

LAND AT FORMER MMU CAMPUS ST JAMES PARK, DIDSBURY

COMPLETION REPORT PLOTS 20, 22 & 23

Job Number: LKC 16 1066
Date: May 2019
Client: PJ Livesey Holdings Ltd



INCREASING LAND VALUE

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ASBESTOS SURVEYS

FLOOD RISK ASSESSMENT

CONTAMINATED LAND INVESTIGATIONS

JAPANESE KNOTWEED



LAND REMEDIATION

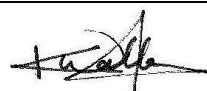
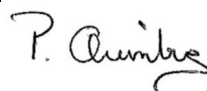
PROJECT MANAGEMENT

AIR TIGHTNESS TESTING

VALIDATION

GEOTECHNICAL INVESTIGATIONS

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Prepared By	Kerrell Walley	Signature	
Reviewed By	Dr Paul Quimby	Signature	

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1 Introduction

1.1 Background

LK Consult Ltd (LKC) has been commissioned by PJ Livesey Holdings Ltd to provide a completion report for the plots 20, 22 and 23 at their development site St James Park on the Former MMU Campus, Didsbury.

The planning application site boundary is approximately 3.89ha in size and centered at NGR 384868N 390547E (Figure 1). The proposed development for the whole site will comprise 42 houses with gardens, construction of a new apartment block, refurbishment of the former 'Administration Building' to apartments with landscaped areas and town houses and refurbishment of the former 'Chapel' to apartments with landscaped areas (Figure 2).

This report will assess the made ground beneath the Plots 20, 22 and 23 to ascertain if it is 'suitable for use' as a residential end use, and to determine whether a formal capping layer is required.

1.2 Previous Reports

The following reports have been undertaken by a number of consultants, including LKC:

- » 'Phase I Desk Study Report for MMU, Didsbury' by Remedios Ltd (ref: 140168, dated August 2014).
- » 'Phase II Ground Engineering Interpretive Report for MMU, Didsbury' by Remedios Ltd (ref: 140178, dated November 2014).
- » 'Additional Contamination Hotspot Investigation Report for MMU, Didsbury' by Remedios Ltd (ref: 140178, dated 8th January 2015).
- » 'Ground Gas Addendum Letter Report for MMU, Didsbury' by Remedios Ltd (ref: 140178, dated 26th January 2015).
- » 'Letter correspondence on Regulator queries for MMU, Didsbury' by Remedios Ltd (ref: 140178, dated 2nd June 2015).
- » 'Site Investigation Brief for MMU, Didsbury' by LKC (ref: LKC 16 1066, dated 23rd February 2016).
- » 'Email agreeing reduction in environmental capping layer thickness and use of 450mg/kg residential assessment criteria for lead' by LKC (dated 30th June 2016).
- » 'Site Works and Validation Checklist for MMU, Didsbury' by LKC (ref: LKC 16 1066, dated 26th July 2016).

LKC understand all previous work has been approved by the appropriate Regulators. A number of plot validation reports for other plots across the site have been issued to the client.

1.3 Validation Requirements

All potential remedial and validation requirements are summarised in the validation checklist presented in Appendix A.

Please note the post demolition investigation works are ongoing. Due to other areas of the site being developed concurrently, LKC advised a precautionary environmental capping layer or additional soil sampling on each block of houses (4-6 plots) or shared landscaped areas to ascertain if soil is 'suitable for use' on a block specific basis.

Based upon the findings of the above the following works and validation were required at the site:

- i) Post demolition site investigation, which is ongoing. This will be reported separately on completion of works.
- ii) Option 1: Environmental capping layer comprising 450mm clean suitable soil in rear gardens and 300mm in front gardens and areas of landscaping over either 100mm MOT stone (with less soil required) or geotextile marker.
- iii) Option 2: Further sampling and risk assessment on a block by block basis (4 soil samples per plot).
- iv) Validation testing of any site won or imported material to be re-used onsite in gardens and soft landscaping to ensure it is 'suitable for use'. All site won or imported material should be tested at a rate of 1 sample per 50m³ for topsoil and 1 sample per 150m³ for subsoil.
- v) Details of unexpected contamination.
- vi) Provision of waste transfer noted for any disposal of contaminated soil offsite.

LKC undertook a validation visit at the site and subsequently failed the cover systems in Plots 20, 22 and 23. Table 1-1 outlines the reason for failures.

Plot Number	Front Garden Topsoil Depth (mm)	Membrane or 100mm MOT	Pass (✓) or Fail (x)	Rear Garden Topsoil Depth (mm)	Membrane or 100mm MOT	Pass (✓) or Fail (x)
20	400	MOT	✓	300	Membrane	x
22	300	Membrane	✓	500	None	x
23	300	Membrane	✓	450	None	x

Table 1-1: Summary of cover system in gardens of Plots 20, 22 and 23.

The cover systems in all front gardens passed and no further work was required.

Due to the lack of sufficient soil depth in the rear of Plot 20 and the absence of a break layer or geotextile membrane in the rears of Plots 22 and 23, further testing of the underlying made ground was required in line with Option 2 of the remediation strategy.

2 Sampling and Risk Assessment

2.1 Introduction

As part of general validation work across the development site, LKC visit site frequently to regularly take soil samples of imported and site won material and to verify the depths of gardens and soft landscaping areas.

Additional work was considered necessary in the rear gardens of Plots 20, 22 and 23 due to insufficient depth of a cover system and / or the absence of a separation layer (geotextile membrane or break layer) for these plots.

Sampling of the made ground beneath the imported soil in the rears of the plots was undertaken to ascertain if an environmental capping layer was required.

LKC investigated 3 points within each of the rear gardens of Plots 20, 22 and 23. The sampling points involved hand excavated trial holes through imported soil, from which made ground was then sampled.

As discussed in Section 3.2.2, a further visit was required to carry out further sampling in the rear garden of Plot 22 due to an elevated Benzo(a)pyrene (B(a)P) result in the made ground. Further sampling was deemed necessary in order to carry out statistical analysis on the material to demonstrate the suitability of the soil. The additional investigation involved the excavation of 6no. locations in the rear garden of Plot 22 through imported topsoil, to sample the underlying made ground.

Made ground was encountered in all investigation locations comprising gravelly clayey sand with rare brick, ash and coal fragments. This is similar strata to the previous site investigation work carried out by LKC. All relevant soil profile logs are presented in Appendix B.

All sampling locations are presented in Figure 3 and selected photographs in Appendix C.

2.2 Sampling Protocol

2.2.1 Soil Sampling (Contamination)

Standard sampling protocol and preservation of samples was undertaken as described in the EA guidance on site investigation¹.

Soil samples of approximately 500g were recovered in amber jars, amber vials for volatile analysis and plastic tubs. All the samples were labelled and stored in cool boxes prior to being collected by courier at the end of the day for delivery to the Chemtest laboratory in Newmarket for chemical testing. If collection was not possible the same day then samples were stored in the sample storage fridge at the LK Group offices below 4°C. Samples were tracked using appropriate Chain of Custody forms provided by Chemtest.

Many of the contamination tests are UKAS or MCERTS accredited and further details are given in the Certificate of Analysis presented in Appendix D. Table 2-1 shows the soil testing undertaken.

¹ EA (2000). "Technical Aspects of Site Investigation. Volumes 1 & 2 Text Supplements Research and Development Technical Report." P5-065/Tr.

Suites and Contaminants	No. Samples	Location & Depth	Justification
Metals / metalloids, pH, water soluble sulphate, speciated PAHs, SOM and asbestos screen.	16	Plot 20 S101 Plot 20 S102 Plot 20 S103 Plot 23 S101 Plot 23 S102 Plot 23 S103	A basic suite with a broad selection of contaminants tested on made ground samples in the rear gardens of Plots 20 and 23 due to the lack of sufficient soil depth in Plot 20 and absence of a separation layer in Plot 23. No significant evidence of contamination was identified (with the exception of occasional ash and coal).
		Plot 22 S101 Plot 22 S102 Plot 22 S103 Plot 22 S104	A basic suite with a broad selection of contaminants tested on made ground samples in the front and rear garden of Plot 22 due to the absence of a separation layer. No significant evidence of contamination was identified (with the exception of occasional ash and coal).
		Plot 22 R1 Plot 22 R2 Plot 22 R3 Plot 22 R4 Plot 22 R5 Plot 22 R6	Further PAH sampling carried out in the rear garden of Plot 22 due to the identification of elevated B(a)P in sample Plot 22 S103 from made ground.

Table 2-1: Summary of soil sample testing undertaken.

Notes:

If asbestos present during screen identification and quantification will be undertaken.

Metal/metalloids=arsenic, cadmium, chromium, (total and hexavalent), copper, lead, mercury, nickel, selenium, vanadium, zinc and boron; PAH=polycyclic aromatic hydrocarbons, SOM=Soil Organic Matter.

3 Soil Risk Assessment

3.1 Introduction

Current good practice requires that the findings from a site investigation should 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 (CLR11²).

3.2 Methodology

With regards to the soil risk assessment LKC will use the following hierarchy:

- Category 4 Screening Levels (C4SLs).
- LQM Suitable 4 Use Levels (S4ULs).
- ATRISK Soil Screening Values (SSVs) and CL:AIRE Generic Assessment Criteria (GACs).

C4SLs were published in 2013^{3,4}. The recent change to the contaminated land guidance has changed the evaluation of risk from 'minimal' (referred to as Health Criteria values (HCVs))⁵ used to generate Soil Guideline Values (SGVs) to 'low' (referred to as Lowest Level of Toxicological Concern (LLTCs)). The policy companion document and supporting letter by Defra, dated 3rd September 2014, states that C4SLs *'could be used under the planning regime, as well as within Part 2A'*. Based on these comments LKC considers the justifications and assumptions used to generate 'low' risk are suitable for the planning regime.

Where no C4SLs have been generated LKC will use the LQM S4ULs⁶. Similar assumptions and land uses to C4SLs have been used. However, toxicological information has been based on 'minimal risk' as per previous guidelines and assumptions^{7,8,9,10}.

If contaminants are not present as C4SLs and S4ULs then LKC will use ATRISK SSVs or CL:AIRE GACs¹¹. These follow the 'minimal' risk principle and more stringent exposure parameters and will be conservative.

The use of the old Soil Guideline Value (SGV) for lead of 450mg/kg was agreed with Manchester City Council (MCC).

² EA (2004). "Model Procedures for the Management of Land Contamination." R&D Publication CLR 11.

³ Defra (2014). "SP1010: Development of Category 4 Screening Levels and Assessment of Land Affected by Contamination – Policy Companion Document."

⁴ CL:AIRE (2013). "SP1010: Development of Category 4 Screening Levels and Assessment of Land Affected by Contamination – Final project Report."

⁵ EA (2008). "Human Health Toxicological Assessment of Contaminants in Soils." Science Report – SC050021/SR2.

⁶ LQM (2014). "The LQM/CIEH S4ULs for Human Health Risk Assessment."

⁷ EA (2008). "Updated Technical Background to the CLEA Model." Science Report – SC050021/SR3.

⁸ EA (2008). "Human Health Toxicological Assessment of Contaminants in Soils." Science Report – SC050021/SR2.

⁹ EA (2008). "A Review of Body Weight and Height Data used within the Contaminated Land Exposure Assessment Model (CLEA)." Project SC050021/Technical Review 1.

¹⁰ EA (2009). "Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values." Science report SC050021/SR7.

¹¹ CL:AIRE (2009). "The Soil Generic Assessment Criteria for Human Health Risk Assessment."

LKC consider the main risk drivers for PAHs are benzo(a)pyrene (B(a)P) and naphthalene. This is due to B(a)P possibly being a carcinogen and most toxic of the PAHs^{12,13} and naphthalene the most volatile and soluble¹⁴. The new C4SLs indicate B(a)P as a surrogate marker for carcinogenic PAHs, if it falls within appropriate limits, since the risk from other non-carcinogenic PAHs are considered negligible¹⁵. For B(a)P to be used as a surrogate marker it should follow the profile described by the HPA (2008)¹⁶ and CL:AIRE (2013). Naphthalene will be treated separately using the LQM S4ULs.

The former MMU campus has been redeveloped into residential houses with the former administration building and chapel refurbished as apartments and town houses. Therefore LKC will compare all soil data to a 'residential with home produce' land use.

All criteria have been generated using the CLEA V1.06 model¹⁷ based either on 1%, 2.5% and 6% Soil Organic matter (SOM). Results will be compared to the nearest appropriate SOM.

A summary of the generic assessment criteria is provided in Appendix E. ATRISK SSVs and CL:AIRE GACs were not required for this dataset and have not been included.

B(a)P as Surrogate Marker

Based on the above assumption for PAHs, LKC undertook an assessment of the data for the site with regards to using B(a)P as a surrogate marker for carcinogenic PAHs as per HPA and CL:AIRE guidelines. The primary toxicological study related to Culp *et al*¹⁸, which was based on coal tar mixtures (>80,000mg/kg of total PAHs) fed in food to mice over a two-year carcinogenicity study.

Graph 3-1 summarises the study site data with respect to how the ratios of carcinogenic PAHs relate to B(a)P, within the confidence limits provided in the HPA document.

¹² EA (2002). "Contaminants in Soils: Collation of Toxicological Data and Intake Values for Humans. Benzo[a]pyrene." R&D Publication TOX2.

¹³ USEPA (1984). "Health Effects Assessment of Polycyclic Aromatic Hydrocarbons (PAHs). EPA 540/1-86-013."

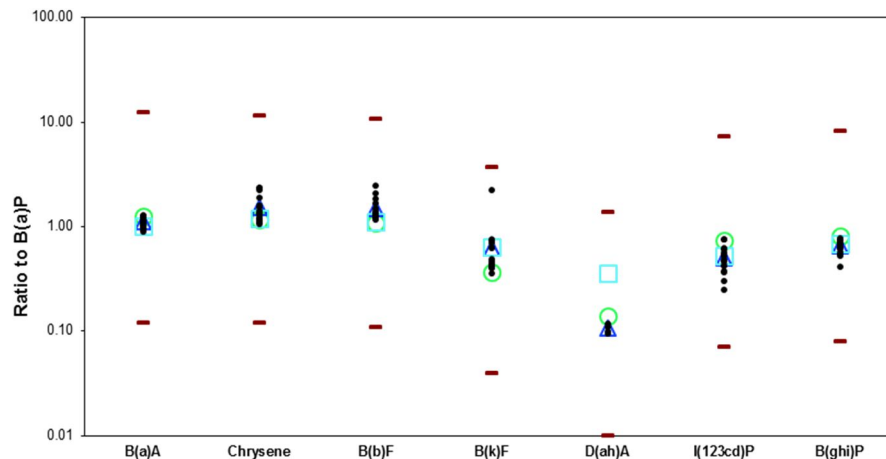
¹⁴ EA (2003). "Review of the Fate and Transport of Selected Contaminants in the Soil Environment." Draft technical report P5- 079/TR1.

¹⁵ CL:AIRE (2013). "SP1010: Development of Category 4 Screening Levels and Assessment of Land Affected by Contamination – Final project Report."

¹⁶ HPA (2010). "HPA Contaminated Land Information Sheet: Risk Assessment Approaches for Polycyclic Aromatic Hydrocarbons (PAHs)." Version 3.

