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PHASE 1: DESK TOP STUDY REPORT

PROPOSED DEVELOPMENT

LAND ADJACENT TO

ALRIC DRIVE

BARNSELEY

SOUTH YORKSHIRE

S71 5PG

Project No: 10-532

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Date: 05 / 11 /2010

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The information and/or advice contained in this Phase 1: Desk Top Study Report is based solely on, and is limited to, the boundaries of the site, the immediate area around the site, and the historical use(s) unless otherwise stated. This 'Report' has been prepared in order to collate information relating to the physical, environmental and industrial setting of the site, and to highlight, where possible, the likely problems that might be encountered when considering the future development of this site for the proposed end use. All comments, opinions, diagrams, cross sections and/or sketches contained within the report, and/or any configuration of the findings is conjectural and given for guidance only and confirmation of the anticipated ground conditions should be considered before development proceeds. Agreement for the use or copying of this report by any Third Party must be obtained in writing from Arc Environmental Limited (ARC). If a change in the proposed land use is envisaged, then a reassessment of the site should be carried out.

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1.0 Introduction

November 2010

Arc Environmental Limited has been instructed by Bernard William Associates on behalf of their client Yorkshire Housing to undertake a Phase 1: Desk Top Study Report for the development of an area of land adjacent to Alric Drive, Barnsley, South Yorkshire. The development will involve the construction of 30 no. residential dwellings.

The primary objectives of the report are to assess the geological and contaminated land conditions on and beneath the surface and a preliminary Conceptual Site Model (CSM) has been developed to define the scope and extent of any further investigation works deemed necessary, prior to commencing with any future redevelopment works.

2.0 Physical Setting

2.1 Site Details:-

Table 2.1

Site Name & Address:	Land adjacent to Alric Drive, Barnsley, South Yorkshire, S71 5PG.
National Grid Reference:	436720, 405720 – representing the centre of the site.
Description of Location:	The site is located east of Barnsley in an area called Cundy Cross, south of Pontefract Road and c.60m to the north of the River Dearne.
Site Boundaries:	Residential to the West, North and East. Open land and the River Dearne to the south (c.60m).
Site Shape & Development Details:	The site is an irregular shape c.0.88 Hectares (Ha) in size. The development involves building 30 no. residential dwellings.
General Topography:	According to anecdotal evidence there was subsidence on the south-east corner of the site and c.6-12 no. of the previous dwellings had to be demolished. Site walkover did show significant sloping to the south-east of the site.
Site Surfacing:	Predominantly recorded as unmanaged soft landscaping, with the remains of the old tarmac road still present on site. There is also a path which runs from the south-west of the site to where the site meets Alric Drive to the north.
Above Ground Structures:	Currently, there are no above ground structures.
Sub-surface Structures & Services:	There is the possibility of relic foundations / buried structures due to historic development on the site and there may be some services present associated with the historic and adjacent developments.
Summary of Recorded Historical Features:	According to archive plans, a development comprising 16 no. residential dwellings, was first recorded on plans dated c.1931, prior to this the site was undeveloped. According to anecdotal evidence the houses were demolished c.1994-c.1997 due to subsidence, though at this stage the reasons for subsidence are unknown. Since this time and according to archive plans the site has remained undeveloped.

3.0 Environmental Setting

3.1 Site Geology:-

The geological assessment for this site has been based on records produced by the British Geological Survey (BGS). The following documents have been reviewed as part of this study: -

- Sheet 87, Barnsley, England and Wales, Solid and Drift Edition, 1:50,000 Series.
- Sections of Strata of the Coal Measures of Yorkshire, together with a few sections in the neighbouring counties compiled from Records of Boring and Sinking By A Committee of the Midland Institute of Mining Engineers, 1927.

3.0 Environmental Setting (Cont'd)

3.1 Site Geology (Cont'd):-

3.1.1 Made Ground

There is no recorded evidence of made ground on the geological plans but there was evidence during the site walkover. Also, when considering the development on site and on adjacent sites, there is likely to be some made ground present, anticipated to be c.<2m.

