Report

DESK STUDY AND INITIAL CONTAMINATION ASSESSMENT
FOR PROPOSED OFFICE DEVELOPMENT
AT EASTERN ROAD, BRACKNELL

Carried out for : John B Reed Limited

DESK STUDY AND INITIAL CONTAMINATION ASSESSMENT

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REPORT NO 140215/C

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1 INTRODUCTION

Soil Mechanics were instructed by Bill Reed Architecture on behalf of John B Reed Ltd, to undertake an initial environmental assessment and geotechnical investigation at the site of the proposed office development at Eastern Road, Bracknell. The instruction to proceed with the work was given in a letter, dated 25 May 2000.

The purpose of the geotechnical investigation was to provide information on the surface conditions at the site to assist in the design and construction of the proposed works. The proposed works are understood to comprise the demolition of the existing printing office and factory building and the construction of twelve two storey office units with associated parking. The scope of the investigation, which was specified by Bill Reed Architecture, comprised five boreholes and two trial pits, laboratory testing and the compilation of a factual report. A report detailing the results of the investigation is presented in Report No 140215/G.

The purpose of the initial environmental assessment of the site was to identify possible sources of contamination and the likelihood of contamination occurring on the site. This assessment includes an historical site review from available maps and records, gas monitoring and contamination testing together with a walkover site survey.

2 DESK STUDY

2.1 Walkover Survey

The site presently comprises office accommodation and is located off Eastern Road, Bracknell, Berkshire.

Access is off the end of Eastern Road. There is an access road on the northern side of the premises at the end of which is an access gate with a brick wall. External to the gate on the northern side is a raised verge up to 1 m high with a mature oak on top and a number of shrubs including rhododendron, brambles and some young oaks.

The site covers an area of approximately 4000 m^2. Ground level dips gently to the east. There is a chainlink security fence around the entire site with the exception of the north-eastern corner which is open to Eastern Road. Beyond the site to the south is another factory/warehouse type premises, to the east are factory type premises and greenhouses (Plate 1). To the north-west is a strip approximately 10 m wide of mature trees beyond which is open ground. To the north is another warehouse type building. Items stocked on site were noted to be garden composts and peat. This property was also noted to have a diesel filling pump with underground tanks a few metres from the site boundary. There is no evidence of spillage around the pumps (Plates 2 and 3).

Taking up most of the site are the Reed printing premises (Plate 4). These consist of 2-storey offices on the northern side of the building and single storey factory premises on the southern side. The building covers an area of about 1500 m^2. There are boiler rooms and store rooms on the outside of the main building. There is a chimney equivalent to 3 storeys high. The building does not exhibit any signs of distress.

Around most of the site, the ground surface is covered by concrete or asphalt. Much of the asphalt surface has eroded away exposing concrete below (Plate 5). There is a carparking area on the northern side (Plate 6) and a yard area on the southern side (Plate 7) with an access road around the back of the building on the western side (Plate 8). Beyond the access road on the western side is a strip of roughly grassed land approximately 3 m wide. Also on the western side is a small landscaped area with a central mature oak tree and a number of young conifers and bench for sitting out (Plate 9). On the northern side of the building next to the office premises is a 3 m wide landscaped strip of land with grass, leylandii and other small shrubs on the eastern side between the building and the boundary fence is a strip approximately 2 m wide overgrown with grass and brambles, a makeshift path has been put through here consisting of fibreboard sheets approximately 0.6 square (Plate 10). The verges between properties to the east and south are vegetated with brambles, ferns and other small shrubs and trees the verge on the northern edge is mostly grass covered

The elevation of the site when compared with neighbouring properties is very variable. The verge on the northern side approximately 1.0 m higher than site level are the premises to the north. The factory premises to the east are at a lower level and are probably in cut. The factory/warehouse premises to the south are at a similar or possibly slightly lower level than our premises. However there is a raised verge a few metres wide with a number of mature trees and through which the boundary fence is positioned.

Ground level relative to the wooded area to the west is similar at the northern end of the site but approximately 0.75 m lower at the southern end. Since the trees are relatively mature, this may indicate some lowering of the site level.

