

CONTAMINATED LAND INTRUSIVE INVESTIGATION

Northney Farm
St. Peter's Road
Hayling Island
Hampshire
PO11 0RX



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1 Introduction and scope of work

Apple Environmental has been appointed to undertake an intrusive soil contamination investigation at Northney Farm, St. Peters Road, Hayling Island, Hampshire PO11 0RX. The report has been prepared in support of the prior approval of the change of use of an agricultural building into a dwelling with associated garden areas.

An environmental desk study and preliminary risk assessment previously undertaken by Apple Environmental for the site (Report Ref.CL/2698/NF) had identified a potential land contamination concern, due principally to the former use of the site for agricultural purposes.

Due to the proposal to introduce soft landscaped garden areas, the conceptual model within the aforementioned desk study had highlighted a perceived risk from the above sources, with potentially significant pathway linkages enabling contamination to reach receptors.

In considering this, the contaminants deemed to be potentially present included heavy metals, inorganics, hydrocarbons (poly-aromatic), volatiles, asbestos and possible ground gases. An intrusive investigation was subsequently recommended in order to determine the presence and extent of any such contamination, and to assess the overall risk more fully. The investigation has focussed on the proposed garden areas associated with the dwelling as well as internal and external areas where the soil may not have been completely protected.

The principal aims of this work therefore have been to devise and implement an appropriate strategy such that it has been possible to:

- determine the nature of the sub-surface material on-site;
- determine the presence of unacceptable ground contamination in this area, its nature and extent;
- assess the degree to which the site itself could be contributing to the contamination of environmental media off-site;
- observe or presume contaminant-pathway-receptor relationships on site; and
- assess the risk to future users of the site, as well as building structures and services.

This type of assessment relies upon visual examination of the area and sub-surface material, as well as the laboratory analysis of material samples.

As such, the specific objectives are:

- to excavate trial pits at seven separate locations across the site to a minimum depth of 1000mm;
- to characterise the nature of the sub-surface material at each of these locations;
- to collect at least two soil samples from each of the pits for laboratory analysis representing the direct contact zone (100 - 200mm) and the indirect contact zone (500 - 600mm);
- to collect additional soil samples from where there may be any other specific or noticeable contamination concern;
- to analyse the soil samples for a range of contamination indicators;
- to ascertain the significance of all chemical or physical data obtained;
- to determine the risk to future users based upon residential usage; and
- to make appropriate recommendations in order to reduce and/or eliminate any risks, as identified.

2 Methodology

The aim of this investigation is to assess the sub-surface of the site in order to determine any risk that may be present as a result of ground contamination from the sources highlighted within the conceptual site model (CSM).

Seven trial pits were excavated to a minimum depth of 1000mm, at the approximate locations shown below in Figure 1.

Figure 1 Plan showing the approximate sampling locations



■ Trial pit locations

The soil profile from each investigated location has been logged within Section 3 below, along with photographs showing the material extracted.

As stated, soil samples were collected from each of the trial pit locations representing depths of 100 - 200mm and 500 - 600mm.

All of these soil samples were placed immediately into sterilised containers and transferred into refrigerated cold-boxes until removed for analysis.

Chemical analysis was undertaken for the following determinands:

- arsenic, boron, cadmium, chromium, copper, lead, mercury, nickel, selenium, zinc;
- sulphate, sulphide, chloride, cyanide, ammonia and asbestos;
- benzene, toluene, ethylbenzene and xylene (all isomers); and
- polycyclic aromatic hydrocarbons (speciated), petroleum hydrocarbons (banded TPHCWG);
- phenols and non-speciated VOCs*

* Photo-ionisation detection was undertaken in-situ on the removed soil material in order to detect vapours originating from any VOC residue (fuels/solvents etc.) that may be present in each excavated area. This was performed by means of an externally calibrated Phocheck Tiger PID. Calibration certification has been appended to this report.

All chemical analyses were undertaken by a UKAS accredited laboratory. Laboratory certification has been appended to this report.

3 On-site observations

The ground surface across the site exists as soft landscaping, compressed soil or concrete which was of a poor state of repair. It is understood that the bedrock at the site is characterised by the Lewes Nodular, Seaford, Newhaven, Culver and Portsdown Chalk Formations.

The bedrock was reached in just one of the excavations, at a depth of around 890mm.

The bedrock in this area is understood to be overlain by superficial river terrace gravels. These are believed to have been observed in all of the excavations.

The sub-surface material strata logs have been reproduced below in Tables 1 to 7.

Photographs showing each trial pit along with the corresponding excavated material have been appended to each strata log (Photographs 1 to 7).

Table 1 Strata log - Location **TP.01**

Location ID	Depth (mm)	Notes
TP.01	0 - 20	Concrete
	20 - 490	Grey, soft clayey made-ground with angular and rounded flints (10-100mm diameter)
	490 - 840	Grey, soft clay with rounded stones (10-30mm diameter)
	840 - 910	Dark-grey firm clay
	910 - 1000	Grey, silty friable clay
Groundwater	-	Groundwater was not reached

Photograph 1 Trial pit and removed soil material - Location TP.01



Table 2 Strata log - Location **TP.02**

Location ID	Depth (mm)	Notes
TP.02	0 - 20	Concrete
	20 - 280	Mid-brown clayey made-ground comprising flints and brick
	280 - 350	Chalk with angular flints (20-50mm diameter)
	350 - 890	Mid-brown stiff clay
	890 - 1000	Chalk
Groundwater	-	Groundwater was not reached

Photograph 2 Trial pit and removed soil material - Location TP.02



Table 3 Strata log - Location **TP.03**

Location ID	Depth (mm)	Notes
TP.03	0 - 20	Concrete
	200 - 250	Clayey made-ground
	250 - 880	Mid-brown, soft clay with angular flints (5mm-30mm diameter)
	880 - 1000	Green, soft clay. Some hydrocarbon residue was noted at 1000mm
Groundwater	-	Groundwater was not reached

Photograph 3 Trial pit and removed soil material - Location TP.03



Table 4 Strata log - Location **TP.04**

Location ID	Depth (mm)	Notes
TP.04	0 - 100	Concrete
	100 - 180	Made-ground (brick)
	180 - 710	Silty, clayey made-ground comprising brick fragments, rounded stones and angular flints (30mm-110mm diameter)
	710 - 830	Mid-brown firm friable clay
	830 - 1000	Mid-brown silty sandy clay
Groundwater	-	Groundwater was not reached

Photograph 4 Trial pit and removed soil material - Location TP.04



Table 5 Strata log - Location **TP.05**

Location ID	Depth (mm)	Notes
TP.05	0 - 20	Grass
	20 - 470	Mid-brown clayey, silty top soil with made-ground comprising pottery, shells, glass, bones, rootlets and metal pipework
	470 - 1000	Orange-brown firm sandy clay
Groundwater	-	Groundwater was not reached

Photograph 5 Trial pit and removed soil material - Location TP.05



Table 6 Strata log - Location **TP.06**

Location ID	Depth (mm)	Notes
TP.06	0 - 410	Dark-brown silty topsoil with made-ground comprising slate, metal and rootlets
	410 - 770	Dark-brown firm clay
	770 - 1000	Orange-brown sandy soft clay
Groundwater	-	Groundwater was not reached

Photograph 6 Trial pit and removed soil material - Location TP.06



Table 7 Strata log - Location **TP.07**

Location ID	Depth (mm)	Notes
TP.07	0 - 20	Grass
	20 - 400	Dark-brown silty clayey topsoil with made-ground comprising pottery and brick fragments
	400 - 1000	Orange-brown firm clay with large angular flints (20-100mm diameter)
Groundwater	-	Groundwater was not reached

Photograph 7 Trial pit and removed soil material - Location TP.07



4 Results from soil analyses

The results from the soil analyses are displayed in Tables 8 to 13 below. Any determinand detected has been highlighted in bold type.

