

A photograph of a rocky stream bed with green moss and vegetation on the banks. The text "Desk study & mining risk assessment" is overlaid in white on the left side of the image.

Desk study & mining risk assessment

Land at Lidgett Lane & New Road, Pilley For Redrow Homes Ltd

Report no: 2222/1

Date: October 2015



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Coal Authority	N/A	Abandonment plans (available on CD, not included in PDF appendices)

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Appendix L – Lithos cross sections

Appendix M – CoDa chemical test results

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Appendix O – Lithos gas monitoring results

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.

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 only included on the accompanying 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. All 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.

DESK STUDY & MINING RISK ASSESSMENT
of land at
LIDGETT LANE & NEW ROAD, PILLEY

1 INTRODUCTION

1.1 The commission and brief

- 1.1.1 Lithos Consulting Limited were commissioned by Redrow Homes Ltd to carry out a desk study, review of third party information, mining risk assessment and gas monitoring at the above site in an attempt to resolve geo-environmental uncertainties and highlight any areas where further information is required.
- 1.1.2 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, including an intrusive ground investigation comprising 15 rotary open boreholes
 - Gas monitoring
- 1.1.3 Primary aims of this phase of investigation were to identify salient geoenvironmental issues affecting the site to support the submission of a planning application, and enable Redrow to obtain budget costs for: foundations; gas protection measures; site preparatory works.
- 1.1.4 Supplementary investigation to satisfy the Local Planning Authority and enable refinement of budget abnormalities is anticipated.

1.2 The proposed development

- 1.2.1 It is understood that consideration is being given to redevelopment of the site with detached 2 to 3 storey domestic dwellings (41 in the west and 35 in the east), associated gardens, POS and adoptable roads and sewers. Site layouts have been provided by Redrow (Drawing references 13/091/-01 & 13/092-01, both dated July 2013) which are reproduced as Drawings 2222/2W & E 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 Sections 2 to 4 are based on information obtained as part of Lithos' own desk study investigation.
- 1.3.4 Sections 6, 7, 9, 10 & 11 are based solely on CoDa's findings as presented in the reports supplied by Redrow, unless stated otherwise in the text.
- 1.3.5 Section 8 is based on a combination of both CoDa's and Lithos' intrusive investigation findings.
- 1.3.6 A review of CoDa's findings is provided in Section 5.

2 SITE DESCRIPTION

2.1 General

- 2.1.1 The site's location is shown on Drawing 2222/1 presented in Appendix B to this report. Site details are summarised in the Table below.
- 2.1.2 Lithos completed a walkover survey of the site on the 22nd September 2015.
- 2.1.3 Existing salient features, at the time of the walkover are presented on Drawing 2222/3 in Appendix B to this report, and summarised in the Table below.

Detail	Remarks	
Sub-site	Lidgett Lane (west)	New Road (east)
Location	6 km south of Barnsley town centre	
NGR	SE 337 003	SE 341 003
Approximate area	2.4ha	2.7ha
Known services	Underground sewer	Underground sewer, overhead electric

2.2 Site features – Lidgett Lane (west)

- 2.2.1 Access to the site is from a small driveway in the north-west corner from Pilley Green. A rough path crosses the site to the south, running east-west.
- 2.2.2 The site is currently an open, grassed field. No evidence of grazing animals was noted.
- 2.2.3 The highest point of the site is the north-west corner, and land falls to the south and east at a gradient of around 1 in 10.
- 2.2.4 Ground immediately adjacent to the eastern site boundary is around 3m higher than the site, indicating possible filling activity.
- 2.2.5 Trees are present along the eastern boundary, reaching over 5m in height.

2.3 Site features – New Road (east)

- 2.3.1 Vehicular access to the site is from either Lidgett Lane in the north-west or New Road in the south-west.
- 2.3.2 The site is currently used for the growing of crops.
- 2.3.3 The site comprises 2 relatively flat areas in the north and south of the site separated by a slope of approximately 1 in 10 in the centre of the site.
- 2.3.4 Trees along the eastern and western boundaries of the site reach over 5m in height.
- 2.3.5 Ground immediately west of the site appears to have been filled up to 5m above the site.

2.3.6 Existing salient features, at the time of the walkover are presented on Drawing 2222/3 in Appendix B to this report, and summarised in the Table below

Feature	Remarks	
	Lidgett Lane (west)	New Road (east)
Current Access	Off Pilley Green	Off Lidgett Lane or New Road
Topography	Slopes to south and east	Slopes to south
Approximate areas	24,000 m ² grass	27,000 m ² crops
Nature of boundaries	North – mature hedge and drystone wall East – wooded area South & west – Mature hedges and trees	North – mature hedges and overhead electric East & west – wooded areas South – rough vegetation
Surrounding land uses	North – Lidgett Lane, houses and open fields beyond East – Wooded area West – Church, Pilley Green and houses South - Houses	North – Lidgett Lane, open fields, scattered houses beyond East – wooded area, single house West – wooded area and playing field South – New Road, wooded area beyond

2.3.7 A selection of site photographs is included on Drawings 2222/4.

3 SITE HISTORY

- 3.1 Site centred extracts from Ordnance Survey (OS) plans dating back to 1855 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
1855	Fields.	Pilley Green and Pilley village to the west. Roads immediately adjacent to the north (Lidgett Lane) and south (New Road) boundaries.
1893	No significant changes.	Housing immediately east. Mission Church immediately west. Birdwell Dike shown along south-east boundary. Spoil tip around 100m south, associated with Silkstone Colliery
1905		Railway shown running north-east to south-west between the two parcels. Knoll Drift property shown north of the railway. Air shaft shown around 70m south of the eastern parcel.
1931		Sludge bed and filter beds shown immediately south-east of New Road.
1957		Railway and air shaft no longer shown. Railway cutting still present. Re-grading of the parcel of land central to the two sites has taken place including filling in the south.
1963		Central field shown as 'sports field'. Spoil tip to south shown as 'disused' to the south-east and labelled 'slag heap' at around 100m south.
1965		Silkstone Colliery no longer shown.
2015		No significant changes.

- 3.3 According to the historical OS plans, no development has taken place on either parcel of land throughout recent history. However, it should be noted that, on the 1:10,000 BGS plan, the site and the wider area is marked as 'made ground', with the central field in between the 2 sites labelled as 'worked out opencast (backfilled) or backfilled quarry'; the latter encroaches into the south-west corner of the eastern parcel of the site.

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 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	1:10,000 BGS map (Sheet SE 30 SW)	Drift – None shown. Solid – Predominantly coal measures, with sandstone units in the far north and east. Shallowest coal seam – Flockton Thick outcrops in the western parcel, the Lidget seam outcrops in the eastern parcel. Strata dip – to the north-east. Faults - Two faults in central field between the two land parcels, trending north-west to south-east, both downthrow to the north-east. A third fault runs through the far north, dissecting the north-west corner of the eastern site (New Road) trending south-west to north-east, which downthrows to the south-east
Mining	Coal Authority	This site is located within a Coal Mining Development High Risk Area. Further details in Section 4.2 below.
Quarrying	Historical OS plans BGS map Envirocheck report	'Old sandstone quarry' noted on BGS map to the east. Numerous BGS recorded mineral sites within 250m of the site, including sandstone and coal quarries/opencasts. One opencast is shown in the central field in between the two sites.
Landfills	Envirocheck Report	No known landfills within 250m
Radon	BRE Report BR211	No measures required.
Hydrogeology	Environment Agency	Source Protection Zone? No. Aquifer: Secondary A (Solid). Groundwater abstractions? None. Soil leaching potential - High. Pollution incidents? None.
Hydrology	Envirocheck Report	Nearest watercourse(s) – 10m south-east, culverted to the south (Birdwell Dike – Tertiary River) flowing west to east. Pollution incidents? None of significance. Abstractions? None. Discharge consents? 40m south-east, British Coal discharging Trade Effluent into a stream/river, revoked in November 1994.
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. The far east of the western parcel is shown as at 'low' risk of surface water flooding.

4.2 Coal & mining

- 4.2.1 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) provides the necessary mining risk assessment required by the proposed planning application.
- 4.2.2 The site lies within a High Risk Area - an area with specific mining legacy risks to the surface, including mine entries; shallow coal workings etc.
- 4.2.3 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).
- 4.2.4 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).
- 4.2.5 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.
- 4.2.6 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.
- 4.2.7 Bell pits may be present beneath this site, and given the absence of loose superficial deposits, it is considered unlikely that such mine entries would have been lined.
- 4.2.8 Faults are believed to present beneath this site, and such features are usually bordered by a shatter zone where the coal is degraded. The nature and extent of a shatter zone varies according to the intensity of the faulting. Early and modern mining practice was to leave the coal in the shatter zone untouched as it was of little economic value. Thus there is usually a margin between the workings and the fault, which based on observations elsewhere might be about 60m wide (30m either side of the fault).
- 4.2.9 The 1:10,000 BGS geological map shows the site to be mostly underlain by undivided Coal Measures bedrock, with an unnamed sandstone unit in the north-east and south-west. The strata are shown to dip to the north-east at an unspecified angle. No drift deposits are shown.
- 4.2.10 There are 3 faults affecting the site which make the geology somewhat complex. Two faults are conjectured to run through the central field between the two land parcels, trending north-west to south-east, both downthrow to the north-east. A third fault is conjectured to run through the far north, dissecting the north-west corner of the eastern site (New Road) trending south-west to north-east, which downthrows to the south-east. Geological features are presented on Drawing 2222/3 in Appendix B.
- 4.2.11 The Flockton Thick coal seam outcrops in the western parcel, trending north-west to south-east. The Lidget Coal outcrops in the south-west of the eastern parcel, also trending north-west to south-east. It is worth noting that the Lidget outcrop is shown as conjectured whereas the Flockton Thick is shown as 'seen'.
- 4.2.12 The Tankersley Ironstone overlies the Flockton Thick coal by about 4m. The Tankersley Ironstone is a seam rich in iron-ore which is, in some areas known to be worked from outcrop and via bell pits. The coal seams which are likely to underlie the site at shallow depth are summarised below, depths given are according to information on the 1:10,000 BGS plan:

Western parcel			Eastern parcel		
Seam	Approx. depth below site (m)	Max. recorded thickness (m)	Seam	Approx. depth below site (m)	Max. recorded thickness (m)
Flockton Thick	Outcrops in the centre	2.9	Lidgett	Outcrops in south-west	1.3
Flockton Thin [^]	14	2.0	Joan	26	0.7
Fenton	25	0.5	Flockton Thick	38	2.9
Parkgate	35	4.0*	-	-	-

* Maximum thickness of 4.0m for the Parkgate shown on BGS 1:10,000 plan however BGS Memoir 87 (Barnsley) states a thickness of between 1.1m and 3.1m at outcrops c. 600m to 700m west of the site

[^] Flockton Thin on the stratigraphic column is only shown to be present partially across the plan's area, therefore may not exist beneath the site

4.2.13 The CA Mining Report states that:

- The site is in the likely zone of influence from workings in 7 seams of coal at 50m to 290m depth, and last worked in 1954, any associated movement should have now ceased. This is likely a reference to the Parkgate, and deeper seams.
- The site is in an area where the CA believe there is coal at or close to the surface which may have been worked. This is likely a reference to the Lidgett, Joan, Flockton Thick & Flockton Thin seams.
- The site is not in the likely zone of influence of any present coal workings.
- There are two mine entries on, or within 20m of the site. One was found, filled and graded over by Barnsley MDC in 1987, the other comprises a brick arch where stopping is visible at the surface. Actually, both entries are located within the central field, beyond the areas of proposed development.
- The site lies within the boundary of an opencast site from which coal was removed by opencast methods. The majority of opencast is located within the central field, but it encroached into the eastern parcel.
- A damage notice or claim for alleged subsidence damage was made in July 1998 for 1 Knoll Drift, Lidgett Lane, Tankersley S75 3BT for repairs to the value of £9,590.68.

4.2.14 The aforementioned seams with workings in from 50m to 290m depth are considered to be at sufficient depth for any mineworkings not to cause a risk of ground movement at the surface.

4.2.15 The two mine entries referred to in the CA report are believed to be adits (CA refs 433400-018 & 433400-002) and lie in the far north of the central field which splits the two parcels of land, and are therefore not within the proposed development site. In any case, records show them to have either been treated or not require treatment.

4.2.16 The two mine entries are also shown on the BGS plan. On both the BGS plan and CA report, the direction of entry of the mine entries is shown to the north, heading into the hillside away from the site, indicating that they were targeting coal beneath land to the north which is topographically higher than the site. Their locations are shown on Drawing 2222/3 in Appendix B.

4.2.17 The property for which damages were claimed is located in the north of the central field which divides the site, just north of the two mine entries.

4.2.18 Of the seams mentioned in the table above (Section 4.2.12), those which pose the most significant risk of subsidence are the Flockton Thick (due its shallow depth and thickness), and the Parkgate (due to its maximum recorded thickness and estimated depth).

- 4.2.19 Consequently, abandonment plans for the Parkgate and the Flockton Thick seams; and for the opencast in the centre of the two sites have been examined and have yielded the following information:
- Workings exist within the Parkgate seam:
 - Across the majority of the western parcel at around 80m depth
 - Across the north of the eastern parcel at around 140m depth
 - In the south –west of the eastern parcel at around 80m depth, including beneath the former opencast
 - Workings exist within the Flockton Thick seam in the north and east of the eastern parcel at around 70m to 80m depth
 - The Flockton Thick Seam was extracted from the former opencast to a maximum depth of around 16m; no other seams were extracted as part of the opencast mining; no 'old-workings' are shown to have been encountered within the opencast
 - No recorded mineworkings are present within the Flockton Thick in the western parcel
- 4.2.20 The abandonment plans contradict the stratigraphic column of the 1:10,000 BGS plan as they show the Parkgate Seam (and indeed the Flockton Thin and Fenton seams) to be around 20m to 45m deeper than those in the table in Section 4.2.12. Based on the Parkgate Seam abandonment plan, the seams underlying the western parcel and the south-west of the eastern parcel would be at the following depths:
- Flockton Thin – 33m
 - Fenton – 55m
 - Parkgate – 80m
- 4.2.21 Based on the above, even if it is conservatively assumed that the full thickness of each of the above seams has been worked beneath the western parcel, they are all at sufficient depth so as to not pose any significant risk of instability at the surface.
- 4.2.22 Based on the maximum depth of the opencast (16m), any workings beneath its footprint within the Flockton Thin seam could pose a risk of subsidence at the surface.
- 4.2.23 The Fenton and Parkgate seams are likely to be at sufficient depth below the base of the opencast so as to not pose any significant risk. However, the depth to rockhead beneath any backfill requires clarification.
- 4.2.24 Copies of the abandonment plans are presented as Drawings 2222/9, 222/10 & 222/11 in Appendix B.

4.3 Anticipated ground conditions & potential issues

- 4.3.1 Based on the data reviewed in Section 4 (Environmental Setting) anticipated ground conditions are expected to comprise:

Anticipated condition	Remarks
Made ground	Possible veneer associated with colliery to the south
Natural soils	Weathered bedrock (firm gravelly clay/clayey gravel)
Bedrock	Shallow coal measures (sandstone/mudstone/siltstone)
Mineworkings	Possible shallow workings in both parcels associated with the Flockton Thick and Lidgett seams
Groundwater	Likely deep within bedrock

- 4.3.2 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	1. Made ground 2. Opencast backfill (eastern parcel) 3. Shallow Mineworkings	1. Associated with colliery to the south (inorganics & organics) 2. Inorganics & organics 3. Hazardous gas generation
Potential off-site contamination sources	1. Backfilled quarries/opencasts	1. Hazardous Gas generation
Potential geotechnical hazards	1. Deep MG 2. steep slopes 3. shallow workings	1. Backfilled opencast (eastern parcel) 2. In the south/central of each site 3. Within underlying Flockton Thick & Lidget Coal seams
Other potential constraints	1. Underground utilities 2. Overhead utilities	1. Water & other 'unknown' services 2. Electric

4.4 Preliminary conceptual site model

- 4.4.1 Based on the information reviewed above, potential sources of contamination affecting the site include made ground associated with the opencast in the south-east of the western parcel, plus any associated with the former colliery to the south. Shallow workings and backfilled quarries/opencasts also pose a potential risk of hazardous gas generation.
- 4.4.2 In addition, the site is shown as open farmland throughout history and 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
Slurry pits, manure heaps, septic tanks	Methane, metals, nitrates, oxygen depletion
Sewage farming, slurry spreading	Methane, metals, nitrates, oxygen depletion
Carcase burial	Anthrax & other biohazards
Crop & animal protection	Pesticides & herbicides
Soil conditioners	Metals, sulphates, PAH
Field sports	Lead shot
Waste burial, land levelling, backfilling ponds/quarries	Methane, metals, PAH etc
Naturally occurring contaminants	Arsenic, metals
Sheepfolds	Arsenic

- 4.4.3 Receptors include site workers, future residents, vegetation and proposed buildings.
- 4.4.4 Significant geotechnical hazards include the presence of slotting ground, possible shallow mineworkings and deep made ground associated with the former opencast in the south-west of the eastern parcel of land.

5 PREVIOUS INVESTIGATION FINDINGS

5.1 General

- 5.1.1 Redrow have provided Lithos with a copy of the following reports:
- *Phase 1 & 2 Engineering and Environmental Assessment for a Residential Development Site Adjacent to New Road, Pilley*. Issued by CoDa Structures in October 2014, project ref. 7217
 - *Phase 1 & 2 Engineering and Environmental Assessment for Land Adjacent to Lidgett Lane, Pilley*. Issued by CoDa Structures in March 2015, project ref. 7217
- 5.1.2 Information provided by the above Reports has been incorporated into Sections 6 to 11 of this Report.

5.2 Lithos Comments

- 5.2.1 In reviewing the information within the CoDa reports, Lithos have noted the following issues.
- 5.2.2 Site descriptions for both parcels are very limited and lack detail.
- 5.2.3 The mining search report obtained by CoDa (prepared by D Bellis Consulting) contains very questionable information; most notably the Flockton Thick coal seam is said to underlie the site and be worked at 52m depth; it is clear from the BGS plans that it outcrops on site. There is no mention of the Lidgett seam which outcrops in the east.
- 5.2.4 No Coal Authority mining report is referred to, or is included, within the appendices of either report.
- 5.2.5 The former opencast adjacent/on site is not considered by CoDa as a potential source of hazardous gas.
- 5.2.6 An insufficient number of topsoil samples were scheduled for analysis. In addition, the testing suite should have included asbestos ID and TOC.
- 5.2.7 An insufficient number of samples were submitted for shrinkability analysis (Atterberg limits and moisture content) from the west parcel, and none were scheduled from the east.
- 5.2.8 No 'raw' gas monitoring data is included in the appendices of either CoDa report. No gas monitoring data is shown at all for the eastern parcel; it is not clear whether any has been carried out or not.
- 5.2.9 Supplementary analysis for soluble magnesium, chloride and nitrate should have been scheduled on samples which yielded a pH of less than 5.5; this was not done. Based on the results obtained, sub-surface concrete should be design class DS-1, ACEC classification AC-2z, CoDa actually state DS-1 AC-1s.
- 5.2.10 CoDa state that plots within 20m of the fault will require semi-rigid rafts; reinforced foundations should suffice.
- 5.2.11 The exploratory hole location drawings show boreholes which have not been drilled, but are missing other exploratory holes.
- 5.2.12 The exploratory hole location drawing for New Road marks two 'possible coal outcrops'; one of which intersects only one trial pit where coal was not encountered. In actual fact, there is one coal outcrop (Flockton Thin) in the south of the site, roughly on the same line as CoDa's trial pits TP7 & TP9 and borehole R2, all of which encountered coal.

- 5.2.13 The standard of logging in the trial pits and trial trenches is poor, often not showing clear boundaries between clay and bedrock.
- 5.2.14 The CoDa reports are generally of poor quality and include large amounts of 'generic' information. Numerous mistakes are present including: irrelevant blank tables; incorrect references to exploratory holes; incorrect references to information within the appendices; and technically incorrect information. This indicates that the report has not been thoroughly reviewed prior to issue and brings its integrity into question.

6 FIELDWORK

6.1 Scope of works

- 6.1.1 Fieldwork was carried out by CoDa on in September and October 2014 and comprised the exploratory holes listed below.

Technique	East		West		Remarks
	Exploratory holes	Final depth(s)	Exploratory holes	Final depth(s)	
Trial pitting (machine dug)	TPs 1 to 13	1.1m to 4.7m	TPs 1 to 12 inc, 6A	2.4m to 4.0m	Vane tests in cohesive soils
Trial trenching (machine dug)	TT1	2.8m	TTs 1 to 5 inc. 1A	3.0m to 3.6m	West: to look for Tankersley Fault
Rotary open probeholes	R1, R2 & R4	30m	R1, R2 & R3	27m to 30m	

- 6.1.2 CoDa's exploratory hole records are present in Appendices F to I, and ground conditions are summarised in the table on pages 12 & 13.
- 6.1.3 Exploratory hole locations are shown on Drawing 2222/6 presented in Appendix B. It should be noted that the locations of TP6A and TT1A in the western parcel are unknown and are therefore not shown on Drawing 222/6.

7 SHALLOW GROUND CONDITIONS (CODA TRIAL PITS)

7.1 Made ground

East

- 7.1.1 Made ground was encountered within TPs 2, 5, and 13. In TPs 2 and 5, materials comprised topsoil and gravelly clay, with occasional metal & wood fragments to respective depths of 1.2m and 0.8m.
- 7.1.2 TP13 was excavated within the vicinity of a former opencast which encroaches into the site; materials within TP13 were 'typical' of opencast backfill (clay with gravel of mudstone and occasional coal fragments). This material was not bottomed out at a depth of 4.7m in TP13.

West

- 7.1.3 CoDa recorded 'possible made ground' in TP2, comprising sand, gravel and cobbles of sandstone to a depth of 1.0m. No other made ground was encountered.

Summary of Ground Conditions

			Depth to base of (m):				Depth to Bedrock [penetration] (m)	Bedrock
Hole	Final depth	Topsoil	Made Ground	Cohesive Residual Soil	Granular Residual Soil	Coal		
East – New Road								
TP1	1.7	0.3			1.1		1.1 [0.6]	Sandstone
TP2	1.3	0.3	1.2				1.2 [0.05]	Sandstone
TP3	1.7	0.3		1.3	1.0		1.3 [0.35]	Sandstone
TP4	3.4	0.3		1.7			1.7 [1.7]	Mudstone
TP5	4.3	0.2	0.8	4.3		3.9	1.6 [1.15]	Mudstone
TP6	1.6	0.2					0.2 [1.45]	Sandstone
TP7	3.3	0.3		1.1			1.1 [2.2]	Mudstone
TP8	3.6	0.2		1.6		3.1	1.6 [1.1] & 3.1 [0.6]	Mudstone
TP9	3.5	0.3		0.8 & 2.4		2.1	2.4 [1.1]	Mudstone
TP10	1.4	0.3		0.9			0.9 [0.5]	Sandstone
TP11	1.1	0.3					0.3 [0.8]	Sandstone
TP12	2.8	0.3		1.6			1.6 [1.2]	Mudstone
TP13	4.7	0.8	>4.7					
TT1	2.8	0.1		0.5			0.5 [2.3]	Mudstone
West – Lidgett Lane								
TP1	2.5	0.3		0.6			0.6 [1.9]	Sandstone
TP2	3.0	0.4	1.0				1.0 [2.0]	Mudstone/Siltstone
TP3	3.5	0.4		2.6*			2.6 [0.9]	Mudstone
TP4	3.5	0.2		2.0*			2.0 [1.5]	Mudstone
TP5	3.5	0.2		1.7*			1.7 [1.9]	Mudstone
TP6	3.5	0.6		1.6*			1.6 [1.9]	Mudstone
TP6A	3.5	0.2		2.1			2.1 [1.4]	Mudstone
TP7	3.9	0.3		0.9*		2.6, 3.1 & >3.9	0.9 [0.8], 2.6 [0.2] & 3.1 [0.5]	Mudstone
TP8	3.2	0.3		1.6			1.6 [1.6]	Mudstone/Siltstone
TP9	4.0	0.4		1.4		2.3, 2.8 & 3.8	1.4 [0.3], 2.3 [0.2], 2.8 [0.6] & 3.8 [0.2]	Mudstone
TP10	3.5	0.3		1.4*			1.4	Mudstone

Hole	Final depth	Topsoil	Depth to base of (m):				Depth to Bedrock [penetration] (m)	Bedrock
			Made Ground	Cohesive Residual Soil	Granular Residual Soil	Coal		
TP11	3.2	0.3		1.4			1.4[1.9]	Mudstone
TT1	3.6	0.3		1.6			1.6[2.0]	Mudstone
TT1A	3.6	0.2			2.5*		2.5[1.1]	Siltstone
TT2	3.0	0.3		1.0			1.0[2.0]	Sandstone
TT3	3.0	0.1		1.1			1.1[1.9]	Sandstone/Mudstone
TT4	3.0	0.3		0.7			1.0[2.0]	Mudstone
TT5	3.0	0.3		1.6			1.6[1.4]	Mudstone

7.2 Natural ground

East

- 7.2.1 Natural ground was encountered in all trial pits with the exception of TP13 and generally comprised topsoil overlying firm clay (cohesive residual soil) to an average depth of 1.5m, with Mudstone/Sandstone bedrock from depths of between 0.2m (TP6) and 2.4m (TP9).
- 7.2.2 Coal was encountered within TPs 5, 8 and 9, ranging from between 0.4m and 1.3m thick, sometimes split by clay/mudstone. This is likely to be the Lidget Coal seam.

West

- 7.2.3 Natural ground typically comprised topsoil overlying firm to stiff clay (cohesive residual soil) to an average of 1.5m with Mudstone, Siltstone and/or Sandstone bedrock below from depths of between 0.6m (TP1) and 2.6m (TP3).
- 7.2.4 Coal was encountered within TPs 7 and 10 at total thicknesses of 2.2m and 1.7m respectively; in both cases interbedded with mudstone. This is likely to be the Flockton Thick coal seam.
- 7.2.5 In addition, a bed of ironstone was noted in TP5 from 1.7m to 2.5m; this might be the Tankersley Ironstone.
- 7.2.6 It should be noted that the logging of materials within a number of trial pits (namely TPs 3, 4, 5, 6, 7, 10 & TT1A) is poor, with boundaries between cohesive residual soils (clay) and solid bedrock often vague (they are grouped as the same stratum on the log).
- 7.2.7 Where there is doubt whether a particular stratum in a trial pit log is residual soil or bedrock, it has been conservatively assumed that the material is residual soil.

7.3 Groundwater

- 7.3.1 CoDa recorded water seepages in the western parcel (Lidgett Lane) TP11, TT1A, TT2 and TT3 at depths of between 1.1m & 3.0m. No groundwater was encountered in the trial pits in the eastern parcel (New Road).
- 7.3.2 Groundwater was encountered during drilling by CoDa in boreholes R1 and R2 in the western parcel (Lidgett Lane) at respective depths of 11.5m and 18.4m. No groundwater was encountered during drilling in the eastern parcel (New Road).
- 7.3.3 CoDa installed monitoring wells within rotary probeholes R1 to R3 in the western parcel (Lidgett Lane) which were dipped as part of their gas investigation. R2 recorded water levels of between 3.9m and 2.2m; boreholes R1 and R3 were dry on each occasion.
- 7.3.4 No monitoring records are available for the eastern parcel (New Road).
- 7.3.5 In addition, Lithos installed wells within 12 shallow probeholes to depths of around 4.5m. Details of the monitoring well installations and ground conditions encountered are shown on the borehole logs in Appendices J & K.

- 7.3.6 To date, the wells have been dipped on one occasion, the results are summarised in the table below:

Hole ID	Groundwater Level (mbgl)	Depth to Base (m)
East (New Road)		
PH01A	3.67	4.34
PH02A	Dry	4.24
PH03A	Dry	4.12
PH04A	2.90	4.40
PH06A	Dry	4.26
PH07A	Dry	4.24
West (Lidgett Lane)		
PH101	Dry	4.25
PH102	Dry	4.23
PH103	Dry	4.25
PH104	Dry	4.25
PH105	3.74	4.33
PH106	Dry	4.23

7.4 Stability

- 7.4.1 The trial pits and trial trenches excavated by CoDa are described as 'stable whilst open' in both parcels of land.

8 MINING INVESTIGATION

- 8.1.1 This section combines data from both CoDa's investigation and an intrusive mining investigation carried out by Lithos in September 2015.
- 8.1.2 Findings of each investigation are presented below along with Lithos' conclusions, which were also presented in letter report 006/2222/MJT dated 8th September 2015.

8.2 CoDa's findings

- 8.2.1 Depth to bedrock (mudstone and sandstone) across both parcels within CoDa's exploratory holes is generally less than 2m, and mostly less than 1m.
- 8.2.2 CoDa's exploratory holes are shown on Drawing 2222/6 in Appendix B.

Western parcel (Lidgett Lane)

- 8.2.3 Coal was encountered within TP7 in the south-west from 1.7m to 3.6m, and in TP9 in the south east from 1.7m to 3.8m. In both trial pits, the seam was interbedded with mudstone. Coal was also encountered in rotary borehole R2 in the south-east from 3.7m to 5.8m.
- 8.2.4 No other coal was encountered in any of the exploratory holes advanced by CoDa, including within rotary probeholes R1 (north-east) and R3 (north-west) which were advanced to 30m and 27m depth respectively. Based on the BGS plan, these boreholes were advanced in separate fault blocks to R2, both are downthrown with respect to the fault block where R2 was drilled.
- 8.2.5 It should be noted that the 1st page (uppermost c. 10m) of the log for borehole R1 is missing; however CoDa's cross section diagram indicates that clay was encountered to around 2.5m, with bedrock below and no coal within this missing section.

- 8.2.6 A fourth probehole (R4) is shown on CoDa's hole location plan, although no record of it is seen in Appendix H (rotary borehole logs); it is assumed that this hole was never drilled.
- 8.2.7 Based on the BGS map and the thickness of the coal encountered by CoDa, the seam encountered in TPs 7 & 9 and R2 is almost certainly the Flockton Thick. Based on the BGS stratigraphic column, the Flockton Thin should be present around 14m below the Flockton Thick and therefore would be expected within borehole R2 at around 20m; it is likely that it has been 'washed out' beneath this part of the site.

Eastern parcel (New Road)

- 8.2.8 Coal was encountered in TP5 (centre) from 2.8m to 3.9m, in TP8 (central south) from 2.7m to 3.1m, and in TP9 (south-east) from 0.8m to 2.1m. In addition, coal was encountered within rotary boreholes R1 (north-west) from 6.3m to 7.5m (plus thinner bands at 19.8m to 20.0m and 20.4m to 20.6m), and in R2 at 9.5m to 10.6m & 22.0m to 22.5m.
- 8.2.9 The borehole log for borehole R4 also shows coal from 22.3m to 23.4m. This borehole is not shown on the hole location plan therefore the log is of limited use.
- 8.2.10 The shallower seam, encountered in TPs 5, 8 & 9 and R1 & R2, with a thickness typically around 1.1m to 1.3m, is most likely to be the Lidget coal. The deeper seam, encountered in R1 & R2 at around 20m depth is most possibly the Joan Coal, but may be an unnamed seam.

