

PHASE II GROUND INVESTIGATION REPORT

for

**NEW BUILDINGS AT THE VINERY, ARUNDEL ROAD,
POLING, WEST SUSSEX BN18 9PY**

on behalf of

TRIBUTES LIMITED C/O PAUL AIREY PLANNING ASSOCIATES

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Site Invest

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EXECUTIVE SUMMARY	
Proposed Development	At the time of reporting, December 2020, the proposed development was understood to comprise the erection of a single store light industrial unit for the storage of coffins with communal soft landscaping in the south-west corner of the site and hardstanding/car parking in the eastern portion of the site. A plan of the proposed development is given in Figure 4.
Geology	The geology map of the British Geological Survey of Great Britain of the Poling area (Chichester and Bognor Sheet No. 317/332) revealed the site to be located on superficial Aeolian Deposits and Undifferentiated River Terrace Deposits overlying the Lambeth Group. No areas of Made Ground or Reworked Ground was noted within a 250m radius.
Hydrogeology	An examination of records on the DEFRA website revealed the site was located on a Secondary A Aquifer comprising the superficial Aeolian Deposits and underlying Undifferentiated River Terrace Deposits. The bedrock deposits of the Lambeth Group were also classed as a Secondary A Aquifer .
Radon	The site was not located in an area where Radon protection measures were unlikely to be required.
Soils Encountered	The ground conditions encountered within the trial holes was generally as anticipated from examination of the geology map. A capping of Made Ground was noted from ground level overlying the soils of the Undifferentiated River Terrace Deposits for the remaining depth of the trial holes.
Groundwater	Seepages of groundwater were encountered at 2.50m bgl in TP1 and 1.50m bgl in TP3 during the intrusive investigation. Groundwater was not encountered in the remaining trial holes. A standing groundwater level of 1.45m and 1.35m bgl was recorded in the standpipes installed within TP1 and TP4 respectively on 1 st April 2020. This was considered to be perched water within more granular bands within the Aeolian Deposits accumulating within a standpipe installed with predominantly cohesive soils rather than a true reflection of the actual groundwater levels.
Foundation Design	Minimum foundation depths are likely to be ~0.90 – 2.70m bgl. See section 6.2 for bearing capacities and anticipated settlements. Given the results of the ground investigation it was considered unlikely that piled foundations will be required at this site.
Infiltration Rates	Soakaways constructed within the cohesive soils of the Aeolian Deposits were unlikely to be successful.
Sub-Surface Concrete	According to BRE Special Digest 1, 2005, 'Concrete in Aggressive Ground' a Sulphate Design Class of DS-1 is appropriate for sub-surface concrete in contact with the soils encountered on site. Table C1 of the Digest indicated an ACEC (Aggressive Chemical Environment for Concrete) classification of AC-1. A DS-1 class with an ACEC of AC-1 will be required for design.
Contamination	Chemical laboratory testing of the Made Ground revealed no elevated levels of determinands above the guideline levels for the 'Commercial' land-use scenario. Insignificant quantities of Chrysotile asbestos (0.003%) were detected in one sample of Made Ground. No remediation of soils or groundwater was considered to be necessary. An Asbestos Management Strategy should be put in place so that any potentially asbestos containing materials are identified and removed from site in a suitable manner to prevent cross-contamination. An asbestos survey of the buildings currently on site is also recommended prior to any demolition and conversion.
Waste Acceptance Protocols	Based on a risk phrase analysis of the chemical laboratory test results, in accordance with EC Hazardous Waste Directive and undertaken by Ground and Water Limited, the sample of Made Ground from TPC/0.20m bgl was classified as HAZARDOUS due to the concentrations of lead recorded. This sample is unlikely to be representative of the bulk of the Made Ground and further testing of the waste is recommended. The remaining samples of the Made Ground encountered on-site were NON-HAZARDOUS . A full WAC Solid Suite Test with single batch leachate was undertaken on one sample of the Made Ground (TPC/0.20m bgl) and indicated the sample conformed to the NOT INERT Waste classification.

The above information must be read in conjunction with the full report.

1.0 INTRODUCTION

1.1 General

Ground and Water Limited were instructed by Tributes Limited c/o Paul Airey Planning Associates, on 20th March 2020, to conduct a Ground Investigation at the proposed new buildings at The Vinery, Arundel Road, Poling, West Sussex BN18 9PY. The scope of the investigation was detailed within the Ground and Water Limited fee proposal ref.: GWQ5343, dated 27th January 2020.

Ground and Water Limited were instructed by Tributes Limited c/o Paul Airey Planning Associates, on 7th October 2020 to conduct a further investigation. The scope of the investigation was detailed within the Ground and Water Limited fee proposal ref.: GWQ5775, dated 25th August 2020.

1.2 Aims of the Investigation

The aim of the investigation was understood to be to supply the client and their designers with information regarding the ground conditions underlying the site to assist them in preparing an appropriate scheme for the development.

The investigation was to be undertaken to provide parameters for the design of foundations by means of in-situ and laboratory geotechnical testing undertaken on soil samples recovered from trial holes. In addition, soakaway tests were undertaken in accordance with BRE365 in order to provide infiltration rates for the sub surface soils to aid the design of a Sustainable Urban Drainage System (SUDS).

Included within the fee proposal was an allowance to undertake chemical laboratory testing on soil samples recovered from the site to enable recommendations for the safe redevelopment of the site and the protection of site workers, end-users and the public from any potential contamination identified, as detailed in the Conceptual Site Model (CSM) within the Ground and Water Limited Desk Study Report (ref. GWPR3898/DS/November 2020) or the revised CSM within this report. This Ground Investigation Report must be read in conjunction with the Desk Study Report.

The techniques adopted for the investigation were chosen considering the anticipated ground conditions and development proposals on-site, and bearing in mind the nature of the site, limitations to site access and other logistical limitations.

This report supersedes the Ground Investigation Report produced by Ground and Water Limited reference GWPR3637/GIR/May 2020 v1.00.

1.3 Conditions and Limitations

This report has been prepared based on the terms, conditions and limitations outlined within Appendix A.

2.0 SITE SETTING

2.1 Site Location

The site comprised a 0.21ha (2125m²) rectangular plot of land, orientated in a west to east direction, and was located in the southern western corner of the Vinery Industrial Estate. The industrial estate was located on the southern side of the A27 to the north of Poling in West Sussex.

The approximate O.S. National Grid reference for the site is TQ 05050 05574. A site location plan is given within Figure 1. A plan showing the site development area is given within Figure 2.

2.2 Site Description

A Site Walkover was undertaken in November 2020. A description of the site, as noted during the Site Walkover, is tabulated below. An aerial view of the site showing an approximate site boundary is given within Figure 3.

Site Description Sheet: The Vinery, Arundel Road, Poling, West Sussex BN18 9PY	
Use of site.	At the time of the Site Walkover, October 2020, the majority of the site comprised open land. A small brick built workshop area and a pair of polytunnels filled with coffins was located in the eastern portion of the site.
Site topography	The site was generally uneven and with a gentle slope to the south. The south-western corner of the site had been raised and was ~1.50 – 2.00m higher than the farmland to the south.
Area topography	The area surrounding the site was generally flat and level with a gentle slope to the south,
Structures on-site	The eastern portion of the site was occupied by a small brick built workshop area and a pair of polytunnels filled with coffins.
Structures off-site and use of surrounding ground	The site was located in an agricultural area with farmland to the south and west, a light industrial estate to the east/north-east and the A27 with woodland beyond to the distant north. The industrial estate had single and double height industrial units and were occupied by a range of companies including antiques restorers, breweries and car servicing.
Boundary features	A ~1.5m high chain link fence on the southern boundary, ~20m high conifers along the western boundary and in the south-east corner and open on the remaining two sides.
Site covering	An area of concrete hardstanding was noted in the north-east corner associated with the polytunnels and along the north-west boundary of the site, with the remainder grass surfaced soft landscaping.
Contamination sources on-site	Made Ground was noted spread across the soft landscaped parts of the site.
Contamination sources off-site	The light industrial estate to the east/north-east occupied by a range of companies including antiques restorers, breweries and car servicing.
Vegetation on-site	~20m high conifers along the western boundary and in the south-east corner
Vegetation off-site	Several trees and bushes were noted to the south.
Services	A drain was known to cross the site in a north to south direction. Services were also assumed to be entering the polytunnels from the east.
Comments	None.

2.3 Proposed Development

At the time of reporting, December 2020, the proposed development was understood to comprise the erection of a single storey light industrial unit for the storage of coffins with communal soft landscaping in the south-west corner of the site and hardstanding/car parking in the eastern portion

of the site. A plan of the proposed development is given in Figure 4.

2.4 Geology

The geology map of the British Geological Survey of Great Britain of the Poling area (Chichester and Bognor Sheet No. 317/332) revealed the site to be located on superficial Aeolian Deposits and Undifferentiated River Terrace Deposits overlying the Lambeth Group. No areas of Made Ground or Reworked Ground was noted within a 250m radius.

Aeolian Deposits

Aeolian Deposits comprises a geologically recent deposit of brown structureless sandy clay of limited thickness that usually overlies Undifferentiated River Terrace Deposits in the area of the site. Its name is derived from its former use in the manufacture of bricks. In general the deposits are 2.00m thick but can be up to 3.50m in places.

Undifferentiated River Terrace Deposits

In the south these deposits consist of gravels and sandy gravels, commonly clayey in the higher terraces. In places, clayey and sandy silty and silty clay overlie the aggregate, perhaps an indication of the preservation of overbank or Aeolian Deposits deposits at the top of each fluvial cycle. In general the terrace deposits are up to 6m thick.

Lambeth Group

The Lambeth Group (formerly known as the Woolwich and Reading Beds) is a sedimentary complex comprising a basal bed (the Upnor Formation also known as the Bottom Bed) composed of glauconitic sand, sandy clay and gravel (well-rounded flint pebbles), with laterally variable sand and clay above. In the eastern part of the area the basal bed is mostly overlain by a shelly grey sandy clay or silty sand and laminated beds (Woolwich Formation). At the top of the sedimentary complex is the Reading Formation, which is made up of multi-coloured mottled clays and silty clays.

Lignite, or brown coal, a carbonaceous rock composed of plant remains which has not been subject to the same intensity of heat and pressure as has ordinary coal, is occasionally found within the Lambeth Group, as are individual logs and groups of logs indicating the position of a former log jam, which was covered by sand and clay at the time of deposition.

A BGS borehole record from 1946 to the immediate east of the site revealed ~3.50m of clay (Brickearth) over ~2m of sand and gravel (Brighton Raised Beach) over ~30m of clay (Lambeth Group). These deposits were underlain by chalk. Groundwater was encountered at ~50m and ~55m bgl with a standing water level of 10m bgl in the borehole.

2.5 Hydrogeology and Hydrology

The Desk Study has revealed the study area was located on a **Secondary A Aquifer** comprising the superficial Aeolian Deposits and underlying Undifferentiated River Terrace Deposits. The bedrock deposits of the Lambeth Group were also classed as a **Secondary A Aquifer**.

Superficial drift deposits are described as permeable unconsolidated (loose) deposits, e.g. sands and gravels. The bedrock is described as solid permeable formations e.g. sandstone, chalk and limestone.

Secondary aquifers include a wide range of drift deposits with an equally wide range of water permeability and storage capacities. Secondary (A) Aquifers consist of deposits with permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified

as Minor Aquifers.

Examination of the Environment Agency records showed that the site did not fall within a Groundwater Source Protection Zone as classified in the Policy and Practice for the Protection of Groundwater.

A study of the GroundSure Environmental Insight Report, presented in Appendix D of this report, revealed that the site was located on a Secondary A Aquifer with a high leaching potential, and that the site was located within a nitrate vulnerable zone.

No active groundwater or surface abstraction licences were within a 250m radius of the site.

The nearest surface water feature to the site was a drain along the western and southern boundaries of the site.

From analysis of hydrogeological and topographical maps groundwater was anticipated to be encountered at shallow to moderate depth (2-6m below existing ground level) and it was considered that the groundwater was flowing in a southerly direction in alignment with the local topography.

Examination of the Environment Agency records showed that the site is located within a **Flood Zone 1**, i.e. an area with a **very low** probability of flooding.

A study of the GroundSure Environmental Insight Report, presented in Appendix D of this report, revealed the site was at a moderate risk of flooding due to groundwater emergence and a negligible risk from surface water flooding.

2.6 Radon

BRE 211 (2015) Map 4 of the Hampshire, Berkshire and South Oxfordshire revealed the site **was not** located within an area where mandatory protection measures against the ingress of Radon were likely to be required. The site **was not** located within an area where a risk assessment was required.

3.0 FIELDWORK

3.1 Scope of Works

Site works were undertaken in two Phases.

Phase I was undertaken on the 25th March 2020 and comprised the machine excavation of four trial pits (TP1 – TP4) to a depth of between 2.00m bgl in TP4 and 2.70m bgl in TP2. Infiltration testing in accordance with the principles of BRE365 was undertaken in TP3. Temporary groundwater monitoring standpipes were installed to a depth of 2.50m bgl in TP1 and 2.00m bgl in TP4. In addition, on the 1st April 2020, dynamic cone penetration (DCP) testing was undertaken at four locations across the site (DCP1 - 4) to provide indicative CBR values.

Phase II was undertaken on the 15th October 2020 and comprised the hand excavation of three trial pits (TPA – TPC) to a depth of 1.00m bgl targeted at areas of proposed soft landscaping.

The trial hole location plan can be seen in Figure 5.

Prior to commencing the ground investigation, a walkover survey was carried out to identify the presence of underground services and drainage. Where underground services/drainage were suspected and/or positively identified, exploratory positions were relocated away from these areas.

As a further precautionary measure, the positions were hand scanned with a Cable Avoidance Tool (CAT scanner) to minimise the risk to services.

Upon completion of the site works, the trial holes were backfilled and made good/reinstated in relation to the surrounding area.

3.2 Sampling Procedures

Small disturbed samples were recovered from the trial holes at the depths shown on the trial hole records. Soil samples were generally retrieved from each change of strata and/or at specific areas of concern. Samples were also taken at approximately 0.5m intervals during broad homogenous soil horizons.

A selection of samples were despatched for geotechnical testing purposes. A selection of soil samples were also sent off for analysis for a broad range of contaminants in accordance with the Conceptual Site Model (CSM) developed within the Ground and Water Desk Study Report (ref. GWPR3898/DS/November 2020) and DEFRA/CLEA methodologies.

4.0 ENCOUNTERED GROUND CONDITIONS

4.1 Soil Conditions

The trial holes were logged by Roger Foord of Ground and Water Limited generally in accordance with BS EN 14688 'Geotechnical Investigation and Testing – Identification and Classification of Soil'.

The ground conditions encountered within the trial holes was as anticipated from examination of the geology map. Made Ground was noted to overlie the soils of the Aeolian Deposits which in turn rest upon the Undifferentiated River Terrace Deposits. Soils of the Lambeth Group were not encountered in the trial holes.

The ground conditions encountered during the investigation are described in this section. For more complete information about the Made Ground, Aeolian Deposits and the Undifferentiated River Terrace Deposits at particular points, reference must be made to the individual trial hole logs within Appendix B.

The trial hole location plan can be viewed in Figure 5.

For the purposes of discussion, the succession of conditions encountered in the trial holes in descending order can be summarised as follows:

Made Ground
Aeolian Deposits (TP1 – TP4 and TPC only)
Undifferentiated River Terrace Deposits (TP1, TP3 and TP4 only)

Made Ground

Made Ground was encountered from ground level to a depth of between 0.30m bgl in TP1 and 1.50m bgl in TP2 during Phase I and to a depth of 0.55m bgl in TPC and for the full depth of TPA and TPB at 1.00m bgl during Phase II. The Made Ground generally comprised a brown and dark brown mottled, locally dark grey mottled sandy gravelly clay. The sand was fine to coarse grained and the gravel was angular to sub-angular, fine to coarse concrete (30 - 70%), brick (20 - 50%), flint (10 - 70%), plastic (5 - 30%), chalk (0 - 5%), glass (5%) and carbonaceous material (ash/clinker/tarmac) (0 - 5%).

Aeolian Deposits

Soils described as the Aeolian Deposits were encountered underlying the Made Ground for the remaining depth of TP2 at 2.70m bgl and to a proved depth of 1.75m bgl in TP1, 2.45m bgl in TP3 and 1.90m bgl in TP4 during Phase I. During Phase II, the soils were encountered underlying the Made Ground for the remaining depth of TPC at 1.00m bgl. The soils generally comprised a brown and orange mottled very silty clay.

Undifferentiated River Terrace Deposits

Soils described as the Undifferentiated River Terrace Deposits were encountered underlying the Aeolian Deposits for the remaining depth of TP1 at 2.50m bgl, TP3 at a depth of 2.60m bgl and TP4 at a depth of 2.00m bgl. The soils generally comprised an orange brown and grey brown mottled (in TP1) and brown and green brown mottled (TP3 and TP4) slightly gravelly to gravelly, slightly sandy to sandy clay. The sand was fine to coarse grained and the gravel was angular to sub-rounded, fine to coarse flint.

For more complete information about the soils encountered during the investigation, reference

should be made to the detailed trial hole records given within Appendix C.

4.2 Roots Encountered

The depth of root penetration observed within each trial hole is tabulated below.

Depth of Root Penetrated Soils Observed Within Trial Holes			
Phase	Trial Hole	Depth of Fresh Root Penetration (m bgl)	Depth of Dark Brown/Black Friable Rootlets (m bgl)
Phase I	TP1	Roots noted to 0.30m bgl	None
	TP2	Roots noted to 1.00m bgl	None
	TP3	Roots noted to 2.40m bgl	None
	TP4	Roots noted to 1.50m bgl	Traces of fine rootlets noted in the sample from 1.50m bgl during the geotechnical laboratory testing
Phase II	TPA	Roots noted to 0.30m bgl	None
	TPB	Roots noted to 0.30m bgl	None
	TPC	Roots noted to 0.30m bgl	None

Roots may be found to greater depths at other locations on the site, particularly close to trees and/or trees that have been removed both within the site and its

4.3 Groundwater Conditions

Seepages of groundwater were encountered at 2.50m bgl in TP1 and 1.50m bgl in TP3 during the intrusive investigation. Groundwater was not encountered in the remaining trial holes.

A standing groundwater level of 0.90m and 1.37m bgl was recorded in the standpipes installed within TP1 and TP4 respectively on 1st April 2020. This was considered to be perched water within more granular bands within the Made Ground accumulating within a standpipe installed with predominantly cohesive soils rather than a true reflection of the actual groundwater levels.

Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage. Exact groundwater levels may only be determined through long term measurements from monitoring wells installed on-site.

The site investigation was conducted in March and April 2020, when groundwater levels should be falling from their annual maximum (highest elevation) and October 2020 when groundwater levels should be rising from their annual minimum (lowest elevation). The long-term groundwater elevation might increase at some time in the future due to seasonal fluctuation in weather conditions. Isolated pockets of groundwater may be perched within any Made Ground found at other locations around the site.

4.5 Obstructions

No artificial or natural sub-surface obstructions were noted during the excavation of the trial pits.

5.0 INSITU AND LABORATORY GEOTECHNICAL TESTING

5.1 In-Situ Geotechnical Testing

5.1.1 Dynamic Cone Penetrometer Tests

Dynamic Cone Penetrometer testing was undertaken to determine the CBR values of the soils underlying the site at shallow depth and a summary of the results is tabulated below.

In-situ CBR Test Results Summary												
CBR No.	Layer 1 (Made Ground)		Layer 2 (Made Ground)		Layer 3 (Made Ground)		Layer 4 (Made Ground)		Layer 5 (Made Ground/ Aeolian Deposits)		Layer 6 (Made Ground/ Aeolian Deposits)	
	Thickness (mm)	In-situ CBR (%)	Thickness (mm)	In-situ CBR (%)	Thickness (mm)	In-situ CBR (%)	Thickness (mm)	In-situ CBR (%)	Thickness (mm)	In-situ CBR (%)	Thickness (mm)	In-situ CBR (%)
DCP1	189mm	47%	59mm	18%	43mm	12%	196mm	6%	191mm	5%	231mm	10%
DCP2	411mm	7%	191mm	5%	120mm	6%	33mm	7%	122mm	8%	-	-
DCP3	145mm	22%	33mm	16%	111mm	11%	144mm	7%	396mm	5%	67mm	7%
DCP4	259mm	26%	107mm	59%	37mm	21%	175mm	12%	214mm	7%	110mm	9%

The test results are presented in Appendix B.

5.2 Laboratory Geotechnical Testing

A programme of geotechnical laboratory testing scheduled by Ground and Water Limited and carried out by K4 Soils Laboratory and DETS Limited was undertaken on samples recovered from the Aeolian Deposits and the Undifferentiated River Terrace Deposits. The results of the tests are presented in Appendix C.

The test procedures used were generally in accordance with the methods described in BS1377:2016 and 2018.

Details of the specific tests used in each case are given below.

Standard Methodology for Laboratory Geotechnical Testing		
Test	Standard	Number of Tests
Atterberg Limit Tests	BS1377:2016:Part 2:Clauses 3.2, 4.3 & 5	7
Water Soluble Sulphate & pH	BS1377:2018:Part 3:Clause 5	1
BRE Special Digest 1 (incl. Ph, Total Sulphate, W/S Sulphate, Total Chlorine, W/S Chlorine, Total Sulphur, Ammonium as NH ₄ , W/S Nitrate, W/S Magnesium)	BRE Special Digest 1 "Concrete in Aggressive Ground" (BRE, 2005).	2

5.2.1 Atterberg Limit Tests

A précis of Atterberg Limit Tests undertaken on four samples of the Aeolian Deposits and three sample of the Undifferentiated River Terrace Deposits can be seen tabulated overpage.

Atterberg Limit Tests Results Summary							
Stratum/Depth	Moisture Content (%)	Passing 425 μm sieve (%)	Modified PI (%)	Soil Class	Consistency Index (Ic)	Volume Change Potential	
						NHBC	BRE
Aeolian Deposits	23 – 25	97 – 100	12.8 – 26.0	CI	Firm – Stiff	Low - Medium	Low - Medium
Undifferentiated River Terrace Deposits	19 – 24	78 – 95	13.8 – 14.8	CI	Firm – V Stiff	Low	Low

NB: NP – Non-plastic

BRE Volume Change Potential refers to BRE Digest 240 (based on Atterberg results)

Soil Classification based on British Soil Classification System.

Consistency Index (Ic) based on BS EN ISO 14688-2:2004.

5.2.2 Comparison of Soil's Moisture Content with Index Properties

5.2.2.1 Liquidity Index Analyses

The results of the Atterberg Limit tests undertaken on four samples of the Aeolian Deposits and three sample of the Undifferentiated River Terrace Deposits were analysed to determine the Liquidity Index of the samples. This gives an indication as to whether the samples recovered showed a moisture deficit and their degree of consolidation. The results are tabulated overpage. The test results are presented within Appendix C.

Liquidity testing indicated that the overconsolidated to heavily overconsolidated samples of the Aeolian Deposits and overconsolidated samples of the Undifferentiated River Terrace Deposits tested showed no evidence of a moisture deficit.

Liquidity Index Calculations Summary					
Stratum/Trial Hole/Depth	Moisture Content (%)	Plastic Limit (%)	Modified Plasticity Index (%)	Liquidity Index	Result
Aeolian Deposits TP1/1.00m bgl Orangish brown mottled bluish grey slightly sandy silty CLAY.	25	20	26	0.19	Heavily Overconsolidated
Undifferentiated River Terrace Deposits TP1/2.00m bgl Orangish brown slightly mottled bluish grey slightly gravelly sandy silty CLAY (gravel was fine to coarse and sub-angular).	19	15	14.82	0.27	Overconsolidated
Aeolian Deposits TP2/1.50m bgl Orangish brown slightly mottled grey sandy silty CLAY with rare fine gravel and dark grey stains.	23	19	12.87	0.31	Overconsolidated
Aeolian Deposits TP3/1.00m bgl Orangish brown mottled bluish grey slightly gravelly sandy silty CLAY (gravel was fine to medium and sub-angular).	24	20	16.49	0.24	Overconsolidated
Undifferentiated River Terrace Deposits TP3/2.50m bgl Orangish brown mottled bluish grey slightly gravelly sandy silty CLAY (gravel was fine to medium and sub-angular).	24	18	14.25	0.42	Overconsolidated
Aeolian Deposits TP4/1.50m bgl Orangish brown slightly mottled greyish brown sandy silty CLAY with rare fine gravel and dark grey stains. Orangish brown slightly mottled grey sandy silty CLAY with rare fine gravel and scattered dark grey stains and traces of fine rootlets.	23	18	17.46	0.29	Overconsolidated
Undifferentiated River Terrace Deposits TP4/2.00m bgl Orangish brown slightly mottled grey slightly gravelly sandy silty CLAY (gravel was fine to medium and sub-angular to rounded).	20	17	13.8	0.22	Overconsolidated

5.2.2.2 Liquid Limit

A comparison of the soil moisture content and the liquid limit can be seen tabulated overpage.

A comparison of the moisture content versus liquid limit indicated that the overconsolidated to heavily overconsolidated samples of the Aeolian Deposits and overconsolidated samples of the Undifferentiated River Terrace Deposits showed no evidence of a moisture deficit.

Moisture Content vs. Liquid Limit				
Strata/Trial Hole/Depth/Soil Description	Moisture Content (MC) (%)	Liquid Limit (LL) (%)	40% Liquid Limit (LL)	Result
Aeolian Deposits TP1/1.00m bgl Orangish brown mottled bluish grey slightly sandy silty CLAY.	25	46	18.4	MC > 0.4 x LL (No significant moisture deficit)
Undifferentiated River Terrace Deposits TP1/2.00m bgl Orangish brown slightly mottled bluish grey slightly gravelly sandy silty CLAY (gravel was fine to coarse and sub-angular).	19	34	13.6	MC > 0.4 x LL (No significant moisture deficit)
Aeolian Deposits TP2/1.50m bgl Orangish brown slightly mottled grey sandy silty CLAY with rare fine gravel and dark grey stains.	23	32	12.8	MC > 0.4 x LL (No significant moisture deficit)
Aeolian Deposits TP3/1.00m bgl Orangish brown mottled bluish grey slightly gravelly sandy silty CLAY (gravel was fine to medium and sub-angular).	24	37	14.8	MC > 0.4 x LL (No significant moisture deficit)
Undifferentiated River Terrace Deposits TP3/2.50m bgl Orangish brown mottled bluish grey slightly gravelly sandy silty CLAY (gravel was fine to medium and sub-angular).	24	33	13.2	MC > 0.4 x LL (No significant moisture deficit)
Aeolian Deposits TP4/1.50m bgl Orangish brown slightly mottled greyish brown sandy silty CLAY with rare fine gravel and dark grey stains. Orangish brown slightly mottled grey sandy silty CLAY with rare fine gravel and scattered dark grey stains and traces of fine rootlets.	23	36	14.4	MC > 0.4 x LL (No significant moisture deficit)
Undifferentiated River Terrace Deposits TP4/2.00m bgl Orangish brown slightly mottled grey slightly gravelly sandy silty CLAY (gravel was fine to medium and sub-angular to rounded).	20	32	12.8	MC > 0.4 x LL (No significant moisture deficit)

5.2.3 Sulphate and pH Tests

Water soluble sulphate and pH tests were undertaken on one sample of the Aeolian Deposits (TP1/1.00m bgl). The soluble sulphate concentration was 260mg/l with a pH of 7.6.

