

Supplementary Table S1. Optimization results for Chungju Reservoir during drought year based on initial water level of 126.2 EL.m.

2015-MM	Water level	Inflow	Water allocation	Spillway discharge	Total discharge	Effective reservoir storage ratio
	EL.m	CMS	CMS	CMS	CMS	%
01	121.7	14.1	104.3	-	104.3	26.0
02	119.3	21.8	67.6	-	67.6	19.9
03	117.6	45.1	72.6	-	72.6	15.8
04	119.1	105.9	82.1	-	82.1	19.2
05	117.1	35.1	66.9	-	66.9	14.5
06	114.5	25.7	65.1	-	65.1	8.8
07	119.7	113.8	33.7	-	33.7	20.7
08	122.8	102.3	44.4	-	44.4	29.4
09	121.8	38.8	59.8	-	59.8	26.3
10	119.6	20.6	58.6	-	58.6	20.7
11	120.4	82.0	67.8	-	67.8	22.7
12	120.0	59.4	66.7	-	66.7	21.6
Average	119.5	55.4	65.8	-	65.8	20.5

Supplementary Table S2. Optimization results for Soyanggang Reservoir during drought year based on initial water level of 165.2 EL.m.

2015-MM	Water level	Inflow	Water allocation	Spillway discharge	Total discharge	Effective reservoir storage ratio
	EL.m	CMS	CMS	CMS	CMS	%
01	165.4	3.11	8.10	-	8.10	24.7
02	162.8	4.61	40.3	-	40.3	19.9
03	160.4	9.2	36.6	-	36.6	15.8
04	162.4	53.4	29.7	-	29.7	19.2
05	159.7	11.9	43.5	-	43.5	14.5
06	156.3	7.47	44.1	-	44.1	9.14
07	163.7	95.3	12.6	-	12.6	21.6
08	168.3	96.9	37.0	-	37.0	30.5
09	166.7	24.8	46.5	-	46.5	27.4
10	163.2	8.2	53.0	-	53.0	20.7
11	164.3	58.2	44.1	-	44.1	22.7
12	163.7	30.3	37.6	-	37.6	21.6
Average	163.1	33.6	36.1	-	36.1	20.6

Supplementary Table S3. Optimization results for Hwacheon Reservoir during drought year based on initial water level of 165.8 EL.m.

2015-MM	Water level	Inflow	Water allocation	Spillway discharge	Total discharge	Effective reservoir storage ratio
	EL.m	CMS	CMS	CMS	CMS	%
01	164.37	4.86	11.56	-	11.56	24.81
02	163	4.69	16.13	-	16.13	19.98
03	161.79	6.06	14.83	-	14.83	15.89
04	162.8	19.81	12.21	-	12.21	19.32
05	161.4	5.8	15.93	-	15.93	14.59
06	159.11	3.11	19.49	-	19.49	7.19
07	162.05	98.22	77.75	-	77.75	16.74
08	164.05	57.48	42.66	-	42.66	23.66
09	163.36	12.41	17.76	-	17.76	21.24
10	163.23	11.51	12.48	-	12.48	20.79
11	163.81	16.62	12.11	-	12.11	22.83
12	163.5	17.32	19.66	-	19.66	21.74
Average	162.71	21.49	22.71	-	22.71	19.07

Supplementary Table S4. Optimization results for Chungju Reservoir during drought year based on initial water level of 128.5 EL.m.

2018-MM	Water level	Inflow	Water allocation	Spillway discharge	Total discharge	Effective reservoir storage ratio
	EL.m	CMS	CMS	CMS	CMS	%
01	124.4	7.9	97.2	-	97.2	33.9
02	120.0	6.7	97.2	-	97.2	21.7
03	119.1	80.5	97.2	-	97.2	19.2
04	123.0	179.4	106.3	-	106.3	29.8
05	129.0	248.2	119.0	-	119.0	49.0
06	125.5	43.7	125.2	-	125.2	37.3
07	135.1	354.0	115.2	-	115.2	72.8
08	138.0	279.8	192.5	-	192.5	85.8
09	138.0	397.5	397.5	-	397.5	85.8
10	139.7	157.5	105.2	-	105.2	93.6
11	139.8	101.4	97.2	-	97.2	94.2
12	138.6	59.6	97.2	-	97.2	88.6
Average	130.8	159.7	137.3	-	137.3	59.3

Supplementary Table S5. Optimization results for Soyanggang Reservoir during drought year based on initial water level of 181.0 EL.m.

