Haigh Huddleston & Associates
Civil & Structural Engineering Consultants
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Our Ref: E19/7465/JF/012A

9th August 2022

(Email Only)

FAO: Stewart Brown
Yorkshire Country Properties
Suite 3
39 Huddersfield Road
Holmfirth
HD9 3JH

Dear Sir,

Re: Development off Abbey Road North, Shepley (Phase 2)

Further to the intrusive site investigation works detailed in the Haigh Huddleston & Associates Geo-Environmental Ground Investigation report (Ref: E19/7465/R004 Dated: February 2021), gas testing was undertaken at the above development to confirm if ground gas migration from probable shallow mine workings in the vicinity, and the historical landfill located north east of the site would adversely affect the development.

Kindly note that this letter only addresses issues with regards to ground gas migration affecting properties. It must be read in conjunction with the aforementioned report. For the preparation of this letter, the following best practice guidance has been taken into account:

- BS8485:2015+A1:2019 “Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings”;
- BS8576:2013 “Guidance on Investigations for Ground Gas – Permanent Gases and Volatile Organic Compounds (VOCs)”;
- CIRIA “Assessing Risks Posed by Hazardous Ground Gases to Buildings”, report C665, 2007;
- CIRIA “The VOCs Handbook. Investigating, Assessing and Managing Risks from Inhalation of VOCs at Land Affected by Contamination”, report C682, 2009;
- CL:AIRE “A Pragmatic Approach to Ground Gas Risk Assessment”, report ref. RB17, November 2012;
- NHBC “Guidance on Evaluation of Development Proposals on Sites Where Methane and Carbon Dioxide are Present”, report version 04, March 2007.

Sixteen boreholes were undertaken to depths of 12-30m beneath the site and found no evidence of coal or shallow workings. In addition to this, five boreholes were drilled and installed with gas monitoring standpipes consisting of 1m of plain pipe at the surface and 2m of slotted pipe. The standpipes were constructed with lockable covers, backfilled with single size gravels and sealed with bentonite.

Six rounds of gas monitoring were undertaken between 8th December 2020 and 12th April 2021 using a Gas Data GFM 436. The results are tabulated in the Appendix to the rear of this letter.

The gas monitoring was undertaken over a range in barometric pressure between 955mb and 1007mb. On the 21st January 2021, 19th February 2021 & 11th March 2021, the readings were carried out under falling barometric pressure.

On site, no methane was detected. Carbon dioxide values were found between 0.1 and 3.6% with oxygen levels between 13.6 and 19.2%. Flow rates were detected in BH05 on 8th December 2020, 21st January 2021 & 11th March 2021. These flow rates took between 30 – 90 seconds to equalise. Additional flow rates were detected in BH08 on both 8th December 2020 & 19th February 2021. These flow rates took between 15 – 185 seconds to equalise.

The initial high flow rates recorded on site (59.1 l/hr in BH08 on 8th December 2020, 86.4 l/hr in BH05 on 21st January 2021, and 111.4 l/hr in BH05 on 11th March 2021) were all instances where the water level in the borehole had risen above the slotted pipe section of the piezometer and compressed the gases within the upper plain pipe section of the piezometer. When the valve is opened to monitor the flow rate, the compressed air is released under pressure, which results in the higher flow rate until the pressure normalises.

On the site visit of 19th February 2021, BH08 was pumped clear of water before the gas monitoring began. When the water level reading was taken after the gas monitoring had been undertaken, it was found to have raised by 0.7m. The peak and steady flow rate recorded on this occasion are therefore a measure of both the gas flow rate and the ingress of the water to the base of the monitoring station forcing the gases upwards. This results in an inflated flow reading.

It is therefore considered that the elevated initial peak gas flow rates recorded on site mentioned above, along with the steady flow rates within BH08 on 19th February 2021 are not representative of the ground gas regime at the site, and it is therefore proposed that the next-highest steady gas flow rate (6.9 litres/hour, recorded as a positive flow in BH08 on 8th December 2020) should be used in the calculation of the gas screening value for carbon dioxide.

