Report type:	Site Appraisal
Site:	New Lodge Estate, Barnsley
Client:	Keepmoat Homes
Ref:	GRM/P5440/F.1
Date:	April 2011

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Site Appraisal for New Lodge Estate, Barnsley

SUMMARY OF RECOMMENDATIONS

Where further assessment is required it is indicated with a "Y" in the right hand column		
Proposed Development	1-2.5 storey houses.	Y
CONTAMINATION ASSESSMENT - REMEDIATION / WASTE DISPOSAL		
End Users	Required - Hotspot removal.	Y
Site Workers	None – other than enforcement of PPE.	N
Construction Materials	Required – use of alternative pipe material and clean inert backfill in service trenches.	N
Groundwater	None.	N
Surface Water	None.	N
Waste Disposal (may include soils, asbestos, oil drums, chemical containers, etc)	Client has a duty of care to ensure that all waste is disposed appropriately to a licensed landfill. The landfill receiving the waste may request additional 'WAC' testing analysis. Waste characterisation can only be confirmed by the landfill site.	Y
GEOTECHNICAL ASSESSMENT – FOUNDATIONS		
Ground Treatment Required	No.	N
Main Bearing Strata	Clay (90%) Granular (5%) Rock (5%).	N
Nett Allowable Bearing Pressure	110kN/m^2 (Clay); 220kN/m^2 (Granular), 300kN/m^2 (Rock).	N
Tree Influence	Some.	Y
Volume Change Potential	Low to Medium – assume medium for design purposes.	N
Likely Foundation Types	Strip/Trench Fill.	N
Likely Foundation Depth Range	Minimum 0.6m, Maximum 2.0m average 1.0m.	Y
Excavation Hazards	Shallow rock.	N
Floor Slab Types	Insitu Suspended.	N
Gas Protection Requirements Radon and/or Landfill	Basic radon protection.	N
GEOTECHNICAL ASSESSMENT - GENERAL		
Slope Stability Risk	Low.	N
Soakaway Potential	Potentially within the granular Coal Measure Strata.	Y
New Access Roads	Observational CBRs (2%-4% natural cohesive).	Y
Buried Concrete Class	DS -1; AC-1s. GEN1 to BS8500 for unreinforced foundations and RC35 for reinforced foundations	N
Retaining Walls	None existing, unlikely proposed.	N
Other Comments	Asbestos survey recommended. Plot specific trial pits recommended to prevent founding on differing bearing strata.	Y

This summary is based on the full report that provides the detailed assessment of the ground risks affecting the development and how to manage them. It should not be used in isolation.

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1 INTRODUCTION

1.1 PREAMBLE

GRM Development Solutions Limited (GRM) has been appointed by Keepmoat Homes (Client) to undertake a Site Appraisal. The desk study and site inspection form Phase I of the assessment and allow the geotechnical and geo-environmental setting of the site to be determined and the identification of areas of particular concern that require targeted investigation. The Phase II works comprise the intrusive ground investigation, geotechnical testing and chemical analysis. The information gained from the Phase II works will be used to refine the conceptual model for the site and determine the most cost effective development solutions for the site.

Although the desk study information was assessed prior to the intrusive investigation works, for ease of reading and efficiency, the Phase I and Phase II aspects of the appraisal are combined within this document.

The site comprises three separate parcels of land that for the purposes of description are referred to as A, B and C in this report. A plan showing the aforementioned areas is presented in Appendix A. The Client proposes to develop the site areas with up to three storey housing, and associated infrastructure. The proposed end use includes gardens and areas of soft landscaping.

The Client has informed GRM of the following potential development hazards:

- Demolished buildings
- Underground services

This site appraisal is intended to provide information that will assist decision making by identifying and recommending solutions to ground engineering and contamination issues.

GRM Standard Limitations of Reporting are provided on the back cover of this report.

Significant Features reported by the Client:
Demolished buildings (buried foundations and substructures) – general and geotechnical hazard Underground services – general hazard

1.2 OBJECTIVES OF THE SITE APPRAISAL

The Client's specific requirements were to undertake a site appraisal in accordance with the supplied quotation.

The principal aims of the Site Appraisal are as follows:

a) Obtain information, from easily accessible sources, about the soil and groundwater conditions within the area of the site.

b) Determine the possible ground related geotechnical and contamination hazards within the site boundaries that may affect the proposed development.

c) Provide preliminary development recommendations.

d) Provide advice on further works required for the cost-effective reduction of risks to the development and procedures likely to satisfy regulators.

Whilst every effort has been made to pre-empt the likely requirements of the Local Authority and the Environment Agency, they are likely to have specific requirements that will need to be discussed and addressed at a later date.

2 PHASE I DESK STUDY AND SITE OBSERVATIONS

2.1 INFORMATION SOURCES

The following sources have been used for the identification and assessment of potential ground hazards:

- Relevant British Standards
- British Geological Survey (BGS) Geology Map Scale 1:10,000 SE 30 NW
- British Geological Survey (BGS) Geology Map Scale 1:50,000 Sheet 87, Barnsley
- BGS Memoir 'Pennines and adjacent Areas'
- Historical Ordnance Survey (OS) Maps
- Environmental Data Supplier (report from GroundSure Ltd)
- Environment Agency Website: http://www.environment-agency.gov.uk/
- Coal Authority - Records
- DEFRA/Environment Agency Contaminated Land publications and DoE Industry Profiles
- BRE Guide BR211 (2007), 'Radon: Guidance on protective measures for new buildings'
- HPA-RPD-033 (2007), 'Indicative Atlas of Radon in England and Wales'
- NRPB Publication W26 (2002), 'Radon Atlas of England and Wales'
- CIRIA C665 'Assessing risks posed by hazardous ground gases to buildings'
- Client supplied information including: the location of the site and utilities plans

Other technical references used throughout this document are detailed in the text.

2.2 SITE DESCRIPTION

2.2.1 Geographical Setting

The site area is located approximately 2.2km north east of Barnsley town centre in the outlying development known as New Lodge. The National Grid Reference (NGR) for the approximate centre of the site is SE343094. Site Location and Boundary Plans are presented in Appendix A.

The three parcels of land comprise a combined area of approximately 0.85 hectares and form part of the larger council housing development known as New Lodge Estate.

Site A (0.25ha)
The northern, eastern and western boundaries are formed by existing residential housing situated along Wakefield Road, New Lodge Crescent and Kirkstall Road respectively. The southern boundary is formed by Kirkstall Road.

Site B (0.54ha)
The northern, eastern and western boundaries are formed by existing residential housing situated along Wakefield Road, New Lodge Crescent and Kirkstall Road respectively. The southern boundary is formed by Kirkstall Road.

Site C (0.06ha)
The northern boundary is formed by Langsett Road, the eastern and southern boundaries by a minor unnamed road and the western boundary by an adjacent residential property (28 Langsett Road).

The topography of the site is flat lying with a very gentle rise towards the south and west.

2.2.2 Site Inspection Observations

The plan in Appendix B illustrates the salient observations made during a site inspection on 8th March 2011.

The ground surface of the Sites A and B is covered by a combination of demolition rubble and grass; the latter representing the former back garden areas. An area of water logged ground was noted in the extreme south east corner of Site B close to the junction of Wakefield and Langsett roads. Ruts in the ground appear to suggest that the surface soils have poor trafficability during wet conditions in this area of the site.

Vegetation included a number of coniferous garden shrubs and semi-mature trees attaining a maximum height of approximately 5m. An arboricultural specialist should conduct a tree survey should cohesive strata be found on site.

Building structures on site included: eight remaining residential properties to the south of Kirkstall Road, a pair of semi-detached properties at the junction of Kirkstall Road and New Lodge Crescent and three properties within the area of Site C. No obvious cracking or subsidence related issues were noted at the time of the inspection. No internal inspection was undertaken, although evidence of asbestos roofing material was observed within the demolition rubble on the site surface.

Systematic fly tipping was not observed at the time of the inspection or site works, although general littering was noted.

Although gas and electric supplies to the former properties have been cut off and removed as part of the demolition works, live services (including sewers, gas, telephone and electricity) still serve the remaining properties.

Significant Features identified during site inspection:
Former buildings (buried foundations and substructures) – excavation hazard
Existing structures (foundations and substructures) – excavation hazard
Remaining buried services – excavation hazard
Made ground – potential gas / contamination / geotechnical hazard
Trees – geotechnical hazard (if cohesive strata found on site)
Standing water and rutted ground – geotechnical hazard
Scatter of asbestos containing materials on site surface – specialist survey recommended

2.3 HISTORICAL DEVELOPMENT OF THE SITE

A review of the available historical Ordnance Survey (OS) maps gives an insight into the development of the site and can highlight potential hazards. Extracts of the maps reviewed are provided in Appendix C. Relevant differences between each edition are highlighted below.

1891: The earliest map reviewed shows sites A and B as part of two fields with an unnamed road (later Wakefield Road) approximately 25m to the north; fields extend around the immediate site area. The Barnsley Coal Extension Railway line is illustrated within 75m of the western boundary of Site A.

Site C is recorded to be occupied by buildings associated with New Lodge (Farm). Further farm buildings are illustrated immediately adjacent to the southern eastern and western site boundaries with fields beyond in all directions.

Approximately 600m to the south east East Gawber Hall Colliery is recorded with Primrose Main and Wharncliff Carlton collieries beyond. Hill End (disused) and North Gawber collieries are recorded approximately 800m to the west and north west respectively. An excavation is recorded approximately 600m to the west, on the outskirts of Upper Carr Green. The River Dearne is illustrated approximately 1km to the south (flowing to the east) and the Aire and Calder Canal a further 200m to the south. Wharncliff Carlton Colliery is linked to the River Dearne by an easterly flowing Mill Race situated approximately mid-way between the River Dearne and the railway line.

1893: No significant changes are illustrated to Sites A and B. Four small structures are recorded adjacent to the northern boundary of Site C.

1904: No significant changes are recorded to the site areas. The four small structures adjacent to the northern boundary of Site C are no longer recorded. An Old Shaft is illustrated to the immediate north of the disused Hill End Colliery. Carlton Views (residential development) is illustrated approximately 100m to the north west of Site A, beyond the unnamed road.

1906: No significant changes are recorded to the site areas or their immediate surroundings.

1930: No significant changes are recorded to the site areas. Allotment gardens are recorded between the western boundary of Site A and the railway line. Further residential properties are illustrated to the north of Wakefield Road (named for the first time), with Carlton Works immediately beyond them to the north. The railway line has been renamed as the Stairfoot and Nostell branch of the London and North Eastern Railway. A minor, southerly flowing, water course is recorded 75m to the south west of Site A, beyond the railway line.

East Gawber Hall Colliery is no longer recorded and is replaced by East Gawber Sewage Works. Both Primrose and Wharncliff Carlton collieries, previously located to the south are no longer recorded. An additional Old Shaft is illustrated in the location of the Hill End colliery. The excavation to the east of Upper Carr Green is recorded as Blackerhill Quarry. Laithes Crescent is illustrated approximately 50m to the north east of Site B with residential development at its junction with Wakefield Road.

1938: No significant changes are recorded to the site areas. Residential development has occurred along Laithes Crescent, Regent crescents and Park Avenue to the north and east of Site B. An Engineering Works is recorded approximately 300m to the south east of Site C.

1948: Residential development is recorded within both Site A and B. The aforementioned residential structures are part of the larger New Lodge development. New Lodge (farm) remains and no significant changes are illustrated to Site C despite the surrounding residential development. Additional housing is recorded to the north of Wakefield Road. The former allotment gardens to the west of Site A have been built over by part of the New Lodge estate.

1951: No significant changes are illustrated to Sites A and B. The structures previously occupying Site C are no longer shown and are presumed demolished. Blackerhill Quarry to the west is recorded as disused as is the Aire and Calder Canal.

1959: The site takes on its current appearance. Residential development is recorded between Wakefield Road and the northern boundary of Sites A and B. Site C is illustrated to be developed with No.s 2-10 Langsett Road.

1961: No significant changes are illustrated to the site areas or their immediate surroundings.

1966: No significant changes are illustrated to the site areas or their immediate surroundings. The outlying developments of Athersley North and South are recorded to the east of the New Lodge Estate. The two Old Shafts to the west are no longer recorded.

1971: No significant changes are illustrated to the site areas or their immediate surroundings. The Stairfoot and Nostell branch of the railway is recorded as dismantled.

1978: No significant changes are illustrated to the site areas or their immediate surroundings. The Blackerhill Quarry to the west is now recorded as a Tip (disused).

1982: No significant changes are illustrated to the site areas or their immediate surroundings. The area formerly occupied by Stand Hill Wood is shown as an extensive excavation. The excavation lies to the south of the disused railway line approximately 75m from the Site C boundary.

1993: No significant changes are illustrated to the site areas or their immediate surroundings. The area formerly occupied by Stand Hill Wood to the south of the disused railway line is shown as a Tip (disused). North Gawber Colliery to the west is no longer recorded and is replaced by a depot, Tip (disused) and residential development within Mapplewell.

2002: No significant changes are illustrated to the site areas or their immediate surroundings. The disused tip to the south is recorded as tree covered.

2011: No significant changes are illustrated to the site areas or their immediate surroundings. The properties adjacent to the eastern boundary of Site C are no longer illustrated and presumed demolished.

The hazards identified are summarised in the table below.

Significant Features identified on OS Maps:
Made ground associated with site development – potential source of contamination
Existing and former site structures (buried foundations and substructures) – potential excavation hazard / potential source of asbestos containing materials
Tips (disused) to the south and west – potential source of ground gas (due to distance from site considered not to be a significant risk)
Proximal collieries and shafts – potential geotechnical hazard and sources of mine gas
Southerly flowing surface water course to south – potential receptor and source of flooding

2.4 ANTICIPATED GEOLOGY

The BGS Geological Sheet for this area 1:50,000 Sheet 87 (Barnsley) shows superficial deposits of Glacial Till across Sites A and B over a solid geology of Wooley Edge Rock (Coal Measures). Site C is illustrated to be devoid of superficial deposits and underlain directly by the Wooley Edge Rock. The superficial deposits are considered likely to be predominantly cohesive in nature.

The geological sheet for the area indicates a dip of approximately 4° to the north. The site is not indicated to be directly affected by faulting; the nearest indicated fault being 18m to the east of Site B and south east of Site C.

The Meltonfield Coal (0.69m-0.89m) is recorded as having been worked by opencast methods approximately 200m to the west. A shaft, situated approximately 50m to the north of Site B, records a depth of 26m to the underlying Meltonfield Coal. The outcrop of the Meltonfield Coal is illustrated approximately 250m to the south of Sites A and B and 150m to south of Site C. From the available information it is likely that the Meltonfield Coal exists at depths of between 13m and 26m beneath the site.

Made ground, including buried foundations, can be expected within the site area due to the presence of buildings (both existing and demolished) and hardstanding, from its historical development.

Significant Features identified from geological data:
Shrinkable strata – geotechnical hazard
Wooley Edge Rock (sandstone) – potential receptor
Made ground – potential source of contamination
Coal seam – geotechnical hazard (considered minimal risk due to anticipated thickness of competent cover)

2.5 HYDROGEOLOGICAL INFORMATION

No detailed information regarding the depths to groundwater is available; however, the groundwater level is likely to be subject to seasonal variations.

The superficial deposits have been classified by the Environment Agency from their website as unproductive strata, and Wooley Edge Rock as a Secondary A aquifer (i.e. 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).

There are no recorded groundwater abstraction licenses within 500m of the site and the site is not recorded to be within a groundwater Source Protection Zone. Information available at this stage suggests a groundwater flow to the north and east in accordance with the underlying geology.

The pathway to the receptor is likely to be restricted by the anticipated cohesive Glacial Till.

Significant Features identified from hydrogeological data:
Secondary A aquifer – potential receptor

2.6 HYDROLOGICAL INFORMATION

Local surface water features include:

- A drain 175m to south west of the site but up gradient of the site and therefore not a viable receptor.
- A southerly flowing water course 75m to the south, also up gradient and therefore not a viable receptor.
- The River Dearne, located approximately 1km to the south, also up gradient and therefore not a viable receptor.

The site is not within 250m of an indicative fluvial floodplain (see Appendix D); the Environment Agency's Internet based flood risk maps suggest there is no risk from river flooding.

No recorded significant pollution incidents have occurred which may affect the site and no nearby surface water abstraction licenses are recorded.

Significant Features identified from hydrological data:
None recorded

2.7 COAL MINERAL RESOURCES

2.7.1 Coal Authority Report and Geological Maps

The Coal Authority report presented in Appendix E states that *the property is in the* likely *zone of influence from 6 seams of coal at 140m to 380m depth, and last worked in 1958. There are no known coal mine entries within, or within, 20m of, the boundary of the property. Any ground movement from these coal workings should have stopped by now.*

Comparison of the Coal Authority information with local geological information suggests that the shallowest coal beneath the site is the Meltonfield Coal at a depth of between 15m and 26m below sites A and B and approximately 13m below Site C.

There is no evidence of shallow mine workings and the Coal Authority report does not highlight there being a particular risk of shallow unrecorded mining. If mining has

taken place it will be mitigated by the presence of a strong, competent sandstone. Based on the recorded seam thicknesses and experience of the area, in excess of ten times the worked seam thickness of competent rock cover is anticipated across all of the site area. At this stage the risk from mine workings is assessed as being very low.

Potential Coal Mining Hazards:
Shallow seams – no significant risk due to competent rock cover

2.8 OTHER MINERAL RESOURCES

There is no recorded evidence of any non-coal mineral extraction having taken place within, or close to, the site area.

A former sandstone quarry (infilled with domestic refuse), is recorded approximately 600m to the west. The former quarry is considered too remote from the site to pose a significant risk.

Potential Other Mining Hazards:
None recorded within influencing distance

2.9 ENVIRONMENTAL INFORMATION

Environmental information has been acquired from GroundSure Limited. There is a considerable amount of data and not all of it is relevant to this appraisal (e.g. air pollution controls). Therefore, summary sheets are presented in Appendix D, along with copies of data sheets relevant to this report. The full set of data will be held on file by GRM.

A summary of the relevant information not included elsewhere in this report is presented below:

- One Environment Agency Historic Landfill is recorded within 500m of the site areas. The entry relates to land to the rear of Subseal Works, 282m north of Site A's northern boundary. Given the distance from the site the landfill is not considered to pose a significant risk.
- Nine potentially contaminative industrial sites are recorded within 250m of the site. The entries include a vehicle sales business 20m to the south west, electricity sub stations, and a pharmacy, none of which are considered likely to have significantly affected the site areas.
- One Fuel Station Entry is recorded 390m to the north west of the site. Given the distance from the site the entry is not considered to pose a significant risk.

Significant Features identified from Environmental data:
None

2.10 ARCHAEOLOGY

Archaeological information has not been sought as part of this desk study and has not been identified as an issue by the Client. Some Local Authorities require at least

an initial archaeological appraisal for development sites. GRM can undertake such appraisals if required.

Archaeological investigations occasionally reveal ground-related problems from ancient times (prior to the 1st Edition OS maps) and can occasionally cause foundation and contamination development hazards.

Archaeological Hazards:
Not researched

2.11 INVASIVE PLANT SPECIES/ECOLOGY

Ecological issues can have a significant effect on developments. GRM is not a specialist in this topic and has not conducted such a survey. However, GRM endeavour to report easily recognisable issues such as Japanese Knotweed, Giant Hogweed, badger sets etc, when seen on site. No such issues have been noted.

Invasive Plant Species/Ecological Hazards:
None noted

2.12 RADON ASSESSMENT

The site has been assessed following the guidelines in 'Radon: guidance on protective measures for new dwellings' (BR211 2007).

The site is within an area recorded to require basic radon protection measures, as shown by map 14, 'Derbyshire, Leicestershire and Nottinghamshire', of the BR211 (2007) guidance.

According to latest available information from the Health Protection Agency (HPA-RPD-033, BGS Radon Atlas), between 3% & 5% of homes in this area are reported to have radon levels above the 'Action Level' in this area.

The environmental report (Appendix D) suggests that based on information provided by the BGS (equivalent to a standard radon report), basic radon protection measures will be required.

Radon Hazard:
Basic protection required

2.13 CONTAMINANTS OF CONCERN

For land uses such as this site's, where no profile is available, likely contaminants of concern are selected by GRM based on past experience of similar sites, a general screening suite of contaminants covered by CLEA and common contaminants from the Industry Profiles.

Asbestos and PCBs are listed in the vast majority of profiles. PCBs are listed as the profiles expect electricity substations and switch boxes on all industrial sites. None have been recorded on this site. Analysis for asbestos will be undertaken as it was observed during the walkover and there is the potential for asbestos containing material to be mixed up with made ground, following the demolition works. Analysis

for petroleum hydrocarbons will be undertaken if visual or olfactory evidence of such contamination is encountered within the ground during the fieldwork.

There are contaminants that are generally tested for as a matter of course as their prevalence on brownfield sites is renowned. These include:

- Arsenic
- Cadmium
- Chromium
- Lead
- Mercury
- Selenium
- Copper
- Nickel
- Zinc
- Phenols
- cyanide (total)
- pH
- Water soluble sulphate
- PAH (polycyclic aromatic hydrocarbons)

In addition, analysis for petroleum hydrocarbons (aliphatic and aromatic bands) will be undertaken if there is any evidence of such contamination observed during the fieldwork.

Monitoring for methane and carbon dioxide will be undertaken in accordance with best practice guidance.

2.14 SUMMARY OF IDENTIFED SIGNIFICANT FEATURES

Potential hazards have been identified in earlier sections and are now summarised in tabular form, with their consequences and possible risk management actions.

Potential Hazard	Potential Consequence	Action
Existing buildings	Danger to personnel	Demolition required – Health & Safety guidelines
Live services	Danger to personnel	Inform relevant parties for disconnection / diversion
Previous buildings	Deepened foundations/buried structures	Ground investigation
Made ground associated with former development	Deepened foundations	Ground investigation
Variable strata	Deepened foundations	Ground investigation
Trees - shrinkable clay	Deepened foundations	Ground investigation plasticity testing/tree survey
Made ground (associated with former development)	Potential risk to end users/site workers/water supply pipes/minor aquifer	Trial Pits / Boreholes
Asbestos containing material associated with former buildings	Site workers	Asbestos survey and subsequent removal prior to demolition
Radon from natural strata	End Users	Geological risk assessment
Ground gases (carbon dioxide & methane) associated with made ground	End Users	Gas monitoring survey

3 PHASE I CONCEPTUAL MODEL

3.1 POTENTIAL SOURCE – PATHWAY – RECEPTOR

The consideration of contamination is based upon the principles of risk assessment, using the 'source-pathway-receptor' model in order to establish the presence, or potential presence, of a pollutant linkage.

To create a risk, contamination must have the potential to cause harm to susceptible targets or receptors such as humans, the water environment or the built environment. The potential for harm to occur requires three conditions to be satisfied:

- The presence of substances that may cause harm (SOURCE).
- The presence of a target which may be harmed (RECEPTOR).
- The existence of a plausible pollutant linkage between the source and the receptor (PATHWAY).

In the absence of a plausible pollutant linkage there is no risk. Where a potential linkage is identified in order for it not to pose a risk to the identified receptor(s) it must be broken.

Sites A and B comprise two separate areas of former residential housing. The buildings have recently been demolished. Site C remains occupied by residential housing, which at the time of the site inspection and site works was vacant.

The site consists of existing and former residential housing with a combined area of approximately 0.85 hectares in size. Potential on site sources include made ground from the existing/former development and potential asbestos containing materials in fly-tipped material, demolition rubble, roofing, cladding and external drainage/guttering.

Potential contaminants of concern for the whole site include those listed in Section 2.14.

The development proposals include residential housing with areas of hardstanding (e.g. car parking) and domestic gardens/landscaping.

The primary human health receptors are residents of the completed development and construction workers. The primary pathways of concern include dermal contact with contaminated soil and soil dust, the ingestion of contaminated soil and soil dust, ingestion of vegetables that have taken up the contamination, indoor and outdoor inhalation of ground gas and soil vapours, and migration of contamination into water supply pipes.

For controlled waters, the primary receptor for the site is the underlying Secondary A aquifer (Wooley Edge Rock). The primary pathways of concern are leaching of contaminants and vertical migration to the groundwater. At this stage the pathway to the receptor is considered likely to be restricted by the anticipated cohesive Glacial Till.

For construction materials, the primary receptors are water pipes and buried concrete. The primary pathways of concern are the migration of contamination leading to degradation of pipe materials and sulphate and/or acid attack on buried concrete.

The pollutant linkage model is illustrated in detail on the following page.

3.2 POLLUTANT LINKAGE MODEL

HUMAN HEALTH			
Source	**Pathway**	**Receptor**	**Solution**
Potentially contaminated made ground. Contaminants of concern include toxic metals and organics.	The ingestion of contaminated soil and soil dust, and dermal contact with contaminated soil and soil dust.	End users of the completed development and construction workers.	Soil capping or removal of contaminated soils.
Potential asbestos containing materials on site surface and possibly mixed with soils.	Inhalation of asbestos fibres.	End users of the completed development and construction workers.	
Potential ground gases (methane, carbon dioxide and radon) from made ground and natural strata.	Indoor and outdoor inhalation of ground gas. Explosion.	End users of the completed development.	Gas protection measures required (basic radon).

CONTROLLED WATERS			
Potentially contaminated made ground. Contaminants of concern include toxic metals and organics.	Leaching of contaminants and vertical migration to the groundwater.	Secondary A aquifer.	Removal/capping of toxic metal contaminated soils, if required.

CONSTRUCTION MATERIALS			
Potentially contaminated made ground. Contaminants of concern include toxic metals and organics.	Migration of contamination through leaks and joints, degradation of pipe materials.	Water pipes.	Upgraded water pipes/clean backfill material.
Made ground and natural strata.	Acid and sulphate attack on buried concrete.	Buried concrete.	Appropriate concrete specification.

4 PHASE II GROUND INVESTIGATION

4.1 FIELDWORK

The ground investigation (including fieldwork, sampling, monitoring and laboratory analyses) has been designed to identify and assess potential ground related problems and to allow cost effective solutions to be advised. It has been planned on the basis of the desk study, site inspection and the proposed development layout (where available). All fieldwork and soil descriptions were carried out in general accordance with relevant British Standards.

The exploratory holes have been positioned and advanced to depths to determine the general ground/groundwater/gas conditions below the site. A general grid pattern has been adopted, where possible, to provide sufficient information based on the current proposed layout scheme. Some holes have been targeted at particular hazards identified in the Phase I assessment. The resultant exploratory hole density is considered to be commensurate with the complexity of the site conditions and detail of information required for this phase of the investigation.

A total of nineteen exploratory holes were undertaken, comprising nine window sample holes and ten trial pits, to a maximum depth of 3.6m begl. The Exploratory Hole Location Plan and Exploratory Hole Logs are presented in Appendix F and Appendix G respectively. Five cores were extracted at points along Kirkstall Road to determine the nature of the road construction. Four additional trial pits were excavated for the purpose of infiltration testing.

The ground investigation fieldwork was conducted on the 8th, 9th and 17th March 2011, with groundwater/gas monitoring visits continuing after that period.

Samples not used for testing will be stored for a month after issue of this report and then disposed of, unless the client requests in writing that they be kept.

4.2 MONITORING INSTALLATIONS

The gas monitoring programme has been designed to broadly comply with the recommendations outlined in CIRIA Report C665 "Assessing risks posed by hazardous ground gas to buildings' (2007).

As the proposed land use is classed as high (residential with gardens) sensitivity, five gas/water monitoring standpipes have been installed across the site (WS1, WS4, WS7, WS8 and WS9). The 50mm standpipes have been installed in window sampling boreholes with response zones targeted at the natural strata.

As the gas hazard is considered low (made ground), the monitoring program would normally comprise six visits over three months. Therefore, only an initial assessment of the local gas regime has been undertaken at this stage and further visits will be required to complete the monitoring program. A separate gas addendum letter report will be issued following the completion of the full monitoring program.

The post fieldwork monitoring has been designed to identify and assess the groundwater and gas regimes below the site. The gas monitoring has been

undertaken using an LMSxi Multifunction Gas Analyser. The results are presented in Appendix H.

4.3 PROVEN GROUND

The following ground conditions were encountered during the investigation fieldwork:

- *Made ground (including* Re-laid Topsoil)
- Glacial Till (superficial deposits)
- Weathered Coal Measures (Solid Strata)
- Coal Measures

4.3.1 Made Ground

No evidence of old foundations or buried substructures was observed during the fieldwork. Three types of made ground were observed:

Made ground A
Generally comprised a brown, grey-brown and locally red-brown sandy slightly clayey *fine to coarse angular gravel including brick and concrete. The material generally* ranged in thickness between 0.1m and 0.3m but was noted to be up to 0.5m where the demolition process had resulted in an admixture of demolition rubble and re-laid topsoil (WS3).

Made ground B
Generally comprised a brown sandy silty clay with some fine to coarse angular to subrounded gravel including brick, sandstone, coal and quartzite. The material ranged in thickness from 0.1m to 0.5m with an average thickness of 0.3m.

Made ground C
Varied from a sandy silty clay with occasional fine to medium angular to subangular gravel including coal, concrete, brick and sandstone. Where present the material ranged in thickness from 0.25m to 0.7m with an average thickness of 0.4m.

Possible Source(s) of Made Ground

Made ground A comprises demolition rubble considered to be derived from the previous residential dwellings. Made ground B comprises material considered to be a re-laid topsoil and made ground C generally consists of natural soils with some anthropogenic material that could have been derived locally.

Distribution of Made Ground Types

Made ground A was found only in the area of the demolished housing and made ground B in the front and rear garden areas of both demolished and existing housing. Made ground C was observed to have a limited distribution, being developed mainly in Site A, with isolated occurrences in Site B and Site C. The distribution may reflect the materials suspected origin as disturbed ground with a mixture of natural and anthropogenic materials.

The road cores, taken at intervals along Kirkstall Road, revealed the presence of approximately 100mm of reinforced concrete sitting directly on the Glacial Till. No evidence of red shale was observed as part of the road construction.

4.3.2 Glacial Till

The Glacial Till was generally observed as a firm orange-brown and grey-brown silty sandy CLAY with occasional to some fine to coarse angular to subangular gravel including sandstone and coal. The material ranged in thickness from 0.15m to 2.6m with an average thickness of approximately 1.1m. The Glacial Till was encountered across the majority of the site with the exception of WS2 and WS9 situated in the north eastern and south western parts of the site respectively. The distribution of the Glacial Till broadly affirms the published geological information.

4.3.3 Solid Strata

In terms of geotechnical behaviour most solid strata are rocks, although some have remained as, or have become, soil (the latter as part of the weathering process). The solid strata at shallow depths beneath this site are representative of a soil (of weathered rock), becoming less weathered with depth until they are a rock. The weathered rock will have the geotechnical characteristics of a soil.

Weathered Coal Measures

Strata representative of weathered Coal Measures were observed as either a:

A medium dense orange-brown clayey sandy fine to coarse angular to subangular GRAVEL including sandstone.

Or

A hard brown and grey-brown silty CLAY with much coarse angular lithorelicts of mudstone and siltstone.

Coal Measures

Strata representative of the Wooley Edge Rock (unweathered rock strata) were generally observed to be a weak to moderately strong grey-brown and orange-brown fine to coarse grained SANDSTONE (often recovered as a sandstone gravel). In WS3 the unweathered Coal Measures was observed to comprise a SILTSTONE. Excavation using the JCB was difficult once the Wooley Edge Rock was encountered.

The Wooley Edge Rock (sandstone/siltstone) was encountered in all of the exploratory holes, with the exception of TP9, WS1 and WS7. Rockhead was proven at depths of 2.0m, 1.8m and 0.9m below Sites A, B and C respectively.

4.4 GROUNDWATER

4.4.1 Groundwater Initial Observations

Groundwater flow was not observed in any of the exploratory holes. However, the exploratory techniques used were rapid and may have masked small water seepages.

4.4.2 Groundwater Monitoring Observations

The results of monitoring are reported in Appendix H. In summary standing water was only recorded at 2.6m in WS1 in the north west corner of Site A.

4.4.3 Groundwater Regime

The groundwater encountered during the investigation is considered to be from *perched volumes within cohesive Glacial Till and not representative* of the regional groundwater table. The groundwater in the underlying aquifer is not likely to be in hydraulic continuity with the observed groundwater. The true groundwater table is only likely to be encountered at depth within the Coal Measures strata in excess of 3.6m beneath the site.

Long term monitoring of groundwater levels has not been conducted as part of this investigation and interpreted levels are approximate and will be dependent on seasonal variations.

4.5 CONTAMINATION OBSERVATIONS

No visual or olfactory evidence of potential contamination, including asbestos fibres and petroleum hydrocarbons, was observed during the fieldwork and monitoring.

4.6 GROUND GAS

4.6.1 Landfill Type Gases and Vapours

The potential sources of ground gas are reported in section 3 and the rationale for the number of gas standpipes and the length of the monitoring programme is discussed in section 4.2. Gas monitoring is currently on-going and a complete assessment of the ground gas regime will be reported at a later date. The gas monitoring results to date, are presented in Appendix H. In summary no methane has been recorded to date, carbon dioxide of up to 2.1%v/v and oxygen as low as 19.1%v/v. No flow was recorded during the monitoring completed to date.