3.1.2 Drift Deposits

British Geological Survey (BGS) plans indicate that the north of the site is free from drift geology, with the possibility of the very south of the site having some alluvial deposits which mainly consist of silts, clays, sands and occasionally natural 'peaty' deposits.

3.1.3 Solid Geology

The solid geology underlying the site comprises the Middle Coal Measures deposited during the Period of the Earth's history known as the Carboniferous, with Oaks Rock sandstone at rockhead level.

3.2 Coal Mining Assessment:-

According to BGS plans the site is situated in an area of known historic coal mining and is positioned directly over the Oaks Rock, sandstone rock unit, which is shown as outcropping / sub-cropping beneath the site. In accordance with the BGS generalised vertical section (GVS), the shallowest coal seam present beneath this site is recorded as the Swinton Pottery seam, recorded within the mudstone strata, c.7m below the base of the Oaks Rock unit.

BGS plans indicate the presence of an abandoned mine shaft c.500m SW of the site. This mine shaft relates to Barnsley Main (Old Oaks) Colliery and is positioned within a similar geological setting as this site, with the Oaks Rock unit recorded outcropping at the surface. Mine shaft records from this Colliery, details the vertical section of the shaft and indicates that the shallowest worked coal seam is the Newhill seam, recorded at c.56.7m bgl's, made up of several coal, shale and dirt bands, up to a total recorded thickness of 1.98m, suggesting the Swinton Pottery seam may be absent in this part of Barnsley.

A Coal and Brine Report has been obtained from the Coal Authority in order to assess the risks posed to the site area with respect to shallow mining. This can be seen in Appendix III.

The Coal and Brine Report concludes that there are records relating to coal workings below the site in 10 seams of coal at 140m to 590m depth, and last worked in 1983.

Whilst the Coal Authority have no records relating to recorded or known workings within the Swinton Pottery seam we cannot be certain at this stage, without the benefit of intrusive works that workings within the Swinton Pottery seam have gone unrecorded and if unrecorded workings are present there may be a risk to this site in terms of future instability issues.

At this stage, although we feel there is a low risk of subsidence from ancient shallow workings causing crown hole formation at the surface, this cannot be fully discounted from the data to hand and as such it would be beneficial to employ appropriate investigation techniques prior to redeveloping the site.

3.0 Environmental Setting (Cont'd)

3.3 Site Hydrogeology:-

Table 3.1

STRATA	Aquifer / Soil Leachability EA Classification	Comments
Made Ground:	Recorded as Soils of High Leaching Potential (U).	Soil information for restored mineral workings and urban areas is based on fewer observations than elsewhere. Subsequently, a worst case vulnerability classification (H) is assumed, until proven otherwise.
Drift Geology:	Majority of the site is recorded as free from drift and is unclassified but the southern portion of the site is a Secondary A Aquifer	The secondary aquifer classification refers to the permeable drift deposits comprising alluvium, likely to consist of sands, gravels, etc. with high permeability and water retention.
Solid Geology:	Secondary A Aquifer	These will be fractured or potentially fractured rocks, which do not have a high primary permeability. Although not producing large quantities of water for abstraction, they are important for local supplies and in supplying base flow to rivers.

- The site does not fall within a source protection zone (SPZ)

3.4 Site Hydrology:-

Table 3.2

SURFACE WATER FEATURE	Location	Comments
GQA Classified River	One recorded within c.250m.	River Dearne is classified overall as River Quality C.
Unclassified Watercourse(s), Canals, Ponds & Lakes	None recorded within c.250m.	~
Flooding	The site is shown to fall outwith the designated Flood Zone II & III.	Although not within the flood zones, the site is positioned directly adjacent to a Flood Zone II, associated with the nearby River Dearne. It is recommended that further consultation with the LA and EA should be made with respect to the potential for flood events in this area and to establish local knowledge of periodic flooding, standing water or poor drainage problems. In addition to this, in accordance with 'Town and Country Planning' this development is a major development, due to the site having an area of more than 0.5 Ha and there being more than 10 dwellings on the site. Therefore a site specific Flood Risk Assessment may be required.
RAINFALL	Measurements (mm)	Comments
Annual	824.7	Based on 'station average' records from Sheffield: 1971-2000.
Precipitation, January	86.5	
Precipitation, July	51.0	

3.5 Radon Assessment:-

The site lies in an area where between 1 & 3% of homes are above the action level, in accordance with the British Geological Survey (BGS), National Geoscience Information Service and their assessment suggests that the site does not require any radon protection measures for new dwellings.

