

14 June 2021

Alison Amoah
Principal Planner
Planning, Directorate for Economic Growth and Neighbourhood Services

Reading Borough Council
Civic Centre
Bridge Street
Reading RG1 2LU

Planning Reference: 201853

To: Planning, Directorate for Economic Growth and Neighbourhood Services

Subject: Brunel Retail Park Rose Kiln Lane Reading

We write in response to consultee response letter to the Reading Borough Council regarding the surface water drainage strategy.

We understand that there are some queries regarding the proposed drainage strategy, which are clarified below:

Query: *The proposal includes a 50% reduction of the 1 in 100 year event which in principle is acceptable. However, the drainage strategy undertakes no assessment of the 1 in 1 year event or 1 in 30 year event which is a mandatory assessment in accordance with National Guidelines.*

Response: The table below shows the existing and proposed discharge rate for 1 in 1 year and 1 in 30 year rainfall events.

Table 1: Existing & Proposed Discharge Rate

Return Period (year)	Rainfall (mm/hr)	Total Site Area, Ha	Existing Discharge Rate (l/s)	Proposed Discharge Rate (l/s)
1 in 1	16.9	3.03	142.95	71.47
1 in 30	41.7	3.03	351.18	175.59

The proposed attenuation volume provided for 1 in 100 + CC event is more than capable to attenuate the surplus runoff water. The Windes MicroDrainage calculations for both phases are included in Appendix A.

Query: *In addition, the private drainage system is located on the Public Highway which extends further into the site than is identified on the proposed drainage layout. A revised drainage layout is therefore required that only includes the development site.*



Response: The drainage layout has been updated as per the Highway Search Plan and all private drainage have been moved within the private land (Appendix B).

Query: *It should also be noted that the development includes two separate phases and therefore a drainage strategy should be provided for both eventualities, i.e an in between strategy between the builds of Phases 1 and 2 or should phase 1 only be developed.*

Please ask the applicants agent to submit suitably amended plans / information prior to determining this application.

Response: The proposal has been developed considering the phases. The plans in Appendix C shows the proposed drainage for both phases as well as the Windes MicroDrainage calculations.

We hope the above clarification clarifies your query.

For any further query, please give me a call or email.
Thank you.

Yours sincerely
HDR | Bradbrook Consulting

Mazedur Rahman
Divisional Director
Mazedur.rahman@hdrinc.com

Appendix A – Windes Results for 1:1 and 1:30 year events for both Phases

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Innovyze		Source Control 2020.1			
<u>Summary of Results for 1 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	8.195	0.195	28.3	81.7	O K
30 min Summer	8.229	0.229	35.9	96.2	O K
60 min Summer	8.248	0.248	39.7	104.1	O K
120 min Summer	8.252	0.252	40.5	106.0	O K
180 min Summer	8.244	0.244	38.9	102.5	O K
240 min Summer	8.233	0.233	36.8	98.1	O K
360 min Summer	8.214	0.214	32.7	90.0	O K
480 min Summer	8.199	0.199	29.2	83.5	O K
600 min Summer	8.186	0.186	26.4	78.2	O K
720 min Summer	8.176	0.176	24.0	73.8	O K
960 min Summer	8.160	0.160	20.5	67.1	O K
1440 min Summer	8.139	0.139	16.1	58.3	O K
2160 min Summer	8.120	0.120	12.5	50.4	O K
2880 min Summer	8.108	0.108	10.3	45.5	O K
4320 min Summer	8.093	0.093	7.8	39.2	O K
5760 min Summer	8.084	0.084	6.4	35.2	O K
7200 min Summer	8.077	0.077	5.5	32.4	O K
8640 min Summer	8.072	0.072	4.8	30.3	O K
10080 min Summer	8.068	0.068	4.3	28.6	O K
15 min Winter	8.215	0.215	32.9	90.5	O K
30 min Winter	8.254	0.254	40.8	106.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	26.180	0.0	95.1	21	
30 min Summer	16.984	0.0	124.0	31	
60 min Summer	10.676	0.0	157.5	46	
120 min Summer	6.602	0.0	195.0	80	
180 min Summer	4.959	0.0	219.9	112	
240 min Summer	4.043	0.0	239.1	142	
360 min Summer	3.030	0.0	268.9	204	
480 min Summer	2.469	0.0	292.1	266	
600 min Summer	2.101	0.0	310.8	326	
720 min Summer	1.838	0.0	326.3	386	
960 min Summer	1.489	0.0	352.2	508	
1440 min Summer	1.106	0.0	392.3	752	
2160 min Summer	0.822	0.0	438.8	1112	
2880 min Summer	0.666	0.0	474.1	1476	
4320 min Summer	0.496	0.0	528.7	2208	
5760 min Summer	0.402	0.0	572.5	2936	
7200 min Summer	0.341	0.0	607.7	3672	
8640 min Summer	0.299	0.0	638.1	4400	
10080 min Summer	0.267	0.0	664.6	5136	
15 min Winter	26.180	0.0	106.8	22	
30 min Winter	16.984	0.0	139.2	31	
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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	8.269	0.269	43.6	113.1	O K
120 min Winter	8.262	0.262	42.2	109.9	O K
180 min Winter	8.244	0.244	38.9	102.5	O K
240 min Winter	8.227	0.227	35.5	95.5	O K
360 min Winter	8.201	0.201	29.7	84.6	O K
480 min Winter	8.183	0.183	25.6	76.8	O K
600 min Winter	8.169	0.169	22.5	70.9	O K
720 min Winter	8.158	0.158	20.1	66.2	O K
960 min Winter	8.141	0.141	16.6	59.3	O K
1440 min Winter	8.121	0.121	12.6	50.7	O K
2160 min Winter	8.103	0.103	9.4	43.4	O K
2880 min Winter	8.093	0.093	7.7	38.9	O K
4320 min Winter	8.079	0.079	5.8	33.3	O K
5760 min Winter	8.071	0.071	4.7	29.8	O K
7200 min Winter	8.065	0.065	4.0	27.4	O K
8640 min Winter	8.061	0.061	3.5	25.6	O K
10080 min Winter	8.058	0.058	3.1	24.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	10.676	0.0	176.5	50
120 min Winter	6.602	0.0	218.5	84
180 min Winter	4.959	0.0	246.4	116
240 min Winter	4.043	0.0	267.9	148
360 min Winter	3.030	0.0	301.3	210
480 min Winter	2.469	0.0	327.3	272
600 min Winter	2.101	0.0	348.2	334
720 min Winter	1.838	0.0	365.6	394
960 min Winter	1.489	0.0	394.7	516
1440 min Winter	1.106	0.0	439.6	758
2160 min Winter	0.822	0.0	491.5	1124
2880 min Winter	0.666	0.0	531.1	1480
4320 min Winter	0.496	0.0	592.4	2208
5760 min Winter	0.402	0.0	641.2	2936
7200 min Winter	0.341	0.0	680.7	3672
8640 min Winter	0.299	0.0	714.8	4416
10080 min Winter	0.267	0.0	744.7	5136

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Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 8.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	420.0	0.200	420.0	1.000	420.0	1.010	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0286-4670-1000-4670
Design Head (m)	1.000
Design Flow (l/s)	46.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	286
Invert Level (m)	8.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	46.7
Flush-Flo™	0.439	46.7
Kick-Flo®	0.781	41.5
Mean Flow over Head Range	-	37.7

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	8.9	1.200	51.0	3.000	79.4	7.000	120.1
0.200	29.5	1.400	54.9	3.500	85.6	7.500	124.2
0.300	45.4	1.600	58.6	4.000	91.4	8.000	128.2
0.400	46.6	1.800	62.0	4.500	96.8	8.500	132.0
0.500	46.5	2.000	65.3	5.000	101.9	9.000	135.8
0.600	45.7	2.200	68.3	5.500	106.7	9.500	139.4
0.800	42.0	2.400	71.3	6.000	111.4		
1.000	46.7	2.600	74.1	6.500	115.8		