4.6.2 Radon Gas

The desk study risk assessment determined that basic radon protection measures are required. Observations during fieldwork confirm that this assessment should not be altered.

4.7 SUMMARY OF FIELDWORK OBSERVATIONS

The fieldwork has revealed/confirmed the following potential hazards, receptors and sources that were not identified during the desk study, but which should be included when assessing the site.

Significant Features identified during fieldwork
Limited made ground – contamination hazard
Cohesive strata – geotechnical hazard if trees present
Existing structures still requiring demolition – general hazard

4.8 LABORATORY ANALYSES AND MONITORING RATIONALE

4.8.1 Chemical Laboratory Analysis

Chemical laboratory analyses were selected to provide the parameters necessary to make an initial assessment of potentially contaminated soils and/or waters, for the budgetary design of the development. The choice of contamination testing was based on the Phase I assessment, identified past use(s) of the site and site observations.

Petroleum hydrocarbon contamination has not been observed during the fieldwork, and therefore hydrocarbon testing (TPH banding, BTEX, etc) has not been undertaken. Although no evidence of asbestos was observed mixed with the soils, an asbestos screen was run on sixteen samples to confirm its absence.

Various other potential contaminants identified in earlier work have been ruled out of the testing suites. These include:

- PCBs as no source was identified within the site area.
- VOCs and SVOCs as no tell tale odours were detected.

pH and water soluble sulphate testing was conducted as part of the chemical analysis suite to determine how aggressive the ground and/or waters are to buried concrete.

The chemical laboratory analysis results are presented in Appendix I (both soils and leachates).

4.8.2 Geotechnical Laboratory Testing

Geotechnical soils testing has been undertaken as part of the ground investigation including the following:

- Atterberg Limits (PI) classification
- pH and water soluble sulphate testing

Geotechnical laboratory tests were selected to provide the parameters necessary for the budgetary design of the development including foundations and infrastructure. Geotechnical laboratory test results are presented in Appendix J.

5 QUANTITATIVE RISK ASSESSMENT – HUMAN HEALTH

5.1 INTRODUCTION

The proposed development comprises up to 2.5 storey residential housing and associated infrastructure.

Various sources of contamination have been put forward in earlier text and summarised in the initial conceptual model. The material on site identified as being the most likely to be contaminated is the made ground.

Representative samples of all strata and those considered to be potentially contaminated by virtue of the desk study and/or based on site observations were collected for further examination and/or potential testing.

Guidance contained in the Environment Agency's CLEA Report has been used to assess the risks posed to human health. For this assessment the default Tier 1 Assessment Criteria (TAC) for 'residential land with plant uptake' have been used, i.e. a female with a start age class of one and an end age class of six. All pathways have been considered including the consumption of home-grown vegetables. This has been carried out in order to provide a precautionary screening approach to assessing the risks posed to human health.

The TAC used by GRM include Soil Guideline Values (SGV) published by the EA, values calculated by GRM using the CLEA v1.06 risk assessment and values and chemical data developed by LQM/CIEH. The TAC used in the assessment of the site is presented in Appendix K.

To assess the risks posed by ground gases such as radon, carbon dioxide and methane, the relevant current guidance has been used. For radon the site has been assessed following the guidelines in 'Radon: guidance on protective measures for new dwellings (BR211: 2007)'. See Sections 2.12 and 4.6.2 of this report. For methane and carbon dioxide the primary guidance document used to determine if protection measures are required is CIRIA Report C665 'Assessing risks posed by hazardous ground gases to buildings' (2007). This uses Gas Screening Values (GSVs), which are gas concentrations multiplied by borehole flow rate, along with additional limiting factors (such as maximum methane concentrations) to classify the gas regime of a site.

The guidance document includes two methods of characterising a site. The main method 'Situation A' is based on work by Wilson and Card and is used for all types of development except low rise housing that meets the assumptions of 'Situation B'. The 'Situation B' method proposed by Boyle and Witherington for the NHBC assumes all properties have pre-cast suspended floors (beam and block) with ventilated underfloor voids.

For this site, as the method of ground floor construction is not yet known and is likely to include a number of different floor types, the risk from ground gases has been assessed using 'Situation A' and 'Situation B'.

5.2 RISK TO END USERS

The chemical analysis test results on soils are presented in Appendix I.

Chemical analyses have been carried out on each of the three types of made identified during the ground investigation.

- Made ground A generally comprised a brown, grey-brown and locally red-brown sandy slightly clayey fine to coarse angular gravel including brick and concrete (demolition derived material).
- Made ground B generally comprised a brown sandy silty clay with some fine to coarse angular to subrounded gravel including brick, sandstone, coal and quartzite (previous topsoil).
- Made ground C varied from a sandy silty clay with occasional fine to medium angular to subangular gravel including coal, concrete, brick and sandstone (natural soil with anthropogenic material).

Sufficient samples have been analysed to categorize the site.

5.2.1 Analysis of Soil Contamination Data

Nearly all of the contaminants tested for had concentrations below the relevant TAC; however, the following had concentrations in excess of the respective TAC:

Made ground C

- Benzo(a)pyrene of 1.9mg/kg in TP9 (0.1m-0.2m) and 5.1mg/kg in WS9 (0.1m-0.2m) exceed the TAC of 0.83mg/kg.

Made ground B

- Lead of 720mg/kg in WS1 (0.1m-0.2m) exceeds the TAC of 450mg/kg.

Review of the results for similar materials indicates that these exceedances are present as hotspots and are considered likely to be due to cross-contamination from the demolition material.

Limited remedial works with respect to benzo(a)pyrene and lead contamination are considered to be necessary.

5.2.2 Analysis of Asbestos Contamination Data

Given the heritage of the site sixteen samples of the made ground were analysed for the presence of asbestos fibres. Only one of the samples, WS8 at 0.35m-0.45m reported the presence of asbestos fibres in the form of Chrysotile (white asbestos). The sample containing the asbestos was of the re-laid topsoil over which was a spread of demolition rubble. It is considered likely that the asbestos fibres have originated within the demolition rubble but become subsequently mixed with the underlying material during the demolition process.

5.2.3 Radon

Radon gas assessments have been made in earlier sections and here is deemed to be a hazard posed by this gas. Accordingly, it is considered that basic radon protection measures are required for the development.

5.2.4 Harmful Soil and Landfill Gases

The gas monitoring results are summarised in section 4.6.1 and are presented in full in Appendix H. As discussed in section 5.1 the site is being assessed using both 'Situation A' and 'Situation B' as described in CIRIA C665.

To produce a positive result a default flow rate of 0.1l/hr has been used in the following assessment.

Situation A
To date no elevated concentrations of methane gas has been detected. Using the same borehole flow rate the maximum carbon dioxide concentration of 2.1%v/v equates to a GSV of 0.0021l/hr. Therefore, as the levels of methane and carbon dioxide are below 1% and 5% respectively, and the GSV is <0.07l/hr, the site has been assessed as 'Characteristic Situation 1' as outlined in table 8.5 of CIRIA C665.

Situation B

To date no elevated concentrations of methane gas has been detected. Using the same borehole flow rate the maximum carbon dioxide concentration of 2.1%v/v equates to a GSV of 0.0021l/hr (<0.78l/hr). Therefore, as the levels of methane and carbon dioxide are below 1% and 5% respectively the site has been assessed as traffic light 'Green' as outlined in table 8.7 of CIRIA C665.

Therefore, based on the available data it is considered that gas protection measures to protect against carbon dioxide and methane are not required, however, basic radon protection measures are required for the proposed development. Gas monitoring is currently on-going at the site and a complete assessment of the ground gas regime will be reported at a later date.

5.2.5 Summary of Risk to End Users

In summary the risk to end users from soil contamination is considered to be low.

At this stage there is considered to be no risk posed to the development from landfill type ground gases (i.e. methane/carbon dioxide). However, further gas monitoring may be required to confirm this assessment to satisfy the Local Authority and/or NHBC). Basic radon precautions **are** required

5.3 RISK TO SITE WORKERS

The risks to site workers are similar to those posed to site end users, although likely to be less severe due to the site workers' shorter exposure to the identified contamination. However, site workers (particularly groundworkers) are more likely to come into direct contact with contaminated soils due to the nature of their work. On

this basis ground and construction workers should be provided with basic Personal Protective Equipment based on the site's general health and safety risk assessment, but including as a minimum safety footwear, gloves and overalls.

A site specific risk assessment should be carried out for all hazards identified within the ground investigation in accordance with current health and safety legislation. This assessment should identify any measures required to further reduce risks i.e. providing further Personal Protective Equipment, welfare facilities and if necessary preventing access to certain areas.

Demolition and dismantling of remaining structures on the site must be carried out to a safe and acceptable standard, in accordance with current UK guidance and best practice. Whilst not ground related, asbestos and hazardous substances surveys should be conducted prior to any demolition. It is recommended that a specialist asbestos contractor is consulted to determine any special measures required to properly determine the risk posed to site workers from the asbestos revealed in the testing and that noted on the site surface.

Any unusual colours, odours and suspicious ground should be reported immediately to site management and then GRM.

Whilst this appraisal has considered the long-term effects of contamination, GRM can also help during the formulation of Health and Safety documentation, if required.

6 QUANTITATIVE RISK ASSESSMENT - CONTROLLED WATERS

6.1 INTRODUCTION

When assessing the risk to Controlled Waters, leachate and groundwater testing is normally carried out. The UK Drinking Water Standards (UKDWS) or Environmental Quality Standards (EQS) are usually adopted for comparison with the leachate/groundwater test results.

The most sensitive receptor is considered to be the Secondary A aquifer underlying the site and therefore the UKDWS are the most appropriate for this site. Initial Tier 1 screening values are presented in Appendix K.

6.2 ASSESSMENT OF THE CHEMICAL ANALYSIS RESULTS

The results of the soil leachate testing are presented in Appendix I. Recorded concentrations of all contaminants are below the UKDWS thresholds.

6.3 SUMMARY OF RISK TO CONTROLLED WATERS

The risk to both the Secondary A aquifer below the site and nearby surface water courses is assessed as negligible.

7 QUANTITATIVE RISK ASSESSMENT - CONSTRUCTION MATERIALS

7.1 INTRODUCTION

The 'screening levels' adopted for the assessment of risk to construction materials are taken from the following documents:

- Water Regulations Advisory Scheme (WRAS) Contamination thresholds for sub-surface water pipes (extract included in Appendix K), for the protection of buried pipes.
- Building Research Establishment (BRE) Special Digest SD1 (2005), 'Concrete in Aggressive Ground', for the protection of buried concrete.

7.2 WATER SUPPLY PIPES

Locally the recorded concentrations of pH (TP8 and TP9) and PAHs (WS9) exceed the acceptable levels listed in the WRAS documentation. Contaminant concentrations recorded are such that plastic MDPE water supply pipes may not be acceptable to the water supply company. Other options such as metal (copper) pipes or Durapipe Protecta-Line System or similar, may be required.

The local water supply company should be contacted to determine its exact requirements in respect of the levels of contamination encountered. It is likely to view the levels of metals present as a risk to future ground workers and a very slight risk to end users due to ingression through failed pipes and joints. The use of plastic MDPE pipes placed within clean inert backfill material may be acceptable, without the removal of any contaminated materials. However, until Water Authority is contacted it would be prudent to allow for the use of upgraded water pipes.

7.3 BURIED CONCRETE

Based on the results of the pH and water soluble sulphate testing and a review of the strata and groundwater encountered, in accordance with the requirements of BRE Special Digest 1 (2005), the Design Sulphate Class for the site should be assumed as DS-1 and the ACEC Class as AC-1s. For unreinforced trench-fill foundations with a width of greater than 450mm, the classifications above equate to a concrete designated as GEN1 in BS8500 and RC35 for reinforced foundations.

Sulphate and pH results are presented in Appendices I and J.

8 PHASE II CONCEPTUAL MODEL

8.1 SOURCE – PATHWAY – RECEPTOR

The intrusive investigation has revealed that only limited contamination of the shallow made ground deposits is present. Contamination includes benzo(a)pyrene (made ground C) and lead in WS1 (made ground B) and an isolated occurrence of asbestos fibres mixed with the re-laid topsoil (made ground B) in WS8. Gas monitoring is currently on-going and, to date, only slightly elevated concentrations of carbon dioxide have been recorded.

Development proposals have been confirmed as including residential houses with areas of hardstanding (e.g. car parking) and domestic gardens / landscaping.

The primary human health receptors are end users of the completed development and construction workers. The pathways of concern include dermal contact with contaminated soil and soil dust, the ingestion of contaminated soil and soil dust, ingestion of vegetables that have taken up the contamination, indoor and outdoor inhalation of ground gas and soil vapours.

For controlled waters, the primary receptor for the site has been confirmed as the underlying Secondary A aquifer. The absence of groundwater underlying the site has been confirmed and soil leachate test results confirm the absence of leachable contaminants.

The concentrations of arsenic and locally pH, lead and PAHs present in the made ground deposits exceed thresholds for water pipes. Specifications for buried concrete have been made in light of the reported pH and water soluble sulphate concentrations.

Considering the above, it is considered that the site poses a low risk to end users, a negligible risk to controlled waters and a low risk to construction materials.

The pollutant linkage model is illustrated in detail on the following page.

8.2 POLLUTANT LINKAGE MODEL

HUMAN HEALTH			
Source	**Pathway**	**Receptor**	**Solution**
Contaminated made ground. Contaminants of concern include benzo(a)pyrene and lead.	The ingestion of contaminated soil and soil dust, and dermal contact with contaminated soil and soil dust.	End users of the completed development and construction workers.	Soil capping or removal of contaminated soils.
Localised occurrence of asbestos fibres (chrysotile) mixed with soils.	Inhalation of asbestos fibres.	End users of the completed development and construction workers.	
Ground gases (radon) from natural strata.	Indoor and outdoor inhalation of ground gas.	End users of the completed development.	Gas protection measures necessary.

CONTROLLED WATERS			
None.	Leaching of contaminants and vertical migration to the groundwater.	Secondary A aquifer.	None considered necessary.

CONSTRUCTION MATERIALS			
Contaminated made ground. Contaminants of concern include arsenic, lead, PAH and pH.	Migration of contamination through leaks and joints, degradation of pipe materials.	Water pipes.	Upgraded water pipes/clean backfill material.
Made ground.	Acid and sulphate attack on buried concrete.	Buried concrete.	Appropriate concrete specification.

9 REMEDIATION

9.1 RECOMMENDED RISK REDUCTION AND REMEDIAL MEASURES

9.1.1 Protection of End Users

Based on the recorded levels of contamination across the site, only limited remediation will be required to protect end users of the proposed residential development.

It is considered that remediation could be restricted to the removal of hotspot areas. The hotspot of benzo(a)pyrene in TP9, lead in WS1 and asbestos fibres in WS8 should be excavated and disposed to an appropriate landfill waste facility. An area measuring approximately 5m by 5m, from the centre of the exploratory holes should be remediated. The sides and base of the excavation should be sampled for validation testing, to ensure no residual contaminated made ground remains.

In addition, the demolition rubble should be excavated and placed under areas of hardstanding to reduce the risk of further hotspots being present. The re-laid topsoil encountered was generally thin and of poor quality, it is recommended that garden areas are capped by the addition of 300mm of clean imported material, which will further reduce the risk of any remnant hotspots.

Following demolition of the remaining houses, an inspection should be undertaken under floor slabs to assess any potential risk of contamination of the underlying soils.

Should any material suspected of being significantly contaminated be encountered during the redevelopment of the site, GRM can be contacted to undertake additional investigation if necessary. The local Environmental Health Officer should be contacted and informed of any additional remedial work required.

9.1.2 Protection of Site Workers

The risk to site workers from the soil contamination is negligible. No remedial measures are required. However the use of suitable PPE should be enforced during the ground works stage of construction and suitable precautions should be taken during the removal of any asbestos containing materials. Any asbestos noted on the site surface should be picked and bagged before any site disturbance to prevent wider contamination. It is recommended that a specialist asbestos contractor is consulted to determine any special measures required to properly determine the risk posed to site workers from the asbestos revealed in the testing and that noted on the site surface.

9.1.3 Protection of Controlled Waters

The risk to controlled waters is negligible and no remedial measures are required.

9.1.4 Protection of Construction Materials

Remedial measures to protect underground plastic water pipes may be required, following consultation with the relevant water supply company. This may take the

form of an alternative pipe material or backfilling of service trenches with clean inert material. At this stage it would be prudent to allow for the use of an alternative pipe material.

There is no additional risk to buried concrete, and accordingly no specific protection is required.

9.1.5 Remedial Actions for Overall Ground Gas Hazard

Gas monitoring is currently on-going at the site and a complete assessment of the ground gas regime will be reported at a later date. However, an initial assessment of the local gas regime, based on the concentrations recorded to date, is given in section 5.2.4. The site has been classified as 'Characteristic Situation 1' (Situation A) and traffic light 'Green' (Situation B); therefore, no special gas protection measures are required.

Basic radon protection measures will be required.

9.2 POST REMEDIATION VALIDATION

The recommended remedial methods should avoid the need for monitoring after validation; however, validation of any remedial measures will be required. Validation will comprise laboratory analysis of the capping material to confirm it is suitable for its intended end-use, and confirmation that the capping layer is of sufficient thickness. This confirmation usually takes the form of hand dug trial pits to determine the exact thickness of the soil capping layer.

Validation analysis of the capping soil is best conducted prior to importing the material. It is likely that the site will be deficient in topsoil and that material will have to be imported. If subsoil/topsoil is to be imported with an existing test certificate, then it is recommended that this be forwarded to GRM to ensure that the material is suitable for use. The test certificate should be for the same suite of contaminants as the GRM soils testing suite, details of which are presented in Appendix I, plus total hydrocarbon concentration, which is now required by the NHBC.

Details of the validation testing of the imported material and verification of the capping layer thickness will be required by the local Environmental Health Officer and the NHBC.

9.3 REMEDIATION METHOD STATEMENT

As the remedial works are limited to localised hotspot removal, this report should be suitable for submission as a Remediation Method Statement.

A Remediation Method Statement will need to be prepared after liaison with the Regulators. The statement should include the procedures to be adopted to achieve the recommended remedial measures and the form of validation following remediation. The recommended remedial strategy will need to be discussed with the local Environmental Health Officer/Contaminated Land Officer.

Following your review of this document, we would recommend that a copy of it be forwarded to the Local Authority for comment and approval, prior to commencing development of the site. The Local Authority may choose to include other consultees as part of the planning process (such as the Environment Agency).

Consultation should be undertaken at the earliest possible opportunity to avoid abortive or delayed works.

9.4 DISPOSAL AND CLASSIFICATION

Under current Waste Management Regulations, waste soil materials produced from the site will require characterisation to enable it to be disposed of correctly.

The analysis results presented in Appendix I should be provided to the relevant landfill operators to establish the characterisation of the waste, confirm its suitability for landfill disposal and provide estimated costings. If material is classified as hazardous which is considered unlikely for this site, then the site will need to be registered with the Environment Agency prior to the movement of the waste. It would be prudent to allow approximately 5% of the soils to be classified as hazardous, the remainder being inert. Depending on the receiving landfill's current permit, further chemical analysis, incorporating Waste Acceptance Criteria (WAC) leachate analysis, may be required.

All materials removed from the site will be classified as 'waste' and therefore must be removed by a suitably licensed carrier of waste. This applies whether or not the waste is contaminated. All waste removed to landfill will attract Landfill Tax.

The developer/builder is likely to be classed as the waste producer and therefore, has a duty of care to ensure that all waste is disposed of appropriately. This includes ensuring the waste carrier is licensed and disposes of the waste to a suitably licensed landfill site. They are also required to keep a paper trail from 'cradle to grave' including copies of the waste disposal tickets.

Efficient materials management on site is recommended as it can lead to significant cost savings when compared to the traditional side casting or single stockpile of arisings. Likewise making the site as volume neutral as possible will reduce the costs of development.

9.5 SITE WASTE MANAGEMENT PLANS

Site Waste Management Plans allow better waste management practices, help to reduce the amount of waste produced and identify best environmental disposal options. Implementing a Site Waste Management Plan (SWMP) can reduce costs (increasing business profits) and maximise resource efficiency.

SWMPs will be a legal requirement for all projects with an overall development cost of over £300k from the 6th April 2008. GRM can assist in the production of SWMPs which comply with the Code of Practice and identify best environmental disposal options when dealing with waste.

10 GEOTECHNICAL ASSESSMENT

10.1 INTRODUCTION

The client has indicated that the proposed development comprises up to 2.5 storey houses.

The finished floor levels of the proposed structures have not been provided by the Client. Therefore, for the purposes of this assessment, it is assumed that finished levels will not vary appreciably from the existing ground levels.

Should the development proposals or finished levels be different from these assumptions then the comments/recommendations below may require revising.

10.2 ENGINEERING GROUND TREATMENT

The near surface soils have the potential to be disturbed by weathering and site traffic. Precautions should be taken to avoid this, as excessive disturbance may entail more onerous floor slab design, road cap thickness and increased amounts of off site disposal etc.

The near surface soils may need treatment or reinforcing to allow safe movement of construction plant and labour. An assessment by the contractor should be undertaken once the type of machinery/plant needed to complete the development is known.

10.3 EXCAVATION CONDITIONS

Excavation of the materials encountered during the ground investigation should be easily achieved using conventional hydraulic excavation techniques. A breaker or similar plant may be required where hardstanding or existing foundations are encountered. A breaker may also be required for deeper excavations in the less weathered sandstone/siltstone, as the machine used for trial pitting was generally struggling to excavate past 2m begl in the northern and western site areas.

From the ground investigation undertaken, it is likely that excavations will be generally stable in the short term. Some materials such as granular soils and made ground are liable to collapse without warning. This situation is likely to be exacerbated by water ingress.

Excavation instability (over-break) can result in damage to existing services or structures (e.g. foundations, roads or boundary walls/fences) both on and off-site, as well as increased foundation concrete costs. In order to minimise this, all excavations deeper than 1.2m deep (or any excavation within 1.5m of any existing structure or service) should be supported. Full support should be provided to the full depth of all near vertically sided excavations in made ground. A reduction to intermediate support should be acceptable within firm and stiffer natural clays.

Wherever possible, man entry into excavations should be prevented; however, where this is not possible, entry to, and time spent in, excavations should be kept to a minimum.

The build program should be tailored to reflect the impact that deep excavations through potentially unstable strata can have on adjacent properties, so that they are not undermined.

All excavations on site should be in accordance with HSE guidelines and stability should be practically maintained at all times. Reference should be made to HSE construction information sheet No. 8 (Revision 1) 'Safety in Excavations'.

Care should be taken to ensure that falls from excavation faces do not adversely affect the integrity of foundation concrete.

It is considered unlikely that dewatering will be required for shallow short-term excavations.

10.4 EXISTING STRUCTURES / SUBSTRUCTURES

There are existing structures on the site including the remaining houses scheduled for demolition. There may also be old foundations or other buried structures from the previous site use (e.g. associated with demolished buildings), that have not been identified from this investigation.

Where practicable, existing buried construction should be fully removed; however, if this is not practicable all new foundations should be carried down to fully penetrate it and it should be broken well away from all new structures.

There may be existing structures and/or infrastructure in close proximity to the proposed development. New build foundations may be constructed next to pavements with existing underground services beneath them, or excavations may be required near existing footings associated with adjacent properties. These potential hazards need to be taken into consideration when designing foundations and the groundworker needs to be made aware of their potential impact during the redevelopment works. Foundations close to existing underground services or buildings may require alternative foundation techniques (such as piling) to protect the integrity of these structures.

The contractor for the works should carry them out in such a fashion so as to not cause excessive overbreak, concrete usage or undermine existing buildings/roads/ services that are to be retained.

10.5 BEARING STRATA

Foundations must not be founded in made ground, buried topsoil or soft natural strata, all of which should be fully penetrated by all new foundations.

The natural cohesive soils (Glacial Till) encountered, at anticipated foundation depths, were generally at least firm. It is anticipated that a nett allowable bearing pressure of at least 110kN/m^2 should be available for conventional strip or trench fill footings. This will allow line loads up to 49kN/m to be taken on footings 450mm wide and 66kN/m on footings 600mm wide. This should result in total settlements of not more than 20mm, keeping differential settlements within acceptable limits.

The natural granular soils (weathered Coal Measures) encountered, at anticipated foundation depths, were generally at least medium dense. It is anticipated that a nett allowable bearing pressure of at least 220kN/m^2 should be available for conventional strip or trench fill footings. This will allow line loads up to 99kN/m to be taken on footings 450mm wide and 132kN/m on footings 600mm wide. This should result in total settlements of not more than 20mm, keeping differential settlements within acceptable limits.

The rock strata (Wooley Edge Sandstone) encountered, at anticipated foundation depths, were generally at least very weak. It is anticipated that a nett allowable bearing pressure of at least 300kN/m^2 should be available for conventional strip or trench fill footings. This will allow line loads up to 135kN/m to be taken on footings 450mm wide and 180kN/m on footings 600mm wide.

Wider footings may be required for higher point/line loads such as at party walls etc. Should wider footings be required for higher point/line loads, GRM should be contacted for further advice.

Soft or hard spots were not observed in trial pits. If they are found during foundation excavation then they should be replaced with suitably compacted material or footings deepened to suitable strata, to avoid differential settlement.

Strata of differing bearing character (e.g. gravel and clay) can be anticipated from the exploratory holes. If differing strata is encountered at foundation levels within the excavations for a single plot then the excavation depths should be altered as appropriate to ensure the foundations rest on a single stratum, or strata that will not induce differential settlement. Where this is impractical then GRM should be contacted to assess a reinforced concrete detail or an alternative foundation solution (e.g. piles or vibro-replacement). Alternatively, plot specific trial pits prior to the excavation of foundations would help minimise potential delays to the development program by highlighting any issues in advance..

10.6 TREE INFLUENCE ON FOUNDATIONS

The soils below the site are of low to moderate volume change potential (see Appendix J); assume moderate for design purposes. As a result deepening of foundations within the influence of trees will be required, in accordance with NHBC Standards Chapter 4.2 'Building near trees'.

Heave precautions will be required where the foundations lie within the heave zone of trees as defined in NHBC Standards Chapter 4.2. Foundations should be remote from the direct action of tree roots, and should not be constructed so close to trees as to significantly damage their root systems.

It is an NHBC requirement that conventional foundations deeper then 2.5m are designed by an Engineer or a deeper foundation technique such as piling is used. Such design can not be started until a tree survey and proposed site levels are available and could involve detailed desiccation testing to prove safe foundation depths. However, at this stage it is estimated that 10% of the site will have deepened foundations due to trees.

Shallow rock will ensure foundations can be terminated 0.15m into a consistent rock stratum.

10.7 TYPE AND DEPTHS OF FOUNDATIONS

At this stage, it is considered that strip or trench fill foundations 150mm into the natural cohesive strata (weathered Coal Measures) will be suitable for the majority of the proposed development. Minimum foundation depths of 0.90m will be applicable.

Due to the presence of presence of trees along parts of the northern boundary, foundation depths of up to 2m should be expected. However, the general depth of foundations is likely to be approximately 1m bgl.

Once the development plan and levels have been finalised, consideration should be given to the most appropriate foundation solution, taking into account removal of old substructures, stability of the strata and proximity to boundaries/services/roads/ existing structures.

TP or WS	Anticipated founding Strata depth(m) / type	Ground Water	Foundation Type	Foundation Size/width (m)	Type of Concrete	Remarks
TP1	0.9m / Clay	-	Trench fill	0.45	GEN-1	Re-laid Topsoil to 0.3m bgl
TP2	1.3m / Rock	-	Trench fill	0.45	GEN-1	MG to 0.4m bgl
TP3	0.5m / Rock	-	Trench fill	0.45	GEN-1	MG to 0.3m Glacial Till to 0.5m bgl
TP4	0.9 / Clay (Rock at 1.4m)	-	Trench fill	0.45	GEN-1	Demolition Rubble over Glacial Till to 0.4m bgl
TP5	0.9m / Clay	-	Trench fill	0.45	GEN-1	Re-laid topsoil to 0.1m bgl
TP6	0.9m / Clay (Rock at 1.4m)	-	Trench fill	0.45	GEN-1	Demolition Rubble to 0.1m bgl
TP7	0.9m / Clay	-	Trench fill	0.45	GEN-1	Demolition rubble to 0.1m bgl
TP8	0.9m / Clay	-	Trench fill	0.45	GEN-1	Demolition rubble to 0.3m bgl
TP9	0.9m / Clay	-	Trench fill	0.45	GEN-1	MG to 0.5m bgl
TP10	0.9m / Clay	-	Trench fill	0.45	GEN-1	MG to 0.3m bgl
WS1	0.9m / Clay	-	Trench fill	0.45	GEN-1	MG to 0.55m bgl
WS2	0.9m / Clay	-	Trench fill	0.45	GEN-1	MG to 0.7m bgl
WS3	0.9m / Clay	-	Trench fill	0.45	GEN-1	MG to 0.5m bgl
WS4	0.65m / Gravel (Rock at 1.5m)	-	Trench fill	0.45	GEN-1	MG to 0.5m, Glacial Till to 0.65m bgl
WS5	0.9m / Clay	-	Trench fill	0.45	GEN-1	MG to 0.3m bgl
WS6	0.8m / Rock	-	Trench fill	0.45	GEN-1	MG to 0.4m bgl
WS7	0.9m / Clay	-	Trench fill	0.45	GEN-1	MG to 0.4m bgl
WS8	0.9m / Clay	-	Trench fill	0.45	GEN-1	MG to 0.5m bgl
WS9	0.7m / Rock	-	Trench fill	0.45	GEN-1	MG to 0.3m bgl

Given the general occurrence of shallow competent sandstone across the site it is considered that the risk posed to the proposed development from shallow mine workings is negligible.

10.8 FLOOR SLABS

Shallow strata are likely to become heavily disturbed by construction activities (especially during inclement weather) and care must be taken not to make them

unsuitable as a bearing stratum as this could result in an increased requirement for suspended slabs.

A suspended floor system incorporating a sub-floor void, such as beam and block, will be required for all properties where the foundations lie within the heave zone of trees as defined by NHBC Standards in Chapter 4.2 or if seasonally desiccated strata are present at the time of construction.

Basic radon gas protection measures are required for the proposed development.

Based on anticipated site levels, the thickness of unsuitable materials and the likely disturbance caused during construction, it is considered that suspended floors should be allowed for throughout the development. Until a tree survey is conducted and the gas monitoring program is completed it would be prudent to allow for all plots to use a voided suspended floor, such as beam and block.

10.9 SLOPE STABILITY AND RETAINING STRUCTURES

The site is generally level with a gentle rise to the south and west in keeping with the surrounding area. Therefore, there is no risk of slope instability occurring on the site.

No retaining walls were observed on site. The present gradients on site are likely to be adjusted by minor earthworks. Future ground profiles may require earth retaining structures, for which further advice may be required when more information is available.

10.10 SOAKAWAY DRAINAGE

Soakaway testing was carried to provide an initial indication of the suitability of the strata for the disposal of surface waters. The testing comprised the excavation of a test pit to a suitable depth, and the placement of water into the pit. The level of water present was then monitored over time. Unfortunately due to the very slow infiltration rate only one test was conducted at each test location.

The soakaway permeability tests were carried out in the Glacial Till and Coal Measures strata present across the site at four locations. A plan showing the approximate locations of the tests is presented in Appendix L.

Infiltration rates have been calculated for each test pit from the data obtained from site. The calculated infiltration rates are presented below in the order in which they were tested: -

- Soak1 – no infiltration over 3 hours test period.
- Soak2 – 4.95×10^{-6} m/s.
- Soak3 – no infiltration over 3 hours test period.
- Soak4 – 5.13×10^{-6} m/s

The results show that the cohesive Glacial Till is not suitable for the disposal of surface water using a soakaway drainage system. Initial indications are that the granular material of the Coal Measures may be suitable for a soakaway drainage

system. This will need to be confirmed once the layout and drainage proposals are confirmed.

The results of the testing should be provided to the project's drainage engineer for inclusion within the site's surface water drainage design after taking into account suitable factors of safety.

It is recommended that the Local Authority and Environment Agency be consulted with regards to the use of soakaways.

In the areas of cohesive geology it is recommended that an alternative drainage system should be considered for the disposal of surface water. It may be possible to re-use the existing site drainage.

10.11 EXISTING ACCESS ROADS

Road cores were extracted at five locations along the length of Kirkstall Road to ascertain the road construction. In all cases the cores revealed 100mm of reinforced concrete overlying cohesive natural strata. No evidence of capping or a sub-base material was identified.

10.12 NEW ACCESS ROADS

Site observations suggest that natural cohesive materials will have CBR values of between 2% and 4%, when suitably drained. Proof rolling and the improvement of soft spots may result in increased CBR values and the incorporation of a geotextile grid into sub-base layers may allow for reduced capping thickness.

