Daily Mean Discharge at Bedukan Gauging Sation (1977)

(unit: m^3/s)

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	6.43	4.97	13.00	2.31	2.00	5.45	5.18	3.66	6.05	6.41	8.37	10.69
2	9.52	4.99	10.61	2.15	1.73	4.19	5.38	3.05	5.23	18.85	11.36	8.59
3	12.11	4.30	9.49	2.03	1.74	3.38	5.13	2.79	4.58	9.61	10.05	7.80
4	7.67	4.50	8.40	1.95	1.83	3.36	4.15	2.64	4.01	8.15	9.97	7.60
5	5.71	38.83	7.56	2.09	1.92	3.34	3.51	2.87	3.41	7.76	10.76	12.21
6	4.61	57.17	8.28	2.28	2.01	4.53	3.53	3.78	2.94	11.26	10.90	15.20
7	4.03	20.96	8.64	2.57	2.09	8.20	3.91	9.02	2.70	27.71	10.74	13.08
8	4.14	22.23	11.30	2.12	2.18	7.71	7.15	8.03	2.59	17.52	13.71	11.64
9	4.45	33.28	8.60	1.94	2.37	6.73	9.35	5.69	2.48	15.95	16.02	10.75
10	4.93	15.82	8.05	1.76	4.24	5.70	11.11	5.02	2.37	12.25	15.70	9.34
11	9.84	11.82	6.49	1.81	2.58	6.55	8.73	4.99	2.26	9.83	21.71	8.25
12	14.19	10.03	5.77	2.11	3.92	7.30	8.07	3.94	2.15	11.34	16.51	7.79
13	13.81	8.50	5.22	3.95	5.14	24.50	12.33	3.49	2.04	11.04	13.49	7.06
14	54.21	12.60	5.10	6.64	5.00	16.33	13.15	3.71	1.93	9.48	12.83	6.39
15	42.14	14.67	5.46	8.39	11.44	20.03	9.49	3.30	1.83	8.37	12.57	6.07
16	23.66	13.79	5.81	4.65	8.03	18.87	7.42	2.82	1.71	8.75	12.29	5.76
17	22.20	26.99	5.52	6.06	4.94	11.80	6.30	2.42	1.51	9.79	10.35	7.07
18	15.30	81.34	6.18	4.22	3.63	20.21	6.65	2.49	1.29	9.09	9.07	8.23
19	13.08	46.96	5.20	2.59	3.20	13.33	5.57	2.68	1.07	8.49	7.79	7.29
20	10.04	95.79	5.74	2.70	2.49	10.28	5.40	2.86	0.89	8.11	7.54	9.17
21	8.33	101.38	4.93	2.83	3.26	9.15	5.64	3.19	0.84	18.73	7.34	8.71
22	7.16	45.96	4.02	2.08	3.67	9.50	6.03	7.39	0.67	10.61	7.13	7.75
23	8.97	39.47	3.74	1.82	5.47	8.77	6.34	9.43	18.40	12.13	7.05	6.71
24	12.42	33.16	3.45	7.13	5.32	8.02	5.18	15.09	10.11	9.62	6.54	6.13
25	10.46	22.31	3.17	3.99	4.82	8.36	5.73	9.45	5.95	7.49	6.39	5.72
26	11.18	17.22	2.92	4.03	10.49	6.29	5.38	7.16	4.49	7.68	8.79	5.36
27	8.56	14.51	2.73	3.36	10.05	5.22	9.13	13.60	3.58	8.00	13.41	5.02
28	6.68	13.77	2.55	2.94	9.97	5.55	12.03	18.11	3.10	8.31	16.88	4.83
29	5.65		2.38	2.91	10.91	5.77	7.88	14.20	3.69	9.33	20.11	4.70
30	5.05		2.50	2.29	8.66	5.38	5.45	9.50	8.59	8.61	18.40	4.56
31	4.95		2.82		7.59		4.48	6.85		8.25		4.43
TOTAL	371.48	817.32	185.63	97.70	152.69	273.80	214.78	193.22	112.46	338.52	353.77	243.90
AVERAGE	11.98	29.19	5.99	3.26	4.93	9.13	6.93	6.23	3.75	10.92	11.79	7.87
MAXIMUM	54.21	101.38	13.00	8.39	11.44	24.50	13.15	18.11	18.40	27.71	21.71	15.20
MINIMUM	4.03	4.30	2.38	1.76	1.73	3.34	3.51	2.42	0.67	6.41	6.39	4.43

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
3355.27	9.19	101.38	0.67

Daily Mean Discharge at Bedukan Gauging Sation (1978)

(unit: m^3/s)

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	4.30	2.98	3.81	1.55	4.69	6.62	9.60	********	4.97	2.57	8.57	6.83
2	4.07	2.88	3.43	3.10	4.17	5.91	10.49	********	4.60	2.70	6.67	5.23
3	3.75	2.81	3.14	5.26	3.98	5.18	9.40	********	2.67	2.80	6.06	6.08
4	3.38	2.74	2.85	2.61	4.05	3.97	8.07	********	2.63	2.14	7.64	13.00
5	3.73	3.52	2.86	1.63	3.51	3.37	6.61	********	4.65	3.04	13.05	13.89
6	21.32	3.06	2.93	********	2.87	3.73	7.03	********	6.46	2.00	13.85	9.31
7	8.30	2.44	2.93	2.54	2.43	6.92	10.39	********	7.18	1.94	18.29	7.65
8	9.27	2.09	3.78	2.22	2.33	5.05	11.04	********	6.63	2.43	11.24	8.56
9	8.75	2.02	8.51	1.85	3.01	16.25	7.50	********	5.21	13.80	11.02	8.04
10	6.99	1.93	15.00	1.53	4.11	13.11	6.89	********	8.94	13.33	10.81	8.33
11	7.63	1.80	5.88	0.93	5.42	11.64	5.94	8.40	4.58	20.64	28.92	9.17
12	10.16	1.83	4.17	0.89	6.37	11.88	5.69	10.05	4.36	15.40	20.07	33.88
13	43.62	1.81	3.41	1.35	5.51	12.79	8.43	6.61	5.36	7.98	17.17	15.80
14	17.94	2.60	2.84	1.95	4.15	8.72	8.76	5.94	3.69	5.32	13.02	13.48
15	10.94	6.10	2.63	11.19	5.09	6.10	9.28	5.42	5.33	4.66	11.22	10.44
16	8.46	6.21	2.50	7.05	8.22	5.87	7.45	4.75	4.33	4.23	12.35	9.94
17	6.88	6.55	2.45	4.70	8.73	7.35	7.88	7.78	3.76	26.50	10.86	14.07
18	6.14	10.16	3.64	3.31	12.91	7.21	7.14	5.19	3.21	16.72	10.65	16.76
19	5.50	4.80	3.32	2.56	9.93	13.42	5.86	5.18	2.64	13.22	9.62	11.15
20	5.09	3.79	2.51	1.78	7.83	15.25	6.99	4.94	2.54	11.00	7.77	9.18
21	4.83	2.97	2.42	1.88	8.09	17.26	7.42	4.50	3.20	10.32	8.09	8.95
22	4.92	2.38	2.64	2.62	14.80	23.52	7.24	4.29	2.81	13.17	7.84	8.77
23	7.12	2.92	4.25	10.09	9.66	15.40	8.48	3.92	4.48	11.04	6.82	7.31
24	11.14	11.11	2.68	10.78	6.56	14.94	8.64	3.33	4.58	9.29	14.55	6.37
25	9.45	13.92	2.45	15.08	5.38	14.01	8.69	2.53	17.07	7.40	9.78	5.63
26	6.52	7.50	2.31	10.70	4.79	10.58	7.54	2.40	8.58	6.61	7.89	5.10
27	5.46	6.56	2.05	12.61	4.26	17.16	6.92	2.58	5.45	7.05	6.72	4.52
28	4.72	4.59	1.81	9.65	3.77	11.15	6.07	2.53	4.02	5.50	6.01	4.47
29	3.94		1.63	10.02	3.40	11.36	5.29	2.22	3.02	6.97	5.45	5.29
30	3.56		1.57	6.20	3.74	8.44	4.98	2.11	2.64	13.04	5.94	4.66
31	3.24		1.52		6.00		5.10	2.89		12.89		10.46
TOTAL	261.12	124.07	107.92	********	179.76	314.16	236.81	********	149.59	275.70	327.94	302.32
AVERAGE	8.42	4.43	3.48	********	5.80	10.47	7.64	********	4.99	8.89	10.93	9.75
MAXIMUM	43.62	13.92	15.00	15.08	14.80	23.52	11.04	10.05	17.07	26.50	28.92	33.88
MINIMUM	3.24	1.80	1.52	********	2.33	3.37	4.98	********	2.54	1.94	5.45	4.47

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
**********	**********	43.62	**********

Daily Mean Discharge at Bedukan Gauging Sation (1979)

(unit: m^3/s)

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	10.93	2.49	0.67	1.93	1.12	4.53	8.10	6.58	6.90	6.83	10.81	11.26
2	10.87	2.45	1.91	2.05	2.01	8.51	10.45	5.94	6.79	5.37	8.54	10.57
3	9.63	2.45	4.56	4.57	3.44	7.98	6.65	5.02	9.86	5.61	7.13	12.58
4	7.67	2.21	3.08	3.18	2.13	7.72	5.08	4.84	5.91	9.76	8.38	12.63
5	7.38	1.98	2.72	6.35	3.03	5.24	6.89	5.02	3.93	14.46	13.43	9.01
6	6.00	1.87	4.91	3.38	2.34	4.22	4.94	5.70	2.88	20.98	14.96	7.97
7	5.13	1.77	3.30	2.47	2.12	2.96	5.23	5.33	2.78	28.73	12.85	7.58
8	4.81	1.64	6.01	2.13	10.80	3.21	4.46	3.94	2.98	40.67	20.78	7.11
9	4.26	1.49	7.52	1.88	14.47	5.45	7.51	3.36	3.15	36.91	20.03	12.05
10	3.97	1.36	3.85	1.63	8.06	8.84	5.54	3.16	6.61	24.62	13.66	19.87
11	3.72	1.89	2.93	1.69	9.17	5.24	4.79	3.03	7.78	17.38	20.25	15.88
12	3.30	2.14	4.15	1.84	9.72	4.53	8.00	3.16	7.16	19.70	26.11	17.32
13	2.83	2.46	4.72	4.20	4.50	10.63	7.67	3.09	6.51	22.28	19.86	14.72
14	2.71	4.54	7.71	4.84	3.34	19.00	8.51	2.72	8.42	14.78	13.88	10.74
15	2.65	6.77	4.23	3.46	2.62	16.80	7.27	2.49	10.66	12.23	12.01	8.94
16	2.59	3.80	20.27	2.51	2.56	9.00	15.81	2.32	7.88	10.79	10.25	7.96
17	2.50	2.66	14.27	2.08	2.24	13.40	14.30	2.19	8.31	9.15	10.51	7.62
18	2.38	2.30	7.06	1.91	2.86	11.61	8.28	2.16	27.69	7.97	12.55	7.14
19	2.29	2.05	5.67	1.78	3.64	12.24	8.87	2.66	14.09	7.41	12.28	6.46
20	2.59	1.82	4.41	1.66	3.37	15.86	10.03	4.60	17.17	13.53	11.42	7.29
21	3.72	1.64	4.82	2.33	2.96	10.87	11.07	5.84	24.87	13.31	9.89	11.62
22	3.07	1.55	3.54	3.54	3.23	9.56	9.84	5.63	14.15	13.17	7.51	14.85
23	3.62	1.50	3.09	2.27	4.18	11.38	16.06	7.59	14.06	10.22	7.98	15.37
24	3.65	1.41	2.74	2.10	2.83	7.19	15.69	5.81	12.46	8.47	11.62	13.56
25	3.42	1.44	2.48	1.92	2.20	6.21	10.81	4.12	9.82	10.59	10.41	12.70
26	3.43	1.32	2.36	2.53	2.16	6.03	8.40	3.49	11.71	9.33	8.98	12.66
27	2.89	1.09	2.21	1.75	2.74	8.64	8.59	4.93	12.74	8.74	9.02	12.23
28	2.45	0.76	2.45	1.57	3.03	7.91	10.61	4.29	8.94	7.68	13.43	12.79
29	2.25		3.48	1.42	1.95	7.85	7.88	8.44	7.00	12.12	10.48	11.88
30	2.33		2.63	1.25	3.40	6.58	6.59	8.00	7.56	22.78	11.36	9.28
31	3.52		2.13		6.07		6.49	6.20		12.39		7.95
TOTAL	132.56	60.85	145.88	76.22	128.29	259.19	270.41	141.65	290.77	457.96	380.37	349.59
AVERAGE	4.28	2.17	4.71	2.54	4.14	8.64	8.72	4.57	9.69	14.77	12.68	11.28
MAXIMUM	10.93	6.77	20.27	6.35	14.47	19.00	16.06	8.44	27.69	40.67	26.11	19.87
MINIMUM	2.25	0.76	0.67	1.25	1.12	2.96	4.46	2.16	2.78	5.37	7.13	6.46

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
2693.74	7.38	40.67	0.67

Daily Mean Discharge at Bedukan Gauging Satien (1980)

(unit: m^3/s)

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	7.19	7.75	5.12	13.60	10.38	13.78	11.73	8.41	7.00	2.72	9.62	5.37
2	7.09	6.92	5.32	7.36	12.65	9.93	9.70	7.57	6.23	2.77	10.10	17.46
3	7.00	6.54	4.63	5.92	13.02	13.85	7.10	7.40	5.60	2.83	8.66	20.56
4	6.97	5.88	4.44	5.55	10.07	11.41	6.23	6.75	5.00	2.63	6.49	13.27
5	8.19	5.32	4.14	5.58	6.59	15.15	5.40	7.63	4.68	2.68	4.92	14.30
6	7.80	5.20	3.65	9.81	5.54	10.49	5.10	13.28	5.30	5.62	5.82	10.02
7	6.31	5.09	8.07	9.30	6.29	10.51	4.23	12.21	5.48	9.90	8.22	8.72
8	7.60	4.92	13.25	8.46	6.39	12.87	3.98	13.91	4.43	8.57	10.22	8.62
9	15.66	4.59	13.72	8.79	4.82	12.00	4.61	20.04	4.08	10.21	19.01	8.42
10	12.15	5.29	15.33	6.12	5.14	8.02	4.11	18.45	4.57	9.46	14.58	9.27
11	9.68	5.92	11.85	5.00	4.70	6.63	3.56	17.81	3.53	11.41	9.14	12.64
12	8.24	5.04	8.11	4.49	5.36	5.74	3.86	15.10	3.26	15.39	7.38	16.06
13	7.62	4.35	6.38	4.78	5.88	6.32	4.01	11.22	3.13	8.92	6.73	13.17
14	8.04	8.01	5.56	4.10	8.54	7.43	5.44	10.90	********	6.54	17.05	10.79
15	9.56	15.02	5.09	3.92	8.79	9.70	6.25	10.46	********	5.81	10.93	9.81
16	7.57	29.82	4.68	3.54	5.97	9.48	4.22	8.36	********	7.46	9.52	16.61
17	12.98	15.33	4.97	3.07	5.16	16.18	3.92	7.80	********	5.06	7.41	16.99
18	13.59	24.99	6.64	2.79	4.44	15.37	6.54	7.90	********	4.09	6.31	27.77
19	11.50	25.02	6.10	5.01	4.22	10.65	7.96	7.31	********	9.17	5.92	30.56
20	9.42	26.81	5.77	4.97	4.91	9.90	7.07	6.24	********	7.88	6.48	25.96
21	7.33	18.60	7.73	8.15	4.41	7.94	4.80	10.16	********	5.24	7.97	17.93
22	24.26	12.82	5.81	7.82	4.76	6.50	6.22	12.67	********	4.58	5.48	16.21
23	51.79	10.63	4.80	5.39	7.21	6.25	9.71	9.03	********	5.22	5.10	27.93
24	44.14	8.99	4.13	4.60	4.13	5.51	25.33	6.93	4.72	3.69	4.83	31.08
25	33.76	8.09	7.10	7.56	3.62	6.64	25.46	6.53	5.87	3.13	4.80	44.97
26	23.38	7.07	7.50	8.18	********	5.84	10.02	19.44	8.00	3.10	7.53	40.59
27	13.78	6.09	12.41	5.42	********	6.76	7.37	26.33	5.10	3.60	8.57	19.84
28	44.63	5.59	9.65	4.52	2.97	8.57	4.56	10.57	4.41	4.68	9.60	15.22
29	34.51	5.16	9.49	4.14	3.04	5.95	4.70	8.06	3.78	4.96	5.38	13.42
30	24.03		11.32	4.88	3.05	12.06	6.69	8.07	3.10	5.76	6.18	12.25
31	13.54		13.11		6.27		16.80	9.56		6.68		20.37
TOTAL	499.31	300.85	235.87	182.82	********	287.03	236.68	346.10	********	189.76	245.95	556.18
AVERAGE	16.11	10.37	7.61	6.09	********	9.57	7.63	11.16	********	6.12	8.20	17.94
MAXIMUM	51.79	29.82	15.33	13.60	13.02	16.18	25.46	26.33	8.00	15.39	19.01	44.97
MINIMUM	6.31	4.35	3.65	2.79	********	5.51	3.56	6.24	********	2.63	4.80	5.37

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
**********	**********	51.79	**********

Daily Mean Discharge at Tomboloi Gauging Station (1970)

(unit: m^3/s)

