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16th December 2009

Dear Sir,

Planning Application for Change of Use & Extension At 120 Wilton Road, Crumpsall, Manchester

This latter is to accompany the ground contamination report regarding the above and is in respect of the buried fuel tank located adjoining the brick boundary wall. This is a retaining wall and is of substantial construction, with the tank extending below the base of the wall. To remove the tank would cause much structural damage to the wall and disturbance of the surrounding area and for this reason we would recommend that the tank remains in its present position below ground, and is filled as detailed in the contamination report and risk assessment.

Yours sincerely



Stuart Smith
Stuart Smith & Associates

PLANNING	
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REC'D	17 DEC 2009



LAND AT

**120 WILTON ROAD
CRUMPSALL**

**GROUND INVESTIGATION
AND RISK ASSESSMENT
REPORT**



Prepared for:

Mr N Hughes
31 Downham Crescent
Prestwich
M25 0EH

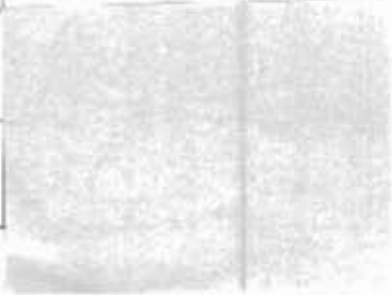
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Document Verification

Site Address	Land at 120 Wilton Road, Crumpsall		
Job Number	CL1513-02		
Report Title	Ground Investigation and Risk Assessment Report		
Date Issued	14 th December 2009	Document Ref.	CL1513-02- R0
Prepared By	Michelle Fallone	Signature	
Checked By	Colin Crompton	Signature	

EXECUTIVE SUMMARY

Site Details	This report was undertaken in support of a future planning application. The site is located west of Wilton Road in Crumpsall, Manchester at National Grid Reference 384170E 402590N. The proposed development comprises the conversion and extension of the existing building to form a residential property with the areas around the building being fully hardstood.
Previous Work	Previous reports have been undertaken on the site by Opus Joynes Pike and Card Geotechnics which identified a hotspot of hydrocarbon and PAH contamination, possibly associated with a heating oil tank onsite.
Tank Decommissioning and Further Investigation	The tank on site was decommissioned by a suitably qualified company and left in situ so not to undermine the adjacent retaining wall. A further phase of ground investigation was undertaken around the tank and involved the excavation of four trial pits / trenches to depths of between 2.5mbgl to 3.2mbgl. Five representative soil samples were taken during the additional investigation and selected for chemical contamination analysis. In addition vapour monitoring was also undertaken via headspace testing of the soil.
Ground Conditions	The general ground conditions beneath the Wilton Road site comprised of made ground underlain by medium sand and occasional sand and gravel and clay.
Soil Risk Assessment & Recommendations (Human Health)	Based upon the previous and current site investigation data elevated levels of chromium and B(a)P were encountered at the site. However, LKA understand that the site is to be fully hardstood, with no areas of garden or soft landscaping. As such the risk from direct contact with these contaminants will be mitigated.
Controlled waters Assessment & Recommendations	Based upon the results of the previous investigation, no elevated levels of contaminants were encountered on site. In the absence of elevated contaminants, this pollutant linkage was considered incomplete.
Hazardous Gas Assessment & Recommendations	Based upon the gas monitoring undertaken during the previous investigation, elevated levels of carbon dioxide were encountered at the site. The site falls within CS2 and as such gas protection measures are required. It should be noted that these measures will need to be retrospectively fitted into the existing building.
Additional Risk Assessment	LKA recommend that the utilities provider be contacted with regard to the specification of water pipes required for the site.

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1 INTRODUCTION

1.1 Background

Leyden Kirby Associates Ltd (LKA) has been commissioned by Mr N Hughes to carry out further investigation and risk assessment works for land at 120 Wilton Road, Crumpsall. This work is being undertaken to support the future redevelopment of the site for residential end use. Information is therefore required on the properties of any potential contaminants that may be present in, on or under the site.

A Preliminary Risk Assessment (PRA) report and Geoenvironmental Interpretive Report have previously been undertaken by Opus Joynes Pyke (Ref: J-S0156_R1_RW, dated April 2009) and Card Geotechnics (Ref: CGN/2630, dated July 2009) respectively and should be read in conjunction with this report.

1.2 Site Details

The site is located west of Wilton Road in Crumpsall, Manchester at National Grid Reference 384170E 402590N (Figure 1-1). The site is bounded to the south by Coppleridge Drive, to the east by Wilton Road, to the west by an electricity sub station and residential property and to the north by vacant land used for the storage of vehicles. The site is currently occupied by an existing single storey brick building.

The site is approximately 0.04ha in size and is approximately level (see Figure 1-2). The site proposed layout is indicated in Figure 1-3 and comprises the conversion and extension of the existing building to form a residential property with the areas around the building being fully hardstood.

1.3 Disclaimer

This report has been prepared by LKA who have exercised such professional skill, care and diligence as may reasonably be expected of a properly qualified and competent consultant experienced in preparing reports of a similar scope.

However, to the extent that the report is based on or relies upon information contained in records, reports or other materials provided to LKA which have not been independently produced or verified, LKA gives no warranty, representation or assurance as to the accuracy or completeness of such information.

This report is issued on the condition that LKA will not be held liable for any loss arising from ground conditions between sampling points (i.e. boreholes/trial pits/hand augers/surface samples) which have not been shown by the sampling points or related testing carried out during the investigation, nor for any loss arising from conditions below the maximum depth of the investigation. Opinions on such conditions, where given, are for general guidance only.

This report is prepared solely for the benefit of Mr N Hughes. It may not be relied upon by, or submitted to a third party for their reliance for the purposes of valuation, mortgage, insurance and regulatory approval, until all invoices have been settled in full. Those using this information in subsequent assessments or evaluations do so at their own risk.

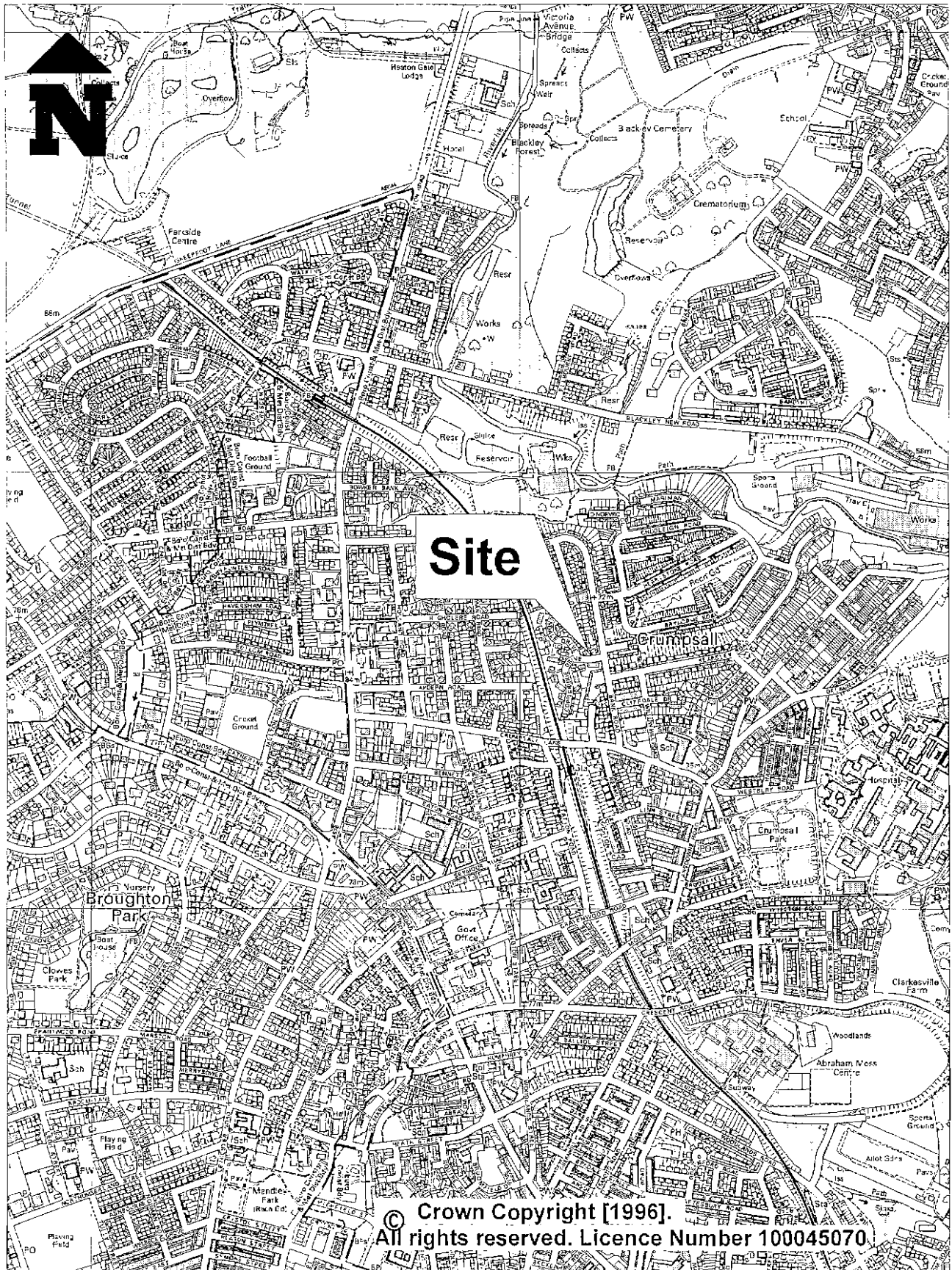
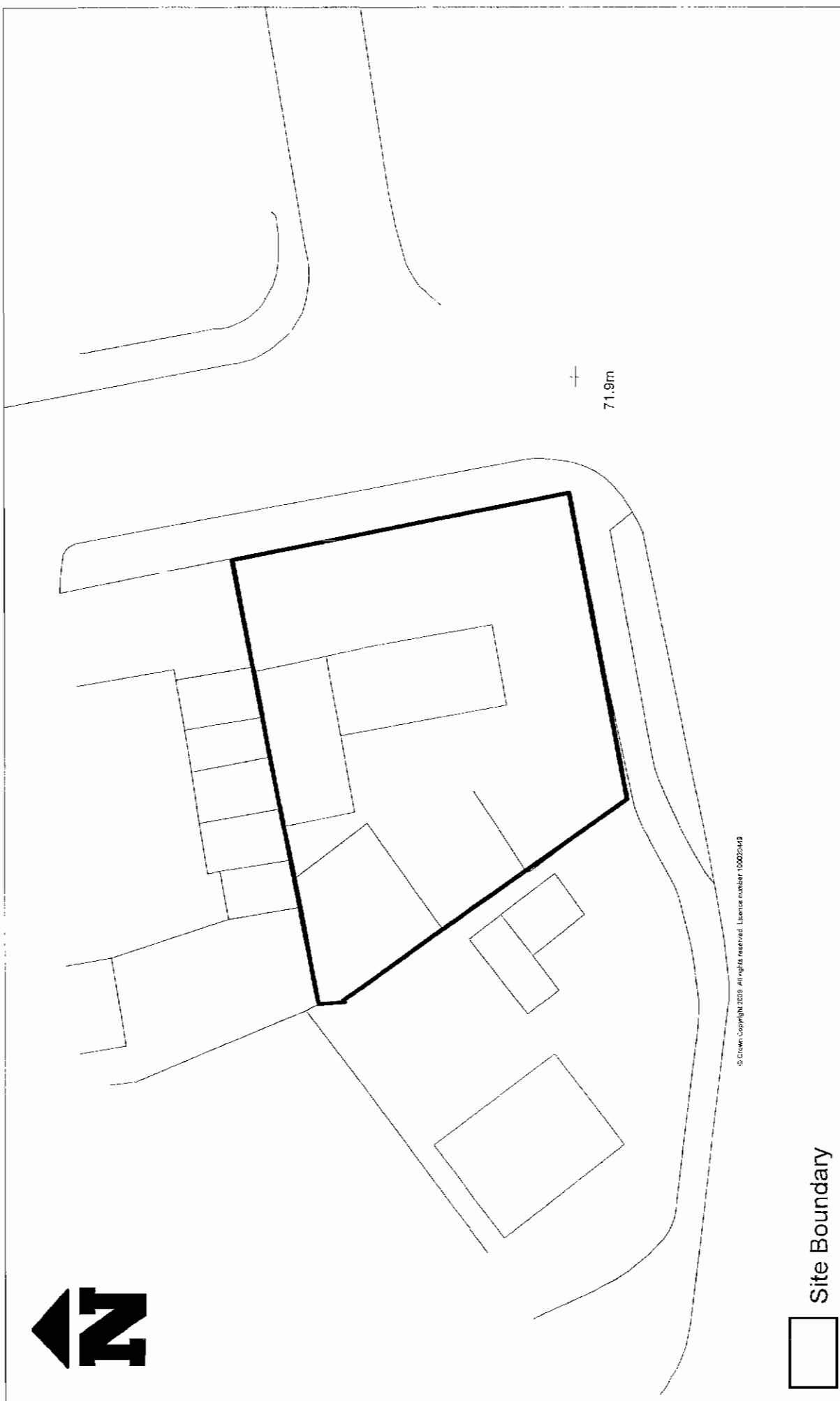


