Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	90.885	0.185	7.7	118.6	Flood Risk
120 min Winter	90.900	0.200	8.1	128.1	Flood Risk
180 min Winter	90.902	0.202	8.1	129.2	Flood Risk
240 min Winter	90.901	0.201	8.1	128.7	Flood Risk
360 min Winter	90.895	0.195	7.9	124.5	Flood Risk
480 min Winter	90.886	0.186	7.7	119.3	Flood Risk
600 min Winter	90.878	0.178	7.5	113.8	Flood Risk
720 min Winter	90.869	0.169	7.2	108.4	Flood Risk
960 min Winter	90.854	0.154	6.7	98.8	Flood Risk
1440 min Winter	90.833	0.133	5.8	85.3	Flood Risk
2160 min Winter	90.813	0.113	4.5	72.6	Flood Risk
2880 min Winter	90.800	0.100	3.8	64.2	Flood Risk
4320 min Winter	90.784	0.084	2.8	53.7	Flood Risk
5760 min Winter	90.772	0.072	2.2	46.3	Flood Risk
7200 min Winter	90.764	0.064	1.9	41.1	Flood Risk
8640 min Winter	90.759	0.059	1.7	37.6	Flood Risk
10080 min Winter	90.755	0.055	1.5	35.4	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	56.713	0.0	127.9	60
120 min Winter	33.722	0.0	152.8	114
180 min Winter	24.576	0.0	167.3	144
240 min Winter	19.534	0.0	177.5	182
360 min Winter	14.061	0.0	191.9	256
480 min Winter	11.142	0.0	202.9	328
600 min Winter	9.297	0.0	211.6	398
720 min Winter	8.015	0.0	218.9	468
960 min Winter	6.338	0.0	230.6	596
1440 min Winter	4.546	0.0	247.1	850
2160 min Winter	3.257	0.0	270.6	1228
2880 min Winter	2.568	0.0	284.1	1588
4320 min Winter	1.836	0.0	302.5	2336
5760 min Winter	1.445	0.0	322.1	3104
7200 min Winter	1.200	0.0	333.9	3816
8640 min Winter	1.031	0.0	343.4	4496
10080 min Winter	0.906	0.0	350.6	5240

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.950
Region	England and Wales	Cv (Winter)	0.950
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.439	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.245

Time From:	(mins) To:	Area (ha)
0	4	0.245

Time Area Diagram

Total Area (ha) 0.001

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000	32	36	0.000	64	68	0.000	96	100	0.000
4	8	0.000	36	40	0.000	68	72	0.000	100	104	0.000
8	12	0.000	40	44	0.000	72	76	0.000	104	108	0.000
12	16	0.000	44	48	0.000	76	80	0.000	108	112	0.000
16	20	0.000	48	52	0.000	80	84	0.000	112	116	0.000
20	24	0.000	52	56	0.000	84	88	0.000	116	120	0.000
24	28	0.000	56	60	0.000	88	92	0.000			
28	32	0.000	60	64	0.000	92	96	0.000			

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 91.000

Tank or Pond Structure

Invert Level (m) 90.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	640.0	0.223	640.0	0.224	1.0

Orifice Outflow Control

Diameter (m) 0.100 Discharge Coefficient 0.600 Invert Level (m) 90.700

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	90.794	0.094	3.4	120.4	Flood Risk
30 min Summer	90.820	0.120	4.9	153.5	Flood Risk
60 min Summer	90.843	0.143	6.4	183.4	Flood Risk
120 min Summer	90.861	0.161	7.0	206.4	Flood Risk
180 min Summer	90.867	0.167	7.1	213.8	Flood Risk
240 min Summer	90.868	0.168	7.2	215.6	Flood Risk
360 min Summer	90.870	0.170	7.2	217.0	Flood Risk
480 min Summer	90.870	0.170	7.2	217.2	Flood Risk
600 min Summer	90.869	0.169	7.2	216.2	Flood Risk
720 min Summer	90.867	0.167	7.1	214.3	Flood Risk
960 min Summer	90.863	0.163	7.0	209.2	Flood Risk
1440 min Summer	90.854	0.154	6.7	197.0	Flood Risk
2160 min Summer	90.841	0.141	6.2	180.2	Flood Risk
2880 min Summer	90.830	0.130	5.6	166.9	Flood Risk
4320 min Summer	90.815	0.115	4.6	147.0	Flood Risk
5760 min Summer	90.804	0.104	4.0	132.8	Flood Risk
7200 min Summer	90.795	0.095	3.5	122.1	Flood Risk
8640 min Summer	90.789	0.089	3.1	113.8	Flood Risk
10080 min Summer	90.784	0.084	2.8	106.9	Flood Risk
15 min Winter	90.794	0.094	3.4	120.4	Flood Risk
30 min Winter	90.820	0.120	5.0	153.7	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	142.716	0.0	91.3	19
30 min Summer	92.222	0.0	124.4	33
60 min Summer	56.713	0.0	175.6	62
120 min Summer	33.722	0.0	211.6	122
180 min Summer	24.576	0.0	232.6	180
240 min Summer	19.534	0.0	247.3	210
360 min Summer	14.061	0.0	267.8	270
480 min Summer	11.142	0.0	283.4	336
600 min Summer	9.297	0.0	295.7	404
720 min Summer	8.015	0.0	305.9	470
960 min Summer	6.338	0.0	322.0	606
1440 min Summer	4.546	0.0	344.0	868
2160 min Summer	3.257	0.0	389.1	1252
2880 min Summer	2.568	0.0	407.5	1620
4320 min Summer	1.836	0.0	430.5	2376
5760 min Summer	1.445	0.0	468.2	3112
7200 min Summer	1.200	0.0	484.6	3824
8640 min Summer	1.031	0.0	496.6	4584
10080 min Summer	0.906	0.0	503.9	5344
15 min Winter	142.716	0.0	91.3	19
30 min Winter	92.222	0.0	124.3	33

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	90.844	0.144	6.4	183.8	Flood Risk
120 min Winter	90.862	0.162	7.0	207.3	Flood Risk
180 min Winter	90.868	0.168	7.2	215.3	Flood Risk
240 min Winter	90.870	0.170	7.2	217.2	Flood Risk
360 min Winter	90.869	0.169	7.2	216.7	Flood Risk
480 min Winter	90.868	0.168	7.2	215.3	Flood Risk
600 min Winter	90.866	0.166	7.1	212.3	Flood Risk
720 min Winter	90.863	0.163	7.0	208.4	Flood Risk
960 min Winter	90.856	0.156	6.8	199.7	Flood Risk
1440 min Winter	90.843	0.143	6.4	182.8	Flood Risk
2160 min Winter	90.828	0.128	5.4	163.4	Flood Risk
2880 min Winter	90.816	0.116	4.7	148.5	Flood Risk
4320 min Winter	90.800	0.100	3.7	127.4	Flood Risk
5760 min Winter	90.789	0.089	3.1	113.3	Flood Risk
7200 min Winter	90.780	0.080	2.6	102.9	Flood Risk
8640 min Winter	90.773	0.073	2.3	93.8	Flood Risk
10080 min Winter	90.768	0.068	2.0	86.7	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	56.713	0.0	175.6	62
120 min Winter	33.722	0.0	211.6	118
180 min Winter	24.576	0.0	232.6	174
240 min Winter	19.534	0.0	247.3	226
360 min Winter	14.061	0.0	267.8	280
480 min Winter	11.142	0.0	283.4	356
600 min Winter	9.297	0.0	295.7	432
720 min Winter	8.015	0.0	305.9	506
960 min Winter	6.338	0.0	322.1	648
1440 min Winter	4.546	0.0	344.0	922
2160 min Winter	3.257	0.0	389.0	1316
2880 min Winter	2.568	0.0	407.5	1700
4320 min Winter	1.836	0.0	430.6	2464
5760 min Winter	1.445	0.0	468.2	3224
7200 min Winter	1.200	0.0	484.7	3968
8640 min Winter	1.031	0.0	496.9	4680
10080 min Winter	0.906	0.0	504.5	5448

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.950
Region	England and Wales	Cv (Winter)	0.950
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.439	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.360

Time From:	(mins) To:	Area (ha)
0	4	0.360

Time Area Diagram

Total Area (ha) 0.001

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000	32	36	0.000	64	68	0.000	96	100	0.000
4	8	0.000	36	40	0.000	68	72	0.000	100	104	0.000
8	12	0.000	40	44	0.000	72	76	0.000	104	108	0.000
12	16	0.000	44	48	0.000	76	80	0.000	108	112	0.000
16	20	0.000	48	52	0.000	80	84	0.000	112	116	0.000
20	24	0.000	52	56	0.000	84	88	0.000	116	120	0.000
24	28	0.000	56	60	0.000	88	92	0.000			
28	32	0.000	60	64	0.000	92	96	0.000			

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 91.000

Tank or Pond Structure

Invert Level (m) 90.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1280.0	0.223	1280.0	0.224	1.0

Orifice Outflow Control

Diameter (m) 0.100 Discharge Coefficient 0.600 Invert Level (m) 90.700

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	90.813	0.113	4.5	90.7	Flood Risk
30 min Summer	90.843	0.143	6.4	114.5	Flood Risk
60 min Summer	90.869	0.169	7.2	134.9	Flood Risk
120 min Summer	90.885	0.185	7.7	147.7	Flood Risk
180 min Summer	90.888	0.188	7.8	150.4	Flood Risk
240 min Summer	90.889	0.189	7.8	151.4	Flood Risk
360 min Summer	90.888	0.188	7.8	150.8	Flood Risk
480 min Summer	90.886	0.186	7.7	148.7	Flood Risk
600 min Summer	90.882	0.182	7.6	145.8	Flood Risk
720 min Summer	90.878	0.178	7.5	142.5	Flood Risk
960 min Summer	90.869	0.169	7.2	135.4	Flood Risk
1440 min Summer	90.853	0.153	6.7	122.2	Flood Risk
2160 min Summer	90.835	0.135	5.9	107.9	Flood Risk
2880 min Summer	90.822	0.122	5.1	97.8	Flood Risk
4320 min Summer	90.805	0.105	4.1	84.1	Flood Risk
5760 min Summer	90.794	0.094	3.4	75.0	Flood Risk
7200 min Summer	90.785	0.085	2.9	68.4	Flood Risk
8640 min Summer	90.779	0.079	2.5	63.2	Flood Risk
10080 min Summer	90.773	0.073	2.3	58.6	Flood Risk
15 min Winter	90.813	0.113	4.5	90.8	Flood Risk
30 min Winter	90.843	0.143	6.4	114.7	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	142.716	0.0	79.4	18
30 min Summer	92.222	0.0	105.9	33
60 min Summer	56.713	0.0	140.8	62
120 min Summer	33.722	0.0	168.5	120
180 min Summer	24.576	0.0	184.7	150
240 min Summer	19.534	0.0	196.1	180
360 min Summer	14.061	0.0	212.0	246
480 min Summer	11.142	0.0	224.2	314
600 min Summer	9.297	0.0	233.8	382
720 min Summer	8.015	0.0	241.9	448
960 min Summer	6.338	0.0	254.7	578
1440 min Summer	4.546	0.0	272.9	836
2160 min Summer	3.257	0.0	301.2	1208
2880 min Summer	2.568	0.0	316.1	1584
4320 min Summer	1.836	0.0	335.5	2296
5760 min Summer	1.445	0.0	359.2	3056
7200 min Summer	1.200	0.0	372.2	3752
8640 min Summer	1.031	0.0	382.5	4504
10080 min Summer	0.906	0.0	389.6	5240
15 min Winter	142.716	0.0	79.4	18
30 min Winter	92.222	0.0	105.9	32

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	90.869	0.169	7.2	135.3	Flood Risk
120 min Winter	90.886	0.186	7.7	148.7	Flood Risk
180 min Winter	90.888	0.188	7.8	150.7	Flood Risk
240 min Winter	90.889	0.189	7.8	150.9	Flood Risk
360 min Winter	90.885	0.185	7.7	148.3	Flood Risk
480 min Winter	90.880	0.180	7.5	144.0	Flood Risk
600 min Winter	90.874	0.174	7.3	139.1	Flood Risk
720 min Winter	90.867	0.167	7.1	134.0	Flood Risk
960 min Winter	90.855	0.155	6.8	124.2	Flood Risk
1440 min Winter	90.837	0.137	6.0	109.2	Flood Risk
2160 min Winter	90.818	0.118	4.8	94.3	Flood Risk
2880 min Winter	90.805	0.105	4.0	84.0	Flood Risk
4320 min Winter	90.788	0.088	3.1	70.7	Flood Risk
5760 min Winter	90.777	0.077	2.4	61.8	Flood Risk
7200 min Winter	90.769	0.069	2.1	54.9	Flood Risk
8640 min Winter	90.763	0.063	1.8	50.0	Flood Risk
10080 min Winter	90.758	0.058	1.6	46.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	56.713	0.0	140.8	60
120 min Winter	33.722	0.0	168.5	116
180 min Winter	24.576	0.0	184.7	166
240 min Winter	19.534	0.0	196.1	188
360 min Winter	14.061	0.0	212.0	264
480 min Winter	11.142	0.0	224.2	338
600 min Winter	9.297	0.0	233.8	410
720 min Winter	8.015	0.0	241.9	478
960 min Winter	6.338	0.0	254.7	614
1440 min Winter	4.546	0.0	272.9	866
2160 min Winter	3.257	0.0	301.2	1252
2880 min Winter	2.568	0.0	316.1	1620
4320 min Winter	1.836	0.0	335.6	2376
5760 min Winter	1.445	0.0	359.3	3120
7200 min Winter	1.200	0.0	372.3	3824
8640 min Winter	1.031	0.0	382.6	4544
10080 min Winter	0.906	0.0	390.0	5240

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.950
Region	England and Wales	Cv (Winter)	0.950
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.439	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.274

Time From:	(mins) To:	Area (ha)
0	4	0.274

Time Area Diagram

Total Area (ha) 0.001

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000	32	36	0.000	64	68	0.000	96	100	0.000
4	8	0.000	36	40	0.000	68	72	0.000	100	104	0.000
8	12	0.000	40	44	0.000	72	76	0.000	104	108	0.000
12	16	0.000	44	48	0.000	76	80	0.000	108	112	0.000
16	20	0.000	48	52	0.000	80	84	0.000	112	116	0.000
20	24	0.000	52	56	0.000	84	88	0.000	116	120	0.000
24	28	0.000	56	60	0.000	88	92	0.000			
28	32	0.000	60	64	0.000	92	96	0.000			

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 91.000

Tank or Pond Structure

Invert Level (m) 90.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	800.0	0.223	800.0	0.224	1.0

Orifice Outflow Control

Diameter (m) 0.100 Discharge Coefficient 0.600 Invert Level (m) 90.700

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	90.825	0.125	5.3	79.9	Flood Risk
30 min Summer	90.857	0.157	6.8	100.3	Flood Risk
60 min Summer	90.883	0.183	7.6	117.2	Flood Risk
120 min Summer	90.897	0.197	8.0	126.2	Flood Risk
180 min Summer	90.901	0.201	8.1	128.4	Flood Risk
240 min Summer	90.901	0.201	8.1	128.8	Flood Risk
360 min Summer	90.898	0.198	8.0	127.0	Flood Risk
480 min Summer	90.894	0.194	7.9	124.0	Flood Risk
600 min Summer	90.888	0.188	7.8	120.4	Flood Risk
720 min Summer	90.882	0.182	7.6	116.7	Flood Risk
960 min Summer	90.871	0.171	7.3	109.2	Flood Risk
1440 min Summer	90.851	0.151	6.6	96.5	Flood Risk
2160 min Summer	90.831	0.131	5.7	84.0	Flood Risk
2880 min Summer	90.818	0.118	4.9	75.6	Flood Risk
4320 min Summer	90.801	0.101	3.8	64.4	Flood Risk
5760 min Summer	90.789	0.089	3.1	57.1	Flood Risk
7200 min Summer	90.781	0.081	2.6	52.0	Flood Risk
8640 min Summer	90.774	0.074	2.3	47.5	Flood Risk
10080 min Summer	90.769	0.069	2.1	43.9	Flood Risk
15 min Winter	90.825	0.125	5.3	79.9	Flood Risk
30 min Winter	90.857	0.157	6.8	100.6	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	142.716	0.0	73.5	18
30 min Summer	92.222	0.0	97.3	33
60 min Summer	56.713	0.0	126.8	62
120 min Summer	33.722	0.0	151.5	110
180 min Summer	24.576	0.0	165.9	140
240 min Summer	19.534	0.0	176.1	172
360 min Summer	14.061	0.0	190.3	238
480 min Summer	11.142	0.0	201.2	306
600 min Summer	9.297	0.0	209.8	374
720 min Summer	8.015	0.0	217.0	440
960 min Summer	6.338	0.0	228.6	568
1440 min Summer	4.546	0.0	245.0	820
2160 min Summer	3.257	0.0	268.4	1188
2880 min Summer	2.568	0.0	281.8	1556
4320 min Summer	1.836	0.0	299.9	2288
5760 min Summer	1.445	0.0	319.4	3000
7200 min Summer	1.200	0.0	331.1	3752
8640 min Summer	1.031	0.0	340.4	4496
10080 min Summer	0.906	0.0	347.4	5240
15 min Winter	142.716	0.0	73.5	18
30 min Winter	92.222	0.0	97.3	32

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	90.884	0.184	7.6	117.6	Flood Risk
120 min Winter	90.899	0.199	8.1	127.0	Flood Risk
180 min Winter	90.900	0.200	8.1	128.1	Flood Risk
240 min Winter	90.899	0.199	8.1	127.6	Flood Risk
360 min Winter	90.893	0.193	7.9	123.5	Flood Risk
480 min Winter	90.885	0.185	7.7	118.3	Flood Risk
600 min Winter	90.876	0.176	7.4	112.9	Flood Risk
720 min Winter	90.868	0.168	7.2	107.6	Flood Risk
960 min Winter	90.853	0.153	6.7	98.0	Flood Risk
1440 min Winter	90.832	0.132	5.7	84.7	Flood Risk
2160 min Winter	90.813	0.113	4.5	72.1	Flood Risk
2880 min Winter	90.800	0.100	3.7	63.8	Flood Risk
4320 min Winter	90.783	0.083	2.8	53.4	Flood Risk
5760 min Winter	90.772	0.072	2.2	46.1	Flood Risk
7200 min Winter	90.764	0.064	1.9	40.9	Flood Risk
8640 min Winter	90.759	0.059	1.7	37.4	Flood Risk
10080 min Winter	90.755	0.055	1.5	35.2	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	56.713	0.0	126.8	60
120 min Winter	33.722	0.0	151.5	114
180 min Winter	24.576	0.0	165.9	144
240 min Winter	19.534	0.0	176.1	182
360 min Winter	14.061	0.0	190.3	256
480 min Winter	11.142	0.0	201.2	328
600 min Winter	9.297	0.0	209.8	398
720 min Winter	8.015	0.0	217.1	466
960 min Winter	6.338	0.0	228.6	596
1440 min Winter	4.546	0.0	245.0	850
2160 min Winter	3.257	0.0	268.4	1228
2880 min Winter	2.568	0.0	281.8	1588
4320 min Winter	1.836	0.0	300.0	2336
5760 min Winter	1.445	0.0	319.5	3112
7200 min Winter	1.200	0.0	331.2	3816
8640 min Winter	1.031	0.0	340.5	4496
10080 min Winter	0.906	0.0	347.7	5144

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.950
Region	England and Wales	Cv (Winter)	0.950
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.439	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.243

Time From:	(mins) To:	Area (ha)
0	4	0.243

Time Area Diagram

Total Area (ha) 0.001

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000	32	36	0.000	64	68	0.000	96	100	0.000
4	8	0.000	36	40	0.000	68	72	0.000	100	104	0.000
8	12	0.000	40	44	0.000	72	76	0.000	104	108	0.000
12	16	0.000	44	48	0.000	76	80	0.000	108	112	0.000
16	20	0.000	48	52	0.000	80	84	0.000	112	116	0.000
20	24	0.000	52	56	0.000	84	88	0.000	116	120	0.000
24	28	0.000	56	60	0.000	88	92	0.000			
28	32	0.000	60	64	0.000	92	96	0.000			

