyond which is Crossley Lane, orientated northwest - southeast. To the west, the site is bounded by a metal rail fence, beyond which is Cold Royd Lane.
- 3.12 Site 5 is bounded to the north by a metal rail fence, with two separate entrances large enough to accommodate heavy good vehicles, beyond which is Crossley Lane (orientated northwest - southeast). To the east, the site is bounded by a chain link fence with concrete posts, beyond which is an area with a single storey building, possibly associated with Northern Gas Networks, which is enclosed by Albany Road to the southeast. The site is bounded to the south by Ox Field Beck, which flows from east to west. Dense vegetation is present along the southern boundary of the site.

### Site History

- 3.13 Ordnance Survey archive maps were obtained for the site. Copies of the maps are included in Appendix B, and a summary of the findings is given below.

<b>Map Date</b>	<b>On-Site</b>	<b>Off-Site</b>
1854-1855	Both sites generally comprise agricultural fields.	Generally surrounded by agricultural fields.  Beyond the site boundary to the east of Site 5, Lepton Mill (Corn) is indicated.
1893	Site 4 generally comprises agricultural fields. Industrial buildings encroach onto the east of the site, from the more developed industrial area to the east. A railway embankment is shown along the northern site boundary (Kirkheaton Station is	To the east of Site 4, industrial buildings of Coal Tar Colour Works are now shown.  A railway embankment is shown along the northern boundary of Site 4. Kirkheaton Station is shown 150m to the southeast of Site 4, and less than

	<p>at 100m to the northeast).</p> <p>Site 5 is shown largely as agricultural fields, except for Lepton Gas Works which are shown in the centre extending to the southern boundary (comprises two cylindrical structures and two small buildings).</p>	100m to the northeast of Site 5.
1907	<p>No significant changes on Site 4.</p> <p>On Site 5, the two cylindrical structures no longer shown, and development no longer labelled as Lepton Gas Works.</p>	Adjacent to the east of Site 4, and adjacent to the north of Site 5, the Coal Tar Colour Works now labelled as Minerva Works (Dyeing and Bleaching).
1918-1919	<p>On Site 4, industrial buildings now shown across the south of the site.</p> <p>On Site 5, further development shown along the northern boundary, probably associated with the Minerva Works to the north.</p>	No significant changes.
1958-1961	<p>On Site 4, further industrial development shown with one large building across the north and centre, and smaller buildings on the south. Labelled as Works.</p> <p>On Site 5, in the centre of the site, further development of numerous smaller industrial buildings is shown. An embankment is shown running approximately from north to south, indicating filling to achieve a level development area. On the north of the site, trenches/pits are shown in an 'm' shape (approx. 40m by 30m).</p>	<p>To the east of Site 5, Lepton Mill (Corn) now labelled as Works, and has been developed with a large industrial building.</p> <p>Immediately to the south of Site 5, a Pump House is indicated, adjacent to the west of where Ox Field Beck meets Lees Head Beck.</p>
1967	<p>On Site 4, industrial buildings labelled as Minerva Works. The railway elevated on the embankment along the northern</p>	No significant change.

	<p>site boundary now indicated as Dismantled Railway.</p> <p>On Site 5, a substation is shown approximately central along the northern boundary. Site is labelled as Minerva Works.</p>	
1985-1989	<p>On Site 4, the large central industrial building shown as extended to the north, to incorporate the former railway embankment and track.</p> <p>On Site 5, the most recent building layout is now shown, with one large building covering the majority of the site. On the south of the site, two structures are shown, the larger of which is a circular water sprinkler tank identified in the Sirius report.</p>	No significant change.
1993	Site 4 now labelled as Works.	To the south of Site 5, Round Wood Beck has been re-routed.
Present day	All buildings on the Site 4 and Site 5 have been removed, with concrete slabs remaining.	No significant change.

3.14 In summary, the east of Site 4 was shown to be encroached on from the adjacent “Coal Tar Colour Works” from as early as 1893, at which time a railway and embankment is shown to the north of Site 4 (dismantled sometime prior to 1958). By 1918, this activity covered most of the south of Site 4 (part of Minerva Works Dyeing and Bleaching). On Site 5, a small gas works was shown on the 1893 map, but no later. By 1918, Minerva Works Dyeing and Bleaching was shown to encroach south onto Site 5. By 1958, the central third of Site 5 is shown to be developed. The most recent ground layout is visible by 1985.

## 4.0 ENVIRONMENTAL SETTING

### Geology

- 4.1 Extracts from the British Geological Survey 1:50,000 Series Geology Maps are included within the Envirocheck Geology Report in Appendix C. The maps show Site 4 and Site 5 to be underlain by undifferentiated strata (mudstones, siltstones and minor sandstone) of the Pennine Lower Coal Measures. Superficial alluvial deposits are shown to overlie the solid strata on Site 5, and on the southern tip of Site 4.
- 4.2 A significant northwest - southeast trending fault passes through the wider site area. The fault crosses the southwest of Site 5 and passes to the west of Site 4. The fault is shown to downthrow strata to the northeast.

### Coal Mining

- 4.3 A coal mining report was included in the third party report by Sirius (under ref. C6268). A summary of the report is given below.
- 4.4 The site is not within the zone of influence of past underground coal workings. The site is unaffected by any present or future proposed underground coal workings. The authority refers to reserves of coal in the locality which could be worked at some time in the future subject to feasibility, licences, and planning consents. However, given the abandonment of the coalfields in this region, future workings are considered highly unlikely.
- 4.5 There are no recorded mine entries within, or within 20 metres of, the site. The site is unaffected by any opencast coal mining.
- 4.6 In view of the above, the site is considered stable with regard to coal mining.

### Coal Recovery

- 4.7 The shallowest coal seam of significant thickness beneath the site is the Hard Bed, which is indicated to be at a depth of at least 100m below all two of the sites. Therefore, there are no seams at sufficiently shallow depth to enable extraction by open excavation. There will be no arisings of coal during proposed development works, and it will not be possible to win any coal from the site before development.

### Hydrogeology

- 4.8 The Landmark Envirocheck Report, included in Appendix D, indicates the Bedrock Aquifer Designation and the overlying Superficial Aquifer Designation are designated a "Secondary A" Aquifer". These Aquifers comprise "permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers".
- 4.9 The soils overlying the site are automatically classed as High Leaching Potential, due to the urban nature of the area. However, actual Leaching Potential will be dependent on the specific ground conditions found on the site.
- 4.10 There is one licensed groundwater abstraction located to the east of Site 4 and to the north of Site 5, which appears to be located within the boundary of the wider Minerva Works site, registered to Jarmain and Sons Ltd (Minerva Works). There are several active groundwater abstractions within 1km of the site, none of which are for sensitive uses.
- 4.11 The site is not within a groundwater Source Protection Zone.

## Hydrology

- 4.12 The general area slopes to the south southwest. The nearest downslope surface water is Ox field Beck which flows west beyond the boundary to the south of Site 5. Beyond the boundary to the west of Site 5, Ox Field Beck is renamed Lees Head Beck, and then flows north being renamed Lees Beck.
- 4.13 Any surface water run-off from Site 4 is likely to be intercepted by road drainage of Crossley Lane or Cold Royd Lane, and from Site 5 is likely to infiltrate the soils and enter Ox Field Beck. In both cases, run-off is likely to eventually enter the Beck.
- 4.14 Site 4 is not at risk of river flooding. On Site 5, the area in the east is within both Zone 2 and Zone 3 flood risk areas. The southern margins and northwest of the site are within a Zone 2 flood risk area. It would be prudent to consult with the Environment Agency with regard to proposed finished floor levels on Site 5, and a Flood Risk Assessment Report is likely to be required. The risks of flooding from other causes, such as adverse topography or insufficient surface water drainage, are not considered in the Envirocheck Report.
- 4.15 There is one surface water abstraction registered within the wider Minerva Works site area, which is located to the east of Site 4 and to the north of Site 5, for Jarmain and Son Ltd. Given the current condition of the site, this abstraction is likely to be inactive. There are three licensed surface water abstraction within 1km of the site, at approximately 431m to the southeast (Jarmain and Son Ltd), 874m to the northwest and 963m to the northwest (Syngenta Ltd). The former is not down hydraulic gradient of the site, and the latter are for non-sensitive industrial purposes (general industrial and general cooling).

## Other Environmental Data

4.16 The Landmark Envirocheck Report, included in Appendix D, contains information on numerous environmental aspects. A summary of the pertinent findings, not already covered, with additional comments, is given below.

4.16.1 There is one Pollution Control Authorisation to the east of Site 4 and to the north of Site 5, on the Minerva Works site, registered to Jarmain and Son Ltd, which has many variations, all of which have been revoked or superseded. There are no active Pollution Control Authorisations within 250m of the site.

4.16.2 There are no discharge consents relating to, or adjacent to, the site.

4.16.3 There are two recorded landfills within 250m. The nearest is adjacent to the south of Site 5, and accepted "excavation waste from Fenay Beck" and "inert and commercial" material. The furthest is 178m to the southeast, and accepted inert material.

4.16.4 No radon protective measures are stated to be necessary for new dwellings or extensions on the site. However, the site is in an intermediate probability radon area, as between 1% and 3% of homes are above the action level. In these circumstances of apparent conflict, it may be prudent to assume basic radon protection is required, to prevent conveyancing difficulties.

4.16.5 Three contemporary trade directories are listed for the site address, the precise locations of which are not clear. One relates to the supply of fireplaces and surrounds. The two others relate to hydraulic cylinder repairs and sheet metal working. Site 5 is known to have been used as a large warehouse for tiles and it is therefore more likely that these recent activities occurred on Site 4.

4.16.6 There are no fuel station entries within 150m of the site.

## **5.0 PRELIMINARY RISK ASSESSMENT AND CONCEPTUAL MODEL**

5.1 Part II A of the Environmental Protection Act (EPA) 1990 became effective from 1<sup>st</sup> April 2000. The Regime was introduced by the Contaminated Land (England) Regulations 2000 (SI 2000, No. 227) along with the associated DEFRA Circular February 2000.

5.2 Section 78A (2) of the Act defines "Contaminated land is any land ..... in such a condition, by reason of substances in, on or under that land that -

(a) significant harm is being caused or there is a significant possibility of such harm being caused; or

(b) pollution of controlled waters is being caused, or there is a significant possibility of such pollution being caused".

From S78A (4) "Harm" : means harm to the health of living organisms or other interference with the ecological systems of which they form part and, in the case of man, includes harm to his property.

Controlled waters are defined as "...the waters in any relevant lake or pond, or of so much of any relevant river or watercourse as is above the freshwater limit, and ground waters, that is to say, any waters contained in underground strata". From the 1<sup>st</sup> October 2004, the definition of groundwater in relation to Part IIA was amended, by the Second Water Act Commencement Order SI 2004 No 2528. This makes clear that "ground waters" does not include waters above the saturation zone, i.e. does not include any soil water and pore water present in the unsaturated zone.

5.3 The objectives of the regime are to ensure that risks associated with contaminated land are reduced to an acceptable level, having regard to the costs of doing so. The costs should be proportionate, manageable and economically sustainable.

- 5.4 In assessing risk, it is necessary to consider the probability, or frequency, of occurrence of the hazard and the magnitude/seriousness of the consequences. Consequently, for land to be classified as contaminated, it must have, or be very likely to have, a detrimental effect on humans or the environment before it can be classified as contaminated land.
- 5.5 In establishing risk, the concept of the pollutant source/pathway/receptor linkage model, based on current and proposed site use, is to be considered. Therefore for a site to be deemed contaminated under the Regime, all three linkages must be in place i.e. the site must not only contain harmful substances, but the substances must have a pathway by which to leak out and cause significant harm to a receptor.
- 5.6 In September 2004, the Environment Agency published the Contaminated Land Report (CLR) 11, "Model Procedures for the Management of Land Contamination". The document is intended to provide the technical framework for structured decision making about land contamination, and is intended to assist all those involved in "managing" the land, in particular landowners, developers, financial service providers, planners and regulators. As the document currently provides the framework for best practice, the general principles are, therefore, followed in conducting the assessment below.

#### Conceptual Site Model

- 5.7 It is known that the site is proposed for residential properties with private gardens. An indicative proposed site layout is included in Appendix E. The solid strata comprise undifferentiated strata (mudstones, siltstones and minor sandstone). Superficial alluvial deposits are shown to overlie the solid strata on Site 5, and on the southern tip of Site 4. The strata beneath the site are designated a Secondary A Aquifer, and the soils are likely to be of High Leaching Potential. The nearest downslope surface water is Oxfield Beck, which flows west beyond the boundary to the south of Site 5. There are no groundwater or surface water abstractions for sensitive uses within 1km of the site. There is a recorded landfill adjacent to the south of Site 5, and one 178m to the southeast.

- 5.8 Site 4 has been used for "Dyeing and Bleaching", including the use of coal tar, and later probably used for sheet metal working and hydraulic cylinder repairs. On Site 5, a small gas works operated for a short period, followed by dyeing and bleaching works, and later a tile warehouse. The most likely contamination sources are considered to be:
- 5.8.1 Possible made ground: - metals inorganics, TPH, PAH, phenol, asbestos.
  - 5.8.2 Additional possible contamination from industrial activity (dyeing and bleaching, gas works, engineering works): - metals inorganics, PAH, VOCs, elevated pH.
  - 5.8.3 Additional possible contamination from burning of coal/fuels for heat and power: - PAH, TPH, metals.
  - 5.8.4 Possible leakage from operating and re-fuelling vehicles and machinery: - TPH, PAH.
  - 5.8.5 Possible ground gas generation due to thickness of made ground, and landfills to the south and southeast: - methane, carbon dioxide and VOCs.
  - 5.8.6 Possible leakage from electricity substation (Site 5): - PCBs
- 5.9 The conceptual model needs to consider sources of contamination, pathways along which contaminants could migrate and the receptors, which may become exposed. Guidance published by the Environment Agency has been consulted with regard to pathways and receptors. The potential sources, pathways, and receptors, applicable to the proposed development are identified on the table below. Any pathways in italics are deemed not to be viable (and the reason given in brackets).

## Potential Source - Pathway - Receptor Matrix

Contamination Sources	Pathways	Receptors
<p>Possible made ground - metals, inorganics, TPH, PAH, phenol, asbestos</p> <p>Possible contamination from industrial activity: - metals inorganics, PAH, VOCs, elevated pH</p> <p>Possible contamination from burning of coal/fuels for heat and power: - PAH, TPH, metals</p> <p>Possible leakage from operating and re-fuelling vehicles and machinery: - TPH, PAH</p> <p>Possible leakage from electricity substation (site 5): - PCBs</p>	<ul style="list-style-type: none"> <li>Inhalation, ingestion and dermal contact with soil and dust</li> <li>Fruit and vegetable intake (with soil)</li> <li>Vapour inhalation outdoor</li> <li>Vapour inhalation indoor</li> </ul>	<p><b>Humans:-</b></p> <ul style="list-style-type: none"> <li>Future occupants</li> <li>Construction workers</li> <li>Maintenance workers</li> <li>Adjacent residents and general public</li> </ul>
	<ul style="list-style-type: none"> <li>Migration in surface water</li> <li>Migration in groundwater</li> </ul>	<p><b>Controlled waters:-</b></p> <ul style="list-style-type: none"> <li>Groundwater (Secondary A Aquifer, no sensitive abstractions within 1km)</li> <li>Surface water (nearest downslope is adjacent to the south of Site 5. No sensitive abstractions within 1km)</li> </ul>
	<ul style="list-style-type: none"> <li>Root uptake</li> </ul>	<p><b>Vegetation:-</b></p> <ul style="list-style-type: none"> <li>Landscape areas</li> <li>Private gardens</li> </ul>
	<ul style="list-style-type: none"> <li>Migration</li> </ul>	<p><b>Services/Utilities:-</b></p> <ul style="list-style-type: none"> <li>Potable water supply</li> </ul>
	<p>Ground gas generation, including landfill within 250m: - methane, carbon dioxide and VOCs</p>	<ul style="list-style-type: none"> <li>Asphyxiation</li> <li>Explosive risk</li> </ul>

5.10 The above matrix indicates there are several potential source - pathway - receptor linkages applicable to the proposed development.

5.11 The assessment was used to inform the design of the subsequent ground investigation. To fully characterise the site, in accordance with BS10175 : 2011 + A1 : 2013 "Investigation of potentially contaminated sites - Code of practice", and to address the above concerns, it was decided that, in addition to geotechnical information required, the site investigation should include:-

- 5.11.1 Trial pit excavations and window sample boreholes carried out on a grid basis, to satisfy the requirements of the British Standard, along with any targeted locations.
- 5.11.2 Samples of the made ground issued for testing for a broad suite of determinands, including metals, inorganics, asbestos, phenols, speciated polyaromatic hydrocarbons (PAH), and total petroleum hydrocarbons (TPH). It was determined that volatile organic compounds (VOCs) and polychlorinated biphenols (PCBs) should also be tested for, due to the historical activities on the site.
- 5.11.3 Landfill gas monitoring due to significant thicknesses of made ground, and landfills within 250m.
- 5.11.4 Upon receipt of contamination test results, any elevated TPH would be speciated to allow further risk assessment, and leachability testing undertaken on all elevated determinands, to give indication of mobility.

## **6.0 SITE INVESTIGATION**

- 6.1 The purpose of the investigation undertaken in June 2016 was to produce an assessment of the site in accordance with BS10175 : 2011 + A1 : 2013 "Investigation of potentially contaminated sites - Code of practice", and to provide geotechnical information to aid design of the development.
- 6.2 The site was gridded on an approximate 25m spacing and trial pits were excavated and sampled on the grid, to satisfy the requirements of the British Standard, along with any targeted locations.
- 6.3 The ARP Geotechnical Ltd investigation on Site 4 comprised:-
- Seven trial pits to depths of between 2.9m and 3.6m
  - Ten windowless sample boreholes to depths of between 0.9m and 5.45m
  - Dynamic probes from the base of two boreholes, to a depth of 9m
  - Installation of monitoring wells in two of the boreholes
- 6.4 The ARP Geotechnical Ltd investigation on Site 5 comprised:-
- Twenty six trial pits to depths of between 2m and 3.2m
  - Twenty windowless sample boreholes to depths of between 3.45m and 5.45m
  - Dynamic probes from the base of eight boreholes, to depths of between 8.1m and 10m
  - Installation of monitoring wells in five of the boreholes

6.5 The trial pits and boreholes were organised, supervised and logged by an Engineer from ARP Geotechnical Ltd. The positions were selected to achieve a 25m grid to satisfy the requirements of the British Standard, along with any targeted locations. All the locations formed part of the grid. Some of the locations were also used to target specific features. Details of these are given below.

<b>LOCATION</b>	<b>REASON</b>
TP6	Targeting former electricity substation
TP18 and TP19	Targeting small former gas works location
WS19	Targeting former possible fuel filling point and buried tank
WS38 and WS47	Targeting above-ground tanks

6.6 Seven ground gas monitoring wells were installed, in WS30, WS36, WS2, WS4, WS9, WS15 and WS17, and subsequently monitored by ARP Geotechnical Ltd. The wells were installed to 3m depth, with the bottom 2m comprising slotted pipe with gravel surround, and the upper 1m comprising plain pipe with bentonite seal and lockable flush cover. Ground gas monitoring results, and conclusions, have already been issued for the larger site, which includes the subject area of this report. Reference should be made to the report, which is included in Appendix H.

6.7 The trial pit and borehole logs are included in Appendix F, along with the location plan.

6.8 Chemical analysis of sixty three (63) soil samples, for metals, inorganics, speciated PAH, TPH, phenols, and asbestos, was undertaken by the UKAS accredited DETS Laboratory in Consett. Elevated determinands were tested further for leachability to determine the potential mobility of the contaminants. In addition, selected samples were tested for VOCs and PCBs. The test certificates are included in Appendix G.

6.9 Analysis for Atterberg Limits, moisture content, pH and water soluble sulphate was undertaken by the UKAS accredited Professional Soils Laboratory (PSL) in Doncaster. The test certificates are included in Appendix G.

## 7.0 SUMMARY OF GROUND CONDITIONS

### Strata and Groundwater

#### **Site 4**

- 7.1 Made ground was identified in all seven trial pits and all ten window sample boreholes. Concrete was present at the surface at each location, between 0.1m and 0.3m in thickness, and often reinforced with steel bars, with the exception of TP40 and WS36. At TP40 (in the centre of the site), sandy gravel of sandstone, brick and concrete (crushed construction materials) was present at the surface, with a relict buried concrete slab identified at 0.3m depth. At WS36 (in the west of the site), sandy gravel of sandstone, brick, clinker and ash was present at the surface, to a depth of possibly up to 2m. Beneath the surface materials described above, both cohesive and granular made ground was present. Most of the made ground comprised granular material and cohesive made ground was present to a lesser extent, as horizons of re-worked natural material.
- 7.2 Granular made ground was present in all locations, to a depth of between 0.4m (TP34, TP35, TP38, WS27 and WS28, in the north and northeast of Site 4) and 2.6m (WS31, west of the site's centre). Granular made ground typically comprised a mixture of sandy gravel of sandstone and/or limestone, and reworked natural materials, such as gravel of sandstone, mixed lithologies (mudstone, siltstone) and trace coal.
- 7.3 Cohesive made ground was identified generally as a minor horizon within the granular made ground, with a thickness between 0.3m (WS36, in the northwest of Site 4) and 2.1m (TP39, east of the site's centre). Cohesive made ground typically comprised re-worked natural materials such as gravelly clay, in which the gravel component included weathered mudstone, siltstone, sandstone and trace coal.
- 7.4 The majority of concrete roads, floors and retaining walls, still remain intact at the surface. A probable sandstone flag floor was present in TP39, from 0.3m to 0.4m depth. Two above ground storage tanks remain in the southwest of the site. An intact buried

drain/culvert was identified, adjacent to the west of TP36, and orientated northeast to southwest.

- 7.5 Below the made ground in the north of the site, cohesive superficial deposits, comprising medium strength/firm (TP36, WS27, WS36) to high strength/stiff (TP34, TP35, WS28, WS29) gravelly clay (or clayey gravel, TP37) was present, in which the gravel component included mudstone, siltstone and sandstone. The cohesive deposits were present between 2m and 4m depth (and up to 5.45m in WS27 and WS28 due to an elevated relative ground level) and are considered likely to be head material. There were no SPT refusals recorded in the upper 5.45m of probable head deposits, although N values ranging from N=9 to N=28 were recorded.
- 7.6 Below the made ground across the site, both cohesive and granular alluvial deposits were present. In general, cohesive alluvial deposits formed the upper layers of the profile, comprising low strength (soft) to high strength (stiff) slightly silty slightly sandy gravelly clay. Cohesive deposits were also present at greater depths i.e. in TP40 from 2.3m to 3m, and WS38 from 2.4m to 4.45m. Granular alluvial deposits were present beneath, comprising loose to dense slightly clayey sandy angular to rounded gravel of mainly sandstone, and locally with subangular cobbles. Two SPT refusals were recorded in the upper 5.45m of alluvial deposits: in the location of WS29 (north of the site's centre), at a depth of approximately 5m, and in the location of WS39 (in the south of Site 4), at a depth of 4.395m. N Values ranging from N=6 to N=27 were recorded through the alluvial deposits.
- 7.7 Trial pits terminated at between 2.8m depth (TP37) and 3.6m depth (TP36) in 'hard to dig' strata (granular alluvial deposits and probable head deposits). In the location of TP37 (north of the site's centre) further excavation beyond 2.8m was prevented, due to a concrete obstruction at the surface preventing full movement of the excavator arm. Window sample boreholes terminated between 3.45m (WS30 and WS36) and 5.45m depth (WS24, WS27 and WS28), in medium dense to dense deposits, or in the case of WS27, WS28, WS36, medium strength (firm) to very high strength (very stiff) alluvial clays.

- 7.8 In three locations, the window sample boreholes were extended through alluvial deposits from the base of the borehole by dynamic probe. In the locations WS24 and WS31, refusal was met at 9.0m, on what is interpreted to be extremely weak to weak (N=150) bedrock strata (possibly mudstone as part of the wider Lower Coal Measures strata).
- 7.9 Slight instability of the trial pit sides was noted in TP34 and TP35 in the upper 0.4m, in TP36 and TP39 in the upper 1m, and in TP37 in the upper 1.2m. Instability was generally associated with the presence of granular made ground. Rapid water ingress was noted in the location of TP38 from the surface, from between the joints of surface slabs. Rapid groundwater ingress was noted in the location of WS39 below 1m depth. In the locations of WS36 and WS39, instability of the borehole was noted in the upper 2m. In the locations of WS24 and WS29, it was noted that the strata were wet below 1m and 4m, respectively.

#### **Site 5**

- 7.10 The concrete floor slabs, footings and retaining walls (along the south and west of former building footprint) remain intact. In the east of the site, a fuel filling point and three gas storage tanks (in an enclosure) are visible. An underground fuel storage tank may be present associated with the fuel pump. However, there is no visual evidence of hydrocarbon staining in the location of WS19 (former fuel filling point). Bitmac is present in the northwest (former car parking area).
- 7.11 Made ground was present in all twenty six trial pits and twenty window sample boreholes, between 0.5m (TP4, WS3 and WS19) and at least 3.45m (WS7). However, it should be noted that in the locations of TP10 (2.9m), TP12 (1.6m), TP15 (2m), WS7 (3.45m) and WS47 (2.08m), the bottom of the made ground could not be reached. The made ground is described in more detail below.
- 7.12 In general, a surface covering of concrete was present, between 0.1m and 0.35m in thickness, which was typically reinforced with steel bars, of 10mm to 20mm diameter,

and spaced lattice 0.1m to 0.3m apart. The full thickness of the concrete was often difficult to penetrate using a hydraulic rotary corer. In certain locations, the hydraulic breaker of the excavator was used to remove the surface slab prior to investigation. In the location of TP1 to TP3 and WS1 (in the northwest of Site 5), bitmac was present at the surface, with a recorded thickness up to 0.1m. In the locations of TP8, TP16, TP19, WS8 and WS47 (along the southern boundary of Site 5), granular made ground materials were present at the surface, up to 0.5m in thickness. In the locations of TP26, WS4, WS12 and WS15, made ground topsoil was present at the surface, up to 0.2m in thickness. Made ground topsoil is present locally only, in the south and west of Site 5.

- 7.13 In general, the upper layers of made ground (and the majority of made ground across the site) were granular and comprised angular tabular gravel sandstone, mudstone, siltstone, ash, clinker, brick, bitmac, and often with medium subangular cobble content of sandstone, siltstone and brick. Occasional boulders up to 0.5m were present locally.
- 7.14 To a lesser extent, often underlying the granular made ground, cohesive made ground was also encountered, comprising very low strength (very soft) to low strength (soft) slightly gravelly silty sandy clay, in which the gravel component includes sandstone, mudstone, brick and coal. In the location of TP10, TP11, TP13, TP14 and WS7 (west of the site's centre), cohesive made ground comprising dark and grey slightly gravelly silty sandy clay, in which the gravel component includes sandstone and clinker, was present, with a thickness in excess of 2m, and was found to contain strong visual and olfactory evidence of hydrocarbon, with a sheen, and possibly methylated spirits (TP13). In WS7, this deposit continued to at least 3.45m.
- 7.15 Below the made ground topsoil, both cohesive and granular alluvial deposits were present. In general, cohesive deposits formed the upper layer of the profile, comprising low strength (soft) to high strength (stiff) slightly silty slightly sandy gravelly clay. Cohesive deposits were also present at greater depths i.e. in WS6 from 4.8m to 5.45m depth. Granular alluvial deposits were present beneath, comprising loose to dense sandy subangular to rounded gravel of mainly sandstone, and locally with subangular cobbles. In the north of the site, granular deposits of sand (WS11) and silt (WS11 and WS17) are

present locally, up to 1.6m in thickness. There were six SPT refusals in the upper 5.45m of alluvial deposits, at WS3 (4.44m), WS8 (4.44m), WS11 (4.45m), WS12 (5.45m), WS14 (4.43m) and WS15 (5.45m). N vales ranging from N=0 to N=49 were recorded in the upper 5.45m of alluvial deposits.

- 7.16 The trial pits and boreholes generally terminated in the alluvial deposits, with the exception of TP10, TP12, TP15, WS7 and WS47. Bedrock was not proven.
- 7.17 In eight locations (WS1, WS6, WS7, WS9, WS10, WS16, WS18 and WS19), the window sample borehole was extended through the alluvial deposits, from the base of the borehole, by dynamic probe. In the location of WS7 and WS9 (to the west and northwest of the site's centre), the probe did not meet refusal by the termination depth of 10m. At WS7, the blow counts were varied and increased to a peak of N=93 (very dense if deposits are granular) at 9.3m, terminating on N=18 (medium dense if deposits are granular) from 9.9m. At WS9, the blow counts steadily increased with depth, to a maximum at 9.9m of N=129 (extremely weak rock, possibly mudstone as part of the wider Lower Coal Measures strata). The remaining dynamic probes met refusal at between 8.1m and 9.5m depth, on what is interpreted to be extremely weak to weak (N=150) bedrock strata (possibly mudstone as part of the wider Lower Coal Measures strata).
- 7.18 Slight instability of the pit sides was noted in TP1 to 1m, TP3 to 0.7m, TP9 to 1.6m, TP10 from 2.4m, TP16 from 1m to 2.3m, TP21 from 1.7m, TP25 from 1.4m and TP26 from 1.4m. Moderate instability of the pit sides was noted in TP5 to 1m. In general, instability of the pit sides was associated with coarse granular made ground and the presence of groundwater in the upper profile, and coarse granular alluvial deposits and the presence of groundwater in the lower profile. Slight groundwater ingress was noted in TP1 from 0.8m, TP2 from 2.25m, TP3 from 0.7m, TP4 from 2.1m, TP6 from 2.1m, TP7 from 2.2m, TP22, from 2.8m and TP24 from 2.4m. Moderate ground water ingress was recorded at TP10 from 0.5m, TP16 from 2m, TP20 from 2.4m, TP21 from 1.7m. In the window sample boreholes, strata were noted to be wet from 0.3m in WS11, from 1m in

WS17 and WS47, from 2m in WS3, WS4, WS5, WS7, WS13, WS13, WS14, WS15, WS18, from 3m in WS8, WS9 and WS12, and from 4m in WS6 and WS10.

### Gas Risk Assessment

- 7.19 Ground gas monitoring was carried out by ARP Geotechnical Ltd on the larger site (Sites 1 to 6 inclusive) and has already been reported. For all of Site 4 and Site 5, CS<sub>2</sub> gas conditions are indicated. CS<sub>2</sub> gas conditions are equivalent to "Amber 1" conditions under the NHBC traffic light classification system, indicating that low level gas protection measures are required, usually comprising a gas membrane and ventilated sub-floor void.

## 8.0 CONTAMINATION ANALYSIS

### Screening Values - Soils

- 8.1 There is presently conflicting opinion with regard to the appropriate generic assessment criteria, or screening values, for soils which should be used in contamination assessment for proposed development. In March 2014, DEFRA published Category 4 Screening Levels (C4SLs) for six contaminants: arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI and lead. The values are based on the toxicological benchmark of a "low level of toxicological concern" (LLTC) rather than the previous regulatory approach of "minimal or tolerable level of risk". As the C4SLs are less protective of health than the previous approach, the Chartered Institute of Environmental Health (CIEH) has advocated an alternative approach based on minimal risk, but with some adjustment of exposure parameters to more realistic scenarios than those previously used. To this end, the CIEH has collaborated with Land Quality Management to publish "Suitable 4 Use Levels" (S4ULs) "The LQM/CIEH S4ULs for Human Health Risk Assessment", November 2014 (LQM/CIEH). However, DEFRA has reiterated its intention that the C4SLs should be used in generic risk assessment for proposed development, and there is indication that other parties will collaborate, in the near future, to extend the range of C4SL determinands beyond the six published so far.
- 8.2 In the absence of a final resolution to the debate, soil contamination test results in this report have been compared first against the more conservative S4UL, and where a C4SL exists for the same determinand, consideration given to the use of the C4SL for any exceedences of the S4UL, within the site specific context. Where no S4UL exists for a determinand, for example lead, the C4SL has been used. The LQM/CIEH screening values have been calculated for soil organic matter contents of 1% and 2.5%, as well as 6%, and the appropriate screening value is used for the organic matter content of the soil. All the C4SL values published are for a soil organic matter content of 6%.
- 8.3 A table showing the screening values (SVs) utilised is included in Appendix G.

## Screening Values - Leachability and Groundwater

- 8.4 In order of preference, the Environmental Quality Standards (EQS) annual averages for freshwater have been used as generic screening values for these results. Where no EQS is available, the stringent UK Drinking Water Standards (DWS) have been used, and other sources in the absence of EQS and DWS, as indicated on the groundwater screening values table in Appendix G.

## Soils Analysis

- 8.5 Sixty-three (63) soil samples were issued to the UKAS accredited Derwentside Environmental Testing Services in Consett for a suite of testing (As, Cd, Cr (VI), Cr(III), Cu, Hg, Ni, Pb, Se, Zn, Total Sulphate, Water Soluble Sulphate, pH, Phenol-monohydric, Speciated PAH, Total TPH, Asbestos, and Organic Matter). Additional samples were tested for VOCs and PCBs at targeted locations. The testing comprised:

### **Site 4**

- Five samples of cohesive made ground
- Thirteen samples of granular made ground

### **Site 5**

- Three samples of made ground/topsoil
- Eighteen samples of cohesive made ground
- Twenty four samples of granular made ground

## EPH Screening Across Site 4 and Site 5

8.6 From all the samples commissioned for testing for EPH by ARP Geotechnical Ltd, in relation to both Site 4 and Site 5, the table below presents those which are above the initial in-house screening value, above which further speciated analysis is carried out.

**EPH (C10-C40) Exceedances**  
Site 4 and Site 5

Sample No	Depth (m)	Site (4 or 5)	EPH (C10-C40) mg/kg
TP01	0.80-1.00	5	660
TP12	0.60-0.80	5	890
TP13	1.40-1.60	5	760
TP14	1.00-1.50	5	1800
TP15	1.00-1.20	5	1200
TP26	0.40-0.60	5	540
WS10	0.75-0.90	5	2300
WS10	1.20-1.40	5	900
WS16	0.50-0.70	5	1200
WS47	1.50-1.70	5	920

8.7 In the light of the exceedances, ARP Geotechnical Ltd commissioned aliphatic - aromatic split speciation testing on the samples with the highest concentrations TP14 and TP15. The individual carbon - weighted components were compared against the screening values, and this indicated no exceedances. The EPH concentrations within the made ground are, therefore, shown to be acceptable.

### Statistical Approach

8.8 For each material on Site 4 and Site 5, any determinands with exceedances of screening values were subjected to statistical analysis in accordance with the CIEH and CL:AIRE document "Guidance on Comparing Soil Contamination Data with Critical Concentrations". The spreadsheet package from the USEPA called "Pro UCL" (Version 4.00.05) was used to carry out the analysis. Each dataset was tested for outliers, and after

removal of the outliers, assessed for "goodness of fit" to a normal distribution. Depending on the results, Upper Confidence Level (UCL) tests were carried out by either normal, gamma, log normal, or non-parametric methods. The results of the analysis are discussed below.

## Results for Site 4

### **Cohesive Made Ground**

8.9 A results summary table for determinands within the cohesive made ground, found to be above screening values, is given below.

<b>Location</b>	<b>Depth (m)</b>	<b>Lead</b>
<b>TP34</b>	<b>1.5-1.7</b>	17
<b>TP39</b>	<b>1.4</b>	44
<b>TP39</b>	<b>1.0</b>	290
<b>WS31</b>	<b>0.8-1.0</b>	130
<b>WS38</b>	<b>2.0-2.4</b>	83
	<b>Screening Value</b>	200.0
	<b>95% UCL*</b>	215.6

Exceedence

Outlier (and above screening value)

Acceptable (after removal of any outliers)

All values in mg/kg unless indicated otherwise

\* After removal of any outliers

8.10 It can be seen from the table that elevated concentrations of lead are considered to be widespread, as the 95% UCL concentration is above the screening value, with no outliers. This will need to be considered further in the risk assessment.

## Granular Made Ground

8.11 A results summary table for determinands within the cohesive made ground found to be above screening values is given below.

Location	Depth (m)	Arsenic	Cadmium	Lead	B(b)F	DiB(a,h)A
TP36	0.1-0.4	20	0.1	38	0.5	0.1
TP37	0.8-1.0	510	0.3	71	0.6	0.1
TP40	0.8-0.9	28.00	0.1	30.00	0.1	0.1
TP40	1.7-1.9	31.00	0.1	88.00	2.80	0.60
WS24	1.2-1.5	130	47	400	0.1	0.1
WS27	0.3-0.4	2.30	0.10	9.20	0.1	0.1
WS29	0.6-0.65	9.30	0.20	36.00	0.50	0.1
WS30	1.4-1.6	120	20	6600	0.1	0.1
WS30	1.4-1.6	43.00	0.50	280.00	0.1	0.1
WS36	0.5-0.7	24.00	0.10	200.00	0.80	0.20
WS38	1.5-1.9	55	0.1	29	3.6	0.5
WS39	1.4-1.7	470.00	0.1	97.00	0.1	0.1
WS39	0.65-0.85	46.00	0.1	77.00	0.1	0.1
	Screening Value	37.0	22.0	200.0	3.7	0.3
	95% UCL	39.41	18.27	220.8	1.46	0.126

Exceedence

Outlier (and above screening value)

Acceptable (after removal of any outliers)

\* Assuming >6% organic matter

^ After removal of outliers

All values in mg/kg unless indicated otherwise

8.12 It can be seen from the table that elevated concentrations of arsenic and lead are widespread, as the 95% UCL concentrations are above the screening values. Outlier concentrations are also present, for arsenic, at TP37, WS24, WS30 and WS39, and for lead, at WS30. Outlier concentrations of other determinands are present (cadmium at WS24, benzo(b)fluoranthene and dibenzo(a,h)anthracene at WS38, and dibenzo(a,h)anthracene at TP40), although general concentrations of these determinands are generally not problematic (except for the outliers), as the 95% UCL concentrations are below the screening value.

8.13 There are no elevated determinands with significant volatility (naphthalene was not found to be present above the screening value). The highest concentrations of PAH are at WS38, and the concentrations here are shown, by their PAH component ratios, to be derived generally from coal, or to a lesser extent from combustion of coal products. The above exceedances will need to be considered further in the risk assessment.

### Volatile Organic Compounds (VOCs)

8.14 Two samples obtained from the location of WS24, from between 1.2m and 1.5m depth, and from, TP36, from between 0.1m and 0.4m depth, were selected for testing (on visual characteristics - there were no significant odours in any of the samples obtained) for a wide range of VOCs. A results summary table is given below.

Sample No	Depth (m)	Organic Matter (SOM) (%)	TCE
WS24	1.20-1.50	>25	21
TP36	0.10-0.40	5.5	0.06
Screening value 2.5% SOM			0.034
Screening value 6% SOM			0.075

Exceedance

All values in mg/kg unless indicated otherwise

TCE = Trichloroethylene

8.15 It can be seen from the table that, at WS24, trichloroethylene (at 21mg/kg) was found to be elevated well above the organic matter-dependent screening value of 0.075mg/kg (S4UL, residential with homegrown produce, >6% SOM). At TP36, all VOCs were below the limit of detection, with the exception of trichloroethylene (0.06mg/kg), which was found to be elevated above the screening value of 0.034mg/kg (S4UL, residential with homegrown produce, 2.5% to 6% SOM).

8.16 The LQM/CIEH S4UL data indicates for trichloroethylene, that the Inhalation of Vapour (indoor) pathway is most significant and contributes up to 95.1% of total exposure, whilst the Consumption of Homegrown Produce Attached to Soil pathway contributes up to

4.8% of total exposure. The elevated concentrations of trichloroethylene identified in the samples from WS24 and TP36, will need to be considered further in the risk assessment.

### **Asbestos**

8.17 Asbestos was detected in three locations on Site 4 (TP36, TP39 and WS39), comprising small fibre bundles of chrysotile on a microscopic scale. No specific quantification testing was undertaken on these three samples. However, as the intrusive investigation and testing regime was originally undertaken across a larger site area of Sites 1 to 5 (inclusive), quantification testing was undertaken on selected samples characteristic of the material encountered. Samples were tested for quantification of asbestos from two locations on Site 3 (TP30 and TP32, adjacent to the east of Site 4). The samples comprised "fibre bundles" of chrysotile and amosite on a microscopic scale. Quantification testing on combined samples showed less than 0.001% asbestos, with no potentially respirable fibres.

### **Results for Site 5**

#### **Made Ground Topsoil**

8.18 No determinands were found to be above the screening value in the samples of made ground topsoil which were obtained from Site 5.

#### **Made Ground - Cohesive**

8.19 A results summary table for determinands within the cohesive made ground found to be above screening values is given on the following page.

Location	Depth(m)	Arsenic	B(a)A	Chrysene	B(b)F	B(a)P	DiB(a,h)A
TP01	0.80-1.00	35.0	8.9	8.7	6.1	8.3	1.0
TP10	1.60-1.90	11.0	0.1	0.1	0.1	0.1	0.1
TP11	0.40-0.60	6.5	0.1	0.1	0.1	0.1	0.1
TP12	0.60-0.80	33.0	8.9	8.0	5.2	7.6	0.9
TP12	0.60-0.80	11.0	1.2	1.1	0.8	1.1	0.1
TP13	1.40-1.60	7.4	0.1	0.1	0.1	0.1	0.1
TP14	1.00-1.50	13.0	0.1	0.1	0.1	0.1	0.1
TP21	0.60-0.80	8.8	0.4	0.5	0.4	0.4	0.1
WS1	0.80-0.90	50.0	0.1	0.1	0.1	0.1	0.1
WS5	0.60-0.80	8.6	0.1	0.1	0.1	0.1	0.1
WS6	0.70-0.90	5.8	0.1	0.1	0.1	0.1	0.1
WS9	1.00-1.20	70.0	0.1	0.1	0.1	0.1	0.1
WS10	0.75-0.90	7.8	24.0	25.0	15.0	20.0	1.3
WS12	0.30-0.50	13.0	1.2	1.2	1.1	1.5	0.2
WS13	0.70-1.00	4.5	1.6	1.9	1.1	1.5	0.1
WS16	0.50-0.70	10.0	16.0	17.0	11.0	14.0	1.4
WS18	0.40-0.60	9.8	2.0	1.8	1.7	1.9	0.4
WS47	0.20-0.40	5.0	1.8	1.4	1.4	1.8	0.4
<b>Screening Value*</b>		37.0	7.2-13.0	15.0-27.0	2.6-3.7	5.0	0.24-0.3
<b>95% UCL<sup>^</sup></b>		27.6	13.3	8.4	1.2	11.8	0.8

Exceedence
Outlier (and above screening value)
Acceptable (after removal of any outliers)

\* Assuming 6% organic matter

<sup>^</sup> After removal of outliers

All values in mg/kg, unless indicated otherwise

8.20 It can be seen from the table that there are outlier exceedances of arsenic at WS9, chrysene at WS10 and WS16, and benzo(b)fluoranthene at TP1, TP12, WS10 and WS16. However, the widespread remaining concentrations for these determinands are not problematic, as the 95% UCL concentrations are below the screening value. Widespread elevated concentrations of benzo(a)anthracene, dibenzo(a,h)anthracene, and benzo(a)pyrene are present, as the 95% UCL concentrations are above the screening values. There are no elevated determinands with significant volatility (naphthalene was not found to be present above the screening value). The highest concentrations of PAH compounds are at WS10, and the concentrations here are shown, by their PAH

component ratios, to be derived from coal. The above exceedances will need to be considered further in the risk assessment.

### Made Ground - Granular

8.21 A results summary table for determinands, within the granular made ground, found to be above screening values is given below. Units are mg/kg unless indicated otherwise.

Location	Depth (m)	Arsenic	Lead	B(a)A	B(b)F	B(a)P	DiB(a,h)A
TP02	0.60-0.70	30.0	54.0	3.6	2.3	3.1	0.3
TP03	0.55-0.70	32.0	42.0	0.8	0.6	1.1	0.1
TP04	0.35-0.50	32.0	85.0	1.0	0.9	0.9	0.1
TP05	0.20-0.40	2.3	7.8	0.1	0.1	0.1	0.1
TP06	0.20-0.40	38.0	48.0	1.7	1.2	2.1	0.2
TP08	0.00-0.15	7.3	25.0	0.1	0.1	0.1	0.1
TP09	0.60-0.60	21.0	35.0	0.1	0.1	0.1	0.1
TP10	0.50-0.70	1.7	7.0	0.1	0.1	0.1	0.1
TP15	1.00-1.20	35.0	360.0	9.4	6.5	8.5	0.6
TP16	0.20-0.50	36.0	96.0	0.7	0.5	0.9	0.1
TP17	0.50-0.70	29.0	41.0	0.1	0.1	0.1	0.1
TP18	0.50-0.70	140.0	46.0	0.1	0.1	0.1	0.1
TP22	0.50-0.70	61.0	57.0	1.7	1.5	2.6	0.6
TP23	0.30-0.50	8.7	240.0	0.1	0.1	0.1	0.1
TP23	0.40-0.60	11.0	30.0	0.7	0.7	0.7	0.1
TP26	0.40-0.60	20.00	45.00	5.20	3.90	5.10	0.40
WS02	0.55-0.70	23.0	44.0	2.2	1.9	2.7	0.4
WS07	1.00-1.20	63.0	1200.0	5.1	3.7	4.5	0.2
WS08	0.40-0.60	8.0	19.0	0.1	0.1	0.1	0.1
WS10	1.20-1.40	77.0	140.0	2.6	2.3	2.7	0.1
WS11	0.50-0.70	38.0	100.0	0.8	0.6	0.8	0.1
WS14	0.50-0.70	24.0	59.0	4.9	4.5	6.5	1.0
WS17	0.20-0.40	37.0	91.0	2.0	1.5	1.8	0.1
WS47	1.50-1.70	2.5	17.0	15.0	9.0	13.0	1.6
	Screening value*	37.0	200.0	13.0	3.7	5.0	0.3
	95%UCL^	35.6	65.6	3.9	1.9	2.5	0.3

Exceedence

Outlier (and above screening value)

Acceptable (after removal of any outliers)

\* Assuming >6% organic matter

^ After removal of outliers

8.22 It can be seen from the table that concentrations of arsenic, lead and four PAH compounds including benzo(a)pyrene and dibenzo(a,h)anthracene, are generally not problematic as the 95% UCL concentrations are below the screening value. However, there are exceptions in the form of outlier concentrations of arsenic at TP18, for lead at TP15, TP23 and WS7, benzo(a)anthracene at WS47, both benzo(b)fluoranthene and benzo(a)pyrene at TP15, WS14 and WS47, and dibenzo(a,h)anthracene at WS14 and WS47. There are no elevated determinands with significant volatility (naphthalene was not found to be present above the screening value). The highest concentrations of PAH are at WS47, and the concentrations here are shown, by their PAH component ratios, to be derived from coal. The above exceedances will need to be considered further in the risk assessment.

**Volatile Organic Compounds (VOCs)/Semi Volatile Organic Compounds (SVOCs)**

8.23 Two samples obtained from the location of TP6, from between 0.2m and 0.4m depth, and from the location of TP10, from between 1.6m and 1.9m depth, were selected for testing (on a visual and olfactory basis) for a wide range of VOCs. A results summary table for determinands found to be above screening values is given below.

Location	Depth (m)	SOM (%)	Vinyl Chloride	Benzene	TCE	Dibenzofuran
TP6	0.20-0.40	7.4	0.01	<0.01	0.29	<0.1
TP10	1.60-1.90	1.3	0.11	0.11	0.06	2.2
		Screening value at 1% SOM	0.00064	0.087	0.016	n/a
		Screening value at 6% SOM	0.0014	0.37	0.075	^0.008

**Exceedance**

^ Sum of PCDDs, PCDFs and dioxin-like PCBs (EA, 2009)  
n/a Not applicable  
Units in mg/kg unless indicated otherwise

- 8.24 In the location of TP6, the majority of VOCs were below the limit of detection (<0.01mg/kg). However, concentrations of vinyl chloride and trichloroethylene, were found to be above the screening values. In the location of TP10, the majority of VOCs and SVOCs were below the limit of detection. However, concentrations of vinyl chloride, benzene, trichloroethylene and dibenzofuran, were found to be above the screening value.
- 8.25 In a residential setting, the most significant contribution to soil total exposure for vinyl chloride, benzene and trichloroethylene (VOCs), is the Inhalation of Vapour (indoor) pathway (up to 95.1%). For dibenzofuran (SVOC), the most significant contribution to soil total exposure is the soil ingestion pathway (73.3% to 84.1%). The exceedances will need to be considered further in the risk assessment.

#### **Polychlorinated Biphenyl (PCBs)**

- 8.26 One sample obtained from the locations of TP6, close to the boundary to the north of the site and adjacent to the east side of an electricity substation, was analysed for a range of PCBs. All PCBs were below the limit of detection (<0.01mg/kg).

#### **Asbestos**

- 8.27 Asbestos was detected in fifteen (15) locations on Site 5 (TP1 to TP4, TP6, TP8, TP15, TP16, TP20, WS2, WS7, WS8, WS10, WS11 and WS16), comprising “fibre bundles” of chrysotile on a microscopic scale, with the exception of TP1, TP20, WS7 and WS10, where amosite was also present as “fibre bundles”. Quantification testing on a sample selected from TP1 showed <0.001% asbestos, with no potentially respirable fibres. At TP7, quantification testing showed 0.009% asbestos, with no potentially respirable fibres.

### Water/Leachability Analysis

8.28 ARP Geotechnical Ltd commissioned leachability testing on one sample of granular made ground from Site 4, three samples of granular made ground from Site 5, and two samples of cohesive made ground from Site 5, for PAH, arsenic and lead. The laboratory certificates are presented in Appendix G. On Site 5, in the locations of TP15, WS7, WS9 and WS16, the analysis indicates negligible leachability. However, on Site 4 and Site 5, in the locations of TP40 and TP1, respectively, the analysis indicates the contaminants tested to have a degree of leachability. It should be noted that the screening values are extremely stringent. The slight leachability does not necessarily prevent retention of material on site, but the additional risks presented must be taken into consideration.

### Summary of Contamination Analysis

8.29 **Site 4:** In the cohesive made ground, there are widespread elevated concentrations of lead (up to 290mg/kg). In the granular made ground, there are widespread elevated concentrations of arsenic and lead, along with some outlier concentrations of up to 510mg/kg of arsenic, 6,600mg/kg of lead, cadmium (47mg/kg) and slightly elevated PAH compounds, none of which are volatile. At WS24, trichloroethylene was found to be significantly elevated (21mg/kg). Chrysotile asbestos was detected on a microscopic scale in three locations on Site 4 (TP36, TP39 and WS39), although its presence is likely to be minor, and is not uncommon (fragments are present in most made ground derived from demolition material).

8.30 **Site 5:** No determinands were found to be above screening values in the samples of made ground/topsoil which were obtained from Site 5. In the cohesive made ground, there are widespread slightly elevated concentrations of PAH compounds, and localised outlier concentrations of arsenic up to (70mg/kg), and PAH compounds. In the granular made ground, concentrations of arsenic, lead, and most PAH compounds, are generally not problematic as the 95% UCL concentrations are below the screening value. However, there are exceptions for these determinands, in the form of outlier concentrations of arsenic at TP18, for lead at TP15, TP23 and WS7.

- 8.31 **Site 5:** Concentrations of vinyl chloride and trichloroethylene were found to be above the screening values at TP6. Concentrations of vinyl chloride, benzene, trichloroethylene and dibenzofuran, were found to be above the screening values in the location of TP10. Both locations are in the northwest of Site 5. These determinands have the potential to reach future occupants of the site by vapour migration, as well as by soil ingestion. Asbestos was detected in fifteen locations on Site 5. Quantification testing showed <0.001% to 0.009% asbestos, with no potentially respirable fibres.
- 8.32 Leachability testing commissioned by ARP Geotechnical Ltd indicates generally negligible leachability, with the exception of locations TP40 and TP1, on Site 4 and Site 5 respectively. The VOCs are automatically assumed to be mobile.

## Updated Risk Assessment and Conceptual Model

8.33 The updated source - pathway - receptor matrix is presented below, taking into account the findings of the investigation. Any pathways in italics are deemed not to be viable, and the reason given.

