PHASE 2 ENVIRONMENTAL

&

GEOTECHNICAL INVESTIGATION

NO 4008/18

AT

28 WOKINGHAM ROAD, READING RG6 1JQ

FOR

PROPOSED HOUSING DEVELOPMENT

CONTENTS

1 INTRODUCTION 2
2 PHASE 2 INVESTIGATION 3
3 GEOTECHNICAL RECOMMENDATIONS 6
4 CONTAMINATION RISK ASSESSMENT (QUANTITATIVE) 17
5 TESTING THE CONCEPTUAL MODEL 32
6 SUMMARY OF THE QUANTITATIVE RISK ASSESSMENT 39
7 RECOMMENDATIONS 39
8 NOTES 45

FIGURES

1. SITE LOCATION
2.-9. SITE PHOTOGRAPHS

APPENDICES

A. BOREHOLE LOCATIONs AND RECORDS
B. SITE SERVICE SCAN
C. GEOTECHNICAL ANALYSIS
D. CONTAMINATION ANALYSIS
E. CONTAMINATION ASSESSMENT CRITERIA
F. GAS MONITORING DATA

PHASE 2 ENVIRONMENTAL
&
GEOTECHNICAL INVESTIGATION
NO 4008/18
AT
28 WOKINGHAM ROAD, READING, RG6 1JQ
FOR
PROPOSED HOUSING DEVELOPMENT

1 INTRODUCTION

1.1 This investigation was commissioned by the site owner, Messrs *Berkshire Van Hire*, in order to provide a ground contamination assessment for the proposed development area together with soil parameters for foundation design, road design, and soakaway design.

1.2 The Contamination Assessments have been carried out with reference to CLR 11 (Model Procedures for the Management of Land Contamination), and BS 10175 (Code of Practice for the Investigation of Potentially Contaminated Sites). This phased approach is set out below.

1.3 A Phase 1 was previously undertaken for this site by Terramech, under report reference 4008/17 dated February 2018 which gives recommendations for physical investigations and reference should be made to that document.

1.4 It is understood that the proposed building will comprise a two and a half storey flat block, of unknown construction.

2 SITE DETAILS

Site Location

2.1 This site is located near Reading town centre, some 2km east of the town centre. The site centre is located at grid reference 473280E 173120N and post code reference RG6 1JQ.

Brief Description

2.2 The area under consideration is approximately 0.08ha and is irregular in shape.

2.3 At the time of the investigation the site was occupied by a tyre fitting firm and a hand carwash firm.

Published Geology

2.4 The British Geological Survey Map, 1 in 10,000 scale Sheet Numbers SU77SW shows the site to be underlain superficial deposits of the Taplow Gravel Formation underlain by bedrock of the Lewes Nodular Chalk, Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated).

Published Hydrogeology

2.5 The Environment Agency Groundwater Maps (http://maps.environment-agency.gov.uk) which have replaced the old Groundwater Vulnerability mapping show the site to be underlain by 'bedrock' deposits (Upper Chalk) which are designated as a Principal Aquifer.

2.6 The overlying superficial gravel deposits are designated as a Secondary (A) Aquifer.

3 PHASE 2 INVESTIGATION

3.1 The site work was carried out on 11 April 2018, and laboratory tests were completed on the 25 April.

Scope of Works

3.2 Concrete coring was carried out to access the ground below using trailer mounted equipment that can rotate and advance cylindrical core barrels (with diamond or tungsten carbide crusted cutting edges) vertically into concrete floors. The rig rotates the core barrel and lifts and drops the motor and barrel with a system of hydraulics that are powered by a diesel engine. The coring rig includes a water supply which is used to cool the cutting edge and carry away the fines created. The barrels vary in diameter from about 100mm to 450mm.

3.3 Six 300mm diameter cores were undertaken through the external floor slab at the site, to enable window sample boreholes to be drilled through the slab.

3.4 Small diameter boreholes were drilled via the cored holes using a small rubber tracked 'Window Sampling' rig. The drilling rig percussively drives sampling tubes into the ground which are then withdrawn by the rig. Further depth is achieved by driving another tube down from the base of the hole left by the first. This process is repeated until the desired depth, or an obstruction, is met. The soil samples are retained inside the sampler tubes by a removable thin plastic liner. The rig therefore produces a continuous core from ground level to depth. The name window sample is a historic term referring to long sections, or windows, cut out of the sampler tube to allow recovery of the samples.

Ground Conditions

3.5 The site surface was entirely covered with concrete hardstanding / building cover. The concrete hardstanding was found to be approximately 200mm thick, containing basal reinforcement. This was underlain by a limestone gravel sub-base in WS2 – WS4 & WS2a.

3.6 Made ground was encountered beneath the concrete/sub-base in all positions across the site. Made ground was found to be variable across the site, although was generally encountered to a depth of approximately 0.8m depth. This was locally much deeper in WS5, where brick fill was encountered to 2.2m depth. Made ground was encountered to termination in WS2.

3.7 With the exception of hydrocarbon impacted soils encountered to 1.5m depth in WS2a, there was no visual or olfactory evidence of significant contamination noted by the logging engineer.

3.8 Beneath made ground, a variable clayey, sandy gravel representative of the mapped superficial Taplow Gravel Formation was encountered. This material was encountered to termination in WS2a, WS4 & WS5. The gravel was encountered to 3.9m and 2.8m depth in WS1 and WS3 respectively.

3.9 Weathered 'putty' chalk was encountered to termination in WS1 and WS3 representative of the mapped upper chalk was encountered. Due to disturbances caused by drilling, it was not possible to describe the chalk in accordance with CIRIA C574 guidance.

3.10 Where encountered, the penetration into the chalk was immediately sealed with bentonite pellets before monitoring wells were installed. This was to avoid creating a preferential pathway into the Chalk Aquifer for any near surface contaminants.

Groundwater

3.11 Groundwater was not observed during the drilling process, or during post site work monitoring.

3.12 There may be significant fluctuation in this observed groundwater level. Seasonal variations, weather induced variations and variations caused by nearby abstractions or discharges could cause rapid and significant changes in the effective groundwater level.

We suggest that it would be prudent to carry out a test excavation immediately prior to construction to ensure the levels have not changed.

Samples for Geotechnical Analysis

3.13 Samples representing the varying strata at the site were recovered for a selection of laboratory tests as follows:

Particle size analysis
Liquid and plastic limit
Sulfate and pH value
As received moisture content

Samples for Contamination Analysis

3.14 Two shallow level samples were taken in each of the window sample boreholes. Each sample was also screened onsite for volatile organic compounds (VOCs) using a Photo-Ionising Detector (PID).

3.15 The cores were split immediately after drilling and the samples were recovered for contamination analysis in accordance with BS10175 (2011). The samples were placed in laboratory supplied containers including amber glass jars with hydrocarbon resistant seals and plastic waterproof pots.

3.16 The samples were then placed in plastic cool boxes with frozen ice packs to be transported to a fridge at our laboratory for storage overnight before being and couriered to an MCERTS accredited laboratory for analysis.

3.17 The assessment parameters and criteria are discussed in separate sections.

4 GEOTECHNICAL RECOMMENDATIONS

Soil Strength

4.1 SPT 'N' values show a steady increase in strength with depth. At a level of 1.0m to 1.5m 'N' values of 8 – 22 (discounting made ground in WS5) were recorded. This increases to

'N' values of 22 – 50 by 2.0m to 2.5m depth. Using the relationship set out by Terzaghi and Peck between SPT 'N' values and allowable bearing pressure we can see that in the absence of groundwater a capacity of 75kN/m^2 would be applicable at 1.0m, increasing to 180kN/m^2 at 2.0m depth

4.2 Although overall settlement at these loads would be within acceptable limits, due to the viabilities in these superficial deposits, nominal reinforcement would be recommended to all foundation trenches to reduce to the effects of differential settlement on the foundations.

Solution Features

4.3 The Phase 1 Desk Study highlighted a high risk of the chalk beneath the site being affected by dissolution features.

4.4 Whilst the chalk was encountered during this investigation, it was highly weathered and disturbed, and no assessment of its competence was therefore possible.

4.5 Based on this and considering the high risk of dissolution features, dynamic probing is recommended along all internal and external load bearing walls in order to further quantify the potential risk of dissolution features. It should be noted that further investigation of this risk is likely to be required in order to satisfy regulatory bodies and warranty providers. The proposed scope of the probing exercise is discussed further below.

4.6 In addition to the above it is recommended that a competent person on the site is designated to inspect the foundation trenches before concreting for any signs of solution holes, ideally this should be a geotechnical engineer. If anomalies are suspected to be present, then a suitable engineering design should be provided to deal with the anomaly.

4.7 As always in an area at risk of being affected by chalk dissolution features, all foundations should contain top and bottom reinforcement and should be 'cruciform' in layout to protect against any future ground settlement.

Shrinkability

4.8 This assessment and recommendations are based upon the NHBC Standards Chapter 4.2 **(2018)** as this appears to be the most concise and robust document for assessing shrinkable soils and the effects of trees.

4.9 Eight representative samples were taken from the *Taplow Gravel Formation* to assess the shrinkage potential of these materials.

4.10 Only two of the samples was found to be plastic, with the remaining six deemed to be non-shrinkable as the grading returned values with less than 35% passing the 63micron sieve.

4.11 Of the two plastic samples, only the sample WS4/1.0 was considered 'shrinkable' ibn accordance with NHBC guidance (low volume change potential).

4.12 The NHBC categories are as follows:

Non-shrinkable
Grading - less than 35% passing the 63 micron sieve (silt & clay), or
Plasticity index less than 10%

Low Volume Change Potential
10% to less than 20%

Medium Volume Change Potential
20% to less than 40%

High Volume Change Potential
40% and greater

4.13 On this basis we would assess the soils over this site to be of low volume change potential for design purposes

Foundation Depths For Low Volume Change Potential Soils

4.14 The NHBC Standard Chapter 4.2 'Building near Trees' calls for a **minimum** foundation depth of 750mm for low volume change potential soils, where foundations are not within the effects of existing trees, proposed planting, or recently removed trees. Where foundations are within the effects of nearby trees, proposed planting or recently removed trees, the depths should be calculated for the tree type and its distance from the foundations, for low volume change potential soil.

4.15 Where trees have been, or are to be, removed from within 2.0m of the face of the proposed foundation, and where the height on removal is less than 50% of the mature height, it may be assumed that the distance from the foundations (D) = 2.0m when calculating foundation depths.

4.16 The table below gives foundation depths relative to **example** trees which may be on or near (i.e in neighbouring gardens) the site, for low volume change potential soils. Tree types and distances should be determined accurately before preparing the foundation design.

Name	Class	Water Demand	Max Height (m)	Distance from Foundation (m)	Volume Change Potential	Minimum Depth of Foundation (m)
Ash	Broadleaf	Moderate	23.0	0.0	Low	1.60
Ash	Broadleaf	Moderate	23.0	1.0	Low	1.55
Ash	Broadleaf	Moderate	23.0	2.0	Low	1.50
Ash	Broadleaf	Moderate	23.0	3.0	Low	1.45
Ash	Broadleaf	Moderate	23.0	4.0	Low	1.39
Ash	Broadleaf	Moderate	23.0	5.0	Low	1.34
Ash	Broadleaf	Moderate	23.0	6.0	Low	1.29
Ash	Broadleaf	Moderate	23.0	7.0	Low	1.24
Ash	Broadleaf	Moderate	23.0	8.0	Low	1.19
Ash	Broadleaf	Moderate	23.0	9.0	Low	1.14
Ash	Broadleaf	Moderate	23.0	10.0	Low	1.09
Ash	Broadleaf	Moderate	23.0	11.0	Low	1.04
Ash	Broadleaf	Moderate	23.0	12.0	Low	0.98
Ash	Broadleaf	Moderate	23.0	13.0	Low	0.93
Ash	Broadleaf	Moderate	23.0	14.0	Low	0.88
Ash	Broadleaf	Moderate	23.0	15.0	Low	0.83
Ash	Broadleaf	Moderate	23.0	16.0	Low	0.78
Ash	Broadleaf	Moderate	23.0	17.0	Low	0.75
Cypress, Leyland	Conifer	High	20.0	0.0	Low	2.48
Cypress, Leyland	Conifer	High	20.0	1.0	Low	2.34
Cypress, Leyland	Conifer	High	20.0	2.0	Low	2.19

Cypress, Leyland	Conifer	High	20.0	3.0	Low	2.05
Cypress, Leyland	Conifer	High	20.0	4.0	Low	1.90
Cypress, Leyland	Conifer	High	20.0	5.0	Low	1.76
Cypress, Leyland	Conifer	High	20.0	6.0	Low	1.62
Cypress, Leyland	Conifer	High	20.0	7.0	Low	1.47
Cypress, Leyland	Conifer	High	20.0	8.0	Low	1.33
Cypress, Leyland	Conifer	High	20.0	9.0	Low	1.18
Cypress, Leyland	Conifer	High	20.0	10.0	Low	1.04
Cypress, Leyland	Conifer	High	20.0	11.0	Low	0.89
Cypress, Leyland	Conifer	High	20.0	12.0	Low	0.75
English Oak	Broadleaf	High	20.0	0.0	Low	2.50
English Oak	Broadleaf	High	20.0	1.0	Low	2.43
English Oak	Broadleaf	High	20.0	2.0	Low	2.36
English Oak	Broadleaf	High	20.0	3.0	Low	2.29
English Oak	Broadleaf	High	20.0	4.0	Low	2.22
English Oak	Broadleaf	High	20.0	5.0	Low	2.15
English Oak	Broadleaf	High	20.0	6.0	Low	2.08
English Oak	Broadleaf	High	20.0	7.0	Low	2.01
English Oak	Broadleaf	High	20.0	8.0	Low	1.94
English Oak	Broadleaf	High	20.0	9.0	Low	1.87
English Oak	Broadleaf	High	20.0	10.0	Low	1.80
English Oak	Broadleaf	High	20.0	11.0	Low	1.73
English Oak	Broadleaf	High	20.0	12.0	Low	1.66
English Oak	Broadleaf	High	20.0	13.0	Low	1.59
English Oak	Broadleaf	High	20.0	14.0	Low	1.52
English Oak	Broadleaf	High	20.0	15.0	Low	1.45
English Oak	Broadleaf	High	20.0	16.0	Low	1.38
English Oak	Broadleaf	High	20.0	17.0	Low	1.31
English Oak	Broadleaf	High	20.0	18.0	Low	1.24
English Oak	Broadleaf	High	20.0	19.0	Low	1.17
English Oak	Broadleaf	High	20.0	20.0	Low	1.10
English Oak	Broadleaf	High	20.0	21.0	Low	1.03
English Oak	Broadleaf	High	20.0	22.0	Low	0.96
English Oak	Broadleaf	High	20.0	23.0	Low	0.89
English Oak	Broadleaf	High	20.0	24.0	Low	0.82
English Oak	Broadleaf	High	20.0	25.0	Low	0.75
Lime	Broadleaf	Moderate	22.0	0.0	Low	1.60
Lime	Broadleaf	Moderate	22.0	1.0	Low	1.55
Lime	Broadleaf	Moderate	22.0	2.0	Low	1.49
Lime	Broadleaf	Moderate	22.0	3.0	Low	1.44
Lime	Broadleaf	Moderate	22.0	4.0	Low	1.39
Lime	Broadleaf	Moderate	22.0	5.0	Low	1.33
Lime	Broadleaf	Moderate	22.0	6.0	Low	1.28
Lime	Broadleaf	Moderate	22.0	7.0	Low	1.22
Lime	Broadleaf	Moderate	22.0	8.0	Low	1.17
Lime	Broadleaf	Moderate	22.0	9.0	Low	1.12
Lime	Broadleaf	Moderate	22.0	10.0	Low	1.06
Lime	Broadleaf	Moderate	22.0	11.0	Low	1.01
Lime	Broadleaf	Moderate	22.0	12.0	Low	0.96
Lime	Broadleaf	Moderate	22.0	13.0	Low	0.90
Lime	Broadleaf	Moderate	22.0	14.0	Low	0.85
Lime	Broadleaf	Moderate	22.0	15.0	Low	0.80
Lime	Broadleaf	Moderate	22.0	16.0	Low	0.75

* These depths are *indicative* only, the NHBC has withdrawn calculated foundation depths below a 2.5m as it is now thought that the interaction between foundations, soil and trees is less predictable at these depths, as the factors combine to produce extreme conditions. It is therefore recommended that below 2.5m either an alternative foundation type is adopted, or site-specific desiccation analysis is required in relation to proposed foundations, and existing trees.

4.17 The following table should be used for new planting of trees and shrubs (NHBC Standard Chapter 4.2 'Building near Trees'). Planting schedules should be agreed with the local planning authority.

Volume Change Potential	Foundation Depth (m)		No Tree planting zone (m)			No Shrubs Planting Zone (m)	
High Medium Low	1.0 0.9 0.75		High Medium Low	1.25 x mature height 0.75 x mature height 0.5 x mature height		Shrub Group A B C	No restriction 0.75 x mature height 1.0 x mature height
Either / or							
Volume Change Potential	**Foundation Depth (m)**		**No Tree planting zone (m)**			**No Shrubs Planting Zone (m)**	
High Medium Low	1.5 1.25 1.0		High Medium Low	1.0 x mature height 0.5 x mature height 0.2 x mature height		Shrub Group A B C	No restriction No restriction 0.5 x mature height
Shrub Group A	Shrubs with a mature height less than 1.8m, of climbing varieties(needing support) which do not exceed 5m – No allowances needed,						
Shrub Group B	Other shrubs (exceeding 1.8m, or 5m supported, e.g ivy, Virgina Creeper, Wisteria, etc.), excluding Pyracantha and Cotoneaster						
Shrub Group C	Pyracantha and Cotoneaster whose height exceeds 1.8m						

Included in shrubs are: Pyracantha, Cotoneaster etc., and climbers such as Ivy, Virginia Creeper, Wisteria etc.

4.18 Should any of the foundations have to be taken below a depth of 1.5m, and are of trench fill design, they will not require compressible membranes on the inner face of external trenches.

4.19 In addition, where substantial root growth is seen in foundation trenches, the depths should be extended to comply with the NHBC Standard Chapter 4.2 'Building near Trees'.

Desiccation

4.20 Using the commonly used, crude estimate to indicate the onset of significant desiccation, where the moisture content is less than 0.4 x Liquid Limit and below the plastic limit, it can be seen based upon the limited plasticity index data, that both samples subjected to plasticity testing have a moisture deficit.

4.21 Given the high granular content within these samples, and considering the lack of proximal vegetation noted, it is considered that this be a natural induced moisture deficit and is not indicative of desiccation.

4.22 Therefore the soils encountered by the investigation are not considered to be desiccated at the time of this investigation, however it should be expected that there would be seasonal variations, with lower moisture content expected in the late summer months.

Strip and Pad Foundations

4.23 It is recommended that all foundations be taken through any fill material or any root penetrated soils found to be present and to a minimum depth of 0.75m, or the depth with respect to trees from the table above, whichever the greater.

4.24 At this depth we would recommend an allowable bearing value of 75kN/m^2. At this loading we would expect settlements to remain within acceptable limits.

4.25 With increasing depth, the allowable bearing pressure can be raised. At a depth of 1.5m an allowable bearing pressure of 110kN/m2 could be used and for foundations placed at 2.0m below ground level we would recommend an allowable bearing pressure of 180kN/m^2.

4.26 The NHBC Standard Chapter 4.2 'Building near Trees', states that "trench fill foundations deeper than 2.5m will only be acceptable where they are designed by an Engineer (See Chapter 1.1Technical Requirement R5).

Piled Foundations

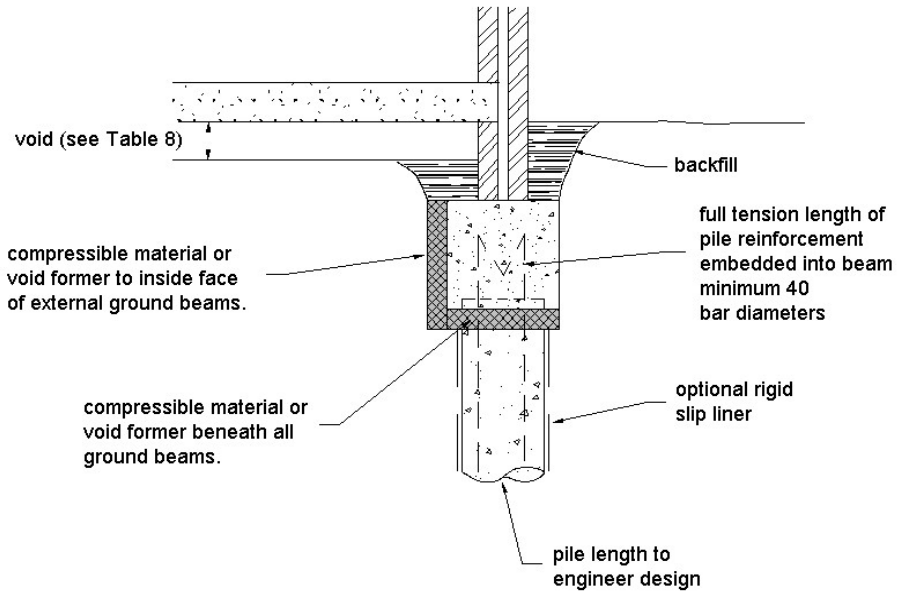
4.27 The borehole information to date will not supply the information required for pile design. If this foundation method is selected we would suggest that a light cable percussive borehole is drilled on the site to provide the necessary information. In order to protect the underlying chalk aquifer this would need to be undertaken via 'clean-drilling' methods until all hydrocarbon sources have been removed from the site.

4.28 It is recommended that the upper portion of pile is sleeved to the depth calculated for strip foundations from the NHBC Standard Chapter 4.2 'Building near Trees'. This will only reduce the effect of negative skin friction, but not completely remove it.

4.29 If the pile type does not lend itself to sleeving, then due allowance should be made in the design to carry the extra loads imposed on the upper portion of pile shaft by the effects of negative skin friction.

Pile and Beam Foundations

4.30 If pile and beam foundations are employed, in low volume change potential soil, a void should be formed beneath at least 50mm deep, but there is no requirement for a void former or compressible material against the sides of the beams. If they are external ground beams, a compressible membrane should also be fitted to the inside face. (See below and Table 7 of The NHBC Standard Chapter 4.2 'Building near Trees'.



Notes on piled foundations

4.31 The pile design would need to take into account the potential presence of dissolution features, as well as the potential creation of a preferential pollutant pathway.

4.32 The final method and design should be made by the piling specialist based on the risks associated with the potential for dissolution features, also the anomalies encountered.

4.33 Any pile design will need to take into account the possibility of:

- If bored piles such as CFA is used, unless each pile position is pre-probed, it will not be possible to establish if the pile has terminated in sound materials.
- High concrete consumption can occur in weak chalk if the pile shaft 'bulges' under the weight of concrete or if a solution feature is intersected.
- Shaft friction cannot be relied upon in loose or voided materials. This may result in irregular pile sections, inducing large additional side forces.
- Slender piles may fail in soft or voided soils as they may have no side support.
- The piles may fail if not installed vertically. Non-verticality may result from piles being installed adjacent to or on steeply sloping softened or voided faces.
- Vibrations from driven piles (not recommended) may initiate collapse of nearby features.
- Percussive boreholes would be required for pile design purposes
- The piling rig and method would need to be appropriate to bypass any thick flint layers.

4.34 We would not recommend the use of driven piles or vibro-stone columns since these methods can either push contaminated soil down into the underlying aquifer, or create a migration pathway for fluid or dissolved contaminants into the aquifer.

4.35 CFA (continuous flight auger) piles would be preferred since the auger continuously brings material upward during drilling and then the concrete is injected as the auger is withdrawn, thus sealing the hole.

Ground Floor Slabs

4.36 Because of the low volume change potential of the soil, suspended ground floor slabs should be installed The NHBC Standard Chapter 4.2 'Building near Trees' calls for a minimum void depth of 200mm for soils of low shrinkage risk, when using pre-cast beam and block construction or suspended timber construction.

Ground Floor Slab Gas Protection

4.37 With reference to the Radon assessment in the Desk Study, or Phase 1 report section, no Radon protective measures are necessary in the construction of new dwellings or extensions in this area.

4.38 There is a risk at this site that Methane, Carbon Dioxide and other ground gases could surface below the development and accumulate below floors and in wall cavities.

4.39 No significant methane or carbon dioxide has been detected in monitoring to date (discussed below).

4.40 Notwithstanding the above, inline with best practice a hydrocarbon vapour proof membrane should be installed in the proposed building to protect against potential ingress of remnant fumes and nuisance vapours; this membrane should be installed in accordance with the manufacturer's guidance by a suitable competent installer. If all vapour generating contaminants can be removed, the specification for the membrane can be reduced.

Sulfates

4.41 There were only low sulfates found as SO_4 in the samples tested and the pH values were sufficiently near to neutral not to require any special precautions being carried out when concreting in ground works. The recommended mixes can be found in BRE Special Digest 1.

Road Design

4.42 On the basis of potential frost susceptibility of the clay matrix surrounding the gravel a minimum construction depth of 450mm should be maintained. This implies a CBR value of 4% (Design Manual for Roads and Bridges – Highways Agency HD 25-94 1994).

4.43 This figure also agrees with the research carried out by the Transport Research Laboratory. Their laboratory report (TRRL LR 1132) gives design CBR values based on the plasticity of clay deposits.

Soakaways

4.44 Soakage tests are to define the permeability of the soil to allow soakaway chambers, trenches and drain fields to be sized. The rate at which water falls as rain (or the rate at which foul water is discharged) is balanced against the rate at which the ground can accept the water, with the remainder needing to be temporarily stored. This testing allows the storage volume of any proposed soakaway system to be defined.

4.45 Soakage tests were not carried out at this site. Given the granular deposits seen on the site, we suspect that infiltration rates would be reasonable.

4.46 If a formal soakaway design is required, it is recommended that full scale soakage tests are carried out using JCB dug trial pit filled with water in accordance with BRE365 recommendations.

4.47 Given the high risk of dissolution features, and new soakaway would need to be positioned **at least** 10m from any building (including those off-site). If this is not possible, an alternative method of surface water attenuation will be required.

4.48 At present, surface waters appear to be flowing off-site, before draining into interceptors, and then presumably into the sewer network. It is recommended that a specific drainage survey be undertaken to confirm this or otherwise.

5 CONTAMINATION RISK ASSESSMENT (QUANTITATIVE)

Soil Contaminants of Concern

5.1 The potential contaminants identified for each potential contamination source are assembled in the conceptual model table, which was presented in the Phase 1 Report. Reference should be made to that document.

5.2 Where no particular sources of contamination can be ascertained, as with horizons of made ground, adherence to the full potential range of contaminants detailed in every DoE Industry profile would obviously be unfeasible, therefore a wide ranging general list is applied in such situations.

Groundwater Contaminants of Concern

5.3 The list of contaminants considered in any groundwater or controlled waters assessment will be those identified for potential contamination sources on site, in the conceptual model. Risks to groundwater from surrounding offsite potential contaminants, not originating from the site, are outside the scope of this report.

Summary Table

5.4 The identified potential contaminants in each linkage from the conceptual model are reproduced below. The most appropriate method for assessment is then defined.

5.5

Contaminants of Concern and Appropriate Testing Suites		
Source	**Associated Contaminants**	**Testing Suite**
Made Ground	Antimony, Arsenic, Water Soluble, Boron, Cadmium, Chromium, Iron, Lead, Magnesium, Mercury, Molybdenum, Nickel, Selenium, Vanadium & Zinc Cyanide (free and total) Thiocyanate, Total Sulphate, Sulphide, Total Sulphur, Monohydric Hydrocarbons *including* Phenols, Mono-cyclic Aromatics and Poly -cyclic Aromatic Hydrocarbons Asbestos Ground gases inc CH_4, CO_2 and H_2S	Terramech 2
Fuel Filling Station	**Gasolene** Aliphatic Hydrocarbons C_5 to C_{12} (Pentane C_5, Hexane C_6 OctaneC_8 And DecanecC_{10}) Traces of Mono-cyclic and traces of Poly cyclic Aromatics from C_8 to C_{10}) Fuel additives such as Lead (Tetramethyl and Tetraethyl Lead) and MTBE **Diesel** 50% Aliphatic Hydrocarbons C_{10} to C_{40} (Decane C_{10}, Eicosane C_{20} and up). 50% Poly cyclic Aromatics from C_{10} to C_{35}). Traces of Mono-cyclic (Benzene etc C_6)	Banded Hydrocarbon Analysis (CWG) with BTEX
Vehicle Repair Garage	**Gasolene** Aliphatic Hydrocarbons C_5 to C_{12} (Pentane C_5, Hexane C_6 OctaneC_8 And DecanecC_{10}) Traces of Mono-cyclic and traces of Poly cyclic Aromatics from C_8 to C_{10}) Fuel additives such as Lead (Tetramethyl and Tetraethyl Lead) and MTBE **Diesel** 50% Aliphatic Hydrocarbons C_{10} to C_{40} (Decane C_{10}, Eicosane C_{20} and up). 50% Poly cyclic Aromatics from C_{10} to C_{35}). Traces of Mono-cyclic (Benzene etc C_6) **Inorganics** Metals associated with worked components. Includes alloys of steel containing chrome, vanadium molybdenum Boron and surface treatments such as chrome cadmium, cyanide nickel and zinc **Lubricants** Light Paraffin based oils as well as heavy engine oil comprising aliphatic hydrocarbons in the C20 to C40 range and aromatics in a similar range if the oil has been used **Solvents** Light aromatics and aliphatics up to C10 (white spirit or Stoddard's Solvent) halogenated hydrocarbons. **Other** Asbestos from brake linings	Terramech 1 suite, VOC suite
Car Sales Forecourt & Car Washing	Leaking fuel leaving legacy of Poly-cyclic Aromatics, lubricants comprising heavy aliphatic hydrocarbons and Poly cyclic Aromatics or antifreeze including members of the Glycol family.	Banded Hydrocarbon Analysis (CWG) with BTEX

Suites of Laboratory Analysis			
Terramech Suite 1	**Terramech Suite 2**	**Banded Hydrocarbon analysis Suite (CWG) with BTEX & MTBE**	**VOC**
Asbestos (Screen)	Asbestos (Screen)	Aliphatic C5-C6	Dichlorodifluoromethane
Antimony		Aliphatic >C6-C8	Methyl Tertiary Butyl Ether
Arsenic	Arsenic	Aliphatic >C8-C10	Chloromethane
Barium		Aliphatic >C10-C12	Vinyl Chloride
Boron (W/S)		Aliphatic >C12-C16	Bromomethane
Cadmium	Cadmium	Aliphatic >C16-C35	Chloroethane
Chromium	Chromium	Aliphatic >C35-C44	Trichlorofluoromethane
Chromium (Hexavalent)		Total Aliphatics (C5-C44)	1,1-Dichloroethene (DCE)
Copper	Copper	Aromatic C6-C7	Carbon Disulphide
Iron		Aromatic >C7-C8	Dichloromethane (DCM)
Lead	Lead	Aromatic >C8-C10	trans-1-2-Dichloroethene
Magnesium (Total)		Aromatic >C10-C12	1,1-Dichloroethane
Mercury	Mercury	Aromatic >C12-C16	cis-1-2-Dichloroethene #M
Molybdenum		Aromatic >C16-C21	2,2-Dichloropropane
Nickel	Nickel	Aromatic >C21-C35	Bromochloromethane
Selenium	Selenium	Aromatic >C35-C44	Chloroform #M
Total Acid Soluble Sulphate		Total Aromatics (C5-C44)	1,1,1-Trichloroethane
Sulphur (Total)		Volatile Hydrocarbons (C5-C12)	1,1-Dichloropropene
Vanadium	EPH C10 to C40 (no aro ali split CWG bands)	Extractable Hydrocarbons (C12-C44)	Carbon tetrachloride

Zinc		Total Hydrocarbons (C5-C44)	1,2-Dichloroethane
Free Cyanide		MTBE	Benzene
Total Cyanide	Total Cyanide	Benzene	Trichloroethene (TCE)
Organic Matter		Toluene	1,2-Dichloropropane
Organic Carbon		Ethylbenzene	Dibromomethane
Fraction Organic Carbon		m-Xylenes	Bromodichloromethane
pH		o-Xylene	cis-1-3-Dichloropropene
W/S Sulphate as SO4	Water Soluble Sulphates	p-Xylenes	Toluene
Acid Soluble Sulphide			trans-1-3-Dichloropropene
Thiocyanate as SCN			1,1,2-Trichloroethane
Phenol	Phenol by HPLC		Tetrachloroethene (PCE)
Total Phenols			1,3-Dichloropropane
CWG Hydrocarbons			Dibromochloromethane
BTEX aromatics			1,2-Dibromoethane
PAH 16	PAH 16		Chlorobenzene
			1,1,1,2-Tetrachloroethane
			Ethylbenzene
			p/m-Xylene
			o-Xylene
			Styrene
			Bromoform
			Isopropylbenzene
			1,1,2,2-Tetrachloroethane
			Bromobenzene
			1,2,3-Trichloropropane
			Propylbenzene
			2-Chlorotoluene
			1,3,5-Trimethylbenzene
			4-Chlorotoluen
			tert-Butylbenzene
			1,2,4-Trimethylbenzene
			sec-Butylbenzene
			4-Isopropyltoluene
			1,3-Dichlorobenzene
			1,4-Dichlorobenzene
			n-Butylbenzene
			1,2-Dichlorobenzene
			1,2-Dibromo-3-chloropropane
			1,2,4-Trichlorobenzene
			Hexachlorobutadiene
			Naphthalene
			1,2,3-Trichlorobenzene

Soils Assessment Criteria

5.6 Soil Guideline Values (SGVs) have been published by the Environment Agency for Arsenic, Cadmium, Nickel, Mercury, Selenium, Benzene, Toluene, Ethylbenzene, Xylene and Phenol together with Dioxins Furans and Dioxin like PCBs. These were calculated using the CLEA model (v1.04) and Environment Agency guidance documents SR2 (Human Health Toxicological Assessment of Contaminants in Soil) and SR3 (Updated Technical Background to the CLEA Model).

