Table 4-30 Drainage Calculation by Pump (Q_p= 6000 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$2.33^{\times 10^3}$	$2.33^{\times 10^3}$	$11.90^{\times 10^3}$	$0^{\times 10^3}$	7.50	1,460
2	5.02	5.02	"	0	"	"
3	19.44	19.44	"	7.54	9.40	6,420
4	20.28	27.82	"	15.92	10.05	10,170
5	8.56	24.48	"	12.58	9.85	8,740
6	30.61	43.19	"	31.29	10.95	20,010
7	50.61	81.90	"	70.00	12.25	55,820
8	0.56	70.56	"	58.66	11.95	46,930
9	12.84	71.50	"	59.60	12.00	49,400
10	0	59.60	"	47.70	11.60	33,490
11	10.88	58.58	"	46.68	"	"
12		46.68	"	34.78	11.10	22,700
13		34.78	"	22.88	10.50	14,080
14		22.88	"	10.98	9.70	7,850
15		10.98	"	0	7.50	1,460

Table 4-31 Drainage Calculation by Pump (Qp= 3200 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$3.26^{\times 10^3}$	$3.26^{\times 10^3}$	$6.30^{\times 10^3}$	$0^{\times 10^3}$	7.50	1,460
2	27.34	27.34	"	21.04	10.40	12,930
3	39.99	61.03	"	54.73	11.85	43,230
4	1.95	56.68	"	50.38	11.70	37,050
5	0.19	50.57	"	44.27	11.45	30,080
6	5.21	49.48	"	43.18	11.40	28,010
7	13.76	56.94	"	50.64	11.75	38,290
8	3.91	54.55	"	48.25	11.60	33,490
9	6.88	55.13	"	48.83	11.65	35,860
10	1.30	50.13	"	43.83	11.45	30,080
11	37.57	81.40	"	75.10	12.40	58,050
12	6.32	81.42	"	75.12	"	"
13		75.12	"	68.82	12.25	55,820
14		68.82	"	62.52	12.10	51,330
15		62.52	"	56.22	11.90	44,460
16		56.22	"	49.92	11.70	37,050
17		49.92	"	43.62	11.45	30,080
18		43.62	"	37.32	11.20	23,990
19		37.32	"	31.02	10.95	20,010
20		31.02	"	24.72	10.65	15,560
21		24.72	"	18.42	10.20	11,260
22		18.42	"	12.12	9.75	8,300
23		12.12	"	5.82	9.20	5,680
24		5.82	"	0	7.50	1,460

Table 4-32 Drainage Calculation by Pump (Q_P= 3900 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$3.26^{\times 10^3}$	$3.26^{\times 10^3}$	$7.70^{\times 10^3}$	$0^{\times 10^3}$	7.50	1,460
2	27.34	27.34	"	19.64	10.35	12,350
3	39.99	59.63	"	51.93	11.75	38,290
4	1.95	53.88	"	46.18	11.55	32,310
5	0.19	46.37	"	38.67	11.25	25,290
6	5.21	43.88	"	36.18	11.15	23,350
7	13.76	49.94	"	42.24	11.40	28,010
8	3.91	46.15	"	38.45	11.20	23,990
9	6.88	45.33	"	37.63	"	"
10	1.30	38.93	"	31.23	10.95	20,010
11	37.57	68.80	"	61.10	12.05	50,040
12	6.32	67.42	"	59.72	12.00	49.400
13		59.72	"	52.02	11.75	38,290
14		52.02	"	44.32	11.45	30,080
15		44.32	"	36.62	11.20	23,990
16		36.62	"	28.92	10.85	18,530
17		28.92	"	21.22	10.40	12,930
18		21.22	"	13.52	9.90	9,190
19		13.52	"	5.82	9.20	5,680
20		5.82	"	0	7.50	1,460

Table 4-33 Drainage Calculation by Pump (Qp= 4600 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$3.26^{\times 10^3}$	$3.26^{\times 10^3}$	$9.10^{\times 10^3}$	$0^{\times 10^3}$	7.50	1,460
2	27.34	27.34	"	18.24	10.20	11,260
3	39.99	58.23	"	49.13	11.65	35,860
4	1.95	51.08	"	41.98	11.40	28,010
5	0.19	42.17	"	33.07	11.00	20,750
6	5.21	38.28	"	29.18	10.85	18,530
7	13.76	42.94	"	33.84	11.05	22,050
8	3.91	37.75	"	28.65	10.85	18,530
9	6.88	35.53	"	26.43	10.70	16,300
10	1.30	27.73	"	18.63	10.30	11,810
11	37.57	56.20	"	47.10	11.60	33,490
12	6.32	53.42	"	44.32	11.45	30,080
13		44.32	"	35.22	11.10	22,700
14		35.22	"	26.12	10.70	16,300
15		26.12	"	17.02	10.15	10,720
16		17.02	"	7.92	9.40	6,420
17		7.92	"	0	7.50	1,460

Table 4-34 Drainage Calculation by Pump (Qp=5300 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$3.26^{\times 10^3}$	$3.26^{\times 10^3}$	$10.50^{\times 10^3}$	$0^{\times 10^3}$	7.50	1,460
2	27.34	27.34	"	16.84	10.15	10,720
3	39.99	56.83	"	46.33	11.55	32,310
4	1.95	48.28	"	37.78	11.20	23,990
5	0.19	37.97	"	27.47	10.75	17,040
6	5.21	32.68	"	22.18	10.45	13,500
7	13.76	35.94	"	25.44	10.65	15,560
8	3.91	29.35	"	18.85	10.30	11,810
9	6.88	25.73	"	15.23	10.00	9,630
10	1.30	16.53	"	6.03	9.20	5,680
11	37.57	43.60	"	33.10	11.00	20,750
12	6.32	39.42	"	28.92	10.85	18,530
13		28.92	"	18.42	10.20	11,260
14		18.42	"	7.92	9.40	6,420
15		7.92	"	0	7.50	1,460

Table 4-35 Drainage Calculation by Pump (Q_p= 6000 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$3.26^{\times 10^3}$	$3.26^{\times 10^3}$	$11.90^{\times 10^3}$	$0^{\times 10^3}$	7.50	1,460
2	27.34	27.34	"	15.44	10.00	9,630
3	39.99	55.43	"	43.53	11.45	30,080
4	1.95	45.48	"	33.58	11.05	22,050
5	0.19	33.77	"	21.87	10.45	13,500
6	5.21	27.08	"	15.18	10.00	9,630
7	13.76	28.94	"	17.04	10.15	10,720
8	3.91	20.95	"	9.05	9.50	6,720
9	6.88	15.93	"	4.03	9.00	4,940
10	1.30	5.33	"	0	7.50	1,460
11	37.57	37.57	"	25.67	10.70	16,300
12	6.32	31.99	"	20.09	10.35	12,350
13		20.09	"	8.19	9.40	6,420
14		8.19	"	0	7.50	1,460

Table 4-36 Drainage Calculation by Pump (Q_p=3200 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$28.00^{\times 10^3}$	$28.00^{\times 10^3}$	$6.30^{\times 10^3}$	$21.70^{\times 10^3}$	10.45	13,500
2	92.01	113.71	"	107.41	12.95	65,700
3	9.77	117.18	"	110.88	13.00	66,690
4		110.88	"	104.58	12.95	65,700
5		104.58	"	98.28	12.80	63,850
6		98.28	"	91.98	12.75	63,330
7		91.98	"	85.68	12.60	61,360
8		85.68	"	79.38	12.50	60,270
9		79.38	"	73.08	12.35	57,160
10		73.08	"	66.78	12.20	53,890
11		66.78	"	60.48	12.00	49,400
12		60.48	"	54.18	11.80	40,760
13		54.18	"	47.88	11.60	33,490
14		47.88	"	41.58	11.40	28,010
15		41.58	"	35.28	11.10	22,700
16		35.28	"	28.98	10.85	18,530
17		28.98	"	22.68	10.50	14,080
18		22.68	"	16.38	10.05	10,170
19		16.38	"	10.08	9.60	7,410
20		10.08	"	3.78	9.00	4,940
21		3.78	"	0	7.50	1,460

Table 4-37 Drainage Calculation by Pump (Q_P= 3900 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$28.00^{\times 10^3}$	$28.00^{\times 10^3}$	$7.70^{\times 10^3}$	$20.30^{\times 10^3}$	10.35	12,350
2	92.01	112.31	"	104.61	12.95	65,700
3	9.77	114.38	"	106.68	"	"
4		106.68	"	98.98	12.85	64,710
5		98.98	"	91.28	12.70	62,990
6		91.28	"	83.58	12.60	61,360
7		83.58	"	75.88	12.40	58,050
8		75.88	"	68.18	12.20	53,890
9		68.18	"	60.48	12.00	49,400
10		60.48	"	52.78	11.80	40,760
11		52.78	"	45.08	11.50	31,120
12		45.08	"	37.38	11.20	23,990
13		37.38	"	29.68	10.90	19,270
14		29.68	"	21.98	10.45	13,500
15		21.98	"	14.28	9.90	9,190
16		14.28	"	6.58	9.30	6,180
17		6.58	"	0	7.50	1,460

Table 4-38 Drainage Calculation by Pump (Qp= 4600 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$28.00^{\times 10^3}$	$28.00^{\times 10^3}$	$9.10^{\times 10^3}$	$18.90^{\times 10^3}$	10.30	11,810
2	92.01	110.91	"	101.81	12.90	65,110
3	9.77	111.58	"	102.48	"	"
4		102.48	"	93.38	12.75	63,330
5		93.38	"	84.28	12.60	61,360
6		84.28	"	75.18	12.40	58,050
7		75.18	"	66.08	12.15	52,610
8		66.08	"	56.98	11.90	44,460
9		56.98	"	47.88	11.60	33,490
10		47.88	"	38.78	11.25	25,290
11		38.78	"	29.68	10.90	19,270
12		29.68	"	20.58	10.40	12,930
13		20.58	"	11.48	9.70	7,850
14		11.48	"	2.38	7.50	1,460
15		2.38	"	0	"	"

Table 4-39 Drainage Calculation by Pump (Q_p= 5300 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$28.00^{\times 10^3}$	$28.00^{\times 10^3}$	$10.50^{\times 10^3}$	$17.50^{\times 10^3}$	10.20	11,260
2	92.01	109.51	"	99.01	12.85	64,710
3	9.77	108.78	"	98.28	12.80	63,850
4		98.28	"	87.78	12.65	62,170
5		87.78	"	77.28	12.45	58,940
6		77.28	"	66.78	12.20	53,890
7		66.78	"	56.28	11.90	44,460
8		56.28	"	45.78	11.55	32,310
9		45.78	"	35.28	11.10	22,700
10		35.28	"	24.78	10.65	15,560
11		24.78	"	14.28	9.90	9,190
12		14.28	"	3.78	9.00	4,940
13		3.78	"	0	7.50	1,460

Table 4-40 Drainage Calculation by Pump (Q_p= 6000 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$28.00^{\times 10^3}$	$28.00^{\times 10^3}$	$11.90^{\times 10^3}$	$16.10^{\times 10^3}$	10.05	10,170
2	92.01	108.01	"	96.21	12.80	63,850
3	9.77	105.98	"	94.08	12.75	63,330
4		94.08	"	82.18	12.55	60,810
5		82.18	"	70.28	12.25	55,820
6		70.28	"	58.38	11.95	46,930
7		58.38	"	46.48	11.55	32,310
8		46.48	"	34.58	11.10	22,700
9		34.58	"	22.68	10.50	14,080
10		22.68	"	10.78	9.70	7,850
11		10.78	"	0	7.50	1,460

Table 4-41 Drainage Calculation by Pump (Qp= 3200 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$7.81^{\times 10^3}$	$7.81^{\times 10^3}$	$6.30^{\times 10^3}$	$1.51^{\times 10^3}$	7.50	1,460
2	0.47	1.98	"	0	"	"
3	1.12	1.12	"	0	"	"
4	14.42	14.42	"	8.12	9.40	6,420
5	42.42	50.54	"	44.24	11.45	30,080
6	17.58	61.82	"	55.52	11.90	44,460
7	9.40	64.92	"	58.62	11.95	46,930
8	22.51	81.13	"	74.83	12.40	58,050
9	9.12	83.95	"	77.65	12.45	58,940
10	0.74	78.39	"	72.09	12.30	56,270
11	2.51	74.60	"	68.30	12.20	53,890
12		68.30	"	62.00	12.05	50,040
13		62.00	"	55.70	11.90	44,460
14		55.70	"	49.40	11.65	35,860
15		49.40	"	43.10	11.40	28,010
16		43.10	"	36.80	11.20	23,990
17		36.80	"	30.50	10.95	20,010
18		30.50	"	24.20	10.55	14,820
19		24.20	"	17.90	10.20	11,260
20		17.90	"	11.60	9.75	8,300
21		11.60	"	5.30	9.10	5,430
22		5.30	"	0	7.50	1,460

Table 4-42 Drainage Calculation by Pump (Q_p= 3900 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$7.81^{\times 10^3}$	$7.81^{\times 10^3}$	$7.70^{\times 10^3}$	$0.11^{\times 10^3}$	7.50	1,460
2	0.47	0.58	"	0	"	"
3	1.12	1.12	"	0	"	"
4	14.42	14.42	"	6.72	9.30	6,180
5	42.42	49.14	"	41.44	11.35	26,980
6	17.58	59.02	"	51.32	11.75	38,290
7	9.40	60.72	"	53.02	11.80	40,760
8	22.51	75.53	"	67.83	12.20	53,890
9	9.12	76.95	"	69.25	12.25	55,820
10	0.74	69.99	"	62.29	12.05	50,040
11	2.51	64.80	"	57.10	11.90	44,460
12		57.10	"	49.40	11.65	35,860
13		49.40	"	41.70	11.40	28,010
14		41.70	"	34.00	11.05	22,050
15		34.00	"	26.30	10.70	16,300
16		26.30	"	18.60	10.30	11,810
17		18.60	"	10.90	9.70	7,850
18		10.90	"	3.20	7.50	1,460
19		3.20	"	0	"	"

Table 4-43 Drainage Calculation by Pump (Q_p= 4600 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$7.81^{\times 10^3}$	$7.81^{\times 10^3}$	$9.10^{\times 10^3}$	$0^{\times 10^3}$	7.50	1,460
2	0.47	0.47	"	0	"	"
3	1.12	1.12	"	0	"	"
4	14.42	14.42	"	5.32	9.10	5,430
5	42.42	47.74	"	38.64	11.25	25,290
6	17.58	56.22	"	47.12	11.60	33,490
7	9.40	56.52	"	47.42	"	"
8	22.51	69.93	"	60.83	12.05	50,040
9	9.12	69.95	"	60.85	"	"
10	0.74	61.59	"	52.49	11.75	38,290
11	2.51	55.00	"	45.90	11.55	32,310
12		45.90	"	36.80	11.20	23,990
13		36.80	"	27.70	10.80	17,790
14		27.70	"	18.60	10.30	11,810
15		18.60	"	9.50	9.60	7,410
16		9.50	"	0.40	7.50	1,460
17		0.40	"	0	"	"

Table 4-44 Drainage Calculation by Pump (Q_P= 5300 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$7.81^{\times 10^3}$	$7.81^{\times 10^3}$	$10.50^{\times 10^3}$	$0^{\times 10^3}$	7.50	1,460
2	0.47	0.47	"	0	"	"
3	1.12	1.12	"	0	"	"
4	14.42	14.42	"	3.92	9.00	4,940
5	42.42	46.34	"	35.84	11.15	23,350
6	17.58	53.42	"	42.94	11.40	28,010
7	9.40	52.32	"	41.82	"	"
8	22.51	64.33	"	53.83	11.80	40,760
9	9.12	62.95	"	52.45	11.75	38,290
10	0.74	53.19	"	42.69	11.40	28,010
11	2.51	45.20	"	34.70	11.10	22,700
12		34.70	"	24.20	10.55	14,820
13		24.20	"	13.70	9.90	9,190
14		13.70	"	3.20	7.50	1,460
15		3.20	"	0	"	"

Table 4-45 Drainage Calculation by Pump (Qp=6000 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$7.81^{\times 10^3}$	$7.81^{\times 10^3}$	$11.90^{\times 10^3}$	$0^{\times 10^3}$	7.50	1,460
2	0.47	0.47	"	0	"	"
3	1.12	1.12	"	0	"	"
4	14.42	14.42	"	2.52	"	"
5	42.42	44.94	"	33.04	11.00	20,750
6	17.58	50.62	"	38.72	11.25	25,290
7	9.40	48.12	"	36.22	11.15	23,350
8	22.51	58.73	"	46.83	11.60	33,490
9	9.12	55.95	"	44.05	11.45	30,080
10	0.74	44.79	"	32.89	11.00	20,750
11	2.51	35.40	"	23.50	10.55	14,820
12		23.50	"	11.60	9.75	8,300
13		11.60	"	0	7.50	1,460

Table 4-46 Drainage Calculation by Pump (Qp= 3200 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$6.33^{\times 10^3}$	$6.33^{\times 10^3}$	$6.30^{\times 10^3}$	$0.03^{\times 10^3}$	7.50	1,460
2	12.00	12.03	"	5.73	9.20	5,680
3	19.91	25.64	"	19.34	10.30	11,810
4	1.12	20.46	"	14.16	9.90	9,190
5	0.19	14.35	"	8.05	9.40	6,420
6	12.56	20.61	"	14.31	9.90	9,190
7	14.33	28.64	"	22.34	10.45	13,500
8	12.56	34.90	"	28.60	10.85	18,530
9	7.91	36.51	"	30.21	10.90	19,270
10	6.61	36.82	"	30.52	10.95	20,010
11	31.35	61.87	"	55.57	11.90	44,460
12	2.98	58.55	"	52.25	11.75	38,290
13	16.37	68.62	"	62.32	12.05	50,040
14	2.05	64.37	"	58.07	11.95	46,930
15	4.65	62.72	"	56.42	11.90	44,460
16		56.42	"	50.12	11.70	37,050
17		50.12	"	43.82	11.45	30,080
18		43.82	"	37.52	11.20	23,990
19		37.52	"	31.22	10.95	20,010
20		31.22	"	24.92	10.65	15,560
21		24.92	"	18.62	10.30	11,810
22		18.62	"	12.32	9.75	8,300
23		12.32	"	6.02	9.20	5,680
24		6.02	"	0	7.50	1,460

Table 4-47 Drainage Calculation by Pump (Q_P=3900 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$6.33^{\times 10^3}$	$6.33^{\times 10^3}$	$7.70^{\times 10^3}$	$0^{\times 10^3}$	7.50	1,460
2	12.00	12.00	"	4.30	9.00	4,940
3	19.91	24.21	"	16.51	10.15	10,720
4	1.12	17.63	"	9.93	9.60	7,410
5	0.19	10.12	"	2.42	7.50	1,460
6	12.56	14.98	"	7.28	9.30	6,180
7	14.33	21.61	"	13.91	9.90	9,190
8	12.56	26.47	"	18.77	10.30	11,810
9	7.91	26.68	"	18.98	"	"
10	6.61	25.59	"	17.89	10.20	11,260
11	31.35	49.24	"	41.54	11.40	28,010
12	2.98	44.52	"	36.82	11.20	23,990
13	16.37	53.19	"	45.49	11.50	31,120
14	2.05	47.54	"	39.84	11.30	25,940
15	4.65	44.49	"	36.79	11.20	23,990
16		36.79	"	29.09	10.85	18,530
17		29.09	"	21.39	10.40	12,930
18		21.39	"	13.69	9.90	9,190
19		13.69	"	5.99	9.20	5,680
20		5.99	"	0	7.50	1,460

Table 4-48 Drainage Calculation by Pump (Qp= 4600 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$6.33^{\times 10^3}$	$6.33^{\times 10^3}$	$9.10^{\times 10^3}$	$0^{\times 10^3}$	7.50	1,460
2	12.00	12.00	"	2.90	"	"
3	19.91	22.81	"	13.71	9.90	9,190
4	1.12	14.83	"	5.73	9.20	5,680
5	0.19	5.92	"	0	7.50	1,460
6	12.56	12.56	"	3.46	"	"
7	14.33	17.79	"	8.69	9.50	6,720
8	12.56	21.25	"	12.15	9.75	8,300
9	7.91	20.06	"	10.96	9.70	7,850
10	6.61	17.57	"	8.47	9.40	6,420
11	31.35	39.82	"	30.72	10.95	20,010
12	2.98	33.70	"	24.60	10.65	15,560
13	16.37	40.97	"	31.87	11.00	20,750
14	2.05	33.92	"	24.82	10.65	15,560
15	4.65	29.47	"	20.37	10.35	12,350
16		20.37	"	11.27	9.70	7,850
17		11.27	"	2.17	7.50	1,460
18		2.17	"	0	"	"

Table 4-49 Drainage Calculation by Pump (Qp=5300 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$6.33^{\times 10^3}$	$6.33^{\times 10^3}$	$10.50^{\times 10^3}$	$0^{\times 10^3}$	7.50	1,460
2	12.00	12.00	"	1.50	"	"
3	19.91	21.41	"	10.91	9.70	7,850
4	1.12	12.03	"	1.53	7.50	1,460
5	0.19	1.72	"	0	"	"
6	12.56	12.56	"	2.06	"	"
7	14.33	16.39	"	5.89	9.20	5,680
8	12.56	18.45	"	7.95	9.40	6,420
9	7.91	15.86	"	5.36	9.10	5,430
10	6.61	11.97	"	1.47	7.50	1,460
11	31.35	32.82	"	22.32	10.45	13,500
12	2.98	25.30	"	14.80	10.00	9,630
13	16.37	31.17	"	20.67	10.40	12,930
14	2.05	22.72	"	12.22	9.75	8,300
15	4.65	16.87	"	6.37	9.20	5,680
16		6.37	"	0	7.50	1,460

Table 4-50 Drainage Calculation by Pump (Qp=6000 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$6.33^{\times 10^3}$	$6.33^{\times 10^3}$	$11.90^{\times 10^3}$	$0^{\times 10^3}$	7.50	1,460
2	12.00	12.00	"	0.10	"	"
3	19.91	20.01	"	8.11	9.40	6,420
4	1.12	9.23	"	0	7.50	1,460
5	0.19	0.19	"	0	"	"
6	12.56	12.56	"	0.66	"	"
7	14.33	14.99	"	3.09	"	"
8	12.56	15.65	"	3.75	"	"
9	7.91	11.66	"	0	"	"
10	6.61	6.61	"	0	"	"
11	31.35	31.35	"	19.45	10.30	11,810
12	2.98	22.43	"	10.53	9.70	7,850
13	16.37	26.90	"	15.00	10.00	9,630
14	2.05	17.05	"	5.15	9.10	5,430
15	4.65	9.80	"	0	7.50	1,460

Table 4-51 Drainage Calculation by Pump (Q_p= 3200 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$3.91^{\times 10^3}$	$3.91^{\times 10^3}$	$6.30^{\times 10^3}$	$0^{\times 10^3}$	7.50	1,460
2	12.09	12.09	"	5.79	9.20	5,680
3	39.43	45.22	"	38.92	11.25	25,290
4	20.65	59.57	"	53.27	11.80	40,760
5	13.95	67.22	"	60.92	12.05	50,040
6	13.86	74.78	"	68.48	12.20	53,890
7		68.48	"	62.18	12.05	50,040
8		62.18	"	55.88	11.90	44,460
9		55.88	"	49.58	11.70	37,050
10		49.58	"	43.28	11.40	28,010
11		43.28	"	36.98	11.20	23,990
12		36.98	"	30.68	10.95	20,010
13		30.68	"	24.38	10.55	14,820
14		24.38	"	18.08	10.20	11,260
15		18.08	"	11.78	9.75	8,300
16		11.78	"	5.48	9.10	5,430
17		5.48	"	0	7.50	1,460

Table 4-52 Drainage Calculation by Pump (Qp=3900 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$3.91^{\times 10^3}$	$3.91^{\times 10^3}$	$7.70^{\times 10^3}$	$0^{\times 10^3}$	7.50	1,460
2	12.09	12.09	"	4.39	9.00	4,940
3	39.43	43.82	"	36.12	11.15	23,350
4	20.65	56.77	"	49.07	11.65	35,860
5	13.95	63.02	"	55.32	11.85	43,230
6	13.86	69.18	"	61.48	12.05	50,040
7		61.48	"	53.78	11.80	40,760
8		53.78	"	46.08	11.55	32,310
9		46.08	"	38.38	11.20	23,990
10		38.38	"	30.68	10.95	20,010
11		30.68	"	22.98	10.50	14,080
12		22.98	"	15.28	10.00	9,630
13		15.28	"	7.58	9.40	6,420
14		7.58	"	0	7.50	1,460

Table 4-53 Drainage Calculation by Pump (Qp=4600 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$3.91^{\times 10^3}$	$3.91^{\times 10^3}$	$9.10^{\times 10^3}$	$0^{\times 10^3}$	7.50	1,460
2	12.09	12.09	"	2.99	"	"
3	39.43	42.42	"	33.32	11.00	20,750
4	20.65	53.97	"	44.87	11.50	31,120
5	13.95	58.82	"	49.72	11.70	37,050
6	13.86	63.58	"	54.48	11.80	40,760
7		54.48	"	45.38	11.50	31,120
8		45.38	"	36.28	11.15	23,350
9		36.28	"	27.18	10.75	17,040
10		27.18	"	18.08	10.20	11,260
11		18.08	"	8.98	9.50	6,720
12		8.98	"	0	7.50	1,460