5.2.4 BRE Special Digest 1

In accordance with BRE Special Digest 1 'Concrete in Aggressive Ground' (BRE, 2005) two samples of the Aeolian Deposits (TP1/2.50m and TP3/1.50m bgl) were scheduled for laboratory analysis to determine parameters for concrete specification.

The results are given within Appendix C and a summary is tabulated overpage.

Summary of Results of BRE Special Digest Testing			
Determinand	Unit	Minimum	Maximum
pH	-	7.7	7.8
Ammonium as NH ₄	mg/l	0.06	0.22
Sulphur	%	<0.02	<0.02
Chloride (water soluble)	mg/l	5.2	6.1
Magnesium (water soluble)	mg/l	1.2	1.7
Nitrate (water soluble)	mg/l	<1.5	2.1
Sulphate (water soluble)	mg/l	12	13
Sulphate (total)	%	<0.02	<0.02

6.0 ENGINEERING CONSIDERATIONS

6.1 Soil Characteristics and Geotechnical Parameters

Based on the results of the intrusive investigation and geotechnical laboratory testing the following interpretations have been made with respect to engineering considerations.

- Made Ground was encountered from ground level to a depth of between 0.30m bgl in TP1 and 1.50m bgl in TP2.

As a result of the inherent variability of Made Ground it is usually unpredictable in terms of bearing capacity and settlement characteristics. Foundations should, therefore, be taken through any Made Ground and either into, or onto a suitable underlying natural stratum of adequate bearing characteristics.

Made Ground may be found to deeper depth at other locations on the site, especially close to former structures/foundations and service runs.

- Soils described as the Aeolian Deposits were encountered underlying the Made Ground for the remaining depth of TP2 at 2.70m bgl and to a proved depth of 1.75m bgl in TP1, 2.45m bgl in TP3 and 1.90m bgl in TP4 during Phase I. During Phase II, the soils were encountered underlying the Made Ground for the remaining depth of TPC at 1.00m bgl. The soils generally comprised a brown and orange mottled very silty clay.

The cohesive soils of the Aeolian Deposits were shown to have a **low to medium** potential for volume change in accordance with both BRE240 and NHBC Standards Chapter 4.2. Geotechnical analyses indicated the soils were firm to stiff, overconsolidated to heavily overconsolidated and with no potential moisture deficits.

The soils of the Aeolian Deposits were overconsolidated to heavily overconsolidated cohesive soils and were likely to be a suitable stratum for lightly to moderately loaded spread foundations for the proposed development provided a conservative bearing capacity was adopted. The settlements induced on loading are likely to be moderate.

- Soils described as the Undifferentiated River Terrace Deposits were encountered underlying the Aeolian Deposits for the remaining depth of TP1 at 2.50m bgl, TP3 at a depth of 2.60m bgl and TP4 at a depth of 2.00m bgl. The soils generally comprised an orange brown and grey brown mottled (in TP1) and brown and green brown mottled (TP3 and TP4) slightly gravelly to gravelly, slightly sandy to sandy clay. The sand was fine to coarse grained and the gravel was angular to sub-rounded, fine to coarse flint.

The cohesive soils of the Undifferentiated River Terrace Deposits were shown to have a **low** potential for volume change in accordance with both BRE240 and NHBC Standards Chapter 4.2. Geotechnical analyses indicated the soils were firm to very stiff, overconsolidated and with no potential moisture deficits.

The soils of the Undifferentiated River Terrace Deposits were overconsolidated cohesive soils and given their depth were therefore likely to be a suitable stratum for lightly to moderately loaded piled foundations for the proposed development. The settlements induced on loading are likely to be low to moderate.

The final design of foundations will need to take into account the volume change potential of the soil, the depth of root penetration and/or desiccation and the likely serviceability and settlement requirements of the proposed structure. These parameters for design are discussed in the next section of this report.

- Roots were generally noted to a depth of between 0.30 - 1.50m bgl and locally deeper to 2.40m bgl in TP3.
- Seepages of groundwater were encountered at 2.50m bgl in TP1 and 1.50m bgl in TP3 during the intrusive investigation. Groundwater was not encountered in the remaining trial holes.

A standing groundwater level of 0.90m and 1.37m bgl was recorded in the standpipes installed within TP1 and TP4 respectively on 1st April 2020. This was considered to be perched water within more granular bands within the Made Ground accumulating within a standpipe installed with predominantly cohesive soils rather than a true reflection of the actual groundwater levels.

6.2 Spread Foundations

At the time of reporting, December 2020, the proposed development was understood to comprise the erection of a single storey light industrial unit for the storage of coffins with communal soft landscaping in the south-west corner of the site and hardstanding/car parking in the eastern portion of the site. A plan of the proposed development is given in Figure 4.

The proposed development is likely to fall within Geotechnical Design Category 2 in accordance with Eurocode 7. The proposed foundation loads were not known to Ground and Water Limited at the time of reporting but are likely to range between 75 – 150kN/m².

The cohesive soils of the Aeolian Deposits were shown to have a **low to medium** potential for volume change in accordance with both BRE240 and NHBC Standards Chapter 4.2. Geotechnical analyses indicated the soils were firm to stiff, overconsolidated to heavily overconsolidated and with no potential moisture deficits.

The cohesive soils of the Undifferentiated River Terrace Deposits were shown to have a **low** potential for volume change in accordance with both BRE240 and NHBC Standards Chapter 4.2. Geotechnical analyses indicated the soils were firm to very stiff, overconsolidated and with no potential moisture deficits.

Foundations constructed within the soils of Aeolian Deposits or the Undifferentiated River Terrace Deposits should be designed therefore in accordance with soils of **medium volume change potential** in accordance with BRE Digest 240 NHBC Chapter 4.2.

Foundations therefore must not be placed within cohesive root penetrated and/or desiccated soils and the influence of the trees surrounding the site must be taken into account. The base of foundation excavations must extend at least 300mm into non-root penetrated cohesive soils or onto granular soils of no volume change potential.

Should trees be removed from the footprint of the proposed structure then consideration should be given to the adoption of a piled foundation solution.

Made Ground was noted to a maximum proved depth of 1.50m bgl in TP2.

Roots were generally noted to a depth of between 0.30 - 1.50m bgl and locally deeper to 2.40m bgl in TP3. Therefore based on the above the minimum foundation depths are likely to range between the minimum required for the soils encountered of 0.90m bgl and 1.80m bgl. Foundations may need to be locally deepened in the vicinity of TP3 to 2.70m bgl. A number of mature trees were noted along the western and southern boundaries and depending on the proposed site layout the influence of these trees will need to be taken into account in final design of the founding depths.

It was considered that strip or pad foundations could be adopted for the proposed redevelopment with foundations taken through any Made Ground, disturbed and/or desiccated ground, below any roots and into or onto the Aeolian Deposits.

Foundations constructed on the soils of the Aeolian Deposits at ~1.00m can be designed based on a presumed safe bearing capacity of 75kN/m², increasing to 90kN/m² at 1.80m bgl and deeper. This is based on trial hole records, inspection of samples recovered, geotechnical laboratory results, and referral to BS 8004:2015, *Code of Practice for Foundations*, and based on a 5m long by 600mm wide foundation and a maximum settlement of ~25mm.

It must be mentioned that it was assumed that excavations will be kept dry and either concreted or blinded as soon after excavation as possible in order to avoid ponding of groundwater within the foundation excavations. If water were allowed to accumulate on the formation for even a short time not only would an increase in heave occur resulting from the soil increasing in volume by taking up water, but also the shear strength and hence the bearing capacity would also be reduced.

Seepages of groundwater were encountered at 2.50m bgl in TP1 and 1.50m bgl in TP3 during the intrusive investigation. A standing groundwater level of 0.90m and 1.37m bgl was recorded in the standpipes installed within TP1 and TP4 respectively on 1st April 2020. This was considered to be perched water within more granular bands within the Made Ground accumulating within a standpipe installed with predominantly cohesive soils rather than a true reflection of the actual groundwater levels. Groundwater was not encountered in the remaining trial holes, therefore, foundations are unlikely to be constructed within the saturated aquifer. Perched water may be encountered within the Made Ground and Aeolian Deposits after periods of prolonged rainfall.

General Recommendations for Foundations:

- Roots may be found to greater depths at other locations on the site, particularly close to trees and/or trees that have been removed both within the site and its close environs.
- Inspection of foundation excavations, prior to concreting, must be made by a competent and suitably qualified person to check for any soft spots and to check for the presence of roots.
- Any groundwater or surface water ingress must be prevented from entering foundation trenches. Excavations must be kept dry and either concreted or blinded as soon after excavation as possible. If water were allowed to accumulate on the formation for even a short time not only would an increase in heave occur resulting from the soil increasing in volume by taking up water, but also the shear strength and hence the bearing capacity would also be reduced and this could result in increased settlements.

- Foundation excavations must be carefully bottomed out and any loose soil or soft spots removed prior to the foundation concrete or blinding being placed. Failure to ensure that foundation excavations are suitably bottomed out could result in additional settlements.
- Foundations must not be cast over foundations of former structures and/or other hard spots.
- Isolated Pad Foundations must be at least 1.5 times the width of the widest pad apart to keep to the anticipated settlements.
- Final designs for the foundations should be carried out by a suitably qualified Engineer based on the findings of this investigation and with reference to the anticipated loadings, serviceability requirements for the structure and the developments proximity to former, present and proposed trees.

6.3 Piled Foundations

Based upon the results of the ground investigation, piled foundations were unlikely to be required at the site.

6.4 Ground Floor Slabs

Ground bearing slabs, based on an applied load of $\sim 10\text{kN/m}^2$, could be considered for the proposed development, assuming that settlement or heave sensitive equipment/storage systems are not adopted and that the possibility of settlement or movement of slab can be tolerated (maximum 25mm).

Cohesive deposits were encountered in each of the trial pits and roots were noted to depths of 0.30 – 2.40m bgl. Consequently, in order to reduce the effects, the potential for seasonal movements caused by the water demand from roots, the root penetrated cohesive soils should be removed from the footprint of the proposed structure.

The formation level should then be proof rolled and any soft spots removed and infilled with a suitably compacted granular material. Site levels should be brought up to underside of proposed slab level using with suitable granular soil (Type I or Type II) rolled in thin layers. The slabs must be reinforced and cast in small bays with dowels cast at the interface between each of the bays to reduce the risk of differential settlement affecting the slab.

Given the presence of cohesive soils at shallow depth, special foundation precautions will be required to prevent possible future shrinkage/swelling within clay strata affecting the integrity of the outside faces of ground beams. A void, void former or compressible layer must be provided to accommodate potential movement.

6.5 Excavations and Stability

Shallow excavations in the Topsoil, Made Ground, Aeolian Deposits and Undifferentiated River Terrace Deposits are likely to be marginally stable at best. Long, deep excavations, through these strata are likely to become unstable.

Unsupported earth faces formed during excavation may be liable to collapse without warning and suitable safety precautions should therefore be taken to ensure that such earth faces are adequately supported before excavations are entered by personnel.

6.6 Sub-Surface Concrete

For the classification given below, the “mobile” and “natural” case was adopted given the geology encountered and the history of the site.

Made Ground

The water-soluble sulphates in the Made Ground tested (from the chemical laboratory testing) were found to be range between 29 - 121mg/l with a pH of 7.8 - 8.1.

Natural Ground – Aeolian Deposits

The water-soluble sulphates were found to range between 12 – 260mg/l (from the chemical laboratory tests). The total potential sulphate concentration (3x Sulphur) was found to be <0.06%. The pH was 7.6 – 7.8.

For spread and piled foundations sulphate concentrations measured in 2:1 water/soil extracts taken from the Aeolian Deposits, fell into Class **DS-1** of the BRE Special Digest 1, 2005, ‘Concrete in Aggressive Ground’. Table C1 of the Digest indicated an ACEC (Aggressive Chemical Environment for Concrete) classification of **AC-1**. **Consequently, a Sulphate Design Class of DS-1 and ACEC classification of AC-1 should be used for concrete design**

Concrete to be placed in contact with soil or groundwater must be designed in accordance with the recommendations of Building Research Establishment Special Digest 1, 2005, ‘Concrete in Aggressive Ground’ taking into account the pH of the soils.

6.7 Surface Water Disposal

A soakaway test, in accordance with the principles of BRE365, were undertaken in TP3 at a depth of 2.50m bgl. The majority of the trial pit was excavated through Aeolian Deposits and was bottomed out within soils of the Undifferentiated River Terrace Deposits, comprising a brown and green brown mottled slightly gravelly slightly sandy silty clay. The infiltration rate recorded within the trial pit can be seen tabulated below.

BRE365 Soakway Test Results					
Trial Hole/Depth of Trial Pit (m)	Test	Initial Water Level (m bgl)	Final Water Level (m bgl)	Time taken (mins)	Infiltration Rate (m/s)
TP3 @ 2.50m bgl	1	1.62m	1.63m	244 mins	1.07×10^{-7} m/s

Due to the slow infiltration rate it was not possible to complete three fillings of the pit within the time available. It must be noted that the test within TP3 did not drain 75%. The test was left for 4 hours, with limited drainage (0.01m), due to time constraints this was all that could be achieved so the soakage rate provided for TP3 is that from this 4-hour period.

Consequently, soakaway construction within the cohesive soils of the Aeolian Deposits and the Undifferentiated River Terrace Deposits were considered unlikely to prove satisfactory due to the very low infiltration rates. Therefore an alternative method of surface water disposal is required.

Consultation with the Environment Agency must be sought regarding any use that may have an impact on groundwater resources.

The principles of sustainable urban drainage system (SUDS) should be applied to reduce the risk of

flooding from surface water ponding and collection associated with the construction of the foundations.

6.8 Road and Hardstanding

In-situ dynamic cone penetration (DCP) testing was undertaken at four locations across the site (DCP1 - 4) to provide indicative CBR values. A summary of the results is tabulated below.

In-situ CBR Test Results Summary												
CBR No.	Layer 1 (Made Ground)		Layer 2 (Made Ground)		Layer 3 (Made Ground)		Layer 4 (Made Ground)		Layer 5 (Made Ground/ Aeolian Deposits)		Layer 6 (Made Ground/ Aeolian Deposits)	
	Thickness (mm)	In-situ CBR (%)	Thickness (mm)	In-situ CBR (%)	Thickness (mm)	In-situ CBR (%)	Thickness (mm)	In-situ CBR (%)	Thickness (mm)	In-situ CBR (%)	Thickness (mm)	In-situ CBR (%)
DCP1	189mm	47%	59mm	18%	43mm	12%	196mm	6%	191mm	5%	231mm	10%
DCP2	411mm	7%	191mm	5%	120mm	6%	33mm	7%	122mm	8%	-	-
DCP3	145mm	22%	33mm	16%	111mm	11%	144mm	7%	396mm	5%	67mm	7%
DCP4	259mm	26%	107mm	59%	37mm	21%	175mm	12%	214mm	7%	110mm	9%

Intrusive works revealed a Topsoil and Made Ground thickness of between 0.20 - 0.60m bgl mantling the site. Where roads and hardstanding are to be founded in the Topsoil or Made Ground, a CBR value of 1% could be adopted. Given that the Topsoil and Made Ground soils encountered beneath the site are clay-based soils, these deposits are likely to be **frost susceptible**.

Where shallow Made Ground was noted, roads and hardstanding constructed on the medium volume change potential soils of the Aeolian Deposits should be designed based on a CBR value of 2.0%. This is based on reference to Table C1 of TRL1132 and average construction conditions. Based on wet conditions a CBR of 1.5% should be adopted, with dry conditions a CBR of 2.0% being applicable. Given that the soils encountered beneath the site are mainly clay-based soils (poorly drained) with plasticity indexes above 20%, **these deposits are likely to be non-frost susceptible**.

All formation levels for roads and hardstanding should be proof rolled to highlight any soft areas which should then be dug out and replaced with selected granular material compacted in thin layers to a suitable specification.

7.0 PHASE 2 CONTAMINATION RISK ASSESSMENT

7.1 Results of the Phase 1 Risk Assessment (Conceptual Site Model)

The tabulated Conceptual Site Model developed by the Ground and Water Desk Study (ref. GWPR33898/DS/November 2020) is reproduced in this section and can be seen below.

Tabulated Conceptual Site Model – Pollutant Linkage Summary			
Potential On-site Sources	Potential Absorption Pathways	Potential Receptors	Risk Classification
Contaminants introduced on-site by historic use of the site as a nursery and construction activities. - Heavy metals & semi-metals (incl. Arsenic, Cadmium, Chromium, Lead etc); - Combustion products (PAH's, benzo(a)pyrene, fluoranthene, dibenz(a,h)anthracene); - Organic compounds (fuel oils, ash, tar); - Asbestos (building material, pipe lagging); - Pesticides and herbicides.	Human Health - Direct ingestion of soil and soil derived dust - Dermal contact of soil and soil derived dust - Ingestion of soil and groundwater with elevated concentration of determinands - Dermal contact with impacted soils and groundwater - Inhalation of impacted dust with elevated concentration of determinands - Inhalation of vapours	Human Health - Construction workers. - Future site residents/visitors. - Neighbours and public.	Low
	Groundwater - Surface water runoff - Anthropogenic (man-made) pathways - Vertical and lateral migration in permeable strata	Groundwater Secondary A Aquifer (Undifferentiated River Terrace Deposits and Lambeth Group) underlying the site.	Low
	Vegetation Direct uptake of impacted water	Vegetation - Vegetation within residential soft landscaping. - Vegetation within Public open space.	Low
Aggressive ground conditions with Made Ground and natural ground; - Sulphates - PAH, TPH	Building Materials and Services Direct contact with aggressive ground conditions	Building Materials and Services - Buried concrete. - Underground services (water supply pipes)	Moderate
Potential Off-site Sources	Potential Absorption Pathways	Potential Receptors	Risk Classification
Contaminants introduced on-site by historic use of the site as a nursery and construction activities. - Heavy metals & semi-metals (incl. Arsenic, Cadmium, Chromium, Lead etc); - Combustion products (PAH's, benzo(a)pyrene, fluoranthene, dibenz(a,h)anthracene); - Organic compounds (fuel oils, ash, tar); - Asbestos (building material, pipe lagging); - Pesticides and herbicides.	Human Health - Direct ingestion of soil and soil derived dust - Dermal contact of soil and soil derived dust - Ingestion of soil and groundwater with elevated concentration of determinands - Dermal contact with impacted soils and groundwater - Inhalation of impacted dust with elevated concentration of determinands - Inhalation of vapours	Human Health - Construction workers. - Future site residents/visitors. - Neighbours and public.	Low
	Groundwater - Surface water runoff - Anthropogenic (man-made) pathways - Vertical and lateral migration in permeable strata	Groundwater Secondary A Aquifer (Undifferentiated River Terrace Deposits and Lambeth Group) underlying the site.	Low
	Vegetation Direct uptake of impacted water	Vegetation - Vegetation within residential soft landscaping. - Vegetation within Public open space.	Low

Made Ground was encountered from ground level to a depth of between 0.30m bgl in TP1 and 1.50m bgl in TP2 during Phase I and to a depth of 0.55m bgl in TPC and for the full depth of TPA and TPB at 1.00m bgl during Phase II. The Made Ground generally comprised a brown and dark brown mottled, locally dark grey mottled sandy gravelly clay. The sand was fine to coarse grained and the gravel was angular to sub-angular, fine to coarse concrete (30 - 70%), brick (20 - 50%), flint (10 - 70%), plastic (5 - 30%), chalk (0 - 5%), glass (5%) and carbonaceous material (ash/clinker/tarmac) (0 - 5%).

Made Ground was anticipated to be encountered on-site. Consequently, there was no need to modify the tabulated Conceptual Site Model developed by the Ground and Water Desk Study (ref. GWPR3898/DS/November 2020).

7.2 Sampling Locations

The methodology for sampling locations can be seen tabulated below. A trial hole location plan is given within Figure 4.

Methodology for Sampling Locations		
Trial Hole	Sampling Strategy	Proposed End Use
TPA	Targeted Sampling Location	Proposed Soft Landscaping
TPB		
TPC		

The area investigated as part of the proposed development totals 0.21ha (2125m²) and with seven sampling locations, given an unknown hotspot shape, the sampling density means that a hotspot with an area of approximately 455m² and a radius of approximately 12m would be encountered (CLR 4).

Soil sampling depths were chosen to reflect the receptors of concern, human health, and typically comprised a surface or near surface sample. The receptors relevant to the sampling depths can be seen below:

Near surface samples	Direct ingestion, dermal contact and dust inhalation. Protection of end-users and maintenance workers e.g. Landscape Gardeners. Protection of shallow rooted plants Perched Water/Surface Water Run-off
>0.5m below ground level	Protection of deep rooted plants Perched Water/Surface Water Run-off Aquifer

The depth of soil sampling can be seen within the trial hole logs presented in Appendix B.

7.3 Chemical Laboratory Testing – Human Health Risk Assessment

A programme of chemical laboratory testing, scheduled by Ground and Water Limited, and carried out by DETS Limited, was undertaken on 4No. samples of Made Ground (TPA/0.50m, TPB/0.20m, TPB/1.00m and TPC/0.20m bgl). The samples tested and the reasons for testing can be seen tabulated overpage.

Methodology for Chemical Laboratory Testing			
Trial Hole	Depth (m bgl)	Sampling Strategy	Proposed End Use
TPA	0.50m	Targeted Sampling Locations	Proposed Soft Landscaping
TPB	0.20m		
TPB	1.00m		
TPC	0.20m		

The analysis suite is presented below and comprised:

- Semi Metals and Heavy Metals incl. Arsenic, Cadmium, Chromium (incl. Hexavalent Chromium), Copper, Lead, Mercury, Nickel, Selenium, Vanadium, Zinc (TPA/0.50m, TPB/0.20m, TPB/1.00m and TPC/0.20m bgl);
- Asbestos Screen (TPA/0.50m, TPB/0.20m, TPB/1.00m and TPC/0.20m bgl);
- Polycyclic Aromatic Hydrocarbons (PAHs) incl. Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, Benzo(ghi)perylene (TPA/0.50m, TPB/0.20m, TPB/1.00m and TPC/0.20m bgl);
- Fuel Oils – Speciated TPH including full aliphatic/aromatic split (TPB/1.00m and TPC/0.20m bgl);
- BTEX compounds (Benzene, Toluene, Ethylbenzene, Xylene) and MTBE – used as marker compounds for Volatile Organic Compounds (VOCs) (TPB/1.00m and TPC/0.20m bgl);
- Organochlorine Pesticides (TPA/0.50m and TPB/0.20m bgl);
- Organophosphorus Pesticides (TPA/0.50m and TPB/0.20m bgl);
- INERT WAC Single Stage (10:1) (TPC/0.20m bgl).

The chemical laboratory results are presented in Appendix D.

7.3.1 Soil Assessment Criteria

The derivation of Soil Assessment Criteria used within this report can be seen within Appendix E.

7.3.2 Determination of Representative Contamination Concentrations

At the time of reporting, December 2020, the proposed development was understood to comprise the erection of a single storey light industrial unit for the storage of coffins with communal soft landscaping in the south-west corner of the site and hardstanding/car parking in the eastern portion of the site. A plan of the proposed development is given in Figure 4.

Therefore, the results of the chemical laboratory testing were compared to the LQM/CIEH Suitable 4 Use Levels (S4UL) and General Assessment Criteria (GAC) for an ‘Commercial’ land-use scenario, as this was considered the most appropriate land-use scenario. The C4SL LLTC for Lead was compared to a ‘Commercial’ land-use scenario.

Where no LQM/CIEH S4UL/C4SL LLTC was available for a particular determinant then preliminary reference was made to the laboratory detection limit of the determinant. If a positive concentration was noted then further risk assessment was undertaken.

For Cyanide, where no SGC/GAC or C4SL LLTC was available a Site Specific Assessment Criteria of 10mg/kg was adopted. This is based on ICRCL 59/83, TCL, ATRISK (SOIL) Screening Value and Dutch Intervention Value (ranging from 20 – 34mg/kg). Therefore, a SSAC of ~10mg/kg is considered conservative.

Where a contaminant of concern's LQM/CIEH S4UL/C4SL LLTC varies according to the Soil's Organic Matter (SOM), the SOM recorded for each soil sample was used to derive the appropriate SGV/GAC. The average SOM of the samples analysed was 3.5% (SOM ranged between 2.3 – 4.6%) and therefore a SOM of 2.5% was adopted for the analyses.

