

A photograph of a cross-section of a stream bed, showing a mix of dark brown soil, light brown sand, and various sized rocks and pebbles. The water is clear and flows over the bed. The banks are covered in green grass and some small plants.

Geoenvironmental Appraisal

Land at New Road, Pilley

For Barratt & David Wilson Homes
Yorkshire West

Report no: 2222/2

Date: June 2016



SUMMARY OF GEOENVIRONMENTAL ISSUES

Job No.	2222	Site area/ha	2.7
Client:	Barratt & David Wilson Homes Yorkshire West	NGR:	SE 341 003
Site:	New Road, Pilley	Nearest postcode:	S75 3BP

The site is located off New Road, approximately 6km south of Barnsley, and currently comprises a single parcel of arable farmland. No significant development appears to have taken place on site in recent history. However, land adjacent to the west was historically mined by opencast methods; the former opencast encroached into the south-west corner of the site.

Lithos were commissioned by Barratt to provide a geoenvironmental appraisal of the site. It is understood that the site is to be redeveloped with housing. Lithos' investigation included a review of 3rd party reports, the site's history and environmental setting, and a ground investigation comprising 14 trial pits, 4 trial trenches.

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

Issue	Remarks
Made ground	Encountered within the south-west only (area of former opencast) to depths in excess of 3.7m. Material generally comprises medium dense very clayey gravel/ firm to stiff gravelly clay; gravel includes mudstone, siltstone and occasional coal with rare fragments of clayware and metal.
Natural ground	Natural ground across the central, south and west typically comprises residual soils (firm to stiff gravelly clay) with mudstone/siltstone bedrock at an average depth of 2.5m. In the north, topsoil is underlain by dense gravel of sandstone (weathered sandstone) with sandstone bedrock at notably shallower depth (average of 1.0m). Shallow coal (Lidget seam) was encountered in a number of trial pits, outcropping roughly north-west to south-east across the centre of the site.
Contamination	No significant contamination has been encountered and therefore no remediation is necessary, although it should be ensured that coal is not present within 1,000mm of finished levels in gardens. Topsoil is considered chemically suitable for re-use.
Mining & quarrying	This site is located within a Coal Mining Development High Risk Area, with possible shallow mineworkings present at <30m depth which could pose a risk of subsidence. A former opencast mine (>3.7m deep) encroaches into the south-west.
Hazardous gas	The on-site and adjacent areas of backfilled opencast, along with any shallow mineworkings are considered potential sources of hazardous gas. An intrusive hazardous gas investigation and risk assessment should be carried out.
Foundations	The majority of plots will be founded on strip/trench fill footings within residual soils. Foundation excavations which encounter coal will require deepening to beyond the base of the seam. Plots located within former opencast will require piled solution. The plot layout for this site should take account of the known opencast high walls.
Groundwater & excavations	A groundwater inflow was noted in TT03 (E) at 2.5m within the mudstone bedrock. No other significant inflows were encountered. Stability of excavations within the natural soils was generally good. Shoring may be required for excavations over around 2.0m within the Opencast Backfill.
Flooding & drainage	The site lies within flood zone 1. Based on observations made during the site investigation and topography, soakaways are considered unlikely to provide a suitable drainage solution. Water balancing will likely be required.
Highways	Natural deposits should yield CBR values in excess of 3%. If changes to the site layout are made resulting in highways spanning the opencast 'high-wall' and deep opencast backfill, further advice from Lithos should be sought.

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

- Piled foundations for any plots located within the opencast backfill, with consideration of high wall issues.

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APPENDICES

Appendix A - General notes

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

Appendix B - Drawings

Drawing	Revision	Title
2222/E/1	-	Site location plan
2222/E/2	-	Proposed site layout
2222/E/3	-	Site features
2222/E/4	-	Site photographs
2222/E/5	-	Preliminary conceptual site model
2222/E/6	-	Exploratory hole locations
2222/E/7	-	Revised conceptual site model
2222/E/9	-	Abandonment Plan (Flockton Thick)
2222/E/10	-	Abandonment Plan (Parkgate)
2222/E/11	-	Abandonment Plan (Opencast)

Appendix C - Commission

Appendix D - Historical OS plans

Appendix E - Search responses

From	Date	Content
Landmark	24/09/2015	Environmental search data
Coal Authority	24/19/2015	Mining report
Coal Authority	N/A	Abandonment plans (available on CD, not included in PDF appendices)

Appendix F - Trial pit records

Appendix G - Chemical test results

Appendix H - Geotechnical test 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.

GEOENVIRONMENTAL APPRAISAL

of land at

NEW ROAD, PILLEY

1 INTRODUCTION

1.1 The commission and brief

- 1.1.1 Lithos Consulting Limited were commissioned by Barratt & David Wilson Homes Yorkshire West to carry out a geoenvironmental appraisal of land at New Road, Pilley.
- 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 site walkover and inspection
 - An assessment of the land use history
 - Determination of the site's environmental setting
 - An intrusive ground investigation comprising 14 trial pits and 4 trial trenches
 - Assessment of the geotechnical properties of the near surface deposits to enable provision of foundation and highway recommendations
 - A qualitative assessment of contamination risks
 - Recommendations for the necessary site preparatory works
- 1.1.3 Primary aims of this investigation were to identify salient geoenvironmental issues affecting the site to support the submission of a planning application, and also to enable Barratt to obtain budget costs for: foundations; and site preparatory works.

1.2 The proposed development

- 1.2.1 It is understood that consideration is being given to redevelopment of the site with 56 two to three storey domestic dwellings, associated gardens, POS and adoptable roads and sewers. A site layout has been provided by Barratt ('Planning Layout' ref. PL01, dated 25/05/16) which is reproduced as Drawing 2222/E/2 in Appendix B to this report.

1.3 Report format and limitations

- 1.3.1 All standard definitions, procedures and guidance are contained within Appendix A, which includes background, generic information on:
- Assessment of the site's environmental setting
 - Ground investigation fieldwork
 - Geotechnical testing
 - Contamination testing
- 1.3.2 General notes and limitations relevant to all Lithos geoenvironmental investigations are described in the Foreword and should be read in conjunction with this report. The text of the report draws specific attention to any modification to these procedures and to any other special techniques employed.
- 1.3.3 In accordance with the agreed scope of works, the ground investigation reported here is not fully compliant with Eurocode 7 (EC7) and this report does not purport to be a Ground Investigation Report, nor a Geotechnical Design Report as defined by EC7. The ground appraisal, parametric assessment and preliminary design guidance presented are intended to assist others as they prepare the design of the proposed works

2 SITE DESCRIPTION

2.1 General

- 2.1.1 The site's location is shown on Drawing 2222/E/1 presented in Appendix B to this report. Site details are summarised in the Table below.

Detail	Remarks
Location	6 km south of Bamsley town centre
NGR	SE 341 003
Approximate area	2.7ha
Known services	Underground sewer, overhead electric.

2.2 Site features

- 2.2.1 Vehicular access to the site is from either Lidgett Lane in the north-west or New Road in the south-west.
- 2.2.2 The site is currently used for the growing of crops and comprises two relatively flat areas in the north and south of the site separated by a slope of approximately 1 in 10 gradient in the centre of the site.
- 2.2.3 Trees along the eastern and western boundaries of the site reach over 5m in height.
- 2.2.4 Ground immediately west appears to have been filled up to 5m above the site.
- 2.2.5 Existing salient features, at the time of the walkover are presented on Drawing 2222/E/3 in Appendix B to this report, and summarised in the Table below.

Feature	Remarks
Current Access	Off Lidgett Lane or New Road
Topography	Slopes to south at a gradient of around 1 in 10 in the centre
Approximate areas	27,000 m ² crops
Nature of boundaries	North – mature hedges and overhead electric East & west – wooded areas South – rough vegetation
Surrounding land uses	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

- 2.2.6 A selection of site photographs is included on Drawing 2222/E/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.	Fields, with Pilley Green and Pilley village further west. Roads immediately adjacent to the north (Lidgett Lane) and south (New Road) boundaries.
1893	No significant changes.	Housing immediately east. 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 immediately west. Knoll Drift property shown north of the railway. Air shaft shown around 70m south.
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 immediately west has taken place including filling in the south.
1963		Land immediately west 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 site 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 field immediately west labelled as 'worked out opencast (backfilled) or backfilled quarry'; the latter encroaches into the south-west corner 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 a sandstone unit in the far north and east. Shallowest coal seam – Lidget seam outcrops in the centre of the site, running roughly east-west. Strata dip – to the north-east. Faults – Two faults in field to the west, 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 site 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 immediately west.
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.
- 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. The strata are shown to dip to the north-east at an unspecified angle. No drift deposits are shown.
- 4.2.10 There are two faults affecting the site, conjectured to run through the field to the west, trending north-west to south-east, both downthrow to the north-east. Geological features are presented on Drawing 2222/E/3 in Appendix B.
- 4.2.11 The Lidget Coal outcrops in the central-west trending north-west to south-east. The Flockton Thick coal seam outcrops around 30m to the south, 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, and is also shown to outcrop in the far south-east. 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.

- 4.2.13 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:

Seam	Approx. depth below site (m)	Max. recorded thickness (m)
Lidget	Outcrops in south-west	1.3
Joan	26	0.7
Flockton Thick	38	2.9
Flockton Thin [^]	52	2.0
Fenton	63	0.5
Parkgate	73	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. 800m 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

- 4.2.14 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 Lidget, 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 around 100m & 150m to the north-west, beyond the site boundary.
- The site lies within the boundary of an opencast site from which coal was removed by opencast methods. The majority of opencast is located immediately west, but it encroached into the far south-east.
- A damage notice or claim for alleged subsidence damage was made in July 1998 for 1 Knoll Drift, Lidget Lane, Tankersley S75 3BT for repairs to the value of £9,590.68.

- 4.2.15 Workings in seams at 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.

- 4.2.16 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 adjacent field to the west, and are therefore not within the proposed development site. In any case, records show them to have either been treated or not require treatment.

- 4.2.17 The two mine entries are also shown on the 1:10,000 BGS map. 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/E/3 in Appendix B.

- 4.2.18 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.

- 4.2.19 Of the seams mentioned in the table above (Section 4.2.13), those which pose the most significant risk of subsidence are the Lidget (due to its shallow depth), the Flockton Thick (due its shallow depth and thickness), and the Parkgate (due to its maximum recorded thickness and estimated depth).

- 4.2.20 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 north of the site at around 140m depth
 - In the south-west at around 80m depth, including beneath the former opencast
 - Workings exist within the Flockton Thick seam in the north and east 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 land further west of the opencast
- 4.2.21 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 the depths stated in Section 4.2.13. Based on the Parkgate Seam abandonment plan, the seams underlying the south-west of the site would be at the following depths:
- Flockton Thin – 33m
 - Fenton – 55m
 - Parkgate – 80m
- 4.2.22 Based on the maximum depth of the opencast (16m), and the maximum thickness of the Flockton Thin (2.0m) any workings beneath its footprint within the Flockton Thin seam could pose a risk of subsidence at the surface. 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.
- 4.2.23 Copies of the abandonment plans are presented as Drawings 2222/E/9, 222/E/10 & 222/E/11 in Appendix B.

4.3 Mineral safeguarded areas

- 4.3.1 The site is underlain by coal and might therefore be considered by the Local Authority to lie within a Mineral Safeguarding Area (MSA). MSAs are areas of known mineral resources that are of sufficient economic or conservation value to warrant protection for generations to come. The purpose of MSAs is not to preclude automatically other forms of development, but to make sure that mineral resources are adequately and effectively considered in land-use planning decisions.
- 4.3.2 Specialist guidance on Mineral Safeguarding "A Guide to Mineral Safeguarding in England" has been produced by The Coal Authority and the British Geological Survey.
- 4.3.3 Paragraph 143 of the National Planning Policy Framework (NPPF) requires Local Authorities, when preparing Local Plans to:
- Define Minerals Safeguarding Areas and adopt appropriate policies in order that known locations of specific minerals resources of local and national importance are not needlessly sterilised by non-mineral development, whilst not creating a presumption that resources defined will be worked; and define Minerals Consultation Areas based on these Minerals Safeguarding Areas.
 - Set out policies to encourage the prior extraction of minerals, where practicable and environmentally feasible, if it is necessary for non-mineral development to take place.

- 4.3.4 NPPF Paragraph 144 notes that when determining planning applications, local planning authorities should give weight to the benefits of the mineral extraction.
- 4.3.5 As a consequence of the NPPF, and the presence of coal beneath the site, the Local Authority may require Barratt to consider the opportunity to recover (extract) the coal. Applicants submitting planning applications may need to demonstrate to the Local Authority that they will extract the coal, unless:
- It can be shown it is not economically viable to do so, or
 - It is not environmentally acceptable to do so, or
 - The need for the development outweighs the need to extract the coal, or
 - The coal will not be sterilised by the development

5 PREVIOUS INVESTIGATION FINDINGS

5.1 General

- 5.1.1 Lithos' scope of works for report 2222/1 included a review 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

5.2 Summary of CoDa's findings

- 5.2.1 CoDa's ground investigation works comprised:
- 14 Trial pits (TPs 1 to 13 & TT1) excavated to between 1.1m and 4.7m.
 - 3 rotary probeholes (PHs R1, R2, & R4) advanced to 30m each.
 - 7 chemical laboratory tests (including pH & metals and PAH on 4 samples of topsoil and 3 samples of made ground).
 - Monitoring wells were installed within CoDa's probeholes, but no gas monitoring was undertaken.
- 5.2.2 CoDa's exploratory holes are shown on Drawing 2222/E/6 in Appendix B
- 5.2.3 Ground conditions encountered by CoDa have been incorporated in Lithos' summary table on pages 14 & 15, but 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).
- 5.2.4 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 seam.
- 5.2.5 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.
- 5.2.6 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.

- 5.2.7 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. The coal in TPs 5 and 9 was split by mudstone/clay.
- 5.2.8 In addition, coal was encountered within rotary boreholes details of which are shown in the table below. 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.

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

- 5.2.9 Borehole R4 is not shown on the hole location plan therefore the log is of limited use.
- 5.2.10 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.
- 5.2.11 No significant contamination was recorded within the samples tested by CoDa.

5.3 Lithos comments

- 5.3.1 In reviewing the information within the CoDa reports, Lithos have noted the following issues.
- 5.3.2 No Coal Authority mining report is referred to, or is included, within the appendices of the report.
- 5.3.3 The former opencast adjacent/on site is not considered by CoDa as a potential source of hazardous gas.
- 5.3.4 An insufficient number of topsoil samples were scheduled for analysis. In addition, the testing suite should have included asbestos ID and TOC.
- 5.3.5 No samples were scheduled for geotechnical analysis (Atterberg limits and moisture content).
- 5.3.6 No gas monitoring data is shown; it is not clear from the report whether any has been carried out or not.
- 5.3.7 CoDa state that plots within 20m of the fault will require semi-rigid rafts; reinforced foundations should suffice.
- 5.3.8 The exploratory hole location drawing shows a borehole which has not been drilled, but is missing other exploratory holes which, according to the report text and logs, were drilled/excavated.
- 5.3.9 The standard of logging in the trial pits and trial trenches is poor, often not showing clear boundaries between clay and bedrock.

- 5.3.10 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 GROUND INVESTIGATION DESIGN

6.1 Anticipated ground conditions & potential issues

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

Anticipated condition	Remarks
Made ground	Deep made ground (>10m) within former opencast, possible veneer elsewhere in the north as encountered by CoDa.
Natural soils	Weathered coal measures (firm to stiff clay).
Bedrock	Mudstone bedrock (sandstone in the north) at <3m depth.
Mineworkings	Possible within the Lidgett and Joan coal at <30m depth.
Groundwater	Unlikely at shallow depth, true groundwater likely to be at depth within bedrock.

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

Type of issue	Specific issue	Remarks
Potential on-site contamination sources	1. Made ground 2. Opencast backfill (south-west) 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 made ground 2. Steep slopes 3. Shallow workings	1. Backfilled opencast (south-west) 2. In the south/central 3. Within underlying Lidgett & Joan coal seams
Other potential constraints	1. Underground utilities	1. Water & other 'unknown' services

6.2 Preliminary conceptual site model

- 6.2.1 A preliminary conceptual site model, presented as Drawing 2222/E/5 in Appendix B, has been prepared after consideration of all the data presented in Sections 2 to 6.1 inclusive of this report.
- 6.2.2 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, 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.

- 6.2.3 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
Sewage farming, slurry spreading	Methane, metals, nitrates, oxygen depletion
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

- 6.2.4 Receptors include site workers, future residents, vegetation and proposed buildings.
- 6.2.5 Significant geotechnical hazards include the presence of sloping ground, possible shallow mineworkings and deep made ground associated with the former opencast in the south-west.

6.3 Ground investigation design & strategy

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

Exploratory holes	Purpose
TPs 1 to 14	To determine the general nature of soils underlying the site, including the: - Nature, distribution and thickness of shallow soils, including any made ground - Suitability of the ground for founding structures and highways
TTs 1 to 4	To determine the location of the former opencast 'highwall'.

- 6.3.2 Proposed exploratory hole locations were selected to provide a representative view of the strata beneath the site and to target potential areas of interest identified in Section 6 above. A nominal 50m grid spacing was proposed. Additional exploratory locations might be scheduled by the site engineer in light of the ground conditions actually encountered.
- 6.3.3 The number of representative samples taken will be reflective of the geological complexity actually encountered. However, in general about 3 samples will be taken from most trial pits.

7 FIELDWORK

7.1 Scope of works

7.1.1 Fieldwork was supervised by Lithos on 16th & 17th May 2016. Works undertaken are summarised below:

Technique	Exploratory holes	Final depth(s)	Remarks
Trial pitting (machine dug)	TPs 1 to 14, & 6A	0.9m to 3.6m	Vane tests in cohesive soils
Trial trenches (machine dug)	TTs 1 to 4	1.5m to 3.7m	Targeting boundary of the opencast

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

7.1.3 Exploratory hole logs are presented in Appendix F to this Report. These logs include details of the:

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

7.1.4 Exploratory hole locations are shown on Drawing 2222/E/6 presented in Appendix B.

8 GROUND CONDITIONS

8.1 General

8.1.1 A complete record of strata encountered beneath the proposed development site is given on the exploratory hole records, presented in Appendix F.

8.2 Made ground

8.2.1 Made ground was only encountered in the south-west of the site (area of former opencast) to depths in excess of 3.7m.

8.2.2 Trial trenching was undertaken across the suspected boundary of the opencast; the 'highwall' was identified in all 4 trial trenches, and was subsequently surveyed-in. Where encountered in TTs 01 to 04, the highwall appeared very steep/near vertical. Made was encountered in most TTs on the 'outside' on the opencast to depths of up to 2.9m, in some cases 'stepping' upwards moving away from the opencast.

8.2.3 Material generally comprises very clayey gravel/firm to stiff gravelly clay; gravel includes mudstone, siltstone and occasional coal with rare fragments of clayware and metal.

8.2.4 In TT02, dense gravel of siltstone was encountered at 1.7m depth, thought to be 'engineered fill'.

8.2.5 The majority of the backfill is essentially re-worked natural soils which often look to have been placed with some degree of engineering/compaction and therefore can be easily misinterpreted as natural soils.

8.2.6 Outside of the opencast, CoDa encountered made ground within their TPs 2 and 5. Lithos' TPs 9, 12 and 14 were excavated within the vicinity of the above exploratory holes but did not encounter any made ground.

- 8.2.7 After review of CoDa's trial pit logs, it seems likely that the made ground logged in TP2 only extends to 0.7m and is essentially topsoil with occasional anthropogenic materials. The material logged as made ground from 0.7m to 1.2m has been misinterpreted and is considered by Lithos to be natural, weathered sandstone.

8.3 Obstructions

- 8.3.1 In TT04(S) a concrete service pipe, roughly 0.5m diameter, was noted encountered at 0.9m in the north face. Its location was surveyed in and this information has been passed on to Barratt. No damage was done to this service pipe. Its nature is unknown as it is not shown on any statutory service records, however it looks likely to be a water/sewage pipe.

8.4 Natural ground

- 8.4.1 Natural ground was encountered in the majority of the exploratory holes, and typically comprised topsoil (generally 300mm in thickness), over residual soils (firm to stiff gravelly clay) with mudstone/siltstone bedrock at an average depth of 2.5m.
- 8.4.2 In the north and east the topsoil is underlain by dense gravel of sandstone (weathered sandstone) with sandstone bedrock at notably shallower depth (average of 1.0m), as encountered in TPs 9 to 12 & 14.
- 8.4.3 Coal was encountered within TPs 08 and 13 (Lidget seam) in the central-west at depths of 0.8m to 2.2m and 0.4m to 1.9m respectively.
- 8.4.4 Evidence of the Lidget seam was also encountered in TPs 02 and 03 to the south although in these locations it was highly weathered and much thinner (max. 0.5m thickness).

8.5 Visual & olfactory evidence of organic contamination

- 8.5.1 No visual/olfactory evidence of organic contamination was noted in any of the trial pits.

8.6 Groundwater

- 8.6.1 A groundwater inflow was noted in TT03 (E) at 2.5m within the mudstone bedrock. No other significant inflows were encountered.

8.7 Stability

- 8.7.1 Some slight collapse of excavations was noted when excavating through the Opencast Backfill.
- 8.7.2 Stability of excavations within the natural ground was generally good.

Summary of Ground Conditions

Hole	Final depth (m)	Depth to Base of (m)							Depth to Rockhead (m)	Bedrock
		Topsoil	Made Ground	Opencast Backfill	Completely Weathered Coal Measures (clay)	Weathered Coal Measures (gravel/cobble)	Wedathered Lidget coal seam	Lidget Coal seam (thickness)		
Lithos TPs – May 2016										
TP01	2.6	0.2			1.5	2.1			2.1	Siltstone
TP02	3.6	0.3			2.0				2.0 / 3.3	Mudstone / Siltstone
TP03	2.1	0.3			2.0	> 2.1				
TP04	2.5	0.3			> 2.5		0.9			
TP05	2.4	0.4			1.3	> 2.4				
TP06	2.7	0.2			2.5	> 2.7				
TP07	2.2	0.3			1.4 / 2.1		1.5		2.1	Siltstone
TP08	3.0	0.3			0.8 / 2.5	> 3.0		2.2 (1.4)		
TP09	1.0	0.3				0.95			0.95	Sandstone
TP10	1.55	0.3				1.5			1.5	Sandstone
TP11	1.05	0.3			1.0	0.6			1.0	Sandstone
TP12	1.1	0.3				1.0			1.0	Sandstone
TP13	2.1	0.4			0.4 / 1.3 / > 2.1		1.1 / 1.9			
TP14	0.9	0.4				0.8			0.8	Sandstone
TT01 (N)	2.5	0.4		0.8		1.2			1.2	Mudstone
TT01 (S)	2.4	0.4		> 2.4						
TT02 (N)	2.0	0.4		1.5					1.5	Mudstone
TT02 (C)	3.6	0.4		2.5					2.5	Mudstone
TT02 (S)	3.6	0.4		> 3.6						
TT03 (E)	2.5	0.6		1.6	2.2				2.2	Mudstone
TT03 (C)	3.0	0.6		2.9					2.9	Mudstone
TT03 (W)	3.6	0.6		> 3.6						
TT04 (N)	3.7	0.3		> 3.7						
TT04 (S)	1.5	0.3		1.3	> 1.5					
CoDa TPs – September 2014										
TP1	1.7	0.3				1.1			1.1	Sandstone
TP2	1.3	0.3	1.2						1.2	Sandstone

Hole	Final depth (m)	Depth to Base of (m)							Depth to Rockhead (m)	Bedrock
		Topsoil	Made Ground	Opencast Backfill	Completely Weathered Coal Measures (clay)	Weathered Coal Measures (gravel/cobble)	Wedathered Lidget coal seam	Lidget Coal seam (thickness)		
TP3	1.7	0.3			1.3	1.0			1.3	Sandstone
TP4	3.4	0.3			1.7				1.7	Mudstone
TP5	4.3	0.2	0.8		4.3			3.9 (0.9)	1.6	Mudstone
TP6	1.6	0.2							0.2	Sandstone
TP7	3.3	0.3			1.1				1.1	Mudstone
TP8	3.6	0.2			1.6			3.1 (0.35)	1.6 & 3.1	Mudstone
TP9	3.5	0.3			0.8 & 2.4			2.1 (1.3)	2.4	Mudstone
TP10	1.4	0.3			0.9				0.9	Sandstone
TP11	1.1	0.3							0.3	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

8.8 Revised conceptual ground model (ground conditions)

- 8.8.1 The Preliminary Conceptual Site Model has been revised in light of data obtained during the ground investigation, most notably with respect to:
- The nature and distribution of made ground
 - The absence of contamination (based on visual/olfactory evidence only)
- 8.8.2 The revised Conceptual Site Model is presented in Appendix B, as Drawing 2222/E/7. Further refinement of the Conceptual Site Model is presented in Section 10.1, where the results of laboratory testing for contaminants have been considered.