Figure 1-1: Location Plan, Land at 120 Wilton Road, Crumpsall

Drawn: December 2009

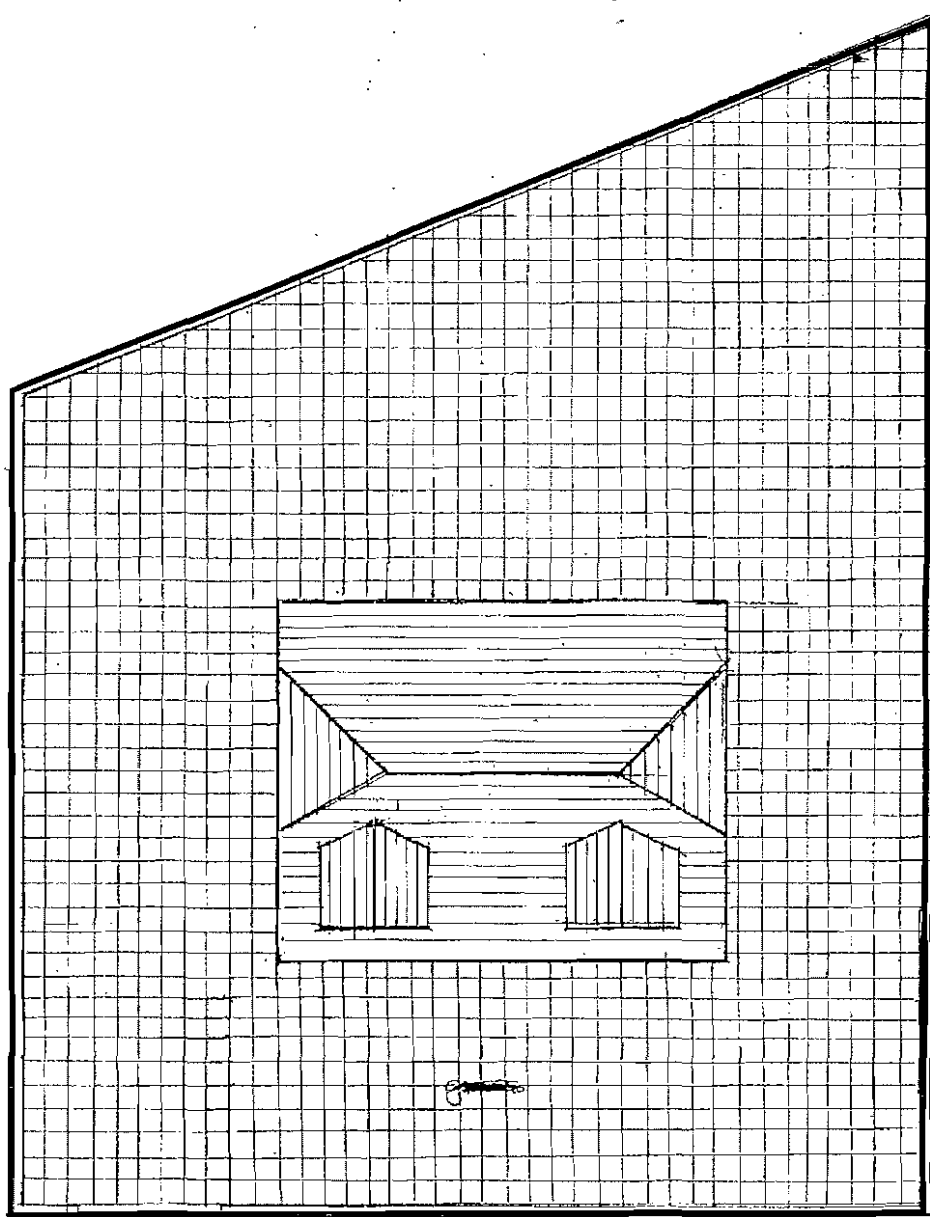


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 Site Boundary

Figure 1-2: Location Plan, Wilton Road, Crumpsall

Drawn: December 2009



Area of hardstanding



Site Boundary

Adapted from plan provided by Bass Construction

Figure 1-3: Proposed Layout Plan, Land at 120 Wilton Road, Crumpsall

Drawn: December 2009



2 PREVIOUS WORK

2.1 *Preliminary Risk Assessment*

A Phase I Desk Study and Preliminary Risk Assessment report has previously been undertaken by Opus Joynes Pyke (Ref: J-S0156_R1_RW, dated April 2009).

The report comprised a review of factual information sources such as site history via historical mapping, geology, hydrogeology, archaeological survey and Coal Authority and ground stability search. A conceptual model was also provided.

A summary of the available information is provided below along with a preliminary conceptual model which has been derived by LKA from the information provided within the previous reports..

2.1.1 *Site History*

The site remained vacant until 1922 mapping when a series of small rectangular buildings were indicated along the western site boundary. These were removed by 1932 mapping. Five rectangular units were constructed in the western and central part of the site by the 1952 mapping, two of which were demolished by the 1989 mapping. By 2009, only one building remained in the centre of the site. Anecdotal information indicates that the site may have been used as a small depot for the storage of scrap metal.

The immediate surrounding areas have been mainly developed for residential usage. Several potentially contaminative land-uses have been identified within 250m of the study site including railway sidings, embankments, domestic garages and an electricity sub station.

2.1.2 *Site Geology, Hydrogeology and Hydrology*

The study site is understood to be underlain by Glacial Sand and Gravel drift deposits, followed by Sherwood Sandstone. No geological faults were indicated within influencing distance of the site.

The Sherwood Sandstone deposits are classified as a Major Aquifer. The nearest surface watercourse is the River Irk, which is located approximately 358m north of the study site.

2.1.3 *Landfill Sites*

There are no Local Authority or BGS Recorded Landfill sites within 1km of the site. The nearest Historical landfill site is located 360m north of the site.

2.1.4 Coal Authority and Ground Stability Report

A Coal Authority Ground Stability Report has been undertaken on the site. A summary of the results of the search show the following:

- The property **is not** within the likely zone of influence of any past underground coal workings.
- The property **is not** within the likely zone of influence of any present underground coal workings.
- The property **is not** in an area where the Coal Authority believes there is coal at or close to the surface which may have been worked at sometime in the past.
- There **are no** known coal mine entries within, or within 20m of the boundary of the property.

2.1.5 Site Reconnaissance

A limited site reconnaissance was undertaken at the time of the previous report from the perimeter of the site, the key observations included;

- The site was occupied by a rectangular single storey brick building.
- An area of soft landscaping was present in the eastern part of the site, to the front of the building.
- The remaining groundcover was observed to comprise concrete hardstanding.

2.1.6 Potential Contaminants

The preliminary contamination conceptual model adapted from the conceptual model in the previous report is summarised in Table 2-1 below. The conceptual model is based upon contaminant-pathway-receptor pollutant linkages, on the premise that if there is no pollutant linkage then there will be no risk to the receptor¹.

Potential contaminants that may be present on the site could be associated with the site's use for the storage of scrap metal and with any made ground which may be present on site. Therefore potential contaminants may include heavy metals (such as arsenic and lead) and Polycyclic Aromatic Hydrocarbons (PAHs, such as benzo(a)pyrene (B(a)P))². The existing building structure may also contain Asbestos Containing Materials (ACMs). Furthermore, there may be localised spillages of hydrocarbons associated with the storage of vehicles and scrap metal on site.

In addition any made ground on-site may comprise ash and clinker waste from hearths and boilers, which was historically often used as level raising material. This material may contribute to heavy metal and PAH contamination as may any atmospheric fallout from nearby chimneys. Depending upon the sulphate content of the combusted coal, soluble sulphate may also be generated.

Infilled features have the potential to generate hazardous gas (primarily carbon dioxide and methane). The previous report did not identify any landfill sites within 250m of the site.

Hazardous gas generation can also occur from made ground on the site, however this is strongly dependant upon its quantity and composition. If significant amounts of putrescible or degradable material is found on site hazardous gas generation may be possible.

¹ Defra (2004). "Model Procedures for the Management of Land Contamination." R&D Publication CLR 11

² Defra (2002). "Potential Contaminants for the Assessment of Land." R&D Publication CLR 8

The pathways by which the receptors could be exposed to the potential hazards present are through dermal contact, inhalation, uptake or ingestion of contaminated soils or dust, migration along service runs, permeation through and attack of building materials and consumption of potentially tainted water supplies and uptake of contaminants.

Potential receptors with respect to human health and hazards present on the site include residents of the proposed development and future site construction workers. Depending on the nature and concentration of the potential contaminants, the underlying Major Aquifer may also be considered as potential receptors. The fabric of the proposed buildings and building materials are also considered to be potential receptors along with any vegetation in areas of proposed soft landscaping.

The River Irk is not considered a viable receptor given its distance from the site.

Pollutant	Contaminant					Pathway	Receptor
Linkage	ACM	Gases		Contaminants			
No.		Hazardous	Ground	Organic	Inorganic		
1	?	x	x	?	?	-Dermal Contact. -Ingestion of soils and vegetables. -Inhalation of contaminated soil and dust.	-Future site residents inc. veg uptake. -Future site workers -Nearby properties (windblown dust).
2	x	x	x	?	x	-Inhalation of vapours. -Vapour migration through the sand and gravel. -Vapour migration through sand lenses within the underlying coal measures. -Vapour migration through non-cohesive made ground.	-Future site users. -Future site workers -Nearby properties
3	x	?	x	x	x	-Inhalation of hazardous gas. -Migration through the non cohesive made ground.	-Future site residents. -Future site workers -Offsite receptors (if gas is generated on site)
4	x	x	x	?	?	-Groundwater migration via porous lenses within the underlying coal measures. -Groundwater migration through underlying sand and gravel -Perched waters migration on site.	-Major Aquifer.
5	x	?	x	x	?	-Contact with potential hazards	-Site Buildings
6	?	x	x	?	?	-Ingestion of tainted water supply. -Direct contact and inhalation of dust and vapours.	-Future site residents. -Future pipe installers -Maintenance workers.
7	x	x	x	x	?	-Root uptake of phytotoxic contaminants	-Flora in future landscaping.

Table 5-1 Contamination Conceptual Model for the land at 120 Wilton Road site.

(Key: ? – pollutant linkage possible; x – pollutant linkage unlikely)

The conceptual model for the land at 120 Wilton Road site identified seven generic potential pollutant linkages, all of which were considered possible. It was considered that detailed intrusive investigations were required to further assess these linkages.

2.2 Geoenvironmental Interpretative Report

A site investigation and risk assessment report was carried out by Card Geotechnics (Ref: CGN/2630, dated July 2009).

A total of seven window sample boreholes were undertaken to depths of between 3.0m below ground level (mbgl) and 5.0mbgl.

2.2.1 Ground Conditions

Made ground was encountered in all of the boreholes to depths between 1.6mbgl and 4.8mbgl. The made ground comprised concrete, bricks, reworked clay, silt and sand with gravel of brick, coal, concrete, pottery, slag and wood.

The natural ground was found to comprise glacial sand and gravels underlain by Till. The sand and gravels were encountered to a depth of between 2.8mbgl and 4.8mbgl.

The Till deposits were recorded at depths between 2.8mbgl and 5.0mbgl and comprised a firm to stiff slightly gravelly clay.

Groundwater strikes were generally recorded within the made ground between 2.0mbgl and 3.2mbgl, suggesting that perched groundwater is held within the made ground. A groundwater strike was also recorded in the natural strata at 4.2mbgl in WS5.

Generally no visual or olfactory evidence of contamination was encountered during the site investigation, however a slight hydrocarbon odour was recorded in WS3 in the made ground between 1.2mbgl and 1.6mbgl and between 2.8mbgl and 3.0mbgl in the natural Till.

WS3 was located in close proximity to the possible UST feature noted in the southern part of the site and as such the hydrocarbon odour was possibly attributed to this feature. WS7 was drilled to confirm the presence of any further hydrocarbon contamination near to the tank, however none was identified.

2.2.2 Chemical Analysis

Seven soil samples were selected and analysed for a range of contaminants. The results identified elevated levels of Aliphatic EC12 to EC16 within WS3 at 1.5mbgl. Elevated levels of benzo(a)pyrene (B(a)P) was also recorded in WS3 at 0.3mbgl. It was considered that WS3 was a single hotspot of contamination, probably associated within the presence of the UST and fragments of coal recorded.

In addition, the soil samples were subjected to leachability analysis for a similar range of contaminants. The results indicated that there were no levels of leachable contaminants.

