

A photograph of a cross-section of a stream bed, showing a mix of green moss, brown soil, and grey rocks. The text "Geoenvironmental Appraisal" is overlaid in white.

Geoenvironmental Appraisal

Land at Merchant Fields, Cleckheaton For Harron Homes

Report no: 2828/1A

Date: July 2019



SUMMARY OF GEOENVIRONMENTAL ISSUES

Job No.	2828	Site area/ha	12.1 ha (29.7 acres)
Client:	Harron Homes	NGR:	SE 190 264
Site:	Merchant Fields, Cleckheaton	Nearest postcode:	BD19 4ED

The site is located off Kilroyd Drive, approximately 1.2km north of Cleckheaton town centre, and currently comprises series of rough grassed fields separated by hedgerows, with the north sloping down to the east, and the centre and south sloping down to the south at about 1 in 10 (locally up to 1 in 8). The majority of the site has remained undeveloped although Merchant Fields Colliery was located in the far east in the late 1800s, and a tennis court was present in the north between 1932 and 1957.

Lithos were commissioned by Harron to provide a geoenvironmental appraisal of the site, which it is understood is to be redeveloped with 307 traditional two storey domestic dwellings, associated gardens, POS and adoptable roads and sewers. Lithos' investigation included a review of 3rd party reports, the site's history and environmental setting, and a ground investigation comprising 57 trial pits and 20 'deep' rotary open probeholes, with a further 19 shallow probeholes to install monitoring wells.

A summary of salient geoenvironmental issues is provided in the table below.

Issue	Remarks
Made ground	Encountered in 3 of 57 trial pits, typically to shallow depth (c. 0.4m) comprising Granular Made Ground and Reworked Natural Ground. Locally in the far east deeper made ground was encountered 'mounded' above the area of known mine shafts. A relict wall and foundation were encountered in the far east (TP38) to 0.6m depth in the vicinity of former cottages.
Natural ground	Topsoil (typically 300mm in thickness), over Cohesive Residual Soil (firm to stiff gravelly clay) to between 0.6m and 3.5m depth (typically 1.7m) underlain by Granular Residual Soil (clayey gravel). Coal Measures bedrock was encountered in the majority of trial pits from between 1.1m and 3.5m depth (average 2.2m) and typically comprised moderately weak to medium strong sandstone, locally siltstone. Coal or weathered coal was encountered in 10 of the 57 trial pits in in the north and centre (Wheatley Lime Coal) and far south (Middleton 11 Yard Coal).
Mining & quarrying	Shallow mineworking have been identified in the far west in the Middleton 11 Yard Coal. The coal appears to be laterally discontinuous, likely due to packed former mineworkings. No mineworkings have been identified in the Wheatley Lime Coal, but this seam underlies c. 40% of the site at very shallow depth <10m and is typically c. 1m thick. Mitigation against the risk of subsidence associated with shallow mineworkings in the Middleton 11 Yard Coal will be required in the west, and within the Blocking Coal in the south, likely via drilling and grouting. In addition, proof drilling of plots and highways will be required in areas underlain by suspected 'packed workings' within the Middleton 11 Yard Coal (majority of site). Of the 4 known mine entries situated on site, 3 in the east associated with the former Merchant Fields Colliery have been located and surveyed in. The single mine entry in the far west has not been located following topsoil stripping. The possibility of further unrecorded shafts/bell pits cannot be discounted. It is understood a Carlow tank is to be placed in the far east above known shafts. Liaison with the CA and tank manufacturer is recommended at the earliest opportunity to confirm this is possible.
Contamination	Testing suggests the topsoil is chemically suitable for re-use. Made ground encountered in the far east of the site (former Merchant Fields Colliery) has yielded elevated concentrations of inorganic determinands and CVs. An underground attenuation tank is proposed here. Made ground should be excavated and stockpiled during excavation of the tank, subsequently being replaced and isolated beneath 500mm thick surface cover of "clean" soil, or placed beneath areas of hardstanding. Material excavated from areas of burnt ground should be redistributed beneath concrete oversite or areas of hardstanding, or disposed of offsite.
Hazardous gas	The site is in an area where less than 1% of homes are estimated to be above the radon action level. Shallow coal and mineworkings underlie the site and an area of landfilling is located 230m northwest. Consequently, gas monitoring is currently underway to determine whether special precautions against hazardous gas are required.
Preparatory works	Topsoil strip and stockpile. Surface scrape and stockpiling of areas of burnt material for subsequent isolation or disposal offsite. Treatment of mine entries in accordance with an approved Specification.

This brief summary should not be assumed to represent a complete account of all the potential geo-environmental issues that may exist at the site. As such it is strongly recommended that the report be read in its entirety.

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Client:	Harron Homes	NGR:	SE 190 264
Site:	Merchant Fields, Cleckheaton	Nearest postcode:	BD19 4ED

Issue	Remarks
Foundations	All plots will be founded on traditional strip/trench-fill footings at a minimum depth of 0.9m depth in Cohesive Residual Soil, overdeepened where necessary due to the influence of trees, and 0.6m in Granular Residual Soil. For plots which overly areas of treated mineworkings, reinforcement of foundations (or possibly rafts) will be required, in accordance with NHBC Standards.
Groundwater & excavations	Groundwater was encountered as seepages or inflows in approximately half of the exploratory holes. Subsequent monitoring indicates groundwater lies at between 1.3m and 4.8m bgl. Shallow excavations should remain stable during the construction phase in the short term.
Flooding & drainage	The site lies in Flood Zone 1, where the risk of flooding from rivers or the sea is classified as low. Based on observations made during the investigation, soakaways are unlikely to provide a suitable drainage solution for surface water run-off at the site. Consequently, it will be necessary to consider alternative sustainable drainage systems (SUDS), and there may be a need for surface water balancing.
Highways	Based on visual inspection of the shallow natural materials and published guidance, the Cohesive Residual Soils should provide a CBR value of at least 3%. This value should be verified prior to or during construction.

Significant developer abnormals relating to geoenvironmental issues at the site are:

- Requirement for consolidation of shallow mineworkings
- The presence of 4 mine entries on site (3 of which have been located)
- Topography will necessitate significant earthworks

Consideration should be given to a geophysical survey given the risk of bell pitting

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APPENDICES

Appendix A - General notes

01	Environmental setting
02	Ground investigation fieldwork
03	Geotechnical testing
04	Contamination laboratory analysis & interpretation
05	Hazardous gas

Appendix B - Drawings

Drawing	Revision	Title
2828/1	-	Site location plan
2828/2	-	Proposed site layout
2828/3	-	Site features
2828/4A	-	Site photographs – general
2828/4B	-	Site photographs – detailed
2828/5	-	Preliminary conceptual site model
2828/6	-	Exploratory hole locations
2828/7	-	Revised conceptual site model
2828/8	-	Geology & Coal Authority data
2828/9	-	Blocking Coal abandonment plan
2828/10A	-	Shaft locations & photographs
2828/10B	-	Shaft search & photographs
2828/11	-	Mining investigation results & Section Lines 1 to 4
2828/12	-	Approximate ('worst-case') areas requiring grouting

Appendix C - Commission

Appendix D - Historical OS plans#

Appendix E - Search responses#

From	Date	Content
Landmark	6 th November 2015	Environmental search data
Coal Authority	6 th November 2015	Mining report
	5 th March 2019	Mine entry data sheets
	19 th March 2019	Abandonment plans

Appendix F to G - Exploratory records

Appendix F	TP01 to TP57
Appendix G	PH01 to PH20, PH01A to PH06A, PH08A to PH20A

Appendix H - Chemical test results

Appendix I - Geotechnical test results

Appendix J - Gas monitoring results

Some of this data is not included within the paper or PDF copies of this report; by request, it can be provided on a CD.

FOREWORD (geoenvironmental appraisal report)

This report has been prepared for the sole internal use and reliance of the Client named on page 1. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Lithos Consulting Limited (Lithos); such authorisation not to be unreasonably withheld. If any unauthorised third party comes into possession of this report, they rely on it at their peril and the authors owe them no duty of care and skill.

This report has been reviewed by a Competent Person, as defined in the National Planning Policy Framework. We ensure that all projects are managed by individuals with necessary experience, relevant qualifications, and current membership of a relevant professional organisation. Records of engineers, project managers and reviewers involved in this project are maintained by us. Lithos QA/QC procedures for all our work forms an integral part of our ISO9001 accreditation and as such is regularly audited.

The report presents observations and factual data obtained during our site investigation and provides an assessment of geoenvironmental issues with respect to information provided by the Client regarding the proposed development. Further advice should be sought from Lithos prior to significant revision of the development proposals.

The report should be read in its entirety, including all associated drawings and appendices. Lithos cannot be held responsible for any misinterpretations arising from the use of extracts that are taken out of context. However, it should be noted that in order to keep the number of sheets of paper in the hard copy to a minimum, some information (e.g. full copy of the Landmark/Groundsure Report) is not included in the pdf, by request, it can be provided on a CD.

The findings and opinions conveyed in this report (including review of any third-party reports) are based on information obtained from a variety of sources as detailed within this report, and which Lithos believes are reliable. Reasonable care and skill has been applied in examining the information obtained. Nevertheless, Lithos cannot and does not guarantee the authenticity or reliability of the information it has relied upon.

The report represents the findings and opinions of experienced geoenvironmental consultants. Lithos does not provide legal advice and the advice of lawyers may also be required.

Intrusive investigation can only investigate shallow ground beneath a small proportion of the total site area. It is possible therefore that the intrusive investigation undertaken by Lithos, whilst fully appropriate, may not have encountered all significant subsurface conditions. Consequently, no liability can be accepted for conditions not revealed by the exploratory holes. Any opinion expressed as to the possible configuration of strata between or below exploratory holes is for guidance only and no responsibility is accepted as to its accuracy

It should be borne in mind that the timescale over which the investigation was undertaken may not allow the establishment of equilibrium groundwater levels. Particularly relevant in this context is that groundwater levels are susceptible to seasonal and other variations and may be higher during wetter periods than those encountered during this commission.

Where the report refers to the potential presence of invasive weeds such as Japanese Knotweed, or the presence of asbestos containing materials, it should be noted that the observations are for information only and should be verified by a suitably qualified expert.

This report assumes that ground levels will not change significantly from those existing at present and that houses will be of two storey construction. If this is not to be the case, then some modification to this report may be required.

Lithos cannot be responsible for the consequences of changing practices, revisions to waste management legislation etc that may affect the viability of proposed remediation options.

Lithos reserve the right to amend their conclusions and recommendations in the light of further information that may become available.

GEOENVIRONMENTAL APPRAISAL
of land at
MERCHANT FIELDS, CLECKHEATON

1 INTRODUCTION

1.1 The commission and brief

- 1.1.1 Lithos Consulting Limited were commissioned by Harron Homes to carry out a geoenvironmental appraisal of land at Merchant Fields, Cleckheaton.
- 1.1.2 This document is a revision of the Geoenvironmental Appraisal (Report 2828/1) issued by Lithos in April 2019; Report 2828/1 is superseded. This document now includes the findings of supplementary rotary drilling undertaken at the site, with the only significant revisions to 2828/1 having been made in Sections 4.3, 8.6, 8.8, 11.3 & 13.2 and to Drawings 2828/6, 2828/11 and 2828/13 as well as Section Lines 1 to 4.
- 1.1.3 Correspondence regarding Lithos' appointment, including the brief for this investigation, is included in Appendix C. The agreed scope of works included:
- A review of third party reports
 - A site walkover and inspection
 - An assessment of the land use history & determination of the site's environmental setting
 - A mining risk assessment in accordance with Coal Authority guidance.
 - An intrusive ground investigation comprising 57 trial pits, 4 areas of topsoil stripping (shaft search), 49 'deep' rotary open probeholes and a further 19 shallow probeholes to install monitoring wells
 - Assessment of the geotechnical properties of the near surface deposits to enable provision of foundation and highway recommendations
 - A qualitative assessment of contamination risks
 - Recommendations for the necessary site preparatory and remediation works
- 1.1.4 Primary aims of this investigation were to identify salient geoenvironmental issues affecting the site to support the submission of a planning application, and also to enable Harron to obtain budget costs for: foundations; gas protection measures; and site preparatory and remediation works.

1.2 The proposed development

- 1.2.1 It is understood that consideration is being given to redevelopment of the site with 307 traditional two storey domestic dwellings, associated gardens, POS and adoptable roads and sewers. A site layout has been provided by Harron (Drawing reference 122-10-SK-10, dated November 2018) which is reproduced as Drawing 2828/2 in Appendix B to this report.

1.3 Report format and limitations

- 1.3.1 All standard definitions, procedures and guidance are contained within Appendix A, which includes background, generic information on:
- Assessment of the site's environmental setting
 - Ground investigation fieldwork
 - Geotechnical testing
 - Contamination testing
 - Hazardous gas

- 1.3.2 General notes and limitations relevant to all Lithos geoenvironmental investigations are described in the Foreword and should be read in conjunction with this report. The text of the report draws specific attention to any modification to these procedures and to any other special techniques employed.
- 1.3.3 In accordance with the agreed scope of works, the ground investigation reported here is not fully compliant with Eurocode 7 (EC7) and this report does not purport to be a Ground Investigation Report, nor a Geotechnical Design Report as defined by EC7. The ground appraisal, parametric assessment and preliminary design guidance presented are intended to assist others as they prepare the design of the proposed works.

2 SITE DESCRIPTION

2.1 General

- 2.1.1 The site's location is shown on Drawing 2828/1 presented in Appendix B to this report. Site details are summarised in the table below.

Detail	Remarks
Location	1.2 km north of Cleckheaton town centre
NGR	SE 190 264
Approximate area	12.1ha (29.7 acres)
Known services	Underground electric, gas, sewer & water Overhead electric & telecoms

2.2 Site features

- 2.2.1 Lithos completed a walkover survey of the site on 4th March 2019.
- 2.2.2 Existing salient features, at the time of the walkover are presented on Drawing 2828/3 in Appendix B to this report and summarised in the table below. A selection of site photographs is included on Drawings 2828/4A and 2828/4B.

Feature	Remarks
Current Access	Off Kilroyd Drive
Topography	The north slopes down to the east at c. 1 in 12 The centre slopes down to the southwest and southeast at up to 1 in 8 A steep slope (c. 1 in 5) is located close to the southwest boundary
Approximate areas	700m ² tarmac hardstand 11,200m ² grass 100m ² watercourse (Nann Hall Beck)
Nature of boundaries	Mixture of fencing types, stone walls and hedgerows; no physical boundary in some locations
Surrounding land uses	North – Housing off Kilroyd Avenue & Mazebrook Crescent East – Open fields and housing off Brookfield View South – Housing off Kestrel View Southwest – Industrial units West – Hunsworth Lane and Links Avenue with housing beyond

- 2.2.3 The site can be accessed off Kilroyd Drive in the north via a tarmac access track and comprises a series of rough grassed fields separated by hedgerows. Alternative access can be found in the far east off Brookfield View via a makeshift barrier of scaffold tubes and plyboard.

- 2.2.4 The north slopes down to the east at about 1 in 12 towards Nann Hall Beck, and the centre and south slope down to the south at about 1 in 10 (locally up to 1 in 8). The central-west is relatively flat. Towards the southwest boundary the slope becomes steeper at c. 1 in 5.
- 2.2.5 The northeast field is accessed through a locked gate, off the tarmac access track, and is approximately 1.0m lower than the adjacent track. At the time of the walkover the field was being used to keep horses. A public footpath runs north-south in the east of the field beyond which Nann Hall Beck flows south along the field's eastern boundary. A small footbridge crosses the beck in the far northeast corner.
- 2.2.6 The northwest, west and southwest fields are accessed off the access track via a small slope and were vacant at the time of the walkover. A number of roughly circular burn patches were noted, indicating recent fires. Hedgerows separating the fields appear to have been recently cut and were approximately 1.0m in height. An area in the far west of the south-western field appears to have been recently cleared of vegetation, with only small stumps remaining.
- 2.2.7 The south-eastern field can be accessed off Brookfield View on the eastern boundary and was being used to keep horses. An area of land in the northeast of this field appears to have been raised creating a small mound approximately 1.5m high. The area of land surrounding the mound appears to have previously been densely vegetated which has recently been cleared.
- 2.2.8 The southern fields are separated by an unmade track running north-south. Either side of the track is lined by hedgerow/trees which appear to have been recently cut to approximately 1.0m in height.
- 2.2.9 At the time of the walkover the site was dry and ground underfoot appeared good. However, after a period of heavy rain (immediately prior to fieldwork) vast areas of boggy ground and standing water were noted in the northwest and northeast fields. Additionally, a ditch adjacent to the unmade track in the south contained flowing water following the rainfall.
- 2.2.10 Overhead electric cables (11kVa) run adjacent to the tarmac access track in the north and overhead electric (low voltage) and telecom cables cross the western field northwest-southeast supplying adjacent residential properties. Both sets of overhead cables are supported by wooden pylons

3 SITE HISTORY

- 3.1 Site centred extracts from Ordnance Survey (OS) plans dating back to 1854 have been examined. Some of these plans are presented in Appendix D to this report.
- 3.2 The table below provides a summary of the salient points relating to the history of the site. It is not the intention of this report to describe in detail all the changes that have occurred on or adjacent to the site. Significant former uses/operations are highlighted in **bold** text for ease of reference.

Date	Site	Surrounding land
1854	Site labelled Merchant Fields comprising open fields with track running northeast-southwest in centre south Nann Hall Beck in far northeast Coal Pit on far west boundary	Merchant House immediately east Balme Mill Lane on southwest boundary and Hunsworth Lane on western boundary Spen River c. 50m southwest Cleckheaton town c. 600m south
1894	Colliery with small buildings, two shafts and a spoil heap in far east Track orientated north-south crosses centre north of site from Merchant Fields Farm	Merchant House relabelled Merchant Fields Farm Weir shown on northeast boundary Mill Pond and Balme Mill immediately south Brookhouse Ironworks 70m southeast Spen river channel straightened with several mill buildings to the south Houses shown 50m west Cleckheaton Colliery with associated shafts, buildings and spoil heaps 250m northwest
1907	Colliery and shafts no longer shown; some small buildings on eastern boundary remain	Cleckheaton Colliery shown to be disused
1922	No significant changes	Additional mill buildings shown to the north of Spen River immediately beyond southwest boundary
1932	Cricket Ground shown in centre north	No significant changes
1938	Tennis courts and Pavilion shown in centre north	Housing shown immediately beyond southeast and northwest boundaries Ironworks to the southeast relabelled mills Excavations and Old Quarry shown 100m east beyond Nann Hall Beck Spen River culverted beneath mill buildings to the southwest
1957	Small buildings on eastern boundary labelled Merchant Fields Cottages Cricket ground/tennis courts no longer shown	Old quarry to the east no longer shown
1958	No significant changes	Major expansion of mill buildings to the southwest Mill pond no longer labelled; replaced by marshland Shafts no longer shown at former Cleckheaton Colliery
1963		Housing shown immediately north
1972		Plant Hire Depot and warehouse shown on former Cleckheaton Colliery; spoil heaps no longer shown
1984	Merchant Fields Cottages no longer shown in east	No significant changes
1992	No significant changes	Mill buildings to the southwest no longer shown
2015		Industrial units beyond southwest boundary Houses shown immediately south in footprint of former mill pond

- 3.3 The shafts at Merchant Fields Colliery were sunk between 1873 and 1878 with operations at the colliery running until 1892.

4 ENVIRONMENTAL SETTING

4.1 General

- 4.1.1 Notes describing how the site's environmental setting has been assessed are included in Appendix A to this report. Extracts from the response received from Landmark, and response from the Coal Authority are presented in Appendix E. These responses are summarised below, together with the findings of our own "desk study" investigation.

Issue	Data reviewed	Summary
Geology	1:50,000 BGS map (Sheet 77) 1:10,000 BGS map (Sheet SE12NE)	Made Ground is mapped in the far east (former colliery). Drift – none mapped. Solid – Pennine Lower Coal Measures Formation (sandstone in the north and south, with mudstone, siltstone and sandstone in the centre). Shallowest coal seam – Wheatley Lime Coal outcrops onsite. See further details in Section 4.3 below. Strata dip - unknown. Faults – Northeast-southwest trending fault in far northeast.
Mining	Coal Authority	The majority of this site is located within a Coal Mining Development High Risk Area. Further details in Section 4.3 below.
Quarrying	Historical OS plans	No known quarries on or within 50m.
Radon	Public Health England	The site lies in an area where less than 1% of homes are estimated to be above the action level.
Hydrogeology	Environment Agency	Groundwater Source Protection Zone? No. Aquifer Secondary A (Solid). Groundwater abstractions? Borehole abstraction 510 west operated by Metrotect Ltd for use in chemicals industry. Soil leaching potential – Majority of site is Low, High in the far west. Pollution incidents? Category 3 (minor) incident 415m west with oil entering groundwater leading to the pollution of a tributary of Spen River.
Hydrology	Environment Agency Envirocheck Report	Nearest watercourse(s) – Nann Hall Beck on northeast boundary flowing south towards Spen River. Water quality – Site located within Spen Beck from Source to River Calder catchment area currently rated as ecologically moderate and chemically good. Pollution incidents? Category 1 (major) incident 70m west with mud/clay/soil entering Spen River. Abstractions? None recorded within 1000m. Discharge consents? Nearest consent 95m west with sewage discharges (storm water overflow) entering Spen River.
Flood risk	Environment Agency	The site lies in Flood Zone 1, where the risk of flooding from rivers or the sea is classified as low. In accordance with Chapter 10 of the National Planning Policy Framework, a site-specific flood risk assessment is required for proposals of 1 hectare or greater in Flood Zone 1, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the Environment Agency).

4.2 Landfills

- 4.2.1 Known or suspected areas of landfill in the vicinity of the proposed development site are summarised below:

Location	NGR (proximity to site)	Remarks	Source of data
Land off Whitehall Road	SE 186 267 (230m northwest)	Operated between 1979 and 1994 by Hunsworth Dying Co Ltd Accepted Industrial, Non-hazardous and Inert wastes and industrial effluent treatment sludge Currently used as warehousing and offices	EA Envirocheck Report

- 4.2.2 In addition to the above, a former mill pond was situated immediately south which was shown until 1958 after which it was shown to be marshland. This area was subsequently built on between 1995 and 2015.
- 4.2.3 A former quarry is also shown on historical OS plans 100m east from the late 1930s, no longer shown (likely backfilled) by 1957 (see Section 3).

4.3 Coal & mining

- 4.3.1 In July 2011 the Coal Authority (CA) formalised their requirements in relation to planning applications and introduced some new terminology relating to coal mining development areas. This Section (and Section 8.8) provides the necessary mining risk assessment required by the proposed planning application.
- 4.3.2 Coal has been mined in Yorkshire for centuries; the first mining probably took place in the fifteenth century. Early mining methods included drifts or adits from outcrop. Where mining extended further from the crop, bell pits were often sunk, and as the coal got deeper still, shafts were used to access gallery workings (pillar & stall).
- 4.3.3 The shafts associated with bell pits are typically only about 1.2m in diameter, and the bell pit itself was typically 5m to 10m in diameter (bell pit size would have been constrained by roof stability). Consequently, bell pits are often closely spaced; the most intensive concentration of shafts recorded to date (66 per acre) was at the Middleton Broom Opencast site.
- 4.3.4 As coal was removed during bell pitting, the unsupported strata above formed a bee-hive shape around the base of the shaft which forms the characteristic vertical section. The depth limit of bell pit mining is almost certainly 15m, and this is considered a deep bell pit; the vast majority were probably less than half this depth.
- 4.3.5 At greater depths, pillar and stall workings appear to have been the preferred method, and such workings were often accessed via a single shaft. Consequently, shafts associated with such workings are more widely spaced; but rarely exceeded one quarter of a mile (400m) shaft to shaft, due to problems with ventilation and underground haulage. It was customary to view the life expectancy of an individual pit as about three to five years and at any one time several new pits would be sinking to replace those currently operating.

- 4.3.6 Up until the last decades of the eighteenth century, coal mining almost always represented a short-term interruption to ongoing use of land for agricultural. The right to sink shafts and extract coal was usually conditional upon restoration of the surface after coal extraction was complete. This not only involved filling the shaft, but also required that any subsequent settlement of shaft fill material did not result in depressions in the field surface. Consequently, it was usual to fill the shaft and heap excess arisings into a dome over the shaft eye. Over subsequent years, the dome supplied material to compensate for settlement of the shaft fill. In the normal course of events, at the conclusion of the recovery period, any remaining spoil accumulations above ground level would have been planed off to leave a relatively stable, level surface where the shaft had been.
- 4.3.7 In general plan, gallery workings consisted of a series of parallel, rectangular working chambers separated by long piers or pillars of coal, colloquially referred to as benks or banks. The major axis of the galleries was generally up the dip although strike working was not uncommon.
- 4.3.8 Although the broad direction of the stalls was adhered to, there tended to be considerable wandering in the alignment of the pillars, which followed the natural partings provided by the cleat of the coal. There is no sense of the disciplined influence of a surveyed pre-plan, but rather it would appear that the skill of individual miners conditioned the degree to which the workings approached formal regularity. The fact that some pillars drifted into adjacent stalls implies a lack of formal control of progress. It may be that the intermittent cross headings that penetrated laterally through the pillars were intended to provide a check upon the extent to which parallel headings were being preserved.
- 4.3.9 Usually, the length of the stall extended for up to 10m but some were extremely attenuated, occasionally running uninterrupted for 15m or more. There was considerable variation in the width of the stalls, ranging between 2m and 6m and an even more noticeable variation in the width of the pillars. The most substantial pillars were about 2.5m in width but many were reduced to less than 0.5m in width. It is possible that this reduction in pillar width was a result of robbing.
- 4.3.10 Timber props supported the roof where the stall span was greater than about 2m. Prop withdrawal on closure of a mine does not seem to have been prevalent.
- 4.3.11 From the late 18th century onwards, packing of mineworkings became common practice. Packing of workings (known as 'goaf' packing) was done using unwanted materials associated with mining of the target seam (e.g. dirt partings, dark mudstone, clay, poor quality coal etc). This material was then 'packed' by hand into the stalls (voids) from which the coal had been removed, as mining of 'fresh' coal progressed.
- 4.3.12 As mining continued, the 'roof' of the stall often lost support and would sag/subside, coming to rest on, and compressing, the packed material. This process was done systematically, meaning that the vast majority (if not all) of the stalls were fully packed come the end of mining. However, a small area around the shaft (also known as a 'shaft porch'), tramways and waterways (used to drain workings towards a pumping shaft) would not be packed. Tramways and waterways are linear and of limited width (unlike 'open' stalls), making them very difficult to target during an intrusive investigation.
- 4.3.13 Compression of the packed materials, and the fact that they comprise re-worked Coal Measures rock, make such former mineworkings very difficult to identify in rotary open probholes (and possibly even in a cored boreholes).
- 4.3.14 The majority of the site is located within a Coal Mining Development High Risk Area - an area with specific mining legacy risks to the surface, including mine entries; shallow coal workings etc)

- 4.3.15 Geological maps suggest that 4 coal seams underlie the site at shallow depth, all dipping northwest. These are the:
- Wheatley Lime Coal (up to 1.1m thick) outcropping in the centre and north,
 - Middleton 11 Yard Coal (about 0.3m thick) at c. 10m below the Wheatley Lime
 - Blocking Rider Coal, a thin (0.1m) seam, at c. 26m below the Wheatley Lime, and
 - Blocking (Silkstone) Coal (0.5m to 0.8m thick), at c. 33m below the Wheatley Lime
- 4.3.16 The approximate outcrop of the Wheatley Lime is shown on Drawing 2828/8.
- 4.3.17 Given dip and topography, the Wheatley Lime seam is expected to underlie an area of about 5.0ha in the north and west. The other 3 seams are expected to underlie the entire site. No further significant seams underlie the Blocking Coal within 25m.
- 4.3.18 It should be noted that seam outcrops plotted on geological maps have been known to be inaccurate by distances in excess of 100m.
- 4.3.19 The BGS memoir for Sheet 77 indicates the Wheatley Lime Coal has been mined across the wider Huddersfield and Halifax area via shallow workings and "day-eyes" (also known as an adit). However, given its high ash content is also known as the 'Mucky Bed Coal' and therefore may be of inferior quality.
- 4.3.20 Limited detail regarding the Middleton 11 Yard coal is available in the memoir, with no record of underground workings. However, at Gomersal (1km east) the coal is recorded as having a thickness of c. 1.6m and comprised:
- Coal smut – 3 in. (8cm)
 - Spavin and ironstones – 33 in. (84cm)
 - **Coal** – 3.5 in. (9cm)
 - Soft white earth – 9 in. (23cm)
 - Dirt – 10 in. (25cm)
 - **Coal** – 3 in. (8cm)
- 4.3.21 The Blocking Coal has been extensively mined across the wider area for household and engine purposes. The memoir states that in the Cleckheaton area, the coal is made up of: "clod" [seatearth] 8 in, top coal 13in, muck 1 in, middle coal 7in, muck 1 in, bottom coal 10 in." This equates to a total thickness of c. 1m, slightly thicker than the maximum thickness of 0.8m stated on the BGS plan.
- 4.3.22 A CA mining report states that:
- *The property is in the likely zone of influence from workings in 4 seams of coal at shallow to 170m depth, and last worked in 1970. The shallow depth relates to seams at less than 30m depth and probably refers to the Blocking Coal and possibly Wheatley Lime Coal.*
 - *The property is not in the likely zone of influence of any present underground coal workings.*
 - *The property is not in an area for which the Coal Authority are determining whether to grant a licence to remove coal using underground methods.*
 - *The property is not in an area that is likely to be affected at the surface from any planned future workings.*
 - *Within, or within 20m, of the boundary of the property there are 4 mine entries. These are shown on Drawing 2828/8; three are in the far east and one is in the far west.*
 - *The Authority is not aware of any evidence of damage arising due to geological faults or other lines of weakness that have been affected by coal mining.*

- The property is not within the boundary of an opencast site, or within 800m of the boundary of an opencast site for which the Coal Authority is determining whether to grant a licence to remove coal by opencast methods.
- The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50m.
- There is no record of a mines gas emission requiring action.
- The property is in an area for which notices of entitlement to withdraw support were published in 1951 & 1954.

- 4.3.23 UK Coal generally work on a five-year rolling plan updated annually in March/April. However, following closure of the Yorkshire coalfield there is no current 5 year plan with respect to coal beneath the proposed development, and it considered extremely unlikely that coal will be extracted from beneath the site in the foreseeable future.
- 4.3.24 It is our understanding that if a new colliery were ever opened, and mining were to proceed in the future, then UK Coal/The Coal Authority would be liable for damage claims arising from future mining beneath the site.
- 4.3.25 Immediately prior to development it would be prudent to check the above with UK Coal, but risks appear negligible.
- 4.3.26 Abandonment plans have been obtained from the Coal Authority for the Blocking Coal which shows recorded workings beneath approximately 65% of the site area in the centre, east and north.
- 4.3.27 The workings are dated between April 1875 and November 1892. No depths are recorded, although Shaft 419426-005 is recorded as 24 yards (c. 22m) deep which may give an indication of depth of workings in that area.
- 4.3.28 The Coal Authority has records for 4 known mine entries on site, as detailed below. However, there are no further details regarding shaft diameter or treatment (e.g. filling/capping).

Shaft Ref	Depth (m)	Details	Coordinates	Source
419426-001	21.9	Merchant Fields Colliery ventilation shaft	419078E, 426357N	Abandonment plans
419426-002	21.9	Merchant Fields Colliery pumping shaft	419111E, 426363N	Abandonment plans
419426-005	19.0	Merchant Fields Colliery winding pit	419092E, 426348N	Abandonment plans
418426-008	Unknown	Unknown – likely associated with Coal Pit on 1854 OS map	418795E, 426470N	Geological plan

- 4.3.29 All 3 shafts associated with Merchant Fields Colliery are around 20m and all are shown on an abandonment plan for the Blocking coal suggesting that was their 'target seam'.
- 4.3.30 It is worth noting that CA shaft positions are often only approximate, and in some cases the same shaft has been recorded in multiple locations, or some other feature such as a chimney has erroneously been recorded as a shaft.
- 4.3.31 Given the depths of Shafts 001, 002 & 005 (c. 20m), they were most likely sunk to target the Blocking Coal seam.

4.4 Mineral safeguarded areas

- 4.4.1 The site is underlain by coal and might therefore be considered by the Local Authority to lie within a Mineral Safeguarding Area (MSA).
- 4.4.2 MSAs are areas of known mineral resources that are of sufficient economic or conservation value to warrant protection for generations to come. The purpose of MSAs is not to preclude automatically other forms of development, but to make sure that mineral resources are adequately and effectively considered in land-use planning decisions.
- 4.4.3 Specialist guidance on Mineral Safeguarding "A Guide to Mineral Safeguarding in England" has been produced by The Coal Authority and the British Geological Survey.
- 4.4.4 Paragraph 204 of the National Planning Policy Framework (NPPF) requires Local Authorities, when preparing Local Plans to:
- Define Minerals Safeguarding Areas and adopt appropriate policies in order that known locations of specific minerals resources of local and national importance are not needlessly sterilised by non-mineral development, whilst not creating a presumption that resources defined will be worked; and define Minerals Consultation Areas based on these Minerals Safeguarding Areas.
 - Set out policies to encourage the prior extraction of minerals, where practicable and environmentally feasible, if it is necessary for non-mineral development to take place.
- 4.4.5 NPPF Paragraph 144 notes that when determining planning applications, local planning authorities should give weight to the benefits of the mineral extraction.
- 4.4.6 As a consequence of the NPPF, and the presence of coal beneath the site, the Local Authority may require Harron to consider the opportunity to recover (extract) the coal. Applicants submitting planning applications may need to demonstrate to the Local Authority that they will extract the coal, unless:
- It can be shown it is not economically viable to do so, or
 - It is not environmentally acceptable to do so, or
 - The need for the development outweighs the need to extract the coal, or
 - The coal will not be sterilised by the development
- 4.4.7 The viability of coal extraction at this site is considered later in this Report (Section 14.7) in light of the findings of Lithos' intrusive mining investigation, which comprised the drilling of 20 rotary probeholes to depths of between 6.0m and 45.0m (see Section 8.8).

5 PREVIOUS INVESTIGATION FINDINGS

5.1 General

- 5.1.1 Harron have provided Lithos with a copy of the following report: Stage 1 Desk Study Report at Kilroyd Avenue, Cleckheaton (Ref. HHO/08r1), issued by ARP Geotechnical Ltd in November 2015.
- 5.1.2 The report includes a review of data from a Landmark Envirocheck report and historical OS maps dating back to 1854. A site walkover was not undertaken. Sections 1 to 4 of this Lithos Report include similar content to the ARP report, but with further detail.
- 5.1.3 Where relevant, the findings of ARP's report have been included within this report.

5.2 Lithos comments

- 5.2.1 Lithos agree with ARP's conclusion that an intrusive investigation is required with sampling of topsoil and made ground to determine the presence of any contamination and rotary drilling the determine the depth and extent of any shallow mineworkings.
- 5.2.2 In addition to the above, the known mine entries will require locating and gas monitoring will be required.

6 GROUND INVESTIGATION DESIGN

6.1 Anticipated ground conditions & potential issues

- 6.1.1 Based on the data reviewed in Sections 4 (Environmental Setting) and 5 (Previous Investigation Findings), anticipated ground conditions are expected to comprise:

Anticipated condition	Remarks
Made ground	Veneer likely in vicinity of former tennis courts (north) and former buildings & colliery (east)
Natural soils	Topsoil over residual soils (gravelly clay/clayey gravel)
Bedrock	Sandstone, siltstone and mudstone at relatively shallow depth (<3m)
Mineworkings	Recorded workings beneath c. 65% of the site in the Blocking Coal from c. 20m depth and likely workings in Wheatley Lime Coal at shallow depth in north and west, possibly via bell pitting.
Groundwater	Likely at depth in bedrock

- 6.1.2 Based on the data above and that in Sections 2 (Site Description) and 3 (History), potential ground-related issues associated with this site are likely to include:

Type of issue	Specific issue	Remarks
Potential on-site contamination sources	- Naturally occurring contaminants - Colliery - Former tennis courts & buildings - Farming activities	- Metals in topsoil - Metals and PAHs associated with coal extraction - Made ground of unknown composition - Metals and PAHs associated with soil improvement
Potential off-site contamination sources	Landfill	Migration of hazardous gas

Type of issue	Specific issue	Remarks
Potential geotechnical hazards	1. Relict buried obstructions 2. Steep slopes 3. Shallow workings 4. Shafts	1. Associated with former buildings 2. On southwest boundary 3. Potential surface instability due to collapse of workings 4. Will require locating and treating
Other potential constraints	1. Underground and overhead utilities	1. Underground gas, sewer, electric and overhead electric & telecom

6.2 Preliminary conceptual site model

- 6.2.1 A preliminary conceptual site model, presented as Drawing 2828/5 in Appendix B, has been prepared after consideration of all the data presented in Sections 2 to 6.1 inclusive of this report.
- 6.2.2 Historical plans show that the site has been occupied by arable farmland which is not considered likely to have caused significant ground contamination. Nonetheless, activities such as slurry spreading, the discharge of chemicals to ground, and unregulated burial have all occurred on farmland. Potential pollutants associated with farming activity might include any of the following:

Agricultural activity	Potential contaminant
Sewage farming, slurry spreading	Methane, metals, nitrates, oxygen depletion
Plant & animal protection	Pesticides & herbicides
Field sports	Lead shot
Waste burial, land levelling, backfilling ponds/quarries	Methane, metals, PAH etc
Derelict buildings	Asbestos

- 6.2.3 An assessment of potential contaminants associated with the former uses (tennis courts, colliery) has been undertaken with reference to CLR8. As a consequence of this assessment, anticipated potential contaminants, within soil and/or groundwater include:
- Inorganics (metals & asbestos)
 - Organics (PAHs)
- 6.2.4 Potential pollutant linkages are shown on the preliminary conceptual site model.
- 6.2.5 Potential contaminant pathways include:
- Ingestion
 - Dermal contact
 - Inhalation of contaminated particulates
 - Surface water run-off, including existing drainage infrastructure
 - Downward infiltration of leachable/mobile contaminants to groundwater
- 6.2.6 Potential contaminant receptors include:
- The environment – Secondary A aquifer and surface water courses (Spen River and Nann Hall Beck)
 - End users of the site (residents)
- 6.2.7 Historical plans show the presence of tennis courts in the north and former buildings in the far east that should be targeted during the ground investigation.

6.3 Ground investigation design & strategy

- 6.3.1 The preliminary conceptual site model was used as a basis for design of an appropriate ground investigation, the scope of which is summarised below.

Exploratory holes	Purpose
About 60 Trial Pits	To determine the general nature of soils underlying the site, including the: • Nature, distribution and thickness of made ground • Nature, degree and extent of contamination • Proportion of undesirable elements e.g. biodegradable matter, foundations etc • Suitability of the ground for founding structures and highways
Topsoil strip	To determine the location of Coal Authority recorded shafts.
15 Probeholes	To check for the presence of voids or broken ground associated with possible unrecorded shallow mine workings
20 Probeholes	To install monitoring wells across the site in order to: • Monitor for hazardous gas • Determine groundwater levels and assess flow direction

- 6.3.2 Proposed exploratory hole locations were selected to provide a representative view of the strata beneath the site and to target potential areas of interest identified in Section 6.1 above. A nominal 50m grid spacing was proposed. Additional exploratory locations might be scheduled by the site engineer in light of the ground conditions actually encountered.
- 6.3.3 The number of representative samples taken will be reflective of the geological complexity actually encountered. However, in general about 3 samples will be taken from most trial pits.

7 FIELDWORK

7.1 Objectives

7.1.1 The original investigation strategy is outlined in Section 6.3 above.

7.2 Exploratory hole location constraints

7.2.1 No exploratory holes could be advanced in the tarmac access track in the north as it is the only point of access to the residential properties immediately east (former Merchants Field Farm).

7.2.2 The north-western field was found to be very boggy at the time of the investigation. In addition, a small stone 'ramp' had to be constructed for plant at the entrance point off Kilroyd drive, due to the field lying c. 1m lower than the road.

7.3 Scope of works

7.3.1 Fieldwork was supervised by Lithos between the following dates and comprised the exploratory holes listed in the table below:

- Trial pitting between 13th and 15th March 2019
- Shaft search and drilling between 1st and 4th April 2019
- Supplementary drilling & shaft probing between 11th and 14th June 2019

Technique	Exploratory holes	Final depth(s)	Remarks
Trial pitting (machine dug)	TPs 01 to 57	1.1m to 3.5m	Vane tests in cohesive soils
Topsoil strip			To determine location of shafts
Hand excavated pits	HPs 01 to 03	0.2m	Excavated in areas of burnt ground to recover samples for testing
Rotary open-hole probeholes	PHs 01 to 49	6.0m to 45.0m	
	PHs 01A to 06A & 08A to 20A	4.0m to 6.0m	Monitoring wells installed Shaft 419426-005 drilled

7.3.2 Notes describing ground investigation techniques, in-situ testing and sampling are included in Appendix A to this report.

7.3.3 Exploratory hole logs are presented in Appendices F & G to this Report. These logs include details of the:

- Samples taken
- Descriptions of the solid strata, and any groundwater encountered.
- Results of the in-situ testing
- The monitoring wells installed

7.3.4 Exploratory hole locations are shown on Drawing 2828/6 presented in Appendix B; trial pit positions are based on data from a hand-held GPS (typically +/- 3m accuracy) and have not been surveyed in. Probehole and shaft positions have been surveyed in by a suitably qualified surveyor.

8 GROUND CONDITIONS

8.1 General

- 8.1.1 A complete record of strata encountered beneath the proposed development site is given on the various exploratory hole records, presented in Appendices F & G.

8.2 Made ground

- 8.2.1 The made ground on site can be categorised as one of 2 broad types:
- **Granular Made Ground:** encountered in the far east in the vicinity of the former colliery, comprising ashy gravel of predominantly coal and clinker with rare brick, glass, ceramic, metal, sandstone and mudstone to depths of up to 1.6m.
 - **Reworked Natural Ground:** Encountered in a single trial pit (TP42) to 0.5m depth comprising clay with gravel and occasional cobbles of sandstone
- 8.2.2 Made ground is almost entirely restricted to the vicinity of the former Merchant Fields Colliery in the east; typically to shallow depth (<0.5m), but locally up to 1.6m where ground has been raised above the shafts.
- 8.2.3 A thin veneer of Burnt Material was encountered in the 3 hand pits excavated in areas of burnt ground. The material comprised ash with some gravel of wood and metal.
- 8.2.4 TPs 01 & 02 were dug within the footprint of the former tennis courts (c. 1930s to 1950s) in the north, but neither encountered significant made ground. This suggests the courts were grass, rather than tarmac or red shale.
- 8.2.5 Whilst not encountered during this investigation, the possibility of 'burial pits', and/or asbestos sheeting (used as shuttering) cannot be entirely discounted.

8.3 Obstructions

- 8.3.1 It is apparent from a review of historical OS Plans (see Section 3) that buildings (total footprint c. 600m²) have been present in the far east, associated with the former colliery. Furthermore, tarmac hardstand covers approximately 700m² in the far north (associated with a track). Drawing 2828/3 shows the footprints of the former structures, and areas of hardstand.
- 8.3.2 A trial pit (TP38) advanced in the footprint of former cottages in the far east encountered a brick wall between ground level and 0.6mbgl with a sandstone slab footing.
- 8.3.3 Given the above, it is apparent that whilst former buildings have been demolished, some foundations, bases etc remain below ground.

8.4 Natural ground

- 8.4.1 Natural ground was encountered in all of the exploratory holes, and typically comprised:
- **Topsoil:** clayey, friable topsoil was identified across the site to a typical depth of 300mm.
 - **Cohesive Residual Soil:** firm to stiff gravelly clay encountered across the site from shallow depth to an average depth of 1.5m (maximum 2.9m).
 - **Granular Residual Soil:** clayey sandy gravel of sandstone encountered at depth beneath cohesive soils.
 - **Coal Measures:** typically, moderately weak to medium strong, thickly laminated sandstone encountered across the site from between 1.1m and 3.5m depth (average 2.2m). Locally encountered as siltstone or mudstone.

- 8.4.2 Coal or weathered coal was encountered in the north and centre (Wheatley Lime Coal) and far south (Middleton 11 Yard Coal).

8.5 Visual & olfactory evidence of organic contamination

- 8.5.1 No evidence of significant organic contamination was noted in any of the exploratory holes.

8.6 Groundwater

- 8.6.1 Groundwater was encountered as seepages, inflows or within land drains between 0.2m and 3.3m depth in approximately half of the trial pits.

- 8.6.2 Groundwater levels have been recorded in the monitoring wells on 5 visits to date (15th April to 7th June 2019), as summarised below.

Hole ID	Response zone (depth range & strata)	Groundwater body	Typical standing water level	
			m bgl	m AoD [#]
PH01A	3.0m to 6.0m (sandstone and mudstone)	Deep (solid)	3.4	98.1
PH02A	2.0 m to 4.0m (sandstone and mudstone)		2.6	98.8
PH03A	3.0 m to 6.0m (sandstone and mudstone)		3.3	98.2
PH04A	2.0 m to 4.0m (Coal, sandstone and mudstone)		2.4	93.5
PH05A	3.0 m to 6.0m (sandstone and mudstone)		2.5	84.9
PH06A	3.0 m to 6.0m (sandstone and mudstone)		1.5	88.9
PH08A	3.0 m to 6.0m (sandstone and mudstone)		1.9	92.8
PH09A	2.0 m to 6.0m (sandstone and mudstone)		3.7	95.8
PH10A	2.0 m to 4.0m (sandstone and mudstone)		3.3	95.2
PH11A	2.0 m to 4.0m (sandstone and mudstone)		3.4	92.9
PH12A	3.0 m to 6.0m (sandstone and mudstone)		4.9	91.6
PH13A	3.0 m to 6.0m (sandstone and mudstone)		4.8	95.9
PH14A	3.0 m to 6.0m (sandstone and mudstone)		4.6	95.7
PH15A	3.0 m to 6.0m (sandstone and mudstone)		2.2	97.7
PH16A	3.0 m to 6.0m (Coal, sandstone and mudstone)		3.6	79.0
PH17A	3.0 m to 6.0m (Coal, sandstone and mudstone)		4.9	82.6
PH18A	3.0 m to 6.0m (sandstone and mudstone)		5.0	87.4
PH19A	3.0 m to 6.0m (sandstone and mudstone)		3.3	84.7
PH20A	3.0 m to 6.0m (sandstone and mudstone)		4.3	88.4

[#] levelled-in by survey

8.7 Stability

- 8.7.1 Stability of excavations within natural ground was generally good with only minor spalling noted in granular soils and made ground.

Summary of Ground Conditions

Hole ID	Final Depth (m)	Depth to Base of Made Ground (m)	Depth to Base (mbgl)								Depth to Coal Measures Bedrock (m)	Penetration (m)	Remarks
			Made Ground			Natural Ground							
			Made Ground Topsoil	Granular Made Ground	Reworked Natural Ground	Topsoil	Cohesive Residual Soil	Granular Residual Soil	Cohesive Residual Soil	Granular Residual Soil			
TP01	3.3	-	-	-	-	0.2	1.7	2.1	-	-	2.1	1.2	At 2.1m, groundwater seepage
TP02	2.2	0.2	0.2	-	-	-	1.0	2	-	-	2.0	0.2	At 0.2m, groundwater seepage
TP03	1.7	-	-	-	-	0.3	1.3	1.7	-	-	1.7	0.0	At 1.7m, slight groundwater seepage
TP04	3.2	-	-	-	-	0.3	2.0	3.2	-	-	>3.2	-	At 0.5m, flowing terracotta land drain
TP05	2.6	-	-	-	-	0.3	1.3	2.6	-	-	2.6	0.0	At 2.6m, groundwater seepage
TP06	2.2	-	-	-	-	0.2	2.1	-	-	-	2.1	0.1	Unable to excavate beyond 2.1m
TP07	2.1	-	-	-	-	0.3	0.8	1.1	1.8	2.1	2.1	0.0	Unable to excavate beyond 2.1m
TP08	2.0	-	-	-	-	0.5	1.5	2.0	-	-	2.0	0.0	Unable to excavate beyond 2m
TP09	1.1	-	-	-	-	0.3	0.9	1.1	-	-	1.1	0.0	Unable to excavate beyond 1.1m
TP10	1.7	-	-	-	-	0.3	1.7		-	-	1.7	0.0	Unable to excavate beyond 1.7m
TP11	2.1	-	-	-	-	0.3	1.1	2.1	-	-	>2.1	0.0	At 2.0m, groundwater seepage
TP12	1.5	-	-	-	-	0.3	1.3	1.5	-	-	1.5	0.0	Unable to excavate beyond 1.5m
TP13	2.0	-	-	-	-	0.3	0.9	2.0	-	-	>2.0	-	At 2.0m, groundwater seepage
TP14	2.5	-	-	-	-	0.2	2.4	2.5	-	-	2.5	0.0	Unable to excavate beyond 2.5m
TP15	2.6	-	-	-	-	0.3	1.1	2.6	-	-	2.6	0.0	Unable to excavate beyond 2.6m
TP16	3.2	-	-	-	-	0.3	2.2	3.2	-	-	>3.2	-	
TP17	2.7	-	-	-	-	0.3	1.3	2.7	-	-	>2.7	-	At 2.7m, groundwater seepage
TP18	2.4	-	-	-	-	0.2	1.7	2.4	-	-	2.4	0.0	Unable to excavate beyond 2.4m
TP19	3.5	-	-	-	-	0.3	1.2	2.3	2.9, 3.5	3.4	3.5	0.0	Unable to excavate beyond 3.5m
TP20	2.1	-	-	-	-	0.2	1.7	2.0	-	-	2.0	0.1	At 0.6m, groundwater in land drain. Difficult to excavate beyond 2.1m
TP21	2.4	-	-	-	-	0.2	1.9	2.4	-	-	>2.4	-	Difficult to excavate beyond 2.4m
TP22	3.0	-	-	-	-	0.2	2.1	3.0	-	-	>3.0	-	At 0.6m, terracotta land drain
TP23	2.9	-	-	-	-	0.2	2.1	2.5	-	-	2.5	0.4	Difficult to excavate beyond 2.9m
TP24	2.9	-	-	-	-	0.2	2.3	2.7	-	-	2.7	0.2	Difficult to excavate beyond 2.9m
TP25	3.3	-	-	-	-	0.3	1.7	2.0	-	-	2.0	1.3	At 0.6m, terracotta land drain, At 1.0m groundwater inflow.
TP26	2.9	-	-	-	-	0.2	1.7	2.3	-	-	2.3	0.6	At 0.6m, terracotta land drain
TP27	2.6	-	-	-	-	0.2	1.7	2.3	-	-	2.3	0.3	
TP28	2.6	-	-	-	-	0.2	2.4	-	-	-	2.4	0.2	
TP29	3.1	-	-	-	-	0.2	1.7	1.9	2.5	2.7	2.7	0.4	Unable to excavate beyond 3.1m
TP30	1.6	-	-	-	-	0.3	0.7	1.6	-	-	1.6	0.0	At 1.6m, groundwater seepage
TP31	3.3	-	-	-	-	0.3	0.8	0.9	2.3	3.3	>3.2	-	At 3.3m, groundwater seepage

Hole ID	Final Depth (m)	Depth to Base of Made Ground (m)	Depth to Base (mbgl)								Depth to Coal Measures Bedrock (m)	Penetration (m)	Remarks
			Made Ground			Natural Ground							
			Made Ground Topsoil	Granular Made Ground	Reworked Natural Ground	Topsoil	Cohesive Residual Soil	Granular Residual Soil	Cohesive Residual Soil	Granular Residual Soil			
TP32	1.5	-	-	-	-	0.2	0.6	0.8	1.5	-	1.5	0.0	Unable to excavate beyond 1.5m
TP33	3.4	-	-	-	-	0.2	0.9	1.0	1.5	3.4	>3.4	-	At 0.8m, groundwater seepage
TP34	2.0	-	-	-	-	0.2	1.7	1.9	-	-	1.9	0.1	Unable to excavate beyond 2.0m
TP35	2.4	-	-	-	-	0.3	1.7	2.4	-	-	2.4	0.0	Unable to excavate beyond 2.4m
TP36	1.5	-	-	-	-	0.2	1.4	-	-	-	1.4	0.1	At 0.6m, terracotta land drain, unable to excavate beyond 1.5m
TP37	2.9	-	-	-	-	0.3	2.3	2.9	-	-	2.9	0.0	At 2.5m, groundwater seepage. Unable to excavate beyond 2.9m
TP38	2.1	0.4	-	0.4	-	-	2.1	-	-	-	>2.1	-	From 0.0m to 0.6m brick wall with stone slab footing in East end of pit. At 1.2m, groundwater seepage
TP39	1.8	-	-	-	-	0.2	1.3	1.8	-	-	1.8	0.0	Unable to excavate beyond 1.8m
TP40	2.8	-	-	-	-	0.2	1.5	2.8	-	-	>2.8	-	At 0.5m terracotta land drain. At 2.0m groundwater seepage. Difficult to excavate beyond 2.8m.
TP41	2.1	-	-	-	-	0.3	1.5	2.1	-	-	2.1	0.0	Unable to excavate beyond 2.1m
TP42	2.8	0.5	0.2	-	0.5	-	1.1	1.6	-	-	1.6	0.2	At 1.6m groundwater inflow
TP43	2.4	-	-	-	-	0.3	1.4	2.4	-	-	2.4	0.0	At 0.7m, groundwater seepage. Unable to excavate beyond 2.3m
TP44	1.2	-	-	-	-	0.2	0.6	1.1	-	-	1.1	0.1	At 1.1m groundwater seepage. Unable to excavate beyond 1.2m
TP45	3.3	-	-	-	-	0.3	1.3	3.3	-	-	>3.3	-	At 0.5m, terracotta land drain.
TP46	2.2	-	-	-	-	0.2	1.4	1.8	-	-	1.8	0.4	At 0.5m land drain. At 1.9m groundwater. Unable to excavate beyond 2.2m.
TP47	3.3	-	-	-	-	0.2	1.2	3.0	-	-	>3.0	-	
TP48	3.1	-	-	-	-	0.3	2.9	3.1	-	-	>3.1	-	
TP49	3.3	-	-	-	-	0.3	1.6	3.3	-	-	>3.3	-	
TP50	3.5	-	-	-	-	0.3	1.8	3.5	-	-	>3.5	-	
TP51	2.3	-	-	-	-	0.2	1.6	2.3	-	-	2.3	0.0	Unable to excavate beyond 2.3m
TP52	3.0	-	-	-	-	0.3	0.6	3.0	-	-	3.0	0.0	At 3.0m, groundwater seepage. Unable to excavate beyond 3.0m.
TP53	3.0	-	-	-	-	0.2	1.5	3.0	-	-	3.0	0.0	Unable to excavate beyond 3.0m.
TP54	2.9	-	-	-	-	0.3	1.0	2.9	-	-	2.9	0.0	Unable to excavate beyond 2.9m
TP55	2.5	-	-	-	-	0.2	1.9	2.2	-	-	2.2	0.3	At 0.6m, terracotta land drain. Unable to excavate beyond 2.5m.
TP56	2.7	-	-	-	-	0.2	2.1	2.5	-	-	2.5	0.2	Difficult to excavate beyond 2.7m
TP57	2.0	-	-	-	-	0.2	0.7	1.6	1.9	-	1.9	0.1	At 2.0m unable to excavate.

8.8 Mining investigation

Shallow workings (rotary probeholes)

- 8.8.1 It is clear from the desk study that the site is underlain by known, shallow mineworkings associated with the Blocking Coal and possibly also unrecorded mineworkings in the Wheatley Lime and Middleton 11 Yards coal seams.
- 8.8.2 The conjectured outcrop of the Wheatley Lime seam is shown on Drawing 2828/8 in Appendix B to this report.
- 8.8.3 Consequently, a mining investigation has been undertaken, comprising the drilling of 49 'deep' rotary open-hole probeholes. The investigation identified soft ground, broken ground and coal as summarised in the Table on page 22.

Wheatley Lime

- 8.8.4 Analysing the data obtained from the 49 mining investigation probeholes, it is apparent that:
- The Wheatley Lime Coal underlies about 5.4ha of the site in the north and west, outcropping approximately 30m further southwest than that shown on BGS plans.
 - None of the 27 holes advanced through the Wheatley Lime seam encountered evidence of workings.
 - The Wheatley Lime seam is between 0.1m (close to outcrop) and 1.3m thick (average 0.9m).
 - The thickness of competent (rock) cover above the Wheatley Lime seam is always less than 10 times seam thickness.
- 8.8.5 Given the number of probeholes advanced through the Wheatley Lime with none encountering evidence of workings, it appears this seam has not been worked. However, the risk of localised mineworkings via bell-pits cannot be entirely discounted.

Middleton 11 Yard

- 8.8.6 With regards to the Middleton 11 Yard Coal, the mining investigation indicates:
- The seam underlies the entire site and is between 0.3m and 1.7m thick (average 1.1m). It is shallowest in the far south becoming deeper towards the north.
 - Evidence of shallow mineworkings was encountered in 3 of the 40 deeper holes advanced through the Middleton 11 Yard Coal.
 - 12 of the 40 holes advanced to depths where the Middleton 11 Yard should be encountered found no evidence of solid coal or mineworkings, indicating wash-out of the seam, or packed workings (see Section 4.3.11).
 - The Middle 11 Yard was often encountered as 'dark mudstone with coal traces' as opposed to a solid seam.
 - The thickness of competent (rock) cover above mineworkings in the west is between 9 and 13 times seam thickness. The thickness of competent rock cover above solid coal towards the south is as little as two times seam thickness (PH16).
- 8.8.7 The 12 deeper holes which did not encounter coal or evidence of mineworkings could indicate that the Middleton 11 Yard Coal was extensively mined and then 'packed' as mining was completed (see Section 4.3.11). This is further supported by the presence of 'dark mudstone with coal traces' in a number of probeholes (indicative of packed workings) at the anticipated level of this seam, and the fact that it is present as a full solid seam (c. 1 to 1.3m thick) in other holes.

- 8.8.8 Loss of flush was noted in two probeholes in the west (PHs 30 & 31) which may support this theory. However, no irregular penetration was noted and the loss of flush occurred shallower than the anticipated depth of the Middleton 11 Yard Coal, and so could simply have been due to a fractures/joints in the bedrock.
- 8.8.9 Based on the depths of the seam encountered and the presence of workings, an area of 14,000m² in the north will require mitigation against risks of mining (see Drawing 2828/12 Rev. A). In addition, given that the seam is likely to have been extracted from beneath the majority of the site, but then re-packed during mining (see above and Section 4.3.11), there are residual risks of localised voids (e.g. associated with tramways, water ways etc) where packing has not occurred.

Blocking & Blocking Rider

- 8.8.10 The abandonment plan for the Blocking Coal (see Drawing 2828/9) shows 3 "pits" (shafts) in the south-east, which look to be extending down to "tunnels" shown on abandonment plans in the Blocking seam. All 3 of these shafts have been located by trenching (see below).
- 8.8.11 Shaft 419426-005 (winding pit) was been drilled as part of the supplementary investigation and the base was encountered at 18.5m depth.
- 8.8.12 The Blocking Coal has not been encountered in any of the probeholes advanced across the site. However, evidence of mineworkings (soft/broken ground) was encountered in 4 probeholes, all advanced in the far east (vicinity of shafts). The depth of the workings (between 15.5m and 21.6m depth) broadly matches the depth of the shaft recorded on site (18.5m) and on CA records (19m).
- 8.8.13 Where workings were encountered within the Blocking seam, they were consistently 7m to 8m below the Middleton 11 Yard.
- 8.8.14 Given the above, it is now considered the Blocking Coal is at shallower depth than originally anticipated based on the BGS plan (see Section 4.3.15), and is worked in the south-east of the site.
- 8.8.15 The evidence of workings within the Blocking coal is limited to an area of c. 11,000m² around the shafts in the east. Beyond this, similar to the Middleton 11 Yard seam, the Blocking Coal was not encountered in the form of workings nor as a solid seam despite numerous holes in the south & east being drilled deep enough to have encountered it. This could be a result of localised wash-out, or packed workings.
- 8.8.16 No solid coal or voids were encountered, therefore, in order to calculate the thickness of competent cover required, a conservative seam thickness of 1.5m has been assumed. This was the typical thickness of the workings encountered, and is slightly thicker than the geological memoir indicates (1m). On this basis, the base of the workings will need to be at least 16.5m below rockhead (11 x 1.5m) for mitigation measures to not be required.
- 8.8.17 Based on current ground levels, and assuming that localised areas of workings could exist within suspected 'packed workings' in the far south, around 27,000m² in the south & east will therefore require mitigation against risks of workings within the Blocking coal seam (see Drawing 2828/12 rev. A).
- 8.8.18 It should be noted that the Blocking Coal and the Middleton 11 Yard Coal both contain dirt partings. If withdrawn from the ground, unwanted material such as dirt partings would usually be 'tipped' at, or close to the shafts in a spoil heap. No such features are shown close to the shafts on site, possibly indicating that the spoil was instead disposed of underground (i.e. to pack the workings). Indeed, this would make more economic sense than having to haul unwanted materials to surface.

- 8.8.19 The Blocking Rider has not been encountered in any of the deep probeholes, likely due to the thin seam thickness (c. 0.1m) and possible localised washouts.
- 8.8.20 A further 19 probeholes were taken to shallow depth to enable the installation of gas monitoring wells.

Mine entry search

- 8.8.21 As discussed in Section 4.3 there are 4 known mine entries within the site's boundary. Prior to excavation, the location of each mine entry was set out by a surveyor, based on co-ordinates included within the CA's Mine Entry Data Sheets, and consideration was given to Desk Study data to ensure the pegged position was appropriate.
- 8.8.22 Of the 4 known shafts, 3 in the east associated with the former Merchant Fields Colliery have been located and surveyed following a topsoil and subsoil strip, with details provided in the table below.

Shaft Ref	Diameter (m)	Details	Coordinates	Distance from CA recorded position
419426-001	2.6	Circular, unlined with black gravelly ash and grey gravel of mudstone fill	419080.174 E, 426355.379 N	2.7m south-east
419426-002	3.2	Circular, partially brick lined with black clayey gravelly ashy fill	419109.590 E, 426361.738 N	1.9m south-west
419426-005	2.7 (internal) 3.2 (external)	Circular, brick lined with black ashy fill with gravel of coal, clinker, sandstone	419091.913 E, 426347.452 N	0.5m south

- 8.8.23 Between 0.7m and 1.6m of made ground was encountered above the shaft positions which typically comprised gravelly sand/sandy gravel of mixed lithologies including brick, coal, clinker, etc.
- 8.8.24 In the west of the site, topsoil and subsoil was stripped over an area of approximately 400m² in an attempt to locate Shaft 418426-008. However, to date it has not been found. It should be noted that an area of approximately 190m² to the west of the shaft has not been searched due to a steep slope.
- 8.8.25 Photographs of the findings of the search areas in the east and west are shown on Drawings 2828/10A & 10B, with drawings of the areas stripped.
- 8.8.26 Drilling of Shaft 419426-005 (winding pit) confirmed its depth to be 18.5m.

8.9 Revised conceptual ground model (ground conditions)

- 8.9.1 The Preliminary Conceptual Site Model has been revised in light of data obtained during the ground investigation, most notably with respect to:
- The absence of significant made ground within the footprint of the former tennis courts
 - The depths to, and thicknesses of, coal/shallow workings
 - The nature and distribution of contamination (based on visual/olfactory evidence only)
- 8.9.2 Further refinement of the Conceptual Site Model is presented in Section 10.2, where the results of laboratory testing for contaminants have been considered.

Summary of rotary drilling

Hole	Final depth (m)	Depth to Rockhead (m)	Wheatley Lime Coal				Middleton 11 Yard Coal				Blocking Coal			
			Depth to base (m)	Evidence of workings	Thickness of coal (m)	11x cover present?	Depth to base (m)	Evidence of workings	Thickness of coal/workings (m)	11x cover present?*	Depth to base (m)	Evidence of workings	Thickness of workings (m)	11x cover present? \$
PH01	27.0	2.5	9.5	No	1.0	No	-	-	-	-	Shallow hole #		N/A	
PH02	12.0	2.0	9.5	No	1.0	No	Shallow hole #		N/A		Shallow hole #		N/A	
PH03	27.0	3.0	10.5	No	1.0	No	21.5	Yes	1.5	Yes	Shallow hole #		N/A	
PH04	18.0	2.0	2.5	No	0.5	No	-	-	-	-	Shallow hole #		N/A	
PH05	35.0	3.0	Beyond outcrop of coal				-	-	-	-	Shallow hole #		N/A	
PH06	15.0	2.5	Beyond outcrop of coal				-	-	-	-	Shallow hole #		N/A	
PH07	18.0	2.5	Beyond outcrop of coal				13.7	No	1.2	No	Shallow hole #		N/A	
PH08	6.0	2.5	2.6	No	0.1	No	Shallow hole #		N/A		Shallow hole #		N/A	
PH09	21.0	2.5	7.0	No	1.0	No	17.0	Yes	1.5	No	Shallow hole #		N/A	
PH10	45.0	1.0	6.0	No	1.0	No	-	-	-	-	-	-	-	-
PH11	9.0	1.5	5.5	No	0.5	No	Shallow hole #		N/A		Shallow hole #		N/A	
PH12	21.0	1.0	7.5	No	1.0	No	18.0	No	1.0	Yes	Shallow hole #		N/A	
PH13	24.0	1.0	8.5	No	1.0	No	21.0	Yes	1.5	Yes	Shallow hole #		N/A	
PH14	12.0	1.2	8.0	No	1.0	No	Shallow hole #		N/A		Shallow hole #		N/A	
PH15	9.0	1.0	8.2	No	1.0	No	Shallow hole #		N/A		Shallow hole #		N/A	
PH16	33.0	2.0	Beyond outcrop of coal				5.2	No	1.7	No	-	-	-	-
PH17	9.0	1.0	Beyond outcrop of coal				7.0	No	1.5	No	Shallow hole #		N/A	
PH18	15.0	1.0	Beyond outcrop of coal				-	-	-	-	Shallow hole #		N/A	
PH19	9.0	1.3	Beyond outcrop of coal				-	-	-	-	Shallow hole #		N/A	
PH20	16.0	1.2	3.0	No	0.5	No	14.0	No	1.0	Yes	Shallow hole #		N/A	
PH21	21.0	2.0	Beyond outcrop of coal				17.5^	No	0.5	Yes	Shallow hole #		N/A	
PH22	21.0	1.2	Beyond outcrop of coal				14.2^	No	1.4	No	-	-	-	-
PH23	20.0	1.5	Beyond outcrop of coal				17.0^	No	1.5	No	Shallow hole #		N/A	
PH24	24.0	1.6	3.1	No	1.1	No	21.5^	No	2.1	No	Shallow hole #		N/A	
PH25	27.0	1.5	7.2	No	1.1	No	24.8^	No	1.3	Yes	Shallow hole #		N/A	
PH26	11.3	2.0	Beyond outcrop of coal				8.3	No	1.3	No	Shallow hole #		N/A	
PH27	7.7	1.8	Beyond outcrop of coal				4.7	No	1.2	No	Shallow hole #		N/A	

Hole	Final depth (m)	Depth to Rockhead (m)	Wheatley Lime Coal				Middleton 11 Yard Coal				Blocking Coal			
			Depth to base (m)	Evidence of workings	Thickness of coal (m)	11x cover present?	Depth to base (m)	Evidence of workings	Thickness of coal/workings (m)	11x cover present?*	Depth to base (m)	Evidence of workings	Thickness of workings (m)	11x cover present? \$
PH28	12.0	1.5		Beyond outcrop of coal			8.9	No	1.3	No	Shallow hole #		N/A	
PH29	21.0	1.5		Beyond outcrop of coal			-	-	-	-	Shallow hole #		N/A	
PH30	20.0	1.5	4.3	No	1.3	No	-	-	-	-	Shallow hole #		N/A	
PH31	24.0	1.5	9.9	No	1.3	No	-	-	-	-	Shallow hole #		N/A	
PH32	21.0	1.5	7.0	No	1.3	No	-	-	-	-	Shallow hole #		N/A	
PH33	30.0	2.0		Beyond outcrop of coal			12.5^	No	0.5	Yes	-	-	-	-
PH34	24.0	2.0		Beyond outcrop of coal			10.5^	No	0.5	Yes	18.5	Yes	2.0	No
PH35	30.0	2.0	2.3	No	0.3	No	13.1	No	1.3	No	-	-	-	-
PH36	24.0	1.5	3.5	No	0.5	No	22.2	No	1.0	Yes	Shallow hole #		N/A	
PH37	23.0	1.5	6.8	No	0.8	No	Shallow hole #		N/A			Shallow hole #		N/A
PH38	27.0	1.0	6.0	No	1.0	No	26.0	No	0.3	Yes	Shallow hole #		N/A	
PH39	20.0	1.5	9.5	No	1.0	No	Shallow hole #		N/A			Shallow hole #		N/A
PH40	12.0	1.5	9.0	No	1.3	No	Shallow hole #		N/A			Shallow hole #		N/A
PH41	27.0	1.5	9.0	No	1.2	No	-	-	-	-	Shallow hole #		N/A	
PH42	24.0	1.5	6.2	No	1.2	No	26.0	No	1.0	Yes	Shallow hole #		N/A	
PH43	9.0	1.5	7.3	No	0.9	No	Shallow hole #		N/A			Shallow hole #		N/A
PH44	21.0	2.0		Beyond outcrop of coal			11.0	No	1.0	No	18.5	Yes	2.0	No
PH45	24.0	2.0		Beyond outcrop of coal			14.3^	No	1.0	Yes	21.6	Yes	1.6	Yes
PH46	21.0	2.0		Beyond outcrop of coal			9.9^	No	0.9	No	17.0	Yes	1.5	Yes
PH47	18.0	1.5		Beyond outcrop of coal			5.0^	No	1.0	No	-	-	-	-
PH48	18.0	2.0		Beyond outcrop of coal			5.0^	No	0.9	No	-	-	-	-
PH49	21.0	1.5		Beyond outcrop of coal			5.3^	No	1.0	No	-	-	-	-

Notes: * where worked, the max. thickness of coal on site (1.7m) or the thickness of the working (whichever is the less) has been used to calculate 11x cover for the Middleton 11 Yd Coal
 \$ typical thickness of workings (1.5m) has been used to calculate 11x cover for the Blocking Coal as no solid coal has been encountered
 # Hole not drilled deep enough to encounter coal seam
 ^ Middleton 11 Yard Coal encountered as dark mudstone with coal traces
 - Seam not encountered, hole drilled beyond anticipated seam depth.

9 CONTAMINATION (ANALYSIS)

9.1 General

- 9.1.1 The site has been formerly used as grazing land with a former colliery present in the far east until 1907 and a cricket ground/tennis courts with pavilion in the far north between 1932 and 1957. Small isolated areas of burnt ground were present in a number of the fields likely associated with the burning of trees from the recent vegetation clearance.
- 9.1.2 Across the majority of the site (fields), former usage (farmland/grassland) is considered unlikely to have given rise to any significant ground contamination. However, samples of topsoil have been recovered in order to confirm its suitability for re-use. Some (likely localised) contamination is possible associated with the made ground in the vicinity of the former colliery & shafts (far east).
- 9.1.3 It should be noted that no sampling of the tarmac within the access drive in the north has been undertaken to date due to access constraints. In addition, the rough track in the south has not been sampled although based on observations made on-site it is unlikely to be of significant thickness or composition.
- 9.1.4 An assessment of potential contaminants associated with the former uses has been undertaken; see Section 6.2.
- 9.1.5 In the context of risks to human health associated with residential redevelopment, the Tier 1 Soil Screening Values referenced in this report have been derived via the CLEA default conceptual site model (CSM) used for generating SGVs, but amended, where appropriate, to be more specific to redevelopment within the planning process.
- 9.1.6 Where available, Category 4 Screening Levels (C4SL) have also been referenced.
- 9.1.7 Generic Note 04 in Appendix A provides further details with respect to current guidance and the interpretation of analytical data.

9.2 Testing scheduled

- 9.2.1 Based on the above assessment, Lithos submitted a test schedule (summarised in the table below) to a UKAS accredited laboratory.

Type of sample	No. of samples	Determinands
Made ground	6	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc) TOC, Speciated Polycyclic Aromatic Hydrocarbons (PAH)
	3	Asbestos ID Water soluble sulphate, chloride, nitrate and magnesium
	2	Calorific Value (CV)
Topsoil (incl. Made Ground Topsoil)	18	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc) & Asbestos ID TOC, Speciated Polycyclic Aromatic Hydrocarbons (PAH)
	3	Clay/sand/silt content and visible contaminants, sharps (glass etc) to check compliance with BS3882:2015 Phenoxy Acetic Acid Herbicides (PAAHs)

9.3 Soil contamination results

9.3.1 The soil contamination test results are summarised in the tables on page 26.

9.3.2 Laboratory test certificates as received from the laboratory are presented in Appendix H to this report.

Inorganic determinands

9.3.3 Of the 21 samples of Topsoil and made ground analysed for inorganic parameters, 14 can be classified as uncontaminated and 7 could be classified as contaminated.

9.3.4 These samples have been classified by comparison with Tier 1 Soil Screening Values for an end use including domestic gardens and any area where plants are to be grown (the most sensitive of the proposed end-uses).

9.3.5 The most common contaminants are arsenic, copper, lead and zinc in samples of Granular Made Ground and Burnt Material. Three Topsoil samples yielded slightly elevated concentrations of arsenic.

