

Appendix B Leap-Environmental Ground Appraisal Report

Thomas Richards
Thakeham Partnerships
Thakeham House
Summer Place
Stane Street
Billingshurst
West Sussex
RH14 9GN



23rd November 2021
Our ref. LP2616/Ph2/1

Dear Thomas

Re: LP2616 Lees Yard, Additional Investigation of Made Ground and Topsoil Pesticide Analysis

I Introduction

Leap Environmental Ltd (hereafter referred to as **LEAP**) has been appointed by Thakeham Partnerships Ltd (hereafter referred to as Thakeham) to undertake an additional investigation of the ground at a site referred to as Lee's Yard located on Lidsey Road, Woodgate, West Sussex, PO20 3SU (Figure 1, Appendix A). It is understood that Thakeham proposes to develop the site with 38 No. two to three-storey residential properties along with a community hub, public open spaces and associated access roads. The proposed development layout is presented in Drawing 1428A-SK-002, Appendix B.

The site has been the subject of two previous investigations by **LEAP**. The reader is referred to these earlier reports which should be read in conjunction with this report:

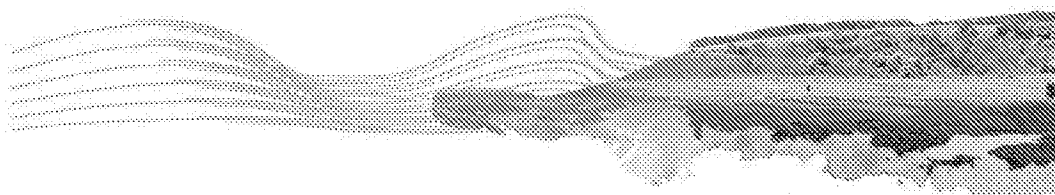
- Phase I Desk Study and Site Reconnaissance for Land North of Lee's Yard, Woodgate, for Thakeham Ref. LP2616/DS/1 dated August 2021.
- Phase II Site Investigation Report and Land North of Lee's Yard, Woodgate for Thakeham Ref. LP2616/SI/2 dated October 2021.

The additional works were commissioned as a result of the recommendations for further works outlined in **LEAP**'s Phase II site investigation report (Ref. LP2616/SI/2) dated 15th October 2021.

The objectives of this additional investigation were:

- To delineate the lateral extent and vertical thickness of the made ground encountered during the previous investigation, in particular around WS07; and
- To sample the shallow soils across the site for the potential presence of historical pesticides and herbicides.

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2 Background Information

2.1 Site Description

The site is an approximately 1.53 ha undeveloped field with the centre of the village of Woodgate around 400m to the north. The site slopes gently downwards from around 8.7m AOD in the west of the site to around 6.9m AOD in the east-southeast. The field is predominantly grassed and has been cropped until recent times. An area of long grass, wildflowers and shrubs was previously present in the north of the site, however during the site visit the hedges, trees and shrubs had been removed. An L-shaped hedge divides off the north-eastern corner from the rest of the site and was planted sometime between 2000 and 2012. No buildings are present, but two small electrical boxes are present on the northern boundary within a patch of trees.

Along all boundaries of the site are dense mature evergreen hedges and young to mature trees, including elm, poplar, silver birch and Leyland cypress.

The surrounding area is predominantly rural and low density residential. The site is bounded to the north by an unnamed access road with residential housing beyond; to the east by a caravan park; to the south by a car sales yard with fields beyond; and to the west by Lidsey Road (A29) with residential housing beyond.

2.2 Site History

The site has been a field since the earliest available historical OS maps. The surrounding area was mostly farmland until the 1930s when sporadic residential properties commenced construction in the vicinity of the site. A brickfield was present 150m to the east of the site from the late 1930s until the early 1970s. This area is now a caravan park. A sawmill adjacent to the south of the site was constructed in the 1990s and is now a car sales facility (Lee's Yard).

2.3 Environmental Setting

2.3.1 Geology and Hydrogeology

The site is mapped as being underlain by superficial River Terrace Deposits over the London Clay Formation. The superficial deposits are classified as a Secondary A Aquifer whilst the London Clay is classified as Unproductive Strata.

The site is not situated within a Groundwater Source Protection Zone (SPZ) and no groundwater abstraction licences are located within 1km.

2.3.2 Hydrology and Flooding

There are no surface water features on-site although a field drain is located 15m to the south-west. The closest substantial surface water feature is the river Lidsey Rife located approximately 380m east of the site.

The site is not located within a surface water flood zone but the risk of groundwater flooding is indicated as high in the east of the site reducing to moderate in the west.

2.4 Previously Encountered Ground Conditions

The desk study indicated that potential on site sources of contamination which may pose a risk to human health were limited including pesticides from historical farming, hydrocarbons from farm machinery.

LEAP's site investigation was carried out in August 2021 and comprised a total of 8 No. machine excavated trial pits to a maximum depth of 3m and 7No. windowless sampler boreholes to 4m bgl. 5 No. windowless locations were installed as combined groundwater and gas monitoring wells.

The investigation generally encountered topsoil over sandy clays and clayey sands and locally gravels (River Terrace Deposits) over firm to stiff clay (London Clay Formation). The River Terrace Deposits were generally thinner in the east of the site and increased in thickness towards the west and south-west. A layer of made ground was encountered beneath the topsoil in WS07 in the north of the site close to the site entrance but was not observed elsewhere on-site. The made ground comprised brown sandy gravel with fragments of concrete and brick, with the gravel being fine to coarse sub-angular flint.

The results of chemical testing recorded none of the contaminants that were analysed for above acceptable levels for a residential development with private gardens. Based on the findings of the investigation the report concluded that there was little evidence to suggest contamination was present on-site. However, further shallow investigation and sampling was recommended to delineate the extent of the made ground around WS07 and to enable testing pesticides within the shallow soils.

3 Fieldwork

The intrusive investigation was carried out on 2nd November 2021 and comprised 8 No. inspection pits hand dug using a hand auger and spade.

A site plan for the location of each excavation is presented in Figure 2 of Appendix A. Photographs are provided in Appendix B and the trial hole logs in Appendix C.

Hand pits HPI01 to HPI03 were excavated in the vicinity of WS07 where made ground was previously encountered to assess its vertical and spatial extent. HPI04 was excavated near

the northern boundary of the site where limited previous investigation could be undertaken due to access constraints. HP105 to HP108 were completed across the wider site to enable sampling for pesticide testing.

The weather during the visit was predominantly cold, dry and sunny.

Samples of the made ground were collected from HP101 to HP103, with topsoil samples collected from HP104 to HP108. The samples were sent to The Environmental Laboratory for chemical analysis. Samples from HP101 to HP104 were scheduled for the following analysis:

- Heavy metals;
- Polycyclic aromatic hydrocarbons (USEPA 16 PAHs);
- Asbestos identification;
- Total organic carbon (TOC); and
- pH.

The topsoil samples from HP105 to HP108 were analysed for a pesticide suite comprising organochlorine pesticides, organophosphorus pesticides and triazine herbicides.

4 Encountered Ground Conditions

The logs for each hand pit are presented in the Appendix C, and Table 1 below provides a summary of the ground conditions that were encountered.

Table 1. Summary of the Hand Pit Logs

Depth Range	Geology	Description
GL – 0.15 /0.25	TOPSOIL	Grass over TOPSOIL: dark brown occasionally gravelly slightly sandy slightly silty clay with roots and rootlets. Where encountered, gravel is subrounded to angular fine to coarse flint. Absent from HP101, HP102 and HP103.
GL – 0.2/0.25	MADE GROUND	Grass and sometimes moss over MADE GROUND: dark brown sandy slightly clayey gravel with occasional rootlets. Gravel is subrounded to angular fine to cobble flint, occasional fine to medium brick fragments, occasional concrete and occasional blacktop with an organic odour. HP101, HP102 and HP103 only.
0.15/0.25 – 0.3*/0.5*	CLAY	Firm light brown gravelly very sandy occasionally silty CLAY with rootlets. Gravel is subrounded to angular fine to coarse flint and occasionally fine to medium chalk.

*Maximum depth of excavation

The made ground encountered was similar in composition to that previously encountered in WS07 in the north of the site, as a sandy gravel with fragments of brick and concrete. The thickness of the made ground in WS07 was 0.25m, which is also similar to the thickness encountered in HPI01, HPI02 and HPI03.

Spatially, the made ground appears to be confined to the portion of ground directly west and south of the overgrown area in the north of the site, extending around 2m out from the overgrown area. Little or no grass was present at the surface where the made ground was encountered. Using this observation, it is interpreted that the made ground extends northwards underneath and beyond the access gate to the northern boundary of the site, with the eastern extent finishing approximately 1m to the east of HPI01.

HPI04, undertaken in the north of the site in the previously overgrown area, encountered similar shallow soils to those across the rest of the site.

5 Soil Analytical Results and Human Health Risk Assessment

The soil laboratory certificates are provided in Appendix D.

The laboratory results have been compared to the same Generic Assessment Criteria as those that were used in the previous Phase II investigation, where available i.e. published Soil Guideline Values (SGVs), Category 4 Screening Levels (C4SLs), or LQM/CIEH Sutable 4 Use Values (S4ULs) for a residential with home grown produce (resi HGP) end use, which best reflects the proposed development. Table 2 provides a summary of the results along with the relevant GACs. No pesticides were detected above the limit of detection and so, are not included in the table.

Table 2: Summary of Soil Contamination Test Results

Determinand	Number of samples	Number >LOD	Maximum Conc. (mg/kg unless otherwise stated)	Generic Assessment Criteria (mg/kg)	Number of Exceedances
METALS					
Arsenic	4	1	11.6	37	0
Cadmium	4	0.5	<0.5	22	0
Chromium	4	5	37.5	910	0
Hexavalent Chromium	4	0.8	<0.8	21	0
Copper	4	5	19.3	2,400	0
Lead	4	5	89.2	200	0
Mercury ¹	4	0.5	<0.5	40	0
Nickel	4	5	21.9	130	0
Selenium	4	1	<1.0	250	0
Zinc	4	5	71.7	3,700	0
ASBESTOS					
Asbestos	4	0	No asbestos detected	Presence	No asbestos detected
HYDROCARBONS					
Benzo(a)pyrene ²	4	0.1	2.8	5.0	0
Naphthalene ³	4	0.1	0.1	5.6	0
Total PAHs	4	0.4	31.8	n.v.	-

Notes to table

1. Assessment criterion based on inorganic mercury
 2. As a surrogate marker for genotoxic PAH
 3. As a marker compound for threshold PAH
- n.v. – no appropriate value

The samples generally contained low concentrations of contaminants in the made ground and topsoil samples. A relatively high total PAH concentration of 31.8mg/kg was present within the made ground sample in HPI01 at 0.1m, with the other two made ground samples and topsoil sample from HPI04 containing much lower total PAH concentrations of between 0.8mg/kg and 2.0mg/kg. Generally, the topsoil sample from HPI04 had lower concentrations of heavy metals in comparison with the made ground samples, but these values did not vary greatly. Overall, no contaminants exceeded their respective GACs for resi HGP.

All pesticides tested for were below the laboratory limits of detection.

6 Conclusions and Recommendations

Made ground was encountered in the three hand pits (HPI01, HPI02 and HPI03) in the northwest of the site to a maximum proven depth of 0.25m bgl with natural silty sandy clay beneath, although it is noted that HPI01 did not penetrate the full depth of made ground, due to difficulties excavating through the dense gravelly soils.

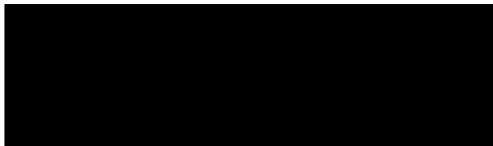
The made ground was restricted to the area directly west and south of the overgrown area in the north of the site, with a maximum thickness of 0.25m. The analytical results did not identify any contaminants in the made ground at concentrations which would indicate a risk to human health, and there is therefore considered to be no risk to future residents from the made ground.

The five hand pits undertaken across the wider field did not encounter any made ground. Instead, topsoil was encountered between 0.15 and 0.25m bgl and was of a similar composition to that previously encountered. Below the made ground or topsoil, light brown gravelly very sandy occasionally silty clay was encountered to the full depth of excavation. None of the contaminants tested for exceeded the GACs for residential HGP within these natural samples, and no pesticides were detected above the laboratory limits of detection.

Based on the investigation and subsequent laboratory testing no remedial action is considered necessary on-site in regard to human health.

Please do not hesitate to contact the undersigned if you require any further information.

Yours sincerely,



Lauren Stillwell

Enc.

Appendix A - Figures

Appendix B – Photographic Record

Appendix C – Exploratory Logs

Appendix D – Laboratory Test Results

LIMITATIONS

This letter report has been prepared by Leap Environmental Ltd on the basis of information received from a variety of sources which Leap Environmental Ltd believes to be accurate. Nevertheless, Leap Environmental Ltd cannot and does not guarantee the authenticity or reliability of the information it has obtained from others.

Leap Environmental Ltd has used all reasonable skill, care and diligence in the design and execution of this report, taking into account the manpower and resources devoted to it in agreement with the Client. Although every reasonable effort has been made to obtain all relevant information, all potential contamination, environmental constraints or liabilities associated with the site may not necessarily have been revealed.

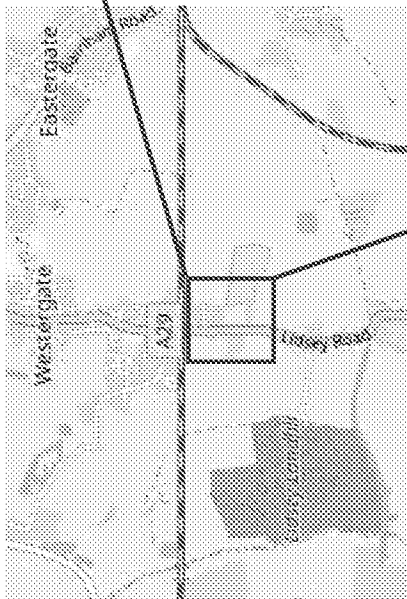
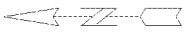
This report is generally consistent with the Eurocode requirements for a Ground Investigation Report, noting the limitations on brief to provision of pile design information only. However, the laboratory testing has been carried out on samples which do not comply with the Eurocode classifications as identified in tables 2 and 3 of EN ISO 22475-1. This report should not be deemed as a Geotechnical Design Report, and where any calculations have been made, these are not Eurocode compliant and are for indicative purposes only.

The conclusions reached in this report are necessarily restricted to those which can be determined from the information consulted, and may be subject to amendment in the light of additional information becoming available. These conclusions may not be appropriate for alternative schemes.

This report is confidential to the Client, and Leap Environmental Ltd accepts no responsibility whatsoever to third parties to whom this report, or any part thereof, is made known, unless formally agreed by Leap Environmental Ltd beforehand. Any such party relies upon the report at their own risk.