Table 8 Results for specified inorganics - metals

Determinand (mg/kg)	TP.01		TP.02		TP.03	
	Depth 100-200mm	Depth 500-600mm	Depth 100-200mm	Depth 500-600mm	Depth 100-200mm	Depth 500-600mm
Arsenic	4	5	4	6	8	13
Boron	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	0.3	0.3	0.4	0.5	< 0.2	< 0.2
Chromium	11	18	9	16	24	35
Hexavalent chromium	< 2	< 2	< 2	< 2	< 2	< 2
Copper	11	10	11	14	15	21
Lead	14	7	7	9	17	14
Mercury (total)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Nickel	9	11	7	13	13	24
Selenium	< 3	< 3	< 3	< 3	< 3	< 3
Zinc	45	33	27	41	57	67

Table 8 (Cont.)

Results for specified inorganics - metals

Determinand (mg/kg)	TP.04		TP.05	
	Depth 100-200mm	Depth 100-200mm	Depth 100-200mm	Depth 500-600mm
Arsenic	5	6	14	9
Boron	< 1	1.1	< 1	1.1
Cadmium	0.3	0.2	0.9	0.6
Chromium	12	14	32	28
Hexavalent chromium	< 2	< 2	< 2	< 2
Copper	17	15	95	50
Lead	341	185	188	162
Mercury (total)	< 0.05	< 0.05	< 0.05	0.09
Nickel	8	9	32	24
Selenium	< 3	< 3	< 3	< 3
Zinc	50	61	759	434

Table 8 (Cont.) Results for specified inorganics - metals

Determinand (mg/kg)	TP.06		TP.07	
	Depth 100-200mm	Depth 500-600mm	Depth 100-200mm	Depth 500-600mm
Arsenic	14	17	11	10
Boron	1.2	< 1	< 1	< 1
Cadmium	1.2	0.9	1.4	0.6
Chromium	30	33	33	33
Hexavalent chromium	< 2	< 2	< 2	< 2
Copper	73	84	72	47
Lead	1550	568	303	166
Mercury (total)	< 0.05	< 0.05	0.15	0.30
Nickel	37	38	27	26
Selenium	< 3	< 3	< 3	< 3
Zinc	801	575	662	626

Table 9 Results for specified inorganics - non-metals

Determinand (mg/kg)	TP.01		TP.02		TP.03	
	Depth 100-200mm	Depth 500-600mm	Depth 100-200mm	Depth 500-600mm	Depth 100-200mm	Depth 500-600mm
Cyanide (total)	<2	<2	<2	<2	<2	<2
Sulphate (total)	483	345	441	356	570	212
Sulphide	<5	<5	<5	<5	<5	<5
Chloride	67	86	57	48	110	106
Asbestos	None detected	None detected	None detected	None detected	None detected	None detected

Table 9 (Cont.) Results for specified inorganics - non-metals

Determinand (mg/kg)	TP.04		TP.05	
	Depth 100-200mm	Depth 100-200mm	Depth 100-200mm	Depth 500-600mm
Cyanide (total)	<2	<2	3	<2
Sulphate (total)	2258	2098	1045	758
Sulphide	<5	<5	<5	<5
Chloride	128	169	54	57
Asbestos	None detected	None detected	None detected	None detected

Table 9 (Cont.) Results for specified inorganics - non-metals

Determinand (mg/kg)	TP.06		TP.07	
	Depth 100-200mm	Depth 500-600mm	Depth 100-200mm	Depth 500-600mm
Cyanide (total)	3	5	<2	<2
Sulphate (total)	1332	1066	724	758
Sulphide	<5	<5	<5	<5
Chloride	56	64	61	35
Asbestos	Chrysotile	Chrysotile	None detected	None detected

Table 10 Results for poly-aromatic hydrocarbons

Determinand (mg/kg)	TP.01		TP.02		TP.03	
	Depth 100-200mm	Depth 500-600mm	Depth 100-200mm	Depth 500-600mm	Depth 100-200mm	Depth 500-600mm
Naphthalene	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	0.17	< 0.1	< 0.1	< 0.1	0.20	< 0.1
Pyrene	0.15	< 0.1	< 0.1	< 0.1	0.16	< 0.1
Benzo(a)anthracene	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chrysene	0.11	< 0.1	< 0.1	< 0.1	0.13	< 0.1
Benzo(b)fluoranthene	0.15	< 0.1	< 0.1	< 0.1	0.19	< 0.1
Benzo(k)fluoranthene	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	< 0.1	< 0.1	< 0.1	< 0.1	0.13	< 0.1
Indeno(123-cd)pyrene	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(ah)anthracene	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Coronene	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total PAHs	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6

Table 10 (Cont.) Results for poly-aromatic hydrocarbons

Determinand (mg/kg)	TP.04		TP.05	
	Depth 100-200mm	Depth 500-600mm	Depth 100-200mm	Depth 500-600mm
Naphthalene	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	< 0.1	< 0.1	1.09	< 0.1
Fluorene	< 0.1	< 0.1	0.94	< 0.1
Phenanthrene	0.15	< 0.1	8.31	0.15
Anthracene	< 0.1	< 0.1	2.22	< 0.1
Fluoranthene	0.31	< 0.1	15.50	0.35
Pyrene	0.29	< 0.1	9.78	0.29
Benzo(a)anthracene	< 0.1	< 0.1	5.05	0.16
Chrysene	0.20	< 0.1	4.56	0.18
Benzo(b)fluoranthene	0.27	< 0.1	4.93	0.25
Benzo(k)fluoranthene	< 0.1	< 0.1	1.63	< 0.1
Benzo(a)pyrene	0.19	< 0.1	3.97	0.17
Indeno(123-cd)pyrene	0.14	< 0.1	2.01	< 0.1
Dibenzo(ah)anthracene	< 0.1	< 0.1	0.47	< 0.1
Benzo(ghi)perylene	0.18	< 0.1	1.85	0.12
Coronene	< 0.1	< 0.1	0.35	< 0.1
Total PAHs	1.7	<1.6	62.7	1.7

Table 10 (Cont.) Results for poly-aromatic hydrocarbons

Determinand (mg/kg)	TP.06		TP.07	
	Depth 100-200mm	Depth 500-600mm	Depth 100-200mm	Depth 500-600mm
Naphthalene	< 0.1	0.44	< 0.1	< 0.1
Acenaphthylene	0.24	1.69	< 0.1	< 0.1
Acenaphthene	0.69	0.55	< 0.1	< 0.1
Fluorene	0.70	2.28	< 0.1	< 0.1
Phenanthrene	44.70	18.80	0.53	< 0.1
Anthracene	3.37	2.90	< 0.1	< 0.1
Fluoranthene	58.50	41.70	1.29	< 0.1
Pyrene	44.10	31.20	1.18	< 0.1
Benzo(a)anthracene	11.10	13.70	0.67	< 0.1
Chrysene	9.46	13.30	0.68	< 0.1
Benzo(b)fluoranthene	10.60	13.70	0.83	< 0.1
Benzo(k)fluoranthene	3.48	7.24	0.27	< 0.1
Benzo(a)pyrene	7.55	10.40	0.64	< 0.1
Indeno(123-cd)pyrene	3.78	7.22	0.37	< 0.1
Dibenzo(ah)anthracene	0.83	1.86	< 0.1	< 0.1
Benzo(ghi)perylene	3.42	6.14	0.34	< 0.1
Coronene	0.60	1.27	< 0.1	< 0.1
Total EPA-16 PAHs	203	174	6.8	<1.6

