

014/4473/JBr/JHR

31st December 2022

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Dear Guy

Storthes Hall, Kirkburton – gas risk assessment

Further to issue of our Geoenvironmental Appraisal Report (No. 4473/1, dated September 2022), gas monitoring at the above site has now been completed and we are able to issue this supplementary letter report together with copies of the monitoring results. This letter, which should be read in conjunction with Report No. 4473/1, reviews soil-gas conditions, assesses risks and details any mitigation measures required to render the site suitable for the proposed development.

Background

The site is located approximately 5.3 km southeast of Huddersfield town centre at NGR SE 180 127 and comprises student accommodation blocks and an events space with associated access roads, parking and areas of grass and woodland. It covers an area of approximately 13.8 hectares (34.1 acres).

In relation to hazardous gas, the above-mentioned report found:

- An on site backfilled sandstone quarry (c. 200m²).
- Two backfilled sandstone quarries within influencing distance (<250m) of the site's boundaries, located 60m to the west and 10m to the north.
- A veneer of made ground (maximum recorded thickness 2.1m) on site.

Based on the above, it was considered that the site might be at risk from hazardous gas and therefore monitoring wells were installed in 13 boreholes. Details of the individual installations are provided in Appendix E of this letter.

The proposed residential redevelopment comprises two and three storey domestic dwellings, associated gardens, POS, adoptable roads and sewers, as shown on Drawing 4473/2 in Report No. 4473/1.

The majority of houses will be founded on traditional strips and/or trenchfill footings within the residual soils or Grenoside Sandstone. In any areas where made ground is found to be >2.5m an alternative foundation solution such as piles may be required.

Scope of works

The generation potential of the gas source was initially considered to be Very Low. Consequently, in accordance with CIRIA Report C665, given the proposed residential end use, 6 visits have been completed over a 3-month period, between August and December 2022.



A standard procedure was followed in accordance with CIRIA guidance; this procedure involved measurement, in the following order of:

- Atmospheric temperature, pressure and ambient oxygen concentration on site immediately prior to and on completion of monitoring
- Methane, oxygen and carbon dioxide concentrations and flow rates using a Gas Data GFM436 infra-red gas analyser
- Standing water level using a dipmeter

Gas monitoring results

The monitoring results are enclosed and summarised below:

Monitoring well	Response zone	Range of methane concentrations (% v/v)	Range of carbon dioxide concentrations (% v/v)	Range of steady flow rates (litre/hour)
WS01	1.0 – 1.7m (Granular Residual & Grenoside Sandstone)	None detected	0.4 – 0.7	None detected
WS02	0.5 – 2.0m (Granular Residual & Grenoside Sandstone)		0.6 – 0.9	
WS03	0.5 – 1.4m (Granular Residual & Grenoside Sandstone)		0.3 – 0.7	
WS04	1.0 – 3.0m (Granular Residual & Grenoside Sandstone)		0.7 – 3.2	
WS08	1.0 – 1.5m (Granular Residual & Grenoside Sandstone)		N.D – 0.7	
WS10	1.0 – 2.5m (Residual Soil & Grenoside Sandstone)		0.2 – 0.7	
WS11	2.0 – 4.0m (Cohesive Residual & Grenoside Sandstone)		0.6 – 1.0	
WS12	1.0 – 2.2m (Grenoside Sandstone)		1.6 – 2.0	
WS14	0.5 – 1.7m (Residual Soil & Grenoside Sandstone)		1.5 – 3.3	
WS22	0.5 – 1.2m (Granular Made Ground)		N.D – 0.6	
WS25	1.0 – 2.0m (Granular Made Ground)		0.1 – 0.7	
WS27	0.9 – 1.9m (Cohesive Residual & Grenoside Sandstone)		1.5 – 6.2	
WS29	1.0 – 2.0m (Cohesive Residual & Grenoside Sandstone)		1.9 – 3.6	

Note: Atmospheric pressures varied between 988mb and 1029mb. N.D – Not detected.

Numbers in bold **exceed** the CS2 lower threshold.

During visit 5 atmospheric pressure was below 1000mb for the duration of the visit. Plots of atmospheric pressure versus time, with the monitoring visits indicated, are presented in Appendix D of this letter report.

In accordance with the DETR approach, a default value of 0.1 litres/hour has been used in the absence of any recorded flows; i.e. the limit of detection of the flow rate equipment.

Current guidance

Generic Notes (01 Site Characterisation) outlining how monitoring results are interpreted are enclosed.

Current gas regime

The proposed residential redevelopment comprises two and three storey domestic dwellings, associated gardens, POS, adoptable roads and sewers. Consequently, the gas regime has been characterised in accordance with the Situation A (Wilson & Card) methodology outlined in CIRIA Report C665 and BS8485:2015+A1:2019¹.

No methane was recorded during any of the 6 visits.

Based on worst-case (peak) gas concentration of carbon dioxide and the default value for flow, the Gas Screening Value (GSV)² for carbon dioxide is 0.0062. This GSV equates to Characteristic Situation **CS1**.

A single elevated carbon dioxide concentration over 5% was recorded on one occasion (WS27 – Visit 3). The elevation is marginal and highly likely to be associated with microbial activity within the substrata. Based on the isolated occurrence of a marginally elevated concentration and the complete absence of flow, it is not considered necessary to raise the site's classification to CS2.

Scope of protection measures

Based on the site characterisation discussed above, the proposed foundation solution, and with reference to the gas protection “scoring” system outlined in BS8485:2015+A1:2019, Lithos consider that the following protective measures should be incorporated in all new buildings:

Characterisation. situation (Wilson & Card, '99)	Gas “score” req'd by BS8485	Protective measures (Residential, low-rise housing)		
		Floor slab (BS8485 “score”)	Sub-floor ventilation (BS8485 “score”)	Membrane
				Type (BS8485 score)
1	0	well constructed ground-bearing or suspended	Not required for ground bearing slab, otherwise to comply with Building Regulations (Part C).	Waterproof DPM

Footnotes:

1. Building Type A is defined in Table 3 and Section 7 of BS8485:2015+A1:2019 as: private ownership with no building management controls on alterations to the internal structure, the use of rooms, the ventilation of rooms or the structural fabric of the building. Examples include private housing and some retail premises

BRE\Environment Agency Report BR 414 (2001) – “Protective Measures for housing on gas-contaminated land” provides a practical guide to good practice for the detailing and construction of passive soil gas protection measures for new residential development. Of particular relevance are a list of ‘Watchpoints’, which offer practical information for installation and buildability.

Radon

On 1st December 2022 the British Geological Society (BGS) and the UK Health Protection Agency (UKHPA) published an updated radon potential map for Great Britain. Based on the updated radon map, the site is in an area where **less than 1%** of homes are estimated to be above the action level. Consequently, basic radon protection measures are not required. However, in light of Public Health England advice, the Developer might consider providing all new dwellings with basic radon protection measures.

¹ Code of Practice for the characterisation & remediation from ground gas in affected developments.

² Gas Screening Values (GSVs) are calculated by the equation: $GSV = flow \times (gas\ concentration / 100)$.

We trust the above is sufficient for your present needs, but should you have any queries please contact the undersigned.

Yours sincerely

Julia Reynolds
Principal Engineer
for and on behalf of
LITHOS CONSULTING LIMITED

Enc.

Appendix A – General notes

Appendix B – Drawings

Appendix C – Gas monitoring results

Appendix D – Atmospheric pressure graphs

Appendix E – Monitoring well installations

APPENDIX A
General notes

Current guidance

CIRIA Report 151 (1995)ⁱ identified that there was inadequate guidance on trigger concentrations for ground gases. CIRIA concluded that the most important aspect of a gas regime below or adjacent to a site was the surface emission rate, i.e. how quickly the gas is coming out of the ground. The lower the surface emission rate the lower the risk. CIRIA Report C665 (2006)ⁱⁱ advocates two methodologies (both refer to Gas Screening Values - GSV) for characterising sites:

A – All developments except low rise housing. The advocated methodology is that proposed by Wilson & Card, 1999ⁱⁱⁱ

B – Low rise housing. An alternative (traffic light) methodology, derived by Boyle and Witherington, 2006^{iv} for NHBC

Other relevant UK guidance includes:

- BS8485:2015+A1:2019 – Code of Practice for the characterisation & remediation from ground gas in affected developments.
- BS8576:2013 Guidance on investigations for ground gas – permanent gases and volatile organic compounds
- Boyle & Witherington (2007) – Guidance on evaluation on development proposals on sites where methane and carbon dioxide are present, incorporating "traffic lights". Report Ref. 10627-R01-(02), for NHBC
- Wilson, Card & Haines (CIEH, 208) The Local Authority Guide to Ground Gas
- CL:AIRE Research Bulletin RB17 (November 2012) A Pragmatic Approach to Ground Gas Risk Assessment
- CL:AIRE Research Bulletin RB13 (February 2011) The Utility of Continuous Monitoring in Detection & Prediction of 'Worst-Case' Ground Gas Concentration
- BRE\Environment Agency Report BR 414 (2001) – "Protective Measures for housing on gas-contaminated land".
- YALPAG (December 2016) - Verification Requirements for Gas Protection Systems - Technical Guidance for Developers, Landowners and Consultants.
- Environment Agency Report LFTGN 03 - Guidance on the management of landfill gas, June 2014

A – All developments except low rise housing. (Wilson & Card, 1999)^v revised Table 28 of CIRIA 149^v in terms of borehole gas volume flow rate (now GSV) in order to achieve a more consistent design of protection measures. This was done to reflect the importance of recognising the gas surface emission rate. Wilson & Card then developed a method for classifying gassing sites (Table 1 below), which took into account the combined gas concentration and GSV.

