

CONTAMINATED LAND RISK ASSESSMENT

PHASE 2 INTRUSIVE SITE INVESTIGATION

Hill's Rubber Company Ltd

**85 Bedford Road
Reading**



Client:

Hill's Rubber Company Ltd
161 Cardiff Road
Reading
RG1 8HD

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**85 Bedford Road
Reading**

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



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EXECUTIVE SUMMARY

A Phase 2 site investigation have been undertaken for 85 Bedford Road. The initial Phase 1 report concluded that some risks to human health, controlled waters and buildings were considered to exist from on-site sources (former rubber factory).

Subsequently a scope for a Phase 2 site investigation works was submitted and agreed with the Environmental Health Officer at Reading Borough Council by email on the 15th August 2017.

The site investigation consisted of sampling for soil analysis and risk assessment.

The Phase 2 site investigation revealed that the ground conditions beneath the site generally consisted of shallow depths of made ground generally comprising sandy clay with gravel and crushed brick over gravelly CLAY over chalk (see full borehole logs in Appendix A).

Laboratory results (Appendix B) indicated that concentrations of all contaminants are within LQM/CIEH GAC and EA guideline values for residential use.

No significant sources are present and therefore no plausible pollutant linkages to future residents are considered to exist.

1. INTRODUCTION AND OBJECTIVES

1.1 Introduction

This report details the findings of a Phase 2 site investigation which examines 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:

Hills Rubber Co Ltd
85 Bedford Road
Reading
RG1 7EZ

OS Grid Ref: 470660,173680

The proposal is for residential development. Planning Application 161767 – *demolition of existing single storey factory extension and erection of two semi-detached two-bedroom houses with associated parking.*

This report details the Phase 2 investigation programme and results.

1.2 Objectives

The objectives of the investigation were to categorise and evaluate the risk to human health, controlled waters and buildings.

This was agreed to involve the assessment of the potential presence of contaminants on the site from the former rubber factory activities.

Site work was undertaken on the 6th March 2018 to insert four boreholes for soil sampling.

The ultimate objective is to assess the risk from potentially elevated concentrations of contaminants from on-site sources.

2. SCOPE OF WORKS

The Phase 2 intrusive investigation was conducted on 6th March 2018 to undertake the installation of four boreholes to depth in order to take soil samples for laboratory analysis. The field work was undertaken in accordance with current guidelines as outlined in the BS10175:2011 and CIRIA C665 and C682 documents under the supervision of an experienced and fully qualified environmental consultant (PGC Contaminated Land Management).

The scope of works was as follows:

- 4 x targeted (two in the former workshop building) and untargeted boreholes to ~ 3 m bgl. Take one sample from the upper strata in each of the locations (see Drawing 1). Additional samples taken to account for any change in strata at greater depths or pollutant linkages and be tested at a later date if elevated concentrations of contaminants are detected in the upper strata.
- VOC testing will be undertaken on each strata removed from borehole with a hand-held PID detector.
- Test the samples (one from each location) in a UKAS/MCERTS accredited laboratory for hydrocarbons (speciated PAH, aliphatic and aromatic fractions), metals, asbestos, pH and organic carbon, VOCs and SVOCs and toluene.
- Risk assessment reporting.

3. SITE DESCRIPTION

The site assessed for this investigation comprises 0.03 ha of land located west of Bedford Road, Reading. Residential dwellings bound the site to the south and west with Great Knolly Street to the north and Bedford Road to the east (Photo 1). The site has been recently cleared of the former commercial buildings. The general topography of the site and surrounding land is relatively level.

PHOTO 1 Aerial view



4. SUMMARY OF THE PRELIMINARY RISK ASSESSMENT

Buildings were mapped on the site pre-1879, with the Rubber Factory mapped c. 1963.

The Phase 1 study concluded that a low to moderate risk was considered to exist with regards to the former rubber factory activities. Metals, hydrocarbons, asbestos and toluene could be present at concentrations above guideline values which could pose a risk to human health.

A Phase 2 investigation was therefore recommended with sampling of the site in order to substantiate the possible risks from contamination.

Current soils, geology and hydrology

British Geological Survey (BGS) maps indicate that the site is located on:

Superficial geology

1:50 000 scale superficial deposits description: Taplow Gravel Formation - Sand and Gravel. Superficial Deposits formed up to 2 million years ago in the Quaternary Period. Local environment previously dominated by rivers.

