



Ground Gas Addendum Report
Northenden College

Reference:13-969-R2-1
Date: May 2021



GROUND GAS ADDENDUM REPORT

Northenden College
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Prepared for:
Cushman and Wakefield / The Manchester College

Report Ref: 13-969-R2-1
Date Issued: May 2021

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1. INTRODUCTION

1.1. BACKGROUND

E3P has previously completed a ground investigation on the site known as Northenden College. The findings of the ground investigation are presented within the E3P report entitled Phase II Geo-environmental Site Assessment (report ref: 13-969-R1-1).

During the investigation E3P installed ground gas monitoring wells, which were to be monitored over six months after installation. The data collected from the gas monitoring wells are summarised in this report and this comprises the completed ground gas assessment.

1.2. PROPOSED DEVELOPMENT

E3P understands that Cushman and Wakefield are progressing a marketing campaign in relation to the proposed divestment and future redevelopment of Northenden College, Greater Manchester for low-rise residential housing with associated adopted estate roads and utility infrastructure.

At present, there is no proposed development plan available.

1.3. OBJECTIVES

The objectives of the ground gas addendum report are to provide a detailed assessment of ground gas risk based on all available data from the E3P ground investigation works.

1.4. LIMITATIONS

The limitations of this report are presented in Appendix I.

1.5. CONFIDENTIALITY

E3P has prepared this report solely for the use of the client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from E3P; a charge may be levied against such approval.



2. INVESTIGATION RATIONALE

The Initial Conceptual Site Model has identified that the underlying MADE GROUND and potentially infilled areas in the north of the site may represent a potential source of ground gas generation. Ground conditions are discussed in more detail in Section 3. Based on the identification of these sources, E3P has determined that the site represents a low ground gas source generation potential.

Within the context of the proposed residential end use and ground gas generation potential, the gas assessment requires that nine visits are required over six months, with at least two sets of readings at low or falling atmospheric pressure as set out within CIRIA 665 Tables 5.5a and 5.5b.

TABLE 2.1 GROUND GAS MONITORING LOCATION RATIONALE

LOCATION	GROUND GAS SOURCE	DEPTH OF MONITORING WELL (m)
WS102	Natural strata / Deeper Groundwater Well	1.00–5.00
WS103	Natural strata / Deeper Groundwater Well	1.00–5.00
WS105	Natural strata / Deeper Groundwater Well	1.00–2.00
WS106	Natural strata / Deeper Groundwater Well	1.00–5.00
WS109	Natural strata / Deeper Groundwater Well	1.00–5.00
WS110	Natural strata / Deeper Groundwater Well	1.00–5.00
WS111	Natural strata / Deeper Groundwater Well	1.00–3.00
WS113	Made Ground / Natural Strata / Deeper Groundwater Well	1.00–3.00
WS115	Made Ground / Natural Strata / Deeper Groundwater Well	0.50–3.50
WS117	Natural strata / Deeper Groundwater Well	1.00–5.00
WS121	Natural strata / Deeper Groundwater Well	1.00–5.00
WS123	Natural strata / Deeper Groundwater Well	1.00–5.00
WS124	Natural strata / Deeper Groundwater Well	1.00–5.00
WS125	Made Ground / Natural Strata / Deeper Groundwater Well	1.00–3.00
WS127	Natural strata / Deeper Groundwater Well	1.00–5.00
WS128	Natural strata / Deeper Groundwater Well	1.00–5.00
WS129	Natural strata / Deeper Groundwater Well	1.00–4.00

2.1. MONITORING METHODOLOGY

Concentrations of methane (CH₄), carbon dioxide (CO₂) and oxygen (O₂) were measured using a calibrated infra-red gas analyser (GFM435) with gas flow rates were measured using an integrated flow meter.

Gas measurements were recorded for a minimum of 60 seconds at each location, at which point the maximum concentration of CH₄ and CO₂, together with the lowest concentration of O₂ were recorded. The results of the ground gas monitoring are presented in Table 2.2.