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	133.00	72.00	********	70.00	********	********	215.00	159.00	130.00	97.00	119.00	261.00
2	115.00	73.00	********	********	********	********	158.00	123.00	139.00	186.00	91.00	167.00
3	130.00	77.00	********	********	********	********	125.00	116.00	130.00	217.00	137.00	272.00
4	119.00	161.00	********	********	********	********	144.00	90.00	134.00	174.00	237.00	584.00
5	104.00	323.00	********	********	********	517.00	172.00	78.00	132.00	167.00	118.00	********
6	108.00	243.00	39.00	********	********	348.00	137.00	86.00	105.00	120.00	132.00	852.00
7	101.00	143.00	31.00	********	********	284.00	129.00	119.00	91.00	103.00	160.00	543.00
8	184.00	114.00	28.00	********	********	203.00	109.00	404.00	79.00	119.00	170.00	346.00
9	147.00	99.00	27.00	********	********	192.00	121.00	177.00	81.00	115.00	648.00	258.00
10	211.00	86.00	26.00	********	********	149.00	109.00	438.00	77.00	236.00	285.00	216.00
11	489.00	77.00	25.00	********	********	142.00	84.00	394.00	76.00	160.00	477.00	171.00
12	302.00	74.00	24.00	********	********	112.00	75.00	355.00	71.00	146.00	302.00	144.00
13	249.00	72.00	24.00	********	********	93.00	68.00	244.00	58.00	128.00	255.00	161.00
14	169.00	61.00	23.00	********	********	81.00	61.00	201.00	53.00	130.00	194.00	129.00
15	132.00	55.00	22.00	********	********	77.00	58.00	146.00	62.00	237.00	191.00	109.00
16	113.00	53.00	24.00	********	********	86.00	85.00	155.00	52.00	164.00	186.00	98.00
17	108.00	49.00	32.00	********	********	113.00	80.00	223.00	49.00	124.00	174.00	92.00
18	134.00	45.00	24.00	********	********	105.00	********	152.00	102.00	114.00	133.00	86.00
19	142.00	42.00	23.00	********	********	83.00	57.00	139.00	73.00	97.00	123.00	80.00
20	124.00	40.00	54.00	********	********	72.00	55.00	123.00	81.00	141.00	131.00	72.00
21	112.00	40.00	38.00	********	********	105.00	58.00	152.00	212.00	126.00	123.00	73.00
22	338.00	38.00	29.00	********	********	92.00	67.00	107.00	199.00	263.00	121.00	70.00
23	292.00	38.00	26.00	********	********	87.00	63.00	139.00	161.00	260.00	101.00	76.00
24	202.00	36.00	24.00	********	********	384.00	137.00	120.00	348.00	165.00	91.00	68.00
25	161.00	34.00	25.00	********	********	182.00	90.00	103.00	236.00	133.00	82.00	118.00
26	134.00	32.00	24.00	********	********	199.00	74.00	95.00	151.00	113.00	102.00	81.00
27	113.00	32.00	37.00	********	********	198.00	80.00	90.00	186.00	86.00	211.00	105.00
28	97.00	********	50.00	********	********	197.00	146.00	83.00	212.00	85.00	271.00	174.00
29	97.00		56.00	********	********	282.00	148.00	194.00	145.00	129.00	243.00	124.00
30	87.00		48.00	********	********	413.00	116.00	207.00	117.00	121.00	161.00	146.00
31	77.00		49.00		********		129.00	139.00		134.00		185.00
TOTAL	5024.00	********	********	********	********	********	5351.00	3742.00	4592.00	5769.00	********	
AVERAGE	162.06	********	********	********	********	********	172.61	124.73	148.13	192.30	********	
MAXIMUM	489.00	323.00	56.00	70.00	********	517.00	215.00	438.00	348.00	263.00	648.00	852.00
MINIMUM	77.00	********	********	********	********	********	78.00	49.00	85.00	82.00	********	

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
**********	**********	852.00	**********

Daily Mean Discharge at Tomboloi Gauging Station (1971)

(unit: m^3/s)

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	156.00	213.00	214.00	54.00	91.00	********	95.00	********	215.00	83.00	155.00	186.00
2	180.00	130.00	240.00	51.00	62.00	********	142.00	********	224.00	75.00	116.00	127.00
3	125.00	124.00	154.00	52.00	87.00	********	629.00	********	147.00	69.00	99.00	133.00
4	102.00	113.00	132.00	52.00	59.00	330.00	********	********	119.00	78.00	93.00	111.00
5	97.00	206.00	114.00	50.00	50.00	65.00	********	********	105.00	73.00	87.00	96.00
6	126.00	1018.00	104.00	48.00	53.00	126.00	********	********	98.00	77.00	167.00	89.00
7	115.00	1876.00	115.00	45.00	63.00	81.00	********	228.00	163.00	55.00	138.00	150.00
8	156.00	1540.00	108.00	44.00	94.00	259.00	********	163.00	109.00	50.00	135.00	126.00
9	161.00	2150.00	110.00	44.00	72.00	280.00	********	147.00	92.00	47.00	126.00	127.00
10	210.00	1225.00	228.00	46.00	83.00	93.00	********	131.00	127.00	42.00	109.00	103.00
11	154.00	1259.00	119.00	42.00	59.00	160.00	********	184.00	124.00	43.00	********	260.00
12	147.00	668.00	106.00	42.00	57.00	37.00	********	208.00	110.00	68.00	********	239.00
13	137.00	440.00	93.00	42.00	72.00	33.00	********	119.00	92.00	62.00	********	254.00
14	129.00	550.00	103.00	52.00	65.00	27.00	********	101.00	285.00	86.00	339.00	165.00
15	110.00	555.00	122.00	42.00	63.00	31.00	********	87.00	161.00	92.00	334.00	139.00
16	96.00	535.00	221.00	43.00	79.00	26.00	********	99.00	179.00	64.00	239.00	136.00
17	87.00	400.00	260.00	44.00	88.00	24.00	********	109.00	211.00	76.00	367.00	141.00
18	79.00	367.00	265.00	63.00	82.00	20.00	********	173.00	165.00	95.00	********	125.00
19	74.00	337.00	220.00	201.00	86.00	18.00	********	144.00	161.00	81.00	********	115.00
20	107.00	273.00	131.00	74.00	132.00	22.00	********	135.00	188.00	174.00	********	114.00
21	109.00	245.00	121.00	129.00	132.00	43.00	********	106.00	171.00	106.00	********	112.00
22	80.00	205.00	111.00	81.00	85.00	54.00	********	174.00	138.00	109.00	********	107.00
23	171.00	173.00	88.00	96.00	62.00	23.00	********	125.00	185.00	157.00	********	134.00
24	158.00	153.00	82.00	80.00	56.00	74.00	********	101.00	295.00	112.00	********	372.00
25	224.00	209.00	84.00	57.00	********	51.00	********	176.00	342.00	102.00	********	241.00
26	278.00	214.00	70.00	47.00	********	32.00	********	388.00	187.00	131.00	********	178.00
27	207.00	274.00	76.00	43.00	********	84.00	********	370.00	149.00	148.00	110.00	136.00
28	179.00	263.00	71.00	43.00	********	43.00	********	210.00	126.00	293.00	144.00	143.00
29	148.00		63.00	46.00	********	45.00	********	160.00	108.00	322.00	121.00	150.00
30	162.00		93.00	55.00	********	59.00	********	145.00	91.00	213.00	135.00	194.00
31	143.00		63.00		********		********	152.00		167.00		227.00
TOTAL	4407.00	15715.00	4081.00	1808.00	********	********	********	********	4867.00	3350.00	********	4930.00
AVERAGE	142.16	561.25	131.65	60.27	********	********	********	********	162.23	108.06	********	159.03
MAXIMUM	278.00	2150.00	265.00	201.00	132.00	330.00	629.00	388.00	342.00	322.00	367.00	372.00
MINIMUM	74.00	113.00	63.00	42.00	********	********	********	********	91.00	42.00	********	89.00

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
**********	**********	2150.00	**********

Daily Mean Discharge at Tomboloi Gauging Station (1972)

(unit: m^3/s)

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	386.00	188.50	93.60	341.10	35.10	99.70	32.80	21.60	117.70	158.00	150.40	401.90
2	217.50	146.10	82.30	244.20	58.20	79.30	31.40	23.10	117.40	181.90	127.90	226.40
3	225.70	152.50	72.90	216.30	72.10	76.40	36.30	23.20	117.30	182.50	101.40	201.50
4	248.00	164.60	65.90	192.40	68.10	97.40	30.10	35.50	116.40	207.50	83.40	158.40
5	330.10	143.10	61.70	137.70	79.00	76.50	28.60	45.80	113.20	172.30	73.30	163.80
6	206.80	112.30	79.20	109.70	64.60	91.50	27.80	29.80	180.80	234.00	81.70	116.40
7	161.50	96.50	85.20	94.70	108.40	116.60	27.60	28.00	111.70	255.50	104.90	101.90
8	159.40	86.30	84.80	96.20	120.30	128.90	28.30	43.20	124.20	272.40	78.50	105.70
9	131.30	79.00	73.80	113.60	166.00	84.50	26.80	73.50	96.90	264.50	71.40	161.60
10	111.00	75.70	66.80	143.50	142.60	74.40	25.60	83.40	95.80	313.60	66.20	153.50
11	97.90	79.70	62.90	99.90	105.20	88.40	25.00	82.10	86.70	264.70	102.70	97.80
12	91.00	68.90	66.80	84.30	117.60	99.00	24.00	52.60	74.30	213.00	168.80	83.40
13	83.10	60.30	57.20	73.40	76.40	81.70	23.10	44.90	75.60	194.90	84.30	73.30
14	80.00	56.70	56.10	63.50	84.80	62.70	23.00	44.70	86.60	208.90	70.70	71.10
15	147.90	53.20	49.50	59.40	79.80	54.20	23.80	50.10	71.50	230.30	81.30	65.60
16	146.30	53.60	47.80	54.30	78.80	60.40	26.30	********	74.90	169.10	119.50	59.40
17	288.50	193.90	53.90	63.40	80.50	88.70	42.40	52.40	74.20	121.60	124.60	52.90
18	651.40	202.30	122.10	51.50	120.00	65.20	71.30	175.80	145.90	100.60	93.00	50.30
19	569.90	111.60	98.60	57.40	134.40	65.60	36.50	105.90	163.40	89.00	87.80	51.40
20	368.30	95.40	133.00	49.10	221.20	52.70	43.30	73.60	130.70	83.60	70.20	49.30
21	295.60	90.50	110.20	43.50	159.90	53.40	36.70	85.40	183.00	75.30	72.30	46.30
22	260.80	159.70	89.60	40.80	164.50	58.40	30.80	64.60	199.90	79.80	91.90	44.70
23	254.90	135.00	96.20	41.70	153.60	61.60	31.70	51.20	172.50	105.00	274.70	45.00
24	203.70	203.20	229.00	43.50	159.90	51.90	27.00	79.20	263.80	70.60	213.10	40.80
25	158.10	286.00	115.90	71.10	126.70	44.90	27.60	159.60	297.70	67.70	135.90	64.20
26	140.10	219.10	90.80	49.50	125.70	40.50	25.60	216.00	307.10	62.50	103.20	55.20
27	118.10	150.70	77.70	38.60	123.70	41.40	25.30	165.00	258.10	51.50	110.80	46.10
28	106.20	116.50	65.40	35.60	100.30	53.90	27.00	115.10	254.20	74.60	98.10	40.40
29	106.60	99.30	63.40	34.50	143.30	38.50	24.70	219.80	179.80	90.70	83.70	36.20
30	107.30		180.80	33.70	215.30	39.50	24.00	168.00	159.10	144.40	99.00	35.90
31	129.50		233.40		192.60		22.00	125.90		332.30		36.30
TOTAL	6582.50	3680.20	2866.50	2778.10	3678.60	2127.80	936.40	********	4450.40	5072.30	3224.70	2936.70
AVERAGE	212.34	126.90	92.47	92.60	118.66	70.93	30.21	********	148.35	163.62	107.49	94.73
MAXIMUM	651.40	286.00	233.40	341.10	221.20	128.90	71.30	219.80	307.10	332.30	274.70	401.90
MINIMUM	80.00	53.20	47.80	33.70	35.10	38.50	22.00	********	71.50	51.50	66.20	35.90

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
**********	**********	651.40	**********

Daily Mean Discharge at Tomboloi Gauging Station (1973)

(unit: m^3/s)

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	57.50	21.50	14.50	15.70	134.70	46.60	99.30	********	52.40	285.00	351.70	113.80
2	62.90	21.10	********	14.00	112.60	49.80	148.30	********	68.40	212.00	291.70	91.10
3	45.00	21.10	********	22.50	73.80	44.20	163.20	********	144.10	171.10	288.00	85.30
4	117.60	20.50	********	36.30	83.50	59.00	109.30	********	125.90	261.90	297.60	80.50
5	77.30	20.20	********	24.60	74.90	********	92.50	********	156.70	165.20	237.90	76.60
6	126.00	19.60	********	18.20	55.20	********	77.80	********	254.90	169.50	162.10	84.80
7	83.70	19.10	********	15.00	101.90	33.70	********	********	153.00	132.30	337.60	76.80
8	60.70	18.80	********	14.10	125.60	31.30	********	********	129.40	114.00	332.00	79.10
9	50.60	20.10	********	13.80	131.30	32.20	********	********	123.00	134.50	199.20	64.50
10	45.50	19.20	********	12.50	166.80	29.70	********	********	152.30	126.80	166.30	57.70
11	41.20	18.50	********	12.00	130.90	39.80	********	********	212.50	117.90	140.20	52.30
12	37.70	18.20	********	14.00	92.40	43.50	********	159.30	278.20	133.70	183.00	48.20
13	34.70	18.90	********	13.90	84.40	32.80	********	120.90	172.00	122.40	123.90	46.70
14	34.30	22.30	13.20	14.90	90.80	27.70	********	95.80	266.30	139.30	104.60	46.10
15	46.20	25.50	13.80	22.50	82.10	25.40	********	105.10	417.90	118.40	89.60	78.10
16	37.40	22.40	13.20	22.60	60.80	24.40	********	94.60	653.80	121.50	91.70	61.00
17	32.80	20.70	13.20	22.00	51.70	24.90	********	82.80	476.90	109.40	185.10	81.80
18	29.40	19.10	15.40	38.90	48.10	29.00	********	63.60	399.70	85.30	155.70	103.20
19	27.90	18.20	15.70	63.10	49.50	33.80	********	53.20	260.60	91.10	187.20	78.70
20	26.60	17.70	14.00	72.00	79.50	48.30	********	45.40	267.00	85.10	124.40	67.10
21	25.70	19.10	13.30	41.50	117.00	51.30	********	40.10	180.60	81.60	114.00	64.50
22	26.80	18.40	16.00	41.20	74.80	64.20	********	35.40	176.50	69.60	108.10	100.20
23	25.40	17.30	23.10	80.50	61.00	85.60	********	32.30	153.00	79.20	95.30	70.00
24	24.10	15.90	17.10	94.20	84.40	78.30	********	31.10	287.60	74.50	92.20	60.30
25	23.90	15.40	15.70	61.20	78.40	58.80	********	36.10	457.00	73.70	101.50	76.00
26	23.40	15.40	13.80	51.60	59.90	53.50	********	40.80	746.60	61.00	230.10	115.80
27	23.70	14.50	12.60	53.10	58.70	53.50	********	31.30	530.90	68.20	170.90	93.60
28	23.00	14.30	12.60	86.10	59.30	70.20	********	42.70	349.90	130.60	122.70	269.50
29	22.20		12.90	184.40	48.40	50.90	********	34.60	404.00	142.80	100.40	173.50
30	21.50		12.60	173.30	42.90	132.80	********	30.30	345.30	118.90	119.90	305.10
31	21.00		13.60		51.50		********	59.80		112.20		248.20
TOTAL	1335.70	533.00	********	1349.70	2566.80	********	********	********	8396.40	3908.70	5304.60	3050.10
AVERAGE	43.09	19.04	********	44.99	82.80	********	********	********	279.88	126.09	176.82	98.39
MAXIMUM	126.00	25.50	23.10	184.40	166.80	132.80	163.20	159.30	746.60	285.00	351.70	305.10
MINIMUM	21.00	14.30	********	12.00	42.90	********	********	********	52.40	61.00	89.60	46.10

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
**********	**********	746.60	**********

Daily Mean Discharge at Tomboloi Gauging Station (1974)

(unit: m^3/s)

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	201.60	188.70	********	********	********	87.20	324.30	125.10	61.30	84.10	50.30	45.30
2	208.60	352.10	********	********	********	96.50	165.50	131.20	50.10	82.30	44.70	44.20
3	345.70	145.70	********	********	********	83.00	125.70	199.70	50.50	113.60	43.00	227.00
4	237.70	124.90	********	********	********	74.80	100.50	145.80	45.20	129.60	40.10	91.90
5	181.40	303.10	********	********	********	60.90	82.90	152.70	40.20	147.60	37.70	64.50
6	155.90	280.70	********	********	********	56.80	69.40	164.50	45.70	157.30	40.00	87.20
7	170.20	162.00	********	********	********	52.40	62.60	129.50	38.70	123.40	37.30	63.80
8	168.20	133.60	********	********	********	50.20	56.80	95.40	39.10	119.70	35.10	58.60
9	248.80	129.20	********	********	********	45.20	52.90	79.70	36.80	89.30	33.60	186.50
10	477.90	160.10	********	********	********	48.10	49.60	71.80	36.90	72.10	31.70	134.60
11	236.80	157.30	********	********	********	50.20	52.60	62.60	33.70	61.70	37.60	254.50
12	174.90	349.70	********	********	88.00	43.20	108.60	56.60	32.00	75.20	39.10	118.30
13	138.40	********	********	********	71.00	45.30	273.30	55.30	29.40	100.90	61.30	98.20
14	117.60	********	********	********	82.10	56.60	135.30	50.50	30.70	77.80	46.50	104.50
15	98.70	********	********	********	119.20	50.50	210.50	45.70	43.50	61.40	41.30	86.40
16	103.80	********	********	********	142.20	51.40	108.10	42.90	49.50	55.00	228.40	86.20
17	84.80	********	********	********	131.70	48.70	134.90	41.30	53.20	51.30	76.30	68.20
18	200.60	********	********	********	526.10	55.10	201.00	39.50	37.40	75.40	57.40	63.50
19	140.40	********	********	********	302.30	52.90	161.10	39.40	35.60	220.80	48.70	193.30
20	115.70	********	********	********	278.60	72.70	172.50	44.20	59.20	88.90	57.00	124.00
21	127.60	********	********	********	233.10	83.90	142.10	76.20	126.00	72.40	44.60	90.70
22	145.90	********	********	********	249.90	83.10	109.80	96.00	97.40	56.70	83.90	64.90
23	116.70	********	********	********	299.00	112.40	95.40	75.00	129.60	51.10	101.30	57.40
24	95.60	********	********	********	268.40	126.30	84.90	93.30	73.50	48.50	77.10	76.10
25	80.80	********	********	********	176.50	328.60	77.40	53.50	123.60	46.00	56.30	74.50
26	83.60	********	********	********	176.10	383.30	87.10	61.80	365.20	48.50	53.50	88.70
27	95.20	********	********	********	203.10	441.70	73.60	134.40	149.70	54.30	48.90	114.60
28	90.90	********	********	********	299.10	190.60	67.50	73.30	101.20	44.60	43.60	158.70
29	73.70		********	********	153.30	150.20	66.20	95.60	117.80	40.50	48.90	98.50
30	68.00		********	********	107.50	218.00	101.70	71.50	108.20	40.80	42.60	83.70
31	69.10		********		90.80		109.20	96.00		54.40		70.00
TOTAL	4854.80	********	********	********	********	3299.80	3663.00	2700.00	2240.90	2545.20	1687.80	3178.50
AVERAGE	156.61	********	********	********	********	109.99	118.16	87.10	74.70	82.10	56.26	102.53
MAXIMUM	477.90	352.10	********	********	526.10	441.70	324.30	199.70	365.20	220.80	228.40	254.50
MINIMUM	68.00	********	********	********	********	43.20	49.60	39.40	29.40	40.50	31.70	44.20