There is a raised fuel tank next to the sitting out areas approximately 1.0 m by 3 m in plan and 1.5 m high (Plate 11). There is some staining on the ground immediately below the outlet tap (Plate 12), but no staining elsewhere. There is no evidence of tipping on the site but there is a little rubbish on site, eg vending cups and plastic drinking bottles, bits of polythene, shredded paper, hole punchings, broken pallets, broken glass, pieces of chipboard (Plate 13). There are the remains of a bonfire 2 m diameter on the south western site with ash debris with some small pieces of wood within the ash. Within the yard area attached to the building wall is a small concrete and mesh cupboard approximately 4.5 m long by 0.9 m wide (Plate 14). It is understood that this cupboard area housed chemicals used in the factory but it is now empty and there is no evidence of spillage around the cupboard.

2.2 Published Geology

Reference to the British Geological Survey 1:50 000 Series, Sheet 269, 'Windsor', Solid and Drift Edition, 1981, indicates the site to be underlain by the London Clay Formation of the Eocene.

The published hydrogeological map of the area (NRA, 1994) shows the underlying strata to be a non-aquifer. The Upper Chalk at depth is an aquifer, but the London Clay and Reading Beds above the chalk will form a barrier to downward groundwater flow. Groundwater flow within any Made Ground and surface water flow would be expected to follow topography and flow due east.

2.3 Site History

A number of historical maps, covering the site area have been reviewed in order to establish the history of the site.

The earliest map of the area viewed, dated 1872, shows the site as being woodland, later called Long Grove Coppice, with open ground to the north. By 1899 although the site itself was still woodland there had been some development to the north east, this included a brickworks approximately 150 m north east and an old kiln is shown immediately north east of the site. By 1912 the brickworks were disused. Two pits are shown on the 1912 map within the brickworks area. There had also been further development to the north east.

The map of 1932 shows some development of the previously disused brickworks which appear to be operational again. A similar situation is shown on maps dated up to 1961 although sometime between 1932 and 1961 an engineering works had been constructed about 50 m to the south east.

By 1966 there had been significant development of the area, Eastern Road had been constructed, and the printing works had been built on the site. The two mature oaks that exist on the site today are shown and these appear to be relicts from the coppice, and thus indicate original ground levels. There are also slopes shown on the south-eastern and south-western boundaries of the site, concurrent with existing verges, again indicating that there has been some cut on the site. A warehouse and depot are shown to the north of the site, and playing fields to the south-west. A small area of woodland, still entitled Long Grove Coppice lies to the north-east and strips of woodland to the south-west and south-east. The aforementioned brickworks had gone by 1966. However some areas of depression are still shown.

The 1973 map shows further development along Eastern Road. The woodland to the north-east has been developed for a workshop premises. A similar situation is shown up to 1991. By consideration of development layouts the warehouse now in existence to the east of the site post dates 1991.

Dumbleton, 1984, discusses brickmaking in the area and refers to the aforementioned brickworks as Bullbrook which was established in 1878 and had become disused by

1909, to be made operational again with new kiln and chimney by 1932. Thames Crocker, farmer, made bricks here in 1895, followed by his son, Charles, to 1915. Charles R Collins Limited, tilers, started here in the 1920's and seems to have continued to as late as 1960. No other brickworks are referred to in the immediate vicinity.

It is understood that chemicals involved with the printing processes at the Reed farm factory included: ISO propyl alcohol, blanket wash, lithographic printing inks and photographic developers. Small quantities were kept in the building and the remainder kept in the store cupboard referred to in the walkover survey. We are advised by Reedfarm all wastes from these chemicals have been removed from the factory by waste disposal contractors or specialist refining companies.

2.4 Previous Ground Investigations

A ground investigation for the building Foundation House, Eastern Road, Bracknell approximately 150 m north east of the site was carried out by Soil Mechanics in 1969 (SM 1969). The investigation included boring to a depth of 50 ft (15 m approx). The investigation revealed up to 3.3 m approximately of Made Ground consisting of soft black, grey and brown sandy silt with organic matter and traces of gravel and some Made Ground of stiff brown sandy clay. Below the Made Ground, London Clay was encountered to the full depth of boring and was described as firm becoming very stiff grey clay with laminae and pockets of silty sand.