TABLE 2.2 SUMMARY OF GROUND GAS MONITORING RESULTS

WELL	DATE	CH ₄ INITIAL (%V/V)	CH ₄ STEADY (%V/V)	CH ₄ GSV (l/hr)	CO ₂ INITIAL (%V/V)	CO ₂ STEADY (%V/V)	CO ₂ GSV (l/hr)	O ₂ (%V/ V)	ATMOS (mb)	ATMOS. DYNAMIC	FLOW (l/hr)	RESPONS E ZONE (m bgl)	DEPTH TO BASE (m bgl)	DEPTH TO WATER (m bgl)	
WS102	04/06/20	0.10	0.10	-0.00039	1.40	1.40	-0.00546	19.7	1002	Falling	-0.39	1.00–5.00	4.95	2.46	
	18/06/20	0.10	0.10	0.00026	1.10	1.10	0.00286	19.8	1007	Falling	0.26		4.90	2.54	
	08/07/20	0.10	0.10	0.00052	1.30	1.30	0.00676	19.6	1010	Steady	0.52		4.92	2.50	
	24/07/20	0.10	0.10	0.00026	0.90	0.90	0.00234	19.8	1009	Falling	0.26		4.88	2.51	
	13/08/20	0.10	0.10	0.0001	0.60	0.60	0.0006	20.0	1012	Steady	0.10		4.87	2.53	
	08/09/20	0.10	0.10	0.00013	0.80	0.80	0.00104	19.7	1005	Steady	0.13		4.85	2.64	
	02/10/20	0.10	0.10	0.00026	1.00	1.00	0.0026	19.6	999	Rising	0.26		4.85	2.54	
	26/10/20	Could not locate vegetation and leaves covering well.													
	16/11/20	Could not locate vegetation and leaves covering well.													
WS103	04/06/20	0.10	0.10	0.00199	1.80	1.80	0.03582	19.5	1002	Falling	1.99	1.00–5.00	5.06	2.18	
	18/06/20	0.10	0.10	0.00183	1.40	1.40	0.02562	19.6	1007	Falling	1.83		5.06	2.24	
	08/07/20	0.10	0.10	0.00152	1.50	1.50	0.0228	19.4	1010	Steady	1.52		5.05	2.30	
	24/07/20	0.10	0.10	0.00245	2.90	2.90	0.07105	18.2	1009	Falling	2.45		5.06	2.28	
	13/08/20	0.10	0.10	0.00398	3.20	3.20	0.12736	17.6	1012	Steady	3.98		5.07	2.27	
	08/09/20	0.10	0.10	0.00274	2.90	2.90	0.07946	17.9	1005	Steady	2.74		5.05	2.39	
	02/10/20	0.10	0.10	0.00264	2.40	2.40	0.06336	18.2	999	Rising	2.64		5.04	2.32	
	26/10/20	0.10	0.10	0.00191	4.60	4.60	0.08786	14.3	991	Rising	1.91		5.02	1.55	
	16/11/20	0.10	0.10	0.00234	3.90	3.90	0.09126	15.9	1005	Rising	2.34		5.02	1.50	



WS105	04/06/20	0.10	0.10	-0.00039	0.90	0.90	-0.00351	20.1	1002	Falling	-0.39	1.00–2.00	2.08	2.07	
	18/06/20	0.10	0.10	-0.00013	0.80	0.80	-0.00104	20.2	1007	Falling	-0.13		2.07	2.07	
	08/07/20	0.10	0.10	0.00013	0.60	0.60	0.00078	20.3	1010	Steady	0.13		2.07	2.07	
	24/07/20	Could not locate vegetation and leaves covering well.													
	13/08/20	Could not locate vegetation and leaves covering well.													
	08/09/20	Could not locate vegetation and leaves covering well.													
	02/10/20	Could not locate vegetation and leaves covering well.													
	26/10/20	Could not locate vegetation and leaves covering well.													
	16/11/20	Could not locate vegetation and leaves covering well.													
WS106	04/06/20	0.10	0.10	-0.00013	2.30	2.30	-0.00299	19.2	1002	Falling	-0.13	1.00–5.00	3.82	1.95	
	18/06/20	0.10	0.10	-0.00052	2.10	2.10	-0.01092	19.4	1007	Falling	-0.52		3.81	1.97	
	08/07/20	0.10	0.10	-0.00026	2.40	2.40	-0.00624	19.1	1010	Steady	-0.26		3.81	1.99	
	24/07/20	0.10	0.10	0.00013	3.40	3.40	0.00442	17.2	1009	Falling	0.13		3.75	1.97	
	13/08/20	0.10	0.10	0.0001	4.00	4.00	0.004	16.5	1012	Steady	0.10		3.74	2.00	
	08/09/20	0.10	0.10	0.00052	3.70	3.70	0.01924	16.9	1005	Steady	0.52		3.75	2.10	
	02/10/20	0.10	0.10	0.00013	3.20	3.20	0.00416	17.2	999	Rising	0.13		3.75	2.01	
	26/10/20	Could not locate vegetation and leaves covering well.													
	16/11/20	Could not locate vegetation and leaves covering well.													



WS109	04/06/20	0.10	0.10	-0.00039	1.80	1.80	-0.00702	19.2	1002	Falling	-0.39	1.00–5.00	4.94	1.83	
	18/06/20	0.10	0.10	0.00026	1.60	1.60	0.00416	19.4	1007	Falling	0.26		4.92	1.70	
	08/07/20	0.10	0.10	0.00052	2.00	2.00	0.0104	18.9	1010	Steady	0.52		4.93	1.74	
	24/07/20	0.10	0.10	0.00026	1.70	1.70	0.00442	19.2	1009	Falling	0.26		4.92	1.72	
	13/08/20	0.10	0.10	0.0001	1.50	1.50	0.0015	18.9	1012	Steady	0.10		4.92	1.73	
	08/09/20	0.10	0.10	0.00026	1.80	1.80	0.00468	18.3	1005	Steady	0.26		4.91	1.80	
	02/10/20	0.10	0.10	0.00052	1.40	1.40	0.00728	18.6	999	Rising	0.52		4.92	1.72	
	26/10/20	Could not locate vegetation and leaves covering well.													
	16/11/20	Could not locate vegetation and leaves covering well.													
WS110	04/06/20	0.10	0.10	-0.00039	0.80	0.80	-0.00312	20.1	1002	Falling	-0.39	1.00–5.00	4.87	1.93	
	18/06/20	0.10	0.10	-0.00013	0.70	0.70	-0.00091	20.2	1007	Falling	-0.13		4.86	1.97	
	08/07/20	0.10	0.10	-0.00026	0.90	0.90	-0.00234	19.9	1010	Steady	-0.26		4.85	1.92	
	24/07/20	0.10	0.10	0.00013	1.40	1.40	0.00182	19.5	1009	Falling	0.13		4.85	1.90	
	13/08/20	0.10	0.10	0.0001	1.80	1.80	0.0018	19.4	1012	Steady	0.10		4.84	1.86	
	08/09/20	0.10	0.10	0.00013	1.50	1.50	0.00195	19.6	1005	Steady	0.13		4.84	1.95	
	02/10/20	0.10	0.10	0.00026	1.20	1.20	0.00312	19.7	999	Rising	0.26		4.83	1.79	
	26/10/20	0.10	0.10	0.00079	1.90	1.90	0.01501	18.1	991	Rising	0.79		4.77	1.50	
	16/11/20	0.10	0.10	0.00052	1.70	1.70	0.00884	18.5	1005	Rising	0.52		4.78	1.48	