9 CONTAMINATION (ANALYSIS)

9.1 General

- 9.1.1 The site's former usage (arable farmland with opencast mining in the far south-west) is considered unlikely to have given rise to any significant ground contamination. Furthermore, outside of the opencast backfill, no significant made ground was encountered during the ground investigation. However, samples of topsoil have been recovered in order to confirm its suitability for re-use. Selected samples of the made ground (Opencast Backfill) have also been scheduled for chemical testing.
- 9.1.2 An assessment of potential contaminants associated with the former uses has been undertaken; see Section 0.
- 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).
- 9.1.6 Generic Note 04 in Appendix A provides further details with respect to current guidance and the interpretation of analytical data.

9.2 Testing scheduled

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

Type of sample	No. of samples	Determinands
Topsoil	6	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc)
	5	Asbestos ID TOC Speciated Polycyclic Aromatic Hydrocarbons (PAH)
	2	Organo Chlorine Pesticides Organo Phosphorus Pesticides
Opencast Backfill	3	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc) Asbestos ID TOC Speciated Polycyclic Aromatic Hydrocarbons (PAH) Water soluble sulphate, chloride, nitrate and magnesium

9.3 Soil contamination results

- 9.3.1 The soil contamination test results are summarised in the table on page 18.
- 9.3.2 Laboratory test certificates as received from the laboratory are presented in Appendix G to this report.
- 9.3.3 No significant inorganic or organic contamination has been encountered in any of the samples tested.

10 CONTAMINATION (QUALITATIVE RISK ASSESSMENT)

10.1 Topsoil

- 10.1 Topsoil, typically 300mm thick underlies the entire site. Testing suggests this material is chemically suitable for re-use.
- 10.2 Given the nature of the topsoil present on this site it would be expected to be suitable to support plant growth. However, no testing in accordance with BS3882:2015 Specification for Topsoil (N-P-K, clay content etc) has been undertaken to date.

10.2 Revised conceptual ground model (contamination)

- 10.2.1 The Preliminary Conceptual Site Model has been amended in light of data obtained during the ground investigation, most notably with respect to the lack of contaminants within the made ground.
- 10.2.2 A revised Conceptual Site Model is presented as Drawing 2222/E/7 in Appendix B.

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		Asbestos I.D.
				B(a)P ∞	Naphthalene											
						37	5	26	3000	200	200	169	127	350	200	
TP01	0.1	Topsoil	9.3	23	<1	<1	22	43	81	<1	21	<3	150	0.4	0.1	N.D.
TP03	0.1	Topsoil	7.0	17	<1	<1	21	42	59	<1	21	<3	120	<0.1	<0.1	N.D.
TP06	0.1	Topsoil	7.1	21	<1	<1	24	47	79	<1	27	<3	180	0.2	0.1	N.D.
TP08	0.1	Topsoil	7.0	21	<1	<1	23	43	69	<1	23	<3	130	<0.1	<0.1	N.D.
TP10	0.1	Topsoil	7.2	16	<1	<1	18	34	60	<1	20	<3	120	<0.1	<0.1	N.D.
TP12	0.1	Topsoil	7.0	16	<1	<1	18	44	66	<1	19	<3	120	-	-	
TT01 (S)	0.6	Opencast Backfill	6.6	13	<1	<1	23	34	46	<1	27	<3	120	0.2	<0.1	N.D.
TT03 (E)	0.8	Opencast Backfill	7.5	7	<1	<1	22	39	33	<1	48	<3	140	<0.1	<0.1	N.D.
TT04 (S)	0.8	Opencast Backfill	7.5	13	<1	<1	23	36	48	<1	33	<3	130	<0.1	<0.1	N.D.
Key								Source of Guidance Trigger Level								
36	Parameter tested for and found to be in excess of Tier 1 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. Values assume contaminants located in a sandy loam, with 6% soil organic matter (SOM).								
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 screen would be 21mg/kg															
*	Assumes mercury present as an inorganic compound (cf elemental metal or within organic compound). See Science Report SC050021/Mercury SGV.															
								N.D.	Not detected, applicable to asbestos I.D. screen only							

11 HAZARDOUS GAS

11.1 General

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

Source	Receptors	Hazard	Pathway	Initial risk
On-site & immediately adjacent made ground (Backfilled opencast)	Human health	Asphyxiation & explosion	Vertical migration, ingress & accumulation	Very low: made ground essentially re-worked natural soils, with little degradable matter
	Buildings	Explosion		
Possible shallow mineworkings	Human health	Asphyxiation & explosion	Vertical migration, ingress & accumulation	Moderate: no significant thickness of low permeability drift or bedrock above workings
	Buildings	Explosion		

- 11.1.2 Given the above, it is recommended that monitoring wells be installed across the site and a gas monitoring programme comprising at least 6 visits over 3 months be carried out.

12 GEOTECHNICAL TESTING

12.1 General

- 12.1.1 A total of 10 samples of natural soil were delivered to a suitably accredited laboratory with a schedule of geotechnical testing drawn up by Lithos.
- 12.1.2 The geotechnical laboratory test results are presented in Appendix H to this report.

12.2 Atterberg limits

- 12.2.1 The plasticity indices of 6 samples of cohesive soil have been determined; results are summarised below.

Soil type	Moisture content range (average)	Range of Plasticity Indices* (average)	Shrinkability
Weathered Coal Measures	18-37 (30)	17-42 (33)	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.

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

12.3 Soluble sulphate and pH

- 12.3.1 In accordance with BRE Special Digest 1:2005, this site has been classified as greenfield with a mobile groundwater regime.
- 12.3.2 It is envisaged foundations will extend to depths of about 1m through made ground (opencast only) and natural strata and samples taken from this depth range have been submitted for pH and water-soluble sulphate (2:1 soil/water extract).

12.3.3 The concentrations of sulphate in the aqueous natural soil extracts of 10 samples were determined. In addition, 3 samples of made ground were tested as part of the contamination suite. The pH value of each sample has also been determined.

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

Soil type	Lowest pH values	Highest soluble sulphate concentration (mg/l)
Opencast Backfill	6.6	<10
Natural soils	5.0	74

12.3.5 Two samples yielded pH values below 5.5, therefore supplementary analysis to determine the concentrations of magnesium, chloride and nitrate was scheduled. The equivalent sulphate concentrations for chloride and nitrate were determined and added to the soluble sulphate concentration for each sample; these results have been included in the above table.

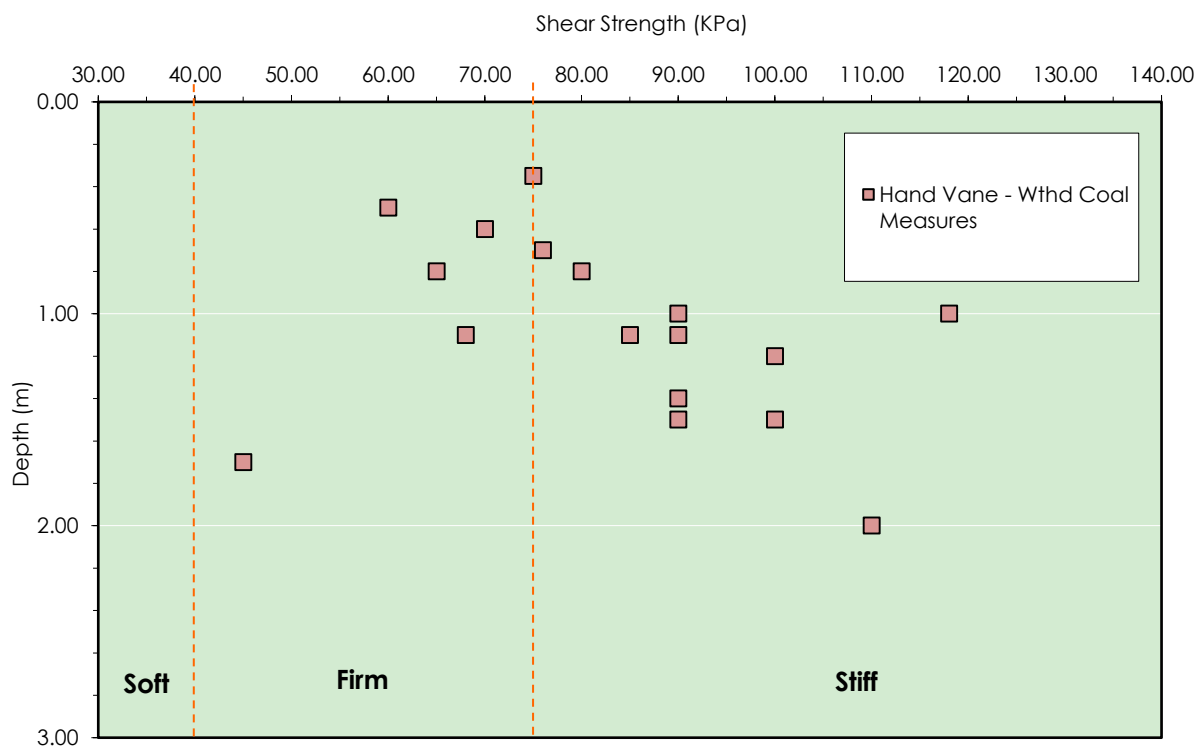
12.3.6 In accordance with Tables C1 and C2 of SD1, sub-surface concrete should be Design Sulphate Class DS-1, with the site allocated an ACEC Classification of AC-2z.

Hand shear vane testing

12.3.7 Hand shear vane testing was undertaken within trial pits in-situ to around 1.2m depth and from larger blocks of excavated clay below that depth.

12.3.8 The results are summarised within the plot below and illustrate a linear increase in undrained shear strength (S_u) with depth within the Weathered Coal Measures stratum. Below approximately 0.9m depth S_u is typically greater than 65kPa.

12.3.9 The plot below provides a summary of undrained shear strengths.



13 GEOTECHNICAL ISSUES

13.1 Conceptual site model

- 13.1.1 The majority of the site is underlain by firm to stiff gravelly clay (Weathered Coal Measures), overlying mudstone/siltstone bedrock at an average depth of 2.5m.
- 13.1.2 In the north and east the topsoil is underlain by dense gravel of sandstone (weathered sandstone) with sandstone bedrock at notably shallower depth (average of 1.0m).
- 13.1.3 Coal was encountered within TPs 08 and 13 (Lidget seam) in the central-west at depths of 0.8m to 2.2m and 0.4m to 1.9m respectively.
- 13.1.4 Made ground (Opencast Backfill) was encountered in the south-west only to depths in excess of 3.7m.
- 13.1.5 Trial trenching was undertaken across the suspected boundary of the opencast; the 'highwall' was identified in all 4 trial trenches, and was subsequently surveyed in.

13.2 Mining & quarrying

- 13.2.1 This site is located within a Coal Mining Development High Risk Area; an area of Opencast Backfill to depths in excess of 3.7m has been identified in the far south-west.
- 13.2.2 There are no known quarries on, or within 50m of the site.
- 13.2.3 Lithos' ground investigation and the results from CoDa's rotary boreholes indicates the presence of shallow coal (Lidget seam) underlying much of the north of the site, outcropping in the centre trending roughly north-east to south-west.
- 13.2.4 No evidence of any workings was encountered by CoDa within the Lidget seam, however it is considered that an insufficient amount of probeholes was advanced by CoDa.
- 13.2.5 The abandonment plans suggest that the Flockton Thin, Fenton and Parkgate seams lie at around 33m, 55m and 80m beneath the site respectively.
- 13.2.6 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.
- 13.2.7 Given the absence of loose superficial deposits, if bell pits are present, it is considered unlikely that such mine entries would have been lined.
- 13.2.8 Whilst the Coal Authority (and NHBC) discourage development over or adjacent to shafts, such features are typically of less concern where they only extend to relatively shallow seams. Consequently, they are not expected to result in the need for "no-build" zones, but any found will require grouting, and any plots built over or adjacent to mine entries will require appropriate foundation design.

13.3 Site regrade

- 13.3.1 Given the sloping nature of the site, it is likely that some 'cut and fill' earthworks will be required to form level development platforms for a number of plots.

- 13.3.2 There will also likely be a need for retaining walls, as well as possibly some underbuild and tanking.

13.4 Foundation recommendations

General

- 13.4.1 Foundation recommendations assume that development will be two or three storey construction and that line loads will not exceed 90kN/m run. If this is not the case significant alteration to these recommendations will be required.
- 13.4.2 We have assumed that final development levels will not differ significantly from ground levels existing at the time of investigation. Any digital terrain modelling undertaken, or commissioned, by Barratt should consider implications for the foundation recommendations outlined below.
- 13.4.3 Made ground is not considered a suitable foundation material and foundations should therefore be taken through these materials into underlying natural strata of adequate bearing capacity.
- 13.4.4 Two main foundation solutions are considered likely to be most appropriate for proposed dwellings at this site:
- Strips/trench fill for plots located **beyond** the opencast backfill; and
 - Piles for plots located **within** the opencast backfill
- 13.4.5 Any plot layout for this site should take account of the known high walls (as shown on Drawing 2222/E/6. Most notably, the foundations of plots just *beyond* the area of opencast backfill would ideally be placed below a line drawn up at 45° from the base of the high wall. Assuming a quarry depth of 12m and sub-vertical high walls this would effectively result in a sterile zone about 12m wide. However, a slimmer sterile zone of 3m should suffice, subject to NHBC approval, provided plots between 3m and 7m from the high wall are founded entirely in rock. This is likely to be the case for Plot 33.
- 13.4.6 Piles for plots that only extend 1m or 2m over a steep high wall may encounter problems with socketing.

Strip/trench fill footings

- 13.4.7 It is considered that shallow strip or deepened trench fill footings will be the most suitable foundation solution for the majority of two or three storey houses located **beyond** the opencast backfill. This solution is viable where the made ground is less than about 2.5m thick, and firm clay or competent rock is the founding material.
- 13.4.8 Reinforcement, as a precaution against differential settlement, is recommended only where foundation excavations encounter significant lateral and vertical variations in strata. One layer of B385 mesh placed 75mm above the base of the footing is likely to provide suitable reinforcement, but further advice should be sought from the Structural Engineer.
- 13.4.9 Foundations will be required to be placed below a line drawn up at 45° from the base of any service or similar excavation.
- 13.4.10 Overdeepened foundations should be stepped in accordance with NHBC Standards, Chapter 4.4.
- 13.4.11 In order to minimise softening and swelling of cohesive soils or loosening of granular soils, it is recommended that footings are cast as soon as formation level is reached (or alternatively formation could be blinded using concrete with as low a water:cement ratio as possible).

- 13.4.12 Barratt or their groundworker should seek further advice from Lithos if unexpected ground conditions are encountered in foundation or sewer excavations, including any conflict between soft ground associated with a backfilled trial pit excavation and the line of a proposed footing.

Granular soils (weathered bedrock) – north & east

- 13.4.13 The weathered in-situ sandstone is assumed to have a relative density of at least medium dense (in accordance with BS5930:2015).
- 13.4.14 A safe bearing capacity of around 170kPa can be assumed if the following are true:
- A maximum foundation line load of 90kN/m run
 - A foundation length of 8m
 - A foundation breadth of 0.6m
 - A foundation thickness of 225mm
 - A foundation depth of 0.6m
 - An angle of shearing resistance of $\phi=33^\circ$ for the granular deposits
- 13.4.15 Assuming the foundation geometry detailed above, minimal settlements would be anticipated.
- 13.4.16 In accordance with NHBC Standards, a minimum founding depth of 450mm (due to potential frost susceptibility) is required in granular soils. This depth should be taken from finished ground level to the underside of the footing. If finished ground level is to be above existing ground level then the foundation excavation simply needs to ensure that there is sufficient depth of excavation to allow casting of the footing entirely within natural ground (not made ground or topsoil).
- 13.4.17 However, if the excavation is dug from original ground level in cold conditions when freezing is expected, then foundation depth should be taken from the existing, not finished, ground level.
- 13.4.18 It should be noted that founding at shallow depth (450mm), whilst desirable from an excavation stability viewpoint, may not provide sufficient bearing capacity due to the lesser depth of (resisting) overburden. Consequently, a minimum founding depth of 600mm is recommended.
- 13.4.19 It should also be noted that the footing may require deepening or stepping in order to allow plot drainage to exit the plot footprint (either over or under the footing).

Clay/cohesive soils – central, south & west

- 13.4.20 A safe bearing capacity of around 170kPa can be assumed if the following are true
- A maximum foundation line load of 90kN/m run
 - A foundation length of 8m
 - A foundation breadth of 0.6m
 - A foundation thickness of 225mm
 - A foundation depth of 0.9m depth
 - An undrained shear strength of 65kPa for the firm clay (typical minimum recorded on site)
- 13.4.21 Assuming the foundation geometry detailed above, minimal settlements would be anticipated.
- 13.4.22 Clay classification tests suggest that natural cohesive soils at the site should be regarded as being of medium shrinkability. A minimum founding depth of 900mm is therefore recommended for all soils on the site where strip footings are proposed.
- 13.4.23 In accordance with NHBC Standards, founding depths in cohesive soils should be taken from original or finished ground level, whichever is the lower, to the underside of the footing.
- 13.4.24 Foundations should be deepened near trees in accordance with NHBC Standards Chapter 4.2. It is estimated that up to 30% of the proposed plots may be affected by trees.

Bedrock

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

Coal

- 13.4.29 Given the position of the Lidget seam outcrop (as shown on Drawing 2222/E/2), and depending on final development levels, it is likely that coal will be encountered during any 'cutting' of the slope as part of the site re-grade; and also within foundation excavations of a number of plots across the central-north/east of the site.
- 13.4.30 Care should be taken not to unnecessarily overdeepen foundations, in order to minimise the chance of encountering coal.

- 13.4.31 Where foundation excavations do come into contact with coal, the foundation should be taken through the coal seam, into underlying natural in-situ strata of adequate bearing capacity. The full thickness of coal should then be sealed with concrete to create a trench fill foundation. To prevent the ingress of air, the mass concrete fill should be placed as soon as possible after exposing the seam.
- 13.4.32 By virtue of the provisions of the Coal Industry Act 1994 interests in unworked coal and coal mines previously vested in the British Coal Corporation are now vested in the Coal Authority. The developer will need to contact the Coal Authority to dig or carry away such coal as they encounter in connection with redevelopment of the site (this is often referred to as incidental coal).

Geological fault

- 13.4.33 Drawing 2222/E/2 shows the approximate line of two faults superimposed on the proposed housing layout; the faults both cross the south-east corner.
- 13.4.34 It should be noted that the line of a fault on a geological map is often very approximate, and it may be inaccurate by 10m or more. Furthermore, the presence of a fault is usually 'masked' by overlying drift or residual soils; they can only be seen where long trenches are excavated into bedrock.
- 13.4.35 At this site, no movement associated with past, present or future mining is anticipated, therefore building can take place over the fault, without the need to search for the fault, and without the need to adopt special precautions in the footings of those plots suspected to lie in the vicinity of the fault.
- 13.4.36 However, NHBC like to see reinforcement of footings with one layer of B385 mesh placed 75mm above the base of the footing. Given the uncertainty regarding the precise line of the fault, it would be prudent to reinforce the footings of all plots within 25m of its assumed line; i.e. Plots 18 to 41.
- 13.4.37 Further advice should be sought if a significant weak zone is encountered (e.g. ground comprising loose, broken or soft 'gouge' material) during the excavation of footings. If associated with a fault, the weak zone is likely to form a fairly continuous "linear belt", rather than a localised "pocket", and be anything from a few centimetres to a few metres in width.

Piled foundations

- 13.4.38 Piled foundations will be required for plots proposed **within** are of the former opencast. The following general comments relating to piling are provided for guidance, and further advice should be sought from a specialist-piling contractor.
- 13.4.39 Piled foundations should extend into the underlying bedrock. The safe working load that may be supported on a pile is dependent on the pile diameter, its founding depth and the method of installation.
- 13.4.40 Plots in the vicinity of steep high walls should ideally be set-back at least 3m from the high wall and founded entirely on bedrock, or extend over the high wall by between 3m and 6m. Piles for plots that only extend 1m or 2m over a steep high wall are more likely to encounter problems with socketing.
- 13.4.41 As piles would be founded in bedrock, they will be essentially end-bearing.
- 13.4.42 Consequently, preliminary estimates for pile lengths in the order of 15m to 20m.
- 13.4.43 Given the presence of cohesive made ground (opencast backfill), it is essential that pile design allows for downdrag (negative skin friction).

- 13.4.44 It is recommended that flexible service connections are used on this site, especially where they enter the buildings, in order to avoid any possible damage due to self-settlement of the weak strata once the site is developed.
- 13.4.45 It should be noted that driven piles can induce some ground vibration. Assessment of any vibration risk to adjacent structures and/or existing site features should be undertaken by pile designer.
- 13.4.46 Should any impenetrable shallow obstructions be encountered, i.e. boulders, they should either be grubbed-up, or alternatively the piling layout could be re-designed (although might also require design of foundations able to span and/or cantilever as necessary).
- 13.4.47 New houses can be built off ring beams designed to span the piles. In order to bond them to the piles, the tops of the piles must be broken out to expose the reinforcement, which can then be tied to that of the beams.
- 13.4.48 Where plots are founded close to or over any high walls associated with the former opencast, piles must be socketed into rock and not allowed to deflect off the high wall. This may require pre-drilling and casing of piles. An allowance should also be made for changing piling locations and ground beam design to account for any difficulties encountered with high walls associated with the former opencast.
- 13.4.49 NHBC generally require pile lengths to be at least 3m; therefore where plots cross a high-wall and rock is encountered at shallow depth (<3m) on the 'outside' of the opencast, pre-boring of piles may be required to reach required depths.
- 13.4.50 If ground beams are found to span across the high wall it should be ensured that they span from the pile head onto competent rock.
- 13.4.51 For piled foundations suspended floor slabs should be utilised. A pre-cast 'Beam and Block' concrete ground floor construction suspended across the ring beams could be utilised.
- 13.4.52 A proprietary driven piling system, incorporating ring beams and pre-cast concrete ground floor construction could be considered for this development.
- 13.4.53 Ground conditions at this site are considered likely to require provision of a piling mat (working platform) and further advice should be sought from the appointed specialist-piling contractor regarding the proposed plant loadings and resulting pressures. This data, together with a knowledge of the strength and variability of the near-surface ground conditions is required in order that design of a mat can be undertaken in accordance with guidance provided in the 2004 BRE document, "BR 470: Working platforms for tracked plant".
- 13.4.54 The design of working platforms for tracked plant is a geotechnical design process and should be carried out by a competent person. The following parties should have input into the design:
- Permanent works designer, to consider additional uses for platform material as part of the overall development
 - Principal contractor, to define any other purposes for which the platform might be used
 - Contractor or subcontractor, to specify requirements for the the platform, including gradients, ramps and edges

Summary of foundation recommendations

- 13.4.55 In summary, the following foundation solutions are likely to be most appropriate (subject to Barratt preferences regarding site preparatory works, final levels & costs associated with each foundation option).