Table 1 – Site classification (Wilson & Card)

Characteristic Situation (W&C, 1999)	Gas Screening Value, CH ₄ or CO ₂ (l/hr)	Additional limiting factors	Typical source of generation
1	<0.07	Methane not to exceed 1% v/v and carbon dioxide not to exceed 5% v/v	Natural soils with low organic content
2	<0.7	Borehole air flow rate not to exceed 70 litre/hr otherwise increase to Characteristic Situation 3	Natural soil, high peat/organic content
3	<3.5		Old landfill, inert waste, mineworking flooded.
4	<15	Quantitative Risk Assessment required to evaluate scope of protection measures.	Mineworking – susceptible to flooding, completed landfill, inert waste (WMP 26B criteria)
5	<70		Mineworking unflooded, inactive
6	>70		Recent landfill site

Notes:

Borehole flow rate = volume of gas (regardless of composition) which is escaping from well (l/hr)

Gas Screening Value (litre/hour) = gas concentration (%) / 100 x borehole flow rate (l/hr)

To facilitate design implementation, the limiting values for both methane and carbon dioxide are identical

B – Low rise housing. NHBC have developed a characterisation system similar to that of Wilson & Card above, but specific to low-rise housing development (Boyle and Witherington) (Table 8.7). This approach compares measured gas emission rates with generic "Traffic Lights". The Traffic Lights include "Typical Maximum Concentrations" for initial screening, and risk-based Gas Screening Values (GSVs) for consideration of situations where the Typical Maximum Concentrations are exceeded. Calculations are carried out for both methane and carbon dioxide and the worst case adopted in order to establish the appropriate protection measures.

Table 8.7 NHBC Traffic light system for 150 mm void

Traffic Light Classification	Methane ¹		Carbon Dioxide ¹	
	Typical Maximum Concentration ⁵ (%v/v)	Gas Screening Value ^{2,4,6} (l/hr)	Typical Maximum Concentration ⁵ (%v/v)	Gas Screening Value ^{2,3,4,6} (l/hr)
Green	1	0.16	5	0.78
Amber 1	5	0.63	10	1.56
Amber 2	20	1.56	30	3.13
Red				

Notes:

1. The worst gas-regime identified at the site, either methane or carbon dioxide, recorded from monitoring in the worst temporal conditions, will be the decider for which Traffic Light and GSV is allocated.
2. Generic GSVs are based on guidance contained within "The Building Regulations: Approved Document C" (2004) and assume a sub-floor void of 150 mm thickness.
3. The small room is considered to be a downstairs toilet, with dimensions of 1.50 × 1.50 × 2.50 m, with a soil pipe passing into the sub-floor void.
4. The GSV, in litres per hour, is as defined in Wilson and Card (1999) as the borehole flow rate multiplied by the concentration in the air stream of the particular gas being considered.
5. The Typical Maximum Concentrations can be exceeded in certain circumstances should the conceptual site model indicate it is safe to do so. This is where professional judgment will be required, based on a thorough understanding of the gas regime identified at the site where monitoring in the worst temporal conditions has occurred.
6. The GSV thresholds should not generally be exceeded without completion of a detailed gas risk assessment taking into account site-specific conditions.

ⁱ Harries CR, Witherington PJ and McEntee JM (1995). *Interpreting measurements of gas in the ground*. CIRIA Report 151

ⁱⁱ CIRIA (2006) – *Assessing risks posed by hazardous ground gases to buildings*.

ⁱⁱⁱ Wilson SA and Card GB (February 1999). *Reliability and Risk in Gas Protection Design*. Ground Engineering.

^{iv} Boyle & Witherington (2006) – *Guidance on evaluation on development proposals on sites where methane and carbon dioxide are present, incorporating "traffic lights"*. Report Ref. 10627-R01-(02), for NHBC.

^v Wilson SA and Card GB (February 1999). *Reliability and Risk in Gas Protection Design*. Ground Engineering.

APPENDIX B

Drawings



**The Site
SE 180 127**

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CLIENT

**UBRIQUE
INVESTMENTS
LIMITED**

JOB TITLE

**STORTES HALL,
KIRKBURTON**

DRAWING TITLE

**SITE LOCATION
PLAN**

DRAWN

JBR

DATE

13/07/2022

CHECKED

GLM

DATE

13/07/2022

STATUS

FOR COMMENT ☐

DRAFT ☐

FOR APPROVAL ☐

FINAL ☒

SCALE

1:25,000

SHEET

A4

DRAWING NO.

4473/1

REVISION



NOTES

- WOODLAND
- GRASS & OVERGROWN AREAS
- BUILDING
- TARMAC HARDSTAND
- BLOCK SURFACING & CONCRETE HARDSTAND
- HISTORICAL (FUEL) STORAGE TANKS
- WINDOW SAMPLE LOCATION
- APPROXIMATE SITE BOUNDARY

EXPLORATORY HOLE LOCATIONS BASED ON DATA FROM A HAND-HELD GPS (+/- 3M ACCURACY)

REV.	DESCRIPTION	DATE
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CLIENT

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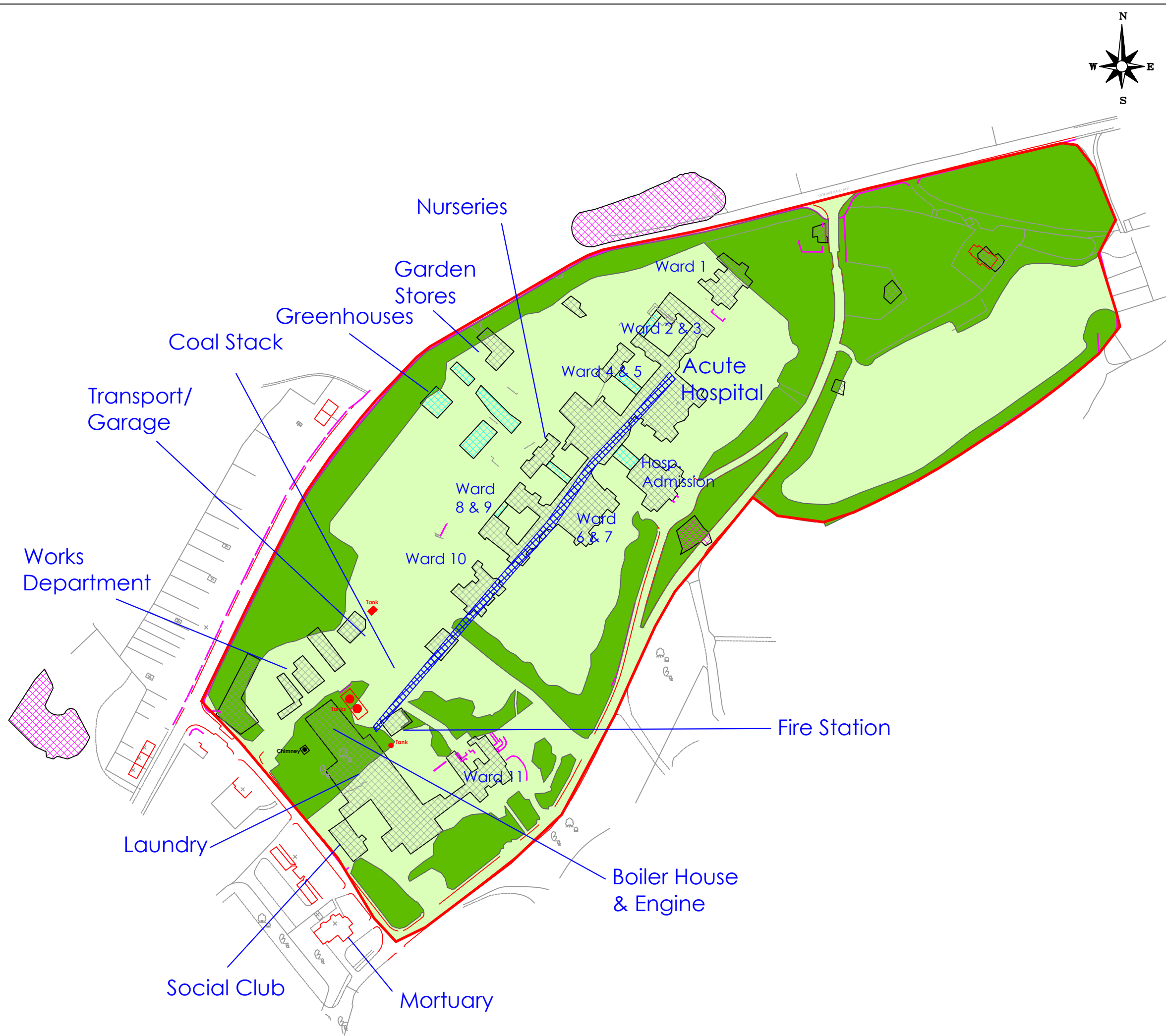
JOB TITLE

STORTHES HALL, KIRKBURTON

DRAWING TITLE

EXPLORATORY HOLE LOCATIONS (MONITORING WELLS ONLY)

DRAWN	JBR	DATE	25/07/2022	STATUS FOR COMMENT ☐ FOR APPROVAL ☐ DRAFT ☐ FINAL ☒			
CHECKED	GLM	DATE	25/07/2022				
SCALE	1:2,000	SHEET	A3	DRAWING NO.	4473/8	REVISION	



NOTES

- CURRENT WOODLAND/TREES
- CURRENT TARMAC HARDSTAND
- CURRENT GRASS & OVERGROWN AREAS

HISTORICAL FEATURES SUPERIMPOSED FROM 1891 OS PLAN (QUARRIES) 1977 OS PLANS (BUILDINGS/GLASSHOUSES) & 1985 OS PLAN (TANKS). HISTORICAL BUILDINGS SUPERIMPOSED FROM 1950s ARCHIVE PLAN