Table 4-54 Drainage Calculation by Pump (Qp=5300 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$3.91^{\times 10^3}$	$3.91^{\times 10^3}$	$10.50^{\times 10^3}$	$0^{\times 10^3}$	7.50	1,460
2	12.09	12.09	"	1.59	"	"
3	39.43	41.02	"	30.52	10.95	20,010
4	20.65	51.17	"	40.67	11.35	26,980
5	13.95	54.62	"	44.12	11.45	30,080
6	13.86	57.98	"	47.48	11.60	33,490
7		47.48	"	36.98	11.20	23,990
8		36.98	"	26.48	10.70	16,300
9		26.48	"	15.98	10.05	10,170
10		15.98	"	5.48	9.10	5,430
11		5.48	"	0	7.50	1,460

Table 4-55 Drainage Calculation by Pump (Qp=6000 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$3.91^{\times 10^3}$	$3.91^{\times 10^3}$	$11.90^{\times 10^3}$	$0^{\times 10^3}$	7.50	1,460
2	12.09	12.09	"	0.19	"	"
3	39.43	39.62	"	27.72	10.80	17,790
4	20.65	48.37	"	36.47	11.15	23,350
5	13.95	50.42	"	38.52	11.25	25,290
6	13.86	52.38	"	40.48	11.30	25,940
7		40.48	"	28.58	10.85	18,530
8		28.58	"	16.68	10.15	10,720
9		16.68	"	4.78	9.10	5,430
10		4.78	"	0	7.50	1,460

Table 4-56 Drainage Calculation by Pump (Q_p= 3200 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$0.74^{\times 10^3}$	$0.74^{\times 10^3}$	$6.30^{\times 10^3}$	0	7.50	1,460
2	2.94	2.94	"	0	"	"
3	61.47	61.47	"	55.17	11.85	43,230
4	3.35	58.52	"	52.22	11.75	38,290
5	0	52.22	"	45.92	11.55	32,310
6	0.47	46.39	"	40.09	11.30	25,940
7	9.86	49.95	"	43.65	11.45	30,080
8	21.02	64.67	"	58.37	11.95	46,930
9	1.49	59.86	"	53.56	11.80	40,760
10	0.93	54.49	"	48.19	11.60	33,490
11		48.19	"	41.89	11.40	28,010
12		41.89	"	35.59	11.15	23,350
13		35.59	"	29.29	10.85	18,530
14		29.29	"	22.99	10.50	14,080
15		22.99	"	16.69	10.15	10,720
16		16.69	"	10.39	9.60	7,410
17		10.39	"	4.09	9.00	4,940
18		4.09	"	0	7.50	1,460

Table 4-57 Drainage Calculation by Pump (Q_p=3900 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$0.74^{\times 10^3}$	$0.74^{\times 10^3}$	$7.70^{\times 10^3}$	$0^{\times 10^3}$	7.50	1,460
2	2.98	2.98	"	0	"	"
3	61.47	61.47	"	53.77	11.80	40,760
4	3.35	57.12	"	49.42	11.65	35,860
5	0	49.42	"	41.72	11.40	28,010
6	0.47	42.19	"	34.49	11.05	22,050
7	9.86	44.35	"	36.65	11.20	23,990
8	21.02	57.67	"	49.97	11.70	37,050
9	1.49	51.46	"	43.76	11.45	30,080
10	0.93	44.69	"	36.99	11.20	23,990
11		36.99	"	29.29	10.85	18,530
12		29.29	"	21.59	10.45	13,500
13		21.59	"	13.89	9.90	9,190
14		13.89	"	6.19	9.20	5,680
15		6.19	"	0	7.50	1,460

Table 4-58 Drainage Calculation by Pump (Qp= 4600 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$0.74^{\times 10^3}$	$0.74^{\times 10^3}$	$9.10^{\times 10^3}$	$0^{\times 10^3}$	7.50	1,460
2	2.98	2.98	"	0	"	"
3	61.47	61.47	"	52.37	11.75	38,290
4	3.35	55.72	"	46.62	11.60	33,490
5	0	46.62	"	37.52	11.20	23,990
6	0.47	37.99	"	28.89	10.85	18,530
7	9.86	38.75	"	29.65	10.90	19,270
8	21.02	50.67	"	41.57	11.40	28,010
9	1.49	43.06	"	33.96	11.05	22,050
10	0.93	34.89	"	25.79	10.70	16,300
11		25.79	"	16.69	10.15	10,720
12		16.69	"	7.59	9.40	6,420
13		7.59	"	0	7.50	1,460

Table 4-59 Drainage Calculation by Pump (Q_P= 5300cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$0.74^{\times 10^3}$	$0.74^{\times 10^3}$	$10.50^{\times 10^3}$	$0^{\times 10^3}$	7.50	1,460
2	2.98	2.98	"	0	"	"
3	61.47	61.47	"	50.97	11.75	38,290
4	3.35	54.32	"	43.82	11.45	30,080
5	0	43.82	"	33.32	11.00	20,750
6	0.47	33.79	"	23.29	10.50	14,080
7	9.86	33.15	"	22.65	"	"
8	21.02	43.67	"	33.17	11.00	20,750
9	1.49	34.66	"	24.16	10.55	14,820
10	0.93	25.09	"	14.59	10.00	9,630
11		14.59	"	4.09	9.00	4,940
12		4.09	"	0	7.50	1,460

Table 4-60 Drainage Calculation by Pump (Q_P=6000 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$0.74^{\times 10^3}$	$0.74^{\times 10^3}$	$11.90^{\times 10^3}$	$0^{\times 10^3}$	7.50	1,460
2	2.98	2.98	"	0	"	"
3	61.47	61.47	"	49.57	11.70	37,050
4	3.35	52.92	"	41.02	11.35	26,980
5	0	41.02	"	29.12	10.85	18,530
6	0.47	29.59	"	17.69	10.20	11,260
7	9.86	27.55	"	15.65	10.05	10,170
8	21.02	36.67	"	24.77	10.65	15,560
9	1.49	26.26	"	14.36	9.90	9,190
10	0.93	15.29	"	3.39	7.50	1,460
11		3.39	"	0	"	"

Table 4-61 Drainage Calculation by Pump (Qp= 3200 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$1.02^{\times 10^3}$	$1.02^{\times 10^3}$	$6.30^{\times 10^3}$	$0^{\times 10^3}$	7.5	1,460
2	0.65	0.65	"	0	"	"
3	2.33	2.33	"	0	"	"
4	32.83	32.83	"	26.53	10.75	17,040
5	12.28	38.81	"	32.51	11.00	20,750
6	19.44	51.95	"	45.65	11.55	32,310
7	18.69	64.34	"	58.04	11.95	46,930
8	2.60	60.64	"	54.34	11.80	40,760
9		54.34	"	48.04	11.60	33,490
10		48.04	"	41.74	11.40	28,010
11		41.74	"	35.44	11.10	22,700
12		35.44	"	29.14	10.85	18,530
13		29.14	"	22.84	10.50	14,080
14		22.84	"	16.54	10.15	10,720
15		16.54	"	10.24	9.60	7,410
16		10.24	"	3.94	9.00	4,940
17		3.94	"	0	7.50	1,460

Table 4-62 Drainage Calculation by Pump (Qp=3900 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$1.02^{\times 10^3}$	$1.02^{\times 10^3}$	$7.70^{\times 10^3}$	$0^{\times 10^3}$	7.50	1,460
2	0.65	0.65	"	0	"	"
3	2.33	2.33	"	0	"	"
4	32.83	32.83	"	25.13	10.65	15,560
5	12.28	37.41	"	29.71	10.90	19,270
6	19.44	49.15	"	41.45	11.35	26,980
7	18.69	60.14	"	52.44	11.75	38,290
8	2.60	55.34	"	47.64	11.60	33,490
9		47.64	"	39.94	11.30	25,940
10		39.94	"	32.24	11.00	20,750
11		32.24	"	24.54	10.65	15,560
12		24.54	"	16.84	10.15	10,720
13		16.84	"	9.14	9.50	6,720
14		9.14	"	1.44	7.50	1,460
15		1.44	"	0	"	"

Table 4-63 Drainage Calculation by Pump (Qp=4600 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$1.02^{\times 10^3}$	$1.02^{\times 10^3}$	$9.10^{\times 10^3}$	$0^{\times 10^3}$	7.50	1,460
2	0.65	0.65	"	0	"	"
3	2.33	2.33	"	0	"	"
4	32.83	32.83	"	23.73	10.55	14,820
5	12.28	36.01	"	26.91	10.75	17,040
6	19.44	46.35	"	37.25	11.20	23,990
7	18.69	55.94	"	46.84	11.60	33,490
8	2.60	49.44	"	40.34	11.30	25,940
9		40.34	"	31.24	10.95	20,010
10		31.24	"	22.14	10.45	13,500
11		22.14	"	13.04	9.85	8,740
12		13.04	"	3.94	9.00	4,940
13		3.94	"	0	7.50	1,460

Table 4-64 Drainage Calculation by Pump (Qp= 5300 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$1.02^{\times 10^3}$	$1.02^{\times 10^3}$	$10.50^{\times 10^3}$	$0^{\times 10^3}$	7.50	1,460
2	0.65	0.65	"	0	"	"
3	2.33	2.33	"	0	"	"
4	32.83	32.83	"	22.33	10.45	13,500
5	12.28	34.61	"	24.11	10.55	14,820
6	19.44	43.55	"	33.05	11.00	20,750
7	18.69	51.74	"	41.24	11.35	26,980
8	2.60	43.84	"	33.34	11.00	20,750
9		33.34	"	22.84	10.50	14,080
10		22.84	"	12.34	9.75	8,300
11		12.34	"	1.84	7.50	1,460
12		1.84	"	0	"	"

Table 4-65 Drainage Calculation by Pump (Q_p= 6000 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$1.02^{\times 10^3}$	$1.02^{\times 10^3}$	$11.90^{\times 10^3}$	$0^{\times 10^3}$	7.50	1,460
2	0.65	0.65	"	0	"	"
3	2.33	2.33	"	0	"	"
4	32.83	32.83	"	20.93	10.40	12,930
5	12.28	33.21	"	21.31	"	"
6	19.44	40.75	"	28.85	10.85	18,530
7	18.69	47.54	"	35.64	11.15	23,350
8	2.60	38.24	"	26.34	10.70	16,300
9		26.34	"	14.44	9.90	9,190
10		14.44	"	2.54	7.50	1,460
11		2.54	"	0	"	"

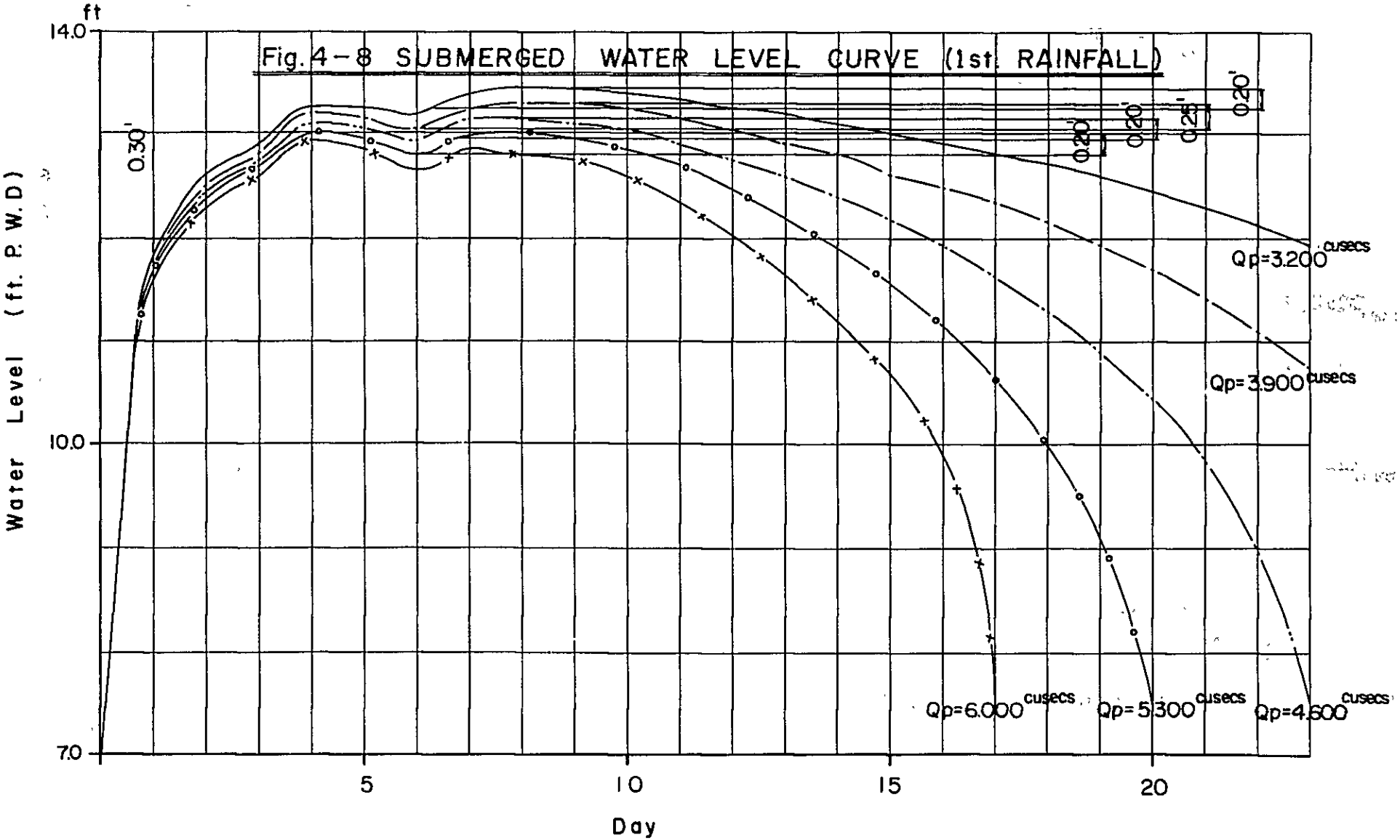
Fig. 4-8 SUBMERGED WATER LEVEL CURVE (1st RAINFALL)
ft
14.0
10.0
7.0
Water Level (ft. P. W. D)
5
10
15
20
Day
0.30'
0.20'
0.20'
0.25'
0.20'
Qp=3.200 cusecs
Qp=3.900 cusecs
Qp=6.000 cusecs
Qp=5.300 cusecs
Qp=4.600 cusecs

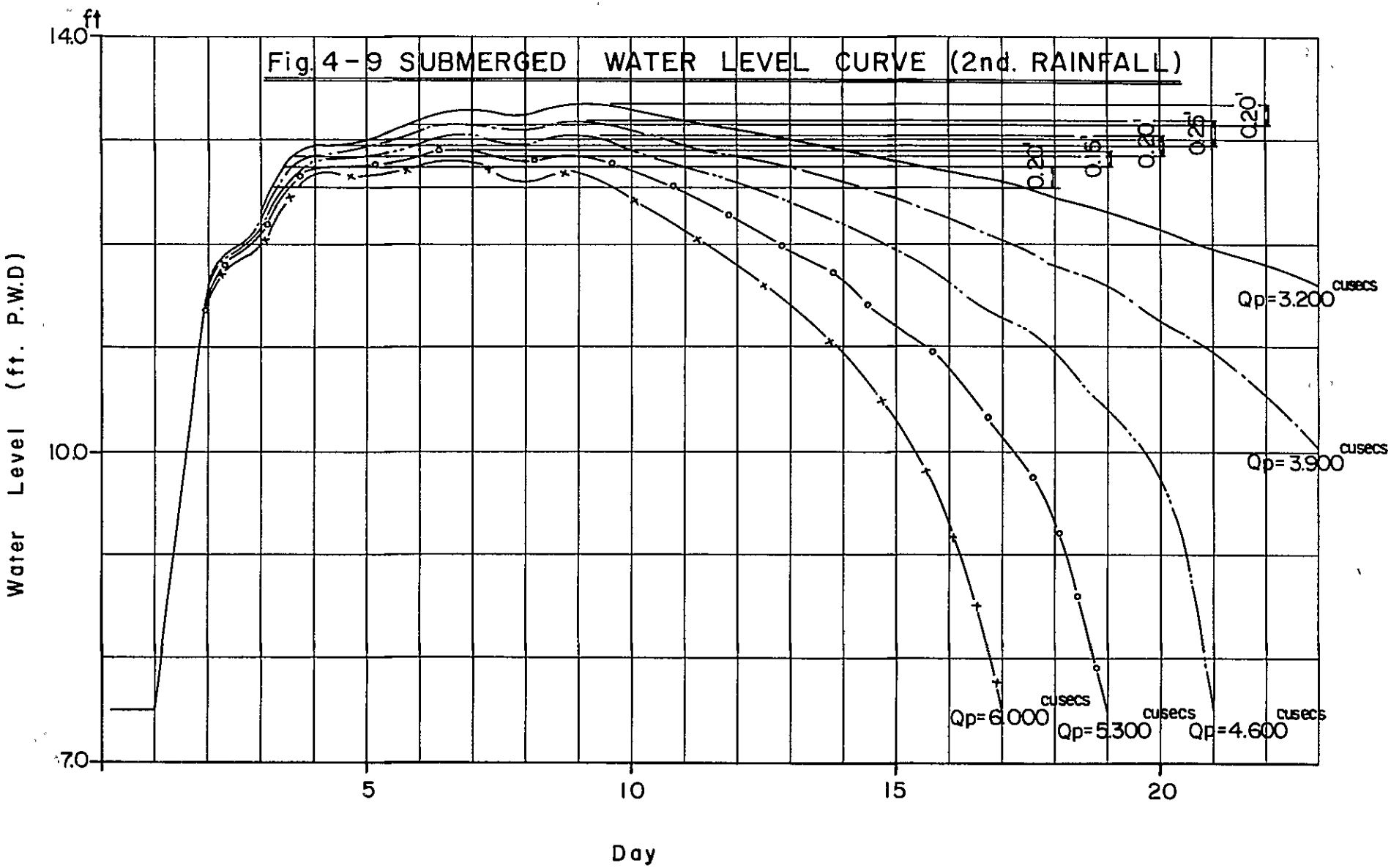
Fig. 4-9 SUBMERGED WATER LEVEL CURVE (2nd. RAINFALL)
ft
14.0
10.0
7.0
Water Level (ft. P.W.D)
5
10
15
20
Day
Qp=3.200 cusecs
Qp=3.900 cusecs
Qp=6.000 cusecs
Qp=5.300 cusecs
Qp=4.600 cusecs

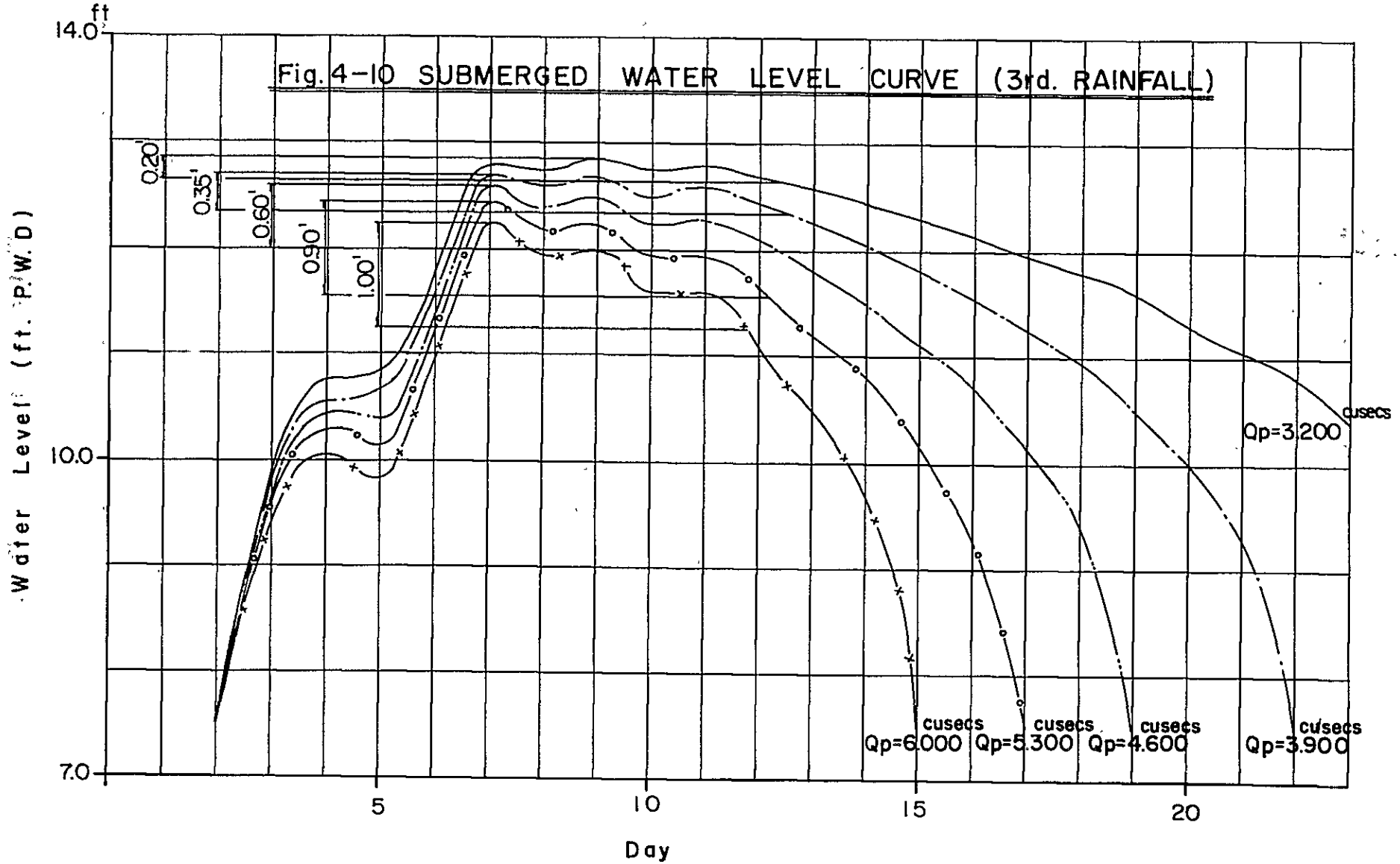
Fig. 4-10 SUBMERGED WATER LEVEL CURVE (3rd. RAINFALL)
ft
14.0
10.0
7.0
Water Level (ft. P.W.D)
0.20'
0.35'
0.60'
0.90'
1.00'
5
10
15
20
Day
Qp=6,000 cusecs
Qp=5,300 cusecs
Qp=4,600 cusecs
Qp=3,900 cusecs
Qp=3,200 cusecs

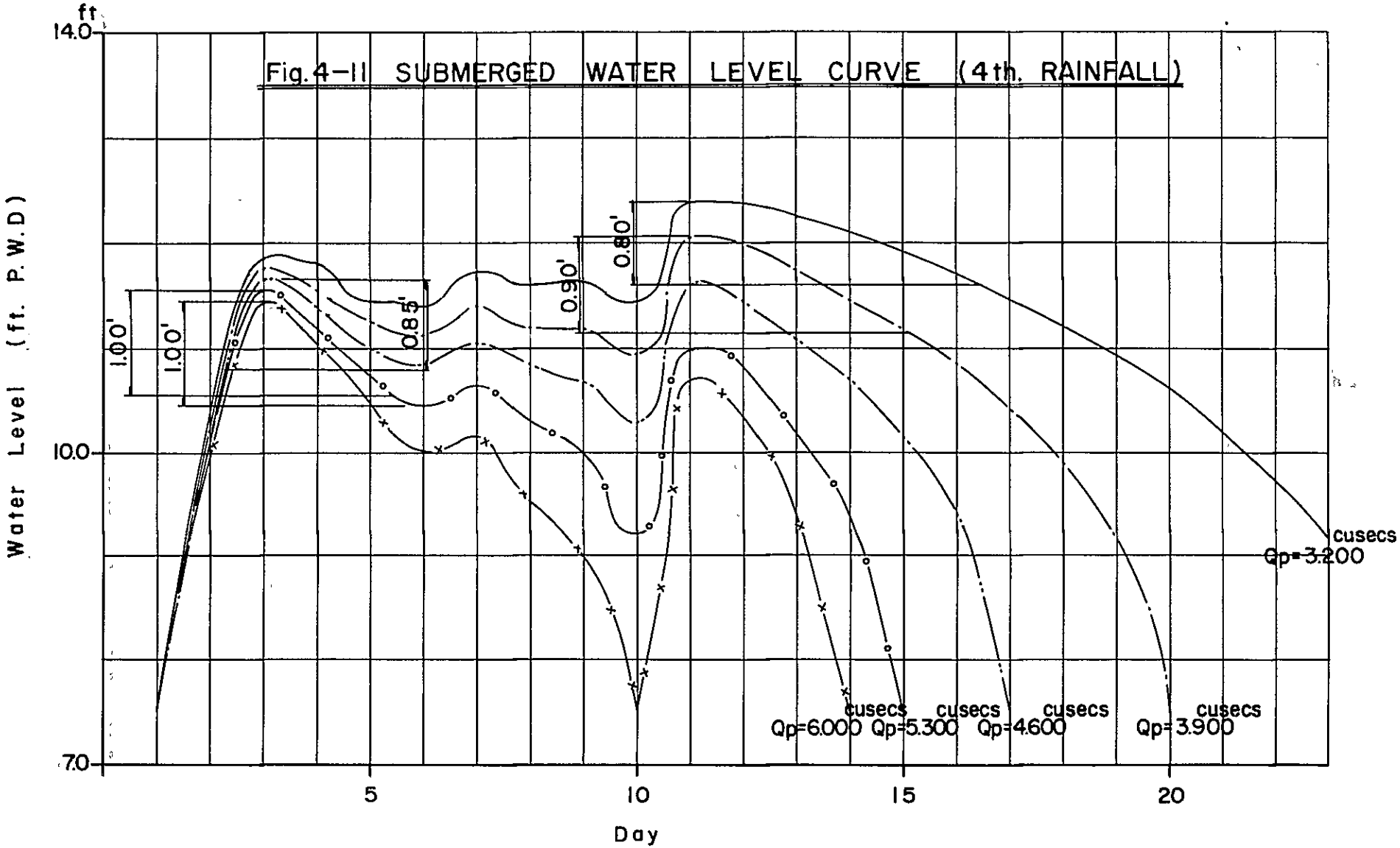
Fig. 4-11 SUBMERGED WATER LEVEL CURVE (4th. RAINFALL)
ft
14.0
10.0
7.0
Water Level (ft. P.W.D)
1.00'
1.00'
0.85'
0.90'
0.80'
5
10
15
20
Day
cusecs
Qp=3.200
cusecs
Qp=6.000
cusecs
Qp=5.300
cusecs
Qp=4.600
cusecs
Qp=3.900