### **Source - Pathway - Receptor Matrix**

<b>Contamination Sources</b>	<b>Pathways</b>	<b>Receptors</b>
<p><b>Site 4:</b> widespread lead and arsenic, cadmium at WS24, TCE at TP36 and WS24, non-volatile PAH. &lt;0.001% chrysotile.</p> <p><b>Site 5:</b> PAH widespread, arsenic at TP18 &amp; WS9, lead at TP15, TP23 &amp; WS7. Vinyl chloride &amp; TCE at TP6, vinyl chloride, TCE, benzene &amp; dibenzofuran at TP10. Chrysotile and amosite from 0.001% to 0.009%.</p> <p>Some contaminants on both sites shown to have a degree of leachability.</p>	<ul style="list-style-type: none"> <li>• Ingestion of, inhalation of, and dermal contact with, soil and dust</li> <li>• Fruit and vegetable intake (with soil)</li> <li>• Vapour inhalation outdoor</li> <li>• Vapour inhalation indoor</li> </ul>	<p><b>Humans:-</b></p> <ul style="list-style-type: none"> <li>• Future occupants</li> <li>• Construction workers</li> <li>• Maintenance workers</li> <li>• Adjacent residents and general public</li> </ul>
	<ul style="list-style-type: none"> <li>• Migration in surface water</li> <li>• Migration in groundwater</li> </ul>	<p><b>Controlled waters:-</b></p> <ul style="list-style-type: none"> <li>• Groundwater (Secondary A Aquifer, no sensitive abstractions within 1km)</li> <li>• Surface water (nearest downslope flows past the boundary to the south of Site 5. No sensitive abstractions within 1km)</li> </ul>
	<ul style="list-style-type: none"> <li>• Root uptake</li> </ul>	<p><b>Vegetation:-</b></p> <ul style="list-style-type: none"> <li>• Landscape areas</li> <li>• Private gardens</li> </ul>
	<ul style="list-style-type: none"> <li>• Migration</li> </ul>	<p><b>Services/Utilities:-</b></p> <ul style="list-style-type: none"> <li>• Potable water supply</li> </ul>
<p>Landfill 85m to southeast - possible methane and carbon dioxide (monitoring complete and reported separately)</p>	<ul style="list-style-type: none"> <li>• Asphyxiation</li> <li>• Explosive risk</li> </ul>	<ul style="list-style-type: none"> <li>• Construction/demolition workers</li> <li>• Future occupants</li> <li>• Buildings</li> </ul>

8.34 It can be seen from the above matrix that several pathways to receptors are operative, and this may affect users of the finished development. Some form of remedial action is, therefore, considered necessary to allow residential development without excess risk.

**Landfill Gases**

- 8.35 Ground gas monitoring indicates that, for all of Site 4 and Site 5, CS<sub>2</sub> gas conditions are indicated, for carbon dioxide. CS<sub>2</sub> gas conditions are equivalent to "Amber 1" conditions under the NHBC traffic light classification system, indicating that low level gas protection measures are required, usually comprising a gas membrane and ventilated sub-floor void.

**Made Ground - Ingestion, Dust Inhalation, Dermal Contact, Root Uptake, and Fruit and Vegetable Intake With Soil**

- 8.36 This pathway is automatically blocked where buildings or hardstanding are present above the material. However, in garden areas, provision of a cover blanket of a minimum 600mm thickness will be required, to reduce the risk to future users of the site to acceptable levels from these pathways. This assumes a worst case double dig scenario (i.e. 2 x spade depths). However, to prevent inadvertent future exposure due to other forms of excavation such as tree planting or construction of ponds, provision of a hard break layer or robust geotextile or geogrid is recommended at the base of the cover blanket.

**Made Ground- Vapour Inhalation Pathways**

- 8.37 Trichloroethylene is present in granular made ground at WS24 and TP36 on site 4. On Site 5, trichloroethylene and vinyl chloride is present in granular made ground at TP6 and cohesive made ground at TP10, with benzene and dibenzofuran also present at TP10. The main pathway from the vapours is by indoor air inhalation. Outdoor air inhalation is not significant.
- 8.38 Blocking of the indoor air pathway can be achieved by removal of the affected material from site, or by excluding the material from below building footprints, and from a 2m

radius beyond. The pathway may also be blocked by upgrading the carbon dioxide gas protection, already specified for the site, to methane impermeable barriers.

### **Made Ground - Surface Water and Groundwater Pathways**

- 8.39 Risks to groundwater and surface water are considered minimal for the majority of the made ground, but can be reduced further by ensuring the cover blanket in soft areas includes at least 450mm thickness of material with at least 35% silt/clay content (at least 35% passing a 63 micron sieve), for example clay, sandy clay, or gravelly clay.
- 8.40 The elevated VOC concentrations (including trichloroethylene, vinyl chloride, benzene and dibenzofuran, at WS24 on site 4, and TP6 and TP10 on Site 5) will have a degree of mobility, and could migrate to contaminate groundwater and surface water. The most effective way of blocking the pathways to groundwater and surface water is to remove the source, by excavation of the material. Following its removal, the sides and base of the excavation would need to be tested to confirm the full extent had been removed. Successful removal should also have the benefit of removing any requirement for the use of hydrocarbon membranes in proposed properties in this area. It would be beneficial to sample around the affected areas (WS24, TP6, TP10) on a closer grid to determine, in advance, the likely extent of the material. At present, this is only represented by the nearest existing "uncontaminated" sampling locations, which will be around 25m away (see ARP Geotechnical Ltd drawing SI.07, in Appendix F).

### **Migration to Utilities**

- 8.41 The local water company are likely to require details of the contaminants present on the site, to make a judgment on any requirement for protection of buried water supply pipes from chemical attack/ingress. It is considered possible that water supply pipes may require protection.

## Risks During Construction Period

8.42 It is also necessary to consider the effects of the contamination present on the site in relation to the risks to adjacent residents, construction workers and the general public during construction. This is assessed in the following matrix.

Source	Pathway	Potential risk	Risk after employing suitable Health and Safety plan.
Existing made ground	Inhalation	Moderate	Damping down of the site during dry periods and timely placement of the existing made ground below barriers, or removal from site, should reduce the risk to LOW.
Existing made ground	Ingestion	Moderate	Provision of washing facilities and a clean mess room from which work boots and overalls are excluded should reduce the risk to LOW. Site fencing will exclude access to members of the public. Existing made ground will be contained within the site boundary, and placed below barriers, or removed from site, as soon as possible.
Existing made ground	Contact	Moderate	Education of workers to use adequate hygiene and PPE should reduce the risk to LOW.
Existing made ground	Surface water	Moderate	Preventing surface water run off by minimising open exposure times of the existing made ground, and using bunds or cut off trenches as necessary will reduce the risk to LOW. Any rolling of material into watercourses should be prevented by diligence and gravel boards.

8.43 Provision of all the above measures will ensure that all the identified pathways for the contamination will be blocked.

### Summary of Remedial Options

8.44 The contamination risk assessment, and assessment of remedial options, has indicated that, provided that the following remedial measures are adopted then the risks to the identified receptors are deemed acceptable for the proposed development of residential properties with private gardens.

8.44.1 CS<sub>2</sub> gas conditions apply to the site, for carbon dioxide (equivalent to "Amber 1" conditions under the NHBC traffic light classification system). Low level gas

protection measures are, therefore, required, usually comprising a gas membrane and ventilated sub-floor void.

8.44.2 Where any garden or landscape areas overlie the existing made ground, a minimum 600mm thickness of uncontaminated soils (topsoil and subsoil) should be provided. It is recommended that the cover blanket be underlain by a minimum 100mm thick hard break layer of coarse stone, or by a robust geogrid or geotextile, to prevent future occupants excavating the material. In areas of hardstanding or building footprints, the cover blanket is not required.

8.44.3 Where used, the cover blanket should include at least 450mm thickness of material with at least 35% silt/clay content (at least 35% passing a 63 micron sieve), for example clay, sandy clay, or gravelly clay.

8.44.4 Significant concentrations of volatile organic compounds were detected in the made ground at WS24 on Site 4 (trichloroethylene), and TP6 and TP10 on Site 5 (trichloroethylene, vinyl chloride, benzene and dibenzofuran). As these pose a threat to future occupants by migration of vapours into properties, and to controlled waters, it would be prudent to remove this material from site, to a licensed facility. It may be beneficial to sample around the affected areas on a closer grid to determine, in advance, the likely extent of the material. The relevant depth of the material is 0.2m to 0.7m in TP6, 1.6m to 2.9m in TP10, and 1.2m to 1.9m in WS24.

8.44.5 The local water company are likely to require details of the contaminants present on the site, to make a judgment on any requirement for protection of buried water supply pipes from chemical attack/ingress. It is considered possible that water supply pipes may require protection.

8.45 A Contamination Remediation Statement is included in Appendix J.

## 9.0 GEOTECHNICAL TESTING

9.1 Selected samples of the natural strata were delivered to PSL in Doncaster for testing with regard to plasticity indices and moisture content. Test certificates are presented in Appendix G and a summary of the results, including Modified Plasticity Indices, is given below.

Location	Depth (m)	MC	LL	PL	PI	<425µm	I <sub>p</sub>
TP15	1.6-1.8	41	52	26	26	100	26
TP22	1.0-1.2	37	58	27	31	100	31
TP36	1.4-1.6	45	64	29	35	100	35
WS4	1.7-1.9	35	47	22	25	100	25
WS13	1.2-1.4	29	46	24	22	100	22
WS18	1.0-1.2	33	45	24	21	100	21
WS24	2.0-2.2	32	46	24	22	100	22
WS27	0.7-0.9	16	38	18	20	100	20
WS38	1.0-1.2	26	48	25	23	100	23
	<b>No. of results</b>	9	9	9	9	9	9
	<b>Min.</b>	16	38	18	20	100	20
	<b>Max.</b>	45	64	29	35	100	35

I <sub>p</sub>	VCP
>40%	High
20% - <40%	Medium
10% - <20%	Low

MC= Moisture Content (%)    LL= Liquid Limit (%)    PL= Plastic Limit (%)  
 PI= Plasticity Index (%)    I<sub>p</sub>= Modified PI (%)    VCP= NHBC Standard Chapter 4.2  
 Volume Change Potential

9.2 The plasticity test data shows the natural clays to range from intermediate to high plasticity, in accordance with BS 5930 (1999) "Code of Practice for Site Investigations". When the percentage retained on the 425 micron BS sieve is considered, the Modified Plasticity Index, in accordance with NHBC Standard Chapter 4.2 "Building Near Trees" is a maximum of 35. In accordance with the Standard, this equates to Medium Volume Change Potential.

9.3 Geochemical testing (water soluble sulphate and pH) was undertaken on selected samples by DETS, comprising a total of 15 samples of natural strata and 35 samples of made ground. In accordance with the BRE Special Digest 1 "Concrete in aggressive ground", the characteristic values for the two materials are given below:

**Characteristic Values – Site 4**

<b>Material</b>	<b>pH</b>	<b>SO<sub>4</sub></b>	<b>ACEC Class</b>	<b>Concrete Class*</b>
Made Ground	6.92	1220	AC-2	FND2
Natural Strata	6.5	79	AC-2z	FND2z

**Characteristic Values – Site 5**

<b>Material</b>	<b>pH</b>	<b>SO<sub>4</sub></b>	<b>ACEC Class</b>	<b>Concrete Class*</b>
Made Ground	7.1	647.78	AC-2	FND2
Natural Strata	5.9	206.7	AC-2z	FND2z

SO<sub>4</sub> = Sulphate content in mg/l on a 2:1 water : soil extract    pH = Acidity

\* Unreinforced concrete    ACEC = Aggressive Chemical Environment for Concrete

9.4 In the light of the above, therefore, in accordance with BS 8500-1:2006, the use of FND2z designated concrete will be necessary for unreinforced buried concrete on both Site 4 and Site 5. For reinforced concrete, other design-specific mixes will apply.

## 10.0 COMMENTS AND CONCLUSIONS

### Site Description

- 10.1 The area covered by this report (“The Site”) comprises Site 4 and Site 5 of a larger area. Site 4 sloped down gently to the south-southwest. The majority of the site was covered with concrete slabs. All buildings previously on the site had been demolished. Remnants of the former industrial buildings remain, such as a large concrete retaining wall along the northern site boundary. There are several stockpiles of crushed construction materials and general waste on the site. On the southwest of the site, two cylindrical tanks remain, along with the associated pipework. Intersecting the site, in the southeast, is a bund of crushed construction materials, approximately 2m to 3m high.
- 10.2 Site 5 slopes gently to the southwest. However, the majority of the site is currently flat in the area of the former industrial buildings. Therefore, on the southwest of the site, the concrete ground slab of the former buildings is retained 1.5m above ground level. On the northeast of the site, the concrete floor slab of the former buildings is at ground level. The previous industrial buildings have been demolished, with the concrete ground slabs left intact. There is only a thin strip of land along the southern boundary which is not covered by hardstanding. There is a car parking area on the northwest of the site (45m by 30m) and small, fenced electricity substation is indicated on plans nearby, but this had been removed at the time of the investigation. On the east of the site, three above ground gas tanks (possibly propane) are present, as well as a fuel filling pump (possibly diesel), which is likely to be fed by an underground storage tank (unknown volume). Beyond the hardstanding on the south of the site, the concrete base of a large cylindrical storage container (possibly gas) is present.

### Site History

- 10.3 Ordnance Survey archive maps show the east of Site 4 was shown to be encroached on from the adjacent “Coal Tar Colour Works” from as early as 1893, at which time a railway and embankment is shown to the north of Site 4 (dismantled sometime prior to

1958). By 1918, this activity covered most of the south of Site 4 (part of Minerva Works Dyeing and Bleaching). On Site 5, a small gas works was shown on the 1893 map, but no later. By 1918, Minerva Works Dyeing and Bleaching was shown to encroach south onto Site 5. By 1958, the central third of Site 5 is shown to be developed. The most recent ground layout is visible by 1985.

### Geology

- 10.4 The geological map shows Site 4 and Site 5 to be underlain by undifferentiated strata (mudstones, siltstones and minor sandstone) of the Pennine Lower Coal Measures. Superficial alluvial deposits are shown to overlie the solid strata on Site 5, and on the southern tip of Site 4.
- 10.5 A significant northwest - southeast trending fault passes through the wider site area. The fault crosses the southwest of Site 5 and passes to the west of Site 4. The fault is shown to downthrow strata to the northeast.

### Coal Mining and Coal Recovery

- 10.6 The coal mining report indicates the site is stable with regard to coal mining.
- 10.7 There will be no arisings of coal during proposed development works, and it will not be possible to win any coal from the site before development.

### Environmental Data

- 10.8 The strata beneath the site are classed as a Secondary A Aquifer. There are no groundwater abstractions for sensitive uses within 1km of the site.
- 10.9 The nearest downslope surface water is Ox Field Beck which flows west beyond the southern boundary of Site 5. However, there are no surface water abstractions for sensitive uses within 1km down hydraulic gradient of the site.

- 10.10 Site 4 is not at risk of river flooding. On Site 5, the area in the east is within both Zone 2 and Zone 3 flood risk areas. The southern margins and northwest of the site are within a Zone 2 flood risk area. It would be prudent to consult with the Environment Agency with regard to proposed finished floor levels on Site 5, and a Flood Risk Assessment Report is likely to be required. The risks of flooding from other causes, such as adverse topography or insufficient surface water drainage, are not considered in the Envirocheck Report.
- 10.11 No radon protective measures are stated to be necessary for new dwellings or extensions on the site. However, the site is in an intermediate probability radon area, as between 1% and 3% of homes are above the action level. In these circumstances of apparent conflict, it may be prudent to assume basic radon protection is required, to prevent conveyancing difficulties. This is usually achieved by incorporating an appropriate barrier within a solid floor system, lapping through the cavity wall.
- 10.12 There are two recorded landfills within 250m. The nearest is adjacent to the south of Site 5, and the furthest is 178m to the southeast. Gas monitoring has been completed, and indicates that CS<sub>2</sub> gas conditions apply to the site, for carbon dioxide (equivalent to "Amber 1" conditions under the NHBC traffic light classification system). Low level gas protection measures are, therefore, required, usually comprising a gas membrane and ventilated sub-floor void.

#### Ground Conditions Encountered

- 10.13 Most of Site 4 is covered by concrete up to 0.3m thick, overlying made ground between 0.3m and 2.6m thick. The majority of made ground across the site was granular, but cohesive made ground was also encountered, to a lesser extent, with superficial deposits of cohesive and granular head and alluvial deposits beneath. Slight instability of the trial pit sides was noted locally, to a depth of no more than 1.2m. Instability was generally associated with the presence of granular made ground. Rapid water ingress was noted

locally, of water perched in the made ground. Natural strata were also noted to be locally wet.

- 10.14 Most of Site 5 is covered by concrete up to 0.35m thick, overlying made ground at least 3.45m thick locally. The majority of made ground across the site was granular, but cohesive made ground was also encountered, to a lesser extent, with superficial deposits of cohesive and granular alluvium beneath. In general, instability of the pit sides was associated with coarse granular made ground and the presence of groundwater in the upper profile, and coarse granular alluvial deposits and the presence of groundwater in the lower profile. Groundwater ingress occurred sporadically within the made ground, of variable depth and rate, and was observed locally in some areas within the natural strata, from depths of around 2m to 4m.

#### Contamination Assessment

##### **Site 4**

- 10.15 In the cohesive made ground, there are widespread elevated concentrations of lead (up to 290mg/kg). In the granular made ground, there are widespread elevated concentrations of arsenic and lead, along with some outlier concentrations of up to 510mg/kg of arsenic, 6,600mg/kg of lead, cadmium, and slightly elevated PAH compounds, none of which are volatile. At WS24, trichloroethylene was found to be significantly elevated (21mg/kg). Chrysotile asbestos was detected on a microscopic scale in three locations on Site 4 (TP36, TP39 and WS39), although its presence is likely to be minor, and is not uncommon (fragments are present in most made ground derived from demolition material).

##### **Site 5**

- 10.16 No determinands were found to be above screening values in the samples of made ground/topsoil which were obtained from Site 5. In the cohesive made ground, there are widespread slightly elevated concentrations of PAH compounds, and localised outlier

concentrations of arsenic up to (70mg/kg), and PAH compounds. In the granular made ground, outlier concentrations of arsenic are present at TP18, and lead at TP15, TP23 and WS7. Asbestos was detected by microscopy in fifteen locations on Site 5. Quantification testing showed <0.001% to 0.009% asbestos, with no potentially respirable fibres.

10.17 Concentrations of vinyl chloride and trichloroethylene were found to be above the screening values at TP6. Concentrations of vinyl chloride, benzene, trichloroethylene and dibenzofuran, were found to be above the screening values in the location of TP10. Both locations are in the northwest of Site 5. These determinands have the potential to reach future occupants of the site by vapour migration, as well as by soil ingestion.

10.18 Leachability testing commissioned by ARP Geotechnical Ltd indicates generally negligible leachability, with the exception of locations TP40 and TP1, on Site 4 and Site 5 respectively. The VOCs are automatically assumed to be mobile.

10.19 The contamination risk assessment confirmed that, provided remedial measures are implemented, risks can be reduced to acceptable levels for the proposed development. Further detail is provided in the Remediation Statement in Appendix J.

10.20 This Report should be issued to the local water company for it to make a judgment on any requirement for protection of buried water supply pipes from chemical attack/ingress.

#### Foundations

10.21 On the western area of Site 4 (WS31 and WS38) competent strata were only present from 4.0m depth, and a piled foundation is likely to be the favoured solution in this area (particularly due to the requirement for halving allowable bearing pressures in the presence of shallow groundwater). This may also be the case on the rest of the southwestern two thirds of Site 4; and also sporadically on areas of Site 5, for example WS3 to WS5, WS9 to WS12, WS14, WS17 to WS19, TP10, TP13, and TP14.

- 10.22 Elsewhere, the natural strata appear suitable for the use of traditional strip/trench fill foundations, using an allowable bearing pressure of  $90\text{kN/m}^2$ . Softer/looser natural alluvial material is locally present in some areas above the medium dense/strength material, and the foundations should penetrate this, where present, to ensure founding on adequate strata. In practice, only the northeastern third of Site 4 may reliably support strip/trench fill foundations. On Site 5, the presence of suitable strata is erratic and interspersed between areas within which piling is recommended. Unless detailed additional investigation is carried out on a block by block basis, it is recommended that piled foundations are assumed on Site 5. This also has the benefit of minimising the volume of contaminated arisings.
- 10.23 Any strip/trench fill foundations (if utilised) on Site 5 should be provided with two layers of B503 mesh, to minimise the effects of any differential settlement. This will also provide protection against any weakening from the geological fault passing through Site 5.
- 10.24 The clays were shown to be of Medium Volume Change Potential. Therefore, in accordance with NHBC Standard Chapter 4.2 "Building Near trees", in the absence of trees, and where strip/trench fill foundations are proposed, a minimum foundation depth of 1.0m below existing or proposed ground level is applicable where clay is present, whichever is the lower. However, in the presence of any proposed, existing or removed trees, the foundation may need to be deepened, depending on the type of tree and its distance from the face of the foundation.
- 10.25 Where the clays are absent, and the founding strata are non-plastic, the minimum foundation depths given in NHBC Standard Chapter 4.2 "Building Near Trees" do not apply. However, to protect against fines washing subsidence in the event of a burst water supply pipe, it is recommended that a foundation depth of 0.9m is adopted for the site.
- 10.26 The whole plan area of the foundation should be placed on similar material and deepened where necessary to achieve this. The foundation should also be taken below the depth of any existing foundations or obstructions, onto natural ground.

### Excavations

- 10.27 It is likely that excavations into the cohesive natural strata will remain stable in the short term, requiring minimal trench support, in accordance with the prevailing statutory guidance. However, localised instability may be anticipated within the made ground present on the site, and sporadically within the granular alluvial deposits, particularly where groundwater was encountered in these deposits. Excavation depths should be minimised, and avoided as far as possible within the granular alluvium.
- 10.28 Slight to moderate groundwater seepages were recorded sporadically from depths of between 0.7m and 2.4m. In some cases, ingress may lead to instability of the faces.
- 10.29 Excavations into natural strata should be readily achieved using conventional hydraulic plant. However, excavations through the surface slabs will require a hydraulic breaker, and a breaker is also likely to be required for excavations through old foundations and structures, particularly on Site 4 but also on Site 5, unless these are removed prior to development. Buried tanks and basements may also be present.
- 10.30 Any groundwater pumped out of excavations in the areas of WS24, TP6 and TP10, should not be discharged into other areas, or down any drain, unless tested in the laboratory and found to present no significant contamination risk.

### Chemical Precautions

- 10.31 In accordance with BS 8500-1:2006, the use of FND2z designated concrete will be necessary for unreinforced buried concrete on both Site 4 and Site 5. For reinforced concrete, other design-specific mixes will apply.

### Road Pavement Construction

- 10.32 For any areas of road pavement, including parking areas, the formation will be the natural clays. Below any obvious soft spots, and at equilibrium moisture content, a design California Bearing Ratio (CBR) value of 2% is considered applicable. Formation of roads on the made ground will not be acceptable and the use of granular capping material may be required under pavement construction, subject to levels.
- 10.33 It is possible that, locally, a formation for adoptable road pavement on natural strata may be impractical, due to the depth of existing made ground on the site. There are several potential solutions for this situation, including complete excavation of the made ground to natural strata, and placement of engineered fill to controlled specification, or partial excavation and replacement, with or without layers of geogrid. The proposed measures will need to be agreed with the adopting authority and, therefore, consultations with the relevant authority should be undertaken at the earliest stage.

### Soakaways

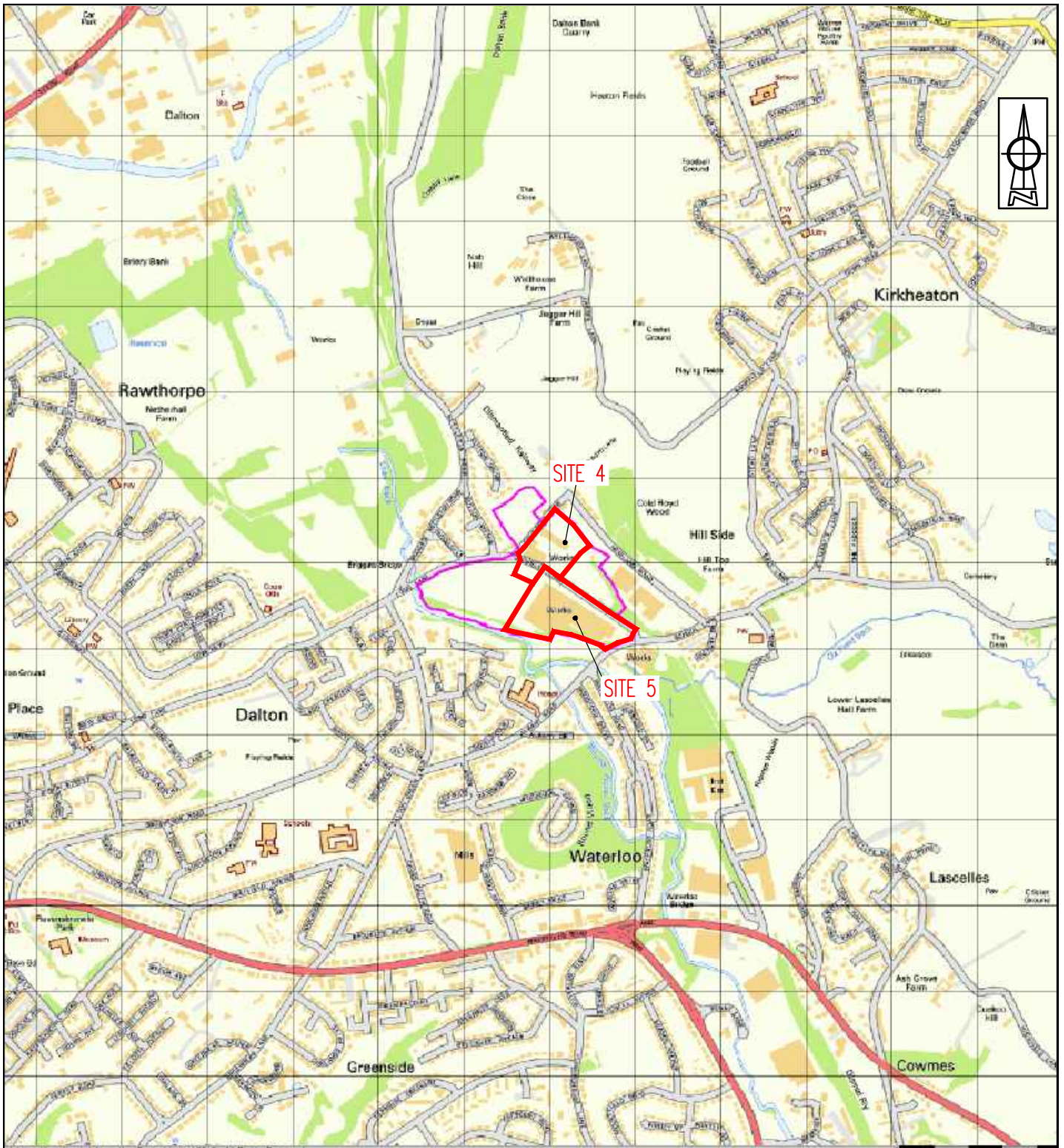
- 10.34 The disposal of surface water using soakaways is unlikely to be feasible on the site, given the presence of generally low permeability strata, close proximity of watercourses, and shallow groundwater.


### Other Issues

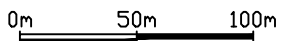
- 10.35 There is a large retaining wall on the northeastern boundary of Site 4. If the wall is to remain, it would be prudent for the wall to be inspected by a Structural Engineer.

**A P P E N D I X   A**

**S I T E   L O C A T I O N   P L A N   A N D   S I T E   P L A N**



/ FTH .		Issued for approval		HM	
Rev	By	Date	Amendment	Chk	
Title		 <b>ARP ASSOCIATES</b> CHARTERED CONSULTING ENGINEERS Northwest House • 5/6 Northwest Business Park Servia Hill • Leeds LS6 2QH Telephone : 0113 245 8498 • Fax : 0113 244 3864 E-Mail : leeds@arpassociates.co.uk		Scale	Drawn
SITE LOCATION PLAN				NTS @ A4	FTH
Project/Client		Date	Chk.	HM	
Crossley Lane, Dalton <b>Minerva Works Developments LTD</b>		Drg. No.	Rev		
		<b>MWD/01/Sl.05</b>	/		



Rev	By	Date	Amendment	Chk
/	FTH	.	Issued for approval	HM
Title			Scale	Drawn
SITE PLAN			NTS @ A4	FTH
Project/Client			Date	Chk.
Crossley Lane, Dalton Minerva Works Developments LTD			AUG 16	HM
ARP ASSOCIATES CHARTERED CONSULTING ENGINEERS Northwest House • 5/6 Northwest Business Park Servia Hill • Leeds LS6 2QH Telephone : 0113 245 8498 • Fax : 0113 244 3864 E-Mail : leeds@arpassociates.co.uk			Drg. No.	Rev
			MWD/01/SI.06	/

**A P P E N D I X B**

**ORDNANCE SURVEY ARCHIVE MAPS**

**APPENDIX C**

**LANDMARK GEOLOGY MAPS**

**APPENDIX D**

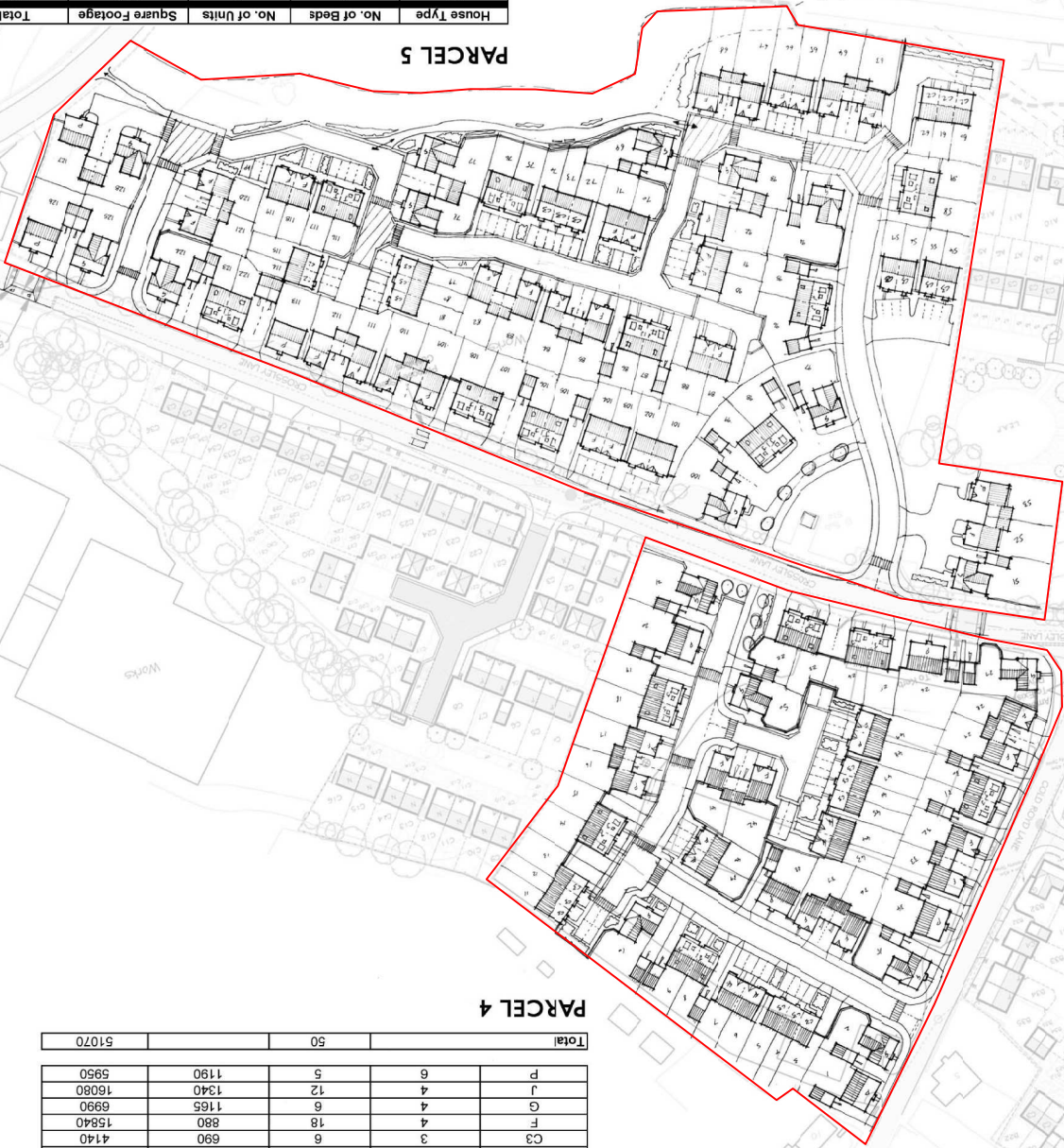
**LANDMARK ENVIROCHECK REPORT**

**APPENDIX E**

**INDICATIVE PROPOSED SITE LAYOUT**

House Type	No. of Beds	No. of Units	Square Footage	Total
C2	2	3	690	3450
C3	3	10	690	6900
F	4	30	880	26400
G	4	11	1165	12815
J	4	18	1340	24120
P	6	4	1190	4760
<b>Total</b>		<b>78</b>		<b>78445</b>

House Type	No. of Beds	No. of Units	Square Footage	Total
C2	2	3	690	2070
C3	3	6	690	4140
F	4	18	880	15840
G	4	4	1165	6990
J	4	12	1340	16080
P	6	5	1190	5950
<b>Total</b>		<b>50</b>		<b>51070</b>



GROSS RED LINE AREA / 1.37 HA

GROSS RED LINE AREA = APPROX 6.56 ACRES / 2.65 HA

GREENSPACE (INCLUDING NON-DEVELOPABLE) = 0.9 A / 0.36 HA

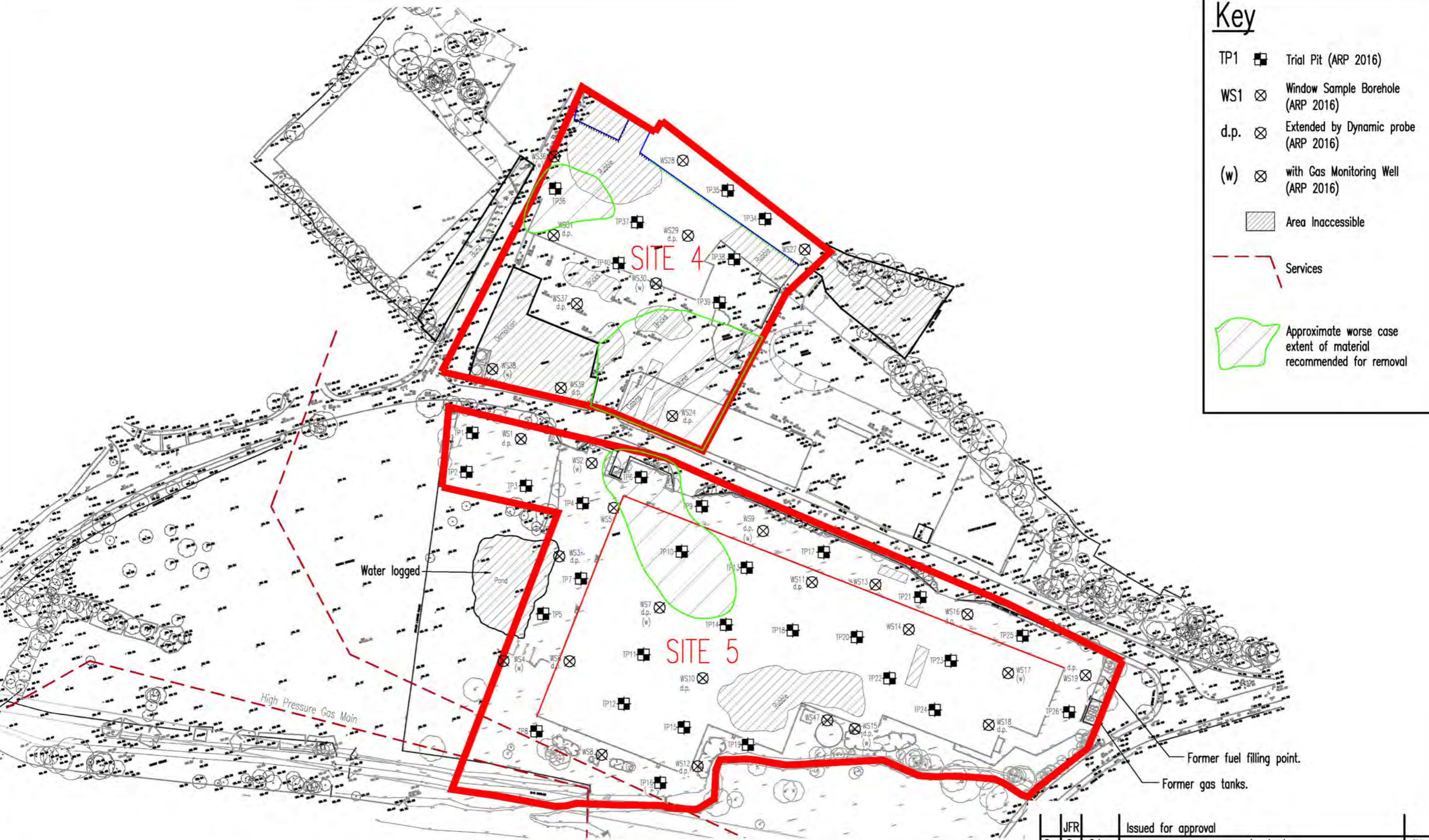
House Type	No. of Beds	No. of Units	Square Footage	Total
C2	2	8	690	5520
C3	3	16	690	11040
F	4	48	880	42240
G	4	17	1165	19805
J	4	30	1340	40200
P	6	9	1190	10710
<b>Total</b>		<b>128</b>		<b>129515</b>

## **APPENDIX F**

### **BOREHOLE AND TRIAL PIT LOCATION PLAN AND LOGS**

# Key

- TP1 Trial Pit (ARP 2016)
- WS1 Window Sample Borehole (ARP 2016)
- d.p. Extended by Dynamic probe (ARP 2016)
- (w) with Gas Monitoring Well (ARP 2016)
- Area Inaccessible
- Services
- Approximate worse case extent of material recommended for removal



Rev	By	Date	Issued for approval	Amendment	Chk
	JFR				

Project  
**CROSSLEY LANE, DALTON**

Client  
**MINERVA WORKS DEVELOPMENT LTD**

Title  
**INVESTIGATION LOCATION PLAN**  
**13th - 17th JUNE 2016**



**ARP ASSOCIATES**  
CHARTERED CONSULTING ENGINEERS

Northwest House • 5/6 Northwest Business Park • Servio Hill • Leeds LS6 2QH  
Tel: 0113 2458488 • Fax: 0113 2443864 • E-Mail: Leeds@arpassociates.co.uk

Date	<b>AUG 16</b>	Scale	<b>NTS @ A3</b>
Drawn	<b>JFR</b>	No	<b>MWD/01/SI.07</b>
Chk.	<b>ETH</b>	Rev	<b>/</b>



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
Crossley Lane, Dalton, Huddersfield

**Trial Pit Number**  
**TP01**

<b>Excavation Method</b> Using a JCB 3CX backhoe excavator with a two foot wide toothed bucket.	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 13/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10-0.50	D1				(0.10) 0.10	MADE GROUND: Bituminous macadam.		
					(0.70)	MADE GROUND: Buff grey sandy fine to coarse angular and subangular GRAVEL of limestone.		
0.80-1.00	D2		Water strike(1) at 0.80m.	0.80	(0.20)	MADE GROUND: Dark greyish brown and dark grey slightly sandy slightly gravelly CLAY. Gravel is angular and subangular, of sandstone, clinker and ceramic.		1
1.20 1.20-1.50	HSV 53.33kPa D3		40,70,50/Av. 53.33	1.00	(1.20)	Firm (medium strength) orange mottled grey slightly gravelly CLAY. Gravel is angular, of sandstone. Trace gravel sized fragments of coal. Medium angular cobble content, of sandstone (Alluvium).		
2.40-2.50	D4			2.20 (0.20) 2.40 (0.10) 2.50	(2.40) (0.10) 2.50	Dark reddish brown and orangish brown slightly clayey sandy fine to coarse angular and subangular GRAVEL of sandstone (Alluvium). Dark reddish brown slightly clayey sandy fine to coarse angular to subrounded GRAVEL of sandstone. High angular tabular cobble content, of sandstone (up to 60mm bedded) (Alluvium). Terminated in hard strata.		
						Complete at 2.50m		

<b>Plan</b>								
						<b>Remarks</b>		
						Slight instability noted to a depth of 1m, through the granular made ground. Slight groundwater ingress noted from below 0.8m. Trial pit backfilled with arisings on completion.		
						<b>Scale (approx)</b>	<b>Logged By</b>	<b>Figure No.</b>
						1:25	EGH	MWD/01.TP01



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Trial Pit Number**  
**TP02**

<b>Excavation Method</b> JCB 3CX	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 13/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.60-0.70	D1				0.05	MADE GROUND: Bituminous macadam.		
					(0.45)	MADE GROUND: Light brown/grey sandy angular to sub-angular fine to coarse GRAVEL of limestone.		
1.20	HSV 120.67kPa		120,120,122/Av. 120.67		(0.25)	MADE GROUND: Dark grey/black sandy angular fine to coarse GRAVEL of sandstone, ash, mixed lithology and trace clinker.		
					(0.40)	Stiff brown mottled grey silty slightly gravelly CLAY. Gravel is sub-angular to angular, of mudstone and trace coal (Alluvium).		
1.40-1.60	D2				1.15	High strength (stiff) orange/brown mottled grey slightly gravelly CLAY. Gravel is sub-angular to sub-rounded, of sandstone (Alluvium).		
					(1.10)			
					2.25	Grey sandy clayey sub-angular to rounded fine to coarse GRAVEL of sandstone and occasional coal with low cobble content (Alluvium). Becoming slightly moist below 2.25m.		
					(0.75)			
					3.00	Complete at 3.00m		

<b>Plan</b> .	<b>Remarks</b>  Slight groundwater ingress below 2.5m. Strata remained dry. Hole backfilled with arisings on completion.	
		<b>Scale (approx)</b> 1:25



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Trial Pit Number**  
**TP03**

<b>Excavation Method</b> Using a JCB 3CX backhoe excavator with a two foot wide toothed bucket.	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 13/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.55-0.70	D1				0.10	MADE GROUND: Bituminous macadam.		
					0.10	MADE GROUND: Buff grey sandy fine to coarse angular and subangular GRAVEL of limestone.		
					(0.45)			
					0.55			
0.80	HSV 78.33kPa		Water strike(1) at 0.80m. 80,80,75/Av. 78.33		(0.15)	MADE GROUND: Dark greyish brown clayey fine to coarse angular to rounded GRAVEL of sandstone, limestone, clinker, ceramic (possible hydrocarbon odour).		
					0.70	High strength (stiff) orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is angular to subrounded, of sandstone (Alluvium).		
					(0.80)			
1.20	HSV 85kPa		75,100,80/Av. 85.00					
1.20-1.50	D2				1.50	Dark reddish brown and grey slightly clayey slightly sandy fine to coarse angular to subrounded GRAVEL of sandstone. Medium angular tabular cobble content, of sandstone (up to 80mm bedded). Trace gravel sized fragments of coal (Alluvium).		
					(0.50)			
1.90-2.00	D3				2.00	Terminated in hard strata.		
						Complete at 2.00m		

<b>Plan</b> .	<b>Remarks</b> Some slight instability noted to a depth of 0.7m, through the granular made ground. Slight groundwater ingress noted from below 0.7m. Trial pit backfilled with arisings on completion.					
	<table border="1"> <tr> <td><b>Scale (approx)</b></td> <td><b>Logged By</b></td> <td><b>Figure No.</b></td> </tr> <tr> <td>1:25</td> <td>EGH</td> <td>MWD/01.TP03</td> </tr> </table>	<b>Scale (approx)</b>	<b>Logged By</b>	<b>Figure No.</b>	1:25	EGH
<b>Scale (approx)</b>	<b>Logged By</b>	<b>Figure No.</b>				
1:25	EGH	MWD/01.TP03				



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Trial Pit Number**  
**TP04**

<b>Excavation Method</b> JCB 3CX	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 13/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.60-0.70	D1				(0.20) 0.20 (0.15) 0.35 (0.15) 0.50	MADE GROUND: Reinforced concrete.		
						MADE GROUND: Grey sandy angular fine to coarse GRAVEL of limestone.		
						MADE GROUND: Dark grey/black sandy angular fine to coarse GRAVEL of sandstone, brick, ash, mixed lithology and trace clinker.		
					(0.25) 0.75	Stiff brown mottled grey slightly gravelly CLAY. Gravel is sub-angular to sub-rounded, of sandstone (Alluvium).		
1.20	D 75kPa		75,80,70/Av. 75.00		(0.75)	High strength (stiff) brown mottled grey slightly gravelly friable CLAY. Gravel is sub-angular to sub-rounded and tabular, of sandstone and occasional coal (Alluvium).		
1.40-1.60	D2				1.50	Brown clayey sandy sub-angular to sub-rounded tabular fine to coarse GRAVEL of sandstone. Low cobble content of sandstone (Alluvium).		
					(1.50)	Becoming slightly moist below 2.1m		
					3.00	Complete at 3.00m		

<b>Plan</b> .	<b>Remarks</b>		
	Slight groundwater ingress below 2.1m. Sides remained stable throughout. Hole backfilled with arisings on completion.		
	<b>Scale (approx)</b>	<b>Logged By</b>	<b>Figure No.</b>
	1:25	MCB	MWD/01.TP04



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Trial Pit Number**  
**TP05**

<b>Excavation Method</b> Using a JCB 3CX backhoe excavator with a two foot wide toothed bucket.	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 13/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					0.15	MADE GROUND: Concrete slab (very hard, with closely spaced 200mm reinforcing bars, 20mm thick)		
					0.25	MADE GROUND: Grey sandy fine to coarse angular and subangular GRAVEL of limestone.		
					0.40	MADE GROUND: Buried ceramic drainage pipe, 300mm to 400mm wide, orientated NNE to SSW. Pipe was in tact and was not live.		
			Water strike(1) at 0.80m.		0.60	From 0.4m to 1.0m: MADE GROUND: Greyish brown subangular to rounded GRAVEL of limestone (Pipe Surround).		1
					1.00	Greyish brown mottled orange slightly sandy slightly gravelly CLAY. Gravel is angular to subrounded, of sandstone (Alluvium).		
					2.00	Greyish brown sandy fine to coarse angular to subrounded GRAVEL of sandstone. Medium angular tabular cobble content, of sandstone (Alluvium).		
					2.40	Terminated due to constant ingress of water into base of pit from the granular pipe surround. Complete at 2.40m		

<b>Plan</b> .	<b>Remarks</b> Moderate instability of trial pit sides to 1m depth, through granular made ground. Rapid ingress of water from the granular pipe surround in to the pit. Trial pit backfilled with arisings on completion.		
	<table border="1"> <tr> <td><b>Scale (approx)</b> 1:25</td> <td><b>Logged By</b> EGH</td> <td><b>Figure No.</b> MWD/01.TP05</td> </tr> </table>	<b>Scale (approx)</b> 1:25	<b>Logged By</b> EGH
<b>Scale (approx)</b> 1:25	<b>Logged By</b> EGH	<b>Figure No.</b> MWD/01.TP05	



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
Crossley Lane, Dalton, Huddersfield

**Trial Pit Number**  
**TP06**

<b>Excavation Method</b> JCB 3CX	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 13/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20-0.40	D1				(0.10) (0.10) (0.10) 0.20	MADE GROUND: Reinforced concrete. MADE GROUND: Light brown sandy angular fine to coarse GRAVEL of limestone.		
1.00	D 50kPa		55,45,50/Av. 50.00		(0.50)  0.70  (0.90)	MADE GROUND: Dark grey/black sandy angular fine to coarse GRAVEL of sandstone, ash, mixed lithology and trace clinker.  Medium strength (firm) brown silty slightly gravelly CLAY. Gravel is sub-angular, of sandstone and trace coal (Alluvium).		
1.80-2.00	D2				1.60  (0.50)  2.10  (0.90)  3.00	Firm orange/brown mottled grey slightly sandy gravelly CLAY. Gravel is sub-angular to sub-rounded, of sandstone (Alluvium).  Brown very clayey sub-angular to sub-rounded tabular fine to coarse GRAVEL of sandstone (Alluvium). Becoming slightly moist below 2.1		
						Complete at 3.00m		

<b>Plan</b> .	<b>Remarks</b>  Slight groundwater ingress below 2.1m. Sides remained stable throughout. Hole backfilled with arisings on completion.		
	<table border="1"> <tr> <td><b>Scale (approx)</b> 1:25</td> <td><b>Logged By</b> MCB</td> <td><b>Figure No.</b> MWD/01.TP06</td> </tr> </table>	<b>Scale (approx)</b> 1:25	<b>Logged By</b> MCB
<b>Scale (approx)</b> 1:25	<b>Logged By</b> MCB	<b>Figure No.</b> MWD/01.TP06	



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Trial Pit Number**  
**TP07**

<b>Excavation Method</b> Using a JCB 3CX backhoe excavator with a two foot wide toothed bucket.	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 13/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.70-0.90	D1				(0.15) 0.15	MADE GROUND: Concrete slab (very hard, with closely spaced 200mm reinforcing bars, 20mm thick).		
					(0.55)	MADE GROUND: Buff grey sandy fine to coarse angular and subangular GRAVEL of limestone.		
0.90	HSV 75kPa		70,75,80/Av. 75.00		0.70 (0.20)	MADE GROUND: Dark greyish brown slightly sandy CLAY (possible hydrocarbon odour).		
1.10	HSV 85kPa		80,90,85/Av. 85.00		0.90	Borderline medium strength (firm ) to high strength (stiff) grey mottled orange slightly sandy gravelly CLAY. Gravel is angular and subangular, of sandstone (Alluvium).		
					(1.30)	From 1.1m: High strength (stiff).		
			Water strike(1) at 2.20m.		2.20 (0.20)	Orangish brown slightly clayey slightly sandy fine to coarse angular and subangular GRAVEL of sandstone (Alluvium).		1
					2.40	Terminated in hard strata.		
						Complete at 2.40m		

<b>Plan</b> .	<b>Remarks</b> Trial pit sides generally remained stable for the short period of exposure. Slight groundwater ingress below 2.2m depth. Trial pit backfilled with arisings on completion.					
	<table border="1"> <tr> <td><b>Scale (approx)</b></td> <td><b>Logged By</b></td> <td><b>Figure No.</b></td> </tr> <tr> <td>1:25</td> <td>EGH</td> <td>MWD/01.TP07</td> </tr> </table>	<b>Scale (approx)</b>	<b>Logged By</b>	<b>Figure No.</b>	1:25	EGH
<b>Scale (approx)</b>	<b>Logged By</b>	<b>Figure No.</b>				
1:25	EGH	MWD/01.TP07				



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Trial Pit Number**  
**TP08**

<b>Excavation Method</b> JCB 3CX	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 13/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.15	D1				(0.15)	MADE GROUND: Brown sandy angular fine to coarse GRAVEL of brick, concrete and sandstone.		
					0.15			
					(0.15)	MADE GROUND: Light brown/grey sandy sub-angular to angular fine to coarse GRAVEL of limestone.		
					0.30	MADE GROUND: Brown gravelly friable CLAY. Gravel is sub-angular to sub-rounded, of sandstone and trace brick.		
					(1.20)			
					1.50	MADE GROUND: Brown clayey sub-angular to angular fine to coarse GRAVEL of sandstone, brick, limestone, mixed lithology and trace metal.		
					(0.40)			
					1.90	Firm light brown silty slightly gravelly CLAY. Gravel is angular, of coal (Alluvium).		
					(1.10)			
					3.00	From 2.7m: Low cobble content of sub-angular to sub-rounded tabular sandstone.		
					Complete at 3.00m			

<b>Plan</b> .	<b>Remarks</b> Strata remained dry. Sides remained stable throughout. Hole backfilled with arisings on completion.		
		<table border="1"> <tr> <td><b>Scale (approx)</b> 1:25</td> <td><b>Logged By</b> MCB</td> <td><b>Figure No.</b> MWD/01.TP08</td> </tr> </table>	<b>Scale (approx)</b> 1:25
<b>Scale (approx)</b> 1:25	<b>Logged By</b> MCB	<b>Figure No.</b> MWD/01.TP08	



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Trial Pit Number**  
**TP09**