5.7 Further numbers of contaminants were assessed on this basis using the same CLEA Model by CIEH/LQM (The Chartered Institute of Environmental Health and Land Quality Management Ltd). Soil guideline values were published in their report on Generic Assessment Criteria for Human Health Assessments (2009). This 2009 guidance was replaced in 2015 by new S4UL values (Suitable '4' Use Levels) which are intended by CIEH/LQM to provide a complete and updated replacement for the values published in

their 2009 report (see CIEH/LQM S4UL – 1.1). The S4UL values are the copyright of Land Quality Management Ltd and are reproduced with permission; Publication Number S4UL3262 - All rights reserved.

5.8 Where there is no Environment Agency SGV or S4UL, Terramech Investigations have derived values using the CLEA Model with old TOX reports as well as the SR2 report and the SR3 report, as suggested by the Environment Agency.

5.9 The assessments should be based on a hierarchy where the Environment Agency SGVs and S4UL from the Chartered Institute of Environmental Health are most preferred, followed by values derived by Terramech using the CLEA model.

DEFRA SP1010 & C4SL

5.10 We have also considered C4SL values derived for 6 contaminants in the Department of the Environment Farming and Rural Affairs (DEFRA) SP1010 report. The report describes how levels of contamination at a site are placed in one of four categories. Category 4 is where the level of risk posed is acceptably low, to Category 1, where the level of risk is clearly unacceptable. The Category 4 values presented in the report were primarily intended for use under the Part 2A of the Environmental Protection Act 1990 to screen out low risk sites.

5.11 The Category 4 values are however, determined using a Lower Level of Toxicological Concern (LLTC) assessment methodology which differs from the Health Condition Values (HCVs) discussed in Environment Agency SR2 report, these consider minimal or tolerable levels of risk.

5.12 A direction was given by the Department for Communities and Local Government (DCLG) and DEFRA for the C4SL system to be used for assessments for Planning as well as assessments under Part 2A of the Environmental Protection Act (SP1010 Companion Document December 2014).

5.13 In order to maintain consistency in our approach to all contaminants (i.e. minimal or tolerable levels of risk), we have continued to use the slightly more conservative Environment Agency SR2 – SR3 based values for the 43 contaminants considered in the Environment Agency SGV reports and partner S4UL publication from CIEH/LQM.

5.14 Unfortunately, the Environment Agency and CIEH/LQM documents do not give any guidelines for Lead concentrations. The SP1010 publication (March 2014 - Appendix H - Table 4.1) does a give a provisional Category 4 value for Lead determined using the original HCV CLEA methodology. We consider this value is to be consistent with the minimal or tolerable levels of risk methodology used for the other 43 contaminants by the Environment Agency and CIEH/LQM.

5.15 On this basis we have adopted the values for Lead calculated to be protective of children as the critical receptors. For a residential garden, where plants are grown for consumption by the residents, the guideline value is 190mg/kg. No guideline concentrations are given by DEFRA in the SP1010 document for adults under that assessment methodology. Values for the other land use scenarios are presented in the appended tables.

Asbestos

5.16 CIRIA C733 (Asbestos In Soil And Made Ground) shows how respirable fibre exposure estimates can be carried out based on measured soil concentrations. We have used this methodology to derive guideline values for a number of exposure scenarios based on the minimal or tolerable levels risk level of 1 in 100,000 used to derive HCVs for other contaminants.

5.17 We have used the most conservative values for the exposure estimates wherever possible. It should be noted that these values are not corroborated by any other

organisation and they are also subject to the notes and caveats set out in the wider CIRIA C733 document.

Exposure Scenario

5.18 The generic exposure scenario for residential land use, where occupants are not expected to grow and consume fruits and vegetables on the site, has been selected for the assessment of soil contamination concentrations.

5.19 The generic guideline values are appended.

Assessment of the Measured Concentrations in Soil

5.20 The measured concentrations of contaminants in the samples recovered from this site were compared with the assessment criteria described above as follows. The laboratory result sheets are appended.

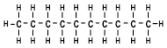
Metal Compounds

5.21 Analysis has shown that most of the metals considered in the analysis were at acceptable concentration apart from Lead. This metal was detected at elevated concentrations in some samples exceeding what we would expect to be present naturally. The samples with the highest Lead concentrations were also seen to contain the highest Zinc concentrations. Lead and zinc have white oxides which were commonly used as pigments in white paint and we suspect that the Lead that was detected in WS2A and WS4 was from historic use of white exterior paint.

5.22 Pathways for Lead into the human body are limited to absorption by the gut after direct soil ingestion or the consumption of plants which have taken up Lead. Green vegetables and tuber vegetables have the most significant Lead uptake compared with root vegetables and fruit. Dermal absorption is insignificant as a pathway, as are the dust inhalation pathways. On this basis the guideline for Lead in soils from gardens where no cultivation of food is to take place is 310mg/kg.

5.23 Only the lead concentration in sample WS2A/0.6m (381mg/kg) exceeded the guideline value.

Hydrocarbon Totals

5.24 Five samples were analysed using a basic total hydrocarbons test which gives the concentrations in the C10 to C40 range over a range of carbon chain length bands (Texas Bands). This test does not differentiate between Aliphatic Hydrocarbons (open chain molecules  and Aromatic Hydrocarbons (ringed molecules).

5.25 The hydrocarbon concentrations detected in any one band will however comprise both Aliphatic and Aromatic Hydrocarbons and the guideline values for hydrocarbons are given individually for Aliphatic and Aromatic Hydrocarbon bands. Where the measured total concentration does not exceed the guideline values for either Aliphatic or Aromatic Hydrocarbons, it is not possible for the guideline values to have been exceeded.

5.26 If the un-differentiated concentrations exceed the guideline values for either Aliphatic or Aromatic Hydrocarbons, then the results could not be compared with the CIEH/LQM derived S4UL values and it would be necessary to carry out more detailed analysis which differentiates between Aliphatic Hydrocarbons and Aromatic Hydrocarbons.

5.27 The analysis showed that there were elevated concentrations in the C16 – C21 and C21 to C35 bands, the highest value was 110mg/kg in sample WS5/0.7. This value did not exceed either limits for Aliphatic or Aromatic Hydrocarbons and is therefore expected to pose a minimal or tolerable level of risk to this development.

5.28 An additional five samples from around the site were analysed using a banded analysis method where concentrations are also divided in to two main hydrocarbon groups Aliphatic Hydrocarbons and Aromatic Hydrocarbons.

5.29 With the exception of sample WS2a/0.6m (discussed below), only traces of hydrocarbons were seen in over all hydrocarbon bands (both aliphatic and aromatic). None of the concentrations in any one band exceeded the guideline value for that band.

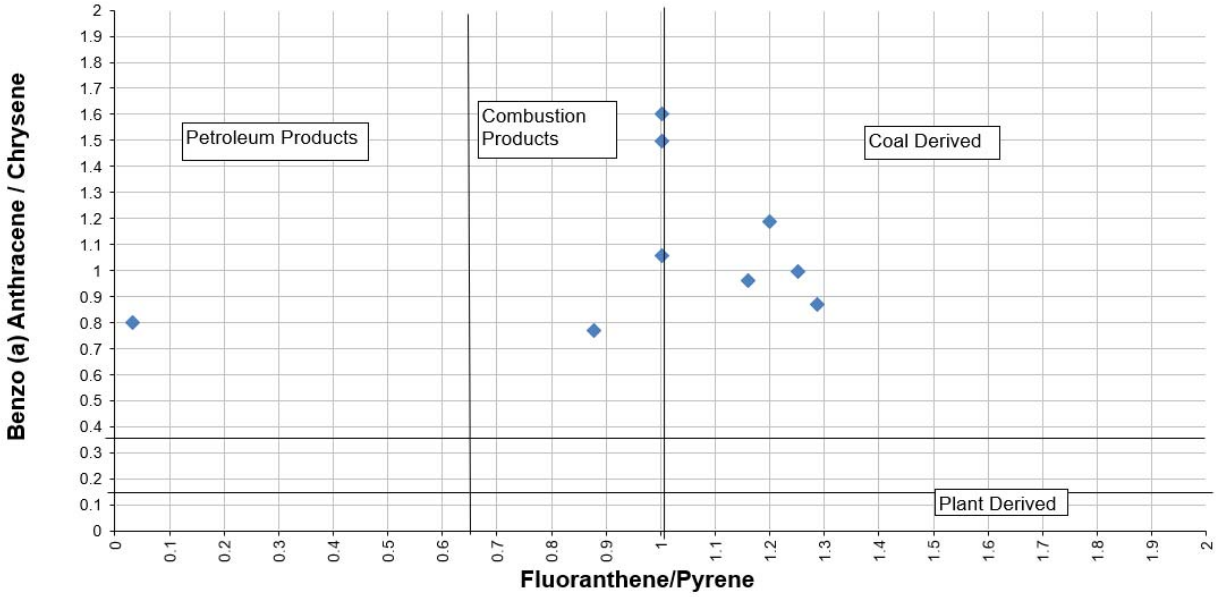
5.30 With regards to sample WS2a/0.6m, elevations of hydrocarbons were detected across all nearly all carbon bands, in both aliphatic and aromatic fractions. Of the 15 carbon bands tested for, four exceedances of the guideline values were recorded, including notably C21-C35 (aromatic) where a concentration of 13028mg/kg was recorded, compared to the guideline value of 1900mg/kg.

Poly-cyclic Aromatic Hydrocarbons

5.31 Poly-cyclic Aromatic Hydrocarbons (PAH) are present in coal tars, combustion by-products and fuels and they are one of the most common forms of soil contamination, often as a legacy of the UK's industrial past.

5.32 These tarry hydrocarbons are made up of long chains of hydrogen and carbon atoms, which unlike the open ended chains seen in the Aliphatic group, have linked to form rings ( ). There are many different configurations of these rings resulting in a vast number of different compounds. We have focused our attention on a group of sixteen of these hydrocarbon compounds which were identified by the United States Environmental Protection Agency as being the most common and/or the most toxic..

5.33 A number of these compounds were seen to exceed their respective guideline values. These were Benzo (a) Pyrene and Dibenzo (a,h) Anthracene, naphthalene, benzo(a)anthracene & benzo(b)fluoranthene.



Above a plot of the ratios of Benzo Anthracene / Chrysene vs the ratio of Fluoranthene / Pyrene

5.34 In order to identify the source of these hydrocarbons (i.e. petroleum products combustion by-products, plant derived or coal derived) we have looked at the proportions of particular individuals (by plotting concentration ratios – see plot above)

5.35 The ratios suggest that these compounds are generally coal or coal ash derived however, the ratios of PAH in the sample from WS2A at 0.6m suggested tyre oils or coal tar

Hydrocarbons (Phenols)

5.36 Phenols (total Monohydric Phenols includes Cresols or Methylphenol and Chlorinated Phenols) were below detection limits in all samples and therefore the concentrations did not exceed the guideline value for Phenol published in the new Soil Guideline Value (SGV) report.

Mono-cyclic Aromatic Hydrocarbons

5.37 Five samples were tested for the presence of Mono-cyclic Aromatics (single ring molecule such as Benzene and its derivatives (Toluene, Ethylbenzene and Xylenes)

as well as the petrol additive MTBE. Of the five samples tested, these compounds were only detected in sample WS2a/0.6.

5.38 Concentrations exceeded respective guideline values for benzene, ethylbenzene, p/m-xylene and o-xylene.

VOC Analysis

5.39 Volatile Organic Compound (VOC) analysis was carried out on sample WS2a/0.6 after high concentrations (90.6ppm) were detected on site using a Photo-Ionising Detector

5.40 These compounds evaporate or volatilise readily at room temperatures and are often used as solvents.

5.41 There are thousands of variations of these hydrocarbon based compounds which include Light Aliphatic compounds such as Pentane, Hexane and Octane as well as Mono-cyclic Aromatic Hydrocarbons such as Benzene and its derivatives (BTEX group). Halogenated compounds are also common solvents. These are created by replacement of the hydrogen atoms with halogens such as Chlorine or Fluorine for example.

5.42 Our analysis has focussed on a group of 60 of the most commonly used solvents and also included 'TICS' assessment (Tentatively Identified Compounds) where any other compounds detected in the VOC range are also identified.

5.43 The analysis showed that as well as the aforementioned 'BTEX' compounds, various other volatile organic compounds were detected including 1,2,4-trimethylbenzne, sec-butylbenzene, 4-isopropytoluene and n-butylbenzene.

5.44 These results are consistent with volatiles being generated by diesel fuel decaying in the ground.

Cyanide Compounds

5.45 Cyanide is a common industrial contaminant and can be used in the case hardening of steel, or it can be present as a combustion by product. Older industries such as town gas

works produced Cyanide based waste called Blue Billy (Ferric Cyanide). Cyanides can also be present as a result of plants such as Laurel (in the berries) as well as other plant roots seeds and berries.

5.46 The analysis did not detect any Cyanide Compounds. The testing was for total Cyanides which can include Thiocyanates, one of the most complex form of Cyanide formed by metabolisation by plants and animals, Cyanide Salts which involve metals such as Iron (which forms Blue Billy), and free Cyanide which is the most toxic.

Asbestos

5.47 Asbestos was detected on the samples from WS5 at 0.3m depth and was identified as Amosite (Brown) Asbestos, and Chrysotile (white) Asbestos. The laboratory has reported the values as 'quantifiable'.

5.48 Chrysotile Asbestos and amosite asbestos were detected at trace levels within the brick fill encountered in WS5 (sample WS5/0.3m). The levels were reported as being less than 0.001%.

5.49 We have used the CIRIA C733 (Asbestos In Soil And Made Ground) respirable fibre exposure estimate methodology to derive guideline values for a number of exposure scenarios based on the minimal or tolerable levels risk level of 1 in 100,000 used to derive HCVs for other contaminants. These values are appended.

5.50 These guideline values show that any detectable concentration of amosite is considered an unacceptable risk in a residential setting.

Groundwater Contamination

5.51 Concentrations of soil contamination were assessed using the Environment Agency R&D20 spreadsheet which was used to determine generic guideline values at Tier 1 stage for a range of contaminants. Soil properties were taken from the Environment

Agency CLEA model v1.06 (Generic UK Soil) and chemical properties were taken from the reports supporting the CLEA model under the SC050021 reference.

5.52 Concentrations of Arsenic and Nickel exceeded the Tier 1 values however, these metals were thought to be present naturally with the Iron, which was detected at high concentrations. Since these metals have been present in open soils in the millennia that have passed since their deposition, any soluble fractions have been washed away long ago. The concentrations were not therefore considered to represent a risk to groundwater/controlled waters.

5.53 The calculated Tier 1 values are well below the detection limits of the analysis and therefore these results cannot be used in a Tier 1 assessment. However given the hydrocarbon contamination identified and considering the sensitivity of the underlying chalk aquifer, these values **are** considered a potential risk to groundwater.

Ground Gases

5.54 The potential for ground gases has been assessed and one monitoring visit had been made at the time of completion of this report. A further two visits are planned and these results will be reported on in due course.

5.55 The monitoring has shown that a maximum concentration for Carbon Dioxide of 1.5% were recorded. A maximum active gas flow rate of 0.1 l/hr was detected. Methane was not detected.

5.56 CIRIA C665 'Assessing risks posed by hazardous ground gases to buildings' has been used to determine the gas guideline value and characteristic situation for the Methane and Carbon Dioxide concentrations determined.

5.57 For Carbon Dioxide, a gas screening value of 0.0015 l/hr has been determined based on an active gas flow of 1.5%. Using the 'modified Wilson and Card classification' scheme, Characteristic situation 1 has been determined.

5.58 It should be noted that Carbon Dioxide does not represent an explosion risk, and that Carbon Dioxide is not intrinsically toxic. Carbon Dioxide causes asphyxia at high concentrations purely by exclusion/displacement of Oxygen.

5.59 According to BS8485:2015 characteristic situation CS1 does not require gas protection measures to be installed. That said, given the former fuel filling station usage of the site, and considering the fact that significant quantities of hydrocarbons have been detected in the investigation. Unless all of the impacted soils can be removed it is strongly recommended that a hydrocarbon proof membrane be installed in the new building, to protect against vapours and the ingress of nuisance odours.

5.60 This hydrocarbon proof membrane should be fitted inline with the manufacturers recommendations, and must be suitably lapped and taped around service entries etc by a competent person, as per the manufacturers instructions.

Selection of Supply Pipe Materials (UK WIR)

5.61 Water pipes laid in contaminated ground can absorb some contaminants and allow then to contaminate the water running in the pipes. Our assessments are based on the *UKWIR Report Ref No 10/WM/03/21* which gives a mandatory list of contaminants and threshold concentrations for those contaminants in relation to different types of water pipe materials. Various considerations are listed about the sampling techniques, depths and frequency of tests based on the initial characterisation of the site.

5.62 Given the type and nature of the contaminants found on this site, we would not recommend that water pipe installation workers enter the trenches under any circumstances without appropriate PPE, given the risks posed by respirable fibres, volatiles and gases.

5.63 The results show that the soils at pipe installation depth contained solvents, mineral oils ,and VOC compounds, indicating compounds that can penetrate plastic pipe. Unless

these contaminants are removed from the WS2A location or anywhere else they are found on site, we would recommend barrier pipe for water supplies comprising either layered plastic pipe (PE Al PE), wrapped steel, wrapped ductile iron or copper pipe.

Waste Classification

5.64 Assessment of soils destined for landfills takes two stages. The first is basic site characterisation, the second stage is compliance testing to assess the behaviour of these materials when they are buried.

5.65 Waste Acceptance Criteria (WAC) compliance testing involves a series of leachate or solubility tests for metalloid compounds and total concentrations of hydrocarbon based compounds as well as organic matter content. The leachate and total concentrations where then compared to values set out in BS EN 12457-3.

5.66 The purpose of these tests is to assess the risk posed by the material when placed in a landfill. These risks range from the leaching of soluble contaminants out of the material and into groundwater or water courses, to the risk posed by matter which could decay and generate gases such as Methane, Hydrogen Sulphide or Carbon Dioxide.

5.67 Waste Acceptance Criteria (WAC) testing has not been carried out on samples from this site. However, a review of the total concentrations of contaminants on the WAC list has shown that sufficient concentrations of metal and inorganic (non hydrocarbon based) contaminants were present for the leaching limits to be exceeded..

5.68 The hydrocarbon totals, including volatiles and PCBs etc. and organic matter contents exceeded the limits for inert waste. On this basis these soils should be classified as hazardous waste.

5.69 The results should be forwarded to the landfill proposed to receive the arisings/excavated material

Summary of Laboratory Analysis

5.70 The results showed that elevated concentrations of lead, poly-cyclic aromatic hydrocarbons, asbestos and petroleum hydrocarbons were present at concentrations unsuitable for a residential garden.

5.71 Given that most of the topsoil/surface soil will be removed from the site during the development, we consider that the Lead or the Chrysotile fibres pose a minimal or tolerable level of risk.

5.72 This was consistent with the findings of the desk study which predicted the presence of hydrocarbons given the sites former usage as a fuel filling station.

6 TESTING THE CONCEPTUAL MODEL

6.1 Testing of the conceptual model can be carried out on the basis of the intrusive investigations carried out at the site.

6.2 Observations of ground conditions such as permeability, surface water and groundwater together with the laboratory analysis can be used to determine if any of the linkages could be broken by separation of either source or pathway from associated receptors.

6.3 Linkages from the conceptual model which were assessed as acceptable have been reproduced. The linkages are then examined in the light of actual contamination concentrations. Sections of a linkage can then be discounted or demonstrated as plausible. The reasoning for the discounting of any part of a linkage is given in italics.

6.4 The findings of the intrusive works may also require the addition of further linkages to the model.

6.5 Linkages may remain because there is not enough information to agree or to discount a particular linkage or because the linkage has been proved and therefore some action to mitigate the risks to receptors should be carried out.

6.6 Mitigation measures can include remediation to remove sources of contamination or encapsulation to sever the migration pathways between source and receptor.

Linkage 1

Source On Site	Location	Associated Contaminants	*Dismissed?*	Migration Pathway	*Dismissed?*	Absorption Pathway	*Dismissed?*	Receptor	*Dismissed?*
Made ground	Whole site	Antimony, Arsenic, Water Soluble, Boron, Cadmium, Chromium, Iron, Lead, Magnesium, Mercury, Molybdenum, Nickel, Selenium, Vanadium & Zinc Cyanide (free and total) Thiocyanate, Total Sulphate, Sulphide, Total Sulphur, Monohydric Hydrocarbons *including* Phenols, Mono-cyclic Aromatics and Poly -cyclic Aromatic Hydrocarbons Asbestos Ground gases inc CH_4, CO_2 and H_2S	*No – elevated lead, hydrocarbons and asbestos detected*	Present at surface on site	*No – elevated lead, hydrocarbons and asbestos detected*	Dermal contact with soil	*No – elevated lead, hydrocarbons and asbestos detected*	Construction Workers.	*No – elevated lead, hydrocarbons and asbestos detected*
				Migrating off site via the surface or via porous soils	*No – elevated lead, hydrocarbons and asbestos detected*	Ingestion of Soil	*No – elevated lead, hydrocarbons and asbestos detected*	Service and Maintenance Workers	*No – elevated lead, hydrocarbons and asbestos detected*
						Inhalation of fugitive soil dust (outside)	*No – elevated lead, hydrocarbons and asbestos detected*	Site Occupiers	*No – elevated lead, hydrocarbons and asbestos detected*
						Dermal contact with household/indoor dust	*No – elevated lead, hydrocarbons and asbestos detected*	Wider public	*No – elevated lead, hydrocarbons and asbestos detected*
						Ingestion of household/indoor dust.	*No – elevated lead, hydrocarbons and asbestos detected*	Groundwater	*No – elevated lead, hydrocarbons and asbestos detected*
						Inhalation of fugitive household/indoor dust	*No – elevated lead, hydrocarbons and asbestos detected*		
						Ingestion of contaminated vegetables	*Yes – Growing of vegetables not expected in proposed development*		
				Directly to groundwater	*No – elevated lead, hydrocarbons and asbestos detected*	Ingestion of contaminated soil attached to vegetables	*Yes – Growing of vegetables not expected in proposed development*		
						Inhalation of vapours or gases outside	*No – elevated lead, hydrocarbons and asbestos detected*		
						Inhalation of vapours/gases inside.	*No – elevated lead, hydrocarbons and asbestos detected*		
						Groundwater			

Linkage 2

Source On Site	Location	Associated Contaminants	*Dismissed?*	Migration Pathway	*Dismissed?*	Absorption Pathway	*Dismissed?*	Receptor	*Dismissed?*
Fuel Filling Station	Whole site	**Gasolene** Aliphatic Hydrocarbons C_5 to C_{12} (Pentane C_5, Hexane C_6 OctaneC_8 And DecanecC_{10}) Traces of Mono-cyclic and traces of Poly cyclic Aromatics from C_8 to C_{10}) Fuel additives such as Lead (Tetramethyl and Tetraethyl Lead) and MTBE **Diesel** 50% Aliphatic Hydrocarbons C_{10} to C_{40} (Decane C_{10}, Eicosane C_{20} and up). 50% Poly cyclic Aromatics from C_{10} to C_{35}). Traces of Mono-cyclic (Benzene etc C_6)	*No – elevated hydrocarbons detected & direct investigation of fuel tanks is yet to be undertaken*	Present at surface on site	*No – elevated hydrocarbons detected & direct investigation of fuel tanks is yet to be undertaken*	Dermal contact with soil	*No – elevated hydrocarbons detected & direct investigation of fuel tanks is yet to be undertaken*	Construction Workers.	*No – elevated hydrocarbons detected & direct investigation of fuel tanks is yet to be undertaken*
				Migrating off site via the surface or via porous soils	*No – elevated hydrocarbons detected & direct investigation of fuel tanks is yet to be undertaken*	Ingestion of Soil	*No – elevated hydrocarbons detected & direct investigation of fuel tanks is yet to be undertaken*	Service and Maintenance Workers	*No – elevated hydrocarbons detected & direct investigation of fuel tanks is yet to be undertaken*
						Inhalation of fugitive soil dust (outside)	*No – elevated hydrocarbons detected & direct investigation of fuel tanks is yet to be undertaken*	Site Occupiers	*No – elevated hydrocarbons detected & direct investigation of fuel tanks is yet to be undertaken*
						Dermal contact with household/indoor dust	*No – elevated hydrocarbons detected & direct investigation of fuel tanks is yet to be undertaken*	Wider public	*No – elevated hydrocarbons detected & direct investigation of fuel tanks is yet to be undertaken*
						Ingestion of household/indoor dust.	*No – elevated hydrocarbons detected & direct investigation of fuel tanks is yet to be undertaken*	Groundwater	*No – elevated hydrocarbons detected & direct investigation of fuel tanks is yet to be undertaken*

								Inhalation of fugitive household/indoor dust	*No – elevated hydrocarbons detected & direct investigation of fuel tanks is yet to be undertaken*			
								Ingestion of contaminated vegetables	*Yes – Growing of vegetables not expected in proposed development*			
					Directly to groundwater	*No – elevated hydrocarbons detected & direct investigation of fuel tanks is yet to be undertaken*		Ingestion of contaminated soil attached to vegetables	*Yes – Growing of vegetables not expected in proposed development*			
								Inhalation of vapours or gases outside	*No – elevated hydrocarbons detected & direct investigation of fuel tanks is yet to be undertaken*			
								Inhalation of vapours/gases inside.	*No – elevated hydrocarbons detected & direct investigation of fuel tanks is yet to be undertaken*			
								Groundwater				

Linkage 3

Source On Site	Location	Associated Contaminants	*Dismissed?*	Migration Pathway	*Dismissed?*	Absorption Pathway	*Dismissed?*	Receptor	*Dismissed?*
Vehicle Repair Garage	Whole Site, particularly beneath existing building and proximal to inspection pit	**Gasolene** Aliphatic Hydrocarbons C_5 to C_{12} (Pentane C_5, Hexane C_6 OctaneC_8 And DecanecC_{10}) Traces of Mono-cyclic and traces of Poly cyclic Aromatics from C_8 to C_{10}) Fuel additives such as Lead (Tetramethyl and Tetraethyl Lead) and MTBE **Diesel** 50% Aliphatic Hydrocarbons C_{10} to C_{40} (Decane C_{10}, Eicosane C_{20} and up). 50% Poly cyclic Aromatics from C_{10} to C_{35}). Traces of Mono-cyclic (Benzene etc C_6) **Inorganics** Metals associated with worked components. Includes alloys of steel containing chrome, vanadium molybdenum Boron and surface treatments such as chrome cadmium,	*No – elevated hydrocarbons detected & direct investigation beneath the workshop floor & inspection pit is yet to be undertaken*	Present at surface on site	*No – elevated hydrocarbons detected & direct investigation beneath the workshop floor & inspection pit is yet to be undertaken*	Dermal contact with soil	*No – elevated hydrocarbons detected & direct investigation beneath the workshop floor & inspection pit is yet to be undertaken*	Construction Workers.	*No – elevated hydrocarbons detected & direct investigation beneath the workshop floor & inspection pit is yet to be undertaken*
				Migrating off site via the surface or via porous soils	*No – elevated hydrocarbons detected & direct investigation beneath the workshop floor & inspection pit is yet to be undertaken*	Ingestion of Soil	*No – elevated hydrocarbons detected & direct investigation beneath the workshop floor & inspection pit is yet to be undertaken*	Service and Maintenance Workers	*No – elevated hydrocarbons detected & direct investigation beneath the workshop floor & inspection pit is yet to be undertaken*
						Inhalation of fugitive soil dust (outside)	*No – elevated hydrocarbons detected & direct investigation beneath the workshop floor & inspection pit is yet to be undertaken*	Site Occupiers	*No – elevated hydrocarbons detected & direct investigation beneath the workshop floor & inspection pit is yet to be undertaken*
						Dermal contact with household/indoor dust	*No – elevated hydrocarbons detected & direct investigation beneath the workshop floor & inspection pit is yet to be undertaken*	Wider public	*No – elevated hydrocarbons detected & direct investigation beneath the workshop floor & inspection pit is yet to be undertaken*

		cyanide nickel and zinc **Lubricants** Light Paraffin based oils as well as heavy engine oil comprising aliphatic hydrocarbons in the C20 to C40 range and aromatics in a similar range if the oil has been used **Solvents** Light aromatics and aliphatics up to C10 (white spirit or Stoddard's Solvent) halogenated hydrocarbons. **Other** Asbestos from brake linings						Ingestion of household/indoor dust.	*No – elevated hydrocarbons detected & direct investigation beneath the workshop floor & inspection pit is yet to be undertaken*		Groundwater	*No – elevated hydrocarbons detected & direct investigation beneath the workshop floor & inspection pit is yet to be undertaken*
								Inhalation of fugitive household/indoor dust	*No – elevated hydrocarbons detected & direct investigation beneath the workshop floor & inspection pit is yet to be undertaken*			
								Ingestion of contaminated vegetables	*Yes – Growing of vegetables not expected in proposed development*			
					Directly to groundwater	*No – elevated hydrocarbons detected & direct investigation beneath the workshop floor & inspection pit is yet to be undertaken*		Ingestion of contaminated soil attached to vegetables	*Yes – Growing of vegetables not expected in proposed development*			
								Inhalation of vapours or gases outside	*No – elevated hydrocarbons detected & direct investigation beneath the workshop floor & inspection pit is yet to be undertaken*			
								Inhalation of vapours/gases inside.	*No – elevated hydrocarbons detected & direct investigation beneath the workshop floor & inspection pit is yet to be undertaken*			
								Groundwater				

Linkage 4

Source On Site	Location	Associated Contaminants	*Dismissed?*	Migration Pathway	*Dismissed?*	Absorption Pathway	*Dismissed?*	Receptor	*Dismissed?*
Car Sales Forecourt & Car Washing	Whole Site	Leaking fuel leaving legacy of Poly-cyclic Aromatics, lubricants comprising heavy aliphatic hydrocarbons and Poly cyclic Aromatics or antifreeze including members of the Glycol family.	*No – elevated hydrocarbons detected during the investigation*	Present at surface on site	*No – elevated hydrocarbons detected during the investigation*	Dermal contact with soil	*No – elevated hydrocarbons detected during the investigation*	Construction Workers.	*No – elevated hydrocarbons detected during the investigation*
				Migrating off site via the surface or via porous soils	*No – elevated hydrocarbons detected during the investigation*	Ingestion of Soil	*No – elevated hydrocarbons detected during the investigation*	Service and Maintenance Workers	*No – elevated hydrocarbons detected during the investigation*
						Inhalation of fugitive soil dust (outside)	*No – elevated hydrocarbons detected during the investigation*	Site Occupiers	*No – elevated hydrocarbons detected during the investigation*
						Dermal contact with household/indoor dust	*No – elevated hydrocarbons detected during the investigation*	Wider public	*No – elevated hydrocarbons detected during the investigation*
						Ingestion of household/indoor dust.	*No – elevated hydrocarbons detected during the investigation*	Groundwater	*No – elevated hydrocarbons detected during the investigation*
						Inhalation of fugitive household/indoor dust	*No – elevated hydrocarbons detected during the investigation*		
						Ingestion of contaminated vegetables	*Yes – Growing of vegetables not expected in proposed development*		
				Directly to groundwater	*No – elevated hydrocarbons detected during the investigation*	Ingestion of contaminated soil attached to vegetables	*Yes – Growing of vegetables not expected in proposed development*		
						Inhalation of vapours or gases outside	*No – elevated hydrocarbons detected during the investigation*		
						Inhalation of vapours/gases inside.	*No – elevated hydrocarbons detected during the investigation*		
						Groundwater			

7 SUMMARY OF THE QUANTITATIVE RISK ASSESSMENT

7.1 As predicted by the Phase 1 desk study, any linkages appear to be proven showing that unacceptable risks remain at the site with respect to the links from soil contaminants to construction workers and links from soil contaminants to new occupants.