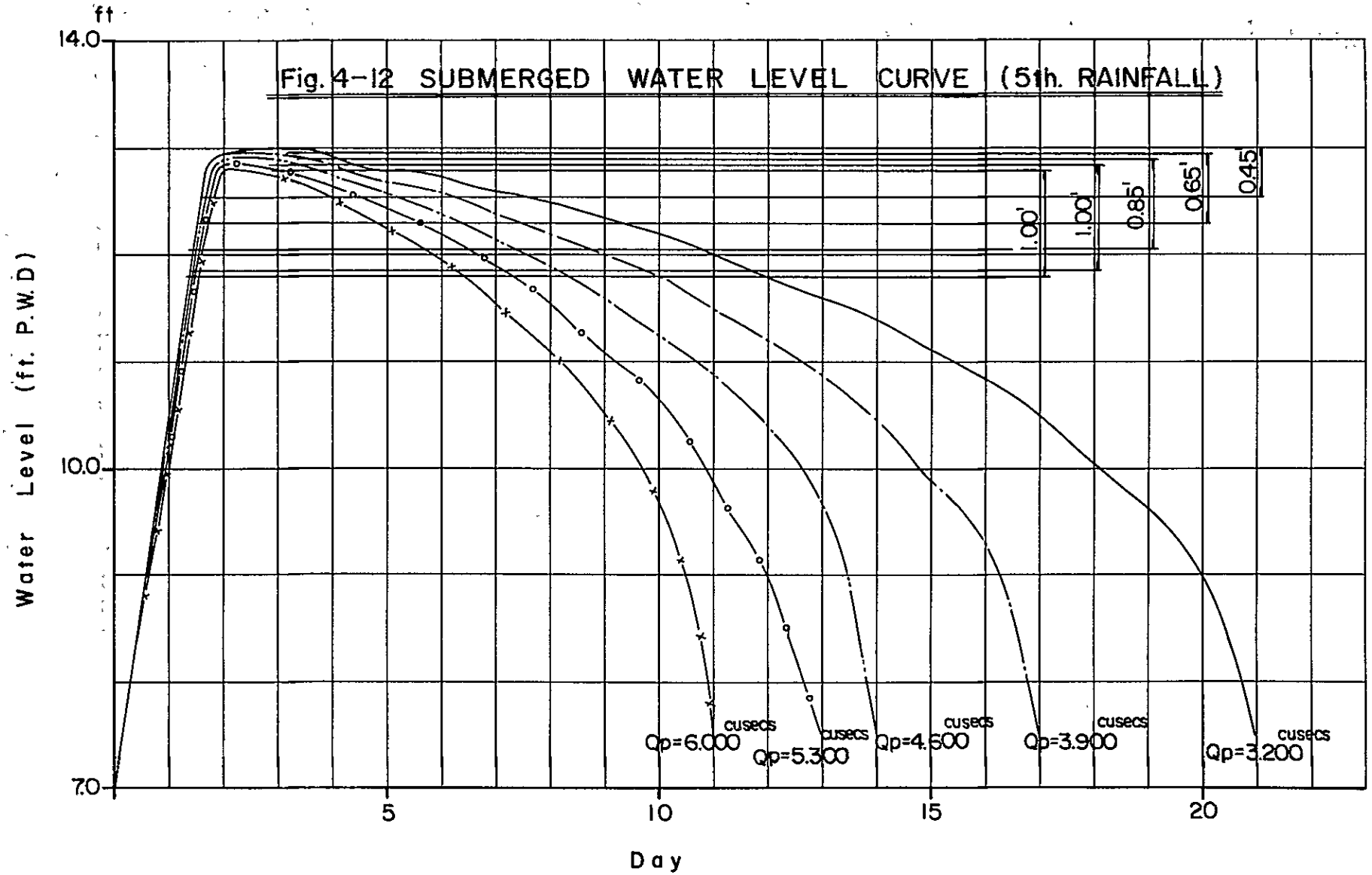
Fig. 4-12 SUBMERGED WATER LEVEL CURVE (5th. RAINFALL)
ft
14.0
10.0
7.0
Water Level (ft. P.W.D)
5
10
15
20
Day
1.00'
1.00'
0.85'
0.65'
0.45'
Qp=6.000 cusecs
Qp=5.300 cusecs
Qp=4.600 cusecs
Qp=3.900 cusecs
Qp=3.200 cusecs

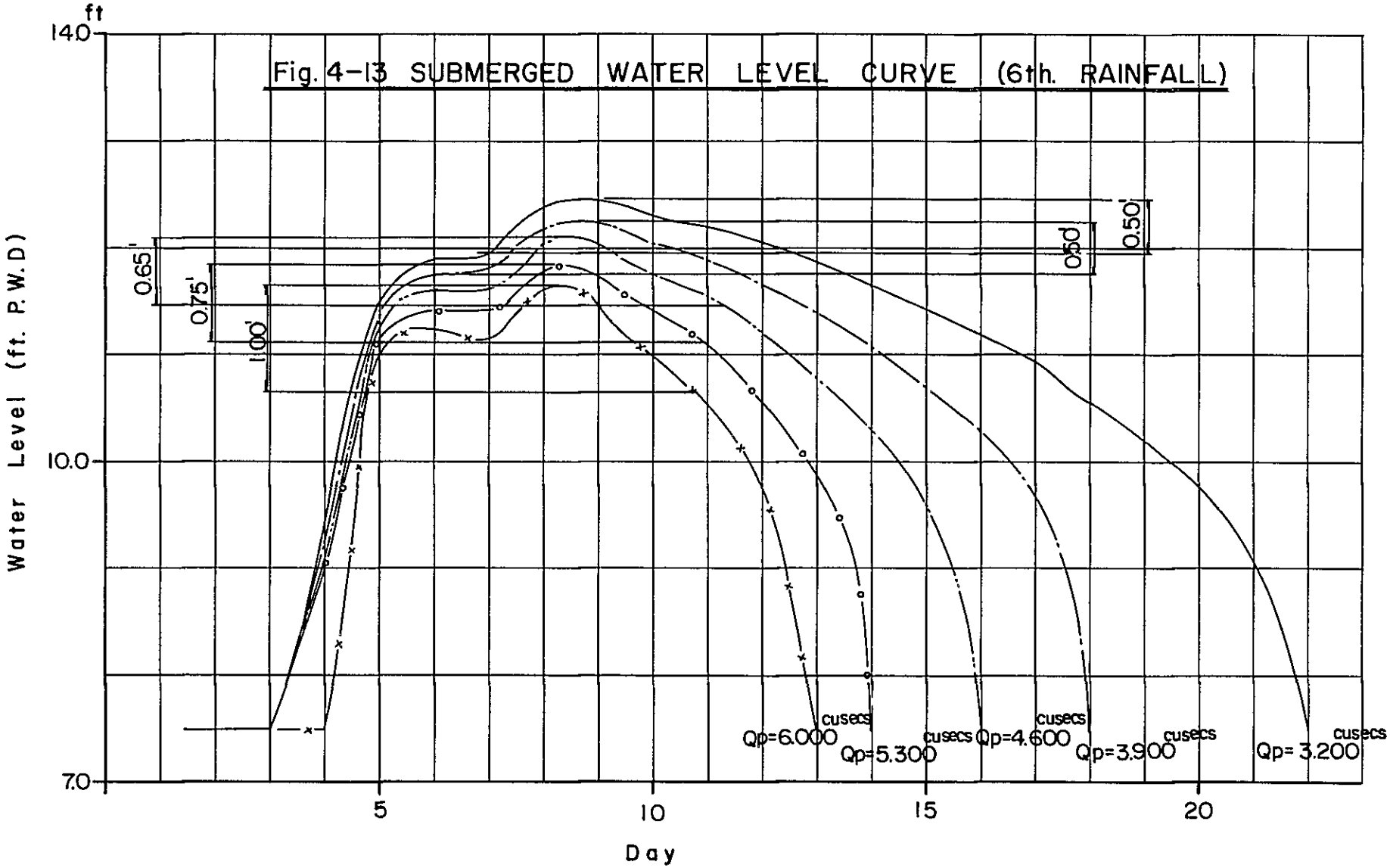
Fig. 4-13 SUBMERGED WATER LEVEL CURVE (6th. RAINFALL)
ft
14.0
10.0
7.0
Water Level (ft. P.W.D)
0.65'
0.75'
1.00'
0.50'
0.5d'
Qp=6.000 cusecs
Qp=5.300 cusecs
Qp=4.600 cusecs
Qp=3.900 cusecs
Qp= 3.200 cusecs
5
10
15
20
Day

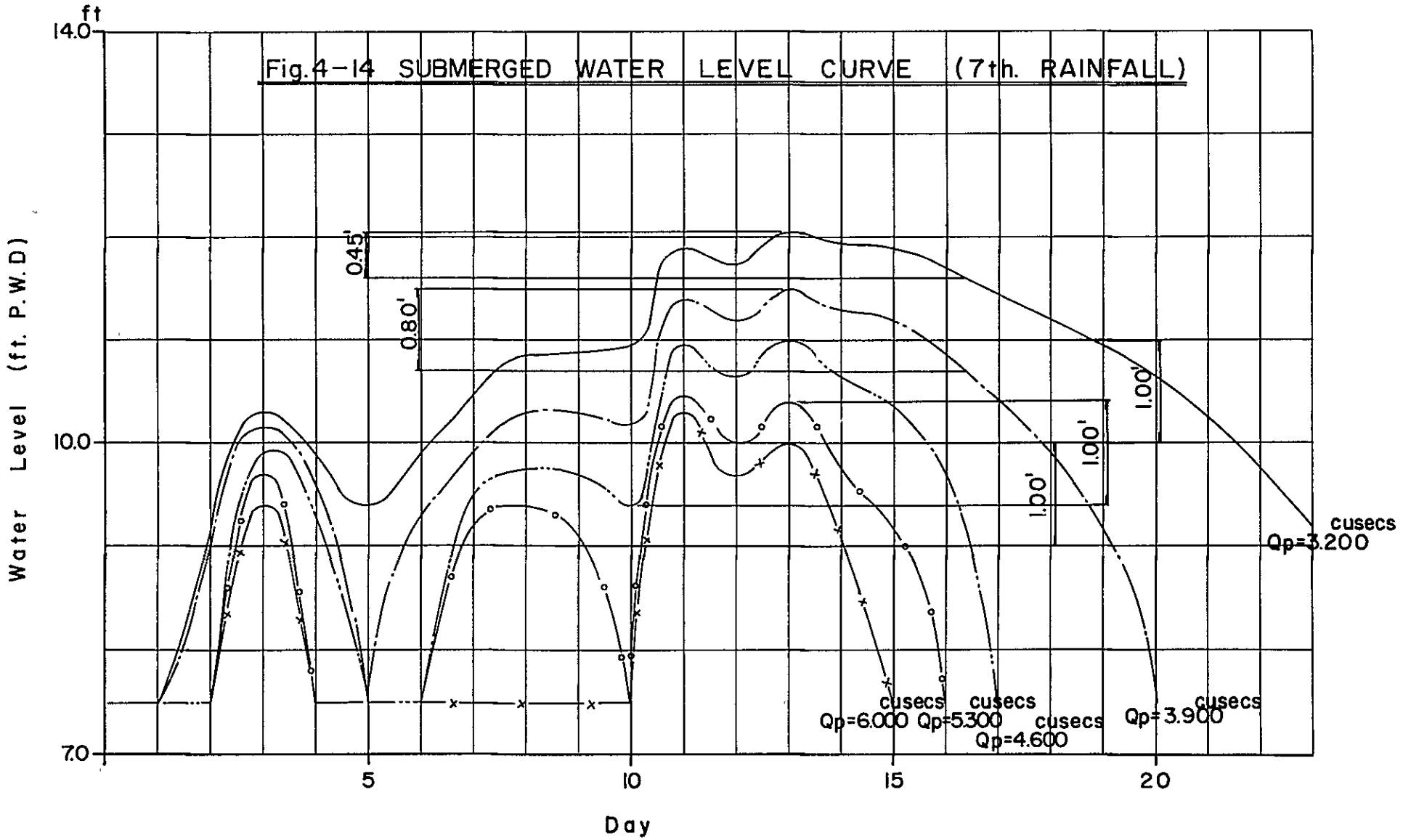
Fig.4-14 SUBMERGED WATER LEVEL CURVE (7th. RAINFALL)
ft
14.0
10.0
7.0
Water Level (ft. P.W.D)
5
10
15
20
Day
0.45'
0.80'
1.00'
1.00'
1.00'
Qp=3.200 cusecs
Qp=6.000 cusecs
Qp=5.300 cusecs
Qp=4.600 cusecs
Qp=3.900 cusecs

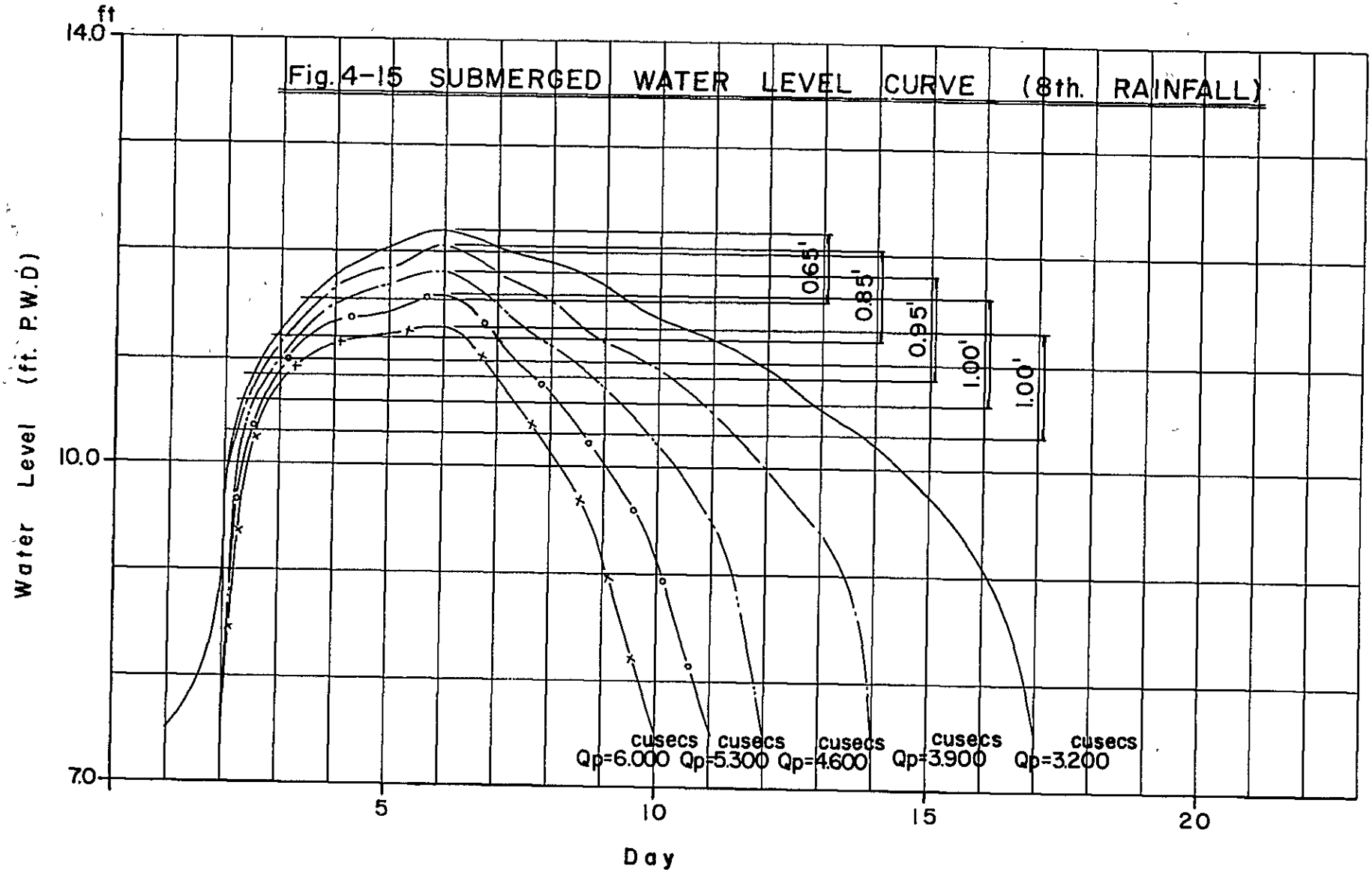
Fig. 4-15 SUBMERGED WATER LEVEL CURVE (8th. RAINFALL)
ft
14.0
10.0
7.0
Water Level (ft. P.W.D)
0.65'
0.85'
0.95'
1.00'
1.00'
cusecs Qp=6.000
cusecs Qp=5.300
cusecs Qp=4.600
cusecs Qp=3.900
cusecs Qp=3.200
5
10
15
20
Day

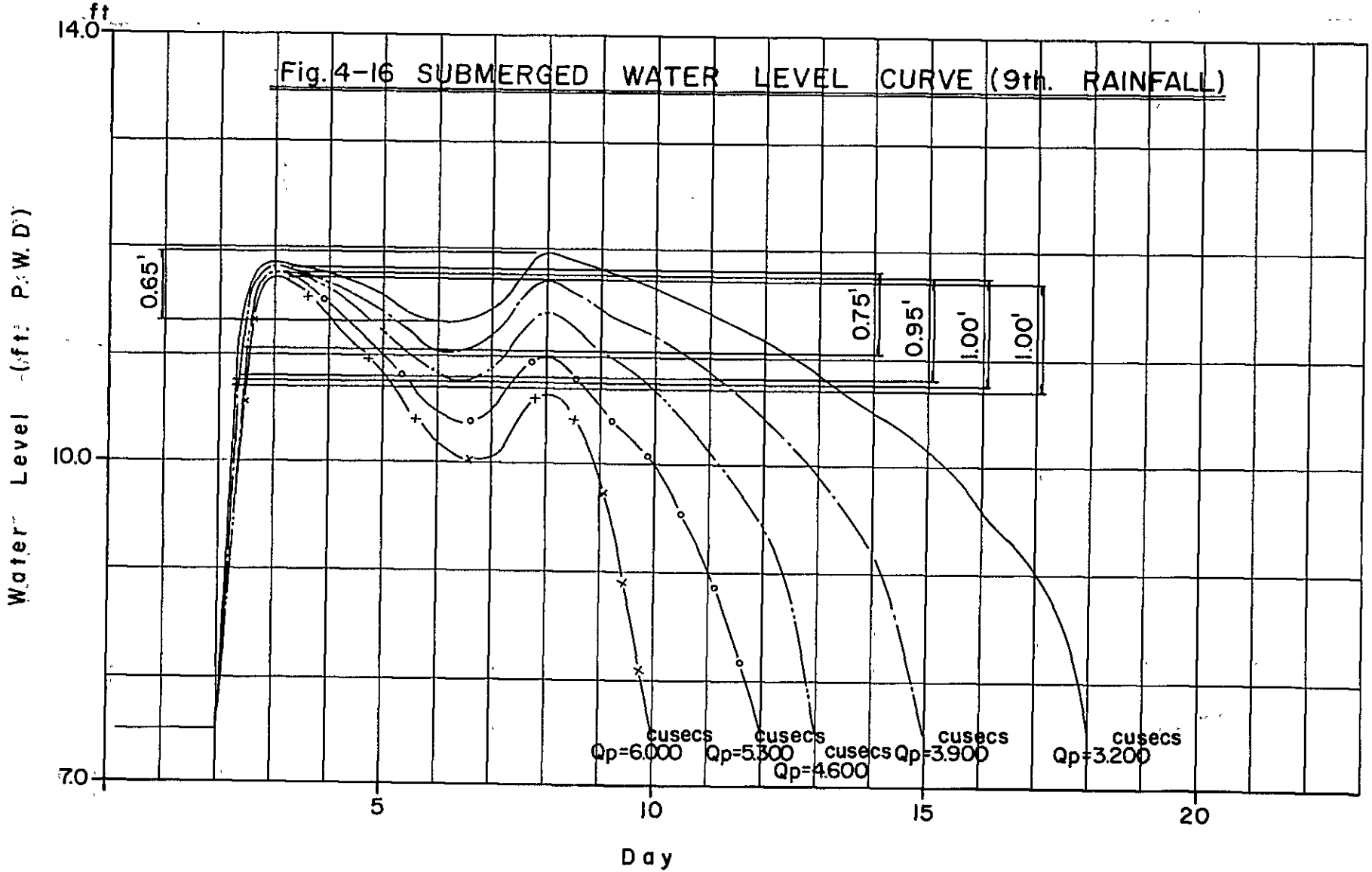
Fig. 4-16 SUBMERGED WATER LEVEL CURVE (9th. RAINFALL)
ft
14.0
10.0
7.0
Water Level (ft: P.W.D)
0.65'
0.75'
0.95'
1.00'
1.00'
Qp=6.000 cusecs
Qp=5.300 cusecs
Qp=4.600 cusecs
Qp=3.900 cusecs
Qp=3.200 cusecs
5
10
15
20
Day

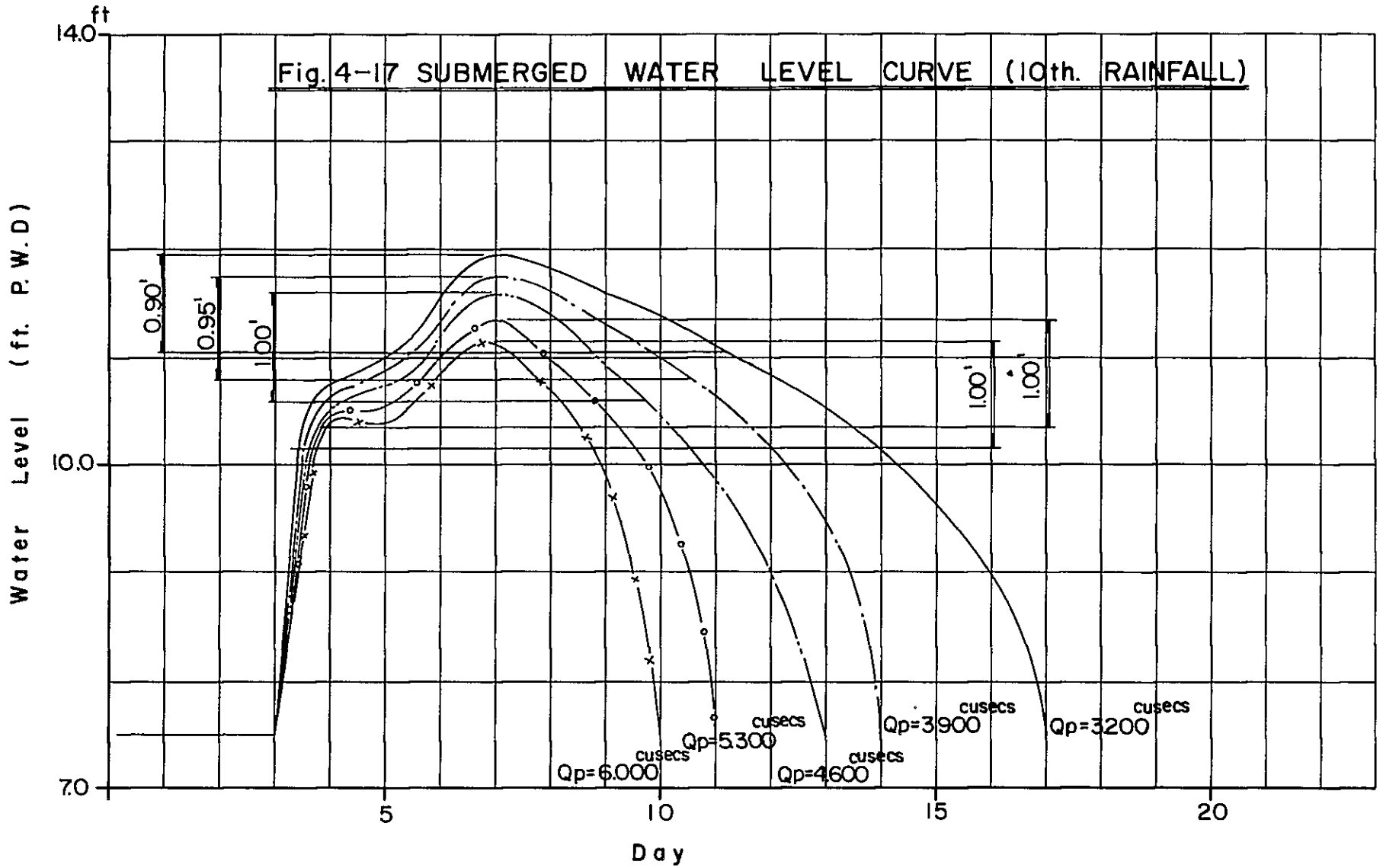
Fig. 4-17 SUBMERGED WATER LEVEL CURVE (10th. RAINFALL)
ft
14.0
10.0
7.0
Water Level (ft. P.W.D)
0.90'
0.95'
1.00'
1.00'
1.00'
Qp=6,000 cusecs
Qp=5,300 cusecs
Qp=4,600 cusecs
Qp=3,900 cusecs
Qp=3,200 cusecs
5
10
15
20
Day

4.5 Identification of Pumping Capacity

(1) Cultivable Areas at Different Elevations

Area A : This area is made up of the highland above the inundation water level. The main irrigation canals are running along its lowest contour line. Its area is estimated at 2,700 ac.