The adopting authority should be consulted at the earliest opportunity as to local requirements regarding sub grade and testing requirements. Incorporation of a geotextile grid into sub-base layers may allow for reduced capping thickness. Site observations should be confirmed by in situ or laboratory testing in accordance with the adopting Local Authority's preference.

10.13 BURIED CONCRETE

Based on the recorded water soluble sulphate and pH levels in the soils below the site and assuming static groundwater conditions, in accordance with requirements of BRE Special Digest 1 (2005), 'Concrete in Aggressive Ground', the Design Sulphate Class for buried concrete at the site should be assumed as DS-1 and the ACEC Class as AC-1s. For unreinforced trench-fill foundations with a width of greater than 450mm, the classifications above equate to a concrete designated as GEN1 in BS8500 and RC35 for reinforced foundations.

The results of the water soluble sulphate and pH testing of are presented in Appendices I and J.

11 FURTHER INVESTIGATION

Some further investigation, to determine more accurately the effect of some of the identified hazards on the development, is recommended. This includes the following:

- Gas monitoring will continue after submission of this document. Subsequently, an addendum letter report will be issued to confirm the ground gas risk assessment.
- Trial pitting and an inspection should be carried out to assess any potential risk of contamination of the underlying soils, following demolition of the remaining houses.
- Validation inspection and testing following hotspot removal.
- A tree survey prior to site clearance, carried out by an arboricultural specialist.
- Preparation of a foundation schedule including compliance with NHBC Standards Chapter 4.2 'Building near Trees'.
- Consultation is required with the highways authority regarding their requirements for the proposed new roads.
- An asbestos survey is recommended prior to further site disturbance.

A copy of this report should be submitted to the Planning Department of the Local Authority/Local Authority EHO for review, if planning conditions exist for this site. A copy should also be sent to the NHBC for their records.

GRM can provide additional services to assist with the progress of this development. Budget costs for these services can be itemised under separate cover if required.

12 CONCLUSIONS

This Site Appraisal has shown the site is suitable for the proposed development, assuming compliance with all the recommendations contained within this report.

See 'Summary of Recommendations' table at the beginning of the report.

Document prepared by	**Paul Wardle BSc MA (Geologist)**
Reviewed by	**Geoffrey Beckett C.Geol FGS (Senior Engineering Geologist)**
Approved by	**Chris Jerram FGS CGeol (Director)**
When required in-house geological, geotechnical, environmental, structural and civil staff helped to produce this document.	

NOTES ON LIMITATIONS

General

GRM Development Solutions Limited has prepared this report solely for the use of the Client and those parties with whom a warranty agreement had been executed, or with whom an assignment had been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from GRM Development Solutions Limited; a charge may be levied against such approval.

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Phase I Environmental Audits/ Desk Studies

The work undertaken to provide the basis of this report comprised a study of available documented information from a variety of sources (including the Client), together with (where appropriate) a brief walk over inspection of the site and meetings and discussions with relevant authorities and other interested parties. The opinions given in this report have been dictated by the finite data on which they are based and are relevant only to the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. Should additional information become available which may affect the opinions expressed in this report, GRM Development Solutions Limited reserves the right to review such information and, if warranted, to modify the opinions accordingly. It should be noted that any risks identified in a Phase 1 report are perceived risks based on the information reviewed; actual risks can only be assessed following a physical investigation of the site.

Phase II Environmental Audits (Contamination Investigations)

The investigation of the site has been carried out to provide sufficient information concerning the type and degree of contamination, ground and groundwater conditions to allow a reasonable risk assessment to be made. The objectives of the investigation have been limited to establishing the risks associated with potential human targets, building materials, and controlled waters.

The amount of exploratory work and chemical testing undertaken has necessarily been restricted by the short timescale available, and the locations of exploratory holes have been restricted to the areas unoccupied by the building(s) on the site and by buried services. A more comprehensive investigation may be required if the site is to be redeveloped as, in addition to risk assessment, a number of important engineering and environmental issues need to be resolved.

For these reasons if costs have been included in relation to site remediation these must be considered as tentative only and must, in any event, be confirmed by a commercial adviser.

The exploratory holes undertaken, which investigate only a small volume of the ground in relation to the size of the site, can only provide a general indication of site conditions. The number of sampling points and methods of sampling and testing do not preclude the existence of localised "hotspots" of contamination where concentrations may be significantly higher than those actually encountered.

The risk assessment and opinions provided, inter alia, take in to consideration currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values.

Phase II Geo-environmental Investigations (Combined Geotechnical and Contamination Investigations)

The investigation of the site has been carried out to provide sufficient information concerning the type and degree of contamination, geotechnical characteristics, and ground and groundwater conditions to provide a reasonable assessment of the environment risks together with engineering and development implications. If costs have been included in relation to site development a commercial adviser must confirm these.

The exploratory holes undertaken, which investigate only a small volume of the ground in relation to the size of the site can only provide a general indication of site conditions. The opinions provided and recommendations given in this report are based on the ground conditions apparent at the site for each of the exploratory holes. There may be exceptional ground conditions elsewhere on the site which have not been disclosed by this investigation and which have therefore not been taken into account in this report.

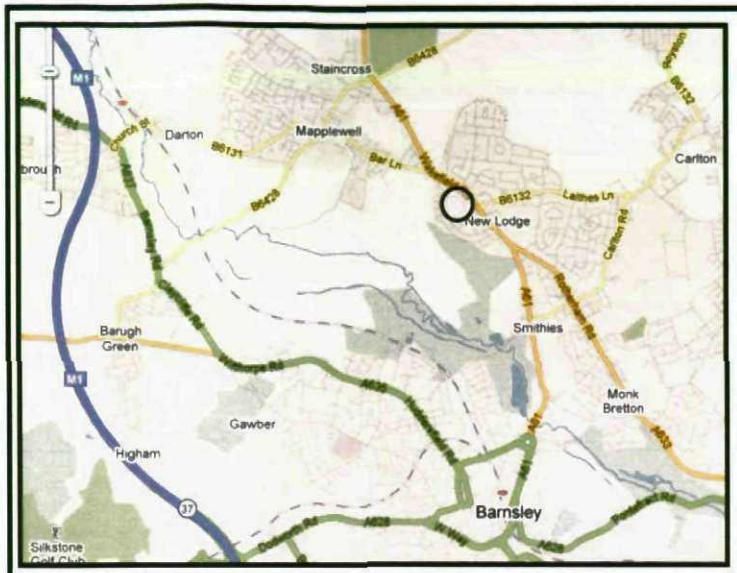
The comments made on groundwater conditions are based on observations made at the time the site work was conducted. It should be noted that groundwater levels will vary owing to seasonal, tidal and weather related effects.

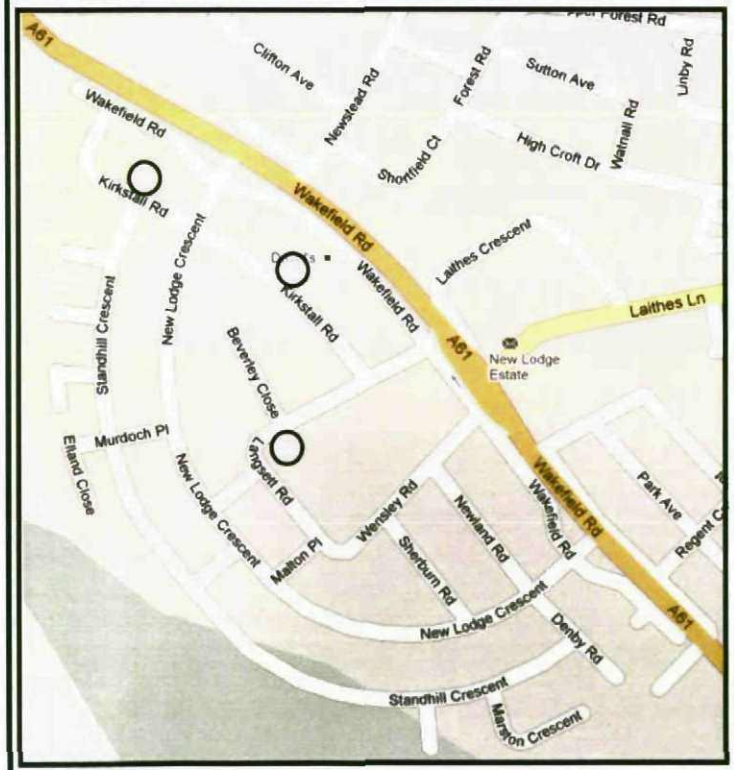
The scope of the investigation was selected on the basis of the specific development proposed by the Client and may be inappropriate to another form of development or scheme.

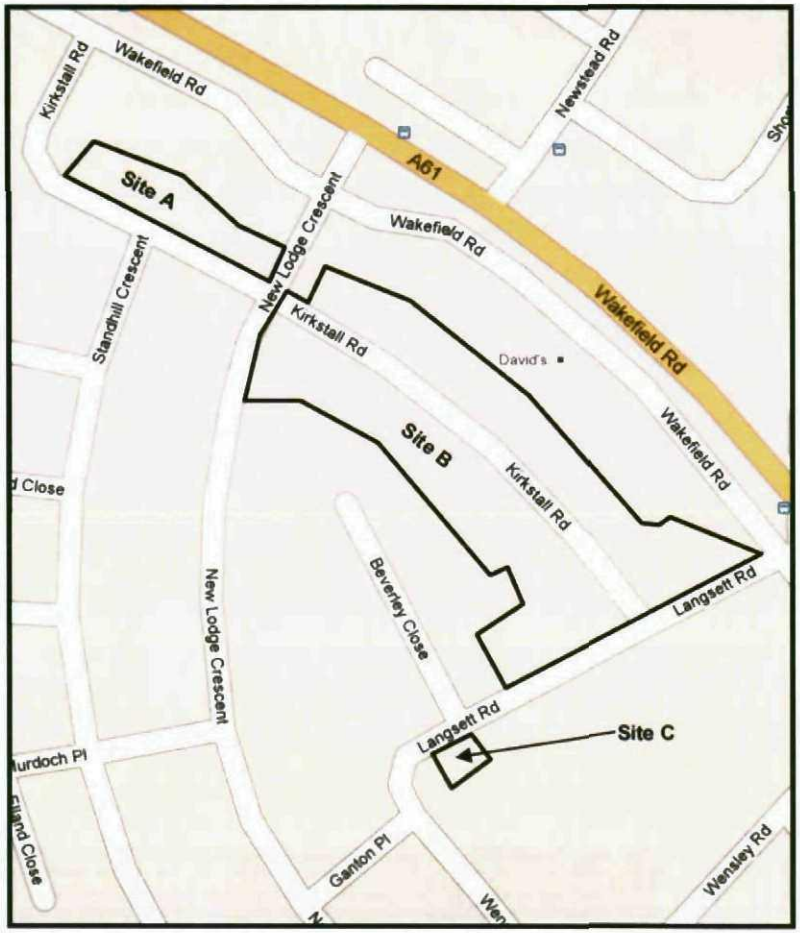
The risk assessment and opinion provided, inter alia, take into consideration currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values.

APPENDIX A

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NOTES:

○ Approximate Site Location

□ Approximate Site Area

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CLIENT:
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PROJECT:
New Lodge Estate, Barnsley

TITLE:
Site Location Plan

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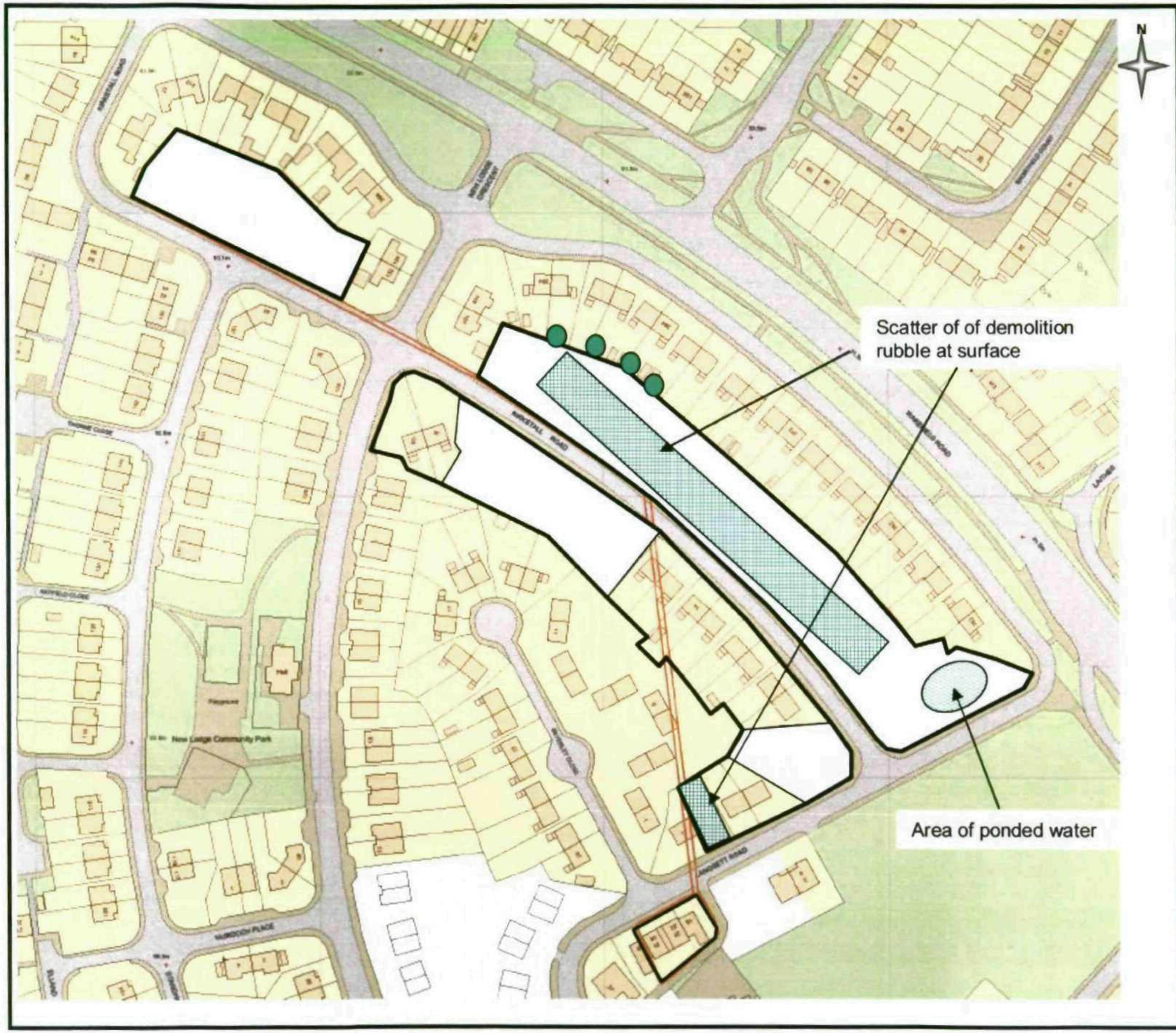
TITLE:
Site Boundary Plan

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APPENDIX B

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NOTES:

Approximate Demolition areas

Trees

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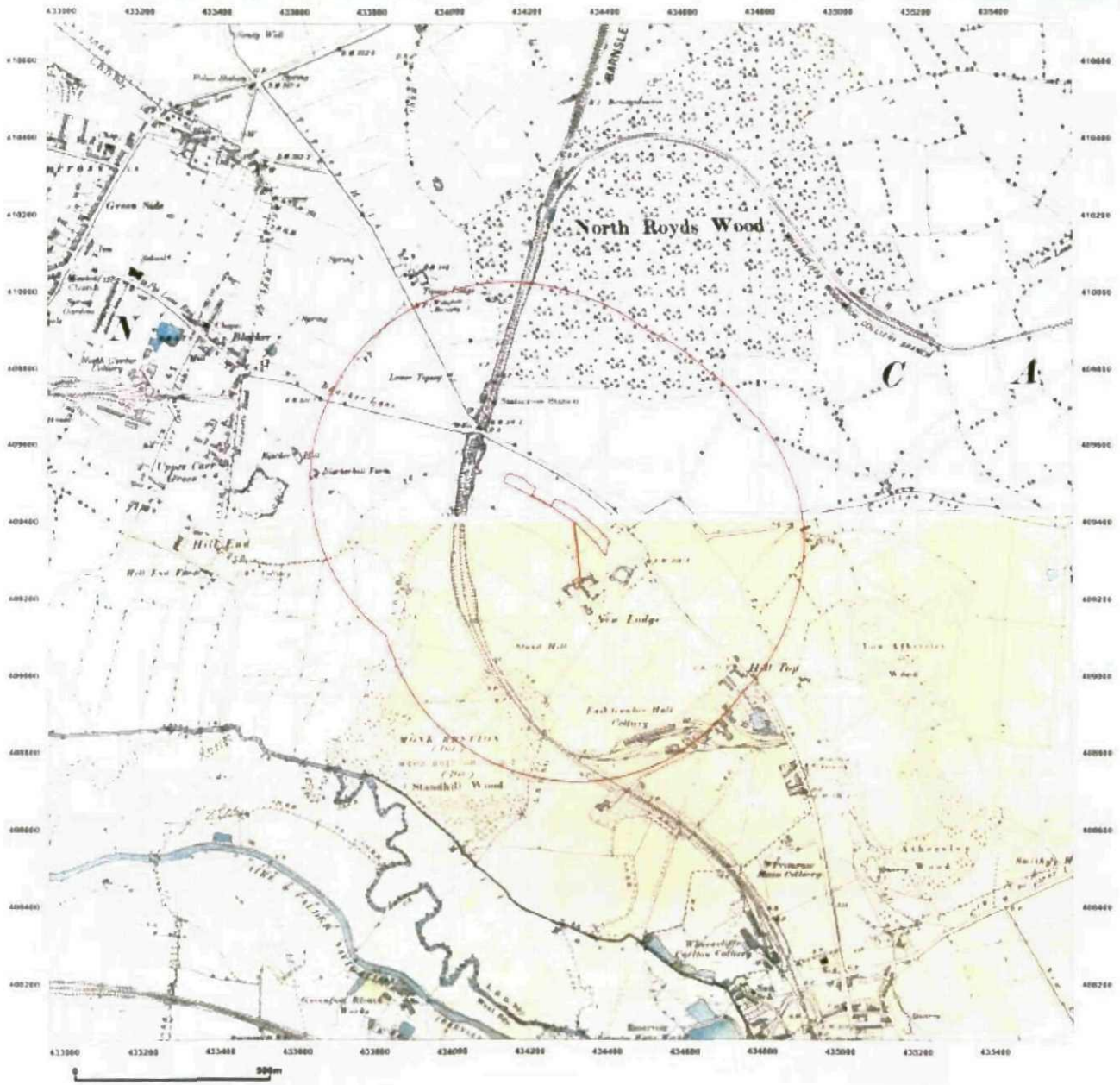
Site Observations Plan

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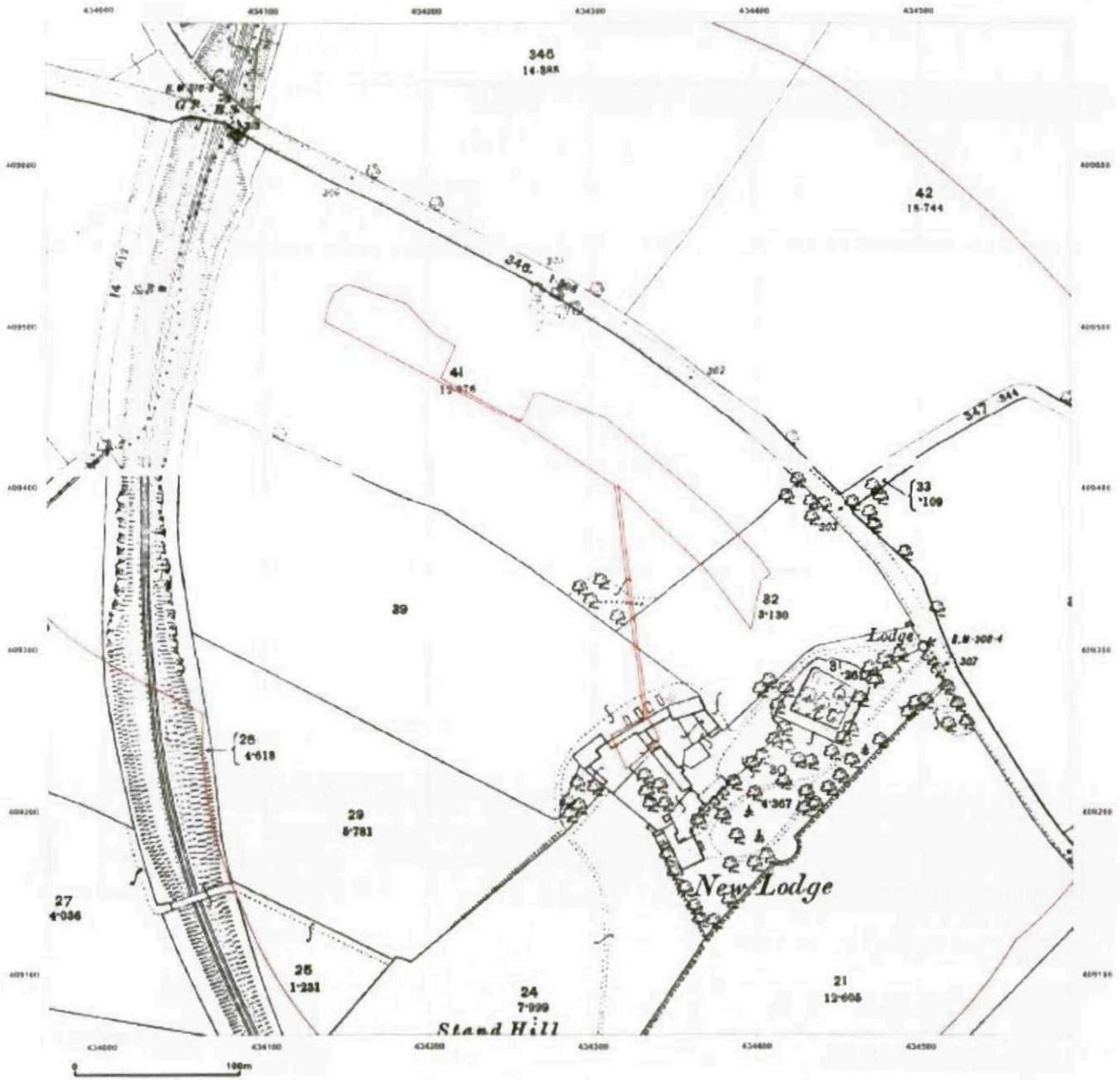
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TITLE:
Historical Mapping: 1891

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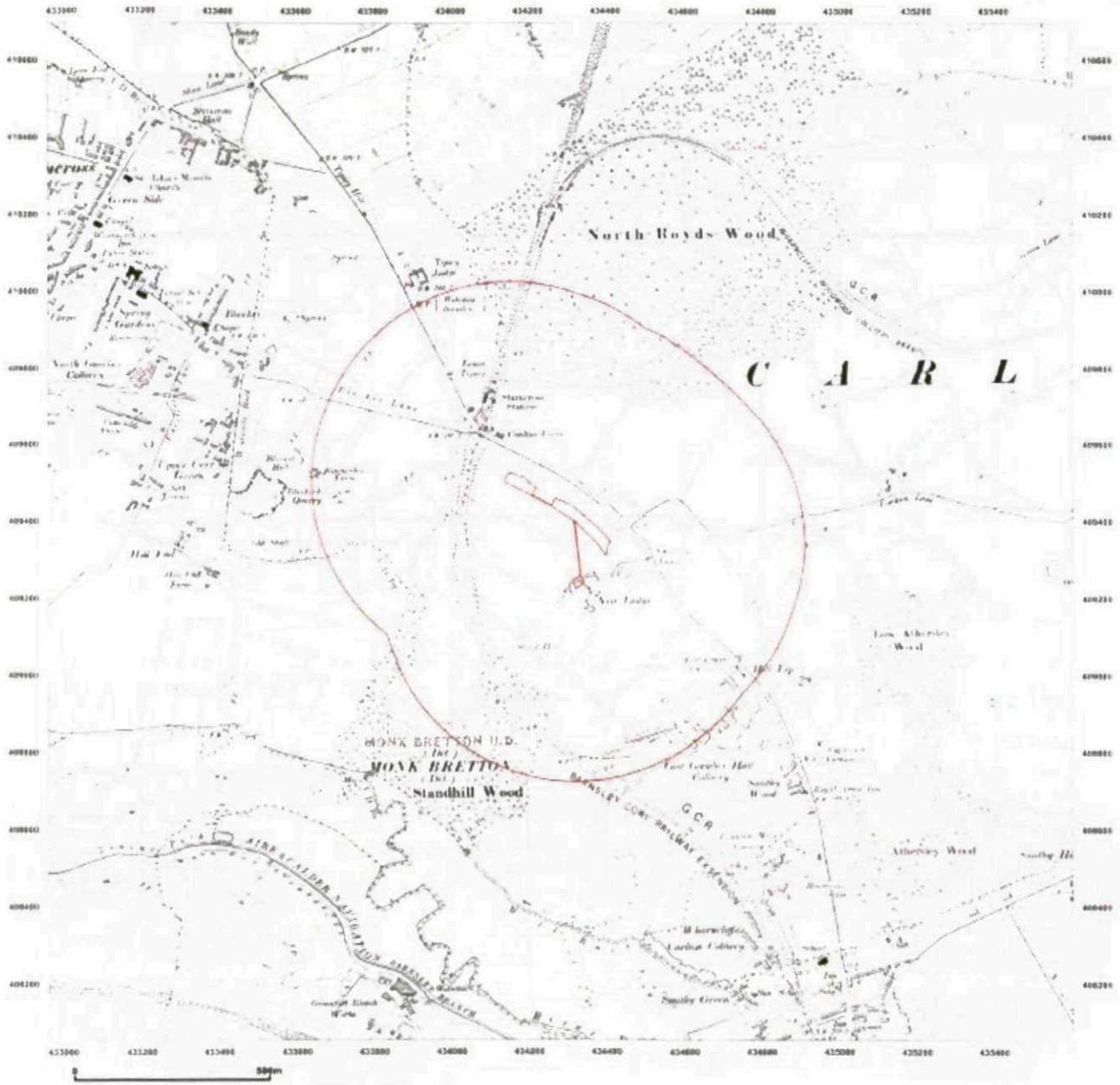
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TITLE:
Historical Mapping: 1893

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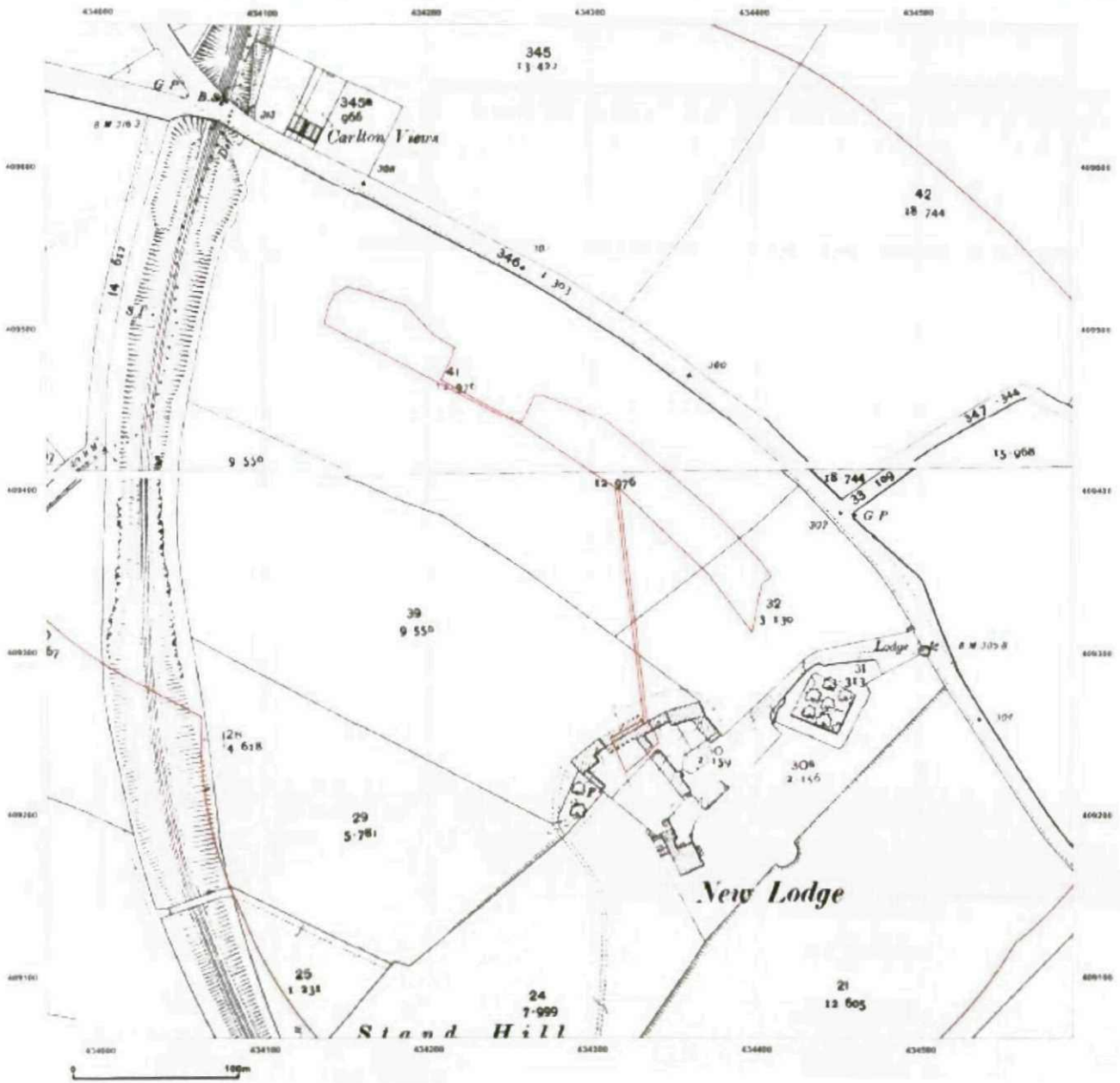
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PROJECT:
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TITLE:
Historical Mapping: 1904

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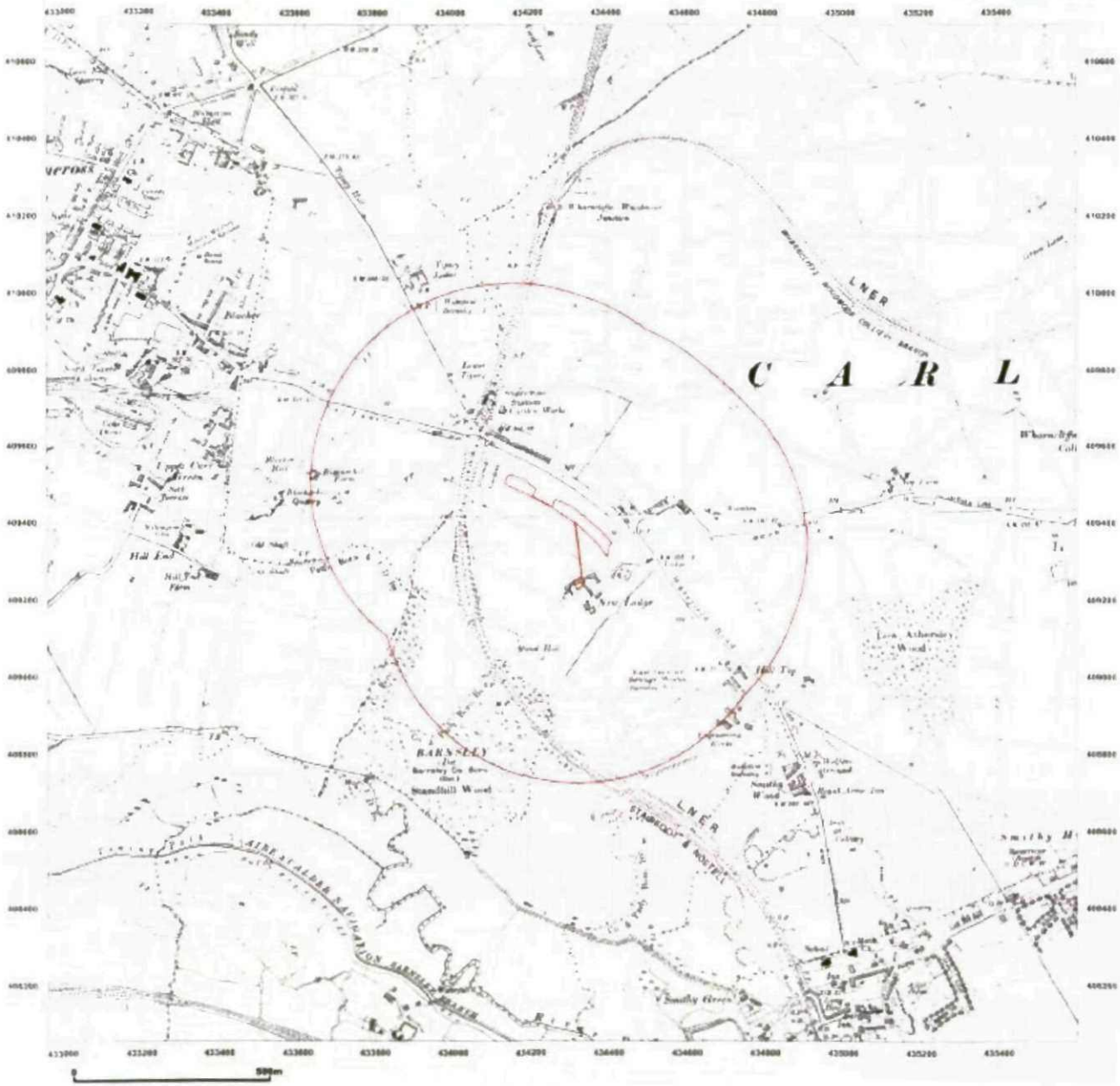
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PROJECT:
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TITLE:
Historical Mapping: 1906