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 91.000

Tank or Pond Structure

Invert Level (m) 90.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	640.0	0.223	640.0	0.224	1.0

Orifice Outflow Control

Diameter (m) 0.100 Discharge Coefficient 0.600 Invert Level (m) 90.700

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	90.831	0.131	6.8	144.1	Flood Risk
30 min Summer	90.866	0.166	9.6	182.2	Flood Risk
60 min Summer	90.895	0.195	11.1	214.8	Flood Risk
120 min Summer	90.914	0.214	11.8	235.7	Flood Risk
180 min Summer	90.918	0.218	12.0	240.3	Flood Risk
240 min Summer	90.920	0.220	12.0	242.0	Flood Risk
360 min Summer	90.919	0.219	12.0	241.4	Flood Risk
480 min Summer	90.917	0.217	11.9	238.6	Flood Risk
600 min Summer	90.913	0.213	11.8	234.3	Flood Risk
720 min Summer	90.908	0.208	11.6	229.3	Flood Risk
960 min Summer	90.899	0.199	11.2	218.7	Flood Risk
1440 min Summer	90.880	0.180	10.4	198.5	Flood Risk
2160 min Summer	90.860	0.160	9.1	176.2	Flood Risk
2880 min Summer	90.846	0.146	8.0	160.2	Flood Risk
4320 min Summer	90.826	0.126	6.4	138.1	Flood Risk
5760 min Summer	90.812	0.112	5.3	123.4	Flood Risk
7200 min Summer	90.802	0.102	4.5	112.5	Flood Risk
8640 min Summer	90.795	0.095	4.0	104.0	Flood Risk
10080 min Summer	90.788	0.088	3.6	96.6	Flood Risk
15 min Winter	90.831	0.131	6.8	144.2	Flood Risk
30 min Winter	90.866	0.166	9.6	182.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	142.716	0.0	124.4	19
30 min Summer	92.222	0.0	166.1	33
60 min Summer	56.713	0.0	222.2	62
120 min Summer	33.722	0.0	266.2	120
180 min Summer	24.576	0.0	291.8	152
240 min Summer	19.534	0.0	309.8	182
360 min Summer	14.061	0.0	335.0	248
480 min Summer	11.142	0.0	354.3	316
600 min Summer	9.297	0.0	369.6	384
720 min Summer	8.015	0.0	382.3	450
960 min Summer	6.338	0.0	402.6	580
1440 min Summer	4.546	0.0	431.1	836
2160 min Summer	3.257	0.0	477.0	1208
2880 min Summer	2.568	0.0	500.5	1584
4320 min Summer	1.836	0.0	530.8	2296
5760 min Summer	1.445	0.0	569.3	3056
7200 min Summer	1.200	0.0	589.8	3752
8640 min Summer	1.031	0.0	606.0	4504
10080 min Summer	0.906	0.0	616.9	5248
15 min Winter	142.716	0.0	124.4	18
30 min Winter	92.222	0.0	166.1	32

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	90.896	0.196	11.1	215.4	Flood Risk
120 min Winter	90.916	0.216	11.9	237.3	Flood Risk
180 min Winter	90.919	0.219	12.0	241.1	Flood Risk
240 min Winter	90.920	0.220	12.0	241.5	Flood Risk
360 min Winter	90.916	0.216	11.9	237.9	Flood Risk
480 min Winter	90.911	0.211	11.7	231.6	Flood Risk
600 min Winter	90.904	0.204	11.4	224.2	Flood Risk
720 min Winter	90.897	0.197	11.1	216.5	Flood Risk
960 min Winter	90.883	0.183	10.6	201.7	Flood Risk
1440 min Winter	90.862	0.162	9.3	178.5	Flood Risk
2160 min Winter	90.841	0.141	7.6	154.7	Flood Risk
2880 min Winter	90.826	0.126	6.4	138.1	Flood Risk
4320 min Winter	90.806	0.106	4.8	116.5	Flood Risk
5760 min Winter	90.793	0.093	3.9	102.0	Flood Risk
7200 min Winter	90.783	0.083	3.3	90.8	Flood Risk
8640 min Winter	90.775	0.075	2.9	82.6	Flood Risk
10080 min Winter	90.770	0.070	2.6	76.9	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	56.713	0.0	222.2	60
120 min Winter	33.722	0.0	266.2	116
180 min Winter	24.576	0.0	291.9	168
240 min Winter	19.534	0.0	309.8	188
360 min Winter	14.061	0.0	335.1	264
480 min Winter	11.142	0.0	354.3	338
600 min Winter	9.297	0.0	369.6	410
720 min Winter	8.015	0.0	382.3	480
960 min Winter	6.338	0.0	402.6	616
1440 min Winter	4.546	0.0	431.1	878
2160 min Winter	3.257	0.0	477.0	1256
2880 min Winter	2.568	0.0	500.5	1640
4320 min Winter	1.836	0.0	531.1	2380
5760 min Winter	1.445	0.0	569.3	3120
7200 min Winter	1.200	0.0	589.9	3848
8640 min Winter	1.031	0.0	606.2	4576
10080 min Winter	0.906	0.0	617.6	5248

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.950
Region	England and Wales	Cv (Winter)	0.950
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.439	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.435

Time From:	(mins) To:	Area (ha)
0	4	0.435

Time Area Diagram

Total Area (ha) 0.001

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000	32	36	0.000	64	68	0.000	96	100	0.000
4	8	0.000	36	40	0.000	68	72	0.000	100	104	0.000
8	12	0.000	40	44	0.000	72	76	0.000	104	108	0.000
12	16	0.000	44	48	0.000	76	80	0.000	108	112	0.000
16	20	0.000	48	52	0.000	80	84	0.000	112	116	0.000
20	24	0.000	52	56	0.000	84	88	0.000	116	120	0.000
24	28	0.000	56	60	0.000	88	92	0.000			
28	32	0.000	60	64	0.000	92	96	0.000			

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 91.000

Tank or Pond Structure

Invert Level (m) 90.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1100.0	0.223	1100.0	0.224	1.0

Orifice Outflow Control

Diameter (m) 0.120 Discharge Coefficient 0.600 Invert Level (m) 90.700

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	90.793	0.093	3.3	232.0	Flood Risk
30 min Summer	90.819	0.119	4.9	297.6	Flood Risk
60 min Summer	90.844	0.144	6.4	360.6	Flood Risk
120 min Summer	90.867	0.167	7.1	416.9	Flood Risk
180 min Summer	90.877	0.177	7.4	443.5	Flood Risk
240 min Summer	90.883	0.183	7.6	457.4	Flood Risk
360 min Summer	90.887	0.187	7.7	467.8	Flood Risk
480 min Summer	90.888	0.188	7.8	470.1	Flood Risk
600 min Summer	90.889	0.189	7.8	471.6	Flood Risk
720 min Summer	90.889	0.189	7.8	472.1	Flood Risk
960 min Summer	90.888	0.188	7.8	471.1	Flood Risk
1440 min Summer	90.885	0.185	7.7	462.5	Flood Risk
2160 min Summer	90.877	0.177	7.4	442.5	Flood Risk
2880 min Summer	90.868	0.168	7.2	420.5	Flood Risk
4320 min Summer	90.852	0.152	6.7	379.9	Flood Risk
5760 min Summer	90.839	0.139	6.1	348.4	Flood Risk
7200 min Summer	90.830	0.130	5.6	324.4	Flood Risk
8640 min Summer	90.822	0.122	5.1	304.7	Flood Risk
10080 min Summer	90.815	0.115	4.7	288.2	Flood Risk
15 min Winter	90.793	0.093	3.3	232.0	Flood Risk
30 min Winter	90.819	0.119	4.9	297.8	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	142.716	0.0	138.1	23
30 min Summer	92.222	0.0	193.3	37
60 min Summer	56.713	0.0	304.1	66
120 min Summer	33.722	0.0	370.0	126
180 min Summer	24.576	0.0	408.3	184
240 min Summer	19.534	0.0	434.8	242
360 min Summer	14.061	0.0	471.6	360
480 min Summer	11.142	0.0	499.1	424
600 min Summer	9.297	0.0	520.5	482
720 min Summer	8.015	0.0	537.8	544
960 min Summer	6.338	0.0	564.4	674
1440 min Summer	4.546	0.0	597.5	942
2160 min Summer	3.257	0.0	717.8	1348
2880 min Summer	2.568	0.0	750.5	1736
4320 min Summer	1.836	0.0	786.2	2508
5760 min Summer	1.445	0.0	881.7	3232
7200 min Summer	1.200	0.0	910.1	3968
8640 min Summer	1.031	0.0	930.1	4752
10080 min Summer	0.906	0.0	940.1	5448
15 min Winter	142.716	0.0	138.1	23
30 min Winter	92.222	0.0	193.3	37

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	90.844	0.144	6.4	360.9	Flood Risk
120 min Winter	90.867	0.167	7.1	417.8	Flood Risk
180 min Winter	90.878	0.178	7.5	444.9	Flood Risk
240 min Winter	90.884	0.184	7.6	459.2	Flood Risk
360 min Winter	90.888	0.188	7.8	470.9	Flood Risk
480 min Winter	90.889	0.189	7.8	473.3	Flood Risk
600 min Winter	90.889	0.189	7.8	471.5	Flood Risk
720 min Winter	90.888	0.188	7.8	471.0	Flood Risk
960 min Winter	90.887	0.187	7.7	466.3	Flood Risk
1440 min Winter	90.880	0.180	7.5	448.9	Flood Risk
2160 min Winter	90.867	0.167	7.1	417.5	Flood Risk
2880 min Winter	90.855	0.155	6.8	387.5	Flood Risk
4320 min Winter	90.836	0.136	6.0	341.0	Flood Risk
5760 min Winter	90.823	0.123	5.2	308.0	Flood Risk
7200 min Winter	90.813	0.113	4.5	282.6	Flood Risk
8640 min Winter	90.805	0.105	4.0	262.5	Flood Risk
10080 min Winter	90.798	0.098	3.6	246.1	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	56.713	0.0	304.0	66
120 min Winter	33.722	0.0	370.0	122
180 min Winter	24.576	0.0	408.3	180
240 min Winter	19.534	0.0	434.8	238
360 min Winter	14.061	0.0	471.6	350
480 min Winter	11.142	0.0	499.1	454
600 min Winter	9.297	0.0	520.5	494
720 min Winter	8.015	0.0	537.9	564
960 min Winter	6.338	0.0	564.4	716
1440 min Winter	4.546	0.0	597.7	1014
2160 min Winter	3.257	0.0	717.8	1436
2880 min Winter	2.568	0.0	750.6	1848
4320 min Winter	1.836	0.0	786.2	2600
5760 min Winter	1.445	0.0	881.7	3400
7200 min Winter	1.200	0.0	910.3	4112
8640 min Winter	1.031	0.0	930.6	4920
10080 min Winter	0.906	0.0	941.0	5648

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.950
Region	England and Wales	Cv (Winter)	0.950
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.439	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.690

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.345	4	8	0.345

Time Area Diagram

Total Area (ha) 0.001

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000	32	36	0.000	64	68	0.000	96	100	0.000
4	8	0.000	36	40	0.000	68	72	0.000	100	104	0.000
8	12	0.000	40	44	0.000	72	76	0.000	104	108	0.000
12	16	0.000	44	48	0.000	76	80	0.000	108	112	0.000
16	20	0.000	48	52	0.000	80	84	0.000	112	116	0.000
20	24	0.000	52	56	0.000	84	88	0.000	116	120	0.000
24	28	0.000	56	60	0.000	88	92	0.000			
28	32	0.000	60	64	0.000	92	96	0.000			

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 91.000

Tank or Pond Structure

Invert Level (m) 90.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2500.0	0.223	2500.0	0.224	1.0

Orifice Outflow Control

Diameter (m) 0.100 Discharge Coefficient 0.600 Invert Level (m) 90.700

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	82.879	0.879	150.0	500.9	O K
30 min Summer	83.100	1.100	150.0	627.2	O K
60 min Summer	83.195	1.195	149.9	681.4	O K
120 min Summer	83.151	1.151	150.0	655.9	O K
180 min Summer	83.047	1.047	150.0	596.7	O K
240 min Summer	82.921	0.921	150.0	525.2	O K
360 min Summer	82.706	0.706	150.0	402.6	O K
480 min Summer	82.559	0.559	149.0	318.4	O K
600 min Summer	82.463	0.463	145.7	264.0	O K
720 min Summer	82.412	0.412	138.0	234.6	O K
960 min Summer	82.356	0.356	114.5	203.0	O K
1440 min Summer	82.294	0.294	85.2	167.4	O K
2160 min Summer	82.244	0.244	62.6	139.1	O K
2880 min Summer	82.214	0.214	49.8	122.2	O K
4320 min Summer	82.179	0.179	35.9	101.9	O K
5760 min Summer	82.157	0.157	28.4	89.6	O K
7200 min Summer	82.143	0.143	23.7	81.2	O K
8640 min Summer	82.131	0.131	20.2	74.9	O K
10080 min Summer	82.123	0.123	17.8	69.9	O K
15 min Winter	82.876	0.876	150.0	499.5	O K
30 min Winter	83.097	1.097	150.0	625.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	142.716	0.0	641.9	25
30 min Summer	92.222	0.0	830.4	36
60 min Summer	56.713	0.0	1023.7	56
120 min Summer	33.722	0.0	1217.6	88
180 min Summer	24.576	0.0	1331.2	122
240 min Summer	19.534	0.0	1410.9	154
360 min Summer	14.061	0.0	1523.4	214
480 min Summer	11.142	0.0	1609.6	272
600 min Summer	9.297	0.0	1678.7	326
720 min Summer	8.015	0.0	1736.7	382
960 min Summer	6.338	0.0	1830.9	502
1440 min Summer	4.546	0.0	1969.6	744
2160 min Summer	3.257	0.0	2118.3	1108
2880 min Summer	2.568	0.0	2227.1	1472
4320 min Summer	1.836	0.0	2386.6	2204
5760 min Summer	1.445	0.0	2507.6	2936
7200 min Summer	1.200	0.0	2602.6	3672
8640 min Summer	1.031	0.0	2681.9	4400
10080 min Summer	0.906	0.0	2749.5	5136
15 min Winter	142.716	0.0	641.9	26
30 min Winter	92.222	0.0	830.4	36

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	83.183	1.183	150.0	674.2	O K
120 min Winter	83.088	1.088	150.0	620.4	O K
180 min Winter	82.914	0.914	150.0	521.1	O K
240 min Winter	82.741	0.741	150.0	422.3	O K
360 min Winter	82.497	0.497	147.2	283.1	O K
480 min Winter	82.398	0.398	132.5	226.8	O K
600 min Winter	82.353	0.353	113.1	201.4	O K
720 min Winter	82.322	0.322	98.6	183.6	O K
960 min Winter	82.280	0.280	78.9	159.6	O K
1440 min Winter	82.232	0.232	57.2	132.0	O K
2160 min Winter	82.193	0.193	41.2	109.7	O K
2880 min Winter	82.169	0.169	32.5	96.5	O K
4320 min Winter	82.142	0.142	23.4	80.7	O K
5760 min Winter	82.125	0.125	18.4	71.0	O K
7200 min Winter	82.113	0.113	15.3	64.4	O K
8640 min Winter	82.104	0.104	13.1	59.6	O K
10080 min Winter	82.098	0.098	11.5	55.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	56.713	0.0	1023.7	58
120 min Winter	33.722	0.0	1217.6	94
180 min Winter	24.576	0.0	1331.2	128
240 min Winter	19.534	0.0	1410.9	160
360 min Winter	14.061	0.0	1523.4	214
480 min Winter	11.142	0.0	1609.6	266
600 min Winter	9.297	0.0	1678.7	326
720 min Winter	8.015	0.0	1736.7	386
960 min Winter	6.338	0.0	1830.9	504
1440 min Winter	4.546	0.0	1969.7	746
2160 min Winter	3.257	0.0	2118.3	1108
2880 min Winter	2.568	0.0	2227.2	1472
4320 min Winter	1.836	0.0	2386.7	2204
5760 min Winter	1.445	0.0	2507.6	2936
7200 min Winter	1.200	0.0	2602.7	3664
8640 min Winter	1.031	0.0	2682.0	4408
10080 min Winter	0.906	0.0	2749.7	5088

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.950
Region	England and Wales	Cv (Winter)	0.950
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.439	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.902

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.476	4	8	0.476	8	12	0.475	12	16	0.475

Time Area Diagram

Total Area (ha) 0.001

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000	32	36	0.000	64	68	0.000	96	100	0.000
4	8	0.000	36	40	0.000	68	72	0.000	100	104	0.000
8	12	0.000	40	44	0.000	72	76	0.000	104	108	0.000
12	16	0.000	44	48	0.000	76	80	0.000	108	112	0.000
16	20	0.000	48	52	0.000	80	84	0.000	112	116	0.000
20	24	0.000	52	56	0.000	84	88	0.000	116	120	0.000
24	28	0.000	56	60	0.000	88	92	0.000			
28	32	0.000	60	64	0.000	92	96	0.000			

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 85.000

Tank or Pond Structure

Invert Level (m) 82.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	570.0	1.200	570.0	1.201	2.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0465-1500-1200-1500
Design Head (m)	1.200
Design Flow (l/s)	150.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	465
Invert Level (m)	82.000
Minimum Outlet Pipe Diameter (mm)	500
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	149.9
Flush-Flo™	0.652	150.0
Kick-Flo®	1.012	138.0
Mean Flow over Head Range	-	114.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	12.1	1.200	149.9	3.000	234.6	7.000	355.6
0.200	44.0	1.400	161.6	3.500	253.0	7.500	367.8
0.300	88.1	1.600	172.5	4.000	270.1	8.000	379.7
0.400	133.4	1.800	182.7	4.500	286.2	8.500	391.2
0.500	147.3	2.000	192.4	5.000	301.4	9.000	402.4
0.600	149.7	2.200	201.5	5.500	315.8	9.500	413.2
0.800	148.0	2.400	210.3	6.000	329.6		
1.000	138.9	2.600	218.7	6.500	342.8		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	90.755	0.055	1.4	82.5	Flood Risk
30 min Summer	90.770	0.070	2.1	105.6	Flood Risk
60 min Summer	90.785	0.085	2.9	127.5	Flood Risk
120 min Summer	90.797	0.097	3.6	145.8	Flood Risk
180 min Summer	90.802	0.102	3.9	152.8	Flood Risk
240 min Summer	90.804	0.104	4.0	155.4	Flood Risk
360 min Summer	90.804	0.104	4.0	156.7	Flood Risk
480 min Summer	90.805	0.105	4.1	157.7	Flood Risk
600 min Summer	90.805	0.105	4.1	158.1	Flood Risk
720 min Summer	90.805	0.105	4.1	158.1	Flood Risk
960 min Summer	90.805	0.105	4.0	156.8	Flood Risk
1440 min Summer	90.802	0.102	3.9	152.4	Flood Risk
2160 min Summer	90.796	0.096	3.5	144.5	Flood Risk
2880 min Summer	90.791	0.091	3.2	137.0	Flood Risk
4320 min Summer	90.783	0.083	2.7	124.4	Flood Risk
5760 min Summer	90.776	0.076	2.4	114.2	Flood Risk
7200 min Summer	90.771	0.071	2.2	105.8	Flood Risk
8640 min Summer	90.766	0.066	2.0	99.1	Flood Risk
10080 min Summer	90.762	0.062	1.8	93.7	Flood Risk
15 min Winter	90.755	0.055	1.4	82.5	Flood Risk
30 min Winter	90.770	0.070	2.1	105.7	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	142.716	0.0	50.0	19
30 min Summer	92.222	0.0	70.7	34
60 min Summer	56.713	0.0	109.4	64
120 min Summer	33.722	0.0	133.4	122
180 min Summer	24.576	0.0	147.3	182
240 min Summer	19.534	0.0	157.0	240
360 min Summer	14.061	0.0	170.6	296
480 min Summer	11.142	0.0	180.7	354
600 min Summer	9.297	0.0	188.7	420
720 min Summer	8.015	0.0	195.2	488
960 min Summer	6.338	0.0	205.4	624
1440 min Summer	4.546	0.0	218.4	894
2160 min Summer	3.257	0.0	256.9	1296
2880 min Summer	2.568	0.0	268.5	1676
4320 min Summer	1.836	0.0	281.4	2424
5760 min Summer	1.445	0.0	314.4	3176
7200 min Summer	1.200	0.0	324.8	3896
8640 min Summer	1.031	0.0	331.7	4664
10080 min Summer	0.906	0.0	334.9	5352
15 min Winter	142.716	0.0	50.0	19
30 min Winter	92.222	0.0	70.7	33

