

**KINGSBRIDGE ROAD
HARPURHEY**

**FINAL PHASE 2
GEO-ENVIRONMENTAL
INVESTIGATION,
RISK ASSESSMENT AND
REMEDIATION STRATEGY**



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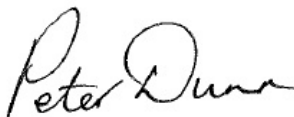
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EXECUTIVE SUMMARY

Site Details

Site Location:	West of Kingsbridge Road, north of Camelia Road, Harpurhey. Centred at National Grid Reference 385430E 401210N.
Site Area:	Approximately 5,700m ² . Development area is 2,400m ² .
Current Land Use:	Grassed areas and dense vegetation over the whole site, with numerous trees present across the site.
Proposed Development:	Planning Application No. 110464/MO/2015/N1: 12no semi-detached residential properties with private gardens and car parking.
Purpose of Report:	Contamination and Geotechnical Assessment.

Preliminary Risk Assessment

PRA Details:	Undertaken by GeoAssist in September 2014. Ref: 5657/PKH.
History:	Public House in the SE with associated bowling green.
Geology / Hydrogeology:	Till (Secondary A Aquifer) over Bunter Sandstone (Principal Aquifer).
Mining:	No recorded mining.
Relevant Environmental Setting:	River Irk 70m W. Two active water abstractions within 250m of the site. Not within Source Protection Zone.
Preliminary Conceptual Model: PL=Pollutant Linkage	PL1 Direct Contact (Human Health): Moderate Risk (asbestos, metals, PAHs), Low Risk (Petroleum hydrocarbons and other inorganic/organic contaminants). PL2 Inhalation of Vapours: Low Risk (volatile contaminants). PL3 Gas: Moderate Risk (hazardous gas). PL4 Controlled Waters: Low Risk (mobile contaminants). PL5 Sulphate Attack: Moderate Risk (sulphate). PL6 Water Pipelines: Moderate Risk (organic contaminants). PL7 Phytotoxic: Low Risk (metals).
Recommendations:	Site Investigation was recommended to further assess all the above pollutant linkages.

Ground Investigation Work Undertaken

Investigation Date:	8 th December 2017.
Intrusive Investigation Work Undertaken:	5no. window sample boreholes (WS101-WS105). 1no. hand excavated trial holes (HA101).
Monitoring Wells:	Installed in WS101, WS102, WS103 and WS104.
Soil Sampling:	7no. samples tested for metals, speciated PAHs, pH, sulphate, asbestos and SOM. 3no. samples tested for metals, speciated PAHs, cyanide, pH, sulphate, asbestos, phenol, TPHCWG, BTEX and SOM.
Groundwater Sampling:	2no groundwater samples and 2no. surface water samples tested for metals, speciated PAHs, cyanide, pH, sulphate, hardness, phenol, TPHCWG and BTEX.
Monitoring:	6no. gas monitoring visit over 3 months.
Insitu / Laboratory Geotechnical Testing:	8no. moisture content and plasticity tests. 2no. additional soil samples tested for pH and sulphate.

Ground Conditions and Geotechnical Assessment

Proposed Development:	- 12no. three storey semi-detached dwelling houses in the development area of the site with associated gardens and driveways.
General Ground Conditions:	- Made Ground to 0.4-1.0mbgl. - Natural Ground: Firm to stiff gravelly sandy CLAY to >5.45mbgl. SPTs N=10-31. Localised dry, friable clay. Localised coarse sand bands of approx. 5cm thickness present from 1.8mbgl in WS104 only. - No bedrock encountered. - Groundwater encountered during drilling in WS104 only.
Anticipated Foundation Type:	- Traditional shallow foundations recommended from approximately 1.3mbgl below the made ground in the natural clay strata. Due to the presence of trees onsite and if soft ground is encountered, foundations may need to be deepened / widened or ground replaced with compacted granular material (see below). - There may also be localised deeper made ground (particularly in the southeast) where foundations may need to be deepened.
Allowable Bearing Pressure:	- Allowable bearing pressure of 100kN/m ² at 1.3m in the gravelly sandy CLAY based on a minimum shear strength of 40kN/m ² . - Net bearing stress of 76kN/m ² at 1.3m in the gravelly sandy CLAY. - The above bearing pressures are within tolerance for settlement.
Plasticity:	- Consideration will need to be given to the shrink / swell of the clay strata if it is to be used as founding strata, particularly where trees/hedges are present. - A low to medium volume change potential has been calculated for the site.
NHBC Chapter 4.2 Calculations:	- Based on Hawthorn as worst-case (high demand, mature tree) 6m away from footings with a medium plasticity: Foundations may need to be deepened to approx. 1.84mbgl with 50mm of heave precaution material and 250mm of void below ground floor slab (suspended floor). - It is advised to seek advice during site works from a suitably qualified structural engineer regarding NHBC Building near trees calculation and foundation depths.
Concrete:	- Concrete requirement, based on BRE Digest 2005 ¹ : DS-2 AC-2 recommended.
Services	- Services may need to be re-routed.
Temporary Support of Excavation:	- May be required; however, no trial pits were undertaken across the site.
Road / Pavement Design:	- A design CBR value of 2.5% should be adopted for the made ground and 2% for the natural ground.

¹ BRE (2005). "Concrete in Aggressive Ground." Special Digest 1.

Contamination Risk Assessment

The table below shows a summary of the risk assessments undertaken for each pollutant linkage, the revised conceptual model and recommendation for remediation.

Pollutant Linkage		Risk	Recommendations
1	Contaminants posing a risk to site users via dermal contact, ingestion and inhalation (of soil, dust, fibres and vegetables).	Moderate	- Elevated arsenic and lead identified across the site. Recommendations: Remediation required in gardens.
		Low	- No elevated PAHs, petroleum hydrocarbons or other inorganic/organic contaminants identified. - Asbestos not identified in any of the soil samples tested. Recommendations: No remediation required.
2	Volatile contaminants posing a risk to site users via the inhalation of vapours.	Low	- No elevated volatile contamination identified. Recommendations: No remediation required.
3	Gas posing a risk to buildings and site users via the migration of gas into building causing explosion and asphyxiation.	Low	- No significant concentrations of gas (max. CO ₂ 2.2%v/v, max. CH ₄ 0.2%v/v, max. flow 0.2l/hr) and max GSV recorded as 0.0044l/hr (Characteristic Situation 1 / Green). Recommendation: No remediation required.
4	Mobile contamination posing a risk to controlled waters via the migration through permeable strata.	Low	- Although slightly elevated chromium and selenium identified it is not considered to pose a risk to groundwater or surface water due to the environmental setting and ground conditions. Recommendations: No remediation required.
5	Sulphate posing a risk to building via direct contact (sulphate attack).	Moderate / Low	- Elevated sulphate identified. Recommendations: Sulphate resistant concrete (DS-2 AC-2) required.
6	Organic contaminants posing a risk to water pipes.	Moderate	- Elevated naphthalene encountered in the made ground at expected potable water depth, which could permeate water pipes and contaminate water supply. Recommendations: Barrier pipe recommended.
7	Phytotoxic metals posing a risk to flora via root uptake.	Low	- Elevated zinc and copper identified which may be taken up by flora in gardens. Recommendations: Remediation associated with PL1 will be more than sufficient.

Recommendations and Remedial Strategy

The table below shows the remediation and validation requirements for the site. This information should be documented in a Site Completion Report for submission to the local authority.

PL	Remediation Requirements	Validation Requirements
1 & 7	Made ground varies in depth from 0.4mbgl to 1.0mbgl. The shallower made ground was identified in the west and north of the site. It is understood that due to current and proposed site levels there will be some movement of soil to the rear of the site (west). Given the available information, LKC recommend that the most feasible remediation is as follows: <u>Source Removal</u> Removal of all reworked topsoil / made ground from garden and soft landscaping and raise levels (as required) with suitably chemically validated subsoil and topsoil. If during the remedial work, made ground is found to exceed 300mm in front gardens or 600mm in back garden, it may become more feasible to install a cover system as detailed below. The final decision on the type of remediation will be determined during earthworks, in consultation with LKC. <u>Environmental Cover System</u> Back Gardens: 600mm thick cover comprising: <u>Either</u> 100mm physical break layer (MOT type 1 material, 20-30mm, minimal fines) and at least 500mm comprising clean inert fill and sufficient topsoil for a growing medium. <u>Or</u> geotextile membrane and at least 600mm comprising clean inert fill and sufficient topsoil for a growing medium. Front Gardens: 300mm thick cover comprising: <u>Either</u> 100mm physical break layer (MOT type 1 material, 20-30mm, minimal fines) and at least 200mm comprising clean inert fill and sufficient topsoil for a growing medium. <u>Or</u> geotextile membrane and at least 300mm comprising clean inert fill and sufficient topsoil for a growing medium. Areas of TPO's If there are TPO's in influencing distance of the gardens it is likely the arboriculture officer may only allow a 150mm clean cover system over a geotextile membrane.	Site visits during earthworks and garden dig out to be documented and photographs taken. <u>Source Removal</u> Consignment notes confirming the removal of made ground. Photographic evidence of natural strata. Chemical validation of imported soils: See Table 9-2. <u>Environmental Cover System</u> Measuring depth of environmental cover system using a staff and providing photographic evidence. Photographic evidence of the granular physical break or geotextile layer will also be collected. Chemical validation of imported soils: See Table 9-2.
5	<u>Sulphate Resistant Concrete</u> Sulphate Resistant Concrete in line with DS-2 AC-2 recommended.	N/A
6	<u>Potable Water Pipes</u> Barrier pipe recommended.	Delivery Notes of Pipe Material. Photographs of the Installed Pipe.
2,3,4,7	No remediation required.	N/A

CONTENTS

1	INTRODUCTION	1
1.1	Background.....	1
1.2	Site Details.....	1
2	PREVIOUS WORK	2
2.1	Summary of Existing Information	2
2.2	Site History	2
2.3	Environmental Setting.....	3
2.4	Site Reconnaissance	6
2.5	Contamination Sources, Pathways and Receptors	7
2.6	LKC Preliminary Contamination Conceptual Model.....	8
2.7	Recommendations.....	9
3	GROUND INVESTIGATION	11
3.1	Site Investigation Design and Methodology.....	11
3.2	Well Installations.....	11
3.3	Sampling Protocol.....	12
3.4	Gas Monitoring	13
3.5	Site Investigation Scope	14
3.6	Geotechnical Testing	14
4	GROUND CONDITIONS	15
4.1	Geology – Generalised Sequence	15
4.2	Groundwater	16
4.3	In-situ Geotechnical Testing	16
4.4	Geotechnical Laboratory Testing	17
5	GEOTECHNICAL ASSESSMENT	19
6	GENERIC RISK ASSESSMENT	20
6.1	Introduction	20
6.2	Soil Risk Assessment	20
6.3	Gas Risk Assessment.....	23
6.4	Controlled Water Assessment	25
6.5	Additional Risk Assessments.....	27
6.6	Revised Contamination Conceptual Model.....	28
7	WASTE DISPOSAL ASSESSMENT	30
8	CONCLUSIONS	31
8.1	Ground Conditions and Geotechnical Assessment	31
8.2	Contamination Assessment	32
9	RECOMMENDATIONS AND REMEDIAL STRATEGY	33
9.1	Remediation and Validation Recommendations.....	33
9.2	Validation of Subsoil / Topsoil.....	35
9.3	Site Completion Report.....	35

FIGURES

Figure 1: Site Location Plan

Figure 2: Site Boundary Plan

Figure 3: Proposed Development Plan

Figure 4: Site Investigation Location Plan

Figure 5: Surface Water Samples Plan

APPENDICES

Appendix A: Updated Site Reconnaissance

Appendix B: Risk Matrix

Appendix C: Profile Logs

Appendix D: Certificate of Analysis – Soil

Appendix E: Certificate of Analysis – Water

Appendix F: Gas Monitoring Results

Appendix G: Certificates of Analysis – Geotechnical

Appendix H: Generic Assessment Criteria Values

Appendix I: United Utilities Risk Assessment for Water Pipes

Appendix J: HazWasteOnline Output Sheets

Appendix K: Environmental Cover System Construction

1 INTRODUCTION

1.1 Background

LK Consult Ltd (LKC) has been commissioned by Prime Developers Ltd to carry out a Phase 2 Geo-Environmental Investigation, Risk Assessment and Remediation Strategy for land at Kingsbridge Road, Harpurhey. The investigation was undertaken in support of a planning application (reference number 110464/MO/2015/N1) to develop the site for residential end use.

The following work has previously been undertaken:

- Phase 1 Desk Study and Preliminary Contaminated Land Risk Assessment report, undertaken by GeoAssist Limited (Ref: 5657/PKH, dated September 2014).

This investigation has been undertaken to confirm the ground conditions below the site and to allow a contamination and geotechnical assessment to be undertaken.

The investigation will aim to confirm the risks of the potential pollutant linkages identified in the PRA and recommend further assessment / remediation, as required.

An Interim Geo-Environmental Investigation and Risk Assessment Report was issued in December 2017. This is a Final Report, issued on completion of all investigation work and following liaison with the Local Authority.

1.2 Site Details

A summary of the site details is presented in Table 1-1. Figures 1 and 2 indicate the site location and boundary. Figure 3 indicates the proposed development.

Location	West of Kingsbridge Road, north of Camelia Road, Harpurhey, Manchester. National Grid Reference 385430E 401210N.
Area	Approximately 5,700m ² . Development area is 2,400m ² .
Topography	50-65 metres above ordnance datum (AOD). Development area is approximately level, remainder of the site slopes towards the River Irk.
Land Use	<u>Site</u> Grassed areas and dense vegetation over the whole site, with numerous trees present across the site. <u>Surrounding Area</u> North: Vacant overgrown land. East: Kingsbridge Road and residential properties. South: Camelia Road and cemetery. West: River Irk and industrial properties.
Proposed Development	Residential properties including gardens and car parking.

Table 1-1: Summary of site details.

2 PREVIOUS WORK

2.1 Summary of Existing Information

A PRA report (Ref: 5657/PKH, dated September 2014) has previously been undertaken by GeoAssist Limited and is summarised in Section 2.2-2.6.

The PRA report relates to the whole site boundary, however, this risk assessment report related only to the development area (see Figure 2).

The conceptual model (Section 2.6) for the development area has been updated to be in line with LKC current risk assessment methodology.

2.2 Site History

An extract from the report relating to the site history is provided in Box 2-1.

Examination of the historical maps of the area confirms that a small area to the south eastern corner of the site has been previously developed with a public house and associated bowling green.

A series of historical maps and ordnance plans have been reviewed as part of this search. The following table highlights plans and maps that are of particular significance for the purpose of this report. Where possible, reference to the large scale (1:500, 1:1056, 1:1250 & 1:2,500) plans and maps has been made in preference to those at smaller scales (1:10,560 & 1:10,000) as the details on the smaller scale plans and maps are often lacking because of the lower resolution at which they were originally drafted.

Date of Mapping	Scale	Potentially contaminative Feature within 250m of site boundary	Remarks	Direction from site	Distance from site(m)	Feature still present on 2012/13 edition
1848	1:10,560	Print Works		N	25	No
1891	1:500	Dye & Print Works		N	40	No
		Cotton Mills		NW	30	No
		Paper Mill		W	100	No
		Chemical Works		W	10	No
		Reservoirs, Chimneys, Tanks		N, W & NW	30 - 180	No
1893 to 1909	1:2,500					
1908 to 1909	1:2,500	Bleach Works		NW	30	No
1922	1:2,500					
1949 to 1950	1:1,250	Asbestos Works	becomes works	W	50	No
1951	1:2,500					
1951 to 1977	1:1,250					
1965 to 1969	1:2,500					
1968 to 1988	1:1,250					
1975	1:1,250					
1977 to 1987	1:1,250					
1992	1:1,250					
1992 to 1995	1:1,250					
1999	1:10,000					
2014	1:10,000					

Box 2-1: Extract from GeoAssist Limited report detailing significant historical features.

2.3 Environmental Setting

Extracts from the GeoAssist report relating to the environmental setting are provided in Box 2.2.

3.4.1 Historical Land uses

The Environmental data search report referenced 60126342_1_1, summarises that past and present use of the site indicates that there are no potentially contaminative land uses on the site. The report also summarises that adjacent areas up to 250m indicate several potentially contaminative land uses including:

- A Discharge Consent
- Several Local Authority Pollution Prevention Controls
- Several Pollution Incidents to Controlled Waters

Data from the historical plans indicate that the site and the immediate surrounds (250m) possess little potential to be significantly impacted by land contamination because of the elevation of the site above the industrial area identified to the north and the northwest of the site.

3.4.2 Statutory Authorisations, Incidents and Registers

The Environmental data search report referenced 60126342_1_1, confirms that within 250m of the site boundary there is/are:

- one active discharge consent to the River Irk for a storm sewage overflow registered to United Utilities.
- four permitted or authorised local authority pollution prevention controls, three of which are for mobile plant and the remainder for textile coating.
- Two local authority pollution prevention controls enforcements for release to air
- Four pollution incidents to controlled waters all of which are noted as minor category three.

The horizontal and vertical distance between the site and the location of authorisations and incidents and the time that has elapsed since incidents occurred, indicate that these authorisations and incidents are unlikely to have impacted the site.

3.4.3 Landfill & Other Waste Sites

The Environmental data search report referenced 60126342_1_1, indicates that Manchester City Council has supplied landfill data to the Environment Agency. The Environment Agency England and Wales have supplied the following landfill and waste site data.

Box 2-2: Extract from GeoAssist Limited report detailing the environmental setting.

Table 3.4 A summary of the landfill data as provided by the Environment Agency England & Wales & the environmental data search report referenced 60126342_1_1

Site name	Material deposited	Operational period	Approximate distance from site (m)	Direction from site
No registered landfills or historic landfills or within 250m of the site				
Unit 5b	End of life vehicle dismantling	2004 to present (no evidence that business still trades)	108m	East

The potential for ground gas generation from registered landfill sources and subsequent ingress into the proposed development is classified as low given the distance of any recorded potential sources of landfill.

3.4.4 In-Filled Land

Data from the County Series Surveys and the Ordnance Survey plans of the area confirms that there are not likely to be any significant areas of infilled land on the site or significant areas of infilled land within 250m of the site boundary capable of producing landfill gas in the ground under pressure.

4. Geology & Hydrogeology

4.1 Site Geology

The relevant 1:10,000 scale published geological map of the area 104NE Lancashire shows the site to be located in an area where drift deposits of Glacial Boulder Clay are present.

The underlying solid geology is shown as Permo-triassic Bunter Sandstone. No faults are shown as passing directly beneath the site.

4.2 Radon Affected Area

The Environmental data search report referenced 60126342_1_1, indicates that the site is in an area where radon protective measures are not required.

4.3 Hydrogeology and Groundwater Vulnerability

The Bedrock Aquifer Designation as determined by the British Geological Survey is: Principal Aquifer - These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer. The Superficial Aquifer Designation as determined by the British Geological Survey is: Secondary A - permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers

4.4 Surface Water

The plans of the site confirm that the nearest surface water course is the River Irk approximately 10m to the NW of the site boundary. There is no evidence that the site in its present state, or any proposed

Box 2-2 (continued): Extract from GeoAssist Limited report detailing the environmental setting.

development, will significantly impact surface water receptors and consequently the risk to surface waters is classified as low.

4.5 Subsurface Water

There is no evidence that the site in its present state or the proposed development will impact sub surface water receptors and consequently the risk to sub surface waters is classified as low.

4.6 Water Abstractions

The Environmental data search report referenced 60126342_1_1, indicates that there are two active water abstractions within 250m of the site and the site does not lie within a source protection zone. The Environment Agency England and Wales has defined Source Protection Zones (SPZs) for 2000 groundwater sources such as wells, boreholes and springs used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area. The closer the activity, the greater the risk. The maps show three main zones (inner Zone I, outer Zone II and total catchment Zone III).

5. Mineworkings & Mineral Sites

Information provided by the Coal Authority as part of the Environmental data search report referenced 60126342_1_1 indicates that the property is in an area that may be affected by coal mining with inconclusive evidence.

The report from the Coal Authority referenced 51000618664001, indicates that:

1. The property is not within the likely zone of physical influence on the surface from past underground workings
2. The property is not in an area for which the Coal Authority is determining whether to grant a licence to remove coal using underground methods.
3. There are no known coal mine entries within, or within 20 metres of, the boundary of the property.
4. There is no record of mine gas emissions in the area requiring action by The Coal Authority.
5. The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50m, since 31st October 1994. There is no current Stop Notice delaying the start of remedial works or repairs to the property. The Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

The site is not located within a Coal Authority Development High Risk Area.

Consequently the risk to the development on this site in respect of past, present or future coal workings or brine extraction is classified as low.

Box 2-2 (continued): Extract from GeoAssist Limited report detailing the environmental setting.

6. Designated Environmentally Sensitive Sites

The environmental data search report referenced 60126342_1_1 indicates the site is situated within a nitrate vulnerable zone (NVZ herein). NVZs were set up under Council Directive 91/676/EEC and have been established in areas where nitrate from agricultural land is causing, or could cause, pollution of the water environment. In these zones Action Programmes of compulsory measures apply. These measures include a requirement for farmers to limit their applications of livestock manures and, in some circumstances, to observe closed periods for the application of organic manure to agricultural land. Action Programme measures apply to all land within designated NVZs from: i) 1996 for 66 NVZs to protect drinking water sources. These amounted to 8% of England's land area; ii) 19th December 2002 (2001/2002 review) for around 55% of England; and iii) (2005/2006 review) for a further land area of 15% (total around 70%) in England.

The purpose of NVZs is to enforce a reduction of Nitrate leaching into water courses, to ensure a reduction in Eutrophic waters.

Box 2-2 (continued): Extract from GeoAssist Limited report detailing the environmental setting.

2.4 Site Reconnaissance

A site reconnaissance was undertaken by GeoAssist. An extract from the report relating to the site reconnaissance is provided in Box 2.3.

2. Description of the Site

The site is located on a brownfield site in a residential area on the junction of Kingsbridge Road and Camelia Road in Harpurhey, approximately 2.8km to the north east of Manchester City Centre.

The site is an irregular shape and slopes steeply towards the River Irk which meanders past the site to form part of the northern and north western and south western boundary. A plateau area is evident to the south eastern corner of the site where a public house and associated bowling green were previously established. The site boundary follows Camelia Road towards the River Irk where much of the site is retained by dilapidated walls along the boundary. The Slopes of the site are heavily vegetated with scrub and tree growth. Elsewhere the area of the former bowling green is overgrown and trees and bushes now encroach. At the time of the site visit the site was not in use. Besides some minor fly tipping/littering no obvious visual or olfactory observations of contaminants were noted during the site walkover. Photographs from the site visit form appendix A2 to this report.

Box 2-3: Extract from GeoAssist Limited report detailing the site reconnaissance.

An updated site reconnaissance was undertaken by LKC on the 8th December 2017.

An annotated plan with photographs is provided in Appendix A.

Relevant features identified on site are summarised below:

- Rough ground across the majority of the site with numerous shrubs and trees, bounded by metal fencing to the east.
- No buildings are present on the site.
- Fly tipping (timber, plastic, household waste, clothes, carpet underlay, chipboard) observed in the south and east of the site.
- The development area is roughly flat, with land to the east of the site sloping steeply down towards the River Irk.

- A retaining wall is present at the southern boundary of the site, along Camelia Road.
- Made ground was observed, which contained varying quantities of brick, glass, ash, clinker, timber, ceramic, plastic, concrete and tarmac to 0.3-0.5mg/l over natural clay.
- Access to the site is off Kingsbridge Road, at the northwest corner of the site.

The surrounding area comprises:

- North: Vacant overgrown land.
- East: Kingsbridge Road and residential properties.
- South: Camelia Road and cemetery.
- West: River Irk and industrial properties.

2.5 Contamination Sources, Pathways and Receptors

Potential contamination sources are detailed in Table 2-1.

Source	Contaminants
Onsite Former Buildings	-Asbestos Containing Material (ACM).
Onsite Former Bowling Green	-Ash and clinker (often used for site raising/levelling and drainage): Heavy metals, sulphates and PAHs.
Onsite Former Car Park	-Spillages / leakages: petroleum hydrocarbons, oils (source expected to be minimal and localised).
Onsite Made Ground (fly tipping, general made ground)	-Ash and clinker (e.g. from hearths and boilers, often historically used for site raising / levelling): Heavy metals, sulphates and PAHs. -Other unknown inorganic / organic contaminants (dependant on fill source and fly tipped material). -If significant depth of organic / putrescible material: Hazardous gas (principally carbon dioxide and methane).
Offsite Potentially Infilled Ground	-Hazardous gas (principally carbon dioxide and methane). -Given age, size and location of potentially infilled features, not considered to be a significant source.
Offsite Cemetery (20m S)	-Nitrates such as ammoniacal nitrogen, formaldehydes from embalming fluids and coffin manufacture, sulphates, chlorides, heavy metals such as mercury from amalgam fillings and other, non-ferrous metals from jewellery and orthopaedic items buried with bodies, inorganic contaminants such as phosphorus and calcium ² . -Hazardous gas (principally carbon dioxide and methane). -Pathogens are not considered to be a risk due to the low likelihood of them surviving outside of the body after death.
Offsite Former Asbestos Works	-Potential atmospheric deposition of asbestos fibres from the adjacent former asbestos works.
Surrounding Industries (chemical works, dye works, bleach works, cotton mill and paper mill)	-Metals, inorganic compounds and organic compounds. -Not expected to be a significant source due to distance from site.

Table 2-1: Potential contamination sources.

² Environment Agency (2004). Potential Groundwater Pollutants from Cemeteries.

Potential receptors are detailed in Table 2-2.

Receptors	
Human Health	- Future site users (including residents, visitors and site workers). - Offsite land users.
Controlled Waters	- River Irk 70m W. - Principal Aquifer.
Buildings and structures.	
Potable water pipes.	
Flora within future gardens/landscaping.	

Table 2-2: Potential receptors.

Potential pathways are detailed in Table 2-3.

Pathways		
Soil	Human Health ³	- Ingestion of soil. - Ingestion of soil-derived indoor dust. - Ingestion of contaminated vegetables. - Ingestion of soil attached to vegetables . - Dermal contact with soil. - Dermal contact with soil-derived indoor dust. - Inhalation of soil-derived outdoor dust. - Inhalation of soil-derived indoor dust. - Inhalation of vapours outside. - Inhalation of vapours inside.
		- Windblown dust / fibres to adjacent receptors.
		- Direct contact with receptors (building foundations, services).
		- Root uptake.
Water		- Surface run-off over impermeable surface.
		- Infiltration into the ground, through potentially contaminated material (contamination possibly going into solution).
		- Migration through potentially permeable strata and preferential pathways. - Superficial (Till) likely to be low permeability. - Bedrock (sandstone) likely to be relatively permeable. - No preferential pathways are anticipated.
Gas		- Migration through Migration through potentially permeable strata and preferential pathways. - Superficial (Till) likely to be low permeability. - Bedrock (sandstone) likely to be relatively permeable. - No preferential pathways are anticipated.
		- Migration into buildings (e.g. via services) and accumulation of gases in confined spaces (potentially causing explosion if methane is present).

Table 2-3: Potential pathways.

2.6 LKC Preliminary Contamination Conceptual Model

The previous Phase 1 Desk Study has been submitted to Manchester City Council as part of the planning application; however, correspondence with the Contaminated Land Officer suggests the recommendations from the desk study are not sufficient. Therefore, the preliminary contamination conceptual model in the GeoAssist report has been updated to be in line with LKC current risk assessment methodology (detailed below). The model is based on the contamination sources, pathways and receptors identified in the original report.

The preliminary contamination conceptual model using contaminant-pathway-receptor linkages based on guidance in CLR11⁴ has been summarised in Table 2-4.

³ EA (2008). "Updated Technical Background to the CLEA Model." Science Report – SC050021/SR3.

The aim of the conceptual model is to provide a preliminary assessment of the likelihood of a pollutant linkage for each potential combination of contaminant, pathway and receptor. A conceptual model can be used to make an informed decision on the contamination risks associated with the site and determine what site investigation work is required.

The preliminary contamination conceptual model has identified seven generic potential pollutant linkages. Each linkage is described along with an assessment of the risk based upon guidance on probabilities and consequences outlined in CIRIA C552⁵.

In order to assess the potential risk for each pollutant linkage, an assessment of the magnitude of the potential consequence (severity) of the risk occurring and the magnitude of the probability (likelihood) of the risk occurring has been considered and classified. This is based on the guidance provided in CIRIA C552 and further details including a risk matrix is provided in Appendix B.

Where LKC identified a low to very low risk, limited intrusive investigation work, a watching brief (during construction work) or no investigation work will be recommended. This will be dependent on the nature of the site and the proposed development.

Where the risk falls into the moderate/low risk, LKC will undertake an assessment to establish what category the pollutant linkage will fall into (i.e. moderate or low risk will be chosen).

Where LKC identifies a moderate or higher risk, intrusive work or precautionary remedial measures will be recommended.

The conceptual model is based on the future use of the site (post development), in line with proposed development scheme.

It should be noted that there may be risk from short term exposure from contaminated soil to site workers during development work. The Preliminary Contamination Conceptual Model deals with long term exposure to key receptors associated with the future use of the site. Acute risks can be easily mitigated by good environmental management of the site during site works. Standard health and safety precautions (as per HSE guidance⁶) should be adopted by all workers involved with site enabling and construction works. Therefore, this receptor is not considered in the contamination conceptual model.

2.7 Recommendations

Based upon the updated Preliminary Contamination Conceptual Model a site investigation was recommended to assess the potential pollutant linkages further.

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

⁵ CIRIA (2001). "Contaminated land risk assessment: A guide to good practice". C552.

⁶ HSE (1991). "Protection of Workers and the General Public during Development of Contaminated Land" London HMSO.

Pollutant Linkage	Pathway	Receptor	Contaminant (source)	Probability	Consequence	Risk	Assessment and Recommendations
PL1	- Dermal contact. - Inhalation of soil, fibres and dust. - Ingestion of soils, dust, vegetables, soil attached to vegetables. - Windblown dust.	- Future site users. - Offsite receptors.	- ACM (former buildings, atmospheric deposition, potentially in made ground). - Heavy metals & PAHs (bowling green, made ground, fly tipping).	Likely	Medium	Moderate	- Likely probability of ACMs given age and date of demolition of the former public house onsite and potential atmospheric deposition of asbestos fibres from former offsite asbestos works. - Likely probability of heavy metals and PAHs given history of site, identified made ground and fly tipping onsite and potential pathway to receptors in gardens. - Recommendation: Intrusive investigation required.
			- Petroleum hydrocarbons (made ground, former car park onsite).	Low Likelihood	Medium	Moderate / Low	- Low probability of hydrocarbons as minimal spills / leakages expected from a car park associated with the former public house. However, potential pathway exists to receptors in gardens. - Low risk assumed as significant source not expected. - Recommendation: Testing (TPHCWG) if evidence of hydrocarbons identified in the ground.
			- Other inorganic and organic contaminants (fly tipping, offsite former mills and works).	Unlikely	Medium	Low	- Unlikely probability given the limited site history (only been public house onsite), offsite mills and works are at a significantly lower elevation than the site with an intervening watercourse. Fly tipped material did not appear to be a source of other contaminants. - Recommendation: Testing if evidence of other contaminants identified.
PL2	- Inhalation of vapours. - Migration through permeable strata / preferential pathways.	- Future site users. - Offsite receptors.	- Volatile Contaminants such as hydrocarbons (made ground, former car park).	Low Likelihood	Medium	Low	- Low probability as contamination source is only from a car park associated with the former public house therefore significant leakages / spillages of volatile contamination considered unlikely. - Recommendation: Testing if evidence of volatile contaminants identified in the ground.
PL3	- Inhalation of gas. - Migration through permeable strata / preferential pathways. - Explosion in confined spaces.	- Future site users. - Buildings. - Offsite land users.	- Methane, carbon dioxide. (potentially infilled features 250m of the site).	Low Likelihood	Severe	Moderate	- Low probability due to limited viable sources of gas identified and sensitive nature of development (residential). - Recommendation: Precautionary gas monitoring or precautionary measures required.
PL4	- Surface Run-off. - Migration through permeable strata and preferential pathways. - Perched waters migration.	- Groundwater (Principal Aquifer). - Surface water (River Irk).	- Mobile contaminants such as metals, PAHs, hydrocarbons (made ground, car park).	Low Likelihood	Medium	Moderate / Low	- Low probability as contamination source is only from a former car park and public house therefore significant leakages / spillages of mobile contamination considered unlikely. Offsite former mills and works likely to be a more significant source of contamination. - Clay expected below the site will also prevent migration. - Moderate risk assumed as a precaution at this stage. - Recommendation: Precautionary testing required.
PL5	- Sulphate attack on concrete.	- Building structure.	- Sulphate (ash possible in made ground).	Likely	Mild	Moderate / Low	- Likely probability as ash is likely to be present in the made ground, which may be in contact with concrete used in future buildings. - Moderate risk assumed at this stage. - Recommendation: Intrusive investigation required as part of PL1.
PL6	- Ingestion of tainted water supply.	- Future site users. - Water pipes.	- Organic Contaminants such as hydrocarbons (made ground, car park).	Low Likelihood	Medium	Moderate / Low	- Low probability as significant contamination not anticipated at pipeline depth (0.75-1.35m). - Moderate risk at this stage due to unknown depth of made ground. - Recommendation: Sampling required if made ground present at pipeline installation depths.
PL7	- Direct Contact (plant uptake).	- Flora.	- Phytotoxic Contaminants (made ground).	Likely	Minor	Low	- Likely probability as contamination considered possible, which may be taken up by flora in gardens. - Recommendation: Investigation work as part of PL1.