¹⁷ EA (2008). "CLEA Software (Version 1.05) Handbook." Science Report – SC050021/SR4.

¹⁸ Culp, S; Gaylor, D; Sheldon, W; Goldstein, L and Beland, F (1998). "A Comparison of Tumours Induced by Coal Tar and Benzo-a-pyrene in a 2-Year Bioassay." Carcinogenesis. Vol 19, no. 1, pp. 117-124.



Graph 3-1: The ratio of PAH to B(a)P in soil for all available data at the site based on 16 samples (where values were >LOD to allow the calculation of a ratio).

Notes:

B(a)P = Benzo(a)pyrene; D(ah)A = Dibenzo(ah)anthracene; B(a)A = Benzo(a)anthracene; B(b)F = Benzo(b)fluoranthene;
B(k)F = benzo(k)fluoranthene; I(123cd)P = Indeno(123cd)pyrene; B(ghi)P = Benzo(ghi)perylene
● = Ratio to B(a)P for all data ○ = Mean ratio to B(a)P for Culp data △ = Mean ratio to B(a)P from all data at the site
□ = Mean ratio to B(a)P for UK data presented by HPA — = Upper and Lower limits (order of magnitude from Culp data)

All the data points that could be used to calculate ratios fall inside the upper or lower limits.

Based on this distribution of data LKC considers B(a)P can be used as a surrogate marker for carcinogenic PAHs and the C4SL criteria is suitable for this dataset.

3.2.2 Soil Results Comparison against Assessment Criteria

Plots 20 & 23

Due to insufficient depth of soil (300mm) in the rear of Plot 20 and the absence of a separation layer in the rear of Plot 23, the made ground underlying imported topsoil has been subjected to contamination testing.

Results have been compared to the relevant assessment criteria and no elevated contaminants were identified. Therefore LKC considers the made ground to be of low risk and no formal capping layer is required in the rear gardens of Plots 20 and 23.

Plot 22

Due to the absence of a separation layer in the rear of Plot 22, further testing was carried out on the made ground underlying imported topsoil.

All analysis sheets are presented in Appendix D. Elevated and pertinent results are presented in Table 3-1.

Contaminant	Units	No. of samples	Elevated Results	Sample Location	Criteria (1%/2.5%/6%)	Source of Criteria
PAHs						
Benzo(a)pyrene	mg/kg	10	6.9	Plot 22 S103	5	C4SL
GENERAL						
pH	pH	10	Range 8.1 to 9.5			
SOM	%	10	Range 2.6 to 5.7			
Asbestos	N/A	10	None detected			

Table 3-1: Summary of elevated and pertinent analytical results.

Notes:

Only results that exceeded assessment criteria have been shown and results from **all depths** are noted. Results have been compared to the nearest appropriate SOM.

Elevated PAHs have been identified in one of the samples (S103) from Plot 22 therefore further sampling (Plot 22 R1-R6) was undertaken in order to perform a statistical analysis to ascertain whether the made ground was suitable for use (see section 3.2.3).

3.2.3 Statistical Analysis

Statistical analysis has been undertaken on the data generated from the made ground in the rear of Plot 22 due to elevated levels of B(a)P, as the nature of the soil and the proposed land use is similar.

Current UK guidance on the use of statistical testing (CL:AIRE/CIEH¹⁹) for contaminated land has been revised from the original CLR7²⁰ methodology. The latest guidance separates the planning and Part 2A regimes and is based upon the Null Hypothesis and Alternate Hypothesis approach. LKC have used the ESI contaminated land statistics calculator²¹ to undertake this work, which follows the new UK guidance.

For the planning scenario the question to be answered will be “can we confidently say that the level of contamination on this land is low relative to some appropriate measure of risk [e.g. C4SL or GAC values].” The statistical test should show which hypothesis is true within a defined level of confidence (normally 95%), using the upper confidence limit (UCL_{0.95}).

For the planning scenario, where the aim is to demonstrate the land is suitable for use the Null Hypothesis is the level of concentration that “is the same as, or higher than, the critical concentration [e.g. C4SL, S4UL, SSV or GAC value]” and the Alternative Hypothesis will be where the level of concentration “is lower than the critical concentration (Cc).”

If the Null Hypothesis is rejected, then it can be concluded that the Alternative Hypothesis is true (true mean (μ) < Cc) and that potentially the site may be ‘suitable for use.’ If the Null Hypothesis is accepted (μ > Cc) then further measures may be needed and land may not be ‘suitable for use.’

Care must be used in selecting data for the statistical test. Where possible the site should be zoned (vertically and laterally). This is because these statistics cannot be

¹⁹ CL:AIRE (2008). “Guidance on Comparing Soil Contamination Data with a Critical Concentration.”

²⁰ EA (2002). “Assessment of Risks to Human Health from Land Contamination: An Overview of the Development of Soil Guideline Values and related Research (CLR7).”

²¹ ESI (2011). “ESI Contaminated Land Statistics Calculator User Manual.” Version 2.

undertaken on targeted (unbiased) samples. LKC did not undertake targeted sampling in these areas of the site therefore the use of the statistical analysis is considered applicable.

Soil concentrations that are considered outliers may show areas that deviate from the true mean concentration and need to be investigated separately (e.g. they may be hotspots that need to be remediated separately). These are calculated using the Grubb test originally described in CLR7, but only relates to normally distributed data. Log transformation may be used on data to also establish normal distribution for outliers, if required, following CL:AIRE guidance. The test for outliers was based on a 5% level of significance.

In addition, detection limits are dealt with by using half the limits of detection (LOD) as per the guidelines.

Furthermore, the guidance takes into account if the data follows a normal distribution (parametric), where a one-sided t-test can be used or non-normal distribution (non-parametric), where the Chebychev theorem should be used. This is done by using the Shapiro-Wilk test and graphical use of q-q plots.

Statistical Analysis Assessment – Plot 22

Nine soil samples from the rear garden of Plot 22 and one representative sample from the front garden were used in the statistical analysis. Output sheets are provided in Appendix F and a summary of the statistical findings is presented in Table 3-2.

An outlier was identified for B(a)P however the CIEH guidance (page 25) indicates that outliers should only be removed from the dataset where there is an obvious demonstrable error in the laboratory data or clear evidence of more than one soil population. For this dataset there were no demonstrable laboratory errors in the data and made ground was of similar composition. Therefore, as stipulated in the CIEH guidance note 'outlying data should be assumed to be genuine and reflective of the full range of soil concentrations to which receptors may be exposed'.

Plot 22									
Contaminant	Critical Conc. (Old SGV) mg/kg	n	Max Value (exceedences)	LOD (Number)	Outlier	Distribution	Mean mg/kg	UCL _{0.95} mg/kg	$\mu < C_c$
B(a)P	5.0	10	6.9	<0.1 (0)	1	NN	1.821	4.37	✓

Table 3-2: Summary of statistical analysis for made ground in the rear garden of Plot 22, land at former MMU Campus, St James Park, Didsbury.

Notes

NN = Non-normal Distribution; ✓ = $\mu < C_c$; X = $\mu > C_c$ or not enough evidence.

Considering the above the upper confidence limit (UCL_{0.95}) on the true mean concentration for the full B(a)P dataset is 4.37mg/kg compared with the C4SL of 5.0mg/kg.

The dataset is considered to be reflective of soil in Plot 22 and not an outlier.

The Null Hypothesis for B(a)P can be rejected and therefore the B(a)P concentration in the soil is not considered to pose a significant risk to future users.

It should also be noted that the rear garden of Plot 22 comprises a soil depth of 500mm therefore, this provides additional reassurance that the underlying made ground is a low risk to the end user and no formal capping layer is required.

4 Conclusions

Additional site investigation work was carried out in the rear gardens of Plots 20, 22 and 23 due to an insufficient depth of a cover system (Plot 20) and the absence of a geotextile membrane (Plots 22 and 23).

Based on additional sampling and risk assessment, LKC consider the made ground underlying imported soil in the rear gardens of Plots 20, 22 and 23 to be suitable for use.

Figures

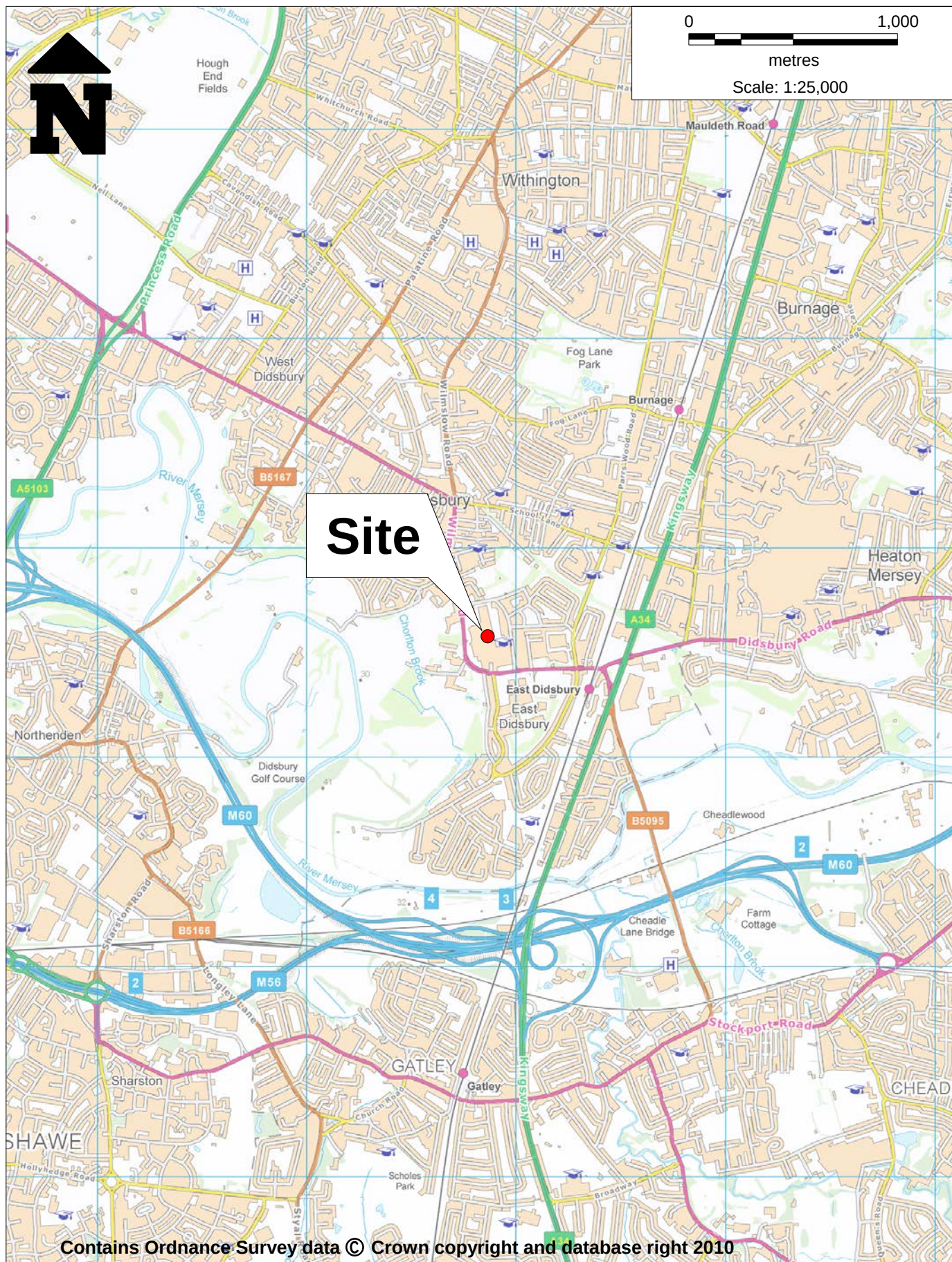
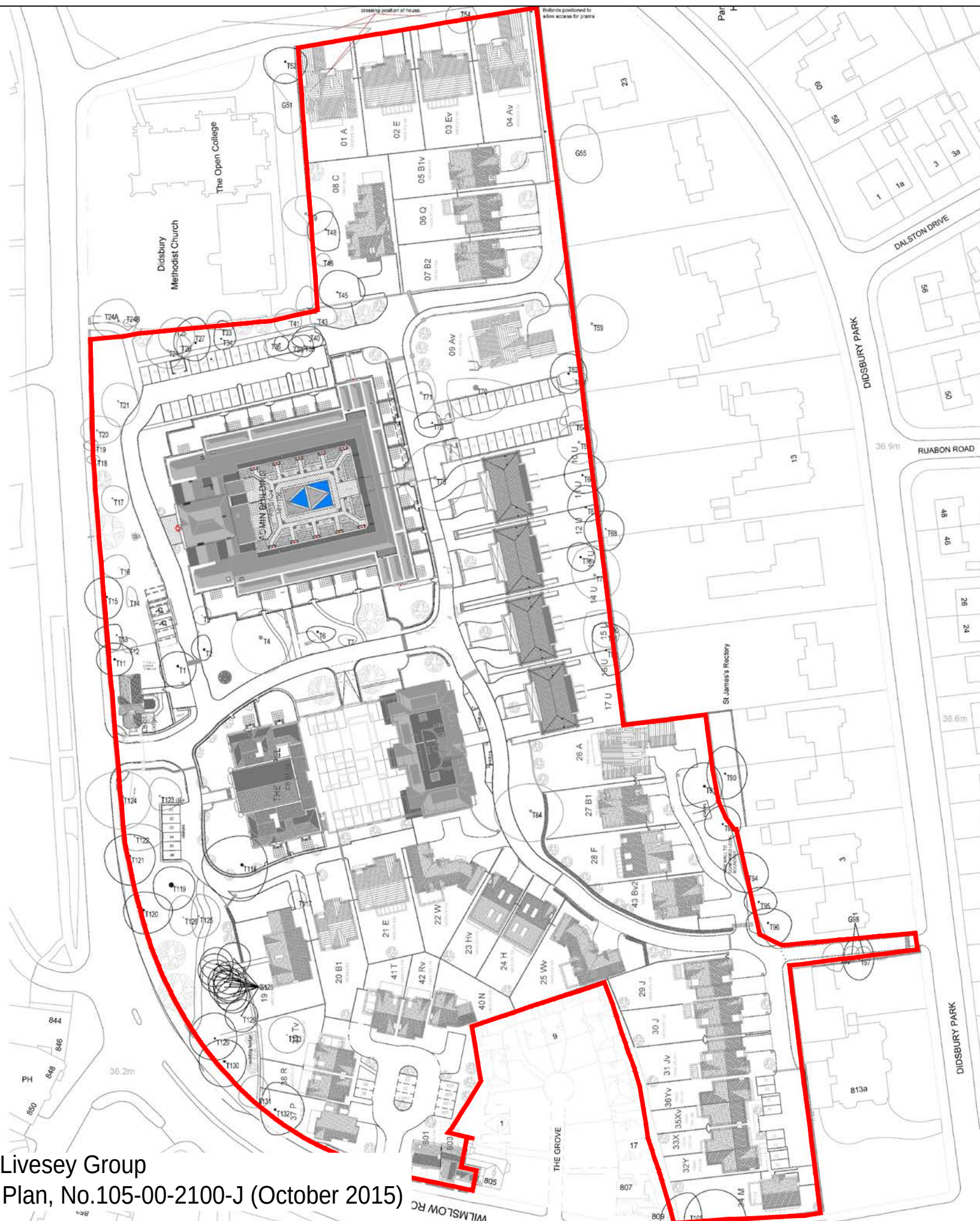
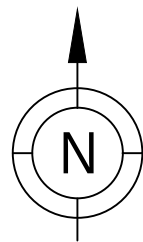
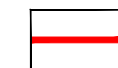