Plot nos	Foundation solution(s)	Remarks (influencing factors)
6 to 9, 11 to 16, 46 to 55	Strips at 0.6m to 0.9m	Granular weathered bedrock. Can be placed on bedrock if encountered at depths >450mm.
1 to 5, 10, 17 to 30, 34 to 45, 56	Strips at >0.9m	Medium shrinkability clays. Deepened where necessary due to coal/trees. Can be placed on bedrock if/when encountered at >450mm.
33	Deep strips to c.1.5m	Within vicinity of backfilled opencast; deepened strips must reach mudstone bedrock.
31 & 32	Piles to about 15m.	Made ground associated with backfilled opencast. Spanning highwall & pre-boring for shallow piles may be required

- 13.4.56 Lithos could prepare a detailed Foundation Schedule if provided with: an External Works Drawing (with proposed FFLs & infrastructure details); a topographic survey and a tree survey. Such a schedule would take into account tree influence and the plots which would require deepening due to coal.
- 13.4.57 The foundation solutions outlined in the above table assume that ground levels will not change significantly from those existing at present. If this is not to be the case, further advice should be sought from Lithos.

13.5 Floor slabs

- 13.5.1 It is considered that, outside the zone of influence of trees, the natural ground is generally suitable for the use of ground bearing floors. However, ground bearing slabs should not be cast on topsoil or made ground. Where plots are elevated for design reasons, the depth of engineered stone below a ground bearing slab should not exceed 600mm, in accordance with NHBC guidance.
- 13.5.2 Suspended floor slabs should be utilised where the depth of made ground or engineered stone exceeds 600mm in accordance with NHBC Standards Chapter 5.1 (to negate potential settlement problems).
- 13.5.3 Where foundations are within the influence of existing or proposed trees, and a trench fill foundation depth of 1.5m or greater is required, the ground floor should be constructed using block and beam, or another suitable voided construction. A suitable approved compressible void former, should be used on the internal face of all external walls.
- 13.5.4 The natural ground beneath this site includes cohesive soils and is therefore subject to seasonal variation in moisture content. If ground slabs were constructed on desiccated soil, heave of the slab would occur on re-hydration of the ground. If any significantly desiccated soil is present, a block and beam floor construction should be adopted. In accordance with NHBC Standards Chapter 4.2, a minimum void height of 250mm should be adopted.
- 13.5.5 It should be noted that NHBC have suffered a significant number of claims resulting from the use of ground bearing floor slabs. Consequently, if ground bearing slabs are proposed, care should be taken correct and careful construction. For example, if fill to the internal face of the foundation excavation is not properly compacted, subsequent settlement can result in cracking of the slab.
- 13.5.6 In the event that coal is exposed beneath the floor void, it would be prudent to prevent air ingress and the potential for spontaneous combustion by blinding with concrete, or removing the coal.

13.6 Designated concrete mixes

- 13.6.1 The following designated mixes in accordance with BRE Special Digest SD1 and BS 8500: Part 1: 2006 will be suitable for use on this site.

Application	DS-1 conditions ACEC Class AC-2z
Unreinforced strip/trench fill footings	FND2Z
Reinforced strip/ trench fill footings (mesh reinforcement)	FND2Z
Pads, rafts and ground beams	FND2Z
Unreinforced concrete floor slabs	FND2Z
In situ reinforced concrete floor slabs	RC28/35

Note. The use of an FND mix imposes a strength class of C28/35 on the structural designer; if this is not acceptable a designed mix in accordance with BS8500-1:2006 should be specified.

The specification of concrete to floors in AC-2s conditions and above assumes the concrete is isolated from the ground via a damp proof membrane and blinding.

13.7 Excavations

- 13.7.1 Groundwater should be controlled in accordance with CIRIA report 113 "Control of Groundwater for Temporary Works".
- 13.7.2 Based on the results of the investigation it is considered unlikely that major groundwater flows will be encountered in shallow excavations across the majority of the site.
- 13.7.3 Within the area of Opencast Backfill, inflows should be anticipated at around 2.0m depth.
- 13.7.4 Excavations should remain stable in the short term but if left open for any significant period of time may require shoring most notably in the opencast backfill. Some collapse of the Opencast Backfill is likely when excavating through it for foundation trenches; shoring is recommended for deeper excavations (eg for drainage) in this area of the site.
- 13.7.5 Sandstone bedrock was encountered in several exploratory holes, in the north and east. Based on the exploratory hole logs, excavation greater than 1m is likely to prove difficult across about 30% of the site. It would therefore be prudent to allow for excavation of hard rock in any deep excavations such as those that may be required for drainage etc.

13.8 Drainage

- 13.8.1 Based on observations made during the investigation, soakaways are unlikely to provide a suitable drainage solution for surface water run-off across the majority of the site. However, where sandstone bedrock was encountered (in the north and east), soakaways may be more successful.
- 13.8.2 Whilst the site may not lend itself to the adoption of discrete soakaways, ground should have the capacity to absorb surface water run-off, and systems which spread infiltration over a wider area (e.g. an infiltration basin, swales and/or pervious paving) may provide the best solution.

13.8.3 Alternative SUDS options (see CIRIA C697:2007 for further details) include:

- Swales – linear grassed features in which surface water can be stored or conveyed. Where suitable, swales can be designed to allow infiltration.
- Infiltration basins – vegetated depressions designed to store runoff and infiltrate it gradually into the ground.
- Pervious Pavements – provide a surface suitable for pedestrian and/or vehicular traffic, while allowing rainwater to infiltrate into subsurface storage, with subsequent infiltration or controlled discharge. Pavement could be porous (water able to infiltrate across entire surface material; e.g. reinforced grass), or permeable (water infiltrates via joints between concrete blocks).
- Ponds – designed to have permanent pool of water, but with capacity to provide temporary storage controlled discharge.

13.8.4 When considering soakaways it should be borne in mind that CIRIA C697:2007 recommends that soakaways should not be constructed 'in ground where the water table reaches a level within 1 m below the base of the soakaway at any time of the year'.

13.8.5 Due to the sloping nature of the site, consideration should also be given to the possibility of springs occurring down-hill as a result of soakaways.

13.8.6 It is recommended that the developer contact Yorkshire Water Services with respect to capacity in existing foul and surface water sewers in the vicinity of the development area.

13.9 Highways

13.9.1 Based on visual inspection of the natural materials and the recorded plasticity indices at the site, published tables (Interim Advice Note 73/06 Revision 1 (2009), Chapter 5. Characterisation of Materials Design Guidance For Road Pavement Foundations - Draft HD25) indicate that the natural soils will have a CBR value of at least 3%. These values should also be verified prior to or during construction.

13.9.2 Whilst the CBRs estimated above should be achievable, significant deterioration during/after periods of significant rainfall is likely and/or site trafficking. Consequently, it would be prudent to consider flexibility in the groundworks programme to enable highway construction during prolonged dry/warm weather (typically between May and September) when formation will be least vulnerable to deterioration. Alternatively, a minimum 200mm thickness of suitable granular fill (ie a "blanket" of 6F2) could be placed along the line of proposed highways to protect formation during the construction phase.

13.9.3 Special precautions would be required if an adoptable highway crosses the area of deep opencast backfill in the south-west. Based on the current layout, it is understood that this is not the case. If any changes to the current layout be made, further advice should be sought from Lithos.

13.10 External works

13.10.1 Any digital terrain modelling undertaken, or commissioned by Barratt should be made available to their Engineering Designer prior to issue of an External Works Drawing.

13.10.2 Given the sloping nature of the site, there is likely to be a need for retaining walls and some underbuild, tanking etc.

14 REDEVELOPMENT ISSUES

14.1 General

- 14.1.1 This report has presented options with respect to foundation solutions, etc that are considered technically feasible and in line with current good practice. Consequently, we would expect to obtain regulatory approval for whichever option is adopted, although this cannot be guaranteed. Copies of this report should be forwarded to the relevant regulatory authorities (Warranty Provider & Local Authority) for their comment/approval.

14.2 Control of excavation arisings

- 14.2.1 The groundworker should carefully segregate (and stockpile separately) made ground arisings and any coal from arisings of "clean" natural soils, in order that an excessive volume of unsuitable material is not generated.
- 14.2.2 It should be ensured that the groundworker understands the need for good materials management. Most notably the importance of not mixing different materials within a given stockpile; i.e. there should be separate stockpiles of: topsoil; made ground; coal; excess clean, natural soil arisings; general construction waste etc.

14.3 Good practice guidance

- 14.3.1 The construction phase groundworker should follow good environmental practice to minimise the risks of spillage, leakage etc with reference, but not limited, to the following documents:
- CIRIA C502 'Environmental Good Practice on Site'
 - EA Pollution Prevention Guidelines:
 - PPG6 - Working at construction and demolition sites
 - PPG2 - Above ground oil storage tank
 - PPG7 – The safe operation of refuelling facilities.
 - PPG21 – Incident Response Planning

14.4 New utilities

- 14.4.1 It is strongly recommended that all statutory service bodies are consulted at an early stage with respect to the ground conditions within which they will lay services in order to enable them to assess at an early stage any potential abnormal costs.
- 14.4.2 Drainage and other utilities should not be placed within any coal seam; the seam should either be removed to below the base of the lowest service, or services should be placed in oversize trenches cut into the seam & backfilled with inert material.
- 14.4.3 This site is greenfield, and no previous or current usage of the site or its immediate surroundings is likely to have resulted in ground contamination. Furthermore, no significant made ground was encountered in any of the exploratory holes during the ground investigation.
- 14.4.4 Consequently, the use of 'standard' polyethylene water supply pipes should be acceptable, although Barratt should consult Yorkshire Water at the earliest opportunity to confirm this.

14.5 Health & safety issues - construction workers

- 14.5.1 Access into excavations etc. must be controlled and only undertaken in accordance with the Confined Spaces Regulations 1997. The atmosphere in shored trenches in excess of 1.2m should be monitored for oxygen and hazardous gas (methane & carbon dioxide), prior to personnel entering such excavations. Monitoring should continue whilst personnel are working in deep excavations.
- 14.5.2 Before site operations are started, the necessary COSHH statements and Health & Safety Plan should be drafted in accordance with the CDM regulations.

14.6 Shallow coal in garden areas

- 14.6.1 Whilst there is no explicit guidance in NHBC Standards, liaison with NHBC suggests their stance is essentially the same as that they would apply to potentially combustible fills (such as Ash & Clinker). So where significant coal is present at very shallow depth in garden areas (uppermost 1m), it should either be removed, or covered with inert subsoil/topsoil so that it lies at greater than 1m depth.
- 14.6.2 The most pragmatic way of dealing with shallow coal in gardens will be to inspect foundation excavations, and where coal is recorded within the uppermost 1m or so then excavate an inspection pit in the rear garden. Further advice should be sought from Lithos during the construction phase.
- 14.6.3 As with foundation arisings, the developer will need to contact the Coal Authority to dig or carry away excavated (incidental) coal.

14.7 Potential development constraints

- 14.7.1 The 'unknown' underground service in the south-east of the site presents a potential development constraint unless it can be relocated. Additional enquiries are required to ascertain the feasibility of such diversionary works and the particular easement required by each service undertaker if they remain in-situ.
- 14.7.2 Yorkshire Water may seek to restrict changes in site level if the depth of cover above their sewer was adversely affected by any development proposals. This aspect requires further clarification.

15 SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

15.1 General

- 15.1.1 The site is located about 6km south of Barnsley and comprises a single parcel of arable farmland between New Road (south) and Lidgett Lane (north), sloping downwards to the south.
- 15.1.2 The proposed development comprises 56 two to three storey domestic dwellings, associated gardens, POS and adoptable roads and sewers.
- 15.1.3 Ground conditions across the central, south and west typically comprise residual soils (firm to stiff gravelly clay) with mudstone/siltstone bedrock at an average depth of 2.5m.
- 15.1.4 In the north, topsoil is underlain by dense gravel of sandstone (weathered sandstone) with sandstone bedrock at notably shallower depth (average of 1.0m).
- 15.1.5 Shallow coal (Lidget seam) was encountered in a number of trial pits, outcropping roughly north-west to south-east across the centre of the site.
- 15.1.6 An area of deep opencast backfill underlies the far south-west to depths in excess of 3.7m. Backfill materials are essentially re-worked natural soils. The highwall of the opencast has been found in four trial trenches and is shown on Lithos' Drawing 2222/E/2.

15.2 Mining

- 15.2.1 This site is located within a Coal Mining Development High Risk Area.
- 15.2.2 No evidence of mineworkings was encountered by CoDa in any of the seams considered to be within influencing distance of the ground's surface, yet it is considered an insufficient number of probeholes were drilled.
- 15.2.3 A former opencast mine encroaches into the south-west; the 'highwalls' which mark the edge of the opencast have been identified and surveyed in.

15.3 Hazardous gas

- 15.3.1 The on-site and adjacent areas of backfilled opencast, along with any shallow mineworkings are considered potential sources of hazardous gas.
- 15.3.2 An intrusive hazardous gas investigation and risk assessment should be carried out.

15.4 Contamination & remediation

- 15.4.1 No significant contamination has been encountered and therefore no remediation is necessary, although it should be ensured that coal is not present within 1,000mm depth of gardens areas upon completion.
- 15.4.2 Topsoil is considered chemically suitable for re-use.

15.5 Foundations

- 15.5.1 The majority of plots will be founded on strip/trench fill footings at >0.6m within the granular residual soils (north & east), and >0.9m within the cohesive residual soils (central, south & west). Those founded in the latter stratum will require deepening where plots lie within the zone of influence of trees/hedges along site boundaries.
- 15.5.2 Foundation excavations which encounter coal will require deepening through to beyond the base of the seam.

- 15.5.3 Plots located within former opencast will required piled solution. The plot layout for this site should take account of the known opencast high walls.

15.6 Flooding

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

15.7 Drainage

- 15.7.1 Based on observations made during the investigation, soakaways constructed in natural granular soils or weathered bedrock might provide a suitable drainage solution for surface water run-off at this site.
- 15.7.2 However, CIRIA C697:2007 recommends that soakaways should not be constructed 'in ground where the water table reaches a level within 1 m below the base of the soakaway at any time of the year'.
- 15.7.3 Furthermore, the sloping nature of the site could result in springs being created down-gradient so rendering soakaways unfeasible.

15.8 Highways

- 15.8.1 Natural deposits should yield CBR values in excess of 3%.
- 15.8.2 If changes to the site layout are made resulting in highways spanning the opencast 'high-wall' and deep opencast backfill, further advice from Lithos should be sought.

Appendix A

General Notes

Generic notes – geoenvironmental Investigations

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.

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.

Determination of analytical suite

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

Common Contaminants

Common **Inorganic** Contaminants include:

- metals, most notably cadmium, copper, chromium, mercury, lead, nickel, and zinc.
- semi-metals, most notably arsenic, selenium, and (water soluble) boron
- non-metals, most notably sulphur
- inorganic anions, most notably cyanides (free & complex), sulphates, sulphides, and nitrates.

With respect to the terminology used by most analytical laboratories:

Total cyanide = Free cyanide + Complex cyanide

Total cyanide (CN) is determined by acid extraction; whereas free cyanide is the water soluble fraction.

Complex cyanide is "bound" in compounds and is hard to breakdown. Laboratory determination of complex CN involves subjecting the sample to uv digestion for determination of both free and total CN.

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

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

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

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

Petroleum hydrocarbons are a mixture of hydrocarbons produced from the distillation of crude oil. They include aliphatics (alkanes, alkenes and cycloalkanes), aromatics (single or multi benzene ringed compounds) and hydrocarbon-like compounds containing minor amounts of oxygen, sulphur or nitrogen.

Petroleum hydrocarbons can be grouped based on the carbon number range:-

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

However, it should be borne in mind that the terms "GRO" and "DRO" analysis are purely descriptive terms, the exact definition of which varies.

Total Petroleum Hydrocarbons (TPH) is also a poorly defined term; some testing laboratories regard TPH as hydrocarbons ranging from C₅-C₄₀, whereas other define TPH as C₁₀-C₃₀.

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

Gasoline contains light aliphatic hydrocarbons (especially within the C₄ to C₅ range) that will rapidly evaporate. The aromatic hydrocarbons in gasoline are primarily benzene, toluene, ethylbenzene and xylenes, referred to as BTEX. Small amounts of polyaromatic hydrocarbons (PAHs) such as benzo(a)pyrene may also be present.

Diesel and light fuel oils have higher molecular weights than gasoline. Consequently, they are less volatile and less water soluble. About 25 to 35% is composed of aromatic hydrocarbons. BTEX concentrations are generally low.

Heavy Fuel Oils are typically dark in colour and considerably more viscous than water. They contain 15 to 40% aromatic hydrocarbons. Polar nitrogen, sulphur and oxygen-containing compounds (NSO) compounds are also present.

Lubricating Oils are relatively viscous and insoluble in groundwater. They may contain 10 to 30% aromatics, including the heavier PAHs. NSO compounds are also common.

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

Generic notes – geoenvironmental investigations

Semi-Volatile Organic Compounds (sVOCs) include a variety of compounds, which as the names suggest have relatively low boiling points; however, VOC's are much more volatile than sVOC's. Examples of VOC's include benzene, chloroform and toluene; sVOC's include phenol, florene. Both groups of chemicals are readily absorbed through skin and some, such as benzene, are believed to be linked to tumour growth.

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

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

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

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

Methods of Analysis (Organic Compounds)

TPH by GC-FID is a more refined analytical technique which only detects hydrocarbons (aliphatic and aromatic) in the range C10 to C40 (volatiles, heavy tars, humic material and sulphur are not detected). The laboratory can provide a breakdown of the TPH results into diesel range organics (DRO) and heavier lubricating oil range organics (LRO).

GRO (PRO) by GC-FID analysis detects the more volatile C6-C9 hydrocarbons (aliphatic and aromatic), including those organic compounds present in petrol.

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

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

Note: PAHs are hydrocarbons and consequently (where present) will be picked-up when scheduling TPH. by GC-FID. Naphthalene (the lightest PAH) is also one of the 58 US EPA VOCs.

Speciated TPH by GC-FID provides a "banded" TPH, initially split into aromatic and aliphatic fractions and then further divided into fraction specific carbon bandings based upon behavioural characteristics.

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

Current UK guidance

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

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

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

Generic notes – geoenvironmental investigations

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

$$HI = \sum_{F_i=1}^{36} HQ F_i = \frac{\text{Measured concentration } F_i \text{ (mg kg}^{-1}\text{)}}{SGV F_i \text{ (mg kg}^{-1}\text{)}}$$

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

Other screening values used by Lithos

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

- Approved Document C, Building Regulations 2000
- Boyle & Witherington (2007) – Guidance on evaluation on development proposals on sites where methane and carbon dioxide are present, incorporating "traffic lights". Report Ref. 10627-R01-(02), for NHBC
- CIRIA C665 (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

Waste classification & WAC

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

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

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

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

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

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

Generic notes – geoenvironmental investigations

Possible action in event of Tier 1 exceedance

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

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

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

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

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

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

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

Appendix B

Drawings



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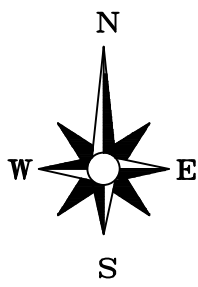
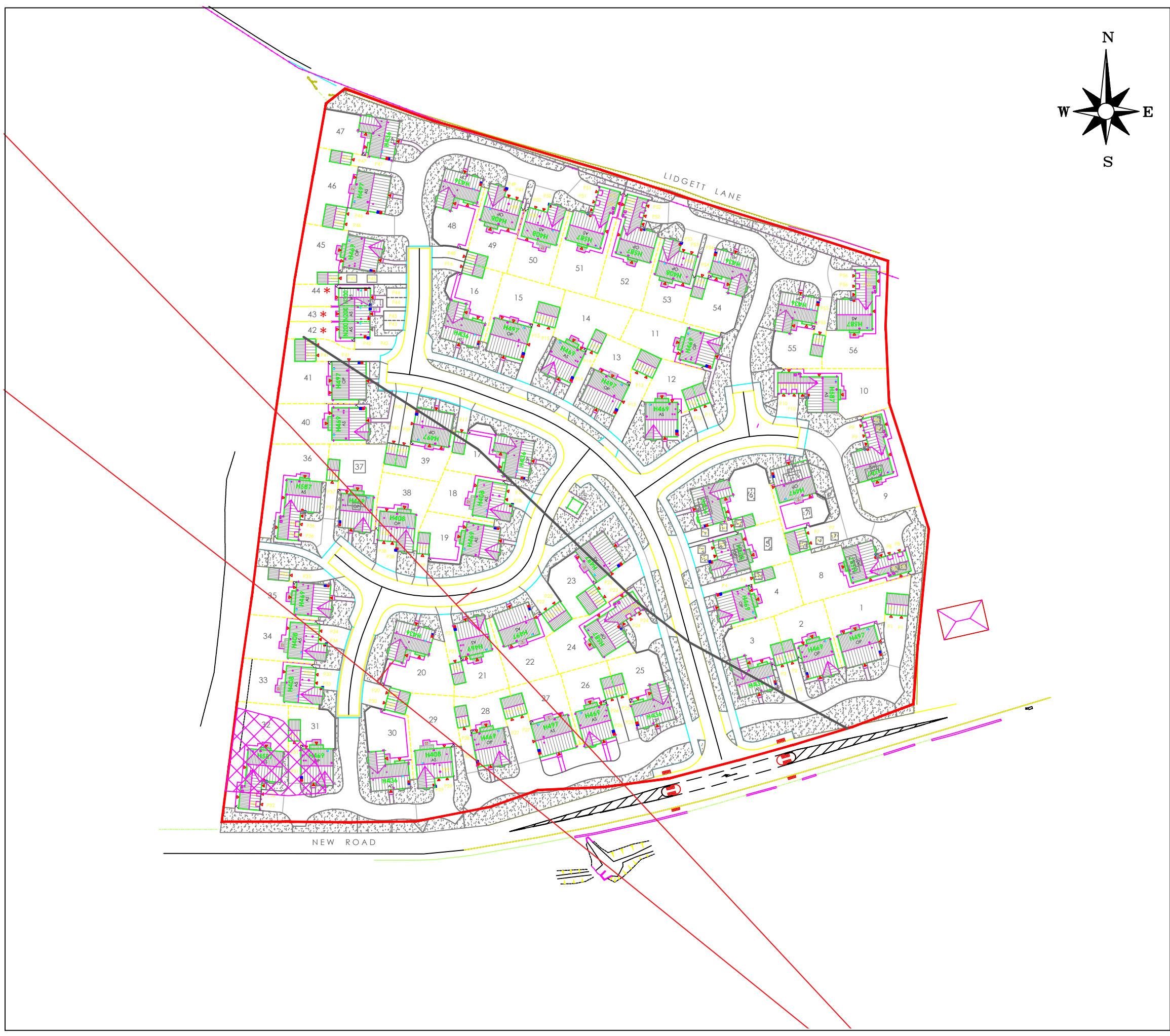
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**BARRATT & DAVID
WILSON HOMES
YORKSHIRE WEST**

**NEW ROAD,
PILLEY,
BARNSELY**

**SITE LOCATION
PLAN**

DRAWN	MJT	DATE	07/06/2016
CHECKED	REG	DATE	08/06/2016
STATUS	FOR COMMENT ☐	DRAFT	☐
	FOR APPROVAL ☐	FINAL	☒
SCALE	1:25,000	SHEET	A4
DRAWING NO.	2222/E/1	REVISION	



NOTES

— APPROXIMATE SITE BOUNDARY

FORMER OPENCAST (AS ENCOUNTERED)

— LIDGET SEAM OUTCROP (AS ENCOUNTERED)

REPRODUCED FROM BARRAT'S DRAWING
'PLANNING LAYOUT' REF. PL01 DATED
25/05/2016

REV.	DESCRIPTION	DATE
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CLIENT