8.3 Lithos' findings

- 8.3.1 Lithos undertook an intrusive mining investigation on the 21st & 22nd September 2015. Fieldwork comprised rotary open-hole probeholes as summarised in the table below:

Exploratory holes	Final Depths	Remarks
PHs 01 to 07	6m to 36m	Advanced within the eastern parcel (New Road)
PHs 101 to 109	9m to 36m	Advanced within the western parcel (Lidget Lane)
PHs 01A to 03A, 05A to 7A and 101A to 106A	4.5m	Advanced adjacent to the respective 'deep' probehole to enable installation of shallow monitoring wells

- 8.3.2 The locations of the exploratory holes, along with those advanced by CoDa, are shown on Drawing 2222/6 in Annex A. Cross sections, based on Lithos' probeholes are present in Annex B, the corresponding cross section lines are shown on Drawing 2222/6.
- 8.3.3 Ground conditions encountered in the probeholes are summarised in the table below, which also includes the findings of CoDa's investigation:

Hole ID	Final depth (m)	Depth to rockhead (m)	Depth to coal (m)	Thickness of coal (m)	Seam	Remarks
East (New Road):						
PH01	36.0	1.0	0.5	0.4	Lidget	
PH02	12.0	0.5	3.3	0.3	Lidget	
PH03	24.0	1.0	3.3/15.1	0.3/0.5	Lidget & possibly Joan	
PH04	6.0	3.3				Advanced within former opencast
PH05	15.0	11.7				
PH06	33.0	0.5	8.0	1.0	Lidget	
PH07	12.0	0.5	3.1	1.2	Lidget	

Hole ID	Final depth (m)	Depth to rockhead (m)	Depth to coal (m)	Thickness of coal (m)	Seam	Remarks
CoDa R1	30.0	0.3	6.1/19.8/20.4	1.5/0.2/0.2	Lidget & possibly Joan	Seam split by mudstone
CoDa R2	30.0	0.4	9.5/22.0	1.1/0.5	Lidget & Joan	Seam split by mudstone
CoDa R4	30.0	1.8	11.4/22.3	0.1/1.1	Unnamed & possibly Lidget	Location unknown
West (Lidget Lane):						
PH101	36.0	4.0	9.5	1.5	Flockton Thick	
PH102	15.0	1.0	11.7	1.5	Flockton Thick	
PH103	12.0	1.0	5.9	1.5	Flockton Thick	
PH104	12.0	1.0	4.1	1.5	Flockton Thick	
PH105	24.0	1.0				
PH106	15.0	1.0	11.5	1.5	Flockton Thick	
PH107	12.0	1.0	7.2	1.5	Flockton Thick	
PH108	15.0	1.0	9.5	1.5	Flockton Thick	
PH109	9.0	1.0	4.6	1.5	Flockton Thick	
CoDa R1	30.0	2.5				
CoDa R2	30.0	1.8	3.7	2.1	Flockton Thick	Seam split by mudstone
CoDa R3	27.0	0.6				

Risk Assessment - Western parcel (Lidgett Lane)

8.3.4 There are 3 fault blocks shown on the BGS plan within the western parcel:

Central fault block (majority of site):

8.3.5 The drilling has confirmed the presence of the Flockton Thick beneath the majority of the western parcel at depths of between 3.7m and 11.5m, at typical thickness of 1.5m. Insufficient competent cover would be present above any workings within the Flockton Thick in the western parcel; however no such workings were recorded within the 9 Lithos probeholes (nor 1 CoDA probehole) where the seam was encountered. This concurs with the information abandonment plans; It is therefore considered unlikely that this seam has been worked.

8.3.6 Drilling has confirmed the dip of the strata to the north-east, at a rate of 6°, see Drawing 2222/8 in Appendix B.

8.3.7 The Parkgate seam was not encountered within 36m depth in PH101. Given a maximum thickness of 3.1m within the vicinity of the site, at over 36m depth, any associated workings should not pose a risk to surface stability.

North-east & north-west fault blocks:

8.3.8 PH105 and R1, located within the north-eastern fault block, encountered no coal within 24m and 30m respectively. R3, located within the north-western fault block encountered no coal within 27m depth. The shallowest seam within these fault blocks should be the Joan Coal which has a maximum thickness of 0.7m. Therefore, if present at depths in excess of 24m, any associated mineworkings would be at sufficient depth not to pose a risk of ground movement at the surface.

Risk Assessment- Eastern parcel (New Road)

8.3.9 There are 3 fault blocks shown on the BGS plan within the eastern parcel:

Central/north fault block (majority of site):

8.3.10 The drilling has confirmed the presence of the Lidget coal at shallow depth across much of the site, with a typical thickness of around 1.0m, maximum 1.5m. A deeper seam was also encountered in R1, which is likely to be the Joan coal but could possibly be another, unnamed seam.

8.3.11 Insufficient competent cover would be present above any workings within the Lidget seam; however no such workings were recorded within the 6 probeholes (nor 2 CoDA probeholes) where the seam was encountered. It is considered unlikely therefore that this seam has been worked, especially given its limited thickness.

Southern fault block:

8.3.12 Based on the ground conditions encountered, PH03 was most likely drilled within the south-west fault block and encountered coal at 3.3m to 3.6m (likely the Lidget seam or an unnamed seam). This coal was recorded as 'highly weathered'; it is therefore highly unlikely to have been worked, especially given its limited thickness.

8.3.13 Coal was also encountered in PH03 at 15.1m to 15.6 (likely to the Joan Coal); any mineworkings within this seam would be at sufficient depth not to pose a risk of ground movement at the surface.

South-east corner fault block:

8.3.14 This is the same fault block as 'central' block which covers the majority of the western parcel.

8.3.15 PHs 04 and 05 were drilled in the far south-west in an effort to target the area of opencast which encroaches onto the site from the west.

8.3.16 PH04 encountered rock at 3.3m; PH05 found rock at 11.7m. It is clear that significant backfilling has taken place associated with the former opencast, with the target seam understood to have been the Flockton Thick.

8.3.17 Below the Flockton Thick, the next shallowest seams are the Flockton Thin (possibly 'washed out' beneath the site, the Fenton and the Parkgate (see Section 4.2.20).

8.3.18 Based on the maximum thicknesses of these seams, subsidence issues could arise beneath the area of opencast if the seams lie within the following depths beneath the base of the backfill:

- Flockton Thin: 14m
- Fenton: 5m
- Parkgate: 31m

8.3.19 Flush returns were lost within the backfill when drilling and therefore the strata beneath the base of the opencast could not be identified.

8.3.20 The abandonment plans suggest that the Flockton Thin, Fenton and Parkgate seams lie at around 33m, 55m and 80m beneath the site respectively. Based on the depth to bedrock beneath the opencast (11.7m), the maximum thicknesses of the above coal seams, and their depth recorded on abandonment plans, none should pose any significant risk of subsidence beneath the area of opencast.

Summary

- 8.3.21 Ground stability problems above workings such as 'pillar and stall' methods can arise as the roof collapses, pillars fail and/or the floor heaves. The mechanism of roof collapse involves progressive upward migration of a void until it is either choked by the spalled roof debris, or reaches the surface as a crown hole.
- 8.3.22 CIRIA ('Construction over abandoned mine workings', 1989) suggest a thickness of solid rock through which a void can migrate as 7h to 10h above the roof of the workings, where h is the height of the workings (generally assumed to be similar to the seam thickness). The lower end of this range (7h) is generally only applicable where the overlying strata are predominantly thickly bedded sandstones.
- 8.3.23 The succession here comprises mudstones and sandstones and it is therefore considered appropriate to use a figure of 10h for void migration calculations.
- 8.3.24 The Flockton Thick underlies the western parcel (Lidget Lane) at shallow depth with a typical thickness of 1.5m; the Lidget Coal underlies the eastern parcel (Lidget Lane) at shallow depth with a typical thickness of around 1.0m to 1.5m. Any workings within these seams would not have sufficient competent rock cover. However, neither of these seams appears to have been worked; and no workings are recorded within the Flockton Thick on Coal Authority abandonment plans.
- 8.3.25 The Joan coal was encountered at depths of between 15m and 21m beneath the eastern parcel (New Road). No workings were encountered within this seam; in any case, based on a maximum thickness of 0.5m, there is sufficient competent cover above any workings so as to not pose a risk of ground movement at the surface.
- 8.3.26 The Parkgate and Fenton Seams were not encountered within 36m depth in the western parcel. Given respective maximum thicknesses of 3.1m and 0.5m, both should have sufficient competent cover above any associated mineworkings.
- 8.3.27 The proposed layout supplied by Redrow suggests that no building is to take place within the vicinity of the former opencast on the south-west of the eastern parcel; it is occupied by rear gardens of proposed plots. It is recommended however that some trial-trenching is undertaken in order to pin-point the extent of the former opencast, including the location of any 'highwalls' in the bedrock.
- 8.3.28 In summary, beyond the area of opencast backfill, no evidence of coal mining has been found.
- 8.3.29 Given the information contained on CA abandonment plans, the number of probeholes drilled, and the absence of any evidence of voids or broken ground, it is considered unlikely that the site is underlain by shallow mineworkings in any of the seams.
- 8.3.30 However, given the shallow depth and consistent thickness of the Flockton Thick, consideration could be given to further drilling in the western parcel of the site to remove any residual uncertainty.
- 8.3.31 It is possible that bell pits may be present at this site, although no evidence of their existence has been encountered to date. 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.

9 CONTAMINATION (ANALYSIS)

9.1 General

- 9.1.1 The following section is based entirely on data present within the two CoDa reports.
- 9.1.2 CoDa tested a total of 12 soil samples from across both sites for chemical analysis, which have been compared against Lithos' Tier 1 values.
- 9.1.3 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.
- 9.1.4 Where available, Category 4 Screening Levels (C4SL) have also been referenced.
- 9.1.5 This site is essentially greenfield and no evidence of significant contamination was noted. Consequently, 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).

9.2 Soil contamination results

- 9.2.1 The soil contamination test results are summarised in the Table on page 21.
- 9.2.2 CoDa's laboratory test certificates are presented in Appendix M to this report.

Calorific value

- 9.2.3 In addition to the testing summarised in the table on page 21, TP2 0.5m (Made Ground – Topsoil) and TP13 2.5m (Made Ground – Opencast Backfill) from the eastern parcel were tested for calorific value testing. Results were 2.4MJ/kg and 1.5MJ/kg respectively.
- 9.2.4 The result of 1.5MJ/kg is not considered potentially combustible and the result of 2.5MJ/kg is at the lower end of the range where the potential for combustion exists and is not considered a significant hazard, especially given the limited areas of the site where such material was encountered by CoDa.

Inorganic determinands

- 9.2.5 CoDa tested a total of 12 samples for inorganic analysis.
- 9.2.6 Slightly elevated zinc was encountered in samples taken TP1 0.1m (Topsoil) and TP2 0.5m (Made Ground – Topsoil), at concentrations of 270mg/kg and 340mg/kg respectively.
- 9.2.7 Zinc is a phytotoxic metal; phytotoxicity describes the inhibitive and toxic effect high concentrations of some substances can have on plant growth.
- 9.2.8 Most substances are harmful to human health at lower concentrations than would be detrimental to plant growth. However, there are three notable exceptions - Boron, Copper and Zinc. Plants are the more sensitive receptor to these elements i.e. detrimental effects are seen in plants at concentrations which do not present a risk to human health. Consequently, for Zinc, consideration and protection of flora would also be protective of human health.

Summary of degree of soils contamination (inorganics)

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.												
			pH	As ∞	B ~	Cd ∞	Cr x	Cu♣\$	Pb ∞	Hg *	Ni	Se	Zn \$	PAH	
				B(a)P ∞	Naphthalene										
				37	5	26	3000	200	200	169	127	350	200	5	4
West (Lidgett Lane)															
TP1	0.1	Topsoil	6.6	16	<1	<1	22	37	72	<1	21	<3	96	0.7	<0.1
TP3	0.3	Topsoil	7.4	12	<1	<4	19	28	38	<1	20	<3	83	<0.1	<0.1
TP6	0.3	Topsoil	7.3	16	<1	<5	23	33	56	<1	23	<3	100	<0.1	<0.1
TP10	0.1	Topsoil	7.0	13	<1	<8	23	32	61	<1	29	<3	100	<0.1	<0.1
TP2	0.9	Granular Residual Soil (Possible MG)	8.4	7	<1	<3	18	20	12	<1	26	<3	55	<0.1	<0.1
East (New Road)															
TP1	0.1	Topsoil	7.0	19	<1	3	22	58	96	<1	22	<3	270	0.5	0.2
TP06	0.1	Topsoil	6.6	11	<1	<1	14	23	42	<1	14	<3	72	0.3	0.1
TP12	0.1	Topsoil	7.0	16	<1	<1	16	33	59	<1	16	<3	84	0.4	0.1
TP13	1.0	Made Ground (Opencast Backfill)	7.1	7	<1	<1	20	30	32	<1	31	<3	90	<0.1	<0.1
TP13	2.5	Made Ground (Opencast Backfill)	7.0	6	<1	<1	18	25	24	<1	28	<3	68	<0.1	<0.1
TP2	0.5	Made Ground (Topsoil)	6.7	37	<1	<1	16	65	92	<1	28	<3	340		
TP2	1.2	Made Ground	6.4	7	<1	2	14	20	32	<1	22	<3	190	0.5	<0.1
Key							Source of guidance trigger level								
36	Parameter tested for and found to be in excess of Tier 1 concentration.						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 concentration.														
12	Parameter tested for but not found to be in excess of Tier 1 concentration.						∞	Category 4 Screening Level – SP1010, December 2013 (CL:AIRE/Defra).							
	Parameter not tested for.						\$	Ministry of Agriculture, Fisheries & Food. 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.														
*	Assumes mercury present as an inorganic compound (cf elemental metal or within organic compound). See Science Report SC050021/Mercury SGV.														

- 9.2.9 Allowable concentrations of heavy metals in arable soils have been set by the Department of Environment¹. The value for Zinc is 200mg/kg, and is based on a continued annual application of heavy metal rich fertiliser (sludge); as such it is not representative of activity in a standard UK garden.
- 9.2.10 Lithos have also derived a value for Zinc in relation to risks to human health, using the CLEA model, assuming a residential end use with consumption of home grown produce in a sandy loam soil with 6% SOM. The reported value is 2,170mg/kg, ten times greater than the potential phytotoxic concentration.
- 9.2.11 On balance, given the context of a residential development and the relatively low concentrations recorded, Zinc is not considered significant and no special remedial measures are considered necessary.
- 9.2.12 None of the other samples tested by CoDa breach Lithos' Tier 1 screening values.

Organic determinands

- 9.2.13 CoDa tested a total of 11 samples for speciated poly aromatic hydrocarbons (PAH) analysis, and no significant concentrations of either were recorded.

9.3 Summary

- 9.3.1 With respect to the samples tested by CoDa, no significant contamination has been identified.

10 HAZARDOUS GAS

10.1 General

- 10.1.1 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
On-site made ground (opencast backfill)	Human health	Asphyxiation & explosion	Vertical migration, ingress & accumulation	Low: made ground essentially inert, with little degradable matter in limited volumes.
	Buildings	Explosion		
Off-site made ground (opencast quarries backfill)	Human health	Asphyxiation & explosion	Lateral migration, ingress & accumulation	Moderate: no significant drift deposits, numerous large areas of backfilling within the vicinity.
	Buildings	Explosion		
Mineworkings	Human health	Asphyxiation & explosion	Vertical migration, ingress & accumulation	High. Based on monitoring results obtained previously by CoDa.
	Buildings	Explosion		

- 10.1.2 Monitoring wells were installed in CoDa boreholes R1 to R3 in the western parcel (Lidgett Lane). CoDa carried out a total of 6 gas monitoring visits between the 28th October 2014 and 3rd March 2014. No monitoring appears to have taken place in the eastern parcel (New Road).
- 10.1.3 It should be noted that the 'raw data' has not been supplied. However, the monitoring is summarised within the text of the CoDa report, as discussed below.

¹ Department of Environment Code of Practice for Agricultural use of Sewage Sludge 1996

- 10.1.4 Gas monitoring results for the western parcel recorded significantly elevated (between 24.1% and 51.3% on 4 out the 6 visits within R1, along with an elevated result of 5% on visit 2. In addition, positive flow readings were recorded in R1 in 3 of the 6 visits, including 2 visits where flows reached 33.9l/hr and 73.0l/Hr.
- 10.1.5 A gas sample was collected from R1 by CoDa which yielded results of 4,758 ppm ethane, 31%v/v methane and 2.4% carbon dioxide.
- 10.1.6 CoDa requested that British Gas inspect one of their mains which lies on Lidgett Lane, within the vicinity of R1 (although a distance is not given by CoDa). The findings of this inspection are unknown.
- 10.1.7 Given the above, gas monitoring wells have been installed in 12 Lithos boreholes across the two parcels. Details of the installations are given on the probehole logs presented in Appendices J & K to this the report.
- 10.1.8 Initially, 6 visits have been scheduled over a 3 month period. However, it seems likely that monitoring will need to be extended.

10.2 Scope of works

- 10.2.1 To date, the wells have been monitored on one occasion for groundwater levels and soils-gases, and the results are presented in Appendix O.
- 10.2.2 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 LMSx infra-red gas analyser
 - Standing water level using a dipmeter
 - Ambient oxygen concentration (check for instrument drift)

10.3 Monitoring results

10.3.1 The results of the monitoring 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)
East (New Road)				
PH01A	1.3 – 4.5 (Coal Measures Bedrock)	0.0	1.9	0.0
PH02A	1.3 – 4.5	0.0	2.1	0.0
PH03A	(Coal & Coal Measures Bedrock)	0.0	0.5	0.0
PH05A	1.3 – 4.5	0.0	2.0	0.0
PH06A	(Coal Measures Bedrock)	0.0	0.3	0.0
PH07A	1.3 – 4.5 (Coal & Coal Measures Bedrock)	0.0	3.1	0.0
West (Lidgett Lane)				
PH101A	1.3 – 4.5 (Coal Measures Bedrock)	0.0	1.9	0.0
PH102A		0.0	1.0	0.0
PH103A		0.0	0.8	0.0
PH104A	1.3 – 4.5 (Coal & Coal Measures Bedrock)	0.0	0.8	0.0
PH105A	1.3 – 4.5	0.0	4.1	0.0
PH106A	(Coal Measures Bedrock)	0.0	1.5	0.0

10.3.2 Generic Notes outlining how monitoring results are included as Generic Note 05 in Appendix A.

10.3.3 A hazardous gas risk assessment incorporating all of the results will be issued on completion of monitoring in January 2015.

11 GEOTECHNICAL TESTING

11.1 General

- 11.1.1 A total of 5 samples taken from the western parcel (Lidget Lane) of natural soil were scheduled for analysis by CoDa. No geotechnical analysis appears to have been undertaken on any samples taken from the eastern site (New Road).

11.2 Atterberg limits

- 11.2.1 The plasticity indices of 5 samples of cohesive soil were determined; results are summarised below. One sample (TP4 2.1m) was classified as non-plastic.

Soil type	Range of Plasticity Indices* (average)	Shrinkability
Weathered Coal Measures	20-36 (29)	Medium

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

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

- 11.2.2 It should be noted that the results presented in the CoDa report have not been modified in accordance with NHBC standards.

11.3 Soluble sulphate and pH

- 11.3.1 In accordance with BRE Special Digest 1:2005, this site should be classified as greenfield with a mobile groundwater regime.
- 11.3.2 CoDa submitted a total of 17 samples analysis comprising pH and water-soluble sulphate (2:1 soil/water extract). However, 7 of these samples are of topsoil, therefore the results are essentially irrelevant as this material be very unlikely to come into contact with building foundations.
- 11.3.3 The highest water-soluble sulphate concentration and the lowest pH value for each soil type analysed are shown in the Table below.

Soil type	Lowest pH values	Highest soluble sulphate concentration (mg/l)
Made Ground	5.1	<10
Natural soils	6.7	<10

- 11.3.4 Three samples of natural soils yielded pH values below 5.5, therefore supplementary analysis to determine the concentrations of magnesium, chloride and nitrate should have been scheduled; this has not been done.
- 11.3.5 In addition, no samples of coal were scheduled for pH and water-soluble sulphate.
- 11.3.6 Based on the above results and 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.
- 11.3.7 However, further analysis is recommended including on samples of shallow coal, and concentrations of magnesium, chloride and nitrate where pH is less than 5.5.

11.4 Undrained shear strength testing

Hand shear vane testing

- 11.4.1 Hand shear vane testing was undertaken by CoDa within 8 of the 32 trial pits/trial trenches at depths of between 0.7m and 1.2m.
- 11.4.2 Results ranged from 50kPa to 80kPa, typically between 50 and 65kPa suggesting that the majority of the cohesive soils are firm.

12 SUMMARY & RECOMMENDATIONS

12.1 General

- 12.1.1 Lithos have been supplied with two third party (CoDa) reports relating to two parcels of land where Redrow are considering redevelopment with housing.
- 12.1.2 Data from the two CoDa reports has been combined with Lithos' own desk study and intrusive mining investigation.
- 12.1.3 Although no formal reliance can be placed on the data presented in the CoDa reports, some useful data has been obtained, and tentative recommendations based on this information are presented below.

12.2 Mining

- 12.2.1 This site is located within a Coal Mining Development High Risk Area.
- 12.2.2 Lithos' mining investigation, combined with CoDa's data and Coal Authority information, suggests that no shallow mineworkings are present beneath the site.
- 12.2.3 Given the number of probeholes drilled, and the absence of any evidence of voids or broken ground, it is considered unlikely that the site is underlain by shallow mineworkings in any of the seams, although consideration could be given to further drilling in the west of the site to remove any residual uncertainty.
- 12.2.4 It is recommended that some trial-trenching is undertaken in order to delineate the extent of the former opencast in the south-west of the eastern parcel, including the location of any 'highwalls' in the bedrock.

12.3 Hazardous gas

- 12.3.1 The site is considered to be risk from hazardous gas from the areas of deep made ground on site, and within the former opencast which lies between the two parcels.
- 12.3.2 Monitoring by CoDa found significantly elevated methane and high flows on a number of occasions.
- 12.3.3 The proposed development comprises low rise residential housing. Consequently, the gas regime will be characterised in accordance with the Situation B (traffic light) methodology outlined in CIRIA Report C665.
- 12.3.4 Based on worst-case (peak) gas concentrations and steady flows reported by CoDa, Gas Screening Values (GSVs) result in site characterisation (Traffic Light) as Red. However, this is not uncommon in the Barnsley area (especially east of the M1), where fluctuating gas concentrations associated with interconnected mineworkings have often been reported.
- 12.3.5 If a classification of Red is confirmed by further monitoring, it should not preclude development. The Local Authority have started insist on the inclusion of gas measures within the deeds of properties on such developments, a need for maintained by the owner.
- 12.3.6 Lithos have conducted one monitoring visit to date which found no elevated methane or carbon dioxide.
- 12.3.7 A hazardous gas risk assessment will be issued upon completion of the monitoring programme.

12.4 Contamination & remediation

- 12.4.1 No significant contamination was encountered by CoDa, and it is unlikely that any significant remediation works will be required prior to redevelopment.
- 12.4.2 Testing suggests that the topsoil should be suitable for re-use. However, more samples should be tested to confirm this.

12.5 Foundations

- 12.5.1 The majority of plots are likely to be founded on traditional strip/trench fill footings within the Residual Soils/Bedrock.
- 12.5.2 Foundations within Cohesive Residual Soils will require overdeepening where plots lie within the zone of influence of nearby trees/hedgerows.
- 12.5.3 Ideally, no development should take place over the area of deep made ground associated with the former opencast in the south-west of the eastern parcel due to potential settlement issues. However, if plots are proposed within this area, a piled solution will likely be required.

12.6 Flooding

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

12.7 Drainage

- 12.7.1 Based on the ground conditions encountered by CoDa, soakaways are unlikely to provide a suitable drainage solution at the site, therefore there will likely be a need for water balancing.
- 12.7.2 In addition, site topography could result in springs down-gradient so rendering soakaways unfeasible.

12.8 Highways

- 12.8.1 Natural soils encountered by CoDa should yield CBR values of at least 3%; this should be verified prior to road constructions.

12.9 Further works

- 12.9.1 As a result of the review of the CoDa data, Lithos would recommend the following supplementary works:
- Additional trial pitting in the east in order to:
 - enable retrieval of samples for shrinkability testing (not carried out by CoDa)
 - delineate the area of opencast backfill in the south-west and identify the positions of any 'highwalls' within the bedrock
 - Additional trial pitting in the east and west to confirm ground conditions encountered by CoDa
 - Scheduling of around 12 samples of topsoil from across both sites to assess suitability for re-use

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 from the Local Authority and by reference to current and historical OS plans. A coal mining report is obtained from the Coal Authority (CA).

In July 2011, the 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 areas of higher risk (known as the Coal Mining Development Referral Area) and lower risk (known as the Standing Advice Area). The Coal Mining Development Referral Areas contain a range of specific mining legacy risks to the surface, including mine entries; shallow coal workings; workable coal seam outcrops; mine gas; geological features; and previous surface mining sites. The Standing Advice Area is the remainder of the defined coalfield. In this area no known defined risks have been recorded; although there may still be unrecorded issues.

Landfills

Lithos obtain data from the Landmark Information Group, the Environment Agency and the Local Authority with respect to known areas of landfilling within 250m of the proposed development site. Reference is also made to historical OS plans, which are 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 BR211, 2007: "Radon: guidance on protective measures for new buildings", and to information from the BGS / HPA (Health Protection Agency) radon potential dataset provided by the Landmark Information Group. The level of protection needed is site-specific and is determined by reference to the maps contained in Annex A of BR211. These maps are derived from the Radon Atlas of England and Wales (2007), and indicate 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 (average annual radon concentration of 200 Bq.m-3), as follows:

- Unshaded grid squares where less than 3% of homes are estimated to be above the Action Level, and no radon protection is required in new dwellings
- Light grey shaded grid squares where between 3% & 10% of homes are estimated to be above the Action Level, and basic radon protection is required in new dwellings
- Dark grey shaded grid squares where greater than 10% of homes are estimated to be above the Action Level, and full radon protection is required
- Sites where either basic or full radon protective measures are required (i.e. Where greater than 3% of homes are estimated to be above the Action Level) are referred to as Radon Affected Areas

BR211 provides a preliminary indication of the measures required for a particular site, as the Annex A maps indicate the highest geological radon potential within each 1km grid square, but in many cases the radon potential varies considerably within the grid square. The Landmark information is more site-specific and therefore may allow the adoption of a lower level of protection than that indicated in the Annex A maps. Alternatively, a BR211 Radon Report can be obtained from the BGS in order to provide more site-specific information.

It should be noted that in July 2010 the Health Protection Agency (HPA) published new advice (Document RCE-15: "Limitation of Human Exposure to Radon"), in which they recommend that all new buildings, extensions, conversions & refurbished buildings in the UK include (at least) basic radon protective measures. The HPA also widened the definition of Radon Affected Areas to include areas where greater than 1% of homes are estimated to be above the Action Level.

Generic notes – geoenvironmental Investigations

Hydrogeology

Lithos obtain information from the Environment Agency (EA) and the Landmark Information Group 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 type 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 drift 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 drift deposits with an equally wide range of water permeability and storage. Secondary aquifers are subdivided into two 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 - has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type

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

Note: The maps only display the principal and secondary aquifers as coloured areas. All uncoloured areas on the bedrock designation 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 drift is present. To do this, it is necessary to consult the published geological survey maps.

For the purposes of our 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 drift overlies principal bedrock, an overall designation of principal is assumed)

The EA have also designated 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 the Landmark Information Group with respect to:

- surface water quality
- recorded pollution incidents
- licensed abstractions (groundwater & surface waters)
- licensed discharge consents
- site susceptibility to flooding

Generic notes – geoenvironmental Investigations

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 six 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 provide 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 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 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

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 (or 1 in 200 year as appropriate), 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 consultant who can advise on appropriate mitigating measures; ie raising slab levels, provision of storage etc.

COMAH & explosive sites

Lithos obtain information from the Landmark Information Group with respect to COMAH or explosive sites within 1km of the proposed development site. Lithos's 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 ground 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 targets.

Potential pollutant linkages are shown on a preliminary conceptual site model, presented as a Drawing in an Appendix to this Geoenvironmental Report. The preliminary model is revised in light of data arising from the subsequent ground investigation.

General

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

- BS5930:1999 "Code of practice for site investigation"
- BS10175:2011 "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 logs are presented in Appendices to this Geoenvironmental Report. These logs include details of the:

- Investigation technique adopted
- Samples taken
- Descriptions of the solid strata, and any groundwater encountered.
- Results of any in-situ testing
- Any gas\groundwater monitoring well installed

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: 1999 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. 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 tricone rock roller 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

Where relative densities of granular materials given on the trial pit and window sample 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 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.

Generic notes – geoenvironmental investigations

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).

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.

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

Generic notes – geoenvironmental investigations

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)
pH & metals only	1 kg plastic tub
organics (TPH, PAH) etc only	500ml wide-necked glass jar. Vial required if TPH is to include GRO.
VOCs (incl. naphthalene and/or GRO) only	Glass vial & 1kg plastic tub
pH & metals, and organics	1 litre wide-necked glass jar & 1kg plastic tub
pH & metals, and organics (incl. VOCs or GRO)	Glass vial; 1 litre wide-necked glass jar; & 1kg plastic tub

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 an Lithos investigation are described (logged) in general accordance with BS 5930. 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(ces) containing the logs. There are two Keys – Symbols & Legends and Terms & Definitions.

Generic notes – geoenvironmental investigations

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

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

- Grading
- Compaction tests
- Particle density

The test results are presented as received in an Appendix to this 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:

$$I'p = Ip * (\% < 425\mu m / 100)$$

ie 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 adopt a conservative approach and recommend 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 (DC 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.

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 (Version 1.05) Handbook 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). Lithos consider it reasonable to adopt the CLEA default TOC for made ground. 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

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 and 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.

Generic notes – geoenvironmental investigations

Lithos have assumed the source of contamination is directly below the building foundations i.e. a depth to 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 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 Category 4 Screening Levels 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 Category 4 Screening Levels 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 YAHFAC (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 four Scenarios A to D are presented below:

Inorganic contaminant	Source	Tier 1 assessment criteria (mg/kg) for Scenarios A to D						Comments/notes
		SGV*	C4SL*	A	B	C	D	
As	CLEA	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	C4SL adopted
Cd	CLEA	10	26	26		149	410	C4SL adopted
Cr	CLEA			3,000		3,000	30,000	Assumes Cr is CrIII.
Pb	CLEA	(450)	200	200		310	2,330	C4SL adopted
Ni	CLEA	130		127		127	1,700	Assessment of health risk only
Se	CLEA	350		350		595	13,000	
Hg	CLEA	170		169		238	3,640	Assumes in an inorganic compound
B	Lithos			5		5	5	Based on phytotoxic risks as plants are the more sensitive receptor (Cu is pH dependant)
Cu	DoE			80-200		80-200	80-200	
Zn	DoE			200		200	200	
Cyanide	CLEA			527		530	14,000	

* For a residential end use

Generic notes – geoenvironmental investigations

With respect to **organic** determinands, Lithos derived Tier 1 values for the four Scenarios A to D 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	
Benzene	0.33	0.87	0.87	0.87	3.3	98	C4SL adopted
Toluene	610		497	1,440	1,690	4,360	
Ethyl Benzene	350		240	416	498	2,840	
Xylenes	240		127	146	183	2,620	
Phenol	420		412	2,360	557	38,700	
PCBs			1.7	1.8	1.8	1.8	Based on toxicity of EC7.
Benzo(a)pyrene		5	5	25	5.3	76	C4SL adopted. Where source is not a coal tar.
Naphthalene			4	4	5	430	
Gasoline Range Organics			15	16	21	1,000	See 3-step assessment of TPH below.
Diesel Range Organics			151	153	232	5,000	
Lubricating Range Org			1,000	5,000	1,000	5,000	

* For a residential end use

Note: **PAH** cannot be assessed as a single "total" value, as each individual PAH compound has different toxicity and mobility in the environment. Speciated analysis is required to determine the concentrations of the various compounds, most notably the key PAHs: benzo(a)pyrene (considered the most toxic of the PAHs); and Naphthalene (the most mobile and volatile of the PAHs).