Figure 1: Site Location Plan, MMU, Didsbury

Drawn: October 2016 Scale: 1:25,000 @ A4 (see scale bar)



KEY



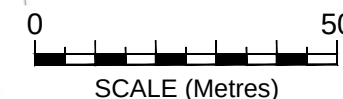
Site Boundary

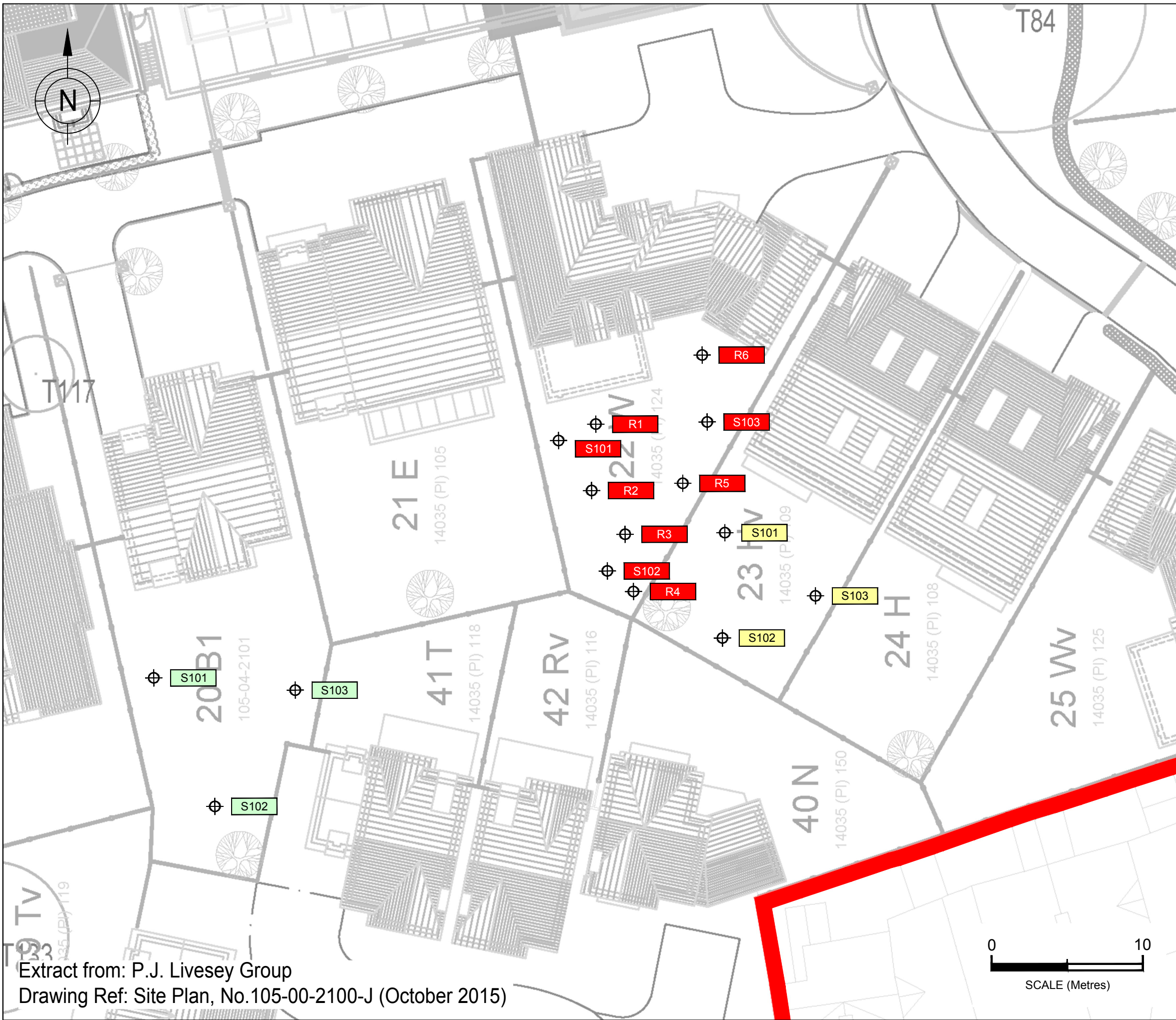
Sampling Locations and features annotated by LK Consult Ltd are approximate and are based upon observed measurements unless otherwise stated. Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing includes information provided to LK Consult Ltd by others, LK Consult Ltd gives no warranty, representation or assurance as to the accuracy of such information.



Client: P.J. Livesey Group Ltd			
Site: MMU, Didsbury			
Title: Site Boundary & Proposed Site Use Plan			
Job No.: LKC 16 1066	Scale (See Scale Bar): 1:1250 @ A3	Figure: 2	Revision:
Drawn By: AC	Checked By: PQ	Drawn: Oct 2016	

Extract from: P.J. Livesey Group
Drawing Ref: Site Plan, No.105-00-2100-J (October 2015)





KEY

Site Boundary

Hand Excavated Trial Hole Location

Sampling Locations and features annotated by LK Consult Ltd are approximate and are based upon observed measurements unless otherwise stated. Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing includes information provided to LK Consult Ltd by others, LK Consult Ltd gives no warranty, representation or assurance as to the accuracy of such information.

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CONSULT LIMITED

Client:

P.J. Livesey Holdings Ltd

Site:

Land at Former MMU Campus,
St. James Park, Didsbury

Title:

Sampling Location Plan
(Plots 20, 22 & 23)

Job No.:

LKC 16 1066

Scale (See Scale Bar):

1:250 @ A3

Figure:

3

Revision:

Drawn By:

AC

Checked By:

KW

Drawn:

Mar 2016

Extract from: P.J. Livesey Group
Drawing Ref: Site Plan, No.105-00-2100-J (October 2015)

Appendix A

Validation Summary

Site Works / Validation Check List – LKC 16 1066 – MMU Didsbury Housing Development



Plots	Validation Work	Additional Notes
Imported / Site Won Soil / stone	-Require information from soil provider on source and amount of soil provided (if sourced offsite). -LKC will need to collect and analyse a suitable number of samples per stockpile/source. -Topsoil tested at 1 sample 50m³. -Subsoil tested at 1 sample per 150m³. -Stone tested at 1 sample per 500m³. -If provenance proven that subsoil is natural quarried material then no testing required. -A minimum of 3 samples per source is required. -If site won material then should be stockpiled and tested at the same rate, but will need appropriate exemptions / permits to re-use onsite.	-Soil sampling should be undertaken from source or from a stockpile onsite. Can be sampled when in gardens; however, may have to be removed if unsuitable. -Soil samples will be undertaken on an accelerated 3 working day turnaround.
Option 2 Block Specific SI	-Useful if time constraints and where you do not wish for an environmental capping layer. -Nominal 3 soil sample from rear garden and 1 soil sample from front. -Selected soil sampling in landscaped (POS) areas. -All data in that block / POS will be risk assessed and a Block by Block / POS assessment and recommendations provided in a report. -This additional sampling will apply near TPO's, where the full environmental capping layer may not be able to be achieved. Due to root protection.	-If data fail then an environmental capping layer will still be required and a report will not be needed. - If soil passes and no formal environmental capping layer is required then a formal depth is not necessary. A nominal 150mm topsoil is recommended as a growing medium and to cover undesirable material.
Option 1 Garden Areas	Rear Gardens <i>Unless a Block by Block site investigation is undertaken and soil passes.</i> -450mm total depth soil capping layer (includes minimum 150m topsoil) required for these plots. -This includes a Hi-Viz geotextile at the base of the capping layer OR 100mm MOT type 1 (minimal fines) and 350mm depth soil capping layer (includes minimum 150mm topsoil).	-Site manager to photograph laying of separation geotextile OR 100mm MOT in each garden area. -LKC need to validate the depth of the cover layer by digging small hole in each garden area, measuring the depth and taking validatory photos.
Option 1 Landscaped Areas	All Front gardens and Landscaped Areas <i>Unless a Block by Block / POS site investigation is undertaken and soil passes.</i> -300mm total depth soil capping layer (includes minimum 150m topsoil) required for these landscaped areas. -This includes a Hi-Viz geotextile at the base of the capping layer OR 100mm MOT type 1 (minimal fines) and 200mm depth soil capping layer (includes minimum 150mm topsoil).	-Site manager to photograph laying of separation geotextile OR 100mm MOT in each garden area. -LKC need to validate the depth of the cover layer by digging small hole in each garden area, measuring the depth and taking validatory photos.
Site	Unexpected Contamination -During earthworks if contractor finds visual or olfactory evidence of contamination and/or asbestos then LKC should be informed and if necessary material will need to be sampled so that it can be disposed of at an appropriate licensed tip. -Material should be stockpiled on Visqueen and covered prior to disposal and/or testing. -All disposal tickets will be required for the Completion Report.	-If considerable earthworks or soil movement is occurring it would be advisable that LKC undertake a Watching Brief during earthworks.
Site	Local Authority Site Completion Report -Manchester Council require a Site Completion Report for whole site once all validation complete. -Individual plot reports may be required for NHBC for individual plot sales before site is fully completed.	-Can only be done once development is completed. -Manchester Council may provide a letter of comfort for each plot that has been completed satisfactory (if individual plot reports undertaken).

NOTE:

Minimum 24 hours notice to attend site.

Contacts

LK Consult

Unit 29, Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS Tel: 0161 763 7200

Paul Quimby – p.quimby@thelkgroup.com

Kerrell Walley – k.walley@thelkgroup.com

SUITABILITY OF ANY IMPORTED MATERIAL AS CLEAN COVER

Recommended validation sampling requirements for environmental capping layer soils presented in the following table.

Material Type	Source	Suite of Analysis	Sampling Rate
Topsoil	Greenfield	Suite A	1 sample per 50m ³ (minimum of 3 samples per source)
	Brownfield / Unknown / Site Won	Suite B	
Subsoil	Brownfield / Unknown / Site Won	Suite B	1 sample per 150m ³ (minimum of 3 samples per source)
	First Generation i.e. quarried sand (su (break layer)	No testing is required. Certification of material provenance is required.	
Physical Stone Break Layer	Recycled Stone (6F2 / min. fines)	Suite B	1 sample per 500m ³ (minimum of 3 samples per source)

Recommended validation sampling requirements for environmental capping layer soils.

Notes:

Suite A - Heavy metals, pH, water soluble sulphate, speciated PAH, soil organic matter and asbestos screen.

Suite B - Heavy metals, pH, water soluble sulphate, speciated PAH, phenol, total and free cyanide, soil organic matter, asbestos screen, banded petroleum hydrocarbons (TPH CWG), BTEX, MTBE.

ENVIRONMENTAL COVER LAYER

Private Gardens

Private garden areas should comprise a cover layer depth of at least 450mm. A typical construction detail is provided below. Subsoil may be replaced by topsoil if required.

GROUND LEVEL

450mm (minimum)		150mm (minimum) chemically validated TOPSOIL
		200mm chemically validated SUBSOIL
		100mm PHYSICAL BREAK LAYER (typically MOT Type 1)
		Existing MADE GROUND

Soft Landscaped Areas and Front Gardens

Soft landscaping areas and front gardens should comprise a cover layer depth of at least 300mm. A typical construction detail is provided below:

GROUND LEVEL

300mm (minimum)		200mm (minimum) chemically validated TOPSOIL
		100mm PHYSICAL BREAK LAYER (typically MOT Type 1)
		Existing MADE GROUND

If suitable break layer material is not available, then the **break layer may be substituted for a separation geotextile** and the subsoil / topsoil depth increased by 100mm to maintain the required capping layer material depth.

Appendix B

Profile Logs



LK CONSULT LTD
Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com

Site
MMU, Didsbury

**Trial Pit
Number**
TP101

Excavation Method
Trial Pit.

Dimensions

Ground Level (mOD)

Client
P.J. Livesey Group Ltd

**Job
Number**
LKC 16 1066

Location

Dates
08/03/2016

Project Contractor
Bemus

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.20	D1 PID = 0.0ppm				(0.20)	MADE GROUND: Dark brown/black gravelly slightly clayey sand with occasional subangular cobbles of sandstone, rare whole bricks, coal, pottery fragments, ash and clinker. Sand is fine to medium. Gravel is fine to coarse angular to subrounded comprising sandstone.		
0.20-0.80	D2				0.20			
					(0.60)	Brown gravelly slightly clayey SAND with occasional rootlets. Sand is fine to medium. Gravel is fine to coarse angular to subrounded comprising sandstone.		
					0.80			
1.00-1.50	D3				(1.00)	Brownish orange very gravelly SAND with abundant subangular cobbles of sandstone. Sand is fine to medium. Gravel is fine to coarse angular to subrounded comprising sandstone.		
					1.80			
						Complete at 1.80m		



Remarks

Trial pit dry and stable.

Scale (approx)

1:20

Logged By

KW

Figure No.

LKC 16 1066.TP101



Site	MMU, Didsbury
------	---------------

**Trial Pit
Number**
TP102

Excavation Method	
Trial Pit.	

Dimensions

Ground Level (mOD)

Client	P.J. Livesey Group Ltd
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Job Number	LKC 16 1066
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Location

Dates	06/07/2016
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Project Contractor	Bemus
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Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.40	D1 PID = 0.0ppm				(0.40)	MADE GROUND: Dark brown gravelly clayey sand with abundant angular to subangular cobbles of brick and sandstone, occasional fragments of pottery, glass, ash and clinker. Sand is fine to medium. Gravel is fine to coarse angular to subrounded comprising sandstone.		
0.40-0.60	D2				0.40 (0.20) 0.60	MADE GROUND: Red brick sand and gravel subbase. Sand is fine to medium. Gravel is fine to coarse angular to subrounded comprising sandstone.		
1.50-2.00	B1				(2.20)	Light brownish orange very gravelly SAND with occasional subangular cobbles of sandstone. Sand is fine to medium. Gravel is fine to coarse angular to subrounded comprising sandstone.		
					2.80	Complete at 2.80m		



Remarks

Trial pit dry and stable

Scale (approx)

1:20

Logged By

KW

Figure No.

LKC 16 1066.TP102

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

MMU, Didsbury

**Trial Pit
Number****TP103****Excavation Method**

Trial Pit.

Dimensions**Ground Level (mOD)****Client**

P.J. Livesey Group Ltd

**Job
Number**

LKC 16 1066

Location**Dates**

06/07/2016

Project Contractor

Bemus

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.30	D1 PID = 0.0ppm				(0.30)	MADE GROUND: Dark brown gravelly slightly clayey sand with abundant angular to subangular cobbles of brick and sandstone, occasional fragments of glass, pottery, ash and clinker. Sand is fine to medium. Gravel is fine to coarse angular to subrounded comprising sandstone.		
0.50-1.00 0.50-1.00	B1 D2				0.30 (0.80)	Light brownish orange very gravelly SAND with occasional subangular cobbles of sandstone. Sand is fine to medium. Gravel is fine to coarse angular to subrounded comprising sandstone.		
					1.10	Complete at 1.10m		

**Remarks**

Trial pit dry and stable.