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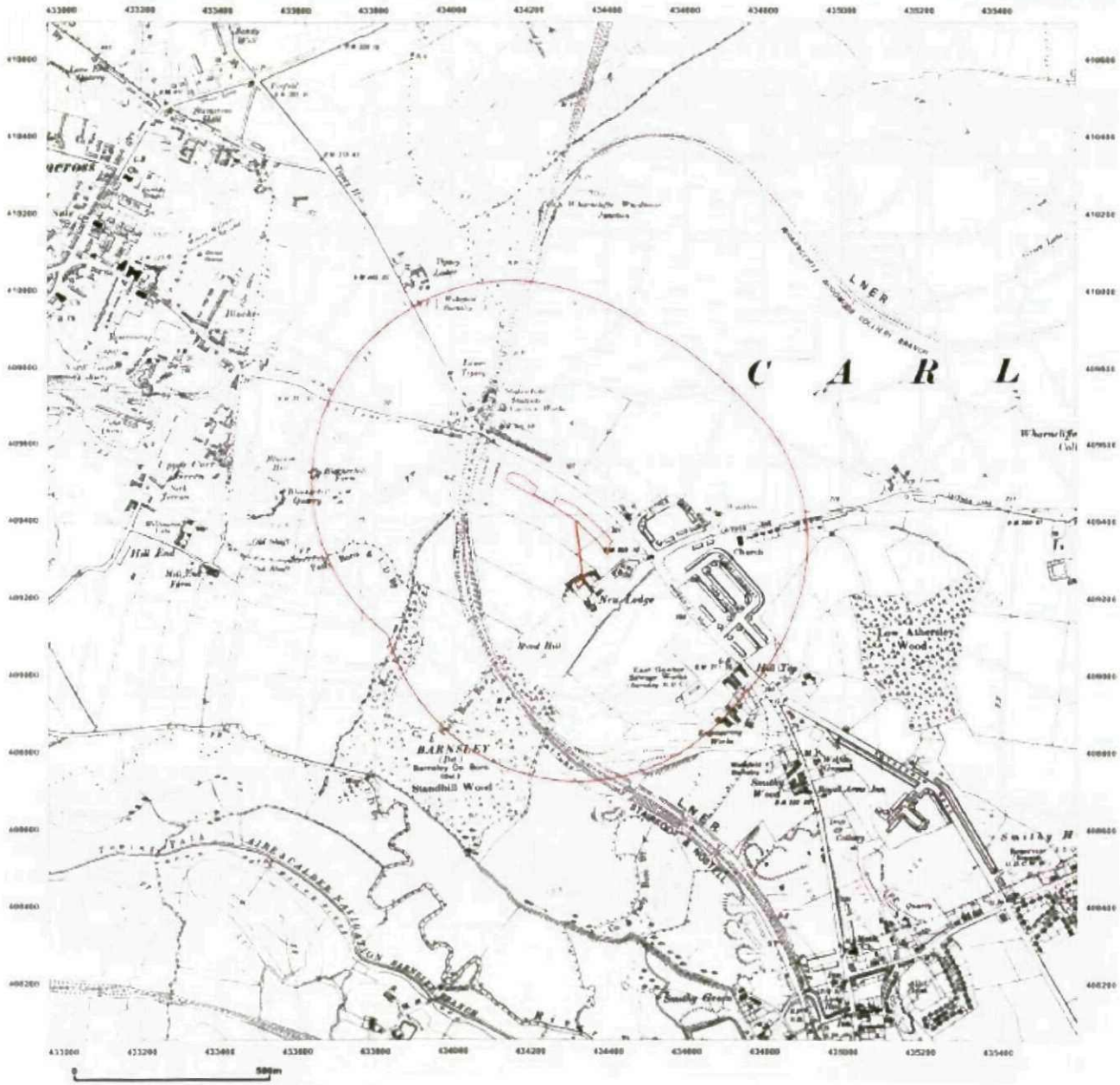
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PROJECT:
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TITLE:
Historical Mapping: 1930

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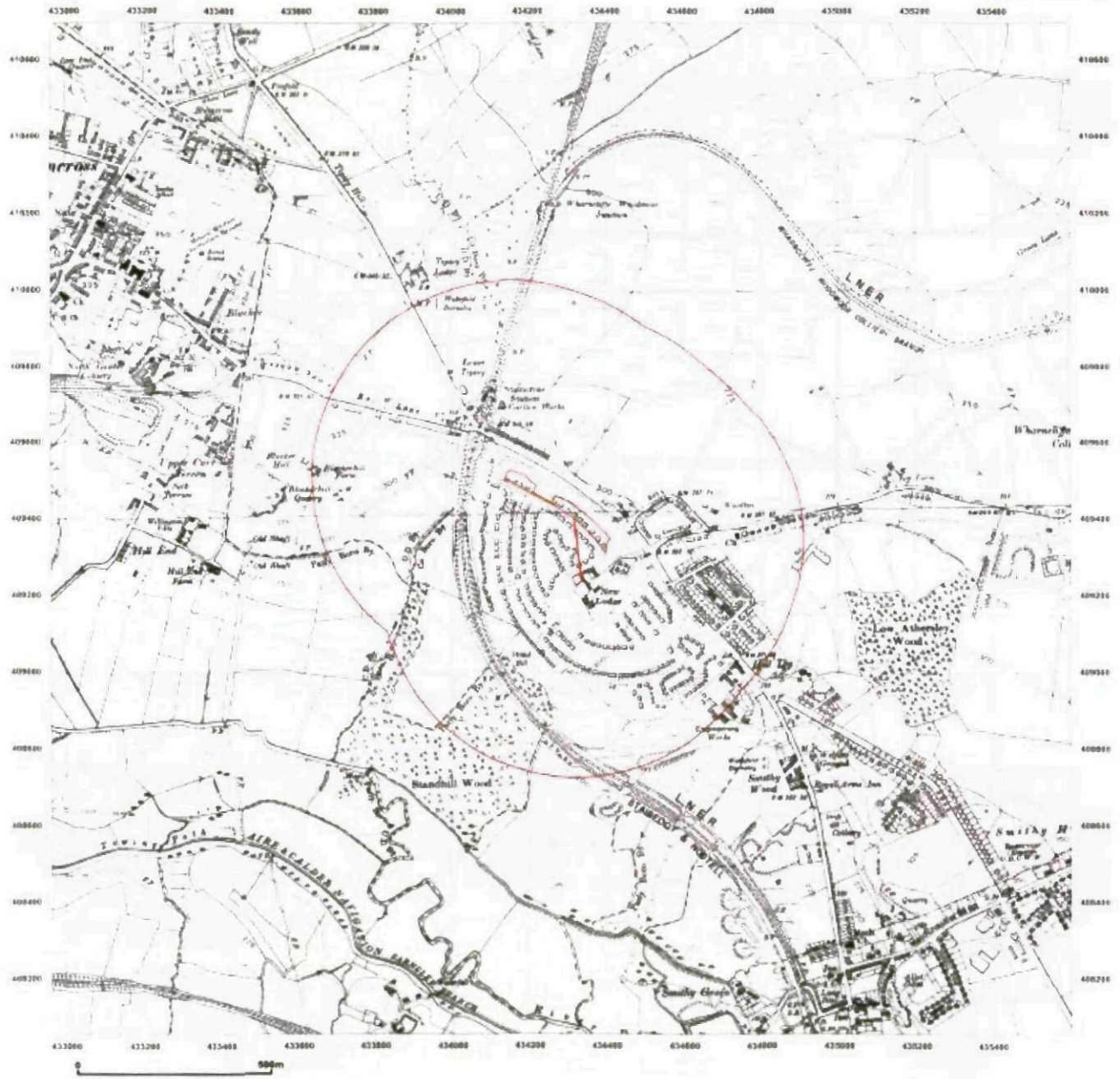
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PROJECT:
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TITLE:
Historical Mapping: 1938

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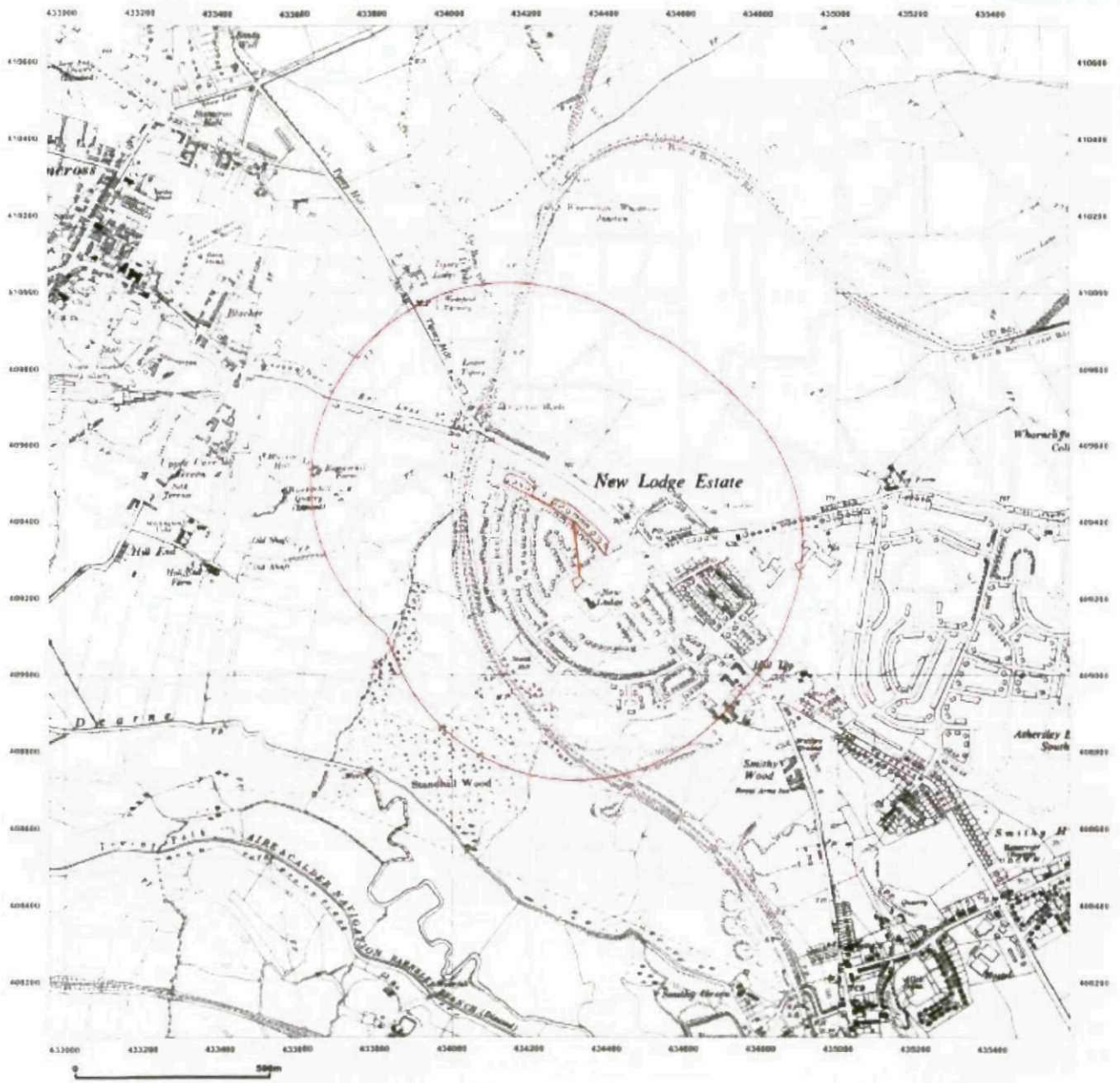
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PROJECT:
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TITLE:
Historical Mapping: 1948

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PROJECT:
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TITLE:
Historical Mapping: 1951

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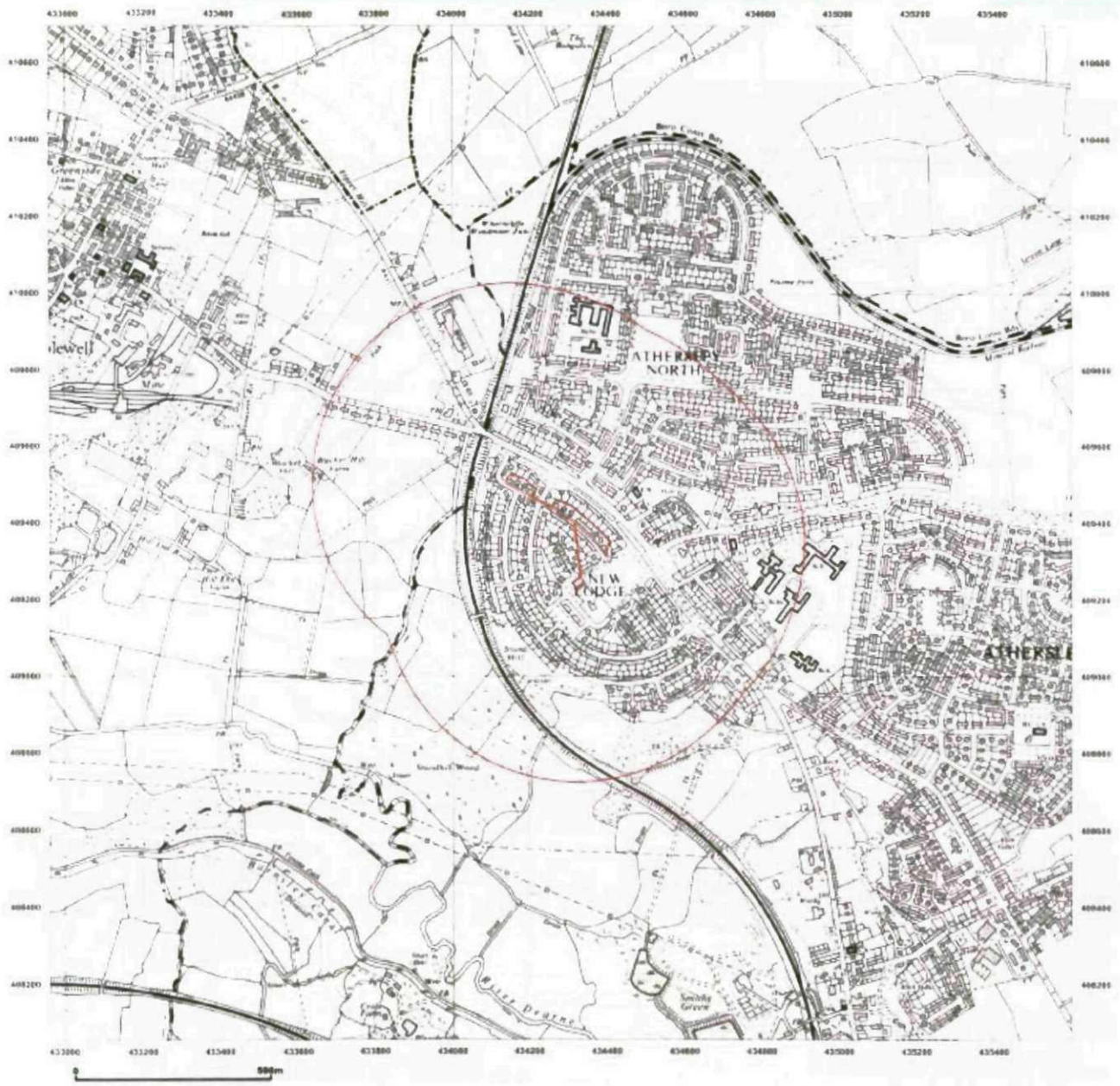
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PROJECT:
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TITLE:
Historical Mapping: 1961

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CLIENT:
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PROJECT:
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TITLE:
Historical Mapping: 1966

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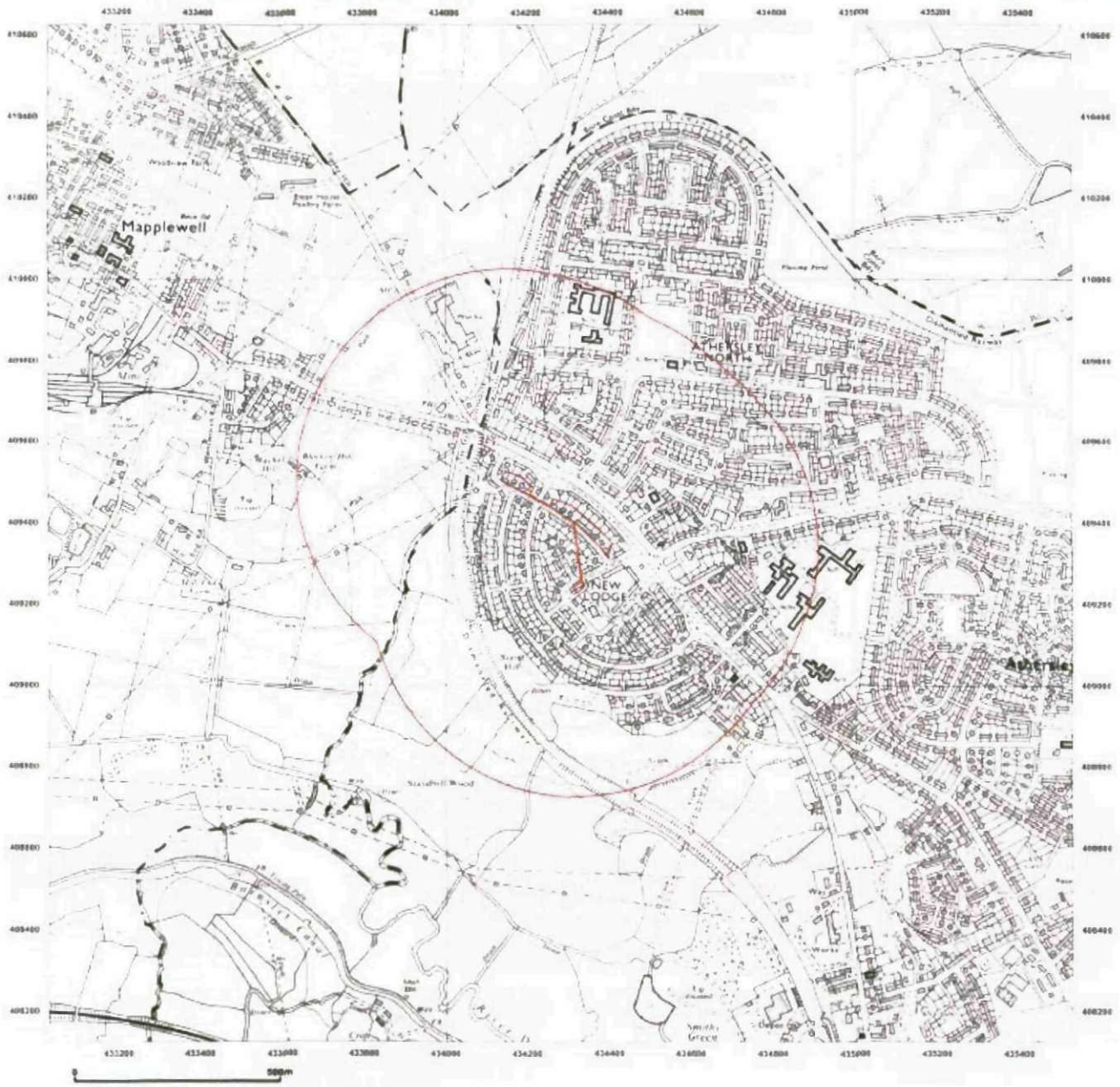
CLIENT:
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PROJECT:
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TITLE:
Historical Mapping: 1971

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Laurus House, First Ave, Centrum 100,
Burton-on-Trent, Staffordshire
Tel: 01283 551 249 Fax 01283 211 968

CLIENT:
Keepmoat Homes

PROJECT:
New Lodge Estate, Barnsley

TITLE:
Historical Mapping: 1978

SCALE@SIZE:	ISSUE:
NTS	FINAL
DESIGN/DRAWN: CRS	DATE: 03/2011
PROJECT No: P5440	DRAWING No: Figure 16

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CLIENT:
Keepmoat Homes

PROJECT:
New Lodge Estate, Barnsley

TITLE:
Historical Mapping: 1982

SCALE@SIZE :	ISSUE:
NTS	FINAL
DESIGN/DRAWN :	DATE:
CRS	03/2011
PROJECT No:	DRAWING No:
P5440	Figure 17

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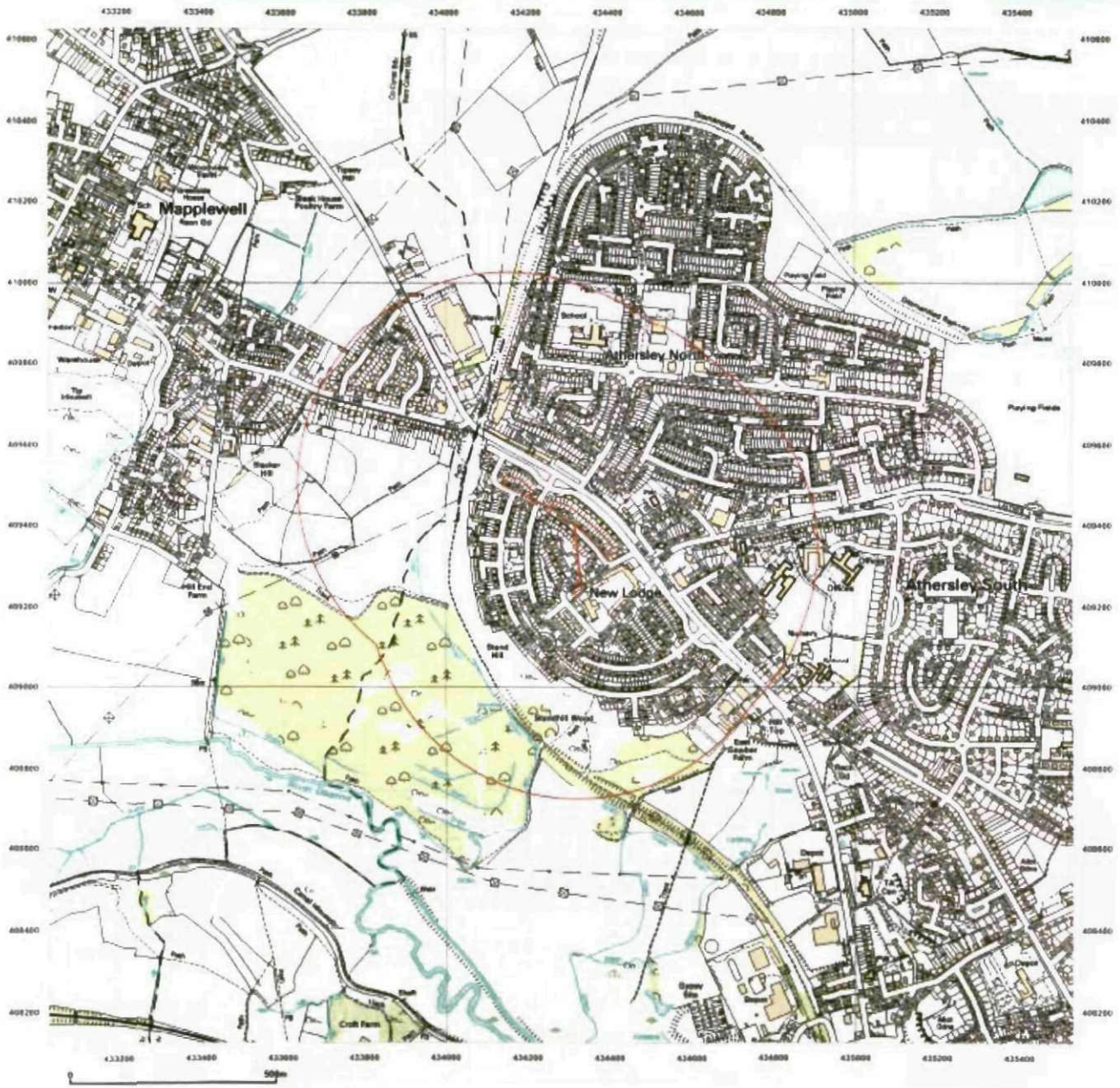
CLIENT:
Keepmoat Homes

PROJECT:
New Lodge Estate, Barnsley

TITLE:
Historical Mapping: 1993

SCALE@SIZE:	ISSUE:
NTS	FINAL
DESIGN/DRAWN: CRS	DATE: 03/2011
PROJECT No: P5440	DRAWING No: Figure 18

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CLIENT:
Keepmoat Homes

PROJECT:
New Lodge Estate, Barnsley

TITLE:
Historical Mapping: 2002

SCALE@SIZE:	ISSUE:
NTS	FINAL
DESIGN/DRAWN:	DATE:
CRS	03/2011
PROJECT No:	DRAWING No:
P5440	Figure 19

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CLIENT:
Keepmoat Homes

PROJECT:
New Lodge Estate, Barnsley

TITLE:
Historical Mapping: 2011

SCALE@SIZE:	ISSUE:
NTS	FINAL
DESIGN/DRAWN: CRS	DATE: 03/2011
PROJECT No: P5440	DRAWING No: Figure 20

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APPENDIX D

GRM Development Solutions
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GroundSure EnviroInsight

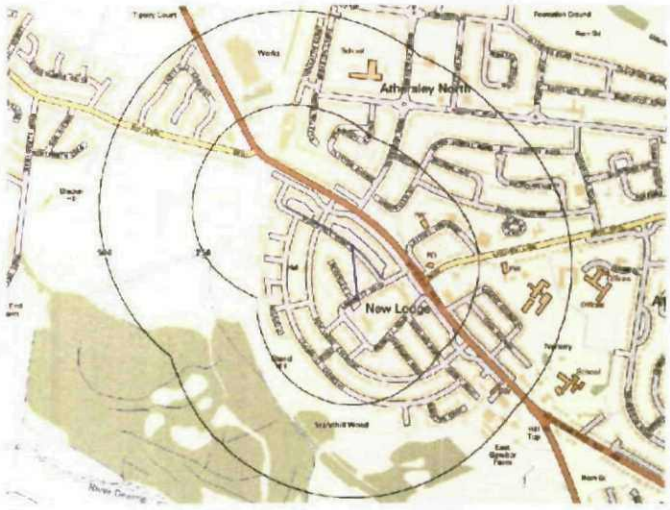
Address: Kirkstall Road,New Lodge Estate,Barnsley,S71 1RY

Date: Mar 2, 2011

GroundSure Reference: EMS-122129_162610

Your Reference: EMS_122129_162610

Client: EmapSite



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Aerial Photograph of Study Site



Aerial photography supplied by Getmapping PLC.
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Site Name: Kirkstall Road,New Lodge Estate,Barnsley,S71 1RY
Grid Reference: 434292,409413
Size of Site: 0.85 ha

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Overview of Findings

For further details on each dataset, please refer to each individual section in the main report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

Report Section	Number of records found within (X) m of the study site boundary					
1. Environmental Permits, Incidents and Registers	**on-site**	**0-50**	**51-250**	**251-500**	**501-1000**	**1000-1500**
1.1 Industrial Sites Holding Environmental Permits and/or Authorisations						
Records of historic IPC Authorisations	0	0	0	0	-	-
Records of Part A(1) and IPPC Authorised Activities	0	0	0	0	-	-
Records of Water Industry Referrals (potentially harmful discharges to the public sewer)	0	0	0	0	-	-
Records of Red List Discharge Consents (potentially harmful discharges to controlled waters)	0	0	0	0	-	-
Records of List 1 Dangerous Substances Inventory sites	0	0	0	0	-	-
Records of List 2 Dangerous Substances Inventory sites	0	0	0	0	-	-
Records of Part A(2) and Part B Activities and Enforcements	0	1	2	2	-	-
Records of Category 3 or 4 Radioactive Substances Authorisations	0	0	0	0	-	-
Records of Licensed Discharge Consents	0	1	0	9	-	-
Records of Planning Hazardous Substance Consents and Enforcements	0	0	0	0		
1.2 Records of COMAH and NIHHS sites	0	0	0	0	-	-
1.3 Environment Agency Recorded Pollution Incidents						
National Incidents Recording System, List 2	0	0	0	-	-	-
National Incidents Recording System, List 1	0	0	0	-	-	-
1.4 Sites Determined as Contaminated Land under Part IIA EPA 1990	0	0	0	0	-	-
2. Landfill and Other Waste Sites	**on-site**	**0-50**	**51-250**	**251-500**	**501-1000**	**1000-1500**
2.1 Landfill Sites						
Environment Agency Registered Landfill Sites	0	0	0	0	0	-
Landfill Data - Operational Landfill Sites	0	0	0	0	0	-
Environment Agency Historic Landfill Sites	0	0	0	1	3	5
Landfill Data - Non-Operational Landfill Sites	0	0	0	0	1	-
BGS/DoE Landfill Site Survey	0	0	0	0	0	1
GroundSure Local Authority Landfill Sites Data	0	0	0	0	2	1
2.2 Landfill and Other Waste Sites Findings						
Operational Waste Treatment, Transfer and Disposal Sites	0	0	0	0	-	-
Non-Operational Waste Treatment, Transfer and Disposal Sites	0	0	0	0	-	-
Environment Agency Licensed Waste Sites	0	0	0	0	2	7

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3. Current Land Uses	on-site	0-50	51-250	251-500	501-1000	1000-1500
3.1 Current Industrial Sites Data	0	1	8	-	-	-
3.2 Records of Petrol and Fuel Sites	0	0	0	1	-	-
3.3 Underground High Pressure Oil and Gas Pipelines	0	0	0	0	-	-

4. Geology	Description
4.1 Are there any records of Artificial Ground and Made Ground present beneath the study site? *	No
4.2 Are there any records of Superficial Ground and Drift Geology present beneath the study site? *	Yes
4.3 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section.	

Source: Scale: 1:50,000 BGS Sheet 087

* This includes an automatically generated 50m buffer zone around the site.

5. Hydrogeology and Hydrology	on-site	0-50	51-250	251-500	501-1000	1001-2000
5.1 Are there any records of Productive Strata in the Superficial Geology within 500m of the study site?				Yes		
5.2 Are there any records of Productive Strata in the Bedrock Geology within 500m of the study site?				Yes		
5.3 Groundwater Abstraction Licences (within 1000m of the study site).	0	0	0	0	0	-
5.4 Surface Water Abstraction Licences (within 1000m of the study site).	0	0	0	0	0	-
5.5 Potable Water Abstraction Licences (within 2000m of the study site).	0	0	0	0	0	0
5.6 Are there any Source Protection Zones within 500m of the study site?					No	

5.7 River Quality	on-site	0-50	51-250	251-500	501-1000	1001-1500
Is there any Environment Agency information on river quality within 1500m of the study site?	No	No	No	No	Yes	No
5.8 Detailed River Network entries within 500m of the site	0	0	3	6	-	-
5.9 Surface water features within 250m of the study site	No	No	Yes	-	-	-

6. Flooding	
6.1 Are there any Environment Agency indicative Zone 2 floodplains within 250m of the study site?	No
6.2 Are there any Environment Agency indicative Zone 3 floodplains within 250m of the study site?	No
6.3 Are there any Flood Defences within 250m of the study site?	No
6.4 Are there any areas benefiting from Flood Defences within 250m of the study site?	No
6.5 Are there any areas used for Flood Storage within 250m of the study site?	No
6.6 What is the maximum BGS Groundwater Flooding susceptibility within 50m of the study site?	Not Applicable
6.7 What is the BGS confidence rating for the Groundwater Flooding susceptibility areas?	Moderate

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7. Designated Environmentally Sensitive Sites	on-site	0-50	51-250	251-500	501-1000	1001-1500
7.1 Records of Sites of Special Scientific Interest (SSSI)	0	0	0	0	-	-
7.2 Records of National Nature Reserves (NNR)	0	0	0	0	-	-
7.3 Records of Local Nature Reserves (LNR)	0	0	0	0	-	-
7.4 Records of Special Areas of Conservation (SAC)	0	0	0	0	-	-
7.5 Records of Special Protection Areas (SPA)	0	0	0	0	-	-
7.6 Records of Ramsar sites	0	0	0	0	-	-
7.7 Records of World Heritage Sites	0	0	0	0	-	-
7.8 Records of Environmentally Sensitive Areas	0	0	0	0	-	-
7.9 Records of Areas of Outstanding Natural Beauty (AONB)	0	0	0	0	-	-
7.10 Records of National Parks	0	0	0	0	-	-
7.11 Records of Nitrate Sensitive Areas	0	0	0	0	-	-
7.12 Records of Nitrate Vulnerable Zones	1	0	0	1	-	-

8. Natural Hazards

8.1 What is the maximum risk of natural ground subsidence?	Low

9. Mining

9.1 Are there any coal mining areas within 75m of the study site?	Yes
9.2 What is the risk of subsidence relating to shallow mining within 150m of the study site?	Low-Moderate
9.3 Are there any brine affected areas within 75m of the study site?	No

APPENDIX E

GRM Development Solutions
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The Coal Authority

Issued by:
The Coal Authority, Mining Reports Office, 200 Lichfield Lane, Berry Hill, Mansfield, Nottinghamshire NG18 4RG
ON-Line Service: www.groundstability.com - Phone: 0845 762 6848 - DX 716176 MANSFIELD 5

PAUL,
GROUND RISK MANAGEMENT LTD,
BRETBY BUISNESS PARK,
ASHBY ROAD,
BURTON-ON-TRENT,
STAFFORDSHIRE,
DE15 0YZ

Person dealing with this matter:	**Darren Moody**
Our reference:	**00014375-11**
Your reference:	P5440
Electronic Ref:	
RRUID:	007.00029926620001
Date of your enquiry:	**04 March 2011**
Date we received your enquiry:	**08 March 2011**
Date of issue:	**09 March 2011**

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

Non-Residential Coal and Brine Report

New Lodge Estate, Barnsley, 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	Yes
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 6 seams of coal at 140m to 380m depth, and last worked in 1958.

