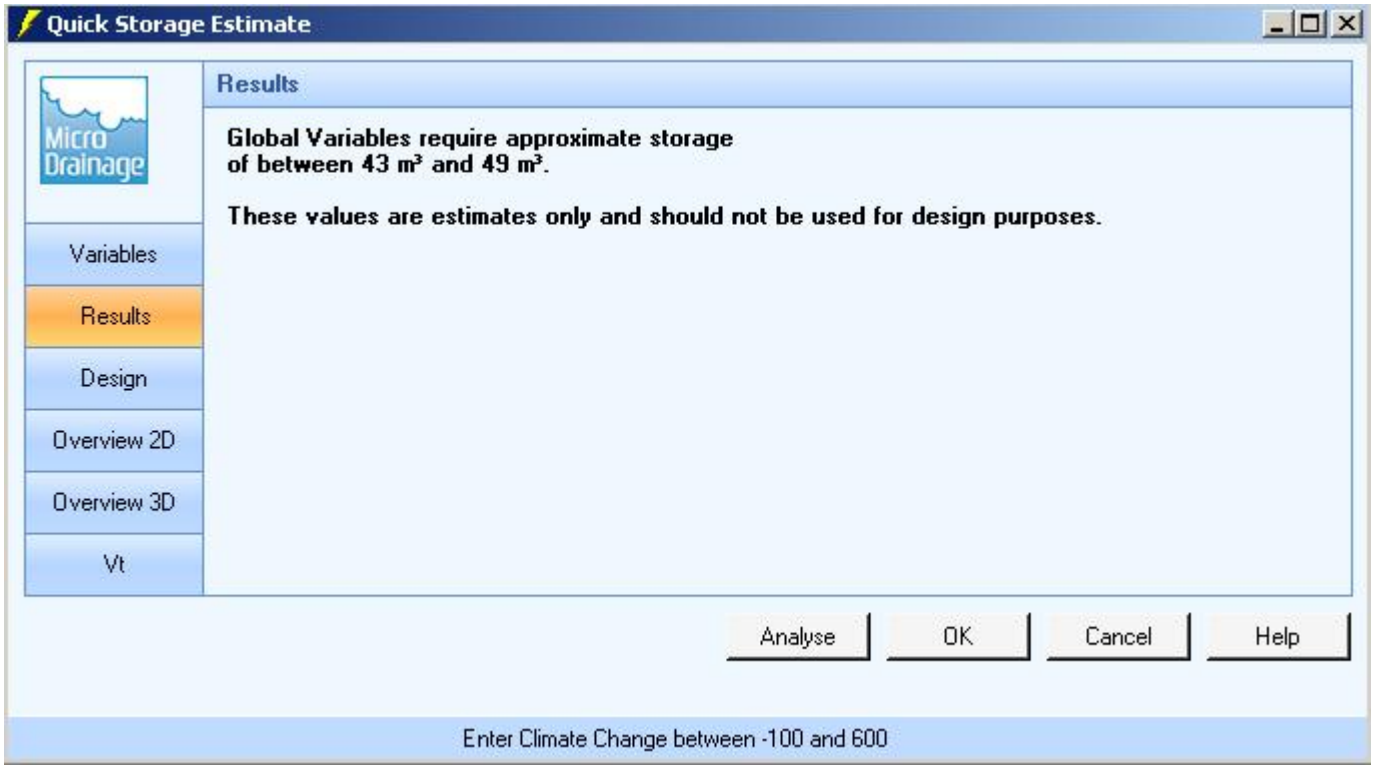

Figure 2: Storage Volume (Source: Microdrainage Version 2017.1.2)

Regards

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Appendix B

Rainfall runoff calculations

Critical Storm Duration and volume requirements

The table below presents storage volumes for the 1 in 100 year plus climate change (40%) used to assess the impact of the proposed development and calculate the required storage volumes for the critical storm duration for attenuation features, limited to a maximum discharge rate of 1 l/s. According to calculations, the 1 hour storm is the critical storm duration when applying a discharge rate of 1 l/s.

Table 5: Critical Storm Durations and storage requirements associated with the development

Rainfall event duration (Hours)	Outflow to 1 l/s (m^3)	Inflow from impermeable surfaces (m^3)	Storage Required for Critical Storm Duration (m^3)
0.25	0.90	17.90	17.00
0.5	1.80	22.98	21.18
0.75	2.70	25.95	23.25
1	3.60	28.06	24.46
2	7.20	36.11	28.91
3	10.80	41.22	30.42
4	14.40	44.84	30.44
5	18.00	47.54	29.54
6	21.60	49.61	28.01
8	28.80	52.46	23.66
10	36.00	54.43	18.43
12	43.20	55.91	12.71
16	57.60	58.05	0.45
20	72.00	59.48	-12.52
24	86.40	60.57	-25.83
28	100.80	61.48	-39.32
32	115.20	62.28	-52.92
36	129.60	63.01	-66.59

The calculations in the following sheets should relate either to the footprint of the proposed development and or the entire site area. In either case, be consistent.

The following colour conventions have been used:

inputs
calculations
cell values reference another cell

Input parameters for run-off calculations			
Total site area:	622	m^2	How have these areas been defined? (This is important for QA!)
Current permeable ground cover	215	m^2	Reddington road - 4 bedroom house to 8 bedroom house with two storey basement level - *Total site area used:* ***624m2***
Current impermeable ground cover	407	m^2	
Proposed permeable ground cover	202	m^2	
Proposed impermeable ground cover	422	m^2	
Underlying soil type (from soilscapes)	Slowly permeable seasonally wet acid loamy and clayey soils		Cranfield soilscapes website
SAAR	664	mm	FEH CD ROM (NERC, 2009)
Region	6		Hydrological region (see sheet)
Climate change factor	30%		Refer to NPPF for development planned lifetime and the correct climate change multiplication factor to use.
Run-off coefficient	100%		100% run-off assumed for impermeable land. Note - this is not referenced in the spreadsheet, so values will not update automatically.

Current impermeable area as % of total	65%
Proposed impermeable area as % of total	68%

Change in permeable area (m2)	-13
Change in impermeable area (m2)	15
Change in impermeable area as % of total	2.4%

Discharge Rate (l/s)	5	0.005

VERSION "FEH Web Service (2.0.0.0) " Version 1.0.0 exported a 12:34:11 GMT Wed 07-Mar-18
Parameters
Rainfall mo FEH 2013
Calculation Design rainfall
Calculation For a point
Calculation Point GB 525638 186088 TQ 25638 86088
Duration= 6 Hours
Fixed durat no
Return per 2.3 Years
Annual ma yes
A design rainfall of 28.94 mm was calculated.
This design rainfall has been calculated for a return period on the annual maximum scale.
The data in the following table have been computed using sliding durations.
The data in the following table have been computed using sliding durations.

Duration minutes	Duration hours	Duration days	10 year rainfa mm	20 year rainfa mm	50 year rainfa mm	100 year rainfa mm	200 year rainfa mm	500 year rainfall mm	1 year rainfa mm	30 year rainfall mm	2.3 QBAR
15	0.25	0.010417	17.71	22	27.86	32.63	37.85	45.25	7.83	24.48	
30	0.5	0.020833	22.42	27.95	35.55	41.88	48.82	58.64	9.93	31.24	
45	0.75	0.03125	25.22	31.5	40.14	47.31	55.13	66.32	11.17	35.23	
60	1	0.041667	27.22	33.95	43.33	51.15	59.57	71.66	12.07	38.04	
75	1.25	0.052083	29.59	36.72	46.78	55.24	64.46	77.74	13.45	41.09	
90	1.5	0.0625	31.86	39.32	50	59.09	69.13	83.55	14.96	43.92	
105	1.75	0.072917	33.94	41.68	52.93	62.61	73.44	88.9	16.46	46.48	
120	2	0.083333	35.81	43.79	55.55	65.82	77.39	93.75	17.87	48.77	
135	2.25	0.09375	37.25	45.44	57.69	68.51	80.71	97.67	18.87	50.6	
150	2.5	0.104167	38.52	46.89	59.59	70.93	83.69	101.16	19.77	52.22	
165	2.75	0.114583	39.65	48.19	61.3	73.13	86.39	104.3	20.57	53.67	
180	3	0.125	40.67	49.37	62.86	75.14	88.85	107.13	21.3	54.98	
195	3.25	0.135417	41.59	50.43	64.28	76.98	91.1	109.72	21.97	56.18	
210	3.5	0.145833	42.44	51.4	65.59	78.68	93.17	112.08	22.59	57.27	
225	3.75	0.15625	43.21	52.29	66.8	80.26	95.08	114.25	23.16	58.27	
240	4	0.166667	43.93	53.11	67.92	81.73	96.85	116.25	23.69	59.19	
255	4.25	0.177083	44.58	53.86	68.96	83.1	98.45	118.09	24.17	60.03	
270	4.5	0.1875	45.19	54.56	69.93	84.37	99.94	119.78	24.63	60.82	
285	4.75	0.197917	45.75	55.21	70.83	85.55	101.33	121.35	25.06	61.55	
300	5	0.208333	46.29	55.82	71.68	86.65	102.62	122.81	25.46	62.23	
315	5.25	0.21875	46.78	56.39	72.47	87.69	103.82	124.17	25.84	62.87	
330	5.5	0.229167	47.25	56.93	73.21	88.66	104.95	125.45	26.2	63.47	
345	5.75	0.239583	47.7	57.44	73.91	89.57	106.01	126.64	26.54	64.04	
360	6	0.25	48.12	57.92	74.57	90.43	107.01	127.76	26.86	64.58	28.94
375	6.25	0.260417	48.51	58.37	75.18	91.21	107.94	128.8	27.16	65.1	
390	6.5	0.270833	48.89	58.8	75.76	91.95	108.81	129.78	27.44	65.58	
405	6.75	0.28125	49.25	59.21	76.3	92.64	109.64	130.7	27.71	66.05	
420	7	0.291667	49.59	59.6	76.82	93.3	110.42	131.57	27.97	66.49	
435	7.25	0.302083	49.91	59.97	77.32	93.93	111.17	132.4	28.22	66.91	
450	7.5	0.3125	50.23	60.33	77.78	94.52	111.87	133.18	28.46	67.31	
465	7.75	0.322917	50.53	60.67	78.23	95.09	112.54	133.93	28.68	67.69	
480	8	0.333333	50.82	61	78.66	95.63	113.18	134.64	28.9	68.06	
495	8.25	0.34375	51.1	61.31	79.07	96.14	113.79	135.32	29.12	68.41	
510	8.5	0.354167	51.37	61.62	79.46	96.64	114.38	135.97	29.32	68.75	
525	8.75	0.364583	51.63	61.91	79.84	97.11	114.93	136.59	29.52	69.07	
540	9	0.375	51.88	62.19	80.2	97.57	115.47	137.19	29.72	69.39	
555	9.25	0.385417	52.12	62.47	80.54	98.01	115.98	137.76	29.9	69.69	
570	9.5	0.395833	52.36	62.73	80.88	98.43	116.47	138.31	30.08	69.98	
585	9.75	0.40625	52.59	62.99	81.2	98.83	116.95	138.83	30.26	70.26	
600	10	0.416667	52.81	63.24	81.51	99.22	117.4	139.34	30.43	70.52	
615	10.25	0.427083	53.03	63.48	81.81	99.6	117.84	139.83	30.6	70.79	
630	10.5	0.4375	53.24	63.71	82.1	99.96	118.26	140.3	30.76	71.04	
645	10.75	0.447917	53.44	63.94	82.38	100.32	118.67	140.76	30.92	71.28	
660	11	0.458333	53.64	64.16	82.65	100.66	119.06	141.2	31.07	71.52	
675	11.25	0.46875	53.83	64.37	82.91	100.99	119.45	141.62	31.22	71.75	
690	11.5	0.479167	54.02	64.58	83.17	101.31	119.81	142.03	31.37	71.97	
705	11.75	0.489583	54.21	64.79	83.41	101.62	120.17	142.43	31.51	72.18	
720	12	0.5	54.39	64.98	83.65	101.92	120.51	142.82	31.65	72.39	
735	12.25	0.510417	54.56	65.18	83.88	102.21	120.84	143.19	31.79	72.58	
750	12.5	0.520833	54.73	65.36	84.09	102.5	121.16	143.55	31.93	72.77	
765	12.75	0.53125	54.9	65.55	84.31	102.78	121.47	143.89	32.06	72.95	
780	13	0.541667	55.06	65.73	84.51	103.05	121.77	144.23	32.19	73.12	
795	13.25	0.552083	55.22	65.9	84.71	103.32	122.06	144.56	32.32	73.3	
810	13.5	0.5625	55.38	66.07	84.91	103.58	122.34	144.88	32.44	73.46	
825	13.75	0.572917	55.53	66.24	85.1	103.83	122.62	145.19	32.57	73.63	
840	14	0.583333	55.69	66.41	85.29	104.07	122.89	145.5	32.69	73.79	
855	14.25	0.59375	55.84	66.57	85.48	104.31	123.15	145.79	32.81	73.95	
870	14.5	0.604167	55.98	66.73	85.66	104.54	123.4	146.08	32.92	74.11	
885	14.75	0.614583	56.13	66.88	85.83	104.76	123.65	146.37	33.04	74.26	
900	15	0.625	56.27	67.03	86.01	104.98	123.9	146.64	33.15	74.41	