Table 2-4: Preliminary Contamination Conceptual Model.

3 GROUND INVESTIGATION

3.1 Site Investigation Design and Methodology

In order to assess the ground conditions and the potential pollutant linkages identified in the preliminary contamination conceptual model an intrusive investigation was undertaken.

The investigation was carried out on 8th December 2017 and comprised the following:

- 5no. window sample boreholes drilled to a maximum depth of 5.45 metres below ground level (mbgl) (ref. WS101 to WS105).
- 1no. hand dug pit (using hand auger / spade) excavated to 0.8mbgl (ref. HA101).

A hand dug pit was undertaken where access was restricted to drilling rigs.

WS104 and WS105 had to be re-positioned due to felled trees and access restrictions respectively.

WS105 was terminated at 0.8mbgl due to a possible concrete obstruction at 0.8mbgl. The extent of concrete could not be confirmed.

All site investigation locations are shown in Figure 4.

The locations were chosen to allow an adequate assessment of ground conditions across the site as well as target areas of concern. Table 3-1 details the targeted and general coverage (non-targeted) site investigation locations.

Site Investigation Locations	Rationale
WS101, WS102, WS103 and WS104	Former bowling green and general site coverage.
WS105 and HA101	Former public house and general site coverage.

Table 3-1: Summary of sampling locations.

The number of site investigation points corresponds to approximately one location per approximately 20m square centres. This is considered to be a conservative sampling density and is in line with BS10175⁷ for a 'main investigation'.

All profile logs are provided in Appendix C and are in line with BS14688-1⁸ and BS5930⁹.

3.2 Well Installations

4no. (WS101-WS104) of the boreholes were installed with monitoring wells for gas and groundwater monitoring. Monitoring wells were installed in accordance with BS10175 and CIRIA C665¹⁰ and generally comprised approximately 1m plain pipe over a length of slotted pipe surrounded by pea gravel and sealed at the top with bentonite and concrete.

Well installation details are provided in Profile Logs in Appendix C.

⁷ British Standard (2011). "Investigation of Potentially Contaminated Sites – Code of Practice." BS10175:2011.

⁸ British Standards (2002) Geotechnical investigation and testing – Identification and Classification of Soil. Part 1: Identification and description. BS EN ISO 14688-1:2002.

⁹ British Standard (2015). "Code of Practice for Ground Investigations". BS5930:2015.

¹⁰ CIRIA (2007). "Assessing Risks Posed by Hazardous Ground Gases to Buildings." CIRIA C665.

3.3 Sampling Protocol

3.3.1 Soil Sampling (Contamination)

Standard sampling protocol and preservation of samples was undertaken as described in the EA guidance on site investigation¹¹.

Soil was collected for onsite testing. A plastic zip bag was half filled with soil allowing a suitably sized headspace. The bag was sealed and stored for at least 20 minutes before being tested for total volatile organic compounds (TVOCs) using a PhoCheck Tiger photoionisation detector (PID). Results of the PID readings are presented on the profile logs (Appendix C). The on-site monitoring was carried out in line CIRIA C665¹² to aid in screening samples for volatile analysis.

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 3-2 shows the soil testing undertaken.

Suites and Contaminants	No. Samples	Location & Depth	Justification
Metals / metalloids, pH, water soluble sulphate, speciated PAHs, SOM and asbestos screen.	7	WS102 0.0-0.5m WS102 0.5-1.0m WS103 0.0-0.4m WS103 0.4-1.0m WS104 0.0-0.5m WS104 0.5-1.0m HA101 0.0-0.8m	A basic suite with a broad selection of contaminants tested on samples across the site where no significant evidence of contamination was identified (with the exception of occasional ash and brick) and no TVOCs identified from the PID tests.
Metals / metalloids, pH, water soluble sulphate, cyanide suite, phenol, TPHCWG, BTEX, MTBE, speciated PAHs, SOM and asbestos screen.	3	WS101 0.3-1.0m WS101 1.0-2.0m WS105 0.0-0.8m	A faint bitumen odour was noted in WS101 at 0.3-1.0m, therefore this strata and the strata below was tested for a comprehensive suite of contaminants. Tarmacadam noted in WS105 therefore comprehensive suite of contaminants undertaken to identify any contamination risk.

Table 3-2: 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; TPHCWG=carbon banded and aromatic/aliphatic split petroleum hydrocarbons; PAH=polycyclic aromatic hydrocarbons, BTEX=benzene, toluene, ethylbenzene and xylenes; MTBE=Methyl tert-butyl ether, SOM=Soil Organic Matter.

¹¹ EA (2000). "Technical Aspects of Site Investigation. Volumes 1 & 2 Text Supplements Research and Development Technical Report." P5-065/Tr.

¹² CIRIA (2007). "Assessing Risks Posed by Hazardous Ground Gases to Buildings." CIRIA C665.

3.3.2 Water Sampling

To establish the condition of groundwater LKC undertook 2no. groundwater samples (referenced WS101 and WS104).

The groundwater samples were collected 1 week after drilling had finished and following well development. Sample collection was undertaken using a disposable bailer. The boreholes were purged of all standing water and the sample collected from the recharged water where possible. The samples were collected in glass and plastic bottles and a glass vial.

WS101 did not recharge after purging, therefore a sample was collected from the purged water.

To establish the condition of the near by River Irk, 2no. surface water samples were collected (referenced SW101 and SW102) from upstream and downstream of the site.

All water samples were placed in glass bottles, plastic bottles and septum topped vials and stored in ice packed cool boxes. The samples were sent to Chemtest on the same day for analysis.

Sampling was carried out in general accordance with BS5930¹³ and BS5667-11¹⁴.

Many of the tests are UKAS or MCERTS accredited and further details are given in the Certificate of Analysis presented in Appendix E. Table 3-3 shows the groundwater and surface water testing undertaken. Figure 5 shows the sampling location of the surface water samples collected.

Suites and Contaminants	No. Samples	Location	Justification
Metals / metalloids, pH, sulphate, cyanide suite, TPHCWG, BTEX, MTBE, speciated PAHs, phenol and hardness.	4	WS101 (G) WS104 (G) SW101 (S) SW102 (S)	Detailed suite undertaken to confirm the absence of contamination.

Table 3-3: Summary of groundwater and surface water sampling tests undertaken.

Notes:

G=Groundwater Sample; S=Surface Water Sample.

Metal/metalloids=arsenic, cadmium, chromium, (total and hexavalent), copper, lead, mercury, nickel, selenium, vanadium, zinc and boron; TPHCWG=carbon banded and aromatic/aliphatic split petroleum hydrocarbons; PAH=polycyclic aromatic hydrocarbons, BTEX=benzene, toluene, ethylbenzene and xylenes; MTBE=Methyl tert-butyl ether.

3.4 Gas Monitoring

Six gas monitoring visits have been undertaken over a 3-month period (14th December 2017 to 21st March 2018) in all installed boreholes.

Monitoring was undertaken using a Geotechnical Instruments GA2000 plus / GA5000 in accordance with the monitoring protocol outlined in CIRIA C665¹⁵ (flow rate measured first). The monitoring was undertaken over a range of weather conditions (including low and falling barometric pressure and heavy rain) to demonstrate worst-case conditions.

¹³ British Standard (2015). "Code of Practice for Ground Investigations". BS5930:2015.

¹⁴ British Standard (2009). "Water Quality – Sampling. Part 11: Guidance on Sampling of Groundwaters". BS ISO 5667-11:2009.

¹⁵ CIRIA (2007). "Assessing Risks Posed by Hazardous Ground Gases to Buildings." CIRIA C665.

WS102 could not be monitored as the well was not accessible during monitoring (due to site clearance work).

The gas monitoring results are reproduced in full in Appendix E.

3.5 Site Investigation Scope

The scope of the contaminated land investigation was agreed with the Local Authority prior to undertaking the work (email dated 28th November 2017). This investigation was in line with the scope; however, locations had to be altered slightly due to the presence of felled trees and obstructions on the site.

LKC do not consider the changes to be significant and sufficient investigation work has been undertaken to assess the site.

3.6 Geotechnical Testing

3.6.1 In-situ Geotechnical Testing

In-situ geotechnical tests were performed in the boreholes to further characterise the sub-soil conditions. The following tests were undertaken:

- Standard Penetration Tests (SPTs) were performed in the window sample boreholes at approximately 1m intervals, generally within the natural strata.
- Shear Vane tests (giving undrained shear strength) were performed in the window sample boreholes (to a maximum depth of 3mbgl) at approximately 1m intervals, within the natural clay strata.

Shear vanes tests were not always possible due to the friable or gravel rich nature of some of the clay deposits.

The SPT and shear vane readings are provided within the profile logs (Appendix C).

3.6.2 Laboratory Geotechnical Testing

Soil samples taken during the investigation were collected in bulk bags and sent to Murray Rix Laboratories for geotechnical testing.

Many of the tests are UKAS accredited and further details are given in the laboratory report presented in Appendix G. Table 3-4 shows the geotechnical testing undertaken.

Suites and Contaminants	No. Samples	Location	Justification
pH and water soluble sulphate	2	WS101 2-3m WS104 1-2m	Samples of natural ground taken to assess the pH and sulphate for geotechnical purposes. pH and water soluble sulphate is also included in the contamination suites.
Atterberg Limits (plasticity testing)	8	WS101 1-2m WS101 2-3m WS102 1-2m WS103 0.4-1m WS103 1-2m WS104 0.5-1m WS104 1-2m WS104 2-3m	A selection of clay samples across the site were tested for Atterberg Limits to assess their shrinkability potential associated with current and proposed trees.

Table 3-4: Summary of geotechnical testing undertaken.

4 GROUND CONDITIONS

4.1 Geology – Generalised Sequence

The ground conditions beneath the site comprised made ground underlain by natural gravelly sandy clay. Summary sections of the logs are provided in Plate 4-1, with additional comments below.

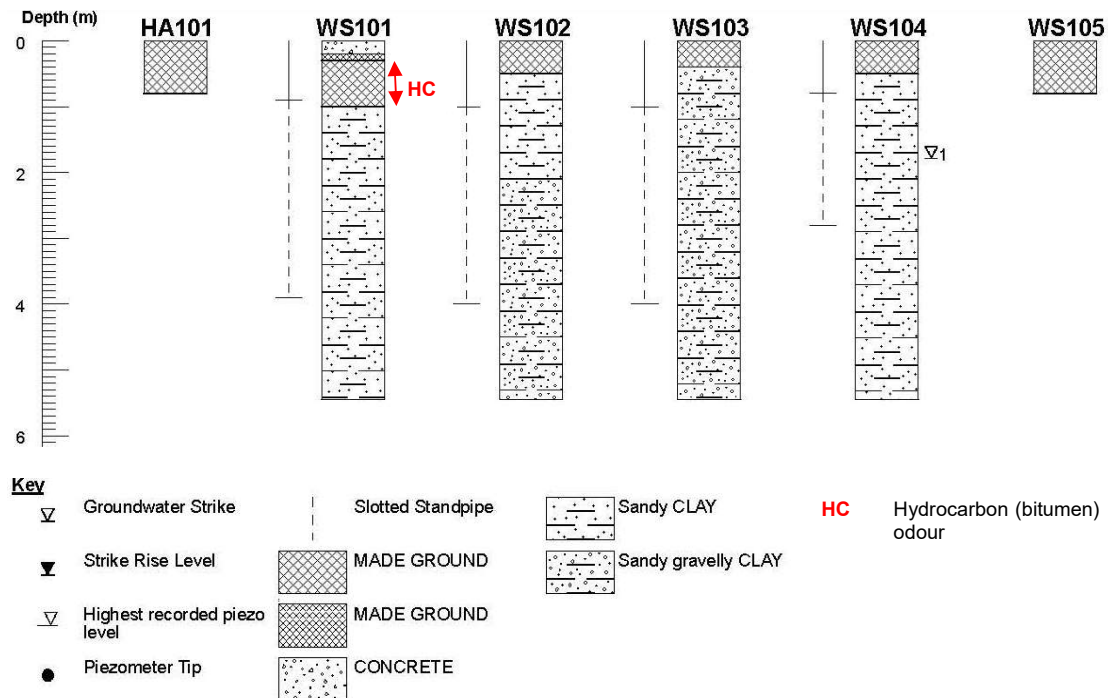


Plate 4-1: Summary of ground conditions.

Additional information on ground conditions:

- Made ground was recorded to a depth of 0.4-1.0mbgl and generally consisted of gravelly sandy clay with brick, ash, clinker, ceramics, glass, concrete, tarmacadam and slate. Exceptions to this were:
 - WS101 0.0-0.3m – Tarmacadam underlain by sandstone flagstones (made ground).
 - WS102 0.0-0.5mbgl – gravelly clayey sand with ash, clinker, brick, slate and ceramics (made ground).
 - WS104 0.0-0.5mbgl – sandy clayey gravel with brick and tarmac (made ground).
- A faint hydrocarbon (bitumen) odour was recorded in WS101 at 0.3-1.0mbgl. Hydrocarbon odours were not identified in any underlying strata.
- In-ground structures were identified in WS105 (concrete slab at 0.8m).
- Superficial deposits generally comprised gravelly sandy clay with occasional bands of sandy clay to the base of the boreholes.

4.2 Groundwater

Groundwater strikes were recorded during the investigation in the boreholes and the hand dug pit. In addition, groundwater monitoring within the borehole wells has been undertaken on six occasions as part of the gas monitoring. An oil-water interface probe (approximately 1cm detection limit) was used to detect the presence of free phase hydrocarbons within each borehole.

Results are summarised in Table 4-1.

BH/TP	Water Strike Depths (mbgl)	Well Response Zone (mbgl)	No. of Monitoring Visits	Monitoring Depths (mbgl)			Sample Taken?	Evidence of Contam?
				Min	Max	Base		
WS101	Dry	0.9-3.9 (MG/C)	5	1.02	0.1	3.9	Yes*	No
WS102	Dry	1.0-4.0 (C)	0	-	-	-	No	No
WS103	Dry	1.0-4.0 (C)	6	3.93	0.83	4.0	No	No
WS104	1.8	0.8-2.8 (C)	6	0.5	0.15	2.8	Yes	No
WS105	Dry	Not installed						

Table 4-1: Summary of water strike depths within boreholes.

Response Zones:

MG=Made Ground; C=Clay.

Notes:

*=Sample taken from purged groundwater as no recharge within borehole.

The high groundwater levels recorded, particularly in WS101 and WS104 may not be true readings. Given the boreholes were dry during drilling; it is likely that the monitoring wells are allowing some ingress of surface water.

4.3 In-situ Geotechnical Testing

4.3.1 Standard Penetration Tests

In-situ standard penetration tests (SPTs) were undertaken, predominantly in the natural ground. The results are summarised in Table 4-2 and provided within the profile logs in Appendix C.

Approximate Depth (mbgl)	SPT 'N' Values					
	WS101	WS102	WS103	WS104	WS105	HA101
1-2	14 (C)	11 (C)	13 (C)	10 (C)	-	-
2-3	21 (C)	12 (C)	15 (C)	9 (C)	-	-
3-4	20 (C)	12 (C)	16 (C)	16 (C)	-	-
4-5	23 (C)	15 (C)	22 (C)	27 (C)	-	-
5-6	20 (C)	18 (C)	23 (C)	31 (C)	-	-
GW Strike	Dry	Dry	Dry	1.8	Dry	Dry

Table 4-2: Summary of SPT (N) values.

Notes:

C=Clay.

Groundwater level based on strikes during investigation.

4.3.2 Shear Vanes

Hand shear vane readings, recording undrained shear strength (USS), were taken within the clay strata. The results are summarised in Table 4-3 and provided within the profile logs in Appendix C.

Approximate Depth (mbgl)	Average Undrained Shear Strength (kN/m ²)					
	WS101	WS102	WS103	WS104	WS105	HA101
0-1	-	-	-	-	-	-
1-2	-	40	70	-	-	-
2-3	40	70	105	70	-	-
3-4	-	100	-	-	-	-
GW Strike	Dry	Dry	Dry	1.8	Dry	Dry

Table 4-3: Summary of average hand shear vane readings.

Notes:

Groundwater level based on strikes during investigation.

Shear vane readings can be influenced by coarse material including coarse silt.

4.4 Geotechnical Laboratory Testing

4.4.1 Atterberg Limits

Representative samples of natural clay were subjected to Atterberg Limits (plasticity) and Moisture Content testing. Results are presented in Appendix G and summarised in Table 4-4.

Table 4-4 also includes the modified plasticity index as detailed in Chapter 4.2-D5 of the NHBC standards (modified plasticity index = plasticity index x % less than 425µm sieve / 100%).

Location	Depth (mbgl)	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Class	Passing 425 micron (%)	Modified Plasticity Index (%)
WS101	1.0-2.0	17	38	14	24	CI	91	21.84
WS101	2.0-3.0	17	37	14	23	CI	90	20.70
WS102	1.0-2.0	16	38	15	23	CI	86	19.78
WS103	0.4-1.0	15	39	14	25	CI	90	22.50
WS103	1.0-2.0	17	40	15	25	CI	93	23.25
WS104	0.5-1.0	18	34	12	22	CL	88	19.36
WS104	1.0-2.0	24	34	13	21	CL	79	16.59
WS104	2.0-3.0	20	37	13	24	CI	85	20.40

Table 4-4: Summary of plasticity index testing.

The modified plasticity index is between 16% and 23%. This characterises the clay as having a low to medium volume change potential.

4.4.2 Sulphate and pH

Water soluble sulphate and pH tests were carried out on soil and groundwater samples. Full results are presented in Appendix D (soils) and Appendix E (groundwater) and summarised in Table 4-5.

Strata	pH		Sulphate	
	Soil	Groundwater	Soil (g/l)	Groundwater (mg/l)
Made Ground	5.8-9.4	7.7-8.0	<0.01-1.3	75-130
Natural	5.9-8.4		<0.01-0.68	

Table 4-5: Summary of pH and sulphate results.

5 GEOTECHNICAL ASSESSMENT

Final foundation design will need to be confirmed once loadings of proposed buildings are known and details of ground works (i.e. potential cut and fill exercises) are known. A preliminary foundation assessment is summarised in Table 5-1.

Proposed Development:	- 12no. three storey semi-detached dwelling houses in the development area of the site with associated gardens and driveways.
General Ground Conditions:	- Based on WS101-WS105 and HA101. Maximum investigation depth 5.45mbgl. - Made Ground to 0.4-1.0mbgl. - Natural Ground: Firm to stiff gravelly sandy CLAY to >5.45mbgl. SPTs N=10-14 at 1mbgl, N=9-21 at 2m, N=12-31 at 3-5mbgl. - Dry, friable clay encountered in WS102 to 2.1mbgl only. - Coarse sand bands of approx. 5cm thickness present from 1.8mbgl in WS104 only. - No bedrock encountered. Groundwater encountered during drilling in WS104 only.
Anticipated Foundation Type:	- Ground conditions below the proposed dwelling houses comprise made ground to a maximum depth of 1.0mbgl, underlain by clay ranging from firm to stiff. It is unknown whether the previous building had a basement, therefore obstructions or deeper made ground may be encountered around WS105. - Traditional shallow foundations recommended from approximately 1.3mbgl below the made ground in the natural clay strata. Due to the presence of trees onsite and if soft ground is encountered, foundations may need to be deepened / widened or ground replaced with compacted granular material (see below).
Allowable Bearing Pressure:	- Allowable bearing pressure of 100kN/m ² at 1.3m in the gravelly sandy CLAY based on a minimum shear strength of 40kN/m ² . - Net bearing stress of 76kN/m ² at 1.3m in the gravelly sandy CLAY. - The above bearing pressures are within tolerance for settlement.
Plasticity:	- Clays exist on the site in thickness and lateral extent to be potentially susceptible to shrink or swell effects by influence of trees. This may lead to desiccation and seasonal ground movements, possibly resulting in heave and subsidence to foundations. Removal of trees and shrubs may cause re-hydration in the clays leading to heave. - Consideration will need to be given to the shrink / swell of the clay strata if it is to be used as founding strata, particularly where trees/hedges are present. - A low to medium volume change potential has been calculated for the site. - It is recommended that once it is known which trees are to remain, if trees are found to be within the potential influence zone of any footings the depth of foundations should be adjusted according to NHBC Chapter 4.2 'Building Near Trees'.
NHBC Chapter 4.2 Calculations:	- Based on Hawthorn (high demand, mature tree) 6m away from footings with a medium plasticity: Foundations may need to be deepened to approx. 1.84mbgl with 50mm of heave precaution material and 250mm of void below ground floor slab (suspended floor). - Based upon Ash (moderate demand, mature tree) 9m away from footings with a medium plasticity: Foundations may need to be deepened to approx. 1.28mbgl with no heave precautions. - It is advised to seek advice during site works from a suitably qualified structural engineer regarding NHBC Building near trees calculation and foundation depths.
Concrete:	- Concrete requirement, based on BRE Digest 2005 ¹⁶ : DS-2 AC-2 recommended.
Services:	- Consideration to the presence of any services, which may need to be re-routed.
Temporary support of excavation:	- May be required; however, no trial pits were undertaken across the site.
Road / Pavement Design:	- A design CBR value of 2.5% should be adopted for the made ground. - As clayey natural strata is predominant across the site below the made ground, LKC recommend a preliminary design CBR of 2% should be adopted.

Table 5-1: Preliminary Foundation Assessment.

¹⁶ BRE (2005). "Concrete in Aggressive Ground." Special Digest 1.

6 GENERIC RISK ASSESSMENT

6.1 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 (CLR11¹⁷). Information gathered from the risk assessment has been collated in the revised contamination conceptual model in Section 6.6.

6.2 Soil Risk Assessment

6.2.1 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^{18,19}. The recent change to the contaminated land guidance has changed the evaluation of risk from 'minimal' (referred to as Health Criteria values (HCVs))²⁰ 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 S4ULs²¹. 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^{22,23,24,25}.

If contaminants are not present as C4SLs and S4ULs then LKC will use ATRISK SSVs or CL:AIRE GACs²⁶. These follow the 'minimal' risk principle and more stringent exposure parameters and will be conservative.

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^{27,28} and

¹⁷ EA (2004). "Model Procedures for the Management of Land Contamination." R&D Publication CLR 11.

¹⁸ Defra (2014). "SP1010: Development of Category 4 Screening Levels and Assessment of Land Affected by Contamination – Policy Companion Document."

¹⁹ CL:AIRE (2013). "SP1010: Development of Category 4 Screening Levels and Assessment of Land Affected by Contamination – Final project Report."

²⁰ EA (2008). "Human Health Toxicological Assessment of Contaminants in Soils." Science Report – SC050021/SR2.

²¹ LQM (2014). "The LQM/CIEH S4ULs for Human Health Risk Assessment."

²² EA (2008). "Updated Technical Background to the CLEA Model." Science Report – SC050021/SR3.

²³ EA (2008). "Human Health Toxicological Assessment of Contaminants in Soils." Science Report – SC050021/SR2.

²⁴ EA (2008). "A Review of Body Weight and Height Data used within the Contaminated Land Exposure Assessment Model (CLEA)." Project SC050021/Technical Review 1.

²⁵ EA (2009). "Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values." Science report SC050021/SR7.

²⁶ CL:AIRE (2009). "The Soil Generic Assessment Criteria for Human Health Risk Assessment."

²⁷ EA (2002). "Contaminants in Soils: Collation of Toxicological Data and Intake Values for Humans. Benzo[a]pyrene." R&D Publication TOX2.

²⁸ USEPA (1984). "Health Effects Assessment of Polycyclic Aromatic Hydrocarbons (PAHs). EPA 540/1-86-013."

naphthalene the most volatile and soluble²⁹. 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 negligible³⁰. For B(a)P to be used as a surrogate marker it should follow the profile described by the HPA (2008)³¹ and CL:AIRE (2013). Naphthalene will be treated separately using the LQM S4ULs.

The proposed development is for residential houses with gardens, therefore the assessment criteria for residential with plant uptake has been used.

All criteria have been generated using the CLEA V1.06 model³² based on either 1%, 2.5% or 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 H. 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.*³³, 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 6-1 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.



Graph 6-1: The ratio of PAH to B(a)P in soil for all available data at the site based on 4 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)

²⁹ EA (2003). "Review of the Fate and Transport of Selected Contaminants in the Soil Environment." Draft technical report P5- 079/TR1.

³⁰ CL:AIRE (2013). "SP1010: Development of Category 4 Screening Levels and Assessment of Land Affected by Contamination – Final project Report."

³¹ HPA (2010). "HPA Contaminated Land Information Sheet: Risk Assessment Approaches for Polycyclic Aromatic Hydrocarbons (PAHs)." Version 3.

³² EA (2008). "CLEA Software (Version 1.05) Handbook." Science Report – SC050021/SR4.

³³ 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.

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.

6.2.2 Soil Results Comparison against Assessment Criteria

All analysis sheets are presented in Appendix D. All the data has been compared to relevant assessment criteria. Elevated and pertinent results are presented in Table 6-1.

Contaminant	Units	No. of samples	Elevated Result	Sample Location	Criteria (1%/2.5%/6%)	Source of Criteria
Metals						
Arsenic	mg/kg	10	42	WS102 (0.0-0.5m)	37	C4SL
			47	WS104 (0.0-0.5m)		
Lead	mg/kg	10	210	WS102 (0.0-0.5m)	200	C4SL
			420	WS105 (0.0-0.8m)		
			480	HA101 (0.0-0.8m)		
General						
pH	pH	10	Range 5.8 to 9.4			
SOM	%	10	Range 0.74 to 7.4			
Asbestos	N/A	10	None Detected			

Table 6-1: Summary of elevated and pertinent analytical results.

Notes:

Only results that exceeded assessment criteria have been shown and results from **all depths** are noted.

Elevated results have been identified for arsenic (WS102 and WS104) and lead (WS102, WS105 and HA101).

6.2.3 Hazard Quotient

As no significant concentrations of petroleum hydrocarbons were identified in any of the soil samples a hazard index (HI) as described by the Environment Agency³⁴ technical report (to examine the potential additivity of toxicological effects between the petroleum hydrocarbon fractions) has not been undertaken as part of this assessment.

6.2.4 Direct Contact Risk – Pollutant Linkage 1

Elevated metals (arsenic and lead) have been identified on site. Given the number and location of elevated samples, the contamination is considered to be site wide as a conservative measure. The source of the contamination is expected to be the ash, clinker and ceramics noted in the made ground.

At the concentrations identified, the contaminants are considered to pose a potential risk to future site users (residents) in gardens and soft landscaped areas, where made ground may be exposed / in contact with vegetables. The principal pathways are the ingestion pathways (soil, dust and vegetables) and dermal contact.

The probability of metal contamination affecting site users is likely. With a medium consequence, the risk is considered to be moderate and remediation is recommended.

No asbestos was identified in any of the samples, therefore the probability of asbestos affecting site users is considered to be unlikely. With a medium consequence, the risk is

³⁴ EA (2005). "The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils." Science Report P5-080/TR3.

low and remediation is not required. However, as a precaution, construction workers should be and vigilant for any suspected ACM during groundworks (discussed further in Section 8.2).

No elevated hydrocarbons or PAHs were identified, therefore the probability of these contaminants posing a risk to site users is considered unlikely. With a medium consequence, the risk is considered to be moderate and no remediation is recommended.

6.2.5 Risk from Inhalation of Vapours – Pollutant Linkage 2

The PID did not detect any TVOCs during the investigation. Confirmatory soil analysis did not detect any volatile TPH fractions above detection limits.

LKC therefore consider the probability of volatile contaminants affecting site users as unlikely. The consequence is expected to be medium, giving a low risk and no remediation is required with respect to Pollutant Linkage 2.

6.3 Gas Risk Assessment

6no. gas monitoring visits have been undertaken on the study site. Gas monitoring results in full are presented in Appendix E. Following guidance set out in CIRIA C665³⁵ and BS8485³⁶ peak methane and carbon dioxide concentrations have been used in the gas risk assessment. In addition, and as per guidance, flow rates were measured first.

All gas concentrations, flow, pressure and groundwater levels are shown in Table 6-2.

³⁵ CIRIA (2007). "Assessing Risks Posed by Hazardous Ground Gases to Buildings." CIRIA C665.

³⁶ BSI (2015). "Code of Practice for the Characterisation and Remediation from Ground Gas in Affected Developments." BS8485:2015.

Boreholes	Visit	CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)	H ₂ S (ppm)	CO (ppm)	Flow (l/h)	Groundwater (mbgl)	Pressure (mb)
WS101	1	UR	UR	UR	UR	UR	UR	0.1	UR
	2	0.2	0.2	20.1	<0.1	<0.1	-0.1	0.78	980 (f)
	3	<0.1	0.2	21.5	<0.1	1	<0.1	0.9	998 (r)
	4	<0.1	0.2	19.6	<0.1	<0.1	<0.1	1.02	1011 (r)
	5	0.1	0.2	20.1	<0.1	<0.1	<0.1	0.83	983 (f)
	6	UR	UR	UR	UR	UR	UR	1.21	UR
WS102	1	UR	UR	UR	UR	UR	UR	UR	UR
	2	UR	UR	UR	UR	UR	UR	UR	UR
	3	UR	UR	UR	UR	UR	UR	UR	UR
	4	UR	UR	UR	UR	UR	UR	UR	UR
	5	UR	UR	UR	UR	UR	UR	UR	UR
	6	UR	UR	UR	UR	UR	UR	UR	UR
WS103	1	0.1	2.2	18.2	<0.1	1	<0.1	3.93	975 (f)
	2	0.2	1.4	18.7	<0.1	<0.1	<0.1	1.24	981 (f)
	3	<0.1	1.2	21.3	<0.1	<0.1	<0.1	0.83	998 (r)
	4	<0.1	1.0	21.0	<0.1	<0.1	<0.1	1.06	1011 (r)
	5	0.1	1.7	20.9	<0.1	<0.1	<0.1	1.02	983 (f)
	6	<0.1	1.6	19.1	<0.1	<0.1	<0.1	1.23	1021 (f)
WS104	1	UR	UR	UR	UR	UR	UR	0.15	UR
	2	0.2	0.1	20.4	<0.1	<0.1	0.2	0.25	982 (f)
	3	<0.1	0.1	21.6	<0.1	<0.1	<0.1	0.27	998 (r)
	4	<0.1	0.2	21.1	<0.1	<0.1	<0.1	0.5	1010 (r)
	5	0.1	0.1	21.1	<0.1	<0.1	<0.1	0.2	983 (f)
	6	<0.1	0.2	21.3	<0.1	<0.1	-14.6	0.39	1021 (f)

Table 6-2: Summary of gas monitoring.