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HOMES YORKSHIRE WEST

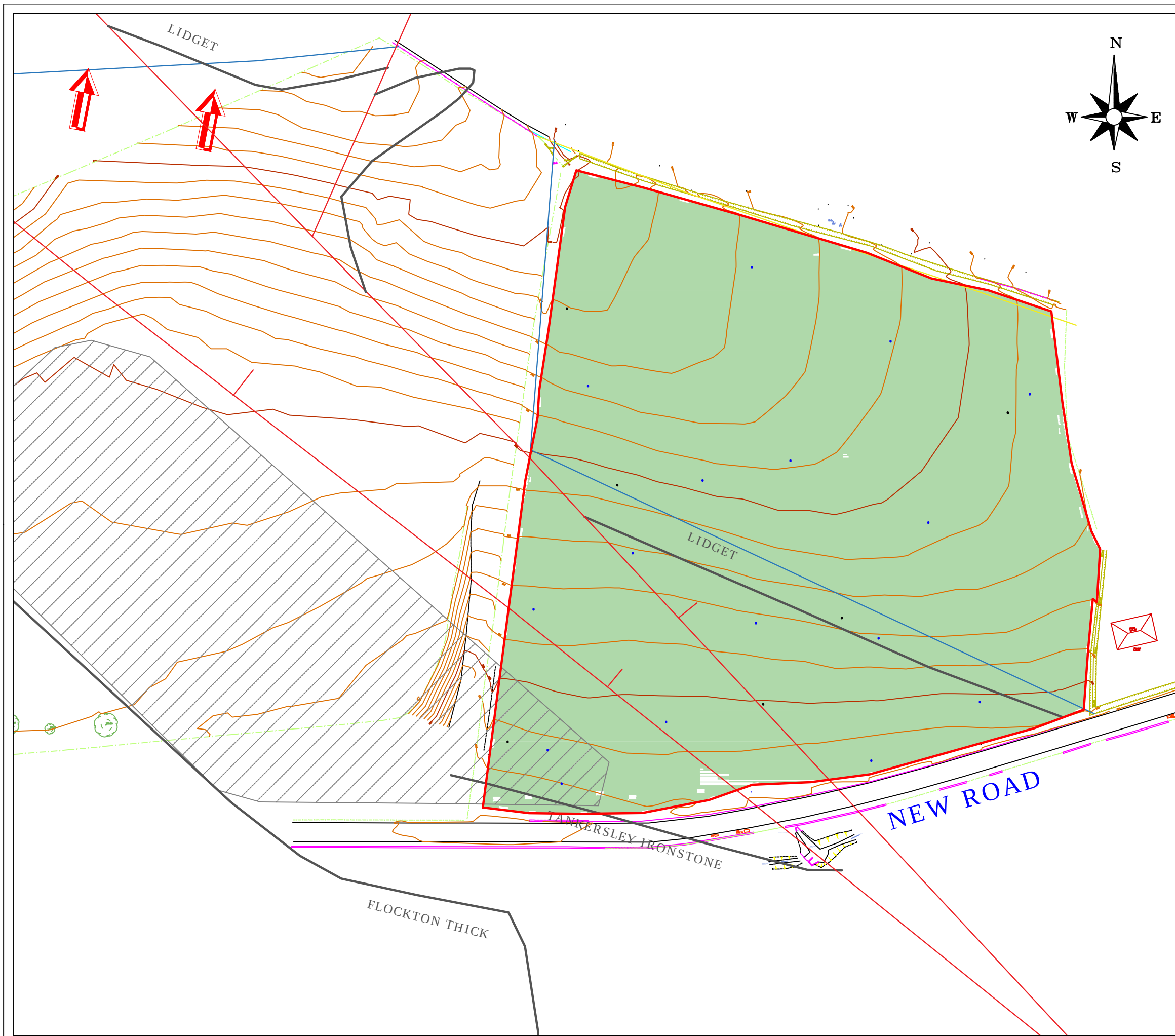
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NEW ROAD,
PILLEY,
BARNSELY

DRAWING TITLE

PROPOSED SITE LAYOUT &
GEOLOGICAL HAZARDS

DRAWN	DATE	STATUS	
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CHECKED	DATE	FOR APPROVAL	☐
REG	08/06/2016	DRAFT	☐
		FINAL	☒
SCALE	SHEET	DRAWING NO.	REVISION
1:1,000	A3	2222/E/2	



NOTES

- APPROXIMATE SITE BOUNDARY
- COAL OUTCROP (BGS MAP)
- - - FAULT
- FORMER OPENCAST
- ↓ ADIT
- ⊕ SHAFT
- GRASS & OVERGROWN AREAS

REV.	DESCRIPTION	DATE
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JOB TITLE

NEW ROAD,
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DRAWING TITLE

GEOLOGICAL & SITE FEATURES

DRAWN MJT	DATE 07/06/2016	STATUS FOR COMMENT ☐
CHECKED MAR	DATE 08/06/2016	FOR APPROVAL ☐
		DRAFT ☐
		FINAL ☒

SCALE NTS	SHEET A3	DRAWING NO. 2222/E/3	REVISION
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NOTES

— APPROXIMATE SITE BOUNDARY

👁 LOCATION & ORIENTATION OF PHOTOGRAPH

REV.	DESCRIPTION	DATE

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JOB TITLE

**NEW ROAD,
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SITE PHOTOGRAPHS

DRAWN	DATE	STATUS	
MJT	07/06/2016	FOR COMMENT	☐
CHECKED	DATE	FOR APPROVAL	☐
MJT	07/06/2016	DRAFT	☐
		FINAL	☒
SCALE	SHEET	DRAWING NO.	REVISION
NTS	A3	2222/E/4	

NOTES		
REV.	DESCRIPTION	DATE



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JOB TITLE

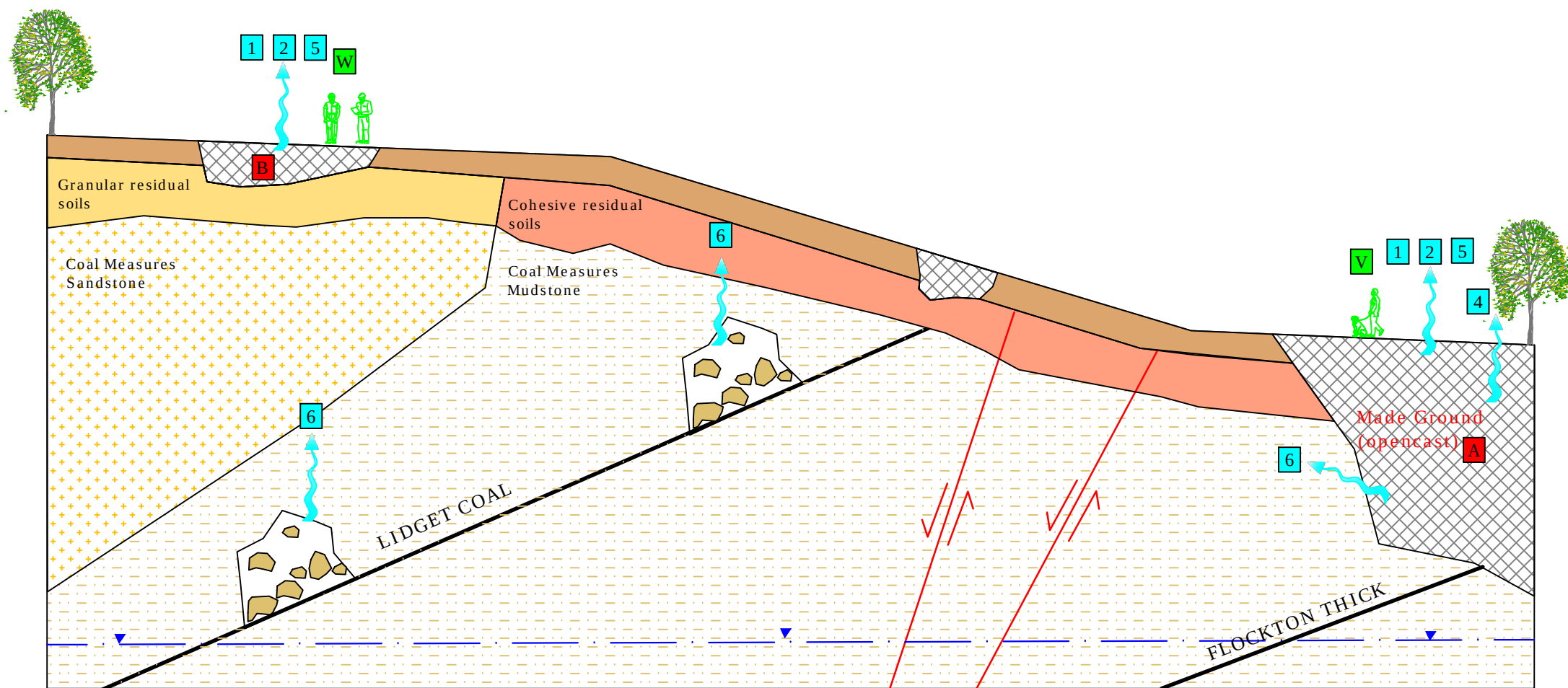
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DRAWING TITLE

PRELIMINARY CONCEPTUAL SITE
 MODEL

DRAWN	DATE	STATUS	
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CHECKED	DATE	FOR APPROVAL	☐
		DRAFT	☐
		FINAL	☒

SCALE	SHEET	DRAWING NO.	REVISION
Not to scale	A3	2222/E/5	



SOURCES	
A	MADE GROUND (Opencast)
B	MADE GROUND (CoDa SI)
C	MINEWORKINGS

PATHWAYS	
1	DERMAL CONTACT
2	INGESTION\INHALATION
3	LEACHING OF CONTAMINANTS
4	UPTAKE BY PLANTS
5	VOLATILISATION
6	MIGRATION OF GAS

RECEPTORS	
V	END USERS (RESIDENTS)
W	SITE WORKERS
X	VEGETATION
Y	SURFACE WATERS
Z	GROUNDWATER



NOTES

- LITHOS TRIAL PIT (2016)
- CODA PROBEHOLE
- CODA TRIAL PIT LOCATION
- FORMER OPENCAST (CA PLAN)
- FORMER OPENCAST (AS ENCOUNTERED)
- LIDGET SEAM OUTCROP (AS ENCOUNTERED)
- APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE
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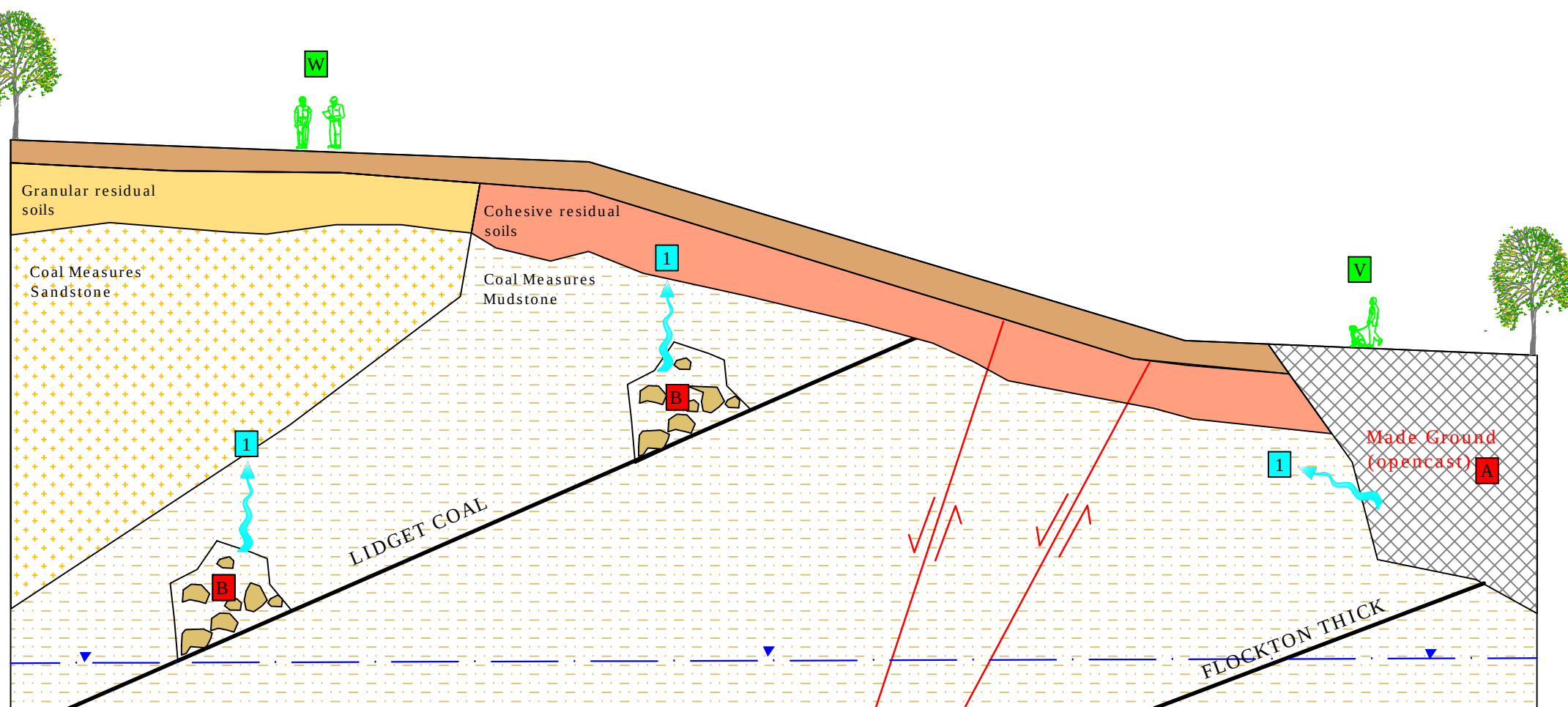
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EXPLORATORY HOLE LOCATIONS
& GEOLOGICAL HAZARDS

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CHECKED	DATE	FOR COMMENT ☐
REG	18/05/2016	FOR APPROVAL ☐
		DRAFT ☐
		FINAL ☒

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



SOURCES	
A	MADE GROUND (Opencast)
B	MINEWORKINGS

PATHWAYS	
1	MIGRATION OF GAS

RECEPTORS	
V	END USERS (RESIDENTS)
W	SITE WORKERS
X	VEGETATION
Y	SURFACE WATERS
Z	GROUNDWATER

NOTES		
REV.	DESCRIPTION	DATE



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CLIENT
BARRATT DAVID WILSON HOMES YORKSHIRE WEST

JOB TITLE
NEW ROAD, PILLEY, BARNSELY

DRAWING TITLE
REVISED CONCEPTUAL SITE MODEL

DRAWN	DATE	STATUS	
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CHECKED	DATE	FOR APPROVAL	☐
REG	09/06/2016	DRAFT	☐
		FINAL	☒

SCALE	SHEET	DRAWING NO.	REVISION
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NOTES

APPROXIMATE SITE BOUNDARY

EXTENT OF WORKINGS

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DRAWING TITLE

ABANDONMENT PLAN
FLOCKTON THICK SEAM

DRAWN MJT	DATE 09/06/2016	STATUS FOR COMMENT FOR APPROVAL DRAFT FINAL
CHECKED REG	DATE 09/06/2016	☐ ☐ ☐ ☒

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

— APPROXIMATE SITE BOUNDARY

▨ EXTENT OF WORKINGS

REV.	DESCRIPTION	DATE

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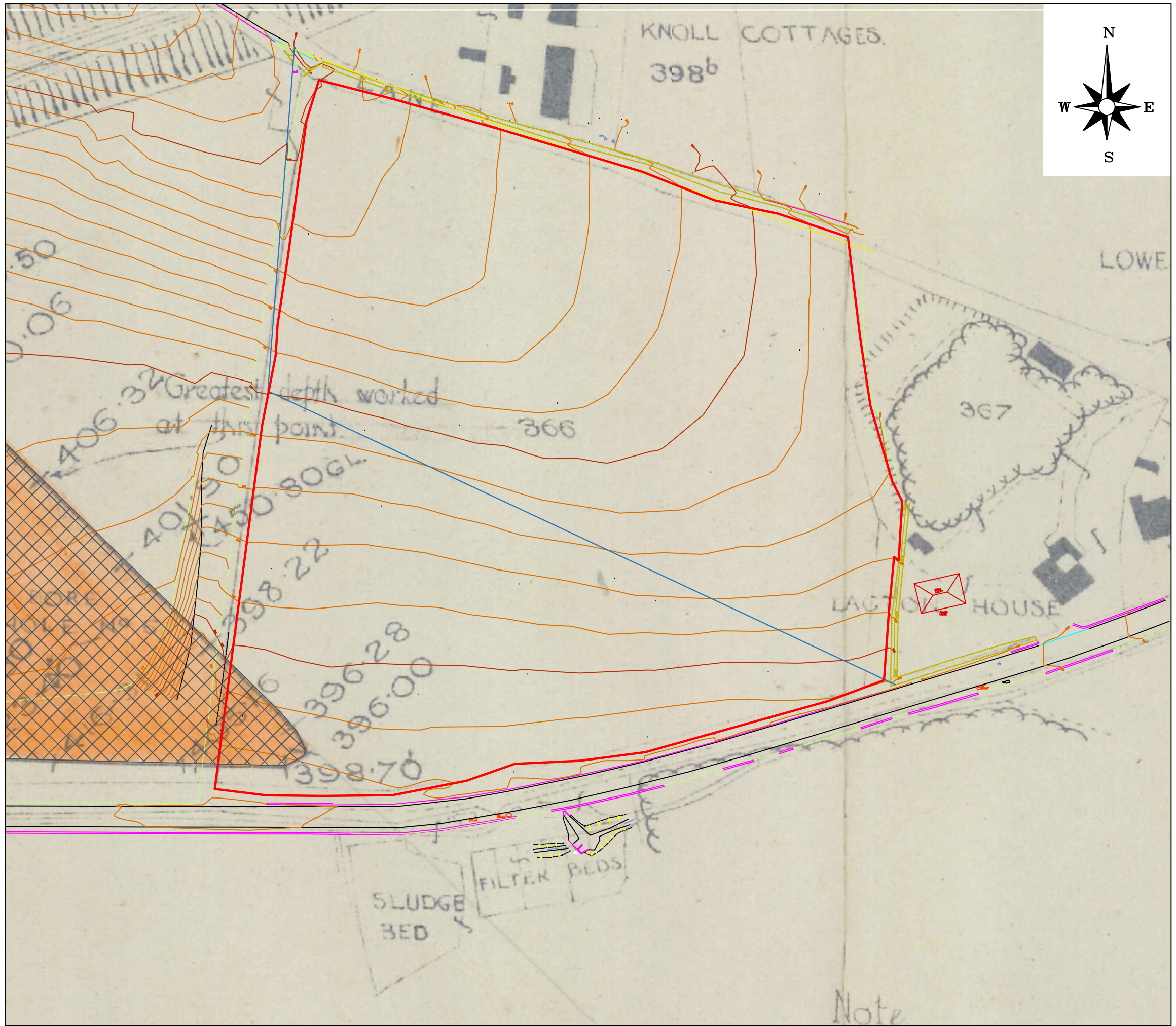
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BARNSELY**

DRAWING TITLE

**ABANDONMENT PLAN
PARKGATE SEAM**

DRAWN	DATE	STATUS
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CHECKED	DATE	FOR APPROVAL
REG	09/06/2016	DRAFT
		FINAL

SCALE	SHEET	DRAWING NO.	REVISION
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NOTES
— APPROXIMATE SITE BOUNDARY
▨ EXTENT OF WORKINGS

REV.	DESCRIPTION	DATE
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JOB TITLE
**NEW ROAD,
PILLEY,
BARNSELY**

DRAWING TITLE
**ABANDONMENT PLAN
OPENCAST**

DRAWN MJT	DATE 09/06/2016	STATUS FOR COMMENT ☐ FOR APPROVAL ☐ DRAFT ☐ FINAL ☒
CHECKED REG	DATE 09/06/2016	
SCALE 1:1,000	SHEET A3	DRAWING NO. 2222/E/11
		REVISION

Appendix C

Commission

015/2222/MJT

6th May 2016

Daria Matkowska
Barratt & David Wilson Homes Yorkshire West
Raynham Close
Morley
Leeds
LS27 0WH



Registered in England 07068066

Parkhill
Wetherby
West Yorkshire
LS22 5DZ

T 01937 545 330

www.lithos.co.uk

Dear Daria

New Road, Pilley

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

Lithos have previously issued a report relating to this site to a third party, which we understand has been made available to Barratts – ‘Desk Study and Mining Risk Assessment, Land at Lidgett Lane & New Road, Pilley’ ref. 2222/1 dated October 2015.

The above report included a review of 3rd party SI reports (by CoDa structures), an intrusive mining investigation and a hazardous gas investigation.

In addition, Lithos have carried out a gas risk assessment which we understand will be made available to Barratts.

The aforementioned documents should be read in conjunction with this fee proposal, but in summary, outstanding issues relating to the New Road (east) site are:

- No geotechnical analysis (Atterbergs) has been carried out to date
- Very limited topsoil testing has been undertaken, more samples are required
- The lateral extent of the area of opencast in the south-west is currently unknown and requires delineation
- Poor logging within 3rd party reports means that additional trial pitting should be undertaken to confirm ground conditions encountered

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

This proposal allows for the following works:

Desk study: Environmental search data already obtained will be incorporated and updated where necessary for use within our final report.

Fieldwork: We have allowed for two day’s trial pitting, to be supervised and logged by an experienced geoenvironmental engineer.

The purpose of the trial pitting is to confirm ground conditions encountered by CoDa and to enable delineation of the area of opencast in the south-west.



To achieve this, around 12 trial pits will be excavated across the site, and then a number of trial trenches will be excavated across the suspected area of opencast in the south-west in order to enable identification of any associated 'highwalls'. Once located, the location the highwalls will be clearly marked on the ground and surveyed in.

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

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

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

Soils testing: This will comprise routine geotechnical soils analysis, including 8 moisture content & Atterberg limits, and 8 pH & water soluble sulphate.

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

The site is understood to be essentially Greenfield, and therefore testing of potentially contaminated samples should only be required if made ground is encountered in the exploratory holes. However, we have allowed for analysis of topsoil (6 samples) to confirm its suitability for re-use. The test suite will include heavy metals and speciated PAH; two samples will also be analysed for pesticides.

Within in our proposal we have allowed for the screening (ID) of 6 samples for asbestos. In the event that positive IDs are reported, it is likely that we will need to schedule further analysis (asbestos quantification), in order to determine the significance of the results. Asbestos quantification is currently a relatively expensive test and consequently we have not allowed for it at this stage. We will inform you immediately after receipt of results if we consider asbestos quantification is required.

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

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

Fieldwork could be commenced within 2 weeks of receipt of your written instruction to proceed. Our comprehensive geoenvironmental appraisal report will be issued within 4 weeks of fieldwork completion.

A copy of the final report will be issued to the relevant regulatory authorities on receipt of written instruction from yourselves.

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 our invoice for this project with the final 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.

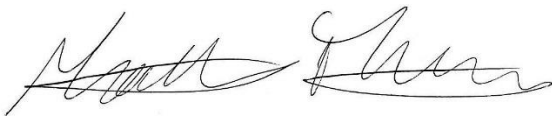
Utility plans are required in order to protect operatives from the hazards associated with striking buried services and avoid potentially substantial disruption\repair costs. We will make every effort not to damage any services (including review of utility plans and use of a CAT detector). However, Lithos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

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

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

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

Yours sincerely

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

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

DEFINITIONS AND INTERPRETATION

- 1.1 In this Agreement, unless the context otherwise requires, the following words and expressions have the following meanings:

"Agreement" shall mean these Terms (entitled "Terms and Conditions for the Appointment of Lithos Consulting"), the Proposal, any document recording the Client's unequivocal acceptance of the Proposal and any other documents or parts of other documents expressly referred to in any of the foregoing;

"Client" shall mean the party for whom the Services are being provided by Lithos;

"Documents" shall mean all documents of any kind and includes plans, drawings, reports, programmes, specifications, Bills of Quantities, calculations, letters, e-mails, faxes, memoranda, films and photographs (including negatives), or any other form of record prepared or provided or received by, or on behalf of Lithos, and whether in paper form or stored electronically or on disk, or otherwise;

"Lithos" shall mean Lithos Consulting Limited whose registered office is at Parkhill, Walton Road, Wetherby, West Yorkshire, LS22 5DZ.