915	15.25	0.635417	56.41	67.18	86.18	105.2	124.13	146.91	33.26	74.56
930	15.5	0.645833	56.55	67.33	86.34	105.41	124.36	147.17	33.37	74.7
945	15.75	0.65625	56.68	67.48	86.51	105.61	124.59	147.43	33.48	74.84
960	16	0.666667	56.81	67.62	86.67	105.81	124.81	147.68	33.59	74.98
975	16.25	0.677083	56.95	67.76	86.83	106.01	125.02	147.93	33.69	75.12
990	16.5	0.6875	57.08	67.9	86.98	106.2	125.23	148.17	33.79	75.26
1005	16.75	0.697917	57.2	68.03	87.14	106.38	125.44	148.4	33.9	75.39
1020	17	0.708333	57.33	68.17	87.29	106.57	125.64	148.63	34	75.53
1035	17.25	0.71875	57.45	68.3	87.44	106.75	125.84	148.86	34.09	75.66
1050	17.5	0.729167	57.58	68.43	87.58	106.92	126.03	149.08	34.19	75.79
1065	17.75	0.739583	57.7	68.55	87.73	107.09	126.22	149.3	34.29	75.91
1080	18	0.75	57.82	68.68	87.87	107.26	126.41	149.51	34.38	76.04
1095	18.25	0.760417	57.94	68.8	88.02	107.41	126.59	149.72	34.48	76.17
1110	18.5	0.770833	58.06	68.92	88.16	107.57	126.76	149.93	34.57	76.3
1125	18.75	0.78125	58.17	69.04	88.3	107.72	126.93	150.13	34.66	76.43
1140	19	0.791667	58.29	69.16	88.45	107.86	127.1	150.33	34.75	76.56
1155	19.25	0.802083	58.41	69.28	88.59	108.01	127.27	150.52	34.84	76.68
1170	19.5	0.8125	58.52	69.4	88.72	108.15	127.43	150.71	34.92	76.81
1185	19.75	0.822917	58.63	69.51	88.86	108.29	127.59	150.9	35.01	76.93
1200	20	0.833333	58.74	69.63	88.99	108.43	127.75	151.09	35.1	77.06
1215	20.25	0.84375	58.86	69.74	89.13	108.57	127.91	151.27	35.18	77.18
1230	20.5	0.854167	58.97	69.85	89.26	108.7	128.06	151.45	35.27	77.3
1245	20.75	0.864583	59.08	69.96	89.39	108.83	128.21	151.63	35.35	77.42
1260	21	0.875	59.18	70.07	89.52	108.96	128.36	151.8	35.43	77.54
1275	21.25	0.885417	59.29	70.18	89.64	109.09	128.51	151.97	35.52	77.65
1290	21.5	0.895833	59.4	70.29	89.77	109.22	128.65	152.14	35.6	77.77
1305	21.75	0.90625	59.5	70.4	89.9	109.34	128.8	152.31	35.68	77.89
1320	22	0.916667	59.61	70.5	90.02	109.47	128.94	152.48	35.76	78
1335	22.25	0.927083	59.71	70.61	90.14	109.59	129.08	152.64	35.84	78.12
1350	22.5	0.9375	59.82	70.71	90.26	109.71	129.22	152.8	35.92	78.23
1365	22.75	0.947917	59.92	70.82	90.38	109.83	129.35	152.96	36	78.34
1380	23	0.958333	60.02	70.92	90.5	109.94	129.49	153.11	36.08	78.45
1395	23.25	0.96875	60.12	71.02	90.62	110.06	129.62	153.27	36.15	78.56
1410	23.5	0.979167	60.22	71.12	90.74	110.17	129.75	153.42	36.23	78.67
1425	23.75	0.989583	60.32	71.22	90.85	110.28	129.88	153.57	36.31	78.78
1440	24	1	60.42	71.32	90.96	110.4	130	153.72	36.38	78.89
1455	24.25	1.010417	60.52	71.42	91.07	110.51	130.13	153.86	36.46	79
1470	24.5	1.020833	60.61	71.52	91.18	110.62	130.26	154	36.54	79.1
1485	24.75	1.03125	60.71	71.62	91.29	110.73	130.38	154.14	36.61	79.21
1500	25	1.041667	60.81	71.72	91.39	110.83	130.5	154.28	36.69	79.31
1515	25.25	1.052083	60.9	71.82	91.49	110.94	130.62	154.42	36.76	79.41
1530	25.5	1.0625	61	71.92	91.6	111.05	130.74	154.56	36.84	79.51
1545	25.75	1.072917	61.09	72.02	91.7	111.15	130.86	154.69	36.91	79.61
1560	26	1.083333	61.19	72.11	91.8	111.26	130.98	154.82	36.99	79.71
1575	26.25	1.09375	61.28	72.21	91.9	111.36	131.1	154.95	37.06	79.81
1590	26.5	1.104167	61.37	72.3	92	111.46	131.21	155.08	37.13	79.91
1605	26.75	1.114583	61.46	72.4	92.1	111.56	131.33	155.21	37.21	80.01
1620	27	1.125	61.56	72.49	92.2	111.66	131.44	155.34	37.28	80.11
1635	27.25	1.135417	61.65	72.59	92.3	111.76	131.55	155.47	37.35	80.21
1650	27.5	1.145833	61.74	72.68	92.39	111.86	131.66	155.59	37.42	80.3
1665	27.75	1.15625	61.83	72.78	92.49	111.96	131.77	155.71	37.49	80.4
1680	28	1.166667	61.92	72.87	92.58	112.06	131.88	155.84	37.57	80.5
1695	28.25	1.177083	62.01	72.96	92.68	112.16	131.99	155.96	37.64	80.59
1710	28.5	1.1875	62.1	73.06	92.77	112.25	132.1	156.08	37.71	80.69
1725	28.75	1.197917	62.19	73.15	92.87	112.35	132.21	156.2	37.78	80.78
1740	29	1.208333	62.28	73.24	92.96	112.44	132.31	156.32	37.85	80.88
1755	29.25	1.21875	62.36	73.33	93.05	112.54	132.42	156.43	37.92	80.97
1770	29.5	1.229167	62.45	73.42	93.14	112.63	132.52	156.55	37.99	81.06
1785	29.75	1.239583	62.54	73.51	93.23	112.72	132.62	156.66	38.06	81.15
1800	30	1.25	62.63	73.6	93.32	112.81	132.73	156.78	38.13	81.25
1815	30.25	1.260417	62.71	73.69	93.41	112.91	132.83	156.89	38.2	81.34
1830	30.5	1.270833	62.8	73.78	93.5	113	132.93	157	38.27	81.43
1845	30.75	1.28125	62.88	73.87	93.59	113.09	133.03	157.11	38.33	81.52
1860	31	1.291667	62.97	73.96	93.68	113.18	133.13	157.22	38.4	81.61
1875	31.25	1.302083	63.05	74.05	93.77	113.26	133.23	157.33	38.47	81.7
1890	31.5	1.3125	63.14	74.14	93.86	113.35	133.33	157.44	38.54	81.79
1905	31.75	1.322917	63.22	74.22	93.94	113.44	133.42	157.54	38.61	81.88
1920	32	1.333333	63.31	74.31	94.03	113.53	133.52	157.65	38.67	81.97
1935	32.25	1.34375	63.39	74.4	94.11	113.62	133.61	157.76	38.74	82.06
1950	32.5	1.354167	63.48	74.49	94.2	113.7	133.71	157.86	38.81	82.14
1965	32.75	1.364583	63.56	74.57	94.28	113.79	133.8	157.96	38.87	82.23
1980	33	1.375	63.64	74.66	94.37	113.87	133.9	158.07	38.94	82.32
1995	33.25	1.385417	63.72	74.74	94.45	113.96	133.99	158.17	39.01	82.41
2010	33.5	1.395833	63.81	74.83	94.54	114.04	134.08	158.27	39.07	82.49
2025	33.75	1.40625	63.89	74.91	94.62	114.12	134.18	158.37	39.14	82.58
2040	34	1.416667	63.97	75	94.7	114.21	134.27	158.47	39.21	82.66
2055	34.25	1.427083	64.05	75.08	94.78	114.29	134.36	158.57	39.27	82.75
2070	34.5	1.4375	64.13	75.17	94.87	114.37	134.45	158.67	39.34	82.84
2085	34.75	1.447917	64.21	75.25	94.95	114.45	134.54	158.77	39.4	82.92
2100	35	1.458333	64.3	75.34	95.03	114.54	134.63	158.86	39.47	83.01
2115	35.25	1.46875	64.38	75.42	95.11	114.62	134.71	158.96	39.53	83.09
2130	35.5	1.479167	64.46	75.5	95.19	114.7	134.8	159.05	39.6	83.17

2145	35.75	1.489583	64.54	75.59	95.27	114.78	134.89	159.15	39.66	83.26
2160	36	1.5	64.62	75.67	95.35	114.86	134.98	159.24	39.72	83.34
2175	36.25	1.510417	64.69	75.75	95.43	114.94	135.06	159.34	39.79	83.42
2190	36.5	1.520833	64.77	75.84	95.51	115.02	135.15	159.43	39.85	83.51
2205	36.75	1.53125	64.85	75.92	95.59	115.09	135.23	159.52	39.92	83.59
2220	37	1.541667	64.93	76	95.67	115.17	135.32	159.61	39.98	83.67
2235	37.25	1.552083	65.01	76.08	95.74	115.25	135.4	159.7	40.04	83.75
2250	37.5	1.5625	65.09	76.16	95.82	115.33	135.48	159.79	40.11	83.84
2265	37.75	1.572917	65.17	76.24	95.9	115.4	135.57	159.88	40.17	83.92
2280	38	1.583333	65.24	76.33	95.98	115.48	135.65	159.97	40.23	84
2295	38.25	1.59375	65.32	76.41	96.05	115.56	135.73	160.06	40.29	84.08
2310	38.5	1.604167	65.4	76.49	96.13	115.63	135.81	160.15	40.36	84.16
2325	38.75	1.614583	65.48	76.57	96.2	115.71	135.89	160.24	40.42	84.24
2340	39	1.625	65.55	76.65	96.28	115.78	135.98	160.32	40.48	84.32
2355	39.25	1.635417	65.63	76.73	96.36	115.86	136.06	160.41	40.54	84.4
2370	39.5	1.645833	65.71	76.81	96.43	115.93	136.14	160.5	40.61	84.48
2385	39.75	1.65625	65.78	76.89	96.51	116	136.21	160.58	40.67	84.56
2400	40	1.666667	65.86	76.97	96.58	116.08	136.29	160.67	40.73	84.64
2415	40.25	1.677083	65.94	77.05	96.65	116.15	136.37	160.75	40.79	84.72
2430	40.5	1.6875	66.01	77.13	96.73	116.22	136.45	160.83	40.85	84.8
2445	40.75	1.697917	66.09	77.2	96.8	116.3	136.53	160.92	40.91	84.87
2460	41	1.708333	66.16	77.28	96.88	116.37	136.6	161	40.98	84.95
2475	41.25	1.71875	66.24	77.36	96.95	116.44	136.68	161.08	41.04	85.03
2490	41.5	1.729167	66.31	77.44	97.02	116.51	136.76	161.16	41.1	85.11
2505	41.75	1.739583	66.39	77.52	97.09	116.58	136.83	161.25	41.16	85.19
2520	42	1.75	66.46	77.6	97.17	116.65	136.91	161.33	41.22	85.26
2535	42.25	1.760417	66.54	77.67	97.24	116.72	136.98	161.41	41.28	85.34
2550	42.5	1.770833	66.61	77.75	97.31	116.79	137.06	161.49	41.34	85.42
2565	42.75	1.78125	66.69	77.83	97.38	116.86	137.13	161.57	41.4	85.5
2580	43	1.791667	66.76	77.9	97.45	116.93	137.21	161.65	41.46	85.57
2595	43.25	1.802083	66.83	77.98	97.53	117	137.28	161.72	41.52	85.65
2610	43.5	1.8125	66.91	78.06	97.6	117.07	137.36	161.8	41.58	85.72
2625	43.75	1.822917	66.98	78.14	97.67	117.14	137.43	161.88	41.64	85.8
2640	44	1.833333	67.05	78.21	97.74	117.21	137.5	161.96	41.7	85.88
2655	44.25	1.84375	67.13	78.29	97.81	117.28	137.57	162.03	41.76	85.95
2670	44.5	1.854167	67.2	78.36	97.88	117.35	137.65	162.11	41.82	86.03
2685	44.75	1.864583	67.27	78.44	97.95	117.41	137.72	162.19	41.88	86.1
2700	45	1.875	67.35	78.52	98.02	117.48	137.79	162.26	41.94	86.18
2715	45.25	1.885417	67.42	78.59	98.09	117.55	137.86	162.34	42	86.25
2730	45.5	1.895833	67.49	78.67	98.16	117.62	137.93	162.41	42.06	86.33
2745	45.75	1.90625	67.56	78.74	98.23	117.68	138	162.49	42.12	86.4
2760	46	1.916667	67.64	78.82	98.29	117.75	138.07	162.56	42.18	86.48
2775	46.25	1.927083	67.71	78.89	98.36	117.82	138.14	162.63	42.23	86.55
2790	46.5	1.9375	67.78	78.97	98.43	117.88	138.21	162.71	42.29	86.63
2805	46.75	1.947917	67.85	79.04	98.5	117.95	138.28	162.78	42.35	86.7
2820	47	1.958333	67.92	79.12	98.57	118.01	138.35	162.85	42.41	86.77
2835	47.25	1.96875	68	79.19	98.64	118.08	138.41	162.92	42.47	86.85
2850	47.5	1.979167	68.07	79.27	98.7	118.14	138.48	163	42.53	86.92
2865	47.75	1.989583	68.14	79.34	98.77	118.21	138.55	163.07	42.58	86.99
2880	48	2	68.21	79.42	98.84	118.27	138.62	163.14	42.64	87.07
2895	48.25	2.010417	68.28	79.49	98.91	118.34	138.68	163.21	42.7	87.14
2910	48.5	2.020833	68.36	79.57	98.98	118.4	138.75	163.28	42.76	87.22
2925	48.75	2.03125	68.43	79.64	99.05	118.46	138.81	163.34	42.82	87.29
2940	49	2.041667	68.5	79.72	99.12	118.53	138.88	163.41	42.88	87.37
2955	49.25	2.052083	68.58	79.79	99.19	118.59	138.94	163.48	42.94	87.44
2970	49.5	2.0625	68.65	79.87	99.26	118.65	139.01	163.55	43	87.52
2985	49.75	2.072917	68.72	79.94	99.32	118.71	139.07	163.61	43.06	87.59
3000	50	2.083333	68.79	80.02	99.39	118.77	139.13	163.68	43.12	87.67
3015	50.25	2.09375	68.87	80.09	99.46	118.84	139.2	163.75	43.17	87.74
3030	50.5	2.104167	68.94	80.17	99.53	118.9	139.26	163.81	43.23	87.82
3045	50.75	2.114583	69.01	80.24	99.6	118.96	139.32	163.88	43.29	87.89
3060	51	2.125	69.08	80.32	99.67	119.02	139.39	163.94	43.35	87.97
3075	51.25	2.135417	69.16	80.39	99.73	119.08	139.45	164.01	43.41	88.04
3090	51.5	2.145833	69.23	80.47	99.8	119.14	139.51	164.07	43.47	88.11
3105	51.75	2.15625	69.3	80.54	99.87	119.2	139.57	164.14	43.52	88.19
3120	52	2.166667	69.37	80.61	99.94	119.26	139.63	164.2	43.58	88.26
3135	52.25	2.177083	69.44	80.69	100	119.32	139.7	164.27	43.64	88.33
3150	52.5	2.1875	69.51	80.76	100.07	119.38	139.76	164.33	43.7	88.41
3165	52.75	2.197917	69.59	80.84	100.14	119.44	139.82	164.39	43.76	88.48
3180	53	2.208333	69.66	80.91	100.21	119.5	139.88	164.46	43.81	88.55
3195	53.25	2.21875	69.73	80.98	100.27	119.56	139.94	164.52	43.87	88.63
3210	53.5	2.229167	69.8	81.06	100.34	119.62	140	164.58	43.93	88.7
3225	53.75	2.239583	69.87	81.13	100.41	119.68	140.06	164.65	43.99	88.77
3240	54	2.25	69.94	81.2	100.47	119.74	140.12	164.71	44.05	88.85
3255	54.25	2.260417	70.01	81.28	100.54	119.8	140.18	164.77	44.1	88.92
3270	54.5	2.270833	70.08	81.35	100.61	119.86	140.24	164.83	44.16	88.99
3285	54.75	2.28125	70.15	81.42	100.67	119.92	140.3	164.89	44.22	89.06
3300	55	2.291667	70.22	81.49	100.74	119.98	140.36	164.96	44.27	89.13
3315	55.25	2.302083	70.3	81.57	100.8	120.04	140.42	165.02	44.33	89.21
3330	55.5	2.3125	70.37	81.64	100.87	120.1	140.48	165.08	44.39	89.28
3345	55.75	2.322917	70.44	81.71	100.94	120.15	140.54	165.14	44.45	89.35
3360	56	2.333333	70.51	81.78	101	120.21	140.59	165.2	44.5	89.42

