2 Vicars Lane,
Chester,
CH1 1QX
Tel: 01244 348787 Fax: 01244 348788
e mail: admin@cooperassociates.co.uk

Cooper Associates

CHARTERED CONSULTING ENGINEERS
Civil • Structural • Geotechnical • Environmental

Our ref: 3927br2

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Basic Site Investigation Report

for land at

Vine Street, Gorton, Manchester

For : Chorley Homes Limited
Atrium House
574 Manchester Road
Bury
BL9 9SW

And

The Governor & Company of Bank of Scotland

19 December 2006

Document Verification

Project Title	Vine Street, Gorton, Manchester
Project Number	3927
Document Title	Basic Site Investigation Report for land at Vine Street, Gorton, Manchester
Document Number	3927br
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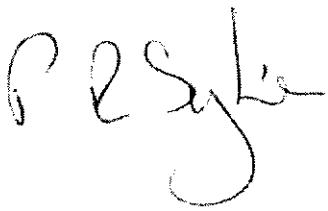
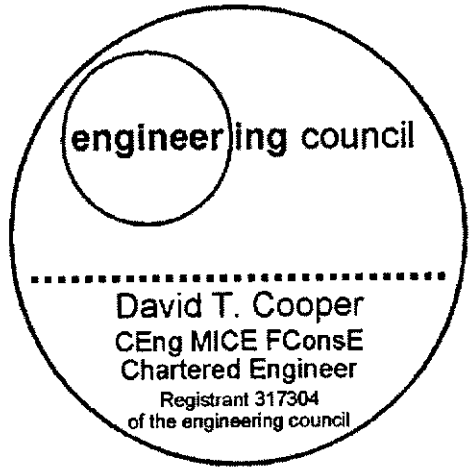
Prepared by



P R Sykes
BSc (Hons), MSc (Eng), FGS

Checked and Approved



Document Revision

Report Reference	Date	Description	Prepared	Checked and Approved
3927ia	13 January 2006	Initial Appraisal Report for Viability	D P Cox	P R Sykes
3927br	7 December 2006	Basic Site Investigation Report	P R Sykes	D T Cooper
3927br2	19 December 2006	Basic Site Investigation Report with additional assignee	P R Sykes	D T Cooper

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1.0 Introduction

1.1 This report is a basic appraisal of the ground conditions, some engineering aspects and anticipated foundation requirements for a proposed residential development on land at Vine Street, Gorton, Manchester. This report was prepared on instructions received from our client, Chorley Homes Limited, Atrium House, 574 Manchester Road, Bury, BL9 9SW, and The Governor & Company of the Bank of Scotland, and supersedes Cooper Associates Executive Summary Report, reference: 3927ia, dated 13 January 2006.

1.2 The copyright of this report and the associated plans/documents prepared by Cooper Associates is solely owned by Cooper Associates. Consequently neither this report nor the associated plans/documents may be reproduced, published or adapted without the express written approval of Cooper Associates. Complete copies of this report may, however, be made and distributed by our client as an expedient in dealing with matters directly related to its commission.

1.3 The accuracy of map extracts cannot be guaranteed and it should be recognised that different conditions on /adjacent the site may have existed between and subsequent to the various map surveys.

1.4 Where data supplied by others, including that from previous investigations, has been used it has been assumed that the information is correct. No responsibility can be accepted by Cooper Associates for inaccuracies within the data supplied by others. We would advise that our client makes their own detailed enquiries to the Local Authorities to determine any additional planning constraints which may be applied to this site and which have not been identified within this report.

1.5 The results of the trial pit and borehole explorations are based upon the facts established from observations and field tests. It should be recognized that strata may vary considerably from point to point and the groundwater regime may be influenced by seasonal or other factors. While every attempt is made to assess the likelihood and extent of such variations, conditions may nevertheless exist which are undisclosed by this investigation.

1.6 This report has been prepared in accordance with the requirements of the revised NHBC Standard Chapter 4.1 which was effective from July 2003. The scope of this report complies with the criteria for certification under the Initial Assessment including the Desk Study (D1), the Walkover Survey (D2), and the Basic Investigation (D4).

1.7 The further actions deemed necessary to be completed prior to development of the proposed site for residential development have been listed in Section 27.0 of this report. The full extent of further actions may not be limited to those issues stated and, during the course of the development, additional further actions may be required.

1.8 Arboricultural Survey and advice on arboricultural issues are considered to be outside the scope of this report except for their effect on the foundations to the proposed buildings. Where identification of any species is made, especially invasive plants such as Japanese Knotweed, Himalayan Balsam or Giant Hogweed, this should only be considered as a preliminary assessment and subject to confirmation by a professional Arboriculturist. Cooper Associates takes no responsibility for failing to identify, or the incorrect identification, of any tree or plant species on site.

1.9 This report is prepared and written in the context of the purposes stated above and should not be used in a different context. Furthermore, new information, improved practices and legislation may necessitate an alteration to this report in whole or in part after its submission. Therefore with any change in circumstances or after the expiry of one year from the date of this Report, the report should be referred to Cooper Associates for reappraisal.

2.0 Executive Summary

Grid Reference	SJ 893 969
Approximate Areas	Approximately 0.70 hectares (1.73 acres)
Exploratory Holes undertaken on site	5 No. cable percussive boreholes drilled by TBV Stanger between 20 and 23 September 1994 (1 to 4 and 3A, commissioned by others). 9 No. trial pits excavated by Cooper Associates on 10 January 2006 (TP1 to TP9). 11 No. cable percussive boreholes drilled by Geotechnics between 14 and 28 March 2006 (BH1 to BH8, and BH7A to BH7C)
British Geological Survey Sourced Borehole Logs	10 No. borehole logs on or immediately adjacent to, the site – not available from BGS due to client confidentiality.
Site Description and Boundaries (Refer to Sections 4.0 and 5.0)	The proposed site is located off Vine Street in the district of Gorton, Manchester. The location of the site is shown on the Site Location Plan, Drawing No. 3927/L1. The irregular shaped parcel of relatively level open ground, is currently predominantly rough grassland with areas of open ground, Japanese Knotweed and wooded copses. The site is bounded to the north by a railway cutting, east by Vine Street and south and west by open ground. It is understood that the site and adjacent open ground are classified as a landfill (Local Authority reference number 59).
Site History (Refer to Section 6.0)	Agricultural fields with 2 No. ponds up to 1900's whereafter open ground adjacent railway line in cutting to the north (predates 1848), and a branch line to the west (predates 1910). Eastern site area regraded as early as 1922. No internal features noted after 1987, suggesting possible landfilling after this period. Railway cutting west of site still noted on 2005 OS map edition, although aerial photography suggests it was infilled prior to this date, possibly in the 1990's.
Hazardous Installations (Refer to Section 7.0)	Site does not fall within a consultation zone for hazardous installations. No Planning Hazardous Substances Consents, Water Industry Act Referrals, or Integrated Pollution Controls within a 250m radius. Air Pollution Controls apply to a garage workshop 167m west of the site, concerning regarding the respraying of road vehicles. 7 No. trade directory entries within a 250m radius of the site. Businesses include car breakers/dismantlers, garage workshops and light engineering. Local Authority – Planning Department reply indicates adjacent industrial land usages are unlikely to affect the proposed redevelopment of the site. Recommend obtaining service records.
Landfill Sites & Ground Gases (Refer to Sections 8.0 and 23.0 to 26.0)	No current landfill sites within a 250m radius. However infilled ground up to 10.2m deep within the site, dating from the 1980's. Infilled railway cutting adjacent western boundary dates probably from the 1990's. Local Authority refers to development area as "Vine Street Landfill". Limited ground gas monitoring undertaken in 1994 by others recorded methane in excess of 10% by volume, associated with depressed oxygen and carbon dioxide levels. Gas spike survey in 2000 recorded an absence of methane at near surface associated with low levels (0.3% to 2.3%) of carbon dioxide. 3 months ground gas monitoring over a 9 month period completed on site. Methane up to 52% by volume, carbon dioxide up to 11.8% by volume recorded. Very low flows recorded from all boreholes. Ground gases appear dormant within ground or very slowly passively vented to the atmosphere. Risk assessment conducted in accordance with Wilson and Card. Classified site as Characteristic Situation 3 requiring gas membrane and underslab void.
Geology & Hydrogeology (Refer to Section 9.0)	Drift – Glacial Till beneath entire site. Drift 45.1m thick, 550m north of the site. Bedrock – Manchester Marl Formation. Permian in age. Dips south west at an undisclosed angle. Faults – Unaffected. Groundwater – Non aquifer. No discharge consents within a 750m radius of the site. No watercourses within a 500m radius No groundwater abstraction boreholes within a 1km radius of the site. No pollution incidents higher than Category 3 (minor) within a 750m radius. Higher category pollution incident 849m south of site. Unlikely to have an impact on the development. Flood Risk – Site unaffected. Compressible Ground – No to very low risk from natural hazards.
Animal Burial Sites and other Environmental, Ecological and Conservation Issues (Refer to Section 10.0)	No sensitive land uses within a 1km radius. Site unlikely to be affected by animal burial sites. Areas of suspected Japanese Knotweed within the site – needs surveying and treating prior to development commencing.