3.0 Environmental Setting (Cont'd)

3.5 Radon Assessment (Cont'd):-

This corresponds with the BRE Digest, BR211 (2007) Radon: Guidance on protective measures for new buildings, the site is situated within a clear grid square (1km), and therefore **NO** radon protective measures are required for the site.

4.0 Industrial Setting

4.1 Recent Site History:-

Copies of old survey plans covering this site area and adjacent land are included in Appendix II, and a summary of the site history based on these plans is provided below and on the following page (Table 4.1).

Table 4.1

Date	Scale	Site	Adjacent Areas
c.1854- c.1855	1:10,560	The site is undeveloped.	The site is located in a rural area with some minor settlements and the Dearne River c.60m south of the site. Adjacent sites are also undeveloped. The Dove canal (c.200m) and railway lines (c.500m) recorded to the south and the Barnsley Canal (c.300m) to the north-west. Remains of Monk Bretton Priory to the East. Various quarries around the site (beyond c.250m).
c.1894	1:2500 & 1:10,560	Generally as c.1854-c.1855.	There are now two more, railway lines . One recorded c.400m west of the site trending east to north and one recorded c.500m east of the site trending north to south. Stairfoot to the south-east has expanded (residential dwellings, infrastructure etc.) and there is a smaller settlement of Hunningley. Adjacent sites remain undeveloped. Old Oaks Colliery is recorded c. 600m to the SW of the site. Filter beds to the south of the site appear to be connected to 'Almshouses'.
c.1906- c.1907	1:2500 & 1:10,560	Generally as c.1892-c.1894.	Filter beds now labelled ' filter pits '. Continued extension of the railway network associated with the industrialisation of the area. Hunningley has greatly expanded with a residential expansion. Along with some other smaller settlements. Sewerage farm to the south of the site (across the river).
c.1931- c.1932	1:2500 & 1:10,560	Residential housing, 16 no. dwellings , recorded across the site as part of the 'The Square'.	Sewerage farm expanded, now adjacent to the south side of the site as well as a sewerage pumping station . Old Oaks Colliery now recorded as Barnsley Main Colliery and has expanded to within c.500m of the site. Continued residential development recorded within the vicinity of the site to the north-west, north-east and north named as 'Cundy Cross' and 'Lundwood'.
c.1938- c.1955	1:10,560 & 1:10,000	Generally as c.1931-c.1932.	Continued residential development and associated infrastructure within the locale. Quarry to the south west is now a refuse tip (unlabelled) (c.600m).
c.1961- c.1966	1:1,250 & 1:10,000	Generally as c.1938-c.1955.	Sewerage farm and pumping station and no longer on the maps. Further residential expansion in the south. Evidence of a tip to the north (unlabelled) (c.700m).
c. 1974	1:10,000	Generally as c.1961-c.1966.	Quarry south west of the site is now labelled ' Tip (disused)' (c.600m). Unlabelled northern tip has expanded (c.700m). And further residential expansion north west of site.
c.1984	1:10,000	Generally as c.1974.	Both refuse tips no longer on the map. Majority of the railways to the west and east have been dismantled.
c.1993	1:2,500 & 1:10,000	Generally as c.1984.	All but one railway now dismantled (in the south-west) (c.500m).

Significant features/potential contamination sources highlighted in **bold** text.

4.0 Industrial Setting (Cont'd)

4.1 Recent Site History (Cont'd):-

Table 4.1 (Cont'd)

Date	Scale	Site	Adjacent Areas
c.1994- c.1997	1:1,125	'The Square' is no longer recorded and the residential houses have been demolished, the site is free from development.	Generally as c.1993.
c.2000- c.2010	1:10,000	Generally as c.2000.	Generally as c.1994-c.1997.