9.3.6 Statistical analysis of 18 results has been carried out in general accordance with the methods outlined in "Guidance on Comparing Soil Contamination Data with a Critical Concentration", CIEH/CL:AIRE (2008) (see comments in Appendix A, Contamination Testing) and the results are summarised below.

Stratum	No. of samples	US ₉₅ values for contaminants that have yielded one or more Tier 1 exceedances for a given made ground type
		Arsenic (37)
Topsoil	18	35

Notes: Values in **bold** indicate that the US95 value exceeds the relevant Tier 1 value.

9.3.7 Where there is 95% confidence or greater that the true mean concentration of a given contaminant within a particular soil type is less than the Tier 1 value, it can be concluded that the contaminant does not pose a significant risk to human health.

9.3.8 This statistical analysis indicates that the upper 95th percentile bound value (US95) for arsenic in Topsoil is not elevated in comparison with relevant Lithos Soil Screening Values.

9.3.9 No outliers were detected.

9.3.10 Given the above, the 3 samples yielding slightly elevated concentrations of arsenic are not considered significant.

9.3.11 Given the limited amount of Granular Made Ground encountered, it was not possible to collect a sufficient number of soil samples to enable meaningful statistical analysis of results for these material types (typically a minimum of 6 samples are required).

Calorific value

9.3.12 The calorific value of two samples of Granular Made Ground have yielded an average CV of 6.8 MJ/kg. Materials whose CVs exceed 10MJ/kg are almost certainly combustible, while those with values below 2MJ/kg are unlikely to burn.

Asbestos

9.3.13 No asbestos fibres were identified in any of the 21 samples screened.

Summary of degree of soils contamination

Expl Hole	Depth (m)	Material	Concentrations in mg/kg unless otherwise stated. Results are quoted to 1 decimal place if <10, and whole numbers if >10. Trigger Level Concentrations are shown in BLUE and assume a residential with gardens end-use.															Asbestos I.D.
			pH	As ∞	B ~	Cd ∞	Cr x	Cu♣\$	Pb ∞	Hg *	Ni	Se	Zn \$	CV	% TOC	PAH		
				37	5	26	3000	200	200	169	127	350	200	2	5	8		
TP20	0.1	Topsoil	5.8	30	0.4	0.3	25	47	66	0.1	20	< 0.5	120	-	5.1	< 0.1	< 0.1	N.D.
TP22	0.1	Topsoil	6.0	25	0.4	0.4	20	36	59	0.1	17	< 0.5	150	-	5.1	< 0.1	< 0.1	N.D.
TP25	0.1	Topsoil	6.3	31	0.4	0.4	22	57	74	0.1	23	0.8	100	-	5.9	0.1	0.1	N.D.
TP28	0.1	Topsoil	6.5	24	0.5	0.3	22	39	61	0.1	20	0.7	100	-	5.0	0.1	< 0.1	N.D.
TP47	0.1	Topsoil	5.9	37	0.4	0.6	22	47	72	0.1	19	1.0	100	-	4.7	< 0.1	< 0.1	N.D.
TP48	0.1	Topsoil	6.7	37	0.5	0.6	25	50	79	0.2	24	0.9	110	-	4.8	0.1	< 0.1	N.D.
TP50	0.1	Topsoil	6.2	43	0.5	0.7	23	54	77	0.2	25	1.0	130	-	5.7	< 0.1	< 0.1	N.D.
TP03	0.2	Topsoil	6.5	21	0.4	0.3	19	60	51	0.2	17	< 0.5	93	-	4.7	< 0.1	< 0.1	N.D.
TP07	0.2	Topsoil	6.4	16	0.5	0.2	13	28	41	0.1	11	< 0.5	62	-	5.3	< 0.1	< 0.1	N.D.
TP09	0.2	Topsoil	6.6	30	0.7	0.6	25	40	71	0.2	20	< 0.5	120	-	5.6	< 0.1	< 0.1	N.D.
TP12	0.2	Topsoil	5.6	30	0.3	0.5	20	45	71	0.2	21	< 0.5	130	-	5.8	< 0.1	< 0.1	N.D.
TP15	0.2	Topsoil	6.5	25	0.4	0.6	22	36	68	0.2	20	0.8	120	-	4.6	< 0.1	< 0.1	N.D.
TP17	0.2	Topsoil	6.1	27	0.4	0.5	21	41	66	0.1	22	< 0.5	110	-	4.3	< 0.1	< 0.1	N.D.
TP19	0.2	Topsoil	5.7	43	0.5	0.5	27	59	94	0.2	25	0.8	140	-	5.8	0.1	< 0.1	N.D.
TP30	0.2	Topsoil	5.7	30	0.3	0.4	23	44	85	0.1	21	1.0	110	-	4.7	< 0.1	< 0.1	N.D.
TP37	0.2	Topsoil	6.1	53	0.4	0.5	20	49	76	0.2	20	1.2	97	-	5.8	< 0.1	< 0.1	N.D.
TP02	0.1	Topsoil	6.3	20	0.5	0.3	16	25	52	0.1	14	< 0.5	200	-	5.4	< 0.1	< 0.1	N.D.
TP42	0.1	Topsoil	5.5	37	0.4	0.6	29	47	80	0.1	26	2.0	150	-	3.8	0.1	< 0.1	N.D.
HP01	0.1	Burnt Material	8.6	28	2.6	0.5	27	54	81	0.1	18	0.5	140	-	5.7	< 0.1	< 0.1	-
HP02	0.1	Burnt Material	8.1	23	2.8	0.4	20	71	110	0.1	17	< 0.5	320	-	6.6	0.1	< 0.1	-
HP03	0.1	Burnt Material	7.5	180	1.7	0.5	160	250	1,700	0.1	21	< 0.5	250	-	6.3	< 0.1	< 0.1	-
TP42	0.4	Reworked Natural Ground	6.1	11	0.4	0.3	19	22	33	< 0.1	19	0.7	96	-	1.5	< 0.1	< 0.1	N.D.
TP38	0.1	Granular Made Ground	7.2	97	0.6	1.2	34	170	730	0.3	45	1.5	500	6.6	17.0	0.2	< 0.1	N.D.
TP38	0.3	Granular Made Ground	7.1	110	0.6	0.7	24	130	630	0.3	37	0.9	300	6.9	19.0	0.1	< 0.1	N.D.

Key		Source of guidance trigger level	
36	Parameter tested for and found to be in excess of Tier 1 value.	With the exception of those annotated with one of the symbols below (∞ , \$, ~), all Soil Screening Values in brackets above have been derived using CLEA v1.06.	
179	Parameter tested for and found to be > 5 x Tier 1 value.		
12	Parameter tested for but not found to be in excess of Tier 1 value.	∞	Category 4 Screening Level – SP1010, December 2013 (CL:AIRE/Defra).
-	Parameter not tested for.	\$	MAFF. Code of Practice for Agricultural Practice for the Protection of Soil, 1998.
♣	Tier 1 Value is pH dependent.	~	Engineering judgement (Lithos). Boron is a phytotoxic, although most phytotoxic compounds can pose a risk to human health if sufficient concentrations are present. However, plants represent the most sensitive receptor, and a Tier 1 value which is protective of flora is therefore also protective of human health.
x	Assumes Cr is CrIII. If demonstrated Cr is CrVI Tier 1 would be 21mg/kg.		
ND	No fibres detected (asbestos screen)		
		*	Assumes mercury present as an inorganic compound (cf elemental metal or within organic compound). See Science Report SC050021/Mercury SGV.

Organic determinands

- 9.3.14 The majority of this site is essentially greenfield and therefore for organic compounds, the Tier 1 Values used in this report have been derived with reference to a CSM that assumes a residential with gardens end use, with no clean soil cover will be placed in gardens/landscaped areas (Lithos Scenario A).
- 9.3.15 Lithos have used the CLEA model to derive risk-based screening values for hydrocarbons, in accordance with the methodology detailed by the TPHCWG, and reviewed by a UK workshop of experts with respect to UK adoption of the method.
- 9.3.16 However, these screening values assume a Soil Organic Matter (SOM) of 6% (equivalent to a TOC of 3.5%). Many organic contaminants are more mobile when the SOM is lower, and consequently comparison of soil results with lower screening values may be required.
- 9.3.17 In order to check the validity of Lithos' Tier 1 Soil Screening Values, the average TOC for each common fill type (beyond any areas of obvious hydrocarbon impact) have been determined.

Fill type	Typical TOC (%)	Comparison of soil results with revised screening value necessary?
Topsoil	5.1	No
Reworked Natural Ground	1.5	Yes, but no significant organic contamination was recorded in the one sample tested. All determinands were below limit of detection.
Granular Made Ground	>5%	No

Hydrocarbons (TPH & PAH)

Polycyclic Aromatic Hydrocarbons (PAH)

- 9.3.18 There are numerous PAH compounds. The USEPA identified 16 PAHs that are considered to represent the most problematic in terms of toxicology, fate and behaviour. The UK have also focused on these 16 and these are included in the laboratory report where speciated PAH analysis has been scheduled.
- 9.3.19 Speciated PAH analysis has been undertaken in order to determine concentrations of the key "marker" compounds: benzo(a)pyrene (considered the most toxic of the PAHs); and naphthalene (the most mobile and volatile of the PAHs).
- 9.3.20 Speciated analysis has confirmed the absence of significant concentrations of both benzo(a)pyrene and naphthalene in the soils beneath this site.

Insecticides

- 9.3.21 All 3 of the topsoil samples scheduled for insecticide analysis (Organochlorine & Organophosphorous Insecticides) yielded results for the various determinands below the laboratory limit of detection (0.01 mg/kg).

9.4 Topsoil

9.4.1 Topsoil (and made ground topsoil), typically 300mm thick is present across the entire site. Testing suggests this material is chemically suitable for re-use.

9.4.2 Given the nature of the topsoil present on this site it would be expected to be suitable to support plant growth.

Topsoil grading

9.4.3 The clay/sand/silt content and visible contaminants, sharps (glass etc) of 3 topsoil samples have been determined to check compliance with BS3882:2015¹ requirements. BS3882 considers visual contaminants to comprise 'undesirable potentially injurious foreign object(s) visible to the naked eye'.

9.4.4 It should be noted that this is a reduced suite of analysis, and no N-P-K etc. testing has been undertaken.

9.4.5 The results are summarised below:

Parameter	BS3882 Specification	TP50, 0.1m	TP20, 0.15m	TP15, 0.2m
Retained on 2mm sieve	< 30%	< 1.0	< 1.0	< 1.0
Retained on 20mm sieve	< 10%	< 1.0	< 1.0	< 1.0
Retained on 50mm sieve	0%	< 1.0	< 1.0	< 1.0
Clay content	5 to 35%	10	18	15
Silt content	0 to 65%	67	66	66
Sand content	0 to 90%	23	16	19
Visible contaminants	< 0.5%	< 0.1	< 0.1	< 0.1

Notes

Values in **bold** type fail the required specification for multipurpose topsoil

* for pH < 6.0

9.4.6 The results indicate that the topsoil complies with the requirements for multipurpose topsoil, with the exception of the silt content.

9.4.7 In terms of textural class, the topsoil falls into the silt loam class

9.4.8 Further advice could be sought from an agricultural soils' expert, but it might be possible to blend existing topsoil with sand and manure to generate a more suitable material.

9.4.9 Given the nature of the topsoil present on this site it would be expected to be suitable to support plant growth.

¹ BS3882:2015. Specification for topsoil. Published by BSI Standards Limited.

10 CONTAMINATION (QUALITATIVE RISK ASSESSMENT & REMEDIATION)

10.1 Summary of significant contamination

- 10.1.1 Topsoil, typically 300mm thick underlies the entire site. Testing suggests this material is chemically suitable for re-use.
- 10.1.2 A veneer of Granular Made Ground is present in the far east, locally up to 1.6m thick above former mine shafts. Additionally, a number of areas of burnt ground are present in the fields which have a thin veneer of ashy burnt material at the surface.
- 10.1.3 Both the made ground in the east, and the burnt material, contain elevated concentrations of a number of inorganic determinands and contains materials (e.g. clinker, coal, brick, etc.), which would generally be considered undesirable as a near-surface material in garden areas.
- 10.1.4 No areas of significant organic (hydrocarbon) contamination have been identified.
- 10.1.5 It should be noted that no sampling of the tarmac within the access drive in the north has been undertaken to date due to access constraints. In addition, the rough track in the south has not been sampled although based on observations made on-site it is unlikely to be of significant thickness or composition.

10.2 Revised conceptual ground model (contamination)

- 10.2.1 The Preliminary Conceptual Site Model has been amended in light of data obtained during the ground investigation, most notably with respect to the distribution of made ground and contaminants.
- 10.2.2 A revised Conceptual Site Model is presented as Drawing 2828/7 in Appendix B. The Model includes the contaminants described in Section 10.1 above, and potential pollutant linkages (summarised below in Section 10.4) to receptors.

10.3 Environmental setting & end use

- 10.3.1 As discussed in Section 10.1 above, (minor) contamination exists in the soil beneath the far east of the site. In order to assess the significance of this contamination, consideration must be given to the site's environmental setting and the proposed end use.
- 10.3.2 The underlying Lower Coal Measures bedrock is classified as a Secondary A aquifer. The nearest surface watercourse is the Nann Hall Beck, which flows in a southerly direction, located in the far northeast of the site. Therefore, the site's environmental setting is considered to be high sensitivity.
- 10.3.3 With respect to human health, the proposed end use (residential) is considered sensitive.
- 10.3.4 Transient risks to construction workers can be addressed by the adoption of appropriate health and safety measures, see Section 14.6.

10.4 Pollutant linkages

10.4.1 In terms of a proposed redevelopment of this site, plausible pollutant linkages can be summarised as follows.

Contaminants

10.4.2 Contaminants have been summarised in Section 10.1 above.

Pathways

10.4.3 Potential contaminant pathways include:

- Ingestion
- Dermal contact
- Inhalation of contaminated particulates

Receptors

10.4.4 Potential contaminant receptors include:

- End users of the site (residents)

10.4.5 It can be concluded that there are plausible pathways between the soil contaminants summarised in Section 10.1 above and potential receptors. Consequently, some remediation will be required; either treatment/removal of the contaminant, or "breakage" of the pathway.

10.5 Potential remediation options

General

10.5.1 Approval of the recommendations given below should be sought from the appropriate regulatory authorities prior to commencement of site redevelopment.

Combustibility & inorganic contamination

10.5.2 The made ground encountered in the far east has yielded elevated concentrations of a number of metals; most notably arsenic, copper and lead. In addition, it has yielded an average CV of 6.8 MJ/kg which is in the middle of the range where the potential for combustion exists.

10.5.3 Based on the proposed site layout this area is to be Public Open Space with an underground surface water attenuation tank. Therefore, it is recommended that the made ground is excavated and temporarily stockpiled during excavation of the underground storage tank, subsequently being replaced and isolated beneath a geotextile membrane and a 500mm thick surface cover of "clean" soil within POS. This cover will break potential pollutant linkages between the contaminated made ground and future end-users.

10.5.4 Alternatively, the Granular Made Ground is considered suitable for redistribution beneath concrete oversite or areas of hardstanding, where they would be satisfactorily isolated from end users.

10.5.5 Material excavated from areas of burnt ground should be redistributed beneath 500mm of "clean" soil cover within POS, concrete oversite or areas of hardstanding, where they would be satisfactorily isolated from end users, or disposed offsite.

10.5.6 The made ground should not be placed beneath garden areas due to the inorganic contamination and elevated CV.

10.6 Summary of potential pollutant linkages & mitigation

- 10.6.1 In terms of the proposed redevelopment plausible pollutant linkages, and feasible remediation options, can be summarised as follows:

Receptors	Pathways	Contaminants	Plausible pollutant linkage? (and remediation options where required)
Human health (Future residents) ◇	Consumption of contaminated vegetables	Metals in the made ground	Yes – Isolation beneath 500mm clean soil cover in landscaped area in far east OR Isolation beneath areas of hardstanding
	Ingestion		
	Dermal contact		
	Inhalation (dust)		
Buildings	Migration & accumulation of explosive gas	Methane	To be assessed on completion of monitoring and gas risk assessment

◇ transient risks to construction workers will be addressed by the adoption of appropriate health and safety measures in accordance with the Health and Safety at Work Act 1974 and regulations made under the Act including for example the COSHH Regulations.

10.7 Waste classification

- 10.7.1 Disposal of the made ground off site is generally not considered appropriate, economically viable, nor in line with current Government philosophy regarding sustainable development. However, some excess arisings may be generated by excavations for foundations, sewers etc. Disposal to landfill (or an appropriate soil / aggregate transfer station) may be the most practical solution, if redistribution and retention on site is not feasible.
- 10.7.2 Following excavation and stockpiling, sampling will be required prior to disposal.
- 10.7.3 As there is no WRAP protocol for soils, the characterisation, sampling and classification of soils arising from brownfield sites has been incorporated within the Environment Agency's Technical Guidance WM3². Classification of soils as non-hazardous or hazardous in accordance with WM3 is quite a complex process, although it ultimately results in a simple classification as hazardous or non-hazardous. Note: inert is not a class under WM3; WAC testing is required to determine whether a waste soil can be considered inert.
- 10.7.4 If waste soil is classed as hazardous following classification under WM3, and destined for landfill, waste acceptance criteria (WAC) leachate testing will need to be undertaken. Similarly, if waste soil destined for landfill is classed as non-hazardous under WM3, and suspected to be inert, WAC leachate testing will need to be undertaken. However, non-hazardous soil waste can go to a non-hazardous landfill facility; no further testing (e.g. WAC) is required.
- 10.7.5 WAC analysis is different to the 'routine' laboratory testing (such as that included earlier in this Section) undertaken in order to determine hazardous properties. Lithos typically only include WAC analysis if significant off-site disposal (of soil classified as hazardous waste) is anticipated.
- 10.7.6 It is critical if material is to be exported from site that this is allocated an appropriate waste code, following the steps within WM3. Waste carriers transporting, and sites accepting, this material should have a corresponding code within their permits. It is the responsibility of those generating the waste (i.e. the site), to ensure that the waste is handled and disposed of appropriately.

² Technical Guidance WM3 – Guidance on the classification and assessment of waste. Environment Agency 2015

- 10.7.7 Soil treatment facilities (STFs) provide an alternative to landfill. STFs are regulated by the Environment Agency and allow soils to be treated and screened (effectively recycled to be used at other sites). Export to an STF does not require WAC testing and suitability of various soil types will be dependent on material waste codes, which may be allocated after consideration of the data in Section 9 but will often need supplementing with further testing after soils have been stockpiled (see also advice in Section 14.3).
- 10.7.8 Most STFs are permitted to accept soils with waste code 17 05 04 (i.e. soils which do not exhibit hazardous properties). Lithos has a list of permitted STFs and can help identify one local to this development site.
- 10.7.9 With respect to asbestos, waste soils will be classed hazardous if the soil mass contains more than 0.1% asbestos fibres that are free and dispersed. However, WM3 states that where the waste contains identifiable pieces of asbestos (i.e. any particle of a size that can be identified as potentially being asbestos by a competent person if examined by the naked eye), then the waste is hazardous if the concentration of asbestos in the pieces alone is 0.1%. If a stockpile of soil contained rare fragments of broken asbestos-cement sheeting, the whole stockpile would be classed as hazardous unless all the fragments could be picked-out (even though the concentration of asbestos in the soil mass might be orders of magnitude less than 0.1%).
- 10.7.10 As discussed in Section 8.3, tarmac hardstand is present in an access drive in the far north of the site. No investigation into the thickness or composition has been possible to date due to access constraints.
- 10.7.11 This tarmac could be recycled and crushed to yield a 6F3 selected granular material, provided the recovered bitumen content is less than 10% (determined in accordance with BS598-1:2011). Crushed tarmac could also be blended with crushed concrete etc to generate 6F2 graded material. 6F2 can contain up to 50% recycled tarmac/asphalt (provided it does not pose a contamination risk to controlled waters and, if the proportion of asphalt is greater than 20%, the recovered bitumen content is less than 2%).
- 10.7.12 However, if off-site disposal is anticipated, tarmac assessment is based on the amount of coal tar present, this will vary depending on the age of the tarmac. The assessment is based on the amount of benzo(a)pyrene and has a concentration limit of 50mg/kg.
- 10.7.13 Contractors exporting waste from the site should review the site investigation data and make their own assessment. Alternatively, Lithos could undertake this assessment once exported waste streams have been identified.

11 HAZARDOUS GAS

11.1 General

- 11.1.1 Consideration of the conceptual site model and potential linkages has enabled a preliminary qualitative assessment of risks associated with gas:-

Source	Receptors	Hazard	Pathway	Initial risk
Off-site landfill (230m northwest)	Human health	Asphyxiation & explosion	Lateral migration, ingress & accumulation	Low: natural strata to at least 5m depth are generally of low permeability
	Buildings	Explosion		
Shallow mineworkings	Human health	Asphyxiation & explosion	Vertical migration, ingress & accumulation	Moderate: no significant thickness of low permeability drift or bedrock above workings
	Buildings	Explosion		
Old quarry (100m east) & mill pond (immediately south)	Human health	Asphyxiation & explosion	Lateral migration, ingress & accumulation	Low: natural strata to at least 5m depth are generally of low permeability
	Buildings	Explosion		

- 11.1.2 The mill pond to the south is not considered to be a significant source of hazardous gas generation given a residential development (Kestrel View) is currently situated above the former mill pond.
- 11.1.3 Given the above gas monitoring wells have been installed in 19 boreholes across the site. Details of the installations are given on the probehole logs presented in Appendix G to this the report.
- 11.1.4 The generation potential of the gas source was initially considered to be Low and this has been confirmed by the monitoring results obtained. Consequently, in accordance with CIRIA Report C665, given the proposed residential end use, 9 visits have been scheduled over a 6-month period.

11.2 Scope of works

- 11.2.1 To date, the wells have been monitored on five occasions for groundwater levels and soils-gases, and the results are presented in Appendix J.
- 11.2.2 A standard procedure was followed, in accordance with CIRIA guidance:
- Ambient oxygen concentration
 - Atmospheric temperature & pressure
 - Methane, oxygen and carbon dioxide concentrations and flow rates using a Gas Data GFM436 infra-red gas analyser
 - Standing water level using a dipmeter
 - Ambient oxygen concentration (check for instrument drift)

11.3 Monitoring results

11.3.1 The results of 5 monitoring visits (15th April to 7th June 2019) completed to date are summarised below.

Well	Response zone	Range of methane concentrations (% v/v)	Range of carbon dioxide concentrations (% v/v)	Range of steady flow rates (litre/hour)
PH01A	3.0m to 6.0m (sandstone and mudstone)	N.D.	0.4 – 1.5	N.D.
PH02A	2.0 m to 4.0m (sandstone and mudstone)	N.D.	0.1 – 3.6	N.D. – 3.2
PH03A	3.0 m to 6.0m (sandstone and mudstone)	N.D.	0.6 – 2.5	N.D.
PH04A	2.0 m to 4.0m (Coal, sandstone and mudstone)	N.D.	1.1 – 4.7	N.D. – 4.2
PH05A	3.0 m to 6.0m (sandstone and mudstone)	N.D.	0.3 – 0.5	N.D.
PH06A	3.0 m to 6.0m (sandstone and mudstone)	N.D.	0.2 – 2.7	N.D.
PH08A	3.0 m to 6.0m (sandstone and mudstone)	N.D.	0.2 – 0.7	N.D.
PH09A	2.0 m to 6.0m (sandstone and mudstone)	N.D.	0.7 – 3.5	N.D.
PH10A	2.0 m to 4.0m (sandstone and mudstone)	N.D.	1.2 – 2.3	N.D.
PH11A	2.0 m to 4.0m (sandstone and mudstone)	N.D.	0.8 – 3.4	N.D.
PH12A	3.0 m to 6.0m (sandstone and mudstone)	N.D.	1.4 – 3.3	N.D.
PH13A	3.0 m to 6.0m (sandstone and mudstone)	N.D.	0.6 – 6.6	N.D.
PH14A	3.0 m to 6.0m (sandstone and mudstone)	N.D.	1.6 – 6.6	N.D.
PH15A	3.0 m to 6.0m (sandstone and mudstone)	N.D.	0.3 – 0.7	N.D.
PH16A	3.0 m to 6.0m (Coal, sandstone and mudstone)	N.D.	0.6 – 3.2	N.D.
PH17A	3.0 m to 6.0m (Coal, sandstone and mudstone)	N.D.	1.0 – 2.4	N.D. – 1.4
PH18A	3.0 m to 6.0m (sandstone and mudstone)	N.D.	0.1 – 2.0	N.D.
PH19A	3.0 m to 6.0m (sandstone and mudstone)	N.D.	0.8 – 2.8	N.D.
PH20A	3.0 m to 6.0m (sandstone and mudstone)	N.D.	0.7 – 6.7	N.D. – 0.8

N.D. – None detected

11.4 Discussion

11.4.1 Generic Note 05 in Appendix A outlines how monitoring results are interpreted.

11.4.2 A hazardous gas risk assessment incorporating all of the results will be issued on completion of monitoring in November 2019. At this stage, a likely worst-case scenario of AMBER 1 measures could be assumed, with a best case scenario of GREEN.

11.5 Radon

11.5.1 Information from Landmark suggests that radon protection measures are not required. This is confirmed by the Public Health England UK radon map which indicates that the site lies in an area where less than 1% of homes are estimated to be above the action level.

11.5.2 As such, no special precautions against radon are required on this site.

12 GEOTECHNICAL TESTING

12.1 General

12.1.1 A total of 32 samples of natural soil were delivered to a suitably accredited laboratory with a schedule of geotechnical testing drawn up by Lithos.

12.1.2 The geotechnical laboratory test results are presented in Appendix I to this report.

12.2 Atterberg limits

12.2.1 The plasticity indices of 20 samples of cohesive soil have been determined; results are summarised below.

Soil type	No. samples tested	Moisture content range (average)	Range of Plasticity Indices* (average)	Shrinkability
Cohesive Residual Soil	20	15 to 28 (23)	13 to 38 (25)	Low to medium

* Modified where appropriate in accordance with Chapter 4.2 of the NHBC Standards.

Note. The term Shrinkability is equivalent to the term Volume Change Potential used in Chapter 4.2.

12.2.2 For the purposes of foundation design, it is recommended that all cohesive soils be regarded as being of medium shrinkability.

12.3 Soluble sulphate and pH

12.3.1 In accordance with BRE Special Digest 1:2005, this site has been classified as greenfield with a mobile groundwater regime.

12.3.2 It is envisaged foundations will extend to depths of about 1m through made ground and natural strata and samples taken from this depth range have been submitted for pH and water-soluble sulphate (2:1 soil/water extract).

12.3.3 The concentrations of sulphate in the aqueous natural soil extracts of 32 samples were determined. In addition, 3 samples of made ground were tested as part of the contamination suite. The pH value of each sample has also been determined.

12.3.4 The highest water-soluble sulphate concentration and the lowest pH value for each soil type analysed are shown in the table below.

Soil type	No. samples tested	Lowest pH values	Highest soluble sulphate concentration (mg/l)
Cohesive Made Ground	1	6.1	26
Granular Made Ground	2	7.1	55
Cohesive Residual Soil	20	5.6	58
Granular Residual Soil	9	5.4	44
Coal Measures	1	6.4	22
Coal	2	5.2	16

12.3.5 Two samples yielded pH values below 5.5, therefore supplementary analysis to determine the concentrations of magnesium, chloride and nitrate was scheduled. Both samples yielded magnesium, chloride and nitrate results of less than 10mg/l, and consequently the equivalent sulphate concentrations are negligible.

12.3.6 In accordance with Tables C1 and C2 of SD1, sub-surface concrete should be Design Sulphate Class DS-1, with the site allocated an ACEC Classification of AC-2z.

12.4 Compaction tests

- 12.4.1 Laboratory compaction tests are useful wherever ground improvement is anticipated, for example to provide a satisfactory CBR beneath proposed highways.
- 12.4.2 In accordance with BS5930:2015 engineered fill is defined as material which is selected, placed and compacted to an appropriate specification so that it will exhibit the required engineering behaviour.
- 12.4.3 Grading and moisture content control the degree to which materials can be effectively compacted. If the grading or moisture content of an in-situ material is not suitable to facilitate its compaction then screening, wetting, or lime addition may be required.
- 12.4.4 Laboratory compaction testing was scheduled on 4 samples of Cohesive Residual Soil (using a 2.5kg rammer) to determine their suitability for re-engineering.
- 12.4.5 Laboratory compaction tests are only appropriate if:
- At least 90% of the material passes the 37.5mm sieve; and/or
 - At least 70% of the material passes the 20mm sieve
- 12.4.6 It is apparent from the gradings tabulated below, that the samples scheduled for compaction tests are suitable (i.e. at least 70% of the material is finer than 20mm).
- 12.4.7 The material particle density (G_s) is required in order to plot the 0, 5 and 10% air voids lines on the compaction graph for each material type.
- 12.4.8 The results are summarised in the tables below:

Sample location & depth	Material description	% passing 37.5mm sieve	% passing 20mm sieve
TP05, 0.4m	Slightly sandy slightly gravelly CLAY	100	100
TP29, 0.8m		100	100
TP42, 0.7m		100	100
TP51, 0.7m	Slightly sandy gravelly CLAY	100	100

Sample location & depth	Material description	G_s (Mg/m ³)	MDD (Mg/m ³)	OMC (%)	Allowable mc range for 95% MDD & <5% air voids	Typical in-situ moisture content (%)
TP05, 0.4m	Slightly sandy slightly gravelly CLAY	2.65	1.60	23	22.0 to 27.5	23
TP29, 0.8m		2.69	1.70	19	18.5 to 24.5	
TP42, 0.7m		2.70	1.89	15	13.0 to 19.0	
TP51, 0.7m	Slightly sandy gravelly CLAY	2.58	1.46	26	26.5 to 31.5	

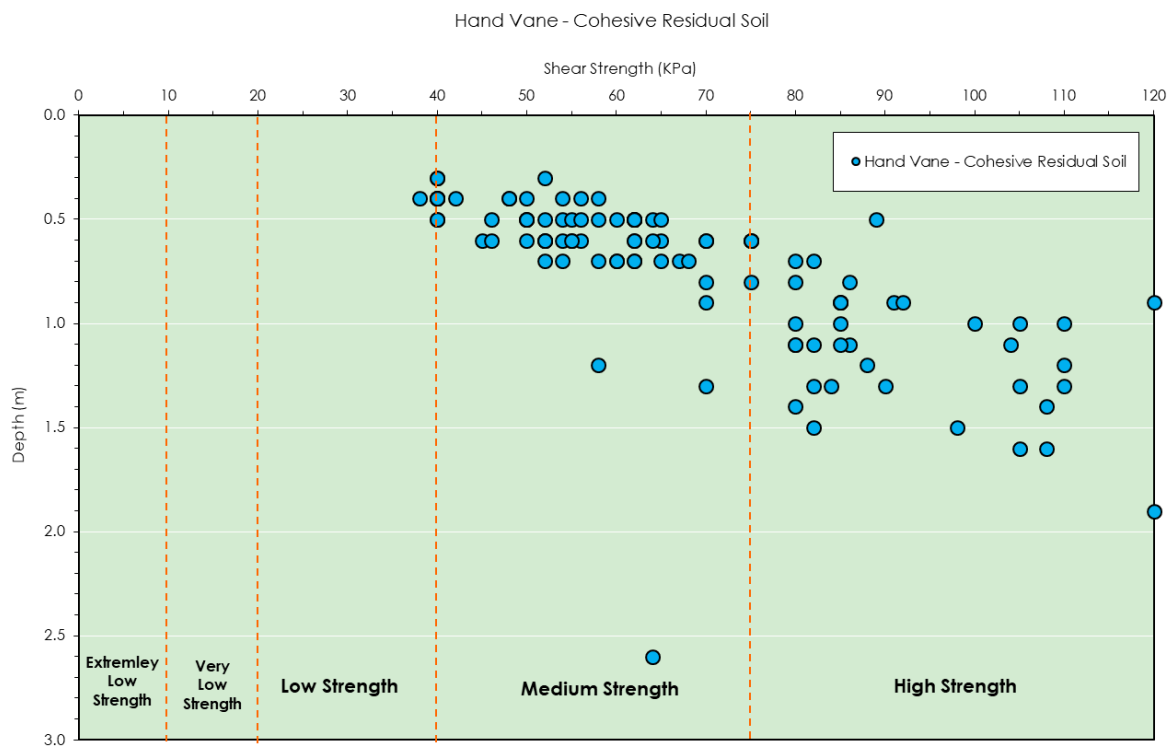
- 12.4.9 It is apparent that the in-situ moisture content of the Cohesive Residual Soil is generally within the allowable moisture content range to achieve 95% MDD. On this basis it is considered that suitable for re-engineering, but additional samples should be taken prior to, or during, earthworks.
- 12.4.10 Depending on the time of year that earthworks are undertaken, the natural cohesive soils may require some drying out before they can be utilised for engineered fill.

- 12.4.11 Drying out of these soils will require careful management on site. They should be placed in sealed stockpiles during periods of wet weather, or while the site is unattended. During periods of favourable weather (ideally warm & windy) the soils should be spread in thin layers over as wide an area as possible and aerated by turning with an excavator. Alternatively, consideration could be given to lime stabilisation
- 12.4.12 Acceptability of the cohesive soils for use in the proposed controlled earthworks will need detailed appraisal by the Earthworks Designer in light of the required performance characteristics.

12.5 Undrained shear strength testing

Hand shear vane testing

- 12.5.1 Hand shear vane testing was undertaken within trial pits in-situ to around 1.2m depth and from larger blocks of excavated clay below that depth.
- 12.5.2 The results are summarised within the plot below and illustrate a broad linear increase in undrained shear strength (S_u) with depth within the Cohesive Residual Soil. Below approximately 0.9m depth S_u is typically greater than 70kPa.
- 12.5.3 The plot below provides a summary of undrained shear strengths.



13 GEOTECHNICAL ISSUES

13.1 Conceptual site model

- 13.1.1 A veneer of made ground (<0.5m thick) has been encountered in the far east associated with the former Merchant Fields Colliery. Locally the made ground is up to 1.6m thick over the mine shafts. The proposed layout suggests this area will be Public Open Space, with an underground surface water attenuation tank.
- 13.1.2 Natural ground comprises Cohesive Residual Soil (firm to stiff gravelly clay) to an average depth of 1.7m, underlain by Granular Residual Soil (clayey gravel).
- 13.1.3 Coal Measures bedrock was encountered across the site from between 1.1m and 3.5m depth (average 2.2m) and typically comprised moderately weak to medium strong sandstone. Coal or weathered coal was encountered in trial pits in the north and centre (Wheatley Lime Coal) and far south (Middleton 11 Yard Coal).

13.2 Mining & quarrying

- 13.2.1 There are no known quarries on, or within 50m of the site.
- 13.2.2 The majority of this site is located within a Coal Mining Development High Risk Area.

Shallow mineworkings

- 13.2.3 Mitigation against the risk of subsidence associated with shallow mineworkings in the Middleton 11 Yard Coal will be required in the west, likely via drilling and grouting (as shown on Drawing 2828/12 Rev. A).
- 13.2.4 In addition, evidence of suspected 'packed workings' has been encountered across the majority of the site within the Middleton 11 Yard coal, at depths which could potentially influence surface stability if/where voids are present.
- 13.2.5 By nature, the packed workings should not require any treatment (e.g. consolidation by drilling & grouting) because they are already effectively consolidated. However, any localised voids (e.g. old tramways, waterways etc) will be difficult to identify by further investigation, due to their discrete nature.
- 13.2.6 Therefore, it is recommended that, as part of the proposed drilling & grouting works plots underlain by the Middleton 11 Yard within influencing depth, should be proof-drilled in order to determine the need for any grouting within this seam. Grout takes in the vast majority of proof-drilled holes would be expected to be very low.
- 13.2.7 In addition, the centre-line of proposed highway routes should be proof drilled every 3m. The area requiring proof drilling in the Middleton 11 Yard seam (majority of the site) is shown on Drawing 2828/12 (rev. A).
- 13.2.8 The Blocking Coal seam has been identified at shallow depth and is worked in the south and east. Like the Middleton 11 Yard coal, it is thought that this seam has also been 'packed' to some extent. Workings within this seam in the south will also require consolidation by drilling and grouting; the affected area is shown on Drawing 2828/12 (rev. A).
- 13.2.9 Where workings are identified and within influencing depth of the surface, it is considered that the necessary consolidation (grouting) would require drilling holes on a 4.5m grid. A viscous grout composed of appropriate proportions of OPC, PFA, sand or pea gravel would then be injected into the workings via these holes.

- 13.2.10 Further holes would need to be drilled in areas of high grout take (to confirm filling of void space), and in areas where several adjacent holes encountered solid coal (to confirm that the local area is underlain by no workings, rather than pillars).
- 13.2.11 Drilling and grouting operations should be carried out with engineering supervision and be undertaken in accordance with a revision of Lithos' "General Specification for the Treatment of Shallow Mineworkings" tailored to the site-specifics.

Mine entries

- 13.2.12 As discussed in Section 4.3 there are 4 known mine entries within the site's boundary, 3 located in the far east, associated with the former Merchant Fields Colliery, and one located on the western boundary.

East

- 13.2.13 Topsoil and made ground was stripped from the locations of recorded shafts down to natural soils which was subsequently inspected. Circular mine entries were identified in close proximity to the CA recorded position.
- 13.2.14 Excavations encountered Shaft Backfill (gravelly clay and clayey gravel of sandstone, mudstone and coal with rare brick cobbles) within the mine entries. One of the shafts was found to have a brick lining, about 250mm thick, with a second being partially brick lined.
- 13.2.15 Each of the 3 shafts have been surveyed-in; co-ordinates are provided in the table below. The mine entry locations, along with illustrative photographs, are shown on Drawing 2828/10A in Appendix B.

Shaft Ref.	Coordinates	Diameter/m	Depth to bedrock/m	Approx. location
419426-001	419080.174 E, 426355.379 N	2.6	2.2 (average across the site)	Far east of site, beneath proposed attenuation tank & area of POS
419426-002	419109.590 E, 426361.738 N	3.2		
419426-005	419091.913 E, 426347.452 N	2.7		

- 13.2.16 Based on a sketch Layout provided by Harron, it is not expected that the position of these shafts will affect any nearby plots.
- 13.2.17 However, it is understood an underground surface water attenuation tank is proposed over the top of these shafts, within an area of POS. Early liaison with the Coal Authority and the tank manufacturer is recommended regarding the feasibility of positioning the attenuation tank above these shafts.
- 13.2.18 Initial discussions with the Coal Authority suggest that, whilst not recommended, they will consider an application to place the tank above the shafts, provided it can be proven the tank cannot be situated elsewhere in the development and suitable remedial works are carried out (likely to comprise an engineered cap at rockhead).
- 13.2.19 The concrete cap should be designed to be capable of supporting the weight of the tank when full and any fill material placed above. It may be possible to design the base of the tank to act as a shaft cap. However, further advice should be sought from a competent structural engineer and the tank manufacturer.

West

13.2.20 To date, despite topsoil stripping over an area of approximately 400m² (see Drawing 2828/10B), the CA recorded mine entry in the far west has not been located. A steep slope partly restricted the search area.

13.2.21 Consequently, for now the CA will expect Harron's layout to assume potential no-build "zones of influence" around each shaft based on the following calculation:

Zone of influence = 0.5 x assumed shaft diameter + departure + drift/made ground depth

13.2.22 In essence, departure relates to the degree of certainty with respect to the entry's location; approximate co-ordinates are provided on the CA's mine entry data sheets; see Appendix E). In turn, departure is dictated by the "source" of the entry's location as provided by the CA's mine entry data sheets.

13.2.23 Consequently, at this stage the zones of influence associated with each shaft must be assumed to be:

Shaft Ref.	Source	Departure /m	Diameter /m	Depth to bedrock/m	Zone of influence (circle of radius)/m	Approx. location
418426-008	BGS maps	10	≈2.5	2.5	13.75	Adjacent to Hunsworth Ln (far west)

13.2.24 Based on Harron's current proposed layout, this shaft is unlikely to affect development proposals. Nonetheless, it should be located (or its' position proven to be off-site) prior to development. This would be best done as part of the required topsoil strip.

13.2.25 If located, the mine entry should be treated in accordance with an appropriate Specification (Lithos can prepare this), likely involving an engineered cap at rockhead. The cap should be a least twice the internal diameter of the shaft and be designed by a competent structural engineer.

Entire site

13.2.26 It is possible that unrecorded "shallow" shafts (possibly bell pits) may be present at this site, and consideration should be given to a geophysical survey, although success would be dependent on the "contrast" between shaft backfill and the surrounding ground (i.e. the survey is likely to be more successful if shaft backfill is significantly different material or less dense than the surrounding ground). Follow-up intrusive investigation (pitting) would be recommended to determine the cause of any anomalies identified by the geophysics.

13.2.27 If bell pits are present, given the likely depth constraints discussed in Section 4.3, it seems likely they will be limited to the north, south and west; perhaps about 40% of the total site area, targeting the Wheatley Lime and possibly the Middleton 11 Yard coal seams.

13.2.28 Given the absence of loose superficial deposits, it is considered unlikely that such mine entries would have been lined.

13.2.29 Whilst the Coal Authority (and NHBC) discourage development over or adjacent to all mine entries, Lithos consider such features to pose a low risk to surface stability where they only extend to relatively shallow workings that require treatment (grouting). Consequently, we would not expect any (previously unrecorded) shallow shafts, encountered during site preparatory works and/or the subsequent construction phase, to result in the need for "no-build" zones and/or revision of the planning-approved layout although Harron may choose to do this.

- 13.2.30 However, where build over a shaft(s) is proposed, Harron will need to discuss proposed treatment (which is likely to include both grouting of the shaft backfill, and a cap at rockhead) and bespoke foundation design, by a suitably qualified structural engineer, with the Coal Authority. A Permit to Enter or Disturb Coal Authority Mining Interests will be required prior to construction of any shaft cap.
- 13.2.31 Proposals to treat the mineworkings and shafts will need to be discussed with both the Local Authority (most notably Highways), the Coal Authority and NHBC well in advance of starting works on site.
- 13.2.32 Any shafts encountered during the development of this site should be made safe by treatment in accordance with an appropriate Specification (Lithos can prepare this) and a Coal Authority Permit to Enter or Disturb Coal Authority Mining Interests.

13.3 Site regrade and/or ground improvement

- 13.3.1 Given existing topography (much of the site is sloping; with gradients of up to 1 in 5 in the southwest), some site regrade is anticipated, with the need for underbuild and retaining walls.
- 13.3.2 Careful consideration will need to be given to earthworks design, and implications for treatment of mineworkings, slope stability, retaining walls, foundations, highway gradients and drainage
- 13.3.3 Any digital terrain modelling undertaken or commissioned by Harron should consider implications for the foundation recommendations outlined below.
- 13.3.4 Natural ground underlying this site is often clayey, therefore consideration should be given to the implication of undertaking earthworks in poor/wet weather when the ground surface is likely to become difficult to cross with heavy machinery.
- 13.3.5 Wherever possible, Lithos recommend that excavated soils are retained on site. However, if this is not possible the comments in Section 10.7 should apply.

13.4 Foundation recommendations

General

- 13.4.1 Foundation recommendations assume that development will be two or three storey construction and that line loads will not exceed 90kN/m run. If this is not the case significant alteration to these recommendations will be required.
- 13.4.2 Finished ground levels are likely to differ from those at the time of the investigation in certain areas following anticipated re-grading (see Section 13.3 above). However, natural ground conditions across the site were fairly consistent and the foundation recommendations given below assume that foundation excavations will encounter Cohesive/ Granular Residual Soils, and locally, bedrock, at founding depth.
- 13.4.3 Made ground is not considered a suitable foundation material and foundations should therefore be taken through these materials into underlying natural strata of adequate bearing capacity.
- 13.4.4 Sub-surface concrete in contact with the made and natural ground should be Design Sulphate Class DS-1, with the site allocated an ACEC Classification of AC-2z.

Strip/trench fill footings

- 13.4.5 It is considered that shallow strip or deepened trench fill footings will be the most suitable foundation solution for two or three storey houses constructed at the site. Footings will be founded in firm clay or competent rock.
- 13.4.6 Shallow spread foundations could be utilised for plots above and treated shallow mineworkings. Where underlying mineworkings are to be consolidated, foundations should be "beefed-up" to accommodate any potential time dependant differential settlement. Further advice regarding reinforcement should be sought from the appointed Structural Engineer, but in the meantime, reference should be made to the table below.

Rock cover above grouted seam	Preferred Foundation
<5 x seam thickness	Raft - designed to span 3m over potential soft spots and cantilever 1.5m at corners. Either stiffened, flat-bottomed rafts a minimum of 300mm thick, on 450mm of compacted Type 1 material, with reinforcement top and bottom. Or, rafts could be of 300mm concrete with a 150mm upstand to allow for wall construction provided that the base of compacted type 1 material lies at a depth of at least 600mm
>5 x seam thickness – 10m	Strip footing OK, but thickened (300mm), and reinforced top and bottom
>10m	Strip footing OK, but needs to be 300mm thick reinforced with one layer of mesh

- 13.4.7 Beyond areas of treated mineworkings, reinforcement, as a precaution against differential settlement, is recommended only where foundation excavations encounter significant lateral and vertical variations in strata. One layer of B385 mesh placed 75mm above the base of the footing is likely to provide suitable reinforcement, but further advice should be sought from the Structural Engineer.
- 13.4.8 Foundations of plots placed over relict foundations (possible in the east; vicinity of former colliery buildings) should be taken to greater depth than the relict foundations and into natural ground of adequate bearing capacity.
- 13.4.9 Foundations will be required to be placed below a line drawn up at 45° from the base of any service or similar excavation.

- 13.4.10 Overdeepened foundations should be stepped in accordance with NHBC Standards, Chapter 4.4.
- 13.4.11 In order to minimise softening and swelling of cohesive soils or loosening of granular soils, it is recommended that footings are cast as soon as formation level is reached (or alternatively formation could be blinded using concrete with as low a water:cement ratio as possible).
- 13.4.12 Harron or their groundworker should seek further advice from Lithos if unexpected ground conditions are encountered in foundation or sewer excavations, including any conflict between soft ground associated with a backfilled trial pit excavation and the line of a proposed footing.

Cohesive Residual Soil

- 13.4.13 Clay classification tests suggest that natural cohesive soils at the site should be regarded as being of medium shrinkability. A minimum founding depth of 900mm is therefore recommended for all soils on the site where strip footings are proposed.
- 13.4.14 In accordance with NHBC Standards, founding depths in cohesive soils should be taken from original or finished ground level, whichever is the lower, to the underside of the footing.
- 13.4.15 Foundations should be deepened near trees in accordance with NHBC Standards Chapter 4.2. It is estimated that up to 40% of the site may be affected by trees.
- 13.4.16 The current layout suggests some plots will be built on ground from which hedgerows will be removed. Whilst the hedgerows at the site are relatively low (<2.5m height) and appear to have been maintained at that height by trimming, it is often difficult to definitively prove that they have not desiccated soils to significant depth. In theory, if mature Hawthorn is removed from within the footprint of a plot, founding depth (in medium shrinkability clay) would be >2.5m.
- 13.4.17 It is apparent from the site walkover (see Section 2) that large bushes, hedgerows and trees are present along a number of the field boundaries, and previously there were trees in the far east and west. Other localised areas of vegetation in the fields have also been cleared.
- 13.4.18 Lithos have no information regarding tree species or height, and therefore the depth to which these trees will have influenced the moisture content of shallow soils is not known. Moisture content recovery in clay soils typically takes several years and it is not possible to predict when such soils have rehydrated and no longer pose a heave risk to foundations.
- 13.4.19 Consequently, at this stage a worst-case scenario with respect to deepening of foundations due to tree influence must be assumed; i.e. a high water demand tree (e.g. Poplar) at mature height (28m). This results in footings in excess of 2.5m where new dwellings are situated within 9m of a felled tree, and the zone of influence still required deepening to 1.2m at a distance of 30m from the felled tree.
- 13.4.20 Trench fill foundations should be designed in accordance with NHBC Standards, Chapter 4.2. Heave precautions (a suitable approved compressible void former) should be used on the internal face of all external walls where the foundation is within the zone of influence of trees and greater than 1.5m deep.
- 13.4.21 Any trench fill foundation deeper than 2.5m will need to be designed by a Chartered Engineer, whose status is accepted by NHBC (NHBC Standards, Technical Requirement R5); however, it is likely that the presence of granular soils/bedrock will result in few, if any, foundations being deeper than 2.5m.
- 13.4.22 It would therefore be prudent to prepare a detailed foundation schedule and seek approval from NHBC in order to determine likely foundation abnormalities.

- 13.4.23 A safe bearing capacity of at least 150kPa, allowing a maximum foundation line load of 90kN/m run, can be assumed if the following are true:
- A foundation length of 8m
 - A foundation breadth of 0.6m
 - A foundation thickness of 225mm
 - A foundation depth of 0.9m
 - An undrained shear strength of 65kPa for the firm clay (typical minimum recorded below 0.9m)
- 13.4.24 Assuming the foundation geometry detailed above, settlements of less than 25mm would be anticipated. This is considered likely to be acceptable. However, further advice should be sought from the Structural Engineer responsible for foundation design.

Granular Residual Soil

- 13.4.25 The weathered in-situ sandstone (sand, gravel and cobbles) is assumed to have a relative density of at least medium dense (in accordance with BS5930:2015).
- 13.4.26 A safe bearing capacity of at least 150kPa, allowing a maximum foundation line load of 90kN/m run, can be assumed if the following are true:
- A foundation length of 8m
 - A foundation breadth of 0.6m
 - A foundation thickness of 225mm
 - A foundation depth of 0.6m depth
 - An angle of shearing resistance of $\phi=32^\circ$ for the granular deposits
- 13.4.27 Assuming the foundation geometry detailed above, settlements of less than 25mm would be anticipated. This is considered likely to be acceptable. However, further advice should be sought from the Structural Engineer responsible for foundation design.
- 13.4.28 In accordance with NHBC Standards, a minimum founding depth of 450mm (due to potential frost susceptibility) is required in granular soils. This depth should be taken from finished ground level to the underside of the footing. If finished ground level is to be above existing ground level then the foundation excavation simply needs to ensure that there is sufficient depth of excavation to allow casting of the footing entirely within natural ground (not made ground or topsoil).
- 13.4.29 However, if the excavation is dug from original ground level in cold conditions when freezing is expected, then foundation depth should be taken from the existing, not finished, ground level.
- 13.4.30 Where ground level is being raised, it would be prudent to proof roll the exposed granular soils after stripping topsoil (to mitigate any near-surface disturbance), and ideally fill should be placed prior to construction (otherwise the Developer will need to consider the potential for movement associated with placement of the fill).
- 13.4.31 It should also be noted that the footing may require deepening or stepping in order to allow plot drainage to exit the plot footprint (either over or under the footing).

Bedrock

- 13.4.32 The sandstone bedrock (locally mudstone/siltstone) is generally considered to have a safe bearing capacity of at least 300kPa and minimal settlements would be anticipated.
- 13.4.33 Where rock is encountered at shallow depth foundations should be placed entirely on rock and not partially on rock and partially on soil. This may, depending on surface gradient, necessitate significant overdeepening of foundations.
- 13.4.34 Locally the bedrock at the site comprises mudstone which can be easily excavated using a backhoe excavator and will be recovered as a tabular gravel. Where in-situ mudstone is encountered at founding depth (minimum of 450mm), it will provide a suitable founding stratum for two or three storey dwellings and need only be penetrated by the proposed foundation thickness. Note: any overlying residual soil (typically clay with gravel-sized lithorelicts of mudstone) is likely to be a shrinkable soil; Mudstone is not.

Coal

- 13.4.35 The Wheatley Lime Coal is likely to be encountered in any shallow excavations along the line of outcrop. In addition, some excavations in the far south may encounter the Middleton 11 Yard Coal.
- 13.4.36 Care should be taken not to unnecessarily overdeepen foundations, in order to minimise the chance of encountering coal.
- 13.4.37 Where foundation excavations do come into contact with coal, the foundation should be taken through the coal seam, into underlying natural in-situ strata of adequate bearing. The full thickness of coal should then be sealed with concrete to create a trench fill foundation. To prevent the ingress of air, the mass concrete fill should be placed as soon as possible after exposing the seam.
- 13.4.38 By virtue of the provisions of the Coal Industry Act 1994 interests in unworked coal and coal mines previously vested in the British Coal Corporation are now vested in the Coal Authority. The developer will need to contact the Coal Authority to dig or carry away such coal as they encounter in connection with redevelopment of the site (this is often referred to as incidental coal).
- 13.4.39 Proposed finished ground levels should take into account the resultant likelihood of encountering coal in foundation excavations.

Geological fault

- 13.4.40 Drawing 2828/8 shows the approximate line of the fault crossing the northeast corner site. Based on the sketch layout provided (Drawing reference 122-10-SK-10, dated November 2018) no plots are proposed within 50m of the fault given the presence of Nann Hall Beck.
- 13.4.41 It should be noted that the line of a fault on a geological map is often very approximate, and it may be inaccurate by 10m or more. Furthermore, the presence of a fault is usually 'masked' by overlying drift or residual soils; they can only be seen where long trenches are excavated into bedrock.
- 13.4.42 Further advice should be sought if a significant weak zone is encountered (e.g. ground comprising loose, broken or soft 'gouge' material) during the excavation of footings. If associated with a fault, the weak zone is likely to form a fairly continuous "linear belt", rather than a localised "pocket", and be anything from a few centimetres to a few metres in width.

13.5 Floor slabs

- 13.5.1 Suspended floor slabs should be utilised where the depth of made ground or engineered stone exceeds 600mm in accordance with NHBC Standards Chapter 5.1 (to negate potential settlement problems).
- 13.5.2 Where foundations are within the influence of existing or proposed trees (and are underlain by shrinkable soils), NHBC require a suspended floor slab, with sub-floor void. The floor slab is most commonly a precast block and beam construction, but alternatively could comprise a suspended timber floor, or a slab cast on a suitable compressible void former. Ground-bearing and cast in-situ suspended slabs (other than those cast on a void former) are not acceptable where foundations are within the influence of trees.
- 13.5.3 In accordance with NHBC Standards Chapter 4.2, a minimum void height of 250mm should be adopted for a precast block and beam (or suspended timber) floor; this includes a 150mm ventilation allowance. If a suspended, cast in-situ slab (on a void former) is proposed, a minimum clear void height of 100mm should be adopted; of course, the actual thickness of the void former will be significantly greater.
- 13.5.4 Beyond the influence of existing or proposed trees, it is considered that the natural ground is generally suitable for the use of ground bearing floors. However, ground bearing slabs should not be cast on topsoil or made ground. Where plots are elevated for design reasons, the depth of engineered stone below a ground bearing slab should not exceed 600mm, in accordance with NHBC guidance.
- 13.5.5 The natural ground beneath this site includes cohesive soils and is therefore subject to seasonal variation in moisture content. If ground slabs were constructed on desiccated soil, heave of the slab would occur on re-hydration of the ground. If any significantly desiccated soil is present, a suspended floor slab, with sub-floor void will be required.
- 13.5.6 It should be noted that NHBC have suffered a significant number of claims resulting from the use of ground bearing floor slabs. Consequently, if ground bearing slabs are proposed, care should be taken to ensure correct and careful construction. For example, if fill to the internal face of the foundation excavation is not properly compacted, subsequent settlement can result in cracking of the slab.
- 13.5.7 In the event that coal is exposed beneath the floor void, it would be prudent to prevent air ingress and the potential for spontaneous combustion by blinding with concrete or removing the coal.
- 13.5.8 Floor slab design should be finalised/take account of the results of the gas monitoring and protection measures required, which will be detailed in Lithos' gas risk assessment, to be issued on completion of monitoring in November 2019.

13.6 Designated concrete mixes

- 13.6.1 Designated mixes are considered in BRE Special Digest SD1 and BS 8500 -1:2015+A1:2016. However, in addition to soil chemistry (sulphate class), there are a number of other considerations relating to structural design that need to be taken into account when determining an appropriate concrete mix.
- 13.6.2 Consequently, Harron should seek advice from their appointed Structural Engineer.

13.7 Excavations

- 13.7.1 Groundwater should be controlled in accordance with CIRIA report 113 "Control of Groundwater for Temporary Works".
- 13.7.2 Based on the results of the investigation it is considered likely that groundwater seepages will be encountered in shallow excavations with inflows possible, especially should land drains be encountered.
- 13.7.3 Excavations should remain stable in the short term but if left open for any significant period of time may require shoring most notably in granular soils and made ground.
- 13.7.4 Bedrock was encountered in the majority of exploratory holes at between 1.1m and 3.5m depth. Based on the exploratory hole logs, excavation greater than 2.5m is likely to prove difficult across much of the site. It would therefore be prudent to allow for excavation of hard rock in any deep excavations such as those that may be required for drainage etc.
- 13.7.5 The Wheatley Lime Coal is likely to be encountered in any shallow excavations along the line of outcrop. In addition, some excavations in the far south may encounter the Middleton 11 Yard Coal.

13.8 Drainage

- 13.8.1 Based on existing topography and observations made during the investigation, soakaways are unlikely to provide a suitable drainage solution for surface water run-off at the site. Consequently, it will be necessary to consider alternative sustainable drainage systems (SUDS), and there may be a need for surface water balancing.
- 13.8.2 Alternative SUDS options (see CIRIA C753:2015 for further details) include:
 - Swales – linear grassed features in which surface water can be stored or conveyed. Where suitable, swales can be designed to allow infiltration.
 - Pervious Pavements – provide a surface suitable for pedestrian and/or vehicular traffic, while allowing rainwater to infiltrate into subsurface storage, with subsequent infiltration or controlled discharge. Pavement could be porous (water able to infiltrate across entire surface material; e.g. reinforced grass), or permeable (water infiltrates via joints between concrete blocks).
 - Ponds – designed to have permanent pool of water, but with capacity to provide temporary storage-controlled discharge.
- 13.8.3 Yorkshire Water have published a guide³ for developers and designers outlining their design requirements for surface water attenuation assets.
- 13.8.4 With respect to detention basins, which should normally be dry, water table levels should be taken from borehole monitoring wells over 4 consecutive seasons, for at least 3 points in the basin area. The detention basin should be designed to ensure that there is a minimum of 1m of unsaturated soil between the maximum groundwater level and the lowest part of the structure.
- 13.8.5 Appropriate design usually comprises a fall across the short axis (to centre of basin), and then along the long axis (possibly inclusive of a pipe in gravel trench) to the outfall.
- 13.8.6 The guide also discusses required access to flow control chambers, large diameter (i.e. >900mm) surface water storage pipes, and surface water storage tanks.

³ Design Requirements for Surface Water Attenuation Assets, February 2017.

- 13.8.7 Land drains were encountered within the site investigation trial pits. Provision of surface drainage infrastructure will negate the need for field drainage. However, field drainage encountered during construction of the infrastructure works, should where practicable and where the layout allows, be maintained.
- 13.8.8 It is recommended that the developer contact Yorkshire Water Services with respect to capacity in existing foul and surface water sewers in the vicinity of the development area.

13.9 Highways

- 13.9.1 This site is greenfield and the routes, formation level and total length, of proposed estate roads are currently unknown. Consequently, there was no merit in obtaining CBR values at this stage.
- 13.9.2 The natural soils present at shallow depth (anticipated formation) are predominantly cohesive. Based on visual inspection of the natural materials and the recorded plasticity indices at the site, published tables⁴ indicate that the Cohesive Residual Soil would be expected to provide a CBR value of at least 3%. This value should be verified prior to or during construction.
- 13.9.3 Whilst the CBRs estimated above should be achievable, significant deterioration during/after periods of significant rainfall and/or site trafficking is likely. Consequently, it would be prudent to consider flexibility in the groundworks programme to enable highway construction during prolonged dry/warm weather (typically between May and September) when formation will be least vulnerable to deterioration. Alternatively, a minimum 200mm thickness of suitable granular fill (i.e. a "blanket" of 6F2) could be placed along the line of proposed highways to protect formation during the construction phase.
- 13.9.4 As noted in Section 13.2, bell pits (or other unknown mine entries) could be present beneath this site. If encountered within the zone of influence of proposed highways, the Adopting Authority and Coal Authority should be consulted at an early stage to discuss appropriate treatment options.

13.10 External works

- 13.10.1 Any digital terrain modelling undertaken, or commissioned by Harron should be made available to their Engineering Designer prior to issue of an External Works Drawing.
- 13.10.2 Given existing topography some site regrade is anticipated, with the need for underbuild and retaining walls.

⁴ Interim Advice Note 73/06 Revision 1 (2009), Chapter 5. Characterisation of Materials Design Guidance for Road Pavement Foundations - Draft HD25

14 REDEVELOPMENT ISSUES

14.1 General

- 14.1.1 This report has presented options with respect to foundation solutions, treatment of contamination and re-use of topsoil etc that are considered technically feasible and in line with current good practice. Consequently, we would expect to obtain regulatory approval for whichever option is adopted, although this cannot be guaranteed. Copies of this report should be forwarded to the relevant regulatory authorities (Warranty Provider & Local Authority) for their comment/approval.
- 14.1.2 If unanticipated ground is encountered during the site preparatory works, the Contractor should immediately seek further advice from the Engineer.

14.2 Remediation strategy

- 14.2.1 Given the absence of any significant contamination, a remediation strategy is not considered necessary. Whilst a detailed remediation strategy report is unlikely to be required, preparation of a Remediation Statement would be prudent and should include:
- General site clearance of surface materials and vegetation
 - Excavation of surface material within areas of burnt ground and subsequent stockpiling for redistribution beneath areas of hardstand or disposal offsite
 - Isolation of made ground in the far east beneath a 500mm thickness of topsoil in landscaped area, or redistribution beneath areas of hardstand
 - Topsoil strip & stockpile
 - Location of the mine entry in the far west
- 14.2.2 Given the proposed end-use of land in the far east of the site, chasing out the relict foundations encountered is not considered to be necessary, although this may need to be revised in light of the final layout.
- 14.2.3 No areas of gross contamination were encountered during the site investigation. However, if any buried drums, "oily", odorous, brightly coloured etc. materials are encountered, further advice should be sought from Lithos.

14.3 Control of excavation arisings

- 14.3.1 Excavations into made ground are likely to yield contaminated arisings. The groundworker should carefully segregate (and stockpile separately) made ground arisings from arisings of "clean" natural soils, in order that an excessive volume of unsuitable material is not generated.
- 14.3.2 It should be ensured that the groundworker understands the need for good materials management. Most notably the importance of not mixing different materials within a given stockpile; i.e. there should be separate stockpiles of: topsoil; made ground; tarmac; excess clean, natural soil arisings; coal; general construction waste etc.
- 14.3.3 Further characterisation of stockpiled materials is likely to be required if off-site disposal is proposed. See also comments in Section 10.7 regarding asbestos.

14.4 Good practice guidance

- 14.4.1 The construction phase groundworker should follow good environmental practice to minimise the risks of spillage, leakage etc with reference, but not limited, to the following documents:
- CIRIA C502 'Environmental Good Practice on Site'
 - EA Pollution Prevention Guidelines⁵:
 - PPG6 - Working at construction and demolition sites
 - PPG2 - Above ground oil storage tank
 - PPG7 – The safe operation of refuelling facilities.
 - PPG21 – Incident Response Planning
- 14.4.2 Site preparatory works associated with this project are likely to involve the re-use of both natural and made ground soils on site. Therefore, the Contractor should prepare a Materials Management Plan (MMP) in accordance with the CL:AIRE Code of Practice (v2, March 2011).
- 14.4.3 The MMP will document how all of the materials to be excavated during the proposed site preparatory and remediation earthworks are to be dealt with.

14.5 New utilities

- 14.5.1 It is strongly recommended that all statutory service bodies are consulted at an early stage with respect to the ground conditions within which they will lay services in order to enable them to assess at an early stage any potential abnormal costs.
- 14.5.2 Drainage and other utilities should not be placed within any coal seam; the seam should either be removed to below the base of the lowest service, or services should be placed in oversize trenches cut into the seam & backfilled with inert material.
- 14.5.3 This vast majority of this site is greenfield, and contamination is confined to the far east only, and to limited depths.
- 14.5.4 Consequently, the use of 'standard' polyethylene water supply pipes should be acceptable, although Harron should consult Yorkshire Water at the earliest opportunity to confirm this.

14.6 Health & safety issues - construction workers

- 14.6.1 Access into excavations etc. must be controlled and undertaken in accordance with the CDM Regulations 2015, most notably Regulation 22, to mitigate risk of collapse or asphyxiation.
- 14.6.2 Before site operations are started, the necessary COSHH statements and Health & Safety Plan should be drafted in accordance with the CDM regulations.
- 14.6.3 The bulk of the made ground will be retained on site. This made ground contains contaminants at concentrations above the guidance threshold values for an end use that includes domestic gardens. Workers involved in excavations for foundations, drainage, utilities etc are likely to come into direct contact with the made ground.
- 14.6.4 Although workers will only be exposed to the contaminated soil for a relatively short time, the contaminants represent a risk, and simple precautionary measures are required, i.e. good personal hygiene and basic personnel protective equipment.

⁵ Whilst this has formally been withdrawn it can still be accessed via the EA archives and provides useful information on managing risks.

- 14.6.5 Consequently, during the remediation and construction phases of the site development it will be necessary to protect the health and safety of site personnel. General guidance on these matters is given in the Health and Safety Executive (HSE) document "Protection of Workers and the General Public during the Redevelopment of Contaminated Land".

14.7 Coal extraction

- 14.7.1 The Wheatley Lime Coal (c. 0.8m thick) underlies the north and west of the site; typically at depths of between 5m and 10m. In addition, the Middleton 11 Yard Coal underlies the entire site at shallow depth (c. 5m) in the south becoming deeper (up to c. 20m depth) towards the north.
- 14.7.2 Prior extraction of coal is encouraged by both the Coal Authority and Planning Authorities, largely because a potential mineral resource will not be sterilised by the development. However, it is worth noting that the UK market for coal is changing (driven by government carbon emission targets) – most notably very few power stations are still burning coal. Consequently, prior extraction of coal has become less attractive in recent times.
- 14.7.3 There can be financial benefits to extraction, since the extraction contractor would pay the landowner a disturbance allowance for the coal (likely to be between £2 and £4 per tonne), and there would be a saving because grouting would not be required.
- 14.7.4 Furthermore, any unrecorded mine entries would also be found and removed. Traffic movements (associated with coal export) are expected to be similar to those associated with grouting (import of PFA and cement).
- 14.7.5 However, coal extraction is not without drawbacks; these include:
- The creation of 'high-walls' around the margins of the extraction area (essentially the whole of the site's perimeter).
 - The time required to ensure significant settlement of the replaced overburden (anticipated residual settlement must be less than 25mm) is typically at least 12 months. However, the actual delay to build programme might be longer, since it is impossible to predict the actual time required for ongoing creep settlements to fall to tolerable levels. Prediction is hampered by uncertainties associated with groundwater rebound and the nature of the excavated material with respect to suitability for compaction.
 - Local environmental issues associated with noise and dust.
 - Public perception issues.
 - Concerns that once an initial excavation has been opened, the coal extraction contractor might decide there is insufficient coal remaining and abort further work, or even run into financial difficulties, leaving Harron with increased foundation abnormalities and no royalties.
- 14.7.6 Assuming the above factors do not preclude further consideration at the 'first hurdle', the viability of extraction is influenced by physical factors, most notably:
- the presence (or not) of old mineworkings;
 - seam thickness (greater the better); and
 - seam depth (shallower the better).
- 14.7.7 No mineworkings have been identified in the Wheatley Lime Coal to date. However, as discussed in Section 13.2), old mineworkings have been encountered in the Middleton 11 Yard Coal beneath the west of the site.
- 14.7.8 Further drilling has been recommended to confirm the absence of mineworkings in the Wheatley Lime Coal and to determine the area of the site underlain by mineworkings in the Middleton 11 Yard Coal.

- 14.7.9 Indeed, if the Wheatley Lime were extracted, this would result in a reduction of the competent cover above the Middleton 11 Yard seam, potentially putting more of the site at risk of subsidence.
- 14.7.10 At this stage it is considered unlikely that prior extraction of coal from this site would be economically viable. Further consideration could be given to prior extraction of coal in light of the findings of supplementary drilling.

14.8 Shallow coal in garden areas

- 14.8.1 Whilst there is no explicit guidance in NHBC Standards, liaison with NHBC suggests their stance is essentially the same as that they would apply to potentially combustible fills (such as Ash & Clinker). So where significant coal is present at very shallow depth in garden areas (uppermost 1m), it should either be removed, or covered with inert subsoil/topsoil so that it lies at greater than 1m depth.
- 14.8.2 In theory this could be an issue for about 5% of the total site area. However, given seam dip and topography it seems likely that coal will only be present at such shallow depth beneath less than 2% of the area. This should be reviewed in light of any proposed earthworks as significant changes to topography and ground levels are likely to affect this.
- 14.8.3 The most pragmatic way of dealing with shallow coal in gardens will be to inspect foundation excavations, and where coal is recorded within the uppermost 1m or so then excavate an inspection pit in the rear garden. Further advice should be sought from Lithos during the construction phase.
- 14.8.4 As with foundation arisings, the developer will need to contact the Coal Authority to dig or carry away excavated (incidental) coal.

14.9 Potential development constraints

- 14.9.1 The overhead electric lines in the north present a potential development constraint unless they can be relocated. Additional enquiries are required to ascertain the feasibility of such diversionary works and the particular easement required by each service undertaker if they remain in-situ.
- 14.9.2 Yorkshire Water may seek to restrict changes in site level if the depth of cover above their sewers were adversely affected by any development proposals. This aspect requires further clarification, with an easement will probably be required should they remain in-situ. Alternatively, diversionary works may be required.
- 14.9.3 It is understood an underground surface water attenuation tank is to be located beneath the area of POS in the far east. Given the presence of mine entries in this area, liaison with the Coal Authority and the tank manufacturer is recommended at the earliest opportunity to confirm this is possible.
- 14.9.4 Depending on final layout proposals and its 'as-built' location, the mine entry in the west might pose a potential development constraint to any infrastructure (drainage, roads etc) in this area.

15 SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

15.1 General

- 15.1.1 The site is located approximately 1.2km north of Cleckheaton town centre and comprises a series of rough grassed fields separated by hedgerows. The north slopes down to the east at about 1 in 12 towards Nann Hall Beck, and the centre and south slopes down to the south at about 1 in 10 (locally up to 1 in 8). Towards the south-west boundary the slope becomes steeper at c. 1 in 5.
- 15.1.2 It is understood that consideration is being given to redevelopment of the site with 307 traditional two storey domestic dwellings, associated gardens, POS and adoptable roads and sewers.
- 15.1.3 A veneer of made ground (typically <0.5m thick) has been encountered in the far east associated with the former Merchant Fields Colliery. Locally the made ground is up to 1.6m thick over known mine shafts. The proposed layout suggests this area will be Public Open Space, with an underground surface water attenuation tank
- 15.1.4 Natural ground comprises Cohesive Residual Soil (firm to stiff gravelly clay) to an average depth of 1.7m, underlain by Granular Residual Soil (clayey gravel).
- 15.1.5 Coal Measures bedrock was encountered across the site from between 1.1m and 3.5m depth (average 2.2m) and typically comprised moderately weak to medium strong sandstone. Coal or weathered coal was encountered in trial pits in the north and centre (Wheatley Lime Coal) and far south (Middleton 11 Yard Coal).

15.2 Mining

- 15.2.1 Four coal seams underlie the site at shallow depth, all dipping northwest. These are the:
- Wheatley Lime Coal (up to 1.1m thick) outcropping in the centre and north,
 - Middleton 11 Yard Coal (about 0.3m thick) at c. 10m below the Wheatley Lime
 - Blocking Rider Coal, a thin (0.1m) seam, at c. 26m below the Wheatley Lime, and
 - Blocking (Silkstone) Coal (0.5m to 0.8m thick), at c. 33m below the Wheatley Lime
- 15.2.2 This site is located within a Coal Mining Development High Risk Area, and is underlain by known, shallow mineworkings associated with the Blocking Coal and possibly also unrecorded mineworkings in the Wheatley Lime and Middleton 11 Yards coal seams. Consequently, an intrusive mining investigation has been undertaken, comprising the drilling of 49 'deep' rotary open-hole probeholes.
- 15.2.3 Given the number of probeholes advanced through the Wheatley Lime with none encountering evidence of workings, it appears this seam has not been worked. However, the risk of localised mineworkings via bell-pits cannot be entirely discounted
- 15.2.4 The intrusive mining investigation has identified shallow mineworkings in the Middleton 11 Yard Coal in the far west at between 15.5m and 21.5m depth.
- 15.2.5 Mitigation against the risk of subsidence associated with shallow mineworkings in the Middleton 11 Yard Coal will be required in the west, and within the Blocking Coal in the south, likely via drilling and grouting. In addition, proof drilling of plots and highways will be required in areas underlain by suspected 'packed workings' within the Middleton 11 Yard Coal (majority of site).
- 15.2.6 Areas requiring treatment and proof drilling are shown on Drawing 2828/12 (rev. A).