2.2.3 Gas Monitoring

Three of the boreholes were converted to gas monitoring wells with their response zones located within the made ground strata. At the time of the previous report, only two gas monitoring visits had been completed, with additional visits scheduled.

The results of the two gas monitoring visits indicated no methane was present on site and a maximum concentration of carbon dioxide of 8.8%v/v. The maximum flow rate detected was 0.3l/hr.

2.2.4 Recommendations

Based upon the above information, the previous report made the following recommendations for the site;

- Nature and extent of possible UST to be established. If a UST is confirmed, then an experienced tank decommissioning contractor should be instructed to remove the contents, the tank, pipework and any surrounding bedding material (including the area of hydrocarbon encountered around WS3).
- Following the removal of the tank, the surrounding soil should be validated via soil samples taken from the base and sides of the excavation.
- An asbestos survey should be undertaken of the existing building.
- A 300mm clean capping layer should be installed in the soft landscaping areas.
- Gas protection measures in line with Amber 1 should be installed into the building.
- A hydrocarbon resistant membrane was also recommended.

2.3 Regulatory Discussions

LKA understand that both of the previous reports have been submitted Manchester City Council (MCC). Supplementary information was requested by MCC and copies of the correspondence are provided in Appendix A. The information requested included;

1. Justification for the site investigation design.
2. Justification for use of Generic Assessment Criteria Values derived in-house by Card Geotechnics.
3. Further site investigation to be undertaken around the possible tank.
4. Correspondence with the Environment Agency in reference to the risk to controlled waters.
5. Further assessment of the gas risk to the site following the completion of the additional monitoring visits.
6. A more detailed remedial strategy for the site.

LKA understand that Card Geotechnics have previously supplied MCC with their justification for the site investigation design (Point 1). For the purpose of this report LKA will be addressing points 3, 5 and 6 through the use of the existing and additional site investigation data. LKA will be providing an updated risk assessment of the site using published guideline values and not those derived by Card Geotechnics. Therefore Point 2 is no longer applicable.

3 FURTHER INVESTIGATION

3.1 *Introduction*

In order to further investigate the nature and extent of the possible UST on site, LKA attended the site on the 19th October 2009 during the tank decommissioning works. Following completion of these works a further phase of site investigation was undertaken on 21st October 2009. Further details are provided in the following Sections.

3.2 *Tank Decommissioning Works*

The initial site inspection indicated the tank was almost empty and approximately 1.5m in diameter by approximately 1.8m in length. The tank was encased in concrete and appeared to abut adjacent to the foundations of the retaining wall on the southern site boundary. A pipe was noted emerging from the wall however this was empty and without any discernable odour. A faint hydrocarbon smell, possibly heating oil, was noted in the fluid at the base of the tank.

The tank was decommissioned by Tank-Care of Eccles. This included pumping out and removal off site of the residual fluid in the tank. The tank was then filled with water, which in turn was drained and removed off site.

The tank was then sand blasted internally to bare metal. Tank-Care operatives noted that there was no re-entry of water through the tank welds following completion of sand blasting which generally indicates the tank is intact and not perforated.

Following completion, the atmosphere within the tank was tested for vapours. None were recorded. The pipe emergent from the retaining wall was bent over and sealed by Tank-Care.

Photographs and Tank-Care's testing certificate are provided in Appendix B.

3.3 *Site Investigation Design and Methodology*

Following the above works and information and it was considered appropriate to leave the tank in-situ so not to undermine the retaining wall. However, LKA considered it prudent to undertake further excavations and sampling in the area surrounding the tank and around WS3 where previous hydrocarbon contamination had been encountered.

A total of four trial pits and trenches (referenced TP101 to TP104) were undertaken. TP101 was undertaken adjacent to the western part of the tank, TP102 was undertaken adjacent to the northwestern part of the tank, TP103 was undertaken adjacent to the northern part of the tank and extended to the location of WS103 (northeast of the tank and location of the previously identified hydrocarbon hot-spot) and TP104 was undertaken adjacent to the eastern part of the tank. The southern extent of the tank could not be investigated due to the presence of the retaining wall.

All sample locations are shown in Figure 3-1. The trial pits were extended to depths of between 2.5mbgl and 3.2mbgl i.e. below the depth of the base of the tank.

All the trial pit descriptions were carried out in general accordance with BS5930³ by suitably qualified and experienced members of staff. Soil profile logs for the site are presented in Appendix C.

During the course of the site investigation the tank was found to be cased in concrete. No visual or olfactory evidence of hydrocarbon contamination was encountered around the tank. It should also be noted that TP103 was extended between the tank, WS3 and the existing building; however no evidence of pipework connecting the property to the tank was encountered.

3.4 *Sample Collection*

Soil samples of approximately 500g were recovered in plastic tubs and amber jars and vials. All the samples were labelled and stored in cool boxes prior to being collected by courier for delivery to Chemtest Laboratories in Newmarket. If samples could not be delivered the same day then samples were stored in the LKA sample fridge at approximately 4°C. Samples were tracked using appropriate Chain of Custody forms provided by Chemtest.

Six representative soil samples taken during the site investigation were selected for chemical contamination analysis. The samples were subjected to the following analysis:

- pH, speciated banded TPH (TPH CWG), BTEX, MTBE and organic matter.

In addition, three samples were also subjected to analysis for USEPA PAH 16.

No visual or olfactory evidence of any hydrocarbon contamination was encountered during the further site investigation.

The majority of the tests are UKAS or MCERTS accredited and further details are given in the certificate of analyses presented in Appendix D. A summary of the analytical results is given in Section 5.

3.5 *Vapour Monitoring*

Monitoring for volatiles was undertaken during the excavation of the trial pits via headspace testing. A total of 10 headspace tests were undertaken across the four trial pits and were generally taken at every significant change of strata.

The samples were monitored for volatiles using TVA 1000B PID. The vapour monitoring results are provided in the soil profile logs in Appendix A and are summarised in Section 5.2.2.

³ British Standard (BS5930:1999). "Code of Practice for Site Investigations."

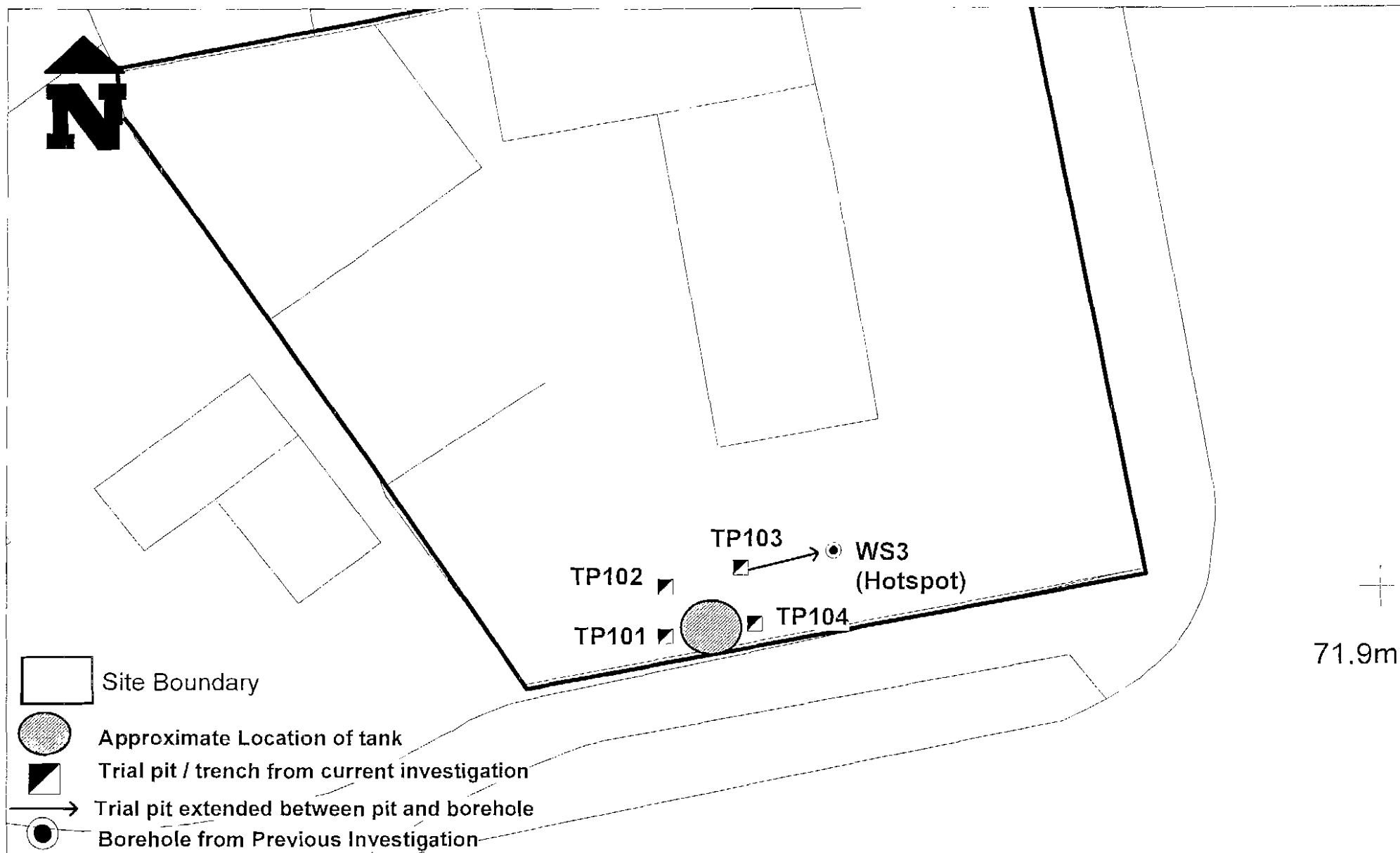


Figure 3-1: Additional Sampling Location Plan, Wilton Road, Crumpsall

Drawn: December 2009

4 GROUND CONDITIONS

4.1 Summary

The general ground conditions beneath the Land at 120 Wilton Road site comprised of made ground underlain by medium sand and occasional sand and gravel and clay. Typical soil profiles (as per the borehole logs from the previous site investigation and the trial pit logs from the current investigation) are summarised below in Table 4-1.

Description of Stratum	Depth where Stratum encountered (mbgl)	Thickness of Stratum (m)	Typical Description	Where Encountered
Made Ground	0.0-4.8	1.6-4.8	Topsoil or concrete underlain by reworked sand, clay and / or silt with gravel of brick, coal, concrete, slag, pottery, wood and bone.	All Boreholes and trial pits
Glacial Sand and Gravel	2.0>5.0	>0.2>1.2	Fine to medium SAND / Silty SAND / clayey SILT / silty SAND and GRAVEL	WS1, WS2, WS3, TP101
Glacial Till	1.6>5.0	0.2>2.0	Brown gravelly CLAY. Occasionally slightly sandy.	WS1, WS3, WS4, WS5, WS6, WS7, TP101, TP102, TP103 and TP104.

Table 4-1: Summary of Soil Profile encountered across land at 120 Wilton Road, Crumpsall

4.2 Made Ground

Made ground was encountered in all of the sampling locations to depths of between 0.6mbgl and 4.8mbgl. The made ground was found to generally comprise topsoil or concrete underlain by reworked sand, clay or silt mixed with brick, coal, slag, pottery and concrete.

Olfactory evidence of hydrocarbons was recorded in WS3 between 1.2mbgl and 1.6mbgl and TP103 at 1.5mbgl.

4.3 Natural Ground

Natural ground was encountered in all of the sampling locations and comprised glacial sand and gravel deposits underlain by glacial till deposits.

The glacial sand and gravel deposits were recorded in four of the sampling locations have comprised a fine to medium sand, silty sand, clayey silt or silty sand and gravel to depths greater than 5.0mbgl.

Till deposits were encountered in ten of the eleven sampling locations and were found to comprise of a brown gravelly, occasionally slightly sandy clay, to depths greater than 5.0mbgl.

Olfactory evidence of hydrocarbon contamination was encountered in the natural ground in WS3 between 2.8mbgl and 3.0mbgl and at 2.0 to 2.3mbgl in TP103.

5 GENERIC QUANTITATIVE RISK ASSESSMENT

5.1 Introduction

Current good practice requires that the findings from a site investigation be evaluated on a site specific basis, using a risk based approach. Risk assessment involves identification and evaluation of the hazards presented by the concentrations of contaminants measured, followed by an evaluation of the risks, which are associated with these hazards (CLR11⁴). Information gathered from the risk assessment has been collated in the revised contamination conceptual model in Section 5.6.

In addition, the results from the previous investigation are considered valid. Where appropriate, these results have been combined with those from the current investigation. This therefore enables a more robust coverage of the study site with respect to sampling and a more substantial set of data which risk assessments can be performed on.

5.2 Soil Risk Assessment

The results of the samples from both the previous and current investigation were compared to the new Soil Guideline Values (SGVs). Unfortunately, there are only a select number of new SGVs currently available and therefore, where there are no SGVs LQM GACs have been used as screening values. These have been generated using the CLEA V1.04 model⁵ based on 6% SOM and although no justification for their chemical derivation has been detailed are still considered scientifically robust and conservative. All these criteria now follow current UK methodology^{6,7,8,9}. A summary of the LQM GACs are attached (Appendix E).