Coal Mining (Refer to Section 11.0)	Site unaffected by shallow coal mining. No special precautions anticipated.
Radon (Refer to Section 12.0)	Site unaffected – No special precautions anticipated.
Ground Conditions (Refer to Section 13.0)	Topsoil/Madeground – Not encountered. Hardstanding – 50mm band of tarmac at 200mm depth in north east corner of site (TP1). Existing Structures – None on site. Fill – Encountered in every exploratory hole to depths in excess of 8500mm (BH2). Predominantly demolition fill with lesser amounts of clay fill. Hydrocarbon odour noted occasionally in boreholes for near surface fills. Natural Strata – Medium dense and dense, becoming very dense sands at depths of between 2800mm and 7500mm, deepening north to south. Bedrock – Not encountered. Groundwater – Seepages occasionally noted within fill from 1300mm during trial pit excavation. 1994 boreholes recorded deeper ingresses from within fill or natural strata at depths of between 1800mm and 8000mm. Standing water noted in gas standpipes between 6m and 10m.
Sub Soil Classification (Refer to Section 16.0)	Clay strata and clay fills – DS-1, AC-1s, DC-1 (assumed) Sand strata and sand fills – DS-1, AC-1, DC-1 Clay strata and clay fills – Low shrinkage potential Sand strata and sand fills – Frost susceptible
Contamination (Refer to Section 15.0)	Fill – near surface fills slightly affected by elevated arsenic and benzo(a)pyrene. Both risk assessed as not detrimental to human health. Hydrocarbon odours noted in some near surface fill samples from boreholes need further investigation. Natural Strata – Uncontaminated. Groundwater – Slightly contaminated by copper and benzo(a)pyrene and negligible hydrocarbons. Not considered detrimental to watercourses or aquifer. Remediation – Not anticipated other than topsoil in front and rear gardens. Potable Water Pipes – Protectorline with sterile trench. Disposal – Non-hazardous, however elevated TOC due to coals and ash in fills. May need segregation or other pre-treatment before disposal.
Trees (Refer to Section 17.0)	Site not affected by TPO's. Numerous trees along eastern site boundary and within the site. Heave precautions not anticipated due to presence of deep, predominantly granular fill. Tree survey for foundation appraisal not recommended.
Ground Floor Slabs (Refer to Section 18.0)	Groundbearing – Not anticipated. Suspended – 100% of site area. Heave precautions not anticipated.
Anticipated Foundations (Refer to Section 19.0)	Trenchfill/Deep Reinforced Strip Foundation – Possibly in north eastern site area. Piled Foundation – Majority of development area. Preboring anticipated due to oversized material in fill. Due to age and nature of fill, piles would need to be designed for the affects of negative skin function. Current planning layout does not have any dwellings within 5m of crest of slope. Slope stability assessment not considered applicable in this case.
Dewatering (Refer to Section 21.0)	Anticipated for deeper excavations.
Road Sub-Grade (Refer to Section 22.0)	Anticipated formation strata – In situ granular fills. No estimate of CBR due to material variability. In situ CBR testing recommended.
Further Actions (Refer to Section 27.0)	**Further action which may be required to progress the project up to Basic (D4) Report level could include, but not necessarily be limited to: -** ▪ Forward Cooper Associates Basic Site Investigation Report to Manchester City Council for their review and comments. ▪ Trial pitting, soil sampling and chemical analysis for hydrocarbons in the vicinity of Geotechnics boreholes BH2, BH5, BH6, BH7 and BH7B. ▪ Trial pitting, soil sampling and chemical analysis for naphthalene in the vicinity of trial pit TP2. ▪ Possible continuation of ground gas monitoring during the planning stages of the development. ▪ Independent verification of workmanship for installation of gas precaution measures. ▪ Validation of topsoil material to be imported to site and used in front and rear gardens. ▪ Provide report to specialist contractors to design pile lengths.

3.0 Location

(Refer to Appendix 14)

3.1 The proposed site was located off Vine Street in the district of Gorton, Manchester, at National Grid reference SJ 893 969. The location of the site is shown on Drawing No. 3927/L1 in Appendix 14.

3.2 The irregular shaped parcel of open ground, approximately 0.70 hectares (1.73 acres) in area, was predominantly rough grassland with areas of open ground, Japanese Knotweed and wooded copses.

3.3 The site was relatively level and bounded to the north by a railway cutting, east by Vine Street and south and west by open ground. It was understood that the site and adjacent open ground are classified as a landfill (Local Authority reference number 59).

4.0 Site Description

(Refer to the Site Plan in Appendix 14)

4.1 Information obtained during the site walkover has been presented on the Site Plan, Drawing No. 3927/01.

4.2 The site (refer to Figures 1 and 2) comprised of poor quality grass with areas of immature trees and dense vegetation (refer to Figure 3). Sporadic semi-mature trees were present along the eastern boundary, fronting onto Vine Street.



Figure 1: Panoramic photograph of the site viewed from Vine Street near the southern part of the site boundary. Note that the view is distorted due to 180° panoramic photograph; the road (Vine Street) in the foreground is actually straight.



Figure 2: Panoramic photograph of the site taken from beyond the northwestern corner of the site looking east towards Vine Street.



Figure 3: Showing areas of dense vegetation and immature trees. Photograph taken from beyond the western site boundary looking east towards Vine Street.

4.3 The surrounding area (refer to Figure 4) comprised predominantly of private residential housing, with some industrial units, and a railway line. Some of the houses in the vicinity were partially boarded up with windows broken. Access on to the site (refer to Figure 1) was open from Vine Street with no precautions to limit vehicle access.