The results of the comparison of the representative contaminant concentrations are presented in the table overpage:

Soil Contamination Test Results and Guideline Value					
Determinand	Number of Samples	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Adopted Screening Value (mg/kg)	Was the adopted screening value exceeded for relevant land-use scenario?
INORGANICS					
Asbestos	3	ND	ND	ND	Bundles of Chrysotile (0.003%) (TP5/0.50m bgl)
Cyanide (total)	3	<2	<2	24	No
Phenols	3	<2	<2	760	No
METALS					
Arsenic	3	8	16	640	No
Boron	3	<1	<1	240000	No
Cadmium	3	<0.2	0.4	190	No
Chromium (III)	3	21	29	8600	No
Chromium (Hexavalent)	3	<2	<2	33	No
Copper	3	18	36	68000	No
Lead	3	148	1210	2300	No
Mercury	3	<1	<1	58	No
Nickel	3	12	21	980	No
Selenium	3	<3	<3	12000	No
Vanadium	3	25	50	9000	No
Zinc	3	73	374	730000	No
TOTAL PETROLEUM HYDROCARBONS (TPHs)					
Aliphatic >C5 - C6	2	< 0.01	< 0.01	3200	No
Aliphatic >C6 - C8	2	< 0.05	< 0.05	7800	No
Aliphatic >C8 - C10	2	< 2	< 2	2000	No
Aliphatic >C10 - C12	2	< 2	< 2	9700	No
Aliphatic >C12 - C16	2	< 3	< 3	59000	No
Aliphatic >C16 - C21	2	< 3	< 3	1600000	No
Aliphatic >C21 - C35	2	< 10	< 10		
Aliphatic >C35 - C44	2	-	-	1600000	No
Aromatic >C5 - C7	2	< 0.01	< 0.01	26000	No
Aromatic >C7 - C8	2	< 0.05	< 0.05	56000	No
Aromatic >C8 - C10	2	< 2	< 2	3500	No
Aromatic >C10 - C12	2	< 2	< 2	16000	No
Aromatic >C12 - C16	2	< 2	< 2	36000	No
Aromatic >C16 - C21	2	<3	<3	28000	No
Aromatic >C21 - C35	2	13	<10	28000	No
Benzene	2	<0.002	<0.002	27	No
Toluene	2	<0.005	<0.005	56000	No
Ethylbenzene	2	<0.002	<0.002	5700	No
m,p-Xylene	2	<0.002	<0.002	5900	No
o-Xylene	2	<0.002	<0.002	6600	No

(continued overpage)

(continued from previous page)

Soil Contamination Test Results and Guideline Value					
Determinand	Number of Samples	Minimum Concentration	Maximum Concentration	Adopted Screening Value	Was the adopted screening value exceeded for relevant land-use scenario?
POLYCYCLIC-AROMATIC HYDROCARBONS (assuming 2.5% SOM)					
Acenaphthene	3	<0.1	<0.1	84000	No
Acenaphthylene	3	<0.1	<0.1	83000	No
Anthracene	3	<0.1	<0.1	520000	No
Benzo(a)anthracene	3	<0.1	0.35	170	No
Benzo(a)pyrene	3	<0.1	0.32	35	No
Benzo(b)fluoranthene	3	0.12	0.52	44	No
Benzo(ghi)perylene	3	<0.1	0.25	3900	No
Benzo(k)fluoranthene	3	<0.1	0.19	1200	No
Chrysene	3	<0.1	0.42	350	No
Dibenzo(a,h)anthracene	3	<0.1	<0.1	3.5	No
Fluoranthene	3	<0.1	0.55	23000	No
Fluorene	3	<0.1	<0.1	63000	No
Indeno(1,2,3-cd)pyrene	3	<0.1	0.26	500	No
Naphthalene	3	<0.1	<0.1	190	No
Phenanthrene	3	<0.1	0.25	22000	No
Pyrene	3	0.12	0.48	54000	No
VOC MARKER COMPOUND					
Methyl tert-butyl ether (MTBE)	2	<5	<5	7900	No
ORGANOCHLORINE PESTICIDES*					
p,p' - DDE	2	0.02	0.03	n/a	TPA/ 0.50m (0.02mg/kg) TPB/0.20m (0.03 ng/kg)
ORGANOPHOSPHOROUS PESTICIDES*					
Notes:					
The derivation of the Soil Assessment Criteria used within this report can be seen within Appendix E. The soil concentrations were typically compared to the LQM/CIEH Suitable for Use Levels (S4UL) (2014), based upon the assumption of 2.5% soil organic matter. A screening value for Lead is based on the Category 4 Screening Levels (C4SLs). Where no S4UL or C4SL is available for Cyanide, a SoBRA acute GAC is assigned. Where no S4UL or C4SL is available for MTBE, a CL:AIRE 2010 GAC is assigned.					
*only concentrations of pesticides above the laboratory detection level reported.					

Two samples of Made Ground (TPA/0.50m and TPB/0.20m bgl) were found to have a positive concentration of p,p' – DDE (dichlorodiphenyldichloroethylene) of 0.02 mg/kg and 0.03mg/kg respectively. Dichlorodiphenyldichloroethylene (DDE) is a chemical compound formed by the loss of hydrogen chloride from DDT, of which it is one of its more common breakdown products.

No published UK guideline values are available for DDT or DDE. Internet based research indicated that the EA SR7 report for Priority Organic Pollutants contained physical-chemical data for DDT.

A document published by the European Commission (*European Commission (2007) EUR 22805 EN: Derivation Methods of Soil Screening Values in Europe. A Review and Evaluation of National Procedures Towards Harmonisation*) compiled screening values for potentially unacceptable risk (residential use) used in European Countries. Finland, Poland and the Netherlands have screening values of 1.00mg/kg, 2.01mg/kg and 4.00mg/kg respectively for

a sum of DDT, DDE and DDD compounds.

A New Zealand guidance document (*Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health*) provided intake values (TDI, background exposure), dermal absorption factors and bioconcentration factors for DDT and has derived a guideline value of 45mg/kg for DDT (based on residential use with 2.5% homegrown produce).

The Indiana Department of Environmental Management provides a residential screening level of 24mg/kg for DDT.

The California Human Health Screening Level for DDT for residential land use is 1.6mg/kg, or 5.5mg/kg for sum of DDD, DDE and DDT.

These values appear to vary quite considerably and the concentration identified on the site does not exceed any of the above thresholds/screening values.

The concentrations of p,p' – DDE identified (0.02 – 0.03 mg/kg) on the site do not exceed any of the thresholds/screening values and are therefore unlikely to pose a risk to end-users. Based on the results of the intrusive works and chemical analyses undertaken, no remedial measures are required for pesticides.

Chemical laboratory testing of the Made Ground revealed no other elevated levels of determinands above the guideline levels for the '**Commercial**' land-use scenario.

The intrusive investigation did not reveal any visual or olfactory evidence to suggest any hydrocarbon-type contamination in the trial holes excavated on the site. The chemical laboratory results have verified that no elevated concentrations of aliphatic/aromatic hydrocarbons (C5-C35) BTEX compounds are present in the soils underlying the site.

Asbestos was identified in one of the samples tested as shown in the table below. The risk of asbestos to human health is based on the concentration and type of microscopic asbestos found, the porosity of the soil where the asbestos is located and the amount of human exposure. Asbestos causes lung cancer and mesothelioma within humans. An acceptable risk is stated as an insignificant risk in CIRIA733, as shown by Table 14.1 for mesothelioma and Table 14.3 for lung cancer.

The results of the CIRIA733 Asbestos Risk Assessment has been summarised in the below table. The results can be viewed within Appendix G.

CIRIA733 Asbestos Risk Assessment						
Sample	Asbestos Type	Asbestos Concentration (%)	Mesothelioma		Lung Cancer	
			Cumulative Exposure Value (from age 30, over 5 years) (fibre/ml.year)	Lifetime Risk Per 100,000 People Exposed	Cumulative Exposure Value (from age 30, over 5 years) (fibre/ml.year)	Lifetime Risk Per 100,000 People Exposed
TP2/0.20m bgl	Small bundle of chrysotile fibres	0.003	0.00272	Insignificant	0.00194	Insignificant

An **Asbestos Management Strategy** should be put in place so that any potentially asbestos containing materials are identified and removed from site in a suitable manner to prevent cross-contamination.

An **asbestos survey** of the buildings currently on site is also recommended prior to any demolition and conversion.

7.4 Groundwater Risk Assessment

The Desk Study has revealed the study area was located on a **Secondary A Aquifer** comprising the superficial Aeolian Deposits and underlying Undifferentiated River Terrace Deposits. The bedrock deposits of the Lambeth Group were also classed as a **Secondary A Aquifer**.

Examination of the Environment Agency records showed that the site did not fall within a Groundwater Source Protection Zone as classified in the Policy and Practice for the Protection of Groundwater.

A study of the GroundSure Environmental Insight Report, presented in Appendix D of this report, revealed that the site was located on a Secondary A Aquifer with a high leaching potential, and that the site was located within a nitrate vulnerable zone.

No active groundwater or surface abstraction licences were within a 250m radius of the site.

The nearest surface water feature to the site was a drain along the western and southern boundaries of the site.

From analysis of hydrogeological and topographical maps groundwater was anticipated to be encountered at shallow to moderate depth (2-6m below existing ground level) and it was considered that the groundwater was flowing in a southerly direction in alignment with the local topography.

Examination of the Environment Agency records showed that the site is located within a **Flood Zone 1**, i.e. an area with a **very low** probability of flooding.

A study of the GroundSure Environmental Insight Report, presented in Appendix D of this report, revealed the site was at a moderate risk of flooding due to groundwater emergence and a negligible risk from surface water flooding.

The potential receptors are presented below and comprise:

- Secondary A Aquifers directly underlying the site.

However, given the low levels of determinants noted in the soils and the likely limited mobility of determinants, the tMade Ground encountered onsite was unlikely to pose a risk to groundwater, it was concluded that no remediation to soils was required to protect groundwater/controlled waters.

7.5 Re-Evaluated Phase 2 Conceptual Site Model

Following completion of the Phase 2 Site Investigation, the CSM within Section 7.1 of this report was re-evaluated and can be seen overpage. The plausible pollutant linkages remaining after risk assessment are shown and where risk assessment has indicated no unacceptable risk to sensitive receptors, the pollutant linkages have been crossed out.

Tabulated Conceptual Site Model – Pollutant Linkage Summary

Potential On-site Sources	Potential Absorption Pathways	Potential Receptors	Risk Classification
Contaminants introduced on-site by historic use of the site as a nursery and construction activities. - Heavy metals & semi metals (incl. Arsenic, Cadmium, Chromium, Lead etc); - Combustion products (PAH's, benzo(a)pyrene, fluoranthene, dibenz(a,h)anthracene); - Organic compounds (fuel oils, ash, tar); - Asbestos (building material, pipe lagging); - Pesticides and herbicides. The presence of asbestos in soil poses a risk to construction works, service and maintenance workers. An Asbestos Management Strategy should be put in place so that any potentially asbestos containing materials are identified and removed from site in a suitable manner to prevent cross-contamination. An asbestos survey of any buildings on site prior to demolition should be undertaken.	Human Health - Direct ingestion of soil and soil derived dust - Dermal contact of soil and soil derived dust - Ingestion of soil and groundwater with elevated concentration of determinands - Dermal contact with impacted soils and groundwater - Inhalation of impacted dust with elevated concentration of determinands - Inhalation of vapours	Human Health - Construction workers. - Future site residents/visitors. - Neighbours and public.	Low
	Groundwater - Surface water runoff - Anthropogenic (man-made) pathways - Vertical and lateral migration in permeable strata	Groundwater Secondary A Aquifer (Undifferentiated River Terrace Deposits and Lambeth Group) underlying the site.	Low
	Vegetation Direct uptake of impacted water	Vegetation - Vegetation within residential soft landscaping. - Vegetation within Public open space.	Low
Aggressive ground conditions with Made Ground and natural ground; - Sulphates - PAH, TPH Fall into Classes GS-1 and AC-1.	Building Materials and Services Direct contact with aggressive ground conditions	Building Materials and Services - Buried concrete. - Underground services (water supply pipes)	Low
Potential Off-site Sources	Potential Absorption Pathways	Potential Receptors	Risk Classification
Contaminants introduced on-site by historic use of the site as a nursery and construction activities. - Heavy metals & semi metals (incl. Arsenic, Cadmium, Chromium, Lead etc); - Combustion products (PAH's, benzo(a)pyrene, fluoranthene, dibenz(a,h)anthracene); - Organic compounds (fuel oils, ash, tar); - Asbestos (building material, pipe lagging); - Pesticides and herbicides. The presence of asbestos in soil poses a risk to construction works, service and maintenance workers. An Asbestos Management Strategy should be put in place so that any potentially asbestos containing materials are identified and removed from site in a suitable manner to prevent cross-contamination. An asbestos survey of any buildings on site prior to demolition should be undertaken.	Human Health - Direct ingestion of soil and soil derived dust - Dermal contact of soil and soil derived dust - Ingestion of soil and groundwater with elevated concentration of determinands - Dermal contact with impacted soils and groundwater - Inhalation of impacted dust with elevated concentration of determinands - Inhalation of vapours	Human Health - Construction workers. - Future site residents/visitors. - Neighbours and public.	Low
	Groundwater - Surface water runoff - Anthropogenic (man-made) pathways - Vertical and lateral migration in permeable strata	Groundwater Secondary A Aquifer (Undifferentiated River Terrace Deposits and Lambeth Group) underlying the site.	Low
	Vegetation Direct uptake of impacted water	Vegetation - Vegetation within residential soft landscaping. - Vegetation within Public open space.	Low

Based on the results of the intrusive works and chemical analyses undertaken, no remedial measures are likely to be required across the site.

An **Asbestos Management Strategy** should be put in place so that any potentially asbestos containing materials are identified and removed from site in a suitable manner to prevent cross-contamination. An asbestos survey of any buildings on site prior to demolition should be undertaken.

7.7 Discovery Strategy

There may be areas of contamination that have not been identified during the course of the intrusive investigation. For example, there may have been underground storage tanks (UST's) not identified during the Desk Study and/or Ground Investigation for which there is no historical or contemporary evidence.

Such occurrences may be discovered during the demolition and construction phases for the redevelopment of the site.

Groundworkers should be instructed to report to the Site Manager any evidence for such contamination; this may comprise visual indicators, such as fibrous materials within the soil, discolouration, or odours and emission. Upon discovery advice must be taken from a suitably qualified person before proceeding, such that appropriate remedial measures and health and safety protection may be applied.

Should a new source of contamination be suspected or identified then the Local Authority will need to be informed.

7.8 Waste Disposal

The excavation of foundations is likely to produce waste which will require classification and then recycling or removal from site.

Under the Landfill (England and Wales) Regulations 2002 (as amended), prior to disposal all waste must be classified as;

- Inert;
- Non-hazardous, or;
- Hazardous.

The Environment Agency's Hazardous Waste Technical Guidance (WM3) document outlines the methodology for classifying wastes.

Once classified the waste can be removed to the appropriately licensed facilities, with some waste requiring pre-treatments prior to disposal. Any Hazardous waste destined to Landfill will need to be pre-treated prior to disposal.

Asbestos was detected in one of the three samples of the Made Ground tested. No asbestos was found in the remaining two samples analysed.

Asbestos is the name given to a group of naturally occurring minerals which consist of flexible fibres. The most common types of asbestos are Chrysotile (white), Amosite (brown) and Crocidolite (blue). The properties of asbestos, in particular its strength, high thermal and electrical insulation, chemical

resistance and fire resistance made it a very useful building material. However, breathing in asbestos fibres can cause diseases of the respiratory system. Whilst its use has now been banned, there are still many buildings which have asbestos containing materials which were installed before the ban came into effect.

Asbestos is both carcinogenic and toxic. The threshold limit for carcinogenic materials (0.1%) is lower than the threshold for toxic materials (3%). In practice this means that any material containing more than 0.1% asbestos is classed as hazardous waste.

Chrysotile asbestos (0.003%) was identified in one of the three samples of the Made Ground tested. This was below the hazardous waste threshold; therefore, the levels of asbestos noted were **NON-HAZARDOUS**.

Based on a risk phrase analysis of the chemical laboratory test results, in accordance with EC Hazardous Waste Directive and undertaken by Ground and Water Limited, the sample of Made Ground from TPC/0.20m bgl was classified as **HAZARDOUS** due to the concentrations of lead recorded. This sample is unlikely to be representative of the bulk of the Made Ground and further testing of the waste is recommended. The remaining samples of the Made Ground encountered on-site were **NON-HAZARDOUS**. The results of the assessment are given within Appendix H.

It is important to note that whilst we consider our in-house assessment tool to be an accurate interpretation of the requirements of WM3, therefore producing an initial classification in accordance with the guidance, landfill operators have their own assessment tools and can often come to different conclusions. As a result, some landfill operators could refuse to take apparently suitable waste. It is recommended that the receiving landfill views the results of this assessment and the chemical laboratory results to determine their own classification.

Following this initial waste hazard assessment a Full WAC Solid Suite Test with single batch leachate was undertaken on one sample of the Made Ground (TPC/020m bgl) to determine which landfill category the waste conformed to. The results of the WAC test can be seen summarised below and the full results in Appendix D.

Summary of WAC Tests	
Trial Hole	Classification
TPC/0.20m	NOT INERT Waste Landfill due to lead concentrations

7.9 Imported Material

Any soil which is to be imported onto the site must undergo chemical analysis to prove that it is suitable for the purpose for which it is intended.

The Topsoil must be fit for purpose and must either be supplied with traceable chemical laboratory test certificates or be tested, either prior to placing (ideally) or after placing, to ensure that the human receptor cannot come into contact with compounds that could be detrimental to human health. The compounds that are to be tested for are those given in the LQM CIEH Generic Assessment Criteria, which can be viewed in Appendix E of this report.

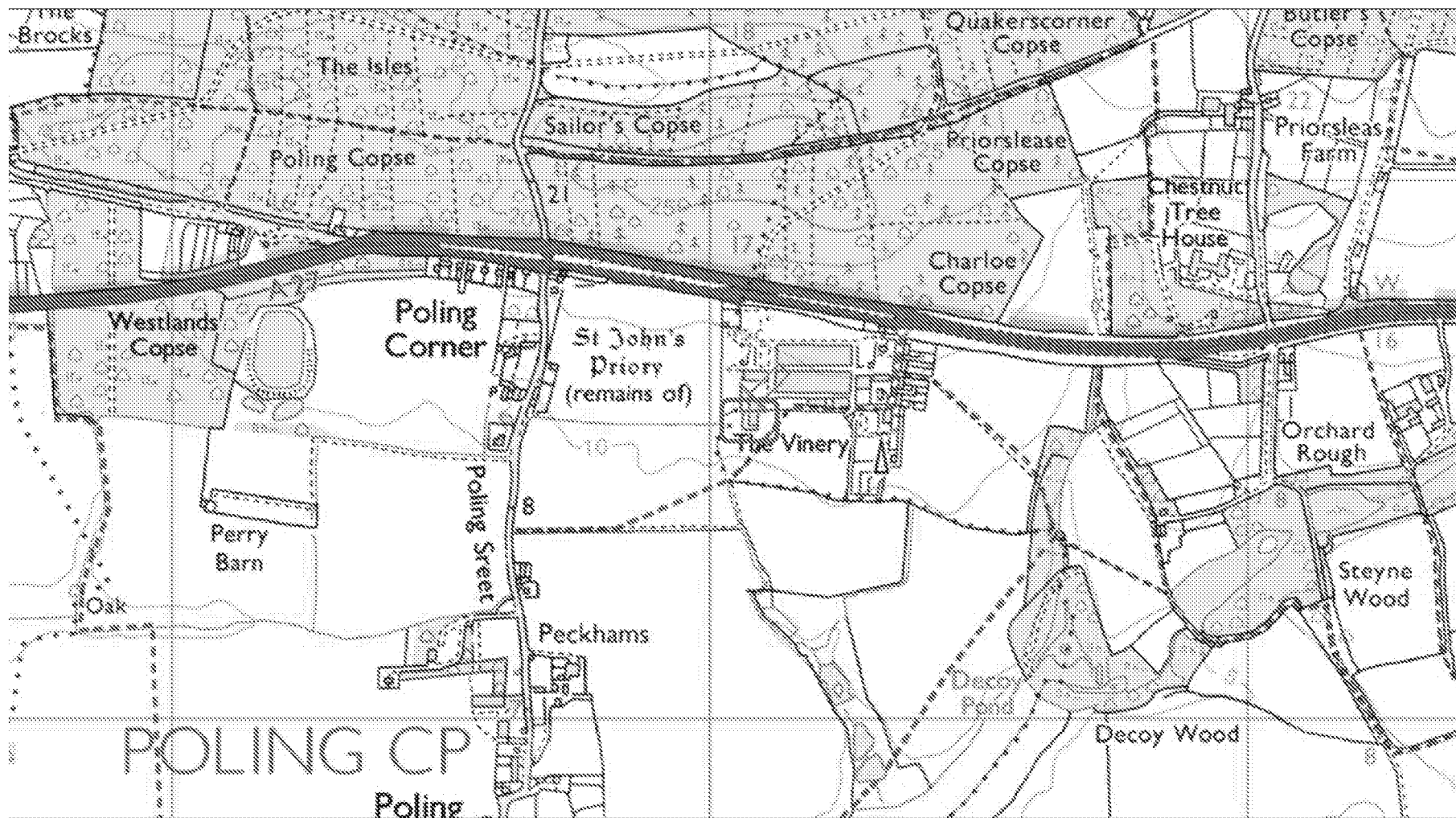
7.10 Duty of Care

Groundworkers must maintain a good standard of personal hygiene including the wearing of overalls, boots, gloves and eye protectors and the use of dust masks during periods of dry weather.

To prevent exposure to airborne dust by both the general public and construction personnel the site should be kept damp during dry weather and at other times when dust were generated as a result of construction activities.

The site should be securely fenced at all times to prevent unauthorised access. Washing facilities should be provided and eating restricted to mess huts.

The presence of Asbestos fibres within the Made Ground will need to be take into account when producing Method Statement for construction and remedial works. Dampening down of excavation is likely to be required along with PP3 marks, gloves and overalls for all site operatives. Perimeter dust monitoring may be required.



APPROXIMATE SITE BOUNDARY

NOT TO SCALE

Project:

The Vinery, Arundel Road, Poling, West Sussex BN18 9PY

Client:

Tributes Limited c/o Paul Airey Planning Associates

Date:

December 2020

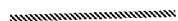
Site Location Plan

Ref:

GWPR3898

Figure 1





APPROXIMATE SITE BOUNDARY

NOT TO SCALE

Project:

The Vinery, Arundel Road, Poling, West Sussex BN18 9PY

Client:

Tributes Limited c/o Paul Airey Planning Associates

Date:

December 2020

Site Development Area

Ref:

GWPR3898

Figure 2





APPROXIMATE SITE BOUNDARY

NOT TO SCALE

Project:

The Vinery, Arundel Road, Poling, West Sussex BN18 9PY

Client:

Tributes Limited c/o Paul Airey Planning Associates

Date:

December 2020

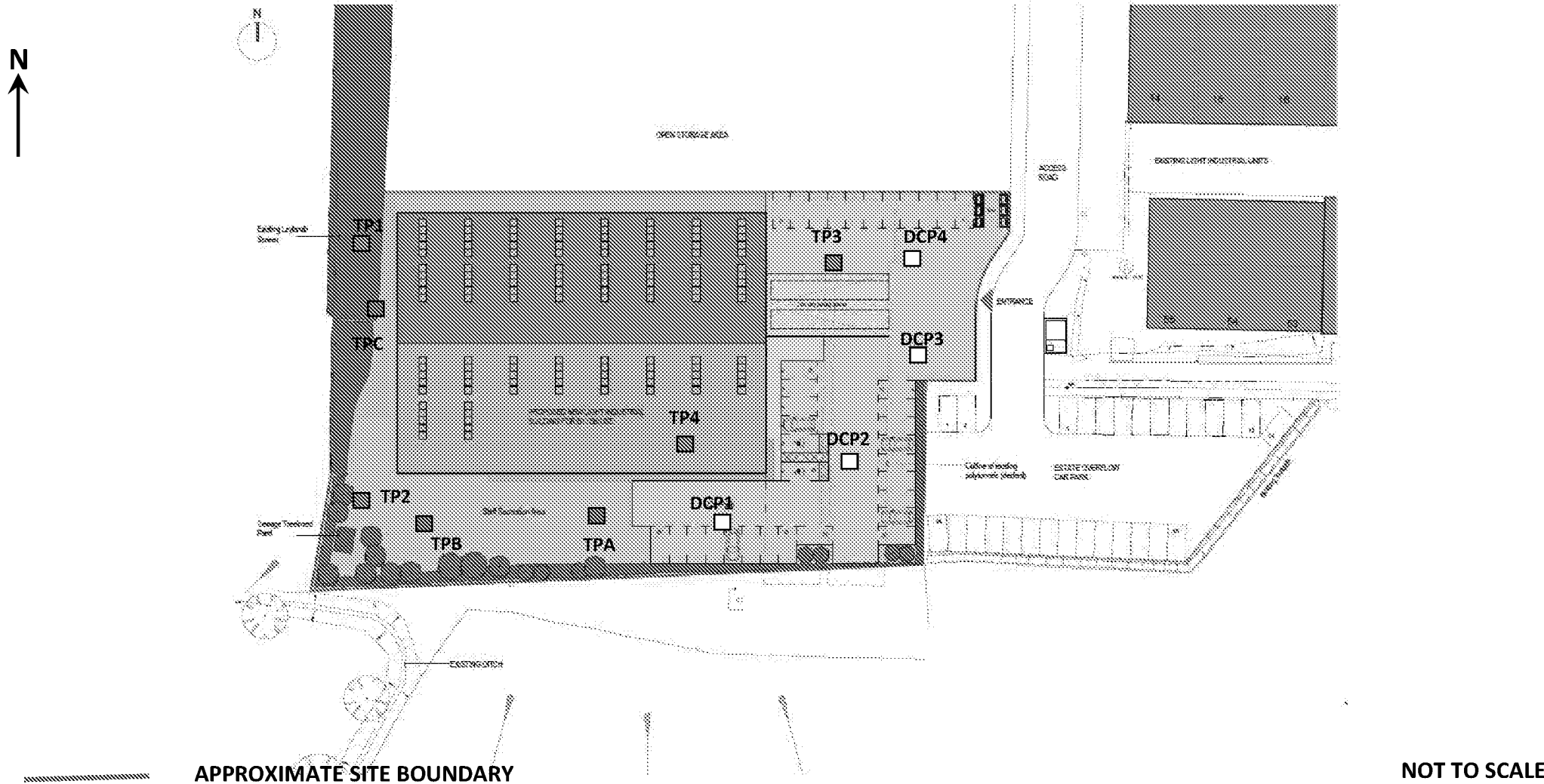
Aerial View of the Site

Ref:

GWPR3898

Figure 3





Project: The Vinery, Arundel Road, Poling, West Sussex BN18 9PY

Client: Tributes Limited c/o Paul Airey Planning Associates

Date: December 2020

Trial Hole Location Plan

Ref: GWPR3898

Figure 5



APPENDIX A

Conditions and Limitations

The ground is a product of continuing natural and artificial processes. As a result, the ground will exhibit a variety of characteristics that vary from place to place across a site, and also with time. Whilst a ground investigation will mitigate to a greater or lesser degree against the resulting risk from variation, the risks cannot be eliminated.

The report has been prepared on the basis of information, data and materials which were available at the time of writing. Accordingly any conclusions, opinions or judgements made in the report should not be regarded as definitive or relied upon to the exclusion of other information, opinions and judgements.

The investigation, interpretations, and recommendations given in this report were prepared for the sole benefit of the client in accordance with their brief; as such these do not necessarily address all aspects of ground behaviour at the site. No liability is accepted for any reliance placed on it by others unless specifically agreed in writing.

