Table E.1- 3 Results of Lateral Loading Test

B.No.	Depth (m)	Rock Type	Classifi-cation	Coef.of Deformation D(kg/cm²)	Coef.of Tangent Elasticity E(kg/cm²)
	31.00-31.50	f.Wt	CM	27,300	56,400
	34.70-35.20	〃	CM	7,300	11,600
2	44.50-45.00	〃	CM	14,000	36,700
	62.50-63.00	Wt	CH	29,400	69,400
	68.50-69.00	〃	CM	21,200	73,500
	73.00-73.50	〃	CM	13,400	24,500
	65.50-66.00	Wt	CL	3,500	4,200
3	77.00-77.50	〃	CM	16,300	18,400
	87.50-88.00	〃	CM	10,600	14,700
4	44.20-44.70	Wt	CH	30,600	45,900
	57.50-58.00	〃	CH	16,600	19,600
5	13.50-14.00	f.Wt	CM	5,800	7,300
	25.50-26.00	Wt	CM	12,600	28,400
	16.70-17.20	f.Wt	CM	10,400	27,200
6	25.50-26.00	Wt	CH	153,100	490,000
	36.00-36.50	〃	CM	-	26,200
	10.00-10.50	Wt	CL	1,900	3,600
7	19.00-19.50	〃	CL	3,900	4,900
	30.50-31.00	〃	CM	22,800	27,200

Table E.1-4 Results of Physical Laboratory Test

B-No.	Depth	Elevation	Classification Specimen	Hardness	Density	Moisture ratio	Compressive strength
No. 1	9.1- 9.2	EL 800	mortar		1.72	17.5	171.4
	24.0- 24.1	785	mortar		1.99	10.6	215.4
	24.5- 24.6	784	rubble		2.20	5.2	180.3
	28.0- 28.1	781	mortar		1.92	11.9	106.8
	39.0- 39.1	770	Wt	CM	2.09	9.6	186.2
	53.0- 53.1	756			2.25	6.1	347.9
	65.8- 65.9	743			2.28	5.3	507.6
	74.9- 75.0	734			2.39	3.4	766.9
	88.3- 88.4	721	Wt	CM	2.26	5.5	161.8
No. 2	6.7- 6.8	802	mortar		1.62	23.0	70.6
	8.4- 8.5	801	rubble		2.19	6.2	354.1
	23.3- 23.4	786	mortar		1.83	14.7	115.8
	25.1- 25.2	784	rubble		2.26	3.8	642.2
	27.3- 27.4	782	mortar		1.73	19.1	93.0
	31.3- 31.5	778	Wt	CM	2.12	8.5	299.9
	40.1- 40.2	769			1.58	8.5	299.9
	72.9- 73.0	736			2.31	48.0	-
	82.5- 82.6	727	Wt		2.34	4.9	330.4
	104.8-104.9	704			2.17	7.1	-
No. 3	8.9- 9.0	797	Ar	D	1.87	13.1	64.0
	10.7- 10.8	795			1.91	12.7	48.1
	43.0- 43.1	762	Tf	CM	1.94	14.4	268.4
	54.1- 54.2	751		CL	-	-	51.8
	61.0- 61.1	745	Wt		1.78	15.2	36.0
	69.0- 69.1	737			1.77	17.9	73.1
	89.9- 90.0	716		CL	1.86	16.1	63.4
No. 4	5.9 - 6.0	788	Wt	CL	1.87	12.6	85.4
	16.9 -17.0	777		CH	2.18	7.9	333.7
	29.9 -30.0	764		CM	2.20	6.5	297.2
	37.4 -37.5	757		CH	2.23	6.1	457.8
	46.8- 46.9	747			2.23	6.0	468.0
	55.0 -55.1	739			2.26	5.1	476.2
No. 5	10.1 -10.2	781	Wt	CM	2.03	10.0	198.7
	28.0 -28.1	763			2.13	10.1	164.7
	31.9 -32.0	759			2.23	5.2	322.7
	46.3 -46.5	745		CH	2.24	5.3	427.6
No. 6	12.8- 12.9	745	Wt	CM	2.20	7.1	316.1
	18.0- 18.1	740			2.27	5.8	254.7
	26.7- 26.8	731			2.12	9.1	305.1
	37.2- 37.3	721	Tf		2.17	10.4	-
	54.9- 55.0	703	Wt		1.97	12.4	82.9
No. 7	8.1- 8.2	799	Az	D	1.75	17.5	33.7
	13.8- 13.9	793		D	1.79	15.7	-
	24.0- 24.2	783		CM	2.06	8.9	112.7
	29.0- 29.1	778			2.05	10.0	242.0
	34.4- 34.5	773			2.09	9.9	253.6

Table E.1-4 Results of Physical Laboratory Test

B-No.	Depth	Elevation	Classification Specimen	Classification Hardness	Density	Moisture ratio	Compressive strength
No.8	19.2- 19.3	788	Wt	CH	2.38	2.0	723.9
	34.9- 35.0	773		D	1.52	25.0	37.4
	47.9- 48.0	760		CM	1.57	20.3	152.5
	55.9- 56.0	752		CM	1.60	17.8	119.6
Selguapa		(Cobble in Selguapa River Bed)					
C-1				B	2.11	5.5	594.8
C-2				B	2.67	2.0	371.5
C-3				B	2.31	2.4	546.1

E.2 Present Condition of The Coyolar Dam

(1) Water Reservoir

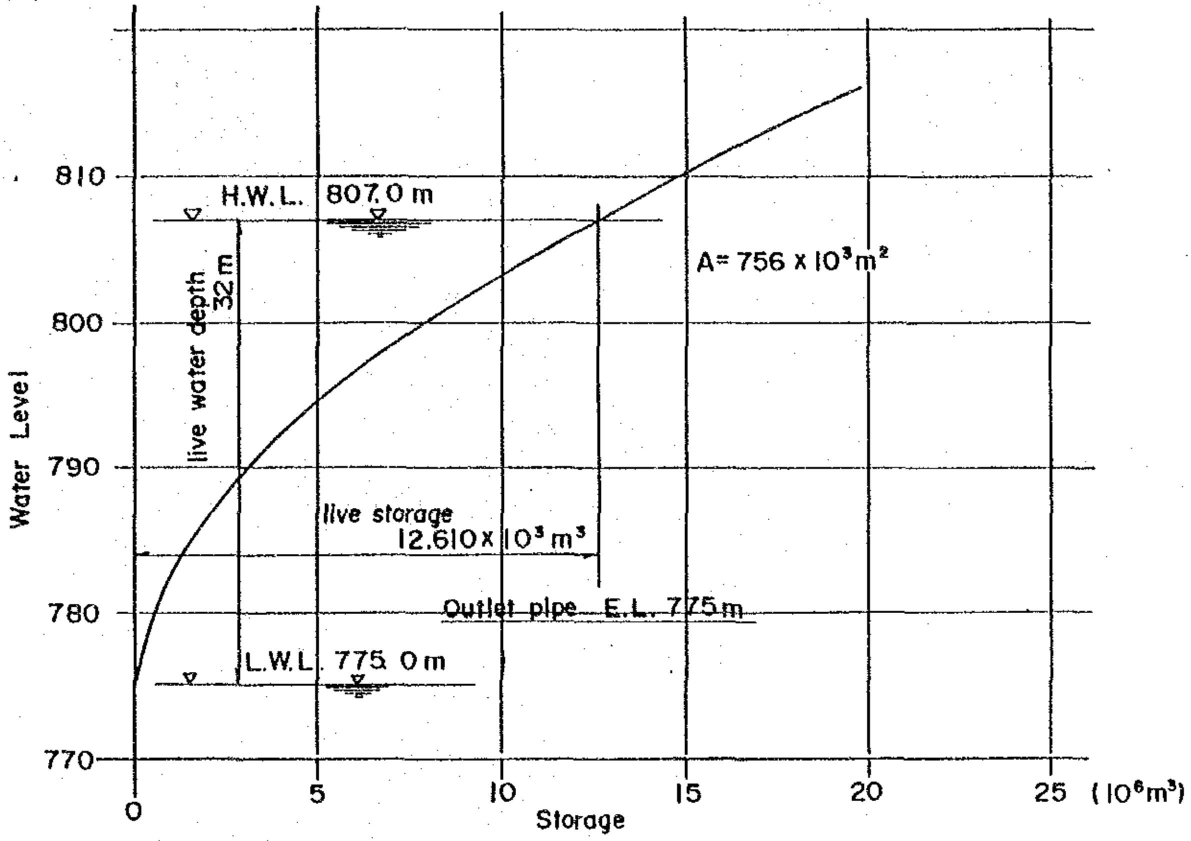


Fig. E.2-1 Water Level and Reservoir Volume Curve

Table E.2-1 Reservoir Level - Area - Volume

Water Level W.L	Surface Area A	District Capacity V	Gross Capacity V
815	956	4.46	19.45
810	831	2.38	14.99
807	756	4.75	12.61
800	605	2.73	7.86
795	490	2.12	5.12
790	360	1.50	3.01
785	245	0.96	1.50
780	145	0.54	0.54
775	75	-	0.00

Table E.2-2 Reservoir Level - Volume

W.L	V
816	20,470
815	19,450
814	18,558
813	17,666
812	16,774
811	15,882
810	14,990
809	14,197
808	13,403
807	12,610
806	11,931
805	11,253
804	10,574
803	9,895
802	9,217
801	8,538
800	7,860

W.L	V
800	7,860
799	7,312
798	6,764
797	6,216
796	5,668
795	5,120
794	4,698
793	4,276
792	3,854
791	3,432
790	3,010
785	1,500
780	540
775	0

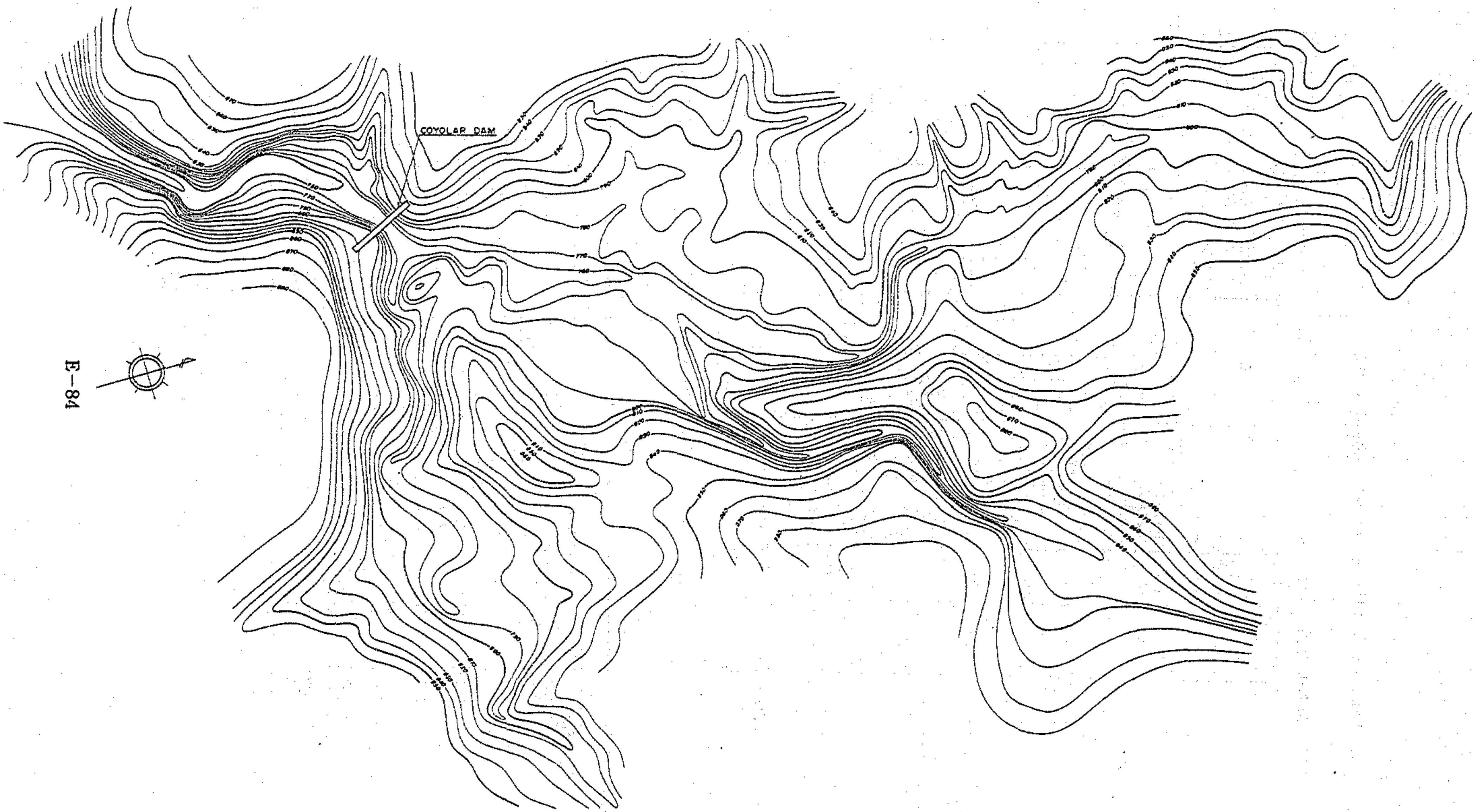


Fig. E.2-2 Topographical Map of Coyolar Dam

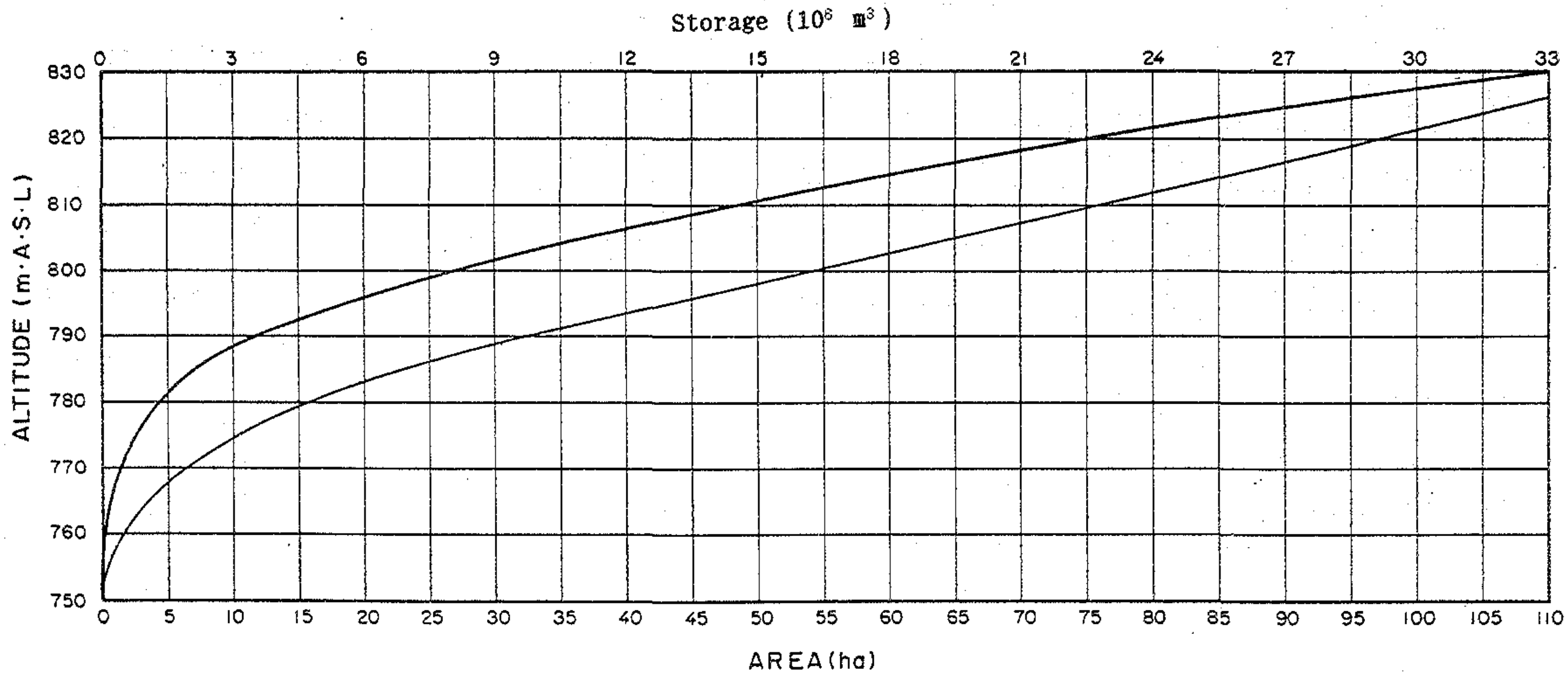


Fig. E.2-3 H-Q and H-A Curve

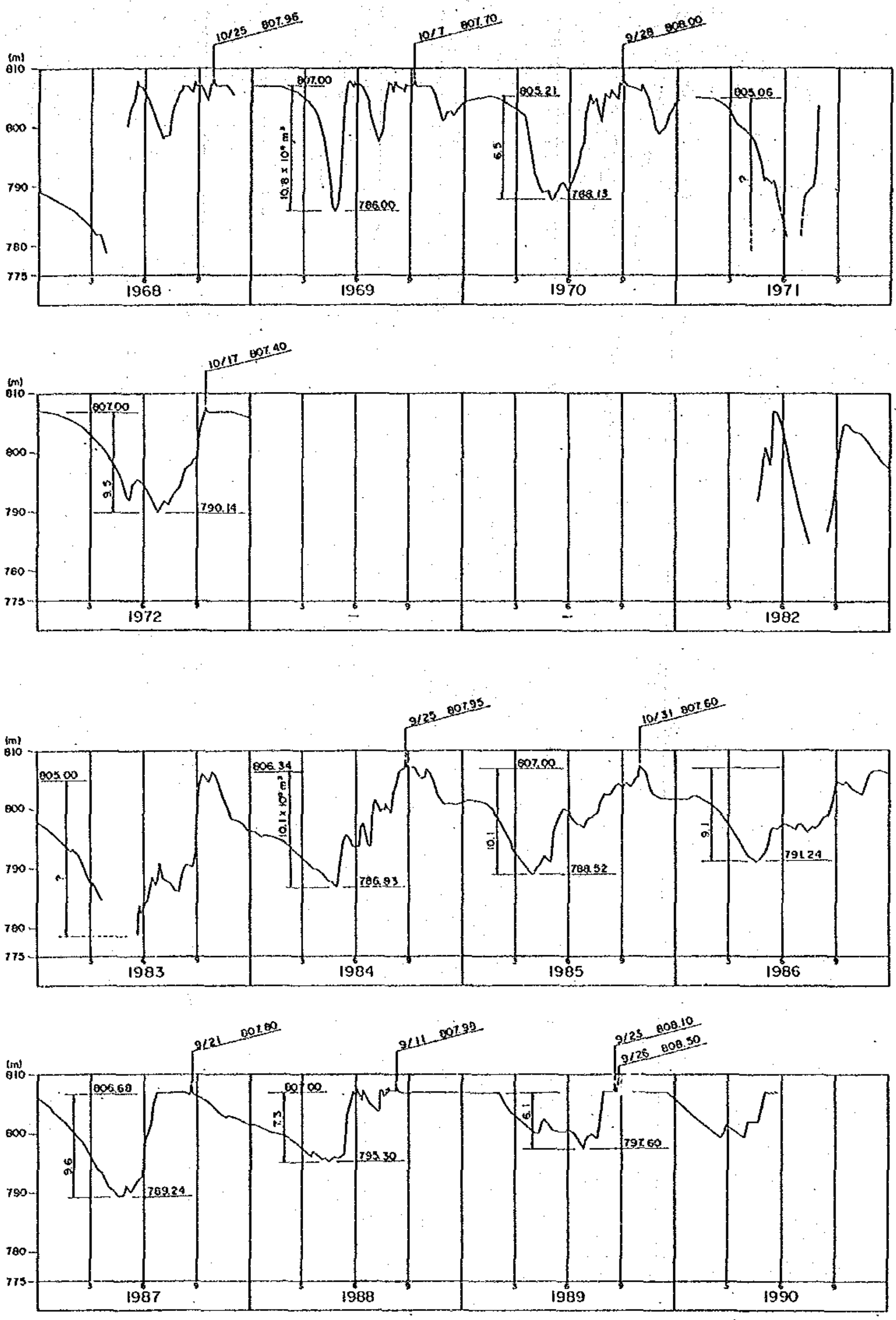


Fig. E.2-4 Recent Fluctuation of the Water Level at the Reservoir

Table E.2-3 Data of Reservoir Level (1/6)

	1966	1969	1970	1971	1972	1974	1982	1983	1984	1985	1986	1987	1988	1989	1990
1. 1	789.21	807.07	804.06	804.56	807.02	806.94	-	797.58	796.96	801.16	801.96	805.96	801.50	807.04	805.80
2		807.08			807.02		-	797.70	796.90	801.24	801.92	805.90	801.52	807.04	805.76
3		807.08		804.78	807.02		-	797.76	796.82	801.30	801.86	805.76	801.60	807.04	805.76
4		807.09			807.02		-	797.72	796.72	801.32	801.83	805.80	801.60	807.04	805.60
5	789.18	807.09	804.40		807.01	806.89	-	797.60	796.62	801.40	801.91	805.74	801.54	807.04	805.50
6		807.08			807.02		-	797.45	796.54	801.54	801.90	805.66	801.54	807.04	805.40
7		807.08			807.01		-	797.32	796.44	801.55	801.90	805.60	801.50	807.04	805.40
8		807.08			807.01		-	797.20	796.36	801.58	801.79	805.44	801.44	807.04	805.20
9		807.08			807.05		-	797.18	796.26	801.60	801.79	805.34	801.50	807.04	805.10
10	789.08	807.07	804.62		807.01	806.96	-	797.10	796.16	801.62	801.87	805.28	801.56	807.04	805.02
11		807.07					-	797.00	796.03	801.62	801.85	805.34	801.55	807.04	804.90
12		807.07					-	796.90	795.91	801.72	801.89	805.29	801.45	807.04	804.80
13		807.06	804.90				-	796.86	795.80	801.72	801.85	805.20	801.35	807.04	804.70
14		807.05					-	796.78	795.72	801.70	801.83	805.06	801.32	807.04	804.60
15	788.80	807.06	804.74		806.94	806.94	-	796.70	795.66	801.68	801.80	804.90	801.30	807.04	804.48
16		807.06					-	796.64	795.58	801.64	801.79	804.80	801.18	807.04	804.36
17		807.06					-	796.56	795.50	801.62	801.74	804.64	801.22	807.03	804.26
18		807.06					-	796.54	795.40	801.60	801.71	804.66	801.15	807.03	804.14
19		807.06					-	796.46	795.29	801.56	801.76	804.58	801.10	807.03	804.06
20	788.27	807.08	804.85		806.92	806.94	-	796.44	795.30	801.60	801.84	804.48	801.02	807.03	803.96
21		807.08					-	796.42	795.36	801.55	802.01	804.30	801.08	807.04	803.90
22		807.10					-	796.30	795.48	801.50	802.17	804.22	801.02	807.06	803.82
23		807.08					-	796.30	795.48	801.50	802.35	804.12	800.85	807.04	803.76
24		807.05					-	796.18	795.62	801.57	802.40	803.94	800.76	807.06	803.68
25	788.00	807.04	804.90		806.89	806.78	-	796.06	795.68	801.57	802.36	803.98	800.82	807.10	803.60
26		807.03					-	795.96	795.68	801.55	802.47	803.92	800.76	807.10	803.50
27		807.03					-	795.82	795.66	801.63	802.52	803.80	800.74	807.12	803.28
28		807.02					-	795.70	795.62	801.60	802.50	803.68	800.70	807.10	803.20
29		807.03					-	795.58	795.72	801.57	802.49	803.56	800.68	807.09	803.14
30		807.04					-	795.58	795.74	801.52	802.50	803.44	800.52	807.08	803.10
31	787.82	807.05	805.04	-	806.71	806.54	-	795.46	795.64	801.47	802.38	803.32	800.48	807.08	802.98
2. 1		807.04		805.01			-	795.34	795.64	801.42	802.38	803.36	800.55	807.08	802.96
2		807.03					-	795.20	795.56	801.38	802.43	803.26	800.55	807.10	802.90
3		807.02					-	795.06	795.48	801.44	802.43	803.16	800.50	807.10	802.86
4		807.02					-	794.96	795.38	801.38	802.44	803.06	800.50	807.08	802.80
5	787.51	807.06	805.15	904.97	806.42	806.44	-	794.80	795.40	801.32	802.43	802.96	800.55	807.08	802.70
6		807.04					-	794.78	795.34	801.26	802.30	802.86	800.44	807.09	802.60
7		807.03					-	794.64	795.32	801.22	802.16	802.68	800.40	807.09	802.52
8		807.02					-	794.54	795.28	801.17	802.12	802.73	800.46	807.08	802.42
9		807.01					-	794.40	795.26	801.10	802.13	802.62	800.45	807.08	802.32
10	787.27	807.00	805.18	805.00	806.26	806.04	-	794.32	795.22	801.17	802.10	802.52	800.43	807.08	802.22
11		807.00					-	794.22	795.18	801.12	802.05	802.42	800.40	807.08	802.14
12							-	794.06	795.22	801.05	801.99	802.24	800.40	807.08	802.06
13							-	794.00	795.14	800.97	801.94	802.14	800.22	807.08	801.98
14							-	793.96	795.10	800.91	801.88	802.04	800.24	807.07	801.90
15	786.85	806.75	805.21	805.06	806.10	805.72	-	793.86	795.01	800.86	801.82	802.08	800.32	807.07	801.80
2. 16							-	793.70	795.06	800.71	801.84	801.98	800.32	807.07	801.70
17							-	793.76	795.04	800.55	801.75	801.88	800.30	807.06	801.60
18							-	793.76	795.02	800.38	801.70	801.74	800.02	807.06	801.52
19							-	793.71	795.02	800.20	801.65	801.60	800.18	807.05	801.36
20	786.72	806.63	805.12	805.06	805.88	805.38	-	793.66	794.96	800.00	801.51	801.46	799.98	807.05	801.40
21							-	793.66	794.92	799.78	801.45	801.34	799.90	807.02	801.36
22							-	793.64	794.82	799.55	801.38	801.28	799.96	807.02	801.30
23							-	793.62	794.76	799.35	801.40	801.14	799.96	806.98	801.20
24							-	793.46	794.66	799.15	801.34	801.04	799.92	807.02	801.06
25	786.32	806.40		804.95	805.71	804.98	-	793.30	794.60	798.96	801.20	800.92	799.90	806.98	800.96
26							-	793.17	794.64	798.78	801.03	800.70	799.88	807.02	800.86
27							-	793.10	794.56	798.60	800.98	800.58	799.70	806.98	800.76
28		806.20	804.75	804.90		804.76	-	793.18	794.48	798.42	800.90	800.36	799.62	806.98	800.68
29	786.07				805.60				794.32				799.68		

Table E.2-3 Data of Reservoir Level (2/6)

	1968	1969	1970	1971	1972	1974	1982	1983	1984	1985	1986	1987	1988	1989	1990
3. 1							-	793.10	794.02	798.24	800.84	800.38	799.64	806.96	800.59
2							-	792.94	794.14	798.04	800.82	800.24	799.60	806.96	800.52
3							-	792.70	794.06	797.82	800.75	600.08	799.58	806.95	800.48
4							-	792.58	794.06	797.60	800.68	799.92	799.54	806.90	800.38
5	785.60	806.08	804.68	804.74	805.34	804.36	-	792.34	793.96	797.37	800.55	799.78	799.35	806.70	800.28
6							-	792.28	793.86	797.14	800.45	799.66	799.24	806.40	800.22
7							-	792.34	793.80	796.94	800.33	799.54	799.28	806.10	800.14
8							-	792.42	793.72	796.72	800.20	799.52	799.24	805.90	800.08
9							-	792.14	793.66	796.55	800.12	799.42	799.18	805.70	799.98
10	785.12	805.88	804.38	804.54	805.00	803.80	-	791.94	793.58	796.38	800.02	799.28	799.12	805.50	799.92
11							-	791.60	793.58	796.24	799.91	799.12	799.06	805.20	799.82
12							-	791.30	793.46	796.14	799.81	799.02	798.90	805.06	799.76
13							-	791.24	793.38	795.99	799.71	798.94	798.86	804.90	799.66
14							-	791.30	793.26	795.78	799.60	798.68	798.90	804.75	799.54
15	784.47	805.70	804.00	804.31	804.47	803.18	-	790.98	793.16	795.62	799.48	798.72	798.84	804.65	799.42
16							-	790.80	793.06	795.40	799.28	798.60	798.80	804.50	799.30
17							-	790.52	792.96	795.24	799.14	798.44	798.76	804.36	799.18
18							-	790.24	792.96	795.04	799.01	798.28	798.70	804.20	799.48
19							-	789.96	792.84	794.86	798.88	798.12	798.50	804.10	799.71
20	784.16	805.47	803.76	803.96	803.94	802.56	-	789.74	792.74	794.66	798.76	797.94	798.38	803.98	799.82
21							-	789.79	792.56	794.64	798.66	797.78	798.42	803.80	799.97
22							-	789.48	792.44	794.56	798.36	797.80	798.32	803.70	800.12
23							-	789.14	792.28	794.38	798.27	797.66	798.36	803.64	800.22
24							-	788.90	792.18	794.20	798.17	797.50	798.32	803.60	800.30
25	783:62	805.12	803.78	803.68	803.40	801.82	-	788.66	792.36	793.99	798.04	797.20	798.26	803.55	800.48
26							-	788.40	792.26	793.80	797.80	796.98	798.10	803.50	800.54
27							-	788.33	792.18	793.60	797.71	796.72	797.98	803.40	800.80
28							-	788.06	792.14	793.30	797.66	796.50	798.02	803.30	801.20
29							-	787.68	792.04	792.98	797.60	796.52	797.78	803.10	801.54
30							-	787.40	791.94	792.60	797.51	796.52	797.65	803.02	801.46
31	783.20	804.84	803.20	802.94	803.00	800.88	-	787.24	791.84	792.28	797.40	796.01	797.54	802.96	801.46
4. 1							-	787.13	791.86	792.06	797.28	795.82	797.40	802.86	801.45
2							-	787.16	791.72	791.98	797.02	795.50	797.28	802.70	801.39
3							-	787.21	791.60	791.82	796.90	795.28	797.16	802.60	801.30
4							-	787.03	791.40	791.86	796.77	795.08	797.20	802.50	801.20
5	782.35	804.77	802.61	802.50	803.70	800.02	-	786.81	791.21	791.88	796.60	794.98	797.16	802.35	801.14
6							-	786.56	791.06	791.82	796.48	794.78	797.10	802.25	801.01
7							-	786.84	790.92	791.72	796.38	794.56	797.02	802.15	800.91
8							-	786.64	790.95	791.58	796.20	794.36	796.96	802.10	800.83
9							-	786.44	790.80	791.44	796.04	794.16	796.72	802.02	800.70
10		804.32	802.02	800.69	802.16	799.00	-	786.24	790.70	791.26	795.88	793.96	796.60	801.95	800.60
11							-	786.04	790.56	791.08	795.70	793.72	796.64	801.86	800.42
12							-	785.84	790.40	790.82	795.54	793.84	796.60	801.78	800.42
13							-	785.64	790.26	790.70	795.40	793.84	796.60	801.70	800.44
14	- -						-	785.44	790.10	790.61	795.26	793.64	796.54	801.50	800.38
15	782.30	803.80	801.78	800.42	801.56	798.64	-	785.24	790.16	790.50	795.08	793.58	796.30	801.40	800.22
16							-	785.04	790.08	790.32	794.90	793.50	796.26	801.30	800.08
17							-	784.84	789.96	790.16	794.72	793.44	796.54	801.20	799.96
18							-		789.96	790.06	794.54	793.46	796.90	801.10	799.90
19							-		789.96	789.92	794.36	793.52	796.92	800.96	799.92
20		803.08	798.96	800.00	801.10	797.10	-		789.94	789.80	794.28	793.28	796.88	800.90	799.86
21	780.48						-		789.94	789.70	794.08	792.96	796.88	800.80	799.84
22							-		789.90	789.48	793.88	792.70	796.88	800.76	799.80
23							-		789.76	789.28	793.70	792.44	796.60	800.70	799.76
24							-		789.80	789.06	793.50	792.20	796.52	800.60	799.70
25	779.00	801.90	795.66	799.54	800.44	796.10	-		789.80	788.90	793.20	791.96	796.56	800.50	799.65
26	- -						-		789.80	788.77	793.04	792.02	796.48	800.40	799.60
27							-		789.82	788.52	793.02	791.80	796.36	800.40	799.80
28							-		789.72	788.70	792.83	791.54	796.34	800.40	799.90
29							-		789.70	788.80	792.66	791.16	796.30	800.40	800.02
30		799.87	792.10	798.74	799.78	795.06	-		789.44	788.96	792.48	790.90	796.10	800.42	800.66

Table E.2-3 Data of Reservoir Level (3/6)

	1968	1969	1970	1971	1972	1974	1982	1983	1984	1985	1986	1987	1988	1989	1990
5. 1							-		789.50	789.74	792.32	790.85	795.96	800.44	801.02
2							-		789.40	790.20	792.15	790.60	795.99	800.40	801.46
3							-		789.30	790.35	791.96	790.64	795.94	800.42	801.78
4							-		789.35	790.34	791.96	790.60	795.84	800.40	801.98
5		798.10	790.45	798.27	798.80	794.00	-		789.18	790.40	791.88	790.50	795.72	800.38	802.10
6							-		789.26	790.30	791.85	790.34	795.74	800.38	802.30
7							-		789.06	790.20	791.81	790.25	795.78	800.34	802.42
8							-		788.86	790.30	791.75	790.28	795.82	800.30	802.42
9							-		788.56	790.52	791.70	790.26	795.86	800.26	802.38
10		794.98	789.58	797.88	797.90	793.70	-		788.38	790.66	791.80	790.23	795.90	800.22	802.38
11							-		788.22	790.73	791.82	790.20	795.94	800.40	802.36
12							-		788.06	790.80	791.74	790.04	795.98	800.70	802.30
13							-		788.12	790.98	791.58	789.86	795.90	801.10	802.28
14							-		787.90	791.20	791.40	789.70	795.60	801.50	802.26
15		791.52	788.83	796.28	796.70	793.10	-		787.82	791.25	791.24	789.60	795.30	801.90	802.24
5.16							-		787.77	791.34	791.25	789.55	795.40	802.10	802.20
17							-		787.67	791.36	791.27	789.50	795.60	802.20	802.14
18							-		787.73	791.42	791.27	789.40	795.70	802.25	802.08
19							-		787.64	791.86	791.28	789.24	795.86	802.30	802.02
20		788.66	789.10	794.94	796.06	794.52	-		787.78	791.96	791.36	789.44	795.94	802.33	802.08
21							792.32		787.62	791.80	791.41	789.60	795.98	802.30	802.05
22						796.48	792.44		787.47	791.66	791.66	789.70	795.86	802.30	802.04
23							792.82		787.28	791.62	791.78	789.70	795.80	802.20	802.22
24							794.00		787.10	791.60	791.87	789.70	795.84	802.10	802.48
25		786.73	789.16	791.58	794.48	797.72	795.20		786.94	791.46	792.12	789.50	795.90	801.98	803.54
26							795.80		786.83	791.30	792.30	789.70	795.96	801.84	804.06
27		786.00					796.20		786.90	791.18	792.54	789.74	796.02	801.74	804.40
28							797.86		787.18	791.10	792.64	790.30	795.80	801.60	804.58
29		787.60		791.06			798.76		787.40	791.19	792.68	790.52	795.60	801.50	804.70
30							799.26		787.60	791.23	792.74	790.66	795.74	801.30	804.95
31	-	786.98	788.13	791.58	792.78	797.74	800.40		789.80	791.46	792.74	790.90	795.84	801.20	805.85
6. 1	800.55	787.20				-	800.90		790.10	792.30	792.75	791.10	795.96	801.10	806.70
2							800.90		790.30	792.64	792.76	790.98	796.10	800.88	807.10
3		793.12					800.76		790.96	794.04	792.68	790.80	796.20	800.80	807.05
4							800.76		791.56	795.96	792.64	790.68	796.15	800.60	806.88
5	803.17	795.48	788.50	791.48	791.94		800.40		792.50	796.38	793.40	790.50	795.90	800.50	806.76
6							800.10		792.80	796.60	793.66	790.34	795.90	800.40	806.77
7		797.82					799.90		792.98	796.80	794.94	790.45	796.10	800.20	806.77
8					793.80		799.58		793.12	796.99	796.02	790.24	796.14	800.50	806.75
9							799.10		794.10	797.20	796.30	790.10	796.24	800.50	806.75
10	804.28	802.30	788.90	790.80	794.74		798.64		794.80	797.40	796.46	790.40	796.40	800.46	806.74
11	804.27	805.35					798.20	779.60	795.10	797.76	796.62	791.16	797.40	800.42	806.79
12	807.15						798.70	779.12	795.20	798.02	796.68	791.46	798.20	800.60	806.94
13	807.70						803.80		795.38	798.24	796.76	791.75	800.60	800.56	807.30
14	807.50	806.26					807.40		795.66	798.62	796.80	791.80	801.80	800.52	807.10
15	807.36	807.50	790.53	791.34	795.38		807.24		795.60	799.18	796.82	791.85	802.85	800.50	807.05
16	807.06	807.60					807.20		795.78	799.46	796.88	791.76	803.40	800.50	806.90
17	807.06	807.40					807.10	779.14	795.70	799.66	796.84	791.70	803.86	800.60	806.94
18	807.06	807.60					807.03	779.96	795.48	799.80	796.76	791.96	804.30	800.58	806.98
19	807.07	807.30					807.04	781.80	795.18	799.96	796.70	792.16	804.70	800.55	807.04
20	807.10	807.30	790.60	788.34	795.47		807.04	782.34	795.08	800.07	796.60	792.23	804.90	800.50	807.14
21	807.48	807.18		-			807.10	783.48	794.90	800.12	796.53	792.36	805.20	800.44	806.98
22	807.18	807.10					807.06	783.78	794.58	800.06	796.76	792.60	805.60	800.40	806.76
23	807.10	807.08					806.94	783.34	794.26	800.01	796.94	792.70	806.70	800.32	806.58
24	807.04	807.00					806.70	782.64	793.90	799.93	797.05	792.75	806.40	800.20	806.80
25	807.00	806.87	789.76		794.98		806.35	782.79	793.76	799.96	797.05	792.65	807.14	800.20	806.98
26		807.18					806.02	782.94	793.76	799.96	797.20	792.70	806.98	800.20	
27	806.65	807.46					805.72	783.09	793.76	799.84	797.28	795.40	806.75	800.40	
28		807.18					805.40	783.24	793.76	799.76	797.47	797.60	806.80	800.40	
29		807.26					805.08	783.39	793.68	799.65	797.66	798.10	806.60	800.60	
30	805.88	807.14	789.86		794.68	-	804.60	783.54	793.60	799.55	797.78	798.50	806.40	800.54	