WS111	04/06/20	0.10	0.10	-0.00052	0.70	0.70	-0.00364	20.2	1002	Falling	-0.52	1.00–3.00	2.62	2.29	
	18/06/20	0.10	0.10	-0.00052	0.70	0.70	-0.00364	20.1	1007	Falling	-0.52		2.64	2.30	
	08/07/20	0.10	0.10	-0.00013	0.50	0.50	-0.00065	20.3	1010	Steady	-0.13		2.64	2.28	
	24/07/20	Could not locate vegetation and leaves covering well.													
	13/08/20	Could not locate vegetation and leaves covering well.													
	08/09/20	Could not locate vegetation and leaves covering well.													
	02/10/20	Could not locate vegetation and leaves covering well.													
	26/10/20	Could not locate vegetation and leaves covering well.													
	16/11/20	Could not locate vegetation and leaves covering well.													
WS113	04/06/20	0.10	0.10	-0.00039	2.70	2.70	-0.01053	18.4	1002	Falling	-0.39	1.00–3.00	2.46	2.43	
	18/06/20	0.10	0.10	0.00052	2.70	2.70	0.01404	18.2	1007	Falling	0.52		2.44	2.40	
	08/07/20	0.10	0.10	0.00026	2.50	2.50	0.0065	18.7	1010	Steady	0.26		2.45	2.41	
	24/07/20	0.10	0.10	-0.00052	2.10	2.10	-0.01092	18.5	1009	Falling	-0.52		2.45	2.42	
	13/08/20	0.10	0.10	-0.00175	1.80	1.80	-0.0315	18.9	1012	Steady	-1.75		2.46	2.45	
	08/09/20	0.10	0.10	-0.00088	1.90	1.90	-0.01672	18.6	1005	Steady	-0.88		2.45	2.43	
	02/10/20	0.10	0.10	-0.00013	2.10	2.10	-0.00273	18.3	999	Rising	-0.13		2.45	2.42	
	26/10/20	Could not locate vegetation and leaves covering well.													
	16/11/20	Could not locate vegetation and leaves covering well.													



WS115	04/06/20	0.10	0.10	0.00092	1.30	1.30	0.01196	19.1	1002	Falling	0.92	0.50–3.00	3.06	2.88
	18/06/20	0.10	0.10	0.00013	0.70	0.70	0.00091	19.7	1007	Falling	0.13		3.04	2.70
	08/07/20	0.10	0.10	0.00052	0.90	0.90	0.00468	19.5	1010	Steady	0.52		3.05	2.74
	24/07/20	0.10	0.10	0.00126	0.40	0.40	0.00504	20.2	1009	Falling	1.26		3.04	2.90
	13/08/20	0.10	0.10	0.00179	0.20	0.20	0.00358	20.7	1012	Steady	1.79		3.04	2.87
	08/09/20	0.10	0.10	0.00096	0.50	0.50	0.0048	20.1	1005	Steady	0.96		3.04	2.90
	02/10/20	0.10	0.10	0.00126	0.40	0.40	0.00504	20.0	999	Rising	1.26		3.02	2.94
	26/10/20	0.10	0.10	0.0001	1.00	1.00	0.001	19.1	991	Rising	0.10		3.03	2.40
	16/11/20	0.10	0.10	0.00026	0.90	0.90	0.00234	19.4	1005	Rising	0.26		3.02	2.46
WS117	04/06/20	0.10	0.10	-0.00013	3.70	3.70	-0.00481	18.1	1002	Falling	-0.13	1.00–5.00	4.88	2.06
	18/06/20	0.10	0.10	-0.00052	1.30	1.30	-0.00676	19.0	1007	Falling	-0.52		4.76	2.07
	08/07/20	0.10	0.10	-0.00013	1.90	1.90	-0.00247	18.9	1010	Steady	-0.13		4.77	2.10
	24/07/20	0.10	0.10	0.00159	1.70	1.70	0.02703	19.1	1009	Falling	1.59		4.75	2.16
	13/08/20	0.10	0.10	0.00251	1.60	1.60	0.04016	19.5	1012	Steady	2.51		4.75	2.12
	08/09/20	0.10	0.10	0.00176	1.40	1.40	0.02464	19.6	1005	Steady	1.76		4.75	2.30
	02/10/20	0.10	0.10	0.00229	1.20	1.20	0.02748	19.6	999	Rising	2.29		4.76	2.40
	26/10/20	0.10	0.10	0.00079	3.00	3.00	0.0237	16.6	991	Rising	0.79		4.75	1.82
	16/11/20	0.10	0.10	0.000124	2.50	2.50	0.0310	17.2	1005	Rising	1.24		4.75	1.89