Figure 4: Showing site (green area) and surrounding land use. Photograph supplied by Google from millennium edition survey.

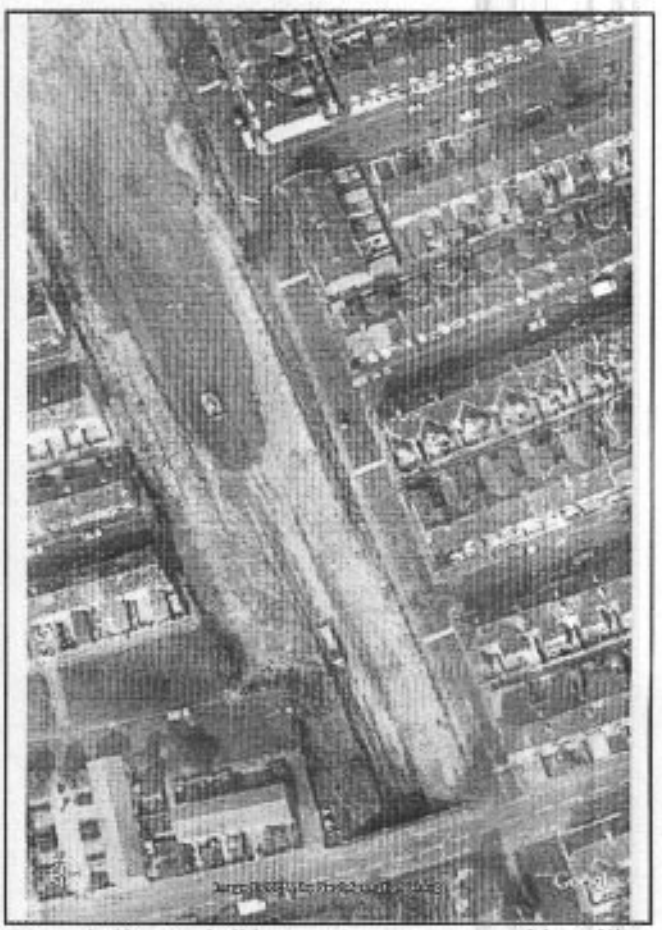

Figure 5: Showing bulldozer and wagon as part of the infilling of railway cutting beyond the southern and western boundary. Photograph supplied by Google from millennium edition survey.

4.4 The site topography was generally level with minor variations. Approximately 5m beyond the undefined northern site boundary was a small raised embankment (refer to Figure 6) up to 0.5m high, beyond which was a steep slope down to an active electrified railway line (refer to Figures 6, 7 and 9) less than 10m lower than the site. This cutting slope was retained at the base and contained immature to semi-mature trees. The slope showed possible signs of shallow instability including fallen/mis-shapen trees and shallow depressions. At the base of the embankment was a row of Heras fencing inhibiting access on to the railway line.



Figure 6: Showing railway line (left of picture), raised embankment (center of picture), and open ground/buffer zone (right of picture) between the site and the cutting. Note that the area of no vegetation represents a path utilised by local residents for dog walking. Photograph taken from beyond the northwestern corner of the site looking east towards Vine Street (background).



Figure 7: Showing railway line and steep embankment beyond the northern boundary. Photograph taken beyond the northwestern corner of the site looking west.

4.5 Beyond the western boundary was an infilled former railway line which originally converged with the railway line to the northwest of the site. Aerial photography (refer to Figures 4 and 5) indicate this was likely to be infilled in the last 10 years. The topography and vegetation do not vary between the site and former railway, indicating potential shallow reworking of the periphery of the site (refer to Figure 8). On the western periphery of the infilled railway embankment (furthest from the site) adjacent to rear gardens off Franklin Avenue and Gathurst Road, the topography grades to match the levels of the rear gardens. Where the infilled railway joins the current railway line the topography drops along the line tracks in between the new and old embankments creating a relatively shallower slope down to the railway line (refer to Figure 9). The boundary between the infilled railway and the previously existing railway embankment is shown by the lack of trees over the infilled area.



Figure 8: Showing the former line of the infilled railway (centre and right of picture) with continuation of current topography to that of the site (left of picture). Photograph taken beyond the western boundary looking south.

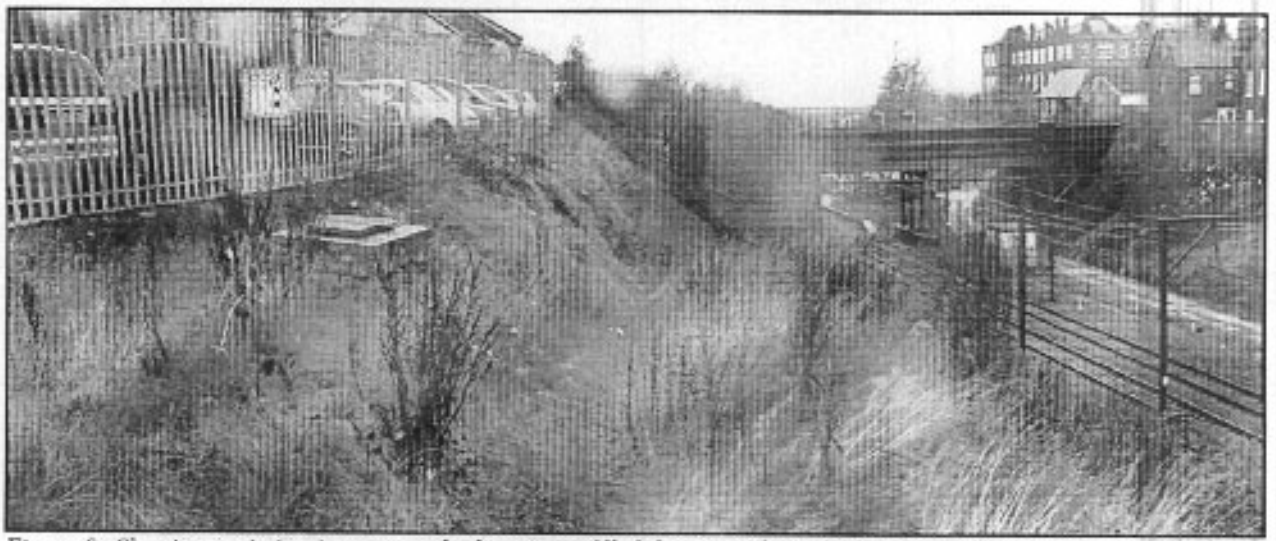

Figure 9: Showing variation in topography between infilled former railway (right of centre) and original embankment (left of centre). Photograph taken beyond the northwestern corner of the site looking west.

4.6 Small patches of Japanese Knotweed (refer to Figures 10 and 11) were noted in the vicinity of the southeastern part of the site. No signs of treatment or management of the Japanese Knotweed was evident. No other invasive, hazardous or notifiable species were noted on within the vicinity of the site.





Figures 10 and 11 showing Japanese knotweed present in the vicinity of the southeastern boundary.

5.0 Site Boundaries

(Refer to the Site Plan in Appendix 14)

5.1 North

5.1.1 This boundary was undefined, beyond which was the railway and associated cutting. The railway line was separated from the site by a Heras fence near the base of the cutting.

5.2 East

5.2.1 This boundary was defined by a line of concrete posts with intermittent wire mesh sheets. Beyond the boundary was Vine Street.