Table 11 Results for petroleum hydrocarbons

Determinand (mg/kg)	TP.01		TP.02		TP.03	
	Depth 100-200mm	Depth 500-600mm	Depth 100-200mm	Depth 500-600mm	Depth 100-200mm	Depth 500-600mm
Aliphatic C5 - C6	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6 - C8	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic C8 - C10	< 2	< 2	< 2	< 2	< 2	< 2
Aliphatic C10 - C12	< 2	4	< 2	< 2	< 2	< 2
Aliphatic C12 - C16	< 3	21	< 3	< 3	< 3	< 3
Aliphatic C16 - C21	< 3	19	< 3	< 3	< 3	< 3
Aliphatic C21 - C34	< 10	< 10	< 10	< 10	< 10	< 10
Total Aliphatic (C5 - 34)	< 21	44	< 21	< 21	< 21	< 21
Aromatic C5 - C7	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7 - C8	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic C8 - C10	< 2	< 2	< 2	< 2	< 2	< 2
Aromatic C10 - C12	< 2	< 2	< 2	< 2	< 2	< 2
Aromatic C12 - C16	< 2	14	< 2	3	< 2	< 2
Aromatic C16 - C21	< 3	25	< 3	< 3	< 3	< 3
Aromatic C21 - C35	< 10	< 10	< 10	< 10	< 10	< 10
Total Aromatic (C5 -35)	< 21	39	< 21	< 21	< 21	< 21
Total (C5 - 35)	< 42	84	< 42	< 42	< 42	< 42

Table 11 (Cont.) Results for petroleum hydrocarbons

Determinand (mg/kg)	TP.04		TP.05	
	Depth 100-200mm	Depth 100-200mm	Depth 100-200mm	Depth 500-600mm
Aliphatic C5 - C6	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6 - C8	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic C8 - C10	< 2	< 2	< 2	< 2
Aliphatic C10 - C12	< 2	< 2	< 2	< 2
Aliphatic C12 - C16	< 3	< 3	< 3	< 3
Aliphatic C16 - C21	5	<3	< 3	< 3
Aliphatic C21 - C34	93	22	< 10	< 10
Total Aliphatic (C5 - 34)	98	22	< 21	< 21
Aromatic C5 - C7	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7 - C8	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic C8 - C10	< 2	< 2	< 2	< 2
Aromatic C10 - C12	< 2	< 2	< 2	< 2
Aromatic C12 - C16	< 2	< 2	7	<2
Aromatic C16 - C21	<3	<3	58	<3
Aromatic C21 - C35	65	<10	159	<10
Total Aromatic (C5 -35)	65	<21	224	<21
Total (C5 - 35)	163	<42	224	<42

Table 11 (Cont.) Results for petroleum hydrocarbons

Determinand (mg/kg)	TP.06		TP.07	
	Depth 100-200mm	Depth 500-600mm	Depth 100-200mm	Depth 500-600mm
Aliphatic C5 - C6	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6 - C8	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic C8 - C10	< 2	< 2	< 2	< 2
Aliphatic C10 - C12	< 2	< 2	< 2	< 2
Aliphatic C12 - C16	< 3	< 3	< 3	< 3
Aliphatic C16 - C21	< 3	< 3	< 3	< 3
Aliphatic C21 - C34	< 10	< 10	< 10	< 10
Total Aliphatic (C5 - 34)	< 21	< 21	< 21	< 21
Aromatic C5 - C7	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7 - C8	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic C8 - C10	< 2	< 2	< 2	< 2
Aromatic C10 - C12	< 2	< 2	< 2	< 2
Aromatic C12 - C16	6	22	< 2	< 2
Aromatic C16 - C21	99	259	8	< 3
Aromatic C21 - C35	226	606	49	< 10
Total Aromatic (C5 - 35)	331	887	57	< 21
Total (C5 - 35)	331	887	57	< 42

Table 12 Results for specified hydrocarbons

Determinand (mg/kg)	TP.01		TP.02		TP.03		TP.04	
	Depth 100- 200mm	Depth 500- 600mm	Depth 100- 200mm	Depth 100- 200mm	Depth 100- 200mm	Depth 100- 200mm	Depth 100- 200mm	Depth 500- 600mm
Benzene	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Toluene	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Ethylbenzene	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
p & m-Xylene	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
o-Xylene	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MTBE	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Phenols	<2	<2	<2	<2	<2	<2	<2	<2
Determinand (mg/kg)	TP.05		TP.06		TP.07			
	Depth 100- 200mm	Depth 500- 600mm	Depth 100- 200mm	Depth 100- 200mm	Depth 100- 200mm	Depth 100- 200mm		
Benzene	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002		
Toluene	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005		
Ethylbenzene	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002		
p & m-Xylene	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002		
o-Xylene	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002		
MTBE	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005		
Phenols	<2	<2	<2	<2	<2	<2		

Table 13 Non-specified VOCs - measured by means of photo ionisation detection in-situ

TP.01	TP.01	TP.02	TP.02	TP.03	TP.03
Depth 100-200mm	Depth 500-600mm	Depth 100-200mm	Depth 500-600mm	Depth 100-200mm	Depth 500-600mm
2.1ppm	<0.1ppm	<0.1ppm	<0.1ppm	<0.1ppm	<0.1ppm
TP.04	TP.04	TP.05	TP.05	TP.06	TP.06
Depth 100-200mm	Depth 500-600mm	Depth 100-200mm	Depth 500-600mm	Depth 100-200mm	Depth 500-600mm
<0.1ppm	<0.1ppm	<0.1ppm	<0.1ppm	<0.1ppm	<0.1ppm
TP.07	TP.07				
Depth 400-600mm	Depth 900-1100mm				
<0.1ppm	<0.1ppm				

5 Interpretation

Tables 14 to 16 below show the soil guideline concentrations used as part of this assessment.

It is proposed to redevelop the site for residential use, for which relevant soil guideline concentrations derived using CLEA software packages have principally been referred to.

For some substances other referenced guidelines may have been consulted, however in all instances guideline values for residential end-use with home-grown produce will have been considered wherever possible.

For the purposes of this assessment therefore, the following values have been referred to:

- Environment Agency Category 4 Screening Levels (2014);
- CIEH (LQM) GAC 3rd Edition (residential end-use);
- Atkins ATRISK SSVs (residential end-use with home-grown produce);
- GAC CLEA generated value for residential end-use with home-grown produce; and
- others, as available.

Note that for some guideline values a choice of soil organic matter (SOM) concentration is provided whereby different guideline concentrations exist for SOM values of between 1% and 6%.

In this instance the guideline value for 1% SOM was referred to, as the mean organic content was determined as 2.02%; which approximates to 3.48% SOM.

Table 14 Soil guideline concentrations referred to for this assessment

Determinand	Origin	
	1% SOM	
Arsenic	37	Atkins ATRISK Category 4 Screening Level
Boron	290	LQM/CIEH S4ULs (CLEA 1.06) for residential with home-grown produce
Cadmium	22.1	Atkins ATRISK Category 4 Screening Level
Chromium	14300	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
Chromium VI	20.5	Atkins ATRISK Category 4 Screening Level
Copper	4730	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
Lead	200	Category 4 Screening Level ^(a)
Mercury (elemental)	0.0863	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
Mercury (inorganic Hg ²⁺)	180	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
Nickel	136	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
Selenium	375	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
Zinc	20000	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
Free Cyanide	34	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
Sulphate	10000	ICRCL Action Value domestic gardens ^(b)
Sulphide	1000	ICRCL Action Value all uses ^(b)
Phenols (SOM 1%)	267	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
Benzene (SOM 1%)	0.137	Atkins ATRISK (C4SL) for residential with home-grown produce
Toluene (SOM 1%)	113	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
Ethylbenzene (SOM 1%)	50.7	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
o-Xylene (SOM 1%)	26.4	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
m-Xylene (SOM 1%)	25	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
p-Xylene (SOM 1%)	24	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce

(a) Quoted for residential land-use 0-7 year-old child taking into account bioavailability, with exposure parameters as detailed in report SR3.

(b) This 'withdrawn' value has been quoted in the absence of any other available published guideline.