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<u>Summary of Results for 30 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	8.413	0.413	111.2	173.6	O K
30 min Summer	8.486	0.486	113.6	204.3	O K
60 min Summer	8.511	0.511	114.0	214.8	O K
120 min Summer	8.472	0.472	113.2	198.2	O K
180 min Summer	8.416	0.416	111.3	174.7	O K
240 min Summer	8.374	0.374	107.0	157.1	O K
360 min Summer	8.323	0.323	88.8	135.8	O K
480 min Summer	8.290	0.290	75.4	121.7	O K
600 min Summer	8.266	0.266	65.9	111.6	O K
720 min Summer	8.247	0.247	58.5	103.8	O K
960 min Summer	8.221	0.221	48.3	92.6	O K
1440 min Summer	8.187	0.187	36.2	78.7	O K
2160 min Summer	8.159	0.159	27.0	66.8	O K
2880 min Summer	8.142	0.142	21.8	59.4	O K
4320 min Summer	8.120	0.120	15.9	50.3	O K
5760 min Summer	8.107	0.107	12.8	44.7	O K
7200 min Summer	8.097	0.097	10.7	40.8	O K
8640 min Summer	8.090	0.090	9.3	37.8	O K
10080 min Summer	8.085	0.085	8.2	35.5	O K
15 min Winter	8.462	0.462	113.0	194.2	O K
30 min Winter	8.548	0.548	114.4	230.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	64.005	0.0	235.9	20	
30 min Summer	41.724	0.0	308.1	29	
60 min Summer	26.061	0.0	386.2	46	
120 min Summer	15.842	0.0	469.6	78	
180 min Summer	11.734	0.0	521.9	108	
240 min Summer	9.450	0.0	560.4	138	
360 min Summer	6.932	0.0	616.7	198	
480 min Summer	5.545	0.0	657.7	258	
600 min Summer	4.661	0.0	691.1	318	
720 min Summer	4.045	0.0	719.8	378	
960 min Summer	3.233	0.0	767.0	500	
1440 min Summer	2.355	0.0	837.9	742	
2160 min Summer	1.714	0.0	915.6	1104	
2880 min Summer	1.367	0.0	973.6	1472	
4320 min Summer	0.993	0.0	1060.1	2204	
5760 min Summer	0.791	0.0	1127.2	2936	
7200 min Summer	0.663	0.0	1180.6	3672	
8640 min Summer	0.574	0.0	1225.8	4368	
10080 min Summer	0.507	0.0	1264.6	5136	
15 min Winter	64.005	0.0	264.4	21	
30 min Winter	41.724	0.0	345.2	31	
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Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	8.557	0.557	114.4	233.9	O K
120 min Winter	8.471	0.471	113.2	197.7	O K
180 min Winter	8.387	0.387	110.0	162.6	O K
240 min Winter	8.343	0.343	96.3	144.1	O K
360 min Winter	8.289	0.289	75.0	121.3	O K
480 min Winter	8.255	0.255	61.5	107.1	O K
600 min Winter	8.232	0.232	52.5	97.3	O K
720 min Winter	8.214	0.214	45.9	90.0	O K
960 min Winter	8.190	0.190	37.1	79.6	O K
1440 min Winter	8.160	0.160	27.2	67.1	O K
2160 min Winter	8.135	0.135	19.9	56.7	O K
2880 min Winter	8.120	0.120	15.9	50.3	O K
4320 min Winter	8.101	0.101	11.6	42.5	O K
5760 min Winter	8.090	0.090	9.3	37.8	O K
7200 min Winter	8.082	0.082	7.8	34.5	O K
8640 min Winter	8.076	0.076	6.7	31.9	O K
10080 min Winter	8.072	0.072	6.0	30.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	26.061	0.0	432.6	48
120 min Winter	15.842	0.0	526.1	82
180 min Winter	11.734	0.0	584.6	110
240 min Winter	9.450	0.0	627.8	140
360 min Winter	6.932	0.0	690.9	200
480 min Winter	5.545	0.0	736.8	262
600 min Winter	4.661	0.0	774.1	322
720 min Winter	4.045	0.0	806.3	382
960 min Winter	3.233	0.0	859.2	502
1440 min Winter	2.355	0.0	938.6	744
2160 min Winter	1.714	0.0	1025.6	1108
2880 min Winter	1.367	0.0	1090.5	1472
4320 min Winter	0.993	0.0	1187.6	2204
5760 min Winter	0.791	0.0	1262.5	2920
7200 min Winter	0.663	0.0	1322.4	3624
8640 min Winter	0.574	0.0	1373.0	4336
10080 min Winter	0.507	0.0	1416.7	5136

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Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 8.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	420.0	0.200	420.0	1.000	420.0	1.010	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0418-1147-1000-1147
Design Head (m)	1.000
Design Flow (l/s)	114.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	418
Invert Level (m)	8.000
Minimum Outlet Pipe Diameter (mm)	450
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	114.7
Flush-Flo™	0.577	114.5
Kick-Flo®	0.862	106.7
Mean Flow over Head Range	-	86.0

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	11.3	1.200	125.3	3.000	195.9	7.000	296.9
0.200	40.7	1.400	135.1	3.500	211.3	7.500	307.2
0.300	79.5	1.600	144.1	4.000	225.6	8.000	317.1
0.400	110.6	1.800	152.7	4.500	239.0	8.500	326.7
0.500	113.8	2.000	160.7	5.000	251.7	9.000	336.0
0.600	114.4	2.200	168.4	5.500	263.7	9.500	345.0
0.800	109.8	2.400	175.7	6.000	275.3		
1.000	114.7	2.600	182.7	6.500	286.3		