The lead GAC has been derived using a threshold substance, which differs from the original SGV blood level model. In the interim before the official SGV for lead has been published LKA will continue to use the original SGV for lead.

Site specific SOM of 2.5% have been used based upon the results of the soil samples. Where samples have not been analysed for SOM, 1% SOM has been assumed as a conservative approach. The default sandy loam is considered appropriate based on the composition of the near surface material identified at this site. It should be noted the type of soil has limited effect on the generated value.

LKA consider the main risk drivers for PAHs are benzo(a)pyrene (B(a)P), dibenzo(a,h)anthracene (D(a,h)A) and naphthalene. This is due to B(a)P and D(a,h)A possibly being carcinogens and most toxic of the PAHs^{10,11} and naphthalene the most volatile and soluble¹². These determinands will be used to establish the risk from PAHs,

⁴ Defra (2004). "Model Procedures for the Management of Land Contamination." R&D Publication CLR 11

⁵ EA (2008). "CLEA Software (Version 1.03 beta) Handbook." Science Report – SC050021/SR4.

⁶ EA (2008). "Updated Technical Background to the CLEA Model." Science Report – SC050021/SR3.

⁷ EA (2008). "Human Health Toxicological Assessment of Contaminants in Soils." Science Report – SC050021/SR2.

⁸ EA (2008). "A Review of Body Weight and Height Data used within the Contaminated Land Exposure Assessment Model (CLEA)." Project SC050021/Technical Review 1.

⁹ EA (2009). "Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values." Science report SC050021/SR7.

¹⁰ EA (2002). "Contaminants in Soils: Collation of Toxicological Data and Intake Values for Humans. Benzo[a]pyrene." R&D Publication TOX2.

¹¹ USEPA (1984). "Health Effects Assessment of Polycyclic Aromatic Hydrocarbons (PAHs). EPA 540/1-86-013."

¹² EA (2003). "Review of the Fate and Transport of Selected Contaminants in the Soil Environment." Draft technical report P5-079/TR1.

although high concentrations of other PAHs will be compared to LQM GACS, where appropriate

Both the SGVs and LQM GACs are dependent upon the land-use of the proposed development. All the results of the investigation have been compared with "residential" SGVs and residential with plant uptake SSVs.

	Contaminant	Units	No. of samples	Max. Result	No. Exceeded	Assessment Criteria	Source of Criteria
Metals	Chromium (Total)	mg/kg	5	16 (WS2 0.4m)	5	4.3	LQM GAC
PAHs	B(a)P	mg/kg	8	3.8 (WS3 0.3m)	2	0.94	LQM GAC
General	pH	pH	5	Range: 7.7 to 8.1			
	Organic Matter	%	11	Range: 1.8 to 7.2			

Table 5-1: Summary of analytical results, Land at 120 Wilton Road, Crumpsall

Only results that exceeded SSV/GAC have been shown and results from all depths are noted.

5.2.1 Pollutant linkage 1 (Direct Contact)

Elevated levels of chromium and two elevated levels of B(a)P have been identified on the study site.

The primary exposure pathway for these contaminants is via direct contact. However, LKA understand that the site is to be completely hardstood, using block paving set in either concrete or cement in order to provide a permanent base

Given the above information, LKA consider that the risk to the future resident from direct contact with the identified contaminants will be mitigated through the presence of the hardstanding. Therefore pollutant linkage 1 is considered complete pending the installation of the hardstanding on-site.

5.2.2 Pollutant Linkage 2 (Vapour Inhalation)

No elevated refined petroleum hydrocarbon concentrations (individual fractions) were noted from any of the soil samples.

In addition, headspace testing for volatile contaminants was undertaken during the current investigation. No significant concentrations of vapours were detected in any of the samples. Therefore LKA consider that pollutant linkage 2 (vapours) is considered incomplete and no remedial measures are required.

5.2.3 Conclusions of Soil Risk Assessment

Based upon the above findings there is a potential risk from chromium and B(a)P. However, LKA understand that the site is to be fully hardstood and as such this will mitigate the risk from direct contact.

Therefore, LKA consider that pollutant linkage 1 (direct contact) is considered complete pending the installation of the hardstanding at the site.

In addition, no elevated levels of volatile contaminants were encountered and therefore LKA consider that pollutant linkage 2 (vapours) is considered incomplete and no remedial measures are required.

5.3 Controlled Water Risk Assessment

Two soil samples (WS10.8m and WS5 0.8m) were subjected to leachability analysis during the previous investigation.

The site is underlain by a Major Aquifer and the River Irk is located 358m north of the site. Given the distance of the River Irk from the site, LKA consider the underlying aquifer to be the primary controlled waters receptor.

Therefore it is considered appropriate to compare the results with the UK Drinking Water Standards (UKDWS) in the first instance. Where UKDWS values are not available Environment Agency Values¹³ for Environmental Quality Standards (EQS) may be used.

The results of the leachability analysis did not indicate any elevated levels of contaminants above the UKDWS. As such, LKA still consider pollutant linkage 4 is incomplete and no remedial measures are required.

5.4 Hazardous Gas Risk Assessment

A potential gas risk was identified from the previous report given the unknown depth and composition of any made ground on-site.

A total of four gas monitoring visits were undertaken as part of the previous investigation. The visits were undertaken over a range of atmospheric pressures, with one visit being undertaken below 1000mb. The results of the gas monitoring visits are provided in Appendix F and are summarised below.

Boreholes	Max CH ₄ (%v/v)	Max CO ₂ (%v/v)	Max Flow (l/h)	Groundwater Level Range (mbgl)	Max GSV (l/hr)	CS / TL
WS1	<0.1	2.9	0.1	2.28-2.42	2.9 E-03	CS1/Green
WS4	<0.1	13.0	0.3	2.40-2.64	3.9 E-02	CS1/Green
WS5	<0.1	4.8	0.3	2.33-2.56	1.4 E-02	CS1/Green

Table 5-2: Summary of ground gas monitoring for Wilton Road, Crumpsall.

If concentrations / flow are zero then equipment detection limits are assumed.

CS – Characteristic Situation. TL – Traffic Light.

In accordance with current guidance CIRIA C665 a Gas Screening Value (GSV) may be calculated. Assuming worst case scenario maximum concentrations and flow for methane and carbon dioxide generated GSVs of 3.0E-04 l/hr and 3.9E-02 l/hr respectively placing the gas risk within a Characteristic Situation (CS) 1.

However, guidance provided in CIRIA C665 indicates that where methane concentrations exceed 1.0%v/v and / or carbon dioxide concentrations exceed 5.0%v/v, that an increase to Characteristic Situation 2 should be considered. LKA consider that the gas concentrations within WS4 are likely to be from the coal, ash and rootlets within the made ground, which would typically have detectable concentrations of carbon dioxide but low flow rates.

Therefore, based upon the available information, pollutant linkages 3 is considered complete and no remedial measures are required.

¹³ Environment Agency (2001). "Environment Agency technical advice to third parties on Pollution of Controlled Waters for Part IIA of the Environment Protection Act 1990, December 2001"

5.5 Additional Risk Assessment

The concentrations of soluble sulphate in the soil from the previous investigation when contrasted to BRE Digest 2005 categorise the concrete requirement as DS-1 AC-1. Therefore pollutant linkage 5 (sulphate) is considered incomplete no and specific measures are required.

The concentrations of heavy metals, petroleum hydrocarbons and PAHs are above the trigger concentrations as outlined in the United Utilities¹⁴ Pipeline Risk Assessment document. United Utilities should be consulted as to whether protective water pipes and/or sterile trenches are required should the pipes be installed in the made ground. Therefore, at this stage, LKA consider that pollutant linkage 6 is considered complete.

The concentrations of copper, nickel and zinc are below those concentrations considered to be phytotoxic as outlined in document ICRL 59/83¹⁵. Although this document has been withdrawn by DEFRA as a basis for human health risk assessments, it still provides a useful tool in assessing the risk to areas of soft landscaping. As such LKA consider that pollutant linkage 7 (risk to flora) is considered incomplete and no remedial measures are required. In addition no areas of soft landscaping areas are proposed.

5.6 Revised Conceptual Model

A revised conceptual model may be undertaken for the site using all available data. A revised conceptual model is presented in Table 5-2. Only pollutant linkages that possibly still exist and were determined from the site investigation are shown. A description of the likelihood for the pollutant linkage to exist is summarised below.

Pollutant Linkage No.	Contaminant					Pathway	Receptor
	ACM	Gases		Contaminants			
		Hazardous	Ground	Organic	Inorganic		
1	x	x	x	✓	✓	-Dermal Contact. -Ingestion of soils and vegetables. -Inhalation of contaminated soil and dust	-Future site residents inc. veg uptake. -Future site workers. -Nearby properties (windblown dust).
3	x	✓	x	x	x	-Inhalation of hazardous gas. -Migration through the non cohesive made ground	-Future site residents. -Future site workers. -Offsite receptors (if gas is generated on site).
6	x	x	x	✓	✓	-Ingestion of tainted water supply. -Direct contact and inhalation of dust and vapours.	-Future site residents -Future pipe installers. -Maintenance workers.

Table 5-3: Revised Contamination Conceptual Model for Wilton Road site.

Key: ✓ – pollutant linkage identified; x – pollutant linkage unlikely; ? - pollutant linkage possible

Pollutant linkage 1 has been identified with respect to elevated levels of chromium and one elevated level of B(a)P. LKA understand that this risk will be mitigated through the installation of permanent hardstanding in the form of block paving set in concrete or cement.

Pollutant linkage 3 has been identified because of the elevated levels of carbon dioxide encountered on the site. Gas protection measures will be required in the existing building and the proposed extension on site.

¹⁴ United Utilities (2005). "Waster supply pipeline risk assessment".

¹⁵ ICRL 59/83 (1987) "Guidance on the assessment and redevelopment of contaminated land". 2nd edition

Pollutant linkage 6 has been identified due to the presence of heavy metals, PAHs and TPH and consultation with the utilities provider will be required with respect to the specification of water pipes required at the site.

Further details of the outline remedial proposals are given in Section 6.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 *Conclusions*

Historical activities undertaken at the site have included a possible depot for scrap metal. Any level raising / sub base material for the previous buildings on-site may be responsible for the presence of made ground across the site and the associated elevated levels of chromium and B(a)P encountered during the previous site investigation.

An underground storage tank has been identified on site. However, the tank has been cleaned and its integrity demonstrated and site investigation works around the tank have not identified any remnant hydrocarbon contamination.

The site investigation has identified three pollutant linkages which are considered complete and one which is considered possible at this stage. Based on the available data, LKA consider the site may be safely developed with recourse to standard remedial measures and precautionary construction practices.

Outline remedial recommendations and precautions are discussed below.

6.2 *Recommendations*

6.2.1 *Soil Contamination (Pollutant Linkage 1)*

Pollutant linkage 1 relating to direct contact of contamination has been identified for chromium and B(a)P. The potential risks will need to be addressed to satisfy the contaminated land planning conditions.

LKA understand that the site is to be fully hardstood through the use of block paving set in cement or concrete in order to provide a permanent base. LKA consider that this hardstanding will be sufficient to mitigate the risk from the identified contaminants.

It should be noted that should the development layout design change to include for soft landscaping or a private garden area, then remedial measures in the form of a clean capping layer will be required.

6.2.2 *Hazardous Gas (Pollutant Linkage 3)*

Four return gas monitoring visits were undertaken as part of the previous investigation at the site which indicates that the site falls within Characteristic Situation 2 or Amber 1 dependant upon foundation design.

Since the existing building on site is being converted to a residential property, retrospective gas protection measures will be required and should include:

- An uprated damp proof membrane, such as Visqueen 2000g, fitted by a professional contractor.
- Ventilation of confined spaces within building.
- All services entries lapped and taped.
- Validation of gas protection measures.

An extension to the existing building is also proposed. Precautionary gas protection measure should also been installed in the extension in line with the current standard document of gas control practice in CIRIA C665. These protection measures should be commensurate with the Characteristic Situation (CS) 2 and should include as a minimum

- Ventilation of confined spaces within the building.
- Well-constructed reinforced suspended, raft or cast in situ ground slab.
- Up-rated damp proofing membrane, such as Visqueen 2000g lapped through the cavity wall.
- Passively vented sub-floor void.
- Minimum penetration of ground slab by services.
- All joints and penetrations to be sealed.
- Validation of gas protection measures.

Current guidance provided in BS8485:2007 for new rise homes indicates that a point score of three points is required for CS2. Based upon the above recommendations, LKA consider the point score for this site is likely to be the following:

- Passively vented sub-floor void (assumed good performance) - **1 point** (a maximum of 2.5 points could be achieved for very good performance);
- Reinforced concrete floor slab – **0.5 points**; and,
- Installation of membrane to reasonable levels of workmanship/in line with current good practice under independent inspection - **1 point**.