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

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 coal using underground methods.

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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

There are no known coal mine entries within, or within 20 metres of, the boundary of the property.

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

Coal-mining geology

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

Opencast Coal Mining

Past

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

Present

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

Future

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

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

Coal-mining subsidence

The Coal Authority has not received a damage notice or claim for the property since 1 January 1984. There is no current Stop Notice delaying the start of remedial works or repairs to the property.

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

Mine gas

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

Hazards related to coal mining

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

Withdrawal of Support

The property is in an area for which a notice of entitlement to withdraw support was published in 1982.

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.

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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.

Information from the Cheshire Brine Subsidence Compensation Board

The property lies outside the Cheshire Brine Compensation District.

Additional remarks

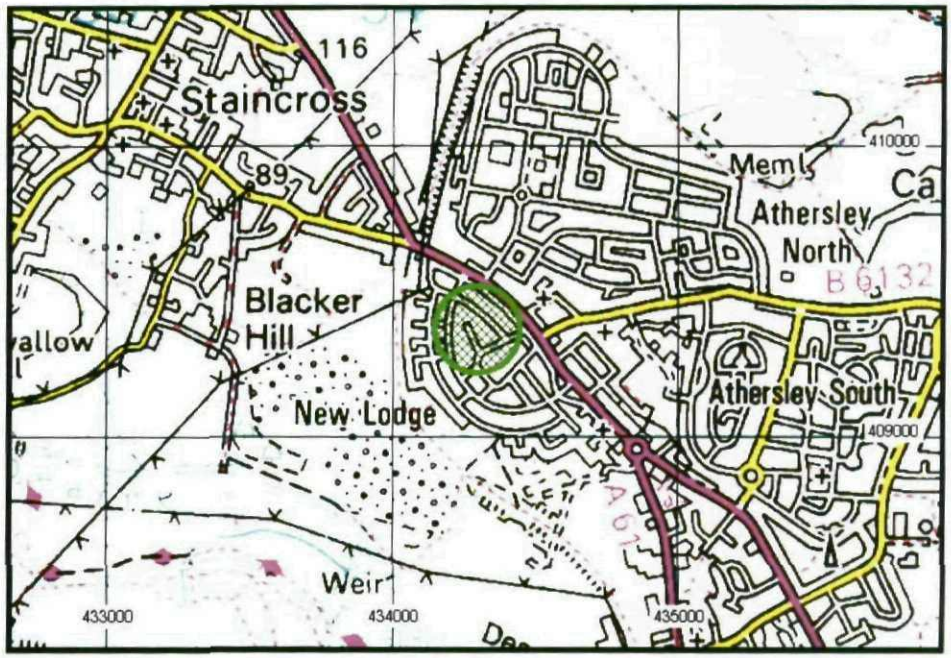
This report is prepared in accordance with the Law Society's Guidance Notes 2006, the User Guide 2006 and the Coal Authority and Cheshire Brine Board's Terms and Conditions 2006. The report is compliant with Home Information Pack requirements.

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Issued by:	The Coal Authority, 200 Lichfield Lane, Mansfield, Nottinghamshire, NG18 4RG
Date:	08 Mar 2011
Coal and Brine Report at:	New Lodge Estate, Barnsley, South Yorkshire
Reference number:	00014375-11
Cost:	£64.00
Plus VAT:	£12.80
Total received:	£76.80
VAT registration number:	598 5850 68

Location map

Approximate position of property

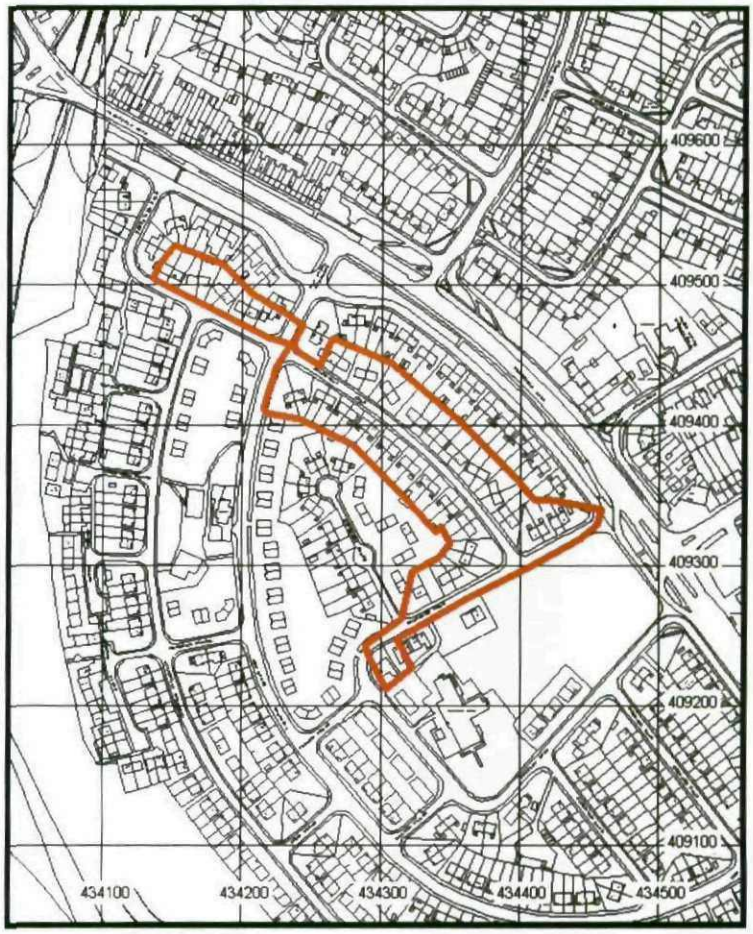


Enquiry boundary

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Key

Approximate position of enquiry boundary shown



Mapping sourced from Ordnance Survey

APPENDIX F

GRM Development Solutions
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DO NOT SCALE

NOTES:

- TP1 — Trial Pit Location
- WS1 — Window Sampling Borehole
- WS1* — Window Sampling Borehole (with gas and water monitoring standpipe)
- SA1 — Soakaway Test Pit Location

N.B. All positions approximate only

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Tel: 01283 551 249 Fax: 01283 211 968

CLIENT:
Keepmoat Homes

PROJECT:
New Lodge Estate, Barnsley

TITLE:
Exploratory Hole Location Plan

SCALE@SIZE:	ISSUE:
NTS	FINAL
DESIGN/DRAWN: CRS	DATE: 03/2011
PROJECT No: P5440	DRAWING No: Figure 21

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APPENDIX G

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Burton-on-Trent (HQ) Tel: 01283 551249
Market Harborough Tel: 01858 414981
Email: mail@grm-uk.com Web: www.grm-uk.com

Trial Pit Log

Trial Pit Number: **TP1**

Site: New Lodge Estate, Barnsley

Ground Level mAOD: 0.000

Client: Keepmoat Homes

GRM Project ref: P5440

Coordinates: 0.00E 0.00N

Scale: 1:25

GROUNDWATER		SAMPLES	INSITU TESTING		STRATA		STRATA RECORD	
Strike	Depth (m)	Depth/Type/Ref (m)	Depth (m)	Hand Vane Strength (kN/m²)	Depth (m)	Level (mAOD)	Legend	Description
		0.10-0.20/D/D1						Brown sandy silty clay with some fine to coarse angular to subangular gravel including brick and sandstone (Re-laid Topsoil).(MADE GROUND)
					0.30	-0.30		Firm orange-brown and grey-brown grading to red-brown and grey-brown silty slightly sandy CLAY with occasional to some (becoming much below 1.4m) fine to coarse angular to subangular gravel including sandstone and coal.(GLACIAL TILL)
		0.90-1.00/D/D2						
	1							
					1.50	-1.50		Medium dense grey-brown and orange-brown clayey fine to coarse angular GRAVEL including siltstone and sandstone.(WEATHERED COAL MEASURES)
		1.80-1.90/D/D3						
	2							
		2.25-2.35/D/D4			2.20	-2.20		Weak weathered grey-brown mottled orange-brown clayey fine to coarse grained SANDSTONE (recovered as a gravel of sandstone with ironstone).(COAL MEASURES)
					2.50	-2.50		*End of Trial Pit at 2.50 m*

Excavation Details

Date excavated: 09/03/2011
Date backfilled: 09/03/2011
Shoring: None available
Stability: Stable during excavation
Plant: JCB-3CX
Logged by: PW

Dimensions (m)



Final Depth (m): 2.50

Groundwater Observations

None observed

General Remarks:

Strata strengths/densities determined by observation only.

GRM
Burton-on-Trent (HQ) Tel: 01283 551249
Market Harborough Tel: 01858 414981
Email: mail@grm-uk.com Web: www.grm-uk.com

Trial Pit Log

Trial Pit Number **TP2**

Site: New Lodge Estate, Barnsley

Ground Level mAOD: 0.000

Client: Keepmoat Homes

GRM Project ref: P5440

Coordinates: 0.00E 0.00N

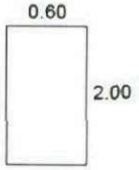
Scale: 1:25

GROUNDWATER	SAMPLES		INSITU TESTING		STRATA		STRATA RECORD	
Strike	Depth (m)	Depth/Type/Ref (m)	Depth (m)	Hand Vane Strength (kN/m²)	Depth (m)	Level (mAOD)	Legend	Description
		0.15-0.25/D/D1 0.15-0.25/J/J1			0.10	-0.10		Dark brown sandy silty clay with some fine to medium angular tio subrounded gravel including brick, sandstone and quartzite (Re-laid Topsoil).(MADE GROUND)
					0.40	-0.40		Brown clayey silty fine to coarse sand and fine to coarse angular gravel including brick and concrete.(MADE GROUND)
		0.90-1.00/D/D2						Firm orange-brown silty slightly sandy CLAY with some becoming much below 1.1m fine to coarse angular gravel including sandstone.(GLACIAL TILL)
	1							
					1.30	-1.30		Very weak highly weathered orange-brown mottled grey-brown slightly clayey fine to medium grained SANDSTONE (recovered as a sandstone gravel). Stratum becoming moderately strong below 1.6m.(COAL MEASURES)
		1.70-1.80/D/D3						
	2				2.00	-2.00		*End of Trial Pit at 2.00 m*

Excavation Details

Date excavated: 09/03/2011
Date backfilled: 09/03/2011
Shoring: None available
Stability: Stable during excavation
Plant: JCB-3CX
Logged by: PW

Dimensions (m)



Final Depth (m): 2.00

Groundwater Observations

Non observed

General Remarks:

Machine struggling to excavate below 1.6m.

Strata strengths/densities determined by observation only.

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Trial Pit Log

Trial Pit Number: **TP3**

Site: New Lodge Estate, Barnsley

Ground Level mAOD: 0.000

Client: Keepmoat Homes

GRM Project ref: P5440

Coordinates: 0.00E 0.00N

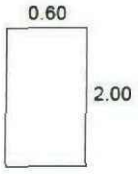
Scale: 1:25

GROUNDWATER	SAMPLES		INSITU TESTING		STRATA		STRATA RECORD	
Strike	Depth (m)	Depth/Type/Ref (m)	Depth (m)	Hand Vane Strength (kN/m²)	Depth (m)	Level (mAOD)	Legend	Description
		0.05-0.15/D/D1 0.05-0.15/J/J1						Brown silty slightly sandy clay (Re-laid Topsoil).(MADE GROUND)
					0.30	-0.30		Orange-brown silty slightly sandy CLAY. (GLACIAL TILL)
					0.50	-0.50		Very weak highly weathered orange-brown thinly bedded fine to medium grained SANDSTONE (recovered as a sandstone gravel). Stratum becoming moderately strong below 1.5m.(COAL MEASURES)
		0.90-1.00/D/D2						
	1							
					1.80	-1.80		*End of Trial Pit at 1.80 m*
	2							

Excavation Details

Date excavated: 09/03/2011
Date backfilled: 09/03/2011
Shoring: None available
Stability: Stable during excavation
Plant: JCB-3CX
Logged by: PW

Dimensions (m)



Final Depth (m): 1.80

Groundwater Observations

None observed

General Remarks:

Machine struggling to excavate below 1.5m. Pit terminated at 1.8m

Strata strengths/densities determined by observation only.

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Email: mail@grm-uk.com Web: www.grm-uk.com

Trial Pit Log

Trial Pit Number **TP4**

Site: New Lodge Estate, Barnsley

Ground Level mAOD: 0.000

Client: Keepmoat Homes

GRM Project ref: P5440

Coordinates: 0.00E 0.00N

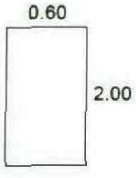
Scale: 1:25

GROUNDWATER	SAMPLES		INSITU TESTING		STRATA		STRATA RECORD	
Strike	Depth (m)	Depth/Type/Ref (m)	Depth (m)	Hand Vane Strength (kN/m²)	Depth (m)	Level (mAOD)	Legend	Description
		0.20-0.30/D/D1 0.20-0.30/J/J1			0.10	-0.10		Loose grey-brown and red-brown sandy fine to coarse angular gravel including brick and concrete (Demolition Rubble).(MADE GROUND)
					0.40	-0.40		Soft to firm red-brown and orange-brown silty slightly sandy CLAY. (GLACIAL TILL)
	1	1.00-1.10/D/D2						Firm orange-brown and red-brown silty slightly sandy CLAY with occasional fine to coarse angular gravel including sandstone.(GLACIAL TILL)
		1.80-1.90/D/D3			1.40	-1.40		Very weak highly weathered orange-brown very thinly bedded fine to coarse grained SANDSTONE (recovered as a sandstone gravel). Stratum becoming moderately strong below 1.7m.(COAL MEASURES)
	2				2.00	-2.00		*End of Trial Pit at 2.00 m*

Excavation Details

Date excavated: 09/03/2011
Date backfilled: 09/03/2011
Shoring: None available
Stability: *Stable during excavation*
Plant: JCB-3CX
Logged by: PW

Dimensions (m)



Final Depth (m): 2.00

Groundwater Observations

None observed

General Remarks:

Machine struggling to excavate below 1.7m. Pit terminated at 2.0m.

Strata strengths/densities determined by observation only.

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Market Harborough Tel: 01858 414981
Email: mail@grm-uk.com Web: www.grm-uk.com

Trial Pit Log

Trial Pit Number: **TP5**

Site: New Lodge Estate, Barnsley

Ground Level mAOD: 0.000

Client: Keepmoat Homes

GRM Project ref: P5440

Coordinates: 0.00E 0.00N

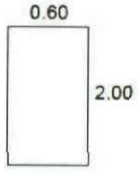
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GROUNDWATER		SAMPLES		INSITU TESTING		STRATA		STRATA RECORD	
Strike	Depth (m)	Depth/Type/Ref (m)	Depth (m)	Hand Vane Strength (kN/m²)	Depth (m)	Level (mAOD)	Legend	Description
		0.20-0.30/D/D1 0.20-0.30/J/J1			0.10	-0.10		Dark brown silty slightly sandy clay with occasional fine to medium angular gravel including brick and sandstone (Re-laid Topsoil).(MADE GROUND)
					0.50	-0.50		Firm orange-brown silty slightly sandy CLAY with occasional fine to medium subangular gravel including sandstone.(GLACIAL TILL)
					0.80	-0.80		Firm orange-brown silty slightly sandy CLAY with occasional to some fine to coarse angular gravel including sandstone, coal and mudstone.(GLACIAL TILL)
	1	1.00-1.10/D/D2						Firm to stiff red-brown silty slightly sandy CLAY with some fine to coarse angular gravel including sandstone.(GLACIAL TILL)
		1.90-2.00/D/D3			1.80	-1.80		Firm to stiff red-brown locally mottled grey-brown silty CLAY with occasional fine to coarse angular gravel including sandstone and coal. Occasional cobble of sandstone.(GLACIAL TILL)
	2							
		2.85-2.95/D/D4						
					3.00	-3.00		Strong orange-brown fine to coarse grained SANDSTONE.(COAL MEASURES)
					3.10	-3.10		*End of Trial Pit at 3.10 m*

Excavation Details

Date excavated: 09/03/2011
Date backfilled: 09/03/2011
Shoring: None available
Stability: Stable during excavation
Plant: JCB-3CX
Logged by: PW

Dimensions (m)



Final Depth (m): 3.10

Groundwater Observations

None observed

General Remarks:

Strata strengths/densities determined by observation only.

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Trial Pit Log

Trial Pit Number **TP6**

Site: New Lodge Estate, Barnsley

Ground Level mAOD: 0.000

Client: Keepmoat Homes

GRM Project ref: P5440

Coordinates: 0.00E 0.00N

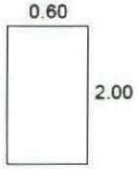
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GROUNDWATER	SAMPLES		INSITU TESTING		STRATA		STRATA RECORD	
Strike	Depth (m)	Depth/Type/Ref (m)	Depth (m)	Hand Vane Strength (kN/m²)	Depth (m)	Level (mAOD)	Legend	Description
		0.15-0.25/D/D1 0.15-0.25/J/J1			0.10	-0.10		Loose grey-brown brown and red-brown sandy fine to coarse angular gravel including brick and concrete (Demolition Rubble).(MADE GROUND)
					0.30	-0.30		Firm brown silty slightly sandy CLAY with occasional fine to medium angular gravel including sandstone. (GLACIAL TILL)
		0.90-1.00/D/D2						Firm orange-brown grading to red-brown silty slightly sandy CLAY with occasional to some fine to medium angular to subangular gravel including coal and sandstone. Increase in size and frequency of sandstone gravel below 1.3m.(GLACIAL TILL)
	1							
					1.40	-1.40		Moderately strong slightly weathered orange-brown thinly bedded SANDSTONE.(COAL MEASURES)
		1.60-1.70/D/D3			1.80	-1.80		*End of Trial Pit at 1.80 m*
	2							

Excavation Details

Date excavated: 09/03/2011
Date backfilled: 09/03/2011
Shoring: None available
Stability: Stable during excavation
Plant: JCB-3CX
Logged by: PW

Dimensions (m)



Final Depth (m): 1.80

Groundwater Observations

None observed

General Remarks:

Machine struggling below 1.6m. Pit terminated at 1.8m.

Strata strengths/densities determined by observation only.

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Trial Pit Log

Trial Pit Number: **TP7**

Site: New Lodge Estate, Barnsley

Ground Level mAOD: 0.000

Client: Keepmoat Homes

GRM Project ref: P5440

Coordinates: 0.00E 0.00N

Scale: 1:25

GROUNDWATER	SAMPLES		INSITU TESTING		STRATA		STRATA RECORD	
Strike	Depth (m)	Depth/Type/Ref (m)	Depth (m)	Hand Vane Strength (kN/m²)	Depth (m)	Level (mAOD)	Legend	Description
		0.20-0.30/D/D1 0.20-0.30/J/J1			0.10	-0.10		Loose grey-brown and red-brown sandy fine to coarse angular to subangular gravel including brick and concrete (Demolition Rubble).(MADE GROUND)
					0.40	-0.40		Firm and slightly friable orange-brown sandy silty CLAY. (GLACIAL TILL)
	1	1.00-1.10/D/D2						Firm orange-brown grading to red-brown silty slightly sandy CLAY with occasional fine to medium angular gravel including coal and sandstone. Occasional sandstone cobbles below 1.3m.(GLACIAL TILL)
		1.80-1.90/D/D3			1.40	-1.40		Medium dense orange-brown clayey fine to coarse angular to subangular GRAVEL including sandstone.(WEATHERED COAL MEASURES)
	2							
		2.45-2.55/D/D4			2.40	-2.40		Weak weathered orange-brown very thinly bedded fine to medium grained SANDSTONE (recovered as a sandstone gravel).(COAL MEASURES)
					2.60	-2.60		*End of Trial Pit at 2.60 m*

Excavation Details

Date excavated: 09/03/2011
Date backfilled: 09/03/2011
Shoring: None available
Stability: Stable during excavation
Plant: JCB-3CX
Logged by: PW

Dimensions (m)



Final Depth (m): 2.60

Groundwater Observations

None observed

General Remarks:

Machine struggling to excavate below 2.4m. Pit terminated at 2.6m.

Strata strengths/densities determined by observation only.

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Trial Pit Log

Trial Pit Number **TP8**

Site New Lodge Estate, Barnsley

Ground Level mAOD 0.000

Client Keepmoat Homes

GRM Project ref: P5440

Coordinates 0.00E 0.00N

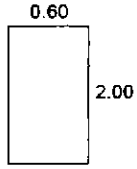
Scale: 1:25

GROUNDWATER		SAMPLES		INSITU TESTING		STRATA		STRATA RECORD	
Strike	Depth (m)	Depth/Type/Ref (m)		Depth (m)	Hand Vane Strength (kN/m²)	Depth (m)	Level (mAOD)	Legend	Description
		0.10-0.20/D/D1 0.10-0.20/J/J1				0.30	-0.30		Loose clayey silty fine to coarse sand and fine to coarse angular gravel including brick and concrete (Demolition Rubble).(MADE GROUND)
	1	1.00-1.10/D/D2							Firm to stiff red-brown mottled grey-brown silty slightly sandy CLAY with some fine to medium angular to subangular gravel including sandstone and coal.(GLACIAL TILL)
		1.90-2.00/D/D3				1.80	-1.80		Firm to stiff brown mottled grey-brown silty slightly sandy CLAY with some fine to medium subangular gravel including coal and sandstone.(GLACIAL TILL)
	2								
		2.45-2.55/D/D4				2.40	-2.40		Moderately strong slightly weathered thinly bedded orange-brown fine to coarse grained SANDSTONE.(COAL MEASURES)
						2.60	-2.60		*End of Trial Pit at 2.60 m*

Excavation Details

Date excavated: 09/03/2011
Date backfilled: 09/03/2011
Shoring: None available
Stability: Stable during excavation
Plant: JCB-3CX
Logged by: PW

Dimensions (m)



Final Depth (m): 2.60

Groundwater Observations

None observed

General Remarks:

Machine struggling to excavate bnelow 2.4m. Pit terminated at 2.6m.

Strata strengths/densities determined by observation only.

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Trial Pit Log

Trial Pit Number: **TP9**

Site: New Lodge Estate, Barnsley

Ground Level mAOD: 0.000

Client: Keepmoat Homes

GRM Project ref: P5440

Coordinates: 0.00E 0.00N

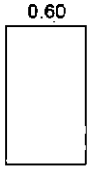
Scale: 1:25

GROUNDWATER		SAMPLES		INSITU TESTING		STRATA		STRATA RECORD	
Strike	Depth (m)	Depth/Type/Ref (m)		Depth (m)	Hand Vane Strength (kN/m²)	Depth (m)	Level (mAOD)	Legend	Description
		0.10-0 20/D/D1 0.10-0 20/J/J1							Brown sandy clay with much fine to coarse angular to rounded gravel including brick, concrete, quartzite and sandstone.(MADE GROUND)
						0.50	-0.50		Firm orange-brown grading to red-brown silty slightly sandy CLAY with occasional to some fine to medium angular gravel including coal and sandstone.(GLACIAL TILL)
		0.90-1.00/D/D2							
	1								
						1.40	-1.40		Medium dense red-brown and grey-brown clayey GRAVEL including mudstone.(WEATHERED COAL MEASURES)
		1.90-2.00/D/D3							
	2								
						2.60	-2.60		Stiff brown and blue-grey silty CLAY with some lithoreliicts of mudstone.(WEATHERED COAL MEASURES)
		2.90-3.00/D/D4							
		3.40-3.50/D/D5							
						3.60	-3.60		*End of Trial Pit at 3.60 m*

Excavation Details

Date excavated: 09/03/2011
Date backfilled: 09/03/2011
Shoring: None available
Stability: Stable during excavation
Plant: JCB-3CX
Logged by: PW

Dimensions (m)



Final Depth (m): 3.60

Groundwater Observations

Slight seepage at base of made ground

General Remarks:

Strata strengths/densities determined by observation only.

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Trial Pit Log

Trial Pit Number **TP10**

Site: New Lodge Estate, Barnsley

Ground Level mAOD: 0.000

Client: Keepmoat Homes

GRM Project ref: P5440

Coordinates: 0.00E 0.00N

Scale: 1:25

GROUNDWATER	SAMPLES		INSITU TESTING		STRATA		STRATA RECORD	
Strike	Depth (m)	Depth/Type/Ref (m)	Depth (m)	Hand Vane Strength (kN/m²)	Depth (m)	Level (mAOD)	Legend	Description
		0.10-0.20/D/D1 0.10-0.20/J/J1						Brown sandy silty CLAY with some to much fine to coarse angular to subrounded gravel including brick, concrete, paving slabs, coal, sandstone and quartz (Re-laid Topsoil).(MADE GROUND)
					0.40	-0.40		Orange-brown silty sandy CLAY. (GLACIAL TILL)
					0.50	-0.50		Firm orange-brown silty slightly sandy CLAY with occasional fine to medium angular gravel including coal and sandstone.(GLACIAL TILL)
	1	1.00-1.10/D/D2						
					1.20	-1.20		Firm to stiff and slightly friable red-brown silty slightly sandy CLAY with some fine to coarse angular gravel including coal and sandstone.(GLACIAL TILL)
					1.60	-1.60		Medium dense red-brown and grey-brown clayey sandy fine to coarse angular GRAVEL including sandstone and mudstone. Occasional cobble of sandstone.(WEATHERED COAL MEASURES)
		1.90-2.00/D/D3						
	2							
					2.20	-2.20		Hard brown and grey-brown silty CLAY with much coarse angular lithorelicts of mudstone and siltstone.(WEATHERED COAL MEASURES)
		3.20-3.30/D/D4						
					3.40	-3.40		Moderately strong slightly weathered orange-brown fine to coarse grained SANDSTONE.(COAL MEASURES)
					3.60	-3.60		*End of Trial Pit at 3.60 m*

Excavation Details

Date excavated: 09/03/2011
Date backfilled: 09/03/2011
Shoring: None available
Stability: Stable during excavation
Plant: JCB-3CX
Logged by: PW

Dimensions (m)



Final Depth (m): 3.60

Groundwater Observations

None observed

General Remarks:

Machine struggling to excavate below 3.4m. Pit terminated at 3.6m.

Strata strengths/densities determined by observation only.

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Window Sample Borehole

Borehole Number **WS1**

Site: New Lodge Estate, Barnsley

GRM Project ref: P5440

Ground Level mAOD 0.000

Client: Keepmoat Homes

Equipment:

Crew: DS UK Ltd Logger PW

Coordinates: - -

Scale: 1:25

GROUNDWATER		SAMPLES	INSITU TESTING			STRATA RECORD			
Installation	Depth (m)	Depth/Type/Ref (m)	Depth/Type (m)	N Value	Casing Depth (m)	Depth (m)	Level (mAOD)	Key	Description
		0.10-0.20/D/D1 0.10-0.20/J/J1							Grass over: Brown slightly sandy silty clay with occasional fine to medium angular gravel including coal, sandstone and metal fragments (Re-laid Topsoil).(MADE GROUND)
		0.40-0.50/D/D2				0.30	-0.30		Firm brown locally mottled orange-brown silty slightly sandy clay with occasional fine to medium angular to subangular gravel including coal, sandstone and rare brick fragments.(MADE GROUND)
		0.90-1.00/D/D3				0.55	-0.55		Stiff orange-brown and grey-brown silty slightly sandy CLAY with occasional fine to medium angular to subangular gravel including siltstone, sandstone, mudstone and coal.(GLACIAL TILL)
	1		1.00 C	N=14 (2,2,2,3,4,5)					
		1.80-1.90/D/D4				1.30	-1.30		Very stiff red-brown mottled grey-brown silty slightly sandy CLAY with occasional to some fine to medium angular to subangular gravel including sandstone, siltstone and coal.(GLACIAL TILL)
	2		2.00 C	N=29 (4,4,5,7,8,9)					
		2.80-2.90/D/D5				2.20	-2.20		Hard brown locally mottled red-brown and grey-brown silty slightly sandy CLAY with some fine to coarse angular gravel including sandstone and coal.(GLACIAL TILL)
	3		3.00 C	N=46 (7,7,8,10,13,15)		3.00	-3.00		*End of Borehole at 3.00 m*
	4								

Hole Started 08/03/2011 Hole Complete 08/03/2011

General Remarks: Refusal at 3.0m

Groundwater Remarks: None observed

Test Type: S = Standard Penetration Test, C = Cone Penetration Test. N values reported are uncorrected. N value 50/275 = 50 blows in 275mm.

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Window Sample Borehole

Borehole Number **WS2**

Site: New Lodge Estate, Barnsley

GRM Project ref: P5440

Ground Level mAOD 0.000

Client: Keepmoat Homes

Equipment:

Crew: DS UK Ltd Logger PW

Coordinates: - -

Scale: 1:25

GROUNDWATER		SAMPLES	INSITU TESTING			STRATA RECORD			
Installation	Depth (m)	Depth/Type/Ref (m)	Depth/Type (m)	N Value	Casing Depth (m)	Depth (m)	Level (mAOD)	Key	Description
		0.05-0.15/D/D1 0.05-0.15/J/J1				0.20	-0.20		Brown locally mottled orange-brown silty slightly sandy clay with some fine to medium angular to subangular gravel including sandstone, brick and ceramic tile fragments.(MADE GROUND)
		0.50-0.60/D/D2				0.70	-0.70		Firm brown silty slightly sandy clay with occasional to some fine to coarse angular to subangular gravel including sandstone, siltstone, mudstone and coal.(MADE GROUND)
	1	0.90-1.00/D/D3	1.00 C	N=21 (1,3,5,5,5,6)		1.30	-1.30		Stiff orange-brown and grey-brown silty slightly sandy CLAY with occasional fine to coarse angular to subangular gravel including sandstone and coal.(GLACIAL TILL)
		1.80-1.90/D/D4				1.40	-1.40		Orange-brown fine to medium SAND.(WEATHERED COAL MEASURES)
	2		2.00 C	50/235mm (10,9,8,10,20,12)		2.00	-2.00		Dense to very dense red-brown mottled orange-brown sandy and locally very sandy silty clayey fine to coarse angular to subangular GRAVEL including sandstone and coal fragments. Occasional cobbles of sandstone.(WEATHERED COAL MEASURES)
	3								*End of Borehole at 2.00 m*
	4								

Hole Started 08/03/2011 Hole Complete 08/03/2011

General Remarks: Refusal at 2.0m

Groundwater Remarks: None observed

Test Type: S = Standard Penetration Test, C = Cone Penetration Test. N values reported are uncorrected. N value 50/275 = 50 blows in 275mm

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Window Sample Borehole

Borehole Number **WS3**

Site: New Lodge Estate, Barnsley

GRM Project ref: P5440

Ground Level mAOD 0.000

Client: Keepmoat Homes

Equipment:

Crew: DS UK Ltd Logger PW

Coordinates: - -

Scale: 1:25

GROUNDWATER		SAMPLES	INSITU TESTING			STRATA RECORD			
Installation	Depth (m)	Depth/Type/Ref (m)	Depth/Type (m)	N Value	Casing Depth (m)	Depth (m)	Level (mAOD)	Key	Description
		0.10-0.20/D/D1 0.10-0.20/J/J1							Brown dark-brown mottled red-brown and orange-brown sandy silty clay with occasional fine to medium angular to subangular gravel including sandstone, coal, plastic sheeting and rare brick fragments (admixture of topsoil and made ground).(MADE GROUND)
		0.55-0.65/D/D2				0.50	-0.50		Soft to firm red-brown silty slightly sandy CLAY with occasional fine to medium subrounded to subangular gravel including sandstone. (GLACIAL TILL)
						0.70	-0.70		Orange-brown subangular cobble of sandstone.(GLACIAL TILL)
	1		1.00 C	N=12 (1,1,2,3,3,4)		0.90	-0.90		Stiff orange-brown and grey-brown silty slightly sandy CLAY with occasional fine to medium subangular gravel including sandstone and coal.(GLACIAL TILL)
		1.70-1.80/D/D3				1.60	-1.60		Very weak highly weathered sandy clayey SILTSTONE (recovered as a clayey sandy gravel).(COAL MEASURES)
	2		1.90 C	50/265mm (9,9,11,10,14,15)		1.90	-1.90		*End of Borehole at 1.90 m*
	3								
	4								

Hole Started 08/03/2011 Hole Complete 08/03/2011

General Remarks:

Groundwater Remarks: None observed

Test Type: S = Standard Penetration Test, C = Cone Penetration Test. N values reported are uncorrected. N value 50/275 = 50 blows in 275mm.