Significant features/potential contamination sources highlighted in **bold** text.

4.2 Landfill & Waste:-

The following information relating to landfill and waste has been obtained from the Landmark Information Group, the Environment Agency and from the walkover survey completed;

- There are two Local Authority Recorded Landfill Sites recorded on or within c.250m of the site, one of which is adjacent to the south-east boundary of the site and the second is c.217m to the south-east. Recorded either side of Grange Lane. However, there are no details listed within the Envirocheck Report relating to these entries.
- There are two Historical Landfill Sites recorded on or within c.250m of the site, these entries appear to be positioned at the same locations as the Local Authority Recorded Landfill Sites. Details are that they have received inert and commercial waste.
- Two Registered Landfill Sites are recorded on or within c.250m of the site, the first entry relates to the site adjacent to the south-east boundary and the second to the edge of a 250m buffered zone associated with a landfill site recorded c.286m to the south of this site.
- One Licensed Waste Management Facility and one Registered Waste Treatment / Disposal Site are recorded on or within c.250m of the site. Both operated by the same organisation and are recorded as scrap yards (metal recycling), it is anticipated that the entries relate to the same site.

4.3 Statutory Requirements / Authorisations:-

Table 4.2

TYPE	Location	Comments
Local Authority Pollution Prevention and Controls	One recorded within c.250m.	Permit related to extracting non-ferrous metals for scrap, recorded c.249m S of the site and not considered to be a risk to the site or its future development.
Local Authority Integrated Pollution Prevention and Control	None recorded within c.250m.	~
Registered Radioactive Substances	None recorded within c.250m.	~
Prosecutions Relating to Authorised Processes	None recorded within c.250m.	~
Enforcement and Prohibition Notices	None recorded within c.250m.	~

4.0 Industrial Setting (Cont'd)

4.3 Statutory Requirements / Authorisations (Cont'd):-

Table 4.2 (Cont'd)

TYPE	Location	Comments
Planning Hazardous Substances Consents/Enforcements	None recorded within c.250m.	~
COMAH Sites	None recorded within c.250m.	~
Contemporary Trade Entries	Ten recorded within c.250m.	Six are inactive and none are within c.100m of the site. Therefore, none are considered to represent a risk to the site or its development.
Fuel Station Entries	One recorded within c.250m.	Site is more than c.100m from the site so is therefore not considered as a risk to the site or its development.

4.4 Pollution Incidents and Discharge Consents:-

Table 4.3

TYPE	Location	Comments
Discharge Consents	Seven recorded within c.250m.	None attributable or within c.150m of the site. Not considered a risk to the site or its development.
Water Industry Act Referrals	None recorded within c.250m.	~
Prosecutions Relating to Controlled Waters	None recorded within c.250m.	~
Pollution Incidents to Controlled Waters	Twelve recorded within c.250m.	Majority recorded as minor incidents and none are attributable to this site or are considered to represent a risk to this site or its proposed development.
Substantiated Pollution Incident Register	None recorded within c.250m.	~

5.0 Conceptual Site Model (CSM)

The Conceptual Site Model (CSM) is one of the primary planning tools that can be used to support the decision making process of managing contaminated land and groundwater on any given site, and allows a better understanding of what needs to be done to achieve risk management, and from this appropriate remediation techniques, if required for those risk management goals can be chosen. This can be done by undertaking a *source-pathway-receptor* analysis of the site. The anticipated *sources*, *pathways* and *receptors* for this site are summarized in Table 5.1 below.

Table 5.1

<i>Sources (S)</i>		<i>Pathways (P)</i>		<i>Receptors (R)</i>	
S1	Made ground of unknown source	P1	Ingestion	R1	Human health (Users and construction workforce)
S2	Hazardous assorted adjacent site ground gas (landfill)	P2	Inhalation of indoor / outdoor air	R2	Groundwater (Secondary A Aquifer)
S3	Stythe gas rise could also represent a risk if shallow coal workings are present below the site.	P3	Dermal contact	R3	Building materials*
		P4	Migration through existing services	R4	Adjacent sites
		P5	Direct contact with building materials	R5	Flora and fauna*
		P6	Surface run off and leachate Migration		

* = Not included in the Human Health & Controlled Waters Risk Assessment

5.0 Conceptual Site Model (CSM) (Cont'd)

A graphical representation of the CSM has been produced for this site and is attached in Appendix IV which sets out the critical pollutant linkages of concern for this particular site, with regard to contamination.

