

FIGURE HYDROGRAPH OF IRRAWADDY RIVER AT PROMÉ

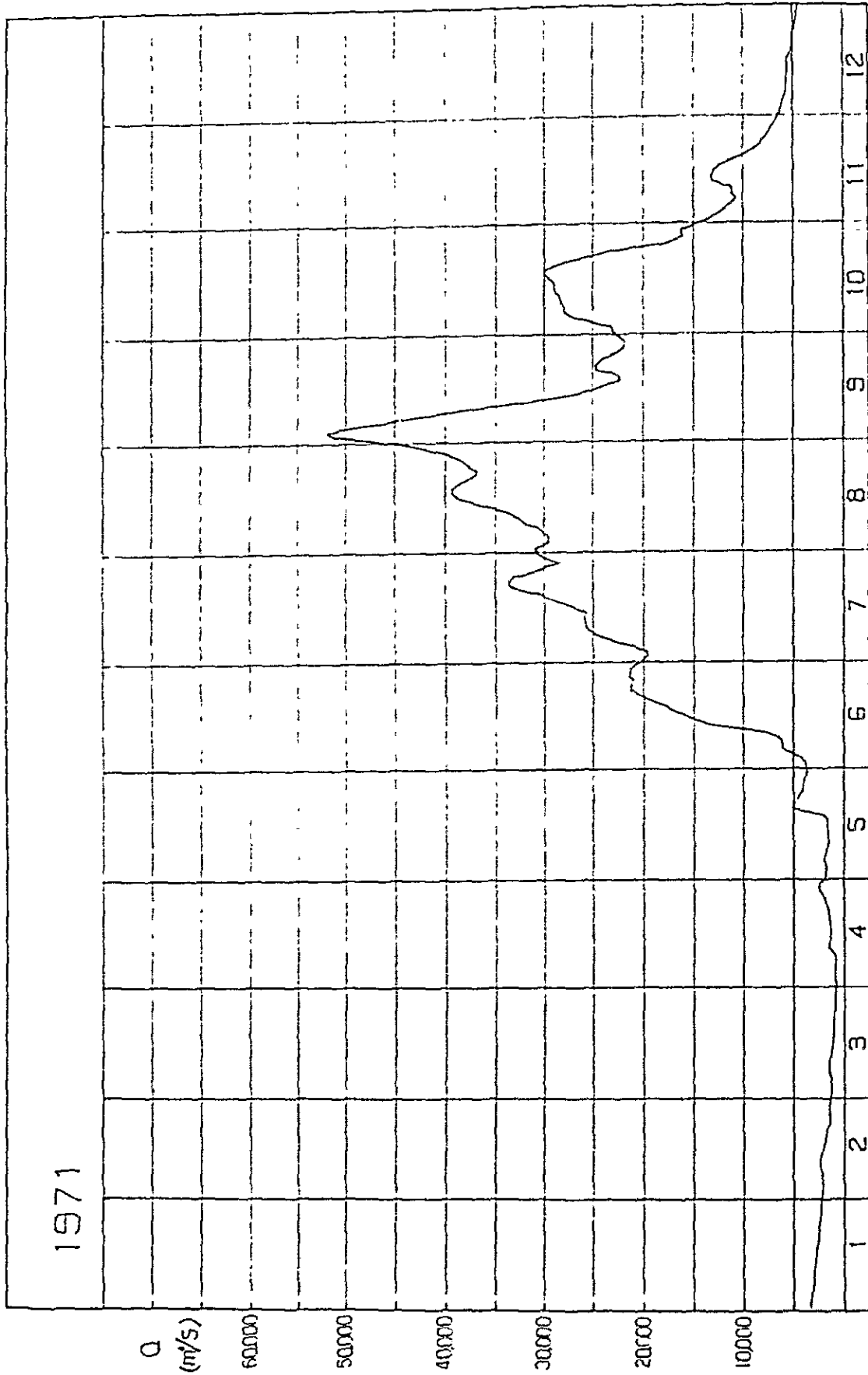


FIGURE HYDROGRAPH OF IRRAWADDY RIVER AT PROME

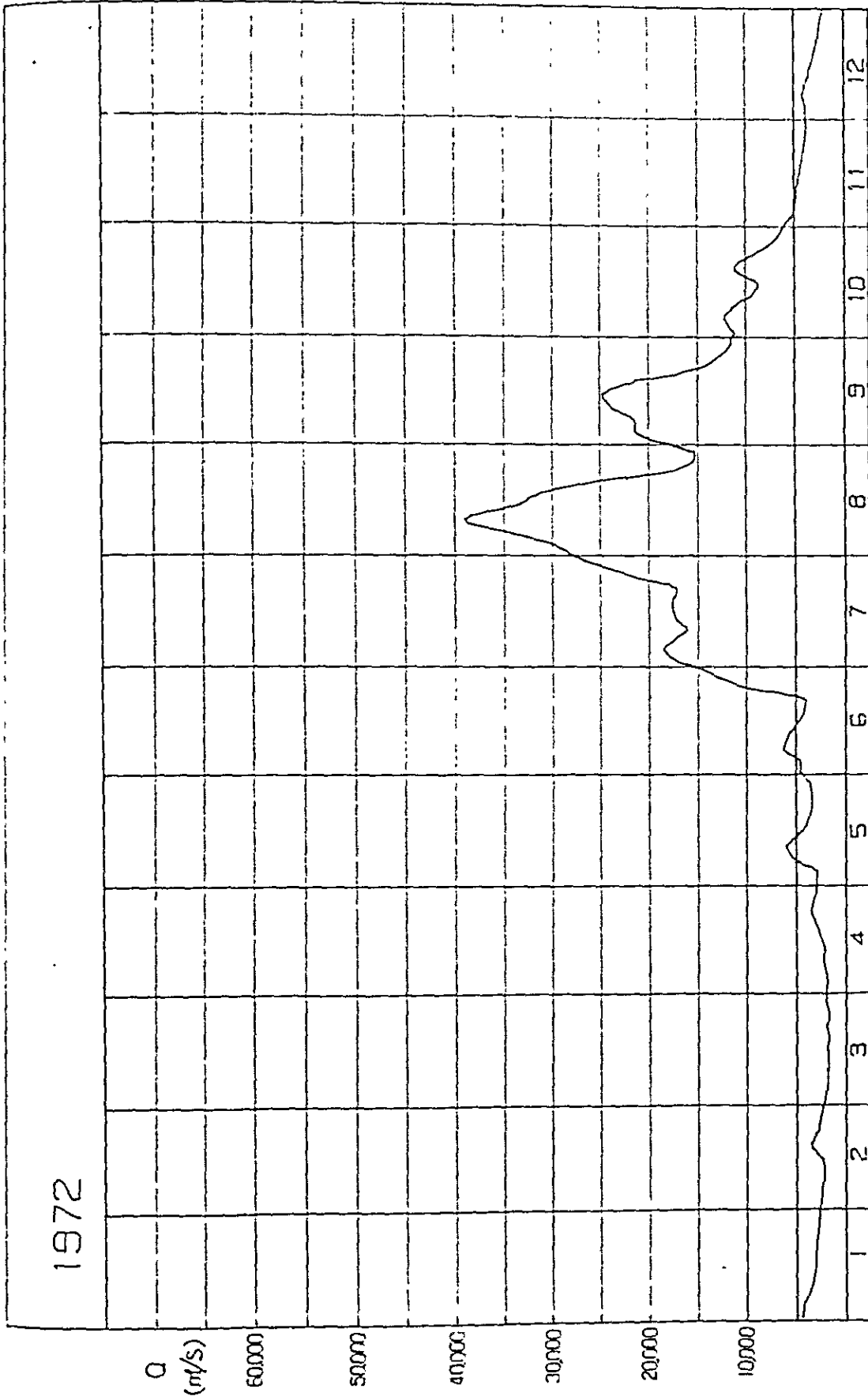


FIGURE HYDROGRAPH OF IRRAWADDY RIVER AT PROME

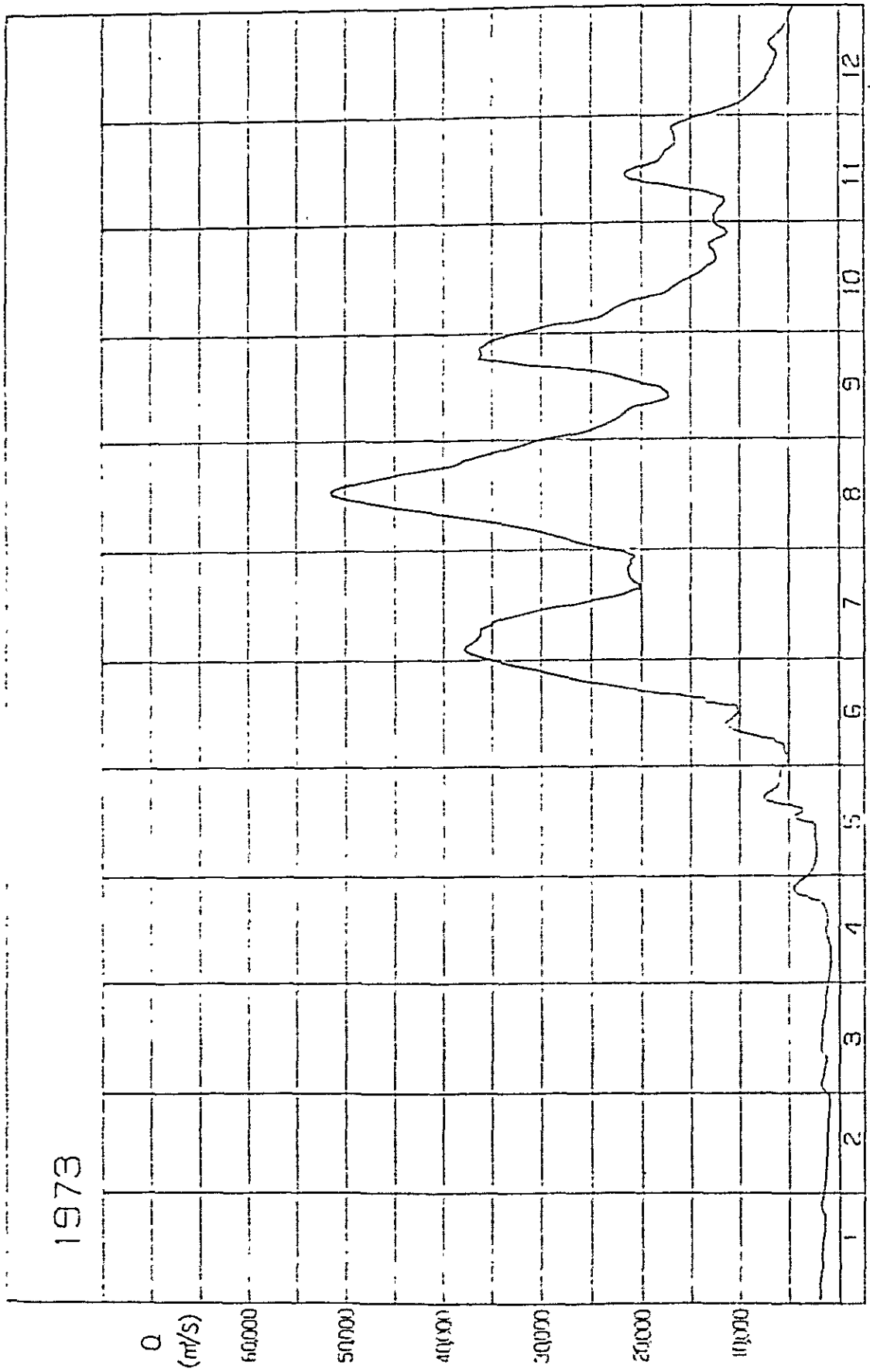


FIGURE HYDROGRAPH OF IRRAWADDY RIVER AT PROMÉ

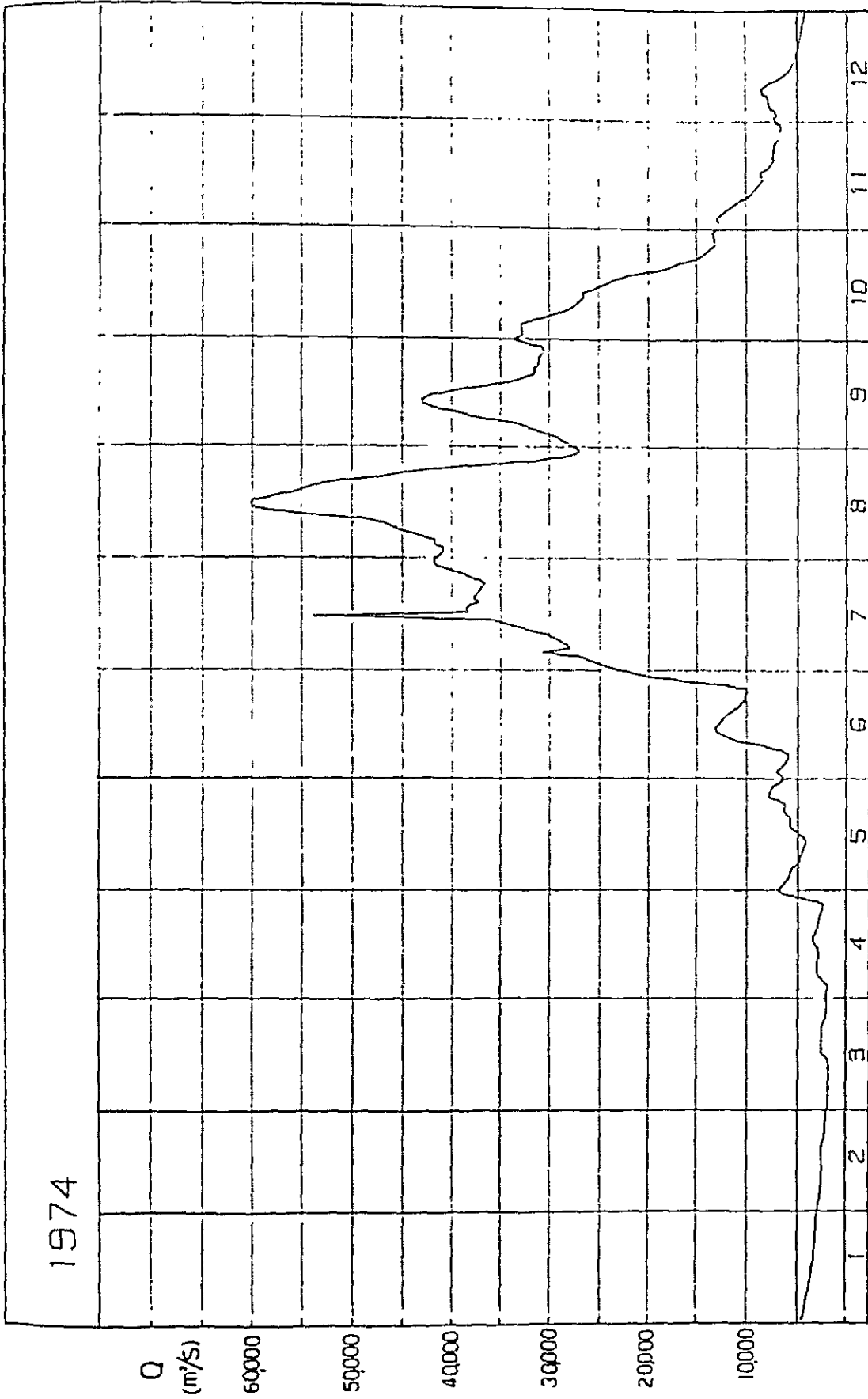


FIGURE HYDROGRAPH OF IRRAWADDY RIVER AT PROMÉ

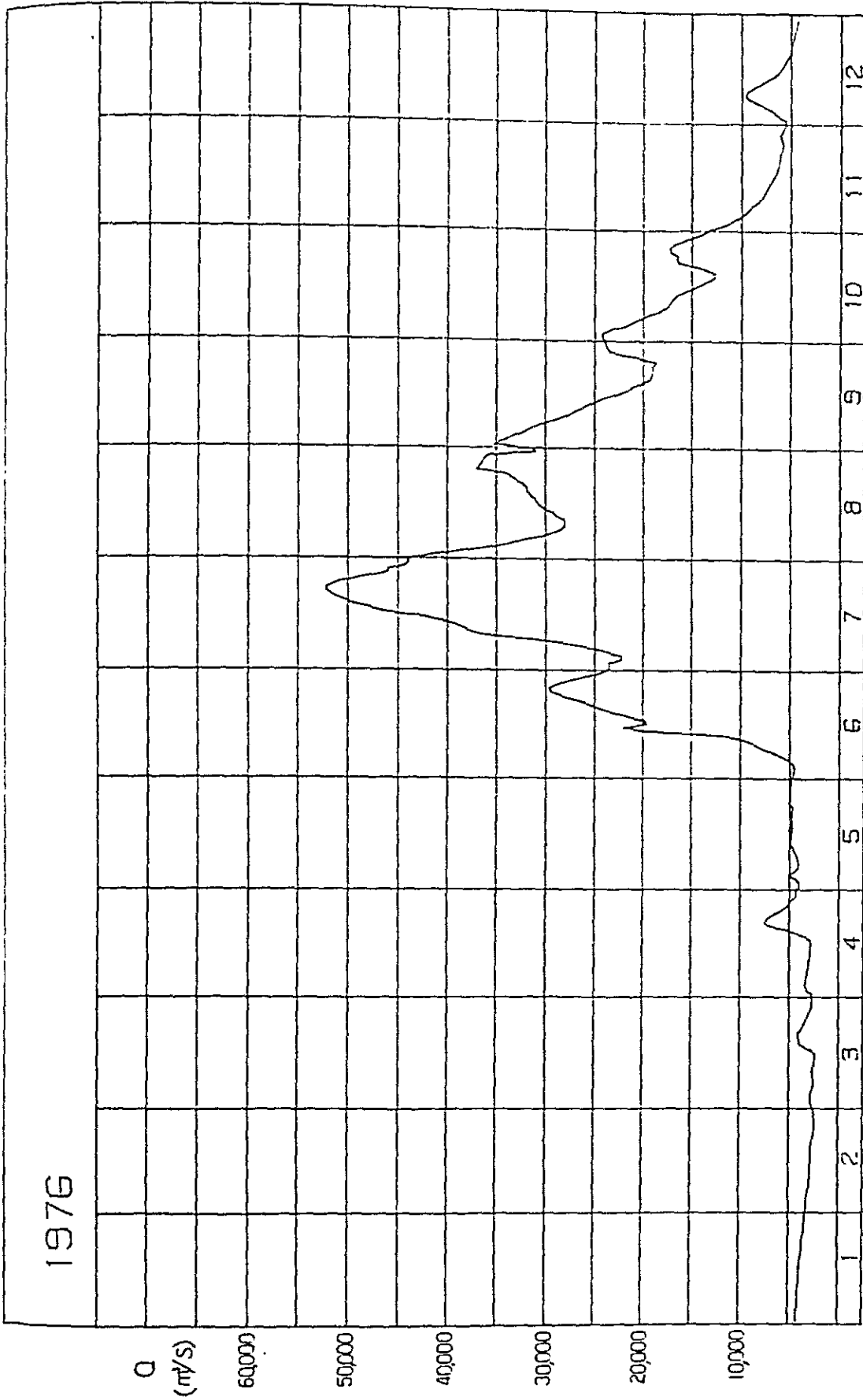


FIGURE HYDROGRAPH OF IRRAWADDY RIVER AT PROMÉ

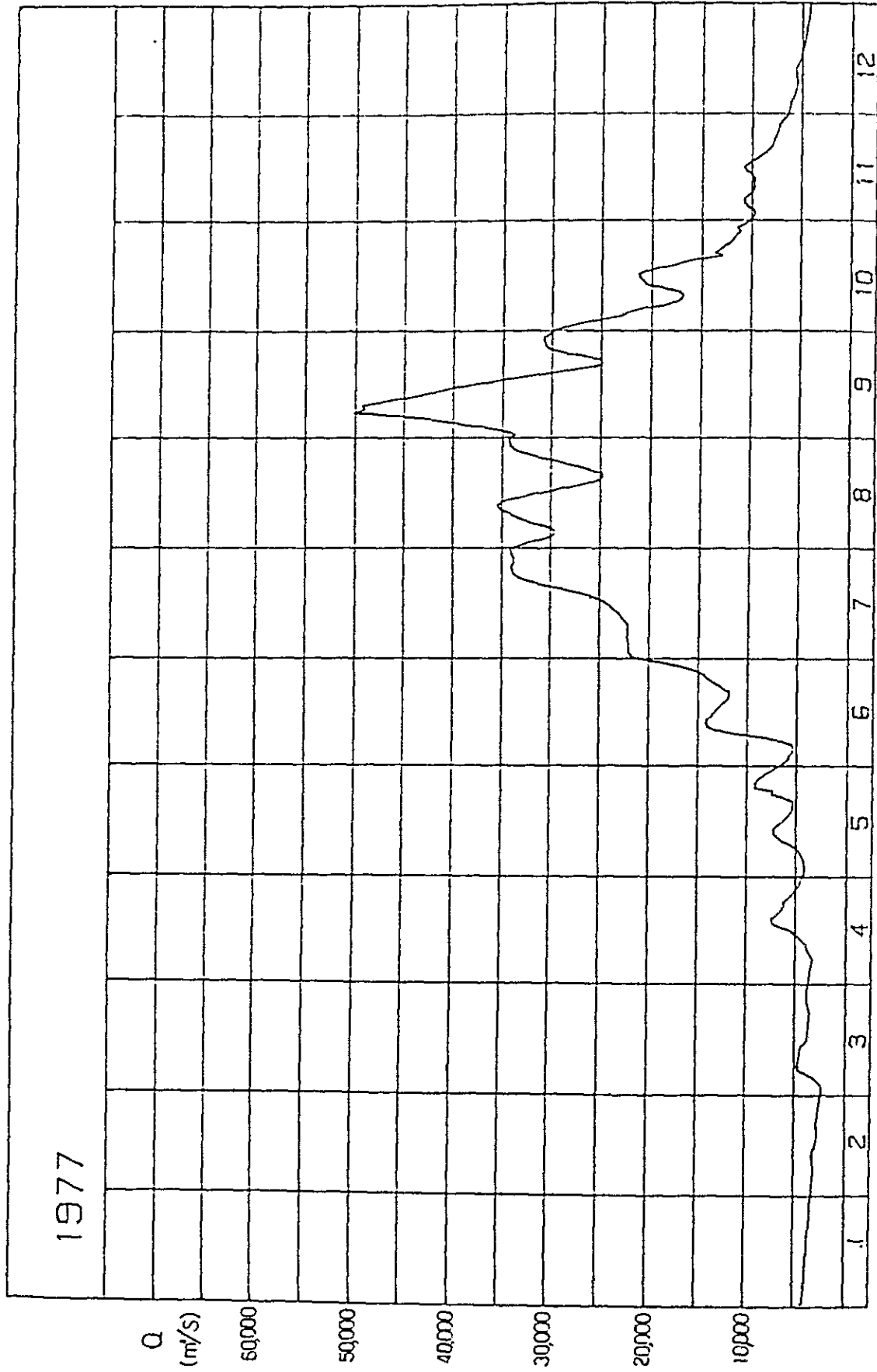


FIGURE HYDROGRAPH OF IRRAWADDY RIVER AT PROME