Total = 2.5 points.

LKA acknowledge that the point score for the site does not meet the three point score requirement as per the guidance in BS8485, however in light of the gas risk assessment for the site which takes into consideration the low gas risk to the site, gas monitoring data obtained, the type of gas protection measures to be installed and that the installation and workmanship of the gas protection measures are to be validated, LKA consider that the gas protection measures installed are more than sufficient for the site.

The foundation design has not been provided to LKA at this time. We would advise that the foundation design follow BRE 414¹⁶ and drawings are provided to the Local Authority for approval. In addition, specifications of the damp proof membrane should be sent to the Local Authority for their approval.

We should bring to your attention that Manchester City Council may insist on further ground gas monitoring visits of the existing boreholes. As a minimum gas monitoring would likely comprise an additional two visits be over a month period. All the above gas mitigation proposals will need to be discussed with the Local Authority.

6.2.3 Water Pipes (Pollutant Linkage 6)

LKA recommend that the utilities provider be contacted with regard to the specification of water pipes required for the site. It is considered likely that protectaline pipes or standard alkathene pipes and sterile trenches will be required in the pipes are to be set within the made ground on site.

¹⁶ BRE (2001). "Protective Measures for Housing on Gas-Contaminated Land." BRE 414.

6.3 *Other considerations*

In working with, removing or treating any contaminating material it is important that any potential risks associated with the actual site works are mitigated by good environmental management of the site during the remedial phases. Standard health and safety precautions should be adopted by all workers involved with site enabling and construction works. These should include as a minimum:

- Ensuring wind blow is minimised by dampening down exposed surfaces.
- Ensuring all vehicles leaving the site are clean and if necessary have used a wheel wash.
- Limiting unauthorised access to the site to prevent exposure to contaminated materials.
- The provision and use of washing facilities for site staff, requirement for high standards of personal hygiene to be adopted by all site staff, particularly before and during meals.

At this stage LKA have not identified a significant contamination source associated with the tank. Therefore it is proposed to backfill the tank with 20:1 concrete slurry mix as per guidance provided by the petroleum officer.

6.4 *Remediation Verification & Site Completion Report*

It is strongly recommended that any remediation carried out on the site is validated by a third party and suitable documentary evidence provided in a Site Completion Report, such as photographs, consignment documents and soil depth measurements. This should include as a minimum:

- Verification of gas protection measures to ensure the membrane has been installed correctly and evidence of appropriate ground joints, welds and service entry seals.
- Information on the installation of protective pipes.
- Validation of the installation of the hardstanding.

The Site Completion Report will assist the Local Authority in the discharge of any future relevant planning condition and will also be of use to solicitors acting on behalf of any prospective homebuyer or conveyancer who may have concerns over the former use of the site.

APPENDIX A

REGULATORY CORRESPONDENCE

From: Carolyn Parry [mailto:c.parry@manchester.gov.uk]
Sent: 23 July 2009 10:34
To: Matthew Gray
Subject: RE: 120 Wilton Rd - App. 086699

Matthew,

I have heard back from our Contaminated Land Section on the new information you sent over via email last week. Their comments are as follows:

The Contaminated Land Section has received a copy of the following information:

- Geoenvironmental Interpretative Report, Card Geotechnics Limited, Reference: CGN/2630. Dated: July 2009.

Previously, this section reviewed the following information:

- Details of site investigation proposals, Email and letter from Kathleen Bryant, Card Geotechnics Limited. Dated: 12th June 2009.

The Contaminated Land Section has reviewed the above information in order to assess the following points:

1. The adequacy of the desk study information available for this site.
2. The adequacy of the site investigation.
3. The adequacy of the final risk assessment.
4. The acceptability of the proposed remediation strategy.
5. Whether the information submitted is sufficient to discharge the relevant contamination and/or gas condition from the planning approval.

A rectangular single storey brick building, a concrete surfaced yard and a heavily overgrown landscaped area occupy the site. Adjacent land use includes residential properties, an electrical substation, and an enclosed yard. Previous land uses on or adjacent to the site have included railway land, coal wharf, infilled feature, timber yard and an electrical substation to the west. The site does not lie within 250 metres of any known landfill sites, and is not in close proximity to any known surface watercourses, and lies above the Sherwood Sandstone major aquifer.

1. The adequacy of the desk study information available for this site

The desk study information and proposed site investigation works were found to be **adequate** in an earlier review.

2. The adequacy of the site investigation

The intrusive investigation comprised of:

Technique	Date	No.	Notes
Window Sample Boreholes	July 2009	7	Formed to depths ranging between 3.0m and 5.0m bgl.
Ground Gas and Groundwater Monitoring Installations	July 2009	3	Installation of combined gas and groundwater standpipes with response zones within the made ground. 2No. rounds of in situ ground gas and groundwater level monitoring. Gas monitoring is on-going.
Soil Sampling / Analysis	July 2009	7	Metals, Inorganics, TPH (Speciated), PAH (Speciated), Phenols, pH, and Organic Carbon
Leachability Sampling / Analysis	July 2009	2	Metals, Inorganics, TPH (Speciated), PAH (Speciated), Phenols, pH, and Organic Carbon
Groundwater Sampling / Analysis	-	-	Not undertaken in this investigation.

Site Ground Conditions: Made Ground was proven to depths of between 1.6m and 4.8m bgl, generally comprising concrete, brick, reworked clay, silt and sand. The Made Ground was found to overlie Glacial Sand and Gravel comprising silty sand and sand and gravel, encountered to a depth of 2.8m and 4.8m. Glacial Till was recorded between depths of 2.8m and 5.0m, comprising generally firm to stiff, locally soft, slightly gravelly clay.

A slight hydrocarbon odour was noted within the soils at WS3. The odour was noted between depths of 1.2m and 1.6m within the clayey silt Made Ground and again at between 2.8m and 3.0m within the natural Glacial Till Strata. This odour was not accompanied by visual evidence of contamination. WS3 is located close to the possible UST feature noted in the southern end of the site. It is therefore, considered that this feature could be attributable for this odour within the underlying soils. WS7 was drilled to confirm the presence of any further evidence of hydrocarbon contamination within the area of the suspected tank; the soils recovered from this hole did not exhibit evidence of hydrocarbon contamination.

Generally, the soil results show concentrations below the relevant guideline values, apart from benzo(a)pyrene and TPH Aliphatic C12 to C16 within WS3.

Card Geotechnics recommended, that to mitigate the risk to end users, the possible tank feature in the southern portion of the site be investigated so that the exact nature can be clarified and any decommissioning or removal can be undertaken and validated prior to development commencing on site.

Site Water Conditions: Groundwater strikes were recorded generally within the Made Ground between 2.0m and 3.2m bgl, suggesting perched groundwater held within the Made Ground. A groundwater strike within the natural strata at 4.2m bgl was also recorded. No groundwater sampling was undertaken during this investigation. Two number leachate samples were taken, the results indicate no concentrations above the relevant UK Drinking Water guidelines

Site Ground Gas Conditions: Gas monitoring has been undertaken on two occasions in June and July 2009, when atmospheric pressures ranged between 1007 and 1009 (both falling and steady conditions). Gas monitoring indicated no significant methane concentrations. Carbon dioxide concentrations were recorded between zero and 8.8% v/v. Generally flow was undetected within the exploratory holes during monitoring however a maximum flow rate of 0.3l/hr was recorded within WS4 fluctuating between 0.1l/hr and 0.3l/hr over a period of 12 minutes. Depleted oxygen (<18% v/v) has been recorded to minimum levels of 9.0% and 17.0% v/v

The site investigation information that has been provided for this development is **inadequate**. In addition to the information provided, further information should be submitted which addresses the following issues:

- In light of the data obtained from the site investigation, further investigation within the vicinity of the possible tank is required as recommended by Card Geotechnics Limited. The initial conceptual model should be refined once the further investigations have been undertaken.

3. The adequacy of the final risk assessment

Ground Assessment: The soil results have been compared to Generic Assessment Criteria (GACs) that have been derived in-house by CARD. Generally, the soil results show concentrations of contaminants below the relevant guideline values. Detailed information on the derivation of the CARD GACs and the statistical analysis of the soils results have been supplied.

Based on the conceptual site model and the chemical results obtained as part of the investigation, Card Geotechnics state it is generally considered that the soils tested pose a negligible risk to future end users/landscaping. The soils recovered from WS3 in the area of a potential UST are considered to pose a low to medium risk to future end users / landscaping. The principal risk driver is considered to be benzo(a)pyrene where present within the shallow soils. The deeper soil contamination (TPH) within the locality of WS3 may also pose a risk to future site users due to the generation of vapours and accumulation of these vapours within buildings. However, this will be mitigated through the removal of the potential UST and any surrounding contaminated soils.

The location of WS3 with the recorded elevated concentration of Benzo(a)pyrene is considered to form part of the driveway of the new development and therefore any pollutant linkage will be broken by this hard standing capping layer.

Controlled Waters Assessment: Two number leachate samples were taken. The results were compared to the Drinking Water Standards as the site is situated over a major aquifer and away from any surface watercourses. The results indicate no concentrations above the relevant UK Drinking Water guidelines.

Please note that the Environment Agency is the regulator of controlled waters and as such need to be consulted and forwarded copies of all the relevant information for this site. This Section will require confirmation that the Environment Agency has approved the risk assessment and recommendations.

Ground Gas Assessment: The gas monitoring data indicates a worst case gas screening value (GSV) of 0.026l/hr for carbon dioxide and hence the site conforms to a 'Green' classification under the NHBC traffic light system. However, since the maximum recorded concentration of carbon dioxide is above 5% consideration should be given to increasing the classification to 'Amber 1'. The risk classification for 'Amber 1' is considered to be low to intermediate requiring low level gas protection measures, comprising a gas protection membrane and ventilated sub floor void to create a permeability contrast to limit the ingress of gas into the building.

Gas monitoring is currently ongoing with the results to be forwarded under separate cover, with the revision of a ground gas risk assessment.

The final risk assessment provided for this development is **inadequate**. In addition to the information provided, the following issues require further clarification:

- Justification for the use of non-UK generic quantitative risk assessment criteria. Use of non-UK criteria would be expected to include a discussion of the conceptual model and assumptions used to derive the generic criteria together with an assessment of the underpinning toxicological data.
- Copies of the relevant statistical analysis for the soil results.
- A more detailed ground gas risk assessment in accordance with current best practice.
- Confirmation of Environment Agency approval for the controlled waters risk assessment and conclusions.

4. The acceptability of the proposed remediation strategy

The following measures are proposed so that the contamination identified on site no longer presents a risk:

- Soft landscaping areas and garden to be capped with an appropriate thickness of clean imported topsoil no less than 0.3m thick.
- Should the possible UST be confirmed it is recommended that an experienced tank decommissioning / removal contractor be instructed to undertake the removal of the contents of the tank, the tank and any surrounding bedding material and supply lines under appropriate duty of care and in line with an approved method statement / remediation statement.
- Upon removal validation of surrounding soils from the sides and base of the excavation are to be undertaken to include appropriate inspection, sampling and soil analysis.
- Where excess spoil is generated, or it is deemed materials are unsuitable for on-site retention, wastes are to be disposed of in accordance with the Duty of Care Regulations and the Landfill Directive.
- WAC analysis to be undertaken.
- If any areas of contamination encountered, the works will cease and further advice to be sought from a suitably qualified consultant.
- Asbestos survey to be completed prior to demolition.
- Due to the hydrocarbon contamination encountered a hydrocarbon resistant membrane is required above the floor slab as a precautionary measure. The membrane is to be taped sealed at the joints with proprietary tape, sealed around service penetrations and its installation inspected.
- Ground gas protection measures to be detailed on completion of ground-gas monitoring.

The remediation strategy that has been provided for this development is **inadequate**. In addition to the data already provided, further information should be submitted that addresses the following issues:

- Details of the proposed works that should include:
- Proposed phasing of the works and appropriate timescales.
- Details of appropriate consents, agreements and licences, for example discharge consents and waste management licences should be provided.
- Site management procedures designed to protect site neighbours, the local environment and amenity during works should be provided, including where appropriate:
- Health and safety procedures.
- Appropriate measures to control dust, noise and odours.
- Control of surface run off.
- Details of how the works will be validated to ensure the remediation objectives have been met are required and should include details of:
- The sampling strategy chosen.
- Appropriate use of on-site observations, including visual and/or olfactory evidence.

- Appropriate post-remediation chemical analysis and/or monitoring data.
- Justification for the proposed clean-up standards including target contaminant concentrations.