Scale (approx)

1:20

Logged By

KW

Figure No.

LKC 16 1066.TP103

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

MMU, Didsbury

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

Trial Pit.

Dimensions**Ground Level (mOD)****Client**

P.J. Livesey Group Ltd

**Job
Number
LKC 16 1066****Location****Dates**

06/07/2016

Project Contractor

Bemus

**Sheet
1/1**

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.60	D1 PID = 0.0ppm				(0.80)	MADE GROUND: Dark brown very gravelly slightly clayey sand with abundant angular to subangular cobbles of brick and sandstone; occasional fragments of glass, pottery, ash and clinker. Sand is fine to medium. Gravel is fine to coarse angular to subrounded comprising sandstone.		
1.00-1.50	D2				0.80	Light brownish orange very gravelly SAND with occasional subangular cobbles of sandstone. Sand is fine to medium. Gravel is fine to coarse angular to subrounded comprising sandstone. Colour lightens with depth.		
1.50-2.00	B1				(1.80)			
					2.60	Complete at 2.60m		

**Remarks**

Trial pit dry and stable.

Scale (approx)

1:20

Logged By

KW

Figure No.

LKC 16 1066.TP104



LK CONSULT LTD
Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com

Site MMU, Didsbury	Trial Pit Number TP105
Client P.J. Livesey Group Ltd	Job Number LKC 16 1066
Project Contractor Bemus	Sheet 1/1

Excavation Method Trial Pit.		Dimensions		Ground Level (mOD)	
Location		Dates 06/07/2016		Project Contractor Bemus	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)
0.00-0.60	D1 PID = 0.0ppm				(0.60)
0.60-1.00	D2				0.60
1.00-1.50	B1				(0.80)
					1.40
					Complete at 1.40m



Remarks Trial pit dry and stable.		
Scale (approx) 1:20	Logged By KW	Figure No. LKC 16 1066.TP105



LK CONSULT LTD

Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com

Site

MMU, Didsbury

**Trial Pit
Number
TP106**

Excavation Method

Trial Pit.

Dimensions

Ground Level (mOD)

Client

P.J. Livesey Group Ltd

**Job
Number
LKC 16 1066**

Location

Dates

06/07/2016

Project Contractor

Bemus

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.60	D1 PID = 0.0ppm				(0.60)	MADE GROUND: Dark brown very gravelly slightly clayey sand with abundant angular to subangular cobbles of brick and sandstone; occasional fragments of glass, ash and clinker. Sand is fine to medium. Gravel is fine to coarse angular to subrounded comprising sandstone.		
0.60-1.00	D2				0.60	Brownish orange very gravelly SAND with subangular cobbles of sandstone. Sand is fine to medium. Gravel is fine to coarse subangular to subrounded comprising sandstone.		
1.50-2.00	B1				(1.80)			
					2.40	Complete at 2.40m		



Remarks

Trial pit dry and stable.

Scale (approx)

1:20

Logged By

KW

Figure No.

LKC 16 1066.TP106



LK CONSULT LTD
Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com

Site
MMU, Didsbury

**Trial Pit
Number**
TP107

Excavation Method Trial Pit.	Dimensions	Ground Level (mOD)	Client P.J. Livesey Group Ltd	Job Number LKC 16 1066
	Location	Dates 06/07/2016	Project Contractor Bemus	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50	D1 PID = 0.0ppm				(0.60)	MADE GROUND: Dark brown gravelly slightly clayey sand with abundant angular to subangular cobbles of brick and sandstone; occasional glass, pottery, timber, rootlets, clothing, food wrappers, tarmac, ash and clinker. Sand is fine to medium. Gravel is fine to coarse angular to subrounded comprising sandstone.		
1.00-1.50	D2				0.60 (1.40)	Brownish orange very gravelly SAND with abundant subangular cobbles of sandstone. Sand is fine to medium. Gravel is fine to coarse angular to subrounded comprising sandstone.		
1.50-2.00	B1				2.00	Complete at 2.00m		



Remarks

Trial pit dry and stable.

Scale (approx) 1:20	Logged By KW	Figure No. LKC 16 1066.TP107
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LK CONSULT LTD

Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com

Site

MMU, Didsbury

Trial Pit Number

TP108

Excavation Method

Trial Pit.

Dimensions

Ground Level (mOD)

Client

P.J. Livesey Group Ltd

Job Number

LKC 16 1066

Location

Dates

06/07/2016

Project Contractor

Bemus

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50	D1 PID = 0.0ppm					MADE GROUND: Dark brown gravelly slightly clayey sand with abundant angular to subangular cobbles of brick and sandstone; occasional glass, pottery, tarmac, ash and clinker. Sand is fine to medium. Gravel is fine to coarse angular to subrounded comprising sandstone.		
					(1.10)	Possible former brick drain encountered at 0.5mbgl.		
1.10-1.50	D2				1.10	Brownish orange very gravelly SAND with abundant subangular cobbles of sandstone. Sand is fine to medium. Gravel is fine to coarse angular to subrounded comprising sandstone.		
					(1.40)			
2.00-2.50	B1				2.50	Complete at 2.50m		



Remarks

Trial pit dry and stable.

Scale (approx)

1:20

Logged By

KW

Figure No.

LKC 16 1066.TP108



LK CONSULT LTD

Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com

Site

MMU, Didsbury

**Trial Pit
Number**

TP109

Excavation Method

Trial Pit

Dimensions

Ground Level (mOD)

Client

P.J. Livesey Group Ltd

**Job
Number**

LKC 16 1066

Location

Dates

06/07/2016

Project Contractor

Bemus

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.70	D1 PID = 0.0ppm				(0.70)	MADE GROUND: Dark brown gravelly slightly clayey sand with abundant angular to subangular cobbles of brick and sandstone; occasional glass, pottery, tarmac, ash and clinker. Sand is fine to medium. Gravel is fine to coarse angular to subrounded comprising sandstone. Possible brick wall encountered at 0.3mbgl.		
0.70-1.00	D2				0.70	Brownish orange very gravelly SAND with abundant subangular cobbles of sandstone. Sand is fine to medium. Gravel is fine to coarse angular to subrounded comprising sandstone.		
1.50-2.00	B1				(1.70)			
					2.40	Complete at 2.40m		



Remarks

Trial pit dry and stable.

Scale (approx)

1:20

Logged By

KW

Figure No.

LKC 16 1066.TP109

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

MMU, Didsbury

**Trial Pit
Number
TP110****Excavation Method**

Trial Pit.

Dimensions**Ground Level (mOD)****Client**

P.J. Livesey Group Ltd

**Job
Number**

LKC 16 1066

Location**Dates**

06/07/2016

Project Contractor

Bemus

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50	D1 PID = 0.0ppm				(0.10) 0.10	MADE GROUND: Compacted red brick and gravel. Gravel is fine to coarse angular to subrounded comprising sandstone.		
					(0.60)	MADE GROUND: Dark brown gravelly slightly clayey sand with abundant angular to subangular cobbles of brick and sandstone; occasional glass, pottery, tarmac, ash and clinker. Sand is fine to medium. Gravel is fine to coarse angular to subrounded comprising sandstone.		
					0.70			
1.00-1.50	D2				(1.40)	Brownish orange very gravelly SAND with abundant subangular cobbles of sandstone. Sand is fine to medium. Gravel is fine to coarse angular to subrounded comprising sandstone.		
1.50-2.00	B1				2.10	Complete at 2.10m		

**Remarks**

Trial pit dry and stable.

Scale (approx)

1:20

Logged By

KW

Figure No.

LKC 16 1066.TP110



LK CONSULT LTD

Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com

Site

MMU, Didsbury

**Trial Pit
Number
TP111**

Excavation Method

Trial Pit.

Dimensions

Ground Level (mOD)

Client

P.J. Livesey Group Ltd

**Job
Number
LKC 16 1066**

Location

Dates

06/07/2016

Project Contractor

Bemus

**Sheet
1/1**

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.40	D1 PID = 0.0ppm				(0.40)	MADE GROUND: Dark brown black gravelly sandy clay with abundant angular to subangular cobbles of brick and sandstone; occasional glass, pottery, brick, rootlets, ash and clinker. Sand is fine to medium. Gravel is fine to coarse angular to subrounded comprising sandstone.		
0.50-1.00	D2				0.40 (0.10) 0.50	MADE GROUND: White to grey subangular sandstone subbase. Sandstone is fine to coarse angular to subrounded.		
					(0.80)	MADE GROUND: Brownish orange very gravelly slightly clayey sand with occasional brick fragments and rootlets. Sand is fine to medium. Gravel is fine to coarse angular to subrounded comprising sandstone.		
					1.30	Brownish orange very gravelly SAND with subangular cobbles of sandstone. Sand is fine to medium. Gravel is fine to coarse subangular to subrounded comprising sandstone.		
					(1.20)			
2.50-2.70	B1				2.50	Brownish red slightly gravelly slightly sandy CLAY. Sand is fine to medium. Gravel is fine to medium angular to subrounded comprising sandstone.		
			Water strike(1) at 2.70m.		(0.20) 2.70	Complete at 2.70m		V1



Remarks

Trial pit stable.

Scale (approx)

1:20

Logged By

KW

Figure No.

LKC 16 1066.TP111

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

MMU, Didsbury

**Trial Pit
Number****TP112****Excavation Method**

Trial Pit.

Dimensions**Ground Level (mOD)****Client**

P.J. Livesey Group Ltd

**Job
Number**

LKC 16 1066

Location**Dates**

01/08/2016

Project Contractor

Bemus

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10-2.00	D2					MADE GROUND: Brownish orange cobbly very gravelly sand with abundant brick fragments and occasional half bricks. Sand is fine to medium. Gravel is fine to coarse angular to subrounded comprising sandstone.		
0.50-1.00	D1 PID = 0.0ppm				(1.20)			
					1.20	Brownish orange slightly gravelly SAND with subangular cobbles of sandstone. Sand is fine to medium. Gravel is fine to coarse subangular to subrounded comprising sandstone.		
					(1.30)			
					2.50	Complete at 2.50m		

**Remarks**

Trial pit stable.

Scale (approx)

1:20

Logged By

PQ

Figure No.

LKC 16 1066.TP112

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

MMU, Didsbury

**Trial Pit
Number****TP113****Excavation Method**

Trial Pit

Dimensions**Ground Level (mOD)****Client**

P.J. Livesey Group Ltd

**Job
Number**

LKC 16 1066

Location**Dates**

30/11/2016

Project Contractor

Bemus

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50 0.00-0.50	ES1 PID <0.1ppm					MADE GROUND: Brown slightly cobbly gravelly sand with occasional wood. Sand is fine to coarse. Gravel is fine to coarse, angular to rounded, of brick, concrete, coal, sandstone, and pebble.		
					(0.50)			
					0.50			
					(0.50)	Pale orange slightly gravelly SAND. Sand is medium to coarse. Gravel is fine to medium, sub-rounded to rounded, of pebble and sandstone.		
					1.00			
					(1.00)	Pale orange gravelly SAND. Sand is medium to coarse. Gravel is fine to medium, sub-rounded to rounded, of pebble and sandstone.		
					2.00			
					2.05	Black very gravelly sandy CONGLOMERATE (possible iron pan cemented gravel). Sand is coarse. Gravel is fine to medium, sub-rounded to rounded, of pebble.		
					(0.65)	Pale orange very gravelly SAND. Sand is medium to coarse. Gravel is fine to medium, sub-rounded to rounded, of pebble and sandstone.		
					2.70	Complete at 2.70m		

**Remarks**

No groundwater encountered.

Scale (approx)

1:20

Logged By

NS

Figure No.

LKC 16 1066.TP113

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

MMU, Didsbury

**Trial Pit
Number
TP114****Excavation Method**

Trial Pit

Dimensions**Ground Level (mOD)****Client**

P.J. Livesey Group Ltd

**Job
Number
LKC 16 1066****Location****Dates**

30/11/2016

Project Contractor

Bemus

**Sheet
1/1**

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.30 0.00-0.30	ES1 PID <0.1ppm				(0.30) 0.30	MADE GROUND: Dark brown very gravelly sandy clay with occasional brick and wire. Sand is fine to coarse. Gravel is fine to coarse, angular to rounded, of brick, concrete, coal, tarmacadam, sandstone, and pebble.		
					(0.70) 1.00	Orange gravelly SAND. Sand is medium to coarse. Gravel is fine to coarse, sub-rounded to rounded, of pebble and sandstone.		
					(1.50) 2.50	Orange very gravelly SAND. Sand is medium to coarse. Gravel is fine to medium, sub-rounded to rounded, of pebble and sandstone.		
2.50	SV 50.67kPa		Water strike(1) at 2.50m. 54, 54, 44/Av. 50.67		(0.20) 2.70	Firm consistency medium strength brown sandy CLAY. Sand is fine to medium.		▽1
						Complete at 2.70m		

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

1:20

Logged By

NS

Figure No.

LKC 16 1066.TP113

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

MMU, Didsbury

**Trial Pit
Number
TP115****Excavation Method**

Trial Pit

Dimensions**Ground Level (mOD)****Client**

P.J. Livesey Group Ltd

**Job
Number
LKC 16 1066****Location****Dates**

30/11/2016

Project Contractor

Bemus

**Sheet
1/1**

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50 0.00-0.50	ES1 PID <0.1ppm				0.05 (0.25) 0.30 (0.20) 0.50 (0.70) 1.20 (1.30) 2.50	MADE GROUND: Dark brown sandy slightly gravelly clay with frequent rootlets and occasional wood. Sand is fine to medium. Gravel is fine to medium, angular to sub-rounded, of brick, sandstone, coal, slate and limestone. MADE GROUND: Light grey sandy gravel (MOT). Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded, of limestone. MADE GROUND: Orange / red sandy gravelly cobbles with occasional wood and wire. Sand is fine to coarse. Gravel and cobbles are fine to coarse, angular to rounded, of brick, slate and coal. Yellow / orange gravelly SAND. Sand is medium to coarse. Gravel is fine to medium, sub-rounded to rounded, of pebble and sandstone. Yellow / orange very gravelly SAND. Sand is medium to coarse. Gravel is fine to medium, sub-rounded to rounded, of pebble and sandstone.	    	
2.50	SV 50.67kPa		54, 54, 44/Av. 50.67		2.50	Complete at 2.50m		

**Remarks**

No groundwater encountered.

Scale (approx)

1:20

Logged By

NS

Figure No.