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	90.785	0.085	2.9	127.8	Flood Risk
120 min Winter	90.797	0.097	3.6	146.2	Flood Risk
180 min Winter	90.802	0.102	3.9	153.7	Flood Risk
240 min Winter	90.804	0.104	4.0	156.7	Flood Risk
360 min Winter	90.805	0.105	4.0	157.3	Flood Risk
480 min Winter	90.805	0.105	4.1	157.9	Flood Risk
600 min Winter	90.805	0.105	4.1	157.6	Flood Risk
720 min Winter	90.804	0.104	4.0	156.6	Flood Risk
960 min Winter	90.802	0.102	3.9	153.5	Flood Risk
1440 min Winter	90.797	0.097	3.6	146.1	Flood Risk
2160 min Winter	90.790	0.090	3.2	135.2	Flood Risk
2880 min Winter	90.784	0.084	2.8	125.9	Flood Risk
4320 min Winter	90.774	0.074	2.3	110.5	Flood Risk
5760 min Winter	90.766	0.066	2.0	99.1	Flood Risk
7200 min Winter	90.761	0.061	1.7	90.8	Flood Risk
8640 min Winter	90.757	0.057	1.5	84.9	Flood Risk
10080 min Winter	90.754	0.054	1.4	80.6	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	56.713	0.0	109.4	62
120 min Winter	33.722	0.0	133.4	120
180 min Winter	24.576	0.0	147.3	176
240 min Winter	19.534	0.0	157.0	232
360 min Winter	14.061	0.0	170.6	326
480 min Winter	11.142	0.0	180.7	370
600 min Winter	9.297	0.0	188.7	446
720 min Winter	8.015	0.0	195.2	522
960 min Winter	6.338	0.0	205.3	672
1440 min Winter	4.546	0.0	218.3	954
2160 min Winter	3.257	0.0	256.9	1364
2880 min Winter	2.568	0.0	268.5	1784
4320 min Winter	1.836	0.0	281.5	2552
5760 min Winter	1.445	0.0	314.5	3288
7200 min Winter	1.200	0.0	324.8	4032
8640 min Winter	1.031	0.0	331.8	4752
10080 min Winter	0.906	0.0	335.3	5448

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.950
Region	England and Wales	Cv (Winter)	0.950
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.439	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.245

Time From:	(mins) To:	Area (ha)
0	4	0.245

Time Area Diagram

Total Area (ha) 0.001

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000	32	36	0.000	64	68	0.000	96	100	0.000
4	8	0.000	36	40	0.000	68	72	0.000	100	104	0.000
8	12	0.000	40	44	0.000	72	76	0.000	104	108	0.000
12	16	0.000	44	48	0.000	76	80	0.000	108	112	0.000
16	20	0.000	48	52	0.000	80	84	0.000	112	116	0.000
20	24	0.000	52	56	0.000	84	88	0.000	116	120	0.000
24	28	0.000	56	60	0.000	88	92	0.000			
28	32	0.000	60	64	0.000	92	96	0.000			

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 91.000

Tank or Pond Structure

Invert Level (m) 90.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1500.0	0.223	1500.0	0.224	1.0

Orifice Outflow Control

Diameter (m) 0.100 Discharge Coefficient 0.600 Invert Level (m) 90.700

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	90.787	0.087	3.0	122.0	Flood Risk
30 min Summer	90.811	0.111	4.4	155.7	Flood Risk
60 min Summer	90.833	0.133	5.8	186.6	Flood Risk
120 min Summer	90.851	0.151	6.6	210.7	Flood Risk
180 min Summer	90.856	0.156	6.8	219.0	Flood Risk
240 min Summer	90.858	0.158	6.9	221.2	Flood Risk
360 min Summer	90.859	0.159	6.9	222.9	Flood Risk
480 min Summer	90.860	0.160	6.9	223.6	Flood Risk
600 min Summer	90.859	0.159	6.9	223.1	Flood Risk
720 min Summer	90.858	0.158	6.9	221.7	Flood Risk
960 min Summer	90.855	0.155	6.8	217.4	Flood Risk
1440 min Summer	90.848	0.148	6.5	206.6	Flood Risk
2160 min Summer	90.837	0.137	6.0	191.2	Flood Risk
2880 min Summer	90.827	0.127	5.4	178.2	Flood Risk
4320 min Summer	90.813	0.113	4.5	158.1	Flood Risk
5760 min Summer	90.803	0.103	3.9	143.5	Flood Risk
7200 min Summer	90.795	0.095	3.4	132.3	Flood Risk
8640 min Summer	90.788	0.088	3.1	123.5	Flood Risk
10080 min Summer	90.783	0.083	2.8	116.3	Flood Risk
15 min Winter	90.787	0.087	3.0	122.0	Flood Risk
30 min Winter	90.811	0.111	4.4	155.9	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	142.716	0.0	88.3	19
30 min Summer	92.222	0.0	121.1	33
60 min Summer	56.713	0.0	174.5	62
120 min Summer	33.722	0.0	210.7	122
180 min Summer	24.576	0.0	231.8	180
240 min Summer	19.534	0.0	246.6	220
360 min Summer	14.061	0.0	267.2	278
480 min Summer	11.142	0.0	282.8	340
600 min Summer	9.297	0.0	295.1	408
720 min Summer	8.015	0.0	305.3	476
960 min Summer	6.338	0.0	321.3	610
1440 min Summer	4.546	0.0	342.8	878
2160 min Summer	3.257	0.0	390.9	1256
2880 min Summer	2.568	0.0	409.4	1644
4320 min Summer	1.836	0.0	431.7	2380
5760 min Summer	1.445	0.0	472.1	3120
7200 min Summer	1.200	0.0	488.4	3888
8640 min Summer	1.031	0.0	500.1	4584
10080 min Summer	0.906	0.0	507.0	5344
15 min Winter	142.716	0.0	88.3	19
30 min Winter	92.222	0.0	121.1	33

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	90.834	0.134	5.8	187.0	Flood Risk
120 min Winter	90.851	0.151	6.6	211.6	Flood Risk
180 min Winter	90.858	0.158	6.9	220.6	Flood Risk
240 min Winter	90.859	0.159	6.9	223.2	Flood Risk
360 min Winter	90.859	0.159	6.9	223.0	Flood Risk
480 min Winter	90.859	0.159	6.9	222.4	Flood Risk
600 min Winter	90.857	0.157	6.8	220.0	Flood Risk
720 min Winter	90.855	0.155	6.8	216.8	Flood Risk
960 min Winter	90.849	0.149	6.6	209.1	Flood Risk
1440 min Winter	90.839	0.139	6.1	193.9	Flood Risk
2160 min Winter	90.825	0.125	5.3	174.9	Flood Risk
2880 min Winter	90.814	0.114	4.6	159.9	Flood Risk
4320 min Winter	90.799	0.099	3.7	138.2	Flood Risk
5760 min Winter	90.788	0.088	3.1	123.3	Flood Risk
7200 min Winter	90.780	0.080	2.6	112.2	Flood Risk
8640 min Winter	90.773	0.073	2.3	102.6	Flood Risk
10080 min Winter	90.768	0.068	2.0	94.9	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	56.713	0.0	174.5	62
120 min Winter	33.722	0.0	210.7	118
180 min Winter	24.576	0.0	231.8	174
240 min Winter	19.534	0.0	246.6	228
360 min Winter	14.061	0.0	267.2	284
480 min Winter	11.142	0.0	282.8	360
600 min Winter	9.297	0.0	295.1	436
720 min Winter	8.015	0.0	305.3	510
960 min Winter	6.338	0.0	321.3	654
1440 min Winter	4.546	0.0	342.8	926
2160 min Winter	3.257	0.0	390.9	1336
2880 min Winter	2.568	0.0	409.3	1728
4320 min Winter	1.836	0.0	431.9	2468
5760 min Winter	1.445	0.0	472.2	3232
7200 min Winter	1.200	0.0	488.5	4032
8640 min Winter	1.031	0.0	500.4	4752
10080 min Winter	0.906	0.0	507.6	5448

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.950
Region	England and Wales	Cv (Winter)	0.950
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.439	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.364

Time From:	(mins) To:	Area (ha)
0	4	0.364

Time Area Diagram

Total Area (ha) 0.001

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000	32	36	0.000	64	68	0.000	96	100	0.000
4	8	0.000	36	40	0.000	68	72	0.000	100	104	0.000
8	12	0.000	40	44	0.000	72	76	0.000	104	108	0.000
12	16	0.000	44	48	0.000	76	80	0.000	108	112	0.000
16	20	0.000	48	52	0.000	80	84	0.000	112	116	0.000
20	24	0.000	52	56	0.000	84	88	0.000	116	120	0.000
24	28	0.000	56	60	0.000	88	92	0.000			
28	32	0.000	60	64	0.000	92	96	0.000			

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 91.000

Tank or Pond Structure

Invert Level (m) 90.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1400.0	0.223	1400.0	0.224	1.0

Orifice Outflow Control

Diameter (m) 0.100 Discharge Coefficient 0.600 Invert Level (m) 90.700

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	90.768	0.068	2.1	130.6	Flood Risk
30 min Summer	90.787	0.087	3.0	167.5	Flood Risk
60 min Summer	90.805	0.105	4.1	202.6	Flood Risk
120 min Summer	90.821	0.121	5.0	232.5	Flood Risk
180 min Summer	90.828	0.128	5.4	245.0	Flood Risk
240 min Summer	90.830	0.130	5.6	250.3	Flood Risk
360 min Summer	90.832	0.132	5.7	252.7	Flood Risk
480 min Summer	90.832	0.132	5.7	254.4	Flood Risk
600 min Summer	90.833	0.133	5.7	255.3	Flood Risk
720 min Summer	90.833	0.133	5.8	255.5	Flood Risk
960 min Summer	90.832	0.132	5.7	254.2	Flood Risk
1440 min Summer	90.829	0.129	5.5	248.2	Flood Risk
2160 min Summer	90.823	0.123	5.2	236.6	Flood Risk
2880 min Summer	90.817	0.117	4.8	225.0	Flood Risk
4320 min Summer	90.807	0.107	4.2	205.0	Flood Risk
5760 min Summer	90.799	0.099	3.7	189.2	Flood Risk
7200 min Summer	90.792	0.092	3.3	176.5	Flood Risk
8640 min Summer	90.786	0.086	2.9	166.0	Flood Risk
10080 min Summer	90.782	0.082	2.7	157.3	Flood Risk
15 min Winter	90.768	0.068	2.1	130.6	Flood Risk
30 min Winter	90.787	0.087	3.0	167.6	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	142.716	0.0	77.6	19
30 min Summer	92.222	0.0	109.5	34
60 min Summer	56.713	0.0	171.2	64
120 min Summer	33.722	0.0	208.8	122
180 min Summer	24.576	0.0	230.7	182
240 min Summer	19.534	0.0	246.0	240
360 min Summer	14.061	0.0	267.2	312
480 min Summer	11.142	0.0	283.1	372
600 min Summer	9.297	0.0	295.5	434
720 min Summer	8.015	0.0	305.6	498
960 min Summer	6.338	0.0	321.3	636
1440 min Summer	4.546	0.0	341.2	908
2160 min Summer	3.257	0.0	404.4	1300
2880 min Summer	2.568	0.0	422.9	1700
4320 min Summer	1.836	0.0	443.1	2464
5760 min Summer	1.445	0.0	496.4	3224
7200 min Summer	1.200	0.0	512.3	3960
8640 min Summer	1.031	0.0	523.1	4672
10080 min Summer	0.906	0.0	528.5	5448
15 min Winter	142.716	0.0	77.6	19
30 min Winter	92.222	0.0	109.5	33

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	90.806	0.106	4.1	202.8	Flood Risk
120 min Winter	90.821	0.121	5.0	233.2	Flood Risk
180 min Winter	90.828	0.128	5.5	246.1	Flood Risk
240 min Winter	90.831	0.131	5.7	252.0	Flood Risk
360 min Winter	90.833	0.133	5.7	254.7	Flood Risk
480 min Winter	90.833	0.133	5.7	255.0	Flood Risk
600 min Winter	90.833	0.133	5.7	255.1	Flood Risk
720 min Winter	90.832	0.132	5.7	254.1	Flood Risk
960 min Winter	90.830	0.130	5.6	250.1	Flood Risk
1440 min Winter	90.825	0.125	5.3	239.3	Flood Risk
2160 min Winter	90.816	0.116	4.7	222.6	Flood Risk
2880 min Winter	90.808	0.108	4.2	207.9	Flood Risk
4320 min Winter	90.796	0.096	3.5	184.6	Flood Risk
5760 min Winter	90.787	0.087	3.0	167.3	Flood Risk
7200 min Winter	90.780	0.080	2.6	153.7	Flood Risk
8640 min Winter	90.774	0.074	2.3	141.7	Flood Risk
10080 min Winter	90.769	0.069	2.1	132.0	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	56.713	0.0	171.2	62
120 min Winter	33.722	0.0	208.8	120
180 min Winter	24.576	0.0	230.7	178
240 min Winter	19.534	0.0	246.0	232
360 min Winter	14.061	0.0	267.1	338
480 min Winter	11.142	0.0	283.1	380
600 min Winter	9.297	0.0	295.5	456
720 min Winter	8.015	0.0	305.6	532
960 min Winter	6.338	0.0	321.2	682
1440 min Winter	4.546	0.0	341.0	968
2160 min Winter	3.257	0.0	404.3	1388
2880 min Winter	2.568	0.0	422.8	1788
4320 min Winter	1.836	0.0	443.2	2592
5760 min Winter	1.445	0.0	496.4	3344
7200 min Winter	1.200	0.0	512.3	4112
8640 min Winter	1.031	0.0	523.3	4848
10080 min Winter	0.906	0.0	529.1	5552

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.950
Region	England and Wales	Cv (Winter)	0.950
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.439	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.388

Time From:	(mins) To:	Area (ha)
0	4	0.388

Time Area Diagram

Total Area (ha) 0.001

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000	32	36	0.000	64	68	0.000	96	100	0.000
4	8	0.000	36	40	0.000	68	72	0.000	100	104	0.000
8	12	0.000	40	44	0.000	72	76	0.000	104	108	0.000
12	16	0.000	44	48	0.000	76	80	0.000	108	112	0.000
16	20	0.000	48	52	0.000	80	84	0.000	112	116	0.000
20	24	0.000	52	56	0.000	84	88	0.000	116	120	0.000
24	28	0.000	56	60	0.000	88	92	0.000			
28	32	0.000	60	64	0.000	92	96	0.000			

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 91.000

Tank or Pond Structure

Invert Level (m) 90.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1920.0	0.223	1920.0	0.224	1.0

Orifice Outflow Control

Diameter (m) 0.100 Discharge Coefficient 0.600 Invert Level (m) 90.700

APPENDIX 13.3 – THAMES WATER CONSULTATION

From: BCTAdmin@thameswater.co.uk
To: Planning
Subject: 3rd Party Planning Application - N6/2015/0294/PP (amended documents)
Date: 10 September 2015 11:07:44

Head Of Development Control
Welwyn Hatfield District Council
Council Offices, Campus East
Welwyn Garden City
Hertfordshire
AL8 6AE

Our DTS Ref: 26322
Your Ref: N6/2015/0294/PP (amended documents)

10 September 2015

Dear Sir/Madam

Re: FORMER SHREDDED WHEAT FACTORY COMPLEX, AND LAND ADJOINING AT BROADWATER ROAD WEST, WELWYN GARDEN CITY, HERTFORDSHIRE, AL7 3BU

Waste Comments
Thames Water requests that the Applicant should incorporate within their proposal, protection to the property by installing for example, a non-return valve or other suitable device to avoid the risk of backflow at a later date, on the assumption that the sewerage network may surcharge to ground level during storm conditions.

Thames Water recommends the installation of a properly maintained fat trap on all catering establishments. We further recommend, in line with best practice for the disposal of Fats, Oils and Grease, the collection of waste oil by a contractor, particularly to recycle for the production of bio diesel. Failure to implement these recommendations may result in this and other properties suffering blocked drains, sewage flooding and pollution to local watercourses.

There are public sewers crossing or close to your development. In order to protect public sewers and to ensure that Thames Water can gain access to those sewers for future repair and maintenance, approval should be sought from Thames Water where the erection of a building or an extension to a building or underpinning work would be over the line of, or would come within 3 metres of, a public sewer. Thames Water will usually refuse such approval in respect of the construction of new buildings, but approval may be granted in some cases for extensions to existing buildings. The applicant is advised to contact Thames Water Developer Services on 0800 009 3921 to discuss the options available at this site.

A Trade Effluent Consent will be required for any Effluent discharge other than a 'Domestic Discharge'. Any discharge without this consent is illegal and may result in prosecution. (Domestic usage for example includes - toilets, showers, washbasins, baths, private swimming pools and canteens). Typical Trade Effluent processes include: - Laundrette/Laundry, PCB manufacture, commercial swimming pools, photographic/printing, food preparation, abattoir, farm wastes, vehicle washing, metal plating/finishing, cattle market wash down, chemical manufacture, treated cooling water and any other process which produces contaminated water. Pre-treatment, separate metering, sampling access etc, may be required before the Company can give its consent. Applications should be made at http://www.thameswater.co.uk/business/9993.htm or alternatively to Waste Water Quality, Crossness STW, Belvedere Road, Abbeywood, London. SE2 9AQ. Telephone: 020 3577 9200.

Thames Water would recommend that petrol / oil interceptors be fitted in all car parking/washing/repair facilities. Failure to enforce the effective use of petrol / oil interceptors could result in oil-polluted discharges entering local watercourses.

No impact piling shall take place until a piling method statement (detailing the depth and type of piling to be undertaken and the methodology by which such piling will be carried out, including measures to prevent and minimise the potential for damage to subsurface sewerage infrastructure, and the programme for the works) has been submitted to and approved in writing by the local planning authority in consultation with Thames Water. Any piling must be undertaken in

accordance with the terms of the approved piling method statement. Reason: The proposed works will be in close proximity to underground sewerage utility infrastructure. Piling has the potential to impact on local underground sewerage utility infrastructure. The applicant is advised to contact Thames Water Developer Services on 0800 009 3921 to discuss the details of the piling method statement.

'We would expect the developer to demonstrate what measures he will undertake to minimise groundwater discharges into the public sewer. Groundwater discharges typically result from construction site dewatering, deep excavations, basement infiltration, borehole installation, testing and site remediation. Any discharge made without a permit is deemed illegal and may result in prosecution under the provisions of the Water Industry Act 1991. Should the Local Planning Authority be minded to approve the planning application, Thames Water would like the following informative attached to the planning permission:"A Groundwater Risk Management Permit from Thames Water will be required for discharging groundwater into a public sewer. Any discharge made without a permit is deemed illegal and may result in prosecution under the provisions of the Water Industry Act 1991. We would expect the developer to demonstrate what measures he will undertake to minimise groundwater discharges into the public sewer. Permit enquiries should be directed to Thames Water's Risk Management Team by telephoning 02035779483 or by emailing wwqriskmanagement@thameswater.co.uk. Application forms should be completed on line via www.thameswater.co.uk/wastewaterquality."