Area B : This area corresponds to a belt of cultivable area spreading between Area A and the elevation at which the inundation water would be less than 1 ft in depth or less than 6 days in duration at its peak period. The cultivable area spreading below this elevation would be obtained by the H-A curve (irrigable area). As the upper limit elevation of Area B remains undetermined, the total area belonging to Area B would be obtainable only after determining those of Areas C and D.

Area C : The area falling between the elevation which has been obtained in Area B above and the elevation which would be 3 ft below the peak inundation water level.

Area D : The area falling between the two elevations, the upper limit being the level which would be 3 ft below the peak inundation water level and the other, the level which would be 6 ft below the peak inundation water level. The latter level would correspond to the cultivable area situated at the water level of the constant retarding basin.

The cultivable area of each one of the above four areas categorized into A, B, C and D would be estimated as per Table 4-66.

Table 4-66 Area by Elevation under Different Pump Capacities (1)

Rain-fall Type	Pump Capacity [cusecs]	Peak Sub-merged Water Level [ft]	Area (Acre)						Total Area
			Higher than Main Canal Water Level	Submerged within 1 ft and 6 days		Submerged from 1 ft to 3 ft		Submerged from 3 ft to 6 ft		
				Water Level	Irrigable Area	Water Level	Irrigable Area	Water Level	Irrigable Area	
1st	3,200	13.45	2700	~ 13.25	28600	13.25~10.45	45900	10.45~7.50	11000	88200
	3,900	13.30	"	~ 13.05	30400	13.05~10.30	45400	10.30~7.50	9700	"
	4,600	13.15	"	~ 12.95	31400	12.95~10.15	45600	10.15~7.50	8500	"
	5,300	13.00	"	~ 12.80	33100	12.80~10.00	45000	10.00~7.50	7400	"
	6,000	12.95	"	~ 12.65	34900	12.65~ 9.95	43500	9.95~7.50	7100	"
2nd	3,200	13.35	"	~ 13.15	29400	13.15~10.35	45900	10.35~7.50	10200	"
	3,900	13.20	"	~ 12.95	31400	12.95~10.20	45200	10.20~7.50	8900	"
	4,600	13.05	"	~ 12.85	32400	12.85~10.05	45300	10.05~7.50	7800	"
	5,300	12.90	"	~ 12.75	33700	12.75~ 9.90	45100	9.90~7.50	6700	"
	6,000	12.80	"	~ 12.60	35600	12.60~ 9.80	43700	9.80~7.50	6200	"
3rd	3,200	12.85	"	~ 12.65	34900	12.65~ 9.85	44200	9.85~7.50	6400	"
	3,900	12.70	"	~ 12.35	37500	12.35~ 9.70	42500	9.70~7.50	5500	"
	4,600	12.60	"	~ 12.00	45400	12.00~ 9.60	35100	9.60~7.50	5000	"
	5,300	12.45	"	~ 11.55	56600	11.55~ 9.45	24500	9.45~7.50	4400	"
	6,000	12.25	"	~ 11.25	63800	11.25~ 9.25	18100	9.25~7.50	3600	"

Unit: Water Level = ft. PWD

Area = Ac

Table 4-66 Area by Elevation under Different Pump Capacities (2)

Rain-fall Type	Pump Capacity [cusecs]	Peak Sub-merged Water Level [ft]	Area (Acre)						Total Area
			Higher than Main Canal Water Level	Submerged within 1 ft and 6 days		Submerged from 1 ft to 3 ft		Submerged from 3 ft to 6 ft		
				Water Level	Irrigable Area	Water Level	Irrigable Area	Water Level	Irrigable Area	
4th	3,200	12.40	2700	~ 11.60	55400	11.60~9.40	25900	9.40~7.50	4200	88200
	3,900	12.05	"	~ 11.15	65300	11.15~9.05	17200	9.05~7.50	3000	"
	4,600	11.65	"	~ 10.80	70300	10.80~8.65	13300	8.65~7.50	1900	"
	5,300	11.55	"	~ 10.55	73300	10.55~8.55	10600	8.55~7.50	1600	"
	6,000	11.45	"	~ 10.45	74500	10.45~8.45	9500	8.45~7.50	1500	"
5th	3,200	13.00	"	~ 12.55	36200	12.55~10.00	41900	10.00~7.50	7400	"
	3,900	12.95	"	~ 12.30	37800	12.30~9.95	40600	9.95~7.50	7100	"
	4,600	12.90	"	~ 12.05	44000	12.05~9.90	34800	9.90~7.50	6700	"
	5,300	12.85	"	~ 11.85	49100	11.85~9.85	30000	9.85~7.50	6400	"
	6,000	12.80	"	~ 11.80	50400	11.80~9.80	28900	9.80~7.50	6200	"
6th	3,200	12.45	"	~ 11.95	46600	11.95~9.45	34500	9.45~7.50	4400	"
	3,900	12.25	"	~ 11.75	51600	11.75~9.25	30300	9.25~7.50	3600	"
	4,600	12.05	"	~ 11.40	60500	11.40~9.05	22000	9.05~7.50	3000	"
	5,300	11.80	"	~ 11.05	66800	11.05~8.80	16400	8.80~7.50	2300	"
	6,000	11.60	"	~ 10.60	72700	10.60~8.60	11000	8.60~7.50	1800	"

Table 4-66 Area by Elevation under Different Pump Capacities (3)

Rain-fall Type	Pump Capacity [cusecs]	Peak Sub-merged Water Level [ft]	Area (Acre)						Total Area
			Higher than Main Canal Water Level	Submerged within 1 ft and 6 days		Submerged from 1 ft to 3 ft		Submerged from 3 ft to 6 ft	
				Water Level	Irrigable Area	Water Level	Irrigable Area	Water Level	Irrigable Area	
7th	3,200	12.05	2700	~ 11.60	55400	11.60~9.05	27100	9.05~7.50	3000	88200
	3,900	11.50	"	~ 10.70	71500	11.70~8.50	12500	8.50~7.50	1500	"
	4,600	11.00	"	~ 10.00	78100	10.00~8.00	6900	8.00~7.50	500	"
	5,300	10.45	"	~ 9.45	81100	9.45~7.50	4400	—	—	"
	6,000	10.30	"	~ 9.30	81800	9.30~7.50	3700	—	—	"
8th	3,200	12.20	"	~ 11.55	56600	11.55~9.20	25400	9.20~7.50	3500	"
	3,900	12.05	"	~ 11.20	64500	11.20~9.05	18000	9.05~7.50	3000	"
	4,600	11.80	"	~ 10.85	69700	10.85~8.80	13500	8.80~7.50	7300	"
	5,300	11.60	"	~ 10.60	72700	10.60~8.60	11000	8.60~7.50	1800	"
	6,000	11.30	"	~ 10.30	75800	10.30~8.30	8600	8.30~7.50	1100	"
9th	3,200	11.95	"	~ 11.30	63000	11.30~8.95	19800	8.95~7.50	2700	"
	3,900	11.80	"	~ 11.05	66800	11.05~8.80	16400	8.80~7.50	2300	"
	4,600	11.75	"	~ 10.80	70300	10.80~8.75	12900	8.75~7.50	2300	"
	5,300	11.75	"	~ 10.75	70900	10.75~8.75	12300	8.75~7.50	2300	"
	6,000	11.70	"	~ 10.70	71500	10.70~8.70	12000	8.70~7.50	2000	"

Table 4-66 Area by Elevation under Different Pump Capacities (4)

Rain-fall Type	Pump Capacity [cusecs]	Peak Sub-merged Water Level [ft]	Area (Acre)							Total Area
			Higher than Main Canal Water Level	Submerged within 1 ft and 6 days		Submerged from 1 ft to 3 ft		Submerged from 3 ft to 6 ft		
				Water Level	Irrigable Area	Water Level	Irrigable Area	Water Level	Irrigable Area	
10th	3,200	11.95	2700	~ 11.05	66900	11.05~8.95	15900	8.95~7.50	2700	88200
	3,900	11.75	"	~ 10.80	70300	10.80~8.75	12900	8.75~7.50	2300	"
	4,600	11.60	"	~ 10.60	72700	10.60~8.60	11000	8.60~7.50	1800	"
	5,300	11.35	"	~ 10.35	75400	10.35~8.35	8900	8.35~7.50	1200	"
	6,000	11.15	"	~ 10.15	77000	10.15~8.15	7700	8.15~7.50	800	"

(2) Cumulative Area

From the areas which have been estimated from inundation water levels resulting from different rainfall patterns, the cumulative area would be computed, by taking into consideration the frequency of each rainfall pattern, on the following assumptions:

(i) The cropped area under the 1st rainfall pattern would be assumed to suffer from no inundation damage for ten years out of ten. Therefore, the cropped area of each Area would be appropriated for ten years; the cropped area would remain unchanged if the rainfall happens to be less.

(ii) The cropped area under the 2nd rainfall pattern would suffer from inundation damage once in ten years. Such damage would be assumed to have occurred in terms of reduction of the cropped area falling in Area B (namely, decrease in farm income). Therefore, the cropped area under the 1st rainfall pattern would be appropriated for one year and, for the remaining nine years, that under the 2nd rainfall pattern.

(iii) Likewise, the cropped area under the 10th rainfall pattern would be appropriated for one year only, while that under nine other rainfall patterns would be appropriated for one year each.

Total cropped area for ten years under different rainfall patterns would be computed according to the above procedure as shown in Table 4-67.

Table 4-67 Cropping Area by Rainfall under Different Pump Capacities (1)

Rainfall Type	Pump Capacity	A	B	C	D	Total
1st	3,200	27,000	286,000	459,000	110,000	882,000
	3,900	"	304,000	454,000	97,000	"
	4,600	"	314,000	456,000	85,000	"
	5,300	"	331,000	450,000	74,000	"
	6,000	"	349,000	435,000	71,000	"
2nd	3,200	27,000	293,200	459,000	102,800	882,000
	3,900	"	313,000	452,200	89,800	"
	4,600	"	323,000	453,300	78,700	"
	5,300	"	336,400	450,900	67,700	"
	6,000	"	355,300	436,800	62,900	"
3rd	3,200	27,000	337,200	445,400	72,400	882,000
	3,900	"	361,800	430,600	62,600	"
	4,600	"	427,000	371,700	56,300	"
	5,300	"	519,600	286,100	49,300	"
	6,000	"	580,900	232,000	42,100	"
4th	3,200	27,000	480,700	317,300	57,000	882,000
	3,900	"	556,400	253,500	45,100	"
	4,600	"	601,300	219,100	34,600	"
	5,300	"	636,500	188,800	29,700	"
	6,000	"	655,800	171,800	27,400	"
5th	3,200	27,000	365,500	413,300	76,200	882,000
	3,900	"	391,400	393,900	69,700	"
	3,600	"	443,500	348,100	63,400	"
	5,300	"	491,300	305,200	58,500	"
	6,000	"	511,200	288,200	55,600	"

Table 4-67 Cropping Area by Rainfall under Different Pump Capacities (2)

Rainfall Type	Pump Capacity	A	B	C	D	Total
6th	3,200	27,000	417,500	376,500	61,200	882,000
	3,900	"	460,400	342,400	52,200	"
	4,600	"	526,000	284,100	44,900	"
	5,300	"	579,800	237,200	38,000	"
	6,000	"	622,700	198,700	33,600	"
7th	3,200	27,000	452,700	346,700	55,600	882,000
	3,900	"	540,000	271,200	43,800	"
	4,600	"	596,400	223,700	34,900	"
	5,300	"	637,000	189,200	28,800	"
	6,000	"	659,100	169,500	26,400	"
8th	3,200	27,000	456,300	341,600	57,100	882,000
	3,900	"	519,000	287,700	48,300	"
	4,600	"	571,200	243,500	40,300	"
	5,300	"	611,800	209,000	34,200	"
	6,000	"	641,100	184,200	29,700	"
9th	3,200	27,000	469,100	330,400	55,500	882,000
	3,900	"	523,600	284,500	46,900	"
	4,600	"	572,400	242,300	40,300	"
	5,300	"	608,200	211,600	35,200	"
	6,000	"	632,500	191,000	31,500	"
10th	3,200	27,000	473,000	326,500	55,500	882,000
	3,900	"	527,100	281,000	46,900	"
	4,600	"	574,800	240,400	39,800	"
	5,300	"	612,700	208,200	34,100	"
	6,000	"	638,000	186,700	30,300	"

(3) Calculation of Total Farm Incomes

Total farm incomes would be computed by taking into consideration the cropped area specified by different rainfall patterns and pumping capacities.

(i) Farm Income per Acre

Farm incomes per ac accruing from the cropping patterns corresponding to given inundation water levels are given in Table 4-68.

Table 4-68 Farm Incomes per Ac by Cropping Patterns

Cropping Pattern	Farm Income per Ac (Tk)
A	5,500
B	6,500
C	5,600
D	4,200

(ii) Calculation of Total Farm Incomes

Total farm incomes aggregated for 10 years have been computed by taking into consideration the above-mentioned gross income per ac and the cultivable areas under four land categories, as shown in Table 4-69.

Table 4-69 Gross Farm Incomes by Rainfall Types and Pump Capacities (1)

Rainfall Type	Pump Capacity	A	B	C	D	Total
1st	3,200	1,485	18,590	25,704	4,620	50,399
	3,900	"	19,760	25,424	4,074	50,743
	4,600	"	20,410	25,536	3,570	51,001
	5,300	"	21,515	25,200	3,108	51,308
	6,000	"	22,685	24,360	2,982	51,512
2nd	3,200	1,485	19,058	25,704	4,318	50,565
	3,900	"	20,345	25,323	3,772	50,925
	4,600	"	20,995	25,385	3,305	51,170
	5,300	"	21,866	25,250	2,843	51,444
	6,000	"	23,095	24,461	2,642	51,683
3rd	3,200	1,485	21,918	24,942	3,041	51,386
	3,900	"	23,517	24,114	2,629	51,745
	4,600	"	27,755	20,815	2,365	52,420
	5,300	"	33,774	16,022	2,071	53,352
	6,000	"	37,759	12,992	1,768	54,004
4th	3,200	1,485	31,246	17,769	2,394	52,894
	3,900	"	36,166	14,196	1,894	53,741
	4,600	"	39,085	12,270	1,453	54,293
	5,300	"	41,373	10,573	1,247	54,678
	6,000	"	42,627	9,621	1,151	54,884
5th	3,200	1,485	23,758	23,145	3,200	51,588
	3,900	"	25,441	22,058	2,927	51,911
	4,600	"	28,828	19,494	2,663	52,470
	5,300	"	31,935	17,091	2,457	52,968
	6,000	"	33,228	16,139	2,335	53,187

Unit 10^5 Taka

Table 4-69 Gross Farm Incomes by Rainfall Types and Pump Capacities (2)

Rainfall Type	Pump Capacity	A	B	C	D	Total
6th	3,200	1,485	27,138	21,084	2,570	52,277
	3,900	"	29,926	19,174	2,192	52,777
	4,600	"	34,190	15,910	1,886	53,471
	5,300	"	37,687	13,283	1,596	54,051
	6,000	"	40,476	11,127	1,411	54,499
7th	3,200	1,485	29,426	19,415	2,335	52,661
	3,900	"	35,100	15,187	1,840	53,612
	4,600	"	38,766	12,527	1,466	54,244
	5,300	"	41,405	10,595	2,100	54,695
	6,000	"	42,842	9,492	1,109	54,929
8th	3,200	1,485	29,660	19,130	2,398	52,673
	3,900	"	33,934	16,111	2,029	53,559
	4,600	"	37,128	13,636	1,693	53,942
	5,300	"	39,767	11,704	1,436	54,392
	6,000	"	41,672	10,315	1,247	54,719
9th	3,200	1,485	30,492	18,502	2,331	52,810
	3,900	"	34,285	15,932	1,970	53,672
	4,600	"	37,206	13,569	1,693	53,953
	5,300	"	39,533	11,850	1,478	54,346
	6,000	"	41,113	10,696	1,323	54,617
10th	3,200	1,485	30,745	18,284	2,331	52,845
	3,900	"	34,504	15,736	1,970	53,695
	4,600	"	37,362	13,462	1,672	53,981
	5,300	"	39,826	11,659	1,432	54,402
	6,000	"	41,470	10,455	1,273	54,683

(4) Costs of Pumping Stations

Pumping station costs comprise of (1) pumping machinery and their installation costs, (2) civil work costs, and (3) construction costs of the pumping stations. The total pumping station costs have been estimated on the basis of the pumping capacity at 3,300,000 Tk/m^3/sec. Pumping capacity-wise costs have been estimated as shown in Table 4-70.

Table 4-70 Pumping Station Costs by Pumping Capacities

Pumping Capacity cusecs	Pumping Capacity m^3/sec	Pumping Station Cost (100,000 Tk)
3,200	90	2,970
3,900	110	3,630
4,600	130	4,290
5,300	150	4,950
6,000	170	5,610

(5) Power Costs

The operation costs of the pumping stations would be considerable, judging, for instance, from their drainage duty of the enormous amount of rain water falling within a large area during the monsoon season. The prime mover of the pump being an electric motor, power costs should be taken into consideration.

(i) Estimation of Electric Power Consumption

(a) Total Runoff During the Monsoon Season

The total precipitation and runoff therefrom during the five months (May-September) are given in Table 4-71.

Table 4-71 Total Runoff During the Monsoon Season

Rainfall Type	Year	Total Rainfall		Total Runoff
		Inch	m	
				$x10^8 m^3$
1	1976	72.40	1,839	8.31
2	1975	65.23	1,657	7.49
3	1968	61.75	1,568	7.09
4	1974	70.41	1,788	8.08
5	1971	83.00	2,108	9.53
6	1970	56.84	1,444	6.53
7	1969	54.30	1,379	6.23
8	1972	52.64	1,337	6.04
9	1973	75.34	1,914	8.65
10	1967	60.41	1,534	6.93

(b) Total Output of Motors

The total output of the motors required for pumping drainage of the monsoon season runoff would be as follows:

Total Head

Total head is expressed by the following formula:

Total Head = Outside Water Level - Average Inside Water Level + Conveyance Loss + Screen Loss + Pump Loss

The location of pumping stations and the average inside water levels taken as a whole, outside water levels have been determined at H.W.L. 20.5 ft (P.W.D.).

The losses would be assumed as follows:

Conveyance Loss = 3.0 ft
Screen Loss = 1.0 ft
Pump Loss = 3.0 ft

Accordingly, total head is expressed by:

Total Head = 20.5 - Average Inside Water Level + 3.0 + 1.0 + 3.0
= (27.5 - Average Inside Water Level) x 0.3048 m

The average inside water levels are quoted from Table 5-15 in the Main Report; however, as the variation in the water levels among different capacities of the pump is negligible, the mean value would be adopted.

Calculation of Total Output

The shaft power of a pump can be computed by the following formula:

$$Pp = \frac{0.163\gamma HQ(1+\alpha)}{\eta_p \eta}$$

Pp : Shaft Power
γ : Specific Gravity of Water
H : Total Head
Q : Pumping Discharge
η_p : Pump Efficiency
η : Conduction Efficiency
α : Clearance Efficiency

The total output of a motor can be computed by the following formula:

$$\Sigma P = Ppxhr = \frac{0.163\gamma HQ(1+\alpha)}{\eta_p \cdot \eta} \times \frac{\Sigma Q}{Qx60} \times \frac{0.0027\gamma H(1+\alpha)\Sigma Q}{\eta_p \eta}$$

ΣP : Total Output
Pp : Shaft Power
hr : Pumping Operation Hour
ΣQ : Total Drainage Discharge

Assuming that a diameter of a pump is about 1,650 mm, the efficiencies of pump, conduction and clearance have been computed as follows:

$$\eta_p = 0.78$$
$$\eta = 0.95$$
$$\alpha = 0.1$$

By taking into consideration the above efficiencies, the total output of a motor has been computed as follows:

$$\Sigma P = \frac{0.0027 \times 1.0 \times H \times (1+0.1) \times \Sigma Q}{0.78 \times 0.95} = 0.004 \cdot H \cdot \Sigma Q$$

Total outputs under different rainfall patterns are represented in Table 4-72.

Table 4-72 Total outputs by Rainfall Patterns

Rainfall Type	Total Head	Total Drainage Capacity	Total Output
	m	$\times 10^8 m^3$	$\times 16^6$KWH
1	4.70	8.31	15.62
2	4.74	7.49	14.20
3	4.91	7.09	13.92
4	5.10	8.08	16.48
5	4.88	9.53	18.60
6	5.10	6.53	13.32
7	5.49	6.23	13.68
8	5.13	6.04	12.39
9	5.10	8.65	17.65
10	5.18	6.93	14.36
			$\times 10^6$
Total			150.22

(ii) Power Costs and Their Specifications

According to the specifications by the "Ministry of Flood Control, Water Resources and Power (Power Division), which is the administrative agency for the control of electric power, the power costs applicable to the project read as follows:

Rate-D High tension power supply to large-scale industries (more than 50 kW at the receiving end)

(a) Minimum Rate 42.0 TK/KVA/month

(b) Consumption Charges

- Monthly Consumption: less than 200 KWH/KVA: 36 paisa/KWH
- Monthly Consumption: more than 200 KWH/KVA: 31 paisa/KWH

(c) Power Costs

Power costs are equal to the sum of (a) and (b).

Therefore, total power costs would be computed through the combination of the minimum rate on the rated capacities and the charges on the electric power consumed. KVA corresponding to different rated capacities has been assumed in consideration of the motor efficiency and its power efficiency as follows:

Pumping Capacity	Rated Capacity	Power Supply
cusecs	KW	KVA
3,200	9,200	12,300
3,900	11,200	14,900
4,600	13,200	17,600
5,300	15,300	20,400
6,000	17,300	23,100

(a) Qp = 3,200 cusecs

Minimum Rate : 42.0x12,300x12x10=62,000,000 Tk
Consumption Charges : 0.36x150.22x10^6=54,100,000 Tk
Power Costs : 62,000,000+54,100,000=116,100,000Tk

(b) Qp = 3,900 cusecs

Minimum Rate : 42.0x14,900x12x10=75,100,000 Tk
Consumption Charges : 0.36x150.22x10^6=54,100,000 Tk
Power Costs : 75,100,000+54,100,000=129,200,000Tk

(c) Qp = 4,600 cusecs

Minimum Rate : 42.0x17,600x12x10=88,700,000 Tk
Consumption Charges : 0.36x150.22x10^6=54,100,000 Tk
Power Costs : 88,700,000+54,100,000=142,800,000Tk

(d) Qp = 5,300 cusecs

Minimum Rate : 42.0x20,400x12x10=102,800,000 Tk
Consumption Charges : 0.36x150.22x10^6=54,100,000 Tk
Power Costs : 102,800,000+54,100,000=156,900,000Tk

(e) Qp = 6,000 cusecs

Minimum Rate : 42.0x23,100x12x10=116,400,000 Tk
Consumption Charges : 0.36x150.22x10^6=54,100,000 Tk
Power Costs : 116,400,000+54,100,000=170,500,000Tk

The above-mentioned figures are summarized in the following Table.