- 15.2.7 Of the 4 known mine entries situated on site, 3 in the far east associated with the former Merchant Fields Colliery have been located and surveyed in. The single mine entry in the far west has not been located following topsoil stripping.
- 15.2.8 The possibility of further unrecorded shafts/bell pits cannot be discounted, and consideration should be given to a geophysical survey. Follow-up intrusive investigation (pitting) would be recommended to determine the cause of any anomalies identified by the geophysics.
- 15.2.9 If bell pits are present, given the likely depth constraints, it seems likely they will be limited to the north, south and west; perhaps about 40% of the total site area, targeting the Wheatley Lime and possibly the Middleton 11 Yard coal seams.
- 15.2.10 It is understood an underground surface water attenuation tank is to be located beneath the area of POS in the far east. Given the presence of mine entries in this area, liaison with the Coal Authority and the tank manufacturer is recommended at the earliest opportunity to confirm this is possible.

15.3 Hazardous gas

- 15.3.1 The site is in an area where less than 1% of homes are estimated to be above the radon action level.
- 15.3.2 Shallow coal and mineworkings underlie the site and an area of landfilling is located 230m northwest. Consequently, gas monitoring is currently underway to determine whether special precautions against hazardous gas are required.

15.4 Contamination & remediation

- 15.4.1 Testing suggests the topsoil is chemically suitable for re-use.
- 15.4.2 Made ground encountered in the far east of the site (former Merchant Fields Colliery) has yielded elevated concentrations of inorganic determinands and CVs.
- 15.4.3 Based on the proposed site layout this area is to be Public Open Space with an underground surface water attenuation tank. Therefore, it is recommended that the made ground is excavated and temporarily stockpiled during excavation of the tank, subsequently being replaced and isolated beneath 500mm thick surface cover of "clean" soil. This cover will break potential pollutant linkages between the contaminated made ground and future end-users.
- 15.4.4 Alternatively, the Granular Made Ground is considered suitable for redistribution beneath concrete oversite or areas of hardstanding, where they would be satisfactorily isolated from end users.
- 15.4.5 Material excavated from areas of burnt ground should be redistributed beneath concrete oversite or areas of hardstanding, where they would be satisfactorily isolated from end users, or disposed of offsite.

15.5 Foundations

- 15.5.1 All plots will be founded on traditional strip/trench-fill footings at a minimum depth of 0.9m depth in Cohesive Residual Soil, overdeepened where necessary due to the influence of trees, and 0.6m in Granular Residual Soil.
- 15.5.2 For plots which overly areas of treated mineworkings, reinforcement of foundations (or possibly rafts) will be required, in accordance with NHBC standards.

15.6 Flooding

- 15.6.1 The EA indicate that the site is not located within an indicative floodplain.

15.7 Drainage

- 15.7.1 Based on observations made during the investigation, soakaways are unlikely to provide a suitable drainage solution for surface water run-off at the site. Consequently, it will be necessary to consider alternative sustainable drainage systems (SUDS), and there may be a need for surface water balancing.
- 15.7.2 Furthermore, the sloping nature of the site could result in springs being created down-gradient so rendering soakaways unfeasible.

15.8 Highways

- 15.8.1 Based on visual inspection of the shallow natural materials and published guidance, the Cohesive Residual Soils should provide a CBR value of at least 3%. This value should be verified prior to or during construction.

15.9 Further works

- 15.9.1 Given the very shallow depth to the Wheatley Lime in the north and Middleton 11 Yard in the south, and therefore the possibility of bell pits, consideration should be given to a geophysical survey.

Appendix A
General Notes

General

Third party information obtained from the British Geological Survey (BGS), the Coal Authority, the Local Authority etc is presented in the "Search Responses" Appendix of this Geoenvironmental Report.

Geology, mining & quarrying

In order to establish the geological setting of a site, Lithos refer to BGS maps for the area, and the relevant geological memoir. Further information is sourced by reference to current and historical OS plans.

In July 2011, the Coal Authority (CA) formalised their requirements in relation to planning applications and introduced some new terminology. The CA, using its extensive records has prepared plans for all coalfield Local Planning Authorities, which effectively refines the defined coalfield areas into High Risk and Low Risk areas. High Risk areas are likely to be affected by a range of legacy issues that pose a risk to surface stability, including: mine entries; shallow coal workings; workable coal seam outcrops; mines gas; and previous surface mining sites. Low Risk areas comprise the remainder of the defined coalfield, and are areas where no known defined risks have been recorded; although there may still be unrecorded issues. Where a site lies within either a High or Low Risk area, a mining report is obtained from the CA.

Landfills

Lithos obtain data from Landmark or Groundsure, the Environment Agency and the Local Authority with respect to known areas of landfilling within 250m of the proposed development site. Historical OS plans are also inspected for evidence of backfilled quarries, railway cuttings, colliery spoil tips etc.

Radon

Radon is a colourless, odourless gas, which is radioactive. It is formed in strata that contain uranium and radium (most notably granite), and can move through fissures eventually discharging to atmosphere, or the spaces under and within buildings. Where radon occurs in high concentrations, it can pose a risk to health.

In order to assess potential risks associated with radon gas, Lithos refer to BRE Report BR211¹, and the Public Health England website. Advice on the limitation of exposure of the population to radon in buildings was originally published in 1990 by the National Radiological Protection Board (NRPB), which joined the Health Protection Agency (HPA) in 2005; the HPA updated NRPB advice in July 2010². The HPA became part of Public Health England in 2013.

The HPA recommended that the NRPB radon Action Level for homes be retained, and a new Target Level for radon in homes be introduced. The values of the Action Level and Target Level, expressed as the annual average radon concentration in the home, are 200 Bq m⁻³ and 100 Bq m⁻³ respectively. The Target Level was to provide an objective for remedial action in existing homes and preventive action in new homes.

The term 'radon Affected Area' is defined as those parts of the country with >1% of homes estimated to be above the Action Levels. The NRPB first indicated which parts of the country should be regarded as radon Affected Areas in 1990. A more detailed mapping method was developed by the HPA in conjunction with the British Geological Survey in 2007³. The level of protection needed is site-specific and can be determined by reference to this mapping on the Public Health England website, which indicates the highest radon potential within each 1km grid square. Each 1km grid square is classified on the basis of the percentage of existing homes within that grid square estimated to have radon concentrations above the Action Level. There are 6 'bands': <1%; 1 to 3%; 3 to 5%; 5 to 10%; 10 to 30%; and >30%.

The NRPB advised that action should be taken to reduce radon concentrations in existing homes if the radon concentration exceeded the Action Level of 200 Bq m⁻³ in room air averaged over a year; ten times the average UK domestic radon concentration. NRPB advice informed changes in the requirements for radon protection in new buildings.

- **Basic** preventive measures are required in new buildings, extensions, conversions and refurbishments if the probability of exceeding the Action Level is **>3%** in England and Wales, and >1% in Scotland and Northern Ireland.
- Provision for further preventive (**Full**) measures is required in new buildings if the probability of exceeding the Action Level is **>10%**.

At present Building Regulations Approved Document C advocates basic measures for the probability banding 3% to 10%, and full measures if >10%. However, Public Health England would like to see all new build include basic measures.

Action and Target Levels should also be applied to non-domestic buildings with public occupancy exceeding 2,000 hours per year and to all schools.

Hydrogeology

Lithos obtain information from the Environment Agency (EA), and Landmark or Groundsure with respect to:

- Groundwater quality
- Recorded pollution incidents
- Licensed groundwater abstractions

From April 2010 the EA's Groundwater Protection Policy uses aquifer designations that are consistent with the Water Framework Directive. These designations reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply), but also their role in supporting surface water flows and wetland ecosystems. The aquifer designation data is based on geological mapping provided by the British Geological Survey. The maps are split into two different types of aquifer designation:

- Superficial (Drift) - permeable unconsolidated (loose) deposits. For example, sands and gravels
- Bedrock - solid permeable formations e.g. sandstone, chalk and limestone

The maps display the following aquifer designations:

Principal aquifers: These are layers of rock or superficial deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.

Secondary aquifers: These include a wide range of rock layers or superficial deposits with an equally wide range of water permeability and storage. Secondary aquifers are subdivided into three types:

- Secondary A - 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. These are generally aquifers formerly classified as minor aquifers
- Secondary B - predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers
- Secondary undifferentiated - In most cases, this is because the rock type in question has previously been designated as both a minor and non-aquifer in different locations due to the variable characteristics.

¹ BRE Report BR211, 2015: "Radon: guidance on protective measures for new buildings.

² Limitation of Human Exposure to Radon, Documents of the Health Protection Agency - Radiation, Chemical and Environmental Hazards, RCE-15. July 2010.

³ Miles JCH, Appleton JD, Rees DM, Green BMR, Adlam KAM and Myers AH (2007). Indicative Atlas of Radon in England and Wales. Chilton, HPA-RPD-033.

Unproductive strata: These are rock layers or superficial deposits with low permeability that have negligible significance for water supply or river base flow.

The EA maps only display the principal and secondary aquifers as coloured areas. All uncoloured areas on the map will be unproductive strata. However, for uncoloured areas on the superficial (drift) designation map it is not possible to distinguish between areas of unproductive strata and areas where no superficial deposits are present; to do this, it is necessary to consult the published geological survey maps.

For the purposes of the EA's Groundwater Protection Policy the following default position applies, unless there is site specific information to the contrary:

- If no superficial (drift) aquifers are shown, the bedrock designation is adopted
- In areas where the bedrock designation shows unproductive strata (the uncoloured areas) the superficial designation is adopted
- In all other areas, the more sensitive of the two designations is used (e.g. If secondary superficial overlies principal bedrock, an overall designation of principal is assumed)

The EA have also designated groundwater Source Protection Zones, which are based on proximity to a groundwater source (springs, wells and abstraction boreholes). The size of a Source Protection Zone is a function of the aquifer, volume of groundwater abstracted and the effective rainfall, and may vary from tens to several thousand hectares.

Hydrology

Lithos obtain information from the Environment Agency and Landmark or Groundsure with respect to:

- Surface water quality
- Recorded pollution incidents
- Licensed abstractions (groundwater & surface waters)
- Licensed discharge consents
- Site susceptibility to flooding

The EA have set water quality targets for all rivers. These targets are known as River Quality Objectives (RQOs). The water quality classification scheme used to set RQO planning targets is known as the River Ecosystem scheme. The scheme comprises five classes (RE1 to RE5) which reflect the chemical quality requirements of communities of plants and animals occurring in our rivers.

General Quality Assessment (GQA) grades reflect actual water quality. They are based on the most recent analytical testing undertaken by the EA. There are 6 GQA grades (denoted A to F) defined by the concentrations of biochemical oxygen demand, total ammonia and dissolved oxygen.

The susceptibility of a site to flooding is assessed by reference to a Flood Map on the Environment Agency's website. These maps show natural floodplains - areas potentially at risk of flooding if a river rises above its banks, or high tides and stormy seas cause flooding in coastal areas. There are two different kinds of area shown on the Flood Map:

1. Dark blue areas (Flood Zone 3) could be flooded by the sea by a flood that has a 0.5% (1 in 200) or greater chance of happening each year, or by a river by a flood that has a 1% (1 in 100) or greater chance of happening each year
2. Light blue areas (Flood Zone 2) show the additional extent of an extreme flood from rivers or the sea. These outlying areas are likely to be affected by a major flood, with up to a 0.1% (1 in 1000) chance of occurring each year

These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements. Where there is no blue shading (Flood Zone 1), there is less than a 0.1% (1 in 1000) chance of flooding occurring each year.

The maps also show all flood defences built in the last five years to protect against river floods with a 1% (1 in 100) chance of happening each year, or floods from the sea with a 0.5% (1 in 200) chance of happening each year, together with some, but not all, older defences and defences which protect against smaller floods.

The Agency's assessment of the likelihood of flooding from rivers and the sea at any location is based on the presence and effect of all flood defences, predicted flood levels, and ground levels.

It should also be noted that as the floodplain shown is the 1 in 100 year, areas outside this may be flooded by more extreme floods (e.g. the 1 in 1000 year flood). Also, parts of the areas shown at risk of flooding will be flooded by lesser floods (e.g. the 1 in 5 year flood). In some places due to the shape of the river valley, the smaller floods will flood a very similar extent to larger floods but to a lesser depth.

If a site falls within a floodplain, it is recommended that a flood survey be undertaken by a specialist who can advise on appropriate mitigating measures; i.e. raising slab levels, provision of storage etc. In accordance with Chapter 10 of the National Planning Policy Framework, a site-specific flood risk assessment is required for: proposals of 1 hectare or greater in Flood Zone 1, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the Environment Agency); and any new development in Flood Zones 2 and 3.

COMAH & explosive sites

Lithos obtain information from Landmark or Groundsure with respect to Control of Major Accident Hazards (COMAH) or explosive sites within 1km of the proposed development site. Lithos' report refers to any that are present, and recommends that the Client seeks further advice from the HSE.

Areas around COMAH sites (chemical plants etc) are zoned with respect to the implementation of emergency plans. The HSE are a statutory consultee to the local planning authority for all COMAH sites. The COMAH site may have to revise its emergency action plan if development occurs. This might be quite straightforward or could entail significant expenditure. Consequently, the COMAH site may object to a proposed development (although it is the Local Authority who have final say, and they are likely to place more weight on advice from the HSE).

Preliminary conceptual site model

The site's environmental setting (and proposed end use) is used by Lithos to assess the significance of any contamination encountered during the subsequent ground investigation.

Assessment of contaminated land is based on an evaluation of pollutant linkages (source-pathway-receptor). Contaminants within the near surface strata represent a potential source of pollution. The environment (most notably groundwater), site workers and end users are potential receptors.

Potential pollutant linkages are shown on a preliminary conceptual site model (pCSM). A CSM is essentially a cross-section through a site that reflects both the surface topography and underlying geology, and shows surface features of interest. The most significant sources of contamination are then superimposed onto this cross-section together with potential receptors (human health & controlled waters), and plausible pathways between the two. In addition to environmental issues, the CSM should also highlight geotechnical issues.

A pCSM is prepared after consideration of all available "desk study" data, and before design of the ground investigation. Data reviewed should include historical plans (with superimposition on a current-day plan), previous SI reports, geological maps etc. The pCSM, in conjunction with knowledge of site constraints (buildings, services, slopes etc) is used to design the ground investigation.

The revised CSM takes account of data obtained during the ground investigation, including the distribution of made ground, the nature and distribution of contamination etc.

General

Lithos Ground Investigations are undertaken in accordance with current UK guidance including:

- BS5930:2015 "Code of practice for site investigation"
- Eurocode 7: BS EN 1997-1:2004. Geotechnical design - Part 1: General rules
- Eurocode 7: BS EN 1997-2:2007. Geotechnical design - Part 2: Ground investigation and testing
- BS10175:2013 "Code of practice for the identification of potentially contaminated sites"
- "Technical Aspects of Site Investigation" – EA R&D Technical Report P5-065/TR (2000)
- "Development of appropriate soil sampling strategies for land contamination" – EA R&D Technical Report P5-066/TR (2001)
- Contaminated Land Reports 1 to 6, most notably CLR Report No. 4 "Sampling strategies for contaminated land"
- "Guidance on the protection of housing on contaminated land" – NHBC & EA R&D Publication 66 (2000)
- AGS: 1996 "Guide to the selection of Geotechnical Soil Laboratory Testing"

Exploratory hole locations

Exploratory hole locations are selected by Lithos, prior to commencement of fieldwork, to provide a representative view of the strata beneath the site and to target potential contaminant sources identified during the preliminary investigation (desk study). Additional exploratory locations are often determined by the site engineer in light of the ground conditions actually encountered; this enables better delineation of the depth and lateral extent of organic contamination, poor ground, relict structures etc.

Investigation techniques

Ground conditions can be investigated by a number of techniques; the procedures used are in general accordance with BS5930: 2015 and BS1377: 1990. Techniques most commonly used by Lithos include:

- Machine excavated trial pits, usually equipped with a backactor and a 0.6m wide bucket.
- Cable percussive (Shell & Auger) boreholes, typically using 150mm diameter tools and casing.
- Window or windowless sampling boreholes (dynamic sampling). Constraints associated with existing buildings, operations and underground service runs can render some sites partly or wholly inaccessible to a mechanical excavator. In such circumstances, window sampling is often the most appropriate technique. A window sampling drilling rig can be manoeuvred in areas of restricted access and results in minimal disturbance of the ground (a 150mm diameter tarmac/concrete core can be lifted and put to one side). However, it should be noted that window sampling allows only a limited inspection of the ground (especially made ground with a significant proportion of coarse material).
- Rotary percussive open-hole probeholes are typically drilled using a tri-cone rock roller or polycrystalline diamond compact (PDC) bit with air as the flushing medium. Probeholes are generally lined through made ground with temporary steel casing to prevent hole collapse.

Where installed, gas\groundwater monitoring wells typically comprise a lower slotted section, surrounded by a filter pack of 10 mm non-calcareous gravel and an upper plain section surrounded in part by a bentonite seal and in part by gravel or arisings. The top of the plain pipe is cut off below ground level and the monitoring well protected by a square, stopcock type manhole cover set in concrete, or the plain pipe is cut off just above ground level and the well protected by 100mm diameter steel borehole helmet set in concrete. Monitoring well details, including the location of the response zone and bentonite seal are presented on the relevant exploratory hole logs.

In-situ testing

Relative densities of granular materials given on the trial pit logs are based on visual inspection only, they do not relate to any specific bearing capacities.

The relative densities of granular materials encountered in cable percussive boreholes are based on Standard Penetration Test (SPT) results. SPTs are carried out boreholes, in accordance with BS 1377 1990, Part 9 Section 3.3. Where full penetration (600mm) is not possible, N values are calculated by linear extrapolation and are shown on the logs as $N^* = x$. The strength of cohesive deposits is determined using a hand shear vane.

Shear strength test results (hand vane readings) reported on trial pit logs are considered to be more reliable than those reported on window sample logs. Significant sample disturbance occurs during window sampling and consequently shear strength results on disturbed window samples are generally lower than results obtained during trial pitting, in-situ or in large excavated blocks.

Sampling

Typically Lithos collect at least three soil samples from each exploratory hole, although in practice a greater number are often taken. The collection of a sufficient number of samples provides a sound basis upon which to schedule laboratory analysis, ensuring:

- A sufficient number of samples from each (common) site material are tested
- Horizontal and vertical coverage of the site is adequate, thereby providing a robust data set for use in the conceptual ground model
- Any localised, significant, but non-pervasive conditions are considered

Made ground and natural soils encountered in the field during a ground investigation often contain a significant proportion of coarse grained material (e.g. brick etc). Soil samples obtained during most investigations are often only truly representative of the in-situ soil mass where there is an absence of particles coarser than medium gravel; i.e the entire soil mass would pass a 20mm sieve.

Representative bulk samples of the soil mass are retrieved from coarse soils for specific geotechnical tests (most notably grading and compaction); this typically requires the collection of at least 10kg of soil, and occasionally >50kg. However, in the context of assessing land contamination, it is generally accepted that samples should be representative of the soil matrix of the stratum from which they are taken. Consequently, truly representative samples of coarse soils for subsequent contaminant analysis are not obtained - only the finer fraction is placed in sample containers. Coarse constituents not sampled would typically comprise any 'particles' with an average diameter greater than about 20mm (i.e. coarse gravel, cobble and boulder).

At present, neither ISO/IEC 17025 nor MCERTS specify sample pre-treatment with respect to stone removal. Unsurprisingly therefore UKAS accredited testing laboratories do not adopt the same approach to stones¹ – some crush and test the "as received" soil, whilst others sieve out stones and analyse only the residual soil (the sieve size used varies depending on the laboratory).

¹ Mark Perrin. Stoned – Sample Preparation for Soils Analysis. Ground Engineering, April 2007.

In essence, samples taken from coarser soils for contaminant analysis are "screened" by the geoenvironmental engineer in the field, and often sieved again by the laboratory during sample preparation. Geoenvironmental engineers do not typically re-calculate soil mass contaminant concentrations by taking account of the unsampled coarse fraction. Likewise, laboratories that remove stones typically report contaminant concentrations based on the dry weight of soil passing the sieve. In the context of land contamination and human health risk assessment, this is considered reasonable, because it is the soil matrix which is of greatest concern. Stones are unlikely to:

- Provide a significant source for plant uptake (consumption of vegetables)
- Remain on vegetables after washing (consumption of vegetables)
- Be eaten (accidentally by an adult, or deliberately by a child)
- Be whipped-up by the wind for dust generation (inhalation)
- Stick to the skin for any length of time (dermal contact)
- Yield toxic vapour (inhalation)

Consequently, Lithos instruct labs to remove all stones >10mm, and to report the results as dry-weight based on the mass of matrix tested. However, the laboratory are given site-specific instruction where coarse stones are coated in say oil, or impregnated with mobile contaminants such as diesel. Where the stones are predominantly natural, or inert (e.g. brick, concrete etc), removal will clearly result in higher reported concentrations, than if the stones were crushed and added to the matrix.

Where the stones include a significant proportion of contaminant-rich material (e.g. slag, fragments of galvanised metal etc) an argument could be made for crushing and analysing. However, provided the stones are stable (i.e. unlikely to disintegrate or degrade) they should not pose a significant risk to human health for the reasons stated above.

Sometimes it is necessary to obtain samples that are not representative of the wider soil matrix, for example when investigating localised, significant, but non-pervasive conditions. Any such unrepresentative samples are annotated with the suffix '*' (eg 2D*, or 4G*). Lithos' site engineer describes both the unrepresentative sample, and the soil mass from which it was been taken.

Sample Containers (for contaminant analysis). Samples of soil for contaminant testing are placed into appropriate containers (see below). Soil samples for organic analysis are stored in cool boxes, at a temperature of approximately 4°C, until delivery to the selected laboratory.

Anticipated testing	Container(s)
Asbestos identification	500ml plastic tub
pH & metals, and non-volatile organics	500ml glass jar
Speciated TPH	500ml & 50ml glass jars
VOCs (incl. naphthalene and/or GRO)	50ml glass jar

Sample Containers (for geotechnical analysis). The majority of samples are only scheduled for PI and sulphate testing, for which 500g of sample is required (a full 0.5-litre plastic tub). However, bulk bags are taken where scheduling of compaction or grading tests is proposed.

Groundwater

Where encountered during fieldwork, groundwater is recorded on exploratory hole logs. If monitoring wells are installed, groundwater levels are also recorded on one or more occasions after completion of the fieldwork. Long-term monitoring of standpipes or piezometers is always recommended if water levels are likely to have a significant effect on earthworks or foundation design.

It should be borne in mind that the rapid excavation rates used during a ground investigation may not allow the establishment of equilibrium water levels. Water levels are likely to fluctuate with season/rainfall and could be substantially higher at wetter times of the year than those found during this investigation.

Description of strata

Soils encountered during a Lithos investigation are described (logged) in general accordance with BS 5930:2015. The descriptions and depth of strata encountered are presented on the exploratory hole logs and summarised in the Ground Conditions section within the main body of text. The materials encountered in the trial pits are logged, samples taken, and tests performed on the in-situ materials in the excavation faces, to depths of up to 1.2m; below this depth these operations are conducted at the surface on disturbed samples recovered from the excavation.

Key to exploratory hole logs

Keys to logs are presented in the Appendix containing the logs. There are two Keys – Symbols & Legends and Terms & Definitions.

General

Soil samples are delivered to the laboratory for testing along with a schedule of testing drawn up by Lithos. All tests are carried out in accordance with BS 1377:1990. The following laboratory testing is routinely carried out on a selection of samples:

- Atterberg limits & moisture contents
- Soluble sulphate & pH

Where soft, cohesive soils are encountered, one-dimensional consolidation tests are scheduled in order to assess settlement characteristics, and unconsolidated undrained triaxial compression tests to assess shear strength.

The additional tests are typically only scheduled where significant earthworks regrade is anticipated:

- Grading
- Compaction tests
- Particle density

Test results are presented as received in an Appendix to the Geoenvironmental Report.

Atterberg limits & moisture content

The Liquid and Plastic Limits of samples of natural in-situ clay are determined using the cone penetrometer method and the rolling thread test. These tests enable determination of an average Plasticity Index (PI) for each "type" of clay, although judgement is applied where variable results are reported.

PI can be related to shrinkability (low, medium or high) and then to minimum founding depth. Lithos typically only consider a soil to be shrinkable if the proportion finer than 63µm is >35%. PI results are compared against guidance given in the NHBC Standards, Chapter 4.2 (revised April 2003), which advocates the use of modified Plasticity Index (I_p), defined as:

$$I_p = I_p * (\% < 425\mu\text{m} / 100)$$

i.e. if PI is 30%, but the soil contains 80% < 425µm, then: $I_p = 30 * 80 / 100 = 24\%$.

It should be noted that in accordance with the requirements of BS 1377, the % passing the 425µm sieve is routinely reported by testing labs. Lithos apply engineering judgment where PI results are spread over a range of classifications. Consideration is given to:

- The average values for each particular soil type (ie differentiate between residual soil and alluvium)
- The number of results in each class and
- The actual values

Unless the judgment strongly indicates otherwise, Lithos typically adopts a conservative approach and recommends assumption of the higher classification.

Soluble sulphate and pH

Sulphates in soil and groundwater are the chemical agents most likely to attack sub-surface concrete, resulting in expansion and softening of the concrete to a mush. Another common cause of concrete deterioration is groundwater acidity.

The rate of chemical attack depends on the concentration of aggressive ions and their replenishment at the reaction surface. The rate of replenishment is related to the presence and mobility of groundwater.

Lithos refer to BRE Special Digest 1 (SD1) "Concrete in aggressive ground. Part 1: Assessing the aggressive chemical environment" (2005). SD 1 provides definitions of:

- The nature of the site (greenfield, brownfield or pyritic)
- The groundwater regime (static, mobile or highly mobile)
- The design sulphate class (DS class) and
- The aggressive chemical environment for concrete (ACEC class)

Lithos reports clearly state each of the above for the site being considered.

The concentrations of sulphate in aqueous soil/fill extracts are determined in the laboratory using the gravimetric method. The results are expressed in terms of SO₄ for direct comparison with BS 5328:1997. The pH value of each sample was determined by the electrometric method.

SD1 also discusses determination of "representative" sulphate concentration from a number of tests. Essentially if <10 samples of a given soil-type have been tested, the highest measured sulphate concentration should be taken. If >10 samples have been tested, the mean of the highest 20% of the sulphate test results can be taken. With respect to groundwater, the highest sulphate concentration should always be taken.

With respect to pH (soil & groundwater) the value used is the lowest value if <10 samples have been tested and the mean of the lowest 20% if >10 samples have been tested.

Oedometer (Consolidation) tests

Oedometer tests measure a soil's consolidation properties, and are performed by applying different loads to a soil sample and measuring the deformation response. Typically the sample is subject to 5 incremental pressures (4 loading & 1 unloading), and the convention is for each subsequent pressure to be double the previous pressure. BS1377 suggests the initial pressure should be:

- For stiff soils the effective overburden pressure*
- For firm soils "somewhat less" than the effective overburden pressure
- For soft soils "appreciably less" than the effective overburden pressure, usually 25 kPa or less
- For very soft soils very low, typically 5 kPa or 10 kPa

* Effective overburden pressure (kNm⁻²) = depth (m) x soil bulk unit weight (kNm⁻³)

Results from these tests are used to predict how a soil in the field will deform in response to a change in effective stress.

Triaxial tests

This test measures the mechanical properties of a soil by placing the sample between two parallel platens which apply stress in one (usually vertical) direction, with fluid used to apply a confining pressure in the perpendicular directions. During the test, the surrounding fluid is pressurized, and then stress on the platens is increased until the material in the cylinder fails.

From triaxial test data, it is possible to extract fundamental material parameters, including its angle of shearing resistance, apparent cohesion, and dilatancy angle. These parameters are then used in computer models to predict how the material will behave in a larger-scale engineering application.

Quick (single stage, Unconsolidated, Undrained tests) are most appropriate for foundation design. This is because load is applied relatively quickly, and shear strength of the clay will be lowest initially; after the applied load causes some consolidation of the ground (after drainage results in dissipation of short-term excess pore water pressure), the in-situ clays will become progressively stronger and hence the factor of safety will increase. Confining pressure is specified as equivalent to overburden pressure (kNm^{-2}).

Foundations on granular soils would use effective shear strength parameters (c' and ϕ') to assess safe bearing capacity, as the soil would fully drain quickly. These effective shear strength parameters could be determined from Consolidated Undrained (or sometimes the more expensive Consolidated Drained) triaxial tests, but often correlations to the SPT are used.

Unconsolidated Undrained triaxial tests are most appropriate for assessment of the stability of fill slopes on clays. Similar to foundations, the application of load gradually increases the strength of the clays and hence the critical case is the short term undrained condition.

Consolidated Undrained (or sometimes Consolidated Drained) triaxial tests are most appropriate for assessment of the stability of cut slopes in clays. This is because unloading of the ground leads to short term reduction in pore pressures that approximately balance the unloading, hence the soil strength is largely unchanged. Over time the reduced pore pressures suck water in, which leads in to the progressive increase in pore pressure and loss of strength. The fully drained state is critical, which must be modelled using effective strength parameters and a reasonable estimate of the long term water table conditions.

Slopes formed in granular soils would use effective shear strength parameters (c' and ϕ') to assess safe bearing capacity, as the soil would fully drain quickly. These effective shear strength parameters could be determined from Consolidated Undrained (or sometimes the more expensive Consolidated Drained) triaxial tests, but often correlations to the SPT are used.

Determination of analytical suite

An assessment of potential contaminants associated with the former usages of the site is undertaken with reference to CLR 8 "Potential contaminants for the assessment of land" and the relevant DETR Industry Profile(s).

Common contaminants

Common Inorganic Contaminants include:

- Metals, most notably cadmium, copper, chromium, mercury, lead, nickel, and zinc
- Semi-metals, most notably arsenic, selenium, and (water soluble) boron
- Non-metals, most notably sulphur
- Inorganic anions, most notably cyanides (free & complex), sulphates, sulphides, and nitrates

With respect to the terminology used by most analytical laboratories:

Total cyanide = Free cyanide + Complex cyanide

Total cyanide (CN) is determined by acid extraction; whereas free cyanide is the water soluble fraction. Complex cyanide is "bound" in compounds and is hard to breakdown. Laboratory determination of complex CN involves subjecting the sample to UV digestion for determination of both free and total CN.

Thiocyanate (SCN) is a different species combined with sulphur.

Elemental sulphur (S) and free sulphur are the same. Total sulphur is all forms, including that present in sulphates (SO₄), sulphides etc.

There are 2 forms of chromium (Cr), chromium VI and chromium III. Chromium VI is the more toxic of these. In soils, total chromium is determined by a strong aqua regia acid digestion. Chromium VI is an empirical method based on a water extract test.

Common Organic Contaminants include hydrocarbons, phenols, and polychlorinated biphenyls.

Petroleum is a mixture of hydrocarbons produced from the distillation of crude oil, and includes aliphatics (alkanes, alkenes and cycloalkanes), aromatics (benzene and derivatives) and hydrocarbon-like compounds containing minor amounts of oxygen, sulphur or nitrogen. Petroleum hydrocarbons can be grouped based on the carbon number range:

- GRO – Gasoline Range Organics (typically C₆ to C₁₀). Also referred to as PRO – Petroleum Range Organics
- DRO – Diesel Range Organics (typically C₁₀ to C₂₈)
- LRO – Lubricating Oil Range Organics (typically C₂₈ to C₄₀)
- MRO – Mineral Oil Range Organics (typically C₁₈ to C₄₄)

However, it should be borne in mind that the terms "GRO" and "DRO" analysis are purely descriptive terms, the exact definition of which varies. Total Petroleum Hydrocarbons (TPH) is also a poorly defined term; some testing laboratories regard TPH as hydrocarbons ranging from C₅-C₄₀, whereas others define TPH as C₁₀-C₃₀.

The composition of a TPH plume migrating through the ground can vary significantly; this is primarily dictated by the nature of the source (eg petrol, diesel, engine oil etc). Furthermore, different hydrocarbons are affected differently by weathering processes, and this can result in further variation in the chemical composition of the TPH.

Gasoline contains light aliphatic hydrocarbons (especially within the C₄ to C₅ range) that are volatile. The aromatic hydrocarbons in gasoline are primarily benzene, toluene, ethylbenzene and xylenes, referred to as BTEX. Small amounts of polycyclic aromatic hydrocarbons (PAHs) such as benzo(a)pyrene may also be present. Diesel and light fuel oils have higher molecular weights than gasoline. Consequently, they are less volatile and less water soluble. About 25 to 35% is composed of aromatic hydrocarbons. BTEX concentrations are generally low.

Heavy Fuel Oils are typically dark in colour and considerably more viscous than water. They contain 15 to 40% aromatic hydrocarbons. Polar nitrogen, sulphur and oxygen-containing compounds (NSO) compounds are also present. Lubricating Oils are relatively viscous and insoluble in groundwater. They may contain 10 to 30% aromatics, including the heavier PAHs. NSO compounds are also common.

Polycyclic Aromatic Hydrocarbons (PAHs) have more than two fused benzene rings as a structural characteristic. PAH compounds are present in both petrol and diesel, although in significantly lower concentrations than in coal tars. Certain PAH compounds are carcinogenic (benzo(a)pyrene) and/or mobile in the environment (naphthalene).

Volatile Organic Compounds (VOCs) are organic chemicals, and most are liquids that readily evaporate on exposure to air. Examples include benzene, toluene, xylene, chloroform etc. Semi-Volatile Organic Compounds (SVOCs) include phenol and benzo(a)pyrene, and have relatively low boiling points. Both groups of chemicals are readily absorbed through skin and some, such as benzene, are believed to be linked to tumour growth.

Phenols are compounds that have a hydroxyl group (-OH) attached to an aromatic ring (ie include a benzene ring and an -OH group). Most are colourless solids. A solution of phenol in water is known as carbolic acid, and is a powerful antiseptic. However, phenol vapour is toxic, and skin contact can result in burns.

Polychlorinated Biphenyls (PCBs) were used in pre-1974 transformers as dielectric fluids. PCB's are of increasing toxicity relative to the degree of chlorination. Acute symptoms of PCB poisoning are irritation of the respiratory tract leading to coughing and shortness of breath. Nausea, vomiting and abdominal pain are caused by ingestion of PCB's.

Dioxins and furans (polychlorinated dibenzodioxins and polychlorinated dibenzofurans) are some of the most toxic chemicals known; in the environment, they tend to bio-accumulate in the food chain. Dioxin is a general term that describes a group of hundreds of chemicals that are highly persistent in the environment. The most toxic compound is 2,3,7,8-tetrachlorodibenzo-p-dioxin or TCDD.

Dioxin is formed by burning chlorine-based chemical compounds with hydrocarbons. The major source of dioxin in the environment comes from waste-burning incinerators and also from backyard burn-barrels. Dioxin pollution is also affiliated with paper mills which use chlorine bleaching in their process and with the production of Polyvinyl Chloride (PVC) plastics and with the production of certain chlorinated chemicals (like many pesticides).

Methods of analysis (organic compounds)

TPH by GC-FID is an analytical technique which only detects hydrocarbons (aliphatic and aromatic) in the range C₁₀ to C₄₀ (volatiles, heavy tars, humic material and sulphur are not detected). The laboratory can provide a broad, 'banded' breakdown of the TPH results into gasoline range organics (GRO), diesel range organics (DRO) and heavier lubricating oil range organics (LRO), or fully speciated results with the reporting of hydrocarbon concentrations in 14 specific carbon bandings based upon behavioural characteristics, e.g. aliphatic C₆ to C₈, aromatic C₁₀ to C₁₂ etc.

Speciated VOC (by GC-MS) analysis quantifies the concentrations of 30 USA-EPA priority compounds. These include chlorinated alkanes and alkenes (in the molecular weight range chloroethane to tetrachloroethane); trimethylbenzenes; dichlorobenzenes; and the 4 BTEX compounds (benzene, ethyl-benzene, toluene & xylene).

Speciated sVOC by (GC-MS) analysis quantifies the concentrations of a variety of organic compounds, including the 16 USA-EPA priority PAHs, phenols, 7 USA EPA priority PCB congeners, herbicides & pesticides.

Note: PAHs are hydrocarbons and consequently (where present) will be picked-up when scheduling TPH by GC-FID.

Note: Risk assessment models require physiochemical properties (solubilities, toxicities etc) of compounds in order to model their behaviour in the environment. These physiochemical properties cannot be derived from a single "TPH", "GRO" or "DRO" value. However, the carbon banded fractions can be used in risk assessment models.

Current UK guidance

The UK approach to contaminated land is set out in Contaminated Land Report No. 11 (2004) "Model Procedures for the Management of Land Contamination". The approach is based upon risk assessment, where risk is defined as the combination of the probability of occurrence of a defined hazard and the magnitude of the consequences of the occurrence.

In the context of land contamination, there are three essential elements to any risk: (1) a contaminant source; (2) a receptor (eg controlled water or people); and (3) a pathway linking (1) and (2). Risk can only exist where all three elements combine to create a pollutant linkage. Risk assessment requires the formulation of a conceptual model which supports the identification and assessment of pollutant linkages.

Lithos adopt a tiered approach to risk assessment, consistent with UK guidance and best practice. The initial step of such a risk assessment (or Tier 1) is the comparison of site data with appropriate UK guidance levels, Lithos risk-derived screening values, or remedial targets. It should be noted that exceedance of Tier 1 does not necessarily mean that remedial action will be required.

Soil screening values used by Lithos

In March 2002 DEFRA and the Environment Agency published a series of technical papers (R&D Publications CLR 7, 8, 9 and 10) outlining the UK approach to the assessment of risk to human health from land contamination. In 2008 CLR 7, 9 and 10 and all corresponding SGV and Tox reports were withdrawn and superseded by new guidance including:

- Guidance on Comparing Soil Contamination Data with a Critical Concentration - CL:AIRE and CIEH, May 2008
- Evaluation of models for predicting plant uptake of chemicals from soil - Science Report – SC050021/SR
- Human health toxicological assessment of contaminants in soil - Science Report: SC050021/SR2
- Updated technical background to the CLEA model - Science Report: SC050021/SR3
- CLEA Software Handbook (Version 1.071), Science report: SC050021/SR4
- Compilation of data for priority organic pollutants for derivation of Soil Guideline Values - Science Report: SC050021/SR7

The approach set out in these documents represents current scientific knowledge and thinking; and includes the Contaminated Land Exposure Model (CLEAv1.06). The Environment Agency are in the process of using this updated approach to regenerate a selection of Soil Guideline Values (SGVs).

CLEA SGVs were derived for standard land use scenarios predominantly in the context of Part IIA, using a conceptual site model (CSM) defined in SR3. Lithos have incorporated amendments to the CSM used to derive SGVs, that more accurately reflect redevelopment within the planning regime; consequently, Lithos have not adopted any published SGV as a screening value.

The CLEA conceptual site model assumes a source located in a sandy loam, with 6% soil organic matter (SOM) - equivalent to 3.5% total organic carbon (TOC). However, where the average TOC value for a particular soil type is significantly lower than the 3.5%, evaluation of Lithos Screening Values should be undertaken and a site specific risk assessment will usually be required. Other CLEA default characteristics adopted by Lithos are:

Sandy Loam characteristics (source)	Default values adopted
Total porosity (fraction)	0.53
Water filled porosity (fraction)	0.33
Air filled porosity (fraction)	0.2

Lithos have derived Screening Values for four different CSMs (scenarios); these are:

- A - Residential with gardens, but no cover (or only up to 300mm)
- B - Residential with gardens and 600mm 'clean' cover
- C - Residential apartments with landscaping (i.e. no home grown produce)
- D - Commercial/industrial with landscaping
- E - Importation of soil cover

The exposure pathways considered for each scenario are detailed in the table below.

Scenario	Land use	Pathways	Justification
A	Residential with garden, but no cover (or only up to 300mm)	• Direct ingestion of soil • Dermal contact • Consumption of vegetables & soil attached to vegetables • Inhalation of indoor vapours and dust • Inhalation of outdoor vapours and dust	Minimal cover – insufficient to break any pathways therefore all exposure pathways are relevant.
B	Residential with garden minimum 600mm cover	• Inhalation of indoor vapours • Inhalation of outdoor vapours	The 600mm cover removes the risk from all pathways other than inhalation.
C	Residential apartments with landscaped areas and minimum 300mm cover	• Direct ingestion of soil • Dermal contact • Inhalation of indoor vapours and dust • Inhalation of outdoor vapours and dust	All pathways applicable due to possible exposure from landscaped areas. However consumption of home grown produce not included as unlikely to be grown in landscaped areas. Where vegetables are to be grown site specific QRA may be required.
D	Commercial/ industrial with landscaped areas no cover	• Direct ingestion of soil • Dermal contact • Inhalation of indoor vapours and dust • Inhalation of outdoor vapours and dust	All pathways applicable due to possible exposure from landscaped areas. Assumed the commercial development consists of offices to provide a conservative assessment.
E	Importation of soil for cover in garden and landscaped areas	• Direct ingestion of soil • Dermal contact • Consumption of vegetables & soil attached to vegetables • Inhalation of outdoor vapours and dust	Material used as cover to break existing pathways therefore all direct and indirect pathways relevant; however cover is not placed below plots therefore indoor inhalation is not relevant.

Lithos have assumed the source of contamination is directly below the building foundations; i.e. a depth of source of 0.15m as opposed to the CLEA default of 0.65m. This assumption provides for a more conservative approach than the UK default. This adjustment has been included to account for sites where made ground is re-engineered to enable new buildings to be established on raft foundations. In such situations contamination may lie directly beneath the foundation.

The Soil Screening Values referred to in this document are not intended to be used when considering potential risks associated with:

- Existing land uses in the context of Part IIA of the Environment Protection Act 1990;
- End uses such as allotments, sports fields, children's playgrounds, care homes, hospitals etc; and
- Controlled waters.

In December 2013 Defra published the results of research project SP1010 – Development of Category 4 Screening Levels (C4SLs) for Assessment of Land Affected by Contamination. The objective of this project was provide technical guidance in support of Defra's revised Statutory Guidance for Part 2A of the Environmental Protection Act 1990 (Part 2A). The revised Statutory Guidance, published in April 2012, introduced a new four-category system for classifying land under Part 2A where Category 1 includes land where the level of risk is clearly unacceptable, and Category 4 includes land where the level of risk posed is acceptably low. Project SP1010 aimed to deliver:

- A methodology for deriving C4SLs for four generic land-uses comprising residential, commercial, allotments and public open space; and
- Demonstration of the methodology, via derivation of C4SLs for 6 substances – arsenic, cadmium, chromium IV, lead, benzene & benzo(a)pyrene.

The methodology for deriving both the previous Soil Guideline Values and the new Category 4 Screening Levels is based on the Environment Agency's Contaminated Land Exposure Assessment (CLEA) methodology. Development of C4SLs has been achieved by modifying the toxicological and/or exposure parameters used within CLEA (while maintaining current exposure parameters).

The Part 2A Statutory Guidance was developed on the basis that C4SLs could be used under the planning regime. However, policy responsibility for the National Planning Policy Framework falls to the Department for Communities and Local Government. Defra anticipate that, where they exist, C4SLs will be used as generic screening criteria, and Lithos consider C4SLs to be suitable for use as Tier 1 Screening Values. Lithos have discussed this matter with both NHBC and YAHPAC (collection of Yorkshire & Humberside local authorities) and received confirmation that they are satisfied with this approach.

With respect to inorganic determinands, Lithos derived Tier 1 values for the five Scenarios A to E are presented below:

Inorganic contaminant	Tier 1 assessment criteria (mg/kg) for Scenarios A to D							Comments/notes
	SGV*	C4SL*	A	B	C	D	E	
As	32	37	37	Use (A) in SI Report for initial "screen". If >5 x A, then consider increase of cover to 1,000mm	40	640	37	C4SL adopted
Cd	10	26	26		149	410	26	C4SL adopted
Cr			3,000		3,000	30,000	3,000	Assumes Cr is CrIII
Pb	450	200	200		310	2,330	200	C4SL adopted
Ni	130		127		127	1,700	127	Assessment of health risk only
Se	350		350		595	13,000	434	
Hg	170		169		238	3,640	199	Assumes in an inorganic compound
B			5		5	5	5	
Cu			80-200		80-200	80-200	80-200	Based on phytotoxic risks as plants are the more sensitive receptor (Cu is pH dependant)
Zn			200		200	200	200	

With respect to organic determinands, Lithos derived Tier 1 values for the five Scenarios A to E are presented below:

Organic contaminant (all sourced via CLEA)	Tier 1 assessment criteria (mg/kg) for Scenarios A to D							Comments/notes
	SGV*	C4SL*	A	B	C	D	E	
Benzene	0.33	0.87	0.9	0.9	3.3	98	N/A	C4SL adopted
Toluene	610		600	3,000	2,700	5,000	N/A	Calculated value over 10,000
Ethyl Benzene	350		350	932	843	5,000	N/A	
Xylenes	240		246	327	321	5,000	N/A	
Phenol	420		412	2,400	519	5,000	N/A	
PCBs			2	8	2	38	N/A	Based on toxicity of EC7
Benzo(a)pyrene		5	5	25	5.3	76	5	C4SL adopted. Where source is not a coal tar
Naphthalene			8	9	9	1,000	12	
Gasoline Range Organics			30	34	34	5,000	45	See 3-step assessment of TPH below
Diesel Range Organics			151	156	154	5,000	219	
Lubricating Range Org			1,000	5,000	2,000	5,000	1,000	

* For a residential end use

The significance of PAHs can be determined by considering indicator compounds. In most cases benzo(a)pyrene (BaP) is adopted as an indicator due to the amount of toxicological data available and has been used by various authoritative bodies to assess the carcinogenic risk of PAHs in food. A surrogate marker approach can be used to estimate the toxicity of a mixture of PAHs in soil using toxicity data for individual indicator compounds within that mixture. Exposure to the surrogate marker is assumed to represent exposure to all PAHs in that matrix. The surrogate marker approach relies on a number of assumptions:

- Surrogate marker (bap) must be present in all soil samples
- Profile of the different pah relative to bap should be similar in all samples
- PAH profile in the soil samples should be similar to that used in the pivotal toxicity study¹

¹ SP1010 Appendix E, Provisional C4SLs for benzo(a)pyrene as a surrogate marker for PAHs, CL:AIRE 2013

04 - Contamination analysis & interpretation (including WAC)

Generic notes – geoenvironmental investigations



To assess the PAH profile in a soil sample, the ratio of the seven genotoxic PAHs (benz[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene, chrysene, dibenz[a,h]anthracene and indeno[1,2,3-c,d]pyrene), relative to BaP, should be calculated. The ratio relative to BaP should lie within an order of magnitude above and below the mean ratio to BaP.

Naphthalene should also be considered separately against its generic screen. Whilst classed as a PAH, naphthalene is more volatile and mobile in the environment than most other PAHs. As such the significance of naphthalene cannot be considered within the surrogate marker approach.

Similarly, TPH cannot be assessed as a single "total" value, and reference has been made to the Environment Agency's document P5-080/TR3, "The UK approach for evaluating human health risks from petroleum hydrocarbons in soils". This document supports the assumptions and recommendations made by the US Total Petroleum Hydrocarbons Criteria Working Group (TPHCWG). The TPHCWG have broken down "TPH" into representative constituent fractions or "EC Bandings". The TPHCWG have derived a series of physiochemical and toxicological parameters for each of the bandings.

The significance of speciated TPH results can be assessed by following the 3 steps outlined in the tables below.

Step	Result	Action
1. Consider indicator compounds: Are BTEX, naphthalene, benzo(a)pyrene above their respective Tier 1 values?	Yes	Remediation or dQRA required
	No	Proceed to Step 2
2. Consider individual TPH fractions: are they above respective screening values?	Yes	Remediation or dQRA required
	No	Proceed to Step 3
3. Assess Cumulative effects: Is the calculated Hazard Index for each source >1	Yes	Remediation or dQRA required
	No	TPH compounds pose no significant risk

Step 1 - Assessing indicator compounds

TPH fraction Indicator compound	End use specific screening value (mg/kg)			
	A: Residential no cover	B: Residential with 600mm cover	C: Residential no gardens	D: Commercial\ industrial
Benzene	0.9	0.9	3.3	98
Toluene	600	3,000	2,700	5,000
Ethyl Benzene	350	932	843	5,000
Xylenes	246	327	321	5,000
Naphthalene	8	9	9	1,000
Benzo(a)pyrene	5	25	5.3	76

Step 2 - Assessing individual TPH fractions

TPH fraction		End use specific screening value (mg/kg)			
		A: Residential no cover	B: Residential with 600mm cover	C: Residential with no gardens	D: Commercial/ industrial
Aliphatic 5-6	GRO	41	41	42	5,000 [^] per fraction
Aliphatic 6-8	GRO	125	125	125	
Aliphatic 8-10	GRO	31	31	32	
Aliphatic 10-12	DRO	151	156	154	
Aliphatic 12-16	DRO	500 [^]	500 [^]	500 [^]	
Aliphatic 16-21	DRO	1,000 [^]	5,000 [#]	1,000 [^]	
Aliphatic 21-35	LRO	1,000 [^]	5,000 [#]	1,000 [^]	
Aromatic 5-7	GRO	100	123	122	
Aromatic 7-8	GRO	30	34	34	
Aromatic 8-10	GRO	47	50	50	
Aromatic 10-12	DRO	215	287	266	
Aromatic 12-16	DRO	689	1,000 [*]	1,000 [*]	
Aromatic 16-21	DRO	1,000 [^]	5,000 [#]	1,000 [^]	
Aromatic 21-35	LRO	1,000 [^]	5,000 [#]	1,000 [^]	

* Calculated Screening Value exceeded soil saturation limit and could indicate free product, therefore calculated soil saturation limit adopted as a target

[^] Calculated Screening Value close to soil saturation limit, screening value selected by Lithos considering visual and olfactory impacts.

[#] Five times the screening value for Scenario A.

Step 3 - Assessing Cumulative Effects

$$HI = \sum_{F_i=1}^{16} HQ F_i = \frac{\text{Measured concentration } F_i \text{ (mg kg}^{-1}\text{)}}{SGV F_i \text{ (mg kg}^{-1}\text{)}}$$

where HI = Hazard Index
 HQ = Hazard Quotient
 F_i = Fraction _i
 SGV = Soil Guideline Value

Other screening values used by Lithos

Tier 1 risk assessment of hazardous gas is undertaken through reference to the following documents (and further information is presented in Generic Note No. 5 – Hazardous Gas):

- Approved Document C, Building Regulations 2000
- Boyle & Witherington (2007) – Guidance on evaluation on development proposals on sites where methane and carbon dioxide are present, incorporating “traffic lights”. Report Ref. 10627-R01-(02), for NHBC
- CIRIA C665 (2007) – Assessing risks posed by hazardous ground gases to buildings
- BS 8485:2015 – Code of Practice for the characterisation & remediation from ground gas in affected developments

With respect to the assessment of potential phytotoxic effects of contaminants, Lithos refer to “The Soil Code” (MAFF, 1998) for copper and zinc. The CLEA SGV is adopted for nickel due to its human health effects.

The potential risk to building materials is considered through reference to relevant BRE Digests, with particular emphasis on BRE Special Digest 1, ‘Concrete in aggressive ground’, 2005.

With respect to the interpretation of the calorific values, at present there are no accepted methods to assess whether a sample is combustible and under what circumstances it might smoulder. Some guidance is given in ICRC Note 61/84 “Notes on the fire hazards of contaminated land” which states that: “In general ... it seems likely that materials whose CV's exceed 10MJ/kg are almost certainly combustible, while those with values below 2MJ/kg are unlikely to burn”.

Tier 1 groundwater risk assessments are undertaken by comparing leachate or groundwater concentrations with the appropriate water quality standard. Tier 1 Screening Values have been discussed with the Environment Agency, and typically those in bold below are adopted.

Analyte	Source of Tier 1 Screening Value (µg/l)			
	Surface water (Abstraction for drinking) 1996	Water Supply Regulations 2000	Water Framework Directive	EA Advice
Arsenic	50	10	50	
Selenium	10	10		
Cadmium	5	5	1.5	
Chromium	50	50	32	
Copper	50	2,000	28	
Lead	50	10	7.2	
Nickel		20	20	
Zinc	3,000		125	
Boron		1,000		
Mercury	1	1	0.07	
Petroleum Hydrocarbons				10
1,1,1-Trichloroethane			100	
1,1 Dichloroethane				100
1,2-Dichloroethane		3	10	
1,1-Dichloroethene				100
Benzene		1	10	
Ethylbenzene				10
Tetrachloroethene		10	10	
Toluene			50	
Trichloroethene		10	10	
Vinyl Chloride		0.5		
Trichloromethane			2.5	
Xylenes			30	
Chloroethane				100

Waste classification & WAC

In the context of waste soils generated by remediation and/or groundworks activities on brownfield sites, the following definitions (from the Landfill Regulations 2002) apply:

- Inert (e.g. uncontaminated ‘natural’ soil, bricks, concrete, tiles & ceramics)
- Non-Hazardous (e.g. soil excavated from a contaminated site which contains dangerous substances, but at concentrations below prescribed thresholds)
- Hazardous (e.g. soil excavated from a contaminated site which contains dangerous substances at concentrations above prescribed thresholds)

Dangerous substances include compounds containing a variety of determinants commonly found in contaminated soils on brownfield sites, for example arsenic, lead, chromium, benzene etc.

Landfill operators require Waste Acceptance Criteria (WAC) laboratory data, if soil waste is classified as hazardous, and such waste must have been subjected to pre-treatment. However, subject to WAC testing it may be possible to classify it as stable, non-reactive hazardous waste, which can be placed within a dedicated cell within the non-hazardous landfill.

Lithos typically only include WAC analysis in site investigation proposals and reports, if significant off-site disposal (of soil classified as hazardous waste) is anticipated, for example where redevelopment proposals include basement construction etc. If off-site disposal of soils classified as hazardous waste during redevelopment is anticipated, then WAC analysis should be scheduled at an early stage in the remediation programme. However, organic compounds (BTEX, TPH, PAH etc) are the most common contaminants that result in soils being classed as hazardous, and these contaminants can often be dealt with by alternative technologies (eg by bioremediation or stabilisation) and consequently retention on site is often possible.

It should be noted that non-hazardous soil waste can go to a non-hazardous landfill facility; no further testing (eg WAC) is required.

Possible action in event of Tier 1 exceedance

Should any of the Tier 1 criteria detailed above be exceeded, then three potential courses of action are available. (The first is only applicable in terms of human health, but the second and third could also be applied to groundwater or landfill gas).

1. Undertake further statistical analysis following the approach set out in "*Guidance on Comparing Soil Contamination Data with a Critical Concentration - CL:AIRE and CIEH, May 2008*" in order to determine whether contaminant concentrations of inorganic contaminants within soil\fill actually present a risk (only applicable to assessing the risk to human health).
2. Carry out a more detailed quantitative risk assessment in order to determine whether contamination risks actually exist.
3. Based on a qualitative risk assessment, advocate an appropriate level of remediation to "break" the pollutant linkage - for example the removal of the contaminated materials or the provision of a clean cover.

Prior to undertaking any statistical analysis the issue of the averaging area requires further consideration. The CL:AIRE\CIEH document still refers to CLR 7, which suggests averaging area should reflect receptor behaviour and therefore might be a single garden, or an open area used by the local community as a play area. This approach to averaging areas is considered applicable within the context of Part IIA of the Environmental Protection Act (EPA) 1990, in terms of an existing residential development.

However, Lithos consider the concept of a single garden as an averaging area to be inappropriate with respect to brownfield redevelopment, which is regulated by the planning regime. In this context, contamination across the entire site needs to be characterised by reference to the Conceptual Site Model. Consequently, Lithos gather and analyse sample results by fill type, and \or by former use in a given sub-area of the site, before undertaking statistical analysis; ie the averaging area is associated with the extent of a particular fill type, or an area affected by spillage\leakage.

In terms of brownfield redevelopment, this is considered a more appropriate methodology which provides a more representative sample population for statistical analysis. As such the entire site is considered in terms of the proposed end use, be this residential with, or without gardens.

Analysis by soil\fill type is appropriate for essentially immobile contaminants associated with a particular fill type, for example arsenic in colliery spoil, metals in ash & clinker, sulphate in plaster-rich demolition rubble etc.

Analysis by former use is appropriate where more mobile contaminants have entered the ground, for example diesel associated with leakage from a former fuel tank, downward migration of leachable metals through granular materials, various soluble contaminants present in a wastewater leaking into the ground via a fractured sewer etc. In these circumstances, it may be appropriate to undertake statistical analysis of sample results from a variety of different soil\fill types. However, consideration would have to be given to factors such as porosity which might influence impregnation of a mobile contaminant into the soil mass, ie contamination would normally be more pervasive and significant in granular soils than cohesive soils

General

Hazardous gas is considered to be any mixture of potentially explosive, toxic or asphyxiating gases, most notably methane, carbon dioxide and oxygen (deficiency). In addition, radon, a naturally occurring radioactive gas is also considered. Further information about radon is included in Notes 01 – Environmental Setting.

Assessment of potential risks associated with hazardous gas are based on a review of data obtained from the Landmark Information Group, the Environment Agency and the Local Authority and the British Geological Survey. Reference is also made to historical OS plans, which are inspected for evidence of backfilled quarries, railway cuttings, colliery spoil tips etc.

Where landfilling has occurred within 250m of the site boundary, the Local Planning Authority may request a landfill gas investigation in accordance with the Town and Country Planning General Development Order, 1988.

Sources

Potential sources of hazardous gas include:

- Landfill sites
- Made ground, especially where significant depths are present
- Shallow mineworkings associated with coal extraction
- Geological strata, including peat, organic silts, coal and limestone (reaction with acidic waters), granite (radon)
- Groundwater can sometimes act as a "carrier" for hazardous gas
- Leakages from pipelines or storage tanks
- Sewers, septic tanks and cess pits

Generation

Wherever biodegradable material is deposited, landfill gas (principally a mixture of methane and carbon dioxide) is likely to be generated by microbial activity. Carbon dioxide is an asphyxiant and toxic; methane is flammable and a mixture containing between 5% and 15% methane by volume in air is explosive. Landfill gas in the ground is unlikely in itself to pose a significant risk, though it may damage vegetation. However, infiltration of landfill gas into confined spaces (e.g. cellars, services, etc) may give rise to considerable risk.

There is no typical figure for the length of time that landfill gas will be evolved, but at many sites significant gas generation continues for at least 15 years after the last deposit of waste.

Migration

Gas migration from a landfill site may occur in several ways. It may migrate through adjacent strata; the distance of migration being dependent on the pressure gradients, volume of gas and permeability of the strata. Where there are faults, cavities and fissures within the strata, gas may move considerable distances. Other migration pathways for gas include man-made features such as mine shafts, roadways and underground services.

Gas migration is influenced by a number of climatic factors, such as atmospheric pressure variations, water table level variations and the influence of a covering of snow or ice over the surface of the site and surrounding area.

Gas monitoring procedure

Lithos adopt a standard gas monitoring procedure, in accordance with CIRIA guidance. This procedure involves the measurement, in the following order of:

- Atmospheric temperature, pressure and ambient oxygen concentration
- Gas emission rate
- Methane, oxygen and carbon dioxide concentrations using an infra-red gas analyser
- Standing water level using a dipmeter.

In addition, ground conditions at each sampling location are recorded together with prevailing weather conditions and any other observations such as any vandalism. Where samples of gas are required for laboratory analysis, Gresham Tubes or multi-layer Tedlar / ALTEF sampling bags are used. Gas concentrations in the well are typically recorded immediately before and after retrieval of a sample.

Current guidance

CIRIA Report 151 (1995)ⁱ identified that there was inadequate guidance on trigger concentrations for ground gases. CIRIA concluded that the most important aspect of a gas regime below or adjacent to a site was the surface emission rate, i.e. how quickly the gas is coming out of the ground. The lower the surface emission rate the lower the risk. CIRIA Report C665 (2007)ⁱⁱ advocates two methodologies for characterising sites:

A – All developments except low rise housing. The advocated methodology is that proposed by Wilson & Card, 1999ⁱⁱⁱ

B – Low rise housing. An alternative (traffic light) methodology, derived by Boyle and Witherington, 2006^{iv} for NHBC

Both methodologies refer to Gas Screening Values (GSV); previously referred to as limiting borehole gas volume flow.

A – All developments except low rise housing

(Wilson & Card, 1999)^v revised Table 28 of CIRIA 149ⁱ in terms of borehole gas volume flow rate (now GSV) in order to achieve a more consistent design of protection measures. This was done to reflect the importance of recognising the gas surface emission rate. Wilson & Card then developed a method for classifying gassing sites (Table 1 below), which took into account the combined gas concentration and GSV.

Characteristic Situation	Gas Screening Value, CH ₄ or CO ₂ (l/hr)	Additional limiting factors	Typical source of generation
1	<0.07	Methane not to exceed 1% v/v and carbon dioxide not to exceed 5% v/v	Natural soils with low organic content
2	<0.7	Borehole air flow rate not to exceed 70 litre/hr otherwise increase to Characteristic Situation 3	Natural soil, high peat/organic content
3	<3.5		Old landfill, inert waste, mineworkings flooded.
4	<15	Quantitative Risk Assessment required to evaluate scope of protection measures.	Mineworkings – susceptible to flooding, completed landfill, inert waste
5	<70		Mineworkings unflooded, inactive
6	>70		Recent landfill site

Notes: Borehole flow rate = volume of gas (regardless of composition) which is escaping from well (l/hr). Gas Screening Value (litre/hour) = gas concentration (%) / 100 x borehole flow rate (l/hr). To facilitate design implementation, the limiting values for both methane and carbon dioxide are identical.

B – Low rise housing.

NHBC have developed a characterisation system similar to that of Wilson & Card above, but specific to low-rise housing development (Boyle and Witherington) (Table 8.7). This approach compares measured gas emission rates with generic "Traffic Lights". The Traffic Lights include "Typical Maximum Concentrations" for initial screening, and risk-based Gas Screening Values (GSVs) for consideration of situations where the Typical Maximum Concentrations are exceeded. Calculations are carried out for both methane and carbon dioxide and the worst case adopted in order to establish the appropriate protection measures.

Table 8.7 NHBC Traffic light system for 150 mm void

Traffic Light Classification	Methane ¹		Carbon Dioxide ¹	
	Typical Maximum Concentration ⁵ (%v/v)	Gas Screening Value ^{2,4,6} (l/hr)	Typical Maximum Concentration ⁵ (%v/v)	Gas Screening Value ^{2,3,4,6} (l/hr)
Green	1	0.16	5	0.78
Amber 1	5	0.63	10	1.56
Amber 2	20	1.56	30	3.13
Red				

Notes:

- The worst gas-regime identified at the site, either methane or carbon dioxide, recorded from monitoring in the worst temporal conditions, will be the decider for which Traffic Light and GSV is allocated.
- Generic GSVs are based on guidance contained within "The Building Regulations: Approved Document C" (2004) and assume a sub-floor void of 150 mm thickness.
- A leak of gas from the sub-floor void into a small room (e.g. downstairs toilet with soil pipe potentially passing into sub-floor void) of dimensions 1.50m × 1.50m × 2.50m, with a total room volume of 5.63m³ has been considered.
- The GSV, in litres per hour, is as defined in Wilson and Card (1999) as the borehole flow rate multiplied by the concentration in the air stream of the particular gas being considered.
- The Typical Maximum Concentrations can be exceeded in certain circumstances should the conceptual site model indicate it is safe to do so. This is where professional judgment will be required, based on a thorough understanding of the gas regime identified at the site where monitoring in the worst temporal conditions has occurred.
- The GSV thresholds should not generally be exceeded without completion of a detailed gas risk assessment taking into account site-specific conditions.

ⁱ Harries CR, Witherington PJ and McEntee JM (1995). *Interpreting measurements of gas in the ground*. CIRIA Report 151

ⁱⁱ CIRIA (2007) – *Assessing risks posed by hazardous ground gases to buildings*.

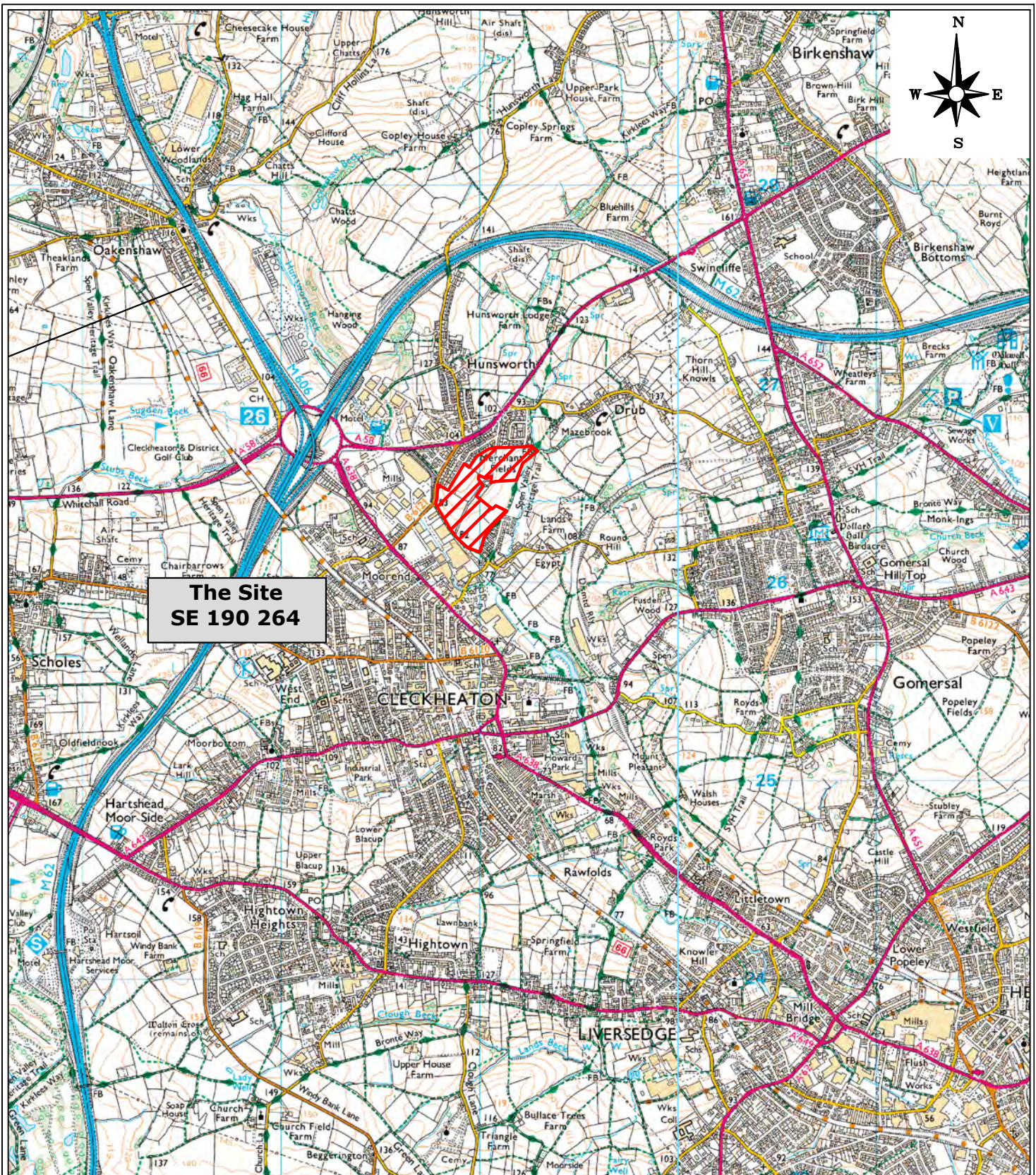
ⁱⁱⁱ Wilson SA and Card GB (February 1999). *Reliability and Risk in Gas Protection Design*. Ground Engineering.

^{iv} Boyle & Witherington (2006) – *Guidance on evaluation on development proposals on sites where methane and carbon dioxide are present, incorporating "traffic lights"*. Report Ref. 10627-R01-02, for NHBC

^v Wilson SA and Card GB (February 1999). *Reliability and Risk in Gas Protection Design*. Ground Engineering.

Appendix B

Drawings



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CLIENT

HARRON
HOMES

JOB TITLE

MERCHANT
FIELDS,
CLECKHEATON

DRAWING TITLE

SITE LOCATION
PLAN

DRAWN

CC/LEW

DATE

01/03/19

CHECKED

MJT

DATE

01/03/19

STATUS

FOR COMMENT ☐

DRAFT ☐

FOR APPROVAL ☐

FINAL ☒

SCALE

1:25,000

SHEET

A4

DRAWING NO.