3375	56.25	2.34375	70.58	81.86	101.07	120.27	140.65	165.26	44.56	89.49
3390	56.5	2.354167	70.65	81.93	101.13	120.33	140.71	165.32	44.62	89.57
3405	56.75	2.364583	70.72	82	101.2	120.39	140.77	165.38	44.67	89.64
3420	57	2.375	70.79	82.07	101.26	120.44	140.83	165.44	44.73	89.71
3435	57.25	2.385417	70.86	82.14	101.33	120.5	140.88	165.5	44.79	89.78
3450	57.5	2.395833	70.93	82.22	101.39	120.56	140.94	165.56	44.84	89.85
3465	57.75	2.40625	70.99	82.29	101.46	120.62	141	165.62	44.9	89.92
3480	58	2.416667	71.06	82.36	101.52	120.67	141.06	165.68	44.96	89.99
3495	58.25	2.427083	71.13	82.43	101.59	120.73	141.11	165.74	45.01	90.06
3510	58.5	2.4375	71.2	82.5	101.65	120.79	141.17	165.8	45.07	90.13
3525	58.75	2.447917	71.27	82.57	101.72	120.84	141.23	165.86	45.13	90.2
3540	59	2.458333	71.34	82.64	101.78	120.9	141.28	165.91	45.18	90.27
3555	59.25	2.46875	71.41	82.72	101.84	120.96	141.34	165.97	45.24	90.34
3570	59.5	2.479167	71.48	82.79	101.91	121.01	141.4	166.03	45.29	90.42
3585	59.75	2.489583	71.55	82.86	101.97	121.07	141.45	166.09	45.35	90.49
3600	60	2.5	71.62	82.93	102.04	121.12	141.51	166.15	45.41	90.56
3615	60.25	2.510417	71.69	83	102.1	121.18	141.56	166.2	45.46	90.63
3630	60.5	2.520833	71.75	83.07	102.16	121.24	141.62	166.26	45.52	90.7
3645	60.75	2.53125	71.82	83.14	102.23	121.29	141.68	166.32	45.57	90.77
3660	61	2.541667	71.89	83.21	102.29	121.35	141.73	166.37	45.63	90.83
3675	61.25	2.552083	71.96	83.28	102.35	121.4	141.79	166.43	45.68	90.9
3690	61.5	2.5625	72.03	83.35	102.42	121.46	141.84	166.49	45.74	90.97
3705	61.75	2.572917	72.1	83.42	102.48	121.51	141.9	166.54	45.8	91.04
3720	62	2.583333	72.16	83.49	102.54	121.57	141.95	166.6	45.85	91.11
3735	62.25	2.59375	72.23	83.56	102.61	121.62	142.01	166.66	45.91	91.18
3750	62.5	2.604167	72.3	83.63	102.67	121.68	142.06	166.71	45.96	91.25
3765	62.75	2.614583	72.37	83.7	102.73	121.73	142.11	166.77	46.02	91.32
3780	63	2.625	72.44	83.77	102.79	121.79	142.17	166.82	46.07	91.39
3795	63.25	2.635417	72.5	83.84	102.86	121.84	142.22	166.88	46.13	91.46
3810	63.5	2.645833	72.57	83.91	102.92	121.9	142.28	166.93	46.18	91.53
3825	63.75	2.65625	72.64	83.98	102.98	121.95	142.33	166.99	46.24	91.6
3840	64	2.666667	72.71	84.05	103.05	122.01	142.38	167.04	46.29	91.66
3855	64.25	2.677083	72.77	84.12	103.11	122.06	142.44	167.1	46.35	91.73
3870	64.5	2.6875	72.84	84.19	103.17	122.11	142.49	167.15	46.4	91.8
3885	64.75	2.697917	72.91	84.26	103.23	122.17	142.54	167.21	46.46	91.87
3900	65	2.708333	72.97	84.33	103.29	122.22	142.6	167.26	46.51	91.94
3915	65.25	2.71875	73.04	84.39	103.36	122.28	142.65	167.32	46.57	92.01
3930	65.5	2.729167	73.11	84.46	103.42	122.33	142.7	167.37	46.62	92.07
3945	65.75	2.739583	73.18	84.53	103.48	122.38	142.75	167.43	46.68	92.14
3960	66	2.75	73.24	84.6	103.54	122.44	142.81	167.48	46.73	92.21
3975	66.25	2.760417	73.31	84.67	103.6	122.49	142.86	167.53	46.79	92.28
3990	66.5	2.770833	73.38	84.74	103.66	122.54	142.91	167.59	46.84	92.35
4005	66.75	2.78125	73.44	84.81	103.73	122.6	142.96	167.64	46.9	92.41
4020	67	2.791667	73.51	84.88	103.79	122.65	143.02	167.69	46.95	92.48
4035	67.25	2.802083	73.58	84.94	103.85	122.7	143.07	167.75	47.01	92.55
4050	67.5	2.8125	73.64	85.01	103.91	122.76	143.12	167.8	47.06	92.62
4065	67.75	2.822917	73.71	85.08	103.97	122.81	143.17	167.85	47.11	92.68
4080	68	2.833333	73.78	85.15	104.03	122.86	143.22	167.9	47.17	92.75
4095	68.25	2.84375	73.84	85.22	104.09	122.91	143.27	167.96	47.22	92.82
4110	68.5	2.854167	73.91	85.28	104.15	122.97	143.33	168.01	47.28	92.89
4125	68.75	2.864583	73.97	85.35	104.22	123.02	143.38	168.06	47.33	92.95
4140	69	2.875	74.04	85.42	104.28	123.07	143.43	168.11	47.38	93.02
4155	69.25	2.885417	74.11	85.49	104.34	123.12	143.48	168.17	47.44	93.09
4170	69.5	2.895833	74.17	85.56	104.4	123.18	143.53	168.22	47.49	93.15
4185	69.75	2.90625	74.24	85.62	104.46	123.23	143.58	168.27	47.55	93.22
4200	70	2.916667	74.3	85.69	104.52	123.28	143.63	168.32	47.6	93.29
4215	70.25	2.927083	74.37	85.76	104.58	123.33	143.68	168.37	47.66	93.35
4230	70.5	2.9375	74.44	85.83	104.64	123.38	143.73	168.42	47.71	93.42
4245	70.75	2.947917	74.5	85.89	104.7	123.44	143.78	168.48	47.76	93.49
4260	71	2.958333	74.57	85.96	104.76	123.49	143.83	168.53	47.82	93.55
4275	71.25	2.96875	74.63	86.03	104.82	123.54	143.88	168.58	47.87	93.62
4290	71.5	2.979167	74.7	86.1	104.88	123.59	143.93	168.63	47.92	93.69
4305	71.75	2.989583	74.76	86.16	104.94	123.64	143.98	168.68	47.98	93.75
4320	72	3	74.83	86.23	105	123.69	144.03	168.73	48.03	93.82
4335	72.25	3.010417	74.89	86.3	105.06	123.75	144.08	168.78	48.09	93.88
4350	72.5	3.020833	74.96	86.36	105.12	123.8	144.13	168.83	48.14	93.95
4365	72.75	3.03125	75.02	86.43	105.18	123.85	144.18	168.88	48.19	94.02
4380	73	3.041667	75.09	86.5	105.24	123.9	144.23	168.93	48.25	94.08
4395	73.25	3.052083	75.15	86.56	105.3	123.95	144.28	168.98	48.3	94.15
4410	73.5	3.0625	75.22	86.63	105.36	124	144.33	169.03	48.35	94.21
4425	73.75	3.072917	75.28	86.7	105.42	124.05	144.38	169.08	48.41	94.28
4440	74	3.083333	75.35	86.76	105.48	124.1	144.43	169.13	48.46	94.35
4455	74.25	3.09375	75.41	86.83	105.54	124.15	144.48	169.18	48.51	94.41
4470	74.5	3.104167	75.48	86.9	105.6	124.21	144.53	169.23	48.57	94.48
4485	74.75	3.114583	75.54	86.96	105.66	124.26	144.57	169.28	48.62	94.54
4500	75	3.125	75.61	87.03	105.72	124.31	144.62	169.33	48.67	94.61
4515	75.25	3.135417	75.67	87.1	105.78	124.36	144.67	169.38	48.73	94.67
4530	75.5	3.145833	75.74	87.16	105.84	124.41	144.72	169.43	48.78	94.74
4545	75.75	3.15625	75.8	87.23	105.89	124.46	144.77	169.48	48.83	94.8
4560	76	3.166667	75.87	87.29	105.95	124.51	144.82	169.53	48.88	94.87
4575	76.25	3.177083	75.93	87.36	106.01	124.56	144.87	169.57	48.94	94.93
4590	76.5	3.1875	75.99	87.43	106.07	124.61	144.91	169.62	48.99	95

4605	76.75	3.197917	76.06	87.49	106.13	124.66	144.96	169.67	49.04	95.06
4620	77	3.208333	76.12	87.56	106.19	124.71	145.01	169.72	49.1	95.13
4635	77.25	3.21875	76.19	87.62	106.25	124.76	145.06	169.77	49.15	95.19
4650	77.5	3.229167	76.25	87.69	106.31	124.81	145.1	169.82	49.2	95.26
4665	77.75	3.239583	76.32	87.76	106.37	124.86	145.15	169.87	49.26	95.32
4680	78	3.25	76.38	87.82	106.42	124.91	145.2	169.91	49.31	95.39
4695	78.25	3.260417	76.44	87.89	106.48	124.96	145.25	169.96	49.36	95.45
4710	78.5	3.270833	76.51	87.95	106.54	125.01	145.29	170.01	49.41	95.52
4725	78.75	3.28125	76.57	88.02	106.6	125.06	145.34	170.06	49.47	95.58
4740	79	3.291667	76.63	88.08	106.66	125.11	145.39	170.1	49.52	95.64
4755	79.25	3.302083	76.7	88.15	106.72	125.16	145.44	170.15	49.57	95.71
4770	79.5	3.3125	76.76	88.21	106.77	125.21	145.48	170.2	49.62	95.77
4785	79.75	3.322917	76.83	88.28	106.83	125.26	145.53	170.25	49.68	95.84
4800	80	3.333333	76.89	88.34	106.89	125.3	145.58	170.3	49.73	95.9
4815	80.25	3.34375	76.95	88.41	106.95	125.35	145.62	170.34	49.78	95.97
4830	80.5	3.354167	77.02	88.47	107.01	125.4	145.67	170.39	49.83	96.03
4845	80.75	3.364583	77.08	88.54	107.07	125.45	145.72	170.44	49.89	96.09
4860	81	3.375	77.14	88.6	107.12	125.5	145.76	170.48	49.94	96.16
4875	81.25	3.385417	77.21	88.67	107.18	125.55	145.81	170.53	49.99	96.22
4890	81.5	3.395833	77.27	88.73	107.24	125.6	145.86	170.58	50.04	96.29
4905	81.75	3.40625	77.33	88.8	107.3	125.65	145.9	170.62	50.1	96.35
4920	82	3.416667	77.4	88.86	107.35	125.7	145.95	170.67	50.15	96.41
4935	82.25	3.427083	77.46	88.93	107.41	125.75	146	170.72	50.2	96.48
4950	82.5	3.4375	77.52	88.99	107.47	125.79	146.04	170.76	50.25	96.54
4965	82.75	3.447917	77.59	89.06	107.53	125.84	146.09	170.81	50.3	96.6
4980	83	3.458333	77.65	89.12	107.59	125.89	146.13	170.86	50.36	96.67
4995	83.25	3.46875	77.71	89.19	107.64	125.94	146.18	170.9	50.41	96.73
5010	83.5	3.479167	77.77	89.25	107.7	125.99	146.23	170.95	50.46	96.8
5025	83.75	3.489583	77.84	89.32	107.76	126.04	146.27	171	50.51	96.86
5040	84	3.5	77.9	89.38	107.82	126.09	146.32	171.04	50.57	96.92
5055	84.25	3.510417	77.96	89.44	107.87	126.13	146.36	171.09	50.62	96.99
5070	84.5	3.520833	78.03	89.51	107.93	126.18	146.41	171.13	50.67	97.05
5085	84.75	3.53125	78.09	89.57	107.99	126.23	146.45	171.18	50.72	97.11
5100	85	3.541667	78.15	89.64	108.04	126.28	146.5	171.22	50.77	97.17
5115	85.25	3.552083	78.21	89.7	108.1	126.33	146.55	171.27	50.83	97.24
5130	85.5	3.5625	78.28	89.76	108.16	126.38	146.59	171.32	50.88	97.3
5145	85.75	3.572917	78.34	89.83	108.22	126.42	146.64	171.36	50.93	97.36
5160	86	3.583333	78.4	89.89	108.27	126.47	146.68	171.41	50.98	97.43
5175	86.25	3.59375	78.46	89.96	108.33	126.52	146.73	171.45	51.03	97.49
5190	86.5	3.604167	78.53	90.02	108.39	126.57	146.77	171.5	51.08	97.55
5205	86.75	3.614583	78.59	90.08	108.44	126.62	146.82	171.54	51.14	97.62
5220	87	3.625	78.65	90.15	108.5	126.66	146.86	171.59	51.19	97.68
5235	87.25	3.635417	78.71	90.21	108.56	126.71	146.91	171.63	51.24	97.74
5250	87.5	3.645833	78.78	90.28	108.61	126.76	146.95	171.68	51.29	97.8
5265	87.75	3.65625	78.84	90.34	108.67	126.81	146.99	171.72	51.34	97.87
5280	88	3.666667	78.9	90.4	108.73	126.86	147.04	171.77	51.4	97.93
5295	88.25	3.677083	78.96	90.47	108.79	126.9	147.08	171.81	51.45	97.99
5310	88.5	3.6875	79.02	90.53	108.84	126.95	147.13	171.86	51.5	98.05
5325	88.75	3.697917	79.09	90.59	108.9	127	147.17	171.9	51.55	98.12
5340	89	3.708333	79.15	90.66	108.95	127.05	147.22	171.94	51.6	98.18
5355	89.25	3.71875	79.21	90.72	109.01	127.09	147.26	171.99	51.65	98.24
5370	89.5	3.729167	79.27	90.78	109.07	127.14	147.31	172.03	51.7	98.3
5385	89.75	3.739583	79.33	90.85	109.12	127.19	147.35	172.08	51.76	98.37
5400	90	3.75	79.4	90.91	109.18	127.24	147.39	172.12	51.81	98.43
5415	90.25	3.760417	79.46	90.97	109.24	127.28	147.44	172.17	51.86	98.49
5430	90.5	3.770833	79.52	91.04	109.29	127.33	147.48	172.21	51.91	98.55
5445	90.75	3.78125	79.58	91.1	109.35	127.38	147.53	172.25	51.96	98.61
5460	91	3.791667	79.64	91.16	109.41	127.42	147.57	172.3	52.01	98.68
5475	91.25	3.802083	79.71	91.23	109.46	127.47	147.61	172.34	52.06	98.74
5490	91.5	3.8125	79.77	91.29	109.52	127.52	147.66	172.39	52.12	98.8
5505	91.75	3.822917	79.83	91.35	109.58	127.57	147.7	172.43	52.17	98.86
5520	92	3.833333	79.89	91.42	109.63	127.61	147.75	172.47	52.22	98.92
5535	92.25	3.84375	79.95	91.48	109.69	127.66	147.79	172.52	52.27	98.99
5550	92.5	3.854167	80.01	91.54	109.74	127.71	147.83	172.56	52.32	99.05
5565	92.75	3.864583	80.07	91.6	109.8	127.75	147.88	172.6	52.37	99.11
5580	93	3.875	80.14	91.67	109.86	127.8	147.92	172.65	52.42	99.17
5595	93.25	3.885417	80.2	91.73	109.91	127.85	147.96	172.69	52.47	99.23
5610	93.5	3.895833	80.26	91.79	109.97	127.89	148.01	172.73	52.53	99.29
5625	93.75	3.90625	80.32	91.86	110.02	127.94	148.05	172.78	52.58	99.36
5640	94	3.916667	80.38	91.92	110.08	127.99	148.09	172.82	52.63	99.42
5655	94.25	3.927083	80.44	91.98	110.14	128.03	148.14	172.86	52.68	99.48
5670	94.5	3.9375	80.5	92.04	110.19	128.08	148.18	172.91	52.73	99.54
5685	94.75	3.947917	80.56	92.11	110.25	128.13	148.22	172.95	52.78	99.6
5700	95	3.958333	80.63	92.17	110.3	128.17	148.26	172.99	52.83	99.66
5715	95.25	3.96875	80.69	92.23	110.36	128.22	148.31	173.04	52.88	99.73
5730	95.5	3.979167	80.75	92.29	110.41	128.27	148.35	173.08	52.93	99.79
5745	95.75	3.989583	80.81	92.36	110.47	128.31	148.39	173.12	52.99	99.85
5760	96	4	80.87	92.42	110.53	128.36	148.44	173.16	53.04	99.91

Greenfield Site Run-Off Calculations usng the IoH124 method

Greenfield peak run-off rate (QBAR):

Parameters	Input	Units	Comments
Area	50	ha	mimimum 50ha
SAAR	664	mm	FEH CD ROM (NERC, 2009)
SPR	0.47	N/A	Soil run-off coefficient
Region	6	N/A	Region on Hydrological area map

QBAR

$$Q_{BAR(rural)} = 1.08AREA^{0.89}SAAR^{1.17}SPR^{2.17}$$

Where:

$Q_{BAR(rural)}$	is the mean annual flood (a return period of 2.3 years) in l/s
AREA	is the area of the catchment in km² (minimum of 0.5km²)
SAAR	is the standard average rainfall for the period 1941 to 1970 in mm
SPR	is the soil run-off coefficient

$Q_{BAR(rural)}$ can be factored by the UK Flood Studies Report regional growth curves to produce peak flood flows for any return period.