- GLASS/GREENHOUSES & CONSERVATORIES/ORANGERIES
- HISTORIC BUILDING
- QUARRY
- HISTORIC TUNNEL/SUBWAY
- HISTORICAL (FUEL) STORAGE TANKS
- APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE
------	-------------	------



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CLIENT

UBRIQUE INVESTMENTS LIMITED

JOB TITLE

STORTHES HALL, KIRKBURTON

DRAWING TITLE

HISTORICAL SITE FEATURES

DRAWN	JBR	DATE	31/08/2022	STATUS	FOR COMMENT	☐
CHECKED	GLM	DATE	31/08/2022	FOR APPROVAL	DRAFT	☐
				FINAL		☒
SCALE	1:2,500	SHEET	A3	DRAWING NO.	4473/3A	REVISION

APPENDIX C
Gas monitoring results

Visit 1											
Job Title:								Job No:			
Storthes Hall, Kirkburton								4473			
Client:								Sheet :			
Ubrique Investments								1 of 6			
Date:		Arrival Time:		Depart Time:		Operator:					
10/08/2022		07:30		10:30		Cameron Daniel					
Gas Monitoring Results:											
Ambient Concentration (% Volume):				CH ₄ :	ND	CO ₂ :	ND	O ₂ :	20.9		
Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady		
		CH ₄	CO ₂	CH ₄	CO ₂	O ₂					
		(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre / hr	litre / hr		
WS01	ND	ND	0.5	ND	0.5	20.6	0.1	ND	5.0	1.38	
WS02	ND	ND	0.6	ND	0.6	20.7	ND	ND	ND	1.96	
WS03	ND	ND	0.6	ND	0.6	20.5	ND	ND	ND	1.16	
WS04	ND	ND	3.2	ND	3.2	19.1	ND	ND	ND	2.87	
WS08	ND	ND	0.2	ND	0.2	20.9	0.1	ND	10.0	1.46	
WS10	ND	ND	0.2	ND	0.2	20.9	ND	ND	ND	2.40	
WS11	ND	ND	0.6	ND	0.6	20.1	ND	ND	ND	3.91	
WS12	ND	ND	2.0	ND	2.0	19.2	-0.1	ND	5.0	2.04	
WS14	ND	ND	3.3	ND	3.3	17.4	0.1	ND	10.0	1.77	
WS22	ND	ND	0.1	ND	0.1	20.9	ND	ND	ND	1.24	
WS25	ND	ND	0.1	ND	0.1	20.9	ND	ND	ND	1.86	
WS27	ND	ND	4.5	ND	4.5	16.0	ND	ND	ND	1.72	Screw stuck, pulled up headworks for monitoring.
WS29	ND	ND	2.2	ND	2.2	18.8	ND	ND	ND	1.97	
Equipment Used:						Next Calibration Date				Key	
Gas Data GFM436 Infrared Gas Analyser						08/03/2023				ND None Detected	
Geotechnical Instruments Dipmeter										NR Not Recorded	
										1.0 Recorded value does not breach trigger levels	
										5.0 Recorded value breaches trigger level 1	
										10.0 Recorded value breaches trigger level 2	
	Site Data:			Weather Station Data (Reinwood Station)							
	Temp (°C):	15 to 21		Barometric Pressure Trend:			Steady				
Time:	07:48	09:26	10:16	01:00	06:00	07:45	09:25	10:15	12:00	Trigger level 1	1.0 5.0 16.0
Pressure (mb):	1008	1007	1007	1029	1028	1028	1028	1028	1027	Trigger level 2	5.0 10.0 10.0
	Weather Conditions:		Sunny/ Still								
	Surface Ground Conditions:		Dry								
Remarks:											

Job Title:										Job No:		
Storthes Hall, Kirkburton										4473		
Client:										Sheet :		
Ubrique Investments										2 of 6		
Date:		Arrival Time:		Depart Time:		Operator:						
08/09/2022		08:30		10:00		Toby Tapp						

Gas Monitoring Results:									
Ambient Concentration (% Volume):			CH ₄ :	ND	CO ₂ :	ND	O ₂ :	20.7	

Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady		
		CH ₄	CO ₂	CH ₄	CO ₂	O ₂					
		% v/v	(%)	% v/v	(%)	(%)					
WS01	ND	ND	0.7	ND	0.7	20.1	ND	ND	ND	1.39	
WS02	ND	ND	0.8	ND	0.8	20.0	ND	ND	ND	1.98	
WS03	ND	ND	0.7	ND	0.7	20.1	ND	ND	ND	1.16	
WS04	ND	ND	3.2	ND	3.2	18.1	ND	ND	ND	2.85	
WS08	ND	ND	0.1	ND	0.1	20.6	ND	ND	ND	1.46	
WS10	ND	ND	0.3	ND	0.3	20.3	ND	ND	ND	2.38	
WS11	ND	ND	1.0	ND	1.0	19.5	ND	ND	ND	3.90	
WS12	ND	ND	2.0	ND	2.0	19.2	ND	ND	ND	2.03	
WS14	ND	ND	2.7	ND	2.7	18.5	ND	ND	ND	1.77	
WS22	ND	ND	ND	ND	ND	20.6	ND	ND	ND	1.25	
WS25	ND	ND	0.3	ND	0.3	20.4	ND	ND	ND	1.88	
WS27	ND	ND	4.0	ND	4.0	15.3	ND	ND	ND	1.73	
WS29	ND	ND	2.5	ND	2.5	18.2	ND	ND	ND	1.97	

Equipment Used:						Next Calibration Date				Key				
Gas Data GFM436 Infrared Gas Analyser						08/03/2023				ND				None Detected
Geotechnical Instruments Dipmeter										NR				Not Recorded
										1.0				Recorded value does not breach trigger levels
										5.0				Recorded value breaches trigger level 1
										10.0				Recorded value breaches trigger level 2

	Site Data:			Weather Station Data (Reinwood Station)							CH ₄	CO ₂	O ₂	
	Temp (°C):	13 to 14		Barometric Pressure Trend:			Falling							
Time:	08:44	09:38	09:55	01:00	06:45	08:40	09:40	09:55	11:55	Trigger level 1	1.0	5.0	16.0	
Pressure (mb):	985	984	982	1005	1004	1004	1004	1004	1004	Trigger level 2	5.0	10.0	10.0	
	Weather Conditions:			Fog / Still										
	Surface Ground Conditions:			Damp										
Remarks:														

Job Title:								Job No:					
Storthes Hall, Kirkburton								4473					
Client:								Sheet :					
Ubrique Investments								3 of 6					
Date:		Arrival Time:		Depart Time:		Operator:							
03/10/2022		08:30		10:10		Toby Tapp							

Gas Monitoring Results:											
Ambient Concentration (% Volume):				CH ₄ :	ND	CO ₂ :	ND	O ₂ :	20.4		

Monitoring Point	Groundwater level (m) bgl	Concentrations					Gas Flow Rates			Bottom of well m	Remarks
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum litre / hr	Steady litre / hr	Time to fall from highest to steady secs		
		CH ₄	CO ₂	CH ₄	CO ₂	O ₂					
		% v/v	(%)	% v/v	(%)	(%)					
WS01	ND	ND	0.5	ND	0.5	20.2	ND	ND	ND	1.40	
WS02	ND	ND	0.7	ND	0.7	20.1	ND	ND	ND	1.97	
WS03	ND	ND	0.5	ND	0.5	20.3	ND	ND	ND	1.16	
WS04	ND	ND	2.2	ND	2.2	18.7	ND	ND	ND	2.87	
WS08	ND	ND	0.1	ND	0.1	20.4	ND	ND	ND	1.47	
WS10	ND	ND	0.4	ND	0.4	20.1	ND	ND	ND	2.38	
WS11	ND	ND	1.0	ND	1.0	19.3	ND	ND	ND	3.89	10 ppm CO
WS12	ND	ND	2.0	ND	2.0	18.5	ND	ND	ND	2.03	
WS14	ND	ND	2.1	ND	2.1	18.5	ND	ND	ND	1.77	
WS22	ND	ND	0.1	ND	0.1	20.4	ND	ND	ND	1.23	
WS25	ND	ND	0.3	ND	0.3	20.2	ND	ND	ND	1.88	
WS27	ND	ND	6.2	ND	6.2	13.8	ND	ND	ND	1.72	
WS29	ND	ND	2.6	ND	2.6	18.3	ND	ND	ND	1.97	

Equipment Used:						Next Calibration Date				Key				
Gas Data GFM436 Infrared Gas Analyser						08/03/2023				ND				None Detected
Geotechnical Instruments Dipmeter										NR				Not Recorded
										1.0				Recorded value does not breach trigger levels
										5.0				Recorded value breaches trigger level 1
										10.0				Recorded value breaches trigger level 2

	Site Data:			Weather Station Data (Reinwood Station)							CH ₄	CO ₂	O ₂	
	Temp (°C):	9 to 11		Barometric Pressure Trend:			Fluctuating							
Time:	08:45	09:33	10:03	01:05	06:30	08:30	09:35	10:05	12:05	Trigger level 1	1.0	5.0	16.0	
Pressure (mb):	1006	1005	1004	1026	1026	1025	1026	1025	1024	Trigger level 2	5.0	10.0	10.0	
	Weather Conditions:			Clear / Still										
	Surface Ground Conditions:			Damp										
Remarks:														

Job Title:								Job No:					
Storthes Hall, Kirkburton								4473					
Client:								Sheet :					
Ubrique Investments								4 of 6					
Date:		Arrival Time:		Depart Time:		Operator:							
26/10/2022		12:45		14:55		Toby Tapp							

Gas Monitoring Results:											
Ambient Concentration (% Volume):				CH ₄ :	ND	CO ₂ :	ND	O ₂ :	20.5		