2828/1

REVISION



NOTES

— APPROXIMATE SITE BOUNDARY

REPRODUCED FROM HARRON HOMES
DRAWING REFERENCE 122-10-SK-10, DATED
NOVEMBER 2018

REV.	DESCRIPTION	DATE



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CLIENT

HARRON
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JOB TITLE

MERCHANT
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CLECKHEATON

DRAWING TITLE

PROPOSED SITE LAYOUT

DRAWN	CC/LEW	DATE	06/03/19	STATUS	FOR COMMENT	☐
CHECKED	MJT	DATE	06/03/19	FOR APPROVAL	DRAFT	☐
				FINAL		☒

SCALE	1:2000	SHEET	A3	DRAWING NO.	2828/2	REVISION	



NOTES		
	GRASS & OVERGROWN AREAS	
	TREES/DENSE VEGETATION	
	CLEARED TREES/DENSE VEGETATION	
	CUT HEDGEROW/TREES	
	TARMAC HARDSTAND	
	SURFACE WATER FEATURE	
	APPROXIMATE SITE BOUNDARY	
	LOCATION & ORIENTATION OF PHOTOGRAPH	
REV.	DESCRIPTION	DATE



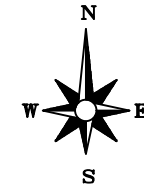
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CLIENT
HARRON HOMES

JOB TITLE
MERCHANT FIELDS, CLECKHEATON

DRAWING TITLE
SITE PHOTOGRAPHS - GENERAL

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CHECKED	MJT	DATE	29 03 19	FOR APPROVAL	DRAFT	☐
					FINAL	☒
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NOTES		
	GRASS & OVERGROWN AREAS	
	TREES/DENSE VEGETATION	
	CLEARED TREES/DENSE VEGETATION	
	CUT HEDGEROW/TREES	
	TARMAC HARDSTAND	
	SURFACE WATER FEATURE	
	APPROXIMATE SITE BOUNDARY	
	LOCATION & ORIENTATION OF PHOTOGRAPH	
REV.	DESCRIPTION	DATE

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CLIENT

HARRON HOMES

JOB TITLE

MERCHANT FIELDS, CLECKHEATON

DRAWING TITLE

SITE PHOTOGRAPHS - DETAILED

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SCALE	NOT TO SCALE	SHEET	A3	DRAWING NO.	2828/4B	REVISION



NOTES		
	TRIAL PIT LOCATION	
	PROBEHOLE LOCATION	
	GRASS & OVERGROWN AREAS	
	TREES/DENSE VEGETATION	
	CLEARED TREES/DENSE VEGETATION	
	CUT HEDGEROW/TREES	
	TARMAC HARDSTAND	
	SURFACE WATER FEATURE	
	RECORDED SHAFT LOCATION (FROM COAL AUTHORITY DATA)	
	MAPPED OUTCROP OF WHEATLEY LIME COAL (FROM PUBLISHED BGS PLANS)	
	INFERRED OUTCROP OF WHEATLEY LIME COAL (FROM LITHOS EXPLORATORY HOLES)	
	APPROXIMATE SITE BOUNDARY	
A	SUPPLEMENTARY PROBEHOLES ADDED	17 06 19
REV.	DESCRIPTION	DATE

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CLIENT

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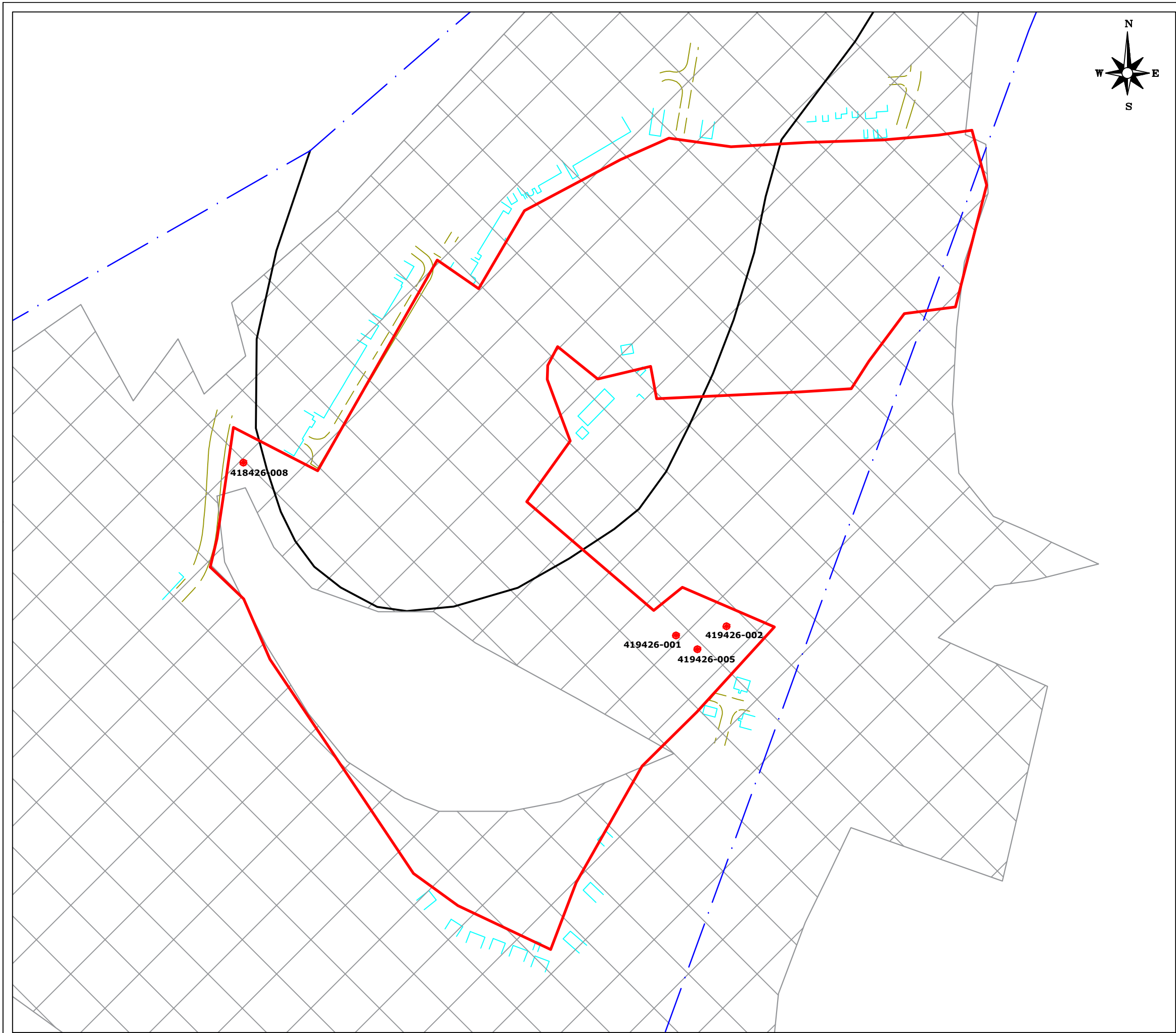
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MERCHANT FIELDS,
CLECKHEATON

DRAWING TITLE

EXPLORATORY HOLE LOCATIONS

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CHECKED		DATE		FOR APPROVAL ☐	
MJT		05 04 19		DRAFT ☐	
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SCALE		SHEET		DRAWING NO.	
1:2000		A3		2828/6	
				REVISION	
				A	



- NOTES
- COAL AUTHORITY DEVELOPMENT HIGH RISK AREA (FROM CA)
 - CA RECORDED SHAFT
 - MAPPED OUTCROP OF WHEATLEY LIME COAL
 - MAPPED FAULT LINE
 - APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE



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CLIENT

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JOB TITLE

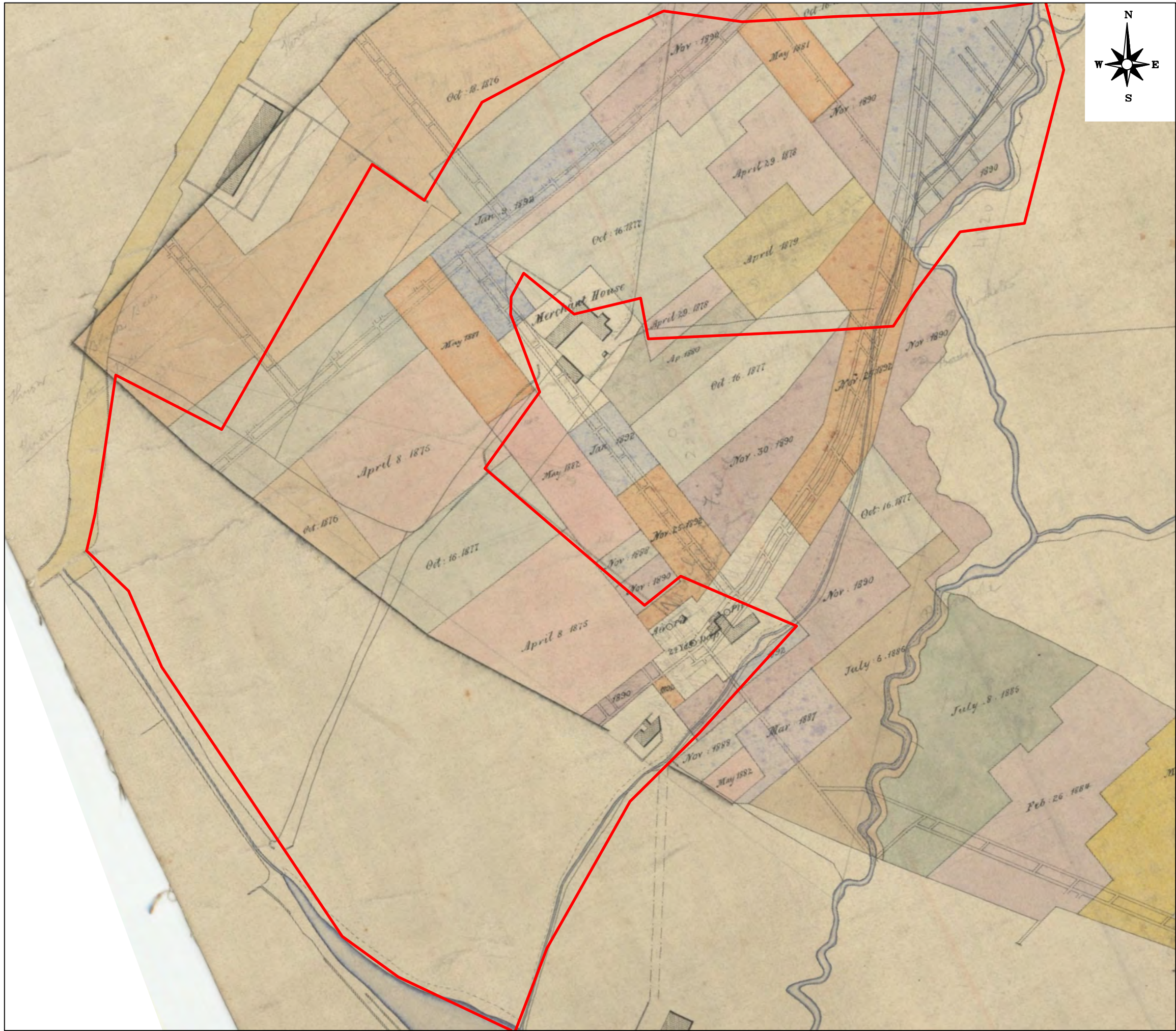
MERCHANT
FIELDS,
CLECKHEATON

DRAWING TITLE

GEOLOGY & COAL AUTHORITY
DATA

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				FINAL		☒

SCALE	1:2500	SHEET	A3	DRAWING NO.	2828/8	REVISION	



NOTES

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REV.	DESCRIPTION	DATE

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CLIENT

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JOB TITLE

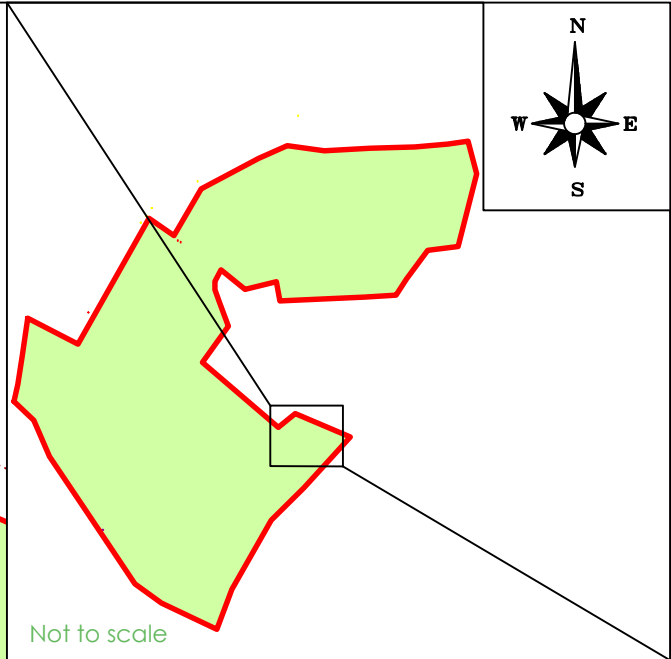
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DRAWING TITLE

BLOCKING COAL ABANDONMENT PLAN

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				FINAL	☒	

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NOTES		
	CA RECORDED SHAFT	
	SHAFT LOCATION (AS SURVEYED)	
	LOCATION & ORIENTATION OF PHOTOGRAPH	
	APPROXIMATE SITE BOUNDARY	
REV.	DESCRIPTION	DATE



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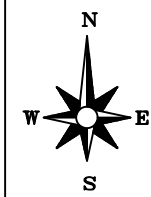
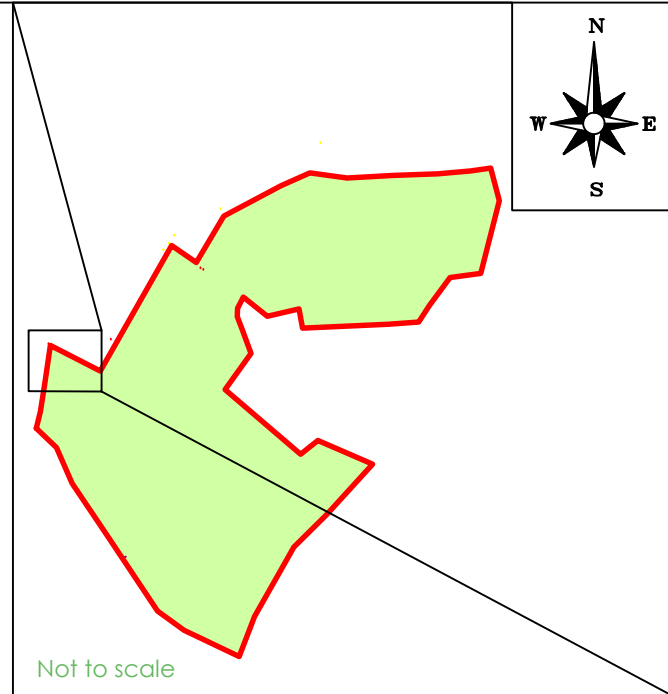
SHAFT LOCATIONS &
PHOTOGRAPHS

DRAWN	CC/LEW	DATE	11/03/19	STATUS	FOR COMMENT	☐
CHECKED	MJT	DATE	11/03/19	FOR APPROVAL	DRAFT	☒
SCALE	1:250	SHEET	A3	DRAWING NO.	2828/10A	REVISION

419426-001

419426-002

419426-005



NOTES		
	AREA OF SHAFT SEARCH	
	INACCESSIBLE AREA (STEEP SLOPE)	
	CA RECORDED SHAFT	
	LOCATION & ORIENTATION OF PHOTOGRAPH	
	APPROXIMATE SITE BOUNDARY	
REV.	DESCRIPTION	DATE

418426-008



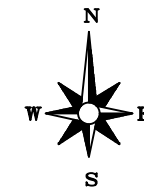
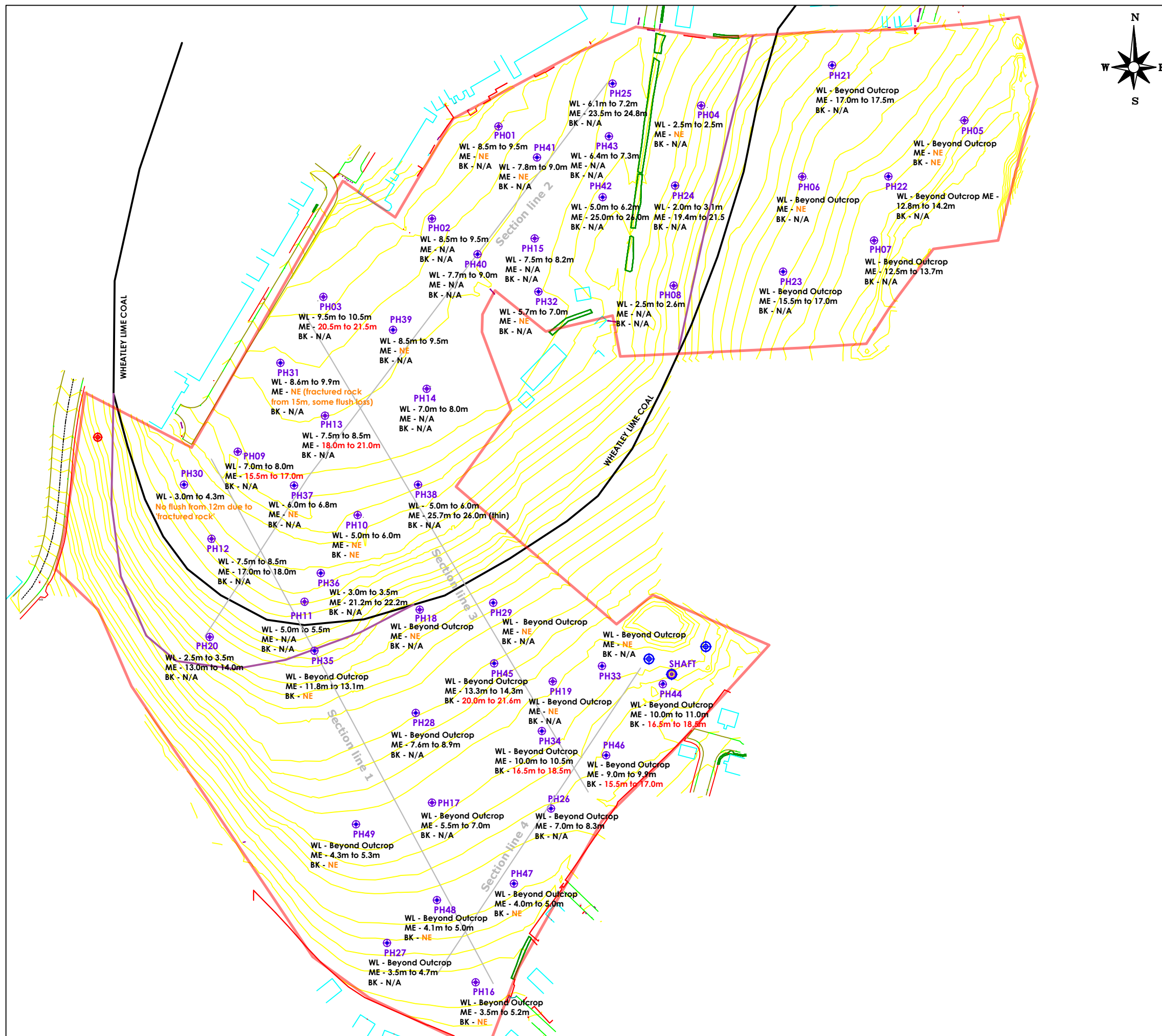
info@lithos.co.uk
www.lithos.co.uk
Tel 01937 545330

HARRON
HOMES

MERCHANT
FIELDS,
CLECKHEATON

SHAFT SEARCH AREA &
PHOTOGRAPHS

DRAWN	CC/LEW	DATE	11/03/19	STATUS	FOR COMMENT	☐
CHECKED	MJT	DATE	11/03/19	FOR APPROVAL	DRAFT	☐
SCALE	1:250	SHEET	A3	DRAWING NO.	2828/10B	REVISION



NOTES		
	PROBEHOLE LOCATION	
	CA RECORDED SHAFT (TO BE LOCATED)	
	SHAFT LOCATION (AS SURVEYED)	
	MAPPED OUTCROP OF WHEATLEY LIME COAL (FROM PUBLISHED BGS PLANS)	
	INFERRED OUTCROP OF WHEATLEY LIME COAL (FROM LITHOS EXPLORATORY HOLES)	
	APPROXIMATE SITE BOUNDARY	
<u>IDENTIFIED COAL SEAMS</u>		
WL	= WHEATLEY LIME COAL	
ME	= MIDDLETON 11 YARD COAL	
BK	= BLOCKING COAL	
<u>DEPTH TO COAL/WORKINGS</u>		
8.0m	= SOLID COAL ENCOUNTERED	
8.0m	= BROKEN/SOFT GROUND	
NE	= SEAM NOT ENCOUNTERED	
N/A	= HOLE NOT OF SUFFICIENT DEPTH TO INTERCEPT SEAM	
B	ADDITIONAL PHS ADDED (MJT)	28/16/19
REV.	DESCRIPTION	DATE

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CLIENT

HARRON HOMES

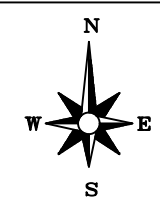
JOB TITLE

MERCHANT FIELDS, CLECKHEATON

DRAWING TITLE

MINING INVESTIGATION FINDINGS

DRAWN	CC/LEW	DATE	11 04 19	STATUS FOR COMMENT ☐ FOR APPROVAL ☐ DRAFT ☐ FINAL ☒
CHECKED	MJT	DATE	11 04 19	
SCALE	1:2000	SHEET	A3	DRAWING NO.
				2828/11
				REVISION
				A



- NOTES
- PROBEHOLE LOCATION
 - CA RECORDED SHAFT (NOT LOCATED)
 - SHAFT LOCATION (AS SURVEYED)
 - AREA REQUIRING GROUTING - MIDDLETON 11 YARD COAL
 - AREA REQUIRING PROOF DRILLING - MIDDLETON 11 YARD COAL
 - AREA REQUIRING GROUTING - BLOCKING COAL
 - MAPPED OUTCROP OF WHEATLEY LIME COAL (FROM PUBLISHED BGS PLANS)
 - INFERRED OUTCROP OF WHEATLEY LIME COAL (FROM LITHOS EXPLORATORY HOLES)

A	UPDATED WITH SUPPLEMENTARY PH FINDINGS (MJT)	28/06/2019
REV.	DESCRIPTION	DATE



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CLIENT

HARRON HOMES

JOB TITLE

MERCHANT FIELDS, CLECKHEATON

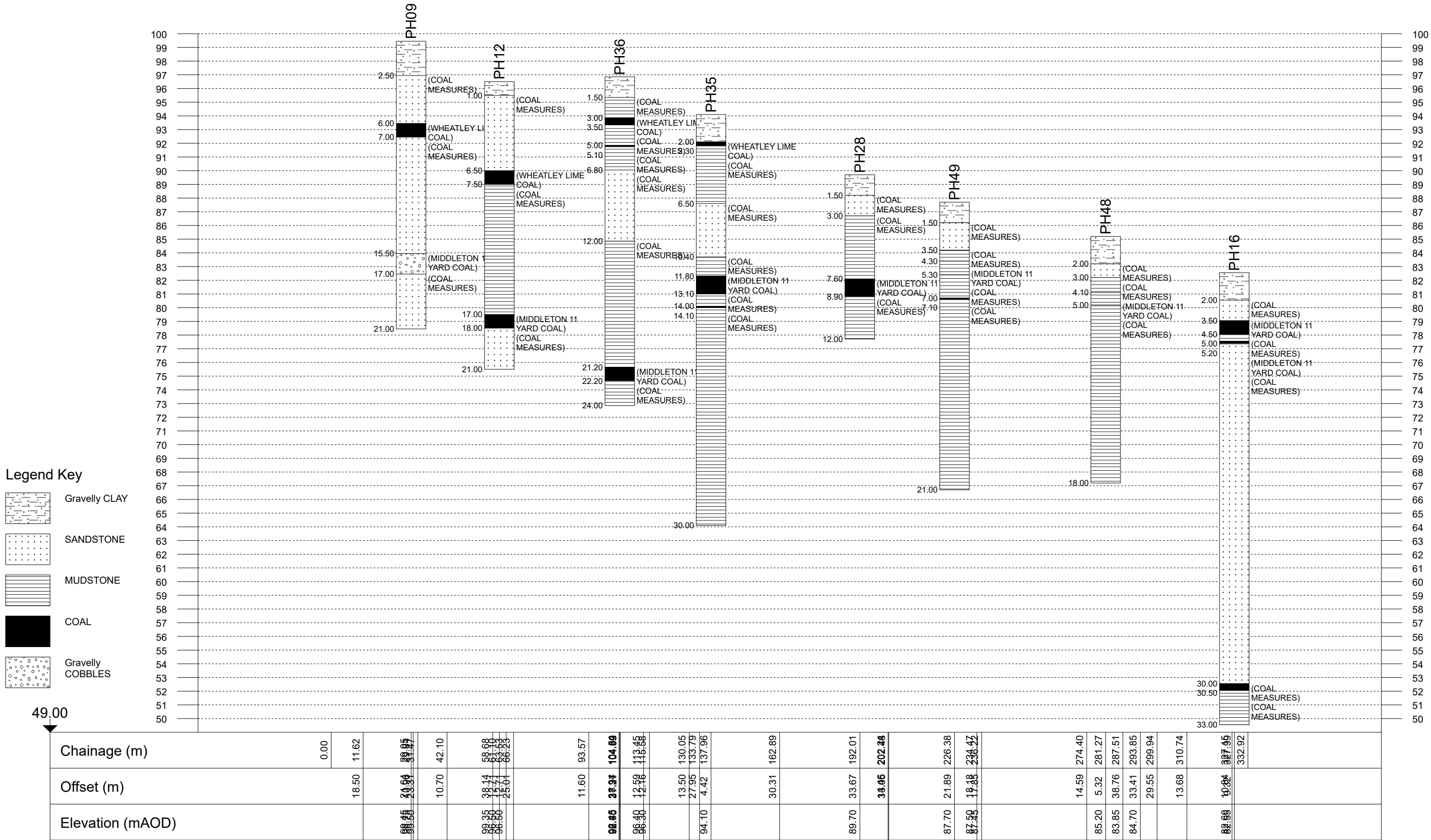
DRAWING TITLE

APPROXIMATE GROUT AREAS

DRAWN		DATE		STATUS	
CC/LEW		30 04 19		FOR COMMENT ☐	
CHECKED		DATE		FOR APPROVAL ☐	
MJT		30 04 19		DRAFT ☐	
				FINAL ☒	
SCALE		SHEET		DRAWING NO.	
1:2000		A3		2828/12	
				REVISION	
				A	

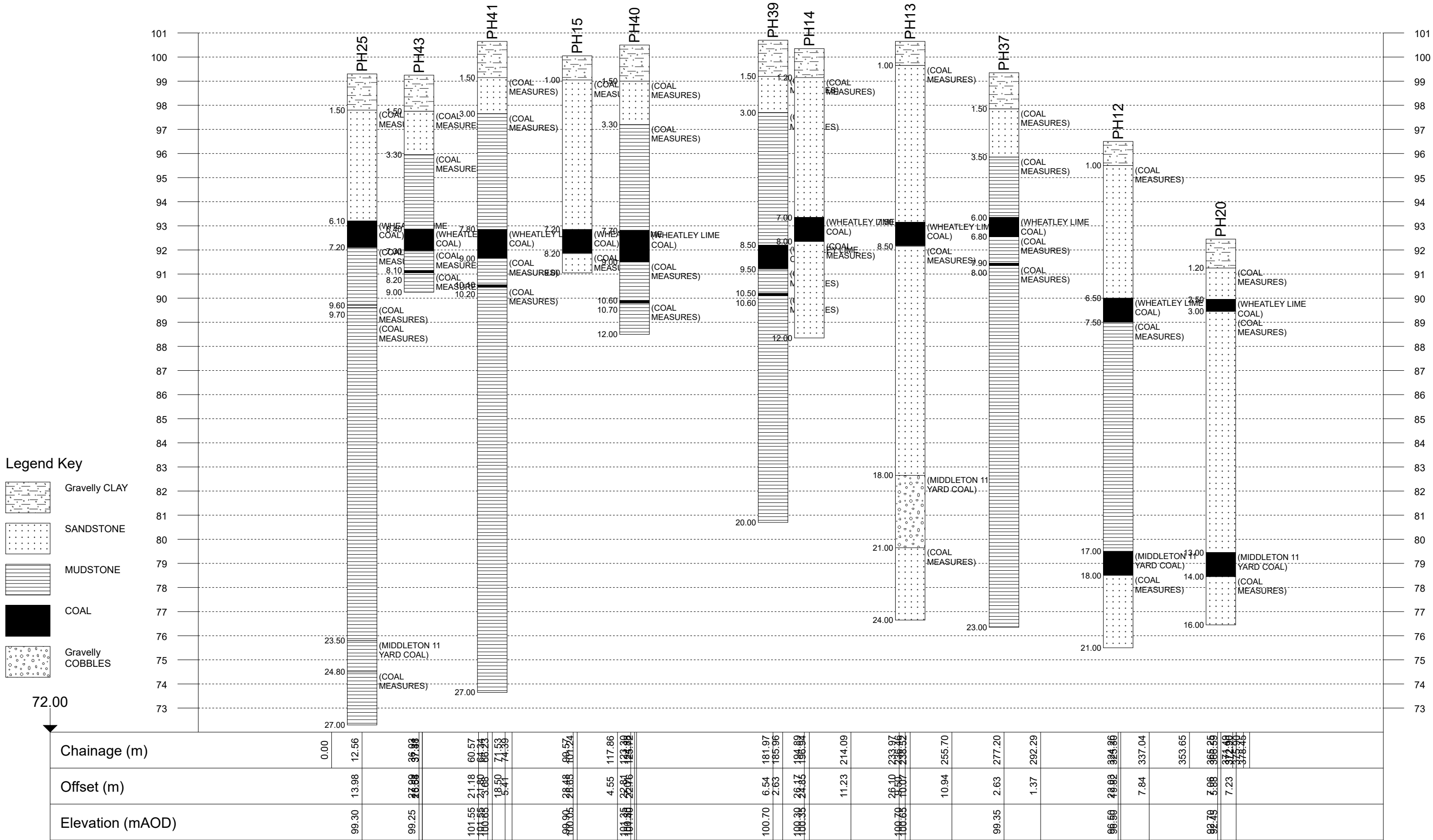
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Project Title: Merchant Fields, Cleckheaton
Location: West Yorkshire
Client: Harron Homes

Title: Section line 1
Vertical Scale: 1:269
Horizontal Scale: 1:1338
Engineer:



Project Id: 2828
Project Title: Merchant Fields, Cleckheaton
Location: West Yorkshire
Client: Harron Homes

Title: Section line 2
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Engineer:

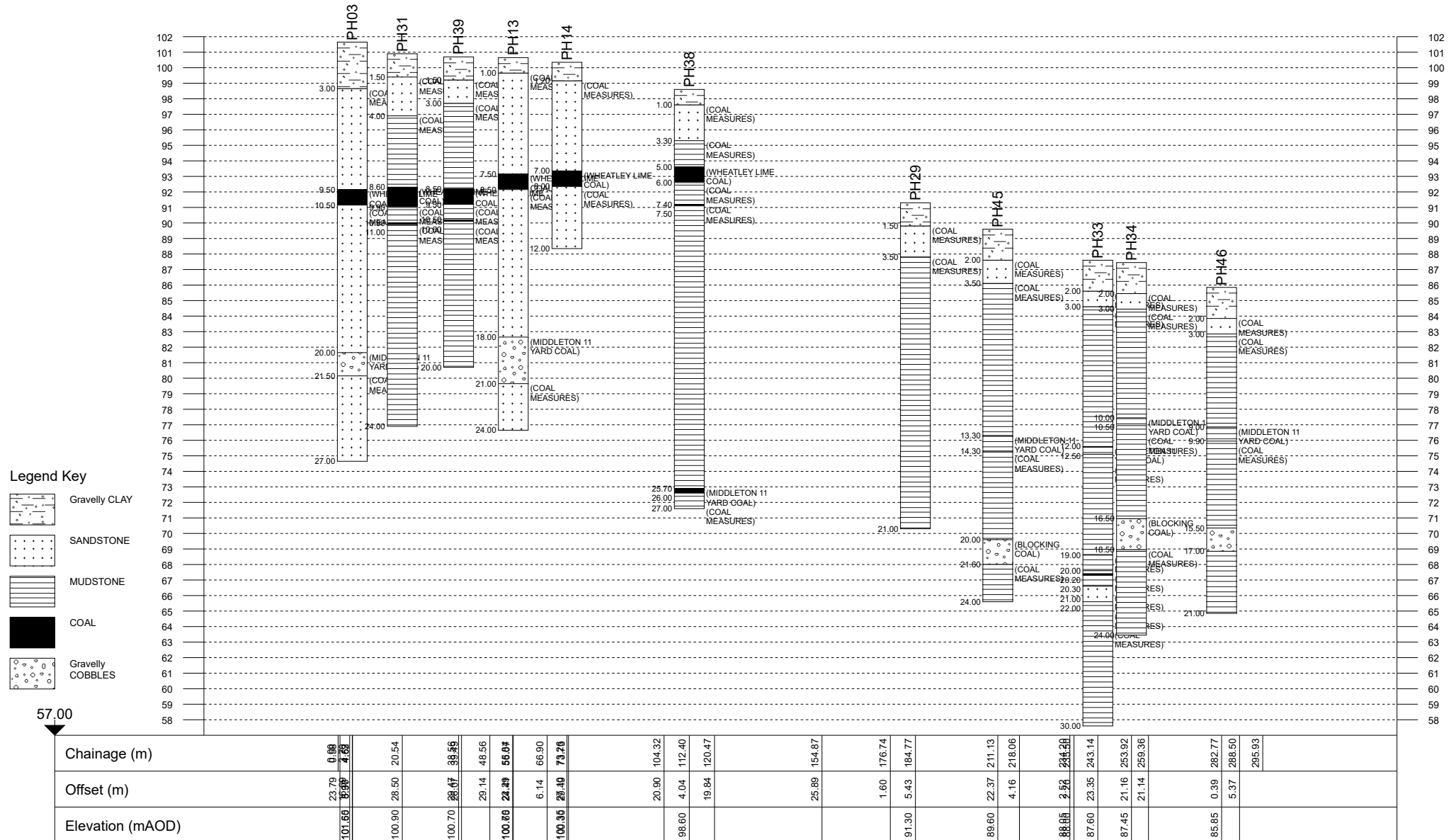


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Vertical Scale: 1:345

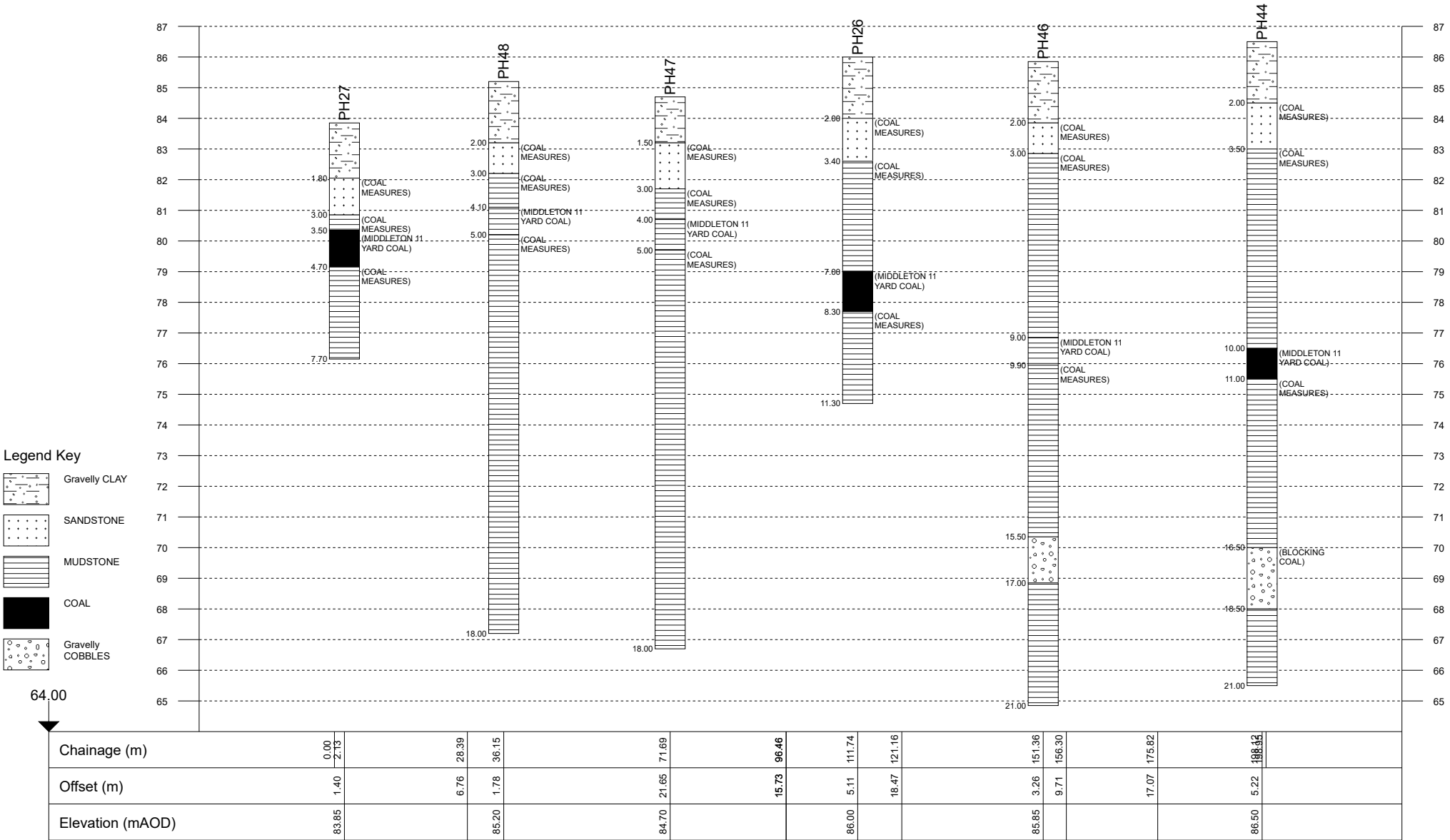
Horizontal Scale: 1:1714

Engineer:



Project Id: 2828
Project Title: Merchant Fields, Cleckheaton
Location: West Yorkshire
Client: Harron Homes

Title: Section line 4
Vertical Scale: 1:176
Horizontal Scale: 1:1153
Engineer:



Appendix C

Commission

002/2828/MJT

21st August 2018



Registered in England 07068066

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Temple point
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LS15 9JL

Parkhill
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LS22 5DZ

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Dear Matthew

Merchants Field, Cleckheaton

Further to your recent invitation, please find attached our proposal for undertaking a site investigation on the above land. We understand that your proposed development will include traditional 2 storey domestic dwellings with associated gardens, POS and adoptable roads and sewers.

Review of the information supplied suggests that the site consists of a single parcel of land of approximately 12 hectares off Kilroyd Drive, Cleckheaton. Review of Google Maps suggests the site comprises rough pastures, divided into numerous fields by walls/hedging.

Harron Homes have provided Lithos with a copy of ARP's desk study report, dated November 2015. Key points from a brief review of ARP's report, geological maps and Environment Agency data are:

- The site appears to have remained largely undeveloped throughout its history, with the exception of a former tennis ground/pavilion in the north, and a colliery building in the south-east
- The colliery in the south-east had a small associated spoil head and 3 shafts, treatment details of which are unknown at this stage. A fourth shaft is located on the south-western boundary
- The Wheatley Lime coal (up to 1.1m thick) outcrops on, and underlies most of, the site.
- A landfill is located 230m south
- The site is not within a groundwater source protection zone

Brief examination of the relevant geological map suggests the site is underlain by Lower Coal Measure bedrock. This site is located within a Coal Mining Development High Risk Area (an area with specific mining legacy risks to the surface, including mine entries; shallow coal workings etc), therefore a mining report will be obtained.

In addition, mine entry datasheets for all 4 mine entries on site will be requested from the Coal Authority, along with copies of any abandonment plans which they hold.

Due to the presence of shallow coal the Local Authority may consider the site to lie within a Mineral Safeguarding Area. As a consequence of this and the NPPF, the Local Authority may require you to consider the opportunity to recover (extract) the coal. Our report will include an assessment of the feasibility of coal extraction.

Our site investigation will be undertaken in accordance with UK good practice (as outlined in BS5930, BS10175, CLR11 etc). Our Report may not be fully compliant with Eurocode 7 (EC7) and will not purport to be a Ground Investigation Report, nor a Geotechnical Design Report as defined by EC7. Our ground appraisal is intended to assist others as they proceed with design of the proposed development.



This proposal allows for the following works:

Desk study: Environmental search data and historical maps (contained within the ARP report), will be reviewed in order to determine whether any past land uses have had any effect on the proposed development. In addition, published geological plans of the area will be examined. We will also visit site to undertake a walkover survey.

Fieldwork: We have allowed for the excavation of around 60 trial pits and the drilling of around 16 rotary probeholes. All trial pits and boreholes will be supervised and logged by an experienced geoenvironmental engineer.

An additional day of trial pitting will also be spent searching for the mine entries in the south-east and far south-west, although no guarantee can be made that they will be located.

No allowance has been made for soakaway testing at this stage. If required, or considered feasible based on the ground actually encountered, soakaway tests could be undertaken for an additional fee of about £ . This would include tests in around 6 trial pits. If successful, and soakaways were pursued as a drainage solution, additional tests may be needed on a tighter grid at a later stage.

Representative soil samples of natural and man-made ground, including any contaminated samples, will be taken during the works. In-situ shear strengths of any cohesive soils encountered will be determined by the use of a hand-held shear vane.

We will make every effort to compact arisings and 'sweep' them over each pit. However, you should be aware that on completion of the investigation, "graves" of spoil (each about 3m long by 1m wide) unsuitable for trafficking, will be left up to 400mm proud at each trial pit location. At this stage, no allowance has been made for any further reinstatement such as removal of excess arisings, replacement of turf etc.

If the pitting encounters significant thicknesses of made ground or very soft/loose deposits (neither considered likely), boreholes may be required to obtain geotechnical data from greater depth. We will advise you of any need for boreholes within 2 days of completion of the pitting.

This investigation should yield sufficient data to enable a foundation zoning plan, and possibly a detailed Foundation Schedule. However, if ground conditions are found to be more variable than anticipated, a 'tighter' grid of pits will be necessary prior to preparation of a detailed Foundation Schedule. This proposal does not allow for the preparation of a detailed Foundation Schedule, but we will provide a quote on completion of the site investigation if requested.

The site is underlain by the Whealey Lime coal seam, and therefore we have allowed for the drilling of around 16 rotary probeholes to check for the presence of mineworkings. This drilling should be sufficient to determine whether old mineworkings are present and pose a significant risk to surface stability of the site. However, if a potential risk is perceived to exist, further probeholes may be required to delineate the extent of workings in order to obtain fixed price quotations for the necessary consolidation works.

It will be necessary to submit an application (with the associated fee) to the Coal Authority (CA) for 'Permission to enter CA mining interests'; and we have allowed for this. Given the proximity of surrounding housing (within 50m of much of the general site area), and in accordance with CA requirements we have had to assume that around 1/3 of the probeholes will need to be advanced using water as the flushing medium (as reinforced by recent CA guidance on managing the risk of hazardous gas). Our drilling sub-contractor will need to locate the wash outs close to the site, and procure a standpipe and licence from Yorkshire Water. Given the site's size, we have also allowed for provision of a tractor-towed water bowser to move water around site for use in drilling (to be filled at the nearest standpipe).

With reference to the control, management and disposal of surplus water and flush arising from the works, we have assumed that potentially discoloured surplus water will be allowed to flow and settle into the field.

We have also assumed that it will be possible to park plant on site overnight.

Given the likely presence of shallow mineworkings and an area of landfill within 250m of the site, we have allowed for the installation of wells in 20 holes and monitoring for hazardous gas (and any shallow groundwater).

The generation potential of this gas source is considered likely to be Low. Therefore, in accordance with CIRIA Report C665, we have initially allowed for 9 visits over a 6 month period. A hazardous gas risk assessment will be issued on completion of monitoring.

This proposal has been put together without a visit to the site and it has been assumed that access is available for a JCB-type excavator and a track mounted drilling rig with associated tele-handler. If the ground is significantly boggy, we may need to switch to a tracked excavator, which would add around £ to the overall cost.

All exploratory hole locations will be surveyed in by a suitably qualified surveyor, who will also visit site prior to the excavation of the shaft search areas in order to mark out the location of shaft search areas prior to excavation (done to Coal Authority co-ordinates).

Testing: This will comprise routine geotechnical soils analysis, including 20 moisture content & Atterberg limits, and 25 pH & water soluble sulphate.

This site is greenfield and therefore we could obtain in-situ CBR values from plate tests on site. However, at this stage routes, formation level and total length, of proposed estate roads are unknown. Consequently, we will simply estimate CBR values from strata descriptions and classification test results.

At this stage, we have no reason to expect wide areas of the site to be underlain by significant thicknesses of made ground. Consequently, we have only allowed for contaminant testing of up to 12 made ground samples, plus a further 12 samples of topsoil to confirm its suitability for re-use. The test suite will include heavy metals, speciated PAH, and banded TPH (with supplementary speciation as/where appropriate); 3 samples will also be analysed for pesticides. Visible contaminants, sharps and the clay/sand/silt content of 3 topsoil samples will be determined to check compliance with BS3882 requirements.

If more significant made ground is encountered, we will inform you immediately and provide costs for the recommended chemical testing.

Within in our proposal we have allowed for the screening (ID) of 28 samples for asbestos. In the event that positive IDs are reported, it is likely that we will need to schedule further analysis (asbestos quantification), in order to determine the significance of the results. Asbestos quantification is currently a relatively expensive test and consequently we have not allowed for it at this stage. We will inform you immediately after receipt of results if we consider asbestos quantification is required.

Reporting & timescales: In order to provide you with sufficient information to enable assessment of abnormal costs at the earliest opportunity we will issue a concise overview report within 3 days of fieldwork completion.

On completion of the desk study, fieldwork and laboratory testing a comprehensive bound, factual and interpretative report will be issued. This will contain detailed engineering records, laboratory test results, copies of all relevant correspondence and drawings of the site. The report will include qualitative risk assessment with respect to both controlled waters and human health. The report will also include consideration of foundation types.

Fieldwork could be commenced within 4 weeks of receipt of your written instruction to proceed. Our comprehensive geoenvironmental appraisal report will be issued within 4 weeks of fieldwork completion. This report will comment on issues associated with hazardous gas, but the gas risk assessment will not be issued until monitoring is completed.

Invoicing: The attached proposal provides a breakdown of the costs associated with this project. This breakdown is for information only and the proposal can be regarded as a lump sum price of £ plus VAT. Variation will only occur in the event that a given item is not undertaken or that substantial additional works are recommended, in which case we will inform you immediately, provide costs for the required works, and seek your prior consent.

Our proposal allows for submission of the report to the Local Authority and NHBC, and for submission of a single piece of subsequent correspondence with each regulator to address any queries they may have. Any further meetings, correspondence etc, would be chargeable.

We will submit invoices for this project at the milestones defined below:

- 1st milestone invoice (Items A, B, C & D) within 5 days of fieldwork completion, with exploratory hole logs and an interim letter report outlining our initial findings
- 2nd milestone invoice (Items E, F, G & H) on issue of the final SI report
- 3rd and final invoice (Item I) after completion of the gas monitoring/issue of the supplementary letter report

Health, safety & welfare: The works outlined above will be carried out in accordance with Lithos' task- and site- specific Risk Assessments and Method Statements.

Details of welfare will be included within the Method Statements, however, this investigation is expected to last for around 1 week, and therefore this proposal includes for provision of a Welfare Unit, with the benefit of full canteen facilities, hot water with full size sink, toilet and drying room.

Utility plans are required in order to protect operatives from the hazards associated with striking buried services and avoid potentially substantial disruption\repair costs. We will make every effort not to damage any services (including review of utility plans and use of a CAT detector). However, Lithos cannot accept liability for damage to any underground services that are not accurately marked on plans made available to us prior to commencement of our field investigation, or have not been accurately marked on the ground by a responsible third party (e.g. utility company, site owner).

Most developers have copies of the necessary utility plans (including electricity, gas, water, drainage & telecom), and it would be appreciated if you could forward these prior to the proposed fieldworks. However, if you do not have the necessary plans, Lithos will obtain them direct from each of the utility companies.

Under the CDM Regulations 2015, Lithos must be provided with pre-construction information already in your possession, or information that can reasonably be obtained through sensible enquiry. This information must be relevant to the project, have an appropriate level of detail, and be proportionate to the nature of the risks.

Terms & conditions: This work will be undertaken in accordance with our Standard Terms and Conditions, a copy of which are enclosed.

It is hoped the above is sufficient for your present needs. However, should you require any further information, please contact the undersigned.

Yours sincerely

A handwritten signature in black ink, appearing to read "Matt Thompson".

Matt Thompson
Principal Engineer
for and on behalf of
LITHOS CONSULTING LIMITED

1 DEFINITIONS AND INTERPRETATION

- 1.1 In this Agreement, unless the context otherwise requires, the following words and expressions have the following meanings:
- "Agreement" shall mean these Terms (entitled "Terms and Conditions for the Appointment of Lithos Consulting"), the Proposal, any document recording the Client's unequivocal acceptance of the Proposal and any other documents or parts of other documents expressly referred to in any of the foregoing;
- "Client" shall mean the party for whom the Services are being provided by Lithos;
- "Documents" shall mean all documents of any kind and includes plans, drawings, reports, programmes, specifications, Bills of Quantities, calculations, letters, e-mails, faxes, memoranda, films and photographs (including negatives), or any other form of record prepared or provided or received by, or on behalf of Lithos, and whether in paper form or stored electronically or on disk, or otherwise;
- "Lithos" shall mean Lithos Consulting Limited whose registered office is at Parkhill, Walton Road, Wetherby, West Yorkshire, LS22 5DL.
- "Intellectual Property" includes all rights to, and any interests in, any patents, designs, trade marks, copyright, know-how, trade secrets and any other proprietary rights or forms of intellectual property (protectable by registration or not) in respect of any technology, concept, idea, data, programme or other software (including source and object codes), specification, plan, drawing, schedule, minutes, correspondence, scheme, programme, design, system, process logo, mark, style, or other matter or thing, existing or conceived, used, developed or produced by any person;
- "Parties" shall mean the Client and Lithos
- "Project" shall mean the project described in the Proposal and any enquiry from the Client on which Lithos has based its Proposal;
- "Proposal" means the offer document prepared by Lithos in response to an enquiry or otherwise, in connection with the proposed provision of the Services;
- "Services" means the work and services relating to the Project to be provided by Lithos pursuant to the Agreement and as set out in the Proposal and shall include any additions or amendments thereto made in accordance with these Terms;
- "Terms" means these terms entitled "Lithos Consulting Terms of Appointment".
- 1.2 Words importing the singular only shall also include the plural and vice versa, where the context requires.
- 1.3 Words importing persons or parties shall include firms, corporations and any organisation having legal capacity and vice versa, where the context requires; and words importing a particular gender include all genders.
- 1.4 The sub-headings to the clauses of these Terms are for convenience only and shall not affect the construction of the Agreement.
- 1.5 A reference to legislation includes that legislation as from time to time amended, re-enacted or substituted and any Orders in Council, orders, rules, regulations, schemes, warrants, by-laws, directives or codes of practice issued under any such legislation.
- 1.6 In the event of conflict between the documents forming part of the Agreement, the Proposal shall prevail, followed by the Terms.
- 2 APPOINTMENT
- 2.1 The Client agrees to engage Lithos and Lithos agrees to provide the Services in accordance with the provisions of the Agreement.
- 3 OBLIGATIONS OF LITHOS
- 3.1 Lithos shall perform the Services using the reasonable standard of skill and care normally exercised by similar professional Environmental firms in performing similar services under similar conditions.
- 3.2 Lithos shall use all reasonable endeavours to perform the Services in accordance with all relevant environmental and safety legislation.
- 4 OBLIGATIONS OF THE CLIENT
- 4.1 Throughout the period of this Agreement the Client shall afford to Lithos or procure the affording to Lithos of access to any site where access is required for the performance of the Services.
- 4.2 The Client accepts responsibility for ensuring that Lithos is notified in writing of all special site and/or plant conditions, including without prejudice to the generality of the foregoing, the existence and precise location of all underground services, cables, pipes, drains or underground buildings, constructions or any hazards known or suspected by the Client, which the Client shall clearly mark on the ground or identify on accurate location plans supplied to Lithos prior to the commencement of the Services. The Client shall also inform Lithos in writing of any relevant operating procedures including any site safe operating procedures and any other regulations relevant to the carrying out of the Services. The Client shall indemnify Lithos against all costs, claims, demands and expenses arising as a result of any non-disclosure in this respect, including but not limited to indemnification against any action brought by the owner of the land or otherwise.
- 4.3 If the Client discovers any conflict, defect or other fault in the information or designs provided by Lithos pursuant to the Agreement, he will advise Lithos in writing of such defect, conflict or other fault and Lithos shall have the right to rectify the same or where necessary, to design the solution for rectification of any works carried out by others pursuant the conflicting, defective or in any other way faulty information or designs.
- 5 INTELLECTUAL PROPERTY
- 5.1 The copyright in all Intellectual Property prepared by or on behalf of Lithos in connection with the Project for delivery to the Client shall remain vested in Lithos.
- 5.2 The Client shall have a non-exclusive licence to copy and use such Intellectual Property for purposes directly related to the Project. Such licence shall enable the Client to copy and use the Intellectual Property but solely for its own purposes in connection with the Project and such use shall not include any licence to reproduce any conceptual designs or professional opinions contained therein nor shall it include any licence to amend any drawing, design or other Intellectual Property produced by Lithos.
- 5.3 Should the Client wish to use such Intellectual Property in connection with any other works or for any other purpose not directly related to the Project or wish to pass any Intellectual Property to any third party, it must obtain the prior written consent of Lithos. The giving of such consent shall be at the discretion of Lithos and shall be upon such terms as may be required by Lithos. Lithos shall not be liable for the use by any person of such Intellectual Property for any purpose other than that for which the same were prepared by or on behalf of Lithos.
- 5.4 Ownership of any proposals submitted to the Client that are not subsequently confirmed as part of the Services to be provided for the Client remain with Lithos and such proposals must not be used as the basis for any future work undertaken by the Client or a third party and no liability can be accepted howsoever arising from such proposals.
- 5.5 In the event of the Client being in default of payment of any fees or other amounts due, Lithos may suspend further use of the licence on giving 2 days' notice of the intention to do so. Use of the licence may be resumed on receipt of the outstanding amounts.
- 6 TITLE
- 6.1 Lithos shall transfer only such title or rights in respect of the Documents as it has, and if any part is purchased from a third party Lithos shall transfer only such title or rights as that party had and has transferred to Lithos.
- 6.2 Title in the Documents shall remain with and shall not pass to the Client until the amount due under the invoice(s) (including interest and costs) has been paid in full.
- 6.3 Until title passes, the Client shall hold the Documents as bailee for Lithos and shall store or mark them so that they can at all times be identified as the property of Lithos.
- 6.4 At any time before title passes (save and except where payment is not due), but only after prior consultation with the Client, Lithos may without any liability to the Client repossess and use or sell all or any of part of the Documents and by doing so terminate the right of the Client to use, sell or otherwise deal in the Documents.
- 6.5 Lithos may maintain an action for the price of the Documents notwithstanding that title in them has not passed to the Client.
- 7 CONFIDENTIALITY
- 7.1 Lithos undertakes not to divulge or disclose to any third party without the written consent of the Client information which is designated confidential by the Client or which can reasonably be considered to be confidential and arises during the performance of the Services unless required to do so by law or necessary in the proper performance of its duties in relation to the Project, or in order to make full frank and proper disclosure to its insurers or intended insurers, or to obtain legal or accounting advice.
- 7.2 Subject to the above, Lithos shall be permitted to use information related to the Services if provides in connection with the Project for the purposes of marketing its services and in proposals for work of a similar type.

8 THIRD PARTIES

- 8.1 The Agreement or any part thereof or any benefit or interest thereunder may not be assigned by the Client without the prior written consent of Lithos. The giving of such consent shall be at the discretion of Lithos and Lithos will only agree to an assignment on its terms and in return for payment of a fee by the Client to Lithos to cover Lithos's legal and other costs associated with any assignment.
- 8.2 The Agreement shall not confer and shall not purport to confer on any third party any benefit or any right to enforce any term of this Agreement for the purposes of the Contracts (Rights of Third Parties) Act 1999 or otherwise.
- 8.3 Lithos will consider and may consent to any request from the Client for Lithos to enter a collateral warranty with a third party with regard to the Services provided under the Agreement. The giving of such consent shall be at the discretion of Lithos and Lithos will only enter a collateral warranty on its terms and in return for payment of a fee by the Client to Lithos to cover Lithos's legal and other costs associated with any collateral warranty.
- 9 INSURANCE
- 9.1 Lithos warrants to the Client that there is in force a policy of Professional Indemnity insurance covering its liabilities for negligence under this Agreement, with a limit of indemnity of £5,000,000 (FIVE MILLION POUNDS) any one claim, save for pollution and contamination claims and asbestos claims both of which carry £2,000,000 (TWO MILLION) in the aggregate cover. This policy is annually renewable and whilst renewal is not automatic, Lithos agrees to use reasonable endeavours to maintain such insurance at all times until six years from the date of the completion (or termination) of the Services under the Agreement, provided such insurance is available at commercially reasonable rates having regard, inter alia, to premiums required and policy terms obtainable.
- 9.2 If for any period such insurance is not available at commercially reasonable rates, Lithos shall forthwith inform the Client and shall obtain in respect of such period such reduced level of Professional Indemnity insurance as is available and as would be fair and reasonable in the circumstances for Lithos to obtain.
- 10 LIMITATIONS ON LIABILITY
- 10.1 Unless otherwise agreed in writing, Lithos's liability under or in connection with the Agreement whether in contract, tort, negligence, breach of statutory duty or otherwise (other than in respect of personal injury or death) shall be limited to and shall not exceed the lesser of either five million pounds in the aggregate (unless it is a pollution, contamination or asbestos claim in which case it is two million pounds in the aggregate) or 10 times the total value of invoices issued to the Client for consultancy work instructed under the Agreement.
- 10.2 No action or proceedings under or in respect of the Agreement whether in contract, tort, negligence, under statute or otherwise shall be commenced against Lithos after the expiry of a period of six years from the date of the completion (or termination) of the Services under the Agreement.
- 10.3 Whilst Lithos will scan all potential exploratory locations with a Cable Avoidance Tool, Lithos shall not be liable for any damage to underground services, cables, pipes, drains or underground buildings, constructions and the like which were either not marked on site or for which accurate plans were not provided.
- 10.4 Lithos shall not be liable for the cost of rectifying any defect, conflict or other fault in the information or designs provided by Lithos or for the cost of designing a solution for and rectifying any subsequent works carried out by others pursuant to the conflicting, defective or in any other way faulty information or designs, unless Lithos has been advised in writing of the same by the Client and has been given the opportunity to rectify the same or where necessary, to design the solution for rectification of any subsequent works carried out by others pursuant to the same.
- 11 PAYMENT
- 11.1 Invoices for services rendered will be submitted for payment in accordance with the Proposal.
- 11.2 The due date for payment is the date of the invoice and the final date for payment is 28 days from the date of the invoice.
- 11.3 If the Client disputes the amount included for payment in an invoice a written notice must be served on Lithos by the Client not later than 14 days before the final date for payment. If no notice is given the amount due shall be the amount stated in the invoice.
- 11.4 In the event of failure on the part of the Client to pay any monies in accordance with the foregoing payment provisions, Lithos will be entitled to charge interest on any monies owed to it by the Client, such interest to be at a rate of 8% above the base rate of a clearing bank from time to time calculated from the final date for payment to the date of actual payment on a compound basis.
- 12 DELAY
- 12.1 Lithos will comply with any timescale agreed for completion of the Services unless delayed or prevented by circumstances beyond its reasonable control and in the event of any such circumstances arising Lithos undertakes to complete the Services within a reasonable period, but will not be liable to the Client for any delay as a result.
- 13 TERMINATION
- 13.1 The Agreement may be terminated by either party in the event of the other making a composition or arrangement with its creditors, becoming bankrupt, or being a company, making a proposal for a voluntary arrangement for a composition of debts, or has a provisional liquidator appointed, or has a winding-up order made, or passes a resolution for voluntary winding-up (except for the purposes of a bona fide scheme of amalgamation or reconstruction), or has an administrator or an administrative receiver appointed to the whole or any part of its assets. Notice of termination must be given to the party which is insolvent by the other party.
- 13.2 If for any reason the performance of the Services by Lithos is suspended for a period in excess of three calendar months then Lithos shall be entitled to terminate its appointment in respect of the Services by seven days written notice to the Client.
- 13.3 If the Client shall fail to pay in full any sum due under the terms of the Agreement by the final date for payment for that sum and no effective notice of intention to withhold payment has been issued, Lithos may serve written notice on the Client demanding payment within 14 days of such notice. If the Client shall fail to comply with such notice, Lithos shall be entitled to terminate its employment under the Agreement forthwith.
- 13.4 Any termination of the appointment of Lithos howsoever caused shall be without prejudice to the right of Lithos to require payment for all services performed up to the date of such termination including but not limited to payment of a fair and reasonable proportion of any figure identified in the Proposal or otherwise for fees in respect of a particular service which Lithos has started, but not completed.
- 14 NOTICES
- 14.1 Any notice provided for in the Agreement shall be in writing and shall be deemed to be properly given if delivered by hand or sent by first class post to the address of the relevant party as may have been notified by each party to the other or, in the absence of notification, to the address of Lithos set out above or to the registered address of the Client.
- 14.2 Such notice shall be deemed to have been received on the day of delivery if delivered by hand or on the second working day after the day of posting if sent by first class post.
- 15 ENTIRE AGREEMENT
- 15.1 The Agreement constitutes the complete and entire agreement between the Client and Lithos with respect to the Services and supersedes any prior oral and/or written warranties, terms, conditions, communications and representations, whether express or implied and any claim against Lithos in respect of the Services can only be made in contract under the provisions of the Agreement and not otherwise under the law or tort or otherwise.
- 15.2 No amendments, modifications or variation of the Agreement shall be valid unless made in writing and agreed to by both the Client and Lithos; such agreement must be recorded in writing by at least one of the Parties.
- 15.3 Lithos will not be bound by any standard or printed terms or conditions furnished by the Client in any of its documents unless Lithos specifically states in writing separately from such documents that it intends such terms and conditions to apply.
- 16 DISPUTES AND GOVERNING LAW
- 16.1 The Agreement shall be governed by and construed in accordance with English law and the Parties irrevocably and unconditionally submit to the jurisdiction of the English Courts.
- 16.2 Where the Housing Grants, Construction and Regeneration Act 1996 applies, any dispute between the Parties may be referred to adjudication in accordance with The Scheme for Construction Contracts Regulations 1998 or any amendment or modification thereof being in force at the time of the dispute, as applicable to England, Wales, Scotland and Northern Ireland.

Lewis Whiteley

From: Gillian Hurst <gillhurst@harronhomes.co.uk>
Sent: 04 March 2019 15:13
To: Matt Thompson
Cc: Matthew Tuffy
Subject: POR Number

Matt

Our POR number for your quote for our Merchants Field, Cleckheaton development amounting to £ is
54719 which must be referenced on any relevant invoices in order to avoid any delay in payment.

Many thanks.

Best Regards

Gill Hurst
Technical Secretary
Harron Homes Ltd
Tel: 0113 204 4670
Email: gillhurst@harronhomes.co.uk
Web: www.harronhomes.co.uk



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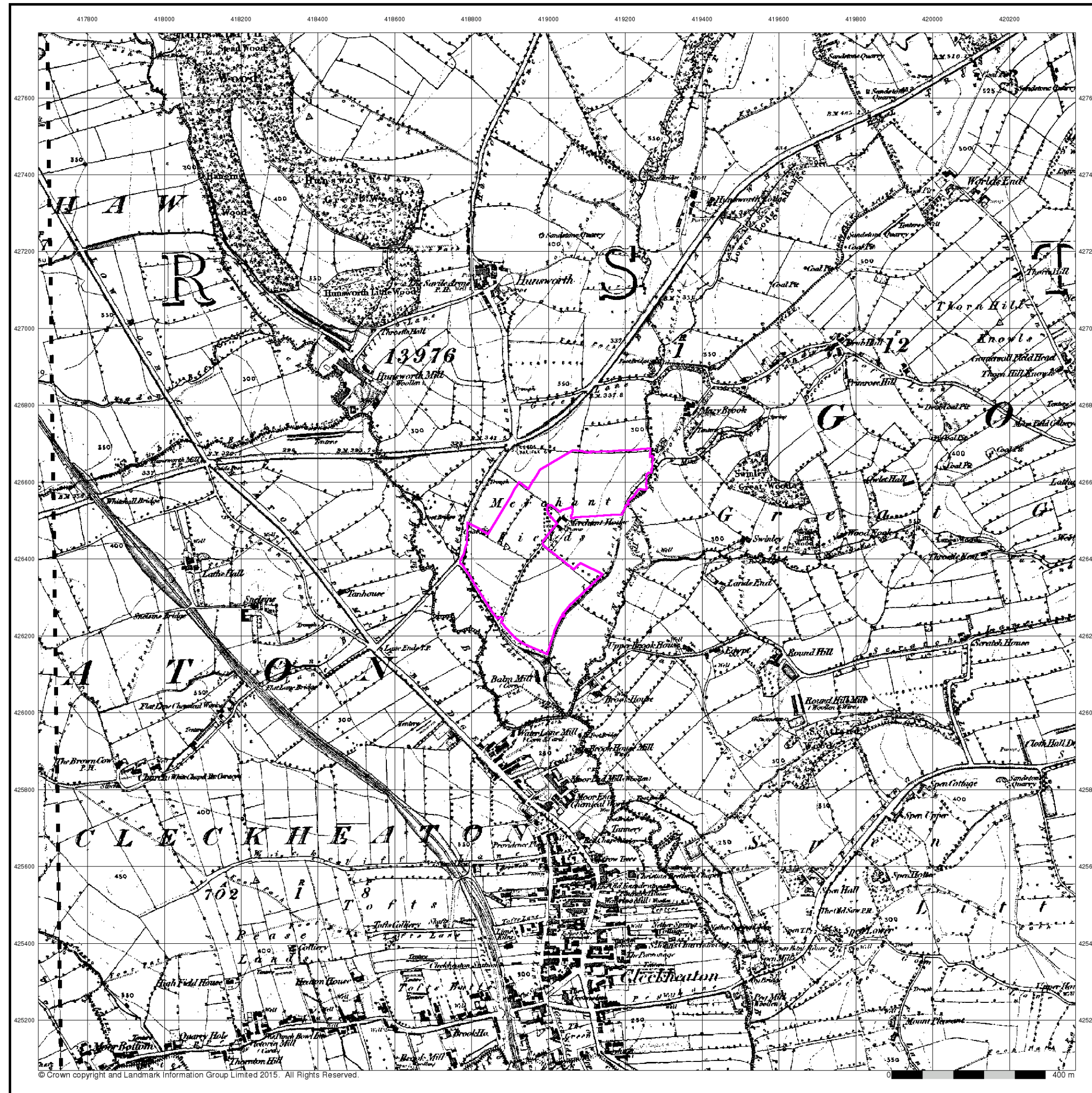
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Appendix D

Historical OS Plans



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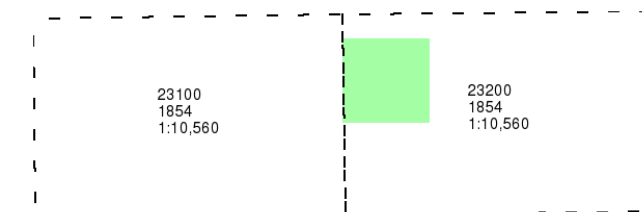
Yorkshire

Published 1854

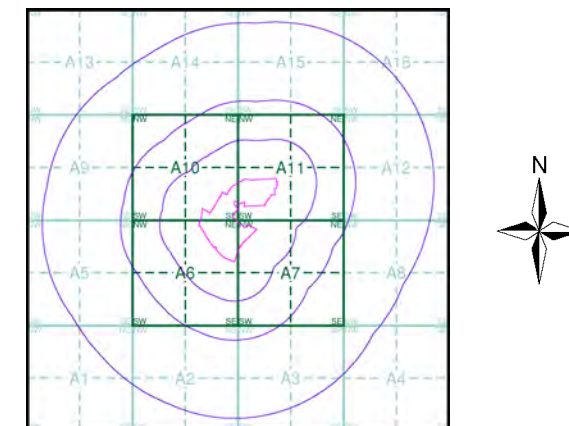
Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

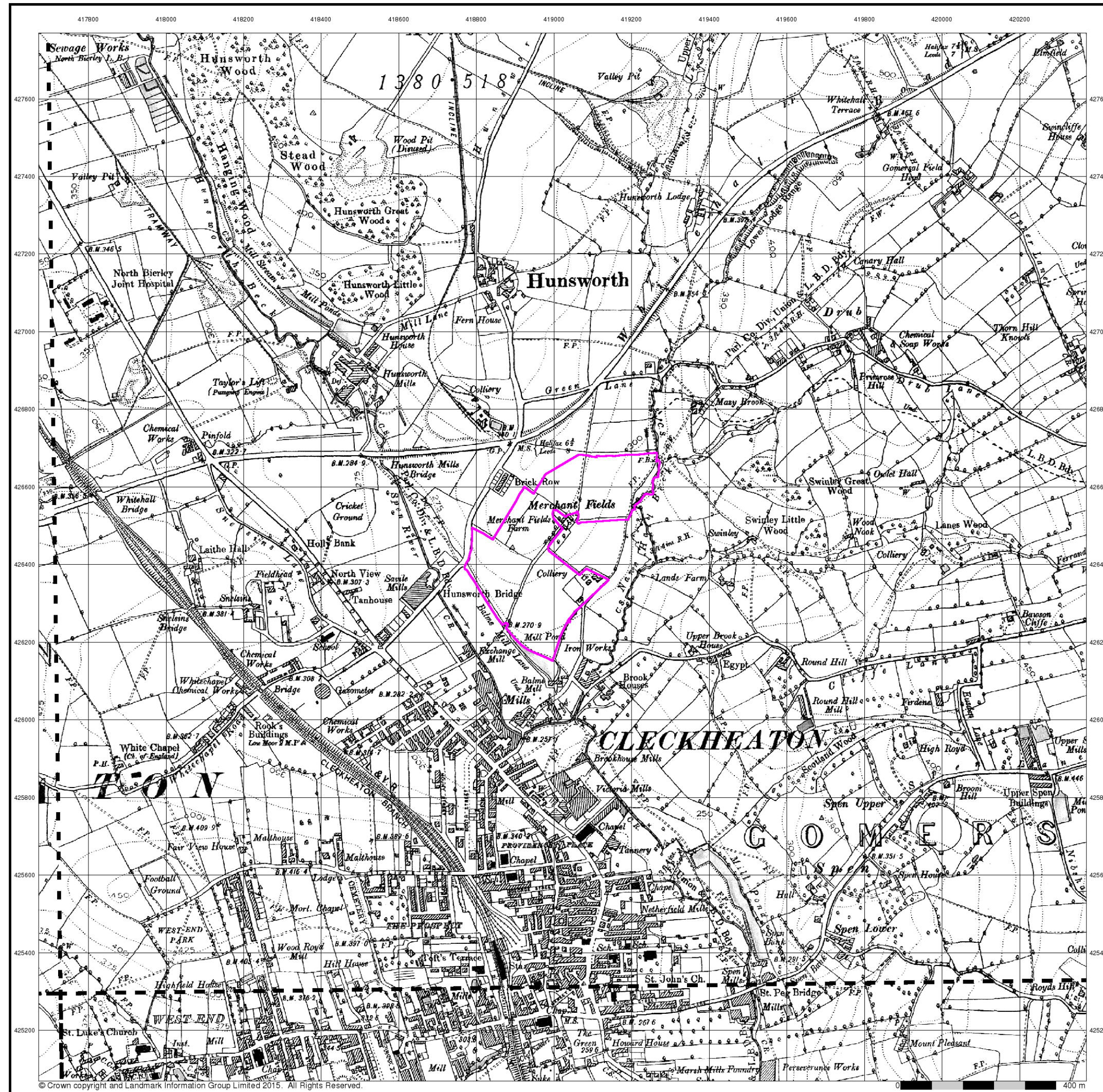
Order Number: 74641727_1_1
Customer Ref: HHO/08
National Grid Reference: 419030, 426450
Slice: A
Site Area (Ha): 12.08
Search Buffer (m): 1000

Site Details

Kilroyd Avenue, CLECKHEATON, West Yorkshire, BD19 4ED



Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



ARP GEOTECHNICAL LIMITED
CHARTERED CONSULTING ENGINEERS

Yorkshire

Published 1894

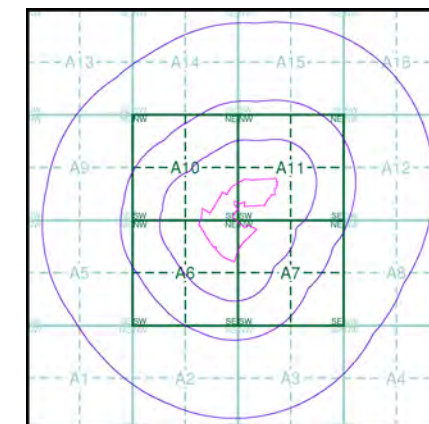
Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)

231NE 1894 1:10,560	232NW 1894 1:10,560
231SE 1894 1:10,560	232SW 1894 1:10,560

Historical Map - Slice A



Order Details

Order Number: 74641727_1_1
Customer Ref: HHO/08
National Grid Reference: 419030, 426450
Slice: A
Site Area (Ha): 12.08
Search Buffer (m): 1000

Site Details

Kilroyd Avenue, CLECKHEATON, West Yorkshire, BD19 4ED



Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk

Appendix E

Search Responses & other Correspondence



Envirocheck[®] Report:

Datasheet

Order Details:

Order Number:

74641727_1_1

Customer Reference:

HHO/08

National Grid Reference:

419030, 426450

Slice:

A

Site Area (Ha):

12.08

Search Buffer (m):

1000

Site Details:

Kilroyd Avenue
CLECKHEATON
West Yorkshire
BD19 4ED

Client Details:

Mr J Race
ARP Geotechnical Ltd
Northwest House
5-6 Northwest Business Park
Servia Hill
Leeds
LS6 2QH



Report Section	Page Number
Summary	-
Agency & Hydrological	1
Waste	32
Hazardous Substances	39
Geological	40
Industrial Land Use	77
Sensitive Land Use	83
Data Currency	84
Data Suppliers	89
Useful Contacts	90

Introduction

The Environment Act 1995 has made site sensitivity a key issue, as the legislation pays as much attention to the pathways by which contamination could spread, and to the vulnerable targets of contamination, as it does the potential sources of contamination. For this reason, Landmark's Site Sensitivity maps and Datasheet(s) place great emphasis on statutory data provided by the Environment Agency/Natural Resources Wales and the Scottish Environment Protection Agency; it also incorporates data from Natural England (and the Scottish and Welsh equivalents) and Local Authorities; and highlights hydrogeological features required by environmental and geotechnical consultants. It does not include any information concerning past uses of land. The datasheet is produced by querying the Landmark database to a distance defined by the client from a site boundary provided by the client.

In the attached datasheet the National Grid References (NGRs) are rounded to the nearest 10m in accordance with Landmark's agreements with a number of Data Suppliers.

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Radon Potential dataset Copyright Notice

Information supplied from a joint dataset compiled by The British Geological Survey and Public Health England.