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Window Sample Borehole

Borehole Number **WS4**

Site: New Lodge Estate, Barnsley

GRM Project ref: P5440

Ground Level mAOD 0.000

Client: Keepmoat Homes

Equipment:

Crew: DS UK Ltd Logger PW

Coordinates: - -

Scale: 1:25

GROUNDWATER Installation	Depth (m)	SAMPLES Depth/Type/Ref (m)	INSITU TESTING Depth/Type (m)	N Value	Casing Depth (m)	STRATA RECORD Depth (m)	Level (mAOD)	Key	Description
		0.10-0.20/D/D1 0.10-0.20/J/J1							Grass over: Dark brown sandy silty clay with occasional to some fine to medium angular gravel including coal, sandstone and brick fragments (Re-laid Topsoil). (MADE GROUND)
						0.50	-0.50		Firm orange-brown sandy CLAY. (GLACIAL TILL)
						0.65	-0.65		Medium dense orange-brown clayey sandy fine to coarse angular to subangular GRAVEL including sandstone.(WEATHERED COAL MEASURES)
	1	0.90-1.00/D/D2	1.00 C	N=22 (3,4,5,5,5,7)					
						1.50	-1.50		Very weak highly weathered orange-brown locally mottled grey-brown fine to medium grained SANDSTONE.(COAL MEASURES)
		1.80-1.90/D/D3							
	2		2.00 C	50/145mm (11,14,17,33,0,0)		2.00	-2.00		*End of Borehole at 2.00 m*
	3								
	4								

Hole Started 08/03/2011 Hole Complete 08/03/2011

General Remarks:

Groundwater Remarks: None observed

Test Type: S = Standard Penetration Test, C = Cone Penetration Test. N values reported are uncorrected. N value 50/275 = 50 blows in 275mm.

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Window Sample Borehole

Borehole Number **WS5**

Site: New Lodge Estate, Barnsley

GRM Project ref: P5440

Ground Level mAOD 0.000

Client: Keepmoat Homes

Equipment:

Crew: DS UK Ltd Logger PW

Coordinates: - -

Scale: 1:25

GROUNDWATER		SAMPLES	INSITU TESTING			STRATA RECORD			
Installation	Depth (m)	Depth/Type/Ref (m)	Depth/Type (m)	N Value	Casing Depth (m)	Depth (m)	Level (mAOD)	Key	Description
		0.10-0.20/D/D1 0.10-0.20/D/J1				0.30	-0.30		Brown locally orange-brown silty slightly sandy clay with occasional fine to medium angular to subrounded gravel including sandstone, brick and concrete.(MADE GROUND)
		0.80-0.90/D/D2							*Stiff becoming friable below 0.6m orange-brown grading* to red-brown below 0.6m silty slightly sandy CLAY with occasional fine to medium angular to subangular gravel including sandstone, siltstone and coal.(GLACIAL TILL)
	1		1.00 C	N=17 (2,3,3,4,5,5)					
		1.85-1.95/D/D3				1.80	-1.80		Moderately strong slightly weathered grey-brown and orange-brown fine to medium grained SANDSTONE.(COAL MEASURES)
	2		2.00 C	50/90mm - Abandoned		2.00	-2.00		*End of Borehole at 2.00 m*
	3								
	4								

Hole Started 08/03/2011 Hole Complete 08/03/2011

General Remarks: Refusal at 2.0m

Groundwater Remarks: None observed

Test Type: S = Standard Penetration Test, C = Cone Penetration Test. N values reported are uncorrected. N value 50/275 = 50 blows in 275mm.

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Window Sample Borehole

Borehole Number: WS6

Site: New Lodge Estate, Barnsley

GRM Project ref: P5440

Ground Level mAOD: 0.000

Client: Keepmoat Homes

Equipment:

Crew: DS UK Ltd Logger PW

Coordinates: - -

Scale: 1:25

GROUNDWATER		SAMPLES	INSITU TESTING			STRATA RECORD			
Installation	Depth (m)	Depth/Type/Ref (m)	Depth/Type (m)	N Value	Casing Depth (m)	Depth (m)	Level (mAOD)	Key	Description
		0.10-0.20/D/D1 0.10-0.20/J/J1				0.40	-0.40		Grass over: Dark brown sandy silty clay with some fine to coarse angular to subrounded gravel including sandstone, coal, ceramic tile and brick (Re-laid Topsoil).(MADE GROUND)
		0.50-0.60/D/D2				0.70	-0.70		Firm orange-brown silty slightly sandy CLAY. (GLACIAL TILL)
		0.80-0.90/D/D3				0.80	-0.80		Medium dense to dense orange-brown and grey-brown sandy fine to coarse angular GRAVEL including sandstone.(WEATHERED COAL MEASURES)
	1		1.00 C	49/265mm - Abandoned		1.00	-1.00		Moderately strong slightly weathered orange-brown fine to coarse grained SANDSTONE.(COAL MEASURES)
									End of Borehole at 1.00 m
	2								
	3								
	4								

Hole Started 08/03/2011 Hole Complete 08/03/2011

General Remarks: Refusal at 1.0m

Groundwater Remarks: None observed

Test Type: S = Standard Penetration Test, C = Cone Penetration Test. N values reported are uncorrected. N value 50/275 = 50 blows in 275mm.

GRM Development Solutions geoenvironmental civil structural
Burton-on-Trent (HQ) Tel: 01283 551249
Market Harborough Tel: 01858 414981
Email: mail@grm-uk.com Web: www.grm-uk.com

Window Sample Borehole

Borehole Number **WS7**

Site: New Lodge Estate, Barnsley

GRM Project ref: P5440

Ground Level mAOD 0.000

Client: Keepmoat Homes

Equipment:

Crew: DS UK Ltd Logger PW

Coordinates: - -

Scale: 1:25

GROUNDWATER		SAMPLES	INSITU TESTING			STRATA RECORD			
Installation	Depth (m)	Depth/Type/Ref (m)	Depth/Type (m)	N Value	Casing Depth (m)	Depth (m)	Level (mAOD)	Key	Description
		0.10-0.20/D/D1 0.10-0.20/J/J1				0.40	-0.40		Dark brown sandy silty clay with some fine to coarse angular to rounded gravel including sandstone, coal and quartzite (Re-laid Topsoil).(MADE GROUND)
	1	0.90-1.00/D/D2	1.00 C	N=12 (1,2,2,3,3,4)		1.40	-1.40		Stiff red-brown and grey-brown silty slightly sandy CLAY with some fine to medium angular gravel including coal.(GLACIAL TILL)
	2	1.90-2.00/D/D3	2.00 C	N=20 (3,4,4,4,6,6)					Stiff becoming very stiff red-brown and gery-brown silty slightly sandy CLAY with occasional and locally some fine to medium subangular gravel including coal, sandstone and siltstone.(GLACIAL TILL)
	3	2.90-3.00/D/D4	3.00 C	N=50 (6,7,10,13,13,14)		3.00	-3.00		*End of Borehole at 3.00 m*
	4								

Hole Started 08/03/2011 Hole Complete 08/03/2011

General Remarks:

Groundwater Remarks: None observed

Test Type: S = Standard Penetration Test, C = Cone Penetration Test. N values reported are uncorrected. N value 50/275 = 50 blows in 275mm.

GRM Development Solutions
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Window Sample Borehole

Borehole Number **WS8**

Site: New Lodge Estate, Barnsley

GRM Project ref: P5440

Ground Level mAOD 0.000

Client: Keepmoat Homes

Equipment:

Crew: DS UK Ltd Logger PW

Coordinates: - -

Scale: 1:25

GROUNDWATER		SAMPLES		INSITU TESTING			STRATA RECORD			
Installation	Depth (m)	Depth/Type/Ref (m)		Depth/Type (m)	N Value	Casing Depth (m)	Depth (m)	Level (mAOD)	Key	Description
		0.10-0.20/D/D1 0.10-0.20/J/J1								Loose dark brown mottled red-brown slightly clayey fine to coarse sand and fine to medium angular gravel including brick, sandstone, concrete and quartzite (Demolition rubble).(MADE GROUND)
		0.35-0.45/D/D2					0.30	-0.30		Dark brown sandy to very sandy silty clay with some fine to medium angular gravel including plastic sheeting and sandstone (Buried Topsoil). (MADE GROUND)
							0.50	-0.50		Firm orange-brown sandy silty CLAY.(GLACIAL TILL)
	1	0.90-1.00/D/D3		1.00 C	N=8 (1,1,2,2,2,2)					
							1.20	-1.20		Firm orange-brown locally mottled red-brown silty slightly sandy CLAY with some fine to medium angular to subangular gravel including sandstone.(GLACIAL TILL)
		1.65-1.75/D/D4					1.60	-1.60		Weak moderately weathered orange-brown slightly clayey fine to coarse grained SANDSTONE (recovered as a gravel of sandstone).(COAL MEASURES)
	2			2.00 C	50/85mm (9,13,33,17,0,0)		2.00	-2.00		*End of Borehole at 2.00 m*
	3									
	4									

Hole Started 08/03/2011 Hole Complete 08/03/2011

General Remarks: Refusal at 2.0m

Groundwater Remarks: None observed

Test Type: S = Standard Penetration Test, C = Cone Penetration Test. N values reported are uncorrected. N value 50/275 = 50 blows in 275mm

GRM Development Solutions geoenvironmental civil · structural
Burton-on-Trent (HQ) Tel: 01283 551249
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Window Sample Borehole

Borehole Number **WS9**

Site: New Lodge Estate, Barnsley

GRM Project ref: P5440

Ground Level mAOD 0.000

Client: Keepmoat Homes

Equipment:

Crew: DS UK Ltd Logger PW

Coordinates: - -

Scale: 1:25

GROUNDWATER		SAMPLES	INSITU TESTING			STRATA RECORD			
Installation	Depth (m)	Depth/Type/Ref (m)	Depth/Type (m)	N Value	Casing Depth (m)	Depth (m)	Level (mAOD)	Key	Description
		0.10-0.20/D/D1 0.10-0.20/J/J1				0.30	-0.30		Dark brown slightly clayey fine to coarse sand with some fine to coarse angular gravel including sandstone, brick and ceramic pipe fragments (Re-laid Topsoil).(MADE GROUND)
									Dense orange-brown fine to coarse SAND and fine to coarse angular GRAVEL including sandstone.(WEATHERED COAL MEASURES)
		0.90-1.00/D/D2				0.70	-0.70		Moderately strong slightly weathered brown fine to coarse grained SANDSTONE.(COAL MEASURES)
	1		1.00 C	50/235mm (5,8,10,14,20,6)		1.00	-1.00		*End of Borehole at 1.00 m*
	2								
	3								
	4								

Hole Started 08/03/2011 Hole Complete 08/03/2011

General Remarks: Refusal at 1.0m

Groundwater Remarks: None observed

Test Type. S = Standard Penetration Test, C = Cone Penetration Test. N values reported are uncorrected. N value 50/275 = 50 blows in 275mm

APPENDIX H

GRM Development Solutions
geoenvironmental - civil - structural

MONITORING OF SOIL GASES & GROUNDWATER

GRM Development Solutions Limited
Laurus House
First Avenue
Burton-upon-Trent
Staffordshire
DE15 0YZ

Telephone: (01283) 551 249
Facsimile: (01283) 211 968
Email: mail@grm-uk.com

PROJECT NO. P5440

SITE. New Lodge Estate, Barnsley

CLIENT. Keepmoat Homes

DATE. 17-Mar-11

CONDITIONS. *WEATHER:* Bright/DRY
ATMOSPHERIC PRESSURE: 1001

OPERATOR. Tony Heron

EQUIPMENT. LMXSi Gas Data Recorder

RESULTS

Borehole/ Well Ref. No.	Methane (CH_4) %v/v	Carbon Dioxide (CO_2) %v/v	Oxygen (O_2) %v/v	Flow (l/hr)	L.E.L	Depth to Groundwater (mbegl)	Total Depth (mbegl)
WS1	0.0	1.5	19.2	0.0	0.0	3.5	3.5
WS4	0.0	1.4	19.2	0.0	0.0	Dry	2.3
WS7	0.0	1.3	19.4	0.0	0.0	3.0	3.1
WS8	0.0	0.20	20.60	0.00	0.00	Dry	2.0
WS9	0.0	0.40	20.20	0.00	0.00	Dry	1.0

Notes

L.E.L.	Lower Explosive Limit (100% L.E.L.'= 5% Flammable Gas)
N.D.	Not Detected
N.R.	Not Recorded
%	By Volume

BH1 & BH3 have dual installations

MONITORING OF SOIL GASES & GROUNDWATER

PROJECT NO. P5388

SITE. New Lodge Estate, Barnsley

CLIENT. Keepmoat Homes

DATE. 28-Mar-11

CONDITIONS. *WEATHER:* Dry

ATMOSPHERIC PRESSURE: 1000

OPERATOR. Steve Morris

EQUIPMENT. LMXSi Gas Data Recorder

GRM Development Solutions Limited
Laurus House
First Avenue
Burton-upon-Trent
Staffordshire
DE15 0YZ

Telephone: (01283) 551 249
Facsimile: (01283) 211 968
Email: mail@grm-uk.com

RESULTS

Borehole/ Well Ref. No.	Methane (CH_4) %v/v	Carbon Dioxide (CO_2) %v/v	Oxygen (O_2) %v/v	Flow (l/hr)	L.E.L	Depth to Groundwater (mbegl)	Total Depth (mbegl)
WS1	0.0	2.1	16.3	0.0	0.0	2.6	3.3
WS4	0.0	2.0	18.1	0.0	0.0	Dry	2.3
WS7	0.0	1.5	18.4	0.0	0.0	1.9	3.1
WS8	0.0	0.70	16.70	0.00	0.00	Dry	2.0
WS9	Could not find						

L.E.L.	Lower Explosive Limit (100% L.E.L.'= 5% Flammable Gas)
N.D.	Not Detected
N.R.	Not Recorded
%	By Volume

BH1 & BH3 have dual installations

APPENDIX I

GRM Development Solutions
geoenvironmental - civil - structural

Nicholls Colton & Partners Limited
7-11 Harding Street, Leicester, LE1 4DH
Tel: 0116 253 6333. Fax: 0116 251 4709
e-mail: testing@nicholls-colton.co.uk
website: www.nicholls-colton.co.uk

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mCERTS

Nicholls Colton ANALYTICAL

TEST REPORT

GRM DEVELOPMENT SOLUTIONS SOIL SUITE

P5440 – NEW LODGE

REPORT NO. E11/GRM/371/001		
ORDER REFERENCE: GRM/P5440		DATE OF ISSUE: 30/03/2011
DATE & TIME OF SAMPLING: NOT PROVIDED	DATE OF RECEIPT: 11/03/2011	DATE OF TESTING: 14/03 TO 28/03/2011

NCA SAMPLE REFERENCE:		11-4171
SAMPLE MATRIX:		Clay
MOISTURE CONTENT:	(%)	18
STONE CONTENT:	(%)	0.2

CLIENT SAMPLE REFERENCE:		TP2
SAMPLE LOCATION:		TP2
SAMPLE DEPTH:		0.15-0.25m
VISUAL DESCRIPTION:		Dark brown slightly sandy slightly gravelly clay

Acenaphthene	(mg/kg)	< 0.1
Acenaphthylene	(mg/kg)	< 0.1
Anthracene	(mg/kg)	0.2
Benzo (a) anthracene	(mg/kg)	0.6
Benzo (a) pyrene	(mg/kg)	0.5
Benzo (b) fluoranthene	(mg/kg)	0.7
Benzo (g, h, i) perylene	(mg/kg)	0.3
Benzo (k) fluoranthene	(mg/kg)	0.3
Chrysene	(mg/kg)	0.7
Dibenzo (a,h) anthracene	(mg/kg)	0.1
Fluoranthene	(mg/kg)	1.2
Fluorene	(mg/kg)	< 0.1
Indeno (1, 2, 3,-cd) pyrene	(mg/kg)	0.4
Naphthalene	(mg/kg)	< 0.1
Phenanthrene	(mg/kg)	0.6
Pyrene	(mg/kg)	1.0

TOTAL PAH CONTENT	(mg/kg)	7.0

Arsenic	(mg/kg)	14
Cadmium	(mg/kg)	< 1
Chromium (Hexavalent)	(mg/kg)	< 1.2
Chromium (Total)	(mg/kg)	19
Copper	(mg/kg)	25
Lead	(mg/kg)	57
Mercury	(mg/kg)	< 1
Nickel	(mg/kg)	13
Selenium	(mg/kg)	< 3
Zinc	(mg/kg)	68

PHENOLS CONTENT	(mg/kg)	< 1.2

PH VALUE		7.0

SOM	(%)	4.6

Cyanide (Total)	(mg/kg)	< 1.2
Sulphate (As SO_4)	(mg/l)	15.5

NOTES:
1. Analysis was carried out in accordance with NCA method statements: MS - CL - PAH, MS - CL - Phenols (Skalar), MS - CL - Anions, MS - CL - Chromium, MS - CL - Cyanide, MS - CL - TOC (SOM) and BS 1377: Parts 1 and 3 : 1990.
2. Testing was carried out on an air dried sample for all tests with the exception of phenols, cyanide and hexavalent chromium that were determined on an as received sample.
3. Concentrations are reported as a percentage mass of the dry soil passing the 10mm BS test sieve, where appropriate these results have been corrected for moisture content but not stone content.
4. Moisture Content was determined in accordance with NCA method statement MS - CL - Sample Prep, oven dried at <30˚C.
5. Stone Content was determined in accordance with NCA method statement MS - CL - Sample Prep and refers to the percentage of stones retained on the 10mm test sieve.
6. Sample was supplied by customer.
7. MCERTS accreditation does not cover cyanide, chromium (hexavalent), anthracene, acenaphthylene, total PAH (USEPA list 16), SOM, sulphate and pH value. All testing is UKAS accredited with the exception of SOM, sulphate, cyanide and hexavalent chromium.
8. Metals analysis was subcontracted to SAL, this testing is not covered by over accreditation.

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Nicholls Colton
ANALYTICAL

TEST REPORT

GRM DEVELOPMENT SOLUTIONS SOIL SUITE

P5440 – NEW LODGE

REPORT NO. E11/GRM/371/002		
ORDER REFERENCE: GRM/P5440		DATE OF ISSUE: 30/03/2011
DATE & TIME OF SAMPLING: NOT PROVIDED	DATE OF RECEIPT: 11/03/2011	DATE OF TESTING: 14/03 TO 28/03/2011

NCA SAMPLE REFERENCE:		11-4172
SAMPLE MATRIX:		Loam
MOISTURE CONTENT:	(%)	22
STONE CONTENT:	(%)	6.0

CLIENT SAMPLE REFERENCE:	TP3
SAMPLE LOCATION:	TP3
SAMPLE DEPTH:	0.05-0.15m
VISUAL DESCRIPTION:	Dark brown slightly sandy slightly gravelly clay with root fragments

Acenaphthene	(mg/kg)	< 0.1
Acenaphthylene	(mg/kg)	< 0.1
Anthracene	(mg/kg)	0.1
Benzo (a) anthracene	(mg/kg)	0.3
Benzo (a) pyrene	(mg/kg)	0.3
Benzo (b) fluoranthene	(mg/kg)	0.4
Benzo (g, h, i) perylene	(mg/kg)	0.2
Benzo (k) fluoranthene	(mg/kg)	0.2
Chrysene	(mg/kg)	0.5
Dibenzo (a,h) anthracene	(mg/kg)	< 0.1
Fluoranthene	(mg/kg)	0.7
Fluorene	(mg/kg)	< 0.1
Indeno (1, 2, 3,-cd) pyrene	(mg/kg)	0.2
Naphthalene	(mg/kg)	0.3
Phenanthrene	(mg/kg)	0.5
Pyrene	(mg/kg)	0.6

TOTAL PAH CONTENT	(mg/kg)	4.7

Arsenic	(mg/kg)	13
Cadmium	(mg/kg)	< 1
Chromium (Hexavalent)	(mg/kg)	< 1.2
Chromium (Total)	(mg/kg)	20
Copper	(mg/kg)	28
Lead	(mg/kg)	52
Mercury	(mg/kg)	< 1.0
Nickel	(mg/kg)	15
Selenium	(mg/kg)	< 3
Zinc	(mg/kg)	90

PHENOLS CONTENT	(mg/kg)	< 1.2

pH VALUE		5.4

SOM	(%)	6.1

Cyanide (Total)	(mg/kg)	< 1.2
Sulphate (As SO_4)	(mg/l)	17.2

NOTES:
1. Analysis was carried out in accordance with NCA method statements: MS - CL - PAH, MS - CL - Phenols (Skalar), MS - CL - Anions, MS - CL - Chromium, MS - CL - Cyanide, MS - CL - TOC (SOM) and BS 1377: Parts 1 and 3 : 1990.
2. Testing was carried out on an air dried sample for all tests with the exception of phenols, cyanide and hexavalent chromium that were determined on an as received sample.
3. Concentrations are reported as a percentage mass of the dry soil passing the 10mm BS test sieve, where appropriate these results have been corrected for moisture content but not stone content.
4. Moisture Content was determined in accordance with NCA method statement MS - CL - Sample Prep, oven dried at <30°C.
5. Stone Content was determined in accordance with NCA method statement MS - CL - Sample Prep and refers to the percentage of stones retained on the 10mm test sieve.
6. Sample was supplied by customer.
7. MCERTS accreditation does not cover cyanide, chromium (hexavalent), anthracene, acenaphthylene, total PAH (USEPA list 16), SOM, sulphate and pH value. All testing is UKAS accredited with the exception of SOM, sulphate, cyanide and hexavalent chromium.
8. Metals analysis was subcontracted to SAL, this testing is not covered by over accreditation.

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Nicholls Colton ANALYTICAL

TEST REPORT

GRM DEVELOPMENT SOLUTIONS SOIL SUITE

P5440 – NEW LODGE

REPORT NO. E11/GRM/371/003		
ORDER REFERENCE: GRM/P5440		DATE OF ISSUE: 28/03/2011
DATE & TIME OF SAMPLING: NOT PROVIDED	DATE OF RECEIPT: 11/03/2011	DATE OF TESTING: 14/03 TO 28/03/2011

NCA SAMPLE REFERENCE:		11-4173
SAMPLE MATRIX:		Clay
MOISTURE CONTENT:	(%)	17
STONE CONTENT:	(%)	1.4

CLIENT SAMPLE REFERENCE:	TP4
SAMPLE LOCATION:	TP4
SAMPLE DEPTH:	0.2-0.3m
VISUAL DESCRIPTION:	Dark brown slightly sandy gravelly clay

Acenaphthene	(mg/kg)	< 0.1
Acenaphthylene	(mg/kg)	< 0.1
Anthracene	(mg/kg)	< 0.1
Benzo (a) anthracene	(mg/kg)	< 0.1
Benzo (a) pyrene	(mg/kg)	< 0.1
Benzo (b) fluoranthene	(mg/kg)	< 0.1
Benzo (g, h, i) perylene	(mg/kg)	< 0.1
Benzo (k) fluoranthene	(mg/kg)	< 0.1
Chrysene	(mg/kg)	< 0.1
Dibenzo (a,h) anthracene	(mg/kg)	< 0.1
Fluoranthene	(mg/kg)	< 0.1
Fluorene	(mg/kg)	< 0.1
Indeno (1, 2, 3,-cd) pyrene	(mg/kg)	< 0.1
Naphthalene	(mg/kg)	< 0.1
Phenanthrene	(mg/kg)	< 0.1
Pyrene	(mg/kg)	< 0.1

TOTAL PAH CONTENT	(mg/kg)	< 1.6

Arsenic	(mg/kg)	6
Cadmium	(mg/kg)	< 1
Chromium (Hexavalent)	(mg/kg)	< 1.2
Chromium (Total)	(mg/kg)	13
Copper	(mg/kg)	14
Lead	(mg/kg)	26
Mercury	(mg/kg)	< 1
Nickel	(mg/kg)	11
Selenium	(mg/kg)	< 3
Zinc	(mg/kg)	46

PHENOLS CONTENT	(mg/kg)	< 1.2

PH VALUE		6.3

SOM	(%)	2.8

Cyanide (Total)	(mg/kg)	< 1.2
Sulphate (As SO_4)	(mg/l)	90.8

NOTES:
1. Analysis was carried out in accordance with NCA method statements: MS - CL - PAH, MS - CL - Phenols (Skalar), MS - CL - Anions, MS - CL - Chromium, MS - CL - Cyanide, MS - CL - TOC (SOM) and BS 1377: Parts 1 and 3 : 1990.
2. Testing was carried out on an air dried sample for all tests with the exception of phenols, cyanide and hexavalent chromium that were determined on an as received sample.
3. Concentrations are reported as a percentage mass of the dry soil passing the 10mm BS test sieve, where appropriate these results have been corrected for moisture content but not stone content.
4. Moisture Content was determined in accordance with NCA method statement MS - CL - Sample Prep, oven dried at <30°C.
5. Stone Content was determined in accordance with NCA method statement MS - CL - Sample Prep and refers to the percentage of stones retained on the 10mm test sieve.
6. Sample was supplied by customer.
7. MCERTS accreditation does not cover cyanide, chromium (hexavalent), anthracene, acenaphthylene, total PAH (USEPA list 16), SOM, sulphate and pH value. All testing is UKAS accredited with the exception of SOM, sulphate, cyanide and hexavalent chromium.
8. Metals analysis was subcontracted to SAL, this testing is not covered by over accreditation.

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Nicholls Colton ANALYTICAL

TEST REPORT

GRM DEVELOPMENT SOLUTIONS SOIL SUITE

P5440 – NEW LODGE

REPORT NO. E11/GRM/371/004		
ORDER REFERENCE: GRM/P5440		DATE OF ISSUE: 30/03/2011
DATE & TIME OF SAMPLING: NOT PROVIDED	DATE OF RECEIPT: 11/03/2011	DATE OF TESTING: 14/03 TO 28/03/2011

NCA SAMPLE REFERENCE:		11-4174
SAMPLE MATRIX:		Clay
MOISTURE CONTENT:	(%)	21
STONE CONTENT:	(%)	0

CLIENT SAMPLE REFERENCE:		TP6
SAMPLE LOCATION:		TP6
SAMPLE DEPTH:		0.15-0.25m
VISUAL DESCRIPTION:		Dark brown slightly sandy gravelly clay

Acenaphthene	(mg/kg)	< 0.1
Acenaphthylene	(mg/kg)	< 0.1
Anthracene	(mg/kg)	< 0.1
Benzo (a) anthracene	(mg/kg)	0.2
Benzo (a) pyrene	(mg/kg)	0.2
Benzo (b) fluoranthene	(mg/kg)	0.3
Benzo (g, h, i) perylene	(mg/kg)	0.1
Benzo (k) fluoranthene	(mg/kg)	0.1
Chrysene	(mg/kg)	0.3
Dibenzo (a,h) anthracene	(mg/kg)	< 0.1
Fluoranthene	(mg/kg)	0.4
Fluorene	(mg/kg)	< 0.1
Indeno (1, 2, 3,-cd) pyrene	(mg/kg)	0.1
Naphthalene	(mg/kg)	< 0.1
Phenanthrene	(mg/kg)	< 0.1
Pyrene	(mg/kg)	0.3

TOTAL PAH CONTENT	(mg/kg)	2.8

Arsenic	(mg/kg)	6
Cadmium	(mg/kg)	< 1
Chromium (Hexavalent)	(mg/kg)	< 1.2
Chromium (Total)	(mg/kg)	18
Copper	(mg/kg)	14
Lead	(mg/kg)	25
Mercury	(mg/kg)	< 1
Nickel	(mg/kg)	12
Selenium	(mg/kg)	< 3
Zinc	(mg/kg)	46

PHENOLS CONTENT	(mg/kg)	< 1.2

PH VALUE		6.8

SOM	(%)	3.1

Cyanide (Total)	(mg/kg)	< 1.2
Sulphate (As SO_4)	(mg/l)	19.9

NOTES:
1. Analysis was carried out in accordance with NCA method statements: MS - CL - PAH, MS - CL - Phenols (Skalar), MS - CL - Anions, MS - CL - Chromium, MS - CL - Cyanide, MS - CL - TOC (SOM) and BS 1377: Parts 1 and 3 : 1990.
2. Testing was carried out on an air dried sample for all tests with the exception of phenols, cyanide and hexavalent chromium that were determined on an as received sample.
3. Concentrations are reported as a percentage mass of the dry soil passing the 10mm BS test sieve, where appropriate these results have been corrected for moisture content but not stone content.
4. Moisture Content was determined in accordance with NCA method statement MS - CL - Sample Prep, oven dried at <30°C.
5. Stone Content was determined in accordance with NCA method statement MS - CL - Sample Prep and refers to the percentage of stones retained on the 10mm test sieve.
6. Sample was supplied by customer.
7. MCERTS accreditation does not cover cyanide, chromium (hexavalent), anthracene, acenaphthylene, total PAH (USEPA list 16), SOM, sulphate and pH value. All testing is UKAS accredited with the exception of SOM, sulphate, cyanide and hexavalent chromium.
8. Metals analysis was subcontracted to SAL, this testing is not covered by over accreditation.

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Nicholls Colton ANALYTICAL

TEST REPORT

GRM DEVELOPMENT SOLUTIONS SOIL SUITE

P5440 – NEW LODGE

REPORT NO. E11/GRM/371/005		
ORDER REFERENCE: GRM/P5440		DATE OF ISSUE: 30/03/2011
DATE & TIME OF SAMPLING: NOT PROVIDED	DATE OF RECEIPT: 11/03/2011	DATE OF TESTING: 14 TO 28/03/2011

NCA SAMPLE REFERENCE:		11-4176
SAMPLE MATRIX:		Clay
MOISTURE CONTENT:	(%)	31
STONE CONTENT:	(%)	77

CLIENT SAMPLE REFERENCE:		TP8
SAMPLE LOCATION:		TP8
SAMPLE DEPTH:		0.1-0.2m
VISUAL DESCRIPTION:		Light brown sandy gravelly clay

Acenaphthene	(mg/kg)	< 0.1
Acenaphthylene	(mg/kg)	< 0.1
Anthracene	(mg/kg)	0.2
Benzo (a) anthracene	(mg/kg)	0.3
Benzo (a) pyrene	(mg/kg)	0.2
Benzo (b) fluoranthene	(mg/kg)	0.2
Benzo (g, h, i) perylene	(mg/kg)	0.1
Benzo (k) fluoranthene	(mg/kg)	< 0.1
Chrysene	(mg/kg)	0.3
Dibenzo (a,h) anthracene	(mg/kg)	< 0.1
Fluoranthene	(mg/kg)	0.4
Fluorene	(mg/kg)	< 0.1
Indeno (1, 2, 3,-cd) pyrene	(mg/kg)	< 0.1
Naphthalene	(mg/kg)	< 0.1
Phenanthrene	(mg/kg)	0.1
Pyrene	(mg/kg)	0.3

TOTAL PAH CONTENT	(mg/kg)	2.7

Arsenic	(mg/kg)	7
Cadmium	(mg/kg)	< 1
Chromium (Hexavalent)	(mg/kg)	< 1.3
Chromium (Total)	(mg/kg)	19
Copper	(mg/kg)	15
Lead	(mg/kg)	77
Mercury	(mg/kg)	< 1
Nickel	(mg/kg)	13
Selenium	(mg/kg)	< 3
Zinc	(mg/kg)	57

PHENOLS CONTENT	(mg/kg)	< 1.3

PH VALUE		9.0

SOM	(%)	2.3

Cyanide (Total)	(mg/kg)	< 1.3
Sulphate (As SO_4)	(mg/l)	1300

NOTES:
1. Analysis was carried out in accordance with NCA method statements: MS - CL - PAH, MS - CL - Phenols (Skalar), MS - CL - Anions, MS - CL - Chromium, MS - CL - Cyanide, MS - CL - TOC (SOM) and BS 1377: Parts 1 and 3 : 1990.
2. Testing was carried out on an air dried sample for all tests with the exception of phenols, cyanide and hexavalent chromium that were determined on an as received sample.
3. Concentrations are reported as a percentage mass of the dry soil passing the 10mm BS test sieve, where appropriate these results have been corrected for moisture content but not stone content.
4. Moisture Content was determined in accordance with NCA method statement MS - CL - Sample Prep, oven dried at <30°C.
5. Stone Content was determined in accordance with NCA method statement MS - CL - Sample Prep and refers to the percentage of stones retained on the 10mm test sieve.
6. Sample was supplied by customer.
7. MCERTS accreditation does not cover cyanide, chromium (hexavalent), anthracene, acenaphthylene, total PAH (USEPA list 16), SOM, sulphate and pH value. All testing is UKAS accredited with the exception of SOM, sulphate, cyanide and hexavalent chromium.
8. Metals analysis was subcontracted to SAL, this testing is not covered by over accreditation.