5.3 South

5.3.1 This boundary was undefined, beyond which was open ground.

5.4 West

5.4.1 This boundary was undefined, beyond which was open ground associated with an infilled railway cutting.

6.0 Site History

(Refer to Appendix 14)

6.1 A significant amount of information regarding the history of the site and its immediate adjacent areas is shown on the historical Ordnance Survey maps obtained from Cooper Associates archives.

6.2 The history of the site is summarised in Table 1 below and copies of extracts from the relevant historical Ordnance Survey maps are reproduced on Drawing No's 3927/02 to 3927/09 in Appendix 14.

6.3 Relevant former features indicated on these maps have been reproduced on the Site Plan, Drawing No. 3927/01 also contained in Appendix 14.

Table 1 – Summary of Site History

O S Map Edition	Site	Adjacent (not shown on historical maps due to size of development site)
1848 (6" to 1 mile)	The site is shown to comprise portions of two fields. Two suspected ponds are shown in the southern part of the site with a hedgerow/ditchline in between the ponds. A track is shown to run just within the western boundary of the site.	The site is surrounded by agricultural fields and a railway line approximately 10m to the north incutting.
1910 (6" to 1 mile)	The site is shown to be open land and possibly part of the Brick Works adjacent. The site is shown to have a slope along the western boundary.	A railway line in cutting has been constructed along the western boundary of the site. Beyond this is a Brick Works with terraced housing to the south and north. To the east lies another Brick Works.
1922/23 (6" to 1 mile)	The site appears to have been reduced in level since 1910 as the slope adjacent to the railway line has moved eastwards across the site and close to the eastern boundary.	Residential housing now shown to the east of the site where the Brick Works was formerly located. The Brick Works to the west of the site has also been omitted from the map and appears as open land.
1938 (6" to 1 mile)	No significant changes from the previous map edition.	The open land to the west of the site that was formerly the Brick Works appears to be under construction for residential housing. Road layouts are shown on the land.
1956 (1:10,560)	No significant changes form previous map edition.	Redevelopment of the former Brick Works site appears to have been completed for residential housing.
1968 (1:10,560)	No significant changes form previous map edition.	No significant changes form previous map edition.
1987 (1:10,000)	No significant changes form previous map edition.	No significant changes form previous map edition.
2005 (1:2,500)	No significant changes form previous map edition.	No significant changes form previous map edition.

7.0 Hazardous Installations

(Refer to Appendix 1)

Enquiries to : Manchester City Council – Planning (MCCP)
Reply Reference : None
Reply Dated : 10 January 2006

And

Enquiries to	: Manchester City Council – Regulatory & Enforcement Services (MCCRES)
Reply Reference	: MCC/EnvH/32957
Reply Dated	: 24 January 2006

And

Enquiries to	: Envirocheck Report - Datasheet
Report Reference	: 16475231-1-1
Dated	: 4 January 2006

And

Enquiries to	: Environment Agency (EA)
Reference	: What's in your backyard – Maps (Waste OPRA)
Search Dated	: 26 November 2005

7.1 Findings

7.1.1 The Envirocheck Report indicates that there are no COMAH sites, NIHHS sites, Hazardous Substance Consents, IPPC sites, registered radioactive substances or explosive sites within a 1km radius of the proposed development. However Air Pollution Controls apply to at least four premises within 500m of the site. Industries include respraying of cars, petrol station, coal yard and di-isocynate process.

7.1.2 MCCP have confirmed that the site does not fall within a "consultation zone" for a hazardous installation. MCCRES have confirmed many of the statements made in the Envirocheck Report concerning IPPC sites, etc.

7.1.3 The Envirocheck Report confirms that there are no licensed Waste Management facility or waste transfer stations within 250m of the site.

7.1.4 MCCRES note that they have one record of environmental nuisance issues (i.e. noise, odour, etc.) relating to a property in Burstead Street in 2002.

7.1.5 There is one fuel station site within a 250m radius of the site on Butman Street.

7.1.6 The Envirocheck Report indicates that there are 7 No. trade directory entries within a 250m radius of the site. Trades include wrought ironworks, confectionery manufacturers, car body repairs and garage services, washing machine services/repairs, and car breakers/dismantlers.

7.2 Conclusions

7.2.1 Based on the above, we consider that the site will be unaffected by any hazardous industries in the area.

7.2.2 Due to the known presence of services within or immediately adjacent to the site it would be prudent to obtain a complete set of service records. In addition, discussions should be held with the service providers to determine which services require decommissioning and re-routing, the required easements (if any) for retained services, and if there are any restrictions to site operations in their vicinity. It would be prudent to confirm the line and depth of the underground services, including the former drain which crosses beneath the central area of the site.

8.0 Landfill Sites and Ground Gases

(Refer to Appendices 1, 2, 7 and 14)

Enquiries to	: Manchester City Council – Regulatory & Enforcement Services (MCCRES)
Reply Reference	: MCC/EnvH/32957
Reply Dated	: 24 January 2006

And

Enquiries to	: Envirocheck Report - Datasheet
Report Reference	: 16475231-1-1
Dated	: 4 January 2006

And

Enquiries to	: Environment Agency (EA)
Reference	: What's in your backyard – Maps (landfill sites)
Search Dated	: 26 November 2005

8.1 Findings

8.1.1 A review of the EA website and Envirocheck Report indicates that the site is unaffected by current or former landfill sites within a 250m radius.

8.1.2 The reply from MCCRES has stated that the site lies within a 250m radius of a landfill site which is commonly known as Vine Street Landfill. MCCRES states that a planning application (F30092) relating to the infilling of the site and erection of housing was approved in 1988. MCCRES further states that although the infilling occurred, housing was never constructed.

8.1.3 MCCRES has provided details of gas monitoring undertaken by Waste Management Associates in 1990 and 2000, and TBV Stanger in 1994. The results of gas monitoring by Waste Management Services in 1990 were obtained via a 1.2m perforated aluminium gas probe at 30 points across the site. Monitoring was conducted on five occasions over a ten day period in July 1990. On each occasion the barometric pressure was above 1000mbar and the results indicated low concentrations of methane (up to 0.28% by volume) and negligible concentrations of carbon dioxide. A copy of the Waste Management Associates correspondence is contained in Appendix 2.

8.1.4 TBV Stanger drilled four cable percussive boreholes down to between 8.5m and 10.0m. Installations were constructed between 4.0m and 8.5m with fill materials. Gas monitoring of the installations were carried out on three occasions, (two in October 1994 and one in December 1994). The results are included in Appendix 2, the borehole logs in Appendix 7 and the borehole locations on the Site Plan in Appendix 14. The results indicate that methane was present up to 21% by volume. A gas spike survey at 20 locations across the site by Waste Management Services in July 2000 did not record any ground gases.

8.1.5 A review of the historical Ordnance Survey maps has indicated that two suspected ponds were on the site in 1848 and that landraising had occurred in the recent past.

8.1.6 Intrusive investigations by Cooper Associates has established that at least 10.0m of fill materials cover parts of the site. No putrescible or peaty material was noted within the fill although some hydrocarbon odours and timber were occasionally noted on the borehole logs.

8.2 Conclusions

8.2.1 Based upon the desk study information and the findings of the intrusive investigation, a ground gas investigation was considered to be essential if residential development was going to be approved by the local authority on this site. Three months of ground gas data was obtained over an eight month period by Cooper Associates. The strategy and findings of the gas investigation are included within sections 23.0 and 26.0 of this report.