Report Version v50.0



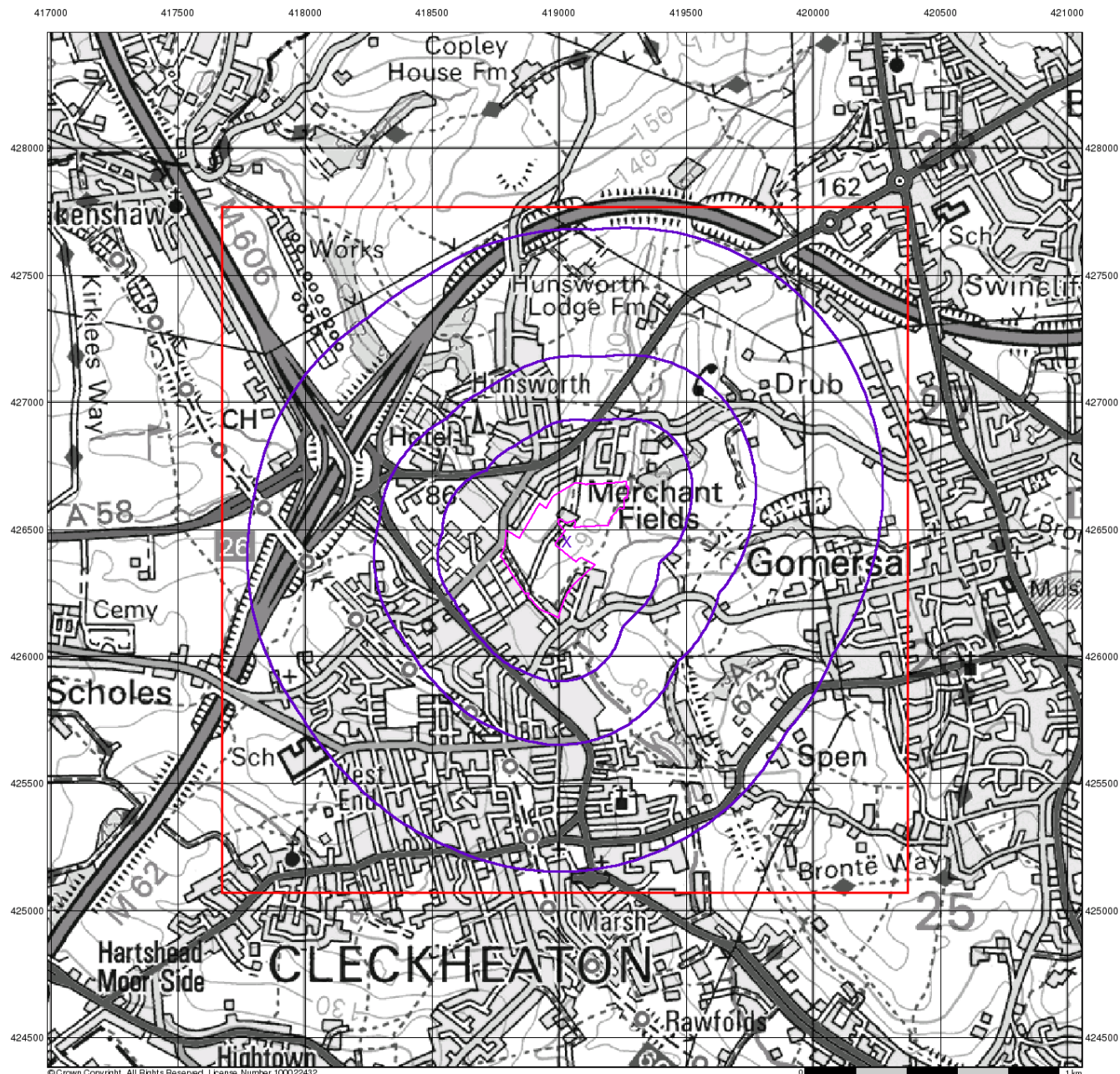
Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Agency & Hydrological					
Contaminated Land Register Entries and Notices					
Discharge Consents	pg 1		5	1	26
Enforcement and Prohibition Notices					
Integrated Pollution Controls	pg 9		3	7	
Integrated Pollution Prevention And Control	pg 10		1		2
Local Authority Integrated Pollution Prevention And Control					
Local Authority Pollution Prevention and Controls	pg 11		2	3	6
Local Authority Pollution Prevention and Control Enforcements					
Nearest Surface Water Feature	pg 12	Yes			
Pollution Incidents to Controlled Waters	pg 13		14	13	22
Prosecutions Relating to Authorised Processes					
Prosecutions Relating to Controlled Waters					
Registered Radioactive Substances					
River Quality	pg 21		3		1
River Quality Biology Sampling Points					
River Quality Chemistry Sampling Points					
Substantiated Pollution Incident Register	pg 21		3	3	3
Water Abstractions	pg 22				5 (*3)
Water Industry Act Referrals					
Groundwater Vulnerability	pg 24	Yes	n/a	n/a	n/a
Bedrock Aquifer Designations	pg 24	Yes	n/a	n/a	n/a
Superficial Aquifer Designations			n/a	n/a	n/a
Source Protection Zones					
Extreme Flooding from Rivers or Sea without Defences	pg 24		Yes	n/a	n/a
Flooding from Rivers or Sea without Defences	pg 25		Yes	n/a	n/a
Areas Benefiting from Flood Defences				n/a	n/a
Flood Water Storage Areas				n/a	n/a
Flood Defences				n/a	n/a
Detailed River Network Lines	pg 25	Yes	Yes	Yes	n/a
Detailed River Network Offline Drainage	pg 31		Yes		n/a



Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Waste					
BGS Recorded Landfill Sites	pg 32			1	3
Historical Landfill Sites	pg 32		1	5	5
Integrated Pollution Control Registered Waste Sites					
Licensed Waste Management Facilities (Landfill Boundaries)					
Licensed Waste Management Facilities (Locations)	pg 34				1
Local Authority Recorded Landfill Sites					
Registered Landfill Sites	pg 35			3	4
Registered Waste Transfer Sites	pg 37		1		2
Registered Waste Treatment or Disposal Sites					
Hazardous Substances					
Control of Major Accident Hazards Sites (COMAH)					
Explosive Sites					
Notification of Installations Handling Hazardous Substances (NIHHS)	pg 39			1	
Planning Hazardous Substance Consents	pg 39			2	
Planning Hazardous Substance Enforcements					
Geological					
BGS 1:625,000 Solid Geology	pg 40	Yes	n/a	n/a	n/a
BGS Estimated Soil Chemistry	pg 40	Yes	Yes	Yes	Yes
BGS Recorded Mineral Sites	pg 72		1	1	11
BGS Urban Soil Chemistry					
BGS Urban Soil Chemistry Averages					
Brine Compensation Area			n/a	n/a	n/a
Coal Mining Affected Areas	pg 74	Yes	n/a	n/a	n/a
Mining Instability	pg 74	Yes	n/a	n/a	n/a
Man-Made Mining Cavities					
Natural Cavities					
Non Coal Mining Areas of Great Britain	pg 74	Yes	Yes	n/a	n/a
Potential for Collapsible Ground Stability Hazards	pg 74	Yes		n/a	n/a
Potential for Compressible Ground Stability Hazards	pg 75		Yes	n/a	n/a
Potential for Ground Dissolution Stability Hazards				n/a	n/a
Potential for Landslide Ground Stability Hazards	pg 75	Yes	Yes	n/a	n/a
Potential for Running Sand Ground Stability Hazards	pg 76		Yes	n/a	n/a
Potential for Shrinking or Swelling Clay Ground Stability Hazards	pg 76	Yes		n/a	n/a
Radon Potential - Radon Affected Areas			n/a	n/a	n/a
Radon Potential - Radon Protection Measures			n/a	n/a	n/a



Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Industrial Land Use					
Contemporary Trade Directory Entries	pg 77		54	n/a	n/a
Fuel Station Entries	pg 82				2
Sensitive Land Use					
Areas of Adopted Green Belt	pg 83	1			
Areas of Unadopted Green Belt					
Areas of Outstanding Natural Beauty					
Environmentally Sensitive Areas					
Forest Parks					
Local Nature Reserves					
Marine Nature Reserves					
National Nature Reserves					
National Parks					
Nitrate Sensitive Areas					
Nitrate Vulnerable Zones	pg 83	1			
Ramsar Sites					
Sites of Special Scientific Interest					
Special Areas of Conservation					
Special Protection Areas					



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Source Protection Zones

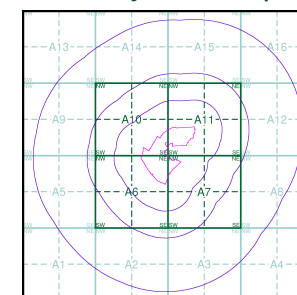
General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

Agency and Hydrological

- Inner zone (Zone 1)
- Inner zone - subsurface activity only (Zone 1c)
- Outer zone (Zone 2)
- Outer zone - subsurface activity only (Zone 2c)
- Total catchment (Zone 3)
- Total catchment - subsurface activity only (Zone 3c)
- Special interest (Zone 4)
- Source Protection Zone Borehole

Site Sensitivity Context Map - Slice A



Order Details

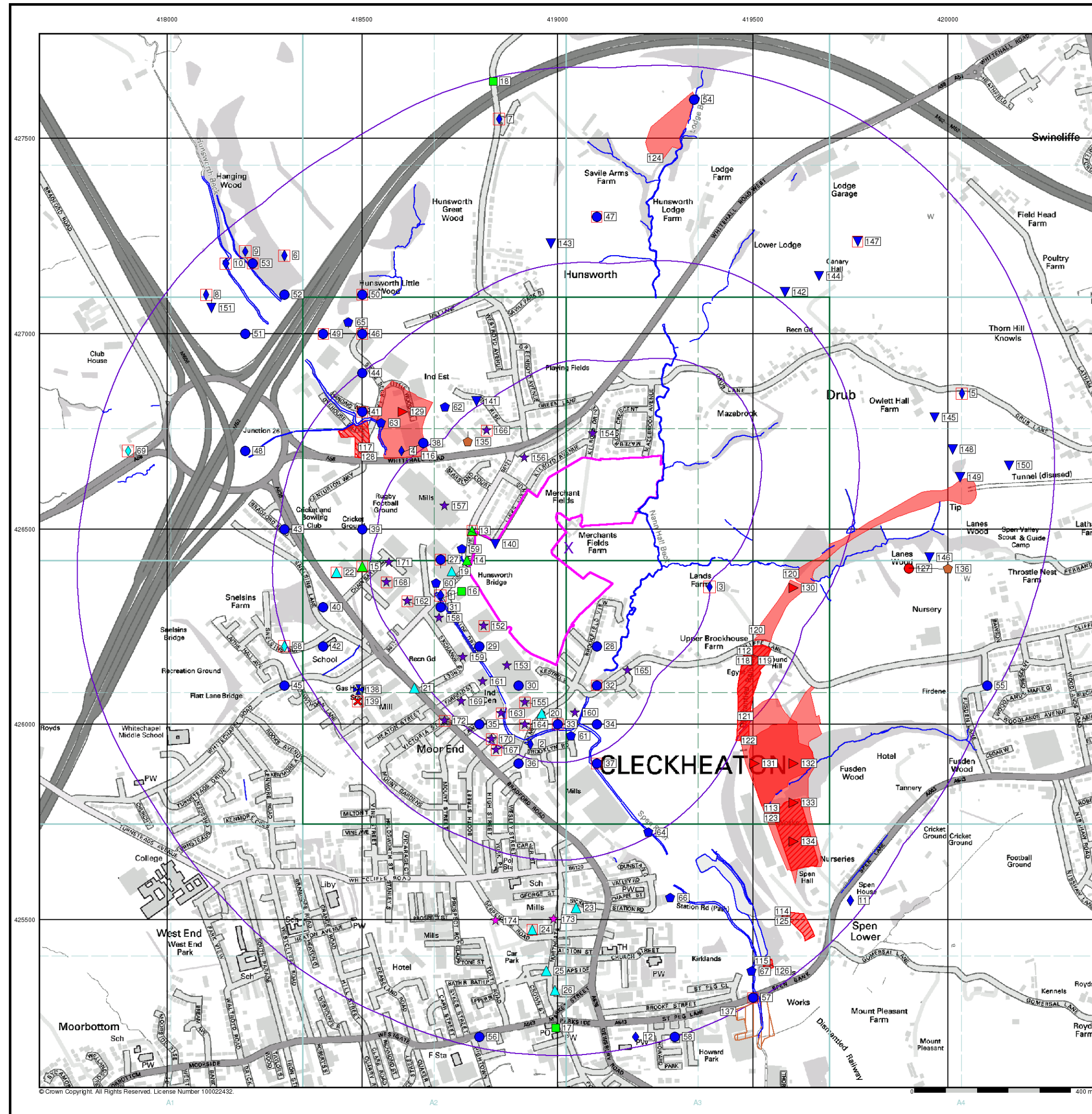
Order Number: 74641727_1_1
Customer Ref: HHO/08
National Grid Reference: 419030, 426450
Slice: A
Site Area (Ha): 12.08
Search Buffer (m): 1000

Site Details

Kilroyd Avenue, CLECKHEATON, West Yorkshire, BD19 4ED



Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



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General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Map ID
- Several of Types at Location

Agency and Hydrological

- Contaminated Land Register Entry or Notice (Location)
- Contaminated Land Register Entry or Notice
- Discharge Consent
- Enforcement or Prohibition Notice
- Integrated Pollution Control
- Integrated Pollution Prevention Control
- Local Authority Integrated Pollution Prevention and Control
- Local Authority Pollution Prevention and Control Enforcement
- Pollution Incident to Controlled Waters
- Prosecution Relating to Authorised Processes
- Prosecution Relating to Controlled Waters
- Registered Radioactive Substance
- River Network or Water Feature
- River Quality Sampling Point
- Substantiated Pollution Incident Register
- Water Abstraction
- Water Industry Act Referral

Waste

- BGS Recorded Landfill Site (Location)
- BGS Recorded Landfill Site
- EA Historic Landfill (Buffered Point)
- EA Historic Landfill (Polygon)
- Integrated Pollution Control Registered Waste Site
- Licensed Waste Management Facility (Landfill Boundary)
- Licensed Waste Management Facility (Location)
- Local Authority Recorded Landfill Site (Location)
- Local Authority Recorded Landfill Site
- Registered Landfill Site
- Prosecution Relating to Authorised Processes
- Registered Landfill Site (Point Buffered to 100m)
- Registered Landfill Site (Point Buffered to 250m)
- Registered Waste Transfer Site (Location)
- Registered Waste Transfer Site
- Registered Waste Treatment or Disposal Site (Location)
- Registered Waste Treatment or Disposal Site

Hazardous Substances

- COMAH Site
- Explosive Site
- NIHHS Site
- Planning Hazardous Substance Consent
- Planning Hazardous Substance Enforcement

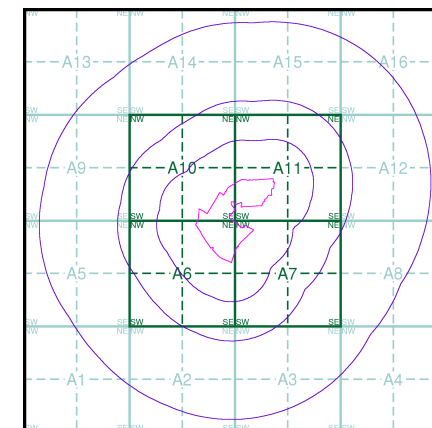
Geological

- BGS Recorded Mineral Site

Industrial Land Use

- Contemporary Trade Directory Entry
- Fuel Station Entry

Site Sensitivity Map - Slice A



Order Details

Order Number: 74641727_1_1
Customer Ref: HHO/08
National Grid Reference: 419030, 426450
Slice: A
Site Area (Ha): 12.08
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Site Details

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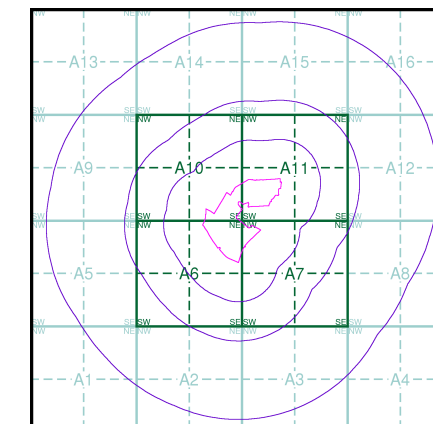
General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point

Agency and Hydrological (Flood)

- Extreme Flooding from Rivers or Sea without Defences (Zone 2)
- Flooding from Rivers or Sea without Defences (Zone 3)
- Area Benefiting from Flood Defence
- Flood Water Storage Areas
- Flood Defence

Flood Map - Slice A

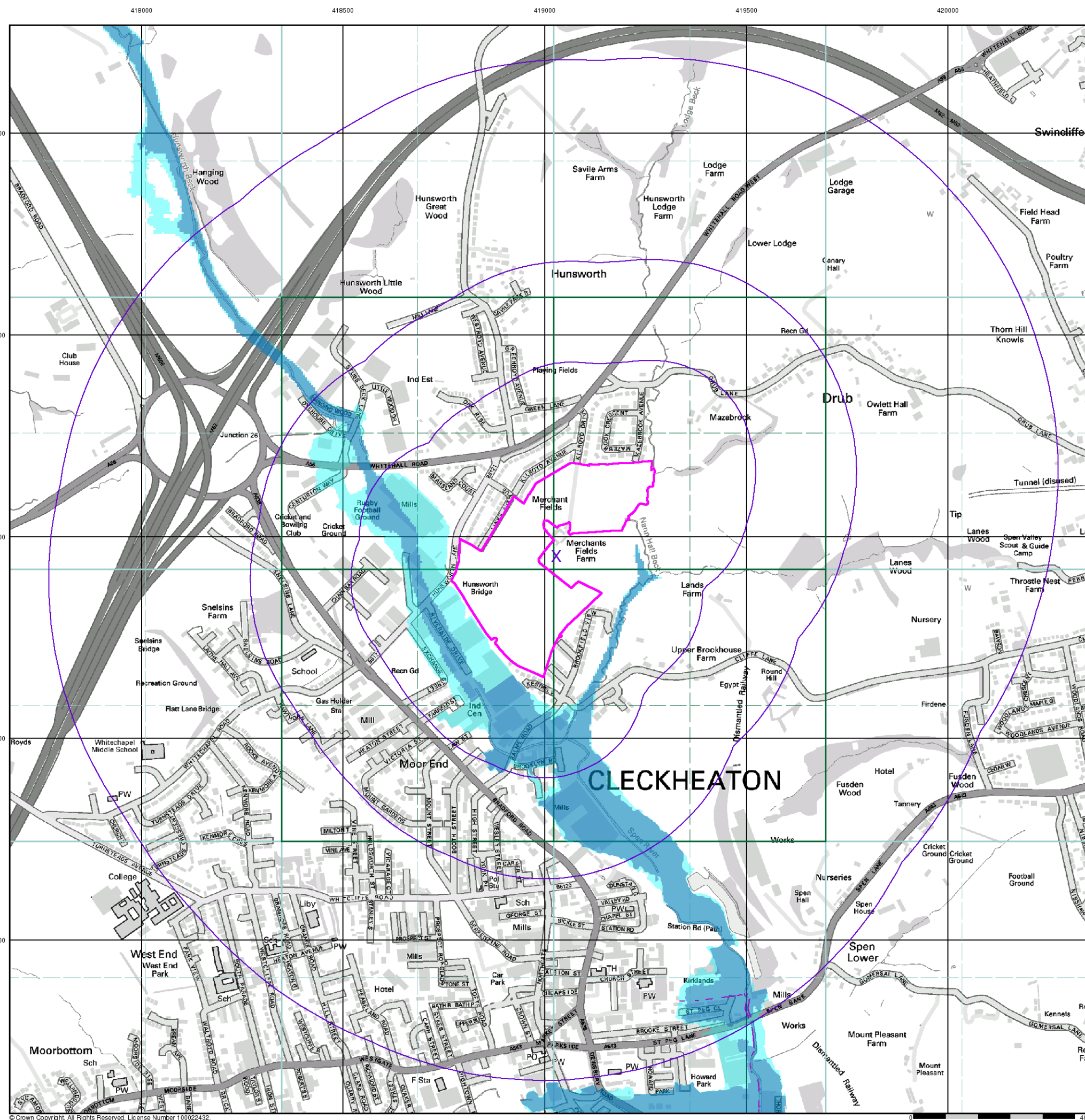


Order Details

Order Number: 74641727_1_1
Customer Ref: HHO/08
National Grid Reference: 419030, 426450
Slice: A
Site Area (Ha): 12.08
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Site Details

Kilroyd Avenue, CLECKHEATON, West Yorkshire, BD19 4ED





General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Map ID

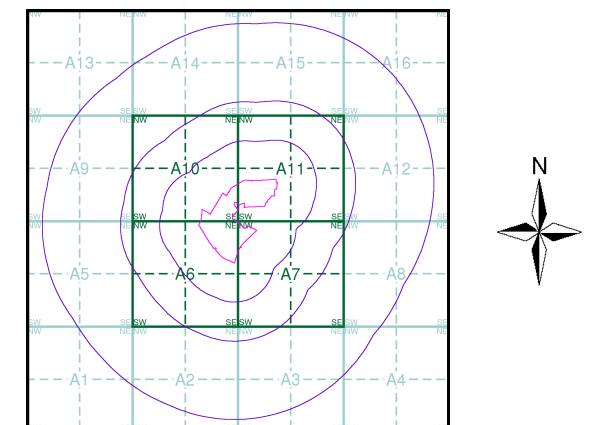
Detailed River Network Data

Primary River	Extended Culvert (greater than 50m)
Secondary River	Underground River (inferred)
Tertiary River	Underground River (local knowledge)
Canal	Downstream of High Water Mark
Canal Tunnel	Downstream of Seaward Extension
Undefined River	Not assigned River feature
Lake/Reservoir	
Offline Drainage Feature	

Contours (height in metres)

- Standard Contour 105
- Master Contour 100
- Spot Height 167.3
- MLW Mean Low Water
- MHW Mean High Water

E/NRW Detailed River Network Map - Slice A



Order Details

Order Number: 74641727_1_1
Customer Ref: HHO/08
National Grid Reference: 419030, 426450
Slice: A
Site Area (Ha): 12.08
Search Buffer (m): 1000

Site Details

Kilroyd Avenue, CLECKHEATON, West Yorkshire, BD19 4ED

Issued by:

The Coal Authority, Property Search Services, 200 Lichfield Lane, Berry Hill, Mansfield, Nottinghamshire, NG18 4RG
Website: www.groundstability.com Phone: 0345 762 6848 DX 716176 MANSFIELD 5

**LANDMARK INFORMATION GROUP
LIMITED
SOWTON INDUSTRIAL ESTATE
ABBAY COURT
UNIT 5/7 EAGLE WAY
EXETER
DEVON
EX2 7HY**

Our reference: **51001033182001**
Your reference: **74644188_1**
Date of your enquiry: **06 November 2015**
Date we received your enquiry: **06 November 2015**
Date of issue: **06 November 2015**

This report is for the property described in the address below and the attached plan.

Non-Residential Coal Authority Mining Report

SITE AT KILROYD AVENUE, CLECKHEATON, WEST YORKSHIRE,

This report is based on and limited to the records held by, the Coal Authority, and the Cheshire Brine Subsidence Compensation Board's records, at the time we answer the search.

Coal mining	See comments below
Brine Compensation District	No

Information from the Coal Authority

Underground coal mining

Past

The property is in the likely zone of influence from workings in 4 seams of coal at shallow to 170m depth, and last worked in 1970.

Present

The property is not in the likely zone of influence of any present underground coal workings.

Future

The property is not in an area for which the Coal Authority is determining whether to grant a licence to remove coal using underground methods.

The property is not in an area for which a licence has been granted to remove or otherwise work coal using underground methods.

The property is not in an area that is likely to be affected at the surface from any planned future workings.

However, reserves of coal exist in the local area which could be worked at some time in the future.

No notice of the risk of the land being affected by subsidence has been given under section 46 of the Coal Mining Subsidence Act 1991.

Mine entries

Within, or within 20 metres of, the boundary of the property there are 4 mine entries, the approximate positions of which are shown on the attached plan.

There is no record of what steps, if any, have been taken to treat the mine entries.

Records may be incomplete. Consequently, there may exist in the local area mine entries of which the Coal Authority has no knowledge.

For an additional fee, the Coal Authority will provide a supplementary Mine Entry Interpretive Report. The report will provide a separate assessment for the mine entry (entries) referred to in this report. It will give details based on information in the Coal Authority's possession, together with an opinion on the likelihood of mining subsidence damage arising from ground movement as a consequence of the existence of the mine entry/entries. It will also give details of the remedies available for subsidence damage where the mine entry was sunk in connection with coal mining.

Please note that it may not be possible to produce a report if the main building to the property cannot be identified from Coal Authority plans (ie. for development sites and new build).

For further advice on how to order this additional information visit www.groundstability.com or telephone 0345 7626 848.

Coal mining geology

The Authority is not aware of any evidence of damage arising due to geological faults or other lines of weakness that have been affected by coal mining.

Opencast coal mining

Past

The property is not within the boundary of an opencast site from which coal has been removed by opencast methods.

Present

The property does not lie within 200 metres of the boundary of an opencast site from which coal is being removed by opencast methods.

Future

The property is not within 800 metres of the boundary of an opencast site for which the Coal Authority is determining whether to grant a licence to remove coal by opencast methods.

The property is not within 800 metres of the boundary of an opencast site for which a licence to remove coal by opencast methods has been granted.

Coal mining subsidence

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

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

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

Mine gas

There is no record of a mine gas emission requiring action by the Coal Authority within the boundary of the property.

Hazards related to coal mining

The property has not been subject to remedial works, by or on behalf of the Authority, under its Emergency Surface Hazard Call Out procedures.

Withdrawal of support

The property is in an area for which notices of entitlement to withdraw support were published in 1951, 1954.

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

Working facilities orders

The property is not in an area for which an Order has been made under the provisions of the Mines (Working Facilities and Support) Acts 1923 and 1966 or any statutory modification or amendment thereof.

Payments to owners of former copyhold land

The property is not in an area for which a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

Comments on Coal Authority information

The attached plan shows the approximate location of the disused mine entry/entries referred to in this report. For reasons of clarity, mine entry symbols may not be drawn to the same scale as the plan.

Property owners have the benefit of statutory protection (under the Coal Mining Subsidence act 1991*). This contains provision for the making good, to the reasonable satisfaction of the owner, of physical damage from disused coal mine workings including disused coal mine entries. A leaflet setting out the rights and the obligations of either the Coal Authority or other responsible persons under the 1991 Act can be obtained by telephoning 0345 762 6848.

If you wish to discuss the relevance of any of the information contained in this report you should seek the advice of a qualified mining engineer or surveyor. If you or your adviser wish to examine the source plans from which the information has been taken these are normally available at our Mansfield office, free of charge, by prior appointment, telephone 01623 637225. Should you or your adviser wish to carry out any physical investigations that may enter, disturb or interfere with any disused mine entry the prior permission of the owner must be sought. For coal mine entries the owner will normally be the Coal Authority.

The Coal Authority, regardless of responsibility and in conjunction with other public bodies, provide an emergency call out facility in coalfield areas to assess the public safety implications of mining features (including disused mine entries). Our emergency telephone number at all times is 01623 646333.

*Note, this Act does not apply where coal was worked or gotten by virtue of the grant of a gale in the Forest of Dean, or any other part of the Hundred of St. Briavels in the county of Gloucester.

In view of the mining circumstances a prudent developer would seek appropriate technical advice before any works are undertaken.

Therefore if development proposals are being considered, technical advice relating to both the investigation of coal and former coal mines and their treatment should be obtained before beginning work on site. All proposals should apply good engineering practice developed for mining areas. No development should be undertaken that intersects, disturbs or interferes with any coal or mines of coal without the permission of the Coal Authority. Developers should be aware that the investigation of coal seams/former mines of coal may have the potential to generate and/or displace underground gases and these risks both under and adjacent to the development should be fully considered in developing any proposals. The need for effective measures to prevent gases entering into public properties either during investigation or after development also needs to be assessed and properly addressed. This is necessary due to the public safety implications of any development in these circumstances.

Information from the Cheshire Brine Subsidence Compensation Board

The property lies outside the Cheshire Brine Compensation District.

Additional Remarks

Information provided by the Coal Authority in this report is compiled in response to the Law Society's Con29M Coal Mining and Brine Subsidence Claim enquiries. The said enquiries are protected by copyright owned by the Law Society of 113 Chancery Lane, London WC2A 1PL. Please note that Brine Subsidence Claim enquiries are only relevant for England and Wales. This report is prepared in accordance with the Law Society's Guidance Notes 2006, the User Guide 2006 and the Coal Authority and Cheshire Brine Board's Terms and Conditions applicable at the time the report was produced.

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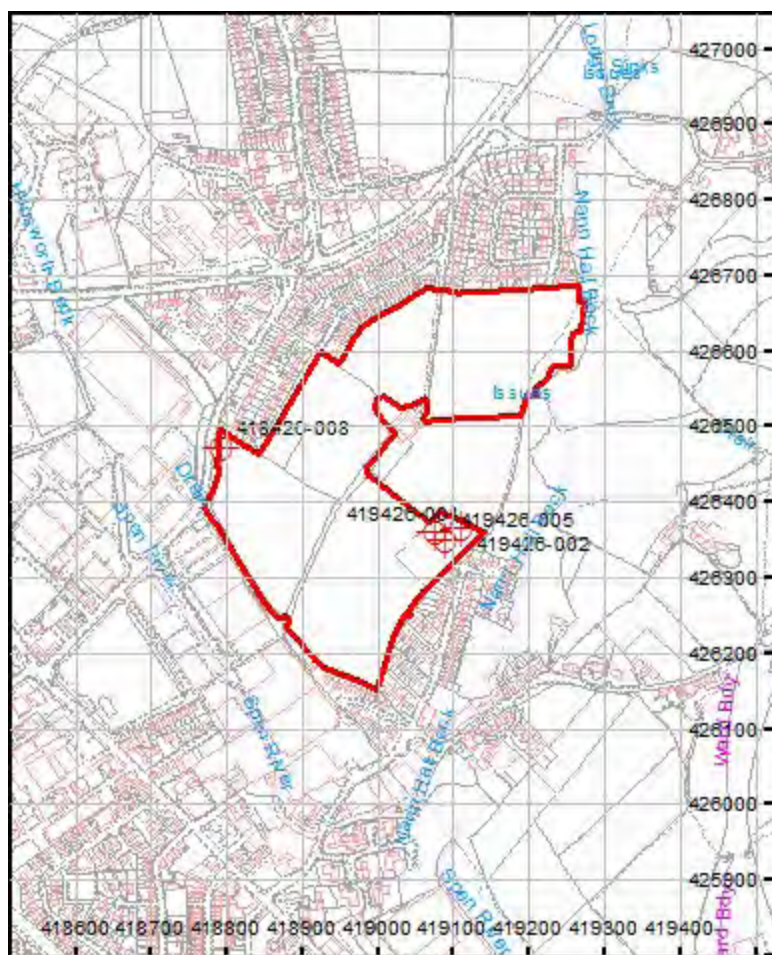
Approximate position
of property



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Approximate position of enquiry
boundary shown

Disused Adit or Mineshaft



Issued by:

The Coal Authority, Property Search Services, 200 Lichfield Lane, Berry Hill, Mansfield, Nottinghamshire, NG18 4RG
Website: www.groundstability.com Phone: 0345 762 6848

**LITHOS CONSULTING LTD
PARKHILL
WALTON ROAD
WETHERBY
LEEDS
LS22 5DZ**

Our reference:	51002046652001
Your reference:	PO14249/2828/LEW
Date of your enquiry:	05 March 2019
Date we received your enquiry:	05 March 2019
Date of issue:	05 March 2019

This report is for the property described in the address below and the attached plan.

Shaft Plan and Data Sheets

MERCHANTS FIELD, CLECKHEATON, KIRKLEES, BD19 4ED

I refer to the enquiry dated 05 March 2019, received 05 March 2019, in connection with the above.

As requested I enclose the mine entry data sheet(s) held for the mine entry/entries referred to.

Mine Entry Data

Shaft/adit:	Shaft
Reference:	419426-005
Source:	Ab plans 2918 M259
Colliery name:	Unknown
Entry name:	Merchant Fields Colliery Winding Pit
Date abandoned:	Unknown
Depth of superficial deposits (m):	Unknown
Depth of shaft (m):	19.0
Diameter of shaft (m):	Unknown
Probable adit azimuth:	Not Applicable
Treatment details:	Unknown
Conveyance:	Not Applicable
Easting:	419092
Northing:	426348
Other information:	None

Mine Entry Data (continued)

Shaft/adit:	Shaft
Reference:	419426-002
Source:	1st and 2nd Ed. 1/2500 O.S. Ab plans 2918 M259
Colliery name:	Unknown
Entry name:	Merchant Fields Colliery Pumping Shaft
Date abandoned:	Unknown
Depth of superficial deposits (m):	Unknown
Depth of shaft (m):	21.9
Diameter of shaft (m):	Unknown
Probable adit azimuth:	Not Applicable
Treatment details:	Unknown
Conveyance:	Not Applicable
Easting:	419111
Northing:	426363
Other information:	None

Mine Entry Data (continued)

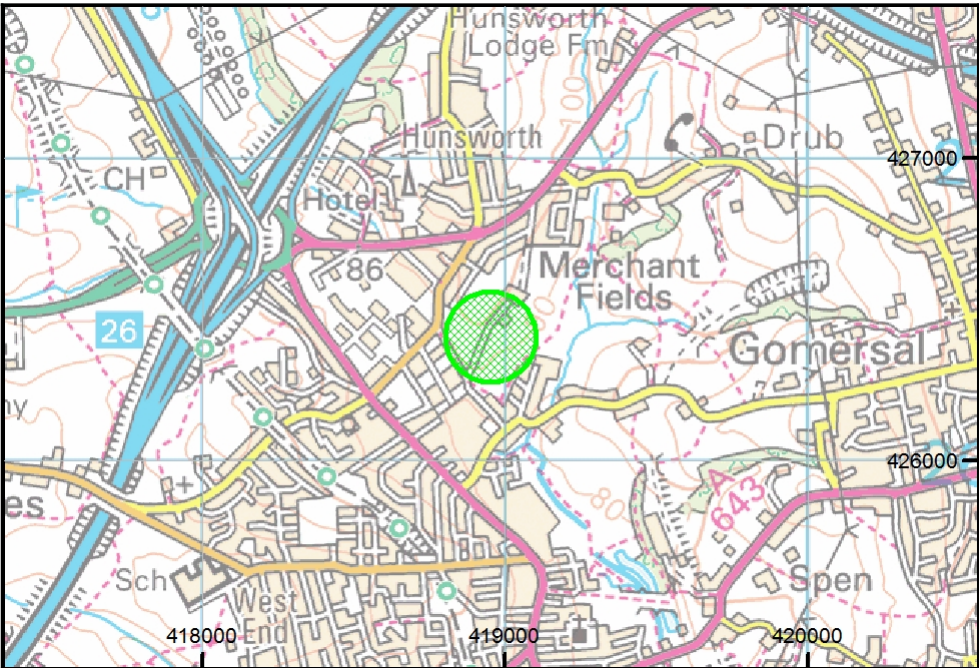
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Reference:	419426-001
Source:	1st and 2nd Ed. 1/2500 O.S. Ab plans 2918 M259
Colliery name:	Unknown
Entry name:	Merchant Fields Colliery Ventilation Shaft
Date abandoned:	Unknown
Depth of superficial deposits (m):	Unknown
Depth of shaft (m):	21.9
Diameter of shaft (m):	Unknown
Probable adit azimuth:	Not Applicable
Treatment details:	Unknown
Conveyance:	Not Applicable
Easting:	419078
Northing:	426357
Other information:	None

Mine Entry Data (continued)

Shaft/adit:	Shaft
Reference:	418426-008
Source:	1st Ed. Geological
Colliery name:	Unknown
Entry name:	Unknown
Date abandoned:	Unknown
Depth of superficial deposits (m):	Unknown
Depth of shaft (m):	Unknown
Diameter of shaft (m):	Unknown
Probable adit azimuth:	Not Applicable
Treatment details:	Unknown
Conveyance:	Not Applicable
Easting:	418795
Northing:	426470
Other information:	None

Location map

Approximate position of enquiry



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This plan shows the approximate location of the disused mine entry / entries referred to in the attached mining report. For reasons of clarity, mine entry symbols may not be drawn to the same scale as the plan.

Property owners have the benefit of statutory protection (under the Coal Mining Subsidence Act 1991). This contains provision for the making good, to the reasonable satisfaction of the owner, of physical damage from disused coal mine workings including disused coal mine entries. A leaflet setting out the rights and obligations of either the Coal Authority or other responsible persons under the 1991 Act can be obtained by visiting www.groundstability.com.

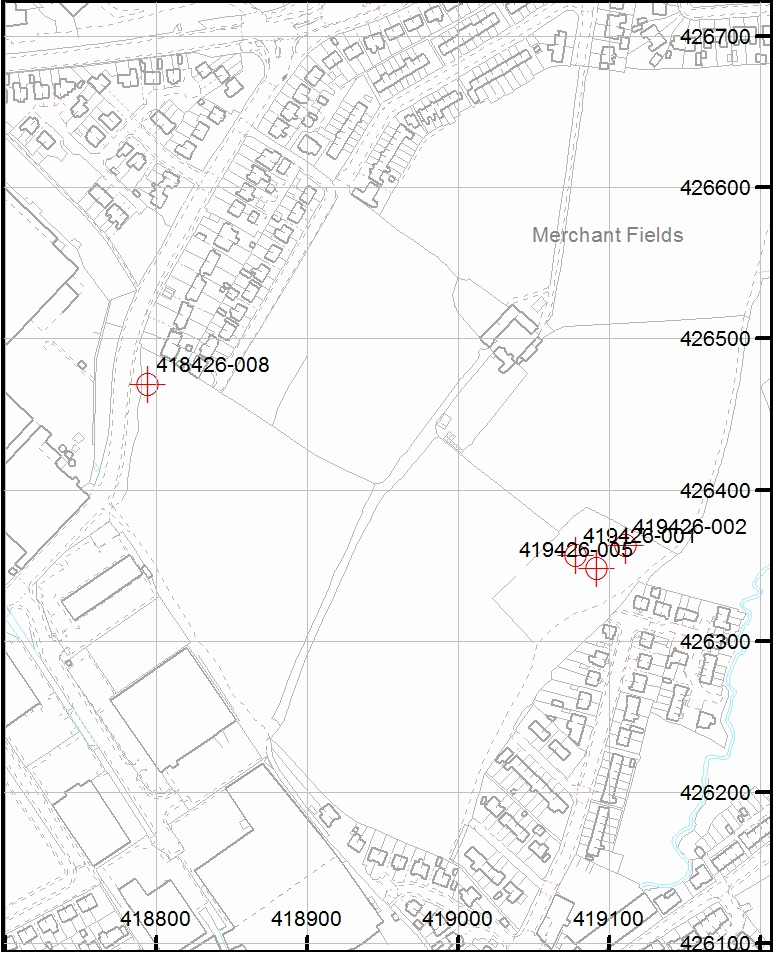
If you wish to discuss the relevance of any of the information contained in this report, you should seek the advice of a qualified mining engineer or surveyor. If you or your advisor wish to examine the source plans from which the information has been taken, these are available to view, free of charge, at our Head Office in Mansfield. To book an appointment please ring 01623 637225. Should you or your advisor wish to carry out a physical investigation that may enter, disturb or interfere with any disused mine entry, prior permission of the owner must be sought. For coal mine entries, the owner will normally be the Coal Authority.

The Coal Authority, regardless of responsibility and in conjunction with other public bodies, provide an emergency call out facility in coalfield areas to assess the public safety implications of mining features (including disused mine entries).

Our emergency telephone number is 01623 646333.

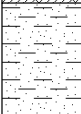
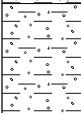
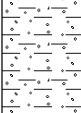
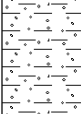
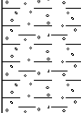
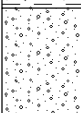
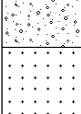
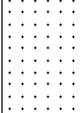
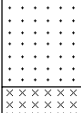
Key

Disused Adit or Mineshaft

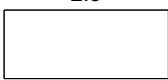
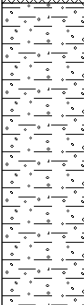
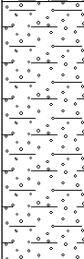
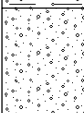


Appendix F

Trial Pit Logs

LITHOS CONSULTING				Trial Pit Log				Trialpit No TP01 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419072.00 - 426663.00		Date 13/03/2019		
Location: West Yorkshire				Dimensions (m):		1.9		Scale 1:20		
Client: Harron Homes				Depth 3.30		0.6		Logged LEW		
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
	Depth	Type	Results							
▼	0.10	J&T		0.20			TOPSOIL: Dark brown slightly sandy CLAY with occasional rootlets. (TOPSOIL)	1		
				0.50			Firm brown slightly sandy CLAY. (COHESIVE RESIDUAL SOIL)			
	0.70	D	HVP=80				Stiff orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone. (COHESIVE RESIDUAL SOIL)			
			HVP=80							
							From 1.2m, clay is gravelly.			
							No hand vane shear tests could be undertaken due to gravel content of clay.			
				1.70			Greyish brown clayey sandy subangular fine to coarse GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)		2	
				2.10			Moderately weak brown thinly bedded fine grained SANDSTONE recovered as sandy angular tabular fine to coarse gravel with high cobble content. (COAL MEASURES) At 2.1m, groundwater seepage.			
				2.80			Weak grey thinly laminated SILTSTONE recovered as sandy angular tabular fine to coarse gravel with low cobble content. (COAL MEASURES)			3
				3.30			Difficult to excavate beyond 3.3m. End of pit at 3.30 m			
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage was encountered at 2.1m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.										
Stability: 1. The sides of the trial pit remained stable during excavation.										



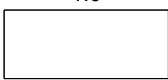
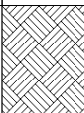
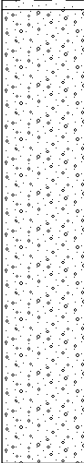
				Trial Pit Log				Trialpit No TP02 Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419055.00 - 426627.00 Level:		Date 13/03/2019	
Location: West Yorkshire				Dimensions (m):		2.5		Scale 1:20	
Client: Harron Homes				Depth 2.20				Logged LEW	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.10	J&T	HVP=75	0.20			MADE GROUND: Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is angular to subrounded fine to medium of predominantly sandstone with rare clinker. (MADE GROUND TOPSOIL)		
				1.00			Stiff orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone. (COHESIVE RESIDUAL SOIL) <i>At 0.2m, groundwater seepage.</i>		
	1.20	T		1.70			Light brown very clayey slightly sandy angular to subangular fine to coarse GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)		
				2.00			Brown slightly clayey sandy angular to subangular fine to coarse GRAVEL of sandstone with low cobble content. (GRANULAR RESIDUAL SOIL)		
				2.20			Med strong brown thinly bedded fine grained SANDSTONE recovered as sandy angular tabular fine to coarse gravel with low cobble content. (COAL MEASURES)		
						<i>Unable to excavate beyond 2.2m.</i> End of pit at 2.20 m			
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage was encountered at 0.2m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.									
Stability: 1. The sides of the trial pit remained stable during excavation.									



				Trial Pit Log				Trialpit No TP03 Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419022.00 - 426650.00 Level:		Date 13/03/2019	
Location: West Yorkshire						Dimensions (m): 2.5 0.6		Scale 1:20	
Client: Harron Homes						Depth 1.70		Logged CC	

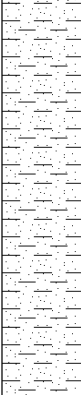
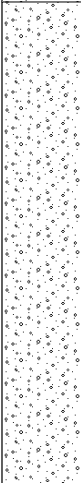
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
▼	0.20	J&T	HVP=58	0.30			TOPSOIL: Dark grey organic rich slightly sandy CLAY with occasional rootlets. (TOPSOIL)
	0.50	D					Firm light orange and grey mottled slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded, fine of mixed lithologies. (COHESIVE RESIDUAL SOIL)
						Light orangish grey sandy slightly clayey GRAVEL. Gravel is angular to subrounded fine to coarse of sandstone lithorelicts. (GRANULAR RESIDUAL SOIL)	
						At 1.7m, slight water seepage. Unable to excavate further due to competent rock. End of pit at 1.70 m	
				1.30			
				1.70			

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Slight groundwater seepage was encountered at 1.7m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.	
Stability: 1. The sides of the trial pit remained stable during excavation.	

				Trial Pit Log			Trialpit No TP04 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419054.00 - 426581.00 Level:		Date 13/03/2019	
Location: West Yorkshire				Dimensions (m):		1.6		Scale 1:20	
Client: Harron Homes				Depth 3.20				Logged CC	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.20	J&T	HVP=55	0.30			TOPSOIL: Dark grey organic rich slightly sandy CLAY with occasional rootlets. (TOPSOIL)		
	0.50	D					Firm light orange and grey mottled slightly sandy CLAY. (COHESIVE RESIDUAL SOIL)		
							At 0.5m, flowing terracotta land drain encountered.		
							From 1.1m, clay becomes more sandy.		
				2.00			Light orange and grey sandy slightly clayey GRAVEL. Gravel is angular to subangular of sandstone lithorelicts. (GRANULAR RESIDUAL SOIL)		
				3.20			End of pit at 3.20 m		
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.									
Stability: 1. The sides of the trial pit remained stable during excavation.									



				Trial Pit Log				Trialpit No TP05 Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419019.00 - 426607.00 Level:		Date 13/03/2019	
Location: West Yorkshire						Dimensions (m): 2.4 0.6		Scale 1:20	
Client: Harron Homes						Depth 2.60		Logged CC	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼	0.10	J&T	HVP=62	0.25			TOPSOIL: Dark grey organic rich slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to coarse of mixed lithologies. (TOPSOIL)	1
	0.40	D&B		1.30		Firm light orange and grey slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to medium of mixed lithologies including mudstone. (COHESIVE RESIDUAL SOIL)		
				2.60		Light orange and grey sandy slightly clayey GRAVEL. Gravel is angular to subangular of sandstone lithorelicts. (GRANULAR RESIDUAL SOIL)	2	
	At 2.6m, water seepage. Unable to excavate further due to competent rock. End of pit at 2.60 m						3	
								4

Remarks:	1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage was encountered at 2.6m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.
Stability:	1. The sides of the trial pit remained stable during excavation.

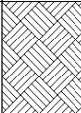
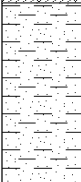
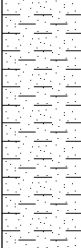
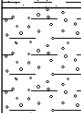


LITHOS CONSULTING				Trial Pit Log			Trialpit No TP06 Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419001.00 - 426623.00 Level:		Date 13/03/2019
Location: West Yorkshire				Dimensions (m):		2.2		Scale 1:20
Client: Harron Homes				Depth 2.20		0.6		Logged LEW
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.90	D	HVP=62	0.20			TOPSOIL: Dark brown slightly sandy CLAY with occasional rootlets. (TOPSOIL)	
			HVP=91	0.60			Firm light brown slightly sandy CLAY. (COHESIVE RESIDUAL SOIL)	
			HVP=110	1.30			Stiff orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)	
	1.50	D	HVP=98	2.10			Stiff grey mottled brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)	
				2.20			From 1.7m, clay is gravelly.	
								Medium strong light brown thinly bedded fine to medium grained SANDSTONE recovered as sandy angular tabular fine to coarse gravel with med cobble content. (COAL MEASURES) Unable to excavate beyond 2.2m. End of pit at 2.20 m

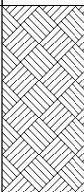
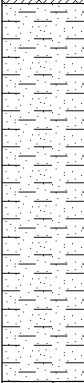
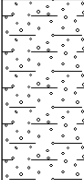
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

Stability: 1. The sides of the trial pit remained stable during excavation.

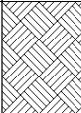
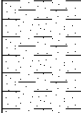


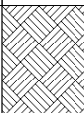
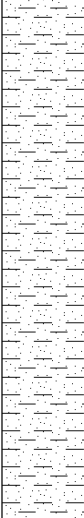
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Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418986.00 - 426577.00 Level:		Date 14/03/2019	
Location: West Yorkshire						Dimensions (m): 2.6 0.6 		Scale 1:20	
Client: Harron Homes						Depth 2.10		Logged CC	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.20	J&T	HVP=54	0.30			TOPSOIL: Dark grey organic rich slightly sandy slightly gravelly CLAY with occasional rootlets. (TOPSOIL)		
	0.40	D					Firm light orange and grey mottled slightly sandy slightly gravelly CLAY. Gravel is fine to medium angular to subangular of mudstone. (COHESIVE RESIDUAL SOIL)		
			0.80			Light grey slightly clayey angular COBBLES of SANDSTONE. (GRANULAR RESIDUAL SOIL)			
			1.10			Stiff light orange and grey mottled slightly sandy slightly gravelly CLAY. Gravel is fine to medium angular to subangular of mixed lithologies. (COHESIVE RESIDUAL SOIL)			
			1.80			Light grey slightly clayey angular to subrounded fine to coarse GRAVEL of sandstone and mudstone lithorelicts. (GRANULAR RESIDUAL SOIL)			
			2.10		Unable to excavate beyond 2.1m due to competent bedrock. ----- End of pit at 2.10 m				
4									
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.									
Stability: 1. The sides of the trial pit remained stable during excavation.									



				Trial Pit Log			Trialpit No TP08 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419025.00 - 426539.00 Level:		Date 14/03/2019	
Location: West Yorkshire				Dimensions (m):		2.6		Scale 1:20	
Client: Harron Homes				Depth 2.00				Logged CC	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.30	B J&T		0.50			TOPSOIL: Dark grey organic rich slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies. (TOPSOIL)		
	0.30						At 0.3m, barbed wire.		
	0.80	D		1.50			Firm light orange and grey mottled slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mixed lithologies including mudstone. (COHESIVE RESIDUAL SOIL)		
				2.00			Light greyish orange sandy slightly clayey angular to subangular fine to coarse GRAVEL of sandstone lithorelicts. (GRANULAR RESIDUAL SOIL)		
							At 1.6m, groundwater seepage.		
							Unable to excavate beyond 2.0m due to competent bedrock.		
							End of pit at 2.00 m		
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage was encountered at 1.6m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.									
Stability: 1. The sides of the trial pit remained stable during excavation.									

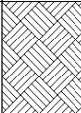
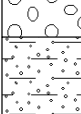
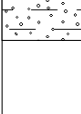


				Trial Pit Log			Trialpit No TP09 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418922.00 - 426554.00 Level:		Date 14/03/2019	
Location: West Yorkshire				Dimensions (m):		2.3		Scale 1:20	
Client: Harron Homes				Depth 1.10				Logged CC	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
▼	0.20	J&T		0.30			TOPSOIL: Dark grey organic rich slightly sandy slightly gravelly CLAY with occasional rootlets. (TOPSOIL)		
							Firm light orange and grey mottled slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to medium of mixed lithologies including mudstone. (COHESIVE RESIDUAL SOIL)		
	0.70	D		0.90			At 0.6m, slight groundwater seepage.		
							Light greyish orange sandy slightly clayey angular to subangular fine to coarse GRAVEL of sandstone lithorelicts with a medium cobble content. (GRANULAR RESIDUAL SOIL)		
				1.10			Unable to excavate beyond 1.1m due to competent bedrock. End of pit at 1.10 m		
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Slight groundwater seepage was encountered at 0.6m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.									
Stability: 1. The sides of the trial pit remained stable during excavation.									

				Trial Pit Log			Trialpit No TP10 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418953.00 - 426517.00 Level:		Date 14/03/2019	
Location: West Yorkshire				Dimensions (m):		2.7		Scale 1:20	
Client: Harron Homes				Depth 1.70				Logged CC	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.20	J&T	HVP=62	0.30			TOPSOIL: Dark grey organic rich slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies. (TOPSOIL)		
	0.60	D		1.70			Firm light orange and grey mottled slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies including mudstone and sandstone. (COHESIVE RESIDUAL SOIL) At 0.5m, land drain.		
							At 1.4m, clay becomes more sandy. Recovered as sand and gravel.		
							Unable to excavate beyond 1.7m due to competent bedrock.		
							End of pit at 1.70 m		
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.									
Stability: 1. The sides of the trial pit remained stable during excavation.									



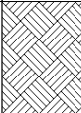
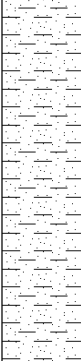
				Trial Pit Log			Trialpit No TP11 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418977.00 - 426466.00 Level:		Date 14/03/2019	
Location: West Yorkshire						Dimensions (m): 2.2		Scale 1:20	
Client: Harron Homes						Depth 2.10		Logged CC	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼	0.20	J&T		0.30			TOPSOIL: Dark grey organic rich slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies. (TOPSOIL)	1
			HVP=40				Firm light orange and grey mottled slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies including sandstone and mudstone. (COHESIVE RESIDUAL SOIL)	
	0.60	D		1.10			Light orangish grey tabular angular BOULDERS of sandstone up to 0.6m in size. (GRANULAR RESIDUAL SOIL)	
			HVP=62	1.20			Light orangish grey clayey slightly sandy angular fine to coarse GRAVEL of sandstone lithorelicts. (GRANULAR RESIDUAL SOIL)	
				2.10			At 2.0m, groundwater seepage.	2
							End of pit at 2.10 m	3
								4

Remarks:	1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage was encountered at 2.0m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.
Stability:	1. The sides of the trial pit remained stable during excavation.



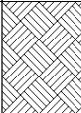
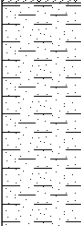
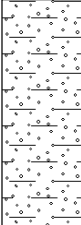
				Trial Pit Log			Trialpit No TP12 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418952.00 - 426430.00 Level:		Date 14/03/2019	
Location: West Yorkshire						Dimensions (m): 2.7 0.6		Scale 1:20	
Client: Harron Homes						Depth 1.50		Logged CC	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20	J&T	HVP=46	0.30			TOPSOIL: Dark grey organic rich slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies. (TOPSOIL)
	0.70	D		1.30		Firm light orange and grey mottled sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone and mudstone. (COHESIVE RESIDUAL SOIL)	
	1.40	T		1.50		Light greyish orange sandy slightly clayey subangular to subrounded fine to coarse GRAVEL of sandstone lithorelicts. (GRANULAR RESIDUAL SOIL)	
	At 1.5m, slight groundwater seepage. Unable to excavate beyond 1.5m due to competent bedrock. End of pit at 1.50 m						

Remarks:	1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Slight groundwater seepage was encountered at 1.5m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.
Stability:	1. The sides of the trial pit remained stable during excavation.



				Trial Pit Log			Trialpit No TP13 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418920.00 - 426455.00 Level:		Date 14/03/2019	
Location: West Yorkshire				Dimensions (m):		2.5 0.6		Scale 1:20	
Client: Harron Homes				Depth 2.00				Logged CC	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼	0.20	J&T	HVP=54	0.30			TOPSOIL: Dark grey organic rich slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies including sandstone. (TOPSOIL)	1
	0.60	D				Firm light orange and grey mottled sandy slightly gravelly CLAY with a low cobble content. Gravel is subangular to subrounded fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)		
				0.90		Light orangish grey gravelly angular COBBLES and BOULDERS of thinly bedded sandstone. Gravel is coarse of sandstone. (GRANULAR RESIDUAL SOIL)		
				1.40		Light orangish grey clayey sandy subangular to subrounded fine to coarse GRAVEL of sandstone lithorelicts. (GRANULAR RESIDUAL SOIL) At 1.6m, spalling of sides of pit wall.		
				2.00		At 2.0m, groundwater seepage. End of pit at 2.00 m	2	
								3
								4

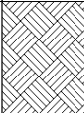
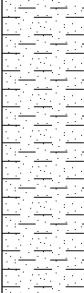
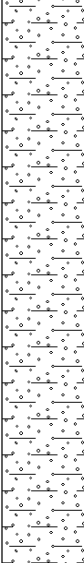
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage was encountered at 2.0m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.		
Stability: 1. The sides of the trial pit were slightly unstable with spalling of the sides of the trial pit at 1.6m depth during excavation.		

				Trial Pit Log				Trialpit No TP14 Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418890.00 - 426529.00 Level:		Date 14/03/2019	
Location: West Yorkshire						Dimensions (m): 2.7 0.6 2.50		Scale 1:20	
Client: Harron Homes								Logged CC	

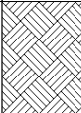
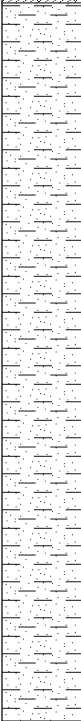
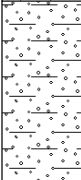
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&T					TOPSOIL: Dark grey organic rich sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies including sandstone. (TOPSOIL)
	0.30	D	HVP=40	0.20			
	0.70	D	HVP=54	0.40			
				1.30			
				2.40			
			2.50		At 2.5m, slight groundwater seepage. Unable to excavate beyond 2.5m due to competent bedrock. End of pit at 2.50 m		

Remarks:	1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Slight groundwater seepage was encountered at 2.5m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.
Stability:	1. The sides of the trial pit remained stable during excavation.



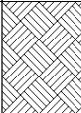
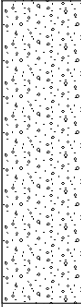
				Trial Pit Log			Trialpit No TP15 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418856.00 - 426476.00 Level:		Date 14/03/2019	
Location: West Yorkshire				Dimensions (m):		2.6		Scale 1:20	
Client: Harron Homes				Depth 2.60				Logged CC	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.20 0.20	B J&T	HVP=64	0.30			TOPSOIL: Dark grey organic rich slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to coarse of mixed lithologies. (TOPSOIL)		
	0.60	D		1.10			Firm light orange and grey mottled sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies. (COHESIVE RESIDUAL SOIL)		
				2.60			Light orangish grey clayey sandy subangular to subrounded fine to coarse GRAVEL of sandstone lithorelicts. (GRANULAR RESIDUAL SOIL) <i>Becoming cobbly with depth</i>		
						<i>Unable to excavate beyond 2.6m due to competent bedrock.</i> End of pit at 2.60 m			
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.									
Stability: 1. The sides of the trial pit remained stable during excavation.									



				Trial Pit Log			Trialpit No TP16 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418815.00 - 426473.00 Level:		Date 14/03/2019	
Location: West Yorkshire				Dimensions (m):		1.9		Scale 1:20	
Client: Harron Homes				Depth 3.20				Logged CC	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.20	J&T	HVP=52	0.30			TOPSOIL: Dark grey organic rich slightly sandy CLAY with many rootlets. (TOPSOIL)		
	0.50	D					Firm light orange and grey mottled slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mixed lithologies including mudstone. (COHESIVE RESIDUAL SOIL)		
				2.20			Dark grey clayey angular to subangular fine to coarse GRAVEL of mudstone. (GRANULAR RESIDUAL SOIL)		
				2.70			Black vitreous angular fine to medium GRAVEL of coal. (GRANULAR RESIDUAL SOIL)		
				3.00			Dark grey slightly clayey angular to subangular fine to coarse GRAVEL of thinly laminated mudstone. (GRANULAR RESIDUAL SOIL)		
			3.20			End of pit at 3.20 m			
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.									
Stability: 1. The sides of the trial pit remained stable during excavation.									



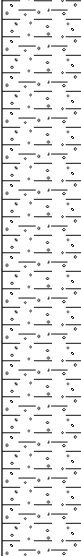
				Trial Pit Log			Trialpit No TP17 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418816.00 - 426402.00 Level:		Date 14/03/2019	
Location: West Yorkshire						Dimensions (m): 2.4 0.6 		Scale 1:20	
Client: Harron Homes						Depth 2.70		Logged CC	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼	0.20	J&T	HVP=62	0.30			TOPSOIL: Dark grey organic rich slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies. (TOPSOIL)	1
	0.70	D		1.30		Firm light orange and grey mottled slightly sandy CLAY. (COHESIVE RESIDUAL SOIL)		
	1.50	D		1.90		Black vitreous angular to subangular fine to coarse GRAVEL of coal. (GRANULAR RESIDUAL SOIL)	2	
				2.70		Light orange slightly clayey SAND and subangular to subrounded fine to coarse GRAVEL of sandstone lithorelicts. (GRANULAR RESIDUAL SOIL)		
						At 2.7m, groundwater seepage.		3
						End of pit at 2.70 m		4

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage was encountered at 2.7m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

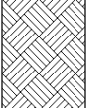
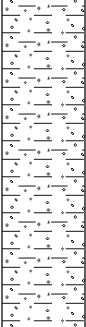
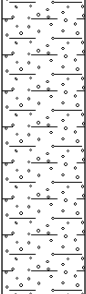
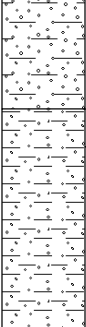
Stability: 1. The sides of the trial pit remained stable during excavation.



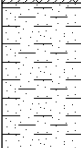
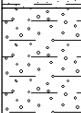
				Trial Pit Log			Trialpit No TP18 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418871.00 - 426390.00 Level:		Date 14/03/2019	
Location: West Yorkshire				Dimensions (m):		2.2		Scale 1:20	
Client: Harron Homes				Depth 2.40				Logged CC	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.10	J&T	HVP=48	0.20		TOPSOIL: Dark grey organic rich slightly sandy CLAY with occasional rootlets. (TOPSOIL)			
	0.70	D					Firm light orange and grey mottled slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone lithorelicts. (COHESIVE RESIDUAL SOIL)		
				1.70			Light orange clayey slightly sandy angular to subangular fine to coarse GRAVEL of sandstone lithorelicts. (GRANULAR RESIDUAL SOIL)		
	2.40	At 2.4m, groundwater seepage. Unable to excavate beyond 2.4m due to competent bedrock. End of pit at 2.40 m							
1 2 3 4 1 2 3 4									
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage was encountered at 2.4m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.									
Stability: 1. The sides of the trial pit remained stable during excavation.									



				Trial Pit Log				Trialpit No TP19 Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418911.00 - 426371.00 Level:		Date 14/03/2019	
Location: West Yorkshire						Dimensions (m): 2.2 Depth 3.50		Scale 1:20 Logged CC	
Client: Harron Homes									

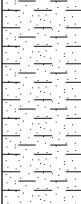
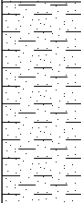
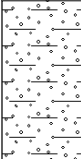
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
▼	0.20	J&T	HVP=40	0.30			TOPSOIL: Dark grey organic rich slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies. (TOPSOIL)
	0.60	D		1.20		Firm light orange sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone lithorelicts. (COHESIVE RESIDUAL SOIL)	
			2.30		Light orange slightly clayey slightly sandy angular to subangular GRAVEL of sandstone lithorelicts. (GRANULAR RESIDUAL SOIL)		
			2.90		Firm light orange and grey mottled gravelly slightly sandy CLAY. (COHESIVE RESIDUAL SOIL) At 2.4m, lens of reddish orange slightly gravelly CLAY.		
			3.40		Black vitreous angular to subangular fine to coarse GRAVEL of coal. (GRANULAR RESIDUAL SOIL)		
			3.50		Firm light grey slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mudstone lithorelicts. (COHESIVE RESIDUAL SOIL) Unable to excavate beyond 3.5m due to competent bedrock. End of pit at 3.50 m		

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage was encountered at 2.0m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.	
Stability: 1. The sides of the trial pit remained stable during excavation.	

LITHOS CONSULTING				Trial Pit Log				Trialpit No TP20 Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419200.00 - 426662.00 Level:		Date 14/03/2019	
Location: West Yorkshire						Dimensions (m):		Scale 1:20	
Client: Harron Homes						Depth 2.10		Logged LEW	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
▼	0.10 0.15	J&T B		0.20			TOPSOIL: Dark brown slightly sandy CLAY with occasional rootlets. (TOPSOIL)		
						Stiff orangish brown mottled grey slightly sandy CLAY. (COHESIVE RESIDUAL SOIL)			
	0.90	D	HVP=89 HVP=110				At 0.6m, terracotta land drain.		
							At 0.6m, groundwater in land drain.		
	1.80	T		1.70			Grey and light brown clayey sandy angular to subangular fine to coarse GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)		
				2.00 2.10			Moderately weak brown thinly bedded fine grained SANDSTONE. Recovered as sandy angular tabular fine to coarse GRAVEL. (COAL MEASURES)		
							Difficult to excavate beyond 2.1m. End of pit at 2.10 m		
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.									
Stability: 1. The sides of the trial pit remained stable during excavation.									

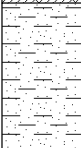
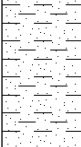
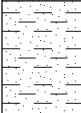
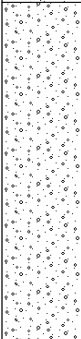


				Trial Pit Log			Trialpit No TP21 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419233.00 - 426618.00 Level:		Date 14/03/2019	
Location: West Yorkshire						Dimensions (m):		Scale 1:20	
Client: Harron Homes						Depth 2.40		Logged LEW	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J&T		0.20			TOPSOIL: Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine of mixed lithologies. (TOPSOIL)	
			HVP=50				Firm orangish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)	
	1.00	D		0.80			Stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)	1
			HVP=92					
	1.60	D						
			HVP=108					
				1.90			From 1.8m, gravelly. Orangish brown and grey slightly clayey sandy angular to subangular fine to medium GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)	2
				2.40			Difficult to excavate beyond 2.4m. End of pit at 2.40 m	
								3
								4

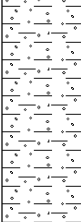
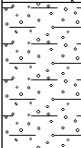
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.		
Stability: 1. The sides of the trial pit remained stable during excavation.		

				Trial Pit Log			Trialpit No TP22 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419191.00 - 426561.00 Level:		Date 14/03/2019	
Location: West Yorkshire						Dimensions (m):		Scale 1:20	
Client: Harron Homes						Depth 3.00		Logged LEW	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J&T		0.20		 TOPSOIL: Dark brown slightly sandy CLAY with occasional rootlets. (TOPSOIL)	1	
			HVP=62		 Firm orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone. (COHESIVE RESIDUAL SOIL)			
					At 0.6m, terracotta land drain.			
	0.90	D				 From 0.9m, stiff.	2	
			HVP=70					
	1.30	D		1.80		 Stiff grey mottled light brown slightly sandy gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone and rare fragments of coal. (COHESIVE RESIDUAL SOIL)	3	
			HVP=90					
			HVP=105					
				2.10		 Brown clayey sandy angular to subangular fine to medium GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)	4	
				3.00		 End of pit at 3.00 m		

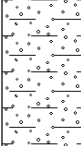
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.		
Stability: 1. The sides of the trial pit remained stable during excavation.		

				Trial Pit Log			Trialpit No TP23 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419166.00 - 426607.00 Level:		Date 14/03/2019	
Location: West Yorkshire						Dimensions (m):		Scale 1:20	
Client: Harron Homes						Depth 2.90		Logged LEW	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J&T		0.20		 TOPSOIL: Dark brown slightly sandy CLAY with occasional rootlets. (TOPSOIL)		
			HVP=45			 Firm orangish brown mottled grey slightly sandy CLAY. (COHESIVE RESIDUAL SOIL)		
			HVP=70			From 0.8m, stiff.		
	1.10	D	HVP=104	1.00		 Stiff grey mottled light brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone. (COHESIVE RESIDUAL SOIL)	1	
						From 1.6m, gravelly.		
	1.70	D		2.10		 Greyish brown clayey sandy angular to subangular fine to coarse GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)	2	
						Difficult to excavate from 2.1m.		
				2.50		 Moderately weak grey thinly to thickly laminated SILTSTONE interbedded with brown fine grained SANDSTONE. Recovered as slightly clayey sandy angular tabular fine to coarse gravel. (COAL MEASURES)		
						From 2.6m, occasional ironstone nodules.		
				2.90		Difficult to excavate beyond 2.9m.		
						End of pit at 2.90 m	3	
							4	

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.	
Stability: 1. The sides of the trial pit remained stable during excavation.	

				Trial Pit Log				Trialpit No TP24 Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419151.00 - 426532.00 Level:		Date 14/03/2019	
Location: West Yorkshire						Dimensions (m):		Scale 1:20	
Client: Harron Homes						Depth 2.90		Logged LEW	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.20			TOPSOIL: Dark brown slightly sandy CLAY with occasional rootlets. (TOPSOIL)	
	0.60	D	HVP=50				Firm orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone. (COHESIVE RESIDUAL SOIL)	
			HVP=80					
			HVP=86	1.20				1
	1.50	D					Stiff grey mottled brown slightly sandy gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone. (COHESIVE RESIDUAL SOIL)	
				2.30			Greyish brown clayey sandy angular to subangular fine to medium GRAVEL of siltstone. (GRANULAR RESIDUAL SOIL)	
				2.70			Weak grey thinly laminated SILTSTONE. Recovered as clayey sandy angular to subangular fine to coarse gravel. (COAL MEASURES)	
				2.90			<i>Difficult to excavate beyond 2.9m.</i> End of pit at 2.90 m	3
								4

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.	
Stability: 1. The sides of the trial pit remained stable during excavation.	

				Trial Pit Log			Trialpit No TP25 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton		Project No. 2828		Co-ords: 419095.00 - 426530.00		Date 14/03/2019			
Location: West Yorkshire				Dimensions (m):		Scale 1:20			
Client: Harron Homes				Depth 3.30		Logged LEW			
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
▼	0.10	J&T	HVP=62	0.30			TOPSOIL: Dark brown slightly sandy CLAY with occasional rootlets. (TOPSOIL)	1	
	0.40	J&T					Firm orangish brown mottled grey slightly sandy CLAY. (COHESIVE RESIDUAL SOIL)		
					At 0.6m, terracotta land drain.				
					Weak black carbonaceous MUDSTONE. Recovered as clayey sandy angular fine to medium gravel. (COAL MEASURES)				
					At 1.0m, locally black vitreous coal.				
	1.00	T		1.20			Firm light brown slightly gravelly sandy CLAY. (COHESIVE RESIDUAL SOIL)		
					1.70				Light brown clayey sandy angular to subangular fine to coarse GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)
	1.80	T		2.00			Moderately weak brown thinly laminated SILTSTONE. Recovered as slightly clayey sandy angular tabular fine to coarse gravel. (COAL MEASURES)		
			2.60			Weak brittle black vitreous COAL. Recovered as sandy angular fine to medium gravel.			
			2.80			Light brown clayey sandy angular to subangular fine to medium GRAVEL of siltstone. (GRANULAR RESIDUAL SOIL)	2		
			3.30			End of pit at 3.30 m	3		
							4		

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater inflow was encountered at 1.0m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

Stability: 1. The sides of the trial pit remained stable during excavation.



				Trial Pit Log			Trialpit No TP26 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419111.00 - 426570.00 Level:		Date 14/03/2019	
Location: West Yorkshire						Dimensions (m):		Scale 1:20	
Client: Harron Homes						Depth 2.90		Logged LEW	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.80	D	HVP=65	0.20		 TOPSOIL: Dark brown slightly sandy CLAY with occasional rootlets. (TOPSOIL)	1	
			Firm orangish brown slightly sandy CLAY. (COHESIVE RESIDUAL SOIL)					
			At 0.6m, terracotta land drain.					
			Stiff orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)					
			From 1.5m, locally very clayey sandy angular to subangular fine to coarse gravel.					
			HVP=86	0.70			2	
		HVP=85						
		HVP=108						
				1.70		Light brown and grey slightly clayey sandy angular to subangular fine to coarse GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)		
				2.30		Moderately weak greyish brown thinly laminated SILTSTONE. Recovered as sandy angular tabular fine to coarse gravel with a low cobble content. (COAL MEASURES)		
				2.90		From 2.5m, occasional ironstone nodules.		
						Difficult to excavate beyond 2.9m.		
						End of pit at 2.90 m	3	
							4	

Remarks:	1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.
Stability:	1. The sides of the trial pit remained stable during excavation.



				Trial Pit Log			Trialpit No TP27 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419130.00 - 426636.00 Level:		Date 14/03/2019	
Location: West Yorkshire				Dimensions (m):		0.6		Scale 1:20	
Client: Harron Homes				Depth 2.60				Logged LEW	

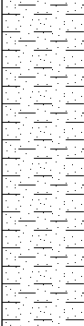
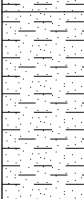
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J&T		0.20			TOPSOIL: Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine of mixed lithologies. (TOPSOIL)	
			HVP=50				Firm light brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine of sandstone. (COHESIVE RESIDUAL SOIL)	
			HVP=65	0.60			Firm orangish brown mottled grey CLAY. (COHESIVE RESIDUAL SOIL)	
	1.10	D	HVP=80				<i>From 1.0m, stiff.</i>	1
			HVP=82				<i>From 1.3m, slightly gravelly.</i>	
	1.80	T		1.70			Greyish brown clayey sandy angular to subangular fine to medium GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)	2
				2.30			Weak light brown thinly to thickly laminated fine grained SANDSTONE interbedded with brown SILTSTONE. Recovered as sandy angular tabular fine to coarse gravel with a low cobble content. (COAL MEASURES)	
				2.60			End of pit at 2.60 m	3
								4

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

Stability: 1. The sides of the trial pit remained stable during excavation.

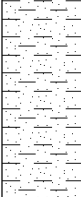
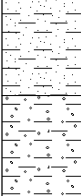
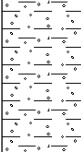
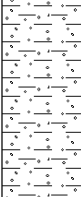


				Trial Pit Log				Trialpit No TP28 Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419111.00 - 426669.00 Level:		Date 14/03/2019	
Location: West Yorkshire						Dimensions (m):		Scale 1:20	
Client: Harron Homes						Depth 2.60		Logged LEW	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J&T		0.20			TOPSOIL: Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine of mixed lithologies including rare coal. (TOPSOIL)	
	0.40	J&T	HVP=70 HVP=80				Stiff orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone. (COHESIVE RESIDUAL SOIL)	1
	1.60	D&B		1.90			<i>From 1.1m, gravelly.</i>	
							<i>From 1.6m, very stiff.</i>	
	2.10	D					Very stiff brownish grey slightly sandy slightly gravelly CLAY. Gravel is subangular fine of mudstone lithorelicts. (COHESIVE RESIDUAL SOIL)	2
				2.40			Weak dark grey thinly laminated MUDSTONE. Recovered as clayey sandy angular tabular fine to medium gravel. (COAL MEASURES)	
				2.60			End of pit at 2.60 m	3
								4

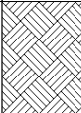
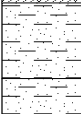
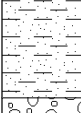
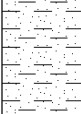
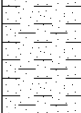
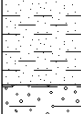
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.		
Stability: 1. The sides of the trial pit remained stable during excavation.		

				Trial Pit Log			Trialpit No TP29 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419090.00 - 426612.00 Level:		Date 15/03/2019	
Location: West Yorkshire						Dimensions (m):		Scale 1:20	
Client: Harron Homes						Depth 3.10		Logged LEW	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J&T		0.20		 TOPSOIL: Dark brown slightly sandy CLAY with occasional rootlets. (TOPSOIL)		
			HVP=75			 Stiff orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)		
	0.80	D&B	HVP=85	1.00		 Stiff light brown mottled grey slightly sandy gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)	1	
	1.30	D				 From 1.5m, locally very clayey gravel.		
				1.70		 Light brown clayey sandy angular to subangular fine to medium GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)		
				1.90		 Stiff brownish grey slightly sandy very gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone lithorelicts. (COHESIVE RESIDUAL SOIL)	2	
	2.60	T		2.50		 Greyish brown clayey sandy angular to subangular fine to medium GRAVEL of mudstone. (GRANULAR RESIDUAL SOIL)		
				2.70		 Weak dark grey thinly laminated carbonaceous MUDSTONE. Recovered as sandy angular tabular fine to coarse gravel. (COAL MEASURES)		
				3.10		 Unable to excavate beyond 3.1m.	3	
						End of pit at 3.10 m	4	

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.	
Stability: 1. The sides of the trial pit remained stable during excavation.	