Notes:

UR=Unable to record.

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

Table shows peak concentrations of CH₄, CO₂, H₂S and CO. Low O₂.**Bold** where CO₂ exceeds 5%v/v and CH₄ exceeds 1%v/v.

Atmospheric pressure (over past 24hrs): r=rising, f=falling, s=steady

Borehole WS102 was unable to be accessed due to site clearance works. Monitoring well WS101 was destroyed after visit 5 and could not be monitored during visit 6.

Gas monitoring had to be terminated early on some occasions due to high water levels in WS101, WS103 and WS104 (water entering machine tubing). No monitoring was possible in WS101 during visits 1 and 6 due to borehole flooding.

Flow was recorded as -14.6l/hr in WS104 visit 6. This corresponds to high water levels in the borehole (above the response zone) and falling pressure over the previous 24 hours. The negative flow is not expected to be representative of site conditions and has not been used as part of the later assessment.

Maximum carbon dioxide was recorded as 2.2%v/v, maximum methane was recorded as 0.2%v/v. Maximum flow (excluding WS104, visit 6) was recorded as 0.2l/hr.

No hydrogen sulphide was recorded above detection limits and maximum carbon monoxide was 1ppm. Minimum oxygen was recorded as 18.2%v/v.

Gas Screening Value

In accordance with CIRIA C665³⁷, a Gas Screening Value (GSV) may be calculated. Assuming worst-case scenario maximum gas concentrations and flow for each borehole have been used to calculate the GSV. The GSV can be used to determine the characteristic situation (CS).

Table 6-3 shows the maximum GSV for WS101, WS103 and WS104 and the appropriate characteristic situation (based on GSV only). An overall site assessment has also been included (worst case values across the site).

Boreholes	Max GSV (l/hr)	CS / TL
WS101	0.0002	CS1 / Green
WS103	0.0022	CS1 / Green
WS104	0.0004	CS1 / Green
SITE WIDE	0.0004 (CH ₄) 0.0044 (CO ₂)	CS1 / Green

Table 6-3: Summary of worst-case Gas Screening Values (GSV).

Notes:

CS – Characteristic Situation; TL= Traffic Light.

In addition, in accordance with CIRIA C665, if carbon dioxide and methane are recorded above 5%v/v and 1%v/v respectively, you should consider upgrading the characteristic situation from CS1 to CS2. All the concentrations fall well below these threshold values.

Although the data is a little limited due to the inaccessible borehole (WS102), borehole flooding / high water levels and well damage, LKC consider that there is sufficient data to assess the site based on the existing data. The values recorded are low with minimal and Characteristic Situation 1 / Green is considered appropriate for the site.

Gas can potentially migrate into buildings, accumulate in confined spaces and cause explosions (methane) and asphyxiation. LKC consider the probability of carbon dioxide and methane gas affecting site users and buildings as unlikely. Assuming a severe consequence, there is a moderate / low risk. Given the minimal gas concentrations and low flow, a low risk is considered most appropriate and no remediation is required.

6.4 Controlled Water Assessment

LKC considers the River Irk and Principal Aquifer as the primary receptors for this site.

LKC have compared results above Limits of Detection (LOD). Where relevant the review of priority substances take precedence considering threshold values for groundwater cannot be used '*as part of site specific investigations*'. The hierarchy is as follows:

- River Basin District Standards³⁸ and updated Water Framework Directive³⁹ for Annual Average / Maximum Allowable Concentration Environmental Quality Standards (AA-MAC-EQS) for priority substances (surface water risk).
- 2001 Environment Agency Values for Environmental Quality Standards (EQS) and UK Drinking Water Standard (UKDWS)⁴⁰.
- 2009 UK Drinking Water Standard (UKDWS)⁴¹.

³⁷ CIRIA (2007). "Assessing Risks Posed by Hazardous Ground Gases to Buildings." CIRIA C665.

³⁸ Defra (2010). "The River Basin Districts Typology, Standards and Groundwater Threshold Values". Water Framework Directive (England and Wales) Directions 2010.

³⁹ Defra (2015). "Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015".

⁴⁰ EA (2002). "Environment Agency technical advice to third parties on Pollution of Controlled Waters for Part IIA of the Environment Protection Act 1990."

- Surface Water Abstraction Directive (SWAD)⁴² based on A2 treatment (TPH only).
- Resource Protection Values (RPVs)⁴³.
- Minimal Reporting Values (MRVs).

The SWAD criteria is considered appropriate for TPH and would be more realistic criteria than UKDWS. For example, the UKDWS for hydrocarbons (dissolved/emulsified) is 10µg/l, whereas it would be 200µg/l using SWAD for normal physical/chemical treatment (A2 treatment). This standard has been repealed in 2007⁴⁴, but values have not been replaced currently in the Water Framework Directive. A recent document by the EA on risk from petroleum hydrocarbons in groundwater⁴⁵ has not derived EQS values for emulsified hydrocarbons but state that it must not form distinctive films or produce harmful effect to fish. It is understood that the EA are working on providing guideline values for individual carbon bands. Until this has occurred, LKC considers the use of SWAD to be still acceptable for TPH for surface waters.

With regards to hydrocarbon mixtures (TPHCWG) for UKDWS, LKC will use the CL:AIRE guidance on petroleum hydrocarbons in groundwater⁴⁶ based on WHO guidelines.

No criteria values have been presented for surface waters (EQS) except the odour, visual evidence and taste test for fish⁴⁷. However, criteria for each banding has been presented by WHO within the CL:AIRE report for drinking water and will be used in the assessment.

The risk from List 2 compound (EC Dangerous Substance Directive 76/464/EEC) in a freshwater ecosystem is governed by the hardness of the water. Where applicable the hardness was taken into account for these contaminants.

Elevated contaminants above limits of detection are presented in Table 6-4 below and all analysis sheets are presented in Appendix E.

Contaminant	Units	No. of samples	Elevated Result	Location	Assessment Criteria	Source of Criteria
Metals						
Chromium	µg/l	4	96	WS101	50	EQS ¹
Selenium	µg/l	4	18	WS101	10	UKDWS
General						
pH	pH	4	Range 7.6 to 8.0			
Hardness	mg/l CaCO ₃	4	110 to 340			

Table 6-4: Summary of elevated surface water and groundwater results.

Notes:

¹ = Based on hardness.

EQS (2001) and AA / MAC-EQS (2010) = Surface water criteria.

UKDWS (2001, 2009) and WHO (2017) = Groundwater criteria (potable supply).

Elevated results have been identified for chromium and selenium in WS101 only.

No free product was noted in any water samples.

Marginal exceedances have been identified for chromium and selenium in one of the boreholes. The PRA identified a moderate / low risk with respect to controlled waters as no

⁴¹ Statutory Instruments (2009). "The Private Water Supplies Regulation 2009." No. 3101

⁴² Surface Water Directive (EC 75/440/EEC); Water Supply (Water Quality) Regulations 1989, as modified.

⁴³ SEPA (2010). "Assigning Groundwater Assessment Criteria for Pollutant Inputs." WAT-PS-10-01.

⁴⁴ DWI (2008). "The 2009 Periodic Review of Prices – Guidance on Drinking Water Quality Requirements."

⁴⁵ EA (2009). "Petroleum Hydrocarbons in Groundwater: Supplementary Guidance for Hydrological Risk Assessment."

⁴⁶ CL:AIRE (2017). "Petroleum Hydrocarbons in Groundwater: Guidance on Assessing Petroleum Hydrocarbons Using Existing Hydrological Risk Assessment Methodologies."

⁴⁷ EA (2009). "Petroleum Hydrocarbons in Groundwater: Supplementary Guidance for Hydrological Risk Assessment."

significant source of mobile contamination was anticipated. Groundwater levels recorded in WS101 and WS104 are indicative of surface water ingress through the well head and is not likely to be representative of shallow groundwater conditions. Furthermore, the clay present on the site should significantly reduce any sub-surface migration, and natural attenuation processes such as sorption, dispersion, dilution and biodegradation will reduce the concentration of contamination to acceptable levels.

Based on the above, LKC considers the probability of contaminants on site affecting the River Irk and Principal Aquifer as unlikely. Given the medium consequence, a low risk is anticipated (Pollutant Linkage 4) and no remediation is required.

6.5 Additional Risk Assessments

6.5.1 Concrete (Pollutant Linkage 5)

As stated in Section 5, sulphate resistant concrete will be required at the site. The site was classified as DS-2 AC-2.

Based on the above, the probability of sulphate concentrations affecting buildings is likely. Given the consequence is considered to be mild, the risk (Pollutant Linkage 5) is anticipated to be moderate/low with a moderate risk deemed appropriate and remediation (sulphate resistant concrete) is required. This should be confirmed with the structural engineer.

6.5.2 Potable Water Supply (Pollutant Linkage 6)

Soil results were compared to United Utilities (UU) guidelines for the selection of potable water pipes in land potentially affected by contamination⁴⁸. Only contaminants of concern, based on the preliminary conceptual model and ground conditions encountered, were analysed. The following contaminants were not considered to be a risk and therefore not included in the analysis suites: chlorinated compounds, cresols, ethers, nitrobenzene, ketones, aldehydes and amines.

The following elevated contaminants were identified:

- Elevated TVOCs (naphthalene) in made ground in WS101 0.3-1.0mbgl (0.62mg/kg) and WS105 0-0.8mbgl (0.54mg/kg).

Pipeline depth is anticipated to be a minimum of 600mm below ground level. Given there will be some changes to site levels, it is assumed that potable water pipes will be installed within the made ground. Barrier pipe is therefore recommended. A UU risk assessment has been carried out and is provided in Appendix I. This should be provided to UU for review.

At this stage, the probability of organic contaminants affecting potable water pipes is likely. Given the consequence is considered to be medium, the risk (Pollutant Linkage 6) is anticipated to be moderate.

6.5.3 Phytotoxicity (Pollutant Linkage 7)

Soil results were compared to phytotoxic guideline values as outlined in BS3882⁴⁹.

⁴⁸ UU (2011). "United Utilities Water Supplementary Guidance for the Selection of Water Pipes in Land Potentially Affected by Contamination."

⁴⁹ BS (2015). "Specifications for Topsoil and Requirements for Use." BS3882:2015.

Elevated zinc (maximum concentration 1300mg/kg) and copper (maximum concentration 530mg/kg) were identified. The probability of phytotoxic contaminants affecting vegetation is considered to be likely. With a minor consequence, the risk (Pollutant Linkage 7) is anticipated to be low. Although the risk is low, some remediation is recommended. The remediation associated with PL1 (cover system) will be more than sufficient for PL7.

6.6 Revised Contamination Conceptual Model

The preliminary contamination conceptual model (Table 2-4) has been revised following the risk assessments undertaken in Sections 6.1-6.5. The revised contamination conceptual model follows the same methodology and guidance used in the preliminary contamination conceptual model. The risk matrix is provided in Appendix B.

The revised contamination conceptual model is presented in Table 6-5.

Where a very low risk is identified, no specific remediation is required.

Where a low risk is identified, some form of remediation may be required depending on the pollutant linkage, the type and concentration of contaminants present and the proposed development.

Where there is a moderate/low risk is identified, an assessment will be undertaken to establish what category the pollutant linkage will fall into.

Where LKC identifies a moderate or higher risk, remediation or further investigation work is recommended.

Further details of the remedial proposals and a remedial option appraisal are given in Section 7.

Pollutant Linkage	Pathway	Receptor	Contaminant	Probability	Consequence	Risk	Assessment
PL1	- Dermal contact. - Inhalation of soil, fibres and dust. - Ingestion of soils, dust, vegetables, soil attached to vegetables. - Windblown dust.	- Site users. - Offsite receptors.	Heavy metals: - Arsenic and lead.	Likely	Medium	Moderate	- Likely probability as elevated metals (arsenic and lead) identified in the made ground across the site that could come into contact with site users in gardens / soft landscaping areas. - Recommendation: Remediation required. Likely to include an environmental cover system in gardens / soft landscaping areas.
			- ACMs. - PAHs. - Petroleum hydrocarbons. - Other inorganic and organic contaminants.	Unlikely	Medium	Low	- No elevated levels of PAHs, hydrocarbons and other inorganic/organic contaminants identified across the site. No ACMs encountered within any of the soil samples collected. - Recommendation: No remediation required.
PL2	- Inhalation of vapours. - Migration through permeable strata and preferential pathways.	- Future site users.	- Volatile contaminants such as hydrocarbons.	Unlikely	Medium	Low	- No elevated volatile contaminants identified across the site. - Recommendation: No remediation required.
PL3	- Inhalation of gas. - Migration through permeable strata and preferential pathways. - Explosion in confined spaces (methane only).	- Future site users. - Buildings. - Offsite land users.	- Carbon dioxide. - Methane.	Unlikely	Severe	Moderate / Low	- No significant concentrations of gas (max. CO₂ 2.2%v/v, max. CH₄ 0.2%v/v, max. flow 0.2l/hr) and max GSV recorded as 0.0044l/hr (Characteristic Situation 1 / Green). Therefore, unlikely probability and low risk considered appropriate. - Recommendation: No remediation required.
PL4	- Surface Run-off. - Migration through permeable strata and preferential pathways. - Perched waters migration.	- Groundwater (Principal Aquifer). - Surface water (River Irk).	Mobile contaminants: - Metals PAHs, hydrocarbons.	Unlikely	Medium	Low	- Although slightly elevated metals identified in WS101, given the environmental settings and ground conditions encountered not considered to pose a significant risk to groundwater or surface water. - Recommendation: No remediation required.
PL5	- Sulphate attack on concrete.	- Building structure.	- Sulphate.	Likely	Mild	Moderate / Low	- Elevated sulphate identified (max. 1.3g/l) therefore moderate risk considered appropriate. - Recommendation: Sulphate resistant concrete in line with DS-2 AC-2.
PL6	- Ingestion of tainted water supply.	- Future site users (via potable water).	Organic Contaminants: - Naphthalene.	Likely	Medium	Moderate	- Likely probability as elevated naphthalene encountered in the made ground at expected pipeline installation depth, which could permeate water pipes and contaminate water supply. - Recommendation: Barrier pipe recommended.
PL7	- Direct Contact (plant uptake).	- Flora.	Phytotoxic Contaminants: - Zinc, copper.	Likely	Minor	Low	- Elevated zinc and copper identified, which may be taken up by flora in soft landscaping / gardens. - Recommendation: Given risk to flora, some remediation is recommended. Remediation associated with PL1 will be more than sufficient.

Table 6-5: Revised Contamination Conceptual Model.

7 WASTE DISPOSAL ASSESSMENT

The soil contamination results as presented in Appendix D have been used to help determine the disposal route should any material be earmarked for off-site disposal.

As an initial screen, the soil results were inputted into 'HazWasteOnline'. This is a web-based facility that allows an assessment of contaminant soils and classifies the soils as either hazardous or non-hazardous waste.

It is understood that HazWasteOnline has been designed to cover the European Waste Catalogue code number 17 05 03 "soil and stones containing dangerous substances" and follows current guidance^{50,51,52,53,54}.

Where less than limits of detection (LOD) were recorded, the value of the LOD was inputted.

Where applicable relevant metal species were used relating to an ash source, such as metal oxides. This will provide a more realistic classification assessment.

The results show that all the samples tested are classified as **NON-HAZARDOUS WASTE**. The output sheets are provided in Appendix J.

⁵⁰ EA (2013). "Hazardous Waste: Interpretation of the Definition and Classification of Hazardous Waste". Technical Guidance WM3. 1st Edition 2015.

⁵¹ The Hazardous Waste Directive, (HWD, Council Directive 91/689/EC).

⁵² European Waste Catalogue, 2002 (EWC 2002, Commission Decision 2000/532/EC) as amended by Commission Decision 2001/118/EC, 2001/119/EC and Council Decision 2001/573/E.

⁵³ List of Wastes (England) Regulations 2005.

⁵⁴ Approved Supply List (Eighth Edition), 2002. ISBN: 0 7176 2368 8.

8 CONCLUSIONS

8.1 Ground Conditions and Geotechnical Assessment

A summary of the ground conditions and preliminary foundation assessment is presented in Table 8-1 below.

Proposed Development	- 12no. three storey semi-detached dwelling houses in the development area of the site with associated gardens and driveways.
General Ground Conditions	- Made Ground to 0.4-1.0mbgl. - Natural Ground: Firm to stiff gravelly sandy CLAY to >5.45mbgl. SPTs N=10-31. Localised dry, friable clay. Localised coarse sand bands of approx. 5cm thickness present from 1.8mbgl in WS104 only. - No bedrock encountered. - Groundwater encountered during drilling in WS104 only.
Anticipated Foundation Type	- Traditional shallow foundations recommended from approximately 1.3mbgl below the made ground in the natural clay strata. Due to the presence of trees onsite and if soft ground is encountered, foundations may need to be deepened / widened or ground replaced with compacted granular material (see below). - There may also be localised deeper made ground (particularly in the southeast) where foundations may need to be deepened.
Allowable Bearing Pressure	- Allowable bearing pressure of 100kN/m ² at 1.3m in the gravelly sandy CLAY based on a minimum shear strength of 40kN/m ² . - Net bearing stress of 76kN/m ² at 1.3m in the gravelly sandy CLAY. - The above bearing pressures are within tolerance for settlement.
Plasticity	- Consideration will need to be given to the shrink / swell of the clay strata if it is to be used as founding strata, particularly where trees/hedges are present. - A low to medium volume change potential has been calculated for the site.
NHBC Chapter 4.2 Calculations	- Based on Hawthorn as worst-case (high demand, mature tree) 6m away from footings with a medium plasticity: Foundations may need to be deepened to approx. 1.84mbgl with 50mm of heave precaution material and 250mm of void below ground floor slab (suspended floor). - It is advised to seek advice during site works from a suitably qualified structural engineer regarding NHBC Building near trees calculation and foundation depths.
Concrete	- Concrete requirement, based on BRE Digest 2005 ⁵⁵ : DS-2 AC-2 recommended.
Services	- Services may need to be re-routed.
Temporary support of excavation	- May be required; however, no trial pits were undertaken across the site.
Road / Pavement Design	- A design CBR value of 2.5% should be adopted for the made ground and 2% for the natural ground.

Table 8-1: Summary of preliminary foundation assessment.

Further advice on foundation design should be sought from a structural engineer.

⁵⁵ BRE (2005). "Concrete in Aggressive Ground." Special Digest 1.

8.2 Contamination Assessment

A revised contamination conceptual model has been produced by LKC which is summarised in Table 8-2 below (more detailed model provided in Section 6).

Pollutant Linkage		Risk	Recommendations
1	Contaminants posing a risk to site users via dermal contact, ingestion and inhalation (of soil, dust, fibres and vegetables).	Moderate	- Elevated arsenic and lead identified across the site. - Recommendations: Remediation required in garden areas.
		Low	- No elevated PAHs, petroleum hydrocarbons or other inorganic/organic contaminants identified. - Asbestos not identified in any of the soil samples tested. - Recommendations: No remediation required.
2	Volatile contaminants posing a risk to site users via the inhalation of vapours.	Low	- No elevated volatile contamination identified across the site. - Recommendations: No remediation required.
3	Gas posing a risk to buildings and site users via the migration of gas into building causing explosion and asphyxiation.	Low	- No significant concentrations of gas (max. CO ₂ 2.2%v/v, max. CH ₄ 0.2%v/v, max. flow 0.2l/hr) and max GSV recorded as 0.0044l/hr (Characteristic Situation 1 / Green). Therefore, unlikely probability and low risk considered appropriate. - Recommendation: No remediation required.
4	Mobile contamination posing a risk to controlled waters via the migration through permeable strata.	Low	- Although slightly elevated chromium and selenium identified it is not considered to pose a risk to groundwater or surface water due to the environmental setting and ground conditions. - Recommendations: No remediation required.
5	Sulphate posing a risk to building via direct contact (sulphate attack).	Moderate	- Elevated sulphate identified. - Recommendations: Sulphate resistant concrete (DS-2 AC-2) required.
6	Organic contaminants posing a risk to water pipes.	Moderate	- Likely probability as elevated naphthalene encountered in the made ground at expected potable water depth, which could permeate water pipes and contaminate water supply. - Recommendations: Barrier pipe recommended.
7	Phytotoxic metals posing a risk to flora via root uptake.	Low	- Elevated zinc and copper identified which may be taken up by flora in gardens. - Recommendations: Remediation associated with PL1 will be more than sufficient.

Table 8-2: Summary Risk Table.

Remedial recommendations are presented in Section 9.

9 RECOMMENDATIONS AND REMEDIAL STRATEGY

The recommendations provided below are considered appropriate for the site based on the site investigation work undertaken. LKC should stress that no remediation, enabling works or designing works should take place until Regulatory approval has been obtained.

9.1 Remediation and Validation Recommendations

Table 9-1 details the remedial recommendations / requirements.

PL	Remediation Requirements	Validation Requirements
1 & 7	Made ground varies in depth from 0.4mbgl to 1.0mbgl. The shallower made ground was identified in the west and north of the site. It is understood that due to current and proposed site levels there will be some movement of soil to the rear of the site (west). Given the available information, LKC recommend that the most feasible remediation is as follows: <u>Source Removal</u> Removal of all reworked topsoil / made ground from garden and soft landscaping and raise levels (as required) with suitably chemically validated subsoil and topsoil. If during the remedial work, made ground is found to exceed 300mm in front gardens or 600mm in back garden, it may become more feasible to install a cover system as detailed below. The final decision on the type of remediation will be determined during earthworks, in consultation with LKC. <u>Environmental Cover System</u> Back Gardens: 600mm thick cover comprising: <u>Either</u> 100mm physical break layer (MOT type 1 material, 20-30mm, minimal fines) and at least 500mm comprising clean inert fill and sufficient topsoil for a growing medium. <u>Or</u> geotextile membrane and at least 600mm comprising clean inert fill and sufficient topsoil for a growing medium. Front Gardens: 300mm thick cover comprising: <u>Either</u> 100mm physical break layer (MOT type 1 material, 20-30mm, minimal fines) and at least 200mm comprising clean inert fill and sufficient topsoil for a growing medium. <u>Or</u> geotextile membrane and at least 300mm comprising clean inert fill and sufficient topsoil for a growing medium. A diagram of a typical environmental cover system is shown in Appendix K. Areas of TPO's If there are TPO's in influencing distance of the gardens it is likely the arboriculture officer may only allow a 150mm clean cover system over a geotextile membrane.	Site visits during earthworks and garden dig out to be documented and photographs taken. <u>Source Removal</u> Consignment notes confirming the removal of made ground. Photographic evidence of natural strata. Chemical validation of imported soils: See Table 9-2. <u>Environmental Cover System</u> Measuring depth of environmental cover system using a staff and providing photographic evidence. Photographic evidence of the granular physical break or geotextile layer will also be collected. Chemical validation of imported soils: See Table 9-2.

Table 9-1: Remediation and validation requirements.

Notes: See Table 6-1 for pollutant linkage (PL) details.

PL	Remediation Requirements	Validation Requirements
5	<u>Sulphate Resistant Concrete</u> Sulphate Resistant Concrete in line with DS-2 AC-2 recommended.	N/A
6	<u>Potable Water Pipes</u> Barrier pipe recommended.	Delivery Notes of Pipe Material. Photographs of the Installed Pipe.
Other Considerations	<u>Grubbing Out of In-Ground Structures</u> It is recommended that in-ground structures are grubbed out as part of the groundworks.	
	<u>Re-use of site won material</u> To ensure material is compliant with appropriate waste regulations, any site won material re-used onsite should be in recourse to appropriate exemptions. A U1 and T5 exemption should be registered. This will allow the following: 1,000 tonnes (c. 600m ³) of non-hazardous soil 5,000 tonnes (c. 3,000m ³) of natural sand and gravels. 50,000 tonnes (c. 25,000m ³) of bituminous material to be used in roadways. 5,000 tonnes (c. 3,000m ³) of crushed concrete / stone. It is understood from the client that re-use of material should not exceed that above volumes, therefore a Materials Management Plan (MMP) is not expected to be required.	
	<u>Unexpected Contamination</u> The relevant contractors should be briefed that during development works at the site should any unusual ground conditions and / or visual or olfactory evidence of contamination (including asbestos containing material) be encountered at the site, LKC and the Local Authority should be informed and further assessment of the material may be required. Should asbestos be identified during groundworks, precautions should be taken to ensure the safety of the construction workers and nearby land users. It would be advisable to introduce an asbestos management strategy in line with CIRIA C733 ⁵⁶ .	
	<u>Health and Safety Considerations</u> In working with, removing or treating any contaminating material it is important that any potential risks associated with the actual site works are mitigated by good environmental management of the site during the remedial phases. Standard health and safety precautions (as per HSE guidance ⁵⁷) should be adopted by all workers involved with site enabling and construction works.	

Table 9-1 (continued): Further work, remediation and validation requirements.

Notes: See Table 6-1 for pollutant linkage (PL) details.⁵⁶ CIRIA (2014). "Asbestos in Soil and Made Ground: A Guide to Understanding and Managing Risks". C733.⁵⁷ HSE (1991). "Protection of Workers and the General Public during Development of Contaminated Land" London HMSO.

9.2 Validation of Subsoil / Topsoil

Chemical validation of all imported soils to be used on site in gardens and soft landscaping areas should be undertaken. Imported soils should be accompanied by a certificate of analysis and source details.

A summary of the required imported material sampling requirements are presented in Table 9-2. Ideally, the material should be sampled at source to prevent double handling if soil fails, with confirmatory sampling undertaken on importation to site. However, where this is not possible then material imported should be segregated based on source and soil type. Validation samples should be taken prior to placement in gardens to ensure suitability for use.

Material Type	Source	Suite of Analysis	Sampling Rate*
Topsoil	Greenfield	Suite A	1 sample per 50m³
	Brownfield / Unknown	Suite B	
Subsoil	Brownfield / Unknown	Suite B	1 sample per 150m³
	Site won natural material	Suite A	
		First Generation i.e. quarried sand (subsoil) or stone (break layer)	No testing is required.
Physical Stone Break Layer		Certification of material provenance is required.	
	Recycled Stone (6F2 / screened)	Suite B	1 sample per 500m³

Table 9-2: Sampling requirements for imported 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.

*Minimum sampling rate of 3 samples per source.

Any soil with visual or olfactory evidence of hydrocarbons should be rejected.

In addition, it should be ensured that the matrix of the topsoil is suitable as a growing medium and no undesirable material is present (in line with BS3882⁵⁸). LKC advise this information is provided by the supplier before material is imported onto site.

Imported material to be used in gardens will be compared against residential with plant uptake criteria (as used in the contamination risk assessment (Section 6-1)). Appropriate remedial target criteria are presented in Appendix D.

9.3 Site Completion Report

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

- Provision of waste transfer documents.
- If Source Removal: Validation of any made ground removal (photographic evidence that natural strata was reached).
- Environmental Cover System: Validation of environmental cover system.
- Verification testing of all imported soil for garden areas.
- Information on the installation of protective pipes.
- Details of any unexpected contamination identified onsite, suitably risk assessed and / or validated.

⁵⁸ BS (2015). "Specifications for Topsoil and Requirements for use." BS3882:2015.