<b>Excavation Method</b> Using a JCB 3CX backhoe excavator with a two foot wide toothed bucket.	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 13/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20-0.60	D1				0.20	MADE GROUND: Concrete slab (very hard, with closely spaced 200mm reinforcing bars, 20mm thick).		
					0.40	MADE GROUND: Yellowish brown fine to coarse angular to subrounded GRAVEL of sandstone.		
0.60-0.80	D2				0.60	MADE GROUND: Dark greyish brown and reddish brown sandy fine to coarse angular to subrounded GRAVEL of sandstone.		
					1.00			
					1.60	Firm orangish brown mottled grey slightly gravelly CLAY. Gravel is angular to subangular tabular, of sandstone (Alluvium).		
2.00-2.20	D3		Water strike(1) at 2.20m.		(1.10)			1
2.40	HSV 66.67kPa		60,70,70/Av. 66.67			From 2.4m: Medium strength (firm).		
					2.70	Terminated due to slow progress of excavation. Complete at 2.70m		

<b>Plan</b> 	<b>Remarks</b>		
	Slight instability of pit sides to 1.6m, through the granular made ground. Strata remained dry. Trial pit backfilled with arisings on completion.		
	<b>Scale (approx)</b>	<b>Logged By</b>	<b>Figure No.</b>
	1:25	EGH	MWD/01.TP09



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Trial Pit Number**  
**TP10**

<b>Excavation Method</b> JCB 3CX	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 13/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50-0.70	D1				(0.15)	MADE GROUND: Reinforced concrete.		
					0.15	MADE GROUND: Light grey angular to sub-rounded fine to coarse GRAVEL of limestone.		
					0.20	MADE GROUND: Brown sandy clayey sub-angular to rounded fine to coarse GRAVEL of sandstone.		
					(0.30)	MADE GROUND: Dark grey clayey sub-angular to tabular GRAVEL of mudstone, red brick, ash and mixed lithology.		
1.60-1.90	D2				0.50	MADE GROUND: Firm brown silty slightly gravelly CLAY. Gravel is sub-angular to sub-rounded, of sandstone (Reworked natural)..		
					(0.60)			
					1.10	MADE GROUND: Firm grey with black streaks slightly gravelly CLAY. Gravel is sub-angular to rounded, of sandstone (Possible reworked natural) From 1.8: Very strong hydrocarbon odour.		
					(0.50)			
					1.60	MADE GROUND: Firm grey with black streaks slightly gravelly CLAY. Gravel is sub-angular to rounded, of sandstone (Possible reworked natural) From 1.8: Very strong hydrocarbon odour.		
				(1.30)				
					2.90	Terminated on hard strata, suspected concrete slab. Complete at 2.90m		

<b>Plan</b> .	<b>Remarks</b>		
	Moderate groundwater ingress below 0.5m. Slight instability below 2.4m. Hole backfilled with arisings on completion.		
	<b>Scale (approx)</b>	<b>Logged By</b>	<b>Figure No.</b>
	1:25	MCB	MWD/01.TP10



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Trial Pit Number**  
**TP11**

<b>Excavation Method</b> JCB 3CX	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 14/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.40-0.60	D1				0.10	MADE GROUND: Reinforced concrete.		
					0.30	MADE GROUND: Brown slightly clayey sub-angular to rounded fine to coarse GRAVEL of limestone.		
					0.40	MADE GROUND: Dark grey gravelly CLAY. Gravel is sub-angular to rounded, of mudstone, sandstone and occasional brick. Perched water at 0.4m.		
					0.60			
					1.00	MADE GROUND: Dark grey clayey sub-angular to angular fine to coarse GRAVEL of siltstone, sandstone, mudstone, brick, ash and trace clinker. Slight hydrocarbon odour.		
					0.80			
1.80-2.00	D2				1.80	Firm orange/brown sandy slightly gravelly friable CLAY. Gravel is sub-angular, of coal (Alluvium).		
					1.20			
					3.00	Complete at 3.00m		

<b>Plan</b> .	<b>Remarks</b>  Perched water at 0.4m (No groundwater ingress encountered). Sides remained stable throughout. Hole backfilled with arisings on completion.		
		<table border="1"> <tr> <td><b>Scale (approx)</b> 1:25</td> <td><b>Logged By</b> MCB</td> <td><b>Figure No.</b> MWD/01.TP11</td> </tr> </table>	<b>Scale (approx)</b> 1:25
<b>Scale (approx)</b> 1:25	<b>Logged By</b> MCB	<b>Figure No.</b> MWD/01.TP11	



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**Site**  
 Crossley Lane, Dalton, Huddersfield

**Trial Pit Number**  
**TP12**

<b>Excavation Method</b> JCB 3CX	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 14/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.60-0.80	D1				(0.15)	MADE GROUND: Reinforced concrete.		
					0.15	MADE GROUND: Brown sandy clayey sub-angular to rounded fine to coarse GRAVEL of sandstone.		
					(0.25)	MADE GROUND: Dark grey gravelly CLAY. Gravel is sub-angular to rounded, of siltstone, brick, mixed lithology and occasional coal.		
					0.40			
					(1.20)			
					1.60	Terminated at 1.6m on brick and concrete. Complete at 1.60m		

<b>Plan</b> .	<b>Remarks</b> Strata remained dry. Sides remained stable throughout. Hole backfilled with arisings on completion.		
	<table border="1"> <tr> <td><b>Scale (approx)</b> 1:25</td> <td><b>Logged By</b> MCB</td> <td><b>Figure No.</b> MWD/01.TP12</td> </tr> </table>	<b>Scale (approx)</b> 1:25	<b>Logged By</b> MCB
<b>Scale (approx)</b> 1:25	<b>Logged By</b> MCB	<b>Figure No.</b> MWD/01.TP12	



<b>Excavation Method</b> Using a JCB 3CX backhoe excavator with a two foot wide toothed bucket.	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 13/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.30-0.50	D1		Water strike(1) at 0.10m.		(0.15) 0.15 (0.15) 0.30	MADE GROUND: Concrete (very hard, with closely spaced 200mm reinforcing bars, 20mm thick). MADE GROUND: Greyish brown sandy fine to coarse angular to rounded GRAVEL of sandstone. MADE GROUND: Dark greyish brown sandy fine to coarse angular and subangular GRAVEL of ash, clinker, sandstone and ceramic.		1
1.40-1.60	D2				(1.10)			
2.60-2.80	D3				1.40 (1.20) 2.60 (0.30) 2.90	MADE GROUND: Dark greyish brown slightly sandy CLAY. Trace gravel sized fragments of ceramic. From 1.4m: Strong olfactory evidence of hydrocarbon, and possibly methylated spirits. Orangish brown and grey slightly clayey sandy fine to coarse angular and subangular GRAVEL of sandstone (Alluvium). Terminated due to constant moderate ingress of water from the surface into the base of the pit. Complete at 2.90m		

<b>Plan</b> .	<b>Remarks</b> Trial pit sides generally remained stable for the short period of exposure. Rapid ingress of water from the surface into the pit, through the joints in the overlying concrete slabs. Trial pit backfilled with arisings on completion.						
	<table border="1"> <tr> <td><b>Scale (approx)</b></td> <td><b>Logged By</b></td> <td><b>Figure No.</b></td> </tr> <tr> <td>1:25</td> <td>EGH</td> <td>MWD/01.TP13</td> </tr> </table>	<b>Scale (approx)</b>	<b>Logged By</b>	<b>Figure No.</b>	1:25	EGH	MWD/01.TP13
<b>Scale (approx)</b>	<b>Logged By</b>	<b>Figure No.</b>					
1:25	EGH	MWD/01.TP13					



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**Site**  
 Crossley Lane, Dalton, Huddersfield

**Trial Pit Number**  
**TP14**

<b>Excavation Method</b> Using a JCB 3CX backhoe excavator with a two foot wide toothed bucket.	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 14/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.40-0.60	D1		Water strike(1) at 0.20m.		(0.20)	MADE GROUND: Concrete slab (very hard, with closely spaced 200mm reinforcing bars, 20mm thick).		1
					0.20	MADE GROUND: Yellowish brown sandy fine to coarse angular and subangular GRAVEL of sandstone.		
1.00-1.50	D2				(0.20)	MADE GROUND: Dark greyish brown clayey sandy fine to coarse angular GRAVEL of sandstone, siltstone, ash, clinker and brick. Low angular boulder content, of sandstone (up to 0.5m).		
					(0.60)			
					1.00	MADE GROUND: Dark greyish brown and dark lustrous grey, slightly gravelly silty sandy CLAY. Gravel is angular and subangular, of sandstone and clinker (strong olfactory evidence of hydrocarbon).		
					(2.00)			
					3.00	Orangish brown silty sandy fine to coarse angular to rounded GRAVEL of sandstone (Alluvium).		
				(0.20)				
					3.20	Terminated in hard strata.		
						Complete at 3.20m		

<b>Plan</b> .	<b>Remarks</b> Trial pit sides generally remained stable for the short period of exposure. Rapid ingress of water from the surface into the pit, through the joints in the overlying concrete slabs. Trial pit backfilled with arisings on completion.					
	<table border="1"> <tr> <td><b>Scale (approx)</b></td> <td><b>Logged By</b></td> <td><b>Figure No.</b></td> </tr> <tr> <td>1:25</td> <td>EGH</td> <td>MWD/01.TP14</td> </tr> </table>	<b>Scale (approx)</b>	<b>Logged By</b>	<b>Figure No.</b>	1:25	EGH
<b>Scale (approx)</b>	<b>Logged By</b>	<b>Figure No.</b>				
1:25	EGH	MWD/01.TP14				



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**Site**  
 Crossley Lane, Dalton, Huddersfield

**Trial Pit Number**  
**TP15**

<b>Excavation Method</b> Using a JCB 3CX backhoe excavator with a two foot wide toothed bucket.	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 14/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20-0.40	D1		Water strike(1) at 0.20m.		(0.20) 0.20 (0.20) 0.40	MADE GROUND: Concrete slab (very hard, with closely spaced 200mm reinforcing bars, 20mm thick). MADE GROUND: Yellowish brown and orangish brown slightly clayey sandy GRAVEL of sandstone. MADE GROUND: Dark greyish brown and orangish brown clayey sandy fine to coarse angular to rounded GRAVEL of sandstone, mudstone, brick, ash and clinker. With a few gravel sized fragments of siltstone and ceramic. Medium subangular cobble content, of brick and sandstone. Low angular and subangular boulder content (up to 0.5m), of sandstone.		1
1.00-1.20	D2				(1.60)			
					2.00	Terminated due to constant moderate ingress of water from the surface into the base of the pit. Complete at 2.00m		

<b>Plan</b> .	<b>Remarks</b> Trial pit sides generally remained stable for the short period of exposure. Rapid ingress of water from the surface into the pit, through the joints in the overlying concrete slabs. Trial pit backfilled with arisings on completion.		
	<b>Scale (approx)</b> 1:25	<b>Logged By</b> EGH	<b>Figure No.</b> MWD/01.TP15



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Trial Pit Number**  
**TP16**

<b>Excavation Method</b> JCB 3CX	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 13/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20-0.50	D1				(0.50)	MADE GROUND: Brown clayey angular to sub-rounded sandy fine to coarse GRAVEL of sandstone, brick and trace concrete.		
					0.50	MADE GROUND: Dark grey gravelly CLAY. Gravel is sub-angular to sub-rounded, of sandstone.		
					(1.80)	Sandstone flags and bricks at 1.3m.		
2.35 2.35-2.50	D 50.67kPa D2		50,52,50/Av. 50.67		2.30	Medium strength (firm) light brown slightly mottled grey silty CLAY (Alluvium).		
					(0.70)			
					3.00	Complete at 3.00m		

<b>Plan</b> 	<b>Remarks</b>		
	Moderate groundwater ingress below 2.0m. Moderate instability below 1.0m. Hole backfilled with arisings on completion.		
	<b>Scale (approx)</b>	<b>Logged By</b>	<b>Figure No.</b>
	1:25	MCB	MWD/01.TP16



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**Site**  
 Crossley Lane, Dalton, Huddersfield

**Trial Pit Number**  
**TP17**

<b>Excavation Method</b> Using a JCB 3CX backhoe excavator with a two foot wide toothed bucket.	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 17/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50-0.70	D1		Water strike(1) at 0.20m.		0.10	MADE GROUND: Reinforced concrete.		1
					0.30	MADE GROUND: Grey sandy angular to sub-angular fine to coarse GRAVEL of sandstone.		
					0.50	MADE GROUND: Dark grey/black sandy angular to sub-angular fine to coarse GRAVEL of ash, sandstone, and trace brick, coal and clinker.		
					0.90	Light brown slightly sandy gravelly friable CLAY. Gravel is sub-angular to sub-rounded, of sandstone (Alluvium).		
					1.70	From 2.0m: Low cobble content of sandstone.		
					2.60	Brown very clayey sub-rounded to rounded fine to coarse GRAVEL of sandstone (Alluvium).		
3.00	Complete at 3.00m							

<b>Plan</b> .	<b>Remarks</b> Trial pit sides generally remained stable for the short period of exposure. Rapid ingress of water from the surface into the pit, through the joints in the overlying concrete slabs. Trial pit backfilled with arisings on completion.					
	<table border="1"> <tr> <td><b>Scale (approx)</b></td> <td><b>Logged By</b></td> <td><b>Figure No.</b></td> </tr> <tr> <td>1:25</td> <td>EGH</td> <td>MWD/01.TP17</td> </tr> </table>	<b>Scale (approx)</b>	<b>Logged By</b>	<b>Figure No.</b>	1:25	EGH
<b>Scale (approx)</b>	<b>Logged By</b>	<b>Figure No.</b>				
1:25	EGH	MWD/01.TP17				



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**Site**  
 Crossley Lane, Dalton, Huddersfield

**Trial Pit Number**  
**TP18**

<b>Excavation Method</b> JCB 3CX	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 14/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50-0.70	D1				0.10	MADE GROUND: Reinforced concrete.		
					0.40	MADE GROUND: Brown slightly clayey sub-angular to rounded fine to coarse GRAVEL of limestone.		
2.90-3.10	D2				0.50	MADE GROUND: Dark brown/black sandy fine to coarse GRAVEL of brick, sandstone, mixed lithology, ash and clinker. Perched water at 0.5m .		
					0.90			
					1.40	Firm brown slightly sandy slightly gravelly friable CLAY. Gravel is sub-angular, of sandstone (Alluvium).		
					1.50	Becoming sandy and gravelly below 2.0m.		
					2.70	Becoming very gravelly below 2.7m.		
					2.90 (0.20)	Brown very clayey sandy sub-rounded to rounded fine to coarse GRAVEL of sandstone (Alluvium).		
					3.10	Complete at 3.10m		

<b>Plan</b> .	<b>Remarks</b>  Perched water at 0.5m. (No groundwater ingress). Sides remained stable throughout. Hole backfilled with arisings on completion.		
		<table border="1"> <tr> <td><b>Scale (approx)</b> 1:25</td> <td><b>Logged By</b> MCB</td> <td><b>Figure No.</b> MWD/01.TP18</td> </tr> </table>	<b>Scale (approx)</b> 1:25
<b>Scale (approx)</b> 1:25	<b>Logged By</b> MCB	<b>Figure No.</b> MWD/01.TP18	



**ARP GEOTECHNICAL LIMITED**  
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**Site**  
 Crossley Lane, Dalton, Huddersfield

**Trial Pit Number**  
**TP19**

<b>Excavation Method</b> JCB 3CX backhoe excavator with two foot wide toothed bucket.	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 14/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50-0.70	D1				0.10	MADE GROUND: Dark brown slightly gravelly clayey TOPSOIL. Gravel is subangular to subrounded, of sandstone. With a few gravel sized fragments of concrete.		
					0.90	MADE GROUND: Dark greyish brown gravelly CLAY. Gravel is subangular, of limestone. Low subangular cobble content, of brick.		
					1.00	Complete at 1.00m		

<b>Plan</b> .	<b>Remarks</b> No groundwater seepages encountered. Sides remained stable throughout. Hole backfilled with arisings on completion.		
	<table border="1"> <tr> <td><b>Scale (approx)</b> 1:25</td> <td><b>Logged By</b> MCB</td> <td><b>Figure No.</b> MWD/01.TP19</td> </tr> </table>	<b>Scale (approx)</b> 1:25	<b>Logged By</b> MCB
<b>Scale (approx)</b> 1:25	<b>Logged By</b> MCB	<b>Figure No.</b> MWD/01.TP19	



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**Site**  
Crossley Lane, Dalton, Huddersfield

**Trial Pit Number**  
**TP20**

<b>Excavation Method</b> JCB 3CX	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 14/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.60-0.80	D1				(0.15)	MADE GROUND: Reinforced concrete.		
					0.15	MADE GROUND: Brown sandy sub-rounded to rounded fine to coarse GRAVEL of limestone.		
					(0.25)	MADE GROUND: Light brown sandy sub-rounded to rounded fine to coarse GRAVEL of sandstone and mixed lithology.		
					0.40	MADE GROUND: Dark grey/black sandy sub-angular to angular fine to coarse GRAVEL of sandstone, mudstone, brick, ash and clinker.		
					(0.20)	MADE GROUND: Brown sandy slightly gravelly CLAY. Gravel is sub-angular to sub-rounded, of sandstone and occasional brick and coal.		
					0.60	Firm grey silty slightly gravelly friable CLAY. Gravel is sub-angular, of mudstone with trace coal (Alluvium).		
					(0.30)	Firm orange/brown sandy slightly gravelly CLAY. Gravel is sub-rounded to rounded and tabular, of sandstone (Alluvium).		
				1.30	Brown very clayey sub-rounded to rounded fine to coarse GRAVEL of sandstone. Low cobble content of sandstone (Alluvium).			
				(0.60)	Complete at 3.20m			

<b>Plan</b> .	<b>Remarks</b>  Moderate groundwater ingress below 2.4m. Sides remained stable throughout. Hole backfilled with arisings on completion.		
	<table border="1"> <tr> <td><b>Scale (approx)</b> 1:25</td> <td><b>Logged By</b> MCB</td> <td><b>Figure No.</b> MWD/01.TP20</td> </tr> </table>	<b>Scale (approx)</b> 1:25	<b>Logged By</b> MCB
<b>Scale (approx)</b> 1:25	<b>Logged By</b> MCB	<b>Figure No.</b> MWD/01.TP20	



**ARP GEOTECHNICAL LIMITED**  
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**Site**  
 Crossley Lane, Dalton, Huddersfield

**Trial Pit Number**  
**TP21**

<b>Excavation Method</b> JCB 3CX	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 15/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.60-0.80	D1		Water strike(1) at 1.70m.		0.10	MADE GROUND: Reinforced concrete.		
					0.20	MADE GROUND: Grey sub-angular to sub-rounded fine to coarse GRAVEL of sandstone.		
					0.30	MADE GROUND: Dark grey/black sandy sub-angular to sub-rounded fine to coarse GRAVEL of sandstone, brick, ash, and occasional clinker.		
					0.60	MADE GROUND: Dark grey/black silty CLAY.		
					0.80	Firm grey silty slightly gravelly CLAY. Gravel is sub-angular, of coal (Alluvium).		
					1.10	High strength (stiff) orange/brown sandy slightly gravelly CLAY. Gravel is sub-angular to rounded and tabular of sandstone (Alluvium).		
					2.00	Brown very clayey sub-angular to rounded fine to coarse GRAVEL of sandstone (Alluvium).		
					2.90	Complete at 2.90m		

<b>Plan</b> .	<b>Remarks</b>  Moderate groundwater ingress below 1.7m. Slight nstability below 1.7m. Hole backfilled with arisings on completion.		
	<table border="1"> <tr> <td><b>Scale (approx)</b> 1:25</td> <td><b>Logged By</b> MCB</td> <td><b>Figure No.</b> MWD/01.TP21</td> </tr> </table>	<b>Scale (approx)</b> 1:25	<b>Logged By</b> MCB
<b>Scale (approx)</b> 1:25	<b>Logged By</b> MCB	<b>Figure No.</b> MWD/01.TP21	





**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Trial Pit Number**  
**TP23**

<b>Excavation Method</b> JCB 3CX	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 14/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.40-0.60	D1				0.10	MADE GROUND: Reinforced concrete.		
					0.20	MADE GROUND: Grey sub-angular to angular fine to coarse GRAVEL of limestone. Perched water at 0.3m.		
					0.30			
					0.60	MADE GROUND: Light brown sandy sub-angular to rounded fine to coarse GRAVEL of sandstone and mixed lithology.		
					0.70	MADE GROUND: Grey silty CLAY.		
2.50-3.00	D2				0.50	Firm grey silty CLAY (Alluvium).		
					1.20	Firm orange/brown sandy slightly gravelly friable CLAY. Gravel is sub-angular, of sandstone and coal (Alluvium).		
					1.30	From 2.0m: Very gravelly.		
					2.50	Brown very clayey sub-angular to rounded fine to coarse GRAVEL of sandstone. Low cobble content, of sandstone (alluvium).		
					3.00	Complete at 3.00m		

<b>Plan</b> .	<b>Remarks</b>  Perched water at 0.3m. (No groundwater ingress). Sides remained stable throughout. Hole backfilled with arisings on completion.					
		<table border="1"> <tr> <td><b>Scale (approx)</b></td> <td><b>Logged By</b></td> <td><b>Figure No.</b></td> </tr> <tr> <td>1:25</td> <td>MCB</td> <td>MWD/01.TP23</td> </tr> </table>	<b>Scale (approx)</b>	<b>Logged By</b>	<b>Figure No.</b>	1:25
<b>Scale (approx)</b>	<b>Logged By</b>	<b>Figure No.</b>				
1:25	MCB	MWD/01.TP23				



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
Crossley Lane, Dalton, Huddersfield

**Trial Pit Number**  
**TP24**

<b>Excavation Method</b> JCB 3CX	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 14/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.20	D1				(0.20)	MADE GROUND: Dark brown clayey gravelly TOPSOIL. Gravel is sub-angular to sub-rounded, of mixed lithology.		
					0.20 (0.20)	MADE GROUND: Brown clayey sub-rounded to rounded fine to coarse GRAVEL of sandstone, mixed lithology and occasional brick and ceramic.		
					0.40 (0.60)	MADE GROUND: Dark grey gravelly CLAY. Gravel is sub-angular to rounded, of sandstone, mixed lithology and brick.		
					1.00 (1.40)	Firm light brown sandy slightly gravelly friable CLAY. Gravel is sub-angular to sub-rounded and tabular, of sandstone.  Low cobble content below 1.8m.  Becoming gravelly below 2.0m.		
			Water strike(1) at 2.40m.		2.40 (0.60)	Brown very clayey sub-angular to rounded fine to coarse GRAVEL of sandstone.		1
					3.00	Complete at 3.00m		

<b>Plan</b> .	<b>Remarks</b> Slight groundwater ingress below 2.4m. Sides remained stable throughout. Hole backfilled with arisings on completion.		
	<table border="1"> <tr> <td><b>Scale (approx)</b> 1:25</td> <td><b>Logged By</b> MCB</td> <td><b>Figure No.</b> MWD/01.TP24</td> </tr> </table>	<b>Scale (approx)</b> 1:25	<b>Logged By</b> MCB
<b>Scale (approx)</b> 1:25	<b>Logged By</b> MCB	<b>Figure No.</b> MWD/01.TP24	





**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Trial Pit Number**  
**TP26**

<b>Excavation Method</b> JCB 3CX	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 14/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.40-0.60	D1				0.10	MADE GROUND: Reinforced concrete.		
					0.10	MADE GROUND: Grey fine to coarse sub-angular to sub-rounded GRAVEL of limestone and mixed lithology.		
					0.25	MADE GROUND: Brown sandy fine to coarse sub-angular to sub-rounded GRAVEL of sandstone and occasional mudstone.		
					0.40	MADE GROUND: Dark grey/black clayey GRAVEL of sandstone.		
					0.50	Firm light brown sandy slightly gravelly friable CLAY. Gravel is sub-angular to sub-rounded, of sandstone (Alluvium).		
2.00-2.20	D2				1.40	Brown very clayey sub-angular to rounded fine to coarse GRAVEL of sandstone (Alluvium).		
					1.50			
					2.90	Complete at 2.90m		

<b>Plan</b> .	<b>Remarks</b>  Strata remained dry. Moderate instability below 1.4m. Hole backfilled with arisings on completion.	<b>Scale (approx)</b> 1:25	<b>Logged By</b> MCB	<b>Figure No.</b> MWD/01.TP26
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**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Trial Pit Number**  
**TP34**

<b>Excavation Method</b> Using a JCB 3CX backhoe excavator with a two foot wide toothed bucket.	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 15/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20-0.40	D2		140,140,140/Av. 140.00		0.20	MADE GROUND: Concrete slab (very hard, with closely spaced 200mm reinforcing bars, 20mm thick).		
0.40	HSV 140kPa				0.20	MADE GROUND: Orangish brown and greyish brown sandy fine to coarse angular and subangular GRAVEL of sandstone and limestone.		
1.50-1.70	D1				(2.60)	High strength (stiff/ very stiff) greyish brown and orangish brown slightly sandy slightly silty gravelly CLAY. Gravel is angular tabular of sandstone and siltstone. Low angular tabular cobble content, of sandstone (up to 30mm bedded) (Possible Head).		
					3.00	From 1.5m: With medium angular tabular cobble content, of sandstone. Low angular boulder content, of sandstone.		
						Terminated due to hard strata and excavator almost at full stretch. Complete at 3.00m		

<b>Plan</b> 	<b>Remarks</b>		
	Slight instability of pit sides to 0.4m, through the granular made ground. Strata remained dry. Trial pit backfilled with arisings on completion.		
	<b>Scale (approx)</b>	<b>Logged By</b>	<b>Figure No.</b>
	1:25	EGH	MWD/01.TP34



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
Crossley Lane, Dalton, Huddersfield

**Trial Pit Number**  
**TP35**

<b>Excavation Method</b> Using a JCB 3CX backhoe excavator with a two foot wide toothed bucket.	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 15/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20-0.40	D1		120,140,140/Av. 133.33		0.20	MADE GROUND: Concrete slab (very hard, with closely spaced 200mm reinforcing bars, 20mm thick).		
0.40	HSV 133.33kPa				0.20	MADE GROUND: Orangish brown and greyish brown sandy fine to coarse angular and subangular GRAVEL of sandstone and limestone.		
					0.40	Stiff orangish brown and grey slightly gravelly silty sandy CLAY. Gravel is angular, of sandstone and siltstone. Medium angular cobble content (up to 40mm bedded), of sandstone and siltstone (Possible Head).		
					(2.60)			
					3.00	Terminated in hard strata. Complete at 3.00m		

<b>Plan</b> .	<b>Remarks</b>		
	Slight instability of pit sides to 0.4m, through the granular made ground. Strata remained dry. Trial pit backfilled with arisings on completion.		
	<b>Scale (approx)</b>	<b>Logged By</b>	<b>Figure No.</b>
	1:25	EGH	MWD/01.TP35







**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Trial Pit Number**  
**TP38**

<b>Excavation Method</b> Using a JCB 3CX backhoe excavator with a two foot wide toothed bucket.	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 16/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.80-1.00	D1		Water strike(1) at 0.20m.		0.20	MADE GROUND: Concrete slab (very hard, with closely spaced 200mm reinforcing bars, 20mm thick).		1
					0.20	MADE GROUND: Orangish brown and yellowish brown sandy fine to coarse angular GRAVEL of sandstone.		
					0.40	Firm greyish brown and orangish brown slightly sandy slightly gravelly silty CLAY. Gravel is angular tabular, of sandstone. Medium angular tabular cobble content, of sandstone (Possible Head).		
					(2.50)			
					2.90	Complete at 2.90m		

<b>Plan</b> .	<b>Remarks</b> Trial pit sides generally remained stable for the short period of exposure. Rapid ingress of water from the surface into the pit, through the joints in the overlying concrete slabs. Trial pit backfilled with arisings on completion.					
	<table border="1"> <tr> <td><b>Scale (approx)</b></td> <td><b>Logged By</b></td> <td><b>Figure No.</b></td> </tr> <tr> <td>1:25</td> <td>EGH</td> <td>MWD/01.TP38</td> </tr> </table>	<b>Scale (approx)</b>	<b>Logged By</b>	<b>Figure No.</b>	1:25	EGH
<b>Scale (approx)</b>	<b>Logged By</b>	<b>Figure No.</b>				
1:25	EGH	MWD/01.TP38				



**ARP GEOTECHNICAL LIMITED**  
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**Site**  
 Crossley Lane, Dalton, Huddersfield

**Trial Pit Number**  
**TP39**

<b>Excavation Method</b> Using a JCB 3CX backhoe excavator with a two foot wide toothed bucket.	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 16/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.60-1.00	D1		Water strike(1) at 0.20m.		(0.20) 0.20 (0.10) 0.30 (0.10) 0.40 (0.60)	MADE GROUND: Concrete slab (very hard, with closely spaced 200mm reinforcing bars, 20mm thick). MADE GROUND: Reddish brown COBBLES of brick. MADE GROUND: Orangish brown and greyish brown subangular tabular BOULDERS of sandstone (stone flags). MADE GROUND: Dark greyish brown and reddish brown slightly clayey sandy fine to coarse angular to rounded GRAVEL of ash, clinker, sandstone, brick and ceramic.		1
1.20-1.40	D2				1.00 (2.10)	MADE GROUND: Dark greyish brown slightly sandy gravelly CLAY. Gravel is angular tabular, of sandstone.		
					3.10 (0.30)	Greyish brown slightly clayey sandy fine to coarse angular to rounded GRAVEL of sandstone (Alluvium).		
					3.40	Terminated in hard strata and excavator almost at full stretch. Complete at 3.40m		

<b>Plan</b> .	<b>Remarks</b> Moderate instability of pit sides to 1m, through the granular made ground. Rapid ingress of groundwater below 1m, into the base of the pit. Trial pit backfilled with arisings on completion.					
	<table border="1"> <tr> <td><b>Scale (approx)</b></td> <td><b>Logged By</b></td> <td><b>Figure No.</b></td> </tr> <tr> <td>1:25</td> <td>EGH</td> <td>MWD/01.TP39</td> </tr> </table>	<b>Scale (approx)</b>	<b>Logged By</b>	<b>Figure No.</b>	1:25	EGH
<b>Scale (approx)</b>	<b>Logged By</b>	<b>Figure No.</b>				
1:25	EGH	MWD/01.TP39				



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
Crossley Lane, Dalton, Huddersfield

**Trial Pit Number**  
**TP40**

<b>Excavation Method</b> JCB 3CX	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 16/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.80-0.90	D1				0.10	MADE GROUND: Brown sandy sub-angular to angular fine to coarse GRAVEL with medium cobble content of sandstone, brick and concrete.		
					0.20			
					0.30	MADE GROUND: Brown sandy sub-angular to sub-rounded fine to coarse GRAVEL of limestone. Brickwall encountered down to 2.0m.		
					0.30			
					0.60	MADE GROUND: Concrete slab.		
					0.80	MADE GROUND: Grey sandy angular to sub-angular fine to coarse GRAVEL of sandstone.		
0.80								
1.70-1.90	D2	Water strike(1) at 1.70m.			1.00	MADE GROUND: Dark brown slightly clayey sub-angular fine to coarse GRAVEL of ash, sandstone and trace clinker.		
					1.00			
					1.50	MADE GROUND: Brown slightly gravelly CLAY. Gravel is sub-angular, of sandstone and trace clinker.		
					1.50			
1.70	MADE GROUND: Dark brown slightly clayey sub-angular to sub-rounded fine to coarse GRAVEL of sandstone, ash and trace clinker. Perched water at 1.7m.							
1.70								
					2.30	Stiff grey slightly sandy slightly gravelly CLAY. Gravel is sub-angular, of sandstone (Alluvium).		
					3.00	Complete at 3.00m		

<b>Plan</b> .	<b>Remarks</b>  Perched water at 1.7m (No groundwater ingress). Sides remained stable throughout. Hole backfilled with arisings on completion.		
		<table border="1"> <tr> <td><b>Scale (approx)</b> 1:25</td> <td><b>Logged By</b> MCB</td> <td><b>Figure No.</b> MWD/01.TP40</td> </tr> </table>	<b>Scale (approx)</b> 1:25
<b>Scale (approx)</b> 1:25	<b>Logged By</b> MCB	<b>Figure No.</b> MWD/01.TP40	



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Number**  
**WS01**

<b>Excavation Method</b> Tracked Windowless Sampling Rig.	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 13/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50-0.70	D1				(0.50)	MADE GROUND: Grey sandy fine to coarse angular GRAVEL of limestone.		
0.80-0.90	D2				0.50 (0.25) 0.75	MADE GROUND: Dark reddish brown grey and light grey sandy fine to coarse angular to rounded GRAVEL of limestone, ash and clinker.		
1.00-1.45 1.10-1.30	SPT N=6 D3		1,1/1,1,2,2		(0.35) 1.10	MADE GROUND: Brown and grey CLAY.  Low strength (soft) orangish brown mottled grey slightly sandy CLAY (Alluvium).		
2.00-2.45	SPT N=24		4,3/5,4,5,10		1.90  (1.30)	High strength (stiff/ very stiff) orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is angular to subangular, of sandstone (Alluvium).		
3.00-3.45	SPT N=22		0,1/3,4,7,8		3.20 (0.40)	Medium dense grey clayey fine to coarse SAND (Alluvium).		
4.00-4.45	SPT N=32		6,7/7,8,8,9		3.60  (1.85)	Borderline medium dense/ dense reddish brown and grey slightly clayey slightly sandy fine to coarse angular and subangular GRAVEL of sandstone (Alluvium).		
5.00-5.45	SPT N=40		8,10/10,10,10,10		5.45	From 4.6m: High angular tabular cobble content, of sandstone.  From 5m: Dense.  No SPT Refusal. Complete at 5.45m		

<b>Remarks</b> Strata remained dry. Borehole backfilled with arisings on completion.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	EGH
	<b>Figure No.</b> MWD/01.WS01	



**ARP GEOTECHNICAL LIMITED**  
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**Site**  
 Crossley Lane, Dalton, Huddersfield

**Number**  
**WS02**

<b>Excavation Method</b> Tracked Windowless Sampling Rig	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 13/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.55-0.70	D1				(0.20) 0.20 (0.35) 0.55 (0.15) 0.70 (0.20) 0.90 (0.10) 1.00	MADE GROUND: Concrete. MADE GROUND: Grey angular GRAVEL of limestone. MADE GROUND: Dark grey/black slightly clayey sandy angular fine to coarse GRAVEL of ash and mixed lithology.		
1.00-1.45	SPT N=9		1,2/2,2,2,3		(0.50)	MADE GROUND: Dark grey slightly gravelly silty CLAY. Gravel is sub-angular to angular, of coal and mudstone (Reworked natural).		
1.20-1.30	D2				1.50	Stiff grey silty slightly gravelly CLAY. Gravel is sub-rounded to sub-angular, of mudstone (Alluvium). Medium strength (firm) brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is sub-angular, of mudstone (Alluvium).		
2.00-2.45	SPT N=25		1,2/3,5,7,10		(1.30)	Firm brown slightly sandy very gravelly CLAY. Gravel is sub-angular, of sandstone (Alluvium). From 2.0m: High strength Low cobble content below 1.7m.		
3.00-3.45	SPT N=23		5,6/6,6,5,6		2.80 (0.65) 3.45	High strength (stiff) dark grey gravelly CLAY. Gravel is sub-angular to rounded, of sandstone (Alluvium).		
						Complete at 3.45m		

<b>Remarks</b> Strata remained dry. Sides remained stable throughout. Gas monitoring well installed to 3m. Lower 2m comprising slotted pipe with gravel surround, and upper 1m comprising solid pipe with bentonite cap. Valve and flush cover.	<b>Scale (approx)</b> 1:40	<b>Logged By</b> MCB
	<b>Figure No.</b> MWD/01.WS2	



**ARP GEOTECHNICAL LIMITED**  
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**Site**  
 Crossley Lane, Dalton, Huddersfield

**Number**  
**WS03**

<b>Excavation Method</b> Tracked Windowless Sampling Rig.	<b>Dimensions</b>	<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>	<b>Dates</b> 13/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.00-1.45 1.00-1.20	SPT N=7 D1		1,1/1,2,2,2		(0.20) 0.20 (0.30) 0.50  (0.90)  1.40	MADE GROUND: Concrete slab. MADE GROUND: Grey sandy fine to coarse angular and subangular GRAVEL of limestone. Orangish brown and grey CLAY.  From 1m: Low strength (soft).	  	
2.00-2.45 2.40-2.60	SPT N=15 D2		Water strike(1) at 2.00m. 5,7/5,4,3,3		2.00	Low strength (soft) orangish brown and grey slightly sandy slightly gravelly CLAY. Gravel is angular and subangular, of sandstone (Alluvium). Medium dense brownish grey slightly sandy clayey fine to coarse angular to rounded GRAVEL of sandstone (Alluvium).		1
3.00-3.45	SPT N=38		7,7/8,10,10,10		(2.45)	From 3m: Dense.		
4.00-4.44	SPT 50/290		11,12/13,13,14,10		4.45	SPT refusal. Complete at 4.45m		

<b>Remarks</b> Strata wet below 2m. Backfilled with arisings on completion.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	EGH
	<b>Figure No.</b> MWD/01.WS03	



**ARP GEOTECHNICAL LIMITED**  
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**Site**  
 Crossley Lane, Dalton, Huddersfield

**Number**  
**WS04**

<b>Excavation Method</b> Tracked Windowless Sampling Rig	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 13/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.55-0.70	D1				(0.15) 0.15	MADE GROUND: Dark brown clayey slightly gravelly TOPSOIL. Gravel is sub-angular, of sandstone and mixed lithology.		
					(0.70)	MADE GROUND: Brown sandy sub-angular to angular GRAVEL of sandstone and limestone.		
1.00-1.45	SPT N=6		2,2/1,2,1,2		0.85 (0.45)	MADE GROUND: Stiff brown slightly gravelly silty CLAY. Gravel is sub-angular, of coal and mixed lithology.		
1.70-1.90	D2				1.30	Low strength (soft) brown slightly sandy slightly gravelly silty CLAY. Gravel is sub-angular, of sandstone (Alluvium).		
2.00-2.45	SPT N=15		0,0/0,6,4,5 Water strike(1) at 2.20m.		(1.20)	From 2.0m: High strength.		1
2.70-3.00	D3				2.50	Medium dense brown slightly sandy very clayey sub-angular to sub-rounded fine to coarse GRAVEL of sandstone (Alluvium).		
3.00-3.45	SPT N=15		2,3/3,3,4,5		(0.95)			
					3.45	Complete at 3.45m		

<b>Remarks</b> Strata wet below 2.2m. Sides remained stable throughout. Gas monitoring well installed to 3m. Lower 2m comprising slotted pipe with gravel surround, and upper 1m comprising solid pipe with bentonite cap. Valve and flush cover. Backfilled with arisings on completion.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	MCB
<b>Figure No.</b> MWD/01.WS4		



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Number**  
**WS05**

<b>Excavation Method</b> Tracked Windowless Sampling Rig.	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 13/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.60-0.80	D1				0.20 0.20	MADE GROUND: Concrete slab.		
					0.40	MADE GROUND: Grey sandy fine to coarse angular to subangular GRAVEL of limestone.		
					0.60 0.20 0.80	MADE GROUND: Greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular, of sandstone.		
1.00-1.45	SPT N=8		2,1/2,2,2,2		0.75	Borederline low to medium strength (soft to firm) grey mottled orange slightly sandy CLAY (Alluvium).		
					1.55	Borederline medium to high strength (firm to stiff) orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is angular and subangular, of sandstone (Alluvium).		
2.00-2.45	SPT N=15		3,3/3,4,4,4		1.15			
2.70-3.00	D2				2.70	Loose dark greyish brown clayey sandy fine to coarse angular to subrounded GRAVEL of sandstone (Alluvium).		1
3.00-3.45	SPT N=6		Water strike(1) at 2.90m. 4,3/2,2,1,1					
					(2.75)	From 4m: Dense.		
4.00-4.45	SPT N=35		3,9/8,9,9,9					
					5.45	No SPT refusal. Complete at 5.45m		
5.00-5.45	SPT N=49		11,11/9,11,12,17					

<b>Remarks</b> Strata wet below 2.9m. Backfilled with arisings on completion.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	EGH
	<b>Figure No.</b> MWD/01.WS05	



<b>Excavation Method</b> Tracked Windowless Sampling Rig	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 13/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.70-0.90	D1				(0.35)	MADE GROUND: Concrete.		
1.00-1.45	SPT N=12		2,2/3,3,3,3		0.35 (0.25) 0.60 (1.00)	MADE GROUND: Brown sandy angular fine to coarse GRAVEL of sandstone. Low cobble content of sandstone.  MADE GROUND: Dark grey/brown gravelly CLAY. Gravel is sub-angular to angular, of mudstone, brick and trace sandstone.		
2.00-2.45	SPT N=10		2,2/2,2,2,4		1.60 (0.20) 1.80 (0.80)	MADE GROUND: Grey sandy angular fine to coarse GRAVEL of limestone.  MADE GROUND: Brown slightly gravelly silty CLAY. Gravel is sub-angular to sub-rounded, of sandstone (Alluvium).		
3.00-3.45	SPT N=40		7,6/8,9,11,12		2.60 (1.00)	Dense brown sandy very clayey sub-angular to sub-rounded fine to coarse GRAVEL of sandstone (Alluvium).		
3.60-4.00	D2				3.60 (0.40)	Grey clayey sub-rounded to rounded fine to coarse GRAVEL of sandstone (Alluvium).		
4.00-4.45	SPT N=26		6,6/6,6,6,8		4.00 (0.80)	Dense light brown very clayey sandy sub-angular to angular fine to coarse GRAVEL of sandstone (Alluvium).		
5.00-5.45	SPT N=32		7,7/7,8,8,9		4.80 (0.65) 5.45	Stiff dark grey gravelly CLAY. Gravel is sub-rounded, of sandstone (Alluvium). From 5.0m: Very high strength.		
						No SPT Refusal. Complete at 5.45m		

<b>Remarks</b> Strata wet below 4.0m. Sides remained stable throughout. Backfilled with arisings on completion.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	MCB
	<b>Figure No.</b> MWD/01.WS6	



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Number**  
**WS07**

<b>Excavation Method</b> Tracked Windowless Sampling Rig.	<b>Dimensions</b>	<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>	<b>Dates</b> 13/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.30-0.50	D1				(0.20) 0.20 0.25	MADE GROUND: Concrete slab.		
1.00-1.45 1.00-1.20	SPT N=35 D2		7,9/12,10,8,5		(0.65) 0.90	MADE GROUND: Reddish brown and greyish brown sandy fine to coarse angular to rounded GRAVEL of sandstone and limestone.  MADE GROUND: Greyish brown slightly gravelly silty sandy CLAY. Gravel is angular, of sandstone and mudstone.		
2.00-2.45 2.20-2.40	SPT N=2 D3		Water strike(1) at 2.00m. 0,0/0,0,1,1		(0.75) 1.65	MADE GROUND: Dense greyish brown reddish brown and dark grey slightly sandy clayey fine to coarse angular to rounded GRAVEL of ash, clinker, brick, sandstone and limestone.  MADE GROUND: Borderline extremely low to very low strength (very soft) greyish brown and orangish brown silty sandy CLAY (hydrocarbon odour). From 2m: Medium strength (firm).		1
3.00-3.45	SPT N=11		2,2/3,2,3,3		(1.80) 3.45	From 2.9m to 3m: angular gravel and cobbles, of sandstone.  Borehole extended by dynamic probe from base to 10m (see separate log DP07). Complete at 3.45m		

<b>Remarks</b> Strata wet below 2m. Borehole extended by dyanamic probe from base to 10m (see separate log DP07). Gas monitoring well installed to 3m. Lower 2m comprising slotted pipe with gravel surround, and upper 1m comprising solid pipe with bentonite cap. Valve and flush cover.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	EGH
	<b>Figure No.</b> MWD/01.WS07	



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Number**  
**WS08**

<b>Excavation Method</b> Tracked Windowless Sampling Rig	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 13/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.40-0.60	D1				(0.40) 0.40	MADE GROUND: Brown/grey sandy angular fine to coarse GRAVEL of limestone and mixed lithology.		
1.00-1.45	SPT N=10		3,2/1,2,3,4		(0.60) 1.00	MADE GROUND: Brown gravelly CLAY. Gravel is sub-angular to sub-rounded, of sandstone, mudstone and occasional brick.		
2.00-2.45	SPT N=8		1,1/2,2,2,2		(0.80) 1.80 2.10	MADE GROUND: Brown sandy angular GRAVEL of mudstone, limestone, brick and mixed lithology.		
3.00-3.45	SPT N=29		3,12/8,7,7,7		(0.90) 3.00	Firm light brown silty slightly gravelly CLAY. Gravel is sub-rounded to rounded, of sandstone (Alluvium).		
4.00-4.44	SPT 50/290		6,8/12,15,11,12		(0.94) 4.44	Medium strength (firm) light brown mottled grey sandy slightly gravelly CLAY. Gravel is sub-angular to angular, of sandstone (Alluvium).		
						Dense brown clayey sub-angular fine to coarse GRAVEL of sandstone (Alluvium)		
						Stiff dark grey slightly sandy gravelly CLAY. Gravel is sub-angular to sub-rounded, of sandstone (Alluvium).		
						Complete at 4.44m		

<b>Remarks</b> Strata wet below 3.0m. Sides remained stable throughout. Backfilled with arisings on completion.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	MCB
	<b>Figure No.</b> MWD/01.WS8	



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Number**  
**WS09**

<b>Excavation Method</b> Tracked Windowless Sampling Rig.	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 14/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.00-1.45 1.00-1.20	SPT N=6 D1		1,1/1,1,2,2		(0.20) 0.20 0.25 (0.65) 0.90 (0.80)	MADE GROUND: Concrete slab. MADE GROUND: Buff grey sandy fine to coarse angular and subangular GRAVEL of limestone. MADE GROUND: Dark grey, reddish brown and greyish brown sandy fine to coarse angular to rounded GRAVEL of sandstone, ash clinker and limestone. MADE GROUND: Greyish brown and blueish grey slightly silty slightly sandy gravelly CLAY. Gravel is angular to subrounded, of sandstone, siltstone. Trace gravel sized fragments of coal.		
2.00-2.45	SPT N=8		2,1/2,1,2,3		1.70 (1.10)	Borderline low strength to medium strength (soft to firm) orangish brown and greyish brown slightly silty slightly sandy slightly gravelly CLAY. Gravel is angular tabular, of sandstone (Alluvium).		
3.00-3.45	SPT N=17		Water strike(1) at 3.00m. 4,4/4,4,4,5		2.80 (0.60)	From 2.6m to 2.8m: Very thin bed (up to 20mm) of angular gravel and cobbles, of sandstone. High strength (stiff) greyish brown and blueish grey slightly sandy clayey fine to coarse angular GRAVEL of sandstone (Alluvium).		1
3.50-3.70	D2				3.40	Medium dense? yellowish brown and greyish brown slightly clayey sandy fine to coarse angular to rounded GRAVEL of sandstone (Alluvium).		
4.00-4.45	SPT N=25		8,8/7,7,6,5		(2.05)			
5.00-5.45	SPT N=33		6,8/8,7,8,10		5.45	From 5m: Dense. Borehole extended by dynamic probe from base to 10m (see separate log DP09). Complete at 5.45m		

<b>Remarks</b> Strata wet below 3m. Borehole extended by dyanamic probe from base to 10m (see separate log DP09). Borehole backfilled with arisings on completion.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	EGH
	<b>Figure No.</b> MWD/01.WS09	



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
Crossley Lane, Dalton, Huddersfield

**Number**  
**WS10**

<b>Excavation Method</b> Tracked Windowless Sampling Rig	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 14/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.75-0.90	D1				(0.25)	MADE GROUND: Concrete.		
1.00-1.45	SPT N=29		6,8/8,8,7,6		0.25	MADE GROUND: Brown clayey sandy sub-angular to rounded fine to coarse GRAVEL of sandstone and mixed lithology.		
1.20-1.40	D2				(0.25)	MADE GROUND: Dark grey/black gravelly CLAY. Gravel is sub-rounded, of sandstone and mixed lithology.		
					(0.70)			
					1.20	MADE GROUND: Dark grey/black slightly clayey sandy angular to sub-rounded fine to coarse GRAVEL of sandstone, limestone, mixed lithology, ash and red brick.		
					(0.50)			
1.80-2.00	D3				1.70	Low strength (soft) grey slightly mottled brown slightly gravelly silty CLAY. Gravel is sub-angular, of mudstone and coal (Alluvium).		
2.00-2.45	SPT N=6		1,2/1,2,1,2		(0.60)			
					2.30	Low strength (soft) orange/brown sandy gravelly CLAY. Gravel is sub-angular to sub-rounded, of sandstone (Alluvium).		
					(1.30)			
3.00-3.45	SPT N=12		3,3/3,3,2,4		3.60	From 3.0m: Medium strength.		
					(1.85)			
4.00-4.45	SPT N=33		5,5/10,8,8,7		5.45	Dense brown very clayey slightly sandy sub-angular to rounded fine to coarse GRAVEL of sandstone (Alluvium).		
5.00-5.45	SPT N=30		9,7/6,7,8,9			No SPT Refusal. Borehole extended by dynamic probe from base to 9m (see separate log DP10) Complete at 5.45m		

<b>Remarks</b> Strata wet below 4.0m. Sides remained stable throughout. Dynamic probe carried out at base to 9.0m. Backfilled with arisings on completion.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	MCB
	<b>Figure No.</b> MWD/01.WS10	



<b>Excavation Method</b> Tracked Windowless Sampling Rig.	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 14/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50-0.70	D1		Water strike(1) at 0.30m.		(0.25) 0.25	MADE GROUND: Concrete slab.		1
					(0.25) 0.50	MADE GROUND: Yellowish brown sandy fine to coarse angular and subangular GRAVEL of sandstone.		
					(0.40) 0.90	MADE GROUND: Dark greyish brown, reddish brown and buff grey sandy fine to coarse angular to rounded GRAVEL of sandstone, brick, ash and clinker.		
1.00-1.45	SPT N=6		1,1/1,1,2,2		(1.00)	Low strength (soft) orangish brown silty sandy CLAY (Alluvium).		
1.90-2.10 2.00-2.45	D2 SPT N=5		2,2/2,1,1,1		1.90 (1.05)	Loose reddish brown and orangish brown clayey gravelly fine to coarse SAND. Gravel is angular, of sandstone (Alluvium).		
3.00-3.45	SPT N=11		1,1/2,2,3,4		2.95 (0.85)	Medium dense buff grey slightly clayey sandy gravelly SILT. Gravel is angular to rounded, of sandstone (Alluvium).		
4.00-4.45	SPT 50/295		7,9/12,11,14,13		3.80 (0.65)	Very dense dark grey and greyish brown clayey fine to coarse angular GRAVEL of sandstone. Medium angular cobble content, of sandstone (Alluvium).		
					4.45	SPT refusal.		
						Complete at 4.45m		

<b>Remarks</b> Strata wet below 0.3m. Borehole backfilled with arisings on completion.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	EGH
	<b>Figure No.</b> MWD/01.WS11	



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Number**  
**WS12**

<b>Excavation Method</b> Tracked Windowless Sampling Rig	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 14/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.30-0.50	D1				(0.10) (0.20) 0.30	MADE GROUND: Dark brown clayey gravelly TOPSOIL. Gravel is sub-angular to sub-rounded, of sandstone, concrete and mixed lithology.		
1.00-1.45	SPT N=6		1,1/1,1,2,2		(0.90) 1.20	MADE GROUND: Brown clayey sub-angular to angular GRAVEL of limestone (sub-base).  MADE GROUND: Brown gravelly CLAY. Gravel is sub-angular to angular, of sandstone, mudstone and occasional coal and brick.		
2.00-2.45	SPT N=0		0,0/0,0,0,0		(1.70)	MADE GROUND: Grey slightly gravelly silty CLAY. Gravel is sub-angular to sub-rounded, of mudstone and coal (Alluvium).		
3.00-3.45	SPT N=4		1,1/1,1,1,1		(2.90) (3.00)	Dark grey fibrous PEAT (Alluvium).  No Recovery.	SMz	
4.00-4.45	SPT N=35		5,7/8,8,10,9		(3.70) (0.80)	Soft grey slightly gravelly silty CLAY. Gravel is sub-rounded to rounded, of sandstone, mixed lithology and fibrous wood (Alluvium).		
4.50-4.70	D2				4.50	Brown very clayey silty sub-angular to rounded fine to coarse GRAVEL of sandstone (Alluvium).		
5.00-5.45	SPT 50/295		10,12/14,14,13,9		(0.95) 5.45	SPT Refusal. Complete at 5.45m		

<b>Remarks</b> Strata wet below 3.7m. Sides remained stable throughout. Backfilled with arisings on completion.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	MCB
	<b>Figure No.</b> MWD/01.WS12	



