

18th September 2019

ref: A11057/190918/L1

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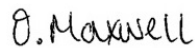
Dear Rafal,

RE: Ground Gas Assessment - Kenavon Drive, Reading

Please find attached OEC Report A11057/190906/L1 detailing results of all ground gas monitoring undertaken by OEC and Terramech, together with an overall ground gas assessment which considers all monitoring undertaken to date.

If you have any questions, please do not hesitate to contact us.

Yours sincerely,
For Omnia Environmental Consulting



Olivia Maxwell
Graduate Geo-Environmental Consultant



Tim Mitchell
Associate Director

Attachments

Attachment 1: Site Figures

- Figure 1: Site Location Plan
- Figure 2: Proposed Development
- Figure 3: Gas Monitoring Install Locations

Attachment 2: Terramech Borehole Logs

GROUND GAS MONITORING REPORT

Site Address	Kenavon Drive, Reading, RG1 3HS
Grid Reference	472270, 173570

1.0 Background & Objectives

Omnia Environmental Consulting (OEC) were commissioned by Berkeley Homes (Oxford and Chiltern) Ltd to undertake a Gas Risk Assessment at the site following previous rounds of investigations. An initial investigation by Card Geotechnics Limited (CG/18679 November 2016) classified the gas regime at the site as CS-3, in accordance with BS 8485:2015, based on 6 monitoring visits. A further investigation was undertaken by OEC (A11057/2.0 March 2019) which included a further 3 gas monitoring visits. OEC did not identify any concentrations of methane or carbon dioxide greater than 0.1% and 4.5% respectively. Due to limited monitoring results the initial CGL classification of CS-3 was adopted within the recommendation on the report by OEC.

Further to additional correspondence, Berkeley Homes commissioned additional gas monitoring post completion of demolition, alongside further gas risk assessment. Monitoring well installation was completed by Terramech, with OEC acting as the Environmental Consultant, completing the gas risk assessment, as presented herein.

Terramech undertook site works, comprising the installation of five (5no.) monitoring wells and six (6no.) follow on ground gas monitoring visits. Following this further monitoring a total of 94 data points are available, with 32 data points for 2019. This data will be assessed in accordance with guidance set out in BS8485:2015, in order to classify the gas regime of the site and assess potential risks to future site users.

A site location plan and intrusive location plan are presented within Attachment 1.

2.0 Site Works

Siteworks were undertaken by Terramech commencing on the 10th July 2019 and comprised the advancement of five (5no.) windowless sample boreholes to a maximum depth of 6.00m bgl around the perimeter across the site. Advanced boreholes were installed to 5.68 – 6.00mbgl in order to facilitate further gas monitoring. Following the site investigation, six (6no.) rounds of ground gas monitoring were conducted.

Borehole logs are presented within Attachment 2.

2.1 Ground Gas and Groundwater Monitoring

Following the installation of monitoring wells, six (6no.) rounds of ground gas monitoring were conducted at all locations on the following dates:

1. 29/07/2019
2. 05/08/2019
3. 09/08/2019
4. 12/08/2019
5. 19/08/2019
6. 22/08/2019

A further two monitoring visits were undertaken on 22/07/2019 and 25/07/2019 at WS203 & WS205 and WS203, WS204 and WS205 respectively. Monitoring was undertaken under rising and falling pressure, with barometric conditions ranging between 983 – 1026 mb.

Concentrations of methane (CH₄), carbon dioxide (CO₂) and Oxygen (O₂) were measured using an infrared gas analyser (GA5000) with ground gas flow rates measured using an internal flow pod. Gas concentrations were recorded at 15 second intervals until concentrations stabilised for three consecutive readings and for a minimum of 180 seconds at each location. Groundwater was also recorded.

Ground gas and groundwater monitoring results are presented and discussed in Section 4.0.

3.0 Ground Gas Assessment

The potential impact on the development from ground gases has been assessed with reference to standards and guidelines published in BS 8485:2015 (*Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings*). However, it is recommended that the full ground gas assessment and any recommended protection measures are agreed with the local authority prior to their adoption on site. Furthermore, any potential ground gas protection measures should be validated by a suitably qualified engineer.

Ground gas and groundwater monitoring data collected during the recent phase of investigation is presented in Table 1.0. To assist with the assessment, it has been subdivided into the party completing monitoring:

2019 Monitoring – Omnia Environmental Consulting & Terramech

Six (6no.) ground gas and groundwater monitoring visits were undertaken on weekly intervals at locations WS201 – WS205, with a further two monitoring visits undertaken on 22/07/2019 and 25/07/2019 at WS203 & WS205 and WS203, WS204 and WS205 respectively. The initial investigation undertaken by OEC comprised three (3no.) ground gas and groundwater monitoring visits over the period 26/02/2019 – 12/03/2019 at BH10001a, BH1002 and BH1003; with a further visit undertaken at WS3, WS5, and WS6 which were previously installed by CGL. All monitoring data undertaken by OEC and Terramech is detailed within Table 1.0.

A review of Table 1.0 indicates that concentrations of methane (CH₄) were recorded to a maximum 0.2% v/v at WS205. Carbon Dioxide (CO₂) concentrations were recorded to a maximum of 4.5% v/v at location WS5. Negligible ground gas flow was recorded across the site, with a maximum ground gas flow rate of 0.3l/hr being recorded.

In accordance with the methodology outlined with BS 8485:2015, OEC have utilised the results of the ground gas monitoring to calculate tentative Gas Screening Values (GSVs). Where ground gas concentrations have been recorded at less than the equipment limit of detect (LOD) of 0.1% v/v, these concentrations have been assumed to be 0.1% v/v in order to adopt a conservative approach and facilitate the calculation of a GSV. The maximum GSV calculated for methane was 0.00031l/hr whilst the maximum GSV for carbon dioxide was 0.0090l/hr.

It is understood that the proposed development is to comprise a development of multi-storey residential apartment blocks as set out in drawing No. AL6086-2010 provided by Berkeley Homes. Therefore, the proposed development is defined under BS 8485:2015 as private ownership with central building management assessed under BS8485:2015 classed as a **Type B** building (Table 3 of BS 8485:2015).