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

FIGURES

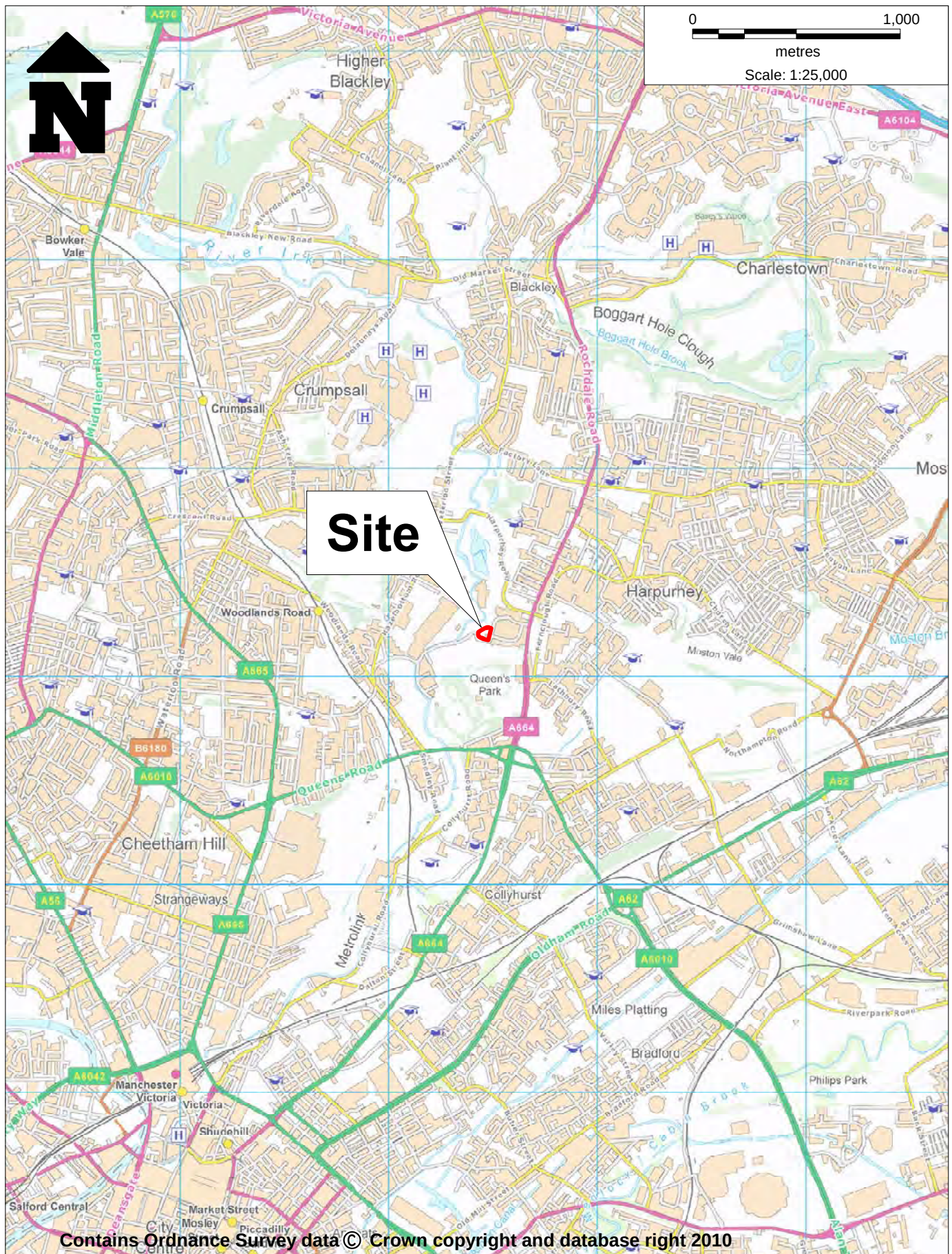
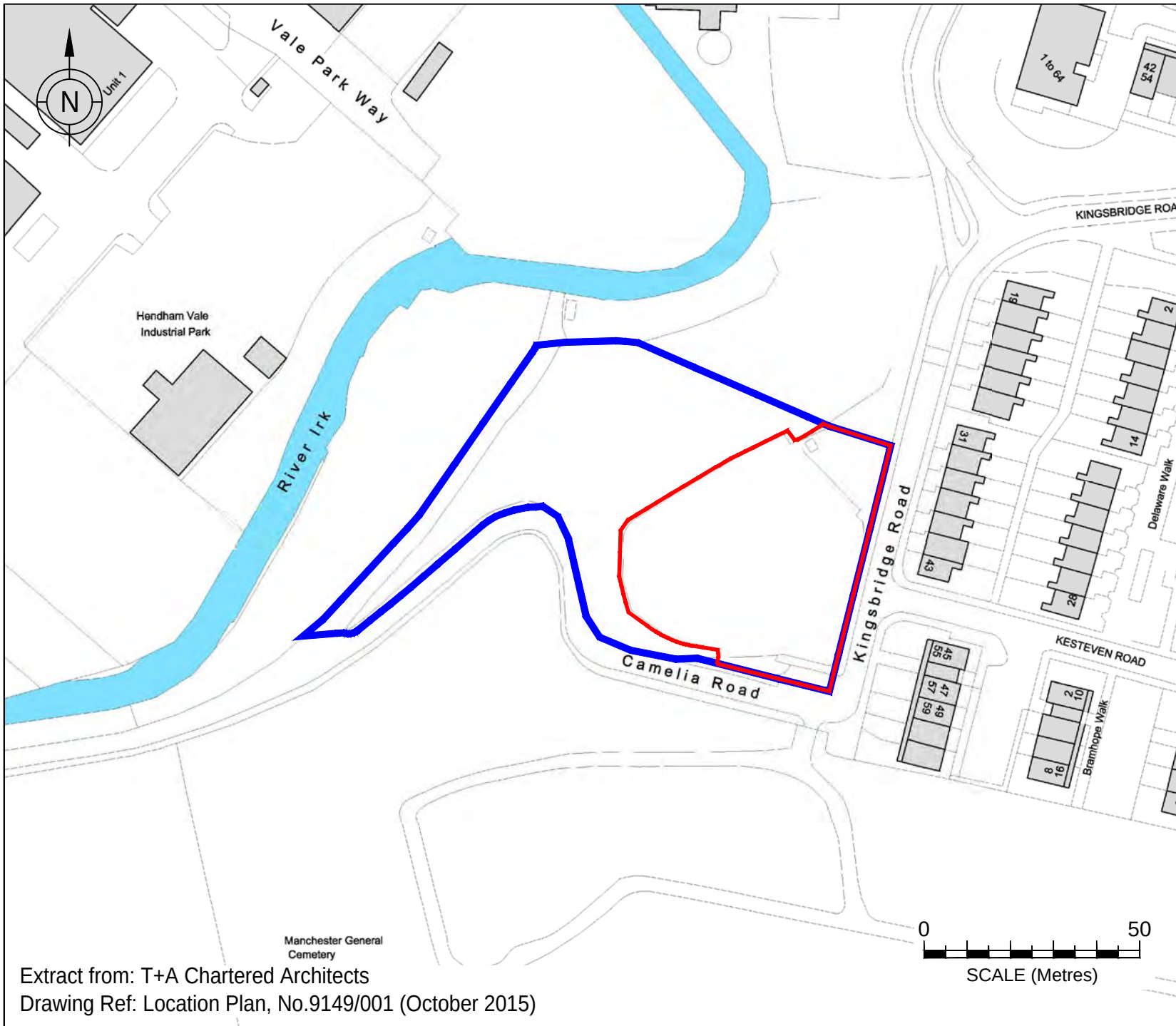


Figure 1: Site Location Plan, Kingsbridge Road, Harpurhey

Drawn: December 2017 Scale: 1:25,000 @ A4 (see scale bar)



KEY

- Development Area Boundary
- 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: Prime Developers Limited

Site: Kingsbridge Road, Harpurhey

Title: Site Boundary Plan

Job No.: LKC 17 1427	Scale (See Scale Bar): 1:1250 @ A4	Figure: 2	Revision:
Drawn By: AC	Checked By: RP	Drawn: Dec 2017	

Extract from: T+A Chartered Architects
Drawing Ref: Location Plan, No.9149/001 (October 2015)

Development Area
Boundary

LK
CONSULT LIMITED

Job No.: LKC 17 1427		Scale (See Scale Bar): 1:500 @ A4		Figure: 3	Revision:
Drawn By: AC	Checked By: RP	Drawn: Dec 2017			

Extract from: DK Architects
Drawing Ref: Proposed Site Plan, No.NK.335.01C, Rev:C (06/07/2015)



- Development Area Boundary
- Window Sample Borehole (WS)
- Hand Dug Trial Pit (HA)

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.



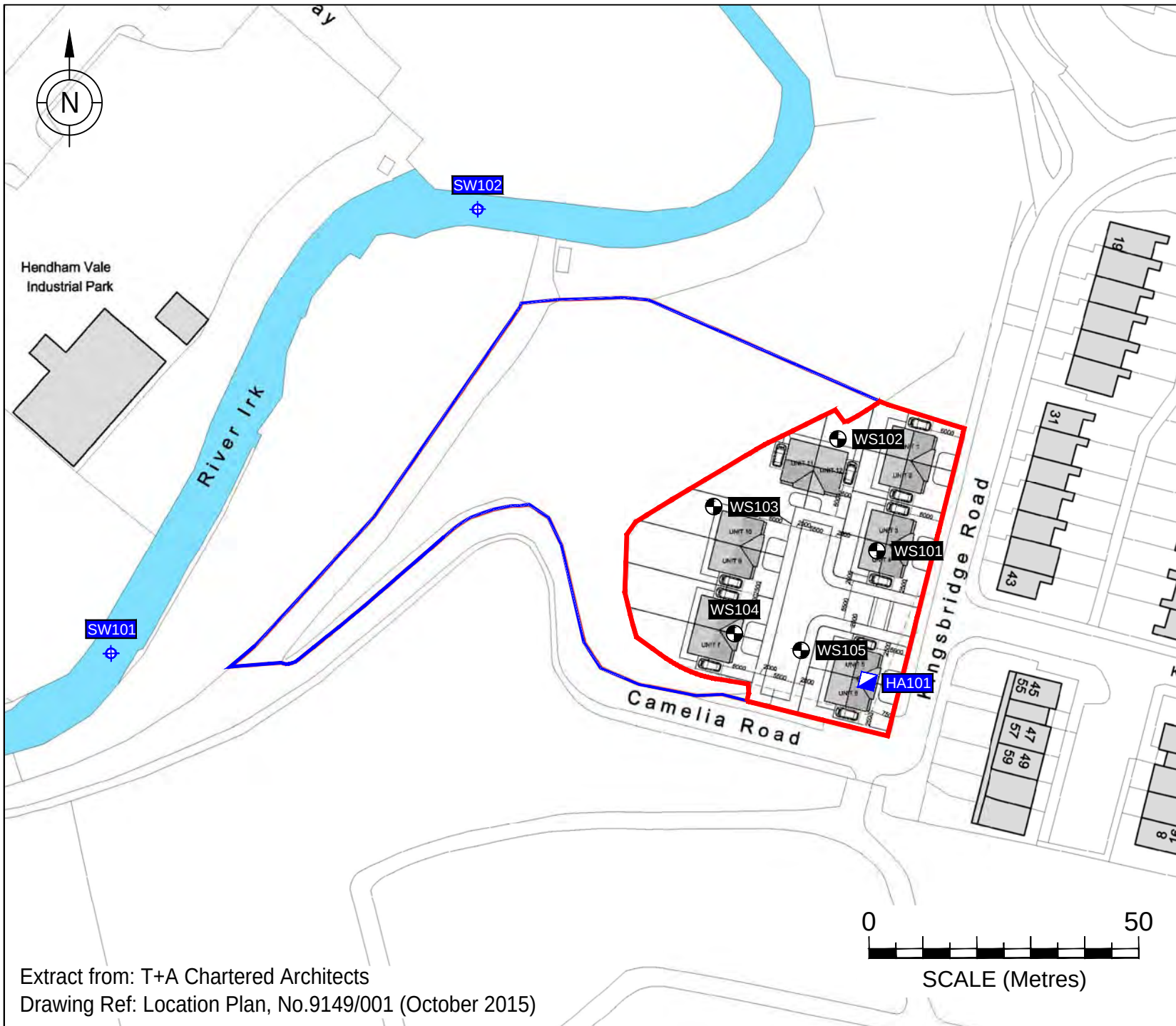
Client: Prime Developers Limited

Site: Kingsbridge Road, Harpurhey

Title: **Site Investigation Location Plan**

Job No.: LKC 17 1427		Scale (See Scale Bar): 1:500 @ A4		Figure: 4	Revision:
Drawn By: AC	Checked By: RP	Drawn: Dec 2017			

Extract from: DK Architects
Drawing Ref: Proposed Site Plan, No.NK.335.01C, Rev:C (06/07/2015)



KEY

-  Development Area Boundary
-  Site Boundary
-  Window Sample Borehole (WS)
-  Hand Dug Trial Pit (HA)
-  Surface Water Sample (SW)

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: Prime Developers Limited

Site: Kingsbridge Road, Harpurhey

Title: Surface Water Samples Plan

Job No.: LKC 17 1427	Scale (See Scale Bar): 1:000 @ A4	Figure: 5	Revision:
Drawn By: AC	Checked By: RP	Drawn: Dec 2017	

Extract from: T+A Chartered Architects
Drawing Ref: Location Plan, No.9149/001 (October 2015)

0 50
SCALE (Metres)

APPENDIX A

SITE RECONNAISSANCE

Site Reconnaissance – Kingsbridge Road, Harpurhey



Photograph 1 (P1)
View looking west towards cleared area in the centre of the site.



Photograph 2 (P2)
Trees and temporary fencing at the western boundary of the development area.



Photograph 3 (P3)
Cleared vegetation and overgrown areas in the southwest of the site.



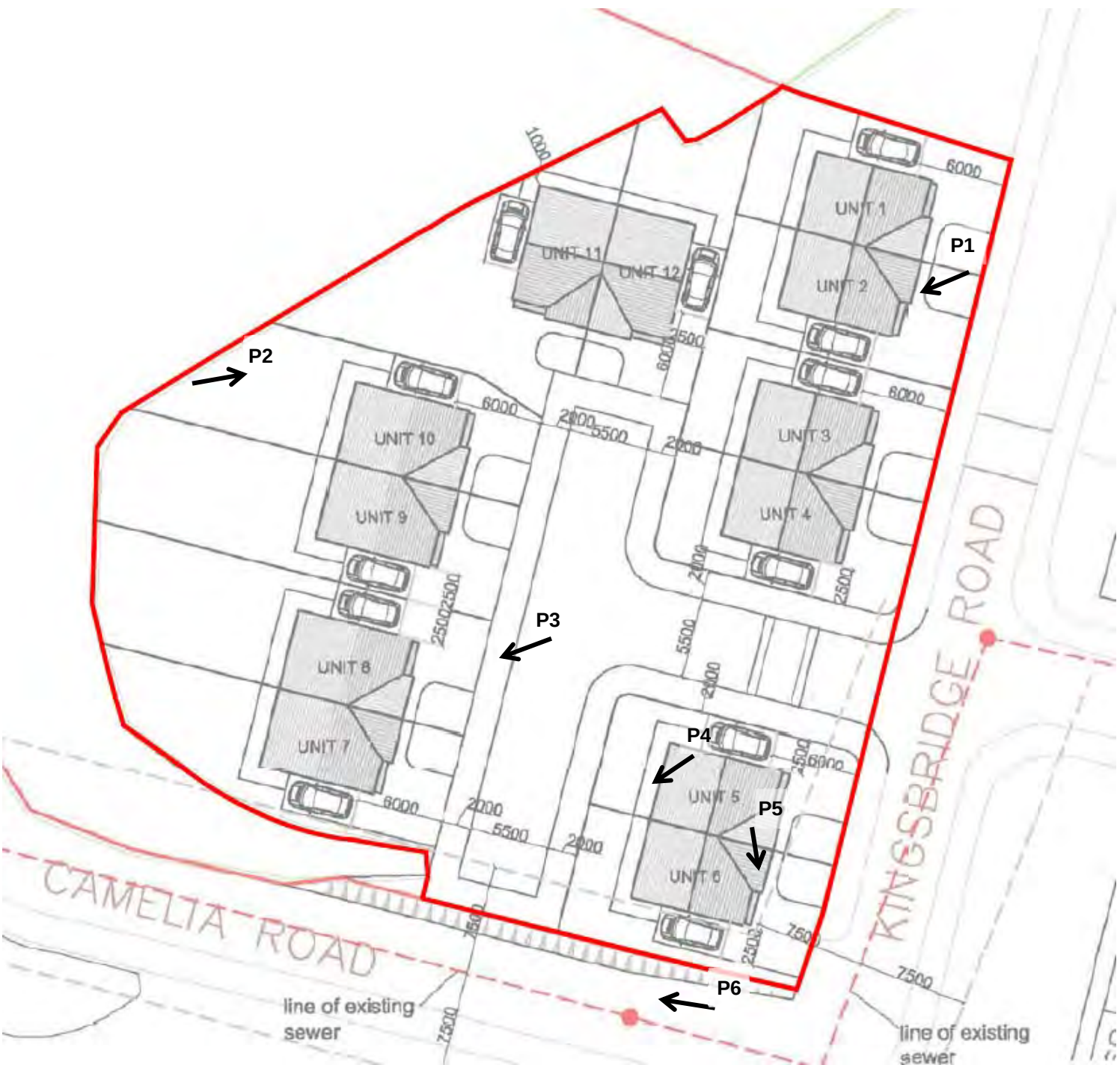
Photograph 4 (P4)
View looking towards the southern boundary of the site showing sloping ground in this area.



Photograph 5 (P5)
Rubbish and fly tipping in the southern corner of the site.



Photograph 6 (P6)
Retaining wall and off-site fly tipping to the south of the site.



Not to scale

APPENDIX B

RISK MATRIX

Risk Evaluation

The method for risk evaluation is a qualitative method of interpreting the output from the risk estimation stage of the assessment, based on CIRIA 552⁵⁹. It involves the classification of the:

- Magnitude of the potential consequence (severity) of the risk occurring (Table A).
- Magnitude of the probability (likelihood) of the risk occurring (Table B).

Consequence (Severity)		
Classification	Definition	Example
Severe	- Short term (acute) risk to human health likely to result in 'significant harm' as defined by the Environment Protection Act 1990, Part IIA. - Short term risk of pollution (note: water Resources Act contains no scope for considering significance of pollution) of sensitive water resource. - Catastrophic damage to buildings/properties. - A short term risk to a particular ecosystem, or organism forming part of such ecosystem (note: the definition of ecological systems within the Draft Circular on Contaminated Land, DETR, 2000).	- High Concentrations of cyanide on the surface of an informal recreation area. - Major spillage of contaminants from site into controlled waters. - Explosion, causing building collapse (can also equate to short term human health risk if buildings are occupied).
Medium	- Chronic damage to Human Health ('significant harm' as defined in DETR, 2000). - Pollution of sensitive water resources (note Water Resources Act contains no scope for considering significance of pollution). - A significant change in a particular ecosystem, or organism forming part of such ecosystem.	- Concentrations of a contaminant from site exceed generic, or site specific assessment criteria. - Leaching of contaminants from a site to a major or minor aquifer (Principal and Secondary). - Death of a species within a designated nature reserve.
Mild	- Pollution of non-sensitive water resources. - Significant damage to crops, buildings, structures and services ('significant harm' as defined in DETR, 2000). - Damage to sensitive buildings/structures/services or the environment.	- Pollution of non-classified groundwater. - Damage to building rendering it unsafe to occupy (e.g. foundation damage resulting in instability).
Minor	- Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. - Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc). - Easily repairable damage to buildings, structures and services.	- The presence of contaminants at such concentrations that protective equipment is required during site works. - The loss of plants in a landscaping scheme. - Discoloration of concrete.

Table A: Classification of Consequence.

Probability (Likelihood)	
Classification	Definition
High Likelihood	- There is a pollutant linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.
Likely	- There is a pollutant linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. - Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low Likelihood	- There is a pollutant linkage and circumstances are possible under which an event could occur. - However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term.
Unlikely	- There is a pollutant linkage but circumstances are such that it is improbable that an event would occur in the very long term.

Table B: Classification of Probability.

⁵⁹ CIRIA C552 (2001) Contaminated Land Risk Assessment - A guide to good practice.

These classifications are then compared to indicate the risk presented by each pollutant linkage (Table C). It is important that this classification is only applied where there is a possibility (which can range from high likelihood to unlikely) of a pollutant linkage existing.

		Consequence			
		Severe	Medium	Mild	Minor
Probability	High Likelihood	Very High Risk	High Risk	Moderate Risk	Moderate / Low Risk
	Likely	High Risk	Moderate Risk	Moderate / Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate / Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate / Low Risk	Low Risk	Very Low Risk	Very Low Risk

Table C: Comparison of Consequence against Probability.

Once the risk has been determined, the corresponding action can be assessed (Table D).

Risk	Action Required
Very High Risk	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not already undertaken) and remediation are likely to be required.
High Risk	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the longer term.
Moderate Risk	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term.
Low Risk	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.
Very Low Risk	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.

Table D: Description of the Classification and Likely Action Required.

Where a very low risk is identified, no specific remediation is required.

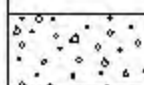
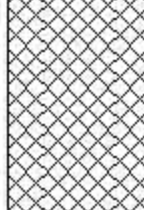
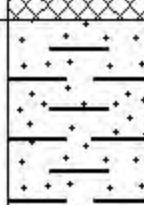
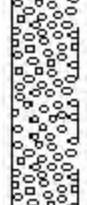
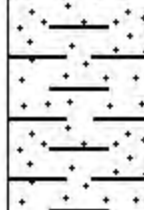
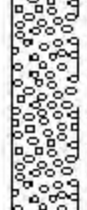
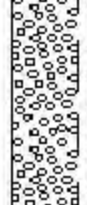
Where a low risk is identified, some form of remediation may be required depending on the pollutant linkage, the type and concentration of contaminants present and the proposed development.

Where there is a moderate/low risk identified, an assessment will be undertaken to establish what category the pollutant linkage will fall into.

Where LKC identifies a moderate or higher risk, remediation or further investigation work is recommended.

APPENDIX C

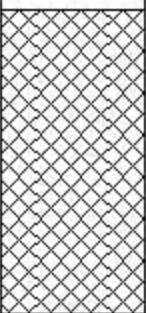
PROFILE LOGS

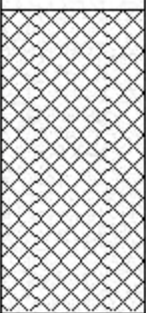
LK GROUP LK CONSULT LTD Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS Tel: 0161 763 7200 web: www.thelkgroup.com					Site Kingsbridge Road, Harpurhey					Number WS101	
Excavation Method Drive-in Windowless Sampler		Dimensions		Ground Level (mOD) 62.70		Client Prime Developers Limited			Job Number LKC 17 1427		
		Location (Observed measurements)		Dates 08/12/2017		Engineer LKC			Sheet 1/1		
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr		
0.30-1.00	D1 PID=0.3ppm			62.50 62.40	(0.20) (0.20) (0.50)	TARMACADAM MADE GROUND: Yellowish brown coarse sandstone flagstone.	 		 		
1.00-2.00 1.00-2.00 1.20-1.65	B2 D3 PID=0.1ppm SPT N=14		3,3/3,3,4,4	61.70	(0.70) 1.00	MADE GROUND: Dark brown gravelly sandy CLAY with gravel sized fragments of frequent brick, occasional ceramic and tarmac. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular, of sandstone. Faint bitumen odour. Stiff consistency medium strength brown and grey mottled very sandy CLAY. Sand is fine to medium. Friable.					
2.00 2.00-2.45 2.00-3.00	SV 40kPa SPT N=21 B4		4,4/4,5,6,6			Slightly gravelly from 2.0m. Gravel is fine, subangular, of mudstone.					
3.00-3.45 3.00-4.00	SPT N=20 B5		3,4/4,5,5,6		(4.45)						
4.00-4.45	SPT N=23		3,4/4,5,7,7								
5.00-5.45	SPT N=20		3,3/4,5,5,6	57.25	5.45	Complete at 5.45m					
Remarks Borehole dry. Borehole complete at 5.45m.							Scale (approx) 1:40	Logged By KC	Figure No. LKC 17 1427.WS101		

LK GROUP LK CONSULT LTD Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS Tel: 0161 763 7200 web: www.thelkgroup.com					Site Kingsbridge Road, Harpurhey			Number WS102	
Excavation Method Drive-in Windowless Sampler		Dimensions		Ground Level (mOD) 62.50		Client Prime Developers Limited		Job Number LKC 17 1427	
		Location (Observed measurements)		Dates 08/12/2017		Engineer LKC		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-0.50	D1 PID=0.2ppm				(0.50)	MADE GROUND: Black slightly gravelly clayey SAND with frequent rootlets and gravel sized fragments of occasional ash and clinker, rare brick, slate and ceramic. Sand is fine to coarse. Gravel is fine to coarse, subangular, of sandstone and mudstone.			
0.50-1.00	D2 PID=0.0ppm			62.00	0.50				
1.00-2.00 1.20 1.20-1.65	B3 SV 40kPa SPT N=11		2,3/3,3,3,2		(1.60)	Firm becoming stiff consistency medium strength brown and grey mottled very sandy CLAY with frequent rootlets. Sand is fine to medium. Dry and friable.			
2.00 2.00-2.45 2.00-3.00	SV 70kPa SPT N=12 B4		2,3/3,3,3,3	60.40	2.10	Stiff consistency high strength slightly gravelly sandy CLAY. Sand is fine to medium. Gravel is fine to medium, subangular to subrounded, of sandstone and mudstone.			
3.00 3.00-3.45 3.00-4.00	SV 100kPa SPT N=12 B5		3,3/3,3,3,3		(3.35)				
4.00-4.45	SPT N=15		3,3/3,4,4,4						
5.00-5.45	SPT N=18		3,3/4,4,5,5						
				57.05	5.45	Complete at 5.45m			
Remarks Borehole dry Borehole complete at 5.45m.							Scale (approx) 1:40	Logged By KC	
							Figure No. LKC 17 1427.WS102		

LK GROUP LK CONSULT LTD Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS Tel: 0161 763 7200 web: www.thelkgroup.com					Site Kingsbridge Road, Harpurhey			Number WS103	
Excavation Method Drive-in Windowless Sampler		Dimensions		Ground Level (mOD) 62.00		Client Prime Developers Limited		Job Number LKC 17 1427	
		Location (Observed measurements)		Dates 08/12/2017		Engineer LKC		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-0.40	D1 PID=0.2ppm				(0.40)	MADE GROUND: Dark brown slightly gravelly slightly sandy CLAY with frequent rootlets and gravel sized fragments of rare brick. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded, of mudstone and sandstone.			
0.40-1.00 0.40-1.00	B2 D3 PID=0.1ppm			61.60	0.40	Stiff becoming very stiff consistency high strength slightly gravelly very sandy CLAY with orange mottling and frequent rootlets to 2.0m, rare sandstone and mudstone cobbles. Sand is fine to medium. Gravel is fine to medium, subrounded, of sandstone and mudstone.			
1.00-2.00 1.20 1.20-1.65	B4 SV 70kPa SPT N=13		3,3/3,3,3,4						
2.00 2.00-2.45 2.00-3.00	SV 105kPa SPT N=15 B5		2,3/3,4,4,4						
3.00-3.45 3.00-4.00	SPT N=16 B6		3,3/3,4,4,5		(5.05)				
4.00-4.45	SPT N=22		3,4/4,5,6,7						
5.00-5.45	SPT N=23		3,4/4,6,6,7						
				56.55	5.45	Complete at 5.45m			
Remarks Borehole complete at 5.45m. Borehole dry.							Scale (approx) 1:40	Logged By KC	Figure No. LKC 17 1427.WS103

LK GROUP LK CONSULT LTD Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS Tel: 0161 763 7200 web: www.thelkgroup.com					Site Kingsbridge Road, Harpurhey			Number WS104	
Excavation Method Drive-in Windowless Sampler		Dimensions		Ground Level (mOD) 62.70		Client Prime Developers Limited		Job Number LKC 17 1427	
		Location (Observed measurements)		Dates 08/12/2017		Engineer LKC		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-0.50	D1 PID=0.1ppm			62.20	(0.50)	MADE GROUND: Black sandy clayey GRAVEL with frequent rootlets and gravel sized fragments of brick and tarmac. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular, of sandstone.			
0.50-1.00 0.50-1.00	B2 D3 PID=0.1ppm				0.50	Stiff consistency medium strength brown sandy CLAY with orange and grey mottling to 1.0m and frequent rootlets. Sand is fine to medium.			
1.00-2.00 1.20-1.65	B4 SPT N=10		1,1/2,2,3,3						
2.00 2.00-2.45 2.00-3.00	SV 70kPa SPT N=9 B5		Water Strike(1) at 1.80m. 3,2/2,2,2,3			Coarse sand bands of approximately 5.0cm thickness present from 1.8m.		▽1	
3.00-3.45	SPT N=16		2,2/3,3,5,5		(4.95)				
4.00-4.45	SPT N=27		6,6/6,7,7,7						
5.00-5.45	SPT N=31		7,7/8,6,8,9						
				57.25	5.45	Complete at 5.45m			
Remarks Water strike recorded at 1.8m. Borehole complete at 5.45m. Borehole collapsing from 2.8m, installation only possible to this depth.							Scale (approx) 1:40	Logged By KC	Figure No. LKC 17 1427.WS104

 LK CONSULT LTD Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS Tel: 0161 763 7200 web: www.thelkgroup.com					Site Kingsbridge Road, Harpurhey		Number WS105		
Excavation Method Drive-in Windowless Sampler		Dimensions		Ground Level (mOD) 62.50		Client Prime Developers Limited		Job Number LKC 17 1427	
		Location (Observed measurements)		Dates 08/12/2017		Engineer LKC		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
0.00-0.80	D1 PID=0.3ppm			61.70	(0.80) 0.80	MADE GROUND: Dark brown gravelly sandy CLAY with frequent rootlets and gravel sized fragments of brick, occasional slate, glass and concrete, rare tarmac, slate, ceramic and timber. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular, of sandstone and mudstone. Concrete slabs encountered at 0.8m. Terminated at 0.80m			
Remarks Borehole dry. Borehole terminated at 0.8m, concrete slab encountered.						Scale (approx) 1:40		Logged By KC	
						Figure No. LKC 17 1427.WS105			

 LK CONSULT LTD Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS Tel: 0161 763 7200 web: www.thelkgroup.com					Site Kingsbridge Road, Harpurhey		Trial Pit Number HA101		
Excavation Method Hand Dug Pit		Dimensions		Ground Level (mOD) 61.50		Client Prime Developers Limited		Job Number LKC 17 1427	
		Location (Observed measurements)		Dates 08/12/2017		Engineer LKC		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
0.00-0.80	D1 PID=1.5ppm			60.70		MADE GROUND: Dark brown gravelly sandy CLAY with gravel sized fragments of frequent brick, occasional timber, slate, concrete and glass, rare ceramic and plastic. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular, of sandstone and mudstone.			
					0.80	Complete at 0.80m			



Remarks
 Trial pit dry.
 Trial pit complete at 0.8m.

