

CONTAMINATED LAND RISK ASSESSMENT

PHASE 2 SITE INVESTIGATION

ADP Architects Ltd

**17 South Street
Havant**



Our Ref: SES/ADP/SS/2#1

Date: 25th September 2014

Client:

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**17 South Street
Havant**

A report prepared on behalf of **Soil Environment Services** by:



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INSTITUTE OF PROFESSIONAL SOIL SCIENTISTS

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1. INTRODUCTION AND OBJECTIVES

The purpose of this assessment is to examine specifically the current and potential risks to human, ecological and ground and surface water receptors associated with possible contamination of the ground at the site located at:

17 South Street
Havant
PO9 1BU
Grid Ref. 471800, 106160

The site is to be developed for residential purposes.

Evaluation of the risks is given and subsequently, if needed, further investigation or remediation recommendations made with regard to risk reduction and or evaluation.

Investigation scope

The site was visited on the 3rd September 2014 to insert four boreholes to a maximum depth of 4 m bgl in order to take soil samples and undertake laboratory analysis as agreed with the Environmental Control Officer at Havant Council. The field work was undertaken in accordance with guidelines outlined in the British Code of Practice BS10175:2011 under the supervision of an experienced and fully qualified environmental consultant.

As agreed with the council, the client excavated a series of trial holes for drainage works on the 20th August 2014. An additional three samples were taken from the trial holes and tested for hydrocarbons (speciated PAH, aliphatic and aromatic fractions), metals, asbestos, pH and organic carbon.

General guidance used:

BS 10175:2011 Investigation of potentially contaminated sites. British Standards Institution, London.

CLR 11: Model procedures for the management of land contamination. Environment Agency.

Environment Agency Guiding Principles for Land Contamination (GPLC).

(2010) Environment Agency.

2. SITE CHARACTERISATION AND FORMER INVESTIGATIONS

Current setting and condition (Drawing 1)

The site assessed for this investigation currently comprises an area of land located on South Street, Havant. The site consists of an unused area of land (Photo 1) with a road to the north (Photo 2). Residential properties bound the site to the east, south and west.

Photo 1 Aerial photograph



Former investigations and site history

A Phase 1 desktop report was prepared for the site by Soil Environment Services Ltd in March 2011 (ref SES/JO/SS/1#1). This concluded that no significant uncertainties were considered to exist on site other than the risk from radon. The council were however concerned with the off-site works and garage located to the north of Twittens Way. A Phase 2 investigation was therefore recommended in order to assess the possible risks from potential contamination.

Current geology and hydrogeology

Geology

BGS maps indicate that the site is located on:

1:50 000 scale superficial deposits description: Head - Gravel, Clayey. Superficial Deposits formed up to 3 million years ago in the Quaternary Period. Local environment previously dominated by subaerial slopes.

1:50 000 scale bedrock geology description: Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation. Sedimentary Bedrock formed approximately 71 to 94 million years ago in the Cretaceous Period. Local environment previously dominated by warm chalk seas.

Soils

The Phase 2 site investigation revealed that made ground was encountered in all of the exploratory boreholes (see full borehole logs in Appendix A). The made ground to 0.5 m bgl consisted of dark brown dense gravelly sandy clay and brick.

Natural ground from 0.5 m bgl was encountered in all of the exploratory boreholes and consisted of very stiff very flinty clay (or gravel in BH4) to 1.3 m bgl over pale orange brown firm dense sand to 2.7 m bgl over red brown stiff very gravelly clay.

Perched water was encountered within all of the boreholes. No other water was detected

There was little variation in strata between boreholes.

No visible oily discolorations, marked odours or organic rich soils were detected in any of the made ground and natural soils collected.

Hydrogeology

Flow to groundwater may occur through the soils finding a possible route to the aquifer at depth.

Surface water flow could find a possible route via surface water drains and channels to the west leading to Brockhampton Springs 485m west of the site.