Table 15 Soil guideline concentrations for PAHs referred to for this assessment

Determinand	Origin	
	1% SOM	
Naphthalene	2.3	LQM/CIEH S4ULs (CLEA 1.06) for residential with home-grown produce
Acenaphthylene	608	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
Acenaphthene	210	LQM/CIEH S4ULs (CLEA 1.06) for residential with home-grown produce
Fluorene	735	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
Phenanthrene	95	LQM/CIEH S4ULs (CLEA 1.06) for residential with home-grown produce
Anthracene	10200	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
Fluoranthene	983	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
Pyrene	668	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
Benzo(a)anthracene	7.2	LQM/CIEH S4ULs (CLEA 1.06) for residential with home-grown produce
Chrysene	15	LQM/CIEH S4ULs (CLEA 1.06) for residential with home-grown produce
Benzo(b)fluoranthene	2.6	LQM/CIEH S4ULs (CLEA 1.06) for residential with home-grown produce
Benzo(k)fluoranthene	77	LQM/CIEH S4ULs (CLEA 1.06) for residential with home-grown produce
Benzo(a)pyrene	2.2	LQM/CIEH S4ULs (CLEA 1.06) for residential with home-grown produce
Indeno(123-cd)pyrene	27	LQM/CIEH S4ULs (CLEA 1.06) for residential with home-grown produce
Dibenzo(ah)anthracene	0.24	LQM/CIEH S4ULs (CLEA 1.06) for residential with home-grown produce
Benzo(ghi)perylene	320	LQM/CIEH S4ULs (CLEA 1.06) for residential with home-grown produce

Table 16 Soil guideline concentrations for TPHs referred to for this assessment

Determinand	Origin	
	1% SOM	
Aliphatic TPH C5-C6	42.7	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
Aliphatic TPH C6-C8	99.3	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
Aliphatic TPH C8-C10	13.9	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
Aliphatic TPH C10-C12	81.7	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
Aliphatic TPH C12-C16	385	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
Aliphatic TPH C16-35	210000	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
Aliphatic TPH C35-C44	65000	LQM/CIEH S4ULs (CLEA 1.06) for residential with home-grown produce
Aromatic TPH C5-C7	0.137	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
Aromatic TPH C7-C8	113	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
Aromatic TPH C8-C10	20.5	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
Aromatic TPH C10-C12	70	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
Aromatic TPH C12-16	165	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
Aromatic TPH C16-21	319	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
Aromatic TPH C21-C35	1120	Atkins ATRISK (CLEA 1.07) for residential with home-grown produce
Aromatic TPH C5-C35	1100	LQM/CIEH S4ULs (CLEA 1.06) for residential with home-grown produce

6 Summary of soil analyses

As detailed above, seven trial pits were excavated on this site, from each of which two soil samples were collected for laboratory analysis. The samples represented soil depths of 100 - 200mm and 500 - 600mm.

The sampled locations represented the proposed garden areas associated with the dwelling as well as internal and external areas where the soil may not have been completely protected.

Through reference to Tables 15 to 19 above, it has been shown that there were a number of substances present above their corresponding soil guideline levels; namely lead, poly-aromatic hydrocarbons (PAHs) and asbestos.

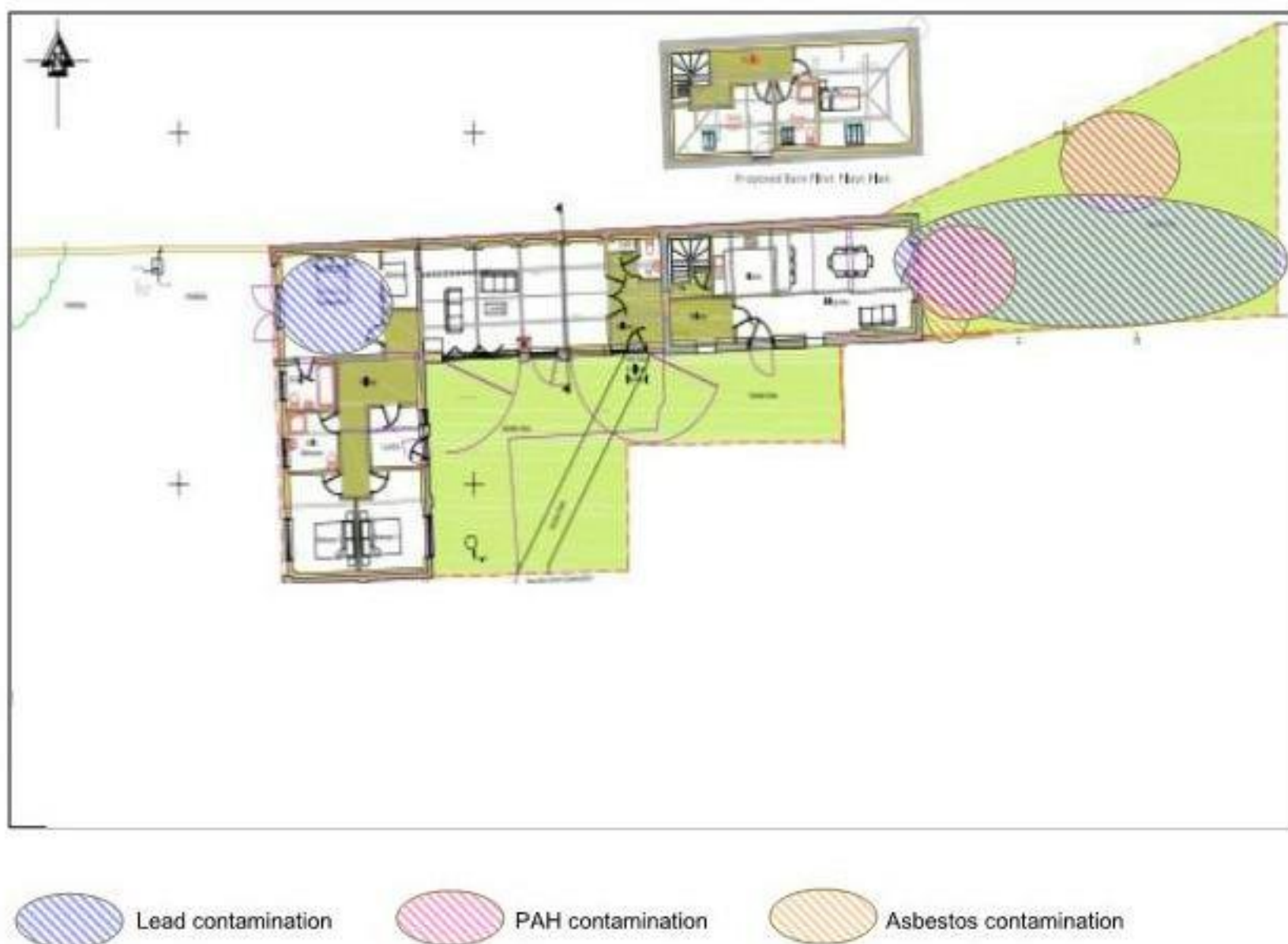
The exceedances have been summarised below in Table 17, and the affected areas have been indicated in Figure 2 below.

Table 17 Soil guideline criteria exceedences

Trial pit	Lead	Benzo(a) anthracene	Benzo-(b) fluoranthrene	Benzo-(a) pyrene	Dibenzo-(ah) anthracene
TP.04/01					
TP.05/01					
TP.06/01					
TP.06/02					
TP.07/01					

 Guideline exceedence

Figure 2 Plan showing the indicative extent of ground contamination



The source of this identified PAH contamination within trial pits TP.05 and TP.06 could be due to waste oil or fuel, and may have some association with the parking, storage or use of agricultural vehicles/machinery on this site.

The source of the identified lead contamination within trial pits TP.04, TP.06 and TP.07 is most likely to be associated with the made-ground that was present in this area.