During the site visits on 21st January 2021 and 11th March 2021, it was not possible to take readings from BH01, BH08 & BH12 due to high ground water levels risking flooding the monitor. Although it wasn't possible to take readings from every borehole on each visit, there was little variance in concentrations for individual boreholes except where pumping was required. We are therefore confident that the above represents a true reflection of the gas regime affecting any new development.

Discussions

Based on a high sensitivity end use under the NHBC traffic light system in conjunction with CIRIA C665, the GSV value corresponds to the site being

characterised as **Green.** The GSV value is obtained by multiplying the maximum gas concentration by maximum steady borehole flow rate (Where the peak flow rate is recorded at the start of the monitoring session, this can be discounted due to the artificially high pressure within the standpipe).
i.e. Carbon Dioxide - 0.036 x 6.9 = **0.2484** l/hr.

In addition to this, we can confirm that the site is not within a Radon Affected Area, as less than 1% of properties are above the action level. Therefore, **No Radon Protection Measures are required.**

When consulting BS 8485:2015 Table 2 the site can be characterised as CS1 for Type A buildings. When consulting table 4, a score of 0 is suggested. Consulting tables 5 - 7 we would recommend that a standard floor construction would suffice for all proposed properties within the development.

-	Fully vented minimum 250mm deep void below suspended slab.	0 Points
-	Continuous membrane across the cavity/party walls.	0 Points
-	Cavity tray in the external walls.	0 Points
-	Fully sealed service entries and ducts to manufactures specification.	0 Points
-	Beam and block floor construction	0 Points
-	A 1200 gauge visqueen DPM:	0 Points