Scale (approx)
 1:40

Logged By
 KC

Figure No.
 LKC 17 1427.HA101

APPENDIX D

CERTIFICATE OF ANALYSIS – SOIL



Final Report

Report No.: 17-33120-1

Initial Date of Issue: 15-Dec-2017

Client LK Consult

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

Contact(s): Contaminated Land
Rachel Peart

Project LKC 17 1427 Kingsbridge Road,
Harpurhey

Quotation No.:

Order No.: 735841

No. of Samples: 10

Turnaround (Wkdays): 3

Date Approved: 15-Dec-2017

Date Received: 12-Dec-2017

Date Instructed: 12-Dec-2017

Results Due: 14-Dec-2017

Approved By:

Details: Robert Monk, Technical Manager

Results - Soil

Client: LK Consult	Chemtest Job No.:				17-33120	17-33120	17-33120	17-33120	17-33120	17-33120	17-33120	17-33120
Quotation No.:	Chemtest Sample ID.:				553138	553139	553140	553141	553142	553143	553144	553145
	Client Sample ID.:				WS101	WS101	WS102	WS102	WS103	WS103	WS104	WS104
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.30	1.00	0.00	0.50	0.00	0.40	0.0	0.50
	Bottom Depth (m):				1.00	2.00	0.50	1.00	0.40	1.00	0.50	1.00
	Date Sampled:				08-Dec-2017	08-Dec-2017	08-Dec-2017	08-Dec-2017	08-Dec-2017	08-Dec-2017	08-Dec-2017	08-Dec-2017
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	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	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	13	8.5	15	13	17	13	7.4	14
Soil Colour	N	2040		N/A	Orange	Brown	Black	Brown	Black	Brown	Black	Brown
Other Material	N	2040		N/A	Stones	NONE	Stones	Stones	Stones	Stones	Stones, Roots	Stones
Soil Texture	N	2040		N/A	Cobbles	Clay	Loam	Cobbles	Loam	Cobbles	Loam	Cobbles
Chromatogram (TPH)	N			N/A	See Attached	See Attached						
pH	M	2010		N/A	9.4	8.4	6.2	6.2	5.8	5.9	8.3	7.8
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	1.8	< 0.40						
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	1.3	0.049	< 0.010	< 0.010	< 0.010	0.026	< 0.010	0.068
Cyanide (Free)	M	2300	mg/kg	0.50	< 0.50	< 0.50						
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50	< 0.50						
Arsenic	M	2450	mg/kg	1.0	11	7.9	42	8.9	21	5.1	47	9.3
Cadmium	M	2450	mg/kg	0.10	0.17	0.15	0.46	< 0.10	0.20	< 0.10	0.51	< 0.10
Chromium	M	2450	mg/kg	1.0	12	22	16	26	15	21	8.0	23
Copper	M	2450	mg/kg	0.50	18	24	64	27	42	23	28	25
Mercury	M	2450	mg/kg	0.10	1.6	< 0.10	28	1.0	14	1.4	0.60	< 0.10
Nickel	M	2450	mg/kg	0.50	15	32	22	30	21	27	9.5	37
Lead	M	2450	mg/kg	0.50	77	15	210	20	120	16	120	18
Selenium	M	2450	mg/kg	0.20	< 0.20	< 0.20	0.43	< 0.20	0.24	< 0.20	< 0.20	< 0.20
Vanadium	U	2450	mg/kg	5.0	20	26	26	28	25	23	14	26
Zinc	M	2450	mg/kg	0.50	38	57	340	75	69	50	51	60
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	1.7	1.1	7.4	0.74	6.2	1.3	5.9	1.1
Fuel Type	N	2670		N/A	N/A	N/A						
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0						
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0						
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0						
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0						
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0						
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0						
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0						
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0						
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0						
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0						
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0						
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0						

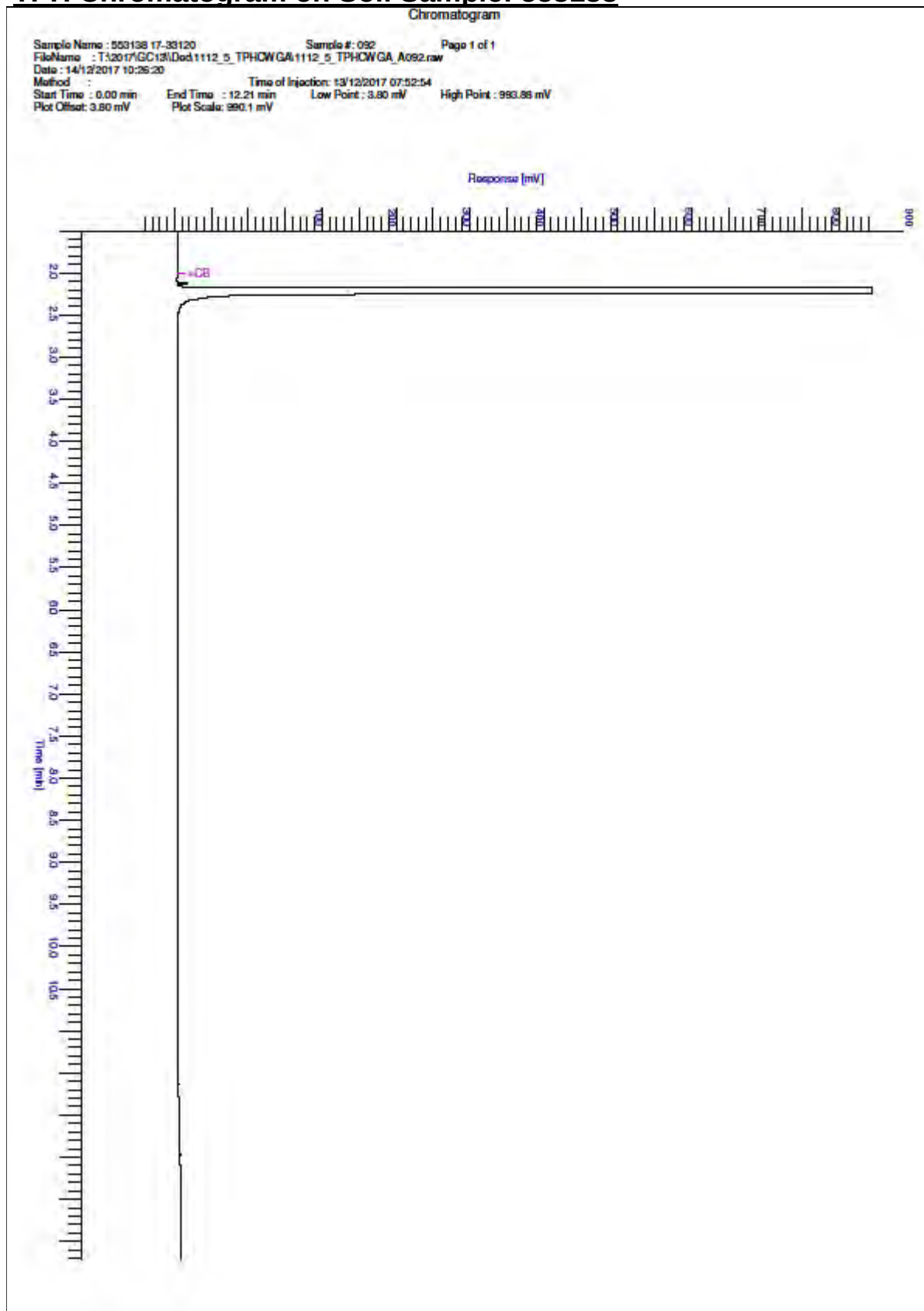
Results - Soil

Client: LK Consult	Chemtest Job No.:				17-33120	17-33120	17-33120	17-33120	17-33120	17-33120	17-33120	17-33120
Quotation No.:	Chemtest Sample ID.:				553138	553139	553140	553141	553142	553143	553144	553145
	Client Sample ID.:				WS101	WS101	WS102	WS102	WS103	WS103	WS104	WS104
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.30	1.00	0.00	0.50	0.00	0.40	0.0	0.50
	Bottom Depth (m):				1.00	2.00	0.50	1.00	0.40	1.00	0.50	1.00
	Date Sampled:				08-Dec-2017	08-Dec-2017	08-Dec-2017	08-Dec-2017	08-Dec-2017	08-Dec-2017	08-Dec-2017	08-Dec-2017
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD								
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0						
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0						
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0						
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0						
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0						
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0						
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10						
Benzene	M	2760	µg/kg	1.0	< 1.0	< 1.0						
Toluene	M	2760	µg/kg	1.0	< 1.0	< 1.0						
Ethylbenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0						
m & p-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0						
o-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0						
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	< 1.0	< 1.0						
Naphthalene	M	2800	mg/kg	0.10	0.62	< 0.10	0.25	< 0.10	0.24	< 0.10	0.35	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.14	< 0.10
Acenaphthene	M	2800	mg/kg	0.10	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	M	2800	mg/kg	0.10	0.53	< 0.10	0.58	< 0.10	0.37	< 0.10	0.66	< 0.10
Anthracene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.11	< 0.10	< 0.10	< 0.10	0.16	< 0.10
Fluoranthene	M	2800	mg/kg	0.10	0.65	< 0.10	1.3	< 0.10	0.57	< 0.10	1.3	< 0.10
Pyrene	M	2800	mg/kg	0.10	0.56	< 0.10	1.3	< 0.10	0.63	< 0.10	1.8	< 0.10
Benzo[a]anthracene	M	2800	mg/kg	0.10	0.10	< 0.10	0.41	< 0.10	0.10	< 0.10	0.85	< 0.10
Chrysene	M	2800	mg/kg	0.10	0.11	< 0.10	0.53	< 0.10	0.13	< 0.10	0.65	< 0.10
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.50	< 0.10	< 0.10	< 0.10	3.3	< 0.10
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.15	< 0.10	< 0.10	< 0.10	0.88	< 0.10
Benzo[a]pyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.34	< 0.10	< 0.10	< 0.10	3.0	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.15	< 0.10	< 0.10	< 0.10	2.1	< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.31	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.30	< 0.10	< 0.10	< 0.10	2.3	< 0.10
Total Of 16 PAH's	N	2800	mg/kg	2.0	2.7	< 2.0	5.9	< 2.0	2.0	< 2.0	18	< 2.0
Total Phenols	M	2920	mg/kg	0.30	< 0.30	< 0.30						

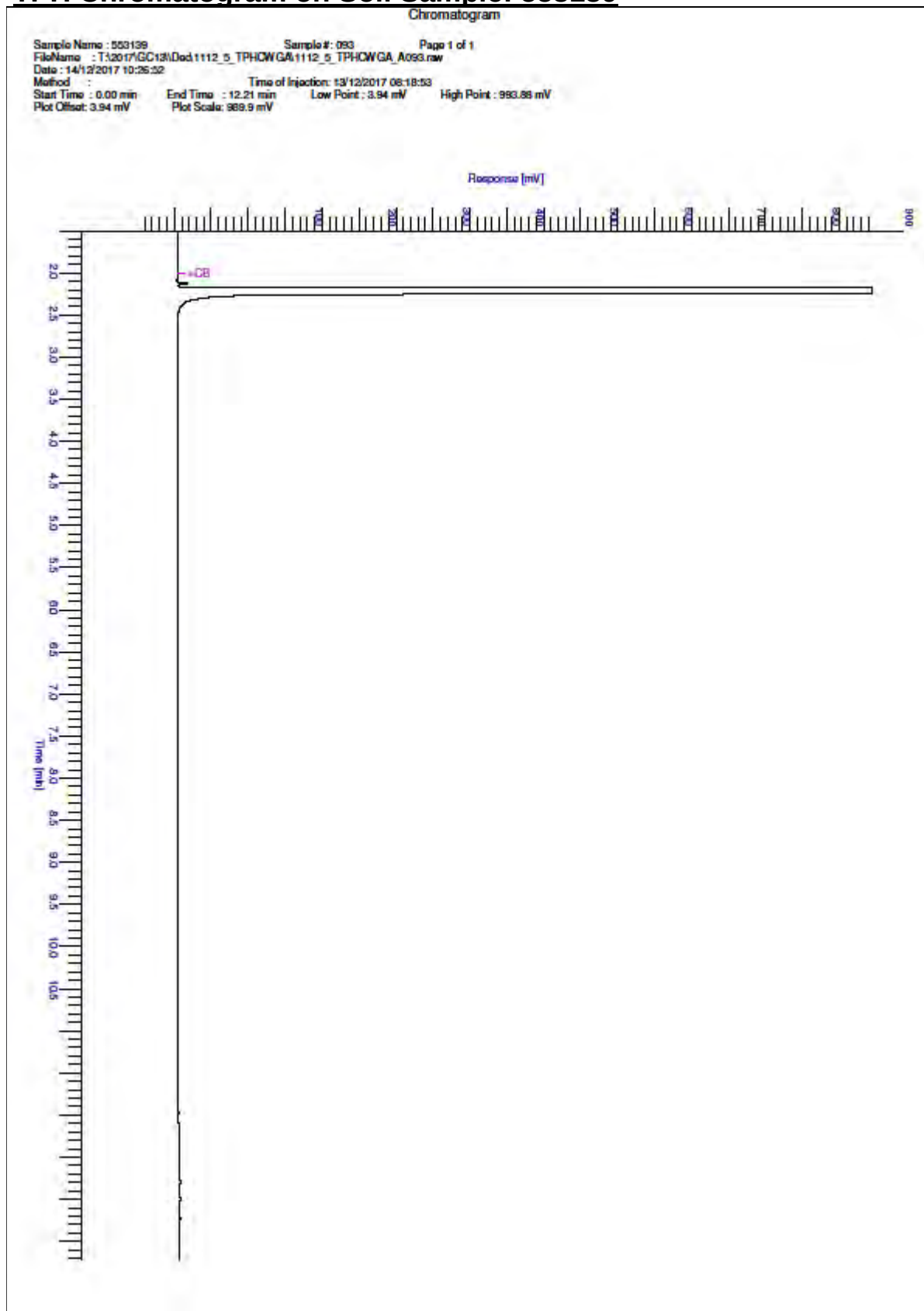
Client: LK Consult	Chemtest Job No.:				17-33120	17-33120
Quotation No.:	Chemtest Sample ID.:				553146	553147
	Client Sample ID.:				WS105	HA101
	Sample Type:				SOIL	SOIL
	Top Depth (m):				0.0	0.0
	Bottom Depth (m):				0.80	0.80
	Date Sampled:				08-Dec-2017	08-Dec-2017
	Asbestos Lab:				COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD		
ACM Type	U	2192		N/A	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	19	19
Soil Colour	N	2040		N/A	Black	Black
Other Material	N	2040		N/A	Stones	Stones, Roots
Soil Texture	N	2040		N/A	Loam	Loam
Chromatogram (TPH)	N			N/A	See Attached	
pH	M	2010		N/A	8.2	8.9
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	1.0	
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	0.22	0.10
Cyanide (Free)	M	2300	mg/kg	0.50	< 0.50	
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50	
Arsenic	M	2450	mg/kg	1.0	22	32
Cadmium	M	2450	mg/kg	0.10	0.62	1.5
Chromium	M	2450	mg/kg	1.0	29	150
Copper	M	2450	mg/kg	0.50	68	530
Mercury	M	2450	mg/kg	0.10	0.95	2.7
Nickel	M	2450	mg/kg	0.50	21	38
Lead	M	2450	mg/kg	0.50	420	480
Selenium	M	2450	mg/kg	0.20	< 0.20	0.34
Vanadium	U	2450	mg/kg	5.0	24	24
Zinc	M	2450	mg/kg	0.50	210	1300
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50
Organic Matter	M	2625	%	0.40	6.9	5.7
Fuel Type	N	2670		N/A	PAH	
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	3.1	
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	

Client: LK Consult	Chemtest Job No.:				17-33120	17-33120
Quotation No.:	Chemtest Sample ID.:				553146	553147
	Client Sample ID.:				WS105	HA101
	Sample Type:				SOIL	SOIL
	Top Depth (m):				0.0	0.0
	Bottom Depth (m):				0.80	0.80
	Date Sampled:				08-Dec-2017	08-Dec-2017
	Asbestos Lab:				COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD		
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	8.4	
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	340	
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	350	
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	350	
Benzene	M	2760	µg/kg	1.0	< 1.0	
Toluene	M	2760	µg/kg	1.0	< 1.0	
Ethylbenzene	M	2760	µg/kg	1.0	< 1.0	
m & p-Xylene	M	2760	µg/kg	1.0	< 1.0	
o-Xylene	M	2760	µg/kg	1.0	< 1.0	
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	< 1.0	
Naphthalene	M	2800	mg/kg	0.10	0.54	0.26
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10
Acenaphthene	M	2800	mg/kg	0.10	0.31	< 0.10
Fluorene	M	2800	mg/kg	0.10	0.25	< 0.10
Phenanthrene	M	2800	mg/kg	0.10	3.1	1.0
Anthracene	M	2800	mg/kg	0.10	0.72	0.21
Fluoranthene	M	2800	mg/kg	0.10	4.7	1.5
Pyrene	M	2800	mg/kg	0.10	4.3	1.6
Benzo[a]anthracene	M	2800	mg/kg	0.10	2.3	0.64
Chrysene	M	2800	mg/kg	0.10	2.2	0.78
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	3.3	0.63
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	1.1	0.15
Benzo[a]pyrene	M	2800	mg/kg	0.10	2.7	0.55
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	1.8	0.31
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	0.23	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	1.8	0.36
Total Of 16 PAH's	N	2800	mg/kg	2.0	29	8.0
Total Phenols	M	2920	mg/kg	0.30	< 0.30	

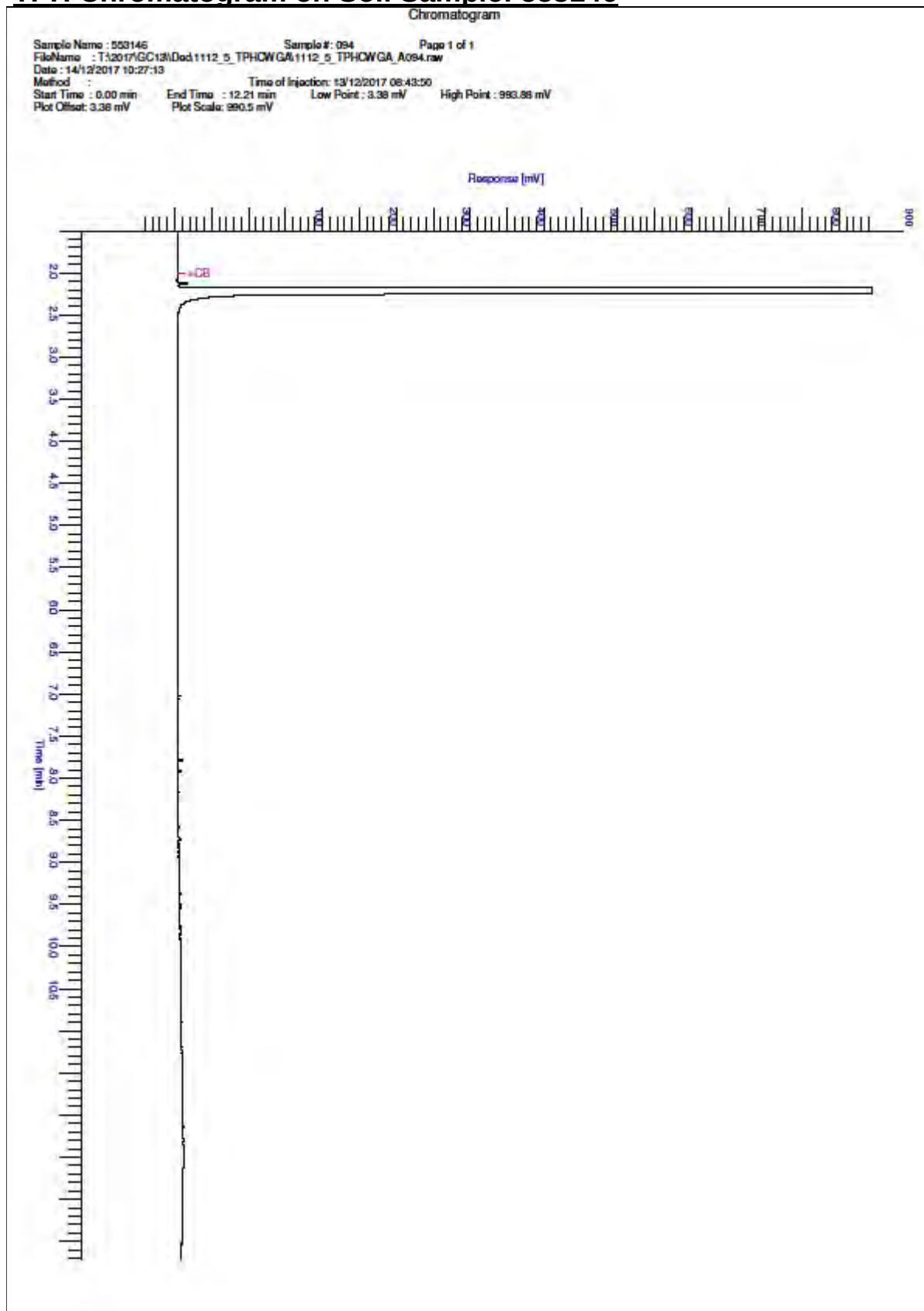
TPH Chromatogram on Soil Sample: 553138



TPH Chromatogram on Soil Sample: 553139



TPH Chromatogram on Soil Sample: 553146



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.

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

APPENDIX E

CERTIFICATE OF ANALYSIS – WATER



2183

Final Report

Report No.: 17-33522-1

Initial Date of Issue: 19-Dec-2017

Client LK Consult

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

Contact(s): Rachel Peart
Contaminated Land

Project LKC 17 1427 - Kingsbridge Road,
Harpurhey

Quotation No.:		Date Received:	15-Dec-2017
Order No.:	735848	Date Instructed:	15-Dec-2017
No. of Samples:	4		
Turnaround (Wkdays):	3	Results Due:	19-Dec-2017
Date Approved:	19-Dec-2017		

Approved By:



Details: Martin Dyer, Laboratory Manager

Project: LKC 17 1427 - Kingsbridge Road, Harpurhey

Client: LK Consult	Chemtest Job No.:				17-33522	17-33522	17-33522	17-33522
Quotation No.:	Chemtest Sample ID.:				555101	555102	555103	555104
	Client Sample ID.:				WS101	WS104	SW101	SW102
	Sample Type:				WATER	WATER	WATER	WATER
	Date Sampled:				14-Dec-2017	14-Dec-2017	14-Dec-2017	14-Dec-2017
Determinand	Accred.	SOP	Units	LOD				
pH	U	1010		N/A	8.0	7.7	7.6	7.6
Sulphate	U	1220	mg/l	1.0	130	75	31	29
Cyanide (Total)	U	1300	mg/l	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Cyanide (Free)	U	1300	mg/l	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Total Hardness as CaCO ₃	U	1270	mg/l	15	340	220	120	110
Arsenic (Dissolved)	U	1450	µg/l	1.0	6.6	4.2	2.3	2.5
Boron (Dissolved)	U	1450	µg/l	20	110	36	33	37
Cadmium (Dissolved)	U	1450	µg/l	0.080	< 0.080	< 0.080	< 0.080	< 0.080
Chromium (Dissolved)	U	1450	µg/l	1.0	96	12	4.8	8.0
Copper (Dissolved)	U	1450	µg/l	1.0	19	8.8	4.3	5.1
Nickel (Dissolved)	U	1450	µg/l	1.0	11	4.1	2.0	2.1
Lead (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	1.9	2.1
Selenium (Dissolved)	U	1450	µg/l	1.0	18	3.0	1.0	< 1.0
Zinc (Dissolved)	U	1450	µg/l	1.0	14	11	25	26
Mercury Low Level	U	1460	µg/l	0.010	< 0.010	0.016	0.28	0.83
Chromium (Hexavalent)	U	1490	µg/l	20	< 20	< 20	< 20	< 20
Total Organic Carbon	U	1610	mg/l	2.0	22	14	15	17
Fuel Type	N	1670		N/A	N/A	N/A	N/A	N/A
Aliphatic TPH >C5-C6	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C6-C8	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C8-C10	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C10-C12	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C16-C21	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C21-C35	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C35-C44	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	N	1675	µg/l	5.0	< 5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C7-C8	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C8-C10	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C10-C12	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C12-C16	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C16-C21	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C21-C35	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C35-C44	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Aromatic Hydrocarbons	N	1675	µg/l	5.0	< 5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	1675	µg/l	10	< 10	< 10	< 10	< 10
Benzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0

Project: LKC 17 1427 - Kingsbridge Road, Harpurhey

Client: LK Consult	Chemtest Job No.:				17-33522	17-33522	17-33522	17-33522
Quotation No.:	Chemtest Sample ID.:				555101	555102	555103	555104
	Client Sample ID.:				WS101	WS104	SW101	SW102
	Sample Type:				WATER	WATER	WATER	WATER
	Date Sampled:				14-Dec-2017	14-Dec-2017	14-Dec-2017	14-Dec-2017
Determinand	Accred.	SOP	Units	LOD				
m & p-Xylene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methyl Tert-Butyl Ether	N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Naphthalene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Acenaphthylene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Acenaphthene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Fluorene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Phenanthrene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Anthracene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Fluoranthene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Pyrene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[a]anthracene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Chrysene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[b]fluoranthene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[k]fluoranthene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[a]pyrene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Indeno(1,2,3-c,d)Pyrene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Dibenz(a,h)Anthracene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[g,h,i]perylene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Of 16 PAH's	N	1800	µg/l	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Total Phenols	U	1920	mg/l	0.030	< 0.030	< 0.030	< 0.030	< 0.030

SOP	Title	Parameters included	Method summary
1010	pH Value of Waters	pH	pH Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1270	Total Hardness of Waters	Total hardness	Calculation applied to calcium and magnesium results, expressed as mg l ⁻¹ CaCO ₃ equivalent.
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.
1415	Cations in Waters by ICP-MS	Sodium; Potassium; Calcium; Magnesium	Direct determination by inductively coupled plasma - mass spectrometry (ICP-MS).
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1460	Mercury low-level in Waters by AFS	Mercury	Atomic Fluorescence Spectrometry, with collimated UV source, wavelength 253.7 nm.
1490	Hexavalent Chromium in Waters	Chromium [VI]	Automated colorimetric analysis by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazine.
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1670	Total Petroleum Hydrocarbons (TPH) in Waters by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO	Pentane extraction / GC FID detection
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35–C44 Aromatics: >C5–C7, >C7–C8, >C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35–C44	Pentane extraction / GCxGC FID detection
1760	Volatile Organic Compounds (VOCs) in Waters by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics. (cf. USEPA Method 8260)	Automated headspace gas chromatographic (GC) analysis of water samples with mass spectrometric (MS) detection of volatile organic compounds.
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[a,h]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.

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

APPENDIX F

GAS MONITORING RESULTS



LK CONSULT LTD

GAS MONITORING RECORD

SITE	Kingsbridge Road, Harpurhey
REF	LKC 17 1427
DATE	3-Jan-2018
STAFF	KC
VISIT	2 of 6

EQUIPMENT*1		
Instrument / Model Type	Serial Number	Comments
Geotechnical Instruments GA5000	G502417	Serviced, calibrated & gas checked.
Geotech dipmeter	79864	Operating Normally

ATMOSPHERIC / GROUND CONDITIONS	
Atmospheric Pressure Trend on Site	Rising
Atmospheric Pressure (Prev 24hrs)	Falling
Weather Conditions	Cloudy, cold, windy
Ground Conditions	Wet

Borehole ID	Date/Time	CH4 (% v/v)	CO2 (% v/v)	O2 (% v/v)	Peak CH4 (% v/v)	Peak CO2 (% v/v)	% of Lower Explosive Limit*2	CO Pod (ppm)	H2S Pod (ppm)	Balance (%)	Barometric Pressure (mb)	Internal Flow *3 (ltr/hr)	Standing Water Level (mbgl)	Installation Base Dip (mbgl)	Notes
WS101	03/01/2018 11:05	0.2	0.1	20.1	0.2	0.2	4.0	0.0	0.0	79.6	980	-0.1	0.78	3.75	
WS102	03/01/2018 11:00	UR	UR	UR	UR	UR	UR	UR	UR	UR	UR	UR	UR	UR	Borehole inaccessible, unable to monitor.
WS103	03/01/2018 11:15	0.2	1.4	18.7	0.2	1.4	4.0	0.0	0.0	79.7	981	0.0	1.24	4.01	
WS104	03/01/2018 11:29	0.2	0.1	20.4	0.2	0.1	4.0	0.0	0.0	79.3	982	0.2	0.25	2.83	

ABBREVIATIONS

*1	Refer to Note 1
ND	Not detected
NR	Not recorded
UR	Unable to record
OS	Off recordable scale
N/A	Not applicable
% v/v	Percentage volume by total volume

ppm	Parts per million
mb	Millibars
ltr/hr	Litres per hour
mbgl	Metres below ground level
LEL	Lower explosive limit in air
OEL	Occupational exposure limit

NOTES

- Equipment is serviced and checked as recommended by the manufacturer. Refer to calibration records. and service certificates.
- CH4 is explosive between the range of 5 - 15% v/v. 100% lower explosive limit is equal to 5% v/v CH4.
- Flow readings are based on a 1 minute average value where flow is detected (equipment range of +/- 12 ltr/hr)
- After CIRIA C665. GSV = gas concentration (%) x flow rate. Peak CH4 and Steady CO2 values used.
- Monitoring is carried out in line with procedures set by LKC Ltd with reference to CIRIA C665. Refer to procedural documents



ATMOSPHERIC / GROUND CONDITIONS	
Atmospheric Pressure Trend on Site	Steady
Atmospheric Pressure (Prev 24hrs)	Rising
Weather Conditions	Sunny, cool, breezy
Ground Conditions	Wet

1. Equipment is serviced and checked as recommended by the manufacturer. Refer to calibration records, and service certificates.
2. CH4 is explosive between the range of 5 - 15% v/v. 100% lower explosive limit is equal to 5% v/v CH4.
3. Flow readings are based on a 1 minute average value where flow is detected (equipment range of +/- 12 ltr/hr)
4. After CIRIA C665. GSV = gas concentration (%) x flow rate. Peak CH4 and Steady CO2 values used.
5. Monitoring is carried out in line with procedures set by LKC Ltd with reference to CIRIA C665. Refer to procedural documents

[illegible]

*1	Refer to Note 1
ND	Not detected
NR	Not recorded
UR	Unable to record
OS	Off recordable scale
N/A	Not applicable
% v/v	Percentage volume by total volume

1. Equipment is serviced and checked as recommended by the manufacturer. Refer to calibration records, and service certificates.
2. CH4 is explosive between the range of 5 - 15% v/v. 100% lower explosive limit is equal to 5% v/v CH4.
3. Flow readings are based on a 1 minute average value where flow is detected (equipment range of +/- 12 ltr/hr)
4. After CIRIA C665. GSV = gas concentration (%) x flow rate. Peak CH4 and Steady CO2 values used.
5. Monitoring is carried out in line with procedures set by LKC Ltd with reference to CIRIA C665. Refer to procedural documents

[illegible]

1. Equipment is serviced and checked as recommended by the manufacturer. Refer to calibration records, and service certificates.
2. CH4 is explosive between the range of 5 - 15% v/v. 100% lower explosive limit is equal to 5% v/v CH4.
3. Flow readings are based on a 1 minute average value where flow is detected (equipment range of +/- 12 ltr/hr)
4. After C1R4 C665. GSV = gas concentration (%) x flow rate. Peak CH4 and Steady CO2 values used.
5. Monitoring is carried out in line with procedures set by ILC Ltd with reference to C1R4 C665. Refer to procedural documents



ATMOSPHERIC / GROUND CONDITIONS	
Atmospheric Pressure Trend on Site	Steady
Atmospheric Pressure (Prev 24hrs)	Falling
Weather Conditions	Cloudy, cold, breezy
Ground Conditions	Damp

1. Equipment is serviced and checked as recommended by the manufacturer. Refer to calibration records, and service certificates.
2. CH4 is explosive between the range of 5 - 15% v/v. 100% lower explosive limit is equal to 5% v/v CH4.
3. Flow readings are based on a 1 minute average value where flow is detected (equipment range of +/- 12 ltr/hr)
4. After CIRIA C665. GSV = gas concentration (%) x flow rate. Peak CH4 and Steady CO2 values used.
5. Monitoring is carried out in line with procedures set by LKC Ltd with reference to CIRIA C665. Refer to procedural documents

APPENDIX G

CERTIFICATE OF ANALYSIS – GEOTECHNICAL



TEST REPORT

Client LK Consult Ltd

Address Unit 29 Eton Business
Eton Hill Road
Radcliffe
Greater Manchester
M26 2ZS

Contract LKC 17 1427 -
Kingsbridge Road, Harpurhey

Job Number MRN 3100/67
Date of Issue 19 December 2017
Page 1 of 11

Approved Signatories

S J Hutchings, O P Davies

Notes

- 1 All remaining samples and remnants from this contract will be disposed 28 days from the date of this report unless you notify us to the contrary.
- 2 Result certificates, in this report, not bearing a UKAS mark, are not included in our UKAS accreditation schedule.
- 3 Opinions and interpretations expressed herein are outside the scope of our UKAS accreditation
- 4 Certified that the samples have been examined and tested in accordance with the terms of the contract/order and unless otherwise stated conform to the standards/specifications quoted. This does not, however, guarantee the balance of the materials from which the tested samples have been taken to be of equal quality.