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
**********	**********	526.10	**********

Daily Mean Discharge at Tomboloi Gauging Station (1975)

(unit: m^3/s)

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	73.20	80.70	119.70	71.20	40.70	143.30	85.60	75.80	138.80	380.50	81.10	243.40
2	96.70	73.70	210.10	51.60	37.10	141.70	65.60	66.40	118.20	251.10	103.10	146.60
3	215.00	60.70	226.70	54.10	38.60	142.20	62.30	59.90	96.80	186.10	150.00	130.90
4	127.10	53.80	292.70	61.80	111.50	194.80	55.20	55.00	128.10	164.40	152.90	122.20
5	105.60	50.20	183.60	84.20	68.30	265.80	54.50	53.30	128.60	161.90	181.80	101.50
6	621.10	46.20	163.80	73.80	86.30	188.30	62.80	53.80	126.80	184.30	191.00	130.00
7	401.50	43.60	132.80	57.60	116.20	178.80	58.00	48.40	170.10	269.70	183.70	110.80
8	258.80	42.60	109.80	49.80	117.10	155.00	86.00	45.60	127.70	239.00	208.80	112.20
9	372.40	41.10	95.60	44.80	195.70	108.60	81.50	43.60	135.20	369.30	190.10	92.40
10	258.70	39.20	85.10	41.50	161.60	101.10	83.80	79.60	152.70	********	148.40	85.20
11	405.90	36.90	90.70	38.30	183.20	131.70	85.80	87.00	260.70	********	156.80	76.10
12	274.40	36.10	77.00	36.70	186.20	114.60	60.10	50.50	278.00	162.80	106.10	128.90
13	185.60	34.90	66.40	35.40	315.20	81.40	52.40	42.80	212.30	145.40	168.90	297.10
14	143.90	34.90	59.70	37.80	505.00	70.20	109.20	39.70	199.80	154.90	202.40	178.80
15	140.90	64.90	57.20	35.60	451.80	63.40	196.90	45.60	150.50	119.10	166.60	167.00
16	337.20	47.50	57.60	33.30	314.00	63.00	238.40	73.00	156.60	112.80	134.50	149.20
17	159.70	37.00	59.30	31.50	255.70	97.20	149.90	289.60	352.70	106.60	108.30	461.70
18	121.60	35.80	62.90	30.60	********	139.70	241.20	105.50	324.80	87.80	118.70	247.10
19	102.00	40.90	125.10	33.90	********	105.50	220.20	123.70	218.30	79.00	110.50	197.50
20	102.70	63.10	87.40	30.20	********	84.50	149.40	144.90	196.00	75.10	87.60	435.70
21	130.00	568.00	81.10	33.30	392.10	81.30	115.40	255.60	180.30	81.50	82.50	268.40
22	148.70	558.50	133.90	49.90	556.30	75.50	119.40	314.90	181.60	76.90	87.00	195.50
23	106.40	362.40	149.80	50.70	323.20	63.00	114.50	253.70	213.50	103.40	79.10	156.20
24	89.70	311.40	139.10	34.90	219.70	55.40	94.50	288.10	239.40	91.40	150.00	188.40
25	77.80	596.40	100.70	30.00	158.80	52.30	97.20	159.30	290.10	65.20	136.90	216.00
26	69.40	277.20	79.10	27.00	128.30	57.50	96.50	140.00	186.30	60.40	125.10	157.00
27	68.00	179.20	68.10	25.60	106.50	68.70	101.70	108.20	169.00	86.60	167.00	135.10
28	62.80	140.00	60.40	25.50	126.00	80.00	140.00	98.50	385.20	111.60	136.80	119.40
29	66.60		55.40	31.70	183.90	72.40	199.10	88.10	553.50	90.50	203.00	254.20
30	55.80		52.20	54.60	121.70	103.60	110.60	100.10	404.10	79.40	347.20	337.90
31	65.20		55.90		127.50		87.90	182.80		69.30		********
TOTAL	5444.40	4156.90	3338.90	1296.90	********	3280.50	3475.60	3573.00	6475.70	********	4465.90	********
AVERAGE	175.63	148.46	107.71	43.23	********	109.35	112.12	115.26	215.86	********	148.86	********
MAXIMUM	621.10	596.40	292.70	84.20	556.30	265.80	241.20	314.90	553.50	380.50	347.20	461.70
MINIMUM	55.80	34.90	52.20	25.50	********	52.30	52.40	39.70	96.80	********	79.10	********

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
**********	**********	621.10	**********

Daily Mean Discharge at Tomboloi Gauging Station (1976)

(unit: m^3/s)

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	254.83	189.67	46.03	40.68	76.18	47.91	49.81	52.66	89.52	31.02	116.62	96.21
2	148.89	182.49	43.58	45.44	54.81	42.46	50.83	53.77	92.27	29.42	107.86	91.80
3	119.14	130.04	40.82	37.75	73.31	38.75	63.49	75.96	79.97	30.53	136.37	96.35
4	100.27	111.46	42.08	36.09	94.82	39.47	95.82	108.54	64.67	61.95	250.11	63.54
5	87.91	96.80	41.96	49.80	114.49	54.91	51.82	77.75	73.05	57.73	163.09	55.80
6	80.33	87.78	53.85	48.15	84.16	98.94	43.67	61.20	56.00	38.44	140.87	51.10
7	72.03	81.34	46.96	53.27	130.93	107.63	94.71	49.38	49.82	39.92	204.07	54.86
8	87.82	73.96	43.59	61.17	101.20	85.41	92.44	43.51	44.79	70.43	283.74	53.97
9	99.60	68.16	64.05	76.89	86.04	104.51	82.77	40.00	42.77	64.49	202.19	46.41
10	78.95	63.16	134.00	72.04	98.17	83.19	114.55	37.70	44.06	56.42	230.88	46.47
11	73.17	68.51	81.40	44.68	169.57	102.30	135.55	38.72	41.89	62.43	401.07	49.39
12	227.15	91.43	57.73	40.38	159.08	81.69	128.41	58.68	37.46	46.47	207.05	43.46
13	215.29	101.96	49.32	79.36	147.71	92.27	129.65	47.70	35.63	44.17	156.78	53.90
14	131.80	93.22	44.29	71.02	101.87	74.30	136.86	41.52	34.51	52.17	160.54	48.06
15	107.00	68.59	41.14	150.95	122.37	59.33	86.86	57.81	32.90	117.37	130.14	42.86
16	110.85	61.56	38.47	142.34	147.20	53.07	95.98	103.06	31.59	119.97	131.24	39.67
17	139.40	56.89	37.03	81.77	139.92	45.80	68.59	100.39	32.26	79.51	102.45	40.04
18	101.77	54.08	38.06	68.41	93.86	42.89	60.91	132.45	33.68	112.20	93.94	41.00
19	143.79	50.78	41.04	58.72	75.80	44.05	61.75	97.36	30.40	135.19	97.16	45.15
20	113.21	48.32	39.53	50.94	84.13	38.62	50.07	95.23	31.49	115.49	79.62	80.16
21	100.02	45.69	41.36	45.25	50.92	37.94	44.71	71.67	40.46	148.89	72.40	202.33
22	94.55	49.30	76.17	41.60	55.32	38.13	43.86	60.20	41.65	134.81	75.64	114.18
23	86.36	60.03	48.63	41.72	114.77	46.33	50.61	108.06	46.33	179.04	77.24	83.20
24	246.45	51.14	38.41	42.26	61.62	43.89	51.40	88.18	154.45	145.43	96.35	91.89
25	560.18	53.00	36.09	43.04	48.48	41.89	55.48	62.33	78.40	215.23	117.31	172.24
26	955.85	50.23	34.84	76.28	43.51	64.58	43.37	53.52	47.41	155.36	94.79	196.05
27	508.73	52.95	35.09	53.87	40.53	37.42	53.89	154.52	38.92	107.41	88.17	115.70
28	420.06	57.59	36.02	48.32	37.84	32.93	79.53	74.63	35.32	129.40	72.47	133.04
29	290.40	49.32	42.31	63.29	41.20	43.34	52.53	117.11	36.44	175.31	84.69	128.33
30	213.37		48.75	60.31	41.27	59.20	59.35	162.06	33.26	168.94	96.23	123.60
31	175.13		50.34		40.10		53.50	106.32		158.96		93.69
TOTAL	6144.30	2249.45	1512.90	1825.79	2731.18	1783.15	2282.77	2431.99	1531.37	3084.10	4271.08	2594.45
AVERAGE	198.20	77.57	48.80	60.86	88.10	59.44	73.64	78.45	51.05	99.49	142.37	83.69
MAXIMUM	955.85	189.67	134.00	150.95	169.57	107.63	136.86	162.06	154.45	215.23	401.07	202.33
MINIMUM	72.03	45.69	34.84	36.09	37.84	32.93	43.37	37.70	30.40	29.42	72.40	39.67

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
32442.53	88.64	955.85	29.42

Daily Mean Discharge at Tomboloi Gauging Station (1977)

(unit: m^3/s)

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	108.36	73.89	********	50.30	51.35	124.79	150.19	69.87	104.27	48.18	122.91	131.17
2	109.17	66.52	********	46.05	54.55	112.51	176.35	61.43	88.23	56.11	167.93	104.54
3	147.34	62.89	********	47.31	44.68	87.99	131.59	63.55	78.07	40.90	160.10	96.98
4	98.76	61.77	********	68.77	40.69	100.92	99.92	61.76	67.64	47.51	124.61	89.59
5	79.40	457.30	********	47.39	38.26	82.70	86.12	62.69	********	79.17	140.25	93.62
6	68.61	1038.37	********	44.27	35.49	147.48	86.95	113.16	********	78.21	193.33	261.93
7	61.11	532.44	********	42.77	48.87	159.95	124.98	212.68	********	179.18	197.45	237.46
8	56.37	400.90	********	44.03	38.04	255.22	107.59	212.56	********	172.99	269.63	170.52
9	52.47	732.69	139.73	46.07	46.42	230.64	111.36	226.05	********	127.04	233.16	222.98
10	54.49	407.32	149.63	40.49	65.15	172.49	220.39	200.40	********	144.94	202.02	145.06
11	55.27	265.17	129.43	********	99.77	170.14	217.13	163.60	********	105.39	230.66	124.96
12	86.67	219.26	114.79	********	63.58	167.05	138.16	115.22	********	170.55	309.52	167.26
13	98.12	162.55	100.72	********	105.32	271.97	182.39	180.94	********	170.61	216.71	150.69
14	144.55	150.59	90.51	********	132.45	242.64	213.30	181.17	********	126.78	192.91	134.41
15	685.84	244.34	86.57	********	201.41	195.27	140.62	99.60	********	133.26	166.20	114.46
16	225.59	162.22	86.43	********	160.37	318.77	111.06	85.08	********	112.82	197.46	********
17	183.73	299.00	87.21	********	112.12	239.45	94.52	73.47	********	140.89	145.58	********
18	141.73	1120.35	76.97	********	78.61	361.47	87.14	82.87	********	119.95	116.93	********
19	152.30	809.92	83.63	********	65.47	279.90	75.16	87.54	********	100.19	99.08	********
20	120.48	788.97	94.25	********	66.65	220.29	68.75	81.17	********	96.64	97.26	********
21	100.84	1633.54	117.52	********	95.66	322.05	79.00	86.30	********	352.80	85.82	********
22	87.78	********	90.42	********	116.14	228.45	137.30	94.71	********	195.93	80.18	********
23	99.99	********	74.10	********	144.82	214.45	105.11	188.46	********	193.30	74.90	********
24	247.53	********	85.95	********	118.80	181.22	83.07	319.00	********	169.89	75.87	********
25	209.00	********	70.21	********	********	144.21	128.15	439.22	74.51	128.03	99.14	********
26	198.18	********	66.63	********	187.72	123.16	108.27	170.34	62.38	107.74	109.45	********
27	135.27	********	63.74	53.26	172.99	103.48	109.12	230.90	69.90	94.66	121.46	********
28	120.34	********	59.62	46.64	150.71	109.44	207.31	348.87	41.56	95.70	150.32	********
29	104.00		54.59	135.42	187.63	144.29	183.70	264.66	40.55	160.45	151.38	********
30	90.60		52.31	60.66	154.41	183.69	101.53	165.95	42.79	114.04	245.55	********
31	80.31		53.37		125.28		82.86	133.27		134.33		********
TOTAL	4205.00	********	********	********	********	5696.08	3949.09	4876.49	********	3998.18	4777.77	********
AVERAGE	135.65	********	********	********	********	189.87	127.39	157.31	********	128.97	159.26	********
MAXIMUM	685.84	1633.54	149.63	135.42	201.41	361.47	220.39	439.22	104.27	352.80	309.52	261.93
MINIMUM	52.47	********	********	********	********	82.70	68.75	61.43	********	40.90	74.90	********

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
**********	**********	1633.54	**********

Daily Mean Discharge at Tampias Gauging Station (1977)

(unit: m^3/s)

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	********	********	********	********	********	********	********	5.91	119.06	66.84	137.35	127.01
2	********	********	********	********	********	********	********	5.83	103.06	73.26	157.69	106.45
3	********	********	********	********	********	********	********	5.81	92.48	49.96	152.15	99.48
4	********	********	********	********	********	********	********	5.76	82.95	67.68	129.46	91.82
5	********	********	********	********	********	********	********	5.76	76.77	90.06	147.63	131.40
6	********	********	********	********	********	********	6.10	6.22	69.44	110.77	175.27	230.22
7	********	********	********	********	********	********	6.22	6.64	64.12	196.73	176.16	209.88
8	********	********	********	********	********	********	6.20	6.64	61.06	168.83	206.76	185.92
9	********	********	********	********	********	********	6.27	6.64	59.03	140.68	198.31	186.81
10	********	********	********	********	********	********	6.74	6.65	58.27	129.95	181.59	147.45
11	********	********	********	********	********	********	6.68	6.49	58.99	109.30	213.20	137.80
12	********	********	********	********	********	********	6.48	6.34	54.37	172.44	242.81	164.43
13	********	********	********	********	********	********	6.66	6.43	50.55	149.69	186.05	144.08
14	********	********	********	********	********	********	6.73	6.40	47.58	135.62	173.65	138.79
15	********	********	********	********	********	********	6.46	6.17	47.25	127.17	160.27	117.60
16	********	********	********	********	********	********	6.29	6.06	45.01	127.85	176.45	105.06
17	********	********	********	********	********	********	6.17	5.96	40.84	143.77	143.65	107.21
18	********	********	********	********	********	********	6.09	6.04	38.87	124.66	123.28	102.51
19	********	********	********	********	********	********	5.97	5.94	47.33	106.86	107.00	100.40
20	********	********	********	********	********	********	5.91	5.87	37.71	102.72	102.55	94.85
21	********	********	********	********	********	********	5.92	6.00	34.03	283.75	91.75	91.70
22	********	********	********	********	********	********	6.36	6.81	32.62	193.59	88.01	88.09
23	********	********	********	********	********	********	6.21	********	58.13	193.65	80.41	74.65
24	********	********	********	********	********	********	6.07	********	85.38	166.46	82.74	67.56
25	********	********	********	********	********	********	6.33	254.20	68.04	141.16	100.29	61.92
26	********	********	********	********	********	********	6.20	159.82	74.18	121.51	104.59	65.81
27	********	********	********	********	********	********	6.26	223.11	84.74	106.53	111.92	60.44
28	********	********	********	********	********	********	6.56	290.79	51.38	105.89	150.79	53.53
29	********		********	********	********	********	6.46	236.79	53.30	134.40	148.99	49.90
30	********		********	********	********	********	6.15	175.73	55.31	124.06	206.17	64.43
31	********		********		********		6.01	143.19		131.58		66.35
TOTAL	********	********	********	********	********	********	********	********	1851.85	4097.42	4456.94	3473.55
AVERAGE	********	********	********	********	********	********	********	********	61.73	132.17	148.56	112.05
MAXIMUM	********	********	********	********	********	********	6.74	290.79	119.06	283.75	242.81	230.22
MINIMUM	********	********	********	********	********	********	********	********	32.62	49.96	80.41	49.90

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
**********	**********	290.79	**********

Daily Mean Discharge at Tampias Gauging Station (1978)

(unit: m^3/s)

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	51.69	56.00	57.44	17.79	87.32	101.55	162.58	106.46	65.95	********	100.92	117.88
2	46.48	51.77	51.01	16.49	69.55	109.66	242.11	136.76	64.01	********	75.13	80.20
3	44.79	47.92	45.69	********	70.77	101.21	181.69	120.48	44.20	********	141.35	74.42
4	39.63	44.88	41.15	********	86.05	77.93	173.18	118.17	39.99	********	207.90	82.52
5	44.66	56.65	37.08	********	68.78	79.92	151.46	155.10	55.53	********	172.33	154.92
6	108.79	45.91	33.85	********	121.60	94.56	146.36	100.45	65.54	********	195.79	114.07
7	83.23	38.16	31.68	********	76.48	114.32	145.81	84.57	61.04	********	240.25	107.17
8	112.05	36.43	46.87	********	79.71	130.10	151.22	78.52	96.10	********	184.65	149.01
9	104.46	34.34	42.71	********	68.19	140.72	141.70	68.48	70.15	********	154.37	117.88
10	88.78	33.61	84.66	********	71.61	160.59	137.33	66.80	********	********	169.07	129.39
11	163.83	35.48	43.14	********	86.88	127.24	116.91	63.30	********	********	********	125.32
12	192.54	32.94	33.70	20.40	125.10	159.87	107.92	70.77	********	********	********	399.06
13	269.01	30.94	30.10	17.89	121.46	180.24	108.69	57.94	********	********	********	224.19
14	218.47	37.49	27.87	48.73	99.50	127.02	178.49	52.53	********	35.23	********	201.27
15	183.83	81.10	27.94	126.50	178.02	137.38	143.76	50.43	********	38.66	********	155.87
16	143.96	68.96	31.23	78.73	258.45	164.14	136.07	47.84	********	37.14	********	175.03
17	121.43	79.83	31.90	49.57	299.75	138.69	155.02	47.67	********	98.13	********	252.18
18	101.40	95.38	38.70	40.28	263.18	135.41	143.52	45.84	********	89.79	********	218.77
19	90.11	62.19	31.37	40.32	263.96	169.43	128.26	42.62	********	75.08	********	161.97
20	82.25	50.98	26.89	40.10	213.01	249.02	130.65	40.86	********	58.57	********	135.63
21	72.69	41.74	21.77	34.39	240.14	240.95	123.39	39.24	********	61.00	********	116.97
22	70.79	38.09	21.41	49.63	267.56	412.28	129.16	36.54	********	153.19	********	104.15
23	93.41	43.63	28.91	123.72	224.96	267.86	126.48	33.49	********	134.86	********	90.72
24	169.24	107.26	23.28	99.37	215.32	226.24	152.59	32.39	********	80.12	88.52	77.41
25	141.90	147.42	23.67	114.18	160.14	199.84	144.30	31.29	********	66.87	92.46	70.61
26	116.69	102.90	21.99	102.93	144.51	166.12	165.56	30.65	********	98.05	74.86	66.43
27	96.08	82.57	20.84	164.42	126.80	200.74	186.99	30.10	********	84.95	63.85	59.04
28	85.68	67.55	18.19	174.77	116.45	188.53	167.78	29.53	********	72.07	62.56	55.86
29	75.35		16.20	145.80	108.00	164.21	132.87	29.00	********	82.85	57.77	54.95
30	67.85		16.69	101.14	105.43	134.82	112.37	31.11	********	101.04	109.95	50.29
31	61.04		17.86		121.52		116.13	38.33		136.95		62.55
TOTAL	3342.11	1652.12	1026.29	********	4540.20	4900.59	4540.35	1917.26	********	********	********	3985.73
AVERAGE	107.81	59.00	33.11	********	146.46	163.35	146.46	61.85	********	********	********	128.57
MAXIMUM	269.01	147.42	84.66	174.77	299.75	412.28	242.11	155.10	96.10	153.19	240.25	399.06
MINIMUM	39.63	30.94	16.20	********	68.19	77.93	107.92	29.00	********	********	********	50.29