Following initial investigation, Thames Water has identified an inability of the existing waste water infrastructure to accommodate the needs of this application. Should the Local Planning Authority look to approve the application, Thames Water would like the following 'Grampian Style' condition imposed. "Development shall not commence until a drainage strategy detailing any on and/or off site drainage works, has been submitted to and approved by, the local planning authority in consultation with the sewerage undertaker. No discharge of foul or surface water from the site shall be accepted into the public system until the drainage works referred to in the strategy have been completed". Reason - The development may lead to sewage flooding; to ensure that sufficient capacity is made available to cope with the new development; and in order to avoid adverse environmental impact upon the community. Should the Local Planning Authority consider the above recommendation is inappropriate or are unable to include it in the decision notice, it is important that the Local Planning Authority liaises with Thames Water Development Control Department (telephone 0203 577 9998) prior to the Planning Application approval.

Water Comments
With regard to water supply, this comes within the area covered by the Affinity Water Company. For your information the address to write to is - Affinity Water Company The Hub, Tamblin Way, Hatfield, Herts, AL10 9EZ - Tel - 0845 782 3333.

Supplementary Comments

There are a number of developments in the area therefore waste drainage issues have been identified and further investigation is needed. Development should be delayed until an impact study can completed. The following drainage strategy documents have been reviewed: Flood Risk Assessment & Drainage Strategy dated February 2015 rev D, Chapter 12, Appendix 12.1 and drawings D-GA-XX-608 to 608. The site must be viewed in the context of the Welwyn Garden City redevelopment as a whole. It is therefore recommended that an impact study for the entire wider area is carried out to confirm the extent of any network reinforcement required.

Yours faithfully
Development Planning Department

Development Planning,
Thames Water,
Maple Lodge STW,
Denham Way,
Rickmansworth,
WD3 9SQ
Tel:020 3577 9998
Email: devcon.team@thameswater.co.uk

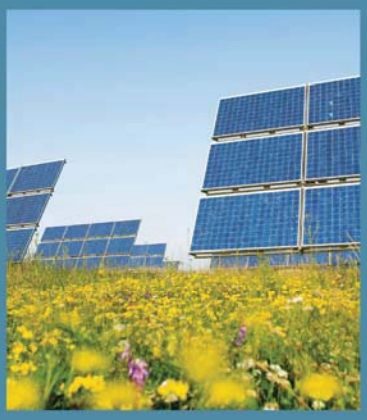
APPENDIX 14

SOILS, GEOLOGY AND CONTAMINATED LAND

APPENDIX 14.1 – PHASE 1 LAND CONTAMINATION REPORT

delta-simons
environmental consultants




A different perspective

Phase I Environmental Assessment, Former Shredded Wheat Factory, Broadwater Road, Welwyn Garden City

For
Spen Hill Developments Ltd

Delta-Simons Project No. 2342.17 V2

delta-simons
environmental consultants

Phase I Environmental Assessment,
Former Shredded Wheat Factory, Broadwater Road,
Welwyn Garden City

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delta-simons
environmental consultants

This Report was issued in January 2015 and prepared by:

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PHASE I ENVIRONMENTAL ASSESSMENT
FORMER SHREDDED WHEAT FACTORY, BROADWATER ROAD,
WELWYN GARDEN CITY
DELTA-SIMONS PROJECT NO: 2342.17 V2

EXECUTIVE SUMMARY

Context and Purpose	The purpose of this Assessment is to undertake an appraisal of environmental ground risk issues with respect to land which may be contaminated, as part of a pre-divestment assessment of the Site. The assessment has been undertaken in the context of the Site being redeveloped with a mixed use including residential, retail, office, hotel, gym and community hub.
Current Site Use	The Site is currently occupied by a former shredded wheat factory located in the north of the Site, and open derelict ground in the south of the Site, the former location of a confectionary factory and Polycell factory not in use since 2008.
Environmental Setting	The majority of the Site is underlain by superficial deposits of the Kesgrave Catchment Sub-group comprising sand and gravel. The north-western part of the Site and the southern edge are indicated to be underlain by the Lowestoft Formation, comprising diamicton (boulder clay). The entire Site is underlain by bedrock of the Lewes Nodular Chalk Formation and Seaford Chalk Formation which is classified as a Principal Aquifer. The Site is located within a Total Catchment (Zone 3) groundwater source protection zone (SPZ3).
Historical Information	The Site was developed from Greenfield in the 1920s as part of the establishment of Welwyn Garden City new town with limited alterations and changes in land use since that time. The north of the Site has been occupied by a shredded wheat factory, the centre of the Site by a plastics factory and later a confectionary factory and the south of the Site was originally developed as a film studio before being occupied by a tobacco factory and later a Polycell Factory. Rail sidings were also present until the 1960s. The principal sources of contamination identified at the Site relate to the former above and below ground solvent and fuel tanks, Polycell liquids production area, effluent disposal and boiler houses.
Ground Conditions	Ground conditions encountered across the Site generally comprise thin Made Ground over clayey sands and gravels, and/ or gravelly clay with chalk (a Principal Aquifer) at depths of between 8 and 18 metres below ground level (m bgl). Resting groundwater levels recorded in all investigations in the chalk aquifer were recorded between 20 m and 26 m bgl.
Site Investigation and Findings	Several phases of investigation have been completed at the Site by Delta-Simons and others which have identified significant solvent contamination of the groundwater in the underlying chalk aquifer and localised soil contamination associated with the former tank farm in the Polycell Factory. Widespread, or significant contamination has not been identified elsewhere at the Site, however, it is acknowledged that Site investigation is incomplete. Japanese knotweed has previously been identified in the north-west of the Site and is understood to have been treated.
Remediation Works	Remediation works have been undertaken in the area of the Polycell tank farm, overseen by Delta-Simons, to remove 13 underground tanks and impacted soils for on-Site bioremediation. A 'pump and treat' groundwater remediation system was installed to remove free product followed by an on-going period of Monitored Natural Attenuation of the dissolved phase contamination. Results to date indicate the remediation scheme has been successful in removing the primary sources and has resulted in significant reductions in dissolved phase contaminant concentrations.
Recommendations	Prior to the redevelopment of the Site, additional Site-wide investigation of the shallow soils, including ground gas and soil vapour monitoring is likely to be required to confirm, through standard planning conditions, that the Site is suitable for the proposed commercial and/or residential end-use.

	In addition, Monitored Natural Attenuation of the groundwater in the south of the Site, by Delta-Simons, is scheduled to continue until September 2015.
Development Abnormals	The following development abnormals should be considered during the redevelopment: Δ Groundworkers who are required to perform sub-surface work at the Site should be made aware of the known contaminants in soil and groundwater and the possibility of encountering additional localised low levels of contamination, including asbestos. Therefore, good standards of personal hygiene should be observed and appropriate levels of PPE utilised where necessary; Δ Suitable dust suppression techniques will need to be implemented by groundworkers during construction and demolition works; Δ Following completion of the additional site investigation works, confirmation should be sought from the Local Water Authority as to whether they will require upgraded pipework to be installed for new service installations; Δ A clean cover system will be required for any proposed landscaped and garden areas, the details of which should be agreed with the Local Authority with reference to the final detailed development design; and Δ Elevated costs above standard inert rates should be anticipated for disposal of engineering arisings from the Made Ground to include landfill tax, currently at a rate of £72/tonne. Additional waste classification testing (including Waste Acceptance Criteria (WAC) testing) is likely to be required to facilitate any off-Site disposal of ground materials.
Additional Risks and Considerations	In addition to the recommendations and development abnormals above, a number of other risks and potential liabilities have been identified during the works to date: Basements/Service Ducts - It is understood that the south-west of the Site may be underlain in part by a basement, the exact location of which is unknown. During the course of the remediation works a number of service ducts/voids beneath the remaining slabs were noted. Most notably, a deep (>2 m) partially water filled service duct was noted in the south-east of the Site parallel to the southern boundary of the Site. Currently the duct is protected by a large metal cover. However, should this become damaged or be removed this would represent a significant safety risk. Furthermore, labels warning of asbestos containing materials were present within the ducts, and it is considered this may relate to pipe lagging noted in the side of the ducts, the extent of which is now known. Asbestos - Small quantities of asbestos cement sheet fragments were noted on the Site surface.
This Environmental Assessment Executive Summary is intended as a summary of the Assessment of the Site based on information received by Delta-Simons at the time of production.	

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PHASE I ENVIRONMENTAL ASSESSMENT
FORMER SHREDDED WHEAT FACTORY, BROADWATER ROAD,
WELWYN GARDEN CITY
FOR
SPEN HILL DEVELOPMENTS LTD
DELTA-SIMONS PROJECT NO. 2342.17 V2

1.0 INTRODUCTION

1.1 Authorisation

Delta-Simons was instructed by Spen Hill Developments Ltd (the 'Client') to undertake a Phase I Environmental Assessment of the former Polycell and Former Shredded Wheat Factory site to the west of Broadwater Road, Welwyn Garden City, Hertfordshire, AL7 3BQ (hereafter referred to as the "Site").

1.2 Context and Purpose

The purpose of this Assessment is to undertake an appraisal of environmental ground risk issues with respect to land which may be contaminated, as part of a pre-divestment assessment of the Site. The assessment has been undertaken in the context of the Site being redeveloped with a mixed use including residential, retail, office, hotel, gym and community hub.

This Environmental Assessment Report forms part of a staged Site appraisal process and is intended to satisfy standard planning conditions requirements relating to the provision of a Phase 1 Desk Study/Preliminary Assessment. Further environmental and geotechnical intrusive investigations, remediation strategies and validation reports are likely to be required in order to satisfy planning conditions relating the redevelopment of the Site. A Phase I Geotechnical Desk Study Assessment of the Site has been produced by Delta-Simons under separate cover.

The principal aims of a Phase I Environmental Assessment, as stated in British Standard BS10175:2011 are to obtain information in order to:

- Δ Evaluate the environmental setting of the Site and to identify sensitive receptors;
- Δ Provide information from which possible contaminant-pathway-receptor relationships can be identified; and

- Formulate a Conceptual Site Model (CSM) to consider the significance of the contaminant-pathway-receptor relationships and identify whether further investigation is required.

This Report adheres to these principal aims and has been undertaken in accordance with current relevant guidance and best practice as set out within Contaminated Land Report (CLR) 11.

1.3 Scope

The scope of works for the Phase I Environmental Assessment is presented in Table 1.

Table 1 - Scope of Works

Data Collection	1. Review of the Site status, environmental and historical setting: a. Review current use/status of Site; b. Review geology and hydrogeology; c. Review Site history from historical ordnance survey (OS) maps; and d. Review regulatory information relating to the Site obtained from a Landmark Envirocheck® Report; 2. Detailed review and collation of key findings from the previous Delta-Simons and third party reports pertaining to the Site;
Interpretation & Reporting	3. Undertake a qualitative environmental risk assessment and development of a Conceptual Site Model; 4. Undertake an assessment of additional investigation or assessment requirements; and 5. Prepare a final Report.

1.4 Limitations

This Report provides an assessment of the contamination status of the Site based upon the available information. It does not provide a flood risk assessment or a geotechnical assessment/interpretation of the ground conditions and, as such, any comments relating to such matters are for information only.

The Report and risk assessment has been produced in accordance with the principles of BS10175. However, although reference may be made to archaeological and ecological issues, or the potential presence of asbestos containing materials (ACMs), the Report does not constitute an archaeological or ecological assessment, nor does it constitute an asbestos inspection. Comments with regard to waste classification information should be regarded as preliminary information in advance of a detailed waste classification assessment.

Delta-Simons obtained, reviewed and evaluated information in preparing the Report provided by Eneotech Limited, Chemtest Limited, Alcontrol Limited, Landmark Information Group, the Client and others. Delta-Simons' conclusions, opinions and recommendations

are based upon this information. Delta-Simons does not warrant the accuracy of the information provided to it and will not be responsible for any opinions which Delta-Simons has expressed, or conclusions which it has reached in reliance upon information which is subsequently proven to be inaccurate.

1.5 Development Proposal

All existing buildings are to be demolished (with the exception of listed facades and structures to be retained), and the Site redeveloped for a mixed use including residential, retail, office, hotel, gym and community hub.

2.0 SITE STATUS, HISTORY AND ENVIRONMENTAL SETTING

2.1 Phase I Desk Study and Walkover Summary

A summary of the current Site status, Site history and environmental setting of the Site is presented in Table 2. This review includes information sourced from a Landmark Envirocheck Report and historical maps, Environment Agency (EA) and British Geological Survey (BGS) Data, previous Site reports and observations made during Delta-Simons previous Site visits.

Table 2 – Summary of Site Status, History and Environmental Setting

General Site Location	The Site is located to the east of Welwyn Garden City centre, immediately east of the main train station. The Site is bound to the north by Bridge Street, the east by Broadwater Road, the south by a recent residential development and to the west by a warehouse, car park and railway. A Site Location Map is included as Figure 1.
National Grid Reference	524120, 212840 (approximate centre of the Site).
Aerial View	 Picture taken from Bing Maps 2013
Site Area and Topography	The Site is irregular in shape occupying an area of approximately 9 hectares (ha). The Site is situated at approximately 85 m Above Ordnance Datum (AOD) and is generally flat.
Site Status and Key Features	The Site is divided into several zones. The northern part of the Site is currently occupied by a former shredded wheat and biscuit factory, not in use since 2008 and the southern part of the Site is unoccupied following the demolition of the former Confectionary and Polycell Factories, also in 2008. The areas are discussed further below and detailed on the Site Layout Plan included as Figure 2. A selection of photographs showing the current and former Site buildings and features is included as Appendix I. North of Hydeway This area comprises several factory buildings constructed in a 1920s art deco style, ranging from single to four storeys high. The buildings are a mix of concrete or brick walled, with large glass windows and flat roofs. Associated buildings include offices, large silos, a generator house, sprinkler tanks and plant rooms.

From anecdotal evidence, it is understood that a boiler house and associated diesel storage tanks were formerly located in the area of the current sprinkler tanks. In addition, the southern area of the main factory had historically been utilised as a print works for the packaging of cereal products. An underground storage tank (UST) is understood to have been located halfway down the vehicle access ramp. Upon inspection, the UST appeared to have been decommissioned and filled as the manhole cover has been concreted. The capacity, or what it had been used for, was not confirmed. A further UST was located to the north of the factory building, under the visitor car parking bays. However, Delta-Simons was informed that this UST had never been used.

The north-western corner of the Site is undeveloped and occupied by rough grassland and hedges. Japanese knotweed has previously been identified in this area of the Site, though Delta-Simons understands that this has previously been treated.

South of Hydeway

The area immediately south of Hydeway is occupied by two disused buildings, understood have been a warehouse for the storage of raw materials/packaging products and a research and development laboratory for the development of new products. A maintenance warehouse and associated storage yard was also understood to have been located in this area. Potential asbestos containing materials (ACMs) in the form of corrugated asbestos cement sheets were noted within the buildings.

Cleared Area (Southern half of the Site)

The southern half of the Site is currently vacant following the demolition of the former Confectionary Factory and the Polycell Factory. The area is predominantly surfaced with hardstanding (concrete and tarmac), with an area of backfilled ground in the area of the tank farm remediation area.

Anecdotal evidence indicates the potential presence of basements under part of this area of the Site, one of which may have been used as a rifle range. During the remediation works Delta-Simons identified the presence of deep flooded ducts close the southern boundary of the Site which contained lagged pipework with asbestos warning labels (marked on Figure 3 and shown in photographs in Appendix I).

From a previous third party report completed prior to the demolition of the buildings it is understood that the original use of the Polycell area of the Site was as a film studio. The buildings were taken over in the 1940s by a cigarette manufacturing company, Ardath Tobacco Company, and then by Polycell in 1964. The factory has not been operational since late 1998.

The factory most recently produced a range of DIY products including Polyfilla and associated products, wallpaper adhesives and paint cleaning fluids. The primary operations carried out on-Site involved mixing of raw materials and packaging of products.

There were two principal areas of production; the Polyfilla powder and paste area and the liquids area. The Polyfilla and paste area was used primarily for the production of dry products and some liquid pastes, and was located in the south-western corner of the Site. Associated with this area was the wastewater tank for receiving the washing water from the paste lines. The warehouse was adjacent to the powders and paste building and was used for storage of all products on-Site. The liquids area, located at the northern end of the factory was used for the production of paint strippers and brush cleansers. Associated with the liquids area was the solvent tank farm comprising 13 (six in use when the Site was last operational, seven redundant) USTs and one above ground storage tank (AST). Naphtha, white spirit and methanol were stored in the six 4,000 gallon USTs (tanks 7 & 8, 5 & 6, and 3 & 4 respectively) and dichloromethane was stored in the 6,250

	gallon AST (tank 14). The seven redundant tanks had volumes ranging from 1,500 to 6,000 gallons and were used to store white spirit, derv, IPA, oxital, naphtha, turps and methanol. A fuel oil UST was also located in the north-east of the Polycell area. Other facilities included the boiler room, located in the centre of the Site with three heavy fuel oil ASTs in the adjacent room. The administration building and goods in warehouse were both located near the gatehouse at the front of the factory on Broadwater Road. In the eastern corner of the Site, it was reported that two USTs were used historically for diesel and petrol. It is reported that these tanks were cleaned, decommissioned and in-filled with concrete in the late 1970s. The Polycell site formerly held a waste management licence to dispose of industrial effluent from wastewater treatment to a soakaway, understood to be located in the vicinity of BH203 adjacent to the tank farm area.
Published Geology	From the BGS online Geology of Britain Viewer it is understood that the majority of the Site is underlain by superficial deposits of the Kesgrave Catchment Sub-group comprising sand and gravel. The north-western part of the Site and the southern edge are indicated to be underlain by the Lowestoft Formation, comprising diamicton (boulder clay). The entire Site is underlain by bedrock of the Lewes Nodular Chalk Formation and Seaford Chalk Formation. The actual ground conditions encountered during the previous site investigation works are summarised in Section 3.0.
Hydrogeology	The EA aquifer designation maps indicate that the Kesgrave Catchment Sub-group superficial sand and gravel deposits underlying the majority of the Site are classified as a *Secondary A Aquifer*. The diamicton of the Lowestoft Formation underlying the north-west and south of the Site is classified as *Unproductive Strata*. The chalk bedrock underlying the Site at depth is classified as a *Principal Aquifer*. The EA also indicates that the Site is located within a Total Catchment (Zone 3) groundwater source protection zone (SPZ3). From information provided within the Landmark Envirocheck® Report, it is understood that the nearest currently licensed groundwater abstraction is located approximately 1.3 km north-west of the Site and used for golf course irrigation. Groundwater abstractions for 'chemicals – process water' are also recorded approximately 100 m south of the Site on the former Roche Products Ltd site. However, this area has recently been redeveloped with residential properties. It is, therefore, considered that this abstraction is no longer active. In addition, a further abstraction, 340 m north of the Site, used by Rank Xerox Ltd for miscellaneous industrial processing is listed as revoked, lapsed or cancelled.
Hydrology	The nearest surface water course is located approximately 320 m north of the Site. From information provided within the Envirocheck® Report, it is understood that there are no licensed abstraction points from surface water within 1 km of the Site. The Site is not located within an area considered by the EA to be at risk of flooding.