5. Whether the information submitted is sufficient to discharge the relevant site investigation and/or gas condition of the planning approval

Before this Section can recommend discharge of conditions from this application, the following information needs to be submitted to the Council for approval:

- (i) Further site investigation works within the vicinity of the possible tank.
- (ii) Further information as detailed in the final risk assessment review.
- (iii) Further information as detailed in the proposed remediation strategy.
- (iv) After completion of site works, a verification report is required to validate that the work undertaken conforms to the remediation proposals received and agreed by this Section. The report would be expected to include the following:
 - Summary of desk study, site investigation report and remediation strategy.
 - Details of who carried out the work.
 - Details and justification of any changes from original remediation strategy.
 - Substantiating validation data that should include where appropriate:
 - Laboratory and *in-situ* test results.
 - Monitoring results for groundwater and gases.
 - Summary data plots and tables relating to clean-up criteria.
 - Plans showing treatment areas and details of any differences from the original remediation strategy.
 - Photographic and other media records.
 - Waste management details and records.
 - Confirmation that remediation objectives have been met.

Please do not hesitate to contact Helen Murphy on 0161 234 1364 if you require any clarification of the above.

Regards

Carolyn Parry

Carolyn Parry
 Planner
 North Area Development Control
 Planning Department
 Manchester City Council
 Town Hall Extension
 PO Box 463
 Manchester
 M60 3NY

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 E-mail: c.parry@manchester.gov.uk
<http://www.manchester.gov.uk>

From: Kathleen Bryant [mailto:KathleenB@cardgeotechnics.co.uk]
Sent: 11 August 2009 15:57
To: danielle.soulsby@environment-agency.gov.uk
Cc: c.parry@manchester.gov.uk; Helen M Murphy; Matthew Gray; Adrian Houlder; Richard Pennock; Cathy Lee
Subject: 120 Wilton Road, Crumpsall, Manchester - App. 086699

Danielle,

As requested by Manchester City Council and further to our telephone conversation please find attached our geoenvironmental interpretative report for the above site on behalf of our client.

Should you have any queries regarding the attached report please do not hesitate to contact us on the details below.

Please confirm receipt of this report and confirm when we are likely to receive a response.

Kind regards,

Kathleen

Kathleen Bryant, Engineer
Card Geotechnics Limited

Tel: 01423 276000

Fax: 01423 531484

Visit us at www.cardgeotechnics.co.uk
GeoTalk Newsletter request: geotalk@cardgeotechnics.co.uk

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Think of the environment; please don't print this e-mail unless you really need to.

-----Original Message-----

From: Carolyn Parry [mailto:c.parry@manchester.gov.uk]
Sent: 11 August 2009 15:05
To: Kathleen Bryant
Cc: mgray@tandgassociates.co.uk
Subject: 120 Wilton Rd - App. 086699

Kathleen,

Please find below Helen Murphy's most recent comments, based on the email you sent on 24 July 2009.

The Contaminated Land Section has received a copy of the following information:

- Email from Kathleen Bryant, Card Geotechnics Limited, Reference: Not Referenced, Dated: 24th July 2009.

Previously, this section reviewed the following information:

- Geoenvironmental Interpretative Report, Card Geotechnics Limited, Reference: CGN/2630, Dated: July 2009.
- Details of site investigation proposals, Email and letter from Kathleen Bryant, Card Geotechnics Limited, Dated: 12th June 2009.

The Contaminated Land Section has reviewed the above information in order to assess the following points:

1. The adequacy of the desk study information available for this site.
2. The adequacy of the site investigation.
3. The adequacy of the final risk assessment.
4. The acceptability of the proposed remediation strategy.
5. Whether the information submitted is sufficient to discharge the relevant contamination and/or gas condition from the planning approval.

A rectangular single storey brick building, a concrete surfaced yard and a heavily overgrown landscaped area occupy the site. Adjacent land use includes residential properties, an electrical substation, and an enclosed yard. Previous land uses on or adjacent to the site have included railway land, coal wharf, infilled feature, timber yard and an electrical substation to the west. The site does not lie within 250 metres of any known landfill sites, and is not in close proximity to any known surface watercourses, and lies above the Sherwood Sandstone major aquifer.

1. The adequacy of the desk study information available for this site

The desk study information and proposed site investigation works were found to be **adequate** in an earlier review.

2. The adequacy of the site investigation

As stated in previous correspondence the site investigation information that has been provided for this development is **inadequate**. In addition to the information provided, further information should be submitted which addresses the following issues:

- In light of the data obtained from the site investigation, further investigation within the vicinity of the possible tank is required as recommended by Card Geotechnics Limited. The initial conceptual model should be refined once the further investigations have been undertaken.

The consultant advises that a proposal to undertake further works has been submitted to T&G Associates.

3. The adequacy of the final risk assessment

Ground Assessment: The soil results have been compared to Generic Assessment Criteria (GACs) that have been derived in-house by CARD. Generally, the soil results show concentrations of contaminants below the relevant guideline values. Detailed information on the derivation of the CARD GACs and the statistical analysis of the soils results have not been supplied

Based on the conceptual site model and the chemical results obtained as part of the investigation, Card Geotechnics state it is generally considered that the soils tested pose a negligible risk to future end users/landscaping. The soils recovered from WS3 in the area of a potential UST are considered to pose a low to medium risk to future end users / landscaping. The principal risk driver is considered to be benzo(a)pyrene where present within the shallow soils. The deeper soil contamination (TPH) within the locality of WS3 may also pose a risk to future site users due to the generation of vapours and accumulation of these vapours within buildings. However, this will be mitigated through the removal of the potential UST and any surrounding contaminated soils.

The location of WS3 with the recorded elevated concentration of Benzo(a)pyrene is considered to form part of the driveway of the new development and therefore any pollutant linkage will be broken by this hard standing capping layer

Controlled Waters Assessment: Two leachate samples were taken. The results were compared to the Drinking Water Standards as the site is situated over a major aquifer and away from any surface watercourses. The results indicate no concentrations above the relevant UK Drinking Water guidelines.

Please note that the Environment Agency is the regulator of controlled waters and as such need to be consulted and forwarded copies of all the relevant information for this site. This Section will require confirmation that the Environment Agency has approved the risk assessment and recommendations.

Ground Gas Assessment: The gas monitoring data indicates a worst case gas screening value (GSV) of 0.026l/hr for carbon dioxide and hence the site conforms to a 'Green' classification under the NHBC traffic light system. However, since the maximum recorded concentration of carbon dioxide is above 5% consideration should be given to increasing the classification to 'Amber 1'. The risk classification for 'Amber 1' is considered to be low to intermediate requiring low level gas protection measures, comprising a gas protection membrane and ventilated sub floor void to create a permeability contrast to limit the ingress of gas into the building.

Gas monitoring is currently ongoing with the results to be forwarded under separate cover, with the revision of a ground gas risk assessment.

The final risk assessment provided for this development is **inadequate**. In addition to the information provided, the following issues require further clarification:

Justification for the use of generic quantitative risk assessment criteria as they were not supplied within the Geoenvironmental Interpretative Report. Use of generic risk assessment criteria would be expected to include a discussion of the conceptual model and assumptions used to derive the generic criteria together with an assessment of the underpinning toxicological data. This information will be held in strict commercial confidence.

- A more detailed ground gas risk assessment in accordance with current best practice, on completion of the monitoring period.
- Confirmation of Environment Agency approval for the controlled waters risk assessment

and conclusions. It is the developers responsibility to contact all statutory consultees in response to environmental issues ascertained at the site.

4. The acceptability of the proposed remediation strategy

Card Geotechnics state that a remediation strategy will form part of the next stage of works and have not prepared or submitted the report yet. Within the initial Geoenvironmental Interpretative Report the following measures were proposed so that the contamination identified on site no longer presents a risk:

- Soft landscaping areas and garden to be capped with an appropriate thickness of clean imported topsoil no less than 0.3m thick.
- Should the possible UST be confirmed it is recommended that an experienced tank decommissioning / removal contractor be instructed to undertake the removal of the contents of the tank, the tank and any surrounding bedding material and supply lines under appropriate duty of care and in line with an approved method statement / remediation statement.
- Upon removal validation of surrounding soils from the sides and base of the excavation are to be undertaken to include appropriate inspection, sampling and soil analysis.
- Where excess spoil is generated, or it is deemed materials are unsuitable for on-site retention, wastes are to be disposed of in accordance with the Duty of Care Regulations and the Landfill Directive.
- WAC analysis to be undertaken.
- If any areas of contamination encountered, the works will cease and further advice to be sought from a suitably qualified consultant.
- Asbestos survey to be completed prior to demolition.
- Due to the hydrocarbon contamination encountered a hydrocarbon resistant membrane is required above the floor slab as a precautionary measure. The membrane is to be taped sealed at the joints with proprietary tape, sealed around service penetrations and its installation inspected.
- Ground gas protection measures to be detailed on completion of ground-gas monitoring.

The remediation strategy that has been provided for this development is **inadequate**. In addition to the data already provided, further information should be submitted that addresses the following issues:

- Details of the proposed works that should include:
 - Proposed phasing of the works and appropriate timescales.
 - Details of appropriate consents, agreements and licences, for example discharge consents and waste management licences should be provided.
 - Site management procedures designed to protect site neighbours, the local environment and amenity during works should be provided, including where appropriate:
 - Health and safety procedures.
 - Appropriate measures to control dust, noise and odours.
 - Control of surface run off.
 - Details of how the works will be validated to ensure the remediation objectives have been met are required and should include details of:
 - The sampling strategy chosen.
 - Appropriate use of on-site observations, including visual and/or olfactory evidence.
 - Appropriate post-remediation chemical analysis and/or monitoring data.
 - Justification for the proposed clean-up standards including target contaminant concentrations.

5. Whether the information submitted is sufficient to discharge the relevant site investigation and/or gas condition of the planning approval

Before this Section can recommend discharge of conditions from this application, the following information needs to be submitted to the Council for approval:

- (i) Further site investigation works within the vicinity of the possible tank.
- (ii) Further information as detailed in the final risk assessment review.
- (iii) Further information as detailed in the proposed remediation strategy.
- (iv) After completion of site works, a verification report is required to validate that the work undertaken conforms to the remediation proposals received and agreed by this Section. The report would be expected to include the following:

- Summary of desk study, site investigation report and remediation strategy.
- Details of who carried out the work.
- Details and justification of any changes from original remediation strategy.
- Substantiating validation data that should include where appropriate:
 - Laboratory and *in-situ* test results.
 - Monitoring results for groundwater and gases.
 - Summary data plots and tables relating to clean-up criteria.
 - Plans showing treatment areas and details of any differences from the original remediation strategy.
- Photographic and other media records.
- Waste management details and records.
- Confirmation that remediation objectives have been met.

Regards

Carolyn Parry

Carolyn Parry
Planner
North Area Development Control
Planning Department
Manchester City Council
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M60 3NY

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<http://www.manchester.gov.uk>

APPENDIX B

**TANK PHOTOGRAPHS AND
DECOMMISSIONING CERTIFICATE**



Photograph 1 Top of the tank



Photograph 2 Excavating around the tank to confirm extent



Photograph 3 TP103



Photograph 4 TP103



Photograph 5 TP102



Photograph 6 TP101



Photograph 7 TP101 Concrete bunding can be seen at the rear face of excavation



Photograph 8 Intact hardstanding looking east towards WS3



Photograph 9 TP101

TANK-CARE

Gas Testing Certificate 120 WILTON ROAD, CRUMPSALL

Atmospheric Gas Test Meter Identification HY0 1457

Calibration date 07/07/2009

Certificate number 282756

Gas Test Certificate

Gas	Mean 1 60ppm/40Hz	Mean 2 50ppm/30Hz	Sensor Type	Alarm Levels
Explosion Limit (lel) 0	0	0	EX	10+20 LEL
Carbon Monoxide 0	1	0	CO	30+60 ppm
Oxygen 20.9	20.9	21.00	O2	191+287 VOL
Hydrogen Sulfide 0	0	0	H2S	5+10 ppm

Conclusion UNDER GROUND OIL TANK IS FREE FROM ALL TRACES OF CONTAMINATION

Signature

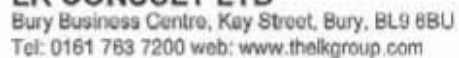
21/07/2009
ate

Certificate issue Number

Tank-ca

APPENDIX C

TRAIL PIT LOGS



Land at 120 Wilton Road, Crumpsall

Trial Pit
Number
TP101

Excavation Method	JCB SCX
-------------------	---------

Dimensions
0.8m x 3.1

Ground Level (mOD)

Client

Mr N Hughes

Job
Number
CL1520

Location

[illegible]

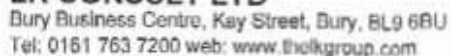
Engineer

Sheet

21/10/2009

LKA

127



Land at 120 Wilson Road, Crumpsall

Trial Pit
Number
TP102

Job
Number
CL1520

Sheet
1/1

Plan	1	2	3	4	5	6	7	8	9	10	Remarks		
1	1	2	3	4	5	6	7	8	9	10			
2	1	2	3	4	5	6	7	8	9	10			
3	1	2	3	4	5	6	7	8	9	10			
4	1	2	3	4	5	6	7	8	9	10			
5	1	2	3	4	5	6	7	8	9	10			
6	1	2	3	4	5	6	7	8	9	10			
7	1	2	3	4	5	6	7	8	9	10	Scale (approx)	Logged By	Figure No.
											1:40	CJC	CL1513.TP100

**LK CONSULT LTD**Bury Business Centre, Kay Street, Bury, BL9 6BU
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Land at 120 Wilton Road, Crumpsall

Trial Pit**Number**
TP104**Excavation Method**

JCB 3CX

Dimensions

0.8m x 2.9

Ground Level (mOD)**Client**

Mr N Hughes

Job**Number**
CL1520**Location****Dates**

21/10/2009

Engineer

LKA

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.10) 0.10	CONCRETE		
					(1.30)	MADE GROUND: Brown clayey gravelly sand. Occasional inclusions of brick and concrete. Inclusions of soft clay.		
1.60-2.00	8 PID 27ppm		- to 1.5m concrete skin of tank enclosure present on western face of pit.		1.40 (0.80)	MADE GROUND: Dark grey silty peaty clay. Natural organic odour. Probable remnant topsoil.		
2.20-2.50	8 PID 31ppm				2.00 (0.50)	Firm to stiff brown slightly sandy CLAY.		
					2.50	Complete at 2.50m		

Plan**Remarks****Scale (approx)**

1:40

Logged By

CJC

Figure No.