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
**********	**********	412.28	**********

Daily Mean Discharge at Tampias Gauging Station (1979)

(unit: m^3/s)

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	93.35	********	21.98	26.18	17.67	148.14	56.37	55.96	54.12	48.82	203.36	166.29
2	114.37	********	25.34	25.04	18.77	131.58	58.97	50.41	74.27	42.44	115.26	165.36
3	91.81	37.69	37.23	29.87	29.66	131.29	52.17	46.36	66.47	39.24	89.38	127.19
4	75.86	36.29	34.15	33.51	30.57	118.63	44.68	43.19	52.49	41.31	89.37	124.49
5	72.94	35.52	35.78	60.57	47.23	111.75	51.20	40.78	43.63	46.69	93.65	91.93
6	66.22	34.53	42.04	37.93	59.94	84.78	43.99	40.89	39.55	63.78	110.21	79.32
7	57.00	30.06	38.17	28.57	35.04	71.88	41.59	37.11	34.38	92.64	120.75	73.04
8	53.92	27.28	41.91	27.64	40.73	67.65	39.22	34.93	33.37	157.61	144.39	71.29
9	53.39	25.26	164.23	25.01	165.88	71.67	35.18	32.15	31.84	122.15	211.77	127.02
10	52.95	23.80	71.01	23.17	91.68	93.96	42.55	30.17	36.51	101.39	158.15	246.92
11	50.80	32.18	103.23	21.86	144.35	68.80	39.72	28.80	51.34	73.39	169.95	159.00
12	49.92	34.48	147.96	36.70	159.31	83.20	80.71	26.47	42.79	74.69	248.63	133.33
13	46.33	28.26	108.42	40.74	88.70	98.96	59.39	25.28	42.61	115.18	283.94	107.87
14	44.99	34.32	111.69	34.83	63.67	132.77	128.83	24.28	60.20	80.03	188.94	91.57
15	41.48	100.01	73.66	35.72	52.38	162.80	72.41	23.39	151.49	65.40	192.29	78.57
16	41.00	62.76	223.34	26.21	48.09	112.86	94.54	22.74	85.95	59.56	158.58	74.27
17	39.14	43.99	165.90	23.41	44.32	109.00	102.40	22.15	63.76	51.97	172.08	78.38
18	39.86	37.62	108.70	21.60	49.70	128.59	86.01	25.69	104.56	52.36	196.52	74.61
19	38.55	35.82	138.90	19.90	45.71	137.29	97.98	29.34	114.13	59.23	158.20	68.25
20	44.05	32.19	81.23	19.23	48.28	216.19	102.47	44.81	91.12	70.11	151.52	69.75
21	50.11	30.34	86.66	22.43	57.21	142.94	89.19	43.92	203.13	131.92	127.29	82.10
22	44.32	28.65	70.52	42.60	269.82	105.41	84.26	41.67	132.49	89.91	107.18	90.31
23	43.61	26.48	56.32	31.63	132.84	109.28	221.97	51.82	91.22	77.07	95.85	112.96
24	49.98	25.74	50.05	23.21	104.62	80.13	156.71	72.77	86.81	61.94	104.49	90.55
25	63.34	28.52	43.90	21.59	107.01	73.75	110.72	49.80	96.34	106.88	95.08	96.84
26	51.77	24.50	39.53	29.06	105.37	68.51	92.82	33.51	85.61	68.93	85.42	110.06
27	********	22.53	35.64	28.01	80.44	71.07	117.78	34.46	104.00	70.40	83.51	98.59
28	********	21.58	35.99	22.10	144.01	99.11	113.74	51.52	72.66	62.07	100.90	130.95
29	********		34.22	19.81	121.27	64.13	83.37	62.49	61.07	102.44	95.49	127.07
30	********		29.73	18.52	133.64	56.26	70.97	79.83	51.73	196.74	165.21	107.55
31	********		27.77		145.98		62.06	50.27		124.39		85.35
TOTAL	********	********	2285.20	856.65	2683.89	3152.38	2533.97	1256.96	2259.64	2550.68	4317.36	3340.78
AVERAGE	********	********	73.72	28.56	86.58	105.08	81.74	40.55	75.32	82.28	143.91	107.77
MAXIMUM	114.37	100.01	223.34	60.57	269.82	216.19	221.97	79.83	203.13	196.74	283.94	246.92
MINIMUM	********	********	21.98	18.52	17.67	56.26	35.18	22.15	31.84	39.24	83.51	68.25

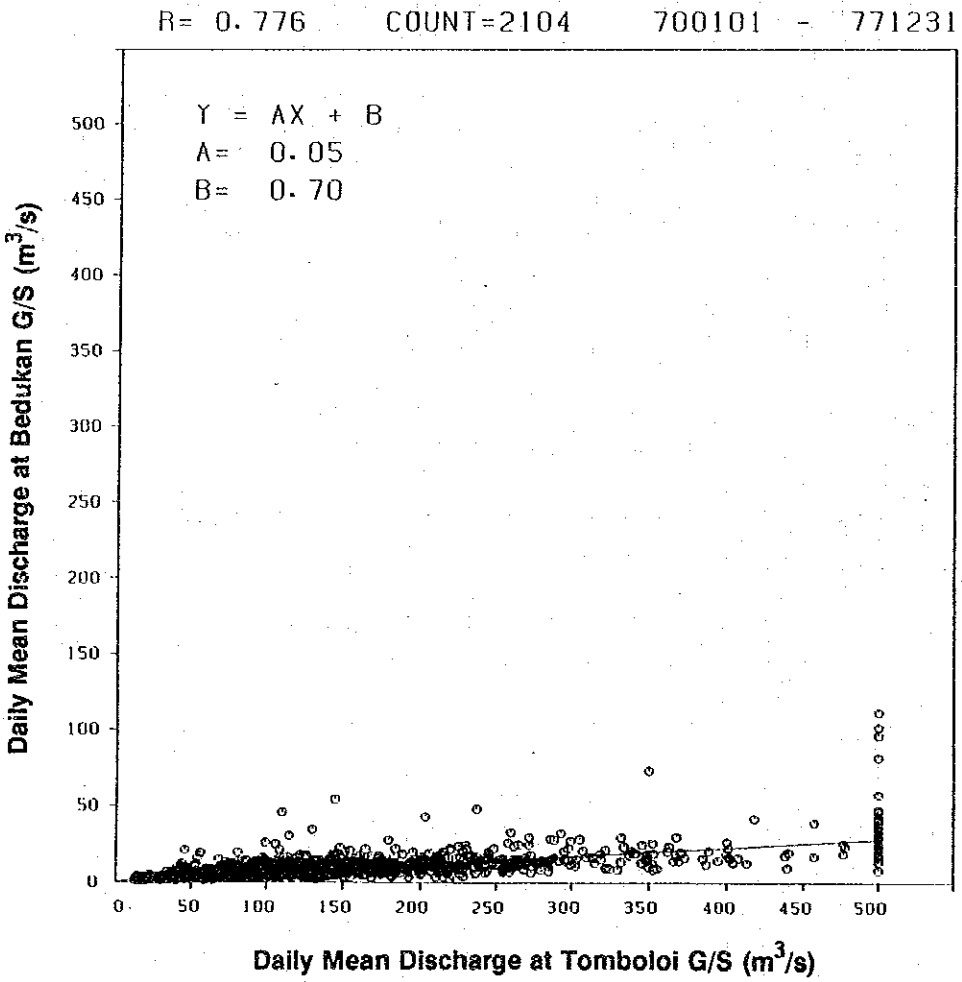
ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
**********	**********	283.94	**********

3. Correlation of Discharge Data

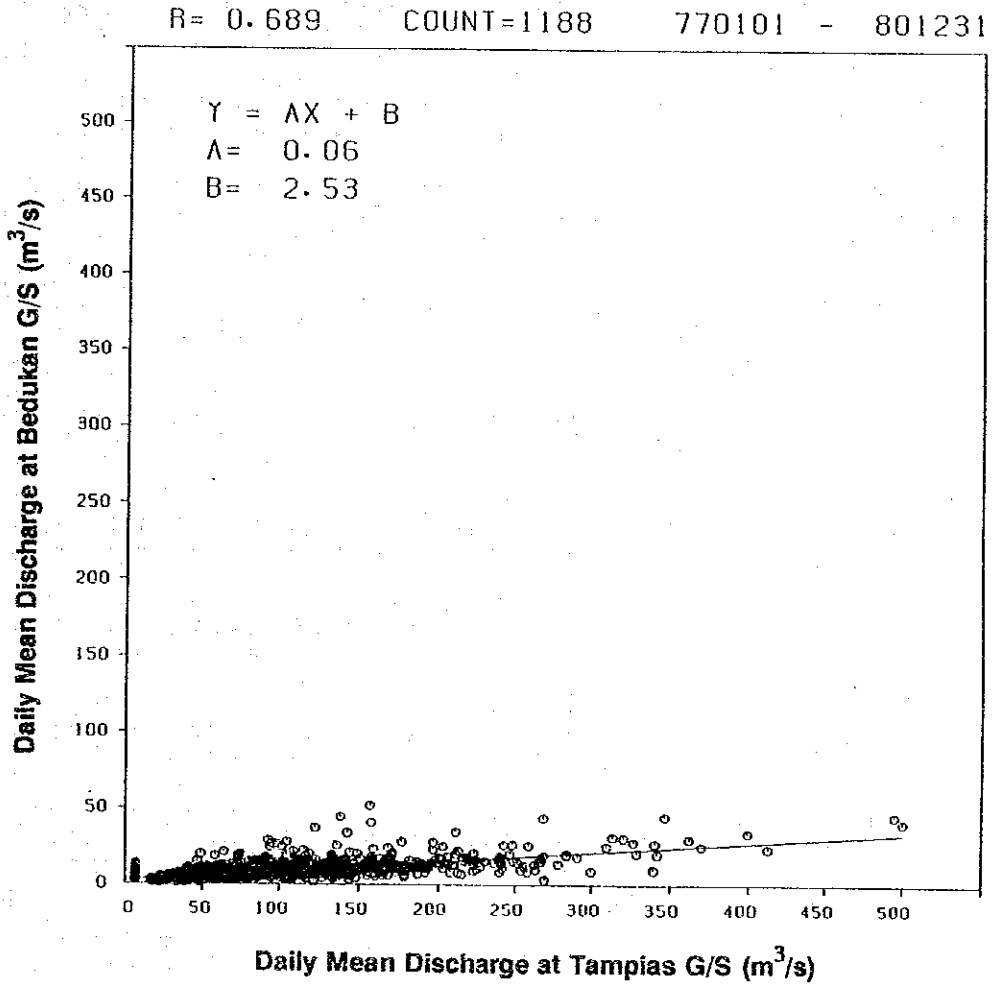
Bedukan G/S - Tomboloi G/S

Bedukan G/S - Tampias

Correlation of Discharge Data between Bedukan G/S and Tomboloi G/S (1970-1977)



Correlation of Discharge Data Between Bedukan G/S and Tampeds G/S (1977-1980)



4. Supplemented Daily Mean Discharge Data at Bedukan G/S

Supplemented Daily Mean Discharge at Bedukan River Gauging Station (1970) (unit: $m^3/s/100km^2$)

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	3.98	1.82	1.01	5.50	3.72	2.15	4.00	3.08	4.33	3.36	5.63	6.67
2	3.26	2.02	1.00	6.11	3.82	1.91	3.42	2.83	5.16	4.87	3.73	5.02
3	3.86	2.51	0.98	3.89	1.86	3.67	2.74	2.46	5.69	2.95	2.88	14.70
4	3.42	5.13	2.33	2.17	2.21	10.94	3.05	2.17	4.28	3.90	3.12	12.69
5	2.82	4.97	1.28	1.84	2.19	14.35	6.69	2.43	3.64	3.85	3.13	13.57
6	2.98	3.12	1.26	1.70	1.91	7.52	4.70	2.61	5.69	2.32	3.09	14.41
7	2.70	2.25	1.13	3.15	1.48	6.41	3.45	3.34	4.42	1.99	5.48	8.03
8	6.02	2.02	1.07	2.55	3.01	4.12	2.60	6.79	2.82	1.98	5.98	6.01
9	4.54	1.92	1.02	1.20	3.79	3.39	2.71	3.29	2.56	1.96	16.12	4.76
10	7.10	1.73	1.01	1.13	2.00	2.80	2.94	8.65	2.09	2.91	7.12	4.16
11	18.22	1.70	0.98	1.13	1.87	2.66	2.16	7.07	1.85	4.25	12.54	3.68
12	10.74	1.74	0.95	1.08	2.63	2.17	2.10	4.50	1.79	9.60	6.20	3.23
13	8.62	1.69	0.91	1.09	3.44	2.01	2.04	3.84	1.64	5.80	4.54	3.23
14	5.42	1.53	0.88	1.06	2.63	1.92	1.85	2.96	1.74	17.15	3.51	3.32
15	3.94	1.45	0.87	0.94	3.25	1.88	2.08	2.51	1.83	23.98	3.23	2.60
16	3.18	1.39	0.88	0.91	1.94	1.91	2.02	4.13	1.61	8.52	3.13	3.13
17	2.98	1.35	0.88	0.90	1.73	2.70	2.11	3.80	1.50	5.30	2.53	2.65
18	4.02	1.25	0.87	0.96	1.77	2.83	1.85	3.12	1.74	5.64	2.36	2.65
19	4.34	1.23	0.95	2.39	5.92	2.32	1.86	2.73	5.15	8.07	2.79	2.44
20	3.62	1.21	1.24	2.23	3.33	2.02	2.00	2.47	4.10	7.52	3.53	2.31
21	3.14	1.21	1.30	3.05	2.19	1.88	2.44	2.87	6.26	5.05	2.95	2.20
22	12.18	1.19	1.02	1.53	1.93	2.07	1.82	4.82	3.47	5.26	2.49	1.46
23	10.34	1.18	0.91	1.28	1.86	3.23	3.81	4.15	4.34	5.64	2.49	1.70
24	6.74	1.15	0.93	1.15	2.06	7.89	4.29	2.79	7.18	4.33	2.64	1.38
25	5.10	1.12	0.91	1.44	3.27	6.64	2.14	2.57	5.15	3.52	2.49	3.38
26	4.02	1.07	1.03	1.98	4.35	6.52	2.48	2.55	3.03	2.79	4.09	1.90
27	3.10	1.01	3.25	1.64	2.86	6.95	5.30	2.08	2.82	2.48	8.65	2.86
28	2.54	1.02	2.35	2.26	1.97	5.33	7.37	2.10	2.95	2.33	6.69	5.62
29	2.54		2.07	2.20	1.88	6.55	4.25	3.55	2.56	2.69	5.64	3.62
30	1.94		1.34	2.77	3.05	6.24	2.83	3.56	2.29	4.49	8.86	4.50
31	1.87		1.47		2.05		3.32	3.26		7.16		6.06
TOTAL	159.35	50.98	38.06	61.23	81.97	132.98	96.42	109.08	103.68	171.66	147.63	153.94
AVERAGE	5.14	1.82	1.23	2.04	2.64	4.43	3.11	3.52	3.46	5.54	4.92	4.97
MAXIMUM	18.22	5.13	3.25	6.11	5.92	14.35	7.37	8.65	7.18	23.98	16.12	14.70
MINIMUM	1.87	1.01	0.87	0.90	1.48	1.88	1.82	2.08	1.50	1.96	2.36	1.38

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
1307.00	3.58	23.98	0.87

Supplemented Daily Mean Discharge at Bedukan River Gauging Station (1971) (unit: $m^3/s/100km^2$)