MURRAY RIX

33C Vauxhall Ind. Estate, Greg Street
Reddish, Stockport SK5 7BR
TEL 0161 475 0870 FAX 0161 475 0871



TEST CERTIFICATE

LIQUID AND PLASTIC LIMIT

BS 1377: PART 2: 1990 Clause 4.4 ONE POINT METHOD & Clause 5.3

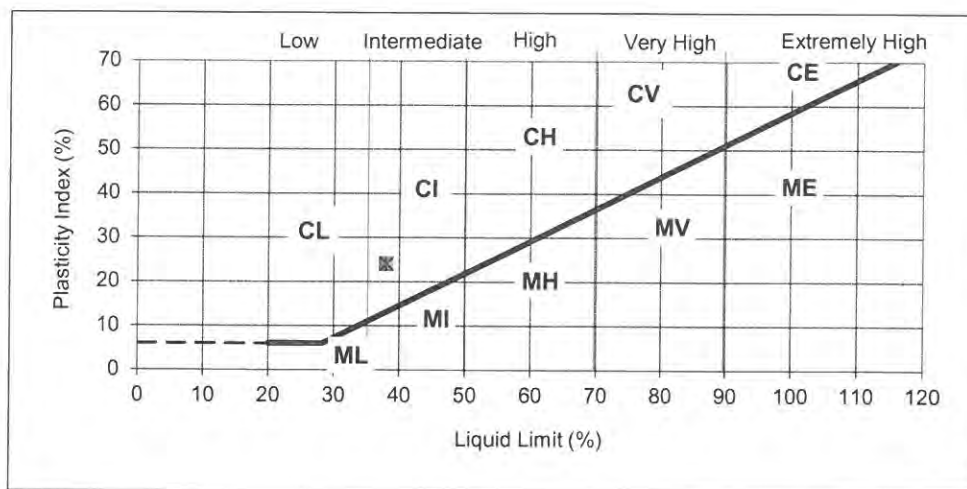
MOISTURE CONTENT METHOD BS 1377: PART 2: 1990 Clause 3.2

CLIENT	LK Consult Ltd
SITE	Kingsbridge Road, Harpurhey
JOB NUMBER	MRN 3100/67

SAMPLE LABEL	WS101 / 1-2m	DATE SAMPLED	11-Dec-17
SAMPLE No.	74260	DATE RECEIVED	12-Dec-17
DATE TESTED	12-Dec-17	SAMPLED BY	Client

MATERIAL	Stiff brown silty sandy CLAY with rare gravel
ADVISED SOURCE	Site Investigation Sample

Moisture Content (Natural) (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
17	38	14	24	91



REMARKS

Sample tested in natural condition

SIGNED

NAME
Page 2 of 11

O.P. Davies
(Deputy Laboratory Manager)

DATE

19-Dec-17

MURRAY RIX

33C Vauxhall Ind. Estate, Greg Street
Reddish, Stockport SK5 7BR
TEL 0161 475 0870 FAX 0161 475 0871



TEST CERTIFICATE

LIQUID AND PLASTIC LIMIT

BS 1377: PART 2: 1990 Clause 4.4 ONE POINT METHOD & Clause 5.3

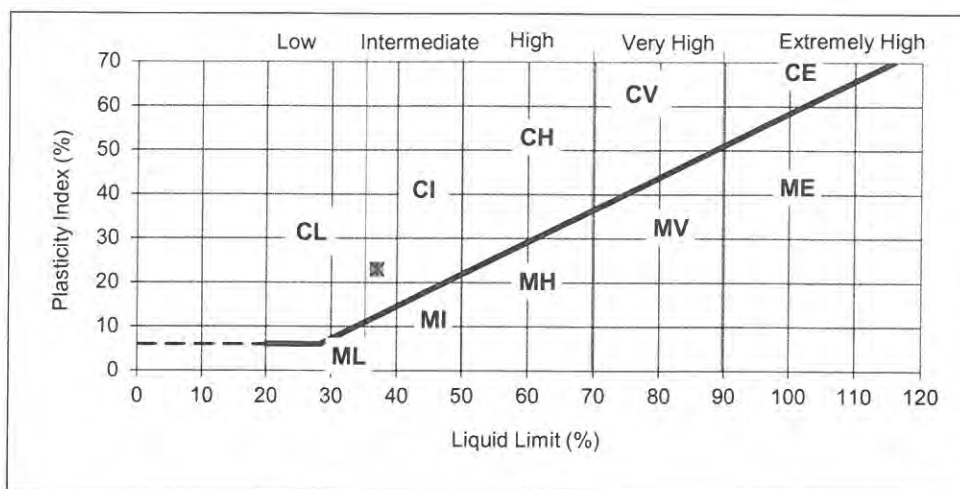
MOISTURE CONTENT METHOD BS 1377: PART 2: 1990 Clause 3.2

CLIENT	LK Consult Ltd
SITE	Kingsbridge Road, Harpurhey
JOB NUMBER	MRN 3100/67

SAMPLE LABEL	WS101 / 2-3m	DATE SAMPLED	11-Dec-17
SAMPLE No.	74261	DATE RECEIVED	12-Dec-17
DATE TESTED	12-Dec-17	SAMPLED BY	Client

MATERIAL	Stiff brown silty sandy CLAY with rare gravel
ADVISED SOURCE	Site Investigation Sample

Moisture Content (Natural) (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
17	37	14	23	90



REMARKS

Sample tested in natural condition

SIGNED

NAME

Page 3 of 11

O.P. Davies

(Deputy Laboratory Manager)

DATE

19-Dec-17

MURRAY RIX

UNIT 33C, VAUXHALL IND. ESTATE, GREG STREET
REDDISH, STOCKPORT, SK5 7BR
TEL 0161 475 0870 FAX 0161 475 0871

TEST CERTIFICATE

pH and Sulphate as SO₄
BS 1377: PART 3: 1990

CLIENT	LK Consult Ltd
SITE	Kingsbridge Road, Harpurhey
JOB NUMBER	MRN 3077/67

SAMPLE LABEL	WS101 / 2-3m	DATE SAMPLED	11 December 2017
LAB SAMPLE No	74261	DATE RECEIVED	12 December 2017
DATE TESTED	13 December 2017	SAMPLED BY	Client

ADVISED SOURCE	Site Investigation Sample
PRE TREATMENT	Air Dried

PH Value	7.0	g/l
Sulphate as SO ₄ (2:1 Water Extract)	0.38	

REMARKS

SIGNED



NAME O.P. Davies
(Deputy Laboratory Manager)

DATE 19 December 2017

MURRAY RIX

33C Vauxhall Ind. Estate, Greg Street
Reddish, Stockport SK5 7BR
TEL 0161 475 0870 FAX 0161 475 0871



TEST CERTIFICATE

LIQUID AND PLASTIC LIMIT

BS 1377: PART 2: 1990 Clause 4.4 ONE POINT METHOD & Clause 5.3

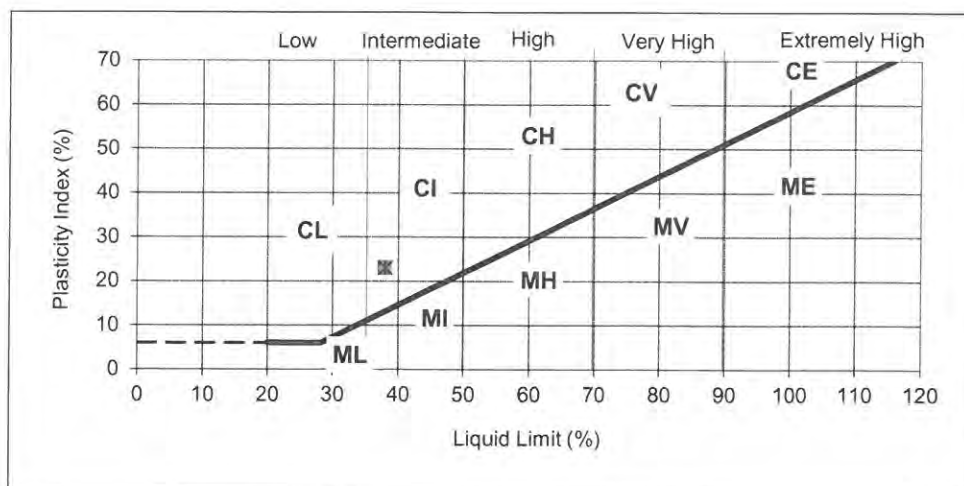
MOISTURE CONTENT METHOD BS 1377: PART 2: 1990 Clause 3.2

CLIENT	LK Consult Ltd
SITE	Kingsbridge Road, Harpurhey
JOB NUMBER	MRN 3100/67

SAMPLE LABEL	WS102 / 1-2m	DATE SAMPLED	11-Dec-17
SAMPLE No.	74262	DATE RECEIVED	12-Dec-17
DATE TESTED	12-Dec-17	SAMPLED BY	Client

MATERIAL	Stiff brown silty sandy CLAY with rare gravel
ADVISED SOURCE	Site Investigation Sample

Moisture Content (Natural) (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
16	38	15	23	86



REMARKS

Sample tested in natural condition

SIGNED

NAME

Page 5 of 11

O.P. Davies

(Deputy Laboratory Manager)

DATE

19-Dec-17

MURRAY RIX

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TEST CERTIFICATE

LIQUID AND PLASTIC LIMIT

BS 1377: PART 2: 1990 Clause 4.4 ONE POINT METHOD & Clause 5.3

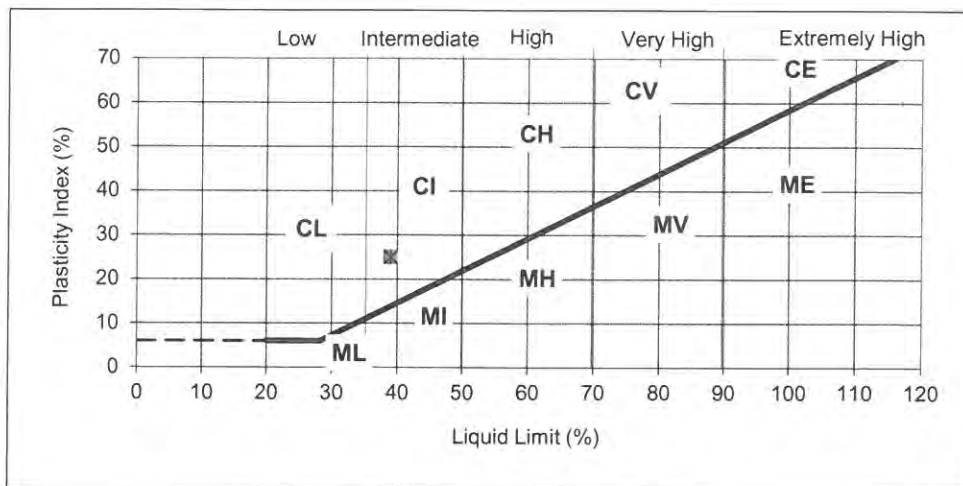
MOISTURE CONTENT METHOD BS 1377: PART 2: 1990 Clause 3.2

CLIENT	LK Consult Ltd
SITE	Kingsbridge Road, Harpurhey
JOB NUMBER	MRN 3100/67

SAMPLE LABEL	WS103 / 0.4-1m	DATE SAMPLED	11-Dec-17
SAMPLE No.	74263	DATE RECEIVED	12-Dec-17
DATE TESTED	12-Dec-17	SAMPLED BY	Client

MATERIAL	Stiff brown silty sandy CLAY with rare gravel
ADVISED SOURCE	Site Investigation Sample

Moisture Content (Natural) (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
15	39	14	25	90



REMARKS

Sample tested in natural condition

SIGNED

NAME

Page 6 of 11

O.P. Davies

(Deputy Laboratory Manager)

DATE

19-Dec-17

MURRAY RIX

33C Vauxhall Ind. Estate, Greg Street
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TEST CERTIFICATE LIQUID AND PLASTIC LIMIT

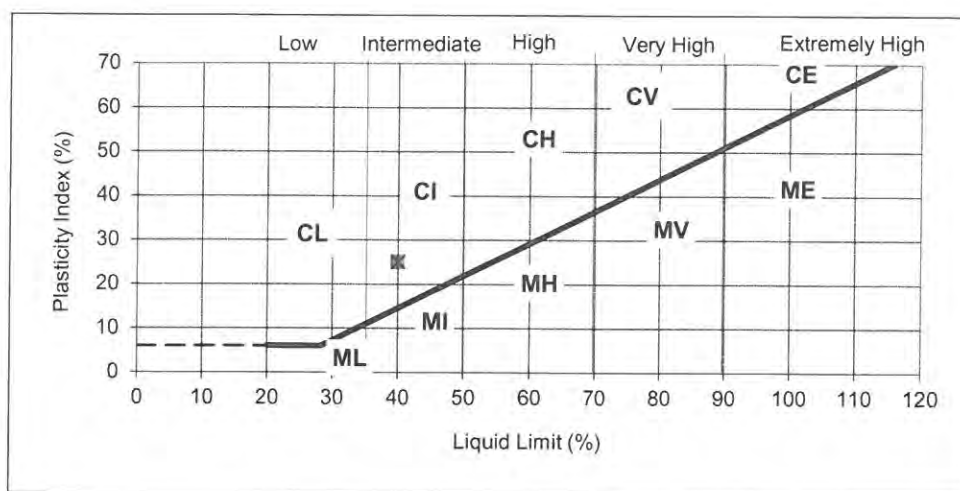
BS 1377: PART 2: 1990 Clause 4.4 ONE POINT METHOD & Clause 5.3
MOISTURE CONTENT METHOD BS 1377: PART 2: 1990 Clause 3.2

CLIENT	LK Consult Ltd
SITE	Kingsbridge Road, Harpurhey
JOB NUMBER	MRN 3100/67

SAMPLE LABEL	WS103 / 1-2m	DATE SAMPLED	11-Dec-17
SAMPLE No.	74264	DATE RECEIVED	12-Dec-17
DATE TESTED	12-Dec-17	SAMPLED BY	Client

MATERIAL	Stiff brown silty sandy CLAY with rare gravel
ADVISED SOURCE	Site Investigation Sample

Moisture Content (Natural) (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
17	40	15	25	93



REMARKS

Sample tested in natural condition

SIGNED

NAME

Page 7 of 11

O.P. Davies

(Deputy Laboratory Manager)

DATE

19-Dec-17

MURRAY RIX

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TEST CERTIFICATE

LIQUID AND PLASTIC LIMIT

BS 1377: PART 2: 1990 Clause 4.4 ONE POINT METHOD & Clause 5.3

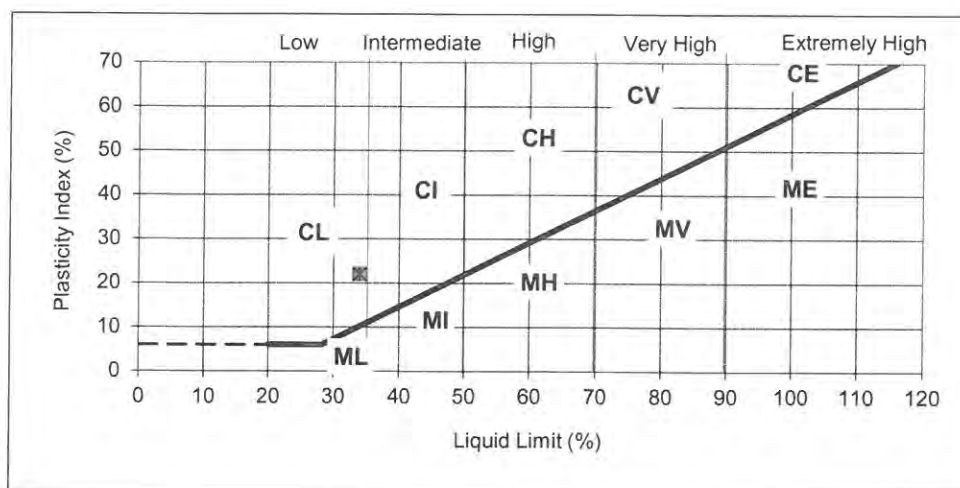
MOISTURE CONTENT METHOD BS 1377: PART 2: 1990 Clause 3.2

CLIENT	LK Consult Ltd
SITE	Kingsbridge Road, Harpurhey
JOB NUMBER	MRN 3100/67

SAMPLE LABEL	WS104 / 0.5-1m	DATE SAMPLED	11-Dec-17
SAMPLE No.	74265	DATE RECEIVED	12-Dec-17
DATE TESTED	12-Dec-17	SAMPLED BY	Client

MATERIAL	Stiff brown silty sandy CLAY with rare gravel
ADVISED SOURCE	Site Investigation Sample

Moisture Content (Natural) (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
18	34	12	22	88



REMARKS

Sample tested in natural condition

SIGNED

NAME

Page 8 of 11

O.P. Davies

(Deputy Laboratory Manager)

DATE

19-Dec-17

MURRAY RIX

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TEST CERTIFICATE

LIQUID AND PLASTIC LIMIT

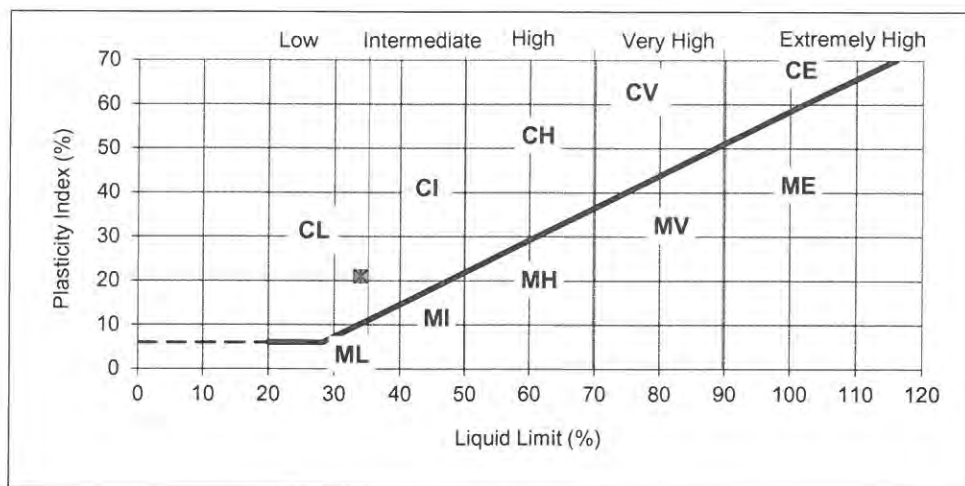
BS 1377: PART 2: 1990 Clause 4.4 ONE POINT METHOD & Clause 5.3
MOISTURE CONTENT METHOD BS 1377: PART 2: 1990 Clause 3.2

CLIENT	LK Consult Ltd
SITE	Kingsbridge Road, Harpurhey
JOB NUMBER	MRN 3100/67

SAMPLE LABEL	WS104 / 1-2m	DATE SAMPLED	11-Dec-17
SAMPLE No.	74266	DATE RECEIVED	12-Dec-17
DATE TESTED	12-Dec-17	SAMPLED BY	Client

MATERIAL	Soft brown silty sandy CLAY with rare gravel
ADVISED SOURCE	Site Investigation Sample

Moisture Content (Natural) (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
24	34	13	21	79



REMARKS

Sample tested in natural condition

SIGNED

NAME

Page 9 of 11

O.P. Davies

(Deputy Laboratory Manager)

DATE

19-Dec-17

MURRAY RIX

UNIT 33C, VAUXHALL IND. ESTATE, GREG STREET
REDDISH, STOCKPORT, SK5 7BR
TEL 0161 475 0870 FAX 0161 475 0871

TEST CERTIFICATE

pH and Sulphate as SO₄
BS 1377: PART 3: 1990

CLIENT	LK Consult Ltd
SITE	Kingsbridge Road, Harpurhey
JOB NUMBER	MRN 3077/67

SAMPLE LABEL	WS104 / 1-2m	DATE SAMPLED	11 December 2017
LAB SAMPLE No	74266	DATE RECEIVED	12 December 2017
DATE TESTED	13 December 2017	SAMPLED BY	Client

ADVISED SOURCE	Site Investigation Sample
PRE TREATMENT	Air Dried

PH Value	7.1	g/l
Sulphate as SO ₄ (2:1 Water Extract)	0.30	

REMARKS

SIGNED



NAME O.P. Davies
(Deputy Laboratory Manager)

DATE 19 December 2017

MURRAY RIX

33C Vauxhall Ind. Estate, Greg Street
Reddish, Stockport SK5 7BR
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TEST CERTIFICATE

LIQUID AND PLASTIC LIMIT

BS 1377: PART 2: 1990 Clause 4.4 ONE POINT METHOD & Clause 5.3

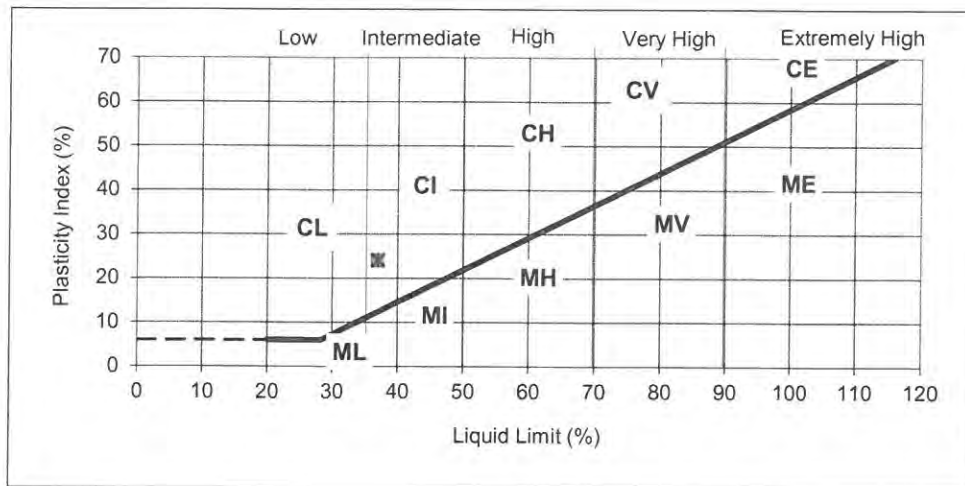
MOISTURE CONTENT METHOD BS 1377: PART 2: 1990 Clause 3.2

CLIENT	LK Consult Ltd
SITE	Kingsbridge Road, Harpurhey
JOB NUMBER	MRN 3100/67

SAMPLE LABEL	WS104 / 2-3m	DATE SAMPLED	11-Dec-17
SAMPLE No.	72467	DATE RECEIVED	12-Dec-17
DATE TESTED	12-Dec-17	SAMPLED BY	Client

MATERIAL	Firm brown silty sandy CLAY with rare gravel
ADVISED SOURCE	Site Investigation Sample

Moisture Content (Natural) (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
20	37	13	24	85



REMARKS

Sample tested in natural condition

SIGNED

NAME

Page 11 of 11

O.P. Davies

(Deputy Laboratory Manager)

DATE

19-Dec-17

APPENDIX H

GENERIC ASSESSMENT CRITERIA VALUES

Category 4 Screening Levels (C4SL)

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	168 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 mg/kg	5.3 mg/kg	5.7 mg/kg	76 mg/kg	10 mg/kg	21 mg/kg
Cadmium	26 mg/kg	149 mg/kg	4.9 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	23 mg/kg	250 mg/kg
Lead	200 mg/kg	310 mg/kg	80 mg/kg	2330 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 I

UNITED UTILITIES RISK ASSESSMENT FOR WATER PIPES

Supplementary guidance for the selection of water pipes in land potentially affected by contamination



Introduction

In January 2011, UK Water Industry Research (UKWIR) published "Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites" (Ref 10/WM/03/21; the 'UKWIR Guidance'). Its aim is to ensure that the correct materials are selected for water pipes and components to be used below ground in brownfield sites to protect the quality of drinking water whilst taking into account the service life of the water distribution system. It supersedes the Water Regulations Advisory Scheme (WRAS) Information and Guidance Note 9-04-03 "Laying Pipes in Contaminated Land" which has been withdrawn.

The UKWIR Guidance is for use by developers, self-lay organisations, water companies and consultants when planning, designing and constructing water mains and/or services in brownfield sites. It defines brownfield sites as "land or premises that have previously been used or developed. They may also be vacant or derelict. However, they are not necessarily contaminated." The UKWIR Guidance states that it does not apply to greenfield sites; however, we consider this supplementary guidance and the relevant sections of the UKWIR guidance as being equally suitable for application to those greenfield sites considered to be potentially affected by contamination. Where greenfield sites are not affected by contamination a preliminary risk assessment (see below) will suffice.

The UKWIR Guidance also states that there should be no departure from its provisions "*except where formally approved by the Water Company, such departure being technically justifiable or representing advances in knowledge or product development*".

We have adopted the UKWIR Guidance in principle and produced this company specific supplementary guidance (the 'UW Guidance') which includes the Risk Assessment for Water Pipes (the 'RA').

This guidance does not cover operative safety, health exposure modelling or accidental pipe damage.

Risk Assessment for Water Pipes in Land Potentially Affected by Contamination

Any application for new water supplies to a development (construction of new properties, or renovation or conversion of existing buildings) in land potentially affected by contamination shall include a completed RA.

As a minimum a desk study (preliminary risk assessment) shall be provided with the RA in accordance with the framework in Environment Agency publication "Model Procedures for the Management of Land Contamination" (ref: CLR11) that sets out whether the land through which the pipes are to be laid may be affected by contamination. The application of the source, pathway, receptor concept will be an integral part of any pipeline risk assessment. For each potential source (the contamination) and each potential receptor (the water pipe), consideration shall be given to whether a potential pathway between source and receptor exists, or may exist in the future, linking the two. There are normally only three pathways by which contamination may come into contact with water pipes. These are direct contact with the soil or backfill, an excessive vapour phase or a contaminated groundwater regime. If none of these conditions exist on site (adopting the source, pathway, receptor concept) then it is likely that extended and/or targeted soil testing will not be required and a simple risk assessment will suffice. For those sites where land may be affected by contamination appropriate testing shall be undertaken on the materials within which the pipes are to be laid, whether that be existing ground materials, remediated materials or imported capping materials. The testing requirements are as described in the following section.

The signatories of the Water Supply Application Form and the RA must ensure that all assessments of land condition have been carried out in accordance with applicable current standards and guidelines by or under the direction of a suitably qualified competent person.

We require the competent person to be a) a chartered member of an appropriate professional body (such as the Institution of Civil Engineers, the Geological Society of London or the Royal Institution of Chartered Surveyors) with relevant experience of investigating contaminated sites or b) a Specialist in Land Condition (SiLC) with appropriate geo-environmental experience.

Testing Requirements

The soil, rock and if appropriate groundwater tests that are required on all sites where the potential for organic contamination has been identified in the desk study and where water pipes are proposed to be laid must be accredited by United Kingdom Accreditation Service (UKAS) as a minimum and where commercially available the Environment Agency's Monitoring Certification Service (MCERTS). These accredited tests should be undertaken for:

Banded hydrocarbons EC5-EC10, EC10-EC16, EC16-EC40 (Total aliphatic and aromatic hydrocarbons for each banding may be summed). Aliphatic/aromatic fractionation and subsequent banding may be required should a more detailed site specific risk assessment be undertaken. The bandings have been amended to take into account readily available laboratory tests. The equivalent carbon number (EC) is used to assess petroleum hydrocarbon mixtures rather than the actual number of carbon atoms in the molecule in line with guidance issued by the Environment Agency (2005).

Volatile organic compounds (VOCs) (method by head space or purge & trap GCMS) with tentative identification of compounds greater than 20µg/kg. The method used should be capable of detecting a wide range of compounds listed in US EPA Method 8260C or similar. The method should include analysis of naphthalene.

BTEX (Benzene, toluene, ethyl benzene and xylenes) plus MTBE (Methyl-tertiary butyl ether) (by head space GCMS)

Semi-Volatile Organic Compounds (SVOCs) (method by GCMS) with tentative identification of compounds greater than 20µg/kg. The method used should be capable of detecting the compounds listed in US EPA Method 8270D or similar. The total concentration of SVOCs excludes polycyclic aromatic hydrocarbons, ethers, nitrobenzene, ketones, aldehydes, phenols, cresols and chlorinated phenols. Phenols, cresols and chlorinated phenols which are detected by the SVOC analysis are given their own assessment criteria.

We do not consider Table G1 and Table 3.1 of the UKWIR Guidance to be a definitive guide for assessing total concentrations. Table 1 in the RA below replaces Table 3.1 of the UKWIR Guidance.

Where previous site uses include the use, storage, treatment, disposal or manufacture of any of the following, appropriate testing for these substances will be required:

Ethers, nitrobenzene, ketones, aldehydes and amines. Note that the presence of amines on any site at the proposed pipe depth +/- 1.0m precludes the use of polyethylene. The methods of analysis and method of calculation of total concentrations of these compounds will need to be agreed with UUW.

To comply with the testing requirements, the suites of tests that are required on all brownfield sites where wrapped steel, wrapped ductile iron or copper pipes are to be laid as minimum must include:

pH, Conductivity and redox potential

Sufficiency of Testing

Water pipes are normally laid at between 0.75 and 1.35m from finished ground level to crown of pipe. Samples taken and tested must represent both a) the soil in which the water pipes are to be laid and b) the soil down to at least 500mm below the underside of the proposed pipe. Where the proposed depth of the pipes is unknown at the time of application, soil samples representative of the ground condition between surface level and 1.5m below finished ground level shall be taken as a minimum. Where appropriate (see UKWIR Guidance) groundwater sampling and groundwater monitoring will also be

necessary. Photo-ionisation detection (PID) monitoring along the proposed route of the pipeline may be employed, though this does not provide a definitive guide to the suitability of water pipe materials.

Where required a sufficient number of test results should be obtained from the material in which the pipes are to be laid. CLAIRE/CIEH 2008 "Guidance on comparing soil contamination data with a critical concentration" may be used, where appropriate, to justify the number of soil samples tested; however, this statistical model should not be used on heterogeneous materials or used to average test results from different types of materials.

Further guidance on representative sampling is contained within BS10175:2011 Code of Practice for the Investigation of Potentially Contaminated Sites, the Department of the Environment's Contaminated Land Research Report "Sampling strategies for contaminated land" prepared by The Centre for Research into the Built Environment, Nottingham Trent University (Ref: CLR 4; 1994) and the Environment Agency's "Secondary Model Procedure for the Development of Appropriate Soil Sampling Strategies for Land Contamination" (ref: R&D Technical Report P5-066/TR; 2000).

Where remediation has been carried out on the site, the test results obtained from validation samples will be used in the assessment. Where a horizontal capping system has been or will be employed using materials spread across a site, sufficient samples will need to be taken to characterise the capping material used and the results presented to UUW. However, the sufficiency of sampling on the horizontal capping system, in which the pipeline will be placed, may be assessed on the basis of the source, quantity and type of materials used.

Detection Limits

Only positive concentrations, ie those above the limit of detection should be used in summation of VOC and SVOC (or other test groups of compounds ie phenols, cresols and chlorinated phenols). Laboratory methods shall provide a minimum limit of detection of 10µg/kg for each individual VOC or SVOC (or other test groups of compounds) quantitatively detected in accordance with the methods described above. For tentatively identified compounds (TICs), only those compounds with a concentration of 20µg/kg or greater shall be used in the summation of VOC and SVOC (or other test groups of compounds).

Protective Measures

Where polyethylene, ductile iron, steel or copper pipes are to be laid on a brownfield site or other land potentially affected by contamination (whether or not it has been remediated) and where the concentrations exceed the generic guideline values set out in Table 1 of the RA, the developer shall provide either:

- a) a robust risk assessment to show how any contaminants will not significantly impact on proposed water supplies or buried assets over the lifetime of the assets; or
- b) more suitable pipe materials; or
- c) an engineering solution to protect the pipe work backed up by an adequate assessment of the risk.

Liquid free phase product (e.g. oil or free solvent layers) shall not remain in the ground or groundwater in the vicinity of water pipes, whether barrier pipe or any other pipe materials are used.

When designing pipe routes on land potentially affected by contamination, new preferential contamination pathways along the route of new water pipes shall not be created. Particular measures may be required to prevent the possible migration of contamination through pipe bedding and into controlled waters.

References

BS10175:2011 "Investigation of Potentially Contaminated Sites Code of Practice"

CLAIRE/CIEH "Guidance on comparing soil contamination data with a critical concentration" 2008

Department of the Environment Contaminated Land Research Report "Sampling strategies for contaminated land" prepared by The Centre for Research into the Built Environment, Nottingham Trent University (Ref: CLR 4) 1994

Environment Agency "Secondary Model Procedure for the Development of Appropriate Soil Sampling Strategies for Land Contamination" (ref: R&D Technical Report P5-066/TR) 2000

Environment Agency "Model Procedures for the Management of Land Contamination" (ref: CLR11), 2004

Environment Agency P5-080/TR3 "The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils", 2005

UK Water Industry Research (UKWIR) "Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites" (Ref 10/WM/03/21)" January 2011

Water Regulations Advisory Scheme (WRAS) Information and Guidance Note 9-04-03 "Laying Pipes in Contaminated Land" 2002



About us

United Utilities is the North West's water company. We keep the taps flowing and toilets flushing for seven million customers every day. From Crewe to Carlisle, we work hard behind the scenes to help your life flow smoothly.

United Utilities Water PLC, Haweswater House, Lingley Mere Business Park, Lingley Green Avenue, Warrington WA5 3LP.
Registered in England and Wales. Registered Number 2366678.

21/01/1995

Risk Assessment for Water Pipes (RA)



The risk assessment for water pipes will help you choose appropriate materials for your development. We are happy to deal with a risk assessment for water pipes in advance of any formal application for a new water supply.

If you need any help completing the form please call us on 0845 026 4296.

When completing this form electronically, the larger text boxes will expand in height if required.

Section 1: Development Details

Development Name <i>(if it has one)</i>	
Development Address	Kingsbridge Road, Harpurhey
OS Grid Reference <i>(mid point)</i>	385430E 401210N
Developers Name	Prime Developers Ltd
UUW reference number <i>(for UU use only)</i>	

Please provide details below of the current and historical use of the site and adjacent sites.

If your supporting information has details of the current and historical site use, please reference below the relevant sections of your report.

Please see Section 2 of LK Consult Ltd Report "Phase 2 Geo-Environmental Investigation and Risk Assessment", Ref: LKC 14 1427-02, dated April 2018.

Site was formerly a public house (southeast) with associated bowling green.