"Intellectual Property" includes all rights to, and any interests in, any patents, designs, trade marks, copyright, know-how, trade secrets and any other proprietary rights or forms of intellectual property (protectable by registration or not) in respect of any technology, concept, idea, data, programme or other software (including source and object codes), specification, plan, drawing, schedule, minutes, correspondence, scheme, programme, design, system, process logo, mark, style, or other matter or thing, existing or conceived, used, developed or produced by any person;

"Parties" shall mean the Client and Lithos

"Project" shall mean the project described in the Proposal and any enquiry from the Client on which Lithos has based its Proposal;

"Proposal" means the offer document prepared by Lithos in response to an enquiry or otherwise, in connection with the proposed provision of the Services;

"Services" means the work and services relating to the Project to be provided by Lithos pursuant to the Agreement and as set out in the Proposal and shall include any additions or amendments thereto made in accordance with these Terms;

"Terms" means these terms entitled "Lithos Consulting Terms of Appointment".
- 1.2 Words importing the singular only shall also include the plural and vice versa, where the context requires.
- 1.3 Words importing persons or parties shall include firms, corporations and any organisation having legal capacity and vice versa, where the context requires; and words importing a particular gender include all genders.
- 1.4 The sub-headings to the clauses of these Terms are for convenience only and shall not affect the construction of the Agreement.
- 1.5 A reference to legislation includes that legislation as from time to time amended, re-enacted or substituted and any Orders in Council, orders, rules, regulations, schemes, warrants, by-laws, directives or codes of practice issued under any such legislation.
- 1.6 In the event of conflict between the documents forming part of the Agreement, the Proposal shall prevail, followed by the Terms.
- 2 APPOINTMENT

- 2.1 The Client agrees to engage Lithos and Lithos agrees to provide the Services in accordance with the provisions of the Agreement.
- 3 OBLIGATIONS OF LITHOS
- 3.1 Lithos shall perform the Services using the reasonable standard of skill and care normally exercised by similar professional Environmental firms in performing similar services under similar conditions.
- 3.2 Lithos shall use all reasonable endeavours to perform the Services in accordance with all relevant environmental and safety legislation.
- 4 OBLIGATIONS OF THE CLIENT
- 4.1 Throughout the period of this Agreement the Client shall afford to Lithos or procure the affording to Lithos of access to any site where access is required for the performance of the Services.
- 4.2 The Client accepts responsibility for ensuring that Lithos is notified in writing of all special site and/or plant conditions, including without prejudice to the generality of the foregoing, the existence and precise location of all underground services, cables, pipes, drains or underground buildings, constructions or any hazards known or suspected by the Client, which the Client shall clearly mark on the ground or identify on accurate location plans supplied to Lithos prior to the commencement of the Services. The Client shall also inform Lithos in writing of any relevant operating procedures including any site safe operating procedures and any other regulations relevant to the carrying out of the Services. The Client shall indemnify Lithos against all costs, claims, demands and expenses arising as a result of any non-disclosure in this respect, including but not limited to indemnification against any action brought by the owner of the land or otherwise.
- 4.3 If the Client discovers any conflict, defect or other fault in the information or designs provided by Lithos pursuant to the Agreement, he will advise Lithos in writing of such defect, conflict or other fault and Lithos shall have the right to rectify the same or where necessary, to design the solution for rectification of any works carried out by others pursuant the conflicting, defective or in any other way faulty information or designs.

5 INTELLECTUAL PROPERTY

- 5.1 The copyright in all Intellectual Property prepared by or on behalf of Lithos in connection with the Project for delivery to the Client shall remain vested in Lithos.
- 5.2 The Client shall have a non-exclusive licence to copy and use such Intellectual Property for purposes directly related to the Project. Such licence shall enable the Client to copy and use the Intellectual Property but solely for its own purposes in connection with the Project and such use shall not include any licence to reproduce any conceptual designs or professional opinions contained therein nor shall it include any licence to amend any drawing, design or other Intellectual Property produced by Lithos.
- 5.3 Should the Client wish to use such Intellectual Property in connection with any other works or for any other purpose not directly related to the Project or wish to pass any Intellectual Property to any third party, it must obtain the prior written consent of Lithos. The giving of such consent shall be at the discretion of Lithos and shall be upon such terms as may be required by Lithos. Lithos shall not be liable for the use by any person of such Intellectual Property for any purpose other than that for which the same were prepared by or on behalf of Lithos.
- 5.4 Ownership of any proposals submitted to the Client that are not subsequently confirmed as part of the Services to be provided for the Client remain with Lithos and such proposals must not be used as the basis for any future work undertaken by the Client or a third party and no liability can be accepted howsoever arising from such proposals.
- 5.5 In the event of the Client being in default of payment of any fees or other amounts due, Lithos may suspend further use of the licence on giving 2 days' notice of the intention to do so. Use of the licence may be resumed on receipt of the outstanding amounts.

6 TITLE

- 6.1 Lithos shall transfer only such title or rights in respect of the Documents as it has, and if any part is purchased from a third party Lithos shall transfer only such title or rights as that party had and has transferred to Lithos.
- 6.2 Title in the Documents shall remain with and shall not pass to the Client until the amount due under the invoice(s) (including interest and costs) has been paid in full.
- 6.3 Until title passes, the Client shall hold the Documents as bailee for Lithos and shall store or mark them so that they can at all times be identified as the property of Lithos.
- 6.4 At any time before title passes (save and except where payment is not due), but only after prior consultation with the Client, Lithos may without any liability to the Client repossess and use or sell all or any of part of the Documents and by doing so terminate the right of the Client to use, sell or otherwise deal in the Documents.
- 6.5 Lithos may maintain an action for the price of the Documents notwithstanding that title in them has not passed to the Client.

7 CONFIDENTIALITY

- 7.1 Lithos undertakes not to divulge or disclose to any third party without the written consent of the Client information which is designated confidential by the Client or which can reasonably be considered to be confidential and arises during the performance of the Services unless required to do so by law or necessary in the proper performance of its duties in relation to the Project, or in order to make full frank and proper disclosure to its insurers or intended insurers, or to obtain legal or accounting advice.
- 7.2 Subject to the above, Lithos shall be permitted to use information related to the Services it provides in connection with the Project for the purposes of marketing its services and in proposals for work of a similar type.

8 THIRD PARTIES

- 8.1 The Agreement or any part thereof or any benefit or interest thereunder may not be assigned by the Client without the prior written consent of Lithos. The giving of such consent shall be at the discretion of Lithos and Lithos will only agree to an assignment on its terms and in return for payment of a fee by the Client to Lithos to cover Lithos's legal and other costs associated with any assignment.
- 8.2 The Agreement shall not confer and shall not purport to confer on any third party any benefit or any right to enforce any term of this Agreement for the purposes of the Contracts (Rights of Third Parties) Act 1999 or otherwise.
- 8.3 Lithos will consider and may consent to any request from the Client for Lithos to enter a collateral warranty with a third party with regard to the Services provided under the Agreement. The giving of such consent shall be at the discretion of Lithos and Lithos will only enter a collateral warranty on its terms and in return for payment of a fee by the Client to Lithos to cover Lithos's legal and other costs associated with any collateral warranty.

9 INSURANCE

- 9.1 Lithos warrants to the Client that there is in force a policy of Professional Indemnity insurance covering its liabilities for negligence under this Agreement, with a limit of indemnity of £5,000,000 (FIVE MILLION POUNDS) any one claim, save for pollution and contamination claims and asbestos claims both of which carry £2,000,000 (TWO MILLION) in the aggregate cover. This policy is annually renewable and whilst renewal is not automatic, Lithos agrees to use reasonable endeavours to maintain such insurance at all times until six years from the date of the completion (or termination) of the Services under the Agreement, provided such insurance is available at commercially reasonable rates having regard, inter alia, to premiums required and policy terms obtainable.
- 9.2 If for any period such insurance is not available at commercially reasonable rates, Lithos shall forthwith inform the Client and shall obtain in respect of such period such reduced level of Professional Indemnity insurance as is available and as would be fair and reasonable in the circumstances for Lithos to obtain.

10 LIMITATIONS ON LIABILITY

- 10.1 Unless otherwise agreed in writing, Lithos's liability under or in connection with the Agreement whether in contract, tort, negligence, breach of statutory duty or otherwise (other than in respect of personal injury or death) shall be limited to and shall not exceed the lesser of either five million pounds in the aggregate (unless it is a pollution, contamination or asbestos claim in which case it is two million pounds in the aggregate) or 10 times the total value of invoices issued to the Client for consultancy work instructed under the Agreement.
- 10.2 No action or proceedings under or in respect of the Agreement whether in contract, tort, negligence, under statute or otherwise shall be commenced against Lithos after the expiry of a period of six years from the date of the completion (or termination) of the Services under the Agreement.
- 10.3 Whilst Lithos will scan all potential exploratory locations with a Cable Avoidance Tool, Lithos shall not be liable for any damage to underground services, cables, pipes, drains or underground buildings, constructions and the like which were either not marked on site or for which accurate plans were not provided.
- 10.4 Lithos shall not be liable for the cost of rectifying any defect, conflict or other fault in the information or designs provided by Lithos or for the cost of designing a solution for and rectifying any subsequent works carried out by others pursuant to the conflicting, defective or in any other way faulty information or designs, unless Lithos has been advised in writing of the same by the Client and has been given the opportunity to rectify the same or where necessary, to design the solution for rectification of any subsequent works carried out by others pursuant to the same.

11 PAYMENT

- 11.1 Invoices for services rendered will be submitted for payment in accordance with the Proposal.
- 11.2 The due date for payment is the date of the invoice and the final date for payment is 28 days from the date of the invoice.
- 11.3 If the Client disputes the amount included for payment in an invoice a written notice must be served on Lithos by the Client not later than 14 days before the final date for payment. If no notice is given the amount due shall be the amount stated in the invoice.
- 11.4 In the event of failure on the part of the Client to pay any monies in accordance with the foregoing payment provisions, Lithos will be entitled to charge interest on any monies owed to it by the Client, such interest to be at a rate of 8% above the base rate of a clearing bank from time to time calculated from the final date for payment to the date of actual payment on a compound basis.

12 DELAY

- 12.1 Lithos will comply with any timescale agreed for completion of the Services unless delayed or prevented by circumstances beyond its reasonable control and in the event of any such circumstances arising Lithos undertakes to complete the Services within a reasonable period, but will not be liable to the Client for any delay as a result.

13 TERMINATION

- 13.1 The Agreement may be determined by either party in the event of the other making a composition or arrangement with its creditors, becoming bankrupt, or being a company, making a proposal for a voluntary arrangement for a composition of debts, or has a provisional liquidator appointed, or has a winding-up order made, or passes a resolution for voluntary winding-up (except for the purposes of a bona fide scheme of amalgamation or reconstruction), or has an administrator or an administrative receiver appointed to the whole or any part of its assets. Notice of determination must be given to the party which is insolvent by the other party.
- 13.2 If for any reason the performance of the Services by Lithos is suspended for a period in excess of three calendar months then Lithos shall be entitled to determine its appointment in respect of the Services by seven days written notice to the Client.
- 13.3 If the Client shall fail to pay in full any sum due under the terms of the Agreement by the final date for payment for that sum and no effective notice of intention to withhold payment has been issued, Lithos may serve written notice on the Client demanding payment within 14 days of such notice. If the Client shall fail to comply with such notice, Lithos shall be entitled to terminate its employment under the Agreement forthwith.
- 13.4 Any determination of the appointment of Lithos howsoever caused shall be without prejudice to the right of Lithos to require payment for all services performed up to the date of such determination including but not limited to payment of a fair and reasonable proportion of any figure identified in the Proposal or otherwise for fees in respect of a particular service which Lithos has started, but not completed.

14 NOTICES

- 14.1 Any notice provided for in the Agreement shall be in writing and shall be deemed to be properly given if delivered by hand or sent by first class post to the address of the relevant party as may have been notified by each party to the other or, in the absence of notification, to the address of Lithos set out above or to the registered address of the Client.
- 14.2 Such notice shall be deemed to have been received on the day of delivery if delivered by hand or on the second working day after the day of posting if sent by first class post.

15 ENTIRE AGREEMENT

- 15.1 The Agreement constitutes the complete and entire agreement between the Client and Lithos with respect to the Services and supersedes any prior oral and/or written warranties, terms, conditions, communications and representations, whether express or implied and any claim against Lithos in respect of the Services can only be made in contract under the provisions of the Agreement and not otherwise under the law or tort or otherwise.
- 15.2 No amendments, modifications or variation of the Agreement shall be valid unless made in writing and agreed to by both the Client and Lithos; such agreement must be recorded in writing by at least one of the Parties.
- 15.3 Lithos will not be bound by any standard or printed terms or conditions furnished by the Client in any of its documents unless Lithos specifically states in writing separately from such documents that it intends such terms and conditions to apply.

16 DISPUTES AND GOVERNING LAW

- 16.1 The Agreement shall be governed by and construed in accordance with English law and the Parties irrevocably and unconditionally submit to the jurisdiction of the English Courts.
- 16.2 Where the Housing Grants, Construction and Regeneration Act 1996 applies, any dispute between the Parties may be referred to adjudication in accordance with The Scheme for Construction Contracts Regulations 1998 or any amendment or modification thereof being in force at the time of the dispute, as applicable to England, Wales, Scotland and Northern Ireland.

From: Matkowska, Daria
Sent: 06 May 2016 13:29
To: Matt Thompson
Cc: Reg
Subject: *Ext: New Road, Pilley

Hi

Thank you for a prompt response. As mentioned on the phone we would like to accept the proposal; please see the Project Order attached for your signature.

As you're aware, we're exchanging contracts on the 20th May and will need to know about the major risks by then.

Please let me know of your start date and we will inform the land owners.

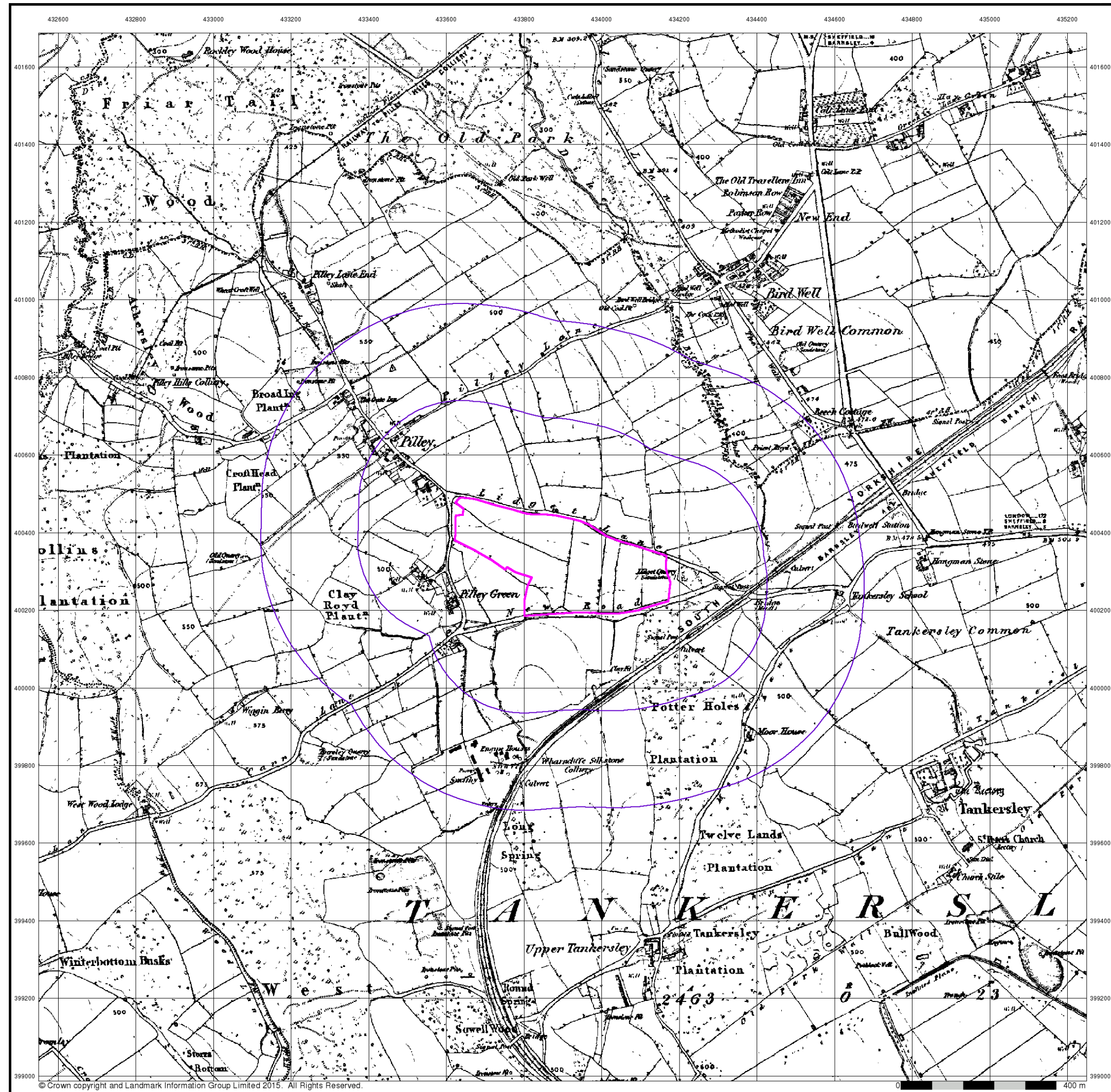
Regards

Daria Matkowska

BDW TRADING LIMITED Region – Barratt & David Wilson Homes Yorkshire West ("the Client")	TO: Lithos Consulting Ltd ("the Consultant")									
This Project Order is issued pursuant to the Agreement dated 17/06/2015 (SHE03)										
Order: The Client requires and instructs the Consultant to carry out the Services in connection with the Project in accordance with and subject to the Terms and Conditions set out in the Agreement and the special conditions (if any) set out in this Project Order.										
The Project: Carry out additional site investigation at New Road, Pilley (eastern parcel) in line with quotation number 015/2222/MJT dated 6 th May 2016.										
Project No: Pilley/DM/1 Project Start Date: 06.05.2016 Project Finish Date: <u>16.05.2016 START FIELDWORK</u> <u>2 DAYS FIELDWORK</u> <u>BY 20.05.2016 ISSE INFORMATION TO ENABLE ASSESSMENT OF ABNORMAL COSTS (opencast mine investigation)</u> <u>Full report - TBC</u>										
Site: New Road, Pilley, Barnsley – eastern parcel										
Works: As detailed in quote number 015/2222/MJT.										
Client Contact: Daria Matkowska daria.matkowska@barrthomes.co.uk 0113 307 6889										
Scope of Services: The Services of Lithos Consulting Ltd Consultant as attached to this Project Order as Schedule 1 subject to the following amendments if any:										
Fee: the sum of £ (exclusive of VAT) payable [monthly] [in stages] as follows: <table border="1" data-bbox="193 1435 1430 1547"> <thead> <tr> <th data-bbox="193 1435 603 1480">Month/Work Stage *</th> <th data-bbox="603 1435 1018 1480">% / Amount of fee due</th> <th data-bbox="1018 1435 1430 1480">Cumulative Fee</th> </tr> </thead> <tbody> <tr> <td>.....</td> <td>.....</td> <td>.....</td> </tr> <tr> <td>.....</td> <td>.....</td> <td>.....</td> </tr> </tbody> </table>		Month/Work Stage *	% / Amount of fee due	Cumulative Fee						
Month/Work Stage *	% / Amount of fee due	Cumulative Fee								
.....										
.....										
Expenses to be paid in addition to the Fee:										
Special Conditions (if any)										
Signed for and on behalf of BDW Trading Limited Daria Matkowska  Dated	Signed for and on behalf of [insert Consultant name] Dated									

Appendix D

Historical OS Plans



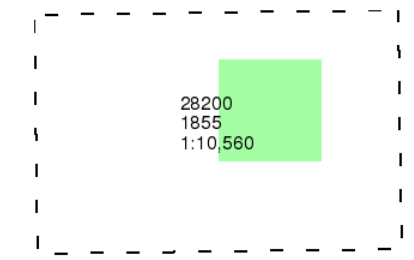
Yorkshire

Published 1855

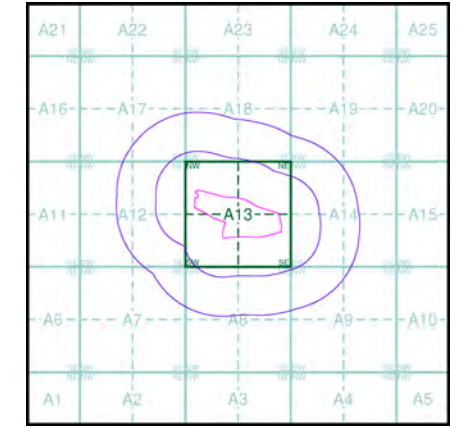
Source map scale - 1:10,560

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



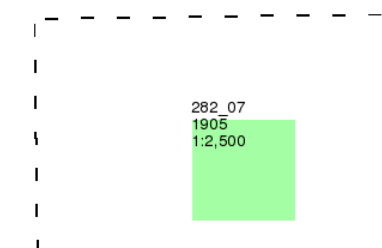
Yorkshire

Published 1905

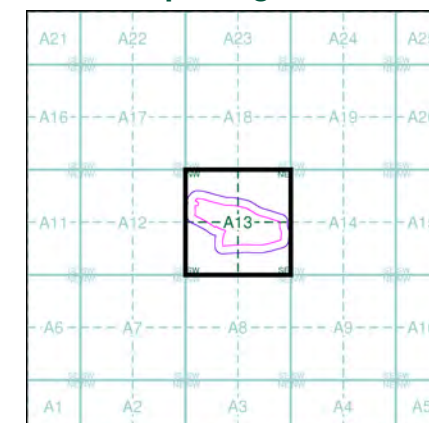
Source map scale - 1:2,500

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

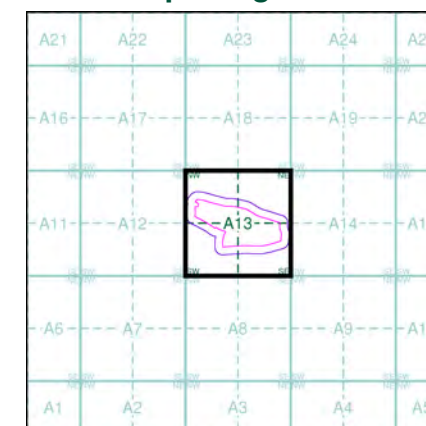
Source map scale - 1:2,500

'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

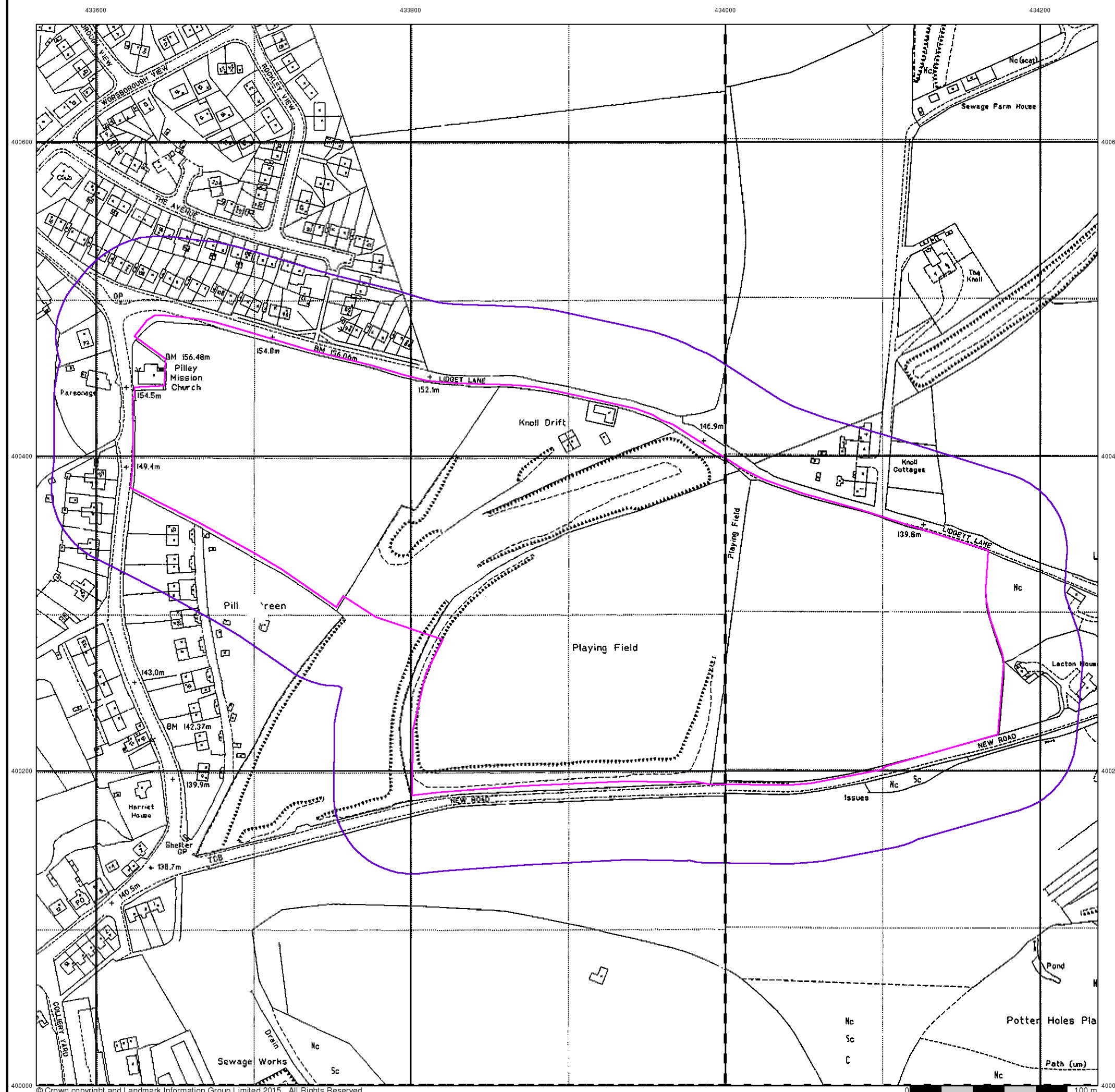
Order Number: 72903369_1_1
Customer Ref: 2222
National Grid Reference: 433890, 400330
Slice: A
Site Area (Ha): 10.09
Search Buffer (m): 50