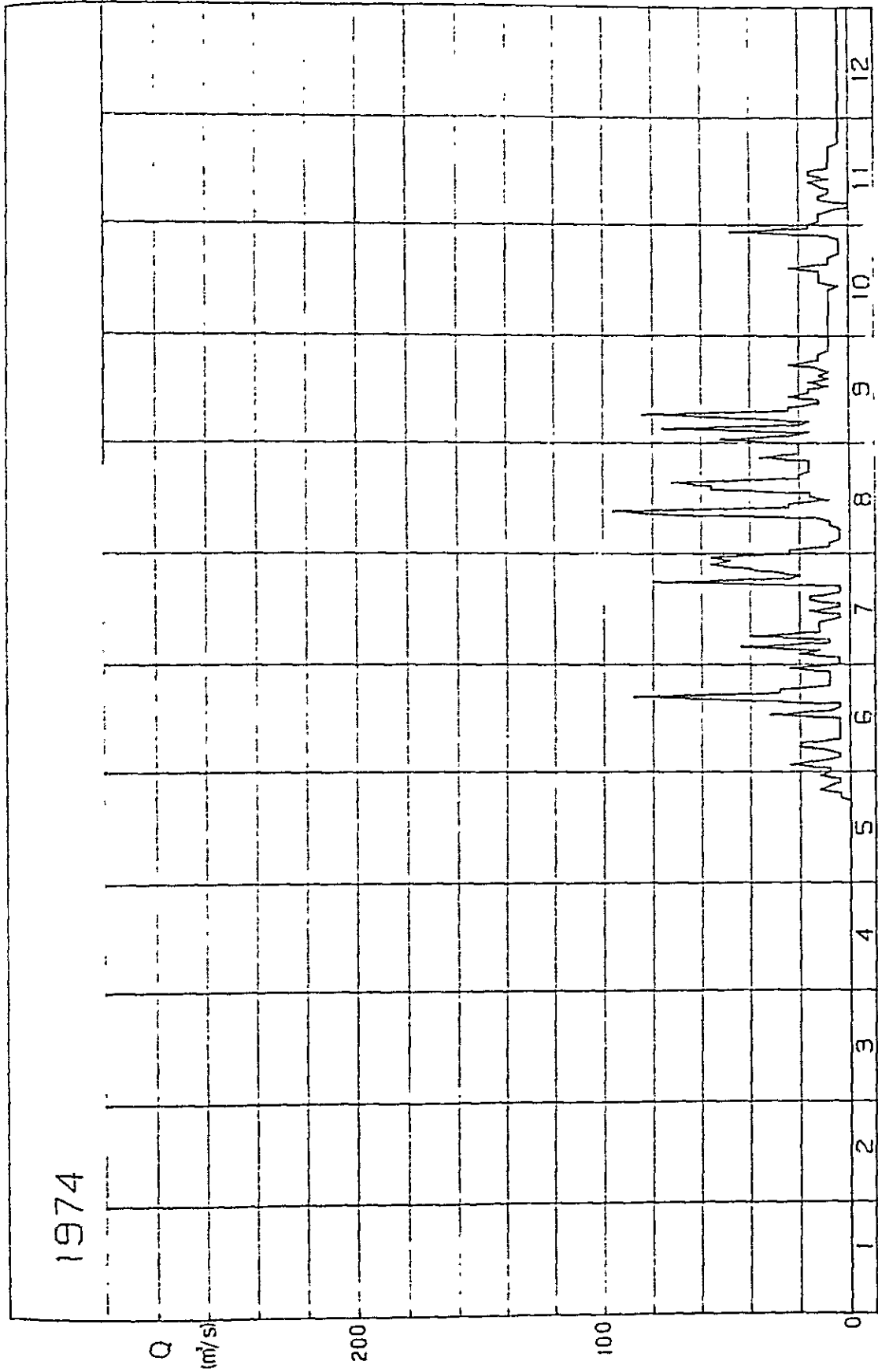
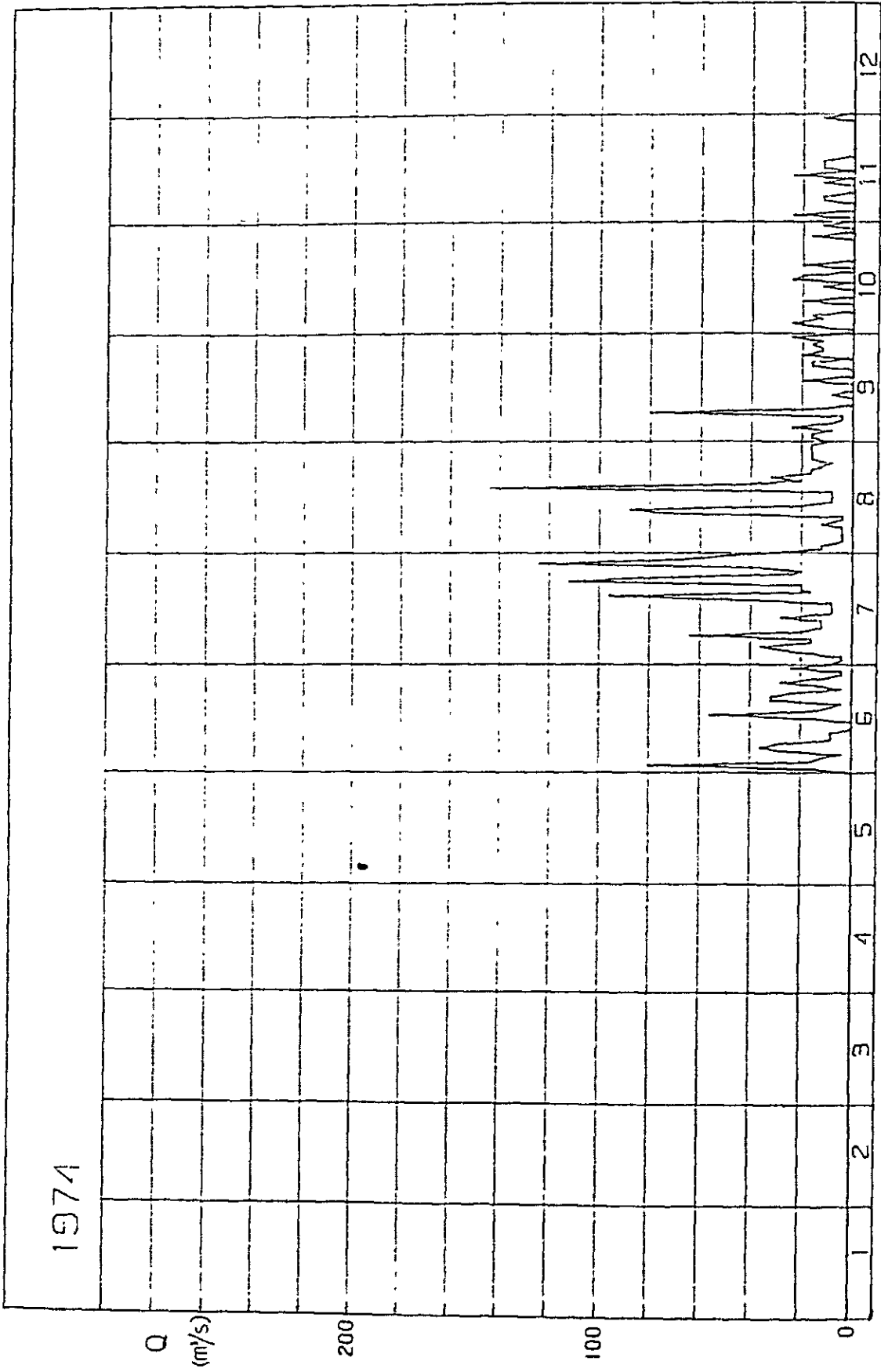


FIGURE HYDROGRAPH OF SOUTH NAWIN RIVER AT YATTHIT

APPENDIX E-6 HYDROGRAPH OF SOUTH NAWIN RIVER AT YATTHIT



APPENDIX F-7 HYDROGRAPH OF WEGY RIVER AT TEME

1974

Q
(m³/s)

200

100

0

12

11

10

9

8

7

6

5

4

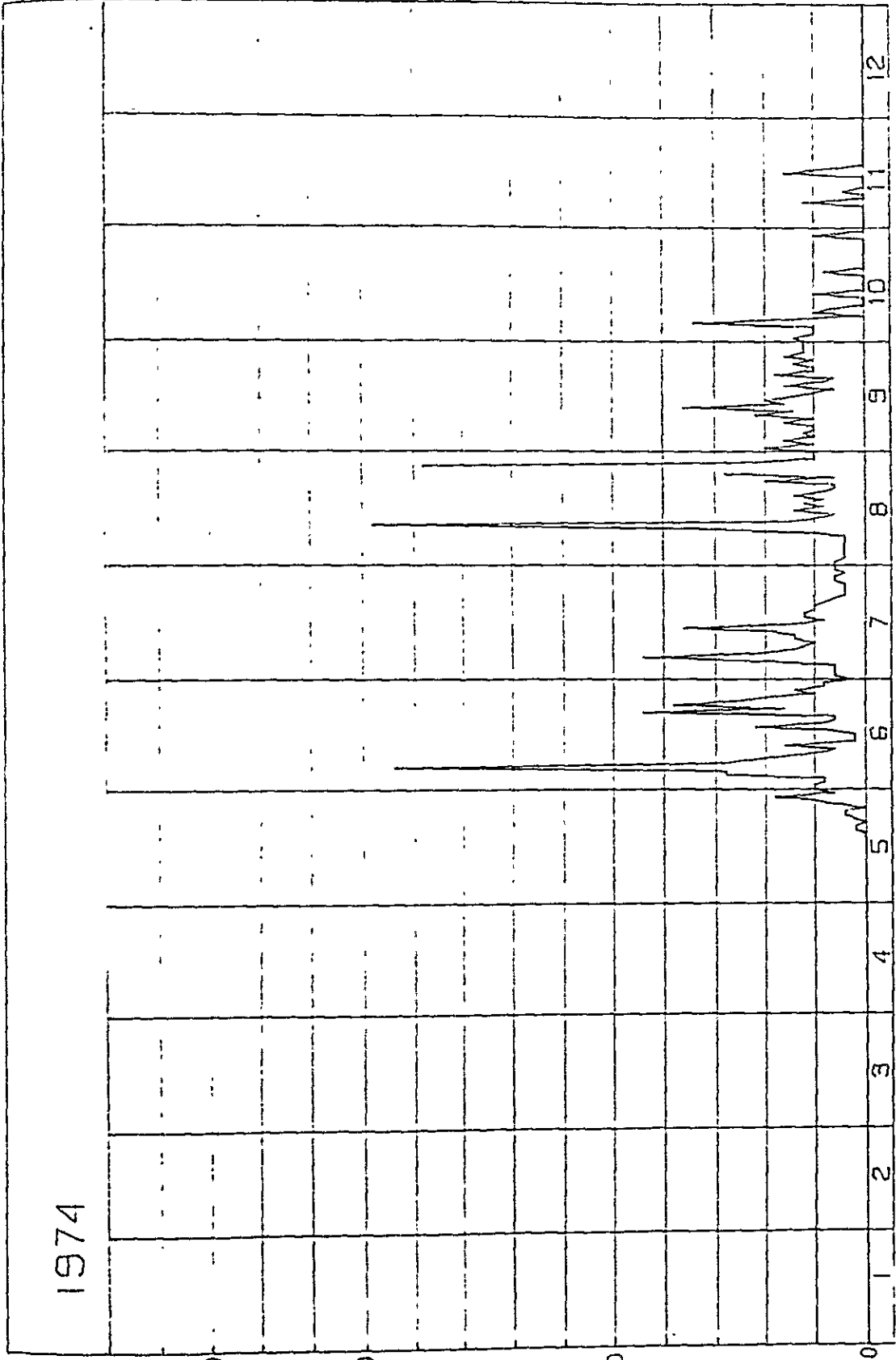
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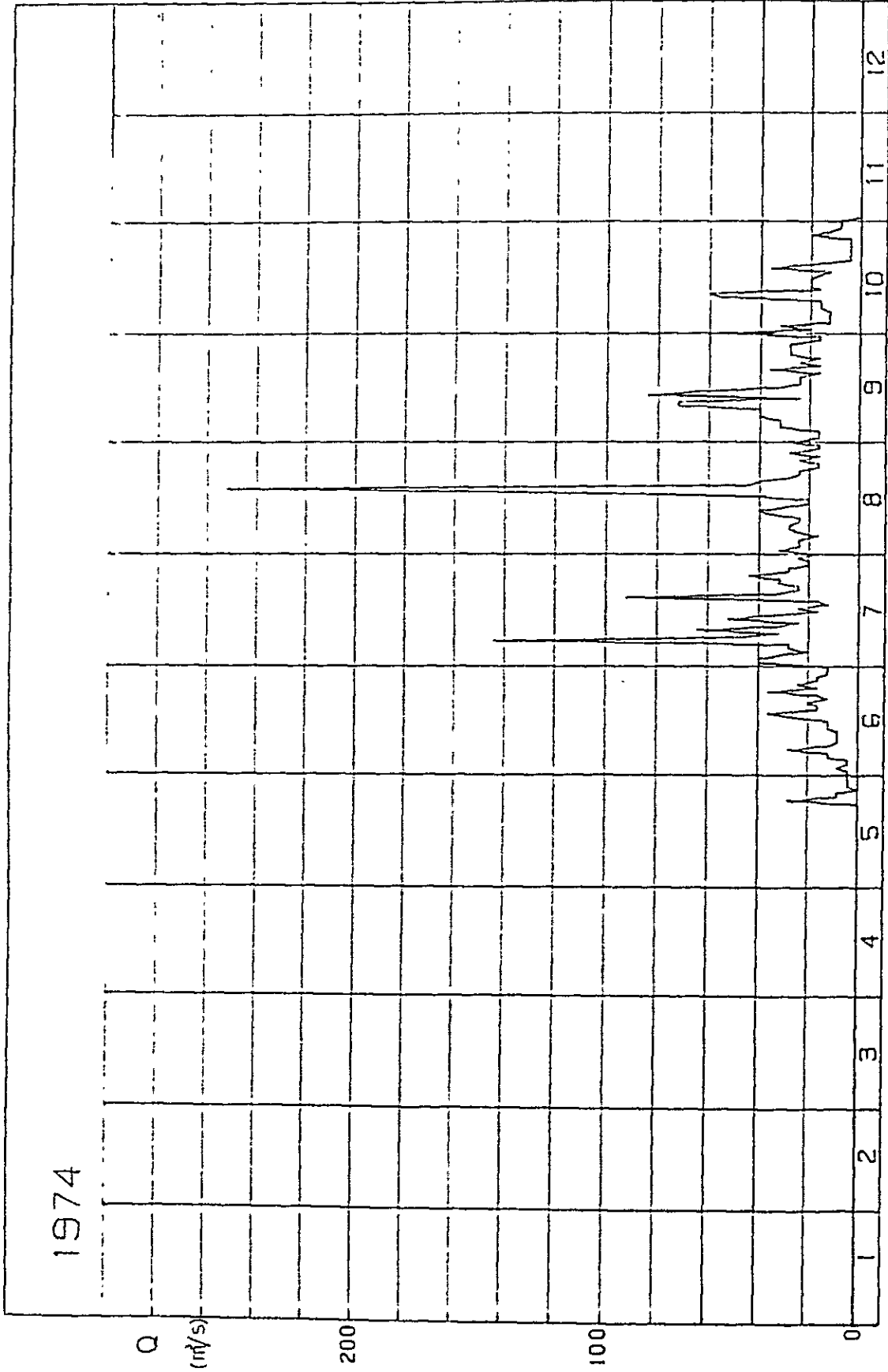
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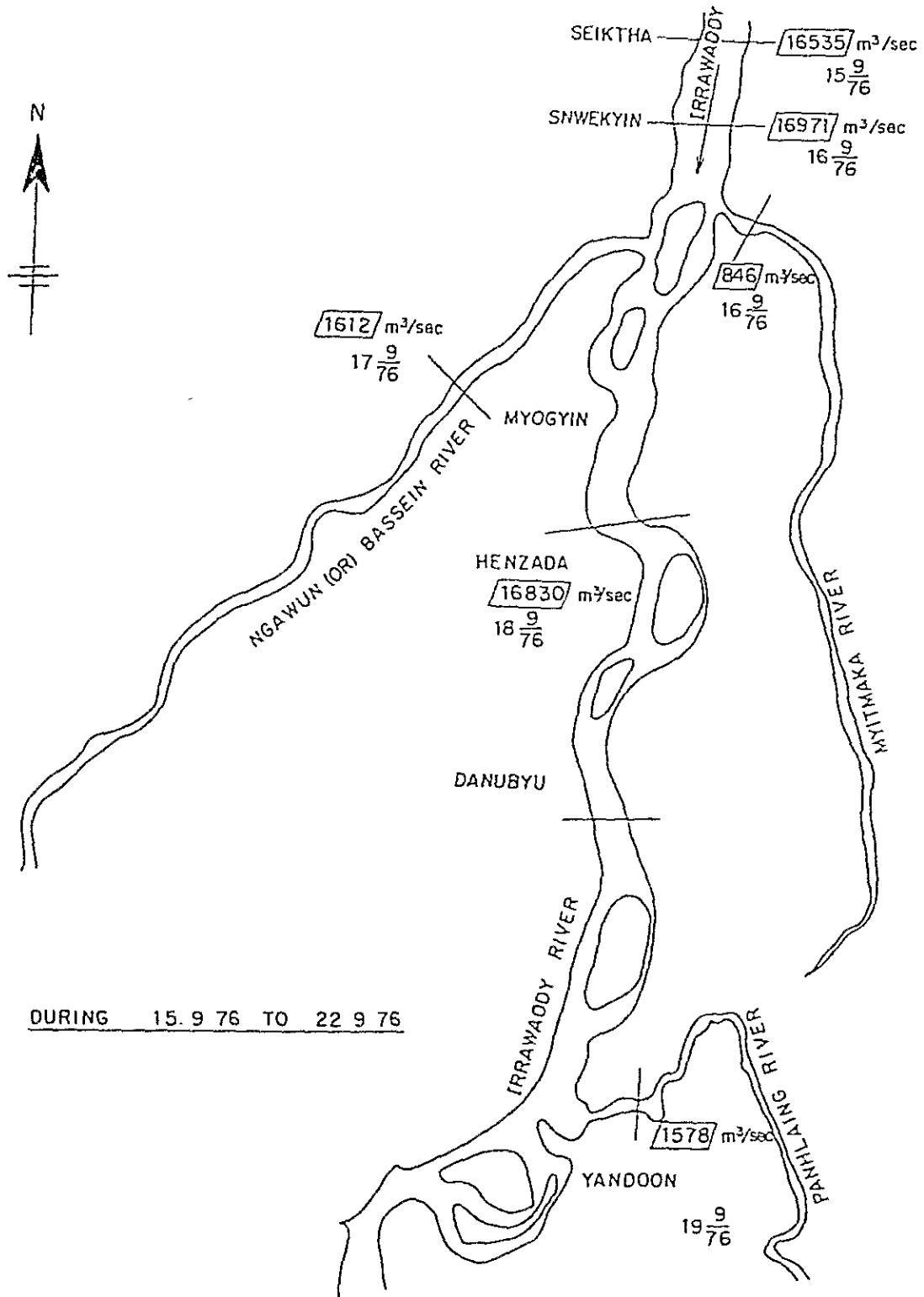
HYDROGRAPH OF KADINBILIN RIVER AT KWETMA