3.1.1 BS 8485:2015 - Type B Building – Private ownership

Guidance set out in BS 8485:2015, which is equivalent to the characteristic situations of the modified Wilson & Card classification set out in CIRIA C665, stipulates a site characteristic maximum GSV of <0.07 l/hr, with typical maximum permissible concentrations of 1% v/v (CH₄) and/or 5% v/v (CO₂) is defined for a classification as Characteristic Situation 1 (CS1).

The maximum recorded concentration of CH₄ was 0.2%v/v and for CO₂ was 4.5%v/v with maximum calculated GSVs of 0.0003l/hr (CH₄) and 0.0090l/hr (CO₂) meet the criteria for classification as **CS-1**. At this classification CIRIA C665 states that a negligible gas regime has been identified and that no special gas protection measures are necessary.

It is therefore considered that the current round of monitoring (2019 data) indicates a CS-1 classification would be appropriate for the site. This assessment is in accordance with CIRIA C665 and BS 8485:2015, with a CS-1 assessment indicating that gas protection measures are not required in new developments.

4.0 Discussion

An initial gas classification of CS-1 for the site has been recommended based on the 2019 data, however historic monitoring data obtained by CGL in 2016 should also be considered to allow an overall assessment to be complete.

Detailed assessment is presented below:

2016 Monitoring - CGL

Review of the report prepared by CGL indicates a classification of CS-3. As per the commentary given above, the Characteristic Value is based on observed gas classifications and flow rate. Each of these items are considered as follows:

Flow Rate:

Upon further review of the CGL data the CS-3 classification appears to have been attributed to a single calculated GSV of 1.0032l/hr, relating to a peak CO₂ result of 8.8% and observed flow rate of 11.4l/hr at DS111. This flow rate is considered anomalous, with only 1 of 94 results identifying a flow rate greater than +/-3.7l/hr, and the majority (89 of 94 results) of recorded flow rates considered negligible. Adopting an average flow rate of 0.1l/hr (based on 26 results above the limit of detection 0.1l/hr) the GSV would provide a classification of CS-1. Therefore, with this result omitted the individual result would fulfil the requirements for a CS-1 classification.

Gas concentrations:

Methane:

A single elevated concentration of methane above 1%v/v was identified at WS1 in 2016 with a peak value of 3.1% v/v. As set out in guidance, an increase from CS-1 to CS-2 should be considered if a concentration of methane above 1%v/v is identified, however as an exceedance was identified in only 1 of 94 results, it is not considered representative such that no increase in classification is considered necessary. Other than the single occurrence of a non-representative result the observed methane concentrations fulfil the criteria for a CS-1 classification.

Carbon Dioxide:

Elevated concentrations of carbon dioxide (above 5%v/v) were identified within 26 results in the range 5.2%v/v to 14.30% v/v, with seven of these results identified at CP04 and CP05, both being installed to the chalk, with a maximum well depth of 12.15m bgl. The remaining 19 results identified an elevated concentration of CO₂ above 5.0% within WS5, WS8A, WS9 and DS111. The elevated concentrations of carbon dioxide were coupled with negligible flow rates in the range -2.0 l/hr (1 occasion) to 3.7l/hr (1 occasion), and one anomalous result of 11.4l/hr as discussed in the 'Flow Rate' section below.

In summary, the identified CO₂ concentrations above the suggested trigger level of 5.0%v/v are not considered to warrant an increase in characteristic value due to limited flow rates. This is further supported with the presence of 68 CO₂ results below 5.0% v/v. As a result, it is considered that a CS-1 classification is suitable in relation to carbon dioxide concentrations.

5.0 Conclusions and Recommendations

In summary, it is considered that a CS-1 classification is appropriate due to:

- Nine rounds of monitoring in 2019 under rising and falling pressure has provided a CS-1 assessment;
- Historic data from 2016 has been skewed by a single anomalous result for CH₄; and single anomalous flow rate;
- Carbon Dioxide concentrations, whilst above 5.0%v/v are associated with negligible flow rates and considered to not warrant an increased gas classification.

Given the above reasoning, and the strength of the dataset drawn from a total of 94 monitoring results, it is considered that a CS-1 classification is appropriate for the site. In accordance with BS8485:2015 a development classified as CS-1 does not require gas protection measures.

Table 1 - Summary of Ground Gas and Groundwater Monitoring Results (2019)