Monitoring Point	Groundwater level (m) bgl	Concentrations					Gas Flow Rates			Bottom of well m	Remarks
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum litre / hr	Steady litre / hr	Time to fall from highest to steady secs		
		CH ₄	CO ₂	CH ₄	CO ₂	O ₂					
		% v/v	(%)	% v/v	(%)	(%)					
WS01	ND	ND	0.4	ND	0.4	20.3	ND	ND	ND	1.39	
WS02	ND	ND	0.9	ND	0.9	19.6	ND	ND	ND	1.98	
WS03	ND	ND	0.3	ND	0.3	20.3	ND	ND	ND	1.16	
WS04	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Could not find well.
WS08	ND	ND	ND	ND	ND	20.5	ND	ND	ND	1.46	
WS10	ND	ND	0.4	ND	0.4	20.1	ND	ND	ND	2.39	
WS11	ND	ND	1.0	ND	1.0	19.4	ND	ND	ND	3.90	
WS12	ND	ND	1.7	ND	1.7	18.9	ND	ND	ND	2.03	
WS14	ND	ND	2.0	ND	2.0	18.9	ND	ND	ND	1.76	
WS22	ND	ND	0.5	ND	0.5	20.1	0.1	ND	5.0	1.24	
WS25	ND	ND	0.4	ND	0.4	20.0	ND	ND	ND	1.88	
WS27	ND	ND	1.5	ND	1.5	18.9	ND	ND	ND	1.74	
WS29	ND	ND	2.8	ND	2.8	17.4	ND	ND	ND	1.97	

Equipment Used:						Next Calibration Date				Key				
Gas Data GFM436 Infrared Gas Analyser						08/03/2023				ND				None Detected
Geotechnical Instruments Dipmeter										NR				Not Recorded
										1.0				Recorded value does not breach trigger levels
										5.0				Recorded value breaches trigger level 1
										10.0				Recorded value breaches trigger level 2

	Site Data:			Weather Station Data (Reinwood Station)							CH ₄	CO ₂	O ₂	
	Temp (°C):	14 to 17		Barometric Pressure Trend:			Rising							
Time:	12:58	14:18	14:45	01:00	10:00	13:00	14:20	14:45	16:45	Trigger level 1	1.0	5.0	16.0	
Pressure (mb):	987	985	985	1004	1003	1005	1006	1006	1007	Trigger level 2	5.0	10.0	10.0	
	Weather Conditions:			Light cloud / Gentle breeze										
	Surface Ground Conditions:			Damp										

Remarks:														
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Job Title:										Job No:		
Storthes Hall, Kirkburton										4473		
Client:										Sheet :		
Ubrique Investments										5 of 6		
Date:		Arrival Time:		Depart Time:		Operator:						
08/11/2022		13:15		14:50		Toby Tapp						

Gas Monitoring Results:									
Ambient Concentration (% Volume):				CH ₄ :	ND	CO ₂ :	ND	O ₂ :	20.5

Monitoring Point	Groundwater level (m) bgl	Concentrations					Gas Flow Rates			Bottom of well m	Remarks
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady		
		CH ₄	CO ₂	CH ₄	CO ₂	O ₂					
		% v/v	(%)	% v/v	(%)	(%)					
WS01	ND	ND	0.4	ND	0.4	20.1	ND	ND	ND	1.39	
WS02	ND	ND	0.8	ND	0.8	19.8	ND	ND	ND	1.98	
WS03	ND	ND	0.7	ND	0.7	19.8	ND	ND	ND	1.16	
WS04	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Could not find.
WS08	ND	ND	0.1	ND	0.1	20.4	ND	ND	ND	1.47	
WS10	ND	ND	0.4	ND	0.4	20.0	3.7	ND	20.0	2.40	Peak flow due to gust of wind.
WS11	ND	ND	1.0	ND	1.0	19.6	ND	ND	ND	3.90	
WS12	ND	ND	1.6	ND	1.6	18.5	ND	ND	ND	2.03	
WS14	ND	ND	1.9	ND	1.9	18.7	0.9	ND	5.0	1.77	
WS22	ND	ND	0.5	ND	0.5	20.0	ND	ND	ND	1.24	
WS25	ND	ND	0.4	ND	0.4	20.1	ND	ND	ND	1.86	
WS27	ND	ND	1.7	ND	1.7	18.3	ND	ND	ND	1.74	
WS29	ND	ND	1.9	ND	1.9	17.8	-0.1	ND	5.0	1.97	

Equipment Used:						Next Calibration Date				Key				
Gas Data GFM436 Infrared Gas Analyser						08/03/2023				ND				None Detected
Geotechnical Instruments Dipmeter										NR				Not Recorded
										1.0				Recorded value does not breach trigger levels
										5.0				Recorded value breaches trigger level 1
										10.0				Recorded value breaches trigger level 2

	Site Data:			Weather Station Data (reinwood Station)						Trigger level 1	Trigger level 2	
	Temp (°C):	10 to 12		Barometric Pressure Trend:			Fluctuating					
Time:	13:36	14:13	14:40	01:00	11:00	13:35	14:10	14:40	16:40			
Pressure (mb):	968	968	968	990	990	989	988	989	988			
	Weather Conditions:			Overcast / Moderate breeze								
	Surface Ground Conditions:			Damp								
Remarks:												

Job Title:										Job No:	
Storthes Hall, Kirkburton										4473	
Client:										Sheet :	
Ubrique Investments										6 of 6	
Date:		Arrival Time:		Depart Time:		Operator:					
05/12/2022		14:10		15:30		Toby Tapp					



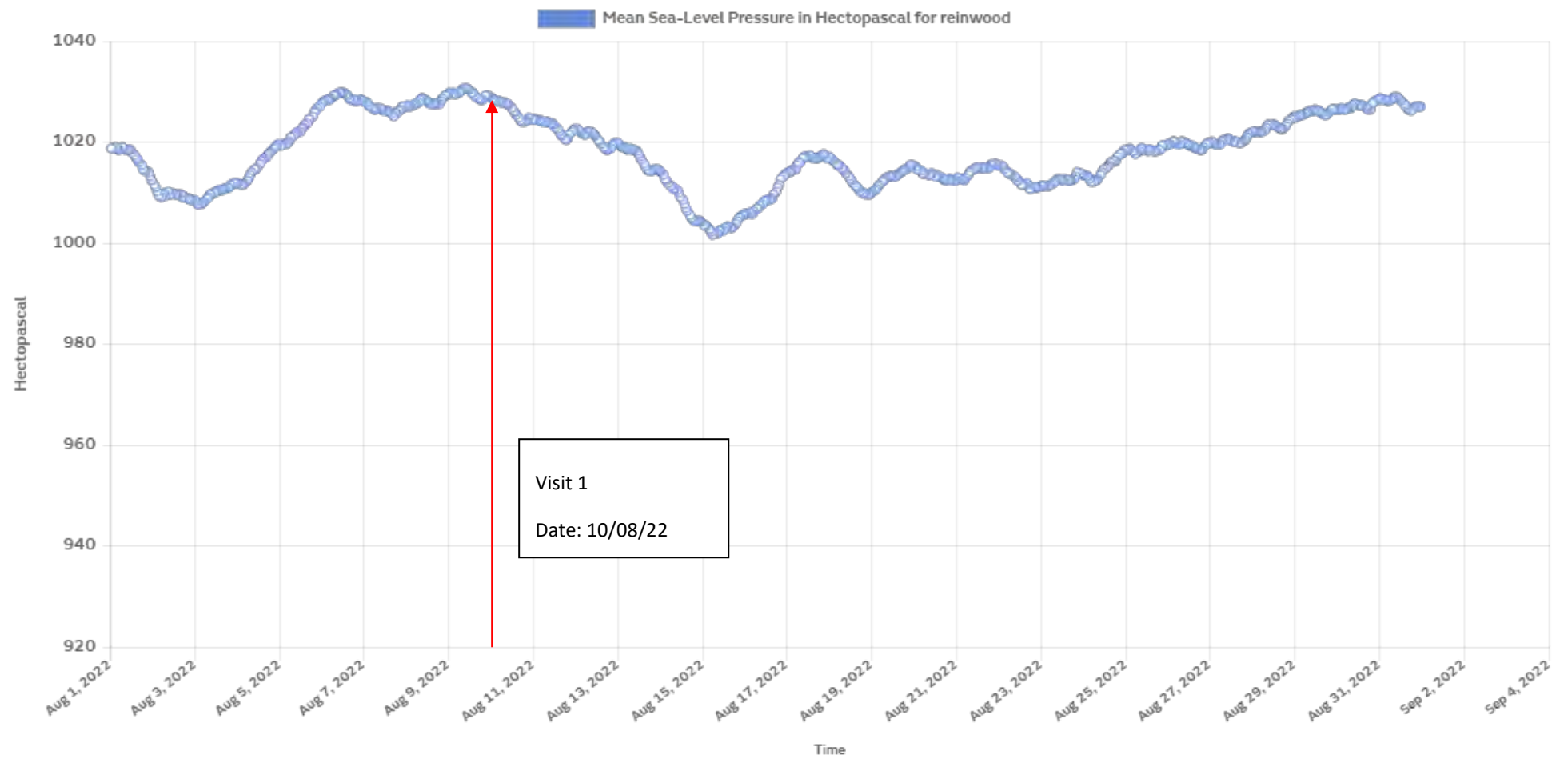
Gas Monitoring Results:												
Ambient Concentration (% Volume):				CH ₄ :	ND	CO ₂ :	ND	O ₂ :	20.3			