WS121	04/06/20	0.10	0.10	-0.00039	0.10	0.10	-0.00039	20.3	1002	Falling	-0.39	1.00–5.00	4.91	1.95
	18/06/20	0.10	0.10	0.0001	0.80	0.80	0.0008	18.5	1007	Falling	0.10		4.95	2.00
	08/07/20	0.10	0.10	0.00026	0.60	0.60	0.00156	18.9	1010	Steady	0.26		4.94	2.10
	24/07/20	0.10	0.10	0.00013	0.50	0.50	0.00065	19.0	1009	Falling	0.13		4.94	2.38
	13/08/20	0.10	0.10	0.00052	0.40	0.40	0.00208	19.4	1012	Steady	0.52		4.95	2.45
	08/09/20	0.10	0.10	0.00026	0.60	0.60	0.00156	19.2	1005	Steady	0.26		4.94	2.50
	02/10/20	0.10	0.10	0.00013	0.40	0.40	0.00052	19.3	999	Rising	0.13		4.93	2.41
	26/10/20	0.10	0.10	0.00079	0.30	0.30	0.00237	19.8	991	Rising	0.79		3.93	1.67
	16/11/20	0.10	0.10	0.00198	0.50	0.50	0.0099	19.6	1005	Rising	1.98		4.90	1.74
WS123	04/06/20	0.10	0.10	0.00741	2.20	2.20	0.16302	15.7	1002	Falling	7.41	1.00–5.00	4.96	1.96
	18/06/20	0.10	0.10	0.00026	0.90	0.90	0.00234	18.9	1007	Falling	0.26		4.74	1.95
	08/07/20	0.10	0.10	0.00052	1.10	1.10	0.00572	18.5	1010	Steady	0.52		4.75	1.99
	24/07/20	0.10	0.10	0.00013	0.90	0.90	0.00117	18.9	1009	Falling	0.13		4.75	2.04
	13/08/20	0.10	0.10	0.00026	0.80	0.80	0.00208	19.1	1012	Steady	0.26		4.75	2.05
	08/09/20	0.10	0.10	0.00052	0.70	0.70	0.00364	19.2	1005	Steady	0.52		4.74	2.14
	02/10/20	0.10	0.10	0.00013	0.60	0.60	0.00078	19.4	999	Rising	0.13		4.75	2.21
	26/10/20	0.10	0.10	-0.00095	2.70	2.20	-0.02565	12.0	991	Rising	-0.95		4.74	1.67
	16/11/20	0.10	0.10	-0.00052	2.40	2.40	-0.01248	13.6	1005	Rising	-0.52		4.74	1.73



WS124	04/06/20	0.10	0.10	-0.00114	3.30	3.30	-0.03762	13.0	1002	Falling	-1.14	1.00–5.00	4.88	1.79
	18/06/20	0.10	0.10	0.00273	3.30	3.30	0.09009	12.0	1007	Falling	2.73		4.86	1.75
	08/07/20	0.10	0.10	0.00196	3.00	3.10	0.0588	12.4	1010	Steady	1.96		4.86	1.80
	24/07/20	0.10	0.10	0.00126	2.70	2.70	0.03402	13.4	1009	Falling	1.26		4.84	1.81
	13/08/20	0.10	0.10	0.00159	2.50	2.50	0.03975	14.5	1012	Steady	1.59		4.85	1.83
	08/09/20	0.10	0.10	0.0022	2.90	2.90	0.0638	13.2	1005	Steady	2.20		4.84	1.90
	02/10/20	0.10	0.10	0.00126	2.30	2.30	0.02898	14.9	999	Rising	1.26		4.85	1.82
	26/10/20	0.10	0.10	0.00721	1.80	1.80	0.12978	12.2	991	Rising	7.21		4.86	1.30
	16/11/20	0.10	0.10	0.0084	1.90	1.90	0.1596	13.1	1005	Rising	8.40		4.85	1.40
WS125	04/06/20	0.10	0.10	-0.00052	1.40	1.40	-0.00728	17.6	1002	Falling	-0.52	1.00–3.00	2.74	2.48
	18/06/20	0.10	0.10	0.00026	1.90	1.90	0.00494	17.7	1007	Falling	0.26		2.75	2.43
	08/07/20	0.10	0.10	0.00052	1.80	1.80	0.00936	18.0	1010	Steady	0.52		2.74	2.50
	24/07/20	Could not locate vegetation and leaves covering well.												
	13/08/20	Could not locate vegetation and leaves covering well.												
	08/09/20	Could not locate vegetation and leaves covering well.												
	02/10/20	Could not locate vegetation and leaves covering well.												
	26/10/20	0.10	0.10	0.00183	3.80	3.80	0.06954	19.2	991	Rising	1.83		2.72	2.02
	16/11/20	0.10	0.10	0.00136	3.40	3.40	0.04624	19.4	1005	Rising	1.36		2.73	2.10