Table E.2-3 Data of Reservoir Level (4/6)

	1968	1969	1970	1971	1972	1974	1982	1983	1984	1985	1986	1987	1988	1989
7. 1		807.08		-		-	804.14	783.70	793.56	799.42	797.84	798.80	806.15	800.46
2		807.06			794.38		803.76	784.00	793.56	799.24	797.86	799.05	807.20	800.40
3		807.03					803.30	784.40	793.62	799.02	797.86	799.30	807.60	800.30
4		807.22					802.80	784.64	793.68	798.90	797.80	799.70	807.20	800.40
5	804.87	807.14	791.56				802.36	784.76	793.72	798.72	797.62	800.10	807.10	800.50
6		807.07					801.98	784.84	793.66	798.60	797.50	800.30	807.02	800.50
7		807.00					801.40	785.00	793.84	798.50	797.57	800.50	806.88	800.48
8							800.90	785.50	795.40	798.35	797.42	800.70	806.60	800.44
9					792.88		800.40	786.40	797.18	798.28	797.34	800.90	807.30	800.30
10	803.87	806.74	792.30				799.84	786.90	797.30	798.19	797.22	801.10	806.10	800.20
11							799.24	788.00	797.53	798.02	797.10	801.80	806.10	800.05
12							798.80	788.34	797.40	797.92	796.98	802.30	806.20	800.05
13							798.32	788.40	797.12	797.88	796.88	803.10	806.80	800.05
14							797.82	788.22	796.84	797.76	796.94	804.10	807.30	799.80
15	802.64	806.10	793.78				797.52	787.88	796.46	797.66	796.94	805.10	807.10	799.64
16							797.20	787.65	796.06	797.55	796.87	805.70	806.96	799.50
17							796.84	787.45	795.66	797.46	796.80	806.05	806.85	799.30
18							796.50	787.38	795.28	797.44	796.73	806.40	806.60	799.10
19							796.10	787.22	794.90	797.48	796.62	806.60	806.30	798.70
20	800.92	804.51	796.10				795.62	787.30	794.58	797.46	796.58	806.95	805.90	798.50
21							795.16	787.39	794.20	797.56	796.56	807.20	805.76	798.30
22							794.66	787.42	793.90	797.52	796.58	807.30	805.60	798.10
23					790.14		794.20	788.90	793.88	797.50	796.60	807.20	805.50	797.95
24							793.70	789.70	793.80	797.44	796.90	807.10	805.36	797.85
25	799.06	803.00	797.44				793.20	790.81	793.80	797.34	797.24	807.20	805.30	797.70
26							792.90	790.48	793.80	797.26	797.42	807.20	805.20	797.60
27	798.25						792.44	790.40	793.80	797.10	797.58	807.10	805.10	797.60
28			799.40				791.94	790.14	793.80	797.02	797.74	807.10	804.90	797.80
29							791.50	789.74	793.98	797.55	797.74	807.06	804.80	797.90
30			800.32		791.34		791.10	789.22	794.60	797.94	797.76	807.02	804.68	798.80
31	798.28	800.34	803.05	-		-	790.62	788.66	795.40	798.14	797.74	806.98	804.60	799.10
8. 1			803.91				790.20	788.54	796.05	798.30	797.70	806.96	804.50	799.35
2			805.26				789.80	788.22	796.50	798.37	797.60	807.02	804.40	799.50
3							789.34	788.26	796.50	798.42	797.36	807.02	804.44	799.60
4							789.12	788.28	796.50	798.58	797.24	807.04	804.50	799.72
5	798.37	798.34	804.88		792.00		788.84	788.22	796.50	798.66	797.12	807.10	804.56	799.84
6				-			788.50	788.12	796.46	798.72	796.98	807.25	804.70	799.90
7				788.22			788.06	788.02	796.24	798.78	796.82	807.20	804.50	800.02
8		797.30					787.60	787.96	795.94	798.79	796.70	807.44	804.20	800.10
9							787.20	788.00	795.60	798.92	796.56	807.20	804.10	800.10
10	798.48	798.23	804.10	789.00	791.72		786.70	788.12	795.30	798.82	796.40	807.10	803.80	800.04
11							786.10	788.12	795.10	798.78	796.26	807.02	803.75	799.96
12	798.73						785.50	788.10	794.98	798.82	796.18	806.98	804.20	799.96
13	800.34						785.16	788.06	795.02	798.86	796.28	806.96	806.80	799.92
14							785.06	787.85	795.04	799.10	796.50	806.96	807.20	799.90
15	802.28	799.70	804.88	789.57	792.40		784.90	787.62	795.06	799.24	796.68	806.96	807.30	799.80
8.16								787.37	794.99	799.35	796.83	806.92	807.20	799.70
17	803.27							787.10	794.98	799.40	796.90	806.95	807.10	799.68
18		804.47						786.83	795.02	799.45	796.98	806.96	806.80	799.66
19								786.52	795.06	799.46	797.02	806.90	806.50	799.62
20	804.37	805.33	803.38	789.89	793.30			786.25	795.10	799.52	797.04	806.82	806.60	799.60
21								785.98	795.56	799.62	797.04	806.80	807.40	801.10
22		806.67						786.04	795.76	800.02	797.02	806.80	807.15	801.60
23		807.04		790.44				786.04	795.68	800.60	796.90	807.02	807.04	801.90
24		807.08						786.00	795.44	801.18	796.86	807.02	807.30	802.10
25	805.85	807.38	801.24	792.46	793.75			786.16	795.18	801.50	796.82	807.02	807.15	802.50
26		807.22	801.06					786.32	794.80	801.76	796.84	807.02	807.60	805.10
27		807.18		797.13				786.45	794.44	801.98	796.92	807.02	807.40	807.30
28		807.16	803.00					786.90	794.10	802.20	797.01	807.04	807.70	807.22
29		807.18		799.26				787.10	793.90	802.37	797.10	807.04	807.30	807.16
30		807.10	804.62					787.40	794.05	802.52	797.06	807.04	807.30	807.40
31	806.44	807.04	805.46	803.48	794.40	-		787.50	794.40	802.58	797.02	807.02	807.40	807.30

Table E.2-3 Data of Reservoir Level (5/6)

	1968	1989	1970	1971	1972	1974	1982	1983	1984	1985	1986	1987	1988	1989
9. 1	806.70	807.00		-		-		788.20	795.70	802.64	797.04	807.02	807.50	807.20
2		806.86			794.75			788.90	798.90	802.70	797.18	807.03	807.30	807.12
3		807.50						789.42	800.10	802.62	797.75	807.06	807.22	807.02
4		807.55						789.72	802.50	802.58	797.93	807.16	807.14	806.98
5		807.26	805.32		795.96			789.88	803.28	802.58	798.10	807.16	807.06	806.90
6	807.00	807.20						789.96	803.52	802.56	798.28	807.16	806.96	806.96
7	807.04	807.24	805.05		797.00			790.00	803.80	802.56	798.38	807.04	806.86	806.98
8	807.25	807.22						790.00	803.94	802.60	798.45	807.02	807.30	806.98
9	807.18	807.35						789.95	804.12	802.68	798.48	806.94	807.16	806.98
10	807.10	807.16	806.28		797.74			790.57	804.58	802.72	798.48	807.04	807.30	807.04
11	807.03	807.13	806.50					790.72	805.70	802.79	798.38	807.04	807.98	807.10
12		807.08						790.70	806.40	802.84	798.23	806.98	807.80	807.40
13		807.04						790.70	806.66	802.94	798.44	806.90	807.40	807.30
14								790.64	806.70	803.06	798.60	806.96	807.20	807.18
15	806.15	806.80	805.82		798.22			790.60	806.80	803.18	798.66	806.96	807.10	807.25
16							787.00	790.50	807.02	803.30	798.75	806.98	807.50	807.30
17	805.92						787.20	790.41	807.16	803.56	798.96	806.98	807.40	807.30
18			804.82				787.40	790.42	807.08	803.90	799.24	806.92	807.20	807.40
19	806.90						788.00	790.40	807.02	804.06	799.45	806.92	807.20	807.40
20	807.03	806.08	805.40		798.66		788.70	790.38	806.90	804.16	799.62	806.90	807.16	807.45
21	807.19	807.28	807.68				789.20	790.34	806.84	804.22	799.80	807.80	807.10	807.25
22	807.70	807.36	807.24				789.80	790.36	806.50	804.26	800.02	807.30	807.08	807.18
23	807.46	807.30	807.12				790.20	790.42	806.26	804.27	800.70	807.14	807.08	808.10
24	807.32	807.20	807.44				790.60	790.54	806.40	804.52	801.20	807.06	807.10	807.60
25	807.20	807.12	807.18		799.01		791.20	791.37	807.95	804.44	801.56	807.02	807.04	807.20
26	807.14	807.06	807.03				791.60	792.60	807.34	804.17	801.80	806.90	807.04	808.50
27	807.17	806.98	807.07				792.40	793.32	807.70	803.98	802.90	806.80	807.02	807.30
28	807.09		807.52		799.17		794.30	793.56	807.36	803.75	803.85	806.70	806.96	807.25
29	807.04	806.92	808.00				795.40	795.94	807.30	803.57	804.28	806.60	806.90	807.40
30	807.14	807.07	807.92	-	799.92	-	796.50	798.88	807.14	803.51	804.50	806.56	806.88	807.35
10. 1	807.09	807.04	807.36	-		-	797.40	800.98	807.24	803.59	804.62	806.60	806.88	807.80
2	807.05	807.02	807.50				797.80	801.97	807.24	803.74	804.60	806.52	806.84	807.50
3	807.06	807.20	807.28		802.85		799.60	802.43	807.24	804.30	804.70	806.44	806.80	807.30
4	807.08	807.16	807.22				800.10	804.00	807.20	804.56	804.58	806.40	806.84	807.16
5	807.05	807.30	807.10		804.22		801.30	804.78	807.13	804.64	804.40	806.34	806.90	807.14
6	807.00	807.50	807.12				803.00	805.65	807.15	804.51	804.20	806.25	806.96	807.20
7		807.70	807.12				802.86	806.02	807.30	804.42	804.10	806.23	807.10	807.16
8		807.54	807.14				803.30	806.20	807.15	804.30	804.05	806.20	807.15	807.12
9		897.36	807.04				803.70	806.22	807.08	804.38	804.02	806.17	807.18	807.06
10	806.10	807.40	807.14		806.42		804.00	806.16	807.02	804.39	804.02	806.12	807.20	806.98
11		807.30	807.10				804.30	806.06	806.95	804.25	804.30	806.08	807.30	807.04
12		807.31	807.00				804.50	805.95	806.80	804.05	804.56	806.13	807.20	807.04
13	805.21	807.30					804.60	805.72	806.60	803.91	804.58	806.10	807.20	807.04
14		807.22			807.04		804.80	805.52	806.38	803.80	804.58	806.10	807.20	807.04
15		807.15	806.70		807.08		804.96	805.34	806.10	803.87	804.55	806.02	807.20	807.04
16	804.80	807.11			807.20		805.00	805.08	805.84	803.95	804.54	805.98	807.20	807.04
17		807.18			807.40		804.98	804.77	805.50	804.25	804.60	805.92	807.20	807.04
18	806.40	807.24			807.20		804.94	804.46	805.46	804.56	804.56	805.82	807.12	807.06
19	806.85	807.84			807.24		804.90	804.14	805.36	804.77	804.38	805.76	807.10	807.06
20	807.34	807.30	806.80		807.28		804.82	804.54	805.25	804.90	804.16	805.65	807.10	807.06
21	807.15	807.19			807.24		804.96	804.71	805.15	804.99	803.94	805.50	807.30	807.10
22	807.06	807.28			807.34		804.90	804.64	805.02	805.06	803.68	805.34	807.30	807.10
23	807.00	807.17			807.22		804.74	805.30	804.98	805.12	803.57	805.18	807.30	807.10
24	807.07	807.26			807.17		804.50	805.74	805.14	805.20	803.50	805.02	807.30	807.10
25	807.96	807.19	806.12		807.14		804.10	805.84	805.30	805.64	803.43	804.85	807.40	807.10
26	807.34	807.16			807.12		803.88	806.04	805.38	805.70	803.43	804.75	807.40	807.10
27	807.20	807.22			807.11		803.74	806.30	805.30	805.70	803.43	804.60	807.30	807.10
28	807.14	807.19			807.10		803.70	806.34	805.18	805.73	803.40	804.48	807.40	807.10
29	807.08	807.16			807.09		803.70	806.26	805.50	805.67	803.36	804.30	807.35	807.10
30	807.04	807.15			807.09		803.74	806.12	806.50	807.20	803.28	804.34	807.20	807.10
31	807.15	807.12	806.30	-	807.08	-	803.70	805.92	806.90	807.30	803.15	804.22	807.20	807.10

Table E.2-3 Data of Reservoir Level (6/6)

	1968	1969	1970	1971	1972	1974	1982	1983	1984	1985	1986	1987	1988	1989
11. 1	807.20	807.08		807.12	807.12	-	803.70	805.70	807.00	807.35	803.05	804.02	807.20	807.10
2	807.06	807.04	807.06		807.09		803.68	805.50	807.00	807.16	803.05	803.90	807.20	807.10
3	807.36	807.00	807.04		807.09		803.64	805.30	806.85	807.08	803.08	803.87	807.18	807.10
4	807.23		807.00		807.07		803.60	805.01	806.60	807.05	803.12	803.75	807.18	807.10
5	807.26	806.80	806.89	807.20	807.06		803.57	804.70	806.30	807.01	803.05	803.68	807.20	807.10
6	807.16				807.06		803.47	804.30	806.10	806.90	803.01	803.62	807.18	807.10
7	807.12				807.05		803.44	804.10	805.85	806.70	802.90	803.52	807.17	807.10
8	807.08				807.08		803.36	803.74	805.50	806.45	802.76	803.55	807.16	807.10
9	807.04				807.06		803.38	803.36	805.20	806.20	802.72	803.45	807.16	807.10
10	807.03	805.80	805.79	807.11	807.06		803.40	803.14	805.05	805.90	802.68	803.38	807.18	807.10
11	807.00				807.06		803.34	802.98	804.70	805.58	802.66	803.30	807.14	807.10
12					807.07		803.26	802.70	804.30	805.15	802.86	803.24	807.14	807.08
13	806.89				807.07		803.21	802.42	803.94	804.80	803.10	803.18	807.14	807.08
14	807.08				807.06		803.15	802.14	803.60	804.40	803.22	803.02	807.14	807.08
15	807.10	804.19	804.25	807.09	807.06		803.06	801.80	803.20	804.14	803.40	803.06	807.10	807.08
11.16	807.12				807.06		802.97	801.50	802.70	803.94	803.80	802.98	807.10	807.08
17	807.12				807.12		802.88	801.20	802.60	803.58	804.20	802.90	807.10	807.08
18	807.12				807.10		802.75	800.86	802.50	803.23	804.40	802.85	807.10	807.08
19	807.12				807.08		802.58	800.50	802.18	803.02	804.60	802.80	807.10	807.08
20	807.12	802.65	802.35	807.05	807.07		802.38	800.14	801.76	802.83	804.80	802.88	807.10	807.08
21	807.12				807.06		802.20	799.81	801.36	802.68	804.98	803.06	807.10	807.08
22	807.12				807.06		802.00	799.52	801.25	802.63	805.24	803.16	807.10	807.08
23	806.80				807.06		801.84	799.22	801.18	802.57	805.52	803.16	807.10	807.08
24					807.05		801.70	799.06	800.96	802.51	805.70	803.12	807.10	807.08
25	806.00	801.07	800.22	807.06	807.05		801.56	798.88	800.74	802.44	805.88	803.04	807.10	807.08
26					807.05		801.34	798.67	800.74	802.38	806.02	802.98	807.10	807.08
27		801.46			807.00		801.20	798.48	800.70	802.30	806.10	802.98	807.10	807.08
28					807.00		801.10	798.34	800.70	802.18	806.18	802.94	807.10	807.08
29							800.96	798.27	800.68	802.06	806.20	802.92	807.10	807.08
30	805.40	801.54	799.09	807.04	806.95	-	800.86	798.24	800.80	801.98	806.30	802.86	807.10	807.08
12. 1	805.40		799.02			-	800.75	798.16	800.92	801.88	806.34	802.80	807.10	807.06
2	-						800.60	798.08	800.96	801.79	806.40	802.74	807.10	807.06
3							800.47	798.10	800.94	801.68	806.40	802.70	807.08	807.06
4							800.34	798.10	800.96	801.57	806.48	802.64	807.08	807.04
5		802.67	799.49	807.06	806.90		800.20	798.08	800.96	801.61	806.37	802.62	807.08	807.04
6							800.06	798.05	800.94	801.65	806.52	802.68	807.08	807.04
7							799.90	798.03	800.90	801.70	806.40	802.65	807.06	807.04
8							799.80	798.05	800.96	801.76	806.44	802.64	807.06	807.04
9		802.74					799.68	797.99	800.94	801.80	806.50	802.63	807.05	807.04
10		802.64	800.07	807.03	806.70		799.55	797.94	800.94	801.79	806.55	802.55	807.05	807.01
11							799.43	797.86	800.90	801.83	806.60	802.47	807.04	807.04
12							799.30	797.79	800.91	801.84	806.60	802.40	807.04	807.04
13		802.24					799.16	797.70	800.90	801.70	806.60	802.44	807.04	807.01
14							799.02	797.62	800.88	801.70	806.65	802.38	807.04	807.04
15		802.60	800.96	807.01	806.47		798.92	797.57	800.84	801.75	806.68	802.30	807.04	807.04
16							798.78	797.64	800.90	801.71	806.60	802.16	807.04	807.02
17							798.68	797.56	800.88	801.68	806.55	802.10	807.04	806.95
18							798.64	797.54	800.86	801.64	806.54	802.02	807.04	806.96
19							798.56	797.52	800.85	801.62	806.50	801.92	807.04	806.96
20		803.00	802.42	807.01	806.29		798.44	797.44	800.84	801.60	806.60	801.95	807.04	806.96
21							798.32	797.35	800.80	801.53	806.46	801.90	807.04	806.94
22							798.20	797.26	800.78	801.56	806.44	801.88	807.04	806.86
23							798.08	797.16	800.82	801.56	806.40	801.86	807.04	806.70
24							797.93	797.09	800.88	801.41	806.30	801.74	807.04	806.60
25		803.44	803.52	807.07	806.25		797.93	797.12	800.84	801.42	806.35	801.70	807.04	806.50
26							797.93	797.18	800.78	801.36	806.25	801.64	807.04	806.36
27							797.88	797.08	800.70	801.40	806.14	801.68	807.04	806.22
28							797.77	796.98	800.66	801.64	806.18	801.62	807.04	806.20
29							797.63	796.88	800.68	801.78	806.10	801.60	807.04	806.12
30							797.50	796.78	[illegible]	801.66	806.04	801.56	807.04	805.94
31	-	803.92	804.43	807.02	806.06	-	797.60	796.68	800.94	801.94	805.94	801.56	807.04	805.90

Table E.2-4 Reservoir-Rainfall (1/6)

	1968				1969				1970				1971		1972				1974	
	R	W.L.	Qs	Qv	R	W.L.	Qs	Qv	R	W.L.	Qs	Qv	R	W.L.	R	W.L.	Qs	Qv	R	W.L.
1. 1		789.21		-		807.07	2	-	0.8	804.06		-	-	804.58		807.02	0	0.0		806.94
2				-	0.5	807.08	2	-				0.1				807.02	0	0.1		
3				0.1	1.2	807.08	2	-				0.1		804.78		807.02	0	0.1	1.1	
4				0.2		807.09	3	-				-				807.02	0	0.1		
5		789.18		0.2		807.09	2	-		804.40		0.1			0.2	807.01	0	0.2		806.89
6				0.2		807.08	2	-				0.2			0.3	807.02	0	0.2		
7				0.2		807.05	2	-				0.1				807.01	0	0.2		
8				0.1		807.08	2	-				0.2				807.01	0	0.2		
9				0.1		807.08	2	-				0.1				807.05	0	-		
10		789.08		0.1		807.07	2	-		804.62		-				807.03	0	0.2		806.96
11				0.1		807.07	2	-				-						0.2		
12				0.1		807.07	2	-				0.1						0.2		
13				0.2		807.06	1	-		804.90		0.2						0.2		
14				0.2		807.06	1	-				0.2						0.2		
15		788.80		0.2		807.08	1	-		804.74		0.2				806.94		0.2		806.94
16				0.2		807.05	1	-				0.2						0.2		
17				0.2		807.06	1	-				0.2						-		
18				0.2		807.05	1	-				0.1						0.2	0.4	
19				0.2		807.08	1	-				0.1						0.2		
20		788.27		0.1	2.4	807.08	2	-		804.85		0.1				806.92		0.2		806.94
21				0.1	6.0	807.08	2	-				0.1						0.2		
22				0.1	0.3	807.10	3	-				0.2						0.2		
23				0.2		807.08	2	-				0.2						-		
24				0.2		807.05	1	0.1				0.2						0.1		
25		788.00		0.2		807.04	1	0.1		804.90		0.1				806.89		0.1		806.78
26				0.2		807.03	1	0.1				0.1						0.2		
27				0.2		807.03	1	0.1				0.1						0.2		
28				0.1		807.02	0	0.1				0.1						0.2		
29				0.1		807.03	1	0.2				0.2						0.1		
30				0.1		807.04	1	0.2				0.2						0.1		
31		787.82		0.1		807.05	1	0.1		805.04		0.1	-	-		806.71		0.2		806.54
2. 1				0.1		807.04	1	0.1				0.1		805.01				0.2		
2				0.1		807.03	1	0.1				0.1						0.2		
3				0.1		807.02	1	0.1				0.2						0.2		
4				0.1	8.2	807.02	1	0.1				0.1						0.2		
5	1.8	787.51		0.1		807.06	2	0.1		805.15		0.1		904.97		806.42		0.2		806.44
6	0.5			0.1		807.04	1	0.1				0.1						-		
7	0.4			0.1		807.03	1	0.1				0.1						0.2		
8				0.1		807.02	1	0.1				0.1	0.2					0.2		
9				0.1		807.01	1	0.1				0.1						0.2		
10		787.27		0.1		807.00		0.1		805.18		0.2		805.00		806.26		0.2		806.04
11				0.1		807.00		0.1				0.1			0.2			0.2		
12				0.1				0.2				0.1						0.2		
13				0.1				0.1				0.1	0.2					-		
14	0.4			0.2				0.2				0.1						0.2		
15		786.85		0.2		806.15		0.2		805.21		0.1		805.06		806.10		0.2		805.72
16				0.1				0.1				0.1						0.2		
17				0.1				0.1				0.1						0.2		
18				0.1				0.2				0.1	20.2					0.2		
19				0.1				0.2				0.2			0.4			0.2		
20		786.72		0.1		806.53		0.2		805.12		0.2		805.06	0.1	805.88		0.2		805.38
21				0.1				0.1				0.2						0.2		
22				0.1				0.1				-						0.2		
23				0.1				0.1				0.2						0.2		
24				0.1				0.2				0.2						0.2		
25		786.32		0.1		806.40		0.2				0.2		804.95		805.71		0.2		804.98
26				0.1				0.2				0.2						0.2		
27				0.1				0.2				0.2						-	3.0	
28				0.1		806.20		0.2		804.75		0.2		804.90				0.2		804.76
29		786.07		0.1												805.60		0.2		

Table E.2-4 Reservoir-Rainfall (2/6)

	1968				1969				1970				1971		1972				1974	
	R	W.L.	Qs	Qv	R	W.L.	Qs	Qv	R	W.L.	Qs	Qv	R	W.L.	R	W.L.	Qs	Qv	R	W.L
3. 1				0.1				0.2				0.1						0.2		
2				0.1				-				0.1						0.2		
3				0.1				0.2				0.1						0.2		
4	1.9			0.1	9.0			0.2				0.1						0.2		
5		785.60		0.1		805.08		0.1		804.68		0.2		804.74		805.34		-		804.36
6				0.1				0.2				0.2						0.2		
7				0.1				0.2				0.2						0.2		
8				0.1				0.2				0.1						0.2		
9				0.1				-				0.2						0.2		
10		785.12		0.1	11.0	805.88		0.2		804.38		0.3		804.54		805.00		0.2		803.80
11				0.1				0.2				0.2						0.2	5.4	
12				0.1				0.2				0.2						0.1		
13				0.1				0.1				0.2						0.2		
14				0.1				0.1				0.2						0.2		
15		784.47		0.1		805.70		-		804.00		0.1		804.91		804.47		0.2		803.18
16				0.1				-				0.2						0.2		
17				0.1				0.1				0.2	1.7					0.2	0.1	
18	1.0			0.1				0.2				0.2						0.2		
19				0.1				0.2				0.2						0.1		
20		784.16		0.1		805.47		0.2		803.76		0.1		803.98		803.94		0.2		802.58
21				0.1				0.2				0.2						0.2		
22				0.1				0.2				0.1			0.7			0.2		
23				0.1				-				0.2						0.2		
24				0.1				0.2				0.2						0.2		
25		783.62		0.1		805.12		0.2		803.78		0.2		803.88		803.40		0.2		801.82
26				0.1				0.2				0.1						0.1		
27				0.1				0.2				0.1						0.2		
28				0.1				0.2				0.2						0.2		
29				0.1				-				0.1						0.2		
30				0.1				-				0.2						-		
31		783.20		-	2.0	804.84		0.2		803.20		0.2		802.94		803.00		-		800.88
4. 1				0.1				0.2				0.2						0.2		
2				0.1				0.2				0.2			4.3			0.1		
3				0.1				-				0.2						0.2	1.6	
4	1.0			0.1				-				0.2	1.5					0.2		
5	16.0	782.35		0.1		804.77		-		802.61		0.1		802.50		803.70		0.2		800.02
6	17.5	- -		0.1				-				0.2	31.5					0.2	0.7	
7	1.7			-				0.2				0.2	0.2					0.2		
8				0.1				0.2				0.2						0.2		
9				0.1				0.2				0.2						0.1		
10				0.1		804.32		0.2		802.02		0.2		800.89		802.16		0.2	0.5	799.00
11				0.1	4.4			0.2				0.2			0.3			0.2		
12				0.1				0.2				0.1						0.2		
13				0.1				-				0.1						0.2		
14		- -		0.1				0.2	25.5			0.1						0.2		
15		782.30		0.1		803.80		0.2	49.9	801.78		0.7		800.42		801.56		0.2		798.84
16				0.1				0.2	3.0			0.7						0.1		
17				0.1				0.2				1.3						0.3		
18				0.2				0.2				1.3			2.4			0.3		
19				0.2				0.2				1.3			6.9			0.3		
20				0.1	11.1	803.98		0.3		798.96		1.3		800.00		801.10		0.3		797.10
21		780.48		0.2				0.5				1.2						0.3		
22				0.2				0.2				1.2						0.3		
23				0.1				-				1.2						0.1		
24				0.1	2.3			0.6				1.2						0.3		
25		779.00		0.1		801.90		1.3		795.66		1.2		799.54		800.44		0.3	0.2	796.10
26		- -		0.1	1.7			0.3				1.1						0.3		
27				0.1	5.4			1.3				1.1						0.3		
28				0.1	5.0			1.3				1.1						0.3		
29				0.1				1.3				1.1						0.3		
30				0.1		799.87		-		792.10		1.1		798.74		799.78		0.1		795.06

Table E.2-4 Reservoir-Rainfall (3/6)

	1968				1969				1970				1971		1972				1974	
	R	W.L.	Qs	Qv	R	W.L.	Qs	Qv	R	W.L.	Qs	Qv	R	W.L.	R	W.L.	Qs	Qv	R	W.L.
5. 1		-		0.1	-			-	-			1.1			1.1			0.2		
2				0.1				1.2	0.2			0.5			0.3			0.2		
3				0.1				1.2				0.2						0.3		
4				0.1				1.2				0.1						0.3		
5						798.10		1.2		790.45		0.2		798.27	4.7	798.80		0.3		794.00
6	14.0							1.2				0.3			2.8			0.3		
7	1.0							1.2	0.3			0.3						0.3	17.7	
8								1.2				0.3						0.3		
9								1.2				0.2	2.2					0.3		
10	18.0					794.98		1.1		789.58		0.2		797.88		797.90		0.3	5.5	793.70
11	10.0							1.1				0.2			2.4			0.3		
12	2.5							1.1				0.2			2.0			0.3		
13	1.7							1.1	8.1			0.2	19.0		0.3			0.3		
14								1.1				0.2	6.8					0.3		
15	9.4					791.52		1.1		788.83		0.2	7.6	796.28		796.70		0.3	11.7	793.10
16								1.0	1.1			0.1	46.1		3.1		-	0.3	23.8	
17	6.0							1.0	0.8			0.1	4.7		38.4			0.3	58.1	
18	8.0							1.0	1.4			0.1	12.1		0.4			0.4	3.3	
19								1.0				0.2	4.2					0.4	29.3	
20	8.4					788.66		1.0		789.10		0.1		794.94		796.06		0.4	10.0	794.52
21	8.0							0.9				0.1						0.4	20.8	
22	1.0							0.9				0.1	13.2		1.1			0.4	100.7	796.48
23	9.5							0.9				0.1			0.3			0.4	0.7	
24	1.5							0.9	1.3			0.1						0.4	10.8	
25						786.73		0.9	1.6	789.16		0.1		791.58		794.48		0.4		797.72
26	1.0							0.9	3.2			0.1			3.3			0.4		
27						786.00		0.9	3.3			0.1			2.7			0.4		
28	5.5							0.9	3.1			0.5			0.5			0.4		
29	20.0					787.60		0.9	2.6			0.5		791.06	4.3			0.4		
30	16.0							0.9	6.3			0.5	25.4					0.4		
31	23.0	-			-	786.98		0.9		788.13		0.2	2.2	791.58		792.78		0.4		797.74
6. 1	9.0	800.55			13.6	787.20		0.9	1.1			0.1	4.6		1.1			-		-
2					17.4			1.0				0.1	4.2		1.2			-	2.4	
3	10.0				24.0	793.12		1.1				0.1	4.4					-	15.3	
4	5.0				13.4			1.1	1.4			0.1						-		
5	3.0	803.17			10.0	795.48		1.2	0.3	788.50		0.1		791.48		791.94		-		
6					93.0			1.2				0.1			16.8			-		
7					3.5	797.82		1.2	0.1			0.1			65.6			-		
8					7.0			1.2				0.1			3.2	793.80		-		
9	21.5				2.0			1.3	1.4			0.1			1.5			-		
10	5.5	804.28			59.4	802.30		1.3		788.90		0.1		790.80		794.74		-		
11	3.5	804.27			6.0	805.35		1.4				0.1	28.7		1.8			-		
12	42.0	807.15	8					1.4	10.3			0.1						-	0.6	
13	42.6	807.70	55					1.4	30.6			0.1	5.8					-		
14	15.4	807.50	33		10.0	806.26		1.4				0.1	9.3					-	4.2	
15	17.4	807.36	20		10.0	807.50	33	1.4	9.9	790.53		0.1	5.1	791.34	1.0	795.38		-	5.3	
16		807.06	1		2.0	807.50	44	1.4				0.5			0.3			-	40.6	
17		807.08	1		5.0	807.40	24	1.4				0.5	2.0					-	4.6	
18	4.5	807.08	1		6.0	807.60	44	1.4	5.7			0.3			0.3			0.1	7.8	
19	0.7	807.07	2		1.5	801.30	15	1.4	9.3			0.3						0.1		
20	14.3	807.10	3		8.5	807.30	15	1.4	31.9	790.60		0.3		788.34		795.47		0.3		
21	59.0	807.48	31		5.6	807.18	1	1.4	7.3			0.5		-	12.9			0.3	9.7	
22		807.18	7			807.10	3	1.4	10.1			0.5						0.3	16.5	
23		807.10	3		8.6	807.08	2	1.4				0.5			15.8			0.3	17.4	
24		807.04	1			807.00		1.4	2.1			0.5						0.1		
25		807.00			8.3	806.67		1.6		789.76		0.5			0.4	794.98		0.1	0.7	
26					2.3	807.48	7	1.4				0.5						0.1	0.6	
27		806.65			38.0	807.48	29	1.4				0.1						0.1	18.1	
28	9.8				20.2	807.18	7	1.4	1.0			0.1						0.1	1.1	
29	1.5				23.8	807.28	13	1.4				0.1						0.1		
30	8.0	805.88			7.0	807.14	5	1.4	1.7	789.88		0.1				794.68		0.2	2.0	-

Table E.2-4 Reservoir-Rainfall (4/6)

	1968				1969				1970				1971		1972				1974	
	R	W.L.	Qs	Qv	R	W.L.	Qs	Qv	R	W.L.	Qs	Qv	R	W.L.	R	W.L.	Qs	Qv	R	W.L.
7. 1						807.08	2	1.4				0.1		-				0.2	-	-
2					16.8	807.06	1	1.4	1.5			-				794.38		0.2		
3	8.8					807.03	1	1.4	1.1			-						0.2		
4	2.4				12.0	807.22	10	1.4	0.6			-						0.2		
5	11.4	804.67			2.4	807.14	5	1.4	0.4	791.56		-						0.2		
6					3.0	807.07	2	1.4	1.1			0.1						0.2		
7						807.00		1.4				0.1						0.2		
8	2.0				8.8			1.4				0.1	0.1					0.2		
9					5.3			1.4				0.1				792.88		0.2		
10	0.8	803.87			10.5	806.74		1.3		792.30		0.1	1.8					0.2		
11								1.4				0.1						0.2		
12	5.5				1.4			1.4	2.9			0.1	2.6					0.2		
13					3.8			1.4	14.7			0.1						0.2		
14								1.4	7.3			0.1	1.5					0.2		
15		802.64				806.10		1.4	1.3	793.78		0.1	1.4					0.2		
16								1.4	0.8			0.1	0.5					0.2		
17								1.4	0.5			0.1	9.9					0.2		
18				0.9				1.4	0.2			0.1	0.1					0.2		
19				0.9				1.4	7.9			0.1						0.2		
20		800.92		0.9	1.5	804.51		1.4	13.9	795.10		0.1			2.1			0.2		
21				0.9				1.4				0.1			1.5			0.2		
22				0.9				1.4				0.1			0.1			-		
23				0.9	8.6			1.4	0.8			0.1			8.9	790.14		-		
24				0.9				1.4				0.1	1.8		0.9			0.2		
25		789.06		0.9		803.00		1.3		797.44		0.1			4.8			0.2		
26				0.9				1.3	0.6			0.1	3.2		4.4			0.2		
27		798.25		0.9				1.3	37.5			0.1	2.2					0.2		
28				0.3				1.3	38.6	799.40		0.1			1.4			0.2		
29	1.2			0.3				1.3				0.1			0.2			0.2		
30				0.3				1.3	1.2	800.32		0.3	0.6			791.34		0.2		
31		796.28		0.3	10.3	800.34		1.3	42.2	803.05		0.3		-	0.4			0.2	-	-
8. 1	2.0			0.3	7.1			1.3	1.4	803.91		0.9	15.9					-		
2				0.3				1.3	1.5	805.26		1.4						0.1		
3				0.3	3.6			1.3				1.4	4.7					0.1		
4				0.3	8.5	-		1.3	1.0			1.4	3.9					0.2		
5		798.37		0.3		798.34		1.2	0.8	804.88		1.4				792.00		0.2	0.4	
6				0.3	10.0			1.2	0.9			1.4		-				0.2		
7				0.3				1.2				1.4	32.1	788.22				0.2		
8				0.3		797.30		1.2	13.1			1.4	4.6		2.2			0.2	0.8	
9	7.3			0.3	52.5			1.2	4.7			1.4			0.7			0.2		
10	2.3	798.48		0.3	30.8	798.23		1.2		804.10		1.4		789.09	0.5	791.72		0.1	0.3	
11	0.6			0.3	10.6			1.2				1.4			0.5			0.1		
12		798.73		0.2	17.3			1.3	26.0			1.4						0.1		
13	31.0	800.36		0.2	0.5			1.3				1.4						-		
14				-	5.3			1.3				1.4						0.1	0.2	
15		802.28		-	5.7	799.70		1.3		804.88		1.4		789.57	11.5	792.40		-	0.1	
16				-	27.7			1.3	0.5			1.4						0.1		
17	2.0	803.27		-	0.7			1.4	1.9			1.4			8.5			0.1	1.5	
18				-	6.4	804.47		1.4	2.4			1.4	4.0					0.1		
19	3.0			-	0.7			1.4				1.4	6.1					0.1		
20	1.0	804.37		-	3.0	805.33		1.4		803.38		1.4		789.89		793.30		0.1	0.5	
21				-				1.4				1.4	2.2					0.1		
22	2.3			-	21.0	805.67		1.4				1.3						0.1		
23				-	8.5	807.04	1	1.4				1.3	11.7	790.44				0.1		
24				0.2	14.0	807.08	2	1.4				1.3	21.1		1.6			0.1		
25	21.3	805.85		0.2	38.5	807.38	22	1.4	5.0	801.26		1.3	26.4	792.46		793.75		0.1		
26	0.5			0.2		807.22	10	1.4	44.9	801.06		1.3	14.6					0.1	48.8	
27				0.2	1.7	807.18	7	1.4	1.5			1.3	40.4	797.13	2.3			-	7.8	
28				0.2	20.0	807.18	6	1.4	38.2	803.00		0.9	9.7		1.1			-	18.5	
29				0.2	9.0	807.18	7	1.4				0.9	13.8	799.26	12.8			-		
30	1.0			0.2		807.10	3	1.4	11.7	804.62		0.9	39.9					-		
31	22.0	806.44		0.2	0.6	807.04	1	1.4	27.7	805.46		1.4	41.4	803.48	0.4	794.40		-	0.8	-