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Number**  
**WS13**

<b>Excavation Method</b> Tracked Windowless Sampling Rig.	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 14/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.70-1.00	D1				0.15 0.15 0.25 0.40 0.30 0.70	MADE GROUND: Concrete slab. MADE GROUND: Yellowish brown sandy fine to coarse angular and subangular GRAVEL of sandstone. MADE GROUND: Dark greyish brown sandy fine to coarse angular to rounded GRAVEL of sandstone, ash, clinker, ceramic. Trace gravel sized fragments of coal.		
1.00-1.45	SPT N=7		1,1/2,2,1,2		0.40 1.10	MADE GROUND: Greyish brown slightly gravelly silty CLAY. Gravel is angular, of sandstone. Low strength (soft) greyish brown and orangish brown silty sandy CLAY (Alluvium).		
1.20-1.40	D2				(0.65)			
2.00-2.45	SPT N=18		Water strike(1) at 2.00m. 6,5/5,4,4,5		1.75	Medium dense reddish brown and greyish brown slightly clayey sandy fine to coarse angular GRAVEL of sandstone (Alluvium).		1
3.00-3.45	SPT N=24		5,4/5,5,6,8		(1.70) 3.45			
						Complete at 3.45m		

<b>Remarks</b> Strata wet below 2m. Gas monitoring well installed to 3m. Lower 2m comprising slotted pipe with gravel surround, and upper 1m comprising solid pipe with bentonite cap. Valve and flush cover.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	EGH
	<b>Figure No.</b> MWD/01.WS13	



<b>Excavation Method</b> Tracked Windowless Sampling Rig	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 14/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50-0.70	D1				(0.20) 0.20 (0.30) 0.50 (0.30)	MADE GROUND: Concrete. MADE GROUND: Brown slightly clayey sandy sub-angular to rounded fine to coarse GRAVEL of sandstone, concrete, mixed lithology and brick. MADE GROUND: Dark brown/dark grey clayey sub-angular to sub-rounded fine to coarse GRAVEL of sandstone, mixed lithology, brick and ash.		
1.00-1.45	SPT N=7		1,1/1,2,2,2		(0.80) (0.15) 0.95 (0.45)	MADE GROUND: Brown/grey clayey sub-angular to sub-rounded fine to coarse GRAVEL of sandstone. Low strength (soft) grey silty slightly gravelly CLAY. Gravel is sub-angular to sub-rounded of mudstone with occasional coal (Alluvium).		
1.40-1.60	D2				1.40 (0.70)	Low strength (soft) brown mottled grey sandy slightly gravelly CLAY. Gravel is sub-angular to sub-rounded, of sandstone (Alluvium).		
2.00-2.45	SPT N=8		Water strike(1) at 2.00m. 1,1/2,2,2,2		2.10 (0.90)	Loose brown very clayey sub-angular to sub-rounded fine to coarse GRAVEL of sandstone and mixed lithology (Alluvium).		1
3.00-3.45	SPT N=24		3,4/5,6,6,7		3.00 (0.70)	No Recovery.		
4.00-4.43	SPT 50/275		8,11/12,14,14,10		3.70 (0.73) 4.43	Dark grey clayey sub-rounded to rounded fine to coarse GRAVEL of sandstone and mixed lithology. From 4.0m: Very dense. Complete at 4.43m		

<b>Remarks</b> Strata wet below 2.0m. Sides remained stable throughout. Backfilled with arisings on completion.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	MCB
	<b>Figure No.</b> MWD/01.WS14	



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Number**  
**WS15**

<b>Excavation Method</b> Tracked Windowless Sampling Rig.	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 14/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.20	D1				(0.20) 0.20	MADE GROUND: Turf over dark greyish brown slightly clayey gravelly TOPSOIL. Gravel is angular, of sandstone. Trace ceramic.		
					(0.60) 0.80	MADE GROUND: Dark greyish brown, reddish brown and buff grey slightly clayey sandy fine to coarse angular to subrounded GRAVEL of sandstone, brick and limestone. Medium angular tabular cobble content, of sandstone.		
1.00-1.45	SPT N=3		0,0/0,1,1,1		(0.80)	Very low strength (very soft) reddish grey brown and orangish brown silty sandy CLAY (Alluvium).		
1.60-1.80	D2				1.60 (0.35)	Orangish brown and grey clayey sandy SILT (Alluvium).		
2.00-2.45	SPT N=18		Water strike(1) at 2.00m. 6,5/5,4,4,5		1.95	Medium dense dark greyish brown, blueish grey and reddish brown clayey sandy fine to coarse angular to rounded GRAVEL of sandstone and mudstone. Trace gravel sized fragment of siltstone and coal (Alluvium).		1
3.00-3.45	SPT N=33		7,7/8,8,8,9		(3.50)	From 3m: Dense.		
4.00-4.45	SPT N=30		13,8/8,7,7,8					
5.00-5.45	SPT 50/295		9,10/11,12,14,13		5.45	SPT refusal. Complete at 5.45m		

<b>Remarks</b> Strata wet below 2m. Gas monitoring well installed to 3m. Lower 2m comprising slotted pipe with gravel surround, and upper 1m comprising solid pipe with bentonite cap. Valve and flush cover.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	EGH
	<b>Figure No.</b> MWD/01.WS15	



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Number**  
**WS16**

<b>Excavation Method</b> Tracked Windowless Sampling Rig.	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 14/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50-0.70	D1				(0.20) 0.20 (0.20) 0.40	MADE GROUND: Concrete slab.		
1.00-1.45	SPT N=10		3,2/3,3,2,2		(1.00)	MADE GROUND: Yellowish brown sandy fine to coarse angular and subangular GRAVEL of sandstone.		
1.40-1.60	D2				1.40	MADE GROUND: Dark greyish brown and reddish brown slightly sandy gravelly CLAY. Gravel is subangular, of sandstone, siltstone, ceramic and brick.		
2.00-2.45	SPT N=19		Water strike(1) at 2.00m. 5,5/5,5,4,5		(0.50) 1.90	From 1m: Medium strength (firm).		
3.00-3.45	SPT N=25		5,7/6,5,6,8		(0.70) 2.60	Orangish brown slightly gravelly clayey fine to coarse SAND (Alluvium).		1
4.00-4.45	SPT N=16		4,4/4,3,4,5		(1.85) 4.45	Medium dense orangish red brown slightly clayey sandy fine to coarse angular and subangular GRAVEL of sandstone. Medium angular cobble content, of sandstone (Alluvium).		
						Medium dense dark greyish brown and reddish brown grey slightly clayey fine to coarse angular to rounded GRAVEL of sandstone (Alluvium).		
						Borehole extended by dyanmic probe from base to 8.4m (see separate log DP16). Complete at 4.45m		

<b>Remarks</b> Strata wet below 2m. Borehole extended by dynamic probe from base to 8.4m (see separate log DP16). Borehole backfilled with arisings on completion.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	EGH
	<b>Figure No.</b> MWD/01.WS16	



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Number**  
**WS17**

<b>Excavation Method</b> Tracked Windowless Sampling Rig.	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 14/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20-0.40	D1				(0.20) 0.20	MADE GROUND: Concrete slab.		
					(0.50)	MADE GROUND: Yellowish brown and greyish brown sandy fine to coarse angular and subangular GRAVEL of sandstone.		
					0.70 (0.20) 0.90	MADE GROUND: Dark greyish brown slightly gravelly clayey sandy SILT. Gravel is angular, of sandstone. Trace gravel sized fragments of coal.		
1.00-1.45	SPT N=4		Water strike(1) at 1.00m. 1,1/1,1,1,1			Borederline loose to very loose brownish grey and orangish brown slightly gravelly clayey sandy SILT. Gravel is angular, of sandstone, mudstone and siltstone (Alluvium).		1
1.70-2.00	D2				(1.60)			
2.00-2.45	SPT N=12		2,2/2,3,3,4			From 2m: Medium dense.		
					2.50			
3.00-3.45	SPT N=33		7,9/10,8,7,8		(0.95)	Medium dense greyish brown and blueish grey slightly clayey silty sandy fine to coarse angular to rounded GRAVEL of sandstone. Trace gravel sized fragments of siltstone (Alluvium).		
					3.45	From 3m: Dense.		
						Complete at 3.45m		

<b>Remarks</b> Strata wet below 1m. Gas monitoring well installed to 3m. Lower 2m comprising slotted pipe with gravel surround, and upper 1m comprising solid pipe with bentonite cap. Valve and flush cover.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	EGH
	<b>Figure No.</b> MWD/01.WS17	



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Number**  
**WS18**

<b>Excavation Method</b> Tracked Windowless Sampling Rig.	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 14/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.40-0.60	D1				(0.20) 0.20 (0.20) 0.40	MADE GROUND: Concrete slab.		
1.00-1.45 1.00-1.20	SPT N=3 D2		0,0/0,1,1,1		(0.50) 0.90	MADE GROUND: Greyish brown slightly gravelly silty sandy CLAY. Gravel is angular, of sandstone and mudstone, with some siltstone. Trace gravel sized fragments, of coal.		
2.00-2.45	SPT N=12		Water strike(1) at 2.00m. 1,1/2,3,3,4		(0.80) 1.70	Very loose greyish brown and orangish brown slightly gravelly sandy SILT. Gravel is angular, of sandstone. Trace gravel sized fragments, of coal and mudstone (Alluvium).		1
3.00-3.45	SPT N=21		4,4/4,6,5,6		(1.10) 2.80	Medium dense reddish brown and orangish brown slightly clayey sandy fine to coarse angular to rounded GRAVEL of sandstone (Alluvium).		
4.00-4.45	SPT N=44		8,9/10,12,11,11		(1.65) 4.45	Medium dense greyish brown and blueish grey slightly clayey sandy fine to coarse angular to rounded GRAVEL of sandstone and siltstone (Alluvium).		
					4.45	Borehole extended by dynamic probe from base to 8.5m (see separate log DP18). Complete at 4.45m		

<b>Remarks</b> Strata wet below 2m. Backfilled with arisings on completion. Borehole extended from base by dynamic probe to 8.5m (see separate log DP18).	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	EGH
	<b>Figure No.</b> MWD/01.WS17	



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Number**  
**WS19**

<b>Excavation Method</b> Tracked Windowless Sampling Rig	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 15/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.25-0.50	D1				(0.20) 0.20 (0.25) 0.25 0.50	MADE GROUND: Concrete. MADE GROUND: Grey sandy sub-angular to angular fine to coarse GRAVEL of sandstone and mixed lithology.		
0.80-1.00	D2				(0.50)	MADE GROUND: Dark grey slightly gravelly CLAY. Gravel is sub-angular to tabular, of siltstone.		
1.00-1.45	SPT N=2		0,0/1,0,1,0		1.00	Stiff grey slightly mottled brown silty slightly gravelly CLAY. Gravel is sub-angular, of coal (Alluvium).		
					(0.70)	Brown/orange sandy slightly gravelly CLAY. Gravel is sub-angular to angular, of sandstone (Alluvium).		
2.00-2.45	SPT N=9		3,2/2,2,3,2		1.70 (0.30) 2.00	Brown very clayey sub-angular to sub-rounded fine to coarse GRAVEL of sandstone (Alluvium).		
					(0.60)	No Recovery.		
3.00-3.45	SPT N=38		6,6/7,9,10,12		2.60	Dense brown clayey sub-angular to rounded fine to coarse GRAVEL of sandstone.		
					(1.85)			
4.00-4.45	SPT N=36		6,9/9,10,9,8		4.45	Complete at 4.45m		

<b>Remarks</b> Groundwater ingress below 2.6m (rising to 0.55m bgl over 1.5hrs). Sides remained stable throughout. Backfilled with arisings on completion.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	MCB
	<b>Figure No.</b> MWD/01.WS19	





**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Number**  
**WS27**

<b>Excavation Method</b> Tracked Windowless Sampling Rig	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 15/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.30-0.40	D1				(0.10) (0.20) (0.30) (0.40)	MADE GROUND: Concrete.		
0.70-0.90	D2					MADE GROUND: Grey sandy angular to sub-angular fine to coarse GRAVEL of limestone (sub-base).		
1.00-1.45	SPT N=15		2,3/3,4,4,4			MADE GROUND: Brown sandy sub-angular to sub-rounded GRAVEL of sandstone.		
						High strength (stiff) slightly sandy gravelly CLAY. Gravel is sub-angular to sub-rounded, of mainly sandstone and mudstone (Possible Head).		
2.00-2.45	SPT N=15		2,3/3,3,4,5		(2.30)			
3.00-3.45	SPT N=17		3,2/4,4,4,5		2.70	High strength (stiff) grey slightly gravelly CLAY. Gravel is sub-angular to sub-rounded, of sandstone (Possible Head).		
4.00-4.45	SPT N=13		2,3/3,3,3,4		(1.70)			
4.40-4.60	D3				4.40	High strength (stiff) grey slightly silty slightly sandy CLAY (Possible Head).		
5.00-5.45	SPT N=36		6,6/6,7,11,12		(1.05)	Becoming very gravelly with sub-rounded sandstone below 4.8m.		
					5.45	Complete at 5.45m		

<b>Remarks</b> Strata remained dry. Borehole backfilled with arisings on completion.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	MCB
	<b>Figure No.</b> MWD/01.WS27	



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
Crossley Lane, Dalton, Huddersfield

**Number**  
**WS28**

<b>Excavation Method</b> Tracked Windowless Sampling Rig.	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 15/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.00-1.45 1.00-1.20	SPT N=28 D1		4,4/5,7,8,8		0.20	MADE GROUND: Concrete slab.		
					0.20 0.20 0.40	MADE GROUND: Grey sandy fine to coarse angular and subangular GRAVEL of limestone.		
2.00-2.45	SPT N=19		3,4/4,5,5,5			High strength (very stiff) greyish brown gravelly CLAY. Gravel is angular tabular, of mudstone. Medium angular cobble content, of sandstone (30mm bedded).		
3.00-3.45	SPT N=13		4,4/3,3,3,4		(5.05)	From 3m: Medium strength (firm).		
4.00-4.45	SPT N=21		4,4/4,5,5,7			From 4m: High strength (stiff).		
5.00-5.45	SPT N=16		2,2/3,4,4,5		5.45	Complete at 5.45m		

<b>Remarks</b> Strata remained dry. Borehole backfilled with arisings on completion.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	EGH
	<b>Figure No.</b> MWD/01.WS28	



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
Crossley Lane, Dalton, Huddersfield

**Number**  
**WS29**

<b>Excavation Method</b> Tracked Windowless Sampling Rig	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 15/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.60-0.65	D1				0.20	MADE GROUND: Concrete.		
0.80-1.00	D2				0.20	MADE GROUND: Grey sandy angular to sub-angular fine to coarse GRAVEL of limestone.		
1.00-1.45	SPT N=26		4,5/7,6,6,7		0.60	MADE GROUND: Black slightly clayey sub-angular fine to coarse GRAVEL of sandstone, brick and mixed lithology.  High strength (stiff) brown slightly sandy slightly gravelly CLAY. Gravel is sub-angular to sub-rounded, of sandstone and trace coal (Possible Head). Gravel of siltstone encountered below 0.8m. Becoming very gravelly below 1.0m, mainly of sandstone.		
					0.65			
2.00-2.45	SPT N=16		3,2/3,4,4,5		(3.35)			
3.00-3.45	SPT N=17		3,3/4,4,4,5					
4.00-4.45	SPT N=20		6,4/3,4,5,8		4.00	Medium dense brown clayey slightly sandy sub-angular to rounded fine to coarse GRAVEL of sandstone (Alluvium).		
4.00-4.40	D3				(1.02)			
4.70-5.02	SPT 25*/115 50/200		16,9/20,20,10		5.02	SPT refusal.		
						Complete at 5.02m		

<b>Remarks</b> Groundwater encountered below 4.0m. Sides remained stable throughout. Backfilled with arisings on completion.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	MCB
	<b>Figure No.</b> MWD/01.WS29	



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Number**  
**WS30**

<b>Excavation Method</b> Tracked Windowless Sampling Rig	<b>Dimensions</b>	<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>	<b>Dates</b> 15/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.00-1.45	SPT N=4		2,1/1,1,1,1		(0.20) 0.20	MADE GROUND: Concrete.		
1.40-1.60	D1				(0.50) 0.70	MADE GROUND: Grey sub-angular to sub-rounded fine to coarse GRAVEL of limestone.		
2.00-2.45	SPT N=4		1,1/1,1,1,1		(1.10) 1.80	MADE GROUND: Dark brown/brown very clayey angular to sub-angular fine to coarse GRAVEL of sandstone, mixed lithology, brick and coal.		
					(0.60) 2.40	Low strength (soft) grey silty CLAY (Alluvium).		
3.00-3.45	SPT N=17		1,2/3,4,5,5		(1.05) 3.45	Low strength (soft) brown slightly sandy slightly gravelly CLAY. Gravel is sub-angular to sub-rounded, of sandstone (Alluvium).		
						From 3m: Medium strength (firm).		
						Complete at 3.45m		

<b>Remarks</b> Groundwater ingress below 1.0m. Sides remained stable throughout. Gas monitoring well installed to 3m. Lower 2m comprising slotted pipe with gravel surround, and upper 1m comprising solid pipe with bentonite cap. Valve and flush cover.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	MCB
	<b>Figure No.</b> MWD/01.WS30	



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
Crossley Lane, Dalton, Huddersfield

**Number**  
**WS31**

<b>Excavation Method</b> Tracked Windowless Sampling Rig.	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 16/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.60-1.40	D1				(0.20) 0.20 (0.20) 0.40 (0.20) 0.60	MADE GROUND: Concrete slab. MADE GROUND: Dark grey sandy fine to coarse angular to rounded GRAVEL of sandstone, clinker and brick. MADE GROUND: Greyish brown slightly sandy gravelly CLAY. Gravel is angular tabular, of sandstone.		
1.00-1.45	SPT N=8		Water strike(1) at 1.00m. 2,1/2,2,2,2		(0.80)	MADE GROUND: Loose dark grey sandy fine to coarse angular to rounded GRAVEL of sandstone, clinker and brick.		1
2.00-2.45	SPT N=4		1,1/1,1,1,1		1.40 (1.00)	MADE GROUND: Borederline low strength (soft) to medium strength (firm) greyish brown slightly sandy gravelly CLAY. Gravel is angular tabular, of sandstone.		
2.80-3.00	D2				2.40 (0.20) 2.60	MADE GROUND: Low strength (soft) greyish brown slightly sandy gravelly CLAY. Gravel is angular tabular, of sandstone.		
3.00-3.45	SPT N=6		1,1/1,1,2,2		(0.40) 3.00	Very low strength (very soft) to low strength (soft) greyish brown and orange, and blueish grey silty CLAY (Alluvium). Loose orangish brown and greyish brown slightly sandy clayey fine to coarse angular GRAVEL of sandstone (Alluvium).		
4.00-4.45	SPT N=22		5,4/4,4,6,8		(1.45) 4.45	From 4m: Medium dense. Borehole extended by dynamic probe from base to 9m (see separate log DP31). Complete at 4.45m		

<b>Remarks</b> Strata wet below 1m. Backfilled with arisings on completion. Borehole extended by dynamic probe from base to 9m (see separate log DP31).	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	EGH
	<b>Figure No.</b> MWD/01.WS31	



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Number**  
**WS36**

<b>Excavation Method</b> Tracked Windowless Sampling Rig	<b>Dimensions</b>	<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>	<b>Dates</b> 15/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50-0.70	D1				(1.00)	MADE GROUND: Dark brown/black sandy sub-angular to angular fine to coarse GRAVEL of sandstone, brick, clinker and ash.		
1.00-1.45	SPT N=6		1,1/2,1,2,1		1.00	NO RECOVERY.		
					(1.00)			
2.00-2.45	SPT N=5		2,1/1,1,2,1		2.00	MADE GROUND: Grey gravelly CLAY. Gravel is sub-angular, of sandstone.		
2.30-2.50	D2				2.30	Medium strength (firm) grey slightly gravelly CLAY. Gravel is sub-angular, of sandstone (Possible Head).		
					(1.15)	From 2.7m: Orange/brown.		
3.00-3.45	SPT N=9		1,1/2,1,2,4		3.45	Complete at 3.45m		

<b>Remarks</b> Strata remained dry. Instability encountered within upper 2.0m. Dynamic probe carried out from base to 8.7m. Gas monitoring well installed to 3m. Lower 2m comprising slotted pipe with gravel surround, and upper 1m comprising solid pipe with bentonite cap. Valve and flush cover.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	MCB
<b>Figure No.</b> MWD/01.WS36		



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Number**  
**WS37**

<b>Excavation Method</b> Tracked Windowless Sampling Rig	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 15/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					0.10	MADE GROUND: Concrete slab. At 0.1m: Concrete slab obstruction, unable to penetrate concrete slab with rotary corer. Complete at 0.30m		

<b>Remarks</b>	<b>Scale (approx)</b> 1:40	<b>Logged By</b> MCB
	<b>Figure No.</b> MWD/01.WS37	



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Number**  
**WS38**

<b>Excavation Method</b> Tracked Windowless Sampling Rig.	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 16/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.50-1.90	D1				(0.30) 0.30	MADE GROUND: Concrete slab.		
2.00-2.40	D2		Water strike(1) at 2.00m.	1.95	(0.45)	MADE GROUND: Loose dark grey, blue grey and orangish brown slightly sandy gravelly CLAY. Gravel is angular, of sandstone.		1
2.90-3.00	D3			2.40	(2.05)	Low strength? (soft) grey becoming orangeish brown slightly sandy silty CLAY (Alluvium).		
				4.45		From 4m: Becoming very stiff/ hard.		
						Complete at 4.45m		

<b>Remarks</b> Groundwater not encountered. SPTs not undertaken due to increased potential for contamination in the shallow subsoils. Gas monitoring well installed to 3m depth. With lower 2m comprising slotted pipe with gravel surround, and with upper 1m comprising plain pipe with bentonite seal. Bung and tap are provided.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	EGH
	<b>Figure No.</b> MWD/01.WS38	



<b>Excavation Method</b> Tracked Windowless Sampling Rig	<b>Dimensions</b>		<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>		<b>Dates</b> 16/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.65-0.85	D1				(0.20) 0.20 0.25	MADE GROUND: Concrete.		
1.00-1.45	SPT N=2		0,0/0,0,1,1		(0.40) 0.65	MADE GROUND: Bituminous maccadam.		
1.40-1.70	D2				(0.55) 1.20	MADE GROUND: Brown gravelly CLAY. Gravel is sub-angular to angular, of sandstone and trace brick.		
2.00-2.45	SPT N=4		1,1/1,1,1,1		(1.00) 2.20	MADE GROUND: Black/dark brown sandy sub-angular fine to coarse GRAVEL of brick, sandstone and occasional clinker.		
3.00-3.45	SPT N=20		3,4/4,4,5,7		2.80	MADE GROUND: Reddish brown slightly gravelly SAND. Gravel is sub-angular to angular, of sandstone and trace brick.		
4.00-4.40	SPT 50/245		9,10/15,15,15,5		(1.60) 4.40	Low strength (soft) light brown sandy slightly gravelly CLAY. Gravel is sub-angular, of sandstone (Alluvium).  From 2.7m: Becoming gravelly.  Medium dense light brown/brown very clayey sub-angular to sub-rounded fine to coarse GRAVEL of sandstone, mudstone and occasional coal. From 2.8m: Low cobble content.  From 4.0m: Very dense  SPT refusal. Complete at 4.40m		

<b>Remarks</b> Strata remained dry. Instability encountered within upper 2.0m. Dynamic probe carried out from base to 8.7m. Gas monitoring well installed to 3m. Lower 2m comprising slotted pipe with gravel surround, and upper 1m comprising solid pipe with bentonite cap. Valve and flush cover.	<b>Scale (approx)</b> 1:40	<b>Logged By</b> MCB
	<b>Figure No.</b> MWD/01.WS39	



**ARP GEOTECHNICAL LIMITED**  
**CHARTERED CONSULTING ENGINEERS**

**Site**  
 Crossley Lane, Dalton, Huddersfield

**Number**  
**WS47**

<b>Excavation Method</b> Tracked Windowless Sampling Rig	<b>Dimensions</b>	<b>Ground Level (mOD)</b>	<b>Client</b> Minerva Works Development Ltd	<b>Job Number</b> MWD/01
	<b>Location</b>	<b>Dates</b> 17/06/2016	<b>Engineer</b> ARP	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20-0.50	D1				0.15 0.15	MADE GROUND: Grey sandy sub-angular to sub-rounded fine to coarse GRAVEL of sandstone and mixed lithology.		
					0.55	MADE GROUND: Dark brown gravelly CLAY. Gravel is sub-angular to angular, of sandstone, brick and mixed lithology.		
					0.70			
					0.30	MADE GROUND: Light brown sandy sub-angular fine to coarse GRAVEL of sandstone.		
1.00-1.45	SPT N=12		Water strike(1) at 1.00m. 2,1/2,4,3,3		1.00	NO RECOVERY.		1
					0.50			
1.50-1.70	D2				1.50	MADE GROUND: Brown sandy angular to sub-angular fine to coarse GRAVEL of sandstone, brick and mixed lithology.		
					0.58			
2.00-2.08	SPT 25*/50 50/30		25/50		2.08	SPT Refusal in the made ground.		
						Complete at 2.08m		

<b>Remarks</b> Strata wet below 1.0m. Sides remained stable throughout. Hole backfilled with arisings on completion.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:40	MCB
	<b>Figure No.</b> MWD/01.WS46	

**SITE:** Crossley Lane, Dalton, Huddersfield  
**CLIENT:** Minerva Works Development Ltd

MWD/01

**ARP GEOTECHNICAL LTD DYNAMIC PROBE RESULTS**

DP01			DP06			DP07			DP09		
DEPTH	BLOWS	N 300	DEPTH	BLOWS	N 300	DEPTH	BLOWS	N 300	DEPTH	BLOWS	N 300
0	0	0	0	0	0	0	0	0	0	0	0
0.1	0	0	0.1	0	0	0.1	0	0	0.1	0	0
0.2	0	0	0.2	0	0	0.2	0	0	0.2	0	0
0.3	0	0	0.3	0	0	0.3	0	0	0.3	0	0
0.4	0	0	0.4	0	0	0.4	0	0	0.4	0	0
0.5	0	0	0.5	0	0	0.5	0	0	0.5	0	0
0.6	0	0	0.6	0	0	0.6	0	0	0.6	0	0
0.7	0	0	0.7	0	0	0.7	0	0	0.7	0	0
0.8	0	0	0.8	0	0	0.8	0	0	0.8	0	0
0.9	0	0	0.9	0	0	0.9	0	0	0.9	0	0
1	0	0	1	0	0	1	0	0	1	0	0
1.1	0	0	1.1	0	0	1.1	0	0	1.1	0	0
1.2	0	0	1.2	0	0	1.2	0	0	1.2	0	0
1.3	0	0	1.3	0	0	1.3	0	0	1.3	0	0
1.4	0	0	1.4	0	0	1.4	0	0	1.4	0	0
1.5	0	0	1.5	0	0	1.5	0	0	1.5	0	0
1.6	0	0	1.6	0	0	1.6	0	0	1.6	0	0
1.7	0	0	1.7	0	0	1.7	0	0	1.7	0	0
1.8	0	0	1.8	0	0	1.8	0	0	1.8	0	0
1.9	0	0	1.9	0	0	1.9	0	0	1.9	0	0
2	0	0	2	0	0	2	0	0	2	0	0
2.1	0	0	2.1	0	0	2.1	0	0	2.1	0	0
2.2	0	0	2.2	0	0	2.2	0	0	2.2	0	0
2.3	0	0	2.3	0	0	2.3	0	0	2.3	0	0
2.4	0	0	2.4	0	0	2.4	0	0	2.4	0	0
2.5	0	0	2.5	0	0	2.5	0	0	2.5	0	0
2.6	0	0	2.6	0	0	2.6	0	0	2.6	0	0
2.7	0	0	2.7	0	0	2.7	0	0	2.7	0	0
2.8	0	0	2.8	0	0	2.8	0	0	2.8	0	0
2.9	0	0	2.9	0	0	2.9	0	0	2.9	0	0
3	0	0	3	0	0	3	0	0	3	0	0
3.1	0	0	3.1	0	0	3.1	0	0	3.1	0	0
3.2	0	0	3.2	0	0	3.2	0	0	3.2	0	0
3.3	0	0	3.3	0	0	3.3	2	6	3.3	0	0
3.4	0	0	3.4	0	0	3.4	3	9	3.4	0	0
3.5	0	0	3.5	0	0	3.5	6	18	3.5	0	0
3.6	0	0	3.6	0	0	3.6	5	15	3.6	0	0
3.7	0	0	3.7	0	0	3.7	10	30	3.7	0	0
3.8	0	0	3.8	0	0	3.8	8	24	3.8	0	0
3.9	0	0	3.9	0	0	3.9	7	21	3.9	0	0
4	0	0	4	0	0	4	7	21	4	0	0
4.1	0	0	4.1	0	0	4.1	8	24	4.1	0	0
4.2	0	0	4.2	0	0	4.2	8	24	4.2	0	0
4.3	0	0	4.3	0	0	4.3	9	27	4.3	0	0
4.4	0	0	4.4	0	0	4.4	11	33	4.4	0	0
4.5	1	0	4.5	0	0	4.5	9	27	4.5	0	0
4.6	2	6	4.6	0	0	4.6	8	24	4.6	1	3
4.7	2	6	4.7	0	0	4.7	9	27	4.7	1	3
4.8	3	9	4.8	0	0	4.8	7	21	4.8	2	6
4.9	5	15	4.9	0	0	4.9	7	21	4.9	3	9
5	9	27	5	0	0	5	8	24	5	4	12
5.1	9	27	5.1	0	0	5.1	8	24	5.1	6	18
5.2	8	24	5.2	0	0	5.2	6	18	5.2	6	18
5.3	10	30	5.3	0	0	5.3	8	24	5.3	6	18
5.4	10	30	5.4	5	15	5.4	11	33	5.4	9	27
5.5	11	33	5.5	11	33	5.5	12	36	5.5	12	36
5.6	13	39	5.6	11	33	5.6	11	33	5.6	10	30
5.7	14	42	5.7	9	27	5.7	10	30	5.7	10	30
5.8	14	42	5.8	11	33	5.8	11	33	5.8	11	33
5.9	15	45	5.9	12	36	5.9	10	30	5.9	12	36
6	10	30	6	10	30	6	11	33	6	11	33
6.1	8	24	6.1	8	24	6.1	13	39	6.1	11	33
6.2	7	21	6.2	8	24	6.2	20	60	6.2	10	30
6.3	8	24	6.3	11	33	6.3	20	60	6.3	10	30
6.4	8	24	6.4	12	36	6.4	20	60	6.4	9	27
6.5	7	21	6.5	11	33	6.5	22	66	6.5	10	30
6.6	10	30	6.6	11	33	6.6	20	60	6.6	11	33
6.7	12	36	6.7	18	54	6.7	19	57	6.7	12	36
6.8	11	33	6.8	15	45	6.8	18	54	6.8	14	42
6.9	11	33	6.9	13	39	6.9	19	57	6.9	14	42
7	10	30	7	11	33	7	23	69	7	13	39
7.1	10	30	7.1	11	33	7.1	20	60	7.1	13	39
7.2	11	33	7.2	11	33	7.2	20	60	7.2	13	39
7.3	12	36	7.3	12	36	7.3	18	54	7.3	12	36
7.4	16	48	7.4	13	39	7.4	18	54	7.4	15	45
7.5	15	45	7.5	15	45	7.5	17	51	7.5	21	63
7.6	18	54	7.6	15	45	7.6	19	57	7.6	27	81
7.7	19	57	7.7	19	57	7.7	18	54	7.7	17	51
7.8	18	54	7.8	23	69	7.8	18	54	7.8	16	48
7.9	15	45	7.9	27	81	7.9	15	45	7.9	14	42
8	15	45	8	30	90	8	20	60	8	13	39
8.1	16	48	8.1	38	114	8.1	22	66	8.1	14	42
8.2	14	42	8.2	50	150	8.2	18	54	8.2	10	30
8.3	12	36	8.3	0	0	8.3	15	45	8.3	9	27
8.4	10	30	8.4	0	0	8.4	15	45	8.4	10	30
8.5	12	36	8.5	0	0	8.5	9	27	8.5	10	30
8.6	12	36	8.6	0	0	8.6	12	36	8.6	9	27
8.7	10	30	8.7	0	0	8.7	12	36	8.7	14	42
8.8	10	30	8.8	0	0	8.8	17	51	8.8	22	66
8.9	13	39	8.9	0	0	8.9	17	51	8.9	24	72
9	12	36	9	0	0	9	20	60	9	22	66
9.1	22	66	9.1	0	0	9.1	29	87	9.1	17	51
9.2	41	123	9.2	0	0	9.2	31	93	9.2	22	66
9.3	45	135	9.3	0	0	9.3	29	87	9.3	23	69
9.4	50	150	9.4	0	0	9.4	19	57	9.4	23	69
9.5	0	0	9.5	0	0	9.5	19	57	9.5	28	84
9.6	0	0	9.6	0	0	9.6	14	42	9.6	30	90
9.7	0	0	9.7	0	0	9.7	14	42	9.7	32	96
9.8	0	0	9.8	0	0	9.8	10	30	9.8	29	87
9.9	0	0	9.9	0	0	9.9	6	18	9.9	43	129

SITE: Crossley Lane, Dalton, Huddersfield Job No: MWD/01  
 CLIENT: Minerva Works Development Ltd

ARP GEOTECHNICAL LTD DYNAMIC PROBE RESULTS

DP10			DP16			DP18			DP19		
DEPTH	BLOWS	N 300	DEPTH	BLOWS	N 300	DEPTH	BLOWS	N 300	DEPTH	BLOWS	N 300
0		0	0		0	0		0	0		0
0.1		0	0.1		0	0.1		0	0.1		0
0.2		0	0.2		0	0.2		0	0.2		0
0.3		0	0.3		0	0.3		0	0.3		0
0.4		0	0.4		0	0.4		0	0.4		0
0.5		0	0.5		0	0.5		0	0.5		0
0.6		0	0.6		0	0.6		0	0.6		0
0.7		0	0.7		0	0.7		0	0.7		0
0.8		0	0.8		0	0.8		0	0.8		0
0.9		0	0.9		0	0.9		0	0.9		0
1		0	1		0	1		0	1		0
1.1		0	1.1		0	1.1		0	1.1		0
1.2		0	1.2		0	1.2		0	1.2		0
1.3		0	1.3		0	1.3		0	1.3		0
1.4		0	1.4		0	1.4		0	1.4		0
1.5		0	1.5		0	1.5		0	1.5		0
1.6		0	1.6		0	1.6		0	1.6		0
1.7		0	1.7		0	1.7		0	1.7		0
1.8		0	1.8		0	1.8		0	1.8		0
1.9		0	1.9		0	1.9		0	1.9		0
2		0	2		0	2		0	2		0
2.1		0	2.1		0	2.1		0	2.1		0
2.2		0	2.2		0	2.2		0	2.2		0
2.3		0	2.3		0	2.3		0	2.3		0
2.4		0	2.4		0	2.4		0	2.4		0
2.5		0	2.5		0	2.5		0	2.5		0
2.6		0	2.6		0	2.6		0	2.6		0
2.7		0	2.7		0	2.7		0	2.7		0
2.8		0	2.8		0	2.8		0	2.8		0
2.9		0	2.9		0	2.9		0	2.9		0
3		0	3		0	3		0	3		0
3.1		0	3.1		0	3.1		0	3.1		0
3.2		0	3.2		0	3.2		0	3.2		0
3.3		0	3.3		0	3.3		0	3.3		0
3.4		0	3.4		0	3.4		0	3.4		0
3.5		0	3.5		0	3.5		0	3.5		0
3.6		0	3.6		0	3.6		0	3.6		0
3.7		0	3.7		0	3.7		0	3.7		0
3.8		0	3.8		0	3.8		0	3.8		0
3.9		0	3.9		0	3.9	4	12	3.9		0
4		0	4		0	4	6	18	4		0
4.1		0	4.1		0	4.1	7	21	4.1		0
4.2		0	4.2		0	4.2	8	24	4.2		0
4.3		0	4.3		0	4.3	13	39	4.3	7	21
4.4		0	4.4	5	15	4.4	13	39	4.4	9	27
4.5		0	4.5	5	15	4.5	13	39	4.5	9	27
4.6		0	4.6	5	15	4.6	10	30	4.6	7	21
4.7		0	4.7	5	15	4.7	14	42	4.7	7	21
4.8		0	4.8	7	21	4.8	13	39	4.8	9	27
4.9		0	4.9	7	21	4.9	11	33	4.9	7	21
5		0	5	5	15	5	11	33	5	7	21
5.1		0	5.1	4	12	5.1	8	24	5.1	9	27
5.2		0	5.2	5	15	5.2	9	27	5.2	8	24
5.3	6	18	5.3	6	18	5.3	14	42	5.3	6	18
5.4	7	21	5.4	8	24	5.4	14	42	5.4	7	21
5.5	7	21	5.5	7	21	5.5	13	39	5.5	7	21
5.6	7	21	5.6	6	18	5.6	11	33	5.6	6	18
5.7	7	21	5.7	7	21	5.7	11	33	5.7	4	12
5.8	6	18	5.8	6	18	5.8	12	36	5.8	6	18
5.9	7	21	5.9	3	9	5.9	11	33	5.9	7	21
6	7	21	6	3	9	6	11	33	6	5	15
6.1	9	27	6.1	4	12	6.1	11	33	6.1	3	9
6.2	10	30	6.2	4	12	6.2	14	42	6.2	4	12
6.3	11	33	6.3	6	18	6.3	13	39	6.3	6	18
6.4	8	24	6.4	5	15	6.4	11	33	6.4	6	18
6.5	10	30	6.5	2	6	6.5	12	36	6.5	7	21
6.6	10	30	6.6	2	6	6.6	11	33	6.6	7	21
6.7	11	33	6.7	2	6	6.7	15	45	6.7	7	21
6.8	9	27	6.8	3	9	6.8	29	87	6.8	11	33
6.9	9	27	6.9	3	9	6.9	16	48	6.9	14	42
7	14	42	7	3	9	7	15	45	7	14	42
7.1	16	48	7.1	4	12	7.1	15	45	7.1	15	45
7.2	17	51	7.2	6	18	7.2	14	42	7.2	16	48
7.3	14	42	7.3	7	21	7.3	12	36	7.3	16	48
7.4	12	36	7.4	8	24	7.4	8	24	7.4	18	54
7.5	10	30	7.5	11	33	7.5	8	24	7.5	24	72
7.6	7	21	7.6	13	39	7.6	8	24	7.6	30	90
7.7	10	30	7.7	13	39	7.7	9	27	7.7	33	99
7.8	12	36	7.8	17	51	7.8	12	36	7.8	33	99
7.9	14	42	7.9	27	81	7.9	15	45	7.9	44	132
8	13	39	8	30	90	8	18	54	8	50	150
8.1	11	33	8.1	33	99	8.1	28	84	8.1		0
8.2	9	27	8.2	38	114	8.2	40	120	8.2		0
8.3	8	24	8.3	50	150	8.3	44	132	8.3		0
8.4	7	21	8.4			8.4	50	150	8.4		0
8.5	6	18	8.5			8.5			8.5		0
8.6	9	27	8.6			8.6			8.6		0
8.7	21	63	8.7			8.7			8.7		0
8.8	33	99	8.8			8.8			8.8		0
8.9	50	150	8.9			8.9			8.9		0
9			9			9			9		0
9.1			9.1			9.1			9.1		0
9.2			9.2			9.2			9.2		0
9.3			9.3			9.3			9.3		0
9.4	0		9.4	0		9.4	0		9.4	0	
9.5	0		9.5	0		9.5	0		9.5	0	
9.6	0		9.6	0		9.6	0		9.6	0	
9.7	0		9.7	0		9.7	0		9.7	0	
9.8	0		9.8	0		9.8	0		9.8	0	
9.9	0		9.9	0		9.9	0		9.9	0	

**SITE:** Crossley Lane, Dalton, Huddersfield  
**CLIENT:** Minerva Works Development Ltd

**ARP GEOTECHNICAL LTD                      DYNAMIC PROBE RESULTS**

DP24			DP31		
DEPTH	BLOWS	N 300	DEPTH	BLOWS	N 300
0		0	0		0
0.1		0	0.1		0
0.2		0	0.2		0
0.3		0	0.3		0
0.4		0	0.4		0
0.5		0	0.5		0
0.6		0	0.6		0
0.7		0	0.7		0
0.8		0	0.8		0
0.9		0	0.9		0
1		0	1		0
1.1		0	1.1		0
1.2		0	1.2		0
1.3		0	1.3		0
1.4		0	1.4		0
1.5		0	1.5		0
1.6		0	1.6		0
1.7		0	1.7		0
1.8		0	1.8		0
1.9		0	1.9		0
2		0	2		0
2.1		0	2.1		0
2.2		0	2.2		0
2.3		0	2.3		0
2.4		0	2.4		0
2.5		0	2.5		0
2.6		0	2.6		0
2.7		0	2.7		0
2.8		0	2.8		0
2.9		0	2.9		0
3		0	3		0
3.1		0	3.1		0
3.2		0	3.2		0
3.3		0	3.3		0
3.4		0	3.4		0
3.5		0	3.5		0
3.6		0	3.6		0
3.7		0	3.7		0
3.8		0	3.8		0
3.9		0	3.9		0
4		0	4		0
4.1		0	4.1		0
4.2		0	4.2		0
4.3		0	4.3	5	15
4.4		0	4.4	6	18
4.5		0	4.5	6	18
4.6		0	4.6	8	24
4.7		0	4.7	8	24
4.8		0	4.8	8	24
4.9		0	4.9	8	24
5		0	5	12	36
5.1		0	5.1	16	48
5.2		0	5.2	16	48
5.3	6	18	5.3	13	39
5.4	11	33	5.4	14	42
5.5	13	39	5.5	11	33
5.6	13	39	5.6	14	42
5.7	13	39	5.7	18	54
5.8	13	39	5.8	18	54
5.9	15	45	5.9	16	48
6	12	36	6	14	42
6.1	14	42	6.1	15	45
6.2	13	39	6.2	19	57
6.3	11	33	6.3	15	45
6.4	8	24	6.4	17	51
6.5	2	6	6.5	20	60
6.6	2	6	6.6	20	60
6.7	8	24	6.7	29	87
6.8	12	36	6.8	13	39
6.9	14	42	6.9	5	15
7	12	36	7	6	18
7.1	10	30	7.1	8	24
7.2	11	33	7.2	7	21
7.3	11	33	7.3	6	18
7.4	10	30	7.4	8	24
7.5	7	21	7.5	9	27
7.6	4	12	7.6	10	30
7.7	4	12	7.7	10	30
7.8	5	15	7.8	10	30
7.9	6	18	7.9	8	24
8	6	18	8	10	30
8.1	6	18	8.1	11	33
8.2	4	12	8.2	15	45
8.3	5	15	8.3	10	30
8.4	8	24	8.4	7	21
8.5	15	45	8.5	7	21
8.6	20	60	8.6	12	36
8.7	22	66	8.7	31	93
8.8	34	102	8.8	46	138
8.9	50	150	8.9	50	150
9			9		0
9.1			9.1		0
9.2			9.2		0
9.3			9.3		0
9.4	0		9.4		0
9.5	0		9.5		0
9.6	0		9.6		0
9.7	0		9.7		0
9.8	0		9.8		0
9.9	0		9.9		0

## **APPENDIX G**

### **LABORATORY TEST CERTIFICATES AND SCREENING VALUES**



**ARP GEOTECHNICAL LIMITED  
SOIL CONTAMINANT SCREENING VALUES  
RESIDENTIAL WITH HOME-GROWN PRODUCE**

Determinand	S4UL (mg/kg)			C4SL (mg/kg)		
	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM
Arsenic	37			37		
Cadmium	11			22		
Chromium (trivalent)	910					
Chromium (hexavalent)	6			21		
Lead				200		
Inorganic Mercury	40					
Selenium	250					
Copper	2400					
Nickel	130					
Zinc	3700					
Acidity (pH)	*Should be Greater Than 5			*Should be Greater Than 5		
	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM
Acenaphthene	210	510	1,100			
Acenaphthylene	170	420	920			
Anthracene	2,400	5,400	11,000			
Benzo(a)anthracene	7.2	11	13			
Benzo(a)pyrene	2.2	2.7	3			5
Benzo(b)fluoranthene	2.6	3.3	3.7			
Benzo(g,h,i)perylene	320	340	350			
Benzo(k)fluoranthene	77	93	100			
Chrysene	15	22	27			
Dibenzo(a,h)anthracene	0.24	0.28	0.3			
Fluoranthene	280	560	890			
Fluorene	170	400	860			
Indeno(1,2,3-cd)pyrene	27	36	41			
Naphthalene	2.3	5.6	13			
Phenanthrene	95	220	440			
Pyrene	620	1,200	2,000			
Phenols	120	200	380			
Total TPH	*Above 500, speciate and compare with values below:					
C5 to C6 Aliphatic	42	78	160			
C6 to C8 Aliphatic	100	230	530			
C8 to C10 Aliphatic	27	65	150			
C10 to C12 Aliphatic	130	48	760			
C12 to C16 Aliphatic	1100	2,400	4,300			
C16 to C35 Aliphatic	65,000	92,000	110,000			
C35 TO C44 Aliphatic	65,000	92,000	110,000			
C5 to C7 Aromatic (Benzene)	70	140	300			
C7 to C8 Aromatic (Toluene)	130	290	660			
C8 to C10 Aromatic	34	83	190			
C10 to C12 Aromatic	74	180	380			
C12 to C16 Aromatic	140	330	660			
C16 to C21 Aromatic	260	540	930			
C21 TO C35 Aromatic	1100	1,500	1,700			
C35 TO C44 Aromatic	1100	1,500	1,700			
Asbestos	*Should be None Detected			*Should be None Detected		

\* In House Value/Approach S4UL = Suitable 4 Use Level, CIEH/LQM 2014 C4SL = Cat 4 Screening Level, DEFRA, 2014

Blank cell indicates no published value or in-house value. Some values presented are above saturation limits.

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**ARP GEOTECHNICAL LIMITED**  
**SOIL CONTAMINANT SCREENING VALUES**  
**RESIDENTIAL WITHOUT HOME-GROWN PRODUCE**

Determinand	S4UL (mg/kg)			C4SL (mg/kg)		
	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM
Arsenic	40			40		
Cadmium	85			150		
Chromium (trivalent)	910					
Chromium (hexavalent)	6			21		
Lead				310		
Inorganic Mercury	56					
Selenium	430					
Copper	7100					
Nickel	180					
Zinc	40000					
Acidity (pH)	*Should be Greater Than 5			*Should be Greater Than 5		
	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM
Acenaphthene	3000	4700	6000			
Acenaphthylene	2900	4600	6000			
Anthracene	31000	35000	37000			
Benzo(a)anthracene	11	14	15			
Benzo(a)pyrene	3.2	3.2	3.2			5.3
Benzo(b)fluoranthene	3.9	4	4			
Benzo(g,h,i)perylene	360	360	360			
Benzo(k)fluoranthene	110	110	110			
Chrysene	30	31	32			
Dibenzo(a,h)anthracene	0.31	0.32	0.32			
Fluoranthene	1500	1600	1600			
Fluorene	2800	3800	4500			
Indeno(1,2,3-cd)pyrene	45	46	46			
Naphthalene	2.3	5.6	13			
Phenanthrene	1300	1500	1500			
Pyrene	3700	3800	3800			
Phenols	440	690	1200			
Total TPH	*Above 500, speciate and compare with values below:					
C5 to C6 Aliphatic	42	78	160			
C6 to C8 Aliphatic	100	230	530			
C8 to C10 Aliphatic	27	65	150			
C10 to C12 Aliphatic	130	330	770			
C12 to C16 Aliphatic	1100	2400	4400			
C16 to C35 Aliphatic	65000	92000	110000			
C35 TO C44 Aliphatic	65000	92000	110000			
C5 to C7 Aromatic (Benzene)	370	690	1400			
C7 to C8 Aromatic (Toluene)	860	1800	3900			
C8 to C10 Aromatic	47	110	270			
C10 to C12 Aromatic	250	590	1200			
C12 to C16 Aromatic	1800	2300	2500			
C16 to C21 Aromatic	1900	1900	1900			
C21 TO C35 Aromatic	1900	1900	1900			
C35 TO C44 Aromatic	1900	1900	1900			
Asbestos	*Should be None Detected			*Should be None Detected		

\* In House Value/Approach S4UL = Suitable 4 Use Level, CIEH/LQM 2014 C4SL = Cat 4 Screening Level, DEFRA, 2014

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**ARP GEOTECHNICAL LIMITED  
SOIL CONTAMINANT SCREENING VALUES  
PUBLIC OPEN SPACE NEAR RESIDENTIAL**

Determinand	S4UL (mg/kg)			C4SL (mg/kg)		
	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM
Arsenic		79			79	
Cadmium		120			220	
Chromium (trivalent)		1500				
Chromium (hexavalent)		7.7			21	
Lead					630	
Inorganic Mercury		120				
Selenium		1100				
Copper		12000				
Nickel		230				
Zinc		81000				
Acidity (pH)	*Should be Greater Than 5					
	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM
Acenaphthene	15000	15000	15000			
Acenaphthylene	15000	15000	15000			
Anthracene	74000	74000	74000			
Benzo(a)anthracene	29	29	29			
Benzo(a)pyrene	5.7	5.7	5.7			10
Benzo(b)fluoranthene	7.1	7.2	7.2			
Benzo(g,h,i)perylene	640	640	640			
Benzo(k)fluoranthene	190	190	190			
Chrysene	57	57	57			
Dibenzo(a,h)anthracene	0.57	0.57	0.57			
Fluoranthene	3100	3100	3100			
Fluorene	9900	9900	9900			
Indeno(1,2,3-cd)pyrene	82	82	82			
Naphthalene	4900	4900	4900			
Phenanthrene	3100	3100	3100			
Pyrene	7400	7400	7400			
Phenols	440	690	1300			
Total TPH	*Above 3,800, speciate and compare with values below:					
C5 to C6 Aliphatic	570000	590000	600000			
C6 to C8 Aliphatic	600000	610000	620000			
C8 to C10 Aliphatic	13000	13000	13000			
C10 to C12 Aliphatic	13000	13000	13000			
C12 to C16 Aliphatic	13000	13000	13000			
C16 to C35 Aliphatic	250000	250000	250000			
C35 TO C44 Aliphatic	250000	250000	250000			
C5 to C7 Aromatic (Benzene)	56000	56000	56000			
C7 to C8 Aromatic (Toluene)	56000	56000	56000			
C8 to C10 Aromatic	5000	5000	5000			
C10 to C12 Aromatic	5000	5000	5000			
C12 to C16 Aromatic	5100	5100	5000			
C16 to C21 Aromatic	3800	3800	3800			
C21 TO C35 Aromatic	3800	3800	3800			
C35 TO C44 Aromatic	3800	3800	3800			
Asbestos	*Should be None Detected			*Should be None Detected		

\* In House Value/Approach S4UL = Suitable 4 Use Level, CIEH/LQM 2014 C4SL = Cat 4 Screening Level, DEFRA, 2014

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**ARP GEOTECHNICAL LIMITED**  
**SOIL CONTAMINANT SCREENING VALUES**  
**SITES FOR COMMERCIAL USE**

Determinand	S4UL (mg/kg)			C4SL (mg/kg)		
Arsenic	640			640		
Cadmium	190			410		
Chromium (trivalent)	8600					
Chromium (hexavalent)	33			49		
Lead				2300		
Inorganic Mercury	1100					
Selenium	12000					
Copper	68000					
Nickel	980					
Zinc	730000					
Acidity (pH)	*Should be Greater Than 5					
	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM
Acenaphthene	84000	97000	100000			
Acenaphthylene	83000	97000	100000			
Anthracene	520000	540000	540000			
Benzo(a)anthracene	170	170	180			
Benzo(a)pyrene	35	35	36			77
Benzo(b)fluoranthene	44	44	45			
Benzo(g,h,i)perylene	3900	4000	4000			
Benzo(k)fluoranthene	1200	1200	1200			
Chrysene	350	350	350			
Dibenzo(a,h)anthracene	3.5	3.6	3.6			
Fluoranthene	2300	2300	2300			
Fluorene	63000	68000	71000			
Indeno(1,2,3-cd)pyrene	500	510	510			
Naphthalene	190	460	1100			
Phenanthrene	22000	22000	23000			
Pyrene	54000	54000	54000			
Phenols	440	690	1300			
Total TPH	*Above 2000, speciate and compare with values below:					
C5 to C6 Aliphatic	3200	5900	12000			
C6 to C8 Aliphatic	7800	17000	40000			
C8 to C10 Aliphatic	2000	4800	11000			
C10 to C12 Aliphatic	9700	23000	47000			
C12 to C16 Aliphatic	59000	82000	90000			
C16 to C35 Aliphatic	1600000	1700000	1800000			
C35 TO C44 Aliphatic	1600000	1700000	1800000			
C5 to C7 Aromatic (Benzene)	26000	46000	86000			
C7 to C8 Aromatic (Toluene)	56000	110000	180000			
C8 to C10 Aromatic	3500	8100	17000			
C10 to C12 Aromatic	16000	28000	34000			
C12 to C16 Aromatic	36000	37000	38000			
C16 to C21 Aromatic	28000	28000	28000			
C21 TO C35 Aromatic	28000	28000	28000			
C35 TO C44 Aromatic	28000	28000	28000			
Asbestos	*Should be None Detected			*Should be None Detected		

\* In House Value/Approach S4UL = Suitable 4 Use Level, CIEH/LQM 2014 C4SL = Cat 4 Screening Level, DEFRA, 2014

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## ARP GEOTECHNICAL LTD

### CONTROLLED WATERS SCREENING VALUES

<b>Determinand</b>	<b>Screening Value for Potable Use * (µg/l)</b>	<b>Screening Value for Environment # (µg/l)</b>
Arsenic	10	50
Boron	1000	2000
Cadmium	5	0.08-0.25
Chromium (total)	50	4.7
Copper	2000	1-28
Lead	10	7.2
Mercury	1	0.05
Selenium	10	-
Nickel	20	20
Zinc	5000	8-125
Sulphate	250,000	400,000
pH	6.5-10	6-9
Anthracene	-	0.1
Benzo(a)pyrene	0.01	0.05
Benzo(b)fluoranthene	Sum (4) <0.1	Sum (2) <0.03
Benzo(k)fluoranthene		Sum (2) <0.002
Benzo(g,h,i)perylene		
Indeno(1,2,3-c,d)pyrene		
Fluoranthene	-	0.1
Naphthalene	-	2.4
Phenols	0.5 (BWR)	7.7
Benzene	1	10
Toluene	700 (WHO)	50
Ethylbenzene	300 (WHO)	-
Xylene	30 (WHO)	30
Total TPH	-	200 (SWAD)

JUNE 2014

Sources, unless indicated otherwise above:

\* = UK Drinking Water Standards (DWS)

# = Environmental Quality Standards (EQS), hardness dependent where range shown.

WHO = World Health Organisation Drinking Water

BWR = Bathing Water (Classification) Regulations 1991

SWAD = Surface Water (Abstraction for Drinking Water) (Classification) Regulations 1996



## Certificate of Analysis

Certificate Number 16-69744

22-Jun-16

*Client* ARP Geotechnical  
5/6 Northwest Business Park  
Servia Hill  
Leeds  
LS6 2QH

*Our Reference* 16-69744

*Client Reference* HQH/03

*Order No* (not supplied)

*Contract Title* CROSSLEY LANE DALTON

*Description* 7 Soil samples.