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	4.90	6.05	9.30	2.40	1.15	1.75	3.30	1.35	10.00	2.05	4.70	5.00
2	5.86	4.05	7.05	2.25	1.25	2.45	3.65	1.50	8.00	1.90	3.30	4.05
3	3.66	3.70	5.30	2.20	1.60	3.30	3.90	1.55	5.35	3.10	2.62	3.30
4	2.74	3.30	4.65	2.00	1.90	4.20	1.90	2.65	3.30	5.85	2.38	2.55
5	2.54	9.60	4.30	2.05	1.35	2.05	1.60	3.65	2.75	6.65	3.65	2.15
6	8.80	104.75	4.00	1.85	1.45	2.40	1.55	4.35	2.35	3.40	4.25	2.00
7	6.85	165.20	4.45	1.75	1.40	2.15	1.40	4.05	2.15	2.50	3.65	1.80
8	6.85	49.75	4.10	1.60	1.35	3.45	1.35	6.05	1.90	2.25	7.40	2.00
9	4.60	165.20	22.75	1.70	1.75	3.95	1.20	5.95	1.75	1.95	4.65	2.10
10	6.70	49.60	10.35	1.80	1.55	3.15	1.10	5.30	3.10	1.85	3.40	2.90
11	6.00	57.30	5.95	1.70	1.35	2.05	1.10	5.35	4.50	5.15	3.15	5.55
12	5.35	14.85	4.55	1.55	1.30	2.55	1.05	4.90	2.80	7.65	3.20	6.70
13	4.30	9.65	4.05	1.50	1.20	1.95	1.20	2.70	2.00	4.50	10.00	4.20
14	3.65	23.60	4.20	1.55	1.25	1.65	1.30	2.25	3.65	7.45	10.30	2.55
15	3.10	17.85	8.90	1.60	1.20	1.95	1.15	2.65	4.25	5.60	11.70	2.20
16	2.70	13.60	10.95	1.55	1.05	1.55	1.20	12.90	5.45	3.95	5.65	3.05
17	2.50	13.20	16.35	1.55	1.10	1.40	1.00	5.05	6.20	6.30	8.30	3.25
18	2.30	14.85	12.30	1.85	1.15	1.40	0.95	8.05	4.55	6.20	88.10	2.50
19	2.25	9.30	11.05	4.55	1.00	1.65	0.90	6.05	3.10	9.85	11.10	2.55
20	4.95	8.90	6.35	1.90	1.05	1.25	0.85	5.10	3.25	7.05	6.95	2.35
21	3.05	10.00	5.35	1.80	2.55	1.45	0.80	7.05	3.85	5.20	8.90	1.75
22	2.35	6.50	4.50	1.70	2.05	1.90	0.80	5.95	6.10	8.25	7.20	1.85
23	3.35	4.95	3.85	1.70	1.35	1.95	0.80	3.70	3.80	6.25	6.45	4.30
24	4.05	4.25	3.50	1.50	1.40	1.80	0.80	4.35	10.20	4.90	5.85	8.05
25	4.50	6.15	3.35	1.35	2.00	1.90	0.75	7.10	9.40	6.35	4.65	4.95
26	4.25	6.75	3.10	1.30	1.55	1.90	1.10	10.30	4.25	7.15	3.90	3.05
27	3.80	5.50	3.10	1.30	3.30	1.60	1.35	9.70	3.25	11.30	3.05	2.20
28	3.70	6.15	2.85	1.25	2.30	1.65	1.55	5.15	3.25	16.15	2.80	2.20
29	7.50		2.70	1.35	1.45	2.00	1.40	3.55	2.70	10.65	3.75	3.55
30	7.40		2.60	1.20	1.25	1.50	1.10	3.60	2.15	7.55	5.70	6.85
31	7.95		2.50		1.25		1.10	6.80		5.70		8.15
TOTAL	142.50	794.55	198.30	53.35	46.85	63.90	43.20	158.65	129.35	184.65	250.70	109.65
AVERAGE	4.60	28.38	6.40	1.78	1.51	2.13	1.39	5.12	4.31	5.96	8.36	3.54
MAXIMUM	8.80	165.20	22.75	4.55	3.30	4.20	3.90	12.90	10.20	16.15	88.10	8.15
MINIMUM	2.25	3.30	2.50	1.20	1.00	1.25	0.75	1.35	1.75	1.85	2.38	1.75

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
2175.65	5.96	165.20	0.75

Supplemented Daily Mean Discharge at Bedukan River Gauging Station (1972) (unit: $m^3/s/100km^2$)

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	5.90	9.30	3.25	9.65	1.00	1.60	0.95	0.40	1.70	3.40	3.35	7.75
2	3.90	4.35	3.25	7.90	1.40	1.55	0.90	0.35	2.65	3.35	2.35	5.30
3	11.95	5.60	2.60	5.80	1.50	1.40	0.90	0.60	3.20	6.65	2.10	6.80
4	6.50	5.00	2.30	4.35	3.75	1.45	1.00	0.85	1.95	7.05	1.75	8.10
5	4.30	3.55	2.15	3.55	2.85	1.35	0.95	0.85	2.75	6.20	1.60	6.00
6	3.50	3.00	4.10	2.70	2.25	1.25	0.95	0.75	2.15	7.10	2.45	4.50
7	4.90	2.45	6.30	3.30	10.65	1.35	0.90	1.80	1.95	5.95	2.86	3.70
8	4.35	2.20	3.85	4.30	6.50	1.55	0.80	1.85	1.85	6.40	1.80	12.40
9	3.45	2.05	2.60	8.30	4.75	1.55	0.75	1.60	1.50	7.50	1.52	5.75
10	2.70	1.90	2.35	9.20	4.40	1.75	0.65	2.30	1.15	8.15	1.31	3.80
11	2.25	1.75	2.10	4.05	3.10	2.95	0.60	2.10	1.60	5.15	2.77	2.95
12	2.15	1.65	2.10	3.00	2.50	1.85	0.65	1.20	1.65	3.50	5.41	2.55
13	1.80	1.55	1.95	2.45	2.00	1.55	0.65	1.10	1.20	3.15	2.03	2.40
14	1.70	1.40	1.95	2.15	1.80	1.35	0.60	1.45	0.90	4.85	1.49	2.00
15	2.45	1.25	1.70	2.10	1.60	1.20	0.60	1.55	0.90	4.35	7.00	1.85
16	3.30	1.25	1.60	1.85	1.45	1.55	0.85	0.95	0.85	2.90	7.75	1.75
17	13.95	5.85	3.20	1.60	1.60	2.80	1.00	0.95	0.85	2.30	4.55	1.70
18	55.60	6.80	7.70	1.45	2.45	1.60	1.25	2.85	2.00	1.95	2.45	1.65
19	20.20	3.35	7.50	1.50	1.70	1.35	0.85	2.10	2.25	1.75	2.15	1.65
20	7.05	2.80	6.40	1.60	2.25	1.30	0.75	1.95	4.55	1.60	1.90	1.45
21	7.05	3.20	4.45	1.30	6.15	1.30	0.70	2.30	4.15	1.50	4.15	1.35
22	5.35	3.45	4.25	1.35	4.30	2.90	0.65	1.65	2.75	1.90	6.85	1.40
23	7.85	5.75	6.80	1.65	2.65	2.95	0.60	0.90	2.80	2.10	6.95	1.40
24	4.50	21.45	4.90	1.35	4.20	1.90	0.55	0.95	6.40	1.55	4.15	1.40
25	3.70	14.05	2.85	1.80	2.55	1.85	0.45	2.60	11.20	1.80	3.25	1.45
26	3.20	7.90	2.55	1.35	1.90	1.30	0.40	4.90	10.40	1.65	2.20	1.55
27	2.90	4.80	2.45	1.15	1.60	1.20	0.40	2.55	12.90	1.60	1.95	1.35
28	2.55	3.65	2.10	1.10	1.65	1.05	0.45	1.75	7.85	1.55	1.85	1.20
29	2.65	3.10	2.10	1.05	2.10	1.05	0.50	1.20	5.40	3.00	2.80	1.15
30	2.75		5.90	1.00	1.90	1.05	0.40	1.65	3.30	9.15	6.50	1.10
31	4.65		8.90		1.75		0.35	1.50		14.75		1.80
TOTAL	209.05	134.40	116.20	93.90	90.25	48.85	22.00	49.50	104.75	133.80	99.24	99.20
AVERAGE	6.74	4.63	3.75	3.13	2.91	1.63	0.71	1.60	3.49	4.32	3.31	3.20
MAXIMUM	55.60	21.45	8.90	9.65	10.65	2.95	1.25	4.90	12.90	14.75	7.75	12.40
MINIMUM	1.70	1.25	1.60	1.00	1.00	1.05	0.35	0.35	0.85	1.50	1.31	1.10

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
1201.14	3.28	55.60	0.35

Supplemented Daily Mean Discharge at Bedukan River Gauging Station (1973) (unit: $m^3/s/100km^2$)

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	2.72	0.48	0.61	1.04	4.05	1.86	3.43	1.97	1.78	5.18	6.14	3.65
2	1.81	0.45	0.74	1.90	2.82	2.25	4.36	1.60	2.39	3.90	7.04	3.60
3	1.41	0.43	0.67	1.82	2.39	2.54	5.65	1.67	3.77	3.90	7.55	4.16
4	2.80	0.43	0.70	1.28	4.06	2.90	4.88	1.51	2.79	11.96	7.29	3.34
5	2.16	0.40	0.69	1.09	3.21	1.93	4.55	1.84	3.85	4.86	5.86	4.54
6	3.14	0.39	0.71	0.83	2.32	1.50	3.91	1.50	5.25	4.02	5.59	4.98
7	1.76	0.36	0.73	0.57	4.43	1.29	3.50	1.30	2.94	3.19	8.66	3.07
8	1.55	0.36	0.78	0.50	3.97	1.69	2.57	2.19	2.19	2.83	6.80	2.60
9	1.39	0.32	0.77	0.46	3.38	1.23	2.47	3.96	2.50	3.16	4.61	2.21
10	1.26	0.32	0.80	0.41	2.68	1.10	2.28	2.91	4.79	2.81	3.83	2.00
11	1.16	0.32	0.76	0.35	3.36	2.02	1.78	9.25	5.25	2.34	3.63	1.81
12	1.08	0.29	0.75	0.32	2.32	2.25	1.52	5.08	5.75	2.19	3.56	1.65
13	0.99	0.42	0.77	0.48	2.48	1.30	1.26	3.38	4.15	2.23	3.12	1.58
14	0.84	0.77	0.77	1.30	3.24	1.06	1.10	2.79	5.80	2.90	2.94	1.71
15	0.84	0.80	0.68	0.93	2.54	0.93	0.94	4.66	20.76	2.48	3.45	1.68
16	0.81	0.69	0.59	0.76	1.77	0.90	0.87	4.11	12.16	2.83	3.64	1.95
17	0.74	0.68	0.79	2.36	1.43	0.92	0.86	2.65	9.31	2.48	4.02	2.47
18	0.72	0.64	0.97	2.94	1.40	1.73	0.81	2.05	9.12	1.94	4.96	2.21
19	0.71	0.61	0.81	1.96	1.34	3.38	0.80	2.04	6.27	2.00	4.18	1.88
20	0.66	0.57	0.83	1.45	1.25	3.67	0.97	1.86	4.80	2.42	3.74	1.61
21	0.64	0.55	0.93	1.61	2.38	2.26	1.73	1.42	4.15	2.09	4.26	1.54
22	0.60	0.50	0.97	1.97	1.63	2.63	2.33	1.13	4.23	1.86	3.79	1.96
23	0.57	0.45	0.94	1.75	1.83	3.13	2.90	0.94	3.99	1.64	3.27	1.85
24	0.54	0.33	0.89	1.47	1.67	2.66	2.82	0.83	6.06	1.53	3.39	2.26
25	0.54	0.32	0.87	1.37	1.36	1.95	4.22	2.59	8.44	1.56	6.10	4.88
26	0.53	0.32	0.84	1.44	1.24	2.33	2.82	1.74	11.45	2.18	12.31	5.43
27	0.53	0.36	0.71	1.10	2.41	3.31	2.38	1.34	6.74	4.12	6.90	4.78
28	0.49	0.30	0.80	3.21	1.89	1.89	2.22	4.13	4.98	5.80	4.78	8.11
29	0.49		0.95	6.46	1.42	2.08	3.52	2.01	6.28	4.25	4.09	5.20
30	0.48		1.16	5.80	1.40	6.30	4.07	1.62	6.38	3.21	4.16	14.17
31	0.48		1.25		2.04		2.44	1.38		4.00		5.56
TOTAL	34.44	12.86	25.23	48.93	73.71	64.99	79.96	77.45	178.32	101.86	153.66	108.44
AVERAGE	1.11	0.46	0.81	1.63	2.38	2.17	2.58	2.50	5.94	3.29	5.12	3.50
MAXIMUM	3.14	0.80	1.25	6.46	4.43	6.30	5.65	9.25	20.76	11.96	12.31	14.17
MINIMUM	0.48	0.29	0.59	0.32	1.24	0.90	0.80	0.83	1.78	1.53	2.94	1.54

ANNUAL

TOTAL	AVERAGE	MAXIMUM	MINIMUM
959.85	2.63	20.76	0.29

Supplemented Daily Mean Discharge at Bedukan River Gauging Station (1974) (unit: $m^3/s/100km^2$)

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	6.05	9.15	7.95	1.72	1.40	2.15	11.63	5.45	1.11	4.90	0.67	1.40
2	5.70	12.75	9.75	1.72	6.05	2.52	5.28	6.30	0.66	3.85	0.45	1.55
3	12.30	7.40	11.90	1.72	5.20	1.98	3.69	6.05	0.68	5.50	0.38	2.55
4	7.40	6.35	7.20	1.15	3.85	1.65	2.68	4.35	0.47	4.25	0.26	1.45
5	6.10	7.65	5.45	2.65	3.30	1.10	1.98	4.05	0.27	3.95	0.17	2.35
6	5.80	7.05	4.85	3.50	2.25	0.93	1.44	10.95	0.49	3.70	0.26	2.85
7	6.35	5.80	4.65	1.25	1.50	0.76	1.16	5.40	0.21	3.20	2.25	1.65
8	8.60	5.25	3.85	1.30	1.30	0.67	0.93	3.60	0.22	3.75	1.90	1.50
9	11.15	5.50	3.40	2.65	4.10	0.47	0.78	3.00	0.13	2.60	1.65	3.25
10	11.50	6.30	3.30	2.65	3.15	0.58	1.10	2.70	0.14	1.75	1.40	3.35
11	8.65	6.95	4.01	2.90	2.25	0.67	1.20	2.15	0.40	1.13	2.00	3.45
12	7.30	36.35	3.84	3.10	1.60	0.39	1.90	2.15	0.60	1.67	2.15	2.15
13	6.40	163.00	3.68	2.95	1.45	0.47	3.05	3.30	0.30	2.70	1.80	1.75
14	5.65	50.40	3.65	2.50	4.25	0.92	2.35	1.75	0.30	1.77	1.65	1.50
15	5.05	17.90	3.70	1.85	3.70	0.68	1.75	1.45	0.65	1.12	1.55	1.50
16	4.85	11.75	3.77	3.35	4.25	0.72	1.55	1.45	0.55	0.86	2.00	1.35
17	4.60	8.75	3.73	3.50	5.10	0.61	2.05	1.30	0.60	0.71	1.40	1.39
18	8.50	7.85	3.71	4.95	10.25	0.86	2.90	1.05	0.60	1.68	1.35	1.20
19	6.40	7.15	2.30	4.25	5.35	0.78	3.40	1.00	0.85	7.49	1.70	6.39
20	5.50	6.45	2.15	2.05	6.65	1.57	3.35	0.90	2.60	2.22	1.30	3.62
21	5.90	6.10	2.00	1.85	5.55	2.02	2.55	3.00	2.45	1.56	1.05	2.29
22	9.55	6.50	1.85	1.55	5.85	1.98	1.65	2.50	2.25	0.93	1.75	1.26
23	5.75	10.75	1.75	1.45	5.80	3.16	1.50	1.66	2.95	0.70	2.95	0.96
24	4.65	12.10	1.65	1.35	4.25	3.71	1.65	2.39	1.25	0.60	2.00	1.70
25	4.35	6.75	1.65	1.05	3.70	11.80	2.45	0.80	2.50	0.50	1.85	1.64
26	5.00	5.75	1.78	1.00	5.70	13.99	3.65	1.13	6.95	0.60	1.90	2.21
27	6.50	4.55	1.74	0.95	6.78	16.33	1.80	4.04	3.10	0.83	1.70	3.24
28	6.10	4.00	1.71	0.90	10.62	6.28	2.10	1.59	1.90	0.44	1.40	5.01
29	5.55		1.71	0.95	4.79	4.67	2.45	2.48	2.30	0.28	1.50	2.60
30	4.65		1.72	1.55	2.96	7.38	4.15	1.52	1.75	0.29	1.30	2.01
31	4.75		1.73		2.29		5.90	2.50		0.84		1.46
TOTAL	206.60	446.25	116.13	65.11	135.24	91.80	84.02	91.96	39.23	66.37	43.69	70.58
AVERAGE	6.66	15.94	3.75	2.17	4.36	3.06	2.71	2.97	1.31	2.14	1.46	2.28
MAXIMUM	12.30	163.00	11.90	4.95	10.62	16.33	11.63	10.95	6.95	7.49	2.95	6.39
MINIMUM	4.35	4.00	1.65	0.90	1.30	0.39	0.78	0.80	0.13	0.28	0.17	0.96

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
1456.98	3.99	163.00	0.13

Supplemented Daily Mean Discharge at Bedukan River Gauging Station (1975) (unit: $m^3/s/100km^2$)

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	1.59	2.03	5.68	1.51	0.29	4.39	2.08	1.69	6.03	13.88	1.90	8.40
2	2.53	1.66	8.04	0.72	0.14	4.33	1.28	1.14	4.06	8.70	2.78	4.52
3	7.26	1.49	8.29	0.82	0.20	4.35	1.15	0.99	3.42	6.10	4.66	3.90
4	3.74	1.24	7.06	1.13	3.12	6.45	0.87	2.78	2.93	5.24	4.78	3.55
5	2.88	1.14	4.79	2.03	1.39	9.29	0.84	6.00	6.07	5.14	5.93	2.72
6	23.50	0.97	3.97	1.61	2.11	6.19	1.17	7.83	3.63	6.03	6.30	3.86
7	14.72	1.03	3.58	0.96	3.31	5.81	0.98	4.78	2.92	9.45	6.01	3.09
8	9.01	0.90	2.93	0.65	3.34	4.86	2.10	10.44	2.58	8.22	7.01	3.15
9	13.56	0.71	2.49	0.45	6.49	3.00	1.92	6.11	3.61	13.43	6.26	2.36
10	9.01	0.88	2.56	0.32	5.12	2.70	2.01	3.78	3.07	8.45	4.60	2.07
11	14.90	0.84	3.99	0.19	5.99	3.93	2.09	3.35	4.61	9.12	4.93	1.70
12	9.64	0.61	2.62	0.13	6.11	3.24	1.06	3.17	6.58	5.17	2.90	3.82
13	6.08	0.53	2.39	0.08	11.27	1.92	0.76	4.08	4.65	4.48	5.42	10.54
14	4.42	1.06	2.01	0.17	18.86	1.47	3.03	3.63	3.90	4.86	6.76	5.81
15	4.30	1.75	2.11	0.08	16.73	1.20	6.54	0.48	3.20	3.42	5.32	5.34
16	12.15	0.69	1.97	0.13	11.22	1.18	8.20	1.58	3.79	3.17	4.04	4.63
17	5.05	0.64	1.03	0.12	8.89	2.55	4.66	10.24	4.14	2.92	2.99	17.13
18	3.52	0.75	1.18	0.12	13.39	4.25	8.31	2.88	4.51	2.17	3.41	8.54
19	2.74	0.75	3.66	0.02	13.82	2.88	7.47	3.61	3.08	1.82	3.08	6.56
20	2.77	1.95	2.16	0.09	12.81	2.04	4.64	4.46	2.59	1.66	2.16	16.09
21	3.86	9.01	1.90	0.09	14.34	1.91	3.28	8.88	3.40	1.92	1.96	9.40
22	4.61	19.55	4.02	0.66	20.91	1.68	3.44	6.42	5.92	1.74	2.14	6.48
23	2.92	11.51	4.65	0.69	11.59	1.18	3.24	7.32	7.20	2.80	1.82	4.91
24	2.25	22.92	4.22	0.06	7.45	0.88	2.44	8.08	8.24	2.32	4.66	6.20
25	1.77	10.58	2.69	0.32	5.01	0.75	2.55	4.58	10.26	1.27	4.14	7.30
26	1.44	5.61	1.82	0.36	3.79	0.96	2.52	3.83	6.11	1.08	3.66	4.94
27	1.38	3.92	1.38	0.42	2.92	1.41	2.73	3.20	5.42	2.12	5.34	4.06
28	1.17	3.63	1.08	0.37	3.70	1.86	4.26	2.63	14.07	3.12	4.13	3.44
29	1.32		0.88	0.30	6.02	1.56	6.62	2.57	20.80	2.28	6.78	8.83
30	1.36		0.75	0.84	3.53	2.80	3.08	3.89	14.82	1.84	12.55	12.18
31	1.55		0.90		3.76		2.18	8.48		1.43		6.69
TOTAL	177.00	108.35	96.80	15.44	227.62	91.02	97.50	142.90	175.61	145.35	138.42	192.21
AVERAGE	5.71	3.87	3.12	0.51	7.34	3.03	3.15	4.61	5.85	4.69	4.61	6.20
MAXIMUM	23.50	22.92	8.29	2.03	20.91	9.29	8.31	10.44	20.80	13.88	12.55	17.13
MINIMUM	1.17	0.53	0.75	0.02	0.14	0.75	0.76	0.48	2.58	1.08	1.82	1.70