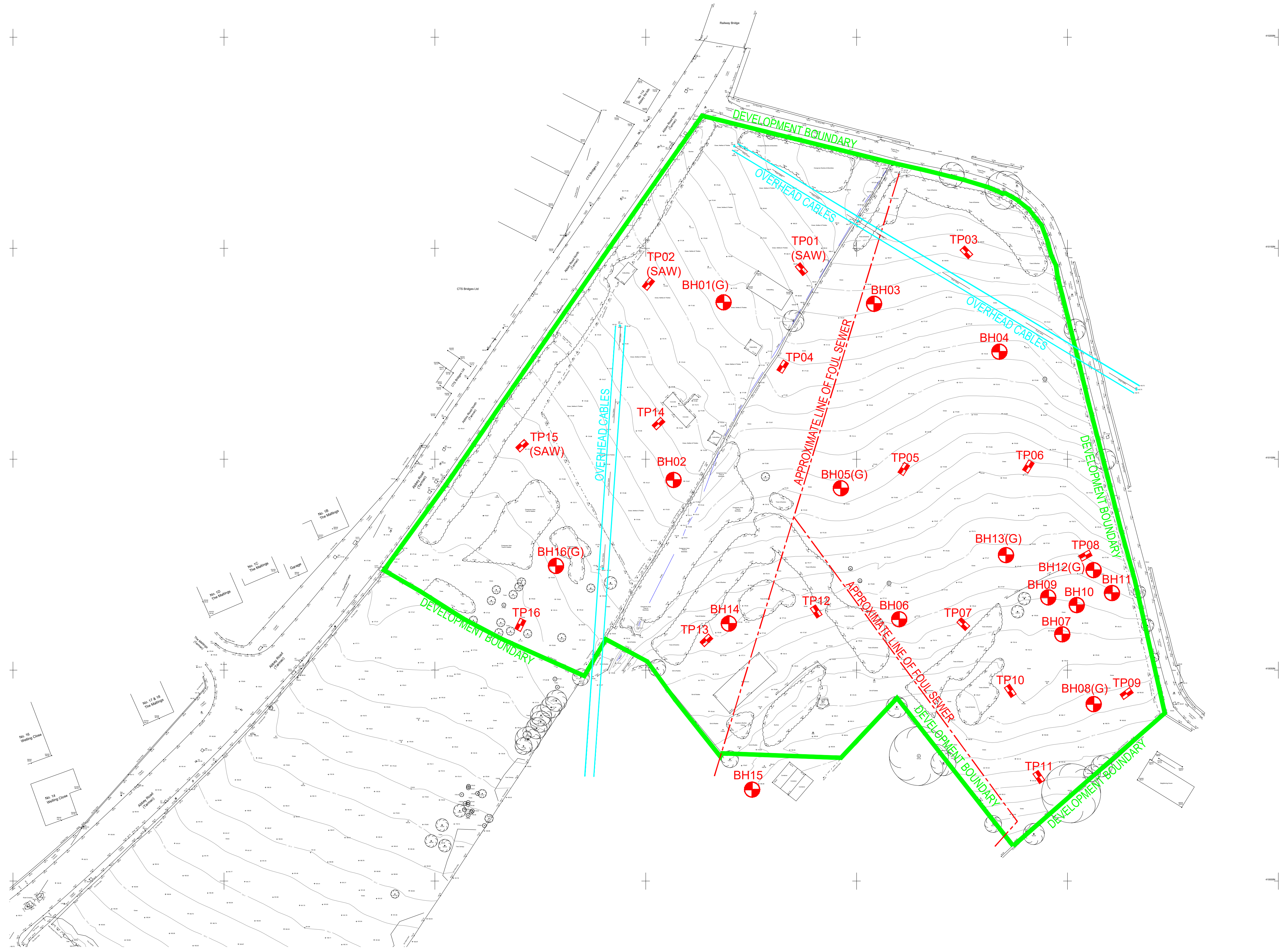
Total **0 Points**

We hope that the above is sufficient for your requirements. However, should you have any queries please do not hesitate to contact me direct.

Yours sincerely,

JAMES FARRAR
j.farrar@haighhuddleston.co.uk

Appendix



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Client
YORKSHIRE COUNTRY PROPERTIES

Project
NORTH ABBEY ROAD, SHEPLEY
PHASE 2

Detail
SITE INVESTIGATION PLAN

Scale	Dwn	Chkd	Date	Dwg No.
1:1000 @A3	MD		Nov'20	E19/7465/003

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SITE:	Abbey Road North, Shepley - Phase 2
CLIENT:	Yorkshire Country Properties LTD
JOB NO:	7465
SHEET NO:	1