7.2 Hydrocarbon concentrations detected were at concentrations potentially harmful to groundwater. Direct groundwater testing has not been undertaken at this stage.

8 RECOMMENDATIONS

Pre demolition

8.1 A 'Hilti' masonry drill (or similar) should be taken to site, to drill numerous very narrow diameter holes (approximately 10mm) through the external floor slab above and surrounding the suspected fuel tank locations. A photoionizing detector (PID) should then be used to 'sniff' each of these holes for volatile organic compounds. This exercise should provide an insight into the extent of fuel contamination and vapour regime of the near surface soils surrounding the suspected locations of these features.

8.2 Three cable percussive boreholes should be drilled across the site until groundwater is encountered, employing 'clean drilling' techniques. These deep boreholes should be installed with monitoring wells to enable samples of groundwater to be taken before, during and after all demolition/construction works, to ensure that groundwater integrity is not being compromised by site activities, and to enable triangulation of the hydraulic gradient. These monitoring wells should be protected against damage for as long as possible, and should not be situated within the proposed building footprint.

8.3 Prior to demolition the possible tank locations identified during the service scan should be examined by a specialist contractor, and any tanks found to be present should be cleared as gas safe by that specialist.

Superstructure Removal

8.4 Upon completion of the above pre-demolition works, we would recommend that the demolition work is carried out as follows. Firstly the superstructures should be removed without disturbance of the floors and hardstanding. The existing building may include some cementicious asbestos materials and we would expect this to have been removed ahead of these works.

8.5 The demolition work, which may include the use of crushers to process the rubble, should stop at ground level and leave floors or hardstanding intact.

8.6 All of the resulting material should then be removed to leave the hardstanding areas clear of any stockpiled materials or site huts etc.

Floor and Hardstanding Removal

8.7 Following removal of the superstructure the hardstanding could then be broken up and removed in sections. Each opened section would then be inspected closely by an experienced engineer who is able to identify asbestos fibre bundles using a hand lens. All visible roof board fragments would then be removed by hand.

8.8 The inspections would look for the tell-tale blackened circles and/or strong odours from areas potentially impacted by fuels, before materials are removed to the agreed formation level. Once the excavations are complete the next section of hardstanding can be broken up and removed.

8.9 This methodology will allow any impacted areas to be treated by hand picking of roof board, or by removal of any heavily blackened or fuel stained soils, without spreading

the contamination over the wider site area. If loose fibres are found on the exposed surface and works are halted for a brief period, then this methodology will also keep the remaining ground covered during this period.

8.10 All fuel tanks that are encountered beneath the slab will need to be confirmed as 'gas safe' prior to removal, with al remnant fuels also disposed of in a controlled manner, prior to the removal of each tank.

8.11 The removal of every tank should be supervised by Terramech, with samples collected from the resulting void as required by the supervising engineer.

8.12 Sampling should also be undertaken beneath the inspection pit within workshop area, upon removal of the surrounding hardstanding

Soil Removal

8.13 This site was seen to be underlain by a layer of made ground ranging from 0.4m to 2.2m deep. The material was seen to be variable, including hydrocarbon impacted clays, brick fill & sub-base. Analysis of samples of these soils showed that some areas contained elevated concentrations of contaminants which would not be acceptable in residential gardens.

8.14 On this basis we have suggested that the made ground is removed to a depth of 0.6m in the garden areas to provide a suitable capping layer however, we understand that the construction methods will also require removal of soils to a similar depth. Where natural soils (pale coloured sands and gravels) are encountered above 0.6m depth in the garden areas, the excavations can be halted. Where the made ground is present below 0.6m it can be left in place so long as it is suitably capped.

8.15 Waste Acceptance Criteria testing is yet to be undertaken. We would suggest that any heavily blackened or odorous soils found below the hardstanding should be stockpiled

for testing to ensure the correct classification is assigned. Any heavily blackened or odorous soil could be rejected by the haulier or landfill supervisor without supporting analysis.

Asbestos Contaminated Soils

8.16 Any areas where loose roof board fragments or any fibrous material is found should be covered immediately while arrangements are made to assess and then deal with the materials.

8.17 The made ground from the WS5 area and any other asbestos contaminated soil should then be removed and stockpiled separately from the other soil on the site. Stockpiles of soil impacted by loose fibres should always be covered and kept damp to prevent dust and fibre liberation. Disposal of soils with loose asbestos fibres is very expensive so any such soils should not be diluted with other materials.

8.18 If the works are carried out in the summer months we would suggest that simple garden sprinklers are provided and used to keep the exposed ground surface damp. The stockpiles should be inspected prior to any disturbance to ensure that the materials are wet and not able to generate fine dust. Ideally the work should be carried out during wet winter months.

8.19 A suitable water supply and low pressure sprinklers and sprays should be made available. Care should be taken to ensure that runoff containing asbestos fibres does not pour off the stockpiles or out of any lorries removing the soils from the site.

8.20 All tipper lorries must be appropriately sheeted on departure to prevent dust liberation or drying of the damp soils while in transit.

Ground Dissolution Feature Risk

8.21 It is further recommended that works to determine the presence of dissolution features should be undertaken. It is suggested that a dynamic probing exercise be undertaken, with probes at approximately 3m intervals along all proposed foundations (including those for internal loadbearing walls), or to span the maximum loss of support that can be accommodated by the structural design. All probes should taken a **minimum** of 5m into competent chalk.

8.22 If a piled foundation system is employed, each pile location should be probed to below the proposed pile installation depth.

8.23 Notwithstanding the results of the probing exercise, all foundations within an area potentially affected by dissolution features should be 'cruciform' in layout, with top & bottom reinforcement to protect against any potential differential settlement.

8.24 Whilst undertaking the probing works, consideration should be given to the potential creation of preferential pollution pathways between near surface hydrocarbons and the underlying chalk aquifer.

Validation

8.25 Following removal of the soil to an appropriate depth we would suggest that samples are recovered in the proposed garden areas to validate the successful removal of the contaminated soils.

8.26 The quality of any imported topsoil will need to be validated. Most topsoil suppliers operate a quality control system for their soils. We would recommend that some proof of such control is obtained for the soil below it is imported.

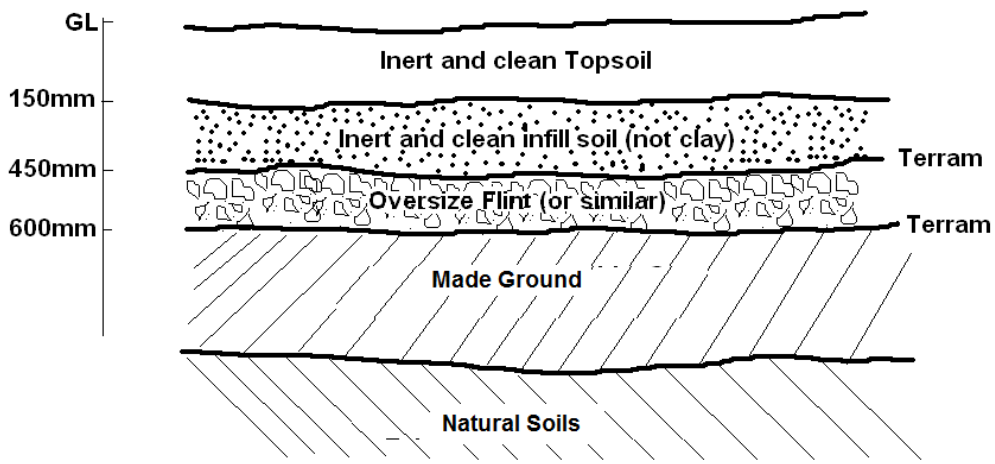
8.27 If no specific tests are available for the actual soil delivered to site, we would recommend that samples are recovered for analysis while the material is still stockpiled.

If the analysis shows any contamination to be present the stockpile should be rejected as out of specification and removed, preferably by the supplier.

8.28 The depth of placement of the break layer and the thickness of the overlying soil should be checked by hand auger or spades in each garden area.

Capping Layer

8.29 Where made ground is still present at a depth of 0.6m the validation sample may show that contaminants are still present. If this is the case then further excavation could be carried out, or a break layer (described below) could be placed above the made ground to separate any remaining made ground from imported fresh soil placed above it.



8.30 Capping should include a granular break layer at a depth of 0.6m sandwiched by a woven geotextile, top and bottom. The granular material would be oversize flint or a similar non porous stone. Crushed brick and concrete will not be suitable.

8.31 The granular layer would then be covered by suitable clean inert soils. This layer should not be clay due to potential waterlogging however, the materials should be able to retain some moisture for any plants or shrubs planted in the garden. The last 150mm should be a clean uncontaminated topsoil which also complies with the multipurpose topsoil specification in BS3882.

Imported Soil

8.32 Materials imported to the site to form piling mats, sub-bases to roadways or topsoils for gardens should be certified free of any contamination, in particular the topsoils. In some cases Local Authorities insist on imported soils being tested insitu rather than trusting analysis carried out by the soil supplier.

9 NOTES

9.1 The comments given in the report and the opinion expressed herein are based on the information sourced by the desk study and other published information. Third party information was therefore used in the preparation of this report and Terramech Investigations Ltd. cannot guarantee the accuracy or completeness of this information.

9.2 There may be other sources of information not included in those listed that hold data relevant to the Desk Study undertaken at the site that could materially affect the conclusions made in this report. The interpretation of the maps and/or other data commented on in this report is subjective.

9.3 The investigation report and the opinion expressed therein are also based on the ground conditions encountered during the site work and on the results of tests made in the field and laboratory. However, there may be special conditions prevailing at the site which have not been disclosed by the investigations and which have not been taken into account in this report.

9.4 Groundwater levels can vary significantly from those observed during this investigation and the range of potential variation has not been defined by ongoing monitoring via installed observation wells.

9.5 The conclusions in this report represent our professional opinion, these conclusions have been drawn up with the greatest care to ensure that all apparent issues were addressed properly in accordance with applicable UK guidance and accepted practice.

Written by:

M. R. Green BSc (Hons) FGS
For and on Behalf of
Terramech Investigations Ltd

Checked by:

J.R. Puzyna BEng (Hons) MCIEH
For and on Behalf of
Terramech Investigations Ltd

MRG/JRP 23 May, 2018

Page 1	JOB NO 4008 – 28 WOKINGHAM ROAD, READING	SITE LOCATION
DATE: 21.05.18		

DATE: 21.05.18

JOB NO 4008 – 28 WOKINGHAM ROAD, READING

SITE PHOTOS

General view of inside tyre fitters

Inspection pit within tyre fitters

Chemical storage container for car wash

General view across forecourt

Concrete 'mound' denoting suspected location of former fuel tank cover

View of site from Wokingham Road

DATE: 21.05.18

JOB NO 4008 – 28 WOKINGHAM ROAD, READING

SITE PHOTOS

WS1 core photo

WS1 Hand pit arising

WS2 Hand pit arisings

WS2A hand pit arisings

WS2A core

WS3 core

WS4 Photo

WS5 photo

PHASE 2 ENVIRONMENTAL

& GEOTECHNICAL

INVESTIGATION

NO 4008/18

AT

28 WOKINGHAM ROAD, READING, RG6 1JQ

FOR

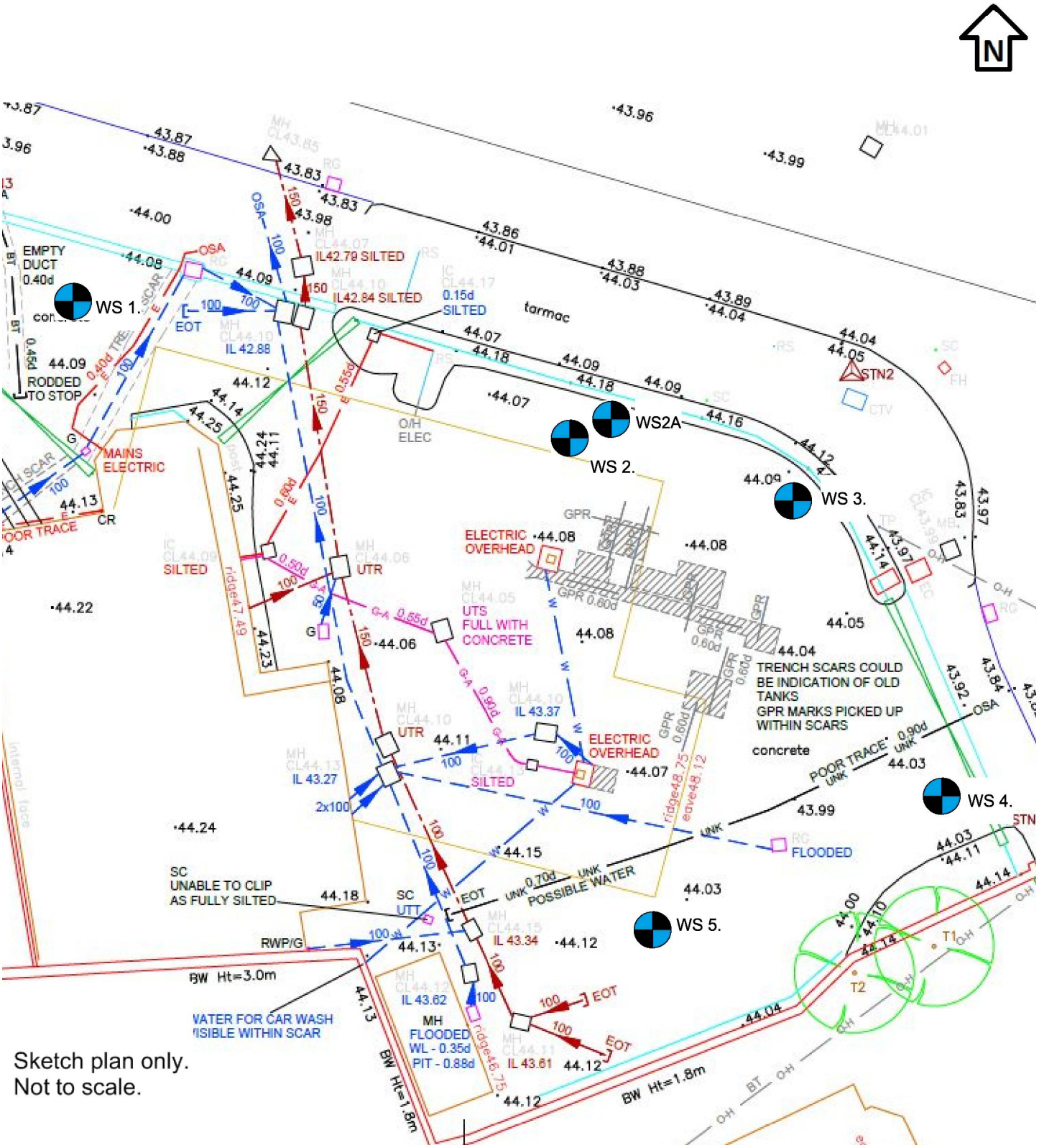
PROPOSED HOUSING DEVELOPMENT

APPENDIX A

BOREHOLE LOCATIONS & RECORDS

PAGE: 10	JOB 4008	BOREHOLE LAYOUT
DATE:12.01.18	28 WOKINGHAM ROAD, READING	

BOREHOLE LAYOUT



PAGE: 11

DATE:12.01.18

JOB 4008

28 WOKINGHAM ROAD, READING

BOREHOLE WS1

DESCRIPTION	REDUCED LEVEL m	DEPTH m	LEGEND	SAMPLE TYPE	SAMPLE DEPTH	THICKNESS m	SPT N	REMARKS
		0.00				0.15		
Concrete slab with grid reinforcment noted at base (rebar c10mm diameter)		0.15		C	0.30	0.35		PID - 0.1ppm -- 4008/WS1 / 0.3C
MADE GROUND: Loose, brown sandy GRAVEL; Gravels are fine to medium & sub-angular - predominantly flint., occasionally brick. Occasional coarse gravels of concrete throughout.		0.50		C CPT B	0.60 1.00 1.00	0.40	8	-- 4008/WS1 / 0.6C - -- 4008/WS1 / 1.0B PID - 0.0ppm
MADE GROUND: Brown, very sandy CLAY with frequent brick fragments (coarse gravel sized). Whole bricks below 0.7m depth		0.90						
SAND: Loose to medium dense, brown clayey fine SAND. Becoming dense by 3.0m, Occasional medium to coarse, sub angular flint gravels throughout				CPT	2.00	3.00	22	-
				CPT	3.00		24	-
CHALK: Very weathered and disturbed, off white putty CHALK		3.90		CPT	4.00	0.10	29	-
		4.00						

Installation: Plain pipe GL - 1.3m depth. Slotted pipe 1.3m - 3.3m depth. 0.6m bentonite plug placed above putty chalk.

TERRAMECH INVESTIGATIONS LIMITED
183 LONG LANE TILEHURST READING

REMARKS:

U100=100mm dia. UNDISTURBED SAMPLE
U38=38mm dia. UNDISTURBED SAMPLE
D=SMALL DISTURBED SAMPLE
B=BULK SAMPLE
W=WATER SAMPLE
SPT=STANDARD PENETRATION TEST
CPT=CONE PENETRATION TEST

PAGE: 12

DATE:12.01.18

JOB 4008

28 WOKINGHAM ROAD, READING

BOREHOLE WS2

DESCRIPTION	REDUCED LEVEL m	DEPTH m	LEGEND	SAMPLE TYPE	SAMPLE DEPTH	THICKNESS m	SPT N	REMARKS
		0.00						
Concrete slab with grid reinforcment at base. Rebar c10mm diameter		0.20				0.20		
MADE GROUND: Sandy gravel sub-base		0.30				0.10		
MADE GROUND: Brown, sandy fine to medium flint GRAVEL		0.60				0.30		
MADE GROUND: Reddish brown, sandy fine to medium GRAVEL. Gravels are fine to medium of brick, concrete & flint. Brick boulder (remnant masonary?) at 0.8m		0.80				0.20		Borehole terminated at 0.8m depth due to boulder sized obstruction at base of hand dug starter pit. WS2A undertaken 1.0m to north

TERRAMECH INVESTIGATIONS LIMITED
183 LONG LANE TILEHURST READING

REMARKS:

U100=100mm dia. UNDISTURBED SAMPLE
U38=38mm dia. UNDISTURBED SAMPLE
D=SMALL DISTURBED SAMPLE
B=BULK SAMPLE
W=WATER SAMPLE
SPT=STANDARD PENETRATION TEST
CPT=CONE PENETRATION TEST

PAGE: 13

DATE:12.01.18

JOB 4008

28 WOKINGHAM ROAD, READING

BOREHOLE WS2a

DESCRIPTION	REDUCED LEVEL m	DEPTH m	LEGEND	SAMPLE TYPE	SAMPLE DEPTH	THICKNESS m	SPT N	REMARKS
		0.00						
Concrete slab with grid reinforcment at base. Rebar c10mm diameter		0.20				0.20 0.15		PID - 90.6ppm @ 0.6m
MADE GROUND: Loose, light brown slightly sandy fine to medium limestone GRAVEL (sub-base)		0.35		C	0.60	0.15 0.35		-- 4008/WS2a/ 0.6C
MADE GROUND: Loose, grey, clayey GRAVEL. Gravels are fine to medium. Rare brick fragements throughout		0.50		CPT C	1.00 1.00		19	- -- 4008/WS2a/ 1.0C
MADE GROUND: Soft, dark grey / black, slightly sandy, silty CLAY. Strong hydrocarbon odour and freuqent organic piecies throughout		0.85		D	1.20			-- 4008/WS2a/ 1.2D PID - 0.1ppm
CLAY: Firm, orangish brown, slightly sandy, gravelly CLAY. Hydrocarbon odour to 1.5m. Gravels are fine to medium flints				CPT B	2.00 2.00	2.15	27	- -- 4008/WS2a/ 2.0B
		3.00		CPT	3.00		32	-

Installation: Plain pipe GL - 1.0m depth.
Slotted pipe 1.0m - 3.0m depth.

TERRAMECH INVESTIGATIONS LIMITED
183 LONG LANE TILEHURST READING

REMARKS:

U100=100mm dia. UNDISTURBED SAMPLE
U38=38mm dia. UNDISTURBED SAMPLE
D=SMALL DISTURBED SAMPLE
B=BULK SAMPLE
W=WATER SAMPLE
SPT=STANDARD PENETRATION TEST
CPT=CONE PENETRATION TEST

PAGE: 14

DATE:12.01.18

JOB 4008

28 WOKINGHAM ROAD, READING

BOREHOLE WS3

DESCRIPTION	REDUCED LEVEL m	DEPTH m	LEGEND	SAMPLE TYPE	SAMPLE DEPTH	THICKNESS m	SPT N	REMARKS
		0.00				0.19		
Concrete slab with grid reinforcment noted at base (rebar c10mm diameter)		0.19		C	0.30	0.21		PID - 0.3ppm -- 4008/WS3 / 0.3C
MADE GROUND: Loose, brown slightly sandy fine to medium limestone GRAVEL (sub-base)		0.40		C D	0.50 0.80	0.30		-- 4008/WS3 / 0.5C PID - 0.2ppm -- 4008/WS3 / 0.8D
GRAVEL: Loose, brown, very clayey fine to medium flint GRAVEL		0.70		CPT	1.00	0.70	19	-
CLAY: Firm, orangish brown, slightly sandy, gravelly CLAY. Gravels are fine flints		1.40						
SAND: Medium dense, orangish brown, slightly clayey, gravelly SAND. Gravels are fine to medium flints.		2.80		CPT B	2.00 2.00	1.40	28	- -- 4008/WS3 / 2.0B
CHALK: Very weathered and disturbed, off white putty CHALK		3.00		CPT	3.00	0.20	32	-

Installation: Plain pipe GL - 1.0m depth. Slotted pipe 1.0m - 2.8m depth. 0.2m bentonite plug placed within putty chalk.

TERRAMECH INVESTIGATIONS LIMITED
183 LONG LANE TILEHURST READING

REMARKS:

U100=100mm dia. UNDISTURBED SAMPLE
U38=38mm dia. UNDISTURBED SAMPLE
D=SMALL DISTURBED SAMPLE
B=BULK SAMPLE
W=WATER SAMPLE
SPT=STANDARD PENETRATION TEST
CPT=CONE PENETRATION TEST

PAGE: 15

DATE:12.01.18

JOB 4008

28 WOKINGHAM ROAD, READING

BOREHOLE WS4

DESCRIPTION	REDUCED LEVEL m	DEPTH m	LEGEND	SAMPLE TYPE	SAMPLE DEPTH	THICKNESS m	SPT N	REMARKS
		0.00						
Concrete slab with grid reinforcment noted at base (rebar c10mm diameter)		0.26		C	0.30	0.26 0.12		PID - 0.0ppm -- 4008/WS4 / 0.3C
MADE GROUND: Loose, brown slightly sandy fine to medium limestone GRAVEL (sub-base)		0.38		C	0.50			-- 4008/WS4 / 0.5C PID - 0.0ppm
SAND: Medium dense, orangish brown slightly silty, clayey, fine to medium SAND		1.80		CPT D	1.00 1.00	1.42	22	- -- 4008/WS4 / 1.0D
GRAVEL: Dense, very sandy fine to medium flint GRAVEL		2.00		CPT	2.00	0.20	50	-

Installation: Plain pipe GL - 1.0m depth.
Slotted pipe 1.0m - 2.0m depth.

TERRAMECH INVESTIGATIONS LIMITED
183 LONG LANE TILEHURST READING

REMARKS:

U100=100mm dia. UNDISTURBED SAMPLE
U38=38mm dia. UNDISTURBED SAMPLE
D=SMALL DISTURBED SAMPLE
B=BULK SAMPLE
W=WATER SAMPLE
SPT=STANDARD PENETRATION TEST
CPT=CONE PENETRATION TEST

PAGE: 16

DATE:12.01.18

JOB 4008

28 WOKINGHAM ROAD, READING

BOREHOLE WS5

DESCRIPTION	REDUCED LEVEL m	DEPTH m	LEGEND	SAMPLE TYPE	SAMPLE DEPTH	THICKNESS m	SPT N	REMARKS
		0.00						
Concrete slab with grid reinforcment noted at base (rebar c10mm diameter)		0.20				0.20		
MADE GROUND: Loose matrix supported brick fill. Matrix comprises grey clayey and.				C	0.30			-- 4008/WS5 / 0.3C
				C	0.70			-- 4008/WS5 / 0.7C PID - 0.0ppm
				CPT	1.00	2.00	4	- PID - 0.0ppm
CLAY: Probable firm, sandy gravelly CLAY		2.20		D	2.50	0.50		-- 4008/WS5 / 2.5D
		2.70						

Installation: Plain pipe GL - 1.5m depth. Slotted pipe 1.5m - 2.5m depth.

Barrel Refusal @ 2.7m. Unable to SPT due to borehole collapse. Unable to redrill with casing due to brick fill.

TERRAMECH INVESTIGATIONS LIMITED
183 LONG LANE TILEHURST READING

REMARKS:

U100=100mm dia. UNDISTURBED SAMPLE
U38=38mm dia. UNDISTURBED SAMPLE
D=SMALL DISTURBED SAMPLE
B=BULK SAMPLE
W=WATER SAMPLE
SPT=STANDARD PENETRATION TEST
CPT=CONE PENETRATION TEST

PHASE 2 ENVIRONMENTAL

& GEOTECHNICAL

INVESTIGATION

NO 4008/18

AT

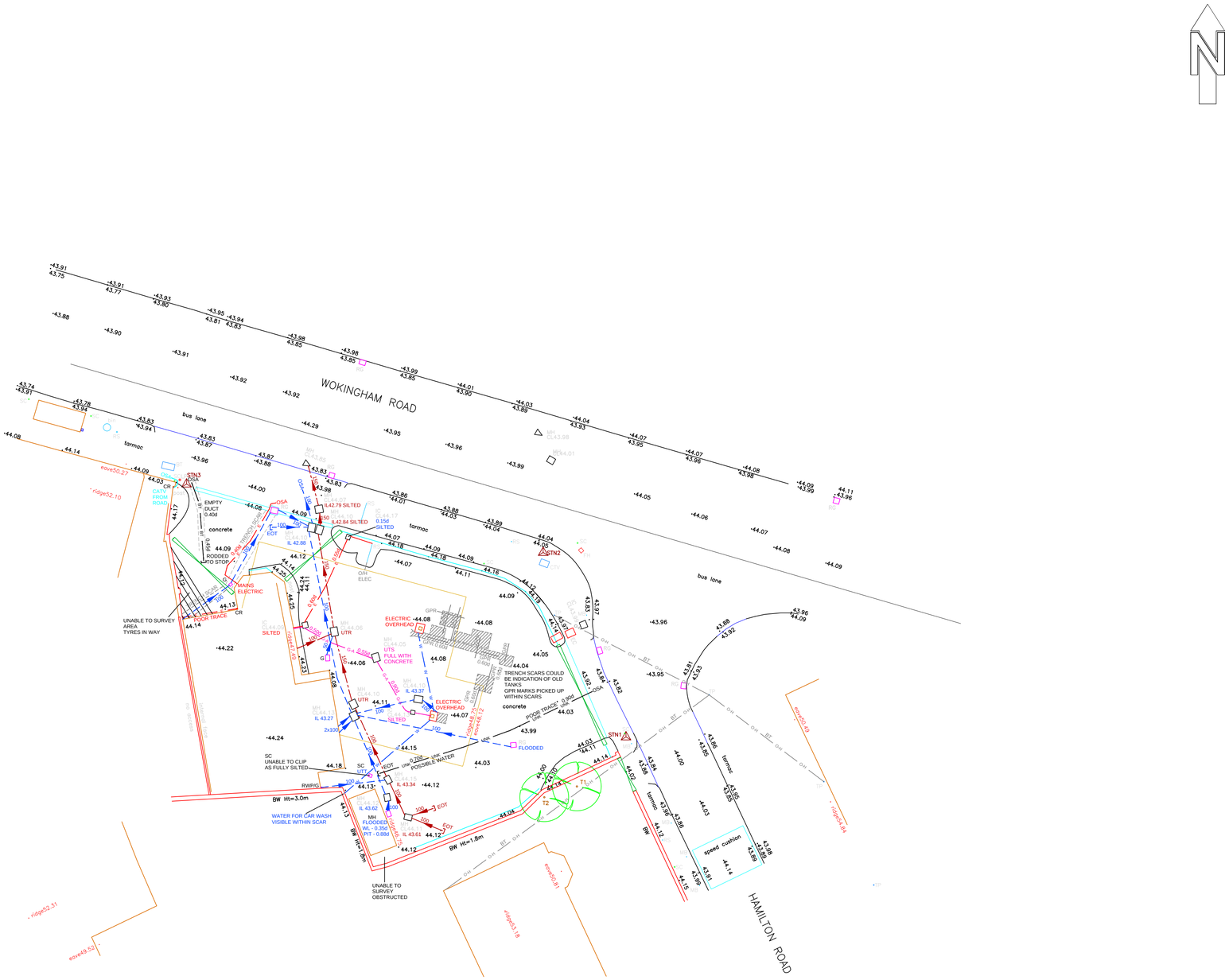
28 WOKINGHAM ROAD, READING, RG6 1JQ

FOR

PROPOSED HOUSING DEVELOPMENT

APPENDIX B

SITE SERVICE SCAN



SCALE

1:100	5M
1:200	10M
1:500	25M

DISCLAIMER: The location of under ground services shown on this drawing has been determined using electro-magnetic (and/or ground probing radar, where requested) techniques and visual observations. The limitations of this drawing should be realised and no guarantee can be given that all services have been identified. This drawing may not include the location of all public services that may cross the site and therefore the relevant service drawings should be obtained from the appropriate utility company and used in conjunction with this drawing. Additional services, structures or other below ground obstructions not indicated on this drawing may be present on site. Reference should be made to historical plans and as built drawings. Excavations in the vicinity of services should be carried out with due diligence ref: HSG47 document 'Avoiding dangers from underground services'. Location accuracy is determined by refering to manufacturers guidelines for the systems deployed. Reference should be made to the latest version of SVS Ltd site procedures document for utility location surveys.