Location	Date	CH ₄ Peak %v/v	CH ₄ Steady %v/v	CH ₄ GSV l/hr	CO ₂ Peak %v/v	CO ₂ Steady %v/v	CO ₂ GSV l/hr	O ₂ %v/v	Atmos (mbar)	Atmos. Dynamic	Flow (l/hr)	Depth to Base (m bgl)	Depth to Water (m bgl)
OEC Results February/March 2019													
WS3	26/02/2019	0.1	0.1	0.0001	4.1	0.6	0.0041	16.5	1026	Falling	0.1	-	-
WS5	26/02/2019	<0.1	<0.1	0.0002	4.5	4.5	0.0090	16.3	1026	Falling	0.2	5.35	2.84
WS6	26/02/2019	<0.1	<0.1	0.0002	2.7	2.7	0.0054	4.2	1026	Falling	0.2	-	-
BH1001a	26/02/2019	0.1	0.1	0.0002	0.8	0.4	0.0016	20.5	1026	Falling	0.2	6.85	3.53
	06/03/2019	<0.1	<0.1	0.0003	0.1	0.1	0.0003	21.3	983	Rising	0.3	6.85	3.53
	12/03/2019	<0.1	<0.1	0.0002	0.3	0.3	0.0006	20.3	996	Falling	0.2	6.80	3.48
BH1002	26/02/2019	<0.1	<0.1	0.0001	2.7	2.7	0.0027	16.5	1026	Falling	0.1	7.01	3.35
	06/03/2019	<0.1	<0.1	0.0001	0.7	0.7	0.0007	20.5	982	Rising	0.1	7.01	3.35
	12/03/2019	<0.1	<0.1	0.0001	2.0	2.0	0.0020	17.9	996	Falling	<0.1	6.95	3.40
BH1003	26/02/2019	<0.1	<0.1	0.0002	0.2	0.2	0.0004	20.3	1026	Falling	0.2	7.85	2.60
	06/03/2019	<0.1	<0.1	0.0002	0.5	0.5	0.0010	19.9	983	Rising	0.2	7.85	2.60
	12/03/2019	<0.1	<0.1	0.0001	0.2	0.2	0.0002	20.8	996	Falling	0.1	7.90	2.55
Terramech Results July August 2019													
WS201	29/07/2019	<0.1	<0.1	0.0001	<0.1	<0.1	0.0001	19.0	1006	Rising	0.1	-	3.16
	05/08/2019	<0.1	<0.1	0.0001	<0.1	<0.1	0.0001	18.9	1006	Stable	0.1	-	3.16
	09/08/2019	<0.1	<0.1	0.0002	<0.1	<0.1	0.0002	18.3	997	Falling	0.2	-	3.16
	12/08/2019	<0.1	<0.1	0.0002	<0.1	<0.1	0.0002	19.9	1011	Rising	0.2	-	3.15
	19/08/2019	<0.1	<0.1	0.0001	<0.1	<0.1	0.0001	20.2	1010	Rising	0.1	-	3.12
	22/08/2019	<0.1	<0.1	0.0001	<0.1	<0.1	0.0001	20.2	1022	Stable	0.1	-	3.15
WS202	29/07/2019	<0.1	<0.1	0.0001	<0.1	<0.1	0.0001	21.0	1006	Rising	0.1	-	2.91
	05/08/2019	<0.1	<0.1	0.0002	0.1	0.1	0.0002	20.4	1006	Stable	0.2	-	2.83
	09/08/2019	<0.1	<0.1	0.0001	0.1	0.1	0.0001	19.0	997	Falling	0.1	-	2.8
	12/08/2019	<0.1	<0.1	0.0002	0.1	0.1	0.0002	19.6	1011	Rising	0.2	-	2.82
	19/08/2019	<0.1	<0.1	0.0001	0.1	0.1	0.0001	18.8	1010	Rising	0.1	-	2.9
	22/08/2019	<0.1	<0.1	0.0001	0.1	0.1	0.0001	20.0	1022	Stable	0.1	-	2.94
WS203	22/07/2019	<0.1	<0.1	0.0002	0.2	0.2	0.0004	7.2	1019	Rising	0.2	-	2.75
	25/07/2019	<0.1	<0.1	0.0001	0.3	0.3	0.0003	5.1	1006	Falling	0.1	-	2.75
	29/07/2019	<0.1	<0.1	0.0002	0.3	0.3	0.0006	7.6	1006	Rising	0.2	-	2.76

	05/08/2019	<0.1	<0.1	0.0001	0.4	0.40	0.0004	6.2	1006	Stable	0.1	-	2.77
	09/08/2019	<0.1	<0.1	0.0002	0.5	0.50	0.0010	6.1	997	Falling	0.2	-	2.82
	12/08/2019	<0.1	<0.1	0.0001	0.5	0.50	0.0005	7.2	1011	Rising	0.1	-	2.82
	19/08/2019	<0.1	<0.1	0.0002	0.6	0.60	0.0012	7.6	1010	Rising	0.2	-	2.75
	22/08/2019	<0.1	<0.1	0.0001	0.5	0.50	0.0005	9.5	1022	Stable	0.1	-	2.77
WS204	25/07/2019	<0.1	<0.1	0.0001	0.1	0.10	0.0001	18.1	1006	Falling	<0.1	-	2.11
	29/07/2019	<0.1	<0.1	0.0001	0.5	0.50	0.0005	20.0	1007	Rising	0.1	-	2.11
	05/08/2019	<0.1	<0.1	0.0003	0.7	0.70	0.0021	20.1	1006	Stable	0.3	-	2.11
	09/08/2019	<0.1	<0.1	0.0001	0.8	0.80	0.0008	19.2	997	Falling	0.1	-	2.1
	12/08/2019	<0.1	<0.1	0.0001	0.9	0.90	0.0009	19.7	1011	Rising	0.1	-	2.1
	19/08/2019	<0.1	<0.1	0.0002	<0.1	<0.1	0.0002	18.8	1010	Rising	0.2	-	2.06
	22/08/2019	<0.1	<0.1	0.0002	<0.1	<0.1	0.0002	17.6	1022	Stable	0.2	-	2.1
WS205	22/07/2019	0.1	0.1	0.0001	2.4	2.40	0.0024	15.8	1020	Rising	<0.1	-	1.68
	25/07/2019	<0.1	<0.1	0.0002	3.2	3.20	0.0064	13.1	1007	Falling	0.2	-	1.81
	29/07/2019	0.1	0.1	0.0001	3.0	2.90	0.0030	16.8	1008	Rising	0.1	-	1.81
	05/08/2019	0.1	0.1	0.0002	2.9	2.90	0.0058	16.1	1006	Stable	0.2	-	1.96
	09/08/2019	0.2	0.2	0.0002	2.3	2.30	0.0023	16.1	997	Falling	0.1	-	1.96
	12/08/2019	0.2	0.2	0.0002	1.6	1.60	0.0016	18.3	1011	Rising	<0.1	-	1.96
	19/08/2019	<0.1	<0.1	0.0002	2.2	2.20	0.0044	17.7	1010	Rising	0.2	-	1.93
	22/08/2019	<0.1	<0.1	0.0001	2.0	2.00	0.0020	17.8	1022	Stable	0.1	-	1.96

Table 2 - Summary of CGL Ground Gas and Groundwater Monitoring Results (2016)