GAS MONITORING RESULTS

	GAS CONCENTRATIONS												FLOW DATA				Qhg per borehole		WELL AND WATER DATA				Comments
Monitoring Point	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Oxygen (%v/v)		H2S (ppm)	CO (ppm)	Hex (%)	PIDCf ()	Flow rate (l/hr)		Differential borehole Pressure (Pa	Time for flow to equalise (secs)	Methane (l/hr)	CO2 (l/hr)	Water level (mbgl)	Depth of well (m)	Response Zone	A Pressure (mB)	
	Peak	Steady	Peak	Steady	Peak	Steady	Min	Steady					Steady	Peak									
AIR	ND	ND	ND	ND	0.1	0.1	20.1	20.1	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0001	NR	NR	NR	978	Time: 13:00 Date: 08.12.20
BH01	ND	ND	ND	ND	1.00	1.00	17.30	17.30	ND	10.0	0.000	1.0	ND	ND	ND	ND	NR	0.001	1.50	3.20	1.0-1.50	978	
BH05	ND	ND	ND	ND	3.60	3.60	19.20	19.20	ND	ND	0.000	1.0	0.9	6.9	5	30	NR	0.0324	0.95	3.20	ND	977	**Wet, Cold, Cloudy**
BH08	ND	ND	ND	ND	2.70	2.70	17.60	17.60	ND	ND	0.000	1.0	6.9	59.1	62	185	NR	0.1863	0.10	3.20	ND	976	
BH12	ND	ND	ND	ND	0.30	0.30	18.00	18.00	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0003	1.55	2.70	1.0-1.55	977	**Rising A.P**
BH16	ND	ND	ND	ND	2.00	2.00	15.10	15.10	ND	38.0	0.000	1.0	ND	ND	ND	ND	NR	0.002	1.60	2.90	1.0-1.60	977	BH08 - Water sucked into machine, reading terminated early @ 2:00 minutes
AIR	ND	ND	ND	ND	0.10	0.10	19.80	19.80	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0001	NR	NR	NR	957	Time: 11.30 Date: 21.01.21
BH01	High Ground Water Table, Water Sucking into machine																		0.40	3.20			
BH05	ND	ND	ND	ND	1.7	1.7	17.4	17.4	ND	ND	0.000	1.0	3.9	86.4	27	60	NR	0.0663	0.30	3.20	ND	955	**Raining, Wet, Windy**
BH08	High Ground Water Table, Water Sucking into machine																		0.30	3.20			
BH12	High Ground Water Table, Water Sucking into machine																		0.50	2.70			**Falling A.P**
BH16	ND	ND	ND	ND	2.10	0.90	16.20	16.20	ND	ND	0.000	1.0	0.0	2.2	ND	ND	NR	0	1.00	2.90	ND	956	
AIR	ND	ND	ND	ND	0.20	0.20	20.00	20.00	ND	ND	0.003	1.0	ND	ND	ND	ND	NR	0.0002	NR	NR	NR	978	Time: 10:00 Date: 19.02.21
BH01	ND	ND	ND	ND	1.40	0.90	16.10	16.30	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0014	1.90	3.20	1.0-1.90	978	
BH05	ND	ND	ND	ND	0.10	0.10	16.90	16.90	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0001	1.90	3.20	1.0-1.90	977	**Raining, Wet, Windy**
BH08	ND	ND	ND	ND	0.10	0.10	17.00	17.00	ND	ND	0.000	1.0	13.8	14.6	145	15	NR	0.0138	2.50	3.20	1.0-2.50	977	
BH12	ND	ND	ND	ND	0.20	0.20	16.90	16.90	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0002	1.60	2.70	1.0-1.60	977	**Falling A.P**
BH16	ND	ND	ND	ND	2.50	2.50	16.70	16.70	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0025	1.60	2.90	1.0-1.60	978	BH05 & BH08 high ground water table - water pumped out then reading taken.
AIR	ND	ND	ND	ND	0.2	0.2	19.9	19.9	ND	ND	0.006	1.0	ND	ND	ND	ND	NR	0.0002	NR	NR	NR	967	Time: 10:45 Date: 11.03.21
BH01	ND	ND	ND	ND	0.5	0.5	16.9	16.9	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0005	2.10	3.20	1.0-2.10	967	
BH05	ND	ND	ND	ND	0.5	0.5	15.8	15.8	ND	ND	0.000	1.0	5.2	111.4	43	90	NR	0.026	0.70	3.20	NR	966	**Cold, Wet, Windy**
BH08	High Ground Water Level. Water Pumped out, reading taken. Terminated early due to water sucking into machine again																		0.30	3.20	NR	NR	
BH12	ND	ND	ND	ND	0.2	0.2	16.5	16.5	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0002	1.50	2.70	1.0-1.50	964	**Falling A.P**
BH16	ND	ND	ND	ND	2.6	2.6	17.2	17.2	ND	10.0	0.000	1.0	ND	ND	ND	ND	NR	0.0026	1.40	2.90	1.0-1.50	966	BH05 & BH08 high ground water table - water pumped out.