2018-MM	Water level	Inflow	Water allocation	Spillway discharge	Total discharge	Effective reservoir storage ratio
	EL.m	CMS	CMS	CMS	CMS	%
01	176.6	1.7	78.3	-	78.3	49.6
02	174.2	2.0	46.2	-	46.2	43.6
03	173.0	28.5	46.2	-	46.2	41.0
04	175.5	86.8	46.2	-	46.2	46.9
05	181.8	156.5	46.2	-	46.2	63.4
06	180.3	16.9	46.2	-	46.2	59.2
07	186.0	156.7	46.2	-	46.2	75.8
08	190.3	168.3	78.2	-	78.2	89.3
09	190.3	63.7	63.7	-	63.7	89.3
10	190.6	51.7	46.2	-	46.2	90.1
11	190.6	46.9	46.2	-	46.2	90.2
12	189.1	13.7	46.2	-	46.2	85.3
Average	183.2	66.1	53.0	-	53.0	68.6

Supplementary Table S6. Optimization results for Hwacheon Reservoir during drought year based on initial water level of 169.4 EL.m.

2018-MM	Water level	Inflow	Water allocation	Spillway discharge	Total discharge	Effective reservoir storage ratio
	EL.m	CMS	CMS	CMS	CMS	%
01	167.8	8.6	22.2	-	22.2	37.7
02	166.3	8.5	22.2	-	22.2	32.0
03	165.0	11.8	22.2	-	22.2	27.1
04	166.4	33.5	22.2	-	22.2	32.2
05	173.8	88.4	22.2	-	22.2	63.1
06	165.8	20.8	94.1	-	94.1	30.0
07	175.0	131.3	47.9	-	47.9	68.9
08	175.0	67.7	67.7	-	67.7	68.9
09	175.0	29.9	29.9	-	29.9	68.9
10	174.5	17.0	22.2	-	22.2	66.5
11	175.0	27.6	22.2	-	22.2	68.9
12	174.1	12.8	22.2	-	22.2	64.5
Average	171.1	38.2	34.8	-	34.8	52.4

Supplementary Table S7. Optimization results for Chungju Reservoir during drought year based on initial water level of 134.4 EL.m.

2020-MM	Water level	Inflow	Water allocation	Spillway discharge	Total discharge	Effective reservoir storage ratio
	EL.m	CMS	CMS	CMS	CMS	%
01	133.9	84.4	97.2	-	97.2	68.0
02	132.7	61.9	97.2	-	97.2	63.1
03	132.2	83.6	97.2	-	97.2	61.1
04	130.1	49.9	106.3	-	106.3	52.9
05	129.1	96.4	119.0	-	119.0	49.6
06	125.0	28.8	125.2	-	125.2	35.7
07	133.9	333.2	115.2	-	115.2	68.1
08	138.0	1024.5	778.0	127.8	905.8	85.8
09	138.0	458.8	458.8	-	458.8	85.8
10	136.0	45.8	105.2	-	105.2	77.0
11	133.7	27.7	97.2	-	97.2	67.0
12	130.6	16.1	97.2	-	97.2	54.9
Average	132.8	192.6	191.1	10.7	201.8	64.1

Supplementary Table S8. Optimization results for Soyanggang Reservoir during drought year based on initial water level of 176.6 EL.m.

2020-MM	Water level	Inflow	Water allocation	Spillway discharge	Total discharge	Effective reservoir storage ratio
	EL.m	CMS	CMS	CMS	CMS	%
01	176.7	47.0	46.2	-	46.2	49.7
02	175.2	20.7	46.2	-	46.2	46.2
03	174.7	37.9	46.2	-	46.2	44.9
04	173.9	32.5	46.2	-	46.2	42.9
05	175.7	75.1	46.2	-	46.2	47.3
06	174.5	26.7	46.2	-	46.2	44.4
07	180.9	156.8	46.2	-	46.2	61.0
08	190.3	545.5	250.0	107.3	357.3	89.3
09	190.3	296.6	250.0	46.6	296.6	89.3
10	189.0	17.7	46.2	-	46.2	85.0
11	187.5	15.1	46.2	-	46.2	80.5
12	185.6	5.4	46.2	-	46.2	74.4
Average	181.2	106.4	80.2	12.8	93.0	62.9

Supplementary Table S9. Optimization results for Hwacheon Reservoir during drought year based on initial water level of 171.6 EL.m.

2020-MM	Water level	Inflow	Water allocation	Spillway discharge	Total discharge	Effective reservoir storage ratio
	EL.m	CMS	CMS	CMS	CMS	%
01	171.6	22.3	22.2	-	22.2	53.3
02	170.9	15.2	22.2	-	22.2	50.3
03	170.4	17.5	22.2	-	22.2	48.1
04	169.4	13.3	22.2	-	22.2	44.1
05	171.2	38.1	22.2	-	22.2	51.5
06	170.6	16.7	22.2	-	22.2	49.0
07	171.6	31.3	22.2	-	22.2	53.3
08	175.0	723.2	185.0	504.7	689.7	68.9
09	175.0	311.2	185.0	126.2	311.2	68.9
10	174.3	14.8	22.2	-	22.2	65.4
11	173.5	14.1	22.2	-	22.2	61.8
12	172.2	9.8	22.2	-	22.2	56.0
Average	172.1	102.3	49.3	52.6	101.9	55.9