THE NAME IN SURVEYS

SHEET LAYOUT

1

LEGEND

Survey Station; Level; Building; Canopy; Fence; Wall; Hedge; Kerb; Drop Kerb; Kerb Top; Manhole; Verge; Tree (Shown To Scale); Tree Canopy; Foliage; Furniture; Gate; Step; Line Markings; Overheads; Speed Hump; Gully Run; Drainage Channel; Banks; Trench Scar; Contour Major; Contour Minor; Cabinet

Foul Drainage; Surface Drainage; Combined Drainage; Electricity; Electricity High Voltage; Traffic Signals; Gas; Water; Cable Television; Close Circuit Television; Communication; British Telecom; Compressed Air; Offset Fill-Line; Oil Pipe; Pipe; Ventilation; Fuel Line; Vapour Recovery; Gauge Line; Telemetry; Fibre Optics; Unknown; Overhead Line; Historical By Layer; End Of Trace

Do Not Drill / Banded Pipes; Tank - W= Water U=Unknown F=Foam P=Product C=Concrete; Stantion; Pump Island; Borehole

ABBREVIATIONS

A/C	AIR CONDITIONER	OSA	OFF SURVEY AREA
A/R	ASSUMED ROUTE	OSBM	ORDNANCE SURVEY BENCH MARK
AV	AIR VALVE	PL	PIT LEVEL
BOLL	BOLLARD	PR	PIPE RISER
ILLU BOLL	ILLUMINOUS BOLLARD	P&R FENCE	POST & RAIL FENCE
BH	BOREHOLE	RET WALL	RETAINING WALL
BTIC	BRITISH TELECOM COVER	RE	RODDING EYE
C/BOX	CONTROL BOX	RS	ROAD SIGN
C/B FENCE	CLOSEBOARD FENCE	RWP	RAIN WATER PIPE
CR	CABLE RISER	S/A	SOAK AWAY
CTV	CABLE TV	SAP	SAPLING
CP	CATCHPIT	S/C	SOUND CONNECTED
CONC	CONCRETE	SEC FENCE	SECURITY FENCE
CL	COVER LEVEL	SL	SPOT LIGHT
D	DEPTH / DEEP	SP	SOIL PIPE
D/CHAN	DRAINAGE CHANNEL	ST	STOP TAP
DP	DOWN PIPE	STN	STATION (DATUM POINT)
E/C	ELECTRICITY COVER	SV	STOP VALVE
ER	EARTH ROD	SVP	SOIL VENT PIPE
EP	ELECTRICITY POLE	TBM	TEMPORARY BENCH MARK
EOT	END OF TRACE	TCL	TREE CANOPY LEVEL
FFL	FINISHED FLOOR LEVEL	TOW	TOP OF WALL LEVEL
F/BED	FLOWER BED	TFR	TAKEN FROM RECORDS
FH	FIRE HYDRANT	THL	THRESHOLD LEVEL
FS	FIRE SWITCH	TL	TRAFFIC LIGHT
GV	GAS VALVE	TP	TELEGRAPH POLE
G	GULLY	TP&R	TIMBER POST & RAIL
G-RUN	GULLY RUN	U/L	UNABLE TO LOCATE
HT	HEIGHT	U/R	UNABLE TO RAISE
IC	INSPECTION COVER	U/S	UNABLE TO SURVEY
IL	INVERT LEVEL	U/T	UNABLE TO TRACE
KD	KERB OUTLET	VR	VAPOUR RECOVERY
LP	LAMP POST	VP	VENT PIPE
M/B	MULTI-BOLE	WM	WATER METER
MH	MANHOLE	WO	WASH OUT
MKR	MARKER	W/FC	WATER FILLED CHAMBER
MTR	METER	WP	WASTE PIPE
MW	MONITORING WELL	U/S	UNDERSIDE
OH	OVERHEAD	Ø	DIAMETER

UTILITY NOTES

LOCATION OF TANKS WITHIN SCARS AND GPR MARKS FOUND WITHIN SCARS

NO BT TO BUILDING, EMPTY DUCT RODDED TO STOP

MANHOLES IN POOR CONDITION

NO INTERCEPTOR LOCATED ON SITE

UNKNOWN SERVICE LOCATED ON FORECOURT, POSSIBLE WATER(ADVISE WATER RECORDS)

NO STATS SUPPLIED

TOPOGRAPHICAL BASEPLAN HAS BEEN PROVIDED BY TERRAMECH

ALL UTILITIES AND FEATURES SHOWN BY SVS HAVE BEEN ADDED TO BASEPLAN BY CREATING A SCALE HAND DRAWING ON SITE THEN TRANSFERRING TO CAD.

DUE TO POTENTIAL INACCURACIES THAT MAY ARISE FROM SUCH TECHNIQUES THE LOCATION OF ALL SVS DRAWN FEATURES MUST BE TREATED AS INDICATIVE AND ANY CRITICAL DIMENSIONS CONFIRMED ON SITE.

REV	DATE	DESCRIPTION

SURVEYS
SITE VISION SURVEYS LIMITED
UTILITY | TOPOGRAPHICAL | MAPPING
T: 01788 575036 W: SVSLTD.NET

CLIENT: TERRAMECH

SITE LOCATION: 28 Wokingham Road, Reading, RG6 1JQ

DRAWING TITLE: Full Utility

SURVEYED BY:	DRAWN BY:	APPROVED BY:
ZD/DG	AW	FL

DRAWING NO:	SURVEY DATE:
0218-TIL-11229	23-02-2018

SCALE:	SHEET NO:	REV:
1:200 @A1	1 OF 1	

PHASE 2 ENVIRONMENTAL

& GEOTECHNICAL

INVESTIGATION

NO 4008/18

AT

28 WOKINGHAM ROAD, READING, RG6 1JQ

FOR

PROPOSED HOUSING DEVELOPMENT

APPENDIX C

GEOTECHNICAL ANALYSIS

NHBC Volume Change Potential Summary

Project No.	Project Name
4008	28 Wokingham Road, Reading

Hole No.	Sample Ref	Sample Top	Sample Type	Sample Description	W.C. %	Passing 63µm %	Passing 425µm %	LL %	PL %	PI %	PI Mod %	NHBC Volume Change Potential Classification	Note
WS01	1	1.00	B	Brown slightly clayey, gravelly SAND	9.6	8	41					Non-Shrinkable	
WS02A	1	1.20	D	Brown, slightly clayey, gravelly SAND	10	6	40					Non-Shrinkable	
WS02A	1	2.00	B	Brown, slightly clayey, sandy GRAVEL	5.5	6	20					Non-Shrinkable	
WS03	1	0.80	D	Brown, slightly clayey sandy GRAVEL	7.4	13	36					Non-Shrinkable	
WS03	1	2.00	B	Brown, slightly clayey, sandy GRAVEL	4.9	7	21					Non-Shrinkable	
WS04	1	1.00	D	Light brown silty CLAY	18		100	29-1pt	15	14		Low	
WS04	1	1.70	D	Brown, clayey SAND	9.4	10	81					Non-Shrinkable	
WS05	1	2.50	D	Brown gravelly CLAY	12		41	24-1pt	17	7	3	Non-Shrinkable	1

Samples classified according to the NHBC Chapter 4.2 building near trees:
Non-shrinkable : Less than 35% passing 63µ sieve, or PI less than 10%
Low Volume Change Potential : Plasticity Index 10% to 19%
Medium Volume Change Potential : Plasticity Index 20% to 39%
High Volume Change Potential : Plasticity Index 40% or greater

Note 1. Modified PI = Normal PI x fraction passing 425 micron sieve. For the modified PI to be used "sufficient sample should be taken to provide confidence that the test results are representative of the soil volume change potential for the site. If in doubt use the higher value of volume change potential"

Note 2. Unless other representative samples, or the soils to depth below the foundations, have a similar or greater coarse sand and/or gravel content to that found in this sample, it is recommended that the design is based on the unmodified PI figure

Note 3. The results of this testing are too close to the non-shrinkable boundary to conclude a 'non-shrinkable' recommendation for this sample. Further testing or engineer judgment is recommended, otherwise it would be prudent to assume the sample is shrinkable

Key: 1pt = LL 1pt cone (otherwise 4pt), cas = Casagrande method, NP = sample is Non Plastic

All tests performed in accordance with BS1377:1990 unless specified otherwise

Sheet no: 1

Date Printed: 25/04/2018

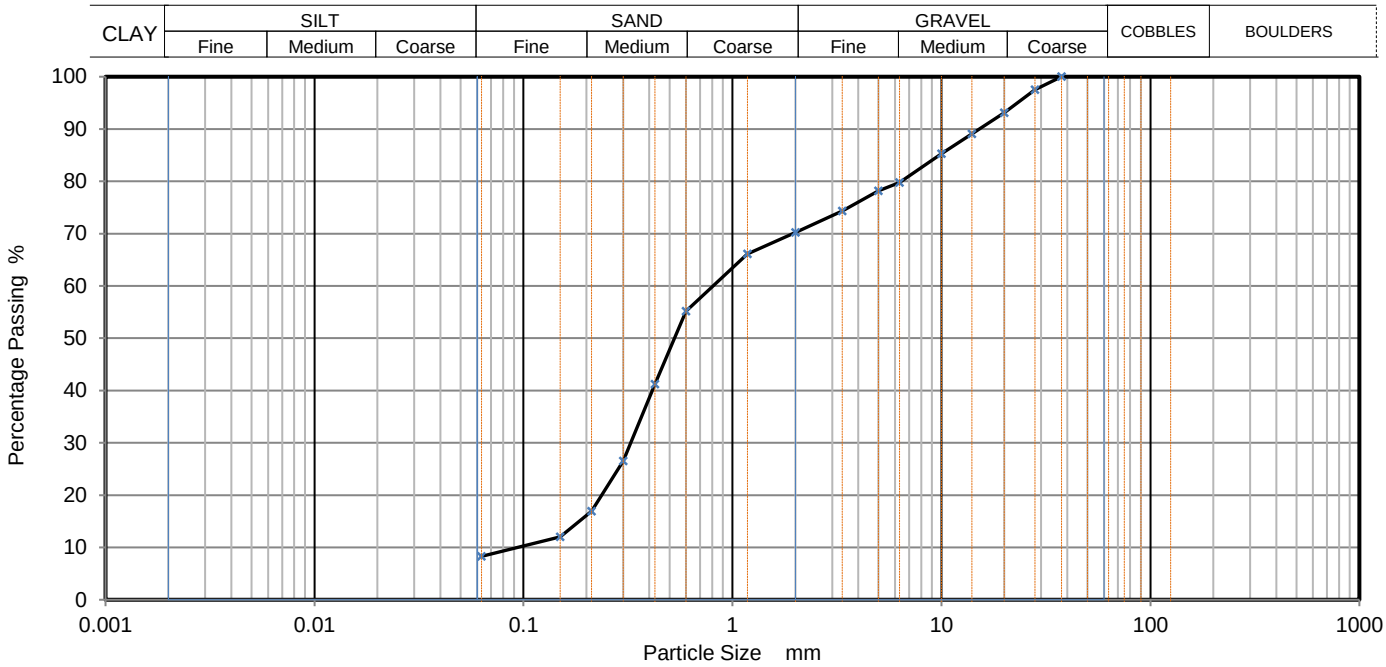
Tested by

Approved by

Terramech Investigations Ltd
Geotechnical and Environmental

Registered Office: 183 Long Lane, Tilehurst, Reading, RG31 6YW
Phone: 0118 9439910 Fax: 0118 9439920
Email: office@terramech.co.uk Web: www.terramech.co.uk

TERRAMECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**4008**
				Borehole/Pit No.	WS01
Site Name	28 Wokingham Road, Reading			Sample No.	1
Soil Description	Brown slightly clayey, gravelly SAND			Depth, m	1.00
Specimen Reference	6	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	TERR201804240



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
37.5	100		
28	98		
20	93		
14	89		
10	85		
6.3	80		
5	78		
3.35	74		
2	**70**		
1.18	66		
0.6	55	Particle density (assumed)	
0.425	41	2.65	Mg/m3
0.3	27		
0.212	17		
0.15	12		
0.063	**8**		

Dry Mass of sample, g	4104

Sample Proportions	% dry mass
Very coarse	0
Gravel	30
Sand	62
Fines <0.063mm	8

Grading Analysis		
D100	mm	37.5
D60	mm	0.809
D30	mm	0.326
D10	mm	0.0942
Uniformity Coefficient		8.6
Curvature Coefficient		1.4

Remarks:
Preparation and testing in accordance with BS1377 unless noted below

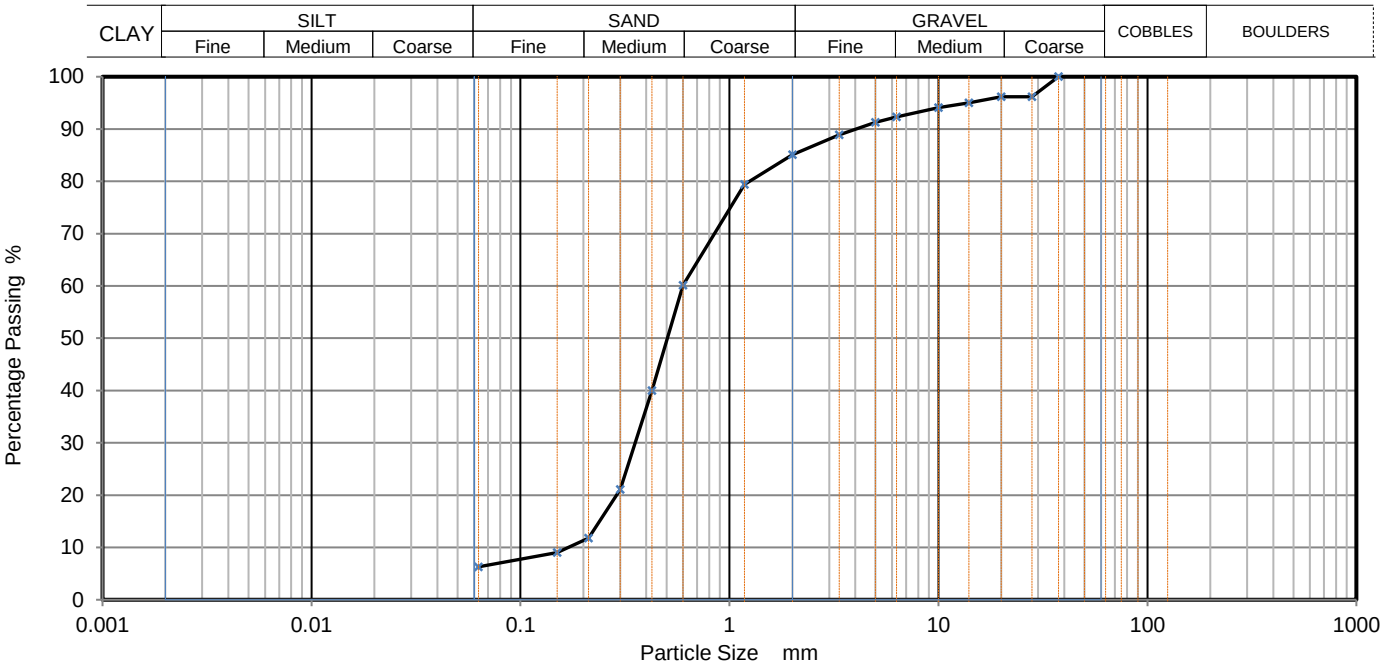
Sheet no: 1
Printed: 25/04/2018

Tested by:
Approved by:

Terramech Investigations Ltd
Geotechnical and Environmental

Registered Office: 183 Long Lane, Tilehurst, Reading, RG31 6YW
Phone: 0118 9439910 Fax: 0118 9439920
Email: office@terramech.co.uk Web: www.terramech.co.uk

TERRAMECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**4008**
				Borehole/Pit No.	WS02A
Site Name	28 Wokingham Road, Reading			Sample No.	1
Soil Description	Brown, slightly clayey, gravelly SAND			Depth, m	1.20
Specimen Reference	6	Specimen Depth	m	Sample Type	D
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	TERR201804241



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
37.5	100		
28	96		
20	96		
14	95		
10	94		
6.3	92		
5	91		
3.35	89		
2	**85**		
1.18	79		
0.6	60	Particle density (assumed)	
0.425	40	2.65	Mg/m3
0.3	21		
0.212	12		
0.15	9		
0.063	**6**		

Dry Mass of sample, g	2083

Sample Proportions	% dry mass
Very coarse	0
Gravel	15
Sand	79
Fines <0.063mm	6

Grading Analysis		
D100	mm	37.5
D60	mm	0.599
D30	mm	0.353
D10	mm	0.17
Uniformity Coefficient		3.5
Curvature Coefficient		1.2

Remarks:
Preparation and testing in accordance with BS1377 unless noted below

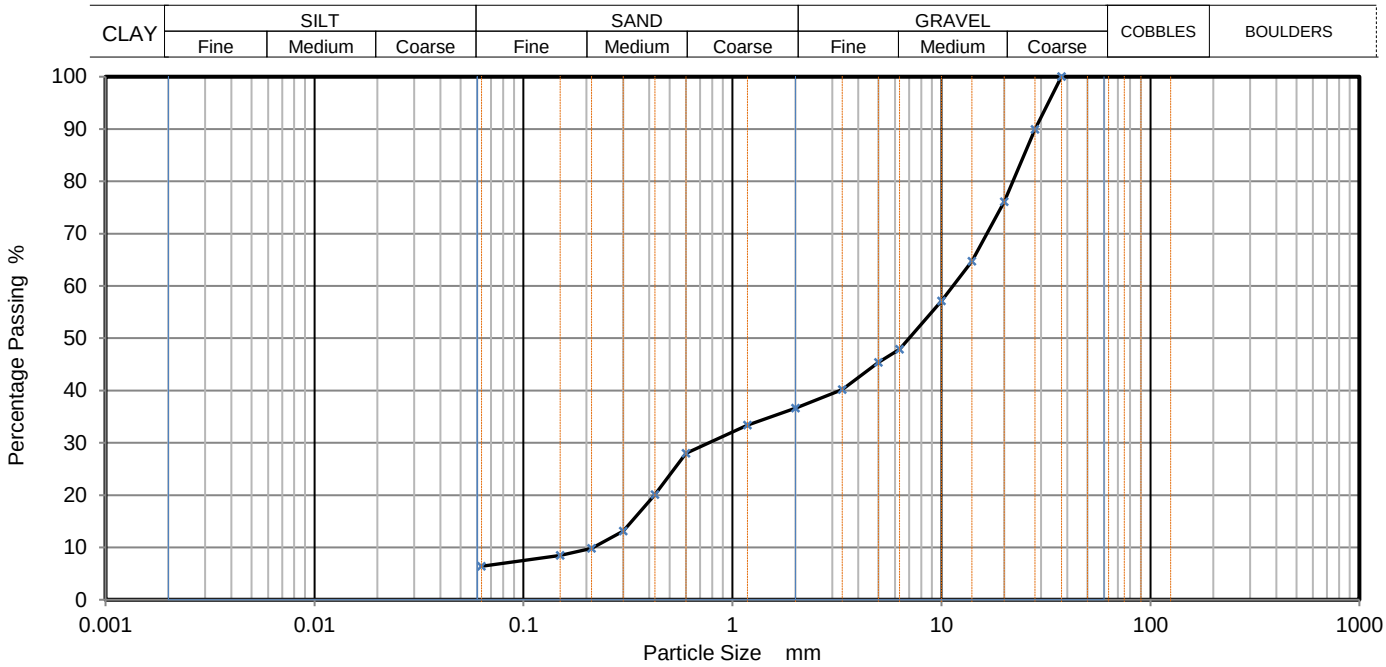
Sheet no: 2
Printed: 25/04/2018

Tested by:
Approved by:

Terramech Investigations Ltd
Geotechnical and Environmental

Registered Office: 183 Long Lane, Tilehurst, Reading, RG31 6YW
Phone: 0118 9439910 Fax: 0118 9439920
Email: office@terramech.co.uk Web: www.terramech.co.uk

TERRAMECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**4008**
				Borehole/Pit No.	WS02A
Site Name	28 Wokingham Road, Reading			Sample No.	1
Soil Description	Brown, slightly clayey, sandy GRAVEL			Depth, m	2.00
Specimen Reference	6	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	TERR201804242



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
37.5	100		
28	90		
20	76		
14	65		
10	57		
6.3	48		
5	45		
3.35	40		
2	**37**		
1.18	33		
0.6	28	Particle density (assumed)	
0.425	20	2.65	Mg/m3
0.3	13		
0.212	10		
0.15	9		
0.063	**6**		

Dry Mass of sample, g	3919

Sample Proportions	% dry mass
Very coarse	0
Gravel	63
Sand	30
Fines <0.063mm	6

Grading Analysis		
D100	mm	37.5
D60	mm	11.4
D30	mm	0.773
D10	mm	0.216
Uniformity Coefficient		53
Curvature Coefficient		0.24

Remarks:
Preparation and testing in accordance with BS1377 unless noted below

Sheet no: 3

Printed: 25/04/2018

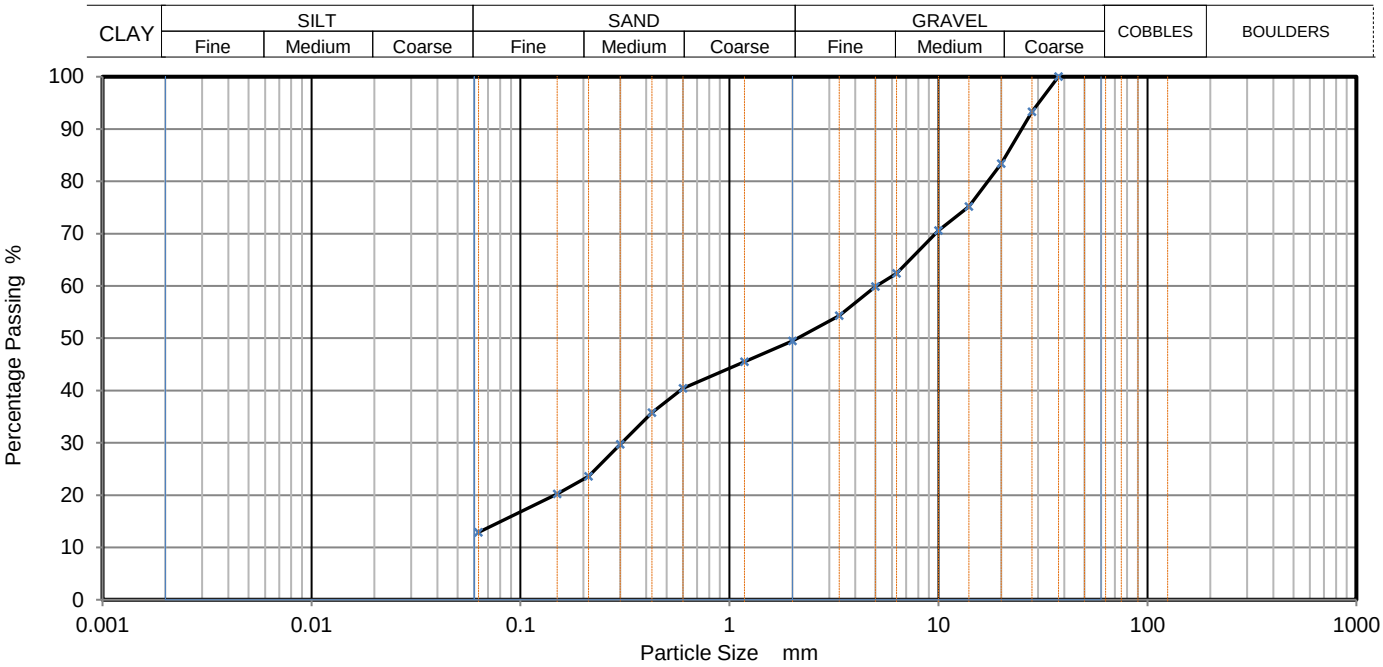
Tested by:

Approved by:

Terramech Investigations Ltd
Geotechnical and Environmental

Registered Office: 183 Long Lane, Tilehurst, Reading, RG31 6YW
Phone: 0118 9439910 Fax: 0118 9439920
Email: office@terramech.co.uk Web: www.terramech.co.uk

TERRAMECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**4008**
				Borehole/Pit No.	WS03
Site Name	28 Wokingham Road, Reading			Sample No.	1
Soil Description	Brown, slightly clayey sandy GRAVEL			Depth, m	0.80
Specimen Reference	6	Specimen Depth	m	Sample Type	D
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	TERR201804243



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
37.5	100		
28	93		
20	83		
14	75		
10	71		
6.3	62		
5	60		
3.35	54		
2	**50**		
1.18	46		
0.6	40	Particle density (assumed)	
0.425	36	2.65	Mg/m3
0.3	30		
0.212	24		
0.15	20		
0.063	**13**		

Dry Mass of sample, g	939

Sample Proportions	% dry mass
Very coarse	0
Gravel	51
Sand	37
Fines <0.063mm	13

Grading Analysis		
D100	mm	37.5
D60	mm	5.05
D30	mm	0.305
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks:
Preparation and testing in accordance with BS1377 unless noted below

Sheet no: 4

Printed: 25/04/2018

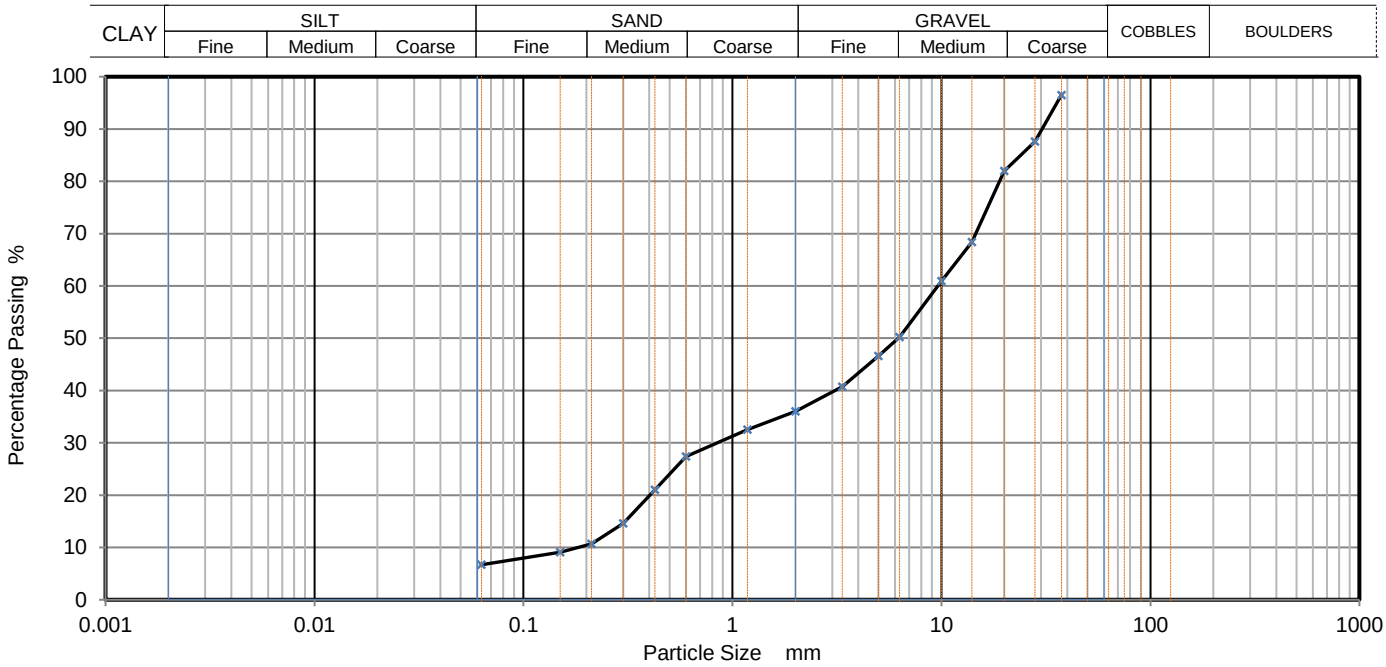
Tested by:

Approved by:

Terramech Investigations Ltd
Geotechnical and Environmental

Registered Office: 183 Long Lane, Tilehurst, Reading, RG31 6YW
Phone: 0118 9439910 Fax: 0118 9439920
Email: office@terramech.co.uk Web: www.terramech.co.uk

TERRAMECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**4008**
				Borehole/Pit No.	WS03
Site Name	28 Wokingham Road, Reading			Sample No.	1
Soil Description	Brown, slightly clayey, sandy GRAVEL			Depth, m	2.00
Specimen Reference	6	Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	TERR201804244



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
37.5	97		
28	88		
20	82		
14	68		
10	61		
6.3	50		
5	47		
3.35	41		
2	**36**		
1.18	33		
0.6	27	Particle density (assumed)	
0.425	21	2.65	Mg/m3
0.3	15		
0.212	11		
0.15	9		
0.063	**7**		

Dry Mass of sample, g	3896

Sample Proportions	% dry mass
Very coarse	0
Gravel	64
Sand	29
Fines <0.063mm	7

Grading Analysis		
D100	mm	
D60	mm	9.61
D30	mm	0.846
D10	mm	0.181
Uniformity Coefficient		53
Curvature Coefficient		0.41

Remarks:
Preparation and testing in accordance with BS1377 unless noted below

Sheet no: 5

Printed: 25/04/2018

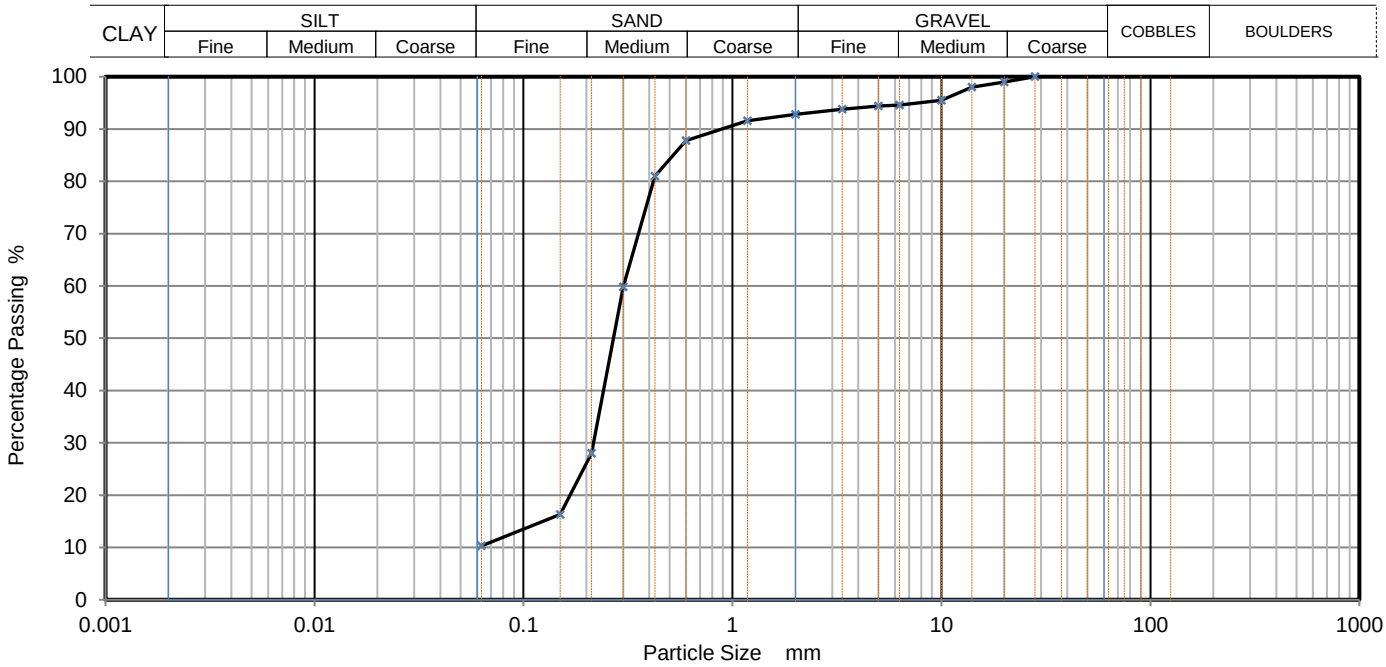
Tested by:

Approved by:

Terramech Investigations Ltd
Geotechnical and Environmental

Registered Office: 183 Long Lane, Tilehurst, Reading, RG31 6YW
Phone: 0118 9439910 Fax: 0118 9439920
Email: office@terramech.co.uk Web: www.terramech.co.uk

TERRAMECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**4008**
				Borehole/Pit No.	WS04
Site Name	28 Wokingham Road, Reading			Sample No.	1
Soil Description	Brown, clayey SAND			Depth, m	1.70
Specimen Reference	5	Specimen Depth	m	Sample Type	D
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	TERR201804246



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
28	100		
20	99		
14	98		
10	96		
6.3	95		
5	94		
3.35	94		
2	**93**		
1.18	92		
0.6	88	Particle density (assumed)	
0.425	81	2.65	Mg/m3
0.3	60		
0.212	28		
0.15	16		
0.063	**10**		

Dry Mass of sample, g	1114

Sample Proportions	% dry mass
Very coarse	0
Gravel	7
Sand	83
Fines <0.063mm	10

Grading Analysis		
D100	mm	28
D60	mm	0.301
D30	mm	0.217
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks:
Preparation and testing in accordance with BS1377 unless noted below

Sheet no: 6

Printed: 25/04/2018

Tested by:

Approved by:

Terramech Investigations Ltd
Geotechnical and Environmental

Registered Office: 183 Long Lane, Tilehurst, Reading, RG31 6YW
Phone: 0118 9439910 Fax: 0118 9439920
Email: office@terramech.co.uk Web: www.terramech.co.uk

Summary of Geotechnical Chemical Test Results

Project No.	Project Name
4008	28 Wokingham Road, Reading

Hole No.	Sample Ref	Sample Top	Sample Base	Sample Type	Sample Description	Org %	LOI %	pH	Sulphate as SO4 Total acid sol. %	Sulphate as SO4 2:1 water :soil g/l	Sulphate as SO4 ground water g/l	Chloride, Cl water sol. %	Chloride, Cl acid sol. %	CO2 %	TDS mg/l	<2mm %	Remarks
WS02A	1	1.20		D	Brown, slightly clayey, gravelly SAND			8		0.12						85	
WS03	1	0.80		D	Brown, slightly clayey sandy GRAVEL			7.6		0.06						50	
WS05	1	2.50		D	Brown gravelly CLAY			7.9		0.08						72	

Tests performed in accordance with BS 1377 unless annotated otherwise

Org	Organic matter content	Cl	Chloride content
LOI	Mass loss on ignition at 440oC	CO2	Carbonate content (rapid titration)
		TDS	Total Dissolved Solids

Sheet no: 1

Printed: 25/04/2018

Tested by:

Approved by:

Terramech Investigations Ltd
Geotechnical and Environmental

Registered Office: 183 Long Lane, Tilehurst, Reading, RG31 6YW
Phone: 0118 9439910 Fax: 0118 9439920
Email: office@terramech.co.uk Web: www.terramech.co.uk

PHASE 2 ENVIRONMENTAL

& GEOTECHNICAL

INVESTIGATION

NO 4008/18

AT

28 WOKINGHAM ROAD, READING, RG6 1JQ

FOR

PROPOSED HOUSING DEVELOPMENT

APPENDIX D

CONTAMINATION ANALYSIS

Exova Jones Environmental

Registered Address : Exova (UK) Ltd, Lochend Industrial Estate, Newbridge, Midlothian, EH28 8PL

Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

Tel: +44 (0) 1244 833780
Fax: +44 (0) 1244 833781

Terramech Investigations Ltd
183 Long Lane
Tilehurst
Reading
Berkshire
RG31 6YW

Attention :	Matt Green
Date :	18th May, 2018
Your reference :	4008
Our reference :	Test Report 18/5451 Batch 1
Location :	28 Wokingham Rd, Reading
Date samples received :	13th April, 2018
Status :	Final report
Issue :	2

Ten samples were received for analysis on 13th April, 2018 of which ten were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Compiled By:

Lucas Halliwell
Project Co-ordinator

Exova Jones Environmental

Client Name: Terramech Investigations Ltd
Reference: 4008
Location: 28 Wokingham Rd, Reading
Contact: Matt Green
JE Job No.: 18/5451

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

J E Sample No.	1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20			
Sample ID	WS1	WS1	WS2A	WS2A	WS3	WS3	WS4	WS4	WS5	WS5			
Depth	0.30	0.60	0.60	1.00	0.30	0.50	0.30	0.50	0.30	0.70	Please see attached notes for all abbreviations and acronyms		
COC No / misc													
Containers	V J	V J	V J	V J	V J	V J	V J	V J	V J	V J			
Sample Date	11/04/2018	11/04/2018	11/04/2018	11/04/2018	11/04/2018	11/04/2018	11/04/2018	11/04/2018	11/04/2018	11/04/2018			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1	LOD/LOR	Units	Method No.
Date of Receipt	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018			
Antimony	<1	-	8	<1	<1	-	3	-	-	-	<1	mg/kg	TM30/PM15
Arsenic #M	6.4	18.8	15.4	13.5	2.5	12.0	15.3	15.1	-	7.0	<0.5	mg/kg	TM30/PM15
Beryllium	<0.5	-	1.0	1.2	<0.5	-	0.9	-	-	-	<0.5	mg/kg	TM30/PM15
Cadmium #M	0.6	<0.1	<0.1	<0.1	0.5	<0.1	<0.1	<0.1	-	<0.1	<0.1	mg/kg	TM30/PM15
Chromium #M	92.3	23.1	97.1	83.9	29.3	45.4	26.9	34.4	-	129.4	<0.5	mg/kg	TM30/PM15
Copper #M	5	12	85	3	4	5	8	7	-	11	<1	mg/kg	TM30/PM15
Iron	11900	-	23830	35710	4780	-	32990	-	-	-	<20	mg/kg	TM30/PM15
Lead #M	38	61	381	8	38	19	111	8	-	107	<5	mg/kg	TM30/PM15
Magnesium	917	-	1223	1218	1635	-	1089	-	-	-	<25	mg/kg	TM30/PM15
Mercury #M	<0.1	<0.1	3.8	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	mg/kg	TM30/PM15
Molybdenum #M	7.7	-	0.7	4.1	1.1	-	1.0	-	-	-	<0.1	mg/kg	TM30/PM15
Nickel #M	7.7	25.5	18.3	24.9	<0.7	10.3	21.7	27.9	-	11.5	<0.7	mg/kg	TM30/PM15
Selenium #M	<1	<1	<1	<1	<1	<1	<1	<1	-	<1	<1	mg/kg	TM30/PM15
Sulphur as S	0.08	-	0.12	<0.01	0.01	-	0.01	-	-	-	<0.01	%	TM30/PM15
Total Sulphate as SO4 #M	1468	588	1251	<50	247	125	248	91	-	1486	<50	mg/kg	TM50/PM29
Vanadium	18	-	29	45	9	-	39	-	-	-	<1	mg/kg	TM30/PM15
Water Soluble Boron #M	0.8	-	2.0	1.0	0.3	-	0.4	-	-	-	<0.1	mg/kg	TM74/PM32
Zinc #M	34	-	96	33	23	-	96	-	-	-	<5	mg/kg	TM30/PM15
Arsenic	-	-	-	-	-	-	-	-	12.1	-	<0.5	mg/kg	TM30/PM62
Cadmium	-	-	-	-	-	-	-	-	0.8	-	<0.1	mg/kg	TM30/PM62
Chromium	-	-	-	-	-	-	-	-	14.1	-	<0.5	mg/kg	TM30/PM62
Copper	-	-	-	-	-	-	-	-	16	-	<1	mg/kg	TM30/PM62
Lead	-	-	-	-	-	-	-	-	196	-	<5	mg/kg	TM30/PM62
Mercury	-	-	-	-	-	-	-	-	<0.1	-	<0.1	mg/kg	TM30/PM62
Nickel	-	-	-	-	-	-	-	-	15.1	-	<0.7	mg/kg	TM30/PM62
Selenium	-	-	-	-	-	-	-	-	<1	-	<1	mg/kg	TM30/PM62
Total Sulphate as SO4	-	-	-	-	-	-	-	-	1478	-	<50	mg/kg	TM50/PM29

Client Name: Terramech Investigations Ltd
Reference: 4008
Location: 28 Wokingham Rd, Reading
Contact: Matt Green
JE Job No.: 18/5451

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

J E Sample No.	1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20	LOD/LOR	Units	Method No.
Sample ID	WS1	WS1	WS2A	WS2A	WS3	WS3	WS4	WS4	WS5	WS5			
Depth	0.30	0.60	0.60	1.00	0.30	0.50	0.30	0.50	0.30	0.70			
COC No / misc													
Containers	V J	V J	V J	V J	V J	V J	V J	V J	V J	V J			
Sample Date	11/04/2018	11/04/2018	11/04/2018	11/04/2018	11/04/2018	11/04/2018	11/04/2018	11/04/2018	11/04/2018	11/04/2018			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018			
PAH MS													
Naphthalene #M	0.09	1.05	7.20AB	<0.04	<0.04	<0.04	<0.04	<0.04	0.07	0.07	<0.04	mg/kg	TM4/PM8
Acenaphthylene	0.07	3.61	1.04AB	<0.03	<0.03	0.11	<0.03	<0.03	0.41	0.22	<0.03	mg/kg	TM4/PM8
Acenaphthene #M	<0.05	0.57	<0.50AB	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Fluorene #M	<0.04	2.31	1.26AB	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Phenanthrene #M	0.18	34.96++	4.12AB	<0.03	0.05	0.27	0.08	<0.03	0.49	0.51	<0.03	mg/kg	TM4/PM8
Anthracene #	0.10	14.01	1.03AB	<0.04	<0.04	0.11	<0.04	<0.04	0.26	0.22	<0.04	mg/kg	TM4/PM8
Fluoranthene #M	0.51	58.74++	10.73AB	0.03	0.05	<0.03	0.09	<0.03	2.93	1.79	<0.03	mg/kg	TM4/PM8
Pyrene #	0.44	49.08++	12.24AB	<0.03	0.04	0.99	0.07	<0.03	2.98	1.78	<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	0.28	26.85++	5.05AB	<0.06	<0.06	0.66	0.07	<0.06	1.93	1.00	<0.06	mg/kg	TM4/PM8
Chrysene #M	0.29	22.50	6.50AB	0.04	0.06	0.82	0.08	<0.02	1.20	0.94	<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #M	0.77	42.85	5.90AB	<0.07	0.21	1.90	0.27	<0.07	4.00	2.48	<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	0.45	25.94++	3.01AB	<0.04	0.13	1.08	0.15	<0.04	2.30	1.39	<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #M	0.30	17.31	2.16AB	<0.04	0.08	0.91	0.10	<0.04	1.82	1.13	<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	0.07	2.91	0.78AB	<0.04	<0.04	0.14	<0.04	<0.04	0.35	0.18	<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	0.35	17.65	2.65AB	0.12	0.08	0.97	0.11	<0.04	1.79	1.27	<0.04	mg/kg	TM4/PM8
PAH 16 Total	3.9	320.3	63.7AB	<0.6	0.7	8.0	1.0	<0.6	20.5	13.0	<0.6	mg/kg	TM4/PM8
Benzo(b)fluoranthene	0.55	30.85	4.25AB	<0.05	0.15	1.37	0.19	<0.05	2.88	1.79	<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	0.22	12.00	1.65AB	<0.02	0.06	0.53	0.08	<0.02	1.12	0.69	<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	93	94	91AB	100	98	94	94	100	93	89	<0	%	TM4/PM8
Methyl Tertiary Butyl Ether #M	-	-	<6	-	-	-	-	-	-	-	<6	ug/kg	TM15/PM10
Benzene #M	-	-	115	-	-	-	-	-	-	-	<5	ug/kg	TM15/PM10
Toluene #M	-	-	21	-	-	-	-	-	-	-	<3	ug/kg	TM15/PM10
Ethylbenzene #M	-	-	818	-	-	-	-	-	-	-	<3	ug/kg	TM15/PM10
p/m-Xylene #M	-	-	3089	-	-	-	-	-	-	-	<4	ug/kg	TM15/PM10
o-Xylene #M	-	-	1124	-	-	-	-	-	-	-	<4	ug/kg	TM15/PM10
Surrogate Recovery Toluene D8	-	-	57	-	-	-	-	-	-	-	<0	%	TM15/PM10
Surrogate Recovery 4-Bromofluorobenzene	-	-	53	-	-	-	-	-	-	-	<0	%	TM15/PM10
EPH >C8-C10 #M	-	<5	-	-	-	<5	-	<5	<5	<5	<5	mg/kg	TM5/PM8
EPH >C10-C12 #M	-	<10	-	-	-	<10	-	<10	<10	<10	<10	mg/kg	TM5/PM8
EPH >C12-C16 #M	-	<10	-	-	-	<10	-	<10	<10	<10	<10	mg/kg	TM5/PM8
EPH >C16-C21 #M	-	31	-	-	-	<10	-	<10	<10	17	<10	mg/kg	TM5/PM8
EPH >C21-C35 #M	-	97	-	-	-	<10	-	<10	81	93	<10	mg/kg	TM5/PM8
EPH >C8-C35 #M	-	128	-	-	-	<30	-	<30	81	110	<30	mg/kg	TM5/PM8

Please see attached notes for all abbreviations and acronyms

Client Name: Terramech Investigations Ltd
Reference: 4008
Location: 28 Wokingham Rd, Reading
Contact: Matt Green
JE Job No.: 18/5451

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

J E Sample No.	1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20	LOD/LOR	Units	Method No.
Sample ID	WS1	WS1	WS2A	WS2A	WS3	WS3	WS4	WS4	WS5	WS5			
Depth	0.30	0.60	0.60	1.00	0.30	0.50	0.30	0.50	0.30	0.70			
COC No / misc													
Containers	V J	V J	V J	V J	V J	V J	V J	V J	V J	V J			
Sample Date	11/04/2018	11/04/2018	11/04/2018	11/04/2018	11/04/2018	11/04/2018	11/04/2018	11/04/2018	11/04/2018	11/04/2018			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018			
TPH CWG													
Aliphatics													
>C5-C6 #M	<0.1	-	<0.2 SV AA	<0.1	<0.1	-	<0.1	-	-	-	<0.1	mg/kg	TM36/PM12
>C6-C8 #M	<0.1	-	6.0 SV AA	<0.1	<0.1	-	<0.1	-	-	-	<0.1	mg/kg	TM36/PM12
>C8-C10	<0.1	-	56.7 SV AA	<0.1	<0.1	-	<0.1	-	-	-	<0.1	mg/kg	TM36/PM12
>C10-C12 #M	<0.2	-	1090.5 ++	<0.2	<0.2	-	<0.2	-	-	-	<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 #M	<4	-	945 ++	<4	<4	-	<4	-	-	-	<4	mg/kg	TM5/PM8/PM16
>C16-C21 #M	<7	-	1933 ++	<7	<7	-	<7	-	-	-	<7	mg/kg	TM5/PM8/PM16
>C21-C35 #M	132	-	17921 ++	158	<7	-	29	-	-	-	<7	mg/kg	TM5/PM8/PM16
>C35-C44	37	-	2016 ++	14	<7	-	<7	-	-	-	<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-44	169	-	23968 ++	172	<26	-	29	-	-	-	<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Aromatics													
>C5-EC7 #	<0.1	-	<0.2 SV AA	<0.1	<0.1	-	<0.1	-	-	-	<0.1	mg/kg	TM36/PM12
>EC7-EC8 #	<0.1	-	<0.2 SV AA	<0.1	<0.1	-	<0.1	-	-	-	<0.1	mg/kg	TM36/PM12
>EC8-EC10 #M	<0.1	-	1.3 SV AA	<0.1	<0.1	-	<0.1	-	-	-	<0.1	mg/kg	TM36/PM12
>EC10-EC12 #	<0.2	-	262.9 ++	<0.2	<0.2	-	<0.2	-	-	-	<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 #	<4	-	353 ++	<4	<4	-	<4	-	-	-	<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 #	<7	-	1581 ++	<7	<7	-	<7	-	-	-	<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 #	88	-	13028 ++	130	<7	-	37	-	-	-	<7	mg/kg	TM5/PM8/PM16
>EC35-EC44	41	-	1323 ++	28	<7	-	15	-	-	-	<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-44	129	-	16549 ++	158	<26	-	52	-	-	-	<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-44)	298	-	40517 ++	330	<52	-	81	-	-	-	<52	mg/kg	TM5/TM36/PM8/PM12/PM16
MTBE #	<5	-	-	<5	<5	-	<5	-	-	-	<5	ug/kg	TM31/PM12
Benzene #	<5	-	-	<5	<5	-	<5	-	-	-	<5	ug/kg	TM31/PM12
Toluene #	<5	-	-	<5	<5	-	<5	-	-	-	<5	ug/kg	TM31/PM12
Ethylbenzene #	<5	-	-	<5	<5	-	<5	-	-	-	<5	ug/kg	TM31/PM12
m/p-Xylene #	<5	-	-	<5	<5	-	<5	-	-	-	<5	ug/kg	TM31/PM12
o-Xylene #	<5	-	-	<5	<5	-	<5	-	-	-	<5	ug/kg	TM31/PM12
Phenol #M	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	TM26/PM21
Natural Moisture Content	7.6	17.2	18.2	10.1	4.8	9.9	14.1	15.3	-	11.2	<0.1	%	PM4/PM0
Natural Moisture Content	-	-	-	-	-	-	-	-	15.0	-	<0.1	%	PM4/PM0
Hexavalent Chromium #	<0.3	-	<0.3	<0.3	<0.3	-	<0.3	-	-	-	<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext) #M	0.1744	-	0.0830	<0.0015	0.0160	-	0.0212	-	-	-	<0.0015	g/l	TM38/PM20
Free Cyanide	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	-	-	-	<0.5	mg/kg	TM89/PM45
Total Cyanide #M	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	mg/kg	TM89/PM45
Total Organic Carbon #	0.11	-	6.62	0.19	0.05	-	0.31	-	-	-	<0.02	%	TM21/PM24
Fraction Organic Carbon	0.001	-	0.066	0.002	<0.001	-	0.003	-	-	-	<0.001	None	TM21/PM24
Organic Matter	<0.2	-	11.4	0.3	<0.2	-	0.5	-	-	-	<0.2	%	TM21/PM24

Please see attached notes for all abbreviations and acronyms

Client Name: Terramech Investigations Ltd
Reference: 4008
Location: 28 Wokingham Rd, Reading
Contact: Matt Green
JE Job No.: 18/5451

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

J E Sample No.	1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20	LOD/LOR	Units	Method No.
Sample ID	WS1	WS1	WS2A	WS2A	WS3	WS3	WS4	WS4	WS5	WS5			
Depth	0.30	0.60	0.60	1.00	0.30	0.50	0.30	0.50	0.30	0.70			
COC No / misc													
Containers	V J	V J	V J	V J	V J	V J	V J	V J	V J	V J			
Sample Date	11/04/2018	11/04/2018	11/04/2018	11/04/2018	11/04/2018	11/04/2018	11/04/2018	11/04/2018	11/04/2018	11/04/2018			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018			
Sulphide	<10	-	<10	<10	<10	-	<10	-	-	-	<10	mg/kg	TM106/PM119
Thiocyanate	<0.6	-	1.0	<0.6	<0.6	-	<0.6	-	-	-	<0.6	mg/kg	TM107/PM119
pH #M	9.37	10.16	7.61	8.45	9.23	8.57	9.47	7.92	9.39	9.06	<0.01	pH units	TM73/PM11
Sample Type	Clayey Sand	Clayey Sand	Clay	Clayey Sand	Clayey Sand	Clayey Sand	Clay	Clayey Sand	NDP	Sand		None	PM13/PM0
Sample Colour	Medium Brown	Medium Brown	Medium Brown	Medium Brown	Medium Brown	Medium Brown	Medium Brown	Medium Brown	NDP	Medium Brown		None	PM13/PM0
Other Items	stones	brick fragments, stones	sand, stones, carbon	stones	stones	stones	sand, stones	none	NDP	stones		None	PM13/PM0

Please see attached notes for all abbreviations and acronyms

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: Terramech Investigations Ltd
Reference: 4008
Location: 28 Wokingham Rd, Reading
Contact: Matt Green
JE Job No.: 18/5451

VOC Report : **Solid**

Please see attached notes for all abbreviations and acronyms

J E Sample No.	5-6	LOD/LOR	Units	Method No.
Sample ID	WS2A			
Depth	0.60			
COC No / misc				
Containers	V J			
Sample Date	11/04/2018			
Sample Type	Soil			
Batch Number	1			
Date of Receipt	13/04/2018			
VOC MS				
Dichlorodifluoromethane	<2	<2	ug/kg	TM15/PM10
Methyl Tertiary Butyl Ether #M	<6	<6	ug/kg	TM15/PM10
Chloromethane #	<3	<3	ug/kg	TM15/PM10
Vinyl Chloride	<2	<2	ug/kg	TM15_A/PM10
Bromomethane	<1	<1	ug/kg	TM15/PM10
Chloroethane #M	<6	<6	ug/kg	TM15/PM10
Trichlorofluoromethane #M	<3	<3	ug/kg	TM15/PM10
1,1-Dichloroethene (1,1 DCE) #M	<6	<6	ug/kg	TM15/PM10
Dichloromethane (DCM) #	<30	<30	ug/kg	TM15/PM10
trans-1-2-Dichloroethene #	<3	<3	ug/kg	TM15/PM10
1,1-Dichloroethane #M	<6	<6	ug/kg	TM15/PM10
cis-1-2-Dichloroethene #M	<7	<7	ug/kg	TM15/PM10
2,2-Dichloropropane	<4	<4	ug/kg	TM15/PM10
Bromochloromethane #M	<4	<4	ug/kg	TM15/PM10
Chloroform #M	<5	<5	ug/kg	TM15/PM10
1,1,1-Trichloroethane #M	<5	<5	ug/kg	TM15/PM10
1,1-Dichloropropene #	<3	<3	ug/kg	TM15/PM10
Carbon tetrachloride #M	<4	<4	ug/kg	TM15/PM10
1,2-Dichloroethane #M	<5	<5	ug/kg	TM15/PM10
Benzene #M	115	<5	ug/kg	TM15/PM10
Trichloroethene (TCE) #M	<5	<5	ug/kg	TM15/PM10
1,2-Dichloropropane #M	<4	<4	ug/kg	TM15/PM10
Dibromomethane #M	<4	<4	ug/kg	TM15/PM10
Bromodichloromethane #M	<4	<4	ug/kg	TM15/PM10
cis-1-3-Dichloropropene	<4	<4	ug/kg	TM15/PM10
Toluene #M	21	<3	ug/kg	TM15/PM10
trans-1-3-Dichloropropene	<3	<3	ug/kg	TM15/PM10
1,1,2-Trichloroethane #M	<4	<4	ug/kg	TM15/PM10
Tetrachloroethene (PCE) #	<3	<3	ug/kg	TM15/PM10
1,3-Dichloropropane #M	<4	<4	ug/kg	TM15/PM10
Dibromochloromethane #M	<5	<5	ug/kg	TM15/PM10
1,2-Dibromoethane #	<3	<3	ug/kg	TM15/PM10
Chlorobenzene #M	<4	<4	ug/kg	TM15/PM10
1,1,1,2-Tetrachloroethane #M	<5	<5	ug/kg	TM15/PM10
Ethylbenzene #M	818	<3	ug/kg	TM15/PM10
p/m-Xylene #M	3089	<4	ug/kg	TM15/PM10
o-Xylene #M	1124	<4	ug/kg	TM15/PM10
Styrene	<3	<3	ug/kg	TM15_A/PM10
Bromoform	<4	<4	ug/kg	TM15/PM10
Isopropylbenzene #	306	<3	ug/kg	TM15/PM10
1,1,2,2-Tetrachloroethane #M	<3	<3	ug/kg	TM15/PM10
Bromobenzene	<2	<2	ug/kg	TM15/PM10
1,2,3-Trichloropropane #M	<4	<4	ug/kg	TM15/PM10
Propylbenzene #	425	<4	ug/kg	TM15/PM10
2-Chlorotoluene	<3	<3	ug/kg	TM15/PM10
1,3,5-Trimethylbenzene #	1516	<3	ug/kg	TM15/PM10
4-Chlorotoluene	<3	<3	ug/kg	TM15/PM10
tert-Butylbenzene #	<5	<5	ug/kg	TM15/PM10
1,2,4-Trimethylbenzene #	8649++	<6	ug/kg	TM15/PM10
sec-Butylbenzene #	811	<4	ug/kg	TM15/PM10
4-Isopropyltoluene #	766	<4	ug/kg	TM15/PM10
1,3-Dichlorobenzene #M	<4	<4	ug/kg	TM15/PM10
1,4-Dichlorobenzene #	<4	<4	ug/kg	TM15/PM10
n-Butylbenzene #	641	<4	ug/kg	TM15/PM10
1,2-Dichlorobenzene #M	<4	<4	ug/kg	TM15/PM10
1,2-Dibromo-3-chloropropane #	<4	<4	ug/kg	TM15/PM10
1,2,4-Trichlorobenzene #	<7	<7	ug/kg	TM15/PM10
Hexachlorobutadiene	<4	<4	ug/kg	TM15/PM10
1,2,3-Trichlorobenzene #	<7	<7	ug/kg	TM15/PM10
Surrogate Recovery Toluene D8	57	<0	%	TM15/PM10
Surrogate Recovery 4-Bromofluorobenzene	53	<0	%	TM15/PM10

Client Name: Terramech Investigations Ltd
Reference: 4008
Location: 28 Wokingham Rd, Reading
Contact: Matt Green

Note:

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level, lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Jones Environmental Laboratory consultant, Jones Environmental Laboratory cannot be responsible for inaccurate or unrepresentative sampling.

Signed on behalf of Jones Environmental Laboratory:

Ryan Butterworth
Asbestos Team Leader

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Date Of Analysis	Analysis	Result
18/5451	1	WS1	0.30	2	20/04/2018	**General Description (Bulk Analysis)**	Soil/Stones
					20/04/2018	**Asbestos Fibres**	NAD
					20/04/2018	**Asbestos Fibres (2)**	NAD
					20/04/2018	**Asbestos ACM**	NAD
					20/04/2018	**Asbestos ACM (2)**	NAD
					20/04/2018	**Asbestos Type**	NAD
					20/04/2018	**Asbestos Type (2)**	NAD
					20/04/2018	**Asbestos Level Screen**	NAD
18/5451	1	WS1	0.60	4	20/04/2018	**General Description (Bulk Analysis)**	Soil/Stone
					20/04/2018	**Asbestos Fibres**	NAD
					20/04/2018	**Asbestos Fibres (2)**	NAD
					20/04/2018	**Asbestos ACM**	NAD
					20/04/2018	**Asbestos ACM (2)**	NAD
					20/04/2018	**Asbestos Type**	NAD
					20/04/2018	**Asbestos Type (2)**	NAD
					20/04/2018	**Asbestos Level Screen**	NAD
18/5451	1	WS2A	0.60	6	20/04/2018	**General Description (Bulk Analysis)**	Soil/Stone
					20/04/2018	**Asbestos Fibres**	NAD
					20/04/2018	**Asbestos Fibres (2)**	NAD
					20/04/2018	**Asbestos ACM**	NAD
					20/04/2018	**Asbestos ACM (2)**	NAD
					20/04/2018	**Asbestos Type**	NAD
					20/04/2018	**Asbestos Type (2)**	NAD
					20/04/2018	**Asbestos Level Screen**	NAD
18/5451	1	WS2A	1.00	8	20/04/2018	**General Description (Bulk Analysis)**	Soil/Stones
					20/04/2018	**Asbestos Fibres**	NAD
					20/04/2018	**Asbestos Fibres (2)**	NAD
					20/04/2018	**Asbestos ACM**	NAD
					20/04/2018	**Asbestos ACM (2)**	NAD
					20/04/2018	**Asbestos Type**	NAD
					20/04/2018	**Asbestos Type (2)**	NAD
					20/04/2018	**Asbestos Level Screen**	NAD
18/5451	1	WS3	0.30	10	20/04/2018	**General Description (Bulk Analysis)**	Soil/Stones
					20/04/2018	**Asbestos Fibres**	NAD
					20/04/2018	**Asbestos Fibres (2)**	NAD

Client Name: Terramech Investigations Ltd
Reference: 4008
Location: 28 Wokingham Rd, Reading
Contact: Matt Green

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Date Of Analysis	Analysis	Result
18/5451	1	WS3	0.30	10	20/04/2018	**Asbestos ACM**	NAD
					20/04/2018	**Asbestos ACM (2)**	NAD
					20/04/2018	**Asbestos Type**	NAD
					20/04/2018	**Asbestos Type (2)**	NAD
					20/04/2018	**Asbestos Level Screen**	NAD
18/5451	1	WS3	0.50	12	20/04/2018	**General Description (Bulk Analysis)**	Soil/Stone
					20/04/2018	**Asbestos Fibres**	NAD
					20/04/2018	**Asbestos Fibres (2)**	NAD
					20/04/2018	**Asbestos ACM**	NAD
					20/04/2018	**Asbestos ACM (2)**	NAD
					20/04/2018	**Asbestos Type**	NAD
					20/04/2018	**Asbestos Type (2)**	NAD
					20/04/2018	**Asbestos Level Screen**	NAD
18/5451	1	WS4	0.30	14	20/04/2018	**General Description (Bulk Analysis)**	Soil/Stone
					20/04/2018	**Asbestos Fibres**	NAD
					20/04/2018	**Asbestos Fibres (2)**	NAD
					20/04/2018	**Asbestos ACM**	NAD
					20/04/2018	**Asbestos ACM (2)**	NAD
					20/04/2018	**Asbestos Type**	NAD
					20/04/2018	**Asbestos Type (2)**	NAD
					20/04/2018	**Asbestos Level Screen**	NAD
18/5451	1	WS4	0.50	16	20/04/2018	**General Description (Bulk Analysis)**	Soil/Stone
					20/04/2018	**Asbestos Fibres**	NAD
					20/04/2018	**Asbestos Fibres (2)**	NAD
					20/04/2018	**Asbestos ACM**	NAD
					20/04/2018	**Asbestos ACM (2)**	NAD
					20/04/2018	**Asbestos Type**	NAD
					20/04/2018	**Asbestos Type (2)**	NAD
					20/04/2018	**Asbestos Level Screen**	NAD
18/5451	1	WS5	0.30	18	20/04/2018	**General Description (Bulk Analysis)**	Soil/Stone/Brick
					20/04/2018	**Asbestos Fibres**	Fibre Bundles
					20/04/2018	**Asbestos Fibres (2)**	Fibre Bundles
					20/04/2018	**Asbestos ACM**	Asbestos Insulating Board Debris
					20/04/2018	**Asbestos ACM (2)**	NAD
					20/04/2018	**Asbestos Type**	Amosite
					20/04/2018	**Asbestos Type (2)**	Chrysotile
					18/05/2018	**Total ACM Gravimetric Quantification (% Asb)**	<0.001 (mass %)
					18/05/2018	**Total Detailed Gravimetric Quantification (% Asb)**	0.001 (mass %)
					18/05/2018	**Total Gravimetric Quantification (ACM + Detailed) (% Asb)**	0.001 (mass %)
					18/05/2018	**Asbestos PCOM Quantification (Fibres)**	<0.001 (mass %)
					18/05/2018	**Asbestos Gravimetric & PCOM Total**	0.001 (mass %)
18/5451	1	WS5	0.70	20	20/04/2018	**General Description (Bulk Analysis)**	Soil/Stones
					20/04/2018	**Asbestos Fibres**	NAD
					20/04/2018	**Asbestos Fibres (2)**	NAD
					20/04/2018	**Asbestos ACM**	NAD
					20/04/2018	**Asbestos ACM (2)**	NAD
					20/04/2018	**Asbestos Type**	NAD

Client Name: Terramech Investigations Ltd
Reference: 4008
Location: 28 Wokingham Rd, Reading
Contact: Matt Green

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Date Of Analysis	Analysis	Result
18/5451	1	WS5	0.70	20	20/04/2018	**Asbestos Type (2)**	NAD
					20/04/2018	**Asbestos Level Screen**	NAD