LKC 16 1066.TP113

Excavation Method
Trial Pit

Dimensions

Ground Level (mOD)

Client

P.J. Livesey Group Ltd

Job Number
LKC 16 1066

Location

Dates	30/11/2016
--------------	------------

Project Contractor
Bemus

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50 0.00-0.50	ES1 PID <0.1ppm					MADE GROUND: Dark brown sandy slightly gravelly clay with frequent rootlets and occasional wood. Sand is fine to medium. Gravel is fine to medium, angular to sub-rounded, of brick, sandstone, coal, slate and limestone.		
					(0.20) 0.20	MADE GROUND: Light grey sandy gravel (MOT). Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded, of limestone.		
					0.40 0.45	MADE GROUND: Dark brown / black slightly sandy gravelly clay. Sand is medium to coarse. Gravel is fine to medium, angular to sub-rounded, of brick and limestone.		
					(0.75)	Orange gravelly SAND. Sand is medium to coarse. Gravel is fine to medium, sub-rounded to rounded, of pebble and sandstone with rare coal fragments.		
					1.20	Orange very gravelly SAND. Sand is medium to coarse. Gravel is fine to medium, sub-rounded to rounded, of pebble and sandstone.		
					(0.80)			
					2.00	Firm consistency medium strength brown very sandy slightly gravelly CLAY. Sand is medium to coarse. Gravel is fine to medium, sub-angular to sub-rounded, of sandstone and pebble.		
					(0.90)			
2.50	SV 49kPa		49, 49,49/Av. 49.00					
					2.90	Complete at 2.90m		



Remarks

No groundwater encountered.

Scale (approx)

1:20

Logged By

NS

Figure No.

LKC 16 1066.TP113

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

MMU, Didsbury

**Trial Pit
Number****TP117****Excavation Method**

Trial Pit

Dimensions**Ground Level (mOD)****Client**

P.J. Livesey Group Ltd

**Job
Number**

LKC 16 1066

Location**Dates**

30/11/2016

Project Contractor

Bemus

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20-0.35 0.20-0.35	ES1 PID <0.1ppm				0.05 0.10 (0.10) 0.20 (0.20) 0.40	MADE GROUND: Brick Paving. MADE GROUND: Tarmacadam. MADE GROUND: Concrete. MADE GROUND: Light grey sandy gravel (MOT). Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded, of limestone.		
					(0.80)	Orange brown gravelly SAND. Sand is medium to coarse. Gravel is fine to medium, sub-rounded to rounded, of pebble and sandstone with rare coal fragments.		
					1.20	Orange brown very gravelly SAND. Sand is medium to coarse. Gravel is fine to medium, sub-rounded to rounded, of pebble and sandstone.		
					(1.40)			
2.50	SV 49kPa		49, 49,49/Av. 49.00		2.60	Complete at 2.60m		

**Remarks**

No groundwater encountered.

Scale (approx)

1:20

Logged By

NS

Figure No.

LKC 16 1066.TP113

Appendix C

Photographs

Plot 20



Photograph 1:

View of rear garden of Plot 20.



Photograph 2:

View of soil in capping layer excavation in rear garden of Plot 20 with geotextile membrane visible.



Photograph 3:

Depth measurement in rear garden of Plot 20. The cover system only comprises 300mm over soil and not the required 450mm therefore Option 2 Assessment (plot by plot) of the Remediation Strategy was undertaken.

Plot 22

	Photograph 4: View of rear garden of Plot 22.
	Photograph 5: View of soil in capping layer excavation in rear garden of Plot 22. No membrane is present, and topsoil has been laid straight onto made ground.
	Photograph 6: Depth measurement in rear garden of Plot 22. No separation layer was present however the soil was laid to an appropriate depth, therefore Option 2 Assessment (plot by plot) of the Remediation Strategy was undertaken.

Plot 23



Photograph 7:
View of rear garden of Plot 23.



Photograph 8:
View of soil in capping layer excavation in rear garden of Plot 23. No membrane is present, and topsoil has been laid straight onto made ground.



Photograph 9:
Depth measurement in rear garden of Plot 23. No separation layer was present however the soil was laid to an appropriate depth, therefore Option 2 Assessment (plot by plot) of the Remediation Strategy was undertaken.

Appendix D

Certificates of Analysis - Soil



Final Report

Report No.: 18-19658-1

Initial Date of Issue: 10-Jul-2018

Client LK Consult

Client Address: Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Manchester
Lancashire
M26 2ZS

Contact(s): Contaminated Land
Paul Quimby

Project LKC 16 1066 MMU Didsbury

Quotation No.: **Date Received:** 06-Jul-2018

Order No.: 736213 **Date Instructed:** 06-Jul-2018

No. of Samples: 3

Turnaround (Wkdays): 3 **Results Due:** 10-Jul-2018

Date Approved: 10-Jul-2018

Approved By:

Details: Martin Dyer, Laboratory Manager

Project: LKC 16 1066 MMU Didsbury

Client: LK Consult	Chemtest Job No.:				18-19658	18-19658	18-19658
Quotation No.:	Chemtest Sample ID.:				649886	649887	649888
	Client Sample ID.:				S101	S102	S103
	Sample Type:				SOIL	SOIL	SOIL
	Date Sampled:				05-Jul-2018	05-Jul-2018	05-Jul-2018
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD			
ACM Type	U	2192		N/A	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	11	13	18
Soil Colour	N	2040		N/A	Brown	Brown	Brown
Other Material	N	2040		N/A	Stones	Stones	Stones
Soil Texture	N	2040		N/A	Sand	Sand	Sand
pH	M	2010		N/A	8.2	8.1	8.1
Sulphate (2:1 Water Soluble) as SO ₄	M	2120	g/l	0.010	0.20	0.030	0.098
Arsenic	M	2450	mg/kg	1.0	24	17	16
Cadmium	M	2450	mg/kg	0.10	0.61	0.35	0.36
Chromium	M	2450	mg/kg	1.0	19	14	15
Copper	M	2450	mg/kg	0.50	36	59	41
Mercury	M	2450	mg/kg	0.10	0.20	0.36	0.30
Nickel	M	2450	mg/kg	0.50	21	15	14
Lead	M	2450	mg/kg	0.50	210	140	130
Selenium	M	2450	mg/kg	0.20	< 0.20	< 0.20	< 0.20
Vanadium	U	2450	mg/kg	5.0	32	23	23
Zinc	M	2450	mg/kg	0.50	85	96	82
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Organic Matter	M	2625	%	0.40	3.8	4.1	5.3
Naphthalene	M	2800	mg/kg	0.10	0.16	0.51	0.43
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	0.19	0.18
Acenaphthene	M	2800	mg/kg	0.10	0.22	0.78	0.35
Fluorene	M	2800	mg/kg	0.10	0.16	0.57	0.29
Phenanthrene	M	2800	mg/kg	0.10	2.3	5.4	3.5
Anthracene	M	2800	mg/kg	0.10	0.49	1.2	0.78
Fluoranthene	M	2800	mg/kg	0.10	4.0	10	6.4
Pyrene	M	2800	mg/kg	0.10	3.3	8.5	5.4
Benzo[a]anthracene	M	2800	mg/kg	0.10	1.3	3.7	2.1
Chrysene	M	2800	mg/kg	0.10	1.5	4.5	2.5
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	1.7	5.2	3.1
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	0.57	1.7	0.97
Benzo[a]pyrene	M	2800	mg/kg	0.10	1.3	4.1	2.1
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	0.81	3.1	1.6
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	0.13	0.48	0.20
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	0.93	2.6	1.6
Total Of 16 PAH's	N	2800	mg/kg	2.0	19	53	32

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenzo[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS

Report Information

Key

- U UKAS accredited
- M MCERTS and UKAS accredited
- N Unaccredited
- S This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
- SN This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
- T This analysis has been subcontracted to an unaccredited laboratory
- I/S Insufficient Sample
- U/S Unsuitable Sample
- N/E not evaluated
- < "less than"
- > "greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

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

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.co.uk



Final Report

Report No.: 18-34206-1

Initial Date of Issue: 12-Nov-2018

Client LK Consult

Client Address: Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Manchester
Lancashire
M26 2ZS

Contact(s): Contaminated Land
Paul Quimby

Project LKC 16 1066 Former MMU Campus,
Didsbury

Quotation No.: **Date Received:** 02-Nov-2018

Order No.: 736496 **Date Instructed:** 02-Nov-2018

No. of Samples: 10

Turnaround (Wkdays): 5 **Results Due:** 08-Nov-2018

Date Approved: 12-Nov-2018

Approved By:

Details: Robert Monk, Technical Manager

Results - Soil

Client: LK Consult	Chemtest Job No.:				18-34206	18-34206	18-34206	18-34206	18-34206	18-34206	18-34206	18-34206
Quotation No.:	Chemtest Sample ID.:				718221	718222	718223	718224	718225	718226	718227	718228
	Client Sample ID.:				TSS01	TS502	TS503	Plot 22	Plot 22	Plot 22	Plot 22	Plot 23
	Sample Location:							S101	S102	S103	S104	S101
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Date Sampled:				31-Oct-2018	31-Oct-2018	31-Oct-2018	31-Oct-2018	31-Oct-2018	31-Oct-2018	31-Oct-2018	31-Oct-2018
	Asbestos Lab:				DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD								
ACM Type	U	2192		N/A	-	-	-	-	-	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	16	12	14	13	14	11	11	13
Soil Colour	N	2040		N/A	Brown,	Brown,	Brown,	Brown,	Brown,	Brown,	Brown,	Brown,
Other Material	N	2040		N/A	Stones,	Stones,	Stones,	Stones,	Stones,	Stones,	Stones,	Stones, Roots,
Soil Texture	N	2040		N/A	Loam,	Loam,	Loam,	Loam,	Loam,	Loam,	Loam,	Loam,
Chromatogram (TPH)	N			N/A	See Attached	See Attached	See Attached					
pH	M	2010		N/A	8.1	8.3	8.3	8.2	8.2	8.4	8.7	8.3
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	0.54	0.64	0.52					
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	0.015	0.027	< 0.010	0.035	0.022	0.083	0.18	0.030
Cyanide (Free)	M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50					
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50					
Arsenic	M	2450	mg/kg	1.0	14	12	10	13	13	13	15	13
Cadmium	M	2450	mg/kg	0.10	0.28	0.22	0.20	0.24	0.21	0.36	0.32	0.23
Chromium	M	2450	mg/kg	1.0	12	11	11	12	11	14	11	11
Copper	M	2450	mg/kg	0.50	29	29	23	23	28	25	22	26
Mercury	M	2450	mg/kg	0.10	0.42	0.41	0.34	0.35	0.46	0.34	0.30	0.39
Nickel	M	2450	mg/kg	0.50	15	15	13	14	14	15	13	14
Lead	M	2450	mg/kg	0.50	110	110	88	97	100	96	92	92
Selenium	M	2450	mg/kg	0.20	0.28	0.22	0.25	< 0.20	0.30	< 0.20	< 0.20	0.22
Vanadium	U	2450	mg/kg	5.0	16	15	14	15	15	18	14	14
Zinc	M	2450	mg/kg	0.50	61	63	54	52	56	61	50	55
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter	M	2625	%	0.40	4.8	4.8	4.1	3.1	5.7	5.3	3.5	4.1
Fuel Type	N	2670		N/A	PAH	PAH	PAH					
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0					
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0					
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0					
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0					
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0					
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0					
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	46	33	26					
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0					
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	46	33	26					
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0					
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0					
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0					

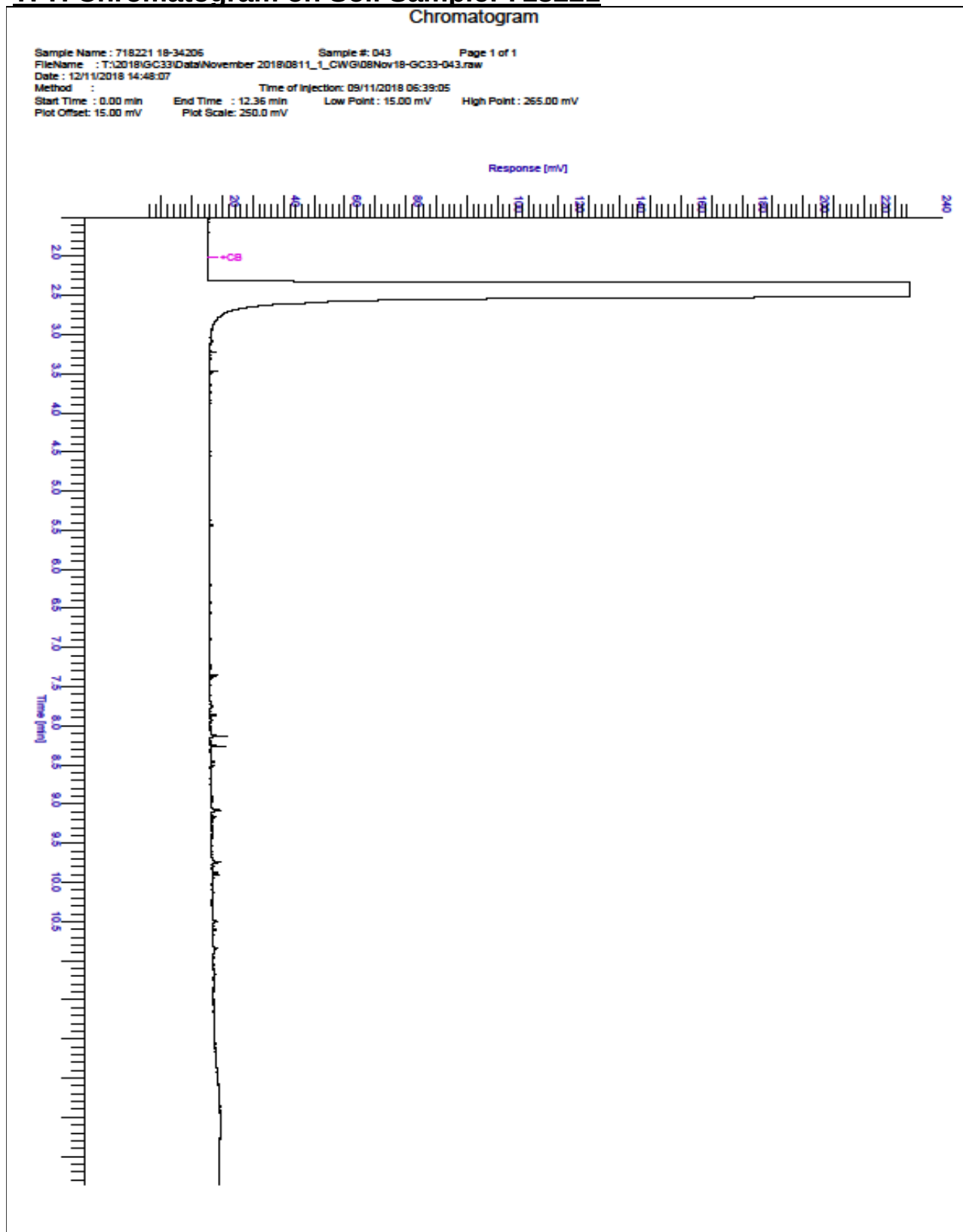
Results - Soil

Client: LK Consult	Chemtest Job No.:				18-34206	18-34206	18-34206	18-34206	18-34206	18-34206	18-34206	18-34206
Quotation No.:	Chemtest Sample ID.:				718221	718222	718223	718224	718225	718226	718227	718228
	Client Sample ID.:				TSS01	TS502	TS503	Plot 22	Plot 22	Plot 22	Plot 22	Plot 23
	Sample Location:							S101	S102	S103	S104	S101
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Date Sampled:				31-Oct-2018	31-Oct-2018	31-Oct-2018	31-Oct-2018	31-Oct-2018	31-Oct-2018	31-Oct-2018	31-Oct-2018
	Asbestos Lab:				DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD								
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0					
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0					
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	9.8	5.7	4.1					
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	200	92	42					
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0					
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	210	97	46					
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	250	130	73					
Benzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0					
Toluene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0					
Ethylbenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0					
m & p-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0					
o-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0					
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0					
Naphthalene	M	2800	mg/kg	0.10	0.13	0.20	0.24	0.46	0.13	0.67	0.11	0.33
Acenaphthylene	N	2800	mg/kg	0.10	0.11	0.16	0.10	0.24	0.15	0.24	< 0.10	0.26
Acenaphthene	M	2800	mg/kg	0.10	< 0.10	0.13	0.46	0.38	0.21	1.8	< 0.10	0.22
Fluorene	M	2800	mg/kg	0.10	< 0.10	0.17	0.27	0.32	0.23	1.6	0.12	0.24
Phenanthrene	M	2800	mg/kg	0.10	1.6	2.8	4.2	4.0	3.0	14	1.6	3.6
Anthracene	M	2800	mg/kg	0.10	0.33	0.65	0.86	1.1	0.72	3.7	0.36	1.1
Fluoranthene	M	2800	mg/kg	0.10	3.2	4.5	5.1	4.7	4.7	18	2.9	5.4
Pyrene	M	2800	mg/kg	0.10	3.3	4.7	4.9	4.6	4.2	15	3.1	5.2
Benzo[a]anthracene	M	2800	mg/kg	0.10	0.98	1.9	1.9	1.6	1.7	6.8	1.3	2.1
Chrysene	M	2800	mg/kg	0.10	1.3	2.3	2.1	2.0	2.0	7.6	1.5	2.5
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	1.3	2.4	2.3	1.9	2.0	8.1	1.7	2.6
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	0.38	0.84	0.66	0.62	0.54	3.4	0.56	0.78
Benzo[a]pyrene	M	2800	mg/kg	0.10	0.83	1.6	1.6	1.4	1.5	6.9	1.4	1.9
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	0.41	0.92	0.82	0.66	0.63	4.2	0.68	1.0
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.76	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	0.63	1.1	1.1	0.96	0.91	3.9	0.87	1.3
Total Of 16 PAH's	N	2800	mg/kg	2.0	15	24	27	25	23	97	16	29
Total Phenols	M	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30					