The site is on a variably permeable minor aquifer (Secondary A Superficial Drift, Principal Bedrock aquifer) zone and is not in a groundwater source protection zone.

Investigation decision record

The intrusive investigation involved placing four boreholes into natural ground at depth across the site (see Drawing 1 for locations) such that samples could be obtained as agreed with the Environmental Control Officer at Havant Council. Samples were taken from within the made ground or upper strata and also from deeper natural strata.

The laboratory analysis chosen represents the typical expected contaminants from the former site uses and the surrounding area.

Soil samples (one sample of the made ground from each borehole) were tested in a UKAS accredited laboratory for hydrocarbons (PAH, EPA16 and aromatic and aliphatic hydrocarbon fractions), metals, asbestos, pH and organic carbon.

All sampling protocol was to BS10175 Sections 8.3.1 and Section 8.2.3.3. Boreholes were logged to BS5930. All equipment was cleaned with deionised water prior to and in between sampling locations and sampling depths to minimise cross contamination. Glass storage jars had been newly purchased prior to the site investigation.

All strata was examined for discolouration and odours however no significant visual or olfactory evidence of contamination was identified during the site survey and intrusive investigation.

Samples were stored in cool boxes to minimise any potential hydrocarbon attenuation.

Gas pipes were inserted during the site investigation (3rd September). Gas monitoring wells were inserted into the boreholes. Solid pipe was inserted to 0.7 m bgl surrounded by an impermeable bentonite seal. The remaining pipe to the base of the wells comprised vented pipes with a clean pea gravel surround.

A return monitoring visit was conducted on the 8th September.

Instruments used were;

Gas: GAS DATA CFM 400

Flow: GF60D Landfill Gas Flow Monitor from AGL Airtesting

Soil samples were assessed on site for volatile organic compounds (VOC's) using a Photo Ionisation Detector (PID).

Boreholes were positioned as follows in order to gain a representative overview of the site (see Drawing 1 for locations):

BH1 – located adjacent to the former garage/works to the north

BH2 – located to the south-west of the site

BH3 – located adjacent to the former garage/works

BH4 – located to the south-east of the site

Sampling depths (made ground)

BH1 –0.40 m bgl

BH2 –0.40 m bgl

BH3 –0.40 m bgl

BH4 –0.40 m bgl

No foundations or subsurface obstructions were encountered in any of the exploratory boreholes.

The client had formerly excavated a series of trial holes on the 20th August in conjunction with drainage works. Three samples were tested from three trial holes (see Drawing 1 for TH locations):

The three samples were referenced as follows in Appendix B:

TH1 350mm depth at 3m from downstream manhole.

TH2 350mm depth at 7m from downstream manhole.

TH3 350mm depth at 11m from downstream manhole.

Soil Environment Services Ltd take no responsibility for the integrity of the trial hole samples.

3. CONCEPTUAL SITE MODEL

The conceptual site model detailed here is by a written and diagrammatical (Drawing 1) description of the sources, pathways and receptors. A cross section is included if this will aid interpretation.

3.1 Sources

Sources generated on-site

Soil sample results

Laboratory results (Appendix B) indicated elevated concentrations of benzo(a)pyrene and lead in BH1, BH4, TH2 and TH3 which exceed LQM/CIEH GAC and EA guideline values for residential use

Elevated concentrations of the following parameters were detected:

Table 1 Elevated contaminant concentrations with respect to site end use.

Contaminant	Guideline values	BH1	BH2	BH3	BH4	TH1	TH2	TH3
Lead	mg/kg 450*	610					680	800
Benzo(a)pyrene	0.83	1			1.3		1	0.9

*old guideline values

All concentrations of potential contaminants in BH2, BH3 and TH1 are within LQM/CIEH GAC and EA guideline values for residential use.

Asbestos

No asbestos was detected in any of the samples.

All PID readings gave very low results (Table 1).

