



Ref: 1CO108540/200323/L1

Date: 23rd March 2020

Luke Fryer
Herringate UK Ltd
16-18 Barnes Wallis Road
Fareham
PO15 5TT

By email to: luke@herringate.com

Dear Luke,

**Geo-Environmental Letter Report –
97A Lovedean Lane, Waterlooville, PO8 9RN**

1. Introduction

Ensafe Consultants (Ensafe), (formerly Resource and Environmental Consultants Ltd), has been commissioned by R&R Design on behalf of Herringate UK Ltd, the "Client", to undertake additional investigative works at 97A Lovedean Lane, Waterlooville, PO8 9RN "the site". A site location plan (Ref: 1CO108540-001) is included within Appendix I.

The proposed development at the site is for the construction of 3no. two-storey residential dwellings with associated gardens and car parking. It is understood that the development will be piled, due to the former chalk pit and ground conditions on site. The proposed development plan (Ref: 1CO108540-002) is included within Appendix I.

The additional investigative works were undertaken at the site in order to investigate if there was a risk to controlled waters from the proposed piling. Samples were obtained from the natural chalk geology in order to assess the potential for leachable contaminants.

2. Previous Works

A series of initial investigations were undertaken at the site by Omnia throughout 2018 and 2019 to assess the potential for ground and gas contamination and discuss remedial options for the site (Report Ref's: A10965/1.0 July 2018; A10965/19092018/L1 August 2018; A10965/2.0 October 2019). It was understood following discussions with the Environmental Health Officer (EHO) in November 2019 that further investigation and sampling was required on site to assess the Made Ground.

REC undertook a Phase II Environmental Assessment at the site in December 2019 (Report Ref 1CO108540/P2/R1). The works comprised 20no. hand pits to a depth of 600mm across the site with laboratory analysis on 20no. samples. Statistical analysis was undertaken on the samples from the

Made Ground obtained by REC during the site investigation, and the samples analysed in the Phase II Omnia site investigation from July 2018. It was concluded that following a comprehensive sampling and analysing exercise, the results indicated that no unacceptable risk to human health was identified.

In a Memorandum dated 28th February 2020 (CONS/20/00292), the EHO has asked for further fieldwork in order to obtain samples within the natural chalk soils at depth. The samples were to undergo leachate analysis, specifically with regard to PAHs, within the natural soils in order to determine the risk to controlled waters within the principal aquifer of the underlying Tarrant Chalk Formation.

3. Scope of work

In accordance with Ensafe's fee proposal Ref. 1CO108540/200303/P1 investigative works were carried out on Thursday 5th March 2020 and comprised the following:

- 2no. window samples to maximum depths of 7.00mbgl within the area of the former chalk pit;
- Installation of one borehole to 7.00mbgl; and,
- Collection of samples for chemical laboratory analysis.

An exploratory hole location plan (drawing reference: 1CO108765-002) is included in Appendix I.

A selection of site photographs is included within Appendix II.

3. Limitations

The limitations to this letter report are presented in Appendix III. Additionally, our glossary is presented within Appendix IV.

4. Ground Conditions

4.1. Summary of Ground Conditions

A summary of ground conditions is presented in Table 4.1 below. Exploratory hole logs are presented within Appendix V.

Table 4.1 Summary of Strata

Stratum	Min Depth to Top of Strata (m)	Max Depth to Top of Strata (m)	Max Thickness (m)
Made Ground	Ground Level	Ground Level	2.40 (WS202)
Head Deposits	1.40	2.40	2.45 (WS201)
Tarrant Chalk Formation	3.85	3.90	3.15 (WS201) NP

NP: Not Proven

4.1.1 Made Ground

Made Ground was identified within both boreholes and generally consisted of grey to dark grey slightly sandy gravelly clay. Sand was fine to coarse. Gravel was angular to rounded fine to coarse metal sheets, ceramic, plastic, brick, flint, organic wood and concrete.

4.1.2 Head Deposits

Head Deposits were found beneath the Made Ground in both locations, consisting of soft to firm brown to orangeish brown slightly sandy slightly gravelly clay. Sand is fine to coarse. Gravel is angular to rounded fine to coarse flint, chalk and relic wood.

