Pro-Soil Surveys
Geotechnical and Environmental

BARNSLEY RUFC

SHAW LANE, BARNSLEY

REPORT ON A SITE INVESTIGATION

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1. INTRODUCTION

This investigation has been carried out for Barnsley RUFC, at the request and to the direction of Nuttall Yarwood and Partners for a proposed redevelopment of the sports complex. It is understood that it is proposed to replace the existing club house with a new building incorporating indoor tennis and squash courts (Nuttall Yarwood and Partners drawing reference 25L-34, drawing number 27, July, 1996). Rugby pitches are to be realigned together with the provision of football pitches and additional bowling greens. There is to be an all-weather floodlit playing area together with outdoor tennis courts. The most northerly football pitch is to be regraded and converted to an archery field. The vehicular access from the east will be extended west and north together with the provision of additional car parking spaces. To these ends, a ground investigation has been carried out to provide geotechnical information for the subsoils together with appropriate laboratory testing and incorporates a limited range of testing for contamination. The work also includes a mining investigation.

2. THE SITE

2.1 Location and Topography

The site, at NGR SE 333 059, lies 1.5 kilometres west of Barnsley town centre and comprises playing fields and associated buildings and is accessed from Shaw Lane to the east, with Holgate Secondary School also to the east. Broadway Park, A6133, passes to the west and south of the site.

The site falls 20 metres from west to east in a series of plateaux which form playing fields and pitches and, within the central eastern part of the site, there are squash courts, a bowling pavilion, and a clubhouse.

2.2 Geology

British Geological survey sheet number 274 SE, County Series, 6 inches to 1 mile, indicates sandstone of the Middle Coal Measures Series beneath the site. The Barnsley Coal seam, which outcrops on the western boundary of the site, dips to the east and beneath the site. Two adits are shown at the outcrop.

West of the outcrop, an exposure in a clay pit records the following:-

poor brown sandstone	10 feet
grey shale with ironstone balls and layers	24 feet
coal	10 inches
fireclay	not given

There is no record of drift deposits across the site.

2.3 Mining

A Coal Authority mining report (Appendix A, reference 44/3305 SR157994-96, dated 16 August, 1996) states that the property is within the likely zone of influence on the surface from 9 seams of coal at shallow to approximately 400 metres depth, the last date of working being 1972.

There are 3 mine entries (2 adits and 1 shaft) recorded in, or about, the north-western corner of the site, but there is no record of what steps, if any, were taken to treat the mine entries. There may also exist unrecorded mine entries in the locality.

The report states that there is no fault or other line of weakness noted at the surface which could affect the stability of the property.

A damage notice or claim for alleged subsidence damage was given, made or pursued in June, 1987, which was discharged by repair.

With the exception of the rugby pitch on the mid-southern boundary, which is understood to have had coal extracted during its construction, the site is unaffected by opencast mining.

3. METHOD OF INVESTIGATION

3.1 Fieldwork

Eighteen trial pits were excavated with a wheeled hydraulic backhoe excavator to depths of between 1.5 and 4.1 metres on 29 and 30 August, 1996. The materials encountered were described and samples recovered for laboratory testing.

In addition, 7 boreholes were put down by rotary percussive openhole techniques to depths of between 6.0 and 10.0 metres on 12 September, 1996. The purpose of the boreholes was to establish the depth to coal beneath the site and to assess the extent of shallow mine workings. An additional borehole was utilised to profile backfill to a mineshaft found during trial pit excavations.

The locations of the trial pits and boreholes are shown on the site plan, Figure 1.

3.2 Laboratory Testing

The following geotechnical tests were carried out on samples recovered from the trial pits:-

- Moisture content determinations on 14 samples
- Classification (Atterberg limits) tests on 4 samples
- Density determinations on 6 samples (recompacted with a 2.5kg rammer)
- Compaction tests (2.5kg rammer) on 2 samples
- Sulphate and pH determinations on 5 samples

Chemical analyses were carried out on soil samples for the following determinands (generally to ICRCL 59/83, second edition, Table 3):-

- Arsenic
- Cadmium
- Chromium (total)
- Lead

- Mercury
- Selenium
- Copper
- Nickel
- Zinc
- pH

4. RESULTS OF THE INVESTIGATION

4.1 Soil Profile (Trial Pits)

Detailed descriptions of the materials encountered, with observations of groundwater and excavation stability, together with sampling information are given on the trial pit records (Appendix B).