Site Details

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



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



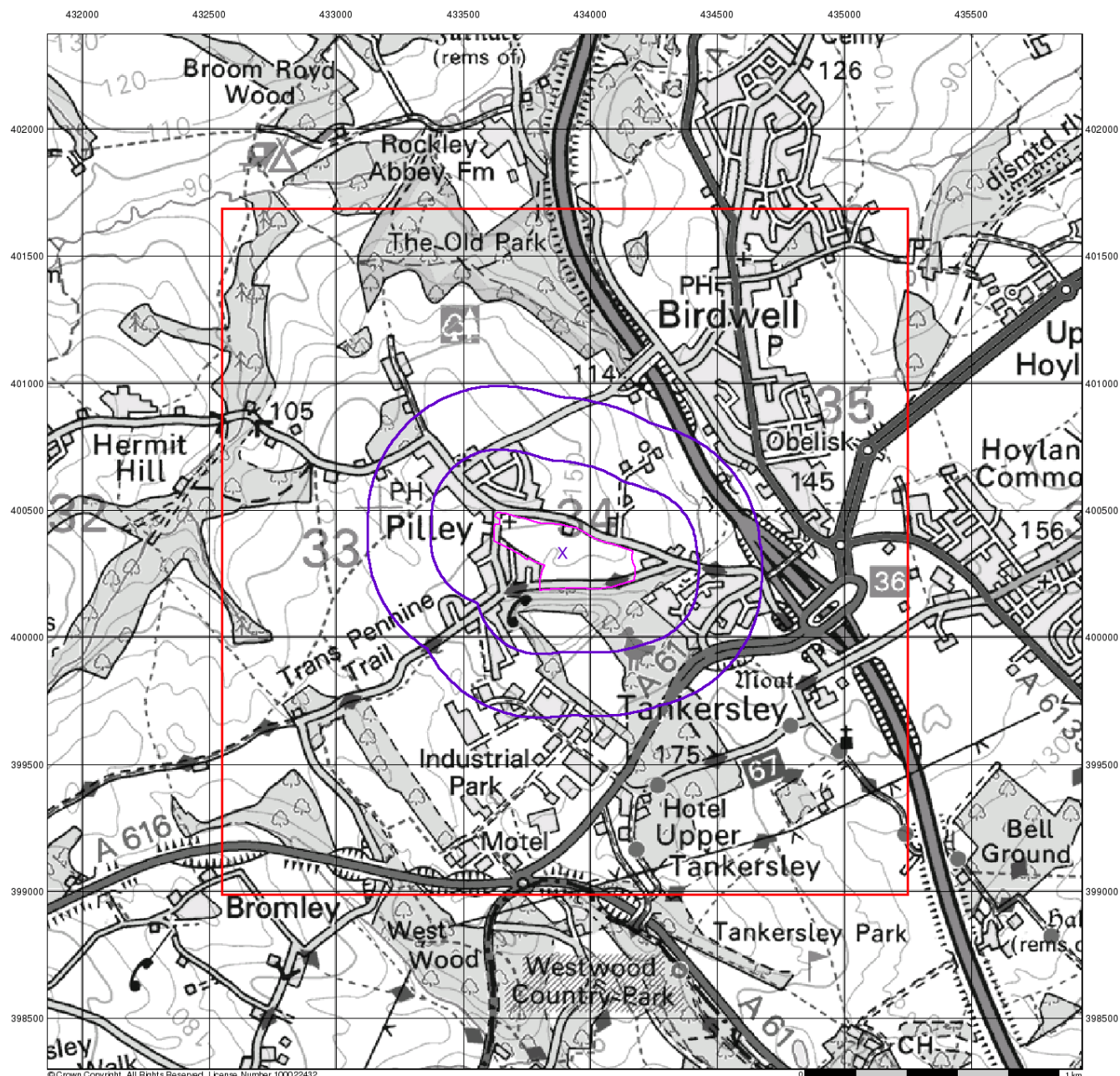
Appendix E

Search Responses & other Correspondence

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

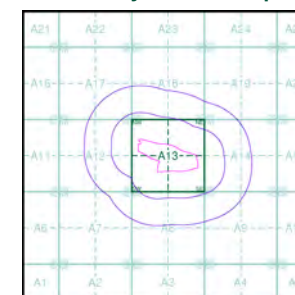
General

- 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



General

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

Agency and Hydrological

- | | | | |
|---|--|---|--|
|  | Contaminated Land Register Entry or Notice (Location) |  | BGS Recorded Landfill Site (Location) |
|  | Contaminated Land Register Entry or Notice |  | BGS Recorded Landfill Site |
|  | Discharge Consent |  | EA Historic Landfill (Buffered Point) |
|  | Enforcement or Prohibition Notice |  | EA Historic Landfill (Polygon) |
|  | Integrated Pollution Control |  | Integrated Pollution Control Registered Waste Site |
|  | Integrated Pollution Prevention Control |  | Licensed Waste Management Facility (Landfill Boundary) |
|  | Local Authority Integrated Pollution Prevention and Control |  | Licensed Waste Management Facility (Location) |
|  | Local Authority Pollution Prevention and Control |  | Local Authority Recorded Landfill Site (Location) |
|  | Local Authority Pollution Prevention and Control Enforcement |  | Local Authority Recorded Landfill Site |
|  | Pollution Incident to Controlled Waters |  | Registered Landfill Site |
|  | Prosecution Relating to Authorised Processes |  | Registered Landfill Site (Location) |
|  | Prosecution Relating to Controlled Waters |  | Registered Landfill Site (Point Buffered to 100m) |
|  | Registered Radioactive Substance |  | Registered Landfill Site (Point Buffered to 250m) |
|  | River Network or Water Feature |  | Registered Waste Transfer Site (Location) |
|  | River Quality Sampling Point |  | Registered Waste Transfer Site |
|  | Substantiated Pollution Incident Register |  | Registered Waste Treatment or Disposal Site (Location) |
|  | Water Abstraction |  | Registered Waste Treatment or Disposal Site |
|  | Water Industry Act Referral | | |

Waste

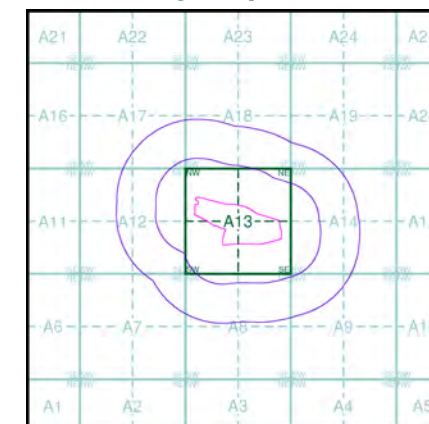
Hazardous Substances

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

Geological

Industrial Land Use

Site Sensitivity Map - Slice A



Order Details

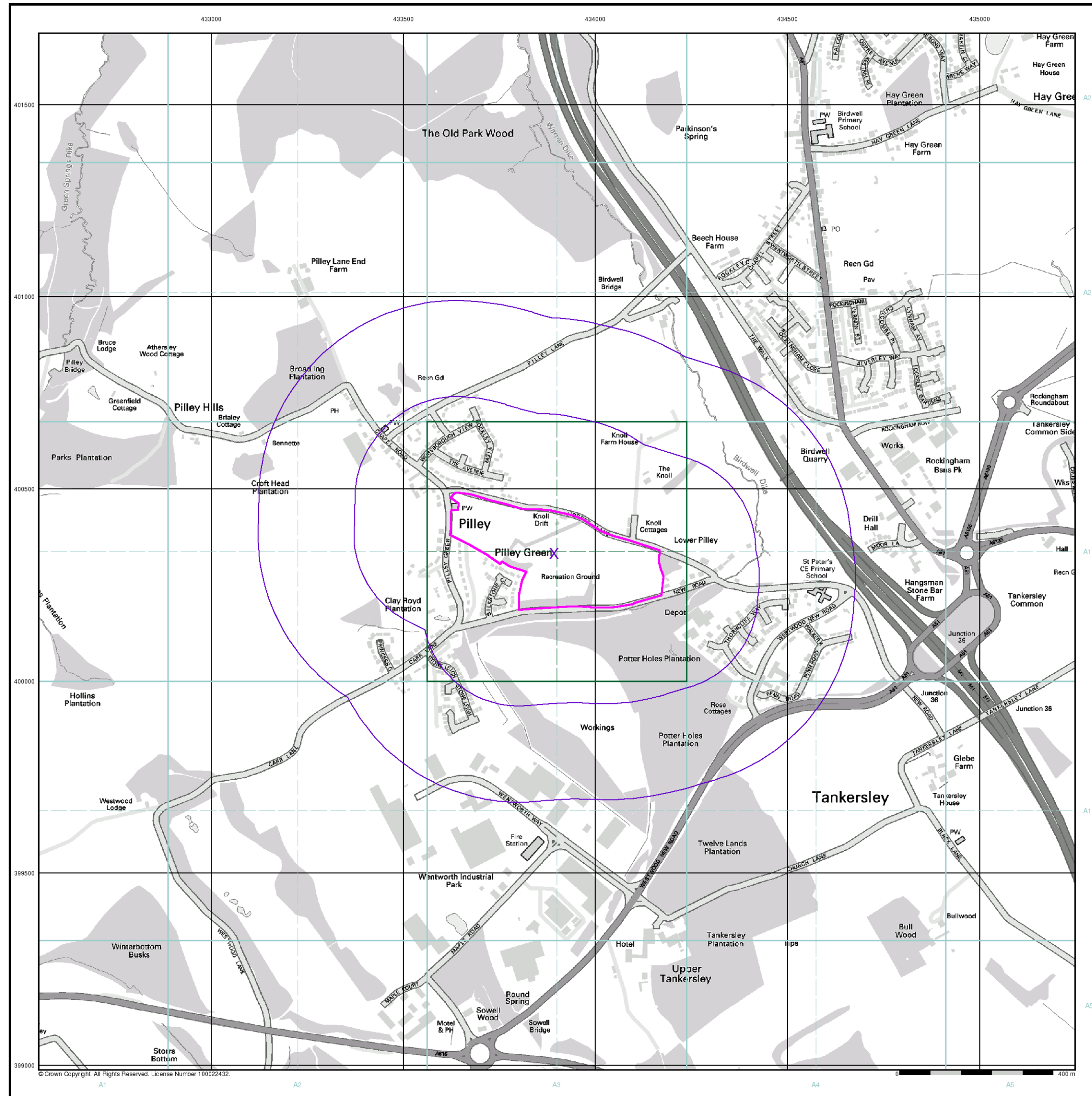
Order Number: 72903369_1_1
Customer Ref: 2222
National Grid Reference: 433890, 400330
Slice: A
Site Area (Ha): 10.09
Search Buffer (m): 500

Site Details

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



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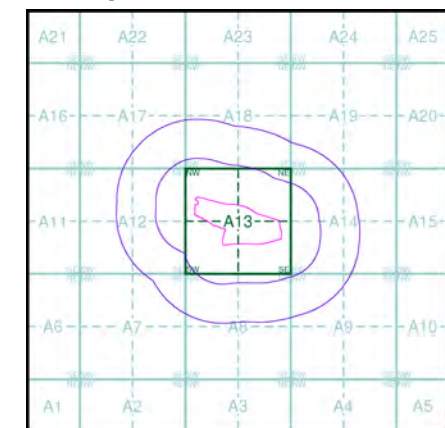
General

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

Agency and Hydrological (Flood)

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

Flood Map - Slice A



Order Details

Order Number: 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
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General

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

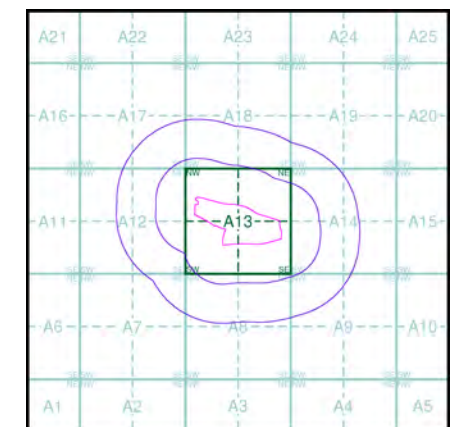
Detailed River Network Data

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

EA/NRW Detailed River Network Map - Slice A



Order Details

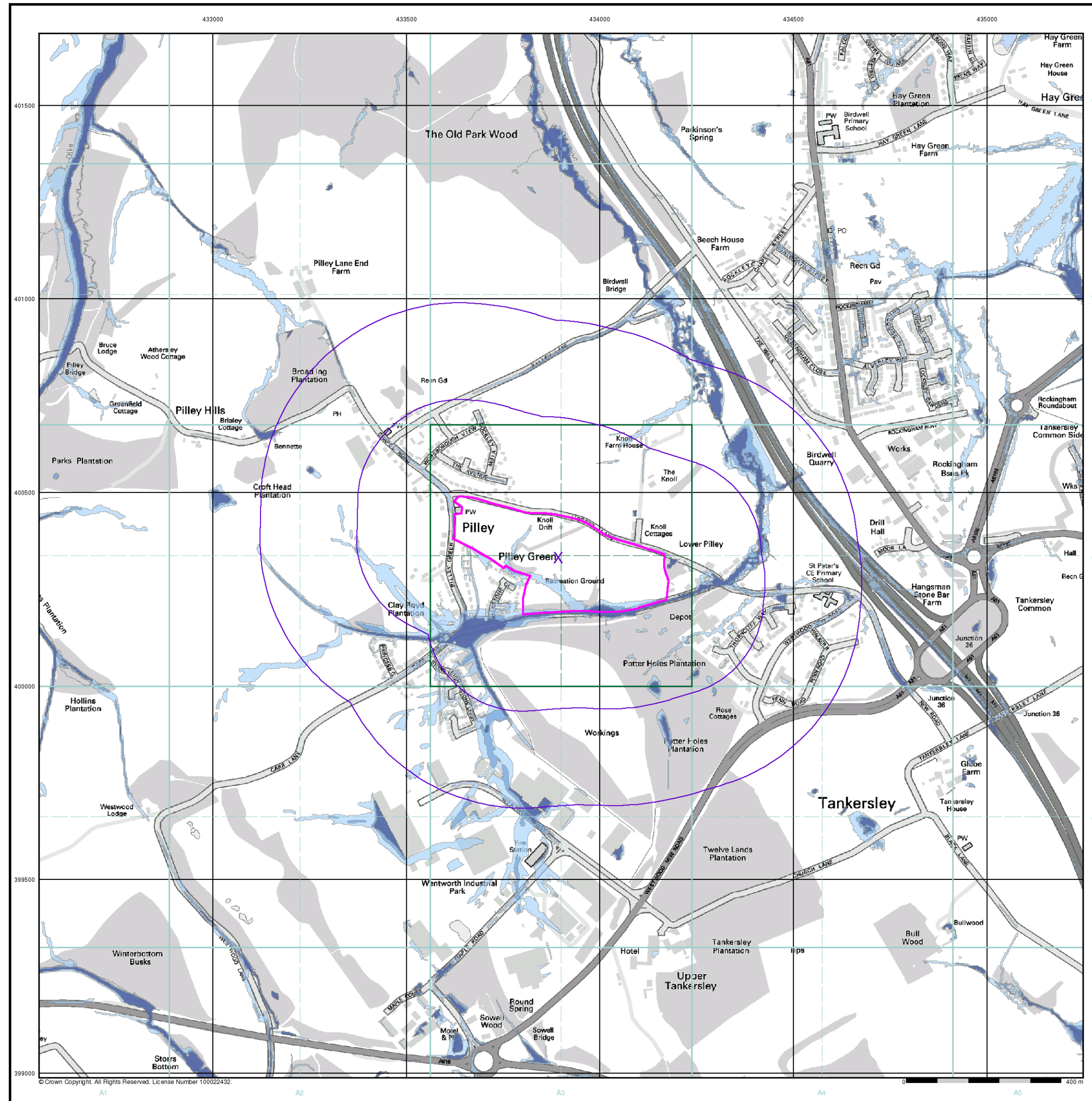
Order Number: 72903369_1_1
Customer Ref: 2222
National Grid Reference: 433890, 400330
Slice: A
Site Area (Ha): 10.09
Search Buffer (m): 500

Site Details

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



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General

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

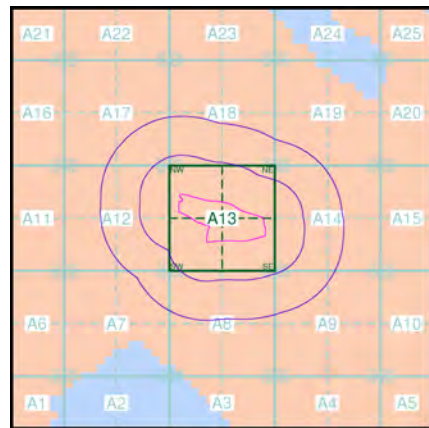
Risk of Flooding from Surface Water

- 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

E/NRW 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
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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

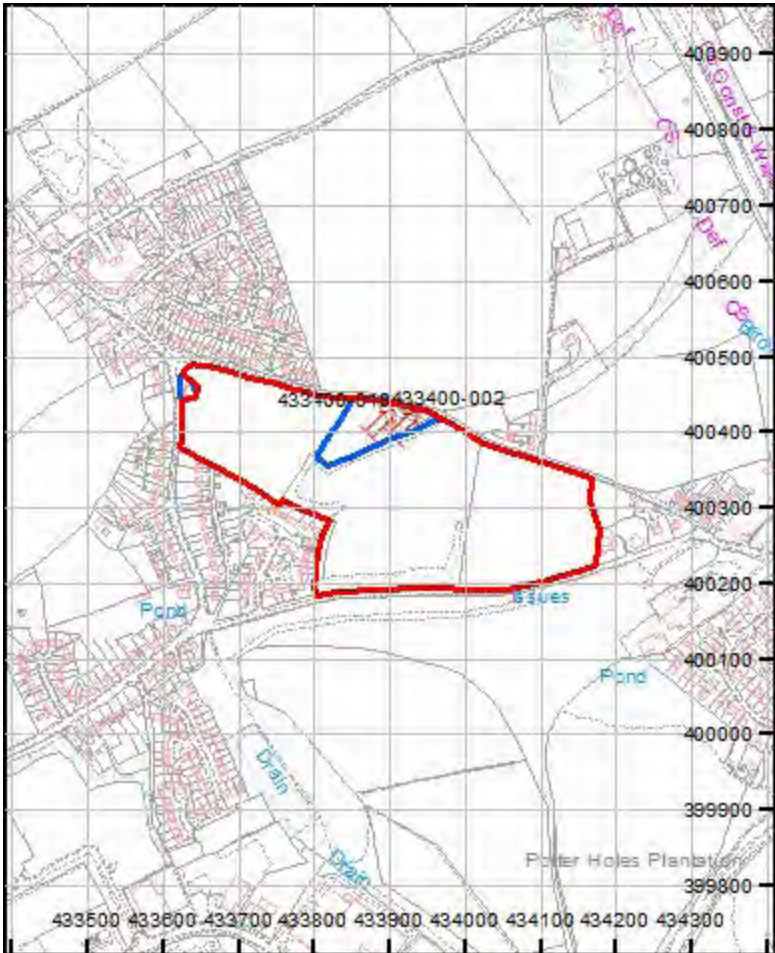
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Key

Approximate position of enquiry boundary shown

Disused Adit or Mineshaft

Coal Claims



Appendix F

Trial Pit Logs

				Trial Pit Log			Trialpit No TP01 Sheet 1 of 1	
Project Name: New Road, Pilley				Project No. 2222		Co-ords: 434039.67 - 400269.44 Level: 137.75		Date 16/05/2016
Location:						Dimensions (m):		Scale 1:25
Client: Barratt & David Wilson Homes Yorkshire West						Depth 2.60		Logged MJT
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J&T		0.20	137.55		TOPSOIL: Dark grey-black organic-rich slightly sandy loamy clay. (TOPSOIL)	
				0.40	137.35		Light brown-grey silty loamy clay occasional medium subangular gravel of sandstone. (SUBSOIL)	
			HVP=60				Firm orange-brown and grey slightly sandy CLAY. (COMPLETELY WEATHERED COAL MEASURES)	
	0.80	D					From 1.2m, mottled and stiff. Occasional subrounded cobble of siderite.	1
			HVP=68					
			HVP=90					
			1.50	136.25		?Medium dense mottled orange-brown and grey very clayey fine to medium GRAVEL of mudstone lithorelics. Locally a very gravelly clay. (WEATHERED COAL MEASURES) From 1.5m to 2.1m, occasional cobble sized lenses of black clayey gravel of coal.	2	
			2.10	135.65		Very weak grey-green thinly bedded SILSTONE. Recovered as subangular to angular coarse gravel and cobble. (COAL MEASURES SILTSTONE)		
	2.20	D		2.60	135.15		End of pit at 2.60 m	3
								4
								5
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.								
Stability:								

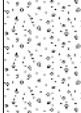
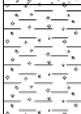
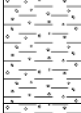
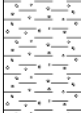
				Trial Pit Log			Trialpit No TP02 Sheet 1 of 1		
Project Name: New Road, Pilley				Project No. 2222		Co-ords: 434075.45 - 400249.09 Level: 136.75		Date 16/05/2016	
Location:						Dimensions (m):		Scale 1:25	
Client: Barratt & David Wilson Homes Yorkshire West						Depth 3.60		Logged MJT	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30	136.45		TOPSOIL: Dark grey-black organic-rich slightly sandy loamy clay. (TOPSOIL)	
				0.50	136.25		Light brown-grey silty loamy clay occasional medium subangular gravel of sandstone. (SUBSOIL)	
	0.80	D	HVP=80				Stiff orange and brown-grey slightly sandy CLAY. (COMPLETELY WEATHERED COAL MEASURES) <i>In north of pit, black gravelly clay (weathered coal) from 0.6m to 0.8m</i>	1
			HVP=85	1.10	135.65		Stiff orange and brown-grey slightly sandy very gravelly CLAY. Gravel is fine to medium of siltstone lithorelics. (COMPLETELY WEATHERED COAL MEASURES)	
				2.00	134.75		Very weak dark brown-black laminated MUDSTONE. Recovered as very clayey fine to coarse gravel and occasional cobble. (COAL MEASURES MUDSTONE)	2
				2.80	133.95		<i>After 2.6m, recovered as gravel and cobble.</i> Very weak grey and black laminated carbonaceous MUDSTONE AND COAL. Recovered as slightly clayey fine gravel with occasional coal fragments. (COAL MEASURES MUDSTONE)	3
	3.00	D		3.30	133.45		Weak grey thinly bedded SILTSTONE. Recovered as very sandy tabular fine to coarse gravel and cobble. (COAL MEASURES SILTSTONE)	
				3.60	133.15		End of pit at 3.60 m	4
								5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.		
Stability:		

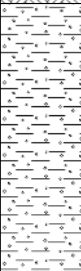
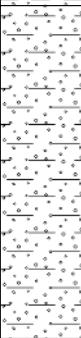
				Trial Pit Log				Trialpit No TP03 Sheet 1 of 1	
Project Name: New Road, Pilley				Project No. 2222		Co-ords: 434111.12 - 400244.72 Level: 136.90		Date 16/05/2016	
Location:						Dimensions (m):		Scale 1:25	
Client: Barratt & David Wilson Homes Yorkshire West						Depth 2.10		Logged MJT	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.10	J&T	HVP=65				TOPSOIL: Dark grey-black organic-rich slightly sandy loamy clay. (TOPSOIL)		
				0.30	136.60		Light brown-grey silty loamy clay occasional medium subangular gravel of sandstone. (SUBSOIL)		
				0.60	136.30		Firm orange-brown and grey slightly sandy CLAY. (COMPLETELY WEATHERED COAL MEASURES)		
	1.00	D		0.90	136.00		Stiff grey CLAY. (COMPLETELY WEATHERED COAL MEASURES) From 0.9m to 1.2m in north, black very clayey fine gravel of mudstone & coal.		
									
