Supplementary Materials

Appendix A

Table 1. Performances of both strategies for all storm events in terms of CSO loads and volumes.

	QBR		HBR				
Storm event	CSO Load (kg)	CSO Volume (m^3)	CSO Load (kg)	CSO Volume (m^3)	Load Difference %)	Volume Difference (%)	Group
1	687.4	3110.7	686.9	3108.7	0.1	0.1	2
2	448.2	2032.9	745.8	3258.1	-39.9	-37.6	2
3	436.3	2911.5	448.0	2939.6	-2.6	-1.0	1
4	541.7	3105.9	542.3	3108.6	-0.1	-0.1	2
5	845.7	3877.8	871.6	3902.0	-3.0	-0.6	3
6	668.4	3536.0	669.3	3542.5	-0.1	-0.2	3
7	196.2	2897.9	225.4	2138.6	-13.0	35.5	1
8	947.0	4978.8	947.3	4984.5	0.0	-0.1	3
9	819.4	2635.6	817.2	2635.1	0.3	0.0	3
10	820.0	4271.4	864.2	4611.8	-5.1	-7.4	2
11	282.8	1116.4	299.6	1175.9	-5.6	-5.1	1
12	634.4	4067.8	631.8	4061.0	0.4	0.2	3
13	1253.0	8407.6	1254.7	8413.1	-0.1	-0.1	3
14	618.7	3381.0	624.6	3396.7	-0.9	-0.5	1
15	544.6	2797.6	548.9	2810.5	-0.8	-0.5	3
16	542.4	2806.0	543.0	2808.4	-0.1	-0.1	2
17	1275.1	5771.4	1344.4	5263.9	-5.2	9.6	2
18	879.2	3505.4	876.2	3501.1	0.4	0.1	3
19	804.4	4353.8	824.0	4426.1	-2.4	-1.6	3
20	839.5	4411.6	894.0	4404.7	-6.1	0.2	1
21	651.4	4401.9	651.9	4405.8	-0.1	-0.1	3
22	186.1	3356.5	205.5	3341.0	-9.4	0.5	3
23	431.5	3930.5	429.6	3935.4	0.4	-0.1	3
24	407.9	1673.4	413.4	1695.1	-1.3	-1.3	3
25	1397.9	9568.6	1395.4	9568.6	0.2	0.0	3
26	268.1	1753.9	213.3	1413.0	25.7	24.1	3
27	391.4	1691.5	390.2	1687.3	0.3	0.2	2
28	136.9	741.8	238.0	1313.7	-42.5	-43.5	1
29	409.6	4366.4	410.1	4366.7	-0.1	0.0	1

30	485.6	2376.9	487.2	2383.3	-0.3	-0.3	2
31	566.1	4210.8	566.5	4212.4	-0.1	0.0	3

Table 2. Performances of both strategies for all storm events in terms of loads and volumes transferred to the WWTP.

	QBR		HBR				
Storm event	WWTP Load (kg)	WWTP Volume (m^3)	WWTP Load (kg)	WWTP Volume (m^3)	Load Difference %)	Volume Difference (%)	Group
1	989.0	4706.8	988.3	4706.8	0.1	0.0	2
2	1717.1	7903.3	1452.0	6992.8	18.3	13.0	2
3	1009.6	4688.8	1006.4	4689.6	0.3	0.0	1
4	1488.3	6278.5	1486.7	6279.1	0.1	0.0	2
5	2239.7	9672.4	2258.2	9670.7	-0.8	0.0	3
6	1394.8	5735.6	1400.3	5747.3	-0.4	-0.2	3
7	1183.8	9257.1	1137.8	10066.5	4.0	-8.0	1
8	2215.9	7074.4	2216.4	7075.5	0.0	0.0	3
9	2262.0	6562.2	2257.2	6562.3	0.2	0.0	3
10	1550.6	7457.3	1479.1	6977.8	4.8	6.9	2
11	1375.1	6124.6	1365.9	6073.5	0.7	0.8	1
12	2266.4	8659.2	2270.1	8660.8	-0.2	0.0	3
13	1511.6	8874.7	1508.9	8873.4	0.2	0.0	3
14	1078.6	6047.1	1077.4	6045.2	0.1	0.0	1
15	846.2	4338.4	845.5	4336.3	0.1	0.0	3
16	1022.6	5093.8	1022.1	5093.3	0.1	0.0	2
17	1360.4	4841.2	1240.7	5351.4	9.7	-9.5	2
18	2637.3	11531.1	2639.2	11536.0	-0.1	0.0	3
19	2493.2	14412.1	2416.2	14389.0	3.2	0.2	3
20	853.0	4051.0	851.8	4097.8	0.1	-1.1	1
21	843.9	3934.8	842.9	3935.8	0.1	0.0	3
22	285.5	3353.4	274.0	3385.6	4.2	-1.0	3
23	1685.7	11635.4	1684.0	11625.1	0.1	0.1	3
24	1424.4	5567.8	1418.2	5550.6	0.4	0.3	3
25	1158.9	6093.0	1159.3	6092.9	0.0	0.0	3
26	1460.8	7462.0	1523.1	7803.2	-4.1	-4.4	3
27	1136.0	4624.2	1135.9	4624.9	0.0	0.0	2
28	1865.3	9091.0	1805.5	9146.4	3.3	-0.6	1
29	1199.1	7446.1	1198.1	7447.2	0.1	0.0	1
30	1382.9	6871.8	1382.6	6872.3	0.0	0.0	2