Pumping Capacity	Power Cost	Annual Average Cost
3,200	1,161	116
3,900	1,292	129
4,600	1,428	143
5,300	1,569	157
6,000	1,705	171

Notes: Pumping capacities are shown in cusecs.
Power Costs are shown in 100,000 Tk.

(6) Calculation of Annual Costs

The pumping station costs having been estimated in the preceding section, the annual costs comprising of the annual interests on the construction costs and the annual depreciation have been computed as follows:

$$C = \text{Annual Interests on Construction Costs} + \text{Annual Depreciation}$$

$$= I \times \left(i + \frac{i}{(1+i)^n - 1}\right)$$

where C : Annual Costs

I : Construction Costs

i : Interest Rate (assumed to be 8%)

n : Life Time of Pumping Stations (assuming that the life time of pumping stations is 20 years)

Those are summarized in Table 4-73.

Table 4-73 Annual Costs under Different Pumping Capacities

(Unit : 100,000 Tk)

Pumping Capacity cusecs	Pumping Station Cost	Dike and Culverts	Construction Cost	Annual Cost
3,200	2,970	1,220	4,190	427
3,900	3,630	"	4,850	495
4,600	4,290	"	5,510	562
5,300	4,950	"	6,170	629
6,000	5,610	"	6,830	697

(7) Calculation of Annual Benefits

The annual benefits can be computed by the following equation:

$$b = B - M$$

where b : Annual Costs

B : Annual Average Incremental Farm Income

M : Annual Maintenance and Operation (Working) Costs

The incremental farm income is defined as the difference between the farm income with project and that without project. The annual farm income with project is given in 1/10 of the value which is obtainable during ten years. On the other hand, the annual farm income without project has been calculated from the agricultural output per ha as adopted in the "Preliminary Study Report", multiplied by the acreage covered by Plan B.

$$13572.5\ \frac{1{,}000\$}{(2035.9\ \frac{100{,}000Tk}{})} \times \frac{35700}{50500} = 9636.4\ \frac{1{,}000\$}{(1445.4\ \frac{100{,}000Tk}{})}$$

(8) Net Annual Benefits

The net annual benefits are calculated by the annual benefits minus the annual costs on the following equation:

Net Annual Benefits = Annual Benefits - Annual Costs

Comparative studies on inundated water levels, inundated areas and net annual benefits under the rainfalls of different probabilities are indicated in Table 4-74, and net annual benefits per acre and per hectare are given in Table 4-75.

Table 4-74 Submerged Areas and Water Levels and Net Annual Benefits by Rainfall Types under Different Pump Capacities

Rainfall Type	Pump Capacity	Submerged Water Level	Submerged Area	Net Annual Benefit
	Cusecs	Ft	Ac	Million Taka
1st	3,200	13.45	71,440	3,052
	3,900	13.30	69,160	3,060
	4,600	13.15	68,420	2,950
	5,300	13.00	66,690	2,900
	6,000	12.95	65,700	2,838
2nd	3,200	13.35	69,750	3,069
	3,900	13.20	68,570	3,024
	4,600	13.05	67,040	2,967
	5,300	12.90	65,110	2,913
	6,000	12.80	63,850	2,855
6th	3,200	12.45	58,940	3,240
	3,900	12.25	55,820	3,209
	4,600	12.05	50,040	3,197
	5,300	11.80	40,760	3,174
	6,000	11.60	33,490	3,137
9th	3,200	11.95	46,930	3,293
	3,900	11.80	40,760	3,298
	4,600	11.75	38,290	3,245
	5,300	11.75	38,290	3,204
	6,000	11.70	37,050	3,149
10th	3,200	11.95	46,930	3,297
	3,900	11.75	38,290	3,301
	4,600	11.60	33,490	3,248
	5,300	11.35	26,980	3,209
	6,000	11.15	23,350	3,155

Table 4-75 Net Annual Benefits per Ac and Ha

Rainfall Type	Pump Capacity	Per Ac.	Per Ha.	Rainfall Type	Pump Capacity	Per Ac.	Per Ha.
1st	Cusecs 3,200	TK 2,730	TK 6,840	6th	Cusecs 3,200	TK 2,900	TK 7,260
	3,900	2,690	6,730		3,900	2,880	7,190
	4,600	2,640	6,610		4,600	2,860	7,160
	5,300	2,600	6,500		5,300	2,840	7,110
	6,000	2,540	6,360		6,000	2,810	7,030
2nd	3,200	2,750	6,880	7th	3,200	2,940	7,340
	3,900	2,710	6,770		3,900	2,950	7,370
	4,600	2,660	6,650		4,600	2,930	7,330
	5,300	2,610	6,530		5,300	2,900	7,260
	6,000	2,560	6,400		6,000	2,850	7,120
3rd	3,200	2,820	7,060	8th	3,200	2,940	7,350
	3,900	2,780	6,960		3,900	2,945	7,360
	4,600	2,770	6,930		4,600	2,910	7,270
	5,300	2,780	6,950		5,300	2,870	7,190
	6,000	2,770	6,920		6,000	2,830	7,080
4th	3,200	2,960	7,390	9th	3,200	2,950	7,380
	3,900	2,960	7,400		3,900	2,960	7,390
	4,600	2,940	7,350		4,600	2,910	7,270
	5,300	2,900	7,250		5,300	2,870	7,180
	6,000	2,840	7,110		6,000	2,820	7,050
5th	3,200	2,840	7,100	10th	3,200	2,950	7,390
	3,900	2,800	6,990		3,900	2,960	7,390
	4,600	2,780	6,940		4,600	2,910	7,280
	5,300	2,740	6,850		5,300	2,880	7,190
	6,000	2,690	6,730		6,000	2,830	7,070

Unit : Taka

4.6 Power Costs

Government of the People's Republic of Bangladesh,
Ministry of Flood Control, Water Resources & Power,
(Power Division)

No.P-VII/4M-17/74/502 Dated 8th November, 1974

In supersession of the prevailing rates for sale of electricity to different classes of consumers by the Power Development Board, the Government is pleased to approve the following Interim Rates with effect from the 1st. December, 1974 :-

I. RATE A- LOW AND MEDIUM VOLTAGE SUPPLY FOR DOMESTIC PURPOSES (LIGHT, FAN AND DOMESTIC APPLIANCES COMBINED)

1. Unit Rates

(i)	Monthly Consumption upto 50 units	29 paisa per KWH
(ii)	Monthly Consumption from 51 to 150 units	23 paisa per KWH
(iii)	Monthly Consumption excess of 150 units	16 paisa per KWH

2. Minimum charge

Minimum charge per month	TK. 6.00

3. Late Payment Surcharge

Surcharge for payment beyond Due Date	6 paisa per KWH

II. RATE B- LOW AND MEDIUM VOLTAGE SUPPLY FOR CEREMONIAL PURPOSES

1. Unit Rates

For all Consumption	100 paisa per KWH

2. Late Payment Surcharge

Surcharge for payment beyond Due Date	20 paisa per KWH

III. RATE C- LOW AND MEDIUM VOLTAGE SUPPLY FOR SMALL INDUSTRIAL AND COMMERCIAL SERVICES

1. Unit Rates

(i)	Monthly Consumption upto 100 KWH per KW of connected load	58 paisa per KWH
(ii)	Monthly Consumption from 101 to 200 KWH per KW of connected load	50 paisa per KWH

Contd 2

(iii) Monthly Consumption excess of 200 KWH of connected load — 40 paisa per KWH

2. Minimum charge

Minimum charge per month — TK. 12.00 per KW of connected load or major fraction thereof but not less than TK. 24.00

3. Late Payment Surcharge

Surcharge for payment beyond Due Date — 10 paisa per KWH

Note: (a) Where the installed capacity is expressed in H.P., the same is to be multiplied by 0.746 to obtain the connected load in KW. Where the rating of the apparatus is expressed in KVA and the power factor rating is not available, the connected load in KW will be taken as the same as the KVA rating

(b) For calculating Unit charges, any fraction of a KW of connected load will be taken as one KW

(c) For calculating Minimum charge, fraction of connected load less than 0.5 KW will be ignored, and fractions of 0.5 and above will be taken as one KW

IV. RATE D- HIGH VOLTAGE BULK SUPPLY FOR LARGE INDUSTRIAL SERVICES (CONNECTED LOAD ABOVE 50 KW)

1. Fixed Charge — TK. 42.00 per KVA of Billing Demand per month

2. Energy Charges

(i) Monthly consumption upto 200 KWH per KVA of Billing demand — 36 paisa per KWH

(ii) Monthly Consumption excess of 200 KWH per KVA of Billing demand — 31 paisa per KWH

3. Total Charge

Total Charge will be the sum of the Fixed Charge and Energy Charges

Contd 3

4. Minimum Charge

Minimum Charge in any month shall not be less than the Fixed Charge

5. Late Payment Surcharge

Interest @ 1% per month on the total billed amount will be charged for payment beyond Due Date

V. RATE E - HIGH VOLTAGE BULK SUPPLY FOR LARGE COMMERCIAL SERVICES (CONNECTED LOAD ABOVE 50 KW)

1. Fixed Charge — TK. 42.00 per KVA of Billing Demand per month

2. Energy Charges

(i) Monthly Consumption upto 200 KWH per KVA of Billing demand — 38 paisa per KWH

(ii) Monthly Consumption excess of 200 KWH per KVA of Billing demand — 34 paisa per KWH

3. Total Charge

Total charge will be the sum of Fixed Charge and Energy Charges

4. Minimum Charge

Minimum Charge in any month shall not be less than the Fixed Charge

5. Late Payment Surcharge

Interest @ 1% per month on the total billed amount will be charged for payment beyond Due Date

VI. RATE F - LOW TENSION BULK SUPPLY FOR LARGE INDUSTRIAL SERVICES (CONNECTED LOAD ABOVE 50 KW)

1. Fixed Charge — TK. 44.00 per KVA of Billing Demand per month

2. Energy Charges

(i) Monthly Consumption upto 200 KWH per KVA of Billing Demand — 38 paisa per KWH

(ii) Monthly Consumption exess of 200 KWH per KVA of Billing Demand — 34 paisa per KWH

Contd 4

3. Total Charge

Total Charge will be the sum of Fixed Charge and Energy Charges

4. Minimum Charge

Minimum Charge in any month shall not be less than the Fixed Charge

5. Late Payment Surcharge

Interest @ 1% per month on the total billed amount will be charged for payment beyond Due Date

VII. RATE G - LOW TENSION BULK SUPPLY FOR LARGE COMMERCIAL SERVICES (CONNECTED LOAD ABOVE 50 KW)

1. Fixed Charge — TK. 44.00 per KVA or Billing Demand per Month

2. Energy Charges

(i) Monthly Consumption upto 200 KWH per KVA of billing demand — 40 paisa per KWH

(ii) Monthly Consumption excess of 200 KWH per KVA of billing demand — 35 paisa per KWH

3. Total Charge

Total Charge will be the sum of Fixed Charge and Energy Charges

4. Minimum Charge

Minimum Charge in any month shall not be less than the Fixed Charge

5. Late Payment Surcharge

Interest @ 1% per month on the total billed amount will be charged for payment beyond Due Date

NOTE: FOR RATES D, E, F & G

(a) Billing Demand for the billing period shall be the highest of the following :-

(i) Maximum Demand in KVA for the month billed for,

(ii) Maximum Demand in KVA established in the previous 11 month,

(iii) The contracted Demand or declared load expressed in KVA,

Contd 5

(b) In case KVA demand indicator is not installed, the maximum demand in KVA for billing purposes will be calculated either by dividing the maximum demand in KW by power factor, or from the readings of voltage and ampere supplied or determined by any other appropriate method applicable

(c) High voltage Bulk Supply tariff will be applicable to consumers receiving supply at above 650 volt upto and including 11 KV nominal where the consumer provides his own transformer and high tension control equipment

(d) Low Tension Bulk Supply tariff will be applicable to consumers where transformer and control equipment has been provided by the Power Development Board

VIII. RATE H - LOW AND MEDIUM VOLTAGE SUPPLY FOR AGRICULTURAL PURPOSES

1. Unit Rates

For all consumption	25 paisa per KWH

2. Late Payment Surcharge

Surcharge for payment beyond Due Date	6 paisa per KWH

IX. RATE L- LOW AND MEDIUM VOLTAGE SUPPLY FOR PUBLIC LIGHTING PURPOSES APPLICABLE TO PAURASAVAS

1. Unit Rates

Same as RATE A for Domestic Purposes

2. Late Payment Surcharge

Surcharge for payment beyond Due Date	6 paisa per KWH

X. EXTRA HIGH VOLTAGE SUPPLY AND SPECIAL INDUSTRIAL PURPOSE SUPPLIES

For Bulk Supplies at 33 KV and above and special industrial purpose supplies, rates will be determined on the Govt.

By order of the Government

Sd/-Abdul Hamii Chowdhury,
Deputy Secretary

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4.7 Comparative Studies on Phase I Area

Comparative studies on Phase I Area have been made on the following assumptions:

(i) In case of the existence of embankment and flood gates without any pumps;

(ii) In case of the existence of one pumping station; and

(iii) In case of the existence of two pumping stations.

(1) Rainfall Pattern

While the above-mentioned assumptions (ii) and (iii) have been studied by adopting the 10th rainfall pattern, the assumption (i) has been studied under long perspective by applying the rainfall figures in 1967 from which the 10th rainfall pattern has been deducted.

(2) Drainage Calculation

Assumption (i)

Since particular care should be given to drainage discharge through the regulating gate, it has been assumed from the results of the field reconnaissance survey that the regulating gate would be:

Gate Width	15 m
Number of Gates	3
Sill Level	±0 ft

Drainage calculation with the assumption (i) has been made as follows:

Assumptions (ii) and (iii)

The same procedure, which has been adopted in the "Main Report", is used for this case. The results of the studies made with the assumptions (ii) and (iii) are represented as follows:

(3) Results

On the basis of the results obtained so far, the relationships between inundation water levels and inundation areas are represented in Table 4-78.

Table 4-78 Results of Drainage Calculation for Phase I Area

	Present Condition	Dike and Regulator	Stage 1 (Pumping Capacity= $35m^3/sec$)	Phase I (Pumping Capacity= $70m^3/sec$)	Notes
Maximum Inundation Water Level	19.91	17.10	12.30	11.85	Unit: ft PWD
Inundation Area	27,200	23,600	1,200	9,200	Unit: ha

Phase I (Area = 29,000 ha, Irrigation Area = 23,100 ha)

Assumption (ii)

Conditions : Rainfall Pattern: The 10th rainfall pattern
Pumping Capacity: Qp=35 m^3/sec = 1,250 cusec
(Pumping Station No. 1 only)

Area : A = 2,700 ac
B = 33,000 ac (above 11.90 ft)
C = 18,700 ac (11.90 ft - 9.30 ft)
D = 2,700 ac (9.30 ft - 7.50 ft)

Total 57,100 ac = 23,100 ha

Assumption (iii)

Conditions : Rainfall Pattern: The 10th rainfall pattern
Pumping Capacity: Qp = 70 m^3/sec = 2,500 cusec
(Pumping Stations No. 1 and No. 2)

Area : A = 2,700 ac
B = 49,500 ac (above 11.00 ft)
C = 4,350 ac (11.00 ft - 8.85 ft)
D = 550 ac (8.85 ft - 7.50 ft)

Total 57,100 ac = 23,100 ha

Table 4-76 Calculation of Natural Drainage (1) April

Date	Rainfall [inch]	Runoff [ac·ft]	Accum. Submerged Water Volume [ac·ft]	Submerged Water Level [ft]	Outside Water Level [ft]	Outflow from Culvent [ac·ft]	Submerged Water Volume [ac·ft]	Submerged Area [ac]
		$\times 10^3$	$\times 10^3$			$\times 10^3$	$\times 10^3$	
1	0.00				5.53			
2	0.00				5.60			
3	0.00				5.55			
4	0.00				5.50			
5	0.00				5.08			
6	0.00				4.65			
7	0.00				4.70			
8	0.00				4.88			
9	0.00				5.08			
10	0.00				5.70			
11	0.00				6.25			
12	0.00				6.63			
13	0.00				6.83			
14	0.00				6.90			
15	0.15	0.895	0.895	7.50	7.08	0.895	0	130
16	0.00				7.48			
17	0.00				7.48			
18	0.00				6.83			
19	0.86	5.132	5.132	7.50	6.28	5.132	0	130
20	0.49	2.924	2.924	7.50	5.63	2.924	0	130
21	0.00				5.45			
22	0.00				5.48			
23	0.44	2.626	2.626	7.50	5.78	2.626	0	130
24	0.00				6.23			
25	0.00				6.60			
26	0.00				6.58			
27	0.00				6.55			
28	0.00				6.63			
29	0.00				6.63			
30	0.91	5.430	5.430	7.50	6.58	5.430	0	130
31								

Table 4-76 Calculation of Natural Drainage (2) May

Date	Rainfall [inch]	Runoff [ac·ft]	Accum. Submerged Water Volume [ac·ft]	Submerged Water Level [ft]	Outside Water Level [ft]	Outflow from Culvent [ac·ft]	Submerged Water Volume [ac·ft]	Submerged Area [ac]
		$\times 10^3$	$\times 10^3$			$\times 10^3$	$\times 10^3$	
1					6.20			
2	0.42	2.506	2.506	7.50	6.25	2.506	0	130
3	0.00				6.18			
4	0.28	1.671		7.50	6.50	2.506	0	130
5	0.00				6.45			
6	1.30	7.757		9.90	6.23	7.757	0	2400
7	0.00				6.13			
8	0.07	0.418		7.50	6.03	0.418	0	130
9	0.00				6.25			
10	0.00				6.93			
11	1.06	6.325		9.40	7.53	6.325	0	1300
12	0.00				8.58			
13	0.00				8.90			
14	0.33	1.969	1.969	7.50	8.88	0	1.969	130
15	0.00		1.969	7.50	8.73	0	1.969	130
16	0.00		1.969	7.50	8.63	0	1.969	130
17	0.00		1.969	7.50	8.43	0	1.969	130
18	0.00		1.969	7.50	8.03	0	1.969	130
19	0.00		1.969	7.50	7.95	0	1.969	130
20	0.30	1.790	3.759	9.20	7.95	3.759	0	900
21	0.00				8.10			
22	0.00				7.88			
23	0.10	0.597	0.597	7.50	8.225	0	0.597	130
24	0.00		0.597		8.23		0.597	130
25	1.37	8.175	8.772	9.90	8.45	8.772	0	2400
26	0.00				8.45			
27	1.09	6.504	6.504	9.50	8.93	6.504	0	1400
28	0.00				9.05			
29	0.00				9.28			
30	0.00				9.45			
31	0.00				9.30			

Table 4-76 Calculation of Natural Drainage (3) June

Date	Rainfall [inch]	Runoff [ac·ft]	Accum. Submerged Water Volume [ac·ft]	Submerged Water Level [ft]	Outside Water Level [ft]	Outflow from Culvent [ac·ft]	Submerged Water Volume [ac·ft]	Submerged Area [ac]
		$\times 10^3$	$\times 10^3$			$\times 10^3$	$\times 10^3$	
1	0.00				9.38			
2	0.00				9.85			
3	0.00				9.93			
4	0.00				10.23			130
5	0.01	0.060	0.060	7.50	10.35	0	0.060	130
6	0.00		0.060	7.50	10.60	0	0.060	130
7	0.13	0.776	0.836	7.50	10.20	0	0.836	130
8	0.00		0.836	7.50	10.83	0	0.836	130
9	0.00		0.836	7.50	10.90	0	0.836	130
10	0.72	4.296	5.132	9.50	10.98	0	5.132	1400
11	0.24	1.432	6.564	9.70	10.85	0	6.564	1800
12	1.88	11.218	17.782	10.90	11.13	0	17.782	2400
13	1.62	9.667	27.449	11.50	11.88	0	27.449	7500
14	0.00		27.449	11.50	12.30	0	27.449	7500
15	1.77	10.562	38.011	12.20	12.43	0	38.011	10400
16	0.00		38.011	12.20	12.33	0	38.011	10400
17	0.00		38.011	12.20	12.13	8.00	30.011	10400
18	2.06	12.292	42.303	12.30	11.90	16.90	25.403	11800
19	0.10	0.597	26.000	11.60	11.98	0	26.000	8000
20	0.62	3.700	29.700	11.70	12.30	0	29.700	8400
21	0.00		29.700	11.70	12.65	0	29.700	8400
22	0.05	0.298	29.998	11.70	12.75	0	29.998	8400
23	0.00		29.998	11.70	13.10	0	29.998	8400
24	0.00		29.998	11.70	13.48	0	29.998	8400
25	0.02	0.119	30.117	11.80	13.93	0	30.117	9500
26	0.08	0.477	30.594	11.80	14.48	0	30.594	9500
27	0.04	0.239	30.833	11.80	14.85	0	30.833	9500
28	0.00		30.833	11.80	15.08	0	30.833	9500
29	0.00		30.833	11.80	15.25	0	30.833	9500
30	0.14	0.835	31.668	11.80	15.39	0	31.668	9500
31								

Table 4-76 Calculation of Natural Drainage (4) July

Date	Rainfall [inch]	Runoff [ac·ft]	Accum. Submerged Water Volume [ac·ft]	Submerged Water Level [ft]	Outside Water Level [ft]	Outflow from Culvent [ac·ft]	Submerged Water Volume [ac·ft]	Submerged Area [ac]
		$\times 10^3$	$\times 10^3$			$\times 10^3$	$\times 10^3$	
1	0.13	0.776	32.444	11.70	15.48	0	32.444	8400
2	0.07	0.418	32.862	11.70	15.61	0	32.862	8400
3	0.10	0.597	33.459	11.80	15.73	0	33.459	9500
4	0.40	2.387	35.846	11.90	15.86	0	35.846	9800
5	1.26	7.518	43.364	12.30	15.93	0	43.364	11800
6	0.00		43.364	12.30	16.03	0	43.364	11800
7	0.91	5.430	48.794	12.50	16.23	0	48.794	12800
8	2.60	15.514	64.308	13.00	16.43	0	64.308	14600
9	1.95	11.636	75.944	13.30	16.58	0	75.944	15500
10	0.38	2.268	78.212	13.30	17.06	0	78.212	15500
11	0.21	1.253	79.465	13.30	17.68	0	79.465	15500
12	0.00		79.465	13.30	17.71	0	79.465	15500
13	0.00		79.465	13.30	17.81	0	79.465	15500
14	0.00		79.465	13.30	17.83	0	79.465	15500
15	0.12	0.716	80.181	13.30	17.91	0	80.181	15500
16	1.19	7.101	87.282	13.40	17.88	0	87.282	15800
17	0.06	0.358	87.640	13.40	17.98	0	87.640	15800
18	0.45	2.685	90.325	13.50	18.08	0	90.325	16000
19	0.00		90.325	13.50	18.16	0	90.325	16000
20	0.00		90.325	13.50	18.21	0	90.325	16000
21	0.10	0.597	90.922	13.50	18.26	0	90.922	16000
22	0.00		90.922	13.50	18.31	0	90.922	16000
23	0.00		90.922	13.50	18.36	0	90.922	16000
24	0.07	0.418	91.340	13.50	18.41	0	91.340	16000
25	0.00		91.340	13.50	18.52	0	91.340	16000
26	0.00		91.340	13.50	18.81	0	91.340	16000
27	0.02	0.119	91.459	13.50	19.03	0	91.459	16000
28	0.44		91.459	13.50	18.62	0	91.459	16000
29	0.12	2.626	94.085	13.60	19.56	0	94.085	16300
30	0.00		94.085	13.60	19.71	0	94.085	16300
31	3.65	21.780	115.865	14.20	19.91	0	115.865	17700

Table 4-76 Calculation of Natural Drainage (5) August

Date	Rainfall [inch]	Runoff [ac·ft]	Accum. Submerged Water Volume [ac·ft]	Submerged Water Level [ft]	Outside Water Level [ft]	Outflow from Culvent [ac·ft]	Submerged Water Volume [ac·ft]	Submerged Area [ac]
		$\times 10^3$	$\times 10^3$			$\times 10^3$	$\times 10^3$	
1	1.20	7.160	123.025	14.30	19.91	0	123.025	18000
2	0.02	0.119	123.144	14.30	19.91	0	123.144	18000
3	0.02	0.119	123.263	14.30	19.91	0	123.263	18000
4	0.11	0.656	123.919	14.30	19.83	0	123.919	18000
5	0.07	0.418	124.337	14.40	19.76	0	124.337	18300
6	0.25	1.492	125.829	14.40	19.73	0	125.829	18300
7	3.53	21.064	146.893	14.90	19.51	0	146.893	19400
8	1.32	7.876	154.769	15.00	19.43	0	154.769	19600
9	2.09	12.471	167.240	15.20	19.36	0	167.240	20000
10	2.01	11.994	179.234	15.50	19.31	0	179.234	20500
11	0.28	1.671	180.905	15.60	19.13	0	180.905	20800
12	0.01	0.060	180.965	15.60	19.06	0	180.965	20800
13	0.04	0.239	181.204	15.60	18.93	0	181.204	20800
14	0.00		181.204	15.60	18.83	0	181.204	20800
15	0.00		181.204	15.60	18.74	0	181.204	20800
16	0.00		181.204	15.60	18.53	0	181.204	20800
17	0.09	0.537	181.741	15.60	18.36	0	181.741	20800
18	0.35	2.089	183.830	15.60	18.16	0	183.830	20800
19	0.17	1.014	184.844	15.70	17.93	0	184.844	21000
20	0.01	0.060	184.904	15.70	17.71	0	184.904	21000
21	0.01	0.060	184.964	15.70	17.48	0	184.964	21000
22	0.11	0.656	185.620	15.70	17.36	0	185.620	21000
23	1.02	6.086	191.706	15.80	17.36	0	191.706	21200
24	0.36	2.148	193.854	15.80	17.43	0	193.854	21200
25	0.65	3.879	197.733	15.90	17.38	0	197.733	21400
26	3.84	22.913	220.646	16.30	17.43	0	220.646	22200
27	0.05	0.298	220.944	16.30	17.58	0	220.944	22200
28	0.00		220.944	16.30	17.68	0	220.944	22200
29	0.76	4.535	225.479	16.40	17.73	0	225.479	22400
30	0.08	0.477	225.956	16.40	17.68	0	225.956	22400
31	0.99	5.907	231.863	16.40	17.63	0	231.863	22400