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
1608.22	4.41	23.50	0.02

Supplemented Daily Mean Discharge at Bedukan River Gauging Station (1976) (unit: $m^3/s/100km^2$)

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	8.85	6.25	1.30	1.08	1.21	0.99	1.37	1.20	2.61	0.58	4.45	4.10
2	4.62	5.96	1.22	0.99	2.55	0.97	1.18	1.62	2.24	0.50	4.06	2.73
3	3.43	3.86	1.15	0.92	3.12	1.15	1.36	3.08	2.79	0.45	5.99	2.26
4	2.67	3.12	1.23	0.99	3.88	1.02	0.83	3.52	1.92	0.42	7.40	2.01
5	2.18	2.53	1.52	1.09	2.64	1.27	0.76	1.68	1.98	0.39	4.77	2.15
6	1.87	2.17	1.94	1.44	1.88	1.46	0.72	1.47	1.39	0.16	4.48	2.44
7	1.54	3.67	1.47	1.04	1.68	1.26	2.24	1.13	1.18	0.27	6.10	2.40
8	2.17	3.40	1.21	1.97	2.26	2.09	2.59	1.00	1.02	2.20	6.53	1.61
9	2.64	3.14	3.59	1.98	2.29	1.78	2.41	0.90	0.92	1.31	8.10	1.31
10	1.82	2.99	5.46	1.23	2.52	1.39	2.88	0.79	0.81	2.06	8.83	1.32
11	1.59	3.63	3.77	0.96	4.30	1.34	3.22	0.74	0.71	1.81	8.23	1.38
12	7.75	2.32	1.96	0.86	3.30	1.69	2.42	0.84	0.78	1.20	5.75	1.42
13	7.27	3.78	1.49	1.25	2.35	1.67	2.33	0.95	0.86	1.38	5.72	1.44
14	3.93	2.72	1.26	1.31	1.92	1.40	1.68	1.06	0.63	5.38	5.98	1.33
15	2.94	2.20	1.14	1.35	1.81	1.29	2.03	1.32	0.51	7.50	5.26	1.20
16	3.09	2.01	1.17	1.95	1.97	0.99	3.85	1.54	0.49	6.02	4.80	1.20
17	4.24	1.90	1.21	1.36	1.71	0.93	1.75	1.33	0.50	4.34	4.11	1.31
18	2.73	1.79	1.25	0.96	2.41	1.05	1.66	0.98	0.54	4.34	3.64	1.42
19	4.41	1.71	1.30	0.83	1.11	1.33	2.77	2.56	0.57	5.06	3.24	4.43
20	3.19	1.63	1.34	0.76	0.94	0.88	1.44	1.95	0.61	6.91	2.79	5.60
21	2.66	1.56	1.64	0.70	1.02	0.75	1.22	1.14	0.65	6.53	2.53	7.46
22	2.44	1.48	2.38	0.71	9.52	0.77	1.18	4.43	0.99	5.23	3.00	5.03
23	2.11	1.41	1.26	0.74	15.21	1.24	1.47	6.80	4.63	6.63	3.69	3.29
24	8.52	1.69	1.17	0.76	2.58	0.84	1.33	5.24	10.51	6.52	5.50	6.38
25	21.07	1.53	1.08	0.79	1.82	0.79	1.03	2.45	2.14	5.07	6.45	6.96
26	36.89	1.84	0.99	0.82	1.46	0.74	0.91	1.83	1.22	4.46	5.29	5.06
27	19.01	1.95	0.91	0.84	1.24	0.69	1.15	1.68	0.90	3.67	4.06	4.15
28	15.46	1.82	1.01	2.47	1.10	0.71	1.27	1.63	0.74	3.05	3.13	3.89
29	10.28	1.42	1.92	3.35	1.03	1.42	1.36	1.82	0.75	3.21	3.42	3.79
30	7.19		1.62	2.11	0.96	1.66	4.18	4.06	0.64	6.04	3.72	4.08
31	5.67		1.22		1.04		1.46	2.69		5.99		3.13
TOTAL	204.23	75.48	51.18	37.61	82.83	35.56	56.05	63.43	46.23	108.68	151.02	96.28
AVERAGE	6.59	2.60	1.65	1.25	2.67	1.19	1.81	2.05	1.54	3.51	5.03	3.11
MAXIMUM	36.89	6.25	5.46	3.35	15.21	2.09	4.18	6.80	10.51	7.50	8.83	7.46
MINIMUM	1.54	1.41	0.91	0.70	0.94	0.69	0.72	0.74	0.49	0.16	2.53	1.20

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
1008.58	2.76	36.89	0.16

Supplemented Daily Mean Discharge at Bedukan River Gauging Station (1977) (unit: $m^3/s/100km^2$)

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	3.21	2.48	6.50	1.15	1.00	2.72	2.59	1.83	3.02	3.20	4.18	5.34
2	4.76	2.49	5.30	1.07	0.86	2.09	2.69	1.52	2.61	9.42	5.68	4.29
3	6.05	2.15	4.74	1.01	0.87	1.69	2.56	1.39	2.29	4.80	5.02	3.90
4	3.83	2.25	4.20	0.97	0.91	1.68	2.07	1.32	2.00	4.07	4.98	3.80
5	2.85	19.41	3.78	1.04	0.96	1.67	1.75	1.43	1.70	3.88	5.38	6.10
6	2.30	28.58	4.14	1.14	1.00	2.26	1.76	1.89	1.47	5.63	5.45	7.60
7	2.01	10.48	4.32	1.28	1.04	4.10	1.95	4.51	1.35	13.85	5.37	6.54
8	2.07	11.11	5.65	1.06	1.09	3.85	3.57	4.01	1.29	8.76	6.85	5.82
9	2.22	16.64	4.30	0.97	1.18	3.36	4.67	2.84	1.24	7.97	8.01	5.38
10	2.46	7.91	4.02	0.88	2.12	2.85	5.55	2.51	1.18	6.13	7.85	4.67
11	4.92	5.91	3.24	0.90	1.29	3.27	4.36	2.49	1.13	4.91	10.85	4.13
12	7.09	5.01	2.88	1.05	1.96	3.65	4.03	1.97	1.07	5.67	8.25	3.89
13	6.90	4.25	2.61	1.97	2.57	12.25	6.16	1.74	1.02	5.52	6.74	3.53
14	27.10	6.30	2.55	3.32	2.50	8.16	6.57	1.85	0.96	4.74	6.41	3.19
15	21.07	7.33	2.73	4.19	5.72	10.01	4.74	1.65	0.91	4.18	6.28	3.03
16	11.83	6.89	2.90	2.32	4.01	9.43	3.71	1.41	0.85	4.38	6.14	2.88
17	11.10	13.49	2.76	3.03	2.47	5.90	3.15	1.21	0.75	4.89	5.17	3.53
18	7.65	40.67	3.09	2.11	1.81	10.10	3.32	1.24	0.64	4.54	4.53	4.11
19	6.54	23.48	2.60	1.29	1.60	6.66	2.78	1.34	0.53	4.24	3.89	3.64
20	5.02	47.89	2.87	1.35	1.24	5.14	2.70	1.43	0.45	4.05	3.77	4.58
21	4.16	50.69	2.46	1.41	1.63	4.57	2.82	1.59	0.42	9.36	3.67	4.35
22	3.58	22.98	2.01	1.04	1.83	4.75	3.01	3.69	0.33	5.30	3.56	3.88
23	4.48	19.73	1.87	0.91	2.73	4.38	3.17	4.71	9.20	6.06	3.52	3.35
24	6.21	16.58	1.72	3.56	2.66	4.01	2.59	7.54	5.05	4.81	3.27	3.06
25	5.23	11.15	1.58	1.99	2.41	4.18	2.86	4.72	2.97	3.74	3.19	2.86
26	5.59	8.61	1.46	2.01	5.24	3.14	2.69	3.58	2.24	3.84	4.39	2.68
27	4.28	7.25	1.36	1.68	5.02	2.61	4.56	6.80	1.79	4.00	6.70	2.51
28	3.34	6.88	1.27	1.47	4.98	2.77	6.01	9.05	1.55	4.15	8.44	2.41
29	2.82		1.19	1.45	5.45	2.88	3.94	7.10	1.84	4.66	10.05	2.35
30	2.52		1.25	1.14	4.33	2.69	2.72	4.75	4.29	4.30	9.20	2.28
31	2.47		1.41		3.79		2.24	3.42		4.13		2.21
TOTAL	185.66	408.59	92.76	48.76	76.27	136.82	107.29	96.53	56.14	169.18	176.79	121.89
AVERAGE	5.99	14.59	2.99	1.63	2.46	4.56	3.46	3.11	1.87	5.46	5.89	3.93
MAXIMUM	27.10	50.69	6.50	4.19	5.72	12.25	6.57	9.05	9.20	13.85	10.85	7.60
MINIMUM	2.01	2.15	1.19	0.88	0.86	1.67	1.75	1.21	0.33	3.20	3.19	2.21

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
1676.68	4.59	50.69	0.33

Supplemented Daily Mean Discharge at Bedukan River Gauging Station (1978) (unit: $m^3/s/100km^2$)

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	2.15	1.49	1.90	0.77	2.34	3.31	4.80	2.84	2.48	1.28	4.28	3.41
2	2.03	1.44	1.71	1.55	2.08	2.95	5.24	2.71	2.30	1.35	3.33	2.61
3	1.88	1.40	1.57	2.63	1.99	2.59	4.70	2.65	1.33	1.40	3.03	3.04
4	1.69	1.37	1.42	1.30	2.02	1.98	4.03	2.65	1.31	1.07	3.82	6.50
5	1.86	1.76	1.43	0.81	1.75	1.68	3.30	2.68	2.32	1.52	6.52	6.94
6	10.66	1.53	1.46	1.41	1.43	1.86	3.51	2.70	3.23	1.00	6.92	4.65
7	4.15	1.22	1.46	1.27	1.21	3.46	5.19	2.68	3.59	0.97	9.14	3.82
8	4.63	1.04	1.89	1.11	1.16	2.52	5.52	2.67	3.31	1.21	5.62	4.28
9	4.38	1.01	4.25	0.92	1.50	8.13	3.75	2.68	2.60	6.90	5.51	4.02
10	3.49	0.96	7.50	0.76	2.05	6.55	3.44	2.68	4.47	6.66	5.40	4.16
11	3.81	0.90	2.94	0.46	2.71	5.82	2.97	4.20	2.29	10.32	14.46	4.58
12	5.08	0.91	2.08	0.45	3.18	5.94	2.84	5.02	2.18	7.70	10.03	16.94
13	21.81	0.90	1.70	0.67	2.75	6.39	4.21	3.30	2.68	3.99	8.58	7.90
14	8.97	1.30	1.42	0.97	2.07	4.36	4.38	2.97	1.84	2.66	6.51	6.74
15	5.47	3.05	1.31	5.59	2.54	3.05	4.64	2.71	2.66	2.33	5.61	5.22
16	4.23	3.10	1.25	3.52	4.11	2.93	3.72	2.38	2.16	2.11	6.17	4.97
17	3.44	3.27	1.22	2.35	4.36	3.67	3.94	3.89	1.88	13.25	5.43	7.03
18	3.07	5.08	1.82	1.65	6.45	3.60	3.57	2.59	1.60	8.36	5.32	8.38
19	2.75	2.40	1.66	1.28	4.96	6.71	2.93	2.59	1.32	6.61	4.81	5.57
20	2.54	1.89	1.25	0.89	3.91	7.63	3.49	2.47	1.27	5.50	3.88	4.59
21	2.41	1.48	1.21	0.94	4.04	8.63	3.71	2.25	1.60	5.16	4.04	4.47
22	2.46	1.19	1.32	1.31	7.40	11.76	3.62	2.14	1.40	6.58	3.92	4.38
23	3.56	1.46	2.13	5.04	4.83	7.70	4.24	1.96	2.24	5.52	3.41	3.65
24	5.57	5.55	1.34	5.39	3.28	7.47	4.32	1.66	2.29	4.64	7.27	3.18
25	4.72	6.96	1.22	7.54	2.69	7.00	4.34	1.26	8.53	3.70	4.89	2.81
26	3.26	3.75	1.15	5.35	2.39	5.29	3.77	1.20	4.29	3.30	3.94	2.55
27	2.73	3.28	1.02	6.30	2.13	8.58	3.46	1.29	2.72	3.52	3.36	2.26
28	2.36	2.29	0.90	4.82	1.88	5.57	3.03	1.26	2.01	2.75	3.00	2.23
29	1.97		0.81	5.01	1.70	5.68	2.64	1.11	1.51	3.48	2.72	2.64
30	1.78		0.78	3.10	1.87	4.22	2.49	1.05	1.32	6.52	2.97	2.33
31	1.62		0.76		3.00		2.55	1.44		6.44		5.23
TOTAL	130.53	61.98	53.88	75.16	89.78	157.03	118.34	75.68	74.73	137.80	163.89	151.08
AVERAGE	4.21	2.21	1.74	2.51	2.90	5.23	3.82	2.44	2.49	4.45	5.46	4.87
MAXIMUM	21.81	6.96	7.50	7.54	7.40	11.76	5.52	5.02	8.53	13.25	14.46	16.94
MINIMUM	1.62	0.90	0.76	0.45	1.16	1.68	2.49	1.05	1.27	0.97	2.72	2.23

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
1289.88	3.53	21.81	0.45

Supplemented Daily Mean Discharge at Bedukan River Gauging Station (1979) (unit: $m^3/s/100km^2$)

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	5.46	1.24	0.33	0.96	0.56	2.26	4.05	3.29	3.45	3.41	5.40	5.63
2	5.43	1.22	0.95	1.02	1.00	4.25	5.22	2.97	3.39	2.68	4.27	5.28
3	4.81	1.22	2.28	2.28	1.72	3.99	3.32	2.51	4.93	2.80	3.56	6.29
4	3.83	1.10	1.54	1.59	1.06	3.86	2.54	2.42	2.95	4.88	4.19	6.31
5	3.69	0.99	1.36	3.17	1.51	2.62	3.44	2.51	1.96	7.23	6.71	4.50
6	3.00	0.93	2.45	1.69	1.17	2.11	2.47	2.85	1.44	10.49	7.48	3.98
7	2.56	0.88	1.65	1.23	1.06	1.48	2.61	2.66	1.39	14.36	6.42	3.79
8	2.40	0.82	3.00	1.06	5.40	1.60	2.23	1.97	1.49	20.33	10.39	3.55
9	2.13	0.74	3.76	0.94	7.23	2.72	3.75	1.68	1.57	18.45	10.01	6.02
10	1.98	0.68	1.92	0.81	4.03	4.42	2.77	1.58	3.30	12.31	6.83	9.93
11	1.86	0.94	1.46	0.84	4.58	2.62	2.39	1.51	3.89	8.69	10.13	7.94
12	1.65	1.07	2.07	0.92	4.86	2.26	4.00	1.58	3.58	9.85	13.05	8.66
13	1.41	1.23	2.36	2.10	2.25	5.31	3.83	1.54	3.25	11.14	9.93	7.36
14	1.35	2.27	3.85	2.42	1.67	9.50	4.25	1.36	4.21	7.39	6.94	5.37
15	1.32	3.38	2.11	1.73	1.31	8.40	3.63	1.24	5.33	6.11	6.00	4.47
16	1.29	1.90	10.13	1.25	1.28	4.50	7.90	1.16	3.94	5.39	5.13	3.98
17	1.25	1.33	7.13	1.04	1.12	6.70	7.15	1.09	4.15	4.57	5.25	3.81
18	1.19	1.15	3.53	0.95	1.43	5.80	4.14	1.08	13.84	3.98	6.27	3.57
19	1.14	1.02	2.83	0.89	1.82	6.12	4.43	1.33	7.04	3.70	6.14	3.23
20	1.29	0.91	2.20	0.83	1.68	7.93	5.01	2.30	8.58	6.76	5.71	3.64
21	1.06	0.82	2.41	1.16	1.48	5.43	5.53	2.92	12.43	6.65	4.94	5.81
22	1.53	0.77	1.77	1.77	1.61	4.78	4.92	2.81	7.07	6.58	3.75	7.42
23	1.81	0.75	1.54	1.13	2.09	5.69	8.03	3.79	7.03	5.11	3.99	7.68
24	1.82	0.70	1.37	1.05	1.41	3.59	7.84	2.90	6.23	4.23	5.81	6.78
25	1.71	0.72	1.24	0.96	1.10	3.10	5.40	2.06	4.91	5.29	5.20	6.35
26	1.71	0.66	1.18	1.26	1.08	3.01	4.20	1.74	5.85	4.66	4.49	6.33
27	1.44	0.54	1.10	0.88	1.37	4.32	4.29	2.46	6.37	4.37	4.51	6.11
28	1.22	0.38	1.22	0.78	1.51	3.95	5.30	2.14	4.47	3.84	6.71	6.39
29	1.13		1.74	0.71	0.97	3.92	3.94	4.22	3.50	6.06	5.24	5.94
30	1.16		1.31	0.63	1.70	3.29	3.29	4.00	3.78	11.39	5.68	4.64
31	1.76		1.06		3.03		3.24	3.10		6.19		3.97
TOTAL	66.19	30.36	72.85	38.05	64.09	129.53	135.11	70.77	145.32	228.89	190.13	174.73
AVERAGE	2.14	1.08	2.35	1.27	2.07	4.32	4.36	2.28	4.84	7.38	6.34	5.64
MAXIMUM	5.46	3.38	10.13	3.17	7.23	9.50	8.03	4.22	13.84	20.33	13.05	9.93
MINIMUM	1.13	0.38	0.33	0.63	0.56	1.48	2.23	1.08	1.39	2.68	3.56	3.23