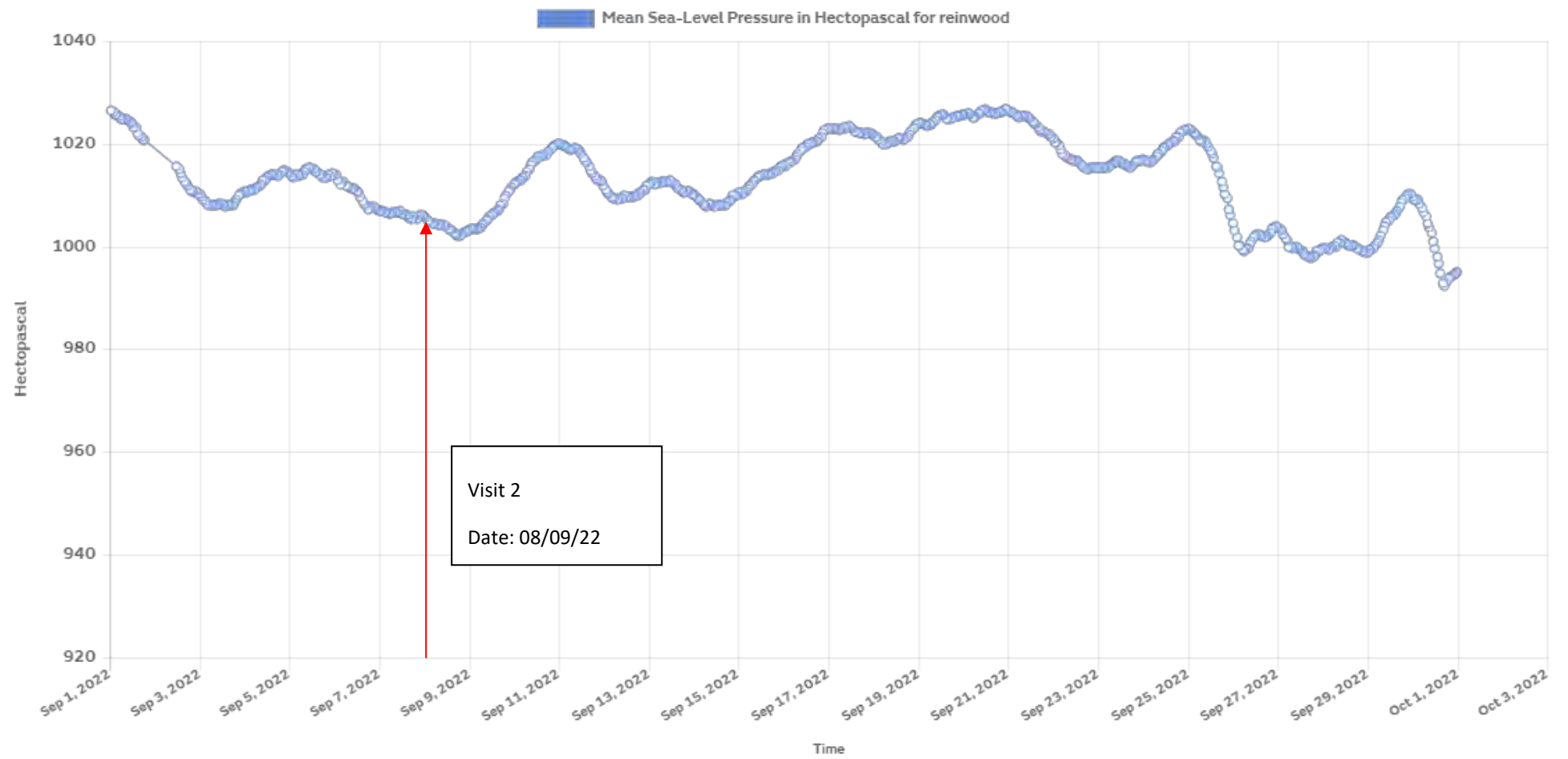
Monitoring Point	Groundwater level (m) bgl	Concentrations					Gas Flow Rates			Bottom of well m	Remarks
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady		
		CH ₄	CO ₂	CH ₄	CO ₂	O ₂					
		% v/v	(%)	% v/v	(%)	(%)					
WS01	ND	ND	0.4	ND	0.4	20.0	-0.1	ND	5.0	1.39	
WS02	ND	ND	0.7	ND	0.7	19.8	0.3	ND	20.0	1.98	
WS03	ND	ND	0.6	ND	0.6	19.9	-0.2	ND	15.0	1.16	
WS04	ND	ND	0.7	ND	0.7	19.3	ND	ND	ND	2.88	
WS08	ND	ND	0.7	ND	0.7	19.2	-2.7	ND	5.0	1.46	
WS10	ND	ND	0.7	ND	0.7	19.8	0.1	ND	5.0	2.39	
WS11	ND	ND	1.0	ND	1.0	19.5	ND	ND	ND	3.89	
WS12	ND	ND	1.9	ND	1.9	18.4	0.3	ND	20.0	2.02	
WS14	ND	ND	1.5	ND	1.5	19.8	ND	ND	ND	1.77	
WS22	ND	ND	0.6	ND	0.6	19.7	ND	ND	ND	1.25	
WS25	ND	ND	0.7	ND	0.7	19.0	1.1	ND	30.0	1.86	
WS27	ND	ND	1.7	ND	1.7	15.9	0.1	ND	10.0	1.74	
WS29	ND	ND	3.6	ND	3.6	14.8	0.1	ND	5.0	1.96	

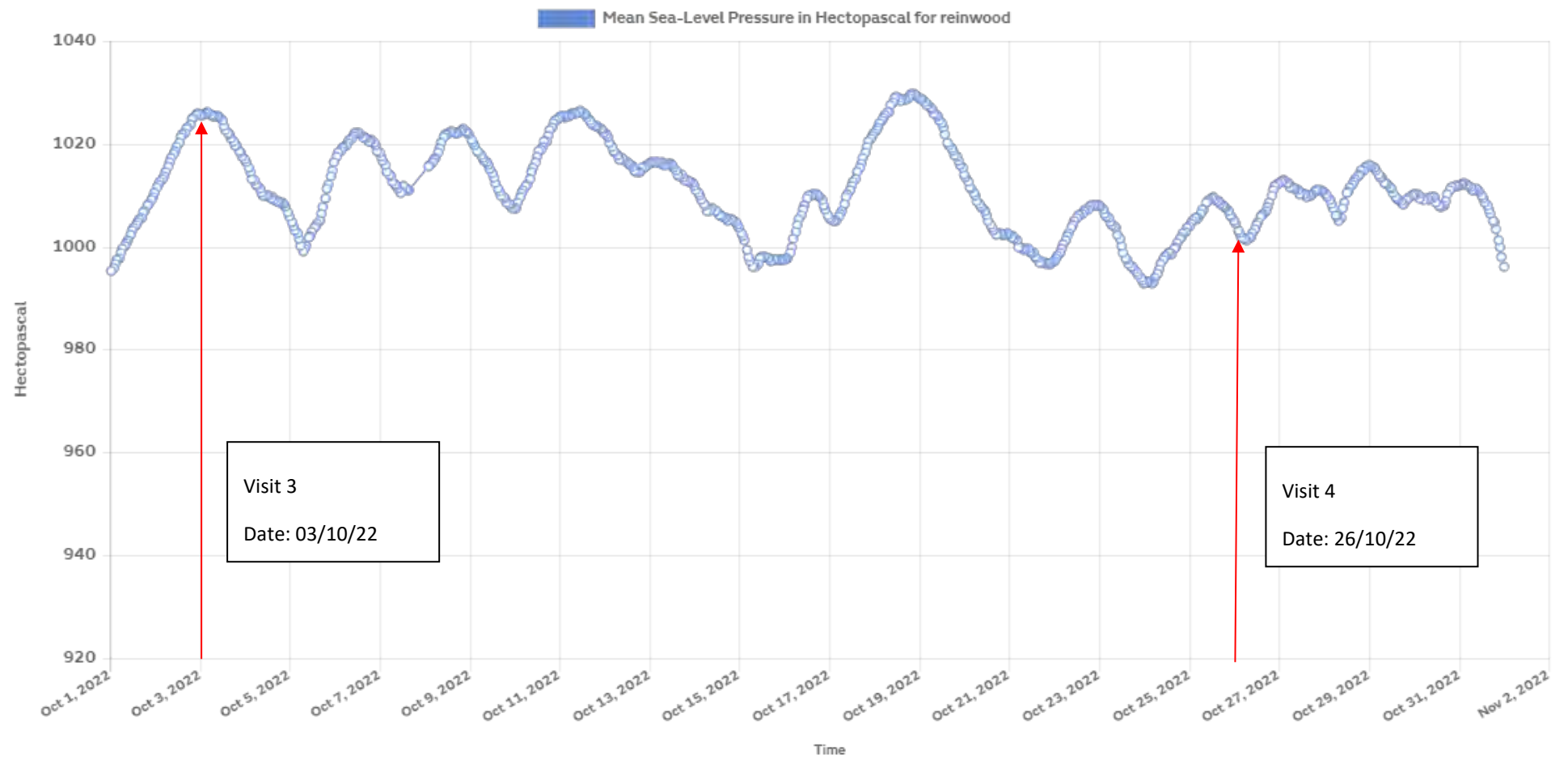
Equipment Used:						Next Calibration Date				Key	
Gas Data GFM436 Infrared Gas Analyser						08/03/2023				ND	
Geotechnical Instruments Dipmeter										NR	
										1.0	
										5.0	
										10.0	