Bedrock geology

1:50 000 scale bedrock geology description: Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated) - Chalk. Sedimentary Bedrock formed approximately 71 to 89 million years ago in the Cretaceous Period. Local environment previously dominated by warm chalk seas.

Hydrology

Flow to groundwater is unlikely to be restricted due to the permeable nature of the bedrock geology mapped on the site.

Surface water flow could possibly find a route via surface water drains and channels to the stream mapped 115 m north-west of the site.

The site is on a Secondary A Superficial Aquifer and Principal Bedrock Aquifer and is not in a groundwater source protection zone

4.1 Summary of the Site History

The Phase 1 report (Soil Environment Services Ltd Ref: SES/AHR/BR/1#1 November 2016) identified that a rubber factory had been present on the site since c.1963 (Table 1).

TABLE 1 Site history

Land use	Direction	Distance (m)	Notes
On-site			
Commercial premises (1879 - 1963)	On site	0	
Rubber factory (1963 - present)	On site	0	
Off site			
Railway (1878 - present)	NW	133	
Dairy (1878 - 1899)	SW	119	
Tank (1899 - 1901)	N	189	<i>Infilled in 1901</i>
Allotment gardens (1931 - present)	W	117	
Engineering works (1977 - present)	NE	127	

4.2 Summary of the Preliminary Conceptual Site Model

Potential sources of contamination from on and off-site sources are considered to pose a possible risk to human health, controlled waters and buildings on the site (Tables 2 and 3):

TABLE 2 Potential sources

Source location	Direction	Distance (m)	Potential Contaminants
On-site			
Commercial premises (1879 - 1963)	On site	0	Metals, hydrocarbons, solvents
Rubber factory (1963 - present)	On site	0	Metals, hydrocarbons, solvents
Elevated lead mapped (300-600 mg/kg)	On site	0	Lead
Off site			
Railway (1878 - present)	NW	133	Metals, hydrocarbons
Dairy (1878 - 1899)	SW	119	Metals, hydrocarbons, pathogens
Tank (1899 - 1901)	N	189	Methane, carbon dioxide
Allotment gardens (1931 - present)	W	117	Herbicides, pesticides
Engineering works (1977 - present)	NE	127	Metals, hydrocarbons

In summary, the preliminary Conceptual Site Model (CSM) indicated (Table 3):

Table 3 Initial Conceptual Site Model

Potential source	Potential contaminants of concern	Plausible pathway	Potential receptor	Probability	Severity	Risk	Justification	Risk classification
ON-SITE								
Rubber factory	Metals, hydrocarbons, solvents	Indoor inhalation, direct soil and dust ingestion and/or inhalation following any movement through the strata	Humans (site users)	Low likelihood	Medium	Moderate/low	Contaminants possibly present	Moderate/low
		Direct contact following any movement through the strata	Controlled waters (groundwater)	Low likelihood	Medium	Moderate/low	Hard standing surface cover restricting any possible spillages or leakages, no spillages or leakages are evident at the time of the walkover survey	Moderate/low
		Direct contact following any movement through the strata	Buildings and services	Low likelihood	Medium	Moderate/low	Hard standing surface cover restricting any possible spillages or leakages, no spillages or leakages are evident at the time of the walkover survey	Moderate/low
Elevated lead mapped	Lead	Direct soil and dust ingestion	Humans (site users)	Low likelihood	Medium	Moderate/low	Contaminants possibly present	Moderate/low
OFF-SITE								
Railway	Metals, hydrocarbons	Indoor inhalation, direct soil and dust ingestion and/or inhalation following any movement through the strata	Humans (site users)	Unlikely	Medium	Low	Distance restricting pathways	Low
Dairy	Metals, hydrocarbons, pathogens	Indoor inhalation, direct soil and dust ingestion and/or inhalation following any movement through the strata	Humans (site users)	Unlikely	Medium	Low	Distance restricting pathways	Low
Tank	Methane, carbon dioxide	Indoor inhalation and/or inhalation following any movement through the strata	Humans (site users)	Unlikely	Medium	Low	Distance restricting pathways, natural attenuation of ground gases*	Low
Allotment gardens	Herbicides, pesticides	Direct soil and dust ingestion	Humans (site users)	Unlikely	Medium	Low	Distance restricting pathways	Low
Engineering works	Metals, hydrocarbons	Indoor inhalation, direct soil and dust ingestion and/or inhalation following any movement through the strata	Humans (site users)	Unlikely	Medium	Low	Distance restricting pathways	Low
Notes to table: * Given the length of time since in-fill, any potential gas generated during decomposition is likely to have peaked and be in decline. This information is based on the document prepared by CIRIA titled 'CIRIA C665 -Assessing risks posed by hazardous gases to buildings'. Section 7.2.5 (Figure 7.1), details that the landfill gas generation rate significantly reduces with the age of the waste. By 30 years, the rate of gas generation is insignificant, and by 50 years, the rate is minimal. Pathway: Classification of human exposure pathways (routes) from The CLEA model, Research and Development Publication CLR10. Probability and severity: Classification of Probability and Consequence from CIRIA C552 Contaminated land risk assessment, a guide to good practice 2001. Risk Classification from DETR Guidelines for Environmental Risk Assessment and Management, 2000								