4.1.3 Tarrant Chalk Formation

The Tarrant Chalk Formation was found beneath the Head Deposits in both locations to the base of each borehole at 7.00mbgl. The chalk was generally recovered as white to off-white white gravelly silt. Gravel is angular to subrounded fine to coarse flint and low to medium density chalk.

In WS201 between 3.85 and 6.20mbgl the chalk was recovered as off-white silty gravel.

4.1.4 Groundwater Conditions

No groundwater was encountered during the investigation.

4.2 Chemical Testing Results

In order to assess the potential for leachable contaminants, chemical leachability testing of soils was undertaken and compared against the Water Quality Standards (WQS) for Drinking Water.

The results are summarised below in Table 4.2.

Table 4.2 Chemical Analysis Screening Table

Determinand	Units	Drinking Water Standard	WS201 @1.80 mbgl	WS201 @4.50 mbgl	WS201 @6.90 mbgl	WS202 @3.50 mbgl	WS202 @5.00 mbgl	WS202 @6.90 mbgl
Arsenic	µg/l	10	<1.1	<1.1	<1.1	1.8	<1.1	<1.1
Barium	µg/l	-	9.6	7.1	4	14	6.7	5.8
Beryllium	µg/l	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cadmium	µg/l	5	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Chromium	µg/l	50	1	1.6	0.6	1.9	0.8	0.6
Copper	µg/l	2000	2	<0.7	1.3	3	<0.7	1.6
Iron	µg/l	-	390	14	56	870	6	26
Lead	µg/l	10	2.2	<1	1.9	<1	<1	1.8
Mercury	µg/l	1	<0.5	<0.5	2.7	<0.5	<0.5	<0.5

Determinand	Units	Drinking Water Standard	WS201 @1.80 mbgl	WS201 @4.50 mbgl	WS201 @6.90 mbgl	WS202 @3.50 mbgl	WS202 @5.00 mbgl	WS202 @6.90 mbgl
Nickel	µg/l	20	<0.3	<0.3	0.6	1.7	1	<0.3
Selenium	µg/l	10	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
Zinc	µg/l	5000	9.1	2.2	5.2	5.9	<0.4	4.2
Magnesium	µg/l	-	1.3	0.63	0.67	2.1	0.66	0.68
Naphthalene	µg/l	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	mg/l	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthene	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	µg/l	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phenanthrene	µg/l	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Anthracene	µg/l	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoranthene	µg/l	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pyrene	µg/l	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)anthracene	µg/l	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chrysene	µg/l	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	µg/l	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(k)fluoranthene	µg/l	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene	µg/l	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(1,2,3-cd)pyrene	µg/l	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dibenz(a,h)anthracene	µg/l	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(ghi)perylene	µg/l	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total EPA-16 PAHs	µg/l	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

The only exceedance of the WQS was observed within WS201 at 6.90mbgl for Mercury.

During previous investigations undertaken by Omnia and REC, samples were analysed from the Made Ground, Head Deposits and Chalk. Soil analysis did not identify mercury above the limit of detection.

Groundwater has not been encountered in any Omnia or REC/Ensafe investigation, and nearby historical borehole logs estimate the groundwater to be at circa 30.00mbgl. There is no evidence of any impact within the vadose zone. Therefore, the concentrations are not likely to result in any unacceptable risk to the water supply.

5.0 Conclusions

The chemical leachability testing of soils shows that the concentrations of leachable contaminants are minimal within the natural soils underlying the site indicating that the pathway is poor, i.e. there is no evidence of contaminants leaching into the underlying natural ground. Consequently it is considered, no unacceptable risks to the drinking water supply have been identified.



We trust this letter and its enclosures are clear. Should you have any queries, please contact the undersigned.