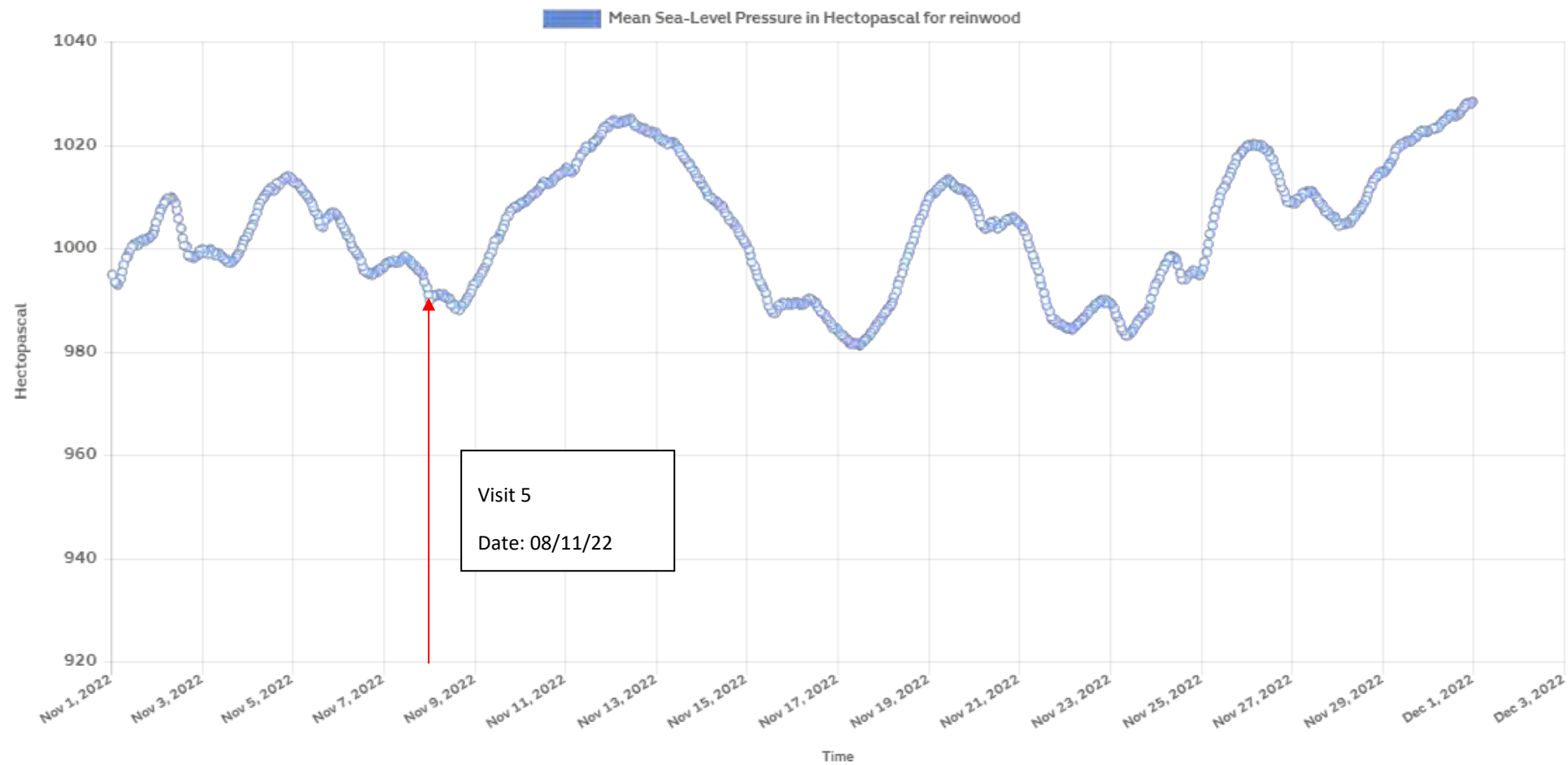
	Site Data:			Weather Station Data (Almondbury Station)					
	Temp (°C):	5 to 6		Barometric Pressure Trend:			Rising slowly		
Time:	14:21	14:54	15:24	01:00	12:00	14:20	14:55	15:25	17:25
Pressure (mb):	1004	1002	1003	1011	1013	1013	1013	1014	1014
	Weather Conditions:			Overcast / Moderate breeze					
	Surface Ground Conditions:			Damp					
Remarks:									

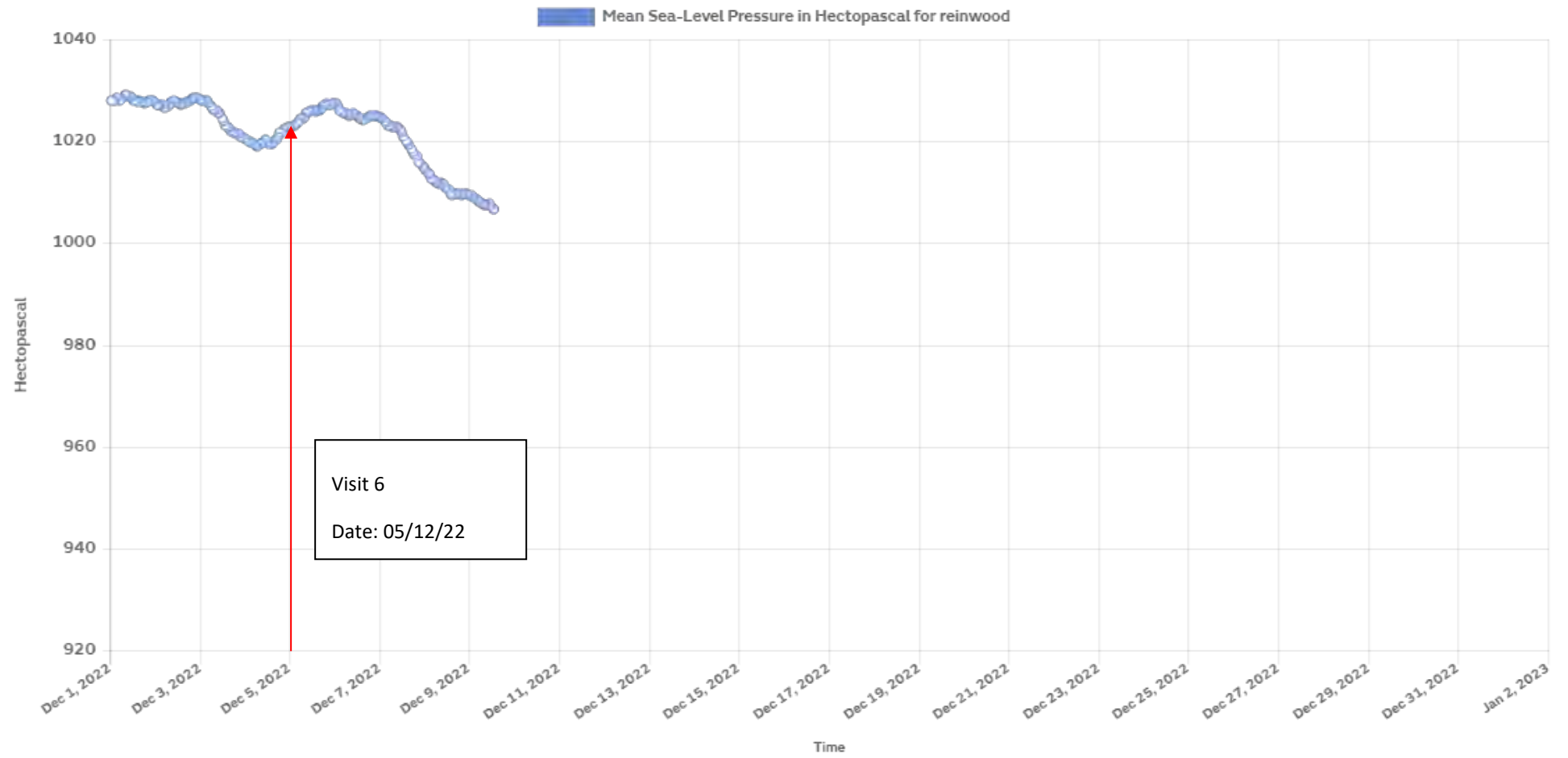
APPENDIX D
Atmospheric Pressure Graphs







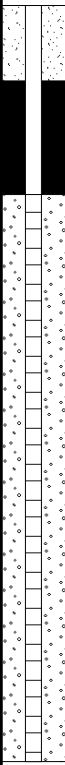
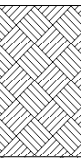
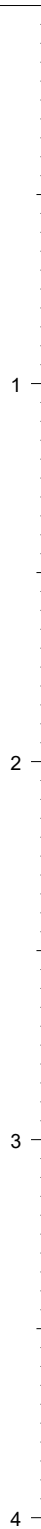
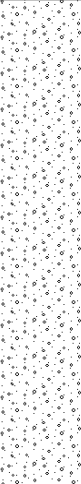
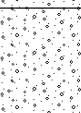
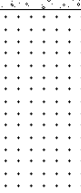




APPENDIX E
Monitoring Well Installations

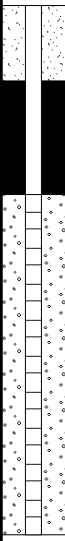
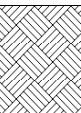
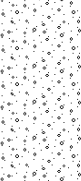
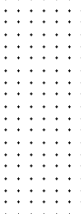
				Borehole Log			Borehole No. WS01 Sheet 1 of 1	
Project Name: Storthes Hall				Project No. 4473		Co-ords: 418359.00 - 412839.00		Hole Type WS
Location: Kirkburton				Level:		Scale 1:20		
Client: Ubrique Investments				Dates: 19/07/2022 - 19/07/2022		Logged By ET		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.25		 Dark brown sandy slightly gravelly CLAY. Gravel is subangular tabular fine to coarse of sandstone. (TOPSOIL)	
					0.60		 Light brown sandy subangular tabular fine to coarse GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)	
					1.00		 Orangish brown gravelly SAND. Gravel is subangular fine to coarse sandstone, (GRANULAR RESIDUAL SOIL)	
					1.60		 Light brown sandy subangular tabular fine to coarse GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)	
					1.70		 Light brown SANDSTONE. Recovered as slightly sandy subangular coarse gravel. (GRENOSIDE SANDSTONE - COAL MEASURES) At 1.7m, refused on bedrock. End of borehole at 1.70 m	
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Co-ordinates from hand held GPS, hole not surveyed in.								