Location	Date	CH ₄ Peak %v/v	CH ₄ Final %v/v	CH ₄ GSV l/hr	CO ₂ Peak %v/v	CO ₂ final %v/v	CO ₂ GSV l/hr	O ₂ %v/v	Atmos (mbar)	Atmos. Dynamic	Flow (l/hr)	Depth to Base (m bgl)	Depth to Water (m bgl)
CGL Results July – October 2017													
WS1	19/07/2016	3.1	2.7	0.0031	<0.1	<0.1	0.0001	18.4	1005	Rising	<0.1	4.04	3.58
WS3	19/07/2016	<0.1	<0.1	-0.0020	<0.1	<0.1	-0.0020	15.9	1005	Rising	-2.0	3.56	3.07
	18/08/2016	<0.1	<0.1	0.0001	0.8	0.8	0.0008	12.2	1004	Rising	<0.1	4.65	3.08
	31/08/2016	<0.1	<0.1	0.0001	0.9	0.9	0.0009	11.9	1014	Falling	<0.1	4.65	3.08
WS5	19/07/2016	<0.1	<0.1	-0.0020	8.0	8.0	-0.1600	11.3	1005	Rising	-2.0	4.91	2.93
	18/08/2016	<0.1	<0.1	-0.0011	8.8	8.8	-0.0968	10.8	1004	Rising	-1.1	4.91	2.61
	13/09/2016	<0.1	<0.1	0.0001	6.9	6.9	0.0069	12.2	1003	Falling	<0.1	4.91	2.90
WS6	19/07/2016	<0.1	<0.1	0.0001	1.9	1.9	0.0019	6.1	1005	Rising	<0.1	3.10	2.71
	18/08/2016	<0.1	<0.1	0.0001	4.2	4.2	0.0042	1.0	1004	Rising	<0.1	3.05	2.67
	31/08/2016	<0.1	<0.1	0.0001	4.6	4.5	0.0046	1.8	1014	Falling	<0.1	3.05	2.67
	13/09/2016	<0.1	<0.1	0.0001	4.8	4.7	0.0048	0.7	1003	Falling	<0.1	3.05	2.66
	27/09/2016	<0.1	<0.1	0.0001	4.2	3.2	0.0042	3.2	1015	Falling	<0.1	4.90	2.85
	11/10/2016	<0.1	<0.1	0.0001	4.7	4.7	0.0047	0.5	1021	Falling	<0.1	3.05	2.63
WS8A	19/07/2016	<0.1	<0.1	0.0001	12.2	12.2	0.0122	4.3	1005	Rising	<0.1	3.00	2.70
	18/08/2016	<0.1	<0.1	0.0001	14.0	14.0	0.0140	5.0	1004	Rising	<0.1	3.06	2.92
	31/08/2016	<0.1	<0.1	0.0001	14.3	14.3	0.0143	4.9	1014	Falling	<0.1	3.06	2.87
	13/09/2016	<0.1	<0.1	0.0001	13.7	13.1	0.0137	4.8	1003	Falling	<0.1	3.06	2.82
	27/09/2016	<0.1	<0.1	0.0001	13.1	13.1	0.0131	6.4	1015	Falling	<0.1	3.06	2.78
	11/10/2016	<0.1	<0.1	0.0001	13.1	13.1	0.0131	6.5	1021	Falling	<0.1	3.05	2.75
WS9	19/07/2016	<0.1	<0.1	0.0001	6.9	6.9	0.0069	11.8	1005	Rising	<0.1	2.11	2.01
	18/08/2016	<0.1	<0.1	0.0001	13.7	9.1	0.0137	8.9	1004	Rising	<0.1	2.09	2.03
	31/08/2016	<0.1	<0.1	0.0001	14.1	9.7	0.0141	7.1	1014	Falling	<0.1	2.09	2.03
	13/09/2016	<0.1	<0.1	0.0001	13.0	9.5	0.0130	7.6	1003	Falling	<0.1	2.09	2.00
	27/09/2016	<0.1	<0.1	0.0001	11.5	9.4	0.0115	8.1	1015	Falling	<0.1	2.10	2.01
	11/10/2016	<0.1	<0.1	0.0001	10.0	10.0	0.0100	8.0	1021	Falling	<0.1	2.10	1.93
DS111	19/07/2016	<0.1	<0.1	0.0001	7.5	6.9	0.0075	11.7	1005	Rising	<0.1	1.70	DRY
	18/08/2016	<0.1	<0.1	0.0114	8.8	5.8	1.0032	11.7	1004	Rising	11.4	1.70	DRY
	31/08/2016	<0.1	<0.1	0.0001	5.4	5.4	0.0054	13.6	1014	Falling	<0.1	1.70	DRY
	13/09/2016	<0.1	<0.1	0.0001	7.3	7.3	0.0073	10.5	1003	Falling	<0.1	1.70	DRY

	11/10/2016	<0.1	<0.1	0.0001	0.5	<0.1	0.0005	20.2	1021	Falling	<0.1	1.70	DRY
CP01	18/08/2016	<0.1	<0.1	0.0001	3.5	3.5	0.0035	18.6	1004	Rising	<0.1	-	-
CP02	18/08/2016	<0.1	<0.1	-0.0011	3.5	0.5	-0.0385	3.6	1004	Rising	-1.1	11.80	2.88
CP03	18/08/2016	<0.1	<0.1	0.0001	0.5	0.1	0.0005	18.7	1004	Rising	<0.1	12.07	2.70
	31/08/2016	<0.1	<0.1	0.0001	4.3	<0.1	0.0043	6.2	1014	Falling	<0.1	12.07	2.70
	13/09/2016	<0.1	<0.1	0.0001	4.5	<0.1	0.0045	10.4	1003	Falling	<0.1	12.07	2.68
	27/09/2016	<0.1	<0.1	0.0001	4.2	3.2	0.0042	16.6	1015	Falling	<0.1	12.08	2.65
	11/10/2016	<0.1	<0.1	0.0001	4.2	<0.1	0.0042	18.6	1021	Falling	<0.1	12.07	2.65
CP04	18/08/2016	<0.1	<0.1	0.0001	5.9	0.3	0.0059	14.4	1004	Rising	<0.1	12.15	2.61
	31/08/2016	<0.1	<0.1	0.0037	9.7	0.1	0.3589	9.2	1014	Falling	3.7	12.15	2.61
	13/09/2016	<0.1	<0.1	0.0001	9.4	1.4	0.0094	9.7	1003	Falling	<0.1	12.15	2.60
	27/09/2016	<0.1	<0.1	0.0001	9.2	0.1	0.0092	9.7	1015	Falling	<0.1	12.15	2.61
	11/10/2016	<0.1	<0.1	0.0001	7.5	1.1	0.0075	9.1	1021	Falling	<0.1	12.15	2.55
CP05	18/08/2016	<0.1	<0.1	0.0001	0.5	0.1	0.0005	12.7	1004	Rising	<0.1	9.75	3.28
	31/08/2016	<0.1	<0.1	0.0001	5.2	<0.1	0.0052	14.9	1014	Falling	<0.1	9.75	3.28
	13/09/2016	<0.1	<0.1	0.0001	6.6	<0.1	0.0066	13.1	1003	Falling	<0.1	9.75	3.27
	27/09/2016	<0.1	<0.1	0.0001	0.3	<0.1	0.0003	19.6	1015	Falling	<0.1	9.76	3.28
	11/10/2016	<0.1	<0.1	0.0001	3.6	<0.1	0.0036	18.6	1021	Falling	<0.1	9.75	3.20