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Innovyze		Source Control 2020.1			
<u>Summary of Results for 1 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	8.186	0.186	19.6	40.9	O K
30 min Summer	8.216	0.216	23.2	47.5	O K
60 min Summer	8.231	0.231	23.9	50.9	O K
120 min Summer	8.228	0.228	23.8	50.1	O K
180 min Summer	8.214	0.214	23.0	47.1	O K
240 min Summer	8.201	0.201	21.5	44.2	O K
360 min Summer	8.179	0.179	18.8	39.5	O K
480 min Summer	8.164	0.164	16.6	36.1	O K
600 min Summer	8.152	0.152	14.8	33.5	O K
720 min Summer	8.143	0.143	13.4	31.4	O K
960 min Summer	8.129	0.129	11.4	28.3	O K
1440 min Summer	8.111	0.111	8.8	24.4	O K
2160 min Summer	8.095	0.095	6.7	21.0	O K
2880 min Summer	8.086	0.086	5.6	18.8	O K
4320 min Summer	8.074	0.074	4.2	16.2	O K
5760 min Summer	8.066	0.066	3.4	14.5	O K
7200 min Summer	8.061	0.061	2.9	13.3	O K
8640 min Summer	8.057	0.057	2.6	12.4	O K
10080 min Summer	8.053	0.053	2.3	11.7	O K
15 min Winter	8.206	0.206	22.1	45.2	O K
30 min Winter	8.241	0.241	24.0	52.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	26.180	0.0	50.9	21	
30 min Summer	16.984	0.0	66.2	30	
60 min Summer	10.676	0.0	83.8	46	
120 min Summer	6.602	0.0	103.7	78	
180 min Summer	4.959	0.0	116.8	110	
240 min Summer	4.043	0.0	127.0	140	
360 min Summer	3.030	0.0	142.8	202	
480 min Summer	2.469	0.0	155.2	262	
600 min Summer	2.101	0.0	165.1	322	
720 min Summer	1.838	0.0	173.3	382	
960 min Summer	1.489	0.0	187.1	502	
1440 min Summer	1.106	0.0	208.4	744	
2160 min Summer	0.822	0.0	232.8	1108	
2880 min Summer	0.666	0.0	251.6	1472	
4320 min Summer	0.496	0.0	280.7	2204	
5760 min Summer	0.402	0.0	303.7	2936	
7200 min Summer	0.341	0.0	322.4	3672	
8640 min Summer	0.299	0.0	338.6	4400	
10080 min Summer	0.267	0.0	352.8	5136	
15 min Winter	26.180	0.0	57.1	21	
30 min Winter	16.984	0.0	74.2	31	
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Innovyze		Source Control 2020.1			
<u>Summary of Results for 1 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	8.252	0.252	24.1	55.4	O K
120 min Winter	8.233	0.233	23.9	51.2	O K
180 min Winter	8.209	0.209	22.4	45.9	O K
240 min Winter	8.190	0.190	20.2	41.8	O K
360 min Winter	8.164	0.164	16.6	36.1	O K
480 min Winter	8.147	0.147	14.1	32.4	O K
600 min Winter	8.135	0.135	12.2	29.7	O K
720 min Winter	8.125	0.125	10.9	27.6	O K
960 min Winter	8.112	0.112	8.9	24.6	O K
1440 min Winter	8.095	0.095	6.7	20.9	O K
2160 min Winter	8.081	0.081	5.1	17.8	O K
2880 min Winter	8.073	0.073	4.1	16.0	O K
4320 min Winter	8.062	0.062	3.1	13.6	O K
5760 min Winter	8.056	0.056	2.5	12.2	O K
7200 min Winter	8.051	0.051	2.1	11.2	O K
8640 min Winter	8.048	0.048	1.9	10.5	O K
10080 min Winter	8.045	0.045	1.7	9.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	10.676	0.0	93.8	48	
120 min Winter	6.602	0.0	116.1	82	
180 min Winter	4.959	0.0	130.9	114	
240 min Winter	4.043	0.0	142.3	144	
360 min Winter	3.030	0.0	160.0	206	
480 min Winter	2.469	0.0	173.8	266	
600 min Winter	2.101	0.0	184.9	328	
720 min Winter	1.838	0.0	194.1	388	
960 min Winter	1.489	0.0	209.6	510	
1440 min Winter	1.106	0.0	233.5	750	
2160 min Winter	0.822	0.0	260.8	1108	
2880 min Winter	0.666	0.0	281.9	1472	
4320 min Winter	0.496	0.0	314.5	2184	
5760 min Winter	0.402	0.0	340.2	2928	
7200 min Winter	0.341	0.0	361.1	3656	
8640 min Winter	0.299	0.0	379.3	4328	
10080 min Winter	0.267	0.0	395.2	5088	
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Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 8.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	220.0	0.200	220.0	1.000	220.0	1.010	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0218-2470-1000-2470
Design Head (m)	1.000
Design Flow (l/s)	24.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	218
Invert Level (m)	8.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	24.7
Flush-Flo™	0.361	24.7
Kick-Flo®	0.736	21.3
Mean Flow over Head Range	-	20.6

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	7.4	1.200	26.9	3.000	41.9	7.000	63.1
0.200	21.4	1.400	29.0	3.500	45.1	7.500	65.3
0.300	24.5	1.600	30.9	4.000	48.1	8.000	67.3
0.400	24.6	1.800	32.7	4.500	50.9	8.500	69.3
0.500	24.3	2.000	34.4	5.000	53.6	9.000	71.3
0.600	23.6	2.200	36.0	5.500	56.1	9.500	73.2
0.800	22.2	2.400	37.6	6.000	58.5		
1.000	24.7	2.600	39.1	6.500	60.9		

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<u>Summary of Results for 30 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	8.396	0.396	60.3	87.1	O K
30 min Summer	8.468	0.468	60.7	103.1	O K
60 min Summer	8.485	0.485	60.7	106.7	O K
120 min Summer	8.429	0.429	60.6	94.4	O K
180 min Summer	8.363	0.363	59.8	79.9	O K
240 min Summer	8.314	0.314	58.6	69.1	O K
360 min Summer	8.264	0.264	49.4	58.0	O K
480 min Summer	8.234	0.234	41.7	51.4	O K
600 min Summer	8.213	0.213	36.2	46.9	O K
720 min Summer	8.197	0.197	32.0	43.4	O K
960 min Summer	8.175	0.175	26.3	38.5	O K
1440 min Summer	8.148	0.148	19.5	32.6	O K
2160 min Summer	8.125	0.125	14.5	27.5	O K
2880 min Summer	8.111	0.111	11.7	24.4	O K
4320 min Summer	8.094	0.094	8.5	20.6	O K
5760 min Summer	8.083	0.083	6.8	18.3	O K
7200 min Summer	8.076	0.076	5.7	16.7	O K
8640 min Summer	8.071	0.071	5.0	15.5	O K
10080 min Summer	8.066	0.066	4.4	14.5	O K
15 min Winter	8.447	0.447	60.7	98.4	O K
30 min Winter	8.532	0.532	60.7	116.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	64.005	0.0	125.5	20	
30 min Summer	41.724	0.0	163.7	29	
60 min Summer	26.061	0.0	205.0	46	
120 min Summer	15.842	0.0	249.2	78	
180 min Summer	11.734	0.0	276.9	108	
240 min Summer	9.450	0.0	297.4	136	
360 min Summer	6.932	0.0	327.3	196	
480 min Summer	5.545	0.0	349.0	256	
600 min Summer	4.661	0.0	366.7	316	
720 min Summer	4.045	0.0	381.9	376	
960 min Summer	3.233	0.0	407.0	496	
1440 min Summer	2.355	0.0	444.6	740	
2160 min Summer	1.714	0.0	485.7	1104	
2880 min Summer	1.367	0.0	516.4	1468	
4320 min Summer	0.993	0.0	562.5	2204	
5760 min Summer	0.791	0.0	597.9	2936	
7200 min Summer	0.663	0.0	626.2	3664	
8640 min Summer	0.574	0.0	650.2	4384	
10080 min Summer	0.507	0.0	670.9	5136	
15 min Winter	64.005	0.0	140.6	21	
30 min Winter	41.724	0.0	183.5	31	
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Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	8.530	0.530	60.7	116.5	O K
120 min Winter	8.422	0.422	60.5	92.8	O K
180 min Winter	8.325	0.325	58.9	71.5	O K
240 min Winter	8.278	0.278	52.8	61.2	O K
360 min Winter	8.230	0.230	40.7	50.6	O K
480 min Winter	8.202	0.202	33.2	44.4	O K
600 min Winter	8.183	0.183	28.2	40.2	O K
720 min Winter	8.169	0.169	24.6	37.1	O K
960 min Winter	8.149	0.149	19.8	32.8	O K
1440 min Winter	8.125	0.125	14.5	27.5	O K
2160 min Winter	8.106	0.106	10.6	23.2	O K
2880 min Winter	8.094	0.094	8.5	20.6	O K
4320 min Winter	8.079	0.079	6.2	17.4	O K
5760 min Winter	8.070	0.070	4.9	15.4	O K
7200 min Winter	8.064	0.064	4.1	14.1	O K
8640 min Winter	8.060	0.060	3.6	13.1	O K
10080 min Winter	8.056	0.056	3.1	12.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	26.061	0.0	229.6	48
120 min Winter	15.842	0.0	279.2	82
180 min Winter	11.734	0.0	310.2	110
240 min Winter	9.450	0.0	333.1	138
360 min Winter	6.932	0.0	366.6	198
480 min Winter	5.545	0.0	390.9	258
600 min Winter	4.661	0.0	410.7	318
720 min Winter	4.045	0.0	427.8	378
960 min Winter	3.233	0.0	455.9	500
1440 min Winter	2.355	0.0	498.1	740
2160 min Winter	1.714	0.0	544.0	1100
2880 min Winter	1.367	0.0	578.5	1452
4320 min Winter	0.993	0.0	630.1	2192
5760 min Winter	0.791	0.0	669.6	2936
7200 min Winter	0.663	0.0	701.4	3656
8640 min Winter	0.574	0.0	728.3	4368
10080 min Winter	0.507	0.0	751.6	5144