WS127	04/06/20	0.10	0.10	-0.00052	2.20	2.20	-0.01144	18.5	1002	Falling	-0.52	1.00-5.00	4.80	1.86
	18/06/20	0.10	0.10	0.0001	0.40	0.40	0.0004	19.4	1007	Falling	0.10		4.62	1.84
	08/07/20	0.10	0.10	0.00026	0.70	0.70	0.00182	19.1	1010	Steady	0.26		4.63	1.89
	24/07/20	0.10	0.10	0.00013	0.90	0.90	0.00117	18.9	1009	Falling	0.13		4.62	1.94
	13/08/20	0.10	0.10	0.00052	1.10	1.10	0.00572	18.9	1012	Steady	0.52		4.62	1.92
	08/09/20	0.10	0.10	0.00026	0.80	0.80	0.00208	19.1	1005	Steady	0.26		4.60	2.01
	02/10/20	0.10	0.10	0.00013	0.70	0.70	0.00091	19.4	999	Rising	0.13		4.60	1.93
	26/10/20	0.10	0.10	0.00257	1.90	1.90	0.04883	18.0	991	Rising	2.57		4.57	1.50
	16/11/20	0.10	0.10	0.00231	1.70	1.70	0.03927	18.3	1005	Rising	2.31		4.58	1.54
WS128	04/06/20	0.10	0.10	-0.00079	5.40	5.40	-0.04266	11.8	1002	Falling	-0.79	1.00-5.00	3.81	1.80
	18/06/20	0.10	0.10	0.00013	4.90	4.90	0.00637	12.5	1007	Falling	0.13		3.77	1.65
	08/07/20	0.10	0.10	0.00052	5.10	5.10	0.02652	12.1	1010	Steady	0.52		3.79	1.70
	24/07/20	0.10	0.10	0.00026	4.80	4.80	0.01248	12.8	1009	Falling	0.26		3.78	1.74
	13/08/20	0.10	0.10	0.00076	4.40	4.40	0.03344	13.6	1012	Steady	0.76		3.78	1.77
	08/09/20	0.10	0.10	0.00052	4.70	4.70	0.02444	13.4	1005	Steady	0.52		3.79	1.80
	02/10/20	0.10	0.10	0.00088	4.10	4.10	0.03608	14.6	999	Rising	0.88		3.78	1.71
	26/10/20	0.10	0.10	0.0014	4.90	4.90	0.0686	9.2	991	Rising	1.40		3.77	1.25
	16/11/20	0.10	0.10	0.00097	4.60	4.60	0.04462	10.2	1005	Rising	0.97		3.78	1.30



WS129	04/06/20	0.10	0.10	-0.00052	3.30	3.30	-0.01716	18.0	1002	Falling	-0.52	1.00–4.00	3.88	1.80
	18/06/20	0.10	0.10	0.00013	3.70	3.70	0.00481	17.6	1007	Falling	0.13		3.82	1.86
	08/07/20	0.10	0.10	0.00026	3.40	3.40	0.00884	17.9	1010	Steady	0.26		3.84	1.90
	24/07/20	0.10	0.10	0.00026	2.90	2.90	0.00754	18.1	1009	Falling	0.26		3.84	1.94
	13/08/20	0.10	0.10	0.00052	2.70	2.70	0.01404	18.4	1012	Steady	0.52		3.83	1.98
	08/09/20	0.10	0.10	0.00013	2.90	2.90	0.00377	18.2	1005	Steady	0.13		3.84	2.04
	02/10/20	0.10	0.10	0.00076	2.40	2.40	0.01824	18.7	999	Rising	0.76		3.83	1.94
	26/10/20	0.10	0.10	0.00174	2.80	2.80	0.04872	14.8	991	Rising	1.74		3.80	1.55
	16/11/20	0.10	0.10	0.00084	2.60	2.60	0.02184	15.1	1005	Rising	0.84		3.81	1.58

NOTES

NHBC Traffic Light System		Typical Max CH ₄ Concentration	GSV CH ₄	Typical Max CO ₂ Concentration	GSV CO ₂
	Amber 1	1	0.16-0.63	5	0.78-1.56
	Amber 2	5	0.63-1.56	10	1.56-3.13
	Red	20	1.56+	30	3.13+

Values in **BOLD** exceed Amber 1 Thresholds

Values in **BLUE** denote water above monitoring well



3. GROUND GAS RISK ASSESSMENT

3.1. GROUND GAS RISK ASSESSMENT METHODOLOGY

The potential impact on the development from ground gases has been assessed with reference to standards and guidelines published in CIRIA Report 665 – *Assessing risks posed by hazardous ground gases to buildings* (2007). However, it is recommended that the full ground gas assessment and recommended protection measures are agreed with the local authority prior to their adoption on site. Furthermore, all protection measures adopted should be validated by a suitably qualified engineer.

CIRIA C665 and NHBC Report No 10627-R01 provide assessments for carbon dioxide and methane based upon gas screening values (GSVs) utilising flow rates and concentrations. The site-based GSVs for steady state methane and carbon dioxide are based upon the following equation:

$$GSV = \frac{\text{concentration (by vol)}}{100} \times \text{flowrate (1 / hr)}$$

The GSVs within CIRIA C665 are based upon all buildings other than standard residential houses. The NHBC GSVs are based upon standard residential houses with precast concrete floors (block and beam). The CIRIA 665 report author (Steve Wilson) since provided further clarification regarding which guidance should be adopted for residential houses that have suspended cast in-situ concrete floor slab: for the avoidance of doubt, it was confirmed that the GSVs within the CIRIA 665 guidance should be adopted.

For this development the NHBC thresholds have been adopted due to the use of a subfloor void.

The thresholds for GSVs based upon NHBC guidance are provided within Table 3.1

TABLE 3.1 RESIDENTIAL THRESHOLDS FOR GAS SCREENING VALUES (GSV) IN ACCORDANCE WITH NHBC REPORT NO 10627-R01 – RESIDENTIAL END USE

CIRIA – NO SUBFLOOR VOID		NHBC – SUBFLOOR VOID		
CLASSIFICATION	GSV (METHANE AND CARBON DIOXIDE)	CLASSIFICATION	GSV (METHANE)	GSV (CARBON DIOXIDE)
CS1	< 0.07	Green	< 0.13	< 0.76
CS2	< 0.70	Amber 1	< 0.63	< 1.60
CS3	< 3.5	Amber 2	< 1.60	< 3.10
CS4	< 15	Red	> 1.60	> 3.10
CS5	< 70	N/A	N/A	N/A
CS6	> 70	N/A	N/A	N/A

Notes

1. The worst-case ground gas regime identified on the site, either methane or carbon dioxide, at the worstcase temporal conditions that the site may be expected to encounter will be the decider as to what Traffic Light is allocated;
2. Gas Screening Value is the Borehole Gas Volume Flow Rate, in litres per hour, as defined in Wilson and Card (1999), which is the borehole flow rate multiplied by the concentration in the air stream of the particular gas being considered;
3. The Typical Maximum Concentrations can be exceeded in certain circumstances should the Conceptual Site Model indicate it is safe to do so;
4. The Gas Screening Value thresholds should not generally be exceeded without the completion of a detailed ground gas risk assessment taking into account site-specific conditions.