A brief and summary description of the materials is given below:-

Topsoil

Topsoil was proved in trial pits 1 to 10, generally as a 0.1 metre cover, but with 0.5, 0.2 and 0.3 metre thicknesses in trial pits 5, 8 and 10 respectively. In trial pit 6, a second layer of topsoil was encountered between 0.7 and 0.9 metre depths.

Made Ground

Made ground was proved in trial pits 1, 2, 4 to 6, and 11 to 18, to depths of between 0.15 and 4.1 metres (trial pits 15 and 1 respectively, in this latter to the base of the trial pit). The made ground strata principally comprise materials derived from Coal Measures strata as mixtures of clays, silts, sands, and gravel to cobble size sandstone and mudstone, and are generally compact or stiff.

In trial pits 11 and 16, ash, slag, glass, china and bottles were noted as a distinct stratum. Trial pit 17, in an area of hardstanding, exposed coated macadam over black ash and slag to 0.15 metre with firm brown and orangey brown gravelly sandy silty clay made ground to 0.4 metre.

In trial pit 10, a 2 metres diameter shaft was exposed, backfilled with colliery waste. Dimensions to the centre of the shaft are given on Figure 1.

Clay Subsoils

These were encountered as generally firm to stiff and stiff variably sandy, variably gravelly silty clays in trial pits 2, 3, 5 to 7, 10 to 13, and 15 to 18, to depths of between 0.4 and 2.4 metres (trial pits 3 and 13 respectively). The clay was noted as soft in trial pit 13 over mudstone below 2.4 metres depth.

In trial pit 15, a band of coal was noted between 0.6 and 1.5 metres depths within clay horizons.

Bedrock

Bedrock was proved principally as weak thinly to thickly laminated mudstone to depths of between 1.2 and 3.2 metres (trial pits 17 and 2 respectively). The material varies as a stiff clay or was recovered as gravel to cobble size mudstone fragments.

In trial pits 3, 4 and 5, a weak thinly and thickly laminated fine and medium grained sandstone, recovered as sand and gravel, was proved to depths of between 1.6 and 3.1 metres (trial pits 3 and 4 respectively).

4.2 Groundwater

The excavations remained dry for their brief period of opening.

4.3 Excavation Stability and Progress

Acceptable excavation progress was achieved in the made ground and natural strata with a wheeled hydraulic backhoe excavator (JCB 3CX).

The excavations remained stable for their brief period of opening, except in made ground horizons in trial pits 10, 11 and 16.

4.4 Laboratory Tests

Geotechnical Testing

Classification (Atterberg limits) tests carried out on cohesive strata, Table 1, gave plasticity indices in the range 25 to 40% (4 tests) and suggest clays of medium shrinkage potential (NHBC Practice Note 3, 1985).

The dry density/moisture content relationships (Figures 2.1 and 2.2), summarised as Table 2, indicate maximum dry densities of 1.64 and 1.65Mg/m^3 with optimum moisture contents of 14 and 15% respectively (2.5kg rammer method). Samples have also been compacted at their as-received moisture content and these results are included in Table 2. Dry densities have been achieved in the range 1.6 to 1.94Mg/m^3, with moisture contents in the range 11 to 23%. A sample of ash from trial pit 11, produced a dry density of 0.99Mg/m^3 at a moisture content of 24%.

The results of sulphate and pH determinations, Table 3, indicate sulphate concentrations of between 0.04 and 0.09% with pH values in the range 6.3 to 8.9 indicating BRE Digest 363 Class 1 conditions.

Chemical Testing

The results of the chemical testing are presented as Table 4, contamination test results, and are discussed below.