TABLE 1. VOC PID readings (ppm)

BH	Strata/depth (m bgl)	VOC
1	0.50	0.1
	1.30	0.0
	2.70	0.0
	3.00	0.0
2	0.50	0.0
	1.30	0.0
	2.70	0.1
	3.00	0.0
3	0.50	0.0
	1.30	0.1
	2.70	0.0
	3.00	0.0
4	0.50	0.0
	1.30	0.1
	2.70	0.0
	3.00	0.0

Ground gases

No significant elevated ground gas concentrations were detected during the monitoring visit (Table 3).

Table 3. Site ground gas concentrations (% Vol)
8th September 2014

BH ref	Carbon dioxide	Methane	Oxygen	Flow (1/hr)
1	2.1	0	18.8	0
2	1.0	0	18.9	0
3	1.8	0	19.1	0
4	2.0	0	18.8	0
Notes: Weather: dry, cloudy Atmospheric pressure: 1020 mB Trend: Rising				

3.2 Receptors

Humans

- Residents in the proposed properties.
- Residents in adjacent properties.

Controlled waters

- Brockhampton Springs 485m west of the site.
- The site is in a variably permeable minor aquifer zone
- The site is in a Secondary A Superficial Drift aquifer zone
- The site is in a Principal Bedrock aquifer zone
- The site is not in a groundwater source protection zone.

Ecology

- Animals and plants are considered to be possible receptors.

Buildings and services

- Underground utility pipes and foundations

3.3 Pathways and plausible pollutant linkages (See Table 1)

Pathways to and from the site could exist via service channels.

Human health

The main pathways considered possible are:

1. Ingestion of soil
2. Ingestion of dust
3. Ingestion of contaminated vegetables
4. Ingestion of soil attached to vegetables
5. Dermal contact with skin
6. Dermal contact with dust
7. Inhalation of fugitive soil dust
8. Inhalation of fugitive dust
9. Inhalation of vapours outside
10. Inhalation of vapours inside
11. Ingress to water supplies is also considered
12. Accumulation and explosion of methane

Controlled waters

Flow to groundwater may occur through the soils finding a possible route to the aquifer at depth.

Surface water flow could find a possible route via surface water drains and channels to the west leading to Brockhampton Springs 485m west of the site.

The site is on a variably permeable minor aquifer (Secondary A Superficial Drift, Principal Bedrock aquifer) zone and is not in a groundwater source protection zone.

4. PLAUSIBLE POLLUTANT LINKAGES & RISK ASSESSMENTS

4.1 Human health

Sources generated on-site

Risks for residential use do exist with respect to lead and slightly elevated benzo(a)pyrene identified on the north-west, south-east and south-west of the site (BH1, BH4, TH2 and TH3).

4.2 Controlled waters

No significant risk is considered to exist as clayey strata encountered at depth is expected to restrict movement to groundwater and hence reduce risk to relatively insignificant.

4.3 Ecology

Animals and plants are considered to be at no risk due to no significant receptors at the site.

4.4 Buildings and services

The site is considered to pose a possible risk to underground utility pipes as PAH's at concentrations which may affect plastic service pipes are evident.

5. CONCLUSIONS AND REMEDIAL OPTIONS

Risks to human health are evident at the site and some remedial action is required.

It is recommended that:

- 1) Removal of 0.6 m depth of made ground around BH 1, BH3, TH2 and TH3. Imported fill may require certification or testing before placement. Topsoil should be in accordance with BS3882.
- 2) If any soils are removed from the site, they will be WAC tested and disposed of accordingly.
- 3) Buildings may require hydrocarbon barriers pending their location on site.
- 4) Development workers wear suitable PPE.
- 5) A photograph based validation report be submitted following completion of the remediation

Normal vigilance should be adopted during re-development and appropriate PPE equipment should be worn by development workers. A watching brief should be conducted. Should any areas of odorous, abnormally coloured or suspected contaminated ground be encountered during general excavation or in pipe trenches, an amended risk assessment of the development should then be undertaken.