In addition to the above, chrysotile asbestos residue was detected in trial pit TP.06 at both the upper and lower sample depths. This trial pit was located close to a barn with an asbestos roof. This asbestos residue is therefore expected to be associated with the structure, either as broken or weathered debris, or possibly remaining from when the building was originally constructed. The asbestos residue detected at depth here may well have fallen into the pit from nearer the surface.

7 Review of conceptual model and risk assessment

Using the sampling results and observations made, the conceptual site model (CSM) from the Phase 1 desk study can now be reviewed and updated. In doing so any uncertainties highlighted within that report can now be readdressed and the corresponding risk reassessed.

In reviewing this conceptual model, Table 18 below highlights any perceived pollutant pathway linkages that may still be present.

It should be noted that the following re-assessment of the risk, has been made on the basis that there will be soft landscaped recreational areas created with the proposed dwelling, as well as the presumption that groundworks will be undertaken for the installation of footings and new services etc.

The risk matrix used for this purpose is reproduced below in Figure 3.

Figure 3 Risk assessment algorithm

Potential severity	Risk rating						Severity of hazard	Probability of hazard	Overall risk
	5	5	10	15	20	25	5 = Fatality	1 = Improbable	1 - 6 Low
	4	4	8	12	16	20	4 = Major	2 = Remote	8 - 12 Medium
	3	3	6	9	12	15	3 = Minor	3 = Possible	15 - 25 High
	2	2	4	6	8	10	2 = Negligible	4 = Probable	
	1	1	2	3	4	5	1 = None	5 = Certainty	
		1	2	3	4	5			
	Probability						Severity of hazard x probability = risk rating		

Table 18 Reviewed comments relating to perceived risk

Contaminants identified	Potential pathways	Perceived level of risk	Comments and reasoning
Lead, PAHs and asbestos	Digestion of soil or soil-derived dust	12	The likelihood of ingesting soil during construction work, gardening or play is low. Ingestion is most likely to be limited to trace quantities through unwashed hands or ingesting airborne dusts etc. However as harmful contaminants are known to be present in some proposed garden areas, the corresponding risk is deemed to be moderate-high.
	Dermal contact with soil or soil-derived dust	12	The potential for touching soil during construction work, gardening or play is high. It is also possible that PAHs could exert a biological effect from absorption through the epidermis, or alternatively be transferred to the mouth. In either instance the extent of uptake is expected to be low, although as harmful contaminants are known to be present in some proposed garden areas, the corresponding risk is deemed to be moderate-high.
	Inhalation of soil or soil-derived dust	15	Uptake from the inhalation of identified contaminants during the disturbance of soil is expected to be limited to trace quantities only. However, due to the presence of asbestos residue the corresponding risk is deemed to be potentially high

Table 18 (Cont.) Reviewed comments relating to perceived risk

Contaminants identified	Potential pathways	Perceived level of risk	Comments and reasoning
Lead, PAHs and asbestos	Ingestion of vegetables	8	Considering the identified presence of localised elevated concentrations of PAHs in the soil, there is some potential for ingestion from home-grown vegetables. Despite this, the extent of uptake is expected to be fairly low. As such the corresponding risk is deemed to be low-moderate.
	Inhalation and/or ignition of gases and/or vapours	6	Despite the concentration of some PAHs exceeding soil guideline values it is not expected for these concentrations (in conjunction with trace hydrocarbons or other VOCs) to be great enough to generate significant vapours. Similarly the general organic carbon content of the soil is again not deemed to be high enough to produce significant quantities of methane or carbon dioxide. The corresponding risk from each is therefore believed to be low.
	Direct contact with buildings and services	8	PAHs can potentially present a risk to building fabric and underground services. If either of these are to be located in the specified areas where the PAH concentration is elevated then appropriate materials resistant to hydrocarbon attack may need to be used. The corresponding risk in these areas must be deemed to be moderate.

8 Summary and remediation proposal

8.1 Summary

This report has been prepared in support of the proposed redevelopment of existing agricultural buildings with associated garden areas. The desk study previously undertaken identified a potential risk from ground contamination due principally to the former use of the site from farming activities.

It has been highlighted within this report that high levels of poly-aromatic hydrocarbons (PAHs) which exceed the guideline levels, were found in two of the seven trial pits; TP.05 and TP.06. This is presumably associated with historic oil or fuel spillages resulting from the storage and use of agricultural machinery on the site.

The report has also noted that lead exceeded its corresponding guideline concentration within three of the seven trial pits; TP.04, TP.06 and TP.07. It is suspected that the source of the contamination may well be due to the made-ground that was noted within each of these areas.

In addition to this, chrysotile asbestos fibres were detected within one trial pit, TP 06 at both sampled depths. This is likely to be associated with the cement-panelled asbestos roofed barn adjacent to the trial pit. Contamination may have occurred from weathering or breakages; or possibly even remaining from when the barn was originally constructed.

Based on the findings of this investigation therefore, the revised conceptual site model (CSM) has concluded that in its current state the site still presents an unacceptable degree of risk to future receptors in these specified areas, on the basis of the proposed residential use.

8.2 Remediation proposal

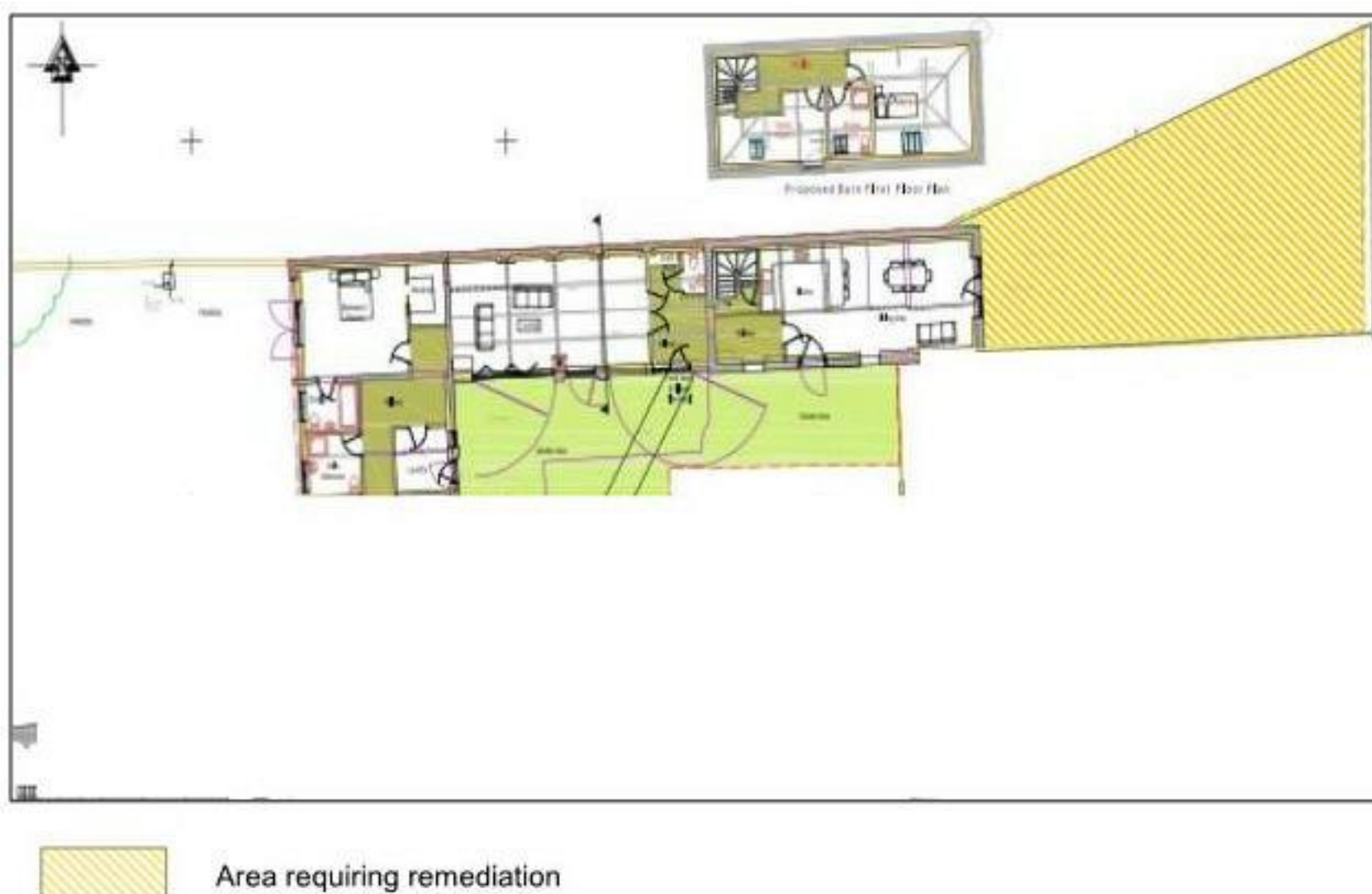
In view of these findings it would be necessary to undertake a programme of remediation in order to bring the risk down to an acceptable level.