Table E.2-4 Reservoir-Rainfall (5/6)

	1968				1969				1970				1971		1972				1974	
	R	W.L.	Qs	Qv	R	W.L.	Qs	Qv	R	W.L.	Qs	Qv	R	W.L.	R	W.L.	Qs	Qv	R	W.L.
9. 1	7.3	806.70		0.2		807.00		1.4	0.9			1.4	-	-				-	0.8	-
2	9.3			0.2	0.6	806.86		1.4	1.0			1.4			5.7	794.75		-		
3	2.5			-	40.0	807.50	33	1.4	0.4			1.4			1.3			-	2.4	
4				-	7.5	807.55	38	1.4	4.9			1.4			1.0			-		
5	6.2			-	24.0	807.28	13	1.4	1.9	805.32		1.4			5.4	795.96		-		
6		807.00		-	7.5	807.20	8	1.4	1.2			1.4			13.1			-		
7	7.0	807.04	1	-	35.4	807.24	11	1.4	11.7	805.05		1.4				797.00		-	7.9	
8	11.7	807.25	12	-	3.5	807.22	10	1.4				1.4						-	10.8	
9	1.3	807.18	7	-	29.1	807.35	19	1.4				1.4						-	5.9	
10		807.10	3	-	10.3	807.16	6	1.4	10.7	806.28		1.4				797.74		-	1.1	
11		807.03	1	-	6.8	807.13	4	1.4	14.4	806.50		1.4						-	3.4	
12				-		807.08	2	1.4				1.4						-	25.3	
13	3.7			-		807.04	1	1.4				1.4						0.2	29.8	
14				-				1.4				1.4						0.1	19.7	
15		806.15		-		806.80		1.4		805.82		1.4				798.22		-		
16	14.6			-	5.0			1.4				1.4						-		
17	8.0	805.92		-				1.4				1.4			16.6			-		
18	17.0			-	6.6			1.4		804.82		1.4						-	8.0	
19	15.0	806.90		-	16.6			1.4	27.3			1.4			0.1			0.1	33.2	
20	7.0	807.03	1	-	23.8	806.08		1.4	1.5	805.40		1.4			0.9	798.66		0.1	53.1	
21	9.4	807.19	8	-	33.0	807.28	19	1.4	45.5	807.68	53	1.4						0.1	24.3	
22	12.6	807.70	55	-	28.6	807.36	27	1.4		807.24	11	1.4						0.1	0.1	
23	13.0	807.46	29	-	14.3	807.30	21	1.4		807.12	4	1.4						-	23.3	
24	4.6	807.32	17	-		807.20	11	1.4	21.4	807.44	28	1.4						-	0.3	
25	0.1	807.20	8	-		807.12	5	1.4		807.18	7	1.4				799.01		0.1	1.5	
26	4.0	807.14	5	-		807.06	2	1.4		807.03	1	1.4						0.1	14.7	
27	4.5	807.17	7	-		806.98		1.4	15.6	807.07	2	1.4			0.9			0.1	25.3	
28		807.09	3	-	1.5			1.4	24.6	807.52	35	1.4			5.5	799.17		0.1		
29	1.3	807.04	1	-	4.2	806.92		1.4	33.4	808.00	94	1.4			14.1			-	2.1	
30	5.2	807.14	5	-	10.5	807.07	2	1.4	41.5	807.92	83	1.4	-	-	4.9	799.92		-		-
10. 1	2.5	807.09	3	0.1		807.04	1	1.4	1.3	807.36	20	1.4	-	-	3.0			-	-	-
2	3.0	807.05	1	0.1	1.0	807.02	0	1.4	24.9	807.50	33	1.4			6.9			-		
3	2.2	807.06	1	0.1	10.9	807.20	8	1.4	13.1	807.28	15	1.4				802.86		-		
4	2.8	807.08	2	0.1	1.2	807.16	5	1.4	15.2	807.22	9	1.4			5.9			-		
5	*	807.05	1	0.1	7.8	807.30	15	1.4		807.10	3	1.4			9.7	804.22		-		
6		807.00		0.1	10.1	807.50	33	1.4	4.9	807.12	4	1.4			0.9			-		
7				0.1	6.4	807.70	55	1.4	3.1	807.12	4	1.4			13.6			-		
8				0.1	3.1	807.54	37	1.4		807.14	5	1.4						-		
9				0.1	3.8	897.36	20	1.4	15.3	807.04	1	1.4						-		
10		806.10		0.1	9.2	807.40	24	1.4	10.9	807.14	5	1.4				806.42		-		
11	11.0			0.1	0.8	807.30	15	1.4	0.2	807.10	3	1.4						0.1		
12				0.1	1.1	807.31	16	1.4	0.6	807.00		1.4			0.7			0.1		
13		805.21		0.1	1.1	807.30	15	1.4				1.4			1.5			-		
14	2.8			0.1		807.22	10	1.4				1.4			0.2	807.04	1	-		
15	1.0			0.7		807.15	5	1.4	2.1	806.70		1.4			6.6	807.08	2	-		
16		804.80		0.5		807.11	3	1.4	0.5			1.4			10.1	807.20	8	-		
17	2.3			0.2	11.3	807.18	7	1.4				1.4			7.7	807.40	24	-		
18	23.0	806.40		0.7	7.7	807.24	11	1.4	9.3			1.4			3.0	807.20	8	-		
19	10.6	806.85		0.1	15.2	807.84	73	1.4	6.1			1.4			2.6	807.24	11	-		
20	51.4	807.34	19	0.1		807.30	15	1.4	4.7	806.80		1.4			3.0	807.28	13	-		
21		807.15	5	0.1		807.19	8	1.4				1.4			2.4	807.24	11	-		
22		807.06	1	0.1	3.0	807.28	14	1.4	1.4			1.4			5.1	807.34	18	-		
23		807.00		0.1	1.1	807.17	7	1.4				1.4				807.22	10	-		
24	11.5	807.07	2	0.1	0.7	807.25	12	1.4	1.0			1.4				807.17	7	-		
25	53.4	807.95	85	0.1	0.7	807.19	8	1.4		806.12		1.4				807.14	5	-		
26	0.6	807.34	19	0.1	5.3	807.16	6	1.4	18.4			1.4				807.12	4	-		
27		807.20	8	0.1	4.8	807.22	10	1.4	9.3			1.4				807.11	3	-		
28		807.14	5	0.1		807.19	8	1.4	3.1			1.4			5.4	807.10	3	-		
29		807.08	2	0.1	0.4	807.16	6	1.4	3.7			1.4				807.09	3	-		
30		807.04	1	0.1		807.15	5	1.4				1.4				807.09	3	-		
31		807.15	5	-		807.12	4	1.4	32.0	806.30		1.4	-	-		807.08	2	-	-	-

Table E.2-4 Reservoir-Rainfall (6/6)

	1968				1969				1970				1971		1972				1974	
	R	W.L.	Qs	Qv	R	W.L.	Qs	Qv	R	W.L.	Qs	Qv	R	W.L.	R	W.L.	Qs	Qv	R	W.L.
11. 1	3.2	807.20	8	-	0.1	807.08	2	1.4	5.7			1.4		807.12	2.0	807.12	4	-	2.2	-
2		807.08	1	0.1		807.04	1	1.4	3.0	807.06	1	1.4			5.3	807.09	3	-	0.4	
3	16.3	807.36	20	-		807.00		1.4	0.6	807.04	1	1.4	3.5			807.09	3	-		
4		807.23	11	-	1.0			1.4		807.00		1.4	15.5			807.07	2	-		
5	16.6	807.26	12	0.7		808.80		1.4		805.89		1.4		807.20		807.06	1	-		
6	1.7	807.16	6	0.7				1.4				1.4				807.06	1	-		
7	1.3	807.12	4	0.7	4.1			1.4				1.4				807.05	1	-		
8		807.08	2	0.7	0.4			1.4				1.4			1.0	807.08	2	-		
9		807.04	1	0.7				1.4				1.4				807.06	1	-		
10	3.4	807.03	1	0.7		805.80		1.4		805.79		1.4		807.11		807.05	1	-		
11		807.00		0.7				1.4	0.7			1.4			0.5	807.06	1	-	0.1	
12	2.3			0.7				1.4	3.1			1.4				807.07	2	-		
13		806.89		0.7				1.4	0.7			1.4	0.3			807.07	2	-	1.5	
14		807.08	2	-				1.4				1.4				807.06	1	-		
15		807.10	3	-		804.19		1.4		804.25		1.4		807.09		807.05	1	-		
16		807.12	4	-				1.4	0.8			1.4				807.06	1	-		
17	2.0	807.12	4	-				1.4				1.4			0.8	807.12	4	-		
18		807.12	4	-	2.5			1.4				1.4				807.10	3	-	0.7	
19	1.0	807.12	4	-	9.9			1.3				1.3				807.08	2	-	2.0	
20		807.12	4	-	0.4	802.65		1.3		802.35		1.3		807.05		807.07	2	-		
21	2.5	807.12	4	-				1.3				1.3	8.1			807.06	1	-	9.6	
22		807.12	4	-				1.3				1.3	3.4			807.06	1	-	0.6	
23		806.80		0.1				1.3				1.3	15.5			807.06	1	-		
24				0.1				1.3	0.7			1.3	0.1			807.05	1	-	0.1	
25		806.00		0.7		801.07		1.3		800.22		1.3		807.05		807.05	1	-	5.8	
26				0.7				0.2				1.3				807.05	1	-		
27				0.7	20.3	801.46		0.2				0.6				807.00		0.2		
28				0.1	0.7			0.7				0.6				807.00		0.2		
29				0.2				0.7	5.1			0.3						0.2		
30	2.2	805.40		0.2		801.54		0.2		799.09		0.3		807.04		806.95		0.2		-
12. 1	-	805.40		0.2	1.3			0.2		799.02		0.3						0.2		-
2		-			1.0			0.2				0.2						0.2		
3								0.2				0.1	1.8					0.1		
4								0.3				0.2						0.2		
5						802.67		0.3		799.49		0.2	0.1	807.06		806.90		0.2		
6								0.3				-						0.2		
7								0.3	0.5			-						0.2		
8								0.3	0.1			-						0.2		
9						802.74		0.5				0.2						0.2	0.1	
10						802.64		0.5		800.07		0.2		807.03	0.1	806.70		0.1		
11								0.5				0.2						0.2		
12								0.5				0.1						0.2		
13						802.24		0.3	11.1			-						0.2		
14								0.1				0.1						0.2		
15						802.60		0.2		800.96		0.1		807.01		806.47		0.2		
16								0.2				0.1						0.2		
17								0.2	4.0			0.1						0.2		
18								0.2	0.1			0.1						0.2		
19								0.2				0.1						0.2	0.3	
20						803.00		0.2		802.42		-		807.01		806.29		0.2	0.4	
21								0.2				0.1						0.2		
22								0.2				0.1	1.5					0.2	3.3	
23								0.2				0.1						0.2		
24								0.1				0.1	8.4					-		
25						803.44		0.1		803.52		0.1		807.07		806.25		-		
26								0.1				0.1						0.2		
27								0.1				-						0.2		
28								0.1				0.1						0.2		
29								0.1				0.1						0.2		
30								0.1				0.1						0.2		
31	-	-				803.92		0.1		804.43		0.1		807.02		806.05		-		-
		807.01																		
	1002.3		589	45.4	1317.		1078	302.4	1073.		422	217.6	839.5		437.9		180	50.8	854.7	

Table E.2-5 Record of Large Inflow/Rainfall (1/3)

	R	W.L	V	
68 6.11	3.5	804.27	10,756	
12	42.0	807.15	12,729	0.5*6*1.4H = 15
13	42.6	807.70	13,165	0.5(6+55)24H =2635
	88.1		2,409	+2,650 =5,059
69. 6. 1	13.6	787.28	690	
2	17.4	789.46	1,348	
3	24.0	793.12	4,327	
4	13.4	794.00	4,698	
5	10.0	795.48	5,383	
6	93.0	796.96	6,194	
7	3.5	797.82	6,665	
8	7.0	798.49	7,033	
9	2.0	798.97	7,296	
10	59.4	802.38	9,475	
11	6.0	805.35	11,490	
	249.3		10,800	
69. 6.14	10.0	806.26	12,108	
15	10.0	807.50	13,007	0.5*33*10.6 = 630
16	2.0	807.60	13,086	0.5(33+44)24 =3326
	22.0		978	+3,956 =4,934
70 4.14	25.5	(801.8)		
15	49.9	801.78		
16		(801.2)		
	75.4		0	
70 9.19	27.3	(805.0)	11,253	
20	1.5	805.40	11,524	
21	45.5	807.68	13,149	0.5*53*8 = 763
	74.3		1,896	+763 =2,659
70 9.27	16.6	807.07	12,666	
28	24.6	807.52	13,023	0.5(2+35)24 = 1598
29	33.4	808.00	13,403	0.5(35+94)24 =5573
	74.6		737	+7,171 =7,908

	R	W.L	V	
72 6. 5		791.94	3,829	
6	16.8	?	?	
7	65.6	?	?	
8	3.2	793.80	4,614	
	85.6		785	
72. 9.30	4.9	799.92	7,816	
10. 1	3.0	800.38	8,118	
2	6.9	802.02	9,231	
3		802.86	9,801	
4	5.9	803.44	10,194	
5	9.7	804.22	10,724	
6	0.9	804.92	11,199	
7	13.8	805.47	11,572	
	45.1		3,756	
82. 6.11.06	?	798.20	6,874	
11.18		798.00		
6.12	?	798.70	7,148	
		800.20		
6.13	?	803.80	10,439	
		806.50		
6.14	?	807.40	12,927	0.5*24*11.6H = 501
			6,053	+501 =6,554
83 6.17	25.8	779.14	447	
18	74.0	779.96	536	
19	31.9	781.80	886	
20	7.5	782.34	989	
21	25.0	783.48	1,208	
22		783.78	1,266	
	164.2		819	

Table E.2-5 Record of Large Inflow/Rainfall (2/3)

	R	W.L	V	
83. 9.28.06	9.5	793.56	4,512	
28.18	30.7	794.68	4,985	
9.29	7.1	795.94	5,635	
	14.2	796.72	6,063	
9.30	19.9	798.88	7,246	
	9.0	799.92	7,816	
10. 1	1.8	800.98	8,525	
	15.4	801.42	8,824	
10. 2	0.7	801.97	9,197	
		802.12	9,299	
10. 3	2.0	802.43	9,509	
	0.3	802.80	9,760	
10. 4	3.7	804.00	10,574	
	5.0	804.62	10,995	
10. 5	0.3	804.78	11,104	
	119.6		6,592	
84 7. 5	6.9	793.72		
6	26.1	793.66	4,555	
7	54.1	793.84	4,630	
8	53.9	795.40	5,339	
9		797.18	6,315	
10	4.5	797.30	6,380	
	144.8		1,825	
84. 9. 1.06	9.6	795.70	5,504	
1.18	4.5	795.80	5,558	
9. 2	38.6	798.90	7,202	
		799.20	7,422	
9. 3	18.2	800.10	7,928	
	0.4	801.70	9,014	
9. 4	1.1	802.50	9,556	
		802.90	9,828	
9. 5		803.28	10,086	
	72.4		4,582	

	R	W.L	V	
85.10.29.06		805.67	11,708	
29.18		805.64	11,687	
10.30	5.2	807.20	12,769	
	1.6	807.30	12,848	
10.31		807.30	12,848	
	6.8		1,140	
87 6.26.06	7.1	792.70	4,149	
26.18		792.90	4,234	
6.27	54.1	795.40	5,339	
	3.3	797.10	6,271	
6.28	0.7	797.60	6,545	
		797.90	6,709	
6.29	2.2	798.10	6,819	
		798.28	6,917	
6.30	0.4	798.50	7,038	
	67.8		2,889	
87 9.20	84.9	806.90	12,542	
	34.5	807.80	13,245	0.5*67*21.7 = 2614
		(807.3)		
	119.4		703	+2,614 =3,317
88 5.10		(795.6)		
5.15	56.3	795.30		
5.16	28.7	795.40		
	85.0			

Table E.2-5 Record of Large Inflow/Rainfall (3/3)

	R	W.L	V	
'88 6. 9.06		796.24	5,800	
9.18	1.6			
6.10	11.9	796.40	5,887	
	0.2	796.80	6,106	
6.11	17.8	797.40	6,435	
	2.3	797.60	6,545	
6.12	18.3	798.20	6,873	
	2.1	798.40	6,983	
6.13	33.6	800.60	8,267	
	8.0	801.10	8,606	
6.14	0.5	801.80	9,081	
	1.0	802.20	9,353	
6.15	10.1	802.85	9,794	
		803.20	10,031	
6.16		803.40	10,167	
	17.8	803.70	10,371	
6.17	15.8	803.86	10,479	
18	2.2	804.30	10,778	
19	11.8	804.70	11,049	
20	19.9	804.90	11,185	
21	0.3	805.20	11,389	
22	11.4	805.60	11,660	
23	12.5	806.70	12,406	
	199.1		6,606	
'88 7. 1	60.2	806.15	12,033	
2	28.7	807.20	12,769	0.5*8*5.2 = 21
3	6.6	807.60	13,086	0.5(8+44)24 =2246
4		(807.2)		
	95.5		1,053	+2,267 =3,320
'88. 8.11.06	3.9	803.75	10,405	
11.18	1.9	803.80	10,439	
8.12	19.3	804.20	10,710	
	1.3	804.90	11,185	
8.13	0.4	806.80	12,474	
	0.2	807.10	12,689	
8.14		807.20	12,769	0.5*8*16.4H = 236
	2.9	807.20	12,769	
8.15	0.1	807.30	12,848	0.5(8+15)24 =994
	3.1	807.14		
	33.1		2,443	+1,230 =3,673

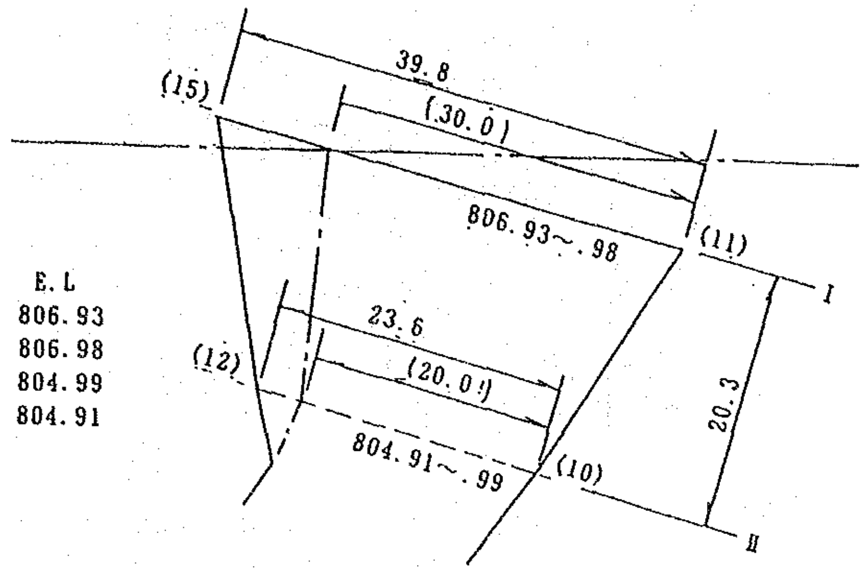
Table E.2-6 Rapid Fall of Water Level.

	W.L	V	Q	Qv	
'69. 4.30	799.87	7,789			
			2.3	1.0	
5. 5	798.10	6,819			
			4.0	1.2	
5.10	794.98	5,112			
			3.4	1.1	
5.15	791.52	3,651			
			2.4	1.0	
5.20	788.66	2,605			
'70 4.10	802.02	9,231			
			0.4	0.2	
4.15	801.78	9,068			
			4.1	1.1	
4.20	798.96	7,290			
			4.2	1.2	
4.25	795.66	5,482			
			3.7	1.1	
4.30	792.10	3,896			
			1.6	0.5	
5. 5	790.45	3,200			
'82 6.25	806.35	12,169			
			2.8	?	
6.30	804.60	10,981			
			3.5	?	
7. 5	802.36	9,461			
			3.9	?	
7.10	799.84	7,772			
			2.9	?	
7.15	797.52	6,501			
			2.4	?	
7.20	795.62	5,460			

(2) Spillway

Outlet Capacity of the Present Spillway

	Y	X	E.L
(15)	1002.56	5149.13	806.93
(11)	992.72	5187.74	806.98
(12)	980.77	5153.18	804.99
(10)	974.43	5157.90	804.91



The water flow has the critical depth at the section I shown in the figure, and becomes a supercritical flow from that point.
Since the plain of the spillway is reduced rapidly, the hydraulic calculations are conducted using the narrower section shown by the broken line in the figure.

The depth of the incoming section can be obtained as follows;

$$hr = hc = \sqrt[3]{Q^2/gB^2}$$

$$g = 9.8,\ B = 30.0$$

$$hc = 0.0484\ Q^{2/3}$$

$$Q = 93.91\ hc^{3/2}$$

Table E.2-7 Outlet Capacity of the Spillway

h m	Q m3/s	h m	Q m3/s	h m	Q m3/s
0.01	0.1	0.25	11.7	1.1	108.3
0.02	0.3	0.30	15.4	1.2	123.5
0.03	0.5	0.35	19.4	1.3	139.2
0.04	0.8	0.40	23.8	1.4	155.6
0.05	1.1	0.45	28.4	1.5	172.5
0.06	1.4	0.50	33.2	1.6	190.1
0.08	2.1	0.60	43.6	1.7	208.2
0.10	3.0	0.70	55.0	1.8	226.8
0.12	3.9	0.80	67.2	1.9	246.0
0.14	4.9	0.90	80.2	2.0	265.6
0.16	6.0	1.00	93.9	2.2	306.5
0.18	7.2				
0.20	8.4				

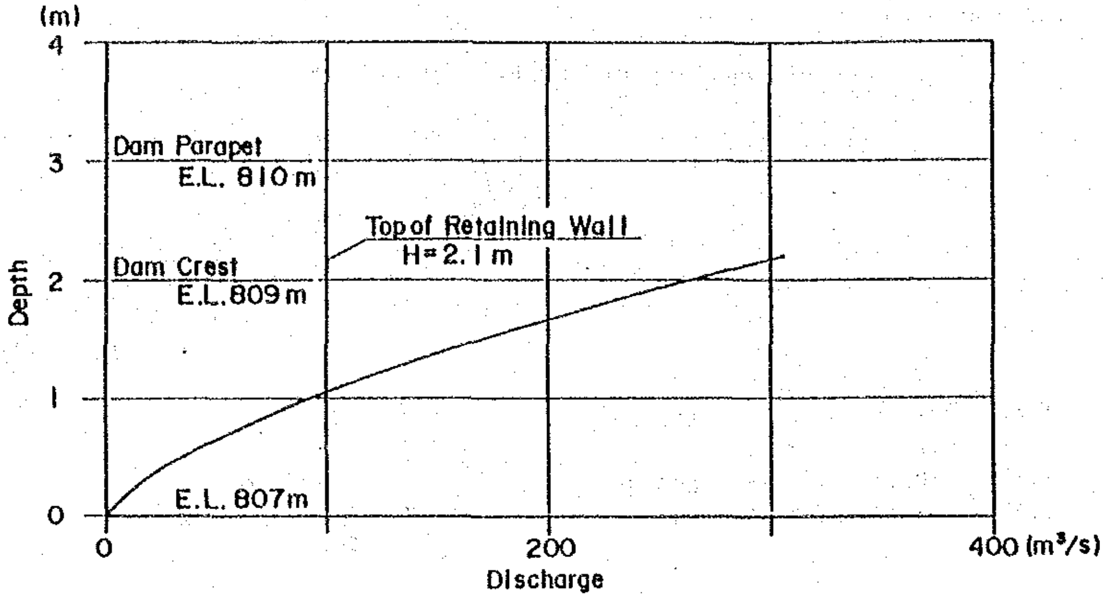


Fig. E.2-5 Discharge Capacity of the Spillway

The volume of flowing water does not flow over both the dam crest and the spillway is around 260 m3/s.

The following equation is built between section I and II.

$$\Delta h + hI + VI^2/2g = hII + VII^2/2g + n^2 \cdot L \cdot V^2/(R^{4/3} \cdot 2g)$$

Table E.2-8 Flow Description of the Spillway

	up stream				down stream			
Q m3/s	h m	A m2	R m	v m/s	h m	A m2	R m	v m/s
5	0.142	4.26	0.141	1.174	0.039	0.78	0.039	6.410
10	0.225	6.75	0.222	1.481	0.076	1.52	0.075	6.579
25	0.414	12.41	0.403	2.015	0.181	3.62	0.178	6.906
50	0.657	19.71	0.629	2.537	0.348	6.96	0.336	7.184
100	1.043	31.28	0.975	3.197	0.663	13.26	0.622	7.541
200	1.655	49.66	1.491	4.027	1.257	25.14	1.117	7.955
300	2.169	65.07	1.895	4.610	1.830	36.60	1.547	8.197

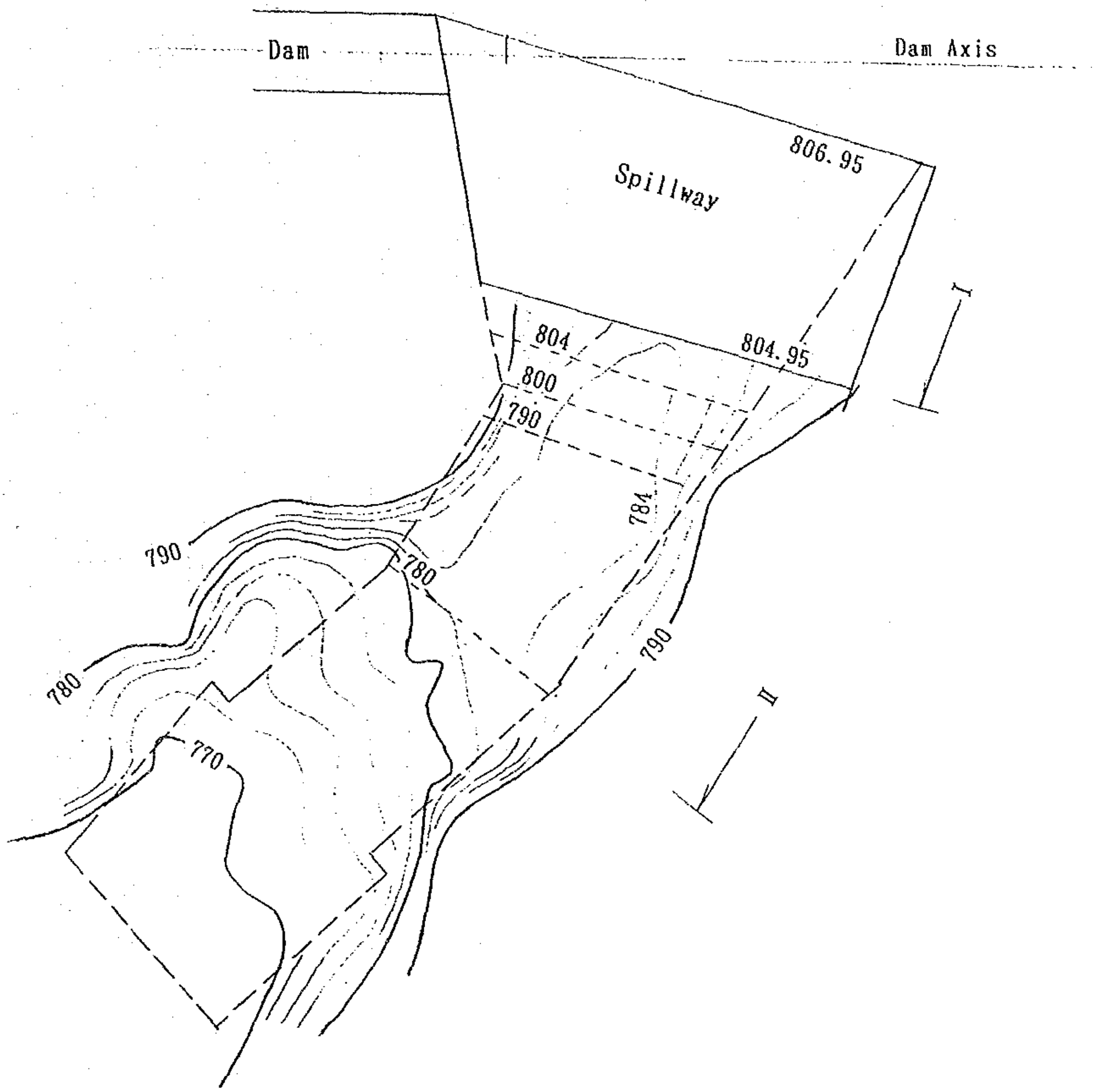


Fig. E.2-6 Washout of Spillway in First Phase of the Construction

Table E.2-9 Coordinates of Longitudinal Profile of the Dam

(Sub Dam Axis)

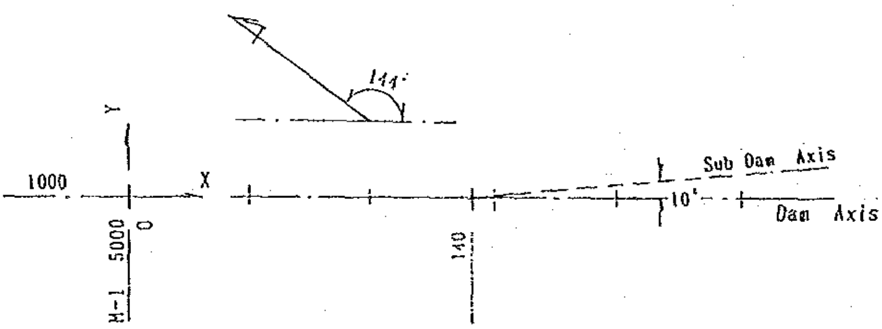
Point X (m)	Grou. G.L (m)	Base E.L (m)	note
4789.0	880.0		
4839.0	850.0		
4859.0	845.0		
4880.0	842.0		
4902.0	841.0		
4926.0	845.0		
4941.0	845.0		
4974.0	835.0		
5000.0	825.5		M-1
5005.0	823.0		
5010.0	820.0		
5015.0	815.8		
5020.0	812.4		
5023.5	809.0	805.0	Dam Right End
5030.0	807.0	802.0	
5035.0	802.0	799.0	
5040.0	797.5	793.0	
5044.8		782.2	P-4
5045.0	789.0	785.0	
5050.0	784.0	780.0	
5055.0	781.0	776.0	
5058.2		771.4	B.No1
5060.0	775.0	771.0	
5065.0	769.5	766.0	
5070.0	765.0	761.5	
5072.9			P-5;Y=990.4
5075.0	762.5	758.0	
5080.0	760.5	753.5	
5085.0	760.5	749.0	
5090.3		748.4	P-2
5095.0	765.5	755.0	
5100.0	778.5	765.5	

Point X (m)	Grou. G.L (m)	Base E.L (m)	note
5104.9		778.3	P-3
5105.0	781.5	778.0	
5105.5		779.4	B.No2
5110.0	799.0	796.0	
5111.1		797.1	P-1
5115.0	799.0	797.0	
5120.0	800.0	798.0	
5125.0	800.0	798.0	
5130.0	802.0	799.0	
5135.0	804.0	799.5	
5140.0	804.0	800.0	
5148.9	806.0	802.0	Left End
5160.0			Spillway End
5187.0			Masonry End
5188.0	808.0		
5194.0	819.0		
5215.0	830.0		
5219.0	835.0		
5235.0	843.0		
5251.0	850.0		ROAD
5257.0	850.0		ROAD
5262.0	851.0		
5275.0	874.0		
5282.0	880.0		
5290.0	882.0		M-2
5303.0	889.0		
5325.0	894.0		ROAD
5332.0	894.0		ROAD

Point (m)	Grou. G.L (m)	Struct. E.L (m)	note
5140.0	804.0		
5149.5	806.3	806.9	Dam End
5150.0		806.9	
5152.5		806.9	Spill. End
5160.0		806.9	
5170.0		807.0	
5176.2		807.0	Mason. End
5177.2	807.0		
5184.7	808.0		
5188.0	810.6		
5190.0	810.0		
5193.7	812.0		
5199.3	816.0		
5207.0	820.0		
5217.5	825.0		
5232.2	830.0		
5250.0	840.0		

Dam Cross Section

Present Y	Present E.L	Improved Y	Improved E.L
-5.40	749.00	-5.40	749.00
-3.00	797.00	-3.00	797.00
-3.00	809.00	-3.00	811.50
3.00	809.00	3.00	811.50
3.00	803.30	3.00	804.83
3.45	800.10	5.10	802.50
6.25	794.10	30.75	774.00
20.72	774.00	52.35	750.00
38.72	749.00	62.40	750.00
		60.00	747.00
		52.35	747.00
5.00	796.78	5.00	802.61
10.00	788.89	10.00	797.06
15.00	781.95	15.00	791.50
20.00	775.00	20.00	785.94
25.00	768.06	25.00	780.39
30.00	761.11	30.00	774.83
35.00	754.17	35.00	769.28
		40.00	763.72
		45.00	758.17
		50.00	752.61



(3) Leakage

The leakage observed at the left side of the dam body is devided into two types.

- The leakage (1),(3) seems to be discharged from cracks and joints directly.

- The leakage (2) which shares most of the discharge has following characters.

Increase/decrease of the leakage volume delays about twelve hours against raising/fall of the water level of the reservoir.

The temperature of leakage water is one or two degrees lower than the one at the same elevation in the reservoir.

7 Feb. 1990	leakage water	21.5°C	reservoir	23.5°C
10 Jul. 1990	leakage water	23.4°C	reservoir	24.5°C

For the reasons mentioned above, it is concluded that the leakage is not discharged directly from the cracks, but discharged through some cracks with some depth in the rocks.