Key Historical Uses	The historical development of the Site has been assessed through a review of available historical Ordnance Survey maps dating from 1878 to 2013, previous reports and an internet search. A summary of the key historical Site uses and developments in the surrounding area is presented below. Copies of the historical maps are included as Appendix III. The Site zones and potential areas of contamination, based on the historical uses, are shown on the Site Zones and Features Plan included and Figure 3. Site History The development of the Site and surrounding area was begun in the 1920s in conjunction with the 'new town' development of the Welwyn Garden City. As such the historical uses of the Site are limited and essentially comprise a single phase of development. ∆ **1878 – 1920s:** The Site was undeveloped, assumed to have been agricultural land; ∆ **1920s to 1965**: The south of the Site had been developed as a Film Studio and an electric heater manufacturer was located in the centre of the Site with a rail siding along the eastern edge of the Site and centre of the Site with a branch line serving the heater manufacturer. The north of the Site had been developed as a Cereals Manufacturer with tanks located close to the centre of the northern boundary of the Site; and ∆ **1967 – 2000s**: The Site had been developed to the final layout and marked as factories and works. The tank farm in the north-east of the Polycell area in the south of the Site was shown from 1960. The centre of the Site occupied by a Confectionary Factory and a Plastics Engineering Works and a Biscuit Factory in the north. Surrounding Area Key potential land uses in the vicinity of the Site include: ∆ **1878 to the present day:** Railway tracks 10 - 50 m west of the Site; ∆ **1920s to 2000:** Chemical and Pharmaceutical works (Roche site) adjacent to the south of the Site; ∆ **1920s – 1970s:** Engineering works 25 m north of the Site; ∆ **1920s – 1970s:** An iron foundry 75 m north-east of the Site; and ∆ **1920s to the present day:** Various small works and warehouses from 20 m east of the Site along Broadwater Road, including garages, a laundry, and wireless manufacturers.
Radon Gas	The Site lies within an area where less than 1% of homes are above the National Radiological Protection Board (NRPB) recommended "action level" for radon. BRE211 (2007) indicates that no radon protective measures are necessary in the construction of new dwellings or extensions at the Site.
Coal Mining	The Site is not located within an area that is likely to be affected by coal mining activity.
Sensitive Areas	There are no relevant environmentally sensitive areas in the vicinity of the Site.
Landmark Envirocheck® Report Review	The Landmark Envirocheck® Report provides a database of environmental information held by various statutory bodies including the EA, Local Authority (LA), Health & Safety Executive (HSE), HPA and the Coal Authority. A full copy of the Envirocheck® Report is provided in Appendix II and the most relevant information is summarised below: On-Site ∆ **Discharge Consents:** None on Site; ∆ **Integrated Pollution Prevention and Control (IPPC) Sites:** None on-Site; ∆ **Local Authority Pollution Prevention and Control (LAPPC) Sites:** None on-Site; ∆ **Pollution Incidents to Controlled Waters:** None on-Site; ∆ **Landfill Sites and Waste Facilities**: A registered landfill and waste

	treatment or disposal site, dated June 1979, relating to a soak way for aqueous effluent waste and industrial effluent treatment sludge is recorded associated with the former Polycell Product Ltd facility. The maximum input rate is listed as less that 10,000 tonnes per year; ∆ **Fuel Station Entries**: None on-Site; and ∆ **Contemporary Trade Directory Entries:** Listed on-Site activities are limited to food product manufacture associated with the cereal factory area of the Site. Off-Site ∆ **Discharge Consents:** The nearest consent (now expired) was located approximately 330 m north of the Site, no other consents are recorded within 1 km of the Site; ∆ **Integrated Pollution Prevention and Control (IPPC) Sites:** The nearest permitted facility is a lead recovery process operated by British Lead Mills Ltd approximately 190 m east of the Site. The former Roche Products Ltd facility to the south of the Site was previously permitted for the manufacture and use of organic chemicals; ∆ **Local Authority Pollution Prevention and Control (LAPPC) Sites:** The nearest permitted facilities are dry cleaners, 210 m west and 260 m north-west of the Site and a petrol filling station 230 m east of the Site; ∆ **Pollution Incidents to Controlled Waters:** The nearest incident relates to a Category 3 – Minor pollution incident associated with the release of unknown chemicals approximately 230 m north-east of the Site in 1991; ∆ **Landfill Sites and Waste Facilities:** The nearest landfill is located approximately 1 km south of the Site, and is dated 1965. The waste types accepted are not specified. The nearest waste facility is a vehicle depollution facility located approximately 350 m north-east of the Site. A former waste transfer (with treatment) facility is recorded on the Rank Xerox site approximately 25 m north of the Site and a former waste solvent storage facility is recorded on the Roche site approximately 100 m south of the Site; ∆ **Fuel Station Entries**: The nearest petrol filling station is located approximately 230 m east of the Site; and ∆ **Contemporary Trade Directory Entries:** Listed activities in the vicinity of the Site include: garage services, MOT testing centres, pharmaceutical manufacturers & distributors, sheet metal works and laboratories.

3.0 GROUND CONDITIONS

3.1 Ground Conditions

Ground conditions encountered in the previous investigations at the Site have been summarised in Table 3.

Table 3 – Generalised Ground Conditions

Strata	Generalised Description of Strata	Depth
Made Ground - Hardstand	Where present, predominantly comprising concrete, sometimes asphalt.	From surface to 0.3 m bgl
Made Ground	Variable inconsistent stratum. Clay, silty sand, gravel, bricks, ash, slag and concrete.	Base of strata between 0.6 m and 2 m bgl
Kesgrave Catchment Subgroup and the Lowestoft Formation	Variable sometimes inconsistent strata across the site. Clayey sands and gravels, and/ or gravelly clay.	Base of strata between 8 m and 18 m bgl
Lewes Nodular Chalk Formation and Seaford Chalk Formation (undifferentiated)	Initially weathered white putty chalk grading to chalk bedrock.	Proven to a maximum depth of 30 m bgl

Resting groundwater levels recorded in all investigations in the shallow chalk aquifer were recorded between 20 m and 26 m bgl.

4.0 PREVIOUS SITE INVESTIGATION SUMMARIES

4.1 Introduction

Delta-Simons has been provided with several third party reports pertaining to the Site. These reports are reviewed in Table 4 to provide further background information on the history and contamination status of the Site. *Delta-Simons does not have reliance on the third party reports, as such, these reviews are included for information purposes only.*

Table 4 - Previous Report Summaries

'Hotspot' Survey Reports for European Sites **Dames & Moore Report** **July 1998**
This report was produced with specific reference to the former Polycell factory occupying the southern part of the Site. The relevant information contained within this report is summarised below: Δ Low-level total petroleum hydrocarbon (TPH) contamiantion was identified adjacent to the USTs along the north-western boundary of the Site. This was considered to be indicative of leakages in the USTs and associated pipework, or historical spillages; Δ Elevated TPH was identified adjacent to the tank farm. This was considered to be indicative of the presence of light aliphatic hydrocarbons (white spirit), from possible leakages in the UST's or associated pipework or historical spillages; and Δ Dichloromethane was [at the time] believed to be sourced from a drum storage area, which was located along the northern boundary of the Polycell Site, to the rear of the liquids production building or from activities within the building itself.
Phase II Site Investigation of Polycell Products Ltd **URS** **March 1999**
The key soil and groundwater quality issues identified at the Site were as follows: Δ Naphtha and dichloromethane Non-Aqueous Phase Liquid (NAPL) impacted soils in the vicinity of the tank farm and liquids production area, and impacted groundwater over much of the Polycell site were identified; and Δ Trichloroethene (TCE), cis-1,2-Dichloroethene (DCE), phenol, nickel and arsenic were detected in the groundwater.
Report on Site Investigation – 18/22 Broadwater Road **Technotrade** **June 2000** **Ref: 19662**
The area covered by the report was the former Confectionary Factory in the central part of the Site. It is noted that several process at the site used solvents or other chemicals. The report also states that "it was known [by 2000] that the adjacent Polycell site (in the south of the Site) had severe soil contamination problems". An intrusive investigation, comprising seven boreholes (to 6 m bgl), five trial pits (up to 3.7 m bgl), collection of 13 soil samples and VOC monitoring was completed in May and June 2000. Elevated concentrations of VOCs, principally dichloromethane and trimethylbenzene, were identified in the soils close to the south-western boundary close the tank farm on the adjacent Polycell site. However, significantly elevated concentrations of contaminants were not identified elsewhere on the Confectionary Factory site.

Final Factual Report - Additional Site Investigations of Polycell Products Limited
Dames and Moore
14th July 2000
Ref: R2779/38842-019-401/WH

The report indicates that a Phase I Environmental Investigation was completed in February 1998 and a Phase II Site Investigation in March 1999 which identified soil and groundwater contamination adjacent to the tank farm and liquid production area in the north-west corner of the Polycell site. A free-phase liquid was identified floating on the groundwater table with a plume of dissolved phase contamination in groundwater. The principal contaminants were dichloromethane (methylene chloride) and a collection of naphtha compounds including 1,2,4-trimethylbenzene, naphthalene and xylenes.

The additional investigation comprised the drilling of six boreholes up to 50 m bgl and the installation of nine monitoring wells (six within the chalk). Soil, groundwater and free-phase product samples were collected. Geophysical logging and packer tests were also conducted on two boreholes to determine hydraulic characteristics of the Chalk.

The key findings of the investigations and risk assessment were as follows:

- Δ The free phase NAPL contamination was considered to be restricted to the north-western corner of the Polycell site with a dissolved-phase plume migrating south-eastwards;
- Δ Soil contamination in the unsaturated zone was considered to be restricted to an area of approximately 15 m by 15 m around the former tank farm;
- Δ The composition of the NAPL free-phase contamination was very consistent, principally comprising 1,2,4-trimethylbenzene (40%) and dichloromethane (40%), but also minor components of xylenes, p-isopropyltoluene, n-propylbenzene and 1,3,5-trimethylbenzene;
- Δ The dissolved–phase contaminants were attenuated as they migrate towards the southern Site boundary. Dichloromethane and xylenes exhibited the most attenuation suggesting preferential degradation. However groundwater concentrations of 1,2,4- and 1,3,5-trimethylbenzene, dichloromethane, p-isopropyltoluene and n-propylbenzene above water target values were recorded at the down-gradient Site boundary; and
- Δ Concentrations of vinyl chloride, cis-1,2-Dichloroethene and Trichloroethene were also identified in the groundwater above target values at the down-gradient site boundary.

Potential risks to controlled waters and Human Health associated with the free phase and dissolved phase contamination were identified.

Final Interpretative Report - Soil Vapour Survey And Risk Assessment
Polycell Products Limited
URS Dames and Moore
22nd August 2000
Ref: R3060/38842-024-401/WH/RJD

The vapour survey was undertaken to assess the potential risks to Site users associated with the VOC in the soils and groundwater around the tank farm. Soil vapours were measured in a series of shallow boreholes using passive diffusion tubes.

Soil vapour concentrations of naphthalene, propylbenzene, trichloroethene and cis-1,2-dichloroethene were all below the detection limit of the analytical method used.

Concentrations of trimethylbenzenes, xylenes and isopropyltoluene were below the screening criteria (adjusted Health and Safety Executive Occupational Exposure Limits), which are protective of public health, and were, therefore, not considered to pose a risk to on-site employees.

Report on Supplementary Site Investigation – 18/22 Broadwater Road
Technotrade
February 2001
Ref: 19662A

The supplementary investigation was undertaken to further assess the extent of VOC contamination identified in the south-west of the former Confectionary Factory site and its possible effects on shallow groundwater.

The intrusive investigation comprised a further eight boreholes (up to 15.0 m bgl) along the south-

western boundary, collection of 22 soil samples and VOC monitoring. Works were completed in January 2001. Groundwater was not encountered during the investigation.

The additional investigation identified elevated concentrations of VOC, principally trimethylbenzene, in six of the additional boreholes at depths of between 3.0 and 7.0 m bgl. Given that VOC was not identified in the shallow Made Ground it was considered that the VOC was migrating [on to the Confectionary Factory site] through the sand and gravel layers and being retained in a clay layer between 5 and 7 m bgl.

Environmental Assessment, Broadwater Road
Delta-Simons
October 2003
Project No. 2342-03

The report covers the former confectionary factory and Polycell factory areas in the context of the site being redeveloped with a commercial end-use.

Intrusive site investigation works were undertaken by Delta-Simons in April 2003. Three boreholes (BHA-BHC) were drilled to 25.0 m bgl in the former confectionary factory area of the Site, and 15 window samples (WS1-WS15) were advanced to 3.0 m bgl across the Site. Soil samples from BHA and the window samples were collected and submitted for analysis. Two rounds of groundwater sampling from the newly installed Delta-Simons boreholes and the previously installed URS boreholes were completed.

Elevated concentrations of VOC were detected in the soils in WS10 and BHA indicating that contamination was present in the former confectionary factory, north of the tank farm in the north-west corner of the former Polycell factory, and was thought to be sourced from this area of known contamination.

A significantly elevated concentration of trichloroethene was also identified in WS10 at 0.50 m bgl and was, therefore, considered to be indicative of contamination in the former confectionary factory part of the Site, but was not considered to be associated with the known contamination from the tank farm.

Widespread groundwater contamination was identified across the investigation area, consistent with the previous site investigation works, including elevated VOC (dichloromethane up to 2,341,600 µg/l in BH209), SVOCs (naphthalene up to 19,990 µg/ in $BH303_{(s)}$) and TPH (up to 17,200 µg/l in BH209). The VOC compounds ethylbenzene, m/p xylene, o-xylene and styrene were all detected at significantly elevated concentrations in a number of boreholes across the investigation area.

These findings confirm the contamination issues identified during the previous investigations associated with the tank farm in the former Polycell factory. Concentrations of TPH in BHB and BHC were also considered to be elevated, however, given the groundwater flow direction, these were considered to be representative of a potential secondary source of contamination.

Phase II Environmental Assessment - Southern Section Of Cereal Partners Site
Delta-Simons
November 2004
Project No. 2342-05

The report covers the southern section of Cereal Partners facility, to the south of Hydeway in the centre of the Site.

The intrusive investigation comprised eight window sample probeholes (WS1 – WS8) to a maximum depth of 3.0 m bgl and one borehole (BH1). In addition, a second borehole (BH2) was drilled in the vicinity of a previous investigation point, WS10, on the former Confectionary Factory site. The boreholes were drilled to a maximum depth of 27.2 m bgl, and were installed as monitoring wells to facilitate groundwater monitoring. A total of 19 soil samples were collected from the borehole and window sample arisings. Groundwater samples were collected from the newly installed boreholes (BH1 and BH2), and two boreholes down gradient (BHB and BH206) on two occasions.

VOC, SVOC and TPH were detected above the laboratory detection limits in a number of soil samples submitted for analysis. However, concentrations were not considered to represent a concern to the

Site. ACMs were positively identified in a sample collected from WS3 at a depth of 0.4 – 0.5 m, which was identified as containing 10 – 15 % chrysotile.

Elevated concentrations of the VOC, SVOC and TPH were identified in the groundwater in BH1, BH2 and BHB. Given the groundwater flow direction (south-eastwards), the elevated concentrations were considered to be representative of a source of contamination located to the north of these boreholes, which has also contributed to contamination of soils at the soil/water interface.

Groundwater Monitoring – Broadwater Road, Welwyn Garden City
Delta-Simons
26th January 2005
Project No. 2342-05

The scope of works performed by Delta-Simons comprised the following:

- Δ Dipping of the monitoring wells installed by URS and Delta-Simons using an interface probe to measure free phase product on the deep aquifer; and
- Δ Collection of 12 groundwater samples from both URS and Delta-Simons boreholes on one occasion.

Free product was identified at three locations (BH209 = 0.1 m, BH303(s) = 0.1 m and BHA = 0.02 m).

Significant SVOC, VOC and TPH contamination was identified at the Site, which was indicative of the contamination previously identified by URS in 1999 and 2000, and Delta-Simons in 2003, associated with the tank farm in the north-west corner of the former Polycell Factory.

Ethylbenzene concentrations in BH209, BH304 and BH303(s) during this round of groundwater monitoring were found to be slightly elevated above the 2003 monitoring results. M/p xylene and o-xylene concentrations in BH304 and BH209 during this round of groundwater monitoring were also found to be slightly above the 2003 monitoring results. Most notable of these increases, were the elevated concentrations of ethylbenzene (145 mg/l) and TPH (20 mg/l) in BH303(s), located in the south-eastern corner of the Site which was considered to indicate that contamination was beginning to migrate off-Site.

Quantitative Risk Assessment, Broadwater Road
Delta-Simons
December 2005
Project No. 2342-06

As part of the Quantitative Risk Assessment (QRA), Delta-Simons completed six window samples (WSA to WSF) in July 2005 to delineate the extent of, and further characterise the nature of previously identified soil contamination in the vicinity of the former tank farm. In addition four boreholes were completed (DS01 to DS04) and installed as groundwater monitoring wells to further define the extent of the contamination plume and to replace BH301(s) which was dry. Two rotary boreholes (R1 and R2) were also drilled by QDS, as part of their pilot test in July 2005. A total of 23 soil samples, 20 groundwater samples and two free product samples were collected for analysis.

Strong visual and olfactory evidence of soil contamination at the interface with the groundwater surface within the chalk was found within samples from all of the boreholes.

Widespread contamination of the groundwater at the Site was identified, considered to relate to the spillage of white spirit and dichloromethane from a tank farm in the north-west of the Polycell factory. Free product was identified on the surface of the groundwater, at depths of approximately 22 m within the Chalk.

Elevated concentrations of TPH, SVOC and VOC at depth within the Chalk, in the direction of groundwater flow, were considered to be associated with the free product on the surface of the groundwater, and relate to a smear zone caused by fluctuations in the height of the water table.

Given that concentrations of TPH, SVOC and VOC were significantly elevated at depth, but that concentrations within the shallow soils were much lower, it was considered likely that the contamination had leaked out from the base of the USTs and migrated directly down to the groundwater through the overlying soils. During the intrusive investigation, it was not possible to

investigate directly below the tank farm (the intrusive work was restricted to the fringes) but it was considered likely that significantly impacted soils would be located in this area.

An increase in the concentration of TPH within groundwater samples between the July 2005 and the August 2005 monitoring events indicated that the groundwater contamination plume may have been spreading to the south-east. Detectable concentrations of TPH, VOC and SVOC within DS04 and within BH302(S) at the southern Site boundary indicated that the contamination may have been beginning to migrate off-Site.

Analysis of deep (approximately 50 m) and shallow (approximately 22 m) groundwater samples from the south-eastern boundary of the Site indicated that there are two distinct groundwater regimes. The concentration of TPH within the deep sample (BH302(D)) was below the analytical detection limit, whereas that from the shallow sample (BH302(S)) was 18 mg/L. Concentrations of SVOC within the deep groundwater sample were also below analytical detection limit, whereas some SVOCs were identified within the shallower groundwater. Traces of several VOCs were detected within the shallower sample and whereas traces of the VOCs dichloromethane and trimethylbenzene only were detected within the deeper sample, indicating that although the deeper water resource was relatively uncontaminated, there was a potential risk that it may become so with time. The difference in contamination concentrations, however, confirmed the presence of the relatively distinct aquifer layers that coincide with a difference in permeability.

The monitoring of manganese, nitrate and sulphate concentrations within the groundwater indicated that biodegradation of the contamination was likely to be taking place at the Site.

A source-pathway-receptor assessment of the contamination issues at the Site identified a pollutant linkage between the identified contamination sourced from the tank farm and the Chalk aquifer. A potential pollutant linkage was also identified between contamination recorded in the groundwater, and the wider aquifer environment, through lateral migration through fissures within the Upper Chalk.

A potential pollutant linkage was identified between the contamination recorded within the soil in the vicinity of the tank farm and future Site users, through the inhalation of vapours

A QRA was undertaken using the EA Spreadsheets associated with R & D Paper 20, “Methodology for the Derivation of Remedial Targets for Soil and Groundwater to Protect Water Resources, Version 2.2”.