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 thirteen representative constituent fractions or "EC Bandings". The TPHCWG have derived a series of physiochemical and toxicological parameters for each of the thirteen 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	0.87	0.87	3.3	98
Toluene	497	1,440	1,690	4,360
Ethyl Benzene	240	416	498	2,840
Xylenes	127	146	183	2,620
Naphthalene	4	4	5	430

Generic notes – geoenvironmental investigations

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	63	5,000 [^]
Aliphatic 6-8	GRO	123	123	191	
Aliphatic 8-10	GRO	30	31	48	
Aliphatic 10-12	DRO	151	153	232	
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	52	56	72	1,000 [^]
Aromatic 7-8	GRO	15	16	21	
Aromatic 8-10	GRO	47	50	77	
Aromatic 10-12	DRO	212	282	390	
Aromatic 12-16	DRO	683	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

$$HI = \sum_{i=1}^n \frac{HQ_i}{F_i} = \frac{\sum_{i=1}^n \frac{Measured\ concentration\ F_i\ (mg\ kg^{-1})}{SGV_i\ F_i\ (mg\ kg^{-1})}}{F_i}$$

where: HI = Hazard Index
HQ = Hazard Quotient
F_i = Fraction
SGV_i = 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 (2006) – Assessing risks posed by hazardous ground gases to buildings
- BS 8485:2007 – 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 ICRL 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".

Generic notes – geoenvironmental investigations

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	Environment Agency 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

Generic notes – geoenvironmental investigations

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 1. – 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 are:

- 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 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 (2006)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.

Generic notes – geoenvironmental investigations

A – All developments except low rise housing

(Wilson & Card, 1999)^v revised Table 28 of CIRIA 149^v 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, mineworking flooded.
4	<15	Quantitative Risk Assessment required to evaluate scope of protection measures.	Mineworking – susceptible to flooding, completed landfill, inert waste
5	<70		Mineworking 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	Methane ⁱ		Carbon dioxide ⁱ	
	Typical maximum concentration ² (% v/v)	Gas screening value (GSV) ^{3,4,5} (litres per hour)	Typical maximum concentration ² (% v/v)	Gas screening value (GSV) ^{3,4,5} (litres per hour)
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.
- The small room is considered to be a downstairs toilet, with dimensions of 1.50 × 1.50 × 2.50 m, with a soil pipe passing into the sub-floor void.
- 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 (2006) – *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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PILLEY, BARNSELY

SITE LOCATION
PLAN

DRAWN MJT DATE 12/10/2015

CHECKED REG DATE 12/10/2015

STATUS FOR COMMENT ☐ DRAFT ☐
FOR APPROVAL ☐ FINAL ☒

SCALE 1:25,000 SHEET A4 DRAWING NO. 2222/1 REVISION



NOTES

— APPROXIMATE SITE BOUNDARY

REPRODUCED FROM MPJ DESIGN DRAWING
REFERENCE 13/091_01, DATED JULY 2013

REV.	DESCRIPTION	DATE

LITHOS CONSULTING

info@lithos.co.uk
www.lithos.co.uk

Tel 01937 545330

CLIENT

REDROW

REDROW HOUSE, BRUNEL ROAD
WAKEFIELD 41, WAKEFIELD, W YORKS, WF2 0XG
Tel: [01924] 822 566 Fax: [01924] 822 599

JOB TITLE

PILLEY, BARNSELY

DRAWING TITLE

PROPOSED SITE LAYOUT (EAST)

DRAWN	DATE	STATUS
MJT	12/10/2015	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
REG	12/10/2015	DRAFT ☐
		FINAL ☒

SCALE	SHEET	DRAWING NO.	REVISION
NTS	A3	2222/2E	



NOTES

— APPROXIMATE SITE BOUNDARY

REPRODUCED FROM MPJ DESIGN DRAWING
REFERENCE 13/092_01, DATED JULY 2013

REV.	DESCRIPTION	DATE

LITHOS CONSULTING

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CLIENT

REDROW

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WAKEFIELD 41, WAKEFIELD, W YORKS, WF2 0XG
Tel: [01924] 822 566 Fax: [01924] 822 599

JOB TITLE

PILLEY, BARNSELY

DRAWING TITLE

PROPOSED SITE LAYOUT (WEST)

DRAWN	DATE	STATUS
MJT	12/10/2015	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
REG	12/10/2015	DRAFT ☐
		FINAL ☒

SCALE	SHEET	DRAWING NO.	REVISION
NTS	A3	2222/2W	



NOTES

- APPROXIMATE SITE BOUNDARY
- COAL OUTCROP
- FAULT
- FORMER OPENCAST
- ADIT
- SHAFT
- GRASS & OVERGROWN AREAS

REV.	DESCRIPTION	DATE
------	-------------	------

LITHOS CONSULTING

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www.lithos.co.uk

Tel 01937 545330

CLIENT

REDROW

REDROW HOUSE, BRUNEL ROAD
WAKEFIELD 41, WAKEFIELD, W YORKS, WF2 0XG
Tel: [01924] 822 566 Fax: [01924] 822 599

JOB TITLE

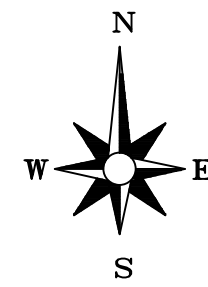
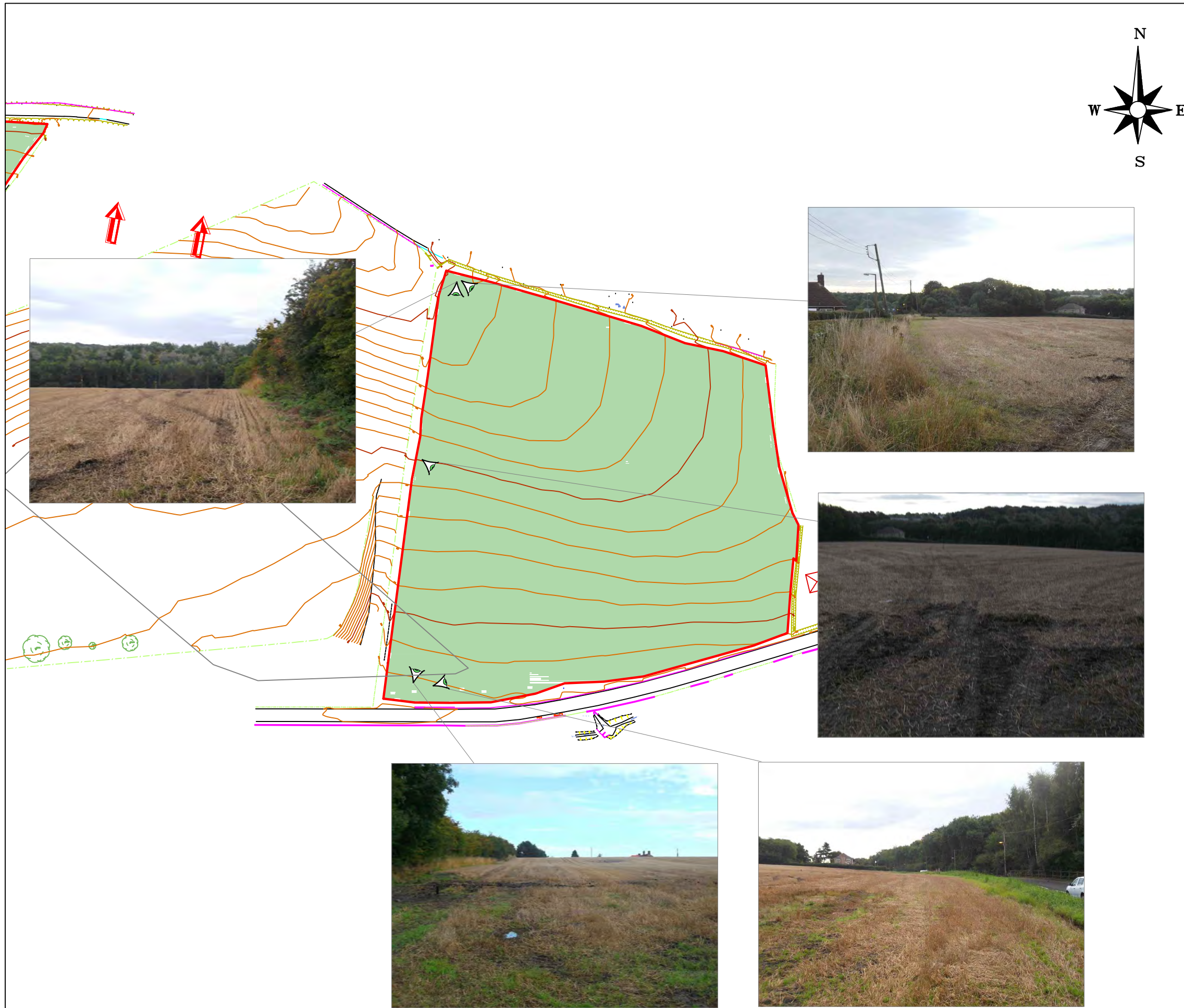
PILLEY, BARNSELEY

DRAWING TITLE

GEOLOGICAL & SITE FEATURES

DRAWN	MAR	DATE	06/10/2015	STATUS	FOR COMMENT	☐
CHECKED	MJT	DATE	06/10/2105	FOR APPROVAL	DRAFT	☐
				FINAL		☒

SCALE	1:2,000	SHEET	A3	DRAWING NO.	2222/3	REVISION	
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NOTES		
APPROXIMATE SITE BOUNDARY LOCATION & ORIENTATION OF PHOTOGRAPH		
REV.	DESCRIPTION	DATE



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



REDROW HOUSE, BRUNEL ROAD
WAKEFIELD 41, WAKEFIELD, W YORKS, WF2 0XG
Tel: [01924] 822 566 Fax: [01924] 822 599

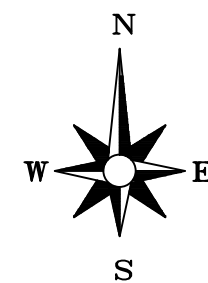
JOB TITLE

PILLEY, BARNSELEY

DRAWING TITLE

SITE PHOTOGRAPHS (EAST)

DRAWN	DATE	STATUS	
MAR	30/09/2015	FOR COMMENT	☐
CHECKED	DATE	FOR APPROVAL	☐
MJT	30/09/2015	DRAFT	☐
		FINAL	☒
SCALE	SHEET	DRAWING NO.	REVISION
NTS	A3	2222/4E	



- NOTES
- APPROXIMATE SITE BOUNDARY
 - LOCATION & ORIENTATION OF PHOTOGRAPH

REV.	DESCRIPTION	DATE



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

CLIENT

REDROW

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WAKEFIELD 41, WAKEFIELD, W YORKS, WF2 0XG
Tel: [01924] 822 566 Fax: [01924] 822 599

JOB TITLE

PILLEY, BARNSELEY

DRAWING TITLE

SITE PHOTOGRAPHS (WEST)

DRAWN		DATE	STATUS
MAR		30/09/2015	FOR COMMENT
CHECKED	DATE	FOR APPROVAL	
MJT	30/09/2015	DRAFT	
		FINAL	

SCALE	SHEET	DRAWING NO.	REVIS
NTS	A3	2222/4W	



NOTES

- APPROXIMATE SITE BOUNDARY
- COAL OUTCROP
- FAULT
- FORMER OPENCAST
- ADIT
- SHAFT
- CODA PROBEHOLE
- CODA TRIAL PIT LOCATION
- LITHOS PROBEHOLE
- X-SECTION LINE

REV.	DESCRIPTION	DATE
------	-------------	------

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

REDROW

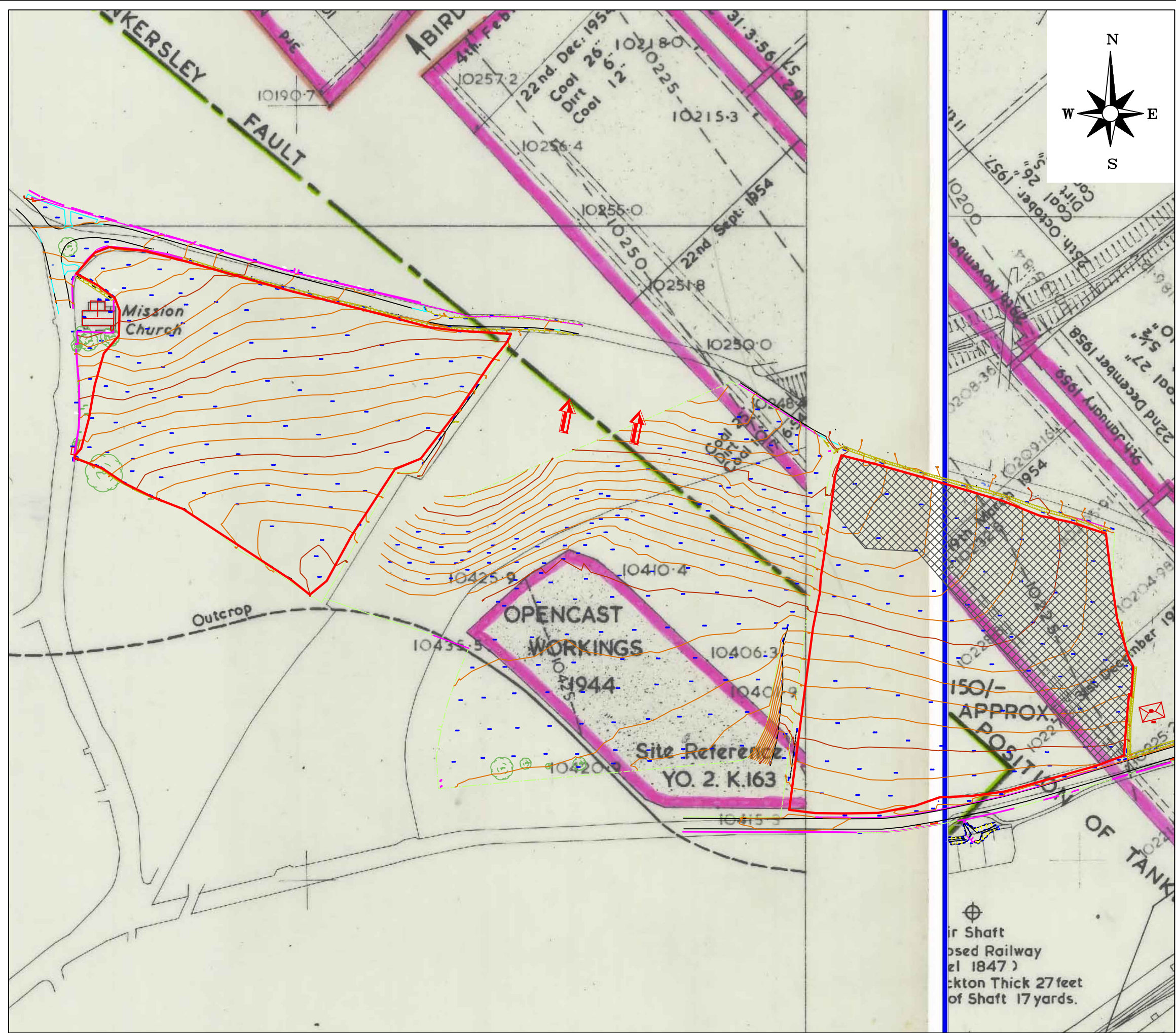
REDROW HOUSE, BRUNEL ROAD
WAKEFIELD 41, WAKEFIELD, W YORKS, WF2 0XG
Tel: [01924] 822 566 Fax: [01924] 822 599

**PILLEY,
BARNSELEY**

EXPLORATORY HOLE LOCATIONS

DRAWN	DATE	STATUS
MAR	06/10/2015	
CHECKED	DATE	FOR COMMENT ☐
MJT	06/10/2015	FOR APPROVAL ☐
		DRAFT ☐
		FINAL ☒

SCALE	SHEET	DRAWING NO.	REVISION
1:2,000	A3	2222/6	



NOTES

- APPROXIMATE SITE BOUNDARY
- ▨ EXTENT OF WORKINGS

REV.	DESCRIPTION	DATE
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www.lithos.co.uk
Tel 01937 545330

CLIENT

REDROW HOUSE, BRUNEL ROAD
WAKEFIELD 41, WAKEFIELD, W YORKS, WF2 0XG
Tel: [01924] 822 566 Fax: [01924] 822 599

JOB TITLE

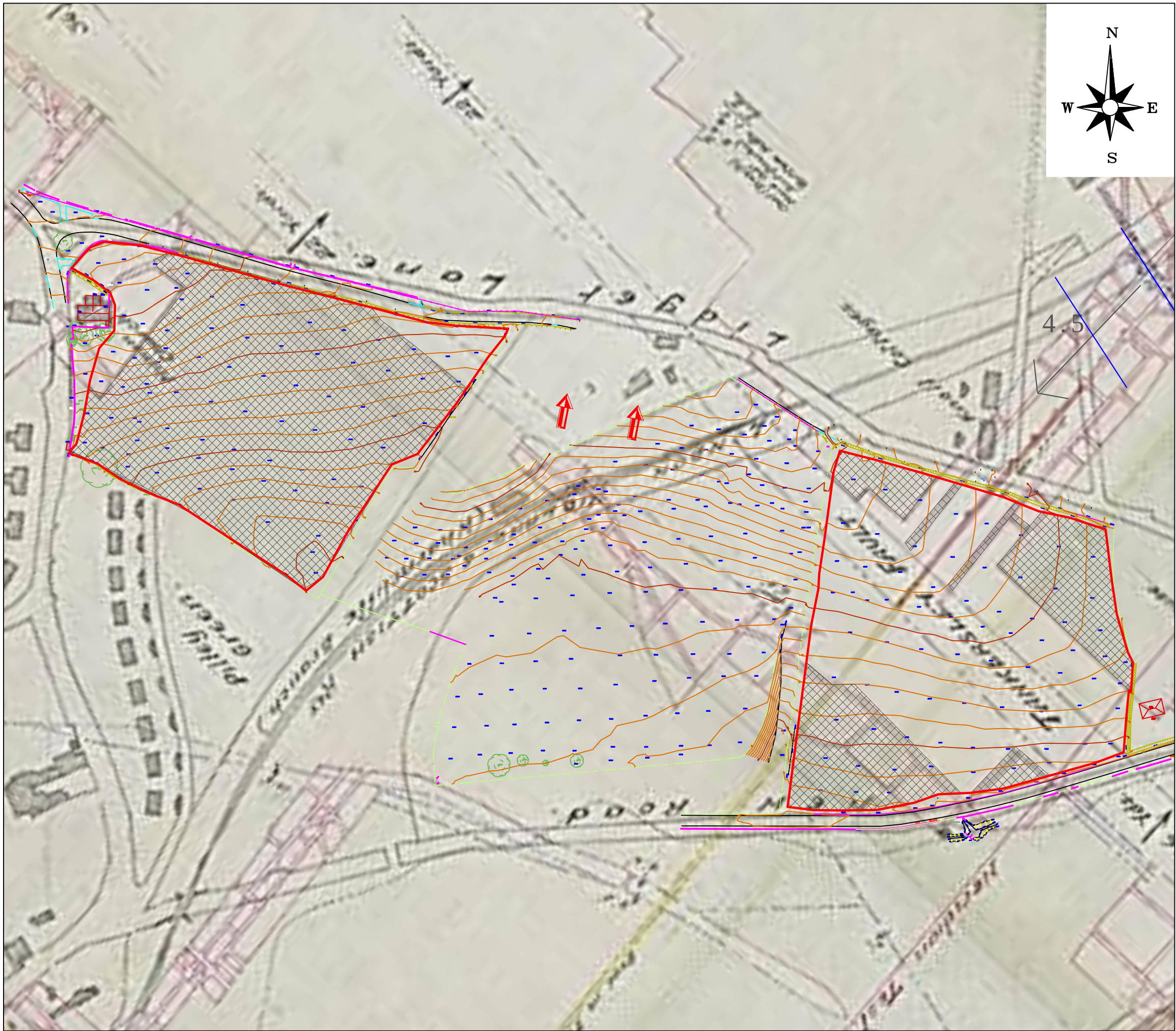
PILLEY,
BARNSELY

DRAWING TITLE

ABANDONMENT PLAN
FLOCKTON THICK SEAM

DRAWN	DATE	STATUS
MAR	30/10/2015	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
MJT	30/10/2105	DRAFT ☐
		FINAL ☒

SCALE	SHEET	DRAWING NO.	REVISION
1:2,000	A3	2222/9	



NOTES

— APPROXIMATE SITE BOUNDARY

▨ EXTENT OF WORKINGS

REV.	DESCRIPTION	DATE

LITHOS CONSULTING

info@lithos.co.uk
www.lithos.co.uk

Tel 01937 545330

CLIENT

REDROW

REDROW HOUSE, BRUNEL ROAD
WAKEFIELD 41, WAKEFIELD, W YORKS, WF2 0XG
Tel: [01924] 822 566 Fax: [01924] 822 599

JOB TITLE

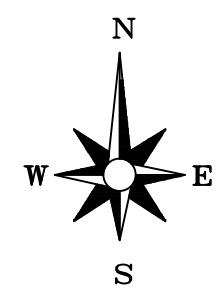
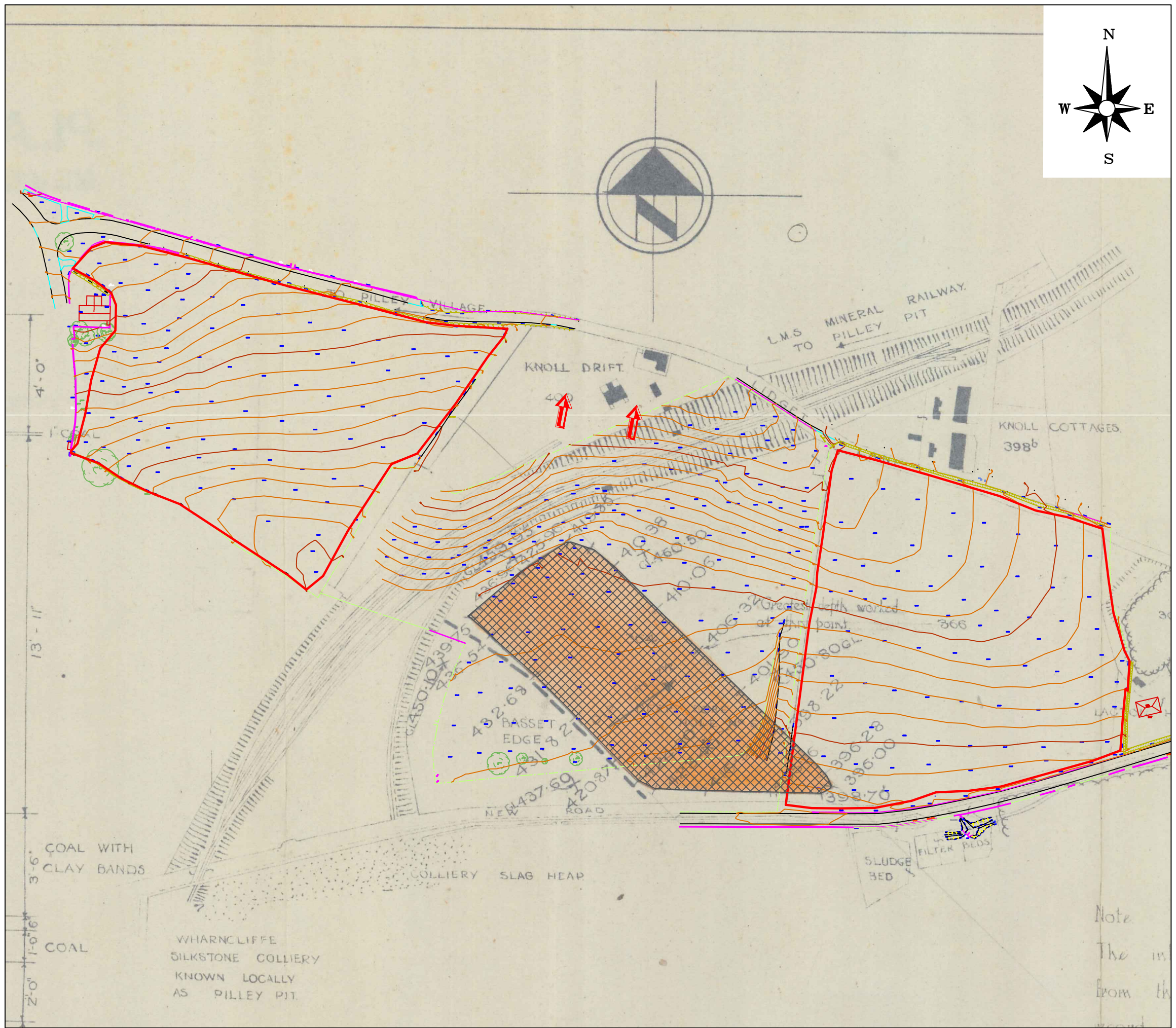
**PILLEY,
BARNSELY**

DRAWING TITLE

**ABANDONMENT PLAN
PARKGATE SEAM**

DRAWN	DATE	STATUS
MAR	30/10/2015	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
MJT	30/10/2105	DRAFT ☐
		FINAL ☒

SCALE	SHEET	DRAWING NO.	REVISION
1:2,000	A3	2222/10	



NOTES

— APPROXIMATE SITE BOUNDARY

▨ EXTENT OF WORKINGS

REV.	DESCRIPTION	DATE

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

CLIENT

REDROW HOUSE, BRUNEL ROAD
WAKEFIELD 41, WAKEFIELD, W YORKS, WF2 0XG
Tel: [01924] 822 566 Fax: [01924] 822 599

JOB TITLE

PILLEY,
BARNSELEY

DRAWING TITLE

ABANDONMENT PLAN
OPENCAST

DRAWN	MJT	DATE	30/10/2015	STATUS	FOR COMMENT	☐
CHECKED	REG	DATE	30/10/2105	FOR APPROVAL	DRAFT	☐
				FINAL		☒

SCALE	1:2,000	SHEET	A3	DRAWING NO.	2222/11	REVISION	
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Appendix C

Commission

002/2222/MJT

8th July 2015

Mr A Calvert
Redrow Homes Ltd
Redrow House
Brunel Road
Wakefield 41
Wakefield
West Yorkshire
WF2 0XG



Registered in England 07068066

Parkhill
Wetherby
West Yorkshire
LS22 5DZ

T 01937 545 330
www.lithos.co.uk

Dear Andy

Pilley, Barnsley

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 is split across two sites, at New Road and Lidget Lane, including a total of 77 traditional 2 storey domestic dwellings with associated gardens, POS and adoptable roads and sewers. Total site area is around 5.1 hectares.

We have been supplied with third party reports for a site investigation by CoDa in March 2015. The scope of works outlined in this fee proposal should be sufficient to supplement the existing data enable Redrow to make an unconditional offer on the site.

The site currently comprises two parcels of arable farmland split by central area where no development is proposed.

Following a brief review of the existing SI reports and online information, the key points regarding the sites are as follows:

- Underlying geology comprises weathered coal measures (firm to stiff clay) with bedrock at shallow depth (typically <2m).
- An deep area of made ground (>4m) was encountered in the south-west of the 'New Road' site, this is likely to be associated with a former opencast located in the area in between the two sites.
- Coal underlies both sites at shallow depth (<5m) as well as deeper seams at around 20m depth, these are likely to be the Tankersley Ironstone, Flockton Thick and possibly the Lidget Coal. Both sites lie within a Coal Mining Development High Risk Area.
- A former sandstone quarry lies immediately adjacent to the east of the New Road site.
- Gas monitoring by CoDa yielded high readings of methane at the Lidget Lane site; further monitoring was recommended.
- No significant contamination appears to have been encountered by CoDa.
- Natural deposits should enable traditional shallow foundation solutions for the proposed dwellings.

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 comment on the feasibility of coal extraction.

We will need a Promap or topo survey in CAD format, to provide a base plan for technical drawings etc. If you do not have one, we could obtain at cost (c. £***) plus £***.



Our site investigation will be undertaken in accordance with UK good practice (as outlined in BS5930, BS10175, CLR11 etc), and allows for the following works:

Desk study: Data from the CoDa reports will be reviewed along with Lithos' own 'desk study' including review of Environmental search data, historical maps (obtained from Landmark or Groundsure) and published geological plans.

Fieldwork: In order to remove ambiguities relating to the site, further intrusive mining investigation and gas monitoring is required.

We have allowed for the drilling of around 10 rotary probeholes to assess the risk from any unrecorded shallow mineworkings beneath the site. All boreholes will be supervised and logged by an experienced geoenvironmental engineer. The boreholes will also allow the installation of gas wells.

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 site's size and location, we should be able to avoid the need to drill holes within 50m of surrounding residential properties and therefore, in accordance with CA requirements, we should be able to use air as the flushing medium.

Potential sources of hazardous gas affecting the site are as follows:

- Former sandstone quarry immediately east of the New Lane site
- Shallow mineworkings within the vicinity of the site
- Deep made ground associated with the former opencast in the centre of the two sites

Given the above and the findings of CoDa's investigation, we have allowed for the installation of wells in 6 holes and monitoring for hazardous gas (and any shallow groundwater). If the CoDa boreholes can be located, these will also be monitored; if not, it may be necessary to install wells in more of the boreholes.

The generation potential of this gas source is considered likely to Moderate. However, some monitoring has already been undertaken by CoDa. Therefore, in accordance with CIRIA Report C665, we have initially allowed for 6 visits over a 3 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 track mounted drilling rig.

Reporting & timescales: We have allowed for a detailed review of all the CoDa reports supplied, along with a letter report detailing the findings of the supplementary mining investigation, which should be available within 1 week of completion of the fieldwork.

The gas risk assessment will be issued on completion of the monitoring programme.

Fieldwork could be commenced within 3 weeks of receipt of your written instruction to proceed.

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) on issue of the Mining Letter and Review of 3rd Party reports
- 2nd and final invoice (Item D) 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 be completed within 2 working days and therefore it is not considered reasonably practicable to provide formal welfare facilities, and our proposal makes no allowance for so doing.

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).

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.

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

You will note that in the last two columns of our costed proposal we have included an estimate of the proportion of the total cost of the works that could be eligible for Land Remediation Tax Relief (LRR).

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
Senior Engineer

for and on behalf of
LITHOS CONSULTING LIMITED

Pilley, Barnsley

Matt

I am pleased to accept your quotation of £**** + VAT for the above site. Please can you submit the Coal Authority Application and provide me with a site start date ASAP?

I have attached a copy of the topographical survey as requested and will forward the utility drawings once I am in receipt next week.

If you need anything more from me, please let me know?