APPENDIX A - FIGURES

Figures

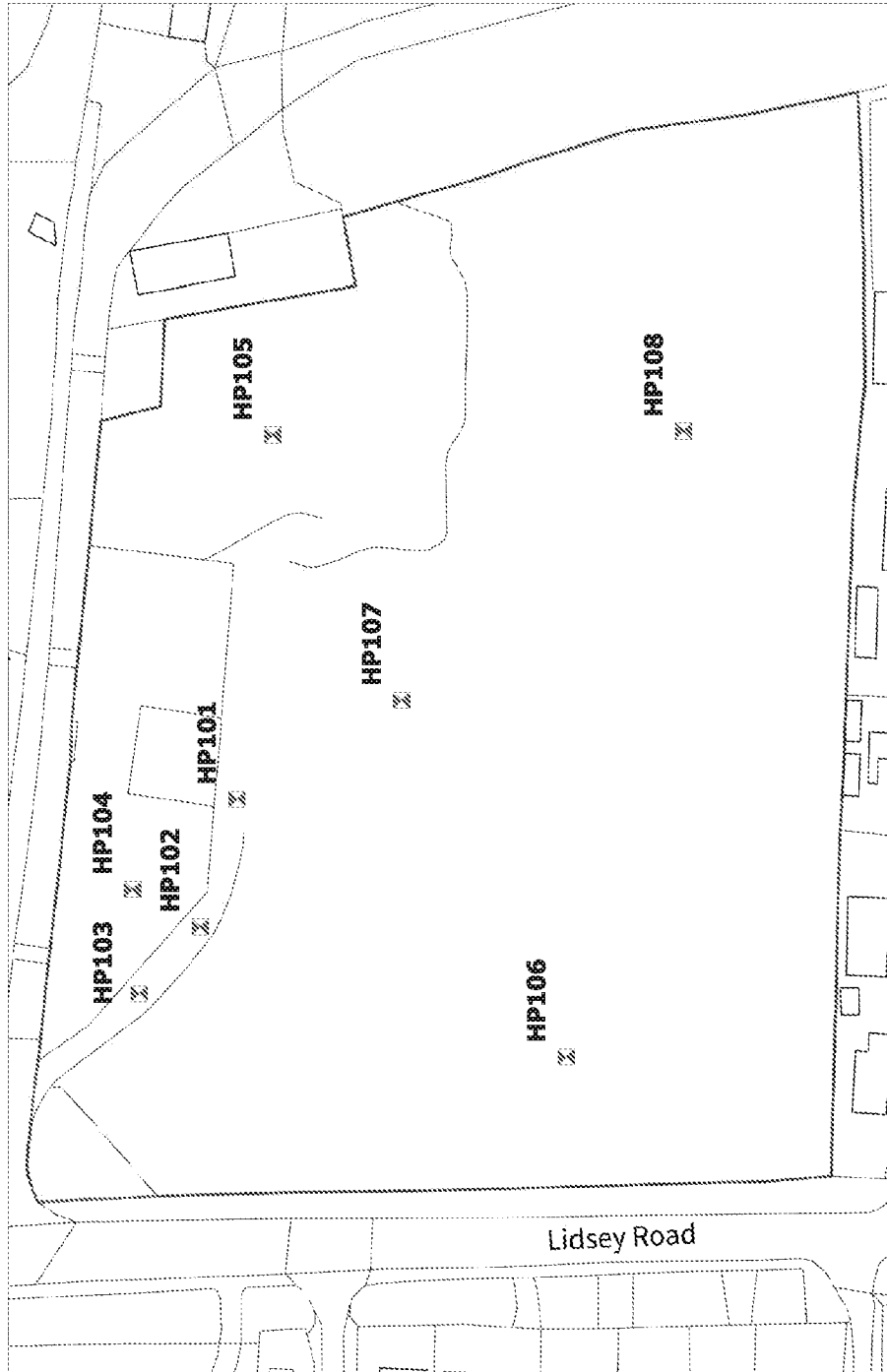


Site Boundary

Basemap: @Openstreetmaps



Client:	Thakeham Partnerships Ltd	Date:	November 2021	Project ID:	LP2616
Project:	Land North of Lee's Yard, Woodgate, PO20 3SU	Title:	Site Location Plan	Fig. No.	1



Key

- Site Boundary
- ⊞ Hand Pits

Basemap: © OpenStreetMap contributors
Note 1: Exploratory holes have been positioned by local measurements made by site engineer and should therefore only be taken as approximate.
Note 2: Exploratory holes shown are not to scale.
Note 3: Elevations not shown



Client:

Thakeham
Partnership Ltd

Title:

Hand Pit
Locations

Project ID:

LP2616

Project:

Land north of Lee's
Yard, Woodgate

Date:

November
2021

Figure No.

2

APPENDIX B – PHOTOGRAPHIC RECORD

Photographic Record



HP101



Arisings from HP102



HP104



HP106

APPENDIX C – EXPLORATORY LOGS

Exploratory Logs

ARUN DISTRICT COUNCIL AL/141/21/RES

Leap Environmental Ltd The Atrium, Curtis Road Dorking, Surrey RH4 1XA Tel: 01306 646510 www.leapenvironmental.com				Trial Pit Log				Trialpit No HP102 Sheet 1 of 1	
Project Name: Land North of Lee's Yard				Project No. LP2616		Co-ords: - Level:		Date 02/11/2021	
Location: Lidsey Road, Woodgate, West Sussex, PO20 3SU						Dimensions (m): Depth 0.30		Scale 1:25	
Client: Thakeham Partnerships Ltd								Logged EL	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.10	ES		0.20 0.30		 	Grass over MADE GROUND: dark brown slightly sandy slightly silty slightly clayey gravel with rootlets. Gravel is subrounded to angular fine to cobble flint, occasional concrete, fine to medium brick fragments and occasional blacktop with an organic odour. Firm light brown very gravelly very sandy CLAY with rootlets. Gravel is subrounded to subangular fine to coarse flint. End of pit at 0.30m		
								1	
								2	
								3	
								4	
								5	
Remarks: Pit remained dry and stable, and was backfilled with arisings.									
Stability: Stable									

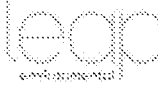


ARUN DISTRICT COUNCIL AL/141/21/RES

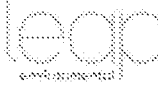
Leap Environmental Ltd The Atrium, Curtis Road Dorking, Surrey RH4 1XA Tel: 01306 646510 www.leapenvironmental.com				Trial Pit Log				Trialpit No HP104 Sheet 1 of 1	
Project Name: Land North of Lee's Yard				Project No. LP2616		Co-ords: - Level:		Date 02/11/2021	
Location: Lidsey Road, Woodgate, West Sussex, PO20 3SU						Dimensions (m):		Scale 1:25	
Client: Thakeham Partnerships Ltd						Depth 0.50		Logged EL	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.05	ES					Dead grass and moss over TOPSOIL: dark brown occasionally gravelly slightly sandy slightly silty clay with roots and rootlets. Gravel is subrounded to subangular fine to medium flint. Firm light brown occasionally gravelly very sandy slightly silty CLAY with rootlets. Gravel is subangular fine to medium flint. ----- End of pit at 0.50m -----	
	0.30	ES		0.20				
				0.50				
								1
								2
								3
								4
								5

Remarks: Pit remained dry and stable, and was backfilled with arisings.	
Stability: Stable	

 Leap Environmental Ltd The Atrium, Curtis Road Dorking, Surrey RH4 1XA Tel: 01306 646510 www.leapenvironmental.com				Trial Pit Log				Trialpit No HP105 Sheet 1 of 1	
Project Name: Land North of Lee's Yard				Project No. LP2616		Co-ords: - Level:		Date 02/11/2021	
Location: Lidsey Road, Woodgate, West Sussex, PO20 3SU						Dimensions (m): Depth 0.20		Scale 1:25	
Client: Thakeham Partnerships Ltd								Logged EL	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.10	ES		0.20		 Grass over TOPSOIL: dark brown occasionally gravelly silty clay with roots and rootlets. Gravel is subangular coarse flint.	End of pit at 0.20m		
								1	
								2	
								3	
								4	
								5	
Remarks: Pit remained dry and stable, and was backfilled with arisings.									
Stability: Stable									

ARUN DISTRICT COUNCIL AL/141/21/RES

 Leap Environmental Ltd The Atrium, Curtis Road Dorking, Surrey RH4 1XA Tel: 01306 646510 www.leapenvironmental.com				Trial Pit Log				Trialpit No HP107 Sheet 1 of 1	
Project Name: Land North of Lee's Yard				Project No. LP2616		Co-ords: - Level:		Date 02/11/2021	
Location: Lidsey Road, Woodgate, West Sussex, PO20 3SU						Dimensions (m): Depth 0.20		Scale 1:25	
Client: Thakeham Partnerships Ltd								Logged EL	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.10	ES		0.20			Grass over TOPSOIL: dark brown slightly sandy silty clay with roots and rootlets. ----- End of pit at 0.20m		
								1	
								2	
								3	
								4	
								5	
Remarks: Pit remained dry and stable, and was backfilled with arisings.									
Stability: Stable									



ARUN DISTRICT COUNCIL AL/141/21/RES

APPENDIX D – LABORATORY TEST RESULTS

Laboratory
Test Results



2683



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St Leonards on Sea
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TN38 9BY
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info@elab-uk.co.uk

THE ENVIRONMENTAL LABORATORY LTD

Analytical Report Number: 21-36948

Issue: 1

Date of Issue: 11/11/2021

Contact: Lauren Stillwell

Customer Details: Leap Environmental Ltd
Book House
Glebelands Centre
Dorking
Surrey RH4 3HW

Quotation No: Q14-00063

Order No: LPO4665

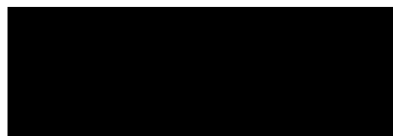
Customer Reference: LP2616

Date Received: 03/11/2021

Date Approved: 11/11/2021

Details: Land North of Lee's Yard

Approved by:



Mike Varley, General Manager

Any comments, opinions or interpretations expressed herein are outside the scope of UKAS accreditation (Accreditation Number 2683)

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Sample Summary

Report No.: 21-36948, issue number 1

Elab No.	Client's Ref.	Date Sampled	Date Scheduled	Description	Deviations
256468	HP101 0.10	02/11/2021	04/11/2021	Sandy silty loam	
256469	HP101 0.10	02/11/2021	04/11/2021	Sandy silty loam	
256470	HP103 0.10	02/11/2021	04/11/2021	Sandy silty loam	
256471	HP104 0.05	02/11/2021	04/11/2021	Silty loam	
256472	HP104 0.30	02/11/2021	04/11/2021		
256473	HP105 0.10	02/11/2021	04/11/2021	Silty loam	
256474	HP106 0.10	02/11/2021	04/11/2021	Silty loam	
256475	HP107 0.10	02/11/2021	04/11/2021	Silty loam	
256476	HP108 0.10	02/11/2021	04/11/2021	Silty loam	
256477	HP109 0.05	02/11/2021	04/11/2021		



Results Summary

Report No.: 21-36948, issue number 1

ELAB Reference	256468	256469	256470	256471
Customer Reference				
Sample ID				
Sample Type	SOIL	SOIL	SOIL	SOIL
Sample Location	HP101	HP101	HP103	HP104
Sample Depth (m)	0.10	0.10	0.10	0.05
Sampling Date	02/11/2021	02/11/2021	02/11/2021	02/11/2021
Determinand	Codes	Units	LOD	
Soil sample preparation parameters				
Moisture Content	N	%	0.1	13.1
Material removed	N	%	0.1	72.3
Description of Inert material removed	N		0	Stones
Metals				
Arsenic	M	mg/kg	1	11.2
Cadmium	M	mg/kg	0.5	< 0.5
Chromium	M	mg/kg	5	34.6
Copper	M	mg/kg	5	19.3
Lead	M	mg/kg	5	24.9
Mercury	M	mg/kg	0.5	< 0.5
Nickel	M	mg/kg	5	21.9
Selenium	M	mg/kg	1	< 1.0
Zinc	M	mg/kg	5	71.7
Inorganics				
Hexavalent Chromium	N	mg/kg	0.8	< 0.8
Miscellaneous				
pH	M	pH units	0.1	10.6
Total Organic Carbon	N	%	0.01	1.9
Polyaromatic hydrocarbons				
Naphthalene	M	mg/kg	0.1	< 0.1
Acenaphthylene	M	mg/kg	0.1	< 0.1
Acenaphthene	M	mg/kg	0.1	< 0.1
Fluorene	M	mg/kg	0.1	< 0.1
Phenanthrene	M	mg/kg	0.1	0.3
Anthracene	M	mg/kg	0.1	0.1
Fluoranthene	M	mg/kg	0.1	0.1
Pyrene	M	mg/kg	0.1	< 0.1
Benzo(a)anthracene	M	mg/kg	0.1	< 0.1
Chrysene	M	mg/kg	0.1	< 0.1
Benzo(b)fluoranthene	M	mg/kg	0.1	< 0.1
Benzo(k)fluoranthene	M	mg/kg	0.1	< 0.1
Benzo(a)pyrene	M	mg/kg	0.1	< 0.1
Indeno(1,2,3-cd)pyrene	M	mg/kg	0.1	< 0.1
Dibenzo(a,h)anthracene	M	mg/kg	0.1	< 0.1
Benzo(g,h,i)perylene	M	mg/kg	0.1	< 0.1
Total PAH(16)	M	mg/kg	0.4	0.8

Tests marked N are not UKAS accredited.