Delta-Simons recommended that the remaining tanks within the tank farm be decommissioned and removed, together with, as far as is practical, any shallow soils in the vicinity which appeared to be contaminated (from visual and olfactory evidence). Followed by groundwater remediation to remove free product from the surface of the groundwater, with further groundwater monitoring be carried out in order to validate the results of the remediation.

It was considered that the risks to Site users from residually contaminated soils beneath the tank farm may need to be further assessed by further QRA work.

Combined Phase I/II Environmental Assessment – Cereal Partners (UK), Broadwater Road
Delta-Simons
July 2006
Project No. 05-3046.01

The report covers the northern part of the Site, occupied by the former shredded wheat factory. Associated with the factory were grain silos, sprinkler tanks, car parking, roadways and two vacant plots of land, one triangular in shape and the other a narrow strip of land.

The Site investigation comprised the drilling of eight boreholes, which were installed as 50 mm monitoring wells, to a maximum depth of 30.0 m bgl, 10 trial pits to a maximum depth of 3.3 m bgl and 11 window sample probeholes to a maximum depth of 4.0 m bgl. A total of 42 soil samples were collected from the borehole, trial pit and window sample probehole arisings and submitted for a selection of chemical analysis. In addition, one round of groundwater (eight samples) and ground gas monitoring was also undertaken.
Visual or olfactory evidence of hydrocarbon contamination (associated with the known groundwater

contamination plume) was identified in BHA at a depth of 26.0 m bgl to a maximum proven depth of 29.8 m bgl, BHC at a depth of 4.2 – 5.0 m bgl and BHE at a depth of 21.3 m bgl to a maximum proven depth of 30.0 m bgl. In addition, ash was encountered in the Made Ground at several locations.

Elevated concentrations of arsenic, PAHs and TPH were identified in the shallow soils. Elevated concentrations of VOC and naphthalene were identified in the groundwater at BH1, BHA and BHE located close to the tank farm on the Polycell site.

Significantly elevated concentrations or flows of ground gases were not identified.

Japanese knotweed was identified on the undeveloped land, close to the railway, in the north-west of the Site.

Supplementary Site Investigation – Cereal Partners (UK), Broadwater Road
Delta-Simons
February 2007
Project No. 05-3046.02

The purpose of the Supplementary Site Investigation was to delineate the previously identified deep groundwater contamination at the Site, and also to identify whether it was attributable to a shallow on-Site source, or whether it had originated from an off-Site source (the tank farm on the Polycell site via a fracture in the underlying chalk).

The supplementary Site investigation was undertaken in November 2006 and comprised the drilling of three boreholes (BHI, BHJ and BHK) to a maximum depth of 30.0 m bgl. All three boreholes were installed as monitoring wells. In addition, eight window sample probeholes (WS1B, WS2B, WS3B, WS6B, WS7B, WS8B, WS9B and WS10B) were advanced to a maximum depth of 4.0 m bgl. A total of 26 soil samples were collected from the borehole and window sample arisings

In addition, groundwater samples were collected from the three newly installed boreholes (BHI, BHJ and BHK) and BH1, BHA and BHE on two occasions. Ground gas monitoring was undertaken on two occasions.

Olfactory evidence of hydrocarbon contamination was observed in BHJ from a depth of 25.5 m bgl and BHK from a depth of 26.0 m bgl.

Shallow heavy metal and hydrocarbon contamination was identified in a number of the soil samples collected from the Site. Aliphatic/aromatic hydrocarbon, SVOC and VOC contamination was identified within deep soil samples collected from BHJ and BHK.

In addition, aliphatic/aromatic hydrocarbons, SVOC and VOC contamination was identified within the groundwater collected from the newly installed BHJ and BHK, as well as the previously installed boreholes BH1, BHA and BHE, where deep groundwater contamination has been previously identified.

Despite the deep soil and groundwater contamination, the shallow contamination identified as part of this Supplementary Site Investigation is not consistent with the contamination identified at depth and, therefore, is not considered to represent the source of the deep soil and groundwater contamination.

A component of the groundwater flow direction for the Site was identified as being towards the north-east, along a narrow ‘corridor’ from BH1 to BHA, which is not consistent with the groundwater flow direction of the wider surrounding area, which has been proven to flow towards the south-east. However, given the historical presence of a groundwater abstraction approximately 330 m north of the Site, it is considered possible that this has over time had an effect on the groundwater flow direction and drawn it northwards, possibly along a fracture zone.

Given that no significant sources of shallow contamination have been identified at the Site, and given the groundwater flow direction towards the north-east, it is the opinion of Delta-Simons that the identified deep soil and groundwater contamination had originated from the tank-farm on the adjacent former Polycell factory.

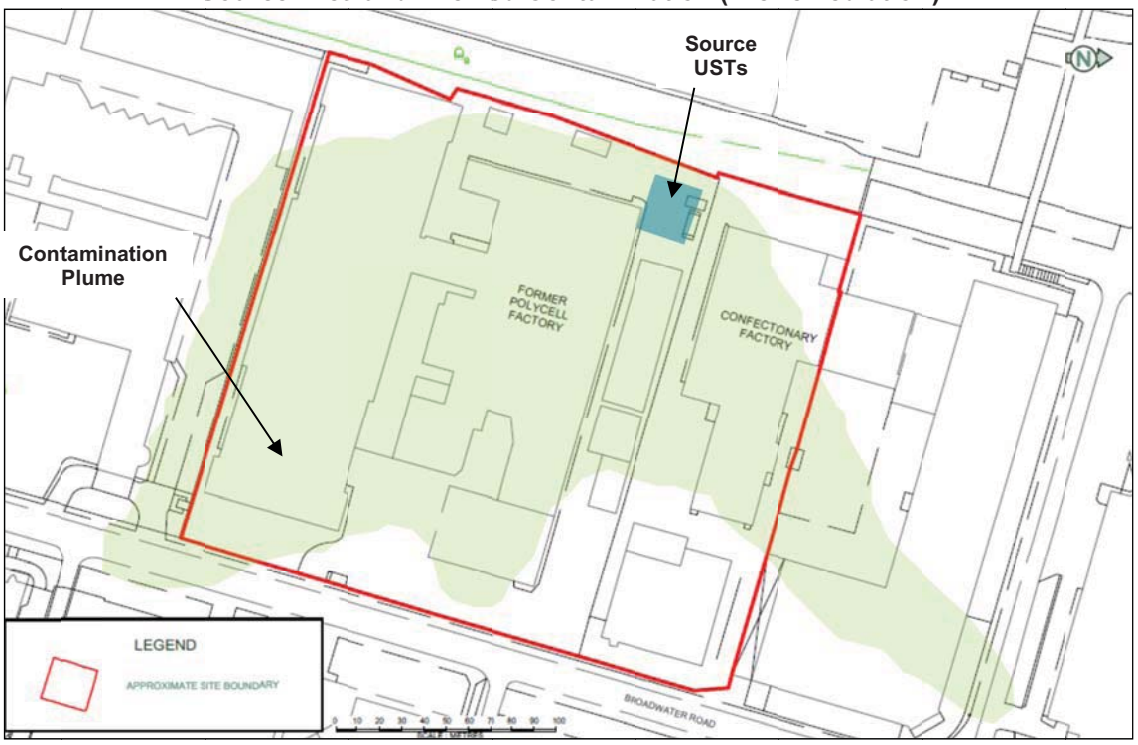
5.0 REMEDIATION WORKS 2008 - 2013

5.1 Introduction

As summarised in the previous Section, several phases of site investigation have been undertaken at the Site by Delta-Simons and others which have identified localised soil contamination and significant widespread contamination at depth in groundwater within the Principal Chalk Aquifer beneath the Site. The source of the contamination was determined to be leakage from USTs and above ground storage tank (AST) located in the north-west of the former Polycell factory part of the Site. The location of the tank farm and inferred groundwater contamination plume is shown on the drawing below.

In order to address the identified groundwater contamination a long term strategy was agreed between the land owner and the Regulators (Environment Agency and Local Authority) to undertake a voluntary groundwater remediation scheme to reduce the environmental risks and liabilities.

Source Area and Inferred Contamination (Pre-remediation)



5.2 Contamination Summary

The key contaminants comprise 'White Spirit' characterised by a mix of light end aliphatic hydrocarbons, dichloromethane, trimethylbenzene, naphthalene, ethylbenzene and xylenes. Non-aqueous phase liquid (NAPL) free product was identified on the surface of the

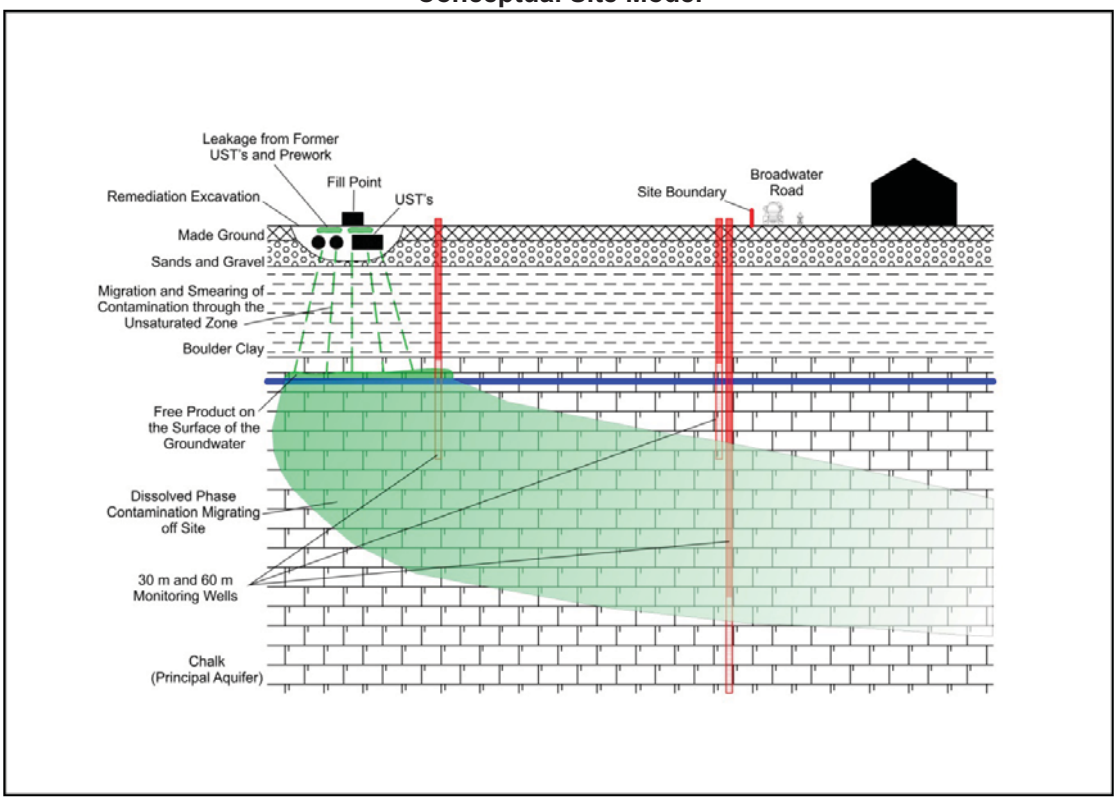
groundwater at a depth of approximately 22 m bgl within the Chalk in the following boreholes: DS01, BH209, BH304, BH303 (s) BHA and BHE. Plans showing the location of the boreholes area attached as Figures 4 and 5.

Elevated concentrations of total petroleum hydrocarbons (TPH) and volatile organic compounds (VOC) were identified within shallow Made Ground around the periphery of the tank farm. The contamination is considered to have been caused by leakages from the pipework associated with the tank farm, or from the USTs/AST themselves.

Elevated concentrations of TPH, semi-volatile organic compounds (SVOC) and VOC at depth within the Chalk, in the direction of the identified groundwater flow (primarily towards the south-east), are considered to be associated with the free product on the surface of the groundwater. A generalised representation of the contamination plume, geology and groundwater at the Site is shown on the cross sectional Conceptual Site Model drawing below.

Groundwater monitoring undertaken prior to the remediation works identified that the dissolved contamination was reaching the boundaries of the Site and investigations on the adjacent Cereal Partners UK (CPUK) land (to the north of the Site) identified deep groundwater contamination in a number of boreholes, which has been identified as originating from the tank farm.

Conceptual Site Model



5.3 Remediation Summary

Given the scale and extent of the groundwater contamination at the Site a remediation strategy and monitoring programme was devised following a quantitative risk assessment (QRA) completed by Delta-Simons in December 2005. The main objective of the remediation strategy was to remove the major source of contamination present at the Site, comprising the tank farm and surrounding impacted shallow soils and the free product on the groundwater at depth beneath the tank farm to prevent the continued contamination of groundwater from the source area. The secondary objective of the remediation programme is to remediate the dissolved phase groundwater contamination to the derived remedial targets, in order to minimise impact to the wider groundwater environment.

The remediation scheme comprises a combination of techniques to remove the source of the contamination and address the dissolved phase contamination plume across the wider Site. These included:

1. Tank pull and soil excavation – *completed September/October 2008*;
2. Excavation validation – *completed October 2008*;
3. On-Site ex situ biopile remediation – *completed July 2009*;

4. Pump and Treat groundwater remediation / Free product recovery – *completed January 2011*;
5. Soil vapour extraction - *completed January 2011*;
6. Oxygen releasing compound injection – *completed early 2011*; and
7. Monitored natural attenuation – ***on-going.***

The works completed to date are summarised in Sections 5.4 to 5.7.

5.4 Soils Remediation Summary

5.4.1 Tank Pull and Soil Excavation Phase

The tank pull phase and soil excavation of the remediation works commenced on 29th September 2008 and was completed on the 27th October 2008. Following the breaking out of the concrete surface a total of 13 tanks were found to be present in two separate tank farms. The western tank farm contained five tanks of various capacities, which appeared to be in a relatively poor condition. Significant visible hydrocarbon contamination was noted within the base and at the sides of the tank farm. The eastern tank farm contained eight tanks of equal capacity which appeared to be of more recent construction and were in a better condition. Visible hydrocarbon contamination was also less apparent in the base and at the sides of the tank farm.

The tanks were removed by a specialist sub-contractor and removed from Site for recycling. Prior to removal the tanks were degassed and confirmed to be free of liquid contents. Following removal of the tanks the concrete bases were broken out and removed from the Site for disposal at an appropriate facility. The surrounding impacted soils were excavated to a depth of approximately three metres within an area of approximately 30 m by 30 m, localised highly impacted areas were excavated to approximately 4.5 m bgl. During the excavation the most significant contamination of the soils was noted around former pipework runs and the former off-set filling point. A selection of Site photographs from the tank pull and excavation phase are included as Appendix I.

Contaminated soils were transferred to on-Site stockpiles (biopiles) to promote bioremediation. Prior to placement, the soils were run through an Allu screening bucket to reduce particle size and increase void space to further promote aerobic bioremediation.

Following excavation of the contaminated soils to the required depth of 3 m bgl, verification sampling of the soils was carried out by Delta-Simons on the basis of one composite sample per 5 m x 5 m square at the base and sides of the excavation to confirm that the source area had been effectively removed. A total of 62 soil samples were collected and submitted to a UKAS and MCERTS accredited laboratory for analysis of speciated total petroleum hydrocarbons (sTPH) and VOC.

5.4.2 Excavation Verification Analysis

The excavation verification sample analysis results were compared to Site-specific remedial target values (SSRTVs) derived for the protection of groundwater and Human Health[1] for the key contaminants. In addition, the results were compared to generic screening criteria for the protection of Human Health (HH-GSVs) for all contaminants in the context of a proposed residential end-use (without private garden areas).

None of the target contaminant concentrations were above the Site-specific remedial target values for groundwater. Exceedences of the Site-specific remedial target values for the protection of Human Health were recorded in eight of the 62 validation samples. However, based on the complete data set it is considered that the principal source of the contamination in the soils around the former tank farm has been effectively removed.

Though exceedences of the generic residential screening criteria for VOCs have been recorded it should be noted that the samples were taken from the base and sides of the excavation at approximately 2 to 3 m below the original ground level. Following completion of the groundwater remediation, the excavation has been backfilled to the original levels. Therefore, the comparison to the screening values is only for information at this stage. However, the identified VOC concentrations will need to be considered during the planning and design stage of any future development, in particular with regard to any subsurface development. It is considered that vapour protection measures may be required and further ground gas monitoring; including volatile vapour monitoring, is likely to be required by the Planning Authority.

5.4.3 Biopile Remediation Verification Analysis

Delta-Simons visited the Site on the 10th July 2009 to undertake a sampling exercise of the soils in the biopile treatment areas to assess the effectiveness of the ex-situ bioremediation

[1] Full details of the Site specific remedial targets are presented in Delta-Simons Quantitative Risk Assessment Report (Ref. 2342-06 December 2005).

of the soils. The sampling was designed to provide verification of the biopile soil sampling exercise carried out by Eneotech on 9th June 2009.

Composite samples were taken by Delta-Simons from each of the six biopiles, with two samples from the larger biopile.

Remedial target values protective of Human Health and groundwater at the Site boundary were derived using SNIFFER and the Environment Agency "Methodology for the Derivation of Remedial Targets for Soil and Groundwater to Protect Water Resources (R & D Paper 20) respectively. The methodology and input parameters used in deriving the screening values is presented in Delta-Simons QRA Report dated December 2005 (Project No. 2342-06).

The results of the validation sampling exercise demonstrated that concentrations of VOC and 'light end' sTPH, typically range from less than the laboratory limit of detection to negligible. Slightly elevated levels of 'mid-to heavy end' sTPH concentrations have been identified, however, none of the composite samples collected from the biopiles exceed the derived screening values for the protection of Human Health or groundwater.

Delta-Simons obtained two additional composite samples from the biopiles for waste classification (WAC) analysis in July 2010. The WAC testing confirms that the bioremediation of the excavated soil has been successful in reducing the contaminants down to concentrations which are below inert threshold limits for disposal to landfill.

The bioremediated soils were placed back into the tank farm excavation area void on completion of the active groundwater remediation stage.

5.5 Groundwater Remediation

Once the tanks and surrounding soils had been removed, the free-product, which represented an ongoing contaminant source as both product smeared throughout the unsaturated zone and as free product on the groundwater, required removal as these sources were still contributing contaminants to the groundwater and soil. The groundwater remediation system was installed by the remediation contractor, Eneotech Ltd (formerly Bilfinger Berger Environmetal Ltd), and comprised a modular 'pump and treat' system including separation, aeration and activated carbon filtration.

A network of 40 No. 100 mm diameter remediation wells were installed in the source area to abstract the contaminated groundwater and re-inject treated water. The remediation wells were installed to a depth of 30 m bgl on a 7-10m grid. The majority of these were installed within the footprint of the tank farm whilst a number were placed outside this area up and down gradient of the source area.

5.5.1 Free Product Recovery

The free product was separated via a two-stage gravity separator with process water running through an air stripping stage prior to granular activated carbon filtration. Aerated and filtered water was then injected back to the groundwater to aid natural attenuation via in-situ bioremediation or was discharged to sewer. All recovered product was sent for off-Site energy recovery.

The 'pump and treat' system operated between December 2008 and January 2011. The purpose of the groundwater remediation plant was the removal of free product, and monitoring of the wells in the remediation area using an electronic oil/water interface probe confirms that free product has not been recorded above the instrument limit of detection of 1 mm thickness since March 2010.