DRAWING 1

Borehole locations

NOTES:

 Site boundary

Soil Environment Services Ltd

Contaminated Land Risk Assessment

Tel.: 0191 243 0686

www.soilenvironmentalservices.co.uk

Drawing Title: Borehole & TH locations

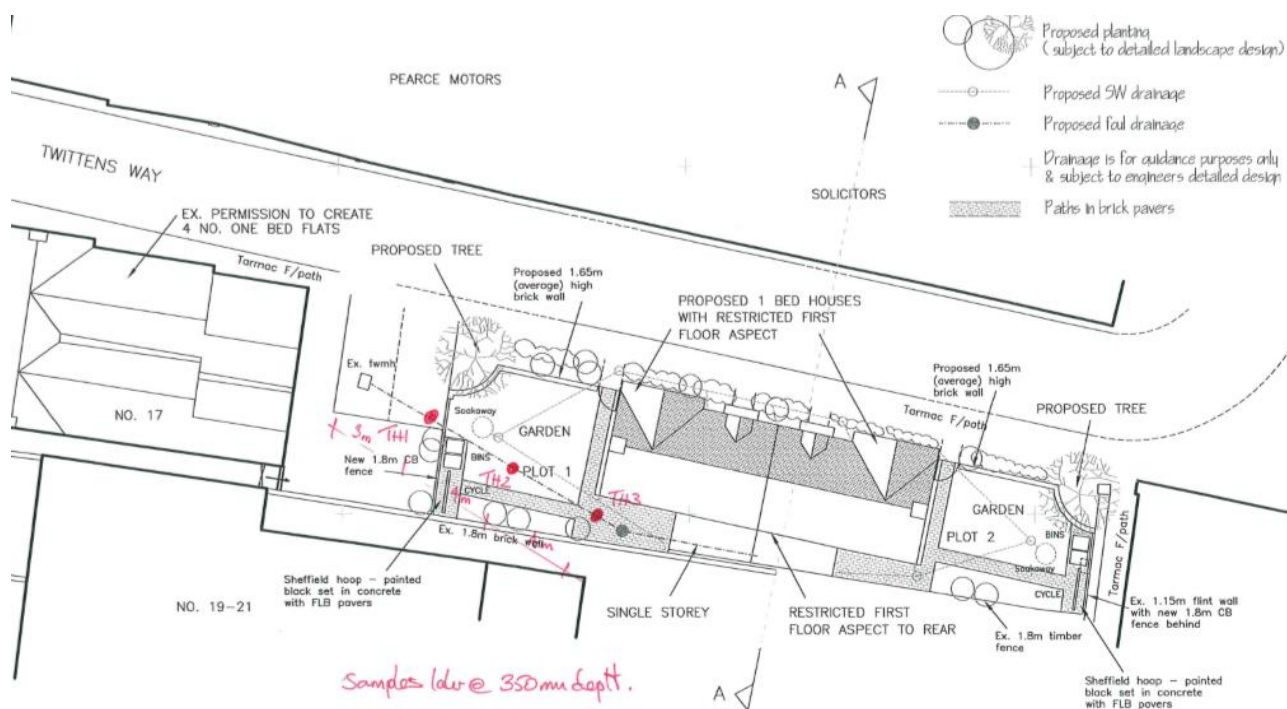
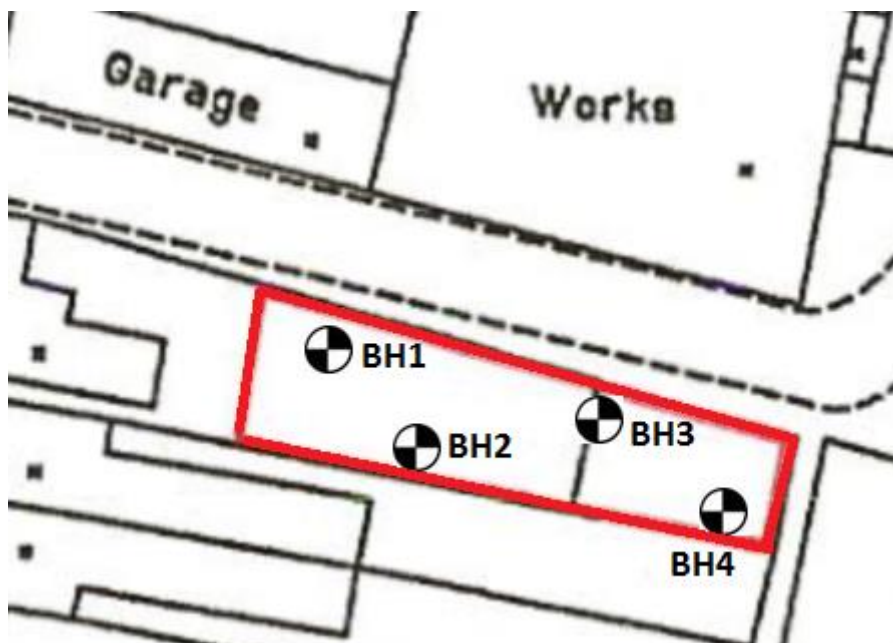
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Client: ADT Architects Ltd