3.1.1. SOURCES OF GROUND GAS

The Phase I report and subsequent ground investigation has identified the following potential sources of ground gas:

- ✳ MADE GROUND deposits; and,
- ✳ Potentially infilled ground in northern sector.

3.1.2. GROUND CONDITIONS

- ✳ Made Ground was encountered primarily within the northern section of the site with an isolated area in the south of the site associated with the basketball court. Made Ground underlying the current buildings on site is anticipated to be at a depth > 1.60mbgl. Furthermore, it should be assumed that the paths in the southern sector of the site will be underlain by 0.30m of Made Ground. The bund along the south-eastern boundary is assumed to contain Made Ground or reworked natural materials. Made Ground was encountered to a maximum depth of 2.10mbgl within TP129, however the full depth could not be proven due to inability to progress excavation due to the density of materials. This was also the case in WS122. Within the northern and central areas of the site TP107, TP108, TP127, TP134, WS119 and WS122 were terminated due to the presence of concrete obstructions, which are considered to be attributed to historical development on the site.
- ✳ At exploratory hole locations within the landscaped areas of the site, this generally comprised of a reworked topsoil that was black brown slightly clayey medium sand with occasional gravel of mudstone and brick. This was underlain by a dark brown slightly clayey gravelly medium sand with occasional cobbles. The gravel comprised of mudstone, brick, concrete, plastic and timber with cobbles of brick.
- ✳ At three locations, TP124, TP125 and TP133 the dark brown gravelly medium sand is overlain by asphalt and a grey sandy gravel (MOT). In the very northern area of the site (TP106, TP136 and TP137) encountered a grey sandy gravel (MOT) with occasional rootlets and gravel of mudstone, limestone and brick from ground level to 0.30m bgl. Within exploratory hole locations within the car parks, these encountered asphalt underlain by a grey sandy gravel (MOT) which was underlain by a black red sandy gravel with gravel of brick or a black brown slightly clayey gravelly medium sand with gravel of mudstone, asphalt and brick.
- ✳ The drift deposits underlying the site generally comprised of a light yellow brown gravelly medium SAND with gravel of mudstone and sandstone underlain by a light grey brown gravelly medium SAND with gravel of mudstone and sandstone. A stiff high strength to very stiff high strength light brown mottled grey gravelly sandy CLAY with gravel of mudstone was subsequently encountered beneath granular deposits. Within WS107 and WS115, a very soft extremely low strength light brown very sandy gravelly CLAY with gravel of mudstone and sandstone was encountered at 1.90m bgl and 3.20m bgl respectively. Furthermore, soft CLAY was identified from 3.10-3.40mbgl within SHDP102, SHDP105 at 3.20-3.30mbgl, 3.00-3.10mbgl within SHDP112, 3.20-3.80mbgl within SHDP116. Laboratory undrained shear strength testing has identified soft clays within WS129 at 3.50-4.00mbgl.
- ✳ The solid bedrock geology was not encountered throughout the site investigation works.



3.1.3. GROUNDWATER

None of the monitoring wells were flooded during the monitoring and therefore all wells can be included within the gas assessment.

Within the wells, groundwater levels were observed to fluctuate over the monitoring period, with levels generally peaking in September. The greatest groundwater change occurred within WS121 where levels increased by 0.83m over the monitoring period. WS121 was set within a low-permeability clay stratum and groundwater may be a result of surface water collecting in the well rather than a measure of true groundwater.

3.1.4. GAS FLOW

During the monitoring a positive flow was noted in all wells. The measure of positive flow is considered to be the result of groundwater fluctuations and flooding of the well causing compression – as opposed to gas generation – as the highest flows are recorded during periods of high groundwater levels.

Negative flows are indicative of back pressure from wind being greater than the active flow from the wells. Negative flows were recorded in WS102, WS105, WS106, WS109, WS110, WS113, WS117, WS121, WS123, WS124, WS125, WS127 and WS128.

3.1.5. GAS CONCENTRATIONS

No elevated concentrations of methane were recorded within any of the remaining monitoring wells.

Carbon dioxide concentrations were recorded within all the monitoring wells at concentrations ranging from 0.30% v/v to 5.40% v/v (WS128). The maximum carbon dioxide levels were also associated with low oxygen concentrations.

3.1.6. GAS ASSESSMENT

In accordance with the methodology outlined with the CIRIA publication C665, E3P have utilised the results of the ground gas monitoring surveys to calculate a tentative gas screening value (GSV). The GSVs for the monitoring positions are summarised in Table 3.2.