The Phase 1 desktop report concluded that the site can be considered to pose a potential risk to human health, controlled waters and buildings from sources on the site as significant sources and plausible pollutant linkages may exist.

5. FIELDWORK

5.1 Methodology and sampling

The intrusive investigation involved placing four boreholes into natural ground across the site (see Drawing 1 for locations) such that samples could be obtained. Samples were taken from within the made ground or upper strata with a sample of deeper natural strata being stored should additional testing be required.

The laboratory analysis represents the typical expected contaminants from on-site sources.

Soil samples were tested in a UKAS accredited laboratory for hydrocarbons (PAH-EPA16 and aromatic and aliphatic hydrocarbon fractions), metals, asbestos, pH and organic carbon, VOCs and SVOCs and toluene.

All sampling protocol was to BS 10175 Sections 8.3.1 and Section 8.2.3.3. The drilling works were undertaken and supervised by Soil Environment Services Ltd who logged the samples in accordance with BS 5930:2015. The samples were obtained using windowless sampling techniques. The soil samples were contained within plastic liners to minimise cross contamination.

All equipment was cleaned with deionised water prior to the site survey and in between sampling locations. Glass storage jars had been newly purchased prior to the site investigation. Boreholes were positioned in order to gain a representative overview of the site and target any areas of potential concern.

5.2 Field observations

The Phase 2 site investigation revealed that the ground conditions beneath the site generally consisted of varying depths of made ground generally comprising sandy clay with gravel and crushed brick over gravelly CLAY over chalk (see full borehole logs in Appendix A).

All strata were examined for discolouration and odours however none were detected.

Groundwater

No water was noted within the boreholes

5.3 Analytical and testing strategies

Soils

Soil samples (one sample 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, VOCs and SVOCs and toluene.

6. RESULTS

Soil sample results

Laboratory results (Appendix B) indicated that all concentrations of potential contaminants are within LQM/CIEH GAC and EA guideline values and DEFRA Category 4 Screening Level guideline values for residential use (Table 4).