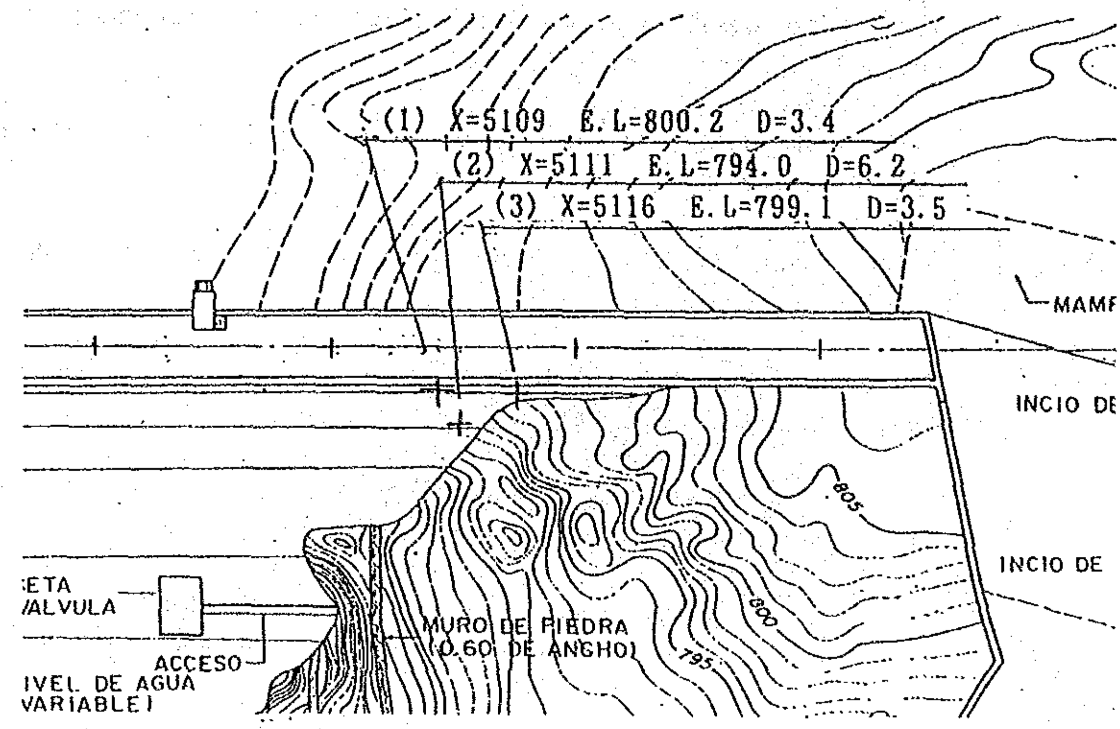


Fig. E.2-7 Location of Leakage Points

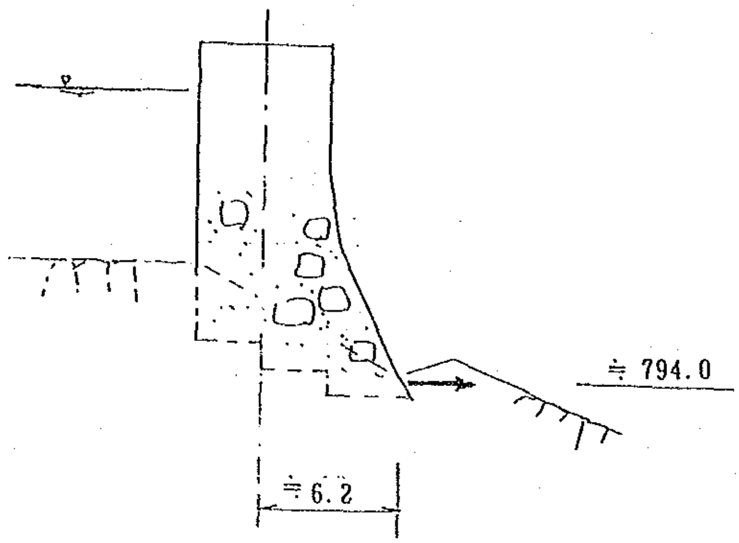


Fig. E.2-8 Section of Leakage Points

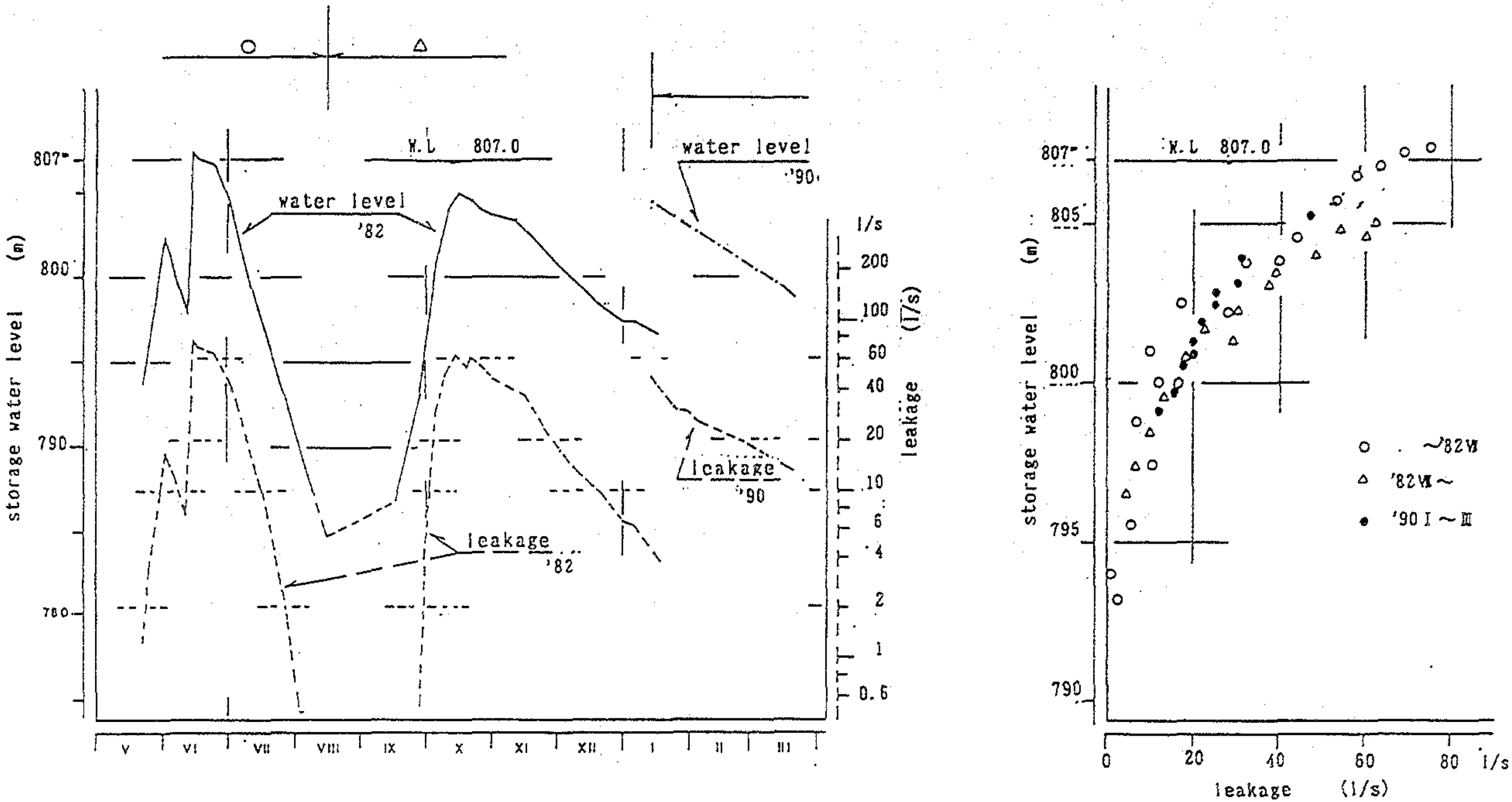


Fig. E.2-9 Correlation of Water Level of Reservoir and Leakage

Table E.2-10 Observation Data of Leakage (1/2)

Date	W.L	Leakage Ql	log Ql
	m	l/s	
'90.1.13	804.60	47.0	1.672
1.24	803.66	31.0	1.491
1.29	803.13	30.0	1.477
2. 3	802.85	25.0	1.398
2. 7	802.44	25.0	1.398
2.14	801.90	22.0	1.342
2.16	801.61	22.0	1.342
2.22	801.30	20.3	1.307
2.26	800.86	20.3	1.307
3. 3	800.47	17.7	1.248
3.12	799.73	15.2	1.182
3.18	799.49	13.1	1.117
6.23	806.54	54.0	1.732
7.10	806.94	54.0	1.732
7.12	806.97	54.0	1.732
8. 8	805.82	37.0	1.568

'82.5.22	793.90	1.2	0.079
5.25	796.70	3.4	0.531
5.28	798.80	7.0	0.845
5.30	801.00	10.0	1.000
5.31	801.90	12.0	1.079
6. 1	802.50	16.7	1.223
6. 5	800.40	12.2	1.086
6.11	798.00	7.0	0.845
6.13	803.80	31.8	1.502
6.13	806.50	58.0	1.763
6.14	807.40	74.9	1.874
6.14	807.35	74.9	1.874
6.15	807.25	69.0	1.839
6.16	807.05	69.0	1.839
6.23	806.80	63.4	1.802
6.27	805.70	53.0	1.724
6.30	804.60	43.8	1.641
7. 2	803.80	40.0	1.602
7. 5	802.20	28.0	1.447
7.10	799.80	16.5	1.217
7.15	797.50	10.5	1.021
7.20	795.60	5.6	0.748
7.25	793.20	2.5	0.398
9.30	796.50	4.4	0.643

Date	W.L	Leakage Ql	log Ql
	m	l/s	
'82.10. 5	801.30	28.9	1.461
10.10	804.00	48.3	1.684
10.15	805.00	61.8	1.791
10.20	804.80	56.6	1.753
10.20	804.80	54.3	1.735
10.21	804.60	60.2	1.780
10.21	804.50	59.7	1.776
10.25	804.10	55.2	1.742
10.31	803.70	45.6	1.659
11. 5	803.60	42.5	1.628
11.10	803.40	38.7	1.587
11.15	803.10	36.7	1.565
11.20	802.30	30.0	1.477
11.25	801.70	22.3	1.348
11.30	800.80	18.5	1.267
12. 5	800.20	15.3	1.185
12.10	799.60	12.8	1.107
12.15	798.90	11.2	1.049
12.20	798.40	9.9	0.996
12.31	797.40	6.7	0.826
'83.1. 5	797.40	6.4	0.806
1.16	796.60	4.0	0.602

Other Data

Date	W.L	Leakage Ql	log Ql
'82.7.31	790.60	0.80	-0.097
8. 5	788.80	0.22	-0.658
8. 9	787.20	0.00	-
8.15	784.70	0.00	-
9.16	787.00	0.00	-
9.27	793.00	0.00	-

Table E.2-10 Observation Data of Leakage (2/2)

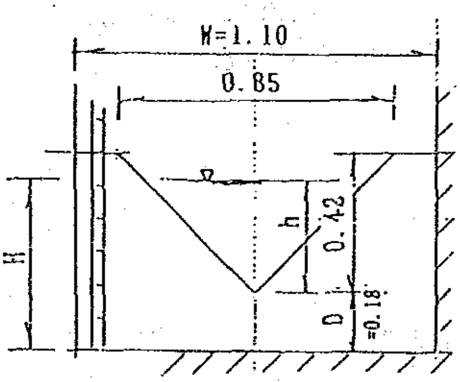
Date	Water Level	Measured Depth H	Leakage Q	Water Temp. (2)	(3)	(3')
90.1.13	804.60	44.0	48.0			
1.24	803.66	40.0	31.0			
1.29	803.13	39.5	29.5			
2.3	802.85	38.0	25.0			
2.7	802.44	38.0	25.0	21.5	24.5	23.5
2.14	801.90	37.0	22.0			
2.16	801.61	37.0	22.0	21.5		23.0
2.22	801.30	36.5	20.5	21.8		
2.26	800.86	36.5	20.5			
3.3	800.47	35.5	17.7			
3.12	799.73	34.5	15.3	22.5	21.5	
3.18	799.49	33.5	13.1			
90.6.23	806.54	45.5	54.0			
7.10	806.94	45.5	54.0	23.4	23.4	
7.12	806.97	45.5	54.0			
8.8	805.82	41.5	37.0			

Measured Depth H	Water Depth h	Coef. C	Leakage Q
60	42	1.405	161.0
58	40	1.400	142.0
56	38	1.396	124.0
54	36	1.392	108.0
52	34	1.389	94.0
50	32	1.386	80.0
49	31	1.384	74.0
48	30	1.383	68.0
47	29	1.382	63.0
46	28	1.381	57.0
45	27	1.380	52.0
44	26	1.379	48.0
43	25	1.379	43.0
42	24	1.378	39.0
41	23	1.378	35.0
40	22	1.377	31.0
39	21	1.377	28.0
38	20	1.378	25.0
37	19	1.378	22.0
36	18	1.378	18.9
35	17	1.379	16.4
34	16	1.380	14.1
33	15	1.381	12.0
32	14	1.383	10.1
31	13	1.385	8.4
30	12	1.387	6.9
29	11	1.390	5.6
28	10	1.394	4.4
27	9	1.394	3.4
26	8	1.394	2.5
25	7	1.394	1.8

Formula for Leakage Calculation

$$Q = 1000 * c * h^{5/2}$$
$$c = 1.355 + 0.61(0.0083h - 0.09)^2$$

Q : l/s   h : m



NUMATI, KUROKAWA and FUTIZAWA's Formula
- 90° Measuring weir

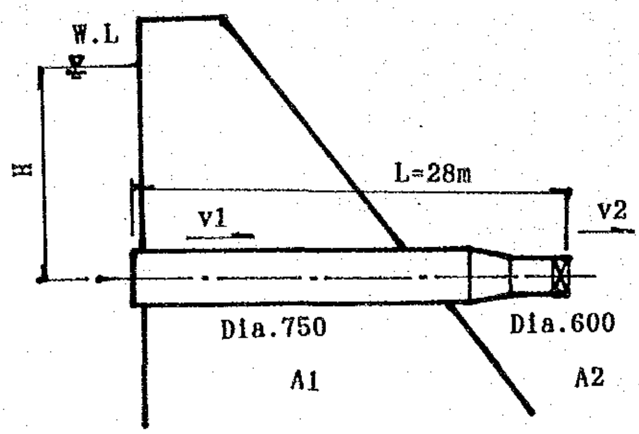
$$Q = Kh^{5/2}$$
$$K = 81.2 + h/0.24 + (8.4 + 12/D)(h/W + 0.09)$$

Q : discharge (m^3/m) h : head (m)

(4) Outlet Work

1) Estimation of Discharge from the Valve (Nov.1974 - Present)

A outlet pipe and a valve are installed in the Dam as shown below.



The discharge is estimated as follows.

$Q = A \cdot v \quad Q = k * \sqrt{2gHo} * A_2$

where, Ho : total head minus head loss
k : discharge efficiency of valve 0.8 - 0.9
assumed 0.8 in this case

The head loss is the total of inflow loss, friction loss and reducing loss.

$\Sigma h = hi + hf + he$

$hi = 0.5 * v_1{}^2/2g = 0.0255 * v_1{}^2$
$hf = 124.6 * n^2 * L * v_1{}^2/(D_1{}^{4/3} * 2 * g)$
where L : 28.0, D_1 = 0.75, n=0.015 (bending pipe)
$he = 0.025 * (1-(A_2/A_1)^2) * v_2{}^2/(8 * \sin(0/2) * 2 * g)$
$= 0.0005 * v_2{}^2$
$= 0.0011 * v_1{}^2$

Therefore the total head loss is;

$h = (0.0255+0.0588+0.0011) * v_1{}^2 = 0.0854 * v_1{}^2$
note : $A_1 = 1/4 * \pi * D_1{}^2 = 1/4 * \pi * 0.75^2 = 0.442\ m^2$
$A2 = 1/4 * \pi * D_2{}^2 = 1/4 * \pi * 0.60^2 = 0.283\ m^2$

$$Q = 0.8 * \sqrt{2gHo} * A_2$$

$$Q = 0.8 * 19.6 * (H - 0.0854 * v_1^2) * 0.283$$

$$Q = 0.835 * H^{1/2}$$

Table E.2-11 Water Discharge from Valve

Howell-Bunger Valve 600 φ

W.L.	h_e	Valve Operated Degree								
	WL-775	1′	2	3	4	5	6	8	10	12′
m	m	m³/s								m³/s
807	32	0.39	0.79	1.18	1.57	1.97	2.36	3.15	3.94	4.723
806	31	0.39	0.77	1.16	1.55	1.94	2.32	3.10	3.87	4.649
805	30	0.38	0.76	1.14	1.52	1.91	2.29	3.05	3.81	4.573
804	29	0.37	0.75	1.12	1.50	1.87	2.25	3.00	3.75	4.497
803	28	0.37	0.74	1.10	1.47	1.84	2.21	2.95	3.68	4.418
802	27	0.36	0.72	1.08	1.45	1.81	2.17	2.89	3.62	4.339
801	26	0.35	0.71	1.06	1.42	1.77	2.13	2.84	3.55	4.258
800	25	0.35	0.70	1.04	1.39	1.74	2.09	2.78	3.48	4.175
799	24	0.34	0.68	1.02	1.36	1.70	2.05	2.73	3.41	4.091
798	23	0.33	0.67	1.00	1.33	1.67	2.00	2.67	3.34	4.005
797	22	0.33	0.65	0.98	1.31	1.63	1.96	2.61	3.26	3.916
796	21	0.32	0.64	0.96	1.28	1.59	1.91	2.55	3.19	3.826
795	20	0.31	0.62	0.93	1.24	1.56	1.87	2.49	3.11	3.734
794	19	0.30	0.61	0.91	1.21	1.52	1.82	2.43	3.03	3.640
793	18	0.30	0.59	0.89	1.18	1.48	1.77	2.36	2.95	3.543
792	17	0.29	0.57	0.86	1.15	1.43	1.72	2.30	2.87	3.443
791	16	0.28	0.56	0.84	1.11	1.39	1.67	2.23	2.78	3.340
790	15	0.27	0.54	0.81	1.08	1.35	1.62	2.16	2.69	3.234
785	10	0.22	0.44	0.66	0.88	1.10	1.32	1.76	2.20	2.641
780	5	0.16	0.31	0.47	0.62	0.78	0.93	1.24	1.56	1.867

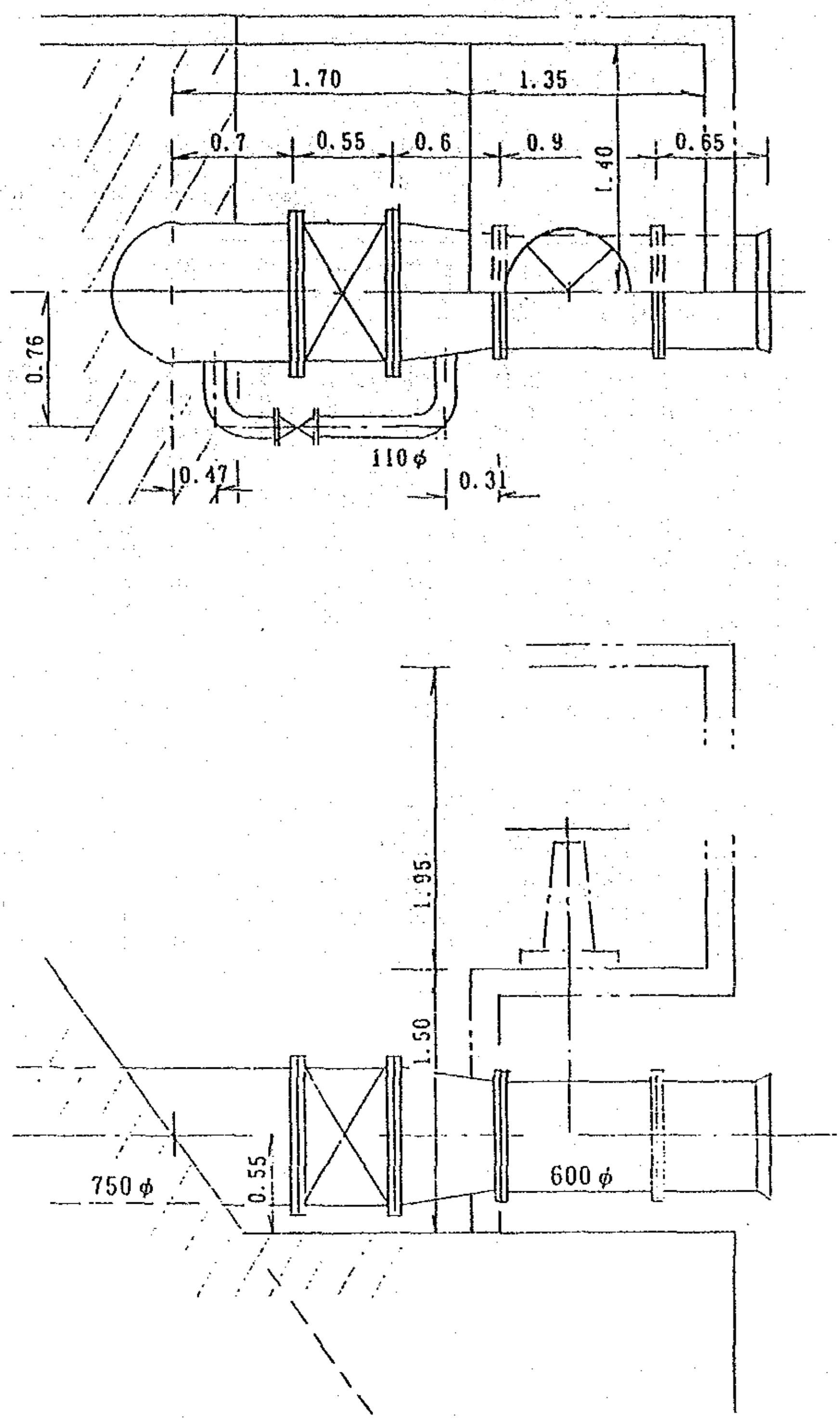


Fig. E.2-10 Details of Valve Location

The outlet discharge is computated by the following formula;

$$Q = C*\sqrt{2gHo}*A$$

where Qo : outlet discharge (m^3/sec)
C : discharge coefficient at full-open stage of valve
g : gravity acceleration
Ho : effective head
A : sectional area of valve (= $PI*D^2/4$) (m^2)
D : diameter of valve

In case of C=0.85

$Q = 2.95*D^2*$ Ho (m^3/sec)

$D = (Qo/(2.95*$ Ho $))^{1/2}*1000$ (mm)

This relation is shown in the following figure.

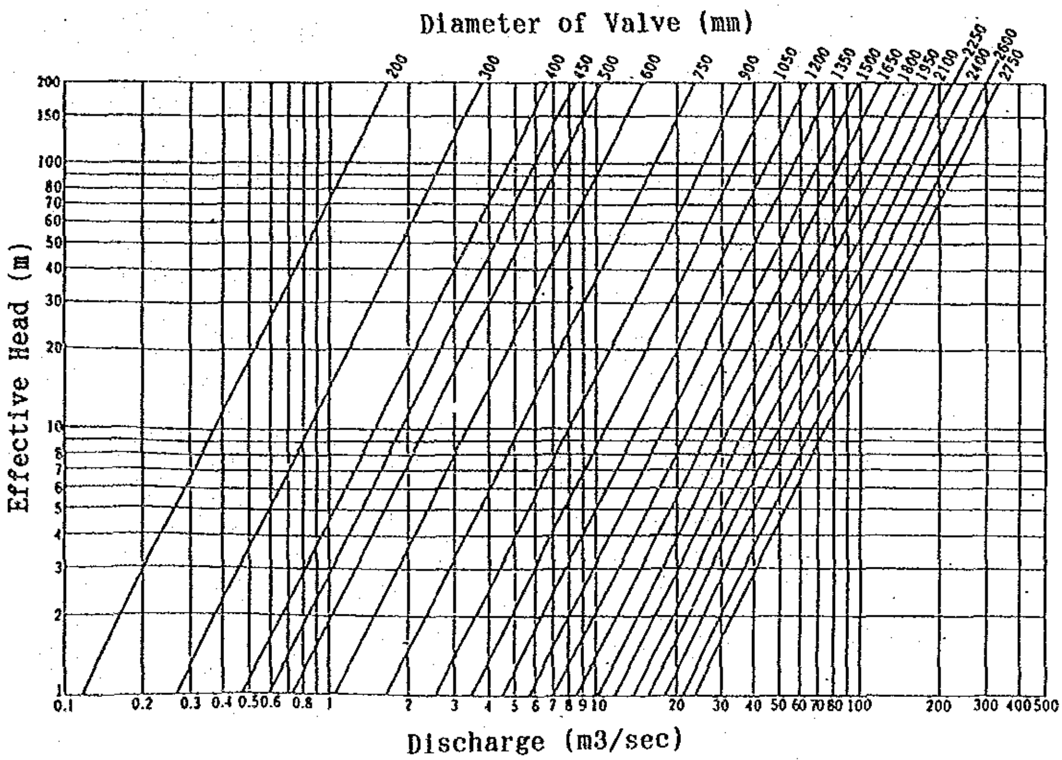


Fig. E.2-11 Correlation of Head, Discharge and Diameter of Valves

(5) Water Balance

Table E.2-12 Water Balance of the Reservoir in 1969

Month	Water Level	Storage Volume	Outfall(+) Storage(-)	Inflow Inflow	Inflow Extra	Outfall Evapo.	Outfall Leakage	Outfall Valve	Outfall Other	Outfall Total
			1)	2)						1)+2)
	m									
	(807.00)	(12,610)								
1	807.00	12,610	0	2,500	4,150	110	320	90	1,980	2,500
2	806.20	12,067	540	1,250	860	110	320	350	1,010	1,790
3	804.84	11,144	920	1,250	-	100	300	350	1,420	2,170
4	799.87	7,789	3,360	1,250	-	100	270	860	3,380	4,610
5	786.98	2,098	5,690	1,250	-	50	120	2,680	4,090	6,940
6	807.00	12,610	-10,510	14,850	21,430	100	280	3,460	500	4,340
7	800.34	8,091	4,520	2,500	1,810	100	280	3,720	2,920	7,020
8	807.00	12,610	-4,520	8,930	5,100	100	270	3,540	500	4,410
9	807.00	12,610	0	4,560	20,040	110	320	3,630	500	4,560
10	807.00	12,610	0	4,650	39,480	110	320	3,720	500	4,650
11	801.54	8,905	3,700	2,500	260	100	280	3,110	2,710	6,200
12	803.92	10,520	-1,610	3,090	-	100	280	600	500	1,480
Total			2,090	48,580	93,130	1,190	3,360	26,110	20,010	50,670
						0.04	0.11	0.83	0.64	1.61

Table E.2-13 Water Balance of the Reservoir in 1972

Month	Water Level	Storage Volume	Outfall(+) Storage(-)	Inflow Inflow	Inflow Extra	Outfall Evapo.	Outfall Leakage	Outfall Valve	Outfall Other	Outfall Total
	m									
	(807.00)	(12,610)								
1	806.71	12,413	200	2,500	0	110	320	420	1,850	2,700
2	805.60	11,660	750	2,500	-	110	310	450	2,380	3,250
3	803.00	9,896	1,760	1,250	-	100	300	460	2,150	3,010
4	799.78	7,739	2,160	1,250	-	90	250	580	2,490	3,410
5	792.78	4,183	3,560	1,250	-	70	170	910	3,660	4,810
6	794.68	4,985	-800	2,500	-	70	150	190	1,290	1,700
7	(791.34)	3,575	1,410	2,500	-	50	110	500	3,250	3,910
8	794.40	4,867	-1,290	3,750	-	60	130	250	2,020	2,460
9	799.92	7,816	-2,950	5,000	-	80	200	100	1,670	2,050
10	807.00	12,610	-4,790	5,690	11,750	100	280	20	500	900
11	806.95	12,576	30	2,500	3,800	110	320	70	2,030	2,530
12	806.06	11,972	600	2,500	-	100	310	470	2,220	3,100
Total			640	33,190	15,550	1,050	2,850	4,420	25,510	33,830
						0.03	0.09	0.14	0.81	1.07

(6) Stability Analysis

Table E.2-14 Results of Stability Calculation on the Present Dam

Present State m=0.72
K =0.15 U =0.50

	H.W.L = 807				H.W.L=797	HHWL =809 K = -
	EL=749 B=44.12	EL=765 B=31.80	EL=780 B=20.25	EL=795 B=8.86	EL=749 B=44.12	EL=749 B=44.12
V (t)	2,054.2	1,096.5	495.6	156.8	2,140.5	2,036.9
H (t)	2,422.2	1,314.3	578.0	139.5	1,799.4	1,853.9
M (t·m)	78,312	31,101	8,973	1,221	62,866	66,703
F.S	3.41	4.30	5.94	10.43	4.63	4.45
l (m)	38.12	28.36	18.11	7.79	29.37	32.75
e (m)	16.06	12.46	7.98	3.36	7.31	10.69
p (t/m2)	46.6	34.5	24.5	17.7	48.5	46.2
p1(t/m2)	148	116	82	58	97	113
p2(t/m2)	-55	- 47	- 33	-23	0	-21

Table E.2-15 Dam Stability Calculation (1/6)

Present m=0.72 H.W.L=807 U=0.50 K=0.15

E.L=749 L=44.12

	V	H	y	x	M
W1	24.0		1.20		29
2	57.6		0.80		46
D1	115.2		1.60		184
2	178.8		5.40		966
3	19.5		9.48		185
4	834.4		7.03		5,866
5	1,464.4		22.47		32,905
P		1,682.0		19.33	32,513
E		53.9		4.67	252
U	-639.7		14.71		-9,410
KD1		17.3		16.00	277
2		26.8		52.55	1,408
3		2.9		47.10	137
4		125.2		22.55	2,823
5		219.7		15.03	3,302
KW		294.4		23.20	6,830
	2,054.2	2,422.2			78,312

Table E.2-15 Dam Stability Calculation (2/6)

Present m=0.72 H.W.L=807 U=0.50 K=0.15

E.L=765 B=31.80

	V	H	y	x	M
W1	16.0		0.80		13
2	25.6		0.53		14
D1	51.2		1.07		55
2	178.8		4.60		822
3	19.5		8.68		169
4	538.4		6.23		3,354
5	600.9		17.83		10,714
P		924.5		14.33	13,248
E		-		-	-
U	-333.9		10.60		-3,539
KD1		7.7		10.67	82
2		26.8		36.55	980
3		2.9		31.10	90
4		80.8		14.55	1,176
5		90.1		9.70	874
KW		181.5		16.80	3,049
	1,096.5	1,314.3			31,101

Table E.2-15 Dam Stability Calculation (3/6)

Present m=0.72 H.W.L=807 U=0.50 K=0.15

E.L=780 B=20.25

	V	H	y	x	M
W1	8.5		0.42		4
2	7.2		0.28		2
D1	14.4		0.57		8
2	178.8		3.85		688
3	19.5		7.93		155
4	260.8		5.48		1,429
5	143.1		13.48		1,929
P		392.0		9.33	3,657
E		-		-	-
U	-136.7		6.75		-923
KD1		2.2		5.67	12
2		26.8		21.55	578
3		2.9		16.10	47
4		39.1		7.05	276
5		21.5		4.70	101
KW		93.5		10.80	1,010
	495.6	578.0			8,973

Table E.2-15 Dam Stability Calculation (4/6)

Present m=0.72 H.W.L=807 U=0.50 K=0.15

E.L=795 B=8.86

	V	H	y	x	M
W1	1.0		0.05		0
2	0.1		0.03		0
D1	0.2		0.07		0
2	168.0		3.10		521
3	14.1		7.02		99
4					
5					
P		84.5		4.33	366
E		-		-	-
U	-26.6		2.92		-78
KD1		0.0		0.67	0
2		25.2		7.00	176
3		2.1		1.70	4
4					
5					
KW		27.7		4.80	133
	156.8	139.5			1,221

Table E.2-15 Dam Stability Calculation (5/6)

m=0.72 H.W.L=798 U=0.50 K=0.15

E.L=749 L=44.12

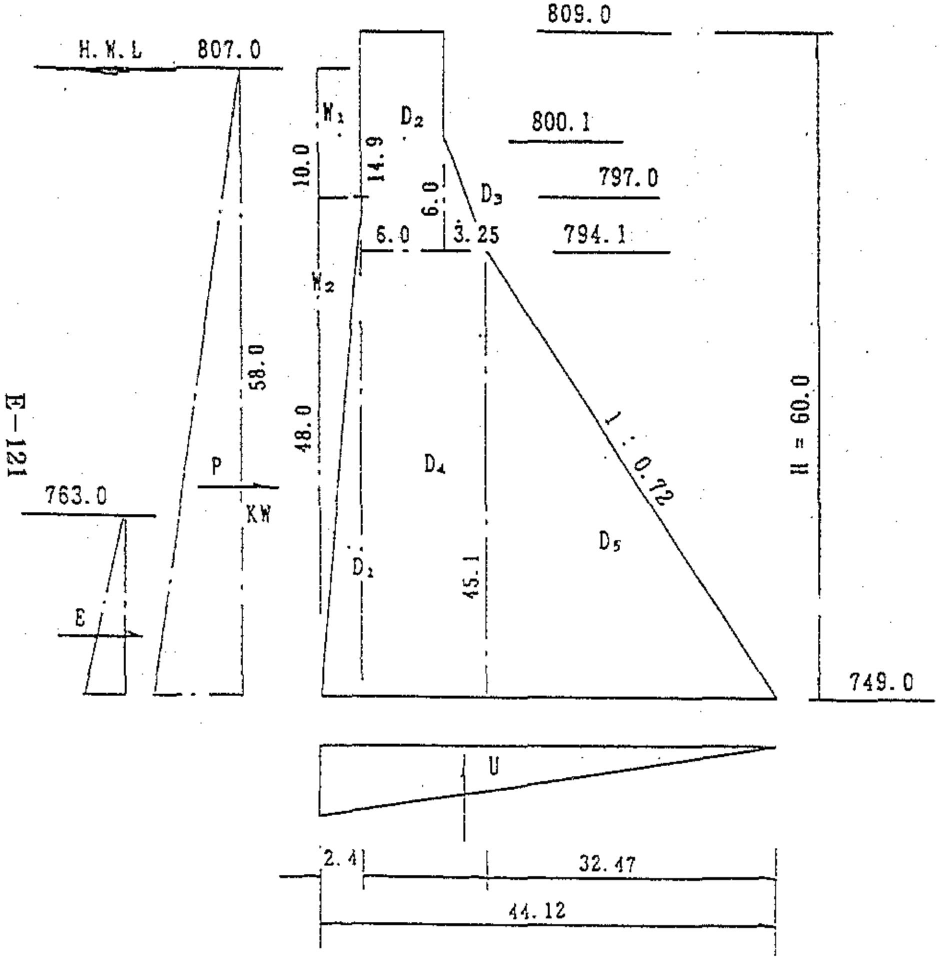
	V	H	y	x	M
W1	2.4		1.20		3
2	57.6		0.80		46
D1	115.2		1.60		184
2	178.8		5.40		966
3	19.5		9.48		185
4	834.4		7.03		5,866
5	1,464.4		22.47		32,905
P		1,200.5		16.33	19,604
E		53.9		4.67	252
U	-540.5		14.71		-7,951
KD1		17.3		16.00	277
2		26.8		52.55	1,408
3		2.9		47.10	137
4		125.2		22.55	2,823
5		219.7		15.03	3,302
KW		210.1		19.60	4,118
	2,131.8	1,856.4			64,125

Table E.2-15 Dam Stability Calculation (6/6)

m=0.72 H.W.L=797 U=0.50 K=0.15

E.L=749 B=44.12

	V	H	y	x	M
W1					-
2	57.6		0.80		46
D1	115.2		1.60		184
2	178.8		5.40		966
3	19.5		9.48		185
4	834.4		7.03		5,866
5	1,464.4		22.47		32,905
P		1,152.0		16.00	18,432
E		53.9		4.67	252
U	-529.4		14.71		-7,787
KD1		17.3		16.00	277
2		26.8		52.55	1,408
3		2.9		47.10	137
4		125.2		22.55	2,823
5		219.7		15.03	3,302
KW		201.6		19.20	3,871
	2,140.5	1,799.4			62,866



Calculation basis :

LOAD	at E.L.749m		
W_1	Water Load W_1 =2.4*10.0 =24.0		y $= {}^1/_2$*2.4 =1.20
W_2	Water Load W_2 $= {}^1/_2$*2.4*48.0 =57.6		y $= {}^1/_3$*2.4 =0.80
D_1	Conc. Dead Lord D_1 $= {}^1/_2$*2.4*48.0*2.0 =115.2 kD_1=0.15*D_1 =17.3	k=0.15	y $= {}^2/_3$*2.4 =1.60 x$= {}^1/_3$*48.0 =16.00
D_2	D_2 =6.0*14.9*2.0 =178.8 kD_2=0.15*D_2 =26.8		y =2.40+$^1/_2$*6.0 =5.40 x =45.10+$^1/_2$*14.9 =52.55
D_3	D_3 $= {}^1/_2$*3.25*6.0*2.0 =19.5 kD_3=0.15*D_3 =2.9		y =2.40+6.00+$^1/_3$*3.25 =9.48 x =45.10+$^1/_3$*6.0 =47.10
D_4	D_4 =9.25*45.1 =834.4 kD_4 =0.15*D_4 =125.2		y =2.40+$^1/_2$*9.25 =7.03 x $= {}^1/_2$*45.1 =22.55
D_5	D_5 $= {}^1/_2$*32.47*45.1*2.0 =1464.4 kD_5 =0.15*1464.4 =219.7		y =2.40+9.25+$^1/_3$*32.47 =22.47 x $= {}^1/_3$*45.1 =15.03
P	Hydrostatic Pressure P $= {}^1/_2$*58.0^2 =1682.0		x $= {}^1/_3$*58.0 =19.33
E	Siltation Pressure E =0.5*1.1*58.0^2 =53.9	Ce =0.5 w =1.1	x $= {}^1/_3$*14.0 =4.67
U	Uplift U $= {}^1/_4$*58.0*44.12 = -639.7	U=0.50	y =1/3*44.12 =14.71
Pd	Hydrodinamic Pressure Pd $= {}^7/_{12}$*1*0.15*58.0^2 =294.4		x $= {}^2/_5$*58.0 =23.20

Fig. E.2-12 Schema of the Present Dam and Calculation Base

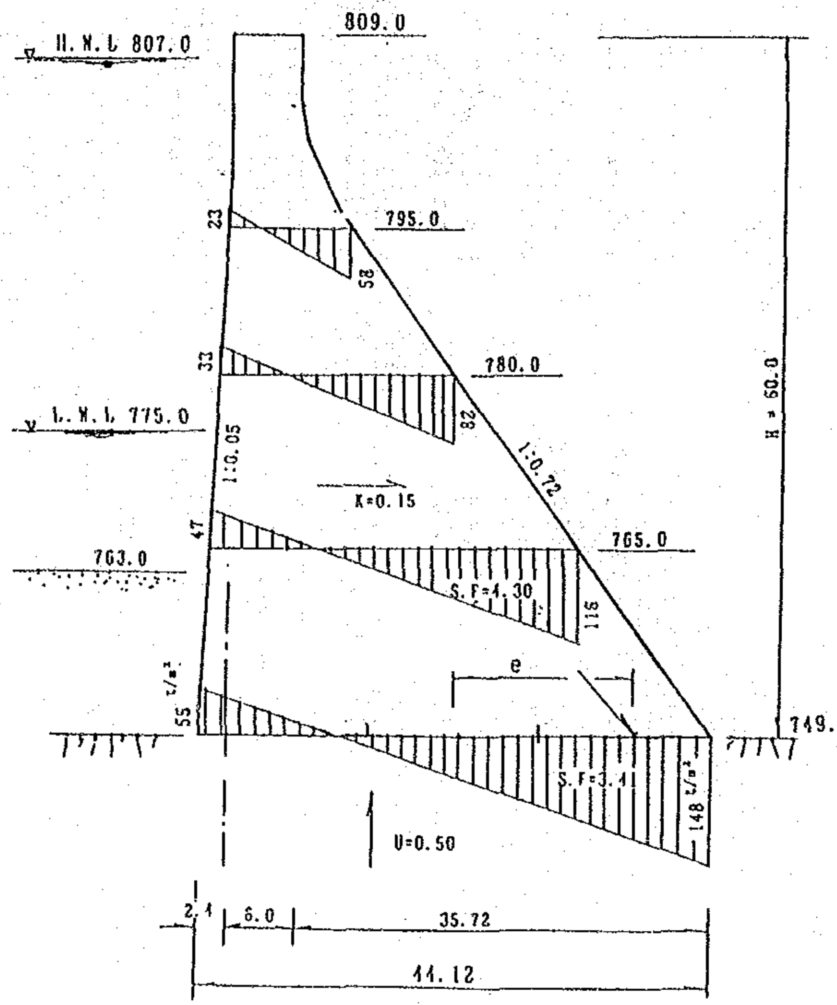


Fig. E.2-13 Calculation of the Present Dam Stability

E.3 The Coyolar Dam Rehabilitation Plan

(1) Design Flood Discharge

The design flood discharge of the Dam is Q = 700 m3/s (T = 1/200) as shown in the following table and figure.