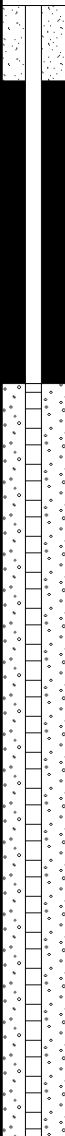
				Borehole Log			Borehole No. WS02 Sheet 1 of 1		
Project Name: Storthes Hall				Project No. 4473		Co-ords: 418324.00 - 412860.00		Hole Type WS	
Location: Kirkburton				Level:		Scale 1:20		Logged By ET	
Client: Ubrique Investments				Dates: 19/07/2022 - 19/07/2022					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.40		 Dark brown sandy slightly gravelly CLAY. Gravel is subangular tabular fine to coarse of sandstone. (TOPSOIL)		
							 Light brown sandy subangular tabular fine to coarse GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)		
					1.70		 Orangish brown gravelly SAND. Gravel is sandy fine to coarse of sandstone. (GRANULAR RESIDUAL SOIL)		
					2.00		 Light brown SANDSTONE. Recovered as subangular coarse gravel. (GRENOSIDE SANDSTONE - COAL MEASURES) <i>On completion hole collapse to 2.0m.</i> <i>At 2.5m, refused on bedrock.</i>		
					2.50		End of borehole at 2.50 m		
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Co-ordinates from hand held GPS, hole not surveyed in.									



				Borehole Log				Borehole No. WS03 Sheet 1 of 1	
Project Name: Storthes Hall				Project No. 4473		Co-ords: 418287.00 - 412819.00		Hole Type WS	
Location: Kirkburton				Level:		Scale 1:20		Logged By ET	
Client: Ubrique Investments				Dates: 19/07/2022 - 19/07/2022					

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30		 Dark brown gravelly slightly clayey SAND. Gravel is subangular tabular fine to coarse of sandstone. (TOPSOIL)	1 2 3 4	
					0.80		 Orangish brown sandy subangular tabular coarse of GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)		
					1.40		 Light brown SANDSTONE. Recovered as slightly sandy subangular tabular coarse gravel. (GRENOSIDE SANDSTONE - COAL MEASURES)		
							At 1.4m, refused on bedrock. End of borehole at 1.40 m		

Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Co-ordinates from hand held GPS, hole not surveyed in.								
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				Borehole Log			Borehole No. WS04 Sheet 1 of 1		
Project Name: Storthes Hall				Project No. 4473		Co-ords: 418050.00 - 412622.00		Hole Type WS	
Location: Kirkburton				Level:		Scale 1:20		Logged By ET	
Client: Ubrique Investments				Dates: 19/07/2022 - 19/07/2022					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	J&T				MADE GROUND: Dark brown gravelly slightly clayey SAND. Gravel is angular fine to coarse of brick, tarmac and sandstone. (MADE GROUND TOPSOIL)		
		0.60	D		0.45		Dark brown sandy CLAY. (RELICT TOPSOIL)		
					0.70		Orangish brown clayey slightly gravelly SAND. Gravel is subangular fine to coarse of sandstone. (GRANULAR RESIDUAL SOIL)		
					1.00		Light brown slightly sandy subangular tabular fine to coarse GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)	1	
					1.30		Orangish brown gravelly slightly clayey SAND. Gravel is subangular tabular fine to coarse sandstone. (GRANULAR RESIDUAL SOIL)	2	
		2.50	D		2.90				
					3.00		Light brown SANDSTONE. Recovered as subangular tabular coarse gravel. (GRENOSIDE SANDSTONE - COAL MEASURES) <i>At 3.0m, refused on bedrock.</i> End of borehole at 3.00 m	3	
								4	

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.
 3. Co-ordinates from hand held GPS, hole not surveyed in.



LITHOS CONSULTING				Borehole Log				Borehole No. WS08 Sheet 1 of 1	
Project Name: Storthes Hall				Project No. 4473		Co-ords: 418060.00 - 412725.00		Hole Type WS	
Location: Kirkburton				Level:		Scale 1:20		Logged By ET	
Client: Ubrique Investments				Dates: 20/07/2022 - 20/07/2022					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.00 - 0.20	J		0.20		MADE GROUND: Dark brown gravelly slightly clayey SAND with occasional rootlets. Gravel is subangular tabular fine to coarse of sandstone. (MADE GROUND TOPSOIL)		
		0.40 - 0.60	J		0.40		MADE GROUND: Light brown sandy subangular tabular fine to coarse GRAVEL of sandstone. (REWORKED NATURAL GROUND)		
					0.60		MADE GROUND: Dark brown sandy slightly gravelly CLAY. Gravel is angular to subangular fine to coarse of sandstone, pottery, chert and coal. (RELICT TOPSOIL)		
		1.10 - 1.20	D		1.10		Orangish brown sandy subangular tabular fine to coarse GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)		
		1.30 - 1.50	T		1.20		Firm orangish brown sandy slightly gravelly CLAY. Gravel is subangular tabular fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)		
					1.50		Light brown to orangish brown SANDSTONE. Recovered as sandy tabular gravel. (GRENSIDE SANDSTONE - COAL MEASURES)		
At 1.5m, refused on bedrock. End of borehole at 1.50 m									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Co-ordinates from hand held GPS, hole not surveyed in.									



LITHOS CONSULTING				Borehole Log				Borehole No. WS10 Sheet 1 of 1	
Project Name: Storthes Hall				Project No. 4473		Co-ords: 418121.00 - 412794.00		Hole Type WS	
Location: Kirkburton				Level:		Scale 1:20		Logged By ET	
Client: Ubrique Investments				Dates: 20/07/2022 - 20/07/2022					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10 - 0.50	J&T		0.10		MADE GROUND: Dark brown CLAY with occasional rootlets. (MADE GROUND TOPSOIL)		
					0.50		MADE GROUND: Dark brown gravelly slightly sandy CLAY. Gravel is subangular fine to coarse sandstone and concrete. Rare fragments of coarse gravel sized of fabric. (COHESIVE MADE GROUND)		
		0.80 - 1.00	J&T		0.80		MADE GROUND: 0.05m thick decorative paving slab underlain by loosely cemented angular GRAVEL of tarmac. (GRANULAR MADE GROUND)		
		1.00 - 1.30	D		1.00		MADE GROUND: Dark brown slightly gravelly SILT. Gravel is angular to subangular fine to coarse sandstone and ceramic. (RELICT TOPSOIL)		
					1.30		Firm orangish brown and brown mottled slightly sandy slightly gravelly CLAY. Gravel is subangular fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)		
					1.60		Orangish brown slightly clayey slightly sandy subangular fine to coarse GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)		
		1.80 - 2.00	T		2.50		Light brown SANDSTONE. Recovered as slightly sandy subangular tabular coarse gravel. (GRENOSIDE SANDSTONE - COAL MEASURES)		
							Between 2.1m and 2.4m, pervasive orange brown iron staining.		
							At 2.5m, refused on bedrock.		
							End of borehole at 2.50 m		
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Co-ordinates from hand held GPS, hole not surveyed in.									

LITHOS CONSULTING					Borehole Log			Borehole No. WS11 Sheet 1 of 1	
Project Name: Storthes Hall					Project No. 4473		Co-ords: 418136.00 - 412746.00		Hole Type WS
Location: Kirkburton					Level:		Scale 1:20		Logged By ET
Client: Ubrique Investments					Dates: 20/07/2022 - 20/07/2022				
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	T		0.19		MADE GROUND: Strong black TARMAC. (TARMAC HARDSTAND)	1	
					0.40		MADE GROUND: Dark brown subangular fine to coarse of mixed lithologies. (GRANULAR MADE GROUND)		
							MADE GROUND: Orangish brown slightly sandy gravelly CLAY. Gravel is subangular fine to coarse of sandstone. (COHESIVE MADE GROUND)		
		1.50	J&T		1.85			2	
	2.00 - 2.50	D		1.95		Dark brown slightly sandy slightly gravelly CLAY with rare decomposing rootlets. Gravel is subangular fine to coarse of sandstone. (RELICT TOPSOIL)			
						Firm light brown gravelly SILT. Gravel is subangular fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)			
		3.00	T		2.80		Light brown SANDSTONE. Recovered as slightly clayey subangular coarse. (GRENOSIDE SANDSTONE - COAL MEASURES)	3	
					4.00		At 4.0m, refused on bedrock.	4	
End of borehole at 4.00 m									

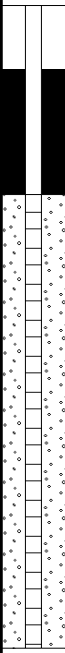
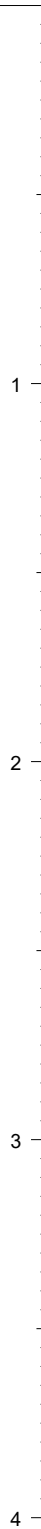
Remarks

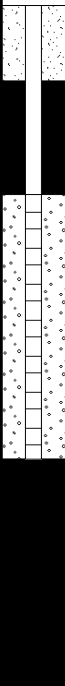
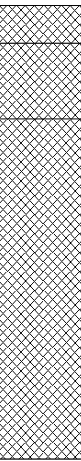
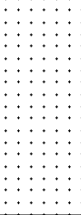
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Co-ordinates from hand held GPS, hole not surveyed in.