TABLE 4 Contaminant exceedances with respect to residential use

Contaminant	Source	Assessment Criteria (mg/kg) Residential with homegrown produce	Max. concentration	Number of exceedances
Metals				
Arsenic	LQM S4UL	37	20	0
Cadmium	LQM S4UL	11	0.3	0
Chromium	LQM S4UL	910	101	0
Copper	LQM S4UL	2400	23	0
Lead	LQM S4UL	82-210	192	0
Mercury	LQM S4UL	40	0.8	0
Nickel	LQM S4UL	180	29	0
Selenium	LQM S4UL	250	1.1	0
Zinc	LQM S4UL	3700	110	0
PAH				
Acenaphthene	LQM S4UL	210	<0.01	0
Acenaphthylene	LQM S4UL	170	<0.01	0
Anthracene	LQM S4UL	2400	0.09	0
Benzo(a)anthracene	LQM S4UL	7.2	0.42	0
Benzo(a)pyrene	LQM S4UL	2.2	0.39	0
Benzo(b)fluoranthene	LQM S4UL	2.6	0.48	0
Benzo(k)fluoranthene	LQM S4UL	77	0.19	0
Benzo(ghi)perylene	LQM S4UL	320	0.3	0
Chrysene	LQM S4UL	15	0.34	0
Dibenzo(a,h)anthracene	LQM S4UL	0.24	0.07	0
Fluoranthene	LQM S4UL	280	0.93	0
Fluorene	LQM S4UL	170	0.02	0
Indeno(123cd)pyrene	LQM S4UL	27	0.26	0
Naphthalene	LQM S4UL	2.3	<0.01	0
Phenanthrene	LQM S4UL	95	0.41	0
Pyrene	LQM S4UL	620	0.76	0
TPH				
VPH Aromatic (>EC5-EC7)	LQM S4UL	70	<0.01	0
VPH Aromatic (>EC7-EC8)	LQM S4UL	130	<0.01	0
VPH Aromatic (>EC8-EC10)	LQM S4UL	34	<0.01	0
EPH Aromatic (>EC10-EC12)	LQM S4UL	74	<1	0
EPH Aromatic (>EC12-EC16)	LQM S4UL	140	<1	0
EPH Aromatic (>EC16-EC21)	LQM S4UL	260	2	0
EPH Aromatic (>EC21-EC35)	LQM S4UL	1100	3	0
EPH Aromatic (>EC35-EC44)	LQM S4UL	1100	<1	0
VPH Aliphatic (>C5-C6)	LQM S4UL	42	<0.1	0
VPH Aliphatic (>C6-C8)	LQM S4UL	100	<0.1	0
VPH Aliphatic (>C8-C10)	LQM S4UL	27	<0.1	0
EPH Aliphatic (>C10-C12)	LQM S4UL	130	6	0
EPH Aliphatic (>C12-C16)	LQM S4UL	1100	9	0
EPH Aliphatic (>C16-C35)	LQM S4UL	65000	61	0
EPH Aliphatic (>C35-C44)	LQM S4UL	65000	<10	0
Toluene	EA SGV	610	<0.01	0
Volatiles	SGVs		<0.01	0
Semi-volatiles	SGVs		<0.1	0
Asbestos				
Asbestos (qualitative)	None detected			
Based upon 1% SOM - It is likely that such material will be low in natural organic matter (although significant amounts of organic contamination may be present). Consequently, in deriving the CWAC we have assumed a more cautious soil organic matter content of 1% (rather than the 6% assumed in deriving the SGVs).				

Asbestos

No asbestos was detected in any of the boreholes.

pH

The pH values of the soils ranged from slightly acidic to slightly alkaline in the boreholes (5.0 in BH4 to 8.8 in BH1).

7. REVISED CONCEPTUAL SITE MODEL

The revised conceptual site model detailed here is by a written and tabular description of the sources, pathways and receptors.

The Phase 2 site investigation revealed that the ground conditions beneath the site generally consisted of varying depths of made ground comprising sandy clay with gravel and crushed brick over gravelly CLAY over chalk (see full borehole logs in Appendix A).

The site is mapped on a variably permeable Secondary A Superficial and Principal Bedrock aquifer and is not in a groundwater source protection zone.

No elevated concentrations of contaminants were detected.

In summary, no significant sources exist.

7.1 Sources

Soil sample results (Appendix B)

Laboratory results (Appendix B) indicated that concentrations of all potential contaminants are within LQM/CIEH GAC and EA guideline values for residential use.

7.2 Receptors

Humans

- Residents in the proposed dwellings.
- Residents and workers in adjacent properties.

Controlled waters

- The site is on a Secondary A Superficial Aquifer and Principal Bedrock Aquifer.
- The site is not in a groundwater source protection zone.
- Nearest surface water feature 115 north west of site.

Ecology

- Animals and plants are considered to be possible receptors.

Buildings and services

- Underground pipes and foundations.

7.3 Pathways and plausible pollutant linkages

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 soil
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

Plausible pollutant linkages

No significant sources or plausible pollutant linkages exist.

Controlled waters

No significant risk is considered to exist as laboratory results (Appendix B) indicate no elevated concentrations of potential contaminants. No groundwater or perched water was encountered.

Ecology

Animals and plants are considered to be at no risk due to no significant sources or receptors.

Buildings and services

No significant risks are considered to exist as no aggressive substances (PAHs) which may affect the building foundations or plastic/metal pipes have been detected on the site. No combustible fill or slag material was encountered on the site (*Ref: The Building Regulations 2010 Site preparation and resistance to contaminants*).