Table E.3-1 Hydrograph

T =1/200, 1/50

Rainfall			Discharge		
T	R_{200}	R_{50}	T	Q_{200}	Q_{50}
hr	mm	mm	hr	m³/s	m³/s
1	0.3	0.3	2.5	3.9	1.2
2	0.4	0.4	3.5	6.7	3.9
3	0.5	0.4	4.5	9.1	6.3
4	0.6	0.4	5.5	12.0	7.6
5	0.8	0.6	6.5	15.4	11.3
6	1.0	0.7	7.5	19.6	14.4
7	1.3	1.0	8.5	26.0	19.1
8	1.8	1.3	9.5	35.8	26.7
9	2.7	2.1	10.5	53.7	41.1
10	4.5	3.5	11.5	91.7	71.5
11	8.8	7.0	12.5	205.3	165.0
12	25.6	21.0	13.5	502.0	427.1
13	60.0	53.5	14.5	685.0	592.1
14	14.2	11.3	15.5	538.4	459.6
15	6.2	4.8	16.5	337.7	282.6
16	3.5	2.6	17.5	199.2	161.3
17	2.2	1.7	18.5	112.9	91.4
18	1.6	1.2	19.5	67.7	53.2
19	1.1	0.8	20.5	42.7	32.4
20	0.8	0.7	21.5	28.6	20.3
21	0.7	0.5	22.5	19.6	14.6
22	0.5	0.4	23.5	14.9	11.4
23	0.5	0.4	24.5	12.2	9.8
24	0.4	0.4	25.5	8.9	7.5
25			26.5	4.9	4.2
26			27.5	2.2	1.9

Unit Hydrograph	
T	Rate
hr	
0.0	0
0.5	0.194
1.0	0.287
1.5	0.368
2.0	0.329
2.5	0.257
3.0	0.188
3.5	0.130
4.0	0.089
4.5	0.059
5.0	0.038
5.5	0.025
6.0	0.016
6.5	0.010
7.0	0.006
7.5	0.004
8.0	0.003
8.5	0.002
9.0	0.001

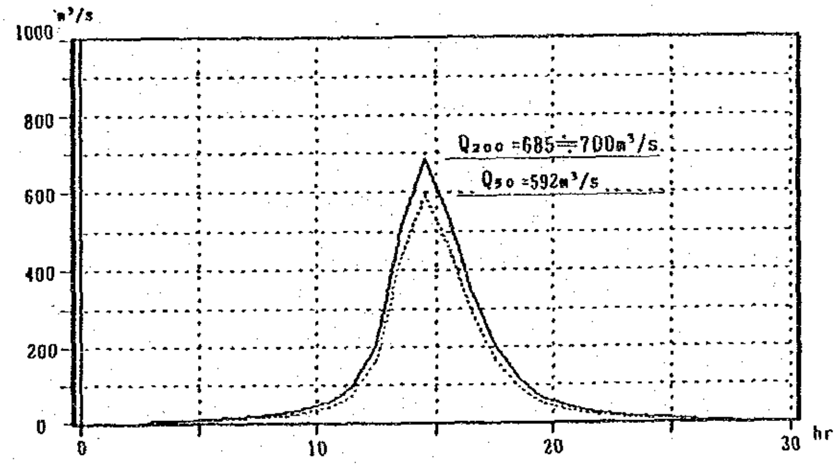


Fig. E.3-1 Hydrograph

(2) Rehabilitation Plan

1) Dam Height

<u>Height of Nonoverflow Section</u>

The Dam height of nonoverflow section is to be studied in accordance with the conditions of the reservoir.

Determine the height of the non-overflow section of the dike, depending on whether the dam under consideration is equipped with flood discharge gate or not, by fixing it to a value greater than the maximum of those given in the Table 11-1 when the dam is of concrete type and fixing it to a value greater than the maximum added with 1 when the dam is of fill type.

Table E.3-2 Height of the Non-overflow Section of the Dike

Article	Category	Height of the non-overflow section of the dike (unit: m)
1	Dam equipped with flood discharge gate	Hn + hw + he + 0.5 (in case hw + he $<$1.5, Hn + 2) Hs + hw + $\frac{he}{2}$ + 0.5 (in case hw + $\frac{he}{2}$ $<$1.5, Hs + 2) Hd + hw + 0.5 (in case hw $<$ 0.5, Hd + 1)
2	Dam not equipped flood charge gate	Hn + hw + he (in case hw + he $<$ 2, Hn + 2) Hs + hw + $\frac{he}{2}$ (in case hw + $\frac{he}{2}$ $<$ 2, Hs + 2) Hd + hw (in case hw $<$ 1, Hd + 1)

The symbols used in the above expressions indicate the following indication:

- Hn: Normal water level (unit: m)
- hw: Height of surge due to wind from the water level of the reservoir at the design flood level (unit: m)
- he: Height of surge due to earthquake with design seismic coefficient, from the water level of the reservoir at normal water level (unit: m)
- Hs: Surcharge water level (unit: m)
- Hd: Design flood level (unit: m)

For a fill dam not equipped with flood gate where water flows down the spillway with depth of 2.5 m or less at the design flood run-off, expressions "in case hw + he < 2, Hn + 2" and "in case hw + $\frac{he}{2}$ < 2, Hs +2" given in the Article 2 should be replaced by those "in case hw + he < 1, Hn + 1" and "in case Hw + $\frac{he}{2}$ < 1, He + 1" respectively.

Height of Surge by Wind

The height of surge due to wind should be calculated in the method S.M.B. When the upstream side of the dike is nearly vertical, this height must be calculated by the following expression as reflected waves change it into total height of wave.

$$hw = 0.00086 * v^{1.1} * F^{0.45}$$

where,

v: Average speed of wind for ten minutes (m/s)
v = 20 m/s

F: Maximum distance from the dike to the opposite bank at the design flood level (m), F = 1000 m

$$hw = 0.00086 * 20^{1.1} * 1000^{0.45} = 0.52$$

Height of Wave by Earthquake

The height of wave due to earthquake is calculated by the expression of Seiichi Sato.

$$he = K \cdot \tau \cdot \sqrt{gHo} / (2\pi)$$

where,

K : Design seismic intensity at the normal water level, K=0.15

τ : Cycle of earthquake, τ= 1 sec

Ho: Depth of reservoir at normal water level (m)

g : Gravity acceleration (9.8 m/s2)

$$he = 0.15*1*\sqrt{9.8*58.0} / (2*\pi) = 0.57$$

Elevation of Nonoverflow Section

The elevation of nonflow section in this Dam is determined by "design flood water level" case as the overflow depth is large.

design flood water level	EL.810.4 m (=807.4+3.4)
extra height	1.0 m
elevation of the nonoverflow section	EL.811.4 m

2) Shape of the Dam

The shape of the rehabilitation dam are decided as follows;

- The elevation of vertex of the basic triangle is EL.811.5 m.
- The shape of downstream dam body is 1:m = 1:0.90
- The shape of upstream dam body is same as the existing one.

The elevation of the overflow section at the center of the dam body is EL.807.0m and used as a spillway.

The shape of the overflow crest at the upstream side of the dam was determined by the approximation of the result of "HARROLD Numbers". The crest shape of the lower stream side was determined by the approximation quadric line.

Upstream side of the dam (3m from dam-axis)

x_1/Hd = 0.282	x_1 =0.92 → 1.00	where the design depth (Hd) =3.25m
x_2/Hd = 0.175	x_2 =0.57 → 0.65	
x_3/Hd = 0.107	x_3 =0.35 → 0.35	
r_1/Hd = 0.5	r_1 =1.63 → 1.80	
r_2/Hd = 0.2	r_2 =0.2 → 0.75	
y/Hd = 0.126	y =0.41 → 0.40	

Downstream side of the dam

$y^2 = 4m^2hx$ $y^2 = 14.58x$ (m=0.90m h=4.5m)

x=	0.05	0.1	0.2	0.4	0.62	1.0	1.5	2.0	2.48	3.5	4.5m
y=	0.85	1.21	1.71	2.41	3.00	3.82	4.68	5.40	6.00	7.14	8.10m

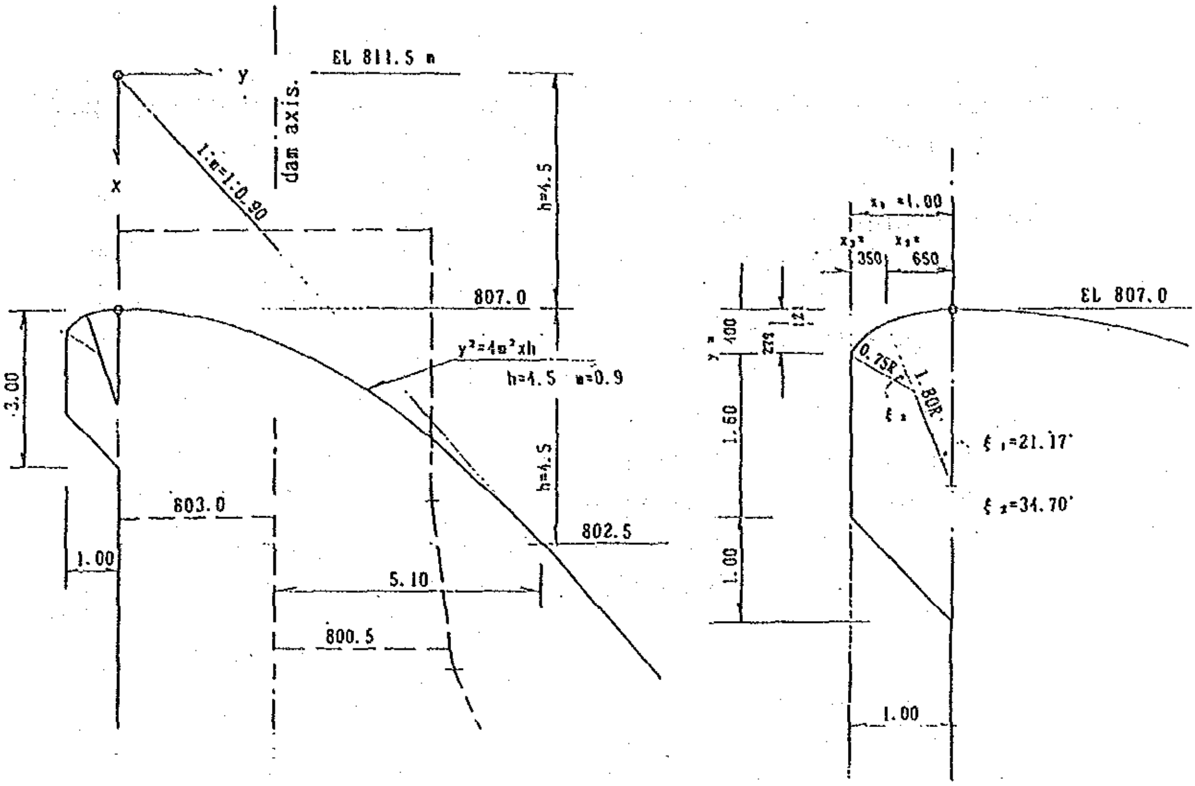


Fig. E.3-2 Shape of Dam Crest

(3) Calculation of Overflow Discharge

The design flood discharge of the Dam (return period of 200 years is assumed as $Q = 700\ m^3/sec$.

Overflow width : 60.0m
Pier : 1.2m x 4each

$$Q = C \times (B - NKH) \times H^{3/2}$$

where,

C : Overflow coefficient (=Cd)
B : Overflow width = 60.0m
N : Numbers of contraction = 4x2 = 8
K : Contraction coefficient = 0.10

$$C = 1.6 \times \{(1+2a(H/Hd))/(1+a(H/Hd))\}$$
$$Cd = 1.971 + 0.498\zeta + 6.63\zeta^2$$
$$\zeta : x/Hd = 0.056 \quad \text{at } y = 0.5Hd$$

$$\therefore \quad Cd = 2.02 = 2.0$$

against Hd = 3.4
$$Q = 2.0 \times (60.0 - 8 \times 0.1 \times 3.4) \times 3.4^{3/2} = 718m^3/sec > 700m^3/sec$$

Therefore, the overflow depth is $Hd \simeq 3.4m$.

(4) Design Seismic Intensity

1) Computation of Design Seismic Intensity from Data of Previous Earthquakes

For determination of design seismic intensity, the previous seismic acceleration at the Dam site are studied statistically from the collected data of past earthquakes.

The collected data covers the period 1898-1976 and is listed below.

It is estimated from the magnitude and focal distance of the earthquake by Okamoto's formula as follows:

$$\log(G/640) = ((x+40)/100) \times (-7.604 + 1.7244M - 0.1036M^2)$$

where,

G : Maximum seismic acceleration (Gal)
x : Distance from the epicenter of earthquake (Km)
M : Magnitude (by Ritcher scale)

The maximum seismic acceleration estimated from the past earthquakes are rearranged in order and the probability calculation was performed based on the statistic data of the non-periodic seismic occurrence probability as follows:

Return period Te = (n/m)

n = Recorded year
m = Order of data
or
y = log Te

$$a = (x.y - xy) / (y^2 - y^2)$$
$$b = x - ay$$
$$x = ay + b$$

2) Others

The collected data of earthquakes covers the period until 1976, however the Comayagua and La Paz earthquakes have taken place lately.
According to the data of the El Cajon Dam, the maximum seismic acceleration of 0.15 was observed by the seismometer installed in October 1987.

Table E.3-3 Data of Earthquake

No.	Y.	M.D	Lat. N.	Dep. W.	Depth Km	Magnitude M.	Dist. L Km	gal max gal
1	1898	4.29	12.00	86.00	0	7.90	305	18
2	1902	4.19	14.00	91.00	0	8.20	379	10
3	'07	12.30	12.10	86.30	0	7.20	279	11
4	'10	1. 1	16.50	84.00	60	7.10	450	1
5	'12	6.12	17.00	89.00	0	6.80	338	2
6	'15	9. 7	14.00	89.00	80	7.90	165	78
7	'16	11.27	12.00	90.00	0	7.50	372	6
8	'19	6.29	13.50	86.50	90	6.75	142	36
9	'21	3.28	12.50	87.50	0	7.30	202	32
10	'25	10. 5	12.25	85.25	135	6.75	335	2
11	'26	11. 5	12.30	85.80	135	7.20	290	9
12	'28	10.25	12.30	85.80	0	6.50	290	2
13	'31	2. 7	13.00	87.00	100	5.75	157	4
14	'32	5.21	12.00	87.50	90	6.90	258	8
15	'34	3. 7	13.25	87.75	0	6.25	122	25
16	'38	4.25	12.20	86.90	0	6.50	244	4
17	'39	12.26	13.25	88.25	75	6.00	143	10
18	'40	2.20	12.50	87.50	0	6.50	202	9
19	'41	11.16	13.25	88.50	80	5.75	160	4
20	'42	8. 6	13.90	90.93	40	8.30	372	11
21	'44	10. 2	14.50	89.75	160	6.50	243	4
22	'45	10. 7	12.25	89.25	0	6.75	297	3
23	'46	6.24	14.75	89.00	260	6.00	168	6
24	'47	7.15	12.50	86.80	30	6.50	216	7
25	'48	6.27	17.00	85.00	100	7.00	402	1
26	'51	5. 6	13.00	87.80	0	6.50	150	22
27	'52	11.20	12.10	87.90	60	6.25	250	2
28	'54	2.19	12.50	87.50	0	6.63	204	11
		1.13	14.00	86.42	100	5.75	124	10
29	'55	4. 4	13.00	87.00	0	6.25	159	12
30	'56	1.24	12.20	86.70	100	7.30	253	17
		10.24	12.00	87.00	0	7.23	266	13
31	'57	4. 5	12.61	87.80	76	5.60	195	1
32	'58	11.14	12.48	86.44	72	6.50	237	5
		6.27	13.00	88.50	60	6.00	183	4
33	'59	2.16	13.11	87.34	0	5.40	138	3
34	'60	3.24	13.50	87.00	0	5.30	108	6
35	'61	5.23	12.70	87.30	138	6.50	183	12
36	'62	11.24	13.00	87.50	25	6.50	149	22
37	'63	12.21	13.40	87.20	30	5.60	110	12
38	'64	2.18	13.00	87.50	30	5.60	149	4
39	'65	5. 3	13.65	89.15	23	6.50	193	10
40	'66	12.27	13.30	88.80	78	5.50	181	1
41	'67	11. 8	16.00	85.90	28	5.45	253	1
42	'68	6.11	13.90	88.80	199	5.28	148	2
43	'69	2.25	15.23	87.47	15	5.00	99	4
44	'70	8.12	12.02	86.54	33	6.30	278	1
45	'71	6.18	14.68	87.57	7	4.78	38	29
46	'72	12.23	12.36	86.12	5	6.20	266	1
47	'73	7.27	12.80	86.70	199	5.28	192	1
48	'74	3. 6	12.30	86.40	110	6.10	256	1
49	'75	3.13	16.30	87.00	33	5.11	224	1
50	'76	2. 4	15.32	89.10	5	7.50	203	39
		9. 2	13.26	89.94	81	6.78	289	4

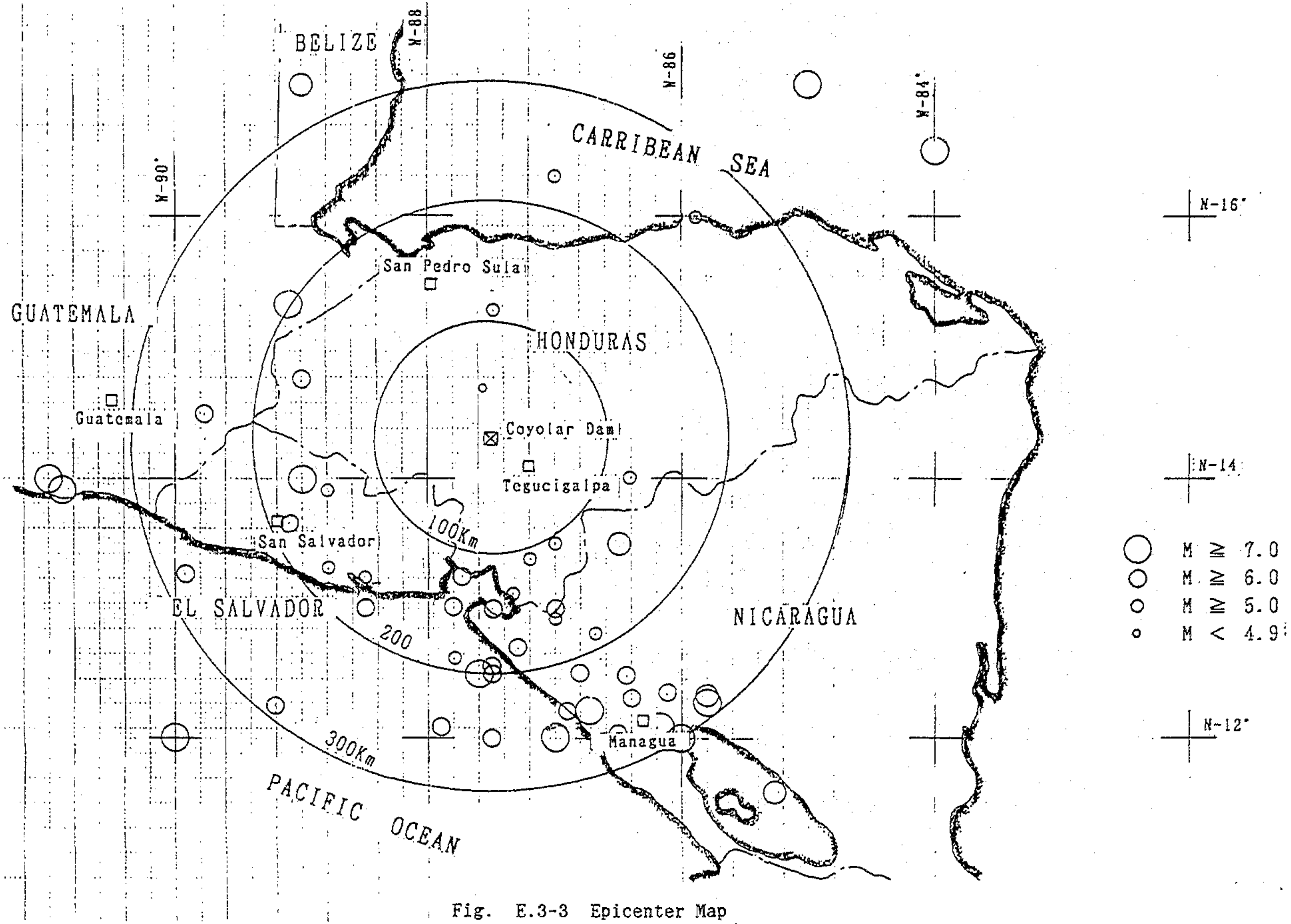


Fig. E.3-3 Epicenter Map

Table E.3-4 Expected Value of Earthquake Acceleration

No.	gal x	x^2	Te n/No.	y=logTe	y^2	xy
	gal					
1	78	6084	44.000	1.6435	1.2820	128.1893
2	39	1521	22.000	1.3424	1.1586	52.3545
3	36	1296	14.667	1.1663	1.0800	41.9879
4	32	1024	11.000	1.0414	1.0205	33.3246
5	29	841	8.800	0.9445	0.9718	27.3900
6	25	625	7.333	0.8653	0.9302	21.6325
7	22	484	6.286	0.7984	0.8935	17.5638
8	22	484	5.500	0.7404	0.8604	16.2880
9	18	324	4.889	0.6892	0.8302	12.4058
10	17	289	4.400	0.6435	0.8022	10.9387
11	13	169	4.000	0.6021	0.7759	7.8268
12	12	144	3.667	0.5643	0.7512	6.7713
13	12	144	3.385	0.5295	0.7277	6.3541
14	12	144	3.143	0.4973	0.7052	5.9679
15	11	121	2.933	0.4674	0.6836	5.1410
16	11	121	2.750	0.4393	0.6628	4.8327
17	11	121	2.588	0.4130	0.6427	4.5430
18	10	100	2.444	0.3882	0.6230	3.8818
19	10	100	2.316	0.3647	0.6039	3.6470
20	10	100	2.200	0.3424	0.5852	3.4242
21	10	100	2.095	0.3212	0.5668	3.2123
22	9	81	2.000	0.3010	0.5487	2.7093
23	9	81	1.913	0.2817	0.5308	2.5355
24	8	64	1.833	0.2632	0.5131	2.1059
25	7	49	1.760	0.2455	0.4955	1.7186
26	6	36	1.692	0.2285	0.4780	1.3709
27	6	36	1.630	0.2121	0.4605	1.2725
28	6	36	1.571	0.1963	0.4431	1.1778
29	5	25	1.517	0.1811	0.4255	0.9053
30	4	16	1.467	0.1663	0.4078	0.6653
31	4	16	1.419	0.1521	0.3900	0.6084
32	4	16	1.375	0.1383	0.3719	0.5532
33	4	16	1.333	0.1249	0.3535	0.4998
34	4	16	1.294	0.1120	0.3346	0.4479
35	4	16	1.257	0.0994	0.3153	0.3975
36	4	16	1.222	0.0872	0.2952	0.3486
37	4	16	1.189	0.0753	0.2743	0.3010
38	3	9	1.158	0.0637	0.2523	0.1910
39	3	9	1.128	0.0524	0.2289	0.1572
40	2	4	1.100	0.0414	0.2035	0.0828
41	2	4	1.073	0.0307	0.1751	0.0613
42	2	4	1.048	0.0202	0.1421	0.0404
43	2	4	1.023	0.0100	0.0999	0.0200
44	2	4	1.000	0.0000	0.0000	0.0000
n=	$\overline{x}$=	$\overline{x^2}$=		$\overline{y}$=	$\overline{y^2}$=	$\overline{xy}$=
44	12.364	338.86		0.4065	0.5658	9.9056

$a = (\overline{x}*\overline{y}-\overline{xy})/(\overline{y}^2-\overline{y^2}) = 12.2$

$b = x - a*\overline{y} = 7.4$

$G = a*y+b = 12.2y+7.4$

Te=100 y=2.0 G=32gal=0.03g

Te=200 y=2.3 G=36 =0.04g

(5) Uplift Force

Piezometric groundwater level in bore hole are observed. Those results are shown in the Table E.3-5.

The measuring level of bore hole No.2 is similar with the water level of the reservoir due to close to the leakeage point of large amount.

There is not plenty of data to decide uplift coefficient. In accordance with the grouting at dam construction stage and drilling data in 1984, it's reasonable to employ high value of coefficient. Therefore, 50 % of uplift coefficient is employed for design of the dam rehabilitation.

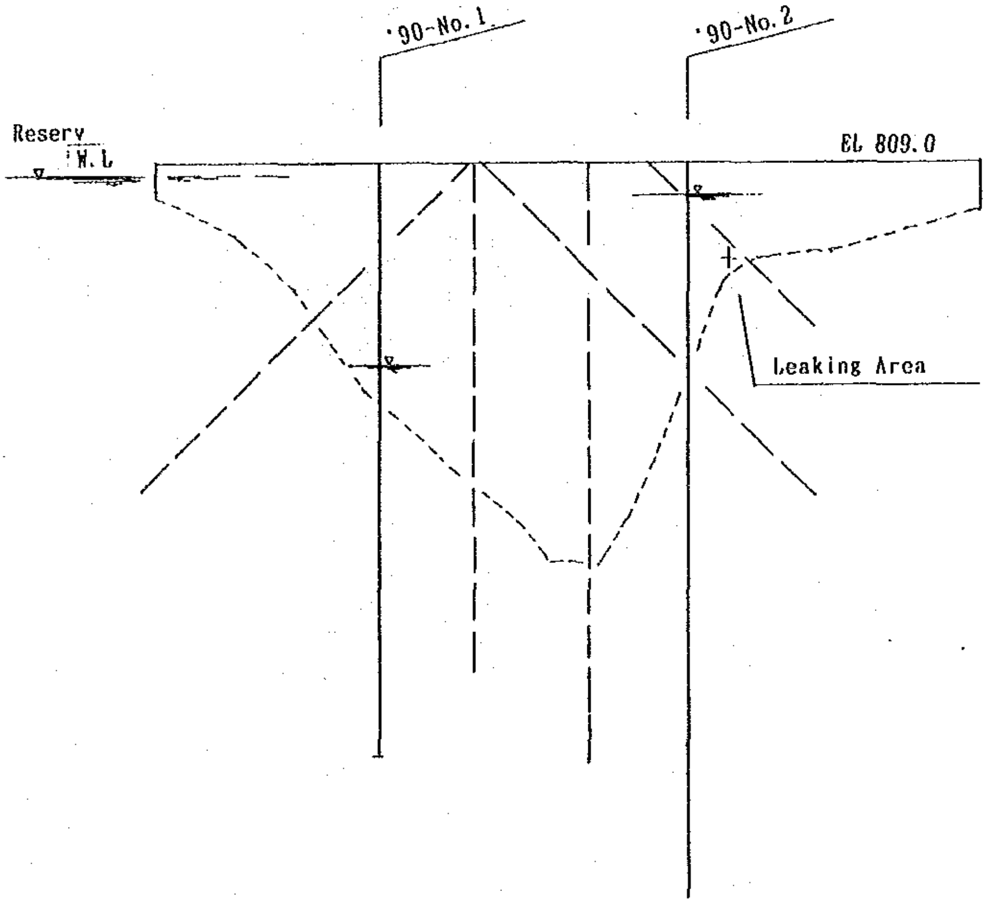
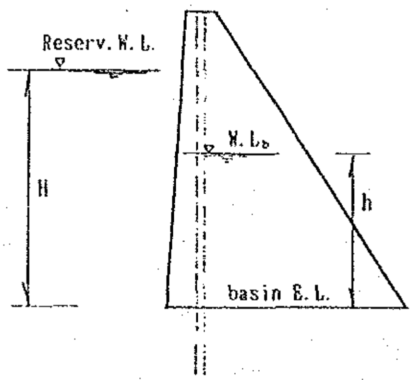


Fig. E.3-4 Groundwater Level along the Dam

Table E.3-5 Summary of Uplift Calculation

Y. M. D	Reserv. W.L.	'90 - No.1 W.L_b	'90 - No.1 U	'90 - No.2 W.L_b	'90 - No.2 U
	m	m		m	
'90.3.24	798.30	775.16	0.140	797.12	0.938
28	799.20	775.62	0.152	797.85	0.932
31	799.46	775.96	0.162	797.98	0.926
4.1	801.45	775.72	0.144	797.96	0.842
4	801.20	775.54	0.139	797.50	0.830
8	800.82	775.35	0.134	797.41	0.841
12	800.42	775.29	0.134	797.17	0.845
16	800.08	774.80	0.119	796.89	0.846
20	799.86	774.44	0.107	796.80	0.850
24	799.70	774.20	0.099	796.55	0.845
28	799.90	774.60	0.112	796.20	0.820
30	800.66	775.00	0.123	797.30	0.842
5.2	801.46	775.48	0.136	797.55	0.823
4	801.98	775.97	0.149	798.28	0.836
6	802.30	776.06	0.151	798.85	0.849
8	802.42	776.17	0.154	799.02	0.852
12	802.30	776.12	0.153	798.57	0.837
16	802.20	775.97	0.148	798.66	0.845
20	802.08	775.88	0.146	798.60	0.847
22	802.04	775.83	0.145	798.46	0.842
24	802.48	776.06	0.150	798.95	0.847
25	803.54	776.70	0.165	800.08	0.857
26	804.06	777.04	0.173	800.16	0.842
27	804.40	777.22	0.176	800.70	0.852
28	804.58	777.40	0.181	801.28	0.869
30	804.95	777.80	0.191	801.74	0.874
31	805.85	778.70	0.212	803.15	0.898
6.1	806.70	779.15	0.220	803.70	0.890
2	807.10	779.40	0.224	804.38	0.902
4	806.88	778.55	0.202	803.69	0.884
8	806.75	778.26	0.194	803.28	0.873
10	806.74	777.70	0.178	803.42	0.879
12	806.94	778.12	0.189	803.21	0.865
14	807.10	778.78	0.207	803.91	0.885
16	806.90	778.47	0.199	803.66	0.882
20	807.14	779.04	0.214	803.72	0.877
22	806.76	777.85	0.182	803.26	0.872
24	806.80	778.58	0.203	803.25	0.870



Uplift U (%) = h/H

Basin E. L. No. 1 =771.4

No. 2 =779.4

(6) Stability Calculation

The stability calculations of the dam are checked in cases of the water level WL= 807.0m, 810.5m (design flood water level after rehabilitation) and 809.0m (maximum water level at present) based on the following assumptions

Combination of Load

Case	Gravity Concrete Dam
Maximum water level and surcharge water level	- Dead load - Water pressure - Dynamic water pressure at seismic stage - Sediment pressure - Seismic inertia force - Uplift force
Design flood water level	- Dead load - Water pressure - Sediment pressure - Uplift force

- Dead load

The dead load of existing and proposed dam body is estimated based on the results of laboratory test as follows:

Existing dam body

Mortar specific gravity	; 1.8
Stone - ditto -	; 2.2
Proportion of stone	; 50-60 %
Unit weight	; γ= 2.0 ton/cm^3

New dam body

The unit weight is estimated γ= 2.3 ton/cm^3 as safe value since no concrete test is executed.

- Water pressure

The water pressure caused by wave is neglected since its influence is quite small.

- Dynamic water pressure and inertias force at seismic stage

Seismic force is considered in case of the occurrence of earthquake with the intensity K=0.15. However, this force does not take into account at the design food water level.

- Sediment pressure

Sediment pressure is considered to operte lower than the actual ground level plus some height due to small sediment volume.

- Uplift force

Triangle load of 50 % of water pressure at upper stream side and 0% at lower stream side is estimated.