$Q_{BAR(rural)}$	=	226.93	l/s for 50ha site
Divided by 50 to scale down	=	4.54	l/s/ha
Actual Area of the entire Site	=	0.06	ha

Return Periods (Growth curves obtained from DEFRA report)

Return Period		Growth Factor	l/s/ha	Peak site run-off rate (l/s)
1	**$Q_{BAR(rural)}$ x**	**0.85**	**3.86**	**0.240**
2	$Q_{BAR(rural)}$ x	0.88	3.99	0.25
5	$Q_{BAR(rural)}$ x	1.28	5.81	0.36
10	$Q_{BAR(rural)}$ x	1.62	7.35	0.46
25	$Q_{BAR(rural)}$ x	2.14	9.71	0.60
30	**$Q_{BAR(rural)}$ x**	**2.24**	**10.17**	**0.632**
50	$Q_{BAR(rural)}$ x	2.62	11.89	0.74
100	**$Q_{BAR(rural)}$ x**	**3.19**	**14.48**	**0.90**
200	$Q_{BAR(rural)}$ x	3.86	17.52	1.09

Greenfield total run-off volume:

= actual area of the entire site x SPR x 6 hour rainfall depth

Return Period	6 hour rainfall (mm) from FEH CD-ROM	Area (ha)	SPR	Total run-off (m^3)
2.3 (QBAR)	28.94	0.06	0.47	8.5
1	26.86	0.06	0.47	7.9
10	48.12	0.06	0.47	14.1
30	64.58	0.06	0.47	18.9
100	90.43	0.06	0.47	26.4

Current site run-off calculation sheet

1 in 1 year

Current impermeable area 0.041 ha

Total volume for 6 hour event excluding climate change 10.93 m³

Duration hours	Rainfall 1 yr event mm	Run-off rate 1 yr event m³
0.25	7.83	3.19
0.5	9.93	4.04
0.75	11.17	4.55
1	12.07	4.91
2	17.87	7.27
3	21.30	8.67
4	23.69	9.64
5	25.46	10.36
6	26.86	10.93
8	28.90	11.76
10	30.43	12.39
12	31.65	12.88
16	33.59	13.67
20	35.10	14.29
24	36.38	14.81
28	37.57	15.29
32	38.67	15.74
36	39.72	16.17
40	40.73	16.58
44	41.70	16.97
48	42.64	17.35

1 in 30 year

Current impermeable area 0.041 ha

Total volume for 6 hour event excluding climate change 26.28 m³

Duration hours	Rainfall 30 yr event mm	Run-off rate 30 yr event m³
0.25	24.48	9.96
0.5	31.24	12.71
0.75	35.23	14.34
1	38.04	15.48
2	48.77	19.85
3	54.98	22.38
4	59.19	24.09
5	62.23	25.33
6	64.58	26.28
8	68.06	27.70
10	70.52	28.70
12	72.39	29.46
16	74.98	30.52
20	77.06	31.36
24	78.89	32.11
28	80.50	32.76
32	81.97	33.36
36	83.34	33.92
40	84.64	34.45
44	85.88	34.95
48	87.07	35.44

1 in 100 year

Current impermeable area 0.041 ha

Total volume for 6 hour event excluding climate change 36.81 m³

Duration hours	Rainfall 100 yr event mm	Run-off rate 100 yr event m³
0.25	32.63	13.28
0.5	41.88	17.05
0.75	47.31	19.26
1	51.15	20.82
2	65.82	26.79
3	75.14	30.58
4	81.73	33.26
5	86.65	35.27
6	90.43	36.81
8	95.63	38.92
10	99.22	40.38
12	101.92	41.48
16	105.81	43.06
20	108.43	44.13
24	110.40	44.93
28	112.06	45.61
32	113.53	46.21
36	114.86	46.75
40	116.08	47.24
44	117.21	47.70
48	118.27	48.14

Developed site run-off calculation sheet

1 in 1 year

Proposed impermeable area	0.042	ha
CC Factor	30%	
Total volume for surfaces during 6 hour event	11.33	m³
Total volume for 6 hour event inc CC	14.74	m³
Total volume for 6 hour event exc CC	11.33	m³

Duration	Rainfall 1 yr event	Run-off rate 1 yr event	Run-off rate 1 yr +cc event
hours	mm	m³	m³
0.25	7.83	3.30	4.30
0.5	9.93	4.19	5.45
0.75	11.17	4.71	6.13
1	12.07	5.09	6.62
2	17.87	7.54	9.80
3	21.30	8.99	11.69
4	23.69	10.00	13.00
5	25.46	10.74	13.97
6	26.86	11.33	14.74
8	28.90	12.20	15.85
10	30.43	12.84	16.69
12	31.65	13.36	17.36
16	33.59	14.17	18.43
20	35.10	14.81	19.26
24	36.38	15.35	19.96
28	37.57	15.85	20.61
32	38.67	16.32	21.21
36	39.72	16.76	21.79
40	40.73	17.19	22.34
44	41.70	17.60	22.88
48	42.64	17.99	23.39

1 in 30 year

Proposed impermeable area	0.042	ha
CC Factor	30%	
Total volume for surfaces during 6 hour event	27.25	m³
Total volume for 6 hour event inc CC	35.43	m³
Total volume for 6 hour event exc CC	27.25	m³

Duration	Rainfall 30 yr event	Run-off volume 30 yr event	Run-off volume 30 yr +cc event
hours	mm	m³	m³
0.25	24.48	10.33	13.43
0.5	31.24	13.18	17.14
0.75	35.23	14.87	19.33
1	38.04	16.05	20.87
2	48.77	20.58	26.76
3	54.98	23.20	30.16
4	59.19	24.98	32.47
5	62.23	26.26	34.14
6	64.58	27.25	35.43
8	68.06	28.72	37.34
10	70.52	29.76	38.69
12	72.39	30.55	39.71
16	74.98	31.64	41.13
20	77.06	32.52	42.28
24	78.89	33.29	43.28
28	80.50	33.97	44.16
32	81.97	34.59	44.97
36	83.34	35.17	45.72
40	84.64	35.72	46.43
44	85.88	36.24	47.11
48	87.07	36.74	47.77

1 in 100 year

Proposed impermeable area	0.042	ha
CC Factor	30%	
Total volume for surfaces during 6 hour event	38.16	m³
Total volume for 6 hour event inc CC	49.61	m³
Total volume for 6 hour event exc CC	38.16	m³

Duration	Rainfall 100 yr event	Run-off volume 100 yr event	Run-off volume 100 yr +cc event
hours	mm	m³	m³
0.25	32.63	13.77	17.90
0.5	41.88	17.67	22.98
0.75	47.31	19.96	25.95
1	51.15	21.59	28.06
2	65.82	27.78	36.11
3	75.14	31.71	41.22
4	81.73	34.49	44.84
5	86.65	36.57	47.54
6	90.43	38.16	49.61
8	95.63	40.36	52.46
10	99.22	41.87	54.43
12	101.92	43.01	55.91
16	105.81	44.65	58.05
20	108.43	45.76	59.48
24	110.40	46.59	60.57
28	112.06	47.29	61.48
32	113.53	47.91	62.28
36	114.86	48.47	63.01
40	116.08	48.99	63.68
44	117.21	49.46	64.30
48	118.27	49.91	64.88

Rainfall event	Greenfield run-off rates (l/s)	Existing run-off rates(l/s)	Potential run-off rates without attenuation (l/s)	Potential minus exisiting (l/s)
QBAR	0.3			
6 hour 1 in 1 year	0.2	0.6	0.6	0.0
6 hour 1 in 10 year	0.5	1.1	1.1	0.0
6 hour 1 in 30 year	0.6	1.5	1.5	0.0
6 hour 1 in 100 year	0.9	2.1	2.2	0.0
6 hour 1 in 100 year + 30% CC			2.8	0.7
6 hour 1 in 100 year + 40% CC			3.0	0.9

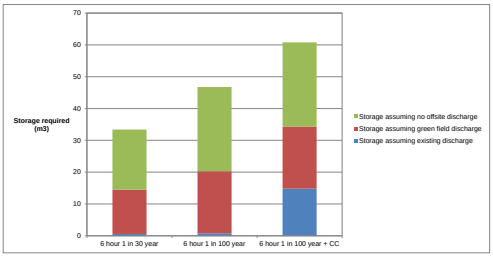
Rainfall event	Greenfield run-off volume (m^3)	Existing run-off volume (m3)*	Potential run-off volume without attenuation (m^3)	Potential minus existing (m^3)
QBAR	8.5			
6 hour 1 in 1 year	7.9	13.6	13.9	0.2
6 hour 1 in 10 year	14.1	23.9	24.3	0.4
6 hour 1 in 30 year	18.9	32.8	33.4	0.6
6 hour 1 in 100 year	26.4	45.9	46.7	0.8
6 hour 1 in 100 year + 30% CC			60.8	14.8
6 hour 1 in 100 year + 40% CC			65.4	19.5

*Assumes 100% run-off from impermeable surfaces. Assumes greenfield run-off from permeable surfaces calculated using the IoH124 method.

	Existing run-off volume (m3)	Potential run-off volume without attenuation (m^3)	Greenfield run-off volume (m^3)	Potential minus existing (m^3)	Extra storage for greenfield run-off	Extra storage for no offsite discharge	Data check
6 hour 1 in 30 year	32.8	33.4	18.9	0.6	13.9	18.9	Y
6 hour 1 in 100 year	45.9	46.7	26.4	0.8	19.5	26.4	Y
6 hour 1 in 100 year + CC	45.9	60.8	26.4	14.8	19.5	26.4	Y

Note CC may change depending on requirement - if so, H16 cell ref will need to change

Storage assuming no offsite discharge
Storage assuming green field discharge
Storage assuming existing discharge



Vol at 5 l/s for 6hrs** 108 m3

**As recommended on the Susdrain website, may vary between sites and depending on discharge route/method

Summary

Entire site area:	0.062	ha
Climate Change Factor	30%	

	Current	*Proposed*
Permeable Surface (ha)	0.022	0.020
Impermeable Surface (ha)	0.041	0.042

1 in 1 year

Greenfield run-off volume total: 7.85 m^3

RUN-OFF During a 1 in 1 year 6 hour event:	Greenfield Site	Current Development	Proposed Development	Proposed Development +CC
From permeable surfaces (using GF total run-off) (m^3)	7.85	2.71	2.55	3.32
From impermeable surfaces (m^3)		10.93	11.33	14.74
TOTAL run-off produced from Site (m^3)	7.85	13.65	13.89	18.05

Difference between greenfield site and proposed +cc development (m^3):	**10.20**
	130%
Difference between current and proposed +cc development (m^3):	**4.40**
	32%
Peak Greenfield run-off rate that must not be exceeded in the run-off from the proposed development (l/s):	**0.24**

1 in 10 year

Greenfield run-off volume total: 14.07 m^3

RUN-OFF During a 1 in 1 year 6 hour event:	Greenfield Site	Current Development	Proposed Development	Proposed Development +CC
From permeable surfaces (using GF total run-off) (m^3)	14.07	4.86	4.57	5.94
From impermeable surfaces (m^3)		19.04	19.74	25.66
TOTAL run-off produced from Site (m^3)	14.07	23.90	24.31	31.60

Difference between greenfield site and proposed +cc development (m^3):	**17.54**
	125%
Difference between current and proposed +cc development (m^3):	**7.70**
	32%
Peak Greenfield run-off rate that must not be exceeded in the run-off from the proposed development (l/s):	**0.46**

1 in 30 year

Greenfield run-off volume total: 18.88 m^3

RUN-OFF During a 1 in 30 year 6 hour event:	Greenfield Site	Current Development	Proposed Development	Proposed Development +CC
From permeable surfaces (using GF total run-off) (m^3)	18.88	6.53	6.13	7.97
From impermeable surfaces (m^3)		26.28	27.25	35.43
TOTAL run-off produced from Site (m^3)	18.88	32.81	33.38	43.40

Difference between greenfield site and proposed +cc development (m^3):	**24.52**
	130%
Difference between current and proposed +cc development (m^3):	**10.59**
	32%
Peak Greenfield run-off rate that must not be exceeded in the run-off from the proposed development (l/s):	**0.63**

1 in 100 year

Greenfield run-off volume total: 26.44 m^3

RUN-OFF During a 1 in 100 year 6 hour event:	Greenfield Site	Current Development	Proposed Development	Proposed Development +CC
From permeable surfaces (using GF total run-off) (m^3)	26.44	9.14	8.59	11.16
From impermeable surfaces (m^3)		36.81	38.16	49.61
TOTAL run-off produced from Site (m^3)	26.44	45.94	46.75	60.77

Difference between greenfield site and proposed +cc development (m^3):	**34.33**
	130%
Difference between current and proposed +cc development (m^3):	**14.83**
	32%
Peak Greenfield run-off rate that must not be exceeded in the run-off from the proposed development (l/s):	**0.90**

Appendix C

Thames Water Asset Location Plan

Asset Location Search

Thames Water Property Searches
12 Vastern Road
READING
RG1 8DB

Search address supplied

50
Redington Road
London
NW3 7RS

Your reference P2092 50 Redington Road
Our reference ALS/ALS Standard/2011_2118696

Search date 8 November 2011

You are now able to order your Asset Location Search requests online by visiting
www.thameswater-propertysearches.co.uk

Thames Water Utilities Ltd

Property Searches
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

T 0118 925 1504
F 0118 923 6655/57
E searches@thameswater.co.uk
I www.thameswater-propertysearches.co.uk

Registered in England and Wales
No. 2366661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB

Asset Location Search

Search address supplied: 50, Redington Road, London, NW3 7RS

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

This search provides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0118 925 1504, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Tel: 0118 925 1504
Fax: 0118 923 6657

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

Thames Water Utilities Ltd

Property Searches
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

T 0118 925 1504
F 0118 923 6655/57
E searches@thameswater.co.uk
I www.thameswater-propertysearches.co.uk

Registered in England and Wales
No. 2366661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB

Asset Location Search

Waste Water Services

Please provide a copy extract from the public sewer map.

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an ‘as constructed’ record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

Enclosed is a map showing the approximate positions of our water mains and associated apparatus. Please note that records are not kept of the positions of individual domestic supplies.

For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer Centre on 0845 920 0800. The Customer Centre can

Thames Water Utilities Ltd

Property Searches
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

T 0118 925 1504
F 0118 923 6655/57
E searches@thameswater.co.uk
I www.thameswater-propertysearches.co.uk

Registered in England and Wales
No. 2366661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB

also arrange for a full flow and pressure test to be carried out for a fee.

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Payment for this Search

A charge will be added to your suppliers account.