TABLE 3.2 GAS RISK PROFILE AND LOCATION

LOCATION	MAX CO ₂ (% v/v)	GSV (l/hr)	MAX CH ₄ (% v/v)	GSV (l/hr)	CLASSIFICATION
WS102	1.40	0.00676	0.10	0.00052	Green/CS1
WS103	4.60	0.12736	0.10	0.00398	Amber 1/CS2
WS105	0.90	-0.00351	0.10	-0.00039	Green/CS1
WS106	4.00	-0.01924	0.10	0.00052	Green/CS1
WS109	2.00	0.01040	0.10	0.00052	Green/CS1
WS110	1.9	-0.01501	0.10	-0.00079	Green/CS1
WS111	0.70	-0.00364	0.10	-0.00052	Green/CS1
WS113	2.70	-0.03150	0.10	0.00175	Green/CS1
WS115	1.30	0.01196	0.10	0.00179	Green/CS1
WS117	3.70	-0.04016	0.10	-0.00251	Green/CS1
WS121	0.80	0.00990	0.10	0.00198	Green/CS1
WS123	2.20	0.16302	0.10	0.00741	Amber 1/CS2
WS124	3.30	0.1596	0.10	0.00840	Amber 1/CS2
WS125	3.80	0.06954	0.10	0.00183	Green/CS1
WS127	2.20	0.04883	0.10	0.00257	Green/CS1
WS128	5.40	0.6860	0.10	-0.00140	Amber 1/CS2
WS129	3.70	0.04872	0.10	-0.00174	Green/CS1

The GSV has been compared to the criteria outlined with CIRIA C665 to determine the level of risk to the proposed development and to ensure the appropriate remedial options are incorporated into any future building design in this area.

Ground gas monitoring suggests that the site can be predominantly classified as CS1, and in these areas it is considered that gas protection measures will not be required.

However, localised areas of the site have been assessed as being CS2 due to elevated GSV's inferred due to increased outflow. However when considering the absence of any gas generation source and the reported concentrations being below 5% v/v (excluding marginal exceedance at 5.4% v/v in WS128) it is determined that there is no credible source of CO₂.

When considering the absence of any elevated concentrations of potentially hazardous ground gasses or credible sources capable of either generating or facilitating gas migration the site should be classified as CS1 in accordance with BS8485.

END OF REPORT



APPENDIX I

LIMITATIONS

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between E3P and the client as indicated in Section 1.3.
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. E3P 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 E3P 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 E3P in this connection without their explicit written agreement there to by E3P.
10. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.



APPENDIX II

GLOSSARY

TERMS

ACM	Asbestos-containing material	MMP	Materials management plan
ADS	Acoustic design statement	ND	Not detected
AST	Above-ground storage tank	NDP	Nuclear density probe
BGS	British Geological Survey	NMP	Noise management plan
BSI	British Standards Institute	NPSE	Noise policy statement for England
BTEX	Benzene, toluene, ethylbenzene, xylenes	NR	Not recorded
CA	Coal Authority	PAH	Polycyclic aromatic hydrocarbon
CBR	California bearing ratio	PCB	Polychlorinated biphenyl
CIEH	Chartered Institute of Environmental Health	PI	Plasticity index
CIRIA	Construction Industry Research Association	PID	Photo ionisation detector
CLEA	Contaminated land exposure assessment	POS	Public open space
CML	Council of Mortgage Lenders	PPE	Personnel protective equipment
CoC	Contaminants of concern	ProPG	Professional practice guidance
CSM	Conceptual site model	QA	Quality assurance
DNAPL	Dense non-aqueous phase liquid (chlorinated solvents, PCB)	SGV	Soil guideline value
DWS	Drinking water standard	SPH	Separate-phase hydrocarbon
EA	Environment Agency	SPT	Standard penetration test
EQS	Environmental quality standard	SVOC	Semi-volatile organic compound
FFL	Finished floor level	TPH	Total and speciated petroleum hydrocarbon
GAC	General assessment criteria	TPH CWG	Total Petroleum Hydrocarbon (Criteria Working Group)
GL	Ground level	UKWIR	United Kingdom Water Infrastructure Risk
GSV	Gas screening value	UST	Underground storage tank
HCV	Health criteria value	VCC	Vibro-concrete column
ICSM	Initial conceptual site model	VOC	Volatile organic compound
LEL	Lower explosive limit	VRSC	Vibro-replacement stone columns
LMRL	Lower method reporting limit	VSC	Vibro-stone columns
LNAPL	Light non-aqueous phase liquid (petrol, diesel, kerosene)	WHO	World Health Organisation
MCV	Moisture condition value	WRAP	Waste and Resources Action Programme