*Date Received* 15-Jun-16

*Date Started* 15-Jun-16

*Date Completed* 22-Jun-16

*Test Procedures* Identified by prefix DETSn (details on request).

*Notes* Opinions and interpretations are outside the scope of UKAS accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

*Approved By*

A handwritten signature in black ink, appearing to read "Rob Brown".

Rob Brown  
Business Manager



# Summary of Chemical Analysis

## Soil Samples

Our Ref 16-69744

Client Ref HQH/03

Contract Title CROSSLEY LANE DALTON

Lab No	1006435	1006436	1006437	1006438	1006439	1006440
Sample ID	TP2 D1	TP4 D1	TP6 D1	TP10 D2	TP16 D1	TP8 D1
Depth	0.60-0.70	0.35-0.50	0.20-0.40	1.60-1.90	0.20-0.50	0.00-0.15
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	13/06/16	13/06/16	13/06/16	13/06/16	13/06/16	13/06/16
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
<b>Metals</b>									
Arsenic	DETSC 2301#	0.2	mg/kg	30	32	38	11	36	7.3
Cadmium	DETSC 2301#	0.1	mg/kg	0.2	0.8	0.1	0.1	0.4	1.4
Chromium III	DETSC 2301*	0.15	mg/kg	19	21	18	25	24	7.9
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	76	70	71	20	69	8.8
Lead	DETSC 2301#	0.3	mg/kg	54	85	48	23	96	25
Mercury	DETSC 2325#	0.05	mg/kg	0.10	0.10	0.14	0.07	0.08	< 0.05
Nickel	DETSC 2301#	1	mg/kg	33	29	34	30	32	6.2
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	1.3	< 0.5	< 0.5	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	55	72	34	80	110	210
<b>Inorganics</b>									
pH	DETSC 2008#			7.9	7.8	8.0	7.8	8.1	9.1
Organic matter	DETSC 2002#	0.1	%	5.5	4.0	7.4	1.3	6.5	2.4
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	320	130	150	140	97	74
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.11	0.07	0.16	0.05	0.11	0.08
<b>Petroleum Hydrocarbons</b>									
EPH (C10-C40)	DETSC 3311#	10	mg/kg	700	260	460	100	170	< 10
<b>PAHs</b>									
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	1.4	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	0.2	< 0.1	< 0.1	0.4	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	1.5	< 0.1	< 0.1	1.2	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	2.7	< 0.1	< 0.1	0.5	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	13	1.0	1.9	< 0.1	1.0	< 0.1
Anthracene	DETSC 3301	0.1	mg/kg	3.4	0.2	0.4	< 0.1	0.3	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	11	1.7	4.0	< 0.1	1.7	< 0.1
Pyrene	DETSC 3301	0.1	mg/kg	8.5	1.6	3.7	< 0.1	1.5	< 0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	3.6	1.0	1.7	< 0.1	0.7	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	3.2	1.0	1.9	< 0.1	0.7	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	2.3	0.9	1.2	< 0.1	0.5	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	1.2	0.5	0.7	< 0.1	0.3	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	3.1	0.9	2.1	< 0.1	0.9	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	2.5	< 0.1	1.9	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	0.3	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	2.2	< 0.1	1.1	< 0.1	< 0.1	< 0.1
PAH Total	DETSC 3301	1.6	mg/kg	58	8.8	21	3.6	7.5	< 1.6

# Summary of Chemical Analysis

## Soil Samples

Our Ref 16-69744  
 Client Ref HQH/03  
 Contract Title CROSSLEY LANE DALTON

<b>Lab No</b>	1006435	1006436	1006437	1006438	1006439	1006440
<b>Sample ID</b>	TP2 D1	TP4 D1	TP6 D1	TP10 D2	TP16 D1	TP8 D1
<b>Depth</b>	0.60-0.70	0.35-0.50	0.20-0.40	1.60-1.90	0.20-0.50	0.00-0.15
<b>Other ID</b>						
<b>Sample Type</b>	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
<b>Sampling Date</b>	13/06/16	13/06/16	13/06/16	13/06/16	13/06/16	13/06/16
<b>Sampling Time</b>	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
<b>PCBs</b>									
PCB 28 + PCB 31	DETSC 3401#	0.01	mg/kg			< 0.01			
PCB 52	DETSC 3401#	0.01	mg/kg			< 0.01			
PCB 101	DETSC 3401#	0.01	mg/kg			< 0.01			
PCB 118	DETSC 3401#	0.01	mg/kg			< 0.01			
PCB 153	DETSC 3401#	0.01	mg/kg			< 0.01			
PCB 138	DETSC 3401#	0.01	mg/kg			< 0.01			
PCB 180	DETSC 3401#	0.01	mg/kg			< 0.01			
PCB 7 Total	DETSC 3401#	0.01	mg/kg			< 0.01			
<b>Phenols</b>									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3	0.6	< 0.3

# Summary of Chemical Analysis

## Soil Samples

Our Ref 16-69744  
 Client Ref HQH/03  
 Contract Title CROSSLEY LANE DALTON

Lab No	1006441
Sample ID	WS2 D1
Depth	0.55-0.70
Other ID	
Sample Type	SOIL
Sampling Date	13/06/16
Sampling Time	n/s

Test	Method	LOD	Units	
<b>Metals</b>				
Arsenic	DETSC 2301#	0.2	mg/kg	23
Cadmium	DETSC 2301#	0.1	mg/kg	0.2
Chromium III	DETSC 2301*	0.15	mg/kg	26
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	44
Lead	DETSC 2301#	0.3	mg/kg	44
Mercury	DETSC 2325#	0.05	mg/kg	0.08
Nickel	DETSC 2301#	1	mg/kg	31
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5
Zinc	DETSC 2301#	1	mg/kg	90
<b>Inorganics</b>				
pH	DETSC 2008#			7.3
Organic matter	DETSC 2002#	0.1	%	3.6
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	89
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.06
<b>Petroleum Hydrocarbons</b>				
EPH (C10-C40)	DETSC 3311#	10	mg/kg	360
<b>PAHs</b>				
Naphthalene	DETSC 3301	0.1	mg/kg	0.3
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	0.3
Fluorene	DETSC 3301	0.1	mg/kg	0.4
Phenanthrene	DETSC 3301	0.1	mg/kg	3.4
Anthracene	DETSC 3301	0.1	mg/kg	0.7
Fluoranthene	DETSC 3301	0.1	mg/kg	5.1
Pyrene	DETSC 3301	0.1	mg/kg	4.8
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	2.2
Chrysene	DETSC 3301	0.1	mg/kg	2.6
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	1.9
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	1.0
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	2.7
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	2.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	0.4
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	2.1
PAH Total	DETSC 3301	1.6	mg/kg	30

## Summary of Chemical Analysis

### Soil Samples

Our Ref 16-69744  
 Client Ref HQH/03  
 Contract Title CROSSLEY LANE DALTON

Lab No	1006441
Sample ID	WS2 D1
Depth	0.55-0.70
Other ID	
Sample Type	SOIL
Sampling Date	13/06/16
Sampling Time	n/s

Test	Method	LOD	Units	
<b>PCBs</b>				
PCB 28 + PCB 31	DETSC 3401#	0.01	mg/kg	
PCB 52	DETSC 3401#	0.01	mg/kg	
PCB 101	DETSC 3401#	0.01	mg/kg	
PCB 118	DETSC 3401#	0.01	mg/kg	
PCB 153	DETSC 3401#	0.01	mg/kg	
PCB 138	DETSC 3401#	0.01	mg/kg	
PCB 180	DETSC 3401#	0.01	mg/kg	
PCB 7 Total	DETSC 3401#	0.01	mg/kg	
<b>Phenols</b>				
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3

# Summary of Chemical Analysis

## Soil VOC/SVOC Samples

Our Ref 16-69744

Client Ref HQH/03

Contract Title CROSSLEY LANE DALTON

Lab No	1006437	1006438
Sample ID	TP6 D1	TP10 D2
Depth	0.20-0.40	1.60-1.90
Other ID		
Sample Type	SOIL	SOIL
Sampling Date	13/06/16	13/06/16
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
<b>VOCs</b>					
Vinyl Chloride	DETSC 3431	0.01	mg/kg	0.01	0.11
1,1 Dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Trans-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	0.02	0.11
1,1-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Cis-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	0.42	1.1
2,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Bromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Chloroform	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,1,1-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,1-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Carbon tetrachloride	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Benzene	DETSC 3431	0.01	mg/kg	< 0.01	0.11
1,2-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Trichloroethylene	DETSC 3431	0.01	mg/kg	0.29	0.06
1,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Dibromomethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Bromodichloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
cis-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Toluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
trans-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,1,2-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Tetrachloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,3-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Dibromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2-dibromoethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Chlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,1,1,2-tetrachloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Ethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
m+p-Xylene	DETSC 3431	0.01	mg/kg	< 0.01	0.01
o-Xylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Styrene	DETSC 3431*	0.01	mg/kg	< 0.01	< 0.01
Bromoform	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Isopropylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Bromobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2,3-trichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
n-propylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
2-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,3,5-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
4-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Tert-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2,4-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01

# Summary of Chemical Analysis

## Soil VOC/SVOC Samples

Our Ref 16-69744

Client Ref HQH/03

Contract Title CROSSLEY LANE DALTON

Lab No	1006437	1006438
Sample ID	TP6 D1	TP10 D2
Depth	0.20-0.40	1.60-1.90
Other ID		
Sample Type	SOIL	SOIL
Sampling Date	13/06/16	13/06/16
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
sec-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
p-isopropyltoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,3-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,4-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
n-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2-dibromo-3-chloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2,4-trichlorobenzene	DETSC 3431	0.01	mg/kg	0.02	< 0.01
Hexachlorobutadiene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2,3-trichlorobenzene	DETSC 3431	0.01	mg/kg	0.04	< 0.01
<b>SVOCs</b>					
Phenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
Aniline	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
2-Chlorophenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
Benzyl Alcohol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
2-Methylphenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
Bis(2-chloroisopropyl)ether	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
3&4-Methylphenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
2,4-Dimethylphenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
Bis-(dichloroethoxy)methane	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
2,4-Dichlorophenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
1,2,4-Trichlorobenzene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
4-Chloro-3-methylphenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
2-Methylnaphthalene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
Hexachlorocyclopentadiene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
2,4,6-Trichlorophenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
2,4,5-Trichlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
2-Chloronaphthalene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
2-Nitroaniline	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
2,4-Dinitrotoluene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
3-Nitroaniline	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
4-Nitrophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
Dibenzofuran	DETSC 3433	0.1	mg/kg	< 0.1	2.2
2,6-Dinitrotoluene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
2,3,4,6-Tetrachlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
Diethylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
4-Chlorophenylphenylether	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
4-Nitroaniline	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
2-Methyl-4,6-Dinitrophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
Diphenylamine	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
4-Bromophenylphenylether	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
Hexachlorobenzene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1

## Summary of Chemical Analysis Soil VOC/SVOC Samples

Our Ref 16-69744

Client Ref HQH/03

Contract Title CROSSLEY LANE DALTON

Lab No	1006437	1006438
Sample ID	TP6 D1	TP10 D2
Depth	0.20-0.40	1.60-1.90
Other ID		
Sample Type	SOIL	SOIL
Sampling Date	13/06/16	13/06/16
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
Pentachlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
Di-n-butylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
Butylbenzylphthalate	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
Bis(2-ethylhexyl)phthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
Di-n-octylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
1,4-Dinitrobenzene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
Dimethylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
1,3-Dinitrobenzene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
1,2-Dinitrobenzene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
2,3,5,6-Tetrachlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1
Azobenzene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1
Carbazole	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1

## Summary of Asbestos Analysis Soil Samples

Our Ref 16-69744

Client Ref HQH/03

Contract Title CROSSLEY LANE DALTON

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1006435	TP2 D1 0.60-0.70	SOIL	Chrysotile	Chrysotile present as fibre bundle	D Wilkinson
1006436	TP4 D1 0.35-0.50	SOIL	Chrysotile	Chrysotile present as fibre bundles	D Wilkinson
1006437	TP6 D1 0.20-0.40	SOIL	Chrysotile	Chrysotile present as fibre bundles	D Wilkinson
1006438	TP10 D2 1.60-1.90	SOIL	NAD	none	D Wilkinson
1006439	TP16 D1 0.20-0.50	SOIL	Chrysotile	Chrysotile present as fibre bundles	D Wilkinson
1006440	TP8 D1 0.00-0.15	SOIL	Chrysotile	Chrysotile present as small bundle	D Wilkinson
1006441	WS2 D1 0.55-0.70	SOIL	Chrysotile	Chrysotile present as fibre bundle	D Wilkinson

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: \* -not included in laboratory scope of accreditation.

## Information in Support of the Analytical Results

Our Ref 16-69744  
 Client Ref HQT/03  
 Contract CROSSLEY LANE DALTON

### Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1006435	TP2 D1 0.60-0.70 SOIL	13/06/16	GV, PG		
1006436	TP4 D1 0.35-0.50 SOIL	13/06/16	GV, PG		
1006437	TP6 D1 0.20-0.40 SOIL	13/06/16	GV x2, PG		
1006438	TP10 D2 1.60-1.90 SOIL	13/06/16	GV x2, PG		
1006439	TP16 D1 0.20-0.50 SOIL	13/06/16	GV, PG		
1006440	TP8 D1 0.00-0.15 SOIL	13/06/16	GV, PG		
1006441	WS2 D1 0.55-0.70 SOIL	13/06/16	GV, PG		

Key: G-Glass P-Plastic V-Vial G-Bag

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

### Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

### Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months



## Certificate of Analysis

Certificate Number 16-69816

23-Jun-16

*Client* ARP Geotechnical  
5/6 Northwest Business Park  
Servia Hill  
Leeds  
LS6 2QH

*Our Reference* 16-69816

*Client Reference* MDW/01

*Order No* (not supplied)

*Contract Title* Crossley Lane, Dalton

*Description* 15 Soil samples.

*Date Received* 16-Jun-16

*Date Started* 16-Jun-16

*Date Completed* 23-Jun-16

*Test Procedures* Identified by prefix DETSn (details on request).

*Notes* Opinions and interpretations are outside the scope of UKAS accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

*Approved By*

A handwritten signature in black ink, appearing to read 'Rob Brown'.

Rob Brown  
Business Manager



# Summary of Chemical Analysis

## Soil Samples

Our Ref 16-69816  
 Client Ref MDW/01  
 Contract Title Crossley Lane, Dalton

Lab No	1006868	1006869	1006870	1006871	1006872	1006873
Sample ID	WS4	TP11	TP22	TP18	WS12	WS6
Depth	0.00-0.15	0.40-0.60	0.50-0.70	0.50-0.70	0.30-0.50	0.70-0.90
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	13/06/16	14/06/16	14/06/16	14/06/16	14/06/16	13/06/16
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
<b>Metals</b>									
Arsenic	DETSC 2301#	0.2	mg/kg	6.4	6.5	61	140	13	5.8
Cadmium	DETSC 2301#	0.1	mg/kg	0.3	0.2	0.3	0.6	0.2	0.1
Chromium III	DETSC 2301*	0.15	mg/kg	220	100	22	31	32	39
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	25	36	91	120	41	35
Lead	DETSC 2301#	0.3	mg/kg	35	21	57	46	39	19
Mercury	DETSC 2325#	0.05	mg/kg	0.08	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Nickel	DETSC 2301#	1	mg/kg	23	47	28	52	37	46
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.6
Zinc	DETSC 2301#	1	mg/kg	180	85	70	220	80	81
<b>Inorganics</b>									
pH	DETSC 2008#			10.4	8.4	10.0	8.2	8.2	6.4
Organic matter	DETSC 2002#	0.1	%	3.8	1.1	9.3	4.9	2.2	1.7
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	230	150	490	270	32	95
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.14	0.21	0.05	0.16	0.03	0.04
<b>Petroleum Hydrocarbons</b>									
EPH (C10-C40)	DETSC 3311#	10	mg/kg	< 10	< 10	230	< 10	160	< 10
<b>PAHs</b>									
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	0.2	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	0.2	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	1.0	< 0.1	1.5	< 0.1
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	0.4	< 0.1	0.4	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	1.7	< 0.1	2.6	< 0.1
Pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	1.6	< 0.1	2.4	< 0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	1.7	< 0.1	1.2	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	1.5	< 0.1	1.2	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	1.5	< 0.1	1.1	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	1.1	< 0.1	0.7	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	2.6	< 0.1	1.5	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	1.9	< 0.1	0.9	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	0.6	< 0.1	0.2	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	1.4	< 0.1	0.6	< 0.1
PAH Total	DETSC 3301	1.6	mg/kg	< 1.6	< 1.6	17	< 1.6	15	< 1.6
<b>Phenols</b>									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	1.7	1.0	< 0.3	< 0.3	< 0.3	< 0.3

# Summary of Chemical Analysis

## Soil Samples

Our Ref 16-69816

Client Ref MDW/01

Contract Title Crossley Lane, Dalton

Lab No	1006874	1006875	1006876	1006877	1006878	1006879
Sample ID	TP26	WS10	WS8	TP26	TP24	WS10
Depth	0.00-0.20	0.75-0.90	0.40-0.60	0.40-0.60	0.00-0.20	1.20-1.40
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	14/06/16	14/06/16	14/06/16	14/06/16	14/06/16	14/06/16
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
<b>Metals</b>									
Arsenic	DETSC 2301#	0.2	mg/kg	35	7.8	8.0	20	26	77
Cadmium	DETSC 2301#	0.1	mg/kg	0.5	0.1	0.1	0.3	0.6	0.3
Chromium III	DETSC 2301*	0.15	mg/kg	36	36	38	27	31	25
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	160	39	38	46	55	150
Lead	DETSC 2301#	0.3	mg/kg	120	32	19	45	100	140
Mercury	DETSC 2325#	0.05	mg/kg	0.34	< 0.05	< 0.05	0.09	0.25	0.22
Nickel	DETSC 2301#	1	mg/kg	33	43	47	28	23	56
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	140	84	96	83	130	120
<b>Inorganics</b>									
pH	DETSC 2008#			7.7	8.1	7.7	8.0	7.3	8.1
Organic matter	DETSC 2002#	0.1	%	5.4	1.7	1.3	2.7	10	4.3
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	28	40	33	19	33	170
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.07	0.02	0.02	0.05	0.09	0.08
<b>Petroleum Hydrocarbons</b>									
EPH (C10-C40)	DETSC 3311#	10	mg/kg	240	2300	< 10	540	200	900
<b>PAHs</b>									
Naphthalene	DETSC 3301	0.1	mg/kg	0.3	25	< 0.1	3.9	< 0.1	0.6
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	0.8	< 0.1	0.1	< 0.1	0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	0.6	15	< 0.1	2.5	< 0.1	1.0
Fluorene	DETSC 3301	0.1	mg/kg	0.5	18	< 0.1	2.3	< 0.1	1.5
Phenanthrene	DETSC 3301	0.1	mg/kg	3.4	95	0.4	13	1.9	7.7
Anthracene	DETSC 3301	0.1	mg/kg	0.8	21	0.1	3.0	0.4	1.7
Fluoranthene	DETSC 3301	0.1	mg/kg	3.5	70	0.4	13	2.3	7.1
Pyrene	DETSC 3301	0.1	mg/kg	2.9	61	0.3	11	2.1	5.7
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	1.5	24	< 0.1	5.2	0.9	2.6
Chrysene	DETSC 3301	0.1	mg/kg	1.7	25	< 0.1	5.3	1.0	2.6
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	1.1	15	< 0.1	3.9	0.7	2.3
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	0.7	9.3	< 0.1	2.5	0.5	1.3
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	1.4	20	< 0.1	5.1	0.9	2.7
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	11	< 0.1	3.2	< 0.1	1.8
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	1.3	< 0.1	0.4	< 0.1	0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	9.6	< 0.1	2.7	< 0.1	1.0
PAH Total	DETSC 3301	1.6	mg/kg	19	420	< 1.6	77	11	40
<b>Phenols</b>									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3

# Summary of Chemical Analysis

## Soil Samples

Our Ref 16-69816  
 Client Ref MDW/01  
 Contract Title Crossley Lane, Dalton

Lab No	1006880	1006881	1006882
Sample ID	TP14	TP12	WS14
Depth	0.60-0.80	0.60-0.80	0.50-0.70
Other ID			
Sample Type	SOIL	SOIL	SOIL
Sampling Date	14/06/16	14/06/16	14/06/16
Sampling Time	n/s	n/s	n/s

Test	Method	LOD	Units			
<b>Metals</b>						
Arsenic	DETSC 2301#	0.2	mg/kg	33	11	24
Cadmium	DETSC 2301#	0.1	mg/kg	0.6	0.1	0.1
Chromium III	DETSC 2301*	0.15	mg/kg	22	28	11
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	83	34	58
Lead	DETSC 2301#	0.3	mg/kg	140	31	59
Mercury	DETSC 2325#	0.05	mg/kg	0.18	< 0.05	< 0.05
Nickel	DETSC 2301#	1	mg/kg	26	33	17
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	210	72	29
<b>Inorganics</b>						
pH	DETSC 2008#			8.0	8.1	7.7
Organic matter	DETSC 2002#	0.1	%	4.9	1.6	3.5
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	280	170	1700
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.14	0.05	0.62
<b>Petroleum Hydrocarbons</b>						
EPH (C10-C40)	DETSC 3311#	10	mg/kg	890	260	490
<b>PAHs</b>						
Naphthalene	DETSC 3301	0.1	mg/kg	0.3	0.4	0.2
Acenaphthylene	DETSC 3301	0.1	mg/kg	1.4	0.2	0.3
Acenaphthene	DETSC 3301	0.1	mg/kg	0.4	0.2	0.2
Fluorene	DETSC 3301	0.1	mg/kg	2.1	0.4	0.3
Phenanthrene	DETSC 3301	0.1	mg/kg	12	1.8	3.1
Anthracene	DETSC 3301	0.1	mg/kg	4.1	0.5	1.3
Fluoranthene	DETSC 3301	0.1	mg/kg	18	2.5	7.0
Pyrene	DETSC 3301	0.1	mg/kg	18	2.1	6.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	8.9	1.2	4.9
Chrysene	DETSC 3301	0.1	mg/kg	8.0	1.1	4.3
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	5.2	0.8	4.5
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	3.8	0.6	3.0
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	7.6	1.1	6.5
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	4.7	< 0.1	5.9
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	0.9	< 0.1	1.0
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	3.1	< 0.1	4.8
PAH Total	DETSC 3301	1.6	mg/kg	98	13	54
<b>Phenols</b>						
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3

## Summary of Asbestos Analysis

### Soil Samples

Our Ref 16-69816

Client Ref MDW/01

Contract Title Crossley Lane, Dalton

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1006868	WS4 0.00-0.15	SOIL	NAD	none	Michael Kay
1006869	TP11 0.40-0.60	SOIL	NAD	none	Michael Kay
1006870	TP22 0.50-0.70	SOIL	NAD	none	Michael Kay
1006871	TP18 0.50-0.70	SOIL	NAD	none	Michael Kay
1006872	WS12 0.30-0.50	SOIL	NAD	none	Michael Kay
1006873	WS6 0.70-0.90	SOIL	NAD	none	Michael Kay
1006874	TP26 0.00-0.20	SOIL	NAD	none	Michael Kay
1006875	WS10 0.75-0.90	SOIL	Chrysotile Amosite	Small bundles of Chrysotile and Amosite	Michael Kay
1006876	WS8 0.40-0.60	SOIL	Chrysotile	Small bundle of Chrysotile	Michael Kay
1006877	TP26 0.40-0.60	SOIL	NAD	none	Michael Kay
1006878	TP24 0.00-0.20	SOIL	NAD	none	Michael Kay
1006879	WS10 1.20-1.40	SOIL	NAD	none	Michael Kay
1006880	TP14 0.60-0.80	SOIL	NAD	none	Michael Kay
1006881	TP12 0.60-0.80	SOIL	NAD	none	Michael Kay
1006882	WS14 0.50-0.70	SOIL	NAD	none	Michael Kay

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: \* -not included in laboratory scope of accreditation.

## Information in Support of the Analytical Results

Our Ref 16-69816  
Client Ref MDW/01  
Contract Crossley Lane, Dalton

### Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1006868	WS4 0.00-0.15 SOIL	13/06/16	GJ 60ml, PG		
1006869	TP11 0.40-0.60 SOIL	14/06/16	GJ 60ml, PG		
1006870	TP22 0.50-0.70 SOIL	14/06/16	GJ 60ml, PG		
1006871	TP18 0.50-0.70 SOIL	14/06/16	GJ 60ml, PG		
1006872	WS12 0.30-0.50 SOIL	14/06/16	GJ 60ml, PG		
1006873	WS6 0.70-0.90 SOIL	13/06/16	GJ 60ml, PG		
1006874	TP26 0.00-0.20 SOIL	14/06/16	GJ 60ml, PG		
1006875	WS10 0.75-0.90 SOIL	14/06/16	GJ 60ml, PG		
1006876	WS8 0.40-0.60 SOIL	14/06/16	GJ 60ml, PG		
1006877	TP26 0.40-0.60 SOIL	14/06/16	GJ 60ml, PG		
1006878	TP24 0.00-0.20 SOIL	14/06/16	GJ 60ml, PG		
1006879	WS10 1.20-1.40 SOIL	14/06/16	GJ 60ml, PG		
1006880	TP14 0.60-0.80 SOIL	14/06/16	GJ 60ml, PG		
1006881	TP12 0.60-0.80 SOIL	14/06/16	GJ 60ml, PG		
1006882	WS14 0.50-0.70 SOIL	14/06/16	GJ 60ml, PG		

Key: G-Glass P-Plastic J-Jar G-Bag

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

### Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

### Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months



## Certificate of Analysis

Certificate Number 16-70377

28-Jun-16

*Client* ARP Geotechnical  
5/6 Northwest Business Park  
Servia Hill  
Leeds  
LS6 2QH

*Our Reference* 16-70377

*Client Reference* MWD/01/EGH

*Order No* (not supplied)

*Contract Title* Crossley Lane, Dalton

*Description* 13 Soil samples.

*Date Received* 21-Jun-16

*Date Started* 22-Jun-16

*Date Completed* 28-Jun-16

*Test Procedures* Identified by prefix DETSn (details on request).

*Notes* Opinions and interpretations are outside the scope of UKAS accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

*Approved By*

Rob Brown  
Business Manager



# Summary of Chemical Analysis

## Soil Samples

Our Ref 16-70377

Client Ref MWD/01/EGH

Contract Title Crossley Lane, Dalton

Lab No	1009951	1009952	1009953	1009954	1009955	1009956	1009957
Sample ID	TP23	TP27	TP29	TP30	TP30	WS21	WS21
Depth	0.30-0.50	0.30-0.50	0.50-0.70	0.00-0.20	1.00-1.00	0.20-0.30	0.70-0.90
Other ID							
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	14/06/16	14/06/16	14/06/16	14/06/16	14/06/16	14/06/16	14/06/16
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units	1009951	1009952	1009953	1009954	1009955	1009956	1009957
<b>Metals</b>										
Arsenic	DETSC 2301#	0.2	mg/kg	8.7	6.1	12	24	46	57	29
Cadmium	DETSC 2301#	0.1	mg/kg	1.2	0.1	0.1	2.7	0.6	0.3	4
Chromium III	DETSC 2301*	0.15	mg/kg	21	30	21	44	21	45	25
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	24	7	1	960	250	130	40
Lead	DETSC 2301#	0.3	mg/kg	240	1	3	20	180	2000	69
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	< 0.05	< 0.05	0.07	< 0.05	0.2	0.7
Nickel	DETSC 2301#	1	mg/kg	24	8	8	33	25	48	25
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	280	100	75	570	150	3200	640
<b>Inorganics</b>										
Loss on Ignition at 440oC	DETSC 2003#	0.01	%							
pH	DETSC 2008#			10.8	8.0	7.8	7.8	8.6	7.2	6.8
Organic matter	DETSC 2002#	0.1	%	0.6	0.7	0.9	3.3	2.2	6.0	5.5
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	230	48	36	1700	1600	62	69
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.02	0.04	0.26	0.13	0.03	0.12	0.03
<b>Petroleum Hydrocarbons</b>										
EPH (C10-C40)	DETSC 3311#	10	mg/kg	< 10	20	10	280	590	10	< 10
<b>PAHs</b>										
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	0.6	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	3.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	2.0	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	0.7	< 0.1	< 0.1	1.2	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	0.2	1.1	< 0.1	1.4	8.1	0.4	< 0.1
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	16	< 0.1	0.5	1.2	0.2	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	0.4	3.4	< 0.1	1.5	3.0	0.7	< 0.1
Pyrene	DETSC 3301	0.1	mg/kg	0.3	29	< 0.1	0.8	1	0.5	< 0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	11	< 0.1	0.8	4.0	0.5	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	8	< 0.1	0.8	4.6	0.4	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	7.0	< 0.1	0.8	2.7	0.5	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	4.7	< 0.1	0.4	1.7	0.2	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	7	< 0.1	0.7	3.0	0.5	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	6.7	< 0.1	< 0.1	2.3	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	2.2	< 0.1	< 0.1	0.3	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	5	< 0.1	< 0.1	2.1	< 0.1	< 0.1
PAH Total	DETSC 3301	1.6	mg/kg	< 1.6	20	< 1.6	9.1	53	3.7	< 1.6

\* Samples which have been crossed out are not relevant to site 4 and site 5

# Summary of Chemical Analysis

## Soil Samples

Our Ref 16-70377

Client Ref MWD/01/EGH

Contract Title Crossley Lane, Dalton

Lab No	1009951	1009952	1009953	1009954	1009955	1009956	1009957
Sample ID	TP23	TP27	TP29	TP30	TP30	WS21	WS21
Depth	0.30-0.50	0.30-0.50	0.50-0.70	0.00-0.20	0.00-0.30	0.20-0.30	0.70-0.90
Other ID							
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	14/06/16	14/06/16	14/06/16	14/06/16	14/06/16	14/06/16	14/06/16
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units							
<b>PCBs</b>										
PCB 28 + PCB 31	DETSC 3401#	0.01	mg/kg						0.01	
PCB 52	DETSC 3401#	0.01	mg/kg						< 0.01	
PCB 101	DETSC 3401#	0.01	mg/kg						0.01	
PCB 118	DETSC 3401#	0.01	mg/kg						< 0.01	
PCB 153	DETSC 3401#	0.01	mg/kg						< 0.01	
PCB 138	DETSC 3401#	0.01	mg/kg						< 0.01	
PCB 180	DETSC 3401#	0.01	mg/kg						< 0.01	
PCB 7 Total	DETSC 3401#	0.01	mg/kg						0.01	
<b>Phenols</b>										
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	1.5	1.1	1.0	1.0	1.5	< 0.3	1.0

# Summary of Chemical Analysis

## Soil Samples

Our Ref 16-70377  
 Client Ref MWD/01/EGH  
 Contract Title Crossley Lane, Dalton

Lab No	1009958	1009959	1009960	1009961	1009962	1009963
Sample ID	WS22	WS22	WS24	WS26	WS30	WS35
Depth	0.00-0.40	1.00-1.30	1.20-1.50	0.40-0.60	1.40-1.60	0.22-0.40
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	14/06/16	14/06/16	14/06/16	14/06/16	14/06/16	14/06/16
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	Method	LOD	Units			
<b>Metals</b>						
Arsenic	DETSC 2301#	0.2	mg/kg	10	93	130
Cadmium	DETSC 2301#	0.1	mg/kg	0.4	0.9	47
Chromium III	DETSC 2301*	0.15	mg/kg	17	25	4.0
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	86	89	220
Lead	DETSC 2301#	0.3	mg/kg	250	170	400
Mercury	DETSC 2325#	0.05	mg/kg	0.07	< 0.05	22
Nickel	DETSC 2301#	1	mg/kg	1	3	8.1
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	* 1.7
Zinc	DETSC 2301#	1	mg/kg	7	1200	270
<b>Inorganics</b>						
Loss on Ignition at 440oC	DETSC 2003#	0.01	%			85
pH	DETSC 2008#			10.4	10.4	4.4
Organic matter	DETSC 2002#	0.1	%	25	45	> 25
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	90	380	1400
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.02	0.02	0.01
<b>Petroleum Hydrocarbons</b>						
EPH (C10-C40)	DETSC 3311#	10	mg/kg	< 10	240	220
<b>PAHs</b>						
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	1.2	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	0.8	< 0.1
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	57	< 0.1
Pyrene	DETSC 3301	0.1	mg/kg	< 0.1	4.4	< 0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	3.5	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	8.0	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	20	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	1	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	2.8	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	1.5	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	0	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	0	< 0.1
PAH Total	DETSC 3301	1.6	mg/kg	< 1.6	28	< 1.6

# Summary of Chemical Analysis

## Soil Samples

Our Ref 16-70377  
 Client Ref MWD/01/EGH  
 Contract Title Crossley Lane, Dalton

Lab No	1009958	1009959	1009960	1009961	1009962	1009963
Sample ID	WS22	WS22	WS24	WS26	WS30	WS33
Depth	0.20-0.40	1.00-1.30	1.20-1.50	0.40-0.60	1.40-1.60	0.20-0.40
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	14/06/16	14/06/16	14/06/16	14/06/16	14/06/16	14/06/16
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units	1009958	1009959	1009960	1009961	1009962	1009963
<b>PCBs</b>									
PCB 28 + PCB 31	DETSC 3401#	0.01	mg/kg						
PCB 52	DETSC 3401#	0.01	mg/kg						
PCB 101	DETSC 3401#	0.01	mg/kg						
PCB 118	DETSC 3401#	0.01	mg/kg						
PCB 153	DETSC 3401#	0.01	mg/kg						
PCB 138	DETSC 3401#	0.01	mg/kg						
PCB 180	DETSC 3401#	0.01	mg/kg						
PCB 7 Total	DETSC 3401#	0.01	mg/kg						
<b>Phenols</b>									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	1.8	1.8	7.2		0.4	1.8

# Summary of Chemical Analysis

## Soil VOC Samples

Our Ref 16-70377

Client Ref MWD/01/EGH

Contract Title Crossley Lane, Dalton

Lab No	1009959	1009960
Sample ID	WS22	WS24
Depth	1.1-1.30	1.20-1.50
Other ID		
Sample Type	SOIL	SOIL
Sampling Date	14/06/16	14/06/16
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
<b>VOCs</b>					
Vinyl Chloride	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,1 Dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Trans-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	0.13
1,1-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Cis-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	0.01	0.46
2,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Bromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Chloroform	DETSC 3431	0.01	mg/kg	< 0.01	0.78
1,1,1-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	0.01
1,1-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Carbon tetrachloride	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Benzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Trichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	21
1,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Dibromomethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Bromodichloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
cis-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Toluene	DETSC 3431	0.01	mg/kg	< 0.01	0.03
trans-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,1,2-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Tetrachloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,3-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Dibromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2-dibromoethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Chlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,1,1,2-tetrachloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Ethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
m+p-Xylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
o-Xylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Styrene	DETSC 3431*	0.01	mg/kg	< 0.01	< 0.01
Bromoform	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Isopropylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Bromobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2,3-trichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
n-propylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
2-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,3,5-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
4-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Tert-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2,4-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01

## Summary of Chemical Analysis Soil VOC Samples

Our Ref 16-70377

Client Ref MWD/01/EGH

Contract Title Crossley Lane, Dalton

Lab No	1009959	1009960
Sample ID	WS22	WS24
Depth	1.00-1.30	1.20-1.50
Other ID		
Sample Type	SOIL	SOIL
Sampling Date	14/06/16	14/06/16
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
sec-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
p-isopropyltoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,3-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,4-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
n-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2-dibromo-3-chloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2,4-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	0.02
Hexachlorobutadiene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2,3-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01

## Summary of Asbestos Analysis Soil Samples

Our Ref 16-70377  
Client Ref MWD/01/EGH  
Contract Title Crossley Lane, Dalton

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1009951	TP23 0.30-0.50	SOIL	NAD	none	Jeff Cruddas
<del>1009952</del>	<del>TP24 0.50-0.70</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>Jeff Cruddas</del>
<del>1009953</del>	<del>TP25 0.50-0.70</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>Jeff Cruddas</del>
<del>1009954</del>	<del>TP26 0.50-0.70</del>	<del>SOIL</del>	<del>Chrysotile</del>	<del>Chrysotile present as fibre bundles</del>	<del>Jeff Cruddas</del>
<del>1009955</del>	<del>TP27 1.00-1.00</del>	<del>SOIL</del>	<del>Amosite</del>	<del>Amosite present as fibre bundles</del>	<del>Jeff Cruddas</del>
<del>1009956</del>	<del>WS21 0.30-0.30</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>Jeff Cruddas</del>
<del>1009957</del>	<del>WS21 0.70-0.90</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>Jeff Cruddas</del>
<del>1009958</del>	<del>WS21 0.30-0.40</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>Jeff Cruddas</del>
<del>1009959</del>	<del>WS22 1.10-1.30</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>Jeff Cruddas</del>
1009960	WS24 1.20-1.50	SOIL	NAD	none	Jeff Cruddas
<del>1009961</del>	<del>WS26 0.40-0.60</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>Jeff Cruddas</del>
1009962	WS30 1.40-1.60	SOIL	NAD	none	Jeff Cruddas
<del>1009963</del>	<del>WS33 0.22-0.40</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>Jeff Cruddas</del>

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: \* -not included in laboratory scope of accreditation.

## Information in Support of the Analytical Results

Our Ref 16-70377  
 Client Ref MWD/01/EGH  
 Contract Crossley Lane, Dalton

### Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1009951	TP23 0.30-0.50 SOIL	14/06/16	GV		
1009952	TP27 0.30-0.50 SOIL	14/06/16	GV, PG		
1009953	TP29 0.50-0.70 SOIL	14/06/16	GV, PG		
1009954	TP30 0.00-0.20 SOIL	14/06/16	GV, PG		
1009955	TP30 1.00-1.00 SOIL	14/06/16	GV, PG		
1009956	WS21 0.20-0.30 SOIL	14/06/16	GV, PG		
1009957	WS21 0.70-0.90 SOIL	14/06/16	GV, PG		
1009958	WS22 0.20-0.40 SOIL	14/06/16	GV, PG		
1009959	WS22 1.10-1.30 SOIL	14/06/16	GV, PG		
1009960	WS24 1.20-1.50 SOIL	14/06/16	GV, PG		
1009961	WS26 0.40-0.60 SOIL	14/06/16	GV, PG		
1009962	WS30 1.40-1.60 SOIL	14/06/16	GV		
1009963	WS35 0.22-0.40 SOIL	14/06/16	GV		

Key: G-Glass V-Vial P-Plastic G-Bag

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

### Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

### Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months



## Certificate of Analysis

Certificate Number 16-70292-1

04-Jul-16

*Client* ARP Geotechnical  
5/6 Northwest Business Park  
Servia Hill  
Leeds  
LS6 2QH

*Our Reference* 16-70292-1

*Client Reference* MWD/01/EGH

*Order No* (not supplied)

*Contract Title* Crossley Lane, Dalton

*Description* 7 Soil samples, 1 Leachate sample.

*Date Received* 21-Jun-16

*Date Started* 21-Jun-16

*Date Completed* 04-Jul-16

*Test Procedures* Identified by prefix DETSn (details on request).

*Notes* **This report supersedes 16-70292. Extra testing.**

Opinions and interpretations are outside the scope of UKAS accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

*Approved By*

A handwritten signature in black ink, appearing to read 'Rob Brown'.

Rob Brown  
Business Manager



# Summary of Chemical Analysis

## Soil Samples

Our Ref 16-70292-1  
 Client Ref MWD/01/EGH  
 Contract Title Crossley Lane, Dalton

Lab No	1009614	1009615	1009616	1009617	1009618	1009619	1009620
Sample ID	WS1	WS5	TP1	TP3	TP5	TP9	TP13
Depth	0.80-0.90	0.60-0.80	0.80-1.00	0.55-0.70	0.20-0.40	0.60-0.60	1.40-1.60
Other ID							
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	13/06/16	13/06/16	13/06/16	13/06/16	13/06/16	13/06/16	13/06/16
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units							
Asbestos Quantification OHR	DETSC 1102	0				Y				
<b>Metals</b>										
Arsenic	DETSC 2301#	0.2	mg/kg	50	8.6	35	32	2.3	21	7.4
Cadmium	DETSC 2301#	0.1	mg/kg	0.2	0.1	0.3	0.2	0.2	< 0.1	< 0.1
Chromium III	DETSC 2301*	0.15	mg/kg	26	23	22	16	18	15	30
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	42	16	110	60	7.1	90	32
Lead	DETSC 2301#	0.3	mg/kg	56	25	160	42	7.8	35	21
Mercury	DETSC 2325#	0.05	mg/kg	0.11	< 0.05	0.11	< 0.05	< 0.05	0.14	< 0.05
Nickel	DETSC 2301#	1	mg/kg	29	18	36	29	14	38	27
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	85	64	140	56	35	59	82
<b>Inorganics</b>										
pH	DETSC 2008#			7.3	8.5	7.5	7.4	10.1	8.1	7.8
Organic matter	DETSC 2002#	0.1	%	5.0	2.5	5.3	9.7	0.4	10	3.6
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	18	48	130	85	30	97	200
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.05	0.06	0.09	0.06	0.04	0.07	0.09
<b>Petroleum Hydrocarbons</b>										
EPH (C10-C40)	DETSC 3311#	10	mg/kg	< 10	< 10	660	130	< 10	< 10	760
<b>PAHs</b>										
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	0.5	< 0.1	< 0.1	< 0.1	3.3
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	0.6	< 0.1	< 0.1	< 0.1	2.2
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	0.6	< 0.1	< 0.1	< 0.1	3.2
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	1.1	< 0.1	< 0.1	< 0.1	4.5
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	10	1.6	< 0.1	< 0.1	1.1
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	3.1	0.4	< 0.1	< 0.1	1.0
Fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	20	2.2	< 0.1	< 0.1	0.6
Pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	18	1.9	< 0.1	< 0.1	1.7
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	8.9	0.8	< 0.1	< 0.1	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	8.7	0.8	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	6.1	0.6	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	3.8	0.2	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	8.3	1.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	5.4	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	1.0	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	4.5	< 0.1	< 0.1	< 0.1	< 0.1
PAH Total	DETSC 3301	1.6	mg/kg	< 1.6	< 1.6	100	9.7	< 1.6	< 1.6	18
<b>Phenols</b>										
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3

# Summary of Chemical Analysis

## Leachate Samples

Our Ref 16-70292-1  
 Client Ref MWD/01/EGH  
 Contract Title Crossley Lane, Dalton

Lab No	1013451
Sample ID	TP1
Depth	0.80-1.00
Other ID	
Sample Type	LEACHATE
Sampling Date	13/06/16
Sampling Time	n/s

Test	Method	LOD	Units	
<b>Preparation</b>				
NRA Leachate Preparation	DETS 036*			Y
<b>PAHs</b>				
Naphthalene	DETS 074*	0.01	ug/l	< 0.01
Acenaphthylene	DETS 074*	0.01	ug/l	< 0.01
Acenaphthene	DETS 074*	0.01	ug/l	< 0.01
Fluorene	DETS 074*	0.01	ug/l	< 0.01
Phenanthrene	DETS 074*	0.01	ug/l	< 0.01
Anthracene	DETS 074*	0.01	ug/l	0.47
Fluoranthene	DETS 074*	0.01	ug/l	< 0.01
Pyrene	DETS 074*	0.01	ug/l	< 0.01
Benzo(a)anthracene	DETS 074*	0.01	ug/l	< 0.01
Chrysene	DETS 074*	0.01	ug/l	< 0.01
Benzo(b)fluoranthene	DETS 074*	0.01	ug/l	< 0.01
Benzo(k)fluoranthene	DETS 074*	0.01	ug/l	< 0.01
Benzo(a)pyrene	DETS 074*	0.01	ug/l	< 0.01
Indeno(1,2,3-c,d)pyrene	DETS 074*	0.01	ug/l	< 0.01
Dibenzo(a,h)anthracene	DETS 074*	0.01	ug/l	< 0.01
Benzo(g,h,i)perylene	DETS 074*	0.01	ug/l	< 0.01
PAH Total	DETS 074*	0.2	ug/l	0.47

## Summary of Asbestos Analysis

### Soil Samples

Our Ref 16-70292-1

Client Ref MWD/01/EGH

Contract Title Crossley Lane, Dalton

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1009614	WS1 0.80-0.90	SOIL	NAD	none	D Wilkinson
1009615	WS5 0.60-0.80	SOIL	NAD	none	D Wilkinson
1009616	TP1 0.80-1.00	SOIL	Chrysotile Amosite	Chrysotile and Amosite present as small fibre bundles	D Wilkinson
1009617	TP3 0.55-0.70	SOIL	Chrysotile	Chrysotile present as small bundle	D Wilkinson
1009618	TP5 0.20-0.40	SOIL	NAD	none	D Wilkinson
1009619	TP9 0.60-0.60	SOIL	NAD	none	D Wilkinson
1009620	TP13 1.40-1.60	SOIL	NAD	none	D Wilkinson

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: \* -not included in laboratory scope of accreditation.

# Summary of Asbestos Quantification Analysis

## Soil Samples

Our Ref 16-70292-1  
 Client Ref MWD/01/EGH  
 Contract Title Crossley Lane, Dalton

Lab No	1009616
Sample ID	TP1
Depth	0.80-1.00
Other ID	
Sample Type	SOIL
Sampling Date	13/06/16
Sampling Time	

Test	Method	Units	
Total Mass% Asbestos (a+b+c)	DETSC 1102	Mass %	< 0.001
Gravimetric Quantification (a)	DETSC 1102	Mass %	na
Detailed Gravimetric Quantification (b)	DETSC 1102	Mass %	<0.001
Quantification by PCOM (c)	DETSC 1102	Mass %	na
Potentially Respirable Fibres (d)	DETSC 1102	Fibres/g	na
Breakdown of Gravimetric Analysis (a)			
Mass of Sample		g	317.11
ACMs present*		type	
Mass of ACM in sample		g	
% ACM by mass		%	
% asbestos in ACM		%	
% asbestos in sample		%	
Breakdown of Detailed Gravimetric Analysis (b)			
% Amphibole bundles in sample		Mass %	<0.001
% Chrysotile bundles in sample		Mass %	<0.001
Breakdown of PCOM Analysis (c)			
% Amphibole fibres in sample		Mass %	na
% Chrysotile fibres in sample		Mass %	na
Breakdown of Potentially Respirable Fibre Analysis (d)			
Amphibole fibres		Fibres/g	na
Chrysotile fibres		Fibres/g	na

\* Denotes test or material description outside of UKAS accreditation.  
 % asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264.  
 Recommended sample size for quantification is approximately 1kg  
 # denotes deviating sample

## Information in Support of the Analytical Results

Our Ref 16-70292-1  
 Client Ref MWD/01/EGH  
 Contract Crossley Lane, Dalton

### Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1009614	WS1 0.80-0.90 SOIL	13/06/16	GJ 60ml, P(other)		
1009615	WS5 0.60-0.80 SOIL	13/06/16	GJ 60ml, P(other)		
1009616	TP1 0.80-1.00 SOIL	13/06/16	GJ 60ml, P(other)		
1009617	TP3 0.55-0.70 SOIL	13/06/16	GJ 60ml, P(other)		
1009618	TP5 0.20-0.40 SOIL	13/06/16	GJ 60ml, P(other)		
1009619	TP9 0.60-0.60 SOIL	13/06/16	GJ 60ml, P(other)		
1009620	TP13 1.40-1.60 SOIL	13/06/16	GJ 60ml, P(other)		
1013451	TP1 0.80-1.00 LEACHATE	13/06/16	GJ 1L (1L)		

Key: G-Glass P-Plastic J-Jar

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

### Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

### Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months



## Certificate of Analysis

Certificate Number 16-69817-1

05-Jul-16

*Client* ARP Geotechnical  
5/6 Northwest Business Park  
Servia Hill  
Leeds  
LS6 2QH

*Our Reference* 16-69817-1

*Client Reference* MWD/01

*Order No* (not supplied)

*Contract Title* MWD

*Description* 9 Soil samples, 4 Leachate samples.

*Date Received* 16-Jun-16

*Date Started* 16-Jun-16

*Date Completed* 05-Jul-16

*Test Procedures* Identified by prefix DETSn (details on request).

*Notes* **This report supersedes 16-69817. Extra testing.**

Opinions and interpretations are outside the scope of UKAS accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

*Approved By*

A handwritten signature in black ink, appearing to read 'Rob Brown'.