						From 1.6m, with much gravel of siltstone lithorelics and occasional cobble of siltstone.			
				2.00	134.90		?Dense slightly clayey sandy coarse GRAVEL AND COBBLE siltstone. (WEATHERED COAL MEASURES)		
				2.10	134.80		End of pit at 2.10 m		
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.									
Stability:									

				Trial Pit Log			Trialpit No TP04 Sheet 1 of 1		
Project Name: New Road, Pilley				Project No. 2222		Co-ords: 434140.56 - 400226.21 Level: 134.70		Date 16/05/2016	
Location:						Dimensions (m):		Scale 1:25	
Client: Barratt & David Wilson Homes Yorkshire West						Depth 2.50		Logged MJT	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J&T	HVP=118	0.30	134.40		TOPSOIL: Dark grey-black organic-rich slightly sandy loamy clay. (TOPSOIL)	1
				0.50	134.20		Light brown-grey silty loamy clay occasional medium subangular gravel of sandstone. (SUBSOIL)	
	0.60	D					?Medium dense black-brown very clayey SAND AND fine GRAVEL of mudstone and coal. Locally a gravelly clay. (WEATHERED LIDGET SEAM)	
				0.90	133.80		Stiff orange-brown and grey slightly sandy CLAY with occasional fine to medium subangular gravel of mudstone. (COMPLETELY WEATHERED COAL MEASURES)	
	1.50	D		1.60	133.10		Stiff orange-brown and grey slightly sandy CLAY with much fine to medium subangular gravel of siltstone lithorelics. (WEATHERED COAL MEASURES)	
							From 2.0m, becoming a very clayey gravel.	2
				2.50	132.20	End of pit at 2.50 m		3
								4
								5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.		
Stability:		

				Trial Pit Log			Trialpit No TP05 Sheet 1 of 1		
Project Name: New Road, Pilley				Project No. 2222		Co-ords: 434108.98 - 400209.18 Level: 133.45		Date 16/05/2016	
Location:						Dimensions (m):		Scale 1:25	
Client: Barratt & David Wilson Homes Yorkshire West						Depth 2.40		Logged MJT	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.40	133.05		TOPSOIL: Dark grey-black organic-rich slightly sandy loamy clay. (TOPSOIL)	
				1.30	132.15		Firm orange-brown CLAY with much subangular fine to medium gravel of mudstone lithorelics. (COMPLETELY WEATHERED COAL MEASURES)	1
				2.40	131.05		?Dense mottled orange and grey very clayey subangular to angular medium to coarse GRAVEL of siltstone. Occasional tabular cobble of siltstone. Cobble sized lenses of very gravelly clay. (WEATHERED COAL MEASURES)	2
							<i>From 2.3m, becoming difficult to excavate.</i> ----- End of pit at 2.40 m	3
								4
								5

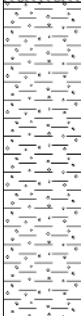
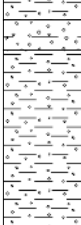
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.		
Stability:		

				Trial Pit Log			Trialpit No TP06 Sheet 1 of 1		
Project Name: New Road, Pilley				Project No. 2222		Co-ords: 434049.34 - 400220.38 Level: 134.55		Date 16/05/2016	
Location:						Dimensions (m):		Scale 1:25	
Client: Barratt & David Wilson Homes Yorkshire West						Depth 2.70		Logged MJT	

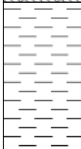
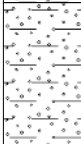
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J&T		0.20	134.35		TOPSOIL: Dark grey-black organic-rich slightly sandy loamy clay. (TOPSOIL)	
	0.90	D	HVP=76				Stiff orange-brown and grey slightly sandy CLAY. Occasional subangular to subrounded coarse gravel and cobble of sandstone. (COMPLETELY WEATHERED COAL MEASURES)	1
			HVP=90					
			HVP=100					
			HVP=110					
				2.50	132.05		From 1.7m, becoming very gravelly with siltstone lithorelics, occasional tabular coarse gravel of mudstone.	2
				2.70	131.85		?Dense orange-brown and grey very clayey tabular fine to coarse GRAVEL of mudstone. (WEATHERED COAL MEASURES)	
							From 2.5m, becoming difficult to excavate. End of pit at 2.70 m	3
								4
								5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.		
Stability:		

				Trial Pit Log				Trialpit No TP07 Sheet 1 of 1	
Project Name: New Road, Pilley				Project No. 2222		Co-ords: 434010.83 - 400253.10 Level: 136.70		Date 16/05/2016	
Location:						Dimensions (m):		Scale 1:25	
Client: Barratt & David Wilson Homes Yorkshire West						Depth 2.20		Logged MJT	

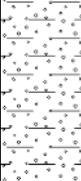
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30	136.40		TOPSOIL: Dark grey-black organic-rich slightly sandy loamy clay. (TOPSOIL)	
	1.00	D	HVP=90				Stiff mottled orange-brown and grey slightly sandy CLAY. Occasional subrounded to subangular fine to medium gravel of mudstone. (COMPLETELY WEATHERED COAL MEASURES)	1
	1.45	D		1.40	135.30		?Dense blue-black clayey sandy fine subangular tabular GRAVEL predominantly of coal. (WEATHERED LIDGET SEAM)	
				1.50	135.20		Stiff mottled orange-brown and grey slightly sandy CLAY. Much subrounded to subangular fine to medium gravel of mudstone. (COMPLETELY WEATHERED COAL MEASURES)	2
				2.10	134.60		Weak grey thinly bedded SILTSTONE. Recovered as very sandy tabular fine to coarse gravel and cobble. (COAL MEASURES SILTSTONE)	
				2.20	134.50		End of pit at 2.20 m	5

Remarks:	1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.	
Stability:		

				Trial Pit Log				Trialpit No TP08 Sheet 1 of 1	
Project Name: New Road, Pilley				Project No. 2222		Co-ords: 434026.67 - 400318.03 Level: 142.35		Date 16/05/2016	
Location:						Dimensions (m):		Scale 1:25	
Client: Barratt & David Wilson Homes Yorkshire West						Depth 3.00		Logged MJT	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.10	J&T	HVP=70	0.30	142.05		TOPSOIL: Dark grey-black organic-rich slightly sandy loamy clay. (TOPSOIL)		
							Firm orange and grey CLAY. (COMPLETELY WEATHERED COAL MEASURES)		
							Very weak black COAL recovered as very sandy tabular gravel and cobble. (LIDGET SEAM)		
	1.20	B				<i>From 1.4m, widely spaced c.0.1m thick beds of firm clay.</i>			
				2.20	140.15		Stiff light grey slightly sandy CLAY with much subangular to angular fine to coarse gravel of siltstone lithorelics. (COMPLETELY WEATHERED COAL MEASURES)		
				2.50	139.85		?Dense orange and grey slightly clayey fine subangular GRAVEL of mudstone lithorelics. (WEATHERED COAL MEASURES)		
				3.00	139.35		End of pit at 3.00 m		
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.									
Stability:									

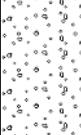
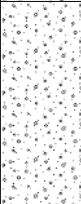


				Trial Pit Log			Trialpit No TP09 Sheet 1 of 1		
Project Name: New Road, Pilley				Project No. 2222		Co-ords: 434085.50 - 400296.32 Level: 141.15		Date 16/05/2016	
Location:						Dimensions (m):		Scale 1:25	
Client: Barratt & David Wilson Homes Yorkshire West						Depth 1.00		Logged MJT	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J&T		0.30	140.85		TOPSOIL: Dark grey-black organic-rich slightly sandy loamy friable clay. Occasional fine gravel of clinker. (TOPSOIL)	
	0.80	D		0.95 1.00	140.20 140.15		?Dense orange sandy very clayey subangular fine to coarse GRAVEL of sandstone. (WEATHERED COAL MEASURES)	
							Moderately weak orange thinly bedded fine grained SANDSTONE. Recovered as sandy tabular gravel and cobble. (COAL MEASURES SANDSTONE) End of pit at 1.00 m	1
								2
								3
								4
								5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.		
Stability:		

				Trial Pit Log			Trialpit No TP10 Sheet 1 of 1		
Project Name: New Road, Pilley				Project No. 2222		Co-ords: 434125.56 - 400278.29 Level: 139.35		Date 16/05/2016	
Location:						Dimensions (m):		Scale 1:25	
Client: Barratt & David Wilson Homes Yorkshire West						Depth 1.55		Logged MJT	

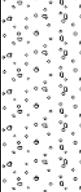
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J&T					TOPSOIL: Dark grey-black organic-rich slightly sandy loamy clay. (TOPSOIL)	
	0.50	J&T					?Medium dense orange sandy subangular fine to coarse GRAVEL AND COBBLE of sandstone. (WEATHERED COAL MEASURES)	
							?Medium dense grey-brown very sandy subangular fine GRAVEL of fine grained sandstone. (WEATHERED COAL MEASURES)	1
				1.50 1.55	137.85 137.80		Moderately weak grey thinly bedded fine grained SANDSTONE. Recovered as tabular cobble. (COAL MEASURES SANDSTONE)	
							End of pit at 1.55 m	2
								3
								4
								5

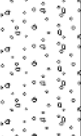
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.		
Stability:		

				Trial Pit Log			Trialpit No TP11 Sheet 1 of 1		
Project Name: New Road, Pilley				Project No. 2222		Co-ords: 434155.04 - 400315.62 Level: 138.80		Date 16/05/2016	
Location:						Dimensions (m):		Scale 1:25	
Client: Barratt & David Wilson Homes Yorkshire West						Depth 1.05		Logged MJT	

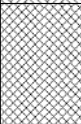
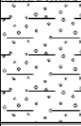
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J&T					TOPSOIL: Dark grey-black organic-rich slightly sandy loamy clay. (TOPSOIL)	
				0.30	138.50		?Medium dense orange and brown very clayey subangular fine to coarse GRAVEL AND COBBLE of sandstone. (WEATHERED COAL MEASURES)	
	0.80	D		0.60	138.20		Stiff orange-light brown slightly sandy CLAY with much subangular fine to coarse gravel of sandstone. Occasional subangular cobble. (COMPLETELY WEATHERED COAL MEASURES)	
				1.00	137.80		Moderately weak grey thinly bedded fine grained SANDSTONE. Recovered as tabular cobble. (COAL MEASURES SANDSTONE)	1
				1.05	137.75		End of pit at 1.05 m	
								2
								3
								4
								5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.		
Stability:		

				Trial Pit Log				Trialpit No TP12 Sheet 1 of 1	
Project Name: New Road, Pilley				Project No. 2222		Co-ords: 434074.29 - 400352.37 Level: 142.90		Date 16/05/2016	
Location:						Dimensions (m):		Scale 1:25	
Client: Barratt & David Wilson Homes Yorkshire West						Depth 1.10		Logged MJT	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.10	J&T		0.30	142.60		TOPSOIL: Dark grey-black organic-rich slightly sandy loamy clay. (TOPSOIL)		
							?Medium dense roughly horizontally orientated very sandy tabular fine to coarse GRAVEL AND COBBLE of fine-grained sandstone. (WEATHERED COAL MEASURES) <i>From 0.6m, becoming ?dense.</i>		
	1.05	D		1.00	141.90		Weak grey thinly bedded fine grained SANDSTONE. Recovered as tabular cobble.		
				1.10	141.80		(COAL MEASURES SANDSTONE) <i>End of pit at 1.10 m</i>		
1 2 3 4 5									
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.									
Stability:									

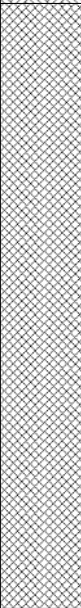
				Trial Pit Log				Trialpit No TP14 Sheet 1 of 1	
Project Name: New Road, Pilley				Project No. 2222		Co-ords: 434114.61 - 400330.98 Level: 141.00		Date 17/05/2016	
Location:						Dimensions (m): Depth 0.90		Scale 1:25 Logged MJT	
Client: Barratt & David Wilson Homes Yorkshire West									
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.60	D		0.30	140.70		TOPSOIL: Dark grey-black organic-rich slightly sandy loamy clay. (TOPSOIL)		
							?Dense orange-brown very sandy angular tabular fine to coarse GRAVEL AND COBBLE of sandstone. (WEATHERED COAL MEASURES)		
				0.80	140.20		Moderately weak orange-brown thinly bedded fine-grained SANDSTONE. Recovered as sandy tabular coarse gravel and cobble. (COAL MEASURES SANDSTONE) End of pit at 0.90 m		
				0.90	140.10				
								1	
								2	
								3	
								4	
								5	
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.									
Stability:									



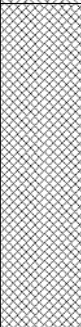
				Trial Pit Log			Trialpit No TT01 (N) Sheet 1 of 1		
Project Name: New Road, Pilley				Project No. 2222		Co-ords: 434006.37 - 400220.89 Level: 134.25		Date 17/05/2016	
Location:						Dimensions (m):		Scale 1:25	
Client: Barratt & David Wilson Homes Yorkshire West						Depth 2.50		Logged MJT	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.40	133.85		TOPSOIL: Dark grey-black organic-rich slightly sandy loamy clay. (TOPSOIL)		
				0.80	133.45		MADE GROUND: Firm dark grey and orange slightly sandy loamy organic-rich clay. Some fine gravel of mudstone lithorelics. (OPENCAST BACKFILL)		
				1.20	133.05		?Medium dense clayey tabular medium to coarse GRAVEL of mudstone. (WEATHERED COAL MEASURES)		
				2.50	131.75		Very weak black thinly bedded MUDSTONE recovered as tabular gravel and cobble. (COAL MEASURES MUDSTONE)		
						End of pit at 2.50 m			
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.									
Stability:									



				Trial Pit Log			Trialpit No TT01 (S) Sheet 1 of 1		
Project Name: New Road, Pilley				Project No. 2222		Co-ords: 434006.37 - 400220.89 Level: 134.25		Date 17/05/2016	
Location:						Dimensions (m):		Scale 1:25	
Client: Barratt & David Wilson Homes Yorkshire West						Depth 2.40		Logged MJT	

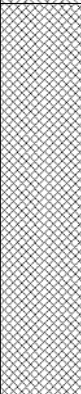
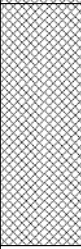
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.60	J&T		0.40	133.85		TOPSOIL: Dark grey-black organic-rich slightly sandy loamy clay. (TOPSOIL)	
							MADE GROUND: Firm dark grey and orange slightly sandy loamy organic-rich clay. Some fine gravel of mudstone lithorelics. (OPENCAST BACKFILL)	1
				2.40	131.85		End of pit at 2.40 m	2
								3
								4
								5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.		
Stability:		

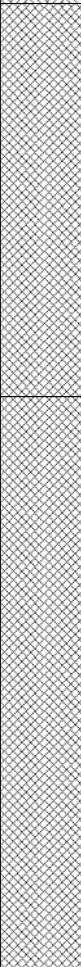
				Trial Pit Log			Trialpit No TT02 (N) Sheet 1 of 1		
Project Name: New Road, Pilley				Project No. 2222		Co-ords: 434018.50 - 400218.05 Level: 134.10		Date 17/05/2016	
Location:						Dimensions (m):		Scale 1:25	
Client: Barratt & David Wilson Homes Yorkshire West						Depth 2.00		Logged MJT	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.40	133.70		TOPSOIL: Dark grey-black organic-rich slightly sandy loamy clay. (TOPSOIL)		
				1.50	132.60		MADE GROUND: Stiff orange, dark brown and grey clay with some randomly orientated subangular fine to coarse gravel of mudstone. Rare medium gravel-sized fragments of clayware. Rare fragments of metal. (OPENCAST BACKFILL)		
				2.00	132.10		Very weak black thinly bedded MUDSTONE recovered as tabular gravel and cobble. (COAL MEASURES MUDSTONE)		
	End of pit at 2.00 m								
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Some slight collapse of trial pit walls within opencast backfill. 4. Backfilled with materials arising upon completion.									
Stability:									

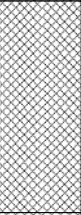


				Trial Pit Log			Trialpit No TT02 (C) Sheet 1 of 1		
Project Name: New Road, Pilley				Project No. 2222		Co-ords: 434018.50 - 400218.05 Level: 134.10		Date 17/05/2016	
Location:						Dimensions (m):		Scale 1:25	
Client: Barratt & David Wilson Homes Yorkshire West						Depth 3.60		Logged MJT	

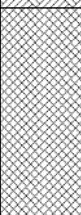
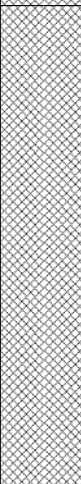
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	3.00	D		0.40	133.70		TOPSOIL: Dark grey-black organic-rich slightly sandy loamy clay. (TOPSOIL)	1
				1.70	132.40		MADE GROUND: Stiff orange, dark brown and grey clay with some randomly orientated subangular fine to coarse gravel of mudstone. Rare medium gravel-sized fragments of clayware. Rare fragments of metal. (OPENCAST BACKFILL)	
				2.50	131.60		MADE GROUND: ?Dense grey subrounded to angular gravel and cobble of siltstone. Occasional boulder (c.0.6m diameter) lenses of gravelly clay. (OPENCAST BACKFILL)	
				3.60	130.50		Very weak black thinly bedded MUDSTONE recovered as tabular gravel and cobble. (COAL MEASURES MUDSTONE)	
								4
								5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Some slight collapse of trial pit walls within opencast backfill. 4. Backfilled with materials arising upon completion.		
Stability:		

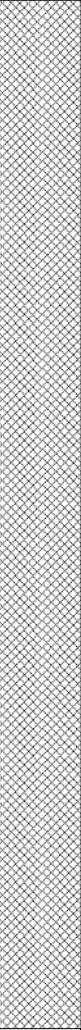
				Trial Pit Log			Trialpit No TT02 (S) Sheet 1 of 1			
Project Name: New Road, Pilley				Project No. 2222		Co-ords: 434018.50 - 400218.05 Level: 134.10		Date 17/05/2016		
Location:						Dimensions (m):		Scale 1:25		
Client: Barratt & David Wilson Homes Yorkshire West						Depth 3.60		Logged MJT		
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
	Depth	Type	Results							
				0.40	133.70		TOPSOIL: Dark grey-black organic-rich slightly sandy loamy clay. (TOPSOIL)			
								MADE GROUND: Stiff orange, dark brown and grey clay with some randomly orientated subangular fine to coarse gravel of mudstone. Rare medium gravel-sized fragments of clayware. Rare fragments of metal. (OPENCAST BACKFILL) <i>From 0.8m, becoming orange-brown.</i>		
				1.70	132.40			MADE GROUND: ?Dense grey subrounded to angular gravel and cobble of siltstone. Occasional boulder (c.0.6m diameter) lenses of gravelly clay. (OPENCAST BACKFILL)		
					3.60	130.50		End of pit at 3.60 m		
1 2 3 4 5										
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Some slight collapse of trial pit walls within opencast backfill. 4. Backfilled with materials arising upon completion.										
Stability:										

				Trial Pit Log			Trialpit No TT03 (E) Sheet 1 of 1			
Project Name: New Road, Pilley				Project No. 2222		Co-ords: 434018.95 - 400203.26 Level: 133.10		Date 17/05/2016		
Location:						Dimensions (m): Depth 2.50		Scale 1:25 Logged MJT		
Client: Barratt & David Wilson Homes Yorkshire West										
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
	Depth	Type	Results							
▼	0.80	J&T	HVP=45	0.60	132.50		TOPSOIL: Dark grey-black organic-rich slightly sandy loamy clay. Occasional 1m lengths of rotting timber. (TOPSOIL)			1
				1.30	131.80		MADE GROUND: Dark grey very clayey subangular medium to coarse gravel of mudstone and occasional coal. (OPENCAST BACKFILL)			
				1.60	131.50		MADE GROUND: Soft to firm black clay with much subangular fine to coarse gravel of mudstone. (OPENCAST BACKFILL)			
				2.20	130.90		Firm (locally soft) orange CLAY. (COMPLETELY WEATHERED COAL MEASURES)			2
				2.50	130.60		Very weak black thinly bedded MUDSTONE recovered as tabular gravel and cobble. (COAL MEASURES MUDSTONE)			
				End of pit at 2.50 m						
							4			
							5			
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 2.5m. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.										
Stability:										



				Trial Pit Log			Trialpit No TT03 (C) Sheet 1 of 1			
Project Name: New Road, Pilley				Project No. 2222		Co-ords: 434018.95 - 400203.26 Level: 133.10		Date 17/05/2016		
Location:						Dimensions (m):		Scale 1:25		
Client: Barratt & David Wilson Homes Yorkshire West						Depth 3.00		Logged MJT		
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
	Depth	Type	Results							
				0.60	132.50	   	TOPSOIL: Dark grey-black organic-rich slightly sandy loamy clay. Occasional 1m lengths of rotting timber. (TOPSOIL)			1
				1.30	131.80		MADE GROUND: Dark grey very clayey subangular medium to coarse gravel of mudstone and occasional coal. (OPENCAST BACKFILL)			
				2.90	130.20		MADE GROUND: Firm dark grey loamy clay with much tabular fine to coarse gravel of mudstone. (OPENCAST BACKFILL)			2
				3.00	130.10	Very weak black thinly bedded MUDSTONE recovered as tabular gravel and cobble. (COAL MEASURES MUDSTONE) End of pit at 3.00 m			3	
										4
									5	
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.										
Stability:										



				Trial Pit Log				Trialpit No TT04 (N) Sheet 1 of 1	
Project Name: New Road, Pilley				Project No. 2222		Co-ords: 434007.36 - 400197.59 Level: 132.50		Date 17/05/2016	
Location:						Dimensions (m): Depth 3.70		Scale 1:25 Logged MJT	
Client: Barratt & David Wilson Homes Yorkshire West									
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	3.00	D	HVP=90	0.30	132.20		TOPSOIL: Dark grey-black organic-rich slightly sandy loamy clay. Occasional 1m lengths of rotting timber. (TOPSOIL)		
							MADE GROUND: Firm to stiff dark grey clay with much tabular subangular fine to coarse gravel of mudstone. (OPENCAST BACKFILL)		
							At 2.7m in south face, mudstone bedrock recovered as tabular gravel and cobble - likely highwall.		
							End of pit at 3.70 m		
1 2 3 4 5									
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. The sides of the trial pit remained stable during excavation. 4. Backfilled with materials arising upon completion.									
Stability:									
									