Table 4-76 Calculation of Natural Drainage (6) September

Date	Rainfall [inch]	Runoff [ac·ft]	Accum. Submerged Water Volume [ac·ft]	Submerged Water Level [ft]	Outside Water Level [ft]	Outflow from Culvent [ac·ft]	Submerged Water Volume [ac·ft]	Submerged Area [ac]
		$\times 10^3$	$\times 10^3$			$\times 10^3$	$\times 10^3$	
1	0.02	0.119	231.982	16.50	17.56	0	231.982	22600
2	0.31	1.850	233.832	16.60	17.46	0	233.832	22800
3	0.89	5.311	239.143	16.60	17.38	0	239.143	22800
4	0.17	1.014	240.157	16.60	17.28	0	240.157	22800
5	0.00		240.157	16.60	17.31	0	240.157	22800
6	0.93	5.549	245.709	16.70	17.23	0	245.709	22900
7	0.81	4.833	250.539	16.80	17.11	0	250.539	23100
8	0.46	2.745	253.284	16.90	17.06	0	253.284	23400
9	0.18	1.074	254.358	16.90	16.93	0	254.358	23400
10	1.09	6.504	260.862	17.10	16.81	22.00	238.862	23600
11	0.00		238.862	16.60	16.76	0	238.862	22800
12	0.00		238.862	16.60	16.68	0	238.862	22800
13	0.02	0.119	238.981	16.60	16.48	10.00	228.981	22800
14	0.00		228.981	16.50	16.21	20.50	208.481	22600
15	0.00		208.481	16.20	15.63	28.50	179.981	22000
16	0.04	0.239	180.220	15.50	15.71	0	180.220	20500
17	0.53	3.163	183.383	15.60	15.61	0	183.383	20800
18	1.17	6.981	190.364	15.80	15.41	22.25	168.114	21200
19	0.16	0.955	169.069	15.30	15.09	15.75	153.319	20100
20	0.00		153.319	15.00	14.93	8.50	144.819	19600
21	0.04	0.239	145.058	14.90	14.75	18.00	127.058	19400
22	0.21	1.253	128.311	14.50	14.85	0	128.311	18500
23	0.33	1.969	130.280	14.60	14.85	0	130.280	18800
24	0.26	1.551	131.831	14.60	14.95	0	131.831	18800
25	0.00		131.831	14.60	15.18	0	131.831	18800
26	0.00		131.831	14.60	15.33	0	131.831	18800
27	0.33	1.969	133.800	14.70	15.35	0	133.800	19000
28	0.76	4.535	138.335	14.70	15.33	0	138.335	19000
29	1.39	8.294	146.629	14.90	15.40	0	146.629	19400
30	0.84	5.012	151.641	15.00	15.40	0	151.641	19600
31								

Table 4-76 Calculation of Natural Drainage (7) October

Date	Rainfall [inch]	Runoff [ac·ft]	Accum. Submerged Water Volume [ac·ft]	Submerged Water Level [ft]	Outside Water Level [ft]	Outflow from Culvent [ac·ft]	Submerged Water Volume [ac·ft]	Submerged Area [ac]
		$\times 10^3$	$\times 10^3$			$\times 10^3$	$\times 10^3$	
1	0.15	0.895	152.536	15.00	15.48	0	152.536	19600
2	0.00		152.536	15.00	15.68	0	152.536	19600
3	0.00		152.536	15.00	15.93	0	152.536	19600
4	0.70	4.177	156.713	15.10	16.03	0	156.713	19800
5	0.45	2.685	159.398	15.10	16.05	0	159.398	19800
6	0.00		159.398	15.10	16.10	0	159.398	19800
7	0.00		159.398	15.10	16.15	0	159.398	19800
8	0.00		159.398	15.10	16.25	0	159.398	19800
9	0.40	2.387	161.785	15.20	16.33	0	161.785	20000
10	0.15	0.895	162.680	15.20	16.43	0	162.680	20000
11	1.01	6.027	168.707	15.30	16.38	0	168.707	20200
12	0.02	0.119	168.826	15.30	16.30	0	168.826	20200
13	0.00		168.826	15.30	16.13	0	168.826	20200
14	0.00		168.826	15.30	15.93	0	168.826	20200
15	0.00		168.826	15.30	16.08	0	168.826	20200
16	0.00		168.826	15.30	15.33	0	168.826	20200
17	0.00		168.826	15.30	14.98	19.00	149.826	20200
18	0.00		149.826	14.90	14.60	18.50	131.326	19400
19	0.00		131.326	14.50	14.23	18.00	113.326	18500
20	0.00		113.326	14.20	14.00	14.50	98.826	17700
21	0.00		98.826	13.80	13.90	0	98.826	16700
22	0.00		98.826	13.80	13.68	7.00	91.826	16700
23	0.00		91.826	13.60	13.35	14.00	77.826	16200
24	0.00		77.826	13.30	13.28	1.00	76.826	15500
25	0.00		76.826	13.30	13.08	14.00	60.826	15500
26	0.00		60.826	12.80	12.78	1.00	59.826	13800
27	0.00		59.826	12.80	12.33	21.00	38.826	13800
28	0.00		38.826	11.90	11.90	0	38.826	19600
29	0.00		38.826	11.90	11.25	21.00	17.826	19600
30	0.00		17.826	10.78	10.78	0	17.826	4800
31	0.00		17.826	10.78	10.45	14.00	3.826	4800

Fig. 4-18 OUTFLOW FROM CULVERT

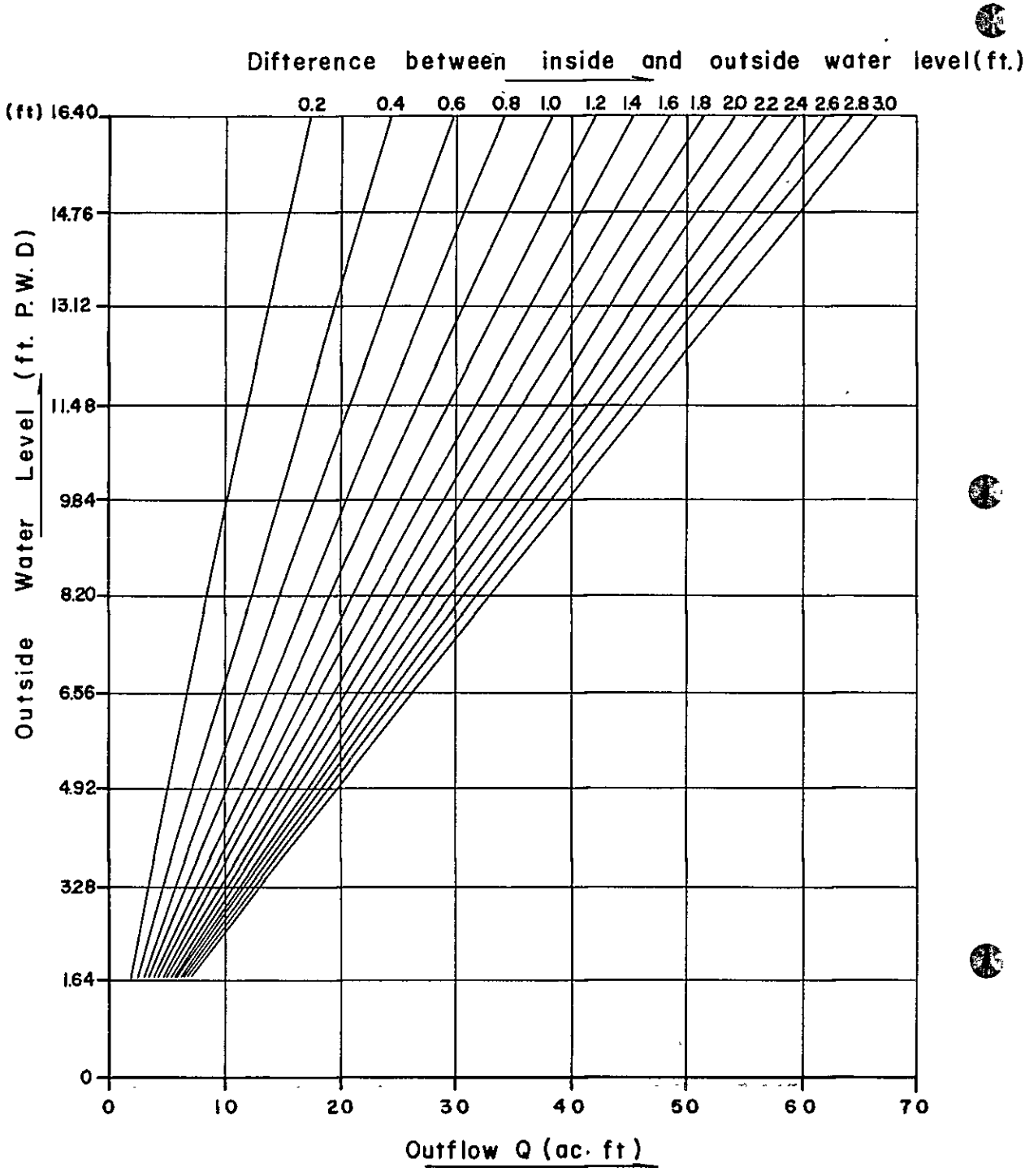
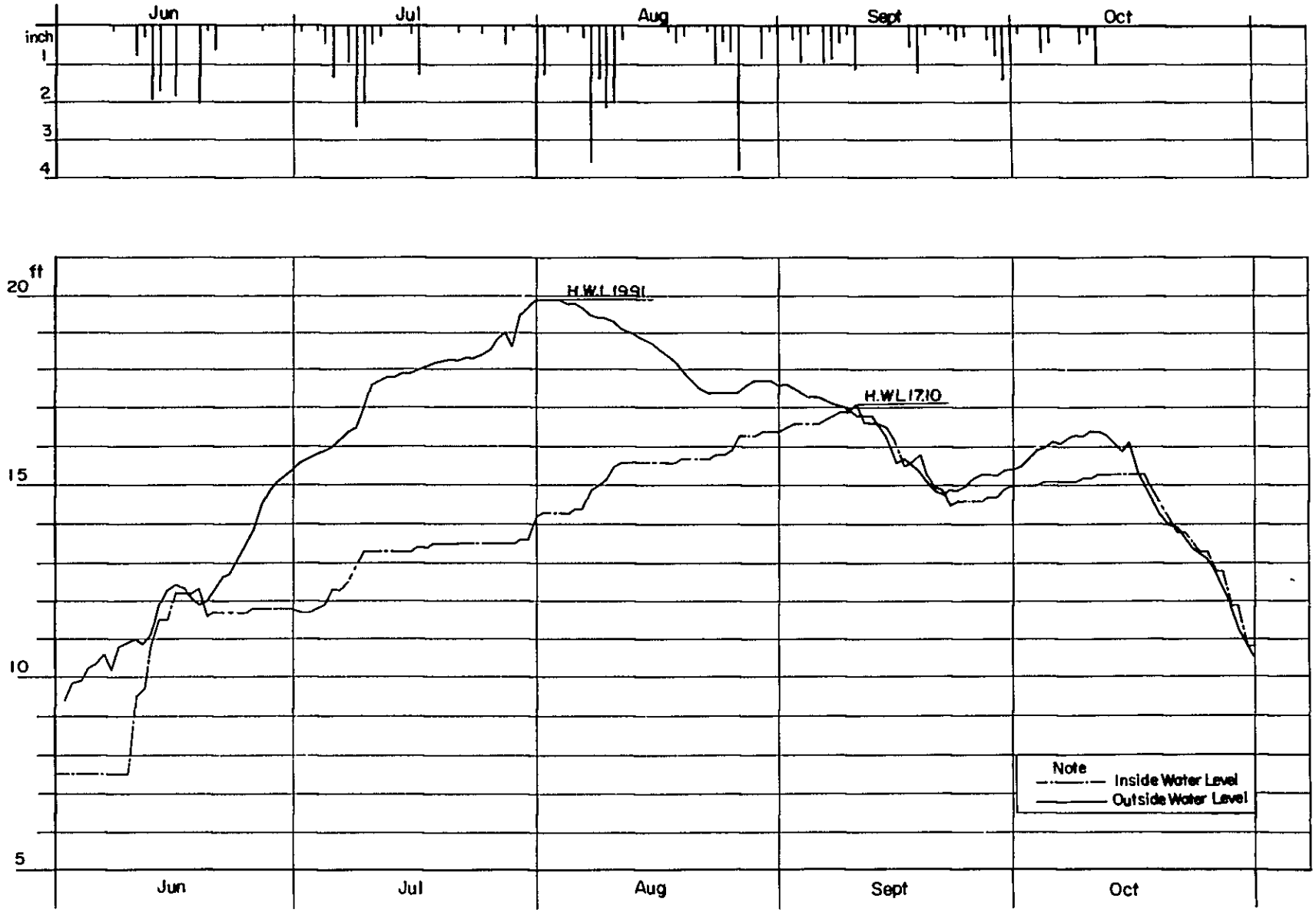


Fig. 4 – 19 RELATION BETWEEN INSIDE WATER LEVEL AND OUTSIDE WATER LEVEL



(35m^3/s)

Table 4-77 Drainage Calculation by Pump (Qp= 1250 cusecs)

Date	Runoff [ac·ft]	Total Submerged Volume [ac·ft]	Pump discharge [ac·ft]	Submerged Volume [ac·ft]	Submerged Water Level [ft]	Submerged Area [ac]
1	$0.66^{\times 10^3}$	$0.66^{\times 10^3}$	$2.48^{\times 10^3}$	$0^{\times 10^3}$	7.50	0
2	0.42	0.42	"	0	"	0
3	1.49	1.49	"	0	"	0
4	21.07	21.07	"	18.59	11.10	13,090
5	7.88	26.47	"	23.99	11.40	16,300
6	12.48	36.47	"	33.99	11.90	22,850
7	12.00	45.99	"	43.51	12.30	29,640
8	1.67	45.18	"	42.70	12.25	28,650
9		42.70	"	40.22	12.15	28,160
10		40.22	"	37.74	12.00	26,180
11		37.74	"	35.26	11.95	25,320
12		35.26	"	32.78	11.90	23,850
13		32.78	"	30.30	11.75	21,610
14		30.30	"	27.82	11.65	19,760
15		27.82	"	25.34	11.45	17,410
16		25.34	"	22.86	11.30	16,180
17		22.86	"	20.38	11.15	14,450
18		20.38	"	17.90	11.00	12,470
19		17.90	"	15.42	10.80	10,500
20		15.42	"	12.94	10.60	8,890
21		12.94	"	10.46	10.40	6,920
22		10.46	"	7.98	10.10	5,440
23		7.98	"	5.50	9.75	4,130
24		5.50	"	3.02	9.30	2,960
25		3.02	"	0.54	8.05	910
26		0.54	"	0	7.50	0

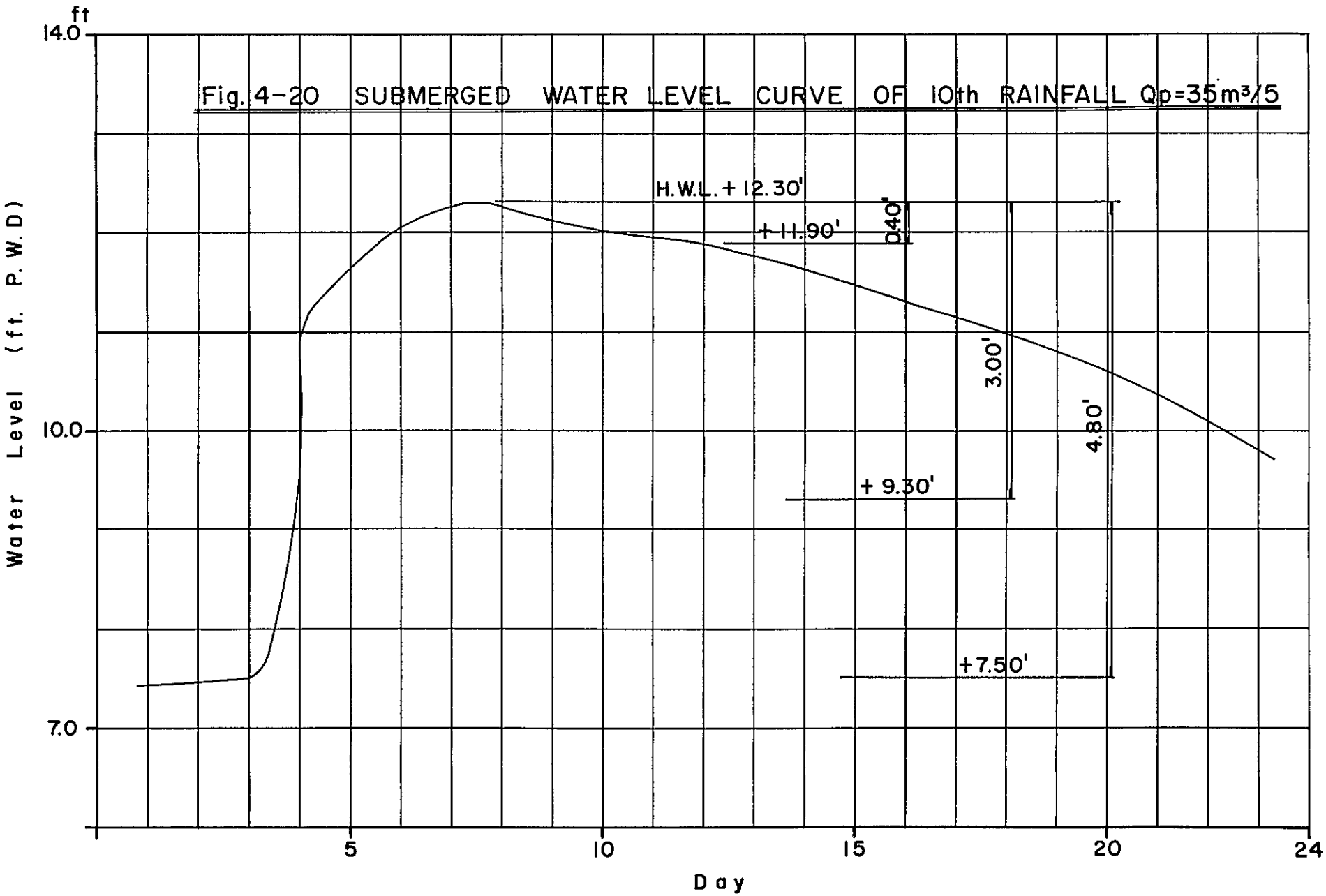


Fig. 4-20 SUBMERGED WATER LEVEL CURVE OF 10th RAINFALL Qp=35m³/5
ft
14.0
10.0
7.0
Water Level (ft. P.W.D)
H.W.L. + 12.30'
+ 11.90'
0.40'
3.00'
4.80'
+ 9.30'
+ 7.50'
5
10
15
20
24
Day

ANNEX V. IRRIGATION

ANNEX V IRRIGATION

5.1 Consumptive Use and Unit Irrigation Requirements

Table 5-1 Calculation of Unit Irrigation Requirements

Crop: Boro 135 days H.Y.V. ; 1R8, BR3

Month	Dec.		Jan.		Feb.		Mar.		Apr.		May		Jun.	
Pattern.														
Crop Factor (Average)			0.30	0.93	1.25	1.28	1.33	1.38	1.43	1.48	1.40	0.65	0	
ETo in.			2.1		2.8		4.7		5.8		5.9		4.4	
ET (Crop.) in.			0.32	0.98	1.75	1.79	3.13	3.24	4.15	4.29	4.13	1.92	0	
Percolation 5 in./M			0.63	1.87	2.50	2.50	2.50	2.50	2.50	2.50	2.50	1.87	0.63	
Crop Water Requirement			0.95	2.85	4.25	4.29	5.63	5.74	6.65	6.79	6.63	3.79	0.63	
Land preparation 7 in.		1.75	3.50	1.75										
Nursery Bed in.	0.06	0.06												
Sub-Total in.	0.06	1.81	4.45	4.60	4.25	4.29	5.63	5.74	6.65	6.79	6.63	3.79	0.63	
Effective Rainfall in.	0	0	0	0	0	0	0	1.60	0	2.44	1.04	0.89	4.09	
Unit Irrigation Requirements in.	0.06	1.81	4.45	4.60	4.25	4.29	5.63	4.14	6.65	4.35	5.59	2.90	0	

Table 5-2 Calculation of Unit Irrigation Requirements

Crop: Boro 120 days H.Y.V. ; BR1, BR2

Month	Dec.		Jan.		Feb.		Mar.		Apr.		May		Jun.	
Pattern.														
Crop Factor (Average)			0.30	0.93	1.25	1.28	1.35	1.43	1.48	1.43	0.68	0		
ETo in.	2.0		2.1		2.8		4.7		5.8		5.9			
ET (Crop.) in.			0.32	0.98	1.75	1.79	3.17	3.36	4.29	4.15	2.01	0		
Percolation 5 in./M			0.63	1.87	2.50	2.50	2.50	2.50	2.50	2.50	1.87	0.63		
Crop Water Requirement			0.95	2.85	4.25	4.29	5.67	5.86	6.79	6.65	3.88	0.63		
Landpreparation in.		1.75	3.50	1.75										
Nursery Bed in.	0.06	0.06												
Sub-Total in.	0.06	1.81	4.45	4.60	4.25	4.29	5.67	5.86	6.79	6.65	3.88	0.63		
Effective Rainfall in.	0	0	0	0	0	0	0	1.60	0	2.44	1.04	0.89		
Unit Irrigation Requirements in.	0.06	1.81	4.45	4.60	4.25	4.29	5.67	4.26	6.79	4.21	2.84	0		

Table 5-3 Calculation of Unit Irrigation Requirements

Crop: T-Aus, 105 days, H.Y.V.

Month	Mar.		Apr.		May		Jun.		Jul.		Aug.		Sep.	
Pattern.														
Crop Factor (Average)				0.60	1.23	1.28	1.35	1.43	1.48	1.43	0.68			
ETo in.			5.8		5.9		4.4		4.3		4.5			
ET (Crop.) in.				1.74	3.63	3.76	2.97	3.15	3.18	3.07	1.53			
Percolation in./M				1.25	2.50	2.50	2.50	2.50	2.50	2.50	1.25			
Crop Water Requirement				2.99	6.13	6.26	5.47	5.65	5.68	5.57	2.78			
Landprepalation 7 in.		1.75	3.50	1.75										
Nursery Bed in.		0.17	0.18											
Sub-Total in.		1.92	3.68	4.74	6.13	6.26	5.47	5.65	5.68	5.57	2.78			
Effective Rainfall in.		1.60	0	2.44	1.04	0.89	4.09	2.43	3.88	3.51	8.95			
Unit Irrigation Requirements in.		0.15	3.68	0.55	5.09	5.37	1.38	3.22	1.80	2.06	0			

Table 5-4 Calculation of Unit Irrigation Requirements

Crop: T-Aus, 135 days, Local V.