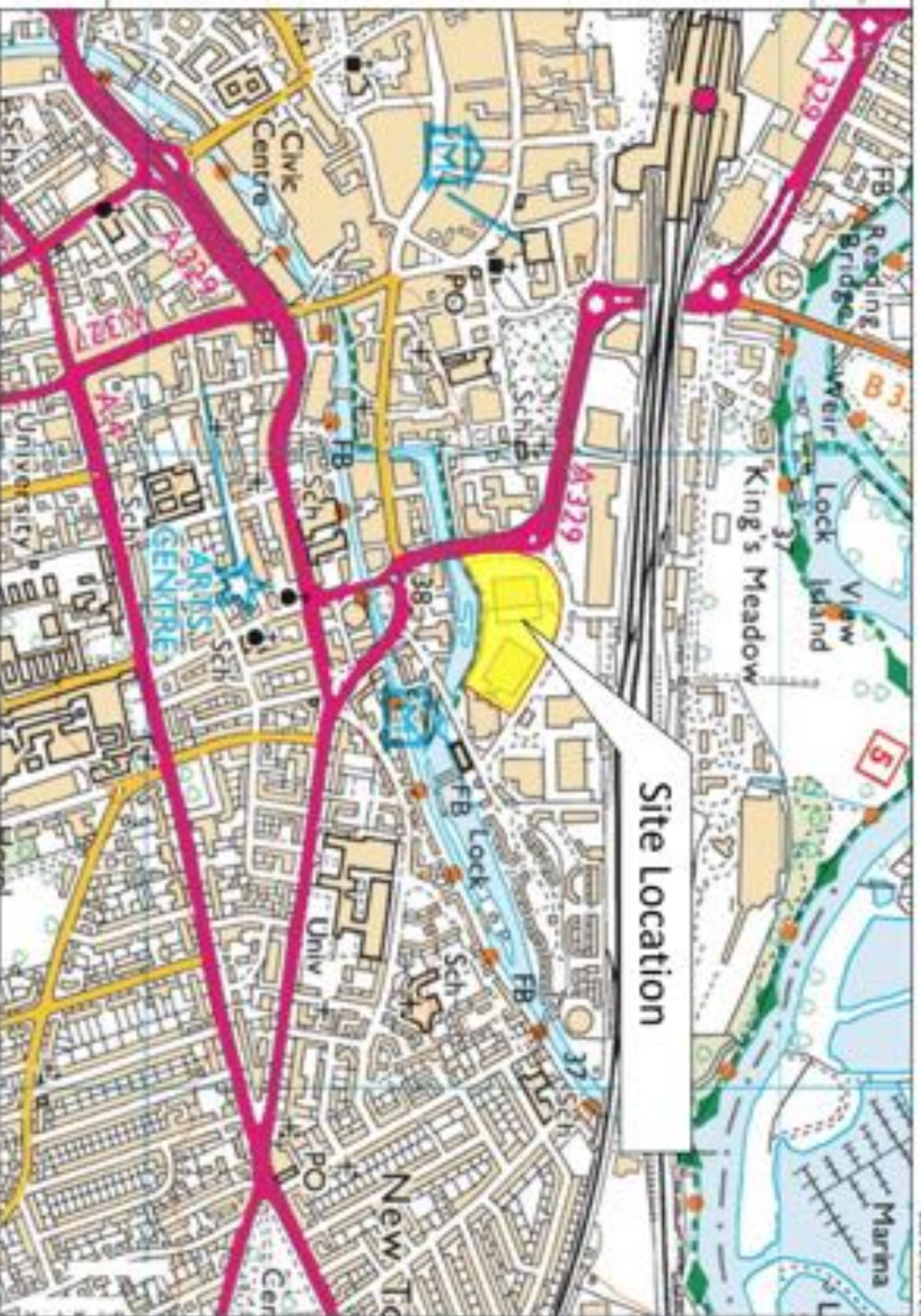
Limitations

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between OE Ltd and the Client as indicated in Section 1.2.
2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information, it has been assumed it is correct. No attempt has been made to verify the information.
3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination, which are enforced, by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.
4. During the site walkover reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not been made known or accessible.
5. Access considerations, the presence of services and the activities being carried out on the site limited the locations where sampling locations could be installed and the techniques that could be used.
6. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities.
7. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials this is for indicative purposes only and do not constitute or replace full and proper surveys.
8. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.
9. OE cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by OE is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by OE in this connection without their explicit written agreement there to by OE.
10. Current information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.

Attachment 1

Drawings

Key



Job Title:

Client:

Project No:

Date:

Drawing Title:

Kenavon Drive, Reading

Bentley Homes (Western) Ltd

Drawn By:

Checked By:

Figure 1.0 - Site Location Plan

1 Square = 1km

OMNIA

Environmental & Engineering

OMNIA Environmental & Engineering is a leading provider of environmental and engineering services. We have a proven track record in delivering high-quality, cost-effective solutions for our clients. Our services include environmental impact assessment, pollution control, and engineering design. We are proud to be a member of the Institution of Environmental Engineers and the Institution of Civil Engineers. For more information, please visit our website at www.omnia-ee.co.uk.