ANNUAL

TOTAL	AVERAGE	MAXIMUM	MINIMUM
1346.02	3.69	20.33	0.33

5. Discharge Duration at Bedukan G/S

Discharge Duration at Bedukan River Gauging Station (1970-1979) (unit: $m^3/s/100km^2$)

NO.	Q i n	NO.	Q i n	NO.	Q i n	NO.	Q i n	NO.
1	58.178	51	6.232	101	4.305	151	3.238	
2	39.672	52	6.174	102	4.290	152	3.226	
3	30.019	53	6.148	103	4.249	153	3.215	
4	24.098	54	6.080	104	4.223	154	3.200	
5	20.103	55	6.047	105	4.190	155	3.184	
6	17.951	56	5.975	106	4.152	156	3.165	
7	17.193	57	5.910	107	4.132	157	3.144	
8	13.987	58	5.874	108	4.105	158	3.123	
9	13.358	59	5.808	109	4.080	159	3.104	
10	12.476	60	5.772	110	4.061	160	3.093	
11	11.843	61	5.747	111	4.039	161	3.070	
12	11.560	62	5.694	112	4.007	162	3.056	
13	10.943	63	5.633	113	3.985	163	3.042	
14	10.714	64	5.599	114	3.958	164	3.021	
15	10.255	65	5.550	115	3.922	165	3.009	
16	10.046	66	5.508	116	3.907	166	2.990	
17	9.810	67	5.476	117	3.857	167	2.974	
18	9.584	68	5.441	118	3.836	168	2.963	
19	9.326	69	5.417	119	3.819	169	2.951	
20	9.105	70	5.381	120	3.798	170	2.925	
21	8.907	71	5.325	121	3.776	171	2.914	
22	8.744	72	5.287	122	3.754	172	2.892	
23	8.608	73	5.250	123	3.737	173	2.871	
24	8.436	74	5.201	124	3.723	174	2.847	
25	8.313	75	5.173	125	3.709	175	2.841	
26	8.237	76	5.125	126	3.695	176	2.807	
27	8.092	77	5.094	127	3.680	177	2.797	
28	7.938	78	5.054	128	3.662	178	2.782	
29	7.850	79	5.021	129	3.640	179	2.775	
30	7.746	80	4.997	130	3.610	180	2.767	
31	7.665	81	4.973	131	3.588	181	2.743	
32	7.603	82	4.939	132	3.559	182	2.729	
33	7.456	83	4.908	133	3.549	183	2.717	
34	7.388	84	4.882	134	3.530	184	2.696	
35	7.323	85	4.860	135	3.507	185	2.669	
36	7.235	86	4.829	136	3.497	186	2.659	
37	7.158	87	4.803	137	3.476	187	2.645	
38	7.114	88	4.785	138	3.464	188	2.623	
39	7.046	89	4.747	139	3.448	189	2.611	
40	6.966	90	4.725	140	3.425	190	2.594	
41	6.888	91	4.699	141	3.416	191	2.577	
42	6.836	92	4.644	142	3.399	192	2.557	
43	6.728	93	4.595	143	3.372	193	2.543	
44	6.664	94	4.548	144	3.350	194	2.531	
45	6.601	95	4.520	145	3.341	195	2.521	
46	6.560	96	4.473	146	3.330	196	2.510	
47	6.499	97	4.446	147	3.311	197	2.501	
48	6.429	98	4.403	148	3.294	198	2.488	
49	6.378	99	4.351	149	3.278	199	2.476	
50	6.299	100	4.329	150	3.248	200	2.459	
51	6.232	101	4.305	151	3.238			

Discharge Duration at Bedukan River Gauging Station (1970-1979) (unit: $m^3/s/100km^2$)

NO.	Q i n	NO.	Q i n	NO.	Q i n	NO.	Q i n	NO.
201	2.447	251	1.826	301	1.279	351	0.709	
202	2.415	252	1.814	302	1.273	352	0.688	
203	2.393	253	1.800	303	1.260	353	0.675	
204	2.380	254	1.789	304	1.246	354	0.658	
205	2.373	255	1.776	305	1.241	355	0.651	
206	2.356	256	1.768	306	1.218	356	0.627	
207	2.342	257	1.755	307	1.212	357	0.606	
208	2.332	258	1.745	308	1.192	358	0.591	
209	2.319	259	1.728	309	1.185	359	0.579	
210	2.313	260	1.719	310	1.170	360	0.552	
211	2.298	261	1.713	311	1.164	361	0.521	
212	2.286	262	1.699	312	1.155	362	0.497	
213	2.273	263	1.688	313	1.140	363	0.468	
214	2.262	264	1.681	314	1.126	364	0.406	
215	2.245	265	1.673	315	1.118	365	0.369	
216	2.232	266	1.662	316	1.107			
217	2.221	267	1.651	317	1.097			
218	2.214	268	1.639	318	1.089			
219	2.199	269	1.627	319	1.072			
220	2.196	270	1.624	320	1.060			
221	2.185	271	1.602	321	1.050			
222	2.165	272	1.596	322	1.043			
223	2.145	273	1.584	323	1.035			
224	2.131	274	1.572	324	1.022			
225	2.122	275	1.560	325	1.014			
226	2.105	276	1.547	326	1.008			
227	2.093	277	1.541	327	1.003			
228	2.090	278	1.536	328	0.987			
229	2.080	279	1.523	329	0.971			
230	2.063	280	1.504	330	0.959			
231	2.052	281	1.494	331	0.955			
232	2.036	282	1.485	332	0.942			
233	2.019	283	1.477	333	0.937			
234	2.009	284	1.462	334	0.930			
235	1.985	285	1.450	335	0.923			
236	1.974	286	1.435	336	0.900			
237	1.963	287	1.426	337	0.893			
238	1.955	288	1.414	338	0.882			
239	1.939	289	1.404	339	0.874			
240	1.927	290	1.393	340	0.869			
241	1.919	291	1.381	341	0.858			
242	1.908	292	1.374	342	0.838			
243	1.898	293	1.359	343	0.822			
244	1.881	294	1.349	344	0.800			
245	1.871	295	1.333	345	0.790			
246	1.866	296	1.322	346	0.774			
247	1.857	297	1.314	347	0.755			
248	1.842	298	1.304	348	0.745			
249	1.839	299	1.293	349	0.737			
250	1.835	300	1.283	350	0.727			
251	1.826	301	1.279	351	0.709			

Appendix 4 DEVELOPMENT PLAN DATA

Appendix 4

DEVELOPMENT PLAN DATA

CONTENTS

1. Data of Site Selection Study in Chapter 5

SMALL HYDRO PROJECTS AT UPPER LIWAGU RIVER

Naradaw A

1.	Inst. Capacity	kW	1,340
2.	Firm Peak Power	kW	1,060
3.	Energy	GWh	10.3
4.	Construction Cost	1,000 M$	11,410
5.	Cost per kW	M$/kW	8,515
6.	Cost per kWh	M$/kWh	1.11
7.	Plant Factor	%	88
8.	Development Plan		Tot. Li Me
	(1) Catchment Area	km^2	60.3 31.9 28.4
	(2) 365 days, 100% flow	m^3/s	0.51 0.37 0.14
	(3) 347 days, 95% flow	m^3/s	0.78 0.55 0.23
	(4) 256 days, 70% flow	m^3/s	1.33 0.84 0.49
	(5) 183 days, 50% flow	m^3/s	2.05 1.22 0.83
	(6) Des. Flow	m^3/s	1.33 0.84 0.49
	(7) Intake WL	m (ft)	L 994 (3,260) M 986 (3,230)
	(8) T'race WL	m (ft)	848 (2,780)
	(9) Gross head	m (ft)	146
	(10) Head loss	m	20.4
	(11) Net Head	m	126
	(12) Firm Power	kW	710
	(13) 100% Power	kW	460

				Cost
9.	Layout			
	(1) Intake		Concrete type	483
	(2) L.P. Pipe	L (m) D (m) L (m) D (m)	Mesilau 1,137 0.6 Liwagu 2,220 0.7	2,404
	(3) L.P. Tunnel	H x B (m) L (m)		
	(4) Head Pond	(m^3)	5,750	424
	(5) Penstock	L (m) x D (m)	547 x 0.8	1,138
	(6) Power Station	Structural Steel Superstructure		247
	(7) Access Roads Improve	km km	4.1 1.2	564
	(8) Turb./Generator	Type RPM V	Turgo Impulse/3ϕ Synchronous Gen. x 2 units 350 3,300	4,370
	(9) Transformer	KVA High (V) Low (V)	1,580 x 1 unit 3ϕ OA 11,000 3,300	
	(10) Trans. Lines	Type Size KV L (km)	Steel Post HAL 0.166 sq.in 11 1.0	43
10.	Construction Cost			
	Establishment	1,000 M$		300
	Civil	1,000 M$		5,303
	Mech/Electr.	1,000 M$		4,370
	Contingencies	1,000 M$		840
	Engineering	1,000 M$		597
	Total	1,000 M$		11,410

SMALL HYDRO PROJECTS AT UPPER LIWAGU RIVER

Naradaw B

1.	Inst. Capacity	kW	850
2.	Firm Peak Power	kW	750
3.	Energy	GWh	6.6
4.	Construction Cost	1,000 M$	8,656
5.	Cost per kW	M$/kW	10,184
6.	Cost per kWh	M$/kWh	1.31
7.	Development Plan		
	(1) Catchment Area	km^2	31.9
	(2) 365. days 100% flow	m^3/s	0.37
	(3) 347. days 95% flow	m^3/s	0.55
	(4) 256. days 70% flow	m^3/s	0.84
	(5) 183. days 50% flow	m^3/s	1.22
	(6) Des. Flow	m^3/s	0.84
	(7) Intake WL	m (ft)	L 994 (3,260)
	(8) T'race WL	m (ft)	848 (2,780)
	(9) Gross head	m	146
	(10) Head loss	m	20.4
	(11) Net Head	m	126
	(12) Firm Power	kW	500
	(13) 100% Power	kW	373

				Cost
9.	Layout			
	(1) Intake		Concrete type	250
	(2) L.P. Pipe	L (m) D (m)	2,220 0.7	287
	(3) Tunnel	H x B (m) L (m)	-- --	1,665
	(4) Head Pond	(m^3)	3,600	335
	(5) Surge Tank	D (m)	--	--
	(6) Penstock	D (m) L (m)	0.6 547	908
	(7) Power Station	Structural steel Superstructure		188
	(8) Access Roads Improv.	km km	P.S 0.8 km, Pipe 2.2 km 1.2 km	432
	(9) Turb./Generator	Type RPM V	Turgo Impulse/3ϕ Synchronous Gen x 2 units 500 3,300	3,481
	(10) Transformer	kVA High (V) Low (V)	1,000 x 1 unit 3ϕ, OA 11,000 3,300	
	(11) Trans. Lines	Type Size kV L (km)	Steel Post HAL 0.166 sq.in 11.0 1.0	43
10.	Construction Cost			
	Establishment			250
	Civil			3,858
	Mech/Electr.			3,481
	Contingencies			616
	Engineering			451
	Total			8,656

SMALL HYDRO PROJECTS AT UPPER LIWAGU RIVER

Naradaw C

1.	Inst. Capacity	kW	490
2.	Firm Peak Power	kW	310
3.	Energy	GWh	3.7
4.	Construction Cost	1,000 M$	6,090
5.	Cost per kW	M$/kW	12,429
6.	Cost per kWh	M$/kWh	1.65
7.	Development Plan		
	(1) Catchment Area	km^2	28.4
	(2) 365, days 100% flow	m^3/s	0.14
	(3) 347, days 95% flow	m^3/s	0.23
	(4) 256, days 70% flow	m^3/s	0.49
	(5) 183, days 50% flow	m^3/s	0.83
	(6) Des. Flow	m^3/s	0.49
	(7) Intake WL	m (ft)	986 (3,230)
	(8) T'race WL	m (ft)	848 (2,780)
	(9) Gross head	m	138
	(10) Head loss	m	13
	(11) Net Head	m	125
	(12) Firm Power	kW	210
	(13) 100% Power	kW	126

				Cost
9.	Layout			
	(1) Intake		Concrete type	203
	(2) L.P. Pipe	L (m) D (m)	1,137 0.6	739
	(3) Tunnel	H x B (m) L (m)	-- --	--
	(4) Head Pond	(m^3)	2,120	257
	(5) Surge Tank	D (m)	--	--
	(6) Penstock	D (m) L (m)	0.5 547	782
	(7) Power Station	Structural Steel Superstructure		135
	(8) Access Roads Improv.	km km	2.0 1.2	304
	(9) Turb./Generator	Type RPM V	Turgo Impulse/3ϕ Synchronous Gen x 2 units 500 rpm 3,300	2,648
	(10) Transformer	kVA High (V) Low (V)	580 x 1 unit 3ϕ, OA 11,000 3,300	
	(11) Trans. Lines	Type Size kV L (km)	Steel Post HAL 0.166 sq.in 11.0 1.0	43
10.	Construction Cost			
	Establishment			250
	Civil			2,463
	Mech/Electr.			2,648
	Contingencies			407
	Engineering			322
	Total			6,090

SMALL HYDRO PROJECTS AT UPPER LIWAGU RIVER

Naradaw D

1.	Inst. Capacity	kW	1,540
2.	Firm Peak Power	kW	1,100
3.	Energy	GWh	11.9
4.	Construction Cost	1,000 M$	11,410
5.	Cost per kW	M$/kW	7,409
6.	Cost per kWh	M$/kWh	0.96
7.	Development Plan		Tot. Li Me
	(1) Catchment Area	km^2	59.2 31.1 28.1
	(2) 365, days 100% flow	m^3/s	0.40 0.26 0.14
	(3) 347, days 95% flow	m^3/s	0.62 0.40 0.22
	(4) 256, days 70% flow	m^3/s	1.17 0.69 0.48
	(5) 183, days 50% flow	m^3/s	1.88 1.06 0.82
	(6) Des. Flow	m^3/s	1.17 0.69 0.48
	(7) Intake WL	m (ft)	Li 1,037 (3,400) Me 1,032 (3,380)
	(8) T'race WL	m (ft)	848 (2,780)
	(9) Gross head	m	189
	(10) Head loss	m	24
	(11) Net Head	m	165
	(12) Firm Power	kW	740
	(13) 100% Power	kW	480

				Cost
9.	Layout			
	(1) Intake		Concrete type	461
	(2) L.P. Pipe	L (m) D (m)	Liwagu 2,640 0.7 Mesilau 600 0.6	2,370
	(3) Tunnel	H x B (m) L (m)		
	(4) Head Pond	(m^3)	5,100	399
	(5) Surge Tank	D (m)	--	
	(6) Penstock	D (m) L (m)	0.7 624	1,167
	(7) Power Station	Structual steel superstructure		291
	(8) Access Roads Improv.	km km	4.1 1.2	564
	(9) Turb./Generator	Type RPM V	Turgo Impulse/3ϕ Synchronous Gen x 2 units 1,000 3,500	4,380
	(10) Transformer	kVA High (V) Low (V)	1,820 x 1 unit 3ϕ, OA 11,000 3,300	
	(11) Trans. Lines	Type Size kV L (km)	Steel Post HAL 0.166 sq.in 11 1.0	43
10.	Construction Cost			
	Establishment			300
	Civil			5,295
	Mech/Electr.			4,380
	Contingencies			839
	Engineering			596
	Total			11,410

SMALL HYDRO PROJECTS AT UPPER LIWAGU RIVER

Naradaw E

1.	Inst. Capacity	kW	1,070
2.	Firm Peak Power	kW	840
3.	Energy	GWh	8.3
4.	Construction Cost	1,000 M$	10,620
5.	Cost per kW	M$/kW	9,925
6.	Cost per kWh	M$/kWh	1.28
7.	Development Plan		Tot. Li Me
	(1) Catchment Area	km^2	60.3 31.9 28.4
	(2) 365, days 100% flow	m^3/s	0.51 0.37 0.14
	(3) 347, days 95% flow	m^3/s	0.78 0.55 0.23
	(4) 256, days 70% flow	m^3/s	1.33 0.84 0.49
	(5) 183, days 50% flow	m^3/s	2.05 1.22 0.83
	(6) Des. Flow	m^3/s	1.33 0.84 0.49
	(7) Intake WL	m (ft)	Li 994 (3,260) Me 986 (3,230)
	(8) T'race WL	m (ft)	874 (2,870)
	(9) Gross head	m	120
	(10) Head loss	m	20
	(11) Net Head	m	100
	(12) Firm Power	kW	560
	(13) 100% Power	kW	370

				Cost
9.	Layout			
	(1) Intake		Concrete type	483
	(2) L.P. Pipe	L (m) D (m)	Liwagu 2,370 0.7 Mesilau 987 0.6	2,419
	(3) Tunnel	H x B (m) L (m)		
	(4) Head Pond	(m^3)	5,750	424
	(5) Surge Tank	D (m)	--	
	(6) Penstock	D (m) L (m)	0.8 317	660
	(7) Power Station		Structual steel superstructure	201
	(8) Access Roads Improv.	km km	4.6 1.2	624
	(9) Turb./Generator	Type RPM V	Turgo Impulse/3ϕ Synchronous Gen x 2 units 750 3,300	4,138
	(10) Transformer	kVA High (V) Low (V)	1,265 x 1 unit 3ϕ, OA 11,000 3,300	
	(11) Trans. Lines	Type Size kV L (km)	Steel Post HAL 0.166 sq.in 11 1	43
10.	Construction Cost			
	Establishment			300
	Civil			4,854
	Mech/Electr.			4,138
	Contingencies			773
	Engineering			555
	Total			10,620

SMALL HYDRO PROJECTS AT UPPER LIWAGU RIVER

Gantong A

1.	Inst. Capacity	kW	1,600
2.	Firm Peak Power	kW	1,260
3.	Energy	GWh	12.3
4.	Construction Cost	1,000 M$	16,580
5.	Cost per kW	M$/kW	10,363
6.	Cost per kWh	M$/kWh	1.35
7.	Plant Factor	%	88
8.	Development Plan		
	(1) Catchment Area	km^2	65.5
	(2) 365 days, 100% flow	m^3/s	0.55
	(3) 347 days, 95% flow	m^3/s	0.85
	(4) 256 days, 70% flow	m^3/s	1.45
	(5) 183 days, 50% flow	m^3/s	2.23
	(6) Des. Flow	m^3/s	1.45
	(7) Intake WL	m (ft)	830 (2,730)
	(8) T'race WL	m (ft)	671 (2,200)
	(9) Gross head	m (ft)	159
	(10) Head loss	m	22
	(11) Net Head	m	137
	(12) Firm Power	kW	840
	(13) 100% Power	kW	540