3 FIELDWORK

3.1 General

Ground conditions were determined by sinking boreholes and excavating trial pits at locations nominated by Bill Reed Architecture, carrying out in situ tests and obtaining disturbed and undisturbed soil samples together with measurements of groundwater behaviour.

The elevation of the boreholes and trial pits referenced to a temporary benchmark were measured by Soil Mechanics using an Optical Level. The temporary benchmark (STN 2) has a value of 20.00 m and is located adjacent to the roundabout, to the north of Borehole 5, as shown on Drawing No 2.

The reduced levels of the exploratory holes are given on the individual records in Appendix B. The positions of the boreholes and pits were located relative to existing features on the site by tape measure and are shown on the Exploratory Hole Location Plan, Figure 2.

Fieldwork was undertaken during the period 21 June to 6 July 2000.

3.2 Boreholes

Cable percussion boring, with a minimum 150 mm nominal diameter was undertaken in five boreholes to a maximum depth of 20.00 m at positions shown on the Exploratory Hole Location Plan.

Standard Penetration Tests (SPT) and undisturbed U100 sampling were carried out at regular intervals in the boreholes. The SPTs were undertaken using a split barrel sampler (S) or a solid cone (C) with the corresponding N-value, uncorrected for over burden pressure effects, presented on the borehole records. These SPT N-values are also presented graphically in Figure A5/1 in Enclosure A. Undisturbed open drive U100 samples of nominal 100 mm diameter were undertaken using a down hole sliding hammer with a weight of 90 kg and maximum freefall of 690 mm. The number of blows were recorded for 450 mm penetration, unless otherwise stated on the borehole records.

Small disturbed samples were generally taken from the U100 shoe as well as from material collected within the SPT tool. Additional disturbed samples were taken between the SPTs and U100s where appropriate. All samples were returned to the laboratory of Soil Mechanics at Wokingham for description, testing and storage.

The strata descriptions which are based on visual examination of the samples are generally in accordance with BS 5930 : 1999. The depths and descriptions of the strata encountered, details of the samples obtained, in situ testing and groundwater behaviour are presented on the borehole records together with a key to the symbols and notation used.

3.3 Trial Pits

Two trial pits were machine excavated to a maximum depth of 3.10 m at positions shown on the Exploratory Hole Location Plan, Drawing 2 in Enclosure C. The trial pits were logged by a geotechnical engineer, in accordance with BS 5930 (1999). descriptions of the strata encountered together with the samples taken are presented on the trial pit records.

At various depths, within the trial pits, CBR Mexecone and Hand Vane tests were carried out. Results of these in situ tests are presented in the geotechnical report No 140215/G.

3.4 Inspection Pits

At two locations within the existing factory building a pneumatic jack hammer was used to break through the existing slab to determine the thickness of concrete. The locations are shown on the Exploratory Hole Location Plan, thicknesses of concrete encountered are detailed below.

Pit	Concrete Thickness	Underlying Material
IP1	320 mm	Clay with red brick fragments
IP2	500 mm	Crushed Concrete

3.5 Water Monitoring and Gas/Water Monitoring Installations

When groundwater inflow was observed during boring operations, drilling was suspended for 20 minutes to allow some equilibration to occur and the change in water level during this time was recorded. These observations are noted on the relevant borehole records in Enclosure A.

To enable long term monitoring, standpipes were installed at all borehole locations to a maximum depth of 6.00 m. Details of these installations are presented with the relevant borehole record presented in Appendix B. Gas and water monitoring for oxygen, methane, carbon dioxide and barometric pressure was carried out during the period 1 August to 29 August 2000. The results are presented in Appendix B.