APPENDIX E-8

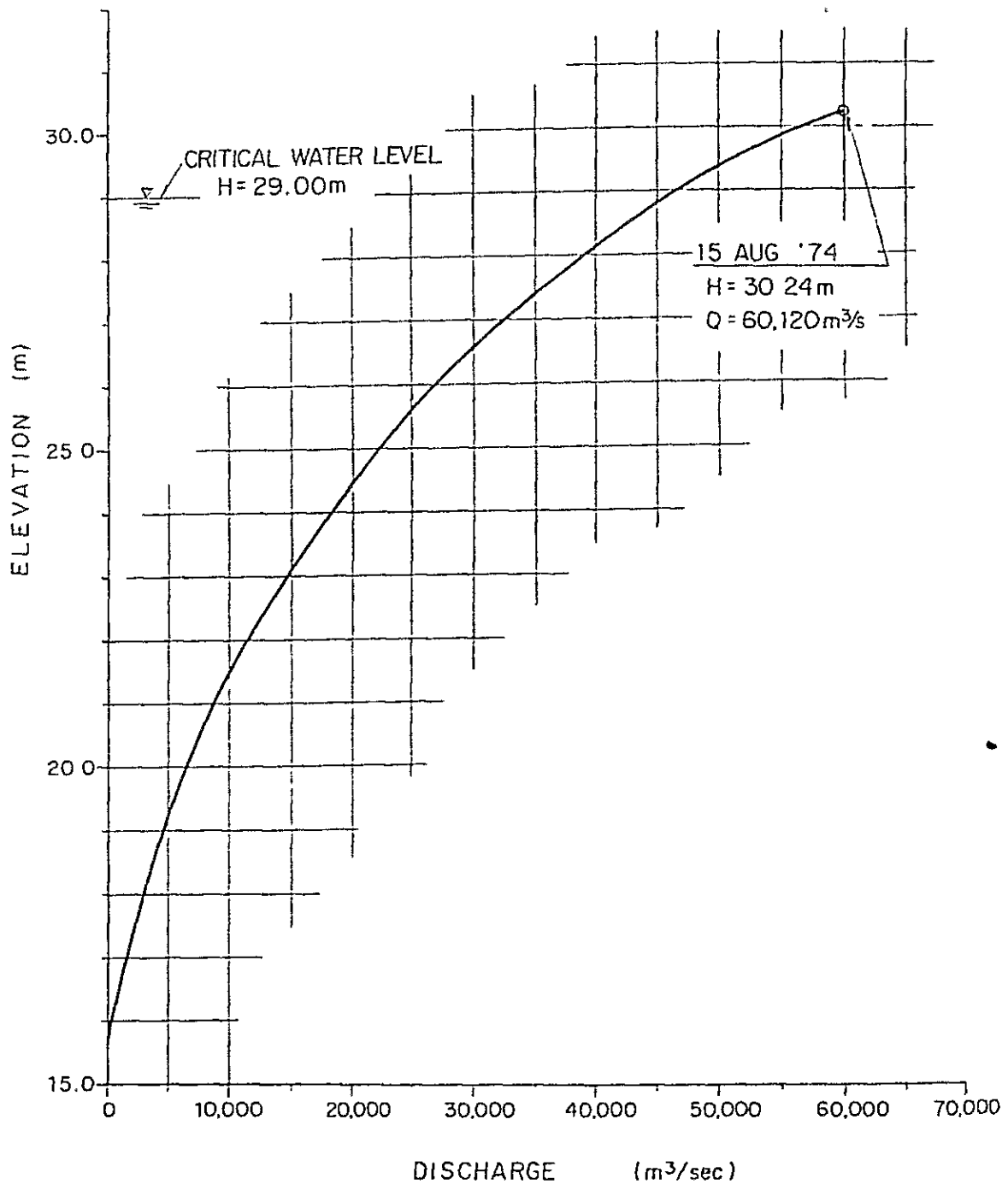




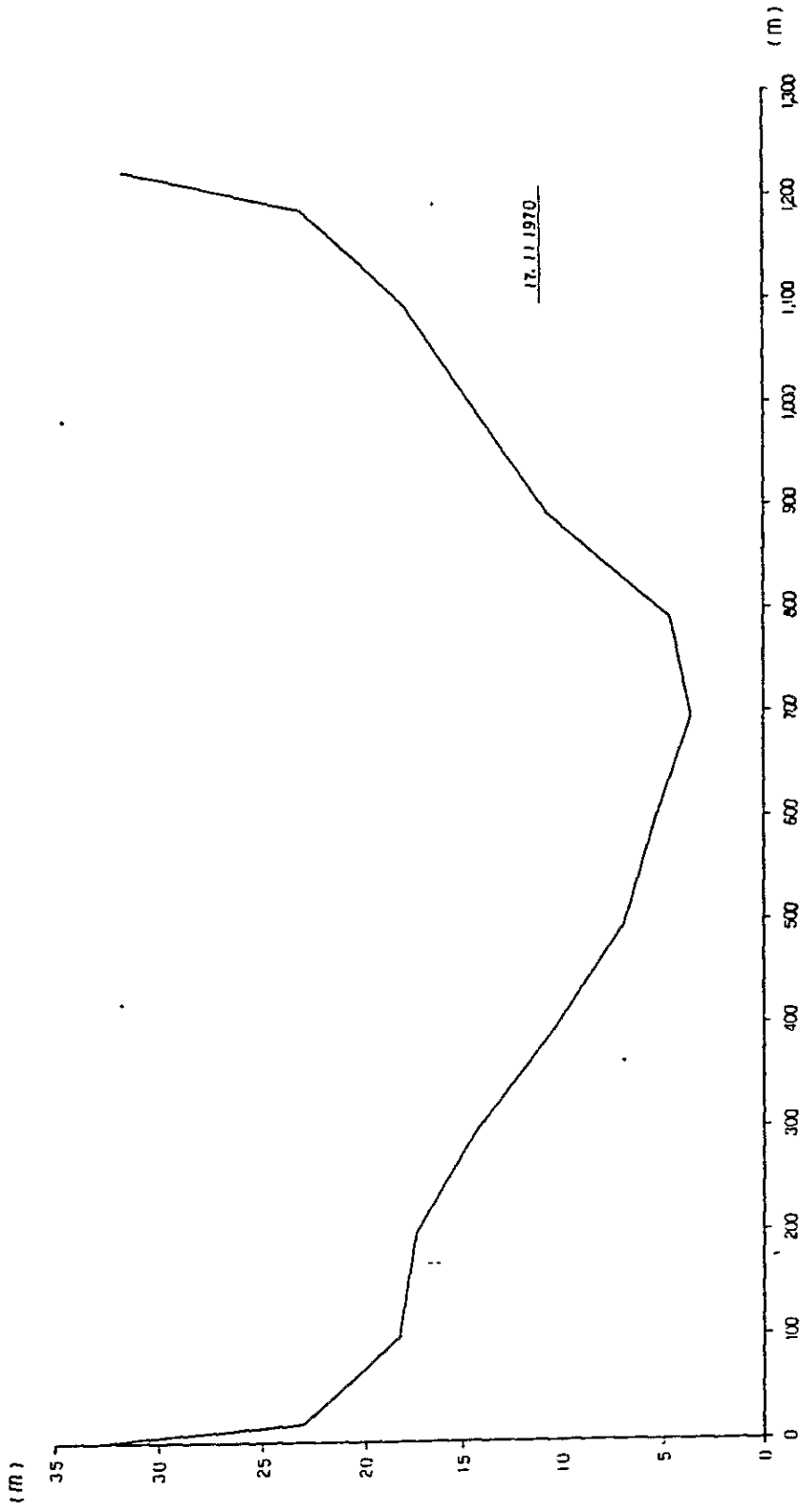
APPENDIX F-9 HYDROGRAPH OF OKKAN RIVER AT KYAUKPYINTHA



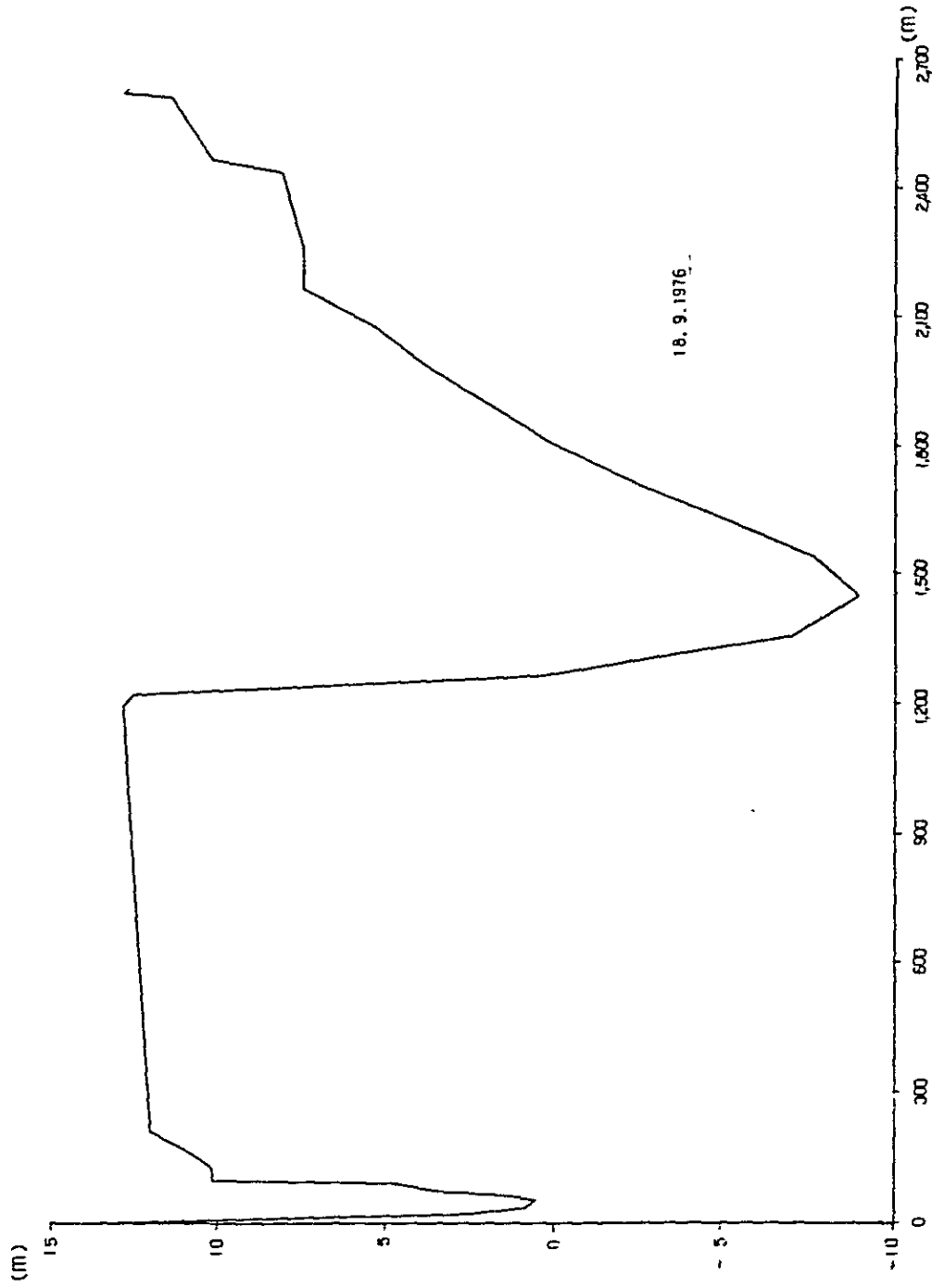
APPENDIX E-10 DISTRIBUTION OF DISCHARGE OF IRRAWADDY RIVER



APPENDIX E-11 RATING CURVE OF IRRAWADDY RIVER AT PROMÉ



APPENDIX D- 12 CROSS SECTION OF IRRAWADDY RIVER AT PROME



APPENDIX F-13 CROSS SECTION OF IRRAWADDY RIVER AT HENZADA

APPENDIX E-14 SUCCESSIVE RAINFALL (THARRAWADDY, PROME, HENZADA)

(Unit: mm)

Year	Daily Maximum			2 day Maximum		
	Tharrawaddy	Prome	Henzada	Tharrawaddy	Prome	Henzada
1947	115.32	47.75	-	132.84	66.29	-
48	121.41	65.79	83.82	151.13	151.41	119.13
49	-	-	-	-	-	-
1950	92.96	-	84.07	111.00	-	111.76
51	106.43	116.08	114.55	161.29	124.97	167.64
52	101.60	98.04	134.37	152.91	130.81	144.27
53	94.49	138.68	99.06	152.40	148.59	168.66
54	117.86	117.86	-	142.75	120.14	-
55	92.96	95.25	154.94	113.79	95.50	187.96
56	83.06	84.58	104.14	134.37	113.78	123.95
57	104.65	60.45	-	171.96	111.51	-
58	98.55	61.98	84.84	130.30	76.96	115.06
59	86.87	55.88	91.69	128.52	100.08	174.75
1960	197.10	83.82	88.14	210.82	108.20	129.29
61	150.37	112.52	231.65	174.75	135.89	278.64
62	127.25	107.95	127.76	161.29	178.05	162.56
63	122.68	68.83	118.11	186.18	91.69	199.3 ^a
64	109.73	84.58	121.92	127.51	113.28	204.47
65	93.98	99.06	-	120.40	157.99	-
66	71.88	62.99	82.80	112.27	66.55	116.33
67	-	62.99	-	-	84.07	-
68	118.62	64.01	98.04	143.00	89.15	130.05
69	69.85	115.06	152.40	107.95	150.11	168.15
1970	205.99	59.94	95.00	249.94	71.88	127.00
71	78.00	93.00	90.00	143.00	178.00	160.00
72	84.00	56.00	80.00	117.00	66.00	105.00
73	246.00	126.00	139.00	297.00	165.00	202.00
74	120.00	131.00	76.00	133.00	176.00	112.00
75	188.00	120.00	96.00	239.00	128.00	106.00
76	185.00	107.00	155.00	240.00	136.00	240.00
77	112.00	61.00	96.00	138.00	73.00	148.00

Note: - No Data

SUCCESSIVE RAINFALL (THARRAWADDY, PROME, HENZADA)

(Unit: mm)

Year	3 day Maximum			6 day Maximum		
	Tharrawaddy	Prome	Henzada	Tharrawaddy	Prome	Henzada
1947	146.30	86.36	-	223.77	126.24	-
48	159.26	120.40	152.91	277.62	151.89	263.14
49	-	-	-	-	-	-
1950	119.38	-	140.21	200.15	-	196.34
51	198.37	139.70	222.25	335.03	230.89	355.35
52	179.32	130.81	155.19	228.35	169.16	219.46
53	152.91	154.43	196.85	213.36	180.85	236.22
54	165.61	123.70	-	266.95	208.53	-
55	125.73	108.20	187.96	164.59	148.08	197.61
56	168.15	137.16	160.02	227.33	186.69	234.95
57	220.98	153.16	-	288.54	195.33	-
58	159.77	92.46	134.62	206.76	126.49	180.34
59	166.37	102.36	226.82	212.85	125.48	309.37
1960	223.77	181.10	169.67	272.03	206.50	207.77
61	180.59	143.76	300.99	232.66	177.55	354.33
62	180.85	196.60	180.09	235.20	245.36	274.32
63	227.84	126.49	250.19	291.85	151.13	336.55
64	141.99	137.16	249.43	150.62	186.69	328.42
65	155.19	159.77	-	233.68	180.34	-
66	141.73	87.12	134.62	246.63	112.78	220.22
67	-	93.98	-	-	112.17	-
68	178.05	92.20	176.53	254.51	117.35	304.29
69	124.46	221.23	170.94	181.36	316.23	234.95
1970	288.04	106.93	144.02	359.16	124.97	233.93
71	207.00	198.00	226.00	254.00	232.00	334.00
72	153.00	68.00	167.00	182.00	104.00	228.00
73	343.00	185.00	251.00	371.00	209.00	322.00
74	154.00	202.00	137.00	269.00	221.00	241.00
75	241.00	130.00	172.00	246.00	160.00	247.00
76	291.00	142.00	263.00	319.00	151.00	273.00
77	153.00	86.00	171.00	212.00	127.00	297.00

Note: - No Data

APPENDIX E-15 PROBABILITY ANALYSIS OF THE MAXIMUM WATER LEVEL AT PROME

***** THE PROBABILITY OF EXCEEDANCE ON IRRAWADDY M/P PROJECT *****

ORDER	YEAR	X	LOG(X)	X+B	LOG(X+B)	Y = LOG(X+B)	UNIT = Y+2	IRRAWADDY M/P PLOT(%)	PROJECT HAZEN PLOT(%)	X**2	X**3
1	1974	30.240	1.48058	30.240	1.48058	2.19212	95.65	97.73	914.46	27653.16	
2	1966	29.630	1.47173	29.630	1.47173	2.16599	91.30	93.18	877.94	26013.24	
3	1976	29.570	1.47085	29.570	1.47085	2.16340	86.96	88.64	874.38	25855.54	
4	1971	29.540	1.47041	29.540	1.47041	2.16211	82.61	84.09	872.61	25776.92	
5	1977	29.380	1.46805	29.380	1.46805	2.15517	78.26	79.55	863.18	25360.32	
6	1968	29.170	1.46494	29.170	1.46494	2.14604	73.91	75.00	850.89	24820.42	
7	1970	29.100	1.46389	29.100	1.46389	2.14298	69.57	70.45	846.81	24642.14	
8	1958	29.060	1.46329	29.060	1.46329	2.14123	65.22	65.91	844.68	24540.68	
9	1956	28.800	1.45939	28.800	1.45939	2.12982	60.87	61.36	829.44	23887.84	
10	1957	28.710	1.45803	28.710	1.45803	2.12586	56.52	56.82	824.26	23664.59	
11	1959	28.710	1.45803	28.710	1.45803	2.12586	52.17	52.27	824.26	23664.59	
12	1963	28.560	1.45576	28.560	1.45576	2.11923	47.83	47.73	815.67	23295.63	
13	1961	28.280	1.45148	28.280	1.45148	2.10679	43.48	43.18	799.76	22617.16	
14	1962	28.220	1.45056	28.220	1.45056	2.10411	39.13	38.64	796.37	22473.48	
15	1965	28.080	1.44840	28.080	1.44840	2.09785	34.78	34.09	789.49	22140.66	
16	1969	28.040	1.44778	28.040	1.44778	2.09606	30.43	29.55	786.24	22046.20	
17	1975	27.980	1.44685	27.980	1.44685	2.09337	26.09	25.00	782.88	21904.98	
18	1972	27.940	1.44623	27.940	1.44623	2.09157	21.74	20.95	780.64	21811.15	
19	1973	27.930	1.44607	27.930	1.44607	2.09112	17.39	15.91	780.08	21787.75	
20	1964	27.680	1.44217	27.680	1.44217	2.07984	13.04	11.36	766.18	21207.91	
21	1967	27.550	1.44012	27.550	1.44012	2.07395	8.70	6.82	759.00	20910.48	
22	1960	27.430	1.43823	27.430	1.43823	2.06849	4.35	2.27	752.40	20638.44	

TOTAL
 MEAN
 XM = 629.598 32.04272 32.04272 46.67287 18030.41 516712.75
 RM = 28.618 1.45649 YM = 1.45649 2.12149 = YVM 819.56 23486.94
 R = ROOT((2*N/(N-1))*((YVM-YM*YM))) = 0.01714
 SX = ROOT((XXM-XM*XM)) = 0.75390
 CS = ((XXXM-3*XXM*XM+2*XM**3)/(5*XM**3)) = 0.17321

***** THE PROBABILITY OF EXCEEDANCE ON IRAWADDY H/P PROJECT *****

X : MAXIMUM WATER LEVEL AT PRDME UNIT= (M)