The Environmental Laboratory Ltd. Reg. No. 3882193



Results Summary

Report No.: 21-36948, issue number 1

ELAB Reference				256468	256469	256470	256471
Customer Reference							
Sample ID							
Sample Type				SOIL	SOIL	SOIL	SOIL
Sample Location				HP101	HP101	HP103	HP104
Sample Depth (m)				0.10	0.10	0.10	0.05
Sampling Date				02/11/2021	02/11/2021	02/11/2021	02/11/2021
Determinand	Codes	Units	LOD				
OrganoChlorine Pesticides							
alpha-HCH	M	ug/kg	10	n/t	n/t	n/t	n/t
beta-HCH	M	ug/kg	10	n/t	n/t	n/t	n/t
gamma-HCH	M	ug/kg	10	n/t	n/t	n/t	n/t
delta-HCH	N	ug/kg	10	n/t	n/t	n/t	n/t
Heptachlor	N	ug/kg	10	n/t	n/t	n/t	n/t
Aldrin	M	ug/kg	10	n/t	n/t	n/t	n/t
Heptachlor epoxide	N	ug/kg	10	n/t	n/t	n/t	n/t
trans-Chlordane	N	ug/kg	10	n/t	n/t	n/t	n/t
alpha cis-Chlordane	N	ug/kg	10	n/t	n/t	n/t	n/t
p,p-DDE	M	ug/kg	10	n/t	n/t	n/t	n/t
Dieldrin	M	ug/kg	10	n/t	n/t	n/t	n/t
Endrin	N	ug/kg	10	n/t	n/t	n/t	n/t
p,p-DDD	M	ug/kg	10	n/t	n/t	n/t	n/t
Endosulfan II	N	ug/kg	10	n/t	n/t	n/t	n/t
Endrin aldehyde	N	ug/kg	10	n/t	n/t	n/t	n/t
p,p-DDT	M	ug/kg	10	n/t	n/t	n/t	n/t
Endosulphan sulphate	M	ug/kg	10	n/t	n/t	n/t	n/t
Methoxychlor	N	ug/kg	10	n/t	n/t	n/t	n/t
Endrin ketone	N	ug/kg	10	n/t	n/t	n/t	n/t
OrganoPhosphorus Pesticides							
Acephate	N	ug/kg	100	n/t	n/t	n/t	n/t
Aziniphos-methyl	N	ug/kg	100	n/t	n/t	n/t	n/t
Chlorpyrifos	N	ug/kg	100	n/t	n/t	n/t	n/t
Demeton-s-methyl	N	ug/kg	100	n/t	n/t	n/t	n/t
Dichlorvos	N	ug/kg	100	n/t	n/t	n/t	n/t
Dimethoate	N	ug/kg	100	n/t	n/t	n/t	n/t
Ethion	N	ug/kg	100	n/t	n/t	n/t	n/t
Malathion	N	ug/kg	100	n/t	n/t	n/t	n/t
Mathidathion	N	ug/kg	100	n/t	n/t	n/t	n/t
Methamidophos	N	ug/kg	100	n/t	n/t	n/t	n/t
Omethoate	N	ug/kg	100	n/t	n/t	n/t	n/t
Pirimifos-methyl	N	ug/kg	100	n/t	n/t	n/t	n/t
Profenofos	N	ug/kg	100	n/t	n/t	n/t	n/t
Pyrazophos	N	ug/kg	100	n/t	n/t	n/t	n/t
Tokuthion	N	ug/kg	100	n/t	n/t	n/t	n/t
Toiclofos-methyl	N	ug/kg	100	n/t	n/t	n/t	n/t
Triazines							
Ametryn	N	mg/kg	0.01	n/t	n/t	n/t	n/t
Atrazine	N	mg/kg	0.01	n/t	n/t	n/t	n/t
Atraton	N	mg/kg	0.01	n/t	n/t	n/t	n/t
Prometon	N	mg/kg	0.01	n/t	n/t	n/t	n/t
Prometryn	N	mg/kg	0.01	n/t	n/t	n/t	n/t
Propazine	N	mg/kg	0.01	n/t	n/t	n/t	n/t
Secbumeton	N	mg/kg	0.01	n/t	n/t	n/t	n/t
Simazine	N	mg/kg	0.01	n/t	n/t	n/t	n/t
Simetryn	N	mg/kg	0.01	n/t	n/t	n/t	n/t
Terbutylazine	N	mg/kg	0.01	n/t	n/t	n/t	n/t
Terbutryn	N	mg/kg	0.01	n/t	n/t	n/t	n/t

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The Environmental Laboratory Ltd. Reg. No. 3882193



Results Summary

Report No.: 21-36948, issue number 1

ELAB Reference				256473	256474	256475	256476
Customer Reference							
Sample ID							
Sample Type				SOIL	SOIL	SOIL	SOIL
Sample Location				HP105	HP106	HP107	HP108
Sample Depth (m)				0.10	0.10	0.10	0.10
Sampling Date				02/11/2021	02/11/2021	02/11/2021	02/11/2021
Determinand	Codes	Units	LOD				
Soil sample preparation parameters							
Moisture Content	N	%	0.1	n/t	n/t	n/t	n/t
Material removed	N	%	0.1	n/t	n/t	n/t	n/t
Description of Inert material removed	N		0	n/t	n/t	n/t	n/t
Metals							
Arsenic	M	mg/kg	1	n/t	n/t	n/t	n/t
Cadmium	M	mg/kg	0.5	n/t	n/t	n/t	n/t
Chromium	M	mg/kg	5	n/t	n/t	n/t	n/t
Copper	M	mg/kg	5	n/t	n/t	n/t	n/t
Lead	M	mg/kg	5	n/t	n/t	n/t	n/t
Mercury	M	mg/kg	0.5	n/t	n/t	n/t	n/t
Nickel	M	mg/kg	5	n/t	n/t	n/t	n/t
Selenium	M	mg/kg	1	n/t	n/t	n/t	n/t
Zinc	M	mg/kg	5	n/t	n/t	n/t	n/t
Inorganics							
Hexavalent Chromium	N	mg/kg	0.8	n/t	n/t	n/t	n/t
Miscellaneous							
pH	M	pH units	0.1	n/t	n/t	n/t	n/t
Total Organic Carbon	N	%	0.01	n/t	n/t	n/t	n/t
Polyaromatic hydrocarbons							
Naphthalene	M	mg/kg	0.1	n/t	n/t	n/t	n/t
Acenaphthylene	M	mg/kg	0.1	n/t	n/t	n/t	n/t
Acenaphthene	M	mg/kg	0.1	n/t	n/t	n/t	n/t
Fluorene	M	mg/kg	0.1	n/t	n/t	n/t	n/t
Phenanthrene	M	mg/kg	0.1	n/t	n/t	n/t	n/t
Anthracene	M	mg/kg	0.1	n/t	n/t	n/t	n/t
Fluoranthene	M	mg/kg	0.1	n/t	n/t	n/t	n/t
Pyrene	M	mg/kg	0.1	n/t	n/t	n/t	n/t
Benzo(a)anthracene	M	mg/kg	0.1	n/t	n/t	n/t	n/t
Chrysene	M	mg/kg	0.1	n/t	n/t	n/t	n/t
Benzo(b)fluoranthene	M	mg/kg	0.1	n/t	n/t	n/t	n/t
Benzo(k)fluoranthene	M	mg/kg	0.1	n/t	n/t	n/t	n/t
Benzo(a)pyrene	M	mg/kg	0.1	n/t	n/t	n/t	n/t
Indeno(1,2,3-cd)pyrene	M	mg/kg	0.1	n/t	n/t	n/t	n/t
Dibenzo(a,h)anthracene	M	mg/kg	0.1	n/t	n/t	n/t	n/t
Benzo(g,h,i)perylene	M	mg/kg	0.1	n/t	n/t	n/t	n/t
Total PAH(16)	M	mg/kg	0.4	n/t	n/t	n/t	n/t

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The Environmental Laboratory Ltd. Reg. No. 3882193



Results Summary

Report No.: 21-36948, issue number 1

ELAB Reference				256473	256474	256475	256476
Customer Reference							
Sample ID							
Sample Type				SOIL	SOIL	SOIL	SOIL
Sample Location				HP105	HP106	HP107	HP108
Sample Depth (m)				0.10	0.10	0.10	0.10
Sampling Date				02/11/2021	02/11/2021	02/11/2021	02/11/2021
Determinand	Codes	Units	LOD				
OrganoChlorine Pesticides							
alpha-HCH	M	ug/kg	10	< 10	< 10	< 10	< 10
beta-HCH	M	ug/kg	10	< 10	< 10	< 10	< 10
gamma-HCH	M	ug/kg	10	< 10	< 10	< 10	< 10
delta-HCH	N	ug/kg	10	< 10	< 10	< 10	< 10
Heptachlor	N	ug/kg	10	< 10	< 10	< 10	< 10
Aldrin	M	ug/kg	10	< 10	< 10	< 10	< 10
Heptachlor epoxide	N	ug/kg	10	< 10	< 10	< 10	< 10
trans-Chlordane	N	ug/kg	10	< 10	< 10	< 10	< 10
alpha cis-Chlordane	N	ug/kg	10	< 10	< 10	< 10	< 10
p,p-DDE	M	ug/kg	10	< 10	< 10	< 10	< 10
Dieldrin	M	ug/kg	10	< 10	< 10	< 10	< 10
Endrin	N	ug/kg	10	< 10	< 10	< 10	< 10
p,p-DDD	M	ug/kg	10	< 10	< 10	< 10	< 10
Endosulfan II	N	ug/kg	10	< 10	< 10	< 10	< 10
Endrin aldehyde	N	ug/kg	10	< 10	< 10	< 10	< 10
p,p-DDT	M	ug/kg	10	< 10	< 10	< 10	< 10
Endosulphan sulphate	M	ug/kg	10	< 10	< 10	< 10	< 10
Methoxychlor	N	ug/kg	10	< 10	< 10	< 10	< 10
Endrin ketone	N	ug/kg	10	< 10	< 10	< 10	< 10
OrganoPhosphorus Pesticides							
Acephate	N	ug/kg	100	< 100	< 100	< 100	< 100
Azinphos-methyl	N	ug/kg	100	< 100	< 100	< 100	< 100
Chlorpyrifos	N	ug/kg	100	< 100	< 100	< 100	< 100
Demeton-s-methyl	N	ug/kg	100	< 100	< 100	< 100	< 100
Dichlorvos	N	ug/kg	100	< 100	< 100	< 100	< 100
Dimethoate	N	ug/kg	100	< 100	< 100	< 100	< 100
Ethion	N	ug/kg	100	< 100	< 100	< 100	< 100
Malathion	N	ug/kg	100	< 100	< 100	< 100	< 100
Mathidathion	N	ug/kg	100	< 100	< 100	< 100	< 100
Methamidophos	N	ug/kg	100	< 100	< 100	< 100	< 100
Omethoate	N	ug/kg	100	< 100	< 100	< 100	< 100
Pirimifos-methyl	N	ug/kg	100	< 100	< 100	< 100	< 100
Profenofos	N	ug/kg	100	< 100	< 100	< 100	< 100
Pyrazophos	N	ug/kg	100	< 100	< 100	< 100	< 100
Tekuthion	N	ug/kg	100	< 100	< 100	< 100	< 100
Tolclofos-methyl	N	ug/kg	100	< 100	< 100	< 100	< 100
Triazines							
Ametryn	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01
Atrazine	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01
Atraton	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01
Prometon	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01
Prometryn	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01
Propazine	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01
Sebumeeton	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01
Simazine	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01
Simetryn	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01
Terbutylazine	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01
Terbutryn	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01

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Results Summary

Report No.: 21-36948, issue number 1

Asbestos Results

Analytical result only applies to the sample as submitted by the client. Any comments, opinions or interpretations (marked #) in this report are outside UKAS accreditation (Accreditation No2683). They are subjective comments only which must be verified by the client.

Elab No	Depth (m)	Clients Reference	Description of Sample Matrix #	Asbestos Identification	Gravimetric Analysis Total (%)	Gravimetric Analysis by ACM Type (%)	Free Fibre Analysis (%)	Total Asbestos (%)
256468	0.10	HP101	Brown sandy soil, stones, crushed concrete	No asbestos detected	n/t	n/t	n/t	n/t
256469	0.10	HP101	Brown sandy soil, stones, crushed concrete	No asbestos detected	n/t	n/t	n/t	n/t
256470	0.10	HP103	Brown sandy soil, stones, crushed concrete	No asbestos detected	n/t	n/t	n/t	n/t
256471	0.05	HP104	Brown soil, stones	No asbestos detected	n/t	n/t	n/t	n/t

Method Summary

Report No.: 21-36948, issue number 1

Parameter	Codes	Analysis Undertaken On	Date Tested	Method Number	Technique
Soil					
SVOC in solids	N	As submitted sample	09/11/2021		GC-MS
Hexavalent chromium	N	As submitted sample	08/11/2021	110	Colorimetry
pH	M	Air dried sample	09/11/2021	113	Electromeric
Aqua regia extractable metals	M	Air dried sample	08/11/2021	118	ICPMS
PAH (GC-FID)	M	As submitted sample	08/11/2021	133	GC-FID
Organochlorine Pesticides in solids	M	As submitted sample	08/11/2021	173	GC-MS
Organophosphorus Pesticides in solids	N	As submitted sample	08/11/2021	173	GC-MS
Total organic carbon/Total sulphur	N	Air dried sample	09/11/2021	210	IR
Asbestos identification	U	Air dried sample	08/11/2021	280	Microscopy

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Report Information

Report No.: 21-36948, issue number 1

Key

U	hold UKAS accreditation
M	hold MCERTS and UKAS accreditation
N	do not currently hold UKAS accreditation
^	MCERTS accreditation not applicable for sample matrix
*	UKAS accreditation not applicable for sample matrix
S	Subcontracted to approved laboratory UKAS Accredited for the test
SM	Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test
NS	Subcontracted to approved laboratory. UKAS accreditation is not applicable.
I/S	Insufficient Sample
U/S	Unsuitable sample
n/t	Not tested
<	means "less than"
>	means "greater than"

LOD LOD refers to limit of detection, except in the case of pH soils and pH waters where it means limit of discrimination.
Soil sample results are expressed on an air dried basis (dried at < 30°C), and are uncorrected for inert material removed.
ELAB are unable to provide an interpretation or opinion on the content of this report.
The results relate only to the sample received.
PCB congener results may include any coeluting PCBs
Uncertainty of measurement for the determinands tested are available upon request
Unless otherwise stated, sample information has been provided by the client. This may affect the validity of the results.

Deviation Codes

a	No date of sampling supplied
b	No time of sampling supplied (Waters Only)
c	Sample not received in appropriate containers
d	Sample not received in cooled condition
e	The container has been incorrectly filled
f	Sample age exceeds stability time (sampling to receipt)
g	Sample age exceeds stability time (sampling to analysis)

Where a sample has a deviation code, the applicable test result may be invalid.

Sample Retention and Disposal

All soil samples will be retained for a period of one month
All water samples will be retained for 7 days following the date of the test report
Charges may apply to extended sample storage

TPH Classification - HWOL Acronym System

HS	Headspace analysis
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent
CU	Clean-up - e.g. by florisil, silica gel
1D	GC - Single coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
2D	GC-GC - Double coil gas chromatography
#1	EH_Total but with humics mathematically subtracted
#2	EH_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry

Phase II Site Investigation Report

at Land North of Lee's
Yard, Lidsey Road,
Woodgate, PO20 3SU

for Thakeham Partnerships
Ltd

Report Reference: LP2616/SI/2

Report Date: 15th October 2021



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ARUN DISTRICT COUNCIL AL141/21/RES/Leap Environmental.com



Regional Offices: Kent, Midlands, South Coast, Thames valley

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APPENDIX B – Figures and Drawings

APPENDIX C – Photographic Record

APPENDIX D – Exploratory Logs

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APPENDIX G – Geotechnical Laboratory Test Results

APPENDIX H– Analytical Summary and Quantitative Risk Assessment Tables

APPENDIX I– Geoenvironmental Analytical Laboratory Certificates

APPENDIX J – Approach to the Selection of Generic Assessment Criteria

APPENDIX K – HazWasteOnline™ Classification Report



EXECUTIVE SUMMARY

The site is located in the south of the village of Woodgate and comprises an undeveloped grassed paddock with trees and hedges along the borders. The site slopes very gently downwards from west to east by approximately 1°. It is proposed to redevelop the site with 38 No. residential dwellings with private gardens, a community hub, public open spaces and associated road infrastructure.

According to the Environment Agency the site is not located withing a surface water flood risk zone, however there is a high risk of groundwater flooding in the east of the site reducing to moderate in the west.