Yours sincerely,

For and on behalf of Ensafe Ltd

Reviewed and Authorised



Lauren Burnett
Geo-Environmental Consultant

Ged Sojka
Operations Director

Appendices:

Appendix I – Drawings

1CO108540-001 – Site Location Plan

1CO108540-002 – Exploratory Hole Location Plan

Appendix II – Site Photographs

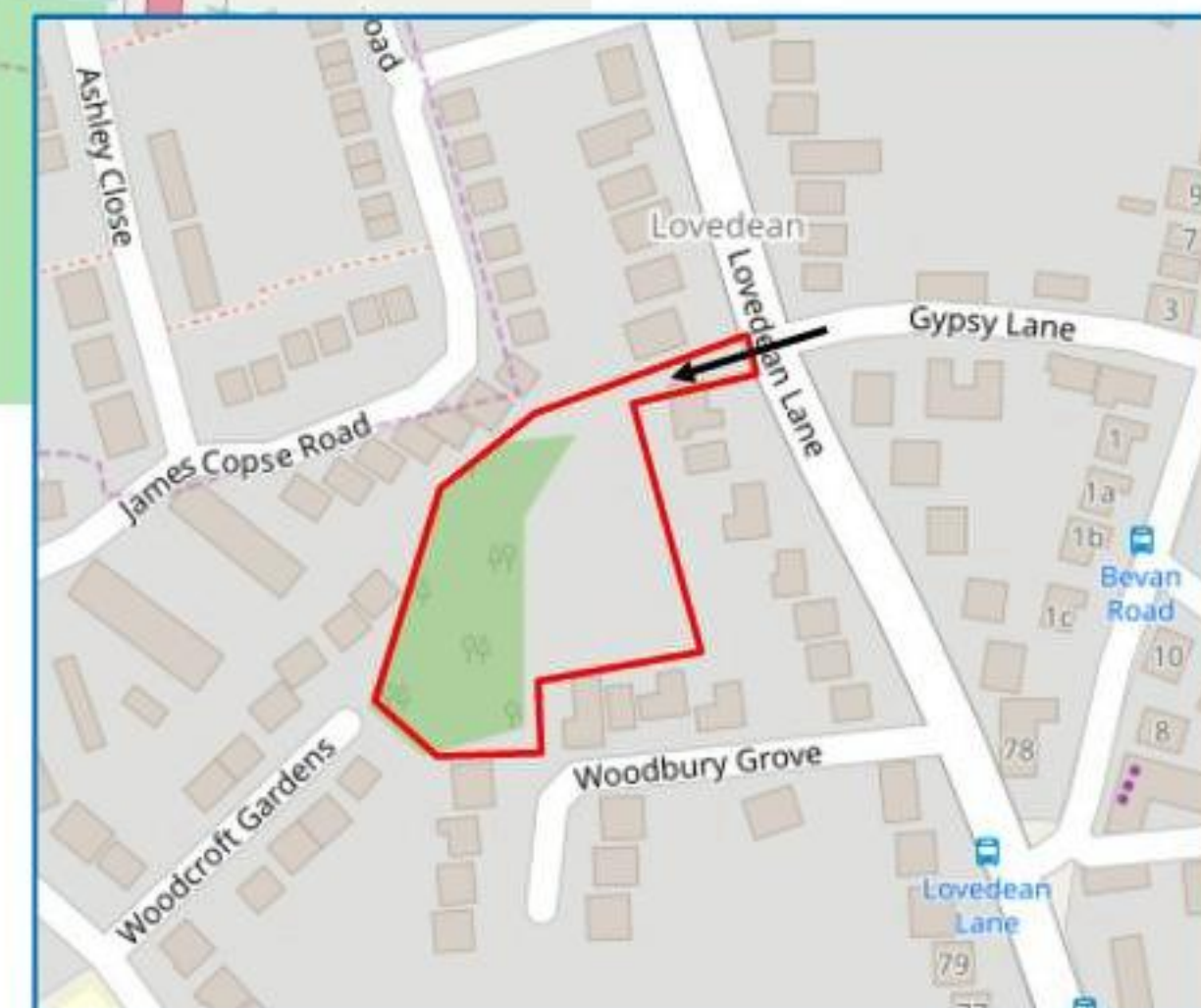
Appendix III – Limitations

Appendix IV – Glossary

Appendix V – Exploratory Hole Logs

Appendix I Drawings

KEY:



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Job No. & Title:

1CO108540
Lovedeane Lane

Client:

Herringgate UK Ltd

Drawn by: LB

Approved by: CL

Date: March 2020

Notes:

Open Street Map, 2020

Drawing Title:

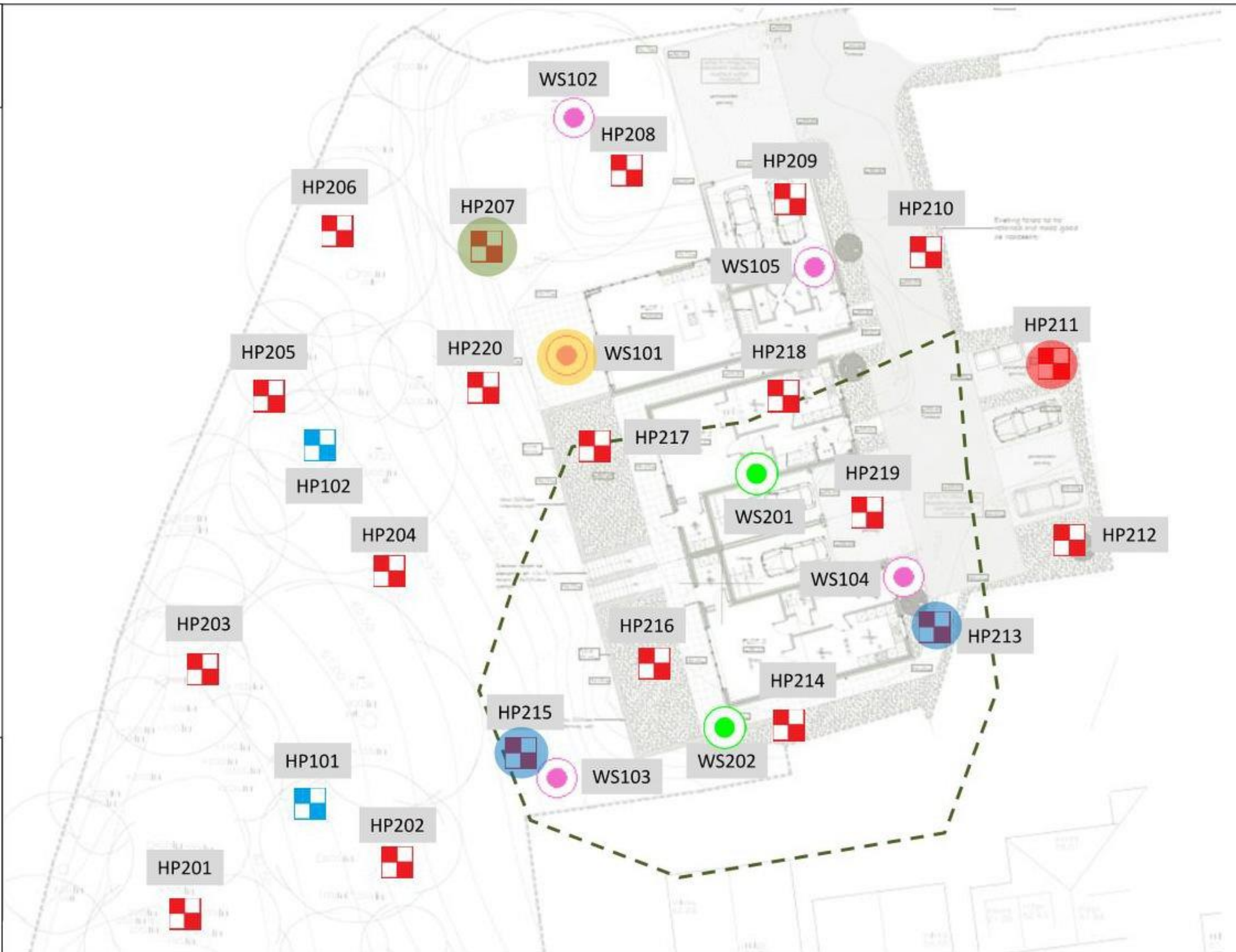
1CO108540-001
Site Location Plan

KEY:



-  Ensafe Hand Pit Location
-  Omnia 2018 Hand Pit
-  Omnia 2018 Investigation Window Sample
-  Ensafe Window Sample Location
-  Cadmium and PAHs in Omnia 2018 investigation
-  Asbestos identified at 0.20mbgl
-  PAH exceedances at 0.20mbgl
-  Lead exceedance at 0.20mbgl
-  Approximate location of former chalk pit

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Job No. & Title:

1CO108540
Lovedean Lane

Client:

Herringate UK Ltd

Drawn by: LB

Approved by: CL

Date: March 2020

Notes:

Extracted from R&R
Design Studio Ltd job
1085 drawing no: 1100.