Month	Apr.		May		Jun.		Jul.		Aug.		Sep.		Oct.	
Pattern.														
Crop Factor (Average)			0.30	0.93	1.25	1.28	1.33	1.38	1.43	1.48	1.40	0.65	0	
ETo in.			5.9		4.4		4.3		4.5		3.7		3.5	
ET (Crop.) in.			0.89	2.74	2.75	2.82	2.86	2.97	3.22	3.33	2.59	1.20	0	
Percolation 5 in./M			0.63	1.87	2.50	2.50	2.50	2.50	2.50	2.50	2.50	1.87	0.63	
Crop Water Requirement			1.52	4.61	5.25	5.32	5.36	5.47	5.72	5.83	5.09	3.07	0.63	
Landprepalation in.		1.75	3.50	1.75										
Nursery Bed in.	0.17	0.18												
Sub-Total in.	0.17	1.93	5.02	6.36	5.25	5.32	5.36	5.47	5.72	5.83	5.09	3.07	0.63	
Effective Rainfall in.	0	2.44	1.04	0.89	4.09	2.43	3.88	3.51	8.95	7.92	0.90	4.74	2.98	
Unit Irrigation Requirements in.	0.17	0	2.94	4.58	1.16	2.89	1.48	1.96	0	0	4.19	0	0	

Table 5-5 Calculation of Unit Irrigation Requirements

Crop: T-Aman 105 days H.Y.V. Pattern A

Month	Jul.		Aug.		Sep.		Oct.		Nov.		Dec.			
Pattern.														
Crop Factor (Average)				0.60	1.23	1.28	1.35	1.43	1.48	1.43	0.68			
ETo in.	4.3		4.5		3.7		3.5		2.5		2.0			
ET (Crop.) in.				2.70	2.28	2.37	2.36	2.50	1.85	1.79	0.68			
Percolation 5 in./M				1.25	2.50	2.50	2.50	2.50	2.50	2.50	1.25			
Crop Water Requirement				3.95	4.78	4.87	4.86	5.00	4.35	4.29	1.93			
Landprepalation 5 in.		1.25	2.50	1.25										
Nursery Bed in.		0.13	0.14											
Sub-Total in.		1.48	2.64	5.20	4.78	4.87	4.86	5.00	4.35	4.29	1.93			
Effective Rainfall in.	3.88	3.51	8.95	7.92	0.90	4.74	2.98	0	1.03	0	0	0		
Unit Irrigation Requirements in.		0	0	0	3.88	0.13	1.88	5.00	3.32	4.29	1.93			

Table 5-6 Calculation of Unit Irrigation Requirements

Crop: T-Aman 105 days H.Y.V. Pattern B & C

Month	Jul.		Aug.		Sep.		Oct.		Nov.		Dec.			
Pattern.														
Crop Factor (Average)				0.30	0.93	1.28	1.35	1.43	1.48	1.43	0.68	0		
ETo in.			4.5		3.7		3.5		2.5		2.0			
ET (Crop.) in.				0.68	1.72	2.37	2.36	2.50	1.85	1.79	0.68	0		
Percolation 5 in./M				0.63	1.87	2.50	2.50	2.50	2.50	2.50	1.87	0.63		
Crop Water Requirement				1.31	3.59	4.87	4.86	5.00	4.35	4.29	2.55	0.63		
Landprepalation 5 in.			1.25	2.50	1.25									
Nursery Bed in.		0.13	0.14											
Sub-Total in.		0.13	1.39	3.81	4.84	4.87	4.86	5.00	4.35	4.29	2.55	0.63		
Effective Rainfall in.		3.51	8.95	7.92	0.90	4.74	2.98	0	1.03	0	0	0		
Unit Irrigation Requirements in.		0	0	0	3.94	0.13	1.88	5.00	3.32	4.29	2.55	0.63		

Table 5-7 Calculation of Unit Irrigation Requirements

Crop: T-Aman 150 days, Local V.

Month	Jun.		Jul.		Aug.		Sep.		Oct.		Nov.		Dec.	
Pattern.														
Crop Factor (Average)			0.30	0.93	1.25	1.28	1.33	1.35	1.38	1.43	1.48	1.40	0.65	
ETo in.			4.3		4.5		3.7		3.5		2.5		2.0	
ET (Crop.) in.			0.65	2.00	2.81	2.88	2.46	2.50	2.42	2.50	1.85	1.75	0.65	0
Percolation 5 in./M			0.63	1.87	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	1.87	0.63
Crop Water Requirement			1.28	3.87	5.31	5.38	4.96	5.00	4.92	5.00	4.35	4.25	2.52	0.63
Landprepalation in.		1.25	2.50	1.25										
Nursery Bed in.	0.13	0.13												
Sub-Total in.	0.13	1.38	3.78	5.12	5.31	5.38	4.96	5.00	4.92	5.00	4.35	4.25	2.52	0.63
Effective Rainfall in.	4.09	2.43	3.88	3.51	8.95	7.92	0.90	4.74	2.98	0	1.03	0	0	0
Unit Irrigation Requirements in.	0	0	0	0.36	0	0	4.06	0.26	1.94	5.00	3.32	4.25	2.52	0.63

Table 5-8 Calculation of Unit Irrigation Requirements

Crop: B-Aman 195 days Local V.

Month	May		Jun.		Jul.		Aug.		Sep.		Oct.		Nov.		Dec.	
Pattern.																
Crop Factor (Average)		0.30	0.91	1.24	1.26	1.29	1.31	1.34	1.35	1.36	1.39	1.41	1.45	1.43	1.03	0.33
ETo in.	5.9		4.4		4.3		4.5		3.7		3.5		2.5		2.0	
ET (Crop) in.		0.89	2.00	2.73	2.71	2.77	2.95	3.02	2.50	2.52	2.43	2.47	1.81	1.79	1.03	0.33
Percolation 5 in./M		0.63	1.88	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	1.88	0.63
Crop Water Requirement		1.52	3.88	5.23	5.21	5.27	5.45	5.52	5.00	5.02	4.93	4.97	4.31	4.29	2.91	0.96
Landprepalation 5 in.	1.25	2.50	1.25													
Nursery Bed in.	0.18	0.17														
Sub-Total in.	1.43	4.19	5.13	5.23	5.21	5.27	5.45	5.52	5.00	5.02	4.93	4.97	4.31	4.29	2.91	0.96
Effective Rainfall in.	1.04	0.89	4.09	2.43	3.88	3.51	8.95	7.92	0.90	4.74	2.98	0	1.03	0	0	0
Unit Irrigation Requirements in.	0.21	2.24	0	2.80	1.33	1.77	0	0	4.10	0.28	1.95	4.97	3.28	4.29	2.91	0.96

Table 5-9 Calculation of Unit Irrigation Requirements

Crop: Wheat 105 days Pattern A

Month		Nov.		Dec.		Jan.		Feb.		Mar.		Apr.			
Pattern.															
Crop Factor (Average)			0.13	0.41	0.65	0.85	1.08	1.20	1.13	0.53	0				
ETo	in.	2.5		2.0		2.1		2.8		4.7					
ET (Crop.)	in.		0.16	0.41	0.65	0.89	1.13	1.68	1.58	1.18	0				
Effective Rainfall	in.	1.13	0	0	0	0	0	0	0	0	2.06				
Sub-Total	①		0.16	0.41	0.65	0.89	1.13	1.68	1.58	1.18	0				
Irrigation Efficiency	②	50%													
① x $\frac{100}{②}$	in.		0.32	0.82	1.30	1.78	2.26	3.36	3.16	2.36	0				
Landpreparation 3	in.	0.75	1.50	0.75											
Unit Irrigation Requirements	in.	0	1.82	1.57	1.30	1.78	2.26	3.36	3.16	2.36	0				

Table 5-10 Calculation of Unit Irrigation Requirements

Crop: Wheat 105 days Pattern B

Month		Nov.		Dec.		Jan.		Feb.		Mar.		Apr.			
Pattern.															
Crop Factor (Average)			0.25	0.55	0.65	0.85	1.08	1.20	1.18	0.50					
ETo	in.	2.5		2.0		2.1		2.8		4.7					
ET (Crop.)	in.		0.31	0.55	0.65	0.89	1.13	1.68	1.65	1.18					
Effective Rainfall	in.	1.13	0	0	0	0	0	0	0	0	2.06				
Sub Total	①		0.31	0.55	0.65	0.89	1.13	1.68	1.65	1.18					
Irrigation Efficiency	②	50%													
① x $\frac{100}{②}$	in.		0.62	1.10	1.30	1.78	2.26	3.36	3.30	2.36					
Landpreparation 3	in.	1.50	1.50												
Unit Irrigation Requirements	in.	0.37	2.12	1.10	1.30	1.78	2.26	3.36	3.30	2.36					

Table 5-11 Calculation of Unit Irrigation Requirements

Crop: Jute 120 days

Month		Mar.		Apr.		May		Jun.		Jul.		Aug.			
Pattern.															
Crop Factor (Average)			0.25	0.58	0.78	1.03	1.33	1.45	1.40	1.40	0.70				
ETo	in.	4.7		5.8		5.9		4.4		4.3					
ET (Crop.)	in.		0.59	1.68	2.26	3.04	3.92	3.19	3.08	3.01	1.51				
Effective Rainfall	in.	0	2.06	0	2.89	1.34	1.35	4.89	3.05	4.26	2.67				
Sub Total	①		0	1.68	0	1.70	2.57	0	0.03	0	0				
Irrigation Efficiency	②	50%													
① x $\frac{100}{②}$	in.		0	3.36	0	3.40	5.14	0	0.06	0	0				
Landpreparation	in.	1.50	1.50												
Unit Irrigation Requirements	in.	1.50	0	3.36	0	3.40	5.14	0	0.06	0	0				

Table 5-12 Calculation of Unit Irrigation Requirements

Crop: Pulses 90 days, Pattern A

Month		Dec.		Jan.		Feb.		Mar.		Apr.		May		Jun.	
Pattern.															
Crop Factor (Average)				0.25	0.60	0.83	1.03	1.10	1.03	0.48					
ETo	in.	2.0		2.1		2.8		4.7		5.8					
ET (Crop.)	in.			0.26	0.63	1.16	1.44	2.89	2.42	1.39					
Effective Rainfall	in.	0	0	0	0	0	0	0	2.06	0	2.89				
Sub Total	①			0.26	0.63	1.16	1.44	2.89	0.36	1.39					
Irrigation Efficiency	②	50%													
① x $\frac{100}{②}$	in.			0.52	1.26	2.32	2.88	5.78	0.72	2.78					
Landpreparation 3	in.		1.50	1.50											
Unit Irrigation Requirements	in.		1.50	2.02	1.26	2.32	2.88	5.78	0.72	2.78					

Table 5-13 Calculation of Unit Irrigation Requirements

Crop: Pulses 90 days Pattern B, C, & D

Month		Dec.		Jan.		Feb.		Mar.		Apr.		May		Jun.	
Pattern.															
Crop Factor (Average)				0.13	0.43	0.71	0.93	1.06	1.06	0.75	0.24				
ETo	in.	2.0		2.1		2.8		4.7		5.8					
ET (Crop.)	in.			0.14	0.45	0.99	1.30	2.49	2.49	2.18	0.70				
Effective Rainfall	in.	0	0	0	0	0	0	0	2.06	0	2.89				
Sub Total	①			0.14	0.45	0.99	1.30	2.49	0.43	2.18	0				
Irrigation Efficiency	②	50%													
① x $\frac{100}{②}$	in.			0.28	0.90	1.98	2.60	4.98	0.86	4.36	0				
Landpreparation 3	in.		1.50	1.50											
Unit Irrigation Requirements	in.		1.50	1.78	0.90	1.98	2.60	4.98	0.86	4.36	0				

Table 5-14 Calculation of Unit Irrigation Requirements

Crop: Oilseed 90 days

Month	Nov.		Dec.		Jan.		Feb.		Mar.		Apr.			
Pattern.														
Crop Factor (Average)				0.13	0.41	0.69	0.91	1.06	1.06	0.75	0.24			
ETo in.			2.0		2.1		2.8		4.7		5.8			
ET (Crop.) in.				0.13	0.43	0.72	1.27	1.48	2.49	1.76	0.70			
Effective Rainfall in.			0	0	0	0	0	0	0	2.06	0	2.29		
Sub Total ①				0.13	0.43	0.72	1.27	1.48	2.49	0	0.70			
Irrigation Efficiency ②	50%													
① x $\frac{100}{②}$ in				0.26	0.86	1.44	2.54	2.96	4.98	0	1.40			
Landpreparation 3 in.			1.50	1.50										
Unit Irrigation Requirements in.			1.50	1.76	0.86	1.44	2.54	2.96	4.98	0	1.40			

Table 5-15 Calculation of Unit Irrigation Requirements

Crop: Summer Vegetable 90 days ; Maize etc. (Others 1)

Month		Mar.		Apr.		May		Jun.		Jul.		Aug.			
Pattern.															
Crop Factor (Average)				0.20	0.53	0.73	0.85	0.93	0.90	0.43					
ETo	in.	4.7		5.8		5.9		4.4		4.3		4.5			
ET (Crop)	in.			0.58	1.54	2.15	2.51	2.05	1.98	0.92					
Effective Rainfall	in.	0	2.06	0	2.89	1.34	1.35	4.89	3.05	4.26	2.67				
Sub Total	①			0.58	0	0.81	1.16	0	0	0					
Irrigation Efficiency	②	50%													
① x $\frac{100}{②}$	in.			1.16	0	1.62	2.32	0	0	0					
Landpreparation	in.		1.50	1.50											
Unit Irrigation Requirements	in.		0	2.66	0	1.62	2.32	0	0	0					

Table 5-16 Calculation of Unit Irrigation Requirements

Crop: Winter Vegatables 90 days ; Potato, Onion, etc. (Others 2)

Month		Dec.		Jan.		Feb.		Mar.		Apr.		May		Jun.	
Pattern.															
Crop Factor (Average)				0.10	0.33	0.55	0.75	0.88	0.85	0.58	0.18				
ETo	in.	2.0		2.1		2.8		4.7		5.8					
ET (Crop)	in.			0.11	0.35	0.77	1.05	2.07	2.00	1.68	0.52				
Effective Rainfall	in.	0	0	0	0	0	0	0	2.06	0	2.89				
Sub Total	①			0.11	0.35	0.77	1.05	2.07	0	1.68	0				
Irrigation Efficiency	②	50%													
① x $\frac{100}{②}$	in.			0.22	0.70	1.54	2.10	4.14	0	3.36	0				
Landpreparation	in.		1.50	1.50											
Unit Irrigation Requirements	in.		1.50	1.72	0.70	1.54	2.10	4.14	0	3.36	0				

Table 5-17 Calculation of Unit Irrigation Requirements

Crop: Sugar Cane

Month		Oct.		Nov.		Dec.		Jan.		Feb.		Mar.		Apr.		May.		Jun.		Jul.		Aug.		Sep.	
Pattern																									
Crop Factor(Average)		1.09	0.94	0.85	0.82	0.90	1.04	1.15	1.24	1.29	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.29	1.28	1.22
ETo	in.	3.5		2.5		2.0		2.1		2.8		4.7		5.8		5.9		4.4		4.3		4.5		3.7	
ET (Crop)	in.	1.91	1.65	1.06	1.03	0.90	1.04	1.21	1.30	1.81	1.82	3.06	3.06	3.77	3.77	3.84	3.84	2.86	2.86	2.80	2.80	2.93	2.90	2.37	2.26
Effective Rainfall	in.	3.38	0	1.13	0	0	0	0	0	0	0	0	2.06	0	2.89	1.34	1.35	4.89	3.05	4.26	2.67	9.84	7.62	1.27	5.34
Sub-Total	①	0	1.65	0	1.03	0.90	1.04	1.21	1.30	1,81	1,82	3.06	1.00	3.77	0.88	2.50	2.49	0	0	0	0.13	0	0	1.10	0
Irrigation Effieiency	②	50%																							
① × 100/②	in.	0	3.30	0	2.06	1.80	2.08	2.42	2.60	3.62	3.64	6.12	2.00	7.54	1.96	5.00	4.98	0	0	0	0.26	0	0	2.20	0
Land Preparation	in.	0.60	0.60	0.60	0.60																				0.60
Unit Irrigation Requirements	in.	0	3.90	0	2.66	1.80	2.08	2.42	2.60	3.62	3.64	6.12	2.00	7.54	1.96	5.00	4.98	0	0	0	0.26	0	0	2.20	0

5.2 Irrigation Requirements per 1,000 Ac by Different Cropping Patterns

Table 5-18 Calculation of Irrigation Requirement per 1,000 ac. for Schematic Cropping Pattern-A

Crops	Month	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Annual Total
		I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	
T. Aus (HYV) 180 ac	I.R. inches						0.15	3.68	0.55	5.09	5.37	1.38	3.22	1.80	2.06	0	0									
	I.R. ac ft						2.3	55.2	8.3	76.4	80.6	20.7	48.3	27.0	30.9	0	0									349.7
T. Aus (Local) 180 ac	I.R. inches							0.17	0	2.94	4.58	1.16	2.89	1.48	1.96	0	0	4.19	0	0						
	I.R. ac ft							2.6	0	44.1	68.7	17.4	43.4	22.2	29.4	0	0	62.9	0	0						290.7
T. Aman (HYV) 180 ac	I.R. inches														0	0	0	3.88	0.13	1.88	5.00	3.32	4.29	1.93		
	I.R. ac ft														0	0	0	58.2	2.0	28.2	75.0	49.8	64.4	29.0		306.6
T. Aman (Local) 180 ac	I.R. inches											0	0	0	0.36	0	0	4.06	0.26	1.94	5.00	3.32	4.25	2.52	0.63	
	I.R. ac ft											0	0	0	5.4	0	0	60.9	3.9	29.1	75.0	49.8	63.8	37.8	9.5	335.2
Sugar Cane 100 ac	I.R. inches	2.42	2.60	3.62	3.64	6.12	2.00	7.54	1.96	5.00	4.98	0	0	0	0.26	0	0	2.20	0	0	3.90	2.66	1.80	2.08		
	I.R. ac ft	20.2	21.7	30.2	30.3	51.0	16.7	62.8	16.3	41.7	41.5	0	0	0	2.2	0	0	18.3	0	0	32.5	0	22.2	15.0	17.3	439.9
Jute 360 ac	I.R. inches					1.50	0	3.36	0	3.40	5.14	0	0.06	0	0											
	I.R. ac ft					45.0	0	100.8	0	102.0	154.2	0	1.8	0	0											403.8
Weat 540 ac	I.R. inches	1.78	2.26	3.36	3.16	2.36	0															0	1.82	1.57	1.30	
	I.R. ac ft	80.1	101.7	151.2	142.2	106.2	0															0	81.9	70.7	58.5	792.5
Pulses 180 ac	I.R. inches	2.02	1.26	2.32	2.88	5.78	0.72	2.78																	1.50	
	I.R. ac ft	30.3	18.9	34.8	43.2	86.7	10.8	41.7																	22.5	288.9
Oilseed 90 ac	I.R. inches	0.86	1.44	2.54	2.96	4.98	0	1.40																1.50	1.76	
	I.R. ac ft	6.5	10.8	19.1	22.2	37.4	0	10.5																11.3	13.2	131.0
Others (1) 90 ac	I.R. inches						0	2.66	0	1.62	2.32	0	0	0												
	I.R. ac ft							20.0	0	12.2	17.4	0	0	0												49.6
Others (2) 90 ac	I.R. inches	1.72	0.70	1.54	2.10	4.14	0	3.36																	1.50	
	I.R. ac ft	12.9	5.3	11.6	15.8	31.1	0	25.2	0																11.3	113.2
Total (217 %) 1,000 ac	I.R. ac ft	150.0	158.4	246.9	253.7	357.4	29.8	318.8	24.6	276.4	362.4	36.1	93.5	49.2	67.9	0	0	200.3	5.9	57.3	182.5	99.6	232.3	163.8	132.3	3,501.1

Table 5-19 Calculation of Irrigation Requirement per 1,000 ac. for Schematic Cropping Pattern-B

Crops \ Month		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Annual Total
		I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	
T. Aman (HYV) 720 ac	I.R. inches														0	0	0	3.94	0.13	1.88	5.00	3.32	4.29	2.55	0.63	
	I.R. ac ft														0	0	0	236.4	7.8	112.8	300.0	199.2	257.4	153.0	37.3	1,303.9
T. Aman (Local) 190 ac	I.R. inches											0	0	0	0.36	0	0	4.06	0.26	1.94	5.00	3.32	4.25	2.52	0.63	
	I.R. ac ft											0	0	0	5.7	0	0	64.3	4.1	30.7	79.2	52.6	67.3	39.9	10.0	353.8
Boro 120 380 ac	I.R. inches	4.45	4.60	4.25	4.29	5.67	4.26	6.79	4.21	2.84	0													0.06	1.81	
	I.R. ac ft	140.9	145.7	134.6	135.9	179.6	134.9	215.0	133.3	89.9	0													1.9	57.3	1,369.0
Boro 135 380 ac	I.R. inches	4.45	4.60	4.25	4.29	5.63	4.14	6.65	4.35	5.59	2.90	0												0.06	1.81	
	I.R. ac ft	140.9	145.7	134.6	135.9	178.3	131.1	210.6	137.8	177.0	91.8	0												1.9	57.3	1,542.9
Sugar Cane 10 ac	I.R. inches	2.42	2.60	3.62	3.64	6.12	2.00	7.54	1.96	5.00	4.98	0	0	0	0.26	0	0	2.20	0	0	3.90	0	2.66	1.80	2.08	
	I.R. ac ft	2.0	2.2	3.0	3.0	5.1	1.7	6.3	1.6	4.2	4.2	0	0	0	0.2	0	0	1.8	0	0	3.3	0	2.2	1.5	1.7	44.0
Jute 60 ac	I.R. inches					1.50	0	3.36	0	3.40	5.14	0	0.06	0	0											
	I.R. ac ft					7.5	0	16.8	0	17.0	25.7	0	0.3	0	0											67.3
Weat 40 ac	I.R. inches	1.78	2.26	3.36	3.30	2.36																0.37	2.12	1.10	1.30	
	I.R. ac ft	5.9	7.5	11.2	11.0	7.9																1.2	7.1	3.7	4.3	59.8
Pulses 100 ac	I.R. inches	1.78	0.90	1.98	2.60	4.98	0.86	4.36	0																1.50	
	I.R. ac ft	14.8	7.5	16.5	21.7	41.5	7.1	36.3	0																12.5	157.9
Oilsead 60 ac	I.R. inches	0.86	1.44	2.54	2.96	4.98	0	1.40																1.50	1.76	
	I.R. ac ft	4.3	7.2	12.7	14.8	24.9	0	7.0																7.5	8.8	87.2
Others (1) 20 ac	I.R. inches						0	2.66	0	1.62	2.32	0	0	0												
	I.R. ac ft						0	4.4	0	2.7	3.9	0	0	0												11.0
Others (2) 30 ac	I.R. inches	1.72	0.70	1.54	2.10	4.14	0	3.36	0																1.50	
	I.R. ac ft	4.3	1.8	3.9	5.3	10.4	0	8.4	0																3.8	37.9
Total (199 %) 1,000 ac	I.R. ac ft	313.1	317.6	316.5	327.6	455.2	274.8	504.8	272.7	290.8	125.6	0	0.3	0	5.7	0	0	302.5	11.9	143.5	382.5	253.0	334.0	209.4	193.0	5,034.7

Table 5-20 Calculation of Irrigation Requirement per 1,000 ac. for Schematic Cropping Pattern-C

Crops	Month	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Annual Total
		I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	
T. Aman (HYV) 700 ac	I.R. inches														0	0	0	3.94	0.13	1.88	5.00	3.32	4.29	2.55	0.63	
	I.R. ac ft														0	0	0	229.8	7.6	109.7	291.7	193.7	250.3	148.8	36.8	1,268.4
T. Aus (Local) 300 ac	I.R. inches							0.17	0	2.94	4.58	1.16	2.89	1.46	1.96	0	0	4.19	0	0						
	I.R. ac ft							4.3	0	73.5	114.5	29.0	72.3	37.0	49.0	0	0	104.8	0	0						484.4
Boro 120 320 ac	I.R. inches	4.45	4.60	4.25	4.29	5.67	4.26	6.79	4.21	2.84	0													0.06	1.81	
	I.R. ac ft	118.7	122.7	113.3	114.4	151.2	113.6	181.1	112.3	75.7	0													1.6	48.3	1,152.9
Boro 135 380 ac	I.R. inches	4.45	4.60	4.25	4.29	5.63	4.14	6.65	4.35	5.59	2.30	0												0.06	1.81	
	I.R. ac ft	140.9	145.7	134.6	135.9	178.3	131.1	210.6	137.8	177.0	91.8	0												1.9	57.3	1,542.9
Pulses 200 ac	I.R. inches	1.78	0.90	1.98	2.60	4.98	0.86	4.36	0																1.50	
	I.R. ac ft	29.7	15.0	33.0	43.3	83.0	14.3	72.7	0																25.0	316.0
Oilseed 100 ac	I.R. inches	0.86	1.44	2.54	2.96	4.98	0	1.40																1.50	1.76	
	I.R. ac ft	7.2	12.0	21.2	24.7	41.5	0	11.7																12.5	14.7	145.5
Total (200 %) 1,000 ac	I.R. ac ft	296.5	295.4	302.1	318.3	454.0	259.0	480.4	250.1	326.2	206.3	29.0	72.3	37.0	49.0	0	0	334.6	7.6	109.7	291.7	193.7	250.3	164.8	182.1	4,910.1

Table 5-21 Calculation of Irrigation Requirement per 1,000 ac. for Schematic Cropping Pattern-D