Any decisions made by you, or by any organisation, agency or person who has read, received or been provided with information contained in the report ("you" or "the Recipient") are decisions of the Recipient and we will not make, or be deemed to make, any decisions on behalf of any Recipient. We will not be liable for the consequences of any such decisions.

Current regulations and good practice were used in the preparation of this report. An appropriately qualified person must review the recommendations given in this report at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

Any Recipient must take into account any other factors apart from the Report of which they and their experts and advisers are or should be aware. The information, data, conclusions, opinions and judgements set out in the report may relate to certain contexts and may not be suitable in other contexts. It is your responsibility to ensure that you do not use the information we provide in the wrong context.

This report is based on readily available geological records, the recorded physical investigation, the strata observed in the works, together with the results of completed site and laboratory tests. Whilst skill and care has been taken to interpret these conditions likely between or below investigation points, the possibility of other characteristics not revealed cannot be discounted, for which no liability can be accepted. The impact of our assessment on other aspects of the development required evaluation by other involved parties.

The opinions expressed cannot be absolute due to the limitations of time and resources within the context of the agreed brief and the possibility of unrecorded previous in ground activities. The ground conditions have been sampled or monitored in recorded locations and tests for some of the more common chemicals generally expected. Other concentrations of types of chemicals may exist. It was not part of the scope of this report to comment on environment/contaminated land considerations.

The conclusions and recommendations relate to the proposed new buildings at The Vinery, Arundel Road, Poling, West Sussex BN18 9PY.

Trial hole is a generic term used to describe a method of direct investigation. The term trial pit, borehole or window sampler borehole implies the specific technique used to produce a trial hole.

The depth to roots and/or of desiccation may vary from that found during the investigation. The client is responsible for establishing the depth to roots and/or of desiccation on a plot-by-plot basis prior to the construction of foundations. Where trees are mentioned in the text this means existing trees, recently removed trees (approximately 15 years to full recovery on cohesive soils) and those planned as part of the site landscaping.

Ownership of copyright of all printed material including reports, laboratory test results, trial pit and borehole log sheets, including drillers log sheets, remain with Ground and Water Limited. Licence is for the sole use of the client and may not be assigned, transferred or given to a third party.

Only our client may rely on this report and should this report or any information contained in it be provided to any third party we accept no responsibility to the third party for the contents of this report save to the extent expressly outlined by us in writing in a reliance letter addressed from us to the third party.

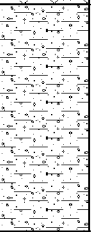
Recipients are not permitted to publish this report outside of their organisation without our express written consent.

APPENDIX B

Fieldwork Logs

Trial Pit Log

Project Name: New Building at the Vinery		Client: Tributes Limited		Date: 25/03/2020	
Location: Arundel Road, Poling, West Sussex BN18 9PY		Contractor:			
Project No. : GWPR3637		Crew Name:		Equipment:	
Location Number TP1	Location Type TP	Level	Logged By RF	Scale 1:25	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	D		0.30			MADE GROUND: Brown and dark brown mottled sandy gravelly CLAY. The sand was fine to coarse grained and the gravel was angular to sub-angular, fine to coarse concrete (60%), brick (20%), flint (10%), chalk (5%) and glass (5%).	1
		0.50	D					AEOLIAN DEPOSITS: Brown and orange brown mottled very silty CLAY.	
		1.00	D						
		1.50	D						
		2.00	D		1.75			UNDIFFERENTIATED RIVER TERRACE DEPOSITS: Orange brown and grey brown mottled gravelly sandy CLAY. The sand was fine to coarse grained and the gravel was angular to sub-rounded, fine to coarse flint.	
		2.50	D		2.50			End of Borehole at 2.500m	2
									3
									4
									5

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks

Remarks	
Groundwater was encountered at 2.50m bgl. Roots were noted to 0.30m bgl.	

Trial Pit Log

Project Name: New Building at the Vinery		Client: Tributes Limited		Date: 25/03/2020	
Location: Arundel Road, Poling, West Sussex BN18 9PY		Contractor:			
Project No. : GWPR3637		Crew Name:		Equipment:	
Location Number TP2	Location Type TP	Level	Logged By RF	Scale 1:25	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	D		0.90			MADE GROUND: Brown and dark brown mottled sandy very gravelly CLAY. The sand was fine to coarse grained and the gravel was angular to sub-angular, fine to coarse brick (50%), concrete (30%), flint (10%), plastic (5%) and glass (5%).	1
		0.50	D						
		1.00	D						
		1.50	D		1.50			MADE GROUND: Brown and dark grey brown mottled sandy gravelly CLAY. The sand was fine to coarse grained and the gravel was angular to sub-angular, fine to coarse brick (30%), plastic (30%), concrete (20%), flint (10%), glass (5%) and carbonaceous material (ash/clinker (5%)).	2
		2.00	D						
		2.50	D		2.70			AEOLIAN DEPOSITS: Brown and orange brown mottled very silty CLAY.	3
								End of Borehole at 2.700m	4
									5

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks

Remarks										
Groundwater was not encountered. Roots were noted to 1.00m bgl.										
COUNCIL A/97/21/DOC										

Trial Pit Log

Project Name: New Building at the Vinery

Client: Tributes Limited

Date: 25/03/2020

Location: Arundel Road, Poling, West Sussex
BN18 9PY

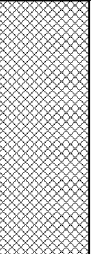
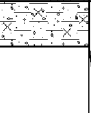
Contractor:

Project No. : GWPR3637

Crew Name:

Equipment:

Location Number TP3	Location Type TP	Level	Logged By RF	Scale 1:25	Page Number Sheet 1 of 1
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Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	D		0.85			MADE GROUND: Brown and dark brown mottled sandy gravelly CLAY. The sand was fine to coarse grained and the gravel was angular to sub-angular, fine to coarse concrete (70%), brick (20%), flint (10%). A band of carbonaceous material (coal/clinker) was noted at 0.80m bgl.	1
		0.50	D						
		1.00	D						
		1.50	D		2.45			AEOLIAN DEPOSITS: Brown and orange brown mottled very silty CLAY.	2
		2.00	D						
		2.50	D						
					2.60			UNDIFFERENTIATED RIVER TERRACE DEPOSITS: Brown and green brown mottled slightly gravelly slightly sandy silty CLAY. The sand was fine to coarse grained and the gravel was angular to sub-rounded, fine to coarse flint.	3
								End of Borehole at 2.600m	

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks

Remarks

Seepage of groundwater was encountered at 1.50m bgl. Roots were noted to 2.40m bgl.



Trial Pit Log

Project Name: New Building at the Vinery		Client: Tributes Limited		Date: 25/03/2020	
Location: Arundel Road, Poling, West Sussex BN18 9PY		Contractor:			
Project No. : GWPR3637		Crew Name:		Equipment:	
Location Number TP4	Location Type TP	Level	Logged By RF	Scale 1:25	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	D		0.45			MADE GROUND: Brown and dark brown mottled sandy gravelly CLAY. The sand was fine to coarse grained and the gravel was angular to sub-angular, fine to coarse flint (70%), concrete (15%0, brick (10%) and carbonaceous material (tarmac) (5%).	1
		0.50	D					AEOLIAN DEPOSITS: Brown and orange brown mottled very silty CLAY.	
		1.00	D						
		1.50	D		1.90 2.00				2
		2.00	D					UNDIFFERENTIATED RIVER TERRACE DEPOSITS: Brown and green brown mottled slightly gravelly slightly sandy silty CLAY. The sand was fine to coarse grained and the gravel was angular to sub-rounded, fine to coarse flint. End of Borehole at 2.000m	
									3
									4
									5

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks

Remarks

Groundwater was not encountered. Roots noted to 1.50m bgl.





Trial Pit Log

Project Name: New Buildings a the Vinery		Client: Tributes Limited		Date: 15/10/2020	
Location: Arundel Road, Poling, West Sussex BN18 9PY		Contractor:			
Project No. : GWPR3898		Crew Name:		Equipment:	
Location Number TPA	Location Type TP	Level	Logged By RF	Scale 1:25	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	D					MADE GROUND: Brown and dark brown mottled sandy gravelly CLAY. The sand was fine to coarse grained and the gravel was angular to sub-angular, fine to coarse concrete (60%), brick (20%), flint (10%), chalk (5%) and glass (5%).	
		0.50	D						
		1.00	D		1.00				1
								End of Borehole at 1.000m	2
									3
									4
									5

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks

Remarks No groundwater encountered. Roots noted to 0.30m bgl.	
---	--



Trial Pit Log

Project Name: New Buildings a the Vinery		Client: Tributes Limited		Date: 15/10/2020	
Location: Arundel Road, Poling, West Sussex BN18 9PY		Contractor:			
Project No. : GWPR3898		Crew Name:		Equipment:	
Location Number TPB	Location Type TP	Level	Logged By RF	Scale 1:25	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	D					MADE GROUND: Brown and dark brown mottled sandy gravelly CLAY. The sand was fine to coarse grained and the gravel was angular to sub-angular, fine to coarse concrete (60%), brick (20%), flint (10%), chalk (5%) and glass (5%).	
		0.50	D						
		1.00	D		1.00				1
								End of Borehole at 1.000m	2
									3
									4
									5

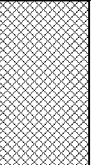
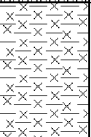
Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks

Remarks No groundwater encountered. Roots noted to 0.30m bgl.	
---	--



Trial Pit Log

Project Name: New Buildings a the Vinery		Client: Tributes Limited		Date: 15/10/2020	
Location: Arundel Road, Poling, West Sussex BN18 9PY		Contractor:			
Project No. : GWPR3898		Crew Name:		Equipment:	
Location Number TPC	Location Type TP	Level	Logged By RF	Scale 1:25	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	D		0.55			MADE GROUND: Brown and dark brown mottled sandy gravelly CLAY. The sand was fine to coarse grained and the gravel was angular to sub-angular, fine to coarse concrete (60%), brick (20%), flint (10%), chalk (5%) and glass (5%).	1
		0.50	D					AROLIAN DEPOSITS: Brown and orange brown mottled very silty CLAY.	
		1.00	D		1.00			End of Borehole at 1.000m	
									2
									3
									4
									5

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks

Remarks	
No groundwater encountered. Roots noted to 0.30m bgl.	

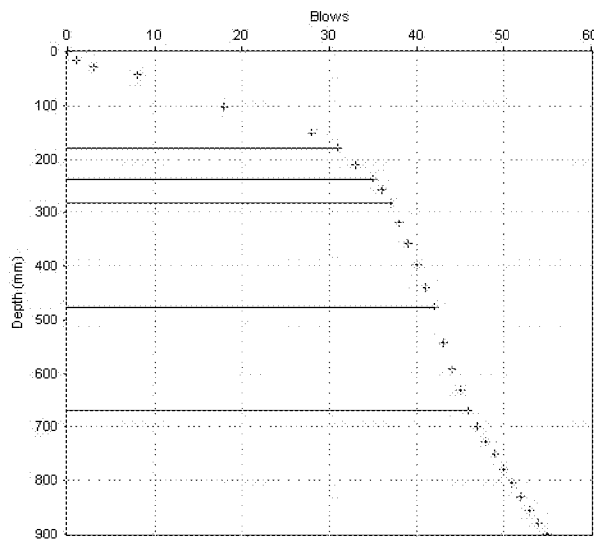
DCP Layer Strength Analysis Report

Project Name: GWPR3637 DCP1

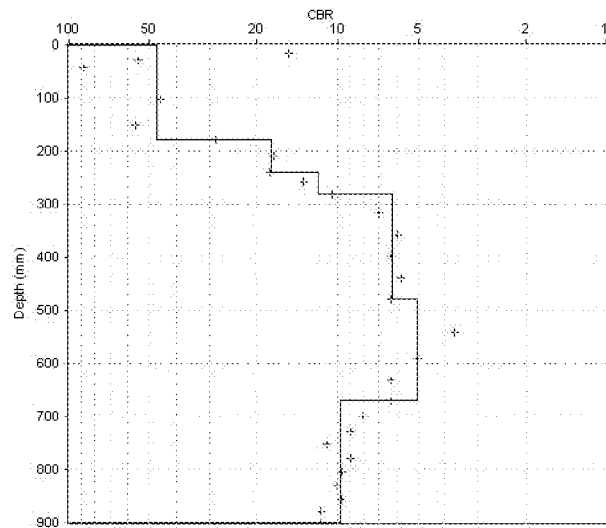
Chainage (km): 0.000
 Direction:
 Location/Offset: Lay-by / other
 Cone Angle: 60 degrees
 Zero Error (mm): 43
 Test Date: 01/04/2020

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Unknown
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 0.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)
1	5.81	47	180	180
2	14.75	18	59	239
3	21.50	12	43	282
4	39.20	6	196	478
5	47.75	5	191	669
6	25.67	10	231	900

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

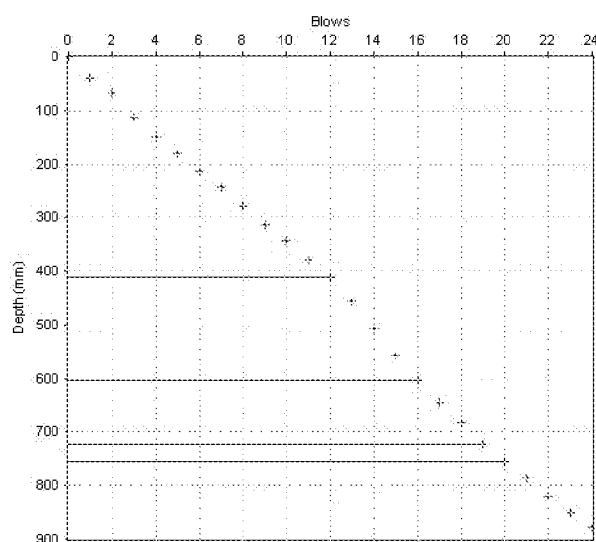
DCP Layer Strength Analysis Report

Project Name: GWPR3637 DCP2

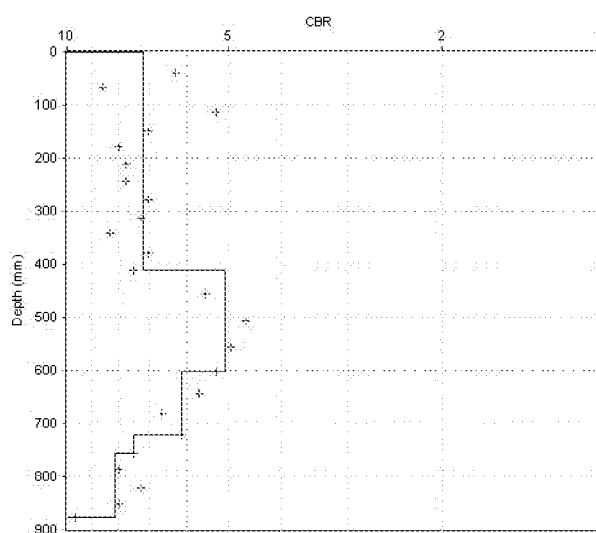
Chainage (km): 0.000
 Direction:
 Location/Offset: Lay-by / other
 Cone Angle: 60 degrees
 Zero Error (mm): 71
 Test Date: 01/04/2020

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Unknown
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 0.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)
1	34.25	7	411	411
2	47.75	5	191	602
3	40.00	6	120	722
4	33.00	7	33	755
5	30.50	8	122	877

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

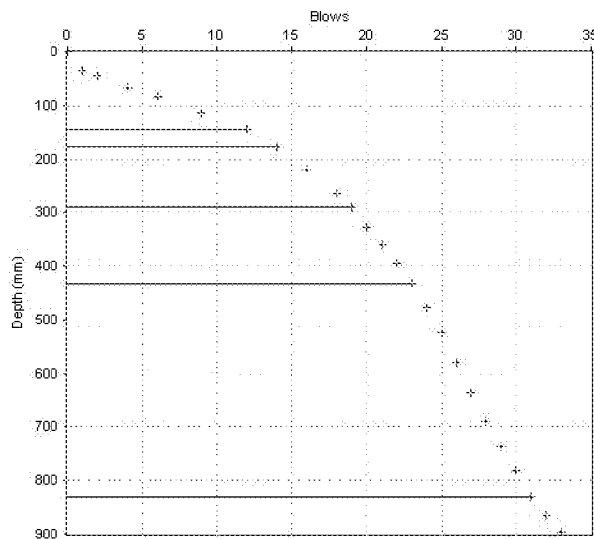
DCP Layer Strength Analysis Report

Project Name: GWPR3637 DCP3

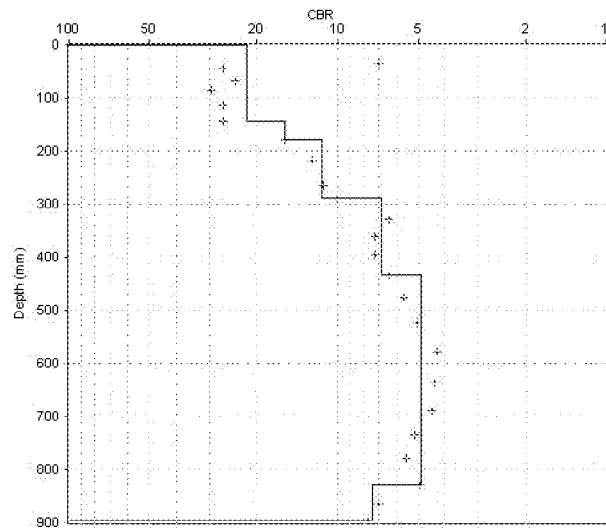
Chainage (km): 0.000
 Direction:
 Location/Offset: Lay-by / other
 Cone Angle: 60 degrees
 Zero Error (mm): 51
 Test Date: 01/04/2020

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Unknown
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 0.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)
1	12.08	22	145	145
2	16.50	16	33	178
3	22.20	11	111	289
4	36.00	7	144	433
5	49.50	5	396	829
6	33.50	7	67	896

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

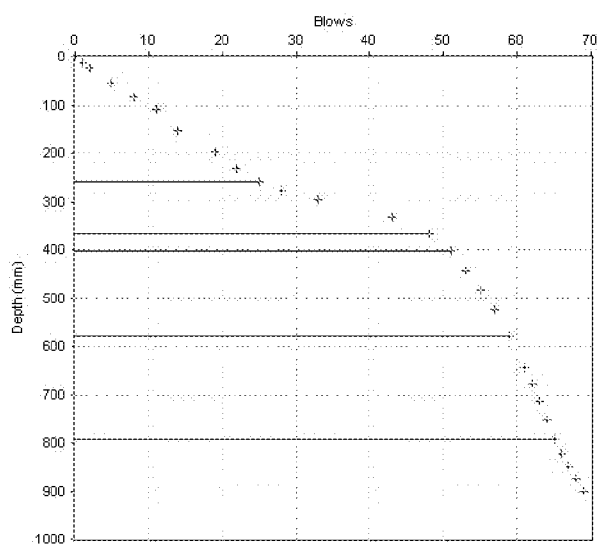
DCP Layer Strength Analysis Report

Project Name: GWPR3637 DCP4

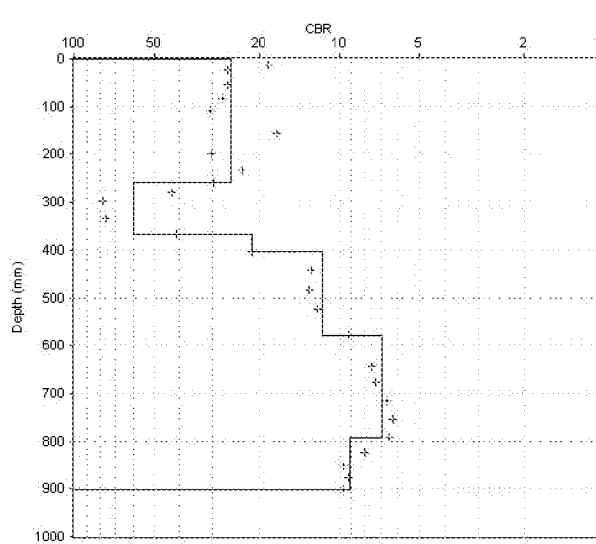
Chainage (km): 0.000
 Direction:
 Location/Offset: Lay-by / other
 Cone Angle: 60 degrees
 Zero Error (mm): 42
 Test Date: 01/04/2020

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Unknown
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 0.000



Layer Boundaries Chart



CBR Chart

Layer Properties

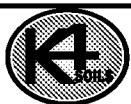
No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)
1	10.36	26	259	259
2	4.65	59	107	366
3	12.33	21	37	403
4	21.88	12	175	578
5	35.67	7	214	792
6	27.50	9	110	902

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

APPENDIX C
Geotechnical Laboratory Test Results



Summary of Natural Moisture Content, Liquid Limit and Plastic Limit Results

Job No. 28147	Project Name New Buildings at the Vinery, Arundel Road, Poling, West Sussex BN18 9PY	Programme	
		Samples received	09/04/2020
Project No. GWPR3637	Client Ground & Water Ltd	Schedule received	09/04/2020
		Project started	09/04/2020
		Testing Started	29/04/2020

Hole No.	Sample				Soil Description	NMC %	Passing 425µm %	LL %	PL %	PI %	Remarks
	Ref	Top m	Base m	Type							
TP1	-	1.00	-	D	Orangish brown mottled bluish grey slightly sandy silty CLAY	25	100	46	20	26	
TP1	-	2.00	-	D	Orangish brown slightly mottled bluish grey slightly gravelly sandy silty CLAY (gravel is fmc and sub-angular)	19	78	34	15	19	
TP2	-	1.50	-	D	Orangish brown slightly mottled grey sandy silty CLAY with rare fine gravel and dark grey stains	23	99	32	19	13	
TP3	-	1.00	-	D	Orangish brown mottled greyish brown slightly gravelly sandy silty CLAY (gravel is fm and sub-angular)	24	97	37	20	17	
TP3	-	2.50	-	D	Orangish brown mottled bluish grey slightly gravelly sandy silty CLAY (gravel is fm and sub-angular)	24	95	33	18	15	
TP4	-	1.50	-	D	Orangish brown mottled greyish brown sandy silty CLAY with rare fine gravel and scattered dark grey stains and traces of fine rootlets	23	97	36	18	18	
TP4	-	2.00	-	D	Orangish brown slightly mottled grey slightly gravelly sandy silty CLAY (gravel is fm and sub-angular to rounded)	20	92	32	17	15	

	Test Methods: BS1377: Part 2: 1990: Natural Moisture Content : clause 3.2 Atterberg Limits: clause 4.3 and 5.0	Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU	Checked and Approved Initials J.P Date: 30/04/2020
2519	Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)		MSF-5-R1(b)

2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

MSF-5-R1(b)

					Sulphate Content (Gravimetric Method) for 2:1 Soil: Water Extract and pH Value - Summary of Results Tested in accordance with BS1377 : Part 3 : 2018, Clause 7.6 & Clause 12				
Job No. 28147		Project Name New Buildings at the Vinery, Arundel Road, Poling, West Sussex BN18 9PY					Programme		
Project No. GWPR3637							Client Ground & Water Ltd		Samples received
							Schedule received	09/04/2020	
							Project started	09/04/2020	
							Testing Started	24/04/2020	
Hole No.	Sample				Soil description	Dry Mass passing 2mm %	SO4 Content mg/l	pH	Remarks
	Ref	Top m	Base m	Type					
TP1	-	1.00	-	D	Orangish brown mottled bluish grey slightly sandy silty CLAY	100	260	7.58	
					Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach 			Checked and Approved Initials J.P Date: 30/04/2020	
2519					Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)			MSF-5-R29	

APPENDIX D
Chemical Laboratory Test Results



Roger Foord
Ground & Water Ltd
2 The Long Barn
Norton Farm
Selborne Road
Alton
Hampshire
GU34 3NB

DETS Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 3JH



DETS Report No: 20-04258

Site Reference: New Buildings at the Vinery, Arundel Road, Poling, West Sussex, BN18 9PY

Project / Job Ref: GWPR3637

Order No: None Supplied

Sample Receipt Date: 07/04/2020

Sample Scheduled Date: 07/04/2020

Report Issue Number: 1

Reporting Date: 15/04/2020

Authorised by:



Dave Ashworth
Technical Manager

Dates of laboratory activities for each tested analyte are available upon request.

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.



DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN



Soil Analysis Certificate						
DETS Report No: 20-04258	Date Sampled	25/03/20	25/03/20			
Ground & Water Ltd	Time Sampled	None Supplied	None Supplied			
Site Reference: New Buildings at the Vinery, Arundel Road, Poling, West Sussex, BN18 9PY	TP / BH No	TP1	TP3			
Project / Job Ref: GWPR3637	Additional Refs	None Supplied	None Supplied			
Order No: None Supplied	Depth (m)	2.50	1.50			
Reporting Date: 15/04/2020	DETS Sample No	472689	472690			

Determinand	Unit	RL	Accreditation					
pH	pH Units	N/a	MCERTS	7.7	7.8			
Total Sulphate as SO ₄	mg/kg	< 200	NONE	< 200	< 200			
Total Sulphate as SO ₄	%	< 0.02	NONE	< 0.02	< 0.02			
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	13	12			
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.01	0.01			
Total Sulphur	%	< 0.02	NONE	< 0.02	< 0.02			
Ammonium as NH ₄	mg/kg	< 0.5	NONE	2.2	0.6			
Ammonium as NH ₄	mg/l	< 0.05	NONE	0.22	0.06			
W/S Chloride (2:1)	mg/kg	< 1	MCERTS	10	12			
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS	5.2	6.1			
Water Soluble Nitrate (2:1) as NO ₃	mg/kg	< 3	MCERTS	4	< 3			
Water Soluble Nitrate (2:1) as NO ₃	mg/l	< 1.5	MCERTS	2.1	< 1.5			
W/S Magnesium	mg/l	< 0.1	NONE	1.7	1.2			

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Samples Descriptions page describes if the test is performed on the dried or as-received portion
 Subcontracted analysis (S)



DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN



Soil Analysis Certificate - Sample Descriptions

DETS Report No: 20-04258

Ground & Water Ltd

Site Reference: New Buildings at the Vinery, Arundel Road, Poling, West Sussex, BN18 9PY

Project / Job Ref: GWPR3637

Order No: None Supplied

Reporting Date: 15/04/2020

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
\$ 472689	TP1	None Supplied	2.50	11.8	Light brown sandy clay
\$ 472690	TP3	None Supplied	1.50	18.2	Light brown clay

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample ^{I/S}

Unsuitable Sample ^{U/S}

\$ samples exceeded recommended holding times



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Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN



Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 20-04258

Ground & Water Ltd

Site Reference: New Buildings at the Vinery, Arundel Road, Poling, West Sussex, BN18 9PY

Project / Job Ref: GWPR3637

Order No: None Supplied

Reporting Date: 15/04/2020

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received



Roger Foord
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DETS Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN

DETS Report No: 20-12417

Site Reference: New Buildings at Vinery, Arundel Road, Poling West Sussex BN18 9PY

Project / Job Ref: GWPR3898

Order No: None Supplied

Sample Receipt Date: 22/10/2020

Sample Scheduled Date: 22/10/2020

Report Issue Number: 1

Reporting Date: 29/10/2020

Authorised by:

Dave Ashworth
Technical Manager

Dates of laboratory activities for each tested analyte are available upon request.