Key



OMNIA
ARCHITECTURAL & ENVIRONMENTAL DESIGN

Job Title:

Kensington Drive, Reading

Client:

Berkeley Homes (Western) Ltd

Project No:

A11057

Date:

06/03/2019

Drawn By:

G. Lacombe

Reviewed By:

T. Mitchell

Scale:

NTS

Drawing Title:

Figure 2.0 - Proposed
Development Plan



Key



- 128 - Approximate Gas Monitoring Installation Location
- 129 - Approximate Gas Monitoring Installation Location
- 12111 - Approximate Gas Monitoring Installation Location
- 12112 - Approximate Gas Monitoring Installation Location
- 12113 - Approximate Gas Monitoring Installation Location
- 12114 - Approximate Gas Monitoring Installation Location
- 12115 - Approximate Gas Monitoring Installation Location

LEGEND

Site Boundary



Job Title:

Client:

Project No: A11053

Date: 10/09/2019

Drawing Title:

Kenarow Drive, Reading

Berkley Homes (Wessex) Ltd

Drawn By: O. Maxwell

Reviewed By: T. Mitchell

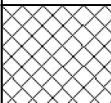
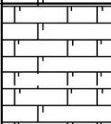
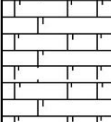
Figure 3.0 - Gas Monitoring Installation Locations

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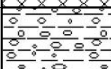
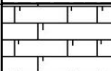
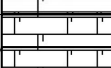
Environmental & Safety Consultants Ltd

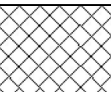
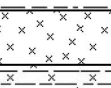
Attachment 2

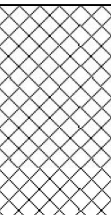
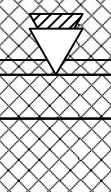
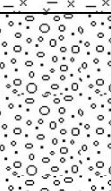
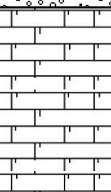
Terramech Borehole Logs

PAGE:		JOB 4159					BOREHOLE WS201		
DATE:10.07.19		KENAVON DRIVE, READING							
DESCRIPTION	REDUCED	DEPTH	LEGEND	SAMPLE		THICKNESS	SPT	REMARKS	
	LEVEL m			TYPE	DEPTH	m			N
MADE GROUND: (very loose) Crushed concrete with brick, brown silty sand and occasional flinty gravel.		0.00				0.46		Coordinates: Easting: 472197.2147 Northing: 173545.4623	
MADE GROUND: (medium dense) white and off-white chalk gravel and silt with occasional red brick and flint. Cobble sized red brick at 0.96m, 1.70m, 1.97m and cobble sized subrounded flint at 1.88. Frequent burnt coal appearing from 1.20m		0.46		D	0.60			-- 4159/WS201/ 0.6D	
				SPT	1.20	1.64	21	-	
			SPT	2.00			27	-	
Structureless white CHALK with occasional gravel. Gravel is medium subangular flint. Occasional light brown staining on chalk. Possible CIRIA Grade Dm (SEAFORD CHALK FORMATION AND NEWHAVEN CHALK FORMATION UNDIFFERENTIATED)		2.10				0.25			
Structureless white CHALK with occasional gravel. Gravel is coarse subangular to subrounded flint. Possible structure observed from 2.6m. Occ. brown staining. Possible CIRIA Grade C5 (SEAFORD CHALK FORMATION AND NEWHAVEN CHALK FORMATION UNDIFFERENTIATED)		2.35		SPT	3.00	1.25	12	-	
		3.18w 3.30w						Standing Water (30 minutes after drilling) Water seepage	
Structureless off-white CHALK with frequent black and brown staining. Frequent orange staining from 3.8m. Possible CIRIA Grade C5. (SEAFORD CHALK FORMATION AND NEWHAVEN CHALK FORMATION UNDIFFERENTIATED)		3.60							
				SPT	4.00	1.00	11	-	
Structured white CHALK with occasional orange staining. Likely to be CIRIA Grade C5. (SEAFORD CHALK FORMATION AND NEWHAVEN CHALK FORMATION UNDIFFERENTIATED)		4.60							
				SPT	5.00		15	-	
						1.40			Monotoring well installed to 5.68.m below ground level. Plain pipe and bentonite fill to 1.32m Slotted pipe and gravel fill to 5.68m Standpipe above current ground level: 0.68m
		6.00							
 TERRAMECH INVESTIGATIONS LIMITED 183 LONG LANE TILEHURST READING			REMARKS: Borehole installed on 25 July 2019 Area CAT scanned prior to drilling						
U100=100mm dia. UNDISTURBED SAMPLE B=BULK SAMPLE W=WATER SAMPLE			U38=38mm dia. UNDISTURBED SAMPLE SPT=STANDARD PENETRATION TEST			D=SMALL DISTURBED SAMPLE CPT=CONE PENETRATION TEST			