Client Name: Terramech Investigations Ltd **Matrix : Solid**
Reference: 4008
Location: 28 Wokingham Rd, Reading
Contact: Matt Green

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	NDP Reason
18/5451	1	WS5	0.30	17-18	Asbestos detected in sample

Client Name: Terramech Investigations Ltd
Reference: 4008
Location: 28 Wokingham Rd, Reading
Contact: Matt Green

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Analysis	Reason
No deviating sample report results for job 18/5451						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.
Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 18/5451

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any test results that may be compromised highlighted on your deviating samples report.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa.
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to an Exova Jones Environmental approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range
AA	x2 Dilution
AB	x10 Dilution

JE Job No: 18/5451

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.	PM0	No preparation is required.				
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes	Yes	AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes	Yes	AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes	Yes	AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes

JE Job No: 18/5451

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM13	A visual examination of the solid sample is carried out to ascertain sample make up, colour and any other inclusions. This is not a geotechnical description.	PM0	No preparation is required.			AR	
TM15	Modified USEPA 8260. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM15	Modified USEPA 8260. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM15	Modified USEPA 8260. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes	Yes	AR	Yes
TM21	Modified USEPA 415.1. Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.			AD	Yes
TM21	Modified USEPA 415.1. Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM21	As received solid or water samples are extracted in Methanol: Sodium Hydroxide (0.1M NaOH) (60:40) by orbital shaker.	Yes	Yes	AR	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes	Yes	AD	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM62	Acid digestion of as received solid samples using Aqua Regia refluxed at 112.5 °C.			AR	Yes

JE Job No: 18/5451

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM31	Modified USEPA 8015B. Determination of Methyltertbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes	Yes	AR	Yes
TM38	Soluble Ion analysis using the Thermo Aquakem Photometric Automatic Analyser. Modified US EPA methods 325.2, 375.4, 365.2, 353.1, 354.1	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes	Yes	AD	Yes
TM38	Soluble Ion analysis using the Thermo Aquakem Photometric Automatic Analyser. Modified US EPA methods 325.2, 375.4, 365.2, 353.1, 354.1	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM50	Acid soluble sulphate (Total Sulphate) analysed by ICP-OES	PM29	Dried and ground solid sample is boiled with dilute hydrochloric acid, the resulting liquor is then analysed.	Yes	Yes	AD	Yes
TM50	Acid soluble sulphate (Total Sulphate) analysed by ICP-OES	PM29	Dried and ground solid sample is boiled with dilute hydrochloric acid, the resulting liquor is then analysed.			AR	Yes
TM65	Asbestos Bulk Identification method based on HSG 248.	PM42	Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 and 9045D and BS1377:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes	Yes	AR	No

JE Job No: 18/5451

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM74	Analysis of water soluble boron (20:1 extract) by ICP-OES.	PM32	Hot water soluble boron is extracted from dried and ground samples using a 20:1 ratio.	Yes	Yes	AD	Yes
TM89	Modified USEPA method OIA-1667. Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide and Thiocyanate analysis.			AR	Yes
TM89	Modified USEPA method OIA-1667. Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide and Thiocyanate analysis.	Yes	Yes	AR	Yes
TM106	Determination of Sulphide by Skalar Continuous Flow Analyser	PM119	As received solid samples are extracted with 1M NaOH by orbital shaker for Sulphide and Thiocyanate analysis.			AR	Yes
TM107	Determination of Thiocyanate by Skalar Continuous Flow Analyser	PM119	As received solid samples are extracted with 1M NaOH by orbital shaker for Sulphide and Thiocyanate analysis.			AR	Yes
TM131	Quantification of Asbestos Fibres and ACM, based on HSG248 and SCA method.	PM42	Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	Yes
TM15_A	Modified USEPA 8260. Quantitative Determination of Volatile Organic Compounds, Vinyl Chloride & Styrene by Headspace GC-MS.	PM10	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes

PHASE 2 ENVIRONMENTAL

& GEOTECHNICAL

INVESTIGATION

NO 4008/18

AT

28 WOKINGHAM ROAD, READING, RG6 1JQ

FOR

PROPOSED HOUSING DEVELOPMENT

APPENDIX E

CONTAMINATION ASSESSMENT CRITERIA

Generic Contamination Assessment Criteria

<u>List 1</u> (Soils Assessment Criteria for Human Health)

1A) - Metals
1B) - Aliphatic Hydrocarbons
1C) - Aromatic Hydrocarbons
1D) - BTEX (Monocyclic Aromatic Hydrocarbons)
1E) - PAH (Poly-cyclic Aromatic Hydrocarbons)
1F) - PCB (Poly Chlorinated Bi-Phenyls)
1G) - Chloroalkanes and Alkenes
1H) - Explosives
1I) - Pesticides
1J) - Chlorobenzenes
1K) - Phenol and Chlorophenol
1L) – Other
1M) - Asbestos

This is a tabulated list of generic soil guideline values for the concentrations of contaminants in soils provided by various authorities to protect human health. These are generic values which make the worst case assumption for every exposure and absorption scenario governing the human uptake of the contaminants considered.

At this time Soil Guideline Values (SGVs) have been published by the Environment Agency for Arsenic, Cadmium, Nickel, Mercury, Selenium, Benzene, Toluene, Ethylbenzene, Xylene and Phenol together with Dioxins Furans and Dioxin like PCBs. These were calculated using the CLEA model (v1.04) and Environment Agency guidance documents SR2 (Human Health Toxicological Assessment of Contaminants in Soil) and SR3 (Updated Technical Background to the CLEA Model).

Further numbers of contaminants were assessed on this basis using the same CLEA Model by CIEH/LQM (The Chartered Institute of Environmental Health and Land Quality Management Ltd). Soil guideline values were published in their report on Generic Assessment Criteria for Human Health Assessments (2009). This 2009 guidance was replaced in 2015 by new S4UL values (Suitable '4' Use Levels) which are intended by CIEH/LQM to provide a complete and updated replacement for the values published in their 2009 report (see CIEH/LQM S4UL – 1.1). The S4UL values are the copyright of Land Quality Management Ltd and are reproduced with permission; Publication Number S4UL3262 - All rights reserved.

Where there is no Environment Agency SGV or S4UL, Terramech Investigations have derived values using the CLEA Model with old TOX reports as well as the SR2 report and the SR3 report, as suggested by the Environment Agency.

The assessments should be based on a hierarchy where the Environment Agency SGVs and S4UL from the Chartered Institute of Environmental Health are most preferred, followed by values derived by Terramech using the CLEA model.

DEFRA SP1010 & C4SL

We have also considered C4SL values derived for 6 contaminants in the Department of the Environment Farming and Rural Affairs (DEFRA) SP1010 report. The report describes how levels of contamination at a site are placed in one of four categories. Category 4 is where the level of risk posed is acceptably low, to Category 1, where the level of risk is clearly unacceptable. The Category 4 values presented in the report were primarily intended for use under the Part 2A of the Environmental Protection Act 1990 to screen out low risk sites.

The Category 4 values are however, determined using a Lower Level of Toxicological Concern (LLTC) assessment methodology which differs from the Health Condition Values (HCVs) discussed in Environment Agency SR2 report, these consider minimal or tolerable levels of risk.

A direction was given by the Department for Communities and Local Government (DCLG) and DEFRA for the C4SL system to be used for assessments for Planning as well as assessments under Part 2A of the Environmental Protection Act (SP1010 Companion Document December 2014).

In order to maintain consistency in our approach to all contaminants (i.e. minimal or tolerable levels of risk), we have continued to use the slightly more conservative Environment Agency SR2 – SR3 based values for the 43 contaminants considered in the Environment Agency SGV reports and partner S4UL publication from CIEH/LQM.

Unfortunately, the Environment Agency and CIEH/LQM documents do not give any guidelines for Lead concentrations. The SP1010 publication (March 2014 - Appendix H - Table 4.1) does a give a provisional Category 4 value for Lead determined using the original HCV CLEA methodology. We consider this value is to be consistent with the minimal or tolerable levels of risk methodology used for the other 43 contaminants by the Environment Agency and CIEH/LQM. On this basis we have adopted the values for Lead calculated to be protective of children as the critical receptors. For a residential garden, where plants are grown for consumption by the residents, the guideline value is 190mg/kg. No guideline concentrations are given by DEFRA in the SP1010 document for adults under that assessment methodology. Values for the other land use scenarios are presented in the following tables.

Asbestos

CIRIA C733 (Asbestos In Soil And Made Ground) shows how respirable fibre exposure estimates can be carried out based on measured soil concentrations. We have used this methodology to derive guideline values for a number of exposure scenarios based on the minimal or tolerable levels risk level of 1 in 100,000 used to derive HCVs for other contaminants.

We have used the most conservative values for the exposure estimates wherever possible. It should be noted that these values are not corroborated by any other organisation and they are also subject to the notes and caveats set out in the wider CIRIA C733 document.

List 2 (Assessment Criteria for Buried Water Supply Pipes)

Water pipes laid in contaminated ground can absorb some contaminants and allow then to contaminate the water running in the pipes. Our assessments are based on the *UKWIR Report Ref No 10/WM/03/21* which gives a mandatory list of contaminants and threshold concentrations for those contaminants in relation to different types of water pipe materials.

However, we would note that some water utility companies assess contaminants on the basis of their own guidances and we have not reproduced lists of contaminants and their thresholds for all of these individual guidances.

List 3 (Assessment Criteria For Soil Disposal)

Assessment of soils destined for landfills takes two stages. The first is site characterisation to determine if the source site is contaminated, the second stage is compliance testing to assess the leachability or solubility of any contaminants that are present at elevated concentrations, as well as the potential for the material to decay and create gases.

Characterisation is carried out by comparing the soil results with the SGVs and GACs in List 1 with respect to human health as well as list 4 for groundwater protection. If the soils are seen to contain unacceptable concentrations of contaminants, then leachate tests will be required to fully classify the risk to groundwater and organic matter tests are required to assess the gas generation potential. The leachate results and total concentrations for a variety of petrochemical products are then compared with thresholds for different waste categories as set out in BS EN 12457-2.

<u>List 4</u> (Groundwater Assessment Criteria)

Assessment of groundwater analysis is carried out using Water Supply (Water Quality) Regulations 2000 (SI 2000/3184 as amended) or the Environmental Quality Standard (EQS) values for fresh or saltwater depending on which is the most applicable background water quality scenario for compliance. Where the groundwater is not abstracted and not supplying water to springs or rivers, the results from upstream groundwater analysis would be used for comparison.

When investigations highlight the presence of soil contaminants at concentrations exceeding what could be expected naturally, the measured contaminant concentrations in soil would be assessed at tier 1 stage with respect to the risk posed to groundwater using the Environment Agency R&D Publication 20 Remedial Targets Worksheet, Release 2.2a.

Generic values for soil properties and chemical partition coefficients for contaminants were taken from the Environment Agency CLEA Model (v1.06) and supporting documents under the SC050021 reference. Exceedance of these values should not be taken as demonstrating a risk to controlled waters. Tier 2 and Tier 3 assessments would need to be carried out if exceedances are noted at Tier 1.

Assessment Criteria for Ground Gases

Ground gases are assessed on the basis of the CIRIA C665 document (Assessing Risks Posed by Hazardous Ground Gases to Buildings) which dictates the monitoring period and the frequency of visits required. Worst case flow rates and gas concentrations are then used to derive a Gas Screening Value (GSV) from which a characteristic situation and then a level of protection is defined.

List 1A (Metals mg/kg)

Contaminant	Generic Exposure Scenario	Terramech (CLEA v1.06 & S4UL methodology)	Environment Agency SGV (CLEA v1.04)	CIEH/LQM S4UL 2015	DEFRA SP1010 'Final' C4SL December 2014
Arsenic	Residential with plant uptake	32	32	37	37
	Residential without plant uptake	35	Not Assessed	40	40
	Allotment		43	43	49
	Commercial	635	640	640	640
	Public Open Space (Residential)	Not Assessed	Not Assessed	79	79
	Public Open Space (Park)	Not Assessed	Not Assessed	170	170
Beryllium	Residential with plant uptake	Not Assessed	Not Assessed	1.7	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	1.7	Not Assessed
	Allotment	Not Assessed	Not Assessed	35	Not Assessed
	Commercial	Not Assessed	Not Assessed	12	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	2.2	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	63	Not Assessed
Boron	Residential with plant uptake	Not Assessed	Not Assessed	Not Assessed	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	Not Assessed	Not Assessed
	Allotment	Not Assessed	Not Assessed	Not Assessed	Not Assessed
	Commercial	Not Assessed	Not Assessed	Not Assessed	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	Not Assessed	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Cadmium	Residential with plant uptake	Not Assessed	10	11	22
	Residential without plant uptake	Not Assessed	Not Assessed	85	150
	Allotment	Not Assessed	1.8	1.9	3.9
	Commercial	Not Assessed	230	190	410
	Public Open Space (Residential)	Not Assessed	Not Assessed	120	220
	Public Open Space (Park)	Not Assessed	Not Assessed	532	880
Chromium III	Residential with plant uptake	Not Assessed	Not Assessed	910	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	910	Not Assessed
	Allotment	Not Assessed	Not Assessed	18000	Not Assessed
	Commercial	Not Assessed	Not Assessed	8600	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	1500	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	3300	Not Assessed
Chromium VI	Residential with plant uptake	Not Assessed	Not Assessed	6	21
	Residential without plant uptake	Not Assessed	Not Assessed	6	21
	Allotment	Not Assessed	Not Assessed	1.8	170
	Commercial	Not Assessed	Not Assessed	33	49
	Public Open Space (Residential)	Not Assessed	Not Assessed	7.7	23
	Public Open Space (Park)	Not Assessed	Not Assessed	220	250
Copper	Residential with plant uptake	Not Assessed	Not Assessed	2400	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	7100	Not Assessed
	Allotment	Not Assessed	Not Assessed	520	Not Assessed
	Commercial	Not Assessed	Not Assessed	68000	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	12000	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	44000	Not Assessed
Lead	Residential with plant uptake	190(4)	450 (old SGV)(5)	Not Assessed	200
	Residential without plant uptake	310(4)	450 (old SGV) (5)	Not Assessed	310
	Allotment	70(4)	Not Assessed	Not Assessed	80
	Commercial	1100(4)	750 (old SGV) (5)	Not Assessed	2300
	Public Open Space (Residential)	Not Assessed	Not Assessed	Not Assessed	630
	Public Open Space (Park)	Not Assessed	Not Assessed	Not Assessed	1300
Inorganic Mercury	Residential with plant uptake	Not Assessed	170	40	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	56	Not Assessed
	Allotment	Not Assessed	80	19	Not Assessed
	Commercial	Not Assessed	3600	1100	Not Assessed
	Public Open Space (Residential)	Not Assessed		120	Not Assessed
	Public Open Space (Park)	Not Assessed		240	Not Assessed
Elemental Mercury	Residential with plant uptake	Not Assessed	1	1.2	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	1.2	Not Assessed
	Allotment	Not Assessed	26	21	Not Assessed
	Commercial	Not Assessed	26	25.8	Not Assessed
	Public Open Space (Residential)	Not Assessed		16	Not Assessed
	Public Open Space (Park)	Not Assessed		25.8	Not Assessed
Methyl Mercury	Residential with plant uptake	Not Assessed	11	11	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	15	Not Assessed
	Allotment	Not Assessed	8	6	Not Assessed
	Commercial	Not Assessed	410	320	Not Assessed
	Public Open Space (Residential)	Not Assessed		40	Not Assessed
	Public Open Space (Park)	Not Assessed		68	Not Assessed
Nickel	Residential with plant uptake	Not Assessed	130	180	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	180	Not Assessed
	Allotment	Not Assessed	230	230	Not Assessed
	Commercial	Not Assessed	1800	980	Not Assessed
	Public Open Space (Residential)	Not Assessed		230	Not Assessed
	Public Open Space (Park)	Not Assessed		3400	Not Assessed

List 1A cont. (Metals mg/kg)

Contaminant	Generic Exposure Scenario	Terramech (CLEA v1.06 & S4UL methodology)	Environment Agency SGV (CLEA v1.04)	CIEH/LQM S4UL 2015 Part 2	DEFRA SP1010 'Final' C4SL December 2014
Selenium	Residential with plant uptake	Not Assessed	350	250	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	430	Not Assessed
	Allotment	Not Assessed	120	88	Not Assessed
	Commercial	Not Assessed	13000	12000	Not Assessed
	Public Open Space (Residential)	Not Assessed		1100	Not Assessed
	Public Open Space (Park)	Not Assessed		1800	Not Assessed
Vanadium	Residential with plant uptake	Not Assessed	Not Assessed	410	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	1200	Not Assessed
	Allotment	Not Assessed	Not Assessed	91	Not Assessed
	Commercial	Not Assessed	Not Assessed	9000	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	2000	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	5000	Not Assessed
Zinc	Residential with plant uptake	Not Assessed	Not Assessed	3700	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	40000	Not Assessed
	Allotment	Not Assessed	Not Assessed	620	Not Assessed
	Commercial	Not Assessed	Not Assessed	730000	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	8100	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	17000	Not Assessed
Free Cyanide	Residential with plant uptake	Not Assessed	Not Assessed	Not Assessed	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	Not Assessed	Not Assessed
	Allotment	Not Assessed	Not Assessed	Not Assessed	Not Assessed
	Commercial	Not Assessed	Not Assessed	Not Assessed	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	Not Assessed	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Complex Cyanide	Residential with plant uptake	Not Assessed	Not Assessed	Not Assessed	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	Not Assessed	Not Assessed
	Allotment	Not Assessed	Not Assessed	Not Assessed	Not Assessed
	Commercial	Not Assessed	Not Assessed	Not Assessed	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	Not Assessed	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	Not Assessed	Not Assessed
Thiocyanate	Residential with plant uptake	Not Assessed	Not Assessed	Not Assessed	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	Not Assessed	Not Assessed
	Allotment	Not Assessed	Not Assessed	Not Assessed	Not Assessed
	Commercial	Not Assessed	Not Assessed	Not Assessed	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	Not Assessed	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	Not Assessed	Not Assessed

This table is not a list of potential contaminants at any one site
All values are subject to ongoing review
CIEH - Chartered Institute for Environmental Health
LQM - Land Quality Management (commercial research)
(1) xx/yy/zz SOM - Soil Organic Matter dependant at 1%/2.5%/6%
(2) xx/yy/zz pH - pH dependant at pH6/pH7/pH8
(3) Internal limits exceeded during calculations
(4) under review by Terramech
(5) Value Withdrawn
S4UL values are the copyright of Land Quality Management Ltd and are reproduced with permission; Publication Number S4UL3262 All rights reserved

Terramech Investigations Limited
183 Long Lane Tilehurst
Reading
RG31 6YW
Email - info@terramech.co.uk
Tel 01189 439 910
Fax 01189 439 920

List 1B (Aliphatic Hydrocarbons mg/kg)

Contaminant	Generic Exposure Scenario	Terramech (CLEA v1.06 & S4UL methodology)	Environment Agency SGV (CLEA v1.04)	CIEH/LQM S4UL 2015 Part 3	DEFRA SP1010 'Final' C4SL December 2014
Aliphatic C5-C6	Residential with plant uptake	Not Assessed	Not Assessed	42/78/160(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	42/76/160(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	730/1700/3900(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	3200(304sol)/5900(558sol)/12000(1150sol) (1&3)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	570000/590000/60000(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	95000(304sol)/130000(558sol)/180000(1150sol) (1&3)	Not Assessed
Aliphatic C6-C8	Residential with plant uptake	Not Assessed	Not Assessed	100/230/530(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	100/230/530(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	2300/5600/13000(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	7800(144sol)/17000(322sol)/40000(736sol)(1&3)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	600000/610000/620000(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	150000(144sol)/220000(322sol)/320000(736sol)(1&3)	Not Assessed
Aliphatic C8-C10	Residential with plant uptake	Not Assessed	Not Assessed	27/65/150(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	27/65/150(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	320/77/1700(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	2000(78sol)/4800(190vap)11000(451vap) (1&3)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	13000/13000/13000(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	14000(78sol)/18000(190vap)/21000(451vap) (1&3)	Not Assessed
Aliphatic C10-C12	Residential with plant uptake	Not Assessed	Not Assessed	130(48vap)/330(118vap)/760(283vap) (1&3)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	130(48vap)/330(118vap)/760(283vap) (1&3)	Not Assessed
	Allotment	Not Assessed	Not Assessed	2200/4400/7300(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	9700(48sol)/23000(118vap)/47000(283vap) (1&3)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	13000/13000/13000(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	21000(48sol)/230000(118vap)/24000(283vap) (1&3)	Not Assessed
Aliphatic C12-C16	Residential with plant uptake	Not Assessed	Not Assessed	1100(24sol)/2400(59sol)/4300(142sol) (1&3)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	1100(24sol)/2400(59sol)/4300(144sol) (1&3)	Not Assessed
	Allotment	Not Assessed	Not Assessed	11000/13000/13000(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	59000(24sol)/82000(59sol)/90000(142sol) (1&3)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	13000/13000/13000(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	25000(24sol)/25000(59sol)/26000(142sol) (1&3)	Not Assessed
Aliphatic C16-C35	Residential with plant uptake	Not Assessed	Not Assessed	65000(8.48sol)/92000(21sol)/110000 (1&3)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	65000(8.48sol)/92000(21sol)/110000 (1&3)	Not Assessed
	Allotment	Not Assessed	Not Assessed	260000/270000/270000(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	1600000/1700000/1800000(1)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	3800/3800/3800(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	3800/3800/3800(1)	Not Assessed
Aliphatic C35-C44	Residential with plant uptake	Not Assessed	Not Assessed	65000(8.48sol)/92000(21sol)/110000 (1&3)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	65000(8.48sol)/92000(21sol)/110000 (1&3)	Not Assessed
	Allotment	Not Assessed	Not Assessed	260000/270000/270000(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	1600000/1700000/1800000(1)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	3800/3800/3800(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	3800/3800/3800(1)	Not Assessed
Aliphatic C44-C70	Residential with plant uptake	Not Assessed	Not Assessed	1600/1800/1900	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	1600/1800/1900	Not Assessed
	Allotment	Not Assessed	Not Assessed	1200/2100/3000	Not Assessed
	Commercial	Not Assessed	Not Assessed	28000/28000/28000	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	3800/3800/3800	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	7800/7800/7800	Not Assessed

This table is not a list of potential contaminants at any one site
All values are subject to ongoing review
CIEH - Chartered Institute for Environmental Health
LQM - Land Quality Management (commercial research)
(1) xx/yy/zz SOM - Soil Organic Matter dependant at 1%/2.5%/6%
(2) xx/yy/zz pH - pH dependant at pH6/pH7/pH8
(3) Internal limits exceeded during calculations. Vapour or solubility saturation limit exceeded (limit presented in brackets)
(4) under review by Terramech
S4UL values are the copyright of Land Quality Management Ltd and are reproduced with permission; Publication Number S4UL3262 All rights reserved

Terramech Investigations Limited
183 Long Lane Tilehurst
Reading
RG31 6YW
Email - info@terramech.co.uk
Tel 01189 439 910
Fax 01189 439 920

List 1C (Aromatic (Mono-cyclic and Poly-cyclic) Hydrocarbons mg/kg)

Contaminant	Generic Exposure Scenario	Terramech (CLEA v1.06 & S4UL methodology)	Environment Agency SGV (CLEA v1.04)	CIEH/LQM S4UL 2015 Part 3	DEFRA SP1010 'Final' C4SL December 2014
Aromatic C5-C7	Residential with plant uptake	Not Assessed	Not Assessed	70/140/300(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	370/690/1400(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	13/27/57(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	26000(1220sol)/46000(2260sol)/86000(4710sol) (1&3)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	56000/56000/56000(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	76000(1220sol)/84000(2260sol)/92000(4710sol) (1&3)	Not Assessed
Aromatic C7-C8	Residential with plant uptake	Not Assessed	Not Assessed	130/290/660(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	860/1800/3900(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	22/51/120(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	56000(869vap)/110000(1920sol)/180000(4360vap) (1&3)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	56000/56000/56000(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	87000(869vap)/95000(1920sol)/100000(4360vap) (1&3)	Not Assessed
Aromatic C8-C10	Residential with plant uptake	Not Assessed	Not Assessed	34/83/190(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	47/110/270(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	8.6/21/51(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	3500(613vap)/8100(1500vap)/17000(3580vap) (1&3)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	5000/5000/5000(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	7200(613vap)/8500(1500vap)/9300(3580vap) (1&3)	Not Assessed
Aromatic C10-C12	Residential with plant uptake	Not Assessed	Not Assessed	74/180/380(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	250/590/1200(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	13/31/74(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	16000(364sol)/28000(899sol)/34000(2150sol) (1&3)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	5000/5000/5000(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	9200(364sol)/9700(899sol)/10000(1&3)	Not Assessed
Aromatic C12-C16	Residential with plant uptake	Not Assessed	Not Assessed	140/330/660(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	1800/2300(419sol)/2500(1&3)	Not Assessed
	Allotment	Not Assessed	Not Assessed	23/57/130(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	36000/(169sol)/37000/38000(1&3)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	5100/5100/5000(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	10000/10000/10000(1)	Not Assessed
Aromatic C16-C21	Residential with plant uptake	Not Assessed	Not Assessed	260/540/930(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	1900/1900/1900(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	46/110/260(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	28000/28000/28000(1)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	3800/3800/3800(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	7600/7700/7800(1)	Not Assessed
Aromatic C21-C35	Residential with plant uptake	Not Assessed	Not Assessed	1100/1500/1700(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	1900/1900/1900(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	370/820/1600(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	28000/28000/28000(1)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	3800/3800/3800(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	7800/7800/7900(1)	Not Assessed
Aromatic C35-C44	Residential with plant uptake	Not Assessed	Not Assessed	1100/1500/1700(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	1900/1900/1900(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	370/820/1600(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	28000/28000/28000(1)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	3800/3800/3800(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	7800/7800/7900(1)	Not Assessed
Aromatic C44-C70	Residential with plant uptake	Not Assessed	Not Assessed	1600/1800/1900(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	1900/1900/1900(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	1200/2100/3000(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	28000/28000/28000(1)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	3800/3800/3800(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	7800/7800/7900(1)	Not Assessed

This table is not a list of potential contaminants at any one site
All values are subject to ongoing review
CIEH - Chartered Institute for Environmental Health
LQM - Land Quality Management (commercial research)
(1) xx/yy/zz SOM - Soil Organic Matter dependant at 1%/2.5%/6%
(2) xx/yy/zz pH - pH dependant at pH6/pH7/pH8
(3) Internal limits exceeded during calculations. Vapour or solubility saturation limit exceeded (limit presented in brackets)
(4) under review by Terramech
S4UL values are the copyright of Land Quality Management Ltd and are reproduced with permission; Publication Number S4UL3262 All rights reserved

Terramech Investigations Limited
183 Long Lane Tilehurst
Reading
RG31 6YW
Email - info@terramech.co.uk
Tel 01189 439 910
Fax 01189 439 920

List 1D (BTEX Mono-cyclic Aromatic Hydrocarbons mg/kg)

Contaminant	Generic Exposure Scenario	Terramech (CLEA v1.06 & S4UL methodology)	Environment Agency SGV (CLEA v1.04)	CIEH/LQM S4UL 2015 Part 3	DEFRA SP1010 'Final' C4SL December 2014
Benzene	Residential with plant uptake	Not Assessed	0.33	0.87/0.17/0.37 (1)	0.87
	Residential without plant uptake	Not Assessed	Not Assessed	0.38/0.70/1.4(1)	3.3
	Allotment	Not Assessed	0.07	0.017/0.034/0.075(1)	0.18
	Commercial	Not Assessed	95	27/47/90(1)	98
	Public Open Space (Residential)	Not Assessed	Not Assessed	72/72/73(1)	79
	Public Open Space (Park)	Not Assessed	Not Assessed	90/11/110(1)	170
Toluene	Residential with plant uptake	Not Assessed	610	130/290/660	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	880(869^{vap})/1900/3900 (1&3)	Not Assessed
	Allotment	Not Assessed	120	22/51/120(1)	Not Assessed
	Commercial	Not Assessed	4400	56000(869 ^{vap})/56000(1920 ^{vap})/56000(4360 ^{vap}) (1&3)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	5600/5600/5600(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	87000(869 ^{vap})/95000(1920 ^{vap})/100000(4360 ^{vap}) (1&3)	Not Assessed
Ethylbenzene	Residential with plant uptake	Not Assessed	350	47/110/260(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	83/190/440(1)	Not Assessed
	Allotment	Not Assessed	90	16/39/91(1)	Not Assessed
	Commercial	Not Assessed	2800	5700(518 ^{vap})/13000(1220 ^{vap})/27000(2840 ^{vap}) (1&3)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	24000/24000/25000(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	17000(518 ^{vap})/22000(1220 ^{vap})/27000(2840 ^{vap}) (1&3)	Not Assessed
o-Xylene	Residential with plant uptake	Not Assessed	250	60/140/330 (1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	88/210/480 (1)	Not Assessed
	Allotment	Not Assessed	160	28/67/160 (1)	Not Assessed
	Commercial	Not Assessed	2600	6600(478^{sol})/15000(1120^{sol})/33000(2620^{sol}) (1&3)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	41000/42000/43000 (1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	17000(478^{sol})/24000(1120^{sol})/33000(2620^{sol}) (1&3)	Not Assessed
m-Xylene	Residential with plant uptake	Not Assessed	240	59/140/320 (1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	52/190/450 (1)	Not Assessed
	Allotment	Not Assessed	180	31/74/170 (1)	Not Assessed
	Commercial	Not Assessed	3500	6200(625 ^{vap})/14000(1470 ^{vap})/31000(3460 ^{vap}) (1&3)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	41000/42000/43000 (1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	17000(625 ^{vap})/24000(1470 ^{vap})/32000(3460 ^{vap}) (1&3)	Not Assessed
p-Xylene	Residential with plant uptake	Not Assessed	230	56/130/310 (1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	79/180/430 (1)	Not Assessed
	Allotment	Not Assessed	160	29/69/160 (1)	Not Assessed
	Commercial	Not Assessed	3200	59000(576^{sol})/14000(1350^{sol})/30000(3170^{sol}) (1&3)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	41000/42000/43000 (1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	17000(576^{sol})/23000(1350^{sol})/31000(3170^{sol}) (1&3)	Not Assessed

This table is not a list of potential contaminants at any one site
All values are subject to ongoing review
CIEH - Chartered Institute for Environmental Health
LQM - Land Quality Management (commercial research)
(1) xx/yy/zz SOM - Soil Organic Matter dependant at 1%/2.5%/6%
(2) xx/yy/zz pH - pH dependant at pH6/pH7/pH8
(3) Internal limits exceeded during calculations. Vapour or solubility saturation limit exceeded (limit presented in brackets)
(4) under review by Terramech
S4UL values are the copyright of Land Quality Management Ltd and are reproduced with permission; Publication Number S4UL3262 All rights reserved

Terramech Investigations Limited
183 Long Lane Tilehurst
Reading
RG31 6YW
Email - info@terramech.co.uk
Tel 01189 439 910
Fax 01189 439 920

List 1E (Poly-cyclic Aromatic Hydrocarbons or PAH - mg/kg)