The site is mapped as being underlain by superficial River Terrace Deposits and further underlain by the London Clay Formation. Ground conditions comprise topsoil over silty sandy clays and clayey gravelly sands/gravels of the River Terrace Deposits to around 2mbgl over firm to stiff silty clay with selenite crystals of the London Clay Formation to the maximum depth of excavation at 4mbgl. A thin layer of made ground (0.25m) was encountered to the south of the field entrance. Groundwater was encountered within the granular horizons of the River Terrace Deposits to between 1.2m and 1.6m below ground level.

A preliminary presumed bearing capacity of 85kPa is recommended for the firm silty sandy clays and/or medium dense gravelly sands below about 1m. Foundations will require deepening near trees to NHBC High VCP precautions, subject to the thickness of the overlying gravels. Deepening will be complicated by the presence of a high groundwater table and piled foundations may be preferred.

Suspended floor slabs are recommended.

Soil sulphates of clays in the River Terrace Deposits fall within BRE design class DS-1 and the site conditions fall within the ACEC class AC-1. Soil sulphates of the London Clay Formation are classified as Design Sulphate Class DS-4 and ACEC class of AC-4. In both instances mobile groundwater has been assumed.

The River Terrace Deposits are not considered suitable for soakaway drainage due to the high groundwater table restricting infiltration.

A preliminary design CBR value of 3% is recommended for the superficial clay soils at ~ 0.5m.

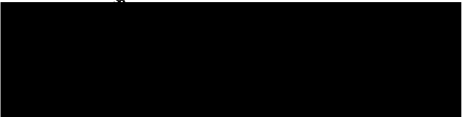
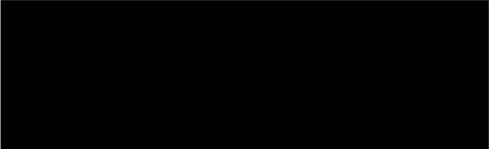
A geo-environmental risk assessment has been carried out. Contamination testing of topsoil and natural strata has not identified any potentially unacceptable contamination with respect to identified human health receptors.

1 No. land gas monitoring visit has been carried out to date. Low concentrations of carbon dioxide and methane were recorded with no flow. A full assessment of the risk to ground gases will be carried out following completion of five further rounds of ground gas monitoring.

As with any redevelopment site, there is always the risk of hitherto undetected contamination, possibly in the north of the site which was inaccessible due to the presence of trees and bushes.

All soil samples analysed are expected to be classified as non-hazardous waste.

It is recommended that additional investigation be undertaken across site to delineate the extent of made ground in the north of the site and to carry out pesticide analysis on the near-surface soils. Deep boreholes are also recommended should piled foundations be the preferred option for foundations.

Signed:	 Lauren Stillwell MSc FGS
Countersigned:	 Kate Baker BSc. MEnvSc. CSci. ASoBRA RSoBRA
Countersigned:	 Richard Brinkworth BEng CEng MICE
Date:	15 October 2021
Revision:	Issue 2 Amendments to intrusive investigation rationale

A INTRODUCTION

1 Authority

Leap Environmental Ltd (hereafter referred to as LEAP) has been appointed by Thakeham Partnerships Ltd to undertake a Phase II Site Investigation of a site located to the north of Lee's Yard, located in Woodgate. The instruction was given in an email dated 10th June 2021 and signed by Thomas Richards of Thakeham Partnerships Ltd.

2 Objective

LEAP understands that Thakeham Partnerships Ltd proposes to redevelop the site with 38 No. residential dwellings with private gardens, as well as a community hub, public open spaces and associated road infrastructures, in accordance with the planning application reference AL/21/20/OUT. B. The proposed development is currently at the initial design phase and has been assessed in accordance with BS EN 1997¹, as being a Geotechnical Category I structure.

An outline scope of works for the investigation was provided by the client (document reference TPL-E 05 Version PI 30.11.20). The overall objectives of this report are to:

- Provide information on the geotechnical and environmental quality of the ground present on the site with respect to the proposed development;
- Assess the potential health and other environmental risks posed by the site to the proposed development and to other specifically identified receptors; and
- Assess the potential for offsite contamination to adversely affect the proposed development.

3 Previous Studies

The site has been the subject of a previous investigation by LEAP. The reader is referred to this earlier report which should be read in conjunction with this report:

- LEAP 'Phase I Desk Study and Site Reconnaissance at Land north of Lee's Yard, Lidsey Road, Woodgate, PO20 3SU for Thakeham Partnerships Ltd' dated 17th August 2021 (ref: LP2616/DS/I).

¹ BS EN 1997-1 (2004)+A1:2013 Eurocode 7:Geotechnical Design: General Rules

The following site investigation reports are also referenced within the desk study, which were carried out on a site located 15m west-northwest of the subject site and comprise information relevant to the desk study. These reports are available on the Chichester District Council Planning Portal.

- Geo-Environmental 'Ground Appraisal Report for the site at Land off Lidsey Road, Woodgate, West Sussex, PO20 3SU on behalf of Thakeham Client Ltd' dated 10th October 2019 rev 2.0 (ref: GE18390-GAR-OCT-19); and
- Geo-Environmental 'RE: Land at Lidsey Road, Woodgate, West Sussex, PO20 3SU – Addendum Ground Gas and Groundwater for Thakeham Client Ltd' dated 28th May 2020 (ref: GE18390-LRv1AP200528).

4 Scope of Works

The Phase II scope of work comprised an intrusive investigation, subsequent monitoring and laboratory analysis. The results of this investigation were used to validate and/or update the initial site conceptual model which was presented in the August 2021 Phase I desk study report. The following tasks were carried out as part of the investigation:

- Ground penetrating radar (GPR) survey;
- 7 No. 4m deep windowless boreholes drilled with a tracked rig;
- 8 No. machine excavated trial pits to a maximum depth of 3m;
- 3 No. BRE365 soakage tests;
- 8 No. in-situ dynamic cone penetrometer CBR tests;
- In-situ geotechnical testing including Standard Penetrometer Tests in the boreholes and perth penetrometer tests in the trial pits;
- Geotechnical laboratory testing including Atterberg limit tests, particle size distribution tests and sulphate tests;
- Chemical Laboratory tests comprising 8 No. LEAP standard soil suite tests; and
- Installation and monitoring of 5 No. combined gas/groundwater monitoring wells and one monitoring visit at the time of writing (5 further visits are planned and will be reported under separate cover).

The intrusive works were completed by contractors who have been scrutinised and are on LEAP's approved contractor list. The GPR survey was carried out by Service Location Ltd, the

windowless sampling was carried out by Oakland Site Investigation and the machine excavated trial pits were carried out by Daren Spillane. All works on site were supervised by LEAP.

Selected samples of soil were scheduled for laboratory testing for a range of common potential contaminants. The laboratory testing was carried out by The Environmental Laboratory Ltd at its laboratories in East Sussex.

Selected soil samples were classified by laboratory analysis for geotechnical design purposes. The laboratory testing was carried out by Geolabs Ltd at its laboratories in Watford.

The final stage in the geoenvironmental assessment comprised a quantitative risk assessment and revision of the preliminary Conceptual Site Model. Preliminary recommendations for remediation have been provided, based on various development assumptions which are detailed in the following sections of this report. The risk assessment was carried out in accordance with UK industry standards and in particular in accordance with LCRM² and BS10175:2011+A2:2017.

The final stage of the geotechnical assessment is the provision of preliminary soil parameters for use in geotechnical design, and broad recommendations for appropriate foundation options. It is intended that the Geotechnical Information section of this report will fulfil the general requirements of the Ground Investigation Report as set out in Section 6 of BS EN 1997-2:2007³.

5 Key Terms

'Geoenvironmental' refers principally to the chemical nature of the ground and the degree of soil, water and/or land gas contamination and the impact that contamination may have on current or future development and also on the wider environment.

'Geotechnical' refers to all other aspects of the ground conditions and the impact they may have on the physical construction of existing or future development, principally foundations, slope stability, drainage, pavement and road design and groundwater control.

² Environment Agency. Land Contamination Risk Management (LCRM), <https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm>

³ BS EN 1997 Eurocode 7- Geotechnical Design- Part 2: Ground Investigation and Testing (2007)

6 Limitations

This report has been prepared by Leap Environmental Ltd on the basis of information received from a variety of sources which Leap Environmental Ltd believes to be accurate. Nevertheless, Leap Environmental Ltd cannot and does not guarantee the authenticity or reliability of the information it has obtained from others.

Leap Environmental Ltd has used all reasonable skill, care and diligence in the design and execution of this report, taking into account the manpower and resources devoted to it in agreement with the Client. Although every reasonable effort has been made to obtain all relevant information, all potential contamination, environmental constraints or liabilities associated with the site may not necessarily have been revealed.

The conclusions reached in this report are necessarily restricted to those which can be determined from the information consulted and may be subject to amendment in the light of additional information becoming available. These conclusions may not be appropriate for alternative schemes.

This report is confidential to the Client, and Leap Environmental Ltd accepts no responsibility whatsoever to third parties to whom this report, or any part thereof, is made known, unless formally agreed by Leap Environmental Ltd beforehand. Any such party relies upon the report at their own risk.

Full details of the limitations are provided in Appendix A.

B SUMMARY OF DESK STUDY

7 Site Description and Environmental Setting

A summary of the information gathered in the Phase I desk study carried out by LEAP (ref: LP2616/DS/I) in August 2021 is provided in Table I. The site location plan and current site layout are provided in Figure I and Drawing I428-P-002 Rev0 in Appendix B.

Table I: Summary of Site Description and Environmental Setting

Subject	Details
Site Location	Lidsey Road, Woodgate, West Sussex. PO20 3SU
Approximate National Grid Reference	493884, 104606
Site Area	1.53 ha
Site Description and Usage	An undeveloped predominantly grassed field with an area of long grass, wildflowers and shrubs in the north of the site. An L-shaped hedge divides off the northeastern corner. Aerial photographs indicate that the site was cropped until recently. No buildings are present but two small electrical boxes are present to the east of an access gate within a patch of trees. Overhead cables are present running along the northern boundary. The boundaries are lined with dense mature evergreen hedges and a mix of young to mature trees including elm, poplar, silver birch and Leyland cypress.
Topography and Elevation	The site slopes gently downwards from ~8.7m AOD in the west to ~8.9m AOD in the east-southeast with an approximate slope angle of 1°.
Surrounding Area	Predominantly rural and low density residential. Immediate surroundings are: • North: Unnamed access road with residential housing beyond. • East: Willows Caravan Park. • South: Car sales yard labelled as 'Lee's Yard' with fields beyond. • West: Lidsey Road (A29) with residential housing beyond.
Site History	The site has remained a field since the earliest historical maps, with the L-shaped hedge planted sometime between 2000 and 2012. The surrounding area was mostly undeveloped farmland until the 1930s when the construction of small residential housing commenced in the area. A brickfield was present 150m to the east of site between the late 1930s and early 1970s. The caravan park was constructed over the location of the brickfield. A sawmill adjacent to the south in the 1990s was redeveloped as Lee's Yard in the mid-2000s.

Subject	Details
Geology and Hydrogeology	Mapped as being underlain by superficial River Terrace Deposits (Secondary A Aquifer) of c.3m thick with a site investigation 15m to the west-northwest recording River Terrace Deposits to between 2 and 4m bgl. Underlying bedrock is mapped as 70-100m of London Clay Formation (Unproductive Strata). Local borehole data and findings of the adjacent site investigation indicate the groundwater table is likely to be between ~1m and 5m bgl, with seasonal fluctuations resulting in shallower groundwater levels, potentially close to ground level. Groundwater flow is anticipated to be in an easterly direction. Not located within a Groundwater Source Protection Zone (SPZ) and no groundwater abstraction licences within 1km.
Hydrology and Flooding	No surface water features on-site although a drain is located 15m to the south-west. The closest substantial surface water feature is the river Lidsay Rife located c.300m east of the site. An active surface water abstraction licence from this river is recorded 363m from the site for spray irrigation. The site is not located within a surface water flood zone but the risk of groundwater flooding is indicated as high in the east of the site (Ambiental Risk Analytics), reducing to moderate in the west.
Evidence of Ground Working	A historical brickfield is located within 150m of the site and is associated with clay and shale extraction. Historical cuttings are mapped c.250m to the north.
Designated Environmentally Sensitive Sites	None within 1km
Radon	1-3% probability of homes being above the action level. No special protective measures required.
UXO	Zetica maps indicate a low risk.

8 Summary of Preliminary Risk Assessment

The preliminary risk assessment developed by LEAP in the August 2021 Phase I report identified the main potential on-site source of contamination as historical agricultural uses, such as the use of pesticides and farm vehicles which may have impacted the ground with petroleum hydrocarbons. Potential off-site sources of contamination were also identified: comprising made ground and the storage and servicing of vehicles on Lee's Yard to the south; and the generation of ground gases from any infilling that may have occurred at the historical brickfield approximately 150m east of the site. The potentially sensitive receptors to

contamination were determined to be future residents, construction workers, the superficial River Terrace Deposits (Secondary A aquifer), proposed on-site buildings and residents/users of neighbouring properties. Surface waters were discounted due to a lack of significant water features close to the site.

Overall, the preliminary risk assessment determined a moderate risk to human health receptors due to the insoluble nature of pesticides such as organochlorine pesticides that may have been used historically on the site. The risk was considered to be slightly reduced for construction workers due to their shorter duration of exposure. The overall risk to the Secondary A aquifer was determined by LEAP to be low because the concentrations of soluble contaminants within the soils on-site were likely to be low, and there are no local groundwater abstraction licences which could be adversely affected. The potential risks to future residents and future buildings on-site from the generation of gases from the former brickfield was also considered to be low, because any putrescible material that may have been used to infill the excavated area is likely to be in the later stages of gas generation and the clays underlying the site would restrict some lateral migration.

The preliminary geotechnical risk register identified a number of geotechnical hazards that could pose substantial risk to the proposed development. A likely high groundwater table with seasonal fluctuations may result in unstable excavations and running sands between bands of sands and gravels and the sandier clays that were encountered on the adjacent site. The clays on the adjacent site were of medium volume change potential (VCP). Combined with the potentially high groundwater table there is a substantial risk of swelling and shrinkage within shallow soils near trees and a substantial risk that foundations will require deepening was determined. Silty sandy clays are susceptible to frost and may affect the design of on-site roads and the underlying London Clay Formation bedrock is generally high in sulphate and pH which could adversely affect any concrete laid within these soils.

C INTRUSIVE INVESTIGATION

9 Investigation Rationale

The main purpose of the site investigation was to collect preliminary geo-environmental and geotechnical information to support the redevelopment of the site in accordance with Drawing I428A-SK-002.

To achieve the investigation rationale, the scope of works comprised a total of fifteen investigation locations across the site: 8 No. machine excavated trial pits to a maximum depth of 3m and 7 No. windowless sampler boreholes to around 4m depth.

The scope of the investigation was non-targeted to give general coverage and, in accordance with BS10175, took into consideration the proposed development plans and the preliminary geo-environmental and geotechnical risk assessments summarised in Section B.