On the basis of the information and data known to-date, remediation will need to occur over fairly large areas of the site in order to ensure that the risk in any uninvestigated sections between other sampled areas has been fully assessed.

Alternatively however, delineation sampling may wish to be undertaken in order to attempt to determine more precisely the extent of asbestos, lead and PAH contamination within the highlighted areas; thereby potentially resulting in a need for less extensive remediation.

In the absence of undertaking any delineation sampling, the recommended areas where ground remediation would be required have been highlighted in Figure 4 below.

Figure 4 Plan showing the recommended areas for remediation



It is suggested that as the lead contamination present within TP.04 is beneath the proposed dwelling, then this area would not need to be remediated, due to the expected immobility of lead contamination.

More specifically, it is suggested that the existing soil and/or hardcore in this highlighted area should be excavated to a depth of at least 600mm below the existing ground level, with the removed soil/material exported off-site for appropriate disposal; or treatment if possible. This depth has been suggested due to the fact that there were soil guideline exceedences within soil samples obtained from a depth of 500 - 600mm in this area.

The sides and base of the excavated area should be checked for possible contamination, and when found to be present at 'safe' levels each area can be backfilled with clean material. If unacceptable concentrations of volatile contaminants are still evident within the sides or base of the excavation then either more material should be removed until it is regarded that the risk has been appropriately lowered or eliminated; or the excavation base and sides could be lined with an appropriate protective membrane.

Any soil imported onto the site for the purposes of backfilling this area should arrive 'fit for purpose' although this will still need to undergo independent confirmatory laboratory analyses.

Photographic evidence of all associated remedial work undertaken should be collated and presented to the LPA in the form of a post-remediation validation report, along with all receipts and other related documentation.

With regards to underground service runs, it should again be ensured that all materials used are safe from chemical or physical attack by hydrocarbon residue in the ground. Consideration may need to be given to the use of appropriate barrier water pipes.

9 Limitations

This work has been undertaken in accordance with Apple Environmental Limited's standard terms and conditions.

The findings represent the professional opinion of the report author. All work carried out is based upon Apple Environmental Limited's current professional knowledge and understanding. It is therefore stated that the conclusions of this report have been based upon information gathered from a number of sources and it can only be assumed that this information provided was accurate and correct.

Intrusive investigation undertaken as part of this work has been restricted to a level of detail required to achieve the stated objectives of this work. The results of any measurements taken may vary spatially or with time, and further confirmatory measurements may wish to be considered, as necessary.

It is also pointed out that soil sampling, may only provide a general indication of contamination present. There is always the possibility that other undetected contaminants exist, or, that detected contaminants may exist at a greater concentration than that specified in areas of the site that have not been intrusively investigated.

10 References and specific sources of information

1. Investigation of potentially contaminated sites - code of practice (BSI 10175:2011+A2:2017)
2. Using Soil Guideline Values - Environment Agency Science Report SC050021/SGV (March 2009)
3. The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment CIEH 3rd Ed. - Land Quality Management Ltd. (2015)
4. Atkins ATRISK SSCs (July 2017)
5. CLEA Software (Version 1.05) Handbook - Environment Agency Science Report SC050021/SR4 (January 2014)
6. ICRL 59/83 Trigger Concentrations - Department of the Environment (1983)
7. Land Affected by Contamination - Planning Practice Guidance - The Department for Communities and Local Government (June 2014)
8. The National Planning Policy Framework (Revised) - July 2018
9. Model procedures for the management of contaminated land (CLR-11) - Environment Agency (September 2004)
10. Contaminated Land Risk Assessment: A Guide to Good Practice (C552) - CIRIA (2001)
11. SP1010 - Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination - CL:AIRE (September 2014)
12. British Geological Survey. Geology of Britain:
<http://mapapps.bgs.ac.uk/geologyofbritain/home.html?>
13. <https://www.ncbi.nlm.nih.gov/pubmed/16003580>

APPENDICES

Laboratory data
Calibration certification



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DETS Report No: 19-11666

Site Reference: None Supplied

Project / Job Ref: CL/2796/NF

Order No: None Supplied

Sample Receipt Date: 15/08/2019

Sample Scheduled Date: 15/08/2019

Report Issue Number: 1

Reporting Date: 21/08/2019

Authorised by:



Dave Ashworth
Technical Manager

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Lenham Heath
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Tel : 01622 850410



Soil Analysis Certificate

DETS Report No: 19-11666	Date Sampled	13/08/19	13/08/19	13/08/19	13/08/19	13/08/19
Apple Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: None Supplied	TP / BH No	TP.01/01/2796	TP.01/02/2796	TP.02/01/2796	TP.02/02/2796	TP.03/01/2796
Project / Job Ref: CL/2796/NF	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Reporting Date: 21/08/2019	DETS Sample No	427967	427968	427969	427970	427971

Determinand	Unit	RL	Accreditation					
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Sample Matrix ^(S)	Material Type	N/a	NONE					
Asbestos Type ^(S)	PLM Result	N/a	ISO17025					
pH	pH Units	N/a	MCERTS	8.2	8.7	8.2	8.3	8.2
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Total Sulphate as SO ₄	mg/kg	< 200	NONE	483	345	441	356	570
Total Sulphate as SO ₄	%	< 0.02	NONE	0.05	0.03	0.04	0.04	0.06
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	50	60	24	24	97
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.05	0.06	0.02	0.02	0.10
Sulphide	mg/kg	< 5	NONE	< 5	< 5	< 5	< 5	< 5
Total Organic Carbon (TOC)	%	< 0.1	MCERTS	1.1	0.3	0.3	0.3	0.6
W/S Chloride (2:1)	mg/kg	< 1	MCERTS	67	86	57	48	110
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS	33.7	43.2	28.3	23.9	55
Arsenic (As)	mg/kg	< 2	MCERTS	4	5	4	6	8
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.3	0.3	0.4	0.5	< 0.2
Chromium (Cr)	mg/kg	< 2	MCERTS	11	18	9	16	24
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	11	10	11	14	15
Lead (Pb)	mg/kg	< 3	MCERTS	14	7	7	9	17
Mercury (Hg) ^(S)	mg/kg	< 0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Nickel (Ni)	mg/kg	< 3	MCERTS	9	11	7	13	13
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	< 3	< 3
Zinc (Zn)	mg/kg	< 3	MCERTS	45	33	27	41	57
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C

Subcontracted analysis (S)



DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410



Soil Analysis Certificate

DETS Report No: 19-11666	Date Sampled	13/08/19	13/08/19	13/08/19	13/08/19	13/08/19
Apple Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: None Supplied	TP / BH No	TP.03/02/2796	TP.04/01/2796	TP.04/02/2796	TP.05/01/2796	TP.05/02/2796
Project / Job Ref: CL/2796/NF	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Reporting Date: 21/08/2019	DETS Sample No	427972	427973	427974	427975	427976