Regards

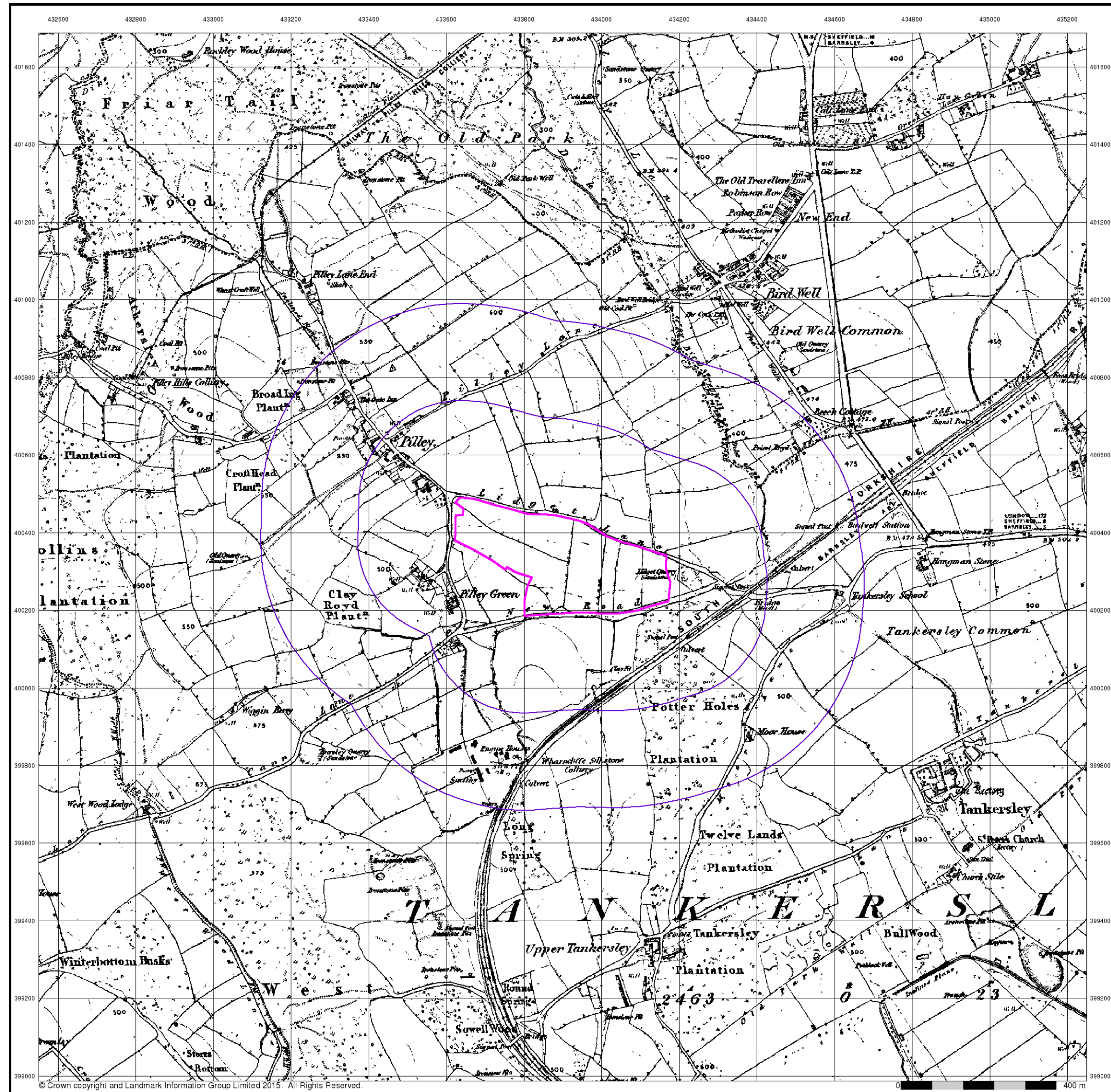
Andrew Calvert

Senior Engineering Manager

Redrow Homes Limited
Redrow House
Brunel Road, Wakefield 41, Wakefield
West Yorkshire, WF2 0XG

Telephone: 01924 822566
Mobile: 07587 134951
Extension: 3923
Website: www.redrow.co.uk

Appendix D
Historical OS Plans



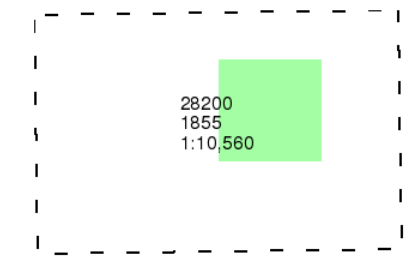
Yorkshire

Published 1855

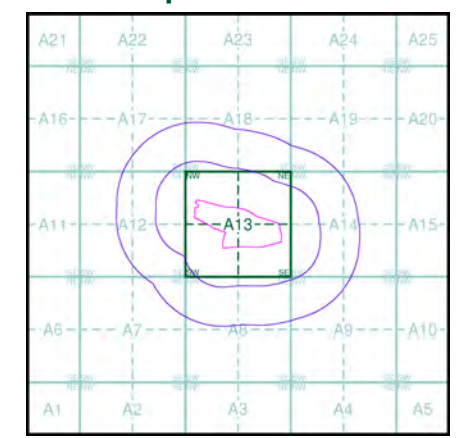
Source map scale - 1:10,560

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: 72903369_1_1
Customer Ref: 2222
National Grid Reference: 433890, 400330
Slice: A
Site Area (Ha): 10.09
Search Buffer (m): 500

Site Details

84 Lidgett Lane, Tankersley, BARNSELY, South Yorkshire, S75 3AG



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



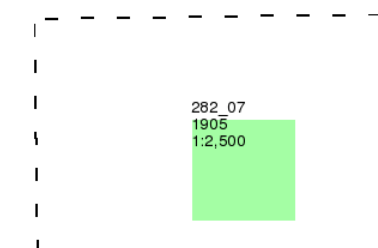
Yorkshire

Published 1905

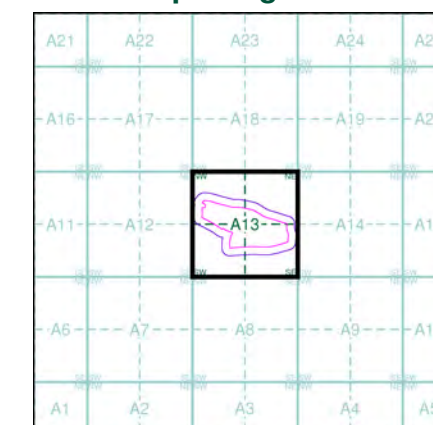
Source map scale - 1:2,500

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 and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below 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.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

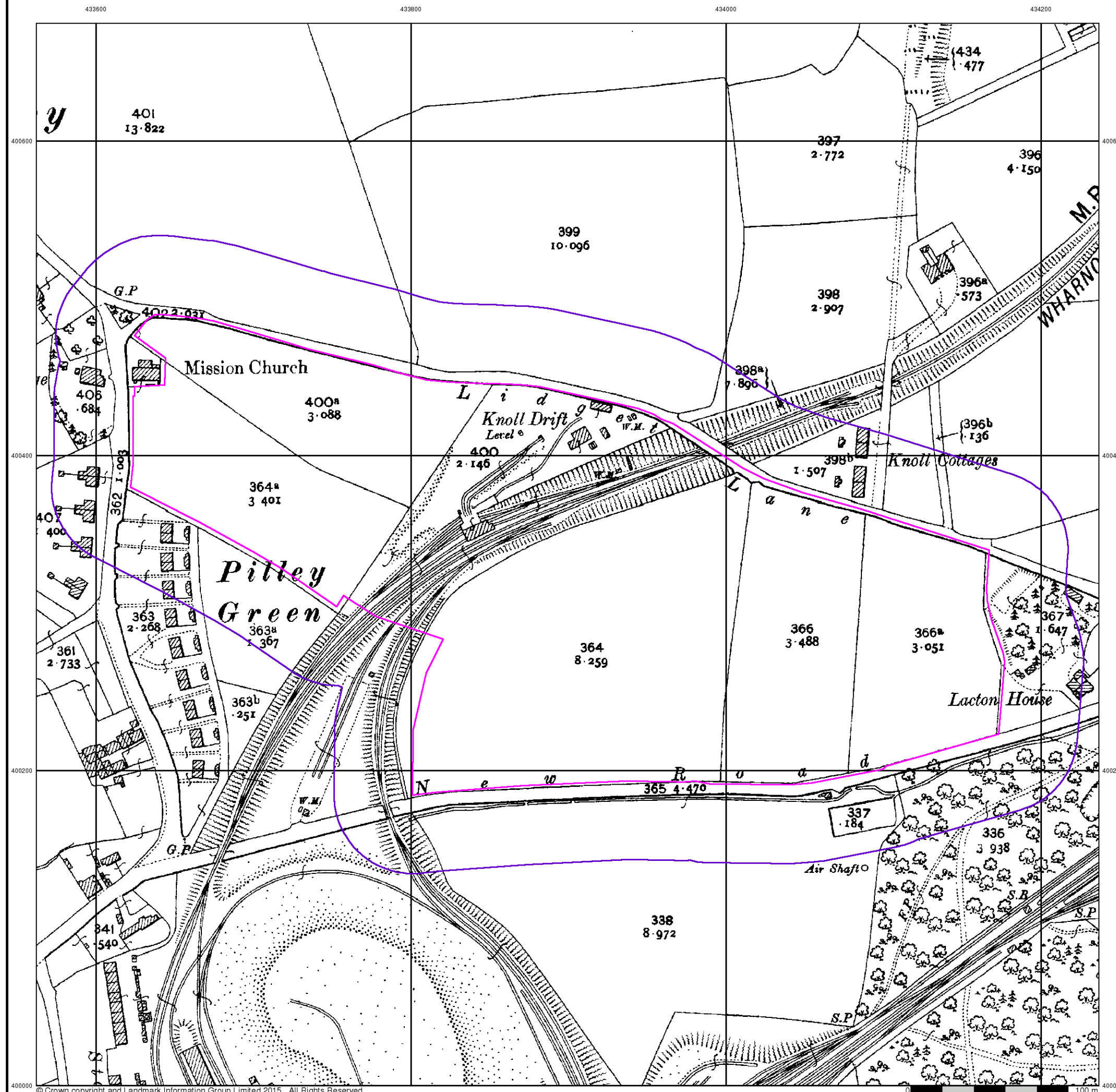
Order Number: 72903369_1_1
Customer Ref: 2222
National Grid Reference: 433890, 400330
Slice: A
Site Area (Ha): 10.09
Search Buffer (m): 50

Site Details

84 Lidgett Lane, Tankersley, BARNSELY, South Yorkshire, S75 3AG



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





Large-Scale National Grid Data

Published 1993

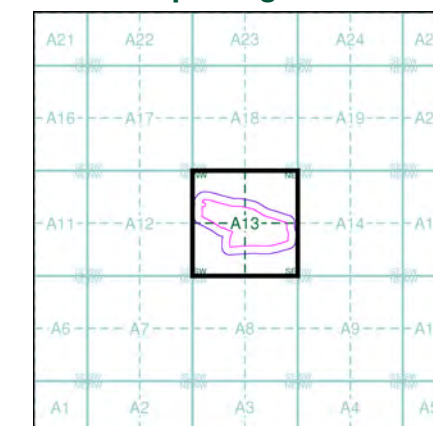
Source map scale - 1:2,500

'Large Scale National Grid Data' superseded SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') in 1992, and continued to be produced until 1999. These maps were the fore-runners of digital mapping and so provide detailed information on houses and roads, but tend to show less topographic features such as vegetation. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)

SE3300	SE3400
1993	1993
12,500	12,500
SK3399	SK3499
1993	1993
12,500	12,500

Historical Map - Segment A13



Order Details

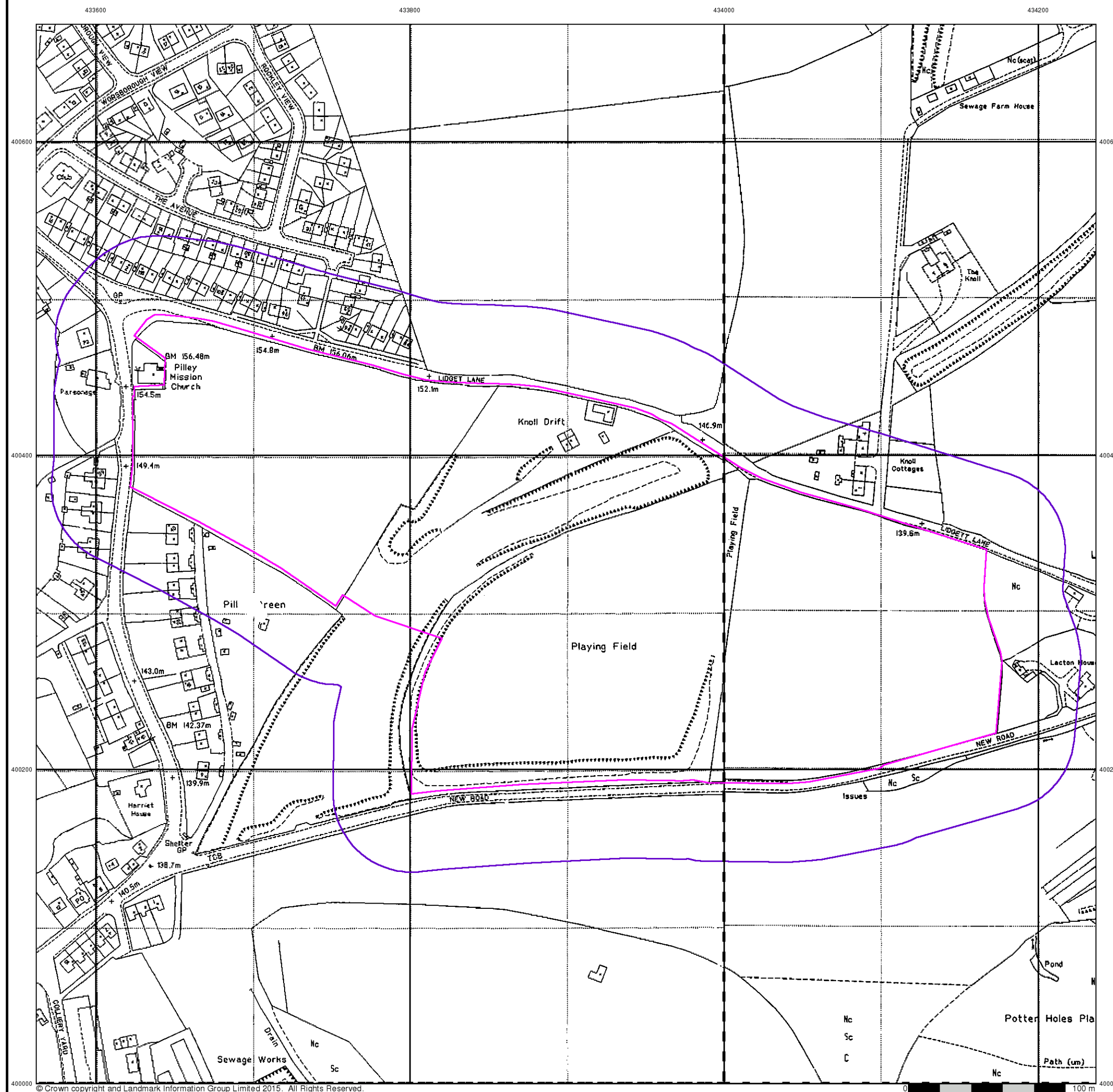
Order Number: 72903369_1_1
Customer Ref: 2222
National Grid Reference: 433890, 400330
Slice: A
Site Area (Ha): 10.09
Search Buffer (m): 50

Site Details

84 Lidgett Lane, Tankersley, BARNSELY, South Yorkshire, S75 3AG



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

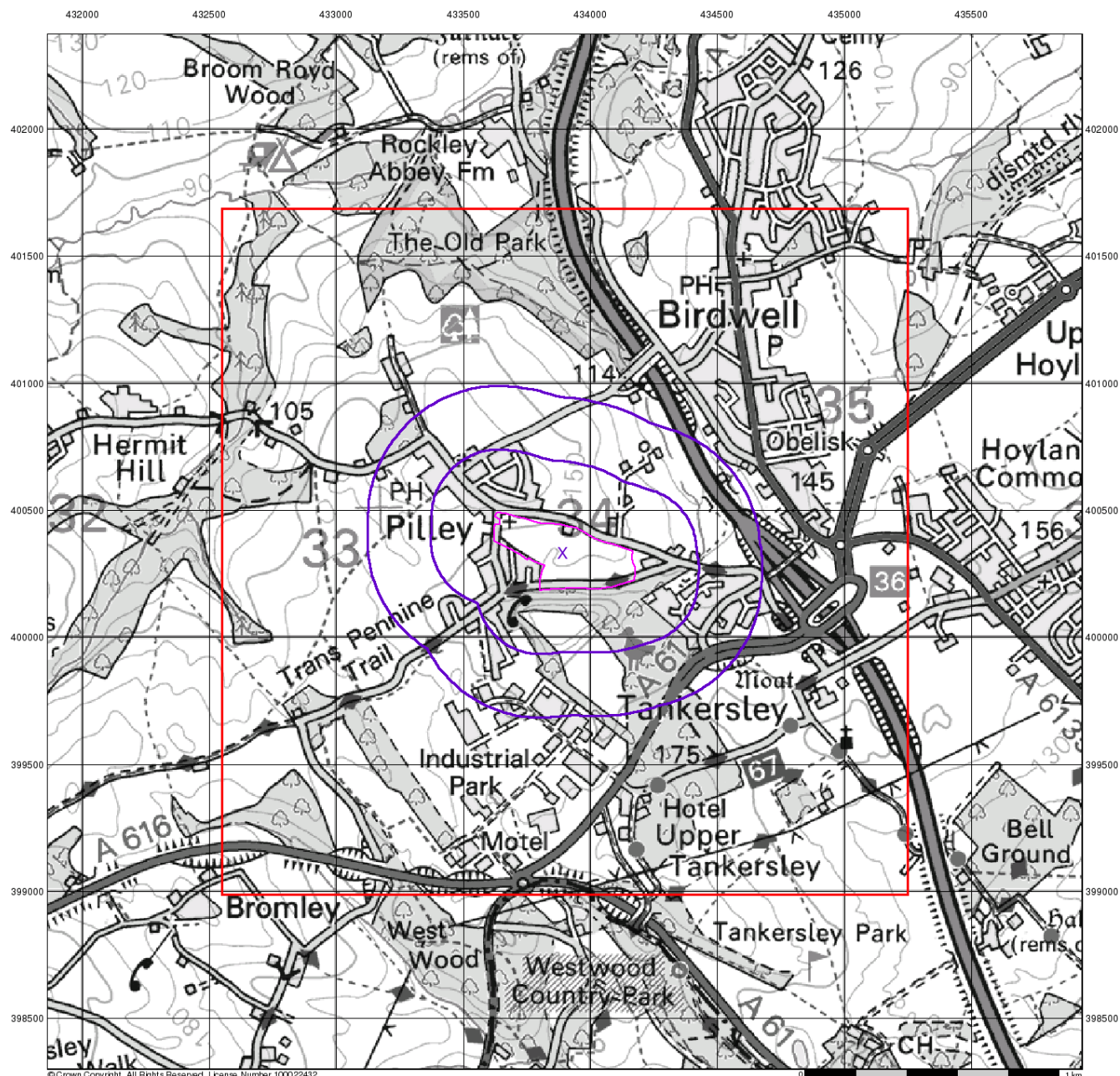


Appendix E
Search Responses

Data Type	Page Number	On Site	0 to 250m	251 to 500m (*up to 1000m)
Agency & Hydrological				
Contaminated Land Register Entries and Notices				
Discharge Consents	pg 1		1	8
Enforcement and Prohibition Notices				
Integrated Pollution Controls				
Integrated Pollution Prevention And Control				
Local Authority Integrated Pollution Prevention And Control				
Local Authority Pollution Prevention and Controls	pg 3			1
Local Authority Pollution Prevention and Control Enforcements				
Nearest Surface Water Feature	pg 3		Yes	
Pollution Incidents to Controlled Waters				
Prosecutions Relating to Authorised Processes				
Prosecutions Relating to Controlled Waters				
Registered Radioactive Substances				
River Quality	pg 3			1
River Quality Biology Sampling Points				
River Quality Chemistry Sampling Points				
Substantiated Pollution Incident Register	pg 3			1
Water Abstractions				
Water Industry Act Referrals				
Groundwater Vulnerability	pg 3	Yes	n/a	n/a
Bedrock Aquifer Designations	pg 3	Yes	n/a	n/a
Superficial Aquifer Designations			n/a	n/a
Source Protection Zones				
Extreme Flooding from Rivers or Sea without Defences				n/a
Flooding from Rivers or Sea without Defences				n/a
Areas Benefiting from Flood Defences				n/a
Flood Water Storage Areas				n/a
Flood Defences				n/a
Detailed River Network Lines	pg 4		Yes	Yes
Detailed River Network Offline Drainage	pg 7		Yes	

Data Type	Page Number	On Site	0 to 250m	251 to 500m (*up to 1000m)
Waste				
BGS Recorded Landfill Sites				
Historical Landfill Sites	pg 8			2
Integrated Pollution Control Registered Waste Sites				
Licensed Waste Management Facilities (Landfill Boundaries)				
Licensed Waste Management Facilities (Locations)				
Local Authority Recorded Landfill Sites	pg 8			2
Registered Landfill Sites				
Registered Waste Transfer Sites				
Registered Waste Treatment or Disposal Sites				
Hazardous Substances				
Control of Major Accident Hazards Sites (COMAH)				
Explosive Sites				
Notification of Installations Handling Hazardous Substances (NIHHS)				
Planning Hazardous Substance Consents	pg 9			1
Planning Hazardous Substance Enforcements				
Geological				
BGS 1:625,000 Solid Geology	pg 10	Yes	n/a	n/a
BGS Estimated Soil Chemistry	pg 10	Yes	Yes	Yes
BGS Recorded Mineral Sites	pg 16	3	5	20
BGS Urban Soil Chemistry				
BGS Urban Soil Chemistry Averages				
Brine Compensation Area			n/a	n/a
Coal Mining Affected Areas	pg 21	Yes	n/a	n/a
Mining Instability	pg 21	Yes	n/a	n/a
Man-Made Mining Cavities				
Natural Cavities				
Non Coal Mining Areas of Great Britain	pg 21	Yes	Yes	n/a
Potential for Collapsible Ground Stability Hazards	pg 22	Yes	Yes	n/a
Potential for Compressible Ground Stability Hazards	pg 22	Yes	Yes	n/a
Potential for Ground Dissolution Stability Hazards				n/a
Potential for Landslide Ground Stability Hazards	pg 22	Yes	Yes	n/a
Potential for Running Sand Ground Stability Hazards	pg 23	Yes	Yes	n/a
Potential for Shrinking or Swelling Clay Ground Stability Hazards	pg 23	Yes	Yes	n/a
Radon Potential - Radon Affected Areas	pg 24	Yes	n/a	n/a
Radon Potential - Radon Protection Measures			n/a	n/a

Data Type	Page Number	On Site	0 to 250m	251 to 500m (*up to 1000m)
Industrial Land Use				
Contemporary Trade Directory Entries (50m)				n/a
Fuel Station Entries				
Sensitive Land Use				
Areas of Adopted Green Belt	pg 25	1		
Areas of Unadopted Green Belt				
Areas of Outstanding Natural Beauty				
Environmentally Sensitive Areas				
Forest Parks				
Local Nature Reserves	pg 25		1	
Marine Nature Reserves				
National Nature Reserves				
National Parks				
Nitrate Sensitive Areas				
Nitrate Vulnerable Zones	pg 25	1		
Ramsar Sites				
Sites of Special Scientific Interest				
Special Areas of Conservation				
Special Protection Areas				



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Source Protection Zones

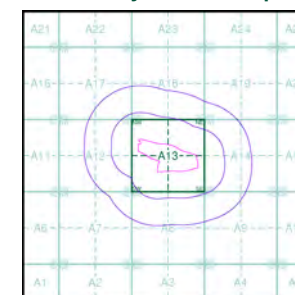
General

- 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

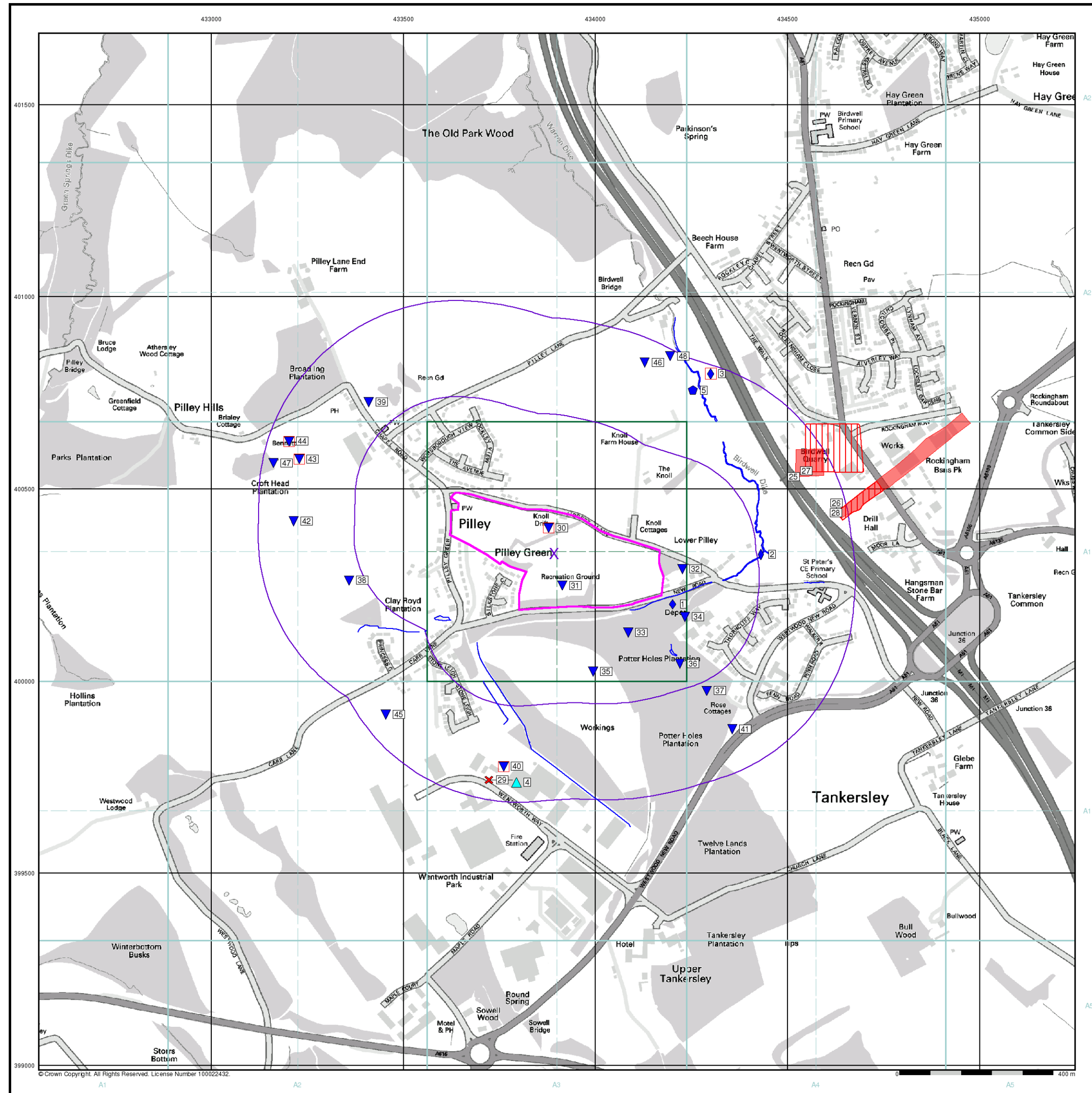
Order Number: 72903369_1_1
 Customer Ref: 2222
 National Grid Reference: 433890, 400330
 Slice: A
 Site Area (Ha): 10.09
 Search Buffer (m): 500

Site Details

84 Lidgett Lane, Tankersley, BARNSEY, South Yorkshire, S75 3AG



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

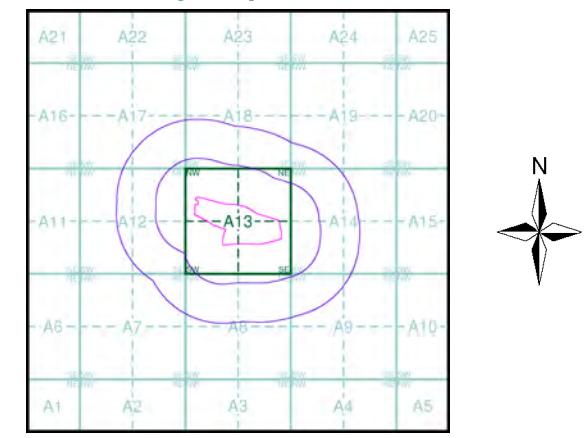


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- General**
- Specified Site
 - Specified Buffer(s)
 - Bearing Reference Point
 - Map ID
 - Several of Type at Location
- Agency and Hydrological**
- Contaminated Land Register Entry or Notice (Location)
 - Contaminated Land Register Entry or Notice
 - 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
 - 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 Landfill Site (Location)
 - 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



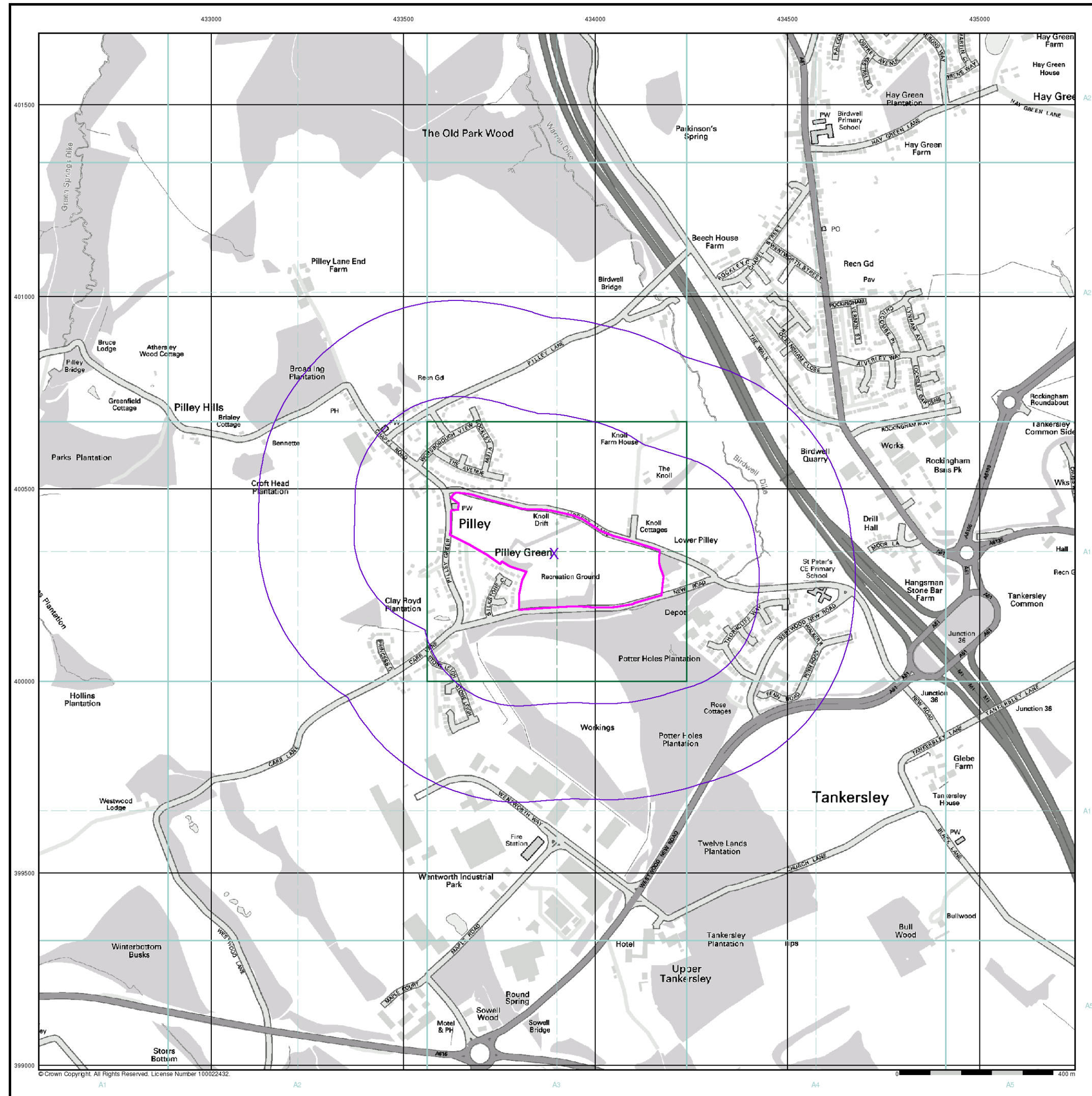
Order Details

Order Number: 72903369_1_1
Customer Ref: 2222
National Grid Reference: 433890, 400330
Slice: A
Site Area (Ha): 10.09
Search Buffer (m): 500