The investigation locations were positioned to provide general coverage and preliminary information on the ground conditions on site. The spacing of the investigation locations was consistent with the recommended density of 25 to 50m for an exploratory investigation after BS10175 Section 7.7.

In addition to the intrusive locations, targeted investigation was undertaken with in-situ dynamic cone penetration (DCP) tests positioned along the length of the proposed road, at an approximate frequency of one test every 50m.

3 No. BRE365 soakage tests were undertaken in trial pits TP01, TP02 and TP03, with TP02 positioned on the proposed pond location in the east-southeast of the site.

Combined gas and groundwater monitoring wells were installed in a selection of boreholes as required in the client's outline scope of works and were located in accordance with the spacing requirements given in CIRIA C665⁴.

The site investigation locations are provided in Figure 2 of Appendix B and Table 2 provides a summary of the rationale, proposed scope and what was achieved in the field:

⁴ CIRIA C665 Assessing risks posed by hazardous ground gases to buildings

Table 2 Rationale and Scope for Investigation Locations

Trial Hole/Test Location	Rationale	Proposed Depth (m bgl)	Achieved Depth (m bgl)	Additional Comments
WS01, WS03 to WS05 and WS07	Provide information on ground conditions and geotechnical parameters, and to collect samples for geoenvironmental and geotechnical analysis. Install combined groundwater/gas monitoring well.	4.0	4.0	
WS02 and WS06	Provide information on ground conditions and geotechnical parameters, and to collect samples for geoenvironmental and geotechnical analysis.	4.0	4.0	
TP01 to TP03	Provide information on ground conditions, and to collect samples for geoenvironmental and geotechnical analysis. Carry out BRE365 soakage tests across the site.	3.0	1.2 to 1.8	Depth of soakage pits restricted due to groundwater seepage within pits.
TP04 to TP08	Provide information on ground conditions and to collect samples for geoenvironmental and geotechnical analysis.	3.0	2.5 to 3.0	Trial pits collapsed from shallow depths, restricting depth of excavation.
DCP01 to DCP07	Provide parameters to aid the design of proposed roads.	n.a.	n.a.	

10 Site Work

10.1 Date and Weather Conditions

The intrusive investigations were undertaken in two phases. The trial pits and soakage tests were carried out on 9th August 2021, when the weather was mostly dry though overcast with intermittent spells of rain. The windowless drilling and DCPs were carried out on 27th August 2021, and the weather was sunny and dry.

The Met Office Climate Summaries⁵ indicate that the weather prior to the investigations was wet. May, June and July all experienced between 125% and 191% of the average rainfall for those months.

10.2 Site Work Methods

10.2.1 Windowless Sampler

Boreholes were drilled using a windowless sampler rig. The windowless sampling rig consists of a tracked barrow with a sampling unit mounted on the top. When in the required position, the mast was raised to a height allowing a mechanised drop weight to fall repeatedly onto an anvil, and drive attached sample tubes or probe rods into the ground to produce reasonably intact continuous samples which were then extracted using the integrated hydraulic ram. To reduce any tendency of the tubes to stick in the ground, a succession of smaller diameters may be used to obtain full depth. Excavated soils were placed aside for inspection and sampling.

On completion the borehole was either installed as a monitoring well or backfilled with excavated material, placed in reverse order, and the surface reinstated.

10.2.2 Trial Pitting

Trial pits were dug by a backhoe excavator. The trial pits had a target depth of 3m bgl and were typically 0.7m wide by 1.8m long. Trial pit dimensions are shown on the trial pit logs, included as Appendix D. Spoil was replaced in reverse order and was left mounded to allow for future settlement.

10.2.3 Soil Logging

Soil samples were recovered from the boreholes and trial pits for field screening, logging and sampling. Boreholes were logged in general accordance with the requirements of BS 5930:⁶ and BS EN ISO 14688⁷. Borehole logs are presented in Appendix D.

Visual and olfactory evidence of contamination was noted if encountered. These observations were used to aid scheduling of samples for chemical laboratory analyses, and are included on the borehole logs in Appendix D and summarised in Section 11.1.2.

10.2.4 Monitoring Well Installation

5 No. monitoring wells were installed within the windowless sample boreholes during this investigation. The monitoring wells were constructed of 63mm diameter HDPE pipe. The

⁵ Met Office Climate Summaries: <https://www.metoffice.gov.uk/research/climate/maps-and-data/summaries/index>

⁶ BS5930:2015+A1:2020 Code of Practice for Ground Investigation

⁷ BS EN ISO 14688 Parts 1-2 (2018) Geotechnical Investigation and Testing. Identification and classification of soil

response zone was targeted to intercept the groundwater surface and/or the potential pathway for ground gases and was surrounded by washed filter gravel. The plain pipe was surrounded with bentonite to provide a seal. The monitoring wells were finished with bungs with gas taps and raised steel covers. Monitoring well installations are shown on the borehole logs in Appendix D and summarised in the following table.

Table 3: Borehole installation details

Borehole	Targeted Medium	Installed Depth (m bgl)	Response Zone (m bgl)	Bentonite Seal (m bgl)	Targeted Stratum
WS01	Groundwater & gas	2.0	1.0-2.0	0.1-1.0	Sand/gravel
WS03	Groundwater & gas	3.0	1.0-3.0	0.1-1.0	Sand/gravel and silty clay
WS04	Groundwater & gas	3.0	1.0-3.0	0.1-1.0	Sand/gravel
WS05	Groundwater	3.0	1.0-3.0	0.1-1.0	Silty clay and Sand/gravel
WS07	Groundwater	3.0	1.0-3.0	0.1-1.0	Sand/gravel

10.3 Sampling and Field Tests

10.3.1 Soil Sampling

Geoenvironmental soil samples were selected to ensure that near-surface exposure of human health via direct contact was targeted, as well as to provide spatial and vertical coverage of the soils encountered on-site.

Geotechnical soil samples were targeted to characterise the geological sequence, and to obtain characteristic soils properties and specific geotechnical design parameters as per the proposed development.

All samples were collected by hand using dedicated nitrile gloves for each sampling location. Samples were placed into suitable sampling containers, specific to the type of analyses required. All sample containers were then sealed and labelled with a unique location identity, depth and date of sampling.

10.3.2 Standard Penetration Tests

Standard penetration tests were undertaken in the boreholes at 1m centres in accordance with BS EN ISO 22476-3;2005. Uncorrected blow counts, 'N values', are recorded on the borehole logs in Appendix D.

10.3.3 In-situ California Bearing Ratio Test -- Dynamic Cone Penetrometer

7 No. in-situ CBR tests were undertaken across the site using the Dynamic Cone Penetrometer (DCP), recording blow counts over 900mm of penetration from test level. The

test method and interpretation of the results were undertaken in accordance with DMRB HD 29/08⁸ using a modified DCP. The results are attached in Appendix E.

10.3.4 BRE365 Soakage Tests

3 No. soakage tests were carried out in TP01, TP02 and TP03 in general accordance with BRE Digest 365⁹. However, due to the lack of movement of water levels and time restrictions, it was only possible to fill and test each location once. The full results are provided in Appendix E.

10.4 Ground Gas and Groundwater Monitoring

Combined gas and groundwater monitoring wells were installed in order to monitor groundwater levels over the winter months. In total 5 No monitoring wells were installed in various locations onsite to provide spatial coverage and to identify any variation in groundwater levels across the site. The monitoring wells were also installed to carry out ground gas monitoring and assess the overall risk of gas generation and migration from the infilled brickfield to the east of the site.

10.4.1 Groundwater Monitoring

One round of groundwater monitoring has been undertaken to date on 20th September 2021. The groundwater monitoring wells were inspected for the presence of water using an electronic dipmeter.

A further five monitoring rounds are proposed to take place at monthly intervals between October 2021 and February 2022. These results will be reported in a separate report.

10.4.2 Ground Gas Monitoring

The placement of gas monitoring wells was considered based on the infilled former brickfield to the east of the site (WS01 and WS03), as well as to provide some general coverage to assess the potential risk to the proposed new residential properties and future residents.

One round of ground gas monitoring has been undertaken to date on 20th September 2021. The wells were monitored for methane, carbon dioxide, oxygen, hydrogen sulphide and carbon monoxide using a GFM 436 portable gas analyser. The full monitoring results are provided in Appendix F.

As previously discussed, five further gas monitoring rounds will be carried out over the same period as the groundwater monitoring and will be reported separately. At the end of the

⁸ CS 229 Data for Pavement Assessment. Design Manual for Roads and Bridges; Pavement; Inspection and Assessment

⁹ Building Research Establishment DG365 Digest Soakaway Design (2016)

monitoring period an assessment of the sufficiency of data will be undertaken with reference to Annex F of BS8576:2013. Further monitoring may be required.

10.5 Laboratory Analysis

10.5.1 Geotechnical Laboratory Testing

Selected samples of the soils were classified by laboratory analysis for geotechnical design purposes. The laboratory testing was carried out by Geolabs Ltd at its laboratories in Watford, in accordance with BS1377¹⁰ and BS EN ISO17892¹¹. The sampling technique, type, storage and transport and the number of laboratory tests were undertaken where possible in accordance with BS EN 1997-2:2007 and BS EN ISO 22475¹².

The following laboratory tests have been undertaken:

Table 4: Geotechnical Laboratory Testing

Test	Number of tests	
	River Terrace Deposits	London Clay Formation
Natural Moisture Content	5	1
Atterberg Limit Test	5	1
Particle Size Distribution Test	1	0
BRESDI Suite B	0	3
Sulphate Determination	2	0
pH	2	0

The geotechnical laboratory test results are provided in Appendix G.

¹⁰ BS1377 Parts 1-9:1990 Methods of test for Soils for Civil Engineering Purposes

¹¹ BS EN ISO 17892 Parts 1-12 Geotechnical Investigation and Testing. Laboratory testing of soil

¹² BS EN ISO 22475 Parts1-3 Geotechnical Investigation and Testing. Sampling methods and groundwater measurements

10.5.2 Chemical Soil Analysis

Selected samples of soil were subjected to laboratory testing. The suite of soil contaminant analysis took into account the potential contaminants of concern identified in the CSM (heavy metals and PAHs) as well as asbestos which can be encountered in buried materials on farmland. Soil samples were also analysed for pH and total organic carbon (TOC) to support the selection of assessment criteria in the subsequent quantitative risk assessment (QRA) for human health.

Sampling techniques and storage have been undertaken as per BS 10175:2011+A1:2013 Code of Practice for Investigation of Potentially Contaminated Sites. The laboratory testing was carried out by The Environmental Laboratory Ltd at its laboratories in East Sussex. Where available, the tests for soils procedures were UKAS and MCERTS accredited.

The following analyses were completed on selected soil samples based on field observations and for general vertical and lateral coverage:

- 8 x metals (As, Cd, Cr, CrVI, Cu, Pb, Hg, Ni, Se, Zn)
- 8 x USEPA 16 PAHs
- 8 x Asbestos identification
- 8 x TOC and pH

The laboratory test results are summarised in Section F and Appendix H, and the laboratory analytical certificates are provided in Appendix I.

10.6 Constraints to the Scope

There were very few constraints limiting the scope of works on site. Access was available across the site aside from in the north of the site where long grass, trees and bushes were present. Utility cables were detected in the east and south of the site however no proposed trial hole locations were affected.

11 Ground Conditions

The ground conditions are described in detail in the logs attached in Appendix D, and photographs of the soils are provided in Appendix C. In summary the soil conditions were as follows:

Table 5: Summary of soils encountered

Depth From (m)	Depth To (m)	Soil Type	Description
GL	0.05 / 0.35	TOPSOIL	Grass over brown and greyish brown sometimes clayey silty occasionally gravelly sandy TOPSOIL with rootlets. Where encountered gravel comprised fine to medium subangular flint and rare fine chalk.
0.05	0.3	MADE GROUND	WS07 only. Brown sandy gravel with fragments of concrete and brick. Gravel is fine to coarse sub-angular of flint.
0.2 / 0.7	0.6 / 1.5	CLAY	Firm to very stiff orange, light brown and grey mottled silty slightly sandy to sandy CLAY with occasional fine to medium sub-rounded flint gravel (RIVER TERRACE DEPOSITS).
0.6 / 1.5	1.5 / 3.8	SAND	Very loose to medium dense light brown sometimes silty fine SAND or loose to medium dense orangish brown, light brown and orange sometimes clayey gravelly medium to coarse SAND. Gravel is fine to coarse sub-rounded to sub-angular of flint. (RIVER TERRACE DEPOSITS).
0.65 / 2.7	1.1 / 3.0	GRAVEL	TP01, WS01, WS02 and WS04 only. Loose orangish brown clayey sometimes silty sandy GRAVEL of fine to coarse sub-angular flint (RIVER TERRACE DEPOSITS)
1.7 / 3.8	2.8* / 4.0*	CLAY	Firm to stiff dark grey silty CLAY with fine selenite crystals (LONDON CLAY)

*Maximum depth of excavation

In TP08 and WS01 subsoil was encountered beneath the topsoil between 0.2m and 0.7m bgl, comprising light brown clayey silty fine sand with occasional fine to medium flint gravel.

Fine shell fragments were encountered within the sand band in WS05 between 2.75m and 3.5m bgl.

A band of grey and orangish brown silty gravelly clay was encountered beneath the sand in TP06 between 1.5m and 2.3m bgl.

Bands of gravel were generally encountered in the centre and east of the site either above or below sand bands.

The River Terrace Deposits (both cohesive and granular strata) were generally thinner in the east of the site and increased in thickness towards the west and southwest of the site, where the London Clay strata were encountered at a greater depth.

It should be noted that the sides of all trial pits aside from TP01 and TP03 collapsed during excavation, mostly within the granular strata from up to 0.3mbgl.

11.1.1 Groundwater

Groundwater strikes were recorded in the following trial holes:

Table 6: Groundwater Strikes

Trial Hole	Date of water strike	Depth to Groundwater strike (mbgl)	Comments
TP02	09/08/2021	1.2	Seepage
TP03	09/08/2021	1.8	Seepage
TP04	09/08/2021	1.1	Seepage
TP05	09/08/2021	1.2	Seepage
TP06	09/08/2021	1.3	Seepage
TP07	09/08/2021	1.8	Seepage
TP08	09/08/2021	1.5	Seepage
WS01	27/08/2021	1.2	
WS02	27/08/2021	1.5	
WS03	27/08/2021	1.2	
WS04	27/08/2021	2.0	
WS05	27/08/2021	1.8	
WS06	27/08/2021	2.1	
WS07	27/08/2021	1.5	

The results of the groundwater monitoring round carried out on 20th September are detailed in Table 7.

Table 7: Groundwater Monitoring Results from Visit Carried Out on 20th September 2021

Monitoring well	Depth to groundwater (mbgl)
WS01	1.20
WS03	1.57
WS04	1.42
WS05	1.60
WS07	1.58

The full monitoring results are provided in Appendix F.

11.1.2 Visual and Olfactory Evidence of Contamination

Discounting the presence of made ground with anthropogenic items in WS07, no visual or olfactory evidence of contamination was encountered during the intrusive investigation or subsequent gas/groundwater monitoring visit.