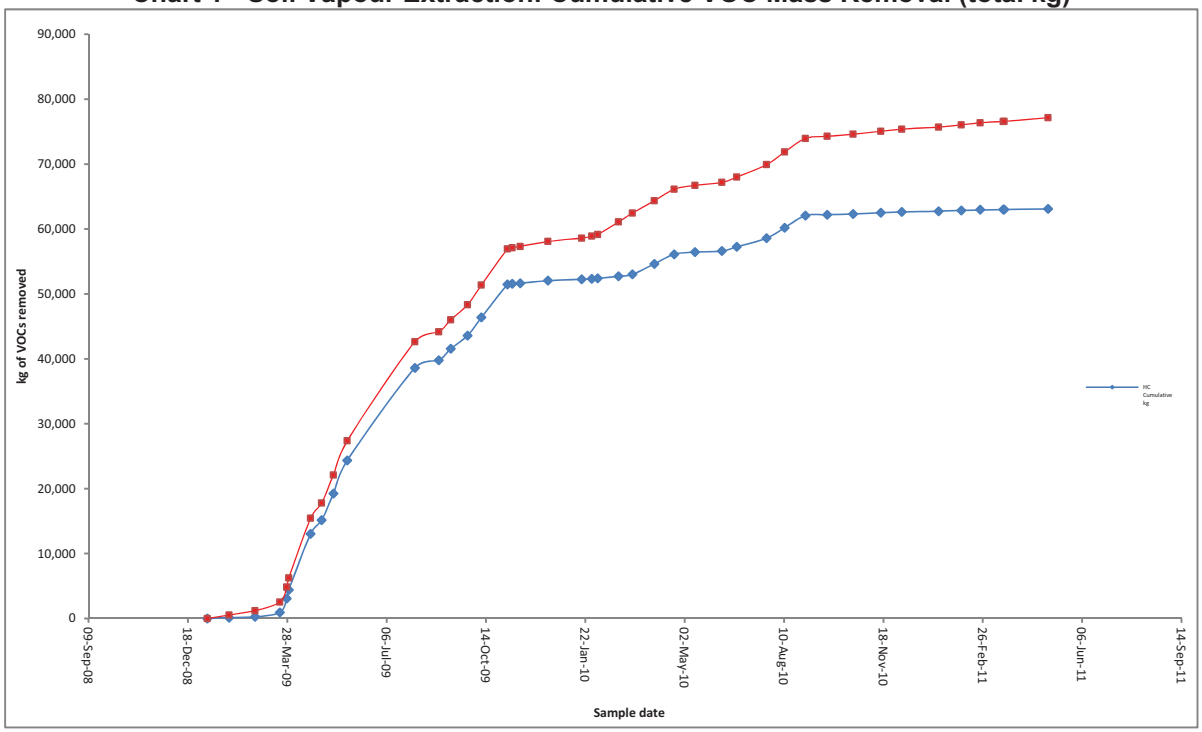
5.5.2 Soil Vapour Extraction (SVE)

During the remediation borehole drilling works significant VOC concentrations were recorded using field instruments throughout the boulder clay and upper chalk deposits. It was decided that an SVE module would need to be added to the remediation plant to remove product smeared through the unsaturated zone below the tank farm.

The SVE module on the treatment plan removed adsorbed and free phase solvent contamination within the vadose and smear zones. SVE plant specification increased during drilling works with an additional set of shallow (12 m) wells installed primarily for SVE so that ongoing risk of contaminant leaching is substantially reduced.

Due to the highly volatility of the free product it was calculated that 70 tonnes of hydrocarbons were removed in the gas phase, as shown in Chart 1.

Chart 1 - Soil Vapour Extraction: Cumulative VOC Mass Removal (total kg)



As Chart 1 shows, a significant volume of VOC was removed in the gas phase, with the bulk of the contamination removed between March and November 2009, with negligible recovery from August 2010 indicating that the remediation scheme had reached a steady state and further operation of the plant was not required.

5.5.3 Oxygen Releasing Compound (ORC) Injection

The final stage of the groundwater remediation works undertaken by Eneotech was the injection of ORC into the groundwater in early 2011 to raise the dissolved oxygen levels within the aquifer and promote the biodegradation of the contaminants. Introduction of ORCs into the groundwater will provide ongoing long-term aeration of the groundwater to promote the ongoing remediation of the aquifer by natural processes.

5.6 Groundwater Monitoring (Monitored Natural Attenuation)

Groundwater monitoring undertaken at the Site prior to the remediation scheme commencement in September 2008 identified significantly elevated concentrations of light end petroleum hydrocarbons (aliphatic and aromatic C5-C12 range) and a mix of VOC, principally dichloromethane, 1.2.4-trimethylbenzene, 1.3.5–trimethylbenzene, propylbenzene, 4-isopropyltoluene and xylenes.

An on-going groundwater monitoring programme was implemented to assess the effectiveness of the active remediation phase and long term remediation through monitored natural attenuation based on the following schedule:

- Monthly monitoring between October 2008 and March 2009;
- Quarterly monitoring between June 2009 and September 2013; and
- Six monthly until project completion in September 2015.

Groundwater samples are collected from up to 22 monitoring wells across the Site during each monitoring visit, with samples submitted to a UKAS accredited laboratory for analysis of sTPH, VOC and naphthalene. A summary of the results is presented in the following sections. The location of the monitoring wells is shown on Figure 5.

5.6.1 Groundwater Levels

The depth to groundwater was recorded in each of the wells during the monitoring visits. Groundwater levels range between 19.05 and 23.77 m bgl, with an average depth of 22.21 m bgl. Groundwater levels within individual wells show variation over time, forming a smear zone at the groundwater interface, from a range of 0.74 m at BHC in the north-east of the Site to 2.59 m at BH202 in the centre of the Site.

The groundwater levels show a slight seasonal fluctuation with higher groundwater levels during the winter months. In addition, the groundwater levels and seasonal trends across the Site, in both the 30 m deep wells and the 60 m deep wells, are generally consistent, indicating that the groundwater within the chalk aquifer beneath the Site is one continuous, interconnected unit.

5.6.2 Free Product

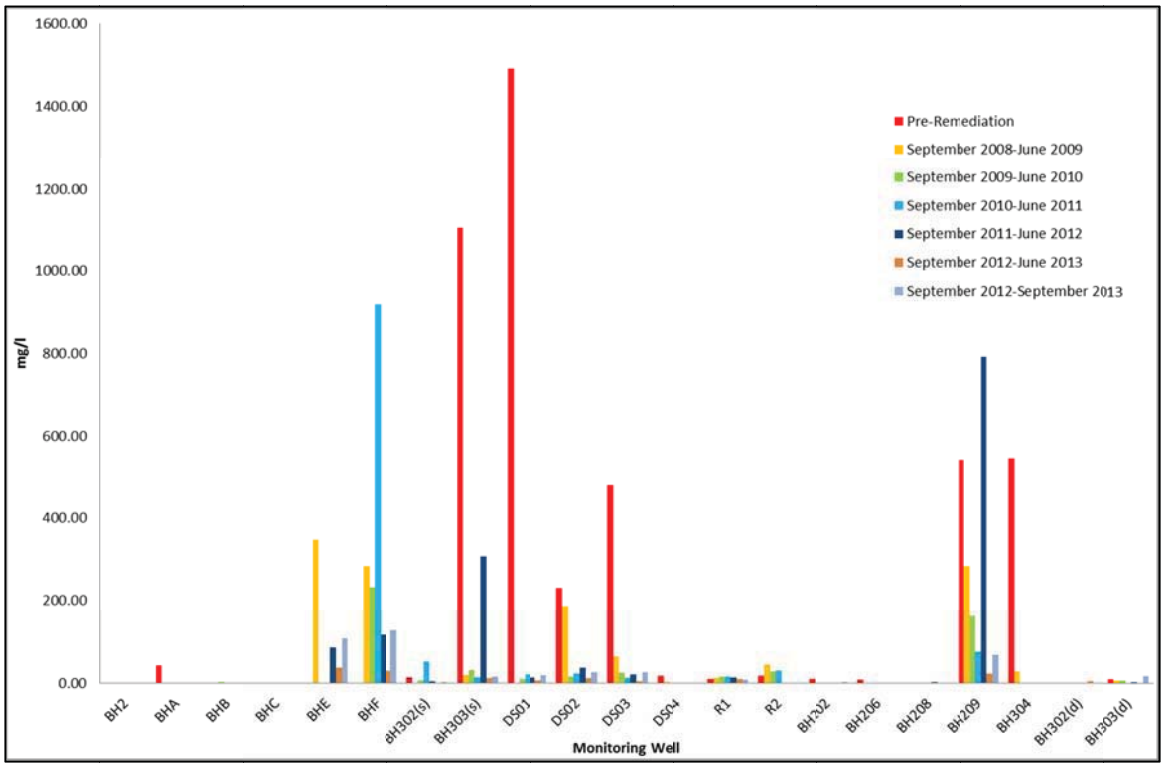
Measurable free product has not been identified on the groundwater since March 2010, though a slight ‘oily’ sheen remains on a number of boreholes in the source area.

5.6.3 Groundwater Analysis Results: sTPH/TPH

All of the groundwater samples were submitted for sTPH analysis, a graphical summary of the TPH results over time is presented in Chart 2. To provide a clear presentation of the variance over time the results have been grouped to provide a comparison between the average concentrations prior to the remediation scheme commencing and the four years of monitoring during the active remediation scheme phase.

The detailed sTPH analysis shows that the hydrocarbon contamination is predominantly within the aromatic and aliphatic C5-C12 range and that the identified concentrations are generally all below the remedial target values for these compounds during the recent monitoring rounds.

Chart 2 – Average TPH Concentrations 2004 – 2013



As the detailed results and Chart 2 show, the TPH contamination at the Site has significantly reduced since the remediation programme commenced in September 2008. The average concentrations show a clear declining trend in the source area TPH concentrations over time, as indicated by DS01/BH31, BH209/BH39, BH304 and BHF; and also down gradient contamination as indicated by DS02, DS03 and BH3039(s). At BHF an anomalous spike in concentration in the October 2010 monitoring round skews the average values for September 2010 to June 2011 period. The subsequent results at this location are back within the normal range and showing a clear declining trend over time.

Concentrations at the remaining wells show variable, but generally reduced, concentrations over time.

5.6.4 Groundwater Analysis Results: VOC & Naphthalene

All of the groundwater samples were submitted for VOC analysis which comprises a suite of approximately 55 compounds, as of September 2013 twenty-one of these compounds remain identifiable in the groundwater at the Site. In addition, naphthalene, a semi volatile polycyclic aromatic hydrocarbon (PAH), is also included within the groundwater analysis suite. Concentrations of the identified VOC concentrations have reduced significantly over time, dissolved phase concentrations as of September 2013 are typically 90 - 99% lower than the previously identified maximum concentrations

Although the VOC results often show a large variance between each round, the overall results and the average results show an overall declining trend over time. With significant reductions in contaminant concentrations at DS01, BH209 and BH304 located close to the source area and DS02, DS03 and BH303(s) down hydraulic gradient of the source area. The monitoring wells at the edge of plume show generally low, but more variable concentrations over time with a less clear overall trend.

5.7 Interim Remediation Findings and Conclusions

The results to date show that the source removal and ex-situ soil remediation have proven to be successful in removing the bulk of the soil contamination source in the vicinity of the Polycell tank farm and treating the contaminated soils.

The active groundwater remediation phase was successful in removing free product from the groundwater, and free product has not been recorded on the groundwater table since March 2010. In addition, the soil vapour extraction system removed approximately 70 tonnes of volatile compounds from the soils beneath the former tank farm.

The results of the ongoing groundwater monitoring programme indicate that the groundwater remediation scheme has been effective in significantly reducing the dissolved phase hydrocarbon and VOC contamination within the source zone. Though it should be noted that contamination levels within the groundwater beneath the former tank farm remain significantly elevated, the identified concentrations are below the remedial target values.

The results continue to show that concentrations of contaminants with the monitoring wells down hydraulic gradient of the source area are showing an overall declining trend, whereas monitoring wells to the south of the main plume show highly variable, but generally reduced concentrations.

6.0 ASSESSMENT OF RISK AND CONCEPTUAL MODEL

6.1 Risk Assessment

The risk assessment procedure which identifies sources, pathways, receptors and pollutant linkages is, therefore, recognised as an appropriate approach to determining the extent and significance of contamination either within the context of Part 2A of the Environmental Protection Act 1990 (when assessing current Site status or when considering the acquisition of an existing development), or as part of the planning process (for the redevelopment of an existing Site, or when considering the acquisition of a Site for redevelopment purposes). In either context the 'suitable for use' approach is adopted in assessing the risks. As such, the source-pathway-receptor assessment defines a conceptual model for the Site under consideration.

6.2 Qualitative Risk Assessment and Conceptual Site Model

For the purposes of this Assessment, in the absence of a defined redevelopment plan, the risk assessment has been undertaken based upon the suitable for use approach in the context of the proposed mixed use including residential, retail, office, hotel, gym and community hub.

The Conceptual Site Model, presented as Table 5 has been formulated taking into account all of the available data from Delta-Simons previous phases of investigation at the Site as summarised and discussed in previous sections of this Report with additional consideration given to the available third party information and site investigation results where available, however, it is acknowledged that Delta-Simons does not have reliance on this data.

Table 5 – Qualitative Risk Assessment: Conceptual Site Model

Source(s)	Receptor(s)	Pathway(s)	Pollutant Linkage	Justification / Additional Site Investigation Requirements and Other Recommended Actions.
Made Ground and general background concentrations of potential contaminants within the soil and groundwater across the Site associated with the former factory uses, including above and potentially below ground tanks. (Not including the Polycell tank farm area).	Future Site users	Direct contact, ingestion and inhalation of dust and vapours	**Low to Medium Risk**	Several phases of site investigation have been completed at the Site. Widespread significant contamination of the shallow soils and shallow groundwater at the Site has not been identified. However, it is acknowledged that the site investigation is incomplete. With the exception of the Polycell tank farm area significantly elevated concentrations of contaminants or significant potential sources have not been identified at the Site. Additional site investigation will be required across the Site to further assess the shallow ground conditions at the Site. However, it is considered that hardstanding and buildings, plus the incorporation of a clean cover system in to landscape and garden areas will mitigate the likely potential risks to Human Health. Subject to the further investigation results, hydrocarbon and/or solvent vapour barriers may need to be installed within buildings in parts of the Site.
	Groundworkers & Site construction workers during redevelopment	Direct contact, ingestion and inhalation of dust and vapours	**Low to Medium Risk**	Several phases of Site investigation have been completed at the Site. Widespread significant contamination of the shallow soils and shallow groundwater at the Site has not been identified. However, it is acknowledged that the site investigation is incomplete. Groundworkers and sub-surface maintenance workers should be made aware of the possibility of encountering contaminated soils through toolbox talks. Safe working procedures should be implemented, good standards of personal hygiene should be observed and appropriate levels of PPE provided and utilised. This recommendation should be captured in Site health and safety documentation and in maintenance plans.
	Maintenance workers during any future sub-surface works undertaken at the Site			
	Off-Site receptors	Windblown contaminated dust	**Low to Medium Risk**	In accordance with good practice, the groundworks contractor will need to implement dust suppression techniques at the Site to limit the potential for the generation of dust during any future redevelopment works at the Site.

Source(s)	Receptor(s)	Pathway(s)	Pollutant Linkage	Justification / Additional Site Investigation Requirements and Other Recommended Actions.
Made Ground and general background concentrations of potential contaminants within the soil and groundwater across the Site associated with the former factory uses, including above and potentially below ground tanks. (Not including the Polycell tank farm area).	Plants in landscaped areas	Uptake via root system	**Low to Medium Risk**	It is recommended that a layer of certified clean topsoil (and subsoil if required) is imported into any landscaped and garden areas to provide a suitable growing medium and clean cover layer. .
	Drinking water supply pipes	Vertical and lateral migration of contaminants and degradation of pipework	**Low to Medium Risk**	Hydrocarbons, especially aromatics and chlorinated solvents, are known to permeate plastic pipes. Assessment of the risk to water pipes for any new supply will have to be undertaken as a requirement of the statutory undertakers who should be provided with a copy of this Site investigation report and provide recommendations for upgrading of potable water supply pipes, if considered necessary.
	Controlled waters – groundwater – Principal Aquifer and SPZ. Sensitive surface water receptors have not been identified in the vicinity of the Site.	Vertical and lateral migration	**Low to Medium Risk**	Several phases of Site investigation have been completed at the Site. Widespread significant contamination of the shallow soils and shallow groundwater at the Site has not been identified. However, it is acknowledged that the site investigation is incomplete. Further targeted site investigation is required to fully assess the potential localised sources (principally small tanks and boiler house area). However, the potential impacts associated with these sources on the deep groundwater within the chalk aquifer are relatively minor when considered in the context of the known contamination associated with the Polycell tank farm.
Asbestos.	Future Site Users		**Low Risk**	The majority of the Site will be covered with buildings and hardstanding which will remove the potential pathways. Clean cover soils will be required within any landscaped or garden areas which will also break the potential pathways.
	Groundworkers		**Low to Medium Risk**	Asbestos containing materials have been identified in the current and former Site buildings and fragments were identified on the Site surface in the area of the demolished buildings in the south of the Site. Lagged pipes with asbestos warning labels have been identified within below ground ducts in the south of the Site. As with all Brownfield developments, groundworkers and sub-surface

Source(s)	Receptor(s)	Pathway(s)	Pollutant Linkage	Justification / Additional Site Investigation Requirements and Other Recommended Actions.
				maintenance workers should be made aware of the possibility of encountering asbestos in Made Ground through toolbox talks. Safe working procedures should be implemented, good standards of personal hygiene should be observed and appropriate levels of PPE provided and utilised. This recommendation should be captured in Site health and safety documentation and in maintenance plans. Further Site investigation, including asbestos analysis recommended to further assess the potential risks.
Residual soil and groundwater contamination associated with the former Polycell tank farm area following completion of remediation works.	Future Site users	Inhalation of volatile vapours	**Low to Medium Risk**	Based on the validation results from the tank farm excavation and bioremediated soils used as backfill. The residual levels of volatile contamination in the shallow soils are considered to be negligible. However, should deep basement excavation be proposed in this area of the Site, risks associated with VOC contamination of the deeper soils may need to be considered. Further site investigation, including soil vapour monitoring is recommended in the vicinity of the former tank farm. Hydrocarbon and/or solvent vapour barriers may need to be installed within buildings in this area of the Site. Given the depth to the groundwater, the residual concentrations of VOC in the dissolved phase are not considered a risk to future Site users.
	Groundworkers & Site construction workers during redevelopment	Direct contact and ingestion and inhalation of vapours	**Low to Medium Risk**	Groundworkers and sub-surface maintenance workers should be made aware of the possibility of encountering contaminated soils through toolbox talks. Safe working procedures should be implemented, good standards of personal hygiene should be observed and appropriate levels of PPE provided and utilised. This recommendation should be captured in Site health and safety documentation and in maintenance plans.

Source(s)	Receptor(s)	Pathway(s)	Pollutant Linkage	Justification / Additional Site Investigation Requirements and Other Recommended Actions.
Residual soil and groundwater contamination associated with the former Polycell tank farm area following completion of remediation works.	Controlled waters – groundwater	Vertical and lateral migration	**Medium Risk**	Post remediation Monitored natural attenuation of the Site is currently on-going and due for completion in September 2015. Results to date show that, though the groundwater beneath the Site remains contaminated removal of the primary source and free product has been successful. Dissolved phase contaminants are showing significant reduction and declining trends over time to be compliant with the remedial target values derived in Delta-Simons QRA.
Potentially hazardous ground gas.	Site buildings and future Site users.	Vertical and lateral migration of ground gas	**Low Risk**	A significant potential source of ground gas has not been identified at the Site, which typically comprises a thin layer of Made Ground over clayey and gravels with chalk at depth. However, further Site investigation and ground gas monitoring is considered to be required in order to satisfy likely planning condition requirements.
Off-Site sources of contamination.	Future Site user, groundworkers and buildings	Vertical and lateral migration of mobile contaminants	**Negligible Risk**	Potential off-Site sources of contamination have been identified, notably a former chemical and pharmaceutical works to the south of the Site and an engineering works and iron foundry to the north and north-east of the Site respectively. Given the ground conditions at the Site, depth to groundwater (>20 m bgl) and groundwater flow direction the potential for contamination migrating on to the Site and presenting a risk to the identified receptors is negligible.
Japanese knotweed.	The Site and structures	Spread of rhizomes	**Low Risk**	Japanese knotweed has previously been identified in the north-west of the Site and it is understood a treatment programme was initiated. It is recommended that the Site is inspected to confirm that the treatment programme has been successful and to assess the remaining areas of the Site for the presence of Japanese knotweed. If required a further treatment programme should be initiated prior to redevelopment.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

The Site was developed from Greenfield in the 1920s as part of the establishment of Welwyn Garden City new town with limited alterations and changes in land use since that time. The north of the Site has been occupied by a shredded wheat factory, the centre of the Site by a plastics factory and later a confectionary factory and the south of the Site was originally developed as a film studio before being occupied by a tobacco factory and later a Polycell Factory. Rail sidings were also present until the 1960s.