				Trial Pit Log				Trialpit No TP31 Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418846.00 - 426435.00 Level:		Date 14/03/2019	
Location: West Yorkshire						Dimensions (m): 2.2 Depth 3.30		Scale 1:20 Logged CC	
Client: Harron Homes									

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	J&T		0.30			TOPSOIL: Dark grey organic rich slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to coarse of mixed lithologies. (TOPSOIL)	1 2 3 4
	0.40	D	HVP=40	0.50			Firm light brown mottled sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)	
			HVP=52				Firm light orange and grey mottled slightly sandy CLAY. (COHESIVE RESIDUAL SOIL)	
	0.80	D		0.85			Light orange tabular COBBLES and BOULDERS of sandstone. (GRANULAR RESIDUAL SOIL)	
				0.90			Firm light orange and grey mottled slightly sandy CLAY. (COHESIVE RESIDUAL SOIL)	
				2.30			Light orangish grey slightly clayey angular to subangular fine to coarse GRAVEL of sandstone and mudstone lithorelicts. (GRANULAR RESIDUAL SOIL)	
			3.10			At 2.8m, gravel becomes orange in colour.		
			3.30			Dark grey clayey angular to subangular fine to coarse GRAVEL of mudstone. (GRANULAR RESIDUAL SOIL) At 3.1m, spalling of sides of pit wall. At 3.3m, groundwater seepage.		
End of pit at 3.30 m								

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage was encountered at 3.3m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

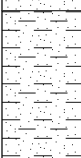
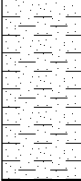
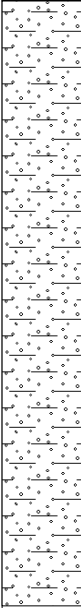
Stability: 1. The sides of the trial pit were slightly unstable with spalling of the sides of the trial pit at 1.6m depth during excavation.



				Trial Pit Log			Trialpit No TP32 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418902.00 - 426494.00 Level:		Date 14/03/2019	
Location: West Yorkshire				Dimensions (m):		2.4		Scale 1:20	
Client: Harron Homes				Depth 1.50				Logged CC	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.10	J&T	HVP=42	0.20			TOPSOIL: Dark grey organic rich slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to coarse of mixed lithologies. (TOPSOIL)		
	0.40	D		0.60			Firm light orange and grey mottled sandy gravelly CLAY. Gravel is angular to subangular fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)		
				0.80			Light grey tabular COBBLES and BOULDERS of sandstone in West end of pit. (GRANULAR RESIDUAL SOIL)		
				1.50			Stiff light orange and grey mottled slightly sandy CLAY in East end of pit. (COHESIVE RESIDUAL SOIL)		
				1.50			Unable to excavate beyond 1.5m due to competent bedrock.		
1 2 3 4									
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.									
Stability: 1. The sides of the trial pit remained stable during excavation.									



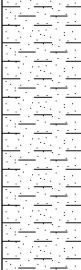
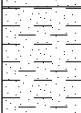
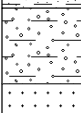
				Trial Pit Log			Trialpit No TP33 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418966.00 - 426398.00 Level:		Date 15/03/2019	
Location: West Yorkshire				Dimensions (m):		2.4 		Scale 1:20	
Client: Harron Homes				Depth 3.40		0.6 		Logged CC	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼	0.10	J&T					TOPSOIL: Dark grey organic rich slightly sandy slightly gravelly CLAY. (TOPSOIL)	
	0.30	D	HVP=40	0.20			Firm light brown sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies. (COHESIVE RESIDUAL SOIL)	
			HVP=46	0.40			Firm light orange and grey mottled slightly sandy CLAY. (COHESIVE RESIDUAL SOIL)	
				0.90			At 0.8m, groundwater seepage.	
				1.00			Black angular to subangular fine to coarse GRAVEL of coal. (GRANULAR RESIDUAL SOIL)	1
	1.20	D	HVP=58				Firm light orange and grey mottled slightly sandy CLAY. (COHESIVE RESIDUAL SOIL)	
			1.50			Black angular to subangular fine to coarse GRAVEL of coal. (GRANULAR RESIDUAL SOIL)		
			1.80			Light greyish orange clayey sandy angular to subangular fine to medium GRAVEL of sandstone lithorelicts. (GRANULAR RESIDUAL SOIL)	2	
			3.40		End of pit at 3.40 m			3
								4

Remarks:	1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage was encountered at ? during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.
Stability:	1. The sides of the trial pit remained stable during excavation.



				Trial Pit Log			Trialpit No TP34 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419001.00 - 426395.00 Level:		Date 15/03/2019	
Location: West Yorkshire						Dimensions (m):		Scale 1:20	
Client: Harron Homes						Depth 2.00		Logged LEW	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10 0.15	J&T B		0.20			TOPSOIL: Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of mixed lithologies including rare coal. (TOPSOIL)	
							Stiff orangish brown mottled grey slightly sandy CLAY. (COHESIVE RESIDUAL SOIL)	
	0.60	D	HVP=70 HVP=120 HVP=110	1.40 1.70 1.90 2.00			From 0.7m to 1.1m, locally black clayey with gravel of coal. Stiff light brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)	1
							Light brown and grey clayey sandy angular to subangular fine to coarse GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)	
							Medium strong light brown thinly to thickly laminated fine grained SANDSTONE with occasional ironstone nodules. Recovered as sandy angular tabular fine to coarse gravel with a low cobble content. (COAL MEASURES)	2
							Unable to excavate beyond 2.0m. End of pit at 2.00 m	3
								4

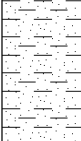
Remarks:	1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.	
Stability:	1. The sides of the trial pit remained stable during excavation.	

				Trial Pit Log			Trialpit No TP35 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418942.00 - 426351.00 Level:		Date 15/03/2019	
Location: West Yorkshire						Dimensions (m): 2.3 2.40		Scale 1:20	
Client: Harron Homes								Logged CC	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J&T		0.25			TOPSOIL: Dark grey organic rich slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to coarse of mixed lithologies. (TOPSOIL)	1
	0.40	D	HVP=50	0.50			Firm light brown sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies. (COHESIVE RESIDUAL SOIL)	
	0.70	D	HVP=60				Firm light orange and grey mottled gravelly slightly sandy CLAY. Gravel is subangular to subrounded fine to coarse ? including coal and sandstone (COHESIVE RESIDUAL SOIL)	
				1.70			Light orangish grey clayey slightly sandy GRAVEL of sandstone lithorelicts with a low cobble content. (GRANULAR RESIDUAL SOIL)	2
				2.40			Unable to excavate beyond 2.4m due to competent bedrock. End of pit at 2.40 m	3
								4

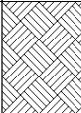
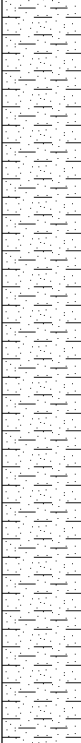
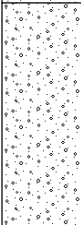
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.		
Stability: 1. The sides of the trial pit remained stable during excavation.		

				Trial Pit Log			Trialpit No TP36 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419026.00 - 426362.00 Level:		Date 15/03/2019	
Location: West Yorkshire						Dimensions (m):		Scale 1:20	
Client: Harron Homes						Depth 1.50		Logged LEW	

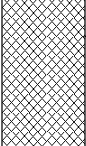
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.20			TOPSOIL: Dark brown slightly sandy CLAY with occasional rootlets. (TOPSOIL)
	0.90	D	HVP=65				Orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone. (COHESIVE RESIDUAL SOIL)
							At 0.6m, terracotta land drain.
							From 0.8m, stiff.
	1.30	D	HVP=105				From 1.2m, gravelly.
				1.40			Strong light brown thickly laminated to thinly bedded fine grained SANDSTONE. Recovered as sandy gravelly angular tabular cobbles. (COAL MEASURES)
				1.50			Unable to excavate beyond 1.5m. End of pit at 1.50 m

Remarks:		1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.
Stability:		1. The sides of the trial pit remained stable during excavation.



				Trial Pit Log				Trialpit No TP37 Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419063.00 - 426337.00 Level:		Date 15/03/2019	
Location: West Yorkshire						Dimensions (m): 2.4 0.6 		Scale 1:20	
Client: Harron Homes						Depth 2.90		Logged CC	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
▼	0.20	J&T	HVP=50	0.30			TOPSOIL: Dark grey organic rich slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies. (TOPSOIL)		
	0.60	D		2.30			Firm light orange and grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies including sandstone. (COHESIVE RESIDUAL SOIL)		
				2.90			Light orangish grey sandy slightly clayey angular to subangular fine to coarse GRAVEL of sandstone lithorelicts. (GRANULAR RESIDUAL SOIL) <i>At 2.5m, groundwater seepage.</i>		
							<i>Unable to excavate beyond 2.9m due to competent bedrock.</i> End of pit at 2.90 m		
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage was encountered at 2.5m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.									
Stability: 1. The sides of the trial pit remained stable during excavation.									

				Trial Pit Log			Trialpit No TP38 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419066.00 - 426304.00 Level:		Date 15/03/2019	
Location: West Yorkshire						Dimensions (m):		Scale 1:20	
Client: Harron Homes						Depth 2.10		Logged LEW	

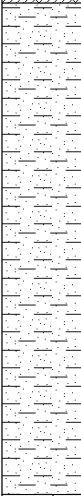
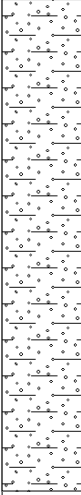
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼	0.10	J,K&T	HVP=82	0.40			MADE GROUND: Dark grey clayey sandy angular to subangular fine to coarse GRAVEL of predominantly coal and clinker with rare glass, brick and ceramic with a low cobble content of brick. (GRANULAR MADE GROUND) <i>From 0.0m to 0.4m, slight spalling.</i>	1
	0.30	J,K&T					Stiff light brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL) <i>From 0.0m to 0.6m, in East end of pit, brick wall with sandstone slab footing.</i>	
	0.50	J&T					<i>At 1.2m, groundwater seepage.</i>	
	1.30	D	HVP=70	1.70	Stiff greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone lithorelicts. (COHESIVE RESIDUAL SOIL)	2		
				2.10			End of pit at 2.10 m	3
								4

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage was encountered at 1.2m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.		
Stability: 1. Spalling of the sides of the trial pit between 0.0m and 0.4m depth during excavation.		

				Trial Pit Log			Trialpit No TP39 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419021.00 - 426302.00 Level:		Date 15/03/2019	
Location: West Yorkshire				Dimensions (m):		2.6		Scale 1:20	
Client: Harron Homes				Depth 1.80				Logged CC	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.10	J&T	HVP=52	0.20			TOPSOIL: Dark grey organic rich slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies. (TOPSOIL)		
	0.30	D		0.40			Firm light brown sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies. (COHESIVE RESIDUAL SOIL)		
	0.70	D	HVP=64	1.30			Firm light orange and grey mottled slightly gravelly slightly sandy CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies including coal and sandstone. (COHESIVE RESIDUAL SOIL)		
							Light orangish grey clayey slightly sandy angular to subangular fine to coarse GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)		
				1.80			Unable to excavate beyond 1.8m due to competent bedrock. End of pit at 1.80 m		
1 2 3 4									
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.									
Stability: 1. The sides of the trial pit remained stable during excavation.									



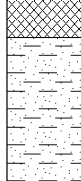
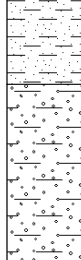
				Trial Pit Log			Trialpit No TP40 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418992.00 - 426325.00 Level:		Date 15/03/2019	
Location: West Yorkshire						Dimensions (m):		Scale 1:20	
Client: Harron Homes						Depth 2.80		Logged LEW	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼	0.90	D	HVP=75	0.20		 TOPSOIL: Dark brown slightly sandy CLAY with occasional rootlets. (TOPSOIL)	1	
			HVP=82			 Stiff orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)		
	1.60	T		1.50	 Light brown clayey sandy angular to subrounded fine to coarse GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)	2		
								At 0.5m, terracotta land drain. From 1.2m, gravelly. From 1.8m, low cobble content. At 2.0m, groundwater seepage.
			2.80		 Difficult to excavate beyond 2.8m. End of pit at 2.80 m	3		
							4	

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage was encountered at 2.0m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.	
Stability: 1. The sides of the trial pit remained stable during excavation.	

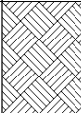
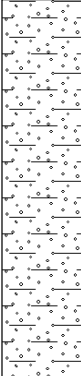
				Trial Pit Log				Trialpit No TP41 Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418948.00 - 426309.00 Level:		Date 15/03/2019	
Location: West Yorkshire						Dimensions (m): 2.6 0.6 2.10		Scale 1:20	
Client: Harron Homes								Logged CC	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.10	J&T					TOPSOIL: Dark grey organic rich slightly sandy CLAY with occasional rootlets. (TOPSOIL)		
	0.40	D	HVP=48 HVP=56	0.25			Firm light brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies. (COHESIVE RESIDUAL SOIL)		
				0.50			Firm light orange and grey mottled slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone and sandstone lithorelicts. (COHESIVE RESIDUAL SOIL)		
				1.50					
				2.10			Light orangish grey clayey sandy subangular to subrounded fine to coarse GRAVEL of sandstone lithorelicts. (GRANULAR RESIDUAL SOIL)		
						Unable to excavate beyond 2.1m due to competent bedrock.		End of pit at 2.10 m	
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.									
Stability: 1. The sides of the trial pit remained stable during excavation.									

				Trial Pit Log			Trialpit No TP42 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418907.00 - 426285.00 Level:		Date 15/03/2019	
Location: West Yorkshire				Dimensions (m): Depth 1.80				Scale 1:20 Logged LEW	
Client: Harron Homes									

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼	0.10	J&T	HVP=60 HVP=85	0.20		 MADE GROUND TOPSOIL: Dark brown slightly sandy CLAY with occasional rootlets. (MADE GROUND TOPSOIL)	1	
	0.40	J&T		0.50	 MADE GROUND: Light brown gravelly CLAY with a low cobble content. Gravel is subangular to subrounded fine to coarse of sandstone. (REWORKED NATURAL GROUND)			
	0.70	D&B		1.10	 Firm light brown mottle grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL) From 0.9m, stiff. From 1.0m, gravelly.			
	1.30	T		1.60	 Light brown clayey sandy angular to subangular fine to coarse GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)			
				1.80	 Strong light brown thickly laminated to thinly bedded fine grained SANDSTONE. Recovered as sandy angular tabular fine to coarse gravel and cobbles. (COAL MEASURES) At 1.6m, groundwater inflow.			
								End of pit at 1.80 m
								3
								4

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater inflow was encountered at 1.6m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.		
Stability: 1. The sides of the trial pit remained stable during excavation.		

				Trial Pit Log			Trialpit No TP43 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419025.00 - 426260.00 Level:		Date 15/03/2019	
Location: West Yorkshire						Dimensions (m): 2.4		Scale 1:20	
Client: Harron Homes						Depth 2.40		Logged CC	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
▼	0.20	J&T	HVP=56	0.30		 TOPSOIL: Dark grey organic rich slightly sandy CLAY with occasional rootlets. (TOPSOIL)	1 2 3 4
	0.70	D	HVP=67			 Firm light orange and grey mottled slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies. (COHESIVE RESIDUAL SOIL) At 0.7m, groundwater seepage.	
	1.60	D		1.40		 Light orangish grey clayey slightly sandy subangular to subrounded fine to coarse GRAVEL of sandstone lithorelicts with a low cobble content. (GRANULAR RESIDUAL SOIL) At 2.0m, becoming more cobbley.	
				2.40		Unable to excavate beyond 2.4m due to competent bedrock. ----- End of pit at 2.40 m	

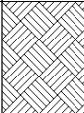
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage was encountered at 0.7m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.	
Stability: 1. The sides of the trial pit remained stable during excavation.	

				Trial Pit Log			Trialpit No TP44 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418919.00 - 426235.00 Level:		Date 15/03/2019	
Location: West Yorkshire						Dimensions (m): Depth 1.20 0.6		Scale 1:20 Logged LEW	
Client: Harron Homes									
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
▼	0.80	T	HVP=55	0.20		 TOPSOIL: Dark brown slightly sandy CLAY with occasional rootlets. (TOPSOIL)	1		
				0.60		 Firm orangish brown mottled grey slightly sandy slightly gravelly CLAY. (COHESIVE RESIDUAL SOIL)			
				1.10		 Light brown very clayey sandy angular to subangular fine to coarse GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)			
				1.20		 From 0.9m, low cobble content.			
						 Strong light brown thinly bedded fine grained SANDSTONE. Recovered as sandy angular tabular fine to coarse gravel with a medium cobble and low boulder content. (COAL MEASURES) At 1.1m, groundwater seepage. Unable to excavate beyond 1.2m. End of pit at 1.20 m		2	
							3		
							4		

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage was encountered at 1.1m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

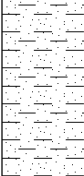
Stability: 1. The sides of the trial pit remained stable during excavation.



				Trial Pit Log				Trialpit No TP45 Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419025.00 - 426260.00 Level:		Date 15/03/2019	
Location: West Yorkshire						Dimensions (m): 2.5 0.6		Scale 1:20	
Client: Harron Homes						Depth 3.30		Logged CC	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.30			TOPSOIL: Dark grey organic rich slightly sandy CLAY with occasional rootlets. (TOPSOIL)		
			HVP=58	0.50			Firm light brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mixed lithologies. (COHESIVE RESIDUAL SOIL)		
			HVP=62				Firm light orange and grey mottled slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mixed lithologies including coal. (COHESIVE RESIDUAL SOIL) <i>At 0.5m, land drain.</i>		
				1.30			Light orangish grey slightly clayey subangular to subrounded fine to coarse GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)		
				1.50			Black slightly clayey angular to subangular fine to medium GRAVEL of coal. (GRANULAR RESIDUAL SOIL)		
				2.80			Light greyish orange slightly sandy angular to subangular fine to coarse GRAVEL of mudstone. (GRANULAR RESIDUAL SOIL)		
				3.00			Black angular to subangular fine to coarse GRAVEL of coal. (GRANULAR RESIDUAL SOIL)		
				3.30		----- End of pit at 3.30 m -----			
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.									
Stability: 1. The sides of the trial pit remained stable during excavation.									

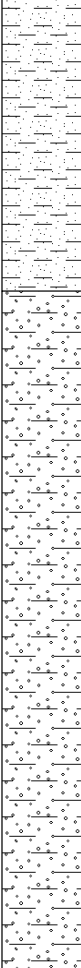


				Trial Pit Log			Trialpit No TP46 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418959.00 - 426232.00 Level:		Date 15/03/2019	
Location: West Yorkshire						Dimensions (m): Depth 2.20		Scale 1:20 Logged LEW	
Client: Harron Homes									

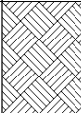
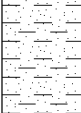
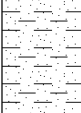
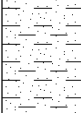
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼	0.10	J&T	HVP=62	0.20		 TOPSOIL: Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of sandstone. (TOPSOIL)	1	
						 Firm orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL) <u>At 0.5m, terracotta land drain.</u>		
						<u>From 0.7m, gravelly.</u>		
	1.20	D		1.00		 Stiff light brown mottled grey slightly sandy gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)		
						 Light brown clayey sandy angular to subangular fine to coarse GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL) <u>From 1.7m, difficult to excavate.</u>		
				1.80		 Moderately weak light brown thickly laminated fine grained SANDSTONE. Recovered as slightly clayey sandy angular tabular fine to coarse gravel. (COAL MEASURES) <u>At 1.9m, groundwater seepage.</u> <u>Unable to excavate beyond 2.2m.</u>	2	
				2.20		End of pit at 2.20 m		4

Remarks:	1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage was encountered at 1.9m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.	
Stability:	1. The sides of the trial pit remained stable during excavation.	

				Trial Pit Log				Trialpit No TP47 Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419010.00 - 426232.00 Level:		Date 15/03/2019	
Location: West Yorkshire						Dimensions (m): 2.9 		Scale 1:20	
Client: Harron Homes						Depth 3.00		Logged CC	

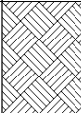
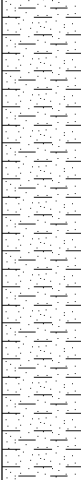
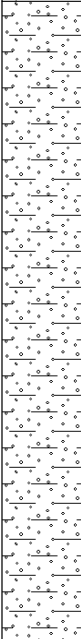
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	B J&T	HVP=62	0.20			TOPSOIL: Dark grey organic rich slightly sandy CLAY with occasional rootlets. (TOPSOIL)	1
	0.10						Firm light orange and grey mottled slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mixed lithologies. (COHESIVE RESIDUAL SOIL)	
	0.50	D		1.20			Light greyish orange sandy slightly clayey subangular to subrounded fine to coarse GRAVEL of sandstone lithorelicts with a low cobble content. (GRANULAR RESIDUAL SOIL)	
	1.40	T		3.00			End of pit at 3.00 m	3
								4

Remarks:	1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.	
Stability:	1. The sides of the trial pit remained stable during excavation.	

				Trial Pit Log				Trialpit No TP48 Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418990.00 - 426170.00 Level:		Date 15/03/2019	
Location: West Yorkshire						Dimensions (m):		Scale 1:20	
Client: Harron Homes						Depth 3.10		Logged LEW	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.10	J&T		0.30			TOPSOIL: Dark brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mixed lithologies including rare brick. (TOPSOIL)		
			HVP=75				Stiff light brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone. (COHESIVE RESIDUAL SOIL)		
			HVP=100						
			HVP=105	1.40			Stiff brownish grey slightly sandy slightly gravelly CLAY. Gravel is subangular fine to medium of mudstone. (COHESIVE RESIDUAL SOIL)		
	1.60	D		2.00			Weak black vitreous thinly laminated COAL. Recovered as slightly clayey sandy angular fine to coarse gravel.		
	2.20	T		2.50			Stiff grey CLAY. (COHESIVE RESIDUAL SOIL)		
				2.90			Grey clayey sandy angular to subangular fine to medium GRAVEL of mudstone. (GRANULAR RESIDUAL SOIL)		
				3.10			End of pit at 3.10 m		
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.									
Stability: 1. The sides of the trial pit remained stable during excavation.									



				Trial Pit Log			Trialpit No TP49 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418978.00 - 426201.00 Level:		Date 15/03/2019	
Location: West Yorkshire				Dimensions (m):		2.7 		Scale 1:20	
Client: Harron Homes				Depth 3.30		0.6 		Logged CC	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
			HVP=52	0.30			TOPSOIL: Dark grey organic rich slightly sandy CLAY. (TOPSOIL)	1
							Firm light orange and grey mottled slightly gravelly slightly sandy CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies including coal. (COHESIVE RESIDUAL SOIL)	
				1.60			Light greyish orange clayey slightly sandy subangular to subrounded fine to coarse GRAVEL of sandstone and mudstone lithorelicts. (GRANULAR RESIDUAL SOIL)	
				3.30			End of pit at 3.30 m	3
								4

Remarks:	1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.	
Stability:	1. The sides of the trial pit remained stable during excavation.	

				Trial Pit Log				Trialpit No TP50 Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418867.00 - 426317.00 Level:		Date 15/03/2019	
Location: West Yorkshire						Dimensions (m): 2.3 Depth 3.50		Scale 1:20 Logged CC	
Client: Harron Homes									

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	B					TOPSOIL: Dark grey organic rich slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to coarse of mixed lithologies. (TOPSOIL)	
	0.10	J&T						
	0.40	B	HVP=40	0.30			Firm light brown sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies including sandstone. (COHESIVE RESIDUAL SOIL)	
			HVP=52	0.50			Firm light orange and grey mottled slightly sandy CLAY. (COHESIVE RESIDUAL SOIL)	
				1.30			Stiff light orange and grey mottled slightly sandy CLAY. (COHESIVE RESIDUAL SOIL)	1
			HVP=80	1.80			Light grey sandy slightly clayey angular to subangular fine to coarse GRAVEL of sandstone and mudstone lithorelicts. (GRANULAR RESIDUAL SOIL)	2
				2.40			Black angular to subangular fine to coarse GRAVEL of coal. (GRANULAR RESIDUAL SOIL)	
				3.00			Light orange sandy angular to subangular fine to coarse GRAVEL of sandstone lithorelicts. (GRANULAR RESIDUAL SOIL)	3
				3.50			End of pit at 3.50 m	4

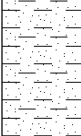
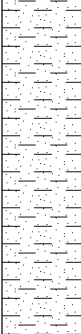
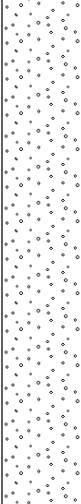
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.		
Stability: 1. The sides of the trial pit remained stable during excavation.		

				Trial Pit Log			Trialpit No TP51 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418877.00 - 426347.00 Level:		Date 15/03/2019	
Location: West Yorkshire				Dimensions (m):		2.5		Scale 1:20	
Client: Harron Homes				Depth 2.30				Logged CC	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.70	D&B		0.20			TOPSOIL: Dark grey organic rich slightly sandy gravelly CLAY with occasional rootlets. (TOPSOIL)		
				0.50			Firm light brown sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies including sandstone and mudstone. (COHESIVE RESIDUAL SOIL)		
							Firm light orange and grey mottled gravelly slightly sandy CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies including mudstone. (COHESIVE RESIDUAL SOIL)		
							<i>Becoming stiffer with depth.</i>		
					1.60			Light grey sandy angular to subangular fine to coarse GRAVEL and COBBLES of sandstone. (GRANULAR RESIDUAL SOIL)	
					2.00			Light orangish grey sandy slightly clayey angular to subangular fine to coarse GRAVEL of sandstone lithorelicts. (GRANULAR RESIDUAL SOIL)	
			2.30			<i>Unable to excavate beyond 2.3m due to competent bedrock.</i> End of pit at 2.30 m			
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.									
Stability: 1. The sides of the trial pit remained stable during excavation.									



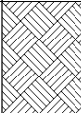
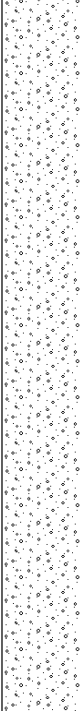


				Trial Pit Log				Trialpit No TP53 Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418794.00 - 426431.00 Level:		Date 15/03/2019	
Location: West Yorkshire						Dimensions (m): 2.6 0.6 		Scale 1:20	
Client: Harron Homes						Depth 3.00		Logged CC	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&T		0.20			TOPSOIL: Dark grey organic rich slightly sandy slightly gravelly CLAY with many rootlets. Gravel is subangular to subrounded fine to coarse of mixed lithologies. (TOPSOIL)
	0.50	D	HVP=38	0.60			Firm light brown sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies including sandstone and mudstone. (COHESIVE RESIDUAL SOIL)
	1.30	D	HVP=58	1.50			Stiff light orange and grey mottled slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies. (COHESIVE RESIDUAL SOIL)
			HVP=84	1.60			Black angular to subangular fine to coarse GRAVEL of coal. (GRANULAR RESIDUAL SOIL)
							Light greyish orange subangular to subrounded fine to coarse GRAVEL of sandstone and mudstone lithorelicts. (GRANULAR RESIDUAL SOIL)
				3.00			Unable to excavate beyond 3.0m due to competent bedrock. End of pit at 3.00 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.	
Stability: 1. The sides of the trial pit remained stable during excavation.	

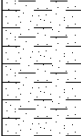
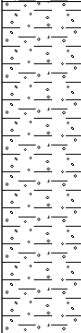
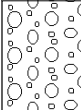
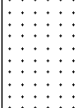
				Trial Pit Log			Trialpit No TP54 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418944.00 - 426489.00 Level:		Date 15/03/2019	
Location: West Yorkshire				Dimensions (m):		2.4 		Scale 1:20	
Client: Harron Homes				Depth 2.90				Logged CC	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30			TOPSOIL: Dark grey organic rich slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to coarse of mixed lithologies. (TOPSOIL)	
				1.00			Firm light orange and grey mottled slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mixed lithologies. (COHESIVE RESIDUAL SOIL)	1
				2.90			Light greyish orange slightly sandy slightly clayey subangular to subrounded fine to coarse GRAVEL of sandstone lithorelicts. (GRANULAR RESIDUAL SOIL)	2
							Unable to excavate beyond 2.9m due to competent bedrock.	3
							End of pit at 2.90 m	4

Remarks:	1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.
Stability:	1. The sides of the trial pit remained stable during excavation.

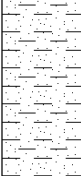
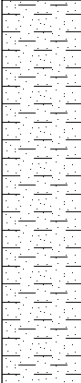
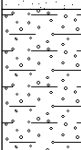


				Trial Pit Log			Trialpit No TP55 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419136.00 - 426591.00 Level:		Date 15/03/2019	
Location: West Yorkshire						Dimensions (m):		Scale 1:20	
Client: Harron Homes						Depth 2.50		Logged LEW	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.20			TOPSOIL: Dark brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine of mixed lithologies including rare coal. (TOPSOIL)	
			HVP=56				Firm orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone. (COHESIVE RESIDUAL SOIL)	
			HVP=85				At 0.6m, terracotta land drain.	
							From 0.7m, locally dark grey.	
							From 0.8m, stiff.	
	1.40	D		1.00			Stiff light brown mottled grey slightly sandy gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)	1
	2.00	T		1.90			Brown slightly clayey sandy angular to subangular fine to coarse COBBLES of sandstone. (GRANULAR RESIDUAL SOIL)	2
				2.20			Moderately weak brown thinly laminated fine grained SANDSTONE interbedded with moderately weak brown SILTSTONE. Recovered as sandy angular tabular fine to coarse gravel with a low cobble content. (COAL MEASURES)	
				2.50			Unable to excavate beyond 2.5m.	
							End of pit at 2.50 m	

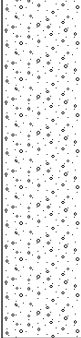
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.		
Stability: 1. The sides of the trial pit remained stable during excavation.		

				Trial Pit Log			Trialpit No TP56 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419157.00 - 426674.00 Level:		Date 15/03/2019	
Location: West Yorkshire						Dimensions (m):		Scale 1:20	
Client: Harron Homes						Depth 2.70		Logged LEW	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.20			TOPSOIL: Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of mixed lithologies. (TOPSOIL)	
			HVP=60				Firm orangish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone. (COHESIVE RESIDUAL SOIL) <i>AT 0.4m, thin (<5cm) band of reddish brown CLAY.</i> <i>From 0.5m, locally dark grey with fragments of coal.</i>	
			HVP=85	0.70			Stiff orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)	1
	1.60	D					<i>From 1.7m, gravelly.</i>	
				2.10			Light brown clayey sandy angular to subangular fine to coarse GRAVEL of siltstone. (GRANULAR RESIDUAL SOIL)	2
				2.50			Weak brown thinly laminated SILTSTONE. Recovered as slightly clayey sandy angular tabular fine to coarse gravel. (COAL MEASURES)	
				2.70			<i>Difficult to excavate beyond 2.7m.</i> End of pit at 2.70 m	3
								4

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.	
Stability: 1. The sides of the trial pit remained stable during excavation.	

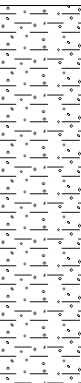
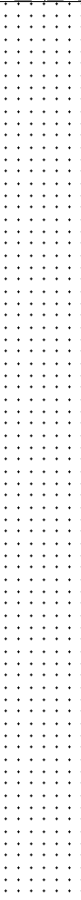
				Trial Pit Log			Trialpit No TP57 Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419246.00 - 426675.00 Level:		Date 15/03/2019	
Location: West Yorkshire						Dimensions (m):		Scale 1:20	
Client: Harron Homes						Depth 2.00		Logged LEW	

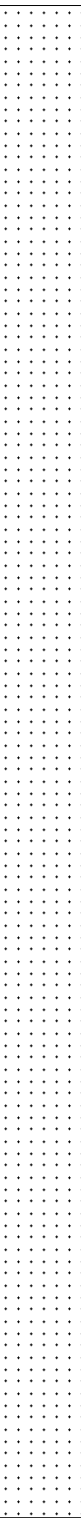
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.90	T	HVP=55	0.20			TOPSOIL: Dark brown slightly sandy CLAY with occasional rootlets. (TOPSOIL)	1
					Firm orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)			
					Orangish brown and grey clayey sandy angular to subangular fine to coarse GRAVEL of sandstone with a low cobble content. (GRANULAR RESIDUAL SOIL)			
				1.60		Stiff grey mottled light brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone. (COHESIVE RESIDUAL SOIL)	2	
				1.90 2.00		Strong light brown thinly bedded fine grained SANDSTONE. Recovered as sandy angular tabular fine to coarse gravel with a medium cobble content. (COAL MEASURES)		
Unable to excavate beyond 2.0m. End of pit at 2.00 m								3
								4

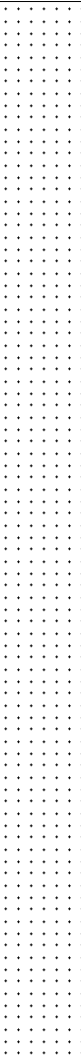
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.		
Stability: 1. The sides of the trial pit remained stable during excavation.		

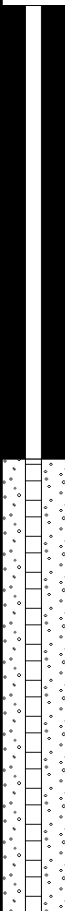
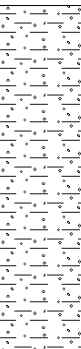
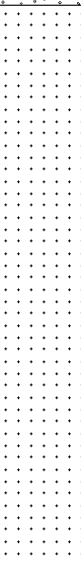
Appendix G

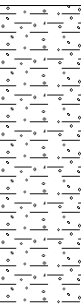
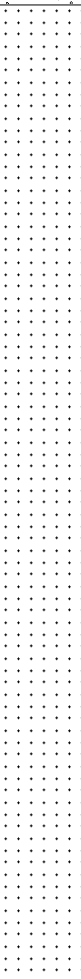
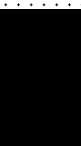
Probehole Logs

				Borehole Log				Borehole No. PH01 Sheet 1 of 3	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419002.40 - 426630.79		Hole Type PH	
Location: West Yorkshire				Level: 101.55		Scale 1:50			
Client: Harron Homes				Dates: 01/04/2019 - 01/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					2.50	99.05		Overburden.	1
								Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	3
								Soft dark grey MUDSTONE with coal traces. (WHEATLEY LIME COAL)	9
								Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	10
Continued on next sheet									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

					Borehole Log			Borehole No. PH01 Sheet 2 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419002.40 - 426630.79		Hole Type PH
Location: West Yorkshire					Level: 101.55		Scale 1:50		
Client: Harron Homes					Dates: 01/04/2019 - 01/04/2019		Logged By CC		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
									11
									12
									13
									14
									15
									16
									17
									18
									19
									20
Continued on next sheet									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									
									

					Borehole Log			Borehole No. PH01 Sheet 3 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419002.40 - 426630.79		Hole Type PH
Location: West Yorkshire					Level: 101.55		Scale 1:50		
Client: Harron Homes					Dates: 01/04/2019 - 01/04/2019		Logged By CC		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					27.00	74.55			21
									22
									23
									24
									25
									26
									27
									28
									29
									30
End of borehole at 27.00 m									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									
									

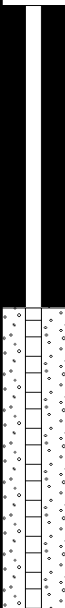
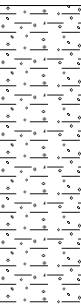
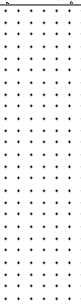
				Borehole Log				Borehole No. PH01A Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419005.06 - 426633.53		Hole Type PH	
Location: West Yorkshire				Level: 101.55		Scale 1:50			
Client: Harron Homes				Dates: 01/04/2019 - 01/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					2.30	99.25		Overburden.	1
								Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	2
									3
									4
									5
					6.00	95.55		End of borehole at 6.00 m	6
									7
									8
									9
									10
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

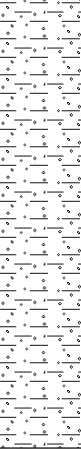
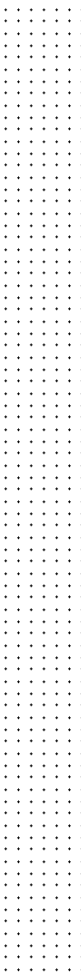
					Borehole Log			Borehole No. PH02 Sheet 1 of 2	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418967.90 - 426582.97		Hole Type PH
Location: West Yorkshire					Level: 101.35		Scale 1:50		
Client: Harron Homes					Dates: 01/04/2019 - 01/04/2019		Logged By CC		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					2.00	99.35		Overburden.	1
								Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	2
									3
									4
					8.50	92.85		Black COAL. (WHEATLEY LIME COAL)	9
					9.50	91.85		Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	10
Continued on next sheet									

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.



					Borehole Log			Borehole No. PH02 Sheet 2 of 2	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418967.90 - 426582.97		Hole Type PH
Location: West Yorkshire					Level: 101.35		Scale 1:50		
Client: Harron Homes					Dates: 01/04/2019 - 01/04/2019		Logged By CC		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					12.00	89.35			11
								End of borehole at 12.00 m	12
									13
									14
									15
									16
									17
									18
									19
									20
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

				Borehole Log				Borehole No. PH02A Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418966.56 - 426580.95		Hole Type PH	
Location: West Yorkshire				Level: 101.40		Scale 1:50			
Client: Harron Homes				Dates: 01/04/2019 - 01/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					2.00	99.40		Overburden.	1
					4.00	97.40		Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	2
							End of borehole at 4.00 m		4
									5
									6
									7
									8
									9
									10
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

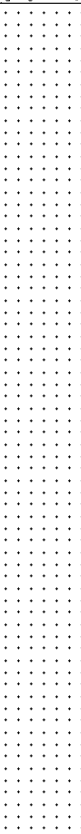
				Borehole Log				Borehole No. PH03 Sheet 1 of 3	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418911.78 - 426542.47		Hole Type PH	
Location: West Yorkshire				Level: 101.65		Scale 1:50			
Client: Harron Homes				Dates: 01/04/2019 - 01/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					3.00	98.65		Overburden.	1
								Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	3
									4
									5
									6
									7
									8
									9
					9.50	92.15		Black COAL (WHEATLEY LIME COAL)	10
Continued on next sheet									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

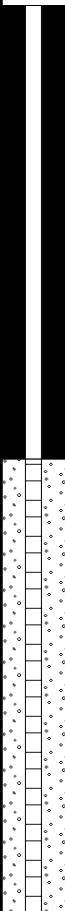
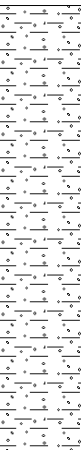
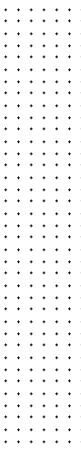
					Borehole Log			Borehole No. PH03 Sheet 2 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418911.78 - 426542.47		Hole Type PH
Location: West Yorkshire					Level: 101.65		Scale 1:50		Logged By CC
Client: Harron Homes					Dates: 01/04/2019 - 01/04/2019				

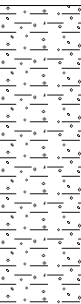
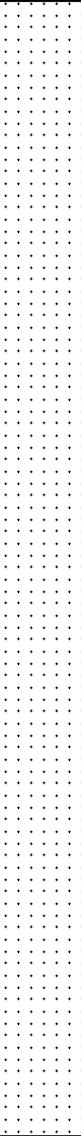
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					10.50	91.15			
						20.00	81.65		Continued on next sheet

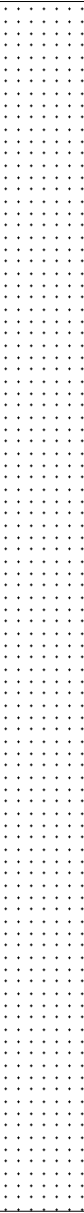
Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

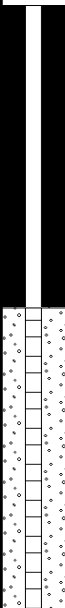
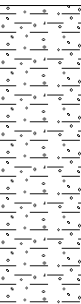
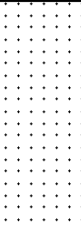


					Borehole Log			Borehole No. PH03 Sheet 3 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418911.78 - 426542.47		Hole Type PH
Location: West Yorkshire					Level: 101.65		Scale 1:50		
Client: Harron Homes					Dates: 01/04/2019 - 01/04/2019		Logged By CC		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					21.50	80.15		Soft ground, lost flush. (MIDDLETON 11 YARD COAL) <u>From 20.0m, lost flush</u>	21
								Hard ground, no returns. (COAL MEASURES)	22
					27.00	74.65			23
									25
									26
									27
								End of borehole at 27.00 m	28
									29
									30
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

				Borehole Log				Borehole No. PH03A Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418908.89 - 426540.44		Hole Type PH	
Location: West Yorkshire				Level: 101.50		Scale 1:50			
Client: Harron Homes				Dates: 01/04/2019 - 01/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					3.00	98.50		Overburden.	1
									Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)
					6.00	95.50		End of borehole at 6.00 m	3
									4
									5
									6
									7
									8
									9
									10
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

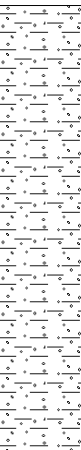
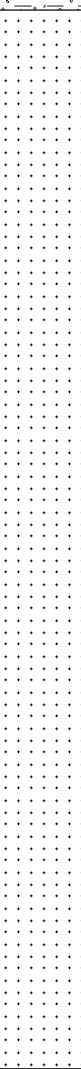
				Borehole Log			Borehole No. PH04 Sheet 1 of 2		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419107.28 - 426641.55		Hole Type PH	
Location: West Yorkshire				Level: 96.25		Scale 1:50			
Client: Harron Homes				Dates: 02/04/2019 - 02/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								Overburden.	1
					2.00	94.25		Black COAL. (WHEATLEY LIME COAL)	2
					2.50	93.75		Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	3
									4
									5
									6
									7
									8
									9
									10
Continued on next sheet									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

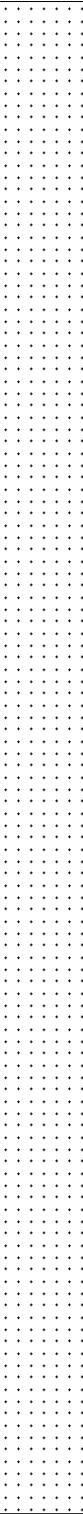
					Borehole Log			Borehole No. PH04 Sheet 2 of 2	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419107.28 - 426641.55		Hole Type PH
Location: West Yorkshire					Level: 96.25		Scale 1:50		
Client: Harron Homes					Dates: 02/04/2019 - 02/04/2019		Logged By CC		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					18.00	78.25			11
									12
									13
									14
									15
									16
									17
									18
									19
									20
									Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

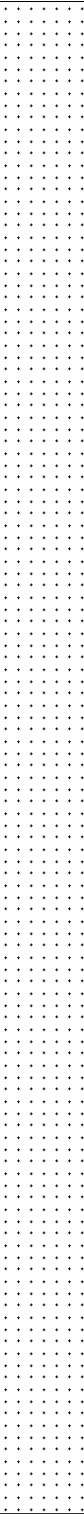
				Borehole Log				Borehole No. PH04A Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419110.35 - 426640.42		Hole Type PH	
Location: West Yorkshire				Level: 95.90		Scale 1:50			
Client: Harron Homes				Dates: 02/04/2019 - 02/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								Overburden.	1
					2.00	93.90		Black COAL. (WHEATLEY LIME COAL)	2
					2.50	93.40		Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	3
					4.00	91.90	End of borehole at 4.00 m		
									5
									6
									7
									8
									9
									10

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.



				Borehole Log				Borehole No. PH05 Sheet 1 of 4	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419243.36 - 426633.84		Hole Type PH	
Location: West Yorkshire				Level: 87.10		Scale 1:50			
Client: Harron Homes				Dates: 02/04/2019 - 02/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					3.00	84.10		Overburden.	1
								Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	2
									3
									4
									5
									6
									7
									8
									9
									10
Continued on next sheet									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

					Borehole Log			Borehole No. PH05 Sheet 2 of 4		
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419243.36 - 426633.84		Hole Type PH	
Location: West Yorkshire					Level: 87.10		Scale 1:50		Logged By CC	
Client: Harron Homes					Dates: 02/04/2019 - 02/04/2019					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
									11	
									12	
									13	
									14	
									15	
									16	
									17	
									18	
									19	
									20	
Continued on next sheet										
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.										
										

					Borehole Log			Borehole No. PH05 Sheet 3 of 4		
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419243.36 - 426633.84		Hole Type PH	
Location: West Yorkshire					Level: 87.10		Scale 1:50		Logged By CC	
Client: Harron Homes					Dates: 02/04/2019 - 02/04/2019					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
									21	
									22	
									23	
									24	
									25	
									26	
									27	
									28	
									29	
									30	
Continued on next sheet										
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.										
										



PH05

Sheet 4 of 4

Project Name: Merchant Fields, Cleckheaton

Project No.
2828

Co-ords: 419243.36 - 426633.84

Hole Type
PH

Location: West Yorkshire

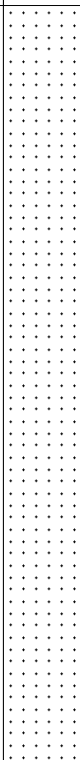
Level: 87.10

Scale
1:50

Client: Harron Homes

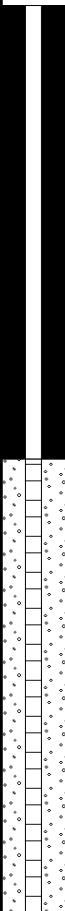
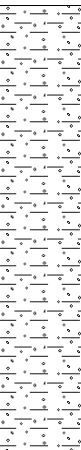
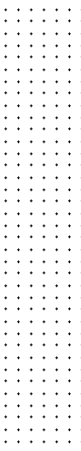
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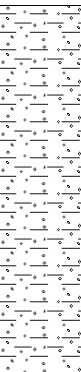
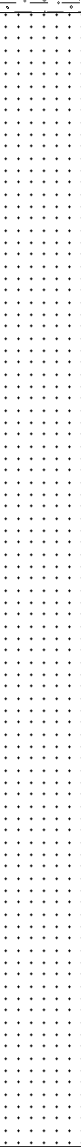
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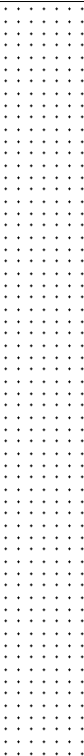
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					35.00	52.10			31
									32
									33
									34
									35
									36
									37
									38
									39
									40

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

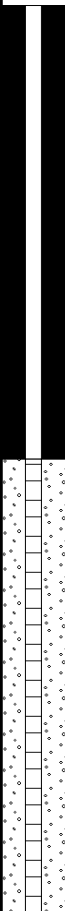
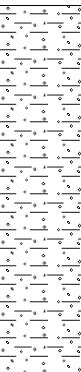
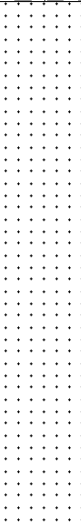


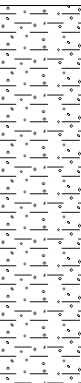
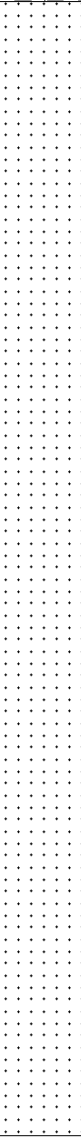
				Borehole Log			Borehole No. PH05A Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419240.69 - 426633.79		Hole Type PH	
Location: West Yorkshire				Level: 87.35		Scale 1:50			
Client: Harron Homes				Dates: 02/04/2019 - 02/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					3.00	84.35		Overburden.	1
					6.00	81.35		Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	2
							End of borehole at 6.00 m		3
									4
									5
									6
									7
									8
									9
									10
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

				Borehole Log				Borehole No. PH06 Sheet 1 of 2	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419159.45 - 426604.72		Hole Type PH	
Location: West Yorkshire				Level: 90.55		Scale 1:50			
Client: Harron Homes				Dates: 02/04/2019 - 02/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					2.50	88.05		Overburden.	1
								Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	2
									3
									4
									5
									6
									7
									8
									9
									10
Continued on next sheet									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

					Borehole Log			Borehole No. PH06 Sheet 2 of 2									
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419159.45 - 426604.72		Hole Type PH								
Location: West Yorkshire					Level: 90.55		Scale 1:50										
Client: Harron Homes					Dates: 02/04/2019 - 02/04/2019		Logged By CC										
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description									
		Depth (m)	Type	Results													
					15.00	75.55			11								
									12								
									13								
									14								
									15								
									16								
									17								
									18								
									19								
									20								
									End of borehole at 15.00 m								

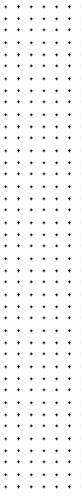
Remarks	
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.	

				Borehole Log				Borehole No. PH06A Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419162.05 - 426603.53		Hole Type PH	
Location: West Yorkshire				Level: 90.40		Scale 1:50			
Client: Harron Homes				Dates: 02/04/2019 - 02/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					2.50	87.90		Overburden.	1
								Light greyish brown interbedded SANDSTONE and MUDSTONE (COAL MEASURES)	2
					6.00	84.40		End of borehole at 6.00 m	3
									4
									5
									6
									7
									8
									9
									10
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

				Borehole Log				Borehole No. PH07 Sheet 1 of 2	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419196.53 - 426571.84		Hole Type PH	
Location: West Yorkshire				Level: 87.25		Scale 1:50			
Client: Harron Homes				Dates: 02/04/2019 - 02/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					2.50	84.75		Overburden.	1
								Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	2
									3
									4
									5
									6
									7
									8
									9
									10
Continued on next sheet									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

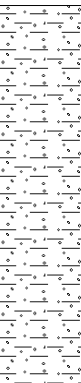
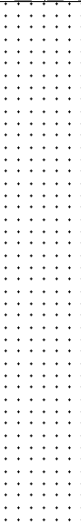
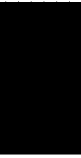
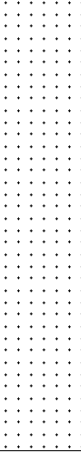
					Borehole Log			Borehole No. PH07 Sheet 2 of 2		
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419196.53 - 426571.84		Hole Type PH	
Location: West Yorkshire					Level: 87.25		Scale 1:50			
Client: Harron Homes					Dates: 02/04/2019 - 02/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					12.50	74.75			11	
					12.70	74.55		Black COAL. (MIDDLETON 11 YARD COAL)	12	
								Light greyish brown MUDSTONE. (COAL MEASURES)	13	
					13.50	73.75		Black COAL. (MIDDLETON 11 YARD COAL)		
					13.70	73.55		Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	14	
									15	
									16	
									17	
					18.00	69.25		End of borehole at 18.00 m	18	
									19	
									20	
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.										

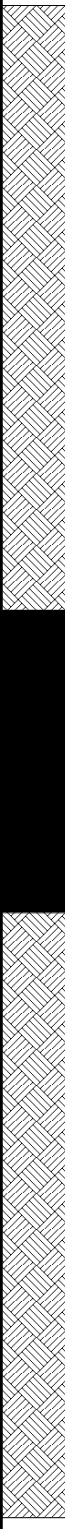
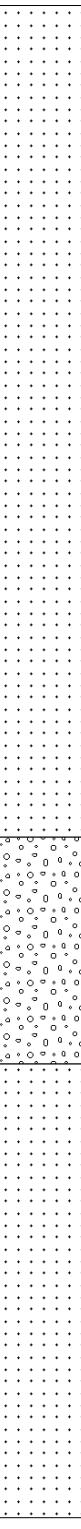
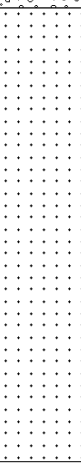
				Borehole Log				Borehole No. PH08 Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419093.10 - 426548.43		Hole Type PH	
Location: West Yorkshire				Level: 94.90		Scale 1:50			
Client: Harron Homes				Dates: 02/04/2019 - 02/04/2019		Logged By CC			

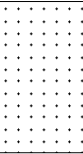
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								Overburden.	1
									2
					2.50 2.60	92.40 92.30		Black COAL. (WHEATLEY LIME COAL)	3
								Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	4
									5
					6.00	88.90		End of borehole at 6.00 m	6
									7
									8
									9
									10

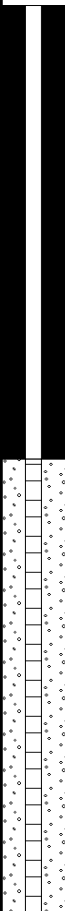
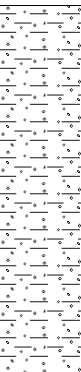
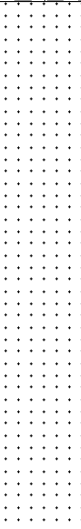
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.		

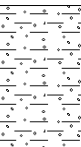
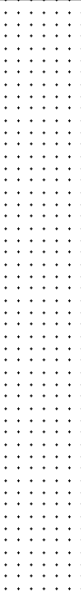
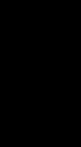
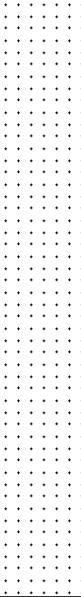
				Borehole Log			Borehole No. PH08A Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419094.47 - 426548.84		Hole Type PH	
Location: West Yorkshire				Level: 94.70		Scale 1:50			
Client: Harron Homes				Dates: 02/04/2019 - 02/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								Overburden	1
									2
					2.50 2.60	92.20 92.10		Black COAL. (WHEATLEY LIME COAL) Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	3
									4
									5
					6.00	88.70		End of borehole at 6.00 m	6
									7
									8
									9
									10
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

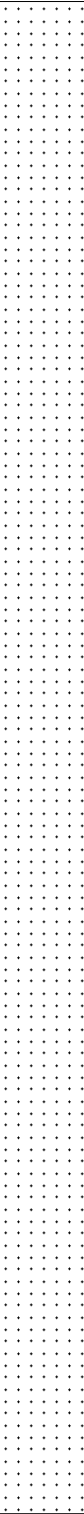
				Borehole Log				Borehole No. PH09 Sheet 1 of 3	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418867.45 - 426462.49		Hole Type PH	
Location: West Yorkshire				Level: 99.45		Scale 1:50			
Client: Harron Homes				Dates: 03/04/2019 - 03/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					2.50	96.95		Overburden.	1
								Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	3
								Soft Black COAL. (WHEATLEY LIME COAL)	6
								Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	7
					6.00	93.45			
					7.00	92.45			
Continued on next sheet									10
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

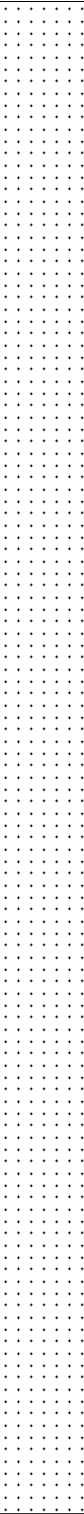
					Borehole Log			Borehole No. PH09 Sheet 2 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418867.45 - 426462.49		Hole Type PH
Location: West Yorkshire					Level: 99.45		Scale 1:50		
Client: Harron Homes					Dates: 03/04/2019 - 03/04/2019		Logged By CC		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					15.50	83.95		Soft broken ground, lost flush (MIDDLETON 11 YARD COAL) <i>From 15.5m, lost flush.</i>	11
					17.00	82.45			
									14
									15
									16
									17
									18
									19
									20
Continued on next sheet									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

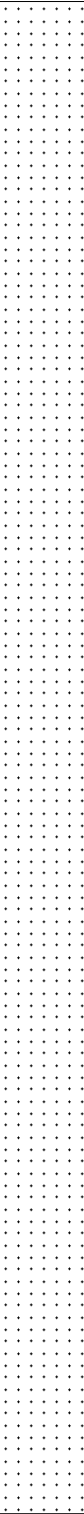
					Borehole Log			Borehole No. PH09 Sheet 3 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418867.45 - 426462.49		Hole Type PH
Location: West Yorkshire					Level: 99.45		Scale 1:50		Logged By CC
Client: Harron Homes					Dates: 03/04/2019 - 03/04/2019				
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					21.00	78.45		End of borehole at 21.00 m	21
									22
									23
									24
									25
									26
									27
									28
									29
									30
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

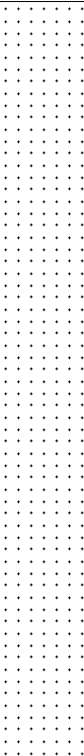
				Borehole Log				Borehole No. PH09A Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418870.11 - 426461.23		Hole Type PH	
Location: West Yorkshire				Level: 99.50		Scale 1:50			
Client: Harron Homes				Dates: 03/04/2019 - 03/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					2.50	97.00		Overburden.	1
								Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	2
					6.00	93.50		End of borehole at 6.00 m	3
									4
									5
									6
									7
									8
									9
									10
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

					Borehole Log			Borehole No. PH10 Sheet 1 of 5		
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418929.55 - 426429.83		Hole Type PH	
Location: West Yorkshire					Level: 98.55		Scale 1:50			
Client: Harron Homes					Dates: 03/04/2019 - 03/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					1.00	97.55		Overburden.		
								Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	1	
										2
										3
					5.00	93.55		Black COAL. (WHEATLEY LIME COAL)	5	
					6.00	92.55		Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	6	
									7	
									8	
									9	
									10	
Continued on next sheet										
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.										

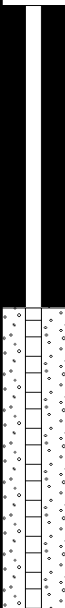
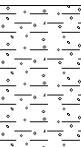
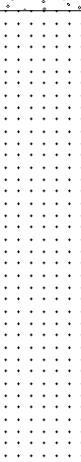
					Borehole Log			Borehole No. PH10 Sheet 2 of 5		
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418929.55 - 426429.83		Hole Type PH	
Location: West Yorkshire					Level: 98.55		Scale 1:50		Logged By CC	
Client: Harron Homes					Dates: 03/04/2019 - 03/04/2019					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
									11 12 13 14 15 16 17 18 19 20	
Continued on next sheet										
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.										
										

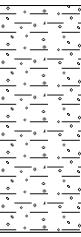
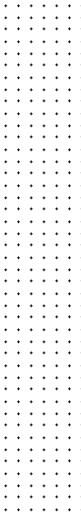
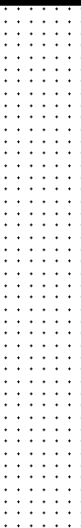
					Borehole Log			Borehole No. PH10 Sheet 3 of 5		
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418929.55 - 426429.83		Hole Type PH	
Location: West Yorkshire					Level: 98.55		Scale 1:50		Logged By CC	
Client: Harron Homes					Dates: 03/04/2019 - 03/04/2019					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
									21	
									22	
									23	
									24	
									25	
									26	
									27	
									28	
									29	
									30	
Continued on next sheet										
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.										

					Borehole Log			Borehole No. PH10 Sheet 4 of 5		
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418929.55 - 426429.83		Hole Type PH	
Location: West Yorkshire					Level: 98.55		Scale 1:50		Logged By CC	
Client: Harron Homes					Dates: 03/04/2019 - 03/04/2019					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
									31	
									32	
									33	
									34	
									35	
									36	
									37	
									38	
									39	
									40	
Continued on next sheet										
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.										

					Borehole Log			Borehole No. PH10 Sheet 5 of 5									
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418929.55 - 426429.83		Hole Type PH								
Location: West Yorkshire					Level: 98.55		Scale 1:50										
Client: Harron Homes					Dates: 03/04/2019 - 03/04/2019		Logged By CC										
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description									
		Depth (m)	Type	Results													
					45.00	53.55			41								
									42								
									43								
									44								
									45								
									46								
									47								
									48								
									49								
									50								
									End of borehole at 45.00 m								

Remarks	
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.	

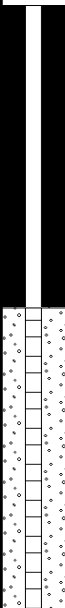
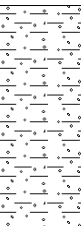
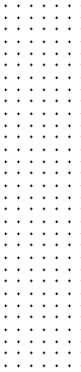
				Borehole Log				Borehole No. PH10A Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418932.35 - 426428.49		Hole Type PH	
Location: West Yorkshire				Level: 98.45		Scale 1:50			
Client: Harron Homes				Dates: 03/04/2019 - 03/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.00	97.45		Overburden.	
					4.00	94.45		Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	1
End of borehole at 4.00 m									2
									3
									4
									5
									6
									7
									8
									9
									10
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

					Borehole Log			Borehole No. PH11 Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418901.90 - 426384.91		Hole Type PH
Location: West Yorkshire					Level: 96.40		Scale 1:50		
Client: Harron Homes					Dates: 03/04/2019 - 03/04/2019		Logged By CC		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.50	94.90		Overburden.	1
								Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	2
					5.00	91.40		Black COAL (WHEATLEY LIME COAL)	5
					5.50	90.90		Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	6
					9.00	87.40	End of borehole at 9.00 m		9
									10

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

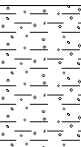
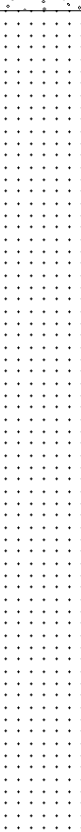
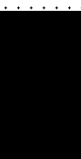
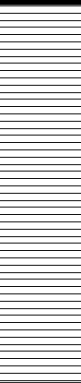


				Borehole Log				Borehole No. PH11A Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418902.60 - 426382.85		Hole Type PH	
Location: West Yorkshire				Level: 96.30		Scale 1:50			
Client: Harron Homes				Dates: 03/04/2019 - 03/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.50	94.80		Overburden.	1
					4.00	92.30		Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	2
End of borehole at 4.00 m									4
									5
									6
									7
									8
									9
									10

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.



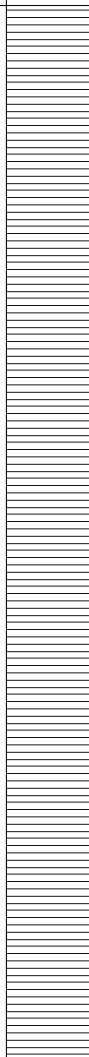
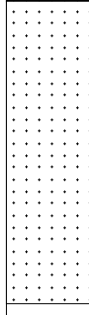
				Borehole Log			Borehole No. PH12 Sheet 1 of 3	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418853.78 - 426417.55		Hole Type PH
Location: West Yorkshire				Level: 96.50		Scale 1:50		
Client: Harron Homes				Dates: 03/04/2019 - 03/04/2019		Logged By CC		

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
								Overburden.		
					1.00	95.50		Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	1	
										2
										3
										4
										5
										6
										7
										8
										9
					6.50	90.00		Black COAL. (WHEATLEY LIME COAL)	7	
					7.50	89.00		Light greyish brown MUDSTONE. (COAL MEASURES)	8	
									9	
									10	

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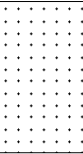
Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

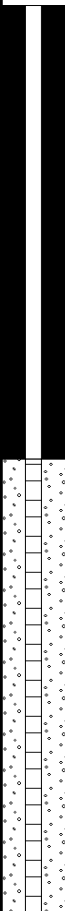
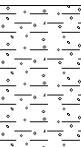
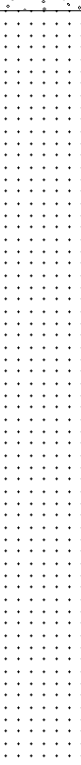


					Borehole Log			Borehole No. PH12 Sheet 2 of 3		
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418853.78 - 426417.55		Hole Type PH	
Location: West Yorkshire					Level: 96.50		Scale 1:50			
Client: Harron Homes					Dates: 03/04/2019 - 03/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
									11 12 13 14 15 16 17 18 19 20	
					18.00	78.50		Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)		
Continued on next sheet										

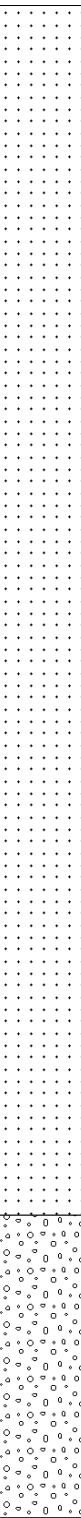
Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.



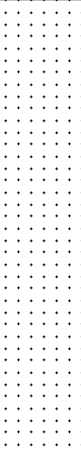
					Borehole Log			Borehole No. PH12 Sheet 3 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418853.78 - 426417.55		Hole Type PH
Location: West Yorkshire					Level: 96.50		Scale 1:50		
Client: Harron Homes					Dates: 03/04/2019 - 03/04/2019		Logged By CC		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					21.00	75.50		End of borehole at 21.00 m	21
									22
									23
									24
									25
									26
									27
									28
									29
									30
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

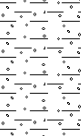
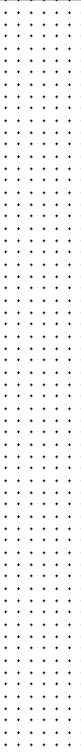
				Borehole Log			Borehole No. PH12A Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418855.00 - 426415.44		Hole Type PH	
Location: West Yorkshire				Level: 96.50		Scale 1:50			
Client: Harron Homes				Dates: 03/04/2019 - 03/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.00	95.50		Overburden.	
								Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	1
									2
									3
									4
									5
					6.00	90.50		End of borehole at 6.00 m	6
									7
									8
									9
									10
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

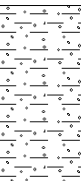
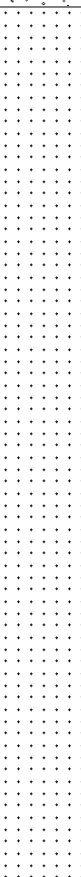
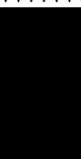
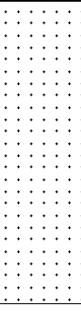
				Borehole Log				Borehole No. PH13 Sheet 1 of 3	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418912.56 - 426481.11		Hole Type PH	
Location: West Yorkshire				Level: 100.65		Scale 1:50			
Client: Harron Homes				Dates: 03/04/2019 - 03/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden.		
				1.00	99.65		Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	1	
								2	
								3	
								4	
								5	
								6	
								7	
				7.50	93.15		Black COAL. (WHEATLEY LIME COAL)	8	
				8.50	92.15		Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	9	
								10	
Continued on next sheet									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									
									

					Borehole Log			Borehole No. PH13 Sheet 2 of 3									
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418912.56 - 426481.11		Hole Type PH								
Location: West Yorkshire					Level: 100.65		Scale 1:50										
Client: Harron Homes					Dates: 03/04/2019 - 03/04/2019		Logged By CC										
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description									
		Depth (m)	Type	Results													
					18.00	82.65			11								
									12								
									13								
									14								
									15								
									16								
									17								
									18								
									19								
									20								
									Continued on next sheet								
									Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.								

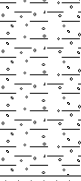
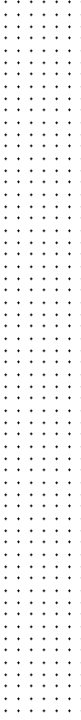


					Borehole Log			Borehole No. PH13 Sheet 3 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418912.56 - 426481.11		Hole Type PH
Location: West Yorkshire					Level: 100.65		Scale 1:50		
Client: Harron Homes					Dates: 03/04/2019 - 03/04/2019		Logged By CC		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					21.00	79.65		Hard ground, no returns. (COAL MEASURES)	21
					24.00	76.65			24
							End of borehole at 24.00 m		24
									25
									26
									27
									28
									29
									30
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

					Borehole Log			Borehole No. PH13A Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418914.20 - 426482.47		Hole Type PH
Location: West Yorkshire					Level: 100.70		Scale 1:50		
Client: Harron Homes					Dates: 03/04/2019 - 03/04/2019		Logged By CC		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.00	99.70		Overburden.	
					6.00	94.70		Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	1
									2
									3
									4
									5
									6
								End of borehole at 6.00 m	7
									8
									9
									10
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

				Borehole Log				Borehole No. PH14 Sheet 1 of 2	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418964.97 - 426495.30		Hole Type PH	
Location: West Yorkshire				Level: 100.35		Scale 1:50			
Client: Harron Homes				Dates: 03/04/2019 - 03/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.20	99.15		Overburden.	1
								Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	2
					7.00	93.35		Black COAL (WHEATLEY LIME COAL)	7
					8.00	92.35		Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	8
Continued on next sheet									10
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

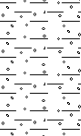
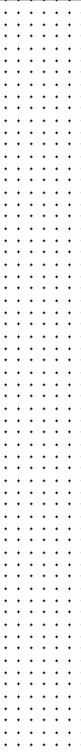
					Borehole Log			Borehole No. PH14 Sheet 2 of 2			
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418964.97 - 426495.30		Hole Type PH		
Location: West Yorkshire					Level: 100.35		Scale 1:50		Logged By CC		
Client: Harron Homes					Dates: 03/04/2019 - 03/04/2019						
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
					12.00	88.35		End of borehole at 12.00 m	11		
									12		
									13		
									14		
									15		
									16		
									17		
									18		
									19		
									20		
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.											

				Borehole Log			Borehole No. PH14A Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418967.23 - 426496.23		Hole Type PH	
Location: West Yorkshire				Level: 100.30		Scale 1:50			
Client: Harron Homes				Dates: 03/04/2019 - 03/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.20	99.10		Overburden.	1
								Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	2
									3
									4
									5
					6.00	94.30		End of borehole at 6.00 m	6
									7
									8
									9
									10
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

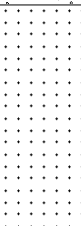
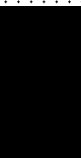
				Borehole Log				Borehole No. PH15 Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419021.10 - 426572.83		Hole Type PH	
Location: West Yorkshire				Level: 100.05		Scale 1:50			
Client: Harron Homes				Dates: 03/04/2019 - 03/04/2019		Logged By CC			

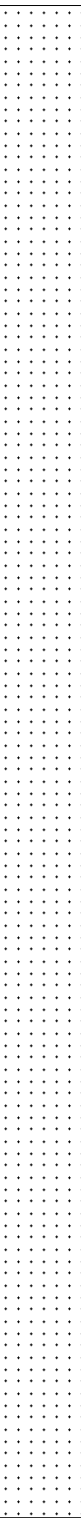
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.00	99.05		Overburden.	1 2 3 4 5 6 7 8 9 10
								Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	
					7.20	92.85		Black COAL. (WHEATLEY LIME COAL)	
					8.20	91.85		Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	
					9.00	91.05		End of hole at 9.0m, ran out of water. End of borehole at 9.00 m	

Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.		

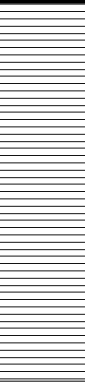
				Borehole Log			Borehole No. PH15A Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419023.56 - 426573.15		Hole Type PH	
Location: West Yorkshire				Level: 99.90		Scale 1:50			
Client: Harron Homes				Dates: 04/04/2019 - 04/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.00	98.90		Overburden.	
					6.00	93.90		Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	1 2 3 4 5 6 7 8 9 10
End of borehole at 6.00 m									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

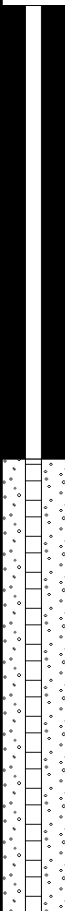
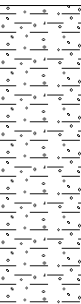
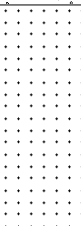
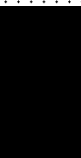
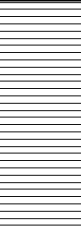


				Borehole Log			Borehole No. PH16 Sheet 1 of 4		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418990.41 - 426188.26		Hole Type PH	
Location: West Yorkshire				Level: 82.55		Scale 1:50			
Client: Harron Homes				Dates: 04/04/2019 - 04/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden.		1
					2.00	80.55		Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	2
					3.50	79.05		Black COAL. (MIDDLETON 11 YARD COAL)	4
					4.50	78.05		Light greyish brown MUDSTONE. (COAL MEASURES)	5
					5.00	77.55		Black COAL. (MIDDLETON 11 YARD COAL)	6
					5.20	77.35		Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	7
									8
									9
									10
	Continued on next sheet								
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

					Borehole Log			Borehole No. PH16 Sheet 2 of 4	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418990.41 - 426188.26		Hole Type PH
Location: West Yorkshire					Level: 82.55		Scale 1:50		
Client: Harron Homes					Dates: 04/04/2019 - 04/04/2019		Logged By CC		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
									11
									12
									13
									14
									15
									16
									17
									18
									19
									20
Continued on next sheet									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

					Borehole Log			Borehole No. PH16 Sheet 3 of 4	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418990.41 - 426188.26		Hole Type PH
Location: West Yorkshire					Level: 82.55		Scale 1:50		Logged By CC
Client: Harron Homes					Dates: 04/04/2019 - 04/04/2019				
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
									21
									22
									23
									24
									25
									26
									27
									28
									29
									30
					30.00	52.55	Continued on next sheet		
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

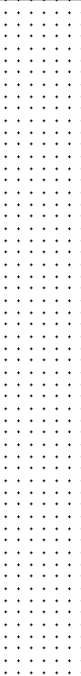
					Borehole Log			Borehole No. PH16 Sheet 4 of 4	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418990.41 - 426188.26		Hole Type PH
Location: West Yorkshire					Level: 82.55		Scale 1:50		
Client: Harron Homes					Dates: 04/04/2019 - 04/04/2019		Logged By CC		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					30.50	52.05		Black COAL. (BLOCKING COAL)	
								Light greyish brown MUDSTONE. (COAL MEASURES)	31
					33.00	49.55		End of borehole at 33.00 m	33
									34
									35
									36
									37
									38
									39
									40
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

				Borehole Log			Borehole No. PH16A Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418988.68 - 426188.22		Hole Type PH	
Location: West Yorkshire				Level: 82.60		Scale 1:50			
Client: Harron Homes				Dates: 04/04/2019 - 04/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								Overburden.	1
					2.00	80.60		Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	2
					3.50	79.10		Black COAL. (MIDDLETON 11 YARD COAL)	4
					4.50	78.10		Light greyish brown MUDSTONE. (COAL MEASURES)	5
					6.00	76.60	End of borehole at 6.00 m		
									7
									8
									9
									10

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.