Drawing Title:

1CO108540-002
Exploratory Hole and
Contamination Plan



Appendix II Site Photographs



Plate 1: Overview of the site facing south and in the direction of the former chalk pit.



Plate 2: Drilling WS201 (left) and WS202 (right).



Plate 3: Window Sample recovery from WS201 showing 1.20 to 7.00mbgl.



Plate 4: Window Sample recovery from WS202 showing 1.20 to 7.00mbgl.

Appendix III Limitations

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between Ensaf e Ltd and the Client as indicated.
2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information it has been assumed it is correct. No attempt has been made to verify the information.
3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination which are enforced by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.
4. During the site walkover reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not be made known or accessible.
5. Access considerations, the presence of services and the activities being carried out on the site limited the locations where sampling locations could be installed and the techniques that could be used.
6. In addition to the above Ensaf e Ltd note that when investigating, or developing, potentially contaminated land it is important to recognise that sub-surface conditions may vary spatially and also with time. The absence of certain ground, ground gas, and contamination or groundwater conditions at the positions tested is not a guarantee that such conditions do not exist anywhere across the site. Due to the presence of existing buildings and structures access could not be obtained to all areas. Additional contamination may be identified following the removal of the buildings or hard standing.
7. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities.
8. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials this is for indicative purposes only and do not constitute or replace full and proper surveys.
9. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.
10. This report presents an interpretation of the geotechnical information established by excavation, observation and testing. Whilst every effort is made in interpretative reporting to assess the soil conditions over the Site it should be noted that natural strata vary from point to point and that man made deposits are subject to an even greater diversity. Groundwater conditions are dependent on seasonal and other factors. Consequently there may be conditions present not revealed by this investigation.
11. Ensaf e cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by Ensaf e is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by Ensaf e in this connection without their explicit written agreement there to by Ensaf e.
12. Rather, this investigation has been undertaken to provide a preliminary characterisation of the existing sub-surface geotechnical characteristics and make up and the findings of this study are our best interpretation of the data collected, within the scope of work and agreed budget. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.
13. This investigation has been undertaken to reasonably characterise existing sub-surface conditions and the findings of this study are our best interpretation of the data collected, within the scope of work and agreed budget. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.

Appendix IV Glossary

TERMS

AST	Above Ground Storage Tank
BGS	British Geological Survey
BSI	British Standards Institute
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CIEH	Chartered Institute of Environmental Health
CIRIA	Construction Industry Research Association
CLEA	Contaminated Land Exposure Assessment
CSM	Conceptual Site Model
DNAPL	Dense Non-Aqueous Phase Liquid (chlorinated solvents, PCB)
DWS	Drinking Water Standard
EA	Environment Agency
EQS	Environmental Quality Standard
GAC	General Assessment Criteria
GL	Ground Level
GSV	Gas Screening Value
HCV	Health Criteria Value
ICSM	Initial Conceptual Site Model
LNAPL	Light Non-Aqueous Phase Liquid (petrol, diesel, kerosene)
ND	Not Detected
LMRL	Lower Method Reporting Limit
NR	Not Recorded
PAH	Poly Aromatic Hydrocarbon
PCB	Poly-Chlorinated Biphenyl
PID	Photo Ionisation Detector
QA	Quality Assurance
SGV	Soil Guideline Value
SPH	Separate Phase Hydrocarbon
Sp.TPH (CWG)	Total Petroleum Hydrocarbon (Criteria Working Group)
SPT	Standard Penetration Test
SVOC	Semi Volatile Organic Compound
UST	Underground Storage Tank
VCCs	Vibro Concrete Columns
VOC	Volatile Organic Compound
WTE	Water Table Elevation