PAGE:		JOB 4159					BOREHOLE WS202		
DATE:10.07.19		KENAVON DRIVE, READING							
DESCRIPTION	REDUCED	DEPTH	LEGEND	SAMPLE		THICKNESS	SPT	REMARKS	
	LEVEL m			TYPE	DEPTH				m
MADE GROUND: (dense) clayey silt. Occasional gravelly and silty chalk Occasional subrounded to rounded medium to coarse flint. Cobble sized red brick and yellow brick. Occasional burnt wood and coal		0.00		SPT	1.20	0.60	5	Coordinates: Easting: 472230.6986 Northing: 173651.4868	
MADE GROUND: (loose) white and off-white chalk with frequent infill of brown silt. Occasional fine to medium subangular to subrounded flint. Occasional burnt coal		0.95							
MADE GROUND: (medium dense) brown silty clay with frequent black staining and coal. Frequent cobble sized red bricks. Occasional fine and medium sized chalk gravel. Rare medium sized grey sand.		1.55 1.60w		SPT	2.00	0.20	3	Water seepage	
MADE GROUND: (very loose to loose) yellow fine to medium sized sand.		1.90							
MADE GROUND: (loose) fine to medium sized red brick. Sub angular, subrounded and rounded flint. Frequent black staining.		2.10		C	2.85	0.15 0.20		-- 4159/WS202/ 2.8C Standing Water (30 minutes after drilling)	
MADE GROUND: (dense) white chalk with occasional flint. Flint is medium subangular to subrounded gravel. Frequent brown silt infill and black staining		2.40 2.96w							
MADE GROUND: (dense) red brick and brown gravelly sandy clay. Sand is fine to medium grained. Gravels are fine, medium and coarse angular to rounded flint. Occasional fine chalk gravel.		2.55		SPT	5.00	0.40	10	pp: 0.75	
MADE GROUND: (stiff to very stiff) black slightly sandy silt. Sand is medium to coarse grained. Occasional medium subangular flint. Occasional brick. Rare shell fragments (<3mm) .		2.75							
Firm to stiff greenish grey mottled black silty CLAY with occasional shell fragement (SUSPECTED ALLUVIAL DEPOSITS)		3.10				1.30			
Soft to firm greenish grey mottled orangey brown silty CLAY with occasional black pseudo-fibrous plant remains (SUSPECTED ALLUVIAL DEPOSITS)		3.50							
Soft black clayey SILT with frequent pseudo-fibrous plant remains. (SUSPECTED ALLUVIAL DEPOSITS)		4.80				0.12 0.42			
Firm greenish grey clayey SILT with occasional orange staining. (SUSPECTED ALLUVIAL DEPOSITS)		4.92							
Soft black clayey SILT with occasional gravel. Gravel is medium subangular flint. (SUSPECTED ALLUVIAL DEPOSITS)		5.34				0.10 0.36			
Soft to firm greenish grey clayey SILT with occasional gravel. Gravel is medium subangular, subrounded and rounded flint. (SUSPECTED ALLUVIAL DEPOSITS)		5.44							
Loose to medium dense orange gravelly SAND. Sand is medium and coarse grained. Gravel is fine, medium and coarse subangular to subrounded flint. Rare chalk silt appearing at 5.80 - 5.85m		5.80				0.20		Monitoring well installed to 5.78m below ground level. Plain pipe and bentonite fill to 0.78m Slotted pipe and gravel fill to 5.78m Standpipe above current ground level: 1.22m	
		6.00							

PAGE:		JOB 4159					BOREHOLE WS203		
DATE:10.07.19		KENAVON DRIVE, READING							
DESCRIPTION	REDUCED	DEPTH	LEGEND	SAMPLE		THICKNESS	SPT	REMARKS	
	LEVEL m			TYPE	DEPTH				m
		0.00				0.30		Coordinates: Easting: 472267.3343 Northing: 173536.9177	
MADE GROUND: (loose) crushed concrete, light brown silt and gravel. Gravels are fine to medium subangular to subrounded flint.		0.30							
MADE GROUND: (loose) crushed concrete, light brown silt and gravel. Gravels are fine to medium subangular to subrounded flint.				SPT	1.00	1.85	7	-	
				SPT	2.00		4	-	
Very soft to soft brown gravelly clayey SILT. Gravels are fine medium and coarse subangular to subrounded flint. (SUSPECTED ALLUVIAL DEPOSITS)		2.15						Standing Water (30 minutes after drilling) Water seepage	
		2.34w 2.35w							
				SPT	3.00	1.05	2	-	
Very soft light brown mottled orange gravelly CLAY. Chalk gravels are fine subrounded to rounded. Occasional flint gravels are fine to medium subangular to subrounded. (SUSPECTED ALLUVIAL DEPOSITS)		3.20				0.65		pp: <0.5	
Very soft light grey mottled orange gravelly clayey SILT. Gravels are fine to medium subrounded chalk and flint.		3.85		SPT	4.00	0.20	9	-	
Structureless off-white and orange CHALK. Frequent light orange silt as infill. Occasional subangular to rounded flint. Rare brown remains of pseudo fibrous rootles. (SEAFORD CHALK FORMATION AND NEWHAVEN CHALK FORMATION UNDIFFERENTIATED)		4.05				1.45			
Structureless dark grey CHALK with occasional gravel. Gravels are medium subangular flint. (SEAFORD CHALK FORMATION AND NEWHAVEN CHALK FORMATION UNDIFFERENTIATED)		5.50				0.15 0.25		Monitoring well installed to 6.05m below ground level. Plain pipe and bentonite fill to 1.05m Slotted pipe and gravel fill to 6.05m Standpipe above current ground level: 0.95m	
		5.65							
Structureless light grey and off-white CHALK with medium subangular flint. Chalk CIRIA grade Dc. (SEAFORD CHALK FORMATION AND NEWHAVEN CHALK FORMATION UNDIFFERENTIATED)						0.10			
Structureless dark grey CHALK with occasional gravel. Gravels are medium subangular flint. (SEAFORD CHALK FORMATION AND NEWHAVEN CHALK FORMATION UNDIFFERENTIATED)		5.90							
		6.00							
 TERRAMECH INVESTIGATIONS LIMITED 183 LONG LANE TILEHURST READING			REMARKS: Borehole installed on 15 July 2019 Area CAT scanned prior to drilling						
U100=100mm dia. UNDISTURBED SAMPLE B=BULK SAMPLE W=WATER SAMPLE			U38=38mm dia. UNDISTURBED SAMPLE SPT=STANDARD PENETRATION TEST			D=SMALL DISTURBED SAMPLE CPT=CONE PENETRATION TEST			