The tentative trigger concentrations for selected contaminants as specified in the Department of the Environment document Interdepartmental Committee on the Reclamation of Contaminated Land (ICRCL) guidance note 59/83, second edition, together with the GLC Classification, are included as Appendix D.

In view of the proposed end use comprising sport halls and covered recreational facilities together with outdoor sports facilities, the concentrations of the determinands in the samples are compared with the ICRCL 59/83 trigger levels for open space, buildings and hard cover.

Of the determinands, the threshold trigger levels are only exceeded for arsenic and the phytotoxic elements (harmful to plants, not normally hazardous to health), copper, nickel and zinc, and are principally concentrated in the sample of ash from trial pit 11. There are no action levels given for Table 3 contaminants. The threshold value for arsenic (40mg/kg) was exceeded in 2 of the 4 samples tested with values of 82.6 and 204.9mg/kg (trial pits 4 and 11 respectively). The threshold values for copper, nickel and zinc (130, 70 and 300mg/kg respectively) were all exceeded in a single sample of ash from trial pit 11, at 375.7, 95.9, and 342.5mg/kg respectively. pH values were in the range 6.2 to 7.0.

4.5 Mining

Descriptions of the materials encountered within the boreholes together with general drilling observations are given on the borehole records (Appendix C). In view of the drilling techniques used, only the main strata types can be identified with mine workings indicated by a change in the drill behaviour, the rate of drilling and loss of returns. A brief description of the materials encountered is given below.

Except for borehole 6, sandy mudstone was proved to depths of between 3.1 and 10.0 metres, boreholes 1 and 8 respectively.

In borehole 6, sandstone was proved between 7.1 and the base of the borehole at 8.0 metres, beneath opencast backfill. It is understood that this area was locally opencast to recover coal at shallow depth whilst regrading the land to provide a playing field. Sandstone was also proved in borehole 2, between 8.4 metres depth and the base of the borehole at 10.0 metres.

Coal was proved as a solid 2.5 metres thickness stratum in boreholes 5 and 7, at 6.1 metres depth. Coal was also proved in borehole 1 at 3.1 metres depth but its thickness was not proved due to loss of flushing returns following a tool rod changeover. Voids and broken ground were proved in boreholes 2, 3 and 4, at depths of between 2.9 and 6.6 metres (boreholes 4 and 2 respectively), and observed to extend vertically for 1.3 metres (borehole 3) and 3.0 metres (borehole 4).

Borehole 8 was sited to profile the mine shaft exposed in trial pit 10. This proved backfill to 7.4 metres with intact mudstone proved below to 10 metres depth. There were traces of poor quality coal at 8.4 metres.

5. DISCUSSION

Details of the proposals are given in the introduction; existing structures are to be replaced together with the provision of new structures, playing fields are to be realigned and regraded and new playing areas to be provided, the latter involving cut and fill up to 2 metres depth.

5.1 Contamination

Although care was taken to site the trial pits to allow optimum coverage of the site, it is possible that areas of contamination may exist which have not been identified.

In assessing the environmental impact of the concentrations of the various contaminants investigated, it must be appreciated that, even though the threshold trigger concentrations may be exceeded in parts of the site, this does not automatically mean that there is a need to undertake remedial works but to consider whether the presence of the contaminant justifies taking remedial action for the proposed end use of the site. However, the action trigger concentration is considered as the more significant parameter for determining the need for remedial action.

From the testing carried out it would appear that contamination at the site is restricted to ash horizons which have slightly elevated concentrations of arsenic, copper, nickel and zinc. It should be noted that no action levels are given. Consequently, in view of the proposed end use, essentially sports fields, hardstandings, and buildings, it is considered that the general risk to health from contaminants to construction workers is not particularly significant provided that good personal hygiene procedures are adopted, and to proposed end users if any ash exposed during the regrading works is provided with a 500mm clean cover. Additionally any ash deposited in landscape areas should be given a clean cover of 500mm.