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Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 8.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	220.0	0.200	220.0	1.000	220.0	1.010	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0320-6080-1000-6080
Design Head (m)	1.000
Design Flow (l/s)	60.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	320
Invert Level (m)	8.000
Minimum Outlet Pipe Diameter (mm)	375
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	60.7
Flush-Flo™	0.475	60.7
Kick-Flo®	0.802	54.6
Mean Flow over Head Range	-	48.1

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	9.6	1.200	66.3	3.000	103.5	7.000	156.5
0.200	32.7	1.400	71.5	3.500	111.5	7.500	161.9
0.300	57.4	1.600	76.2	4.000	119.1	8.000	167.1
0.400	60.3	1.800	80.7	4.500	126.1	8.500	172.1
0.500	60.7	2.000	85.0	5.000	132.8	9.000	177.0
0.600	59.9	2.200	89.0	5.500	139.1	9.500	181.8
0.800	54.7	2.400	92.8	6.000	145.1		
1.000	60.7	2.600	96.5	6.500	150.9		

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<u>Summary of Results for 30 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	8.413	0.413	111.2	173.6	O K
30 min Summer	8.486	0.486	113.6	204.3	O K
60 min Summer	8.511	0.511	114.0	214.8	O K
120 min Summer	8.472	0.472	113.2	198.2	O K
180 min Summer	8.416	0.416	111.3	174.7	O K
240 min Summer	8.374	0.374	107.0	157.1	O K
360 min Summer	8.323	0.323	88.8	135.8	O K
480 min Summer	8.290	0.290	75.4	121.7	O K
600 min Summer	8.266	0.266	65.9	111.6	O K
720 min Summer	8.247	0.247	58.5	103.8	O K
960 min Summer	8.221	0.221	48.3	92.6	O K
1440 min Summer	8.187	0.187	36.2	78.7	O K
2160 min Summer	8.159	0.159	27.0	66.8	O K
2880 min Summer	8.142	0.142	21.8	59.4	O K
4320 min Summer	8.120	0.120	15.9	50.3	O K
5760 min Summer	8.107	0.107	12.8	44.7	O K
7200 min Summer	8.097	0.097	10.7	40.8	O K
8640 min Summer	8.090	0.090	9.3	37.8	O K
10080 min Summer	8.085	0.085	8.2	35.5	O K
15 min Winter	8.462	0.462	113.0	194.2	O K
30 min Winter	8.548	0.548	114.4	230.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	64.005	0.0	235.9	20	
30 min Summer	41.724	0.0	308.1	29	
60 min Summer	26.061	0.0	386.2	46	
120 min Summer	15.842	0.0	469.6	78	
180 min Summer	11.734	0.0	521.9	108	
240 min Summer	9.450	0.0	560.4	138	
360 min Summer	6.932	0.0	616.7	198	
480 min Summer	5.545	0.0	657.7	258	
600 min Summer	4.661	0.0	691.1	318	
720 min Summer	4.045	0.0	719.8	378	
960 min Summer	3.233	0.0	767.0	500	
1440 min Summer	2.355	0.0	837.9	742	
2160 min Summer	1.714	0.0	915.6	1104	
2880 min Summer	1.367	0.0	973.6	1472	
4320 min Summer	0.993	0.0	1060.1	2204	
5760 min Summer	0.791	0.0	1127.2	2936	
7200 min Summer	0.663	0.0	1180.6	3672	
8640 min Summer	0.574	0.0	1225.8	4368	
10080 min Summer	0.507	0.0	1264.6	5136	
15 min Winter	64.005	0.0	264.4	21	
30 min Winter	41.724	0.0	345.2	31	
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Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	8.557	0.557	114.4	233.9	O K
120 min Winter	8.471	0.471	113.2	197.7	O K
180 min Winter	8.387	0.387	110.0	162.6	O K
240 min Winter	8.343	0.343	96.3	144.1	O K
360 min Winter	8.289	0.289	75.0	121.3	O K
480 min Winter	8.255	0.255	61.5	107.1	O K
600 min Winter	8.232	0.232	52.5	97.3	O K
720 min Winter	8.214	0.214	45.9	90.0	O K
960 min Winter	8.190	0.190	37.1	79.6	O K
1440 min Winter	8.160	0.160	27.2	67.1	O K
2160 min Winter	8.135	0.135	19.9	56.7	O K
2880 min Winter	8.120	0.120	15.9	50.3	O K
4320 min Winter	8.101	0.101	11.6	42.5	O K
5760 min Winter	8.090	0.090	9.3	37.8	O K
7200 min Winter	8.082	0.082	7.8	34.5	O K
8640 min Winter	8.076	0.076	6.7	31.9	O K
10080 min Winter	8.072	0.072	6.0	30.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	26.061	0.0	432.6	48
120 min Winter	15.842	0.0	526.1	82
180 min Winter	11.734	0.0	584.6	110
240 min Winter	9.450	0.0	627.8	140
360 min Winter	6.932	0.0	690.9	200
480 min Winter	5.545	0.0	736.8	262
600 min Winter	4.661	0.0	774.1	322
720 min Winter	4.045	0.0	806.3	382
960 min Winter	3.233	0.0	859.2	502
1440 min Winter	2.355	0.0	938.6	744
2160 min Winter	1.714	0.0	1025.6	1108
2880 min Winter	1.367	0.0	1090.5	1472
4320 min Winter	0.993	0.0	1187.6	2204
5760 min Winter	0.791	0.0	1262.5	2920
7200 min Winter	0.663	0.0	1322.4	3624
8640 min Winter	0.574	0.0	1373.0	4336
10080 min Winter	0.507	0.0	1416.7	5136

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Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 8.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	420.0	0.200	420.0	1.000	420.0	1.010	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0418-1147-1000-1147
Design Head (m)	1.000
Design Flow (l/s)	114.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	418
Invert Level (m)	8.000
Minimum Outlet Pipe Diameter (mm)	450
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	114.7
Flush-Flo™	0.577	114.5
Kick-Flo®	0.862	106.7
Mean Flow over Head Range	-	86.0

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	11.3	1.200	125.3	3.000	195.9	7.000	296.9
0.200	40.7	1.400	135.1	3.500	211.3	7.500	307.2
0.300	79.5	1.600	144.1	4.000	225.6	8.000	317.1
0.400	110.6	1.800	152.7	4.500	239.0	8.500	326.7
0.500	113.8	2.000	160.7	5.000	251.7	9.000	336.0
0.600	114.4	2.200	168.4	5.500	263.7	9.500	345.0
0.800	109.8	2.400	175.7	6.000	275.3		
1.000	114.7	2.600	182.7	6.500	286.3		