Site Details
84 Lidgett Lane, Tankersley, BARNSELY, South Yorkshire, S75 3AG

Landmark
Information Group

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



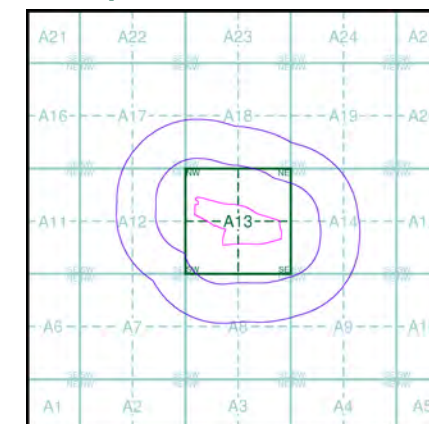
General

- 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: 72903369_1_1
Customer Ref: 2222
National Grid Reference: 433890, 400330
Slice: A
Site Area (Ha): 10.09
Search Buffer (m): 500

Site Details

84 Lidgett Lane, Tankersley, BARNSELY, South Yorkshire, S75 3AG



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



General

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

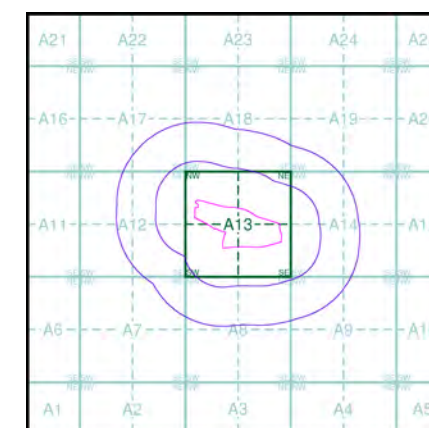
Detailed River Network Data

- | | | | |
|---|--------------------------|---|-------------------------------------|
|  | 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 105 100 95 MLW Mean Low Water
Master Contour MHW Mean High Water
Spot Height * 167.3

EA/NRW Detailed River Network Map - Slice A



Order Details

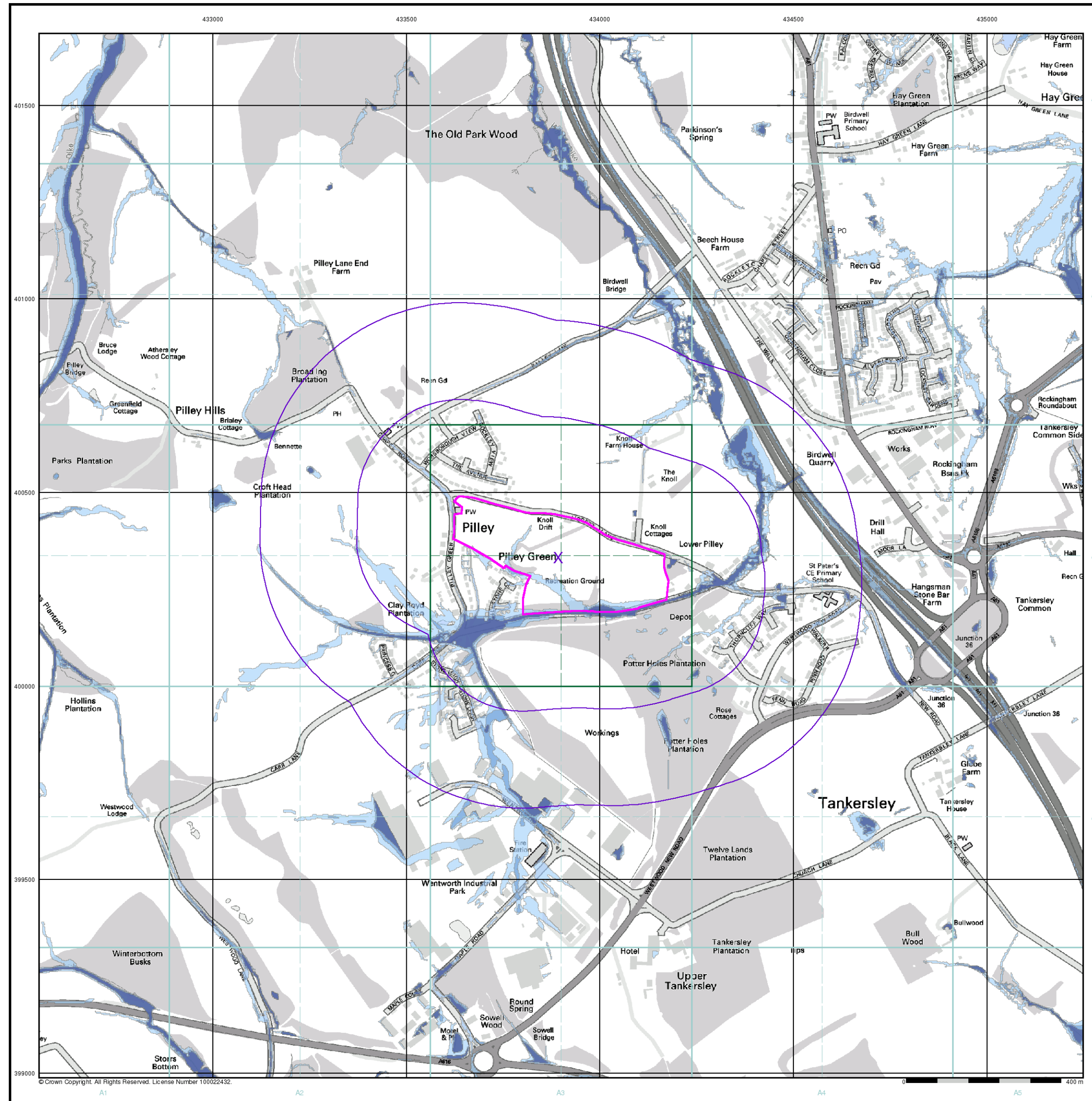
Order Number: 72903369_1_1
Customer Ref: 2222
National Grid Reference: 433890, 400330
Slice: A
Site Area (Ha): 10.09
Search Buffer (m): 500

Site Details

84 Lidgett Lane, Tankersley, BARNSELY, South Yorkshire, S75
3AG



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



General

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

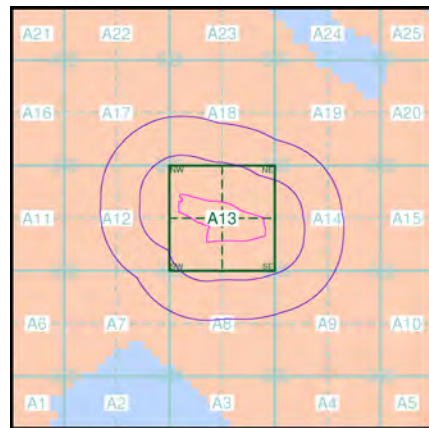
Risk of Flooding from Surface Water

- High - 30 Year Return
- Medium - 100 Year Return
- Low - 1000 Year Return

Suitability

- See the suitability map below
- National to county
 - County to town
 - Town to street
 - Street to parcels of land
 - Property

EANRW Suitability Map - Slice A



Order Details

Order Number: 72903369_1_1
Customer Ref: 2222
National Grid Reference: 433890, 400330
Slice: A
Site Area (Ha): 10.09
Search Buffer (m): 500

Site Details

84 Lidgett Lane, Tankersley, BARNSELY, South Yorkshire, S75 3AG



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

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: **51001006821001**
Your reference: **72903369_2|**
Date of your enquiry: **24 September 2015**
Date we received your enquiry: **24 September 2015**
Date of issue: **24 September 2015**

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

Non-Residential Coal Authority Mining Report

84 LIDGETT LANE, TANKERSLEY BARNESLEY, SOUTH 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 7 seams of coal at 50m to 290m depth, and last worked in 1954.

Any ground movement from these coal workings should have stopped by now.

In addition the property is in an area where the Coal Authority believe there is coal at or close to the surface. This coal may have been worked at some time in the past. The potential presence of coal workings at or close to the surface should be considered prior to any site works or future development activity. Your attention is drawn to the Comments on Coal Authority Information section of the report.

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 2 mine entries, the approximate positions of which are shown on the attached plan.

Our records disclose the following information:

433400-018. was found and subsequently filled and graded over by Barnsley MDC in 1987.

433400-002. a brick arch and stopping is visible at the surface.

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 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

A damage notice or claim for alleged subsidence damage was made in October 2003 for ST PAULS CHURCH PILLEY GREEN, TANKERSLEY, BARNSELY, SOUTH YORKSHIRE, S75 3AE. However, the claim was rejected.

There is no current Stop Notice delaying the start of remedial works or repairs to the property. A damage notice or claim for alleged subsidence damage was made in July 1998 for 1 KNOLL DRIFT LIDGETT LANE, TANKERSLEY, BARNESLEY, SOUTH YORKSHIRE, S75 3BT. The claim was discharged by repairs to the value of £9,590.68.

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.

If further subsidence damage claims information is required in addition to that provided in this report, the Authority need to manually search their records. For further advice on how to order this additional information visit www.groundstability.com or telephone 0345 7626 848.

Mine gas

The property has been subject to remedial works, by or on behalf of the Authority, associated with a mine gas investigation.

Hazards related to coal mining

The property has 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 a notice of entitlement to withdraw support was published in 1951.

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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Location map



Approximate position of property



Enquiry boundary

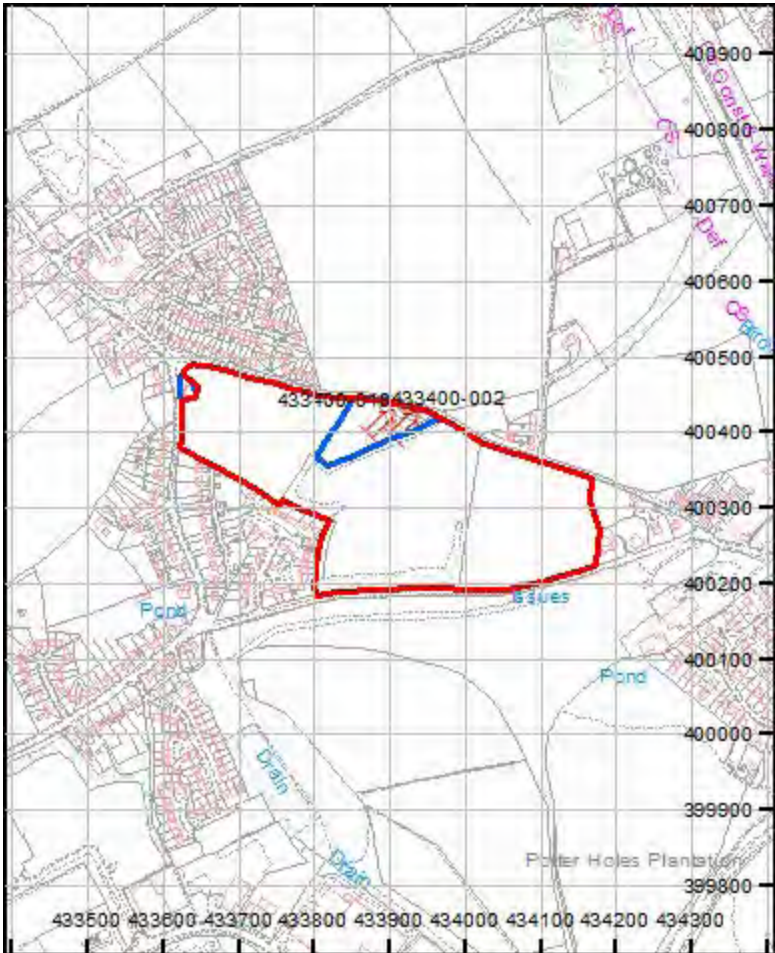
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Key

Approximate position of enquiry boundary shown

Disused Adit or Mineshaft

Coal Claims

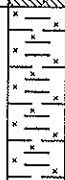
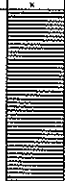


Appendix F

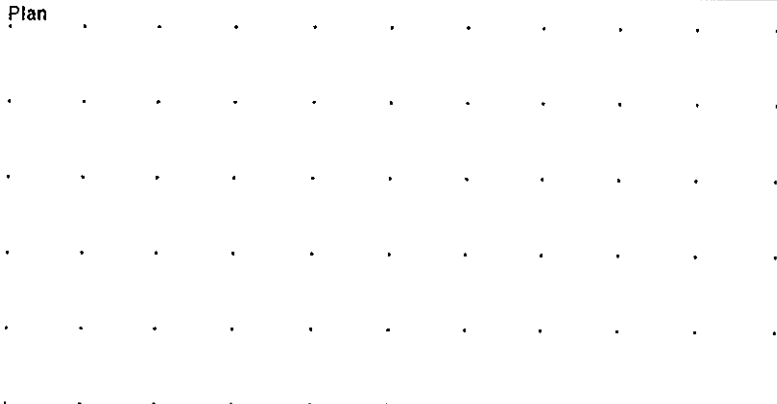
CoDa Trial Pits & Trial Trenches (west)

						Site LIDGET LANE (WEST), PILLEY, SOUTH YORKSHIRE		Trial Pit Number TP2			
Excavation Method MECHANICAL EXCAVATOR		Dimensions 0.60m x 2.10m		Ground Level (mOD)		Client		Job Number NE3346			
		Location AS PLAN		Dates 30/09/2014		Engineer CoDa STRUCTURES		Sheet 1/1			
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water		
0.50	D				(0.38)	Dark brown clayey TOPSOIL.					
					0.38	Brown medium SAND and angular to subangular GRAVEL and COBBLES of sandstone (completeley weathered rock/possible made ground).					
0.90	D				(0.65)						
1.45	D				1.03	Weak brown and grey mottled moderately to slightly weathered silty MUDSTONE and SILTSTONE bands.					
					(1.97)						
2.20	D										
2.80	D				3.00	Complete at 3.00m					
30/09/2014: DRY											
Plan						Remarks					
						Pit sides remained generally vertical. No groundwater entries encountered. Pit orientated West North West to East South East.					
						Scale (approx)		Logged By		Figure No.	
						1:25		DS/SJ		NE3346.TP2	

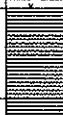
						Site LIDGET LANE (WEST), PILLEY, SOUTH YORKSHIRE		Trial Pit Number TP3					
Excavation Method MECHANICAL EXCAVATOR		Dimensions 0.60m x 2.90m		Ground Level (mOD)		Client		Job Number NE3346					
		Location AS PLAN		Dates 30/09/2014		Engineer CoDa STRUCTURES		Sheet 1/1					
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water				
0.30	D				(0.40)	TOPSOIL.							
					0.40	Firm medium strength brown and yellow brown silty CLAY with localised made ground to 0.70m (old stone land drain).							
0.80	D				(1.00)								
			HV@1.00m, c=56kPa		1.40	Weak brown and light grey highly to moderately weathered silty MUDSTONE, locally completely weathered to a clay.							
1.60	D				(1.20)								
					2.60	Weak grey moderately weathered silty MUDSTONE.							
2.70	D				(0.40)								
					3.00	Moderately weak thinly bedded dark grey slightly weathered shaley MUDSTONE.							
3.10	D				(0.50)								
					3.50	Complete at 3.50m							
Plan						Remarks							
						Pit sides remained generally vertical. No groundwater entries encountered. Pit orientated West North West to East South West. HV = Hand Shear Vane test.							
						Scale (approx)				Logged By		Figure No.	
						1:25				DS/SJ		NE3346.TP3	

						Site LIDGET LANE (WEST), PILLEY, SOUTH YORKSHIRE		Trial Pit Number TP4	
Excavation Method MECHANICAL EXCAVATOR		Dimensions 0.60m x 2.90m		Ground Level (mOD)		Client		Job Number NE3346	
		Location AS PLAN		Dates 30/09/2014		Engineer CoDa STRUCTURES		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.50	D		HV@0.60m, c=80kPa		(0.20)	TOPSOIL			
					0.20	Stiff high strength brown slightly grey in parts silty CLAY.			
1.00	D				(0.60)	Very weak brown completely to highly weathered silty MUDSTONE/CLAY bands.			
					0.80				
1.60	D				(1.20)	Strong grey moderately to slightly weathered silty MUDSTONE with some ironstone nodules.			
					2.00				
2.60	D				(1.50)				
3.30	D								
		30/09/2014: DRY				Complete at 3.50m			
Plan						Remarks			
						Pit sides remained generally vertical. No groundwater entries encountered. Pit orientated North to South HV = Hand Shear Vane test			
						Scale (approx)	Logged By	Figure No.	
						1:25	DS/SJ	NE3346.TP4	

						Site LIDGET LANE (WEST), PILLEY, SOUTH YORKSHIRE		Trial Pit Number TP5	
Excavation Method MECHANICAL EXCAVATOR		Dimensions 0.60m x 2.90m		Ground Level (mOD)		Client		Job Number NE3346	
		Location AS PLAN						Dates 30/09/2014	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.10	D				(0.20)	TOPSOIL			
0.40	D				0.20 (0.30)	Brown sandy CLAY with clay pipe land drains at 0.30m and cast iron pipe at 0.50m in corner of pit.			
1.00	D				0.50 (1.15)	Very weak grey and brown completely to highly weathered silty MUDSTONE weathered to a clay in parts.			
1.70	D				1.65 (0.65)	Weak dark grey moderately weathered MUDSTONE and IRONSTONE bands.			
2.60	D				2.50 (1.00)	Moderately weak thinly bedded dark grey slightly weathered silty MUDSTONE.			
			30/09/2014: DRY		3.50	Complete at 3.50m			
Plan 						Remarks Pit sides remained generally vertical. No groundwater entries encountered Pit orientated East to West			
						Scale (approx) 1:25		Logged By DS/SJ	
								Figure No. NE3346.TP5	

						Site LIDGET LANE (WEST), PILLEY, SOUTH YORKSHIRE		Trial Pit Number TP6		
Excavation Method MECHANICAL EXCAVATOR		Dimensions 0.60m x 2.90m		Ground Level (mOD)		Client		Job Number NE3346		
		Location AS PLAN		Dates 30/09/2014		Engineer CoDa STRUCTURES		Sheet 1/1		
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water	
0.30	D				(0.40)	TOPSOIL.				
					0.40 (0.20)	Friable brown CLAY with cast Iron pipe at 0.60m at one end of pit.				
0.80	D				0.60	Very weak grey completely to highly weathered silty MUDSTONE/CLAY.				
					(1.00)					
					1.60	Weak grey moderately weathered silty MUDSTONE.				
					(0.70)					
					2.30	Moderately weak dark grey thinly bedded moderately to slightly weathered MUDSTONE.				
2.80	D				(1.20)					
					3.50	Complete at 3.50m				
			30/09/2014: DRY							
Plan						Remarks				
						Pit sides remained generally vertical. No groundwater entries encountered. Pit orientated North East to South West.				
Scale (approx)						Logged By		Figure No.		
1:25						DS/SJ		NE3346.TP6		

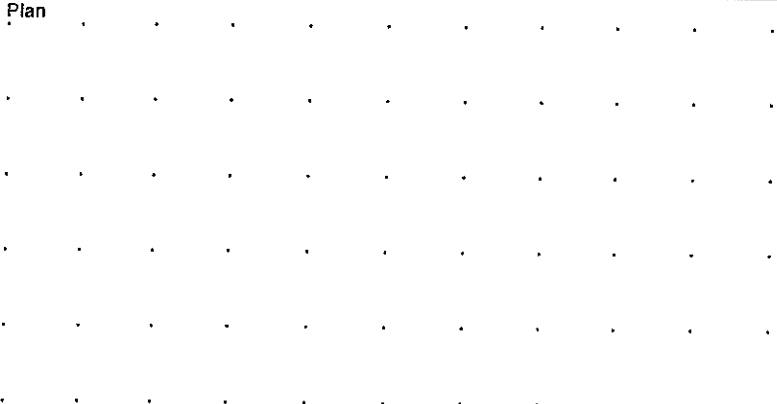
						Site LIDGET LANE (WEST), PILLEY, SOUTH YORKSHIRE		Trial Pit Number TP6A	
Excavation Method MECHANICAL EXCAVATOR		Dimensions 0.60m x 3.00m		Ground Level (mOD)		Client		Job Number NE3346	
		Location AS PLAN		Dates 30/09/2014		Engineer CoDa STRUCTURES		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
0.40	D		HV@0.90m, c=58kPa		(0.35)	TOPSOIL			
					0.35	Firm medium strength light brown silty CLAY.			
1.50	D				(1.05)				
					1.40	Stiff grey silty CLAY, completely weathered mudstone.			
2.20	D				(0.70)				
					2.10	Weak grey and brown moderately to slightly weathered silty MUDSTONE.			
3.10	D				(1.10)				
					3.20	Moderately weak thinly bedded dark grey MUDSTONE.			
3.35	D				(0.30)	 at 3.30m : ironstone band			
					3.50	Complete at 3.50m			
Plan						Remarks			
						Pit sides remained generally vertical. No groundwater entries encountered. Pit orientated North east to South west HV = Hand Shear Vane test.			
						Scale (approx)	Logged By	Figure No.	
						1:25	DS/SJ	NE3346.TP6A	

						Site LIDGET LANE (WEST), PILLEY, SOUTH YORKSHIRE		Trial Pit Number TP7	
Excavation Method MECHANICAL EXCAVATOR		Dimensions 0.60m x 3.20m		Ground Level (mOD)		Client		Job Number NE3346	
		Location AS PLAN		Dates 30/09/2014		Engineer CoDa STRUCTURES		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
0.30	D				(0.25)	TOPSOIL			
					0.25	Friable brown silty CLAY/SUBSOIL.			
(0.35)									
0.60	Very weak orange brown and brown mottled completely to highly weathered silty MUDSTONE/CLAY.								
(0.30)									
0.90	Very weak dark grey and brown highly to moderately weathered silty MUDSTONE.								
(0.60)									
1.50	Weak thinly bedded dark grey moderately to slightly weathered MUDSTONE.								
(0.20)									
1.70	Very weak dark grey moderately weathered silty COAL.								
(0.90)									
2.60	Weak light grey moderately weathered MUDSTONE.								
(0.20)									
2.80	Weak dark grey slightly weathered bright COAL.								
(0.30)									
3.10	Weak grey silty MUDSTONE.								
(0.50)									
3.60	Moderately weak to strong dark grey brittle bright COAL stained brown in parts.								
(0.30)									
3.90	Complete at 3.90m								
Plan						Remarks			
						Pit sides remained stable. No groundwater entries encountered but ground damp at 2.80m to 3.10m Pit orientated North West to South East.			

						Site LIDGET LANE (WEST), PILLEY, SOUTH YORKSHIRE		Trial Pit Number TP8			
Excavation Method MECHANICAL EXCAVATOR		Dimensions 0.60m x 2.90m		Ground Level (mOD)		Client		Job Number NE3346			
		Location AS PLAN		Dates 30/09/2014		Engineer CoDa STRUCTURES		Sheet 1/1			
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water		
0.10	D				(0.25)	TOPSOIL					
					0.25 (0.15)	Friable brown silty CLAY/SUBSOIL.					
0.60	D				0.40	Firm medium strength orange brown and light grey mottled silty CLAY.					
					(1.20)						
1.50	D		HV@1.20m, c=62kPa		1.60	Very weak brown and grey moderately weathered silty MUDSTONE.					
1.80	D				(0.60)						
2.25	D				2.20 (0.10)	Weak dark grey slightly weathered silty MUDSTONE.					
2.50	D				2.30	Weak light grey moderately to slightly weathered silty MUDSTONE.					
					(0.80)						
3.15	D		30/09/2014: DRY		3.10 (0.10)	Strong thinly bedded light grey slightly weathered SILTSTONE.					
					3.20	Complete at 3.20m					
Plan						Remarks Pit sides remained generally vertical. No groundwater entries encountered. Pit orientated North West to South East. HV = Hand Shear Vane test.					
										Scale (approx)	
						1:25		DS/SJ		NE3346.TP8	

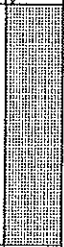
						Site LIDGET LANE (WEST), PILLEY, SOUTH YORKSHIRE		Trial Pit Number TP9		
Excavation Method MECHANICAL EXCAVATOR		Dimensions 0.60m x 3.10m		Ground Level (mOD)		Client		Job Number NE3346		
		Location AS PLAN		Dates 30/09/2014		Engineer CoDa STRUCTURES		Sheet 1/1		
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water	
0.70	D		HV@0.80m, c=56kPa			TOPSOIL				
					(0.40)					
					0.40	Friable brown silty CLAY/SUBSOIL.				
1.10	D		HV@1.20m, c=64kPa		(0.25)					
					0.65	Firm medium strength brown and yellow brown silty CLAY.				
					(0.35)					
1.50	D				1.00	Firm medium strength grey and brown silty CLAY.				
					(0.40)					
					1.40	Very weak brown and grey moderately weathered silty MUDSTONE.				
1.60	D				(0.15)					
					1.55	Very weak dark grey moderately weathered carbonaceous MUDSTONE with coal traces.				
					(0.15)					
2.00	D				1.70	Weak dark grey slightly weathered silty COAL.				
					(0.60)					
					2.30	Weak grey moderately weathered silty MUDSTONE.				
2.90	D				(0.15)					
					2.45	Weak dark grey bright COAL.				
					(0.35)					
3.60	D				2.80	Weak grey slightly weathered silty MUDSTONE.				
					(0.60)					
					3.40	Moderately weak dark grey fresh bright COAL.				
3.90	D		30/09/2014:DRY		(0.40)					
					3.80	Strong light grey slightly weathered to fresh silty MUDSTONE.				
					(0.20)					
Plan					Remarks					
					Pit sides remained generally vertical. No groundwater entries encountered. Pit orientated North East to South West. HV = Hand Shear Vane test.					
					Scale (approx)		Logged By		Figure No.	
					1:25		DS/SJ		NE3346.TP9	

						Site LIDGET LANE (WEST), PILLEY, SOUTH YORKSHIRE		Trial Pit Number TP10	
Excavation Method MECHANICAL EXCAVATOR		Dimensions 0.60m x 2.90m		Ground Level (mOD)		Client		Job Number NE3346	
		Location AS PLAN		Dates 30/09/2014		Engineer CoDa STRUCTURES		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
0.10	D				(0.30)	TOPSOIL			
					0.30	Friable red brown silty CLAY/SUBSOIL.			
0.50	D				(0.40)				
					0.70	Firm medium strength brown and grey mottled silty CLAY.			
1.00	D		HV@1.00m, c=56kPa		(0.50)				
					1.20	Very weak grey and dark grey highly weathered			
1.30	D				(0.15)	MUDSTONE, carbonaceous bands and locally weathered			
					1.35	to a clay.			
1.50	D				(0.25)	Very weak thinly bedded grey and brown moderately			
					1.60	weathered silty MUDSTONE.			
1.90	D					Weak light grey and grey moderately to slightly weathered			
						silty MUDSTONE.			
					(1.90)	 at 2.60m : ironstone band			
3.30	D		Damp(1) at 3.30m.						
			30/09/2014:						
					3.50	Complete at 3.50m			
Plan						Remarks			
						Pit sides remained generally vertical. Ground damp at 3.30m Pit orientated North West to South East. HV = Hand Shear Vane test.			
Scale (approx)						Logged By		Figure No.	
1:25						DS/SJ		NE3346.TP10	

						Site LIDGET LANE (WEST), PILLEY, SOUTH YORKSHIRE		Trial Pit Number TP11	
Excavation Method MECHANICAL EXCAVATOR		Dimensions 0.60m x 2.80m		Ground Level (mOD)		Client		Job Number NE3346	
		Location AS PLAN						Dates 30/09/2014	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
0.10	D				(0.30)	TOPSOIL			
0.40	D				0.30 (0.25)	Friable brown silty CLAY/SUBSOIL.			
					0.55	Firm light grey and brown silty CLAY with occasional lithorelicts of sandstone.			
1.00	D				(0.85)				
					1.40	Weak thinly bedded dark grey moderately weathered shaley MUDSTONE.			
1.50	D				(0.25)				
					1.65	Weak light grey moderately to slightly weathered silty MUDSTONE.			
									
2.20	D				(1.55)				
									
3.00	D		Seepage(1) at 3.00m.						
			30/09/2014:		3.20	Complete at 3.20m			
Plan 						Remarks Pit sides remained generally vertical. Seepage groundwater entry at 3.00m. Pit orientated North West to South East.			