***** B - V A L U E *****

ORDER	XI	XS	XI*XS	XI*XS-XI**2	XI+XS	2*XD-(XI+XS)	BI
1	30.240	27.430	829.483	57.670	11.070	-0.454	-24.375
2	29.630	27.550	816.306	57.180	-2.107	0.036	-58.776
						TOTAL BI =	-83.151
						MEAN B =	-41.575
						B =	0.0

***** THE PROBABLE VALUES BY 'IMAI' METHOD *****

LOG(X + 0.0) = 1.45649 + 0.01714 * E

RETURN PERIOD (YEAR)	E	R	E*R	A*YH+E*R	C=10**A	B	X=C-B
2	0.0	0.0171	0.0	1.4565	28.608	0.0	28.608
3	0.3045	0.0171	0.0052	1.4617	28.954	0.0	28.954
4	0.4769	0.0171	0.0082	1.4647	29.151	0.0	29.151
5	0.5951	0.0171	0.0102	1.4667	29.288	0.0	29.288
6	0.6858	0.0171	0.0118	1.4682	29.393	0.0	29.393
7	0.7547	0.0171	0.0129	1.4694	29.473	0.0	29.473
8	0.8134	0.0171	0.0139	1.4704	29.541	0.0	29.541
9	0.8634	0.0171	0.0148	1.4713	29.599	0.0	29.599
10	0.9062	0.0171	0.0155	1.4720	29.649	0.0	29.649
11	0.9442	0.0171	0.0162	1.4727	29.694	0.0	29.694
12	0.9780	0.0171	0.0168	1.4732	29.734	0.0	29.734
13	1.0084	0.0171	0.0173	1.4738	29.769	0.0	29.769
14	1.0361	0.0171	0.0178	1.4742	29.802	0.0	29.802
15	1.0614	0.0171	0.0182	1.4747	29.832	0.0	29.832
20	1.1630	0.0171	0.0199	1.4764	29.951	0.0	29.951
25	1.2380	0.0171	0.0212	1.4777	30.040	0.0	30.040
30	1.2967	0.0171	0.0222	1.4787	30.110	0.0	30.110
35	1.3453	0.0171	0.0231	1.4795	30.168	0.0	30.168
40	1.3860	0.0171	0.0238	1.4802	30.216	0.0	30.216
45	1.4213	0.0171	0.0244	1.4808	30.258	0.0	30.258
50	1.4520	0.0171	0.0249	1.4814	30.295	0.0	30.295
60	1.5047	0.0171	0.0258	1.4823	30.358	0.0	30.358
70	1.5481	0.0171	0.0265	1.4830	30.410	0.0	30.410
80	1.5849	0.0171	0.0272	1.4836	30.454	0.0	30.454
90	1.6168	0.0171	0.0277	1.4842	30.493	0.0	30.493
100	1.6450	0.0171	0.0282	1.4847	30.527	0.0	30.527
150	1.7499	0.0171	0.0300	1.4865	30.653	0.0	30.653
200	1.8215	0.0171	0.0312	1.4877	30.740	0.0	30.740
250	1.8753	0.0171	0.0321	1.4886	30.805	0.0	30.805
300	1.9184	0.0171	0.0329	1.4894	30.858	0.0	30.858

***** THE PROBABILITY OF EXCEEDANCE ON IRRAWADDY M/P PROJECT *****
X: DAILY MAXIMUM RAINFALL AT THARRAWADDY UNIT-1 M M P.

ORDER	XJ	X5	X1XS	X1XS-XU**2	X1XS	2*XO-(X1+XS)	B1
1	246.000	69.850	17183.094	315.850	4126.848	-87.322	-47.260
2	205.994	71.882	14807.250	277.876	1751.004	-49.348	-35.483
3	197.104	78.000	15374.105	275.104	2317.859	-46.576	-49.765
						TOTAL B1 =	-132.508
						MEAN B =	-44.169
						B =	-44.169

***** THE PROBABLE VALUES BY 'LMAI' METHOD *****

RETURN- PERIOD (YEAR)	E	H	E+H	A=YH+E*H	C=10**A	B	X=C-B
2	0.0	0.3188	0.0	1.8242	66.706	-44.169	110.876
5	0.5951	0.3188	0.1897	2.0139	103.250	-44.169	147.420
10	0.9062	0.3188	0.2889	2.1131	129.740	-44.169	173.909
30	1.2967	0.3188	0.4134	2.2376	172.807	-44.169	216.979
50	1.4520	0.3188	0.4629	2.2871	193.677	-44.169	237.847
100	1.6450	0.3188	0.5244	2.3486	223.156	-44.169	267.326
200	1.8215	0.3188	0.5807	2.4049	254.026	-44.169	298.196
500	2.0350	0.3188	0.6488	2.4729	297.129	-44.169	341.298
1000	2.1850	0.3188	0.6966	2.5208	331.716	-44.169	375.885

APPENDIX E-17 PROBABILITY ANALYSIS OF DAILY MAXIMUM RAINFALL AT PROME

***** THE PROBABILITY OF EXCEEDANCE ON IRRAWADDY M/P PROJECT *****

X: DAILY MAXIMUM RAINFALL AT PROME UNIT - (M M)

CHDEH	YEAR	X	LOG(X)	X+8	Y = LOG(X+8)	YY = Y**2	THOMAS PLOT(Z)	HAZEN PLOT(Z)	X**2	X**3
1	1953	138.000	2.1393	146.000	2.1643	4.6636	96.67	98.28	19233.24	2667341.00
2	1974	131.000	2.1172	139.000	2.1428	4.5826	93.33	94.83	17161.00	2248091.00
3	1973	126.000	2.1003	134.000	2.1276	4.5169	90.00	91.38	15876.00	2000376.00
4	1975	120.000	2.0791	128.000	2.0994	4.4094	86.67	87.93	14400.00	1728000.00
5	1954	117.000	2.0713	125.000	2.0944	4.3894	83.33	84.48	13890.03	1637022.00
6	1951	116.000	2.0647	124.000	2.0878	4.3557	80.00	81.03	13474.09	1564045.00
7	1969	115.000	2.0609	123.000	2.0842	4.3435	76.67	77.59	13239.25	1523334.00
8	1961	112.500	2.0512	120.500	2.0744	4.3039	73.33	74.14	12661.19	1424662.00
9	1962	107.950	2.0322	115.950	2.0542	4.2190	70.00	70.69	11653.19	1257961.00
10	1976	107.000	2.0293	115.000	2.0536	4.2159	66.67	67.24	11449.00	1225043.00
11	1965	99.000	1.9959	107.000	2.0185	4.0744	63.33	63.79	9812.88	972063.06
12	1952	98.000	1.9912	106.000	2.0142	4.0572	60.00	60.34	9612.62	942459.56
13	1955	95.250	1.9788	103.250	2.0023	4.0094	56.67	56.90	9072.55	864160.50
14	1971	93.000	1.9684	101.000	1.9925	3.9701	53.33	53.45	8649.00	804357.00
15	1956	84.582	1.9272	92.582	1.9536	3.8167	50.00	50.00	7154.11	605108.63
16	1964	84.582	1.9272	92.582	1.9536	3.8167	46.67	46.55	7154.11	605108.63
17	1960	83.820	1.9233	91.820	1.9499	3.8023	43.33	43.10	7025.79	588901.13
18	1963	81.034	1.8980	89.034	1.9416	3.7787	40.00	39.66	4738.12	326143.44
19	1948	69.786	1.8101	77.786	1.8407	3.3838	36.67	36.21	4327.79	284708.06
20	1968	64.001	1.8062	72.001	1.8343	3.3641	33.33	32.76	4097.02	262241.94
21	1966	62.942	1.7920	70.942	1.8343	3.3641	30.00	29.31	3967.99	249951.44
22	1967	62.942	1.7920	70.942	1.8343	3.3641	26.67	25.86	3967.99	249951.44
23	1958	61.576	1.7722	69.576	1.8214	3.3407	23.33	22.41	3841.02	238051.13
24	1977	61.000	1.7833	69.000	1.8214	3.3407	20.00	18.97	3721.00	226981.00
25	1957	60.452	1.7814	68.452	1.8188	3.3046	16.67	15.52	3654.44	220918.25
26	1970	59.944	1.7775	67.944	1.8145	3.2925	13.33	12.07	3593.28	215395.56
27	1972	56.000	1.7481	64.000	1.8145	3.2925	10.00	8.62	3136.00	175616.00
28	1959	55.880	1.7476	63.880	1.8145	3.2925	6.67	5.17	3122.57	174489.19
29	1947	47.752	1.6789	55.752	1.7246	2.9747	3.33	1.72	2280.25	108886.50
TOTAL		2558.103	59.83403	56.63591	1.11106532	245964.88			245964.88	25391232.00
MEAN		88.210	1.92511	3.82984	YHM	875559.69			8481.55	

YHM = 1.95298

YM = 0.18078

YMH = 26.46629

YMX = 0.20610

***** THE PROBABILITY OF EXCEEDANCE ON IRRAWADDY M/P PROJECT *****
X: DAILY MAXIMUM RAINFALL AT PROME UNIT-(M M)

INDEX	X1	X5	XI*XS	XI*XS-KU**2	XI+XS	Z*XO-(X(+XS)	B1
1	138.684	47.752	6622.434	186.436	-467.152	-18.037	25.900
2	131.000	55.880	7320.273	186.880	230.688	-18.481	-12.483
3	126.000	56.000	7056.000	182.000	-33.586	-13.601	2.469
						TOTAL B1 =	15.887
						MEAN B =	5.296
						B =	5.296

***** THE PROBABLE VALUES BY 'L'AI' METHOD *****

RETURN- PERIOD (YEAR)	E	R	E*R	A=YM+E*R	C=10**A	B	X=C-B
2	0.0	0.1808	0.0	1.9530	89.735	5.296	84.439
5	0.5451	0.1808	0.1076	2.0605	114.959	5.296	109.664
10	0.9062	0.1808	0.1638	2.1168	130.854	5.296	125.558
30	1.2967	0.1808	0.2344	2.1874	153.950	5.296	148.654
50	1.4520	0.1808	0.2625	2.2155	164.231	5.296	158.936
100	1.6450	0.1808	0.2974	2.2503	177.970	5.296	172.674
200	1.8215	0.1808	0.3293	2.2823	191.938	5.296	186.242
500	2.0350	0.1808	0.3679	2.3209	209.340	5.296	204.044
1000	2.1850	0.1808	0.3950	2.3480	222.828	5.296	217.532

APPENDIX E-18 PROBABILITY ANALYSIS OF DAILY MAXIMUM RAINFALL AT HENZADA

***** THE PROBABILITY OF EXCEEDANCE ON IRRAWADDY M/P PROJECT *****

X: DAILY MAXIMUM RAINFALL AT HENZADA UNIT: M M I

ORDER	YEAR	X	LOG(X)	X+8	Y = LOG(X+8)	YY = Y*2	THOMAS PLOT(Z)	HAZEN PLOT(Z)	X**2	X**3
1	1961	231.048	2.36493	178.194	2.25089	5.06651	96.15	98.00	53660.77	12430407.00
2	1976	155.000	2.19033	101.546	2.00666	4.02669	92.31	94.00	24025.00	3723875.00
3	1955	154.940	2.19016	101.486	2.00640	4.02566	88.46	90.00	24006.39	3719548.00
4	1969	152.400	2.18298	98.946	1.99540	3.98160	86.62	86.00	23225.75	3539602.00
5	1973	139.000	2.14301	85.546	1.93220	3.73339	80.77	82.00	19321.00	2685619.00
6	1952	134.366	2.12829	80.912	1.90801	3.64050	76.92	78.00	18054.21	2425871.00
7	1962	127.762	2.10640	74.308	1.87103	3.50076	73.08	74.00	16323.12	2085473.00
8	1964	121.920	2.08607	68.466	1.83547	3.36896	69.23	70.00	14864.48	1812276.00
9	1963	118.110	2.07229	64.656	1.81061	3.27829	65.38	66.00	13949.96	1647629.00
10	1951	114.554	2.05901	61.100	1.78624	3.18993	61.54	62.00	13122.61	1503247.00
11	1956	104.140	2.01762	50.686	1.70488	2.90663	57.69	58.00	10845.13	1129411.00
12	1953	99.060	1.99590	45.606	1.65902	2.75234	53.85	54.00	9812.88	972063.06
13	1968	98.044	1.99142	44.590	1.64923	2.71997	50.00	50.00	9612.62	942459.56
14	1975	96.000	1.98227	42.546	1.62885	2.65316	46.15	46.00	9216.00	884736.00
15	1977	96.000	1.98227	42.546	1.62885	2.65316	42.31	42.00	9216.00	884736.00
16	1970	94.994	1.97771	41.542	1.61948	2.61949	38.46	38.00	9024.23	857265.88
17	1959	91.694	1.96234	38.240	1.58251	2.50434	34.62	34.00	8407.78	770942.81
18	1971	90.000	1.95424	36.546	1.56283	2.44245	30.77	30.00	8100.00	729000.00
19	1960	88.138	1.94516	34.684	1.54012	2.37198	26.92	26.00	7768.30	684682.25
20	1958	84.836	1.92858	31.382	1.49667	2.24003	23.08	22.00	7197.14	610576.38
21	1950	84.074	1.92466	30.620	1.48600	2.20819	19.23	18.00	7068.43	594270.94
22	1948	83.320	1.92135	30.366	1.48238	2.19745	15.38	14.00	7025.79	588901.13
23	1966	82.804	1.91805	29.350	1.46760	2.15385	11.54	10.00	6856.50	567745.06
24	1972	80.000	1.90309	26.546	1.42399	2.02775	7.69	6.00	6400.00	512000.00
25	1974	76.000	1.88081	22.546	1.35306	1.83077	3.85	2.00	5776.00	438976.00

TOTAL XM = 2799.304 50.81073 42.68709 74.09370 342879.44 46741168.00
 MEAN KM = 111.972 2.03243 1.70748 2.96375 = 13715.18 1869646.00

K = MOD((2*N/(N-1))*((YH-YM)*YH)) = 0.31705

SX = ROOT(XM-XM*XM) = 34.31340

CS = (1+XXM-3*XXM*XM+2*XM**3)/(1SX**3) = 1.73890

***** THE PROBABILITY OF EXCEEDANCE ON IRRAWADDY M/P PROJECT *****
 X: DAILY MAXIMUM RAINFALL AT HENZADA UNIT-j (M M)

CRITER	X1	X2	X1*X2	X1*X2-XU**2	X1*X2	2*XU-(X1+X2)	BI
1	231.648	76.000	17605.242	307.648	5994.594	-92.142	-65.058
2	155.000	80.000	12400.000	235.000	789.352	-19.495	-40.491
3	154.940	82.804	12829.841	237.744	1218.992	-22.238	-54.815
TOTAL BI =							-100.363
MEAN B =							-53.454
B =							-53.454

***** THE PROBABLE VALUES BY METHOD *****

RETURN- PERIOD (YEAR)	F	R	E**	A+YH+E**R	C=10**A	B	X=C-B
2	0.0	0.3170	0.0	1.7075	50.940	-53.454	104.444
5	0.5451	0.3170	0.1887	1.8982	70.733	-53.454	132.188
10	0.9062	0.3170	0.2873	1.9948	98.808	-53.454	152.262
30	1.2467	0.3170	0.4111	2.1186	131.401	-53.454	184.855
50	1.4520	0.3170	0.4604	2.1678	147.176	-53.454	200.630
100	1.6450	0.3170	0.5215	2.2290	169.444	-53.454	222.898
200	1.8215	0.3170	0.5775	2.2850	192.745	-53.454	246.200
500	2.0350	0.3170	0.6452	2.3527	225.455	-53.454	278.909
1000	2.1850	0.3170	0.6927	2.4002	251.322	-53.454	304.776

APPENDIX E-19 PROBABILITY ANALYSIS OF SUCCESSIVE 2 DAYS MAXIMUM RAINFALL AT THARRAWADDY

***** THE PROBABILITY OF EXCEEDANCE ON IRRAWADDY M/P PROJECT *****

X: SUCCESSIVE 2 DAY MAXIMUM RAINFALL AT THARRAWADDY UNIT = M M I

URGER	YEAR	X	LOG(X)	X+U	Y = LOG(X+U)	YY = Y*2	THOMAS PLU(T)	HAZEN PLU(T)	X**2	X**3
1	1973	297.000	2.47276	214.655	2.33174	5.43702	96.67	98.28	88209.00	26198064.00
2	1970	249.236	2.39783	167.591	2.22425	4.94730	93.33	94.83	62467.97	15612991.00
3	1976	240.000	2.38021	157.655	2.19771	4.84992	90.00	91.38	57600.00	13824000.00
4	1975	239.000	2.37840	156.455	2.19495	4.81778	86.67	87.93	57121.00	13651919.00
5	1960	210.820	2.32391	128.475	2.10882	4.44712	83.33	84.48	44445.05	9369902.00
6	1963	186.182	2.26994	103.837	2.01635	4.06568	80.00	81.03	34663.71	6453757.00
7	1961	174.752	2.24242	92.407	1.96571	3.86400	76.67	77.59	30538.24	5336617.00
8	1957	171.958	2.23542	89.213	1.95237	3.81176	73.33	74.14	29569.54	5084716.00
9	1951	161.290	2.20761	78.945	1.89733	3.59985	70.00	70.69	26014.45	4195868.00
10	1962	161.290	2.20761	78.945	1.89733	3.59985	66.67	67.24	26014.45	4195868.00
11	1952	152.908	2.18443	70.563	1.84858	3.41724	63.33	63.79	23380.84	3575117.00
12	1953	152.400	2.18298	70.055	1.84544	3.40565	60.00	60.34	23225.75	3539602.00
13	1948	151.130	2.17935	68.785	1.83750	3.37639	56.67	56.90	22840.26	3451847.00
14	1968	143.022	2.15534	60.655	1.78287	3.17862	53.33	53.45	20449.00	2924327.00
15	1971	142.748	2.15457	60.403	1.78106	3.17218	50.00	50.00	20449.00	2924327.00
16	1954	138.000	2.13988	55.655	1.74551	3.04679	46.67	46.55	20376.98	2908771.00
17	1977	134.366	2.12829	52.021	1.71618	2.94528	43.33	43.10	19044.00	2628072.00
18	1974	133.000	2.12385	50.655	1.70463	2.90575	40.00	39.66	18054.21	2425870.00
19	1947	132.842	2.12333	50.497	1.70327	2.90112	36.67	36.21	17689.00	2352637.00
20	1958	130.402	2.11495	47.957	1.68095	2.82527	33.33	32.76	17646.98	2344259.00
21	1959	128.544	2.10998	46.179	1.66445	2.77039	30.00	29.31	16978.60	2212344.00
22	1964	127.508	2.10554	45.163	1.65479	2.73832	26.67	25.86	16518.41	2123011.00
23	1965	120.396	2.08061	38.051	1.58037	2.49757	23.33	22.41	16258.27	2073059.00
24	1965	117.000	2.06814	34.655	1.53977	2.37089	20.00	18.97	14495.19	1745162.00
25	1972	113.772	2.05611	31.447	1.49758	2.24276	16.67	15.52	13689.00	1601613.00
26	1955	112.268	2.05026	29.923	1.47601	2.17861	13.33	12.07	12948.61	1473447.00
27	1966	110.998	2.04531	28.653	1.45718	2.12336	10.00	8.62	12604.09	1415035.00
28	1950	107.750	2.03322	25.605	1.40833	1.98340	6.67	5.17	12320.54	1367555.00
29	1969	107.750	2.03322	25.605	1.40833	1.98340	3.33	1.72	11653.19	1257961.00

TOTAL 4584.340 63.30644 52.49367 90.67834 787265.25 148267344.00
 MEAN 158.001 2.18298 1.81013 3.33374 27147.07 5112667.00
 R = ROOT<(2*N/(N-1))*((Y*Y)-Y*Y*Y)> = 0.34615
 SX = ROOT<(X*X)-X*X*X> = 46.44876
 CS = (X*X*X)-3*X*X*X+2*X*X*X)/(3*X*X*X) = 1.38826

***** THE PROBABILITY OF EXCEEDANCE ON IRRAWADDY M/P PROJECT *****
 X: SUCCESSIVE 2 DAY MAXIMUM RAINFALL AT PROME UNIT - I M M I

ORDER	XI	XI*XS	XI*XS-XU**2	XI*XS	2*XO-(XI+XS)	BI
1	178.054	11751.559	244.054	-499.387	-22.686	22.013
2	178.000	11803.324	244.294	-450.621	-22.926	19.655
3	176.000	11712.441	242.548	-538.504	-21.180	25.425
					TOTAL BI =	67.094
					MEAN B =	22.365
					B =	22.365