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Reading RG1 8DB

Asset Location Search

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clear Water Court
Vastern Road
Reading
RG1 8DB

Tel: 0845 850 2777
Fax: 0118 923 6613
Email: developer.services@thameswater.co.uk

Should you require any further information regarding budget estimates, diversions or stopping up notices then please contact:

DevCon Team
Asset Investment
Thames Water
Maple Lodge STW
Denham Way
Rickmansworth
Hertfordshire
WD3 9SQ

Tel: 01923 898 072
Fax: 01923 898 106
Email: devcon.team@thameswater.co.uk

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Reading RG1 8DB

Asset Location Search

Clean Water queries

Should you require any advice concerning clean water operational issues or clean water connections, please contact our Kew Service Desk by writing to:

Clean Water Design
Thames Water Utilities
1 Kew Bridge Road
Brentford
Middlesex
TW8 0EF

Tel: 0845 850 2777
Fax: 0208 213 8833
Email: developer.services@thameswater.co.uk

Thames Water Utilities Ltd

Property Searches
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

T 0118 925 1504
F 0118 923 6655/57
E searches@thameswater.co.uk
I www.thameswater-propertysearches.co.uk

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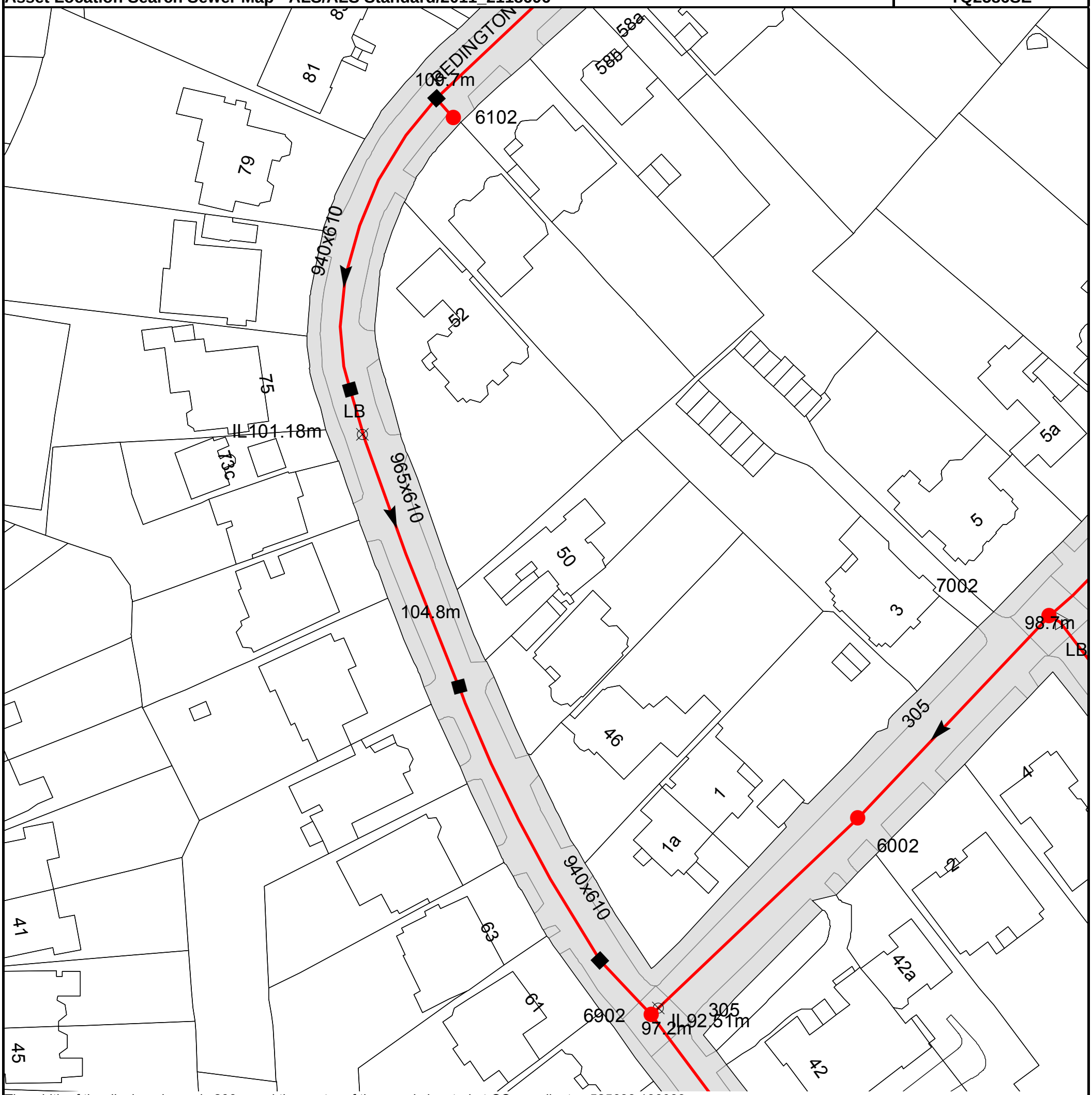
Reading RG1 8DB

Asset Location Search Sewer Map - ALS/ALS Standard/2011_2118696	TQ2586SE



The width of the displayed area is 200m and the centre of the map is located at OS coordinates 525638,186083

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
7002	99.08	94.25
6102	n/a	n/a
6902	97.3	91.98
-	-	-
6002	98.22	93.36

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

Control Valve

Drop Pipe

Ancillary

Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

Outfall

Undefined End

Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.

2) All measurements on the plans are metric.

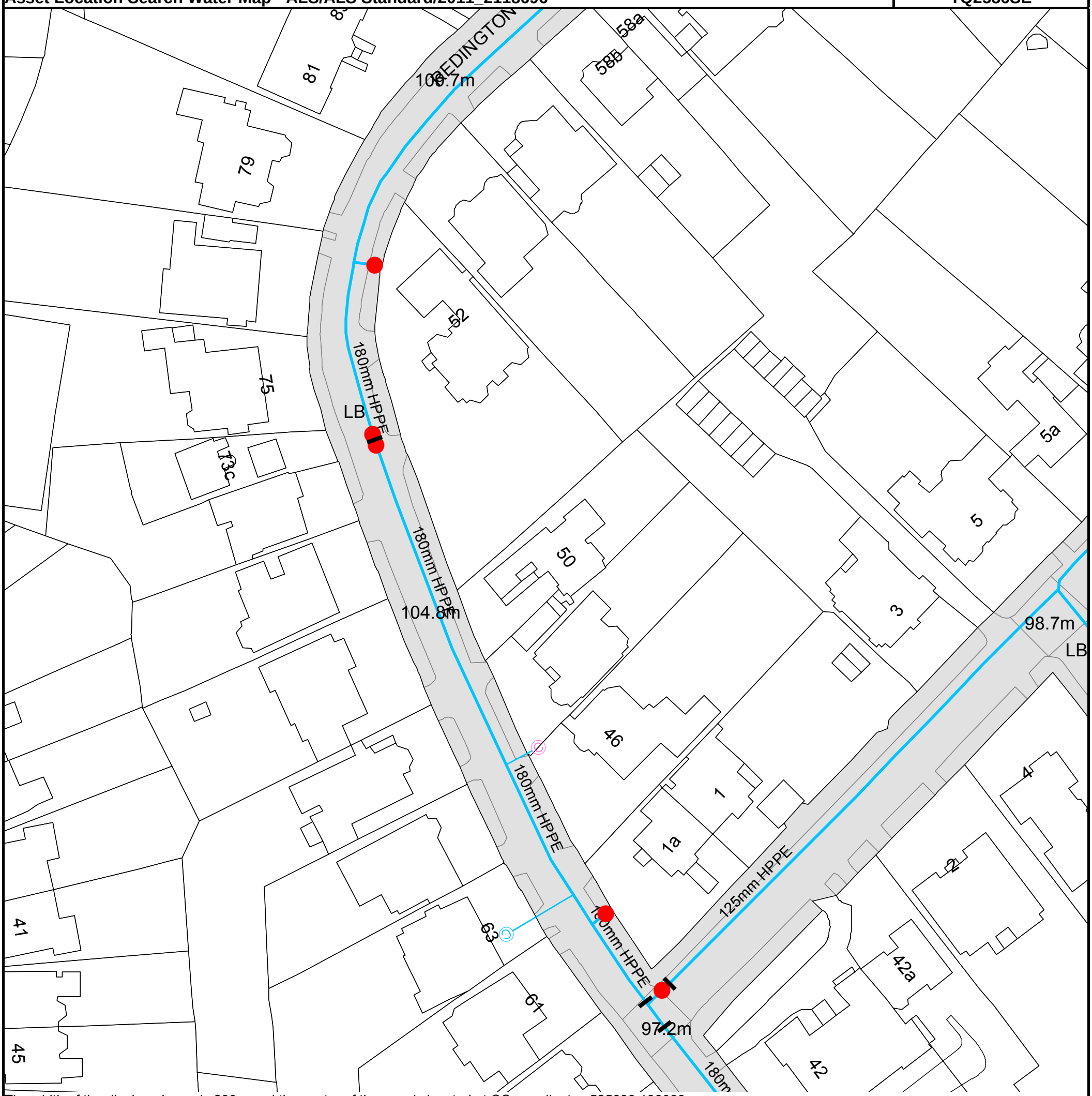
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.

4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.

5) 'na' or '0' on a manhole level indicates that data is unavailable.

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Searches on 0118 925 1504.

Asset Location Search Water Map - ALS/ALS Standard/2011_2118696	TQ2586SE



The width of the displayed area is 200m and the centre of the map is located at OS coordinates 525638,186083

ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"

Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

16"

Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

3" SUPPLY

Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

3" FIRE

Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

3" METERED

Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger

Other Water Pipes (Not Operated or Maintained by Thames Water)

Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

Private Main: Indiates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

Appendix D

London Borough of Camden's Surface Water Drainage Proforma

Advice Note on contents of a Surface Water Drainage Statement

London Borough of Camden

1. Introduction

1.1 The Government has strengthened planning policy on the provision of sustainable drainage and new consultation arrangements for 'major' planning applications will come into force from 6 April 2015 as defined in the Written Ministerial Statement (18th Dec 2014).

1.2 The new requirements make Lead Local Flood Authorises statutory consultees with respect to flood risk and SuDS for all major applications. Previously the Environment Agency had that statutory responsibility for sites above 1ha in flood zone 1.

1.3 Therefore all 'major' planning applications submitted from 6 April 2015 are required demonstrate compliance with this policy and we'd encourage this is shown in a **Surface Water Drainage Statement**.

1.4 The purpose of this advice note is to set out what information should be included in such statements.

2. Requirements

2.1 It is essential that the type of Sustainable Drainage System (SuDS) for a site, along with **details of its extent and position**, is identified within the planning application to clearly demonstrate that the proposed SuDS can be accommodated within the development.

2.2 It will now not be acceptable to leave the design of SuDs to a later stage to be dealt with by planning conditions.

2.3 The NPPF paragraph 103 requires that developments do not increase flood risk elsewhere, and gives priority to the use of SuDS. Major developments must include SuDS for the management of run-off, unless demonstrated to be inappropriate. The proposed minimum standards of operation must be appropriate and as such, a **maintenance plan** should be included within the Surface Water Drainage Statement,clearly demonstrating that the SuDS have been designed to ensure that the maintenance and operation requirements are economically proportionate Planning Practice Guidance suggests that this should be considered by reference to the costs that would be incurred by consumers for the use of an effective drainage system connecting directly to a public sewer.

2.4 Camden Council will use planning conditions or obligations to ensure that there are clear arrangements in place for ongoing maintenance over the lifetime of the development.

2.5 Within Camden, SuDS systems must be designed in accordance with London Plan policy 5.13. This requires that developments should utilise sustainable urban drainage systems (SUDS) unless there are practical reasons for not doing so, and should aim to achieve **greenfield run-off rates** and ensure that surface water run-off is managed as close to its source as possible in line with the following **drainage hierarchy**:

1 store rainwater for later use
2 use infiltration techniques, such as porous surfaces in non-clay areas
3 attenuate rainwater in ponds or open water features for gradual release
4 attenuate rainwater by storing in tanks or sealed water features for gradual release
5 discharge rainwater direct to a watercourse
6 discharge rainwater to a surface water sewer/drain
7 discharge rainwater to the combined sewer.

2.6 The hierarchy above seeks to ensure that surface water run-off is controlled as near to its source as possible to mimic natural drainage systems and retain water on or near to the site, in contrast to traditional drainage approaches, which tend to pipe water off-site as quickly as possible.

2.7 Before disposal of surface water to the public sewer is considered all other options set out in the drainage hierarchy should be exhausted. When no other practicable alternative exists to dispose of surface water other than the public sewer, the Water Company or its agents should confirm that there is adequate spare capacity in the existing system taking future development requirements into account.

2.8 Best practice guidance within the non-statutory technical standards for the design, maintenance and operation of sustainable drainage systems will also need to be followed. Runoff volumes from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the **greenfield runoff volume** for the same event.

2.9 Camden Development Policy 23 (Water) requires developments to reduce pressure on combined sewer network and the risk of flooding by limiting the rate of run-off through sustainable urban drainage systems. This policy also requires that developments in areas known to be at risk of surface water flooding are designed to cope with being flooded. Camden's SFRA surface water flood maps, updated SFRA figures 6 (LFRZs), and 4e (increased susceptibility to elevated groundwater) , as well as the Environment Agency updated flood maps for surface water (ufmfsw), should be referred to when determining whether developments are in an area at risk of flooding.

2.10 Camden Planning Guidance 3 (CPG3) requires developments to achieve a greenfield run off rate once SuDS have been installed. Where it can be demonstrated that this is not feasible, a minimum 50% reduction in run off rate across the development is required. Further guidance on how to reduce the risk of flooding can be found in CPG3 paragraphs 11.4-11.8.

2.11 Where an application is part of a larger site which already has planning permission it is essential that the new proposal does not compromise the drainage scheme already approved.

3. Further information and guidance

3.1 Applicants are strongly advised to discuss their proposals with the Lead Local Flood Authority at the pre-application stage to ensure that an acceptable SuDS scheme is submitted.

3.2 For general clarification of these requirements please Camden's Local Planning Authority or Lead Local Flood Authority

Surface Water Drainage Pro-forma for new developments

This pro-forma accompanies our advice note on surface water drainage. Developers should complete this form and submit it to the Local Planning Authority, referencing from where in their submission documents this information is taken. The pro-forma is supported by the Defra/EA guidance on Rainfall Runoff Management and uses the storage calculator on www.UKsuds.com. This pro-forma is based on current industry best practice and focuses on ensuring surface water drainage proposals meet national and local policy requirements. The pro-forma should be considered alongside other supporting SuDS Guidance.

1. Site Details

Site	50 Redington Road, London
Address & post code or LPA reference	NW3 7RS
Grid reference	TQ 25642 86083
Is the existing site developed or Greenfield?	Developed
Is the development in a LFRZ or in an area known to be at risk of surface or ground water flooding? If yes, please demonstrate how this is managed, in line with DP23?	the Site is located within a Critical Drainage Area (CDA)(Group3_010) but not located within a Local Flood Risk Zone (LFRZ). The EA shows a 'Very Low' Risk of pluvial flooding at the Site which is supported by Figure 3 iv of the SFRA which maps the Site within a Very Low pluvial flood risk area (URS Ltd, 2014). Site is considered to be at Negligible risk of groundwater flooding
Total Site Area served by drainage system (excluding open space) (Ha)*	0.0622 ha

***** The Greenfield runoff off rate from the development which is to be used for assessing the requirements for limiting discharge flow rates and attenuation storage from a site should be calculated for the area that forms the drainage network for the site whatever size of site and type of drainage technique. Please refer to the Rainfall Runoff Management document or CIRIA manual for detail on this.

2. Impermeable Area

	Existing	Proposed	Difference (Proposed-Existing)	Notes for developers
Impermeable area (ha)	407 m2	422 m2	+15 m^2	If the proposed amount of impermeable surface is greater, then runoff rates and volumes will increase. Section 6 must be filled in. If proposed impermeability is equal or less than existing, then section 6 can be skipped and section 7 filled in.
Drainage Method (infiltration/sewer/watercourse)	sewer	sewer	N/A	If different from the existing, please fill in section 3. If existing drainage is by infiltration and the proposed is not, discharge volumes may increase. Fill in section 6.