Rob Brown  
Business Manager



## Summary of Chemical Analysis

### Soil Samples

Our Ref 16-69817-1  
 Client Ref MWD/01  
 Contract Title MWD

Lab No	1006883	1006884	1006885	1006886	1006887
Sample ID	WS7	WS9	WS11	WS13	TP14
Depth	1.00-1.20	1.00-1.20	0.50-0.70	0.70-1.00	1.00-1.50
Other ID					
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	14/06/2016	14/06/2016	14/06/2016	14/06/2016	14/06/2016
Sampling Time	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units					
Asbestos Quantification OHR	DETSC 1102	0		Y				
<b>Metals</b>								
Arsenic	DETSC 2301#	0.2	mg/kg	63	70	38	4.5	13
Cadmium	DETSC 2301#	0.1	mg/kg	0.4	0.4	0.3	0.1	0.2
Chromium III	DETSC 2301*	0.15	mg/kg	24	18	31	39	30
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	390	78	51	22	37
Lead	DETSC 2301#	0.3	mg/kg	1200	67	100	20	29
Mercury	DETSC 2325#	0.05	mg/kg	0.26	< 0.05	1.6	0.07	0.06
Nickel	DETSC 2301#	1	mg/kg	41	33	28	29	23
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	0.6	< 0.5	0.5
Zinc	DETSC 2301#	1	mg/kg	140	120	79	64	60
<b>Inorganics</b>								
pH	DETSC 2008#			7.9	8.2	6.9	8.0	8.7
Organic matter	DETSC 2002#	0.1	%	7.0	3.1	5.2	1.5	2.0
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	560	440	140	51	32
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.19	0.22	0.09	0.02	0.03
<b>Petroleum Hydrocarbons</b>								
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg					< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg					< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg					0.03
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg					< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg					5.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg					3.2
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg					< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg					< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg					0.04
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg					< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg					0.02
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg					2.3
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg					77
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg					170
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg					130
Aromatic C5-C35	DETSC 3072*	10	mg/kg					380
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg					390
EPH (C10-C40)	DETSC 3311#	10	mg/kg	380	< 10	110	180	1800

## Summary of Chemical Analysis

### Soil Samples

Our Ref 16-69817-1  
 Client Ref MWD/01  
 Contract Title MWD

Lab No	1006883	1006884	1006885	1006886	1006887
Sample ID	WS7	WS9	WS11	WS13	TP14
Depth	1.00-1.20	1.00-1.20	0.50-0.70	0.70-1.00	1.00-1.50
Other ID					
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	14/06/2016	14/06/2016	14/06/2016	14/06/2016	14/06/2016
Sampling Time	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units					
<b>PAHs</b>								
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.2	0.6
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	6.6
Acenaphthene	DETSC 3301	0.1	mg/kg	0.5	< 0.1	< 0.1	0.7	4.7
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.8	8.2
Phenanthrene	DETSC 3301	0.1	mg/kg	6.6	0.5	0.8	2.3	19
Anthracene	DETSC 3301	0.1	mg/kg	2.4	< 0.1	0.2	0.7	1.1
Fluoranthene	DETSC 3301	0.1	mg/kg	12	0.5	1.5	3.5	11
Pyrene	DETSC 3301	0.1	mg/kg	11	0.5	1.4	3.1	1.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	5.1	< 0.1	0.8	1.6	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	4.8	< 0.1	0.8	1.9	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	3.7	< 0.1	0.6	1.1	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	2.3	< 0.1	0.5	0.6	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	4.5	< 0.1	0.8	1.5	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	3.4	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	0.2	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	2.7	< 0.1	< 0.1	< 0.1	< 0.1
PAH Total	DETSC 3301	1.6	mg/kg	59	1.6	7.4	18	53
<b>Phenols</b>								
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	0.6	0.9

## Summary of Chemical Analysis

### Soil Samples

Our Ref 16-69817-1  
 Client Ref MWD/01  
 Contract Title MWD

Lab No	1006888	1006889	1006890	1006891
Sample ID	TP15	WS16	WS17	WS18
Depth	1.00-1.20	0.50-0.70	0.20-0.40	0.40-0.60
Other ID				
Sample Type	SOIL	SOIL	SOIL	SOIL
Sampling Date	14/06/2016	14/06/2016	14/06/2016	14/06/2016
Sampling Time	n/s	n/s	n/s	n/s

Test	Method	LOD	Units				
Asbestos Quantification OHR	DETSC 1102	0					
<b>Metals</b>							
Arsenic	DETSC 2301#	0.2	mg/kg	35	10	37	9.8
Cadmium	DETSC 2301#	0.1	mg/kg	0.4	< 0.1	0.3	0.2
Chromium III	DETSC 2301*	0.15	mg/kg	24	34	44	21
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	110	32	52	30
Lead	DETSC 2301#	0.3	mg/kg	360	21	91	23
Mercury	DETSC 2325#	0.05	mg/kg	0.18	< 0.05	1.1	0.07
Nickel	DETSC 2301#	1	mg/kg	30	48	27	23
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	0.6	< 0.5
Zinc	DETSC 2301#	1	mg/kg	140	85	75	70
<b>Inorganics</b>							
pH	DETSC 2008#			7.9	7.6	7.6	8.4
Organic matter	DETSC 2002#	0.1	%	8.8	1.1	6.5	3.0
Sulphate Aqueous Extract as SO <sub>4</sub>	DETSC 2076#	10	mg/l	950	53	170	310
Sulphate as SO <sub>4</sub> , Total	DETSC 2321#	0.01	%	0.25	0.03	0.11	0.10
<b>Petroleum Hydrocarbons</b>							
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01			
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01			
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	0.05			
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5			
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	2.9			
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	16			
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	98			
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	120			
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01			
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01			
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	0.05			
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	5.1			
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	37			
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	150			
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	280			
Aromatic C5-C35	DETSC 3072*	10	mg/kg	470			
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg	580			
EPH (C10-C40)	DETSC 3311#	10	mg/kg	1200	1200	200	320

## Summary of Chemical Analysis

### Soil Samples

Our Ref 16-69817-1  
 Client Ref MWD/01  
 Contract Title MWD

Lab No	1006888	1006889	1006890	1006891
Sample ID	TP15	WS16	WS17	WS18
Depth	1.00-1.20	0.50-0.70	0.20-0.40	0.40-0.60
Other ID				
Sample Type	SOIL	SOIL	SOIL	SOIL
Sampling Date	14/06/2016	14/06/2016	14/06/2016	14/06/2016
Sampling Time	n/s	n/s	n/s	n/s

Test	Method	LOD	Units				
<b>PAHs</b>							
Naphthalene	DETSC 3301	0.1	mg/kg	8.7	0.2	< 0.1	3.2
Acenaphthylene	DETSC 3301	0.1	mg/kg	1.8	1.0	< 0.1	0.2
Acenaphthene	DETSC 3301	0.1	mg/kg	1.8	3.5	0.6	1.2
Fluorene	DETSC 3301	0.1	mg/kg	4.8	0.8	0.8	1.5
Phenanthrene	DETSC 3301	0.1	mg/kg	22	32	5.8	6.5
Anthracene	DETSC 3301	0.1	mg/kg	7.9	8.0	1.5	1.3
Fluoranthene	DETSC 3301	0.1	mg/kg	24	42	5.9	5.4
Pyrene	DETSC 3301	0.1	mg/kg	21	38	4.8	4.7
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	9.4	16	2.0	2.0
Chrysene	DETSC 3301	0.1	mg/kg	9.7	17	2.0	1.8
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	6.5	11	1.5	1.7
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	4.4	6.6	1.0	0.8
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	8.5	14	1.8	1.9
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	5.4	9.1	1.5	1.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	0.6	1.4	< 0.1	0.4
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	4.2	6.9	0.7	0.9
PAH Total	DETSC 3301	1.6	mg/kg	140	210	30	35
<b>Phenols</b>							
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	1.1	2.0

## Summary of Chemical Analysis

### Leachate Samples

Our Ref 16-69817-1  
 Client Ref MWD/01  
 Contract Title MWD

Lab No	1013442	1013443	1013444	1013445
Sample ID	WS7	TP15	WS9	WS16
Depth	1.00-1.20	1.00-1.20	1.00-1.20	0.50-0.70
Other ID				
Sample Type	LEACHATE	LEACHATE	LEACHATE	LEACHATE
Sampling Date	14/06/16	14/06/16	14/06/16	14/06/16
Sampling Time	n/s	n/s	n/s	n/s

Test	Method	LOD	Units				
<b>Preparation</b>							
NRA Leachate Preparation	DETS 036*			Y	Y	Y	Y
<b>Metals</b>							
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	0.26		0.36	
Lead, Dissolved	DETSC 2306	0.09	ug/l	0.26			
<b>PAHs</b>							
Naphthalene	DETS 074*	0.01	ug/l		< 0.01		0.03
Acenaphthylene	DETS 074*	0.01	ug/l		< 0.01		< 0.01
Acenaphthene	DETS 074*	0.01	ug/l		< 0.01		< 0.01
Fluorene	DETS 074*	0.01	ug/l		< 0.01		< 0.01
Phenanthrene	DETS 074*	0.01	ug/l		< 0.01		0.06
Anthracene	DETS 074*	0.01	ug/l		< 0.01		< 0.01
Fluoranthene	DETS 074*	0.01	ug/l		< 0.01		0.02
Pyrene	DETS 074*	0.01	ug/l		< 0.01		0.02
Benzo(a)anthracene	DETS 074*	0.01	ug/l		< 0.01		< 0.01
Chrysene	DETS 074*	0.01	ug/l		< 0.01		< 0.01
Benzo(b)fluoranthene	DETS 074*	0.01	ug/l		< 0.01		< 0.01
Benzo(k)fluoranthene	DETS 074*	0.01	ug/l		< 0.01		< 0.01
Benzo(a)pyrene	DETS 074*	0.01	ug/l		< 0.01		< 0.01
Indeno(1,2,3-c,d)pyrene	DETS 074*	0.01	ug/l		< 0.01		< 0.01
Dibenzo(a,h)anthracene	DETS 074*	0.01	ug/l		< 0.01		< 0.01
Benzo(g,h,i)perylene	DETS 074*	0.01	ug/l		< 0.01		< 0.01
PAH Total	DETS 074*	0.2	ug/l		< 0.20		< 0.20

## Summary of Asbestos Analysis

### Soil Samples

Our Ref 16-69817-1

Client Ref MWD/01

Contract Title MWD

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1006883	WS7 1.00-1.20	SOIL	Chrysotile Amosite	Chrysotile and Amosite present as fibres bundles	D Wilkinson
1006884	WS9 1.00-1.20	SOIL	NAD	none	D Wilkinson
1006885	WS11 0.50-0.70	SOIL	Chrysotile	Chrysotile present as clumps and fibre bundles	D Wilkinson
1006886	WS13 0.70-1.00	SOIL	NAD	none	D Wilkinson
1006887	TP14 1.00-1.50	SOIL	NAD	none	D Wilkinson
1006888	TP15 1.00-1.20	SOIL	Chrysotile	Chrysotile present as clump and fibre bundles	D Wilkinson
1006889	WS16 0.50-0.70	SOIL	Chrysotile	Chrysotile present as fibre bundles	D Wilkinson
1006890	WS17 0.20-0.40	SOIL	NAD	none	D Wilkinson
1006891	WS18 0.40-0.60	SOIL	NAD	none	D Wilkinson

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: \* -not included in laboratory scope of accreditation.

## Summary of Asbestos Quantification Analysis

### Soil Samples

Our Ref 16-69817-1  
 Client Ref MWD/01  
 Contract Title MWD

Lab No	1006883
Sample ID	WS7
Depth	1.00-1.20
Other ID	
Sample Type	SOIL
Sampling Date	14/06/2016
Sampling Time	

Test	Method	Units	
Total Mass% Asbestos (a+b+c)	DETSC 1102	Mass %	<b>0.009</b>
Gravimetric Quantification (a)	DETSC 1102	Mass %	na
Detailed Gravimetric Quantification (b)	DETSC 1102	Mass %	0.009
Quantification by PCOM (c)	DETSC 1102	Mass %	na
Potentially Respirable Fibres (d)	DETSC 1102	Fibres/g	na
Breakdown of Gravimetric Analysis (a)			
Mass of Sample		g	465.93
ACMs present*		type	
Mass of ACM in sample		g	
% ACM by mass		%	
% asbestos in ACM		%	
% asbestos in sample		%	
Breakdown of Detailed Gravimetric Analysis (b)			
% Amphibole bundles in sample		Mass %	0.003
% Chrysotile bundles in sample		Mass %	0.006
Breakdown of PCOM Analysis (c)			
% Amphibole fibres in sample		Mass %	na
% Chrysotile fibres in sample		Mass %	na
Breakdown of Potentially Respirable Fibre Analysis (d)			
Amphibole fibres		Fibres/g	na
Chrysotile fibres		Fibres/g	na

\* Denotes test or material description outside of UKAS accreditation.  
 % asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264.  
 Recommended sample size for quantification is approximately 1kg  
 # denotes deviating sample

## Information in Support of the Analytical Results

Our Ref 16-69817-1  
 Client Ref MWD/01  
 Contract MWD

### Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1006883	WS7 1.00-1.20 SOIL	14/06/16	GJ 60ml, PG		
1006884	WS9 1.00-1.20 SOIL	14/06/16	GJ 60ml, PG		
1006885	WS11 0.50-0.70 SOIL	14/06/16	GJ 60ml, PG		

## Information in Support of the Analytical Results

Our Ref 16-69817-1  
 Client Ref MWD/01  
 Contract MWD

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1006886	WS13 0.70-1.00 SOIL	14/06/16	PG		
1006887	TP14 1.00-1.50 SOIL	14/06/16	GJ 60ml, PG		
1006888	TP15 1.00-1.20 SOIL	14/06/16	GJ 60ml, PG		
1006889	WS16 0.50-0.70 SOIL	14/06/16	GJ 60ml, PG		
1006890	WS17 0.20-0.40 SOIL	14/06/16	GJ 60ml, PG		
1006891	WS18 0.40-0.60 SOIL	14/06/16	GJ 60ml, PG		
1013442	WS7 1.00-1.20 LEACHATE	14/06/16	GJ 1L (1L)		
1013443	TP15 1.00-1.20 LEACHATE	14/06/16	GJ 1L (1L)		
1013444	WS9 1.00-1.20 LEACHATE	14/06/16	GJ 1L (1L)		
1013445	WS16 0.50-0.70 LEACHATE	14/06/16	GJ 1L (1L)		

Key: G-Glass P-Plastic J-Jar G-Bag

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

## Information in Support of the Analytical Results

*Our Ref* 16-69817-1  
*Client Ref* MWD/01  
*Contract* MWD

### Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.  
Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.  
The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

### Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-  
Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months



## Certificate of Analysis

Certificate Number 16-70378-2

15-Jul-16

*Client* ARP Geotechnical  
5/6 Northwest Business Park  
Servia Hill  
Leeds  
LS6 2QH

*Our Reference* 16-70378-2  
*Client Reference* MWD/01/EGH  
*Order No* (not supplied)  
*Contract Title* Crossley Lane, Dalton  
*Description* 12 Soil samples, 2 Leachate samples.  
*Date Received* 21-Jun-16  
*Date Started* 22-Jun-16  
*Date Completed* 15-Jul-16  
*Test Procedures* Identified by prefix DETSn (details on request).

**Notes This report supersedes 16-70378-1. Extra testing**

Opinions and interpretations are outside the scope of UKAS accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

*Approved By*

Rob Brown  
Business Manager



# Summary of Chemical Analysis Soil Samples

\* Samples which have been crossed out are not relevant to site 4 and site 5.

Our Ref 16-70378-2  
Client Ref MWD/01/EGH  
Contract Title Crossley Lane, Dalton

Lab No	1009964	1009965	1009966	1009967	1009968	1009969
Sample ID	WS31	TP32	TP32	TP32	TP34	TP36
Depth	0.80	0.0	0.0	1.0	1.70	0.40
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	16/06/16	16/06/16	16/06/16	16/06/16	16/06/16	16/06/16
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units	1009964	1009965	1009966	1009967	1009968	1009969
<b>Metals</b>									
Arsenic	DETSC 2301#	0.2	mg/kg	12	14	17	16	7.6	20
Cadmium	DETSC 2301#	0.1	mg/kg	0.2	0.1	0.2	0.4	0.1	< 0.1
Chromium III	DETSC 2301*	0.15	mg/kg	27	17	67	29	29	12
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	36	7	47	2	29	72
Lead	DETSC 2301#	0.3	mg/kg	130	150	35	29	17	38
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	0.2	0.2	0.06	< 0.05	< 0.05
Nickel	DETSC 2301#	1	mg/kg	37	16	24	42	35	33
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	110	140	32	50	82	34
<b>Inorganics</b>									
pH	DETSC 2008#			9.7	8.2	7.4	7.3	8.0	7.6
Organic matter	DETSC 2002#	0.1	%	1.0	0.8	1.1	0.9	0.7	5.5
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	65	71	32	44	33	1400
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.03	0.03	0.07	0.05	0.01	0.67
<b>Petroleum Hydrocarbons</b>									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg		< 0.01				
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg		0.4				
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg		< 0.01				
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg		< 1.5				
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg		< 1.2				
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg		< 1.5				
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg		< 3.4				
Aliphatic C5-C35	DETSC 3072*	10	mg/kg		< 10				
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg		< 0.01				
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg		< 0.01				
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg		< 0.01				
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg		< 0.9				
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg		< 0.5				
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg		< 0.6				
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg		< 1.4				
Aromatic C5-C35	DETSC 3072*	10	mg/kg		< 10				
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg		< 10				
EPH (C10-C40)	DETSC 3311#	10	mg/kg	< 10	100	100		< 10	70
<b>PAHs</b>									
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	0.5	< 0.1	0.1	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	11	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	3	0.3	< 0.1	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	1.7	0.3	0.1	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	0	2.1	< 0.1	< 0.1	1.4
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	2	0.5	< 0.1	< 0.1	0.2

# Summary of Chemical Analysis Soil Samples

Our Ref 16-70378-2

Client Ref MWD/01/EGH

Contract Title Crossley Lane, Dalton

Lab No	1009964	1009965	1009966	1009967	1009968	1009969
Sample ID	WS31	TP32	TP32	TP32	TP34	TP36
Depth	0.80	1.00	0.80	1.00	1.70	0.40
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	16/06/16	16/06/16	16/06/16	16/06/16	16/06/16	16/06/16
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units	1009964	1009965	1009966	1009967	1009968	1009969
Fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	0.77	0.72	< 0.1	< 0.1	1.6
Pyrene	DETSC 3301	0.1	mg/kg	< 0.1	0.9	2.6	< 0.1	< 0.1	1.5
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	0.9	1.0	< 0.1	< 0.1	0.6
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	0.1	0.9	< 0.1	< 0.1	0.6
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	0.1	0.1	< 0.1	< 0.1	0.5
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	0.5	0.4	< 0.1	< 0.1	0.5
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	1.1	1.2	< 0.1	< 0.1	0.6
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	0.4	0.6	< 0.1	< 0.1	0.4
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	1.5	0.2	< 0.1	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	0.2	0.6	< 0.1	< 0.1	0.4
PAH Total	DETSC 3301	1.6	mg/kg	< 1.6	3.0	1.3	< 1.6	< 1.6	8.4
<b>Phenols</b>									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	2.2	< 0.3	0.5	< 0.3	< 0.3

# Summary of Chemical Analysis

## Soil Samples

Our Ref 16-70378-2

Client Ref MWD/01/EGH

Contract Title Crossley Lane, Dalton

Lab No	1009970	1009971	1009972	1009973	1009974	1009975
Sample ID	TP37	WS38	WS38	TP39	TP39	TP32
Depth	1.00	2.40	1.90	1.40	1.00	1.00
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	16/06/16	16/06/16	16/06/16	16/06/16	16/06/16	16/06/16
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units	1009970	1009971	1009972	1009973	1009974	1009975
<b>Metals</b>									
Arsenic	DETSC 2301#	0.2	mg/kg	510	27	55	14	25	25
Cadmium	DETSC 2301#	0.1	mg/kg	0.3	0.3	< 0.1	0.1	0.1	0.1
Chromium III	DETSC 2301*	0.15	mg/kg	32	47	21	21	29	41
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	230	100	86	41	150	89
Lead	DETSC 2301#	0.3	mg/kg	71	83	29	44	290	83
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	0.26	< 0.05	0.08	0.12	< 0.05
Nickel	DETSC 2301#	1	mg/kg	110	18	41	22	35	40
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	66	120	53	110	87	32
<b>Inorganics</b>									
pH	DETSC 2008#			8.2	8.6	7.4	8.0	8.0	11.5
Organic matter	DETSC 2002#	0.1	%	0.6	3.3	2.2	1.9	3.7	0.2
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	460	290	670	180	220	150
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.37	0.18	0.24	0.07	0.11	0.08
<b>Petroleum Hydrocarbons</b>									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg						
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg						
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg						
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg						
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg						
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg						
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg						
Aliphatic C5-C35	DETSC 3072*	10	mg/kg						
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg						
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg						
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg						
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg						
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg						
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg						
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg						
Aromatic C5-C35	DETSC 3072*	10	mg/kg						
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg						
EPH (C10-C40)	DETSC 3311#	10	mg/kg	< 10	< 10	250	< 10	46	
<b>PAHs</b>									
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	0.3	< 0.1	< 0.1	0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	0.3	< 0.1	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	2.0	0.5	< 0.1	0.1
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	0.9	0.2	< 0.1	0.1

# Summary of Chemical Analysis

## Soil Samples

Our Ref 16-70378-2

Client Ref MWD/01/EGH

Contract Title Crossley Lane, Dalton

Lab No	1009970	1009971	1009972	1009973	1009974	1009975
Sample ID	TP37	WS38	WS38	TP39	TP39	TP32
Depth	1.00	2.40	1.90	1.40	1.00	1.00
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	16/06/16	16/06/16	16/06/16	16/06/16	16/06/16	16/06/16
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units	1009970	1009971	1009972	1009973	1009974	1009975
Fluoranthene	DETSC 3301	0.1	mg/kg	0.2	< 0.1	7.9	0.5	0.9	0.2
Pyrene	DETSC 3301	0.1	mg/kg	0.3	< 0.1	8.9	0.6	1.1	0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	0.4	5.1	0.3	0.9	0.1
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	0.8	4.8	0.3	0.8	0.2
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	0.6	1.0	3.6	0.7	0.7	0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	0.3	0.2	2.5	0.5	0.5	0.3
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	0.6	< 0.1	4.4	0.5	0.9	0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	2.9	0.2	0.5	0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	0.5	0.1	0.2	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	3.1	0.6	< 0.1	< 0.1
PAH Total	DETSC 3301	1.6	mg/kg	2.2	2.5	48	5.1	6.7	< 2.6
<b>Phenols</b>									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	0.3	< 0.3	< 0.3	< 0.3	< 0.3

## Summary of Chemical Analysis

### Soil VOC Samples

Our Ref 16-70378-2

Client Ref MWD/01/EGH

Contract Title Crossley Lane, Dalton

Lab No	1009969	<del>1009975</del>
Sample ID	TP36	<del>TP32</del>
Depth	0.40	<del>0.40</del>
Other ID		
Sample Type	SOIL	<del>SOIL</del>
Sampling Date	16/06/16	<del>16/06/16</del>
Sampling Time	n/s	<del>n/s</del>

Test	Method	LOD	Units		
<b>VOCs</b>					
Vinyl Chloride	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,1 Dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Trans-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,1-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Cis-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
2,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Bromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Chloroform	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,1,1-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,1-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Carbon tetrachloride	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Benzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Trichloroethylene	DETSC 3431	0.01	mg/kg	0.06	< 0.01
1,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Dibromomethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Bromodichloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
cis-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Toluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
trans-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,1,2-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Tetrachloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,3-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Dibromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2-dibromoethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Chlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,1,1,2-tetrachloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Ethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
m+p-Xylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
o-Xylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Styrene	DETSC 3431*	0.01	mg/kg	< 0.01	< 0.01
Bromoform	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Isopropylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Bromobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2,3-trichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
n-propylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
2-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,3,5-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
4-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Tert-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2,4-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01

# Summary of Chemical Analysis

## Soil VOC Samples

Our Ref 16-70378-2

Client Ref MWD/01/EGH

Contract Title Crossley Lane, Dalton

Lab No	1009969	1009975
Sample ID	TP36	TP37
Depth	0.40	0.40
Other ID		
Sample Type	SOIL	SOIL
Sampling Date	16/06/16	16/06/16
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
sec-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
p-isopropyltoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,3-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,4-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
n-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2-dibromo-3-chloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2,4-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
Hexachlorobutadiene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01
1,2,3-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01

# Summary of Chemical Analysis

## Leachate Samples

Our Ref 16-70378-2  
 Client Ref MWD/01/EGH  
 Contract Title Crossley Lane, Dalton

Lab No	1019837	1019838
Sample ID	TP32	TP37
Depth	0.20	1.00
Other ID		
Sample Type	LEACHATE	LEACHATE
Sampling Date	16/06/16	16/06/16
Sampling Time	s	n/s

Test	Method	LOD	Units		
<b>Preparation</b>					
NRA Leachate Preparation	DETS 036*			Y	Y
<b>Metals</b>					
Arsenic, Dissolved	DETSC 2306	0.16	ug/l		3.0
<b>PAHs</b>					
Naphthalene	DETS 074*	0.01	ug/l	< 0.01	
Acenaphthylene	DETS 074*	0.01	ug/l	< 0.01	
Acenaphthene	DETS 074*	0.01	ug/l	0.03	
Fluorene	DETS 074*	0.01	ug/l	< 0.01	
Phenanthrene	DETS 074*	0.01	ug/l	0.10	
Anthracene	DETS 074*	0.01	ug/l	0.04	
Fluoranthene	DETS 074*	0.01	ug/l	0.29	
Pyrene	DETS 074*	0.01	ug/l	0.09	
Benzo(a)anthracene	DETS 074*	0.01	ug/l	0.09	
Chrysene	DETS 074*	0.01	ug/l	0.0	
Benzo(b)fluoranthene	DETS 074*	0.01	ug/l	0.18	
Benzo(k)fluoranthene	DETS 074*	0.01	ug/l	0.0	
Benzo(a)pyrene	DETS 074*	0.01	ug/l	0.08	
Indeno(1,2,3-c,d)pyrene	DETS 074*	0.01	ug/l	0.04	
Dibenzo(a,h)anthracene	DETS 074*	0.01	ug/l	0.04	
Benzo(g,h,i)perylene	DETS 074*	0.01	ug/l	0.02	
PAH Total	DETS 074*	0.2	ug/l	1.1	

## Summary of Asbestos Analysis

### Soil Samples

Our Ref 16-70378-2

Client Ref MWD/01/EGH

Contract Title Crossley Lane, Dalton

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1009964	WS31 0.80	SOIL	NAD	none	D Wilkinson
<del>1009965</del>	<del>TP32 0.20</del>	<del>SOIL</del>	<del>Chrysotile</del>	<del>Chrysotile present as fibre bundles</del>	<del>D Wilkinson</del>
<del>1009966</del>	<del>TP32 0.80</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>D Wilkinson</del>
<del>1009967</del>	<del>TP32 1.80</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>D Wilkinson</del>
1009968	TP34 1.70	SOIL	NAD	none	D Wilkinson
1009969	TP36 0.40	SOIL	Chrysotile	Chrysotile present as small fibre bundle	D Wilkinson
1009970	TP37 1.00	SOIL	NAD	none	D Wilkinson
1009971	WS38 2.40	SOIL	NAD	none	D Wilkinson
1009972	WS38 1.90	SOIL	NAD	none	D Wilkinson
1009973	TP39 1.40	SOIL	NAD	none	D Wilkinson
1009974	TP39 1.00	SOIL	Chrysotile	Chrysotile present as small bundle	D Wilkinson
<del>1009975</del>	<del>TP32 0.40</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>D Wilkinson</del>

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: \* -not included in laboratory scope of accreditation.

## Information in Support of the Analytical Results

Our Ref 16-70378-2  
 Client Ref MWD/01/EGH  
 Contract Crossley Lane, Dalton

### Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1009964	WS31 0.80 SOIL	16/06/16	GV, PG		
1009965	TP32 0.20 SOIL	16/06/16	GV, PG		
1009966	TP32 0.80 SOIL	16/06/16	GV, PG		
1009967	TP32 1.80 SOIL	16/06/16	GV, PG		
1009968	TP34 1.70 SOIL	16/06/16	GV, PG		
1009969	TP36 0.40 SOIL	16/06/16	GV, PG		
1009970	TP37 1.00 SOIL	16/06/16	GV, PG		
1009971	WS38 2.40 SOIL	16/06/16	GV, PG		
1009972	WS38 1.90 SOIL	16/06/16	GV, PG		
1009973	TP39 1.40 SOIL	16/06/16	GV, PG		
1009974	TP39 1.00 SOIL	16/06/16	GV, PG		
1009975	TP32 0.40 SOIL	16/06/16	GV x2, PG		
1019837	TP32 0.20 LEACHATE	16/06/16	GJ 1L (1L)		
1019838	TP37 1.00 LEACHATE	16/06/16	GJ 1L (1L)		

Key: G-Glass P-Plastic V-Vial G-Bag J-Jar

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

### Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.  
 Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.  
 The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

### Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-  
 Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months



## Certificate of Analysis

Certificate Number 16-70006-1

19-Jul-16

*Client* ARP Geotechnical  
5/6 Northwest Business Park  
Servia Hill  
Leeds  
LS6 2QH

*Our Reference* 16-70006-1

*Client Reference* MWD/01

*Order No* (not supplied)

*Contract Title* Crossley Lane, Dalton

*Description* 12 Soil samples, 2 Leachate samples.

*Date Received* 17-Jun-16

*Date Started* 17-Jun-16

*Date Completed* 19-Jul-16

*Test Procedures* Identified by prefix DETSn (details on request).

**Notes** This report supersedes 16-70006. Extra testing.

Opinions and interpretations are outside the scope of UKAS accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

*Approved By*

Rob Brown  
Business Manager



## Summary of Chemical Analysis Soil Samples

Our Ref 16-70006-1

Client Ref MWD/01

Contract Title Crossley Lane, Dalton

Test	Method	LOD	Units	Lab No	1007796	1007797	1007798	1007799	1007800	1007801
				Sample ID	WS20	WS25	WS25	WS23	TPH3	TPH1
Depth	0-0.40	0-0.40	0-0.40	0-0.50	0-0.40	0-0.80				
Other ID										
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL				
Sampling Date	16/06/16	16/06/16	16/06/16	16/06/16	16/06/16	16/06/16				
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s				
<b>Metals</b>										
Arsenic	DETSC 2301#	0.2	mg/kg	13	11	5	5	2	2	8.8
Cadmium	DETSC 2301#	0.1	mg/kg	0.3	0.1	0.0	0.1	0.2	0.2	0.3
Chromium III	DETSC 2301*	0.15	mg/kg	9	10	2	2	4	4	14
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 0.0	< 0.0	< 0.0	< 0.0	< 0.0	< 0.0	< 0.0
Copper	DETSC 2301#	0.2	mg/kg	49	52	22	29	15	15	22
Lead	DETSC 2301#	0.3	mg/kg	63	66	40	34	15	15	8
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	0.05	< 0.05	0.09	0.10	0.10	0.05
Nickel	DETSC 2301#	1	mg/kg	83	10	83	1	1	1	14
Selenium	DETSC 2301#	0.5	mg/kg	0.5	0.5	< 0.5	0.0	< 0.5	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	8	11	8	8	2	2	6
<b>Inorganics</b>										
pH	DETSC 2008#			7	9.1	10.8	9.1	7.8	7.8	10.7
Organic matter	DETSC 2002#	0.1	%	6	6	2	3	2	2	14
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	24	3	71	70	7	7	100
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.04	0.0	0.06	0.04	0.05	0.05	0.0
<b>Petroleum Hydrocarbons</b>										
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg				< 0.0			
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg				< 0.01			
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg				< 0.01			
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg				< 0.5			
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg				< 0.7			
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg				< 1.0			
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg				< 1.5			
Aliphatic C5-C35	DETSC 3072*	10	mg/kg				< 1.0			
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg				< 0.01			
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg				< 0.0			
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg				< 0.01			
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg				< 0.0			
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg				< 0.5			
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg				< 0.0			
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg				< 0.4			
Aromatic C5-C35	DETSC 3072*	10	mg/kg				< 1.0			
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg				< 1.0			
EPH (C10-C40)	DETSC 3311#	10	mg/kg			100	1500	92	92	120

\* Samples which have been crossed out are not relevant to site 4 and site 5.

## Summary of Chemical Analysis Soil Samples

Our Ref 16-70006-1  
Client Ref MWD/01  
Contract Title Crossley Lane, Dalton

Lab No	1007796	1007797	1007798	1007799	1007800	1007801
Sample ID	WS29	WS25	WS25	WS23	TP43	TP21
Depth	0.20-0.40	0.20-0.40	0.80-0.90	0.20-0.5	0.40-0.8	0.60-0.80
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	16/06/16	16/06/16	16/06/16	16/06/16	16/06/16	16/06/16
Sampling Time	08:30	08:30	08:30	08:30	08:30	08:30
Test	Method	LOD	Units			
<b>PAHs</b>						
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	0.2
Phenanthrene	DETSC 3301	0.1	mg/kg	0.4	< 0.1	0.3
Anthracene	DETSC 3301	0.1	mg/kg	0.1	< 0.1	0.4
Fluoranthene	DETSC 3301	0.1	mg/kg	0.0	< 0.1	2.5
Pyrene	DETSC 3301	0.1	mg/kg	1.0	< 0.1	2.5
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	0.6	< 0.1	1.5
Chrysene	DETSC 3301	0.1	mg/kg	0.4	< 0.1	0.3
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	0.9	< 0.1	1.0
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	0.3	< 0.1	0.7
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	0.5	< 0.1	0.3
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	0.1	< 0.1	0.3
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	1.0
PAH Total	DETSC 3301	1.6	mg/kg	5.5	< 0.6	1.0
<b>Phenols</b>						
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3

## Summary of Chemical Analysis Soil Samples

Our Ref 16-70006-1  
Client Ref MWD/01  
Contract Title Crossley Lane, Dalton

	Lab No	1007802	1007803	1007804	1007805	1007806	1007807
Sample ID		TP23	TP23	WS29	WS30	TP22	TP23
Depth		0.40-0.90	0.40-0.60	0.60-0.65	1.40-1.60	0.40-0.40	0.20-0.50
Other ID							
Sample Type		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date		16/06/16	16/06/16	16/06/16	16/06/16	16/06/16	16/06/16
Sampling Time		n/s	n/s	n/s	n/s	n/s	n/s
Test	Method	LOD	Units				
<b>Metals</b>							
Arsenic	DETSC 2301#	0.2	mg/kg	10	11	9.3	43
Cadmium	DETSC 2301#	0.1	mg/kg	0.2	0.1	0.2	0.5
Chromium III	DETSC 2301*	0.15	mg/kg	10	30	20	24
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	39	67	29	1400
Lead	DETSC 2301#	0.3	mg/kg	18	30	36	280
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	0.08	< 0.05	0.21
Nickel	DETSC 2301#	1	mg/kg	15	36	25	41
Selenium	DETSC 2301#	0.5	mg/kg	0.5	0.8	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	10	84	60	440
<b>Inorganics</b>							
pH	DETSC 2008#			8.7	10.3	11.7	7.6
Organic matter	DETSC 2002#	0.1	%	1.0	1.6	2.1	6.8
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	10	130	110	140
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.09	0.08	0.13	0.09
<b>Petroleum Hydrocarbons</b>							
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg				
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg				
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg				
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg				
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg				
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg				
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg				
Aliphatic C5-C35	DETSC 3072*	10	mg/kg				
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg				
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg				
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg				
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg				
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg				
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg				
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg				
Aromatic C5-C35	DETSC 3072*	10	mg/kg				
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg				
EPH (C10-C40)	DETSC 3311#	10	mg/kg	300	120	250	190

## Summary of Chemical Analysis Soil Samples

Our Ref 16-70006-1  
Client Ref MWD/01  
Contract Title Crossley Lane, Dalton

	Lab No	1007802	1007803	1007804	1007805	1007806	1007807
Sample ID	TP33	TP23	WS29	WS30	TP42	TP28	
Depth	0.00-0.90	0.40-0.60	0.60-0.65	1.40-1.60	0.00-0.40	0.00-0.50	
Other ID							
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	
Sampling Date	16/06/16	16/06/16	16/06/16	16/06/16	16/06/16	16/06/16	
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	
Test	Method	LOD	Units				
<b>PAHs</b>							
Naphthalene	DETSC 3301	0.1	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	0.3	0.3	0.9	< 0.1
Anthracene	DETSC 3301	0.1	mg/kg	0.2	< 0.1	0.2	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	0.6	1.2	1.1	< 0.1
Pyrene	DETSC 3301	0.1	mg/kg	0.5	1.4	1.1	< 0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	0.2	0.7	0.5	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	0.3	0.7	0.5	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	0.1	0.7	0.5	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	0.2	0.4	0.3	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	0.2	0.7	0.5	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	0.7	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	0.3	< 0.1	< 0.1	< 0.1
PAH Total	DETSC 3301	1.6	mg/kg	3.1	6.2	5.7	< 1.6
<b>Phenols</b>							
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	0.4

## Summary of Chemical Analysis Leachate Samples

Our Ref 16-70006-1  
Client Ref MWD/01  
Contract Title Crossley Lane, Dalton

Lab No	1022522	1022523
Sample ID	WS25	WS23
Depth	0.20-0.90	0.20-0.50
Other ID		
Sample Type	LEACHATE	LEACHATE
Sampling Date	16/06/16	16/06/16
Sampling Time		

Test	Method	LOD	Units		
<b>Preparation</b>					
NRA Leachate Preparation	DETS 036*				
<b>Metals</b>					
Lead, Dissolved	DETS 2306	0.09	ug/l	0.92	
<b>PAHs</b>					
Naphthalene	DETS 074*	0.01	ug/l		< 0.01
Acenaphthylene	DETS 074*	0.01	ug/l		< 0.01
Acenaphthene	DETS 074*	0.01	ug/l		< 0.01
Fluorene	DETS 074*	0.01	ug/l		< 0.01
Phenanthrene	DETS 074*	0.01	ug/l		1.0
Anthracene	DETS 074*	0.01	ug/l		0.6
Fluoranthene	DETS 074*	0.01	ug/l		5.7
Pyrene	DETS 074*	0.01	ug/l		4
Benzo(a)anthracene	DETS 074*	0.01	ug/l		2.7
Chrysene	DETS 074*	0.01	ug/l		0.9
Benzo(b)fluoranthene	DETS 074*	0.01	ug/l		5
Benzo(k)fluoranthene	DETS 074*	0.01	ug/l		1.4
Benzo(a)pyrene	DETS 074*	0.01	ug/l		2.0
Indeno(1,2,3-c,d)pyrene	DETS 074*	0.01	ug/l		0.4
Dibenzo(a,h)anthracene	DETS 074*	0.01	ug/l	*	0.65
Benzo(g,h,i)perylene	DETS 074*	0.01	ug/l		2.2
PAH Total	DETS 074*	0.2	ug/l		29

## Summary of Asbestos Analysis Soil Samples

Our Ref 16-70006-1

Client Ref MWD/01

Contract Title Crossley Lane, Dalton

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
<del>1007796</del>	<del>WS20 0.20-0.40</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>Michael Kay</del>
<del>1007797</del>	<del>WS21 0.27-0.40</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>Michael Kay</del>
<del>1007798</del>	<del>WS25 0.30-0.50</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>Michael Kay</del>
<del>1007799</del>	<del>WS23 0.20-0.50</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>Michael Kay</del>
<del>1007800</del>	<del>TP43 0.40-0.50</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>Michael Kay</del>
<del>1007801</del>	<del>TP41 0.60-0.30</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>Michael Kay</del>
<del>1007802</del>	<del>TP33 0.70-0.30</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>Michael Kay</del>
1007803	TP23 0.40-0.60	SOIL	NAD	none	Michael Kay
1007804	WS29 0.60-0.65	SOIL	NAD	none	Michael Kay
1007805	WS30 1.40-1.60	SOIL	NAD	none	Michael Kay
<del>1007806</del>	<del>TP42 0.25-0.10</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>Michael Kay</del>
<del>1007807</del>	<del>TP28 0.20-0.50</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>Michael Kay</del>

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: \* -not included in laboratory scope of accreditation.

## Information in Support of the Analytical Results

Our Ref 16-70006-1  
 Client Ref MWD/01  
 Contract Crossley Lane, Dalton

### Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1007796	WS20 0.20-0.40 SOIL	16/06/16	PG		
1007797	WS35 0.22-0.40 SOIL	16/06/16	PG		
1007798	WS25 0.80-0.90 SOIL	16/06/16	GJ 60ml, PG		
1007799	WS23 0.20-0.50 SOIL	16/06/16	GJ 60ml, PG		
1007800	TP43 0.40-0.60 SOIL	16/06/16	GJ 60ml, PG		
1007801	TP41 0.60-0.80 SOIL	16/06/16	GJ 60ml, PG		
1007802	TP33 0.70-0.90 SOIL	16/06/16	GJ 60ml, PG		
1007803	TP23 0.40-0.60 SOIL	16/06/16	GJ 60ml, PG		
1007804	WS29 0.60-0.65 SOIL	16/06/16	GJ 60ml, PG		
1007805	WS30 1.40-1.60 SOIL	16/06/16	PG		
1007806	TP42 0.25-0.40 SOIL	16/06/16	GJ 60ml, PG		
1007807	TP28 0.20-0.50 SOIL	16/06/16	GJ 60ml, PG		
1022522	WS25 0.80-0.90 LEACHATE	16/06/16	GJ 1L (1L)		
1022523	WS23 0.20-0.50 LEACHATE	16/06/16	GJ 1L (1L)		

Key: P-Plastic G-Bag G-Glass J-Jar

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

### Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

### Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months



## Certificate of Analysis

Certificate Number 16-70466-1

19-Jul-16

*Client* ARP Geotechnical  
5/6 Northwest Business Park  
Servia Hill  
Leeds  
LS6 2QH

*Our Reference* 16-70466-1

*Client Reference* MWD/01

*Order No* (not supplied)

*Contract Title* Crossley Lane, Dalton, Huddersfield

*Description* 10 Soil samples, 1 Leachate sample.

*Date Received* 22-Jun-16

*Date Started* 22-Jun-16

*Date Completed* 19-Jul-16

*Test Procedures* Identified by prefix DETSn (details on request).

*Notes* **This report supersedes 16-70466. Extra testing.**

Opinions and interpretations are outside the scope of UKAS accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

*Approved By*

Rob Brown  
Business Manager



2139

# Summary of Chemical Analysis Soil Samples

Our Ref 16-70466-1  
Client Ref MWD/01  
Contract Title Crossley Lane, Dalton, Huddersfield

Lab No	1010521	1010522	1010523	1010524	1010525	1010526
Sample ID	TP23	TP21	TP26	TP47	TP49	W941
Depth	0.00-0.90	0.60-0.80	0.00-0.20	0.00-0.20	0.00-0.20	0.00-0.30
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	15/06/16	15/06/16	17/06/16	17/06/16	17/06/16	17/06/16
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units	1010521	1010522	1010523	1010524	1010525	1010526	
<b>Metals</b>										
Arsenic	DETSC 2301#	0.2	mg/kg		8.8	7.8	4.9	7.4	4.9	
Cadmium	DETSC 2301#	0.1	mg/kg		0.3	0.3	0.3	0.1	0.2	
Chromium III	DETSC 2301*	0.15	mg/kg		20	20	17	24	25	
Chromium, Hexavalent	DETSC 2204*	1	mg/kg		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Copper	DETSC 2301#	0.2	mg/kg		25	21	11	18	10	
Lead	DETSC 2301#	0.3	mg/kg		65	51	71	79	74	
Mercury	DETSC 2325#	0.05	mg/kg		0.23	< 0.05	0.28	< 0.05	< 0.05	
Nickel	DETSC 2301#	1	mg/kg		21	2	2	3	2	
Selenium	DETSC 2301#	0.5	mg/kg		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	
Zinc	DETSC 2301#	1	mg/kg		94	66	6	9	61	
<b>Inorganics</b>										
pH	DETSC 2008#				6.7	6.1	6.2	6.1	6.4	
Organic matter	DETSC 2002#	0.1	%		6.5	6.2	6.3	6.7	6.2	
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l		450		4	1	25	
Sulphur as S, Total	DETSC 2320	0.01	%	59						
Sulphate as SO4, Total	DETSC 2321#	0.01	%		0.21	0.5	0.07	0.0	0.08	
<b>Petroleum Hydrocarbons</b>										
EPH (C10-C40)	DETSC 3311#	10	mg/kg		< 10	< 10	1.0	13	150	
<b>PAHs</b>										
Naphthalene	DETSC 3301	0.1	mg/kg		< 0.1	< 0.1	1.0	0.1	0.8	
Acenaphthylene	DETSC 3301	0.1	mg/kg		< 0.1	< 0.1	1	< 0.1	< 0.1	
Acenaphthene	DETSC 3301	0.1	mg/kg		< 0.1	< 0.1	1	0.1	1.0	
Fluorene	DETSC 3301	0.1	mg/kg		< 0.1	< 0.1	1.2	0.6	0.9	
Phenanthrene	DETSC 3301	0.1	mg/kg		0.3	< 0.1	6	3.9	4.7	
Anthracene	DETSC 3301	0.1	mg/kg		< 0.1	< 0.1	1.5	0	0.7	
Fluoranthene	DETSC 3301	0.1	mg/kg		0.4	0.6	7	1.6	4.8	
Pyrene	DETSC 3301	0.1	mg/kg		0.5	0.7	1.9	4.3	1.6	
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg		0.4	< 0.1	3.0	2.3	2.3	
Chrysene	DETSC 3301	0.1	mg/kg		0.5	< 0.1	2.7	2.9	1.1	
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg		0.4	< 0.1	1	1.6	1.7	
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg		0.2	< 0.1	1	1.0	1.1	
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg		0.4	< 0.1	2.5	2.1	2.1	
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg		< 0.1	< 0.1	1.2	1.1	0.9	
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg		< 0.1	< 0.1	0	0.3	0.2	
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg		< 0.1	< 0.1	1	1.2	0.8	
PAH Total	DETSC 3301	1.6	mg/kg		3.2	< 1.6	10	2.7	1.9	
<b>Phenols</b>										
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg		1.1	2.0	1.1	1.2	1.0	

\* Samples which have been crossed out are not relevant to site 4 and site 5.

# Summary of Chemical Analysis

## Soil Samples

Our Ref 16-70466-1

Client Ref MWD/01

Contract Title Crossley Lane, Dalton, Huddersfield

Lab No	1010527	1010528	1010529	1010530
Sample ID	WS44	WS46	WS47	WS47
Depth	0.00-0.30	0.00-0.60	0.20-0.40	1.50-1.70
Other ID				
Sample Type	SOIL	SOIL	SOIL	SOIL
Sampling Date	17/06/16	17/06/16	17/06/16	17/06/16
Sampling Time	n/s	n/s	n/s	n/s

Test	Method	LOD	Units	1010527	1010528	1010529	1010530
<b>Metals</b>							
Arsenic	DETSC 2301#	0.2	mg/kg	4.3	4.3	5.0	2.5
Cadmium	DETSC 2301#	0.1	mg/kg	0.3	0.3	0.3	< 0.1
Chromium III	DETSC 2301*	0.15	mg/kg	0.9	0.8	15	8.0
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	32	32	16	30
Lead	DETSC 2301#	0.3	mg/kg	10	10	28	17
Mercury	DETSC 2325#	0.05	mg/kg	n/s	< 0.05	0.10	0.05
NICKEL	DETSC 2301#	1	mg/kg	0.9	0.2	19	9.5
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	2.9
Zinc	DETSC 2301#	1	mg/kg	15	7	73	38
<b>Inorganics</b>							
pH	DETSC 2008#			8.3	5.7	9.1	7.8
Organic matter	DETSC 2002#	0.1	%	5.1	1.2	1.2	1.1
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	15	2	76	58
Sulphur as S, Total	DETSC 2320	0.01	%				
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.07	0.09	0.06	0.07
<b>Petroleum Hydrocarbons</b>							
EPH (C10-C40)	DETSC 3311#	10	mg/kg	7	20	110	920
<b>PAHs</b>							
Naphthalene	DETSC 3301	0.1	mg/kg	0.2	0.2	0.3	2.3
Acenaphthylene	DETSC 3301	0.1	mg/kg	0.1	0.1	0.4	10
Acenaphthene	DETSC 3301	0.1	mg/kg	0.3	0.7	0.2	1.2
Fluorene	DETSC 3301	0.1	mg/kg	0.3	0.1	0.2	8.5
Phenanthrene	DETSC 3301	0.1	mg/kg	2.1	3.1	1.7	52
Anthracene	DETSC 3301	0.1	mg/kg	0.4	0.8	0.6	16
Fluoranthene	DETSC 3301	0.1	mg/kg	3.1	3.0	3.2	41
Pyrene	DETSC 3301	0.1	mg/kg	3.3	3.1	3.0	36
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	0.8	1.0	1.8	15
Chrysene	DETSC 3301	0.1	mg/kg	1.1	1.7	1.4	12
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	0.4	1.1	1.4	9.0
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	*0.8	0.9	1.0	5.7
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	0.8	1.1	1.8	13
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	0.9	< 0.1	0.9	8.5
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	0.3	< 0.1	0.4	1.6
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	0.8	< 0.1	0.8	6.9
PAH Total	DETSC 3301	1.6	mg/kg	20	25	19	240
<b>Phenols</b>							
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	0.6	1.1	< 0.3	< 0.3

Key: \* -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

# Summary of Chemical Analysis

## Leachate Samples

Our Ref 16-70466-1  
 Client Ref MWD/01  
 Contract Title Crossley Lane, Dalton, Huddersfield

Lab No	1000538
Sample ID	WS 4
Depth	0.0 to 0.20
Other ID	
Sample Type	LEACHATE
Sampling Date	11/06/16
Sampling Time	

Test	Method	LOD	Units	
<b>Preparation</b>				
NRA Leachate Preparation	DETS 036*			Y
<b>Metals</b>				
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	0.61

# Summary of Asbestos Analysis

## Soil Samples

Our Ref 16-70466-1

Client Ref MWD/01

Contract Title Crossley Lane, Dalton, Huddersfield

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1010522	TP21 0.60-0.80	SOIL	NAD	none	Colin Patrick
<del>1010523</del>	<del>TP46 0.00-0.20</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>Colin Patrick</del>
<del>1010524</del>	<del>TP47 0.00-0.20</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>Colin Patrick</del>
<del>1010525</del>	<del>TP49 0.00-0.20</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>Colin Patrick</del>
<del>1010526</del>	<del>WS41 0.00-0.30</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>Colin Patrick</del>
<del>1010527</del>	<del>WS44 0.00-0.20</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>Colin Patrick</del>
<del>1010528</del>	<del>WS46 0.00-0.60</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>Colin Patrick</del>
1010529	WS47 0.20-0.40	SOIL	NAD	none	Colin Patrick
1010530	WS47 1.50-1.70	SOIL	NAD	none	Colin Patrick

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in HSGC methods. NAD = NO ASBESTOS Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: \* - not included in laboratory scope of accreditation.

## Information in Support of the Analytical Results

Our Ref 16-70466-1  
 Client Ref MWD/01  
 Contract Crossley Lane, Dalton, Huddersfield

### Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1010521	TP33 0.70-0.90 SOIL	16/06/16	PG		
1010522	TP21 0.60-0.80 SOIL	15/06/16	GV, PG		
1010523	TP46 0.00-0.20 SOIL	17/06/16	GV, PG		
1010524	TP47 0.00-0.20 SOIL	17/06/16	GV, PG		
1010525	TP49 0.00-0.20 SOIL	17/06/16	GV, PG		
1010526	WS41 0.00-0.30 SOIL	17/06/16	GV, PG		
1010527	WS44 0.00-0.20 SOIL	17/06/16	GV, PG		
1010528	WS46 0.00-0.60 SOIL	17/06/16	GV, PG		
1010529	WS47 0.20-0.40 SOIL	17/06/16	GV, PG		
1010530	WS47 1.50-1.70 SOIL	17/06/16	GV, PG		
1022528	WS44 0.00-0.20 LEACHATE	17/06/16	GJ 1L (1L)		

Key: P-Plastic G-Bag G-Glass V-Vial J-Jar

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

### Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

### Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months



## Certificate of Analysis

Certificate Number 16-70124-1

20-Jul-16

*Client* ARP Geotechnical  
5/6 Northwest Business Park  
Servia Hill  
Leeds  
LS6 2QH

*Our Reference* 16-70124-1

*Client Reference* MWD/01

*Order No* (not supplied)

*Contract Title* Crossley Lane, Dalton

*Description* 10 Soil samples, 1 Leachate sample.

*Date Received* 18-Jun-16

*Date Started* 18-Jun-16

*Date Completed* 20-Jul-16

*Test Procedures* Identified by prefix DETSn (details on request).