Section 2: Preliminary Risk Assessment

Has your desk study and site walkover identified any land potentially affected by contamination?	☒ Yes ☐ No
--	---

If the site is potentially affected by contamination but you have not completed any intrusive site investigation please provide details below of the rationale behind the intended pipe selection.

If your supporting information has details of the rationale behind the intended pipe selection, please reference below the relevant sections of your report.

N/A

Section 3: Intrusive Site Investigation	
Have you completed any intrusive site investigation?	☒ Yes ☐ No
Date(s) when the site investigation(s) undertaken	8 th December 2017
At what level has groundwater been encountered?	>1.8 metres below ground level or ☐ Not encountered
Table 1 (Pipeline Selection Risk Assessment Summary (PSRAS)) below classifies testing required where the preliminary risk assessment has identified land potentially affected by contamination. Please provide details below of any test groups which have not been tested and the rationale for not testing. <i>If your supporting information has details of the rationale behind not testing any particular test groups, please reference below the relevant sections of your report.</i>	
Please see Section 5.5.2 of the Phase 2 report. Only contaminants of concern, based on the preliminary conceptual model and ground conditions encountered, were analysed. The following contaminants were not considered to be a risk and therefore not included in the analysis suites: chlorinated compounds, cresols, ethers, nitrobenzene, ketones, aldehydes and amines.	
If the intrusive site investigation has identified concentrations above the PE threshold (see PSRAS) and your intended pipe selection is PE please provide details below of the rationale behind the intended pipe selection. <i>If your supporting information has details of the rationale behind the intended pipe selection, please reference below the relevant sections of your report.</i>	
N/A	

Section 4: Site Remediation	
Please provide details below of any site remediation (which may include a change in site levels) already completed. <i>If your supporting information has details of the site remediation already completed, please reference below the relevant sections of your report.</i>	
N/A.	
Has the PSRAS (Table 1) been completed using appropriate data after remediation?	☐ Yes ☐ No ☒ N/A
Please provide details below of any proposed site remediation and an analysis of whether this will affect your intended pipe selection. <i>If your supporting information has details of any proposed site remediation and whether this will affect your intended pipe selection, please reference below the relevant sections of your report.</i>	
Proposed remediation includes either the removal of made ground in garden areas or the provision of a 600mm/300mm thick soil capping layer in back/front garden areas. This will not affect the intended pipe selection.	

Section 5: Final Use of Site

Please provide details below of any chemicals (including fuel) to be stored on site and any other future contamination risks which may affect your intended pipe selection.

If your supporting information has details of potential contamination risks which may affect your intended pipe selection, please reference below the relevant sections of your report.

LKC are not aware of any.

What water pipe materials are intended to be used on site?

☐ PE ☒ PE Barrier Pipe Type A ☒ PE Barrier Pipe Type B
Other (please specify):

Section 6: Additional Information

Please use the section below to provide any additional details to support your intended pipe selection.

If your supporting information has additional information to support your intended pipe selection, please reference below the relevant sections of your report.

Elevated naphthalene in made ground. Due to varying depths of made ground and intended depth of pipeline (>0.6mbgl), it is considered likely that pipeline will be laid in the made ground. Barrier Pipe Type A or B recommended.

Section 7: Risk Assessor

Name and relevant qualifications of person directing the risk assessment for water pipes	Dr Paul Quimby
Name and address of risk assessor's company	LK Consult Ltd, Eton Business Park, Eton Hill Road, Radcliffe, Manchester M26 2ZS
Date risk assessment performed	27/04/2018

Section 8: Declaration

I confirm I have completed this form and provided supporting information in accordance with 'UKWIR Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites' and UUW's Supplementary Guidance. I also confirm that if any further site investigation is needed and carried out, I will be required to submit an additional Risk Assessment for Water Pipes with the relevant supporting information. I understand that failure to supply any of the required information may delay my application being processed.

Name	Dr Paul Quimby	Company	LK Consult Ltd
Phone Number	0161 763 7200	Date	27/04/2018

Please e-mail the completed form and supporting information to water.connections@uuplc.co.uk. Alternatively you can fax a paper version to 01925 678926 or post to us at United Utilities Water, Metering and Connections, Ullswater House, Lingley Mere, Warrington, WA5 3LP.



About us

United Utilities is the North West's water company. We keep the taps flowing and toilets flushing for seven million customers every day. From Crewe to Carlisle, we work hard behind the scenes to help your life flow smoothly.

United Utilities Water PLC, Haweswater House, Lingley Mere Business Park, Lingley Green Avenue, Warrington WA5 3LP. Registered in England and Wales. Registered Number 2366678.

15014953

Table 1 - Pipe Selection Risk Assessment Summary (PSRAS)

- 1) Testing must be undertaken on the materials within which the pipes are to be laid, whether that be existing ground materials, remediated materials or imported capping materials. Please use the appropriate testing data to complete Table 1 below.
- 2) If more than one pipe selection is being made, for example, for pipes in different areas of a large site, a completed PSRAS is required for each selection.

What materials have been tested to populate Table 1 below?

☒ Existing ground materials ☐ Remediated materials ☐ Imported capping materials

All concentrations in mg/kg

Test Group	Testing Required?	PE threshold	Metal Pipes/ Barrier Pipe	Laboratory Detection Limit	Testing UKAS accredited Y/N	Maximum concentration at proposed pipeline depth See Note [2]	Maximum site concentration See Note [3]	Locations and depths where concentrations exceed proposed pipeline threshold
Total VOCs	Where Preliminary Risk Assessment (PRA) has identified land potentially affected by contamination	0.5	Pass	0.001 / 0.1	Some MCERTs	0.62	0.62	WS101 0.3-1.0mbgl 0.62mg/kg WS105 0-0.8mbgl 0.54mg/kg
Total BTEX & MTBE		0.1	Pass	0.001	Some MCERTs	<0.001	<0.001	None
Total SVOCs (excluding PAHs and those substances marked with an *)		2	Pass	0.5	Some MCERTs	<0.5	<0.5	None
EC5-EC10 aliphatic and aromatic hydrocarbons		2	Pass	1	Some MCERTs	<1	<1	None
EC10-EC16 aliphatic and aromatic hydrocarbons		10	Pass	1	MCERTs	<1	1.6	None
EC16-EC40 aliphatic and aromatic hydrocarbons		500	Pass	1	Some MCERTs	350mg/kg	350mg/kg	None
Phenols* (from SVOC analysis)		2	Pass	0.3	N	<0.3	<0.5	None
Cresols and chlorinated phenols* (from SVOC analysis)		2	Pass	0.5	N	<0.5	<0.5	None
Ethers*	Only where identified	0.5	Pass	N/A				
Nitrobenzene*		0.5	Pass	N/A				
Ketones*		0.5	Pass	N/A				
Aldehydes*		0.5	Pass	N/A				
Amines		Fail	Pass	N/A				
Corrosive	Conductivity, Redox and pH	Pass	See Note [1]	N/A				

Note [1] Threshold: For wrapped steel, corrosive if pH<7 and conductivity > 400µS/cm. For wrapped ductile iron corrosive if pH<5, Eh not neutral and conductivity > 400µS/cm. For copper, corrosive if pH<5 or >8 and Eh positive.

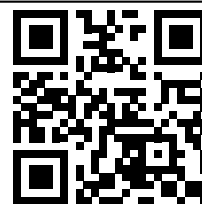
Note [2] Water pipes are normally laid at 0.75-1.35m below finished ground level.

Note [3] Also state if liquid free product is present in soil or groundwater.

APPENDIX J

HAZWASTEONLINE OUTPUT SHEETS

Waste Classification Report



C8NS2-3EF5R-RN2UP

Job name

Kingsbridge Road, Harpurhey

Description/Comments

Project

LKC 17 1427

Site

Waste Stream Template

LK SUITE 1 - 5

Classified by

Name:

Colin Crompton

Date:

18/12/2017 13:55:12 UTC

Telephone:

0161 763 7200

Company:

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

Report

Created by: Colin Crompton

Created date: 18/12/2017 13:55 UTC

Job summary

#	Sample Name	Depth [m]	Classification Result	Hazard properties	Page
1	WS101	0.30	Non Hazardous		2
2	WS101[1]	1.00	Non Hazardous		5
3	WS102	0.00	Non Hazardous		8
4	WS102[1]	0.50	Non Hazardous		10
5	WS103	0.00	Non Hazardous		12
6	WS103[1]	0.40	Non Hazardous		14
7	WS104	0.0	Non Hazardous		16
8	WS104[1]	0.50	Non Hazardous		18
9	WS105	0.0	Non Hazardous		20
10	HA101	0.0	Non Hazardous		23

Appendices

Appendix A: Classifier defined and non CLP determinands

Appendix B: Rationale for selection of metal species

Appendix C: Version

Page

25

26

27

Classification of sample: WS101

 **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:	LoW Code:
WS101	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.30 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
13%	
(no correction)	

Hazard properties

None identified

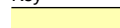
Determinands

Moisture content: **13%** No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
1	arsenic { arsenic trioxide }				11	mg/kg	1.32	14.524	mg/kg	0.00145 %		
	033-003-00-0	215-481-4	1327-53-3									
2	cadmium { cadmium oxide }				0.17	mg/kg	1.142	0.194	mg/kg	0.0000194 %		
	048-002-00-0	215-146-2	1306-19-0									
3	chromium in chromium(III) compounds { chromium(III) oxide }				12	mg/kg	1.462	17.539	mg/kg	0.00175 %		
		215-160-9	1308-38-9									
4	copper { dicopper oxide; copper (I) oxide }				18	mg/kg	1.126	20.266	mg/kg	0.00203 %		
	029-002-00-X	215-270-7	1317-39-1									
5	mercury { mercury dichloride }				1.6	mg/kg	1.353	2.166	mg/kg	0.000217 %		
	080-010-00-X	231-299-8	7487-94-7									
6	nickel { nickel chromate }				15	mg/kg	2.976	44.644	mg/kg	0.00446 %		
	028-035-00-7	238-766-5	14721-18-7									
7	lead { lead chromate }			1	77	mg/kg	1.56	120.106	mg/kg	0.0077 %		
	082-004-00-2	231-846-0	7758-97-6									
8	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<0.2	mg/kg	2.554	<0.511	mg/kg	<0.0000511 %		<LOD
	034-002-00-8											
9	vanadium { divanadium pentaoxide; vanadium pentoxide }				20	mg/kg	1.785	35.704	mg/kg	0.00357 %		
	023-001-00-8	215-239-8	1314-62-1									
10	zinc { zinc oxide }				38	mg/kg	1.245	47.299	mg/kg	0.00473 %		
	030-013-00-7	215-222-5	1314-13-2									
11	chromium in chromium(VI) compounds { chromium(VI) oxide }				<0.5	mg/kg	1.923	<0.962	mg/kg	<0.0000962 %		<LOD
	024-001-00-0	215-607-8	1333-82-0									
12	boron { diboron trioxide; boric oxide }				1.8	mg/kg	3.22	5.796	mg/kg	0.00058 %		
	005-008-00-8	215-125-8	1303-86-2									
13	TPH (C6 to C40) petroleum group				<10	mg/kg		<10	mg/kg	<0.001 %		<LOD
			TPH									

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
14	tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane				<1 mg/kg		<1 mg/kg	<0.0001 %			<LOD
	603-181-00-X	216-653-1	1634-04-4								
15	benzene				<1 mg/kg		<1 mg/kg	<0.0001 %			<LOD
	601-020-00-8	200-753-7	71-43-2								
16	toluene				<1 mg/kg		<1 mg/kg	<0.0001 %			<LOD
	601-021-00-3	203-625-9	108-88-3								
17	ethylbenzene				<1 mg/kg		<1 mg/kg	<0.0001 %			<LOD
	601-023-00-4	202-849-4	100-41-4								
18	xylene				<1 mg/kg		<1 mg/kg	<0.0001 %			<LOD
	601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]								
19	cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<0.5 mg/kg	1.884	<0.942 mg/kg	<0.0000942 %			<LOD
	006-007-00-5										
20	pH				9.4 pH		9.4 pH	9.4 pH			
			PH								
21	naphthalene				0.62 mg/kg		0.62 mg/kg	0.000062 %			
	601-052-00-2	202-049-5	91-20-3								
22	acenaphthylene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
		205-917-1	208-96-8								
23	acenaphthene				0.1 mg/kg		0.1 mg/kg	0.00001 %			
		201-469-6	83-32-9								
24	fluorene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
		201-695-5	86-73-7								
25	phenanthrene				0.53 mg/kg		0.53 mg/kg	0.000053 %			
		201-581-5	85-01-8								
26	anthracene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
		204-371-1	120-12-7								
27	fluoranthene				0.65 mg/kg		0.65 mg/kg	0.000065 %			
		205-912-4	206-44-0								
28	pyrene				0.56 mg/kg		0.56 mg/kg	0.000056 %			
		204-927-3	129-00-0								
29	benzo[a]anthracene				0.1 mg/kg		0.1 mg/kg	0.00001 %			
	601-033-00-9	200-280-6	56-55-3								
30	chrysene				0.11 mg/kg		0.11 mg/kg	0.000011 %			
	601-048-00-0	205-923-4	218-01-9								
31	benzo[b]fluoranthene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
	601-034-00-4	205-911-9	205-99-2								
32	benzo[k]fluoranthene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
	601-036-00-5	205-916-6	207-08-9								
33	benzo[a]pyrene; benzo[def]chrysene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
	601-032-00-3	200-028-5	50-32-8								
34	indeno[123-cd]pyrene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
		205-893-2	193-39-5								
35	dibenz[a,h]anthracene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
	601-041-00-2	200-181-8	53-70-3								
36	benzo[ghi]perylene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
		205-883-8	191-24-2								
Total:									0.0286 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: WS101[1]

✔ **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:	LoW Code:
WS101[1]	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
1.00 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
8.5%	
(no correction)	

Hazard properties

None identified

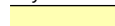
Determinands

Moisture content: 8.5% No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
1	arsenic { arsenic trioxide }				7.9 mg/kg	1.32	10.431 mg/kg	0.00104 %			
	033-003-00-0	215-481-4	1327-53-3								
2	cadmium { cadmium oxide }				0.15 mg/kg	1.142	0.171 mg/kg	0.0000171 %			
	048-002-00-0	215-146-2	1306-19-0								
3	chromium in chromium(III) compounds { chromium(III) oxide }				22 mg/kg	1.462	32.154 mg/kg	0.00322 %			
		215-160-9	1308-38-9								
4	copper { dicopper oxide; copper (I) oxide }				24 mg/kg	1.126	27.021 mg/kg	0.0027 %			
	029-002-00-X	215-270-7	1317-39-1								
5	mercury { mercury dichloride }				<0.1 mg/kg	1.353	<0.135 mg/kg	<0.0000135 %			<LOD
	080-010-00-X	231-299-8	7487-94-7								
6	nickel { nickel chromate }				32 mg/kg	2.976	95.24 mg/kg	0.00952 %			
	028-035-00-7	238-766-5	14721-18-7								
7	lead { lead chromate }			1	15 mg/kg	1.56	23.397 mg/kg	0.0015 %			
	082-004-00-2	231-846-0	7758-97-6								
8	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<0.2 mg/kg	2.554	<0.511 mg/kg	<0.0000511 %			<LOD
	034-002-00-8										
9	vanadium { divanadium pentaoxide; vanadium pentoxide }				26 mg/kg	1.785	46.415 mg/kg	0.00464 %			
	023-001-00-8	215-239-8	1314-62-1								
10	zinc { zinc oxide }				57 mg/kg	1.245	70.949 mg/kg	0.00709 %			
	030-013-00-7	215-222-5	1314-13-2								
11	chromium in chromium(VI) compounds { chromium(VI) oxide }				<0.5 mg/kg	1.923	<0.962 mg/kg	<0.0000962 %			<LOD
	024-001-00-0	215-607-8	1333-82-0								
12	boron { diboron trioxide; boric oxide }				<0.4 mg/kg	3.22	<1.288 mg/kg	<0.000129 %			<LOD
	005-008-00-8	215-125-8	1303-86-2								
13	TPH (C6 to C40) petroleum group				<10 mg/kg		<10 mg/kg	<0.001 %			<LOD
			TPH								

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
14	tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane				<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
	603-181-00-X	216-653-1	1634-04-4									
15	benzene				<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
	601-020-00-8	200-753-7	71-43-2									
16	toluene				<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
	601-021-00-3	203-625-9	108-88-3									
17	ethylbenzene				<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
	601-023-00-4	202-849-4	100-41-4									
18	xylene				<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
	601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]									
19	cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<0.5	mg/kg	1.884	<0.942	mg/kg	<0.0000942 %		<LOD
	006-007-00-5											
20	pH				8.4	pH		8.4	pH	8.4 pH		
			pH									
21	naphthalene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	601-052-00-2	202-049-5	91-20-3									
22	acenaphthylene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-917-1	208-96-8									
23	acenaphthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-469-6	83-32-9									
24	fluorene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-695-5	86-73-7									
25	phenanthrene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-581-5	85-01-8									
26	anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		204-371-1	120-12-7									
27	fluoranthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-912-4	206-44-0									
28	pyrene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		204-927-3	129-00-0									
29	benzo[a]anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	601-033-00-9	200-280-6	56-55-3									
30	chrysene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	601-048-00-0	205-923-4	218-01-9									
31	benzo[b]fluoranthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	601-034-00-4	205-911-9	205-99-2									
32	benzo[k]fluoranthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	601-036-00-5	205-916-6	207-08-9									
33	benzo[a]pyrene; benzo[def]chrysene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	601-032-00-3	200-028-5	50-32-8									
34	indeno[123-cd]pyrene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-893-2	193-39-5									
35	dibenz[a,h]anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	601-041-00-2	200-181-8	53-70-3									
36	benzo[ghi]perylene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-883-8	191-24-2									
Total:										0.0318 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: WS102

 **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:	LoW Code:
WS102	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.00 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
15%	
(no correction)	

Hazard properties

None identified

Determinands

Moisture content: **15% No Moisture Correction applied (MC)**

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
1	arsenic { arsenic trioxide }				42	mg/kg	1.32	55.454	mg/kg	0.00555 %		
	033-003-00-0	215-481-4	1327-53-3									
2	cadmium { cadmium oxide }				0.46	mg/kg	1.142	0.525	mg/kg	0.0000525 %		
	048-002-00-0	215-146-2	1306-19-0									
3	chromium in chromium(III) compounds { chromium(III) oxide }				16	mg/kg	1.462	23.385	mg/kg	0.00234 %		
		215-160-9	1308-38-9									
4	copper { dicopper oxide; copper (I) oxide }				64	mg/kg	1.126	72.057	mg/kg	0.00721 %		
	029-002-00-X	215-270-7	1317-39-1									
5	mercury { mercury dichloride }				28	mg/kg	1.353	37.898	mg/kg	0.00379 %		
	080-010-00-X	231-299-8	7487-94-7									
6	nickel { nickel chromate }				22	mg/kg	2.976	65.478	mg/kg	0.00655 %		
	028-035-00-7	238-766-5	14721-18-7									
7	lead { lead chromate }			1	210	mg/kg	1.56	327.561	mg/kg	0.021 %		
	082-004-00-2	231-846-0	7758-97-6									
8	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				0.43	mg/kg	2.554	1.098	mg/kg	0.00011 %		
	034-002-00-8											
9	vanadium { divanadium pentaoxide; vanadium pentoxide }				26	mg/kg	1.785	46.415	mg/kg	0.00464 %		
	023-001-00-8	215-239-8	1314-62-1									
10	zinc { zinc oxide }				340	mg/kg	1.245	423.203	mg/kg	0.0423 %		
	030-013-00-7	215-222-5	1314-13-2									
11	chromium in chromium(VI) compounds { chromium(VI) oxide }				<0.5	mg/kg	1.923	<0.962	mg/kg	<0.0000962 %		<LOD
	024-001-00-0	215-607-8	1333-82-0									
12	pH				6.2	pH		6.2	pH	6.2 pH		
13	naphthalene				0.25	mg/kg		0.25	mg/kg	0.000025 %		
	601-052-00-2	202-049-5	91-20-3									
14	acenaphthylene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-917-1	208-96-8									

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
15	acenaphthene	201-469-6	83-32-9		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
16	fluorene	201-695-5	86-73-7		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
17	phenanthrene	201-581-5	85-01-8		0.58 mg/kg		0.58 mg/kg	0.000058 %			
18	anthracene	204-371-1	120-12-7		0.11 mg/kg		0.11 mg/kg	0.000011 %			
19	fluoranthene	205-912-4	206-44-0		1.3 mg/kg		1.3 mg/kg	0.00013 %			
20	pyrene	204-927-3	129-00-0		1.3 mg/kg		1.3 mg/kg	0.00013 %			
21	benzo[a]anthracene	601-033-00-9	200-280-6		0.41 mg/kg		0.41 mg/kg	0.000041 %			
22	chrysene	601-048-00-0	205-923-4		0.53 mg/kg		0.53 mg/kg	0.000053 %			
23	benzo[b]fluoranthene	601-034-00-4	205-911-9		0.5 mg/kg		0.5 mg/kg	0.00005 %			
24	benzo[k]fluoranthene	601-036-00-5	205-916-6		0.15 mg/kg		0.15 mg/kg	0.000015 %			
25	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		0.34 mg/kg		0.34 mg/kg	0.000034 %			
26	indeno[123-cd]pyrene	205-893-2	193-39-5		0.15 mg/kg		0.15 mg/kg	0.000015 %			
27	dibenz[a,h]anthracene	601-041-00-2	200-181-8		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
28	benzo[ghi]perylene	205-883-8	191-24-2		0.3 mg/kg		0.3 mg/kg	0.00003 %			
Total:									0.0943 %		

Key

- User supplied data
- Determinand values ignored for classification, see column 'Conc. Not Used' for reason
- Determinand defined or amended by HazWasteOnline (see Appendix A)
- Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD** Below limit of detection
- CLP: Note 1 Only the metal concentration has been used for classification

Classification of sample: WS102[1]

 **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:	LoW Code:
WS102[1]	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.50 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
13%	
(no correction)	

Hazard properties

None identified

Determinands

Moisture content: **13%** No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
1	arsenic { arsenic trioxide }				8.9 mg/kg	1.32	11.751 mg/kg	0.00118 %			
	033-003-00-0	215-481-4	1327-53-3								
2	cadmium { cadmium oxide }				<0.1 mg/kg	1.142	<0.114 mg/kg	<0.0000114 %			<LOD
	048-002-00-0	215-146-2	1306-19-0								
3	chromium in chromium(III) compounds { chromium(III) oxide }				26 mg/kg	1.462	38 mg/kg	0.0038 %			
		215-160-9	1308-38-9								
4	copper { dicopper oxide; copper (I) oxide }				27 mg/kg	1.126	30.399 mg/kg	0.00304 %			
	029-002-00-X	215-270-7	1317-39-1								
5	mercury { mercury dichloride }				1 mg/kg	1.353	1.353 mg/kg	0.000135 %			
	080-010-00-X	231-299-8	7487-94-7								
6	nickel { nickel chromate }				30 mg/kg	2.976	89.288 mg/kg	0.00893 %			
	028-035-00-7	238-766-5	14721-18-7								
7	lead { lead chromate }			1	20 mg/kg	1.56	31.196 mg/kg	0.002 %			
	082-004-00-2	231-846-0	7758-97-6								
8	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<0.2 mg/kg	2.554	<0.511 mg/kg	<0.0000511 %			<LOD
	034-002-00-8										
9	vanadium { divanadium pentaoxide; vanadium pentoxide }				28 mg/kg	1.785	49.985 mg/kg	0.005 %			
	023-001-00-8	215-239-8	1314-62-1								
10	zinc { zinc oxide }				75 mg/kg	1.245	93.354 mg/kg	0.00934 %			
	030-013-00-7	215-222-5	1314-13-2								
11	chromium in chromium(VI) compounds { chromium(VI) oxide }				<0.5 mg/kg	1.923	<0.962 mg/kg	<0.0000962 %			<LOD
	024-001-00-0	215-607-8	1333-82-0								
12	pH				6.2 pH		6.2 pH	6.2 pH			
13	naphthalene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
	601-052-00-2	202-049-5	91-20-3								
14	acenaphthylene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
		205-917-1	208-96-8								

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number							
15	acenaphthene	201-469-6	83-32-9		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
16	fluorene	201-695-5	86-73-7		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
17	phenanthrene	201-581-5	85-01-8		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
18	anthracene	204-371-1	120-12-7		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
19	fluoranthene	205-912-4	206-44-0		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
20	pyrene	204-927-3	129-00-0		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
21	benzo[a]anthracene	601-033-00-9	200-280-6		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
22	chrysene	601-048-00-0	205-923-4		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
23	benzo[b]fluoranthene	601-034-00-4	205-911-9		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
24	benzo[k]fluoranthene	601-036-00-5	205-916-6		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
25	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
26	indeno[123-cd]pyrene	205-893-2	193-39-5		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
27	dibenz[a,h]anthracene	601-041-00-2	200-181-8		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
28	benzo[ghi]perylene	205-883-8	191-24-2		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
Total:								0.0337 %		

Key

- User supplied data
- Determinand values ignored for classification, see column 'Conc. Not Used' for reason
- Determinand defined or amended by HazWasteOnline (see Appendix A)
- Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD** Below limit of detection
- CLP: Note 1 Only the metal concentration has been used for classification

Classification of sample: WS103

 **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:	LoW Code:
WS103	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.00 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
17%	
(no correction)	

Hazard properties

None identified

Determinands

Moisture content: **17% No Moisture Correction applied (MC)**

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
1	arsenic { arsenic trioxide }				21	mg/kg	1.32	27.727	mg/kg	0.00277 %		
	033-003-00-0	215-481-4	1327-53-3									
2	cadmium { cadmium oxide }				0.2	mg/kg	1.142	0.228	mg/kg	0.0000228 %		
	048-002-00-0	215-146-2	1306-19-0									
3	chromium in chromium(III) compounds { chromium(III) oxide }				15	mg/kg	1.462	21.923	mg/kg	0.00219 %		
		215-160-9	1308-38-9									
4	copper { dicopper oxide; copper (I) oxide }				42	mg/kg	1.126	47.287	mg/kg	0.00473 %		
	029-002-00-X	215-270-7	1317-39-1									
5	mercury { mercury dichloride }				14	mg/kg	1.353	18.949	mg/kg	0.00189 %		
	080-010-00-X	231-299-8	7487-94-7									
6	nickel { nickel chromate }				21	mg/kg	2.976	62.502	mg/kg	0.00625 %		
	028-035-00-7	238-766-5	14721-18-7									
7	lead { lead chromate }			1	120	mg/kg	1.56	187.178	mg/kg	0.012 %		
	082-004-00-2	231-846-0	7758-97-6									
8	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				0.24	mg/kg	2.554	0.613	mg/kg	0.0000613 %		
	034-002-00-8											
9	vanadium { divanadium pentaoxide; vanadium pentoxide }				25	mg/kg	1.785	44.63	mg/kg	0.00446 %		
	023-001-00-8	215-239-8	1314-62-1									
10	zinc { zinc oxide }				69	mg/kg	1.245	85.885	mg/kg	0.00859 %		
	030-013-00-7	215-222-5	1314-13-2									
11	chromium in chromium(VI) compounds { chromium(VI) oxide }				<0.5	mg/kg	1.923	<0.962	mg/kg	<0.0000962 %		<LOD
	024-001-00-0	215-607-8	1333-82-0									
12	pH				5.8	pH		5.8	pH	5.8 pH		
13	naphthalene				0.24	mg/kg		0.24	mg/kg	0.000024 %		
	601-052-00-2	202-049-5	91-20-3									
14	acenaphthylene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-917-1	208-96-8									

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
15	acenaphthene	201-469-6	83-32-9		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
16	fluorene	201-695-5	86-73-7		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
17	phenanthrene	201-581-5	85-01-8		0.37 mg/kg		0.37 mg/kg	0.000037 %			
18	anthracene	204-371-1	120-12-7		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
19	fluoranthene	205-912-4	206-44-0		0.57 mg/kg		0.57 mg/kg	0.000057 %			
20	pyrene	204-927-3	129-00-0		0.63 mg/kg		0.63 mg/kg	0.000063 %			
21	benzo[a]anthracene	601-033-00-9	200-280-6		0.1 mg/kg		0.1 mg/kg	0.00001 %			
22	chrysene	601-048-00-0	205-923-4		0.13 mg/kg		0.13 mg/kg	0.000013 %			
23	benzo[b]fluoranthene	601-034-00-4	205-911-9		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
24	benzo[k]fluoranthene	601-036-00-5	205-916-6		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
25	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
26	indeno[123-cd]pyrene	205-893-2	193-39-5		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
27	dibenz[a,h]anthracene	601-041-00-2	200-181-8		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
28	benzo[ghi]perylene	205-883-8	191-24-2		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
Total:									0.0434 %		

Key

- User supplied data
- Determinand values ignored for classification, see column 'Conc. Not Used' for reason
- Determinand defined or amended by HazWasteOnline (see Appendix A)
- Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD** Below limit of detection
- CLP: Note 1 Only the metal concentration has been used for classification

Classification of sample: WS103[1]

 **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:	LoW Code:
WS103[1]	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.40 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
13%	
(no correction)	

Hazard properties

None identified

Determinands

Moisture content: **13%** No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
1	arsenic { arsenic trioxide }				5.1 mg/kg	1.32	6.734 mg/kg	0.000673 %			
	033-003-00-0	215-481-4	1327-53-3								
2	cadmium { cadmium oxide }				<0.1 mg/kg	1.142	<0.114 mg/kg	<0.0000114 %			<LOD
	048-002-00-0	215-146-2	1306-19-0								
3	chromium in chromium(III) compounds { chromium(III) oxide }				21 mg/kg	1.462	30.693 mg/kg	0.00307 %			
		215-160-9	1308-38-9								
4	copper { dicopper oxide; copper (I) oxide }				23 mg/kg	1.126	25.895 mg/kg	0.00259 %			
	029-002-00-X	215-270-7	1317-39-1								
5	mercury { mercury dichloride }				1.4 mg/kg	1.353	1.895 mg/kg	0.000189 %			
	080-010-00-X	231-299-8	7487-94-7								
6	nickel { nickel chromate }				27 mg/kg	2.976	80.359 mg/kg	0.00804 %			
	028-035-00-7	238-766-5	14721-18-7								
7	lead { lead chromate }			1	16 mg/kg	1.56	24.957 mg/kg	0.0016 %			
	082-004-00-2	231-846-0	7758-97-6								
8	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<0.2 mg/kg	2.554	<0.511 mg/kg	<0.0000511 %			<LOD
	034-002-00-8										
9	vanadium { divanadium pentaoxide; vanadium pentoxide }				23 mg/kg	1.785	41.059 mg/kg	0.00411 %			
	023-001-00-8	215-239-8	1314-62-1								
10	zinc { zinc oxide }				50 mg/kg	1.245	62.236 mg/kg	0.00622 %			
	030-013-00-7	215-222-5	1314-13-2								
11	chromium in chromium(VI) compounds { chromium(VI) oxide }				<0.5 mg/kg	1.923	<0.962 mg/kg	<0.0000962 %			<LOD
	024-001-00-0	215-607-8	1333-82-0								
12	pH				5.9 pH		5.9 pH	5.9 pH			
13	naphthalene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
	601-052-00-2	202-049-5	91-20-3								
14	acenaphthylene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
		205-917-1	208-96-8								

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number							
15	acenaphthene	201-469-6	83-32-9		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
16	fluorene	201-695-5	86-73-7		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
17	phenanthrene	201-581-5	85-01-8		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
18	anthracene	204-371-1	120-12-7		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
19	fluoranthene	205-912-4	206-44-0		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
20	pyrene	204-927-3	129-00-0		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
21	benzo[a]anthracene	601-033-00-9	200-280-6		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
22	chrysene	601-048-00-0	205-923-4		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
23	benzo[b]fluoranthene	601-034-00-4	205-911-9		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
24	benzo[k]fluoranthene	601-036-00-5	205-916-6		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
25	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
26	indeno[123-cd]pyrene	205-893-2	193-39-5		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
27	dibenz[a,h]anthracene	601-041-00-2	200-181-8		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
28	benzo[ghi]perylene	205-883-8	191-24-2		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
Total:								0.0268 %		