3. Proposing to Discharge Surface Water via

	Yes	No	Evidence that this is possible	Notes for developers
Existing and proposed MicroDrainage calculations	×		Calculations included within Table's 2, 3 and appendix B of GeoSmart SuDS Report 70589R1 using IH124 method	Please provide MicroDrainage calculations of existing and proposed run-off rates and volumes in accordance with a recognised methodology or the results of a full infiltration test (see line below) if infiltration is proposed.
Infiltration		×		e.g. soakage tests. Section 6 (infiltration) must be filled in if infiltration is proposed.
To watercourse		×		e.g. Is there a watercourse nearby?
To surface water sewer	✓		Thames Water Asset Location Plan obtained to show sewers, GeoSmart SuDS Report 70589R1 for Thames Water Pre-Development application	Confirmation from sewer provider that sufficient capacity exists for this connection.
Combination of above		×		e.g. part infiltration part discharge to sewer or watercourse. Provide evidence above.
Has the drainage proposal had regard to the SuDS hierarchy?	✓		See GeoSmart Report, reference 70589R1	Evidence must be provided to demonstrate that the proposed Sustainable Drainage strategy has had regard to the SuDS hierarchy as outlined in Section 2.5 above.
Layout plan showing where the sustainable drainage infrastructure will be located on site.	✓		See GeoSmart Report, reference 70589R1, Page 3.	Please provide plan reference numbers showing the details of the site layout showing where the sustainable drainage infrastructure will be located on the site. If the development is to be constructed in phases this should be shown on a separate plan and confirmation should be provided that the sustainable drainage proposal for each phase can be constructed and can operate independently and is not reliant on any later phase of development.

4. Peak Discharge Rates – This is the maximum flow rate at which storm water runoff leaves the site during a particular storm event.

	Existing Rates (l/s)	Proposed Rates (l/s)	Difference (l/s) (Proposed-Existing)	% Difference (difference /existing x 100)	Notes for developers
Greenfield QBAR	0.3	N/A	N/A	N/A	QBAR is approx. 1 in 2 storm event. Provide this if Section 6 (QBAR) is proposed.
1 in 1	0.6	0.6	0	0	Proposed discharge rates (with mitigation) should aim to be equivalent to greenfield rates for all corresponding storm events. As a minimum, peak discharge rates must be reduced by 50% from the existing sites for all corresponding rainfall events.
1 in 30	1.5	1.5	0	0	
1in 100	2.1	2.1	0	0	
1 in 100 plus climate change	N/A	2.8	0.7	+ 33%	The proposed 1 in 100 +CC peak discharge rate (with mitigation) should aim to be equivalent to greenfield rates. As a minimum, proposed 1 in 100 +CC peak discharge rate must be reduced by 50% from the existing 1 in 100 runoff rate sites.

5. Calculate additional volumes for storage –The total volume of water leaving the development site. New hard surfaces potentially restrict the amount of stormwater that can go to the ground, so this needs to be controlled so not to make flood risk worse to properties downstream.

	Greenfield runoff volume (m^3)	Existing Volume (m^3)	Proposed Volume (m^3)	Difference (m^3) (Proposed-Existing)	Notes for developers
1 in 1	7.9	13.6	13.9	0.2	Proposed discharge volumes (with mitigation) should be constrained to a value as close as is reasonably practicable to the greenfield runoff volume wherever practicable and as a minimum should be no greater than existing volumes for all corresponding storm events. Any increase in volume increases flood risk elsewhere. Where volumes are increased section 6 must be filled in.
1 in 30	18.9	32.8	33.4	0.6	
1in 100 6 hour	26.4	45.9	46.7	0.8	
1 in 100 6 hour plus climate change	N/A	59.67	60.8	14.8	The proposed 1 in 100 +CC discharge volume should be constrained to a value as close as is reasonably practicable to the greenfield runoff volume wherever practicable. As a minimum, to mitigate for climate change the proposed 1 in 100 +CC volume discharge from site must be no greater than the existing 1 in 100 storm event. If not, flood risk increases under climate change.

6. Calculate attenuation storage – Attenuation storage is provided to enable the rate of runoff from the site into the receiving watercourse to be limited to an acceptable rate to protect against erosion and flooding downstream. The attenuation storage volume is a function of the degree of development relative to the greenfield discharge rate.

		Notes for developers
Storage Attenuation volume (Flow rate control) required to meet greenfield run off rates (m^3)	$44m^3$ – not practical as discharge rate would be 0.3 l/s	Volume of water to attenuate on site if discharging at a greenfield run off rate. Can't be used where discharge volumes are increasing
Storage Attenuation volume (Flow rate control) required to reduce rates by 50% (m^3)	$30m^3$ – discharge rate would be 1.05 l/s	Volume of water to attenuate on site if discharging at a 50% reduction from existing rates. Can't be used where discharge volumes are increasing
Storage Attenuation volume (Flow rate control) required to meet [OTHER RUN OFF RATE (as close to greenfield rate as possible] (m^3)	$30m^3$ – discharge rate to 1 l/s. any lower would be a potential flood risk	Volume of water to attenuate on site if discharging at a rate different from the above – please state in 1st column what rate this volume corresponds to. On previously developed sites, runoff rates should not be more than three times the calculated greenfield rate. Can't be used where discharge volumes are increasing
Storage Attenuation volume (Flow rate control) required to retain rates as existing (m^3)	$21m^3$ – discharge rate to 2.1 l/s (1 in 100 year existing rate)	Volume of water to attenuate on site if discharging at existing rates. Can't be used where discharge volumes are increasing
Percentage of attenuation volume stored above ground,	0 – above ground features cannot be incorporated onto the Site as areas suitable for above ground features are elevated above impermeable areas so are unable to collect surface water run-off from the site without potential backflow along pipework.	Percentage of attenuation volume which will be held above ground in swales/ponds/basins/green roofs etc. If 0, please demonstrate why.

7. How is Storm Water stored on site?

Storage is required for the additional volume from site but also for holding back water to slow down the rate from the site. This is known as attenuation storage and long term storage. The idea is that the additional volume does not get into the watercourses, or if it does it is at an exceptionally low rate. You can either infiltrate the stored water back to ground, or if this isn't possible hold it back with on site storage. Firstly, can infiltration work on site?

			Notes for developers
Infiltration	**State the Site's Geology and known Source Protection Zones (SPZ)**	Bedrock – London Clay Formation Superficial deposits – N/A SPZ – N/A	Avoid infiltrating in made ground. Infiltration rates are highly variable and refer to Environment Agency website to identify and source protection zones (SPZ)
	Are infiltration rates suitable?	No	Infiltration rates should be no lower than $1x10^{-6}$ m/s.
	State the distance between a proposed infiltration device base and the ground water (GW) level	N/A	Need 1m (min) between the base of the infiltration device & the water table to protect Groundwater quality & ensure GW doesn't enter infiltration devices. Avoid infiltration where this isn't possible.

	Were infiltration rates obtained by desk study or infiltration test?	Desk Study - likely infiltration rate associated within the underlying geology is likely to be between 1 x 10^{-6} to 1 x 10^{-9} m/s[1].	Infiltration rates can be estimated from desk studies at most stages of the planning system if a back up attenuation scheme is provided..
	Is the site contaminated? If yes, consider advice from others on whether infiltration can happen.	No	Advice on contaminated Land in Camden can be found on our supporting documents webpage Water should not be infiltrated through land that is contaminated. The Environment Agency may provide bespoke advice in planning consultations for contaminated sites that should be considered.
In light of the above, is infiltration feasible?	**Yes/No? If the answer is No, please identify how the storm water will be stored prior to release**	No – surface water will be attenuated within Rainwater harvesting Butt and underground crate storage system prior to discharging to the sewer.	If infiltration is not feasible how will the additional volume be stored?. The applicant should then consider the following options in the next section.

Storage requirements

The developer must confirm that either of the two methods for dealing with the amount of water that needs to be stored on site.

Option 1 Simple – Store both the additional volume and attenuation volume in order to make a final discharge from site at the greenfield run off rate. This is preferred if no infiltration can be made on site. This very simply satisfies the runoff rates and volume criteria.

Option 2 Complex – If some of the additional volume of water can be infiltrated back into the ground, the remainder can be discharged at a very low rate of 2 l/sec/hectare. A combined storage calculation using the partial permissible rate of 2 l/sec/hectare and the attenuation rate used to slow the runoff from site.

[1] R.F. Craig (2002) Soil Mechanics. Table 2.1. Co-efficient of permeability (m/s) (BS 8004 : 1986); and Figure 20.17 (Pg 396) and Table 25.1 (Pg 546) within the CIRIA SuDS Manual, v.2 (C753) (2015).

		Notes for developers
Please confirm what option has been chosen and how much storage is required on site.	Attenuation for full discharge to combined sewer through underground storm cell attenuation crates (attenuation volume required: 34 m^3 with a discharge rate of 1 l/s to ensure surface water runoff is reduced to the greenfield volumes for the 1 in 100 year (6 hour) storm event, including a 30% allowance for climate change)	The developer at this stage should have an idea of the site characteristics and be able to explain what the storage requirements are on site and how it will be achieved.

8. Please confirm

		Notes for developers
Which Drainage Systems measures have been used, including	Rainwater harvesting butt and underground crate storage system	SUDS can be adapted for most situations even where infiltration isn't feasible e.g. impermeable liners beneath some SUDS devices allows treatment but not infiltration. See CIRIA SUDS Manual C697.
Drainage system can contain in the 1 in 30 storm event without flooding	Yes - system is designed to a 1 in 100 year plus 30% climate change allowance where discharge from the Site is limited to 1 l/s	This a requirement for sewers for adoption & is good practice even where drainage system is not adopted.
Will the drainage system contain the 1 in 100 +CC storm event? If no please demonstrate how buildings and utility plants will be	Yes - system is designed to a 1 in 100 year plus 30% climate change allowance where discharge from the Site is limited to 1 l/s	National standards require that the drainage system is designed so that flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.
Any flooding between the 1 in 30 & 1 in 100 plus climate change storm events will be safely contained on site.	Yes - system is designed to a 1 in 100 year plus 30% climate change allowance where discharge from the Site is limited to 1 l/s	**Safely:** not causing property flooding or posing a hazard to site users i.e. no deeper than 300mm on roads/footpaths. Flood waters must drain away at section 6 rates. Existing rates can be used where runoff volumes are not increased.
How will exceedance events be catered on site without increasing flood risks (both on site and outside the development)?	Exceedance flow into the nearby combined sewer. Two exceedance routes will be established on site – primary route is controlled to sewer by 1 l/s, second which will be utilized during blockage of primary route will be controlled to 5 l/s. Cannot have an exceedance route on site as topographic gradient declines towards towards the sewer system to the front of the development and exceedance route above the crate system will impact the proposed development and potentially cause internal flooding.	**Safely:** not causing property flooding or posing a hazard to site users i.e. no deeper than 300mm on roads/footpaths. Flood waters must drain away at section 6 rates. Existing rates can be used where runoff volumes are not increased. Exceedance events are defined as those larger than the 1 in 100 +CC event.

How are rates being restricted (vortex control, orifice etc)	Primary route – orifice Secondary route – hydrobrake Orifice control will have perforated raiser tube section with controls at each end would enable the control to function. A slightly different anti-clogging design would include debris guards, hooded outlets and orifices protected within T-pieces to reduce risk of blockage and flooding. Both control measures are included within the site management and maintenance plan	Detail of how the flow control systems have been designed to avoid pipe blockages and ease of maintenance should be provided.
Please confirm the owners/adopters of the entire drainage systems throughout	Mr Marcus Donn (owner)	If these are multiple owners then a drawing illustrating exactly what features will be within each owner's remit must be submitted with this Proforma.
How is the entire drainage system to be maintained?	See GeoSmart Report, reference 70589R1, Page 38 for full management and maintenance plan for the Site.	If the features are to be maintained directly by the owners as stated in answer to the above question please answer yes to this question and submit the relevant maintenance schedule for each feature. If it is to be maintained by others than above please give details of each feature and the maintenance schedule. Clear details of the maintenance proposals of all elements of the proposed drainage system must be provided. Details must demonstrate that maintenance and operation requirements are economically proportionate. Poorly maintained drainage can lead to increased flooding problems in the future.

9. Evidence Please identify where the details quoted in the sections above were taken from. i.e. Plans, reports etc. Please also provide relevant drawings that need to accompany your proforma, in particular exceedance routes and ownership and location of SuDS (maintenance access strips etc

Pro-forma Section	Document reference where details quoted above are taken from	Page Number
Section 2	70589R1	Various
Section 3	70589R1	Various
Section 4	70589R1	Various
Section 5	70589R1	Various
Section 6	70589R1	Various
Section 7	70589R1	Various
Section 8	70589R1	Various

The above form should be completed using evidence from the Flood Risk Assessment and site plans. It should serve as a summary sheet of the drainage proposals and should clearly show that the proposed rate and volume as a result of development will not be increasing. If there is an increase in rate or volume, the rate or volume section should be completed to set out how the additional rate/volume is being dealt with.

This form is completed using factual information from the Flood Risk Assessment and Site Plans and can be used as a summary of the surface water drainage strategy on this site.

Form Completed By; Bob Sargent
Qualification of person responsible for signing off this pro-forma: CSci, CEnv, CWEM, CIWEM

Company: GeoSmart Information
On behalf of (Client's details): Mr Marcus Donn
Date: 13/03/2018

Appendix E

Thames Water Pre-Development Enquiry Application

Sam Cogan

From: Sam Cogan
Sent: 07 March 2018 14:08
To: 'DEVELOPER.SERVICES@THAMESWATER.CO.UK'
Subject: pre development enquiry request (50 Redington Road, London, NW3 7RS)
Attachments: 70589__TW Asset Location Search.pdf; 70589__TW Foul Drainage Calculations.pdf; 70589_existing development plan_50 Redington Road.pdf; 70589_proposed development plan_50 Redington Road.pdf; 70589_Surface Water drainage calculations_50 Redington Road.pdf; 70589_Surface Water drainage calculations_CSD_50 Redington Road.pdf; 70589_TW_pre_dev_app_form_50 Redington Road.pdf

Good afternoon,

We would like to make an application for a Thames Water pre-development enquiry for 50 Redington Road, London, NW3 7RS.

Please find attached the relevant documents pertaining to the Site.

Can we have a confirmation of receipt of the application and please can you send the payment details asap.

Kind Regards

Sam

GeoSmart Information
Environmental Thinking

Sam Cogan
Flood Risk Consultant

t. +44 (0)1743 298 100
e. samcogan@geosmartinfo.co.uk
@geosmartinfo
www.geosmartinfo.co.uk

Update in
5 working days.

Thames Water

Mr S Cogan
Geo Smart Information Ltd
Suite 9-11, Old Bank Buildings
Bellstone
Shrewsbury
Shropshire
SY1 1HU

Our Ref number
DS6045715

Developer.services@thameswater.co.uk

0800 009 3921

Mon – Fri 9am-5pm,

20/03/2018

Pre Development Enquiry

Site Address: 50 Redington rd London NW3 7RS

Site details: as per Pre dev application dated 7th March 18' (1 Residential unit)

Dear Mr Cogan

I write in relation to the above site and your Pre Development application regarding the proposed development. We have completed the assessment and review of your application, in relation to the sewer capacity within the existing TW sewer network.

Foul Water

From the information you have provided, we can confirm that the existing TW sewer network have sufficient capacity to accommodate the proposed foul water discharge from the development. .

Surface Water

Surface Water :-

Please note that discharging surface water to the public sewer network should only be considered after all other methods of disposal have been investigated and proven to not be viable. In accordance with the Building Act 2000 Clause H3.3, positive connection to a public sewer will only be consented when it can be demonstrated that the hierarchy of disposal methods have been examined and proven to be impracticable. The disposal hierarchy being: 1st Soakaways; 2nd Watercourses; or any other SUDS techniques 3rd Sewers

Only when it can be proven that soakage into the ground or a connection into the adjacent watercourse is not possible would we consider a restricted discharge into the public surface water sewer network.

We would encourage techniques such as green roofs and/or permeable paving that restricts surface water discharge from your site.

When redeveloping an existing site, policy 5.13 of the London Plan and Policy 3.4 of the Supplementary Planning Guidance (Sustainable Design And Construction) states that every attempt should be made to use flow attenuation and SUDS/storage to reduce the surface water discharge from the site as much as possible.

If they are consulted as part of any planning application, Thames Water Planning team would ask to see why it is not practicable to attenuate the flows to Greenfield run-off rates i.e. 5l/s/hectare of the total site area or if the site is less than hectare in size then the flows should be reduced by 95% of existing flows. Should the policy above be followed, we would envisage no capacity concerns with regards to surface water for this site.