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DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN



Soil Analysis Certificate						
DETS Report No: 20-12417	Date Sampled	14/10/20	14/10/20	14/10/20	14/10/20	
Ground & Water Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: New Buildings at Vinery, Arundel Road, Poling West Sussex BN18 9PY	TP / BH No	TPA	TPB	TPB	TPC	
Project / Job Ref: GWPR3898	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: None Supplied	Depth (m)	0.50	0.20	1.00	0.20	
Reporting Date: 29/10/2020	DETS Sample No	506566	506567	506568	506569	

Determinand	Unit	RL	Accreditation					
Asbestos Screen ⁽⁵⁾	N/a	N/a	ISO17025	Not Detected	Detected	Not Detected	Not Detected	
Sample Matrix ⁽⁵⁾	Material Type	N/a	NONE		Chrysotile Present as bundles			
Asbestos Type ⁽⁵⁾	PLM Result	N/a	ISO17025		Chrysotile			
pH	pH Units	N/a	MCERTS	8.1	7.8	8.0	8.0	
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	37	92	121	29	
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.04	0.09	0.12	0.03	
Organic Matter	%	< 0.1	MCERTS	4.3	2.3	2.9	4.6	
Total Organic Carbon (TOC)	%	< 0.1	MCERTS	2.5	1.4	1.7	2.7	
Arsenic (As)	mg/kg	< 2	MCERTS	16	8	10	12	
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.2	< 0.2	< 0.2	0.4	
Chromium (Cr)	mg/kg	< 2	MCERTS	27	21	27	29	
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	
Copper (Cu)	mg/kg	< 4	MCERTS	36	18	23	36	
Lead (Pb)	mg/kg	< 3	MCERTS	188	148	177	1210	
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	
Nickel (Ni)	mg/kg	< 3	MCERTS	21	11	12	14	
Selenium (Se)	mg/kg	< 2	MCERTS	< 3	< 3	< 3	< 3	
Vanadium (V)	mg/kg	< 1	MCERTS	50	26	33	25	
Zinc (Zn)	mg/kg	< 3	MCERTS	148	73	109	374	
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Samples Descriptions page describes if the test is performed on the dried or as-received portion
 Subcontracted analysis (S)



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Soil Analysis Certificate - Speciated PAHs

DETS Report No: 20-12417	Date Sampled	14/10/20	14/10/20	14/10/20	14/10/20
Ground & Water Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: New Buildings at Vinery, Arundel Road, Poling West Sussex BN18 9PY	TP / BH No	TPA	TPB	TPB	TPC
Project / Job Ref: GWPR3898	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	0.50	0.20	1.00	0.20
Reporting Date: 29/10/2020	DETS Sample No	506566	506567	506568	506569

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	0.25
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	0.27	0.18	< 0.1	< 0.1	0.55
Pyrene	mg/kg	< 0.1	MCERTS	0.27	0.18	0.12	0.12	0.48
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.12	< 0.1	< 0.1	< 0.1	0.35
Chrysene	mg/kg	< 0.1	MCERTS	0.17	< 0.1	< 0.1	< 0.1	0.42
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.19	0.14	0.12	0.12	0.52
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	0.19
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	0.12	< 0.1	< 0.1	< 0.1	0.32
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	0.26
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	0.25
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	< 1.6	< 1.6	3.6



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Soil Analysis Certificate - TPH CWG Banded

DETS Report No: 20-12417	Date Sampled	14/10/20	14/10/20			
Ground & Water Ltd	Time Sampled	None Supplied	None Supplied			
Site Reference: New Buildings at Vinery, Arundel Road, Poling West Sussex BN18 9PY	TP / BH No	TPB	TPC			
Project / Job Ref: GWPR3898	Additional Refs	None Supplied	None Supplied			
Order No: None Supplied	Depth (m)	1.00	0.20			
Reporting Date: 29/10/2020	DETS Sample No	506568	506569			

Determinand	Unit	RL	Accreditation			
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3	< 3	
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	< 10	< 10	
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21	< 21	
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2	< 2	
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	< 10	< 10	
Aromatic (C5 - C35)	mg/kg	< 21	NONE	< 21	< 21	
Total >C5 - C35	mg/kg	< 42	NONE	< 42	< 42	



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Soil Analysis Certificate - BTEX / MTBE

DETS Report No: 20-12417	Date Sampled	14/10/20	14/10/20			
Ground & Water Ltd	Time Sampled	None Supplied	None Supplied			
Site Reference: New Buildings at Vinery, Arundel Road, Poling West Sussex BN18 9PY	TP / BH No	TPB	TPC			
Project / Job Ref: GWPR3898	Additional Refs	None Supplied	None Supplied			
Order No: None Supplied	Depth (m)	1.00	0.20			
Reporting Date: 29/10/2020	DETS Sample No	506568	506569			

Determinand	Unit	RL	Accreditation			
Benzene	ug/kg	< 2	MCERTS	< 2	< 2	
Toluene	ug/kg	< 5	MCERTS	< 5	< 5	
Ethylbenzene	ug/kg	< 2	MCERTS	< 2	< 2	
p & m-xylene	ug/kg	< 2	MCERTS	< 2	< 2	
o-xylene	ug/kg	< 2	MCERTS	< 2	< 2	
MTBE	ug/kg	< 5	MCERTS	< 5	< 5	



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Soil Analysis Certificate - Organochlorine Pesticides						
DETS Report No: 20-12417	Date Sampled	14/10/20	14/10/20			
Ground & Water Ltd	Time Sampled	None Supplied	None Supplied			
Site Reference: New Buildings at Vinery, Arundel Road, Poling West Sussex BN18 9PY	TP / BH No	TPA	TPB			
Project / Job Ref: GWPR3898	Additional Refs	None Supplied	None Supplied			
Order No: None Supplied	Depth (m)	0.50	0.20			
Reporting Date: 29/10/2020	DETS Sample No	506566	506567			

Determinand	Unit	RL	Accreditation				
Aldrin	mg/kg	< 0.02	NONE	< 0.02	< 0.02		
alpha-HCH	mg/kg	< 0.02	NONE	< 0.02	< 0.02		
beta-HCH	mg/kg	< 0.02	NONE	< 0.02	< 0.02		
cis-chlordane	mg/kg	< 0.02	NONE	< 0.02	< 0.02		
delta-HCH	mg/kg	< 0.02	NONE	< 0.02	< 0.02		
Dieldrin	mg/kg	< 0.02	NONE	< 0.02	< 0.02		
Endosulfan A	mg/kg	< 0.02	NONE	< 0.02	< 0.02		
Endosulfan B	mg/kg	< 0.02	NONE	< 0.02	< 0.02		
Endrin	mg/kg	< 0.02	NONE	< 0.02	< 0.02		
gamma-HCH (Lindane)	mg/kg	< 0.02	NONE	< 0.02	< 0.02		
Heptachlor	mg/kg	< 0.02	NONE	< 0.02	< 0.02		
Heptachlor epoxide	mg/kg	< 0.02	NONE	< 0.02	< 0.02		
Hexachlorobenzene (HCB)	mg/kg	< 0.02	NONE	< 0.02	< 0.02		
Isodrin	mg/kg	< 0.02	NONE	< 0.02	< 0.02		
Methoxychlor	mg/kg	< 0.02	NONE	< 0.02	< 0.02		
o,p' - DDD	mg/kg	< 0.02	NONE	< 0.02	< 0.02		
o,p' - DDE	mg/kg	< 0.02	NONE	< 0.02	< 0.02		
o,p' - DDT	mg/kg	< 0.02	NONE	< 0.02	< 0.02		
p,p' - DDD	mg/kg	< 0.02	NONE	< 0.02	< 0.02		
p,p' - DDE	mg/kg	< 0.02	NONE	0.02	0.03		
p,p' - DDT	mg/kg	< 0.02	NONE	< 0.02	< 0.02		
trans-chlordane	mg/kg	< 0.02	NONE	< 0.02	< 0.02		
Trifluralin	mg/kg	< 0.02	NONE	< 0.02	< 0.02		



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Soil Analysis Certificate - Organophosphorus Pesticides						
DETS Report No: 20-12417	Date Sampled	14/10/20	14/10/20			
Ground & Water Ltd	Time Sampled	None Supplied	None Supplied			
Site Reference: New Buildings at Vinery, Arundel Road, Poling West Sussex BN18 9PY	TP / BH No	TPA	TPB			
Project / Job Ref: GWPR3898	Additional Refs	None Supplied	None Supplied			
Order No: None Supplied	Depth (m)	0.50	0.20			
Reporting Date: 29/10/2020	DETS Sample No	506566	506567			

Determinand	Unit	RL	Accreditation					
Azinphos-methyl	mg/kg	< 0.1	NONE	< 0.1	< 0.1			
Chlorfenvinphos, alpha	mg/kg	< 0.1	NONE	< 0.1	< 0.1			
Chlorfenvinphos, beta	mg/kg	< 0.1	NONE	< 0.1	< 0.1			
Chlorpyrifos-methyl	mg/kg	< 0.1	NONE	< 0.1	< 0.1			
Diazinon	mg/kg	< 0.1	NONE	< 0.1	< 0.1			
Dichlorvos	mg/kg	< 0.1	NONE	< 0.1	< 0.1			
Dimethoate	mg/kg	< 0.1	NONE	< 0.1	< 0.1			
Fenitrothion	mg/kg	< 0.1	NONE	< 0.1	< 0.1			
Fenthion	mg/kg	< 0.1	NONE	< 0.1	< 0.1			
Malathion	mg/kg	< 0.1	NONE	< 0.1	< 0.1			
Mevinphos, E	mg/kg	< 0.1	NONE	< 0.1	< 0.1			
Mevinphos, (Z)	mg/kg	< 0.1	NONE	< 0.1	< 0.1			
Parathion-ethyl	mg/kg	< 0.1	NONE	< 0.1	< 0.1			
Parathion-methyl	mg/kg	< 0.1	NONE	< 0.1	< 0.1			
Phorate	mg/kg	< 0.1	NONE	< 0.1	< 0.1			



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Waste Acceptance Criteria Analytical Certificate - BS EN 12457/2

DETS Report No: 20-12417		Date Sampled	14/10/20	Landfill Waste Acceptance Criteria Limits		
Ground & Water Ltd		Time Sampled	None Supplied			
Site Reference: New Buildings at Vinery, Arundel Road, Poling West Sussex BN18 9NY		TP / BH No	TPC			
Project / Job Ref: GWPR3898		Additional Refs	None Supplied			
Order No: None Supplied		Depth (m)	0.20			
Reporting Date: 29/10/2020		DETS Sample No	506569			
Determinand		Unit	MDL			
TOC ^{MU}	%	< 0.1	2.7	Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Loss on Ignition	%	< 0.01	8.20	3%	5%	6%
BTEX ^{MU}	mg/kg	< 0.05	< 0.05	--	--	10%
Sum of PCBs	mg/kg	< 0.1	< 0.1	6	--	--
Mineral Oil ^{MU}	mg/kg	< 10	< 10	1	--	--
Total PAH ^{MU}	mg/kg	< 1.7	3.6	500	--	--
pH ^{MU}	pH Units	N/a	8.0	100	--	--
Acid Neutralisation Capacity	mol/kg (+/-)	< 1	< 1	--	>6	--
				--	To be evaluated	To be evaluated

Eluate Analysis		10:1 mg/l			Cumulative 10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)		
Arsenic ^U		< 0.01			< 0.1	0.5	2	25
Barium ^U		< 0.02			< 0.2	20	100	300
Cadmium ^U		< 0.0005			< 0.005	0.04	1	5
Chromium ^U		< 0.005			< 0.05	0.5	10	70
Copper ^U		0.03			0.3	2	50	100
Mercury ^U		< 0.0005			< 0.005	0.01	0.2	2
Molybdenum ^U		0.003			0.03	0.5	10	30
Nickel ^U		< 0.007			< 0.07	0.4	10	40
Lead ^U		0.094			0.94	3.3	10	50
Antimony ^U		< 0.005			< 0.05	0.06	0.7	5
Selenium ^U		< 0.005			< 0.05	0.1	0.5	7
Zinc ^U		0.070			0.70	4	50	200
Chloride ^U		5.3			53	800	15000	25000
Fluoride ^U		< 0.5			< 5	10	150	500
Sulphate ^U		7.0			70	1000	20000	50000
TDS		83			830	4000	60000	100000
Phenol Index		< 0.01			< 0.1	1	-	-
DOC		19			190	500	800	1000

Leach Test Information								
Sample Mass (kg)		0.10						
Dry Matter (%)		88						
Moisture (%)		13.8						
Stage 1								
Volume Eluate L10 (litres)		0.89						

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Samples Descriptions page describes if the test is performed on the dried or as-received portion
Stated limits are for guidance only and DETS Ltd cannot be held responsible for any discrepancies with current legislation
M Denotes MCERTS accredited test
U Denotes ISO17025 accredited test



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Soil Analysis Certificate - Sample Descriptions	
DETS Report No: 20-12417	
Ground & Water Ltd	
Site Reference: New Buildings at Vinery, Arundel Road, Poling West Sussex BN18 9PY	
Project / Job Ref: GWPR3898	
Order No: None Supplied	
Reporting Date: 29/10/2020	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
506566	TPA	None Supplied	0.50	15.8	Brown loamy sand with stones
506567	TPB	None Supplied	0.20	9.4	Brown sandy clay with stones
506568	TPB	None Supplied	1.00	16.7	Brown loamy sand with stones and brick
506569	TPC	None Supplied	0.20	12	Brown loamy sand with brick and concrete

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample ^{IS}

Unsuitable Sample ^{US}



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Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 20-12417

Ground & Water Ltd

Site Reference: New Buildings at Vinery, Arundel Road, Poling West Sussex BN18 9PY

Project / Job Ref: GWPR3898

Order No: None Supplied

Reporting Date: 29/10/2020

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received

Parameter	Matrix Type	Suite Reference	Expanded Uncertainty Measurement	Unit
TOC	Soil	BS EN 12457	13.49	%
Loss on Ignition	Soil	BS EN 12457	17	%
BTEX	Soil	BS EN 12457	14	%
Sum of PCBs	Soil	BS EN 12457	23	%
Mineral Oil	Soil	BS EN 12457	9	%
Total PAH	Soil	BS EN 12457	20	%
pH	Soil	BS EN 12457	0.399	Units
Acid Neutralisation Capacity	Soil	BS EN 12457	18	%
Arsenic	Leachate	BS EN 12457	16.63	%
Barium	Leachate	BS EN 12457	14.29	%
Cadmium	Leachate	BS EN 12457	14.44	%
Chromium	Leachate	BS EN 12457	18.06	%
Copper	Leachate	BS EN 12457	21.27	%
Mercury	Leachate	BS EN 12457	24.13	%
Molybdenum	Leachate	BS EN 12457	12.55	%
Nickel	Leachate	BS EN 12457	20.08	%
Lead	Leachate	BS EN 12457	13.43	%
Antimony	Leachate	BS EN 12457	18.85	%
Selenium	Leachate	BS EN 12457	18.91	%
Zinc	Leachate	BS EN 12457	13.71	%
Chloride	Leachate	BS EN 12457	16	%
Fluoride	Leachate	BS EN 12457	19.4	%
Sulphate	Leachate	BS EN 12457	19.63	%
TDS	Leachate	BS EN 12457	12	%
Phenol Index	Leachate	BS EN 12457	14	%
DOC	Leachate	BS EN 12457	10	%
Clay Content	Soil	BS 3882: 2015	15	%
Silt Content	Soil	BS 3882: 2015	14	%
Sand Content	Soil	BS 3882: 2015	13	%
Loss on Ignition	Soil	BS 3882: 2015	17	%
pH	Soil	BS 3882: 2015	0.399	Units
Carbonate	Soil	BS 3882: 2015	16	%
Total Nitrogen	Soil	BS 3882: 2015	12	%
Phosphorus (Extractable)	Soil	BS 3882: 2015	24	%
Potassium (Extractable)	Soil	BS 3882: 2015	20	%
Magnesium (Extractable)	Soil	BS 3882: 2015	26	%
Zinc	Soil	BS 3882: 2015	14.9	%
Copper	Soil	BS 3882: 2015	16	%
Nickel	Soil	BS 3882: 2015	17.7	%
Available Sodium	Soil	BS 3882: 2015	23	%
Available Calcium	Soil	BS 3882: 2015	23	%
Electrical Conductivity	Soil	BS 3882: 2015	10	%



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DETS Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 3JH

DETS Report No: 20-13962

Site Reference: New Buildings at Vinery, Arundel Road, Poling West Sussex BN18 9PY

Project / Job Ref: GWPR3898

Order No: GWPR3898

Sample Receipt Date: 22/10/2020

Sample Scheduled Date: 26/11/2020

Report Issue Number: 1

Reporting Date: 03/12/2020

Authorised by:



Dave Ashworth
Technical Manager

Dates of laboratory activities for each tested analyte are available upon request.

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.



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Lenham Heath
Maidstone
Kent ME17 2JN



Soil Analysis Certificate						
DETS Report No: 20-13962	Date Sampled	14/10/20				
Ground & Water Ltd	Time Sampled	None Supplied				
Site Reference: New Buildings at Vinery, Arundel Road, Poling West Sussex BN18 9PY	TP / BH No	TPB				
Project / Job Ref: GWPR3898	Additional Refs	None Supplied				
Order No: GWPR3898	Depth (m)	0.20				
Reporting Date: 03/12/2020	DETS Sample No	512997				

Determinand	Unit	RL	Accreditation				
Asbestos Quantification ^(S)	%	< 0.001	ISO 17025	0.003			

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Samples Descriptions page describes if the test is performed on the dried or as-received portion
Subcontracted analysis (S)



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Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 20-13962

Ground & Water Ltd

Site Reference: New Buildings at Vinery, Arundel Road, Poling West Sussex BN18 9PY

Project / Job Ref: GWPR3898

Order No: GWPR3898

Reporting Date: 03/12/2020

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450°C	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO ₄) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO ₄) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO ₄) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received

APPENDIX E
Soil Assessment Criteria

Appendix E

Soil Guideline Values and General Assessment Criteria

E1 Assessment Criteria

The Contaminated Land Regime reflects the UK Government's stated objectives of achieving sustainable development through the 'suitable for use approach'.

E1.1 Contaminated Land Exposure Assessment Model (CLEA)

Current United Kingdom risk assessment practice is based on the Contaminated Land Exposure Assessment Model (CLEA).

The CLEA Guidance comprises the following documents:

- 1) EA Science Report SC050021/SR2: *Human health toxicological assessment of contaminants in soil.*
- 2) EA Science Report SC050021/SR3: *Updated technical background to the CLEA model.*
- 3) EA CLEA Bulletin (2009).
- 4) CLEA software version 1.06 (2009)
- 5) Toxicological reports and SGV technical notes.

The CLEA guidance and tools:

- *do not cover other types of risk to humans, such as fire, suffocation or explosion, or short-term and acute exposures.*
- *do not cover risks to the environment, such as groundwater, ecosystems or buildings.*
- *do not provide a definitive test for telling when human health risks are significant.*
- *are not a legal requirement in assessing land contamination risks. They are not part of the legal regime for Part 2A of the Environmental Protection Act 1990.*

The CLEA guidance derives soil concentrations of contaminants above which (in the opinion of the EA) there may be a concern that warrants further investigation. It does not provide a definitive test for establishing that the risk is significant.

E1.2 Land-use Scenarios

The CLEA model uses a range of standard land-use scenarios to develop conceptual exposure models as follows:

1 Residential (with home grown produce) (RwHP)

Generic scenario assumes a typical two-storey house built on a ground bearing slab with a private garden having a lawn, flowerbeds and a small fruit and vegetable patch.

- Critical receptor is a young female child (zero to six years old)
- Exposure duration is six years.
- Exposure pathways include direct soil and indoor dust ingestion, consumption of homegrown produce and any adhering soil, skin contact with soils and indoor dust and inhalation of indoor and outdoor dust and vapours.
- Building type is a two-storey small terraced house.

A sub-set of this land-use is residential apartments with communal landscaped gardens where the consumption of home grown vegetables will not occur. (Residential without homegrown produce (RwoHP)).

2) **Allotments**

Provision of open space (about 250sq.m) commonly made available to tenants by the local authority to grow fruit and vegetable for their own consumption. Typically, there are a number of plots to a site which may have a total area of up to 1 hectare. The tenants are assumed to be adults and that young children make occasional accompanied visits.

Although some allotment holders may choose to keep animals including rabbits, hens, and ducks, potential exposure to contaminated meat and eggs is not considered.

- Critical receptor is a young female child (zero to six years old)
- Exposure duration is six years.
- Exposure pathways include direct soil ingestion, consumption of homegrown produce and any adhering soil, skin contact with soils and inhalation of outdoor dust and vapours.
- There is no building.

3) **Commercial/Industrial**

The generic scenario assumes a typical commercial or light industrial property comprising a three-storey building at which employees spend most time indoors and are involved in office-based or relatively light physical work.

- Critical receptor is a working female adult (aged 16 to 65 years old).
- Exposure duration is a working lifetime of 49 years.
- Exposure pathways include direct soil and indoor dust ingestion, skin contact with soils and dusts and inhalation of dust and vapours.
- Building type is a three-storey office (pre 1970).

E1.4 **LQM/CIEH SUITABLE 4 USE LEVELS (S4UL)**

For derivation of these S4UL reference must be made to:

Nathanial, P., McCaffrey, C., Gillet, A., Ogden, R., Nathanial, J.,. *The LQM/CIEH S4UL's for Human Health Risk Assessment*. **Land Quality Press**. 2015

The LQM/CIEH S4UL for a given land use is the concentration of the contaminant in soil at which the predicted daily exposure, as calculated by the CLEA software, equals the Health Criteria Value.

The final output for each contaminant represents a synthesis of new toxicological (and fate and transport) reviews published since the preparation of the 2nd edition LQM/CIEH GAC's (Nathanial et al., 2009).

In the derivation of LQM/CIEH S4UL's the principles of 'minimal' or 'tolerable' risk enshrined in SR2, which has not been withdrawn, has been maintained.

S4UL's have been derived for the basic CLEA land-uses, as described above, and for two new land uses:

- Public Open Spaces near Residential Housing (POSresi)
- Public Park (POSpark).

Public Open Spaces near Residential Housing (POSresi)

Includes the predominantly grassed areas adjacent to high density housing, the central green area on many 1930's – 1970's housing estates, and smaller areas commonly incorporated in newer developments as informal grassed areas or more formal landscaped areas with a mixture of open space and covered soils with planting. It is assumed that the close proximity to the place of residence will allow tracking back of soil to occur.

Public Park (POSpark)

An area of open space, usually owned and maintained by the local authority, provided for recreational uses including family visits and picnics, children's play area, informal sporting activities (not a dedicated sports pitch), and dog walking. It is assumed that tracking back of soils into places of residence will be negligible.

The following LQM/CIEH S4ULs (Copyright Land Quality Management Limited) have been reproduced with permission, to the publication number S4UL3072

E1.5 Category 4 Screening Levels (C4SLs)

In the case of Lead, no SGV or GAC has been published to date. This is likely to be due to the toxicity review that is currently being undertaken by the Environment Agency. In the absence of updated toxicity information the SGV derived using CLEA 1.06 methodology and related toxicity will be used.

The overall objective of the C4SLs research project was to assist the provision of technical guidance in support of Defra's revised Statutory Guidance (SG) for Part 2A of the Environmental Protection Act 1990 (Part 2A) (Defra, 2012a). Specifically, the project aimed to deliver:

- A methodology for deriving C4SLs for four generic land-uses comprising residential, commercial, allotments and public open space; and
- A demonstration of the methodology, via the derivation of C4SLs for six substances – arsenic, benzene, benzo(a)pyrene, cadmium, chromium (VI) and lead.

To help achieve a more targeted approach to identifying and managing contaminated land in relation to the risk (or possibility) of harm to human health, the revised SG presented a new four category system for considering land under Part 2A, ranging from Category 4, where there is no risk that land poses a significant possibility of significant harm (SPOSH), or the level of risk is low, to Category 1, where the risk that land poses a significant possibility of significant harm (SPOSH) is unacceptably high. More specific guidance on what type of land should be considered as Category 4 (Human Health) is provided in Paragraphs 4.21 and 4.22 of the revised SG, as follows:

“4.21 The local authority should consider that the following types of land should be placed into Category 4: Human Health:

(a) Land where no relevant contaminant linkage has been established.

(b) Land where there are only normal levels of contaminants in soil, as explained in Section 3 of this Guidance.

(c) Land that has been excluded from the need for further inspection and assessment because contaminant levels do not exceed relevant generic assessment criteria in accordance with Section 3 of this Guidance, or relevant technical tools or advice that may be developed in accordance with paragraph 3.30 of this Guidance.

(d) Land where estimated levels of exposure to contaminants in soil are likely to form only a small proportion of what a receptor might be exposed to anyway through other sources of environmental exposure (e.g. in relation to average estimated national levels of exposure to substances commonly found in the environment, to which receptors are likely to be exposed in the normal course of their lives).

4.22 The local authority may consider that land other than the types described in paragraph 4.21 should be placed into Category 4: Human Health if following a detailed quantitative risk assessment it is satisfied that the level of risk posed is sufficiently low.”

The C4SLs are intended as “relevant technical tools” (in relation to Paragraph 4.21(c)) to help local authorities and others when deciding to stop further assessment of a site, on the grounds that it falls within Category 4 (Human Health).

The Impact Assessment (IA), which accompanied the revised SG (Defra, 2012b) provides further information on the nature and potential role of the C4SLs. Paragraph 47(h) of the IA states that:

“The new statutory guidance will bring about a situation where the current SGVs/GACs are replaced with more pragmatic (but still strongly precautionary) Category 4 screening levels (C4SLs) which will provide a higher simple test for deciding that land is suitable for use and definitely not contaminated land.”