***** THE PROBABLE VALUES BY 'JMAI' METHOD *****

RETURN- PERIOD (YEAR)	E	N	E*R	A=YH*E*R	C=10**A	B	X=C-B
2	0.0	0.1594	0.0	2.1269	133.949	22.365	111.585
5	0.5451	0.1594	0.0949	2.2218	166.653	22.365	144.289
10	0.9062	0.1594	0.1445	2.2714	186.814	22.365	164.450
30	1.2967	0.1594	0.2067	2.3337	215.609	22.365	193.244
50	1.4520	0.1594	0.2315	2.3584	228.257	22.365	205.893
100	1.6450	0.1594	0.2623	2.3892	245.016	22.365	222.651
200	1.8215	0.1594	0.2904	2.4173	261.416	22.365	239.051
500	2.0350	0.1594	0.3244	2.4514	282.729	22.365	260.364
1000	2.1850	0.1594	0.3483	2.4753	298.733	22.365	276.368

APPENDIX E-21 PROBABILITY ANALYSIS OF SUCCESSIVE 2 DAY MAXIMUM RAINFALL AT HENZADA

***** THE PROBABILITY OF EXCEEDANCE ON IRRAWADDY M/P PROJECT *****

X: SUCCESSIVE 2 DAY MAXIMUM RAINFALL AT HENZADA UNIT = M M 1

ORDER	YEAR	X	LUG(X)	X+B	Y = LUG(X+B)	YY = Y**2	THOMAS PLU(T)	HAZEN PLU(T)	K**2	X**3
1	1901	278.638	2.44504	228.012	2.35796	5.55996	96.15	98.00	17639.06	21633184.00
2	1976	240.000	2.38021	189.374	2.27732	5.18619	92.31	94.00	57600.00	13824000.00
3	1964	204.470	2.31063	153.844	2.18708	4.78332	88.46	90.00	41807.95	8548469.00
4	1973	202.000	2.30535	151.414	2.18005	4.75262	84.62	86.00	40804.00	8242408.00
5	1903	195.390	2.29970	148.764	2.17250	4.71974	80.77	78.00	39756.34	7927014.00
6	1955	187.960	2.27407	137.334	2.13778	4.57009	76.92	74.00	35328.94	6640425.00
7	1959	174.742	2.24242	124.126	2.09386	4.38426	73.08	70.00	30538.24	5336616.00
8	1953	168.140	2.22569	117.822	2.07199	4.28539	69.23	66.00	28444.82	4797388.00
10	1951	167.640	2.22438	117.014	2.07012	4.28539	65.18	62.00	28273.73	4754169.00
11	1962	162.560	2.21101	111.934	2.04896	4.21761	61.54	58.00	28103.15	4711211.00
12	1971	160.000	2.20412	109.374	2.03891	4.15717	57.69	54.00	26425.73	4295766.00
13	1977	148.000	2.17026	97.374	1.98844	3.95390	50.00	50.00	25600.00	4096000.00
14	1952	144.272	2.15918	93.846	1.97149	3.88677	46.15	42.00	21904.00	3241792.00
15	1968	130.048	2.11410	79.422	1.89394	3.60977	42.31	46.00	20814.39	2199432.00
16	1960	129.206	2.11155	78.600	1.88295	3.54548	38.46	38.00	16714.86	2160995.00
17	1970	127.000	2.10380	76.374	1.86526	3.47918	34.00	34.00	16128.99	2048380.00
18	1956	123.552	2.09325	73.326	1.83569	3.36976	30.77	30.00	15364.09	1904408.00
19	1948	119.126	2.07601	68.500	1.81760	3.30368	26.92	26.00	14190.99	1690515.00
20	1966	116.332	2.06570	64.476	1.80913	3.27294	23.08	22.00	13533.12	1574334.00
21	1958	115.052	2.06093	61.374	1.78798	3.19489	19.23	18.00	13239.25	1523333.00
22	1974	112.000	2.04922	61.134	1.78628	3.19080	15.36	14.00	12544.00	1404928.00
23	1950	111.760	2.04829	55.374	1.74331	3.03911	11.54	10.00	12490.29	1395914.00
24	1975	106.000	2.02531	54.374	1.73539	3.01158	7.69	6.00	11025.00	1191016.00
25	1972	105.000	2.02119	54.374	1.73539	3.01158	3.85	2.00	11025.00	1157625.00

TOTAL 3902.049 54.44827 49.72386 99.62135 656418.88 219302096.00
 PEAN KM = 156.082 2.17793 1.98895 3.98485 = YHM 26256.75 4772083.00
 R = RDOT<12*N/(N-1)*{YHM-YM*YH1}> = 43.53371
 SX = RDOT<XKM-KM*KM>
 CS = 1*XXM-3*XXM*XM+2*XM*XH/(SX**3) = 0.99718

***** THE PROBABILITY OF EXCEEDANCE ON IRRAWADDY M/P PROJECT *****
 X: SUCCESSIVE 2 DAY MAXIMUM RAINFALL AT HENZADA UNIT-I M M I

***** H - VALUE *****

ORDER	X1	X2	X1*X2	X1*X2-X0*2	X1*X2	2*X0-(X1+X2)	B1
1	278.638	105.000	29256.980	383.630	6565.625	-82.365	-79.714
2	240.000	106.000	25440.000	346.000	2748.645	-44.727	-61.454
3	204.470	111.760	22851.551	316.230	160.195	-14.957	-10.711
						TOTAL B1 =	-151.878
						MEAN B =	-50.626
						B =	-50.626

***** THE PROBABLE VALUES BY 'IWAI' METHOD *****

RETURN-PERIOD (YEAR)	E	R	E*R	A*YH+E*R	C=10**A	B	X=C-B
2	0.0	0.2455	0.0	1.9890	97.488	-50.626	148.114
5	0.5951	0.2455	0.1461	2.1350	136.465	-50.626	187.091
10	0.9062	0.2455	0.2224	2.2114	162.697	-50.626	213.323
30	1.2967	0.2455	0.3183	2.3072	202.875	-50.626	253.501
50	1.6320	0.2455	0.3564	2.3453	221.407	-50.626	272.113
100	1.8450	0.2455	0.4038	2.3927	247.013	-50.626	297.639
200	1.9215	0.2455	0.4471	2.4360	272.924	-50.626	323.550
500	2.0350	0.2455	0.4995	2.4884	307.925	-50.626	358.551
1000	2.1850	0.2455	0.5363	2.5253	335.168	-50.626	385.794

APPENDIX E-22 PROBABILITY ANALYSIS OF SUCCESSIVE 3 DAY MAXIMUM RAINFALL AT THARRAWADDY

..... THE PROBABILITY OF EXCEEDANCE ON IRRAWADDY M/P PROJECT

X: SUCCESSIVE 3DAY MAXIMUM RAINFALL AT THARRAWADDY UNIT - M M I

UNDEK	YEAR	X	LOG(X)	X+B	Y = LOG(X+B)	YY = Y**2	THOMAS PLDIT(X)	HAZEN PLDIT(X)	X**2	X**3
1	1973	343.000	2.53529	262.644	2.41937	5.85334	96.67	98.28	117649.00	40353600.00
2	1976	291.000	2.46384	210.644	2.32355	5.39888	93.33	94.88	84681.00	24642160.00
3	1970	288.036	2.45965	207.680	2.31739	5.37032	90.00	91.38	82964.63	23896784.00
4	1975	241.000	2.38202	160.644	2.20586	4.86584	86.67	87.93	50081.00	13997521.00
5	1963	227.838	2.35763	147.482	2.16874	4.70343	83.33	84.48	51910.13	11827095.00
6	1960	223.774	2.34901	143.418	2.15660	4.65094	80.00	81.03	50074.77	11205429.00
7	1957	220.980	2.34435	140.624	2.14806	4.61415	76.67	77.59	48832.13	10790920.00
8	1971	207.000	2.31597	126.644	2.10258	4.42086	73.33	74.14	42849.00	8869743.00
9	1951	198.374	2.29748	118.018	2.07195	4.29296	70.00	70.69	39352.21	7806453.00
10	1967	180.848	2.25731	100.492	2.00213	4.00853	66.67	67.24	32705.97	5914807.00
11	1961	180.594	2.25670	100.238	2.00103	4.00412	63.33	63.79	32614.17	5889922.00
12	1952	179.324	2.25364	98.968	1.99549	3.98200	60.00	60.34	32157.07	5766533.00
13	1968	178.054	2.25055	97.698	1.98988	3.95964	56.67	56.90	31703.20	5644880.00
14	1956	168.148	2.22569	87.792	1.94345	3.77701	53.33	53.45	28273.73	4754168.00
15	1959	166.370	2.22108	86.014	1.93457	3.74255	50.00	50.00	27678.96	4604946.00
16	1954	165.608	2.21908	85.252	1.93070	3.72761	46.67	46.55	27425.99	4541961.00
17	1958	159.766	2.20348	79.410	1.89987	3.60952	43.33	43.10	25525.16	4078050.00
18	1948	159.258	2.20210	78.902	1.89709	3.59894	40.00	39.66	25363.09	4039274.00
19	1965	155.194	2.19488	74.838	1.87412	3.51233	36.67	36.21	24085.16	3737871.00
20	1974	154.000	2.18752	73.644	1.86714	3.48620	33.33	32.76	23716.00	3652264.00
21	1972	153.000	2.18469	72.644	1.86120	3.46406	30.00	29.31	23409.00	3581577.00
22	1977	153.000	2.18469	72.644	1.86120	3.46406	26.67	25.86	23409.00	3581577.00
23	1953	152.908	2.18443	72.592	1.86065	3.46201	23.33	22.41	23380.84	3575117.00
24	1947	146.304	2.16526	65.948	1.81920	3.30949	20.00	18.97	21404.84	3131612.00
25	1964	141.986	2.15224	61.630	1.78979	3.20335	16.67	15.52	20160.01	2862437.00
26	1966	141.732	2.15147	61.376	1.78800	3.19693	13.33	12.07	20087.95	2847103.00
27	1955	125.730	2.09944	45.374	1.65681	2.74500	10.00	8.62	15888.02	1987541.00
28	1969	124.460	2.09503	44.104	1.64448	2.70430	6.67	5.17	15490.28	1927919.00
29	1950	119.300	2.07693	39.024	1.59133	2.53233	3.33	1.72	14251.57	1701352.00

ICTAL 5346.645 65.66790 57.12209 113.66046 1065042.00 231210416.00
 MEAN 184.367 2.25062 1.96973 3.41933 = YM 36725.59 7972772.00
 R = ROUT<12N/(M-1)>*(YH-YM*YM) = 0.28606
 SX = HUIT<XH-XM> = 52.29128
 CS = (XXXH-3*XXH+XM+2*XM*3)/(SX**3) = 1.35349

***** THE PROBABILITY OF EXCEEDANCE ON IRRAWADDY M/P PROJECT *****
 X: SUCCESSIVE 3 DAY MAXIMUM RAINFALL AT THARRAWADDY UNIT - M M I

***** B - VALUE *****

CHDKR	X1	X5	X1*X5	X1*X5-X0**2	X1+X5	2*XU-(X1+X5)	B1
1	343.000	119.300	40947.324	462.380	462.380	-104.219	-86.940
2	291.000	124.460	36217.844	415.460	4505.180	-59.299	-75.974
3	288.036	125.730	36214.734	413.766	4502.070	-57.605	-78.155
						TOTAL B1 =	-241.068
						MEAN B =	-80.356
						B *	-80.356

***** THE PROBABLE VALUES BY 'LMAI' METHOD *****

RETURN- PERIOD (YEAR)	E	R	E*R	A*YH+E*R	C=10**A	B	X=C-B
2	0.0	0.2861	0.0	1.9697	93.267	-80.356	171.623
5	0.5921	0.2861	0.1702	2.1400	138.025	-80.356	218.381
10	0.9002	0.2861	0.2592	2.2289	169.414	-80.356	249.770
30	1.2967	0.2861	0.3709	2.3407	219.106	-80.356	299.462
50	1.6420	0.2861	0.4754	2.3851	242.704	-80.356	323.061
100	1.8450	0.2861	0.5276	2.4403	275.605	-80.356	355.961
200	1.8215	0.2861	0.5211	2.4908	309.582	-80.356	389.938
500	2.0350	0.2861	0.5821	2.5518	356.327	-80.356	436.683
1000	2.1850	0.2861	0.6250	2.5948	393.329	-80.356	473.685

APPENDIX E-23 PROBABILITY ANALYSIS OF SUCCESSIVE 3 DAY MAXIMUM RAINFALL AT PROME

***** THE PROBABILITY OF EXCEEDANCE ON IRRAWADDY M/P PROJECT *****

X: SUCCESSIVE 3 DAY MAXIMUM RAINFALL AT PROME UNIT - M M 1

ORCER	YEAR	X	LOG(X)	X+B	LOG(X+B)	YY = Y**2	THOMAS PLOT(Z)	HAZEN PLOT(Z)	X**2	X**3
1	1969	221.234	2.34485	223.583	2.34944	5.51987	96.67	98.28	48944.45	10828172.00
2	1974	202.000	2.30535	204.349	2.31037	5.33782	93.33	94.83	40804.00	8242408.00
3	1971	198.000	2.29667	200.349	2.30179	5.29823	90.00	91.38	39204.00	7762392.00
4	1962	196.596	2.29357	198.945	2.29873	5.28418	86.67	87.93	38649.96	7598424.00
5	1973	185.000	2.26717	187.349	2.27265	5.16495	83.33	84.48	34225.00	6331625.00
6	1960	181.102	2.25792	183.451	2.26352	5.12352	80.00	81.03	32797.91	5939765.00
7	1985	155.786	2.20348	162.115	2.20982	4.88332	76.67	77.59	25225.15	4078049.00
8	1953	154.432	2.18874	156.781	2.19529	4.81932	73.33	74.14	23849.22	3683081.00
9	1957	153.142	2.18515	155.511	2.19176	4.80382	70.00	70.89	23458.58	3592961.00
10	1961	143.764	2.15765	146.113	2.16469	4.68588	66.67	67.24	20668.07	2971323.00
11	1976	142.000	2.15229	144.349	2.15941	4.66307	63.33	63.79	20164.00	2863288.00
12	1951	139.700	2.14520	142.049	2.15244	4.63299	60.00	60.34	19516.07	2726394.00
13	1956	137.160	2.13723	139.509	2.14460	4.59932	56.67	56.90	18812.85	2580369.00
14	1964	137.120	2.13723	139.509	2.14460	4.59932	53.33	53.45	18812.85	2580369.00
15	1952	130.810	2.11664	133.159	2.12437	4.51295	50.00	50.00	17111.25	2238321.00
16	1975	130.000	2.11394	132.349	2.12172	4.50171	46.67	46.55	16900.00	2197000.00
17	1963	126.492	2.10206	128.841	2.11005	4.45233	43.33	43.10	16000.21	2023898.00
18	1954	123.698	2.09236	126.047	2.10053	4.41224	40.00	39.66	15301.18	1892725.00
19	1948	120.396	2.08061	122.745	2.08900	4.36394	36.67	36.21	14495.18	1745161.00
20	1955	108.204	2.03424	110.553	2.04357	4.17618	33.33	32.76	11708.10	1266862.00
21	1970	106.434	2.02912	107.283	2.03855	4.15570	30.00	29.31	11434.87	1222776.00
22	1959	102.562	2.01014	104.711	2.01999	4.08037	26.67	25.86	10477.97	1072545.00
23	1967	93.980	1.97303	96.329	1.98376	3.93530	23.33	22.41	8832.23	830052.56
24	1958	92.456	1.96593	94.805	1.97683	3.90787	20.00	18.97	8548.10	790322.94
25	1968	92.202	1.96474	94.551	1.97507	3.90326	16.67	15.52	8501.20	783827.13
26	1966	87.122	1.94013	89.471	1.95168	3.80907	13.33	12.07	7590.23	661276.06
27	1947	86.360	1.93631	88.709	1.94797	3.79458	10.00	8.62	7458.04	644076.31
28	1977	86.000	1.93450	88.344	1.94620	3.78771	6.67	5.17	7396.00	636056.00
29	1972	68.000	1.83251	70.349	1.84726	3.41237	3.33	1.72	4624.00	314432.00

MEAN = 3906.089 61.19864 61.43016 130.62100 571809.94 90097776.00
 SX = 134.693 2.81030 4.50417 = YHM 19717.58 3106819.00
 CS = 1001<12*N/IN-1>+1YYM-YM*YM> = 0.18309
 CS = 1001<XXM-XM*XM> = 39.69206
 CS = 1001<XXM*XM+2*XM**3>/15X**3 = 0.42534

***** THE PROBABILITY OF EXCEEDANCE ON IRRAWADDY M/P PROJECT *****
 X: SUCCESSIVE 3 DAY MAXIMUM RAINFALL AT PROME UNIT - M M I

***** B - VALUE *****

CHDER	XI	XS	XI*XS	XI*XS-XI**2	XI+XS	2*XO-(XI+XS)	BI
1	221.234	60.000	15043.906	289.234	-1574.648	-31.508	50.135
2	202.000	86.000	17372.000	288.000	753.645	-26.534	-24.970
3	198.000	86.360	17099.273	284.360	480.719	-26.534	-18.117
						TOTAL BI =	7.048
						MEAN B =	2.349
						B =	2.349

***** THE PROBABLE VALUES BY METHOD *****

RETURN- PERIOD (YEAR)	E	H	E*H	A=YH*E*H	C=10**A	B	X=C-B
2	0.0	0.1831	0.0	2.1185	131.367	2.349	129.018
5	0.5951	0.1831	0.1090	2.2274	168.828	2.349	166.479
10	0.9062	0.1831	0.1659	2.2854	192.489	2.349	190.140
30	1.2967	0.1831	0.2374	2.3559	226.937	2.349	224.587
50	1.4520	0.1831	0.2659	2.3843	242.292	2.349	239.943
100	1.6450	0.1831	0.3012	2.4197	262.831	2.349	260.482
200	1.8215	0.1831	0.3335	2.4520	283.135	2.349	280.785
500	2.0350	0.1831	0.3726	2.4911	309.801	2.349	307.452
1000	2.1850	0.1831	0.4001	2.5185	330.026	2.349	327.677

APPENDIX E-24 PROBABILITY ANALYSIS OF SUCCESSIVE 3 DAY MAXIMUM RAINFALL AT HENZADA

***** THE PROBABILITY OF EXCEEDANCE ON (RRAWADDY M/P PROJECT *****
 X: SUCCESSIVE 3 DAY MAXIMUM RAINFALL AT HENZADA UNIT - M M I

ORDER	YEAR	X	LOG(X)	X+B	Y ² LOG(X+B)	YY ²	THUMAS PLOT(%)	HAZFN PLOT(%)	X**2	X**3
1	1961	300.990	2.47855	247.221	2.39308	5.72685	96.15	98.00	90594.81	27268096.00
2	1976	261.000	2.41596	209.231	2.32063	5.38530	92.31	94.00	69169.00	18191440.00
3	1973	251.000	2.39967	197.231	2.29497	5.26691	88.46	90.00	63001.00	15813251.00
4	1963	250.190	2.39827	196.421	2.29319	5.25871	84.62	86.00	62595.00	15660637.00
5	1964	249.428	2.39694	195.659	2.29150	5.25097	80.77	82.00	62214.29	15517979.00
6	1959	226.822	2.35548	173.053	2.23818	5.00944	76.92	78.00	51448.18	11669574.00
7	1971	226.000	2.35411	172.231	2.23611	5.00019	73.08	74.00	51076.00	11543176.00
8	1951	222.250	2.34684	168.481	2.22655	4.95733	69.23	70.00	49395.04	10978043.00
9	1953	196.850	2.29414	143.081	2.15558	4.64653	65.38	66.00	38749.89	7627914.00
10	1955	187.960	2.27407	134.191	2.12772	4.52720	61.54	58.00	35328.94	6640425.00
11	1962	180.086	2.25548	126.317	2.10146	4.41614	57.69	58.00	32430.94	5840356.00
12	1968	176.530	2.24682	122.761	2.08906	4.36417	53.85	54.00	31162.82	5501170.00
13	1975	172.000	2.23533	118.231	2.07273	4.29621	50.00	50.00	29584.00	5088448.00
14	1977	171.000	2.23300	117.231	2.06904	4.28093	46.15	46.00	29241.00	5000211.00
15	1969	170.942	2.23285	117.173	2.06883	4.28004	42.31	42.00	29221.14	4995119.00
16	1960	169.672	2.22961	115.903	2.06409	4.26048	38.46	38.00	28788.56	4884611.00
17	1972	167.000	2.22272	113.251	2.05396	4.21977	34.62	34.00	27889.00	4657463.00
18	1956	160.020	2.20417	106.251	2.02633	4.10602	30.77	30.00	25606.38	4097531.00
19	1952	155.194	2.19088	101.425	2.00614	4.02461	26.92	26.00	24085.16	3737871.00
20	1948	152.408	2.18443	99.139	1.99624	3.98499	23.08	22.00	23380.84	3575115.00
21	1970	144.018	2.15842	90.249	1.95544	3.82375	19.23	18.00	20741.17	2987100.00
22	1950	140.208	2.14677	86.439	1.93671	3.75084	15.38	14.00	19658.27	2756245.00
23	1974	137.000	2.13672	83.231	1.92020	3.68149	11.54	10.00	18769.00	2571353.00
24	1958	134.620	2.12911	80.851	1.90768	3.63926	7.69	6.00	18122.53	2439653.00
25	1966	134.620	2.12911	80.851	1.90768	3.63926	3.85	2.00	18122.53	2439653.00