If any made ground material is to be removed from site, the materials, as tested, generally fall into the GLC range of classification (Appendix D) classes A and B, uncontaminated to slightly contaminated, and may incur slightly enhanced disposal

costs. Material such as the ash encountered in trial pit 11 has isolated determinands falling into GLC Classes B to D, slightly to heavily contaminated and disposal of material would be subject to discussion with the Environment Agency and waste receivers.

5.2 Shallow Mining

The Barnsley coal seam outcrops on the west of the site and dips beneath the site and, from the evidence of the boreholes, has been worked and requires treatment by pressure injection grouting in order to stabilise the ground beneath the proposed building footprints.

With regard to the mineshaft exposed in trial pit 10, it would appear that this has been backfilled to its base, at about 8 metres. In view of this it is considered that no further treatment is necessary except for filling of any slight depression at the surface which may occur as a result of settlement of the backfill. Elsewhere, within and adjacent to the north-west boundary of the site, the Coal Authority report indicates 2 adits together with a mine shaft, which dependent on the proposed use may require locating and stabilising. Similarly, there may be other mine entries within the site which may also be exposed during the works which, dependent on their treatment following abandonment and proposed site use, may also require treatment.

5.3 Foundations

The proposed buildings are located in the south-eastern part of the site and generally stiff clays or weak mudstone will be present at foundation level with depths varying from near the surface to about 1.5 metres depth. For design purposes it is recommended that an allowable bearing pressure of 150kN/m^2 be adopted overall with settlement expected to be less than 25mm. It should be noted that borehole 6, sited south of the proposed clubhouse and changing rooms recorded backfill to 7.1 metres possibly reflecting some localised coal working. Consequently, it is possible that in this area either a localised piled or ground treatment solution may be necessary. It is recommended that, prior to finalisation

of any design, the proposed building is set out and some additional trial pitting be carried out in this location to establish the foundation conditions.

Where strip foundations span mudstone and clay substates some reinforcement should be incorporated into the foundation to mitigate against the effects of any discrete settlement which may occur.

5.4 Earthworks

5.4.1 Acceptable Fill

As part of the overall scheme some regrading is to take place across the site with cutting and filling of up to 2 metres taking place beneath playing areas. Consequently, the proposed filling is unlikely to be subjected to structural loading. The density testing carried out suggests that the materials at the site are generally suitable for recompaction with 95% of maximum dry density achievable for the most part. Materials should be compacted in thin layers (maximum 250mm) in order to ensure adequate compaction.

5.4.2 Excavations

No difficulty was found in advancing the excavations through the strata at the site with a conventional hydraulic backhoe excavator to the anticipated cutting and foundation depths.

All the excavations remained dry for their brief period of opening. Consequently, little ingress of groundwater into excavations is anticipated except following prolonged rainfall and which should be controlled by intermittent pumping from sumps.

Full support is likely to be required through made ground horizons, with nominal support in natural strata.

5.5 Protection of Buried Concrete

BRE Digest 363, 1996, class 1 sulphate concentrations were determined for samples from the site, with near-neutral pH values. Consequently, there is no precaution required in respect of buried concrete.

[redacted]

R Aldridge BSc CPhys MInstP

SHEET 1 OF 1 | **RECORD OF BOREHOLE** | **7**

Type and Diameter of Boring

Rotary percussion

100mm diameter openhole air flush

Location

BARNSLEY RUFC, SHAW LANE,

BARNSLEY

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Ground Level 130.30 m(OD)

Sample/Test Depth (m)	Sample/Test TYPE	Drilling and Casing Progress	Water Level	'N' Value Core Rec. and (RQD)%	Description of Strata	Depth (m)	Level m (OD)	Legend
					MADE GROUND, ash.	1.40	128.90	
					Brown sandy MUDSTONE.	5.90	124.40	
					Grey sandy MUDSTONE.	6.10	124.20	
					COAL.	8.60	121.70	
		12.09.96			Grey sandy MUDSTONE.	9.00	121.30	

Remarks

Solid, good returns throughout.
Borehole dry.