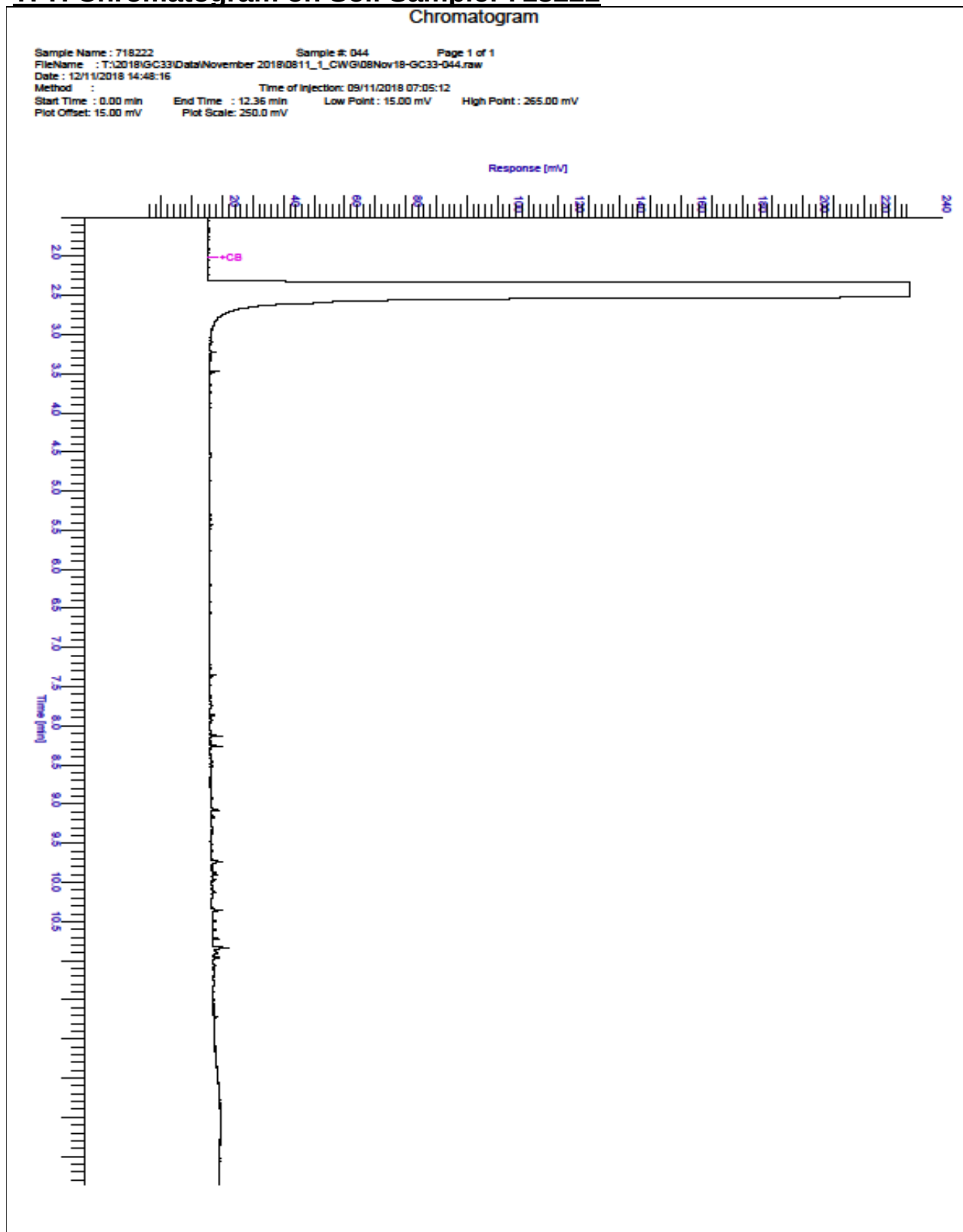
Client: LK Consult	Chemtest Job No.:				18-34206	18-34206
Quotation No.:	Chemtest Sample ID.:				718229	718230
	Client Sample ID.:				Plot 23	Plot 23
	Sample Location:				S102	S103
	Sample Type:				SOIL	SOIL
	Date Sampled:				31-Oct-2018	31-Oct-2018
	Asbestos Lab:				DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD		
ACM Type	U	2192		N/A	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	15	16
Soil Colour	N	2040		N/A	Brown,	Brown,
Other Material	N	2040		N/A	Stones, Roots,	Stones,Roots,
Soil Texture	N	2040		N/A	Loam,	Loam,
Chromatogram (TPH)	N			N/A		
pH	M	2010		N/A	8.2	8.3
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40		
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	0.029	0.072
Cyanide (Free)	M	2300	mg/kg	0.50		
Cyanide (Total)	M	2300	mg/kg	0.50		
Arsenic	M	2450	mg/kg	1.0	13	15
Cadmium	M	2450	mg/kg	0.10	0.26	0.27
Chromium	M	2450	mg/kg	1.0	12	14
Copper	M	2450	mg/kg	0.50	27	32
Mercury	M	2450	mg/kg	0.10	0.41	0.57
Nickel	M	2450	mg/kg	0.50	15	17
Lead	M	2450	mg/kg	0.50	110	120
Selenium	M	2450	mg/kg	0.20	0.27	0.26
Vanadium	U	2450	mg/kg	5.0	15	18
Zinc	M	2450	mg/kg	0.50	59	70
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50
Organic Matter	M	2625	%	0.40	4.8	4.8
Fuel Type	N	2670		N/A		
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0		
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0		
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0		
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0		
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0		
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0		
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0		
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0		
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0		
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0		
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0		
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0		

Client: LK Consult	Chemtest Job No.:				18-34206	18-34206
Quotation No.:	Chemtest Sample ID.:				718229	718230
	Client Sample ID.:				Plot 23	Plot 23
	Sample Location:				S102	S103
	Sample Type:				SOIL	SOIL
	Date Sampled:				31-Oct-2018	31-Oct-2018
	Asbestos Lab:				DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD		
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0		
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0		
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0		
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0		
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0		
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0		
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0		
Benzene	M	2760	µg/kg	1.0		
Toluene	M	2760	µg/kg	1.0		
Ethylbenzene	M	2760	µg/kg	1.0		
m & p-Xylene	M	2760	µg/kg	1.0		
o-Xylene	M	2760	µg/kg	1.0		
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0		
Naphthalene	M	2800	mg/kg	0.10	0.13	0.65
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	0.14
Acenaphthene	M	2800	mg/kg	0.10	0.19	0.85
Fluorene	M	2800	mg/kg	0.10	0.15	0.62
Phenanthrene	M	2800	mg/kg	0.10	2.1	6.2
Anthracene	M	2800	mg/kg	0.10	0.47	1.4
Fluoranthene	M	2800	mg/kg	0.10	3.6	7.3
Pyrene	M	2800	mg/kg	0.10	3.2	6.5
Benzo[a]anthracene	M	2800	mg/kg	0.10	1.4	2.4
Chrysene	M	2800	mg/kg	0.10	1.6	3.1
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	1.6	3.0
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	0.52	0.94
Benzo[a]pyrene	M	2800	mg/kg	0.10	1.3	2.3
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	0.70	1.3
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	0.92	1.7
Total Of 16 PAH's	N	2800	mg/kg	2.0	18	38
Total Phenols	M	2920	mg/kg	0.30		

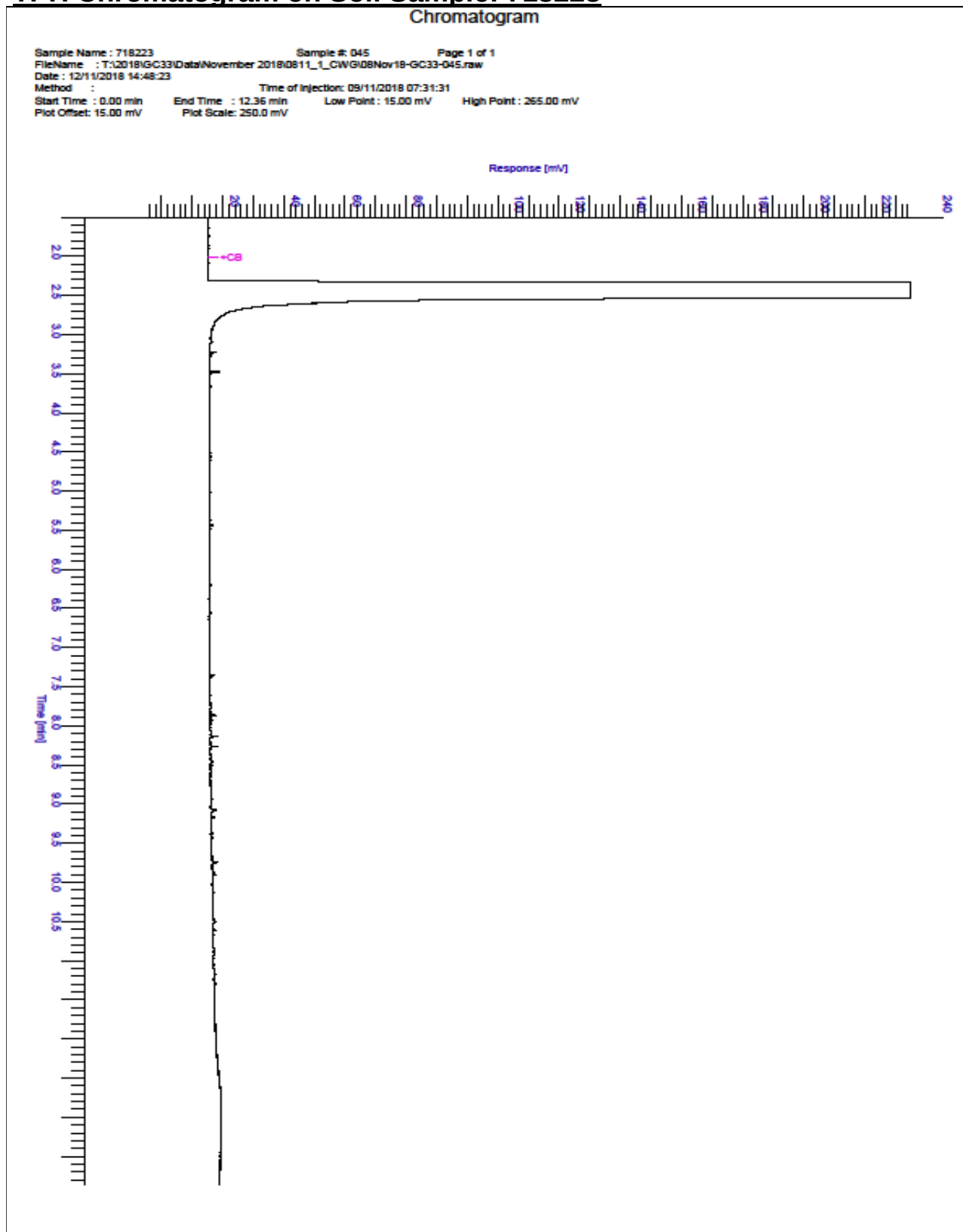
TPH Chromatogram on Soil Sample: 718221



TPH Chromatogram on Soil Sample: 718222



TPH Chromatogram on Soil Sample: 718223



SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenzo[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

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- I/S Insufficient Sample
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- N/E not evaluated
- < "less than"
- > "greater than"

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The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

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

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

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customerservices@chemtest.com



Final Report

Report No.: 19-06678-1

Initial Date of Issue: 05-Mar-2019

Client LK Consult

Client Address: Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Manchester
Lancashire
M26 2ZS

Contact(s): Contaminated Land
Paul Quimby

Project LKC 16 1066 Didsbury MMU

Quotation No.: **Date Received:** 22-Feb-2019

Order No.: 736750 **Date Instructed:** 22-Feb-2019

No. of Samples: 6

Turnaround (Wkdays): 5 **Results Due:** 28-Feb-2019

Date Approved: 05-Mar-2019

Approved By:



Details: Robert Monk, Technical Manager

Results - Soil

Project: LKC 16 1066 Didsbury MMU

Client: LK Consult	Chemtest Job No.:					19-06678	19-06678	19-06678	19-06678	19-06678	19-06678
Quotation No.:	Chemtest Sample ID.:					780854	780855	780856	780857	780858	780859
	Client Sample ID.:					Plot 22 R1	Plot 22 R2	Plot 22 R3	Plot 22 R4	Plot 22 R5	Plot 22 R6
	Sample Type:					SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):					0.20	0.35	0.30	0.30	0.30	0.30
	Bottom Depth (m):					0.40	0.50	0.50	0.55	0.50	0.50
	Date Sampled:					21-Feb-2019	21-Feb-2019	21-Feb-2019	21-Feb-2019	21-Feb-2019	21-Feb-2019
Determinand	Accred.	SOP	Units	LOD							
Naphthalene	M	2800	mg/kg	0.10	0.32	0.14	< 0.10	0.18	< 0.10	< 0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	0.25	0.10	< 0.10	0.19	< 0.10	< 0.10	< 0.10
Acenaphthene	M	2800	mg/kg	0.10	0.16	0.13	< 0.10	0.20	< 0.10	< 0.10	< 0.10
Fluorene	M	2800	mg/kg	0.10	0.32	0.10	< 0.10	0.26	< 0.10	< 0.10	< 0.10
Phenanthrene	M	2800	mg/kg	0.10	4.1	2.4	1.3	4.1	1.5	2.9	2.9
Anthracene	M	2800	mg/kg	0.10	1.4	0.80	0.44	1.3	0.50	1.0	1.0
Fluoranthene	M	2800	mg/kg	0.10	8.1	4.8	3.0	6.4	3.0	5.1	5.1
Pyrene	M	2800	mg/kg	0.10	7.8	4.6	2.9	6.8	3.1	4.8	4.8
Benzo[a]anthracene	M	2800	mg/kg	0.10	2.5	1.5	0.76	1.6	0.79	1.2	1.2
Chrysene	M	2800	mg/kg	0.10	3.5	1.9	1.4	2.9	1.3	2.2	2.2
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	3.0	1.8	1.0	2.4	1.4	2.3	2.3
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	1.7	0.85	0.38	0.98	0.42	2.1	2.1
Benzo[a]pyrene	M	2800	mg/kg	0.10	2.3	1.2	0.60	1.3	0.68	0.93	0.93
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	0.85	0.45	0.15	0.55	0.32	0.28	0.28
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	1.5	0.65	0.25	0.95	0.52	0.49	0.49
Total Of 16 PAH's	N	2800	mg/kg	2.0	38	21	12	30	14	23	23

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2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenzo[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS

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Appendix E

Certificate of Analysis – Generic Assessment Criteria Values

Summary of Category 4 Screening Levels: 2015

Substance	Residential (with home- grown produce)	Residential (without home- grown produce)	Allotments	Commercial	Public Open Space 1	Public Open Space 2
Arsenic	37 mg/kg	40 mg/kg	49 mg/kg	640 mg/kg	79 mg/kg	170 mg/kg
Benzene	0.87 mg/kg	3.3 mg/kg	0.18 mg/kg	98 mg/kg	140 mg/kg	230 mg/kg
Benzo(a)pyrene	5.0 mg/kg	5.3 mg/kg	5.7 mg/kg	77 mg/kg	10 mg/kg	21 mg/kg
Cadmium	22 mg/kg	150 mg/kg	3.9 mg/kg	410 mg/kg	220 mg/kg	880 mg/kg
Chromium VI	21 mg/kg	21 mg/kg	170 mg/kg	49 mg/kg	21 mg/kg	250 mg/kg
Lead	200 mg/kg	310 mg/kg	80 mg/kg	2300 mg/kg	630 mg/kg	1300 mg/kg

Summary Table for the Generic Assessment Criteria for Human Health Risk Assessment Land Quality Management (LQM) S4ULs.

All GAC are based on sandy loam soils with a pH 7.

All GAC are based on sandy loam soils with a pH 7.			LQM Generic Assessment Criteria (mg/kg) Dry weight soil					
Contaminant		SOM	Res +	Res -	Allot.	Comm.	POS _{resi}	POS _{park}
Metals	Inorganic Arsenic	6%	37	40	43	640	79	170
	Beryllium	6%	1.7	1.7	35	12	2.2	63
	Boron	6%	290	11,000	45	240,000	21,000	46,000
	Cadmium	6%	11	85	1.9	190	120	532
	Chromium (III)	6%	910	910	18,000	8,600	1,500	33,000
	Chromium (VI)	6%	6.0	6.0	1.8	33	7.7	220
	Copper	6%	2,400	7,100	520	68,000	12,000	44,000
	Elemental Mercury	6%	1.2	1.2	21	58 (25.8) ^{vap}	16	30 (25.8) ^{vap}
	Inorganic Mercury	6%	40	56	19	1,100	120	240
	Methylmercury	6%	11	15	6.0	320	40	68
	Nickel	6%	180	180	230	980	230	3,400
	Selenium	6%	250	430	88	12,000	1,100	1,800
	Vanadium	6%	410	1,200	91	9,000	2,000	5,000
Zinc	6%	3,700	40,000	620	730,000	81,000	170,000	
BTEX Compounds	Benzene	1%	0.087	0.38	0.017	27	72	90
		2.5%	0.17	0.70	0.034	47	72	100
		6%	0.37	1.4	0.075	90	73	110
	Toluene	1%	130	880 (869) ^{vap}	22	56,000 (869) ^{vap}	56,000	87,000 (869) ^{vap}
		2.5%	290	1,900	51	110,000 (1,920) ^{vap}	56,000	95,000 (1,920) ^{vap}
		6%	660	3,900	120	180,000 (4,360) ^{vap}	56,000	100,000 (4,360) ^{vap}
	Ethylbenzene	1%	47	83	16	5,700 (518) ^{vap}	24,000	17,000 (518) ^{vap}
		2.5%	110	190	39	13,000 (1,220) ^{vap}	24,000	22,000 (1,220) ^{vap}
		6%	260	440	91	27,000 (2,840) ^{vap}	25,000	27,000 (2,840) ^{vap}
	o-xylene	1%	60	88	28	6,600 (478) ^{sol}	41,000	17,000 (478) ^{sol}
		2.5%	140	210	67	15,000 (1,120) ^{sol}	42,000	24,000 (1,120) ^{sol}
		6%	330	480	160	33,000 (2,620) ^{sol}	43,000	33,000 (2,620) ^{sol}
	m-xylene	1%	59	82	31	6,200 (625) ^{vap}	41,000	17,000 (625) ^{vap}
		2.5%	140	190	74	14,000 (1,470) ^{vap}	42,000	24,000 (1,470) ^{vap}
		6%	320	450	170	31,000 (3,460) ^{vap}	43,000	32,000 (3,460) ^{vap}
	p-xylene	1%	56	79	29	5,900 (576) ^{sol}	41,000	17,000 (576) ^{sol}
		2.5%	130	180	69	14,000 (1,350) ^{sol}	42,000	23,000 (1,350) ^{sol}
		6%	310	430	160	30,000 (3,170) ^{sol}	43,000	31,000 (3,170) ^{sol}

NOTES

^{sol/vap} = solubility / vapour limit (potentially use if free product identified, although highly conservative).

f = oral, dermal and inhalation exposures compared to oral HCV.

All GAC are based on sandy loam soils with a pH 7.

All GAC are based on sandy loam soils with a pH 7.			LQM Generic Assessment Criteria (mg/kg) Dry weight soil					
Contaminant		SOM	Res +	Res -	Allot.	Comm.	POS _{resi}	POS _{park}
Polycyclic Aromatic Hydrocarbons (PAHs)	Acenaphthene	1%	210	3,000 (57.1) ^{sol}	34	84,000 (57.0) ^{sol}	15,000	29,000
		2.5%	510	4,700 (141) ^{sol}	85	97,000 (141) ^{sol}	15,000	30,000
		6%	1,100	6,000 (336) ^{sol}	200	100,000	15,000	30,000
	Acenaphthylene	1%	170	2,900 (86.1) ^{sol}	28	83,000 (86.1) ^{sol}	15,000	29,000
		2.5%	420	4,600 (212) ^{sol}	69	97,000 (212) ^{sol}	15,000	30,000
		6%	920	6,000 (506) ^{sol}	160	100,000	15,000	30,000
	Anthracene	1%	2,400	31,000 (1.17) ^{vap}	380	520,000	74,000	150,000
		2.5%	5,400	35,000	950	540,000	74,000	150,000
		6%	11,000	37,000	2,200	540,000	74,000	150,000
	Benz(a)anthracene	1%	7.2	11	2.9	170	29	49
		2.5%	11	14	6.5	170	29	56
		6%	13	15	13	180	29	62
	Benzo(a)pyrene (only)	1%	2.2	3.2	0.97	35	5.7	11
		2.5%	2.7	3.2	2.0	35	5.7	12
		6%	3.0	3.2	3.5	36	5.7	13
	Benzo(b)fluoranthene	1%	2.6	3.9	0.99	44	7.1	13
		2.5%	3.3	4.0	2.1	44	7.2	15
		6%	3.7	4.0	3.9	45	7.2	16
	Benzo(ghi)perylene	1%	320	360	290	3,900	640	1,400
		2.5%	340	360	470	4,000	640	1,500
		6%	350	360	640	4,000	640	1,600
	Benzo(k)fluoranthene	1%	77	110	37	1,200	190	370
		2.5%	93	110	75	1,200	190	410
		6%	100	110	130	1,200	190	440
	Chrysene	1%	15	30	4.1	350	57	93
		2.5%	22	31	9.4	350	57	110
		6%	27	32	19	350	57	120
	Dibenzo(ah)anthracene	1%	0.24	0.31	0.14	3.5	0.57	1.1
		2.5%	0.28	0.32	0.27	3.6	0.58	1.3
		6%	0.3	0.32	0.43	3.6	0.58	1.4
	Fluoranthene	1%	280	1,500	52	23,000	3,100	6,300
		2.5%	560	1,600	130	23,000	3,100	6,300
		6%	890	1,600	290	23,000	3,100	6,400
	Fluorene	1%	170	2,800 (36.0) ^{sol}	27	63,000 (30.9) ^{sol}	9,900	20,000
		2.5%	400	3,800 (76.5) ^{sol}	67	68,000	9,900	20,000
		6%	860	4,500 (183) ^{sol}	160	71,000	9,900	20,000
	Indeno(123-cd)pyrene	1%	27	45	9.5	500	82	150
		2.5%	36	46	21	510	82	170
		6%	41	46	39	510	82	180
	Naphthalene	1%	2.3 ^f	2.3 ^f	4.1 ^f	190 ^f (76.4) ^{sol}	4,900 ^f	1,200 ^f (76.4) ^{sol}
		2.5%	5.6 ^f	5.6 ^f	10 ^f	460 ^f (183) ^{sol}	4,900 ^f	1,900 ^f (183) ^{sol}
		6%	13 ^f	13 ^f	24 ^f	1,100 ^f (432) ^{sol}	4,900 ^f	3,000
Phenanthrene	1%	95	1,300 (36.0) ^{sol}	15	22,000	3,100	6,200	
	2.5%	220	1,500	38	22,000	3,100	6,200	
	6%	440	1,500	90	22,000	3,100	6,300	
Pyrene	1%	620	3,700	110	54,000	7,400	15,000	
	2.5%	1,200	3,800	270	54,000	7,400	15,000	
	6%	2,000	3,800	620	54,000	7,400	15,000	
Coal Tar (B(a)P as surrogate marker)	1%	0.79	1.2	0.32	15	2.2	4.4	
	2.5%	0.98	1.2	0.67	15	2.2	4.7	
	6%	1.1	1.2	1.2	15	2.2	4.8	

NOTES

^{sol} / ^{vap} = solubility / vapour limit (potentially use if free product identified, although highly conservative).

^f = naphthalene is based on comparison of inhalation exposure with TDI_{inhal} for localised effect.

All GAC are based on sandy loam soils with a pH 7.

LQM Generic Assessment Criteria (mg/kg) Dry weight soil

Contaminant	SOM	Res +	Res -	Allot.	Comm.	POS _{resi}	POS _{park}
Aliphatic							
EC 5-6	1%	42	42	730	3,200 (304) ^{sol}	570,000(304) ^{sol}	95,000 (304) ^{sol}
EC>6-8	1%	100	100	2,300	7,800 (144) ^{sol}	600,000	150,000 (144) ^{sol}
EC>8-10	1%	27	27	320	2,000 (78) ^{sol}	13,000	14,000 (78) ^{vap}
EC>10-12	1%	130 (48) ^{vap}	130 (48) ^{vap}	2,200	9,700 (48) ^{sol}	13,000	21,000 (48) ^{vap}
EC>12-16	1%	1,100 (24) ^{sol}	1,100 (24) ^{sol}	11,000	59,000 (24) ^{sol}	13,000	25,000 (24) ^{sol}
EC>16-35	1%	65,000 (8.48) ^{f, sol}	65,000 (8.48) ^{f, sol}	260,000 ^f	160,000 ^f	250,000 ^f	450,000 ^f
EC>35-44	1%	65,000 (8.48) ^{f, sol}	65,000 (8.48) ^{f, sol}	260,000 ^f	160,000 ^f	250,000 ^f	450,000 ^f
Aliphatic							
EC 5-6	2.5%	78	78	1,700	5,900 (558) ^{sol}	590,000	130,000 (558) ^{sol}
EC>6-8	2.5%	230	230	5,600	17,000 (322) ^{sol}	610,000	220,000 (322) ^{sol}
EC>8-10	2.5%	65	65	770	4,800 (190) ^{vap}	13,000	18,000 (190) ^{vap}
EC>10-12	2.5%	330 (118) ^{vap}	330 (118) ^{vap}	4,400	23,000 (118) ^{vap}	13,000	23,000 (118) ^{vap}
EC>12-16	2.5%	2,400 (59) ^{sol}	2,400 (59) ^{sol}	13,000	82,000 (59) ^{sol}	13,000	25,000 (59) ^{sol}
EC>16-35	2.5%	92,000 (21) ^{f, sol}	92,000 (21) ^{f, sol}	270,000 ^f	1,700,000 ^f	250,000 ^f	480,000 ^f
EC>35-44	2.5%	92,000 (21) ^{f, sol}	92,000 (21) ^{f, sol}	270,000 ^f	1,700,000 ^f	250,000 ^f	480,000 ^f
Aliphatic							
EC 5-6	6%	160	160	3,900	12,000 (1,150) ^{sol}	600,000	180,000 (1,150) ^{sol}
EC>6-8	6%	530	530	13,000	40,000 (736) ^{sol}	620,000	320,000 (736) ^{sol}
EC>8-10	6%	150	150	1,700	11,000 (451) ^{vap}	13,000	21,000 (451) ^{vap}
EC>10-12	6%	760 (283) ^{vap}	760 (283) ^{vap}	7,300	47,000 (283) ^{vap}	13,000	24,000 (283) ^{vap}
EC>12-16	6%	4,300 (142) ^{sol}	4,400 (142) ^{sol}	13,000	90,000 (142) ^{sol}	13,000	26,000 (142) ^{sol}
EC>16-35	6%	110,000 ^f	110,000 ^f	270,000 ^f	1,800,000 ^f	250,000 ^f	490,000 ^f
EC>35-44	6%	110,000 ^f	110,000 ^f	270,000 ^f	1,800,000 ^f	250,000 ^f	490,000 ^f
Aromatic							
EC5-7(benzene as non-threshold)	1%	70	370	13	26,000 (1,220) ^{sol}	56,000	76,000 (1,220) ^{sol}
EC>7-8(toluene)	1%	130	860	22	56,000 (869) ^{vap}	56,000	87,000 (869) ^{vap}
EC>8-10	1%	34	47	8.6	3,500 (613) ^{vap}	5,000	7,200 (613) ^{vap}
EC>10-12	1%	74	250	13	16,000 (364) ^{sol}	5,000	9,200 (364) ^{sol}
EC>12-16	1%	140	1,800	23	36,000 (169) ^{sol}	5,100	10,000
EC>16-21	1%	260 ^f	1,900 ^f	46 ^f	28,000 ^f	3,800 ^f	7,600 ^f
EC>21-35	1%	1,100 ^f	1,900 ^f	370 ^f	28,000 ^f	3,800 ^f	7,800 ^f
EC>35-44	1%	1,100 ^f	1,900 ^f	370 ^f	28,000 ^f	3,800 ^f	7,800 ^f
Aromatic							
EC5-7(benzene as non-threshold)	2.5%	140	690	27	46,000 (2,260) ^{sol}	56,000	84,000 (2,260) ^{sol}
EC>7-8(toluene)	2.5%	290	1,800	51	110,000 (1,920) ^{sol}	56,000	95,000 (1,920) ^{sol}
EC>8-10	2.5%	83	110	21	8,100 (1,500) ^{vap}	5,000	8,500 (1,500) ^{vap}
EC>10-12	2.5%	180	590	31	28,000 (899) ^{sol}	5,000	9,700 (899) ^{sol}
EC>12-16	2.5%	330	2,300 (419) ^{sol}	57	37,000	5,100	10,000
EC>16-21	2.5%	540 ^f	1,900 ^f	110 ^f	28,000 ^f	3,800 ^f	7,700 ^f
EC>21-35	2.5%	1,500 ^f	1,900 ^f	820 ^f	28,000 ^f	3,800 ^f	7,800 ^f
EC>35-44	2.5%	1,500 ^f	1,900 ^f	820 ^f	28,000 ^f	3,800 ^f	7,800 ^f
Aromatic							
EC5-7(benzene as non-threshold)	6%	300	1,400	57	86,000 (4,710) ^{sol}	56,000	92,000 (4,710) ^{sol}
EC>7-8(toluene)	6%	660	3,900	120	180,000 (4,360) ^{vap}	56,000	100,000 (4,360) ^{vap}
EC>8-10	6%	190	270	51	17,000 (3,580) ^{vap}	5,000	9,300 (3,580) ^{vap}
EC>10-12	6%	380	1,200	4	34,000 (2,150) ^{sol}	5,000	10,000
EC>12-16	6%	660	2,500	130	38,000	5,100	10,000
EC>16-21	6%	930 ^f	1,900 ^f	260 ^f	28,000 ^f	3,800 ^f	7,800 ^f
EC>21-35	6%	1,700 ^f	1,900 ^f	1,600 ^f	28,000 ^f	3,800 ^f	7,900 ^f
EC>35-44	6%	1,700 ^f	1,900 ^f	1,600 ^f	28,000 ^f	3,800 ^f	7,900 ^f
Aliphatic	1%	1,600 ^f	1,900 ^f	1,200 ^f	28,000 ^f	3,800 ^f	7,800 ^f
+Aromatic	2.5%	1,800 ^f	1,900 ^f	2,100 ^f	28,000 ^f	3,800 ^f	7,800 ^f
>EC44	6%	1,900 ^f	1,900 ^f	3,000 ^f	28,000 ^f	3,800 ^f	7,900 ^f