Contaminant	Generic Exposure Scenario	Terramech (CLEA v1.06 & S4UL methodology)	Environment Agency SGV (CLEA v1.04)	CIEH/LQM S4UL 2015 Part 4	DEFRA SP1010 'Final' C4SL December 2014
Acenaphthene	Residential with plant uptake	Not Assessed	Not Assessed	210/610/1100(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	3000/(57sol)/4700(141sol)/6000(336sol) (1&3)	Not Assessed
	Allotment	Not Assessed	Not Assessed	34/85/200(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	8400(57 sol)/97000(141 sol)/100000(1&3)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	15000/15000/15000(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	29000/30000/30000(1)	Not Assessed
Acenaphthylene	Residential with plant uptake	Not Assessed	Not Assessed	170/420/920(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	2900(86.1 sol)/4600(212 sol)/6000(506 sol) (1&3)	Not Assessed
	Allotment	Not Assessed	Not Assessed	28/69/160(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	83000(86.1 sol)/97000(212 sol)/100000(1&3)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	15000/15000/15000(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	29000/30000/30000(1)	Not Assessed
Anthracene	Residential with plant uptake	Not Assessed	Not Assessed	2400/5400/11000(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	31000(1.17 vap)/35000/37000(1&3)	Not Assessed
	Allotment	Not Assessed	Not Assessed	380/950/2200(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	520000/540000/540000(1)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	74000/74000/74000(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	150000/150000/150000(1)	Not Assessed
Benzo (a) Anthracene	Residential with plant uptake	Not Assessed	Not Assessed	7.2/11/13(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	11/14/15(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	2.9/6.5/13(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	170/170/180(1)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	29/29/29(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	49/56/62(1)	Not Assessed
Benzo (a) Pyrene	Residential with plant uptake	Not Assessed	Not Assessed	2.2/2.7/3.0(1)	5.0
	Residential without plant uptake	Not Assessed	Not Assessed	3.2/3.2/3.2(1)	5.3
	Allotment	Not Assessed	Not Assessed	0.97/2.0/3.5(1)	5.7
	Commercial	Not Assessed	Not Assessed	35/35/36(1)	77
	Public Open Space (Residential)	Not Assessed	Not Assessed	5.7/5.7/5.7(1)	10
	Public Open Space (Park)	Not Assessed	Not Assessed	11/12/13(1)	21
Benzo (b) Fluoranthene	Residential with plant uptake	Not Assessed	Not Assessed	2.6/3.3/3.7(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	3.9/4.0/4.0(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	0.99/2.1/3.9(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	44/44/45(1)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	7.1/7.2/7.2(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	13/15/16(1)	Not Assessed
Benzo (ghi) Perylene	Residential with plant uptake	Not Assessed	Not Assessed	320/340/350(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	360/360/360(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	290/470/640(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	3900/4000/4000(1)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	640/640/640(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	1400/1500/1600(1)	Not Assessed
Benzo (k) Fluoranthene	Residential with plant uptake	Not Assessed	Not Assessed	77/93/100(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	110/110/110(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	37/75/130(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	1200/1200/1200(1)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	190/190/190(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	370/410/440(1)	Not Assessed
Chrysene	Residential with plant uptake	Not Assessed	Not Assessed	15/22/27(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	30/31/32(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	4.1/9.4/19(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	350/350/350(1)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	57/57/57(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	93/110/120(1)	Not Assessed
Dibenzo (ah) Anthracene	Residential with plant uptake	Not Assessed	Not Assessed	0.24/0.28/0.3(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	0.31/0.32/0.32(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	0.14/0.27/0.43(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	3.5/3.6/3.6(1)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	0.57/0.57/0.58(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	1.1/1.3/1.4(1)	Not Assessed
Fluoranthene	Residential with plant uptake	Not Assessed	Not Assessed	280/560/890(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	1500/1600/1600(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	52/130/290(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	23000/23000/23000(1)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	3100/3100/3100(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	6300/6300/6400(1)	Not Assessed
Fluorene	Residential with plant uptake	Not Assessed	Not Assessed	170/400/860(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	2800(30.9 sol)/3800(76.5 sol)/4500(183 sol) (1&3)	Not Assessed
	Allotment	Not Assessed	Not Assessed	27/67/160(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	63000(30.9 sol)/68000/71000(1&3)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	9900/9900/9900(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	20000/20000/20000(1)	Not Assessed

List 1E cont (Poly-cyclic Aromatic Hydrocarbons or PAH - mg/kg)

Contaminant	Generic Exposure Scenario	Terramech (CLEA v1.06 & S4UL methodology)	Environment Agency SGV (CLEA v1.04)	CIEH/LQM S4UL 2015 Part 4	DEFRA SP1010 'Final' C4SL December 2014
Indeno (cd) Pyrene	Residential with plant uptake	Not Assessed	Not Assessed	27/36/41(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	45/46/46(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	9.5/21/39(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	500/510/510(1)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	82/82/82(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	150/170/180(1)	Not Assessed
Naphthalene	Residential with plant uptake	Not Assessed	Not Assessed	2.3/5.6/13(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	2.3/5.6/13(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	4.1/10/24(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	190(76.4 sol)/460(183 sol)/1100(432 sol) (1&3)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	4900/4900/4900(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	1200(76.4 sol)/1900(183 sol)/3000(1&3)	Not Assessed
Phenanthrene	Residential with plant uptake	Not Assessed	Not Assessed	95/220/440(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	1300(36 sol)/1500/1500(1&3)	Not Assessed
	Allotment	Not Assessed	Not Assessed	15/38/90(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	22000/22000/23000(1)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	3100/3100/3100(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	6200/6200/6300(1)	Not Assessed
Pyrene	Residential with plant uptake	Not Assessed	Not Assessed	620/1200/2000(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	3700/3800/3800(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	110/270/620(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	54000/54000/54000(1)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	7400/7400/7400(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	15000/15000/15000(1)	Not Assessed
Coal Tar (Benzo (a) Pyrene as surrogate)	Residential with plant uptake	Not Assessed	Not Assessed	0.79/0.98/1.1(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	1.2/1.2/1.2(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	0.32/0.67/1.2(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	15/15/15(1)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	2.2/2.2/2.2(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	4.4/4.7/4.8(1)	Not Assessed

This table is not a list of potential contaminants at any one site
All values are subject to ongoing review
CIEH - Chartered Institute for Environmental Health
LQM - Land Quality Management (commercial research)
(1) xx/yy/zz SOM - Soil Organic Matter dependant at 1%/2.5%/6%
(2) xx/yy/zz pH - pH dependant at pH6/pH7/pH8
(3) Internal limits exceeded during calculations. Vapour or solubility saturation limit exceeded (limit presented in brackets)
(4) under review by Terramech
S4UL values are the copyright of Land Quality Management Ltd and are reproduced with permission; Publication Number S4UL3262 All rights reserved

Terramech Investigations Limited
183 Long Lane Tilehurst
Reading
RG31 6YW
Email - info@terramech.co.uk
Tel 01189 439 910
Fax 01189 439 920

List 1F (PCBs µg/kg)

Contaminant	Generic Exposure Scenario	Terramech (CLEA v1.06 & S4UL methodology)	Environment Agency New SGV (CLEA v1.04)	CIEH/LQM 2nd Ed 2009 or CIEH/LQM S4UL 2015	DEFRA SP1010 'Final' C4SL December 2014
Sum of PCDDs, PCDFs and dioxin-like PCBs	Residential with plant uptake	Not Assessed	8	Not Assessed	Not Assessed
	Residential without plant uptake	Not Assessed	8	Not Assessed	Not Assessed
	Allotment	Not Assessed		Not Assessed	Not Assessed
	Commercial	Not Assessed	240	Not Assessed	Not Assessed
PCB-77	Residential with plant uptake	Not Assessed	0.0774	Not Assessed	Not Assessed
	Residential without plant uptake	Not Assessed	0.0783	Not Assessed	Not Assessed
	Allotment	Not Assessed	0.233	Not Assessed	Not Assessed
	Commercial	Not Assessed	2.33	Not Assessed	Not Assessed
PCB-81	Residential with plant uptake	Not Assessed	0.0774	Not Assessed	Not Assessed
	Residential without plant uptake	Not Assessed	0.0783	Not Assessed	Not Assessed
	Allotment	Not Assessed	0.233	Not Assessed	Not Assessed
	Commercial	Not Assessed	2.33	Not Assessed	Not Assessed
PCB-126	Residential with plant uptake	Not Assessed	0.0777	Not Assessed	Not Assessed
	Residential without plant uptake	Not Assessed	0.0783	Not Assessed	Not Assessed
	Allotment	Not Assessed	0.247	Not Assessed	Not Assessed
	Commercial	Not Assessed	2.33	Not Assessed	Not Assessed
PCB-169	Residential with plant uptake	Not Assessed	0.0777	Not Assessed	Not Assessed
	Residential without plant uptake	Not Assessed	0.0783	Not Assessed	Not Assessed
	Allotment	Not Assessed	0.251	Not Assessed	Not Assessed
	Commercial	Not Assessed	2.33	Not Assessed	Not Assessed
PCB-105	Residential with plant uptake	Not Assessed	0.0777	Not Assessed	Not Assessed
	Residential without plant uptake	Not Assessed	0.0783	Not Assessed	Not Assessed
	Allotment	Not Assessed	0.247	Not Assessed	Not Assessed
	Commercial	Not Assessed	2.33	Not Assessed	Not Assessed
PCB-114	Residential with plant uptake	Not Assessed	0.0777	Not Assessed	Not Assessed
	Residential without plant uptake	Not Assessed	0.0783	Not Assessed	Not Assessed
	Allotment	Not Assessed	0.247	Not Assessed	Not Assessed
	Commercial	Not Assessed	2.33	Not Assessed	Not Assessed
PCB-118	Residential with plant uptake	Not Assessed	0.0777	Not Assessed	Not Assessed
	Residential without plant uptake	Not Assessed	0.0783	Not Assessed	Not Assessed
	Allotment	Not Assessed	0.247	Not Assessed	Not Assessed
	Commercial	Not Assessed	2.33	Not Assessed	Not Assessed
PCB-123	Residential with plant uptake	Not Assessed	0.0777	Not Assessed	Not Assessed
	Residential without plant uptake	Not Assessed	0.0783	Not Assessed	Not Assessed
	Allotment	Not Assessed	0.247	Not Assessed	Not Assessed
	Commercial	Not Assessed	2.33	Not Assessed	Not Assessed
PCB-156	Residential with plant uptake	Not Assessed	0.0777	Not Assessed	Not Assessed
	Residential without plant uptake	Not Assessed	0.0783	Not Assessed	Not Assessed
	Allotment	Not Assessed	0.251	Not Assessed	Not Assessed
	Commercial	Not Assessed	2.33	Not Assessed	Not Assessed
PCB-157	Residential with plant uptake	Not Assessed	0.0777	Not Assessed	Not Assessed
	Residential without plant uptake	Not Assessed	0.0783	Not Assessed	Not Assessed
	Allotment	Not Assessed	0.251	Not Assessed	Not Assessed
	Commercial	Not Assessed	2.33	Not Assessed	Not Assessed
PCB-156	Residential with plant uptake	Not Assessed	0.0777	Not Assessed	Not Assessed
	Residential without plant uptake	Not Assessed	0.0783	Not Assessed	Not Assessed
	Allotment	Not Assessed	0.251	Not Assessed	Not Assessed
	Commercial	Not Assessed	2.33	Not Assessed	Not Assessed
PCB-157	Residential with plant uptake	Not Assessed	0.0777	Not Assessed	Not Assessed
	Residential without plant uptake	Not Assessed	0.0783	Not Assessed	Not Assessed
	Allotment	Not Assessed	0.251	Not Assessed	Not Assessed
	Commercial	Not Assessed	2.33	Not Assessed	Not Assessed
PCB-167	Residential with plant uptake	Not Assessed	0.0777	Not Assessed	Not Assessed
	Residential without plant uptake	Not Assessed	0.0783	Not Assessed	Not Assessed
	Allotment	Not Assessed	0.251	Not Assessed	Not Assessed
	Commercial	Not Assessed		Not Assessed	Not Assessed
PCB-189	Residential with plant uptake	Not Assessed	0.0778	Not Assessed	Not Assessed
	Residential without plant uptake	Not Assessed	0.0783	Not Assessed	Not Assessed
	Allotment	Not Assessed	0.252	Not Assessed	Not Assessed
	Commercial	Not Assessed	2.33	Not Assessed	Not Assessed

This table is not a list of potential contaminants at any one site. All values are subject to ongoing review
CIEH - Chartered Institute for Environmental Health
LQM - Land Quality Management (commercial research)
(1) xx/yy/zz SOM - Soil Organic Matter dependant at 1%/2.5%/5%
(2) xx/yy/zz pH - pH dependant at pH6/pH7/pH8
(3) Internal limits exceeded during calculations
(4) under review by Terramech

Terramech Investigations Limited
183 Long Lane Tilehurst
Reading
RG31 6YW
Email - info@terramech.co.uk
Tel 01189 439 910
Fax 01189 439 920

List 1G (ChloroAlkanes & Alkenes mg/kg)

Contaminant	Generic Exposure Scenario	Terramech (CLEA v1.06 & S4UL methodology)	Environment Agency SGV (CLEA v1.04)	CIEH/LQM S4UL 2015 Part5	DEFRA SP1010 'Final' C4SL December 2014
1,2 Dichloroethane (1,2 -DCA)	Residential with plant uptake	Not Assessed	Not Assessed	0.0071/0.011/0.019	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	0.0092/0.013/0.023	Not Assessed
	Allotment	Not Assessed	Not Assessed	0.0046/0.0083/0.016	Not Assessed
	Commercial	Not Assessed	Not Assessed	0.67/0.97/1.7	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	29/29/29	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	21/24/28	Not Assessed
1,1,1 Trichloroethane	Residential with plant uptake	Not Assessed	Not Assessed	8.8/18/39	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	9.0/18/40	Not Assessed
	Allotment	Not Assessed	Not Assessed	48/110/240	Not Assessed
	Commercial	Not Assessed	Not Assessed	660/1300/3000	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	14000/14000/14000	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	57000(1425^{vap})/76000(2915^{vap})/100000(6392^{vap})	Not Assessed
1,1,2,2 Tetrachloroethanes	Residential with plant uptake	Not Assessed	Not Assessed	1.6/3.4/7.5	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	3.9/8.0/17	Not Assessed
	Allotment	Not Assessed	Not Assessed	0.41/0.89/2.0	Not Assessed
	Commercial	Not Assessed	Not Assessed	270/550/1100	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	1400/1400/1400	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	1800/2100/2300	Not Assessed
1,1,1,2 Tetrachloroethanes	Residential with plant uptake	Not Assessed	Not Assessed	1.2/2.8/6.4	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	1.5/3.5/8.2	Not Assessed
	Allotment	Not Assessed	Not Assessed	0.79/1.9/4.4	Not Assessed
	Commercial	Not Assessed	Not Assessed	110/250/560	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	1400/1400/1400	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	1500/1800/2100	Not Assessed
Tetrachloroethene	Residential with plant uptake	Not Assessed	Not Assessed	0.18/0.39/0.9	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	0.18/0.4/0.92	Not Assessed
	Allotment	Not Assessed	Not Assessed	0.65/1.5/3.6	Not Assessed
	Commercial	Not Assessed	Not Assessed	19/42/95	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	1400/1400/1400	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	820(424^{sol})/1100(951^{sol})/1500	Not Assessed
Tetrachloromethane Aka Carbon Terachloride	Residential with plant uptake	Not Assessed	Not Assessed	0.026/0.058/0.13	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	0.026/0.058/0.13	Not Assessed
	Allotment	Not Assessed	Not Assessed	0.45/1.0/2.4	Not Assessed
	Commercial	Not Assessed	Not Assessed	2.9/6.3/14	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	890/920/950	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	190/270/400	Not Assessed
Trichloroethene	Residential with plant uptake	Not Assessed	Not Assessed	0.016/0.034/0.075	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	0.017/0.036/0.08	Not Assessed
	Allotment	Not Assessed	Not Assessed	0.041/0.091/0.21	Not Assessed
	Commercial	Not Assessed	Not Assessed	1.2/2.6/6.7	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	120/120/120	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	70/91/120	Not Assessed
Trichloromethane Aka Chloroform	Residential with plant uptake	Not Assessed	Not Assessed	0.91/1.7/3.4	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	1.2/2.1/4.2	Not Assessed
	Allotment	Not Assessed	Not Assessed	0.42/0.83/1.7	Not Assessed
	Commercial	Not Assessed	Not Assessed	99/170/350	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	2500/2500/2500	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	2600/2800/3100	Not Assessed
Chloroethene Aka Vinyl Chloride	Residential with plant uptake	Not Assessed	Not Assessed	0.00064/0.00087/0.0014	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	0.00077/0.0010/0.0015	Not Assessed
	Allotment	Not Assessed	Not Assessed	0.000550.0010/0.0018	Not Assessed
	Commercial	Not Assessed	Not Assessed	0.059/0.077/0.12	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	3.5/3.5/3.5	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	4.8/5.0/5.4	Not Assessed

This table is not a list of potential contaminants at any one site
All values are subject to ongoing review
CIEH - Chartered Institute for Environmental Health
LQM - Land Quality Management (commercial research)
(1) xx/yy/zz SOM - Soil Organic Matter dependant at 1%/2.5%/6%
(2) xx/yy/zz pH - pH dependant at pH6/pH7/pH8
(3) Internal limits exceeded during calculations. Vapour or solubility saturation limit exceeded (limit presented in brackets)
(4) under review by Terramech
S4UL values are the copyright of Land Quality Management Ltd and are reproduced with permission; Publication Number S4UL3262 All rights reserved

Terramech Investigations Limited
183 Long Lane Tilehurst
Reading
RG31 6YW
Email - info@terramech.co.uk
Tel 01189 439 910
Fax 01189 439 920

List 1H (Explosives mg/kg)

Contaminant	Generic Exposure Scenario	Terramech (CLEA v1.06 & S4UL methodology)	Environment Agency SGV (CLEA v1.04)	CIEH/LQM S4UL 2015 Part 6	DEFRA SP1010 'Final' C4SL December 2014
2,4,6 Trinitrotoluene Aka TNT	Residential with plant uptake	Not Assessed	Not Assessed	1.6/3.7/8.1	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	65/66/66	Not Assessed
	Allotment	Not Assessed	Not Assessed	0.24/0.58/1.4	Not Assessed
	Commercial	Not Assessed	Not Assessed	1000/1000/1000	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	130/130/130	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	260/270/270	Not Assessed
RDX	Residential with plant uptake	Not Assessed	Not Assessed	120/250/540	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	13000/13000/13000	Not Assessed
	Allotment	Not Assessed	Not Assessed	17/38/85	Not Assessed
	Commercial	Not Assessed	Not Assessed	21000/21000/21000	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	26000/26000/27000	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	49000(18.7sol)/51000/53000	Not Assessed
HMX	Residential with plant uptake	Not Assessed	Not Assessed	5.7/13/26	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	6700/6700/6700	Not Assessed
	Allotment	Not Assessed	Not Assessed	0.86/1.9/3.9	Not Assessed
	Commercial	Not Assessed	Not Assessed	11000/11000/11000	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	13000/13000/13000	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	23000(0.36^{vap})/23000(0.39^{vap})24000(0.48^{vap})	Not Assessed

This table is not a list of potential contaminants at any one site
All values are subject to ongoing review
CIEH - Chartered Institute for Environmental Health
LQM - Land Quality Management (commercial research)
(1) xx/yy/zz SOM - Soil Organic Matter dependant at 1%/2.5%/6%
(2) xx/yy/zz pH - pH dependant at pH6/pH7/pH8
(3) Internal limits exceeded during calculations. Vapour or solubility saturation limit exceeded (limit presented in brackets)
(4) under review by Terramech
S4UL values are the copyright of Land Quality Management Ltd and are reproduced with permission; Publication Number S4UL3262 All rights reserved

Terramech Investigations Limited
183 Long Lane Tilehurst
Reading
RG31 6YW
Email - info@terramech.co.uk
Tel 01189 439 910
Fax 01189 439 920

List 1I (Pesticides mg/kg)

Contaminant	Generic Exposure Scenario	Terramech (CLEA v1.06 & S4UL methodology)	Environment Agency SGV (CLEA v1.04)	CIEH/LQM S4UL 2015 Part 7	DEFRA SP1010 'Final' C4SL December 2014
Aldrin	Residential with plant uptake	Not Assessed	Not Assessed	5.7/6.6/7.1(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	7.3/7.4/7.5(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	3.2/6.1/9.6(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	170/170/170(1)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	18/18/18(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	30/30/31(1)	Not Assessed
Dieldrin	Residential with plant uptake	Not Assessed	Not Assessed	0.97/2/3.5(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	7/7.3/7.4(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	0.17/0.41/0.96(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	170/170/170(1)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	18/18/18(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	30/30/30(1)	Not Assessed
Atrazine	Residential with plant uptake	Not Assessed	Not Assessed	3.3/7.6/17.4(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	610/620/620(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	0.5/1.2/2.7(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	9300/9300/9400(1)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	1200/1200/1200(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	2300/2400/2400(1)	Not Assessed
Dichlorvos	Residential with plant uptake	Not Assessed	Not Assessed	0.032/0.066/0.14(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	6.4/6.5/6.6(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	0.0049/0.010/0.022(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	140/140/140(1)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	16/16/16(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	26/26/27(1)	Not Assessed
Alpha Endosulfan	Residential with plant uptake	Not Assessed	Not Assessed	7.4/18/41(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	160(0.003vap)/280(0.007 vap)/410(0.016 vap)(1 & 3)	Not Assessed
	Allotment	Not Assessed	Not Assessed	1.2/2.9/6.6(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	5600(0.016 vap)/7400(0.016 vap)/8400(0.016 vap) (1 & 3)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	1200/1200/1200(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	2400/2400/2500(1)	Not Assessed
Beta Endosulfan	Residential with plant uptake	Not Assessed	Not Assessed	7.0/17/39(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	150(0.00007vap)/320(0.0002vap)/440(0.0004vap) (1 & 3)	Not Assessed
	Allotment	Not Assessed	Not Assessed	1.1/2.7/6.4(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	6300(0.00007vap)/7800(0.0002vap)/8700(0.0004vap) (1 & 3)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	1200/1200/1200(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	2400/2400/2500(1)	Not Assessed
Alpha BHC (Hexachlorocyclohexane) Inc Lindane	Residential with plant uptake	Not Assessed	Not Assessed	0.23/0.66/1.2(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	6.9/9.2/11(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	0.035/0.087/0.21(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	170/180/180(1)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	24/24/24(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	47/48/48(1)	Not Assessed
Beta BHC (Hexachlorocyclohexane) Inc Lindane	Residential with plant uptake	Not Assessed	Not Assessed	0.085/0.2/0.46(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	3.7/3.8/3.8(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	0.013/0.032/0.077(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	65/65/65(1)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	8.1/8.1/8.1(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	15/15/16(1)	Not Assessed
Gamma BHC (Hexachlorocyclohexane) Inc Lindane	Residential with plant uptake	Not Assessed	Not Assessed	0.06/0.14/0.33(1)	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	2.9/3.3/3.5(1)	Not Assessed
	Allotment	Not Assessed	Not Assessed	0.0092/0.023/0.054(1)	Not Assessed
	Commercial	Not Assessed	Not Assessed	67/69/70(1)	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	8.2/8.2/8.2(1)	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	14/15/15(1)	Not Assessed
DDT_{TOT} (Sum of DDD, DDE,TDE and DDT)	Residential with plant uptake	Not Assessed	Not Assessed	Not Assessed	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	Not Assessed	Not Assessed
	Allotment	Not Assessed	Not Assessed	Not Assessed	Not Assessed
	Commercial	Not Assessed	Not Assessed	Not Assessed	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	Not Assessed	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	Not Assessed	Not Assessed

This table is not a list of potential contaminants at any one site
All values are subject to ongoing review
CIEH - Chartered Institute for Environmental Health
LQM - Land Quality Management (commercial research)
(1) xx/yy/zz SOM - Soil Organic Matter dependant at 1%/2.5%/6%
(2) xx/yy/zz pH - pH dependant at pH6/pH7/pH8
(3) Internal limits exceeded during calculations. Vapour or solubility saturation limit exceeded (limit presented in brackets)
(4) under review by Terramech
S4UL values are the copyright of Land Quality Management Ltd and are reproduced with permission; Publication Number S4UL3262 All rights reserved

Terramech Investigations Limited
183 Long Lane Tilehurst
Reading
RG31 6YW
Email - info@terramech.co.uk
Tel 01189 439 910
Fax 01189 439 920

List 1J (Chlorobenzenes mg/kg)

Contaminant	Generic Exposure Scenario	Terramech (CLEA v1.06 & S4UL methodology)	Environment Agency SGV (CLEA v1.04)	CIEH/LQM S4UL 2015 Part8	DEFRA SP1010 'Final' C4SL December 2014
Chlorobenzene	Residential with plant uptake	Not Assessed	Not Assessed	0.46/1.0/2.4$_{(1)}$	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	0.46/1.0/2.4$_{(1)}$	Not Assessed
	Allotment	Not Assessed	Not Assessed	5.9/14/32$_{(1)}$	Not Assessed
	Commercial	Not Assessed	Not Assessed	56/130/290$_{(1)}$	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	11000/13000/14000$_{(1)}$	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	1300(675^{sol})/2000(1520^{sol})/2900$_{(1)}$	Not Assessed
1,2 Dichlorobenzene	Residential with plant uptake	Not Assessed	Not Assessed	23/56/130$_{(1)}$	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	24/57/130$_{(1)}$	Not Assessed
	Allotment	Not Assessed	Not Assessed	94/230/540$_{(1)}$	Not Assessed
	Commercial	Not Assessed	Not Assessed	2000(571^{sol})/4800(1370^{sol})/11000(3240^{sol}) $_{(1)}$	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	90000/95000/98000	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	24000(571^{sol})/36000(1370^{sol})/51000(3240^{sol}) $_{(1)}$	Not Assessed
1,3 Dichlorobenzene	Residential with plant uptake	Not Assessed	Not Assessed	0.4/0.1/2.3$_{(1)}$	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	0.44/1.1/2.5$_{(1)}$	Not Assessed
	Allotment	Not Assessed	Not Assessed	0.25/0.6/1.5$_{(1)}$	Not Assessed
	Commercial	Not Assessed	Not Assessed	30/73/170$_{(1)}$	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	300/300/300$_{(1)}$	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	390/440/470$_{(1)}$	Not Assessed
1,4 Dichlorobenzene	Residential with plant uptake	Not Assessed	Not Assessed	61/150/350$_{(1)}$	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	61/150/350$_{(1)}$	Not Assessed
	Allotment	Not Assessed	Not Assessed	19/37/88$_{(1)}$	Not Assessed
	Commercial	Not Assessed	Not Assessed	4400(224^{vap})/10000(540^{vap})/25000(1280^{vap}) $_{(1)}$	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	17000/17000/17000$_{(1)}$	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	36000(224^{vap})/36000(540^{vap})36000(1280^{vap}) $_{(1)}$	Not Assessed
1,2,3 Trichlorobenzene	Residential with plant uptake	Not Assessed	Not Assessed	1.5/3.6/8.6$_{(1)}$	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	1.5/3.7/8.8$_{(1)}$	Not Assessed
	Allotment	Not Assessed	Not Assessed	4.7/12/28$_{(1)}$	Not Assessed
	Commercial	Not Assessed	Not Assessed	102/250/590$_{(1)}$	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	1800/1800/1800$_{(1)}$	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	770(134^{vap})/1100(330^{vap})/1600(789^{vap}) $_{(1)}$	Not Assessed
1,2,4 Trichlorobenzene	Residential with plant uptake	Not Assessed	Not Assessed	2.6/6.4/15$_{(1)}$	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	2.6/6.4/15$_{(1)}$	Not Assessed
	Allotment	Not Assessed	Not Assessed	55/140/320$_{(1)}$	Not Assessed
	Commercial	Not Assessed	Not Assessed	220/530/1300$_{(1)}$	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	15000/17000/19000$_{(1)}$	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	1700(318^{vap})/2600(786^{vap})/4000(1880^{vap}) $_{(1)}$	Not Assessed
1,3,5 Trichlorobenzene	Residential with plant uptake	Not Assessed	Not Assessed	0.33/0.81/1.9$_{(1)}$	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	0.33/0.81/1.9$_{(1)}$	Not Assessed
	Allotment	Not Assessed	Not Assessed	4.7/12/28$_{(1)}$	Not Assessed
	Commercial	Not Assessed	Not Assessed	23/55/130$_{(1)}$	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	1700/1700/1800$_{(1)}$	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	380(36.7^{vap})/580(90.8^{vap})/860(217^{vap}) $_{(1)}$	Not Assessed
1,2,3,4 Tetrachlorobenzenes	Residential with plant uptake	Not Assessed	Not Assessed	15/36/78$_{(1)}$	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	24/56/120$_{(1)}$	Not Assessed
	Allotment	Not Assessed	Not Assessed	4.4/11/26$_{(1)}$	Not Assessed
	Commercial	Not Assessed	Not Assessed	1700(122^{vap})/3080(304^{vap})/4400(728^{vap}) $_{(1)}$	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	830/830/830$_{(1)}$	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	1500(122^{vap})/1600/1600$_{(1)}$	Not Assessed
1,2,3,5 Tetrachlorobenzenes	Residential with plant uptake	Not Assessed	Not Assessed	0.66/1.6/3.7$_{(1)}$	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	0.75/1.9/4.3$_{(1)}$	Not Assessed
	Allotment	Not Assessed	Not Assessed	0.38/0.9/2.2$_{(1)}$	Not Assessed
	Commercial	Not Assessed	Not Assessed	49(39.4^{vap})/120(98.1^{vap})/240235^{vap}) $_{(1)}$	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	78/79/79$_{(1)}$	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	110(39^{vap})120/130$_{(1)}$	Not Assessed
1,2,4,5 Tetrachlorobenzenes	Residential with plant uptake	Not Assessed	Not Assessed	0.33/0.77/1.6$_{(1)}$	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	0.73/1.7/3.5$_{(1)}$	Not Assessed
	Allotment	Not Assessed	Not Assessed	0.06/0.16/0.37$_{(1)}$	Not Assessed
	Commercial	Not Assessed	Not Assessed	42(19.7^{sol})/72(49.1^{sol})/96$_{(1)}$	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	13/13/13$_{(1)}$	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	25/26/26$_{(1)}$	Not Assessed
Pentachlorobenzene	Residential with plant uptake	Not Assessed	Not Assessed	5.8/12/22$_{(1)}$	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	19/30/38$_{(1)}$	Not Assessed
	Allotment	Not Assessed	Not Assessed	1.2/3.1/7.0$_{(1)}$	Not Assessed
	Commercial	Not Assessed	Not Assessed	640(43.0^{sol})/770(107^{sol})/830$_{(1)}$	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	100/100/100$_{(1)}$	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	190/190/190$_{(1)}$	Not Assessed

List 1J (Chlorobenzenes mg/kg) cont

Contaminant	Generic Exposure Scenario	Terramech (CLEA v1.06 & S4UL methodology)	Environment Agency SGV (CLEA v1.04)	CIEH/LQM S4UL 2015 Part8	DEFRA SP1010 'Final' C4SL December 2014
Hexachlorobenzene	Residential with plant uptake	Not Assessed	Not Assessed	1.3(0.2^{vap})/3.3(0.5^{vap})/4.9$_{(1)}$	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	4.1(0.2^{vap})/5.7(0.5^{vap})/6.7(1.2^{vap}) $_{(1)}$	Not Assessed
	Allotment	Not Assessed	Not Assessed	0.47/1.1/2.5$_{(1)}$	Not Assessed
	Commercial	Not Assessed	Not Assessed	110(0.2^{vap})120/120$_{(1)}$	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	16/16/16$_{(1)}$	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	30/30/30$_{(1)}$	Not Assessed

This table is not a list of potential contaminants at any one site
All values are subject to ongoing review
CIEH - Chartered Institute for Environmental Health
LQM - Land Quality Management (commercial research)
(1) xx/yy/zz SOM - Soil Organic Matter dependant at 1%/2.5%/6%
(2) xx/yy/zz pH - pH dependant at pH6/pH7/pH8
(3) Internal limits exceeded during calculations. Vapour or solubility saturation limit exceeded (limit presented in brackets)
(4) under review by Terramech
S4UL values are the copyright of Land Quality Management Ltd and are reproduced with permission; Publication Number S4UL3262 All rights reserved

Terramech Investigations Limited
183 Long Lane Tilehurst
Reading
RG31 6YW
Email - info@terramech.co.uk
Tel 01189 439 910
Fax 01189 439 920

List 1K (Phenols & Chlorophenols mg/kg)