TABLE 6 Updated Conceptual Site Model

Potential source	Potential contaminants of concern	Plausible pathway	Potential receptor	Probability	Severity	Risk	Justification	Risk classification
ON-SITE								
Rubber factory	Metals, hydrocarbons, solvents	Indoor inhalation, direct soil and dust ingestion and/or inhalation following any movement through the strata	Humans (site users)	Unlikely	Medium	Low	Laboratory results indicated no elevated concentrations of potential contaminants	Low
		Direct contact following any movement through the strata	Controlled waters (groundwater)	Unlikely	Medium	Low	Laboratory results indicated no elevated concentrations of potential contaminants	Low
		Direct contact following any movement through the strata	Buildings and services	Unlikely	Medium	Low	Laboratory results indicated no elevated concentrations of potential contaminants	Low
Elevated lead mapped	Lead	Direct soil and dust ingestion	Humans (site users)	Unlikely	Medium	Low	Laboratory results indicated no elevated concentrations of lead with respect to the proposed development	Low
Notes to table: * Given the length of time since in-fill, any potential gas generated during decomposition is likely to have peaked and be in decline. This information is based on the document prepared by CIRIA titled 'CIRIA C665 -Assessing risks posed by hazardous gases to buildings'. Section 7.2.5 (Figure 7.1), details that the landfill gas generation rate significantly reduces with the age of the waste. By 30 years, the rate of gas generation is insignificant, and by 50 years, the rate is minimal. Pathway: Classification of human exposure pathways (routes) from The CLEA model, Research and Development Publication CLR10. Probability and severity: Classification of Probability and Consequence from CIRIA C552 Contaminated land risk assessment, a guide to good practice 2001. Risk Classification from DETR Guidelines for Environmental Risk Assessment and Management, 2000								

8. UNCERTAINTIES AND LIMITATIONS

No significant uncertainties or unacceptable risk is considered to exist.

9. CONCLUSIONS

No risks to human health, controlled waters or the ecology are considered to exist as no sources are present. Therefore, no further investigation is considered necessary on the basis of this study.

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 significant made ground or 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 to determine whether further investigation or remedial works are necessary

This report should be submitted to the council prior to proceeding with any development works.

DRAWING 1

Borehole locations

NOTES:

Soil Environment Services

Project: 85 Bedford Road

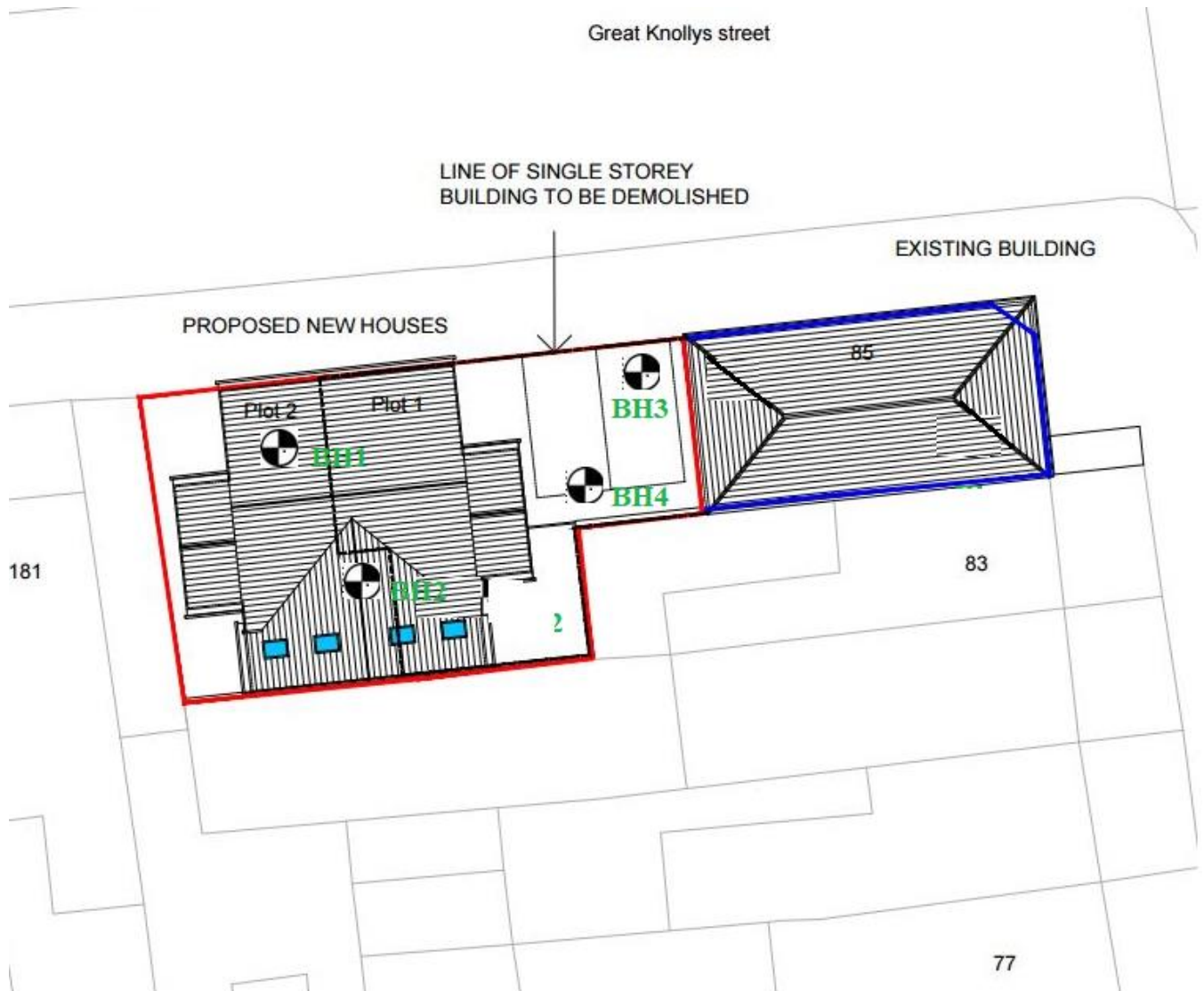
Client: Hill's Rubber Company Ltd

Drawing Title: Borehole locations

Drawing No.: 1

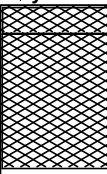
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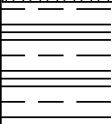
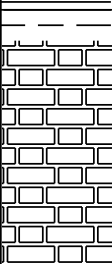
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APPENDIX A

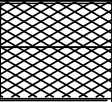
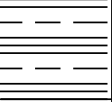
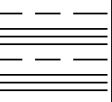
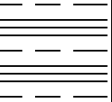
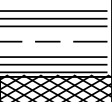
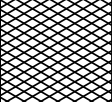
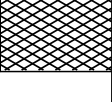
Borehole Logs

Borehole/ Testpit Log		Excavation type and method:	Date
BH/Pit Ref. BH1		Borehole/Window Sampler	06/02/2018
Surface (m OD)			
Depth (m BGL)	Symbol	Description	Notes
		MADE GROUND concrete	
		MADE GROUND brown soft sandy clay with gravel and brick	
1.0		Light orange brown gravelly CLAY with some chalk	
2.0			
3.0			
4.0			

Borehole/ Testpit Log		Excavation type and method:	Date
BH/Pit Ref.	BH2	Borehole/Window Sampler	06/02/2018
Surface (m OD) 			
Depth (m BGL)	Symbol	Description	Notes
		MADE GROUND concrete	
		MADE GROUND brown gravelly sandy clay with brick pieces	
		Orange brown dense sandy CLAY with well rounded gravel	
1.0		Winter friable CHALK	
2.0			
3.0			
4.0			

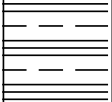
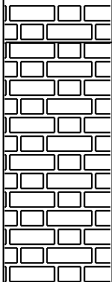
Borehole/ Testpit Log		Excavation type and method:	Date
BH/Pit Ref.	BH3	Borehole/Window Sampler	06/02/2018

Surface (m OD)

Depth (m BGL)	Symbol	Description	Notes
		MADE GROUND concrete and subsoil	
		MADE GROUND brown soft sandy clay with gravel and brick	
1.0		Dark orange brown mottled very sandy silty soft CLAY	
2.0			
		Dense flinty GRAVEL	
3.0			
4.0			

Borehole/ Testpit Log		Excavation type and method: Borehole/Window Sampler	Date
BH/Pit Ref.	BH4		06/02/2018

Surface (m OD)

Depth (m BGL)	Symbol	Description	Notes
		MADE GROUND concrete	
		Orange brown very gravelly firm CLAY1	
1.0		White hard CHALK	
2.0			
3.0			
4.0			

APPENDIX B

Laboratory results

REFERENCES

General guidance used:

DEFRA Category 4 Screening Levels for assessment of land affected by contamination SP1010.

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

BS ISO 5667 Water quality – sampling. British Standards Institution, London.

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

CIRIA C665 Assessing the risks posed by hazardous ground gases 2013.

CIRIA C682 The VOCs Handbook 2009 Investigation, assessing and managing risks from inhalation of Volatile Organic Compounds at land affected by contamination.

Chartered Institute for Environment and Health Indoor air quality in the home.

Environment Agency Guiding Principles for Land Contamination (GPLC).
(2010) Environment Agency.