D GEOTECHNICAL INFORMATION

12 Strata Encountered

12.1 Topsoil

Topsoil was encountered across the site at an approximate thickness of 0.25m, comprising silty sandy clay or silty sand with rootlets.

12.2 Made Ground

Made ground was only encountered in the north of the site close to the access gate to a depth of 0.3m bgl, comprising sandy gravel with fragments of concrete and brick.

Made ground or fill is by nature highly variable in both composition and bearing capacity and can be subject to large differential settlements when loaded. It is therefore generally unsuitable for use as a bearing stratum. In addition, made ground may contain contaminated and/or putrescible material. It can therefore be potential source of contamination and landfill gas.

12.3 River Terrace Deposits

The topsoil was generally underlain by firm to very stiff silty sandy slightly gravelly clays around 1mbgl, and further underlain by very loose to medium dense silty fine sand and/or loose to medium dense slightly clayey gravelly medium to coarse sand with occasional clayey sandy gravel to a maximum depth of 3.8mbgl.

One sample of sand taken from WS04 was scheduled for particle size distribution (PSD) testing. The results of the test is provided in Table 8.

Table 8: Summary of Particle Size Distribution tests for Sand/Gravel

Clay and Silt (%)	Sand (%)	Gravel (%)	Cobbles (%)
13.5	86.5	0	0

The results of the remaining geotechnical laboratory tests and field data are summarised in Table 9 below.

Table 9: Summary of Geotechnical Test Results for Sand/Gravel

Test	Range
SPT 'N value' (clay)	7 -- 13
SPT 'N value' (sand)	6 -- 20
SPT 'N value' (gravel)	2 -- 6
Moisture Content (%)	19.5 -- 24.4
Liquid Limit (%)	39 -- 47
Plastic Limit (%)	15 -- 19
Plasticity Index (%)	22 -- 28
Water Soluble Sulphate (g/l)	<0.01 -- 0.22
pH	8.6

The SPT N values indicate the sands are generally loose to medium dense, whilst the gravels are very loose to loose. However, it is noted that the loose sands and gravels tend to coincide with a water strike and may be a result of the granular soils piping in the base of the borehole.

The Atterberg Limit results indicate that the clays are intermediate plasticity.

The geotechnical laboratory results are less ranging than the results for River Terrace Deposit samples collected from the site 15m to the east, however are generally consistent.

12.4 London Clay Formation

The River Terrace Deposits were underlain by firm to stiff silty clays with selenite crystals to the maximum depth of excavation at 4mbgl. The results of the geotechnical laboratory tests carried out on samples of the London Clay are summarised in Table 10 below.

Table 10: Summary of Geotechnical Test Results for London Clay Formation

Test	Range
SPT 'N value'	8 -- 15
Moisture Content (%)	29.7
Liquid Limit (%)	50
Plastic Limit (%)	21
Plasticity Index (%)	29
Total Acidic Sulphate (%)	0.018 -- 0.061
Water Soluble Sulphate (g/l)	<0.01
Total Sulphur (%)	0.14 -- 0.50
pH	8.1 -- 8.4

The SPT results generally show a slight increase in N value with depth.

The Atterberg Limit results indicate the clays are intermediate plasticity.

E GEOTECHNICAL APPRAISAL

13 Geotechnical Design

The foregoing geotechnical appraisal does not constitute a Geotechnical Design Report in accordance with BSEN1997. The following recommendations are for preliminary design purposes only.

For the detailed design, the short-term and long-term design situations must be considered. Where relevant, the following limit states should be considered:

- Loss of equilibrium of the structure or the ground, considered as a rigid body, in which the strengths of structural material and the ground are significant in providing resistance (EQU)
- Internal failure or excessive deformation of the structure or structural elements in which the strength of structural materials is significant in providing resistance (STR)
- Failure or excessive deformation of the ground, in which the strength of soil or rock is significant in providing resistance (GEO)
- Loss of equilibrium of the structure or the ground due to uplift by water pressure or other vertical actions (UPL)
- Hydraulic heave, internal erosion and piping in the ground caused by hydraulic gradients (HYD)

The following factors should also be considered:

- Overall stability and ground movements
- Nature and size of the proposed construction including the design life
- Conditions with regards to the surroundings (e.g. neighbouring structures, traffic, utilities, vegetation, contamination etc.)
- Ground and groundwater conditions
- Influence of the environment.

14 Geotechnical Appraisal

14.1 Swelling and Shrinkage

Based on the laboratory test results in Section D, the shallow silty sandy clays are classified as NHBC MEDIUM Volume Change Potential (VCP). The shallow clays were underlain by the sands and gravels of the River Terrace Deposits, which would be non-shrinkable. The London Clay was encountered below about 2-2.5m below ground level. A single sample of the London Clay tested as NHBC Medium VCP, however, from local experience, the London Clay may

be HIGH VCP, and for the purpose of preliminary design, it is recommended this more conservative characterisation is used in the absence of further confirmatory testing.

Foundations will therefore require deepening in accordance with NHBC Chapter 4.2 where clay soils are encountered near trees. Foundation depths should be calculated based on the mature height of the tree, however, the existing height is relevant for trees which are to be removed. Where non shrinkable soils overlie shrinkable soils, NHBC Chapter 4.2.9 should be followed to assess whether deepening may be terminated in the granular soils. At this stage the HIGH VCP for the London Clay should be assumed. Further testing may reduce this.

14.2 Sulphates

The potential for high levels of sulphates within the natural soils on site has been identified due to the underlying geology. In particular, construction activities that may substantially disturb previously unweathered strata and expose sulfur minerals such as pyrite to air, water and bacteria can result in the relatively rapid oxidation of such minerals producing high levels of sulphates. In accordance with the BRE¹³ methodology, 3 No. samples of the London Clay were therefore tested for water and acid soluble sulphate, total potential sulphate (TPS) and pH.

Based on the results of the testing, oxidisable sulphides (OS) are generally >0.3%, indicating pyrite is present within the London Clay. Using highest sulphate class calculated from both the water-soluble sulphate, TPS and groundwater testing, the soils are classified as Design Sulphate Class DS-4 and assuming mobile groundwater, the ACEC class is AC-4

2 No. of the River Terrace were tested for sulphate content and pH. In accordance with the BRE methodology and the number of samples tested, the shallow soils have been classified on the highest measured sulphate content. These soils therefore have a preliminary classification of Design Sulphate Class DS-I and assuming mobile groundwater, the ACEC class would be AC-I.

Overall, there is the potential for high sulphate content and pyrite within the London Clay soils, whilst the overlying superficial soils have a low sulphate content. Given the high mobile water table on site, it may be prudent to undertake some groundwater sampling to confirm the prevailing sulphate content and therefore concrete design required. This may be achieved relatively simply during the ongoing groundwater monitoring.

¹³ Building Research Establishment Special Digest 1: 2005. Concrete in aggressive ground. Part 1: Assessing the aggressive chemical environment.

14.3 Groundwater

Groundwater seepages were encountered at between 1.1m and 2.1mbgl and trial pits were unstable in the granular soils.

The groundwater monitoring results carried out to date are given in Section C11.1.1. Groundwater was recorded at around 1.5m below ground level, however water levels are anticipated to be shallower over the winter monitoring period.

14.4 Soakage Potential

14.4.1 Test Results

3 No. soakage tests were undertaken on site in accordance with BRE365¹⁴. Given the time restrictions, it was only possible to fill and test each pit once. The results are attached in Appendix E and are summarised below:

Table 11: Summary of soakage tests

Test Location	Soakage Rate (m/s)	Comments
TP01	0	Water level did not change over five-hour period
TP02	0	Water level did not change over four-hour period
TP03	0	Water level did not change over four-hour period

The water levels within all three pits did not fall over the monitoring period of 4-5 hours, indicating that the water table on site is high, and the granular soils saturated.

14.4.2 Recommendations

Based on the above results, the site is not suitable for conventional soakaways, as the high groundwater table would significantly restrict storage capacity. Soakage testing carried out within the River Terrace Deposits on the site 15m west-northwest of the subject site (ref: GE18390-GAR-OCT-19) returned low to moderate infiltration rates of between 3.4×10^{-6} and 1.2×10^{-5} m/s, which indicates that there may be some soakage potential within the granular soils, however, the high-water table will significantly restrict the potential for infiltration SUDS to be used on site. Groundwater monitoring over the winter period is proposed, and this will determine whether even shallow infiltration systems such as permeable paving may be used. Allowance should be made for surface water to be piped off site at this stage.

¹⁴ Building Research Establishment DG365: 2016. Digest Soakaway Design

14.5 Bearing Capacity and Foundations

14.5.1 Shallow Foundations

Allowable Bearing Capacity or Pressure is a conservative estimate of the ultimate bearing resistance of the ground, selected on the basis of the soil/rock description, and taking a presumed degree of settlement into account. It has traditionally been used to check simple foundation designs. The use of this method is acceptable under BS EN 1997-1¹⁵ as a "prescriptive method", with the allowable bearing pressures now termed "presumed bearing resistance".

The presumed bearing resistance is highly dependent on proposed depth of foundation, width of foundation and the structure's tolerance for settlement. The following section provides a preliminary presumed bearing resistance assuming a stated depth and width of foundation and assumes that settlements of up to 25mm can be tolerated by the structure. Should alternative foundation depths and dimensions be required, or the proposed structure have different long term movement requirements then the following assessment should be re-evaluated.

Traditional foundation construction may also be severely limited by the presence of high groundwater. Current levels could reasonably be expected to rise further over winter, which would further complicate construction.

All loads should be transferred beneath any topsoil, loose, soft, low strength, desiccated or disturbed soils and transferred onto the firm silty sandy clays or medium dense sands and/or gravels at 1m depth. On the basis of the findings of the intrusive investigation to date, and noting in particular the presence of very loose gravels at depth, a preliminary presumed bearing resistance of 85kPa may be assumed for a 600mm wide foundation on the firm silty sandy clays and medium dense sands and/or gravels below about 1m. Foundations will require deepening in the clay soils near trees to NHBC HIGH VCP precautions, though where non shrinkable soils overlie shrinkable soils NHBC Chapter 4.2.9 should be followed to assess whether deepening may be terminated in the granular soils. As mentioned above, deepening may be further complicated by the presence of a high groundwater table and piled foundations may be considered to be a more appropriate solution.

Further information will be required for the detailed design stage, including the foundation design details and further investigation to meet the requirements of BS EN 1997 and BS 8004¹⁶.

Where foundations are stepped or span different soil types, allowance should be made for nominal reinforcement.

¹⁵ BS EN 1997-1(2004)+A1:2013 Eurocode 7:Geotechnical Design: General Rules

¹⁶ BS 8004:2015+A1:2020 Code of Practice for foundations

14.6 Floor Slabs

With reference to NHBC Standard 5.2, suspended floor slabs are recommended:

- Where the depth of fill exceeds 600mm
- Where foundations are deepened below 1.5m in accordance with NHBC Standards Chapter 4.2
- Where desiccated soils are encountered
- Where vibratory ground improvement techniques have been used
- On sloping sites
- Where foundations have been piled.

Suspended floor slabs are therefore recommended on site.

14.7 Roads

14.7.1 Test Results

A series of 7 No. dynamic cone CBR tests were carried out along the line of the proposed access road at approximately 50m intervals. The results ranged between 2.9% and 14.2%, with the results at the anticipated depth of road formation (circa 500-600mm) ranging between 2.9% and 5.2%. The results are attached in Appendix I.

The shallow cohesive soils are assessed as frost susceptible, based on the results of the plasticity testing (see Section D).

14.7.2 Recommendations

Based on the results above a design CBR value of 3% is recommended for a silty sandy slightly gravelly clay subgrade.

Further confirmatory testing may be required if the proposed roads are to be adopted.

14.8 Excavations

Excavations in loose superficial soils are likely to be unstable and subject to collapse. Close lateral support will be required in all excavations where man entry is required.

Excavations below the water table at about 1.5m below ground level, will be unstable in the made ground and the granular soils. Running sands and piping in excavation bases should also be anticipated. Excavations extending below the water table will require dewatering.

Excavations in the silty clays should be stable in the short term. However, groundwater seepages should be anticipated along the more granular horizons and long term groundwater levels at or above 1m below ground level should be anticipated. Excavations will therefore be unstable in the long term and should be backfilled as soon as possible. Allowance should be made for light pumping.

Appropriate Health and Safety precautions must be adhered to where man entry into excavations is required. Even stiff clay soils at shallow depth can collapse, particularly following wet weather. Alternative foundation methods may need to be adopted where trench footings cannot be safely or satisfactorily constructed.

14.9 Filling

The preliminary recommendations contained within this report assume that ground levels are to remain at a similar level across the site for the proposed development, and that no significant changes in level are proposed. In the event that ground levels are to be raised, this may induce significant settlement, particularly across the areas of loose sands, which could adversely affect foundation design, drainage etc. Where significant changes in ground levels are proposed then further investigation will be required to assess the impact of such earthworks on the above recommendations.

14.10 Slope Stability

The site and local topography are relatively level. Provided no significant level changes are proposed, no slope stability issues are anticipated. However, if significant levels changes are proposed, then global stability checks are recommended.

14.11 Settlement

Based on the presumed bearing resistance given in Section 14.5, settlements should be within typical tolerable limits for the low rise development proposed.

If soft clays are encountered at formation level or below, significant settlement should be anticipated and serviceable limit state analyses will be required. For Geotechnical Category 2 and 3 structures, detailed settlement analyses are usually required.

At this stage it is assumed that ground levels will remain at the current level for the proposed development. If significant level raises are proposed, this may induce significant settlement in the natural soils and detailed settlement analyses will be required.

Where foundations are stepped or span different soil types, differential settlement should be anticipated and allowance should be made for nominal reinforcement.

14.12 Heave and Uplift

In accordance with NHBC Standards Chapter 4.2, precautions against heave should be used where foundations are within the influence of trees and the resulting foundation depth is greater than 1.5m. Compressible material must be provided against the inside faces of all external wall foundations greater than 1.5m in depth. For pier and beam foundations, additional voids are required below ring beams.

Heave may also occur where shrinkable soils are unloaded, in say, basement excavations. To avoid uplift pressures, voids or buffer zones should be left beneath floor slabs. As a preliminary guide, allowance should be made for a 300mm void for highly shrinkable clays, reducing for lower plasticity soils. This should be confirmed at the detailed design stage.

15 Geotechnical Recommendations

Further assessment including a geotechnical design report may be required once the details of the proposed construction are known. Deep borehole information should also be obtained if piled foundations are deemed to be more suitable for the site.

F GEO-ENVIRONMENTAL QUANTITATIVE RISK ASSESSMENT

16 Revised Conceptual Site Model

16.1 Introduction

The preliminary conceptual site model reported in the desk study identified a number of plausible contaminant linkages. The revised CSM presented in this Section provides an updated understanding of the site based on the findings of the site investigation and analytical results and was used to inform the quantitative risk assessment (QRA) undertaken in Sections 17 to 18 in the context of the proposed residential landuse.

16.2 Distribution of Contamination

The exploratory logs are provided in Appendix D and a summary of the laboratory analytical results in Appendix H.