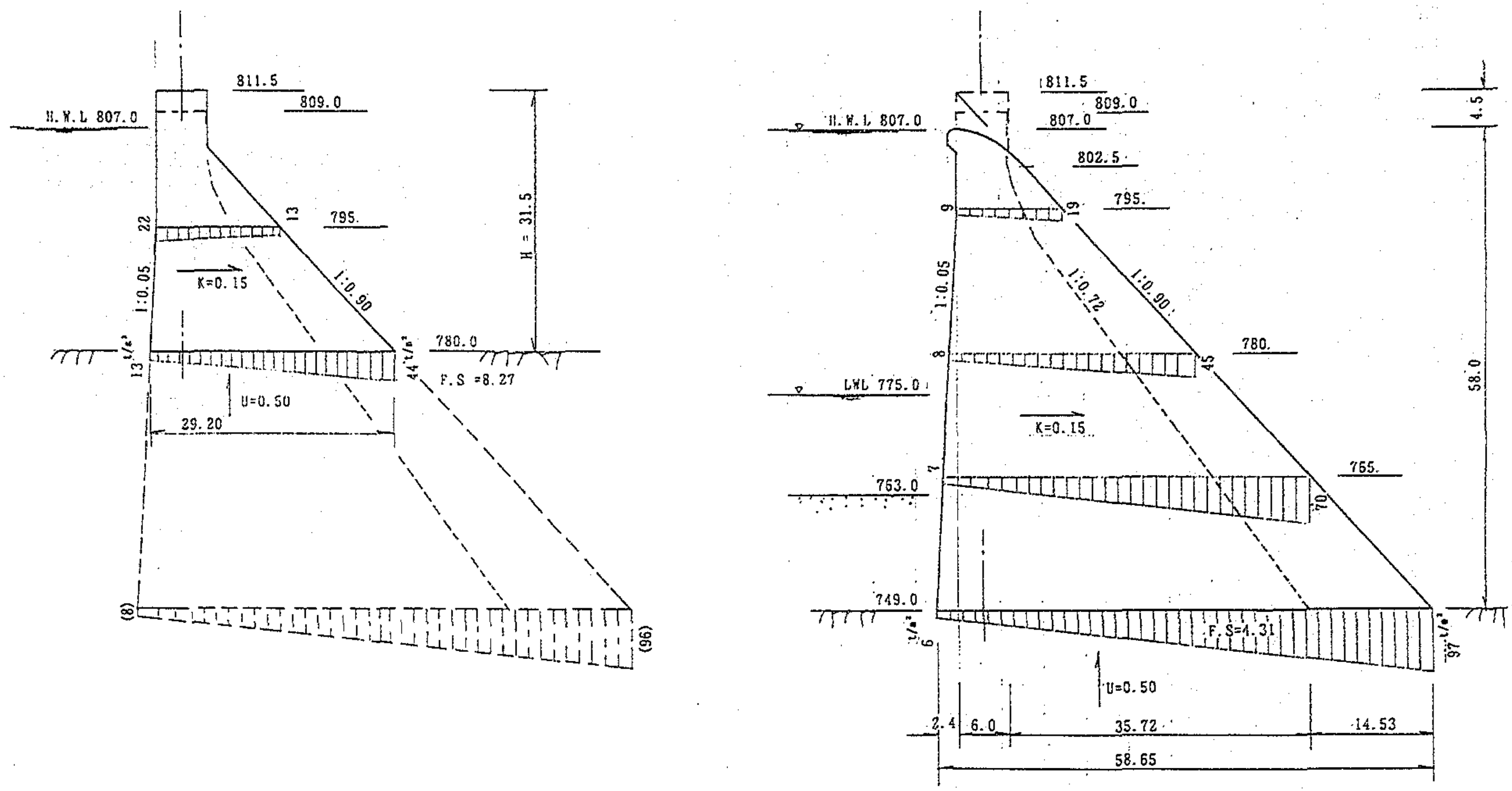


Fig. E.3-5 Results of the Stability Calculation after the Improvement

Table E.3-6 Results of Stability Analysis after Improvement

m=0.90

K = 0.15 U = 0.50

	non - Overflow Section					Overflow Section			
	H.W.L = 807				HHWL=810.5 K = -	H.W.L = 807			
	EL=749 B=58.65	EL=765 B=43.45	EL=780 B=29.20	EL=795 B=14.95	EL=780 B=29.20	EL=749 B=58.65	EL=765 B=43.45	EL=780 B=29.20	EL=795 B=14.95
V (t)	3,073.9	1,731.7	828.6	263.8	806.1	3,008.0	1,665.8	762.7	204.2
H (t)	2,606.8	1,385.5	609.6	145.8	465.1	2,596.9	1,375.6	599.7	136.9
M (t·m)	115,394	46,907	14,337	1,806	12,798	114,418	46,142	13,770	1,717
F.S	4.32	5.70	8.27	16.83	10.80	4.31	5.71	8.32	17.57
l (m)	37.54	27.09	17.30	6.85	15.88	38.04	27.70	18.05	8.41
e (m)	8.21	5.36	2.70	- 0.63	1.28	8.71	5.97	3.45	0.93
p (t/m2)	52.4	39.9	28.4	17.6	27.6	51.3	38.3	26.1	13.7
p1(t/m2)	96	69	44	13	35	97	70	45	19
p2(t/m2)	8	10	13	22	20	6	7	8	9

Table E.3-7 Stability Calculation at Non-overflow Section (1/5)

m=0.90 U=0.50 K=0.15

H.W.L=807 E.L=749 B=58.65

	V	H	y	x	M
W1	24.0		1.20		29
2	57.6		0.80		46
D1	115.2		1.60		184
2	91.8		5.15		473
3	19.5		9.48		185
4	834.4		7.02		5,857
5	1,464.4		22.47		32,905
D11	134.6		5.59		752
12	96.8		12.12		1,173
13	1,086.0		35.48		38,531
P		1,682.0		19.33	32,513
E		53.9		4.67	252
U	-850.4		19.55		-16,625
KD1		17.3		16.00	277
2		13.8		49.03	677
3		2.9		47.10	137
4		125.2		22.55	2,823
5		219.7		15.03	3,302
KD11		20.2		57.54	1,162
12		14.5		49.04	711
13		162.9		19.64	3,199
KW		294.4		23.20	6,830
	3,073.9	2,606.8			115,394

Table E.3-7 Stability Calculation at Non-overflow Section (2/5)

m=0.90 U=0.50 K=0.15

H.W.L=807 E.L=765 B=43.45

	V	H	y	x	M
W1	16.0		0.80		13
2	25.6		0.53		14
D1	51.2		1.07		55
2	91.8		4.35		399
3	19.5		8.68		169
4	538.4		6.22		3,349
5	609.6		17.83		10,869
D11	134.6		4.79		645
12	96.8		11.32		1,096
13	604.4		26.98		16,307
P		882.0		14.00	12,348
E		-		-	-
U	-456.2		14.48		-6,606
KD1		7.7		10.67	82
2		13.8		33.03	456
3		2.9		31.10	90
4		80.8		14.55	1,176
5		91.4		9.70	887
KD11		20.2		41.54	839
12		14.5		33.04	479
13		90.7		13.14	1,192
KW		181.5		16.80	3,049
	1,731.7	1,385.5			46,907

Table E.3-7 Stability Calculation at Non-overflow Section (3/5)

m=0.90 U=0.50 K=0.15

H.W.L=807 E.L=780 B=29.20

	V	H	y	x	M
W1	8.5		0.42		4
2	7.2		0.28		2
D1	14.4		0.57		8
2	91.8		3.55		326
3	19.5		7.93		155
4	260.8		5.48		1,429
5	143.1		13.48		1,929
D11	134.6		4.04		544
12	96.8		10.57		1,023
13	249.0		19.33		4,813
P		364.5		9.00	3,281
E		-		-	-
U	-197.1		9.73		-1,918
KD1		2.2		5.67	12
2		13.8		18.03	249
3		2.9		16.10	47
4		39.1		7.05	276
5		21.5		4.70	101
KD11		20.2		26.54	536
12		14.5		18.04	262
13		37.4		6.66	249
KW		93.5		10.80	1,010
	828.6	609.6			14,337

Table E.3-7 Stability Calculation at Non-overflow Section (4/5)

m=0.90 U=0.50 K=0.15

H.W.L=807 E.L=795 B=14.95

	V	H	y	x	M
W1	1.0		0.05		0
2	0.1		0.03		0
D1	0.2		0.07		0
2	81.0		2.82		-
3	14.1		7.02		99
4	-		-		-
5	-		-		-
D11	134.6		3.29		443
12	77.6		9.59		744
13	-		-		-
P		72.0		4.00	288
E		-		-	-
U	-44.8		4.98		-223
KD1		0.0		0.67	0
2		12.2		3.49	43
3		2.1		1.70	4
4		-		-	-
5		-		-	-
KD11		20.2		11.54	233
12		11.6		3.65	42
13		-		-	-
KW		27.7		4.80	133
	263.8	145.8			1,806

Table E.3-7 Stability Calculation at Non-overflow Section (5/5)

m=0.90 U=0.50 K = -

H.H.W.L=810.5 E.L=780 B=29.20

	V	H	y	x	M
W1	11.5		0.42		5
2	7.2		0.28		2
D1	14.4		0.57		8
2	91.8		3.55		326
3	19.5		7.93		155
4	260.8		5.48		1,429
5	143.1		13.48		1,929
D11	134.6		4.04		544
12	96.8		10.57		1,023
13	249.0		19.33		4,813
P		465.1		10.17	4,730
E		-		-	-
U	-222.6		9.73		-2,166
KD1					
2					
3					
4					
5					
KD11					
12					
13					
KW					
	806.1	465.1			12,798

Table E.3-8 Stability Calculation at Overflow Section (1/4)

Overflow Section m=0.90 U=0.50 K=0.15

H.W.L=807 E.L=749 B=58.65

	V	H	y	x	M
W1	24.0		1.20		29
2	57.6		0.80		46
D1	115.2		1.60		184
2	91.8		5.15		473
3	19.5		9.48		185
4	834.4		7.02		5,857
5	1,464.4		22.47		32,905
D21	5.4		1.96		11
22	52.4		5.77		302
23	34.1		8.52		291
24	73.6		12.84		945
D13	1,086.0		35.48		38,531
P		1,682.0		19.33	32,513
E		53.9		4.67	252
U	-850.4		19.55		-16,625
KD1		17.3		16.00	277
2		13.8		49.03	677
3		2.9		47.10	137
4		125.2		22.55	2,823
5		219.7		15.03	3,302
KD21		0.8		56.66	45
22		7.9		55.30	437
23		5.1		52.15	266
24		11.0		47.90	527
KD13		162.9		19.64	3,199
KW		294.4		23.20	6,830
	3,008.0	2,596.9			114,418

Table E.3-8 Stability Calculation at Overflow Section (2/4)

Overflow Section m=0.90 U=0.50 K=0.15

H.W.L=807 E.L=765 B=43.45

	V	H	y	x	M
W1	16.0		0.80		13
2	25.6		0.53		14
D1	51.2		1.07		55
2	91.8		4.35		399
3	19.5		8.68		169
4	538.4		6.22		3,349
5	609.6		17.83		10,869
D21	5.4		1.16		6
22	52.4		4.97		260
23	34.1		7.72		263
24	73.6		12.04		886
D13	604.4		26.98		16,307
P		882.0		14.00	12,348
E		-		-	-
U	-456.2		14.48		-6,606
KD1		7.7		10.67	82
2		13.8		33.03	456
3		2.9		31.10	90
4		80.8		14.55	1,176
5		91.4		9.70	887
KD21		0.8		40.66	33
22		7.9		39.30	310
23		5.1		36.15	184
24		11.0		31.90	351
KD13		90.7		13.14	1,192
KW		181.5		16.80	3,049
	1,665.8	1,375.6			46,142

Table E.3-8 Stability Calculation at Overflow Section (3/4)

Overflow Section m=0.90 U=0.50 K=0.15

H.W.L=807 E.L=780 B=29.20

	V	H	y	x	M
W1	8.5		0.42		4
2	7.2		0.28		2
D1	14.4		0.57		8
2	91.8		3.55		326
3	19.5		7.93		155
4	260.8		5.48		1,429
5	143.1		13.48		1,929
D21	5.4		0.41		2
22	52.4		4.22		221
23	34.1		6.97		238
24	73.6		11.29		831
D13	249.0		19.33		4,813
P		364.5		9.00	3,281
E		-		-	-
U	-197.1		9.73		-1,918
KD1		2.2		5.67	12
2		13.8		18.03	249
3		2.9		16.10	47
4		39.1		7.05	276
5		21.5		4.70	101
KD21		0.8		25.66	21
22		7.9		24.30	192
23		5.1		21.15	108
24		11.0		16.90	186
KD13		37.4		6.66	249
KW		93.5		10.80	1,010
	762.7	599.7			13,770

Table E.3-8 Stability Calculation at Overflow Section (4/4)

Overflow Section m=0.90 U=0.50 K=0.15

H.W.L=807 E.L=795 B=14.95

	V	H	y	x	M
W1	1.0		0.05		0
2	0.1		0.03		0
D1	0.2		0.07		0
2	81.0		2.82		228
3	14.1		7.02		99
4	-		-		-
5	-		-		-
D21	5.4		-0.34		-2
22	52.4		3.47		182
23	34.1		6.22		212
24	60.7		10.18		618
D13	-		-		-
P		72.0		4.00	288
E		-		-	-
U	-44.8		4.98		-223
KD1		0.0		0.67	0
2		12.2		3.49	43
3		2.1		1.70	4
4		-		-	-
5		-		-	-
KD21		0.8		10.66	9
22		7.9		9.30	73
23		5.1		6.15	31
24		9.1		2.40	22
KD13		-		-	-
KW		27.7		4.80	133
	204.2	135.9			1,717

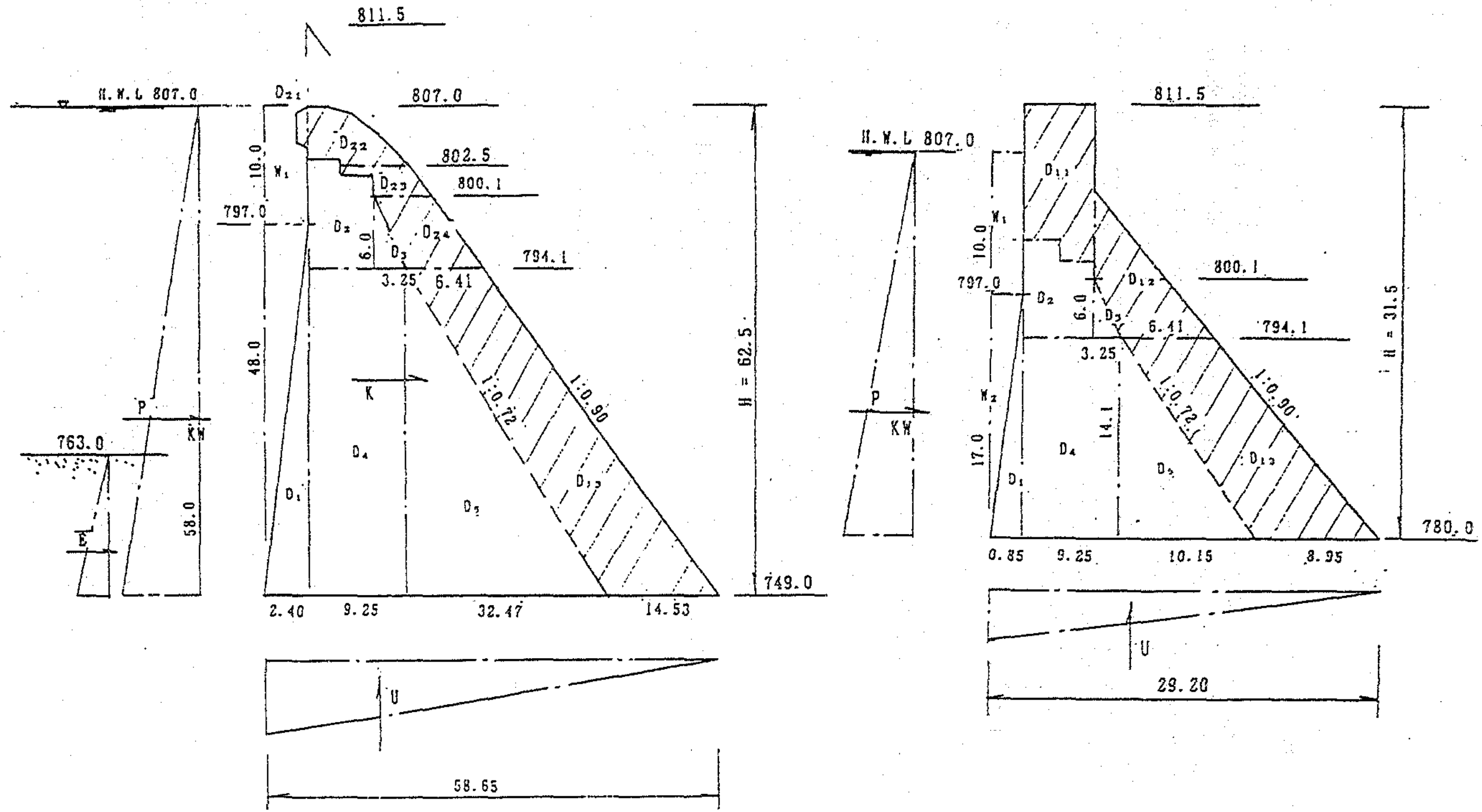


Fig. E.3-6 Dimension of Stability Calculation

(7) Essential Point for Construction

1) Concrete Pouring Season

It is essential to pour concrete in dry season (from November till April), especially at the bottom concrete section which is located at the riverbed side and has maximum width.

The outfall from the Dam reservoir takes place from the outlet pipe (Φ750mm) except when it is discharged from the spillway at the full water level stage.

Raising of the water level occurs due to rainfall in the rainy season on account of its insufficient discharge capacity.

Record of plenty of inflow in the rainy season is shown below.

Increase of storage volume:

	Increase storage		Discharge*		Total (10^3m^3)	Raising of water level
Maximum (1st)	700	+	7200	=	7900	775m → 800m
(2nd)	5800	+	500	=	6300	775m → 797m
Medium	3500			=	3500	775m → 791m
Minimum (3rd)	1100			=	1100	775m → 783m

* Estimated value

The raising of the water level by rainfall possibly occurs although a decrease of the water level at the outlet pipe during the construction period.

According to the second record:

Primary water head = 26m (= 775m - 749m)
Water head after rainfall = 48m (= 797m - 749m)

The water head at the bottom of the Dam increases from 4 kgf/cm^2 to 10 kgf/cm^2.
There is some possibility that the raising of the water level disturbs mainly stress transmission between the present and new Dam body and harms their tight connection. Then, it is better to avoid the rainy season for concrete pouring.

2) Construction Condition of Bottom Concrete

As plenty of concrete is poured, the construction period takes a few years.

The primary concrete will stop below the outlet pipe and the upper concrete will be poured after the installation of the outlet pipe.

The stability of the Dam body under this case is checked as follows.

3) Essential points for Grouting

Obvious leakage is observed at the left side of the Dam body and upper chute of the spillway.

The former leakage dissapears at the water level of m790m and similar characteristic is observed with the latter leakage.

Since the grouting point and leakage point are close especially in the former case, it is effective to lower the water level and to weaken the leakage force.

Table E.3-9 Stability Calculation Placing Concrete up to EL 773m

m = 0.90 (E.L≦773.0)   m = 0.72 (E.L>773.0)

	H.W.L = 807 K=0.15 U=0.50				H.W.L = 807 K = - U=0.50			
	EL=749 B=58.65	EL=773 B=25.64	EL=780 B=20.25	EL=795 B=8.86	EL=749 B=58.65	EL=773 B=25.64	EL=780 B=20.25	EL=795 B=8.86
V t	2,526.3	746.6	495.6	156.8	2,526.3	746.6	495.6	156.8
H t	2,524.6	850.8	578.0	139.5	1,735.9	578.0	392.0	84.5
M tm	101,089	16,498	8,973	1,221	85,155	12,879	6,949	908
F.S	4.29	5.22	5.94	10.43	6.23	7.69	8.76	17.21
l m	40.01	22.10	18.11	7.79	33.71	17.25	14.02	5.79
e m	10.69	9.28	7.98	3.36	4.38	4.43	3.908	1.36
p t/m²	43.1	29.1	24.5	17.7	43.1		24.5	17.7
p_1 t/m²	90	92	82	58	62	59	53	34
p_2 t/m²	- 4	- 34	- 33	-23	24	- 1	- 4	1

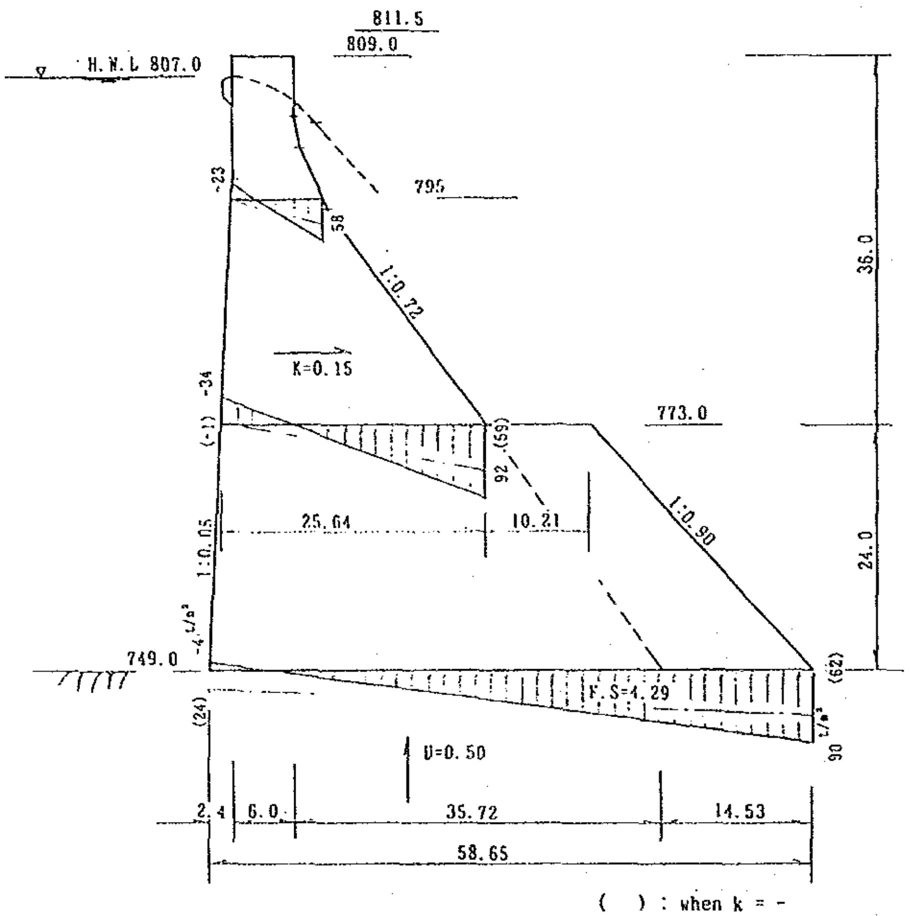


Fig. E.3-7 Stability Calculation Placing Concrete up to EL 773m

ANNEX F : FLORES IRRIGATION

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F.1 Irrigation Plan

(1) Irrigation Water Requirement

1) Evapo-transpiration for Crops (Et crop)

Et crop is obtained in the following equation.

$$Et\ crop = Kc \times ETo$$

where; Kc : Crop Coefficient
ETo: Evapo-transpiration

The monthly crop coefficient of each crop proposed is tabulated in Table F.1-1 below and detailed analysis of each crop's Kc are in Table F.1-2 (1/3- 3/3).

Table F.1-1 Monthly Crop Coefficient

Month / Crops	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Maize (I)	0.48	0.68	0.87	0.94	0.84	0.67	0.00	0.00	0.00	0.00	0.00	0.00
Maize (II)	0.00	0.00	0.00	0.00	0.00	0.53	0.72	0.89	0.94	0.83	0.66	0.00
Maize (III)	0.00	0.00	0.00	0.00	0.00	0.52	0.58	0.78	0.94	0.91	0.77	0.63
Rice (I)	1.07	1.14	1.19	1.16	1.10	1.00	0.00	0.00	0.00	0.00	0.94	0.98
Rice (II)	0.00	0.00	0.00	0.00	0.94	0.98	1.07	1.14	1.19	1.16	1.10	1.00
Tobacco	0.00	0.00	0.00	0.00	0.56	0.79	1.06	1.10	1.03	0.91	0.00	0.00
Soy Bean	0.50	0.63	0.79	0.81	0.85	0.65	0.00	0.00	0.00	0.00	0.00	0.00
Vegeta(A)-1	0.00	0.00	0.00	0.00	0.00	0.56	0.78	0.83	0.91	0.87	0.70	0.00
Vegeta(A)-2	0.00	0.00	0.00	0.00	0.54	0.76	0.82	0.91	0.87	0.70	0.00	0.00
Vegeta(A)-3	0.46	0.66	0.80	0.85	0.92	0.75	0.00	0.00	0.00	0.00	0.00	0.00
Vegeta(A)-4	0.93	0.79	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0.61	0.81	0.83
Vegeta(B)-1	0.00	0.00	0.00	0.00	0.52	0.67	0.78	0.86	0.89	0.80	0.00	0.00
Vegeta(B)-2	0.88	0.78	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.69	0.79	0.86
Vegeta(B)-3	0.00	0.00	0.00	0.00	0.52	0.63	0.77	0.83	0.89	0.84	0.73	0.00
Fruits	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Coffee	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
Pasture	0.55	0.55	0.55	0.55	0.55	0.55	0.50	0.50	0.50	0.50	0.50	0.50

Table F.1-2 Crop Coefficient (Kc) (1/3)

Maize (I)

May			June			July			August			September			October		
1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
0.46	0.46	0.60	0.88	1.05	1.05	1.05	1.05	0.93	0.77	0.63							
	0.46	0.46	0.60	0.88	1.05	1.05	1.05	1.05	0.93	0.77	0.63						
		0.46	0.46	0.60	0.88	1.05	1.05	1.05	1.05	0.93	0.77	0.63					
			0.46	0.46	0.60	0.88	1.05	1.05	1.05	1.05	0.93	0.77	0.63				
				0.46	0.46	0.60	0.88	1.05	1.05	1.05	1.05	0.93	0.77	0.63			
					0.46	0.46	0.60	0.88	1.05	1.05	1.05	1.05	0.93	0.77	0.63		
						0.46	0.46	0.60	0.88	1.05	1.05	1.05	1.05	0.93	0.77	0.63	
0.46	0.46	0.51	0.60	0.69	0.75	0.79	0.88	0.94	0.97	0.93	0.91	0.89	0.85	0.78	0.70	0.63	

Maize (II)

October			November			December			January			February			March		
1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
0.52	0.52	0.65	0.90	1.05	1.05	1.05	1.05	0.93	0.75	0.63							
	0.52	0.52	0.65	0.90	1.05	1.05	1.05	1.05	0.93	0.75	0.63						
		0.52	0.52	0.65	0.90	1.05	1.05	1.05	1.05	0.93	0.75	0.63					
			0.52	0.52	0.65	0.90	1.05	1.05	1.05	1.05	0.93	0.75	0.63				
				0.52	0.52	0.65	0.90	1.05	1.05	1.05	1.05	0.93	0.75	0.63			
					0.52	0.52	0.65	0.90	1.05	1.05	1.05	1.05	0.93	0.75	0.63		
						0.52	0.52	0.65	0.90	1.05	1.05	1.05	1.05	0.93	0.75	0.63	
0.52	0.52	0.56	0.65	0.73	0.78	0.82	0.90	0.95	0.97	0.93	0.91	0.88	0.84	0.77	0.69	0.63	

Maize (III)

October			November			December			January			February			March			April		
1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
		0.52	0.52	0.65	0.90	1.05	1.05	1.05	1.05	0.93	0.75	0.63								
			0.52	0.52	0.65	0.90	1.05	1.05	1.05	1.05	0.93	0.75	0.63							
				0.52	0.52	0.65	0.90	1.05	1.05	1.05	1.05	0.93	0.75	0.63						
					0.52	0.52	0.65	0.90	1.05	1.05	1.05	1.05	0.93	0.75	0.63					
						0.52	0.52	0.65	0.90	1.05	1.05	1.05	1.05	0.93	0.75	0.63				
							0.52	0.52	0.65	0.90	1.05	1.05	1.05	1.05	0.93	0.75	0.63			
								0.52	0.52	0.65	0.90	1.05	1.05	1.05	1.05	0.93	0.75	0.63		
		0.52	0.52	0.56	0.65	0.73	0.78	0.82	0.90	0.95	0.97	0.93	0.91	0.88	0.84	0.77	0.69	0.63		

Rice (I)

March	April			May			June			July			August			September			October		
3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
0.94	0.94	1.10	1.10	1.10	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.00	1.00								
	0.94	0.94	1.10	1.10	1.10	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.00	1.00							
		0.94	0.94	1.10	1.10	1.10	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.00	1.00						
			0.94	0.94	1.10	1.10	1.10	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.00	1.00					
				0.94	0.94	1.10	1.10	1.10	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.00	1.00				
					0.94	0.94	1.10	1.10	1.10	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.00	1.00			
						0.94	0.94	1.10	1.10	1.10	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.00	1.00		
							0.94	0.94	1.10	1.10	1.10	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.00	1.00	
								0.94	0.94	1.10	1.10	1.10	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.00	1.00
0.94	0.94	0.99	1.02	1.04	1.07	1.10	1.12	1.13	1.17	1.20	1.19	1.18	1.17	1.16	1.14	1.13	1.10	1.06	1.00	1.00	1.00

Rice (II)

September	October			November			December			January			February			March			April		
3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
0.94	0.94	1.10	1.10	1.10	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.00	1.00								
	0.94	0.94	1.10	1.10	1.10	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.00	1.00							
		0.94	0.94	1.10	1.10	1.10	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.00	1.00						
			0.94	0.94	1.10	1.10	1.10	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.00	1.00					
				0.94	0.94	1.10	1.10	1.10	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.00	1.00				
					0.94	0.94	1.10	1.10	1.10	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.00	1.00			
						0.94	0.94	1.10	1.10	1.10	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.00	1.00		
							0.94	0.94	1.10	1.10	1.10	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.00	1.00	
								0.94	0.94	1.10	1.10	1.10	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.00	1.00
0.94	0.94	0.99	1.02	1.04	1.07	1.10	1.12	1.13	1.17	1.20	1.19	1.18	1.17	1.16	1.14	1.13	1.10	1.06	1.00	1.00	1.00

Table F.1-2 Crop Coefficient (Kc) (2/3)

September	October			November			December			January			February			March			April		
3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
0.94	0.94	1.10	1.10	1.10	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.00	1.00								
	0.94	0.94	1.10	1.10	1.10	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.00	1.00							
		0.94	0.94	1.10	1.10	1.10	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.00	1.00						
			0.94	0.94	1.10	1.10	1.10	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.00	1.00					
				0.94	0.94	1.10	1.10	1.10	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.00	1.00				
					0.94	0.94	1.10	1.10	1.10	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.00	1.00			
						0.94	0.94	1.10	1.10	1.10	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.00	1.00		
							0.94	0.94	1.10	1.10	1.10	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.00	1.00	
								0.94	0.94	1.10	1.10	1.10	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.00	1.00
0.94	0.94	0.99	1.02	1.04	1.07	1.10	1.12	1.13	1.17	1.20	1.19	1.18	1.17	1.16	1.14	1.13	1.10	1.06	1.00	1.00	1.00

Tobacco

September			October			November			December			January			February		
1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
0.51	0.60	0.75	0.95	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	0.95	0.85				
	0.51	0.60	0.75	0.95	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	0.95	0.85			
		0.51	0.60	0.75	0.95	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	0.95	0.85		
			0.51	0.60	0.75	0.95	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	0.95	0.85	
				0.51	0.60	0.75	0.95	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	0.95	0.85
0.51	0.56	0.62	0.70	0.78	0.90	1.00	1.07	1.10	1.10	1.10	1.10	1.07	1.02	1.00	0.97	0.90	0.85

Soy Beans (2 years rotation)

March			April			May			June			July			August		
1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
	0.50	0.50	0.73	1.00	1.00	1.00	0.85	0.58									
		0.50	0.50	0.73	1.00	1.00	1.00	0.85	0.58								
			0.50	0.50	0.73	1.00	1.00	1.00	0.85	0.58							
				0.50	0.50	0.73	1.00	1.00	1.00	0.85	0.58						
					0.50	0.50	0.73	1.00	1.00	1.00	0.85	0.58					
						0.50	0.50	0.73	1.00	1.00	1.00	0.85	0.58				
							0.50	0.50	0.73	1.00	1.00	1.00	0.85	0.58			
								0.50	0.50	0.73	1.00	1.00	1.00	0.85	0.58		
									0.50	0.50	0.73	1.00	1.00	1.00	0.85	0.58	
	0.50	0.50	0.58	0.55	0.75	0.79	0.80	0.77	0.77	0.81	0.86	0.89	0.86	0.81	0.72	0.58	

Vegetables (A)-1

October			November			December			January			February			March		
1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
	0.52	0.52	0.77	1.05	1.05	1.05	0.90	0.70									
		0.52	0.52	0.77	1.05	1.05	1.05	0.90	0.70								
			0.52	0.52	0.77	1.05	1.05	1.05	0.90	0.70							
				0.52	0.52	0.77	1.05	1.05	1.05	0.90	0.70						
					0.52	0.52	0.77	1.05	1.05	1.05	0.90	0.70					
						0.52	0.52	0.77	1.05	1.05	1.05	0.90	0.70				
							0.52	0.52	0.77	1.05	1.05	1.05	0.90	0.70			
								0.52	0.52	0.77	1.05	1.05	1.05	0.90	0.70		
									0.52	0.52	0.77	1.05	1.05	1.05	0.90	0.70	
	0.52	0.52	0.60	0.72	0.78	0.83	0.84	0.82	0.82	0.86	0.92	0.95	0.93	0.88	0.80	0.70	

Vegetables (A)-2

September			October			November			December			January			February		
1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
0.51	0.51	0.74	1.05	1.05	1.05	0.90	0.70										
	0.51	0.51	0.74	1.05	1.05	1.05	0.90	0.70									
		0.51	0.51	0.74	1.05	1.05	1.05	0.90	0.70								
			0.51	0.51	0.74	1.05	1.05	1.05	0.90	0.70							
				0.51	0.51	0.74	1.05	1.05	1.05	0.90	0.70						
					0.51	0.51	0.74	1.05	1.05	1.05	0.90	0.70					
						0.51	0.51	0.74	1.05	1.05	1.05	0.90	0.70				
							0.51	0.51	0.74	1.05	1.05	1.05	0.90	0.70			
								0.51	0.51	0.74	1.05	1.05	1.05	0.90	0.70		
0.51	0.51	0.59	0.70	0.77	0.82	0.83	0.81	0.81	0.86	0.92	0.95	0.93	0.88	0.80	0.70	0.00	

Table F.1-2 Crop Coefficient (Kc) (3/3)

May			June			July			August			September			October		
1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
	0.46	0.46	0.73	1.05	1.05	1.05	0.90	0.70									
		0.46	0.46	0.73	1.05	1.05	1.05	0.90	0.70								
			0.46	0.46	0.73	1.05	1.05	1.05	0.90	0.70							
				0.46	0.46	0.73	1.05	1.05	1.05	0.90	0.70						
					0.46	0.46	0.73	1.05	1.05	1.05	0.90	0.70					
						0.46	0.46	0.73	1.05	1.05	1.05	0.90	0.70				
							0.46	0.46	0.73	1.05	1.05	1.05	0.90	0.70			
								0.46	0.46	0.73	1.05	1.05	1.05	0.90	0.70		
									0.46	0.46	0.73	1.05	1.05	1.05	0.90	0.70	
	0.46	0.46	0.55	0.68	0.75	0.80	0.81	0.80	0.80	0.85	0.91	0.95	0.93	0.88	0.80	0.70	

Vegetables (A)-4

January			February			March			April			May			June		
1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
		0.52	0.52	0.77	1.05	1.05	1.05	0.90	0.70								
			0.52	0.52	0.77	1.05	1.05	1.05	0.90	0.70							
				0.52	0.52	0.77	1.05	1.05	1.05	0.90	0.70						
					0.52	0.52	0.77	1.05	1.05	1.05	0.90	0.70					
						0.52	0.52	0.77	1.05	1.05	1.05	0.90	0.70				
							0.52	0.52	0.77	1.05	1.05	1.05	0.90	0.70			
								0.52	0.52	0.77	1.05	1.05	1.05	0.90	0.70		
									0.52	0.52	0.77	1.05	1.05	1.05	0.90	0.70	
										0.52	0.52	0.77	1.05	1.05	1.05	0.90	0.70
		0.52	0.52	0.60	0.71	0.78	0.82	0.83	0.82	0.82	0.86	0.92	0.95	0.92	0.88	0.80	0.70

Vegetables (B)-1

September			October			November			December			January			February		
1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
0.51	0.51	0.60	0.83	0.95	0.95	0.95	0.95	0.88	0.73								
	0.51	0.51	0.60	0.83	0.95	0.95	0.95	0.95	0.88	0.73							
		0.51	0.51	0.60	0.83	0.95	0.95	0.95	0.95	0.88	0.73						
			0.51	0.51	0.60	0.83	0.95	0.95	0.95	0.95	0.88	0.73					
				0.51	0.51	0.60	0.83	0.95	0.95	0.95	0.95	0.88	0.73				
					0.51	0.51	0.60	0.83	0.95	0.95	0.95	0.95	0.88	0.73			
						0.51	0.51	0.60	0.83	0.95	0.95	0.95	0.95	0.88	0.73		
							0.51	0.51	0.60	0.83	0.95	0.95	0.95	0.95	0.88	0.73	
								0.51	0.51	0.60	0.83	0.95	0.95	0.95	0.95	0.88	0.73
0.51	0.51	0.54	0.61	0.68	0.73	0.76	0.78	0.79	0.82	0.86	0.89	0.90	0.89	0.88	0.85	0.81	0.73

Vegetables (B)-2

January			February			March			April			May			June		
1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
0.54	0.54	0.65	0.85	0.95	0.95	0.95	0.95	0.87	0.72								
	0.54	0.54	0.65	0.85	0.95	0.95	0.95	0.95	0.87	0.72							
		0.54	0.54	0.65	0.85	0.95	0.95	0.95	0.95	0.87	0.72						
			0.54	0.54	0.65	0.85	0.95	0.95	0.95	0.95	0.87	0.72					
				0.54	0.54	0.65	0.85	0.95	0.95	0.95	0.95	0.87	0.72				
					0.54	0.54	0.65	0.85	0.95	0.95	0.95	0.95	0.87	0.72			
						0.54	0.54	0.65	0.85	0.95	0.95	0.95	0.95	0.87	0.72		
							0.54	0.54	0.65	0.85	0.95	0.95	0.95	0.95	0.87	0.72	
								0.54	0.54	0.65	0.85	0.95	0.95	0.95	0.95	0.87	0.72
0.54	0.54	0.57	0.64	0.70	0.74	0.77	0.79	0.80	0.82	0.86	0.89	0.89	0.88	0.87	0.84	0.79	0.72

Vegetables (B)-3

September			October			November			December			January			February			March
1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1
	0.52	0.52	0.63	0.84	0.95	0.95	0.95	0.95	0.87	0.73								
		0.52	0.52	0.63	0.84	0.95	0.95	0.95	0.95	0.87	0.73							
			0.52	0.52	0.63	0.84	0.95	0.95	0.95	0.95	0.87	0.73						
				0.52	0.52	0.63	0.84	0.95	0.95	0.95	0.95	0.87	0.73					
					0.52	0.52	0.63	0.84	0.95	0.95	0.95	0.95	0.87	0.73				
						0.52	0.52	0.63	0.84	0.95	0.95	0.95	0.95	0.87	0.73			
							0.52	0.52	0.63	0.84	0.95	0.95	0.95	0.95	0.87	0.73		
								0.52	0.52	0.63	0.84	0.95	0.95	0.95	0.95	0.87	0.73	
									0.52	0.52	0.63	0.84	0.95	0.95	0.95	0.95	0.87	0.73
	0.52	0.52	0.56	0.63	0.69	0.74	0.77	0.79	0.80	0.82	0.86	0.89	0.90	0.89	0.88	0.85	0.80	0.73

In accordance with the proposed cropping pattern, monthly ETcrop of each proposed crop are obtained and summarized in Table F.1-3 by equation stated above based on 10 days ETcrop tabulated in Table F.1-4 (1/3- 3/3).