TOTAL 4740.297 56.65369 52.75305 111.80243 950375.06 201482256.00
 MEAN 189.612 2.26615 YH = 2.11012 4.47210 = YHM
 R = ROOT((2*NY/(N-1))*(1+YH-YH*YH)) = 0.20147
 SX = ROOT((XXM-XX*XXM)
 CS = ((XXXH-3*XXXH*XXM+2*XXM**3)/(1+XX**3)) = 0.73799

***** THE PROBABILITY OF EXCEEDANCE ON IRRAWADDY M/P PROJECT *****
 X: SUCCESSIVE 3 DAY MAXIMUM RAINFALL AT HENZADA UNIT - M M I

CRDEN	X1	XS	X1*XS	X1*XS-X0*2	X1*XS	2*X0-(X1+XS)	B1
1	300.000	134.620	40519.223	435.610	6455.523	-66.483	-97.101
2	263.000	134.620	35405.043	397.620	1341.344	-28.493	-47.076
3	251.000	137.000	34387.000	389.000	323.301	-18.873	-17.130
						TOTAL B1 =	-161.308
						MEAN B =	-53.769
						B =	-53.769

***** THE PROBABLE VALUES BY 'IMAI' METHOD *****

RETURN- PERIOD (YEAR)	E	R	E*R	A=YM*E*R	C=L0**A	B	X=C-B
2	0.0	0.2015	0.0	2.1101	128.861	-53.769	182.630
5	0.5951	0.2015	0.1199	2.2300	169.831	-53.769	223.600
10	0.9062	0.2015	0.1826	2.2927	196.198	-53.769	249.967
30	1.2967	0.2015	0.2612	2.3714	235.163	-53.769	288.932
50	1.4520	0.2015	0.2925	2.4027	252.730	-53.769	306.499
100	1.6450	0.2015	0.3314	2.4415	276.402	-53.769	330.171
200	1.8215	0.2015	0.3670	2.4771	299.986	-53.769	353.755
500	2.0350	0.2015	0.4100	2.5201	341.219	-53.769	384.988
1000	2.1050	0.2015	0.4402	2.5503	355.087	-53.769	408.856

APPENDIX E-25 PROBABILITY ANALYSIS OF SUCCESSIVE 6 DAY MAXIMUM RAINFALL AT THARRAWADDY

***** THE PROBABILITY OF EXCEEDANCE ON IRRAWADDY M/P PROJECT *****

X: SUCCESSIVE 6 DAY MAXIMUM RAINFALL AT THARRAWADDY UNIT - (M M)

NUMBER	YEAR	X	LOG(X)	X*B	Y = LOG(X*B)	YY = Y**2	THOMAS PLOT(%)	HAZEN PLOT(%)	X**2	X**3
1	1973	371.000	2.56937	358.241	2.55417	6.52381	96.67	98.28	137641.00	51064800.00
2	1970	359.156	2.55528	346.396	2.53957	6.44943	93.33	94.83	128992.81	46328496.00
3	1951	315.026	2.50208	322.267	2.50821	6.29114	90.00	91.38	112242.31	37604064.00
4	1976	319.000	2.50379	306.241	2.48606	6.18050	86.67	87.93	101761.00	32461744.00
5	1963	291.845	2.46515	279.086	2.44574	5.98163	83.33	84.48	85173.75	24857568.00
6	1957	298.544	2.46021	275.784	2.44057	5.95638	80.00	81.03	83257.44	24023408.00
7	1948	277.622	2.44345	264.863	2.42302	5.87103	76.67	77.59	77073.88	21397376.00
8	1960	272.034	2.43462	259.274	2.41376	5.82623	73.33	74.14	74002.31	20131120.00
9	1974	269.000	2.42975	256.241	2.40865	5.80159	70.00	70.69	72361.00	19465104.00
10	1954	266.954	2.42644	254.195	2.40517	5.78483	66.67	67.24	71264.31	19024272.00
11	1968	254.508	2.40570	241.749	2.38336	5.68043	63.33	63.79	64774.27	16485563.00
12	1971	254.000	2.40483	241.241	2.38245	5.67607	60.00	60.34	64516.00	16387064.00
13	1966	246.634	2.39205	231.875	2.36898	5.61208	56.67	56.90	60828.28	15002315.00
14	1975	246.000	2.39093	233.241	2.36780	5.60650	53.33	53.45	60516.00	14886936.00
15	1962	235.204	2.37144	222.445	2.34722	5.50945	50.00	50.00	55320.88	13011688.00
16	1965	233.680	2.36862	220.921	2.34424	5.49544	46.67	46.55	54606.29	12760393.00
17	1961	232.664	2.36673	219.905	2.34223	5.48606	43.33	43.10	54132.48	12594674.00
18	1952	228.346	2.35859	215.587	2.33362	5.44579	40.00	39.66	52141.86	11906379.00
19	1956	227.330	2.35666	214.571	2.33157	5.43622	36.67	36.21	51678.89	11748156.00
20	1947	223.774	2.34981	211.015	2.32431	5.40074	33.33	32.76	50074.76	11205425.00
21	1953	213.360	2.32911	200.601	2.30233	5.30074	30.00	29.31	45522.45	9712665.00
22	1959	212.852	2.32808	200.093	2.30123	5.29567	26.67	25.86	45305.93	9643454.00
23	1977	212.000	2.32634	199.241	2.29938	5.28714	23.33	22.41	44944.00	9528128.00
24	1958	206.756	2.31546	193.997	2.28779	5.23400	20.00	18.97	42748.01	8838403.00
25	1950	200.152	2.30136	187.393	2.27275	5.16540	16.67	15.52	40060.79	8018243.00
26	1972	192.000	2.28607	169.241	2.22851	4.92623	13.33	12.07	33124.00	6028568.00
27	1967	181.156	2.25851	168.597	2.22605	4.91885	10.00	8.62	3289.97	5964790.00
28	1955	164.592	2.21641	151.833	2.18137	4.75036	6.67	5.17	27090.50	4458876.00
29	1964	150.622	2.17789	137.863	2.13945	4.57723	3.33	1.72	22686.96	3417154.00

TOTAL XM = 7155.988 64.09160
 MEAN XM = 246.753 2.38247
 R = HQ01<120N/(N-1) >*(YYM-YM*YM) > = 0.14067
 SX = ROOT<XXM-XM*XM> = 52.82506
 CS = (XXM-3*XXM*XM+2*XXM*31/1540*31) = 0.54347
 68.39023 161.56050
 5.57105 = YYM
 1846723.00
 63680.10
 497954304.00
 17170832.00

***** THE PROBABILITY OF EXCEEDANCE ON IRRAWADDY M/P PROJECT *****
X: SUCCESSIVE 6 DAY MAXIMUM RAINFALL AT THIRRAWADDY UNIT -(M M)

ORDER	X1	X5	X10	X15	X20	X25	X30	X35	X40	X45	X50	X55	X60	X65	X70	X75	X80	X85	X90	X95	X100	BI	
1	371.000	150.622	55880.734	521.622	-2320.871																	59.324	
2	359.176	164.592	57114.133	523.748	912.527																	-22.123	
3	335.076	181.356	60758.926	516.382	2557.320																	-15.478	
																							-30.277
																							-12.759
																							-12.759

***** THE PROBABLE VALUES BY (L) METHOD *****

RETURN PERIOD (YEAR)	E	R	E-R	A-YM+E-R	C=10**A	B	X=C-B
2	0.0	0.1407	0.0	2.3583	228.183	-12.759	240.942
5	0.5921	0.1407	0.0037	2.4420	276.691	-12.759	289.450
10	0.9062	0.1407	0.1275	2.4858	306.026	-12.759	318.785
30	1.2467	0.1407	0.1824	2.5407	347.288	-12.759	360.047
50	1.4520	0.1407	0.2043	2.5625	365.204	-12.759	377.963
100	1.6450	0.1407	0.2114	2.5897	388.763	-12.759	401.522
200	1.8215	0.1407	0.2562	2.6145	411.636	-12.759	424.395
500	2.0150	0.1407	0.2863	2.6445	441.110	-12.759	453.869
1000	2.1050	0.1407	0.3074	2.6656	463.070	-12.759	475.829

APPENDIX E-27 PROBABILITY ANALYSIS OF SUCCESSIVE 6 DAY MAXIMUM RAINFALL AT HENZADA

***** THE PROBABILITY OF EXCEEDANCE ON IRRAWADDY M/P PROJECT *****

X: SUCCESSIVE 6 DAY MAXIMUM RAINFALL AT HENZADA UNIT - (M M I

ORDER	YEAR	X	LOG(X)	X+B	LOG(X+B)	YY = Y*2	THOMAS PLOT(Z)	HAZEN PLOT(Z)	X**2	X**3
1	1951	355.340	2.55065	439.842	2.64330	6.98701	96.15	98.00	126270.56	44869696.00
2	1961	354.330	2.54941	438.826	2.64229	6.98171	92.31	94.00	125549.63	44485968.00
3	1963	336.550	2.52705	421.046	2.62433	6.88710	88.46	90.00	113265.75	38119552.00
4	1971	334.000	2.52375	418.496	2.62169	6.87327	84.62	86.00	111556.00	37259696.00
5	1964	328.422	2.51643	412.918	2.61586	6.84274	80.77	82.00	107860.88	35423856.00
6	1973	322.030	2.50786	406.496	2.60906	6.80718	76.92	78.00	103684.00	33386240.00
7	1959	309.372	2.49048	393.868	2.59535	6.73584	73.08	74.00	95710.88	29410240.00
8	1968	304.292	2.48329	388.788	2.58971	6.70641	69.23	70.00	92593.44	28175408.00
9	1977	297.000	2.47276	381.496	2.58149	6.66409	65.38	66.00	88209.00	26198064.00
10	1962	274.320	2.43826	358.816	2.55487	6.52737	61.54	62.00	75251.31	20442912.00
11	1976	273.000	2.43616	357.496	2.55327	6.51919	57.69	58.00	74529.00	20346416.00
12	1948	263.144	2.42019	347.640	2.54113	6.45734	53.85	54.00	69244.63	18221280.00
13	1975	237.000	2.37270	331.496	2.52048	6.35281	50.00	50.00	61009.00	15069223.00
14	1974	231.000	2.36202	325.496	2.51255	6.31289	46.15	46.00	58081.00	13997521.00
15	1923	236.220	2.37332	320.716	2.50612	6.28064	42.31	42.00	55799.84	13181034.00
16	1956	234.950	2.37098	319.446	2.50440	6.27201	38.46	38.00	55201.46	12969577.00
17	1969	234.950	2.37098	319.446	2.50440	6.27201	34.62	34.00	55201.46	12969577.00
18	1970	233.934	2.36909	318.430	2.50301	6.26508	30.77	30.00	54725.07	12802050.00
19	1972	228.000	2.35793	312.496	2.49484	6.22425	26.92	26.00	51984.00	11852352.00
20	1966	220.218	2.34285	304.714	2.48389	6.18972	23.08	22.00	48495.92	10679668.00
21	1952	219.456	2.34135	303.952	2.48281	6.18432	19.23	18.00	48160.89	10569191.00
22	1960	207.772	2.31759	292.268	2.46578	6.08008	15.38	14.00	43169.16	8969339.00
23	1955	197.612	2.29581	282.108	2.45042	6.00454	11.54	10.00	39050.46	7716834.00
24	1950	196.342	2.29301	280.838	2.44846	5.99494	7.69	6.00	38550.14	7569007.00
25	1958	180.340	2.25609	264.836	2.42298	5.87082	3.85	2.00	32522.48	5865101.00

TOTAL 6629.551 60.37984 63.47240 161.25343 1825670.00 520947712.00
 MEAN 265.182 2.41519 2.53890 6.45014 = Y*Y 73026.75 20837904.00

R = ROOT<12*N/(N-1)>*(YYH-YM*YM)> = 0.09294
 SX = ROOT<XXM-X*XM> = 52.01321
 CS = (XXXH-3*XXH*XM+2*X*M**3)/(S*X**3) = 0.26789

***** THE PROBABILITY OF EXCEEDANCE ON IRRAWADDY M/P PROJECT *****

X: SUCCESSIVE 5 DAY MAXIMUM RAINFALL AT HENZADA UNIT - (M M)

CRUER	XI	XS	XI*XS	XI*XS-XO**2	XI*XS	2*XS-(XI+XS)	BI
1	355.346	180.340	64083.000	535.686	-3585.055	-15.424	232.436
2	354.330	196.342	69569.750	550.672	1901.688	-30.410	-62.535
3	336.550	197.612	66506.188	534.162	-1161.875	-13.900	83.589
						TOTAL BI =	253.490
						MEAN B =	84.497
						B =	84.497

***** THE PROBABLE VALUES BY 'IMAI' METHOD *****

RETURN-PERIOD (YEAR)	E	R	E*R	A*YH+E*R	C=10**A	B	X=C-B
2	0.0	0.0929	0.0	2.5389	345.856	84.497	261.359
5	0.5951	0.0929	0.0553	2.5942	392.831	84.497	308.335
10	0.9062	0.0929	0.0842	2.6231	419.875	84.497	335.379
30	1.2967	0.0929	0.1205	2.6594	456.473	84.497	371.977
50	1.4520	0.0929	0.1350	2.6739	471.899	84.497	387.403
100	1.6450	0.0929	0.1529	2.6918	491.799	84.497	407.303
200	1.8215	0.0929	0.1693	2.7082	510.732	84.497	426.235
500	2.0350	0.0929	0.1891	2.7280	534.609	84.497	450.112
1000	2.1650	0.0929	0.2031	2.7420	552.050	84.497	467.553

APPENDIX E-28 5-DAYS TOTAL RAINFALL AT THARRAWADDY

1976 (Unit: mm)

<u>Day</u>	<u>July</u> <u>Daily</u>	<u>August</u> <u>Daily</u>	<u>September</u> <u>Daily</u>	<u>October</u> <u>Daily</u>
1	6.0	17.0	22.0	5.0
2	2.0	26.0	1.0	-
3	45.0	-	1.0	3.0
4	23.0	7.0	10.0	39.0
5	27.0	-	-	3.0
Sub-total	103.0	50.0	34.0	50.0
6	4.0	2.0	-	-
7	40.0	4.0	4.0	2.0
8	6.0	-	54.0	-
9	27.0	6.0	4.0	-
10	18.0	1.0	1.0	-
Sub-total	95.0	13.0	63.0	2.0
11	6.0	37.0	1.0	21.0
12	6.0	2.0	12.0	-
13	3.0	52.0	14.0	2.0
14	-	3.0	5.0	3.0
15	4.0	58.0	28.0	5.0
Sub-total	19.0	152.0	60.0	31.0
16	3.0	15.0	7.0	-
17	21.0	1.0	-	-
18	53.0	2.0	-	9.0
19	55.0	-	-	-
20	14.0	-	-	6.0
Sub-total	146.0	18.0	7.0	15.0
21	25.0	-	-	49.0
22	3.0	-	3.0	59.0
23	-	-	13.0	-
24	2.0	4.0	41.0	-
25	14.0	2.0	25.0	-
Sub-total	44.0	6.0	82.0	108.0
26	22.0	13.0	3.0	-
27	9.0	1.0	5.0	3.0
28	7.0	3.0	7.0	-
29	-	52.0	-	-
30	3.0	32.0	-	-
31	8.0	-	-	-
Sub-total	49.0	101.0	15.0	3.0

APPENDIX E-29 5-DAYS TOTAL RAINFALL AT HENZADA

1971 (Unit: mm)

<u>Day</u>	<u>July</u> <u>Daily</u>	<u>August</u> <u>Daily</u>	<u>September</u> <u>Daily</u>	<u>October</u> <u>Daily</u>
1	8.0	10.0	4.0	15.0
2	51.0	85.0	-	-
3	26.0	10.0	-	-
4	32.0	4.0	46.0	1.0
5	4.0	21.0	9.0	1.0
Sub-total	121.0	130.0	59.0	17.0
6	3.0	11.0	-	-
7	46.0	47.0	-	-
8	5.0	10.0	-	-
9	8.0	14.0	26.0	-
10	32.0	4.0	-	-
Sub-total	94.0	86.0	26.0	-
11	84.0	9.0	-	-
12	1.0	5.0	1.0	6.0
13	6.0	36.0	4.0	1.0
14	8.0	2.0	-	-
15	-	47.0	-	-
Sub-total	99.0	99.0	5.0	7.0
16	11.0	2.0	20.0	-
17	35.0	2.0	-	-
18	36.0	8.0	5.0	-
19	70.0	29.0	-	-
20	90.0	4.0	-	-
Sub-total	242.0	45.0	25.0	-
21	66.0	6.0	2.0	-
22	37.0	41.0	5.0	-
23	2.0	28.0	-	-
24	20.0	12.0	-	-
25	51.0	6.0	1.0	-
Sub-total	176.0	93.0	8.0	-
26	36.0	35.0	2.0	8.0
27	-	23.0	30.0	22.0
28	22.0	14.0	5.0	33.0
29	32.0	16.0	10.0	15.0
30	21.0	1.0	33.0	7.0
31	-	12.0	-	-
Sub-total	111.0	101.0	80.0	85.0

APPENDIX E-30 WATER BALANCE AT MONYO AREA

(A = 5,844 ha)

<u>Period</u>	<u>5 Day Total</u> (mm)	<u>Discharge</u> (m ³)	<u>Accumulated Discharge</u> (m ³)	<u>Inner Water Level</u> (m)	<u>Outer Water Level</u> (m)	<u>Remark</u>
7.1-5	103	3,009,660	3,009,660	12.20	13.57	
10	95	2,775,900	5,785,560	12.40	14.27	
15	19	555,180	6,340,740	12.45	14.95	
20	146	4,266,120	10,606,860	12.75	15.27	
25	44	1,285,680	11,892,540	12.85	15.26	
31	49	1,431,780	13,324,320	12.95	15.52	
8.1-5	50	1,461,000	14,785,320	13.00	15.65	
10	13	379,860	15,165,180	13.05	15.84	
15	152	4,441,440	19,606,620	13.12	16.42	
20	18	525,960	20,132,580	13.15	16.55	
25	6	175,320	20,307,900	13.15	15.90	
31	101	2,951,220	23,259,120	13.20	15.01	
9.1-5	34	993,480	24,252,600	13.25	14.74	
10	63	1,840,860	26,093,460	13.30	14.95	
15	60	1,753,200	27,846,660	13.35	15.32	
20	7	204,540	28,051,200	13.35	15.11	
25	82	2,396,040	30,447,240	13.40	15.08	
30	15	438,300	30,885,540	13.42	15.00	
10.1-5	50	1,461,000	32,346,540	13.45	14.69	
10	2	58,440	32,404,980	13.45	14.41	
15	31	905,820	33,310,800	13.50	14.04	
20	15	438,300	33,749,100	-	13.03	
25	108	3,155,760	36,904,860	-	11.63	
31	3	87,660	36,992,520	-	11.02	

Note: Outer Water Level --- Gamon ST. + 2.0 m

APPENDIX E-31 WATER BALANCE AT INGABU AREA

(A = 15,000 ha)

<u>Period</u>	<u>5 Day Total (mm)</u>	<u>Discharge (m³)</u>	<u>Accumulated Discharge (m³)</u>	<u>Inner Water Level (m)</u>	<u>Outer Water Level (m)</u>	<u>Remark</u>
7.1-5	121	9,075,000	9,075,000	10.25	11.68	
10	94	7,050,000	16,125,000	10.40	11.97	
15	99	7,425,000	23,550,000	10.60	12.78	
20	242	18,150,000	41,700,000	11.00	13.08	
25	176	13,200,000	54,900,000	11.20	13.00	
31	111	8,325,000	63,225,000	11.30	13.41	
8.1-5	130	9,750,000	72,975,000	11.40	13.40	
10	86	6,450,000	79,425,000	11.45	13.79	
15	99	7,425,000	86,850,000	11.50	14.45	
20	45	3,375,000	90,225,000	11.60	14.06	
25	93	6,975,000	97,200,000	11.65	13.44	
31	101	7,575,000	104,775,000	11.75	11.91	
9.1-5	59	4,425,000	109,200,000	11.80	12.28	
10	26	1,950,000	111,150,000	11.80	13.10	
15	5	375,000	111,525,000	11.80	13.34	
20	25	1,875,000	113,400,000	11.80	12.62	
25	8	600,000	114,000,000	11.80	12.37	
30	80	6,000,000	120,000,000	11.90	12.59	
10.1-5	17	1,275,000	121,275,000	11.90	12.60	
10	-	-	121,275,000	11.90	11.92	
15	7	525,000	121,800,000	11.90	11.51	
20	-	-	121,800,000	-	10.52	
25	-	-	121,800,000	-	8.67	
31	85	6,375,000	128,175,000	-	8.14	