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TEST REPORT

GRM DEVELOPMENT SOLUTIONS SOIL SUITE

P5440 – NEW LODGE

REPORT NO. E11/GRM/371/006		
ORDER REFERENCE: GRM/P5440		DATE OF ISSUE: 30/03/2011
DATE & TIME OF SAMPLING: NOT PROVIDED	DATE OF RECEIPT: 11/03/2011	DATE OF TESTING: 14/03 TO 28/03/2011

NCA SAMPLE REFERENCE:		11-4177
SAMPLE MATRIX:		Clay
MOISTURE CONTENT:	(%)	12
STONE CONTENT:	(%)	46

CLIENT SAMPLE REFERENCE:		TP9
SAMPLE LOCATION:		TP9
SAMPLE DEPTH:		0.1-0.2m
VISUAL DESCRIPTION:		Dark brown sandy gravelly clay

Acenaphthene	(mg/kg)	< 0.1
Acenaphthylene	(mg/kg)	< 0.1
Anthracene	(mg/kg)	1.9
Benzo (a) anthracene	(mg/kg)	2.5
Benzo (a) pyrene	(mg/kg)	1.9
Benzo (b) fluoranthene	(mg/kg)	1.5
Benzo (g, h, i) perylene	(mg/kg)	1.1
Benzo (k) fluoranthene	(mg/kg)	0.4
Chrysene	(mg/kg)	1.9
Dibenzo (a,h) anthracene	(mg/kg)	0.3
Fluoranthene	(mg/kg)	1.5
Fluorene	(mg/kg)	< 0.1
Indeno (1, 2, 3,-cd) pyrene	(mg/kg)	0.5
Naphthalene	(mg/kg)	0.2
Phenanthrene	(mg/kg)	1.8
Pyrene	(mg/kg)	2.2

TOTAL PAH CONTENT	(mg/kg)	17.9

Arsenic	(mg/kg)	8
Cadmium	(mg/kg)	< 1
Chromium (Hexavalent)	(mg/kg)	< 1.1
Chromium (Total)	(mg/kg)	28
Copper	(mg/kg)	23
Lead	(mg/kg)	120
Mercury	(mg/kg)	< 1
Nickel	(mg/kg)	16
Selenium	(mg/kg)	< 3
Zinc	(mg/kg)	270

PHENOLS CONTENT	(mg/kg)	< 1.1

PH VALUE		9.2

SOM	(%)	6.5

Cyanide (Total)	(mg/kg)	< 1.1
Sulphate (As SO_4)	(mg/l)	1850

NOTES:
1. Analysis was carried out in accordance with NCA method statements: MS - CL - PAH, MS - CL - Phenols (Skalar), MS - CL - Anions, MS - CL - Chromium, MS - CL - Cyanide, MS - CL - TOC (SOM) and BS 1377: Parts 1 and 3 : 1990.
2. Testing was carried out on an air dried sample for all tests with the exception of phenols, cyanide and hexavalent chromium that were determined on an as received sample.
3. Concentrations are reported as a percentage mass of the dry soil passing the 10mm BS test sieve, where appropriate these results have been corrected for moisture content but not stone content.
4. Moisture Content was determined in accordance with NCA method statement MS - CL - Sample Prep, oven dried at <30˚C.
5. Stone Content was determined in accordance with NCA method statement MS - CL - Sample Prep and refers to the percentage of stones retained on the 10mm test sieve.
6. Sample was supplied by customer.
7. MCERTS accreditation does not cover cyanide, chromium (hexavalent), anthracene, acenaphthylene, total PAH (USEPA list 16), SOM, sulphate and pH value. All testing is UKAS accredited with the exception of SOM, sulphate, cyanide and hexavalent chromium.
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TEST REPORT

GRM DEVELOPMENT SOLUTIONS SOIL SUITE

P5440 – NEW LODGE

REPORT NO. E11/GRM/371/007		
ORDER REFERENCE: GRM/P5440	DATE OF ISSUE: 30/03/2011	
DATE & TIME OF SAMPLING: NOT PROVIDED	DATE OF RECEIPT: 11/03/2011	DATE OF TESTING: 14/03 TO 28/03/2011

NCA SAMPLE REFERENCE:		11-4178
SAMPLE MATRIX:		Loam
MOISTURE CONTENT:	(%)	18
STONE CONTENT:	(%)	28

CLIENT SAMPLE REFERENCE:	TP10
SAMPLE LOCATION:	TP10
SAMPLE DEPTH:	0.1-0.2m
VISUAL DESCRIPTION:	Dark brown slightly sandy gravelly clay with root fragments

Acenaphthene	(mg/kg)	< 0.1
Acenaphthylene	(mg/kg)	< 0.1
Anthracene	(mg/kg)	< 0.1
Benzo (a) anthracene	(mg/kg)	0.3
Benzo (a) pyrene	(mg/kg)	0.3
Benzo (b) fluoranthene	(mg/kg)	0.4
Benzo (g, h, i) perylene	(mg/kg)	0.2
Benzo (k) fluoranthene	(mg/kg)	0.1
Chrysene	(mg/kg)	0.3
Dibenzo (a,h) anthracene	(mg/kg)	< 0.1
Fluoranthene	(mg/kg)	0.4
Fluorene	(mg/kg)	< 0.1
Indeno (1, 2, 3,-cd) pyrene	(mg/kg)	0.2
Naphthalene	(mg/kg)	0.2
Phenanthrene	(mg/kg)	0.2
Pyrene	(mg/kg)	0.4

TOTAL PAH CONTENT	(mg/kg)	3.4

Arsenic	(mg/kg)	11
Cadmium	(mg/kg)	< 1
Chromium (Hexavalent)	(mg/kg)	6.1
Chromium (Total)	(mg/kg)	22
Copper	(mg/kg)	41
Lead	(mg/kg)	130
Mercury	(mg/kg)	< 1
Nickel	(mg/kg)	16
Selenium	(mg/kg)	< 3
Zinc	(mg/kg)	220

PHENOLS CONTENT	(mg/kg)	< 1.2

PH VALUE		7.0

SOM	(%)	7.0

Cyanide (Total)	(mg/kg)	< 1.2
Sulphate (As SO_4)	(mg/l)	502

NOTES:
1. Analysis was carried out in accordance with NCA method statements: MS - CL - PAH, MS - CL - Phenols (Skalar), MS - CL - Anions, MS - CL - Chromium, MS - CL - Cyanide, MS - CL - TOC (SOM) and BS 1377: Parts 1 and 3 : 1990.
2. Testing was carried out on an air dried sample for all tests with the exception of phenols, cyanide and hexavalent chromium that were determined on an as received sample.
3. Concentrations are reported as a percentage mass of the dry soil passing the 10mm BS test sieve, where appropriate these results have been corrected for moisture content but not stone content.
4. Moisture Content was determined in accordance with NCA method statement MS - CL - Sample Prep, oven dried at <30°C.
5. Stone Content was determined in accordance with NCA method statement MS - CL - Sample Prep and refers to the percentage of stones retained on the 10mm test sieve.
6. Sample was supplied by customer.
7. MCERTS accreditation does not cover cyanide, chromium (hexavalent), anthracene, acenaphthylene, total PAH (USEPA list 16), SOM, sulphate and pH value. All testing is UKAS accredited with the exception of SOM, sulphate, cyanide and hexavalent chromium.
8. Metals analysis was subcontracted to SAL, this testing is not covered by over accreditation.

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TEST REPORT

GRM DEVELOPMENT SOLUTIONS SOIL SUITE

P5440 – NEW LODGE

REPORT NO. E11/GRM/371/008		
ORDER REFERENCE: GRM/P5440		DATE OF ISSUE: 30/03/2011
DATE & TIME OF SAMPLING: NOT PROVIDED	DATE OF RECEIPT: 11/03/2011	DATE OF TESTING: 14/03 TO 28/03/2011

NCA SAMPLE REFERENCE:		11-4179
SAMPLE MATRIX:		Loam
MOISTURE CONTENT:	(%)	36
STONE CONTENT:	(%)	14

CLIENT SAMPLE REFERENCE:		WS1
SAMPLE LOCATION:		WS1
SAMPLE DEPTH:		0.1-0.2m
VISUAL DESCRIPTION:		Dark brown black sandy gravelly clay with organic matter

Acenaphthene	(mg/kg)	< 0.1
Acenaphthylene	(mg/kg)	< 0.1
Anthracene	(mg/kg)	< 0.1
Benzo (a) anthracene	(mg/kg)	< 0.1
Benzo (a) pyrene	(mg/kg)	< 0.1
Benzo (b) fluoranthene	(mg/kg)	0.1
Benzo (g, h, i) perylene	(mg/kg)	< 0.1
Benzo (k) fluoranthene	(mg/kg)	< 0.1
Chrysene	(mg/kg)	0.1
Dibenzo (a,h) anthracene	(mg/kg)	< 0.1
Fluoranthene	(mg/kg)	< 0.1
Fluorene	(mg/kg)	< 0.1
Indeno (1, 2, 3,-cd) pyrene	(mg/kg)	< 0.1
Naphthalene	(mg/kg)	0.3
Phenanthrene	(mg/kg)	< 0.1
Pyrene	(mg/kg)	< 0.1

TOTAL PAH CONTENT	(mg/kg)	1.8

Arsenic	(mg/kg)	16
Cadmium	(mg/kg)	8
Chromium (Hexavalent)	(mg/kg)	6.8
Chromium (Total)	(mg/kg)	53
Copper	(mg/kg)	210
Lead	(mg/kg)	720
Mercury	(mg/kg)	< 1
Nickel	(mg/kg)	49
Selenium	(mg/kg)	< 3
Zinc	(mg/kg)	1500

PHENOLS CONTENT	(mg/kg)	

PH VALUE		7.2

SOM	(%)	16.8

Cyanide (Total)	(mg/kg)	< 1.4
Sulphate (As SO_4)	(mg/l)	49.5

NOTES:
1. Analysis was carried out in accordance with NCA method statements: MS - CL - PAH, MS - CL - Phenols (Skalar), MS - CL - Anions, MS - CL - Chromium, MS - CL - Cyanide, MS - CL - TOC (SOM) and BS 1377: Parts 1 and 3 : 1990.
2. Testing was carried out on an air dried sample for all tests with the exception of phenols, cyanide and hexavalent chromium that were determined on an as received sample.
3. Concentrations are reported as a percentage mass of the dry soil passing the 10mm BS test sieve, where appropriate these results have been corrected for moisture content but not stone content.
4. Moisture Content was determined in accordance with NCA method statement MS - CL - Sample Prep, oven dried at <30°C.
5. Stone Content was determined in accordance with NCA method statement MS - CL - Sample Prep and refers to the percentage of stones retained on the 10mm test sieve.
6. Sample was supplied by customer.
7. MCERTS accreditation does not cover cyanide, chromium (hexavalent), anthracene, acenaphthylene, total PAH (USEPA list 16), SOM, sulphate and pH value. All testing is UKAS accredited with the exception of SOM, sulphate, cyanide and hexavalent chromium.
8. Metals analysis was subcontracted to SAL, this testing is not covered by over accreditation.

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TEST REPORT

GRM DEVELOPMENT SOLUTIONS SOIL SUITE

P5440 – NEW LODGE

REPORT NO. E11/GRM/371/009		
ORDER REFERENCE: GRM/P5440	DATE OF ISSUE: 30s/03/2011	
DATE & TIME OF SAMPLING: NOT PROVIDED	DATE OF RECEIPT: 11/03/2011	DATE OF TESTING: 14/03 TO 28/03/2011

NCA SAMPLE REFERENCE:		11-4180
SAMPLE MATRIX:		Clay
MOISTURE CONTENT:	(%)	23
STONE CONTENT:	(%)	2.0

CLIENT SAMPLE REFERENCE:	WS1
SAMPLE LOCATION:	WS1
SAMPLE DEPTH:	0.4-0.5m
VISUAL DESCRIPTION:	Dark brown slightly sandy slightly gravelly clay

Acenaphthene	(mg/kg)	< 0.1
Acenaphthylene	(mg/kg)	< 0.1
Anthracene	(mg/kg)	< 0.1
Benzo (a) anthracene	(mg/kg)	0.2
Benzo (a) pyrene	(mg/kg)	0.2
Benzo (b) fluoranthene	(mg/kg)	0.3
Benzo (g, h, i) perylene	(mg/kg)	0.2
Benzo (k) fluoranthene	(mg/kg)	0.1
Chrysene	(mg/kg)	0.3
Dibenzo (a,h) anthracene	(mg/kg)	< 0.1
Fluoranthene	(mg/kg)	0.3
Fluorene	(mg/kg)	< 0.1
Indeno (1, 2, 3,-cd) pyrene	(mg/kg)	0.2
Naphthalene	(mg/kg)	0.2
Phenanthrene	(mg/kg)	< 0.1
Pyrene	(mg/kg)	0.2

TOTAL PAH CONTENT	(mg/kg)	2.6

Arsenic	(mg/kg)	21
Cadmium	(mg/kg)	1
Chromium (Hexavalent)	(mg/kg)	< 1.2
Chromium (Total)	(mg/kg)	31
Copper	(mg/kg)	61
Lead	(mg/kg)	200
Mercury	(mg/kg)	< 1
Nickel	(mg/kg)	23
Selenium	(mg/kg)	< 3
Zinc	(mg/kg)	330

PHENOLS CONTENT	(mg/kg)	< 1.2

PH VALUE		7.2

SOM	(%)	8.6

Cyanide (Total)	(mg/kg)	< 1.2
Sulphate (As SO_4)	(mg/l)	15.1

NOTES:
1. Analysis was carried out in accordance with NCA method statements: MS - CL - PAH, MS - CL - Phenols (Skalar), MS - CL - Anions, MS - CL - Chromium, MS - CL - Cyanide, MS - CL - TOC (SOM) and BS 1377: Parts 1 and 3 : 1990.
2. Testing was carried out on an air dried sample for all tests with the exception of phenols, cyanide and hexavalent chromium that were determined on an as received sample.
3. Concentrations are reported as a percentage mass of the dry soil passing the 10mm BS test sieve, where appropriate these results have been corrected for moisture content but not stone content.
4. Moisture Content was determined in accordance with NCA method statement MS - CL - Sample Prep, oven dried at <30°C.
5. Stone Content was determined in accordance with NCA method statement MS - CL - Sample Prep and refers to the percentage of stones retained on the 10mm test sieve.
6. Sample was supplied by customer.
7. MCERTS accreditation does not cover cyanide, chromium (hexavalent), anthracene, acenaphthylene, total PAH (USEPA list 16), SOM, sulphate and pH value. All testing is UKAS accredited with the exception of SOM, sulphate, cyanide and hexavalent chromium.
8. Metals analysis was subcontracted to SAL, this testing is not covered by over accreditation.

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TEST REPORT

GRM DEVELOPMENT SOLUTIONS SOIL SUITE

P5440 – NEW LODGE

REPORT NO. E11/GRM/371/010		
ORDER REFERENCE: GRM/P5440		DATE OF ISSUE: 30/03/2011
DATE & TIME OF SAMPLING: NOT PROVIDED	DATE OF RECEIPT: 11/03/2011	DATE OF TESTING: 14/03 TO 28/03/2011

NCA SAMPLE REFERENCE:		11-4183
SAMPLE MATRIX:		Clay
MOISTURE CONTENT:	(%)	20
STONE CONTENT:	(%)	27

CLIENT SAMPLE REFERENCE:	WS4
SAMPLE LOCATION:	WS4
SAMPLE DEPTH:	0.1-0.2m
VISUAL DESCRIPTION:	Dark brown sandy slightly gravelly clay with brick fragments (Fill)

Acenaphthene	(mg/kg)	< 0.1
Acenaphthylene	(mg/kg)	< 0.1
Anthracene	(mg/kg)	0.1
Benzo (a) anthracene	(mg/kg)	0.5
Benzo (a) pyrene	(mg/kg)	0.5
Benzo (b) fluoranthene	(mg/kg)	0.7
Benzo (g, h, i) perylene	(mg/kg)	0.4
Benzo (k) fluoranthene	(mg/kg)	0.3
Chrysene	(mg/kg)	0.6
Dibenzo (a,h) anthracene	(mg/kg)	0.1
Fluoranthene	(mg/kg)	0.9
Fluorene	(mg/kg)	< 0.1
Indeno (1, 2, 3,-cd) pyrene	(mg/kg)	0.3
Naphthalene	(mg/kg)	0.3
Phenanthrene	(mg/kg)	0.4
Pyrene	(mg/kg)	0.8

TOTAL PAH CONTENT	(mg/kg)	6.1

Arsenic	(mg/kg)	22
Cadmium	(mg/kg)	2
Chromium (Hexavalent)	(mg/kg)	< 5.3
Chromium (Total)	(mg/kg)	32
Copper	(mg/kg)	78
Lead	(mg/kg)	160
Mercury	(mg/kg)	< 1
Nickel	(mg/kg)	29
Selenium	(mg/kg)	< 3.0
Zinc	(mg/kg)	290

PHENOLS CONTENT	(mg/kg)	< 1.2

PH VALUE	6.7

SOM	(%)	11.3

Cyanide (Total)	(mg/kg)	< 1.2
Sulphate (As SO_4)	(mg/l)	18.0

NOTES:
1. Analysis was carried out in accordance with NCA method statements: MS - CL - PAH, MS - CL - Phenols (Skalar), MS - CL - Anions, MS - CL - Chromium, MS - CL - Cyanide, MS - CL - TOC (SOM) and BS 1377: Parts 1 and 3 : 1990.
2. Testing was carried out on an air dried sample for all tests with the exception of phenols, cyanide and hexavalent chromium that were determined on an as received sample.
3. Concentrations are reported as a percentage mass of the dry soil passing the 10mm BS test sieve, where appropriate these results have been corrected for moisture content but not stone content.
4. Moisture Content was determined in accordance with NCA method statement MS - CL - Sample Prep, oven dried at <30˚C.
5. Stone Content was determined in accordance with NCA method statement MS - CL - Sample Prep and refers to the percentage of stones retained on the 10mm test sieve.
6. Sample was supplied by customer.
7. MCERTS accreditation does not cover cyanide, chromium (hexavalent), anthracene, acenaphthylene, total PAH (USEPA list 16), SOM, sulphate and pH value. All testing is UKAS accredited with the exception of SOM, sulphate, cyanide and hexavalent chromium.
8. Metals analysis was subcontracted to SAL, this testing is not covered by over accreditation.

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TEST REPORT

GRM DEVELOPMENT SOLUTIONS SOIL SUITE

P5440 – NEW LODGE

REPORT NO. E11/GRM/371/011		
ORDER REFERENCE: GRM/P5440		DATE OF ISSUE: 30/03/2011
DATE & TIME OF SAMPLING: NOT PROVIDED	DATE OF RECEIPT: 11/03/2011	DATE OF TESTING: 14/03 TO 28/03/2011

NCA SAMPLE REFERENCE:		11-4185
SAMPLE MATRIX:		Clay
MOISTURE CONTENT:	(%)	31
STONE CONTENT:	(%)	0.5

CLIENT SAMPLE REFERENCE:		WS6
SAMPLE LOCATION:		WS6
SAMPLE DEPTH:		0.1-0.2m
VISUAL DESCRIPTION:		Dark brown slightly sandy gravelly clay with root fragments

Acenaphthene	(mg/kg)	< 0.1
Acenaphthylene	(mg/kg)	< 0.1
Anthracene	(mg/kg)	< 0.1
Benzo (a) anthracene	(mg/kg)	0.8
Benzo (a) pyrene	(mg/kg)	0.8
Benzo (b) fluoranthene	(mg/kg)	1.1
Benzo (g, h, i) perylene	(mg/kg)	0.5
Benzo (k) fluoranthene	(mg/kg)	0.4
Chrysene	(mg/kg)	0.9
Dibenzo (a,h) anthracene	(mg/kg)	0.2
Fluoranthene	(mg/kg)	1.3
Fluorene	(mg/kg)	< 0.1
Indeno (1, 2, 3,-cd) pyrene	(mg/kg)	0.6
Naphthalene	(mg/kg)	0.3
Phenanthrene	(mg/kg)	0.2
Pyrene	(mg/kg)	1.2

TOTAL PAH CONTENT	(mg/kg)	8.6

Arsenic	(mg/kg)	21.0
Cadmium	(mg/kg)	2.0
Chromium (Hexavalent)	(mg/kg)	3.9
Chromium (Total)	(mg/kg)	27.0
Copper	(mg/kg)	76.0
Lead	(mg/kg)	170
Mercury	(mg/kg)	< 1
Nickel	(mg/kg)	22
Selenium	(mg/kg)	< 3
Zinc	(mg/kg)	370s

PHENOLS CONTENT	(mg/kg)	< 1.3

PH VALUE		7.3

SOM	(%)	11.8

Cyanide (Total)	(mg/kg)	<1.3
Sulphate (As SO_4)	(mg/l)	14.6

NOTES:
1. Analysis was carried out in accordance with NCA method statements: MS - CL - PAH, MS - CL - Phenols (Skalar), MS - CL - Anions, MS - CL - Chromium, MS - CL - Cyanide, MS - CL - TOC (SOM) and BS 1377: Parts 1 and 3 : 1990.
2. Testing was carried out on an air dried sample for all tests with the exception of phenols, cyanide and hexavalent chromium that were determined on an as received sample.
3. Concentrations are reported as a percentage mass of the dry soil passing the 10mm BS test sieve, where appropriate these results have been corrected for moisture content but not stone content.
4. Moisture Content was determined in accordance with NCA method statement MS - CL - Sample Prep, oven dried at <30°C.
5. Stone Content was determined in accordance with NCA method statement MS - CL - Sample Prep and refers to the percentage of stones retained on the 10mm test sieve.
6. Sample was supplied by customer.
7. MCERTS accreditation does not cover cyanide, chromium (hexavalent), anthracene, acenaphthylene, total PAH (USEPA list 16), SOM, sulphate and pH value. All testing is UKAS accredited with the exception of SOM, sulphate, cyanide and hexavalent chromium.
8. Metals analysis was subcontracted to SAL, this testing is not covered by over accreditation.

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Nicholls Colton ANALYTICAL

TEST REPORT

GRM DEVELOPMENT SOLUTIONS SOIL SUITE

P5440 – NEW LODGE

REPORT NO. E11/GRM/371/012		
ORDER REFERENCE: GRM/P5440		DATE OF ISSUE: 30/03/2011
DATE & TIME OF SAMPLING: NOT PROVIDED	DATE OF RECEIPT: 11/03/2011	DATE OF TESTING: 14/03 TO 28/03/2011

NCA SAMPLE REFERENCE:		11-4186
SAMPLE MATRIX:		Loam
MOISTURE CONTENT:	(%)	21
STONE CONTENT:	(%)	15

CLIENT SAMPLE REFERENCE:		WS7
SAMPLE LOCATION:		WS7
SAMPLE DEPTH:		0.1-0.2m
VISUAL DESCRIPTION:		Dark brown slightly sandy gravelly clay

Acenaphthene	(mg/kg)	< 0.1
Acenaphthylene	(mg/kg)	< 0.1
Anthracene	(mg/kg)	< 0.1
Benzo (a) anthracene	(mg/kg)	0.1
Benzo (a) pyrene	(mg/kg)	0.2
Benzo (b) fluoranthene	(mg/kg)	0.2
Benzo (g, h, i) perylene	(mg/kg)	0.1
Benzo (k) fluoranthene	(mg/kg)	< 0.1
Chrysene	(mg/kg)	0.2
Dibenzo (a,h) anthracene	(mg/kg)	< 0.1
Fluoranthene	(mg/kg)	0.2
Fluorene	(mg/kg)	< 0.1
Indeno (1, 2, 3,-cd) pyrene	(mg/kg)	0.1
Naphthalene	(mg/kg)	0.3
Phenanthrene	(mg/kg)	< 0.1
Pyrene	(mg/kg)	0.2

TOTAL PAH CONTENT	(mg/kg)	2.3

Arsenic	(mg/kg)	11
Cadmium	(mg/kg)	< 1
Chromium (Hexavalent)	(mg/kg)	< 1.2
Chromium (Total)	(mg/kg)	19
Copper	(mg/kg)	27
Lead	(mg/kg)	44
Mercury	(mg/kg)	< 1
Nickel	(mg/kg)	18
Selenium	(mg/kg)	< 3
Zinc	(mg/kg)	81

PHENOLS CONTENT	(mg/kg)	< 1.2

PH VALUE		6.4

SOM	(%)	7.2

Cyanide (Total)	(mg/kg)	< 1.2
Sulphate (As SO_4)	(mg/l)	23.5

NOTES:
1. Analysis was carried out in accordance with NCA method statements: MS - CL - PAH, MS - CL - Phenols (Skalar), MS - CL - Anions, MS - CL - Chromium, MS - CL - Cyanide, MS - CL - TOC (SOM) and BS 1377: Parts 1 and 3 : 1990.
2. Testing was carried out on an air dried sample for all tests with the exception of phenols, cyanide and hexavalent chromium that were determined on an as received sample.
3. Concentrations are reported as a percentage mass of the dry soil passing the 10mm BS test sieve, where appropriate these results have been corrected for moisture content but not stone content.
4. Moisture Content was determined in accordance with NCA method statement MS - CL - Sample Prep, oven dried at <30°C.
5. Stone Content was determined in accordance with NCA method statement MS - CL - Sample Prep and refers to the percentage of stones retained on the 10mm test sieve.
6. Sample was supplied by customer.
7. MCERTS accreditation does not cover cyanide, chromium (hexavalent), anthracene, acenaphthylene, total PAH (USEPA list 16), SOM, sulphate and pH value. All testing is UKAS accredited with the exception of SOM, sulphate, cyanide and hexavalent chromium.
8. Metals analysis was subcontracted to SAL, this testing is not covered by over accreditation.

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TEST REPORT

GRM DEVELOPMENT SOLUTIONS SOIL SUITE

P5440 – NEW LODGE

REPORT NO. E11/GRM/371/013		
ORDER REFERENCE: GRM/P5440		DATE OF ISSUE: 30/03/2011
DATE & TIME OF SAMPLING: NOT PROVIDED	DATE OF RECEIPT: 11/03/2011	DATE OF TESTING: 14/03 TO 28/03/2011

NCA SAMPLE REFERENCE:		11-4189
SAMPLE MATRIX:		Loam
MOISTURE CONTENT:	(%)	17
STONE CONTENT:	(%)	23

CLIENT SAMPLE REFERENCE:		WS9
SAMPLE LOCATION:		WS9
SAMPLE DEPTH:		0.1-0.2m
VISUAL DESCRIPTION:		Dark brown sandy gravelly clay with organic matter

Acenaphthene	(mg/kg)	0.4
Acenaphthylene	(mg/kg)	0.1
Anthracene	(mg/kg)	2.4
Benzo (a) anthracene	(mg/kg)	5.4
Benzo (a) pyrene	(mg/kg)	5.1
Benzo (b) fluoranthene	(mg/kg)	6.5
Benzo (g, h, i) perylene	(mg/kg)	3.5
Benzo (k) fluoranthene	(mg/kg)	2.5
Chrysene	(mg/kg)	5.5
Dibenzo (a,h) anthracene	(mg/kg)	0.8
Fluoranthene	(mg/kg)	13.0
Fluorene	(mg/kg)	0.3
Indeno (1, 2, 3,-cd) pyrene	(mg/kg)	4.1
Naphthalene	(mg/kg)	0.7
Phenanthrene	(mg/kg)	6.6
Pyrene	(mg/kg)	11.1

TOTAL PAH CONTENT	(mg/kg)	68.0

Arsenic	(mg/kg)	10
Cadmium	(mg/kg)	< 1
Chromium (Hexavalent)	(mg/kg)	1.8
Chromium (Total)	(mg/kg)	19
Copper	(mg/kg)	44
Lead	(mg/kg)	61
Mercury	(mg/kg)	< 1
Nickel	(mg/kg)	21
Selenium	(mg/kg)	< 3
Zinc	(mg/kg)	460

PHENOLS CONTENT	(mg/kg)	< 1.2

PH VALUE		7.0

SOM	(%)	8.4

Cyanide (Total)	(mg/kg)	< 1.2
Sulphate (As SO_4)	(mg/l)	22.5

NOTES:
1. Analysis was carried out in accordance with NCA method statements: MS - CL - PAH, MS - CL - Phenols (Skalar), MS - CL - Anions, MS - CL - Chromium, MS - CL - Cyanide, MS - CL - TOC (SOM) and BS 1377: Parts 1 and 3 : 1990.
2. Testing was carried out on an air dried sample for all tests with the exception of phenols, cyanide and hexavalent chromium that were determined on an as received sample.
3. Concentrations are reported as a percentage mass of the dry soil passing the 10mm BS test sieve, where appropriate these results have been corrected for moisture content but not stone content.
4. Moisture Content was determined in accordance with NCA method statement MS - CL - Sample Prep, oven dried at <30°C.
5. Stone Content was determined in accordance with NCA method statement MS - CL - Sample Prep and refers to the percentage of stones retained on the 10mm test sieve.
6. Sample was supplied by customer.
7. MCERTS accreditation does not cover cyanide, chromium (hexavalent), anthracene, acenaphthylene, total PAH (USEPA list 16), SOM, sulphate and pH value. All testing is UKAS accredited with the exception of SOM, sulphate, cyanide and hexavalent chromium.
8. Metals analysis was subcontracted to SAL, this testing is not covered by over accreditation.

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TEST REPORT

Asbestos Presence

P5440 – New Lodge

Report no. E11/GRM/371/014	
Order reference: GRM/P5440	Date of testing: 30/03/23011
Date of receipt: 11/03/2011	Date of issue: 28/03/2011

NCA sample reference:	Client sample reference:	Depth (m)	Sample Matrix	Asbestos Presence
11-4170	TP2	0.15-0.25	Soil	None Detected
11-4173	TP3	0.05-0.15	Soil	None Detected
11-4174	TP6	0.15-0.25	Soil	None Detected
11-4176	TP8	0.1-0.2	Soil	None Detected
11-4177	TP9	0.1-0.2	Soil	None Detected
11-4178	TP10	0.1-0.2	Soil	None Detected
11-4179	WS1	0.1-0.2	Soil	None Detected
11-4181	WS2	0.05-0.15	Soil	None Detected
11-4182	WS3	0.1-0.2	Soil	None Detected
11-4183	WS4	0.1-0.2	Soil	None Detected
11-4184	WS5	0.1-0.2	Soil	None Detected
11-4185	WS6	0.1-0.2	Soil	None Detected
11-4186	WS7	0.1-0.2	Soil	None Detected
11-4187	WS8	0.1-0.2	Soil	None Detected
11-4188	WS8	0.35-0.45	Soil	Chrysotile (White Asbestos)
11-4189	WS9	0.1-0.2	Soil	None Detected

NOTES:
1. Sample was supplied by customer.
2. Analysis was subcontracted to AOH.

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TEST REPORT

GRM DEVELOPMENT SOLUTIONS LEACHATE ANALYSIS

P5440 – NEW LODGE

REPORT NO. E11/GRM/371/015		
ORDER REFERENCE: GRM/P5440		DATE OF ISSUE: 30/03/2011
DATE & TIME OF SAMPLING: 08 – 09/03/2011	DATE OF RECEIPT: 11/03/2011	DATE OF TESTING: 14/03 TO 28/03/2011

NCA SAMPLE REFERENCE:	11-4170
SAMPLE MATRIX:	Clay
VISUAL DESCRIPTION:	Dark brown sandy gravelly clay with root fragments

CLIENT SAMPLE REFERENCE:	TP1
SAMPLE LOCATION:	TP1
SAMPLE DEPTH:	0.1-0.2m

Benzo (a) pyrene	(µg/l)	< 0.01
Benzo (b) fluoranthene	(µg/l)	< 0.01
Benzo (k) fluoranthene	(µg/l)	< 0.01
Benzo (g,h,i) perylene	(µg/l)	< 0.01
Indeno (1,2,3-c,d)pyrene	(µg/l)	< 0.01
Naphthalene	(µg/l)	< 0.01

Cyanide (Total)	(mg/l)	< 0.5
Ammonia	(mg/l)	< 0.1

Arsenic	(µg/l)	3.7
Cadmium	(µg/l)	0.03
Chromium (Total)	(µg/l)	6
Copper	(µg/l)	4.4
Lead	(µg/l)	0.4
Mercury	(µg/l)	< 0.05
Nickel	(µg/l)	1
Selenium	(µg/l)	1.1
Zinc	(µg/l)	6

PH VALUE		8.0
PHENOL INDEX	(µg/l)	0.5
Sulphate	(mg/l)	10.1

NOTES:
1. Leaching was carried out in accordance with NRA R&D note 301 using a 10 : 1 by wet mass of sample extraction ratio.
2. Results have not been corrected for the extraction ratio with regards to the moisture content of the soil.
3. Results have not been calculated or reported as 'mg of contaminant leached per kg of soil at natural moisture content' as required by the NRA. This information is available on request.
4. Analysis was carried out in accordance with NCA method statements: MS - CL - Cyanide (Skalar), MS-CL-PAH Water, MS - CL - Anions and BS1377 Parts 1 and 3.
5. Testing was carried out on an as received sample.
6. Sample was supplied by client.
7. Ammonia and phenol were subcontracted to Scientifics.
8. Metals were subcontracted to SAL.