Determinand	Unit	RL	Accreditation					
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Sample Matrix ^(S)	Material Type	N/a	NONE					
Asbestos Type ^(S)	PLM Result	N/a	ISO17025					
pH	pH Units	N/a	MCERTS	8.1	8.5	8.6	7.5	7.3
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	3	< 2
Total Sulphate as SO ₄	mg/kg	< 200	NONE	212	2258	2098	1045	758
Total Sulphate as SO ₄	%	< 0.02	NONE	0.02	0.23	0.21	0.10	0.08
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	32	985	808	40	34
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.03	0.99	0.81	0.04	0.03
Sulphide	mg/kg	< 5	NONE	< 5	< 5	< 5	< 5	< 5
Total Organic Carbon (TOC)	%	< 0.1	MCERTS	0.2	0.5	0.5	3.8	3.2
W/S Chloride (2:1)	mg/kg	< 1	MCERTS	106	128	169	54	57
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS	53.1	63.9	84.6	26.9	28.4
Arsenic (As)	mg/kg	< 2	MCERTS	13	5	6	14	9
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	1.1	< 1	1.1
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	< 0.2	0.3	0.2	0.9	0.6
Chromium (Cr)	mg/kg	< 2	MCERTS	35	12	14	32	28
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	21	17	15	95	50
Lead (Pb)	mg/kg	< 3	MCERTS	14	341	185	188	162
Mercury (Hg) ^(S)	mg/kg	< 0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.12	0.09
Nickel (Ni)	mg/kg	< 3	MCERTS	24	8	9	32	24
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	< 3	< 3
Zinc (Zn)	mg/kg	< 3	MCERTS	67	50	61	759	434
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C

Subcontracted analysis (S)



DETS Ltd
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Soil Analysis Certificate

DETS Report No: 19-11666	Date Sampled	13/08/19	13/08/19	13/08/19	13/08/19
Apple Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: None Supplied	TP / BH No	TP.06/01/2796	TP.06/02/2796	TP.07/01/2796	TP.07/02/2796
Project / Job Ref: CL/2796/NF	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	None Supplied	None Supplied	None Supplied	None Supplied
Reporting Date: 21/08/2019	DETS Sample No	427977	427978	427979	427980

Determinand	Unit	RL	Accreditation				
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Detected	Detected	Not Detected	Not Detected
Sample Matrix ^(S)	Material Type	N/a	NONE	Chrysotile present in microscopic loose fibrous asbestos debris	Chrysotile present as fibre bundle		
Asbestos Type ^(S)	PLM Result	N/a	ISO17025	Chrysotile	Chrysotile		
pH	pH Units	N/a	MCERTS	6.2	7.0	7.4	7.2
Total Cyanide	mg/kg	< 2	NONE	3	5	< 2	< 2
Total Sulphate as SO ₄	mg/kg	< 200	NONE	1332	1066	724	758
Total Sulphate as SO ₄	%	< 0.02	NONE	0.13	0.11	0.07	0.08
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	65	60	25	18
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.06	0.06	0.03	0.02
Sulphide	mg/kg	< 5	NONE	< 5	< 5	< 5	< 5
Total Organic Carbon (TOC)	%	< 0.1	MCERTS	6	5	3.3	3.2
W/S Chloride (2:1)	mg/kg	< 1	MCERTS	56	64	61	35
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS	28.2	32	30.4	17.5
Arsenic (As)	mg/kg	< 2	MCERTS	14	17	11	10
W/S Boron	mg/kg	< 1	NONE	1.2	< 1	< 1	< 1
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	1.2	0.9	1.4	0.6
Chromium (Cr)	mg/kg	< 2	MCERTS	30	33	33	33
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	73	84	72	47
Lead (Pb)	mg/kg	< 3	MCERTS	1550	568	303	166
Mercury (Hg) ^(S)	mg/kg	< 0.05	MCERTS	0.19	0.20	0.15	0.30
Nickel (Ni)	mg/kg	< 3	MCERTS	37	38	27	26
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	< 3
Zinc (Zn)	mg/kg	< 3	MCERTS	801	575	662	626
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

Subcontracted analysis (S)



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Soil Analysis Certificate - Speciated PAHs

DETS Report No: 19-11666	Date Sampled	13/08/19	13/08/19	13/08/19	13/08/19	13/08/19
Apple Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: None Supplied	TP / BH No	TP.01/01/2796	TP.01/02/2796	TP.02/01/2796	TP.02/02/2796	TP.03/01/2796
Project / Job Ref: CL/2796/NF	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Reporting Date: 21/08/2019	DETS Sample No	427967	427968	427969	427970	427971

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	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	0.17	< 0.1	< 0.1	< 0.1	0.20
Pyrene	mg/kg	< 0.1	MCERTS	0.15	< 0.1	< 0.1	< 0.1	0.16
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	0.11	< 0.1	< 0.1	< 0.1	0.13
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.15	< 0.1	< 0.1	< 0.1	0.19
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	0.13
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
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	< 0.1
Coronene	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total Oily Waste PAHs	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
Total Dutch 10 PAHs	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6
Total WAC-17 PAHs	mg/kg	< 1.7	NONE	< 1.7	< 1.7	< 1.7	< 1.7	< 1.7

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



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Soil Analysis Certificate - Speciated PAHs

DETS Report No: 19-11666	Date Sampled	13/08/19	13/08/19	13/08/19	13/08/19	13/08/19
Apple Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: None Supplied	TP / BH No	TP.03/02/2796	TP.04/01/2796	TP.04/02/2796	TP.05/01/2796	TP.05/02/2796
Project / Job Ref: CL/2796/NF	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Reporting Date: 21/08/2019	DETS Sample No	427972	427973	427974	427975	427976

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	1.09	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.94	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	0.15	< 0.1	8.31	0.15
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	2.22	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	0.31	< 0.1	15.50	0.35
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	0.29	< 0.1	9.78	0.29
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	5.05	0.16
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	0.20	< 0.1	4.56	0.18
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	0.27	< 0.1	4.93	0.25
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	1.63	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	0.19	< 0.1	3.97	0.17
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	0.14	< 0.1	2.01	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.47	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	0.18	< 0.1	1.85	0.12
Coronene	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	0.35	< 0.1
Total Oily Waste PAHs	mg/kg	< 1	MCERTS	< 1	< 1	< 1	22.6	< 1
Total Dutch 10 PAHs	mg/kg	< 1	MCERTS	< 1	1.2	< 1	45.1	1.1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	1.7	< 1.6	62.3	1.7
Total WAC-17 PAHs	mg/kg	< 1.7	NONE	< 1.7	1.7	< 1.7	62.7	< 1.7

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Soil Analysis Certificate - Speciated PAHs

DETS Report No: 19-11666	Date Sampled	13/08/19	13/08/19	13/08/19	13/08/19
Apple Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: None Supplied	TP / BH No	TP.06/01/2796	TP.06/02/2796	TP.07/01/2796	TP.07/02/2796
Project / Job Ref: CL/2796/NF	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	None Supplied	None Supplied	None Supplied	None Supplied
Reporting Date: 21/08/2019	DETS Sample No	427977	427978	427979	427980

Determinand	Unit	RL	Accreditation				
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	0.44	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	0.24	1.69	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	0.69	0.55	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	0.70	2.28	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	44.70	18.80	0.53	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	3.37	2.90	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	58.50	41.70	1.29	< 0.1
Pyrene	mg/kg	< 0.1	MCERTS	44.10	31.20	1.18	< 0.1
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	11.10	13.70	0.67	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	9.46	13.30	0.68	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	10.60	13.70	0.83	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	3.48	7.24	0.27	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	7.55	10.40	0.64	< 0.1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	3.78	7.22	0.37	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	0.83	1.86	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	3.42	6.14	0.34	< 0.1
Coronene	mg/kg	< 0.1	NONE	0.60	1.27	< 0.1	< 0.1
Total Oily Waste PAHs	mg/kg	< 1	MCERTS	46.8	67.3	3.5	< 1
Total Dutch 10 PAHs	mg/kg	< 1	MCERTS	145	122	4.8	< 1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	202	173	6.8	< 1.6
Total WAC-17 PAHs	mg/kg	< 1.7	NONE	203	174	6.8	< 1.7