Contaminant	Generic Exposure Scenario	Terramech (CLEA v1.06 & S4UL methodology)	Environment Agency SGV (CLEA v1.04)	CIEH/LQM S4UL 2015 Part9	DEFRA SP1010 'Final' C4SL December 2014
Phenol	Residential with plant uptake	Not Assessed	Not Assessed	280/550/1100$_{(1)}$	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	750/1300/2300$_{(1)}$	Not Assessed
	Allotment	Not Assessed	Not Assessed	66/140/280$_{(1)}$	Not Assessed
	Commercial	Not Assessed	Not Assessed	760/1500/3200$_{(1)}$	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	760/1500/3200$_{(1)}$	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	760/1500/3200$_{(1)}$	Not Assessed
Chlorophenol	Residential with plant uptake	Not Assessed	Not Assessed	0.87/2.0/4.5$_{(1)}$	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	94/150/210$_{(1)}$	Not Assessed
	Allotment	Not Assessed	Not Assessed	0.13/0.30/0.7$_{(1)}$	Not Assessed
	Commercial	Not Assessed	Not Assessed	3500/4000/4300$_{(1)}$	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	620/620/620$_{(1)}$	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	1100/1100/1100$_{(1)}$	Not Assessed
Pentachlorophenol	Residential with plant uptake	Not Assessed	Not Assessed	0.22/0.52/1.2$_{(1)}$	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	27(16.4^{vap})/29/31$_{(1)}$	Not Assessed
	Allotment	Not Assessed	Not Assessed	0.03/0.08/0.19$_{(1)}$	Not Assessed
	Commercial	Not Assessed	Not Assessed	400/400/400$_{(1)}$	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	60/60/60$_{(1)}$	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	110/120/120$_{(1)}$	Not Assessed

This table is not a list of potential contaminants at any one site
All values are subject to ongoing review
CIEH - Chartered Institute for Environmental Health
LQM - Land Quality Management (commercial research)
(1) xx/yy/zz SOM - Soil Organic Matter dependant at 1%/2.5%/6%
(2) xx/yy/zz pH - pH dependant at pH6/pH7/pH8
(3) Internal limits exceeded during calculations. Vapour or solubility saturation limit exceeded (limit presented in brackets)
(4) under review by Terramech
S4UL values are the copyright of Land Quality Management Ltd and are reproduced with permission; Publication Number S4UL3262 All rights reserved

Terramech Investigations Limited
183 Long Lane Tilehurst
Reading
RG31 6YW
Email - info@terramech.co.uk
Tel 01189 439 910
Fax 01189 439 920

List 1L (Other mg/kg)

Contaminant	Generic Exposure Scenario	Terramech (CLEA v1.06 & S4UL methodology)	Environment Agency SGV (CLEA v1.04)	CIEH/LQM S4UL 2015 Part 10	DEFRA SP1010
Carbon Disulphide	Residential with plant uptake	Not Assessed	Not Assessed	0.14/0.29/0.62$_{(1)}$	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	0.14/0.29/0.62$_{(1)}$	Not Assessed
	Allotment	Not Assessed	Not Assessed	4.8/10/23$_{(1)}$	Not Assessed
	Commercial	Not Assessed	Not Assessed	11/22/47$_{(1)}$	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	11000/11000/12000$_{(1)}$	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	1300/1900/2700$_{(1)}$	Not Assessed
Hexachlorobutadiene	Residential with plant uptake	Not Assessed	Not Assessed	0.29/0.7/1.6$_{(1)}$	Not Assessed
	Residential without plant uptake	Not Assessed	Not Assessed	0.32/0.78/1.8$_{(1)}$	Not Assessed
	Allotment	Not Assessed	Not Assessed	0.25/0.61/1.4$_{(1)}$	Not Assessed
	Commercial	Not Assessed	Not Assessed	31/66/120$_{(1)}$	Not Assessed
	Public Open Space (Residential)	Not Assessed	Not Assessed	25/25/25$_{(1)}$	Not Assessed
	Public Open Space (Park)	Not Assessed	Not Assessed	48/50/51$_{(1)}$	Not Assessed

This table is not a list of potential contaminants at any one site
All values are subject to ongoing review
CIEH - Chartered Institute for Environmental Health
LQM - Land Quality Management (commercial research)
(1) xx/yy/zz SOM - Soil Organic Matter dependant at 1%/2.5%/6%
(4) under review by Terramech
S4UL values are the copyright of Land Quality Management Ltd and are reproduced with permission; Publication Number S4UL3262 All rights reserved

Terramech Investigations Limited
183 Long Lane Tilehurst
Reading
RG31 6YW
Email - info@terramech.co.uk
Tel 01189 439 910
Fax 01189 439 920

List 1M (Natural Mineral Fibres quantified % weight in soil)

Contaminant	Generic Exposure Scenario	Terramech (CIRIA C733 methodology)	Environment Agency	CIEH/LQM	DEFRA
Chrysotile Asbestos	Residential with active gardening Sandy Soil	0.01%	Not assessed	Not assessed	Not assessed
	Residential with active gardening Int Soil	0.05%	Not assessed	Not assessed	Not assessed
	Residential with active gardening Clay Soil	0.1%	Not assessed	Not assessed	Not assessed
	Allotment Sandy Soil	0.002%	Not assessed	Not assessed	Not assessed
	Allotment Intermediate Soil	0.005%	Not assessed	Not assessed	Not assessed
	Allotment Clay Soil	0.01%	Not assessed	Not assessed	Not assessed
	Commercial Sandy Soil	0.05%	Not assessed	Not assessed	Not assessed
	Commercial Intermediate Soil	0.2%	Not assessed	Not assessed	Not assessed
	Commercial Clay Soil	0.25%	Not assessed	Not assessed	Not assessed
	Public Open Space Sandy Soil (Residential)	0.0015%	Not assessed	Not assessed	Not assessed
	Public Open Space Int Soil (Residential)	0.0025%	Not assessed	Not assessed	Not assessed
	Public Open Space Clay Soil (Residential)	0.001% (clay overtakes sand)	Not assessed	Not assessed	Not assessed
Amosite Asbestos	Residential with active gardening Sandy Soil	Any detectable concentration	Not assessed	Not assessed	Not assessed
	Residential with active gardening Int Soil	Any detectable concentration	Not assessed	Not assessed	Not assessed
	Residential with active gardening Clay Soil	Any detectable concentration	Not assessed	Not assessed	Not assessed
	Allotment Sandy Soil	Any detectable concentration	Not assessed	Not assessed	Not assessed
	Allotment Intermediate Soil	Any detectable concentration	Not assessed	Not assessed	Not assessed
	Allotment Clay Soil	Any detectable concentration	Not assessed	Not assessed	Not assessed
	Commercial Sandy Soil	0.001%	Not assessed	Not assessed	Not assessed
	Commercial Intermediate Soil	0.001%	Not assessed	Not assessed	Not assessed
	Commercial Clay Soil	0.009%	Not assessed	Not assessed	Not assessed
	Public Open Space Sandy Soil (Residential)	Any detectable concentration	Not assessed	Not assessed	Not assessed
	Public Open Space Int Soil (Residential)	Any detectable concentration	Not assessed	Not assessed	Not assessed
	Public Open Space Clay Soil (Residential)	Any detectable concentration	Not assessed	Not assessed	Not assessed
Crocidolite Asbestos	Residential with active gardening Sandy Soil	Any detectable concentration	Not assessed	Not assessed	Not assessed
	Residential with active gardening Int Soil	Any detectable concentration	Not assessed	Not assessed	Not assessed
	Residential with active gardening Clay Soil	Any detectable concentration	Not assessed	Not assessed	Not assessed
	Allotment Sandy Soil	Any detectable concentration	Not assessed	Not assessed	Not assessed
	Allotment Intermediate Soil	Any detectable concentration	Not assessed	Not assessed	Not assessed
	Allotment Clay Soil	Any detectable concentration	Not assessed	Not assessed	Not assessed
	Commercial Sandy Soil	Any detectable concentration	Not assessed	Not assessed	Not assessed
	Commercial Intermediate Soil	Any detectable concentration	Not assessed	Not assessed	Not assessed
	Commercial Clay Soil	Any detectable concentration	Not assessed	Not assessed	Not assessed
	Public Open Space Sandy Soil (Residential)	Any detectable concentration	Not assessed	Not assessed	Not assessed
	Public Open Space Int Soil (Residential)	Any detectable concentration	Not assessed	Not assessed	Not assessed
	Public Open Space Clay Soil (Residential)	Any detectable concentration	Not assessed	Not assessed	Not assessed

This table is not a list of potential contaminants at any one site
All values are subject to ongoing review
CIEH - Chartered Institute for Environmental Health
LQM - Land Quality Management (commercial research)

C733 – CIRIA - Construction Industry Research & Information Association – Asbestos in Made Ground
Sect 13 Respirable fibre exposure estimation using published air-to-air relationships after Addison *et al* (1988).
Details
Dilution of airborne fibre concentrations from the point of origin has not been considered.
Residential assume 90 hours per year gardening activities that result in dust being raised. (Addison et al 1988)
Allotment assume 260 hours per year (2.5 hrs per day every weekend) of activities that result in dust being raised.
Commercial assume 24 hours per year when service trenches could be excavated that results in dust being raised.
Public Open space assume not more than four 8hr maintenance days per year (32hrs/yr) that result in dust being raised as well as game playing in summer hols when soil surface is dry and veg layer is compromised (6wks 8hrs/day + maintenance = 368hrs/yr
Limit of detection usually 0.001%

Terramech Investigations Limited
183 Long Lane Tilehurst
Reading
RG31 6YW
Email - info@terramech.co.uk
Tel 01189 439 910
Fax 01189 439 920

List 2 (Waste Acceptance Criteria (WAC) Analysis)

	Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Solid Waste Analysis - Limit values for compliance			
Total Organic Carbon (%)	3	5	6
Loss on Ignition (%)	-	-	10
Sum of BTEX (mg/kg)	6	-	-
Sum of 7 PCBs (mg/kg)	1	-	-
Mineral Oil (mg/kg)	500	-	-
PAH Sum of 17 (mg/kg)	100	-	-
pH (pH Units)	-	>6	-
Eluate Analysis - Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)			
Arsenic	0.5	2	25
Barium	20	100	300
Cadmium	0.04	1	5
Chromium	0.5	10	70
Copper	2	50	100
Mercury	0.01	0.2	2
Molybdenum	0.5	10	30
Nickel	0.4	10	40
Lead	0.5	10	50
Antimony	0.06	0.7	5
Selenium	0.1	0.5	7
Zinc	4	50	200
Chloride	800	15000	25000
Fluoride	10	150	500
Sulphate as SO_4	1000	20000	50000
Total Dissolved Solids	4000	60000	100000
Phenol Index	1	-	-
Dissolved Organic Carbon	500	800	1000

Terramech Investigations Limited
183 Long Lane Tilehurst
Reading
RG31 6YW
Email - info@terramech.co.uk
Tel 01189 439 910
Fax 01189 439 920

List 3 (Generic Soil Screening Values for the Selection of Appropriate Water Supply Pipe Materials)

		Pipe Material					
		All threshold concentrations in mg/kg					
	Parameter Group	PE	PVC	Barrier pipe (PE-Al-PE	Wrapped Steel	Wrapped Ductile Iron	Copper
1	Extended VOC suite by purge and trap or headspace and GCMS with TICs	0.5	0.125	Pass	Pass	Pass	Pass
1A	+BTEX +MTBE	0.1	0.03	Pass	Pass	Pass	Pass
2	SVOCs by purge and trap or headspace and GCMS with TICs(aliphatic and aromatic C5 – C10	2	1.4	Pass	Pass	Pass	Pass
2E	+Phenols	2	0.4	Pass	Pass	Pass	Pass
2F	+Cresols and chlorinated phenols	2	0.04	Pass	Pass	Pass	Pass
3	Mineral Oil C11 – C20	10	Pass	Pass	Pass	Pass	Pass
4	Mineral Oil C21 – C40	500	Pass	Pass	Pass	Pass	Pass
5	Corrosive (Conductivity, Redox and pH)	Pass	Pass	Pass	Corrosive if pH <7 and conductivity >400µS/cm	Corrosive if pH <5 Eh not neutral and conductivity > 400mS/cm	Corrosive if pH <5 or >8 and Eh positive
	Specific suites identified as relevant following site investigation						
2A	Ethers	0.5	1	Pass	Pass	Pass	Pass
2B	Nitrobenzene	0.5	0.4	Pass	Pass	Pass	Pass
2C	Ketones	0.5	0.02	Pass	Pass	Pass	Pass
2D	Aldehydes	0.5	0.02	Pass	Pass	Pass	Pass
6	Amines	Fail	Pass	Pass	Pass	Pass	Pass

This table is not a list of potential contaminants at any one site
All values are subject to ongoing review.
Table reproduced from *UKWIR Report Ref No 10/WM/03/21 (Table 3.1)*
VOC = Volatile Organic Compounds (solvents)
SVOC = Semi Volatile Organic Compounds
GCMS = Gas Chromatography Mass Spectrometer
TIC = Tentatively Identifiable compound
BTEX = Benzene, Toluene, Ethyl Benzene & Xylene (VOCs)
MTBE = Methyl tertiary butyl ether (petrol additive)

Terramech Investigations Limited
183 Long Lane Tilehurst
Reading
RG31 6YW
Email - info@terramech.co.uk
Tel 01189 439 910
Fax 01189 439 920

List 3 (Generic Soil Screening Values for the Selection of Appropriate Water Supply Pipe Materials - Thames Water Utilities Ltd)

Aliphatic C5 - C12	0.5 mg/kg
Aromatic C5 - C12	0.5 mg/kg
Aliphatic C12 - C21 (not chlorinated)	10 mg/kg
Aromatic C12 - C21 (not BTEX)	10 mg/kg
Aliphatic C21 - C35	500 mg/kg
Aromatic C21 - C35	500 mg/kg
Chlorinated short chain aliphatic hydrocarbons	0.5 mg/kg
Chlorinated short chain aromatic hydrocarbons	2 mg/kg
BTEX compounds	0.1 mg/kg
MTBE compounds	0.1 mg/kg
Naphthalene	5 mg/kg
Phenols (unless present with BTEX)	5 mg/kg
Phenols (in conjunction with BTEX)	2 mg/kg
Phenols (chlorinated)	2 mg/kg

Terramech Investigations Limited
183 Long Lane Tilehurst
Reading
RG31 6YW
Email - info@terramech.co.uk
Tel 01189 439 910
Fax 01189 439 920

List 4 (Tier 1 Generic Soil Target Concentrations for Groundwater Protection - EA R&D 20 method)	
Contaminant	**Remedial Target (Mg/kg)**
Arsenic	5.0 (Natural soils 0 to 35) (3)
Cadmium	1.13
Chromium VI	10
Copper	255
Lead	590
Mercury (inorganic)	0.5
Nickel	10 (Average rural soils 21.1mg/kg) (2)
Selenium	0.5
Zinc	105
Poly Cyclic Aromatics (Total Aromatics C_5 to C_{44})	4.5×10^{-5} (1)
Total Petroleum Hydrocarbons (Aliphatic and Aromatic C_5 to C_{44})	5.8×10^{-3} (1)
(1) organic carbon content sensitive, actual values should be used if possible	
(2) Nickel in Rural soils 1.16 to 216mg/kg average 21.1 mg/kg (ref - EA SC050021 / Nickel SGV)	
(3) Arsenic in Natural Soils 0 to 35mg/kg (ref - BGS Soils Beneath Our Feet website)	

Terramech Investigations Limited
183 Long Lane Tilehurst
Reading
RG31 6YW
Email - info@terramech.co.uk
Tel 01189 439 910
Fax 01189 439 920

List 4 (Selected Generic Groundwater Screening Values mg/litre)						
Contaminant Mg/litre	**EQS Freshwater**	**EQS Saltwater**	**WHO (health)**	**WHO (ATO)**	**EU Drinking water**	**UK Drinking water**
Antimony	-	-	0.005	-	0.005	0.005
Arsenic	0.05	0.025	0.01	-	0.01	0.01
Boron	0.002	0.007	0.0003	-	0.001	0.001
Cadmium	0.005	0.0025	0.003	-	0.005	0.005
Chromium	0.005-0.025	0.015	0.05	-	0.05	0.05
Copper	0.001-0.028	0.005	2	1	2	2
Lead	0.004-0.025	0.025	0.01	-	0.01	0.01
Mercury	0.001	0.0003	0.001	-	0.001	0.001
Molybdenum	-	-	0.07	-	-	-
Nickel	0.05-0.2	0.03	0.02	-	0.02	0.02
Selenium	-	-	0.01	-	0.01	0.01
Vanadium	0.02-0.06	0.1	-	-	-	-
Zinc	0.008-0.5	-	-	3	-	5
Hydrocarbons (dissolved/emulsion)	-	-	-	-	-	0.01
Poly-cyclic Aromatic Hydrocarbons	-	-	-	-	0.0001	0.0001
Benzene	0.3	0.3	0.01	-	0.001	0.001
Toluene	0.5	0.5	0.7	24-170	-	-
Ethylbenzene	-	-	0.3	-	-	-
Xylene	0.03	0.03	0.5	20-1800	-	-
Benzo (a) Pyrene	-	-	0.0007	-	0.00001	0.00001
Phenol	0.03	0.03	-	-	0.0005	0.0005

Terramech Investigations Limited
183 Long Lane Tilehurst
Reading
RG31 6YW
Email - info@terramech.co.uk
Tel 01189 439 910
Fax 01189 439 920

List 4 Drinking Water Regulations

Contaminant	units	EQS freshwater (1)	EQS saltwater (1)	WHO Health (2)	WHO ATO (2)	EU Drinking Water Standards (3)	UK Drinking Water Standards (4)
Acrylamide	ug/l			0.5		0.1	0.1
Alachlor	ug/l			20		0.1	0.1
Aldicarb	ug/l			10		0.1	0.1
Aldrin	ug/l	0.01	0.01	0.03		0.03	0.03
Aluminium	ug/l				200	200	200
Ammonia (NH_3 as N)	mg/l	0.015	0.021		1.5		
Ammonium (as NH_4+)	mg/l					0.5	0.5
Antimony	ug/l			5		5	5
Arsenic	ug/l	50	25	10		10	10
Atrazine	ug/l	2	2	2		0.1	0.1
Azinphos-methyl	ng/l	10 (40)	10 (40)			100	100
Barium	mg/l			0.7			1
Bentazone	mg/l	0.5	0.5	0.03		0.1	0.1
Benzene	ug/l	30 (300)	30 (300)	10		1	1
Benzo [a] pyrene	ug/l			0.7		0.01	0.01
Biphenyl	ug/l	25	25				
Boron	mg/l	2	7	0.3		1	1
Bromate	ug/l					10	10
Bromoxynil	ug/l	100 (1000)	100 (1000)			0.1	0.1
Cadmium	ug/l	5	2.5	3		5	5
Calcium	mg/l						250
Carbofuran	ug/l			5		0.1	0.1
Chlordane (all isomers)	ug/l			0.2		0.1	0.1
Chlorfenvinphos	ug/l	0.01 (0.1)	0.01 (0.1)			0.1	0.1
Chloride	mg/l	250			250	250	250
Chlorine	ug/l	2	10				
Chloroform	ug/l	12	12	200			
Chloroform extractable substances	ug/l						1000
Chlorphenylid	ug/l	0.05	0.05			0.1	0.1
Chloronitrotoluenes	ug/l	10	10				
Chlorothalonil	ug/l	0.1	0.1			0.1	0.1
Chlorpropham	ug/l	10	10			0.1	0.1
Chlorotoluron	ug/l	2	2	30		0.1	0.1
Chromium	ug/l	5 - 250	15	50		50	50
Copper	ug/l	1 - 28	5	2000	1000	2000	2000
Coumaphos	ug/l	0.01 (0.1)	0.04 (0.4)			0.1	0.1
Cyanide	ug/l			70		50	50
Cyfluthrin	ug/l	0.001	0.001			0.1	0.1

Contaminant	units	EQS freshwater (1)	EQS saltwater (1)	WHO Health (2)	WHO ATO (2)	EU Drinking Water Standards (3)	UK Drinking Water Standards (4)
2,4-dichlorophenoxyacetic acid (2,4-D), (ester form)	ug/l	1	1	30		0.1	0.1
Demetons	ug/l	0.5	0.5			0.1	0.1
Diazinon	ug/l	0.01 (0.1)	0.015 (0.15)			0.1	0.1
Dichlorodiphenyltrichloroethane (all isomers)	ug/l	0.025	0.025				
Para, para-DDT	ug/l	0.01	0.01	2		0.1	0.1
1,2-Dichloroethane (1,2-DCA)	ug/l	10	10	30		3	3
1,1-Dichloroethene (1,1-DCE)	ug/l			30			
1,2-Dichloroethene (1,2-DCE)	ug/l			50			
1,2-dibromo-3-chloropropane	ug/l			1		0.1	0.1
1,2-Dichlorobenzene	ug/l			1000	1 to 10		
1,2-Dichloropropane	ug/l			20		0.1	0.1
1,3-Dichloropropene	ug/l			20		0.1	0.1
1,4-Dichlorobenzene	ug/l			300	0.3 to 30		
Di(2-ethylhexyl)adipate	ug/l			80			
Di(2-ethlyhexyl)pthalate	ug/l			8			
Dichloromethane	ug/l			20			
Dichlorprop (DCPP)	ug/l			100		0.1	0.1
Dichlorvos	ng/l	1	40			100	100
Dieldrin	ug/l	0.01	0.01	0.03		0.03	0.03
Dimethoate	ug/l	1	1			0.1	0.1
Drins (total)	ug/l	0.03	0.03			0.1	0.1
Edetic Acid (EDTA)	ug/l			200			
Endosulfan	ng/l	3	3			100	100
Endrin	ug/l	0.005	0.005			0.1	0.1
Epichlorohydrin	ug/l			0.4		0.1	0.1
Ethylbenzene	ug/l			300	2 to 200		
Fenchlorphos	ug/l	0.01 (0.1)	0.01 (0.1)			0.1	0.1
Fenoprop	ug/l			9		0.1	0.1
Fenitrothion	ng/l	10 (250)	10 (250)			100	100
Flucofuron	ug/l	1				0.1	0.1
Fluoride	ug/l			1500		1500	1500
Formaldehyde	ug/l	5 (50)	n/a	900		0.1	0.1
Heptachlor	ug/l			0.03		0.03	0.03
Hexachlorobenzene	ug/l	0.03	0.03	1		0.1	0.1
Hexachlorobutadiene	ug/l	0.1	0.1	0.6			
Hexachlorocyclohexane (lindane)	ug/l	0.1	0.02	2		0.1	0.1
Hydrocarbons (dissolved/emulsions)	ug/l						10
Hydrogen sulphide (H2S as S)	ug/l	0.25 to 1.0	10				

Contaminant	units	EQS freshwater (1)	EQS saltwater (1)	WHO Health (2)	WHO ATO (2)	EU Drinking Water Standards (3)	UK Drinking Water Standards (4)
Ioxynil	ug/l	10 (100)	10 (100)			0.1	0.1
Iron	mg/l	1	1		0.3	0.2	0.2
Isodrin	ug/l	0.005	0.005			0.1	0.1
Isoproturon	ug/l	2 to 20		9		0.1	0.1
Lead (inorganic - dissolved)	ug/l	4 - 250	25	10		10	25 (reducing to 10)
Linuron	ug/l	2	2			0.1	0.1
Magnesium	mg/l						50
Malachite green	ug/l	0.5 (100)					
Malathion	ng/l	10 (500)	20 (500)			100	100
Manganese	ug/l			500	100	50	50
MCPA	ug/l	2	2	2		0.1	0.1
Mecoprop (MCPP)	ug/l	20 (200)	20 (200)	10		0.1	0.1
Mercury	ug/l	1	0.3	1		1	1
Methylbenzene	ug/l	50 (500)	40				
Methoxychlor	ug/l			20		0.1	0.1
Metolachlor	ug/l			10		0.1	0.1
Molinate	ug/l			6		0.1	0.1
Molybdenum	ug/l			70			
Monochlorobenzene	ug/l			300	10 to 120		
Naphthalene	ug/l	10 (100)	5 (80)				
Nickel	ug/l	50 - 200	30	20		20	20
Nitrate (as NO3)	mg/l			50		50	50
Nitrite (as NO2)	ug/l			3		500	100
Nitriloacetic acid	ug/l			200			
Oils/hydrocarbons (by Pet Ether extract)	ug/l						10
Omethoate	ug/l	0.01				0.1	0.1
Polycyclic Aromatic (PAH) Hydrocarbons	ug/l					0.1	0.1
Pendimethalin	ug/l			20		0.1	0.1
Pentachlorophenol	ug/l	2	2	9		0.1	0.1
Permethrin	ug/l	0.01		20		0.1	0.1
Pesticides (individual species, unless specified)	ug/l					0.1	0.1
Pesticides (total)	ug/l					0.5	0.5
Phenol	ug/l	30 (300)	30 (300)			0.5	0.5
Pirimicarb	ug/l	1	1			0.1	0.1
Phosphorous	ug/l					400 (5000)	2200
Potassium	mg/l					10 (12)	12

Contaminant	units	EQS freshwater (1)	EQS saltwater (1)	WHO Health (2)	WHO ATO (2)	EU Drinking Water Standards (3)	UK Drinking Water Standards (4)
Propanil	ug/l			20		0.1	0.1
Propetamphos	ug/l	0.01 (0.1)	0.01 (0.1)			0.1	0.1
Pryridate	ug/l			100		0.1	0.1
Selenium	ug/l			10		10	10
Silver	ug/l	0.05 (0.1)	0.5 (1)				10
Simazine	ug/l	2 (10)	2 (10)	2		0.1	0.1
Sodium	mg/l	170			200	200	200
Styrene	ug/l	50 (500)	50 (500)	20	4 to 2600		
Sulcofuron	ug/l	25	25			0.1	0.1
Sulphate	mg/l	400	250		250	250	250
Sulphide	ug/l	0.25	n/a				
Surfactants	ug/l						200
2,4,5-trichlorophenoxyacetic acid (2,4,5-T)	ug/l			9		0.1	0.1
Tecnazene	ug/l	1 (10)	1				
Tetrachloroethene (PCE)	ug/l	10	10	40		10 (with TCE)	10 (with TCE)
Tetrachloromethane (PCM, carbon tetrachloride)	ug/l	12	12	2			3
Thiabendazole	ug/l	5	5			0.1	0.1
Tin (inorganic)	ug/l	25	10				
Toluene	ug/l	50 (500)	40 (400)	700	24 to 170		
Triazophos	ng/l	5 (50)	5 (50)			100	100
Tributyltin (oxide)	ug/l	0.02	0.02	0.02			
1,1,1-Trichloroethane (1,1,1-TCA)	ug/l	100 (1000)	100 (1000)				
1,1,2-Trichloroethane (1,1,2-TCA)	ug/l	400 (4000)	300 (3000)				
Trichloroethene (TCE)	ug/l	10	10	70		10 (with PCE)	10 (with PCE)
Trichlorobenzenes (total)	ug/l	0.4	0.4	20	5 to 50		
2,4,6-Trichlorophenol	ug/l			200		2-300	
Trihalomethanes (total)	ug/l					150 reducing to 100 by 2008	100
Trifluralin	ug/l	0.1 (1)	0.1 (1)	20		0.1	0.1
Triphenyltin	ug/l	0.02	0.008				
Vanadium	ug/l	20 - 60	100				
Vinyl chloride (chloroethene)	ug/l			5		0.5	0.5
Xylene	ug/l	30	30	500	20 to 1800		
Zinc	ug/l	8 - 500			3000		5000

PHASE 2 ENVIRONMENTAL

& GEOTECHNICAL

INVESTIGATION

NO 4008/18

AT

28 WOKINGHAM ROAD, READING, RG6 1JQ

FOR

PROPOSED HOUSING DEVELOPMENT

APPENDIX F

GAS MONITORING DATA

Monitoring Date:	24/04/2018	**Monitoring Engineer:**	MRG	**Equipment:**	**Geotech GA5000**		
Condition of Well:		**Ambient Gas Conc.:**	**CH4(%):** 0	**CO2(%):** 0	**O2(%):** 21.3		
Weather/Wind:	Clear	**Weather Trend:**		**Atm. Press. Trend**	Steady		
Remarks:							

Borehole ID	Borehole Barometric Pressure (mb)	Atmospheric Barometric Pressure (mb)	Flow (l/hr)	Time (sec)	Methane CH4 (%)	Carbon Dioxide CO2 (%)	Oxygen O2 (%)	Carbon Monoxide CO (ppm)	Hydrogen Sulphide H2S (ppm)	Water Level (m)
				15	0	0.5	18.9	3	0	
			Initial:	**30**	0	0.6	18.1	3	0	
				45	0	0.8	18.2	2	0	
			0.1	**60**	0	1.1	18.3	2	0	
				75	0	1	18.4	2	0	
WS1_	1007	0.09	**Peak:**	**90**	0	0.9	18.4	2	0	
				105	0	0.9	18.5	2	0	
			0.1	**120**	0	0.9	18.5	2	0	
				135	0	1	18.4	2	0	
			Average:	**150**	0	0.9	18.4	2	0	
				165	0	0.8	18.5	2	0	
			0.1	**180**	0	0.8	18.4	2	0	Dry
Borehole ID	**Borehole Barometric Pressure (mb)**	**Atmospheric Barometric Pressure (mb)**	**Flow (l/hr)**	**Time (sec)**	**Methane CH4 (%)**	**Carbon Dioxide CO2 (%)**	**Oxygen O2 (%)**	**Carbon Monoxide CO (ppm)**	**Hydrogen Sulphide H2S (ppm)**	**Water Level (m)**
				15	0	1.4	18.4	3	0	
			Initial:	**30**	0	1.4	17.6	2	0	
				45	0	1.4	17.6	2	0	
			0.1	**60**	0	1.4	17.6	2	0	
				75	0	1.4	17.6	2	0	
WS2_	1007	0.03	**Peak:**	**90**	0	1.4	17.6	2	0	
				105	0	1.4	17.6	2	0	
			0.1	**120**	0	1.5	17.6	2	0	
				135	0	1.5	17.6	2	0	
			Average:	**150**	0	1.5	17.6	2	0	
				165	0	1.5	17.6	2	0	
			0.1	**180**	0	1.5	17.6	2	0	dry
Borehole ID	**Borehole Barometric Pressure (mb)**	**Atmospheric Barometric Pressure (mb)**	**Flow (l/hr)**	**Time (sec)**	**Methane CH4 (%)**	**Carbon Dioxide CO2 (%)**	**Oxygen O2 (%)**	**Carbon Monoxide CO (ppm)**	**Hydrogen Sulphide H2S (ppm)**	**Water Level (m)**
				15	0	0.8	20.1	2	0	
			Initial:	**30**	0	0.8	19.4	1	0	
				45	0	0.8	19.4	1	0	
			0.1	**60**	0	0.8	19.4	1	0	
				75	0	0.8	19.4	1	0	
WS3_	1007	0.05	**Peak:**	**90**	0	0.8	19.4	1	0	
				105	0	0.8	19.4	1	0	
			0.1	**120**	0	0.8	19.4	1	0	
				135	0	0.8	19.4	1	0	
			Average:	**150**	0	0.8	19.4	1	0	
				165	0	0.8	19.4	1	0	
			0.1	**180**	0	0.8	19.3	1	0	dry
Borehole ID	**Borehole Barometric Pressure (mb)**	**Atmospheric Barometric Pressure (mb)**	**Flow (l/hr)**	**Time (sec)**	**Methane CH4 (%)**	**Carbon Dioxide CO2 (%)**	**Oxygen O2 (%)**	**Carbon Monoxide CO (ppm)**	**Hydrogen Sulphide H2S (ppm)**	**Water Level (m)**
				15	0	1.4	20	1	0	
			Initial:	**30**	0	1.4	19.5	1	0	
				45	0	1.4	19.4	1	0	
			0.1	**60**	0	1.4	19.4	1	0	
				75	0	1.4	19.4	1	0	
WS4_	1007	0.07	**Peak:**	**90**	0	1.4	19.4	1	0	
				105	0	1.4	19.4	1	0	
			0.1	**120**	0	1.5	19.5	1	0	
				135	0	1.5	19.5	1	0	
			Average:	**150**	0	1.5	19.5	1	0	
				165	0	1.5	19.5	1	0	
			0.1	**180**	0	1.5	19.5	1	0	dry