CL1513.TP104

APPENDIX D

CERTIFICATES OF ANALYSIS

Depot Road
Newmarket
CB8 0AL
Tel: 01638 506070

Leyden Kirby Associates
Unit 25 Bury Business Centre
Kay Street
Bury, Lancashire
BL9 6BU

FAO Colin Crompton
11 November 2009

Dear Colin Crompton

Test Report Number **79484**
Your Project Reference **CL1513 - 120 Wilton Road**

Please find enclosed the results of analysis for the samples received 4 November 2009.

All soil samples will be retained for a period of one month and all water samples will be retained for 7 days following the date of the test report. Should you require an extended retention period then please detail your requirements in an email to customerservices@chemtest.co.uk. Please be aware that charges may be applicable for extended sample storage.

If you require any further assistance, please do not hesitate to contact the Customer Services team.

Yours sincerely


Authorised Signatory

☐ Darrell Hall	Laboratory Manager
☐ Phil Heller	Operations Director
☒ Keith Jones	Technical Development Manager
☐ John Crawford	Quality Manager
☐ Malcolm Avis	Technical Director



Notes to accompany report:

- The sign < means 'less than'
- Tests marked 'U' hold UKAS accreditation
- Tests marked 'M' hold MCertS (and UKAS) accreditation
- Tests marked 'N' do not currently hold UKAS accreditation
- Tests marked 'S' were subcontracted to an approved laboratory
- n/e means 'not evaluated'
- i/s means 'insufficient sample'
- u/s means 'unsuitable sample'
- Comments or interpretations are beyond the scope of UKAS accreditation
- The results relate only to the items tested

Test Report 79484 Cover Sheet

Leyden Kirby Associates
Unit 25 Bury Business Centre
Kay Street
Bury, Lancashire
BL9 6BU

FAO Colin Crompton
02 November 2009

Dear Colin Crompton

Test Report Number 58230
Your Project Reference CL1513 - 120 Wilton Road

Please find enclosed the results of analysis for the samples received 23 October 2009.

All soil samples will be retained for a period of one month and all water samples will be retained for 7 days following the date of the test report. Should you require an extended retention period then please detail your requirements in an email to customerservices@chemtest.co.uk. Please be aware that charges may be applicable for extended sample storage.

If you require any further assistance, please do not hesitate to contact the Customer Services team.

Yours sincerely

Authorised Signatory


☐ Darrell Hall Laboratory Manager
☐ Phil Hellier Operations Director
☒ Keith Jones Technical Development Manager
☐ John Crawford Quality Manager
☐ Malcolm Avis Technical Director



Notes to accompany report:

- The sign < means 'less than'
- Tests marked 'U' hold UKAS accreditation
- Tests marked 'M' hold MCertS (and UKAS) accreditation
- Tests marked 'N' do not currently hold UKAS accreditation
- Tests marked 'S' were subcontracted to an approved laboratory
- n/a means 'not evaluated'
- i/s means 'insufficient sample'
- u/s means 'unsuitable sample'
- Comments or interpretations are outside of the scope of UKAS accreditation
- The results relate only to the items tested
- Stones represent the quantity of material removed prior to analysis
- All results are expressed on a dry weight basis
- The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, phenols
- For all other tests the samples were dried at < 37°C prior to analysis
- Uncertainties of measurement for the determinands tested are available upon request
- Soil descriptions, including colour and texture, are beyond the scope of MCertS accreditation

Test Report 58230 Cover Sheet

LABORATORY TEST REPORT

Results of analysis of 6 samples
received 23 October 2009
CL1513 - 120 Wilton Road

Login Batch No

Chemtest LIMS ID

Sample ID

Sample No

Sampling Date

Depth

Matrix

		58230					
		AE42132	AE42133	AE42134	AE42135	AE42136	AE42137
		TP101	TP102	TP103	TP103	TP104	TP104
21/10/2009		21/10/2009	21/10/2009	21/10/2009	21/10/2009	21/10/2009	21/10/2009
1m - 1.5m		2.7m	1.5m	2.8m - 2.9m	1.9m - 2m	2.2m - 2.5m	2.2m - 2.5m
SOIL		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
SOP 1 Determinand							
2625 Organic matter		1.5	1.5	3.8	4.5	11	0.98
2675 TPH aliphatic >C5-C6	%	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH aliphatic >C6-C8	mg kg ⁻¹	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH aliphatic >C8-C10	mg kg ⁻¹	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH aliphatic >C10-C12	mg kg ⁻¹	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH aliphatic >C12-C16	mg kg ⁻¹	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH aliphatic >C16-C21	mg kg ⁻¹	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH aliphatic >C21-C35	mg kg ⁻¹	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH aromatic >C5-C7	mg kg ⁻¹	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH aromatic >C7-C8	mg kg ⁻¹	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH aromatic >C8-C10	mg kg ⁻¹	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH aromatic >C10-C12	mg kg ⁻¹	< 0.1	< 0.1	0.4	4.7	< 0.1	< 0.1
TPH aromatic >C12-C16	mg kg ⁻¹	< 0.1	< 0.1	8.2	16	2.3	< 0.1
TPH aromatic >C16-C21	mg kg ⁻¹	< 0.1	< 0.1	36	35	6.8	< 0.1
TPH aromatic >C21-C35	mg kg ⁻¹	< 0.1	< 0.1	34	35	11	< 0.1
Total Petroleum Hydrocarbons	mg kg ⁻¹	< 10	< 10	78	91	20	< 10
Fuel Type (soils)		N/A	N/A	PAH	PAH	PAH	N/A
2780 Benzene	µg kg ⁻¹	< 1	< 1	< 1	< 1	< 1	< 1
Toluene	µg kg ⁻¹	< 1	< 1	< 1	< 1	< 1	< 1
Ethyl benzene	µg kg ⁻¹	< 1	< 1	< 1	< 1	< 1	< 1
m- & p-Xylene	µg kg ⁻¹	< 1	< 1	< 1	< 1	< 1	< 1
o-Xylene	µg kg ⁻¹	< 1	< 1	< 1	< 1	< 1	< 1
Methyl tert-butyl ether	µg kg ⁻¹	< 1	< 1	< 1	< 1	< 1	< 1
2030 Moisture	%	18.4	19.4	24.6	23.3	36.7	14.8
Stones content (>50mm)	%	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
2140 Soil colour		brown	brown	brown	brown	brown	brown
Soil texture		clay	clay	clay	clay	clay	sand
Other material		none	none	none	none	none	none

APPENDIX E

LQM GACS

Table S-8 Contribution to total exposure for the relevant pathways as calculated for Chromium(III) by the CLEA v1.04 software for the generic land-uses

Land use	ADE to HCV ratios		
	Residential	Allotment	Commercial
Oral ADE to HCV ratio at GAC	0.15	0.68	0.09
Inhalation ADE to HCV ratio at GAC	0.85	0.34	0.91
Contribution to total exposure from soil and background sources according to land-use (%)			
Ingestion of soil and indoor dust ¹	85.3	68.6	93.5
Consumption of homegrown produce and attached soil	1.4	28.0	NA
Dermal contact (indoor)	0.0	NA	0.0
Dermal contact (outdoor)	0.0	0.0	0.0
Inhalation of dust (indoor)	0.3	NA	0.6
Inhalation of dust (outdoor)	0.0	<0.1	0.0
Inhalation of vapour (indoor)	0.0	NA	0.0
Inhalation of vapour (outdoor)	0.0	0.0	0.0
Oral background	13.0	3.4	5.9
Inhalation background	<0.1	<0.1	<0.1

¹ Rounded to one decimal place;² Treated as one pathway (Environment Agency, 2009)

ADE = Average Daily Exposure;

HCV = Health Criteria Value;

NA = Not applicable (This exposure pathway is not included in the generic land use).

5.9 The LQM/CIEH Generic Assessment Criteria for Chromium(VI)

(148) The LQM/CIEH GAC for Chromium(VI) for the different generic land-uses are presented in Table 5-9. The land-uses are the generic ones described in SR3 (Environment Agency, 2009). The ADE:HCV ratios and percentage contribution of each pathway calculated by the CLEA v 1.04 software for each generic land-use are presented in Table 5-10.

(149) The oral based assessment criterion has been derived by comparing the oral TDI with estimates of exposure via the oral and dermal exposure pathways relevant to each land use. The inhalation assessment criteria have been derived by comparing the inhalation ID with estimates of exposure via the inhalation pathways relevant to each land use. The GAC for each land use is the lower of the two independently derived assessment criteria.

Table 5-9 LQM/CIEH Generic Assessment Criteria for Chromium(VI) according to land use

Land Use	GAC (mg kg ⁻¹ DW) ^{a,b,c}
	Chromium(VI)
Residential	4.3 ^d
Allotment	2.1 ^e
Commercial	35 ^e

^a Based on a sandy loam soil as defined in Environment Agency (Environment Agency, 2009) and 6% SOM.^b Values are rounded to one or two significant figures^c In applying the rules for non-soil background to the GAC, the background ADE is limited to

being no larger than the contribution from the relevant soil ADE

^d Based on comparison of inhalation exposure with inhalation ID^e Based on comparison of oral and dermal exposure with oral TDI

(150) A generic default dermal absorption factor for inorganics of 0 has been used therefore exposure via the dermal route of entry is zero. The individual assessment criteria and the estimated contribution via each exposure pathway to the total exposure at a soil concentration equal to the assessment criteria for each land use are presented in Table 5-10.

(151) The following observations can be made:

- The inhalation assessment criterion is lower than the oral assessment criterion for the residential and commercial land uses.
- The oral assessment criterion is lower than the inhalation assessment criterion for the allotment land use.
- Background exposure contributes significantly to the total exposure for the allotment land use.
- The soil and dust ingestion exposure pathway contribute significantly to the overall total exposure in the residential and commercial land uses. The inhalation of dust contribute only a small proportion of the overall total exposure however it is the most significant risk driver in both the residential and commercial land uses because of the lower threshold for the inhalation route of entry.
- The consumption of homegrown produce exposure pathway contributes significantly to the total exposure at the GAC for the allotment land use and is the risk driver for the allotment land use.

10.11 The LQM/CIEH GAC for Polycyclic Aromatic Hydrocarbons

(385) The methodology followed in deriving the LQM/CIEH Generic Assessment Criteria (GAC) and the associated limitations are described in Chapter 1 of this publication.

(386) The LQM/CIEH GAC values for Polycyclic Aromatic Hydrocarbons for the different standard land-uses are presented in Table 10-54, Table 10-55 and Table 10-56. The land-uses are the standard ones described in SR3 (Environment Agency, 2009c). For each land-use, three Soil Organic Matter (SOM) contents were considered: 1%, 2.5% and 6% by weight. The ADE:HCV ratios and percentage contribution of each pathway calculated by CLEA 1.04 for the standard land-uses at 6% SOM are presented in Table 10-57, Table 10-58 and Table 10-59.

Table 10-54: LQM/CIEH GAC for Polycyclic Aromatic Hydrocarbons for the residential land-use at 1%, 2.5% and 6% SOM

PAH Congener	Residential land-use		
	LQM/CIEH GAC for Polycyclic Aromatic Hydrocarbons (mg kg ⁻¹ DW) ^{a,b,c,d,e}		
	1% SOM	2.5% SOM	6% SOM
Acenaphthene	210	480	1000
Acenaphthylene	170	400	850
Anthracene	2300	4900	9200
Benz[a]anthracene	3.1	4.7	5.9
Benzo[e]pyrene	0.83	0.94	1.0
Benzo[b]fluoranthene	5.6	6.5	7.0
Benzo[ghi]perylene	44	46	47
Benzo[k]fluoranthene	8.5	9.6	10
Chrysene	6.0	8.0	9.3
Dibenz[ah]anthracene	0.76	0.86	0.90
Fluoranthene	260	460	670
Fluorene	160	380	760
Indeno[123-cd]pyrene	3.2	3.9	4.2
Naphthalene	1.6	3.7	8.7
Phenanthrene	92	200	380
Pyrene	560	1000	1600

^a Based on a sandy loam soil as defined in SR3 (Environment Agency, 2009c) and 1, 2.5 and 6% SOM.