						Site LIDGET LANE WEST, PILLEY, SOUTH YORKSHIRE		Trial Pit Number TT1	
Excavation Method MECHANICAL EXCAVATOR		Dimensions L = 12.00m		Ground Level (MOD)		Client		Job Number NE3346C	
		Location AS PLAN		Dates 03/03/2015		Engineer CoDa STRUCTURES		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (MOD)	Depth (m) (Thickness)	Description	Legend	Water	
					(0.26)	Dark brown clayey TOPSOIL.			
					0.26 (0.34)	Light grey and brown silty CLAY.			
					0.60	Grey and brown silty CLAY with lithorelicts of siltstone.			
					(1.00)				
					1.60 (0.30)	Brown and grey highly weathered MUDSTONE.			
					1.90	Grey moderately weathered MUDSTONE.			
					(1.70)				
					3.60	Complete at 3.60m			
Plan						Remarks Major collapse of pit sides in part of pit. No groundwater encountered.			
						Scale (approx) 1:25	Logged By DS/SJ	Figure No. NE3346C.TT1	

						Site LIDGET LANE WEST, PILLEY, SOUTH YORKSHIRE		Trial Pit Number TT2	
Excavation Method MECHANICAL EXCAVATOR		Dimensions L = 7.50m		Ground Level (mOD)		Client		Job Number NE3346C	
		Location AS PLAN						Dates 03/03/2015	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
					(0.25)	Dark brown clayey TOPSOIL.			
					0.25	Brown and grey silty CLAY with lithorelicts of sandstone.			
					(0.75)				
					1.00	Brown thinly bedded highly weathered fine to medium grained SANDSTONE with some clay partings.			
			Slow Inflow(1) at 1.20m.		(1.30)				
					2.30	Brown thinly bedded moderately weathered fine to medium grained SANDSTONE with some clay partings.			
					(0.70)				
			03/03/2015:		3.00	Complete at 3.00m			
Plan 						Remarks Pit sides remained generally vertical. Localised slow groundwater entry at 1.20m			

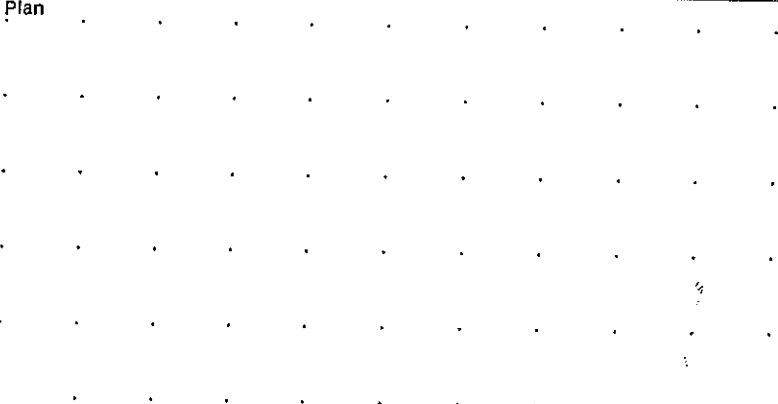
						Site LIDGET LANE WEST, PILLEY, SOUTH YORKSHIRE		Trial Pit Number TT3	
Excavation Method MECHANICAL EXCAVATOR		Dimensions L = 6.50m		Ground Level (mOD)		Client		Job Number NE3346C	
		Location AS PLAN		Dates 03/03/2015		Engineer CoDa STRUCTURES		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
					0.10	Dark brown clayey TOPSOIL.			
					0.10	Brown and grey silty CLAY.			
					(1.00)				
					1.10	Brown thinly bedded moderately weathered fine to medium grained SANDSTONE.			
					(0.80)				
					1.90	Dark grey moderately weathered MUDSTONE.			
			Seepage(1) at 1.70m.		(1.10)				
					3.00	Complete at 3.00m			
03/03/2015:									
Plan					Remarks Pit sides remained generally vertical. Localised groundwater seepage at 1.70m				
					Scale (approx)		Logged By		Figure No.
					1:25		DS/SJ		NE3346C.TT3

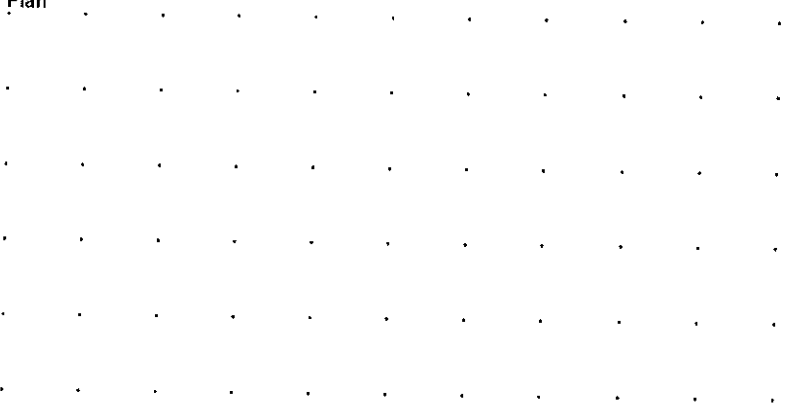
						Site LIDGET LANE WEST, PILLEY, SOUTH YORKSHIRE		Trial Pit Number TT4	
Excavation Method MECHANICAL EXCAVATOR		Dimensions L = 6.00m		Ground Level (mOD)		Client		Job Number NE3346C	
		Location AS PLAN		Dates 03/03/2015		Engineer CoDa STRUCTURES		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
					0.30	Dark brown clayey TOPSOIL.			
					0.30	Yellow brown CLAY.			
					0.70				
					1.00	Dark grey moderately weathered MUDSTONE.			
					2.00				
					3.00	Complete at 3.00m			
		03/03/2015: DRY							
Plan 						Remarks Pit sides remained vertical and stable. No groundwater encountered.			

						Site LIDGET LANE WEST, PILLEY, SOUTH YORKSHIRE		Trial Pit Number TT5	
Excavation Method MECHANICAL EXCAVATOR		Dimensions L = 11.00m		Ground Level (mOD)		Client		Job Number NE3346C	
		Location AS PLAN						Dates 03/03/2015	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
					(0.30)	Dark brown clayey TOPSOIL.			
					0.30	Yellow brown CLAY.			
					(0.60)	Grey and dark grey silty CLAY becoming weathered mudstone.			
					0.90	Grey and dark grey silty CLAY becoming weathered mudstone.			
					(0.70)	Grey and brown moderately to slightly weathered MUDSTONE.			
					1.60	 at 2.00m : ironstone band			
					(1.40)	Complete at 3.00m			
					3.00	Complete at 3.00m			
Plan						Remarks Pit sides remained vertical and stable. No groundwater encountered.			
. .						Scale (approx) 1:25			
						Logged By DS/SJ		Figure No. NE3346C.TT5	

Appendix G

CoDa Trial Pits & Trial Trenches (east)

						Site LIDGET LANE, PILLEY, SOUTH YORKSHIRE		Trial Pit Number TP1	
Excavation Method MECHANICAL EXCAVATOR		Dimensions 0.60m x 3.10m		Ground Level (mOD)		Client		Job Number NE3345	
		Location AS PLAN		Dates 18/09/2014				Engineer CoDa STRUCTURES	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.10	D				(0.30)	Dark brown clayey TOPSOIL.			
0.40	D				0.30 (0.80)	Weak thinly bedded brown completely to highly weathered fine grained SANDSTONE and brown SAND.			
0.90	D				1.10	Strong thinly bedded brown moderately to slightly and fresh fine grained SANDSTONE.			
1.50	D				(0.60)				
			18/09/2014: DRY		1.70	Complete at 1.70m			
Plan						Remarks			
						Pit sides remained generally vertical. No groundwater entries encountered. Pit orientated East to West			
						Scale (approx) 1:25		Logged By DS/SJ	

						Site LIDGET LANE, PILLEY, SOUTH YORKSHIRE		Trial Pit Number TP2	
Excavation Method MECHANICAL EXCAVATOR		Dimensions 0.60m x 2.60m		Ground Level (mOD)		Client		Job Number NE3345	
		Location AS PLAN		Dates 18/09/2014		Engineer CoDa STRUCTURES		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.35 0.50	D				(0.30)	MADE GROUND: topsoil.			
	D				(0.30) (0.10) 0.40	MADE GROUND: brown silty clay.			
					(0.30)	MADE GROUND: topsoil and occasional metal and wood fragments.			
1.00	D				0.70	MADE GROUND: brown and dark brown silty gravelly clay. Gravel is predominately sandstone.			
1.20	D				(0.50)				
			18/09/2014: DRY		1.20 1.25	Strong thinly bedded brown fresh thinly bedded fine grained SANDSTONE. Complete at 1.25m			
Plan						Remarks			
						Pit sides remained generally vertical. No groundwater entries encountered. Pit orientated East to West			
						Scale (approx) 1:25		Logged By DS/SJ	

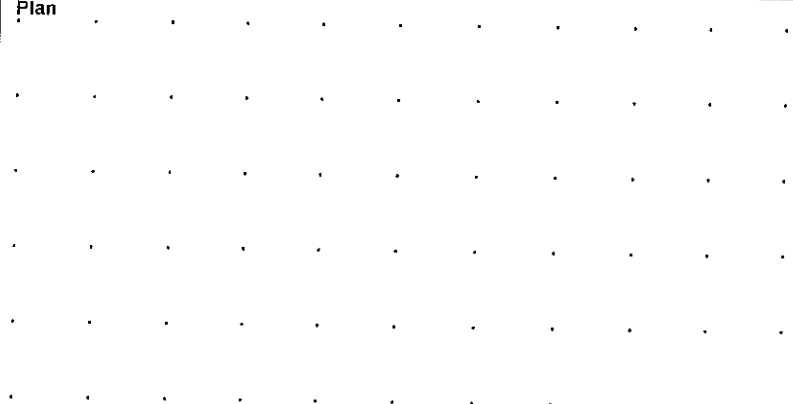
						Site LIDGET LANE, PILLEY, SOUTH YORKSHIRE		Trial Pit Number TP3	
Excavation Method MECHANICAL EXCAVATOR		Dimensions 0.60m x 2.20m		Ground Level (mOD)		Client		Job Number NE3345	
		Location AS PLAN		Dates 18/09/2014				Engineer CoDa STRUCTURES	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.20	D				(0.30)	TOPSOIL.			
0.60	D				0.30 (0.70)	Weak thinly bedded brown highly weathered SANDSTONE, weathered to sand in parts.			
1.10	D		HV@1.10m, c=60kPa		1.00 (0.30)	Firm medium strength light brown and light grey silty CLAY (completely weathered mudstone).			
1.50	D				1.30 (0.35)	Strong thinly bedded brown fresh fine grained SANDSTONE.			
			18/09/2014: DRY		1.65	Complete at 1.65m			
Plan						Remarks Pit sides remained generally vertical. No groundwater entries encountered. HV = Hand Shear Vane test Pit orientated North to South			
						Scale (approx) 1:25	Logged By DS/SJ	Figure No. NE3345.TP3	

						Site LIDGET LANE, PILLEY, SOUTH YORKSHIRE		Trial Pit Number TP7			
Excavation Method MECHANICAL EXCAVATOR		Dimensions 2.10m x 3.30m		Ground Level (mOD)		Client		Job Number NE3345			
		Location AS PLAN		Dates 16/09/2014		Engineer CoDa STRUCTURES		Sheet 1/1			
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water			
0.30	D				(0.25)	TOPSOIL (A).					
					0.25	Firm yellow brown silty CLAY (B).					
0.80	D				(0.65)						
1.70	D				1.10	Very weak grey highly to moderately weathered silty MUDSTONE (C).					
					(0.40)						
2.70	D				1.50	Weak dark grey moderately to slightly weathered silty shaly MUDSTONE (D).					
					(1.80)	at 2.40m : ironstone bands/nodules					
					3.30	Complete at 3.30m					
						16/09/2014: DRY					
Plan						Remarks Pit sides remained generally vertical. No groundwater entries encountered. Pit orientated North to South See Figure 1.					
										Scale (approx)	
						1:25		DS/SJ		NE3345.TP7	

						Site LIDGET LANE, PILLEY, SOUTH YORKSHIRE		Trial Pit Number TP8	
Excavation Method MECHANICAL EXCAVATOR		Dimensions 0.60m x 2.80m		Ground Level (mOD)		Client		Job Number NE3345	
		Location AS PLAN		Dates 18/09/2014		Engineer CoDa STRUCTURES		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.30	D		HV@0.70m, c=70kPa		(0.20)	TOPSOIL			
					0.20	Firm medium strength brown and grey mottled silty CLAY.			
0.90	D		HV@1.20m, c=75kPa		(1.40)				
1.50	D				1.60	Weak thinly bedded grey and brown moderately weathered MUDSTONE.			
2.00	D				(1.10)				
2.60	D				2.70	Weak dark grey bright COAL with many silty bands.			
2.80	D				(0.35)				
3.50	D				3.05	Very weak orange brown silty CLAY quickly becoming grey MUDSTONE.			
					(0.55)				
					3.60	Complete at 3.60m			
Plan						Remarks Pit sides remained generally vertical. No groundwater entries encountered. HV = Hand Shear Vane test Pit orientated East to West			
						Scale (approx)		Logged By	
						1:25		DS/SJ	
								Figure No.	
								NE3345.TP8	

						Site LIDGET LANE, PILLEY, SOUTH YORKSHIRE		Trial Pit Number TP9			
Excavation Method MECHANICAL EXCAVATOR		Dimensions 0.60m x 2.90m		Ground Level (mOD)		Client		Job Number NE3345			
		Location AS PLAN		Dates 18/09/2014		Engineer CoDa STRUCTURES		Sheet 1/1			
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water		
0.40	D				(0.25)	TOPSOIL					
					0.25	Friable brown and grey silty CLAY with lithorelicts of mudstone.					
0.80	D				(0.50)						
					0.75	Weak dark grey moderately weathered silty COAL.					
1.50	D				(0.65)						
					1.40	Firm brown silty CLAY.					
					(0.30)						
					1.70	Weak dark grey silty COAL.					
2.20	D				(0.35)						
					2.05	Firm grey silty CLAY (completely weathered mudstone).					
2.60	D				(0.35)						
					2.40	Very weak brown and orange brown highly to moderately weathered silty MUDSTONE.					
3.10	D				(0.45)						
					2.85	Weak grey moderately to slightly weathered silty MUDSTONE.					
					(0.65)						
					3.50	Complete at 3.50m					
Plan						Remarks Pit sides remained generally vertical. No groundwater entries encountered. Pit orientated North to South					
										Scale (approx)	
						1:25		DS/SJ		NE3345.TP9	

						Site LIDGET LANE, PILLEY, SOUTH YORKSHIRE		Trial Pit Number TP10	
Excavation Method MECHANICAL EXCAVATOR		Dimensions 0.60m x 1.80m		Ground Level (mOD)		Client		Job Number NE3345	
		Location AS PLAN		Dates 18/09/2014		Engineer CoDa STRUCTURES		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.20	D				(0.30)	TOPSOIL.			
					0.30	Stiff high strength brown silty CLAY/completely weathered MUDSTONE.			
0.60	D		HV@0.70m, c=85kPa		(0.60)				
					0.90	Strong brown moderately to slightly weathered thinly bedded SANDSTONE.			
1.10	D				(0.42)				
			18/09/2014: DRY		1.32 (0.08)	Strong brown fresh moderately bedded SANDSTONE with open vertical and subvertical fractures (up to 0.12m and greater in depth).			
					1.40	Complete at 1.40m			
Plan						Remarks Pit sides remained generally vertical. No groundwater entries encountered. HV = Hand Shear Vane test Pit orientated East to West			
						Scale (approx) 1:25	Logged By DS/SJ	Figure No. NE3345.TP10	

						Site LIDGET LANE, PILLEY, SOUTH YORKSHIRE		Trial Pit Number TP11	
Excavation Method MECHANICAL EXCAVATOR		Dimensions 0.60m x 1.80m		Ground Level (mOD)		Client		Job Number NE3345	
		Location AS PLAN		Dates 18/09/2014		Engineer CoDa STRUCTURES		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
0.40	D				(0.30)	TOPSOIL.			
					0.30 (0.30)	Weak thinly bedded orange brown and brown moderately weathered SANDSTONE.			
0.70	D				0.60 (0.50)	Strong brown slightly weathered to fresh fine grained SANDSTONE.			
1.00	D				1.10	Complete at 1.10m			
			18/09/2014: DRY						
Plan					Remarks				
					Pit sides remained generally vertical. No groundwater entries encountered. Pit orientated East to West				
					Scale (approx) 1:25		Logged By DS/SJ		Figure No. NE3345.TP11

						Site LIDGET LANE, PILLEY, SOUTH YORKSHIRE		Trial Pit Number TP12	
Excavation Method MECHANICAL EXCAVATOR		Dimensions 0.60m x 2.40m		Ground Level (mOD)		Client		Job Number NE3345	
		Location AS PLAN		Dates 18/09/2014		Engineer CoDa STRUCTURES		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.10	D				(0.30)	TOPSOIL			
					0.30	Firm medium strength brown and grey silty CLAY.			
0.60	D					 at 0.60m : cast iron pipe (150mm diameter)			
			HV@0.90m, c=50kPa		(1.30)				
1.20	D				1.60	Weak grey and brown highly to moderately weathered silty MUDSTONE.			
2.00	D				(1.20)				
2.50	D				2.80	Complete at 2.80m			
			18/09/2014: DRY						
Plan						Remarks			
						Pit sides remained generally vertical. No groundwater entries encountered. HV = Hand Shear Vane test Pit orientated North to South			
						Scale (approx)	Logged By	Figure No.	
						1:25	DS/SJ	NE3345.TP12	

						Site LIDGET LANE, PILLEY, SOUTH YORKSHIRE		Trial Pit Number TP13			
Excavation Method MECHANICAL EXCAVATOR		Dimensions 0.60m x 3.10m		Ground Level (mOD)		Client		Job Number NE3345			
		Location AS PLAN		Dates 18/09/2014		Engineer CoDa STRUCTURES		Sheet 1/2			
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water		
1.00	D				(0.80)	MADE GROUND: topsoil.					
					0.80	MADE GROUND: dark brown silty clay.					
1.80	D				(0.50)						
					1.30	MADE GROUND: dark brown gravelly silty clay. Gravel is predominately fine mudstone.					
2.50	D				(0.60)						
					1.90	MADE GROUND: brown and dark brown gravelly silty clay. Gravel is mudstone and occasional coal fragments.					
3.10	D				(2.80)						
3.50	D										
Plan						Remarks Pit sides remained generally vertical. No groundwater entries encountered. Pit orientated North to South					
										Scale (approx)	
						1:25		DS/SJ		NE3345.TP13	

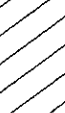
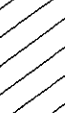
						Site LIDGET LANE, PILLEY, SOUTH YORKSHIRE		Trial Pit Number TP13	
Excavation Method MECHANICAL EXCAVATOR		Dimensions 0.60m x 3.10m		Ground Level (mOD)		Client		Job Number NE3345	
		Location AS PLAN		Dates 18/09/2014		Engineer CoDa STRUCTURES		Sheet 2/2	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
4.10	D		18/09/2014: DRY		4.70	MADE GROUND: brown and dark brown gravelly silty clay. Gravel is mudstone and occasional coal fragments. Complete at 4.70m			
Plan						Remarks			
. .						Scale (approx) 1:25			
						Logged By DS/SJ		Figure No. NE3345.TP13	

						Site LIDGET LANE, PILLEY, SOUTH YORKSHIRE		Trial Pit Number TT1			
Excavation Method MECHANICAL EXCAVATOR		Dimensions 2.80m x 6.00m		Ground Level (mOD)		Client		Job Number NE3345			
		Location AS PLAN		Dates 18/09/2014				Engineer CoDa STRUCTURES		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water		
					0.10	TOPSOIL (A)					
					0.10	Firm yellow brown silty CLAY (B).					
					(0.40)						
					0.50	Very weak grey highly to moderately weathered silty MUDSTONE (C).					
					(0.70)						
					1.20	Weak dark grey moderately to slightly weathered silty shaly MUDSTONE (D).					
					(1.60)						
						at 2.50m: ironstone nodules					
					2.80	Complete at 2.80m					
Plan						Remarks Pit sides remained generally vertical. No groundwater entries encountered. Pit orientated North to South. See Figure 1.					
										Scale (approx)	
						1:25		DS/SJ		NE3345.TT1	

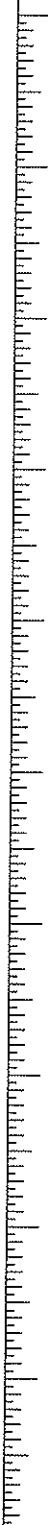
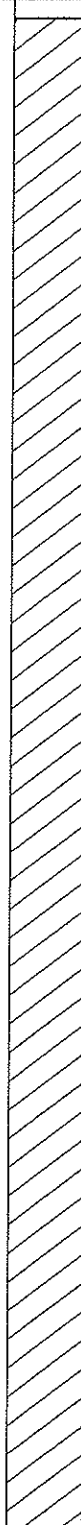
Appendix H
CoDa Rotary Probeholes (west)

								Site LIDGET LANE (WEST), PILLEY, SOUTH YORKSHIRE		Borehole Number R1	
Machine : BERETTA T44			Casing Diameter 140mm to 1.40m			Ground Level (mOD)		Client		Job Number NE3346	
Flush : WATER/AIR			Location AS PLAN			Dates 06/10/2014		Engineer CoDa STRUCTURES		Sheet 2/3	
Core Dia: mm											
Method : ROTARY OPEN HOLE											
Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
								Strong light grey MUDSTONE/SILTSTONE.		V1	
							11.50	Strong dark grey to grey MUDSTONE.			
							(2.50)				
							14.00	Strong light grey MUDSTONE/SILTSTONE.			
							(1.00)				
							15.00	Very strong light grey MUDSTONE/SILTSTONE.			
Remarks											
										Scale (approx) 1:50	
										Logged By DS/SJ	
										Figure No. NE3346.R1	

								Site LIDGET LANE (WEST), PILLEY, SOUTH YORKSHIRE		Borehole Number R1	
Machine : BERETTA T44 Flush : WATER/AIR Core Dia: mm Method : ROTARY OPEN HOLE			Casing Diameter 140mm to 1.40m		Ground Level (mOD)		Client		Job Number NE3346		
			Location AS PLAN		Dates 06/10/2014		Engineer CoDa STRUCTURES		Sheet 3/3		
Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
							(15.00)	Very strong light grey MUDSTONE/SILTSTONE.			
							30.00				
Remarks									Scale (approx)	Logged By	
									1:50	DS/SJ	
									Figure No. NE3346.R1		

								Site LIDGET LANE (WEST), PILLEY, SOUTH YORKSHIRE		Borehole Number R2	
Machine : BERETTA T44 Flush : AIR Core Dia: mm Method : ROTARY OPEN HOLE			Casing Diameter 140mm to 1.40m			Ground Level (mOD)		Client		Job Number NE3346	
			Location AS PLAN			Dates 06/10/2014		Engineer CoDa STRUCTURES		Sheet 1/3	
Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
								TOPSOIL over brown clay.			
							(1.80)				
							1.80	Weak brown MUDSTONE/SANDSTONE.			
							(0.70)				
							2.50 (0.30)	Moderately strong brown and grey SANDSTONE.			
							2.80	Weak orange SANDSTONE.			
							(0.90)				
							3.70	COAL.			
							(0.70)				
							4.40	Moderately strong grey MUDSTONE.			
							(0.80)				
							5.20	COAL.			
							(0.60)				
							5.80	Moderately strong becoming stronger with depth light grey MUDSTONE.			
Remarks Hand excavated inspection pit from GL to 1.20m to check for services. Descriptions based upon foreman drillers records of flush returns. On completion backfilled with arisings and installed a 50mm hdpe gas monitoring standpipe with a gas valve and a gravel surround to 4.50m, a Bentonite seal from 1.00m to 0.20m and a concreted in lockable steel protective cover from 0.20m to GL.									Scale (approx)	Logged By	
									1:50	DS/SJ	
									Figure No. NE3346.R2		

								Site LIDGET LANE (WEST), PILLEY, SOUTH YORKSHIRE		Borehole Number R2	
Machine : BERETTA T44 Flush : AIR Core Dia: mm Method : ROTARY OPEN HOLE			Casing Diameter 140mm to 1.40m		Ground Level (mOD)		Client			Job Number NE3346	
			Location AS PLAN		Dates 06/10/2014		Engineer CoDa STRUCTURES			Sheet 2/3	
Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
							(12.60)	Moderately strong becoming stronger with depth light grey MUDSTONE.			
					Slow Inflow(1) at 18.40m.		18.40	Strong light grey brown MUDSTONE.		Σ1	
							(1.40)				
							19.80	Strong light grey MUDSTONE/SILTSTONE.			
Remarks									Scale (approx) 1:50		Logged By DS/SJ
									Figure No. NE3346.R2		

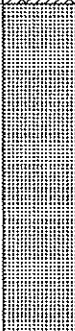
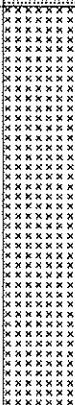
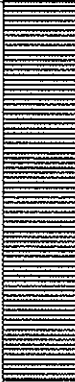
								Site LIDGET LANE (WEST), PILLEY, SOUTH YORKSHIRE		Borehole Number R2	
Machine : BERETTA T44 Flush : AIR Core Dia: mm Method : ROTARY OPEN HOLE			Casing Diameter 140mm to 1.40m		Ground Level (mOD)		Client			Job Number NE3346	
			Location AS PLAN		Dates 06/10/2014		Engineer CoDa STRUCTURES			Sheet 3/3	
Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
							 (10.20)	Strong light grey MUDSTONE/SILTSTONE.			
						06/10/2014:					
							30.00				
Remarks									Scale (approx)	Logged By	
									1:50	DS/SJ	
									Figure No. NE3346.R2		

							Site LIDGET LANE (WEST), PILLEY, SOUTH YORKSHIRE		Borehole Number R3		
Machine : BERETTA T44 Flush : WATER/AIR Core Dia: mm Method : ROTARY OPEN HOLE			Casing Diameter 140mm to 3.40m		Ground Level (mOD)		Client			Job Number NE3346	
			Location AS PLAN		Dates 06/10/2014		Engineer CoDa STRUCTURES			Sheet 1/3	
Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
							(0.40)	TOPSOIL			
							0.40 (0.20) 0.60	Weak yellow brown CLAY.			
							(0.80)	Weak brown SANDSTONE.			
							1.40	Moderately strong dark brown MUDSTONE.			
							(2.00)				
							3.40	Weak dark orange and brown MUDSTONE.			
							(0.80) 4.20	Weak to moderately strong grey to grey brown MUDSTONE.			
							(5.20)				
							9.40	Weak grey to light grey MUDSTONE.			
Remarks Hand excavated inspection pit from GL to 1.20m to check for services. Descriptions based upon foreman drillers records of flush returns. On completion backfilled with arisings and installed a 50mm hdpe gas monitoring standpipe with a gas valve and a gravel surround to 4.50m, a Bentonite seal from 1.00m to 0.20m and a concreted in lockable steel protective cover from 0.20m to GL. Increase in water flow from 12.00m.									Scale (approx) 1:50	Logged By DS/SJ	
									Figure No. NE3346.R3		

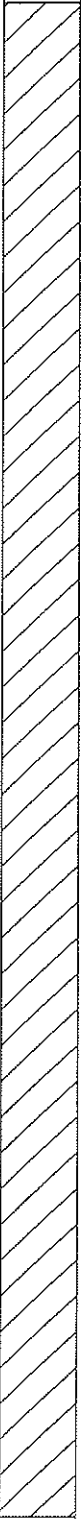
								Site LIDGET LANE (WEST), PILLEY, SOUTH YORKSHIRE		Borehole Number R3	
Machine : BERETTA T44 Flush : WATER/AIR Core Dia: mm Method : ROTARY OPEN HOLE			Casing Diameter 140mm to 3.40m		Ground Level (mOD)		Client			Job Number NE3346	
			Location AS PLAN		Dates 06/10/2014		Engineer CoDa STRUCTURES			Sheet 2/3	
Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
							(1.50)	Weak grey to light grey MUDSTONE.			
						10.90 (0.30)	Very weak grey MUDSTONE.				
						11.20	Strong grey to dark grey MUDSTONE.				
						(1.30)					
							12.50	Strong to very strong light grey MUDSTONE.			
							(6.00)				
							18.50	Very strong light grey SILTSTONE.			
Remarks									Scale (approx) 1:50	Logged By DS/SJ	Figure No. NE3346.R3

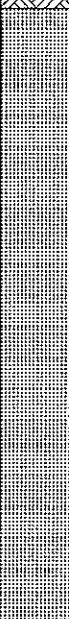
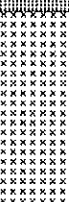
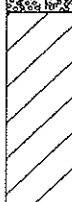
								Site LIDGET LANE (WEST), PILLEY, SOUTH YORKSHIRE		Borehole Number R3	
Machine : BERETTA T44			Casing Diameter 140mm to 3.40m			Ground Level (mOD)		Client		Job Number NE3346	
Flush : WATER/AIR											
Core Dia: mm											
Method : ROTARY OPEN HOLE			Location AS PLAN			Dates 06/10/2014		Engineer CoDa STRUCTURES		Sheet 3/3	
Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
							(8.50)	Very strong light grey SILTSTONE.			
							27.00	Complete at 27.00m			
Remarks									Scale (approx) 1:50	Logged By DS/SJ	
									Figure No. NE3346.R3		

Appendix I
CoDa Rotary Probeholes (east)

								Site LIDGET LANE, PILLEY, SOUTH YORKSHIRE		Borehole Number R1	
Machine : BERETTA T44 Flush : AIR Core Dia: mm Method : ROTARY OPEN HOLE			Casing Diameter			Ground Level (mOD)		Client		Job Number NE3345	
			Location AS PLAN			Dates 18/09/2014		Engineer CoDa STRUCTURES		Sheet 1/3	
Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
							(0.30) 0.30	TOPSOIL			
								Orange brown SANDSTONE.			
							(2.20)				
							2.50	Strong light grey brown SILTSTONE.			
							(2.70)				
							5.20	Strong light grey SILTSTONE.			
							(0.80)				
							6.00	COAL.			
							(0.80)				
							6.80 (0.30)	Light grey MUDSTONE.			
							7.10 (0.40)	COAL.			
							7.50	Strong light grey MUDSTONE.			
Remarks Hand excavated inspection pit from GL to 1.20m to check for services. Descriptions based upon foreman drillers records of flush returns. On completion backfilled with arisings and installed a 50mm dia hdpe gas monitoring standpipe with a gas valve and a gravel surround to 4.50m, a Bentonite seal seal from 1.50m to 0.20m and a concreted in lockable steel protective cover from 0.20m to GL.									Scale (approx)	Logged By	
									1:50	DS/SJ	
									Figure No. NE3345.R1		

								Site LIDGET LANE, PILLEY, SOUTH YORKSHIRE		Borehole Number R1	
Machine : BERETTA T44 Flush : AIR Core Dia: mm Method : ROTARY OPEN HOLE			Casing Diameter			Ground Level (mOD)		Client		Job Number NE3345	
			Location AS PLAN			Dates 18/09/2014		Engineer CoDa STRUCTURES		Sheet 2/3	
Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
							(4.90)	Strong light grey MUDSTONE.			
							12.40 (0.50)	Strong dark grey brown MUDSTONE.			
							12.90 (0.60)	Strong light grey SILTSTONE.			
							13.50	Very hard light grey SILTSTONE.			
							(5.50)				
							19.00 (0.80)	Hard dark grey SILTSTONE.			
							19.80	COAL.			
Remarks									Scale (approx)	Logged By	
									1:50	DS/SJ	
									Figure No. NE3345.R1		

							Site LIDGET LANE, PILLEY, SOUTH YORKSHIRE		Borehole Number R1		
Machine : BERETTA T44 Flush : AIR Core Dia: mm Method : ROTARY OPEN HOLE			Casing Diameter		Ground Level (mOD)		Client		Job Number NE3345		
			Location AS PLAN		Dates 18/09/2014		Engineer CoDa STRUCTURES		Sheet 3/3		
Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
							(0.20) 20.00 (0.40) 20.40 (0.20) 20.60	Strong light grey MUDSTONE. COAL. Strong light grey MUDSTONE.	  		
							(9.40)				
							30.00				
Remarks									Scale (approx) 1:50	Logged By DS/SJ	
									Figure No. NE3345.R1		

								Site LIDGET LANE, PILLEY, SOUTH YORKSHIRE		Borehole Number R2	
Machine : BERETTA T44 Flush : AIR Core Dia: mm Method : ROTARY OPEN HOLE			Casing Diameter			Ground Level (mOD)		Client		Job Number NE3345	
			Location AS PLAN			Dates 18/09/2014		Engineer CoDa STRUCTURES		Sheet 1/3	
Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
							(0.40) 0.40	TOPSOIL			
								Moderately strong yellow orange SANDSTONE.			
							(4.10) 4.50	Hard light grey SILTSTONE.			
							(1.30) 5.80	Strong dark brown SILTSTONE.			
							(3.70) 9.50	COAL.			
							(0.60)				
Remarks Hand excavated inspection pit from GL to 1.20m to check for services. Descriptions based upon foreman drillers records of flush returns. On completion backfilled with arisings and installed a 50mm dia hdpe slotted standpipe with a gas valve and a gravel surround from 4.50m to 1.50m, a Bentonite seal from 1.50m to 0.20m and a concreted in lockable steel protective cover from 0.20m to GL.									Scale (approx) 1:50	Logged By DS/SJ	
									Figure No. NE3345.R2		

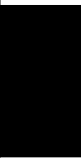
								Site LIDGET LANE, PILLEY, SOUTH YORKSHIRE		Borehole Number R2	
Machine : BERETTA T44 Flush : AIR Core Dia: mm Method : ROTARY OPEN HOLE			Casing Diameter			Ground Level (mOD)		Client		Job Number NE3345	
			Location AS PLAN			Dates 18/09/2014				Engineer CoDa STRUCTURES	
Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
							10.10 (0.20)	Grey MUDSTONE.			
							10.30 (0.30)	COAL.			
							10.60 (0.40)	Strong light grey SILTSTONE.			
							11.00 (1.00)	Strong dark brown SILTSTONE.			
							12.00 (10.00)	Hard light grey SILTSTONE.			
Remarks									Scale (approx) 1:50	Logged By DS/SJ	
									Figure No. NE3345.R2		

								Site LIDGET LANE, PILLEY, SOUTH YORKSHIRE		Borehole Number R4		
Machine : BERETTA T44 Flush : AIR Core Dia: mm Method : ROTARY OPEN HOLE			Casing Diameter			Ground Level (mOD)		Client		Job Number NE3345		
			Location AS PLAN			Dates 18/09/2014		Engineer CoDa STRUCTURES		Sheet 1/3		
Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr	
							(0.40)	TOPSOIL				
							0.40	Dark brown sandy CLAY with stone fragments.				
							(1.40)					
							1.80	Moderately strong greyish brown SANDSTONE.				
							(8.60)					
												
												
												
												
												
												
												
												
												
												
												
												
												
												
Remarks Hand excavated inspection pit from GL to 1.20m to check for services. Descriptions based upon foreman drillers records of flush returns. On completion backfilled with arisings and installed a 50mm dia hdpe slotted standpipe with a gas valve and a gravel surround from 4.50m to 1.50m, a Bentonite seal from 1.50m to 0.20m and a concreted in lockable steel protective cover from 0.20m to GL.									Scale (approx) 1:50		Logged By DS/SJ	
									Figure No. NE3345.R4			

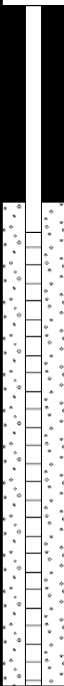
								Site LIDGET LANE, PILLEY, SOUTH YORKSHIRE		Borehole Number R4	
Machine : BERETTA T44 Flush : AIR Core Dia: mm Method : ROTARY OPEN HOLE			Casing Diameter			Ground Level (mOD)		Client		Job Number NE3345	
			Location AS PLAN			Dates 18/09/2014		Engineer CoDa STRUCTURES		Sheet 2/3	
Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
							10.40 (0.20) 10.60	Moderately strong greyish brown SANDSTONE. Strong dark grey MUDSTONE. Light grey MUDSTONE.			
							(0.80)				
							11.40 11.50	COAL. Strong light grey MUDSTONE.			
							(10.80)				
Remarks									Scale (approx)	Logged By	
									1:50	DS/SJ	
									Figure No. NE3345.R4		

Appendix J
Lithos Rotary Probeholes (west)

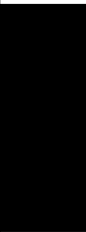
					Borehole Log			Borehole No. PH101 Sheet 1 of 4			
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: 433718.00 - 400408.00		Hole Type PH		
Location:					Level: 147.35		Scale 1:50		Logged By MAR		
Client: Redrow Homes Ltd					Dates: 22/09/2015 - 22/09/2015						
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
					4.00	143.35		OVERBURDEN (WEATHERED COAL MEASURES)			
											Interbedded mudstone and sandstone (PENNINE LOWER COAL MEASURES)
											
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. Full air returns.											