A key distinction between the Soil Guideline Values (SGVs) and the C4SLs is the level of risk that they describe. As described by the Environment Agency (2009a): *“SGVs are guidelines on the level of long-term human exposure to individual chemicals in soil that, unless stated otherwise, are tolerable or pose a minimal risk to human health.”*

The implication of Paragraph 47(h) of the IA is that minimal risk is well within Category 4 and that the C4SLs should describe a higher level of risk which, whilst not minimal, can still be considered low enough to allow a judgement to be made that land containing substances at, or below, the C4SLs would typically fall within Category 4. This reflects Paragraph 4.20 of the revised SG, which states:

“4.20 The local authority should not assume that land poses a significant possibility of significant harm if it considers that there is no risk or that the level of risk posed is low. For the purposes of this Guidance, such land is referred to as a “Category 4: Human Health” case. The authority may decide that the land is a Category 4: Human Health case as soon as it considers it has evidence to this effect, and this may happen at any stage during risk assessment including the early stages.”

C4SLs, therefore, should not be viewed as “SPOSH levels” and they should not be used as a legal trigger for the determination of land under Part 2A.

The generic screening values referred to before usually take the form of risk-based Soil Guideline Values (SGVs) or other Generic Assessment Criteria (GACs) that are most typically derived using the Environment Agency's Contaminated Land Exposure Assessment (CLEA) model, as described in the Environment Agency's SR2, SR3 and SR7 reports (EA, 2009b & c; EA, 2008). It is anticipated that C4SLs will be used in a similar manner; as generic screening criteria that can be used within a GQRA, albeit describing a higher level of risk than the SGVs.

The suggested approach to the development of C4SLs consists of the retention and use of the CLEA framework, modified according to considerations of the underlying science within the context of Defra's policy objectives relating to the revised SG. Within this context, it is suggested that the development of C4SLs may be achieved in one of three ways, namely:

- By modifying the toxicological parameters used within CLEA (while maintaining current exposure parameters);
- By modifying the exposure parameters embedded within CLEA (while maintaining current toxicological “minimal risk” interpretations); and
- By modifying both toxicological and exposure parameters.

There is also a suggested check on “other considerations” (e.g., background levels, epidemiological data, sources of uncertainty) within the approach, applicable to all three options.

It is suggested that a new term is defined for the toxicological guidance values associated with the derivation of C4SLs – a Low Level of Toxicological Concern (LLTC). A LLTC should represent an intake of low concern that remains suitably protective of health, and definitely does not approach an intake level that could be defined as SPOSH.

E1.6 CL:AIRE Generic Assessment Criteria (GAC)

For derivation of the CL:AIRE Generic Assessment Criteria (GAC) reference should be made to the following report:

CL:AIRE, *The Soil Generic Assessment Criteria for Human Health Risk Assessment. Contaminated Land: Applications in the Real Environment*. 2009.

Within this report CL:AIRE provided Generic Assessment Criteria (GAC's) in accordance with the CLEA software and the principles outlined above for a further 35 contaminants sometime encountered on land affected by contamination.

E1.7 Detailed Quantitative Risk Assessments (DQRA)

Where the adoption of an S4UL/GAC/C4SL is not appropriate, for instance when the intended land-use is at variance the CLEA standard land-uses then a DQRA may be undertaken to develop site specific values for relevant soil contaminants.

- | | |
|---|--|
| ⇒ | Establishing the plausibility that generic exposure pathways exist in practice by measurement and observation. |
| ⇒ | Developing more accurate parameters using site data. |

E1.8 Phytotoxicity

CLEA guidance only addresses human health toxicity; assessment of plant toxicity (phytotoxicity) is based on threshold trigger values obtained from the following source:

- ICRCCL 70/90: *Notes on the restoration and aftercare of metalliferous mining sites for pasture and grazing*.

E1.8 Statistical Tests

DEFRA R&D Publication CLR 7 (DOE 1994) addressed the statistical treatment of test results and their comparison to Soil Guideline Values.

Consideration must be given to the appropriate area of land to be considered termed the critical averaging area.

For a communal open space or commercial land-use, the critical averaging area will depend on the proposed layout. For a residential use with private gardens the averaging area is the individual plot.

It may be appropriate to compare the upper 95th percentile concentration with the Soil Guideline Value, subject to applying a statistical test to establish that the range of concentrations are reasonably consistent and belonging to the same underlying distribution of data.

The DEFRA discussion paper Assessing risks from land contamination – a proportionate approach ('the way forward') (CLAN06/2006) aimed to increase understanding of the role that statistics can play in quantifying the uncertainty attached to the estimates of the mean concentration of contaminants in soil. In direct response CL:AIRE/CIEH published a joint report, *Guidance in comparing soil contamination data with a critical concentration* (CL:AIRE/CIEH 2008). A software implementation of the statistical techniques given in the report was published by ESI International (2008).

Treatment of Hot-Spots

- ⇒ A statistical test is applied to establish whether the data is a part of a single set, or whether data outliers are present.
- ⇒ Provided that the data is based on random sampling and no distinct contamination source was present at the sampling location, the hot-spot(s) may be excluded and the mean of the remaining data assessed.

E2 Ground and Water Limited Soil Assessment Criteria

The Soil Assessment Criteria used in the preparation of this report are tabulated in the following pages:

C4SL Low Level of Toxicological Concern

C4SL Low Level of Toxicological Concern						
Contaminant	RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
Lead	<210	<330	<84	<6000	<760	<1400

Phytotoxicity Recommendations

ICRCL 70/90 *Restoration of metalliferous mining areas*

Phytotoxicity (Harmful to Plants) Threshold Trigger Values	
Copper	250mg/kg
Zinc	1000mg/kg
Notes: Many cultivars and specifically grasses have a high tolerance and there will be no ill-effect at the threshold trigger values given for neutral or near neutral pH. Site observation of plant vitality may give additional guidance.	

Cont'd Overleaf:

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LQM CIEH Suitable 4 Use Levels (S4UL's)

LQM/CIEH Suitable 4 Use Levels – Metals and Semi-metals						
Contaminant	RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
<i>Metals:</i>						
Arsenic	37	40	43	640	79	170
Beryllium	1.7	1.7	35	12	2.2	63
Boron	290	11000	45	240000	21000	46000
Cadmium	11	85	1.9	190	120	532
Chromium (III)	910	910	18000	8600	1500	33000
Chromium (VI)	6	6	1.8	33	7.7	20
Copper	2400	7100	520	68000	12000	44000
Elemental Mercury	1.2	1.2	21	58	16	30
Inorganic Mercury	40	56	19	1100	120	240
Methylmercury	11	15	6	320	40	68
Nickel	130	180	230	980	230	3400
Selenium	250	430	88	12000	1100	1800
Vanadium	410	1200	91	9000	2000	5000
Zinc	3700	40000	620	730000	81000	170000

LQM/CIEH Suitable 4 Use Levels – BTEX Compounds							
Contaminant	Soil Organic Matter	RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
Benzene	1.0% SOM	0.087	0.38	0.017	27	72	90
	2.5% SOM	0.170	0.70	0.034	47	72	100
	6.0% SOM	0.370	1.40	0.075	90	73	110
Toluene	1.0% SOM	130	880	22	56000	56000	87000
	2.5% SOM	290	1900	51	110000	56000	95000
	6.0% SOM	660	3900	120	180000	56000	100000
Ethylbenzene	1.0% SOM	47	83	16	5700	24000	17000
	2.5% SOM	110	190	39	13000	24000	22000
	6.0% SOM	260	440	91	27000	25000	27000
o-Xylene	1.0% SOM	60	88	28	6600	41000	17000
	2.5% SOM	140	210	67	15000	42000	24000
	6.0% SOM	330	480	160	33000	43000	33000
m-Xylene	1.0% SOM	59	82	31	6200	41000	17000
	2.5% SOM	140	190	74	14000	42000	24000
	6.0% SOM	320	450	170	31000	43000	33000
p-Xylene	1.0% SOM	56	79	29	5900	41000	17000
	2.5% SOM	130	180	69	14000	42000	23000
	6.0% SOM	310	430	160	30000	43000	31000
The most health protective value in each scenario for Xylene is highlighted in bold.							

Cont'd Overleaf:

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LQM/CIEH Suitable 4 Use Levels For TPH							
Aliphatic		RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
EC 5-6	1.0% SOM	42	42	730	3,200 (304) ^{sol}	570,000 (304) ^{sol}	95,000 (304) ^{sol}
	2.5% SOM	78	78	1,700	5,900 (558) ^{sol}	590,000	130,000 (558) ^{sol}
	6.0% SOM	160	160	3,900	12,000 (1150) ^{sol}	600,000 ^l	180,000 (1150) ^{sol}
EC >6-8	1.0% SOM	100	100	2,300	7,800 (144) ^{sol}	600,000	150,000 (144) ^{sol}
	2.5% SOM	230	230	5,600	17,000 (322) ^{sol}	610,000	220,000 (322) ^{sol}
	6.0% SOM	530	530	13,000	40,000 (736) ^{sol}	620,000	320,000 (736) ^{sol}
EC >8-10	1.0% SOM	27	27	320	2,000 (78) ^{sol}	13,000	14,000 (78) ^{sol}
	2.5% SOM	65	65	770	4,800 (118) ^{vap}	13,000	18,000 (118) ^{vap}
	6.0% SOM	150	150	1,700	11,000 (451) ^{vap}	13,000	21,000 (451) ^{vap}
EC >10-12	1.0% SOM	130 (48) ^{vap}	130 (48) ^{vap}	2,200	9,700 (48) ^{sol}	13,000	21,000 (48) ^{sol}
	2.5% SOM	330 (118) ^{vap}	330 (118) ^{vap}	4,400	23,000 (118) ^{vap}	13,000	23,000 (118) ^{vap}
	6.0% SOM	760 (283) ^{vap}	770 (283) ^{vap}	7,300	47,000 (283) ^{vap}	13,000	24,000 (283) ^{vap}
EC >12-16	1.0% SOM	1,100 (24) ^{sol}	1,100 (24) ^{sol}	11,000	59,000 (24) ^{sol}	13,000	25,000 (24) ^{sol}
	2.5% SOM	2,400 (59) ^{sol}	2,400 (59) ^{sol}	13,000	82,000 (59) ^{sol}	13,000	25,000 (59) ^{sol}
	6.0% SOM	4,300 (142) ^{sol}	4,400 (142) ^{sol}	13,000	90,000 (142) ^{sol}	13,000	26,000 (142) ^{sol}
EC >16-35	1.0% SOM	65,000 (8.48) ^{sol}	65,000 (8.48) ^{sol}	260,000	1,600,000	250,000	450,000
	2.5% SOM	92,000 (21) ^{sol}	92,000 (21) ^{sol}	270,000	1,700,000	250,000	480,000
	6.0% SOM	110,000	110,000	270,000	1,800,000	250,000	490,000
EC >35-44	1.0% SOM	65,000 (8.48) ^{sol}	65,000 (8.48) ^{sol}	260,000	1,600,000	250,000	450,000
	2.5% SOM	92,000 (21) ^{sol}	92,000 (21) ^{sol}	270,000	1,700,000	250,000	480,000
	6.0% SOM	110,000	110,000	270,000	1,800,000	250,000	490,000

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LQM/CIEH Suitable 4 Use Levels For TPH							
Aromatic		RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
EC 5-7 (Benzene)	1.0% SOM	70	370	13	26,000 (1220) ^{sol}	56,000	76,000 (1220) ^{sol}
	2.5% SOM	140	690	27	46,000 (2260) ^{sol}	56,000	84,000 (2260) ^{sol}
	6.0% SOM	300	1,400	57	86,000 (4710) ^{sol}	56,000	92,000 (4710) ^{sol}
EC >7-8 (Toluene)	1.0% SOM	130	860	22	56,000 (869) ^{vap}	56,000	87,000 (869) ^{sol}
	2.5% SOM	290	1,800	51	110,000 (1920) ^{sol}	56,000	95,000 (1920) ^{sol}
	6.0% SOM	660	3,900	120	180,000 (4360) ^{vap}	56,000	100,000 (4360) ^{vap}
EC >8-10	1.0% SOM	34	47	8.6	3,500 (613) ^{vap}	5,000	7,200 (613) ^{vap}
	2.5% SOM	83	110	21	8,100 (1500) ^{vap}	5,000	8,500 (1500) ^{vap}
	6.0% SOM	190	270	51	17,000 (3850) ^{vap}	5,000	9,300 (3580) ^{vap}
EC >10-12	1.0% SOM	74	250	13	16,000 (364) ^{sol}	5,000	9,200 (364) ^{sol}
	2.5% SOM	180	590	31	28,000 (899) ^{sol}	5,000	9,700 (889) ^{sol}
	6.0% SOM	380	1,200	74	34,000 (2150) ^{sol}	5,000	10,000
EC >12-16	1.0% SOM	140	1,800	23	36,000 (169) ^{sol}	5,100	10,000
	2.5% SOM	330	2,300 (419) ^{sol}	57	37,000	5,100	10,000
	6.0% SOM	660	2,500	130	38,000	5,000	10,000
EC >16-21	1.0% SOM	260	1,900	46	28,000	3,800	7,600
	2.5% SOM	540	1,900	110	28,000	3,800	7,700
	6.0% SOM	930	1,900	260	28,000	3,800	7,800
EC >21-35	1.0% SOM	1,100	1,900	370	28,000	3,800	7,800
	2.5% SOM	1,500	1,900	820	28,000	3,800	7,800
	6.0% SOM	1,700	1,900	1,600	28,000	3,800	7,900
EC >35-44	1.0% SOM	1,100	1,900	370	28,000	3,800	7,800
	2.5% SOM	1,500	1,900	820	28,000	3,800	7,800
	6.0% SOM	1,700	1,900	1,600	28,000	3,800	7,900
EC >44-70	1.0% SOM	1,600	1,900	1,200	28,000	3,800	7,800
	2.5% SOM	1,800	1,900	2,100	28,000	3,800	7,800
	6.0% SOM	1,900	1,900	3,000	28,000	3,800	7,900

SOM = Soil Organic Matter Content (%)

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LQM/CIEH Suitable 4 Use Levels For Polycyclic Aromatic Hydrocarbons (PAH's)							
Determinants		RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
Acenaphthene	1.0% SOM	210	3,000 (57.0) ^{sol}	34	84,000(57.0) ^{sol}	15,000	29,000
	2.5% SOM	510	4,700(141) ^{sol}	85	97,000(141) ^{sol}	15,000	30,000
	6.0% SOM	1100	6,000(336) ^{sol}	200	100,000	15,000	30,000
Acenaphthylene	1.0% SOM	170	2,900(86.1) ^{sol}	28	83,000(86.1) ^{sol}	15,000	29,000
	2.5% SOM	420	4,600(212) ^{sol}	69	97,000(212) ^{sol}	15,000	30,000
	6.0% SOM	920	6,000(506) ^{sol}	160	100,000	15,000	30,000
Anthracene	1.0% SOM	2,400	31,000(1.17) ^{vap}	380	520,000	74,000	150,000
	2.5% SOM	5,400	35,000	950	540,000	74,000	150,000
	6.0% SOM	11,000	37,000	2,200	540,000	74,000	150,000
Benzo(a)anthracene	1.0% SOM	7.20	11	2.90	170	29	49
	2.5% SOM	11	14	6.50	170	29	56
	6.0% SOM	13	15	13	180	29	62
Benzo(a)pyrene	1.0% SOM	2.20	3.20	0.97	35	5.70	11
	2.5% SOM	2.70	3.20	2.00	35	5.70	12
	6.0% SOM	3.00	3.20	3.50	36	5.70	13
Benzo(b)fluoranthene	1.0% SOM	2.60	3.90	0.99	44	7.10	13
	2.5% SOM	3.30	4.00	2.10	44	7.20	15
	6.0% SOM	3.70	4.00	3.90	45	7.20	16
Benzo(ghi)perylene	1.0% SOM	320	360	290	3,900	640	1,400
	2.5% SOM	340	360	470	4,000	640	1,500
	6.0% SOM	350	360	640	4,000	640	1,600
Benzo(k)fluoranthene	1.0% SOM	77	110	37	1,200	190	370
	2.5% SOM	93	110	75	1,200	190	410
	6.0% SOM	100	110	130	1,200	190	440
Chrysene	1.0% SOM	15	30	4.10	350	57	93
	2.5% SOM	22	31	9.40	350	57	110
	6.0% SOM	27	32	19	350	57	120
Dibenzo(ah)anthracene	1.0% SOM	0.24	0.31	0.14	3.50	0.57	1.10
	2.5% SOM	0.28	0.32	0.27	3.60	0.57	1.30
	6.0% SOM	0.30	0.32	0.43	3.60	0.58	1.40

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LQM/CIEH Suitable 4 Use Levels For Polycyclic Aromatic Hydrocarbons (PAH's)							
Determinants		RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
Flouranthene	1.0% SOM	280	1,500	52	2,3000	3,100	6,300
	2.5% SOM	560	1,600	130	2,3000	3,100	6,300
	6.0% SOM	890	1,600	290	2,3000	3,100	6,300
Flourene	1.0% SOM	170	2,800 (30.9) ^{sol}	27	63,000(30.9) ^{sol}	9,900	20,000
	2.5% SOM	400	3,800(76.5) ^{sol}	67	68,000	9,900	20,000
	6.0% SOM	860	4,500(183) ^{sol}	160	71,000	9,900	20,000
Indeno(123-cd)pyrene	1.0% SOM	27	45	9.50	500	82	150
	2.5% SOM	36	46	21	510	82	170
	6.0% SOM	41	46	39	510	82	180
Napthalene	1.0% SOM	2.30	2.6	4.10	190 ^f (76.4) ^{sol}	4,900 ^f	1,200 ^f (76.4) ^{sol}
	2.5% SOM	5.60	5.6	10	460 ^f (183) ^{sol}	4,900 ^f	1,900 ^f (183) ^{sol}
	6.0% SOM	13	13	24	1,100 ^f (432) ^{sol}	4,900 ^f	3,000
Phenanthrene	1.0% SOM	95	1,300(183) ^{sol}	18	22,000	3,100	6,200
	2.5% SOM	220	1,500	38	22,000	3,100	6,200
	6.0% SOM	440	1,500	90	23,000	3,100	6,300
Pyrene	1.0% SOM	620	3,700	110	54,000	7,400	15,000
	2.5% SOM	1200	3,800	270	54,000	7,400	15,000
	6.0% SOM	2000	3,800	620	54,000	7,400	15,000
Coal Tar (Benzo(a)pyrene used as marker compound	1.0% SOM	0.79	1.2	0.32	15	2.20	4.40
	2.5% SOM	0.98	1.2	0.67	15	2.20	4.70
	6.0% SOM	1.10	1.2	1.20	15	2.20	4.80

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

^{sol} – GAC presented exceeds the soil saturation limit, which is presented in brackets.

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LQM/CIEH Suitable 4 Use Levels (cont.)

LQM CIEH General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds						
Contaminant	RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
<i>Chloroalkanes & alkenes</i>						
1,2 Dichloroethane						
1.0% SOM	0.0071	0.0092	0.0046	0.67	29	21
2.5% SOM	0.011	0.013	0.0083	0.97	29	24
6.0% SOM	0.019	0.023	0.016	1.70	29	28
1,1,2,2 Tetrachloroethane						
1.0% SOM	1.60	3.90	0.41	270	1,400	1,800
2.5% SOM	3.40	8.00	0.89	550	1,400	2,100
6.0% SOM	7.50	17	2.00	1,100	1,400	2,300
1,1,1,2 Tetrachloroethane						
1.0% SOM	1.20	1.50	0.79	110	1,400	1,500
2.5% SOM	2.80	3.50	1.90	250	1,400	1,800
6.0% SOM	6.40	8.20	4.40	560	1,400	2,100
Tetrachloroethene						
1.0% SOM	0.18	0.18	0.65	19	1,400	810 ^{sol} (424)
2.5% SOM	0.39	0.40	1.50	42	1,400	1,100 ^{sol} (951)
6.0% SOM	0.90	0.92	3.60	95	1,400	1,500
1,1,1 Trichloroethane						
1.0% SOM	8.80	9.00	48	660	140,000	57,000 ^{vap} (1425)
2.5% SOM	18	18	110	1,300	140,000	76,000 ^{vap} (2915)
6.0% SOM	39	40	240	3,000	140,000	100,000 ^{vap} (6392)
Tetrachloromethene						
1.0% SOM	0.026	0.026	0.45	2.90	890	190
2.5% SOM	0.056	0.056	1.00	6.30	920	270
6.0% SOM	0.130	0.130	2.40	14	950	400
Trichloroethene						
1.0% SOM	0.016	0.017	0.041	1.20	120	70
2.5% SOM	0.034	0.036	0.091	2.60	120	91
6.0% SOM	0.075	0.080	0.210	5.70	120	120
Trichloromethane						
1.0% SOM	0.91	1.20	0.42	99	2,500	2,600
2.5% SOM	1.70	2.10	0.83	170	2,500	2,800
6.0% SOM	3.40	4.20	1.70	350	2,500	3,100
Vinyl Chloride						
1.0% SOM	0.00064	0.00077	0.00055	0.059	3.50	4.80
2.5% SOM	0.00087	0.00100	0.00100	0.077	3.50	5.00
6.0% SOM	0.00014	0.00150	0.00180	0.120	3.50	5.40

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LQM CIEH General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds						
Contaminant	RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
Explosives						
2,4,6 Trinitrotoluene						
1.0% SOM	1.60	65	0.24	1,000	130	260
2.5% SOM	3.70	66	0.58	1,000	130	270
6.0% SOM	8.10	66	1.40	1,000	130	270
RDX (Hexogen/Cyclonite/1,3,5- trinitro-1,3,5- triazacyclohexane)						
1.0% SOM	120	13,000	17	210,000	26,000	49,000(18.7) ^{sol}
2.5% SOM	250	13,000	38	210,000	26,000	51,000
6.0% SOM	540	13,000	85	210,000	27,000	53,000
HMX (Octogen/1,3,5,7- tetrenitro-1,3,5,7- tetrazacyclo-octane)						
1.0% SOM	5.70	67,00	0.86	110,000	13,000	23,000(0.35) ^{vap}
2.5% SOM	13	67,00	1.90	110,000	13,000	23,000(0.39) ^{vap}
6.0% SOM	26	67,00	3.90	110,000	13,000	24,000(0.48) ^{vap}
Atrazine						
1.0% SOM	3.30	610	0.50	9,300	1,200	2,300
2.5% SOM	7.60	620	1.20	9,400	1,200	2,400
6.0% SOM	17.40	620	2.70	9,400	1,200	2,400
Pesticides						
Aldrin						
1.0% SOM	5.70	7.30	3.20	170	18	30
2.5% SOM	6.60	7.40	6.10	170	18	31
6.0% SOM	7.10	7.50	9.60	170	18	31
Dieldrin						
1.0% SOM	0.97	7.00	0.17	170	18	30
2.5% SOM	2.00	7.30	0.41	170	18	30
6.0% SOM	3.50	7.40	0.96	170	18	31
Dichlorvos						
1.0% SOM	0.032	6.40	0.0049	140	16	26
2.5% SOM	0.066	6.50	0.0100	140	16	26
6.0% SOM	0.140	6.60	0.0220	140	16	27
Alpha - Endosulfan						
1.0% SOM	7.40	160(0.003) ^{vap}	1.20	5,600(0.003) ^{vap}	1,200	2,400
2.5% SOM	18	280(0.007) ^{vap}	2.90	7,400(0.007) ^{vap}	1,200	2,400
6.0% SOM	41	410(0.016) ^{vap}	6.80	8,400(0.016) ^{vap}	1,200	2,400

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GROUND AND WATER LIMITED

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LQM CIEH General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds						
Contaminant	RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
Pesticides						
Beta - Endosulfan						
1.0% SOM	7.00	190(0.00007) ^{vap}	1.10	6,300(0.00007) ^{vap}	1,200	2,400
2.5% SOM	17	320(0.0002) ^{vap}	2.70	7,800(0.0002) ^{vap}	1,200	2,400
6.0% SOM	39	440(0.0004) ^{vap}	6.40	8700	1,200	2,500
Alpha - Hexachlorocyclohexanes						
1.0% SOM	0.23	6.90	0.035	170	24	47
2.5% SOM	0.55	9.20	0.087	180	24	48
6.0% SOM	1.20	11	0.210	180	24	48
Beta - Hexachlorocyclohexanes						
1.0% SOM	0.085	3.70	0.013	65	8.10	15
2.5% SOM	0.200	3.80	0.032	65	8.10	15
6.0% SOM	0.460	3.80	0.077	65	8.10	16
Gamma - Hexachlorocyclohexanes						
1.0% SOM	0.06	2.90	0.0092	67	8.2	14
2.5% SOM	0.14	3.30	0.0230	69	8.2	15
6.0% SOM	0.33	3.50	0.0540	70	8.2	15
Chlorobenzenes						
Chlorobenzene						
1.0% SOM	0.46	0.46	5.90	56	11,000	1,300(675) ^{sol}
2.5% SOM	1.00	1.00	14	130	13,000	2,000(1520) ^{sol}
6.0% SOM	2.40	2.40	32	290	14,000	2,900
1,2-Dichlorobenzene						
1.0% SOM	23	24	94	2,000 (571) ^{sol}	90,000	24,000(571) ^{sol}
2.5% SOM	55	57	230	4,800 (1370) ^{sol}	95,000	36,000(1370) ^{sol}
6.0% SOM	130	130	540	11,000 (3240) ^{sol}	98,000	51,000(3240) ^{sol}
1,3-Dichlorobenzene						
1.0% SOM	0.40	0.44	0.25	30	300	390
2.5% SOM	1.00	1.10	0.60	73	300	440
6.0% SOM	2.30	2.50	1.50	170	300	470
1,4-Dichlorobenzene						
1.0% SOM	61	61	15	4,400 (224) ^{vap}	17,000 ^g	36,000 (224) ^{vap}
2.5% SOM	150	150	37	10,000 (540) ^{vap}	17,000 ^g	36,000 (540) ^{vap}
6.0% SOM	350	350	88 ^g	25,000 (1280) ^{vap}	17,000 ^g	36,000 (1280) ^{vap}
1,2,3-Trichlorobenzene						
1.0% SOM	1.50	1.50	4.70	102	1,800	770(134) ^{vap}
2.5% SOM	3.60	3.70	12	250	1,800	1,100(330) ^{vap}
6.0% SOM	8.60	8.80	28	590	1,800	1,600(789) ^{vap}

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**LQM CIEH General Assessment Criteria:
Volatile and Semi-Volatile Organic Compounds**