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<u>Summary of Results for 1 year Return Period</u> <table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Control (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>15 min Summer</td><td>8.186</td><td>0.186</td><td>19.6</td><td>40.9</td><td>O K</td></tr><tr><td>30 min Summer</td><td>8.216</td><td>0.216</td><td>23.2</td><td>47.5</td><td>O K</td></tr><tr><td>60 min Summer</td><td>8.231</td><td>0.231</td><td>23.9</td><td>50.9</td><td>O K</td></tr><tr><td>120 min Summer</td><td>8.228</td><td>0.228</td><td>23.8</td><td>50.1</td><td>O K</td></tr><tr><td>180 min Summer</td><td>8.214</td><td>0.214</td><td>23.0</td><td>47.1</td><td>O K</td></tr><tr><td>240 min Summer</td><td>8.201</td><td>0.201</td><td>21.5</td><td>44.2</td><td>O K</td></tr><tr><td>360 min Summer</td><td>8.179</td><td>0.179</td><td>18.8</td><td>39.5</td><td>O K</td></tr><tr><td>480 min Summer</td><td>8.164</td><td>0.164</td><td>16.6</td><td>36.1</td><td>O K</td></tr><tr><td>600 min Summer</td><td>8.152</td><td>0.152</td><td>14.8</td><td>33.5</td><td>O K</td></tr><tr><td>720 min Summer</td><td>8.143</td><td>0.143</td><td>13.4</td><td>31.4</td><td>O K</td></tr><tr><td>960 min Summer</td><td>8.129</td><td>0.129</td><td>11.4</td><td>28.3</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>8.111</td><td>0.111</td><td>8.8</td><td>24.4</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>8.095</td><td>0.095</td><td>6.7</td><td>21.0</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>8.086</td><td>0.086</td><td>5.6</td><td>18.8</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>8.074</td><td>0.074</td><td>4.2</td><td>16.2</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>8.066</td><td>0.066</td><td>3.4</td><td>14.5</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>8.061</td><td>0.061</td><td>2.9</td><td>13.3</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>8.057</td><td>0.057</td><td>2.6</td><td>12.4</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>8.053</td><td>0.053</td><td>2.3</td><td>11.7</td><td>O K</td></tr><tr><td>15 min Winter</td><td>8.206</td><td>0.206</td><td>22.1</td><td>45.2</td><td>O K</td></tr><tr><td>30 min Winter</td><td>8.241</td><td>0.241</td><td>24.0</td><td>52.9</td><td>O K</td></tr></table> <table><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Discharge Volume (m³)</th><th>Time-Peak (mins)</th></tr><tr><td>15 min Summer</td><td>26.180</td><td>0.0</td><td>50.9</td><td>21</td></tr><tr><td>30 min Summer</td><td>16.984</td><td>0.0</td><td>66.2</td><td>30</td></tr><tr><td>60 min Summer</td><td>10.676</td><td>0.0</td><td>83.8</td><td>46</td></tr><tr><td>120 min Summer</td><td>6.602</td><td>0.0</td><td>103.7</td><td>78</td></tr><tr><td>180 min Summer</td><td>4.959</td><td>0.0</td><td>116.8</td><td>110</td></tr><tr><td>240 min Summer</td><td>4.043</td><td>0.0</td><td>127.0</td><td>140</td></tr><tr><td>360 min Summer</td><td>3.030</td><td>0.0</td><td>142.8</td><td>202</td></tr><tr><td>480 min Summer</td><td>2.469</td><td>0.0</td><td>155.2</td><td>262</td></tr><tr><td>600 min Summer</td><td>2.101</td><td>0.0</td><td>165.1</td><td>322</td></tr><tr><td>720 min Summer</td><td>1.838</td><td>0.0</td><td>173.3</td><td>382</td></tr><tr><td>960 min Summer</td><td>1.489</td><td>0.0</td><td>187.1</td><td>502</td></tr><tr><td>1440 min Summer</td><td>1.106</td><td>0.0</td><td>208.4</td><td>744</td></tr><tr><td>2160 min Summer</td><td>0.822</td><td>0.0</td><td>232.8</td><td>1108</td></tr><tr><td>2880 min Summer</td><td>0.666</td><td>0.0</td><td>251.6</td><td>1472</td></tr><tr><td>4320 min Summer</td><td>0.496</td><td>0.0</td><td>280.7</td><td>2204</td></tr><tr><td>5760 min Summer</td><td>0.402</td><td>0.0</td><td>303.7</td><td>2936</td></tr><tr><td>7200 min Summer</td><td>0.341</td><td>0.0</td><td>322.4</td><td>3672</td></tr><tr><td>8640 min Summer</td><td>0.299</td><td>0.0</td><td>338.6</td><td>4400</td></tr><tr><td>10080 min Summer</td><td>0.267</td><td>0.0</td><td>352.8</td><td>5136</td></tr><tr><td>15 min Winter</td><td>26.180</td><td>0.0</td><td>57.1</td><td>21</td></tr><tr><td>30 min Winter</td><td>16.984</td><td>0.0</td><td>74.2</td><td>31</td></tr></table>						Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status	15 min Summer	8.186	0.186	19.6	40.9	O K	30 min Summer	8.216	0.216	23.2	47.5	O K	60 min Summer	8.231	0.231	23.9	50.9	O K	120 min Summer	8.228	0.228	23.8	50.1	O K	180 min Summer	8.214	0.214	23.0	47.1	O K	240 min Summer	8.201	0.201	21.5	44.2	O K	360 min Summer	8.179	0.179	18.8	39.5	O K	480 min Summer	8.164	0.164	16.6	36.1	O K	600 min Summer	8.152	0.152	14.8	33.5	O K	720 min Summer	8.143	0.143	13.4	31.4	O K	960 min Summer	8.129	0.129	11.4	28.3	O K	1440 min Summer	8.111	0.111	8.8	24.4	O K	2160 min Summer	8.095	0.095	6.7	21.0	O K	2880 min Summer	8.086	0.086	5.6	18.8	O K	4320 min Summer	8.074	0.074	4.2	16.2	O K	5760 min Summer	8.066	0.066	3.4	14.5	O K	7200 min Summer	8.061	0.061	2.9	13.3	O K	8640 min Summer	8.057	0.057	2.6	12.4	O K	10080 min Summer	8.053	0.053	2.3	11.7	O K	15 min Winter	8.206	0.206	22.1	45.2	O K	30 min Winter	8.241	0.241	24.0	52.9	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	15 min Summer	26.180	0.0	50.9	21	30 min Summer	16.984	0.0	66.2	30	60 min Summer	10.676	0.0	83.8	46	120 min Summer	6.602	0.0	103.7	78	180 min Summer	4.959	0.0	116.8	110	240 min Summer	4.043	0.0	127.0	140	360 min Summer	3.030	0.0	142.8	202	480 min Summer	2.469	0.0	155.2	262	600 min Summer	2.101	0.0	165.1	322	720 min Summer	1.838	0.0	173.3	382	960 min Summer	1.489	0.0	187.1	502	1440 min Summer	1.106	0.0	208.4	744	2160 min Summer	0.822	0.0	232.8	1108	2880 min Summer	0.666	0.0	251.6	1472	4320 min Summer	0.496	0.0	280.7	2204	5760 min Summer	0.402	0.0	303.7	2936	7200 min Summer	0.341	0.0	322.4	3672	8640 min Summer	0.299	0.0	338.6	4400	10080 min Summer	0.267	0.0	352.8	5136	15 min Winter	26.180	0.0	57.1	21	30 min Winter	16.984	0.0	74.2	31
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status																																																																																																																																																																																																																																																		
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Hurley Palmer Flatt				Page 2	
NWS House, 1 High Street Purley Surrey, CR8 2AS					
Date 14/06/2021 16:17 File Unit 2 Network.SRCX		Designed by MARAHMAN Checked by			
Innovyze		Source Control 2020.1			
<u>Summary of Results for 1 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	8.252	0.252	24.1	55.4	O K
120 min Winter	8.233	0.233	23.9	51.2	O K
180 min Winter	8.209	0.209	22.4	45.9	O K
240 min Winter	8.190	0.190	20.2	41.8	O K
360 min Winter	8.164	0.164	16.6	36.1	O K
480 min Winter	8.147	0.147	14.1	32.4	O K
600 min Winter	8.135	0.135	12.2	29.7	O K
720 min Winter	8.125	0.125	10.9	27.6	O K
960 min Winter	8.112	0.112	8.9	24.6	O K
1440 min Winter	8.095	0.095	6.7	20.9	O K
2160 min Winter	8.081	0.081	5.1	17.8	O K
2880 min Winter	8.073	0.073	4.1	16.0	O K
4320 min Winter	8.062	0.062	3.1	13.6	O K
5760 min Winter	8.056	0.056	2.5	12.2	O K
7200 min Winter	8.051	0.051	2.1	11.2	O K
8640 min Winter	8.048	0.048	1.9	10.5	O K
10080 min Winter	8.045	0.045	1.7	9.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	10.676	0.0	93.8	48	
120 min Winter	6.602	0.0	116.1	82	
180 min Winter	4.959	0.0	130.9	114	
240 min Winter	4.043	0.0	142.3	144	
360 min Winter	3.030	0.0	160.0	206	
480 min Winter	2.469	0.0	173.8	266	
600 min Winter	2.101	0.0	184.9	328	
720 min Winter	1.838	0.0	194.1	388	
960 min Winter	1.489	0.0	209.6	510	
1440 min Winter	1.106	0.0	233.5	750	
2160 min Winter	0.822	0.0	260.8	1108	
2880 min Winter	0.666	0.0	281.9	1472	
4320 min Winter	0.496	0.0	314.5	2184	
5760 min Winter	0.402	0.0	340.2	2928	
7200 min Winter	0.341	0.0	361.1	3656	
8640 min Winter	0.299	0.0	379.3	4328	
10080 min Winter	0.267	0.0	395.2	5088	
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Hurley Palmer Flatt		Page 3
NWS House, 1 High Street Purley Surrey, CR8 2AS		
Date 14/06/2021 16:17 File Unit 2 Network.SRCX	Designed by MARAHMAN Checked by	
Innovyze Source Control 2020.1		

Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 8.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	220.0	0.200	220.0	1.000	220.0	1.010	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0218-2470-1000-2470

Design Head (m) 1.000

Design Flow (l/s) 24.7

Flush-Flo™ Calculated

Objective Minimise upstream storage

Application Surface

Sump Available Yes

Diameter (mm) 218

Invert Level (m) 8.000

Minimum Outlet Pipe Diameter (mm) 300

Suggested Manhole Diameter (mm) 1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	24.7
Flush-Flo™	0.361	24.7
Kick-Flo®	0.736	21.3
Mean Flow over Head Range	-	20.6

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	7.4	1.200	26.9	3.000	41.9	7.000	63.1
0.200	21.4	1.400	29.0	3.500	45.1	7.500	65.3
0.300	24.5	1.600	30.9	4.000	48.1	8.000	67.3
0.400	24.6	1.800	32.7	4.500	50.9	8.500	69.3
0.500	24.3	2.000	34.4	5.000	53.6	9.000	71.3
0.600	23.6	2.200	36.0	5.500	56.1	9.500	73.2
0.800	22.2	2.400	37.6	6.000	58.5		
1.000	24.7	2.600	39.1	6.500	60.9		

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NWS House, 1 High Street Purley Surrey, CR8 2AS					
Date 14/06/2021 16:18 File Unit 2 Network.SRCX		Designed by MARAHMAN Checked by			
Innovyze		Source Control 2020.1			
<u>Summary of Results for 30 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	8.396	0.396	60.3	87.1	O K
30 min Summer	8.468	0.468	60.7	103.1	O K
60 min Summer	8.485	0.485	60.7	106.7	O K
120 min Summer	8.429	0.429	60.6	94.4	O K
180 min Summer	8.363	0.363	59.8	79.9	O K
240 min Summer	8.314	0.314	58.6	69.1	O K
360 min Summer	8.264	0.264	49.4	58.0	O K
480 min Summer	8.234	0.234	41.7	51.4	O K
600 min Summer	8.213	0.213	36.2	46.9	O K
720 min Summer	8.197	0.197	32.0	43.4	O K
960 min Summer	8.175	0.175	26.3	38.5	O K
1440 min Summer	8.148	0.148	19.5	32.6	O K
2160 min Summer	8.125	0.125	14.5	27.5	O K
2880 min Summer	8.111	0.111	11.7	24.4	O K
4320 min Summer	8.094	0.094	8.5	20.6	O K
5760 min Summer	8.083	0.083	6.8	18.3	O K
7200 min Summer	8.076	0.076	5.7	16.7	O K
8640 min Summer	8.071	0.071	5.0	15.5	O K
10080 min Summer	8.066	0.066	4.4	14.5	O K
15 min Winter	8.447	0.447	60.7	98.4	O K
30 min Winter	8.532	0.532	60.7	116.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	64.005	0.0	125.5	20	
30 min Summer	41.724	0.0	163.7	29	
60 min Summer	26.061	0.0	205.0	46	
120 min Summer	15.842	0.0	249.2	78	
180 min Summer	11.734	0.0	276.9	108	
240 min Summer	9.450	0.0	297.4	136	
360 min Summer	6.932	0.0	327.3	196	
480 min Summer	5.545	0.0	349.0	256	
600 min Summer	4.661	0.0	366.7	316	
720 min Summer	4.045	0.0	381.9	376	
960 min Summer	3.233	0.0	407.0	496	
1440 min Summer	2.355	0.0	444.6	740	
2160 min Summer	1.714	0.0	485.7	1104	
2880 min Summer	1.367	0.0	516.4	1468	
4320 min Summer	0.993	0.0	562.5	2204	
5760 min Summer	0.791	0.0	597.9	2936	
7200 min Summer	0.663	0.0	626.2	3664	
8640 min Summer	0.574	0.0	650.2	4384	
10080 min Summer	0.507	0.0	670.9	5136	
15 min Winter	64.005	0.0	140.6	21	
30 min Winter	41.724	0.0	183.5	31	
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Hurley Palmer Flatt				Page 2																																																																																																																																																																																																							
NWS House, 1 High Street Purley Surrey, CR8 2AS																																																																																																																																																																																																											
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<u>Summary of Results for 30 year Return Period</u> <table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Control (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>60 min Winter</td><td>8.530</td><td>0.530</td><td>60.7</td><td>116.5</td><td>O K</td></tr><tr><td>120 min Winter</td><td>8.422</td><td>0.422</td><td>60.5</td><td>92.8</td><td>O K</td></tr><tr><td>180 min Winter</td><td>8.325</td><td>0.325</td><td>58.9</td><td>71.5</td><td>O K</td></tr><tr><td>240 min Winter</td><td>8.278</td><td>0.278</td><td>52.8</td><td>61.2</td><td>O K</td></tr><tr><td>360 min Winter</td><td>8.230</td><td>0.230</td><td>40.7</td><td>50.6</td><td>O K</td></tr><tr><td>480 min Winter</td><td>8.202</td><td>0.202</td><td>33.2</td><td>44.4</td><td>O K</td></tr><tr><td>600 min Winter</td><td>8.183</td><td>0.183</td><td>28.2</td><td>40.2</td><td>O K</td></tr><tr><td>720 min Winter</td><td>8.169</td><td>0.169</td><td>24.6</td><td>37.1</td><td>O K</td></tr><tr><td>960 min Winter</td><td>8.149</td><td>0.149</td><td>19.8</td><td>32.8</td><td>O K</td></tr><tr><td>1440 min Winter</td><td>8.125</td><td>0.125</td><td>14.5</td><td>27.5</td><td>O K</td></tr><tr><td>2160 min Winter</td><td>8.106</td><td>0.106</td><td>10.6</td><td>23.2</td><td>O K</td></tr><tr><td>2880 min Winter</td><td>8.094</td><td>0.094</td><td>8.5</td><td>20.6</td><td>O K</td></tr><tr><td>4320 min Winter</td><td>8.079</td><td>0.079</td><td>6.2</td><td>17.4</td><td>O K</td></tr><tr><td>5760 min Winter</td><td>8.070</td><td>0.070</td><td>4.9</td><td>15.4</td><td>O K</td></tr><tr><td>7200 min Winter</td><td>8.064</td><td>0.064</td><td>4.1</td><td>14.1</td><td>O K</td></tr><tr><td>8640 min Winter</td><td>8.060</td><td>0.060</td><td>3.6</td><td>13.1</td><td>O K</td></tr><tr><td>10080 min Winter</td><td>8.056</td><td>0.056</td><td>3.1</td><td>12.3</td><td>O K</td></tr></table> <table><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Discharge Volume (m³)</th><th>Time-Peak (mins)</th></tr><tr><td>60 min Winter</td><td>26.061</td><td>0.0</td><td>229.6</td><td>48</td></tr><tr><td>120 min Winter</td><td>15.842</td><td>0.0</td><td>279.2</td><td>82</td></tr><tr><td>180 min Winter</td><td>11.734</td><td>0.0</td><td>310.2</td><td>110</td></tr><tr><td>240 min Winter</td><td>9.450</td><td>0.0</td><td>333.1</td><td>138</td></tr><tr><td>360 min Winter</td><td>6.932</td><td>0.0</td><td>366.6</td><td>198</td></tr><tr><td>480 min Winter</td><td>5.545</td><td>0.0</td><td>390.9</td><td>258</td></tr><tr><td>600 min Winter</td><td>4.661</td><td>0.0</td><td>410.7</td><td>318</td></tr><tr><td>720 min Winter</td><td>4.045</td><td>0.0</td><td>427.8</td><td>378</td></tr><tr><td>960 min Winter</td><td>3.233</td><td>0.0</td><td>455.9</td><td>500</td></tr><tr><td>1440 min Winter</td><td>2.355</td><td>0.0</td><td>498.1</td><td>740</td></tr><tr><td>2160 min Winter</td><td>1.714</td><td>0.0</td><td>544.0</td><td>1100</td></tr><tr><td>2880 min Winter</td><td>1.367</td><td>0.0</td><td>578.5</td><td>1452</td></tr><tr><td>4320 min Winter</td><td>0.993</td><td>0.0</td><td>630.1</td><td>2192</td></tr><tr><td>5760 min Winter</td><td>0.791</td><td>0.0</td><td>669.6</td><td>2936</td></tr><tr><td>7200 min Winter</td><td>0.663</td><td>0.0</td><td>701.4</td><td>3656</td></tr><tr><td>8640 min Winter</td><td>0.574</td><td>0.0</td><td>728.3</td><td>4368</td></tr><tr><td>10080 min Winter</td><td>0.507</td><td>0.0</td><td>751.6</td><td>5144</td></tr></table>						Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status	60 min Winter	8.530	0.530	60.7	116.5	O K	120 min Winter	8.422	0.422	60.5	92.8	O K	180 min Winter	8.325	0.325	58.9	71.5	O K	240 min Winter	8.278	0.278	52.8	61.2	O K	360 min Winter	8.230	0.230	40.7	50.6	O K	480 min Winter	8.202	0.202	33.2	44.4	O K	600 min Winter	8.183	0.183	28.2	40.2	O K	720 min Winter	8.169	0.169	24.6	37.1	O K	960 min Winter	8.149	0.149	19.8	32.8	O K	1440 min Winter	8.125	0.125	14.5	27.5	O K	2160 min Winter	8.106	0.106	10.6	23.2	O K	2880 min Winter	8.094	0.094	8.5	20.6	O K	4320 min Winter	8.079	0.079	6.2	17.4	O K	5760 min Winter	8.070	0.070	4.9	15.4	O K	7200 min Winter	8.064	0.064	4.1	14.1	O K	8640 min Winter	8.060	0.060	3.6	13.1	O K	10080 min Winter	8.056	0.056	3.1	12.3	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	60 min Winter	26.061	0.0	229.6	48	120 min Winter	15.842	0.0	279.2	82	180 min Winter	11.734	0.0	310.2	110	240 min Winter	9.450	0.0	333.1	138	360 min Winter	6.932	0.0	366.6	198	480 min Winter	5.545	0.0	390.9	258	600 min Winter	4.661	0.0	410.7	318	720 min Winter	4.045	0.0	427.8	378	960 min Winter	3.233	0.0	455.9	500	1440 min Winter	2.355	0.0	498.1	740	2160 min Winter	1.714	0.0	544.0	1100	2880 min Winter	1.367	0.0	578.5	1452	4320 min Winter	0.993	0.0	630.1	2192	5760 min Winter	0.791	0.0	669.6	2936	7200 min Winter	0.663	0.0	701.4	3656	8640 min Winter	0.574	0.0	728.3	4368	10080 min Winter	0.507	0.0	751.6	5144
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Hurley Palmer Flatt		Page 3
NWS House, 1 High Street Purley Surrey, CR8 2AS		
Date 14/06/2021 16:18 File Unit 2 Network.SRCX	Designed by MARAHMAN Checked by	
Innovyze Source Control 2020.1		

Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 8.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	220.0	0.200	220.0	1.000	220.0	1.010	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0320-6080-1000-6080
Design Head (m)	1.000
Design Flow (l/s)	60.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	320
Invert Level (m)	8.000
Minimum Outlet Pipe Diameter (mm)	375
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	60.7
Flush-Flo™	0.475	60.7
Kick-Flo®	0.802	54.6
Mean Flow over Head Range	-	48.1

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	9.6	1.200	66.3	3.000	103.5	7.000	156.5
0.200	32.7	1.400	71.5	3.500	111.5	7.500	161.9
0.300	57.4	1.600	76.2	4.000	119.1	8.000	167.1
0.400	60.3	1.800	80.7	4.500	126.1	8.500	172.1
0.500	60.7	2.000	85.0	5.000	132.8	9.000	177.0
0.600	59.9	2.200	89.0	5.500	139.1	9.500	181.8
0.800	54.7	2.400	92.8	6.000	145.1		
1.000	60.7	2.600	96.5	6.500	150.9		

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Appendix B – Updated Drainage Layout



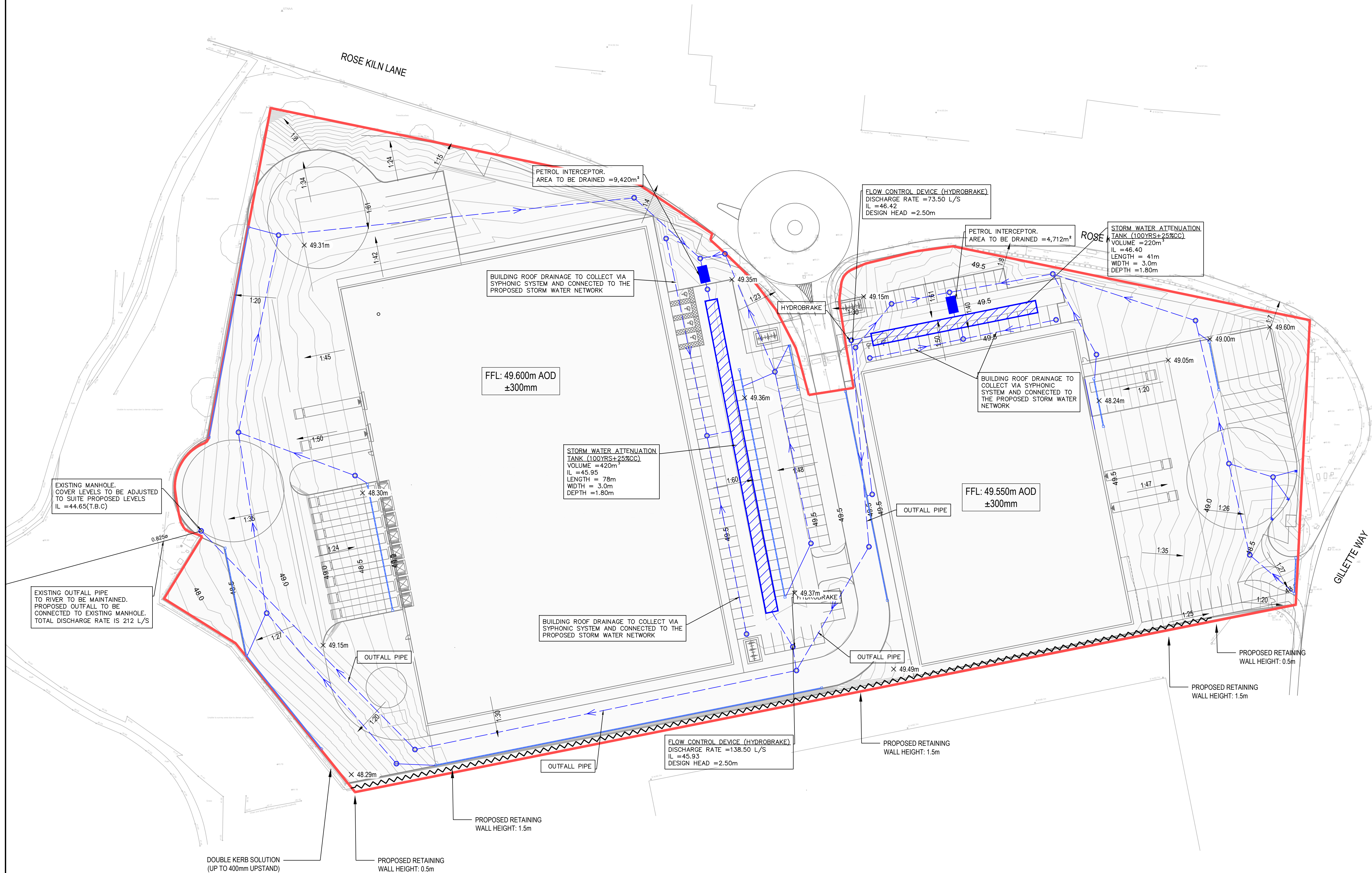
LEGEND

- NEW SW MANHOLE
- PROPOSED SW PIPE
- ATTENUATION TANK

1. DRAWING BASED ON:
1.1. SITE PLAN: FLETCHER RAE, DWG. No. 19032 - SK25, DATED 06.10.20
1.2. TOPOGRAPHICAL SURVEY: STAFSURF, DWG No: 11144, DATED: 19.08.20

LEGEND:

- RETAINING WALL



12	RS	10.06.21	SITE BOUNDARIES UPDATED
11	ZA	10.11.20	DRAFT ISSUE
Rev	Tech	Date	Description

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Kingston upon Thames
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United Kingdom