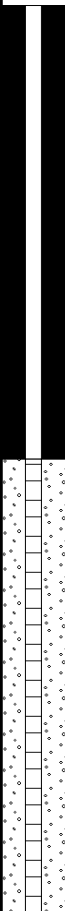
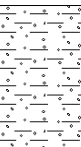
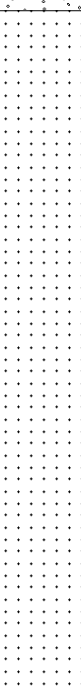
					Borehole Log			Borehole No. PH17 Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418967.95 - 426281.29		Hole Type PH
Location: West Yorkshire					Level: 87.45		Scale 1:50		
Client: Harron Homes					Dates: 04/04/2019 - 04/04/2019		Logged By CC		

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
							Overburden.			
					1.00	86.45		Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	1	
										2
										3
					5.50	81.95	Black COAL. (MIDDLETON 11 YARD COAL)	6		
					7.00	80.45		Light greyish brown MUDSTONE. (COAL MEASURES)	7	
									8	
					9.00	78.45	End of borehole at 9.00 m		9	
									10	

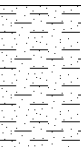
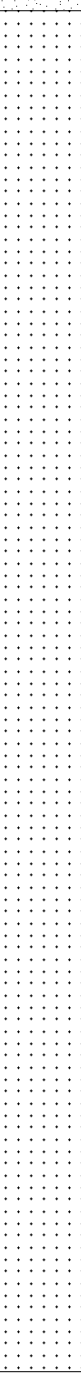
Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

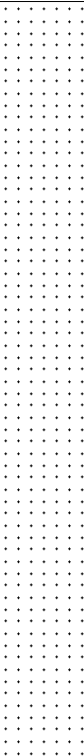


					Borehole Log			Borehole No. PH17A Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418967.36 - 426282.97		Hole Type PH
Location: West Yorkshire					Level: 87.50		Scale 1:50		Logged By CC
Client: Harron Homes					Dates: 04/04/2019 - 04/04/2019				

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.00	86.50		Overburden.	
								Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	1
									2
									3
					5.50	82.00		Black COAL. (MIDDLETON 11 YARD COAL)	4
					6.00	81.50	End of borehole at 6.00 m		5
									6
									7
									8
									9
									10

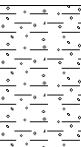
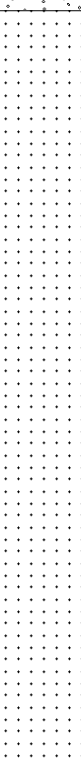
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.		

					Borehole Log			Borehole No. PH18 Sheet 1 of 2	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418961.64 - 426380.64		Hole Type PH
Location: West Yorkshire					Level: 92.50		Scale 1:50		
Client: Harron Homes					Dates: 04/04/2019 - 04/04/2019		Logged By CC		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.00	91.50		Overburden.	
								Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	1
									2
									3
									4
									5
									6
									7
									8
									9
									10
Continued on next sheet									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

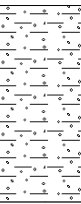
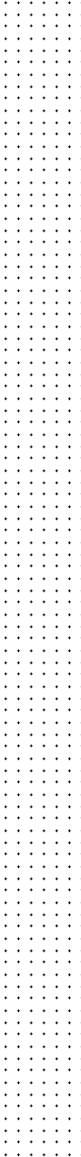
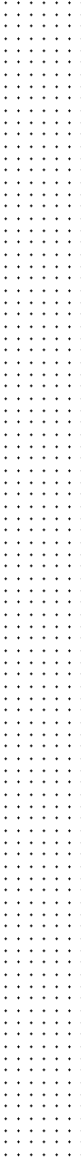
					Borehole Log			Borehole No. PH18 Sheet 2 of 2									
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418961.64 - 426380.64		Hole Type PH								
Location: West Yorkshire					Level: 92.50		Scale 1:50		Logged By CC								
Client: Harron Homes					Dates: 04/04/2019 - 04/04/2019												
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description									
		Depth (m)	Type	Results													
					15.00	77.50			11								
									12								
									13								
									14								
									15								
									16								
									17								
									18								
									19								
									20								
									End of borehole at 15.00 m								

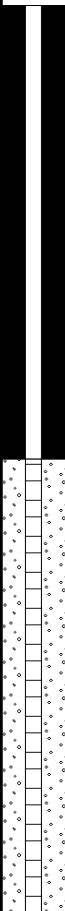
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

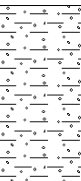
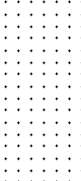
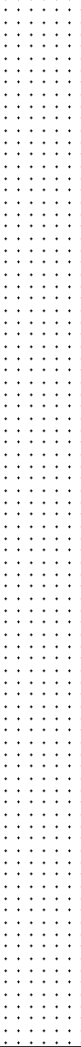
					Borehole Log			Borehole No. PH18A Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418962.29 - 426378.91		Hole Type PH
Location: West Yorkshire					Level: 92.40		Scale 1:50		Logged By CC
Client: Harron Homes					Dates: 04/04/2019 - 04/04/2019				

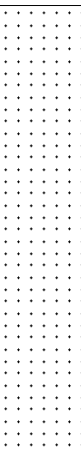
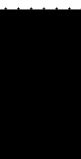
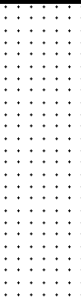
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.00	91.40		Overburden.	
								Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	1
									2
									3
									4
									5
					6.00	86.40		End of borehole at 6.00 m	6
									7
									8
									9
									10

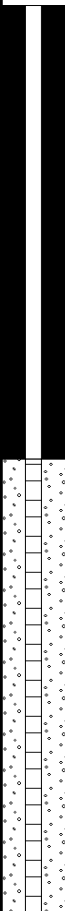
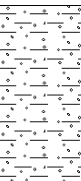
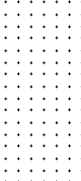
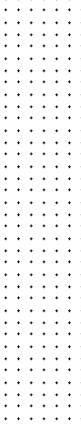
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.		

				Borehole Log				Borehole No. PH19 Sheet 1 of 1																					
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419030.36 - 426343.95		Hole Type PH																					
Location: West Yorkshire				Level: 88.00		Scale 1:50																							
Client: Harron Homes				Dates: 04/04/2019 - 04/04/2019		Logged By CC																							
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description																					
		Depth (m)	Type	Results																									
					1.30	86.70		Overburden.	1																				
								Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	2																				
									3																				
													4																
																	5												
																					6								
																									7				
																													8
					9.00	79.00		End of borehole at 9.00 m	10																				
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.																													

				Borehole Log			Borehole No. PH19A Sheet 1 of 1		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419029.37 - 426344.86		Hole Type PH	
Location: West Yorkshire				Level: 88.05		Scale 1:50			
Client: Harron Homes				Dates: 04/04/2019 - 04/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.30	86.75		Overburden.	1
								Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	2
									3
									4
									5
					6.00	82.05		End of borehole at 6.00 m	6
									7
									8
									9
									10
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

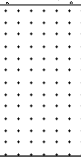
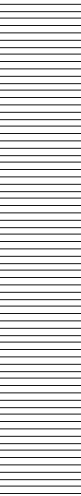
				Borehole Log				Borehole No. PH20 Sheet 1 of 2	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418852.84 - 426366.81		Hole Type PH	
Location: West Yorkshire				Level: 92.45		Scale 1:50			
Client: Harron Homes				Dates: 04/04/2019 - 04/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
									
					1.20	91.25		Overburden.	1
					2.50	89.95		Light greyish brown SANDSTONE. (COAL MEASURES)	2
					3.00	89.45		Black COAL. (WHEATLEY LIME COAL)	3
								Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	4
									5
									6
									7
									8
									9
									10
Continued on next sheet									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

					Borehole Log			Borehole No. PH20 Sheet 2 of 2	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418852.84 - 426366.81		Hole Type PH
Location: West Yorkshire					Level: 92.45		Scale 1:50		
Client: Harron Homes					Dates: 04/04/2019 - 04/04/2019		Logged By CC		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					13.00	79.45			11
					14.00	78.45		Black COAL. (MIDDLETON 11 YARD COAL)	13
					16.00	76.45		Light greyish brown interbedded SANDSTONE. (COAL MEASURES)	14
							End of borehole at 16.00 m		16
									17
									18
									19
									20
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									

					Borehole Log			Borehole No. PH20A Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418854.56 - 426367.28		Hole Type PH
Location: West Yorkshire					Level: 92.70		Scale 1:50		Logged By CC
Client: Harron Homes					Dates: 04/04/2019 - 04/04/2019				
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.20	91.50		Overburden.	1
					2.50	90.20		Light greyish brown SANDSTONE. (COAL MEASURES)	2
					3.00	89.70		Black COAL. (WHEATLEY LIME COAL)	3
								Light greyish brown interbedded SANDSTONE and MUDSTONE (COAL MEASURES)	4
					6.00	86.70		End of borehole at 6.00 m	6
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.									



					Borehole Log			Borehole No. PH21 Sheet 1 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419174.88 - 426662.34		Hole Type PH
Location: West Yorkshire					Level: 91.60		Scale 1:50		
Client: Harron Homes					Dates: 11/06/2019 - 11/06/2019		Logged By LEW		

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden.	1	
					2.00	89.60		Brown SANDSTONE. (COAL MEASURES)	2
					3.00	88.60		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	3
									4
									5
									6
					6.30 6.40	85.30 85.20		Black COAL. Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	7
									8
									9
									10

Continued on next sheet

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



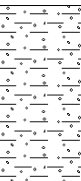
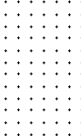
					Borehole Log			Borehole No. PH21 Sheet 2 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419174.88 - 426662.34		Hole Type PH
Location: West Yorkshire					Level: 91.60		Scale 1:50		
Client: Harron Homes					Dates: 11/06/2019 - 11/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
									11
									12
									13
									14
									15
									16
									17
									18
									19
									20
					17.50	74.10		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	18
Continued on next sheet								20	
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.									

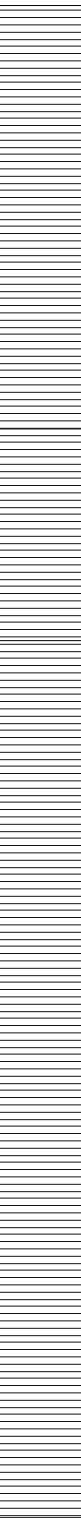
					Borehole Log			Borehole No. PH21 Sheet 3 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419174.88 - 426662.34		Hole Type PH
Location: West Yorkshire					Level: 91.60		Scale 1:50		
Client: Harron Homes					Dates: 11/06/2019 - 11/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					21.00	70.60		End of borehole at 21.00 m	21
									22
									23
									24
									25
									26
									27
									28
									29
									30

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



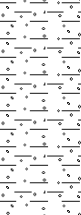
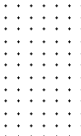
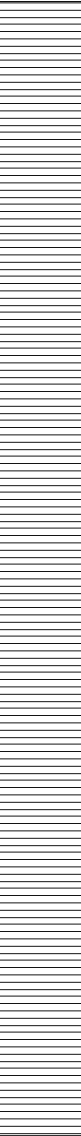
					Borehole Log			Borehole No. PH22 Sheet 1 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419204.02 - 426604.84		Hole Type PH
Location: West Yorkshire					Level: 88.40		Scale 1:50		
Client: Harron Homes					Dates: 11/06/2019 - 11/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.20	87.20		Overburden.	1
								Brown SANDSTONE. (COAL MEASURES)	2
					2.20	86.20		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	3
									4
									5
									6
									7
									8
									9
									10
Continued on next sheet									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.									

					Borehole Log			Borehole No. PH22 Sheet 2 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419204.02 - 426604.84		Hole Type PH
Location: West Yorkshire					Level: 88.40		Scale 1:50		
Client: Harron Homes					Dates: 11/06/2019 - 11/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					12.80	75.60			11
									12
									13
									14
									15
									16
									17
									18
									19
									20
									Continued on next sheet
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.									
									

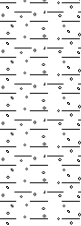
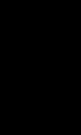
					Borehole Log			Borehole No. PH22 Sheet 3 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419204.02 - 426604.84		Hole Type PH
Location: West Yorkshire					Level: 88.40		Scale 1:50		
Client: Harron Homes					Dates: 11/06/2019 - 11/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					21.00	67.40		End of borehole at 21.00 m	21
									22
									23
									24
									25
									26
									27
									28
									29
									30

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



					Borehole Log			Borehole No. PH23 Sheet 1 of 2	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419149.55 - 426555.63		Hole Type PH
Location: West Yorkshire					Level: 89.85		Scale 1:50		
Client: Harron Homes					Dates: 11/06/2019 - 11/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.50	88.35		Overburden.	1
					2.50	87.35		Brown SANDSTONE. (COAL MEASURES)	2
								Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	3
								4	
								5	
								6	
								7	
								8	
								9	
								10	
Continued on next sheet									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.									

					Borehole Log			Borehole No. PH23 Sheet 2 of 2	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419149.55 - 426555.63		Hole Type PH
Location: West Yorkshire					Level: 89.85		Scale 1:50		
Client: Harron Homes					Dates: 11/06/2019 - 11/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
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					Borehole Log			Borehole No. PH24 Sheet 1 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419093.71 - 426600.14		Hole Type PH
Location: West Yorkshire					Level: 96.90		Scale 1:50		
Client: Harron Homes					Dates: 11/06/2019 - 11/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.60	95.30		Overburden.	1
					2.00	94.90		Brown SANDSTONE. (COAL MEASURES)	2
								Black COAL. (WHEATLEY LIME COAL)	3
					3.10	93.80		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	4
								5	
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Continued on next sheet									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.									



Borehole No.

PH24

Sheet 2 of 3

Project Name: Merchant Fields, Cleckheaton

Project No.
2828

Co-ords: 419093.71 - 426600.14

Hole Type
PH

Location: West Yorkshire

Level: 96.90

Scale
1:50

Client: Harron Homes

Dates: 11/06/2019 - 11/06/2019

Logged By
LEW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description									
		Depth (m)	Type	Results													
					19.40	77.50		Dark grey carbonaceous MUDSTONE with 0.2m thick mudstone parting. (MIDDLETON 11 YARD COAL)	11								
									12								
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									15								
									16								
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									Continued on next sheet								20

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Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



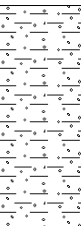
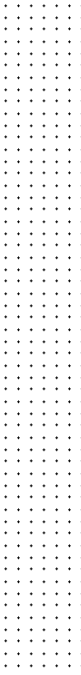
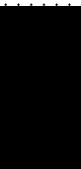
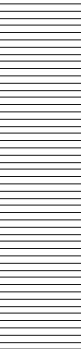
					Borehole Log			Borehole No. PH24 Sheet 3 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419093.71 - 426600.14		Hole Type PH
Location: West Yorkshire					Level: 96.90		Scale 1:50		Logged By LEW
Client: Harron Homes					Dates: 11/06/2019 - 11/06/2019				

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					21.50	75.40		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	21
					24.00	72.90			22
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End of borehole at 24.00 m

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



					Borehole Log			Borehole No. PH25 Sheet 1 of 3		
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419061.34 - 426652.86		Hole Type PH	
Location: West Yorkshire					Level: 99.30		Scale 1:50			
Client: Harron Homes					Dates: 11/06/2019 - 11/06/2019		Logged By LEW			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					1.50	97.80		Overburden.	1	
									Brown SANDSTONE. (COAL MEASURES)	2
										3
										4
										5
					6.10	93.20		Black COAL. (WHEATLEY LIME COAL)	6	
					7.20	92.10		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	7	
									8	
									9	
					9.60 9.70	89.70 89.60		Dark grey carbonaceous MUDSTONE. (COAL MEASURES)	10	
Continued on next sheet										
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.										

					Borehole Log			Borehole No. PH25 Sheet 2 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419061.34 - 426652.86		Hole Type PH
Location: West Yorkshire					Level: 99.30		Scale 1:50		
Client: Harron Homes					Dates: 11/06/2019 - 11/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	11	
								12	
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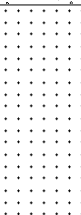
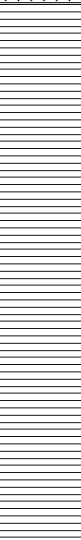
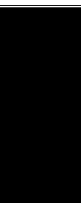
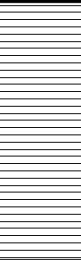
Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



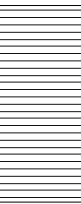
					Borehole Log			Borehole No. PH25 Sheet 3 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419061.34 - 426652.86		Hole Type PH
Location: West Yorkshire					Level: 99.30		Scale 1:50		Logged By LEW
Client: Harron Homes					Dates: 11/06/2019 - 11/06/2019				
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					23.50	75.80		Dark grey carbonaceous MUDSTONE with 0.2m thick mudstone parting. (MIDDLETON 11 YARD COAL)	21
					24.80	74.50		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	22
					27.00	72.30		End of borehole at 27.00 m	23
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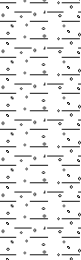
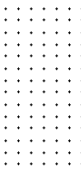
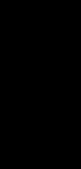
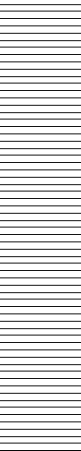
Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



					Borehole Log			Borehole No. PH26 Sheet 1 of 2		
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419029.48 - 426278.06		Hole Type PH	
Location: West Yorkshire					Level: 86.00		Scale 1:50			
Client: Harron Homes					Dates: 12/06/2019 - 12/06/2019		Logged By LEW			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
								Overburden.	1	
					2.00	84.00		Brown SANDSTONE. (COAL MEASURES)	2	
					3.40	82.60		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	3	
					7.00	79.00		Black COAL. (MIDDLETON 11 YARD COAL)	4	
					8.30	77.70		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	5	
Continued on next sheet									6	
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.										

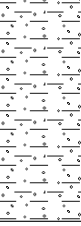
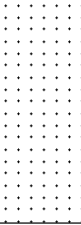
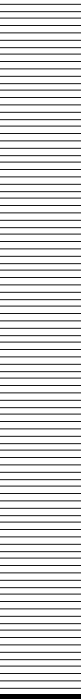
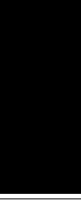
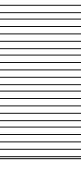


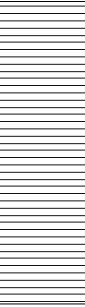
					Borehole Log			Borehole No. PH26 Sheet 2 of 2										
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419029.48 - 426278.06		Hole Type PH									
Location: West Yorkshire					Level: 86.00		Scale 1:50		Logged By LEW									
Client: Harron Homes					Dates: 12/06/2019 - 12/06/2019													
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description										
		Depth (m)	Type	Results														
					11.30	74.70		End of borehole at 11.30 m	11									
									12									
									13									
									14									
									15									
									16									
									17									
									18									
									19									
									20									
									Remarks									
									1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.									

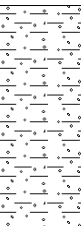
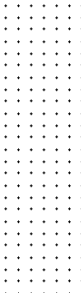
					Borehole Log			Borehole No. PH27 Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418944.65 - 426208.54		Hole Type PH
Location: West Yorkshire					Level: 83.85		Scale 1:50		
Client: Harron Homes					Dates: 12/06/2019 - 12/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.80	82.05		Overburden.	1
					3.00	80.85		Brown SANDSTONE. (COAL MEASURES)	2
					3.50	80.35		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	3
					4.70	79.15		Black COAL. (MIDDLETON 11 YARD COAL)	4
					7.70	76.15		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	5
							End of borehole at 7.70 m	6	
								7	
								8	
								9	
								10	

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



					Borehole Log			Borehole No. PH28 Sheet 1 of 2		
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418959.50 - 426327.48		Hole Type PH	
Location: West Yorkshire					Level: 89.70		Scale 1:50			
Client: Harron Homes					Dates: 12/06/2019 - 12/06/2019		Logged By LEW			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					1.50	88.20		Overburden.	1	
								Brown SANDSTONE. (COAL MEASURES)	2	
					3.00	86.70		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	3	
									4	
									5	
					7.60	82.10		Black COAL. (MIDDLETON 11 YARD COAL)	8	
					8.90	80.80		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	9	
								10		
Continued on next sheet										
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.										

					Borehole Log			Borehole No. PH28 Sheet 2 of 2		
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418959.50 - 426327.48		Hole Type PH	
Location: West Yorkshire					Level: 89.70		Scale 1:50		Logged By LEW	
Client: Harron Homes					Dates: 12/06/2019 - 12/06/2019					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					12.00	77.70				
								End of borehole at 12.00 m		
									11	
									12	
									13	
									14	
									15	
									16	
									17	
									18	
									19	
									20	
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.										

					Borehole Log			Borehole No. PH29 Sheet 1 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418999.59 - 426384.42		Hole Type PH
Location: West Yorkshire					Level: 91.30		Scale 1:50		
Client: Harron Homes					Dates: 12/06/2019 - 12/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.50	89.80		Overburden.	1
								Brown SANDSTONE. (COAL MEASURES)	2
					3.50	87.80		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	3
									4
									5
									6
									7
									8
									9
									10
Continued on next sheet									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 12.0m during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.									



					Borehole Log			Borehole No. PH29 Sheet 2 of 3		
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418999.59 - 426384.42		Hole Type PH	
Location: West Yorkshire					Level: 91.30		Scale 1:50			
Client: Harron Homes					Dates: 12/06/2019 - 12/06/2019		Logged By LEW			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
								At 12.0m, groundwater.	11	
									12	
										13
										14
										15
										16
										17
										18
										19
										20
		Continued on next sheet								
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 12.0m during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.										

					Borehole Log			Borehole No. PH29 Sheet 3 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418999.59 - 426384.42		Hole Type PH
Location: West Yorkshire					Level: 91.30		Scale 1:50		
Client: Harron Homes					Dates: 12/06/2019 - 12/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					21.00	70.30		End of borehole at 21.00 m	21
									22
									23
									24
									25
									26
									27
									28
									29
									30

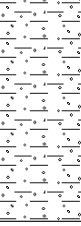
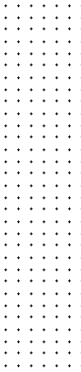
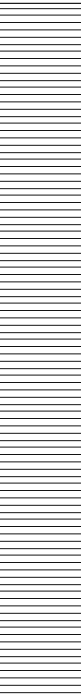
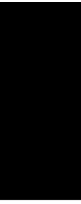
Remarks

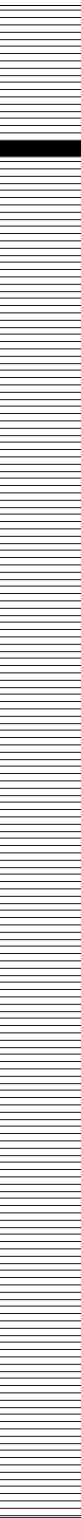
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 12.0m during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



					Borehole Log			Borehole No. PH30 Sheet 1 of 2	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418839.62 - 426445.50		Hole Type PH
Location: West Yorkshire					Level: 96.75		Scale 1:50		
Client: Harron Homes					Dates: 12/06/2019 - 12/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden.	1	
				1.50	95.25		Brown SANDSTONE. (COAL MEASURES)	2	
				2.00	94.75		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	3	
				3.00	93.75		Black COAL. (WHEATLEY LIME COAL)	4	
				4.30	92.45		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	5	
				5.20	91.55		Black COAL.	6	
				5.30	91.45		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	7	
								8	
								9	
								10	
Continued on next sheet									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 12.0m to 20.0m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.									
									

					Borehole Log			Borehole No. PH30 Sheet 2 of 2										
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418839.62 - 426445.50		Hole Type PH									
Location: West Yorkshire					Level: 96.75		Scale 1:50		Logged By LEW									
Client: Harron Homes					Dates: 12/06/2019 - 12/06/2019													
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description										
		Depth (m)	Type	Results														
					12.00	84.75		Solid ground (no returns). At 12.0m, loss of flush due to fractured rock.		11								
										12								
										13								
										14								
										15								
										16								
										17								
										18								
										19								
										20								
										End of borehole at 20.00 m								
										Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 12.0m to 20.0m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.								
																		

					Borehole Log			Borehole No. PH31 Sheet 1 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418889.49 - 426508.44		Hole Type PH
Location: West Yorkshire					Level: 100.90		Scale 1:50		
Client: Harron Homes					Dates: 12/06/2019 - 12/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.50	99.40		Overburden.	1
								Brown SANDSTONE. (COAL MEASURES)	2
					4.00	96.90		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	3
									4
									5
					8.60	92.30		Black COAL. (WHEATLEY LIME COAL)	6
					9.90	91.00		Continued on next sheet	7
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.									

					Borehole Log			Borehole No. PH31 Sheet 2 of 3								
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418889.49 - 426508.44		Hole Type PH							
Location: West Yorkshire					Level: 100.90		Scale 1:50									
Client: Harron Homes					Dates: 12/06/2019 - 12/06/2019		Logged By LEW									
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description								
		Depth (m)	Type	Results												
					10.90 11.00	90.00 89.90		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	11 12 13 14 15 16 17 18 19 20							
								Black COAL. Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)								
								From 15.0m, 20% flush due to fractured rock.								
								Continued on next sheet								

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.

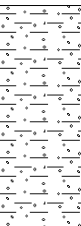
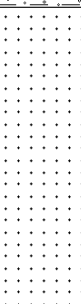
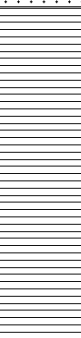
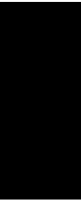
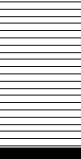
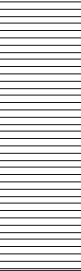


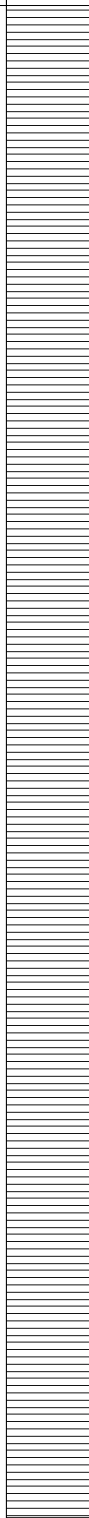
					Borehole Log			Borehole No. PH31 Sheet 3 of 3									
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418889.49 - 426508.44		Hole Type PH								
Location: West Yorkshire					Level: 100.90		Scale 1:50										
Client: Harron Homes					Dates: 12/06/2019 - 12/06/2019		Logged By LEW										
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description									
		Depth (m)	Type	Results													
					24.00	76.90			21								
									22								
									23								
									24								
									25								
									26								
									27								
									28								
									29								
									30								
									End of borehole at 24.00 m								

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



					Borehole Log			Borehole No. PH32 Sheet 1 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419022.99 - 426545.27		Hole Type PH
Location: West Yorkshire					Level: 99.65		Scale 1:50		
Client: Harron Homes					Dates: 12/06/2019 - 12/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.50	98.15		Overburden.	1
					3.50	96.15		Brown SANDSTONE. (COAL MEASURES)	2
					5.70	93.95		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	3
					7.00	92.65		Black COAL. (WHEATLEY LIME COAL)	4
					8.00	91.65		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	5
					8.10	91.55		Black COAL.	6
								Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	7
									8
									9
									10
Continued on next sheet									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.									
									

					Borehole Log			Borehole No. PH32 Sheet 2 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419022.99 - 426545.27		Hole Type PH
Location: West Yorkshire					Level: 99.65		Scale 1:50		
Client: Harron Homes					Dates: 12/06/2019 - 12/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
									11
									12
									13
									14
									15
									16
									17
									18
									19
									20

Continued on next sheet

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.

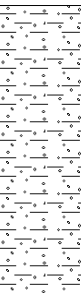
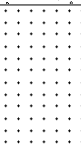
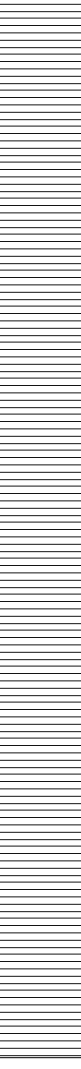


					Borehole Log			Borehole No. PH32 Sheet 3 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419022.99 - 426545.27		Hole Type PH
Location: West Yorkshire					Level: 99.65		Scale 1:50		
Client: Harron Homes					Dates: 12/06/2019 - 12/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					21.00	78.65		End of borehole at 21.00 m	21
									22
									23
									24
									25
									26
									27
									28
									29
									30

Remarks

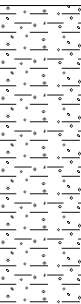
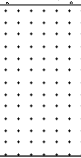
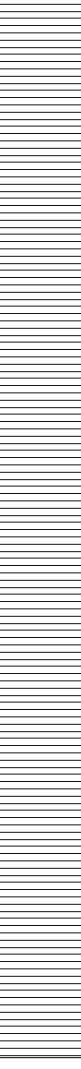
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



					Borehole Log			Borehole No. PH33 Sheet 1 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419055.87 - 426351.73		Hole Type PH
Location: West Yorkshire					Level: 87.60		Scale 1:50		
Client: Harron Homes					Dates: 13/06/2019 - 13/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								Overburden.	1
					2.00	85.60		Brown SANDSTONE. (COAL MEASURES)	2
					3.00	84.60		Grey MUDSTONE. (COAL MEASURES)	3
									4
									5
									6
									7
									8
									9
									10
Continued on next sheet									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 12.0m during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.									

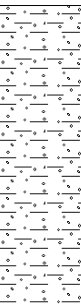
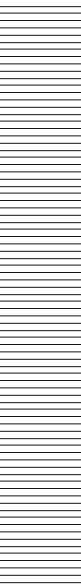
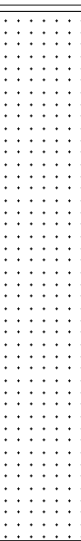
					Borehole Log			Borehole No. PH33 Sheet 2 of 3		
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419055.87 - 426351.73		Hole Type PH	
Location: West Yorkshire					Level: 87.60		Scale 1:50			
Client: Harron Homes					Dates: 13/06/2019 - 13/06/2019		Logged By LEW			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
									11	
										12
										13
										14
					12.00	75.60		Dark grey carbonaceous MUDSTONE with coal traces. (MIDDLETON 11 YARD COAL)		
					12.50	75.10		At 12.0m, groundwater. Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)		
									15	
									16	
									17	
									18	
					19.00	68.60		Dark grey carbonaceous MUDSTONE. (COAL MEASURES)		
					20.00	67.60			20	
Continued on next sheet										
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 12.0m during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.										

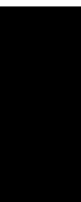
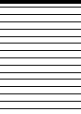
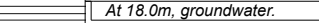
					Borehole Log			Borehole No. PH33 Sheet 3 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419055.87 - 426351.73		Hole Type PH
Location: West Yorkshire					Level: 87.60		Scale 1:50		
Client: Harron Homes					Dates: 13/06/2019 - 13/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					20.20	67.40		Grey MUDSTONE. (COAL MEASURES)	
					20.30	67.30		Black COAL.	
								Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	
					21.00	66.60		Hard brown SANDSTONE. (COAL MEASURES)	21
					22.00	65.60		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	22
									23
								25	
								26	
								27	
								28	
								29	
					30.00	57.60		End of borehole at 30.00 m	30
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 12.0m during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.									
									

					Borehole Log			Borehole No. PH34 Sheet 1 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419024.76 - 426318.12		Hole Type PH
Location: West Yorkshire					Level: 87.45		Scale 1:50		
Client: Harron Homes					Dates: 13/06/2019 - 13/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								Overburden.	1
					2.00	85.45		Brown SANDSTONE. (COAL MEASURES)	2
					3.00	84.45		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	3
									4
									5
									6
									7
									8
									9
									10
					10.00	77.45	Continued on next sheet		
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.									

					Borehole Log			Borehole No. PH34 Sheet 2 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419024.76 - 426318.12		Hole Type PH
Location: West Yorkshire					Level: 87.45		Scale 1:50		
Client: Harron Homes					Dates: 13/06/2019 - 13/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					10.50	76.95		Dark grey carbonaceous MUDSTONE. (MIDDLETON 11 YARD COAL)	
								Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	11
									12
									13
									14
									15
									16
									17
									18
									19
									20
Continued on next sheet									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.									
									

					Borehole Log			Borehole No. PH34 Sheet 3 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419024.76 - 426318.12		Hole Type PH
Location: West Yorkshire					Level: 87.45		Scale 1:50		
Client: Harron Homes					Dates: 13/06/2019 - 13/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					24.00	63.45			21
									22
									23
									24
									25
									26
									27
									28
									29
									30
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion. 									

				Borehole Log			Borehole No. PH35 Sheet 1 of 3		
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 418907.11 - 426359.61		Hole Type PH	
Location: West Yorkshire				Level: 94.10		Scale 1:50			
Client: Harron Homes				Dates: 13/06/2019 - 13/06/2019		Logged By LEW			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								Overburden.	1
					2.00	92.10		Black COAL.	2
					2.30	91.80		(WHEATLEY LIME COAL)	
								Grey MUDSTONE interbedded with brown SANDSTONE.	3
								(COAL MEASURES)	4
									5
									6
					6.50	87.60		Brown SANDSTONE.	7
								(COAL MEASURES)	8
									9
Continued on next sheet								10	
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 18.0m during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.									

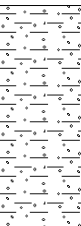
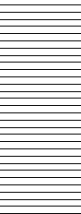
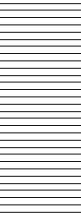
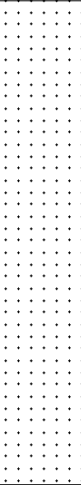
					Borehole Log			Borehole No. PH35 Sheet 2 of 3		
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418907.11 - 426359.61		Hole Type PH	
Location: West Yorkshire					Level: 94.10		Scale 1:50			
Client: Harron Homes					Dates: 13/06/2019 - 13/06/2019		Logged By LEW			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					10.40	83.70		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	11	
						11.80	82.30		Black COAL. (MIDDLETON 11 YARD COAL)	12
						13.10	81.00		Grey MUDSTONE. (COAL MEASURES)	13
						14.00 14.10	80.10 80.00		Black COAL. Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	14
										15
										16
								17		
							 At 18.0m, groundwater.	18		
								19		
								20		

Continued on next sheet

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 18.0m during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



					Borehole Log			Borehole No. PH35 Sheet 3 of 3										
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418907.11 - 426359.61		Hole Type PH									
Location: West Yorkshire					Level: 94.10		Scale 1:50		Logged By LEW									
Client: Harron Homes					Dates: 13/06/2019 - 13/06/2019													
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description										
		Depth (m)	Type	Results														
									21									
									22									
									23									
									24									
									25									
									26									
									27									
									28									
									29									
									30									
									End of borehole at 30.00 m								30	
									Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 18.0m during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.									
																		

					Borehole Log			Borehole No. PH36 Sheet 1 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418910.37 - 426399.79		Hole Type PH
Location: West Yorkshire					Level: 96.85		Scale 1:50		Logged By LEW
Client: Harron Homes					Dates: 13/06/2019 - 13/06/2019				
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
									
					1.50	95.35		Overburden.	1
								Grey MUDSTONE. (COAL MEASURES)	2
					3.00	93.85		Black COAL. (WHEATLEY LIME COAL)	3
					3.50	93.35		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	4
					5.00	91.85		Black COAL.	5
					5.10	91.75		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	6
					6.80	90.05		Brown SANDSTONE. (COAL MEASURES)	7
									8
									9
								10	

Continued on next sheet

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 18.0m during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.





Borehole No.

PH36

Sheet 2 of 3

Project Name: Merchant Fields, Cleckheaton

Project No.
2828

Co-ords: 418910.37 - 426399.79

Hole Type
PH

Location: West Yorkshire

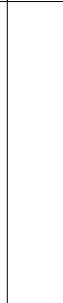
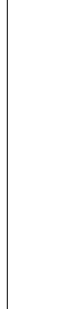
Level: 96.85

Scale
1:50

Client: Harron Homes

Dates: 13/06/2019 - 13/06/2019

Logged By
LEW

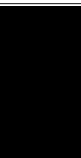
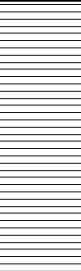
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					12.00	84.85			11
								Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	12
									13
									14
									15
									16
									17
									18
									19
									20

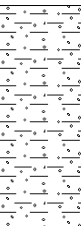
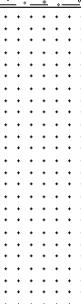
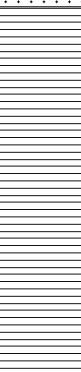
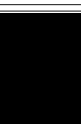
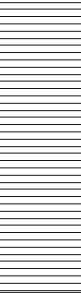
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Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 18.0m during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.

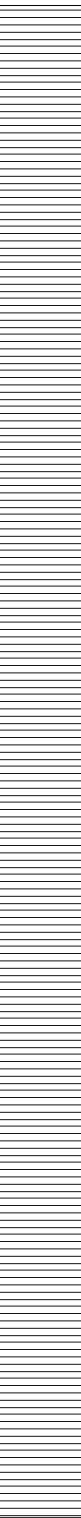


					Borehole Log			Borehole No. PH36 Sheet 3 of 3		
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418910.37 - 426399.79		Hole Type PH	
Location: West Yorkshire					Level: 96.85		Scale 1:50			
Client: Harron Homes					Dates: 13/06/2019 - 13/06/2019		Logged By LEW			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					21.20	75.65		Black COAL. (MIDDLETON 11 YARD COAL)	21	
					22.20	74.65			Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	22
							24.00	72.85		End of borehole at 24.00 m
									25	
									26	
									27	
									28	
									29	
									30	
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 18.0m during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.										

					Borehole Log			Borehole No. PH37 Sheet 1 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418896.58 - 426445.11		Hole Type PH
Location: West Yorkshire					Level: 99.35		Scale 1:50		
Client: Harron Homes					Dates: 13/06/2019 - 13/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
									
					1.50	97.85		Overburden.	1
					3.50	95.85		Brown SANDSTONE. (COAL MEASURES)	2
					6.00	93.35		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	3
					6.80	92.55		Black COAL. (WHEATLEY LIME COAL)	4
					7.90	91.45		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	5
					8.00	91.35		Black COAL.	6
								Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	7
									8
									9
Continued on next sheet								10	

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 21.0m during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



					Borehole Log			Borehole No. PH37 Sheet 2 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418896.58 - 426445.11		Hole Type PH
Location: West Yorkshire					Level: 99.35		Scale 1:50		
Client: Harron Homes					Dates: 13/06/2019 - 13/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
									11
									12
									13
									14
									15
									16
									17
									18
									19
									20

Continued on next sheet

Remarks

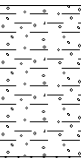
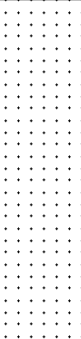
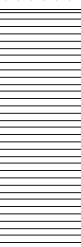
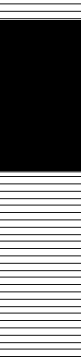
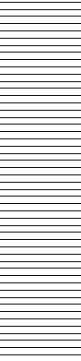
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 21.0m during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



					Borehole Log			Borehole No. PH37 Sheet 3 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418896.58 - 426445.11		Hole Type PH
Location: West Yorkshire					Level: 99.35		Scale 1:50		
Client: Harron Homes					Dates: 13/06/2019 - 13/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
									
					23.00	76.35		At 21.0m, groundwater.	21
									22
									23
								End of borehole at 23.00 m	24
									25
									26
									27
									28
									29
									30

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 21.0m during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



					Borehole Log			Borehole No. PH38 Sheet 1 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418960.70 - 426445.47		Hole Type PH
Location: West Yorkshire					Level: 98.60		Scale 1:50		
Client: Harron Homes					Dates: 13/06/2019 - 13/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden.		
					1.00	97.60		Brown SANDSTONE. (COAL MEASURES)	1
					3.30	95.30		Grey MUDSTONE. (COAL MEASURES)	3
					5.00	93.60		Black COAL. (WHEATLEY LIME COAL)	5
					6.00	92.60		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	6
					7.40	91.20		Black COAL.	
					7.50	91.10		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	8
									9
									10
	Continued on next sheet								

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 18.0m during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



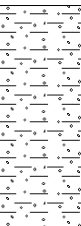
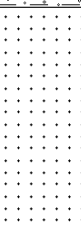
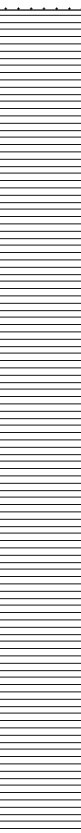
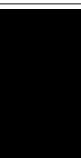
					Borehole Log			Borehole No. PH38 Sheet 2 of 3		
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418960.70 - 426445.47		Hole Type PH	
Location: West Yorkshire					Level: 98.60		Scale 1:50		Logged By LEW	
Client: Harron Homes					Dates: 13/06/2019 - 13/06/2019					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
										
								Continued on next sheet		
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 18.0m during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.										

					Borehole Log			Borehole No. PH38 Sheet 3 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418960.70 - 426445.47		Hole Type PH
Location: West Yorkshire					Level: 98.60		Scale 1:50		Logged By LEW
Client: Harron Homes					Dates: 13/06/2019 - 13/06/2019				

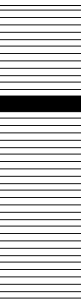
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
									21	
										22
										23
										24
										25
										26
										27
										28
										29
										30
					25.70	72.90				
					26.00	72.60	 Black COAL. (MIDDLETON 11 YARD COAL)			
							 Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)			
					27.00	71.60		End of borehole at 27.00 m		

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 18.0m during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.

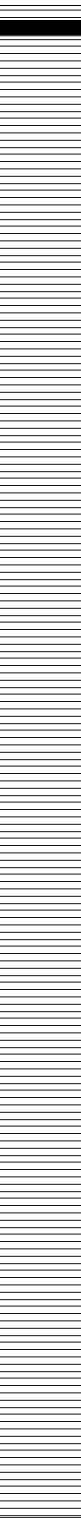
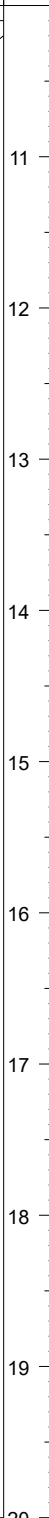


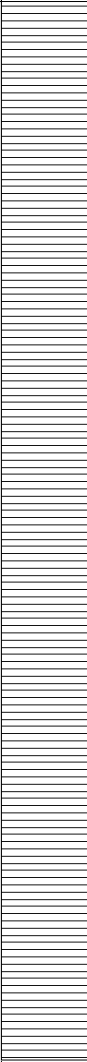
					Borehole Log			Borehole No. PH39 Sheet 1 of 2		
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418947.75 - 426525.51		Hole Type PH	
Location: West Yorkshire					Level: 100.70		Scale 1:50			
Client: Harron Homes					Dates: 13/06/2019 - 13/06/2019		Logged By LEW			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					1.50	99.20		Overburden.	1	
									Brown SANDSTONE. (COAL MEASURES)	2
					3.00	97.70		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	3	
										4
										5
					8.50	92.20		Black COAL. (WHEATLEY LIME COAL)	9	
					9.50	91.20		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	10	
Continued on next sheet										
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 12.0m during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.										

					Borehole Log			Borehole No. PH40 Sheet 1 of 2		
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418991.48 - 426564.64		Hole Type PH	
Location: West Yorkshire					Level: 100.50		Scale 1:50			
Client: Harron Homes					Dates: 13/06/2019 - 13/06/2019		Logged By LEW			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
							Overburden.	1		
				1.50	99.00		Brown SANDSTONE. (COAL MEASURES)	2		
				3.30	97.20		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	3		
				7.70	92.80		Black COAL. (WHEATLEY LIME COAL)	4		
				9.00	91.50		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	5		
Continued on next sheet								6		
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.										
										

					Borehole Log			Borehole No. PH40 Sheet 2 of 2	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418991.48 - 426564.64		Hole Type PH
Location: West Yorkshire					Level: 100.50		Scale 1:50		
Client: Harron Homes					Dates: 13/06/2019 - 13/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					10.60	89.90		Black COAL. Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	11
					10.70	89.80			
					12.00	88.50		End of borehole at 12.00 m	12
									13
									14
									15
									16
									17
									18
									19
									20
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.									

					Borehole Log			Borehole No. PH41 Sheet 1 of 3		
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419022.24 - 426614.68		Hole Type PH	
Location: West Yorkshire					Level: 100.65		Scale 1:50			
Client: Harron Homes					Dates: 13/06/2019 - 13/06/2019		Logged By LEW			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
							Overburden.	1		
				1.50	99.15		Brown SANDSTONE. (COAL MEASURES)	2		
				3.00	97.65		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	3		
				7.80	92.85		Black COAL. (WHEATLEY LIME COAL)	8		
				9.00	91.65		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	9		
Continued on next sheet								10		
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.										

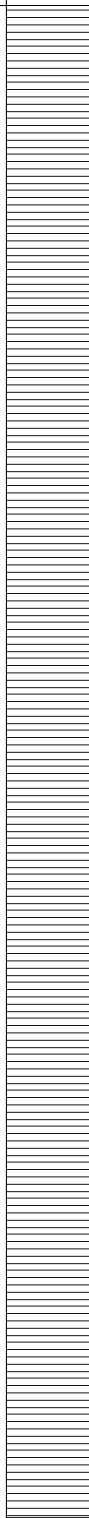
					Borehole Log			Borehole No. PH41 Sheet 2 of 3			
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419022.24 - 426614.68		Hole Type PH		
Location: West Yorkshire					Level: 100.65		Scale 1:50				
Client: Harron Homes					Dates: 13/06/2019 - 13/06/2019		Logged By LEW				
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
					10.10	90.55		Black COAL.			
					10.20	90.45		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)			
Continued on next sheet								20			
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.											

					Borehole Log			Borehole No. PH41 Sheet 3 of 3									
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419022.24 - 426614.68		Hole Type PH								
Location: West Yorkshire					Level: 100.65		Scale 1:50		Logged By LEW								
Client: Harron Homes					Dates: 13/06/2019 - 13/06/2019												
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description									
		Depth (m)	Type	Results													
					27.00	73.65			21								
									22								
									23								
									24								
									25								
									26								
									27								
									28								
									29								
									30								
									End of borehole at 27.00 m								
									Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.								
																	

					Borehole Log			Borehole No. PH42 Sheet 1 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419056.20 - 426594.12		Hole Type PH
Location: West Yorkshire					Level: 98.85		Scale 1:50		Logged By LEW
Client: Harron Homes					Dates: 13/06/2019 - 13/06/2019				
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								Overburden.	1
					1.50	97.35		Brown SANDSTONE. (COAL MEASURES)	2
					3.40	95.45		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	3
					5.00	93.85		Black COAL. (WHEATLEY LIME COAL)	4
					6.20	92.65		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	5
					7.50	91.35		Black COAL.	6
					7.60	91.25		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	7
									8
									9
									10
Continued on next sheet									

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 21.5m during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



					Borehole Log			Borehole No. PH42 Sheet 2 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419056.20 - 426594.12		Hole Type PH
Location: West Yorkshire					Level: 98.85		Scale 1:50		
Client: Harron Homes					Dates: 13/06/2019 - 13/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
									11
									12
									13
									14
									15
									16
									17
									18
									19
									20
									Continued on next sheet
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 21.5m during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.									

					Borehole Log			Borehole No. PH42 Sheet 3 of 3		
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419056.20 - 426594.12		Hole Type PH	
Location: West Yorkshire					Level: 98.85		Scale 1:50		Logged By LEW	
Client: Harron Homes					Dates: 13/06/2019 - 13/06/2019					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
									21	
										22
										23
										24
					25.00	73.85		Black COAL. (MIDDLETON 11 YARD COAL)	25	
					26.00	72.85		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	26	
					27.00	71.85		End of borehole at 27.00 m	27	
									28	
									29	
									30	

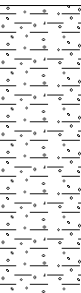
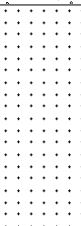
Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 21.5m during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.

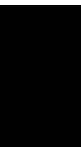
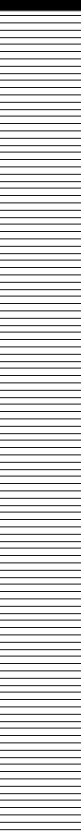
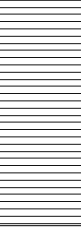


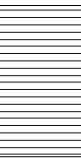
					Borehole Log			Borehole No. PH43 Sheet 1 of 1	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419059.44 - 426625.59		Hole Type PH
Location: West Yorkshire					Level: 99.25		Scale 1:50		
Client: Harron Homes					Dates: 13/06/2019 - 13/06/2019		Logged By LEW		

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden.	1	
				1.50	97.75		Brown SANDSTONE. (COAL MEASURES)	2	
				3.30	95.95		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	3	
				6.40	92.85		Black COAL. (WHEATLEY LIME COAL)	4	
				7.30	91.95		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	5	
				8.10	91.15		Black COAL.	6	
				8.20	91.05		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	7	
				9.00	90.25	End of borehole at 9.00 m		8	
								9	
									10

Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.		

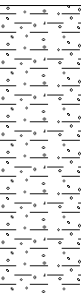
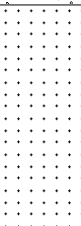
					Borehole Log			Borehole No. PH44 Sheet 1 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419087.58 - 426342.80		Hole Type PH
Location: West Yorkshire					Level: 86.50		Scale 1:50		
Client: Harron Homes					Dates: 14/06/2019 - 14/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								Overburden.	1
					2.00	84.50		Brown SANDSTONE. (COAL MEASURES)	2
					3.50	83.00		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	3
									4
									5
									6
									7
									8
									9
					10.00	76.50			10
Continued on next sheet									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 16.5m to 21.0m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.									
									

					Borehole Log			Borehole No. PH44 Sheet 2 of 3		
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419087.58 - 426342.80		Hole Type PH	
Location: West Yorkshire					Level: 86.50		Scale 1:50			
Client: Harron Homes					Dates: 14/06/2019 - 14/06/2019		Logged By LEW			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					11.00	75.50		Black COAL. (MIDDLETON 11 YARD COAL)		
								Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	11	
										12
										13
					16.50	70.00		Broken ground - lost flush. (BLOCKING COAL)	16	
					18.50	68.00		Solid ground (no returns).	17	
									18	
									19	
									20	
Continued on next sheet										
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 16.5m to 21.0m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.										
										

					Borehole Log			Borehole No. PH44 Sheet 3 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419087.58 - 426342.80		Hole Type PH
Location: West Yorkshire					Level: 86.50		Scale 1:50		
Client: Harron Homes					Dates: 14/06/2019 - 14/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					21.00	65.50		End of borehole at 21.00 m	21
									22
									23
									24
									25
									26
									27
									28
									29
									30

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 16.5m to 21.0m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

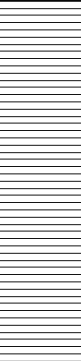


					Borehole Log			Borehole No. PH45 Sheet 1 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419000.07 - 426353.09		Hole Type PH
Location: West Yorkshire					Level: 89.60		Scale 1:50		
Client: Harron Homes					Dates: 14/06/2019 - 14/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								Overburden.	1
					2.00	87.60		Brown SANDSTONE. (COAL MEASURES)	2
					3.50	86.10		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	3
									4
									5
									6
									7
									8
									9
									10
Continued on next sheet									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.									

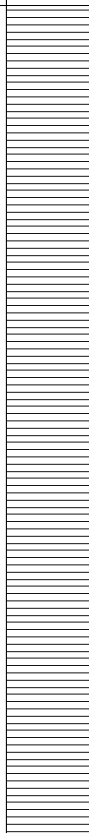
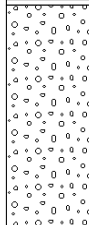
					Borehole Log			Borehole No. PH45 Sheet 2 of 3				
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419000.07 - 426353.09		Hole Type PH			
Location: West Yorkshire					Level: 89.60		Scale 1:50					
Client: Harron Homes					Dates: 14/06/2019 - 14/06/2019		Logged By LEW					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description				
		Depth (m)	Type	Results								
									11			
									12			
									13			
									13.30	76.30	Dark grey MUDSTONE with coal traces. (MIDDLETON 11 YARD COAL)	14
									14.30	75.30	Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	15
									16			
									17			
									18			
									19			
									20			
									20.00	69.60	Continued on next sheet	20

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out.
2. Groundwater was not apparent during drilling.
3. Exploratory hole surveyed in (level and co-ordinates) on completion.



				Borehole Log				Borehole No. PH45 Sheet 3 of 3	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419000.07 - 426353.09		Hole Type PH	
Location: West Yorkshire				Level: 89.60		Scale 1:50			
Client: Harron Homes				Dates: 14/06/2019 - 14/06/2019		Logged By LEW			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					21.60	68.00		Soft ground (BLOCKING COAL) <i>From 20.0m, 50% flush.</i>	21
					24.00	65.60		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	22
							End of borehole at 24.00 m		24
									25
									26
									27
									28
									29
									30
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.									

					Borehole Log			Borehole No. PH46 Sheet 1 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419058.03 - 426305.59		Hole Type PH
Location: West Yorkshire					Level: 85.85		Scale 1:50		
Client: Harron Homes					Dates: 14/06/2019 - 14/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								Overburden.	1
					2.00	83.85		Brown SANDSTONE. (COAL MEASURES)	2
					3.00	82.85		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	3
									4
									5
									6
									7
									8
					9.00	76.85		Dark grey MUDSTONE with coal traces. (MIDDLETON 11 YARD COAL)	9
					9.90	75.95			10
Continued on next sheet									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.									

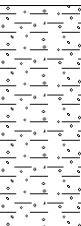
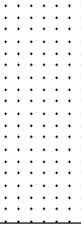
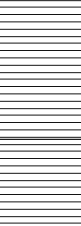
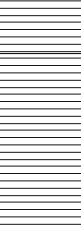
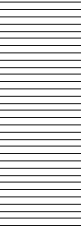
					Borehole Log			Borehole No. PH46 Sheet 2 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419058.03 - 426305.59		Hole Type PH
Location: West Yorkshire					Level: 85.85		Scale 1:50		
Client: Harron Homes					Dates: 14/06/2019 - 14/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					15.50	70.35		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	11
								Soft ground - lost flush.	16
	Solid ground (no returns).	17							
Continued on next sheet								20	
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.									

					Borehole Log			Borehole No. PH46 Sheet 3 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419058.03 - 426305.59		Hole Type PH
Location: West Yorkshire					Level: 85.85		Scale 1:50		
Client: Harron Homes					Dates: 14/06/2019 - 14/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					21.00	64.85		End of borehole at 21.00 m	21
									22
									23
									24
									25
									26
									27
									28
									29
									30

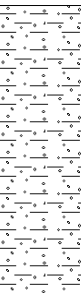
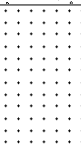
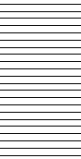
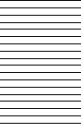
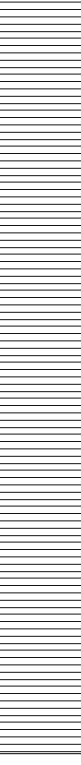
Remarks

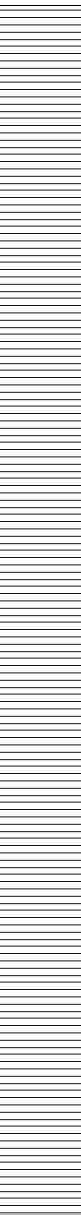
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



					Borehole Log			Borehole No. PH47 Sheet 1 of 2	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419010.29 - 426239.21		Hole Type PH
Location: West Yorkshire					Level: 84.70		Scale 1:50		
Client: Harron Homes					Dates: 14/06/2019 - 14/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.50	83.20		Overburden.	1
					3.00	81.70		Brown SANDSTONE. (COAL MEASURES)	2
					4.00	80.70		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	3
					5.00	79.70		Dark grey MUDSTONE with coal traces. (MIDDLETON 11 YARD COAL)	4
								Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	5
									6
									7
									8
									9
									10
Continued on next sheet									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.									

					Borehole Log			Borehole No. PH47 Sheet 2 of 2									
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419010.29 - 426239.21		Hole Type PH								
Location: West Yorkshire					Level: 84.70		Scale 1:50		Logged By LEW								
Client: Harron Homes					Dates: 14/06/2019 - 14/06/2019												
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description									
		Depth (m)	Type	Results													
					18.00	66.70			11								
									12								
									13								
									14								
									15								
									16								
									17								
									18								
									19								
									20								
									End of borehole at 18.00 m								
									Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.								
																	

					Borehole Log			Borehole No. PH48 Sheet 1 of 2	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418970.47 - 426230.70		Hole Type PH
Location: West Yorkshire					Level: 85.20		Scale 1:50		
Client: Harron Homes					Dates: 14/06/2019 - 14/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								Overburden.	1
					2.00	83.20		Brown SANDSTONE. (COAL MEASURES)	2
					3.00	82.20		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	3
					4.10	81.10		Dark grey MUDSTONE with coal traces. (MIDDLETON 11 YARD COAL)	4
					5.00	80.20		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	5
									6
									7
									8
									9
									10
Continued on next sheet									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 12.0m during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.									

					Borehole Log			Borehole No. PH48 Sheet 2 of 2		
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418970.47 - 426230.70		Hole Type PH	
Location: West Yorkshire					Level: 85.20		Scale 1:50			
Client: Harron Homes					Dates: 14/06/2019 - 14/06/2019		Logged By LEW			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
									11	
										12
										13
										14
										15
										16
										17
										18
										19
										20
		Remarks							1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 12.0m during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.	
										

					Borehole Log			Borehole No. PH49 Sheet 1 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418928.63 - 426269.90		Hole Type PH
Location: West Yorkshire					Level: 87.70		Scale 1:50		Logged By LEW
Client: Harron Homes					Dates: 14/06/2019 - 14/06/2019				
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden.	1	
					1.50	86.20		Brown SANDSTONE. (COAL MEASURES)	2
					3.50	84.20		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	3
					4.30	83.40		Dark grey MUDSTONE with coal traces. (MIDDLETON 11 YARD COAL)	4
					5.30	82.40		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	5
					7.00	80.70		Black COAL.	6
					7.10	80.60		Grey MUDSTONE interbedded with brown SANDSTONE. (COAL MEASURES)	7
									8
									9
									10

Continued on next sheet

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 12.0m during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



					Borehole Log			Borehole No. PH49 Sheet 2 of 3		
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418928.63 - 426269.90		Hole Type PH	
Location: West Yorkshire					Level: 87.70		Scale 1:50		Logged By LEW	
Client: Harron Homes					Dates: 14/06/2019 - 14/06/2019					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
									11	
									12	
									13	
									14	
									15	
									16	
									17	
									18	
									19	
									20	
Continued on next sheet										
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 12.0m during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.										

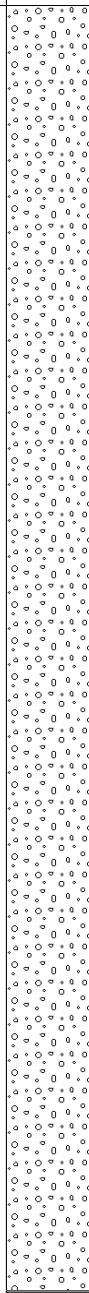
					Borehole Log			Borehole No. PH49 Sheet 3 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 418928.63 - 426269.90		Hole Type PH
Location: West Yorkshire					Level: 87.70		Scale 1:50		Logged By LEW
Client: Harron Homes					Dates: 14/06/2019 - 14/06/2019				
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					21.00	66.70		End of borehole at 21.00 m	21
									22
									23
									24
									25
									26
									27
									28
									29
									30

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 12.0m during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



				Borehole Log				Borehole No. Shaft 419426-005 Sheet 1 of 3	
Project Name: Merchant Fields, Cleckheaton				Project No. 2828		Co-ords: 419091.96 - 426347.49		Hole Type PH	
Location: West Yorkshire				Level: 86.75		Scale 1:50			
Client: Harron Homes				Dates: 12/06/2019 - 12/06/2019		Logged By LEW			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								Soft ground (no returns). (SHAFT BACKFILL)	1 2 3 4 5 6 7 8 9 10
Continued on next sheet									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.									

					Borehole Log			Borehole No. Shaft 419426-005 Sheet 2 of 3	
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419091.96 - 426347.49		Hole Type PH
Location: West Yorkshire					Level: 86.75		Scale 1:50		
Client: Harron Homes					Dates: 12/06/2019 - 12/06/2019		Logged By LEW		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					18.50	68.25			11
									12
									13
									14
									15
									16
									17
									18
									19
									20
									Continued on next sheet
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.									



					Borehole Log			Borehole No. Shaft 419426-005 Sheet 3 of 3									
Project Name: Merchant Fields, Cleckheaton					Project No. 2828		Co-ords: 419091.96 - 426347.49		Hole Type PH								
Location: West Yorkshire					Level: 86.75		Scale 1:50										
Client: Harron Homes					Dates: 12/06/2019 - 12/06/2019		Logged By LEW										
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description									
		Depth (m)	Type	Results													
					24.00	62.75			21								
									22								
									23								
									24								
									25								
									26								
									27								
									28								
									29								
									30								
									End of borehole at 24.00 m								
									Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.								
																	

Appendix H
Chemical Test Results



Certificate of Analysis

Certificate Number 19-05258-1

16-Apr-19

Client Lithos Consulting Ltd
Parkhill
Walton Rd
Wetherby
LS22 5DZ

Our Reference 19-05258-1

Client Reference 2828

Order No (not supplied)

Contract Title Merchant Fields, Cleckheaton

Description 42 Soil samples.

Date Received 20-Mar-19

Date Started 20-Mar-19

Date Completed 16-Apr-19

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

Notes This test supersedes 19-05258, extra testing.

Opinions and interpretations are outside the laboratory's scope of ISO 17025 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. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Adam Fenwick
Contracts Manager



Summary of Chemical Analysis

Soil Samples

Our Ref 19-05258-1

Client Ref 2828

Contract Title Merchant Fields, Cleckheaton

Lab No	1476826	1476827	1476828	1476829	1476830	1476831
Sample ID	TP50	TP20	TP15	HP01	HP02	HP03
Depth	0.10	0.15	0.20	0.10	0.10	0.10
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	15/03/19	14/03/19	14/03/19	15/03/19	15/03/19	15/03/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Subcon to Mountain	\$	0							
Mountainheath Subcon Prep	\$	0							
Preparation									
Metal >2mm	*	0.1	% m/m	< 0.1	< 0.1	< 0.1			
Plastic >2mm	*	0.1	% m/m	< 0.1	< 0.1	< 0.1			
Stones Removed	DETSC 1003*	0		Y	Y	Y			
Stones Removed	DETSC 1003*	0	%	0.0	0.0	0.0			
Stones >2mm	DETSC 1003*	1	% m/m	< 1.0	< 1.0	< 1.0			
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg				28	23	180
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg				2.6	2.8	1.7
Cadmium	DETSC 2301#	0.1	mg/kg				0.5	0.4	0.5
Chromium	DETSC 2301#	0.15	mg/kg				27	20	160
Chromium III	DETSC 2301*	0.15	mg/kg				27	20	160
Chromium, Hexavalent	DETSC 2204*	1	mg/kg			< 1.0	< 1.0	< 1.0	
Copper	DETSC 2301#	0.2	mg/kg				54	71	250
Lead	DETSC 2301#	0.3	mg/kg				81	110	1700
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l						
Mercury	DETSC 2325#	0.05	mg/kg			0.07	0.11	0.12	
Nickel	DETSC 2301#	1	mg/kg			18	17	21	
Selenium	DETSC 2301#	0.5	mg/kg			0.5	< 0.5	< 0.5	
Zinc	DETSC 2301#	1	mg/kg			140	320	250	
Inorganics									
pH	DETSC 2008#					8.6	8.1	7.5	
Calorific Value	DETSC 5008	1	MJ/kg						
Total Organic Carbon	DETSC 2084#	0.5	%			5.7	6.6	6.3	
Chloride Aqueous Extract	DETSC 2055	1	mg/l						
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l						
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l						
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg			< 0.03	< 0.03	0.04	
Acenaphthylene	DETSC 3303#	0.03	mg/kg			< 0.03	< 0.03	< 0.03	
Acenaphthene	DETSC 3303#	0.03	mg/kg			< 0.03	< 0.03	< 0.03	
Fluorene	DETSC 3303	0.03	mg/kg			< 0.03	< 0.03	< 0.03	
Phenanthrene	DETSC 3303#	0.03	mg/kg			< 0.03	0.13	0.07	
Anthracene	DETSC 3303	0.03	mg/kg			< 0.03	0.03	< 0.03	
Fluoranthene	DETSC 3303#	0.03	mg/kg			0.10	0.47	0.16	
Pyrene	DETSC 3303#	0.03	mg/kg			0.06	0.39	0.13	
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg			< 0.03	0.15	0.04	
Chrysene	DETSC 3303	0.03	mg/kg			0.06	0.18	0.06	
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg			0.05	0.13	0.04	
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg			< 0.03	0.06	< 0.03	

Summary of Chemical Analysis Soil Samples

Our Ref 19-05258-1

Client Ref 2828

Contract Title Merchant Fields, Cleckheaton

Lab No	1476826	1476827	1476828	1476829	1476830	1476831
Sample ID	TP50	TP20	TP15	HP01	HP02	HP03
Depth	0.10	0.15	0.20	0.10	0.10	0.10
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	15/03/19	14/03/19	14/03/19	15/03/19	15/03/19	15/03/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg				< 0.03	0.06	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg				< 0.03	0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg				< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg				< 0.03	0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg				0.27	1.6	0.56

Summary of Chemical Analysis

Soil Samples

Our Ref 19-05258-1

Client Ref 2828

Contract Title Merchant Fields, Cleckheaton

Lab No	1476832	1476833	1476834	1476835	1476836	1476837
Sample ID	TP42	TP38	TP38	TP02	TP42	TP20
Depth	0.40	0.10	0.30	0.10	0.10	0.10
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	15/03/19	15/03/19	15/03/19	13/03/19	15/03/19	14/03/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Subcon to Mountain	\$	0							Y
Mountainheath Subcon Prep	\$	0							Y
Preparation									
Metal >2mm	*	0.1	% m/m						
Plastic >2mm	*	0.1	% m/m						
Stones Removed	DETS 1003*	0							
Stones Removed	DETS 1003*	0	%						
Stones >2mm	DETS 1003*	1	% m/m						
Metals									
Arsenic	DETS 2301#	0.2	mg/kg	11	97	110	20	37	30
Boron, Water Soluble	DETS 2311#	0.2	mg/kg	0.4	0.6	0.6	0.5	0.4	0.4
Cadmium	DETS 2301#	0.1	mg/kg	0.3	1.2	0.7	0.3	0.6	0.3
Chromium	DETS 2301#	0.15	mg/kg	19	34	24	16	29	25
Chromium III	DETS 2301*	0.15	mg/kg	19	34	24	16	29	25
Chromium, Hexavalent	DETS 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETS 2301#	0.2	mg/kg	22	170	130	25	47	47
Lead	DETS 2301#	0.3	mg/kg	33	730	630	52	80	66
Magnesium Aqueous Extract	DETS 2076*	10	mg/l	< 10	< 10	< 10			
Mercury	DETS 2325#	0.05	mg/kg	< 0.05	0.28	0.25	0.12	0.12	0.14
Nickel	DETS 2301#	1	mg/kg	19	45	37	14	26	20
Selenium	DETS 2301#	0.5	mg/kg	0.7	1.5	0.9	< 0.5	2.0	< 0.5
Zinc	DETS 2301#	1	mg/kg	96	500	300	200	150	120
Inorganics									
pH	DETS 2008#			6.1	7.2	7.1	6.3	5.5	5.8
Calorific Value	DETS 5008	1	MJ/kg		6.6	6.9			
Total Organic Carbon	DETS 2084#	0.5	%	1.5	17	19	5.4	3.8	5.1
Chloride Aqueous Extract	DETS 2055	1	mg/l	6.1	7.6	5.5			
Nitrate Aqueous Extract as NO3	DETS 2055	1	mg/l	11	16	17			
Sulphate Aqueous Extract as SO4	DETS 2076#	10	mg/l	26	38	55			
PAHs									
Naphthalene	DETS 3303#	0.03	mg/kg	< 0.03	0.04	0.04	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETS 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETS 3303#	0.03	mg/kg	< 0.03	0.05	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	DETS 3303	0.03	mg/kg	< 0.03	0.04	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETS 3303#	0.03	mg/kg	0.04	0.58	0.29	0.06	0.18	0.14
Anthracene	DETS 3303	0.03	mg/kg	< 0.03	0.11	0.05	< 0.03	0.04	< 0.03
Fluoranthene	DETS 3303#	0.03	mg/kg	0.05	1.1	0.44	0.12	0.31	0.21
Pyrene	DETS 3303#	0.03	mg/kg	0.05	0.98	0.40	0.11	0.28	0.18
Benzo(a)anthracene	DETS 3303#	0.03	mg/kg	< 0.03	0.32	0.15	0.05	0.09	0.07
Chrysene	DETS 3303	0.03	mg/kg	< 0.03	0.41	0.20	0.05	0.11	0.08
Benzo(b)fluoranthene	DETS 3303#	0.03	mg/kg	< 0.03	0.35	0.19	0.05	0.10	0.06
Benzo(k)fluoranthene	DETS 3303#	0.03	mg/kg	< 0.03	0.15	0.08	< 0.03	0.04	< 0.03

Summary of Chemical Analysis Soil Samples

Our Ref 19-05258-1

Client Ref 2828

Contract Title Merchant Fields, Cleckheaton

Lab No	1476832	1476833	1476834	1476835	1476836	1476837
Sample ID	TP42	TP38	TP38	TP02	TP42	TP20
Depth	0.40	0.10	0.30	0.10	0.10	0.10
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	15/03/19	15/03/19	15/03/19	13/03/19	15/03/19	14/03/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	0.21	0.11	0.03	0.06	0.04
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	0.12	0.08	< 0.03	0.04	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	0.12	0.09	< 0.03	0.04	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	0.13	4.6	2.1	0.43	1.3	0.79

Summary of Chemical Analysis

Soil Samples

Our Ref 19-05258-1

Client Ref 2828

Contract Title Merchant Fields, Cleckheaton

Lab No	1476838	1476839	1476840	1476841	1476842	1476843
Sample ID	TP22	TP25	TP28	TP47	TP48	TP50
Depth	0.10	0.10	0.10	0.10	0.10	0.10
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	14/03/19	14/03/19	14/03/19	15/03/19	15/03/19	15/03/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Subcon to Mountain	\$	0							Y
Mountainheath Subcon Prep	\$	0							Y
Preparation									
Metal >2mm	*	0.1	% m/m						
Plastic >2mm	*	0.1	% m/m						
Stones Removed	DETS 1003*	0							
Stones Removed	DETS 1003*	0	%						
Stones >2mm	DETS 1003*	1	% m/m						
Metals									
Arsenic	DETS 2301#	0.2	mg/kg	25	31	24	37	37	43
Boron, Water Soluble	DETS 2311#	0.2	mg/kg	0.4	0.4	0.5	0.4	0.5	0.5
Cadmium	DETS 2301#	0.1	mg/kg	0.4	0.4	0.3	0.6	0.6	0.7
Chromium	DETS 2301#	0.15	mg/kg	20	22	22	22	25	23
Chromium III	DETS 2301*	0.15	mg/kg	20	22	22	22	25	23
Chromium, Hexavalent	DETS 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETS 2301#	0.2	mg/kg	36	57	39	47	50	54
Lead	DETS 2301#	0.3	mg/kg	59	74	61	72	79	77
Magnesium Aqueous Extract	DETS 2076*	10	mg/l						
Mercury	DETS 2325#	0.05	mg/kg	0.12	0.14	0.11	0.12	0.22	0.16
Nickel	DETS 2301#	1	mg/kg	17	23	20	19	24	25
Selenium	DETS 2301#	0.5	mg/kg	< 0.5	0.8	0.7	1.0	0.9	1.0
Zinc	DETS 2301#	1	mg/kg	150	100	100	100	110	130
Inorganics									
pH	DETS 2008#			6.0	6.3	6.5	5.9	6.7	6.2
Calorific Value	DETS 5008	1	MJ/kg						
Total Organic Carbon	DETS 2084#	0.5	%	5.1	5.9	5.0	4.7	4.8	5.7
Chloride Aqueous Extract	DETS 2055	1	mg/l						
Nitrate Aqueous Extract as NO3	DETS 2055	1	mg/l						
Sulphate Aqueous Extract as SO4	DETS 2076#	10	mg/l						
PAHs									
Naphthalene	DETS 3303#	0.03	mg/kg	< 0.03	0.11	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETS 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETS 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	DETS 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETS 3303#	0.03	mg/kg	0.10	0.18	0.08	0.10	0.16	0.08
Anthracene	DETS 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	DETS 3303#	0.03	mg/kg	0.14	0.26	0.18	0.21	0.27	0.15
Pyrene	DETS 3303#	0.03	mg/kg	0.12	0.23	0.15	0.18	0.24	0.14
Benzo(a)anthracene	DETS 3303#	0.03	mg/kg	0.04	0.08	0.05	0.07	0.08	0.05
Chrysene	DETS 3303	0.03	mg/kg	0.06	0.09	0.08	0.08	0.11	0.06
Benzo(b)fluoranthene	DETS 3303#	0.03	mg/kg	0.04	0.08	0.08	0.08	0.10	0.05
Benzo(k)fluoranthene	DETS 3303#	0.03	mg/kg	< 0.03	< 0.03	0.04	< 0.03	0.04	< 0.03