PAGE:		JOB 4159					BOREHOLE WS204		
DATE:10.07.19		KENAVON DRIVE, READING							
DESCRIPTION	REDUCED	DEPTH	LEGEND	SAMPLE		THICKNESS	SPT	REMARKS	
	LEVEL m			m	TYPE				DEPTH
MADE GROUND: (loose) crushed concrete, brick and flint		0.00				0.45		Coordinates: Easting: 472355.9056 Northing:173605.8387	
MADE GROUND: (loose) brick, flint, dark brown silt, yellow sand and black stained silt and sand		0.45		C	0.65	0.30	-- 4159/WS204/ 0.6C		
MADE GROUND: (soft) orangey brown gravelly sandy clay. Gravels are fine to medium subangular to subrounded flint. Cobbles are subrounded flint		0.75		SPT	1.00	0.45	6	-	
MADE GROUND: (soft) brown gravelly sandy silt. Gravels are fine to medium subangular to subrounded flint		1.20				0.40			
MADE GROUND: (soft to firm) black clayey silt with occasional gravel and brick. Gravels are medium subrounded		1.60		D	1.70	0.20		-- 4159/WS204/ 1.7D	
Very soft to soft to firm dark grey mottled white and black CLAY with occasional shells (<2mm). (SUSPECTED ALLUVIAL DEPOSITS)		1.80		SPT	2.00	0.75	4	-	
Soft light grey SILT with frequent shells (<5.0mm) and occasional white gravel. Gravels are fine to medium and rounded. (SUSPECTED ALLUVIAL DEPOSITS)		2.55		D	2.70	0.25		-- 4159/WS204/ 2.7D	
Soft grey mottled orange brown silty CLAY. (SUSPECTED ALLUVIAL DEPOSITS)		2.80							
		3.20w 3.25w		D	3.50	1.05		Standing Water (30 minutes after drilling) Water seepage -- 4159/WS204/ 3.5D	
Very soft dark grey silty CLAY with occasional bedding of sand and shell fragments from 3.84m to 3.92m of <3mm thickness. (SUSPECTED ALLUVIAL DEPOSITS)		3.85		SPT	4.00	0.15	1	pp: <0.5	
Very loose to loose grey SAND. Sand is medium grained. (SUSPECTED ALLUVIAL DEPOSITS)		4.00				0.90			
Very soft dark grey mottled black silty CLAY. (SUSPECTED ALLUVIAL DEPOSITS)		4.90		SPT	5.00	0.06 0.04	15	-	
Loose to medium dense orangey brown gravelly SAND with occasional gravel. Sand is medium and coarse grained. Gravels are fine subrounded to rounded and coarse subangular flint. (POSSIBLE TAPLOW GRAVEL MEMBER)		4.96				1.00			
No Recovery. Collapsing sides		5.00							
		6.00						Monotoring well installed to 5.05m below ground level. Plain pipe and bentonite fill to 1.05m Slotted pipe and gravel fill to 5.05m Standpipe above current ground level: 0.95m	
TERRAMECH INVESTIGATIONS LIMITED 183 LONG LANE TILEHURST READING			REMARKS: Borehole installed on 11 July 2019 Area CAT scanned prior to drilling						
U100=100mm dia. UNDISTURBED SAMPLE B=BULK SAMPLE W=WATER SAMPLE			U38=38mm dia. UNDISTURBED SAMPLE SPT=STANDARD PENETRATION TEST			D=SMALL DISTURBED SAMPLE CPT=CONE PENETRATION TEST			

PAGE:		JOB 4159					BOREHOLE WS205		
DATE:10.07.19		KENAVON DRIVE, READING							
DESCRIPTION	REDUCED	DEPTH	LEGEND	SAMPLE		THICKNESS	SPT	REMARKS	
	LEVEL m			TYPE	DEPTH				m
MADE GROUND: (loose) crushed concrete, red brick, gravel and soft brown mottled silty clay. Gravels are fine, medium and coarse subangular to subrounded flint. Frequent black staining		0.00		C	0.30	1.00		Coordinates: Easting: 472358.7268 Northing: 173522.3651 -- 4159/WS205/ 0.3C	
MADE GROUND: (loose) crushed concrete, soft to firm greenish grey clay and occasional red brick. Rare thin metal wire, glass and wood		1.00		SPT	1.00	0.70	4	-	
MADE GROUND: (loose) red and yellow brick and wood		1.63w 1.70w 1.70		C	1.70	0.20		Standing Water (30 minutes after drilling) Water seepage -- 4159/WS205/ 1.7C	
MADE GROUND: (very loose) red brick and grey clay		1.90		D SPT	1.95 2.00	0.40	1	-- 4159/WS205/ 1.9D -	
Soft to firm light grey mottled green CLAY with occasional shells (<4mm) and black pseudo fibrous grass. (SUSPECTED ALLUVIAL DEPOSITS)		2.30		D	2.70	0.90		-- 4159/WS205/ 2.7D	
Very soft dark brown slightly clayey SILT. (SUSPECTED ALLUVIAL DEPOSITS)		3.20				0.70			
Loose sandy GRAVEL. Gravels is fine subrounded to rounded and medium subangular to subrounded flint. Sand is medium and coarse grained		3.90		SPT	4.00	0.90	5	-	
Structureless white, off-white and yellowish white CHALK with frequent gravel. Gravels are fine to medium subangular to rounded flint. Frequent grey silty sand infill (2/8/20) (SEAFORD CHALK FORMATION AND NEWHAVEN CHALK FORMATION UNDIFFERENTIATED)		4.80		SPT	5.00	1.05	29	-	
Structureless white CHALK. Chalk gravels are medium sized within chalk matrix. Possibly CIRIA grade Dm. (SEAFORD CHALK FORMATION AND NEWHAVEN CHALK FORMATION UNDIFFERENTIATED)		5.85		SPT	6.00	0.15	6	Monotoring well installed to 5.93m below ground level. Plain pipe and bentonite fill to 0.93m Slotted pipe and gravel fill to 5.93m Standpipe above current ground level: 1.07m	
		6.00						-	

	TERRAMECH INVESTIGATIONS LIMITED 183 LONG LANE TILEHURST READING	REMARKS: Borehole installed on 15 July 2019 Water level from ground level: 1.63m. Standpipe above ground level: 1.07m	

U100=100mm dia. UNDISTURBED SAMPLE B=BULK SAMPLE W=WATER SAMPLE	U38=38mm dia. UNDISTURBED SAMPLE SPT=STANDARD PENETRATION TEST	D=SMALL DISTURBED SAMPLE CPT=CONE PENETRATION TEST
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