Table F.1-3 Monthly Evapotranspiration by Crops

(Unit: mm)

Month / Crops	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Total
Maize (I)	68.9	87.7	116.7	124.6	99.3	51.9	0.0	0.0	0.0	0.0	0.0	0.0	549.0
Maize (II)	0.0	0.0	0.0	0.0	0.0	61.3	66.9	88.2	103.8	104.4	61.1	0.0	485.7
Maize (III)	0.0	0.0	0.0	0.0	0.0	19.2	53.6	76.9	104.6	114.2	111.8	33.4	513.7
Rice (I)	154.9	147.1	159.5	153.9	129.5	115.0	0.0	0.0	0.0	0.0	50.8	154.3	1,064.9
Rice (II)	0.0	0.0	0.0	0.0	35.7	113.0	98.7	112.9	132.0	145.7	160.8	157.0	955.9
Tobacco	0.0	0.0	0.0	0.0	66.3	91.0	97.8	108.9	114.1	114.1	0.0	0.0	592.2
Soy Bean	47.0	80.8	105.4	108.1	100.8	50.7	0.0	0.0	0.0	0.0	0.0	0.0	492.9
Vegeta(A)-1	0.0	0.0	0.0	0.0	0.0	42.5	72.0	81.8	101.3	109.4	29.4	0.0	436.5
Vegeta(A)-2	0.0	0.0	0.0	0.0	63.2	87.7	75.0	90.1	96.1	28.7	0.0	0.0	440.8
Vegeta(A)-3	43.2	85.1	107.7	113.4	108.7	58.5	0.0	0.0	0.0	0.0	0.0	0.0	516.6
Vegeta(A)-4	134.9	102.3	0.0	0.0	0.0	0.0	0.0	0.0	21.3	77.2	119.4	130.8	585.9
Vegeta(B)-1	0.0	0.0	0.0	0.0	61.3	77.3	71.6	84.8	98.7	100.2	0.0	0.0	494.0
Vegeta(B)-2	127.7	101.1	0.0	0.0	0.0	0.0	0.0	0.0	61.2	87.5	115.8	134.5	627.7
Vegeta(B)-3	0.0	0.0	0.0	0.0	40.0	71.9	70.8	81.9	99.1	106.1	30.7	0.0	500.6
Fruits	123.3	109.6	113.9	113.1	100.3	97.8	78.2	84.1	94.4	107.1	125.0	133.5	1,280.1
Coffee	152.3	135.5	140.7	139.7	123.9	120.8	96.6	104.0	116.6	132.3	154.4	164.9	1,581.3
Pasture	79.8	71.0	73.7	73.2	64.9	63.3	46.0	49.5	55.5	63.0	73.5	78.5	791.7
T o t a l	931.9	920.2	817.5	825.9	994.0	1,121.8	827.3	963.2	1,198.6	1,289.8	1,032.6	986.8	11,909.5
Average	103.5	102.2	116.8	118.0	82.8	74.8	75.2	87.6	92.2	99.2	93.9	123.4	1,169.6

Table F.1-4 Evapotranspiration (Etcrop) by Crops (1/3)

(unit: mm/day)

Month	10 days	ETo	Maize (I) Kc	Maize (I) ETcrop	Maize (II) Kc	Maize (II) ETcrop	Maize (III) Kc	Maize (III) ETcrop	Rice (I) Kc	Rice (I) ETcrop	Rice (II) Kc	Rice (II) ETcrop	Tobacco Kc	Tobacco ETcrop
May	1	5.1	0.46	2.35					1.04	5.30				
	2	5.0	0.46	2.30					1.07	5.35				
	3	4.4	0.51	2.24					1.10	4.84				
Jun	4	4.3	0.60	2.58					1.12	4.82				
	5	4.3	0.69	2.97					1.13	4.86				
	6	4.3	0.75	3.23					1.17	5.03				
July	7	4.4	0.79	3.48					1.20	5.28				
	8	4.5	0.88	3.96					1.19	5.36				
	9	4.5	0.94	4.23					1.18	5.31				
Aug	10	4.5	0.97	4.37					1.17	5.27				
	11	4.4	0.93	4.09					1.16	5.10				
	12	4.4	0.91	4.00					1.14	5.02				
Sept	13	4.1	0.89	3.65					1.13	4.63			0.51	2.09
	14	3.9	0.85	3.32					1.10	4.29			0.56	2.18
	15	3.8	0.78	2.96					1.06	4.03	0.94	3.57	0.62	2.36
Oct	16	3.9	0.70	2.73	0.52	2.03			1.00	3.90	0.94	3.67	0.70	2.73
	17	3.9	0.63	2.46	0.52	2.03			1.00	3.90	0.99	3.86	0.78	3.04
	18	3.7			0.56	2.07	0.52	1.92	1.00	3.70	1.02	3.77	0.90	3.33
Nov	19	2.4			0.65	1.56	0.52	1.25			1.04	2.50	1.00	2.40
	20	3.4			0.73	2.48	0.56	1.90			1.07	3.64	1.07	3.64
	21	3.4			0.78	2.65	0.65	2.21			1.10	3.74	1.10	3.74
Dec	22	3.3			0.82	2.71	0.73	2.41			1.12	3.70	1.10	3.63
	23	3.2			0.90	2.88	0.78	2.50			1.13	3.62	1.10	3.52
	24	3.4			0.95	3.23	0.82	2.79			1.17	3.98	1.10	3.74
Jan	25	3.4			0.97	3.30	0.90	3.06			1.20	4.08	1.07	3.64
	26	3.6			0.93	3.35	0.95	3.42			1.19	4.28	1.02	3.67
	27	4.1			0.91	3.73	0.97	3.98			1.18	4.84	1.00	4.10
Feb	28	4.1			0.88	3.61	0.93	3.81			1.17	4.80	0.97	3.98
	29	4.1			0.84	3.44	0.91	3.73			1.16	4.76	0.90	3.69
	30	4.4			0.77	3.39	0.88	3.87			1.14	5.02	0.85	3.74
Mar	31	4.2			0.69	2.90	0.84	3.53			1.13	4.75		
	32	5.1			0.63	3.21	0.77	3.93			1.10	5.61		
	33	5.4					0.69	3.73	0.94	5.08	1.06	5.72		
Apr	34	5.3					0.63	3.34	0.94	4.98	1.00	5.30		
	35	5.2							0.99	5.15	1.00	5.20		
	36	5.2							1.02	5.30	1.00	5.20		

Table F.1-4 Evapotranspiration (Etcrop) by Crops (2/3)

(unit: mm/day)

	10		Soy Bean		Vegeta(A)-1		Vegeta(A)-2		Vegeta(A)-3		Vegeta(A)-4		Vegeta(B)-1	
Month	days	ETo	Kc	ETcrop	Kc	ETcrop	Kc	ETcrop	Kc	ETcrop	Kc	ETcrop	Kc	ETcrop
	1	5.1									0.92	4.69		
May	2	5.0	0.50	2.50					0.46	2.30	0.95	4.75		
	3	4.4	0.50	2.20					0.46	2.02	0.92	4.05		
	4	4.3	0.58	2.49					0.55	2.37	0.88	3.78		
Jun	5	4.3	0.55	2.37					0.68	2.92	0.80	3.44		
	6	4.3	0.75	3.23					0.75	3.23	0.70	3.01		
	7	4.4	0.79	3.48					0.80	3.52				
July	8	4.5	0.80	3.60					0.81	3.65				
	9	4.5	0.77	3.47					0.80	3.60				
	10	4.5	0.77	3.47					0.80	3.60				
Aug	11	4.4	0.81	3.56					0.85	3.74				
	12	4.4	0.86	3.78					0.91	4.00				
	13	4.1	0.89	3.65			0.51	2.09	0.95	3.90			0.51	2.09
Sept	14	3.9	0.86	3.35			0.51	1.99	0.93	3.63			0.51	1.99
	15	3.8	0.81	3.08			0.59	2.24	0.88	3.34			0.54	2.05
	16	3.9	0.72	2.81			0.70	2.73	0.80	3.12			0.61	2.38
Oct	17	3.9	0.58	2.26	0.52	2.03	0.77	3.00	0.70	2.73			0.68	2.65
	18	3.7			0.60	2.22	0.82	3.03					0.73	2.70
	19	2.4			0.72	1.73	0.83	1.99					0.76	1.82
Nov	20	3.4			0.78	2.65	0.81	2.75					0.78	2.65
	21	3.4			0.83	2.82	0.81	2.75					0.79	2.69
	22	3.3			0.84	2.77	0.86	2.84					0.82	2.71
Dec	23	3.2			0.82	2.62	0.92	2.94					0.86	2.75
	24	3.4			0.82	2.79	0.95	3.23					0.89	3.03
	25	3.4			0.86	2.92	0.93	3.16					0.9	3.06
Jan	26	3.6			0.92	3.31	0.88	3.17					0.89	3.20
	27	4.1			0.95	3.90	0.80	3.28			0.52	2.13	0.88	3.61
	28	4.1			0.93	3.81	0.70	2.87			0.52	2.13	0.85	3.49
Feb	29	4.1			0.88	3.61					0.60	2.46	0.81	3.32
	30	4.4			0.80	3.52					0.71	3.12	0.73	3.21
	31	4.2			0.70	2.94					0.78	3.28		
Mar	32	5.1									0.82	4.18		
	33	5.4									0.83	4.48		
	34	5.3									0.82	4.35		
Apr	35	5.2									0.82	4.26		
	36	5.2									0.86	4.47		

Table F.1-4 Evapotranspiration (Etcrop) by Crops (3/3)

(unit: mm/day)

	10		Vegeta(B)-2		Vegeta(B)-3		Fruits		Coffee		Pasture	
Month	days	ETo	Kc	ETcrop	Kc	ETcrop	Kc	ETcrop	Kc	ETcrop	Kc	ETcrop
May	1	5.1	0.89	4.54			0.85	4.34	1.05	5.36	0.55	2.81
	2	5.0	0.88	4.40			0.85	4.25	1.05	5.25	0.55	2.75
	3	4.4	0.87	3.83			0.85	3.74	1.05	4.62	0.55	2.42
Jun	4	4.3	0.84	3.61			0.85	3.66	1.05	4.52	0.55	2.37
	5	4.3	0.79	3.40			0.85	3.66	1.05	4.52	0.55	2.37
	6	4.3	0.72	3.10			0.85	3.66	1.05	4.52	0.55	2.37
July	7	4.4					0.85	3.74	1.05	4.62	0.55	2.42
	8	4.5					0.85	3.83	1.05	4.73	0.55	2.48
	9	4.5					0.85	3.83	1.05	4.73	0.55	2.48
Aug	10	4.5					0.85	3.83	1.05	4.73	0.55	2.48
	11	4.4					0.85	3.74	1.05	4.62	0.55	2.42
	12	4.4					0.85	3.74	1.05	4.62	0.55	2.42
Sept	13	4.1					0.85	3.49	1.05	4.31	0.55	2.26
	14	3.9			0.52	2.03	0.85	3.32	1.05	4.10	0.55	2.15
	15	3.8			0.52	1.98	0.85	3.23	1.05	3.99	0.55	2.09
Oct	16	3.9			0.56	2.18	0.85	3.32	1.05	4.10	0.55	2.15
	17	3.9			0.63	2.46	0.85	3.32	1.05	4.10	0.55	2.15
	18	3.7			0.69	2.55	0.85	3.15	1.05	3.89	0.55	2.04
Nov	19	2.4			0.74	1.78	0.85	2.04	1.05	2.52	0.50	1.20
	20	3.4			0.77	2.62	0.85	2.89	1.05	3.57	0.50	1.70
	21	3.4			0.79	2.69	0.85	2.89	1.05	3.57	0.50	1.70
Dec	22	3.3			0.80	2.64	0.85	2.81	1.05	3.47	0.50	1.65
	23	3.2			0.82	2.62	0.85	2.72	1.05	3.36	0.50	1.60
	24	3.4			0.86	2.92	0.85	2.89	1.05	3.57	0.50	1.70
Jan	25	3.4	0.54	1.84	0.89	3.03	0.85	2.89	1.05	3.57	0.50	1.70
	26	3.6	0.54	1.94	0.90	3.24	0.85	3.06	1.05	3.78	0.50	1.80
	27	4.1	0.57	2.34	0.89	3.65	0.85	3.49	1.05	4.31	0.50	2.05
Feb	28	4.1	0.64	2.62	0.88	3.61	0.85	3.49	1.05	4.31	0.50	2.05
	29	4.1	0.70	2.87	0.85	3.49	0.85	3.49	1.05	4.31	0.50	2.05
	30	4.4	0.74	3.26	0.80	3.52	0.85	3.74	1.05	4.62	0.50	2.20
Mar	31	4.2	0.77	3.23	0.73	3.07	0.85	3.57	1.05	4.41	0.50	2.10
	32	5.1	0.79	4.03			0.85	4.34	1.05	5.36	0.50	2.55
	33	5.4	0.80	4.32			0.85	4.59	1.05	5.67	0.50	2.70
Apr	34	5.3	0.82	4.35			0.85	4.51	1.05	5.57	0.50	2.65
	35	5.2	0.86	4.47			0.85	4.42	1.05	5.46	0.50	2.60
	36	5.2	0.89	4.63			0.85	4.42	1.05	5.46	0.50	2.60

2) Irrigation Method

Intake Rate test was carried out at five points of representative soil series in the Study Area. The results of the field intake rate tests are tabulated in the following Table F.1-5.

Table F.1-5 Result of Intake Rate Test

No. of Test Pit	Soil Series	Accumulated Infiltration (mm)	Intake Rate (mm/hr)	Basic Intake Rate (mm/hr)
1.	PM	$D=9.9T^{0.58}$	$I=345T^{-0.42}$	34
2.	COM	$D=4.4T^{0.59}$	$I=156T^{-0.41}$	16
3.	CAN	$D=7.4T^{0.58}$	$I=258T^{-0.42}$	67
4.	LEP	$D=3.6T^{0.66}$	$I=143T^{-0.34}$	23
5.	MOC	$D=9.0T^{0.50}$	$I=270T^{-0.50}$	16
			Average	31.2

3) Effective Rainfall

Evapotranspiration and precipitation ratio method by USDA stated in the FAO report described previously is employed in this report.

The result of the calculation is shown in Table F.1-6 below.

Table F.1-6 Effective Rainfall

(Unit: mm)

Month	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Total
Rainfall (1945-88)	129.3	170.3	104.3	125.8	171.8	106.9	25.2	6.2	1.8	6.2	7.2	33.4	888.4
Average ETcrop	103.5	102.2	116.8	118.0	82.8	74.8	75.2	87.6	92.2	99.2	93.9	123.4	1,169.6
*Effective	84.9	101.3	73.3	86.4	82.8	67.3	17.6	4.4	1.2	6.2	5.1	25.0	
Rainfall (Corrected)**	81.8	97.6	70.6	83.2	79.7	64.8	16.9	4.2	1.2	6.0	4.9	24.1	
Effective Rainfall (Employed)	80	95	70	80	75	60	15	0	0	5	0	20	500

Note *: Evapotranspiration/precipitation ratio method (by USDA)
** The correction factor for effective storage is 0.963. (soil water storage 60 mm)

4) Irrigation Efficiency

Taking into account the topographical feature, canal structure, distribution system, irrigation method, irrigation system and so on, irrigation efficiency is estimated in accordance with FAO guideline as below:

Ea: Field Application Efficiency ratio between water directly available to the crop and that received at the field inlet

Eb: Field Canal Efficiency ratio between water received at the field inlet and that received at the field inlet

Ec: Conveyance Efficiency ratio between water received at inlet to a block of fields and that released at the project headworks.

Ep: Project Efficiency ratio between water made directly available to the crop and that released at the headworks, or Ep=Ea x Eb x Ec

Factors affecting conveyance (Ec) are, amongst others, size of the irrigated acreage, size of rotational unit, number and types of crops requiring adjustments in the supply, (Eb) is affected primarily by the method and control of operation, the type of soils in respect of the seepage losses, length of field canals, size of the irrigation block and the fields. As can be expected the distribution efficiency (Ed) has been shown to be particular sensitive to quality of technical as well as organizational operation of procedures (Ed = Ec·Eb). Farm efficiency (Ef) is much dictated by the operation of the main supply system in meeting the field supply requirements as well as by the irrigation skill of the farmers.

Table F.1-7 Conveyance (Ec), Field Canal (Eb), Distribution (Ed) and Field Application Efficiency (Ea)

Conveyance Efficiency (Ec)			
Continuous supply with no substantial change in flow			0.9
Rotational supply in projects of 3,000 - 7,000 ha and rotational areas of 70 - 300 ha, with effective management			0.8
Rotational supply in large schemes (>10,000 ha) and small schemes (<1,000 ha) with respective problematic communication and less effective management:	based on predetermined schedule		0.7
	based on advance request		0.65
Field Canal Efficiency (Eb)			
Blocks larger than 20 ha:	unlined		0.8
	lined or piped		0.9
Blocks up to 20 ha:	unlined		0.7
	lined or piped		0.8
Distribution Efficiency (Ed = Ec·Eb)			
Average for rotational supply with management and	communication adequate		0.65
	sufficient		0.55
	insufficient		0.40
	poor		0.30

Field Application Efficiency (Ea)		USDA	US(SCS)
Surface methods			
	light soils	0.55	
	medium soils	0.70	
	heavy soils	0.60	
	graded border	0.60-0.75	0.53
	basin and level border	0.60-0.80	0.58
	contour ditch	0.50-0.55	
	furrow	0.55-0.70	0.57
	corrugation	0.50-0.70	
Subsurface		up to 0.80	
Sprinkler, hot dry climate		0.60	
moderate climate		0.70	0.67
humid and cool		0.80	
Rice			0.32

Source: ICID/ILRI

	Ea	Eb	Ec	Ep
Furrow Irrigation	0.60	0.90	0.85	0.46

5) Irrigation Water Requirement

The monthly, seasonal, and yearly irrigation water requirements for Sector I and Sector II can be determined for each proposed crop based on the crop requirement, effective rainfall, cropping area for each crop shown in Table F.1-8, 9 and irrigation efficiency by using following equation.

$$W.R = (A \times \text{Net Et crop})/(1 - Lr) \times 10/Ep$$

where;

A : Irrigation area (ha)
Net Et crop : Eto-Pe
ETo : Crop Water Requirement (mm)
Pe : Effective Rainfall (mm)
Ep : Irrigation Efficiency
Lr : Leaching Water Requirement

However, no leaching water requirement is considered in this Project in accordance with results of soil and water quality test.

The result of the 10 days, monthly, seasonal and yearly water requirement calculation for Sector I and Sector II are summarized in Table F.1-10 and irrigation requirement by crops for Sector I and Sector II are shown in Table F.1-11 and 12 respectively. Water Requirement for each crop in Sector I and Sector II are shown in Table F.1-13 to 46.

Table F.1-8 Irrigation Area by Crops in Sector I

(Unit: ha)

Month	10 days	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	TOTAL (ha)
		Name of Crops																	
May	1	13			185							77		77		34	19	34	439
	2	40			226			7			7	63		63		34	19	34	493
	3	67			267			21			21	49		49		34	19	34	560
Jun	4	94			308			35			35	35		35		34	19	34	629
	5	120			329			49			49	21		21		34	19	34	675
	6	147			329			63			63	7		7		34	19	34	703
July	7	161			329			77			77					34	19	34	730
	8	161			329			91			91					34	19	34	758
	9	161			329			105			105					34	19	34	786
Aug	10	161			329			105			105					34	19	34	786
	11	161			308			91			91					34	19	34	738
	12	147			267			77			77					34	19	34	655
Sept	13	120			226		4	63		7	63		7			34	19	34	576
	14	94			185		11	49		21	49		20		7	34	19	34	522
	15	67			144	10	19	35		35	35		34		21	34	19	34	486
Oct	16	40	7		103	31	26	21		49	21		47		35	34	19	34	466
	17	13	19		62	52	30	7	7	63	7		61		49	34	19	34	456
	18		33	7	21	72	30		20	77			74		63	34	19	34	483
Nov	19		46	21		82	30		34	91			88		77	34	19	34	555
	20		59	34		82	30		47	105			102		91	34	19	34	637
	21		72	48		82	30		61	105			108		105	34	19	34	697
Dec	22		79	62		82	30		74	91			108		112	34	19	34	724
	23		79	76		82	30		88	77			102		112	34	19	34	731
	24		79	82		82	30		102	63			88		105	34	19	34	717
Jan	25		79	82		82	30		102	49			74	7	91	34	19	34	682
	26		79	82		82	30		88	35			61	21	77	34	19	34	641
	27		72	82		82	26		74	21		7	47	35	63	34	19	34	597
Feb	28		59	82		82	19		61	7		21	34	49	49	34	19	34	549
	29		46	76		72	11		47			35	20	63	35	34	19	34	491
	30		33	62		52	4		34			49	7	77	21	34	19	34	424
Mar	31		19	48		31			20			63		91	7	34	19	34	366
	32		7	34		10			7			77		105		34	19	34	327
	33			21	21							91		112		34	19	34	330
Apr	34			7	62							105		112		34	19	34	372
	35				103							105		105		34	19	34	399
	36				144							91		91		34	19	34	412

A: Maize (I) B: Maize (II) C: Maize (III) D: Rice (I) E: Rice (II)
F: Tobacco G: Soy Bean H: Vegeta(A)-1 I: Vegeta(A)-2 J: Vegeta(A)-3
K: Vegeta(A)-4 L: Vegeta(B)-1 M: Vegeta(B)-2 N: Vegeta(B)-3 O: Fruits
P: Coffee Q: Pasture

Table F.1-9 Irrigation Area by Crops in Sector II

(Unit: ha)

Month	10 days	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	TOTAL (ha)
		Name of Crops																	
May	1	23			310							129		129		56	31	56	734
	2	68			379			12			12	106		106		56	31	56	826
	3	112			448			35			35	82		82		56	31	56	938
Jun	4	157			517			59			59	59		59		56	31	56	1,053
	5	202			551			82			82	35		35		56	31	56	1,131
	6	247			551			106			106	12		12		56	31	56	1,177
July	7	269			551			129			129					56	31	56	1,222
	8	269			551			153			153					56	31	56	1,270
	9	269			551			176			176					56	31	56	1,316
Aug	10	269			551			176			176					56	31	56	1,316
	11	269			517			153			153					56	31	56	1,235
	12	247			448			129			129					56	31	56	1,096
Sept	13	202			379		6	106		12	106		11			56	31	56	966
	14	157			310		19	82		35	82		34		12	56	31	56	875
	15	112			241	18	31	59		59	59		57		35	56	31	56	815
Oct	16	68	11		172	51	44	35		82	35		80		59	56	31	56	781
	17	23	33		103	86	50	12	11	106	12		102		82	56	31	56	764
	18		55	11	34	120	50		34	129			125		106	56	31	56	808
Nov	19		76	34		138	50		57	153			148		129	56	31	56	929
	20		99	58		138	50		80	176			170		153	56	31	56	1,067
	21		120	80		138	50		102	176			182		176	56	31	56	1,168
Dec	22		131	103		138	50		125	153			182		188	56	31	56	1,214
	23		131	126		138	50		148	129			170		188	56	31	56	1,225
	24		131	138		138	50		170	106			148		176	56	31	56	1,201
Jan	25		131	138		138	50		170	82			125	12	153	56	31	56	1,143
	26		131	138		138	50		148	59			102	35	129	56	31	56	1,074
	27		120	138		138	44		125	35		12	80	59	106	56	31	56	999
Feb	28		99	138		138	31		102	12		35	57	82	82	56	31	56	920
	29		76	126		120	19		80			59	34	106	59	56	31	56	823
	30		55	103		86	6		57			82	11	129	35	56	31	56	709
Mar	31		33	80		51			34			106		153	12	56	31	56	612
	32		11	58		18			11			129		176		56	31	56	547
	33			34	34							153		188		56	31	56	554
Apr	34			11	103							176		188		56	31	56	622
	35				172							176		176		56	31	56	668
	36				241							153		153		56	31	56	691

A: Maize (I) B: Maize (II) C: Maize (III) D: Rice (I) E: Rice (II)
F: Tobacco G: Soy Bean H: Vegeta(A)-1 I: Vegeta(A)-2 J: Vegeta(A)-3
K: Vegeta(A)-4 L: Vegeta(B)-1 M: Vegeta(B)-2 N: Vegeta(B)-3 O: Fruits

Table F.1-10 Summary of Water Requirements by Sector

		Sector I		Sector II		TOTAL	
	10	Water Requirement		Water Requirement		Water Requirement	
Month	days	(MCM)	(m3/s)	(MCM)	(m3/s)	(m3/s)	(l/s/ha)
May	1	0.193	0.446	0.323	0.747	1.192	0.557
	2	0.204	0.472	0.342	0.791	1.263	0.590
	3	0.167	0.386	0.279	0.646	1.032	0.482
Jun	4	0.126	0.291	0.211	0.488	0.779	0.364
	5	0.130	0.302	0.218	0.506	0.807	0.377
	6	0.144	0.333	0.241	0.557	0.890	0.416
July	7	0.305	0.707	0.511	1.183	1.890	0.883
	8	0.341	0.788	0.570	1.320	2.109	0.985
	9	0.350	0.811	0.587	1.358	2.169	1.013
Aug	10	0.297	0.688	0.498	1.152	1.839	0.859
	11	0.264	0.611	0.442	1.024	1.635	0.764
	12	0.233	0.539	0.390	0.902	1.441	0.673
Sept	13	0.182	0.420	0.304	0.704	1.125	0.526
	14	0.120	0.279	0.202	0.467	0.745	0.348
	15	0.078	0.181	0.131	0.303	0.483	0.226
Oct	16	0.104	0.240	0.174	0.402	0.642	0.300
	17	0.101	0.234	0.169	0.392	0.626	0.292
	18	0.096	0.223	0.162	0.374	0.597	0.279
Nov	19	0.169	0.392	0.284	0.657	1.049	0.490
	20	0.310	0.717	0.519	1.201	1.918	0.896
	21	0.347	0.804	0.582	1.347	2.152	1.005
Dec	22	0.437	1.013	0.733	1.696	2.709	1.266
	23	0.441	1.020	0.738	1.708	2.728	1.275
	24	0.472	1.093	0.791	1.830	2.923	1.366
Jan	25	0.459	1.063	0.769	1.781	2.844	1.329
	26	0.456	1.055	0.764	1.768	2.823	1.319
	27	0.476	1.103	0.798	1.847	2.949	1.378
Feb	28	0.405	0.938	0.679	1.571	2.508	1.172
	29	0.350	0.810	0.586	1.357	2.168	1.013
	30	0.312	0.723	0.523	1.210	1.933	0.903
Mar	31	0.263	0.608	0.440	1.019	1.627	0.760
	32	0.277	0.641	0.464	1.073	1.714	0.801
	33	0.305	0.707	0.511	1.184	1.890	0.883
Apr	34	0.294	0.679	0.492	1.138	1.817	0.849
	35	0.325	0.753	0.545	1.261	2.014	0.941
	36	0.355	0.821	0.594	1.376	2.197	1.027
TOTAL		9.888		16.562			
Maximum			1.103		1.847	2.949	1.378

Table F.1-11 Summary of Irrigation Requirement by crops in Sector I

(Unit: MCM)

Month	10 days	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	TOTAL
		Name of Crops																	
May	1				0.105							0.033		0.031		0.012	0.011	0.001	0.193
	2				0.130							0.028		0.023		0.011	0.010	0.001	0.204
	3				0.124							0.014		0.012		0.008	0.008		0.167
Jun	4				0.109							0.005		0.003		0.004	0.005		0.126
	5				0.119							0.001		0.001		0.004	0.005		0.130
	6	0.002			0.131			0.001			0.001					0.004	0.005		0.144
July	7	0.039			0.208			0.019			0.020					0.010	0.009	0.001	0.305
	8	0.056			0.213			0.025			0.026					0.011	0.010	0.001	0.341
	9	0.065			0.210			0.025			0.028					0.011	0.010	0.001	0.350
Aug	10	0.058			0.183			0.018			0.021					0.008	0.008		0.297
	11	0.049			0.161			0.018			0.021					0.008	0.008		0.264
	12	0.042			0.134			0.018			0.022					0.008	0.008		0.233
Sept	13	0.030			0.103			0.016			0.019					0.007	0.007		0.182
	14	0.016			0.071			0.009			0.012					0.006	0.006		0.120
	15	0.007			0.047	0.002		0.004			0.006					0.005	0.006		0.078
Oct	16	0.006	0.000		0.042	0.011	0.004	0.004		0.008	0.005		0.004		0.001	0.009	0.008	0.001	0.104
	17	0.001	0.000		0.025	0.021	0.007	0.000	0.000	0.014	0.001		0.009		0.005	0.009	0.008	0.001	0.101
	18		0.001		0.007	0.027	0.009		0.001	0.017			0.011		0.007	0.008	0.008	0.000	0.096
Nov	19		0.010	0.003		0.035	0.012		0.009	0.029			0.025		0.021	0.011	0.008	0.005	0.169
	20		0.025	0.010		0.055	0.020		0.022	0.051			0.047		0.041	0.017	0.012	0.009	0.310
	21		0.033	0.018		0.057	0.021		0.030	0.051			0.051		0.049	0.017	0.012	0.009	0.347
Dec	22		0.045	0.032		0.065	0.023		0.044	0.055			0.063		0.063	0.020	0.014	0.012	0.437
	23		0.048	0.040		0.064	0.023		0.050	0.049			0.060		0.063	0.020	0.013	0.012	0.441
	24		0.054	0.049		0.070	0.024		0.061	0.044			0.057		0.066	0.021	0.014	0.012	0.472
Jan	25		0.055	0.054		0.072	0.023		0.064	0.033			0.049	0.003	0.059	0.021	0.014	0.012	0.459
	26		0.056	0.060		0.075	0.024		0.063	0.024			0.042	0.009	0.053	0.022	0.015	0.013	0.456
	27		0.057	0.070		0.085	0.023		0.062	0.015		0.003	0.037	0.018	0.049	0.025	0.017	0.015	0.476
Feb	28		0.044	0.064		0.082	0.015		0.048	0.004		0.009	0.024	0.026	0.036	0.024	0.017	0.014	0.405
	29		0.032	0.058		0.071	0.008		0.035			0.017	0.014	0.037	0.025	0.024	0.017	0.014	0.350
	30		0.023	0.049		0.054	0.003		0.024			0.031	0.005	0.051	0.015	0.026	0.018	0.015	0.312
Mar	31		0.012	0.036		0.031			0.013			0.044		0.063	0.005	0.026	0.018	0.015	0.263
	32		0.005	0.029		0.013						0.069		0.091		0.031	0.021	0.018	0.277
	33			0.016	0.022							0.088		0.104		0.033	0.023	0.019	0.305
Apr	34			0.004	0.057							0.083		0.088		0.028	0.020	0.014	0.294
	35				0.099							0.081		0.086		0.027	0.019	0.014	0.325
	36				0.143							0.074		0.077		0.027	0.019	0.014	0.355
TOTAL		0.372	0.501	0.593	2.444	0.889	0.238	0.157	0.525	0.392	0.182	0.581	0.496	0.722	0.560	0.562	0.433	0.241	9.888

A: Maize (I) B: Maize (II) C: Maize (III) D: Rice (I) E: Rice (II) F: Tobacco
G: Soy Bean H: Vegeta(A)-1 I: Vegeta(A)-2 J: Vegeta(A)-3 K: Vegeta(A)-4 L: Vegeta(B)-1
M: Vegeta(B)-2 N: Vegeta(B)-3 O: Fruits P: Coffee Q: Pasture

Table F.1-12 Summary of Irrigation Requirement by crops in Sector II

(Unit: MCM)

Month	10 days	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	TOTAL
		Name of Crops																	
May	1				0.175							0.056		0.052		0.020	0.018	0.002	0.323
	2				0.218							0.047		0.039		0.019	0.017	0.001	0.342
	3				0.208							0.024		0.020		0.013	0.013		0.279
Jun	4				0.182							0.008		0.006		0.006	0.009		0.211
	5				0.200							0.002		0.002		0.006	0.009		0.216
	6	0.003			0.220			0.001			0.001					0.006	0.009		0.241
July	7	0.066			0.348			0.032			0.033					0.017	0.015	0.001	0.511
	8	0.094			0.357			0.041			0.043					0.018	0.016	0.002	0.570
	9	0.109			0.351			0.043			0.048					0.018	0.016	0.002	0.587
Aug	10	0.098			0.307			0.030			0.035					0.014	0.014		0.498
	11	0.082			0.270			0.029			0.035					0.013	0.013		0.442
	12	0.071			0.225			0.031			0.037					0.013	0.013		0.390
Sept	13	0.050			0.173			0.026			0.032					0.012	0.012		0.304
	14	0.027			0.119			0.015			0.020					0.010	0.011		0.202
	15	0.011			0.079	0.004		0.007			0.011					0.009	0.010		0.131
Oct	16	0.011	0.000		0.070	0.018	0.007	0.006		0.013	0.008		0.006		0.002	0.016	0.014	0.002	0.174
	17	0.002	0.000		0.042	0.034	0.011	0.001	0.000	0.023	0.002		0.014		0.008	0.016	0.014	0.002	0.169
	18		0.001		0.013	0.046	0.014		0.002	0.029			0.019		0.013	0.014	0.013	0.000	0.162
Nov	19		0.017	0.006		0.059	0.020		0.015	0.049			0.042		0.035	0.019	0.014	0.008	0.284
	20		0.042	0.017		0.093	0.034		0.037	0.085			0.078		0.069	0.029	0.021	0.014	0.519
	21		0.055	0.029		0.096	0.035		0.051	0.085			0.085		0.082	0.029	0.021	0.014	0.582
Dec	22		0.076	0.053		0.109	0.039		0.074	0.093			0.105		0.106	0.034	0.023	0.020	0.733
	23		0.081	0.068		0.107	0.038		0.083	0.081			0.100		0.106	0.033	0.023	0.019	0.738
	24		0.091	0.082		0.117	0.040		0.102	0.073			0.096		0.110	0.035	0.024	0.021	0.791
Jan	25		0.093	0.090		0.120	0.039		0.107	0.056			0.082	0.005	0.099	0.035	0.024	0.021	0.769
	26		0.094	0.101		0.126	0.039		0.105	0.040			0.070	0.015	0.089	0.037	0.025	0.022	0.764
	27		0.096	0.117		0.143	0.038		0.104	0.025		0.005	0.061	0.029	0.083	0.042	0.029	0.025	0.798
Feb	28		0.073	0.108		0.137	0.026		0.080	0.007		0.015	0.040	0.043	0.060	0.040	0.028	0.023	0.679
	29		0.054	0.097		0.118	0.014		0.059			0.029	0.023	0.061	0.042	0.040	0.028	0.023	0.586
	30		0.038	0.082		0.090	0.005		0.041			0.052	0.007	0.085	0.025	0.043	0.030	0.025	0.523
Mar	31		0.020	0.061		0.052			0.021			0.074		0.106	0.008	0.043	0.030	0.025	0.440
	32		0.008	0.048		0.021						0.116		0.152		0.052	0.036	0.031	0.464
	33			0.027	0.037							0.147		0.174		0.055	0.038	0.033	0.511
Apr	34			0.006	0.095							0.139		0.148		0.046	0.033	0.024	0.492
	35				0.165							0.136		0.143		0.045	0.032	0.023	0.545
	36				0.239							0.124		0.130		0.045	0.032	0.023	0.594
TOTAL		0.624	0.840	0.993	4.093	1.490	0.399	0.262	0.879	0.657	0.304	0.973	0.830	1.210	0.938	0.941	0.725	0.404	16.562