Contaminant	RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
Chlorobenzenes						
1,2,3,- Trichlorobenzene						
1.0% SOM	1.50	1.50	4.70	102	1,800	770(134) ^{vap}
2.5% SOM	3.60	3.70	12	250	1,800	1,100(330) ^{vap}
6.0% SOM	8.60	8.80	28	590	1,800	1,600(789) ^{vap}
1,2,4,- Trichlorobenzene						
1.0% SOM	2.60	2.60	55	220	15,000	1,700(318) ^{vap}
2.5% SOM	6.40	6.40	140	530	17,000	2,600(786) ^{vap}
6.0% SOM	15	15	320	1,300	19,000	4,000(1880) ^{vap}
1,3,5,- Trichlorobenzene						
1.0% SOM	0.33	0.33	4.70	23	1,700	380(36.7) ^{vap}
2.5% SOM	0.81	0.81	12	55	1,700	590(90.8) ^{vap}
6.0% SOM	1.90	1.90	140	130	1,800	860(217) ^{vap}
1,2,3,4,- Tetrachlorobenzene						
1.0% SOM	15	24	4.40	1,700(122) ^{vap}	830	1,500(122) ^{vap}
2.5% SOM	36	56	11	3,080(304) ^{vap}	830	1,600
6.0% SOM	78	120	26	4,400(728) ^{vap}	830	1,600
1,2,3,5,- Tetrachlorobenzene						
1.0% SOM	0.66	0.75	0.38	49(39.4) ^{vap}	78	110(39) ^{vap}
2.5% SOM	1.60	1.90	0.90	120(98.1) ^{vap}	79	120
6.0% SOM	3.70	4.30	2.20	240(235) ^{vap}	79	130
1,2,4, 5,- Tetrachlorobenzene						
1.0% SOM	0.33	0.73	0.06	42(19.7) ^{sol}	13	25
2.5% SOM	0.77	1.70	0.16	72(49.1) ^{sol}	13	26
6.0% SOM	1.60	3.50	0.37	96	13	26
Pentachlorobenzene						
1.0% SOM	5.80	19	1.20	640(43.0) ^{sol}	100	190
2.5% SOM	12	30	3.10	770(107) ^{sol}	100	190
6.0% SOM	22	38	7.00	830	100	190
Hexachlorobenzene						
1.0% SOM	1.80(0.20) ^{vap}	4.10 (0.20) ^{vap}	0.47	110(0.20) ^{vap}	16	30
2.5% SOM	3.30(0.50) ^{vap}	5.70 (0.50) ^{vap}	1.10	120	16	30
6.0% SOM	4.90	6.70 (1.2) ^{vap}	2.50	120	16	30

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**LQM CIEH General Assessment Criteria:
Volatile and Semi-Volatile Organic Compounds**

Contaminant	RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
Phenols & Chlorophenols						
Phenols						
1.0% SOM	280	750	66	760 ^{dir} (31,000)	760 ^{dir} (11,000)	760 ^{dir} (8,600)
2.5% SOM	550	1,300	140	1,500 ^{dir} (35,000)	1,500 ^{dir} (11,000)	1,500 ^{dir} (9,700)
6.0% SOM	1100	2,300	280	3,200 ^{dir} (37,000)	3,200 ^{dir} (11,000)	3,200 ^{dir} (11,000)
Chlorophenols (4 Congeners)						
1.0% SOM	0.87	94	0.13	3,500	620	1,100
2.5% SOM	2.00	150	0.30	4,000	620	1,100
6.0% SOM	4.50	210	0.70	4,300	620	1,100
Pentachlorophenols						
1.0% SOM	0.22	27(16.4) ^{vap}	0.03	400	60	110
2.5% SOM	0.52	29	0.08	400	60	120
6.0% SOM	1.20	31	0.19	400	60	120
Others						
Carbon Disulphide						
1.0% SOM	0.14	0.14	4.80	11	11,000	1,300
2.5% SOM	0.29	0.29	10	22	11,000	1,900
6.0% SOM	0.62	0.62	23	47	12,000	2,700
Hexachloro-1,3- Butadiene						
1.0% SOM	0.29	0.32	0.25	31	25	48
2.5% SOM	0.70	0.78	0.61	68	25	50
6.0% SOM	1.60	1.80	1.40	120	25	51

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CL:AIRE Soil Generic Assessment Criteria				
Contaminant	Residential (mg/kg)	Residential without plant uptake (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)
<i>Metals:</i>				
Antimony	ND	550	ND	7500
Barium	ND	1300	ND	22000
Molybdenum	ND	670	ND	17000

ND – Not Derived.

NA – Not Applicable

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CL:AIRE General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds				
Contaminant	Residential (mg/kg)	Residential without plant uptake (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)
1,1,2 Trichloroethane				
1.0% SOM	0.60	0.88	0.28	94
2.5% SOM	1.20	1.8	0.61	190
6.0% SOM	2.70	3.9	1.40	400
1,1-Dichloroethane				
1.0% SOM	2.40	2.50	9.20	280
2.5% SOM	3.90	4.10	17	450
6.0% SOM	7.40	7.70	35	850
1,1-Dichloroethene				
1.0% SOM	0.23	0.23	2.80	26
2.5% SOM	0.40	0.41	5.60	46
6.0% SOM	0.82	0.82	12	92
1,2,4-Trimethylbenzene				
1.0% SOM	0.35	0.41	0.38	42
2.5% SOM	0.85	0.99	0.93	99
6.0% SOM	2.00	2.30	2.20	220
1,2-Dichloropropane				
1.0% SOM	0.024	0.024	0.62	3.3
2.5% SOM	0.042	0.042	1.20	5.9
6.0% SOM	0.084	0.085	2.60	12
2,4-Dimethylphenol				
1.0% SOM	19	210	3.10	16000*
2.5% SOM	43	410	7.20	24000*
6.0% SOM	97	730	17	30000*
2,4-Dinitrotoluene				
1.0% SOM	1.50	170*	0.22	3700*
2.5% SOM	3.20	170	0.49	3700*
6.0% SOM	7.20	170	1.10	3800*
2,6-Dinitrotoluene				
1.0% SOM	0.78	78	0.12	1900*
2.5% SOM	1.70	84	0.27	1900*
6.0% SOM	3.90	87	0.61	1900*
2-Chloronaphthalene				
1.0% SOM	3.70	3.80	40	390*
2.5% SOM	9.20	9.30	98	960*
6.0% SOM	22	22	230	2200*

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CL:AIRE General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds				
Contaminant	Residential (mg/kg)	Residential without plant uptake (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)
Biphenyl				
1.0% SOM	66*	220*	14	18000*
2.5% SOM	160	500*	35	33000*
6.0% SOM	360	980*	83	48000*
Bis (2-ethylhexyl) phthalate				
1.0% SOM	280*	2700*	47*	85000*
2.5% SOM	610*	2800*	120*	86000*
6.0% SOM	1100*	2800*	280*	86000*
Bromobenzene				
1.0% SOM	0.87	0.91	3.2	97
2.5% SOM	2.0	2.1	7.6	220
6.0% SOM	4.7	4.9	18	520
Bromodichloromethane				
1.0% SOM	0.016	0.019	0.016	2.1
2.5% SOM	0.030	0.034	0.032	3.7
6.0% SOM	0.061	0.070	0.068	7.6
Bromoform				
1.0% SOM	2.8	5.2	0.95	760
2.5% SOM	5.9	11	2.1	1500
6.0% SOM	13	23	4.6	3100
Butyl benzyl phthalate				
1.0% SOM	1400*	42000*	220*	940000*
2.5% SOM	3300*	44000*	550*	940000*
6.0% SOM	7200*	44000*	1300*	950000*
Chloroethane				
1.0% SOM	8.3	8.4	110	960
2.5% SOM	11	11	200	1300
6.0% SOM	18	18	380	2100
Chloromethane				
1.0% SOM	0.0083	0.0085	0.066	1.0
2.5% SOM	0.0098	0.0099	0.13	1.2
6.0% SOM	0.013	0.013	0.23	1.6
Cis 1,2 Dichloroethene				
1.0% SOM	0.11	0.12	0.26	14
2.5% SOM	0.19	0.20	0.50	24
6.0% SOM	0.37	0.39	1.0	47

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CL:AIRE General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds				
Contaminant	Residential (mg/kg)	Residential without plant uptake (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)
Dichloromethane				
1.0% SOM	0.58	2.10	0.10	270
2.5% SOM	0.98	2.80	0.19	360
6.0% SOM	1.70	4.50	0.34	560
Diethyl Phthalate				
1.0% SOM	120*	1800*	19*	150000*
2.5% SOM	260*	3500*	41*	220000*
6.0% SOM	570*	6300*	94*	290000*
Di-n-butyl phthalate				
1.0% SOM	13*	450*	2.00	15000*
2.5% SOM	31*	450*	5.00	15000*
6.0% SOM	67*	450*	12	15000*
Di-n-octyl phthalate				
1.0% SOM	2300*	3400*	940*	89000*
2.5% SOM	2800*	3400*	2100*	89000*
6.0% SOM	3100*	3400*	3900*	89000*
Hexachloroethane				
1.0% SOM	0.20	0.22	0.27	22*
2.5% SOM	0.48	0.54	0.67	53*
6.0% SOM	1.10	1.30	1.60	120*
Isopropylbenzene				
1.0% SOM	11	12	32	1400*
2.5% SOM	27	28	79	3300*
6.0% SOM	64	67	190	7700*
Methyl tert-butyl ether				
1.0% SOM	49	73	23	7900
2.5% SOM	84	120	44	13000
6.0% SOM	160	220	90	24000
Propylbenzene				
1.0% SOM	34	40	34	4100*
2.5% SOM	82	97	83	9700*
6.0% SOM	190	230	200	21000*
Styrene				
1.0% SOM	8.10	35	1.60	3300*
2.5% SOM	19	78	3.70	6500*
6.0% SOM	43	170	8.70	11000*

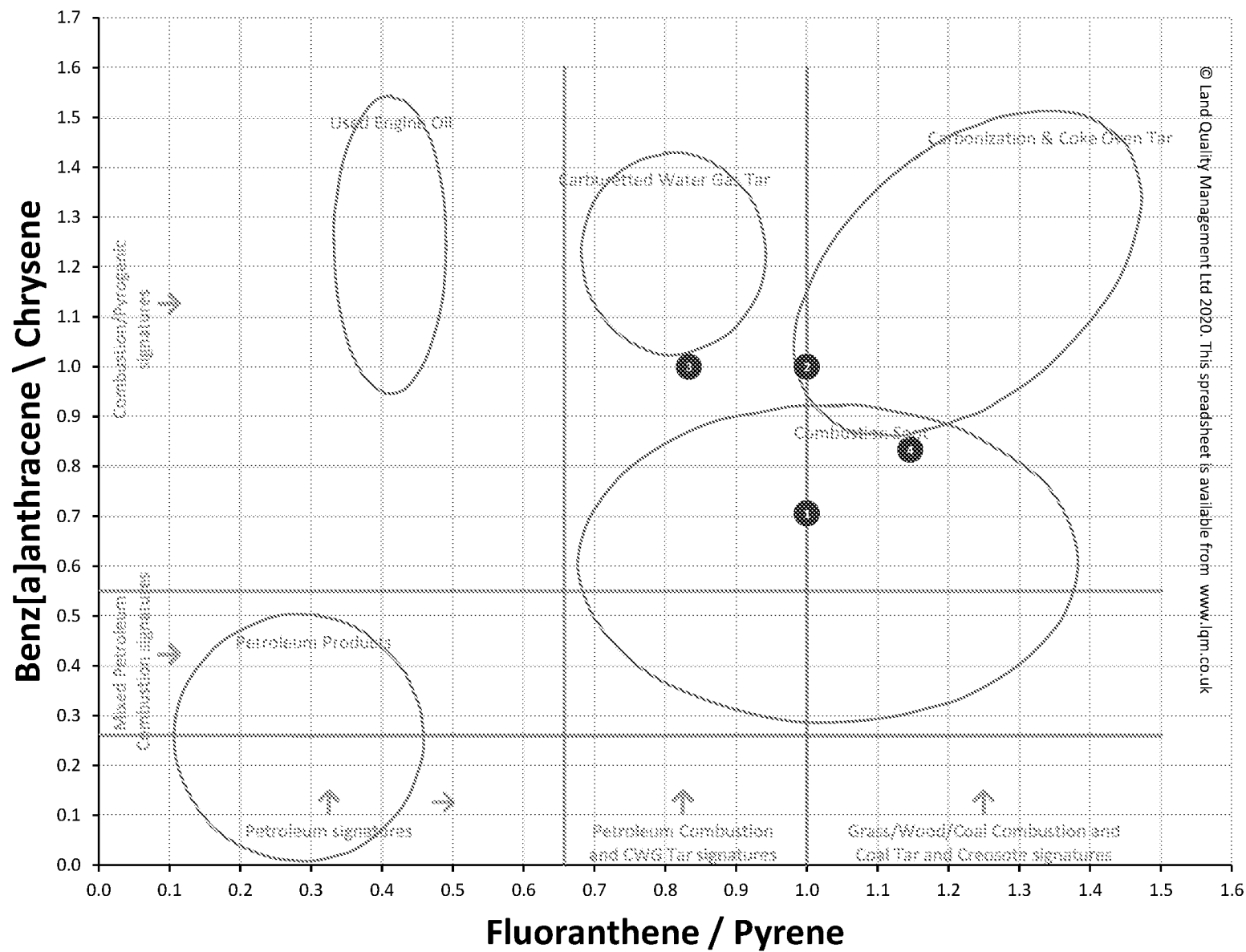
Cont'd Overleaf:

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CL:AIRE General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds				
Contaminant	Residential (mg/kg)	Residential without plant uptake (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)
Total Cresols (2-, 3-, and 4-methylphenol)				
1.0% SOM	80	3700	12	160000
2.5% SOM	180	5400	27	180000*
6.0% SOM	400	6900	63	180000*
Trans 1,2 Dichloroethene				
1.0% SOM	0.19	0.19	0.93	22
2.5% SOM	0.34	0.35	1.90	40
6.0% SOM	0.70	0.71	0.24	81
Tributyl tin oxide				
1.0% SOM	0.25	1.40	0.042	130*
2.5% SOM	0.59	3.10	0.100	180*
6.0% SOM	1.30	5.70	0.240	200*

Notes: *Soil concentration above soil saturation limit

APPENDIX F
PAH Double Ratio Spreadsheets

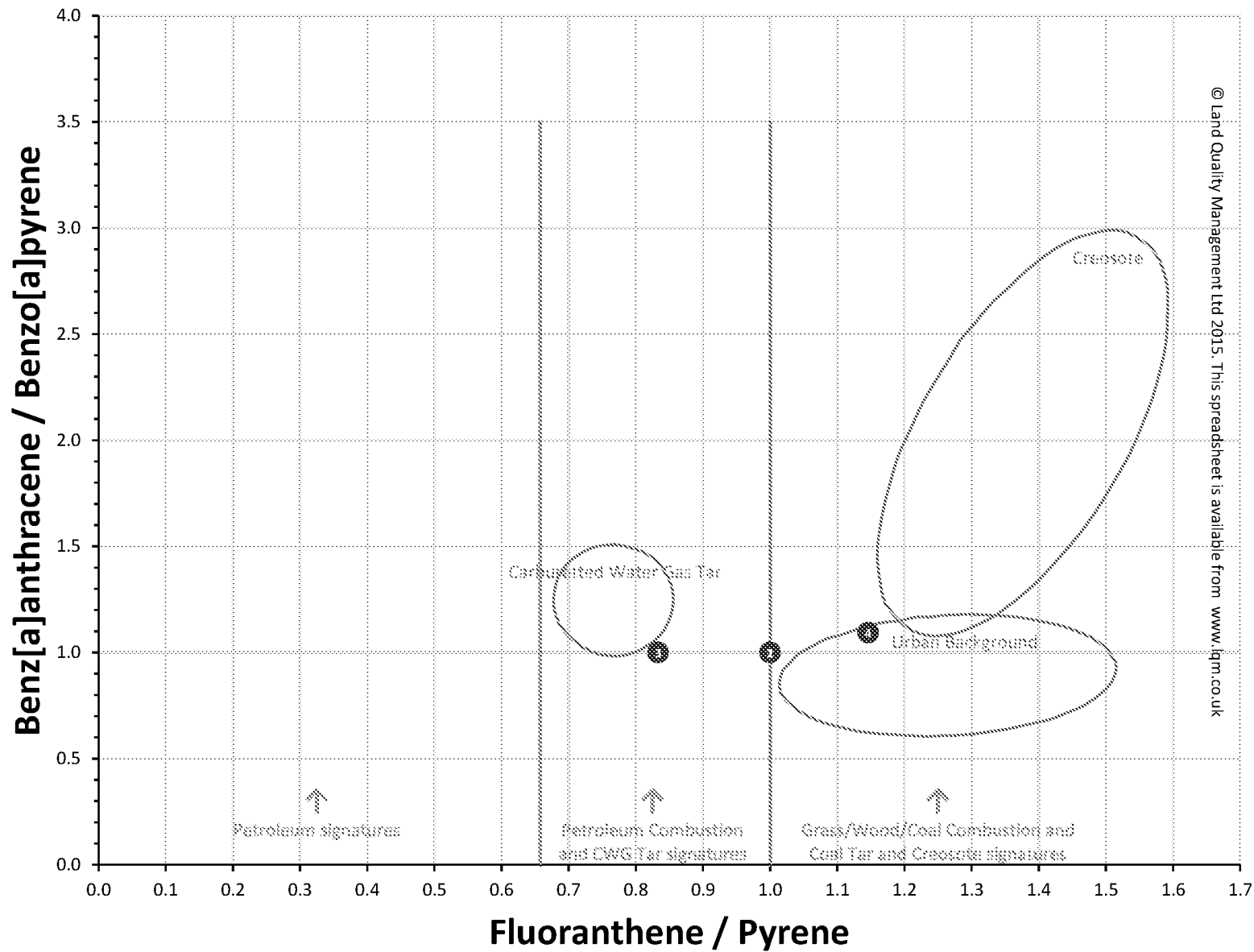


Key:

● Samples collected on site

Based on Figure 6 in Costa & Sauer (2005) with additional details based on a conference presentation by Costa (2005) in San Diego. The potential sources shown are indicative only.

ground
&water

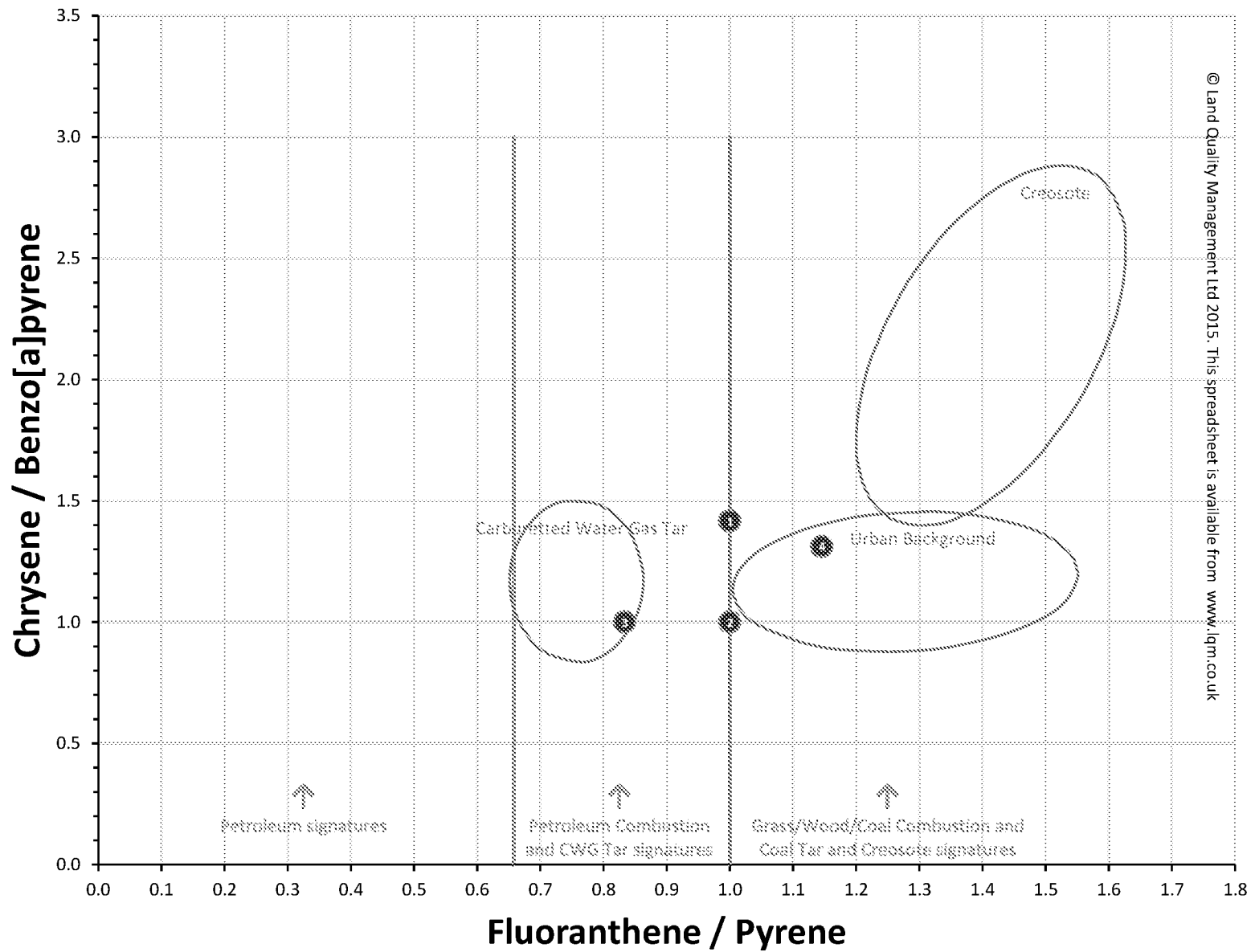


Key:

● Samples collected on site

Based on Figure 7 in Costa & Sauer (2005). The potential sources shown are indicative only.

ground
&water



Based on Figure 8 in Costa & Sauer (2005). The potential sources shown are indicative only.

**ground
&water**

APPENDIX G

Asbestos Risk Assessment

ground&water CIRIA733 Asbestos Risk Assessment									
Site information	Trial Hole Depth (m bgl)	TPB 0.2							
Asbestos Type Considerations	Abestos type	Chrysotile			Amosite			Crocidolite	
	Kasbestos Soil Concentration (Quantification Result in %)	1.3 0.003			1.7			2.0	
Soil Type Considerations	Soil Type	Sand	Sandy Clay	Clay	Sand	Sandy Clay	Clay	Sand	Sandy Clay
	Ksoil	2.9	1.7	0.93	2.9	1.7	0.93	2.9	1.7
	Enter the relevant from the above	1.7							
Constants	Koverall	1.6			1.6			1.6	
	Dust Concentration (mg/m3)	0.1			0.1			0.1	
	Dry Conditions Exposure (hrs)	750			750			750	
	Occupation hours in a year	1920			1920			1920	
Calculation Results	fibre/ml per mg/m3	0.00414							
	fibre/ml	0.000414							
	fibre/ml.hr	0.311							
	fibre/ml.year	0.000162							
Mesothelioma Accumulated Risk	Age (exposure commences)	0			0			0	
	Risk persists for (Years)	60			60			60	
	Cummulative Age Adjustment Factor	16.8			16.8			16.8	
	fibre/ml.year (cumulative)	0.00272							
Lung Cancer Accumulated Risk	Risk persists for (Years)	60			60			60	
	fibre/ml.year (cumulative)	0.00194							

BACKGROUND									
This asbestos risk assessment has been undertaken in accordance with the guidance within CIRIA733. The fibre concentration within the airborne soil dust (in fibres/ml per mg/m3) was calculated based on the results of Addison et al 1988. The airborne concentration of soil dust (0.1mg/m3) was based on ambient urban dust levels and ART modelling. The dry conditions exposure (750hrs) was based upon regional meteorological data suggesting 150hrs of dry conditions per year, when applied over a 5-year segment this equates to 750hours. The occupational hours per year (1920hrs) is based on a 40-hour working week and 48 working weeks in a year. A worst-case exposure scenario has been considered for residents, groundworkers or generally end-users. This was based on the risk persisting for a period of 60 years, accumulated in 5-year increments. As the risk of mesothelioma is age dependent, this considered the exposure commencing at age 0 with the relevant age adjustment factor applied for each 5-year increment. Based on the above considerations, the following equations have been used: $((\text{Kasbestotype} \times \text{Ksoil}) \div \text{Koverall}) \times \text{Soil Concentration} = \text{fibre/ml per mg/m3}$ $\text{Fibre/ml per mg/m3} \times \text{Dust Concentration} = \text{fibre/ml}$ $(\text{f/ml} \times \text{Dry Conditions Exposure (hrs)}) = \text{fibre/ml.hr}$ $\text{Fibre/ml.hr} \div \text{occupational hours per year} = \text{fibre/ml.year}$ Mesothelioma: fibre/ml.year x 16.8 (cumulative age adjustment factor for 60 years) Lung Cancer: fibre/ml.year x 12 (60 years in 5-year increments)									

APPENDIX H

Waste Hazard Assessment

Waste Classification Report



4FCWM-AGR5X-AFHTD

Job name

GWPR3898 The Vinery, Arundel Road, Poling, West Sussex BN18 9PY

Description/Comments

Project

GWPR3898

Site

Related Documents

#	Name	Description
None		

Waste Stream Template

Ground and Water V2 PA

Classified by

Name:	Company:	HazWasteOnline™ Training Record:	
Roger Foord	Ground and Water Brighton	Course	Date
Date:		Hazardous Waste Classification	-
12 Dec 2020 11:17 GMT		Advanced Hazardous Waste Classification	-
Telephone:			

Report

Created by: Roger Foord
Created date: 12 Dec 2020 11:17 GMT

Job summary

#	Sample Name	Depth [m]	Classification Result	Hazard properties	Page
1	GWPR3898 TPA@0.50m	0.5	Non Hazardous		2
2	GWPR3898 TPB@0.20m	0.2	Non Hazardous		4
3	GWPR3898 TPB@1.00m	1	Non Hazardous		6
4	GWPR3898 TPC@0.20m	0.2	Hazardous	HP 7	9

Appendices	Page
Appendix A: Classifier defined and non CLP determinands	12
Appendix B: Rationale for selection of metal species	14
Appendix C: Version	15