Crops \ Month		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Annual Total
		I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	
B. Aman	I.R. inches									0.21	2.24	0	2.80	1.33	1.77	0	0	4.10	0.28	1.95	4.97	3.28	4.29	2.91	0.96	
1,000 ac	I.R. ac ft									17.5	186.7	0	233.3	110.8	147.5	0	0	341.7	23.3	162.5	414.2	273.3	357.5	242.5	80.0	2,590.8
Boro 120	I.R. inches	4.45	4.60	4.25	4.29	5.67	4.26	6.79	4.21	2.84	0													0.06	1.81	
900 ac	I.R. ac ft	296.7	306.7	283.3	286.0	378.0	284.0	452.7	280.7	189.3	0													4.0	120.7	2,882.1
Pulses	I.R. inches	1.78	0.90	1.98	2.60	4.98	0.86	4.36	0																1.50	
200 ac	I.R. ac ft	29.7	15.0	33.0	43.3	83.0	14.3	72.7	0																25.0	316.0
Total (200 %) 1,000 ac	I.R. ac ft	326.4	321.7	316.3	329.3	461.0	298.3	525.4	280.9	206.8	186.7	0	233.3	110.8	147.5	0	0	341.7	23.3	162.5	414.2	273.3	357.5	246.5	225.7	5,788.9

Table 5-22 Calculation of Irrigation Requirement per 1,000 ac. for Schematic Cropping Pattern-E (Extention Area)

Crops \ Month		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Annual Total
		I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	
Boro 120	I.R. inches	4.45	4.60	4.25	4.29	5.67	4.26	6.79	4.21	2.84	0													0.06	1.81	
900 ac	I.R. ac ft	296.7	306.7	283.3	286.0	378.0	284.0	452.7	280.7	189.3	0													4.0	120.7	2,882.1
Pulses	I.R. inches	1.78	0.90	1.98	2.60	4.98	0.86	4.36	0																1.50	
200 ac	I.R. ac ft	29.7	15.0	33.0	43.3	83.0	14.3	72.7	0																25.0	316.0
Total (100 %) 1,000 ac	I.R. ac ft	326.4	321.7	316.3	329.3	461.0	298.3	525.4	280.7	189.3	0	0	0	0	0	0	0	0	0	0	0	0	0	4.0	145.7	3,198.1

Table 5-23 Calculation of Diversion Requirements for Whole Area (1st. Rainfall Area)

Cropping Pattern	Month		Jan. I	Jan. II	Feb. I	Feb. II	Mar. I	Mar. II	Apr. I	Apr. II	May I	May II	Jun. I	Jun. II	
A(Ac)	I.R. per 1000Ac		150.0	158.4	246.9	253.7	357.7	29.8	318.8	24.6	276.4	362.4	38.1	93.5	
2,700	I.R. Ac·ft		405.0	427.7	666.6	685.0	965.0	80.5	860.8	66.4	746.3	978.5	102.9	252.5	
B	I.R. per 1000Ac		313.1	317.6	316.5	327.6	455.2	274.8	504.8	272.7	290.8	125.6	0	0.3	
30,400	I.R. Ac·ft		9,518.2	9,655.0	9,621.6	7,959.0	13,838.1	8,353.9	15,345.9	8,290.1	8,840.3	3,818.2	0	9.1	
C	I.R. per 1000Ac		296.5	295.4	302.1	318.3	454.0	259.0	480.4	250.1	326.2	206.3	29.0	72.3	
45.400	I.R. Ac·ft		13,461.1	13,411.2	13,715.3	14,450.8	20,611.6	11,758.6	21,810.2	11,354.5	14,809.5	9,366.0	1,316.6	3,282.4	
D	I.R. per 1000Ac		326.4	321.7	316.3	329.3	461.0	298.3	525.4	280.7	206.8	186.7	0	233.3	
9,700	I.R. Ac·ft		3,166.1	3,120.5	3,068.1	3,194.2	4,471.7	2,893.5	5,096.4	2,722.8	2,005.0	1,811.0	0	2,263.0	
Total	I.R. Ac·ft		26,550.4	26,614.4	27,071.6	28,289.0	39,886.4	23,086.5	43,113.3	22,433.8	26,401.1	15,973.7	1,419.5	5,807.0	
88,200	Diver-sion R.	Ac·ft	34,515.5	34,598.7	35,193.1	36,775.7	51,852.3	30,012.5	56,047.3	29,163.9	34,321.4	20,765.8	1,845.4	7,549.1	
		Cusecs	1,160	1,163	1,183	1,236	1,743	1,009	1,884	980	1,154	698	62	254	
		m^3/sec	32.9	32.9	33.5	35.0	49.4	28.6	53.3	27.8	32.7	19.8	1.8	7.2	

Cropping Pattern	Month		Jul. I	Jul. II	Aug. I	Aug. II	Sep. I	Sep. II	Oct. I	Oct. II	Nov. I	Nov. II	Dec. I	Dec. II	Annual Total
A(Ac)	I.R. per 1000Ac		49.2	67.9	0	0	200.3	5.9	57.3	182.5	99.6	232.3	163.8	132.3	3,501.1
2,700 Ac	I.R. Ac·ft		132.8	183.3	0	0	540.8	15.9	154.7	492.8	268.9	627.2	442.3	357.2	
B	I.R. per 1000Ac		0	5.9	0	0	302.5	11.9	143.5	382.5	253.0	334.0	209.4	193.0	5,034.7
30,400	I.R. Ac·ft		0	179.4	0	0	9,196.0	361.8	4,362.4	11,628.0	7,691.2	10,153.6	6,365.8	5,867.2	
C	I.R. per 1000Ac		37.0	49.0	0	0	334.6	7.6	109.7	291.7	193.7	250.3	164.8	182.1	4,910.1
45,400	I.R. Ac·ft		1,679.8	2,224.6	0	0	15,190.8	345.0	4,980.4	13,243.2	8,794.0	11,363.6	7,481.9	8,267.3	
D	I.R. per 1000Ac		110.8	147.5	0	0	341.7	23.3	162.5	414.2	273.3	357.5	246.5	225.7	5,788.9
9,700	I.R. Ac·ft		1,074.8	1,430.8	0	0	3,314.5	226.0	1,576.3	4,017.7	2,651.0	3,467.8	2,391.1	2,189.3	
Total	I.R. Ac·ft		2,887.4	4,018.1	0	0	28,242.1	948.7	11,073.8	28,888.9	19,405.1	25,612.2	16,681.1	16,681.0	
88,200	Diver-sion R.	Ac·ft	3,753.6	5,223.5	0	0	36,714.7	1,233.3	14,395.9	37,555.6	25,226.6	33,295.9	21,685.4	21,685.3	
		Cusecs	126	176	0	0	1,234	41	484	1,262	848	1,119	729	729	
		m^3/sec	3.6	5.0	0	0	34.9	1.2	13.7	35.7	24.0	31.7	20.6	20.6	

Table 5-24 Calculation of Diversion Requirements for Whole Area (10th Rainfall Area)

Cropping Pattern	Month		Jan. I	Jan. II	Feb. I	Feb. II	Mar. I	Mar. II	Apr. I	Apr. II	May I	May II	Jun. I	Jun. II	
A (Ac)	I.R. per 1000Ac		150.0	158.4	246.9	253.7	357.4	29.8	318.8	24.6	276.4	362.4	38.1	93.5	
2,700	I.R. Ac.ft		405.0	427.7	666.6	685.0	965.0	80.5	860.8	66.4	746.3	978.5	102.9	252.5	
B	I.R. per 1000Ac		313.1	317.6	316.5	327.6	455.2	274.8	504.8	272.7	290.8	125.6	0	0.3	
70,300	I.R. Ac-ft		22,010.9	22,327.3	22,250.0	23,030.3	32,000.6	19,318.4	35,487.4	19,170.8	20,443.2	8,829.7	0	21.1	
C	I.R. per 1000Ac		296.5	295.4	302.1	318.1	454.0	259.0	480.4	250.1	326.2	206.3	29.0	72.3	
12,900	I.R. Ac-ft		3,824.9	3,810.7	3,897.1	4,106.1	5,856.6	3,341.1	6,197.2	3,226.3	4,208.0	2,661.3	374.1	932.7	
D	I.R. per 1000Ac		326.4	321.7	316.3	329.3	461.0	298.3	525.4	280.7	206.8	186.7	0	233.3	
2,300	I.R. Ac-ft		750.7	739.9	727.5	757.4	1,060.3	686.1	1,208.4	645.6	475.6	429.4	0	536.6	
Total	I.R. Ac-ft		26,991.5	27,305.6	27,541.2	28,578.8	39,882.5	23,426.1	43,753.8	23,109.1	25,873.1	12,898.9	477.0	1,742.9	
88,200	Diversion R.	Ac-ft	35,089.0	35,497.3	35,803.6	37,152.4	51,847.3	30,453.9	56,879.9	30,041.8	33,635.0	16,768.6	620.1	2,265.8	
		Cusecs	1,179	1,193	1,203	1,249	1,743	1,024	1,912	1,010	1,130	564	21	76	
		m^3/sec	33.4	33.8	34.1	35.4	49.4	29.0	54.1	28.6	32.0	16.0	0.6	2.2	

Cropping Pattern	Month		Jul. I	Jul. II	Aug. I	Aug. II	Sep. I	Sep. II	Oct. I	Oct. II	Nov. I	Nov. II	Dec. I	Dec. II	Annual Total
A (Ac)	I.R. per 1000Ac		49.2	67.9	0	0	200.3	5.9	57.3	182.5	99.6	232.3	163.8	132.3	3,501.1
2,700	I.R. Ac.ft		132.8	183.3	0	0	540.8	15.9	154.7	492.8	268.9	627.2	442.3	357.2	
B	I.R. per 1000Ac		0	5.9	0	0	302.5	11.9	143.5	382.5	253.0	334.0	209.4	193.0	5,034.7
70,300	I.R. Ac-ft		0	414.8	0	0	21,265.8	836.6	10,088.8	26,889.8	17,785.9	23,480.2	14,720.8	13,567.9	
C	I.R. per 1000Ac		37.0	49.0	0	0	334.6	7.6	109.7	291.7	193.7	250.3	164.8	182.1	4,910.1
12,900	I.R. Ac-ft		477.3	632.1	0	0	4,316.3	98.0	1,415.1	3,762.9	2,498.7	3,228.9	2,125.9	2,349.1	
D	I.R. per 1000Ac		110.8	147.5	0	0	341.7	23.3	162.5	414.2	273.3	357.5	246.5	225.7	5,788.9
2,300	I.R. Ac-ft		254.8	339.3	0	0	785.9	53.6	373.8	952.7	628.6	822.3	467.0	519.1	
Total	I.R. Ac-ft		864.9	1,569.5			26,908.8	1,004.1	12,031.7	32,098.2	21,182.1	28,158.6	17,856.0	16,793.3	
88,200	Diversion R.	Ac-ft	1,124	2,040.4			34,981.4	1,305.3	15,641.2	41,727.7	27,536.7	36,606.2	23,212.8	21,831.3	
		Cusecs	38	68			1,176	44	526	1,402	926	1,230	780	734	
		m^3/sec	1.1	1.9	0	0	33.3	1.2	14.9	39.7	26.2	34.8	22.1	20.8	

ANNEX VI. IRRIGATION-CUM-DRAINAGE STRUCTURES

6.1 Pumping Facility Plan

(1) Pumping Station No. 1

(i) Pump Bore and Pump Number

Pump bore is automatically determined by the number of pumps. In determining the number of pumps, the following conditions should be taken into consideration:

(a) Minimum water requirements and hourly and seasonal variations of the water requirements;

(b) Equipment costs (pumping machines and their installation), operation and maintenance costs;

(c) Risk dispersion with facilities;

(d) Limits to pumping capacities;

(e) Loads and bearing power of the foundation; and

(f) Engineering and construction costs.

The relationships between pump bores and the required number of pumps are given in Table 6-1.

Table 6-1 Comparison of Pump Bores and Required Pump Number

Case	Pump Bore	Pump Nos. Required	Unit Pump Capacity			
			ft^3/min	cusec	m^3/min	m^3/sec
1	2,000 mm	4	18,600	465	525	8.75
2	1,800	5	14,880	248	420	7.0
3	1,650	6	12,400	207	350	5.83
4	1,500	8	9,300	155	263	4.38
5	1,350	9	8,270	140	233	3.89

Each of the above-mentioned cases is analyzed below, respectively.

Condition (a)

As far as the minimum water requirements are concerned, no particular attention is required for drainage purpose, but it needs to be taken into account for irrigation purpose, as irrigation water requirements experience a considerable seasonal variations. It is desirable that the unit pumping capacity corresponds to a value approximate to the minimum water requirements; during the dry season, the minimum water requirements have been determined at 341 cusec (9.7 m^3/sec) through October into May as per Table 5-37 in the Main Report.

In these circumstances, as the unit pumping capacity lower than 340 cusec promises to achieving the full efficiency of pump operation, the pumping capacity used for Case 1 seems to be inappropriate, except for Cases 2, 3, 4 and 5.

Condition (b)

Pumping facilities have been so planned as to adopt the same pump type with the same capacity in order to either make pumping facility costs including pump costs more economical or making repairs and spare-parts exchange easier. The larger the pumping capacity, the more economical will be the power costs. Judging from the maintenance and operation costs, it is generally favourable to reduce the number of pumps and to use the pumps having the same capacity.

Under these circumstances, Case 5 meant for installation of nine pumps is deemed inappropriate. Therefore, comparative studies on the facility costs would be applicable for Cases 2, 3 and 4. (See Table 6-2.) As far as pumping station costs are concerned, Case 2 would be most advantageous, followed by the order of Case 3 and Case 4 (see Table 6-3). Comparative studies on Cases 2, 3 and 4 would be made in the below.

Condition (c)

Since the number of pumps used for each case has been decided as 5∿8, no serious damages would be expected to the pumps even though pump troubles and unanticipated accidents might occur.

Condition (d)

It would be very difficult to haul the pumps having larger capacities than proposed ones. However, since the pumps would be disassembled for the purpose of making their haulage easier, there would exist no problem in hauling the pumps having the proposed capacities for each case.

Condition (e)

As the project area does not provide good foundation suitable for structures, small-diameter pumps with smaller load per unit space would better be installed.

Condition (f)

For each of Cases 2, 3 and 4, the approximate dimension and its pumping station cost are represented in Table 6-2.

Table 6-2 Approximate Pumping Station Costs

Case	Dimension			Unit Cost	Amount
	Width	Length	Area		
	ft	ft	ft^2	TK/ft^2	1,000 TK
2	90	80	7,200	4,300	30,960
3	100	80	8,000	3,500	28,000
4	120	80	9,600	3,000	28,800

Table 6-3 Comparison of Pumping Station Costs

(Unit: 1,000 TK)

Item \ Case	2	3	4
	D 1,800 mm 5 Nos.	D 1,650 mm 6 Nos.	D 1,500 mm 8 Nos.
Main pump (motor,reducer,etc.)	6,700 × 5 =33,500	6,000 × 6 =36,000	5,300 × 8 =42,400
Supplementary machinery (cooling apparatus 25-ton crane)	3,000	3,000	3,000
Distributing board (transmission∿operation board)	5,400	5,400	5,400
Independent electric power facilities (with board)	1,800 kW 6,700	1,500 kW 5,700	1,300 kW 4,800
Sub-total	48,600	50,100	55,600
Construction and installation costs 15%	7,300	7,500	8,300
Transportation cost (Japan to Bangladesh)	4,900	5,000	5,600
Transportation cost (in Bangladesh) 10%	3,000	3,100	3,400
Sub-total	12,200	12,500	13,900
Total	63,800	65,700	72,900

As a result of the comparative studies on Cases 2, 3 and 4, Case 3 would be, to large extent, most justifiable under every condition mentioned before. Therefore, Case 3 (six pumps with a diameter of 1,650 mm) has been adopted for the project area.

(ii) Pump Type

Pump type can be roughly determined from the given pump head. Different types of pump and their pump heads are shown in Table 6-4.

Table 6-4 Selection of Pump Types by Total Pump Heads

	Horizontal Shaft		Vertical Shaft		Tubular
Centrifugal pump	Single stage	33'∿492'	Single stage	33'∿656'	
	Multi stage	more than 164'	Multi stage	more than 164'	
Mixed flow pump	13'∿49'		Single stage	13'∿197'	13'∿98'
			Multi stage	more than 164'	
Axial flow pump	less than 20'		less than 26'		less than 26'

As the proposed pump has a head of 23 ft (which will be described later), it would be appropriate to adopt the mixed flow type and because of dual purposes to be served by the same pump, it should be vertical shafted double-floor type.

(iii) Head

(a) Suction Water Level

At Irrigation Time

Irrigation water requirements are the largest in two months of March and April. The river water level, during the period, moves within the rage of 3.5∿8.0 ft according to the data recorded at Demra station, though liable to changes from year to year. 10% frequency river water level has been determined at 3.0 ft P.W.D. from the data referring to the river water levels during the last 7 years which have been collected recently. The water level inside the suction reservoir would be determined at 1 ft P.W.D., by taking into account the decrease in the discharge of the Sitalakhya River due to pumping-up as well as such losses as from conveyance, screening and rubbish which would accumulate to an equivalent of about 2 ft.

At Drainage Time

As a result of the drainage calculation, the water level within the project area is expected to rise to 11.0∿12.0 ft P.W.D. at the maximum during the peak drainage time. Since the maximum water level within the project area has been designed at 6.0 ft, its inside water level would be made 5.0 ft P.W.D. Therefore, the water level inside the suction reservoir would be determined at 2.0 ft P.W.D., by taking into account to losses due to conveyance, screening and rubbish.

(b) Discharge Level

At Irrigation Time

The discharge level has been determined at 21.0 ft P.W.D. on the basis of hydraulic analysis made with the main irrigation canals.

At Drainage Time

The discharge level has been determined at 22.0 ft P.W.D. by taking into consideration the 1/25 year return period of the Sitalakhya River.

(c) Actual Head

At irrigation time Ha = 21.0 - 1.0 = 20.0 ft
At drainage time Ha = 22.0 - 2.0 = 20.0 ft

Actual head for both irrigation and drainage has been determined at 20.0 ft.

(d) Total Head

Assuming that the loss of head around pumps is estimated at 3.0 ft, total head can be expressed by:

$$H = 20.0 + 3.0 = 23.0 \text{ ft}$$

(iv) Motor Power

Motor power can be calculated by the following formula:

$$P = \frac{K \times \gamma \times Q \times H}{\eta p \times \eta g} (1 + R)$$

where

P : Motive power (KW)
K : Coefficient (0.163)
γ : Specific gravity of water (1.0)
Q : Pumping capacity (350 m^3/min at drainage time)
H : Total head (H = 23 ft ≒ 6.9 m)
η_p: Pumping efficiency (84%)
η_p: Conductive efficiency (by use of reducer, 95%)
R : Clearance coefficient (by use of motor, 0.1)

$$P = \frac{0.163 \times 1.0 \times 350 \times 6.9}{0.84 \times 0.95} (1 + 0.1)$$

$$= 541 \fallingdotseq 550 \text{ KW}$$

Since six pumps are to be installed in Pumping Station No. 1, total motor power would be as follows:

$$6 \times 550 \text{ KW} = 3,300 \text{ KW}$$

(2) Pumping Station No. 2

Pumping Station No. 2 would be planned in the same way as with Pumping Station No. 1. It would be equipped with the same pumping capacity of 1,240 cusec (35 m^3/sec).

(i) Pump Bore and Pump Number

Exactly the same with Pumping Station No. 1, that is six pumps with a diameter of 1,650 mm each.

(ii) Pump Type

Since the head of the pumps used for Pumping Station No. 2 is assumed to be nearly equivalent to that for Pumping Station No. 1, the same type of the pumps as with Pumping Station No. 1 is employed, i.e. mixed flow type with vertical shaft.

(iii) Head

(a) Suction Water Level

At Irrigation Time

Pumping Station No. 2 is located in the upper stream of Pumping Station No. 1; the inlet level of Pumping Station No. 2 becomes lower than that of Pumping Station No. 1 during the dry season. As the water surface slope has been determined at about 1/100,000, the suction water level of Pumping Station No. 2 would be made at 2.3 ft P.W.D., 0.7 ft lower than that of Pumping Station No. 1. The losses of head around pumps have been assumed to be 2.0 ft and the water level inside the suction reservoir has accordingly be determined at 0.3 ft P.W.D.

At Drainage Time

Inside water level has been determined at 5.0 ft P.W.D., as in the case of Pumping Station No. 1. The suction water level has been determined at 2.0 ft P.W.D. by deducting the losses of head.

(b) Discharge Level

At Irrigation Time

Discharge level has been determined at 22.0 ft P.W.D., as a result of hydraulic analysis with the main canals.

At Drainage Time

In the light of the 1/25 year period of the Sitalakhya River, the discharge level has been determined at 22.8 ft P.W.D.

(c) Actual Head

At irrigation time Ha = 22.0 - 0.3 = 21.7 ft

At drainage time Ha = 22.8 - 2.0 = 20.8 ft

(d) Total Head

Assuming the loss of head around pumps at 3.0 ft, the total head would be:

$$H = 21.7 + 3.0 = 24.7 \text{ ft } (7.4 \text{ m}),$$

because of a greater magnitude of the total head generated by the case of irrigation time.

(iv) Motor Power

Motor power is calculated by the following formula:

$$P = \frac{K \times \gamma \times Q \times H}{\eta p \times \eta g} (1 + R)$$

The same notations as used for Pumping Station No. 1 are taken here.

At Irrigation Time:

$$P = \frac{0.163 \times 1.0 \times 350 \times 7.4}{0.84 \times 0.95} (1 + 0.1)$$

$$= 581 \fallingdotseq 600 \text{ KW}$$

Total motor power for Pumping Station No. 2 can be computed as follows:

$$6 \times 600 \text{ KW} = 3,600 \text{ KW}$$

Fig 6-1 Power Transmisson

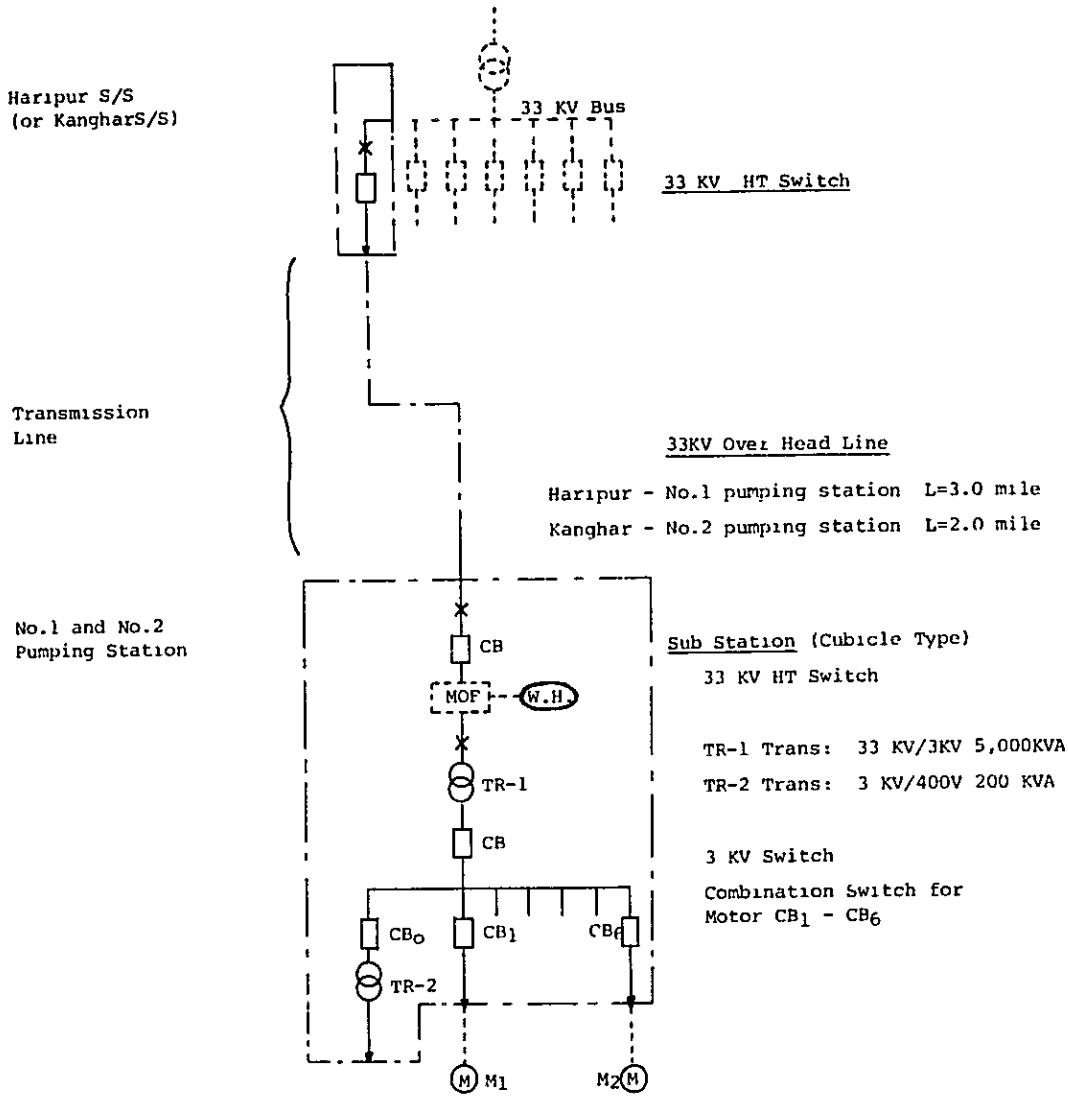


Fig. 6－2 LOCATION OF TRANSMISSON LINE