9.0 Geology, Hydrology & Hydrogeology

(Refer to Appendices 1 and 14)

1:50,000 scale Geological Map Sheet 85 (Manchester) – Combined Solid and Drift Edition
EA Groundwater Vulnerability Map Sheet 17 (Derbyshire and North Staffordshire)
British Geological Survey (BGS) Website

Enquiries to	: Envirocheck Report - Datasheet
Report Reference	: 16475231-1-1
Dated	: 4 January 2006

And

Enquiries to	: Environment Agency (EA)
Reference	: What's in your backyard – Maps (Flood Warning)
Search Dated	: 4 January 2006

And

Enquiries to	: Manchester City Council – Regulatory & Enforcement Services (MCCRES)
Reply Reference	: MCC/EnvH/32957
Reply Dated	: 24 January 2006

9.1 Drift

9.1.1 The geological map shows that Glacial Till (recorded as "Boulder Clay") is noted over the entire site. Drift deposits are noted to be 45.1m thick, 550m to the north of the site on the geological map.

9.1.2 Review of the BGS website for BGS logs indicates there are ten boreholes located on or close to the site. Unfortunately none of the logs are available due to client confidentiality. However the positions of these boreholes are shown on the Site Plan in Appendix 14.

9.2 Bedrock

9.2.1 The geological map shows that the site is underlain by argillaceous (mudstones/siltstones) strata of the Manchester Marl Formation of the Permian age.

9.2.2 Strata is indicated to dip generally south west at an undisclosed angle.

9.3 Geological Faults

9.3.1 The geological map indicates that the site is not affected by faulting.

9.4 Groundwater Vulnerability

9.4.1 The site is designated as a non aquifer overlain by soils of high leaching potential (urban) soils. The site is not located within a Groundwater Source Protection Zone.

9.4.2 According to the Envirocheck Report the nearest protected water source, Chorlton Beck, is located approximately 860m south of the site. The watercourse has a GQA Grade E (poor) for water quality during the year 2003.

9.4.3 According to the Envirocheck Report there are no current groundwater abstractions within a 1km radius of the site. This has been confirmed by the reply from MCCRES.

9.4.4 According to the Envirocheck Report, there are no current discharge consents within a 500m radius of the site.

9.4.5 There are no pollution incidents higher than Category 3 (minor) within a 849m radius of the site. The nearest significant (Category 2) pollution incident to the site involved the overflow of industrial effluents into the Gore Brook in 1993.

9.5 Flood Risk

9.5.1 The site is not within 1km of a Flood Warning Area. Refer to an extract of the EA website for details on the nearest areas of potential flooding to the site contained in Appendix 1.

9.6 Compressible Ground or Subsidence Hazards

9.6.1 Very low risk. No special precautions with regard to foundations anticipated.

10.0 Animal Burial Sites and other Environmental, Ecological and Conservation Issues

(Refer to Appendices 1 and 4)

Enquiries to	: State Veterinary Service (SVS)
Reply Reference	: 8.47.11
Reply Dated	: 18 January 2006

And

Enquiries to	: Envirocheck Report - Datasheet
Report Reference	: 16475231-1-1
Dated	: 4 January 2006

10.1 Findings

10.1.1 Based on a review of the historical Ordnance Survey maps and SVS reply, we consider it unlikely that the site will be affected by animal burial sites, and no special precautions are anticipated.

10.1.2 The walkover survey carried out by Cooper Associates on 10 January 2006 identified Japanese Knotweed to be present in small patches in the south eastern part of the site.

10.1.3 The Envirocheck Report indicates that there are no sensitive land uses within a 1km radius of the site.

11.0 Coal Mining

(Refer to Appendix 5)

Enquiries to	: The Coal Authority (CA)
Reply Reference	: 10004581-06
Reply Dated	: 6 January 2006

11.1 Findings

11.1.1 The Coal Authority Coal Mining Report advises that the proposed site is not within the zone of likely physical influence on the surface from past, present or future underground coal workings.

11.1.2 The Coal Authority records also do not disclose any fault or other line of weakness at the surface as having affected the stability of the property.

11.1.3 The Coal Authority advise that the site is not within 200 metres of any past, present or future proposed opencast site. However, reserves of coal exist in the locality which could be worked at some time in the future subject to feasibility, licenses and planning consents.

11.1.4 The Coal Authority records do not disclose any mine entries to be located within the site or 20m of the site boundary.

11.2 Conclusions

11.2.1 Based on the reply from the Coal Authority and a review of the geological map we would consider it unlikely that the proposed site would be adversely affected by shallow coal mining and no special precautions with regard to foundations are anticipated.

12.0 Radon

BRE Report 211 (1999) Radon: Guidance on Protective Measures for New Dwellings

12.1 Findings

12.1.1 According to the BRE Report 211, the site lies in a 5km grid square where no precaution measures against radon need to be considered or assessed.

12.2 Conclusions

12.2.1 Based upon the information above, the site is unaffected by radon and no special precaution measures are anticipated.

13.0 Trial Pit and Borehole Explorations

(Refer to Appendices 6, 7 and 14)

9 No. trial pits excavated by Cooper Associates on 10 January 2006 (TP1 to TP9)
11 No. cable percussive boreholes drilled by Geotechnics on 14 to 28 March 2006 (BH1 to BH8 and BH7A, BH7B and BH7C)
4 No. cable percussive boreholes drilled by TBV Stanger on 20 to 23 September 1994 (BH1 to BH4).

13.1 General

13.1.1 The locations of the trial pits and boreholes are shown on the Site Plan, Drawing No. 3927/01 in Appendix 14. Copies of the trial pit logs and a summary of the exploratory hole findings are contained in Appendix 6. Copies of the cable percussive borehole logs are contained in Appendix 7.

13.2 Topsoil/Madeground (similar to topsoil)

13.2.1 Natural topsoil or madeground (similar to topsoil) was not encountered within the site. Topsoil will have to be imported to site to meet the requirements of the development in garden areas.

13.3 Hardstanding

13.3.1 Hardstanding had only been encountered within trial pit TP1, comprising a 200mm thick layer of tarmac and boreholes BH1 (Geotechnics) comprising a 70mm thick layer of concrete at a depth of 600mm.

13.4 Existing Structures

13.4.1 No surface structures were present on site during the site investigation.

13.5 Fill

13.5.1 Fill materials were encountered in all trial pits and cable percussive boreholes. In all of the exploratory holes undertaken, fill was bottomed out at depths of between 2.8m and 10.2m.

13.5.2 Fill materials comprised predominantly of sand fill with subordinate areas of clay fill. In all cases the fill materials were dark brown, mottled black, occasionally black and red. The sand fills were predominantly medium dense, occasionally loose and the clay fills were predominantly stiff to firm, occasionally soft. In the sand fills the subordinate constituents were clayey and gravelly and in the clay fills sandy and gravelly. The gravel constituent was typically fine to coarse in size. In both the sand fills and clay fills the minor constituents comprised occasional brick, concrete, ash, glass, timber, tar, metal fragments and cobbles.

13.5.3 Geotechnics boreholes BH2, BH5, BH6, BH7 and BH7B recorded hydrocarbon odours within the fill materials at ground level, to between 1.3m and 4.2m and in BH2 at depths of between 8.7m and 9.15m.

13.5.4 Obstructions within the fill materials, or possibly at the base of the fills were encountered in Geotechnics borehole BH5, as a concrete slab at 9.0m, and refusal on an unidentified obstruction in Geotechnics boreholes BH7 at 9.2m and BH7A at 3.0m. TBV Stanger borehole BH3 also terminated on an obstruction at depth of 2.15m.