Classification of sample: GWPR3898 TPA@0.50m

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

Sample details

Sample Name:	LoW Code:
GWPR3898 TPA@0.50m	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.5 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
15.8%	
(no correction)	

Hazard properties

None identified

Determinands

Moisture content: 15.8% No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
1	✱ pH				8.1	pH		8.1	pH	8.1 pH		
2	✱ cyanides { ✱ salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<2	mg/kg	1.884	<3.768	mg/kg	<0.000377 %		<LOD
	005-007-00-5											
3	✱ arsenic { arsenic trioxide }				16	mg/kg	1.32	21.125	mg/kg	0.00211 %		
	033-005-00-0	215-481-4	1327-53-3									
4	✱ boron { ✱ boron tribromide/trichloride/trifluoride (combined) }				<1	mg/kg	13.43	<13.43	mg/kg	<0.00134 %		<LOD
			10294-33-4, 10294-34-5, 7637-07-2									
5	✱ cadmium { cadmium sulfide }			1	0.2	mg/kg	1.285	0.257	mg/kg	0.00002 %		
	045-010-00-4	215-147-6	1306-23-5									
6	✱ Chromium (III) Sulphate				27	mg/kg		27	mg/kg	0.0027 %		
			10101-53-8									
7	✱ chromium { chromium(VI) oxide }				<2	mg/kg	1.923	<3.846	mg/kg	<0.000385 %		<LOD
	034-001-00-0	215-607-6	1333-82-0									
8	✱ copper { ✱ dicopper oxide; copper (I) oxide }				36	mg/kg	1.126	40.532	mg/kg	0.00405 %		
	029-002-00-X	215-270-7	1317-39-1									
9	✱ lead { ✱ lead compounds with the exception of those specified elsewhere in this Annex (worst case) }			1	188	mg/kg		188	mg/kg	0.0188 %		
	032-001-00-6											
10	✱ mercury { mercury dichloride }				<1	mg/kg	1.353	<1.353	mg/kg	<0.000135 %		<LOD
	060-010-00-X	231-256-6	7487-94-7									
11	✱ nickel { nickel dihydroxide }				21	mg/kg	1.579	33.169	mg/kg	0.00332 %		
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]									

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
12	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<3	mg/kg	1.405	<4.215	mg/kg	<0.000422 %		<LOD
	034-002-00-8											
13	vanadium { divanadium pentaoxide; vanadium pentoxide }				50	mg/kg	1.785	89.259	mg/kg	0.00893 %		
	023-001-00-8	215-239-8	1314-62-1									
14	zinc { zinc oxide }				148	mg/kg	1.245	184.218	mg/kg	0.0184 %		
	030-013-00-7	215-222-5	1314-13-2									
15	phenol				<2	mg/kg		<2	mg/kg	<0.0002 %		<LOD
	004-001-00-2	203-632-7	108-95-2									
16	naphthalene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-052-00-2	202-049-5	91-20-3									
17	acenaphthylene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-917-1	208-96-8									
18	acenaphthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-469-6	93-32-9									
19	fluorene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-695-5	86-73-7									
20	phenanthrene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-581-5	85-01-8									
21	anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		204-371-1	120-12-7									
22	fluoranthene				0.27	mg/kg		0.27	mg/kg	0.000027 %		
		205-912-4	206-44-0									
23	pyrene				0.27	mg/kg		0.27	mg/kg	0.000027 %		
		204-927-5	129-00-0									
24	benzo[a]anthracene				0.12	mg/kg		0.12	mg/kg	0.000012 %		
	001-033-00-9	200-260-6	56-55-3									
25	chrysene				0.17	mg/kg		0.17	mg/kg	0.000017 %		
	001-048-00-0	205-923-4	218-01-9									
26	benzo[b]fluoranthene				0.19	mg/kg		0.19	mg/kg	0.000019 %		
	001-034-00-4	205-911-9	205-99-2									
27	benzo[k]fluoranthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-035-00-5	205-916-6	207-08-9									
28	benzo[a]pyrene; benzo[def]chrysene				0.12	mg/kg		0.12	mg/kg	0.000012 %		
	001-032-00-3	200-028-5	50-32-8									
29	indeno[123-cd]pyrene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-893-2	193-39-5									
30	dibenz[a,h]anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-041-00-2	200-161-8	53-70-3									
31	benzo[ghi]perylene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-663-8	161-24-2									
Total:										0.0614 %		

Key

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

Classification of sample: GWPR3898 TPB@0.20m

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

Sample details

Sample Name: **GWPR3898 TPB@0.20m** LoW Code: Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth: **0.2 m** Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)
Moisture content: **9.4%**
(no correction)

Hazard properties

None identified

Determinands

Moisture content: 9.4% No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
1	⊙ pH				7.8	pH		7.8	pH	7.8 pH		
2	⊙ cyanides { ⊙ salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<2	mg/kg	1.884	<3.768	mg/kg	<0.000377 %		<LOD
3	⊙ arsenic { arsenic trioxide }				8	mg/kg	1.32	10.563	mg/kg	0.00106 %		
4	⊙ boron { ⊙ boron tribromide/trichloride/trifluoride (combined) }				<1	mg/kg	13.43	<13.43	mg/kg	<0.00134 %		<LOD
5	⊙ cadmium { cadmium sulfide }			1	<0.2	mg/kg	1.285	<0.257	mg/kg	<0.00002 %		<LOD
6	⊙ Chromium (III) Sulphate				21	mg/kg		21	mg/kg	0.0021 %		
7	⊙ chromium { chromium(VI) oxide }				<2	mg/kg	1.923	<3.846	mg/kg	<0.000385 %		<LOD
8	⊙ copper { ⊙ dicopper oxide; copper (I) oxide }				18	mg/kg	1.126	20.266	mg/kg	0.00203 %		
9	⊙ lead { ⊙ lead compounds with the exception of those specified elsewhere in this Annex (worst case) }			1	148	mg/kg		148	mg/kg	0.0148 %		
10	⊙ mercury { mercury dichloride }				<1	mg/kg	1.353	<1.353	mg/kg	<0.000135 %		<LOD
11	⊙ nickel { nickel dihydroxide }				11	mg/kg	1.579	17.374	mg/kg	0.00174 %		

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
12	⚠️	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }			<3	mg/kg	1.405	<4.215	mg/kg	<0.000422 %		<LOD
	034-002-00-8											
13	⚠️	vanadium { divanadium pentaoxide; vanadium pentoxide }			26	mg/kg	1.785	46.415	mg/kg	0.00464 %		
	023-001-00-8	215-239-8	1314-62-1									
14	⚠️	zinc { zinc oxide }			73	mg/kg	1.245	90.864	mg/kg	0.00909 %		
	030-013-00-7	215-222-5	1314-13-2									
15	⚠️	phenol			<2	mg/kg		<2	mg/kg	<0.0002 %		<LOD
	004-001-00-2	203-632-7	105-95-2									
16	⚠️	naphthalene			<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-052-00-2	202-049-5	91-20-3									
17	⚠️	acenaphthylene			<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-917-1	208-96-8									
18	⚠️	acenaphthene			<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-469-5	93-32-9									
19	⚠️	fluorene			<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-695-5	86-73-7									
20	⚠️	phenanthrene			<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-581-5	85-01-8									
21	⚠️	anthracene			<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		204-371-1	120-12-7									
22	⚠️	fluoranthene			0.18	mg/kg		0.18	mg/kg	0.000018 %		
		205-912-4	206-44-0									
23	⚠️	pyrene			0.18	mg/kg		0.18	mg/kg	0.000018 %		
		204-927-5	129-00-0									
24	⚠️	benzo[a]anthracene			<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-033-00-9	200-260-6	56-55-3									
25	⚠️	chrysene			<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-048-00-0	205-923-4	218-01-9									
26	⚠️	benzo[b]fluoranthene			0.14	mg/kg		0.14	mg/kg	0.000014 %		
	001-034-00-4	205-911-9	205-99-2									
27	⚠️	benzo[k]fluoranthene			<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-035-00-5	205-916-5	207-08-9									
28	⚠️	benzo[a]pyrene; benzo[def]chrysene			<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-032-00-3	200-028-5	50-32-8									
29	⚠️	indeno[123-cd]pyrene			<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-893-2	193-39-5									
30	⚠️	dibenz[a,h]anthracene			<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-041-00-2	200-161-8	53-70-3									
31	⚠️	benzo[ghi]perylene			<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-653-8	161-24-2									
Total:										0.0385 %		

Key

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

Classification of sample: GWPR3898 TPB@1.00m

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

Sample details

Sample Name:	LoW Code:
GWPR3898 TPB@1.00m	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
1 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
16.7%	
(no correction)	

Hazard properties

None identified

Determinands

Moisture content: 16.7% No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
1	✱ pH				8	pH		8	pH	8pH		
2	✱ cyanides { ✱ salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<2	mg/kg	1.884	<3.768	mg/kg	<0.000377 %		<LOD
	005-007-00-5											
3	✱ arsenic { arsenic trioxide }				10	mg/kg	1.32	13.203	mg/kg	0.00132 %		
	033-005-00-0	215-481-4	1327-53-3									
4	✱ boron { ✱ boron tribromide/trichloride/trifluoride (combined) }				<1	mg/kg	13.43	<13.43	mg/kg	<0.00134 %		<LOD
			10294-33-4, 10294-34-5, 7637-07-2									
5	✱ cadmium { cadmium sulfide }			1	<0.2	mg/kg	1.285	<0.257	mg/kg	<0.00002 %		<LOD
	045-010-00-4	215-147-6	1306-23-5									
6	✱ Chromium (III) Sulphate				27	mg/kg		27	mg/kg	0.0027 %		
			10101-53-8									
7	✱ chromium { chromium(VI) oxide }				<2	mg/kg	1.923	<3.846	mg/kg	<0.000385 %		<LOD
	034-001-00-0	215-607-6	1333-82-0									
8	✱ copper { ✱ dicopper oxide; copper (I) oxide }				23	mg/kg	1.126	25.895	mg/kg	0.00259 %		
	029-002-00-X	215-270-7	1317-39-1									
9	✱ lead { ✱ lead compounds with the exception of those specified elsewhere in this Annex (worst case) }			1	177	mg/kg		177	mg/kg	0.0177 %		
	032-001-00-6											
10	✱ mercury { mercury dichloride }				<1	mg/kg	1.353	<1.353	mg/kg	<0.000135 %		<LOD
	060-010-00-X	231-259-8	7487-94-7									
11	✱ nickel { nickel dihydroxide }				12	mg/kg	1.579	18.954	mg/kg	0.0019 %		
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]									

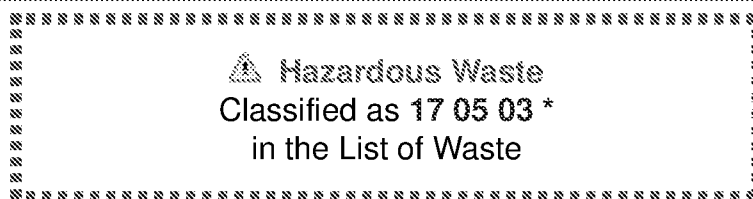
#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
12	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<3	mg/kg	1.405	<4.215	mg/kg	<0.000422 %		<LOD
	034-002-00-8											
13	vanadium { divanadium pentaoxide; vanadium pentoxide }				33	mg/kg	1.785	58.911	mg/kg	0.00589 %		
	023-001-00-8	215-239-8	1314-62-1									
14	zinc { zinc oxide }				109	mg/kg	1.245	135.674	mg/kg	0.0136 %		
	030-013-00-7	215-222-5	1314-13-2									
15	phenol				<2	mg/kg		<2	mg/kg	<0.0002 %		<LOD
	004-001-00-2	203-632-7	108-95-2									
16	naphthalene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-052-00-2	202-049-5	91-20-3									
17	acenaphthylene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-917-1	208-98-8									
18	acenaphthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-469-5	93-32-9									
19	fluorene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-695-5	86-73-7									
20	phenanthrene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-581-5	85-01-8									
21	anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		204-371-1	120-12-7									
22	fluoranthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-912-4	206-44-0									
23	pyrene				0.12	mg/kg		0.12	mg/kg	0.000012 %		
		204-927-5	129-00-0									
24	benzo[a]anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-033-00-9	200-280-6	56-55-3									
25	chrysene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-048-00-0	205-923-4	218-01-9									
26	benzo[b]fluoranthene				0.12	mg/kg		0.12	mg/kg	0.000012 %		
	001-094-00-4	205-911-9	205-99-2									
27	benzo[k]fluoranthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-036-00-5	205-916-6	207-08-9									
28	benzo[a]pyrene; benzo[def]chrysene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-032-00-3	200-028-5	50-32-8									
29	indeno[123-cd]pyrene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-893-2	193-39-5									
30	dibenz[a,h]anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-041-00-2	200-161-8	53-70-3									
31	benzo[ghi]perylene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-663-8	181-24-2									
32	benzene				<0.002	mg/kg		<0.002	mg/kg	<0.0000002 %		<LOD
	001-020-00-8	200-753-7	71-43-2									
33	toluene				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
	001-021-00-3	203-625-9	108-88-3									
34	ethylbenzene				<0.002	mg/kg		<0.002	mg/kg	<0.0000002 %		<LOD
	001-023-00-4	202-849-4	100-41-4									
35	xylene				<0.002	mg/kg		<0.002	mg/kg	<0.0000002 %		<LOD
	001-022-00-9	202-422-2 [1]	95-47-6 [1]									
		203-396-5 [2]	106-42-3 [2]									
		203-576-3 [3]	108-38-3 [3]									
		215-535-7 [4]	1330-20-7 [4]									
36	o-xylene; [1] p-xylene; [2] m-xylene; [3] xylene [4]				<0.002	mg/kg		<0.002	mg/kg	<0.0000002 %		<LOD
	001-022-00-9	202-422-2 [1]	95-47-6 [1]									
		203-396-5 [2]	106-42-3 [2]									
		203-576-3 [3]	108-38-3 [3]									
		215-535-7 [4]	1330-20-7 [4]									
37	diesel petroleum group				<3	mg/kg		<3	mg/kg	<0.0003 %		<LOD
			66334-30-5, 68476-34-6,									

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number							
			94114-59-7, 1159170-26-9							
38	*	TPH (C6 to C40) petroleum group			<42 mg/kg		<42 mg/kg	<0.0042 %		<LOD
			TPH							
Total:								0.0532 %		

Key

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

Classification of sample: GWPR3898 TPC@0.20m



Sample details

Sample Name:	LoW Code:
GWPR3898 TPC@0.20m	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.2 m	Entry:
Moisture content:	17 05 03 * (Soil and stones containing hazardous substances)
12%	
(no correction)	

Hazard properties

HP 7: Carcinogenic "waste which induces cancer or increases its incidence"

Hazard Statements hit:

Carc. 1A; H350 "May cause cancer [state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard]."

Because of determinand:

lead compounds with the exception of those specified elsewhere in this Annex (worst case): (Note 1 conc.: 0.121%)

Determinands

Moisture content: 12% No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
1	* pH				8	pH		8	pH	8pH		
2	cyanides { * salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<2	mg/kg	1.884	<3.768	mg/kg	<0.000377 %		<LOD
	008-007-00-5											
3	arsenic { arsenic trioxide }				12	mg/kg	1.32	15.844	mg/kg	0.00158 %		
	003-003-00-0	215-481-4	1327-53-0									
4	boron { * boron tribromide/trichloride/trifluoride (combined) }				<1	mg/kg	13.43	<13.43	mg/kg	<0.00134 %		<LOD
			10294-33-4, 10294-34-5, 7637-07-2									
5	cadmium { cadmium sulfide }			1	0.4	mg/kg	1.285	0.514	mg/kg	0.00004 %		
	048-010-00-4	215-147-8	1306-23-6									
6	Chromium (III) Sulphate				29	mg/kg		29	mg/kg	0.0029 %		
			10101-53-8									
7	chromium { chromium(VI) oxide }				<2	mg/kg	1.923	<3.846	mg/kg	<0.000385 %		<LOD
	024-001-00-0	215-607-8	1333-82-0									
8	copper { * dicopper oxide; copper (I) oxide }				36	mg/kg	1.126	40.532	mg/kg	0.00405 %		
	029-002-00-X	215-270-7	1317-39-1									
9	lead { * lead compounds with the exception of those specified elsewhere in this Annex (worst case) }			1	1210	mg/kg		1210	mg/kg	0.121 %		
	002-001-00-6											

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
10	mercury { mercury dichloride }				<1	mg/kg	1.353	<1.353	mg/kg	<0.000135 %		<LOD
	030-010-00-X	231-299-8	7487-94-7									
11	nickel { nickel dihydroxide }				14	mg/kg	1.579	22.113	mg/kg	0.00221 %		
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]									
12	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<3	mg/kg	1.405	<4.215	mg/kg	<0.000422 %		<LOD
	034-002-00-8											
13	vanadium { divanadium pentaoxide; vanadium pentoxide }				25	mg/kg	1.785	44.63	mg/kg	0.00446 %		
	023-001-00-8	215-239-8	1314-62-1									
14	zinc { zinc oxide }				374	mg/kg	1.245	465.523	mg/kg	0.0466 %		
	030-013-00-7	215-222-5	1314-13-2									
15	phenol				<2	mg/kg		<2	mg/kg	<0.0002 %		<LOD
	004-001-00-2	203-632-7	108-95-2									
16	naphthalene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-052-00-2	202-040-5	91-20-3									
17	acenaphthylene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-917-1	208-96-8									
18	acenaphthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-459-5	83-32-9									
19	fluorene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-695-5	86-73-7									
20	phenanthrene				0.25	mg/kg		0.25	mg/kg	0.000025 %		
		201-581-5	85-01-8									
21	anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		204-371-1	120-12-7									
22	fluoranthene				0.55	mg/kg		0.55	mg/kg	0.000055 %		
		205-912-4	206-44-0									
23	pyrene				0.48	mg/kg		0.48	mg/kg	0.000048 %		
		204-927-3	129-00-0									
24	benzo[a]anthracene				0.35	mg/kg		0.35	mg/kg	0.000035 %		
	001-033-00-9	200-230-6	56-55-3									
25	chrysene				0.42	mg/kg		0.42	mg/kg	0.000042 %		
	001-048-00-0	205-923-4	218-01-9									
26	benzo[b]fluoranthene				0.52	mg/kg		0.52	mg/kg	0.000052 %		
	001-034-00-4	205-911-9	206-89-2									
27	benzo[k]fluoranthene				0.19	mg/kg		0.19	mg/kg	0.000019 %		
	001-036-00-5	205-916-6	207-08-9									
28	benzo[a]pyrene; benzo[def]chrysene				0.32	mg/kg		0.32	mg/kg	0.000032 %		
	001-032-00-3	200-028-5	50-32-8									
29	indeno[123-cd]pyrene				0.26	mg/kg		0.26	mg/kg	0.000026 %		
		205-593-2	193-39-5									
30	dibenz[a,h]anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	001-041-00-2	200-181-8	53-70-3									
31	benzo[ghi]perylene				0.25	mg/kg		0.25	mg/kg	0.000025 %		
		205-880-6	191-24-2									
32	benzene				<0.002	mg/kg		<0.002	mg/kg	<0.0000002 %		<LOD
	001-020-00-8	200-753-7	71-43-2									
33	toluene				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
	001-021-00-3	203-625-9	108-88-3									
34	ethylbenzene				<0.002	mg/kg		<0.002	mg/kg	<0.0000002 %		<LOD
	001-023-00-4	202-849-4	100-41-4									
35	xylene				<0.002	mg/kg		<0.002	mg/kg	<0.0000002 %		<LOD
	001-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]									
36	o-xylene; [1] p-xylene; [2] m-xylene; [3] xylene [4]				<0.002	mg/kg		<0.002	mg/kg	<0.0000002 %		<LOD
	001-022-00-9	202-422-2 [1] 203-396-5 [2]	95-47-6 [1] 106-42-3 [2]									

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number							
		203-576-3 [3] 215-535-7 [4]	108-98-3 [3] 1330-20-7 [4]							
37	⚠	diesel petroleum group			<3 mg/kg		<3 mg/kg	<0.0003 %		<LOD
			68334-30-5, 68476-34-6, 94114-58-7, 1159170-26-9							
38	⚠	TPH (C6 to C40) petroleum group			<42 mg/kg		<42 mg/kg	<0.0042 %		<LOD
			TPH							
Total:								0.191 %		

Key

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

Appendix A: Classifier defined and non CLP determinands

* pH (CAS Number: PH)

Description/Comments: Appendix C4
Data source: WM3 1st Edition 2015
Data source date: 25 May 2015
Risk Phrases: None.
Hazard Statements: None.

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

CLP index number: 006-007-00-5
Description/Comments: Conversion factor based on a worst case compound: sodium cyanide
Data source: Commission Regulation (EC) No 790/2009 - 1st Adaptation to Technical Progress for Regulation (EC) No 1272/2008. (ATP1)
Additional Risk Phrases: None.
Additional Hazard Statement(s): EUH032 >= 0.2 %
Reason for additional Hazards Statement(s):
14 Dec 2015 - EUH032 >= 0.2 % hazard statement sourced from: WM3, Table C12.2

* boron tribromide/trichloride/trifluoride (combined) (CAS Number: 10294-33-4, 10294-34-5, 7637-07-2)

Description/Comments: Combines the hazard statements and the average of the conversion factors for boron tribromide, boron trichloride and boron trifluoride
Data source: N/A
Data source date: 06 Aug 2015
Risk Phrases: R14 , T+ R26/28 , C R34 , C R35
Hazard Statements: EUH014 , Acute Tox. 2 H330 , Acute Tox. 2 H300 , Skin Corr. 1A H314 , Skin Corr. 1B H314

* Chromium (III) Sulphate (CAS Number: 10101-53-8)

Description/Comments:
Data source: 10101-53-8
Data source date: 24 Jun 2015
Risk Phrases: None.
Hazard Statements: None.

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

CLP index number: 029-002-00-X
Description/Comments: M-factor for long-term aquatic hazard not included as per paragraph (5), ATP9
Data source: Regulation (EU) 2016/1179 of 19 July 2016 (ATP9)
Additional Risk Phrases: N R50/53 , N R50/53 >= 0.25 %
Additional Hazard Statement(s): None.
Reason for additional Hazards Statement(s):
10 Oct 2016 - N R50/53 risk phrase sourced from: WM3 v1 still uses ecotoxic risk phrases
10 Oct 2016 - N R50/53 >= 0.25 % risk phrase sourced from: WM3 v1 still uses ecotoxic risk phrases

* lead compounds with the exception of those specified elsewhere in this Annex (worst case)

CLP index number: 082-001-00-6
Description/Comments: Worst Case: IARC considers lead compounds Group 2A; Probably carcinogenic to humans; Lead REACH Consortium, following CLP protocols, considers lead compounds from smelting industries, flue dust and similar to be Carcinogenic category 1A
Data source: Regulation 1272/2008/EC - Classification, labelling and packaging of substances and mixtures. (CLP)
Additional Risk Phrases: None.
Additional Hazard Statement(s): Carc. 1A H350
Reason for additional Hazards Statement(s):
03 Jun 2015 - Carc. 1A H350 hazard statement sourced from: IARC Group 2A (Sup 7, 87) 2006; Lead REACH Consortium www.reach-lead.eu/substanceinformation.html (worst case lead compounds). Review date 29/09/2015

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

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 17 Jul 2015
Risk Phrases: R22 , R26 , R27 , R36 , R37 , R38
Hazard Statements: Acute Tox. 4 H302 , Acute Tox. 1 H330 , Acute Tox. 1 H310 , Eye Irrit. 2 H319 , STOT SE 3 H335 , Skin Irrit. 2 H315

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

Description/Comments: Data from C&L Inventory Database

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

Data source date: 17 Jul 2015

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

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

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

Description/Comments: Data from C&L Inventory Database

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

Data source date: 06 Aug 2015

Risk Phrases: N R50/53

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

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

Description/Comments: Data from C&L Inventory Database

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

Data source date: 06 Aug 2015

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

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

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

Description/Comments: Data from C&L Inventory Database

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

Data source date: 17 Jul 2015

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

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

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

Description/Comments: Data from C&L Inventory Database

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

Data source date: 21 Aug 2015

Risk Phrases: Xn R22 , N R50/53

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

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

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

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

Data source date: 21 Aug 2015

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

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

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

Description/Comments: Data from C&L Inventory Database

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

Data source date: 06 Aug 2015

Risk Phrases: R40

Hazard Statements: Carc. 2 H351

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

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

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

Data source date: 23 Jul 2015

Risk Phrases: N R50/53

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

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

CLP index number: 601-023-00-4

Description/Comments:

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

Additional Risk Phrases: None.

Additional Hazard Statement(s): Carc. 2 H351

Reason for additional Hazards Statement(s):

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

* **diesel petroleum group** (CAS Number: 68334-30-5, 68476-34-6, 94114-59-7, 1159170-26-9)

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

Data source: WM3 1st Edition 2015

Data source date: 25 May 2015

Risk Phrases: R40 , R51/53 , R65 , R66

Hazard Statements: Flam. Liq. 3 H226 , Skin Irrit. 2 H315 , Acute Tox. 4 H332 , Carc. 2 H351 , Asp. Tox. 1 H304 , STOT RE 2 H373 , Aquatic Chronic 2 H411

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

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

Data source: WM3 1st Edition 2015

Data source date: 25 May 2015

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

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

Appendix B: Rationale for selection of metal species

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

Worst case species

arsenic {arsenic trioxide}

Worst case species based on risk phrases

boron {boron tribromide/trichloride/trifluoride (combined)}

Worst case species based on risk phrases

cadmium {cadmium sulfide}

Worst case species based on risk phrases

chromium {chromium(VI) oxide}

Worst case species based on risk phrases

copper {dicopper oxide; copper (I) oxide}

Most likely common species

lead {lead compounds with the exception of those specified elsewhere in this Annex (worst case)}

Lead unlikely to be lead chromate given the history of the site.

mercury {mercury dichloride}

Worst case species based on risk phrases

nickel {nickel dihydroxide}

Worst case species based on risk phrases

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

Worst case species based on risk phrases

vanadium {divanadium pentaoxide; vanadium pentoxide}

most common form

zinc {zinc oxide}

Zinc unlikely to be zinc chromate given the history of the site.

Appendix C: Version

HazWasteOnline Classification Engine: WM3 1st Edition, May 2015

HazWasteOnline Classification Engine Version: 2020.346.4563.8832 (11 Dec 2020)

HazWasteOnline Database: 2020.346.4563.8832 (11 Dec 2020)

This classification utilises the following guidance and legislation:

WM3 - Waste Classification - May 2015

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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