LITHOS CONSULTING					Borehole Log			Borehole No. WS12 Sheet 1 of 1	
Project Name: Storthes Hall					Project No. 4473		Co-ords: 417909.00 - 412640.00		Hole Type WS
Location: Kirkburton					Level:		Scale 1:20		Logged By ET
Client: Ubrique Investments					Dates: 20/07/2022 - 20/07/2022				
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.00 - 0.04	T		0.04			MADE GROUND: Strong black TARMAC. (TARMAC HARDSTAND)	
					0.14			MADE GROUND: Strong light grey CONCRETE. (CONCRETE HARDSTAND)	
		0.30 - 0.45	J		0.30			MADE GROUND: Multicoloured poorly cemented rounded coarse GRAVEL of mixed lithologies. (GRANULAR MADE GROUND)	
					0.45			At 0.3m, predominately gravel of brick. Brown slightly clayey gravelly SAND. Gravel subangular fine to coarse of sandstone. (GRANULAR RESIDUAL SOIL)	
		0.80	D		1.00			Firm orangish brown gravelly SILT. Gravel is subangular fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)	
					2.20			Light brown SANDSTONE. Recovered as clayey tabular gravel. (GRENOSIDE SANDSTONE - COAL MEASURES)	1
								At 2.2, refused on bedrock.	2
							End of borehole at 2.20 m		3
									4

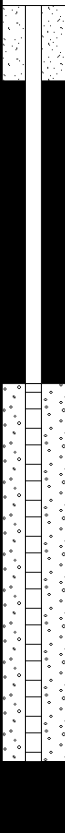
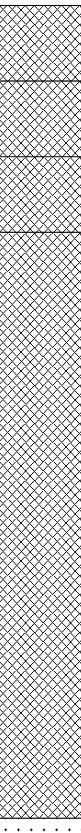
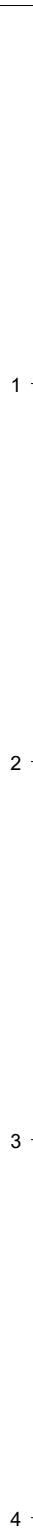
Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Co-ordinates from hand held GPS, hole not surveyed in.

				Borehole Log				Borehole No. WS14 Sheet 1 of 1	
Project Name: Storthes Hall				Project No. 4473		Co-ords: 417926.00 - 412751.00		Hole Type WS	
Location: Kirkburton				Level:		Scale 1:20			
Client: Ubrique Investments				Dates: 20/07/2022 - 20/07/2022		Logged By ET			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	T		0.17		 MADE GROUND: Strong black TARMAC. (TARMAC HARDSTAND)		
					0.30		 MADE GROUND: Grey angular medium to coarse GRAVEL of limestone. (SUB-BASE)		
					0.40		 Dark brown slightly sandy slightly gravelly CLAY. Gravel is angular fine of coal. (RELICT TOPSOIL)		
					0.60		 Firm reddish brown slightly gravelly SILT. Gravel is subangular fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)		
					0.90		 Orangish brown clayey subangular fine to coarse GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)		
		1.10 - 1.20	T		1.70		 Light brown SANDSTONE. Recovered as sandy subangular tabular coarse gravel. (GRENOSIDE SANDSTONE - COAL MEASURES)	1	
							At 1.7m, refused on bedrock.		
							End of borehole at 1.70 m	2	
								3	
								4	
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Co-ordinates from hand held GPS, hole not surveyed in.									
									

				Borehole Log				Borehole No. WS22 Sheet 1 of 1	
Project Name: Storthes Hall				Project No. 4473		Co-ords: 418053.00 - 412808.00		Hole Type WS	
Location: Kirkburton				Level:		Scale 1:20			
Client: Ubrique Investments				Dates: 21/07/2022 - 21/07/2022		Logged By ET			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.00 - 0.10	J		0.10			MADE GROUND: Dark brown friable sandy CLAY with many rootlets. (MADE GROUND TOPSOIL) MADE GROUND: Orange and brown mottled gravelly slightly sandy CLAY. Gravel is subangular fine to coarse of mixed lithologies. (COHESIVE MADE GROUND) MADE GROUND: Orangish brown slightly sandy clayey GRAVEL. Gravel is subangular tabular fine to coarse sandstone and coal. (GRANULAR MADE GROUND)	
		0.20	J		0.30				
		0.50 - 0.80	J&T		1.20				
					1.80		 Light brown SANDSTONE. Recovered as slightly sandy subangular tabular fine to coarse gravel. (GRENOSIDE SANDSTONE - COAL MEASURES) <u>At 1.8m, refused on bedrock.</u>		
End of borehole at 1.80 m									
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Co-ordinates from hand held GPS, hole not surveyed in.									



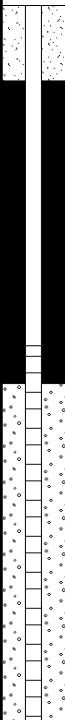
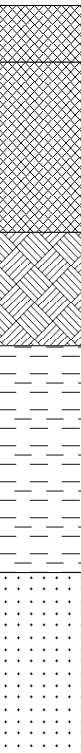
				Borehole Log				Borehole No. WS25 Sheet 1 of 1	
Project Name: Storthes Hall				Project No. 4473		Co-ords: 418108.00 - 412839.00		Hole Type WS	
Location: Kirkburton				Level:		Scale 1:20		Logged By ET	
Client: Ubrique Investments				Dates: 22/07/2022 - 22/07/2022					

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.00 - 0.20	J				MADE GROUND: Dark brown friable slightly sandy CLAY with occasional rootlets. (MADE GROUND TOPSOIL)		
		0.20 - 0.40	J	0.20			MADE GROUND: Light brown sandy subangular fine to coarse GRAVEL of sandstone. Rare angular fine gravel of coal. (GRANULAR MADE GROUND)		
				0.40			MADE GROUND: Multicoloured slightly sandy subangular fine to coarse GRAVEL of clinker and concrete. (GRANULAR MADE GROUND)		
		0.60 - 1.00	J	0.60			MADE GROUND: Red and black mottled sandy angular fine to coarse GRAVEL of clinker and brick. (GRANULAR MADE GROUND)		
		2.00 - 2.15	J		2.15 2.20		Light brown SANDSTONE. Recovered as subangular tabular coarse gravel. (GRENOSIDE SANDSTONE - COAL MEASURES) <i>At 2.2m, refused on bedrock.</i> End of borehole at 2.20 m		

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.
 3. Co-ordinates from hand held GPS, hole not surveyed in.



				Borehole Log			Borehole No. WS27 Sheet 1 of 1	
Project Name: Storthes Hall				Project No. 4473		Co-ords: 418098.00 - 412894.00		Hole Type WS
Location: Kirkburton				Level:		Scale 1:20		
Client: Ubrique Investments				Dates: 22/07/2022 - 22/07/2022		Logged By ET		

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.00 - 0.15	J		0.15		MADE GROUND: Dark brown friable slightly sandy slightly gravelly CLAY. Gravel is subangular fine to coarse of sandstone, concrete and brick. (MADE GROUND TOPSOIL) MADE GROUND: Multicoloured sandy subangular fine to coarse GRAVEL of concrete, limestone and brick. (GRANULAR MADE GROUND) <i>Between 0.2m and 0.3m, gravel is predominantly of concrete.</i> <i>Between 0.3m and 0.35m, gravel is predominantly of limestone.</i> <i>Between 0.2m and 0.3m, gravel is predominantly of brick.</i> Dark brown friable slightly sandy slightly gravelly CLAY with rare rootlets. Gravel is subangular fine of mixed lithologies. (RELICT TOPSOIL) Firm orangish brown slightly sandy slightly gravelly CLAY. Gravel is subangular tabular fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)	1	
		0.60 - 0.90	J		0.60				
		1.00 - 1.50	T		0.90				
		1.50 - 2.00	T		1.50				
					2.00		Light brown SANDSTONE. Recovered as slightly clayey slightly sandy subangular tabular fine to coarse gravel. (GRENOSIDE SANDSTONE - COAL MEASURES) <i>At 2.0m, refused on bedrock.</i> End of borehole at 2.00 m	2	
								3	
								4	

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.
 3. Co-ordinates from hand held GPS, hole not surveyed in.



LITHOS CONSULTING					Borehole Log			Borehole No. WS29 Sheet 1 of 1		
Project Name: Storthes Hall					Project No. 4473		Co-ords: 418205.00 - 412865.00		Hole Type WS	
Location: Kirkburton					Level:		Scale 1:20		Logged By ET	
Client: Ubrique Investments					Dates: 22/07/2022 - 22/07/2022					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		0.10 - 0.60	J		0.10			MADE GROUND: Dark brown friable slightly sandy slightly gravelly CLAY. Gravel is subangular fine to coarse of mixed lithologies. (MADE GROUND TOPSOIL)		
					0.60			MADE GROUND: Light brown gravelly SAND. Gravel is subangular fine to coarse of sandstone, tarmac and rare brick. (GRANULAR MADE GROUND)		
					0.80			MADE GROUND: Orangish brown slightly sandy slightly gravelly CLAY. Gravel is subangular fine to coarse of sandstone. (COHESIVE MADE GROUND)		
		1.00 - 1.50	D		1.00			Dark brown slightly sandy CLAY with occasional decomposing rootlets. (RELICT TOPSOIL)		
					1.50			Firm orangish brown sandy CLAY. (COHESIVE RESIDUAL SOIL)		
					1.80			Firm orangish brown sandy slightly gravelly CLAY. Gravel is subangular tabular fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)		
					2.00			Light brown SANDSTONE. Recovered as subangular tabular coarse gravel. (GRENOSIDE SANDSTONE - COAL MEASURES)		
		At 2.0m, refused on bedrock.								
		End of borehole at 2.00 m								
		Remarks								
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Co-ordinates from hand held GPS, hole not surveyed in.										