13.6 Natural Strata

13.6.1 Within the majority of the cable percussive borehole positions, fill strata was underlain by a generally medium dense to dense, silty, fine to coarse sand with occasional fine to medium gravel of coal at depths of between 3.4m and 10.2m.

13.6.2 In boreholes BH2, BH3, BH7C and BH8 (all drilled by Geotechnics) the natural sands were underlain by a firm or very stiff, brown, slightly sandy to sandy, slightly gravelly (fine to coarse) clay at depths of between 8.8m and 13.10m.

13.7 Bedrock

13.7.1 Bedrock was not encountered in any of the cable percussive boreholes drilled to a maximum depth of 20m.

13.8 Groundwater

13.8.1 Groundwater ingresses as seepages were noted in 3 of the 9 No. trial pits at depths of between 1.3m and 2.8m.

13.8.2 Observations during the drilling of the boreholes recorded water entries at depths of 1.8m to 15.4m. In most cases water entries were only recorded once the borehole had encountered the underlying sand strata. Occasionally, as in TBV Stanger borehole BH1 and Geotechnics BH6, slight seepages within the fill materials were recorded. Likewise in Geotechnics boreholes BH7C and BH8, seepages within sand lenses within the clay strata were recorded, but no seepages within the overlying sand strata. Only Geotechnics boreholes BH4, BH5, BH7 and BH7A did not record any water entries. In the case of Geotechnics boreholes BH5, BH7 and BH7A this was probably because the boreholes did not encounter the underlying stratas due to terminating on obstructions.

13.8.3 Standpipes for ground gas monitoring were installed in Geotechnics boreholes BH1 to BH6, BH7C and BH8. Many installations were dual with response zones within the fill materials and the underlying sand strata. The standpipes were monitored over a period of 9 months and indicated that the top 5.0m of the fill material was generally dry. However, where the response zone of the boreholes straddled the recorded water entry depth, it was observed that these water levels stabilised at depths of between 6m and 10m.

14.0 Basis of Assessments

(Refer to Appendix 14)

14.1 Our assessments assume that the future development of the site will comprise a combination 29 No. 2 storey semi-detached residential dwellings in accordance with the Richard Ward Design Sketch Layout, Vine Street, Gorton, Manchester, Drawing No. 239.01, dated 19 September 2006. This drawing has been reproduced within Appendix 14.

14.2 It is also assumed that all materials and workmanship will comply with the Building Regulations and the NHBC Standards, and that no significant regrading of the site will be carried out.

14.3 In the absence of finalised foul and surface water sewer details, it has been assumed that invert levels are between 1500mm and 2000mm depth.

15.0 Contamination

(Refer to Appendices 1, 6, 7, 10, 12 and 14)

15.1 General

15.1.1 This is a basic appraisal of the issues identified to date regarding contamination with respect to residents occupying the site, groundworks contractors working on site, the surrounding residents, as well as the groundwater and the surrounding ecosystems. The site investigation for Vine Street was originally commissioned by a different client than that currently considering development on this site. During the period of transition between clients, between July and October 2006, no work was undertaken by Cooper Associates.

15.1.2 Our assessments assume that the future development of the site will comprise a combination 29 No.2 storey residential dwellings in accordance with the Richard Ward Design Sketch Layout for Vine Street, Gorton, Manchester, Drawing No. 239.01, dated 19 September 2006. It has been assumed that the 29 No. residential dwellings on site will have both front and rear gardens. The front gardens will be determined as residential without plant uptake and the rear gardens to be residential with plant uptake. The notation of plant uptake refers to the growing of vegetable/fruit products rather than the growth of non vegetable/fruit plants/shrubs and trees. No soft landscaping is shown on the Sketch Layout drawing. Proposed slab levels were not known at the time of this report being written.

15.1.3 Samples of fill, groundwater and natural strata from trial pits, excavated by Cooper Associates were submitted to SAL Limited for laboratory analysis to determine the levels of chemical contamination. A copy of all the test results are contained in Appendix 10. The approximate locations of the exploratory holes are shown on the Site Plan in Appendix 14.

15.1.4 According to the historical maps, the site was open agricultural land with suspected ponds present in 1848, with a railway cutting to the north. By 1910 the land was suspected to be part of a Brick Works, with a railway line in cutting adjacent to the western boundary. By 1923 the site had potentially been worked out by the Brick Works as the cutting slope adjacent to the railway had moved eastwards. The Brick Works was no longer present in 1923, being replaced by terraced housing. The site has remained undisturbed until the late 1980's when infilling works to the adjacent railway line may have included the site in regrading.

15.1.5 It should be noted that potentially contaminated ground may be encountered during site clearance, which has previously remained undisclosed. Should this be the case, the materials should be sampled and tested, and remediated if found to be contaminated under the guidance, advice and supervision of a suitably qualified geoenvironmental consultant.

15.2 Conceptual Model

15.2.1 Fill materials were encountered in all trial pits and cable percussive boreholes. In all of the exploratory holes undertaken, fill was bottomed out at depths of between 2.8m and 10.2m.

15.2.2 Fill materials comprised predominantly of sand fill with subordinate areas of clay fill. In all cases the fill materials were dark brown, mottled black, occasionally black and red. The sand fills were predominantly medium dense, occasionally loose and the clay fills were predominantly stiff to firm, occasionally soft. In the sand fills the subordinate constituents were clayey and gravelly and in the clay fills sandy and gravelly. The gravel constituent was typically fine to coarse in size. In both the sand fills and clay fills the minor constituents comprised occasional brick, concrete, ash, glass, timber, tar, metal fragments and cobbles.

15.2.3 Geotechnics boreholes BH2, BH5, BH6, BH7 and BH7B recorded hydrocarbon odours within the fill materials at ground level, to between 1.3m and 4.2m and in BH2 at depths of between 8.7m and 9.15m.

15.2.4 Obstructions within the fill materials, or possibly at the base of the fills were encountered in Geotechnics borehole BH5, as a concrete slab at 9.0m, and refusal on an unidentified obstruction in Geotechnics boreholes BH7 at 9.2m and BH7A at 3.0m. TBV Stanger borehole BH3 also terminated on an obstruction at depth of 2.15m.

15.2.5 Within the majority of the cable percussive borehole positions, fill strata was underlain by a generally medium dense to dense, silty, fine to coarse sand with occasional fine to medium gravel of coal at depths of between 3.4m and 10.2m.

15.2.6 In boreholes BH2, BH3, BH7C and BH8 (all drilled by Geotechnics) the natural sands were underlain by a firm or very stiff, brown, slightly sandy to sandy, slightly gravelly (fine to coarse) clay at depths of between 8.8m and 13.10m.

15.2.7 Bedrock was not encountered in any of the cable percussive boreholes drilled to a maximum depth of 20m.

15.2.8 Groundwater ingresses as seepages were noted in 3 of the 9 No. trial pits at depths of between 1.3m and 2.8m.

15.2.9 Observations during the drilling of the boreholes recorded water entries at depths of 1.8m to 15.4m. In most cases water entries were only recorded once the borehole had encountered the underlying sand strata. Occasionally, as in TBV Stanger borehole BH1 and Geotechnics BH6, slight seepages within the fill materials were recorded. Likewise in Geotechnics boreholes BH7C and BH8, seepages within sand lenses within the clay strata were recorded, but no seepages within the overlying sand strata. Only Geotechnics boreholes BH4, BH5, BH7 and BH7A did not record any water entries. In the case of Geotechnics boreholes BH5, BH7 and BH7A this was probably because the boreholes did not encounter the underlying stratas due to terminating on obstructions.