The principal sources of contamination identified at the Site from a review of historical information relate to the former above and below ground solvent and fuel tanks, Polycell liquids production area and boiler houses. Potential off-Site sources of significant contamination comprise a former chemical and pharmaceutical works to the south of the Site and an engineering works and iron foundry to the north and north-east, however, these off-Site sources are not considered to pose a significant risk to the Site.

Several phases of investigation have been completed at the Site by Delta-Simons and others which have identified significant solvent (VOC) contamination of the groundwater in underlying chalk aquifer and localised soil contamination associated with the former tank farm in the Polycell Factory. Remediation works have been undertaken in this area of the Site, overseen by Delta-Simons, to remove 13 underground tanks and impacted soils for on-Site bioremediation. A ‘pump and treat’ groundwater remediation system was installed to remove free product followed by an on-going period of Monitored Natural Attenuation of the dissolved phase contamination. Results to date indicate the remediation scheme has been successful in removing the primary sources and has resulted in significant reductions in dissolved phase contaminant concentrations.

Widespread, or significant contamination has not been identified elsewhere at the Site, however, it is acknowledged that Site investigation is incomplete. Japanese knotweed has previously been identified in the north-west of the Site and is understood to have been treated.

Ground conditions encountered across the site generally comprise thin Made Ground over clayey sands and gravels, and/ or gravelly clay with chalk (a Principal Aquifer) at depths of

between 8 and 18 m bgl. Resting groundwater levels recorded in all investigations in the chalk aquifer were recorded between 20 m and 26 m bgl.

7.2 Recommendations

Prior to the redevelopment of the Site, additional Site-wide investigation of the shallow soils, including ground gas and soil vapour monitoring is likely to be required to confirm, through standard planning conditions, that the Site is suitable for the proposed mixed use including residential, retail, office, hotel, gym and community hub.

In addition, Monitored Natural Attenuation of the groundwater in the south of the Site, by Delta-Simons, is scheduled to continue until September 2015.

7.3 Development Abnormals

The following recommendations and development abnormals are considered appropriate based on the current understanding of the Site:

- Groundworkers who are required to perform sub-surface work at the Site should be made aware of the known contaminants in soil and groundwater and the possibility of encountering additional localised low levels of contamination, including asbestos. Therefore, good standards of personal hygiene should be observed and appropriate levels of PPE utilised where necessary;
- Suitable dust suppression techniques will need to be implemented by groundworkers during construction and demolition works;
- Following completion of the additional site investigation works, confirmation should be sought from the Local Water Authority as to whether they will require upgraded pipework to be installed for new service installations;
- A clean cover system will be required for any proposed landscaped and garden areas, the details of which should be agreed with the Local Authority with reference to the final detailed development design; and
- Elevated costs above standard inert rates should be anticipated for disposal of engineering arisings from the Made Ground to include landfill tax, currently at a rate of £72/tonne. Additional waste classification testing (including WAC testing) is likely to be required to facilitate any off-Site disposal of ground materials.

7.4 Risks to the Future Redevelopment of the Site

In addition to the recommendations and development abnormals above, a number of other risks and potential liabilities have been identified during the works to date, summarised below:

Basements/Service Ducts

It is understood that the south-west of the Site may be underlain in part by a basement, the exact location of which is unknown. However, during the course of the remediation works a number of service ducts/voids beneath the remaining slabs were noted, raising potential safety concerns with regards to tracking of plant over these areas.

Most notably, a deep (>2m) partially water filled service duct was noted in the south-east of the Site parallel to the southern boundary of the Site. Currently the duct is protected by a large metal cover. However, should this become damaged or be removed this would represent a significant safety risk.

Furthermore, labels warning of asbestos containing materials were present within the ducts, and it is considered this may relate to pipe lagging noted in the side of the ducts, the extent of which is not known.

The location of the duct is shown on Figure 3 and selected photographs are included in Appendix I.

Asbestos

In addition to the asbestos containing materials noted within the service duct, small quantities of asbestos cement sheet fragments were noted on the Site surface.

8.0 LIMITATIONS TO ENVIRONMENTAL ASSESSMENTS

Delta-Simons obtained, reviewed and evaluated information from the Client, Landmark Information Group Ltd and others. Delta-Simons' conclusions, opinions and recommendations are based on this information and observations made during the Site reconnaissance.

The recommendations contained in this Report represent our professional opinions. These opinions were arrived at in accordance with currently accepted industry practices and hydrological and engineering practices at this time and location and, as such, are not a guarantee that the Site is free of hazardous or potentially hazardous materials or conditions.

This Report was prepared by Delta-Simons Environmental Consultants Limited for our Client. Any third party using this Report does so entirely at their own risk. Delta-Simons makes no warranty or representation whatsoever, express or implied, with respect to the use by a third party of any information contained in this Report or its suitability for any purpose. Delta-Simons assumes no responsibility for any costs, claims, damages or expenses (including any consequential damages) resulting from the use of this Report or any information contained in this Report by a third party.

This Report was prepared by:

29.1.15

John Rhoades Date

Senior Environmental Scientist

This Report was reviewed and authorised by:

29th JAN 2015

Alex Ferguson Date

Operations Direct

Figures

LEGEND

Site Boundary

Scale: 1 / 5,000 @ A4

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TITLE:
Site Location Map
Broadwater Road
Welwyn Garden City

DWN: DE	SCA: To Scale@A4	PROJECT NO.: 2342-17
CHK: JDR	REV: 1	FIGURE NO.: 1
DATE: 18 December 2013		

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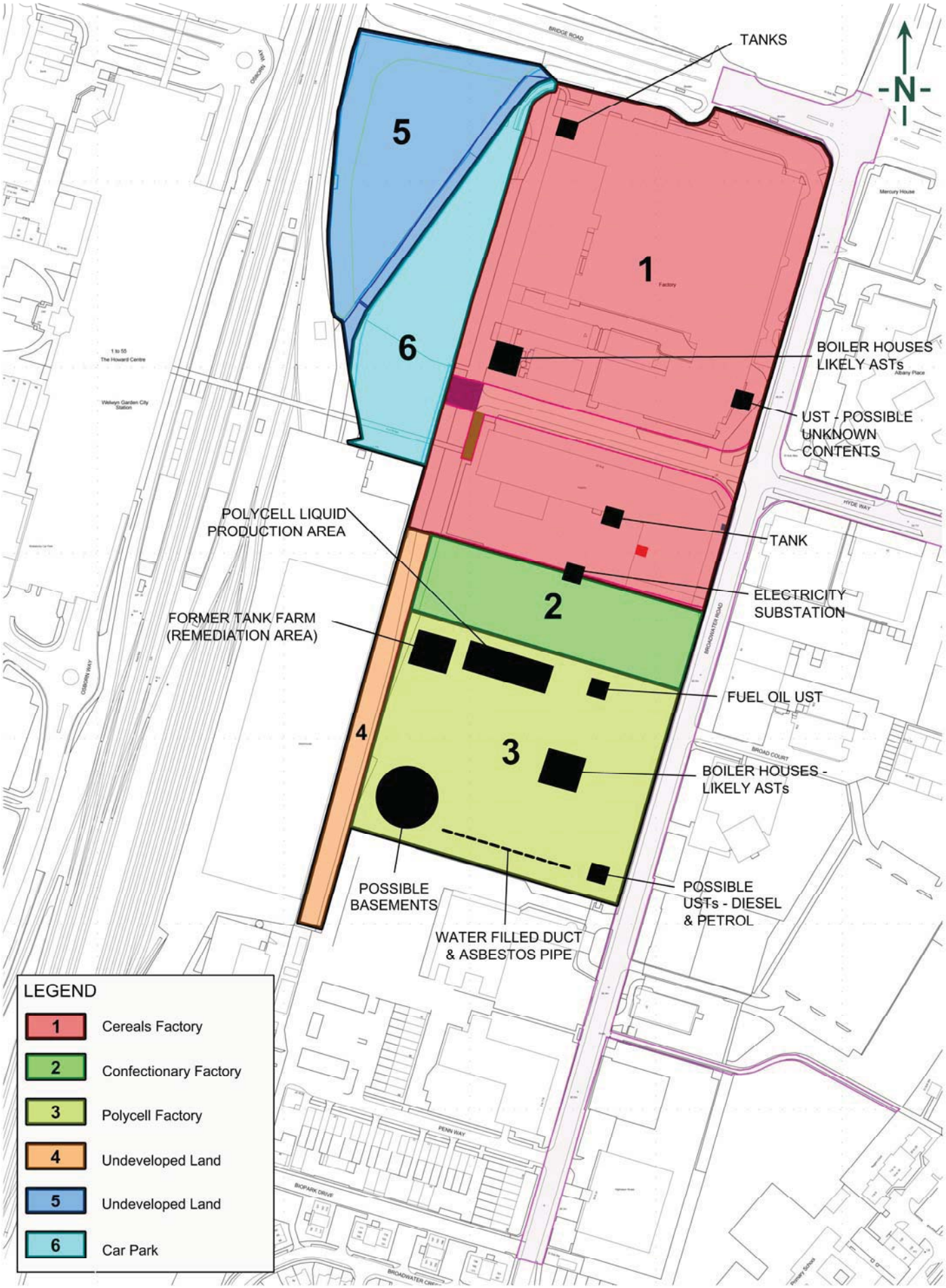
TITLE:
Current Site Layout Plan
Broadwater Road
Welwyn Garden City

DWN: DE	SCA: Not to Scale	PROJECT NO.: 2342-17
CHK: JDR	REV: 1	FIGURE NO.: 2
DATE: 18 December 2013		



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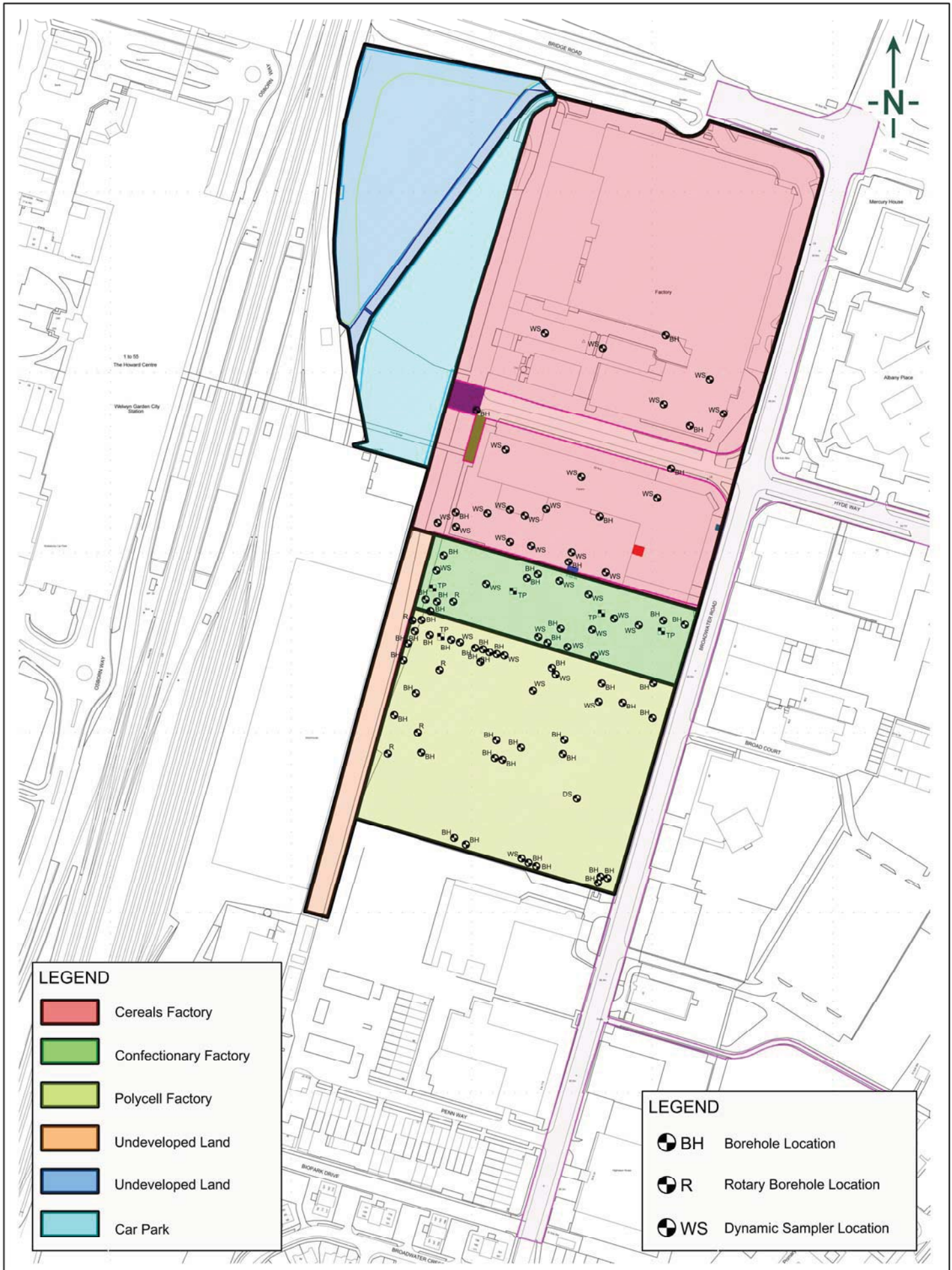
environmental consultants

TITLE:
Site Zones & Features Plan
Broadwater Road
Welwyn Garden City

DWN: DE	SCA: Not to Scale	PROJECT NO.: 2342-17
CHK: JDR	REV: 1	FIGURE NO.: 3
DATE: 18 December 2013		



Data provided by Inspire Design Ltd. Drawing Reference: 132003-AL02.

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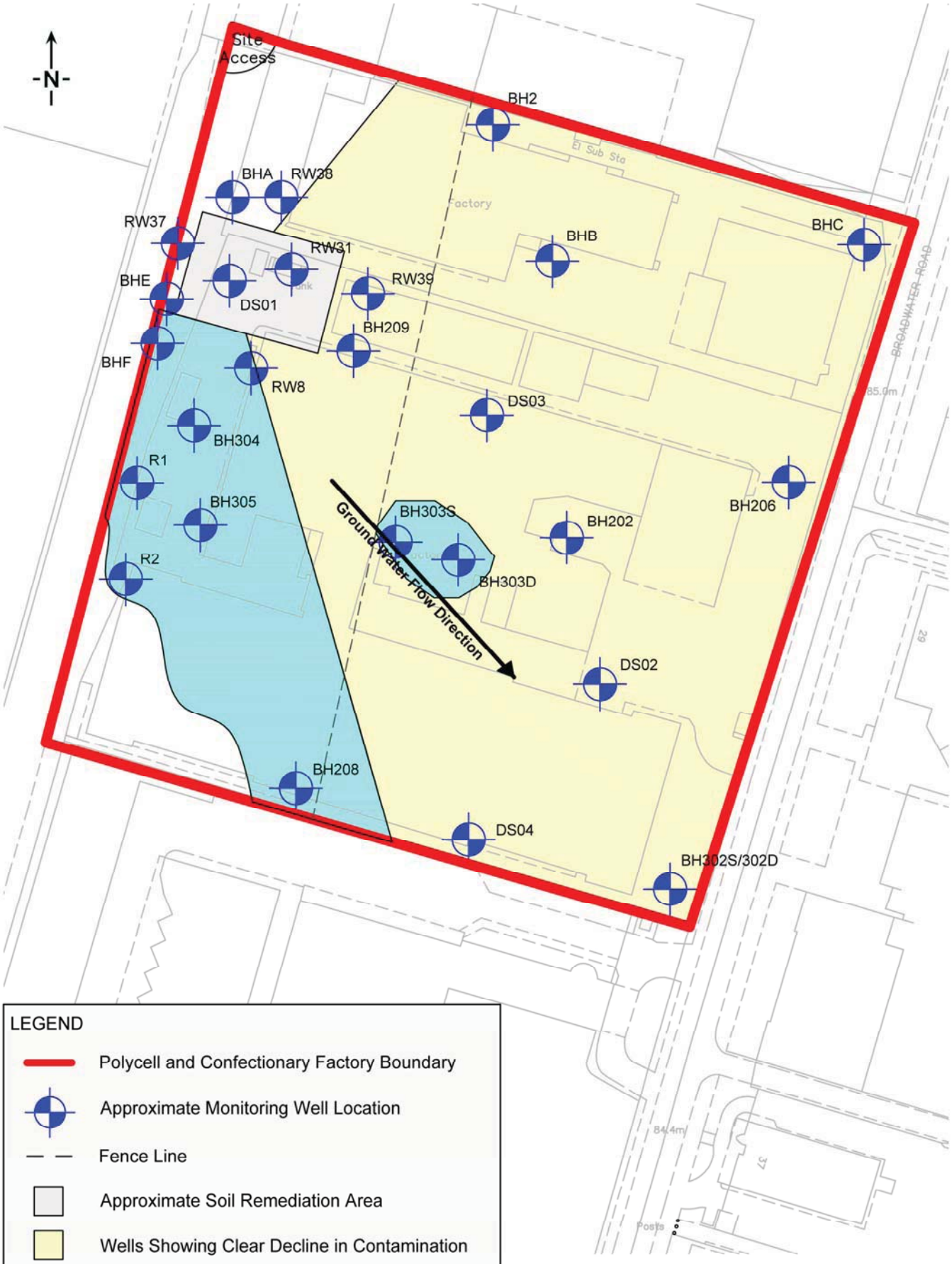
TITLE:
Approximate Intrusive Location Plan
Broadwater Road
Welwyn Garden City

DWN: DE	SCA: Not to Scale	PROJECT NO.: 2342-17
CHK: JDR	REV: 1	FIGURE NO.: 4
DATE: 18 December 2013		



delta-simons
environmental consultants

TITLE:
MNA Borehole Location Plan
Broadwater Road, Welwyn Garden City

DWN:	SCA:	PROJECT NO.:
SEB	Not to Scale	2342-17
CHK:	REV:	FIGURE NO.:
JDR	1	5
DATE:		
18 December 2013		

Appendix I

Broadwater Road, Welwyn Garden City
Delta-Simons Project No. 2342.17

Former Cereal factory in the north of the Site.

Cereal factory in the north of the Site, former boiler house location adjacent to the water tanks on the right and disused rail sidings visible in the road.

Broadwater Road, Welwyn Garden City
Delta-Simons Project No. 2342.17

Grain silos within the former cereal factory.

Former cereal factory buildings to the south of Hydeway.

Broadwater Road, Welwyn Garden City
Delta-Simons Project No. 2342.17

Former cereal factory buildings to the south of Hydeway.

Former Polycell factory (previously a film studio) in the south of the Site prior to demolition.

Broadwater Road, Welwyn Garden City
Delta-Simons Project No. 2342.17

Former confectionary factory in the south of the Site prior to demolition.

Former Polycell factor (left) and confectionary factory (right) in the south of the Site prior to demolition.

Broadwater Road, Welwyn Garden City
Delta-Simons Project No. 2342.17

Fuel oil tank associated with the Polycell factory boiler house during demolition.

Fuel oil tank fill points associated with the Polycell factory boiler house.