The ground conditions generally comprised topsoil to around 0.2mbgl, underlain by natural silty sandy clays and silty sometimes gravelly sands to around 2mbgl and further underlain by silty clays. Made ground was only encountered in the north of the site close to the site entrance, comprising a sandy gravel with fragments of brick and concrete. No visual or olfactory evidence of contamination was encountered within the made ground and natural soils, nor in the groundwater which was encountered at approximately 1.5mbgl.

The laboratory results generally indicate low concentrations of contaminants in all samples, and there is no obvious spatial or vertical distribution of contaminants across the site.

16.3 Human Health

Given the nature of the contaminants encountered, plausible contaminant linkages for exposure to future residents and groundworkers at the site are confirmed as follows:

- Ingestion of contaminated soils.
- Inhalation of contaminated soil particles/dust and asbestos fibres.
- Dermal contact with contaminated soils.
- Ingestion of homegrown produce (future residents only).

As no evidence of VOCs was encountered, the inhalation of soil and groundwater-derived vapours was excluded as a plausible contaminant linkage.

16.4 Controlled Waters

The River Terrace Deposits mapped beneath the site are classified as a Secondary A Aquifer, whilst the underlying London Clay Formation is classified as Unproductive Strata. Groundwater strikes were encountered during the intrusive investigation between 1.0m and 2.1m bgl within granular strata of the River Terrace Deposits, with groundwater strikes generally deeper towards the west and south of the site. Resting groundwater levels of between 1.2m and 1.6mbgl were encountered during the groundwater monitoring round on 20th September 2021, again within granular horizons of the River Terrace Deposits. No surface water features are present on-site or along the site boundaries which could be potential receptors to the migration of any contaminated water leaving the site.

Monitoring to date indicates that groundwater is generally shallow within the River Terrace Deposits across the site. Although there is a potential pathway for leaching of contaminants due to the shallow groundwater, generally low concentrations of contaminants were detected within the soil samples, and as such it is unlikely that significant vertical leaching into the groundwater will occur. Furthermore, the thickness of the Secondary Aquifer is limited (generally between 2-3m) and there is a limited potential as a resource for abstraction, which is evidenced by the lack of groundwater abstraction licenses within 1km of the site. Therefore, the Secondary A aquifer was discounted as a receptor in the revised CSM and was not carried forward to the GQRA.

16.5 Ground Gases

No putrescible or obvious organic inclusions were encountered during the intrusive investigation, which suggests it is unlikely that ground gases will be generated directly beneath the site. However, a potential pathway for migration of ground gases onto site from the infilled former brickfield to the east of the site was identified in the preliminary CSM. The site investigation encountered relatively shallow granular natural strata through which gases could laterally migrate onto site. The former brickfield is also mapped as underlain by the same geology, and it can therefore be assumed that granular material will underlay the infilled pit and provide a plausible pathway for gas migration. Although near-surface natural clayey deposits would act to limit the upward migration of gases, due to the likelihood that these clayey deposits will be disturbed during the redevelopment, migration of ground gas into the new buildings under extreme weather conditions cannot be discounted. Therefore, the migration of ground gases from off-site sources is retained as a plausible contaminant linkage.

17 Human Health Risk Assessment

17.1 Rationale and Approach

The generic quantitative risk assessment (GQRA) for human health was conducted in line with the CLEA methodology by comparing the soil analytical results from the ground investigation with Generic Assessment Criteria (GAC). The GACs were selected using the rationale and assumptions provided in Appendix J.

Sets of soil GACs are available for SOMs of 1%, 2.5% and 6%. In this case, TOC in the samples that were analysed ranged from 0.24% to 1.9%. Using the conversion of $SOM = TOC \times 1.72$, this equates to a SOM range of 0.41% to 3.27%. There was a clear split between the topsoil and natural samples, with the SOMs of the topsoil samples ranging between 2.24% and 3.27% with an average TOC of 2.89%, whilst the SOMs of the samples of the underlying River Terrace Deposits and London Clay were all below 0.6%. As such, SOM GACs of 2.5% were considered appropriate for the topsoil samples and 1% SOM GACs for all other natural samples.

For some contaminants of concern, direct contact will be the dominant pathway for exposure. In order to support with development options, human exposure to all unsaturated soils, irrespective of depth, has been considered for the purpose of this assessment. This will maximise the information available to the design team on the suitability of all unsaturated material and can support with their materials management options.

Future residents were determined in the revised CSM to be at potential risk from ground gases (carbon dioxide and methane). The quantitative assessment of these risks is provided as part of the wider evaluation of ground gases in Section 18.2.

17.2 Evaluation of Potential Risks to Future Residents

The soils that were analysed comprised five topsoil samples and three natural clay samples. The laboratory analytical results were assessed to determine the potential risks to future site users under a generic residential land use scenario assuming that homegrown produce are consumed (resi HGP). The quantitative risk assessment is provided in Appendix H and the laboratory certificates are provided in Appendix I. A summary table is provided in Table 12 below.

Table 12: Summary of Soil Contamination Test Results

Determinand	Number of samples	Number >LOD	Maximum Conc. (mg/kg unless otherwise stated)	Generic Assessment Criteria (mg/kg)	Number of Exceedances
METALS					
Arsenic	8	8	11.1	37	0
Cadmium	8	0	<0.5	22	0
Chromium	8	8	34.8	910	0
Hexavalent Chromium	8	0	<0.8	21	0
Copper	8	8	20.8	2,400	0
Lead	8	8	30.6	260	0
Mercury ¹	8	0	<0.5	40	0
Nickel	8	8	18.2	130	0
Selenium	8	0	<1.0	250	0
Zinc	8	8	151	3,700	0
ASBESTOS					
Asbestos	8	0	NAD	Presence	0
HYDROCARBONS					
Benzo(a)pyrene ²	8	1	0.2	5.0	0
Naphthalene	8	0	<0.1	2.3 / 5.6 ³	0
Total PAHs	8	2	2.0	n.v.	-

Notes to table

1. Assessment criterion based on inorganic mercury
 2. As a surrogate marker for genotoxic PAH
 3. As a marker compound for threshold PAH
- n.v. -- no appropriate value
- * 1% SOM / 2.5% SOM

Concentrations of heavy metals and PAHs in all the topsoil and natural samples analysed are low or not detected and below their relevant assessment criteria. Asbestos was not detected as either free fibres or as asbestos-containing materials (ACMs).

17.3 Evaluation of Potential Risks to Groundworkers

There is a legal duty for employers to ensure that suitable health and safety controls should be in place to protect groundworkers and they should evaluate the potential for exposure including using data provided in this report which should be included in any future Health and Safety file for the site under The Construction (Design and Management) Regulations 2015.

No contamination was encountered in the topsoil nor the natural clay samples and as such there is considered to be minimal risk to groundworkers.

18 Ground Gas Risk Assessment

18.1 Rationale and Approach

An initial assessment has been made using the method outlined in BS8485:2015+A1:2019. Gas concentrations and borehole flow rates are combined to provide Gas Screening Values for both carbon dioxide and methane. In this assessment the highest concentrations have been combined with the highest steady flow rates for each monitoring well to provide a conservative Tier 1 assessment. A Gas Screening Value is assigned to the site in conjunction with the conceptual site model and typical gassing levels associated with the identified source to characterise the gassing regime. Appropriate design protection measures are recommended in line with BS8485:2015.

18.2 Evaluation of Potential Risks from Ground Gas

The gas monitoring results from the visit carried out on 20th September 2021 are summarised in Table 13 below:

Table 13: Summary of Ground Gas Monitoring Results

BH Ref	Maximum Recorded *						
	CO ₂ (%)	CH ₄ (%)	CO (ppm)	O ₂ (%)	Flow rate (l/hr)	Atmospheric Pressure (mB)	Was response zone flooded?
VVS01	1.4	0.2	1	20.0	0.0	1023	Partly
VVS03	2.5	0.2	1	19.1	0.0		Partly
VVS04	1.4	0.2	2	20.2	0.0		Partly
VVS05	1.0	0.2	2	20.3	0.0		Partly
VVS07	1.4	0.1	1	19.8	0.0		Partly

Notes to table

* With the exception of oxygen which is recorded as minimum

Only one round of gas monitoring has been carried out to date, with five further rounds proposed to be carried out between October 2021 and February 2021. As such the recommended number of visits has not yet been carried out.

Carbon dioxide concentrations were generally low in all monitoring wells, though were very slightly elevated in WS03 in the east of the site, which is closest to the infilled gravel pit. Concentrations of methane and carbon monoxide were also very low and all monitoring wells recorded no flow. Oxygen concentrations were overall high and do not indicate depleted oxygen.

We note that in all monitoring wells the response zone was partially flooded, and as such the results are not wholly representative of land gases at the site

Once the winter ground gas and groundwater monitoring programme has been completed, assessment and classification of the gas regime will be undertaken using the guidance and classification system set out in BS8485:2015+A1:2019 and detailed in Section 18.1.

19 Waste Disposal

It is anticipated that the proposed development will generate waste soils and materials will need to be removed from site as part of the construction process.

Where soils are to be disposed off-site, it is the duty of the waste producer, in this case Thakeham Partnerships Ltd, to ensure that all waste is disposed of appropriately and that any that is sent to landfill is sent to an appropriately licensed one. All waste sent to landfill must be classified and must be pre-treated. There are various forms of pre-treatment that are acceptable.

All samples were tested for waste classification purposes using HazWasteOnline™, and the waste report is provided in Appendix K. It is considered that the soils would be classified as non-hazardous for waste disposal purposes.

Further testing and inspection of soils will be required to confirm waste classification of material leaving the site.

It is strongly advised that detailed discussions be held with remediation/groundworks contractors and that receiving landfill sites are identified in advance of commencing any waste removal.

20 Geo-Environmental Conclusions

20.1 Ground Conditions

The intrusive investigation encountered predominantly natural soils comprising topsoil underlain by silty sandy clays and clayey silty sands and gravels, aside from in the north of the site where a thin layer (0.25m) of made ground comprising sandy gravel with concrete fragments was observed adjacent to the field entrance. Groundwater strikes were encountered between 1.1m and 2.1m bgl with resting groundwater levels between 1.2m and 1.6 mbgl.

The works to date have not identified any potentially unacceptable contamination with respect to identified human health receptors. Access for intrusive works was restricted in the north of the site due to the presence of trees, bushes and shrubs however it is considered that there is unlikely to be any significant unidentified contamination within this area.

20.2 Ground Gases

The initial round of ground gas monitoring detected low concentrations of carbon dioxide and methane and high concentrations of oxygen with no flow. However, all monitoring wells were partially flooded. A full assessment of the ground gas regime will be undertaken following completion of the ground gas monitoring regime.

21 Geoenvironmental Recommendations

Based on the findings of the investigation, LEAP considers that sufficient ground investigation has been undertaken to initially characterise the site in the context of the proposed development. Further works will be required to comply with the frequency for a detailed investigation in accordance with BS10175 Section 7.7. At this stage, the extent of made ground around WS07 should be delineated and the materials characterised, and some pesticide analysis should be carried on near-surface soil samples. The scope of further work is subject to the approval of Chichester District Council planning in consultation with the contaminated land/environmental health officer and the EA.

It is anticipated that there will be sufficient clean soils present on-site for the redevelopment. Should uncontaminated natural soils be required to be imported to site, a Materials Management Plan (MMP) will need to be produced and a declaration made to CL:AIRE under DoWCoP. The declaration is required before any material movements are made. It may also be possible for any surplus natural materials to be used on a third-party site, subject to its suitability and this should be carried out under a Material Management Plan and a DoW CoP declaration.

The requirement for gas protection measures should be re-evaluated upon completion of the gas monitoring programme.

The findings of this report should be revisited if the development scheme changes significantly to ensure that they remain valid.

APPENDIX A – Limitations

Limitations

LIMITATIONS

This report is confidential to the Client, and Leap Environmental Ltd accepts no responsibility whatsoever to third parties to whom this report, or any part thereof, is made known, unless formally agreed by Leap Environmental Ltd beforehand. Any such party relies upon the report at their own risk. Unless explicitly agreed otherwise in writing, this report has been prepared under LEAP's standard terms and conditions, as included in the quotation for this works.

This report has been prepared by Leap Environmental Ltd on the basis of information received from a variety of sources which Leap Environmental Ltd believes to be accurate. Nevertheless, Leap Environmental Ltd cannot and does not guarantee the authenticity or reliability of the information it has obtained from others.

Leap Environmental Ltd has used all reasonable skill, care and diligence in the design and execution of this report, taking into account the manpower and resources devoted to it in agreement with the Client. Although every reasonable effort has been made to obtain all relevant information, all potential contamination, environmental constraints or liabilities associated with the site may not necessarily have been revealed. LEAP cannot be held responsible for any disclosures or changes in regulation that are provided post production of this report, and will not automatically update the report.

The conclusions reached in this report are necessarily restricted to those which can be determined from the information consulted, and may be subject to amendment in the light of additional information becoming available. These conclusions may not be appropriate for alternative schemes.

The extent of the exploratory holes, laboratory testing and monitoring undertaken may have been restricted due to a number of factors including accessibility, the presence of buried or overhead services, current development and site usage, timescales or clients specification. The exploratory holes only assess a small proportion of the site area with respect to the site as a whole, and as such may only provide an overall assessment of ground conditions on site. The presence of hotspots of undisclosed contamination or exceptional and unforeseen ground conditions cannot be discounted.

Eurocode 7 gives guidance on the type of sampling, sample quality, number and spacing of intrusive investigations, and number of laboratory tests required. It is intended that the Geotechnical Information section of this report will fulfil the general requirements of the Ground Investigation Report as set out in section 6 of Eurocode7¹⁷, although this is subject to the restrictions imposed on the investigation as listed above. It is noted that standards BS5930 and BS8004 give further recommendations on investigation point spacing for low rise housing.

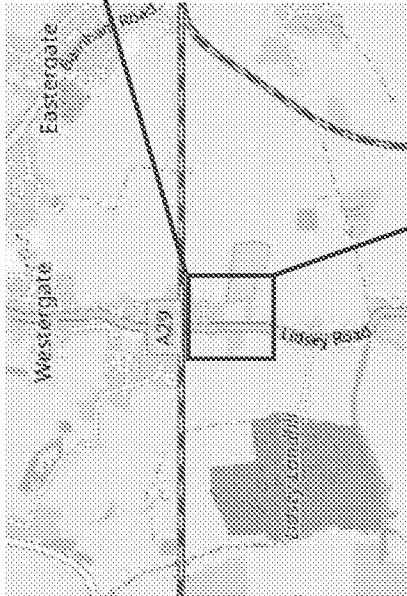
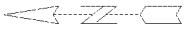
¹⁷ BS EN 1997 Eurocode 7- Geotechnical Design - Part 1: General Rules (2004) and Part 2: Ground Investigation and Testing (2007)

It is intended that this report fulfils the requirement of a preliminary investigation, and as such further detailed investigation may be required to meet the investigation spacing defined in Section 4.2 of BS8004. For geotechnical design, Eurocode 7 requires the Geotechnical Design Report to address both the geotechnical and structural aspects of the geotechnical design for both the limit and serviceability states. The Geotechnical Appraisal section of this report will not meet the requirements of a Geotechnical Design Report (GDR) and should therefore be used for preliminary guidance only.