4 LABORATORY TESTING

An agreed programme of laboratory testing was scheduled and undertaken by Soil Mechanics using methods in general accordance with BS 1377 : 1990 : Methods of test for soils for civil engineering purposes. The programme included the following tests:

Moisture Content	(BS 1377, Part 2, Method 3)
Atterberg Limit	(BS 1377, Part 2, Method 4 and 5)
Particle Size Analysis	(BS 1377, Part 2, Method 9.2)
Particle Size Analysis	(BS 1377, Part 2, Method 9.5)
Sulphate Content of Soil & Water	(BS 1377, Part 3, Method 5)
pH	(BS 1377, Part 3, Method 9)
Oedometer Consolidation Test	(BS 1377, Part 5, Method 3)
Quick Undrained Triaxial Test	(BS 1377, Part 7, Method 8)

The results of the geotechnical laboratory tests are presented in the geotechnical report No 140215/G. Selected tests are also presented in this report in Appendix C.

Five samples of London Clay were tested for common ICRCL listed contaminants. The results of the testing are presented in Appendix C.

5 GROUND CONDITIONS

5.1 General

Made Ground was encountered in all exploratory holes to depths between 0.3 and 0.6 m. London Clay was encountered beneath the Made Ground to the full depths of all holes, the maximum depth being 20.00 m.

5.2 Made Ground

Made Ground is predominantly granular consisting of clayey sandy gravel varying to very sandy gravel. Occasional fragments of brick and concrete are noted and occasional rootlets in the uppermost layers.

A soft orange brown mottled blue grey and black sandy gravelly clay with occasional rootlets was noted in Borehole 2 between 0.25 and 0.60 m.

5.3 London Clay

The London Clay consists of firm becoming very stiff with depth fissured slightly sandy clay. Fissures are extremely closely spaced. Occasional partings of sand have been noted. Some roots have been noted in the uppermost layers.

5.4 Groundwater Conditions

Groundwater was encountered in Boreholes BH2, BH3 and BH5 at depths of 15.5 m, 15.6 m and 15.8 m respectively and rising to depths of 15.30, 15.40 and 15.60 m respectively after 20 minutes. These water strikes may relate to a sandier stratum with the London Clay. Gas monitoring wells (standpipes) were installed in Boreholes BH1 to BH4 to a depth of 6 m. Depths to water measured between 1 and 29 August 2000 ranged between 1.78 m in Borehole BH1 and 2.86 m in Borehole BH3. A well was installed to 0.9 m in Borehole BH5. No water was recorded in this well. It is probable that the water in the wells relates to water coming in through the layers of granular Made Ground and filling up the standpipes. Due to the low permeability of the clay, it will take a long period for such water to soak away. It is considered that these water levels probably do not represent the true groundwater level.

6 COMMENTS ON GROUND CONDITIONS WITH RESPECT TO THE PROPOSED DEVELOPMENT

6.1 Proposed Development

The proposed development is to consist of 12 two-storey office buildings covering a total area of 3000 square metres. It is proposed to support the structure on piled foundations. Cast-in-place concrete ground beams and precast concrete T beams will be used to support a structural screed on which a liquid epoxy damp proof layer will be placed and a 150 mm thick ground floor constructed on this. This form of construction will result in there being a 150 mm ventilated void below the building.

6.2 Basis of Assessment

The assessment of the levels and types of contamination identified in soil samples should be considered in relation to proposed end-use of the site, construction personnel, disposal of excavated material and the potential for contamination of groundwater. Normal practice is to base the assessment of the degree of contamination and hazard on a comparison of results with guidelines issued by the Government for the redevelopment of contaminated land (ICRCL, 1987).

The ICRCL guidelines define "threshold trigger" and "action trigger" concentrations for a number of the more common contaminants. At concentrations below the threshold trigger concentration there is no significant risk that a hazard will occur. The action trigger concentration is the value above which the contaminant should generally be regarded as undesirable and possibly unacceptable and some form of remedial action may be necessary. Where the levels of contaminants are between the threshold and action trigger concentrations, consideration should be given to whether further investigation is justified and whether or not specific remedial action is required.

The ICRCL at present prescribes only threshold trigger concentrations for metal ions. These threshold trigger concentrations are fairly arbitrary values based on the limits for the metal content of sewage sludge applied to agricultural land, not on any degree of hazard. Indeed, the normal concentrations of some metals in natural soils exceed the threshold trigger concentrations.