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Soil Analysis Certificate - TPH CWG Banded						
DETS Report No: 19-11666	Date Sampled	13/08/19	13/08/19	13/08/19	13/08/19	13/08/19
Apple Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: None Supplied	TP / BH No	TP.01/01/2796	TP.01/02/2796	TP.02/01/2796	TP.02/02/2796	TP.03/01/2796
Project / Job Ref: CL/2796/NF	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Reporting Date: 21/08/2019	DETS Sample No	427967	427968	427969	427970	427971

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	4	< 2	< 2	< 2
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3	21	< 3	< 3	< 3
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	19	< 3	< 3	< 3
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21	44	< 21	< 21	< 21
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2	14	< 2	< 2	< 2
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	25	< 3	< 3	< 3
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10
Aromatic (C5 - C35)	mg/kg	< 21	NONE	< 21	39	< 21	< 21	< 21
Total >C5 - C35	mg/kg	< 42	NONE	< 42	84	< 42	< 42	< 42

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



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Soil Analysis Certificate - TPH CWG Banded						
DETS Report No: 19-11666	Date Sampled	13/08/19	13/08/19	13/08/19	13/08/19	13/08/19
Apple Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: None Supplied	TP / BH No	TP.03/02/2796	TP.04/01/2796	TP.04/02/2796	TP.05/01/2796	TP.05/02/2796
Project / Job Ref: CL/2796/NF	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Reporting Date: 21/08/2019	DETS Sample No	427972	427973	427974	427975	427976

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	5	< 3	< 3	< 3
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	< 10	93	22	< 10	< 10
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21	98	22	< 21	< 21
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2	< 2	< 2	7	< 2
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3	58	< 3
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	< 10	65	< 10	159	< 10
Aromatic (C5 - C35)	mg/kg	< 21	NONE	< 21	65	< 21	224	< 21
Total >C5 - C35	mg/kg	< 42	NONE	< 42	163	< 42	224	< 42

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Soil Analysis Certificate - TPH CWG Banded						
DETS Report No: 19-11666	Date Sampled	13/08/19	13/08/19	13/08/19	13/08/19	
Apple Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: None Supplied	TP / BH No	TP.06/01/2796	TP.06/02/2796	TP.07/01/2796	TP.07/02/2796	
Project / Job Ref: CL/2796/NF	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: None Supplied	Depth (m)	None Supplied	None Supplied	None Supplied	None Supplied	
Reporting Date: 21/08/2019	DETS Sample No	427977	427978	427979	427980	

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21	< 21	< 21	< 21	
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	6	22	< 2	< 2	
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	99	259	8	< 3	
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	226	606	49	< 10	
Aromatic (C5 - C35)	mg/kg	< 21	NONE	331	887	57	< 21	
Total >C5 - C35	mg/kg	< 42	NONE	331	887	57	< 42	

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Soil Analysis Certificate - BTEX / MTBE

DETS Report No: 19-11666	Date Sampled	13/08/19	13/08/19	13/08/19	13/08/19	13/08/19
Apple Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: None Supplied	TP / BH No	TP.01/01/2796	TP.01/02/2796	TP.02/01/2796	TP.02/02/2796	TP.03/01/2796
Project / Job Ref: CL/2796/NF	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Reporting Date: 21/08/2019	DETS Sample No	427967	427968	427969	427970	427971

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

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Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 19-11666	Date Sampled	13/08/19	13/08/19	13/08/19	13/08/19	13/08/19
Apple Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: None Supplied	TP / BH No	TP.03/02/2796	TP.04/01/2796	TP.04/02/2796	TP.05/01/2796	TP.05/02/2796
Project / Job Ref: CL/2796/NF	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Reporting Date: 21/08/2019	DETS Sample No	427972	427973	427974	427975	427976

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

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



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Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 19-11666	Date Sampled	13/08/19	13/08/19	13/08/19	13/08/19	
Apple Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: None Supplied	TP / BH No	TP.06/01/2796	TP.06/02/2796	TP.07/01/2796	TP.07/02/2796	
Project / Job Ref: CL/2796/NF	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: None Supplied	Depth (m)	None Supplied	None Supplied	None Supplied	None Supplied	
Reporting Date: 21/08/2019	DETS Sample No	427977	427978	427979	427980	

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

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



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Soil Analysis Certificate - Sample Descriptions

DETS Report No: 19-11666	
Apple Environmental Ltd	
Site Reference: None Supplied	
Project / Job Ref: CL/2796/NF	
Order No: None Supplied	
Reporting Date: 21/08/2019	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
427967	TP.01/01/2796	None Supplied	None Supplied	8.4	Brown sandy clay with stones
427968	TP.01/02/2796	None Supplied	None Supplied	10.5	Brown loamy sand with vegetation and chalk
427969	TP.02/01/2796	None Supplied	None Supplied	16.5	Brown loamy sand with chalk
427970	TP.02/02/2796	None Supplied	None Supplied	16.1	Brown loamy sand with chalk
427971	TP.03/01/2796	None Supplied	None Supplied	9	Brown sandy clay with stones and concrete
427972	TP.03/02/2796	None Supplied	None Supplied	15.1	Brown loamy sand with brick
427973	TP.04/01/2796	None Supplied	None Supplied	9.6	Brown sandy clay with chalk
427974	TP.04/02/2796	None Supplied	None Supplied	10.7	Brown sandy clay with chalk and brick
427975	TP.05/01/2796	None Supplied	None Supplied	10.8	Brown sandy clay with vegetation
427976	TP.05/02/2796	None Supplied	None Supplied	13.4	Brown sandy clay with vegetation
427977	TP.06/01/2796	None Supplied	None Supplied	17	Brown loamy sand with vegetation
427978	TP.06/02/2796	None Supplied	None Supplied	22	Brown loamy sand with vegetation
427979	TP.07/01/2796	None Supplied	None Supplied	13.8	Brown loamy sand with vegetation
427980	TP.07/02/2796	None Supplied	None Supplied	14.2	Brown loamy sand

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

Insufficient Sample ^{U/S}

Unsuitable Sample ^{U/S}



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Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 19-11666

Apple Environmental Ltd

Site Reference: None Supplied

Project / Job Ref: CL/2796/NF

Order No: None Supplied

Reporting Date: 21/08/2019

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

CALIBRATION CERTIFICATE NO: 65685

ISSUED BY: SHAWCITY LIMITED
DATE: 03-Apr-19
APPROVED SIGNATORY: 
NAME: David Godfrey
CUSTOMER: Apple Environmental Ltd
INSTRUMENT: Phocheck Tiger
SERIAL NUMBER: T-113211
CALIBRATION METHOD: CM03
AMBIENT CONDITIONS: 20°C ± 2°C and 50% (± 20%) RH

Prior to calibration the instrument was allowed to stabilise in the laboratory for at least 30 minutes.
The instrument was calibrated by exposing the sensor to known values of gas concentrations.
All gases were sampled through the complete probe and in line filter, where applicable.
The reference value is that generated by the certified source and the indicated value is that measured by the instrument.

CALIBRATION RESULTS

GAS	LOT No	REF. VALUE	INDICATED VALUE
Isobutylene	WO132063-5	100 ppm	100 ppm
Isobutylene	WO130990-3	1000 ppm	1000 ppm
Benzene	WO184558-5	5 ppm	5.1 ppm

COMMENTS:

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor of $k=2$.
This provides a level of confidence of uncertainty of approximately 95%.
The uncertainty of measurement is $\pm 2\%$
The results indicate that the instrument conforms to the applicable parts of the published specification.

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