Please note that the Local Planning authority may comment on surface water discharge under the planning process.

Surface water discharges should ideally go to soakaways / infiltration basins / watercourses (if any present in area). **If it can be illustrated that none of the above are feasible then surface water discharges should be stored on site and attenuated, to the satisfaction of the local authority stipulation. To this end you have to liaise with the local authority and discuss their criteria regarding surface water discharges in that area and adhere to their stipulation**.

At no account should the foul flows be discharged to TW Surfacewater sewers

Also at no account should the surfacewater flows be discharged to TW Foul sewer network.

Please Note

All connection requests are subject to a full Section 106 (Water Industry Act 1991) application before the Company can confirm approval to the connection itself. Please also note that capacity in the public sewerage system cannot be reserved.

Note on trunk sewers: Connecting directly to Trunk sewers can be complex and dangerous, which means we often refuse permission. In this case, you will need to find an alternative sewer

or method of discharge. Please contact the Sewer Connections team through our Helpdesk on 0800 009 39 21 for further information.

If Thames Water permits a connection to the trunk sewer, we will insist on carrying out the connection ourselves under Section 107 of the Water Industry Act. We would advise for you to apply as soon as possible.

The discharge of non-domestic effluent is not permitted until a valid trade effluent consent has been issued by Thames Water. If anything other than domestic sewage is discharged into the public sewers without the above agreement an offence is committed and the applicant will be liable to the penalties contained in Section 109(1) (WIA 1991).

Applicants should contact Trade Effluent prior to seeking a connection approval, to discuss trade effluent consent and conditions of discharge. A Trade Effluent reference number should be obtained and included in the relevant box of the attached application form. The address for Trade Effluent is - Thames Water Utilities Limited, Waste Water Quality, Crossness Sewage Treatment Works, Belvedere Road, Abbeywood, London. SE2 9AQ. Alternatively you can telephone them on 020 8507 4321

Please note that the views expressed by Thames Water in this letter are in response to this pre development enquiry at this time and do not represent our final views on any future planning applications made in relation to this site.

We reserve the right to change our position in relation to any such planning applications.

If you have any further queries then please do not hesitate to contact me, on siva.sivarajan@thameswater.co.uk

Yours sincerely,

Siva Sivarajan

Developer Services- Senior Adoptions Engineer

Office:0203 577 7752

siva.sivarajan@thameswater.co.uk

Thames Water Utilities Ltd, Clearwater Court, Vastern Road, Reading, Berkshire, RG1 8DB

Thames Water

WATER INDUSTRY ACHIEVEMENT AWARDS 2017 FINALIST

DS6045715 DTS57485

Application for a pre-development enquiry

Application form

You can go to our website **thameswater.co.uk/buildover** and apply online or complete this form and return to Thames Water, Developer Services, Clearwater Court, Vastern Road, Reading RG1 8DB

Guidance notes

Pre development enquiries are designed to aid developers and their consultants in understanding the impact of their proposed development on Thames Water sewerage network.

You may also use this application form to enable early discussion/meeting on planning issues such as Flood Risk Assessments, capacity checks, drainage strategies and pre S104 application layouts.

Once we have received your appliation Thames Water will undertake a simple desktop study to determine your sites impact on our network and identify if any detailed further analysis or modelling is required.

Please note, that all relevant sections of the application must be fully completed, as insufficient information will result in your application being returned to you, which will result in your response being delayed.

Applicant Details

Please provide the full name, address and contact details of the person or company making the Pre-development enquiry.
All applications must be paid for prior to any response being answered. Please send your cheque, with the amount (including VAT), to Thames Water Limited with the accompanying fully completed application to:
Thames Water
Developer Services
Clearwater Court
Vastern Road
Reading
Berkshire RG1 8DB

Development site details

The site must hold a comprehensive address, scaled location plan and site layout (if available) which will assist in determining the location of proposed connection points.
A 12 figure grid reference highlighting the centre point of the site will also be helpful to us if an address is difficult to determine.
The type, number of units and size of the development will assist us.

We require information on the history of the site, therefore, if the site is Brownfield ie. land identified for redevelopment, then please let us know if the site has sewerage connections and what was previously occupying the site.

Proposed development and flows

Please indicate the proposed discharge rates for surface water and foul discharge in litres per second (l/s).

Checklist and declartion

Ensure that you have fully completed all relevant sections of the application. Please print your name, sign and date the application form and enclose:

- a scaled location plan
- a scaled site layout
- payment of the required fee of £398 + VAT

What happens next?

- Once we have received your fully completed application form we will provide you with the following response to your application:
- A preliminary assessment of any restrictions and potential connection points to the existing sewerage network.
- A preliminary assessment of any reinforcement works that will be required to service the development.
- Details of any protective measures for sewerage assets which may require diversion or easements.

We will endeavor to respond to you within 15 working days of receipt of your application providing it is not necessary to carry out further investigation works.

If further analysis is required, involving detailed modelling and site investigation (depth loggers, rain gauges or flow monitors) we are able to provide you with a scope, estimated cost and timeframe for undertaking a formal impact study for the price of £400 + VAT. Once completed this study would include a full report detailing the impact and recommendations/network improvements required to alleviate any increased flood risk.

Application for a pre-development enquiry

Please complete all sections of this form in BLOCK CAPITALS

About the person applying

This is the person we'll contact about the application and will recieve all correspondence. This can be the property owner or someone acting on their behalf.

Are you applying as? An individual ☐ or A company ☑

'An individual' is a homeowner and 'A company' is an agent/architect/builder etc acting on behalf of the homeowner

Company name GeoSmart Information Limited

Title Mr ☐ Mrs ☐ Ms ☐ Miss ☑ Dr. ☐ Other:

First name(s) Sam

Last name Cogan

Applicant contact details

We'll use these details to get in touch with you about your application.

Preferred contact number 01743 298 095

Alternative number 01743 298 095

Email address samcogan@geosmartinfo.co.uk

Full postal address

Address line 1: Suite 9-11

Address line 2: Old Bank Buildings, Bellstone

Town: Shrewsbury

County: Shropshire Postcode: SY1 1HU

Nominated contact

Who should we contact to process your application? Applicant ☑ Someone else ☐

(Please tick one)

If someone else:

Title Mr ☐ Mrs ☐ Ms ☐ Miss ☐ Dr. ☐ Other:

First name(s)

Continued...

Last name

Preferred contact number

Alternative number

Email address

Full postal address

Address line 1:

Address line 2:

Town:

County: Postcode:

Invoices

Who should we send invoices to? Applicant ☑ Nominated contact ☐ Someone else ☐

If someone else:

Title Mr ☐ Mrs ☐ Ms ☐ Miss ☐ Dr. ☐ Other:

First name(s)

Last name

Full postal address

Address line 1:

Address line 2:

Town:

County: Postcode:

Email address

Where the work is taking place

What is the address of the property being connected? Same as applicant ☐ Same as the nominated contact ☐ Somewhere else ☑

If somewhere else:

Site name 50 Redington Road,

Continued...

Full postal address

Address line 1: 50 Redington Road,

Address line 2:

Town: London

County: Postcode: NW3 7RS

About the site

What is your local authority? London Borough of Hillingdon

Ordance survey grid ref 525640 186083

What is the site currently used for? Greenfield/agricultural ☐ Industry ☐ Housing ☑ Landfill ☐ Other ☐

Site is currently a four bedroom residential house

VAT development classification

New build house or flat ☐ Relevant residential or charitable ☐

Commercial, existing or other ☐ Listed ☐ Conversion ☐ Mixed ☐

Location of existing connection

Does the site already have any of these sewerage connections?

Foul water Yes ☑ No ☐

If yes:

Current discharge rate 0.003 Litres per second

Size of existing site 1 unit. The Site is 0.064 hectares Number of units/hectares

Location of existing connection? Existing combined water sewer within Redington Road to the west of the Site.

Surface water Yes ☑ No ☐

If yes:

Current discharge rate 2.1 Litres per second

Size of existing site 1 unit. The Site is 0.064 hectares Number of units/hectares

Location of existing connection? Existing combined water sewer within Redington Road to the west of the Site.

Your proposed development

Type of development

Greenfield/agricultural ☐ Industry ☐ Housing ☑ Landfill ☐ Mixed ☐

Preferred foul water connection point

Existing combined water sewer within Redington Road to the west of the Site. Foul sewer flow will not increase

Preferred surface water connection point

Existing combined water sewer within Redington Road to the west of the Site

Size of proposed development

1 unit. The Site is 0.064 hectares Number of units/hectares

Proposed foul water discharge rate

0.003 Litres per second

Proposed surface water discharge rate

5 l/s (but upstream attenuation will be provided for a 1-2 l/s discharge rate. Litres per second

How will development flows reach the connection point?

Pumped ☐ Gravity ☑

Trade effluent agreement required?

Yes ☐ No ☐ Don't know ☑

If Yes, Trade effluent reference number

Planning status

Is the development identified in the local plan?

Yes ☐ No ☐ Don't know ☑ If Yes, reference number

Does the development have outlined planning permission?

Yes ☐ No ☑ Don't know ☐ If Yes, reference number

Does the development have full planning permission?

Yes ☐ No ☑ Don't know ☐ If Yes, reference number

Does the development have building regulation permission?

Yes ☐ No ☐ Don't know ☑

Enclose your documents

All drawings must be of suitable detail and have a drawing reference number on them.

What we need from you to process your application:

Site plan	This should show the site with nearby buidlings, roads and any sewers.
Development plan	This should show propsed layout of new development buildings, roads and sewers.
Site drainage plan	This should show all propsed sewers, pipe sizes and gradients.

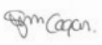
Checklist and Declaration

I have completed the application form and enclose the following information:

- Application fee of £398 + VAT
- A scaled location plan ie. site plans showing existing and proposed layouts.
- The development site drainage plan.

Declaration

I agree, that for the purpsoses of the Water Industry Act 2003 and the Data Protection Act 1998, the information provided in this form and in any accompanying documents, may be held on a computer and processed by Thames Water Ltd and its servants and agents for all purposes connected with the Company's statutory water and sewerage undertakings.

Print name	Sam Cogan
Position within company	Consultant
Company	GeoSmart Information Ltd
Date	07/03/2018
Signature	

Enclosed:

1. Site Location Plan
2. Development Plan
3. Asset Location Plan
4. SuDSmart Pro surface water calculations
5. Summary Foul Calculation Sheet

Getting in touch with us

For enquiries regarding this application or any other questions relating to your building or development work please contact us on:

thameswater.co.uk/developerservices

developer.services@thameswater.co.uk

0800 009 3921
Monday - Friday 8.00am-5.00pm

Thames Water, Developer Services, Clearwater Court, Vastern Road, Reading, Berkshire RG1 8DB

If you have any other questions for Thames Water

thameswater.co.uk

0800 980 8800

- Queries relating to your bill
- Change of address
- Meter readings

Minicom service if you are deaf or hard of hearing 0800 316 6899

0800 316 9800

- For emergencies
- Other non-billing enquiries
- Literature

Minicom service if you are deaf or hard of hearing 0800 316 9898

To contact us from abroad +44 1793 366011

Thames Water, PO Box 286, Swindon, SN38 2RA

This leaflet can be supplied in braille or audio-tape upon request.

12961I 04/15

Asset Location Search

Thames Water Property Searches
12 Vastern Road
READING
RG1 8DB

Search address supplied

50
Redington Road
London
NW3 7RS

Your reference P2092 50 Redington Road
Our reference ALS/ALS Standard/2011_2118696

Search date 8 November 2011

You are now able to order your Asset Location Search requests online by visiting
www.thameswater-propertysearches.co.uk

Thames Water Utilities Ltd

Property Searches
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

T 0118 925 1504
F 0118 923 6655/57
E searches@thameswater.co.uk
I www.thameswater-propertysearches.co.uk

Registered in England and Wales
No. 2366661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB

Asset Location Search

Search address supplied: 50, Redington Road, London, NW3 7RS

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

This search provides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0118 925 1504, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Tel: 0118 925 1504
Fax: 0118 923 6657

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

Thames Water Utilities Ltd

Property Searches
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

T 0118 925 1504
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Registered in England and Wales
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Clearwater Court, Vastern Road
Reading RG1 8DB

Asset Location Search

Waste Water Services

Please provide a copy extract from the public sewer map.

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an ‘as constructed’ record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

Enclosed is a map showing the approximate positions of our water mains and associated apparatus. Please note that records are not kept of the positions of individual domestic supplies.

For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer Centre on 0845 920 0800. The Customer Centre can

Thames Water Utilities Ltd

Property Searches
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

T 0118 925 1504
F 0118 923 6655/57
E searches@thameswater.co.uk
I www.thameswater-propertysearches.co.uk

Registered in England and Wales
No. 2366661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB

also arrange for a full flow and pressure test to be carried out for a fee.

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Payment for this Search

A charge will be added to your suppliers account.

Thames Water Utilities Ltd

Property Searches
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

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F 0118 923 6655/57
E searches@thameswater.co.uk
I www.thameswater-propertysearches.co.uk

Registered in England and Wales
No. 2366661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB

Asset Location Search

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clear Water Court
Vastern Road
Reading
RG1 8DB

Tel: 0845 850 2777
Fax: 0118 923 6613
Email: developer.services@thameswater.co.uk

Should you require any further information regarding budget estimates, diversions or stopping up notices then please contact:

DevCon Team
Asset Investment
Thames Water
Maple Lodge STW
Denham Way
Rickmansworth
Hertfordshire
WD3 9SQ

Tel: 01923 898 072
Fax: 01923 898 106
Email: devcon.team@thameswater.co.uk

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I www.thameswater-propertysearches.co.uk

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No. 2366661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB

Asset Location Search

Clean Water queries

Should you require any advice concerning clean water operational issues or clean water connections, please contact our Kew Service Desk by writing to:

Clean Water Design
Thames Water Utilities
1 Kew Bridge Road
Brentford
Middlesex
TW8 0EF

Tel: 0845 850 2777
Fax: 0208 213 8833
Email: developer.services@thameswater.co.uk