*Notes* **This report supersedes 16-70124, extra testing.**

Opinions and interpretations are outside the scope of UKAS accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

*Approved By*

Rob Brown  
Business Manager



# Summary of Chemical Analysis Soil Samples

Our Ref 16-70124-1

Client Ref MWD/01

Contract Title Crossley Lane, Dalton

Lab No	1008660	1008661	1008662	1008663	1008664	1008665
Sample ID	WS36	TP40	TP40	WS32	WS27	WS34
Depth	0.50-0.70	0.80-0.90	1.70-1.90	0.65-0.85		0.70-0.10
Other ID	1	1	2	1	1	
Sample Type	D	D	D	D	D	D
Sampling Date	16/06/16	17/06/16	17/06/16	16/06/16	16/06/16	16/06/16
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units	1008660	1008661	1008662	1008663	1008664	1008665
<b>Metals</b>									
Arsenic	DETSC 2301#	0.2	mg/kg	24	28	31	25	2.3	23
Cadmium	DETSC 2301#	0.1	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.1	0.2
Chromium III	DETSC 2301*	0.15	mg/kg	19	14	12	30	11	21
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	82	110	150	12	7.6	61
Lead	DETSC 2301#	0.3	mg/kg	200	30	88	70	9.2	19
Mercury	DETSC 2325#	0.05	mg/kg	0.08	0.06	0.10	< 0.05	< 0.05	0.1
Nickel	DETSC 2301#	1	mg/kg	38	35	40	37	11	24
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	140	41	62	23	35	20
<b>Inorganics</b>									
pH	DETSC 2008#			7.7	8.4	7.6	5.0	11.4	7.0
Organic matter	DETSC 2002#	0.1	%	5.9	4.7	7.3	2.3	0.4	1.8
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	1300	84	210	30	54	13
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.54	0.08	0.12	0.01	0.05	0.05
<b>Petroleum Hydrocarbons</b>									
EPH (C10-C40)	DETSC 3311#	10	mg/kg	< 10	< 10	14	< 10	< 10	< 10
<b>PAHs</b>									
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	1.9	< 0.1	0.9	0.1	< 0.1	0.3
Anthracene	DETSC 3301	0.1	mg/kg	0.3	< 0.1	0.3	< 0.1	< 0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	2.4	< 0.1	2.4	< 0.1	< 0.1	0.4
Pyrene	DETSC 3301	0.1	mg/kg	2.3	< 0.1	2.3	< 0.1	< 0.1	0.5
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	1.1	< 0.1	2.6	< 0.1	< 0.1	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	1.1	< 0.1	2.7	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	0.8	< 0.1	2.8	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	0.6	< 0.1	1.9	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	1.0	< 0.1	3.7	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	0.9	< 0.1	2.9	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	0.2	< 0.1	0.6	< 0.1	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	0.7	< 0.1	2.4	< 0.1	< 0.1	< 0.1
PAH Total	DETSC 3301	1.6	mg/kg	13	< 1.6	26	< 1.6	< 1.6	< 1.6
<b>Phenols</b>									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	0.4	< 0.3	< 0.3	0.3	< 0.3

\* samples which have been crossed out are not relevant to site 4 and site 5.

# Summary of Chemical Analysis

## Soil Samples

Our Ref 16-70124-1

Client Ref MWD/01

Contract Title Crossley Lane, Dalton

Lab No	1008665	1008667	1008668	1008669
Sample ID	WS33	WS39	TP17	WS39
Depth	0.50-0.70	1.40-1.70	0.50-0.70	0.65-0.85
Other ID	1	2	1	1
Sample Type	D	D	D	D
Sampling Date	16/06/16	16/06/16	15/06/16	16/06/16
Sampling Time	n/s	n/s	n/s	n/s

Test	Method	LOD	Units	1008665	1008667	1008668	1008669
<b>Metals</b>							
Arsenic	DETSC 2301#	0.2	mg/kg	7.5	470	29	46
Cadmium	DETSC 2301#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Chromium III	DETSC 2301*	0.15	mg/kg	1.9	22	15	15
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	25	220	71	100
Lead	DETSC 2301#	0.3	mg/kg	73	97	41	77
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	< 0.05	< 0.05	0.06
Nickel	DETSC 2301#	1	mg/kg	79	73	32	35
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	0.6	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	63	59	34	59
<b>Inorganics</b>							
pH	DETSC 2008#			8.4	7.9	8.6	8.2
Organic matter	DETSC 2002#	0.1	%	1.7	2.5	6.7	0.7
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	< 10	780	610	370
Sulphate as SO4, Total	DETSC 2321#	0.01	%	< 0.01	0.48	0.22	0.24
<b>Petroleum Hydrocarbons</b>							
EPH (C10-C40)	DETSC 3311#	10	mg/kg	< 10	< 10	< 10	< 10
<b>PAHs</b>							
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	2.0	< 0.1	< 0.1
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	0.4	< 0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	1.9	0.4	0.3
Pyrene	DETSC 3301	0.1	mg/kg	< 0.1	1.7	0.5	0.3
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	0.8	< 0.1	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	0.7	< 0.1	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
PAH Total	DETSC 3301	1.6	mg/kg	< 1.6	7.4	< 1.6	< 1.6
<b>Phenols</b>							
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3

## Summary of Chemical Analysis

### Leachate Samples

Our Ref 16-70124-1

Client Ref MWD/01

Contract Title Crossley Lane, Dalton

Lab No	1022529
Sample ID	TP40
Depth	1.70-1.90
Other ID	
Sample Type	LEACHATE
Sampling Date	17/06/16
Sampling Time	n/s

Test	Method	LOD	Units	
<b>Preparation</b>				
NRA Leachate Preparation	DETS 036*			Y
<b>PAHs</b>				
Naphthalene	DETS 074*	0.01	ug/l	< 0.01
Acenaphthylene	DETS 074*	0.01	ug/l	< 0.01
Acenaphthene	DETS 074*	0.01	ug/l	< 0.01
Fluorene	DETS 074*	0.01	ug/l	< 0.01
Phenanthrene	DETS 074*	0.01	ug/l	< 0.01
Anthracene	DETS 074*	0.01	ug/l	< 0.01
Fluoranthene	DETS 074*	0.01	ug/l	0.07
Pyrene	DETS 074*	0.01	ug/l	0.06
Benzo(a)anthracene	DETS 074*	0.01	ug/l	0.03
Chrysene	DETS 074*	0.01	ug/l	0.09
Benzo(b)fluoranthene	DETS 074*	0.01	ug/l	0.09
Benzo(k)fluoranthene	DETS 074*	0.01	ug/l	0.02
Benzo(a)pyrene	DETS 074*	0.01	ug/l	0.07
Indeno(1,2,3-c,d)pyrene	DETS 074*	0.01	ug/l	0.11
Dibenzo(a,h)anthracene	DETS 074*	0.01	ug/l	< 0.01
Benzo(g,h,i)perylene	DETS 074*	0.01	ug/l	0.10
PAH Total	DETS 074*	0.2	ug/l	0.64

## Summary of Asbestos Analysis Soil Samples

Our Ref 16-70124-1

Client Ref MWD/01

Contract Title Crossley Lane, Dalton

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1008660	WS36 1 0.50-0.70	SOIL	NAD	none	Colin Patrick
1008661	TP40 1 0.80-0.90	SOIL	NAD	none	Colin Patrick
1008662	TP40 2 1.70-1.90	SOIL	NAD	none	Colin Patrick
<del>1008663</del>	<del>WS33 1 0.65-0.95</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>Colin Patrick</del>
1008664	WS27 1	SOIL	NAD	none	Colin Patrick
<del>1008665</del>	<del>WS34 1 0.90-0.10</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>Colin Patrick</del>
<del>1008666</del>	<del>WS35 1 0.80-0.80</del>	<del>SOIL</del>	<del>NAD</del>	<del>none</del>	<del>Colin Patrick</del>
1008667	WS39 2 1.40-1.70	SOIL	Chrysotile	bundle of Chrysotile fibres	Colin Patrick
1008668	TP17 1 0.50-0.70	SOIL	NAD	none	Colin Patrick
1008669	WS39 1 0.65-0.85	SOIL	NAD	none	Colin Patrick

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: \* -not included in laboratory scope of accreditation.

## Information in Support of the Analytical Results

Our Ref 16-70124-1

Client Ref MWD/01

Contract Crossley Lane, Dalton

### Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1008660	WS36 0.50-0.70 SOIL	16/06/16	GJ 60ml, PG		
1008661	TP40 0.80-0.90 SOIL	17/06/16	GJ 60ml, PG		
1008662	TP40 1.70-1.90 SOIL	17/06/16	GJ 60ml, PG		
1008663	WS32 0.65-0.95 SOIL	16/06/16	GJ 60ml, PG		
1008664	WS27 SOIL	16/06/16	GJ 60ml, PG		
1008665	WS34 0.00-0.10 SOIL	16/06/16	GJ 60ml, PG		
1008666	WS33 0.50-0.60 SOIL	16/06/16	GJ 60ml, PG		
1008667	WS39 1.40-1.70 SOIL	16/06/16	GJ 60ml, PG		
1008668	TP17 0.50-0.70 SOIL	15/06/16	GJ 60ml, PG		
1008669	WS39 0.65-0.85 SOIL	16/06/16	GJ 60ml, PG		
1022529	TP40 1.70-1.90 LEACHATE	17/06/16	GJ 1L (1L)		

Key: G-Glass P-Plastic J-Jar G-Bag

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

### Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

### Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months



## Certificate of Analysis

Certificate Number 16-72899

20-Jul-16

*Client* ARP Geotechnical  
5/6 Northwest Business Park  
Servia Hill  
Leeds  
LS6 2QH

*Our Reference* 16-72899

*Client Reference* MWD/01/EGH

*Order No* (not supplied)

*Contract Title* Crossley Lane, Dalton

*Description* One Soil sample.

*Date Received* 14-Jul-16

*Date Started* 14-Jul-16

*Date Completed* 20-Jul-16

*Test Procedures* Identified by prefix DETSn (details on request).

*Notes* Opinions and interpretations are outside the scope of UKAS accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

*Approved By*

A handwritten signature in black ink, appearing to read "Rob Brown".

Rob Brown  
Business Manager



## Summary of Asbestos Quantification Analysis Soil Samples

Our Ref 16-72899

Client Ref MWD/01/EGH

Contract Title Crossley Lane, Dalton

Lab No	1023574
Sample ID	Combined
Depth	
Other ID	
Sample Type	SOIL
Sampling Date	n/s
Sampling Time	

Test	Method	Units	
Total Mass% Asbestos (a+b+c)	DETSC 1102	Mass %	< 0.001
Gravimetric Quantification (a)	DETSC 1102	Mass %	na
Detailed Gravimetric Quantification (b)	DETSC 1102	Mass %	<0.001
Quantification by PCOM (c)	DETSC 1102	Mass %	na
Potentially Respirable Fibres (d)	DETSC 1102	Fibres/g	na

### Breakdown of Gravimetric Analysis (a)

Mass of Sample		g	815.76
ACMs present*		type	
Mass of ACM in sample		g	
% ACM by mass		%	
% asbestos in ACM		%	
% asbestos in sample		%	

### Breakdown of Detailed Gravimetric Analysis (b)

% Amphibole bundles in sample		Mass %	na
% Chrysotile bundles in sample		Mass %	<0.001

### Breakdown of PCOM Analysis (c)

% Amphibole fibres in sample		Mass %	na
% Chrysotile fibres in sample		Mass %	na

### Breakdown of Potentially Respirable Fibre Analysis (d)

Amphibole fibres		Fibres/g	na
Chrysotile fibres		Fibres/g	na

\* Denotes test or material description outside of UKAS accreditation.  
% asbestos in Asbestos Containing Materials (ACMs) is determined by  
by reference to HSG 264.  
Recommended sample size for quantification is approximately 1kg  
# denotes deviating sample

## Information in Support of the Analytical Results

Our Ref 16-72899  
 Client Ref MWD/01/EGH  
 Contract Crossley Lane, Dalton

### Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1023574	Combined TP30 (0-0.2) + TP32 (0.2-0.35) SOIL		PT 1L		

Key: P-Plastic T-Tub<sup>®</sup>

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

### Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-  
 Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months



## Certificate of Analysis

Certificate Number 16-70468

28-Jun-16

*Client* ARP Geotechnical  
5/6 Northwest Business Park  
Servia Hill  
Leeds  
LS6 2QH

*Our Reference* 16-70468

*Client Reference* MWD/01

*Order No* (not supplied)

*Contract Title* Crossley Lane, Dalton

*Description* 21 Soil samples.

*Date Received* 22-Jun-16

*Date Started* 22-Jun-16

*Date Completed* 28-Jun-16

*Test Procedures* Identified by prefix DETSn (details on request).

*Notes* Opinions and interpretations are outside the scope of UKAS accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

*Approved By*

A handwritten signature in black ink, appearing to read 'Rob Brown'.

Rob Brown  
Business Manager



# Summary of Chemical Analysis

## Soil Samples

Our Ref 16-70468

Client Ref MWD/01

Contract Title Crossley Lane, Dalton

<b>Lab No</b>	1010532	1010533	1010534	1010535	1010536	1010537	1010538	1010539	1010540	1010541	1010542	1010543
<b>Sample ID</b>	TP38	TP37	TP13	TP3	WS3	WS5	WS28	WS7	TP34	WS9	WS22	TP48
<b>Depth</b>	0.80-1.00	1.00-1.20	2.60-2.80	1.90-2.00	2.40-2.60	2.70-3.00	1.00-1.20	1.90-2.10	0.20-0.40	3.50-3.70	2.40-2.60	0.60-0.80
<b>Other ID</b>												
<b>Sample Type</b>	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
<b>Sampling Date</b>	16/06/16	16/06/16	n/s	13/06/16	13/06/16	13/06/16	15/06/16	14/06/16	16/06/16	14/06/16	15/06/16	17/06/16
<b>Sampling Time</b>	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units												
<b>Inorganics</b>															
pH	DETSC 2008#			6.5	7.4	5.8	7.5	5.9	6.8	6.7	6.2	12.0	8.5	7.8	6.8
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	45	32	39	62	24	58	< 10	130	35	120	41	14

# Summary of Chemical Analysis

## Soil Samples

Our Ref 16-70468

Client Ref MWD/01

Contract Title Crossley Lane, Dalton

<b>Lab No</b>	1010544	1010545	1010546	1010547	1010548	1010549	1010550	1010551	1010552
<b>Sample ID</b>	TP34	WS16	TP45	TP50	WS21	WS42	WS17	TP1	WS43
<b>Depth</b>	0.20-0.40	1.40-1.60	2.20-2.40	1.20-1.40	2.00-2.20	2.00-2.20	1.70-2.00	2.40-2.50	1.00-1.20
<b>Other ID</b>									
<b>Sample Type</b>	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
<b>Sampling Date</b>	16/06/16	14/06/16	17/06/16	17/06/16	15/06/16	17/06/16	14/06/16	13/06/16	17/06/16
<b>Sampling Time</b>	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units									
<b>Inorganics</b>												
pH	DETSC 2008#			12.6	7.7	7.4	7.3	7.2	6.3	7.3	7.7	6.7
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	19	51	75	30	23	32	24	26	31

## Information in Support of the Analytical Results

Our Ref 16-70468  
Client Ref MWD/01  
Contract Crossley Lane, Dalton

### Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1010532	TP38 0.80-1.00 SOIL	16/06/16	PG		
1010533	TP37 1.00-1.20 SOIL	16/06/16	PG		
1010534	TP13 2.60-2.80 SOIL		PG	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1010535	TP3 1.90-2.00 SOIL	13/06/16	PG	pH + Conductivity (7 days)	
1010536	WS3 2.40-2.60 SOIL	13/06/16	PG	pH + Conductivity (7 days)	
1010537	WS5 2.70-3.00 SOIL	13/06/16	PG	pH + Conductivity (7 days)	
1010538	WS28 1.00-1.20 SOIL	15/06/16	PG		
1010539	WS7 1.90-2.10 SOIL	14/06/16	PG	pH + Conductivity (7 days)	
1010540	TP34 0.20-0.40 SOIL	16/06/16	PG		
1010541	WS9 3.50-3.70 SOIL	14/06/16	PG	pH + Conductivity (7 days)	
1010542	WS22 2.40-2.60 SOIL	15/06/16	PG		
1010543	TP48 0.60-0.80 SOIL	17/06/16	PG		
1010544	TP34 0.20-0.40 SOIL	16/06/16	PG		
1010545	WS16 1.40-1.60 SOIL	14/06/16	PG	pH + Conductivity (7 days)	
1010546	TP45 2.20-2.40 SOIL	17/06/16	PG		
1010547	TP50 1.20-1.40 SOIL	17/06/16	PG		
1010548	WS21 2.00-2.20 SOIL	15/06/16	PG		
1010549	WS42 2.00-2.20 SOIL	17/06/16	PG		
1010550	WS17 1.70-2.00 SOIL	14/06/16	PG	pH + Conductivity (7 days)	
1010551	TP1 2.40-2.50 SOIL	13/06/16	PG	pH + Conductivity (7 days)	
1010552	WS43 1.00-1.20 SOIL	17/06/16	PG		

Key: P-Plastic G-Bag<sup>®</sup>

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### Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

### Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months



## Certificate of Analysis

Certificate Number 16-71240

05-Jul-16

*Client* Professional Soils Laboratory Ltd  
5/7 Hexthorpe Road  
Hexthorpe  
DN4 0AR

*Our Reference* 16-71240

*Client Reference* PSL16/2923

*Order No* (not supplied)

*Contract Title* Crossley Lane, Dalton, Huddersfield

*Description* 9 Soil samples.

*Date Received* 29-Jun-16

*Date Started* 29-Jun-16

*Date Completed* 05-Jul-16

*Test Procedures* Identified by prefix DETSn (details on request).

*Notes* Opinions and interpretations are outside the scope of UKAS accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

*Approved By*

A handwritten signature in black ink, appearing to read 'Rob Brown'.

Rob Brown  
Business Manager



# Summary of Chemical Analysis

## Soil Samples

Our Ref 16-71240

Client Ref PSL16/2923

Contract Title Crossley Lane, Dalton, Huddersfield

<b>Lab No</b>	1014964	1014965	1014966	1014967	1014968	1014969	1014970	1014971	1014972
<b>Sample ID</b>	TP22	TP41	TP46	TP49	WS4	WS23	WS27	WS33	WS46
<b>Depth</b>	1.00-1.20	0.60-0.80	0.60-0.70	1.10-1.30	1.70-1.90	1.30-1.50	0.70-0.90	1.60-1.80	1.80-1.95
<b>Other ID</b>									
<b>Sample Type</b>	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
<b>Sampling Date</b>	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
<b>Sampling Time</b>	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units									
<b>Inorganics</b>												
pH	DETSC 2008#			7.4	7.4	6.9	7.4	7.6	7.5	7.0	7.0	6.3
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	370	230	40	34	53	140	37	62	33

## Information in Support of the Analytical Results

Our Ref 16-71240  
Client Ref PSL16/2923  
Contract Crossley Lane, Dalton, Huddersfield

### Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1014964	TP22 1.00-1.20 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1014965	TP41 0.60-0.80 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1014966	TP46 0.60-0.70 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1014967	TP49 1.10-1.30 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1014968	WS4 1.70-1.90 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1014969	WS23 1.30-1.50 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1014970	WS27 0.70-0.90 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1014971	WS33 1.60-1.80 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1014972	WS46 1.80-1.95 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	

Key: P-Plastic T-Tub

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### Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

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The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

### Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months



## Certificate of Analysis

Certificate Number 16-71238

05-Jul-16

*Client* Professional Soils Laboratory Ltd  
5/7 Hexthorpe Road  
Hexthorpe  
DN4 0AR

*Our Reference* 16-71238

*Client Reference* PSL16/2924

*Order No* (not supplied)

*Contract Title* Land At Crossley Lane, Dalton, Huddersfield

*Description* 12 Soil samples.

*Date Received* 29-Jun-16

*Date Started* 29-Jun-16

*Date Completed* 05-Jul-16

*Test Procedures* Identified by prefix DETSn (details on request).

*Notes* Opinions and interpretations are outside the scope of UKAS accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

*Approved By*

A handwritten signature in black ink, appearing to read "Rob Brown".

Rob Brown  
Business Manager



## Summary of Chemical Analysis Soil Samples

Our Ref 16-71238

Client Ref PSL16/2924

Contract Title Land At Crossley Lane, Dalton, Huddersfield

Lab No	1014949	1014950	1014951	1014952	1014953	1014954	1014955	1014956	1014957	1014958	1014959	1014960
Sample ID	TP36	TP44	TP29	TP27	TP15	WS45	WS13	WS26	WS38	WS24	WS3	WS18
Depth	1.40-1.60	1.00-1.20	1.50-1.70	1.10-1.30	1.60-1.80	0.30-0.60	1.20-1.40	2.00-2.20	2.90-3.00	2.00-2.20	1.00-1.20	1.00-1.20
Other ID												
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units												
<b>Inorganics</b>															
pH	DETSC 2008#			7.2	7.5	7.5	7.2	7.1	7.1	6.7	6.3	7.2	6.7	5.9	7.3
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	73	13	32	36	68	14	58	89	20	85	56	31

## Information in Support of the Analytical Results

Our Ref 16-71238  
 Client Ref PSL16/2924  
 Contract Land At Crossley Lane, Dalton, Huddersfield

### Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1014949	TP36 1.40-1.60 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1014950	TP44 1.00-1.20 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1014951	TP29 1.50-1.70 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1014952	TP27 1.10-1.30 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1014953	TP15 1.60-1.80 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1014954	WS45 0.30-0.60 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1014955	WS13 1.20-1.40 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1014956	WS26 2.00-2.20 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1014957	WS38 2.90-3.00 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1014958	WS24 2.00-2.20 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1014959	WS3 1.00-1.20 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1014960	WS18 1.00-1.20 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	

Key: P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

### Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

### Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months



# LABORATORY REPORT



4043

**Contract Number: PSL16/2923**

Report Date: 30 June 2016  
Client's Reference: MWD/01  
Client Name: Minerva Works Development Ltd  
93 Kirkstall Road  
Leeds  
LS21HD

**For the attention of: M Beasley**

Contract Title: Crossley Lane, Dalton, Huddersfield  
Date Received: 21/6/2016  
Date Commenced: 21/6/2016  
Date Completed: 30/6/2016

**Notes: Opinions and Interpretations are outside the UKAS Accreditation**

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

  
R Gunson  
(Director)

A Watkins  
(Director)

R Berriman  
(Quality Manager)

D Lambe  
(Senior Technician)

S Royle  
(Senior Technician)

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Page 1 of





# SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m <sup>3</sup> Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
TP22			1.00	1.20	37			58	27	31	100	High plasticity CH.
TP41			0.60	0.80	28			50	24	26	100	Intermediate plasticity CI.
TP46			0.60	0.70	34			50	25	25	100	Intermediate plasticity CI.
TP49			1.10	1.30	22			50	24	26	100	Intermediate plasticity CI.
WS4			1.70	1.90	35			47	22	25	100	Intermediate plasticity CI.
WS23			1.30	1.50	40			58	28	30	97	High plasticity CH.
WS27			0.70	0.90	16			38	18	20	100	Intermediate plasticity CI.
WS33			1.60	1.80	35			57	27	30	100	High plasticity CH.
WS46			1.80	1.95	29			48	24	24	100	Intermediate plasticity CI.

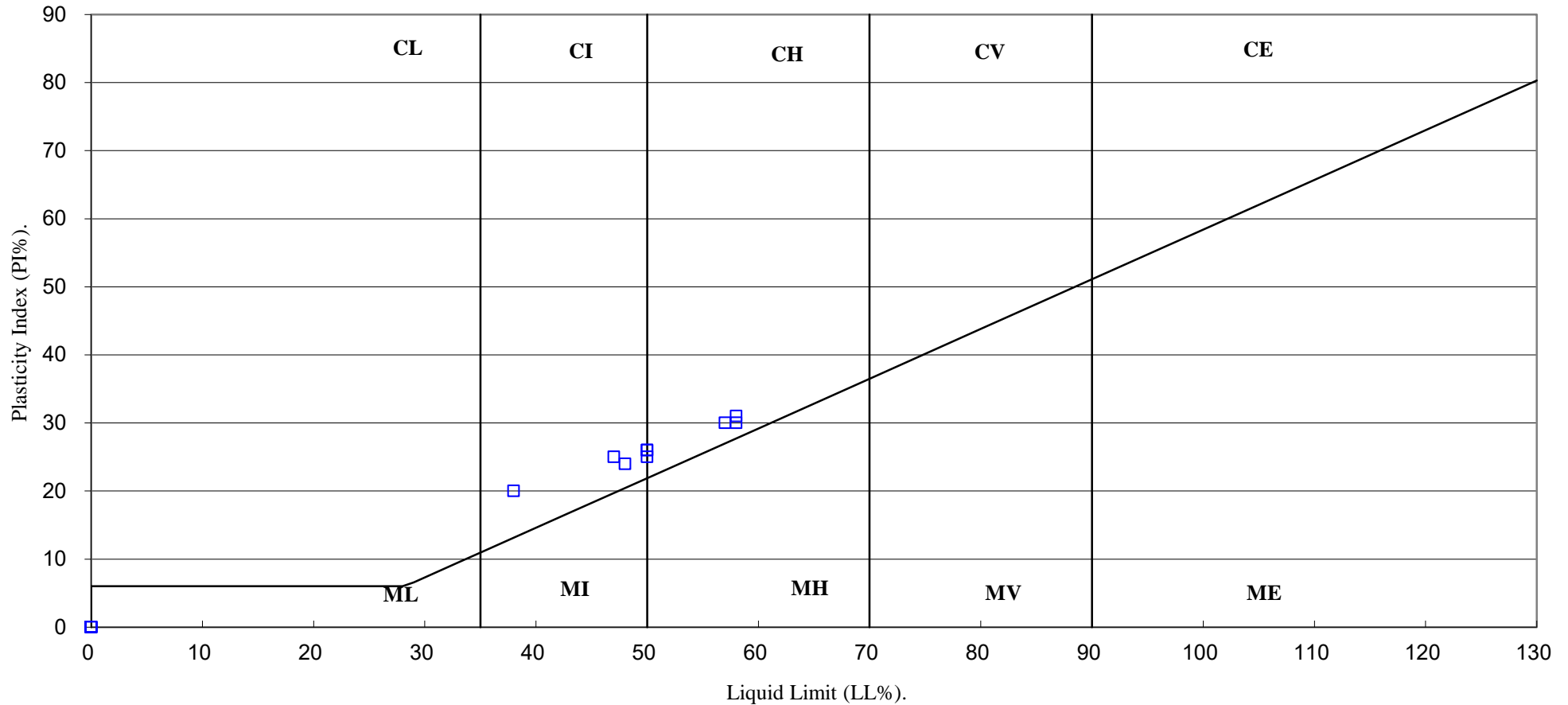
SYMBOLS : NP : Non Plastic

\* : Liquid Limit and Plastic Limit Wet Sieved.

		Checked / Approved	<i>[Signature]</i>	Date	30/06/16	Contract No:		
		Crossley Lane, Dalton, Huddersfield						PSL16/2923
								Client Ref:

# PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

(BS5930 :2015)



Checked /Approved		Date	30/06/16	Contract No:
Crossley Lane, Dalton, Huddersfield				PSL16/2923
				Client Ref:



# LABORATORY REPORT



4043

**Contract Number: PSL16/2924**

Report Date: 30 June 2016  
Client's Reference: MWD/01  
Client Name: Minerva Works Development Ltd  
94 Kirkstall Road  
Leeds  
LS21HD

**For the attention of: Elliot Heatherington**

Contract Title: Land At Crossley Lane, Dalton, Huddersfield  
Date Received: 21/6/2016  
Date Commenced: 21/6/2016  
Date Completed: 30/6/2016

**Notes: Opinions and Interpretations are outside the UKAS Accreditation**

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson  
(Director)

A Watkins  
(Director)

R Berriman  
(Quality Manager)

D Lambe  
(Senior Technician)

S Royle  
(Senior Technician)


L Knight  
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Page 1 of

# SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
TP36		D	1.40	1.60	Brown mottled grey slightly sandy silty CLAY.
TP44		D	1.00	1.20	Brown mottled grey slightly sandy silty CLAY.
TP29		D	1.50	1.70	Brown mottled grey sandy silty CLAY.
TP27		D	1.10	1.30	Brown sandy silty CLAY.
TP15		D	1.60	1.80	Brown mottled grey slightly sandy silty CLAY.
WS45		D	0.30	0.60	Brown slightly sandy silty CLAY.
WS13		D	1.20	1.40	Brown mottled grey slightly sandy silty CLAY.
WS26		D	2.00	2.20	Brown very sandy CLAY.
WS38		D	2.90	3.00	Brown mottled grey sandy silty CLAY.
WS24		D	2.00	2.20	Brown mottled grey sandy silty CLAY.
WS3		D	1.00	1.20	Brown mottled grey sandy silty CLAY.
WS18		D	1.00	1.20	Brown mottled grey sandy silty CLAY.

	Checked / Approved	<i>[Signature]</i>	Date	30/06/16	Contract No:
	Land At Crossley Lane, Dalton, Huddersfield				PSL16/2924
					Client Ref:
					MWD/01/01



# SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m <sup>3</sup> Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
TP36		D	1.40	1.60	45			64	29	35	100	High plasticity CH.
TP44		D	1.00	1.20	29			53	26	27	100	High plasticity CH.
TP29		D	1.50	1.70	29			45	23	22	100	Intermediate plasticity CI.
TP27		D	1.10	1.30	31			43	23	20	100	Intermediate plasticity CI.
TP15		D	1.60	1.80	41			52	26	26	100	High plasticity CH.
WS45		D	0.30	0.60	31			54	27	27	100	High plasticity CH.
WS13		D	1.20	1.40	29			46	24	22	100	Intermediate plasticity CI.
WS26		D	2.00	2.20	14			30	16	14	100	Low plasticity CL.
WS38		D	2.90	3.00	31			49	25	24	100	Intermediate plasticity CI.
WS24		D	2.00	2.20	32			46	24	22	100	Intermediate plasticity CI.
WS38		D	1.00	1.20	26			48	25	23	100	Intermediate plasticity CI.
WS18		D	1.00	1.20	33			45	24	21	100	Intermediate plasticity CI.

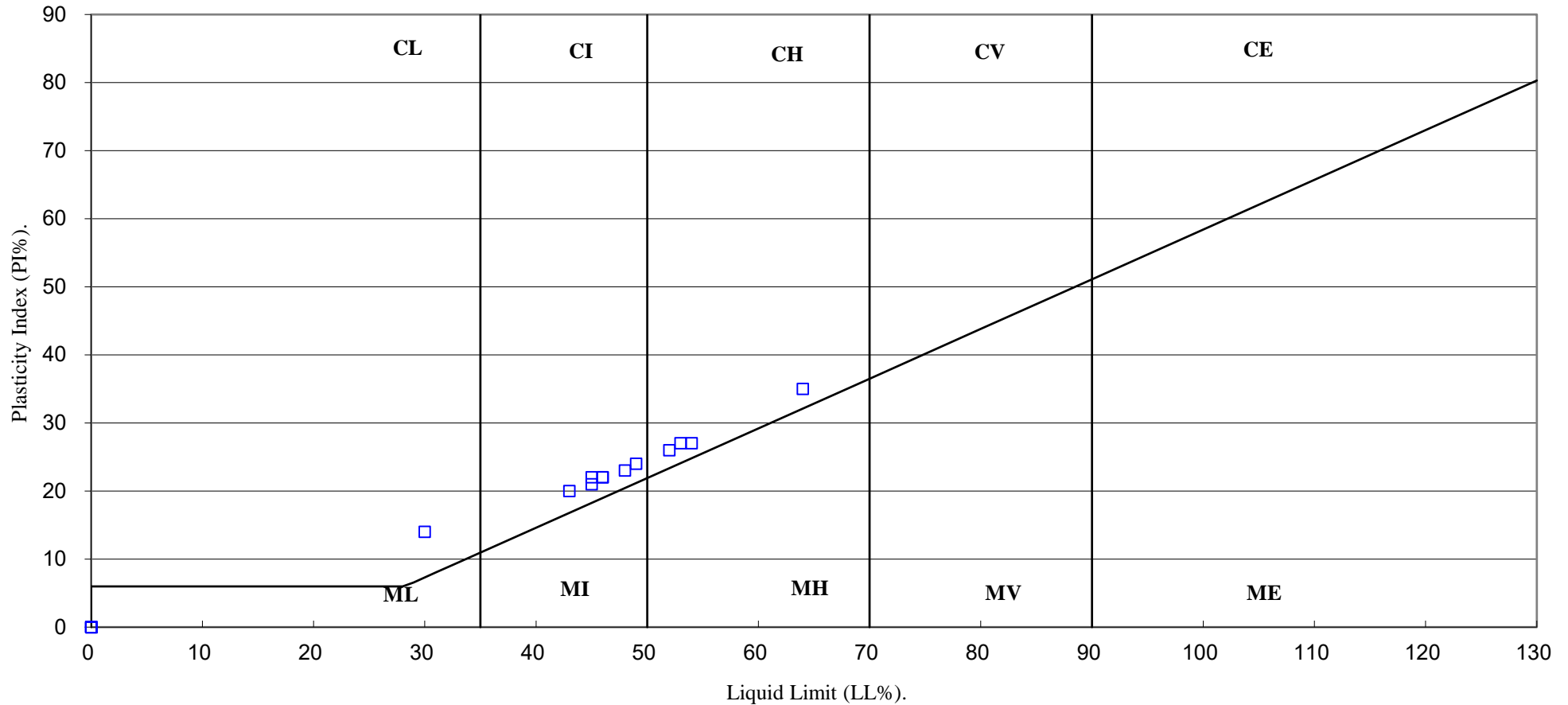
SYMBOLS : NP : Non Plastic

\* : Liquid Limit and Plastic Limit Wet Sieved.

		Checked / Approved	<i>[Signature]</i>	Date	30/06/16	Contract No:	
		Land At Crossley Lane, Dalton, Huddersfield					PSL16/2924
							Client Ref:
							MWD/01/01

# PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

(BS5930 :2015)



Checked /Approved	<i>[Signature]</i>	Date	30/06/16	Contract No:
Land At Crossley Lane, Dalton, Huddersfield				PSL16/2924
				Client Ref:
				MWD/01/01

**A P P E N D I X H**

**GAS MONITORING REPORT**



**ARP GEOTECHNICAL LTD**  
**CHARTERED CONSULTING ENGINEERS**

Minerva Works Developments Ltd  
98 Kirkstall Road  
LEEDS  
LS3 1YN

**For the attention of Mr R Floyd**

-- Dear Sirs

Crossley Lane, Dalton, Huddersfield - Preliminary Gas Risk Letter - Sites 1 to 5

In accordance with our commission, and following the issue of the ARP Geotechnical Ltd (ARP) Stage 1 & 2 Geo-environmental Report, referenced MWD/01r1 and dated August 2016, we have now completed all six of the gas monitoring visits at the above site. It was agreed with Lisa Shaw of Kirklees Council that we would issue the final report, which would include the last monitoring visit (visit six of six). The up to date set of gas monitoring results is attached to this letter report and the results are summarised below.

### **Background**

The overall site is very large (approximately 15ha) and has been divided up into five parcels of land; Sites 1 to 5. The location of the individual sites within the overall site is shown on the enclosed drawing. Site 1 has never been developed and is hence classified as Greenfield land. The other sites have been historically occupied by a number of land uses including gas and coal tar works, a bleach and dye works and as a general works. Due to the presence of made ground over the overall site and a landfill located 85m to the southeast of Site 1, it was considered prudent to carry out ground gas monitoring.

A site investigation was undertaken by Sirius Geotechnical in 2006. Gas wells were installed on Sites 1, 2 and 3 and monitored on four occasions. These results are enclosed, the positions of the wells are shown on the enclosed drawing and the results have been included in the gas risk assessment process.

ARP Geotechnical Ltd undertook a site investigation for the overall site (Sites 1 to 5) in June 2016. As part of the investigation works, a number of gas monitoring wells were installed across the site, and subsequently monitored by ARP Geotechnical Ltd. The wells were installed to 3m depth, with the bottom 2m comprising slotted pipe with gravel surround, and the upper 1m comprising plain pipe with bentonite seal and lockable flush cover.

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**BY E-MAIL**

Our Ref: MWD/01/EGH

12<sup>th</sup> October 2016



ARP GEOTECHNICAL LTD

## **Monitoring Results**

The ground gas investigation was undertaken in accordance with BS 8576 : 2013 "Guidance on investigations for ground gas - Permanent gases and Volatile Organic Compounds (VOCs)". Ground gas risk assessment was carried out in accordance with BS 8485 : 2015 "Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings".

The monitoring visits were carried out to record the levels of methane (CH<sub>4</sub>), oxygen (O<sub>2</sub>), carbon dioxide (CO<sub>2</sub>), groundwater level, and borehole gas flow rate within the wells. The Sirius (historical) visits were made between 1<sup>st</sup> March 2006 and 22<sup>nd</sup> March 2006, during a variety of atmospheric pressures, including three visits during periods of falling pressure. The ARP Geotechnical visits were made between 4<sup>th</sup> August 2016 and 12<sup>th</sup> October 2016, during a variety of atmospheric pressures, including two visits during periods of falling pressure.

Gas monitoring for the overall site identified a range of carbon dioxide concentrations and flow rates. Methane was almost always absent over the entire site, with a localised maximum concentration of 1.0% v/v. (identified in only one well location).

Typically, flow rates were 0 litres/hour (l/hr). But, very localised flows were recorded up to a maximum of (-)14.1 l/hr. Typically carbon dioxide concentrations were between 0.0% v/v and <5.0% v/v with localised concentrations up to 9.3% v/v.

Based on the gas monitoring data obtained, wells on approximately half of the site area have flow rates of around 0.1 l/hr and maximum carbon dioxide concentrations of around 3% v/v. Wells covering the rest of the site have relatively low flow rates (typically <0.5 l/hr), but have carbon dioxide concentrations above 5% v/v.

## **Risk Assessment**

The British Standard, BS 8485 : 2015, utilises the concept of borehole hazardous gas flow rates (Q<sub>hg</sub>), in litres/hour (l/hr), which are obtained by multiplying flow rate by concentrations in the air stream of the particular gas being considered for each borehole. The Q<sub>hg</sub> is used to derive a gas screening value (GSV), which is defined as the "flow rate of a specific hazardous gas representative of a site or zone, derived from assessment of borehole concentration and flow rate measurements and taking account of all other influencing factors, in accordance with a conceptual site model".



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The table below allows the selection of the ‘Characteristic Gas Situation’ (CS) based on GSVs, using a numbering system of 1 to 6, where one equates to a very low hazard potential and six equates to a very high hazard potential.

A table showing the Characteristics Gas Situations is provided below:-

<b>Characteristic Gas Situation (CS)</b>	<b>NHBC Traffic Light</b>	<b>Hazard Potential</b>	<b>Gas Screening Value - l/hr - (GSV)</b>	<b>Additional Factors</b>
1	Green	Very Low	<0.07	Typically <1% CH <sub>4</sub> and <5% CO <sub>2</sub> , otherwise consider an increased Characteristic Gas Regime
2	Amber 1	Low	>0.07 to <0.7	Typical Measured Flow Rate <70l/hr, otherwise consider an increase to CS 3
3	Amber 2	Moderate	>0.7 to <3.5	
4	Red	Moderate to high	>3.5 to <15	
5		High	>15 to <70	
6		Very High	>70	

Based on Table 2 of BS 8485:2015

Due to the large size of the site, the different historical land uses over the site, the varying geology over the site and the different gas concentrations and flow rates over the site, it was considered necessary to zone the site into areas of similar Characteristic Situations (i.e. zones of equal ground gas risk.)

In the gas risk assessment, the worst case CO<sub>2</sub>% v/v, CH<sub>4</sub>% v/v and steady state flow rate, from all the visits undertaken so far, have been used for each individual well location. A worst case GSV has been calculated for each individual well. The worst case results can be seen in the gas summary sheet enclosed with this letter. Below, are typical gas conditions identified by the ARP Geotechnical Ltd site investigation and the subsequent monitoring of gas wells.

For the gas regime identified on the eastern area (of Site 3) and southwestern areas of the site, where typically zero CH<sub>4</sub> was recorded (although up to a maximum CH<sub>4</sub> of 0.2% v/v) and a typical concentration of 3% v/v CO<sub>2</sub> (maximum concentration always <5.0% v/v CO<sub>2</sub>) were recorded, along with typical borehole flow rates of <0.6l/hr, although up to a maximum steady state flow of 8.7l/hr, a maximum GSV of 0.018l/hr (CO<sub>2</sub>) and zero l/hr (CH<sub>4</sub>) is indicated. This equates to CS of 1 for both carbon dioxide and methane, indicative of a low potential ground gas risk.



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For the gas regime identified on the central zone of the site, where CH<sub>4</sub> was typically zero (although up to a maximum of 0.2% v/v CH<sub>4</sub>), and a maximum concentration of 9.3 % v/v CO<sub>2</sub> was recorded, along with a maximum borehole flow rate of (-)9.1l/hr, a maximum GSV of 0.123 l/hr (CO<sub>2</sub>) and 0.028l/hr (CH<sub>4</sub>) is indicated. This equates to a CS of 2 for carbon dioxide, indicative of a Low to Intermediate Potential ground gas risk, and a CS of 1 for methane, indicative of a low potential ground gas risk.

The Sirius data was not available in a digital format. Therefore, the GSVs for individual boreholes were calculated on paper. The Sirius data set indicated CS1 conditions for both carbon dioxide and methane across the site, with the exception of Site 3, at BH3, on two dates (01/03/2006 and 07/03/2006), where CS2 conditions for carbon dioxide are indicated. An example calculation is given below.

$$\begin{array}{rclclcl} (\text{PEAK CO}_2 & / & 100) & \times & (\text{STEADY FLOW l/hr}) & = & \text{GSV l/hr} \\ (5.4\% \text{ CO}_2 & / & 100) & \times & (2.1 \text{ l/hr}) & = & 0.1134\text{l/hr} \end{array}$$

On the table provided on the previous page, where a GSV value of 0.1134l/hr is indicated, this equates to a CS of 2.

The areas of differing risk are shown on the enclosed plan.

**Conclusions**

For almost all of Site 1, CS1 gas conditions are indicated. For the east of Site 3, CS1 gas conditions are also indicated. CS1 gas conditions are equivalent to "Green" conditions under the NHBC traffic light classification system, indicating that no gas protection measures are required on these areas (indicated on the enclosed plan).

For all of Site 2, all of Site 4, all of Site 5, half of Site 3, and a thin strip of Site 1, CS2 gas conditions are indicated. CS2 gas conditions are equivalent to "Amber 1" conditions under the NHBC traffic light classification system, indicating that low level gas protection measures are required, usually comprising a gas membrane and ventilated sub-floor void (indicated on the enclosed plan).



ARP GEOTECHNICAL LTD

We trust the above is sufficient for your requirements. However, should you have any queries, or wish to discuss the matter further, please do not hesitate to contact us at your convenience.

Yours faithfully  
for ARP GEOTECHNICAL LTD

E G Heatherington

Encs

112

## ARP GEOTECHNICAL BOREHOLE MONITORING RESULTS

**JOB NO.** MWD/01

**CLIENT:** MINERVA WORKS DEVELOPMENTS LTD

**SITE:** DALTON

**BH:-** WS2

Date	BH Peak Flow (l/hr)*	BH Steady Flow Rate (l/hr)*	Time for flow to equalise (s)	Peak CH <sub>4</sub> %	Qhg CH <sub>4</sub> (l/hr)	Peak CO <sub>2</sub> %	Qhg CO <sub>2</sub> (l/hr)	Min. O <sub>2</sub> %	Depth to G Water (m)	Comment
04/08/2016	0.0	0.2	60.0	0.0	0.000	7.9	0.016	4.4	2.33	
17/08/2016	0.0	0.1	60.0	0.0	0.000	9.3	0.009	7.2	2.49	
01/09/2016	0.0	0.1	60.0	0.0	0.000	8.8	0.009	5.6	2.38	
14/09/2016	0.0	0.1	60.0	0.0	0.000	7.8	0.008	5.2	2.36	
29/09/2016	0.0	0.1	60.0	0.0	0.000	4.2	0.004	11.8	2.40	
12/10/2016	0.0	0.1	60.0	0.0	0.000	3.6	0.004	9.8	2.38	

\* Where no flow is detected, detection limit of 0.1l/hr should be inserted

Qhg = Hazardous gas flow rate, in accordance with BS8485:2007

Denotes a negative value for Peak Flow or BH Steady Flow Rate

## ARP GEOTECHNICAL BOREHOLE MONITORING RESULTS

**JOB NO.** MWD/01

**CLIENT:** MINERVA WORKS DEVELOPMENTS LTD

**SITE:** DALTON

**BH:-** WS4

Date	BH Peak Flow (l/hr)*	BH Steady Flow Rate (l/hr)*	Time for flow to equalise (s)	Peak CH <sub>4</sub> %	Qhg CH <sub>4</sub> (l/hr)	Peak CO <sub>2</sub> %	Qhg CO <sub>2</sub> (l/hr)	Min. O <sub>2</sub> %	Depth to G Water (m)	Comment
04/08/2016					0.000		0.000			Unable to locate
17/08/2016	0.1	0.1	60.0	0.0	0.000	6.5	0.007	16.9	2.38	
01/09/2016	0.0	0.1	60.0	0.0	0.000	4.9	0.005	15.4	2.39	
14/09/2016	0.1	0.1	60.0	0.0	0.000	5.5	0.006	17.6	2.41	
29/09/2016	0.0	0.1	60.0	0.0	0.000	1.8	0.002	19.9	2.04	
12/10/2016	0.0	0.1	60.0	0.0	0.000	2.3	0.002	18.7	2.08	

\* Where no flow is detected, detection limit of 0.1l/hr should be inserted

Qhg = Hazardous gas flow rate, in accordance with BS8485:2007

Denotes a negative value for Peak Flow or BH Steady Flow Rate

## ARP GEOTECHNICAL BOREHOLE MONITORING RESULTS

**JOB NO.** MWD/01

**CLIENT:** MINERVA WORKS DEVELOPMENTS LTD

**SITE:** DALTON

**BH:-WS7**

Date	BH Peak Flow (l/hr)*	BH Steady Flow Rate (l/hr)*	Time for flow to equalise (s)	Peak CH <sub>4</sub> %	Qhg CH <sub>4</sub> (l/hr)	Peak CO <sub>2</sub> %	Qhg CO <sub>2</sub> (l/hr)	Min. O <sub>2</sub> %	Depth to G Water (m)	Comment
04/08/2016	0.0	0.1	60.0	1.0	0.001	3.9	0.004	0.5	2.37	
17/08/2016	0.0	0.1	60.0	0.0	0.000	3.1	0.003	11.4	2.35	
01/09/2016	0.0	0.1	60.0	0.0	0.000	3.5	0.004	16.5	2.39	
14/09/2016	0.0	0.1	60.0	0.0	0.000	3.9	0.004	12.5	2.42	
29/09/2016	0.7	0.7	60.0	0.5	0.004	4.1	0.029	2.2	2.24	
12/10/2016	0.0	0.1	60.0	0.1	0.000	3.7	0.004	8.5	2.27	

\* Where no flow is detected, detection limit of 0.1l/hr should be inserted

Qhg = Hazardous gas flow rate, in accordance with BS8485:2007

Denotes a negative value for Peak Flow or BH Steady Flow Rate

## ARP GEOTECHNICAL BOREHOLE MONITORING RESULTS

**JOB NO.** MWD/01

**CLIENT:** MINERVA WORKS DEVELOPMENTS LTD

**SITE:** DALTON

**BH:-** WS13

Date	BH Peak Flow (l/hr)*	BH Steady Flow Rate (l/hr)*	Time for flow to equalise (s)	Peak CH <sub>4</sub> %	Qhg CH <sub>4</sub> (l/hr)	Peak CO <sub>2</sub> %	Qhg CO <sub>2</sub> (l/hr)	Min. O <sub>2</sub> %	Depth to G Water (m)	Comment
04/08/2016	0.1	0.1	60.0	0.0	0.000	4.4	0.004	5.9	1.41	
17/08/2016	0.1	0.1	60.0	0.0	0.000	2.2	0.002	18.9	1.44	
01/09/2016	0.0	0.1	60.0	0.0	0.000	2.6	0.003	19.1	1.45	
14/09/2016	0.0	0.1	60.0	0.0	0.000	2.9	0.003	19.8	1.45	
29/09/2016	0.0	0.1	60.0	0.0	0.000	3.4	0.003	16.2	1.38	
12/10/2016	0.0	0.1	60.0	0.0	0.000	2.8	0.003	18.4	1.37	

\* Where no flow is detected, detection limit of 0.1l/hr should be inserted

Qhg = Hazardous gas flow rate, in accordance with BS8485:2007

Denotes a negative value for Peak Flow or BH Steady Flow Rate

## ARP GEOTECHNICAL BOREHOLE MONITORING RESULTS

**JOB NO.** MWD/01

**CLIENT:** MINERVA WORKS DEVELOPMENTS LTD

**SITE:** DALTON

**BH:WS15**

Date	BH Peak Flow (l/hr)*	BH Steady Flow Rate (l/hr)*	Time for flow to equalise (s)	Peak CH <sub>4</sub> %	Qhg CH <sub>4</sub> (l/hr)	Peak CO <sub>2</sub> %	Qhg CO <sub>2</sub> (l/hr)	Min. O <sub>2</sub> %	Depth to G Water (m)	Comment
04/08/2016	0.0	0.1	60.0	0.0	0.000	2.9	0.003	18.4	1.32	
17/08/2016	0.0	0.1	60.0	0.0	0.000	6.5	0.007	11.6	1.56	
01/09/2016	0.0	0.1	60.0	0.0	0.000	1.4	0.001	16.4	1.49	
14/09/2016	0.0	0.1	60.0	0.0	0.000	2.1	0.002	18.4	1.52	
29/09/2016	0.3	0.1	60.0	0.0	0.000	1.7	0.002	19.8	1.08	
12/10/2016	0.0	0.1	60.0	0.0	0.000	2.1	0.002	19.8	1.10	

\* Where no flow is detected, detection limit of 0.1l/hr should be inserted

Qhg = Hazardous gas flow rate, in accordance with BS8485:2007

Denotes a negative value for Peak Flow or BH Steady Flow Rate

## ARP GEOTECHNICAL BOREHOLE MONITORING RESULTS

**JOB NO.** MWD/01

**CLIENT:** MINERVA WORKS DEVELOPMENTS LTD

**SITE:** DALTON

**BH:-WS17**

Date	BH Peak Flow (l/hr)*	BH Steady Flow Rate (l/hr)*	Time for flow to equalise (s)	Peak CH <sub>4</sub> %	Qhg CH <sub>4</sub> (l/hr)	Peak CO <sub>2</sub> %	Qhg CO <sub>2</sub> (l/hr)	Min. O <sub>2</sub> %	Depth to G Water (m)	Comment
04/08/2016	8.7	14.1	60.0	0.2	0.028	0.8	0.113	15.1	1.1	
17/08/2016	0.2	0.5	60.0	0.0	0.000	0.0	0.000	17.0	1.34	
01/09/2016	1.9	1.8	60.0	0.0	0.000	0.2	0.004	18.2	1.29	
14/09/2016	0.0	1.2	60.0	0.0	0.000	0.2	0.002	18.6	1.36	
29/09/2016	0.1	0.1	60.0	0.0	0.000	0.0	0.000	20.8	1.12	
12/10/2016	0.3	0.1	60.0	0.0	0.000	0.0	0.000	20.1	1.19	

\* Where no flow is detected, detection limit of 0.1l/hr should be inserted

Qhg = Hazardous gas flow rate, in accordance with BS8485:2007

Denotes a negative value for Peak Flow or BH Steady Flow Rate

## ARP GEOTECHNICAL BOREHOLE MONITORING RESULTS

JOB NO. MWD/01

CLIENT: MINERVA WORKS DEVELOPMENTS LTD

SITE: DALTON

BH:- WS22

Date	BH Peak Flow (l/hr)*	BH Steady Flow Rate (l/hr)*	Time for flow to equalise (s)	Peak CH <sub>4</sub> %	Qhg CH <sub>4</sub> (l/hr)	Peak CO <sub>2</sub> %	Qhg CO <sub>2</sub> (l/hr)	Min. O <sub>2</sub> %	Depth to G Water (m)	Comment
04/08/2016	0.6	0.4	60.0	0.0	0.000	1.8	0.007	9.7	1.84	
17/08/2016	0.0	0.2	60.0	0.0	0.000	1.4	0.003	11.3	1.82	
01/09/2016	0.0	0.1	60.0	0.0	0.000	1.9	0.002	10.5	1.89	
14/09/2016	0.1	0.2	60.0	0.0	0.000	1.8	0.004	14.3	1.89	
29/09/2016	0.0	0.1	60.0	0.0	0.000	0.5	0.001	20.3	1.35	
12/10/2016	0.0	0.1	60.0	0.0	0.000	1.2	0.001	19.0	1.88	

\* Where no flow is detected, detection limit of 0.1l/hr should be inserted

Qhg = Hazardous gas flow rate, in accordance with BS8485:2007

Denotes a negative value for Peak Flow or BH Steady Flow Rate

## ARP GEOTECHNICAL BOREHOLE MONITORING RESULTS

**JOB NO.** MWD/01

**CLIENT:** MINERVA WORKS DEVELOPMENTS LTD

**SITE:** DALTON

**BH:-** WS30

Date	BH Peak Flow (l/hr)*	BH Steady Flow Rate (l/hr)*	Time for flow to equalise (s)	Peak CH <sub>4</sub> %	Qhg CH <sub>4</sub> (l/hr)	Peak CO <sub>2</sub> %	Qhg CO <sub>2</sub> (l/hr)	Min. O <sub>2</sub> %	Depth to G Water (m)	Comment
04/08/2016					0.000		0.000			Unable to locate
17/08/2016					0.000		0.000			Unable to locate
01/09/2016					0.000		0.000			Unable to locate
14/09/2016					0.000		0.000			Unable to locate
29/09/2016	0.0	0.1	60.0	0.0	0.000	2.9	0.003	18.6	1.45	
12/10/2016	0.0	0.1	60.0	0.0	0.000	2.7	0.003	17.5	1.55	