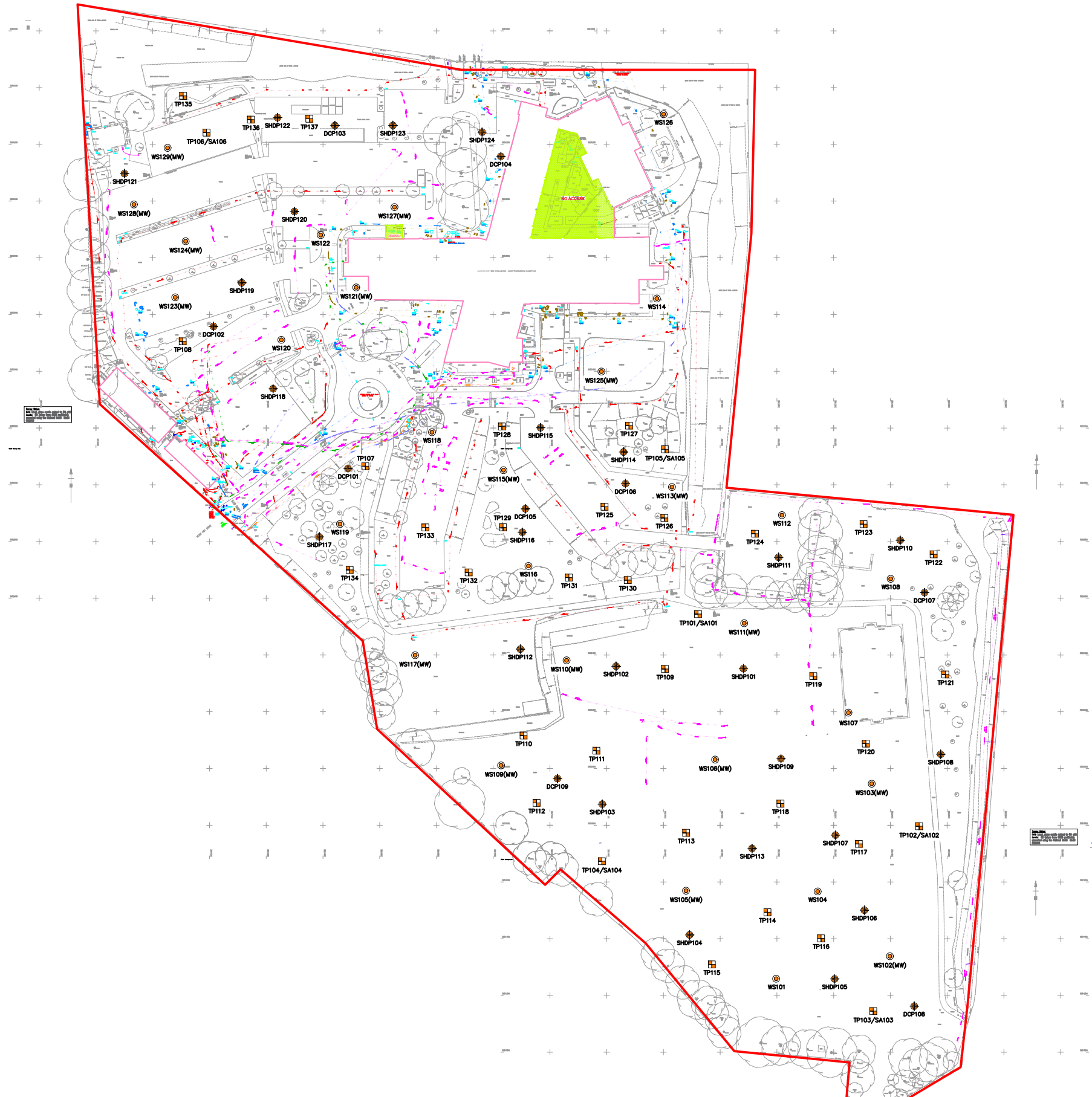


MIBK	Methyl isobutyl ketone	WTE	Water table elevation
m	Metres	ppm	Parts per million
km	Kilometres	mg/m³	Milligram per metre cubed
% v/v	Percent volume in air	m bgl bgl	Metres below ground level
mb	Millibars (atmospheric pressure)	m bcl	Metre below cover level
l/hr	Litres per hour	mAOD	Metres above ordnance datum (sea level)
µg/l	Micrograms per litre (parts per billion)	kN/m²	Kilonewtons per metre squared
ppb	Parts per billion	µm	Micrometre
mg/kg	Milligrams per kilogram (parts per million)	SSRT	Site Specific Remediation Target
PSD	Particle Size Distribution	DD	Dry Density
CL:AIRE	Contaminated Land: Applications in Real Environments	Mc	Moisture Content
ρ	Bulk Density	GPR	Ground Penetrating Radar
NDP	Nuclear Density Probe	FFL	Finished Floor Level
LEL	Lower Explosive Limit	UKWIR	UK Water Industry Research
CIRIA	Construction Industry Research and Information Association	LOD	Limit of Detection



APPENDIX III

DRAWINGS



Location Symbols											
	Approximate Window Sample Probehole Location		Abandoned		Electric cables		Water pipes		Sewer combined overflow		Telemetry cables
	Approximate Window Sample Probehole Location with Install		Acid drain		Effluent pipes		Unidentified GPR or electro location trace		Electric HV cables		Vehicle detection pad
	Approximate Trial Pit Location		British telecom		Fuel line		Rising main		Electric pilot cables		Wash water pipes
	Approximate Super Heavy Dynamic Probe Test Location		Cable TV		Fuel gauge line		Scar trace		Fuel gauge line		Services survey boundary
	Approximate Dynamic Cone Penetrometer Test Location		Communication cables		Fuel vent line		Alarm cables		Earth cables		Assumed route
			Sewer combined		Gas pipes		CCTV cables		Fibre optic cables		Taken from records (Not proven on site)
			Sewer surface water		Heating pipes		Chemical pipes		LPG pipes		End of Trace
			Sewer foul		Traffic light cables		Compressed air pipes		Oil pipes		Group of Services Representation
			Ducting		Vapour recovery pipes		Culvert		Sludge main		

Notes:					
P1	R2	21.07.2020	REVISION	HM	BH
P1	R1	25.06.2020	REVISION	LM	BH
P1	-	04.06.2020	DRAFT	HM	BH
Phase	Revision	Date	Issue	Drawn	Checked

Client:	
Cushman and Wakefield	
Job Title:	
Northenden College	

Job No:	13-969	Date:	21.07.2020
Drawing No:	005	Scale:	NTS
Drawing Title:		Exploratory Hole Location Plan	



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