Summary of Chemical Analysis Soil Samples

Our Ref 19-05258-1

Client Ref 2828

Contract Title Merchant Fields, Cleckheaton

Lab No	1476838	1476839	1476840	1476841	1476842	1476843
Sample ID	TP22	TP25	TP28	TP47	TP48	TP50
Depth	0.10	0.10	0.10	0.10	0.10	0.10
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	14/03/19	14/03/19	14/03/19	15/03/19	15/03/19	15/03/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	0.05	0.05	0.04	0.06	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.04	< 0.03	0.04	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.04	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	0.50	1.1	0.77	0.77	1.2	0.53

Summary of Chemical Analysis

Soil Samples

Our Ref 19-05258-1

Client Ref 2828

Contract Title Merchant Fields, Cleckheaton

Lab No	1476844	1476845	1476846	1476847	1476848	1476849
Sample ID	TP03	TP07	TP09	TP12	TP15	TP17
Depth	0.20	0.20	0.20	0.20	0.20	0.20
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	13/03/19	14/03/19	14/03/19	14/03/19	14/03/19	14/03/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Subcon to Mountain	\$	0						Y	
Mountainheath Subcon Prep	\$	0						Y	
Preparation									
Metal >2mm	*	0.1	% m/m						
Plastic >2mm	*	0.1	% m/m						
Stones Removed	DETS 1003*	0							
Stones Removed	DETS 1003*	0	%						
Stones >2mm	DETS 1003*	1	% m/m						
Metals									
Arsenic	DETS 2301#	0.2	mg/kg	21	16	30	30	25	27
Boron, Water Soluble	DETS 2311#	0.2	mg/kg	0.4	0.5	0.7	0.3	0.4	0.4
Cadmium	DETS 2301#	0.1	mg/kg	0.3	0.2	0.6	0.5	0.6	0.5
Chromium	DETS 2301#	0.15	mg/kg	19	13	25	20	22	21
Chromium III	DETS 2301*	0.15	mg/kg	19	13	25	20	22	21
Chromium, Hexavalent	DETS 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETS 2301#	0.2	mg/kg	60	28	40	45	36	41
Lead	DETS 2301#	0.3	mg/kg	51	41	71	71	68	66
Magnesium Aqueous Extract	DETS 2076*	10	mg/l						
Mercury	DETS 2325#	0.05	mg/kg	0.20	0.08	0.18	0.17	0.17	0.13
Nickel	DETS 2301#	1	mg/kg	17	11	20	21	20	22
Selenium	DETS 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	0.8	< 0.5
Zinc	DETS 2301#	1	mg/kg	93	62	120	130	120	110
Inorganics									
pH	DETS 2008#			6.5	6.4	6.6	5.6	6.5	6.1
Calorific Value	DETS 5008	1	MJ/kg						
Total Organic Carbon	DETS 2084#	0.5	%	4.7	5.3	5.6	5.8	4.6	4.3
Chloride Aqueous Extract	DETS 2055	1	mg/l						
Nitrate Aqueous Extract as NO3	DETS 2055	1	mg/l						
Sulphate Aqueous Extract as SO4	DETS 2076#	10	mg/l						
PAHs									
Naphthalene	DETS 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETS 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETS 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	DETS 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETS 3303#	0.03	mg/kg	0.16	0.08	0.07	< 0.03	0.04	0.06
Anthracene	DETS 3303	0.03	mg/kg	0.03	< 0.03	0.07	< 0.03	< 0.03	< 0.03
Fluoranthene	DETS 3303#	0.03	mg/kg	0.24	0.14	0.13	0.07	0.08	0.11
Pyrene	DETS 3303#	0.03	mg/kg	0.20	0.13	0.12	0.05	0.06	0.10
Benzo(a)anthracene	DETS 3303#	0.03	mg/kg	0.06	0.05	0.04	< 0.03	< 0.03	0.04
Chrysene	DETS 3303	0.03	mg/kg	0.08	0.06	0.04	< 0.03	< 0.03	0.04
Benzo(b)fluoranthene	DETS 3303#	0.03	mg/kg	0.06	0.05	0.04	< 0.03	< 0.03	0.04
Benzo(k)fluoranthene	DETS 3303#	0.03	mg/kg	0.03	0.03	< 0.03	< 0.03	< 0.03	< 0.03

Summary of Chemical Analysis Soil Samples

Our Ref 19-05258-1

Client Ref 2828

Contract Title Merchant Fields, Cleckheaton

Lab No	1476844	1476845	1476846	1476847	1476848	1476849
Sample ID	TP03	TP07	TP09	TP12	TP15	TP17
Depth	0.20	0.20	0.20	0.20	0.20	0.20
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	13/03/19	14/03/19	14/03/19	14/03/19	14/03/19	14/03/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	0.03	0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	0.03	0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	0.80	0.50	0.52	0.12	0.18	0.39

Summary of Chemical Analysis

Soil Samples

Our Ref 19-05258-1

Client Ref 2828

Contract Title Merchant Fields, Cleckheaton

Lab No	1476850	1476851	1476852	1476853	1476854	1476855
Sample ID	TP19	TP30	TP37	TP25	TP44	TP57
Depth	0.20	0.20	0.20	1.00	0.80	0.90
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	14/03/19	14/03/19	15/03/19	14/03/19	15/03/19	15/03/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Subcon to Mountain	\$	0							
Mountainheath Subcon Prep	\$	0							
Preparation									
Metal >2mm	*	0.1	% m/m						
Plastic >2mm	*	0.1	% m/m						
Stones Removed	DETS 1003*	0							
Stones Removed	DETS 1003*	0	%						
Stones >2mm	DETS 1003*	1	% m/m						
Metals									
Arsenic	DETS 2301#	0.2	mg/kg	43	30	53			
Boron, Water Soluble	DETS 2311#	0.2	mg/kg	0.5	0.3	0.4			
Cadmium	DETS 2301#	0.1	mg/kg	0.5	0.4	0.5			
Chromium	DETS 2301#	0.15	mg/kg	27	23	20			
Chromium III	DETS 2301*	0.15	mg/kg	27	23	20			
Chromium, Hexavalent	DETS 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0			
Copper	DETS 2301#	0.2	mg/kg	59	44	49			
Lead	DETS 2301#	0.3	mg/kg	94	85	76			
Magnesium Aqueous Extract	DETS 2076*	10	mg/l						
Mercury	DETS 2325#	0.05	mg/kg	0.21	0.12	0.18			
Nickel	DETS 2301#	1	mg/kg	25	21	20			
Selenium	DETS 2301#	0.5	mg/kg	0.8	1.0	1.2			
Zinc	DETS 2301#	1	mg/kg	140	110	97			
Inorganics									
pH	DETS 2008#			5.7	5.7	6.1	6.4	7.2	7.3
Calorific Value	DETS 5008	1	MJ/kg						
Total Organic Carbon	DETS 2084#	0.5	%	5.8	4.7	5.8			
Chloride Aqueous Extract	DETS 2055	1	mg/l						
Nitrate Aqueous Extract as NO3	DETS 2055	1	mg/l						
Sulphate Aqueous Extract as SO4	DETS 2076#	10	mg/l				22	11	< 10
PAHs									
Naphthalene	DETS 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03			
Acenaphthylene	DETS 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03			
Acenaphthene	DETS 3303#	0.03	mg/kg	0.04	< 0.03	< 0.03			
Fluorene	DETS 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03			
Phenanthrene	DETS 3303#	0.03	mg/kg	0.23	0.14	0.11			
Anthracene	DETS 3303	0.03	mg/kg	0.04	< 0.03	< 0.03			
Fluoranthene	DETS 3303#	0.03	mg/kg	0.33	0.21	0.15			
Pyrene	DETS 3303#	0.03	mg/kg	0.29	0.18	0.12			
Benzo(a)anthracene	DETS 3303#	0.03	mg/kg	0.10	0.07	0.04			
Chrysene	DETS 3303	0.03	mg/kg	0.11	0.07	0.06			
Benzo(b)fluoranthene	DETS 3303#	0.03	mg/kg	0.10	0.05	0.04			
Benzo(k)fluoranthene	DETS 3303#	0.03	mg/kg	0.04	< 0.03	< 0.03			

Summary of Chemical Analysis Soil Samples

Our Ref 19-05258-1

Client Ref 2828

Contract Title Merchant Fields, Cleckheaton

Lab No	1476850	1476851	1476852	1476853	1476854	1476855
Sample ID	TP19	TP30	TP37	TP25	TP44	TP57
Depth	0.20	0.20	0.20	1.00	0.80	0.90
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	14/03/19	14/03/19	15/03/19	14/03/19	15/03/19	15/03/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	0.06	0.04	< 0.03			
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03			
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03			
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03			
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	1.3	0.76	0.52			

Summary of Chemical Analysis

Soil Samples

Our Ref 19-05258-1

Client Ref 2828

Contract Title Merchant Fields, Cleckheaton

Lab No	1476856	1476857	1476858	1476859	1476860	1476861
Sample ID	TP42	TP40	TP20	TP25	TP27	TP55
Depth	1.30	1.60	1.80	1.80	1.80	2.00
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	15/03/19	15/03/19	14/03/19	14/03/19	14/03/19	15/03/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Subcon to Mountain	\$	0							
Mountainheath Subcon Prep	\$	0							
Preparation									
Metal >2mm	*	0.1	% m/m						
Plastic >2mm	*	0.1	% m/m						
Stones Removed	DETSC 1003*	0							
Stones Removed	DETSC 1003*	0	%						
Stones >2mm	DETSC 1003*	1	% m/m						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg						
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg						
Cadmium	DETSC 2301#	0.1	mg/kg						
Chromium	DETSC 2301#	0.15	mg/kg						
Chromium III	DETSC 2301*	0.15	mg/kg						
Chromium, Hexavalent	DETSC 2204*	1	mg/kg						
Copper	DETSC 2301#	0.2	mg/kg						
Lead	DETSC 2301#	0.3	mg/kg						
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l			< 10			
Mercury	DETSC 2325#	0.05	mg/kg						
Nickel	DETSC 2301#	1	mg/kg						
Selenium	DETSC 2301#	0.5	mg/kg						
Zinc	DETSC 2301#	1	mg/kg						
Inorganics									
pH	DETSC 2008#			7.1	6.1	7.2	5.4	6.2	7.0
Calorific Value	DETSC 5008	1	MJ/kg						
Total Organic Carbon	DETSC 2084#	0.5	%						
Chloride Aqueous Extract	DETSC 2055	1	mg/l				2.4		
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l				< 1.0		
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	< 10	25	44	23	16	20
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg						
Acenaphthylene	DETSC 3303#	0.03	mg/kg						
Acenaphthene	DETSC 3303#	0.03	mg/kg						
Fluorene	DETSC 3303	0.03	mg/kg						
Phenanthrene	DETSC 3303#	0.03	mg/kg						
Anthracene	DETSC 3303	0.03	mg/kg						
Fluoranthene	DETSC 3303#	0.03	mg/kg						
Pyrene	DETSC 3303#	0.03	mg/kg						
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg						
Chrysene	DETSC 3303	0.03	mg/kg						
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg						
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg						



Summary of Chemical Analysis Soil Samples

Our Ref 19-05258-1

Client Ref 2828

Contract Title Merchant Fields, Cleckheaton

Lab No	1476856	1476857	1476858	1476859	1476860	1476861
Sample ID	TP42	TP40	TP20	TP25	TP27	TP55
Depth	1.30	1.60	1.80	1.80	1.80	2.00
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	15/03/19	15/03/19	14/03/19	14/03/19	14/03/19	15/03/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg						
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg						
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg						
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg						
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg						

Summary of Chemical Analysis

Soil Samples

Our Ref 19-05258-1

Client Ref 2828

Contract Title Merchant Fields, Cleckheaton

Lab No	1476862	1476863	1477487	1477488	1477489	1481602
Sample ID	TP29	TP48	TP02	TP12	TP47	TP17
Depth	2.60	2.20	1.20	1.40	1.40	1.50
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	14/03/19	15/03/19	13/03/19	14/03/19	15/03/19	14/03/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Subcon to Mountain	\$	0							
Mountainheath Subcon Prep	\$	0							
Preparation									
Metal >2mm	*	0.1	% m/m						
Plastic >2mm	*	0.1	% m/m						
Stones Removed	DETSC 1003*	0							
Stones Removed	DETSC 1003*	0	%						
Stones >2mm	DETSC 1003*	1	% m/m						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg						
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg						
Cadmium	DETSC 2301#	0.1	mg/kg						
Chromium	DETSC 2301#	0.15	mg/kg						
Chromium III	DETSC 2301*	0.15	mg/kg						
Chromium, Hexavalent	DETSC 2204*	1	mg/kg						
Copper	DETSC 2301#	0.2	mg/kg						
Lead	DETSC 2301#	0.3	mg/kg						
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l		< 10				
Mercury	DETSC 2325#	0.05	mg/kg						
Nickel	DETSC 2301#	1	mg/kg						
Selenium	DETSC 2301#	0.5	mg/kg						
Zinc	DETSC 2301#	1	mg/kg						
Inorganics									
pH	DETSC 2008#			6.6	5.2	6.7	7.0	5.6	6.3
Calorific Value	DETSC 5008	1	MJ/kg						
Total Organic Carbon	DETSC 2084#	0.5	%						
Chloride Aqueous Extract	DETSC 2055	1	mg/l		2.3				
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l		< 1.0				
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	14	< 10	25	15	47	16
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg						
Acenaphthylene	DETSC 3303#	0.03	mg/kg						
Acenaphthene	DETSC 3303#	0.03	mg/kg						
Fluorene	DETSC 3303	0.03	mg/kg						
Phenanthrene	DETSC 3303#	0.03	mg/kg						
Anthracene	DETSC 3303	0.03	mg/kg						
Fluoranthene	DETSC 3303#	0.03	mg/kg						
Pyrene	DETSC 3303#	0.03	mg/kg						
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg						
Chrysene	DETSC 3303	0.03	mg/kg						
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg						
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg						



Summary of Chemical Analysis Soil Samples

Our Ref 19-05258-1

Client Ref 2828

Contract Title Merchant Fields, Cleckheaton

Lab No	1476862	1476863	1477487	1477488	1477489	1481602
Sample ID	TP29	TP48	TP02	TP12	TP47	TP17
Depth	2.60	2.20	1.20	1.40	1.40	1.50
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	14/03/19	15/03/19	13/03/19	14/03/19	15/03/19	14/03/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg						
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg						
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg						
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg						
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg						

Summary of Asbestos Analysis

Soil Samples

Our Ref 19-05258-1

Client Ref 2828

Contract Title Merchant Fields, Cleckheaton

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1476832	TP42 0.40	SOIL	NAD	none	Colin Patrick
1476833	TP38 0.10	SOIL	NAD	none	Colin Patrick
1476834	TP38 0.30	SOIL	NAD	none	Colin Patrick
1476835	TP02 0.10	SOIL	NAD	none	Colin Patrick
1476836	TP42 0.10	SOIL	NAD	none	Colin Patrick
1476837	TP20 0.10	SOIL	NAD	none	Colin Patrick
1476838	TP22 0.10	SOIL	NAD	none	Colin Patrick
1476839	TP25 0.10	SOIL	NAD	none	Colin Patrick
1476840	TP28 0.10	SOIL	NAD	none	Colin Patrick
1476841	TP47 0.10	SOIL	NAD	none	Colin Patrick
1476842	TP48 0.10	SOIL	NAD	none	Colin Patrick
1476843	TP50 0.10	SOIL	NAD	none	Colin Patrick
1476844	TP03 0.20	SOIL	NAD	none	Colin Patrick
1476845	TP07 0.20	SOIL	NAD	none	Colin Patrick
1476846	TP09 0.20	SOIL	NAD	none	Colin Patrick
1476847	TP12 0.20	SOIL	NAD	none	Colin Patrick
1476848	TP15 0.20	SOIL	NAD	none	Colin Patrick
1476849	TP17 0.20	SOIL	NAD	none	Colin Patrick
1476850	TP19 0.20	SOIL	NAD	none	Colin Patrick
1476851	TP30 0.20	SOIL	NAD	none	Colin Patrick
1476852	TP37 0.20	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 19-05258-1
 Client Ref 2828
 Contract Merchant Fields, Cleckheaton

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1476826	TP50 0.10 SOIL	15/03/19	GJ 250ml, PG, PT 1L		
1476827	TP20 0.15 SOIL	14/03/19	PG		
1476828	TP15 0.20 SOIL	14/03/19	GJ 250ml, PG, PT 1L		
1476829	HP01 0.10 SOIL	15/03/19	GJ 250ml, GJ 60ml, PT 1L		
1476830	HP02 0.10 SOIL	15/03/19	GJ 250ml, GJ 60ml, PT 1L		
1476831	HP03 0.10 SOIL	15/03/19	GJ 250ml, GJ 60ml, PT 1L		
1476832	TP42 0.40 SOIL	15/03/19	GJ 250ml, PT 1L		
1476833	TP38 0.10 SOIL	15/03/19	GJ 250ml, GJ 60ml, PT 1L		
1476834	TP38 0.30 SOIL	15/03/19	GJ 250ml, GJ 60ml, PT 1L		
1476835	TP02 0.10 SOIL	13/03/19	GJ 250ml, PT 1L		
1476836	TP42 0.10 SOIL	15/03/19	GJ 250ml, PT 1L		
1476837	TP20 0.10 SOIL	14/03/19	GJ 250ml, PT 1L		
1476838	TP22 0.10 SOIL	14/03/19	GJ 250ml, PT 1L		
1476839	TP25 0.10 SOIL	14/03/19	GJ 250ml, PT 1L		
1476840	TP28 0.10 SOIL	14/03/19	GJ 250ml, PT 1L		
1476841	TP47 0.10 SOIL	15/03/19	GJ 250ml, PG, PT 1L		
1476842	TP48 0.10 SOIL	15/03/19	GJ 250ml, PT 1L		
1476843	TP50 0.10 SOIL	15/03/19	GJ 250ml, PG, PT 1L		
1476844	TP03 0.20 SOIL	13/03/19	GJ 250ml, PT 1L		
1476845	TP07 0.20 SOIL	14/03/19	GJ 250ml, PT 1L		
1476846	TP09 0.20 SOIL	14/03/19	GJ 250ml, PT 1L		
1476847	TP12 0.20 SOIL	14/03/19	GJ 250ml, PT 1L		
1476848	TP15 0.20 SOIL	14/03/19	GJ 250ml, PG, PT 1L		
1476849	TP17 0.20 SOIL	14/03/19	GJ 250ml, PT 1L		
1476850	TP19 0.20 SOIL	14/03/19	GJ 250ml, PT 1L		
1476851	TP30 0.20 SOIL	14/03/19	GJ 250ml, PT 1L		
1476852	TP37 0.20 SOIL	15/03/19	GJ 250ml, PT 1L		
1476853	TP25 1.00 SOIL	14/03/19	PT 1L		
1476854	TP44 0.80 SOIL	15/03/19	PT 1L		
1476855	TP57 0.90 SOIL	15/03/19	PT 1L		
1476856	TP42 1.30 SOIL	15/03/19	PT 1L		
1476857	TP40 1.60 SOIL	15/03/19	PT 1L		
1476858	TP20 1.80 SOIL	14/03/19	PT 1L		
1476859	TP25 1.80 SOIL	14/03/19	PT 1L		
1476860	TP27 1.80 SOIL	14/03/19	PT 1L		
1476861	TP55 2.00 SOIL	15/03/19	PT 1L		
1476862	TP29 2.60 SOIL	14/03/19	PT 1L		
1476863	TP48 2.20 SOIL	15/03/19	PT 1L		
1477487	TP02 1.20 SOIL	13/03/19	PT 1L	pH + Conductivity (7 days)	
1477488	TP12 1.40 SOIL	14/03/19	PT 1L	pH + Conductivity (7 days)	
1477489	TP47 1.40 SOIL	15/03/19	PT 1L		
1481602	TP17 1.50 SOIL	14/03/19	PT 1L	pH + Conductivity (7 days)	

Information in Support of the Analytical Results

Our Ref 19-05258-1

Client Ref 2828

Contract Merchant Fields, Cleckheaton

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

Appendix I
Geotechnical Test Results



LABORATORY REPORT



4043

Contract Number: PSL19/1796

Report Date: 01 April 2019
Client's Reference: 2828
Client Name: Lithos Consulting
Parkhill
Walton Road
Wetherby
North Yorkshire
LS22 5DZ

For the attention of: Lewis Whiteley/Matt Thompson

Contract Title: Merchant Fields, Cleckheaton

Date Received: 20/3/2019
Date Commenced: 20/3/2019
Date Completed: 01/4/2019

Notes: Opinions and Interpretations are outside the UKAS Accreditation

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

Checked and Approved Signatories:

R Gunson
(Director)

A Watkins
(Director)

R Berriman
(Quality Manager)

L Knight
(Senior Technician)


S Eyre
(Senior Technician)

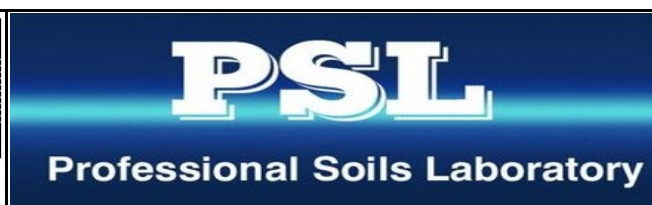
R Cowles
(Senior Technician)

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
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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
TP47	2	D	0.50		Brown mottled grey slightly sandy sandy silty CLAY.
TP11	2	D	0.60		Brown mottled grey sandy silty CLAY.
TP24	1	D	0.60		Brown mottled grey slightly sandy silty CLAY.
TP09	2	D	0.70		Brown mottled grey sandy silty CLAY.
TP18	2	D	0.70		Brown mottled grey slightly gravelly sandy silty CLAY.
TP39	3	D	0.70		Brown mottled grey sandy silty CLAY.
TP06	1	D	0.90		Brown mottled grey slightly sandy silty CLAY.
TP20	3	D	0.90		Brown mottled grey sandy silty CLAY.
TP22	2	D	0.90		Brown mottled grey slightly sandy silty CLAY.
TP27	2	D	1.10		Brown mottled grey slightly sandy silty CLAY.
TP33	3	D	1.20		Brown mottled grey slightly sandy silty CLAY.
TP46	2	D	1.20		Brown mottled grey slightly gravelly very sandy silty CLAY.
TP36	2	D	1.30		Brown mottled grey slightly sandy silty CLAY.
TP38	4	D	1.30		Brown mottled grey slightly sandy silty CLAY.
TP24	2	D	1.50		Brown mottled grey very sandy silty CLAY.
TP28	4	D	2.10		Brown mottled grey slightly gravelly sandy silty CLAY.
TP05	2	D&B	0.40		Brown mottled grey slightly sandy CLAY.
TP42	3	D&B	0.70		Brown gravelly sandy CLAY.
TP51	1	D&B	0.70		Dark brown slightly sandy CLAY.



Merchant Fields, Cleckheaton

Contract No:

PSL19/1796

Client Ref:

2828

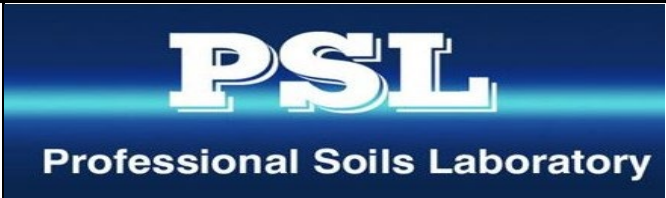
SUMMARY OF SOIL CLASSIFICATION TESTS

(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 ³ Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
TP47	2	D	0.50		26			52	25	27	100	High plasticity CH.
TP11	2	D	0.60		20			44	23	21	100	Intermediate plasticity CI.
TP24	1	D	0.60		25			55	26	29	100	High plasticity CH.
TP09	2	D	0.70		27			41	21	20	100	Intermediate plasticity CI.
TP18	2	D	0.70		21			40	21	19	98	Intermediate plasticity CI.
TP39	3	D	0.70		24			49	23	26	100	Intermediate plasticity CI.
TP06	1	D	0.90		22			54	26	28	100	High plasticity CH.
TP20	3	D	0.90		23			45	22	23	100	Intermediate plasticity CI.
TP22	2	D	0.90		26			55	27	28	100	High plasticity CH.
TP27	2	D	1.10		22			51	24	27	100	High plasticity CH.
TP33	3	D	1.20		24			54	26	28	100	High plasticity CH.
TP46	2	D	1.20		15			34	21	13	97	Low plasticity CL.
TP36	2	D	1.30		27			52	26	26	100	High plasticity CH.
TP38	4	D	1.30		24			55	27	28	100	High plasticity CH.
TP24	2	D	1.50		17			35	21	14	100	Low plasticity CL.
TP28	4	D	2.10		17			48	23	25	96	Intermediate plasticity CI.
TP05	2	D&B	0.40		26			57	25	32	100	High plasticity CH.
TP42	3	D&B	0.70		15			46	21	25	100	Intermediate plasticity CI.
TP51	1	D&B	0.70		28			66	28	38	100	High plasticity CH.

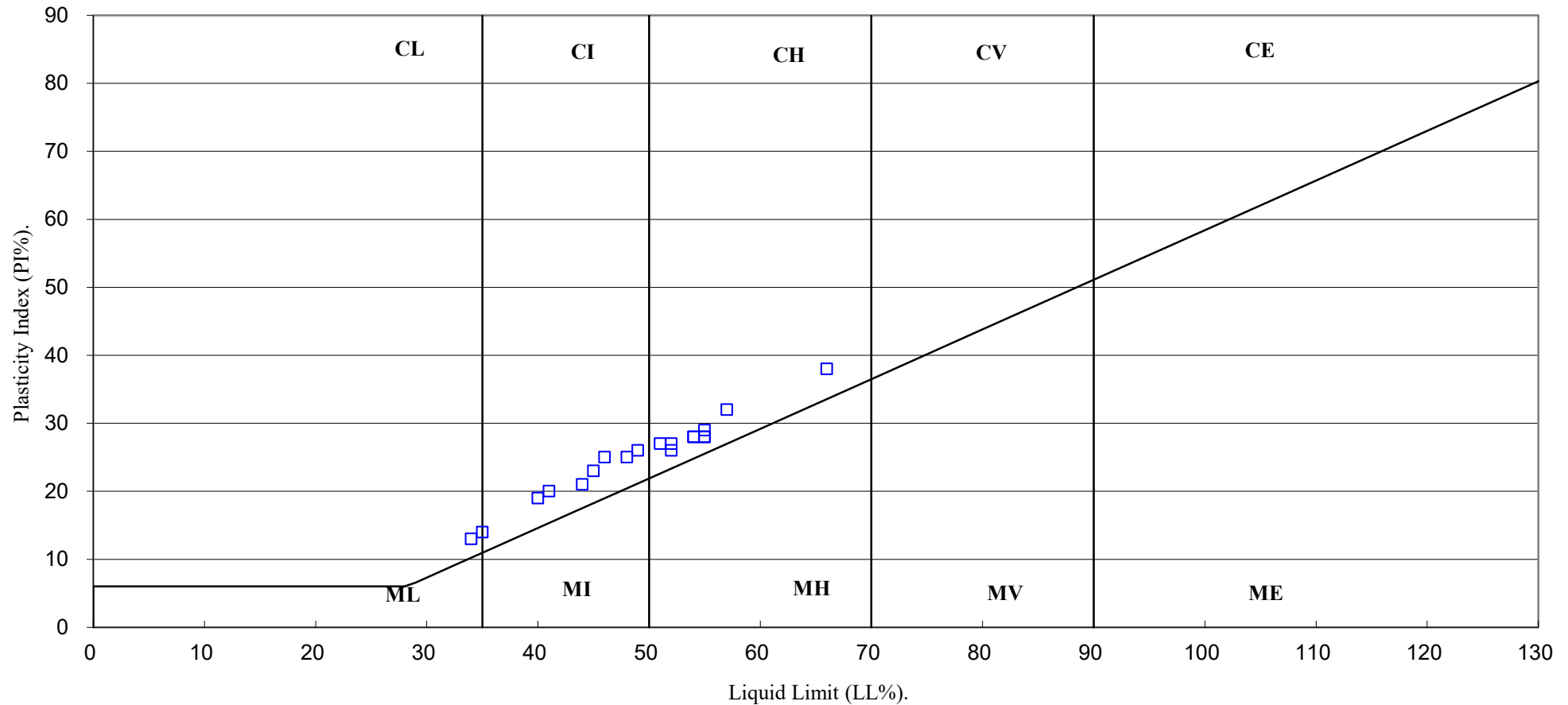
SYMBOLS : NP : Non Plastic

* : Liquid Limit and Plastic Limit Wet Sieved.

		Contract No:	
		PSL19/1796	
		Client Ref:	
		2828	

Merchant Fields, Cleckheaton

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



4043

PSL

Professional Soils Laboratory

Merchant Fields, Cleckheaton

Contract No:

PSL19/1796

Client Ref:

2828

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

[illegible]

SYMBOLS : NP : Non Plastic

*** : Liquid Limit and Plastic Limit Wet Sieved.**



4043

PSL

Professional Soils Laboratory

Merchant Fields, Cleckheaton

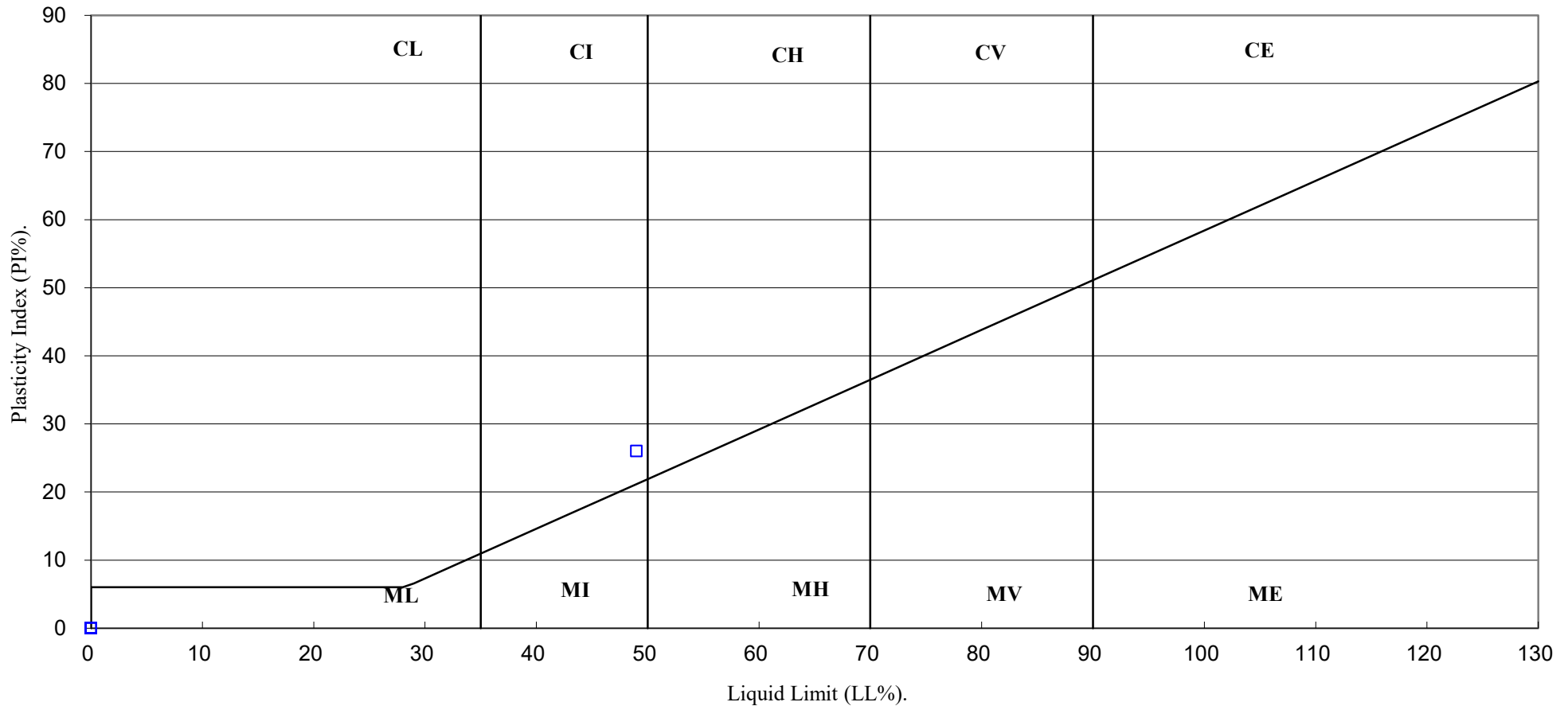
Contract No:

PSL19/1796

Client Ref:

2828

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



4043

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Professional Soils Laboratory

Merchant Fields, Cleckheaton

Contract No:

PSL19/1796

Client Ref:

2828

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : 1990

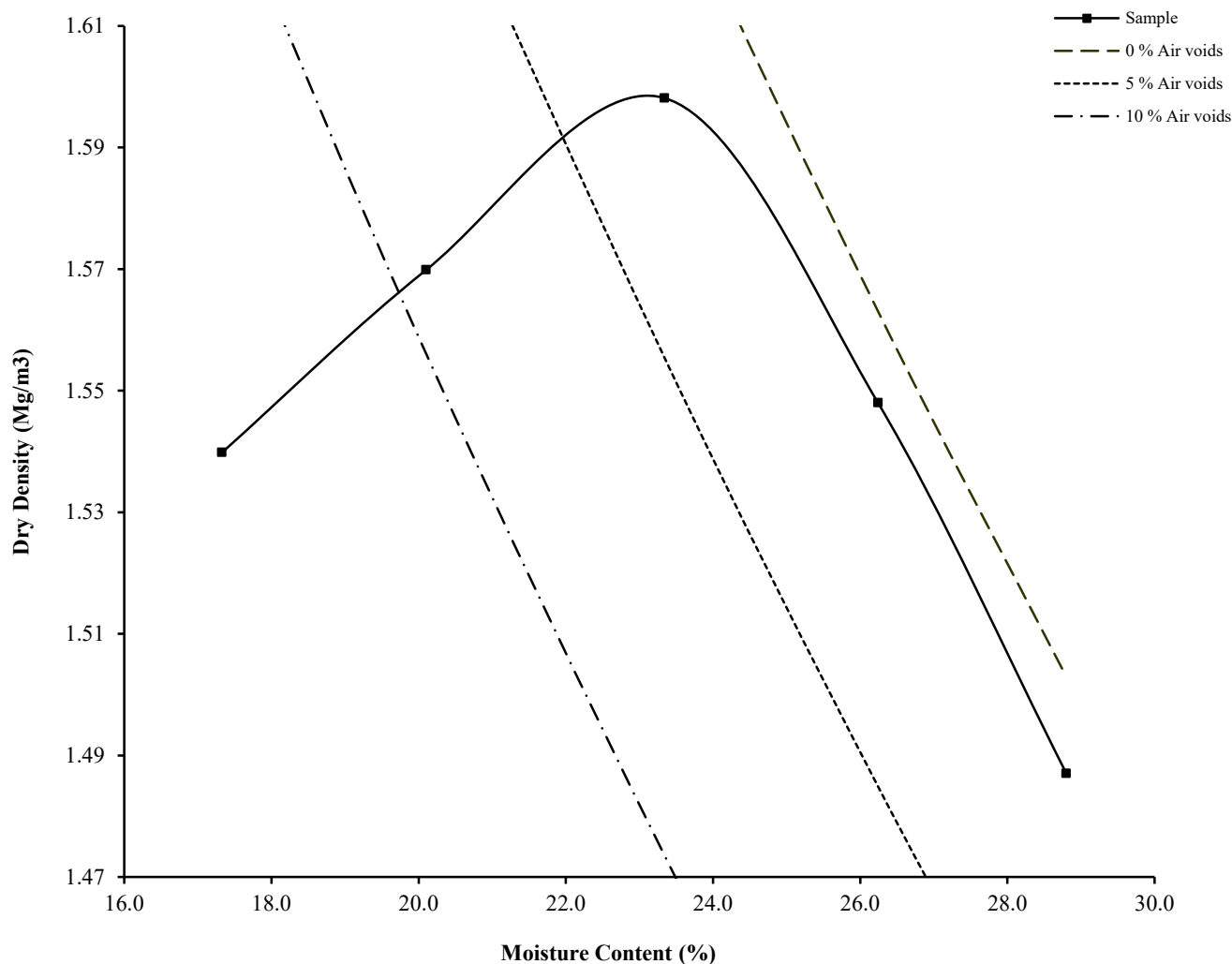
Hole Number: TP05

Top Depth (m) : 0.40

Sample Number: 2

Base Depth (m) :

Sample Type: D&B



Initial Moisture Content:	26	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m ³):	2.65	Assumed	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (Mg/m ³):	1.60		Material Retained on 20.0 mm Test Sieve (%):	0
Optimum Moisture Content (%):	23			
Remarks				
See summary of soil descriptions.				



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Contract
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Client Ref
2828

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : 1990

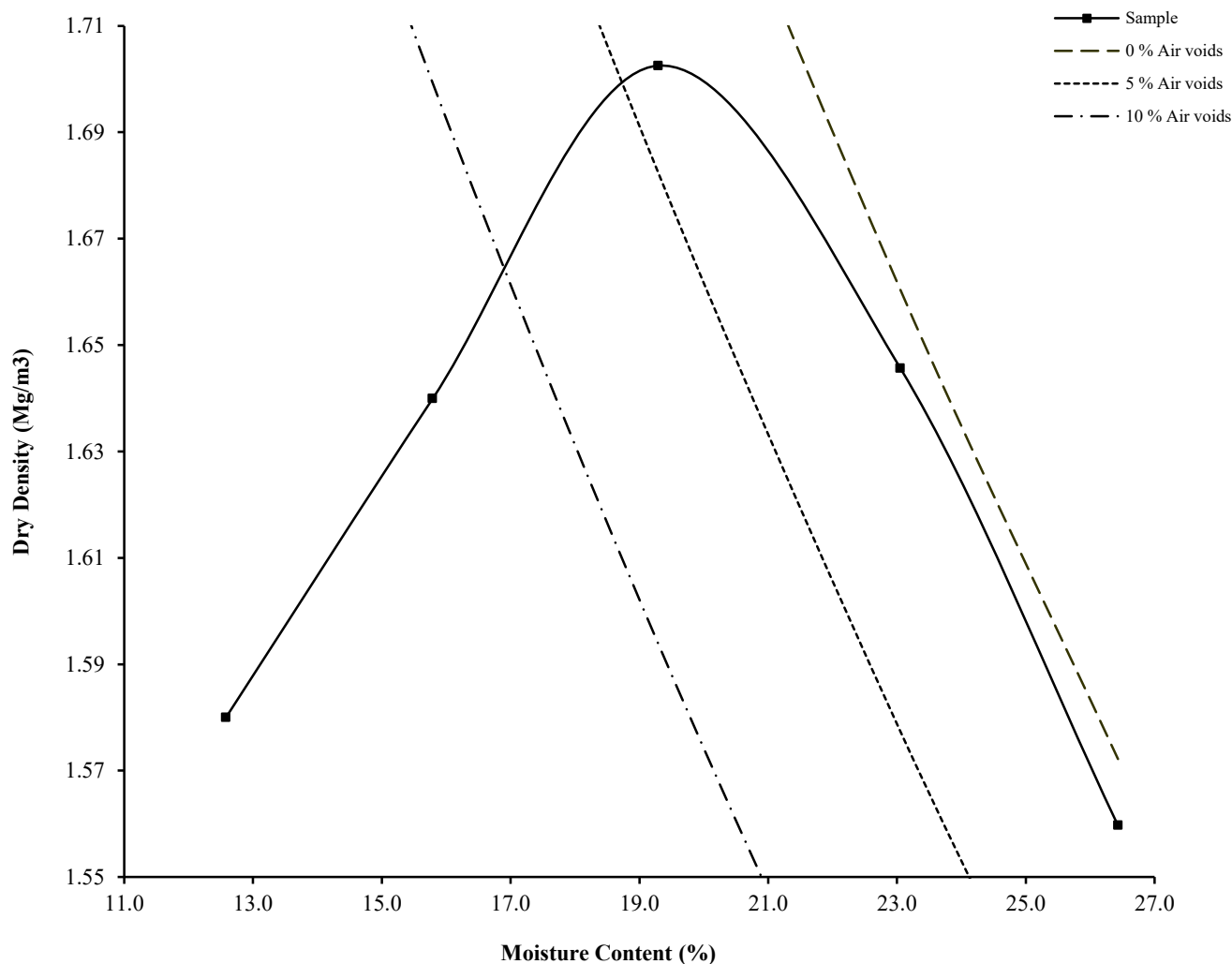
Hole Number: TP29

Top Depth (m) : 0.80

Sample Number: 2

Base Depth (m) :

Sample Type: D&B



Initial Moisture Content:	23	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m ³):	2.69	Assumed	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (Mg/m ³):	1.70		Material Retained on 20.0 mm Test Sieve (%):	0
Optimum Moisture Content (%):	19			
Remarks				
See summary of soil descriptions.				



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Client Ref
2828

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : 1990

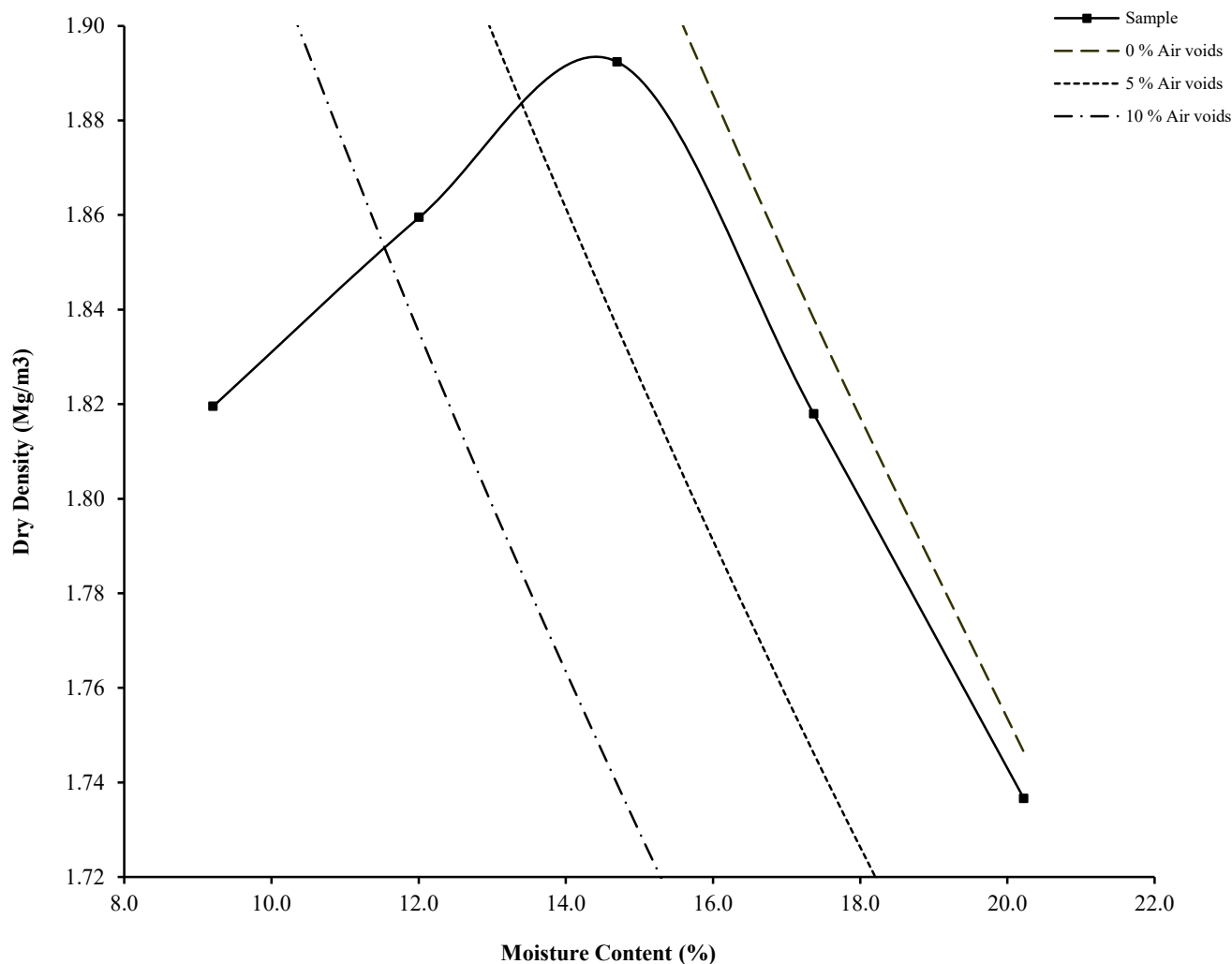
Hole Number: TP42

Top Depth (m) : 0.70

Sample Number: 3

Base Depth (m) :

Sample Type: D&B



Initial Moisture Content:	15	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m ³):	2.7	Assumed	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (Mg/m ³):	1.89		Material Retained on 20.0 mm Test Sieve (%):	0
Optimum Moisture Content (%):	15			
Remarks				
See summary of soil descriptions.				



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DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : 1990

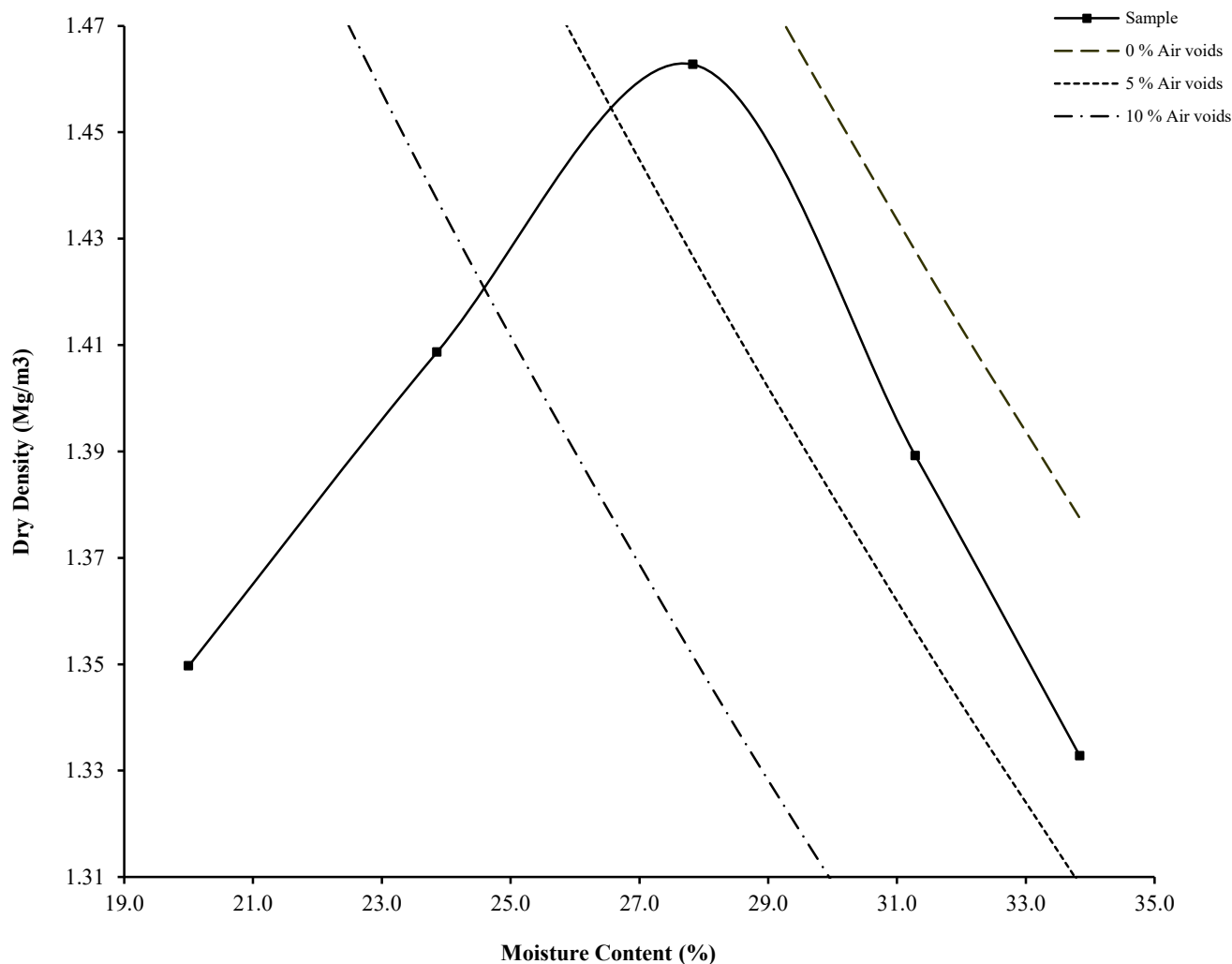
Hole Number: TP51

Top Depth (m) : 0.70

Sample Number: 1

Base Depth (m) :

Sample Type: D&B



Initial Moisture Content:	28	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m ³):	2.58	Assumed	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (Mg/m ³):	1.46		Material Retained on 20.0 mm Test Sieve (%):	0
Optimum Moisture Content (%):	26			
Remarks				
See summary of soil descriptions.				



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Contract
PSL19/1796
Client Ref
2828



Certificate of Analysis

Certificate Number 19-05554

27-Mar-19

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

Our Reference 19-05554

Client Reference PSL19/1796

Order No (not supplied)

Contract Title Merchant Fields, Cleckheaton

Description 20 Soil samples.

Date Received 25-Mar-19

Date Started 25-Mar-19

Date Completed 27-Mar-19

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

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 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. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Adam Fenwick
Contracts Manager



Summary of Chemical Analysis

Soil Samples

Our Ref 19-05554

Client Ref PSL19/1796

Contract Title Merchant Fields, Cleckheaton

Lab No	1478901	1478902	1478903	1478904	1478905	1478906	1478907	1478908	1478909	1478910	1478911
Sample ID	TP47	TP11	TP24	TP09	TP18	TP39	TP06	TP20	TP22	TP27	TP33
Depth	0.50	0.60	0.60	0.70	0.70	0.70	0.90	0.90	0.90	1.10	1.20
Other ID	2	2	1	2	2	3	1	3	2	2	3
Sample Type	D	D	D	D	D	D	D	D	D	D	D
Sampling Date	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

Test	Method	LOD	Units											
Inorganics														
pH	DETSC 2008#			6.8	6.4	6.8	6.9	6.4	6.0	7.2	6.7	6.7	6.4	5.6
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	19	19	16	30	< 10	70	41	13	18	23	31

Summary of Chemical Analysis

Soil Samples

Our Ref 19-05554

Client Ref PSL19/1796

Contract Title Merchant Fields, Cleckheaton

Lab No	1478912	1478913	1478914	1478915	1478916	1478917	1478918	1478919	1478920
Sample ID	TP46	TP36	TP38	TP24	TP28	TP05	TP42	TP51	TP29
Depth	1.20	1.30	1.30	1.50	2.10	0.40	0.70	0.70	0.80
Other ID	2	2	4	2	4	2	3	1	2
Sample Type	D	D	D	D	D	D	D	D	D
Sampling Date	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

Test	Method	LOD	Units									
Inorganics												
pH	DETS 2008#			6.0	6.2	6.5	5.8	6.0	6.7	6.4	6.7	7.0
Sulphate Aqueous Extract as SO4	DETS 2076#	10	mg/l	13	37	58	17	22	31	< 10	< 10	27

Information in Support of the Analytical Results

Our Ref 19-05554
 Client Ref PSL19/1796
 Contract Merchant Fields, Cleckheaton

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1478901	TP47 0.50 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1478902	TP11 0.60 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1478903	TP24 0.60 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1478904	TP09 0.70 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1478905	TP18 0.70 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1478906	TP39 0.70 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1478907	TP06 0.90 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1478908	TP20 0.90 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1478909	TP22 0.90 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1478910	TP27 1.10 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1478911	TP33 1.20 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1478912	TP46 1.20 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1478913	TP36 1.30 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1478914	TP38 1.30 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1478915	TP24 1.50 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1478916	TP28 2.10 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1478917	TP05 0.40 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1478918	TP42 0.70 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1478919	TP51 0.70 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1478920	TP29 0.80 SOIL		PT 1L	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.

Information in Support of the Analytical Results

Our Ref 19-05554
Client Ref PSL19/1796
Contract Merchant Fields, Cleckheaton

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

Appendix J
Gas Monitoring Results

Job Title:										Job No:		
Merchants Field, Cleckheaton										2828		
Client:										Sheet :		
Harron Homes										1 of 1		
Date:		Arrival Time:		Depart Time:		Operator:						
15/04/2019		09:00		16:00		A Taylor						

Gas Monitoring Results:									
Ambient Concentration (% Volume):				CH ₄ :	0.0	CO ₂ :	0.0	O ₂ :	20.0

Monitoring Point	Groundwater level (m) bgl	Concentrations					Gas Flow Rates			Bottom of well m	Remarks
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady		
		CH ₄	CO ₂	CH ₄	CO ₂	O ₂					
		% v/v	(%)	% v/v	(%)	(%)					
PH01A	3.58	ND	0.4	ND	0.4	20.0	15.0	ND	40.0	4.70	Well bailed to 4.28m at 13:17 -5l. Remonitored at 15:31.
PH02A	2.11	ND	0.7	ND	0.7	19.5	0.9	ND	3.0	3.69	Well bailed to 2.98m at 12:53 -4l. Difficult to lower. Remonitored at 15:39.
PH03A	2.89	ND	0.6	ND	0.6	20.0	ND	ND	ND	5.05	Well bailed to 4.49m at 12:39 -12l. Difficult to lower. Remonitored at 15:43.
PH04A	2.17	ND	1.2	ND	1.1	19.6	4.3	ND	10.0	3.60	Well bailed to 3.46m at 09:20 -4l. Remonitored at 15:02.
PH05A	2.39	ND	0.4	ND	0.3	19.9	ND	ND	ND	4.85	Well bailed to 3.32m at 09:48 -22l. Remonitored at 15:09.
PH06A	1.26	ND	2.9	ND	1.0	9.0	0.1	ND	10.0	4.84	Well bailed to 4.82m at 09:33 -7l. Remonitored at 15:16.
PH08A	1.73	ND	1.9	ND	0.5	19.6	ND	ND	ND	4.92	Well bailed to 3.87m at 10:02 -7l. Very heavily silted water. Remonitored at 15:22.
PH09A	3.68	ND	0.7	ND	0.7	19.1	ND	ND	ND	5.30	Well bailed to 5.10m at 11:51 -5l. Remonitored at 15:48.
PH10A	2.81	ND	2.0	ND	2.0	15.9	ND	ND	ND	3.75	Well bailed to 3.00m at 12:02 -3l.
PH11A	3.33	ND	0.8	ND	0.8	177.4	3.0	ND	26.0	3.74	Well bailed to 3.69m at 11:10 -1l.
PH12A	4.37	ND	1.6	ND	1.6	18.4	ND	ND	ND	5.32	Well bailed to 5.13m at 11:37 -3l. Very heavily silted water.
PH13A	4.76	ND	0.6	ND	0.6	18.9	ND	ND	ND	5.71	Well bailed to 4.98m at 12:15 -5l.
PH14A	4.44	ND	1.6	ND	1.6	15.2	1.0	ND	4.0	5.40	Well bailed to 5.30m at 12:26 -2l.
PH15A	1.81	ND	0.5	ND	0.4	19.8	ND	ND	ND	5.67	Well bailed to 4.23m at 13:07 -15l. Remonitored at 15:34.
PH16A	3.55	ND	0.8	ND	0.6	19.0	ND	ND	ND	5.78	Well bailed to 5.77m at 10:21 -6l.
PH17A	4.61	ND	1.6	ND	1.0	16.4	7.6	ND	20.0	5.55	Well bailed to 5.49m at 10:35 -4l.
PH18A	ND	ND	0.6	ND	0.6	19.2	ND	ND	ND	5.42	
PH19A	3.19	ND	0.8	ND	0.8	19.3	1.0	ND	2.0	5.65	
PH20A	4.27	ND	1.0	ND	0.7	19.2	ND	ND	ND	5.59	Well bailed to 5.49m at 11:23 -2l.

Notes									

Equipment Used:						Next Calibration Date				Key							
Gas Data GFM436 Infrared Gas Analyser						12/02/2020				ND				None Detected			
Geotechnical Instruments Dipmeter										NR				Not Recorded			
										1.0				Recorded value does not breach trigger levels			
										5.0				Recorded value breaches trigger level 1			
										10.0				Recorded value breaches trigger level 2			

		Site Data:			Weather Station Data (Salisbury Road Weather Station)										
		Temp (°C):			6 to 12.			Barometric Pressure Trend:				Falling			
Time:	09:00	12:30	16:00	00:04	05:04	08:59	12:29	15:29	20:04	Trigger level 1	1.0	5.0	16.0		
Pressure (mb):	1010	1009	1005	1024	1022	1020	1018	1015	1015	Trigger level 2	5.0	10.0	10.0		
		Weather Conditions:			Overcast.										
		Surface Ground Conditions:			Dry.										
Remarks:															

Job Title:							Job No:						
Merchants Field, Cleckheaton							2828						
Client:							Sheet :						
Harron Homes							1 of 1						
Date:		Arrival Time:		Depart Time:		Operator:							
15/04/2019		09:00		16:00		A Taylor							

Gas Monitoring Results:														
Ambient Concentration (% Volume):			CH ₄ :		0.0		CO ₂ :		0.0		O ₂ :		20.0	

Monitoring Point	Groundwater level (m) bgl	Concentrations					Gas Flow Rates			Bottom of well m	Remarks
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum litre/hr	Steady litre/hr	Time to fall from highest to steady secs		
		CH ₄	CO ₂	CH ₄	CO ₂	O ₂					
		% v/v	(%)	% v/v	(%)	(%)					
PH01A	2.87	ND	0.3	ND	0.3	20.0	ND	ND	ND	4.70	Well bailed to 4.28m at 13:17 -5l. Remonitored at 15:31.
PH02A	2.06	ND	0.8	ND	0.8	19.8	1.2	ND	5.0	3.69	Well bailed to 2.98m at 12:53 -4l. Difficult to lower. Remonitored at 15:39.
PH03A	2.56	ND	0.3	ND	0.2	20.0	ND	ND	ND	5.05	Well bailed to 4.49m at 12:39 -12l. Difficult to lower. Remonitored at 15:43.
PH04A	2.15	ND	2.2	ND	2.2	18.8	ND	ND	ND	3.60	Well bailed to 3.46m at 09:20 -4l. Remonitored at 15:02.
PH05A	2.46	ND	0.1	ND	0.1	20.0	ND	ND	ND	4.85	Well bailed to 3.32m at 09:48 -22l. Remonitored at 15:09.
PH06A	0.99	ND	0.3	ND	0.2	19.9	ND	ND	ND	4.84	Well bailed to 4.82m at 09:33 -7l. Remonitored at 15:16.
PH08A	2.35	ND	0.4	ND	0.4	19.8	ND	ND	ND	4.92	Well bailed to 3.87m at 10:02 -7l. Very heavily silted water. Remonitored at 15:22.
PH09A	3.63	ND	1.0	ND	1.0	18.5	2.7	ND	5.0	5.30	Well bailed to 5.10m at 11:51 -5l. Remonitored at 15:48.
PH10A	2.81	ND	2.0	ND	2.0	15.9	ND	ND	ND	3.75	Well bailed to 3.00m at 12:02 -3l.
PH11A	3.33	ND	0.8	ND	0.8	177.4	3.0	ND	26.0	3.74	Well bailed to 3.69m at 11:10 -1l.
PH12A	4.37	ND	1.6	ND	1.6	18.4	ND	ND	ND	5.32	Well bailed to 5.13m at 11:37 -3l. Very heavily silted water.
PH13A	4.76	ND	0.6	ND	0.6	18.9	ND	ND	ND	5.71	Well bailed to 4.98m at 12:15 -5l.
PH14A	4.44	ND	1.6	ND	1.6	15.2	1.0	ND	4.0	5.40	Well bailed to 5.30m at 12:26 -2l.
PH15A	1.78	ND	0.1	ND	0.1	20.1	28.6	ND	18.0	5.67	Well bailed to 4.23m at 13:07 -15l. Remonitored at 15:34.
PH16A	3.55	ND	0.8	ND	0.6	19.0	ND	ND	ND	5.78	Well bailed to 5.77m at 10:21 -6l.
PH17A	4.61	ND	1.6	ND	1.0	16.4	7.6	ND	20.0	5.55	Well bailed to 5.49m at 10:35 -4l.
PH18A	ND	ND	0.6	ND	0.6	19.2	ND	ND	ND	5.42	
PH19A	3.19	ND	0.8	ND	0.8	19.3	1.0	ND	2.0	5.65	
PH20A	4.27	ND	1.0	ND	0.7	19.2	ND	ND	ND	5.59	Well bailed to 5.49m at 11:23 -2l.

Notes									

Equipment Used:			Next Calibration Date			Key		
Gas Data GFM436 Infrared Gas Analyser			12/02/2020			ND None Detected		
Geotechnical Instruments Dipmeter						NR Not Recorded		
						1.0 Recorded value does not breach trigger levels		
						5.0 Recorded value breaches trigger level 1		
						10.0 Recorded value breaches trigger level 2		

		Site Data:			Weather Station Data (Salisbury Road Weather Station)												
		Temp (°C):			6 to 12.			Barometric Pressure Trend:			Falling						
Time:	09:00	12:30	16:00	00:04	05:04	08:59	12:29	15:29	20:04	Trigger level 1	1.0	5.0	16.0				
Pressure (mb):	1010	1009	1005	1024	1022	1020	1018	1015	1015	Trigger level 2	5.0	10.0	10.0				
		Weather Conditions:			Overcast.												
		Surface Ground Conditions:			Dry.												
Remarks:																	

Visit 2

Job Title:							Job No:						
Merchants Field, Cleckheaton							2828						
Client:							Sheet :						
Harron Homes							1 of 1						
Date:		Arrival Time:		Depart Time:		Operator:							
24/04/2019		13:00		16:00		A Taylor							
Gas Monitoring Results:													
Ambient Concentration (% Volume):				CH₄:	0.0	CO₂:	0.0	O₂:	20.2				
Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks		
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady				
		CH₄	CO₂	CH₄	CO₂	O₂							
	(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre/hr	litre/hr	secs	m			
PH01A	3.12	ND	3.9	ND	0.9	18.9	ND	ND	ND	4.71			
PH02A	2.36	ND	2.8	ND	2.8	12.7	ND	ND	ND	3.69			
PH03A	3.15	ND	0.6	ND	0.6	19.9	ND	ND	ND	5.07			
PH04A	2.26	ND	3.0	ND	2.5	16.3	ND	ND	ND	3.62			
PH05A	2.33	ND	0.7	ND	0.5	19.6	0.3	ND	5.0	4.73			
PH06A	1.25	ND	0.3	ND	0.2	19.9	ND	ND	ND	4.93	Well ripped out, but bung still in place. Open on arrival 13:19. Remonitored 15:50.		
PH08A	1.84	ND	0.8	ND	0.7	19.9	ND	ND	ND	4.83			
PH09A	3.60	ND	1.8	ND	1.8	14.5	0.7	ND	10.0	5.24			
PH10A	3.04	ND	1.2	ND	1.2	17.5	ND	ND	ND	3.77			
PH11A	3.25	ND	1.3	ND	1.3	16.9	ND	ND	ND	3.76			
PH12A	4.78	ND	1.4	ND	1.4	18.1	ND	ND	ND	5.30			
PH13A	4.75	ND	2.9	ND	2.9	11.5	ND	ND	ND	5.51			
PH14A	4.50	ND	2.3	ND	2.3	13.7	ND	ND	ND	5.53			
PH15A	2.23	ND	0.8	ND	0.5	19.8	30.7	ND	10.0	5.60			
PH16A	3.52	ND	2.3	ND	1.4	17.3	30.0	ND	30.0	5.76			
PH17A	4.98	ND	2.3	ND	1.9	12.9	40.0	1.4	240.0	5.02			
PH18A	4.69	ND	0.7	ND	0.7	17.9	ND	ND	ND	5.43			
PH19A	3.09	ND	2.8	ND	2.8	14.8	0.4	ND	15.0	5.60			
PH20A	4.27	ND	3.0	ND	3.0	18.4	35.4	0.8	200.0	5.56			
Notes													
Equipment Used:						Next Calibration Date			Key				
Gas Data GFM436 Infrared Gas Analyser						12/02/2020			ND None Detected				
Geotechnical Instruments Dipmeter									NR Not Recorded				
									1.0 Recorded value does not breach trigger levels				
									5.0 Recorded value breaches trigger level 1				
									10.0 Recorded value breaches trigger level 2				
		Site Data:		Weather Station Data (Scholes Weather Station)									
		Temp (°C):		15 to 18.		Barometric Pressure Trend:		Falling					
Time:	13:00	14:30	16:00	00:04	05:04	13:04	14:29	15:59	20:04	Trigger level 1	1.0		
Pressure (mb):	981	978	978	993.2	990	998.1	987.8	986.5	989	Trigger level 2	5.0		
		Weather Conditions:		Sunny (Haze).									
		Surface Ground Conditions:		Dry.									
Remarks:													

Visit 3

Job Title:				Job No:
Merchants Field, Cleckheaton				2828
Client:				Sheet :
Harron Homes				1 of 1
Date:	Arrival Time:	Depart Time:	Operator:	
08/05/2019	09:30	12:04	A Taylor	



Gas Monitoring Results:

Ambient Concentration (% Volume):	CH₄:	0.0	CO₂:	0.0	O₂:	19.9

Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady		
		CH ₄	CO ₂	CH ₄	CO ₂	O ₂					
		% v/v	(%)	% v/v	(%)	(%)					
PH01A	3.38	ND	4.7	ND	0.8	17.8	ND	ND	ND	4.69	
PH02A	2.63	ND	3.6	ND	3.6	13.0	4.1	3.2	300.0	3.67	
PH03A	3.41	ND	1.0	ND	0.6	16.8	1.2	ND	5.0	5.10	
PH04A	2.37	ND	4.7	ND	4.7	11.2	1.5	1.5	180.0	3.65	
PH05A	2.42	ND	0.6	ND	0.5	19.5	0.2	ND	10.0	4.71	
PH06A	1.41	ND	0.7	ND	0.7	17.6	ND	ND	ND	4.87	
PH08A	1.94	ND	0.2	ND	0.2	19.8	ND	ND	ND	4.75	
PH09A	3.72	ND	2.4	ND	2.4	10.9	0.4	ND	10.0	5.22	
PH10A	3.32	ND	1.7	ND	1.7	17.6	ND	ND	ND	3.76	
PH11A	3.34	ND	2.1	ND	2.0	15.1	1.4	ND	6.0	3.75	
PH12A	5.06	ND	2.7	ND	2.7	15.0	ND	ND	ND	5.29	
PH13A	4.76	ND	2.5	ND	2.5	5.6	ND	ND	ND	5.50	
PH14A	4.55	ND	4.9	ND	4.9	6.4	ND	ND	ND	5.50	
PH15A	2.16	ND	0.3	ND	0.3	19.7	ND	ND	ND	5.58	
PH16A	3.62	ND	3.6	ND	2.5	15.0	4.5	ND	30.0	5.77	
PH17A	4.89	ND	2.2	ND	2.0	12.5	ND	ND	ND	5.69	
PH18A	4.80	ND	2.0	ND	2.0	16.4	ND	ND	ND	5.40	
PH19A	3.23	ND	2.0	ND	2.0	11.1	ND	ND	ND	5.55	
PH20A	4.27	ND	3.0	ND	3.0	18.3	ND	ND	ND	5.56	

Notes

Equipment Used:

Gas Data GFM436 Infrared Gas Analyser
Geotechnical Instruments Dipmeter

Next Calibration Date

12/02/2020

Key

ND	None Detected
NR	Not Recorded
1.0	Recorded value does not breach trigger levels
5.0	Recorded value breaches trigger level 1
10.0	Recorded value breaches trigger level 2

	Site Data:			Weather Station Data (Cleckheaton Weather Station)					
	Temp (°C):	7 to 8.		Barometric Pressure Trend:			Falling		
Time:	09:30	11:27	12:04	00:04	05:04	09:29	11:29	12:04	17:04
Pressure (mb):	983	982	981	1004	997	993	991	990	988
	Weather Conditions:			Raining.					
	Surface Ground Conditions:			Wet.					

Remarks:

Job Title:				Job No:
Merchants Field, Cleckheaton				2828
Client:				Sheet :
Harron Homes				1 of 1
Date:	Arrival Time:	Depart Time:	Operator:	
24/05/2019	07:55	12:30	J Brown	

Ambient Concentration (% Volume):	CH ₄ :	0.0	CO ₂ :	0.0	O ₂ :	20.2

Gas Data GFM436 Infrared Gas Analyser	12/02/2020	ND	None Detected
Geotechnical Instruments Dipmeter		NR	Not Recorded

Job Title:				Job No:
Merchants Field, Cleckheaton				2828
Client:				Sheet :
Harron Homes				1 of 1
Date:	Arrival Time:	Depart Time:	Operator:	
24/05/2019	07:55	12:30	J Brown	

Ambient Concentration (% Volume):	CH ₄ :	0.0	CO ₂ :	0.0	O ₂ :	20.2

Gas Data GFM436 Infrared Gas Analyser	12/02/2020	ND	None Detected
Geotechnical Instruments Dipmeter		NR	Not Recorded

Visit 5

Job Title:							Job No:								
Merchants Field, Cleckheaton							2828								
Client:							Sheet :								
Harron Homes							1 of 1								
Date:		Arrival Time:		Depart Time:		Operator:									
07/06/2019		14:30		16:30		A Taylor									
Gas Monitoring Results:															
Ambient Concentration (% Volume):				CH ₄ :		0.0		CO ₂ :		0.0		O ₂ :		20.3	
Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks				
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady						
		CH ₄	CO ₂	CH ₄	CO ₂	O ₂									
	(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre/hr	litre/hr	secs	m					
PH01A	3.56	ND	1.2	ND	1.2	19.7	ND	ND	ND	4.70					
PH02A	2.87	ND	3.1	ND	3.1	10.9	ND	ND	ND	3.66					
PH03A	3.32	ND	2.5	ND	2.5	8.8	ND	ND	ND	5.09					
PH04A	2.49	ND	2.4	ND	2.4	16.2	ND	ND	ND	3.65					
PH05A	2.62	ND	0.4	ND	0.4	19.6	ND	ND	ND	4.71					
PH06A	1.92	ND	0.5	ND	0.5	19.3	ND	ND	ND	4.86					
PH08A	2.11	ND	0.1	ND	0.1	20.1	ND	ND	ND	4.81					
PH09A	3.70	ND	3.5	ND	3.5	11.5	ND	ND	ND	5.22					
PH10A	3.66	ND	1.4	ND	1.4	18.7	ND	ND	ND	3.78					
PH11A	3.43	ND	3.4	ND	3.4	11.5	ND	ND	ND	3.76					
PH12A	ND	ND	1.5	ND	1.5	18.3	ND	ND	ND	5.27					
PH13A	4.85	ND	6.6	ND	6.6	1.1	ND	ND	ND	4.82					
PH14A	4.70	ND	6.6	ND	6.6	2.0	ND	ND	ND	5.51					
PH15A	2.43	ND	0.7	ND	0.7	19.5	ND	ND	ND	5.42					
PH16A	3.73	ND	1.7	ND	1.7	17.7	ND	ND	ND	5.76					
PH17A	5.09	ND	1.7	ND	1.7	13.7	ND	ND	ND	5.65					
PH18A	5.19	ND	0.5	ND	0.5	19.7	ND	ND	ND	5.40					
PH19A	3.57	ND	2.4	ND	2.4	10.6	ND	ND	ND	5.56					
PH20A	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Couldnt find well amongst very tall grasses.				
Notes															
Equipment Used:						Next Calibration Date			Key						
Gas Data GFM436 Infrared Gas Analyser						12/02/2020			ND None Detected						
Geotechnical Instruments Dipmeter									NR Not Recorded						
									1.0 Recorded value does not breach trigger levels						
									5.0 Recorded value breaches trigger level 1						
									10.0 Recorded value breaches trigger level 2						
		Site Data:		Weather Station Data (Scholes Weather Station)											
		Temp (°C):		13		Barometric Pressure Trend:		Falling							
Time:	14:30	16:15	16:30	00:04	06:04	14:29	16:14	16:29	18:59	Trigger level 1	1.0	5.0	16.0		
Pressure (mb):	993	990	990	1006	1004	1000	999	999	996	Trigger level 2	5.0	10.0	10.0		
		Weather Conditions:		Raining.											
		Surface Ground Conditions:		Wet.											
Remarks:															