15.2.10 Standpipes for ground gas monitoring were installed in Geotechnics boreholes BH1 to BH6, BH7C and BH8. Many installations were dual with response zones within the fill materials and the underlying sand strata. The standpipes were monitored over a period of 9 months and indicated that the top 5.0m of the fill material was generally dry. However, where the response zone of the boreholes straddled the recorded water entry depth, it was observed that these water levels stabilised at depths of between 6m and 10m.

15.2.11 The site is designated as a non aquifer overlain by soils of high leaching potential (urban) soils. The site is not located within a Groundwater Source Protection Zone. According to the Envirocheck Report the nearest protected water source, Chorlton Beck, is located approximately 860m south of the site. The watercourse has a GQA Grade E (poor) for water quality during the year 2003. According to the Envirocheck Report there are no current groundwater abstractions within a 1km radius of the site. This has been confirmed by the reply from MCCRES. According to the Envirocheck Report, there are no current discharge consents within a 500m radius of the site. There are no pollution incidents higher than Category 3 (minor) within a 849m radius of the site. The nearest significant (Category 2) pollution incident to the site involved the overflow of industrial effluents into the Gore Brook in 1993.

15.2.12 It is considered that the primary receptors for this site upon completion of the development will comprise groundwater, the resident within private residential gardens and the landscape gardener within areas of managed landscaping.

15.2.13 The following assessment has determined potential point sources of contamination, potential pathways, as well as determined key receptors for this site. A conclusion has been included at the end of this section, summarizing this solution for the purpose of the developer.

15.3 Potential Point Sources of Contamination

15.3.1 *General fill overlying the site* – This fill has no providence to state where or how it was derived. The fill samples analysed comprised:

- 9 No. samples of sand fill
- 3 No. samples of ash and slag fill

15.3.2 *Proposed Temporary Above Ground Fuel Storage Tank*

Proposed above ground fuel storage tanks associated with the redevelopment of the site may also bring a potential point source of contamination. Plant should be checked and maintained regularly to ensure fuel/oil leakages do not occur.

15.3.3 *Imported fill* – Imported fill requires validating to ensure that contaminated soils are not brought onto site.

15.3.4 *Ground gases* – Elevated concentrations of methane and carbon dioxide were encountered on site from unidentified sources. The ground gas mitigation measures for methane and carbon dioxide will be addressed in Sections 23.0 to 26.0.

15.4 Pathways

15.4.1 *General Fill* – The granular fill allows infiltrated water to flow with least resistance, with cohesive fill forming lower permeability barriers that will impede groundwater flow. Obstructions such as basement walls and concrete slabs may also form barriers within the strata. Potential for lateral and vertical migration of leachable elements and compounds is high within granular fill, with ground waters perching over clay fills.

15.4.2 *Natural Clay* – Generally is very low permeability. Potential for migration of leachable elements and compounds low. Groundwaters tend to perch above allowing a very limited volume of contamination attenuation. This is generally a thin lens and is present between the fill strata and the natural sand.

15.4.3 *Natural Sand* – Permeable strata which may allow leachable groundwaters to migrate laterally and vertically.

15.4.4 *Drains* – Pathway for leachable elements and compounds to flow, if breakages of the pipeline occur this may cause a secondary point source for contamination.

15.4.5 *Dusts* – If the turf is removed from the surface of the site during dry days and during reprofiling the surface may dry sufficiently to be blown in the prevailing wind. We advise during dry periods that any exposed fills be damped down. During occupation, if fills are present on the surface, these may be carried into the house by normal gardening works, by sitting on exposed fill and having soil adhering to clothing as well as soil adhered to the sole of shoes brought into the house. These soils dry, desiccate, flake and form dust.

15.4.6 *Sewer/Service Excavations* – Pathway for leachable elements and compounds within groundwater to migrate from contaminated to uncontaminated areas. Currently this is not an issue, however this pathway may be important if a contamination event occurs on site (i.e. leakage of fuel).

15.4.7 *Direct contact with soils* – Hand to mouth contact, or direct ingestion from soil or soil adhered to vegetation.

15.5 Targets

15.5.1 The proposed planning layout comprises 2 storey residential houses. The land use assessment for this form of housing is anticipated to be residential with plant uptake for rear gardens and residential without plant uptake for front gardens. No soft landscaping areas or Public Open Space is indicated on the Sketch Layout. The proposed layout has been included within Appendix 14.

15.5.2 *Potential residents* – (Domestic dwelling with plant uptake)

Near surface fills. There is a greater risk to residents with private gardens rather than occupants of apartments as there are no restrictions to the usage of garden areas. It has to be considered that the use of the garden area has to be reasonable. It is not feasible to carry out risk assessments regarding extreme land use, therefore it has been assumed that the majority of domestic gardening occurs within the upper 600mm of soil. The predominant depth of regular excavation will be up to 200mm due to the planting of annual and biannual bedding plants with shallow weeding. It is anticipated that the deeper planting will be associated with the planting of deep potted shrubs, and is generally restricted to few occasions over several years. It is anticipated that the majority of the gardens will comprise lawn and ornamental bedding. Residents may utilized their garden as allotments and grow vegetables. It is anticipated that the deepest cropping vegetable will be the potato and generally crops to depths of up to 500mm (it should be noted that potatoes are generally over dug where by during the growth of the crop soil is piled onto the plant). It is therefore considered that the initial 600mm of garden will be the threshold zone for risk to the resident. This assessment concurs with the findings of BRE Report 465, Cover Systems for Land Regeneration. It is highly unlikely that the resident will excavate to depths in excess of 600mm. If this does occur, it will be on the basis of once or possibly twice a year for a very small period of time.

It is highly unlikely that the residents will be planting vegetables for consumption within the front gardens of the houses. It should be noted that there is no clause within the deeds to restrict this practice, however we have to assume reasonable practices within these areas of the site. It is traditional to plant lawn and bedding plants, or pave the entire area of the front garden depending upon residents proficiency regarding gardening. It is generally assumed that the aesthetic value of having a vegetable patch in the front garden is significantly low, and produce may be lost by theft from passers-by. The potential for human health risk regarding the consumption of vegetables grown in these areas is hence negligible and should not be considered.

The transporting of soils into the property also poses a risk to the residents. The soils caked on shoes and adhered to clothing due to contact with soils will dry, desiccate and form dust in the houses.

Vapours of any ground gases present beneath the site may affect residents both in the garden areas as well as beneath the ground floor slab. It is anticipated that vapours will disperse relatively rapidly within garden areas. Vapours beneath proposed buildings will require special precautions for passive venting. The potential for vapour risk is however high due to previous gas monitoring data recorded for this site. It should additionally be noted that the majority of the fill and natural strata has a high permeability and will allow rapid oxidation and dispersion of any ground gases present on site. Risk assessment for ground gases is discussed in Sections 23.0 to 26.0.

Any excavations associated with the constructing of extensions to the property should only be completed after consulting the Planning Department of Manchester City Council.

Children may come into contact with soils during unsupervised playtime through direct ingestion and during supervised playtime through inadvertent consumption of soils from toys which have come into contact with soils. When very young children excavate in soils, it is anticipated the maximum depth will be in the order of 200mm to 300mm. It is anticipated that parents will not leave young children unsupervised in garden areas for any significant period of time.