31	784.9	5760.9	784.0	5761.1	0.1	0.0	3

Appendix B

It is interesting to examine the linear correlations between various variables such as: CSO load difference between QBR and HBR, rainfall parameters, and β. Equation (1) describes the Pearson Product-Moment Correlation (PPMC) coefficient used in this study to measure the correlation of two variables, e.g. *X* and *Y*.

$$PPMC = \frac{\sum_{i=1}^{n}(X_i-\overline{X})(\hat{Y}_i-\overline{Y})}{\sqrt{\sum_{i=1}^{n}(X_i-\overline{X})^2}\sqrt{\sum_{i=1}^{n}(\hat{Y}_i-\overline{Y})^2}} \quad (1)$$

where $\boldsymbol{X_i}$ and $\boldsymbol{Y_i}$ are individual values of *X* and *Y* (i.e. obtained from each storm event), $\overline{\boldsymbol{X}}$ and $\overline{\boldsymbol{Y}}$ are the corresponding means of the individual values. The PPMC coefficient varies from -1 to 1, in which 1 represents a perfectly positive linear relationship and -1 represents a perfectly negative one.

The main goal of the correlation tests is to examine whether there exist linear correlations between: (i) CSO load reduction versus rainfall parameters, (ii) CSO load reduction versus β values, and (iii) β versus rainfall parameters. Initially the computation of PPMC coefficients are done for all 31 storm events but the results show no linear correlation (see Table 3).

Table 3. PPMC matrix for different variables from all the 31 storm events.

	β	CSO load reduction (kg)	CSO load reduction (%)	Rainfall depth (mm)	Rainfall duration (h)	Max rainfall intensity, 5 minutes (mm/h)
β	1					
CSO load reduction (kg)	0.18	1				

CSO load reduction (%)	0.28	0.84	1			
Rainfall depth (mm)	-0.34	-0.05	-0.12	1		
Rainfall duration (h)	-0.12	0.01	0.00	0.52	1	
Max rainfall intensity, 5 minutes (mm/h)	-0.38	-0.17	-0.17	0.33	0.03	1

Similar PPMC coefficients are then calculated for only the 11 storm events that are considered meeting the abovementioned assessment criterion. Table 4 reports the computation of PPMC coefficients for various pairs of variables from these 11 storm events. CSO load reduction is represented by two variables, including both the quantity and percentage difference. However, it is clear from the results that very low correlation values are found for the interested variables. Furthermore, graphical representation of storm events in terms of rainfall depth and rainfall duration (Figure 1) gives no hint to distinguish the three groups through basic rainfall characteristics. Lastly, the correlations between β and other variables indicate that for this dataset, the fitted β of all storm events cannot be estimated by statistical methods such as linear regression with input variables from the tested rainfall characteristics.

Table 4. PPMC matrix for different variables from the 11 storm events meeting the assessment criterion.

	β	CSO load reduction (kg)	CSO load reduction (%)	Rainfall depth (mm)	Rainfall duration (h)	Max rainfall intensity, 5 minutes (mm/h)
β	1					
CSO load reduction (kg)	-0.06	1				
CSO load reduction (%)	0.13	0.79	1			
Rainfall depth (mm)	-0.06	0.25	-0.02	1		
Rainfall duration (h)	-0.05	0.16	0.13	0.32	1	

Max rainfall intensity, 5 minutes (mm/h)	-0.04	-0.25	-0.35	0.35	-0.61	1

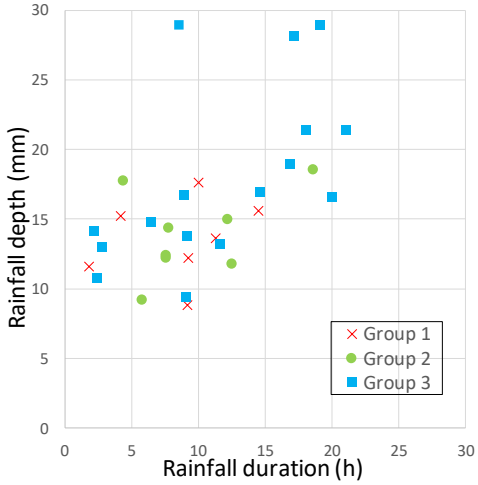

Figure 1. Rainfall depths and rainfall durations of the 31 storm events.