ND - Not detected

NR - Not recorded

NB: where no flow (ND) recorded Qhg values are calculated using equipment limit of detection (0.1 l/hr). Where negative flows recorded, these are converted to positive values for calculation of Qhg.

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SITE:	Abbey Road North, Shepley - Phase 2
CLIENT:	Yorkshire Country Properties LTD
JOB NO:	7465
SHEET NO:	2

GAS MONITORING RESULTS

	GAS CONCENTRATIONS												FLOW DATA				Qhg per borehole		WELL AND WATER DATA				Comments
Monitoring Point	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Oxygen (%v/v)		H2S (ppm)	CO (ppm)	Hex (%)	PIDCf ()	Flow rate (l/hr)		Differential borehole Pressure (Pa	Time for flow to equalise (secs)	Methane (l/hr)	CO2 (l/hr)	Water level (mbgl)	Depth of well (m)	Response Zone	A Pressure (mB)	
	Peak	Steady	Peak	Steady	Peak	Steady	Min	Steady					Steady	Peak									
AIR	ND	ND	ND	ND	0.3	0.0	19.4	19.4	ND	ND	ND	1.0	ND	ND	ND	ND	NR	0.0003	NR	NR	NR	983	Time: 12:45 Date: 26.03.21
BH01	ND	ND	ND	ND	0.80	0.80	17.50	17.50	ND	ND	ND	1.0	ND	ND	ND	ND	NR	0.0008	2.00	3.20	1.0-2.0	983	
BH05	ND	ND	ND	ND	0.10	0.10	16.30	16.30	ND	ND	ND	1.0	ND	ND	ND	ND	NR	0.0001	2.40	3.20	1.0-2.4	981	**Windy, Wet, Cold**
BH08	ND	ND	ND	ND	0.10	0.10	18.40	18.40	ND	ND	ND	1.0	ND	ND	ND	ND	NR	0.0001	3.10	3.20	1.0-3.1	980	
BH12	ND	ND	ND	ND	0.20	0.20	16.90	16.30	ND	ND	ND	1.0	ND	ND	ND	ND	NR	0.0002	1.80	2.70	1.0-1.8	980	
BH16	ND	ND	ND	ND	3.30	3.30	17.50	17.50	ND	75.0	0.012	1.0	ND	ND	ND	ND	NR	0.0033	1.80	2.90	1.0-1.8	981	High water level in BH05, pumped out before reading taken.
AIR	ND	ND	ND	ND	0.20	0.20	19.70	19.70	ND	ND	ND	1.0	ND	ND	ND	ND	NR	0.0002	NR	NR	NR	1006	Time: 11:00 Date: 12.04.21
BH01	ND	ND	ND	ND	0.80	0.80	18.20	18.20	ND	ND	ND	1.0	ND	ND	ND	ND	NR	0.0008	2.10	3.20	1.0-2.1	1007	
BH05	ND	ND	ND	ND	3.50	3.50	13.60	13.60	ND	ND	ND	1.0	ND	ND	ND	ND	NR	0.0035	2.00	3.20	1.0-2.0	1004	**Sunny, Dry, Cold**
BH08	ND	ND	ND	ND	2.60	2.60	16.90	16.90	ND	ND	ND	1.0	ND	ND	ND	ND	NR	0.0026	1.60	3.20	1.0-1.6	1003	
BH12	ND	ND	ND	ND	0.20	0.20	17.80	17.80	ND	ND	ND	1.0	ND	ND	ND	ND	NR	0.0002	2.40	2.70	1.0-2.4	1003	
BH16	ND	ND	ND	ND	2.40	2.40	17.10	17.10	ND	75.0	0.012	1.0	ND	ND	ND	ND	NR	0.0024	1.90	2.90	1.0-1.9	1005	

ND - Not detected

NR - Not recorded

NB: where no flow (ND) recorded Qhg values are calculated using equipment limit of detection (0.1 l/hr). Where negative flows recorded, these are converted to positive values for calculation of Qhg.