The presence of asbestos may be noted during the site walkover survey, intrusive investigations and/or from the results of contamination testing. However, this report does not constitute an asbestos survey. On this basis, the presence of asbestos on site cannot be discounted and a full asbestos survey should be undertaken.

APPENDIX B -- Figures and Drawings

Figures and Drawings



Site Boundary

Basemap: @Openstreetmaps

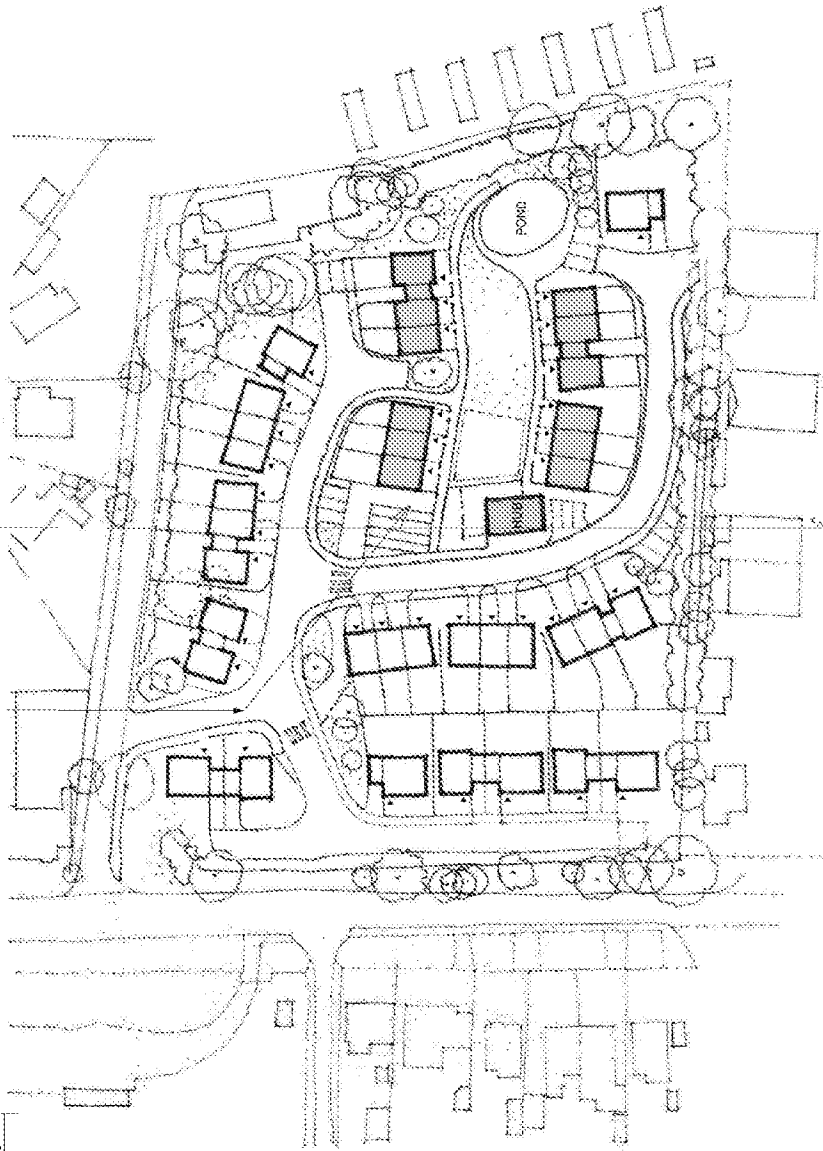


Client:	Thakeham Partnerships Ltd	Date:	October 2021	Project ID:	LP2616
Project:	Land North of Lee's Yard, Woodgate, PO20 3SU	Title:	Site Location Plan	Fig. No.	1

Land At Lidsey Road Indicative Proposed Site Plan

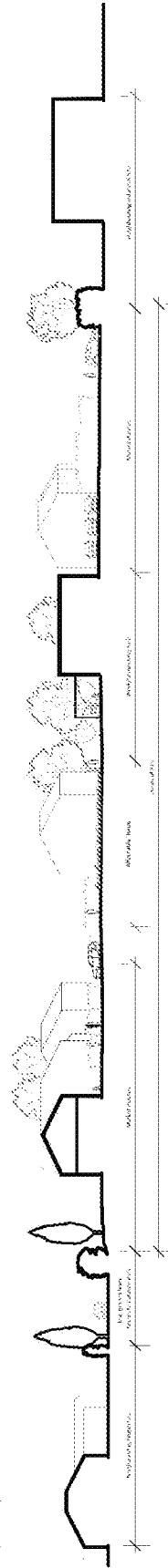
1:500 10m 20 40

View line to central
community space from
entrance to development



Land At Lidsey Road Indicative Section

1:500 5m 10 20 30



Accommodation Schedule:

38 total number of houses comprised of:
26 market homes (68%), and 12 affordable (31%).
Note: all house types are two storeys.

MARKET HOMES

5 x 4B Homes (7 persons) 115sqm GIA. Attached garage (2 spaces)
10 x 4B Homes (5 persons) 93sqm GIA. Single off road car space
11 x 2B Homes (4 persons) 79sqm GIA. Single off road car space

AFFORDABLE HOMES

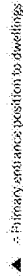
4 x 3B Homes (5 persons) 93sqm GIA. Single off road car space
8 x 2B Homes (4 persons) 79sqm GIA. Single off road car space



The affordable homes are all contained within an area of the site, so that this can be separately demised and managed. This could suit community led housing initiatives.



Communal facilities, such as a hub building, attenuation pond, growing beds and green are all contained and managed within the affordable portion of the site



Primary entrance position to dwellings

4. Other Contact: Planning, Highdown 1461 4465
e: planning@arundistrictcouncil.gov.uk
t: (01243) 794651
a: development@arundistrictcouncil.gov.uk

Revisions:

		Preliminary issue for comment
A	26/09/2019	Issue for comment
B	11/10/2019	Issue for comment
C	06/10/2019	Issue for comment
D	02/02/2020	Issue for comment
E	03/03/2020	Issue for comment

Checked

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Disclaimer:
This document is a preliminary proposal and is not intended to be used for any other purpose. It is not a contract and is not intended to be used for any other purpose. It is not a contract and is not intended to be used for any other purpose.



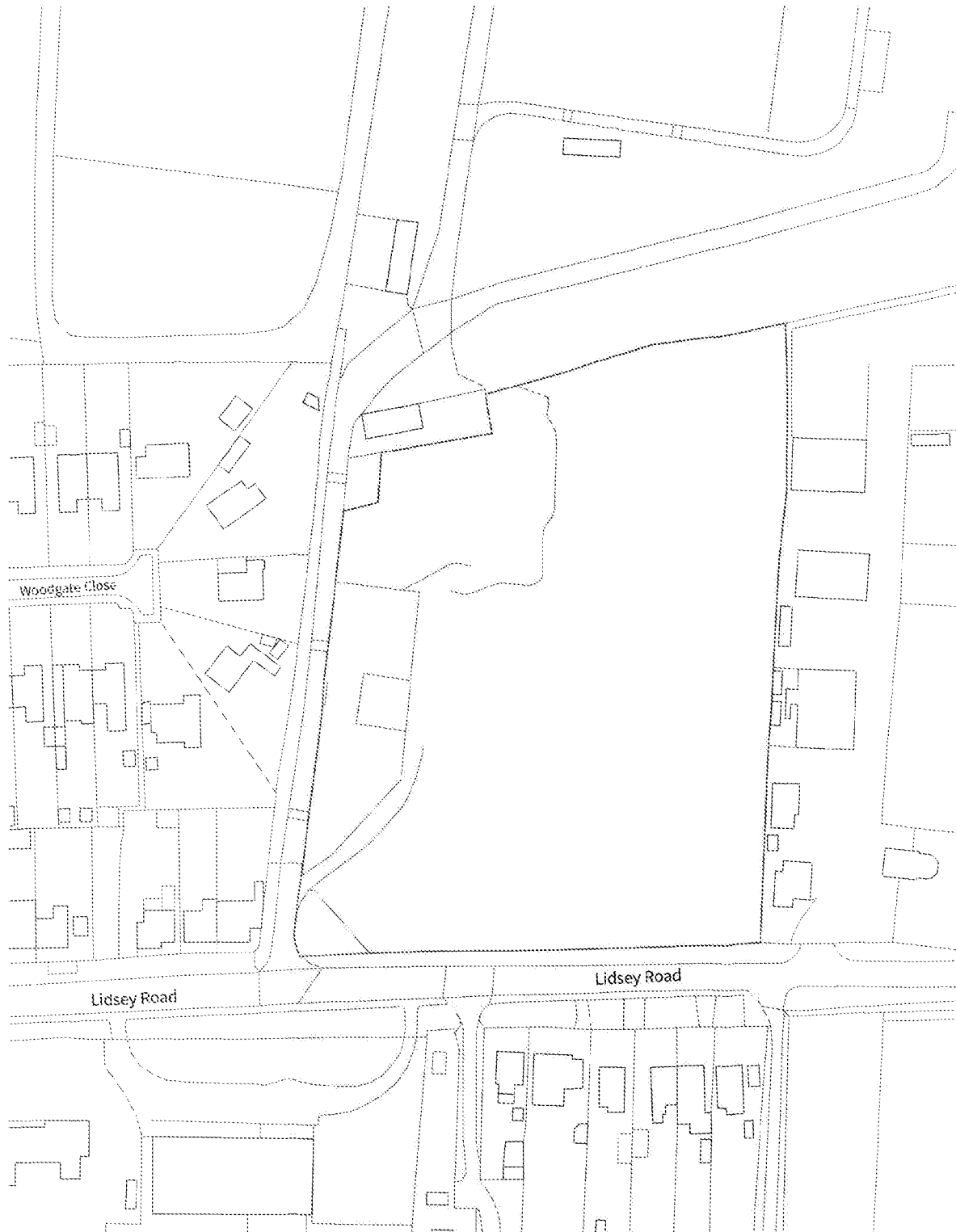
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Dwg No. 1428A-SK-002

Drawing Title: Proposed Site Plan
Address: Land at Lidsey Road
Client: Lid & Stewart Johnson
Scale: 1:250
Stage: Feasibility
Drawn by: AS
Checked by:



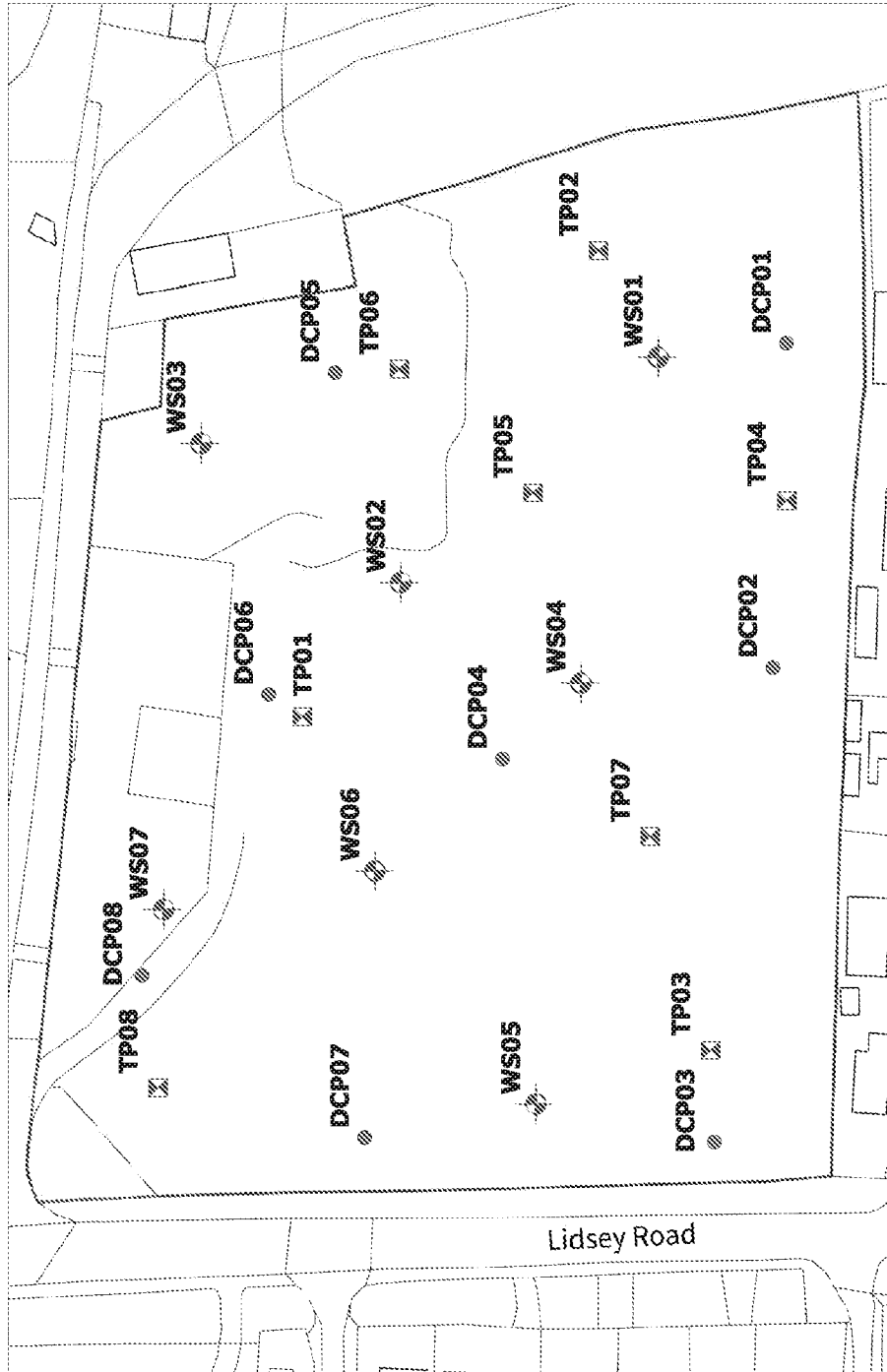
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Draw No. 1428-P-367
Drawing Title: 3D Plan
Address: 1, 2 & 3 Woodgate, Woodgate
Client: The Client
Scale: 1:250
Drawn by: P. 0000000
Checked by: 00



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Key

- Site Boundary
- Trial Pits.
- DCB CBRs
- Windowless Boreholes

Basemap: © OpenStreetMap contributors
Note 1: Exploratory holes have been positioned by local measurements made by site engineer and should therefore only be taken as approximate.
Note 2: Exploratory holes shown are not to scale.
Note 3: Elevations not shown

leap environmental		Client:	Thakeham Partnership Ltd	Title:	Trial Hole Location Plan	Project ID:	LP2616
		Project:	Land North of Lee's Yard, Woodgate	Date:	October 2021	Figure No.	2

APPENDIX C -- Photographic Record

Photographic Record



TP01



Arisings from TP01



TP03



Arisings from TP03