A: Maize (I) B: Maize (II) C: Maize (III) D: Rice (I) E: Rice (II) F: Tobacco
G: Soy Bean H: Vegeta(A)-1 I: Vegeta(A)-2 J: Vegeta(A)-3 K: Vegeta(A)-4 L: Vegeta(B)-1
M: Vegeta(B)-2 N: Vegeta(B)-3 O: Fruits P: Coffee Q: Pasture

Table F.1-13 Irrigation Requirement for Maze (I) in Sector I

(Unit: MCM)

Month	10 days	ETcrop (mm/day)	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area (ha)	Water Requirement
May	1	2.35	23.5	26.7		13	
	2	2.30	23.0	26.7		40	
	3	2.24	22.4	26.7		67	
Jun	4	2.58	25.8	31.7		94	
	5	2.97	29.7	31.7		120	
	6	3.23	32.3	31.7	0.6	147	0.002
July	7	3.48	34.8	23.3	11.4	161	0.039
	8	3.96	39.6	23.3	16.3	161	0.056
	9	4.23	42.3	23.3	19.0	161	0.065
Aug	10	4.37	43.7	26.7	17.0	161	0.058
	11	4.09	40.9	26.7	14.3	161	0.049
	12	4.00	40.0	26.7	13.4	147	0.042
Sept	13	3.65	36.5	25.0	11.5	120	0.030
	14	3.32	33.2	25.0	8.1	94	0.016
	15	2.96	29.6	25.0	4.6	67	0.007
Oct	16	2.73	27.3	20.0	7.3	40	0.006
	17	2.46	24.6	20.0	4.6	13	0.001
	18			20.0			
Nov	19			5.0			
	20			5.0			
	21			5.0			
Dec	22						
	23						
	24						
Jan	25						
	26						
	27						
Feb	28			1.7			
	29			1.7			
	30			1.7			
Mar	31						
	32						
	33						
Apr	34			6.7			
	35			6.7			
	36			6.7			

Table F.1-14 Irrigation Requirement for Maze (II) in Sector I

(Unit: MCM)

Month	10 days	ETcrop (mm/day)	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area (ha)	Water Requirement
	1			26.7			
May	2			26.7			
	3			26.7			
	4			31.7			
Jun	5			31.7			
	6			31.7			
	7			23.3			
July	8			23.3			
	9			23.3			
	10			26.7			
Aug	11			26.7			
	12			26.7			
	13			25.0			
Sept	14			25.0			
	15			25.0			
	16	2.03	20.3	20.0	0.3	7	0.000
Oct	17	2.03	20.3	20.0	0.3	19	0.000
	18	2.07	20.7	20.0	0.7	33	0.001
	19	1.56	15.6	5.0	10.6	46	0.010
Nov	20	2.48	24.8	5.0	19.8	59	0.025
	21	2.65	26.5	5.0	21.5	72	0.033
	22	2.71	27.1		27.1	79	0.045
Dec	23	2.88	28.8		28.8	79	0.048
	24	3.23	32.3		32.3	79	0.054
	25	3.30	33.0		33.0	79	0.055
Jan	26	3.35	33.5		33.5	79	0.056
	27	3.73	37.3		37.3	72	0.057
	28	3.61	36.1	1.7	34.4	59	0.044
Feb	29	3.44	34.4	1.7	32.8	46	0.032
	30	3.39	33.9	1.7	32.2	33	0.023
	31	2.90	29.0		29.0	19	0.012
Mar	32	3.21	32.1		32.1	7	0.005
	33						
	34			6.7			
Apr	35			6.7			
	36			6.7			

Table F.1-15 Irrigation Requirement for Maze (III) in Sector I

(Unit: MCM)

Month	10 days	ETcrop (mm/day)	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area (ha)	Water Requirement
May	1			26.7			
	2			26.7			
	3			26.7			
Jun	4			31.7			
	5			31.7			
	6			31.7			
July	7			23.3			
	8			23.3			
	9			23.3			
Aug	10			26.7			
	11			26.7			
	12			26.7			
Sept	13			25.0			
	14			25.0			
	15			25.0			
Oct	16			20.0			
	17			20.0			
	18	1.92	19.2	20.0		7	
Nov	19	1.25	12.5	5.0	7.5	21	0.003
	20	1.90	19.0	5.0	14.0	34	0.010
	21	2.21	22.1	5.0	17.1	48	0.018
Dec	22	2.41	24.1		24.1	62	0.032
	23	2.50	25.0		25.0	76	0.040
	24	2.79	27.9		27.9	82	0.049
Jan	25	3.06	30.6		30.6	82	0.054
	26	3.42	34.2		34.2	82	0.060
	27	3.98	39.8		39.8	82	0.070
Feb	28	3.81	38.1	1.7	36.5	82	0.064
	29	3.73	37.3	1.7	35.6	76	0.058
	30	3.87	38.7	1.7	37.1	62	0.049
Mar	31	3.53	35.3		35.3	48	0.036
	32	3.93	39.3		39.3	34	0.029
	33	3.73	37.3		37.3	21	0.016
Apr	34	3.34	33.4	6.7	26.7	7	0.004
	35			6.7			
	36			6.7			

Table F.1-16 Irrigation Requirement for Rice (I) in Sector I

(Unit: MCM)

Month	10 days	ETcrop (mm/day)	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area (ha)	Water Requirement
	1	5.30	53.0	26.7	26.4	185	0.105
May	2	5.35	53.5	26.7	26.8	226	0.130
	3	4.84	48.4	26.7	21.7	267	0.124
	4	4.82	48.2	31.7	16.5	308	0.109
Jun	5	4.86	48.6	31.7	16.9	329	0.119
	6	5.03	50.3	31.7	18.6	329	0.131
	7	5.28	52.8	23.3	29.5	329	0.208
July	8	5.35	53.6	23.3	30.2	329	0.213
	9	5.31	53.1	23.3	29.8	329	0.210
	10	5.27	52.7	26.7	26.0	329	0.183
Aug	11	5.10	51.0	26.7	24.4	308	0.161
	12	5.02	50.2	26.7	23.5	267	0.134
	13	4.63	46.3	25.0	21.3	226	0.103
Sept	14	4.29	42.9	25.0	17.9	185	0.071
	15	4.03	40.3	25.0	15.3	144	0.047
	16	3.90	39.0	20.0	19.0	103	0.042
Oct	17	3.90	39.0	20.0	19.0	62	0.025
	18	3.70	37.0	20.0	17.0	21	0.007
	19			5.0			
Nov	20			5.0			
	21			5.0			
	22						
Dec	23						
	24						
	25						
Jan	26						
	27						
	28			1.7			
Feb	29			1.7			
	30			1.7			
	31						
Mar	32						
	33	5.08	50.8		50.8	21	0.022
	34	4.98	49.8	6.7	43.2	62	0.057
Apr	35	5.15	51.5	6.7	44.8	103	0.099
	36	5.30	53.0	6.7	46.4	144	0.143

Table F.1-17 Irrigation Requirement for Rice (II) in Sector I

(Unit: MCM)

Month	10 days	ETcrop (mm/day)	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area (ha)	Water Requirement
May	1			26.7			
	2			26.7			
	3			26.7			
Jun	4			31.7			
	5			31.7			
	6			31.7			
July	7			23.3			
	8			23.3			
	9			23.3			
Aug	10			26.7			
	11			26.7			
	12			26.7			
Sept	13			25.0			
	14			25.0			
	15	3.57	35.7	25.0	10.7	10	0.002
Oct	16	3.67	36.7	20.0	16.7	31	0.011
	17	3.86	38.6	20.0	18.6	52	0.021
	18	3.77	37.7	20.0	17.7	72	0.027
Nov	19	2.50	25.0	5.0	20.0	82	0.035
	20	3.64	36.4	5.0	31.4	82	0.055
	21	3.74	37.4	5.0	32.4	82	0.057
Dec	22	3.70	37.0		37.0	82	0.065
	23	3.62	36.2		36.2	82	0.064
	24	3.98	39.8		39.8	82	0.070
Jan	25	4.08	40.8		40.8	82	0.072
	26	4.28	42.8		42.8	82	0.075
	27	4.84	48.4		48.4	82	0.085
Feb	28	4.80	48.0	1.7	46.3	82	0.082
	29	4.76	47.6	1.7	45.9	72	0.071
	30	5.02	50.2	1.7	48.5	52	0.054
Mar	31	4.75	47.5		47.5	31	0.031
	32	5.61	56.1		56.1	10	0.013
	33	5.72	57.2		57.2		
Apr	34	5.30	53.0	6.7	46.3		
	35	5.20	52.0	6.7	45.3		
	36	5.20	52.0	6.7	45.3		

Table F.1-18 Irrigation Requirement for Tobacco in Sector I

(Unit: MCM)

Month	10 days	ETcrop (mm/day)	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area (ha)	Water Requirement
	1			26.7			
May	2			26.7			
	3			26.7			
	4			31.7			
Jun	5			31.7			
	6			31.7			
	7			23.3			
July	8			23.3			
	9			23.3			
	10			26.7			
Aug	11			26.7			
	12			26.7			
	13	2.09	20.9	25.0		4	
Sept	14	2.18	21.8	25.0		11	
	15	2.36	23.6	25.0		19	
	16	2.73	27.3	20.0	7.3	26	0.004
Oct	17	3.04	30.4	20.0	10.4	30	0.007
	18	3.33	33.3	20.0	13.3	30	0.009
	19	2.40	24.0	5.0	19.0	30	0.012
Nov	20	3.64	36.4	5.0	31.4	30	0.020
	21	3.74	37.4	5.0	32.4	30	0.021
	22	3.63	36.3		36.3	30	0.023
Dec	23	3.52	35.2		35.2	30	0.023
	24	3.74	37.4		37.4	30	0.024
	25	3.64	36.4		36.4	30	0.023
Jan	26	3.67	36.7		36.7	30	0.024
	27	4.10	41.0		41.0	26	0.023
	28	3.98	39.8	1.7	38.1	19	0.015
Feb	29	3.69	36.9	1.7	35.2	11	0.008
	30	3.74	37.4	1.7	35.7	4	0.003
	31						
Mar	32						
	33						
	34			6.7			
Apr	35			6.7			
	36			6.7			

Table F.1-19 Irrigation Requirement for Soy Beans in Sector I

(Unit: MCM)

Month	10 days	ETcrop (mm/day)	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area (ha)	Water Requirement
May	1			26.7			
	2	2.50	25.0	26.7		7	
	3	2.20	22.0	26.7		21	
Jun	4	2.49	24.9	31.7		35	
	5	2.37	23.7	31.7		49	
	6	3.23	32.3	31.7	0.6	63	0.001
July	7	3.48	34.8	23.3	11.4	77	0.019
	8	3.60	36.0	23.3	12.7	91	0.025
	9	3.47	34.7	23.3	11.3	105	0.025
Aug	10	3.47	34.7	26.7	8.0	105	0.018
	11	3.56	35.6	26.7	9.0	91	0.018
	12	3.78	37.8	26.7	11.2	77	0.018
Sept	13	3.65	36.5	25.0	11.5	63	0.016
	14	3.35	33.5	25.0	8.5	49	0.009
	15	3.08	30.8	25.0	5.8	35	0.004
Oct	16	2.81	28.1	20.0	8.1	21	0.004
	17	2.26	22.6	20.0	2.6	7	0.000
	18			20.0			
Nov	19			5.0			
	20			5.0			
	21			5.0			
Dec	22						
	23						
	24						
Jan	25						
	26						
	27						
Feb	28			1.7			
	29			1.7			
	30			1.7			
Mar	31						
	32						
	33						
Apr	34			6.7			
	35			6.7			
	36			6.7			

Table F.1-20 Irrigation Requirement for Vegetable (A)-1 in Sector I

(Unit: MCM)

Month	10 days	ETcrop (mm/day)	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area (ha)	Water Requirement
May	1			26.7			
	2			26.7			
	3			26.7			
Jun	4			31.7			
	5			31.7			
	6			31.7			
July	7			23.3			
	8			23.3			
	9			23.3			
Aug	10			26.7			
	11			26.7			
	12			26.7			
Sept	13			25.0			
	14			25.0			
	15			25.0			
Oct	16			20.0			
	17	2.03	20.3	20.0	0.3	7	0.000
	18	2.22	22.2	20.0	2.2	20	0.001
Nov	19	1.73	17.3	5.0	12.3	34	0.009
	20	2.65	26.5	5.0	21.5	47	0.022
	21	2.82	28.2	5.0	23.2	61	0.030
Dec	22	2.77	27.7		27.7	74	0.044
	23	2.62	26.2		26.2	88	0.050
	24	2.79	27.9		27.9	102	0.061
Jan	25	2.92	29.2		29.2	102	0.064
	26	3.31	33.1		33.1	88	0.063
	27	3.89	38.9		38.9	74	0.062
Feb	28	3.81	38.1	1.7	36.5	61	0.048
	29	3.61	36.1	1.7	34.4	47	0.035
	30	3.52	35.2	1.7	33.5	34	0.024
Mar	31	2.94	29.4		29.4	20	0.013
	32					7	
	33						
Apr	34			6.7			
	35			6.7			
	36			6.7			

Table F.1-21 Irrigation Requirement for Vegetable (A)-2 in Sector I

(Unit: MCM)

Month	10 days	ETcrop (mm/day)	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area (ha)	Water Requirement
May	1			26.7			
	2			26.7			
	3			26.7			
Jun	4			31.7			
	5			31.7			
	6			31.7			
July	7			23.3			
	8			23.3			
	9			23.3			
Aug	10			26.7			
	11			26.7			
	12			26.7			
Sept	13	2.09	20.9	25.0		7	
	14	1.99	19.9	25.0		21	
	15	2.24	22.4	25.0		35	
Oct	16	2.73	27.3	20.0	7.3	49	0.008
	17	3.00	30.0	20.0	10.0	63	0.014
	18	3.03	30.3	20.0	10.3	77	0.017
Nov	19	1.99	19.9	5.0	14.9	91	0.029
	20	2.75	27.5	5.0	22.5	105	0.051
	21	2.75	27.5	5.0	22.5	105	0.051
Dec	22	2.84	28.4		28.4	91	0.055
	23	2.94	29.4		29.4	77	0.049
	24	3.23	32.3		32.3	63	0.044
Jan	25	3.16	31.6		31.6	49	0.033
	26	3.17	31.7		31.7	35	0.024
	27	3.28	32.8		32.8	21	0.015
Feb	28	2.87	28.7	1.7	27.0	7	0.004
	29			1.7			
	30			1.7			
Mar	31						
	32						
	33						
Apr	34			6.7			
	35			6.7			
	36			6.7			

Table F.1-22 Irrigation Requirement for Vegetable (A)-3 in Sector I

(Unit: MCM)

Month	10 days	ETcrop (mm/day)	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area (ha)	Water Requirement
	1			26.7			
May	2	2.30	23.0	26.7		7	
	3	2.02	20.2	26.7		21	
	4	2.37	23.7	31.7		35	
Jun	5	2.92	29.2	31.7		49	
	6	3.23	32.3	31.7	0.6	63	0.001
	7	3.52	35.2	23.3	11.9	77	0.020
July	8	3.65	36.5	23.3	13.1	91	0.026
	9	3.60	36.0	23.3	12.7	105	0.028
	10	3.60	36.0	26.7	9.3	105	0.021
Aug	11	3.74	37.4	26.7	10.7	91	0.021
	12	4.00	40.0	26.7	13.4	77	0.022
	13	3.89	38.9	25.0	13.9	63	0.019
Sept	14	3.63	36.3	25.0	11.3	49	0.012
	15	3.34	33.4	25.0	8.4	35	0.006
	16	3.12	31.2	20.0	11.2	21	0.005
Oct	17	2.73	27.3	20.0	7.3	7	0.001
	18			20.0			
	19			5.0			
Nov	20			5.0			
	21			5.0			
	22						
Dec	23						
	24						
	25						
Jan	26						
	27						
	28			1.7			
Feb	29			1.7			
	30			1.7			
	31						
Mar	32						
	33						
	34			6.7			
Apr	35			6.7			
	36			6.7			

Table F.1-23 Irrigation Requirement for Vegetable (A)-4 in Sector I

(Unit: MCM)

Month	10 days	ETcrop (mm/day)	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area (ha)	Water Requirement
May	1	4.69	46.9	26.7	20.3	77	0.033
	2	4.75	47.5	26.7	20.8	63	0.028
	3	4.05	40.5	26.7	13.8	49	0.014
Jun	4	3.78	37.8	31.7	6.2	35	0.005
	5	3.44	34.4	31.7	2.7	21	0.001
	6	3.01	30.1	31.7		7	
July	7			23.3			
	8			23.3			
	9			23.3			
Aug	10			26.7			
	11			26.7			
	12			26.7			
Sept	13			25.0			
	14			25.0			
	15			25.0			
Oct	16			20.0			
	17			20.0			
	18			20.0			
Nov	19			5.0			
	20			5.0			
	21			5.0			
Dec	22						
	23						
	24						
Jan	25						
	26						
	27	2.13	21.3		21.3	7	0.003
Feb	28	2.13	21.3	1.7	19.7	21	0.009
	29	2.46	24.6	1.7	22.9	35	0.017
	30	3.12	31.2	1.7	29.6	49	0.031
Mar	31	3.28	32.8		32.8	63	0.044
	32	4.18	41.8		41.8	77	0.069
	33	4.48	44.8		44.8	91	0.088
Apr	34	4.35	43.5	6.7	36.8	105	0.083
	35	4.26	42.6	6.7	36.0	105	0.081
	36	4.47	44.7	6.7	38.1	91	0.074

Table F.1-24 Irrigation Requirement for Vegetable (B)-1 in Sector I

(Unit: MCM)

Month	10 days	ETcrop (mm/day)	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area (ha)	Water Requirement
May	1			26.7			
	2			26.7			
	3			26.7			
Jun	4			31.7			
	5			31.7			
	6			31.7			
July	7			23.3			
	8			23.3			
	9			23.3			
Aug	10			26.7			
	11			26.7			
	12			26.7			
Sept	13	2.09	20.9	25.0		7	
	14	1.99	19.9	25.0		20	
	15	2.05	20.5	25.0		34	
Oct	16	2.38	23.8	20.0	3.8	47	0.004
	17	2.65	26.5	20.0	6.5	61	0.009
	18	2.70	27.0	20.0	7.0	74	0.011
Nov	19	1.82	18.2	5.0	13.2	88	0.025
	20	2.65	26.5	5.0	21.5	102	0.047
	21	2.69	26.9	5.0	21.9	108	0.051
Dec	22	2.71	27.1		27.1	108	0.063
	23	2.75	27.5		27.5	102	0.060
	24	3.03	30.3		30.3	88	0.057
Jan	25	3.06	30.6		30.6	74	0.049
	26	3.20	32.0		32.0	61	0.042
	27	3.61	36.1		36.1	47	0.037
Feb	28	3.48	34.8	1.7	33.2	34	0.024
	29	3.32	33.2	1.7	31.5	20	0.014
	30	3.21	32.1	1.7	30.5	7	0.005
Mar	31						
	32						
	33						
Apr	34			6.7			
	35			6.7			
	36			6.7			

Table F.1-25 Irrigation Requirement for Vegetable (B)-2 in Sector I

(Unit: MCM)

Month	10 days	ETcrop (mm/day)	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area (ha)	Water Requirement
May	1	4.54	45.4	26.7	18.7	77	0.031
	2	4.40	44.0	26.7	17.3	63	0.023
	3	3.83	38.3	26.7	11.6	49	0.012
Jun	4	3.61	36.1	31.7	4.5	35	0.003
	5	3.40	34.0	31.7	2.3	21	0.001
	6	3.10	31.0	31.7		7	
July	7			23.3			
	8			23.3			
	9			23.3			
Aug	10			26.7			
	11			26.7			
	12			26.7			
Sept	13			25.0			
	14			25.0			
	15			25.0			
Oct	16			20.0			
	17			20.0			
	18			20.0			
Nov	19			5.0			
	20			5.0			
	21			5.0			
Dec	22						
	23						
	24						
Jan	25	1.84	18.4		18.4	7	0.003
	26	1.94	19.4		19.4	21	0.009
	27	2.34	23.4		23.4	35	0.018
Feb	28	2.62	26.2	1.7	24.6	49	0.026
	29	2.87	28.7	1.7	27.0	63	0.037
	30	3.26	32.6	1.7	30.9	77	0.051
Mar	31	3.23	32.3		32.3	91	0.063
	32	4.03	40.3		40.3	105	0.091
	33	4.32	43.2		43.2	112	0.104
Apr	34	4.35	43.5	6.7	36.8	112	0.088
	35	4.47	44.7	6.7	38.1	105	0.086
	36	4.63	46.3	6.7	39.6	91	0.077

Table F.1-26 Irrigation Requirement for Vegetable (B)-3 in Sector I

(Unit: MCM)

Month	10 days	ETcrop (mm/day)	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area (ha)	Water Requirement
May	1			26.7			
	2			26.7			
	3			26.7			
Jun	4			31.7			
	5			31.7			
	6			31.7			
July	7			23.3			
	8			23.3			
	9			23.3			
Aug	10			26.7			
	11			26.7			
	12			26.7			
Sept	13			25.0			
	14	2.03	20.3	25.0		7	
	15	1.98	19.8	25.0		21	
Oct	16	2.18	21.8	20.0	1.8	35	0.001
	17	2.46	24.6	20.0	4.6	49	0.005
	18	2.55	25.5	20.0	5.5	63	0.007
Nov	19	1.78	17.8	5.0	12.8	77	0.021
	20	2.62	26.2	5.0	21.2	91	0.041
	21	2.69	26.9	5.0	21.9	105	0.049
Dec	22	2.64	26.4		26.4	112	0.063
	23	2.62	26.2		26.2	112	0.063
	24	2.92	29.2		29.2	105	0.066
Jan	25	3.03	30.3		30.3	91	0.059
	26	3.24	32.4		32.4	77	0.053
	27	3.65	36.5		36.5	63	0.049
Feb	28	3.61	36.1	1.7	34.4	49	0.036
	29	3.48	34.8	1.7	33.2	35	0.025
	30	3.52	35.2	1.7	33.5	21	0.015
Mar	31	3.07	30.7		30.7	7	0.005
	32						
	33						
Apr	34			6.7			
	35			6.7			
	36			6.7			

Table F.1-27 Irrigation Requirement for Fruits in Sector I

(Unit: MCM)

Month	10 days	ETcrop (mm/day)	ETcrop (mm/10day)	Po (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area (ha)	Water Requirement
May	1	4.34	43.4	26.7	16.7	34	0.012
	2	4.25	42.5	26.7	15.8	34	0.011
	3	3.74	37.4	26.7	10.7	34	0.008
Jun	4	3.66	36.6	31.7	4.9	34	0.004
	5	3.66	36.6	31.7	4.9	34	0.004
	6	3.66	36.6	31.7	4.9	34	0.004
July	7	3.74	37.4	23.3	14.1	34	0.010
	8	3.82	38.3	23.3	14.9	34	0.011
	9	3.82	38.3	23.3	14.9	34	0.011
Aug	10	3.82	38.3	26.7	11.6	34	0.008
	11	3.74	37.4	26.7	10.7	34	0.008
	12	3.74	37.4	26.7	10.7	34	0.008
Sept	13	3.48	34.8	25.0	9.8	34	0.007
	14	3.32	33.2	25.0	8.1	34	0.006
	15	3.23	32.3	25.0	7.3	34	0.005
Oct	16	3.32	33.2	20.0	13.1	34	0.009
	17	3.32	33.2	20.0	13.1	34	0.009
	18	3.15	31.5	20.0	11.5	34	0.008
Nov	19	2.04	20.4	5.0	15.4	34	0.011
	20	2.89	28.9	5.0	23.9	34	0.017
	21	2.89	28.9	5.0	23.9	34	0.017
Dec	22	2.80	28.0		28.0	34	0.020
	23	2.72	27.2		27.2	34	0.020
	24	2.89	28.9		28.9	34	0.021
Jan	25	2.89	28.9		28.9	34	0.021
	26	3.06	30.6		30.6	34	0.022
	27	3.48	34.8		34.8	34	0.025
Feb	28	3.48	34.8	1.7	33.2	34	0.024
	29	3.48	34.8	1.7	33.2	34	0.024
	30	3.74	37.4	1.7	35.7	34	0.026
Mar	31	3.57	35.7		35.7	34	0.026
	32	4.34	43.4		43.4	34	0.031
	33	4.59	45.9		45.9	34	0.033
Apr	34	4.51	45.1	6.7	38.4	34	0.028
	35	4.42	44.2	6.7	37.5	34	0.027
	36	4.42	44.2	6.7	37.5	34	0.027

Table F.1-28 Irrigation Requirement for Coffee in Sector I

(Unit: MCM)

Month	10 days	ETcrop (mm/day)	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area (ha)	Water Requirement
	1	5.35	53.6	26.7	26.9	19	0.011
May	2	5.25	52.5	26.7	25.8	19	0.010
	3	4.62	46.2	26.7	19.5	19	0.008
	4	4.52	45.2	31.7	13.5	19	0.005
Jun	5	4.52	45.2	31.7	13.5	19	0.005
	6	4.52	45.2	31.7	13.5	19	0.005
	7	4.62	46.2	23.3	22.9	19	0.009
July	8	4.73	47.3	23.3	23.9	19	0.010
	9	4.73	47.3	23.3	23.9	19	0.010
	10	4.73	47.3	26.7	20.6	19	0.008
Aug	11	4.62	46.2	26.7	19.5	19	0.008
	12	4.62	46.2	26.7	19.5	19	0.008
	13	4.31	43.1	25.0	18.0	19	0.007
Sept	14	4.10	40.9	25.0	15.9	19	0.006
	15	3.99	39.9	25.0	14.9	19	0.006
	16	4.10	40.9	20.0	20.9	19	0.008
Oct	17	4.10	40.9	20.0	20.9	19	0.008
	18	3.89	38.9	20.0	18.9	19	0.008
	19	2.52	25.2	5.0	20.2	19	0.008
Nov	20	3.57	35.7	5.0	30.7	19	0.012
	21	3.57	35.7	5.0	30.7	19	0.012
	22	3.47	34.7		34.7	19	0.014
Dec	23	3.36	33.6		33.6	19	0.013
	24	3.57	35.7		35.7	19	0.014
	25	3.57	35.7		35.7	19	0.014
Jan	26	3.78	37.8		37.8	19	0.015
	27	4.31	43.1		43.1	19	0.017
	28	4.31	43.1	1.7	41.4	19	0.017
Feb	29	4.31	43.1	1.7	41.4	19	0.017
	30	4.62	46.2	1.7	44.5	19	0.018
	31	4.41	44.1		44.1	19	0.018
Mar	32	5.35	53.6		53.6	19	0.021
	33	5.67	56.7		56.7	19	0.023
	34	5.57	55.7	6.7	49.0	19	0.020
Apr	35	5.46	54.6	6.7	47.9	19	0.019
	36	5.46	54.6	6.7	47.9	19	0.019

Table F.1-29 Irrigation Requirement for Pasture in Sector I

(Unit: MCM)

Month	10 days	ETcrop (mm/day)	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area (ha)	Water Requirement
May	1	2.81	28.1	26.7	1.4	34	0.001
	2	2.75	27.5	26.7	0.8	34	0.001
	3	2.42	24.2	26.7		34	
Jun	4	2.37	23.7	31.7		34	
	5	2.37	23.7	31.7		34	
	6	2.37	23.7	31.7		34	
July	7	2.42	24.2	23.3	0.9	34	0.001
	8	2.48	24.8	23.3	1.4	34	0.001
	9	2.48	24.8	23.3	1.4	34	0.001
Aug	10	2.48	24.8	26.7		34	
	11	2.42	24.2	26.7		34	
	12	2.42	24.2	26.7		34	
Sept	13	2.26	22.6	25.0		34	
	14	2.15	21.5	25.0		34	
	15	2.09	20.9	25.0		34	
Oct	16	2.15	21.5	20.0	1.4	34	0.001
	17	2.15	21.5	20.0	1.4	34	0.001
	18	2.04	20.4	20.0	0.4	34	0.000
Nov	19	1.20	12.0	5.0	7.0	34	0.005
	20	1.70	17.0	5.0	12.0	34	0.009
	21	1.70	17.0	5.0	12.0	34	0.009
Dec	22	1.65	16.5		16.5	34	0.012
	23	1.60	16.0		16.0	34	0.012
	24	1.70	17.0		17.0	34	0.012
Jan	25	1.70	17.0		17.0	34	0.012
	26	1.80	18.0		18.0	34	0.013
	27	2.05	20.5		20.5	34	0.015
Feb	28	2.05	20.5	1.7	18.8	34	0.014
	29	2.05	20.5	1.7	18.8	34	0.014
	30	2.20	22.0	1.7	20.3	34	0.015
Mar	31	2.10	21.0		21.0	34	0.015
	32	2.55	25.5		25.5	34	0.018
	33	2.70	27.0		27.0	34	0.019
Apr	34	2.65	26.5	6.7	19.8	34	0.014
	35	2.60	26.0	6.7	19.3	34	0.014
	36	2.60	26.0	6.7	19.3	34	0.014

Table F.1-30 Irrigation Requirement for Maze (I) in Sector II

(Unit: MCM)

Month	10 days	ETcrop (mm/day)	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area (ha)	Water Requirement
May	1	2.35	23.5	26.7		23	
	2	2.30	23.0	26.7		68	
	3	2.24	22.4	26.7		112	
Jun	4	2.58	25.8	31.7		157	
	5	2.97	29.7	31.7		202	
	6	3.23	32.3	31.7	0.6	247	0.003
July	7	3.48	34.8	23.3	11.4	269	0.066
	8	3.96	39.6	23.3	16.3	269	0.094
	9	4.23	42.3	23.3	19.0	269	0.109
Aug	10	4.37	43.7	26.7	17.0	269	0.098
	11	4.09	40.9	26.7	14.3	269	0.082
	12	4.00	40.0	26.7	13.4	247	0.071
Sept	13	3.65	36.5	25.0	11.5	202	0.050
	14	3.32	33.2	25.0	8.1	157	0.027
	15	2.96	29.6	25.0	4.6	112	0.011
Oct	16	2.73	27.3	20.0	7.3	68	0.011
	17	2.46	24.6	20.0	4.6	23	0.002
	18			20.0			
Nov	19			5.0			
	20			5.0			
	21			5.0			
Dec	22						
	23						
	24						
Jan	25						
	26						
	27						
Feb	28			1.7			
	29			1.7			
	30			1.7			
Mar	31						
	32						
	33						
Apr	34			6.7			
	35			6.7			
	36			6.7			

Table F.1-31 Irrigation Requirement for Maze (II) in Sector II

(Unit: MCM)

Month	10 days	ETcrop (mm/day)	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area (ha)	Water Requirement
May	1			26.7			
	2			26.7			
	3			26.7			
Jun	4			31.7			
	5			31.7			
	6			31.7			
July	7			23.3			
	8			23.3			
	9			23.3			
Aug	10			26.7			
	11			26.7			
	12			26.7			
Sept	13			25.0			
	14			25.0			
	15			25.0			
Oct	16	2.03	20.3	20.0	0.3	11	0.000
	17	2.03	20.3	20.0	0.3	33	0.000
	18	2.07	20.7	20.0	0.7	55	0.001
Nov	19	1.56	15.6	5.0	10.6	76	0.017
	20	2.48	24.8	5.0	19.8	99	0.042
	21	2.65	26.5	5.0	21.5	120	0.055
Dec	22	2.71	27.1		27.1	131	0.076
	23	2.88	28.8		28.8	131	0.081
	24	3.23	32.3		32.3	131	0.091
Jan	25	3.30	33.0		33.0	131	0.093
	26	3.35	33.5		33.5	131	0.094
	27	3.73	37.3		37.3	120	0.096
Feb	28	3.61	36.1	1.7	34.4	99	0.073
	29	3.44	34.4	1.7	32.8	76	0.054
	30	3.39	33.9	1.7	32.2	55	0.038
Mar	31	2.90	29.0		29.0	33	0.020
	32	3.21	32.1		32.1	11	0.008
	33						
Apr	34			6.7			
	35			6.7			
	36			6.7			

Table F.1-32 Irrigation Requirement for Maze (III) in Sector II

(Unit: MCM)

Month	10 days	ETcrop (mm/day)	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area (ha)	Water Requirement
May	1			26.7			
	2			26.7			
	3			26.7			
Jun	4			31.7			
	5			31.7			
	6			31.7			
July	7			23.3			
	8			23.3			
	9			23.3			
Aug	10			26.7			
	11			26.7			
	12			26.7			
Sept	13			25.0			
	14			25.0			
	15			25.0			
Oct	16			20.0			
	17			20.0			
	18	1.92	19.2	20.0		11	
Nov	19	1.25	12.5	5.0	7.5	34	0.006
	20	1.90	19.0	5.0	14.0	58	0.017
	21	2.21	22.1	5.0	17.1	80	0.029
Dec	22	2.41	24.1		24.1	103	0.053
	23	2.50	25.0		25.0	126	0.068
	24	2.79	27.9		27.9	138	0.082
Jan	25	3.06	30.6		30.6	138	0.090
	26	3.42	34.2		34.2	138	0.101
	27	3.98	39.8		39.8	138	0.117
Feb	28	3.81	38.1	1.7	36.5	138	0.108
	29	3.73	37.3	1.7	35.6	126	0.097
	30	3.87	38.7	1.7	37.1	103	0.082
Mar	31	3.53	35.3		35.3	80	0.061
	32	3.93	39.3		39.3	58	0.048
	33	3.73	37.3		37.3	34	0.027
Apr	34	3.34	33.4	6.7	26.7	11	0.006
	35			6.7			
	36			6.7			

B:

Table F.1-33 Irrigation Requirement for Rice (I) in Sector II

(Unit: MCM)

Month	10 days	ETcrop (mm/day)	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area (ha)	Water Requirement
May	1	5.30	53.0	26.7	26.4	310	0.175
	2	5.35	53.5	26.7	26.8	379	0.218
	3	4.84	48.4	26.7	21.7	448	0.208
Jun	4	4.82	48.2	31.7	16.5	517	0.182
	5	4.86	48.6	31.7	16.9	551	0.200
	6	5.03	50.3	31.7	18.6	551	0.220
July	7	5.28	52.8	23.3	29.5	551	0.348
	8	5.35	53.6	23.3	30.2	551	0.357
	9	5.31	53.1	23.3	29.8	551	0.351
Aug	10	5.27	52.7	26.7	26.0	551	0.307
	11	5.10	51.0	26.7	24.4	517	0.270
	12	5.02	50.2	26.7	23.5	448	0.225
Sept	13	4.63	46.3	25.0	21.3	379	0.173
	14	4.29	42.9	25.0	17.9	310	0.119
	15	4.03	40.3	25.0	15.3	241	0.079
Oct	16	3.90	39.0	20.0	19.0	172	0.070
	17	3.90	39.0	20.0	19.0	103	0.042
	18	3.70	37.0	20.0	17.0	34	0.013
Nov	19			5.0			
	20			5.0			
	21			5.0			
Dec	22						
	23						
	24						
Jan	25						
	26						
	27						
Feb	28			1.7			
	29			1.7			
	30			1.7			
Mar	31						
	32						
	33	5.08	50.8		50.8	34	0.037
Apr	34	4.98	49.8	6.7	43.2	103	0.095
	35	5.15	51.5	6.7	44.8	172	0.165
	36	5.30	53.0	6.7	46.4	241	0.239

Maize (II)

Table F.1-34 Irrigation Requirement for Rice (II) in Sector II

(Unit: MCM)

Month	10 days	ETcrop (mm/day)	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area (ha)	Water Requirement
May	1			26.7			
	2			26.7			
	3			26.7			
Jun	4			31.7			
	5			31.7			
	6			31.7			
July	7			23.3			
	8			23.3			
	9			23.3			
Aug	10			26.7			
	11			26.7			
	12			26.7			
Sept	13			25.0			
	14			25.0			
	15	3.57	35.7	25.0	10.7	18	0.004
Oct	16	3.67	36.7	20.0	16.7	51	0.018
	17	3.86	38.6	20.0	18.6	86	0.034
	18	3.77	37.7	20.0	17.7	120	0.046
Nov	19	2.50	25.0	5.0	20.0	138	0.059
	20	3.64	36.4	5.0	31.4	138	0.093
	21	3.74	37.4	5.0	32.4	138	0.096
Dec	22	3.70	37.0		37.0	138	0.109
	23	3.62	36.2		36.2	138	0.107
	24	3.98	39.8		39.8	138	0.117
Jan	25	4.08	40.8		40.8	138	0.120
	26	4.28	42.8		42.8	138	0.126
	27	4.84	48.4		48.4	138	0.143
Feb	28	4.80	48.0	1.7	46.3	138	0.137
	29	4.76	47.6	1.7	45.9	120	0.118
	30	5.02	50.2	1.7	48.5	86	0.090
Mar	31	4.75	47.5		47.5	51	0.052
	32	5.61	56.1		56.1	18	0.021
	33	5.72	57.2		57.2		
Apr	34	5.30	53.0	6.7	46.3		
	35	5.20	52.0	6.7	45.3		
	36	5.20	52.0	6.7	45.3		