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E: info@bradbrookconsulting.com
W: www.bradbrookconsulting.com

Client
MAYFAIR CAPITAL INVESTMENT MANAGEMENT LTD

Project Title
BRUNEL RETAIL PARK

Drawing Title
PROPOSED DRAINAGE STRATEGY CONCEPT

Purpose of Issue
Information ☒ Preliminary ☐ Approval ☐ Tender ☐ Construction ☐ Record Copy ☐

First Issue Date	Drawn By	Scale	Checked
NOV'20	RS	1:500	MR

Drawing Number	Rev.
20-043/300	12

Appendix C – Drainage Layout for Both Phases



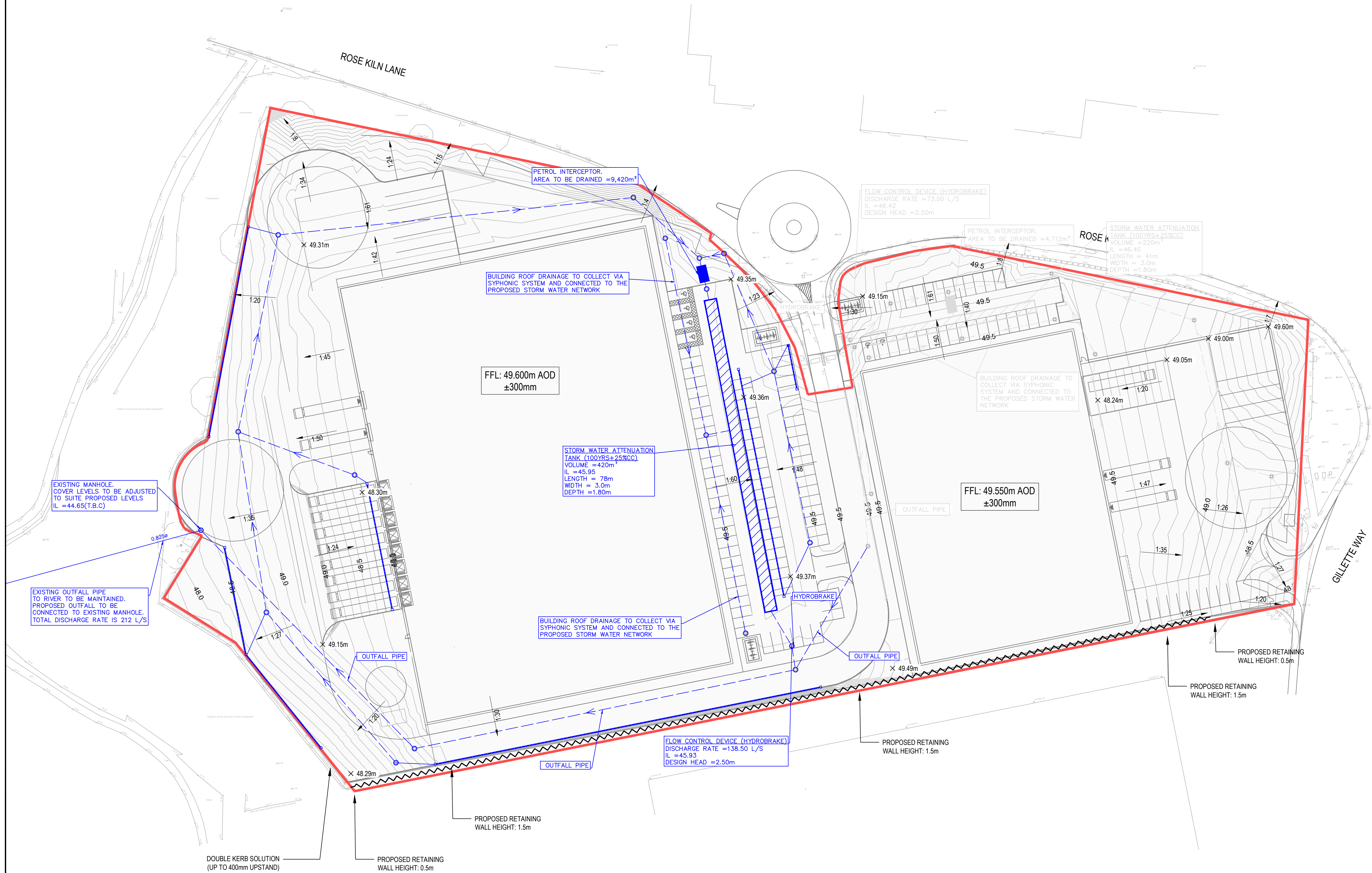
LEGEND

- NEW SW MANHOLE
- PROPOSED SW PIPE
- ATTENUATION TANK

1. DRAWING BASED ON:
- 1.1. SITE PLAN: FLETCHER RAE, DWG. No. 19032 - SK25, DATED 06.10.20
 - 1.2. TOPOGRAPHICAL SURVEY: STAFSURF, DWG NO: 11144, DATED: 19.06.20

LEGEND:

- RETAINING WALL



11	RS	10.06.21	ISSUED FOR INFORMATION
Rev	Tech	Date	Description

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Client	MAYFAIR CAPITAL INVESTMENT MANAGEMENT LTD		
Project Title	BRUNEL RETAIL PARK		
Drawing Title	PROPOSED DRAINAGE STRATEGY CONCEPT PHASE 2		
Purpose of Issue	Information ☒ Preliminary ☐ Approval ☐ Tender ☐ Construction ☐ Record Copy ☐		
First Issue Date	Drawn By	Scale	Checked
JUN'21	RS	1:500	MR
Drawing Number	Rev.		
20-043/302	I1		



LEGEND

- NEW SW MANHOLE
- PROPOSED SW PIPE
- ATTENUATION TANK

- DRAWING BASED ON:
 - 1.1. SITE PLAN: FLETCHER RAE, DWG. No. 19032 - SK25, DATED 06.10.20
 - 1.2. TOPOGRAPHICAL SURVEY: STAFSURF, DWG NO: 11144, DATED: 19.06.20

LEGEND:

- RETAINING WALL