5.1 Geotechnical Considerations:-

The following potential geotechnical issues and hazards have been identified for this site, and these issues should be considered before future development of the site is to take place.

- According to anecdotal evidence the former residential dwellings had to be demolished due to subsidence, therefore, assessment and investigation will be required.
- Actual depth, origin, variability and condition of made ground present on site.
- Lateral support could be needed if localised significant thickness of made ground are present below the site.
- Variable Ground, with alluvium below the southern portion of the site and bedrock at the surface below the northern portion.
- Potential for shallow coal workings within the Swinton Pottery seam.
- Control of surface drainage.
- Geotechnical parameters of natural clay deposits encountered across the development area.
- Problems relating to the creation of deep excavations for drainage / sewers and the like, if competent bedrock is present at shallow depths below the site.
- Possible subsurface structures – services from previous / current housing development housing etc.

In order to determine the geotechnical considerations above with more certainty, it is recommended that boreholes and associated testing are carried out on this site in addition to gas and ground water monitoring. These should take place prior to commencing with any developments in the future. Following this work detailed foundation proposals for future structures can then be prepared.

The information reviewed indicates that the site can be considered as being located within a
MODERATE - HIGH geotechnical risk setting.

5.2 Sources of Contamination and Probable Contaminants:-

The historical Ordnance Survey maps and other environmental information have not revealed any potential sources of heavy or gross ground contamination on or adjacent to this site. However, a number of on-site contaminative issues have been highlighted and these are listed below:-

- Potential areas of made ground present on site from unknown sources.
- Hazardous ground gases from off-site sources – current and historic landfills on adjacent land.
- Stythe gas rise from below the site where coal workings may be present.

It is therefore concluded, that ground contamination testing with groundwater and gas monitoring will need to be incorporated into the design of any intrusive investigation works. Laboratory testing should also be undertaken on representative samples taken from site for naturally occurring contaminants which could have a detrimental effect on building materials.

In consideration of the above and when taking into account the guidance contained in the DEFRA and EA Contaminated Land Reports and the appropriate DoE industry profiles, it would be prudent to test samples of soil from this site for a range of contaminants, as shown on the following page;

5.0 Conceptual Site Model (CSM) (Cont'd)

5.2 Sources of Contamination and Probable Contaminants (Cont'd):-

Soils – Human Health:

Typically comprising; *Arsenic, Cadmium, Chromium (total, III & VI), Copper, Lead, Mercury, Nickel, Selenium, Zinc, Cyanide, Total Organic Carbon (TOC) and Asbestos; due to demolition of former residential dwellings.*

Additional contamination screening for Polycyclic Hydrocarbons (PAH's) should also be undertaken if there is evidence of ashy debris. At this stage, there is currently no requirement for Total Petroleum Hydrocarbons (TPH's) screening, as there are no potential sources identified to date, this may be subject to change if any petrol / oils etc. are found on the site.

The information reviewed indicates that the site can be considered as being located within a
LOW-MODERATE ground contamination risk setting for Human Health.

Groundwater / Leachate – Controlled Waters:

Typically comprising; *Arsenic, Boron, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Zinc, Sulphate, Sulphide & Cyanide*

The area is underlain by a 'Secondary A' aquifer contained within the solid geology and within the alluvial drift deposits, where present on site (southern edge of the site). The site is not located within a Source Protection Zone (SPZ) relating to groundwater abstractions.

If the made ground on site has elevated levels of contaminants present, based on the soil screening carried out, then targeted leachate screening can be completed and the risk to controlled waters should be assessed. This can be carried out on an individual analyte by analyte basis.

The information reviewed indicates that the site can be considered as being located within a
LOW -MODERATE ground contamination risk setting for Controlled Waters.