Assigned trigger concentrations vary depending upon the proposed use of the land, with the trigger concentrations for industrial and commercial development, such as proposed at this site, being higher than those for landscaped areas or domestic gardens. There are no trigger concentrations and no identified hazard for metal ions where a building or hard surface is being constructed. In the case of metal ions, the threshold trigger for open space or ground in which plants are to be grown is used as a rough indicator of the degree of contamination.

6.3 Soil Contamination Found

Five soil samples were tested for common ICRCL listed chemicals. The results are presented in Appendix C and summarised in the table below, together with the ICRCL trigger concentrations for buildings, hard cover and soils in which plants are to be grown.

Table 1

Contaminant	Units	Number of Analyses	Measured		Threshold Trigger Conc.	Number Exceeding Threshold Trigger Conc.	Action Trigger Conc.
			Min	Max			
Arsenic	mg/kg	5	5	8	40	0	*
Cadmium	mg/kg	5	<1	<1	15	0	*
Chromium (total)	mg/kg	5	32	38	1000	0	*
Copper	mg/kg	5	9	13	130	0	*
Lead	mg/kg	5	26	33	2000	0	*
Mercury	mg/kg	5	<0.5	<0.5	20	0	*
Nickel	mg/kg	5	10	30	70	0	*
Selenium	mg/kg	5	<0.50	0.55	6	0	*
Zinc	mg/kg	5	43	54	300	0	*
Cyanide (total)	mg/kg	5	<1	<1	250	0	NL
Sulphide	mg/kg	5	<1	<1	250	0	1000
Sulphate (acid soluble)	mg/kg	5	168	523	2400	0	60000
pH		5	7.1	7.8	NL	0	NL
Phenols	mg/kg	5	<0.5	<0.5	5	0	1000
PAH	mg/kg	5	<10	30	1000	0	10000

Notes: * Not specified by ICRCL
NL No limit

All 'contaminants' were measured at concentrations below the ICRCL trigger threshold concentration and in particular hazard with regard to contamination.

6.4 Ground Gas Levels

Gas monitoring wells installed in the five boreholes were monitored between 1 and 29 August 2000. No methane was detected. Oxygen levels were generally measured between 17.4 and 20.5% by volume. However in Borehole BH2 oxygen levels between 0.5 and 2.3% and carbon dioxide levels up to 3.4% by volume were found. Carbon dioxide is a toxic gas with a short term exposure limit of 1.5% and long term exposure limit of 0.5%. Carbon dioxide is heavier than air and accumulates in depressions and therefore elevated concentrations of carbon dioxide within monitoring wells are not uncommon. Gas protection measures are mandatory in residential buildings when ground carbon dioxide levels exceed 5% by volume – DoE (1992). Given that the structure has a ventilated sub-floor void and a low permeability damp-proof membrane that will serve as a gas protection membrane, it is not considered that any further gas

Consideration has been given as to whether gas could migrate from the infilled brick pits referred to in the desk study. However, the area is underlain by London Clay which should provide an impermeable barrier and prevent gas migration.

6.5 Conclusion

The ground investigation did not reveal any ground contamination. A local area of fuel spillage was noted during the walkover survey beneath the top of the above ground fuel tank. It would not be expected that this would penetrate the concrete surface, however this should be checked during the demolition phase of the works.

Elevated concentrations of carbon dioxide have been measured in boreholes and depleted oxygen measured in one borehole. However carbon dioxide levels do not exceed 5% and the design of the building floor will resist the ingress of ground gas.

No special precautionary measures are required for groundworkers handling the soil. However, normal good hygiene should be observed. Washing facilities should be provided and eating drinking and smoking should be prohibited on site to avoid inadvertent ingestion of the soil. In view of the elevated carbon dioxide levels and the depleted oxygen levels monitored in the boreholes, any personnel required to enter trenches or confined excavations should carry suitable gas monitoring equipment. The gas levels of any such excavation should be checked prior to man entry.

for SOIL MECHANICS

Engineer

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REFERENCES

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PLATES

FIGURES

DRAWINGS

APPENDIX A

HISTORICAL MAPS

APPENDIX B

FIELDWORK

APPENDIX C

LABORATORY TESTING