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TEST REPORT

GRM DEVELOPMENT SOLUTIONS LEACHATE ANALYSIS

P5440 – NEW LODGE

REPORT NO. E11/GRM/371/016		
ORDER REFERENCE: GRM/P5440	DATE OF ISSUE: 30/03/2011	
DATE & TIME OF SAMPLING: 08 – 09/03/2011	DATE OF RECEIPT: 11/03/2011	DATE OF TESTING: 14/03 TO 28/03/2011

NCA SAMPLE REFERENCE:	11-4175
SAMPLE MATRIX:	Clay
VISUAL DESCRIPTION:	Brown slightly sandy gravelly clay

CLIENT SAMPLE REFERENCE:	TP7
SAMPLE LOCATION:	TP7
SAMPLE DEPTH:	0.2-0.3m

Benzo (a) pyrene	(µg/l)	< 0.01
Benzo (b) fluoranthene	(µg/l)	< 0.01
Benzo (k) fluoranthene	(µg/l)	< 0.01
Benzo (g,h,i) perylene	(µg/l)	< 0.01
Indeno (1,2,3-c,d)pyrene	(µg/l)	< 0.01
Naphthalene	(µg/l)	0.37

Cyanide (Total)	(mg/l)	< 0.5
Ammonia	(mg/l)	< 0.1

Arsenic	(µg/l)	0.2
Cadmium	(µg/l)	< 0.02
Chromium (Total)	(µg/l)	4
Copper	(µg/l)	< 0.5
Lead	(µg/l)	< 0.3
Mercury	(µg/l)	< 0.05
Nickel	(µg/l)	< 1
Selenium	(µg/l)	< 0.5
Zinc	(µg/l)	4

PH VALUE		7.8
PHENOL INDEX	(µg/l)	< 0.5
Sulphate	(mg/l)	10.8

NOTES:
1. Leaching was carried out in accordance with NRA R&D note 301 using a 10 : 1 by wet mass of sample extraction ratio.
2. Results have not been corrected for the extraction ratio with regards to the moisture content of the soil.
3. Results have not been calculated or reported as 'mg of contaminant leached per kg of soil at natural moisture content' as required by the NRA. This information is available on request.
4. Analysis was carried out in accordance with NCA method statements: MS - CL - Cyanide (Skalar), MS-CL-PAH Water, MS - CL - Anions and BS1377 Parts 1 and 3.
5. Testing was carried out on an as received sample.
6. Sample was supplied by client.
7. Ammonia and phenol were subcontracted to Scientifics.
8. Metals were subcontracted to SAL.

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TEST REPORT

GRM DEVELOPMENT SOLUTIONS LEACHATE ANALYSIS

P5440 – NEW LODGE

REPORT NO. E11/GRM/371/017		
ORDER REFERENCE: GRM/P5440		DATE OF ISSUE: 30/03/2011
DATE & TIME OF SAMPLING: 08 – 09/03/2011	DATE OF RECEIPT: 11/03/2011	DATE OF TESTING: 14/03 TO 28/03/2011

NCA SAMPLE REFERENCE:	11-4177
SAMPLE MATRIX:	Clay
VISUAL DESCRIPTION:	Dark brown sandy gravelly clay

CLIENT SAMPLE REFERENCE:	TP9
SAMPLE LOCATION:	TP9
SAMPLE DEPTH:	0.1-0.2m

Benzo (a) pyrene	(µg/l)	< 0.01
Benzo (b) fluoranthene	(µg/l)	< 0.01
Benzo (k) fluoranthene	(µg/l)	< 0.01
Benzo (g,h,i) perylene	(µg/l)	< 0.01
Indeno (1,2,3-c,d)pyrene	(µg/l)	< 0.01
Naphthalene	(µg/l)	0.19

Cyanide (Total)	(mg/l)	< 0.5
Ammonia	(mg/l)	< 0.1

Arsenic	(µg/l)	3.6
Cadmium	(µg/l)	0.03
Chromium (Total)	(µg/l)	4
Copper	(µg/l)	3.6
Lead	(µg/l)	< 0.3
Mercury	(µg/l)	< 0.05
Nickel	(µg/l)	4
Selenium	(µg/l)	1.1
Zinc	(µg/l)	6

PH VALUE		9.0
PHENOL INDEX	(µg/l)	< 0.5
Sulphate	(mg/l)	306

NOTES:
1. Leaching was carried out in accordance with NRA R&D note 301 using a 10 : 1 by wet mass of sample extraction ratio.
2. Results have not been corrected for the extraction ratio with regards to the moisture content of the soil.
3. Results have not been calculated or reported as 'mg of contaminant leached per kg of soil at natural moisture content' as required by the NRA. This information is available on request.
4. Analysis was carried out in accordance with NCA method statements: MS - CL - Cyanide (Skalar), MS-CL-PAH Water, MS - CL - Anions and BS1377 Parts 1 and 3.
5. Testing was carried out on an as received sample.
6. Sample was supplied by client.
7. Ammonia and phenol were subcontracted to Scientifics.
8. Metals were subcontracted to SAL.

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ANALYTICAL

TEST REPORT

GRM DEVELOPMENT SOLUTIONS LEACHATE ANALYSIS

P5440 – NEW LODGE

REPORT NO. E11/GRM/371/018		
ORDER REFERENCE: GRM/P5440	DATE OF ISSUE: 30/03/23011	
DATE & TIME OF SAMPLING: 08 – 09/03/2011	DATE OF RECEIPT: 11/03/2011	DATE OF TESTING: 14/03 TO 28/03/2011

NCA SAMPLE REFERENCE:	11-4187
SAMPLE MATRIX:	Sand
VISUAL DESCRIPTION:	Dark brown gravelly sand

CLIENT SAMPLE REFERENCE:	WS8
SAMPLE LOCATION:	WS8
SAMPLE DEPTH:	0.1-0.2m

Benzo (a) pyrene	(µg/l)	0.04
Benzo (b) fluoranthene	(µg/l)	0.04
Benzo (k) fluoranthene	(µg/l)	0.03
Benzo (g,h,i) perylene	(µg/l)	< 0.01
Indeno (1,2,3-c,d)pyrene	(µg/l)	0.03
Naphthalene	(µg/l)	0.20

Cyanide (Total)	(mg/l)	< 0.5
Ammonia	(mg/l)	< 0.1

Arsenic	(µg/l)	2.6
Cadmium	(µg/l)	< 0.02
Chromium (Total)	(µg/l)	4
Copper	(µg/l)	2.1
Lead	(µg/l)	0.4
Mercury	(µg/l)	0.08
Nickel	(µg/l)	< 1
Selenium	(µg/l)	< 0.5
Zinc	(µg/l)	5

PH VALUE		9.1
PHENOL INDEX	(µg/l)	< 0.5
Sulphate	(mg/l)	< 10

NOTES:
1. Leaching was carried out in accordance with NRA R&D note 301 using a 10 : 1 by wet mass of sample extraction ratio.
2. Results have not been corrected for the extraction ratio with regards to the moisture content of the soil.
3. Results have not been calculated or reported as 'mg of contaminant leached per kg of soil at natural moisture content' as required by the NRA. This information is available on request.
4. Analysis was carried out in accordance with NCA method statements: MS - CL - Cyanide (Skalar), MS-CL-PAH Water, MS - CL - Anions and BS1377 Parts 1 and 3.
5. Testing was carried out on an as received sample.
6. Sample was supplied by client.
7. Ammonia and phenol were subcontracted to Scientifics.
8. Metals were subcontracted to SAL.

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TEST REPORT

GRM DEVELOPMENT SOLUTIONS LEACHATE ANALYSIS

P5440 – NEW LODGE

REPORT NO. E11/GRM/371/019		
ORDER REFERENCE: GRM/P5440		DATE OF ISSUE: 30/03/2011
DATE & TIME OF SAMPLING: 08 – 09/03/2011	DATE OF RECEIPT: 11/03/2011	DATE OF TESTING: 14/03 TO 28/03/2011

NCA SAMPLE REFERENCE:	11-4189
SAMPLE MATRIX:	Clay
VISUAL DESCRIPTION:	Dark brown sandy gravelly clay with organic matter

CLIENT SAMPLE REFERENCE:	WS9
SAMPLE LOCATION:	WS9
SAMPLE DEPTH:	0.1-0.2m

Benzo (a) pyrene	(µg/l)	< 0.010
Benzo (b) fluoranthene	(µg/l)	< 0.010
Benzo (k) fluoranthene	(µg/l)	0.02
Benzo (g,h,i) perylene	(µg/l)	< 0.01
Indeno (1,2,3-c,d)pyrene	(µg/l)	0.01
Naphthalene	(µg/l)	< 0.01

Cyanide (Total)	(mg/l)	< 0.5
Ammonia	(mg/l)	< 0.1

Arsenic	(µg/l)	3.0
Cadmium	(µg/l)	0.04
Chromium (Total)	(µg/l)	5
Copper	(µg/l)	6.7
Lead	(µg/l)	1.5
Mercury	(µg/l)	< 0.05
Nickel	(µg/l)	2
Selenium	(µg/l)	< 0.5
Zinc	(µg/l)	19

PH VALUE		8.0
PHENOL INDEX	(µg/l)	< 0.5
Sulphate	(mg/l)	< 10

NOTES:
1. Leaching was carried out in accordance with NRA R&D note 301 using a 10 : 1 by wet mass of sample extraction ratio.
2. Results have not been corrected for the extraction ratio with regards to the moisture content of the soil.
3. Results have not been calculated or reported as 'mg of contaminant leached per kg of soil at natural moisture content' as required by the NRA. This information is available on request.
4. Analysis was carried out in accordance with NCA method statements: MS - CL - Cyanide (Skalar), MS-CL-PAH Water, MS - CL - Anions and BS1377 Parts 1 and 3.
5. Testing was carried out on an as received sample.
6. Sample was supplied by client.
7. Ammonia and phenol were subcontracted to Scientifics.
8. Metals were subcontracted to SAL.

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APPENDIX J

GRM Development Solutions
geoenvironmental - civil - structural

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TEST REPORT

BS 1377 PLASTICITY INDEX AND MOISTURE CONTENT

P5440 New Lodge

Report no. L11/GRM/154/001			
Order reference: GRM/P5440	Date of receipt: 11/03/2011	Date of testing: 22/03/2011 to 24/03/2011	Date of issue: 25/03/2011

NCA Sample reference	Client sample reference	Sample type	Depth (m)	Sample description	Fines passing 425µm (%)	**Liquid limit (%)**	**Plastic limit (%)**	**Plasticity index (%)**	**Moisture content (%)**
11-4114	TP1 0.9-1.0	Disturbed	0.90-1.00	Brown grey slightly gravelly clay	98	**35**	**20**	**15**	**18**

NOTES:
1. Sample preparation was in accordance with BS 1377 : Part 1 : 1990.
2. Plasticity index testing was in accordance with BS 1377 : Part 2 : 1990 Clauses 3, 4.4 (one-point) & 5.
3. Moisture content testing was in accordance with BS 1377 : Part 2 : 1990 Clause 3.2.3.1 .
4. The material was prepared from its natural state .
5. Some information required by BS 1377 : Part 1 : 1990 Clause 9 is not included in the report. The information will be provided if requested

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TEST REPORT

BS 1377 PLASTICITY INDEX AND MOISTURE CONTENT

P5440 New Lodge

Report no. L11/GRM/154/002			
Order reference: GRM/P5440	Date of receipt: 11/03/2011	Date of testing: 22/03/2011 to 24/03/2011	Date of issue: 25/03/2011

NCA Sample reference	Client sample reference	Sample type	Depth (m)	Sample description	Fines passing 425µm (%)	**Liquid limit (%)**	**Plastic limit (%)**	**Plasticity index (%)**	**Moisture content (%)**
11-4115	TP6 0.9-1.0	Disturbed	0.9-1.00	Brown grey clay	99	**45**	**22**	**23**	**21**

NOTES:
1. Sample preparation was in accordance with BS 1377 : Part 1 : 1990.
2. Plasticity index testing was in accordance with BS 1377 : Part 2 : 1990 Clauses 3, 4.4 (one-point) & 5.
3. Moisture content testing was in accordance with BS 1377 : Part 2 : 1990 Clause 3.2.3.1 .
4. The material was prepared from its natural state .
5. Some information required by BS 1377 : Part 1 : 1990 Clause 9 is not included in the report. The information will be provided if requested

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TEST REPORT

BS 1377 PLASTICITY INDEX AND MOISTURE CONTENT

P5440 New Lodge

Report no. L11/GRM/154/003			
Order reference: GRM/P5440	Date of receipt: 11/03/2011	Date of testing: 22/03/2011 to 24/03/2011	Date of issue: 25/03/2011

NCA Sample reference	Client sample reference	Sample type	Depth (m)	Sample description	Fines passing 425µm (%)	**Liquid limit (%)**	**Plastic limit (%)**	**Plasticity index (%)**	**Moisture content (%)**
11-4116	TP9 2.9-3.0	Disturbed	2.90-3.00	Grey silty clay	99	**43**	**22**	**21**	**21**

NOTES:
1. Sample preparation was in accordance with BS 1377 : Part 1 : 1990.
2. Plasticity index testing was in accordance with BS 1377 : Part 2 : 1990 Clauses 3, 4.4 (one-point) & 5.
3. Moisture content testing was in accordance with BS 1377 : Part 2 : 1990 Clause 3.2.3.1 .
4. The material was prepared from its natural state .
5. Some information required by BS 1377 : Part 1 : 1990 Clause 9 is not included in the report. The information will be provided if requested

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TEST REPORT

BS 1377 PLASTICITY INDEX AND MOISTURE CONTENT

P5440 New Lodge

Report no. L11/GRM/154/004			
Order reference: GRM/P5440	Date of receipt: 11/03/2011	Date of testing: 22/03/2011 to 24/03/2011	Date of issue: 25/03/2011

NCA Sample reference	Client sample reference	Sample type	Depth (m)	Sample description	Fines passing 425µm (%)	**Liquid limit (%)**	**Plastic limit (%)**	**Plasticity index (%)**	**Moisture content (%)**
11-4117	TP10 3.2-3.3	Disturbed	3.20-3.30	Brown slightly gravelly sandy clay	88	**24**	**15**	**9**	**12**

NOTES:
1. Sample preparation was in accordance with BS 1377 : Part 1 : 1990.
2. Plasticity index testing was in accordance with BS 1377 : Part 2 : 1990 Clauses 3, 4.4 (one-point) & 5.
3. Moisture content testing was in accordance with BS 1377 : Part 2 : 1990 Clause 3.2.3.1 .
4. The material was prepared from its natural state .
5. Some information required by BS 1377 : Part 1 : 1990 Clause 9 is not included in the report. The information will be provided if requested

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TEST REPORT

BS 1377 PLASTICITY INDEX AND MOISTURE CONTENT

P5440 New Lodge

Report no. L11/GRM/154/005			
Order reference: GRM/P5440	Date of receipt: 11/03/2011	Date of testing: 22/03/2011 to 24/03/2011	Date of issue: 25/03/2011

NCA Sample reference	Client sample reference	Sample type	Depth (m)	Sample description	Fines passing 425µm (%)	Liquid limit (%)	Plastic limit (%)	Plasticity index (%)	Moisture content (%)
11-4118	WS4 0.9-1.0	Disturbed	0.9-1.0	Yellow brown sandy clay with sandstone	-	**Insufficient Sample**			12

NOTES:
1. Sample preparation was in accordance with BS 1377 : Part 1 : 1990.
2. Plasticity index testing was in accordance with BS 1377 : Part 2 : 1990 Clauses 3, 4.4 (one-point) & 5.
3. Moisture content testing was in accordance with BS 1377 : Part 2 : 1990 Clause 3.2.3.1 .
4. The material was prepared from its natural state .
5. Some information required by BS 1377 : Part 1 : 1990 Clause 9 is not included in the report. The information will be provided if requested

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TEST REPORT

BS 1377 WATER SOLUBLE SULFATE CONTENT AND pH OF SOIL

P5440 New Lodge

Report no. L11/GRM/154/006			
Order reference: GRM/P5440	Date of receipt: 11/03/2011	Date of testing: 19/03/2011 to 24/03/2011	Date of issue: 25/03/2011

NCA sample reference	Client sample reference	Sample type	Depth (m)	Sample description	Material passing a 2mm BS test sieve (% dry mass of original sample)	**Sulfate content as SO_3 of 2:1 soil/water extract (g/l):**	**Sulfate content as SO_4 of 2:1 soil/water extract (g/l):**	**pH value**
11-4114	TP1 0.9-1.0	Disturbed	0.9 - 1.0	Brown grey slightly gravelly clay	100	**0.1**	**0.1**	**5.8**

NOTES
1. Sample preparation was in accordance with BS 1377 : Part 1 : 1990.
2. Sulphate testing was in accordance with BS 1377 : Part 3 : 1990 Clause 5.5.
3. pH testing was in accordance with BS 1377 : Part 3 : 1990 Clause 9.5.
4. Sulphate content as SO_4 has been calculated by multiplying the sulphate content as SO_3 by 1.2. BS 1377 : Part 3 : 1990 does not require SO_4 figures to be reported.

.....
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TEST REPORT

BS 1377 WATER SOLUBLE SULFATE CONTENT AND pH OF SOIL

P5440 New Lodge

Report no. L11/GRM/154/007			
Order reference: GRM/P5440	Date of receipt: 11/03/2011	Date of testing: 19/03/2011 to 24/03/2011	Date of issue: 25/03/2011

NCA sample reference	Client sample reference	Sample type	Depth (m)	Sample description	Material passing a 2mm BS test sieve (% dry mass of original sample)	**Sulfate content as SO_3 of 2:1 soil/water extract (g/l):**	**Sulfate content as SO_4 of 2:1 soil/water extract (g/l):**	**pH value**
11-4115	TP6 0.9-1.0	Disturbed	0.9 - 1.0	Brown grey clay	100	**0.1**	**0.1**	**6.5**

NOTES
1. Sample preparation was in accordance with BS 1377 : Part 1 : 1990.
2. Sulphate testing was in accordance with BS 1377 : Part 3 : 1990 Clause 5.5.
3. pH testing was in accordance with BS 1377 : Part 3 : 1990 Clause 9.5.
4. Sulphate content as SO_4 has been calculated by multiplying the sulphate content as SO_3 by 1.2. BS 1377 : Part 3 : 1990 does not require SO_4 figures to be reported.

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TEST REPORT

BS 1377 WATER SOLUBLE SULFATE CONTENT AND pH OF SOIL

P5440 New Lodge

Report no. L11/GRM/154/008			
Order reference: GRM/P5440	Date of receipt: 11/03/2011	Date of testing: 19/03/2011 to 24/03/2011	Date of issue: 25/03/2011

NCA sample reference	Client sample reference	Sample type	Depth (m)	Sample description	Material passing a 2mm BS test sieve (% dry mass of original sample)	**Sulfate content as SO_3 of 2:1 soil/water extract (g/l):**	**Sulfate content as SO_4 of 2:1 soil/water extract (g/l):**	**pH value**
11-4116	TP9 2.9-3.0	Disturbed	2.9 - 3.0	Grey silty clay	100	**0.1**	**0.1**	**6.5**

NOTES
1. Sample preparation was in accordance with BS 1377 : Part 1 : 1990.
2. Sulphate testing was in accordance with BS 1377 : Part 3 : 1990 Clause 5.5.
3. pH testing was in accordance with BS 1377 : Part 3 : 1990 Clause 9.5.
4. Sulphate content as SO_4 has been calculated by multiplying the sulphate content as SO_3 by 1.2. BS 1377 : Part 3 : 1990 does not require SO_4 figures to be reported.

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TEST REPORT

BS 1377 WATER SOLUBLE SULFATE CONTENT AND pH OF SOIL

P5440 New Lodge

Report no. L11/GRM/154/009			
Order reference: GRM/P5440	Date of receipt: 11/03/2011	Date of testing: 19/03/2011 to 24/03/2011	Date of issue: 25/03/2011

NCA sample reference	Client sample reference	Sample type	Depth (m)	Sample description	Material passing a 2mm BS test sieve (% dry mass of original sample)	**Sulfate content as SO_3 of 2:1 soil/water extract (g/l):**	**Sulfate content as SO_4 of 2:1 soil/water extract (g/l):**	**pH value**
11-4117	TP10 3.2-3.3	Disturbed	3.2 0 3.3	Brown slightly gravelly sandy clay	100	**0.1**	**0.1**	**6.5**

NOTES
1. Sample preparation was in accordance with BS 1377 : Part 1 : 1990.
2. Sulphate testing was in accordance with BS 1377 : Part 3 : 1990 Clause 5.5.
3. pH testing was in accordance with BS 1377 : Part 3 : 1990 Clause 9.5.
4. Sulphate content as SO_4 has been calculated by multiplying the sulphate content as SO_3 by 1.2. BS 1377 : Part 3 : 1990 does not require SO_4 figures to be reported.

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TEST REPORT

BS 1377 WATER SOLUBLE SULFATE CONTENT AND pH OF SOIL

P5440 New Lodge

Report no. L11/GRM/154/010			
Order reference: GRM/P5440	Date of receipt: 11/03/2011	Date of testing: 19/03/2011 to 24/03/2011	Date of issue: 25/03/2011

NCA sample reference	Client sample reference	Sample type	Depth (m)	Sample description	Material passing a 2mm BS test sieve (% dry mass of original sample)	**Sulfate content as SO_3 of 2:1 soil/water extract (g/l):**	**Sulfate content as SO_4 of 2:1 soil/water extract (g/l):**	**pH value**
11-4118	WS4 0.9-1.0	Disturbed	0.9 - 1.0	Yellow brown sandy clay with sandstone	95	**0.1**	**0.1**	**7.1**

NOTES
1. Sample preparation was in accordance with BS 1377 : Part 1 : 1990.
2. Sulphate testing was in accordance with BS 1377 : Part 3 : 1990 Clause 5.5.
3. pH testing was in accordance with BS 1377 : Part 3 : 1990 Clause 9.5.
4. Sulphate content as SO_4 has been calculated by multiplying the sulphate content as SO_3 by 1.2. BS 1377 : Part 3 : 1990 does not require SO_4 figures to be reported.

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APPENDIX K

GRM Development Solutions
geoenvironmental - civil - structural

GRM TIER 1 ASSESSMENT CRITERIA									
LAND USE	Residential with Plant Uptake			Residential without Plant Uptake			Commercial & Industrial		
CONTAMINANT	% Soil Organic Matter								
	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%
• Arsenic	32	32	32	35	35	35	640	640	640
• Cadmium	10	10	10	17.7	17.7	17.7	230	230	230
• Chromium III	614	614	614	620	620	620	8,790	8,790	8,790
• Chromium VI	4.15	4.15	4.15	4.17	4.17	4.17	34.5	34.5	34.5
• Lead	450	450	450	450	450	450	750	750	750
• Mercury	170	170	170	170	170	170	3600	3600	3600
• Selenium	350	350	350	595	595	595	13,000	13 000	13,000
• Nickel	130	130	130	786	786	786	1800	1800	1800
• Phenols	184	290	418	310	418	519	1,100,000	1,100,000	1,200,000
• Copper	2330	2330	2330	6200	6200	6200	71,700	71,700	71,700
• Zinc	3,750	3750	3750	40,500	40,500	40,500	667,000	667,000	667,000
• Cyanide	34	34	34	34	34	34	34	34	34
• Benzene	0.06	0.157	0.332	0.266	0.49	0.998	28	50	95
• Toluene	119	270	611	607	1290	2710	869	1,920	4400
• Ethylbenzene	65	154	354	167	361	843	518	1,220	2800
• o - xylene	45	105	246	59.5	139	321	4 780	1,120	2600
• m - xylene	44	103	240	56.4	130	302	625	1 470	3500
• p - xylene	42	98.2	228	53.3	125	288	576	1,350	3200
∞ Acenaphthene	210(328)	480	1000	2020(57)	3090(141)	3910(338)	86000(57)	98000(141)	100,000
∞ Acenaphthylene	188	400	850	1950(66)	3020(212)	3870(508)	84,000	97000(212)	100,000
∞ Anthracene	2300	4900	9200	20,100(1 64)	22,400	23,400	530,000	540,000	540,000
• Benzo(a)anthracene	3 1	4 7	5 9	3 71	5.23	6.22	90	95	97
• Benzo(a)pyrene	0 83	0 94	1	1	1 03	1 04	14	14	14
• Benzo(b)fluoranthene	5 6	6 5	7	6 99	7 25	7 36	100	100	100
• Benzo(ghi)perylene	40	46	47	43	43 6	43 8	660	660	660
• Benzo(k)fluoranthene	8 5	9 6	10	10 1	10 3	10 4	140	140	140
• Chrysene	8	8	9 3	8 84	9 74	10 1	140	140	140
• Dibenzo(ah)anthracene	0 76	0 86	0 9	0 865	0 91	0 928	13	13	13
• Fluoranthene	260	460	670	972	993	1000	23,000	23,000	23,000
∞ Fluorene	180	380	780	1850(30)	2480(78)	2870(183)	64,000	69,000	71,000
• Ideno(1,2,3-cd)pyrene	3 2	3 9	4 2	4 17	4 36	4 43	60	61	62
• Napthalene	1 5	3 7	8 7	1 84	3 92	9 22	200(78)	480(183)	1100(432)
∞ Phenanthrene	92	200	380	731(16)	872	943	22,000	22,000	23,000
• Pyrene	560	1000	1600	2330	2380	2400	54,000	54,000	54,000
ALIPHATIC HYDROCARBONS									
∞ C5-C6	30	55	110	30	55	113	3339(364	6200(664)	13,000(1150)
∞ C6-C8	73	160	370	73	162	371	8300(144)	18,000(322)	42,000(738)
∞ C8-C10	19	46	110	19	46	110	2130(78)	5100(190)	12,000(461)
∞ C10-C12 .	93(48)	230(118)	540(283)	93(48)	230(118)	540(283)	10,000(48)	24,000(118)	49,300(283)
∞ C12-C16	740(24)	1700(99)	3000(142)	745(2 7)	1700(99 1)	3040(142)	61 000(24)	63,000(99)	91,000(142)
• C16-35	45,000	64,000	76,000	89,000	89 000	89,000	1 800,000	1,800,000	1,800,000
AROMATIC HYDROCARBONS									
∞ C5-7 (benzene)	65	130	280	263	483	978	28,000(1220)	49,000(2 350)	90,000(4 710)
∞ C7-8 (toluene)	120	270	611	607	1290	2710	59,000(668)	110,000(1920)	190,000(4 350)
∞ C8-C10	27	65	151	33.2	80.7	189	3570(813)	8500(1900)	18,000(3880)
∞ C10-C12	68	160	348	177	417	895	17,000(364)	29,000(895)	34,500(2150)
∞ C12-C16	140	310	593	1250(188	1560(419)	1710	36,000(188)	37,000	37,800
• C16-C21	250	480	770	1340	1340	1340	28,000	28,000	28,000
• C21-C35	860	1110	1230						

Notes

a SGV (2009)

b LQM/CIEH values or derived using CLEAv1.06 with LQM/CIEH Data

c 2002 SGV values used until further guidance is published

d SGV for inorganic Hg used (ref 2009 SGV, Pg5, Para 4)

e Atkins ATRISKsoil Value

f Oral, dermal and inhalation exposure compared with Oral HCV

Values in brackets present TAC exceeding solubility & vapour saturation limits

GRM.TAC.03.11

UKDWS			EQS for List 1 & 2 Dangerous Substances (µg/l)	WRAS Values (mg/kg)
Parameter	Concentration	Units		
Acrylamide	0.1	µg/l		
Aluminium	200	µgAl/l		
Ammonium	0.5	mgNH4/l	15 (NH3)	
Antimony	5	µgSb/l		10
Arsenic	10	µgAs/l		10*
Benzene	1	µg/l	30	
Benzo(a)pyrene	0.01	µg/l		
Boron	1	mgB/l	2000	
Bromate	10	µgBrO3/l		
Cadmium	5	µgCd/l	5	3
Chromium	50	µgCr/l	32.8	25/ 600 (Cr(VI)/Total)
Chloride (i)	250	mgCl/l		
Conductivity (i)	2500	µS/cm at 20°C		
Copper(ii)	2	mg/l		
Cyanide	50	µgCN/l		25/ 250 (Free/Complex)
1, 2 dichloroethane	3	µg/l		
Epichlorohydrin	0.1	µg/l		
Fluoride	1.5	mgF/l		
Hydrogen ion	10	pH value		
Iron	200	µgFe/l	1000	
Lead (s)	25	µgPb/l		500
Manganese	50	µgMn/l		
Mercury	1	µgHg/l	1	1
Mineral Oil (TPH)	10	µg/l		100/10/1000 (diesel/petrol/mineral)
Nickel (ii)	20	µgNi/l		
Nitrate (s)	50	mgNO3/l		
Nitrite (s)	0.5	mgNO2/l		
Phenol	0.5	µg/l		5
Polycyclic Aromatic Hydroca	0.1	µg/l	10 (Naphtahlene)	50
Selenium	10	µgSe/l		3
Sodium	200	mgNa/l		
Sulphate (i)	250	mgSO4/l		2000
Tetrachloroethene and Trich	10	µg/l		
Tetrachloromethane	3	µg/l		
Toluene/Xylene (m, p, o)		µg/l	50/30	50
Vinyl chloride	0.5	µg/l		
Zinc	5000	µg/l		

Pesticides			
Aldrin	0.03	µg/l	0.01
Dieldrin	0.03	µg/l	0.01
Heptachlor	0.03	µg/l	
Heptachlor epoxide	0.03	µg/l	
other pesticides	0.1	µg/l	Endrin 0.005, Total*drins (0.03)
Pesticides: Total (vi)	0.5	µg/l	

Reference

UK Water Supply (Water Quality) Regulations 2000

* PAHs - sum of specified compounds
  - benzo(b)fluoranthene
  - benzo(k)fluoranthene
  - benzo(ghi)perylene
  - indeno(1,2,3-cd)pyrene

EQS for Hardness Related List 2 Dangerous Substances

Substance	EQS type	EQS (ug/l) for Hardness bands (mg/l CaCO3)					
		0-50	>50-100	>100-150	>150-200	>200-250	>250
Freshwaters, suitable for all fishlife							
Copper (dissolved)	Annual average	1	6	10	10	10	28
Copper (dissolved)	95th percentile	5	22	40	40	40	112
Nickel (dissolved)	Annual average	50	100	150	150	200	200
Vanadium (dissolved)	Annual average	20	20	20	20	60	60
Freshwaters, suitable for Salmonid (game) fish							
Chromium (dissolved)	Annual average	5	10	20	20	50	50
Lead (dissolved)	Annual average	4	10	10	20	20	20
Zinc (total)	Annual average	8	50	75	75	75	125
Zinc (total)	95th percentile	30	200	300	300	300	500
Freshwaters, suitable for Cyprinid (coarse) fish							
Chromium (dissolved)	Annual average	150	175	200	200	250	250
Lead (dissolved	Annual average	20	125	125	250	250	250
Zinc (total)	Annual average	75	175	250	250	250	500
Zinc (total)	95th percentile	300	700	1000	1000	1000	2000

Contaminant Thresholds for Subsurface Water Pipes

Contaminant	Thresholds (mg/kg)
Corrosion	
Wrapped Steel	pH<7 Cond >400µS/cm
Wrapped Ductile Iron	pH<5 Cond >400µS/cm, he not neutral
Copper	pH<5 >8 and Eh +ve
Toxic Substances	
Chromium (total) (Cr)	Applies to above pipe materials
Organic Contaminants	
VOC's	0.5 PE/0.125 PVC
BTEX & MTBE	0.1 PE/0.03 PVC
SVOC	2 PE/1.4 PVC
Phenols	2 PE/0.4 PVC
Cresols & Chlorinated Phenols	2 PE/0.04 PVC
Mineral Oil C11-C20	10 PE
Mineral Oil C21 - C40	500
Ether/Ketone/Amines, Nitrobenzene/Aldehydes	0.5 PE/0.02-1 PVC

Notes.

It is not recommended that water pipes should be laid in sites where these substances are identified or suspected

Local Utility Companies should be consulted prior to pipe specifications being finalised.

Ref: Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites. UKWIR Ref. No. 10/WM/03/21. 2010.