5.3 Preliminary Risk Assessment Summary & Recommendations:-

Human Health – There may be a risk to human health where made ground is recorded on site, due to the possible presence of generic contaminants within these materials.

Controlled Waters – At this stage it is considered that groundwater beneath the site could also be at risk from possible on-site contamination, if present and / or sufficiently mobile.

Therefore, it is recommended that a Phase 2: Ground Investigation (intrusive investigation) is completed for this site to determine if any ground contamination and / or gases are present on the site which could pose a risk towards the proposed end users or the environment. This investigation should be completed prior to commencing with any future developments and should include for the following or similar investigation works;

- A series of boreholes and trial pits, including in-situ geotechnical testing (SPT testing) and sampling to assess with slope stability issues and help aid with future foundation design and to collect samples for subsequent laboratory testing.

5.0 Conceptual Site Model (CSM) (Cont'd)

5.3 Preliminary Risk Assessment Summary & Recommendations (Cont'd):-

- A series of Rotary Boreholes to prove 20m of competent rock, in order to confirm risk posed to the site from shallow coal workings.
- Installation of a minimum of 3 no. combined groundwater and ground gas monitoring standpipes with an appropriate number of visits in accordance with CIRIA C665. These can be incorporated with the boreholes.
- Laboratory geotechnical testing (i.e. particle size distribution (PSD), plasticity, organic matter content, pH & soluble sulphate testing, etc.).
- Generic soil contamination screening on selected samples - where made ground is recorded on site – typical contaminants detailed in Section 5.2.
- Generic leachate contamination screening on selected samples - where made ground is present on site and elevated are recorded within the soils.
- Site supervision and production of a factual and interpretive Phase 2: Ground Investigation Report, including a Level 1 Ground Contamination Risk Assessment.

The samples of soil collected should be forwarded to UKAS and MCERTS accredited laboratory to undertake the recommended testing.

End of Report

GENERAL REFERENCES

- British Geological Survey: Maps, Reports, Memoirs, etc.
 - Sheet 87, Barnsley, England and Wales, Solid and Drift Edition 1:50,000 Series.
- DoE, DEFRA & EA - Contaminated Land Reports

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CLR 2: Guidance on preliminary site inspection of contaminated land. Report by Applied Environmental Research Centre Ltd. Volume 1. DoE, 1994

CLR 3: Documentary research on industrial sites. Report by RPS Group plc. DoE, 1994

CLR 4: Sampling strategies for contaminated land. Report by The Centre for Research into the Built Environment, The Nottingham Trent University. DoE, 1994

CLR 5: Information systems for land contamination. Report by Meta Generics Ltd. DoE, 1994.

CLR 6: Prioritisation & categorisation procedure for sites which may be contaminated. Report by M J Carter Associates. DoE, 1995

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Science Report Final SC50021/SR3: Updated Technical Background to the CLEA Model, 2009

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- BS10175:2001: Code of Practice for the Investigation of Potentially Contaminated Sites
- BS5930:1999: Code of Practice for Site Investigations
- Guidance on Investigation and Assessment for Contaminated Sites (CIRIA SP:103)
- BRE Digest BR211(2007): Radon: Guidance on Protective Measures for New Buildings
- Guidance for the Safe Development of Housing on Land Affected by Contamination, R&D66, 2008 (NHBC, EA, CIEH)
- Methane and Associated Hazards to Construction - CIRIA Reports 149,150,151 & 152
- Assessing Risks Posed by Hazardous Ground Gases to Buildings, CIRIA C665, 2007
- BS8483: 2007: Code of Practice for the Characterization and Remediation from Ground Gas in Affected Developments
- CIRIA Report C624 'Development and flood risk – guidance for the construction industry' and Planning Policy Statement 25 (PPS25)#
- The Town and Country Planning (flooding) (England) direction 2007
- <http://maps.environment-agency.gov.uk/wiyby/>
- Sections of Strata of the Coal Measures of Yorkshire, together with a few sections in the neighbouring counties compiled from Records of Boring and Sinking By A Committee of the Midland Institute of Mining Engineers, 1927.