Client/Contractor

BARNSLEY RUFC

Pro-Soil Surveys

Scale 1:50

Report 6/0121

17
18
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12
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16
6

WORK CARRIED OUT

Optima Foundations Limited

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Our ref: T3074

18 June 2008

FAO Mr P Thompson
Linwood
Barnsley Road
Dodworth
Barnsley
S75 3JR

Dear Pete

RE: BARNSLEY RUGBY CLUB, SHAW LANE

We thank you for your valued enquiry and have pleasure in submitting our proposals and quotation for your consideration.

We understand that you require a system of drilling and grouting at the above site.

We propose to drill a series of grout injection holes and a regular 3.0m grid pattern over the site. Each hole will be drilled to a depth of 1.0m below the coal seam / workings.

We have assumed open hole drilling, we have not included for any casings if required.

Initially grout injection pipes will be inserted for the full depth drilled in the perimeter holes around each plot and a comparatively thick cement based grout injected at carefully controlled pressures as the injection pipes are slowly raised to the surface. The object of the procedure would be, as far as possible, to form a grout barrier around each plot to contain subsequently injected grout into the infill area. On completion of barrier holes a thinner and more penetrative grout will be injected in the infill holes.

In this manner all loose and open zones will be consolidated as far as practically possible, and the risk of settlement of properties built on the site due to this cause will be minimised. We would however point out that our work is designed to deal with the worked coal measures only, if there is any weak strata between this level and the ground surface, additional precautions may be required in the design of the building foundations.

We have based our tender on use of a 10:1 PFA/OPC grout mix, but this may be varied according to conditions encountered. In particular sand may be incorporated into the mix if larger than anticipated grout takes are experienced.

Our prices are based upon payment being on the basis of delivery ticket weights of materials supplied and injected.

You will appreciate that it is difficult to accurately estimate the grout quantity that may be required on site. Our tender estimate is based on a nominal grout quantity of 250.0T for tender purposes.

Our schedule of rates is based on use of a 75mm hydrant supply of water. We understand that a maximum supply of 20mm will be permitted on site. As discussed we may have to revise our schedule of rates if the water supply is not adequate.

We have based our quotation on our present assessment of information given to us and this may be varied in accordance with conditions actually encountered during the course of the works.

We would require that you make all necessary applications to the appropriate authorities to obtain all necessary approvals/permissions in respect of the proposed works including compliance with the Party Wall Act if applicable.

Before commencing work it will be necessary for us to have accurate information regarding the layout of all public and domestic sewers/services in the vicinity of the works. We would point out that we cannot be held responsible for damage / grout infiltration to any services

We would point out that in cases where settlement of a structure has occurred it is likely that the associated drainage systems and/or underground services have been affected by cracking/loss of alignment etc. If it is decided not to repair these services before remedial foundation works are undertaken there will be some risk of grout infiltration.

We cannot be held responsible for any damage or blocking of these services.

We will require the following services and facilities to be provided free of charge and in such a manner that our works are not delayed.

(a) A suitable area adjacent to the works with vehicular road access where we may set up our plant and material store. We have assumed access driveways are suitable for construction vehicles.

(b) We will require a suitable hardstanding to enable setup of our grouting equipment.

(c) A hydrant supply of fresh clean water at normal mains pressure within 25m of our works.

(d) Disposal of surplus and waste material.

(e) Any necessary screening/hoarding off of the working area including provision of protection of the public from our works site area.

(f) Testing, repair and/or realignment of drains and services.

Our price is exclusive of VAT to be added at 17.5%.

Our tender is governed by the JCT conditions of contract except where specifically varied in this letter.

Our quotation is based on continuity of work being available to us. We would require reimbursement at the quoted rates for any standing time due to circumstances outside our control.

We have included for normal contractual insurances with a public liability limit of £2 million. We have not included for any special or non negligent policies. The can normally be arranged at additional premiums if required.

Subject to foregoings we have pleasure in offering to carry out the works in accordance with the attached Schedule. We would be pleased to answer any queries arising from the above and look forward to hearing from you in due course.

Yours sincerely

Nick Humphreys
Director

Enc