15.5.3 *Groundwork's contractor*

Affected by near surface fill. During construction works, ground work's contractors will come into contact with site soils prior to, during and after re-profiling. Soils adhered to boots and clothing may be taken off site and be taken into the groundwork's contractor's house. Vapours may affect groundwork's contractors within confined spaces, and where extremely odorous may create headaches.

No site burning must be permitted and strictly enforced on this site

15.5.4 *Adjacent residents*

Adjacent residents to the development may be affected by fuel from the site migrating beyond the site boundary. During dry periods on site when soils are exposed, contaminated dusts may be created by the development and be carried with the prevailing wind. We would advise that during dry periods, the site is damped down to suppress the dust.

15.6 Contamination Assessment

15.6.1 Contamination assessments have been made in accordance with CLR10 soil guideline values (SGV's) where available. Those elements and compounds which do not currently have SGV's include copper, zinc, water soluble boron, cyanide, as well as the array of compounds which make up the polycyclic aromatic hydrocarbons (PAH). DEFRA have withdrawn ICRCL Guidance Note 59/83 (2nd Edition) on 20 December 2002. As a consequence, we have been advised that in the absence of CLR10 for individual determinants, reference should be made to the relevant Eurocode, or failing that the New Dutchlist or USEPA guidelines. We are aware that no Eurocodes for elements or compounds exist, therefore the New Dutchlist has been adopted for phytotoxic elements and compounds. Benzo(a)pyrene has been utilised as a guide compound for PAHs, this compound is the most carcinogenic.

15.6.2 Cooper Associates have run the CLEA 2002 software provided by the Environment Agency many times for benzo(a)pyrene. Utilising various reasonable parameters it has been determined that the majority of normal results lie between 1mg/kg and 1.2mg/kg. It should be noted that this risk assessment tool has been considered obsolete by the Environment Agency (however the replacement is currently in beta format and should not be relied upon). Utilising the SNIFFER risk assessment model, a concentration of 1.4mg/kg is recognised for residential with plant uptake. As SNIFFER does not account for dermal intake, it has been considered prudent to reduce this threshold by 30% as an overly conservative parameter. A standard site specific assessment criteria of 1mg/kg has been adopted by Cooper Associates for private residential dwellings. Appendix 11 contains a SNIFFER Worksheet for residential without plant uptake.

15.6.3 There is currently no UK agricultural policy regarding the phytotoxic limits applicable for elements such as copper and zinc. The literature utilised by Cooper Associates for review comprise the documents entitled 'Copper in soils and plants' by Loneragan et al, and 'Zinc in soils and plants' by A Robson et al, as well as other recent technical journals generally based in the USA. We have also reviewed the Doyle Report (basis behind former ICRCL thresholds). It should be noted that the majority of the reports relate to produce other than that generally grown in the garden in the UK. The results appear to be highly variable for different plant types in different pH conditions and soil types. Examples of the vast amount of varying information for added zinc are noted below:-

Gall & Barnette (1940)

Corn shoot weight	Reduced 68% in sandy soil at 404mg/kg	No effect at 202mg/kg
Corn shoot weight	Reduced 38% in sandy loam at 334mg/kg	No effect at 222mg/kg
Corn shoot weight	Reduced 33% in clay loam at 632mg/kg	No effect at 474mg/kg
Cowpea shoot weight	Reduced 29% in sandy soil at 141mg/kg	No effect at 81mg/kg
Cowpea shoot weight	Reduced 46% in sandy loam at 222mg/kg	No effect at 112mg/kg
Cowpea shoot weight	Reduced 28% in clay loam at 316mg/kg	No effect at 158mg/kg

Boawn and Rasmussen (1971)

mg Zn/kg in soil	*300*	*500*	*Yield decrease in neutral soils*
Lettuce	250 mg/kg dw	665 mg/kg dw	27%
Potato	163 mg/kg dw	327 mg/kg dw	0%
Spinach	640 mg/kg dw	945 mg/kg dw	10%

White et al (1979)

Soybeans pH 5.5 30% leaf weight reduction of growth at 131mg/kg. No effect at 115mg/kg.

Soybeans pH 6.5 33% leaf weight reduction of growth at 393mg/kg.

Lata & Veer (1990)

Root and shoot length spinach (after 60 days) Concentration of 87mg/kg reduced plant weight by 45%

Root and shoot length coriander (after 60 days) Concentration of 87mg/kg reduced plant weight by 22%

[*Toxicological Benchmarks for Screening Contaminants of potential Concern for Effects on Terrestrial Plants: 1997 Revision. US Dept. of Energy, reference ES/ER/TM-85/R3*]

'The ***tissue concentration*** of zinc [in lettuce] which is regarded as phytotoxic is approximately 200µg/g'

[Doyle P.J, 1978. *Survey of Literature and Experience on the Disposal of Sewage Sludge on Land.* Extract taken from Webber J, 1974. *Sludge handling and disposal practices in England. In Conference Proceedings No. 2 Environment Canada. Research for the Abatement of Municipal Pollution under Provisions of the Canada-Ontario Agreement on the Great Lakes Water Quality*].

15.6.4 We consider that it will be a significant time until suitable thresholds are obtained and produced by regulatory bodies with respect to the potential acceptable thresholds for those elements and compounds deemed as principally phytotoxic, with lesser human health issues. We anticipate that the application of the withdrawn ICRCL thresholds (based on the Doyle Report) may be relevant however appreciate that these threshold values are not defensible.

15.6.5 It should be noted that the EU has not produced European wide threshold levels for elements and compounds, however the following thresholds are adopted by member states:

State	Copper (mg/kg)	Zinc (mg/kg)
Netherlands	36 (optimum)	140 (optimum)
	190 (action)	740 (action)
Sweden	100	350

15.6.6 WS Atkins have produced threshold values for copper (650mg/kg) and zinc (130mg/kg). These and their justifications have not been made available to consultants, however the Statutory Bodies have been noted to utilise these values. It has been stated that the risk assessment tool utilised for their assessment was a modified BP Risc workbook.

15.6.7 In accordance with CLR 8, Potential Contaminants for the Assessment of Land, March 2002, p6, Table 2.1, it has been determined that copper and zinc are hazardous to water, vegetation and the ecosystem. It has been considered that the potential affects to humans are significantly less than that of plants, and hence plants have been utilised as the risk driver.

15.6.8 We consider that in this instance the Swedish threshold for zinc and copper are the most appropriate conservative thresholds for these metals. We accept this is not an ideal method for determining the threshold values, however we have considered the most conservative thresholds. We consider the optimum threshold from the Dutch List (for copper and zinc) and the WS Atkins (for zinc) to be too conservative for use within the UK as there may be considered background levels. According to the BGS Regional Geochemistry for North West England and North Wales (1997), 'with the exception of anthropogenic anomalies, most zinc values are below 400mg/kg over the whole Permo-Triassic outcrop' regarding the geological formation the site is situated over. We acknowledge that the singular use of thresholds for individual metals is not considered suitable, however by adopting these more stringent thresholds, we consider that the site will be adequately protected. As mentioned previously these results are predominantly for a phytotoxic assessment and does not relate to human health.

15.6.9 It is unlikely that the UK guidance will accommodate or facilitate a uniform platform for the assessment of these metals unless it is found that the copper and zinc is actual detrimental to human health.