NOTES

^{sol}/^{vap} = solubility / vapour limit (potentially use if free product identified, although highly conservative).

^f = oral, dermal and inhalation exposures compared to oral HCV.

All GAC are based on sandy loam soils with a pH 7.

		LQM Generic Assessment Criteria (mg/kg) Dry weight soil						
Contaminant		SOM	Res +	Res -	Allot.	Comm.	POS _{resi}	POS _{park}
Chloalkanes and Alkenes & Explosives	1,2 Dichloroethane (DCA)	1%	7.1E-03	9.2E-03	4.6E-03	0.67	29	21
		2.5%	1.1E-02	1.3E-02	8.3E-03	0.97	29	24
		6%	1.9E-02	2.3E-02	1.6E-02	1.7	29	28
	1,1,1 Trichloroethane (TCA)	1%	8.8	9.0	48	660	140,000	57,000 (1,425) ^{vap}
		2.5%	18	18	110	1,300	140,000	76,000 (2,915) ^{vap}
		6%	39	40	240	3,000	140,000	100,000 (6,392) ^{vap}
	1,1,2,2-Tetrachloroethanes (PCA)	1%	1.6	3.9	0.41	270	1,400	1,800
		2.5%	3.4	8.0	0.89	550	1,400	2,100
		6%	7.5	17	2.0	1,100	1,400	2,300
	1,1,1,2-Tetrachloroethanes (PCA)	1%	1.2	1.5	0.79	110	1,400	1,500
		2.5%	2.8	3.5	1.9	250	1,400	1,800
		6%	6.4	8.2	4.4	560	1,400	2,100
	Tetrachloroethene (PCE)	1%	0.18	0.18	0.65	19	1,400	810 (424) ^{sol}
		2.5%	0.39	0.40	1.5	42	1,400	1,100 (951) ^{sol}
		6%	0.90	0.92	3.6	95	1,400	1,500
	Tetrachloromethane (carbon tetrachloride)	1%	2.6E-02	2.6E-02	0.45	2.9	890	190
		2.5%	5.6E-02	5.6E-02	1.0	6.3	920	270
		6%	0.13	0.13	2.4	14	950	400
	Trichloroethene (TCE)	1%	1.6E-02	1.7E-02	4.1E-02	1.2	120	70
		2.5%	3.4E-02	3.6E-02	9.1E-02	2.6	120	91
		6%	7.5E-02	8.0E-02	0.21	5.7	120	120
	Trichloromethane (chloroform)	1%	0.91	1.2	0.42	99	2,500	2,600
		2.5%	1.7	2.1	0.83	170	2,500	2,800
		6%	3.4	4.2	1.7	350	2,500	3,100
	Chloroethene (vinyl chloride)	1%	6.4E-04	7.7E-04	5.5E-04	5.9E-02	3.5	4.8
		2.5%	8.7E-04	1.0E-03	1.0E-03	7.7E-02	3.5	5.0
		6%	1.4E-03	1.5E-03	1.8E-03	0.12	3.5	5.4
	2,4,6-Trinitrotoluene (TNT)	1%	1.6	65	0.24	1,000	130	260
		2.5%	3.7	66	0.58	1,000	130	270
		6%	8.1	66	1.4	1,000	130	270
	RDX	1%	120	13,000	17	210,000	26,000	49,000 (18.7) ^{sol}
		2.5%	250	13,000	38	210,000	26,000	51,000
		6%	540	13,000	85	210,000	27,000	53,000
	HMX	1%	5.7	6,700	0.86	110,000	13,000	23,000 (0.35) ^{vap}
		2.5%	13	6,700	1.9	110,000	13,000	23,000 (0.39) ^{vap}
		6%	26	6,700	3.9	110,000	13,000	24,000 (0.48) ^{vap}
Pesticides	Aldrin	1%	5.7	7.3	3.2	170	18	30
		2.5%	6.6	7.4	6.1	170	18	31
		6%	7.1	7.5	9.8	170	18	31
	Dieldrin	1%	0.97	7.0	0.17	170	18	30
		2.5%	2.0	7.3	0.41	170	18	30
		6%	3.5	7.4	0.96	170	18	31
	Atrazine	1%	3.3	610	0.5	9,300	1,200	2,300
		2.5%	7.8	620	1.2	9,400	1,200	2,400
		6%	17.4	620	2.7	9,400	1,200	2,400
	Dichlorvos	1%	3.2E-02	6.4	4.9E-03	140	16	26
		2.5%	6.6E-02	6.5	1.0E-02	140	16	26
		6%	0.14	6.6	2.2E-02	140	16	27
	Endosulfans (2 isomers)	1%	7.4	160 (3.0E-03) ^{vap}	1.2	5,600 (3.0E-03) ^{vap}	1,200	2,300
		2.5%	18	280 (7.0E-03) ^{vap}	2.9	7,400 (7.0E-03) ^{vap}	1,200	2,400
		6%	41	410 (1.6E-02) ^{vap}	6.8	8,400 (1.6E-02) ^{vap}	1,200	2,500
	Hexachlorocyclohexane (3 isomers), inc Lindane	1%	8.5E-02	3.7	1.3E-02	65	8.1	15
		2.5%	0.2	3.8	3.2E-02	65	8.1	15
		6%	0.46	3.8	7.7E-02	65	8.1	16

NOTES

^{sol} / ^{vap} = solubility / vapour limit (potentially use if free product identified, although highly conservative).

All GAC are based on
sandy loam soils with a pH
7.

All GAC are based on sandy loam soils with a pH 7.			LQM Generic Assessment Criteria (mg/kg) Dry weight soil					
Contaminant		SOM	Res +	Res -	Allot.	Comm.	POS _{resi}	POS _{park}
Chlorobenzenes	Chlorobenzene	1%	0.46	0.46	5.9	56	11,000	1,300 (675) ^{sol}
		2.5%	1.0	1.0	14	130	13,000	2,000 (1,520) ^{sol}
		6%	2.4	2.4	32	290	14,000	2,900
	Dichlorobenzenes (3 isomers)	1%	23	24	94	2,000 (571) ^{sol}	90,000	24,000 (571) ^{sol}
		2.5%	55	57	230	4,800 (1,370) ^{sol}	95,000	36,000 (1,370) ^{sol}
		6%	130	130	540	11,000 (3,240) ^{sol}	98,000	51,000 (3,270) ^{sol}
	Trichlorobenzenes (3 isomers)	1%	2.6	2.6	55	220	15,000	1,700 (318) ^{vap}
		2.5%	6.4	6.4	140	530	17,000	2,600 (786) ^{vap}
		6%	15	15	320	1,300	19,000	4,000 (1,880) ^{vap}
	Tetrachlorobenzenes (3 isomers)	1%	0.66	0.75	0.38	49 (39.4) ^{vap}	78	110 (39) ^{vap}
		2.5%	1.6	1.9	0.90	120 (98.1) ^{vap}	79	120
		6%	3.7	4.3	2.2	240 (235) ^{vap}	79	130
	Pentachlorobenzene	1%	5.8	19	1.2	640 (43.0) ^{sol}	100	190
		2.5%	12	30	3.1	770 (107) ^{sol}	100	190
		6%	22	38	7.0	830	100	190
	Hexachlorobenzene	1%	1.8 (0.20) ^{vap}	4.1 (0.20) ^{vap}	0.47	110 (0.20) ^{vap}	16	30
		2.5%	3.3 (0.50) ^{vap}	5.7 (0.50) ^{vap}	1.1	120	16	30
		6%	4.9	6.7 (1.2) ^{vap}	2.5	120	16	30
Chlorophenol	Chlorophenols (4 congeners)	1%	0.87 ^g	94	0.13 ^g	3,500	620	1,100
		2.5%	2.0	150	0.30	4,000	620	1,100
		6%	4.5	210	0.70	4,300	620	1,100
	Pentachlorophenol	1%	0.22	27 (16.4) ^{vap}	3.0E-02	400	60	110
		2.5%	0.52	29	8.0E-02	400	60	120
		6%	1.2	31	0.19	400	60	120
Others	Carbon Disulphide	1%	0.14	0.14	4.8	11	11,000	1,300
		2.5%	0.29	0.29	10	22	11,000	1,900
		6%	0.62	0.62	23	47	11,000	2,700
	Hexachlorobutadiene	1%	0.29	0.32	0.25	31	25	48
		2.5%	0.7	0.78	0.61	66	25	50
		6%	1.6	1.8	1.4	120	25	51
	Phenol	1%	280	750	66	760 ^{dir} (31,000)	760 ^{dir} (11,000)	760 ^{dir} (8,600)
		2.5%	550	1,300	140	1,500 ^{dir} (35,000)	1,500 ^{dir} (11,000)	1,500 ^{dir} (9,700)
		6%	1,100	2,300	280	3,200 ^{dir} (37,000)	3,200 ^{dir} (11,000)	3,200 ^{dir} (11,000)

NOTES

^{sol / vap} = solubility / vapour limit (potentially use if free product identified, although highly conservative).

^{dir} = S4uls based on threshold protective of direct skin contact with phenol (brackets long term exposure for illustration purposes).

^g = derived based on 2,3,4,6-tetrachlorophenol.

Appendix F

Statistical Output Sheet

Test Results

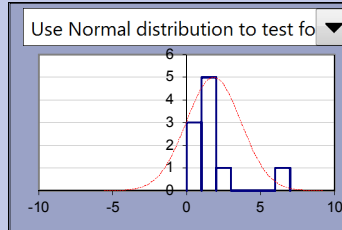
BaP

Client/client ref: PJ Livesey Hold Site ref: Land at Former MMU Campus, St James F Date: 3rd May 2019

Project ref: LKC 16 1066

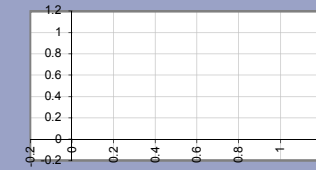
Data description: Plot 22 10 samples front and rear User details: KW

Dataset:	BaP
Sample mean $\bar{x}$	1.821
Sample standard deviation, s	1.8477
Sample size, n	10
Critical concentration, Cc	5



Outliers & non-detects

Outliers present?	Yes
Significance level	1%
Outliers excluded	0
Non-detects	0

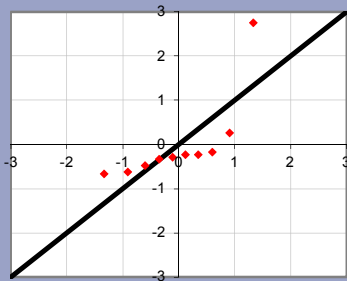


Normality test

Significance level: 1%

Non-normal distribution

Use: Auto: Chebychev

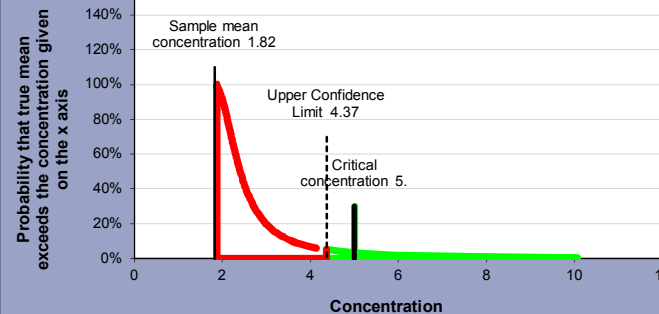


Test scenario:

Planning: is true mean lower than critical concentration ($\mu < C_c$)?

Null hypothesis: The true mean concentration is equal to or greater than the critical concentration: $\mu \geq C_c$

Alternative hypothesis: The true mean concentration is less than the critical concentration: $\mu < C_c$



Evidence against Null hypothesis:

97%

Base decision on: evidence level

Evidence level required: 95%

Balance of probability? N/A

Reject Null Hypothesis? Yes

$\mu < C_c$ (re this dataset)

Back to data

Back to summary

Go to outlier test

Go to normality test

Based across the UK with
offices in Manchester,
London, Liverpool and Glasgow.

Manchester (Head Office)

Unit 29,
Eton Business Park
Eton Hill Rd, Radcliffe
M26 2ZS

t: 0161 763 7200
e: info@thelkgroup.com

London

Brooklands Business Park
Wellington Way
Weybridge
KT13 0TT

t: 01932 871872
e: info@thelkgroup.com

Glasgow

Wright Business Centre
1 Lonmay Road
Glasgow
G33 4EL

t: 0141 773 6269
e: info@thelkgroup.com

Liverpool

The Corn Exchange
Fenwick Street
Liverpool
L2 7QL

t: 0151 235 8716
e: info@thelkgroup.com



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