Project: 17 South Street

Scale: 1:200

Date: 25th September 2014

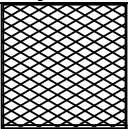
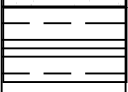
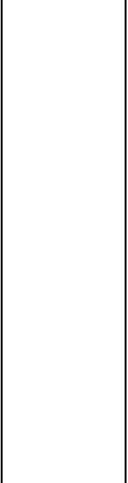


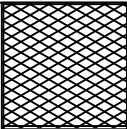
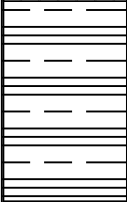
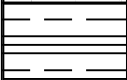
APPENDIX A

Borehole Logs

Borehole/ Testpit Log		Excavation type and method:	Date
BH/Pit Ref.	BH1	Borehole/Window Sampler	03/09/2014

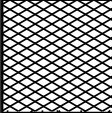
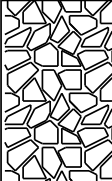
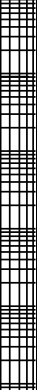
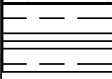
Surface (m OD) NA

Depth (m BGL)	Symbol	Description	Notes	Installations
0.0		MADE GROUND very dark brown dense very sandy clay and brick		
1.0		Yellow brown very stiff very flinty CLAY		
2.0		Pale orange brown very firm medium dense SAND	Perched water at 2.1 m	
3.0		Red brown very gravelly stiff CLAY		
4.0				

Borehole/ Testpit Log		Excavation type and method:	Date	
BH/Pit Ref.	BH2	Borehole/Window Sampler	03/09/2014	
Surface (m OD) NA				
Depth (m BGL)	Symbol	Description	Notes	Installations
		MADE GROUND very dark brown dense very sandy clay and brick		
1.0		Yellow brown very stiff very flinty CLAY		
2.0		Pale orange brown very firm medium dense SAND	Perched water at 2.0 m	
3.0		Red brown very gravelly stiff CLAY		
4.0				

Borehole/ Testpit Log		Excavation type and method: Borehole/Window Sampler	Date	
BH/Pit Ref.	BH4		03/09/2014	

Surface (m OD)		NA		
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Depth (m BGL)	Symbol	Description	Notes	Installations
		MADE GROUND very dark brown dense very sandy clay and brick		
1.0		Pale brown clayey flinty GRAVEL		
2.0		Pale orange brown very firm medium dense SAND	Perched water at 2.1 m	
3.0		Red brown very gravelly stiff CLAY		
4.0				

APPENDIX B

Laboratory results