Thames Water Utilities Ltd

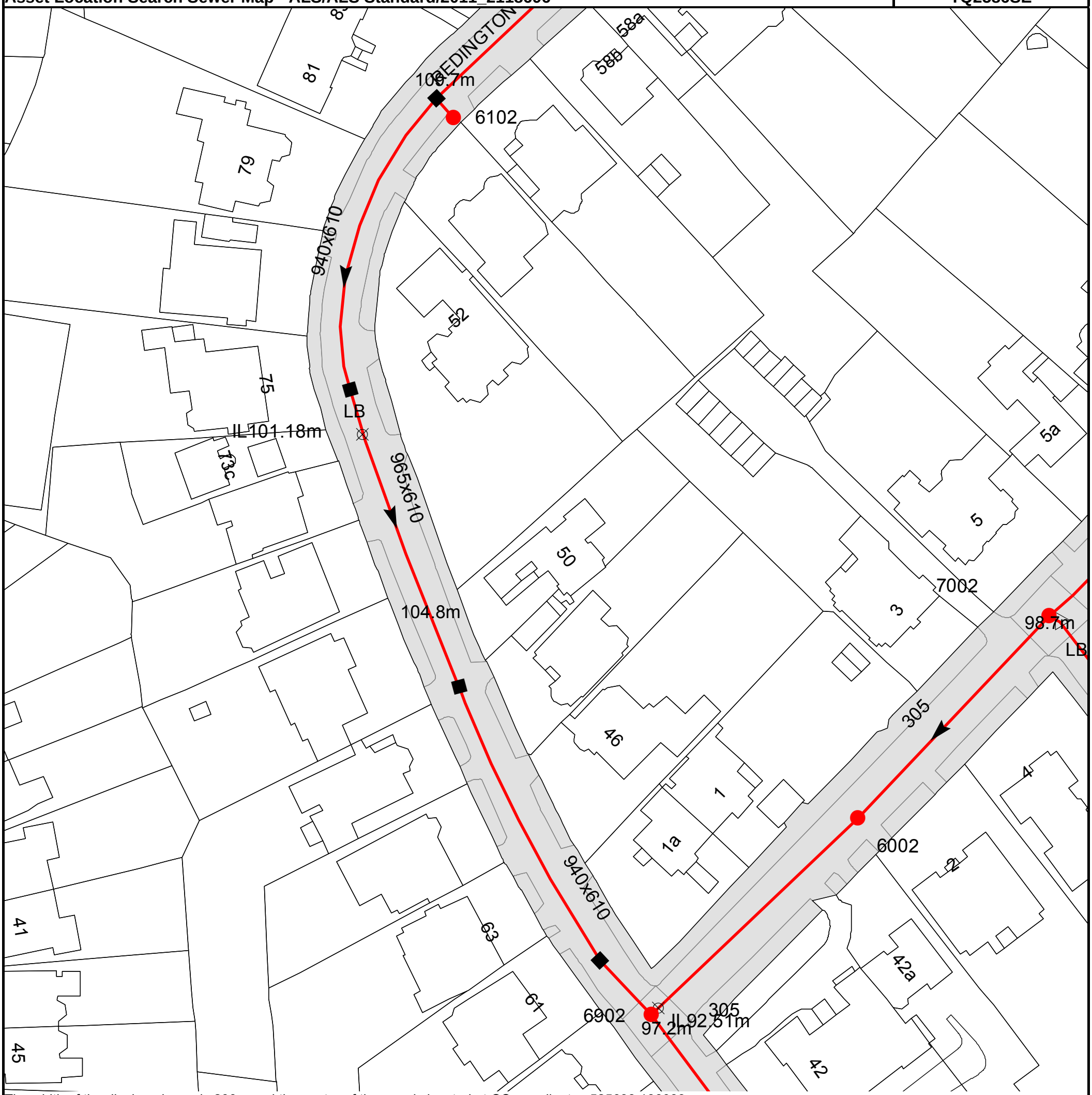
Property Searches
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

T 0118 925 1504
F 0118 923 6655/57
E searches@thameswater.co.uk
I www.thameswater-propertysearches.co.uk

Registered in England and Wales
No. 2366661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB

Asset Location Search Sewer Map - ALS/ALS Standard/2011_2118696	TQ2586SE



The width of the displayed area is 200m and the centre of the map is located at OS coordinates 525638,186083

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
7002	99.08	94.25
6102	n/a	n/a
6902	97.3	91.98
-	-	-
6002	98.22	93.36

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

Control Valve

Drop Pipe

Ancillary

Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

Outfall

Undefined End

Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.

2) All measurements on the plans are metric.

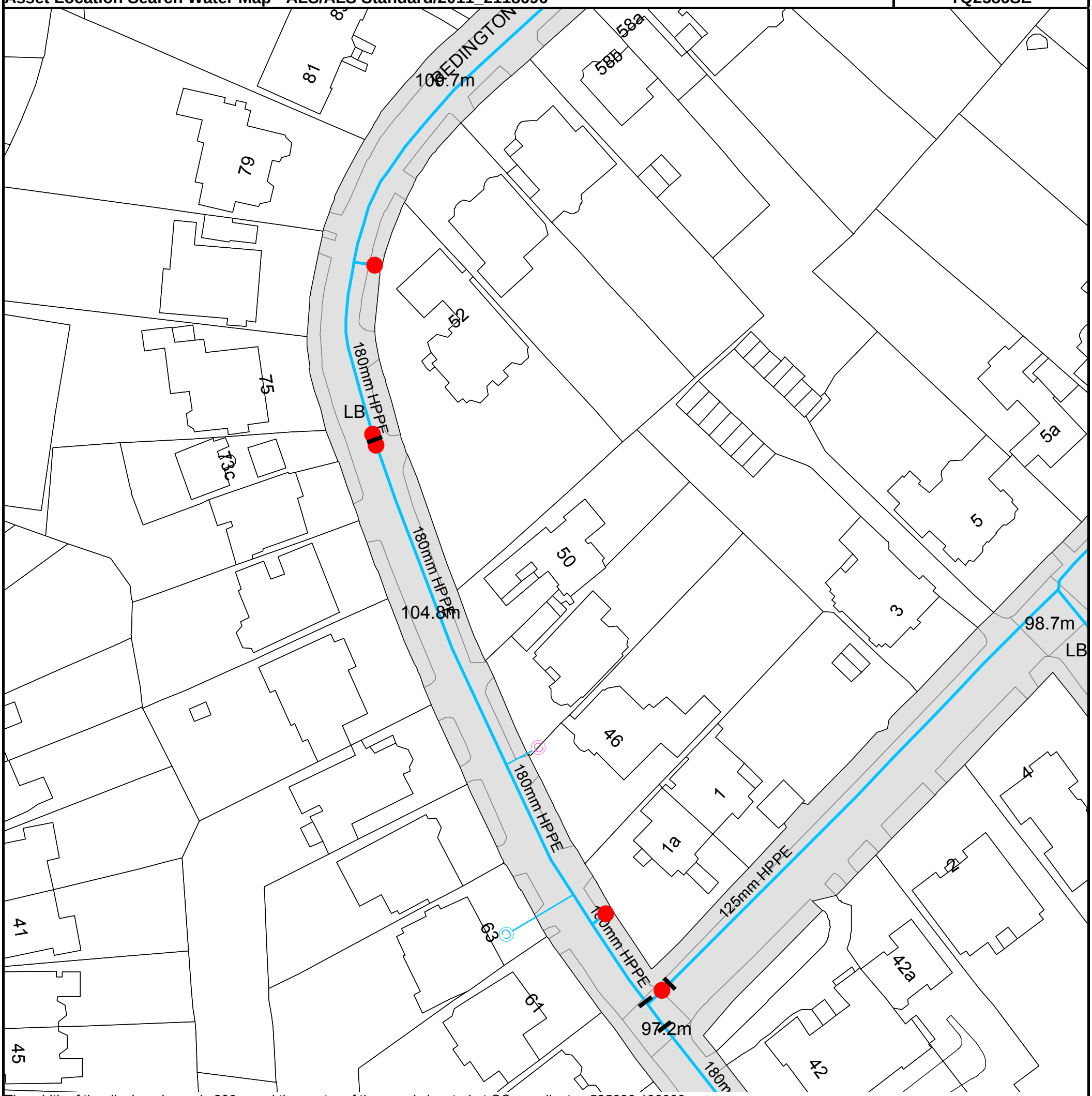
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.

4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.

5) 'na' or '0' on a manhole level indicates that data is unavailable.

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Searches on 0118 925 1504.

Asset Location Search Water Map - ALS/ALS Standard/2011_2118696	TQ2586SE



The width of the displayed area is 200m and the centre of the map is located at OS coordinates 525638,186083

ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"

Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

16"

Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

3" SUPPLY

Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

3" FIRE

Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

3" METERED

Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger

Other Water Pipes (Not Operated or Maintained by Thames Water)

Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

Private Main: Indiates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

Property Type	No of Existing	No of Proposed
General Housing (per property - existing 2 persons, proposed 2 persons)*	1	1
Flat (per property - 2 persons)		
Primary School (per pupil)		
Senior School (per pupil)		
Boarding School (per pupil)		
Assembly Hall (per seat)		
Cinema (per seat)		
Sports Hall (per person)		
Hotel (per room)		
Guest House (per room)		
Motel (per room)		
Holiday Apartment (per person)		
Leisure Park (per person)		
Caravan Park standard (per space)		
Caravan Site serviced (per space)		
Camping site standard (per space)		
Camping site serviced (per space)		
Public House (per seat)		
Restaurant/Day Care Centre (per person)		
Drive in restaurant (per seat)		
Hospital (per bed)		
Nursing/Care Home (per bed)		
Offices (per m sq)		
Shopping Centre (per m sq)		
Warehouse (per m sq)		
Commercial premises (per m sq)		
Manufacturing unit (per m sq)		
Other (Please state units and description)		

One four bedroom house to one eight bedroom house*

Existing	Flow rate (l/p/d)	Flow (l/d/pd)	Flow (l/s)
General Housing (per property - 2 persons)	150	300	0.003
Existing TOTAL	150	300	0.003
Proposed	**Flow rate (l/p/d)**	**Flow (l/d/pd)**	**Flow (l/s)**
General Housing (per property - 2 persons)	150	300	0.003
Proposed TOTAL	150	300	0.003

*British Water sizing criteria (5 people per 3 bed unit and 1
additional person for each room.

**CIRIA PR72 and British Water Code of Practice (Flows and Loads – 4) Sizing Criteria, Treatment Capacity for Sewage Treatment Systems has been used as a guide to quantify foul flow per person per day and the flow in litres per second.

Greenfield Site Run-Off Calculations usng the IoH124 method

Greenfield peak run-off rate (QBAR):

Parameters	Input	Units	Comments
Area	50	ha	mimimum 50ha
SAAR	664	mm	FEH CD ROM (NERC, 2009)
SPR	0.47	N/A	Soil run-off coefficient
Region	6	N/A	Region on Hydrological area map

QBAR

$$Q_{BAR(rural)} = 1.08AREA^{0.89}SAAR^{1.17}SPR^{2.17}$$

Where:

$Q_{BAR(rural)}$	is the mean annual flood (a return period of 2.3 years) in l/s
AREA	is the area of the catchment in km² (minimum of 0.5km²)
SAAR	is the standard average rainfall for the period 1941 to 1970 in mm
SPR	is the soil run-off coefficient

$Q_{BAR(rural)}$ can be factored by the UK Flood Studies Report regional growth curves to produce peak flood flows for any return period.

$Q_{BAR(rural)}$	=	226.93	l/s for 50ha site
Divided by 50 to scale down	=	4.54	l/s/ha
Actual Area of the entire Site	=	0.06	ha

Return Periods (Growth curves obtained from DEFRA report)

Return Period		Growth Factor	l/s/ha	Peak site run-off rate (l/s)
1	**$Q_{BAR(rural)}$ x**	**0.85**	**3.86**	**0.241**
2	$Q_{BAR(rural)}$ x	0.88	3.99	0.25
5	$Q_{BAR(rural)}$ x	1.28	5.81	0.36
10	$Q_{BAR(rural)}$ x	1.62	7.35	0.46
25	$Q_{BAR(rural)}$ x	2.14	9.71	0.61
30	**$Q_{BAR(rural)}$ x**	**2.24**	**10.17**	**0.634**
50	$Q_{BAR(rural)}$ x	2.62	11.89	0.74
100	**$Q_{BAR(rural)}$ x**	**3.19**	**14.48**	**0.90**
200	$Q_{BAR(rural)}$ x	3.86	17.52	1.09

Greenfield total run-off volume:

= actual area of the entire site x SPR x 6 hour rainfall depth

Return Period	6 hour rainfall (mm) from FEH CD-ROM	Area (ha)	SPR	Total run-off (m^3)
2.3 (QBAR)	28.94	0.06	0.47	8.5
1	26.86	0.06	0.47	7.9
10	48.12	0.06	0.47	14.1
30	64.58	0.06	0.47	18.9
100	90.43	0.06	0.47	26.5

Summary

Entire site area:	0.062	ha		
Climate Change Factor	30%			
	Current		*Proposed*	
Permeable Surface (ha)	0.022		0.020	
Impermeable Surface (ha)	0.041		0.042	

1 in 1 year

Greenfield run-off volume total:	7.88	m^3		
RUN-OFF During a 1 in 1 year 6 hour event:	**Greenfield Site**	**Current Development**	**Proposed Development**	**Proposed Development +CC**
From permeable surfaces (using GF total run-off) (m^3)	7.88	2.76	2.55	3.32
From impermeable surfaces (m^3)		10.88	11.33	14.74
TOTAL run-off produced from Site (m^3)	7.88	13.64	13.89	18.05

Difference between greenfield site and proposed +cc development (m^3):	**10.17**
	129%
Difference between current and proposed +cc development (m^3):	**4.41**
	32%
Peak Greenfield run-off rate that must not be exceeded in the run-off from the proposed development (l/s):	**0.24**

1 in 10 year

Greenfield run-off volume total:	14.11	m^3		
RUN-OFF During a 1 in 1 year 6 hour event:	**Greenfield Site**	**Current Development**	**Proposed Development**	**Proposed Development +CC**
From permeable surfaces (using GF total run-off) (m^3)	14.11	4.95	4.57	5.94
From impermeable surfaces (m^3)		18.95	19.74	25.66
TOTAL run-off produced from Site (m^3)	14.11	23.90	24.31	31.60

Difference between greenfield site and proposed +cc development (m^3):	**17.49**
	124%
Difference between current and proposed +cc development (m^3):	**7.70**
	32%
Peak Greenfield run-off rate that must not be exceeded in the run-off from the proposed development (l/s):	**0.46**

1 in 30 year

Greenfield run-off volume total:	18.94	m^3		
RUN-OFF During a 1 in 30 year 6 hour event:	**Greenfield Site**	**Current Development**	**Proposed Development**	**Proposed Development +CC**
From permeable surfaces (using GF total run-off) (m^3)	18.94	6.65	6.13	7.97
From impermeable surfaces (m^3)		26.15	27.25	35.43
TOTAL run-off produced from Site (m^3)	18.94	32.80	33.38	43.40

Difference between greenfield site and proposed +cc development (m^3):	**24.46**
	129%
Difference between current and proposed +cc development (m^3):	**10.60**
	32%
Peak Greenfield run-off rate that must not be exceeded in the run-off from the proposed development (l/s):	**0.63**

1 in 100 year

Greenfield run-off volume total:	26.52	m^3		
RUN-OFF During a 1 in 100 year 6 hour event:	**Greenfield Site**	**Current Development**	**Proposed Development**	**Proposed Development +CC**
From permeable surfaces (using GF total run-off) (m^3)	26.52	9.31	8.59	11.16
From impermeable surfaces (m^3)		36.62	38.16	49.61
TOTAL run-off produced from Site (m^3)	26.52	45.93	46.75	60.77

Difference between greenfield site and proposed +cc development (m^3):	**34.25**
	129%
Difference between current and proposed +cc development (m^3):	**14.84**
	32%
Peak Greenfield run-off rate that must not be exceeded in the run-off from the proposed development (l/s):	**0.90**

Critical Storm Duration and volume requirements

The table below presents storage volumes for the 1 in 100 year plus climate change (40%) used to assess the impact of the proposed development and calculate the required storage volumes for the critical storm duration for attenuation features, limited to a maximum discharge rate of 5 l/s (requested run-off rate with Thames Water).

Table 5: Critical Storm Durations and storage requirements associated with the development

Rainfall event duration (Hours)	Outflow to 5 l/s (m^3)	Inflow from impermeable surfaces (m^3)	Storage Required for Critical Storm Duration (m^3)
0.25	4.50	17.90	13.40
0.5	9.00	22.98	13.98
0.75	13.50	25.95	12.45
1	18.00	28.06	10.06
2	36.00	36.11	0.11
3	54.00	41.22	0

Critical Storm Duration and volume requirements

The table below presents storage volumes for the 1 in 100 year plus climate change (40%) used to assess the impact of the proposed development and calculate the required storage volumes for the critical storm duration for attenuation features, limited to a maximum discharge rate of 1 l/s.

Table 5: Critical Storm Durations and storage requirements associated with the development

Rainfall event duration (Hours)	Outflow to 1 l/s (m^3)	Inflow from impermeable surfaces (m^3)	Storage Required for Critical Storm Duration (m^3)
0.25	0.90	17.90	17.00
0.5	1.80	22.98	21.18
0.75	2.70	25.95	23.25
1	3.60	28.06	24.46
2	7.20	36.11	28.91
3	10.80	41.22	30.42
4	14.40	44.84	30.44
5	18.00	47.54	29.54
6	21.60	49.61	28.01
8	28.80	52.46	23.66
10	36.00	54.43	18.43
12	43.20	55.91	12.71
16	57.60	58.05	0.45
20	72.00	59.48	0