Appendix G

Chemical 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: 571057-1

Date of Report: 27-May-2016

Customer: Lithos Consulting Ltd.
Parkhill
Walton Road
Wetherby
West Yorkshire
LS22 5DZ

Customer Contact: Mr Matt Thompson

Customer Job Reference: 2222/MJT/1-Chem
Customer Purchase Order: 10469/2222/MJT
Customer Site Reference: New Road, Pilley
Date Job Received at SAL: 18-May-2016
Date Analysis Started: 19-May-2016
Date Analysis Completed: 27-May-2016

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

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 Section 25 of the SAL Quality Manual



Report checked
and authorised by :
Emma Spear
Project Manager

Issued by :
Emma Spear
Project Manager



SAL Reference: 571057									
Project Site: New Road, Pilley									
Customer Reference: 2222/MJT/1-Chem									
Soil					Analysed as Soil				
Miscellaneous									
SAL Reference					571057 001	571057 002	571057 004	571057 005	571057 007
Customer Sample Reference					TP01	TP03	TP06	TP08	TP10
Bottom Depth					0.1	0.1	0.1	0.1	0.1
Comments					(TOPSOIL)	(TOPSOIL)	(TOPSOIL)	(TOPSOIL)	(TOPSOIL)
Date Sampled					17-MAY-2016	17-MAY-2016	17-MAY-2016	17-MAY-2016	17-MAY-2016
Type					Topsoil	Topsoil	Topsoil	Topsoil	Topsoil
Determinand	Method	Test Sample	LOD	Units					
Moisture @105C	T162	AR	0.1	%	24	13	23	24	18
pH	T7	AR			9.3	7.0	7.1	7.0	7.2
Arsenic	T6	M40	2	mg/kg	23	17	21	21	16
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	21	24	23	18
Chromium (trivalent)	T85	AR	2	mg/kg	22	21	24	23	18
Chromium VI	T6	AR	1	mg/kg	<1	<1	<1	<1	<1
Copper	T6	M40	1	mg/kg	43	42	47	43	34
Lead	T6	M40	1	mg/kg	81	59	79	69	60
Mercury	T6	M40	1	mg/kg	<1	<1	<1	<1	<1
Nickel	T6	M40	1	mg/kg	21	21	27	23	20
Selenium	T6	M40	3	mg/kg	<3	<3	<3	<3	<3
Zinc	T6	M40	1	mg/kg	150	120	180	130	120
Asbestos ID	T27	AR			N.D.	N.D.	N.D.	N.D.	N.D.
Retained on 10mm sieve	T2	M40	0.1	%	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	T16	AR	0.01	mg/kg	-	-	<0.01	-	-
Chlordane	T16	AR	0.01	mg/kg	-	-	<0.01	-	-
DDD	T16	AR	0.01	mg/kg	-	-	<0.01	-	-
DDE	T16	AR	0.01	mg/kg	-	-	<0.01	-	-
DDT	T16	AR	0.01	mg/kg	-	-	(36) <0.05	-	-
Dieldrin	T16	AR	0.01	mg/kg	-	-	<0.01	-	-
Endosulphan	T16	AR	0.01	mg/kg	-	-	<0.01	-	-
Endrin	T16	AR	0.01	mg/kg	-	-	<0.01	-	-
Heptachlor	T16	AR	0.01	mg/kg	-	-	<0.01	-	-
Heptachlor epoxide	T16	AR	0.01	mg/kg	-	-	<0.01	-	-
Hexachlorobenzene	T1	AR	0.01	mg/kg	-	-	<0.01	-	-
Hexachlorocyclohexane	T16	AR	0.01	mg/kg	-	-	<0.01	-	-
Azinphos methyl	T16	AR	0.01	mg/kg	-	-	<0.01	-	-
Diazinon	T16	AR	0.01	mg/kg	-	-	<0.01	-	-
Dichlorvos	T16	AR	0.01	mg/kg	-	-	<0.01	-	-
Dimethoate	T16	AR	0.01	mg/kg	-	-	<0.01	-	-
Fenitrothion	T16	AR	0.01	mg/kg	-	-	<0.01	-	-
Malathion	T16	AR	0.01	mg/kg	-	-	<0.01	-	-
Mevinphos	T16	AR	0.01	mg/kg	-	-	<0.01	-	-
Parathion	T16	AR	0.01	mg/kg	-	-	<0.01	-	-
Pirimiphos methyl	T16	AR	0.01	mg/kg	-	-	<0.01	-	-
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	0.3	<0.1	0.2	0.1	<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	0.4	<0.1	0.4	0.2	0.1
Pyrene	T207	M105	0.1	mg/kg	0.4	<0.1	0.3	0.2	0.1
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	0.5	<0.1	0.3	0.1	<0.1
Chrysene	T207	M105	0.1	mg/kg	0.4	<0.1	0.2	<0.1	<0.1
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	0.5	<0.1	0.3	0.1	<0.1
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	0.3	<0.1	0.2	<0.1	<0.1
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	0.4	<0.1	0.2	<0.1	<0.1
Indeno(123-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	0.3	<0.1	0.1	<0.1	<0.1
PAH(total)	T207	M105	0.1	mg/kg	3.8	<0.1	2.5	0.7	0.2

Project Site: New Road, Pilley
Customer Reference: 2222/MIT/1-Chem

SAL Reference					571057 009	571057 010	571057 011	571057 012
Customer Sample Reference					TP12	TT01 (S)	TT03 (E)	TT04 (S)
Bottom Depth					0.1	0.6	0.8	0.8
Comments					(TOPSOIL)	(OPENCAST BACKFILL)	(OPENCAST BACKFILL)	(OPENCAST BACKFILL)
Date Sampled					17-MAY-2016	17-MAY-2016	17-MAY-2016	17-MAY-2016
Type					Topsoil	Sandy Soil	Sandy Soil	Sandy Soil
Determinand	Method	Test Sample	LOD	Units				
Moisture @105C	T162	AR	0.1	%	23	23	17	24
pH	T7	AR			7.0	6.6	7.5	7.5
Arsenic	T6	M40	2	mg/kg	16	13	7	13
Boron (water-soluble)	T6	AR	1	mg/kg	<1	<1	<1	<1
Cadmium	T6	M40	1	mg/kg	<1	<1	<1	<1
Chromium	T6	M40	1	mg/kg	18	23	22	23
Chromium (trivalent)	T85	AR	2	mg/kg	18	23	22	23
Chromium VI	T6	AR	1	mg/kg	<1	<1	<1	<1
Copper	T6	M40	1	mg/kg	44	34	39	36
Lead	T6	M40	1	mg/kg	66	46	33	48
Mercury	T6	M40	1	mg/kg	<1	<1	<1	<1
Nickel	T6	M40	1	mg/kg	19	27	48	33
Selenium	T6	M40	3	mg/kg	<3	<3	<3	<3
Zinc	T6	M40	1	mg/kg	120	120	140	130
Asbestos ID	T27	AR			-	N.D.	N.D.	N.D.
Retained on 10mm sieve	T2	M40	0.1	%	<0.1	<0.1	<0.1	<0.1
Aldrin	T16	AR	0.01	mg/kg	<0.01	-	-	-
Chlordane	T16	AR	0.01	mg/kg	<0.01	-	-	-
DDD	T16	AR	0.01	mg/kg	<0.01	-	-	-
DDE	T16	AR	0.01	mg/kg	<0.01	-	-	-
DDT	T16	AR	0.01	mg/kg	(36) <0.05	-	-	-
Dieldrin	T16	AR	0.01	mg/kg	<0.01	-	-	-
Endosulphan	T16	AR	0.01	mg/kg	<0.01	-	-	-
Endrin	T16	AR	0.01	mg/kg	<0.01	-	-	-
Heptachlor	T16	AR	0.01	mg/kg	<0.01	-	-	-
Heptachlor epoxide	T16	AR	0.01	mg/kg	<0.01	-	-	-
Hexachlorobenzene	T1	AR	0.01	mg/kg	<0.01	-	-	-
Hexachlorocyclohexane	T16	AR	0.01	mg/kg	<0.01	-	-	-
Azinphos methyl	T16	AR	0.01	mg/kg	<0.01	-	-	-
Diazinon	T16	AR	0.01	mg/kg	<0.01	-	-	-
Dichlorvos	T16	AR	0.01	mg/kg	<0.01	-	-	-
Dimethoate	T16	AR	0.01	mg/kg	<0.01	-	-	-
Fenitrothion	T16	AR	0.01	mg/kg	<0.01	-	-	-
Malathion	T16	AR	0.01	mg/kg	<0.01	-	-	-
Mevinphos	T16	AR	0.01	mg/kg	<0.01	-	-	-
Parathion	T16	AR	0.01	mg/kg	<0.01	-	-	-
Pirimiphos methyl	T16	AR	0.01	mg/kg	<0.01	-	-	-
Naphthalene	T207	M105	0.1	mg/kg	-	<0.1	<0.1	<0.1
Acenaphthylene	T207	M105	0.1	mg/kg	-	<0.1	<0.1	<0.1
Acenaphthene	T207	M105	0.1	mg/kg	-	<0.1	<0.1	<0.1
Fluorene	T207	M105	0.1	mg/kg	-	<0.1	<0.1	<0.1
Phenanthrene	T207	M105	0.1	mg/kg	-	0.5	<0.1	<0.1
Anthracene	T207	M105	0.1	mg/kg	-	<0.1	<0.1	<0.1
Fluoranthene	T207	M105	0.1	mg/kg	-	0.5	<0.1	<0.1
Pyrene	T207	M105	0.1	mg/kg	-	0.4	<0.1	<0.1
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	-	0.2	<0.1	<0.1
Chrysene	T207	M105	0.1	mg/kg	-	0.2	<0.1	<0.1
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	-	0.2	<0.1	<0.1
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	-	0.1	<0.1	<0.1
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	-	0.2	<0.1	<0.1
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	-	0.1	<0.1	<0.1
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	-	<0.1	<0.1	<0.1
Benzo(ghi)Perylene	T207							

Soil	Analysed as Soil
Miscellaneous	

SAL Reference: 571057									
Project Site: New Road, Pilley									
Customer Reference: 2222/MJT/1-Chem									
Soil		Analysed as Soil							
Lithos BRE Suite									
SAL Reference				571057 010		571057 011		571057 012	
Customer Sample Reference				TT01 (S)		TT03 (E)		TT04 (S)	
Bottom Depth				0.6		0.8		0.8	
Comments				(OPENCASE BACKFILL)		(OPENCASE BACKFILL)		(OPENCASE BACKFILL)	
Date Sampled				17-MAY-2016		17-MAY-2016		17-MAY-2016	
Type				Sandy Soil		Sandy Soil		Sandy Soil	
Determinand		Method	Test Sample	LOD	Units				
(Water soluble) Cl-		T710	AR	0.01	g/l	<0.01	<0.01	<0.01	
(Water soluble) Mg		T251	AR	1	mg/l	2	2	2	
(Water soluble) NO3		T710	AR	0.01	g/l	0.03	<0.01	<0.01	
(Water Soluble) SO4 expressed as SO4		T242	AR	0.01	g/l	<0.01	<0.01	<0.01	

Value	Description
M40	Analysis conducted on sample assisted dried at no more than 40C. Results are reported on a dry weight basis.
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
N.D.	Not Detected
36	LOD Raised due to low Matrix spike recovery
S	Analysis was subcontracted
M	Analysis is MCERTS accredited
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Asbestos was sub-contracted to REC Asbestos.

Value	Description
T27	PLM
T1	GC/MS (HR)
T251	2:1 Extraction/ICP/OES
T7	Probe
T85	Calc
T2	Grav
T242	2:1 Extraction/ICP/OES (TRI, 447, T1)

T162	Grav (1 Dec) (105 C)
T6	ICP/OES
T16	GC/MS
T207	GC/MS (MCERTS)
T21	OX/IR
T710	2:1 Extraction / Discrete Analyser

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Moisture @105C	T162	AR	0.1	%	N	001-002,004-005,007,009-012
pH	T7	AR			M	001-002,004-005,007,009-012
Arsenic	T6	M40	2	mg/kg	M	001-002,004-005,007,009-012
Boron (water-soluble)	T6	AR	1	mg/kg	N	001-002,004-005,007,009-012
Cadmium	T6	M40	1	mg/kg	M	001-002,004-005,007,009-012
Chromium	T6	M40	1	mg/kg	M	001-002,004-005,007,009-012
Chromium (trivalent)	T85	AR	2	mg/kg	N	001-002,004-005,007,009-012
Chromium VI	T6	AR	1	mg/kg	N	001-002,004-005,007,009-012
Copper	T6	M40	1	mg/kg	M	001-002,004-005,007,009-012
Lead	T6	M40	1	mg/kg	M	001-002,004-005,007,009-012
Mercury	T6	M40	1	mg/kg	M	001-002,004-005,007,009-012
Nickel	T6	M40	1	mg/kg	M	001-002,004-005,007,009-012
Selenium	T6	M40	3	mg/kg	M	001-002,004-005,007,009-012
Zinc	T6	M40	1	mg/kg	M	001-002,004-005,007,009-012
Asbestos ID	T27	AR			SU	001-002,004-005,007,010-012
Retained on 10mm sieve	T2	M40	0.1	%	N	001-002,004-005,007,009-012
Aldrin	T16	AR	0.01	mg/kg	U	004,009
Chlordane	T16	AR	0.01	mg/kg	U	004,009
DDD	T16	AR	0.01	mg/kg	U	004,009
DDE	T16	AR	0.01	mg/kg	U	004,009
DDT	T16	AR	0.01	mg/kg	U	004,009
Dieldrin	T16	AR	0.01	mg/kg	U	004,009
Endosulphan	T16	AR	0.01	mg/kg	U	004,009
Endrin	T16	AR	0.01	mg/kg	U	004,009
Heptachlor	T16	AR	0.01	mg/kg	U	004,009
Heptachlor epoxide	T16	AR	0.01	mg/kg	U	004,009
Hexachlorobenzene	T1	AR	0.01	mg/kg	U	004,009
Hexachlorocyclohexane	T16	AR	0.01	mg/kg	U	004,009
Azinphos methyl	T16	AR	0.01	mg/kg	U	004,009
Diazinon	T16	AR	0.01	mg/kg	U	004,009
Dichlorvos	T16	AR	0.01	mg/kg	U	004,009
Dimethoate	T16	AR	0.01	mg/kg	U	004,009
Fenitrothion	T16	AR	0.01	mg/kg	U	004,009
Malathion	T16	AR	0.01	mg/kg	U	004,009
Mevinphos	T16	AR	0.01	mg/kg	U	004,009
Parathion	T16	AR	0.01	mg/kg	U	004,009
Pirimiphos methyl	T16	AR	0.01	mg/kg	U	004,009
Naphthalene	T207	M105	0.1	mg/kg	M	001-002,004-005,007,010-012
Acenaphthylene	T207	M105	0.1	mg/kg	U	001-002,004-005,007,010-012
Acenaphthene	T207	M105	0.1	mg/kg	M	001-002,004-005,007,010-012
Fluorene	T207	M105	0.1	mg/kg	M	001-002,004-005,007,010-012
Phenanthrene	T207	M105	0.1	mg/kg	M	001-002,004-005,007,010-012
Anthracene	T207	M105	0.1	mg/kg	U	001-002,004-005,007,010-012
Fluoranthene	T207	M105	0.1	mg/kg	M	001-002,004-005,007,010-012
Pyrene	T207	M105	0.1	mg/kg	M	001-002,004-005,007,010-012
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	M	001-002,004-005,007,010-012
Chrysene	T207	M105	0.1	mg/kg	M	001-002,004-005,007,010-012
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	M	001-002,004-005,007,010-012
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	M	001-002,004-005,007,010-012
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	M	001-002,004-005,007,010-012
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	M	001-002,004-005,007,010-012
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	M	001-002,004-005,007,010-012
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	M	001-002,004-005,007,010-012
PAH(total)	T207	M105	0.1	mg/kg	U	001-002,004-005,007,010-012
Total Organic Carbon	T21	M40	0.1	%	N	001-002,004-005,007,010-012
(Water soluble) Cl-	T710	AR	0.01	g/l	N	010-012
(Water soluble) Mg	T251	AR	1	mg/l	N	010-012
(Water soluble) NO3	T710	AR	0.01	g/l	N	010-012
(Water Soluble) SO4 expressed as SO4	T242	AR	0.01	g/l	N	010-012

Appendix H
Geotechnical Results



LABORATORY REPORT



4043

Contract Number: PSL16/2262

Report Date: 27 May 2016
Client's Reference: 2222
Client Name: Lithos Consulting
Parkhill
Walton Road
Wetherby
North Yorkshire
LS22 5DZ

For the attention of: Matt Thompson

Contract Title: New Road, Pilley
Date Received: 19/5/2016
Date Commenced: 19/5/2016
Date Completed: 27/5/2016

Notes: Opinions and Interpretations are outside the UKAS Accreditation

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

Checked and Approved Signatories:

R Gunson
(Director)

A Watkins
(Director)

R Berriman
(Quality Manager)

D Lambe
(Senior Technician)

S Royle
(Senior Technician)

L Knight
(Senior Technician)

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awatkins@prosoils.co.uk

Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

[illegible]

PSL
Professional Soils Laboratory

Checked / Approved		Date	27/05/16	Contract No:
New Road, Pilley				PSL16/2262
				Client Ref:
				2222

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m ³ Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
TP01	2	D	0.80		32			73	30	43	98	Very high plasticity CV.
TP02	1	D	0.80		31			64	27	37	100	High plasticity CH.
TP03	2	D	1.00		37			61	26	35	93	High plasticity CH.
TP04	3	D	1.50		31			66	27	39	89	High plasticity CH.
TP06	2	D	0.90		29			61	25	36	100	High plasticity CH.
TP11	2	D	0.80		18			38	20	18	97	Intermediate plasticity CI.

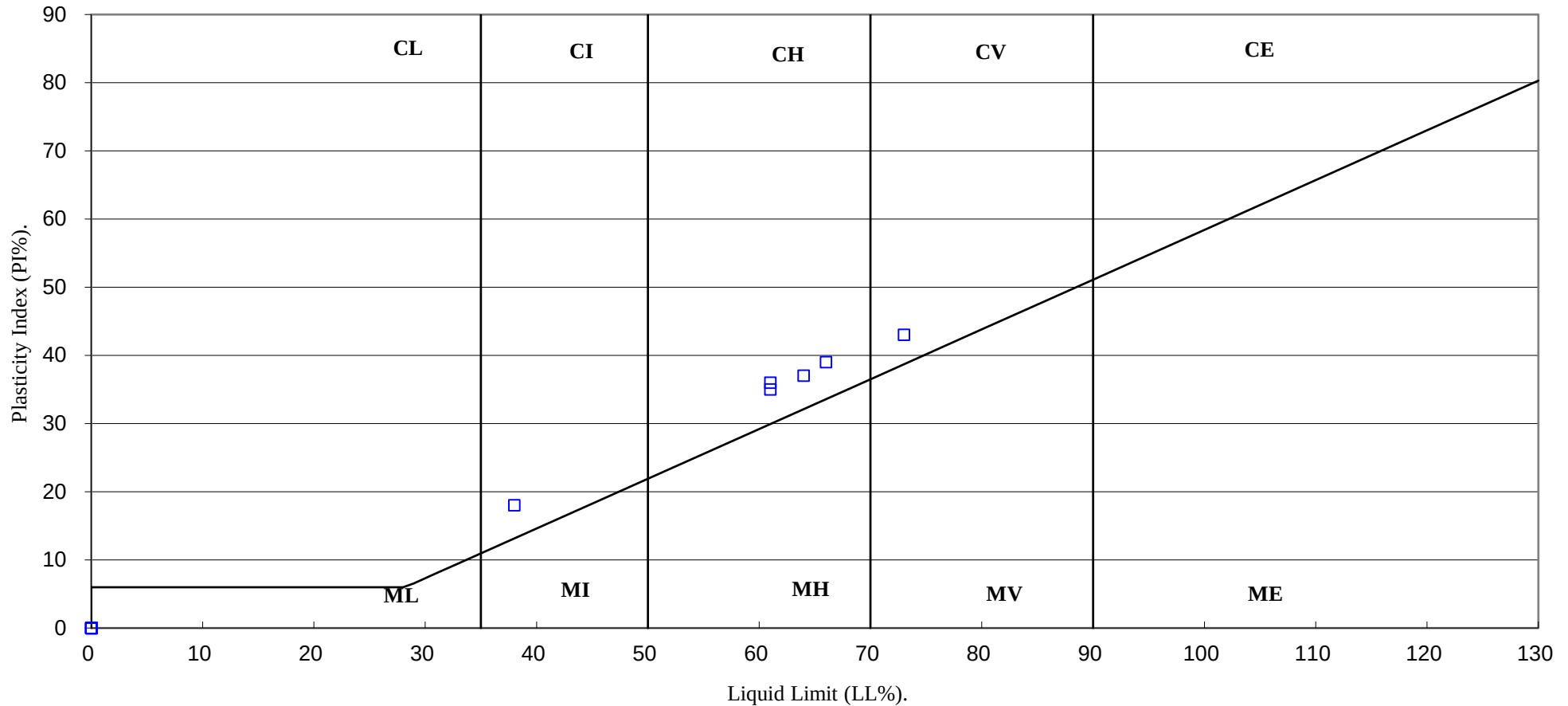
SYMBOLS : NP : Non Plastic

* : Liquid Limit and Plastic Limit Wet Sieved.

		Checked / Approved		Date	27/05/16	Contract No:
		New Road, Pilley				PSL16/2262
						Client Ref:
						2222

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

(BS5930 :2015)



PSL
Professional Soils Laboratory

Checked /Approved

[Signature]

Date

27/05/16

Contract No:

PSL16/2262

Client Ref:

2222

New Road, Pilley



Certificate of Analysis

Certificate Number 16-67689

31-May-16

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

Our Reference 16-67689

Client Reference PSL16/2262

Order No (not supplied)

Contract Title New Road, Pilley

Description 10 Soil samples.

Date Received 26-May-16

Date Started 26-May-16

Date Completed 31-May-16

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

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

Approved By

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

Rob Brown
Business Manager



Summary of Chemical Analysis

Soil Samples

Our Ref 16-67689

Client Ref PSL16/2262

Contract Title New Road, Pilley

Lab No	994369	994370	994371	994372	994373	994374	994375	994376	994377	994378
Sample ID	TP02	TT02	TP12	TP01	TP02	TP04	TP11	TP08	TP09	TP07
Depth	3.00	3.00	1.10	0.80	0.80	1.50	0.80	1.20	0.80	1.50
Other ID										
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	16/05/16	16/05/16	16/05/16	16/05/16	16/05/16	16/05/16	16/05/16	16/05/16	16/05/16	16/05/16
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units										
Inorganics													
pH	DETSC 2008#			7.4	7.2	7.9	5.2	6.7	5.0	7.2	7.1	5.7	6.9
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	21	13	66	62	46	29	< 10	25	42	< 10

Information in Support of the Analytical Results

Our Ref 16-67689
 Client Ref PSL16/2262
 Contract New Road, Pilley

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
994369	TP02 3.00 SOIL	16/05/16	PT 500ml	pH + Conductivity (7 days)	
994370	TT02 3.00 SOIL	16/05/16	PT 500ml	pH + Conductivity (7 days)	
994371	TP12 1.10 SOIL	16/05/16	PT 500ml	pH + Conductivity (7 days)	
994372	TP01 0.80 SOIL	16/05/16	PT 500ml	pH + Conductivity (7 days)	
994373	TP02 0.80 SOIL	16/05/16	PT 500ml	pH + Conductivity (7 days)	
994374	TP04 1.50 SOIL	16/05/16	PT 500ml	pH + Conductivity (7 days)	
994375	TP11 0.80 SOIL	16/05/16	PT 500ml	pH + Conductivity (7 days)	
994376	TP08 1.20 SOIL	16/05/16	PT 500ml	pH + Conductivity (7 days)	
994377	TP09 0.80 SOIL	16/05/16	PT 500ml	pH + Conductivity (7 days)	
994378	TP07 1.50 SOIL	16/05/16	PT 500ml	pH + Conductivity (7 days)	

Key: P-Plastic T-Tub

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

Soil Analysis Notes

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

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

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

Disposal

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

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