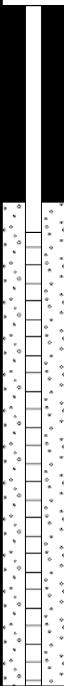
					Borehole Log			Borehole No. PH101 Sheet 2 of 4		
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: 433718.00 - 400408.00		Hole Type PH	
Location:					Level: 147.35		Scale 1:50			
Client: Redrow Homes Ltd					Dates: 22/09/2015 - 22/09/2015		Logged By MAR			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					11.00	136.35		Interbedded mudstone and sandstone (PENNINE LOWER 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. Full air returns.										

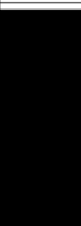
					Borehole Log			Borehole No. PH101 Sheet 3 of 4		
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: 433718.00 - 400408.00		Hole Type PH	
Location:					Level: 147.35		Scale 1:50		Logged By MAR	
Client: Redrow Homes Ltd					Dates: 22/09/2015 - 22/09/2015					
Well	Water Strikes	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. 3. Full air returns.										

					Borehole Log			Borehole No. PH101A Sheet 1 of 1	
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: -		Hole Type PH
Location:					Level:			Scale 1:50	
Client: Redrow Homes Ltd					Dates: 22/09/2015 - 22/09/2015			Logged By MAR	
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								OVERBURDEN (WEATHERED COAL MEASURES)	1
									2
					4.00			Interbedded mudstone and sandstone (PENNINE LOWER COAL MEASURES)	4
					4.50		----- End of borehole at 4.50 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. 3. Full air returns.									

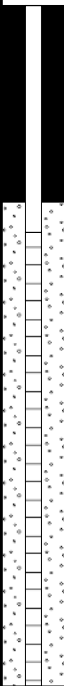
					Borehole Log			Borehole No. PH102 Sheet 1 of 2		
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: 433775.00 - 400388.00		Hole Type PH	
Location:					Level: 145.50		Scale 1:50			
Client: Redrow Homes Ltd					Dates: 22/09/2015 - 22/09/2015		Logged By MAR			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					1.00	144.50		OVERBURDEN (WEATHERED COAL MEASURES)		
								Interbedded mudstone and sandstone (PENNINE LOWER 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. 3. Full air returns.										

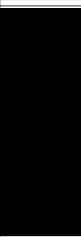
					Borehole Log			Borehole No. PH102 Sheet 2 of 2		
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: 433775.00 - 400388.00		Hole Type PH	
Location:					Level: 145.50		Scale 1:50			
Client: Redrow Homes Ltd					Dates: 22/09/2015 - 22/09/2015		Logged By MAR			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					11.70	133.80			11	
								COAL (FLOCKTON THICK SEAM)	12	
					13.20	132.30		Interbedded mudstone and sandstone (PENNINE LOWER COAL MEASURES)	13	
					15.00	130.50	----- End of borehole at 15.00 m -----		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. Full air returns.										

				Borehole Log				Borehole No. PH102A Sheet 1 of 1	
Project Name: Lidgett Lane and New Road, Pilley				Project No. 2222		Co-ords: -		Hole Type PH	
Location:						Level:		Scale 1:50	
Client: Redrow Homes Ltd						Dates: 22/09/2015 - 22/09/2015		Logged By MAR	
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.00			OVERBURDEN (WEATHERED COAL MEASURES)	1
					4.50			Interbedded mudstone and sandstone (PENNINE LOWER COAL MEASURES)	2
End of borehole at 4.50 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. 3. Full air returns.									

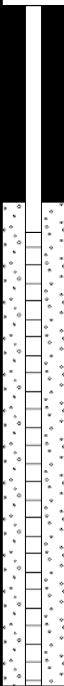
					Borehole Log			Borehole No. PH103 Sheet 1 of 2		
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: 433756.00 - 400363.00		Hole Type PH	
Location:					Level: 143.45		Scale 1:50			
Client: Redrow Homes Ltd					Dates: 22/09/2015 - 22/09/2015		Logged By MAR			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					1.00	142.45		OVERBURDEN	1	
								Interbedded mudstone and sandstone (PENNINE LOWER COAL MEASURES)	2	
									3	
									4	
									5	
					5.90	137.55		COAL (FLOCKTON THICK SEAM)	6	
					7.40	136.05		Interbedded mudstone and sandstone (PENNINE LOWER 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. Full air returns.										



				Borehole Log				Borehole No. PH103A Sheet 1 of 1	
Project Name: Lidgett Lane and New Road, Pilley				Project No. 2222		Co-ords: -		Hole Type PH	
Location:						Level:		Scale 1:50	
Client: Redrow Homes Ltd						Dates: 22/09/2015 - 22/09/2015		Logged By MAR	
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.00			OVERBURDEN (WEATHERED COAL MEASURES)	1
								Interbedded mudstone and sandstone (PENNINE LOWER COAL MEASURES)	2
					4.50		End of borehole at 4.50 m		
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Full air returns.									
									

					Borehole Log			Borehole No. PH104 Sheet 1 of 2		
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: 433704.00 - 400382.00		Hole Type PH	
Location:					Level: 145.05		Scale 1:50			
Client: Redrow Homes Ltd					Dates: 22/09/2015 - 22/09/2015		Logged By MAR			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					1.00	144.05		OVERBURDEN (WEATHERED COAL MEASURES)		
								Interbedded mudstone and sandstone (PENNINE LOWER COAL MEASURES)	1	
									2	
									3	
					4.10	140.95		COAL (FLOCKTON THICK SEAM)	4	
									5	
					5.60	139.45		Interbedded mudstone and sandstone (PENNINE LOWER COAL MEASURES)	6	
									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 not apparent during drilling. 3. Full air returns.										

					Borehole Log			Borehole No. PH104 Sheet 2 of 2									
Project Name: Lidgett Lane and New Road, Pilly					Project No. 2222		Co-ords: 433704.00 - 400382.00		Hole Type PH								
Location:					Level: 145.05		Scale 1:50										
Client: Redrow Homes Ltd					Dates: 22/09/2015 - 22/09/2015		Logged By MAR										
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description									
		Depth (m)	Type	Results													
					12.00	133.05			11								
									12								
									13								
									14								
									15								
									16								
									17								
									18								
									19								
									20								
									End of borehole at 12.00 m								
									Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Full air returns.								
																	

				Borehole Log				Borehole No. PH104A Sheet 1 of 1		
Project Name: Lidgett Lane and New Road, Pilley				Project No. 2222		Co-ords: -		Hole Type PH		
Location:						Level:		Scale 1:50		
Client: Redrow Homes Ltd						Dates: 22/09/2015 - 22/09/2015		Logged By MAR		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					1.00			OVERBURDEN (WEATHERED COAL MEASURES)		
								Interbedded mudstone and sandstone (PENNINE LOWER COAL MEASURES)	1	
										2
										3
					4.10			COAL (FLOCKTON THICK SEAM)	4	
					4.50		End of borehole at 4.50 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. 3. Full air returns.										

					Borehole Log			Borehole No. PH105 Sheet 1 of 3		
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: 433821.00 - 400441.00		Hole Type PH	
Location:					Level: 150.25		Scale 1:50			
Client: Redrow Homes Ltd					Dates: 22/09/2015 - 22/09/2015		Logged By MAR			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					1.00	149.25		OVERBURDEN (WEATHERED COAL MEASURES)		
								Interbedded mudstone and sandstone (PENNINE LOWER 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. 3. Full air returns.										

					Borehole Log			Borehole No. PH105 Sheet 2 of 3										
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: 433821.00 - 400441.00		Hole Type PH									
Location:					Level: 150.25		Scale 1:50		Logged By MAR									
Client: Redrow Homes Ltd					Dates: 22/09/2015 - 22/09/2015													
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. Full air returns.								
																		



PH105

Sheet 3 of 3

Project Name: Lidgett Lane and New Road,
Pilly

Project No.
2222

Co-ords: 433821.00 - 400441.00

Hole Type
PH

Location:

Level: 150.25

Scale
1:50

Client: Redrow Homes Ltd

Dates: 22/09/2015 - 22/09/2015

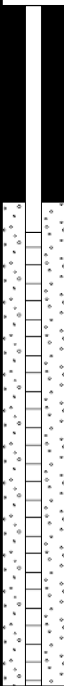
Logged By
MAR

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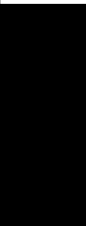
Remarks

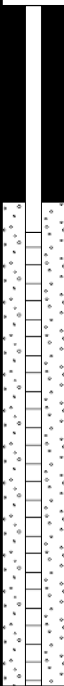
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Full air returns.



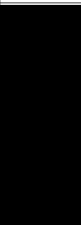
				Borehole Log				Borehole No. PH105A Sheet 1 of 1	
Project Name: Lidgett Lane and New Road, Pilley				Project No. 2222		Co-ords: -		Hole Type PH	
Location:						Level:		Scale 1:50	
Client: Redrow Homes Ltd						Dates: 22/09/2015 - 22/09/2015		Logged By MAR	
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.00			OVERBURDEN (WEATHERED COAL MEASURES)	1
								Interbedded mudstone and sandstone (PENNINE LOWER COAL MEASURES)	2
					4.50		End of borehole at 4.50 m		
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Full air returns.									
									

					Borehole Log			Borehole No. PH106 Sheet 1 of 2		
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: 433681.00 - 400436.00		Hole Type PH	
Location:					Level: 152.85		Scale 1:50			
Client: Redrow Homes Ltd					Dates: 22/09/2015 - 22/09/2015		Logged By MAR			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					1.00	151.85		OVERBURDEN (WEATHERED COAL MEASURES)		
								Interbedded mudstone and sandstone (PENNINE LOWER 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. 3. Full air returns.										

					Borehole Log			Borehole No. PH106 Sheet 2 of 2	
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: 433681.00 - 400436.00		Hole Type PH
Location:					Level: 152.85		Scale 1:50		
Client: Redrow Homes Ltd					Dates: 22/09/2015 - 22/09/2015		Logged By MAR		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					11.50	141.35		COAL (FLOCKTON THICK SEAM)	11
					13.00	139.85			12
					15.00	137.85			13
								Interbedded mudstone and sandstone (PENNINE LOWER COAL MEASURES)	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. Full air returns.									

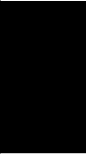
				Borehole Log				Borehole No. PH106A Sheet 1 of 1	
Project Name: Lidgett Lane and New Road, Pilley				Project No. 2222		Co-ords: -		Hole Type PH	
Location:						Level:		Scale 1:50	
Client: Redrow Homes Ltd						Dates: 22/09/2015 - 22/09/2015		Logged By MAR	
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.00			OVERBURDEN (WEATHERED COAL MEASURES)	1
								Interbedded mudstone and sandstone (PENNINE LOWER COAL MEASURES)	2
					4.50		End of borehole at 4.50 m		
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Full air returns.									

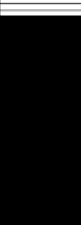


					Borehole Log			Borehole No. PH107 Sheet 1 of 2		
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: 433684.00 - 400406.00		Hole Type PH	
Location:					Level: 148.85		Scale 1:50			
Client: Redrow Homes Ltd					Dates: 22/09/2015 - 22/09/2015		Logged By MAR			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					1.00	147.85		OVERBURDEN (WEATHERED COAL MEASURES)		
									Interbedded mudstone and sandstone (PENNINE LOWER COAL MEASURES)	1
										2
										3
					7.20	141.65		COAL (FLOCKTON THICK SEAM)	4	
					8.70	140.15		Interbedded mudstone and sandstone (PENNINE LOWER 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. Full air returns.										

					Borehole Log			Borehole No. PH107 Sheet 2 of 2		
Project Name: Lidgett Lane and New Road, Pilly					Project No. 2222		Co-ords: 433684.00 - 400406.00		Hole Type PH	
Location:					Level: 148.85		Scale 1:50		Logged By MAR	
Client: Redrow Homes Ltd					Dates: 22/09/2015 - 22/09/2015					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					12.00	136.85		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. Full air returns.										

					Borehole Log			Borehole No. PH108 Sheet 1 of 2		
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: 433781.00 - 400371.00		Hole Type PH	
Location:					Level: 143.95		Scale 1:50			
Client: Redrow Homes Ltd					Dates: 22/09/2015 - 22/09/2015		Logged By MAR			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					1.00	142.95		OVERBURDEN (WEATHERED COAL MEASURES)		
								Interbedded mudstone and sandstone (PENNINE LOWER COAL MEASURES)	1	
									2	
									3	
									4	
									5	
									6	
									7	
									8	
									9	
					9.50	134.45		COAL (FLOCKTON THICK SEAM)	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. Full air returns.										

					Borehole Log			Borehole No. PH108 Sheet 2 of 2			
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: 433781.00 - 400371.00		Hole Type PH		
Location:					Level: 143.95		Scale 1:50		Logged By MAR		
Client: Redrow Homes Ltd					Dates: 22/09/2015 - 22/09/2015						
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
					11.00	132.95		Interbedded mudstone and sandstone (PENNINE LOWER COAL MEASURES)	11		
										12	
									13		
					15.00	128.95		End of borehole at 15.00 m	15		
											16
									17		
									19		
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Full air returns.											

					Borehole Log			Borehole No. PH109 Sheet 1 of 1		
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: 433730.00 - 400370.00		Hole Type PH	
Location:					Level: 143.95		Scale 1:50			
Client: Redrow Homes Ltd					Dates: 22/09/2015 - 22/09/2015		Logged By MAR			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					1.00	142.95		OVERBURDEN (WEATHERED COAL MEASURES)		
								Interbedded mudstone and sandstone (PENNINE LOWER COAL MEASURES)	1	
									2	
									3	
					4.60	139.35		COAL (FLOCKTON THICK SEAM)	4	
					6.10	137.85		Interbedded mudstone and sandstone (PENNINE LOWER COAL MEASURES)	5	
									6	
									7	
									8	
					9.00	134.95		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. 3. Full air returns.



Appendix K

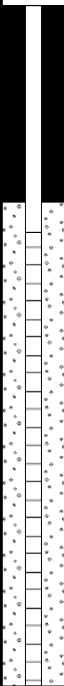
Lithos Rotary Probeholes (east)

					Borehole Log			Borehole No. PH01 Sheet 1 of 4			
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: 434035.00 - 400289.00		Hole Type PH		
Location:					Level: 139.00		Scale 1:50				
Client: Redrow Homes Ltd					Dates: 21/09/2015 - 21/09/2015		Logged By MAR				
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
					1.00	138.00		OVERBURDEN (WEATHERED COAL MEASURES)			
								Interbedded mudstone and sandstone (PENNINE MIDDLE COAL MEASURES)	1 2 3 4 5 6 7 8 9 10		
					10.00	129.00		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. Full air returns.											

					Borehole Log			Borehole No. PH01 Sheet 2 of 4		
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: 434035.00 - 400289.00		Hole Type PH	
Location:					Level: 139.00		Scale 1:50			
Client: Redrow Homes Ltd					Dates: 21/09/2015 - 21/09/2015		Logged By MAR			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					10.90	128.10		Mudstone with coal traces (PENNINE MIDDLE COAL MEASURES)		
								Interbedded mudstone and sandstone (PENNINE MIDDLE 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. Full air returns.										

					Borehole Log			Borehole No. PH01 Sheet 3 of 4		
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: 434035.00 - 400289.00		Hole Type PH	
Location:					Level: 139.00		Scale 1:50			
Client: Redrow Homes Ltd					Dates: 21/09/2015 - 21/09/2015		Logged By MAR			
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. 3. Full air returns.										
										

					Borehole Log			Borehole No. PH01 Sheet 4 of 4			
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: 434035.00 - 400289.00		Hole Type PH		
Location:					Level: 139.00		Scale 1:50		Logged By MAR		
Client: Redrow Homes Ltd					Dates: 21/09/2015 - 21/09/2015						
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
					32.10	106.90		Dark mudstone (PENNINE MIDDLE COAL MEASURES)		31	
										32	
					36.00	103.00		End of borehole at 36.00 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. 3. Full air returns.											

					Borehole Log			Borehole No. PH01A Sheet 1 of 1	
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: -		Hole Type PH
Location:					Level:		Scale 1:50		
Client: Redrow Homes Ltd					Dates: 21/09/2015 - 21/09/2015		Logged By MAR		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.00			OVERBURDEN (WEATHERED COAL MEASURES)	1
								Interbedded mudstone and sandstone (PENNINE MIDDLE COAL MEASURES)	2
					4.50		End of borehole at 4.50 m		
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Full air returns.									
									





PH02

Sheet 2 of 2

Co-ords: 434101.00 - 400252.00

Hole Type
PH

Location:

Level: 137.10

Scale
1:50

Client: Redrow Homes Ltd

Dates: 21/09/2015 - 21/09/2015

Logged By
MAR

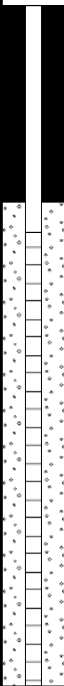
[illegible]

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Full air returns.



				Borehole Log				Borehole No. PH02A Sheet 1 of 1	
Project Name: Lidgett Lane and New Road, Pilley				Project No. 2222		Co-ords: -		Hole Type PH	
Location:						Level:		Scale 1:50	
Client: Redrow Homes Ltd						Dates: 21/09/2015 - 21/09/2015		Logged By MAR	

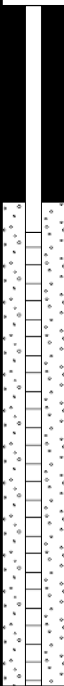
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.50		 OVERBURDEN (WEATHERED COAL MEASURES)	1	
					0.90		 COAL (LIDGET SEAM)		
							 Interbedded mudstone and sandstone (PENNINE MIDDLE COAL MEASURES)	2	
								3	
								4	
					4.50		End of borehole at 4.50 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. 3. Full air returns.								
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					Borehole Log			Borehole No. PH03 Sheet 1 of 3		
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: 434078.00 - 400229.00		Hole Type PH	
Location:					Level: 135.10		Scale 1:50			
Client: Redrow Homes Ltd					Dates: 21/09/2015 - 21/09/2015		Logged By MAR			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					1.00	134.10		OVERBURDEN (WEATHERED COAL MEASURES)		
								Interbedded mudstone and sandstone (PENNINE MIDDLE COAL MEASURES)	1	
					3.30	131.80		COAL (PENNINE MIDDLE COAL MEASURES)		
					3.60	131.50		From 3.3-3.6m, heavily weathered coal. Interbedded mudstone and sandstone (LIDGET SEAM)	4	
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. Full air returns.										

					Borehole Log			Borehole No. PH03 Sheet 2 of 3		
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: 434078.00 - 400229.00		Hole Type PH	
Location:					Level: 135.10		Scale 1:50			
Client: Redrow Homes Ltd					Dates: 21/09/2015 - 21/09/2015		Logged By MAR			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					12.50	122.60			11	
									12	
								Dark mudstone (PENNINE MIDDLE COAL MEASURES)	13	
									14	
					15.10	120.00		COAL (JOAN SEAM)	15	
					15.60	119.50		Interbedded mudstone and sandstone (PENNINE MIDDLE COAL MEASURES)	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. Full air returns.										

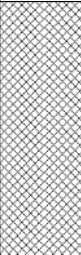
					Borehole Log			Borehole No. PH03 Sheet 3 of 3												
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: 434078.00 - 400229.00		Hole Type PH											
Location:					Level: 135.10		Scale 1:50		Logged By MAR											
Client: Redrow Homes Ltd					Dates: 21/09/2015 - 21/09/2015															
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description												
		Depth (m)	Type	Results																
					24.00	111.10				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. Full air returns.										

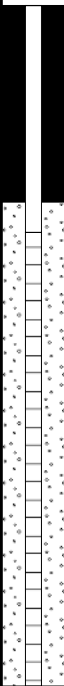
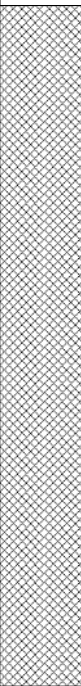
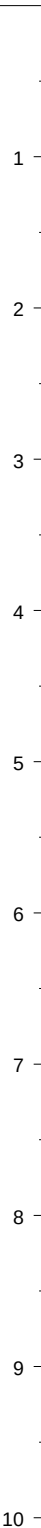
				Borehole Log			Borehole No. PH03A Sheet 1 of 1		
Project Name: Lidgett Lane and New Road, Pilley				Project No. 2222		Co-ords: -		Hole Type PH	
Location:						Level:		Scale 1:50	
Client: Redrow Homes Ltd						Dates: 21/09/2015 - 21/09/2015		Logged By MAR	
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.00		 OVERBURDEN (WEATHERED COAL MEASURES)		
							 Interbedded mudstone and sandstone (PENNINE MIDDLE COAL MEASURES)	1	
					3.30				2
					3.60		 COAL (LIDGET SEAM)		
							 Interbedded mudstone and sandstone (PENNINE MIDDLE COAL MEASURES)	4	
					4.50		End of borehole at 4.50 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. 3. Full air returns.									

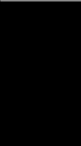
					Borehole Log			Borehole No. PH04 Sheet 1 of 1		
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: 434014.00 - 400223.00		Hole Type PH	
Location:					Level: 134.35		Scale 1:50			
Client: Redrow Homes Ltd					Dates: 21/09/2015 - 21/09/2015		Logged By MAR			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
								MADE GROUND (OPENCASE BACKFILL)		
					3.30	131.05		Interbedded mudstone and sandstone (PENNINE MIDDLE COAL MEASURES)		
					6.00	128.35		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. 3. Full air returns.										





					Borehole Log			Borehole No. PH05 Sheet 2 of 2		
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: 434003.00 - 400218.00		Hole Type PH	
Location:					Level: 134.35		Scale 1:50			
Client: Redrow Homes Ltd					Dates: 21/09/2015 - 21/09/2015		Logged By MAR			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					11.70	122.65	 	Solid (PENNINE MIDDLE COAL MEASURES) <i>From 11.7m, solid ground, no returns.</i>	11	
					15.00	119.35			15	
End of borehole at 15.00 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. 3. Returns lost at approximately 10m.										

					Borehole Log			Borehole No. PH05A Sheet 1 of 1		
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: -		Hole Type PH	
Location:					Level:		Scale 1:50			
Client: Redrow Homes Ltd					Dates: 21/09/2015 - 21/09/2015		Logged By MAR			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					4.50			MADE GROUND (OPENCAST BACKFILL)		
								End of borehole at 4.50 m		
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Full air returns.										
										

					Borehole Log			Borehole No. PH06 Sheet 1 of 4		
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: 434148.00 - 400315.00		Hole Type PH	
Location:					Level: 140.00		Scale 1:50			
Client: Redrow Homes Ltd					Dates: 21/09/2015 - 21/09/2015		Logged By MAR			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					0.50	139.50		OVERBURDEN (WEATHERED COAL MEASURES)		
								Interbedded mudstone and sandstone (PENNINE MIDDLE COAL MEASURES)	1	
									2	
									3	
									4	
									5	
									6	
									7	
						8.00	132.00		COAL (LIDGET SEAM)	8
						9.00	131.00		Interbedded mudstone and sandstone (PENNINE MIDDLE 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. Full air returns.										

					Borehole Log			Borehole No. PH06 Sheet 2 of 4									
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: 434148.00 - 400315.00		Hole Type PH								
Location:					Level: 140.00		Scale 1:50		Logged By MAR								
Client: Redrow Homes Ltd					Dates: 21/09/2015 - 21/09/2015												
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. Full air returns.								
																	

					Borehole Log			Borehole No. PH06 Sheet 3 of 4	
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: 434148.00 - 400315.00		Hole Type PH
Location:					Level: 140.00		Scale 1:50		
Client: Redrow Homes Ltd					Dates: 21/09/2015 - 21/09/2015		Logged By MAR		
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. 3. Full air returns.





PH06

Sheet 4 of 4

Co-ords: 434148.00 - 400315.00

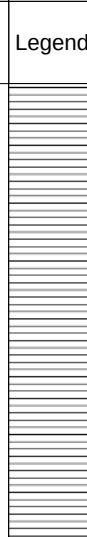
Hole Type
PH

Level: 140.00

Scale
1:50

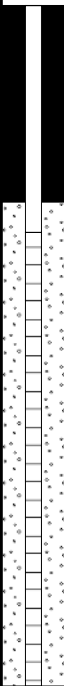
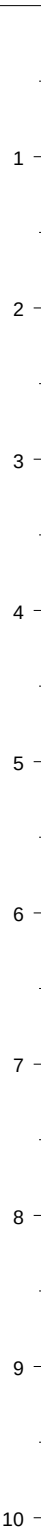
Dates: 21/09/2015 - 21/09/2015

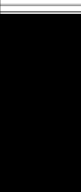
Logged By
MAR

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					33.00	107.00			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. 3. Full air returns.

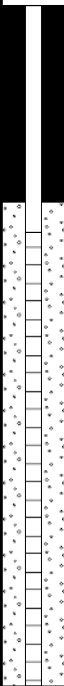
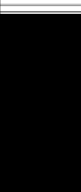


					Borehole Log			Borehole No. PH06A Sheet 1 of 1	
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: -		Hole Type PH
Location:					Level:		Scale 1:50		
Client: Redrow Homes Ltd					Dates: 21/09/2015 - 21/09/2015		Logged By MAR		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.50			OVERBURDEN (WEATHERED COAL MEASURES)	
								Interbedded mudstone and sandstone (PENNINE MIDDLE COAL MEASURES)	
					4.50		End of borehole at 4.50 m		
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Full air returns.									
									

					Borehole Log			Borehole No. PH07 Sheet 1 of 2		
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: 434021.00 - 400342.00		Hole Type PH	
Location:					Level: 144.20		Scale 1:50			
Client: Redrow Homes Ltd					Dates: 21/09/2015 - 21/09/2015		Logged By MAR			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					0.50	143.70		OVERBURDEN (WEATHERED COAL MEASURES)	1	
								Interbedded mudstone and sandstone (PENNINE MIDDLE COAL MEASURES)		2
						3.10	141.10		COAL (LIDGET SEAM)	3
						4.30	139.90		Interbedded mudstone and sandstone (PENNINE MIDDLE 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. 3. Full air returns.										