^b GAC for Polycyclic Aromatic Hydrocarbons will vary according to SOM for all land-uses.

^c Values are rounded to two significant figures.

^d GACs assume that free phase contamination is not present.

^e GACs based on a sub-surface soil to indoor air correction factor of 1.

9.6 The LQM/CIEH Generic Assessment Criteria for Petroleum Hydrocarbons

(176) The methodology followed in deriving the LQM/CIEH Generic Assessment Criteria (GAC) and the associated limitations are described in Chapter 1 of this report.

(177) The LQM/CIEH GAC values for Petroleum Hydrocarbons for the different standard land-uses are presented in Table 9-15, Table 9-16 and Table 9-17. The land-uses are the standard ones described in SR3 (Environment Agency, 2009f). For each land-use, three Soil Organic Matter (SOM) contents were considered: 1%, 2.5% and 6% by weight. The ADE:HCV ratios and percentage contribution of each pathway calculated by the CLEA v1.04 software for each standard land-use are presented in Table 9-18, Table 9-19 and Table 9-20.

(178) In order to consider the additive effects of all the hydrocarbon fractions, the LQM/CIEH GAC should be used to calculate an individual Hazard Quotient (HQ) for each fraction. The HQs can then be added to form a Hazard Index (HI) for petroleum hydrocarbon. Where the HI exceeds unity this can indicate a potentially significant risk to human health. This process has been described in detail by the Environment Agency (2005).

Table 9-15 LQM/CIEH Generic Assessment Criteria for Petroleum Hydrocarbons for the residential land use at 1%, 2.5% and 6% soil organic matter (SOM)

Residential land use	LQM/CIEH GAC for Petroleum Hydrocarbons (mg kg ⁻¹ DW) ^{a,b,c,d,e}		
	1% SOM	2.5% SOM	6% SOM
Aliphatic EC 5-6	30	66	110
Aliphatic EC >6-8	73	160	270
Aliphatic EC >8-10	19	46	110
Aliphatic EC >10-12	83 (48) ^{h,p}	230 (118) ^{h,p}	640 (283) ^{h,p}
Aliphatic EC >12-16	740 (24) ^{h,q}	1700 (59) ^{h,q}	3000 (142) ^{h,q}
Aliphatic EC >16-35	45000 (8.48) ^{h,r}	84000 (21) ^{h,r}	78000 ^{h,r}
Aliphatic EC >35-44	45000 (8.48) ^{h,r}	84000 (21) ^{h,r}	78000 ^{h,r}
Aromatic EC 5-7 (benzene)	65	130	280
Aromatic EC >7-8 (toluene)	120	270	611
Aromatic EC >8-10	27	65	151
Aromatic EC >10-12	69	160	346
Aromatic EC >12-16	140	310	693
Aromatic EC >16-21	260 ^f	480 ^f	770 ^{f,g}
Aromatic EC >21-35	800 ^f	1100 ^f	1230 ^{f,g}
Aromatic EC >35-44	800 ^f	1100 ^f	1230 ^{f,g}
Aliphatic + Aromatic EC >44-70	1200 ^f	1300 ^f	1300 ^{f,g}

^a Based on a sandy loam soil as defined in SR3 (Environment Agency, 2009f) and 1, 2.5 and 6% soil organic matter (SOM).

^b Generic assessment criteria for Petroleum Hydrocarbons will vary according to SOM for all land uses.

^c Figures are rounded to two significant figures.

^d GACs assume that free phase contamination is not present.

^e GACs based on a sub-surface soil to indoor air correction factor of 10.

^f Oral, dermal and inhalation exposure compared with oral HCV.

^g GAC presented exceeds the solubility saturation limit, which is presented in brackets.

^{h,p} GAC presented exceeds the vapour saturation limit, which is presented in brackets.

(179) The following observations can be made from Table 9-18, Table 9-19 and Table 9-20:

- For the residential land use the inhalation of vapours indoors exposure pathway is the most significant exposure pathway for the lighter end aliphatic and aromatic fractions (up to aliphatic EC>12-16 and aromatic EC>10-12). The ingestion of soil and indoor dust and consumption of homegrown produce exposure pathways are the most significant for the higher end fractions (aliphatic EC>16-35 and EC>35-44; aromatics EC>12-16, EC>16-21, EC>21-35, EC>35-44 and EC>44-70).
- For the allotment land use the consumption of homegrown produce exposure pathway is the most significant for the aromatic and lighter end aliphatic fractions. The ingestion of soil and indoor dust is the most significant exposure pathway for the higher end aliphatics EC>12-16, EC>16-35 and EC>35-44.
- For the commercial land use the indoor inhalation of vapour exposure pathway is a significant exposure pathway for the lighter end aliphatic and aromatic fractions (up to aliphatic EC>12-16 and aromatic EC>10-12).
- Background exposure represents a significant proportion of the total exposure for all fractions, except aromatic fractions EC>5-7 and EC>7-8 in all land uses.

APPENDIX F

GAS MONITORING RESULTS

Location :	120 Wilton Road, Crumpsall			Engineer :	RLP	
Date :	25.06.09	Job No :	CGN2630	Time :	8.30-9.00am	

State of ground:	☒ Dry	☐ Moist	☐ Wet	
Wind:	☐ Calm	☒ Light	☐ Moderate	
Cloud cover:	☐ None	☐ Slight	☒ Cloudy	☐ Strong
Precipitation:	☒ None	☐ Slight	☐ Moderate	☐ Overcast
Barometric pressure (mb):	1009 falling		Air temperature (°C):	

LAST CALIBRATION DATE:	18 February 2009
------------------------	------------------

Well No.	Time (s)	Flow (l/hr)	dP (PA)	CO ₂ (% vol. in air)	O ₂ (% vol. in air)	CH ₄ (% vol. in air)	H ₂ S (ppm)	PID (ppm)	Depth to GW (m)	Free product (mm)	Comments (samples taken?)
WS1	0	0.0	0.0	2.7	18.8	0.0	n/a	0.0	2.42	N	Base of hole 3.92m Flow steady (nil)
	180	0.0	0.0	2.6	18.9	0.0		0.0			
	360	0.0	0.0	2.0	19.5	0.0		0.0			
WS4	0	0.1	0.1	0.0	21.4	0.0	n/a	0.0	2.63	N	Base of hole 4.00m. Flow fluctuating 0.1 – 0.3l/hr
	60	0.3	0.4	8.0	12.9	0.0		0.0			
	360	0.3	0.4	4.6	16.1	0.0		0.0			
	600	0.3	0.4	2.0	19.2	0.0		0.0			
	720	0.3	0.4	1.6	19.7	0.0		0.0			
WS5	0	0.1	0.3	0.0	21.4	0.0	n/a	0.0	2.42	N	Base of hole 3.15m. Flow steady (nil) after initial peak of 0.1l/hr
	30	0.0	0.0	3.5	17.0	0.0		0.0			
	60	0.0	0.0	3.6	17.0	0.0		0.0			
	180	0.0	0.0	3.4	17.1	0.0		0.0			
	360	0.0	0.0	3.3	17.2	0.0		0.0			
	600	0.0	0.0	2.9	17.6	0.0		0.0			

BOREHOLE/GAS MONITORING RESULTS

JOB DETAILS

Location :	120 Wilton Road, Crumpsall	Engineer :	KB
Date :	09.07.09	Job No :	CGN2630
		Time :	12.00 – 12.30pm

METEOROLOGICAL AND SITE INFORMATION

State of ground:	☒ Dry	☐ Moist	☐ Wet
Wind:	☐ Calm	☒ Light	☐ Moderate
Cloud cover:	☐ None	☐ Slight	☒ Cloudy
Precipitation:	☐ None	☒ Slight	☐ Moderate
Barometric pressure (mb):	1007 rising		
		Air temperature (°C):	

INSTRUMENTATION USED: Gas Data LMS xi

LAST CALIBRATION DATE: 18 February 2009

Well No.	Time (s)	Flow (l/hr)	dP (PA)	CO ₂ (% vol. in air)	O ₂ (% vol. in air)	CH ₄ (% vol. in air)	H ₂ S (ppm)	PID (ppm)	Depth to GW (m)	Free product (mm)	Comments (samples taken?)
WS1	0	0.0	0.0	0.0	21.0	0.0	n/a	0.0	2.33	N	Base of hole 3.92m
	15	0.0	0.0	0.0	21.2	0.0		0.0			
	30	0.0	0.0	0.0	21.4	0.0		0.0			
	45	0.0	0.0	0.0	21.4	0.0		0.0			
	60	0.0	0.0	0.0	21.4	0.0		0.0			
WS4	0	0.0	0.0	0.0	21.0	0.0	n/a	0.0	2.54	N	Base of hole 4.00m.
	15	0.0	0.0	4.0	10.6	0.0		0.0			
	30	0.0	0.0	7.5	9.6	0.0		0.0			
	45	0.0	0.0	8.5	9.1	0.0		0.0			
	60	0.0	0.0	8.8	9.0	0.0		0.0			
WS5	0	0.0	0.0	0.0	21.2	0.0	n/a	0.0	2.33	N	Base of hole 3.15m.
	15	0.0	0.0	1.2	18.1	0.0		0.0			
	30	0.0	0.0	2.3	17.7	0.0		0.0			
	45	0.0	0.0	3.2	17.4	0.0		0.0			
	60	0.0	0.0	3.3	17.4	0.0		0.0			
	75	0.0	0.0	3.3	17.4	0.0		0.0			

BOREHOLE/GAS MONITORING RESULTS

WSS	0	0.0	0.0	0.0	0.0	18.7	0.0	0.0	n/a	2.25	N	
	15	0.3	0.0	0.0	2.3	16.3	0.0					
	30	0.2	0.0	0.0	4.0	15.9	0.0					
	45	0.0	0.0	0.0	4.4	15.7	0.0					
	60	0.0	0.0	0.0	4.7	15.7	0.0					
	75	0.0	0.0	0.0	4.7	15.7	0.0					
	90	0.0	0.0	0.0	4.7	15.8	0.0					

BOREHOLE/GAS MONITORING RESULTS

JOB DETAILS				
Location :	120 Wilton Road, Crumpsall		Engineer :	KB
Date :	13.08.09	Job No :	CGN2630	Time : 08:00

METEOROLOGICAL AND SITE INFORMATION				
State of ground:	☒ Dry	☐ Moist	☐ Wet	
Wind:	☒ Calm	☐ Light	☐ Moderate	
Cloud cover:	☐ None	☒ Slight	☐ Cloudy	☐ Strong
Precipitation:	☒ None	☐ Slight	☐ Moderate	☐ Overcast
Barometric pressure (mb):	1010start - 1009end		Air temperature (°C):	

INSTRUMENTATION USED:	Gas Data LMS xi
LAST CALIBRATION DATE:	18 February 2009

Well No.	Time (s)	Flow (l/hr)	dP (PA)	CO ₂ (% vol. in air)	O ₂ (% vol. in air)	CH ₄ (% vol. in air)	H ₂ S (ppm)	PID (ppm)	Depth to GW (m)	Free product (mm)	Comments (samples taken?)
WS1	0	0.0	0.0	0.0	21.6	0.0	n/a		2.40	N	
	15	0.0	0.0	0.0	21.4	0.0					
	30	0.0	0.0	1.4	19.5	0.0					
	45	0.0	0.0	2.5	18.7	0.0					
	60	0.0	0.0	2.9	18.7	0.0					
	75	0.0	0.0	2.9	18.7	0.0					
	90	0.0	0.0	2.9	18.7	0.0					
	105	0.0	0.0	2.9	18.7	0.0					
WS4	0	0.0	0.0	0.0	18.7	0.0	n/a		2.54	N	
	15	0.0	0.0	4.6	12.5	0.0					
	30	0.0	0.0	10.0	9.3	0.0					
	45	0.0	0.0	13.0	9.0	0.0					
	60	0.0	0.0	13.0	8.9	0.0					
	75	0.0	0.0	13.0	8.9	0.0					
	90	0.0	0.0	13.0	8.9	0.0					

BOREHOLE/GAS MONITORING RESULTS

WSS	0	0.0	0.0	0.0	0.2	19.4	0.0	n/a	2.56	N
	15	0.0	0.0	0.0	4.7	16.1	0.0			
	30	0.0	0.0	0.0	4.8	15.9	0.0			
	45	0.0	0.0	0.0	4.8	15.9	0.0			
	60	0.0	0.0	0.0	4.8	16.0	0.0			
	75	0.0	0.0	0.0	4.7	16.0	0.0			
	90	0.0	0.0	0.0	4.7	16.0	0.0			