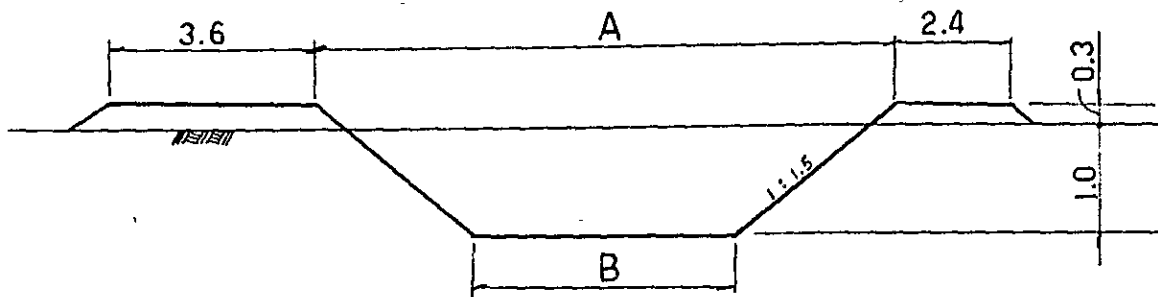
Note: Outer Water Level --- Henzada ST. (1974)

APPENDIX E-32 WATER BALANCE BY PUMP DRAINAGE AT INGABU AREA

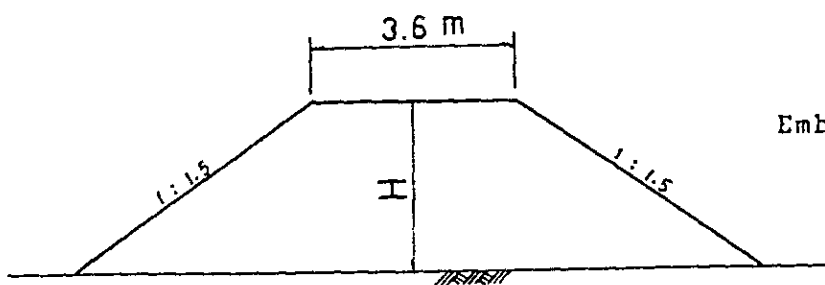
(A = 15,000 ha)

<u>Period</u>	<u>5 day Total (mm)</u>	<u>Discharge (m³)</u>	<u>Accumulated Discharge (m³)</u>	<u>Inner Water Level (m)</u>	<u>Outer Water Level (m)</u>	<u>Remark</u>
7.1-5	121	9,075,000	3,891,000	10.10	11.68	
10	94	7,050,000	5,757,000	10.15	11.97	
15	99	7,425,000	7,998,000	10.20	12.78	
20	242	18,150,000	20,964,000	10.50	13.08	
25	176	13,200,000	28,980,000	10.70	13.00	
31	111	8,325,000	31,084,200	10.75	13.41	
8.1-5	130	9,750,000	35,650,200	10.80	13.40	
10	86	6,450,000	36,916,200	10.80	13.79	
15	99	7,425,000	39,157,200	10.95	14.45	
20	45	3,375,000	37,348,200	10.90	14.06	
25	93	6,975,000	39,139,200	10.95	13.44	
31	101	7,575,000	40,493,400	11.00	11.91	
9.1-5	59	4,425,000	39,734,400	10.95	12.28	
10	26	1,950,000	36,500,400	10.90	13.10	
15	5	375,000	31,691,400	10.75	13.34	
20	25	1,875,000	28,382,400	10.70	12.62	
25	8	600,000	23,798,400	10.60	12.37	
30	80	6,000,000	24,614,400	10.60	12.59	
10.1-5	17	1,275,600	20,705,400	10.50	12.60	
10	-	-	15,521,400	10.35	11.92	
15	7	525,000	10,862,400	10.25	11.51	
20	-	-	5,678,400	10.15	10.52	
25	-	-	494,400	10.00	8.67	
31	85	6,375,000	648,600	10.00	8.14	

Note: Outer Water Level --- Henzada ST. (1974)
 Pump Discharge --- 12 m³/sec



Type	Area (HA)	Discharge (M ³ /SEC)	A (M)	B (M)	Cut (M/M)	Embankment (M ³ /M)
I	500	1.6	4.4	0.5	2.0	2.1
II	1,000	3.2	6.4	2.5	4.0	2.1
III	1,500	4.8	8.4	4.5	6.0	2.1
IV	2,000	6.4	10.4	6.5	8.0	2.1
V	3,000	9.6	14.4	10.5	12.0	2.1



Embankment Volume (M³/M)

$$= 1.5H^2 - 3.6H$$

APPENDIX E-33

TYPICAL CROSS SECTION OF DRAINAGE CANAL AND EMBANKMENT

APPENDIX E-34 DIFFERENCE EXPRESSION OF THE FUNDAMENTAL EQUATIONS

In the flow status of a river, there are two physical phenomena. One is a steady flow that is constant with time, other is an unsteady flow that is changeable with time.

In analysis of an unsteady flow, it is necessary to solve the differential equation. But this equation is a non-linear type, so it is very difficult to solve it directly. Then, it will be solved by means of numerical analysis, which is a kind of mathematical simulation. Here, the Dr. Shiraishi's method is adopted that is famous and popular in Japan.

Hydraulic characteristics of an unsteady flow as a mathematical model are given by simultaneous solution of both the equation of motion and that of continuity. With the down stream boundary as origin the fundamental equation of a one-dimensional flow are expressed as follows;

$$\frac{1}{g} \left(\frac{\partial v}{\partial t} \right) + \frac{1}{g} \frac{\partial}{\partial x} \left(\frac{v^2}{2} \right) + S + \frac{\partial h}{\partial x} + \frac{n^2 |v|}{R^{4/3}} v = 0 \quad (1)$$

$$\frac{\partial A}{\partial t} + \frac{\partial Q}{\partial x} - q = 0 \quad (2)$$

Where;

- g: acceleration of gravity (9.80 m/sec²)
- v: velocity (positive for the upper stream direction)(m/sec)
- t: elapsed time (sec)
- x: distance in longitudinal directions on a horizontal datum plane (m)
- s: river bed slope
- h: water depth (m)
- n: Manning's roughness coefficient
- R: hydraulic radius (m)
- A: cross-sectional area including swampy zone
- Q: discharge through a section (m³/sec)

q: lateral inflow per unit length (positive for inflow, negative for outflow) ($m^3/sec/m$)

In case of hydraulic analysis of mathematical model, these equation, (1) and (2), are converted into difference expressions. Then, for the given initial condition, boundary condition and geometric conditions, the numerical integration is performed. It is desirable to constitute the efficient and economic grid system from the point of the electronic computer performance. The calculation proceeds from the down stream to the upper stream with the distance interval Δx and the time interval Δt . The selection of the time interval to be used is not arbitrary. It is well-known that solving by finite differences method will not produce a stable solution unless the distance interval and the time interval are related to the velocity of the long wave, such as

$$\Delta t < \left| \frac{\Delta x}{v_{\max} \pm \sqrt{g h_{\max}}} \right| \quad (3)$$

If the value of Δt exceeds that given above, the transmission of the hydraulic phenomena goes beyond the tracing speed in the mathematical model and the solution is led to uncoverage. The value of Δt and Δx must be determined to satisfy the expression (3), by speculating in advance the maximum possible velocity and water depth.

The accuracy of the mathematical model is determined by the difference expressions of the fundamental equations. By Dr. Shiraishi, the method of the central difference expression with respect to distance x and time t is studied.

In the difference expression suffix i is used for distance and n for time.

The difference center is taken at the point $(i, n-1)$, and from the initial conditions and the boundary conditions, the unknown values at the point (i, n) are obtained.

From the downstream to the upper stream, the calculation proceeds with distance interval x and the time interval t . (See Figure 1)

1) Difference Expressions of the Equation of Motion

In the equation of motion (1), the central differences for respective terms are expressed as follows.

$$\frac{\partial v}{\partial t} = \frac{n^v i - n-2^v i}{\Delta t}$$

$$\frac{\partial h}{\partial t} = \frac{n-1^h i+1 - n-1^h i-1}{\Delta x}$$

$$\frac{\partial v^2}{\partial x} = \frac{n-1^{v^2} i+1 - n-2^{v^2} i-2}{2\Delta x}$$

$$S = \frac{Z_{i+1} - Z_{i-1}}{\Delta x}$$

$$h = \frac{n-1^h i+1 + n-1^h i-1}{2}$$

$$V = \frac{n^v i + n-2^v i}{2}$$

$$[V] = [n-2^v i]$$

Here, z is the bottom elevation, that is the river bed elevation.

The value of $n^v i$ is calculated by substituting the difference expressions above into the equation of motion (1). (See Figure 2)

The value of $n^v i$ is thus derived from two values of water depth at time $n-1$ and three values of velocity $n-2$.

2) Difference Expressions of the Equation of Continuity

In the equation of continuity (2), the central differences for respective terms are expressed as follows.

$$\frac{\partial A}{\partial t} = \frac{n^A_i - n^{-2}^A_i}{\Delta t}$$

$$\frac{\partial Q}{\partial x} = \frac{1}{\Delta x} \left(\frac{A_2 + A_3}{2} v_m - \frac{A_1 + A_2}{2} v_l \right)$$

The cross-sectional area at point m is given by $(A_2 + A_3)/2$, and that at point l is $(A_1 + A_2)/2$. The velocity at points m and l, v_m and v_l , respectively, are already obtained from the equation of motion. Hence the discharge through point m is given by $(A_2 + A_3)v_m/2$ and that through point l is $(A_1 + A_2)v_l/2$.
(See Figure 3)

To obtain the cross-sectional area in the above difference expressions above, the backward water depth is used. The reason for it is that if a forward unknown value is used, the calculation becomes fairly complicated. Moreover, the central difference expression with respect to distance gives sufficient accuracy, because the change in cross-sectional area with respect to distance is far larger than that with respect to time.

The inflow to and outflow from the open channel concerned are treated by the term q .

The values of n^A_i is calculated by substituting the difference expressions above into the equation of continuity (2).
(See Figure 4)

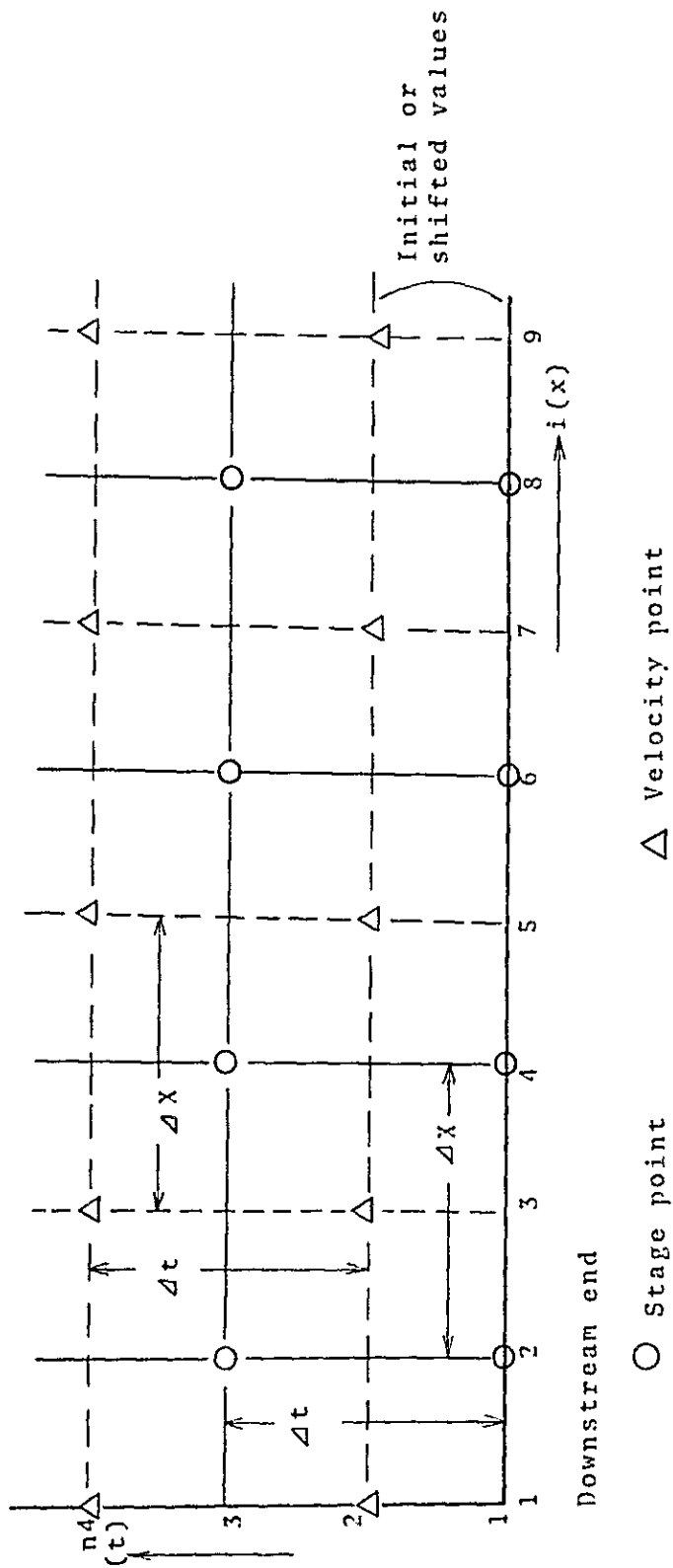


FIGURE 1 OPERATIONAL GRID SYSTEM

\triangle Velocity point \circ Stage point
 \otimes Center of difference

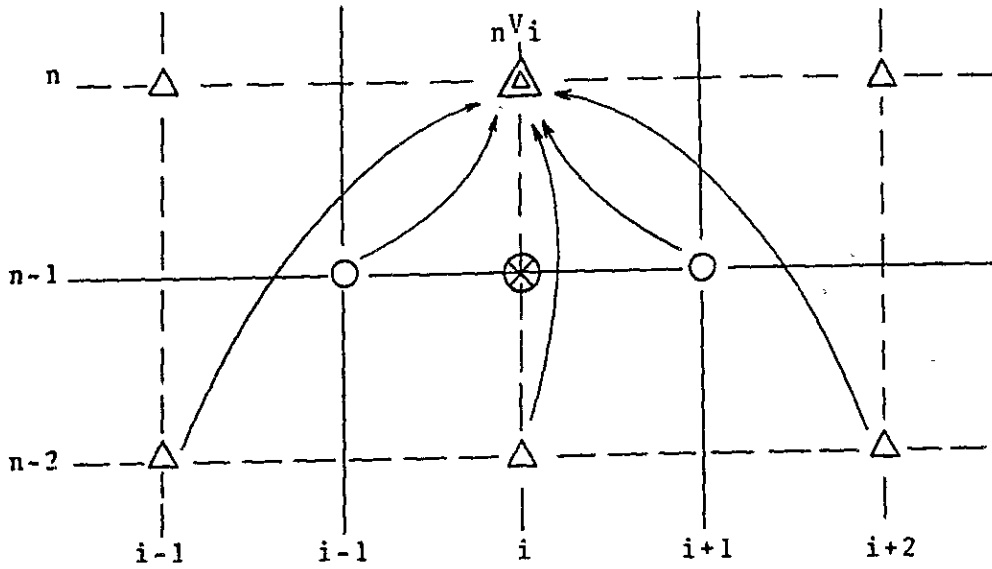


FIGURE 2. OPERATIONAL GRID SYSTEM OF THE EQUATION OF MOTION

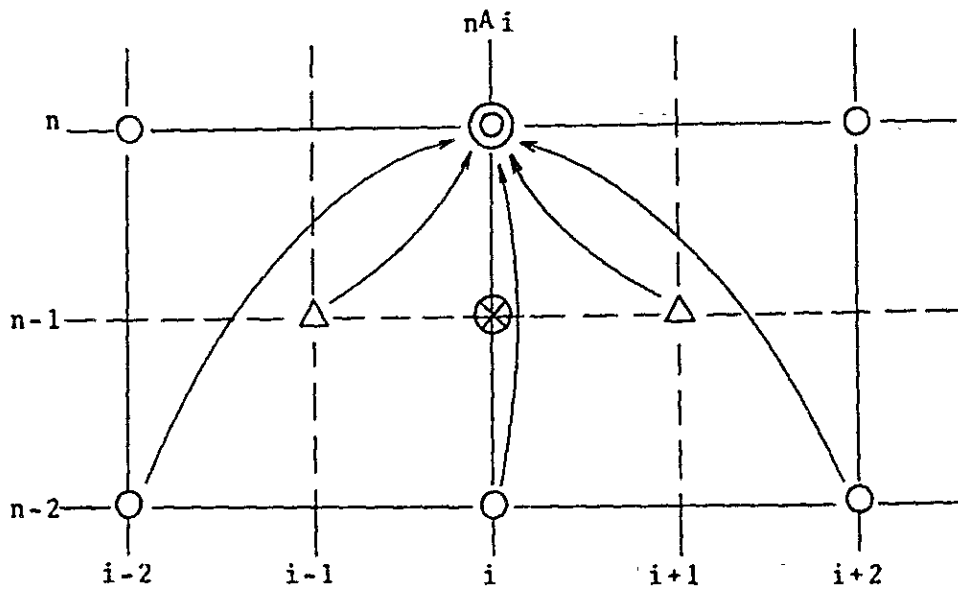


FIGURE 3. OPERATIONAL GRID SYSTEM OF THE EQUATION OF CONTINUITY

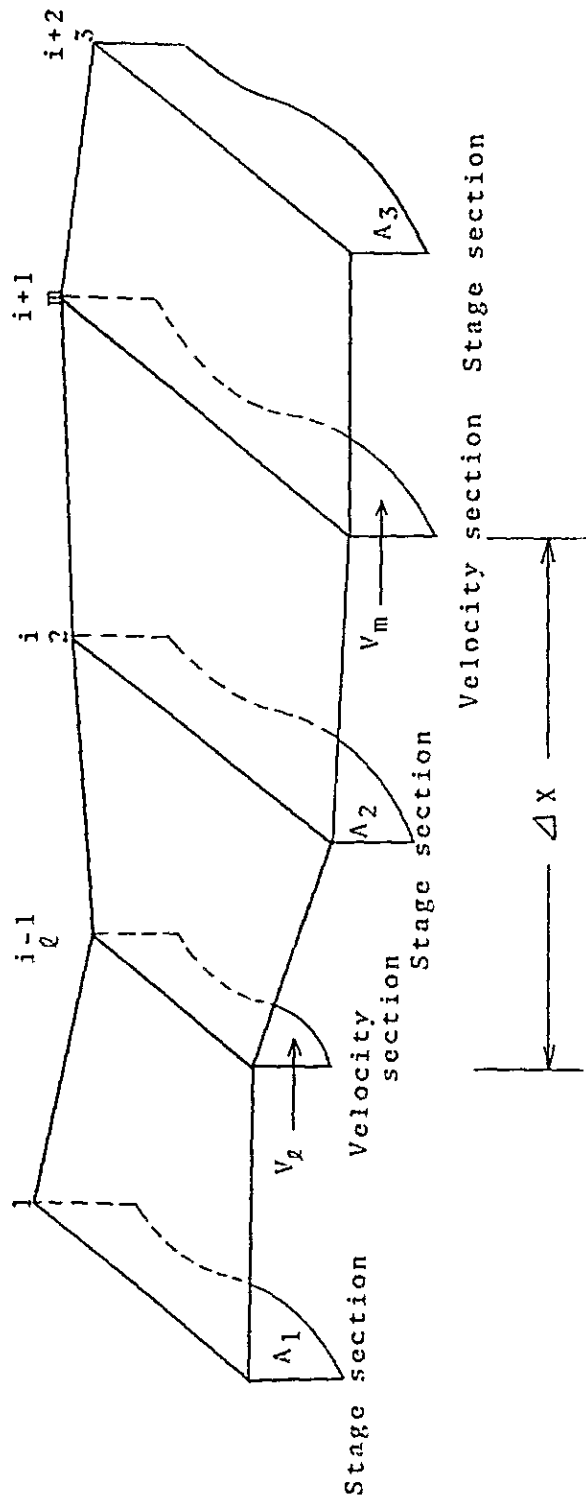


FIGURE 4. TREATMENT OF GEOMETRIC CONDITIONS TO SOLVE THE EQUATION OF CONTINUITY

THE HYDRAULIC ANALYSIS OF THE MODEL OF THE MIDDLE REACHES OF NYITMAKA RIVER
 BOUNDARY : (1) KUNHAYKAIK STATION ; (2) CONFLUENCE WITH IRRAWADDY RIVER
 SECTION : (1) <1> ; (5) DAWKI ST. ; (11) GANNON ST. ; (14) <2>
 INTERVAL : DA = 9500 OR 10000 M ; DT = 600 SEC.
 PERIOD : DURING JUNE 10 SEPTEMBER 1974