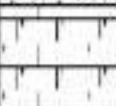
UNITS

m	Metres
km	Kilometres
%	Percent
%v/v	Percent volume in air
mb	Milli Bars (atmospheric pressure)
l/hr	Litres per hour
µg/l	Micrograms per Litre (parts per billion)
ppb	Parts Per Billion
mg/kg	Milligrams per kilogram (parts per million)
ppm	Parts Per Million
mg/m ³	Milligram per metre cubed
m bgl	Metres Below Ground Level
m bcl	Metre Below Cover Level
mAOD	Metres Above Ordnance Datum (sea level)
kN/m ²	Kilo Newtons per metre squared
µm	Micro metre



Appendix V

Exploratory Hole Logs

   			Borehole Log			Borehole No. WS201 Sheet 1 of 1		
Project Name: Lovedean Lane			Proj. ID: 1CO108540		Easting: Northing:		Hole Type WS	
Location: 97a Lovedean Lane, Waterloooville, PO8 9RN			Plant: Archway Dart		Level (m AOD): Final Depth (m): 7.00		Scale: 1:40	
Client: Herringate UK Ltd			Crew: TOR Drilling		Start Date: 05/03/2020 End Date: 05/03/2020		REC Engineer: LB	
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.50 - 0.60	ES1		0.40		Dark grey slightly gravelly slightly sandy CLAY. Sand is fine to coarse. Gravel is angular to rounded fine to coarse brick, concrete, metal, wood and flint. [MADE GROUND]	1
								
		1.50			1.40		Soft to firm brown to orangeish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse flint and chalk. [HEAD DEPOSITS]	2
		1.70						
		1.80 - 2.00	ES2	HVP=48				
		2.00		HVP=61				
		2.20		HVP=59				From 2.20mbgl: Gravelly CLAY.
	3.50 - 3.60	ES3						
				3.85				
		4.50 - 4.60	ES4				CHALK recovered as off-white silty GRAVEL. Gravel is angular to subangular fine to coarse low density chalk and flint. [TARRANT CHALK FORMATION]	4
	5.00 - 5.10	ES5						
	6.00 - 6.10	ES6						
		6.90 - 7.00	ES7		6.20		CHALK recovered as off-white gravelly SILT. Gravel is angular to subrounded fine to coarse low to medium density chalk and flint. [TARRANT CHALK FORMATION]	6
					7.00		End of Borehole at 7.00m	7
								8

Remarks:
 Location cleared for buried services using a Cable Avoidance Tool [CAT]. Hand dug inspection pit excavated to 1.20mbgl. No groundwater encountered. Installed with a gas and groundwater monitoring well to 7.00mbgl and finished with a flush fitting cover set in concrete.



   			Borehole Log			Borehole No. WS202 Sheet 1 of 1			
Project Name: Lovedean Lane			Proj. ID: 1CO108540		Easting: Northing:		Hole Type WS		
Location: 97a Lovedean Lane, Waterloooville, PO8 9RN			Plant: Archway Dart		Level (m AOD): Final Depth (m): 7.00		Scale: 1:40		
Client: Herringate UK Ltd			Crew: TOR Drilling		Start Date: 05/03/2020 End Date: 05/03/2020		REC Engineer: LB		
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.40 - 0.50	ES1		0.75			Dark grey slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to rounded fine to coarse metal, ceramic, plastic, brick and flint. [MADE GROUND]	1
								Grey slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to rounded fine to coarse flint, brick and organic wood. [MADE GROUND]	
		2.50 - 2.60	ES2		2.40			Soft brown to greyish brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to rounded fine to coarse flint, chalk and relic wood. [HEAD DEPOSITS]	3
		3.50 - 3.60	ES3						
		4.00 - 4.10	ES4		3.90			CHALK recovered as white to off-white gravelly SILT. Gravel is angular to subrounded fine to coarse flint and low density chalk. [TARRANT CHALK FORMATION]	4
		5.00 - 5.10	ES5						
		5.50 - 5.60	ES6					..Between 5.20 and 6.00mbgl: CHALK recovered as silty GRAVEL.	6
		6.30 - 6.40	ES7						
		6.90 - 7.00	ES8		7.00			End of Borehole at 7.00m	7
									8
Remarks: Location cleared for buried services using a Cable Avoidance Tool [CAT]. Hand dug inspection pit excavated to 1.20mbgl. No groundwater encountered. Backfilled with arisings and made safe upon completion.									