Key

- User supplied data
- Determinand values ignored for classification, see column 'Conc. Not Used' for reason
- Determinand defined or amended by HazWasteOnline (see Appendix A)
- Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD** Below limit of detection
- CLP: Note 1 Only the metal concentration has been used for classification

Classification of sample: WS104

 **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:	LoW Code:
WS104	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.0 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
7.4%	
(no correction)	

Hazard properties

None identified

Determinands

Moisture content: **7.4%** No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
1	arsenic { arsenic trioxide }				47	mg/kg	1.32	62.055	mg/kg	0.00621 %		
	033-003-00-0	215-481-4	1327-53-3									
2	cadmium { cadmium oxide }				0.51	mg/kg	1.142	0.583	mg/kg	0.0000583 %		
	048-002-00-0	215-146-2	1306-19-0									
3	chromium in chromium(III) compounds { chromium(III) oxide }				8	mg/kg	1.462	11.692	mg/kg	0.00117 %		
		215-160-9	1308-38-9									
4	copper { dicopper oxide; copper (I) oxide }				28	mg/kg	1.126	31.525	mg/kg	0.00315 %		
	029-002-00-X	215-270-7	1317-39-1									
5	mercury { mercury dichloride }				0.6	mg/kg	1.353	0.812	mg/kg	0.0000812 %		
	080-010-00-X	231-299-8	7487-94-7									
6	nickel { nickel chromate }				9.5	mg/kg	2.976	28.275	mg/kg	0.00283 %		
	028-035-00-7	238-766-5	14721-18-7									
7	lead { lead chromate }			1	120	mg/kg	1.56	187.178	mg/kg	0.012 %		
	082-004-00-2	231-846-0	7758-97-6									
8	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<0.2	mg/kg	2.554	<0.511	mg/kg	<0.0000511 %		<LOD
	034-002-00-8											
9	vanadium { divanadium pentaoxide; vanadium pentoxide }				14	mg/kg	1.785	24.993	mg/kg	0.0025 %		
	023-001-00-8	215-239-8	1314-62-1									
10	zinc { zinc oxide }				51	mg/kg	1.245	63.48	mg/kg	0.00635 %		
	030-013-00-7	215-222-5	1314-13-2									
11	chromium in chromium(VI) compounds { chromium(VI) oxide }				<0.5	mg/kg	1.923	<0.962	mg/kg	<0.0000962 %		<LOD
	024-001-00-0	215-607-8	1333-82-0									
12	pH				8.3	pH		8.3	pH	8.3 pH		
13	naphthalene				0.35	mg/kg		0.35	mg/kg	0.000035 %		
	601-052-00-2	202-049-5	91-20-3									
14	acenaphthylene				0.14	mg/kg		0.14	mg/kg	0.000014 %		
		205-917-1	208-96-8									

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number							
15	acenaphthene	201-469-6	83-32-9		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
16	fluorene	201-695-5	86-73-7		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
17	phenanthrene	201-581-5	85-01-8		0.66 mg/kg		0.66 mg/kg	0.000066 %		
18	anthracene	204-371-1	120-12-7		0.16 mg/kg		0.16 mg/kg	0.000016 %		
19	fluoranthene	205-912-4	206-44-0		1.3 mg/kg		1.3 mg/kg	0.00013 %		
20	pyrene	204-927-3	129-00-0		1.8 mg/kg		1.8 mg/kg	0.00018 %		
21	benzo[a]anthracene	601-033-00-9	200-280-6		0.85 mg/kg		0.85 mg/kg	0.000085 %		
22	chrysene	601-048-00-0	205-923-4		0.65 mg/kg		0.65 mg/kg	0.000065 %		
23	benzo[b]fluoranthene	601-034-00-4	205-911-9		3.3 mg/kg		3.3 mg/kg	0.00033 %		
24	benzo[k]fluoranthene	601-036-00-5	205-916-6		0.88 mg/kg		0.88 mg/kg	0.000088 %		
25	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		3 mg/kg		3 mg/kg	0.0003 %		
26	indeno[123-cd]pyrene	205-893-2	193-39-5		2.1 mg/kg		2.1 mg/kg	0.00021 %		
27	dibenz[a,h]anthracene	601-041-00-2	200-181-8		0.31 mg/kg		0.31 mg/kg	0.000031 %		
28	benzo[ghi]perylene	205-883-8	191-24-2		2.3 mg/kg		2.3 mg/kg	0.00023 %		
Total:								0.0363 %		

Key

- User supplied data
- Determinand values ignored for classification, see column 'Conc. Not Used' for reason
- Determinand defined or amended by HazWasteOnline (see Appendix A)
- Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD** Below limit of detection
- CLP: Note 1 Only the metal concentration has been used for classification

Classification of sample: WS104[1]

 **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:	LoW Code:
WS104[1]	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.50 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
14%	
(no correction)	

Hazard properties

None identified

Determinands

Moisture content: **14%** No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
1	arsenic { arsenic trioxide }				9.3 mg/kg	1.32	12.279 mg/kg	0.00123 %			
	033-003-00-0	215-481-4	1327-53-3								
2	cadmium { cadmium oxide }				<0.1 mg/kg	1.142	<0.114 mg/kg	<0.0000114 %			<LOD
	048-002-00-0	215-146-2	1306-19-0								
3	chromium in chromium(III) compounds { chromium(III) oxide }				23 mg/kg	1.462	33.616 mg/kg	0.00336 %			
		215-160-9	1308-38-9								
4	copper { dicopper oxide; copper (I) oxide }				25 mg/kg	1.126	28.147 mg/kg	0.00281 %			
	029-002-00-X	215-270-7	1317-39-1								
5	mercury { mercury dichloride }				<0.1 mg/kg	1.353	<0.135 mg/kg	<0.0000135 %			<LOD
	080-010-00-X	231-299-8	7487-94-7								
6	nickel { nickel chromate }				37 mg/kg	2.976	110.122 mg/kg	0.011 %			
	028-035-00-7	238-766-5	14721-18-7								
7	lead { lead chromate }			1	18 mg/kg	1.56	28.077 mg/kg	0.0018 %			
	082-004-00-2	231-846-0	7758-97-6								
8	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<0.2 mg/kg	2.554	<0.511 mg/kg	<0.0000511 %			<LOD
	034-002-00-8										
9	vanadium { divanadium pentaoxide; vanadium pentoxide }				26 mg/kg	1.785	46.415 mg/kg	0.00464 %			
	023-001-00-8	215-239-8	1314-62-1								
10	zinc { zinc oxide }				60 mg/kg	1.245	74.683 mg/kg	0.00747 %			
	030-013-00-7	215-222-5	1314-13-2								
11	chromium in chromium(VI) compounds { chromium(VI) oxide }				<0.5 mg/kg	1.923	<0.962 mg/kg	<0.0000962 %			<LOD
	024-001-00-0	215-607-8	1333-82-0								
12	pH				7.8 pH		7.8 pH	7.8 pH			
13	naphthalene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
	601-052-00-2	202-049-5	91-20-3								
14	acenaphthylene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
		205-917-1	208-96-8								

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number							
15	acenaphthene	201-469-6	83-32-9		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
16	fluorene	201-695-5	86-73-7		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
17	phenanthrene	201-581-5	85-01-8		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
18	anthracene	204-371-1	120-12-7		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
19	fluoranthene	205-912-4	206-44-0		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
20	pyrene	204-927-3	129-00-0		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
21	benzo[a]anthracene	601-033-00-9	200-280-6		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
22	chrysene	601-048-00-0	205-923-4		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
23	benzo[b]fluoranthene	601-034-00-4	205-911-9		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
24	benzo[k]fluoranthene	601-036-00-5	205-916-6		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
25	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
26	indeno[123-cd]pyrene	205-893-2	193-39-5		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
27	dibenz[a,h]anthracene	601-041-00-2	200-181-8		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
28	benzo[ghi]perylene	205-883-8	191-24-2		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
Total:								0.0327 %		

Key

- User supplied data
- Determinand values ignored for classification, see column 'Conc. Not Used' for reason
- Determinand defined or amended by HazWasteOnline (see Appendix A)
- Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD** Below limit of detection
- CLP: Note 1 Only the metal concentration has been used for classification

Classification of sample: WS105

 **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:	LoW Code:
WS105	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.0 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
19%	
(no correction)	

Hazard properties

None identified

Determinands

Moisture content: **19%** No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
1	arsenic { arsenic trioxide }				22	mg/kg	1.32	29.047	mg/kg	0.0029 %		
	033-003-00-0	215-481-4	1327-53-3									
2	cadmium { cadmium oxide }				0.62	mg/kg	1.142	0.708	mg/kg	0.0000708 %		
	048-002-00-0	215-146-2	1306-19-0									
3	chromium in chromium(III) compounds { chromium(III) oxide }				29	mg/kg	1.462	42.385	mg/kg	0.00424 %		
		215-160-9	1308-38-9									
4	copper { dicopper oxide; copper (I) oxide }				68	mg/kg	1.126	76.56	mg/kg	0.00766 %		
	029-002-00-X	215-270-7	1317-39-1									
5	mercury { mercury dichloride }				0.95	mg/kg	1.353	1.286	mg/kg	0.000129 %		
	080-010-00-X	231-299-8	7487-94-7									
6	nickel { nickel chromate }				21	mg/kg	2.976	62.502	mg/kg	0.00625 %		
	028-035-00-7	238-766-5	14721-18-7									
7	lead { lead chromate }			1	420	mg/kg	1.56	655.122	mg/kg	0.042 %		
	082-004-00-2	231-846-0	7758-97-6									
8	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<0.2	mg/kg	2.554	<0.511	mg/kg	<0.0000511 %		<LOD
	034-002-00-8											
9	vanadium { divanadium pentaoxide; vanadium pentoxide }				24	mg/kg	1.785	42.844	mg/kg	0.00428 %		
	023-001-00-8	215-239-8	1314-62-1									
10	zinc { zinc oxide }				210	mg/kg	1.245	261.39	mg/kg	0.0261 %		
	030-013-00-7	215-222-5	1314-13-2									
11	chromium in chromium(VI) compounds { chromium(VI) oxide }				<0.5	mg/kg	1.923	<0.962	mg/kg	<0.0000962 %		<LOD
	024-001-00-0	215-607-8	1333-82-0									
12	boron { diboron trioxide; boric oxide }				1	mg/kg	3.22	3.22	mg/kg	0.000322 %		
	005-008-00-8	215-125-8	1303-86-2									
13	TPH (C6 to C40) petroleum group				350	mg/kg		350	mg/kg	0.035 %		
			TPH									

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
14	tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane				<1 mg/kg		<1 mg/kg	<0.0001 %			<LOD
	603-181-00-X	216-653-1	1634-04-4								
15	benzene				<1 mg/kg		<1 mg/kg	<0.0001 %			<LOD
	601-020-00-8	200-753-7	71-43-2								
16	toluene				<1 mg/kg		<1 mg/kg	<0.0001 %			<LOD
	601-021-00-3	203-625-9	108-88-3								
17	ethylbenzene				<1 mg/kg		<1 mg/kg	<0.0001 %			<LOD
	601-023-00-4	202-849-4	100-41-4								
18	xylene				<1 mg/kg		<1 mg/kg	<0.0001 %			<LOD
	601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]								
19	cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<0.5 mg/kg	1.884	<0.942 mg/kg	<0.0000942 %			<LOD
	006-007-00-5										
20	pH				8.2 pH		8.2 pH	8.2 pH			
			PH								
21	naphthalene				0.54 mg/kg		0.54 mg/kg	0.000054 %			
	601-052-00-2	202-049-5	91-20-3								
22	acenaphthylene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
		205-917-1	208-96-8								
23	acenaphthene				0.31 mg/kg		0.31 mg/kg	0.000031 %			
		201-469-6	83-32-9								
24	fluorene				0.25 mg/kg		0.25 mg/kg	0.000025 %			
		201-695-5	86-73-7								
25	phenanthrene				3.1 mg/kg		3.1 mg/kg	0.00031 %			
		201-581-5	85-01-8								
26	anthracene				0.72 mg/kg		0.72 mg/kg	0.000072 %			
		204-371-1	120-12-7								
27	fluoranthene				4.7 mg/kg		4.7 mg/kg	0.00047 %			
		205-912-4	206-44-0								
28	pyrene				4.3 mg/kg		4.3 mg/kg	0.00043 %			
		204-927-3	129-00-0								
29	benzo[a]anthracene				2.3 mg/kg		2.3 mg/kg	0.00023 %			
	601-033-00-9	200-280-6	56-55-3								
30	chrysene				2.2 mg/kg		2.2 mg/kg	0.00022 %			
	601-048-00-0	205-923-4	218-01-9								
31	benzo[b]fluoranthene				3.3 mg/kg		3.3 mg/kg	0.00033 %			
	601-034-00-4	205-911-9	205-99-2								
32	benzo[k]fluoranthene				1.1 mg/kg		1.1 mg/kg	0.00011 %			
	601-036-00-5	205-916-6	207-08-9								
33	benzo[a]pyrene; benzo[def]chrysene				2.7 mg/kg		2.7 mg/kg	0.00027 %			
	601-032-00-3	200-028-5	50-32-8								
34	indeno[123-cd]pyrene				1.8 mg/kg		1.8 mg/kg	0.00018 %			
		205-893-2	193-39-5								
35	dibenz[a,h]anthracene				0.23 mg/kg		0.23 mg/kg	0.000023 %			
	601-041-00-2	200-181-8	53-70-3								
36	benzo[ghi]perylene				1.8 mg/kg		1.8 mg/kg	0.00018 %			
		205-883-8	191-24-2								
Total:									0.133 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
•	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i) on Flam. Liq. 1; H224, Flam. Liq. 2; H225, Flam. Liq. 3; H226: **Force this Hazardous property to non hazardous because**
The absence of a free draining liquid, the relatively low concentration of TPH reported and the absence of short chain petroleum hydrocarbon fractions indicate that this risk phrase is not applicable to this waste.

Classification of sample: HA101

✔ **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:	LoW Code:	
HA101	Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
0.0 m		
Moisture content:		
19%		
(no correction)		

Hazard properties

None identified

Determinands

Moisture content: 19% No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
1	arsenic { arsenic trioxide }				32 mg/kg	1.32	42.25	mg/kg	0.00423 %		
	033-003-00-0	215-481-4	1327-53-3								
2	cadmium { cadmium oxide }				1.5 mg/kg	1.142	1.713	mg/kg	0.000171 %		
	048-002-00-0	215-146-2	1306-19-0								
3	chromium in chromium(III) compounds { chromium(III) oxide }				150 mg/kg	1.462	219.233	mg/kg	0.0219 %		
		215-160-9	1308-38-9								
4	copper { dicopper oxide; copper (I) oxide }				530 mg/kg	1.126	596.721	mg/kg	0.0597 %		
	029-002-00-X	215-270-7	1317-39-1								
5	mercury { mercury dichloride }				2.7 mg/kg	1.353	3.654	mg/kg	0.000365 %		
	080-010-00-X	231-299-8	7487-94-7								
6	nickel { nickel chromate }				38 mg/kg	2.976	113.098	mg/kg	0.0113 %		
	028-035-00-7	238-766-5	14721-18-7								
7	lead { lead chromate }			1	480 mg/kg	1.56	748.711	mg/kg	0.048 %		
	082-004-00-2	231-846-0	7758-97-6								
8	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				0.34 mg/kg	2.554	0.868	mg/kg	0.0000868 %		
	034-002-00-8										
9	vanadium { divanadium pentaoxide; vanadium pentoxide }				24 mg/kg	1.785	42.844	mg/kg	0.00428 %		
	023-001-00-8	215-239-8	1314-62-1								
10	zinc { zinc oxide }				1300 mg/kg	1.245	1618.128	mg/kg	0.162 %		
	030-013-00-7	215-222-5	1314-13-2								
11	chromium in chromium(VI) compounds { chromium(VI) oxide }				<0.5 mg/kg	1.923	<0.962	mg/kg	<0.0000962 %		<LOD
	024-001-00-0	215-607-8	1333-82-0								
12	pH				8.9 pH		8.9	pH	8.9 pH		
13	naphthalene				0.26 mg/kg		0.26	mg/kg	0.000026 %		
	601-052-00-2	202-049-5	91-20-3								
14	acenaphthylene				<0.1 mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-917-1	208-96-8								

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
15	acenaphthene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
		201-469-6	83-32-9								
16	fluorene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
		201-695-5	86-73-7								
17	phenanthrene				1 mg/kg		1 mg/kg	0.0001 %			
		201-581-5	85-01-8								
18	anthracene				0.21 mg/kg		0.21 mg/kg	0.000021 %			
		204-371-1	120-12-7								
19	fluoranthene				1.5 mg/kg		1.5 mg/kg	0.00015 %			
		205-912-4	206-44-0								
20	pyrene				1.6 mg/kg		1.6 mg/kg	0.00016 %			
		204-927-3	129-00-0								
21	benzo[a]anthracene				0.64 mg/kg		0.64 mg/kg	0.000064 %			
	601-033-00-9	200-280-6	56-55-3								
22	chrysene				0.78 mg/kg		0.78 mg/kg	0.000078 %			
	601-048-00-0	205-923-4	218-01-9								
23	benzo[b]fluoranthene				0.63 mg/kg		0.63 mg/kg	0.000063 %			
	601-034-00-4	205-911-9	205-99-2								
24	benzo[k]fluoranthene				0.15 mg/kg		0.15 mg/kg	0.000015 %			
	601-036-00-5	205-916-6	207-08-9								
25	benzo[a]pyrene; benzo[def]chrysene				0.55 mg/kg		0.55 mg/kg	0.000055 %			
	601-032-00-3	200-028-5	50-32-8								
26	indeno[123-cd]pyrene				0.31 mg/kg		0.31 mg/kg	0.000031 %			
		205-893-2	193-39-5								
27	dibenz[a,h]anthracene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
	601-041-00-2	200-181-8	53-70-3								
28	benzo[ghi]perylene				0.36 mg/kg		0.36 mg/kg	0.000036 %			
		205-883-8	191-24-2								
Total:									0.313 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Appendix A: Classifier defined and non CLP determinands

■ **chromium(III) oxide** (EC Number: 215-160-9, CAS Number: 1308-38-9)

Conversion factor: 1.462

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 17/07/2015

Risk Phrases: R61 , R60 , R50/53 , R43 , R42 , R38 , R37 , R36 , R22 , R20

Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Repr. 1B H360FD , Skin Sens. 1 H317 , Resp. Sens. 1 H334 , Skin Irrit. 2 H315 , STOT SE 3 H335 , Eye Irrit. 2 H319 , Acute Tox. 4 H302 , Acute Tox. 4 H332

■ **dicopper oxide; copper (I) oxide** (EC Number: 215-270-7, CAS Number: 1317-39-1)

CLP index number: 029-002-00-X

Data source: Regulation (EU) 2016/1179 of 19 July 2016 (ATP9)

Additional Risk Phrases: N R50/53 >= 0.25 % , N R50/53

Additional Hazard Statement(s): None.

Reason for additional Hazards Statement(s)/Risk Phrase(s):

10/10/2016 - N R50/53 >= 0.25 % risk phrase sourced from: WM3 v1 still uses ecotoxic risk phrases

10/10/2016 - N R50/53 risk phrase sourced from: WM3 v1 still uses ecotoxic risk phrases

■ **TPH (C6 to C40) petroleum group** (CAS Number: TPH)

Description/Comments: Hazard statements taken from WM3 1st Edition 2015; Risk phrases: WM2 3rd Edition 2013

Data source: WM3 1st Edition 2015

Data source date: 25/05/2015

Risk Phrases: R65 , R63 , R51/53 , R46 , R45 , R10

Hazard Statements: Aquatic Chronic 2 H411 , Repr. 2 H361d , Carc. 1B H350 , Muta. 1B H340 , STOT RE 2 H373 , Asp. Tox. 1 H304 , Flam. Liq. 3 H226

■ **ethylbenzene** (EC Number: 202-849-4, CAS Number: 100-41-4)

CLP index number: 601-023-00-4

Data source: Commission Regulation (EU) No 605/2014 – 6th Adaptation to Technical Progress for Regulation (EC) No 1272/2008. (ATP6)

Additional Risk Phrases: None.

Additional Hazard Statement(s): Carc. 2 H351

Reason for additional Hazards Statement(s)/Risk Phrase(s):

03/06/2015 - Carc. 2 H351 hazard statement sourced from: IARC Group 2B (77) 2000

■ **salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex**

CLP index number: 006-007-00-5

Data source: Commission Regulation (EC) No 790/2009 - 1st Adaptation to Technical Progress for Regulation (EC) No 1272/2008. (ATP1)

Additional Risk Phrases: None.

Additional Hazard Statement(s): EUH032 >= 0.2 %

Reason for additional Hazards Statement(s)/Risk Phrase(s):

14/12/2015 - EUH032 >= 0.2 % hazard statement sourced from: WM3, Table C12.2

■ **pH** (CAS Number: PH)

Description/Comments: Appendix C4

Data source: WM3 1st Edition 2015

Data source date: 25/05/2015

Risk Phrases: None.

Hazard Statements: None.

■ **acenaphthylene** (EC Number: 205-917-1, CAS Number: 208-96-8)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 17/07/2015

Risk Phrases: R38 , R37 , R36 , R27 , R26 , R22

Hazard Statements: Skin Irrit. 2 H315 , STOT SE 3 H335 , Eye Irrit. 2 H319 , Acute Tox. 1 H310 , Acute Tox. 1 H330 , Acute Tox. 4 H302

■ **acenaphthene** (EC Number: 201-469-6, CAS Number: 83-32-9)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 17/07/2015

Risk Phrases: N R51/53 , N R50/53 , R38 , R37 , R36

Hazard Statements: Aquatic Chronic 2 H411 , Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Skin Irrit. 2 H315 , STOT SE 3 H335 , Eye Irrit. 2 H319

■ **fluorene** (EC Number: 201-695-5, CAS Number: 86-73-7)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 06/08/2015

Risk Phrases: N R50/53

Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400

■ **phenanthrene** (EC Number: 201-581-5, CAS Number: 85-01-8)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 06/08/2015

Risk Phrases: N R50/53 , R43 , R40 , R38 , R37 , R36 , R22

Hazard Statements: Skin Irrit. 2 H315 , Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Skin Sens. 1 H317 , Carc. 2 H351 , STOT SE 3 H335 , Eye Irrit. 2 H319 , Acute Tox. 4 H302

■ **anthracene** (EC Number: 204-371-1, CAS Number: 120-12-7)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 17/07/2015

Risk Phrases: N R50/53 , R43 , R38 , R37 , R36

Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Skin Sens. 1 H317 , Skin Irrit. 2 H315 , STOT SE 3 H335 , Eye Irrit. 2 H319

■ **fluoranthene** (EC Number: 205-912-4, CAS Number: 206-44-0)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 21/08/2015

Risk Phrases: N R50/53 , Xn R22

Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Acute Tox. 4 H302

■ **pyrene** (EC Number: 204-927-3, CAS Number: 129-00-0)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 2014

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 21/08/2015

Risk Phrases: N R50/53 , Xi R36/37/38

Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , STOT SE 3 H335 , Eye Irrit. 2 H319 , Skin Irrit. 2 H315

■ **indeno[123-cd]pyrene** (EC Number: 205-893-2, CAS Number: 193-39-5)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 06/08/2015

Risk Phrases: R40

Hazard Statements: Carc. 2 H351

■ **benzo[ghi]perylene** (EC Number: 205-883-8, CAS Number: 191-24-2)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 28/02/2015

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 23/07/2015

Risk Phrases: N R50/53

Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400

Appendix B: Rationale for selection of metal species

arsenic {arsenic trioxide}

Reasonable case CLP species based on hazard statements/molecular weight and most common (stable) oxide of arsenic. Industrial sources include: smelting; main precursor to other arsenic compounds (edit as required)

cadmium {cadmium oxide}

Reasonable case CLP species based on hazard statements/molecular weight, very low solubility in water. Industrial sources include: electroplating baths, electrodes for storage batteries, catalysts, ceramic glazes, phosphors, pigments and nematocides. (edit as required) Worst case compounds in CLP: cadmium sulphate, chloride, fluoride & iodide not expected as either very soluble and/or compound's industrial usage not related to site history (edit as required)

chromium in chromium(III) compounds {chromium(III) oxide}

Reasonable case species based on hazard statements/molecular weight. Industrial sources include: tanning, pigment in paint, inks and glass (edit as required)

copper {dicopper oxide; copper (I) oxide}

Reasonable case CLP species based on hazard statements/molecular weight and insolubility in water. Industrial sources include: oxidised copper metal, brake pads, pigments, antifouling paints, fungicide. (edit as required) Worse case copper sulphate is very soluble and likely to have been leached away if ever present and/or not enough soluble sulphate detected. (edit as required)

mercury {mercury dichloride}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

nickel {nickel chromate}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

lead {lead chromate}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

selenium {selenium compounds with the exception of cadmium sulposelenide and those specified elsewhere in this Annex}

Harmonised group entry used as most reasonable case. Pigment cadmium sulposelenide not likely to be present in this soil. No evidence for the other CLP entries: sodium selenite, nickel II selenite and nickel selenide, to be present in this soil. (edit as required)

vanadium {divanadium pentaoxide; vanadium pentoxide}

Most conservative species.

zinc {zinc oxide}

The absence of chromium VI within the soil samples indicates that zinc chromate could not be within the site soils. Given this the next most conservative compound has been selected, based on the site not being hardstood and leaching considered possible.

chromium in chromium(VI) compounds {chromium(VI) oxide}

Worst case CLP species based on hazard statements/molecular weight. Industrial sources include: production stainless steel, electroplating, wood preservation, anti-corrosion agents or coatings, pigments (edit as required)

boron {diboron trioxide; boric oxide}

Reasonable case CLP species based on hazard statements/ molecular weight, physical form and low solubility. Industrial sources include: fluxing agent for glass/enamels; additive for fibre optics, borosilicate glass (edit as required)

cyanides {salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex}

Harmonised group entry used as most reasonable case as complex cyanides and those specified elsewhere in the annex are not likely to be present in this soil: [Note conversion factor based on a worst case compound: sodium cyanide] (edit as required)

Appendix C: Version

HazWasteOnline Classification Engine: WM3 1st Edition, May 2015

HazWasteOnline Classification Engine Version: 2017.349.3471.7048 (16 Dec 2017)

HazWasteOnline Database: 2017.349.3471.7048 (16 Dec 2017)

This classification utilises the following guidance and legislation:

WM3 - Waste Classification - May 2015

CLP Regulation - Regulation 1272/2008/EC of 16 December 2008

1st ATP - Regulation 790/2009/EC of 10 August 2009

2nd ATP - Regulation 286/2011/EC of 10 March 2011

3rd ATP - Regulation 618/2012/EU of 10 July 2012

4th ATP - Regulation 487/2013/EU of 8 May 2013

Correction to 1st ATP - Regulation 758/2013/EU of 7 August 2013

5th ATP - Regulation 944/2013/EU of 2 October 2013

6th ATP - Regulation 605/2014/EU of 5 June 2014

WFD Annex III replacement - Regulation 1357/2014/EU of 18 December 2014

Revised List of Wastes 2014 - Decision 2014/955/EU of 18 December 2014

7th ATP - Regulation 2015/1221/EU of 24 July 2015

8th ATP - Regulation (EU) 2016/918 of 19 May 2016

9th ATP - Regulation (EU) 2016/1179 of 19 July 2016

10th ATP - Regulation (EU) 2017/776 of 4 May 2017

POPs Regulation 2004 - Regulation 850/2004/EC of 29 April 2004

1st ATP to POPs Regulation - Regulation 756/2010/EU of 24 August 2010

2nd ATP to POPs Regulation - Regulation 757/2010/EU of 24 August 2010

APPENDIX K

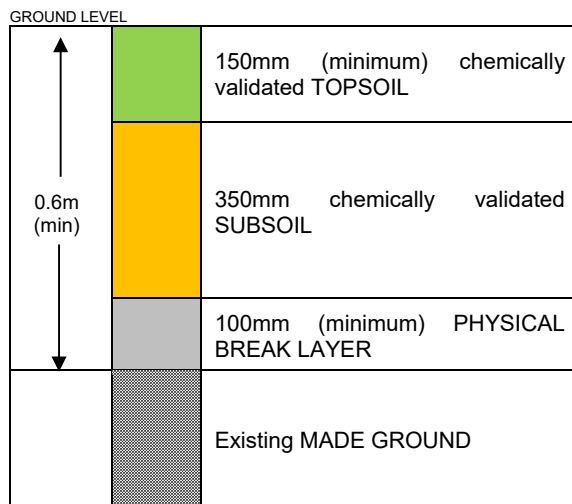
ENVIRONMENTAL COVER SYSTEM CONSTRUCTION

Private Back Gardens

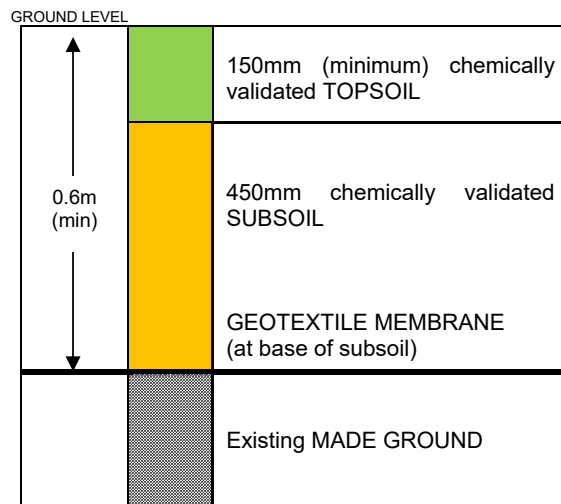
Private Front Gardens

PRIVATE BACK GARDENS:

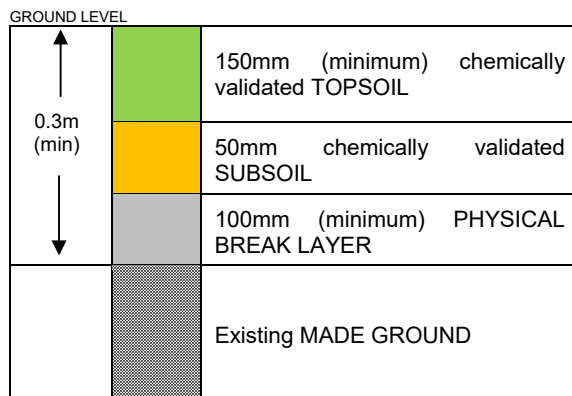
Either (physical break layer)



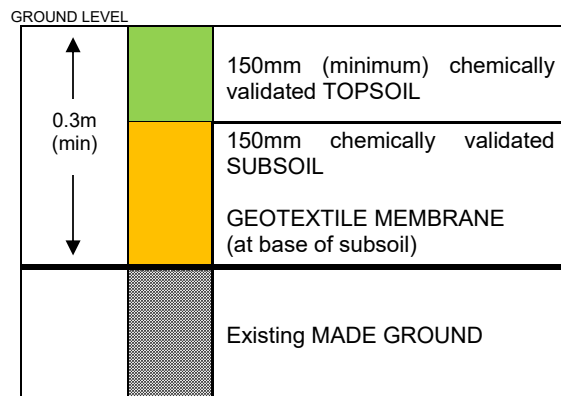
Or (geotextile membrane)

**PRIVATE FRONT GARDENS:**

Either (physical break layer)



Or (geotextile membrane)



Hardstood Areas – No Remediation Required

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