\* Where no flow is detected, detection limit of 0.1l/hr should be inserted

Qhg = Hazardous gas flow rate, in accordance with BS8485:2007

Denotes a negative value for Peak Flow or BH Steady Flow Rate

## ARP GEOTECHNICAL BOREHOLE MONITORING RESULTS

**JOB NO.** MWD/01

**CLIENT:** MINERVA WORKS DEVELOPMENTS LTD

**SITE:** DALTON

**BH:WS33**

Date	BH Peak Flow (l/hr)*	BH Steady Flow Rate (l/hr)*	Time for flow to equalise (s)	Peak CH <sub>4</sub> %	Qhg CH <sub>4</sub> (l/hr)	Peak CO <sub>2</sub> %	Qhg CO <sub>2</sub> (l/hr)	Min. O <sub>2</sub> %	Depth to G Water (m)	Comment
04/08/2016	9.1	7.7	60.0	0.0	0.000	1.6	0.123	6.5	1.79	
17/08/2016	2.1	1.3	60.0	0.0	0.000	1.8	0.023	15.3	1.81	
01/09/2016	0.5	0.2	60.0	0.0	0.000	1.9	0.004	17.4	1.81	
14/09/2016	1.5	0.8	60.0	0.0	0.000	1.4	0.011	9.6	1.75	
29/09/2016	1.6	0.8	60.0	0.0	0.000	0.1	0.001	7.3	1.88	
12/10/2016	1.1	0.7	60.0	0.0	0.000	0.1	0.001	7.8	1.93	

\* Where no flow is detected, detection limit of 0.1l/hr should be inserted

Qhg = Hazardous gas flow rate, in accordance with BS8485:2007

Denotes a negative value for Peak Flow or BH Steady Flow Rate

## ARP GEOTECHNICAL BOREHOLE MONITORING RESULTS

**JOB NO.** MWD/01

**CLIENT:** MINERVA WORKS DEVELOPMENTS LTD

**SITE:** DALTON

**BH:** WS35

Date	BH Peak Flow (l/hr)*	BH Steady Flow Rate (l/hr)*	Time for flow to equalise (s)	Peak CH <sub>4</sub> %	Qhg CH <sub>4</sub> (l/hr)	Peak CO <sub>2</sub> %	Qhg CO <sub>2</sub> (l/hr)	Min. O <sub>2</sub> %	Depth to G Water (m)	Comment
04/08/2016	0.0	0.1	60.0	0.0	0.000	3.2	0.003	14.5	1.83	
17/08/2016	0.0	0.1	60.0	0.0	0.000	2.9	0.003	16.4	1.87	
01/09/2016	0.0	0.1	60.0	0.0	0.000	3.6	0.004	15.9	1.85	
14/09/2016	0.0	0.1	60.0	0.0	0.000	2.1	0.002	17.2	1.89	
29/09/2016	0.2	0.2	60.0	0.0	0.000	2.9	0.006	18.6	1.86	
12/10/2016	0.0	0.1	60.0	0.0	0.000	2.2	0.002	16.5	1.92	

\* Where no flow is detected, detection limit of 0.1l/hr should be inserted

Qhg = Hazardous gas flow rate, in accordance with BS8485:2007

Denotes a negative value for Peak Flow or BH Steady Flow Rate

## ARP GEOTECHNICAL BOREHOLE MONITORING RESULTS

**JOB NO.** MWD/01

**CLIENT:** MINERVA WORKS DEVELOPMENTS LTD

**SITE:** DALTON

**BH:** WS36

Date	BH Peak Flow (l/hr)*	BH Steady Flow Rate (l/hr)*	Time for flow to equalise (s)	Peak CH <sub>4</sub> %	Qhg CH <sub>4</sub> (l/hr)	Peak CO <sub>2</sub> %	Qhg CO <sub>2</sub> (l/hr)	Min. O <sub>2</sub> %	Depth to G Water (m)	Comment
04/08/2016					0.000		0.000			Unable to locate
17/08/2016					0.000		0.000			Unable to locate
01/09/2016					0.000		0.000			Unable to locate
14/09/2016					0.000		0.000			Unable to locate
29/09/2016					0.000		0.000			Unable to locate
12/10/2016					0.000		0.000			Unable to locate

\* Where no flow is detected, detection limit of 0.1l/hr should be inserted

Qhg = Hazardous gas flow rate, in accordance with BS8485:2007

Denotes a negative value for Peak Flow or BH Steady Flow Rate

## ARP GEOTECHNICAL BOREHOLE MONITORING RESULTS

**JOB NO.** MWD/01

**CLIENT:** MINERVA WORKS DEVELOPMENTS LTD

**SITE:** DALTON

**BH:** -WS38

Date	BH Peak Flow (l/hr)*	BH Steady Flow Rate (l/hr)*	Time for flow to equalise (s)	Peak CH <sub>4</sub> %	Qhg CH <sub>4</sub> (l/hr)	Peak CO <sub>2</sub> %	Qhg CO <sub>2</sub> (l/hr)	Min. O <sub>2</sub> %	Depth to G Water (m)	Comment
04/08/2016	0.1	0.1	60.0	0.0	0.000	3.3	0.003	16.6	2.66	
17/08/2016	0.1	0.1	60.0	0.0	0.000	2.7	0.003	18.4	2.63	
01/09/2016	0.0	0.1	60.0	0.0	0.000	3.9	0.004	16.8	2.71	
14/09/2016	0.0	0.1	60.0	0.0	0.000	2.4	0.002	15.3	2.68	
29/09/2016	0.0	0.1	60.0	0.0	0.000	3.6	0.004	17	2.19	
12/10/2016	0.0	0.1	60.0	0.0	0.000	3.0	0.003	17.6	2.36	

\* Where no flow is detected, detection limit of 0.1l/hr should be inserted

Qhg = Hazardous gas flow rate, in accordance with BS8485:2007

Denotes a negative value for Peak Flow or BH Steady Flow Rate

## ARP GEOTECHNICAL BOREHOLE MONITORING RESULTS

JOB NO. MWD/01

CLIENT: MINERVA WORKS DEVELOPMENTS LTD

SITE: DALTON

BH: -WS40

Date	BH Peak Flow (l/hr)*	BH Steady Flow Rate (l/hr)*	Time for flow to equalise (s)	Peak CH <sub>4</sub> %	Qhg CH <sub>4</sub> (l/hr)	Peak CO <sub>2</sub> %	Qhg CO <sub>2</sub> (l/hr)	Min. O <sub>2</sub> %	Depth to G Water (m)	Comment
04/08/2016	0.0	0.4	60.0	0.0	0.000	4.4	0.018	5.9	1.74	
17/08/2016	0.1	0.1	60.0	0.0	0.000	2.6	0.003	19.3	1.83	
01/09/2016	0.0	0.1	60.0	0.0	0.000	2.9	0.003	18.4	1.79	
14/09/2016	0.0	0.2	60.0	0.0	0.000	3.5	0.007	16.4	1.8	
29/09/2016	0.0	0.1	60.0	0.0	0.000	2.8	0.003	19.5	1.75	Overgrown
12/10/2016	0.0	0.1	60.0	0.0	0.000	3.1	0.003	18.4	1.75	

\* Where no flow is detected, detection limit of 0.1l/hr should be inserted

Qhg = Hazardous gas flow rate, in accordance with BS8485:2007

Denotes a negative value for Peak Flow or BH Steady Flow Rate

## ARP GEOTECHNICAL BOREHOLE MONITORING RESULTS

JOB NO. MWD/01

CLIENT: MINERVA WORKS DEVELOPMENTS LTD

SITE: DALTON

BH: -WS43

Date	BH Peak Flow (l/hr)*	BH Steady Flow Rate (l/hr)*	Time for flow to equalise (s)	Peak CH <sub>4</sub> %	Qhg CH <sub>4</sub> (l/hr)	Peak CO <sub>2</sub> %	Qhg CO <sub>2</sub> (l/hr)	Min. O <sub>2</sub> %	Depth to G Water (m)	Comment
04/08/2016	0.0	0.1	60.0	0.0	0.000	3.1	0.003	18.3	1.49	
17/08/2016	0.0	0.1	60.0	0.0	0.000	1.8	0.002	19.9	1.6	
01/09/2016	0.0	0.1	60.0	0.0	0.000	1.9	0.002	19.8	1.58	
14/09/2016	0.0	0.1	60.0	0.0	0.000	2.3	0.002	17.9	1.64	
29/09/2016	0.0	0.1	60.0	0.0	0.000	2.1	0.002	19.7	1.57	Overgrown
12/10/2016	0.0	0.1	60.0	0.0	0.000	2.5	0.003	19.9	1.54	

\* Where no flow is detected, detection limit of 0.1l/hr should be inserted

Qhg = Hazardous gas flow rate, in accordance with BS8485:2007

Denotes a negative value for Peak Flow or BH Steady Flow Rate

## ARP GEOTECHNICAL BOREHOLE MONITORING RESULTS

**JOB NO.** MWD/01

**CLIENT:** MINERVA WORKS DEVELOPMENTS LTD

**SITE:** DALTON

### BAROMETRIC PRESSURES

Monitor Date	Weather on Day	Pressure on Site (mb)	Pressure on Day (mb)*	Pressure on day before (mb)*	Pressure 2 days before (mb)*	Trend*
04/08/2016	Light Showers	995	1005	1002	1008	Various
17/08/2016	Overcast	1007	1015	1021	1025	Falling
01/09/2016	Overcast	1005	1020	1018	1022	Various
14/09/2016	Cloudy	1002	1013	1012	1010	Rising
29/09/2016	Sunny	1007	1007	1016	1017	Falling
12/10/2016	Overcast	1016	1024	1025	1027	High/falling

\*Pressures at midday (EGNM) corrected to sea level.

**JOB NO. MWD/01**  
**GROUND GAS SUMMARY SHEET**

<b>Borehole ref.</b>	<b>Max Recorded Peak Flow (l/hr)</b>	<b>Max Recorded Steady Flow (l/hr)</b>	<b>Max. CO2 (% v/v)</b>	<b>Max CH4 (% v/v)</b>	<b>Max BH Qhg (CO2)</b>	<b>Max BH Qhg (CH4)</b>
WS2	0.0	0.2	9.3	0.0	0.016	0.000
WS4	0.1	0.1	6.5	0.0	0.007	0.000
WS7	0.7	0.7	4.1	1.0	0.029	0.004
WS13	0.1	0.1	4.4	0.0	0.004	0.000
WS15	0.3	0.1	6.5	0.0	0.007	0.000
WS17	8.7	14.1	0.8	0.2	0.113	0.028
WS22	0.6	0.4	1.9	0.0	0.007	0.000
WS30	0.0	0.1	2.9	0.0	0.003	0.000
WS33	9.1	7.7	1.9	0.0	0.123	0.000
WS35	0.2	0.2	3.6	0.0	0.006	0.000
WS36	0.0	0.0	0.0	0.0	0.000	0.000
WS38	0.1	0.1	3.9	0.0	0.004	0.000
WS40	0.1	0.4	4.4	0.0	0.018	0.000
WS43	0.0	0.1	3.1	0.0	0.003	0.000

<b>Worst-credible Qhg (l/hr) *</b>	0.123	0.028
<b>Worst-possible Qhg (l/hr) x</b>	1.311	0.141



**APPENDIX F  
GAS AND  
GROUNDWATER  
MONITORING  
RESULTS**

# MONITORING RESULTS



Client: MPSL Planning and Design Ltd  
 Site: Crossley Lane, Dalton  
 Date: 01/03/06 (Visit 1)

Job No: C1273  
 Sheet: 1 of 1

Ambient concentration (% Volume):											
CH <sub>4</sub> ND				CO <sub>2</sub> ND				O <sub>2</sub> 20.9			
Monitoring Point		Gas Concentration							Gas Emission Rate		Standpipe screen
		Highest			Steady			(Lowest)			
Ref	GWL	CH <sub>4</sub>		CO <sub>2</sub>	CH <sub>4</sub>		CO <sub>2</sub>	O <sub>2</sub>	Litre / Hour		
	(m) bgl	% lcl	% v/v	(%)	% lcl	% v/v	(%)	(%)	I	C	
<b>Site 1</b>											
BH1(50mm)	1.34	ND	ND	1.9	ND	ND	1.9	9.3	-0.5	ND	Natural
BH2(50mm)	1.53	ND	ND	ND	ND	ND	ND	15.9	ND	ND	Natural
BH3(50mm)	1.16	ND	ND	ND	ND	ND	ND	16.5	42.3	0.4	Natural
BH4(50mm)	1.27	ND	ND	0.5	ND	ND	0.5	20.3	ND	ND	Natural
<b>Site 2</b>											
BH1(50mm)	1.65	ND	ND	1.4	ND	ND	1.4	20.3	ND	ND	Natural
BH1(19mm)	1.67	ND	ND	0.3	ND	ND	0.3	20.9	ND	ND	Made Ground
<b>Site 3</b>											
BH1(50mm)	2.31	12.0	0.1	0.6	11.0	0.1	0.6	4.9	ND	ND	Natural
BH1(19mm)	1.15	ND	ND	ND	ND	ND	ND	20.4	ND	ND	Made Ground
BH2(50mm)	1.24	ND	ND	1.0	ND	ND	0.8	19.2	NR	NR	Natural
BH2(19mm)	0.55	ND	ND	ND	ND	ND	ND	20.8	NR	NR	Made Ground
BH3 (taken 02/03/06)	5.00	ND	ND	8.9	ND	ND	8.9	15.1	ND	ND	Natural
WS1(19mm)	0.71	ND	ND	1.6	ND	ND	1.2	18.6	4.2	ND	Natural
<b>Site 4</b>											
BH1(50mm)	3.33	ND	ND	1.1	ND	ND	1.1	16.3	ND	ND	Natural
<b>Barometric Pressure:</b>		0995 on 01/03/06				<b>Monitoring Equipment:</b>		LMSx Multigas			
<b>Barometric Pressure Trend:</b>		0991 on 02/03/06				<b>Date of Last Calibration:</b>		16/02/06			
<b>Weather:</b>		Falling				<b>Operator</b>		MW			
<b>Ground:</b>		Sunny				Tarmac/ grass/ concrete					
<b>Key</b>		<b>Remarks</b>									
ND - None Detected NR - Not Recorded I - Instantaneous Flow C - Constant Flow		Groundwater samples were taken from all 50mm standpipes after purging 3 well volumes.									
		Checked:		APC		Approved:		RHH			

# MONITORING RESULTS



Client: MPSL Planning and Design Ltd  
 Site: Crossley Lane, Dalton  
 Date: 07/03/06 (Visit 2)

Job No: C1273  
 Sheet: 1 of 1

Ambient concentration (% Volume):											
CH <sub>4</sub> ND				CO <sub>2</sub> ND							
O <sub>2</sub> 21.0											
Monitoring Point		Gas Concentration							Gas Emission Rate		Standpipe screen
		Highest			Steady			(Lowest)			
Ref	GWL	CH <sub>4</sub>		CO <sub>2</sub>	CH <sub>4</sub>		CO <sub>2</sub>	O <sub>2</sub>	Litre / Hour		
	(m) bgl	% lel	% v/v	(%)	% lel	% v/v	(%)	(%)	I	C	
<b>Site 1</b>											
BH1(50mm)	1.50	ND	ND	1.9	ND	ND	1.9	8.7	ND	ND	Natural
BH2(50mm)	1.69	ND	ND	ND	ND	ND	ND	16.7	ND	ND	Natural
BH3(50mm)	1.37	ND	ND	ND	ND	ND	ND	17.0	ND	ND	Natural
BH4(50mm)	1.26	ND	ND	1.1	ND	ND	1.1	19.4	ND	ND	Natural
<b>Site 2</b>											
BH1(50mm)	1.80	ND	ND	ND	ND	ND	ND	21.0	ND	ND	Natural
BH1(19mm)	2.36	ND	ND	0.1	ND	ND	0.1	20.9	ND	ND	Made Ground
<b>Site 3</b>											
BH1(50mm)	2.87	10.0	0.1	2.9	10.0	0.1	2.8	0.1	107.0	0.5	Natural
BH1(19mm)	1.20	ND	ND	ND	ND	ND	ND	20.0	ND	ND	Made Ground
BH2(50mm)	1.35	ND	ND	0.9	ND	ND	0.7	20.1	17.3	0.5	Natural
BH2(19mm)	0.58	ND	ND	ND	ND	ND	ND	20.6	ND	ND	Made Ground
BH3(50mm)	5.13	ND	ND	5.4	ND	ND	5.4	17.0	29.2	2.1	Natural
WS1(19mm)	0.84	ND	ND	0.5	ND	ND	0.5	20.3	1.0	0.5	Natural
<b>Site 4</b>											
BH1(50mm)	3.40	ND	ND	0.5	ND	ND	0.5	20.5	ND	ND	Natural
<b>Barometric Pressure:</b>		1002			<b>Monitoring Equipment:</b>			LMSx Multigas Analyser			
<b>Barometric Pressure Trend:</b>		Falling			<b>Date of Last Calibration:</b>			16/02/06			
<b>Weather:</b>		Heavy rain			<b>Operator</b>			MW			
<b>Ground:</b>		Tarmac/ grass/ concrete									
<b>Key</b>		<b>Remarks</b>									
ND - None Detected NR - Not Recorded I - Instantaneous Flow C - Constant Flow		Groundwater samples were taken from all 19mm standpipes after purging 3 well volumes. A Hydrogen Sulphide odour and a sheen were noted while sampling BH1 (Site 3). A sample was also taken from the river (S5)									
		Checked:		APC		Approved:		[Signature]			

# MONITORING RESULTS



Client: MPSL Planning and Design Ltd  
 Site: Crossley Lane, Dalton  
 Date: 15/03/06 (Visit 3)

Job No: C1273  
 Sheet: 1 of 1

Ambient concentration (% Volume):											
CH <sub>4</sub> ND				CO <sub>2</sub> ND							
O <sub>2</sub> 21.0											
Monitoring Point		Gas Concentration							Gas Emission Rate		Base of Standpipe
		Highest			Steady			(Lowest)			
Ref	GWL	CH <sub>4</sub>		CO <sub>2</sub>	CH <sub>4</sub>		CO <sub>2</sub>	O <sub>2</sub>	Litre / Hour		
	(m) bgl	% lcl	% v/v	(%)	% lcl	% v/v	(%)	(%)	I	C	
<b>Site 1</b>											
BH1(50mm)	1.36	ND	ND	1.9	ND	ND	1.9	2.5	85.8	0.4	Natural
BH2(50mm)	1.43	ND	ND	ND	ND	ND	ND	17.0	ND	ND	Natural
BH3(50mm)	1.15	ND	ND	ND	ND	ND	ND	14.5	142.0	0.5	Natural
BH4(50mm)	1.26	ND	ND	0.7	ND	ND	0.2	20.2	ND	ND	Natural
<b>Site 2</b>											
BH1(50mm)	1.64	ND	ND	0.9	ND	ND	0.9	20.4	ND	ND	Natural
BH1(19mm)	0.91	ND	ND	0.1	ND	ND	0.1	20.9	ND	ND	Made Ground
<b>Site 3</b>											
BH1(50mm)	2.81	10.0	0.2	2.0	7.0	0.1	1.9	0.9	44.4	2.4	Natural
BH1(19mm)	1.07	ND	ND	0.1	ND	ND	0.1	20.1	ND	ND	Made Ground
BH2(50mm)	1.35	ND	ND	0.7	ND	ND	0.7	20.0	-55.0	ND	Natural
BH2(19mm)	0.41	ND	ND	ND	ND	ND	ND	20.7	ND	ND	Made Ground
BH3(50mm)	5.11	ND	ND	1.0	ND	ND	1.0	19.7	-10.6	ND	Natural
WS1(19mm)	0.79	ND	ND	ND	ND	ND	ND	19.9	<100	-3.5	Natural
<b>Site 4</b>											
BH1(50mm)	3.15	ND	ND	1.6	ND	ND	0.6	14.5	0.3	ND	Natural
<b>Barometric Pressure:</b>		1017			<b>Monitoring Equipment:</b>			LMSx Multigas Analyser			
<b>Barometric Pressure Trend:</b>		Falling			<b>Date of Last Calibration:</b>			14/03/06			
<b>Weather:</b>		Overcast, sunny spells			<b>Operator</b>			MW			
<b>Ground:</b>		Tarmac/ grass/ concrete									
<b>Key</b>		<b>Remarks</b>									
ND - None Detected NR - Not Recorded I - Instantaneous Flow C - Constant Flow		PID readings: ND in all installations. H <sub>2</sub> S readings: ND in all installations. There was no free phase product detected using a free phase product interface meter.									
<b>Checked:</b>				APC				<b>Approved:</b>		RHH	

# MONITORING RESULTS



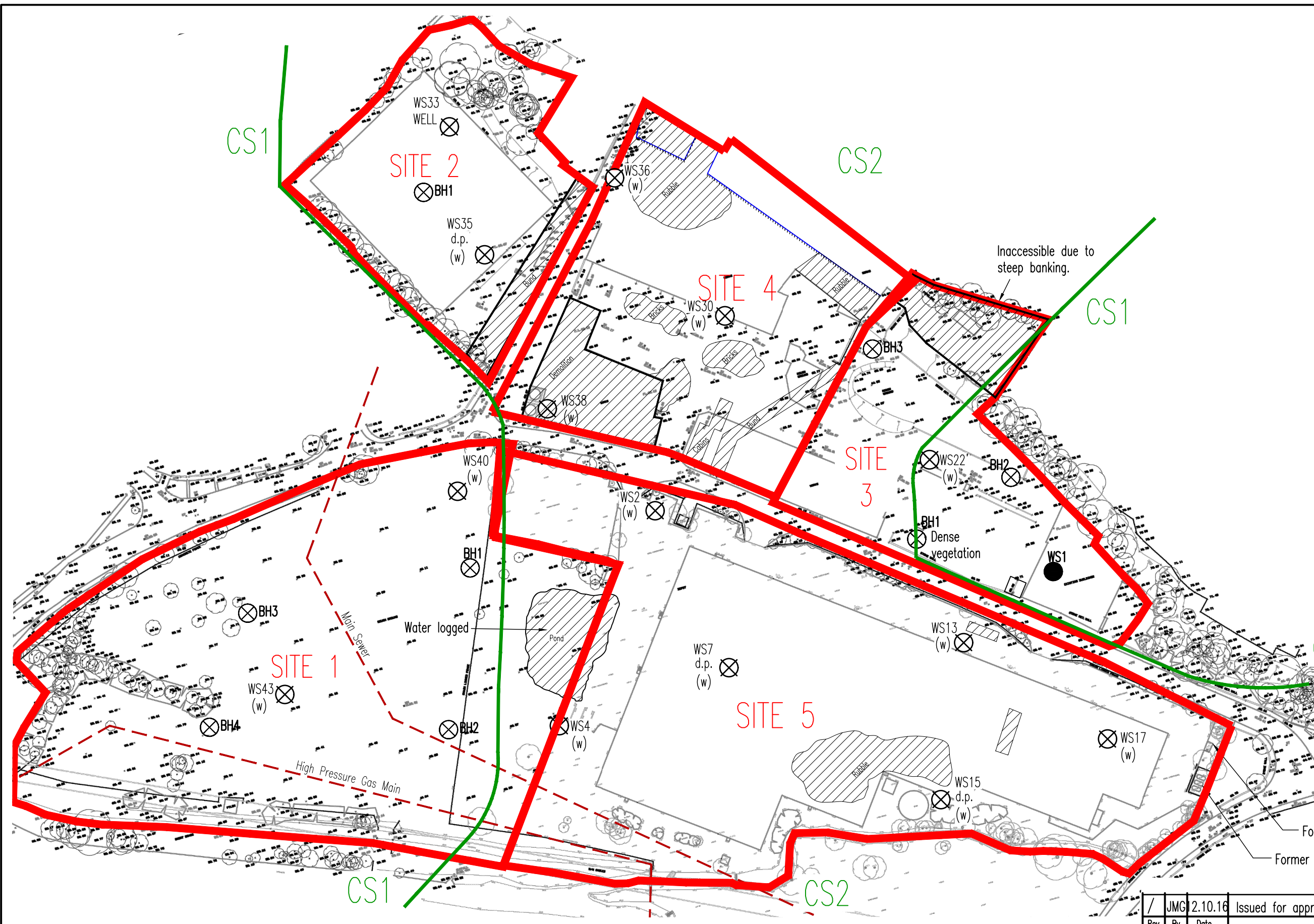
Client: MPSL Planning and Design Ltd  
 Site: Crossley Lane, Dalton  
 Date: 22/03/06 (Visit 4)

Job No: C1273  
 Sheet: 1 of 1

Ambient concentration (% Volume):											
CH <sub>4</sub> ND				CO <sub>2</sub> ND							
O <sub>2</sub> 21.0											
Monitoring Point		Gas Concentration							Gas Emission Rate		Standpipe Screen
		Highest			Steady			(Lowest)			
Ref	GWL	CH <sub>4</sub>		CO <sub>2</sub>	CH <sub>4</sub>		CO <sub>2</sub>	O <sub>2</sub>	Litre / Hour		
	(m) bgl	% lcl	% v/v	(%)	% lcl	% v/v	(%)	(%)	I	C	
<b>Site 1</b>											
BH1(50mm)	1.44	ND	ND	1.8	ND	ND	1.3	4.6	3.8	ND	Natural
BH2(50mm)	1.20	ND	ND	ND	ND	ND	ND	18.6	ND	ND	Natural
BH3(50mm)	1.50	ND	ND	ND	ND	ND	ND	14.8	8.4	ND	Natural
BH4(50mm)	1.22	ND	ND	0.2	ND	ND	0.2	20.2	ND	ND	Natural
<b>Site 2</b>											
BH1(50mm)	1.75	ND	ND	0.6	ND	ND	0.6	20.3	ND	ND	Natural
BH1(19mm)	0.86	ND	ND	ND	ND	ND	ND	20.8	ND	ND	Made Ground
<b>Site 3</b>											
BH1(50mm)	2.81	10.0	0.1	1.6	10.0	0.1	1.6	1.3	2.6	1.4	Natural
BH1(19mm)	1.14	ND	ND	ND	ND	ND	ND	20.4	ND	ND	Made Ground
BH2(50mm)	1.20	ND	ND	0.4	ND	ND	0.4	20.2	-3.6	ND	Natural
BH2(19mm)	0.54	ND	ND	ND	ND	ND	ND	20.9	ND	ND	Made Ground
BH3(50mm)	4.95	ND	ND	4.2	ND	ND	4.2	13.1	0.2	0.2	Natural
WS1(19mm)	0.83	ND	ND	ND	ND	ND	ND	20.9	4.6	1.2	Natural
<b>Site 4</b>											
BH1(50mm)	3.42	ND	ND	1.0	ND	ND	1.0	19.2	ND	ND	Natural
<b>Barometric Pressure:</b>		1005			<b>Monitoring Equipment:</b>			GA94			
<b>Barometric Pressure Trend:</b>		Stable			<b>Date of Last Calibration:</b>			27/02/06			
<b>Weather:</b>		Sunny			<b>Operator</b>			MW			
<b>Ground:</b>		Tarmac/ grass/ concrete									
<b>Key</b>		<b>Remarks</b>									
ND - None Detected NR - Not Recorded I - Instantaneous Flow C - Constant Flow		PID readings: ND in all installations.									
		Checked:		APC		Approved:		RTH			

### Key

- (w) ⊗ Gas Monitoring Well (ARP 2016)
- ⊗ Borehole Gas Monitoring Well (Sirius 2006)
- Window Sample Gas Monitoring Well (Sirius 2006)
- ▨ Area Inaccessible
- - - Services
- Boundary between CS1 & CS2 zones



Rev	By	Date	Amendment	Chk
/	JMG	2.10.16	Issued for approval	AJ

Project  
**CROSSLEY LANE, DALTON**

Client  
**MINERVA WORKS DEVELOPMENT LTD**

Title  
**GAS MONITORING WELL LOCATIONS**



**ARP ASSOCIATES**  
CHARTERED CONSULTING ENGINEERS

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Date	OCT' 16	Scale	NTS @ A3
Drawn	JMG	No	MWD/01/SI.09
Chk.	EGH	Rev	/

**APPENDIX J**

**CONTAMINATION REMEDIATION STATEMENT**



**ARP GEOTECHNICAL LTD  
CHARTERED CONSULTING ENGINEERS**

**CONTAMINATION REMEDIATION STATEMENT**

**FOR**

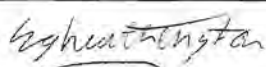

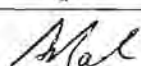
**SITES FOUR AND FIVE**

**LAND AT CROSSLEY LANE, DALTON  
HUDDERSFIELD**

**ON BEHALF OF**

**MINERVA WORKS DEVELOPMENTS LTD**

**MARCH 2017**

<b>Doc. No:</b> MWD/01rem2	<b>Name</b>	<b>Signature</b>	<b>Date</b>
<b>Prepared By:</b>	E G Heatherington BSc MSc FGS		02/03/17
<b>Reviewed By:</b>	J Race BSc CGeol FGS EurGeol		02/03/17
<b>Authorised By:</b>	A Radcliffe BEng CEng MIStructE		02/03/17

**MINERVA WORKS DEVELOPMENTS LTD**

**SITES 4 AND 5  
LAND AT CROSSLEY LANE  
DALTON, HUDDERSFIELD**

**MARCH 2017**

**CONTAMINATION REMEDIATION STATEMENT**

**1.0 Introduction**

1.1 This document has been prepared to provide information for the Client and other interested parties, such as the Regulatory Authorities, outlining how contamination encountered on the site will be managed to ensure that the site is environmentally suitable for the intended residential use. The document should be agreed, prior to implementation, with the relevant Regulatory Authorities, usually the local Planning Authority and NHBC or other building control provider.

**2.0 The Site**

2.1 The ARP Geotechnical Ltd Combined Stage 1 and Stage 2 Desk Study and Geo-environmental Report, dated March 2017 under reference MWD/01r2, makes an assessment of contamination, along with other aspects.

2.2 The conceptual site model is for a proposed development of residential properties with private gardens.

2.3 The area covered by this report (“The Site”) comprises Site 4 and Site 5 of a larger area. Site 4 sloped down gently to the south-southwest. The majority of the site was covered with concrete slabs. All buildings previously on the site had been demolished. Remnants of the former industrial buildings remain, such as a large concrete retaining wall along the northern site boundary. There are several stockpiles of crushed construction materials and general waste on the site. On the southwest of the site, two cylindrical tanks remain, along with the associated pipework. Intersecting the site, in the southeast, is a bund of crushed construction materials, approximately 2m to 3m high.

2.4 Site 5 slopes gently down to the southwest. However, the majority of the site is currently flat in the area of the former industrial buildings. Therefore, on the southwest of the site, the concrete ground slab of the former buildings is retained 1.5m above ground level. On the northeast of the site, the concrete floor slab of the former buildings is at ground level. The previous industrial buildings have been demolished, with the concrete ground slabs left intact. There is only a thin strip of land along the southern boundary which is not covered by hardstanding. There is a car parking area on the northwest of the site (45m by 30m) and small, fenced electricity substation is indicated on plans nearby, but this had been removed at the time of the investigation. On the east of the site, three above ground gas tanks (possibly propane) are present, as well as a fuel filling pump (possibly diesel), which is likely to be fed by an underground storage tank (unknown

volume). Beyond the hardstanding on the south of the site, the concrete base of a large cylindrical storage container (possibly gas) is present.

- 2.5 Archive maps show the east of Site 4 was shown to be encroached on from the adjacent “Coal Tar Colour Works” from as early as 1893, at which time a railway and embankment is shown to the north of Site 4 (dismantled sometime prior to 1958). By 1918, this activity covered most of the south of Site 4 (part of Minerva Works Dyeing and Bleaching). On Site 5, a small gas works was shown on the 1893 map, but no later. By 1918, Minerva Works Dyeing and Bleaching was shown to encroach south onto Site 5. By 1958, the central third of Site 5 is shown to be developed. The most recent ground layout is visible by 1985.
- 2.6 The geological map shows Site 4 and Site 5 to be underlain by undifferentiated strata (mudstones, siltstones and minor sandstone) of the Pennine Lower Coal Measures. Superficial alluvial deposits are shown to overlie the solid strata on Site 5, and on the southern tip of Site 4. A significant northwest - southeast trending fault passes through the wider site area. The fault crosses the southwest of Site 5 and passes to the west of Site 4. The fault is shown to downthrow strata to the northeast.
- 2.7 The strata beneath the site are classed as a Secondary A Aquifer. There are no groundwater abstractions for sensitive uses within 1km of the site. The nearest downslope surface water is Ox Field Beck which flows west beyond the boundary to the south of Site 5. However, there are no surface water abstractions for sensitive uses within 1km down hydraulic gradient of the site.
- 2.8 No radon protective measures are stated to be necessary for new dwellings or extensions on the site. However, the site is in an intermediate probability radon area, as between 1% and 3% of homes are above the action level. In these circumstances of apparent conflict, it may be prudent to assume basic radon protection is required, to prevent conveyancing difficulties. This is usually achieved by incorporating an appropriate barrier within a solid floor system, lapping through the cavity wall.
- 2.9 Most of Site 4 is covered by concrete up to 0.3m thick, overlying made ground between 0.3m and 2.6m thick. The majority of made ground across the site was granular, but cohesive made ground was also encountered, to a lesser extent, with superficial deposits of cohesive and granular head and alluvial deposits beneath. Slight instability of the trial pit sides was noted locally, to a depth of no more than 1.2m. Instability was generally associated with the presence of granular made ground. Rapid water ingress was noted locally, of water perched in the made ground. Natural strata were also noted to be locally wet.
- 2.10 Most of Site 5 is covered by concrete up to 0.35m thick, overlying made ground at least 3.45m thick locally. The majority of made ground across the site was granular, but cohesive made ground was also encountered, to a lesser extent, with superficial deposits of cohesive and granular alluvium beneath. In general, instability of the pit sides was associated with coarse granular made ground and the presence of groundwater in the upper profile, and coarse granular alluvial deposits and the presence of groundwater in the lower profile. Groundwater ingress occurred sporadically within the made ground, of variable depth and rate, and was observed locally in some areas within the natural strata, from depths of around 2m to 4m.

- 2.11 For Site 4, in the cohesive made ground, there are widespread elevated concentrations of lead (up to 290mg/kg). In the granular made ground, there are widespread elevated concentrations of arsenic and lead, along with some outlier concentrations of up to 510mg/kg of arsenic, 6,600mg/kg of lead, cadmium, and slightly elevated PAH compounds, none of which are volatile. At WS24, trichloroethylene was found to be significantly elevated (21mg/kg). Chrysotile asbestos was detected on a microscopic scale in three locations on Site 4 (TP36, TP39 and WS39), although its presence is likely to be minor, and is not uncommon (fragments are present in most made ground derived from demolition material).
- 2.12 For Site 5, no determinands were found to be above screening values in the samples of made ground/topsoil. In the cohesive made ground, there are widespread slightly elevated concentrations of PAH compounds, and localised outlier concentrations of arsenic up to (70mg/kg), and PAH compounds. In the granular made ground, outlier concentrations of arsenic are present at TP18, and lead at TP15, TP23 and WS7. Asbestos was detected by microscopy in fifteen locations on Site 5. Quantification testing showed <0.001% to 0.009% asbestos, with no potentially respirable fibres. Concentrations of vinyl chloride and trichloroethylene were found to be above the screening values at TP6. Concentrations of vinyl chloride, benzene, trichloroethylene and dibenzofuran, were found to be above the screening values in the location of TP10. These determinands have the potential to reach future occupants of the site by vapour migration, as well as by soil ingestion.
- 2.13 Leachability testing commissioned by ARP Geotechnical Ltd indicates generally negligible leachability, with the exception of locations TP40 and TP1, on Site 4 and Site 5 respectively. The VOCs at WS24, TP6 and TP10, are automatically assumed to be mobile.

### **3.0 Remediation Strategy**

- 3.1 Significant concentrations of volatile organic compounds were detected in the made ground at WS24 on Site 4 (trichloroethylene), and TP6 and TP10 on Site 5 (trichloroethylene, vinyl chloride, benzene and dibenzofuran). As these pose a threat to future occupants by migration of vapours into properties, and to controlled waters, it would be prudent to remove this material from site, to a licensed facility. It may be beneficial to sample around the affected areas on a closer grid to determine, in advance, the likely extent of the material. The relevant depth of the material is 0.2m to 0.7m in TP6, 1.6m to 2.9m in TP10, and 1.2m to 1.9m in WS24.

3.2 Where any garden or landscape areas overlie the remaining made ground, on both Site 4 and Site 5, a minimum 600mm thickness of uncontaminated soils (topsoil and subsoil) should be provided. The cover blanket should be underlain by a minimum 100mm thick hard break layer of coarse stone, or by a robust geogrid or geotextile, to prevent future occupants excavating the material. In areas of hardstanding or building footprints, the cover blanket is not required. Where used, the cover blanket should include at least 450mm thickness of material with at least 35% silt/clay content (at least 35% passing a 63 micron sieve), for example clay, sandy clay, or gravelly clay. The placement of clean soils is normally carried out as a building is nearing completion. Details are provided below.

<b>Thickness mm</b>	<b>Description</b>
Minimum 100	Topsoil
Minimum 500	Subsoil with at least 35% silt/clay content (35% passing a 63 micron sieve)
Minimum 100	Hard break layer (crushed stone) OR Robust Geotextile barrier to prevent excavation

#### **4.0 Validation**

4.1 To satisfy the Regulatory Authorities, verification that the above measures have been successfully implemented needs to be independently confirmed, in accordance with the guidance supplied in the document produced by the Yorkshire and Humberside Pollution Advisory Council (YAHPAC): "Guidance on the Verification Requirements for Cover Systems". The measures described below will be required to ensure compliance with the document.

##### Removal of Made Ground at WS24, TP6 and TP10

4.2 On completion of the removal works, the area shall be inspected and a photographic record made to confirm removal of all the affected material. In addition, samples shall be taken from the edges and base of the excavation on an appropriate spacing and tested to confirm acceptability. The disposal/transfer documents should be retained for inclusion in the Validation Report. The results, a location plan, photographs, and transfer documents, will be included in a Validation Report for submission to the regulatory authorities.

##### Cover Blanket in Garden and Landscaped Areas

4.3 Where the made ground is retained on site, then it will be necessary to take samples from one per every four plots, to confirm the required 600mm cover of uncontaminated material has been placed, and the presence of the hard break or geotextile. The trial pits will be photographed, to include a reference scale, and the photographs included within any validation report, to enable the location on site to be identified.

## 5.0 Laboratory Testing

- 5.1 For imported subsoil and topsoil used in the cover blanket, the source will need to be confirmed, and the material tested for the attached suite of contaminants, to comply with the maximum screening values listed. The frequency of testing is given on the table below.

Material Type	Number of Samples
Topsoil or subsoil from greenfield site	Minimum 3No. or 1 per 250m <sup>3</sup> (whichever is greater)
Topsoil or subsoil from brownfield site	Minimum 6No. or 1 per 100m <sup>3</sup> (whichever is greater)

- 5.2 The material should be placed in quarantined stockpiles and once a stockpile has been approved by the Engineer, no further material should be added to the stockpile, and any further import should be stockpiled separately. Any cross contamination of materials should be avoided, and further testing carried out where any cross contamination is suspected to have occurred.
- 5.3 If space is insufficient on the site to store quarantined stockpiles, cover blanket materials can be placed directly into the appropriate gardens/landscape areas, but samples of each material would need to be tested from each of the validation trial pits discussed in Section 4.3.
- 5.4 The results of all the laboratory analysis, excavation logs, plans, photographs, and import/disposal documents will form part of the Remediation Validation Report.
- 5.5 In order to enable the scheme to progress and sales of properties to continue throughout the construction of the development, interim Validation Reports may be prepared for specific plots, if required, showing how the contamination has been dealt with. This will enable enquiries during the sales of the properties to be satisfied. On completion of the development, the discharge of any associated planning condition may be achieved by submission of all the interim validation letters, or issuing the information as a single combined Validation Report.

## 6.0 Unexpected Contamination

- 6.1 Any unexpected contamination uncovered during the works shall be inspected, sampled and analysed in the laboratory for the suite of determinands appended to this Remediation Statement, and compared to the maximum concentration levels listed on the enclosure. Works on the affected materials shall cease until the appraisal is complete and, if necessary, a revised Remediation Statement is to be prepared and approved by the Planning Authority before work is recommenced.

## 7.0 Protection of Workers and the Public During Development Works

- 7.1 Damping down of the site should be implemented during dry periods, and timely placement of contaminated fill below barriers.
- 7.2 Washing facilities and a clean mess room from which work boots and overalls are excluded, should be provided.

- 7.3 Site fencing will be provided to exclude access to members of the public, and contaminated material will be contained within the site boundary, and placed below barriers as soon as possible.
- 7.4 Workers will be educated to use adequate hygiene and PPE.
- 7.5 Surface water run off should be prevented by minimising open exposure times of contaminated material and using bunds or cut off trenches as necessary.
- 7.6 Movement of contamination off site on vehicle wheels shall be minimised by cleaning of vehicle wheels and/or use of road sweeper, as required.



**ARP GEOTECHNICAL LIMITED**  
**SOIL CONTAMINANT SCREENING VALUES**  
**RESIDENTIAL WITH HOME-GROWN PRODUCE**

Determinand	S4UL (mg/kg)			C4SL (mg/kg)		
	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM
Arsenic	37			37		
Cadmium	11			22		
Chromium (trivalent)	910					
Chromium (hexavalent)	6			21		
Lead				200		
Inorganic Mercury	40					
Selenium	250					
Copper	2400					
Nickel	130					
Zinc	3700					
Acidity (pH)	*Should be Greater Than 5			*Should be Greater Than 5		
	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM
Acenaphthene	210	510	1,100			
Acenaphthylene	170	420	920			
Anthracene	2,400	5,400	11,000			
Benzo(a)anthracene	7.2	11	13			
Benzo(a)pyrene	2.2	2.7	3			5
Benzo(b)fluoranthene	2.6	3.3	3.7			
Benzo(g,h,i)perylene	320	340	350			
Benzo(k)fluoranthene	77	93	100			
Chrysene	15	22	27			
Dibenzo(a,h)anthracene	0.24	0.28	0.3			
Fluoranthene	280	560	890			
Fluorene	170	400	860			
Indeno(1,2,3-cd)pyrene	27	36	41			
Naphthalene	2.3	5.6	13			
Phenanthrene	95	220	440			
Pyrene	620	1,200	2,000			
Phenols	120	200	380			
Total TPH	*Above 500, speciate and compare with values below:					
C5 to C6 Aliphatic	42	78	160			
C6 to C8 Aliphatic	100	230	530			
C8 to C10 Aliphatic	27	65	150			
C10 to C12 Aliphatic	130	48	760			
C12 to C16 Aliphatic	1100	2,400	4,300			
C16 to C35 Aliphatic	65,000	92,000	110,000			
C35 TO C44 Aliphatic	65,000	92,000	110,000			
C5 to C7 Aromatic (Benzene)	70	140	300			
C7 to C8 Aromatic (Toluene)	130	290	660			
C8 to C10 Aromatic	34	83	190			
C10 to C12 Aromatic	74	180	380			
C12 to C16 Aromatic	140	330	660			
C16 to C21 Aromatic	260	540	930			
C21 TO C35 Aromatic	1100	1,500	1,700			
C35 TO C44 Aromatic	1100	1,500	1,700			
Asbestos	*Should be None Detected			*Should be None Detected		

\* In House Value/Approach S4UL = Suitable 4 Use Level, CIEH/LQM 2014 C4SL = Cat 4 Screening Level, DEFRA, 2014

Blank cell indicates no published value or in-house value. Some values presented are above saturation limits.

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**ARP GEOTECHNICAL LIMITED**  
**SOIL CONTAMINANT SCREENING VALUES**  
**RESIDENTIAL WITHOUT HOME-GROWN PRODUCE**

Determinand	S4UL (mg/kg)			C4SL (mg/kg)		
	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM
Arsenic	40			40		
Cadmium	85			150		
Chromium (trivalent)	910					
Chromium (hexavalent)	6			21		
Lead				310		
Inorganic Mercury	56					
Selenium	430					
Copper	7100					
Nickel	180					
Zinc	40000					
Acidity (pH)	*Should be Greater Than 5			*Should be Greater Than 5		
	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM
Acenaphthene	3000	4700	6000			
Acenaphthylene	2900	4600	6000			
Anthracene	31000	35000	37000			
Benzo(a)anthracene	11	14	15			
Benzo(a)pyrene	3.2	3.2	3.2			5.3
Benzo(b)fluoranthene	3.9	4	4			
Benzo(g,h,i)perylene	360	360	360			
Benzo(k)fluoranthene	110	110	110			
Chrysene	30	31	32			
Dibenzo(a,h)anthracene	0.31	0.32	0.32			
Fluoranthene	1500	1600	1600			
Fluorene	2800	3800	4500			
Indeno(1,2,3-cd)pyrene	45	46	46			
Naphthalene	2.3	5.6	13			
Phenanthrene	1300	1500	1500			
Pyrene	3700	3800	3800			
Phenols	440	690	1200			
Total TPH	*Above 500, speciate and compare with values below:					
C5 to C6 Aliphatic	42	78	160			
C6 to C8 Aliphatic	100	230	530			
C8 to C10 Aliphatic	27	65	150			
C10 to C12 Aliphatic	130	330	770			
C12 to C16 Aliphatic	1100	2400	4400			
C16 to C35 Aliphatic	65000	92000	110000			
C35 TO C44 Aliphatic	65000	92000	110000			
C5 to C7 Aromatic (Benzene)	370	690	1400			
C7 to C8 Aromatic (Toluene)	860	1800	3900			
C8 to C10 Aromatic	47	110	270			
C10 to C12 Aromatic	250	590	1200			
C12 to C16 Aromatic	1800	2300	2500			
C16 to C21 Aromatic	1900	1900	1900			
C21 TO C35 Aromatic	1900	1900	1900			
C35 TO C44 Aromatic	1900	1900	1900			
Asbestos	*Should be None Detected			*Should be None Detected		

\* In House Value/Approach S4UL = Suitable 4 Use Level, CIEH/LQM 2014 C4SL = Cat 4 Screening Level, DEFRA, 2014

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**ARP GEOTECHNICAL LIMITED**  
**SOIL CONTAMINANT SCREENING VALUES**  
**PUBLIC OPEN SPACE NEAR RESIDENTIAL**

Determinand	S4UL (mg/kg)			C4SL (mg/kg)		
	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM
Arsenic	79			79		
Cadmium	120			220		
Chromium (trivalent)	1500					
Chromium (hexavalent)	7.7			21		
Lead				630		
Inorganic Mercury	120					
Selenium	1100					
Copper	12000					
Nickel	230					
Zinc	81000					
Acidity (pH)	*Should be Greater Than 5					
	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM
Acenaphthene	15000	15000	15000			
Acenaphthylene	15000	15000	15000			
Anthracene	74000	74000	74000			
Benzo(a)anthracene	29	29	29			
Benzo(a)pyrene	5.7	5.7	5.7			10
Benzo(b)fluoranthene	7.1	7.2	7.2			
Benzo(g,h,i)perylene	640	640	640			
Benzo(k)fluoranthene	190	190	190			
Chrysene	57	57	57			
Dibenzo(a,h)anthracene	0.57	0.57	0.57			
Fluoranthene	3100	3100	3100			
Fluorene	9900	9900	9900			
Indeno(1,2,3-cd)pyrene	82	82	82			
Naphthalene	4900	4900	4900			
Phenanthrene	3100	3100	3100			
Pyrene	7400	7400	7400			
Phenols	440	690	1300			
Total TPH	*Above 3,800, speciate and compare with values below:					
C5 to C6 Aliphatic	570000	590000	600000			
C6 to C8 Aliphatic	600000	610000	620000			
C8 to C10 Aliphatic	13000	13000	13000			
C10 to C12 Aliphatic	13000	13000	13000			
C12 to C16 Aliphatic	13000	13000	13000			
C16 to C35 Aliphatic	250000	250000	250000			
C35 TO C44 Aliphatic	250000	250000	250000			
C5 to C7 Aromatic (Benzene)	56000	56000	56000			
C7 to C8 Aromatic (Toluene)	56000	56000	56000			
C8 to C10 Aromatic	5000	5000	5000			
C10 to C12 Aromatic	5000	5000	5000			
C12 to C16 Aromatic	5100	5100	5000			
C16 to C21 Aromatic	3800	3800	3800			
C21 TO C35 Aromatic	3800	3800	3800			
C35 TO C44 Aromatic	3800	3800	3800			
Asbestos	*Should be None Detected			*Should be None Detected		

\* In House Value/Approach S4UL = Suitable 4 Use Level, CIEH/LQM 2014 C4SL = Cat 4 Screening Level, DEFRA, 2014

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**ARP GEOTECHNICAL LIMITED**  
**SOIL CONTAMINANT SCREENING VALUES**  
**SITES FOR COMMERCIAL USE**

Determinand	S4UL (mg/kg)			C4SL (mg/kg)		
Arsenic	640			640		
Cadmium	190			410		
Chromium (trivalent)	8600					
Chromium (hexavalent)	33			49		
Lead				2300		
Inorganic Mercury	1100					
Selenium	12000					
Copper	68000					
Nickel	980					
Zinc	730000					
Acidity (pH)	*Should be Greater Than 5					
	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM
Acenaphthene	84000	97000	100000			
Acenaphthylene	83000	97000	100000			
Anthracene	520000	540000	540000			
Benzo(a)anthracene	170	170	180			
Benzo(a)pyrene	35	35	36			77
Benzo(b)fluoranthene	44	44	45			
Benzo(g,h,i)perylene	3900	4000	4000			
Benzo(k)fluoranthene	1200	1200	1200			
Chrysene	350	350	350			
Dibenzo(a,h)anthracene	3.5	3.6	3.6			
Fluoranthene	2300	2300	2300			
Fluorene	63000	68000	71000			
Indeno(1,2,3-cd)pyrene	500	510	510			
Naphthalene	190	460	1100			
Phenanthrene	22000	22000	23000			
Pyrene	54000	54000	54000			
Phenols	440	690	1300			
Total TPH	*Above 2000, speciate and compare with values below:					
C5 to C6 Aliphatic	3200	5900	12000			
C6 to C8 Aliphatic	7800	17000	40000			
C8 to C10 Aliphatic	2000	4800	11000			
C10 to C12 Aliphatic	9700	23000	47000			
C12 to C16 Aliphatic	59000	82000	90000			
C16 to C35 Aliphatic	1600000	1700000	1800000			
C35 TO C44 Aliphatic	1600000	1700000	1800000			
C5 to C7 Aromatic (Benzene)	26000	46000	86000			
C7 to C8 Aromatic (Toluene)	56000	110000	180000			
C8 to C10 Aromatic	3500	8100	17000			
C10 to C12 Aromatic	16000	28000	34000			
C12 to C16 Aromatic	36000	37000	38000			
C16 to C21 Aromatic	28000	28000	28000			
C21 TO C35 Aromatic	28000	28000	28000			
C35 TO C44 Aromatic	28000	28000	28000			
Asbestos	*Should be None Detected			*Should be None Detected		

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## ARP GEOTECHNICAL LTD

### CONTROLLED WATERS SCREENING VALUES

<b>Determinand</b>	<b>Screening Value for Potable Use * (µg/l)</b>	<b>Screening Value for Environment # (µg/l)</b>
Arsenic	10	50
Boron	1000	2000
Cadmium	5	0.08-0.25
Chromium (total)	50	4.7
Copper	2000	1-28
Lead	10	7.2
Mercury	1	0.05
Selenium	10	-
Nickel	20	20
Zinc	5000	8-125
Sulphate	250,000	400,000
pH	6.5-10	6-9
Anthracene	-	0.1
Benzo(a)pyrene	0.01	0.05
Benzo(b)fluoranthene	Sum (4) <0.1	Sum (2) <0.03
Benzo(k)fluoranthene		Sum (2) <0.002
Benzo(g,h,i)perylene		
Indeno(1,2,3-c,d)pyrene		
Fluoranthene	-	0.1
Naphthalene	-	2.4
Phenols	0.5 (BWR)	7.7
Benzene	1	10
Toluene	700 (WHO)	50
Ethylbenzene	300 (WHO)	-
Xylene	30 (WHO)	30
Total TPH	-	200 (SWAD)

JUNE 2014

Sources, unless indicated otherwise above:

\* = UK Drinking Water Standards (DWS)

# = Environmental Quality Standards (EQS), hardness dependent where range shown.

WHO = World Health Organisation Drinking Water

BWR = Bathing Water (Classification) Regulations 1991

SWAD = Surface Water (Abstraction for Drinking Water) (Classification) Regulations 1996