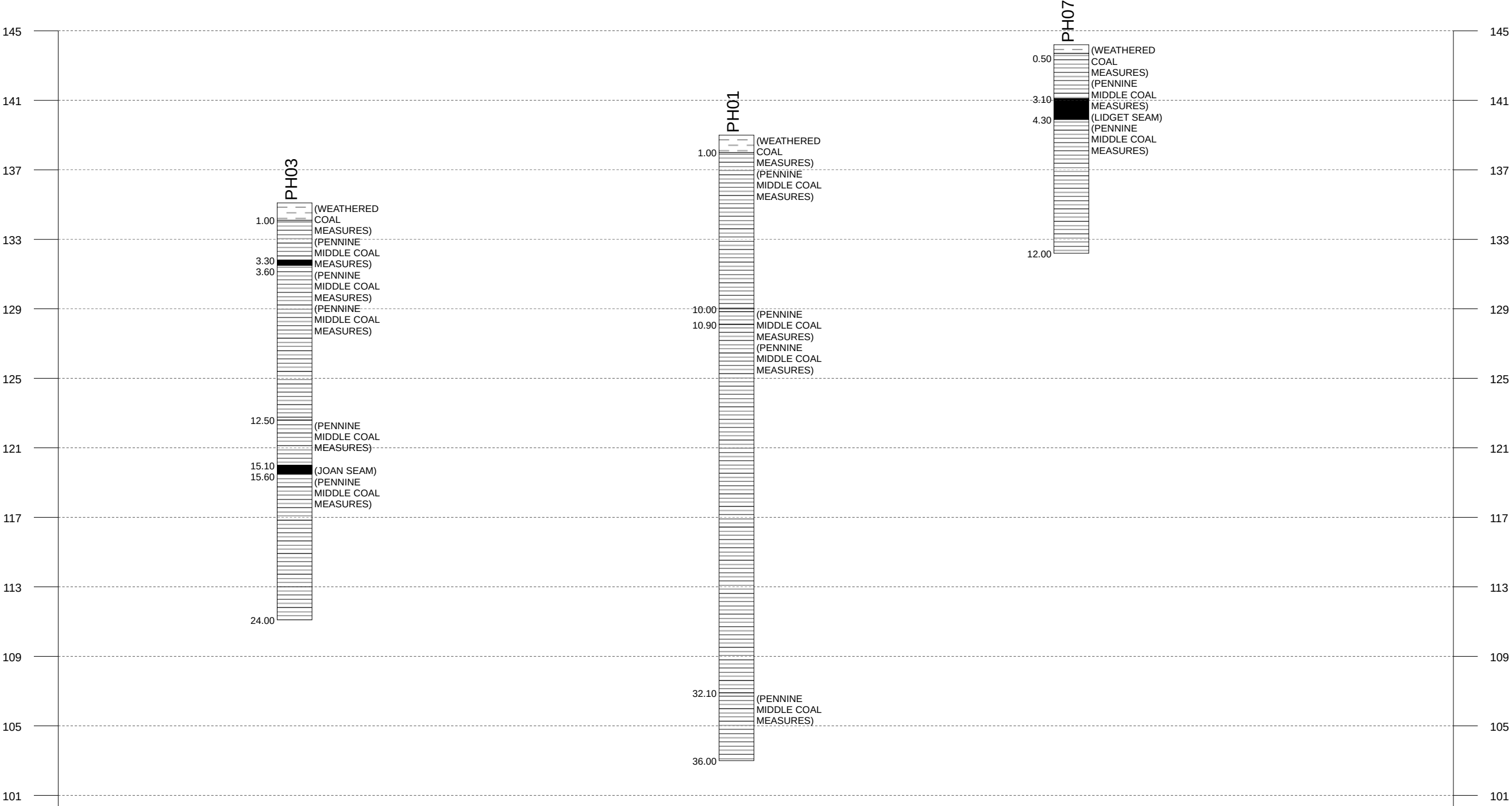
					Borehole Log			Borehole No. PH07 Sheet 2 of 2									
Project Name: Lidgett Lane and New Road, Pilly					Project No. 2222		Co-ords: 434021.00 - 400342.00		Hole Type PH								
Location:					Level: 144.20		Scale 1:50										
Client: Redrow Homes Ltd					Dates: 21/09/2015 - 21/09/2015		Logged By MAR										
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description									
		Depth (m)	Type	Results													
					12.00	132.20			11								
									12								
									13								
									14								
									15								
									16								
									17								
									18								
									19								
									20								
									End of borehole at 12.00 m								
									Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Full air returns.								
																	

					Borehole Log			Borehole No. PH07A Sheet 1 of 1	
Project Name: Lidgett Lane and New Road, Pilley					Project No. 2222		Co-ords: -		Hole Type PH
Location:					Level:		Scale 1:50		
Client: Redrow Homes Ltd					Dates: 21/09/2015 - 21/09/2015		Logged By MAR		

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.50		 OVERBURDEN (WEATHERED COAL MEASURES)	1	
							 Interbedded mudstone and sandstone (PENNINE MIDDLE COAL MEASURES)		2
					3.10		 COAL (LIDGET SEAM)	3	
					4.30 4.50		 Interbedded mudstone and sandstone (PENNINE MIDDLE COAL MEASURES) End of borehole at 4.50 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. 3. Full air returns.								
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Appendix L
Lithos Cross Sections



Legend Key

- CLAY
- MUDSTONE
- COAL

Project Id: 2222

Project Title: Lidgett Lane and New Road, Pilley

Location:

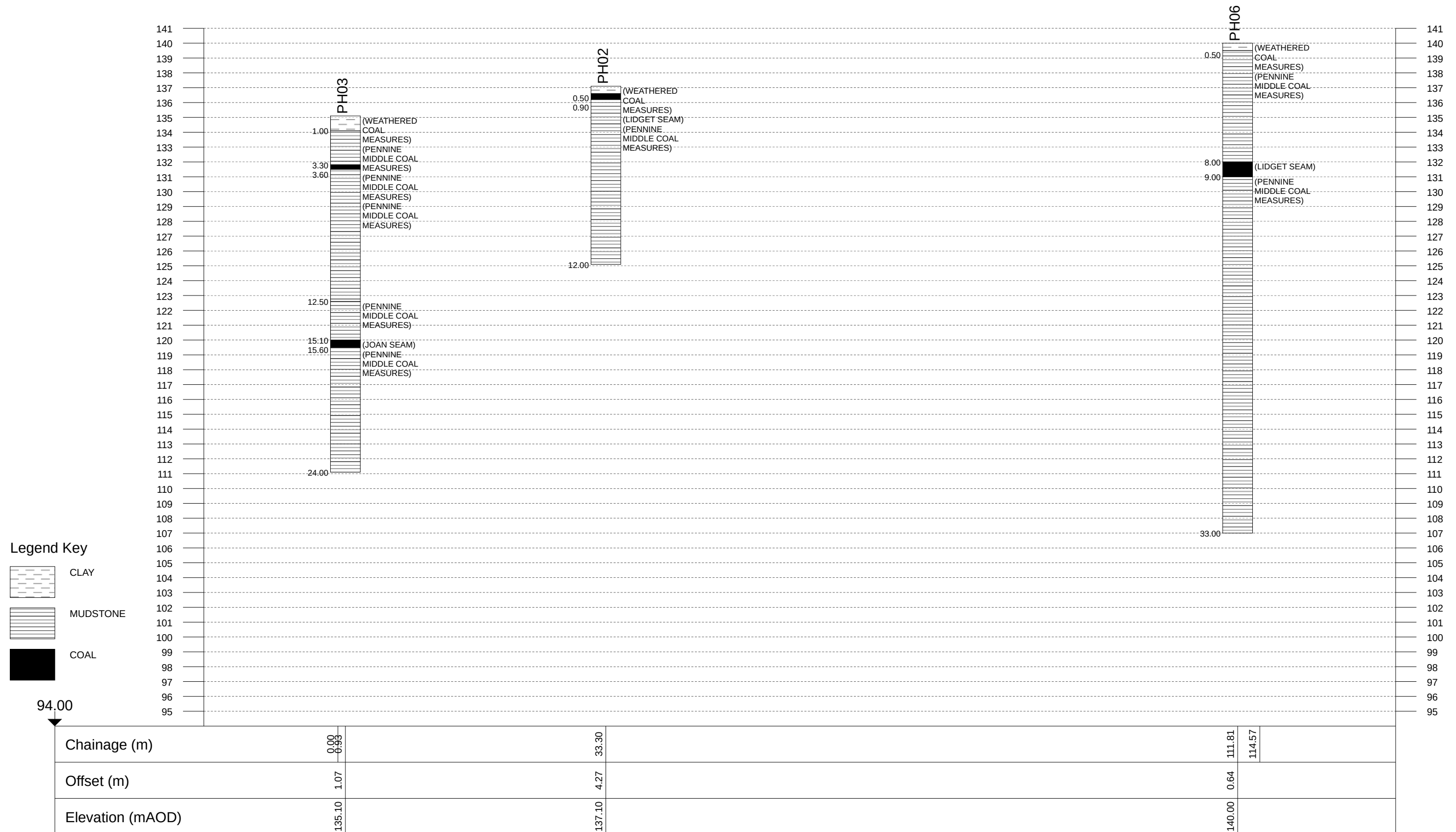
Client: Redrow Homes Ltd

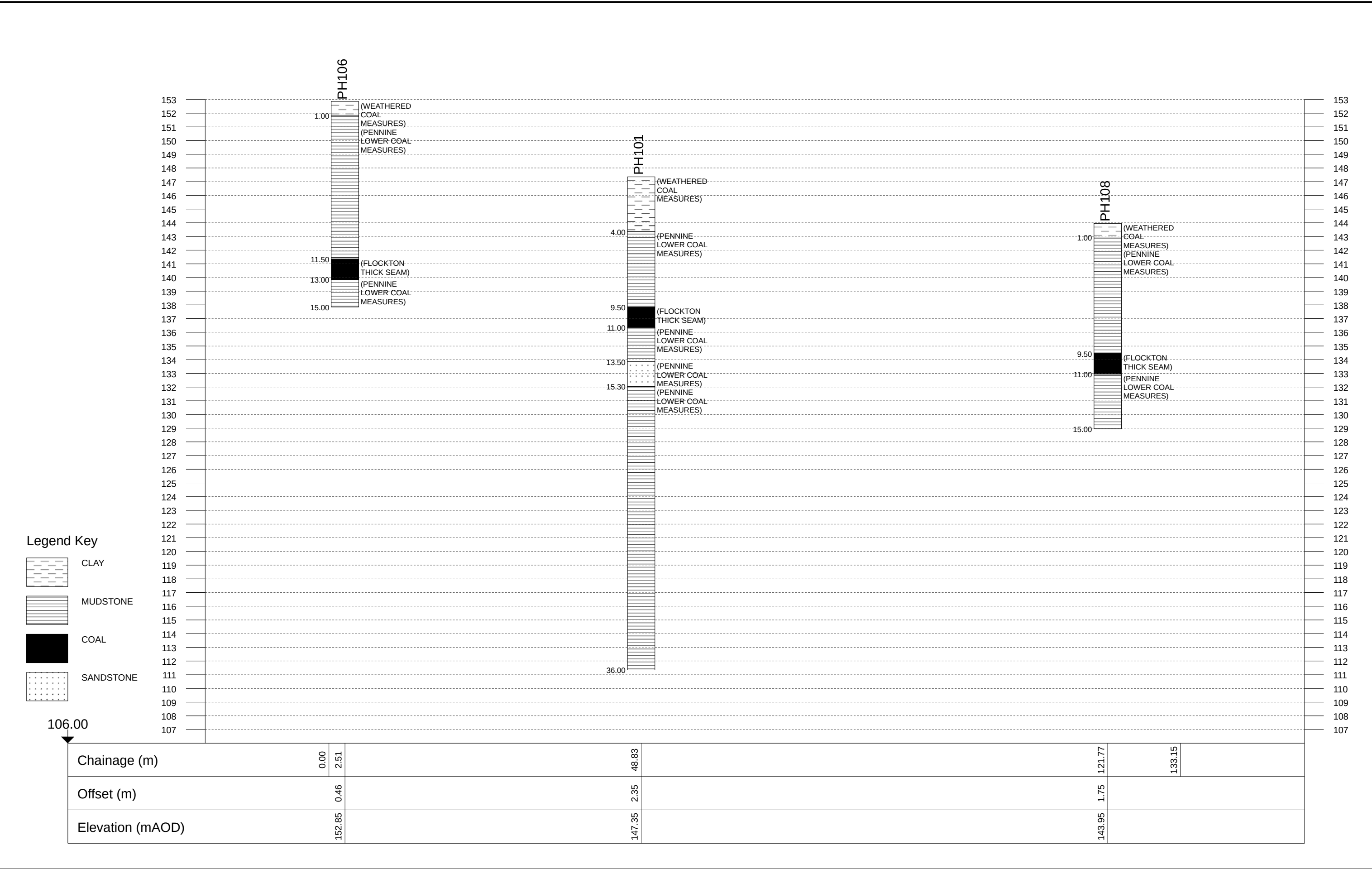
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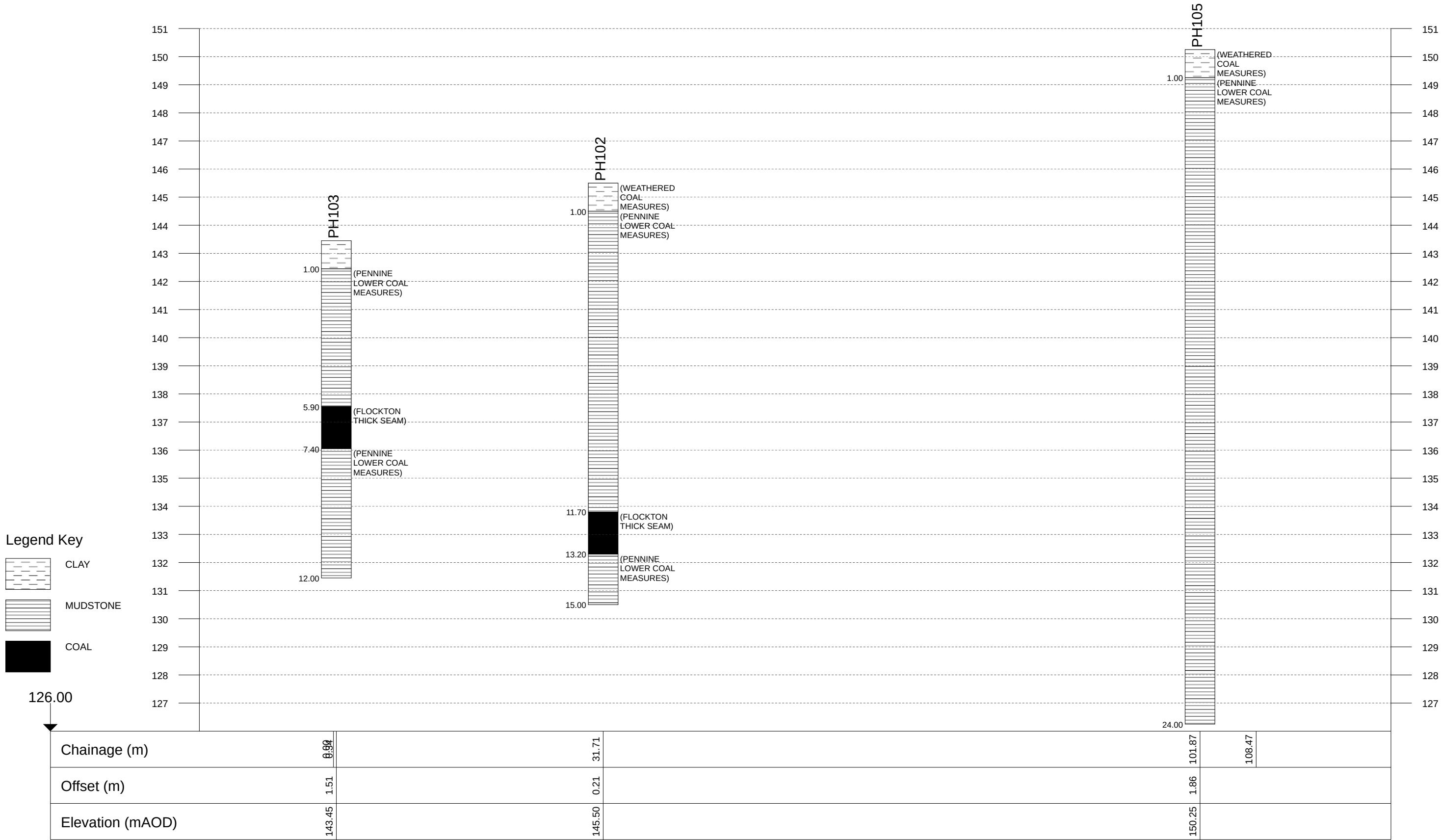
Vertical Scale: 1:250

Horizontal Scale: 1:461

Engineer: REG







Appendix M
CoDa chemical test results



Scientific Analysis Laboratories Ltd

Certificate of Analysis

Hadfield House
Hadfield Street
Cornbrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2468

Scientific Analysis Laboratories is a
limited company registered in England and
Wales (No 2514788) whose address is at
Hadfield House, Hadfield Street, Manchester M16 9FE

Report Number: 429870-1

Date of Report: 27-Oct-2014

Customer: Coda Structures
14 Springfield Court
Guiseley
Leeds
LS20 8FD

Customer Contact: Mr Jon Lawrence

Customer Job Reference: 7219

Customer Site Reference: Lidget Lane, Pilley

Date Job Received at SAL: 16-Oct-2014

Date Analysis Started: 17-Oct-2014

Date Analysis Completed: 27-Oct-2014

The results reported relate to samples received in the laboratory
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with SAL SOPs
All results have been reviewed in accordance with QP22



Report checked
and authorised by :
Mr Richard Wong
Project Manager

Issued by :
Mr Richard Wong
Project Manager

SAL Reference: 429870 Project Site: Lidget Lane, Pilley Customer Reference: 7219													
Soil		Analysed as Soil											
MCERTS Preparation													
SAL Reference		429870 001	429870 002	429870 003	429870 004	429870 005	429870 006	429870 007	429870 008	429870 009			
Customer Sample Reference		TP1 010	TP1 012	TP2 015	TP3 019	TP6 024	TP6 025	TP9 058	TP10 042	TP10 045			
Date Sampled		30-SEP-2014	30-SEP-2014	30-SEP-2014	30-SEP-2014	30-SEP-2014	30-SEP-2014	30-SEP-2014	30-SEP-2014	30-SEP-2014			
Depth		0.10	1.10	0.90	0.30	0.30	0.80	1.60	0.10	1.30			
Type		Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil			
Determinand	Method	Test Sample	LOD	Units									
Moisture @ 105 C	T162	AR	0.1	%	22	17	7.0	15	22	17	31	26	17

SAL Reference: 429870										
Project Site: Lidget Lane, Pilley										
Customer Reference: 7219										
Soil		Analysed as Soil								
Metals Suite										
SAL Reference				429870 001	429870 003	429870 004	429870 005	429870 008		
Customer Sample Reference				TP1 010	TP2 015	TP3 019	TP6 024	TP10 042		
Date Sampled				30-SEP-2014	30-SEP-2014	30-SEP-2014	30-SEP-2014	30-SEP-2014		
Depth				0.10	0.90	0.30	0.30	0.10		
Type				Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil		
Determinand	Method	Test Sample	LOD	Units						
Arsenic	T6	M40	2	mg/kg	16	7	12	16	13	
Boron (water-soluble)	T6	AR	1	mg/kg	<1	<1	<1	<1	<1	
Cadmium	T6	M40	1	mg/kg	<1	<1	<1	<1	<1	
Chromium	T6	M40	1	mg/kg	22	18	19	23	23	
Copper	T6	M40	1	mg/kg	37	20	28	33	32	
Lead	T6	M40	1	mg/kg	72	12	38	56	61	
Mercury	T6	M40	1	mg/kg	<1	<1	<1	<1	<1	
Nickel	T6	M40	1	mg/kg	21	26	20	23	29	
Selenium	T6	M40	3	mg/kg	<3	<3	<3	<3	<3	
Zinc	T6	M40	1	mg/kg	96	55	83	100	100	

SAL Reference: 429870													
Project Site: Lidget Lane, Pilley													
Customer Reference: 7219													
Soil		Analysed as Soil											
Miscellaneous													
SAL Reference		429870 001	429870 002	429870 003	429870 004	429870 005	429870 006	429870 007	429870 008	429870 009			
Customer Sample Reference		TP1 010	TP1 012	TP2 015	TP3 019	TP6 024	TP6 025	TP9 058	TP10 042	TP10 045			
Date Sampled		30-SEP-2014	30-SEP-2014	30-SEP-2014	30-SEP-2014	30-SEP-2014	30-SEP-2014	30-SEP-2014	30-SEP-2014	30-SEP-2014			
Depth		0.10	1.10	0.90	0.30	0.30	0.80	1.60	0.10	1.30			
Type		Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil			
Determinand	Method	Test Sample	LOD	Units									
SO4(2-)	T6	AR	0.1	g/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
pH	T7	AR			6.6	7.3	8.4	7.4	7.3	7.2	5.1	7.0	5.2

Soil	Analysed as Soil
Total and Speciated USEPA16 PAH	

SAL Reference					429870 001	429870 003	429870 004	429870 005	429870 008
Customer Sample Reference					TP1 010	TP2 015	TP3 019	TP6 024	TP10 042
Date Sampled					30-SEP-2014	30-SEP-2014	30-SEP-2014	30-SEP-2014	30-SEP-2014
Depth					0.10	0.90	0.30	0.30	0.10
Type					Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil
Determinand	Method	Test Sample	LOD	Units					
Naphthalene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	T207	M105	0.1	mg/kg	0.8	<0.1	0.1	0.4	<0.1
Anthracene	T207	M105	0.1	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	T207	M105	0.1	mg/kg	1.4	<0.1	0.3	0.4	0.2
Pyrene	T207	M105	0.1	mg/kg	1.1	<0.1	0.2	0.3	0.1
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	0.7	<0.1	0.1	<0.1	<0.1
Chrysene	T207	M105	0.1	mg/kg	0.5	<0.1	0.1	<0.1	<0.1
Benzo(b/k)Fluoranthene	T207	M105	0.1	mg/kg	0.9	<0.1	0.2	<0.1	<0.1
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	0.7	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-cd)Pyrene	T207	M105	0.1	mg/kg	0.2	<0.1	<0.1	<0.1	<0.1
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	0.2	<0.1	<0.1	<0.1	<0.1
PAH[total]	T207	M105	0.1	mg/kg	6.6	<0.1	1.0	1.1	0.3

Value	Description
AR	As Received
M105	Analysis conducted on an "as received" aliquot. Results are reported on a dry weight basis where moisture content was determined by assisted drying of sample at 105C
M40	Analysis conducted on sample assisted dried at no more than 40C. Results are reported on a dry weight basis.
M	Analysis is MCERTS accredited
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Value	Description
T7	Probe
T207	GC/MS (MCERTS)
T6	ICP/OES
T162	Grav (1 Dec) (105 C)

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
SO4(2:1)	T6	AR	0.1	g/l	N	001-009
pH	T7	AR			M	001-009
Moisture @ 105 C	T162	AR	0.1	%	N	001-009
Arsenic	T6	M40	2	mg/kg	M	001,003-005,008
Boron (water-soluble)	T6	AR	1	mg/kg	N	001,003-005,008
Cadmium	T6	M40	1	mg/kg	M	001,003-005,008
Chromium	T6	M40	1	mg/kg	M	001,003-005,008
Copper	T6	M40	1	mg/kg	M	001,003-005,008
Lead	T6	M40	1	mg/kg	M	001,003-005,008
Mercury	T6	M40	1	mg/kg	M	001,003-005,008
Nickel	T6	M40	1	mg/kg	M	001,003-005,008

Final Report

Report Number: 15-04259 Issue-1

Initial Date of Issue: 03-Mar-2015

Client: Sub Surface

Client Address: 3 Peel Street
Preston
Lancashire
PR2 2QS

Contact(s): Simon Gabbatt
David Simpson

Project: NE3346/DS - Pilley West

Quotation No.: Q15-02745

Date Received: 24-Feb-2015

Order No.: NE3346/DS

Date Instructed: 24-Feb-2015

No. of Samples: 1

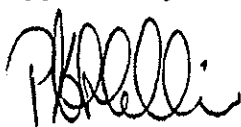
Turnaround: (Wkdays) 15

Results Due Date: 16-Mar-2015

Date Approved: 03-Mar-2015

Subcon Due Date: 17-Mar-2015

Approved By:



Details: Phil Hellier, Project Director



The right chemistry to deliver results

Project: NE3346/DS - Pilley West

Client: Sub Surface	Chemtest Job No.:	15-04259		
Quotation No.: Q15-02745	Chemtest Sample ID.:	107103		
Order No.: NE3346/DS	Client Sample Ref.:	R1		
	Client Sample ID.:	002		
	Sample Type:	GAS		
	Top Depth (m):	0.00		
	Bottom Depth(m):			
	Date Sampled:	11-Feb-15		
Determinand	Accred.	SOP	Units	LOD
Ethane	N		ppmv	10
Propane	N		ppmv	10
Butane	N		ppmv	10
Methane	N		% v/v	0.5
Carbon Dioxide	N		% v/v	0.5
Carbon Monoxide (Subcon)	SU		ppmv	10
Hydrogen Sulphide	N		mg/m3	2
Hydrogen	N		ppmv	50
Oxygen	N		% v/v	20

Results Summary - Gas



Scientific Analysis Laboratories Ltd

Certificate of Analysis

Hadfield House
Hadfield Street
Cornbrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2468

Scientific Analysis Laboratories is a
limited company registered in England and
Wales (No 2514788) whose address is at
Hadfield House, Hadfield Street, Manchester M16 9FE

Report Number: 425808-2

Date of Report: 13-Oct-2014

Customer: Coda Structures
14 Springfield Court
Guiseley
Leeds
LS20 8FD

Customer Contact: Mr Jon Lawrence

Customer Job Reference: 7219

Customer Site Reference: New Road, Pilley

Date Job Received at SAL: 29-Sep-2014

Date Analysis Started: 01-Oct-2014

Date Analysis Completed: 13-Oct-2014

The results reported relate to samples received in the laboratory
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with SAL SOPs
All results have been reviewed in accordance with QP22



Report checked
and authorised by :
Mr Richard Wong
Project Manager

Issued by :
Mr Richard Wong
Project Manager

SAL Reference: 425808												
Project Site: New Road, Pilley												
Customer Reference: 7219												
Soil		Analysed as Soil										
MCERTS Preparation												
SAL Reference		425808 001	425808 002	425808 003	425808 004	425808 005	425808 006	425808 007	425808 008			
Customer Sample Reference		TP1 791	TP2 796	TP2 798	TP5 819	TP6 823	TP12 839	TP13 848	TP13 850			
Depth		0.10	0.50	1.20	0.90	0.10	0.10	1.00	2.50			
Date Sampled		18-SEP-2014	18-SEP-2014	18-SEP-2014	18-SEP-2014	18-SEP-2014	18-SEP-2014	18-SEP-2014	18-SEP-2014			
Type		Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Clay	Sandy Soil		
Determinand	Method	Test Sample	LOD	Units								
Moisture @ 105 C	T162	AR	0.1	%	22	23	5.4	15	19	17	22	17

SAL Reference: 425808												
Project Site: New Road, Pilley												
Customer Reference: 7219												
Soil		Analysed as Soil										
Metals Suite												
SAL Reference		425808 001	425808 002	425808 003	425808 005	425808 006	425808 007	425808 008				
Customer Sample Reference		TP1 791	TP2 796	TP2 798	TP6 823	TP12 839	TP13 848	TP13 850				
Depth		0.10	0.50	1.20	0.10	0.10	1.00	2.50				
Date Sampled		18-SEP-2014	18-SEP-2014	18-SEP-2014	18-SEP-2014	18-SEP-2014	18-SEP-2014	18-SEP-2014				
Type		Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Clay	Sandy Soil				
Determinand	Method	Test Sample	LOD	Units								
Arsenic	T6	M40	2	mg/kg	19	37	7	11	16	7	6	
Boron (water-soluble)	T6	AR	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	
Cadmium	T6	M40	1	mg/kg	3	<1	2	<1	<1	<1	<1	
Chromium	T6	M40	1	mg/kg	22	16	14	14	16	20	18	
Copper	T6	M40	1	mg/kg	58	65	20	23	33	30	25	
Lead	T6	M40	1	mg/kg	96	92	32	42	59	32	24	
Mercury	T6	M40	1	mg/kg	<1	<1	<1	<1	<1	<1	<1	
Nickel	T6	M40	1	mg/kg	22	28	22	14	16	31	28	
Selenium	T6	M40	3	mg/kg	<3	<3	<3	<3	<3	<3	<3	
Zinc	T6	M40	1	mg/kg	270	340	190	72	84	90	68	

SAL Reference: 425808												
Project Site: New Road, Pilley												
Customer Reference: 7219												
Soil		Analysed as Soil										
Miscellaneous												
SAL Reference		425808 001	425808 002	425808 003	425808 004	425808 005	425808 006	425808 007	425808 008			
Customer Sample Reference		TP1 791	TP2 796	TP2 798	TP5 819	TP6 823	TP12 839	TP13 848	TP13 850			
Depth		0.10	0.50	1.20	0.90	0.10	0.10	1.00	2.50			
Date Sampled		18-SEP-2014	18-SEP-2014	18-SEP-2014	18-SEP-2014	18-SEP-2014	18-SEP-2014	18-SEP-2014	18-SEP-2014			
Type		Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Sandy Soil	Clay	Sandy Soil			
Determinand	Method	Test Sample	LOD	Units								
Calorific value	T40	M40	0.1	MJ/kg	-	2.4	-	-	-	-	-	1.5
SO4(2:1)	T6	AR	0.1	g/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
pH	T7	AR			7.0	6.7	6.4	5.1	6.6	7.0	7.1	7.0

Soil	Analysed as Soil
Total and Speciated USEPA16 PAH	

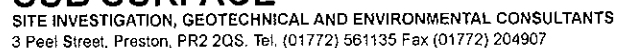
Index to symbols used in 425808-2

Method Index

Accreditation Summary

425808-2

Appendix N
CoDa geotechnical test results



Site : LIDGET LANE (WEST), PILLEY, WEST YORKSHIRE Client : Engineer : CoDa STRUCTURES	Job Number NE3346A Sheet 1 / 1
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Borehole/ Trial Pit	Depth (m)	Sample	Natural Moisture Content %	Sample Passing 425µm Sieve		Liquid Limit %	Plastic Limit %	Plasticity Index %	Liquidity Index	Group Symbol	Laboratory Description
				Percentage %	Moisture Content %						
TP3	0.80	D	36	76	47	74	31	43	0.37	CV	Brown and yellow brown silty CLAY.
TP3	1.60	D	25	98	26	53	26	27	0.00	CH	Brown and light grey high to moderately weathered silty MUDSTONE.
TP4	1.00	D	20	75	27	51	25	26	0.08	CH	Brown completely to highly weathered MUDSTONE/CLAY.
TP4	2.10	D	13								Grey moderately to slightly weathered silty MUDSTONE.
TP9	1.10	D	26	94	28	64	26	38	0.05	CH	Grey and brown silty CLAY.

Remarks :

Appendix O
Lithos gas monitoring results

Job Title:								Job No:					
Pilley								2222					
Client:								Sheet :					
Redrow Homes								1 of 1					
Date:		Arrival Time:		Depart Time:		Operator:							
08/10/2015		12:20		13:30		J Jones							

Gas Monitoring Results:															
Ambient Concentration (% Volume):				CH ₄ :		0.0		CO ₂ :		0.0		O ₂ :		20.4	

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	(%)	(%)	litre/hr	litre/hr	secs		
PH01	3.67	ND	1.9	ND	1.9	14.7	ND	ND	ND	4.34	
PH02	ND	ND	2.1	ND	2.1	15.8	ND	ND	ND	4.24	
PH03	ND	ND	0.5	ND	0.5	19.7	ND	ND	ND	4.12	
PH05	2.90	ND	2.0	ND	2.0	15.4	ND	ND	ND	4.40	
PH06	ND	ND	0.3	ND	0.3	20.0	ND	ND	ND	4.26	
PH07	ND	ND	3.1	ND	3.1	13.9	ND	ND	ND	4.24	
PH101	ND	ND	1.9	ND	1.9	16.8	ND	ND	ND	4.25	
PH102	ND	ND	1.0	ND	1.0	19.7	ND	ND	ND	4.23	
PH103	ND	ND	0.8	ND	0.8	19.4	ND	ND	ND	4.25	
PH104	ND	ND	0.8	ND	0.8	19.0	ND	ND	ND	4.25	
PH105	3.74	ND	4.1	ND	4.1	15.1	ND	ND	ND	4.33	
PH106	ND	ND	1.5	ND	1.5	19.6	ND	ND	ND	4.23	

Notes											
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Equipment Used:				Next Calibration Date				Key						
Gas Data GFM430 Infrared Gas Analyser				29/07/2016				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 (Birdwell, Barnsley Station)										
		Temp (°C):	15	Barometric Pressure Trend:			Rising							
Time:	12:21	12:54	13:27	00:00	04:30	08:15	13:00	17:15	21:45	Trigger level 1	1.0	5.0	16.0	
Pressure (mb):	1002	1001	1000	1012.1	1014.4	1016.1	1018.2	1018.8	1019.9	Trigger level 2	5.0	10.0	10.0	
		Weather Conditions:		Cloudy										
		Surface Ground Conditions:		Dry										
Remarks:														