(DAY = 26 DAY) (HOUR : 0:00) (PRINT NO. 26)

BOUNDARY (NO.) < 1 > < 2 >
 WATER STAGE (M) 4.334 10.145

RIVER	(NO.)	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SECTION (NO.)	(M)	4.334	4.374	4.435	4.535	4.705	4.981	5.414	5.984	6.641	7.363	8.156	8.976	9.939	10.145
VELOCITY (M/SEC)		0.235	0.250	0.283	0.327	0.380	0.436	0.480	0.499	0.493	0.478	0.474	0.461	0.370	0.293
DISCHARGE (M ³ /S)		313.5	288.2	278.1	264.4	250.2	233.7	225.1	209.0	201.1	209.4	198.4	181.0	109.1	159.4
SECTION (M ²)		1332.7	1155.0	982.0	814.9	658.9	535.8	468.6	418.9	408.1	437.8	418.7	392.8	295.2	544.4
HY. RADIUS (M)		6.965	6.022	5.200	4.410	3.680	3.115	2.781	2.556	2.307	1.999	2.165	1.787	1.882	3.562
ROUGHNESS(MANNING)		0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000

(DAY = 27 DAY) (HOUR : 0:00) (PRINT NO. 27)

BOUNDARY (NO.) < 1 > < 2 >
 WATER STAGE (M) 4.334 10.241

RIVER	(NO.)	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SECTION (NO.)	(M)	4.334	4.379	4.445	4.549	4.723	5.004	5.421	5.934	6.560	7.270	8.062	8.927	9.982	10.241
VELOCITY (M/SEC)		0.247	0.260	0.291	0.332	0.384	0.434	0.468	0.479	0.476	0.468	0.467	0.470	0.402	0.333
DISCHARGE (M ³ /S)		328.3	300.1	286.0	271.4	254.1	234.3	219.7	198.4	187.4	195.5	187.3	176.7	121.3	186.3
SECTION (M ²)		1332.7	1155.9	983.8	817.5	662.0	539.7	469.7	414.1	393.8	417.8	401.2	375.8	302.0	559.1
HY. RADIUS (M)		6.965	6.025	5.207	4.422	3.695	3.132	2.785	2.533	2.293	1.913	2.133	1.712	1.903	3.647
ROUGHNESS(MANNING)		0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000

(DAY = 28 DAY) (HOUR : 0:00) (PRINT NO. 28)

BOUNDARY (NO.) < 1 > < 2 >
 WATER STAGE (M) 4.517 10.633

RIVER	(NO.)	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SECTION (NO.)	(M)	4.517	4.546	4.590	4.664	4.797	5.029	5.431	6.016	6.753	7.554	8.472	9.571	10.375	10.633
VELOCITY (M/SEC)		0.200	0.214	0.246	0.283	0.340	0.414	0.478	0.520	0.530	0.528	0.532	0.519	0.428	0.353
DISCHARGE (M ³ /S)		274.0	253.9	243.3	233.1	220.2	204.3	184.4	158.3	142.3	152.7	158.2	142.3	157.3	213.5
SECTION (M ²)		1307.2	1117.4	1010.2	911.8	814.9	714.9	614.4	514.4	427.7	474.4	482.5	478.9	366.8	618.9
HY. RADIUS (M)		7.092	6.144	5.314	4.520	3.772	3.131	2.742	2.501	2.327	2.179	2.240	2.159	2.092	3.988
ROUGHNESS(MANNING)		0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000

THE HYDRAULIC ANALYSIS OF THE MODEL OF THE MIDDLE REACHES OF MYITHAKA RIVER
 BOUNDARY : (1) KUNHAYKAIK STATION ; (2) CONFLUENCE WITH IKKAWADDY RIVER
 SECTION : (1) - (15) DANMI ST. ; (11) GAMMON ST. ; (14) - (2)
 INTERVAL : DX = 9500 CM 10000 M ; DT = 600 SEC.
 PERIOD : DURING JUNE TO SEPTEMBER 1974

(DAY = 107 DAY) (HOUR = 0:00) (PRINT NO. 107)

BOUNDARY (NO.) < 1 > < 2 >
 WATER STAGE (M) 7.809 16.222

RIVER SECTION (NO.)	1	2	3	4	5	6	7	8	9	10	11	12	13	14
WATER ST. (M)	7.809	8.305	8.861	9.452	10.040	10.599	11.197	11.835	12.442	12.985	13.609	14.319	15.387	16.222
VELOCITY (M/SEC)	0.998	0.988	0.949	0.871	0.781	0.732	0.737	0.762	0.793	0.840	0.908	0.966	1.007	1.029
DISCHARGE (M ³ /S)	2054.8	1992.4	1991.9	2020.0	2065.6	2194.1	2101.0	2205.3	2309.7	2316.9	2251.5	2168.6	2121.5	1933.7
SECTION (M ² /S)	2059.3	2016.6	2099.7	2310.2	2643.2	2950.1	2851.4	2895.9	2784.9	2759.1	2480.0	2243.9	2107.5	1878.9
HY. RADIUS (M)	9.197	8.353	7.354	6.343	5.339	4.538	4.535	4.522	5.349	6.173	6.128	6.222	4.813	7.579
ROUGHNESS(MANNING)	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000

(DAY = 108 DAY) (HOUR = 0:00) (PRINT NO. 108)

BOUNDARY (NO.) < 1 > < 2 >
 WATER STAGE (M) 7.931 16.138

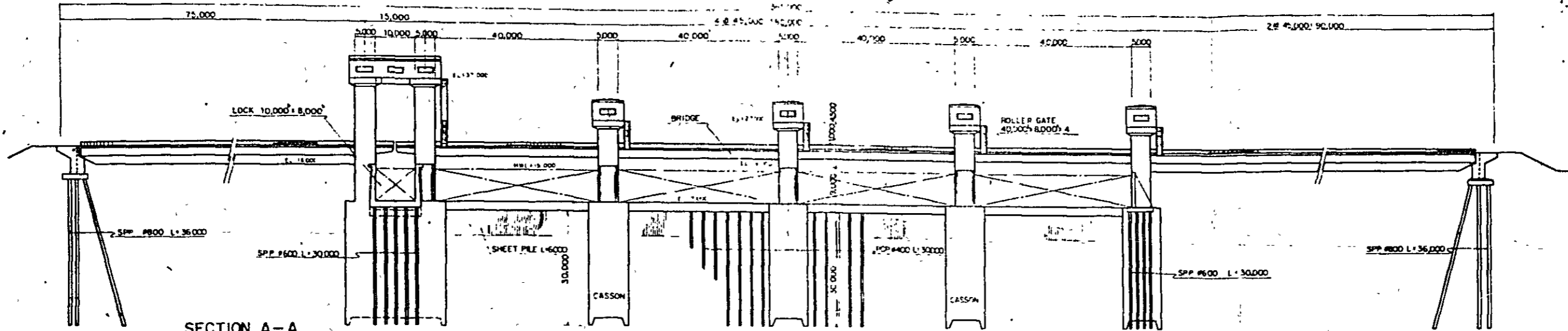
RIVER SECTION (NO.)	1	2	3	4	5	6	7	8	9	10	11	12	13	14
WATER ST. (M)	7.931	8.409	8.955	9.533	10.114	10.668	11.260	11.885	12.472	12.986	13.573	14.262	15.325	16.138
VELOCITY (M/SEC)	0.984	0.977	0.939	0.864	0.778	0.729	0.732	0.751	0.776	0.816	0.888	0.958	0.998	1.015
DISCHARGE (M ³ /S)	2055.7	2007.0	2019.9	2046.5	2096.3	2192.1	2128.3	2211.7	2185.9	2251.4	2175.5	2069.7	2015.7	1839.6
SECTION (M ² /S)	2089.4	2054.3	2150.1	2369.2	2695.8	3006.0	2909.5	2944.7	2818.1	2760.1	2450.8	2160.2	2019.4	1812.7
HY. RADIUS (M)	9.276	8.368	7.356	6.345	5.341	4.540	4.549	4.524	5.349	6.173	6.113	6.221	4.809	7.577
ROUGHNESS(MANNING)	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000

(DAY = 109 DAY) (HOUR = 0:00) (PRINT NO. 109)

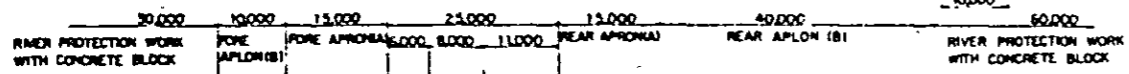
BOUNDARY (NO.) < 1 > < 2 >
 WATER STAGE (M) 7.961 15.989

RIVER SECTION (NO.)	1	2	3	4	5	6	7	8	9	10	11	12	13	14
WATER ST. (M)	7.961	8.463	8.920	9.500	10.176	10.723	11.302	11.907	12.469	12.957	13.506	14.169	15.212	15.989
VELOCITY (M/SEC)	1.007	0.994	0.945	0.863	0.773	0.723	0.722	0.737	0.757	0.791	0.864	0.943	0.981	0.991
DISCHARGE (M ³ /S)	2111.5	2047.2	2064.3	2077.9	2117.9	2194.5	2127.5	2186.5	2131.2	2154.0	2074.6	1909.1	1833.0	1679.6
SECTION (M ² /S)	2046.9	2077.0	2185.3	2411.4	2743.9	3050.2	2945.7	2965.8	2815.0	2723.1	2400.6	2023.8	1869.0	1695.0
HY. RADIUS (M)	9.296	8.369	7.356	6.346	5.342	4.541	4.528	4.524	5.349	6.173	6.083	6.218	4.793	7.574
ROUGHNESS(MANNING)	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000	0.03000

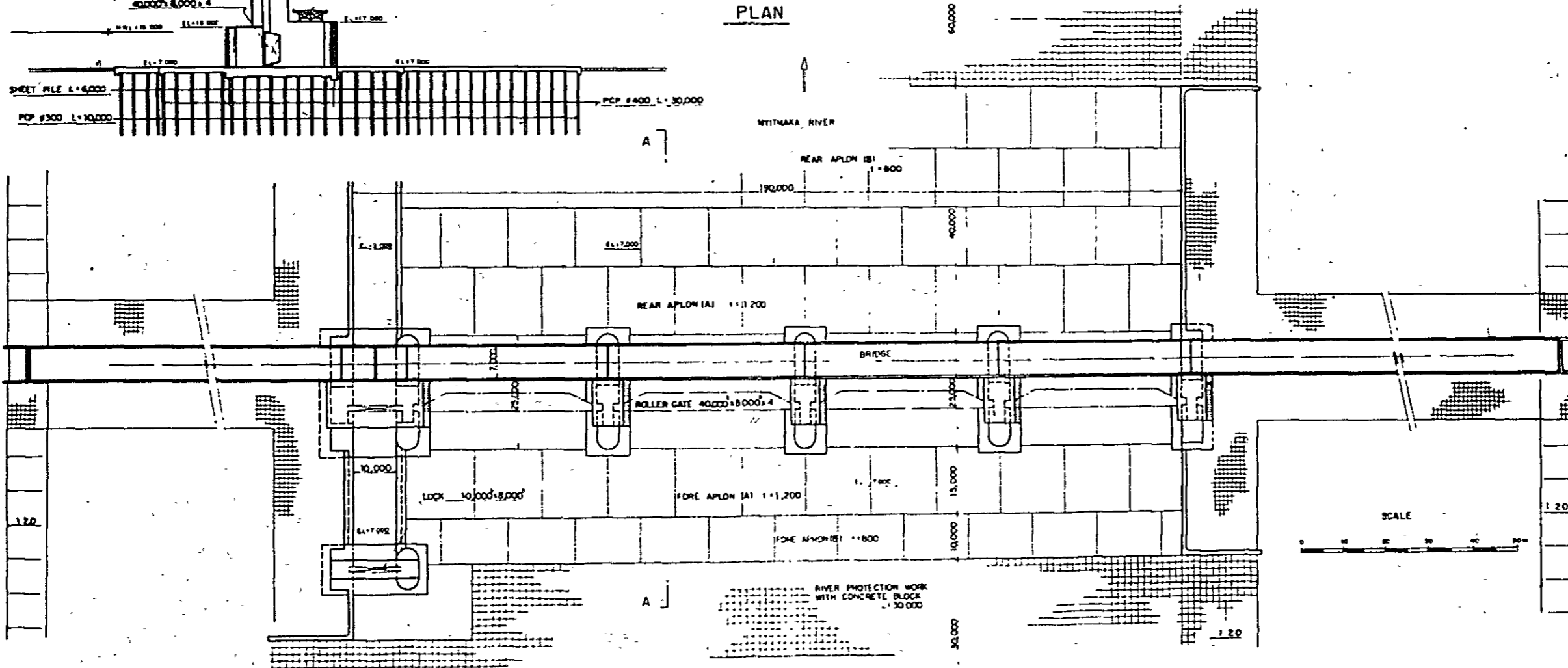
UPSTREAM ELEVATION



SECTION A-A



PLAN



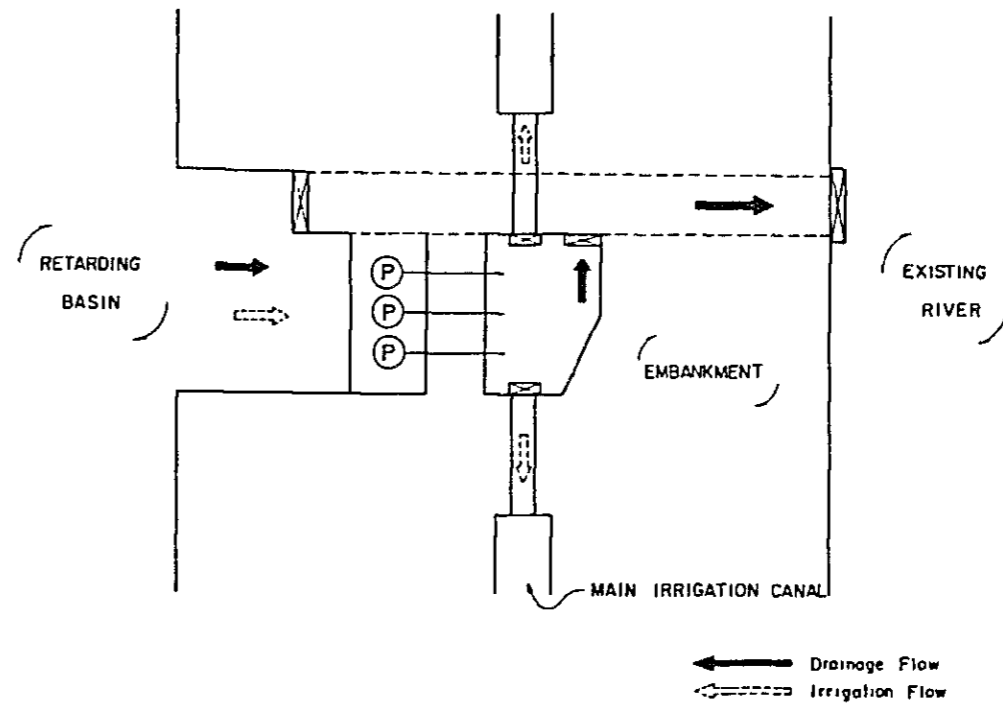
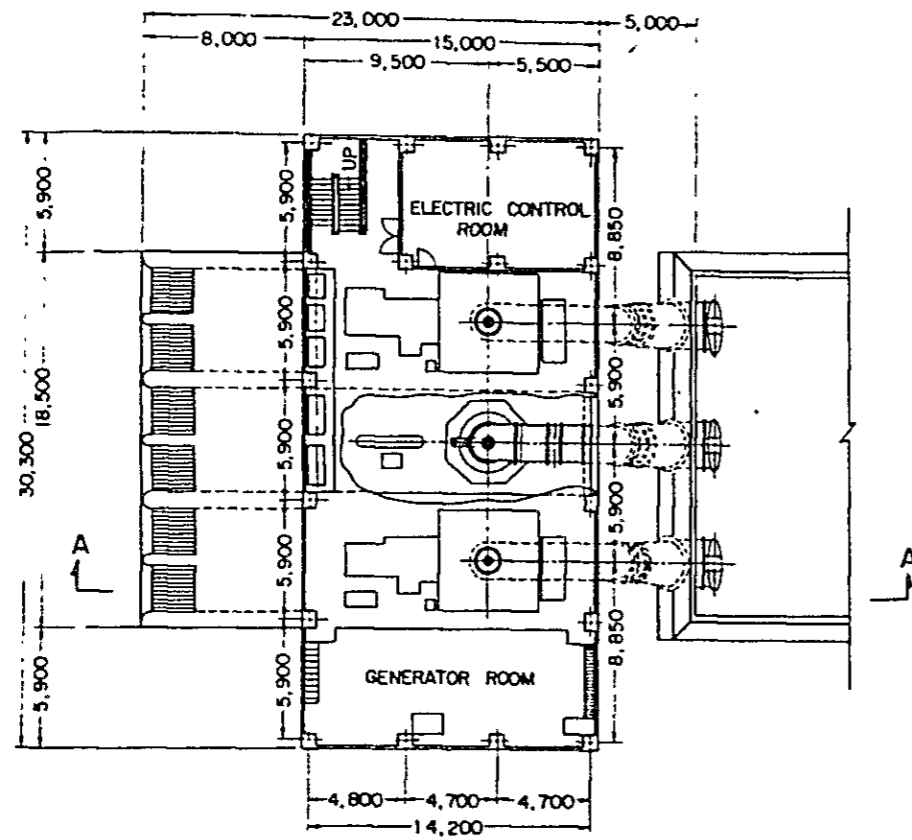
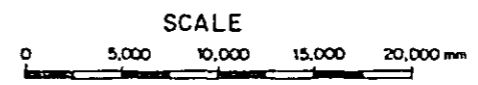
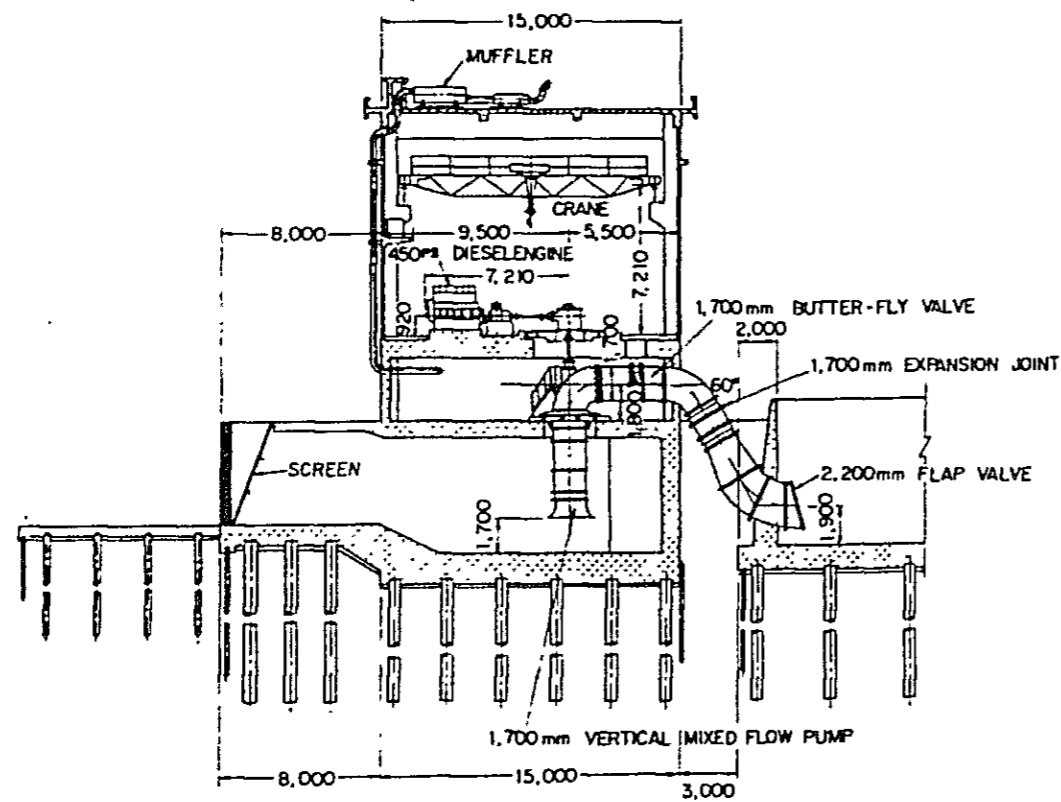


DIAGRAM OF WATER FLOW FOR IRRIGATION AND DRAINAGE



JICA