				Cost
9.	Layout			
	(1) Intake		Concrete type	450
	(2) L.P. Pipe	L (m) D (m)	1,500 1.0	1,620
	(3) L.P. Tunnel	H x B (m) L (m)	1.8 x 1.5 1,000	5,000
	(4) Head Pond	(m^3)	6,264	442
	(5) Penstock	D (m) L (m)	0.8 520	1,082
	(6) Power Station	Structural Steel Superstructure		282
	(7) Access Roads Improve	km km	1.6 3.5	402
	(8) Turb./Generator	Type RPM V	Turgo Impulse/3ϕ Synchronous Gen. x 2 units 750 3,300	4,676
	(9) Transformer	KVA High (V) Low (V)	1,880 x 1 unit 3ϕ OA 11,000 3,300	
	(10) Trans. Lines	Type Size KV L (km)	Steel Post HAL 0.166 sq.in 11.0 1.0	22
10.	Construction Cost			
	Establishment	1,000 M$		300
	Civil	1,000 M$		9,300
	Mech/Electr.	1,000 M$		4,676
	Contingencies	1,000 M$		1,440
	Engineering	1,000 M$		864
	Total	1,000 M$		16,580

SMALL HYDRO PROJECTS AT UPPER LIWAGU RIVER

Gantong B

1.	Inst. Capacity	kW	2,140
2.	Firm Peak Power	kW	1,700
3.	Energy	GWh	16.5
4.	Construction Cost	1,000 M$	21,290
5.	Cost per kW	M$/kW	9,949
6.	Cost per kWh	M$/kWh	1.29
7.	Plant Factor	%	88
8.	Development Plan		
	(1) Catchment Area	km^2	65.5
	(2) 365 days, 100% flow	m^3/s	0.55
	(3) 347 days, 95% flow	m^3/s	0.85
	(4) 256 days, 70% flow	m^3/s	1.45
	(5) 183 days, 50% flow	m^3/s	2.23
	(6) Des. Flow	m^3/s	1.45
	(7) Intake WL	m (ft)	830 (2,730)
	(8) T'race WL	m (ft)	610 (2,000)
	(9) Gross head	m	220
	(10) Head loss	m	36
	(11) Net Head	m	184
	(12) Firm Power	kW	1,130
	(13) 100% Power	kW	730

				Cost
9.	Layout			
	(1) Intake		Concrete type	450
	(2) L.P. Pipe	L (m) D (m)	2,070 1.0	2,236
	(3) Tunnel	H x B (m) L (m)	 1,000	5,000
	(4) Head Pond	(m^3)	6,264	442
	(5) Surge Tank	D (m)	--	0
	(6) Penstock	D (m) L (m)	1.0 1,910	367
	(7) Power Station	Structural Steel Superstructure		
	(8) Access Roads Improv.	km km	3.8 4.0	690
	(9) Turb./Generator	Type RPM V	Turgo Impulse/3ϕ Synchronous Gen x 2 units 1,000 3,300	5,024
	(10) Transformer	kVA High (V) Low (V)	2,520 x 1 unit 3ϕ, OA 11,000 3,300	
	(11) Trans. Lines	Type Size kV L (km)	Steel Post HAL 0.166 sq.in 11,000 1.0	39
10.	Construction Cost			
	Establishment			300
	Civil			12,877
	Mech/Electr.			5,024
	Contingencies			1,977
	Engineering			1,112
	Total			21,290

SMALL HYDRO PROJECTS AT UPPER LIWAGU RIVER

Gantong C

1.	Inst. Capacity	kW	2,340
2.	Firm Peak Power	kW	1,850
3.	Energy	GWh	18.1
4.	Construction Cost	1,000 M$	25,300
5.	Cost per kW	M$/kW	10,812
6.	Cost per kWh	M$/kWh	1.40
7.	Plant Factor	%	88
8.	Development Plan		Tol. Li Mo.
	(1) Catchment Area	km^2	78.5 65.5 13.0
	(2) 365 days, 100% flow	m^3/s	0.66 0.55 0.11
	(3) 347 days, 95% flow	m^3/s	1.02 0.85 0.17
	(4) 256 days, 70% flow	m^3/s	1.74 1.45 0.29
	(5) 183 days, 50% flow	m^3/s	2.67 2.23 0.44
	(6) Des. Flow	m^3/s	1.74 1.45 0.29
	(7) Intake WL	m (ft)	830 (2,730)
	(8) T'race WL	m (ft)	610 (2,000)
	(9) Gross head	m	220
	(10) Head loss	m	52
	(11) Net Head	m	168
	(12) Firm Power	kW	1,230
	(13) 100% Power	kW	800

				Cost
9.	Layout			
	(1) Intake		Concrete type	650
	(2) L.P. Pipe	L (m) D (m)	5,160 1.0 - 1.1	5,765
	(3) Tunnel	H x B (m) L (m)	1.5 x 1.2 1,000	5,000
	(4) Head Pond	(m^3)	7,517	485
	(5) Surge Tank	D (m)	--	0
	(6) Penstock	D (m) L (m)	1.0 1.150	2,737
	(7) Power Station	Structural Steel Superstructure		376
	(8) Access Roads Improv.	km km	5.3 3.5	841
	(9) Turb./Generator	Type RPM V	Turgo Impulse/3ϕ Synchronous Gen x 2 units 1,000 3,300	5,375
	(10) Transformer	kVA High (V) Low (V)	2,760 x 1 unit 3ϕ, OA 11,000 3,300	
	(11) Trans. Lines	Type Size kV L (km)	Steel Post HAL 0.166 sq.in 11.0 0.5	22
10.	Construction Cost			
	Establishment			300
	Civil			15,876
	Mech/Electr.			5,375
	Contingencies			2,426
	Engineering			1,323
	Total			25,300

SMALL HYDRO PROJECTS AT UPPER LIWAGU RIVER

Gantong D

1.	Inst. Capacity	kW	1,610
2.	Firm Peak Power	kW	1,280
3.	Energy	GWh	12.4
4.	Construction Cost	1,000 M$	13,510
5.	Cost per kW	M$/kW	8,391
6.	Cost per kWh	M$/kWh	1.09
7.	Plant Factor	%	88
8.	Development Plan		
	(1) Catchment Area	km^2	63.5
	(2) 365 days, 100% flow	m^3/s	0.53
	(3) 347 days, 95% flow	m^3/s	0.82
	(4) 256 days, 70% flow	m^3/s	1.40
	(5) 183 days, 50% flow	m^3/s	2.16
	(6) Des. Flow	m^3/s	1.40
	(7) Intake WL	m (ft)	842 (2,760)
	(8) T'race WL	m (ft)	671 (2,200)
	(9) Gross head	m	171
	(10) Head loss	m	27
	(11) Net Head	m	144
	(12) Firm Power	kW	1,280
	(13) 100% Power	kW	550

				Cost
9.	Layout			
	(1) Intake		Concrete type	450
	(2) L.P. Pipe	L (m) D (m)	1,920 1.0	2,074
	(3) Tunnel	H x B (m) L (m)	-- --	0
	(4) Head Pond	(m^3)	6,050	435
	(5) Surge Tank	D (m)	--	0
	(6) Penstock	D (m) L (m)	1.0 2,010	3,280
	(7) Power Station	Structual Steel Superstructure		271
	(8) Access Roads Improv.	km km	2.3 1.0	336
	(9) Turb./Generator	Type RPM V	Turgo Impulse/3ϕ Synchronous Gen. x 2 units 750 3,300	4,560
	(10) Transformer	kVA High (V) Low (V)	1,900 x 1 unit 3ϕ, OA 11,000 3,300	
	(11) Trans. Lines	Type Size kV L (km)	Steel Post HAL 0.166 sq.in 11.0 0.5	22
10.	Construction Cost			
	Establishment			300
	Civil			6,868
	Mech/Electr.			4,560
	Contingencies			1,075
	Engineering			707
	Total			13,510

SMALL HYDRO PROJECTS AT UPPER LIWAGU RIVER

Gantong E

1.	Inst. Capacity	kW	1,700
2.	Firm Peak Power	kW	1,320
3.	Energy	GWh	11.2
4.	Construction Cost	1,000 M$	14,340
5.	Cost per kW	M$/kW	8,435
6.	Cost per kWh	M$/kWh	1.28
7.	Plant Factor	%	75
8.	Development Plan		
	(1) Catchment Area	km^2	63.5
	(2) 365 days, 100% flow	m^3/s	0
	(3) 347 days, 95% flow	m^3/s	0.29
	(4) 256 days, 70% flow	m^3/s	1.40
	(5) 183 days, 50% flow	m^3/s	2.16
	(6) Des. Flow	m^3/s	1.40
	(7) Intake WL	m (ft)	842 (2,760)
	(8) T'race WL	m (ft)	671 (2,200)
	(9) Gross head	m	171
	(10) Head loss	m	22
	(11) Net Head	m	149
	(12) Firm Power	kW	350
	(13) 100% Power	kW	0

				Cost
9.	Layout			
	(1) Intake		Concrete type	443
	(2) L.P. Pipe	L (m) D (m)	2,040 1.0	2,203
	(3) Tunnel	H x B (m) L (m)	1.5 x 1.2 500	2,500
	(4) Head Pond	(m^3)	6,050	435
	(5) Surge Tank	D (m)	--	0
	(6) Penstock	D (m) L (m)	0.8 475	988
	(7) Power Station		Structual Steel Superstructure	300
	(8) Access Roads Improv.	km km	3.2 2	509
	(9) Turb./Generator	Type RPM V	Turgo Impulse/3ϕ Synchronous Gen x 2 units 1,000 3,300	4,720
	(10) Transformer	kVA High (V) Low (V)	2,000 x 1 unit 3ϕ, OA 11,000 3,300	
	(11) Trans. Lines	Type Size kV L (km)	Steel Post HAL 0.166 sq.in 11.0 1.0	34
10.	Construction Cost			
	Establishment			300
	Civil			7,412
	Mech/Electr.			4,720
	Contingencies			1,157
	Engineering			751
	Total			14,340

SMALL HYDRO PROJECTS AT UPPER LIWAGU RIVER

Pakai

1.	Inst. Capacity	kW	2,700
2.	Firm Peak Power	kW	850
3.	Energy	GWh	17.7
4.	Construction Cost	1,000 M$	22,270
5.	Cost per kW	M$/kW	8,248
6.	Cost per kWh	M$/kWh	1.26
7.	Plant Factor	%	75
8.	Development Plan		
	(1) Catchment Area	km^2	88.9
	(2) 365 days, 100% flow	m^3/s	0
	(3) 347 days, 95% flow	m^3/s	0.41
	(4) 256 days, 70% flow	m^3/s	1.96
	(5) 183 days, 50% flow	m^3/s	3.02
	(6) Des. Flow	m^3/s	1.96
	(7) Intake WL	m (ft)	625 (2,050)
	(8) T'race WL	m (ft)	415 (1,360)
	(9) Gross head	m (ft)	210
	(10) Head loss	m	37
	(11) Net Head	m	173
	(12) Firm Power	kW	570
	(13) 100% Power	kW	0

				Cost
9.	Layout			
	(1) Intake		Concrete type	549
	(2) L.P. Pipe	L (m) D (m)	3,360 1.0	8,965
	(3) L.P. Tunnel	H x B (m) L (m)	1.8 x 1.5 1,000	0
	(4) Head Pond	(m^3)	8,467	514
	(5) Penstock	D (m) L (m)	0.9 724	1,651
	(6) Power Station	Structural Steel Superstructure		414
	(7) Access Roads Improve	km km	4.4 2.0	531
	(8) Turb./Generator	Type RPM V	Turgo Impulse/3ϕ Synchronous Gen. x 2 units 1,000 3,300	5,731
	(9) Transformer	KVA High (V) Low (V)	3,180 x 1 unit 3ϕ OA 11,000 3,300	
	(10) Trans. Lines	Type Size KV L (km)	Steel Post HAL 0.166 sq.in 11.0 7.0	301
10.	Construction Cost			
	Establishment	1,000 M$		350
	Civil	1,000 M$		13,025
	Mech/Electr.	1,000 M$		5,731
	Contingencies	1,000 M$		2,006
	Engineering	1,000 M$		1,158
	Total	1,000 M$		22,270

SMALL HYDRO PROJECTS AT UPPER LIWAGU RIVER

Kauluan

1.	Inst. Capacity	kW	1,150
2.	Firm Peak Power	kW	620
3.	Energy	GWh	8.8
4.	Construction Cost	1,000 M$	10,980
5.	Cost per kW	M$/kW	9,548
6.	Cost per kWh	M$/kWh	1.25
7.	Plant Factor	%	87
8.	Development Plan		
	(1) Catchment Area	km^2	22.2
	(2) 365, days 100% flow	m^3/s	0.09
	(3) 347, days 95% flow	m^3/s	0.14
	(4) 256, days 70% flow	m^3/s	0.35
	(5) 183, days 50% flow	m^3/s	0.61
	(6) Des. Flow	m^3/s	0.35
	(7) Intake WL	m (ft)	1.418 (4,650)
	(8) T'race WL	m (ft)	976 (3,200)
	(9) Gross head	m	442
	(10) Head loss	m	30
	(11) Net Head	m	412
	(12) Firm Power	kW	410
	(13) 100% Power	kW	270

				Cost
9.	Layout			
	(1) Intake		Concrete type	156
	(2) L.P. Pipe	L (m) D (m)	1,740 0.5	940
	(3) Tunnel	H x B (m) L (m)		0
	(4) Head Pond	(m^3)	1,512	217
	(5) Surge Tank	D (m)	--	--
	(6) Penstock	D (m) L (m)	0.4 2,630	3,630
	(7) Power Station	Structural steel Superstructure		321
	(8) Access Roads Improv.	km km	5.4 2.0	828
	(9) Turb./Generator	Type RPM V	Pelton/3ϕ Synchronous Gen x 2 units 1,500 3,300	3,014
	(10) Transformer	kVA High (V) Low (V)	1,350 11,000 3,300	
	(11) Trans. Lines	Type Size kV L (km)	Steel Post HAL 0.166 sq.in 11 0.8	34
10.	Construction Cost			
	Establishment			300
	Civil			6,126
	Mech/Electr.			3,014
	Contingencies			964
	Engineering			576
	Total			10,980

SMALL HYDRO PROJECTS AT UPPER LIWAGU RIVER

Lamas 2

1.	Inst. Capacity	kW	8,400
2.	Firm Peak Power	kW	4,450
3.	Energy	GWh	65.0
4.	Construction Cost	1,000 M$	37,790
5.	Cost per kW	M$/kW	4,500
6.	Cost per kWh	M$/kWh	0.58
7.	Plant Factor	%	88
8.	Development Plan		
	(1) Catchment Area	km^2	72.9
	(2) 365, days 100% flow	m^3/s	0.61
	(3) 347, days 95% flow	m^3/s	0.95
	(4) 256, days 70% flow	m^3/s	1.61
	(5) 183, days 50% flow	m^3/s	2.48
	(6) Des. Flow	m^3/s	1.61
	(7) Intake WL	m (ft)	1,220 (4,000)
	(8) T'race WL	m (ft)	534 (1,750)
	(9) Gross head	m	686
	(10) Head loss	m	34
	(11) Net Head	m	652
	(12) Firm Power	kW	4,450
	(13) 100% Power	kW	2,870

				Cost
9.	Layout			
	(1) Intake		Concrete type	475
	(2) L.P. Pipe	L (m) D (m)	3,360 1.0	3,629
	(3) Tunnel	H x B (m) L (m)	-- --	
	(4) Head Pond	(m^3)	--	0
	(5) Surge Tank	(m^3)	580	135
	(6) Penstock	D (m) L (m)	0.8 1,370	4,672
	(7) Power Station	Structural Steel Superstructure		1,217
	(8) Access Roads Improv.	km km	84 5	10,303
	(9) Turb./Generator	Type RPM V	Pelton/3ϕ Synchronous Gen x 2 units 1,500 3,300	7,255
	(10) Transformer	kVA High (V) Low (V)	9,880 x 1 unit 3ϕ, OA 66,000 3,300	
	(11) Trans. Lines	Type Size kV L (km)	Steel Tower HAL 0.1045 sq.in 66 32.5	3,900
10.	Construction Cost			
	Establishment			500
	Civil			24,331
	Mech/Electr.			7,255
	Contingencies			3,730
	Engineering			1,974
	Total			37,790

SMALL HYDRO PROJECTS AT UPPER LIWAGU RIVER

Lamas 3

1.	Inst. Capacity	kW	3,180
2.	Firm Peak Power	kW	3,180
3.	Energy	GWh	27.7
4.	Construction Cost	1,000 M$	29,080
5.	Cost per kW	M$/kW	9,145
6.	Cost per kWh	M$/kWh	1.05
7.	Plant Factor	%	99
8.	Development Plan		
	(1) Catchment Area	km^2	72.9
	(2) 365, days 100% flow	m^3/s	0.61
	(3) 347, days 95% flow	m^3/s	0.95
	(4) 256, days 70% flow	m^3/s	1.61
	(5) 183, days 50% flow	m^3/s	2.48
	(6) Des. Flow	m^3/s	0.61
	(7) Intake WL	m (ft)	1,220 (4,000)
	(8) T'race WL	m (ft)	534 (1,750)
	(9) Gross head	m	686
	(10) Head loss	m	34
	(11) Net Head	m	652
	(12) Firm Power	kW	3,180
	(13) 100% Power	kW	2,860

				Cost
9.	Layout			
	(1) Intake		Concrete type	236
	(2) L.P. Pipe	L (m) D (m)	3,360 0.65	2,352
	(3) Tunnel	H x B (m) L (m)	-- --	
	(4) Head Pond	(m^3)		--
	(5) Surge Tank	D (m)		74
	(6) Penstock	D (m) L (m)	0.60 1,370	2,042
	(7) Power Station	Structual steel superstructure		680
	(8) Access Roads Improv.	km km	84 5	10,303
	(9) Turb./Generator	Type RPM V	Pelton/3ϕ Synchronous Gen x 2 units 1,500 3,300	4,464
	(10) Transformer	kVA High (V) Low (V)	3,750 x 1 unit 66,000 3,300	
	(11) Trans. Lines	Type Size kV L (km)	Steel Post HAL 0.1045 sq.in 66 32.5	3,900
10.	Construction Cost			
	Establishment			500
	Civil			19,587
	Mech/Electr.			4,464
	Contingencies			3,013
	Engineering			1,516
	Total			29,080

2. Selection of Optimum Plan in Chapter 9

(1) Saleable Energy of Alternative Plans

(2) Cash Flow of Benefit Cost Ratio of Alternative Plans

(3) Construction Cost of Alternative Plans

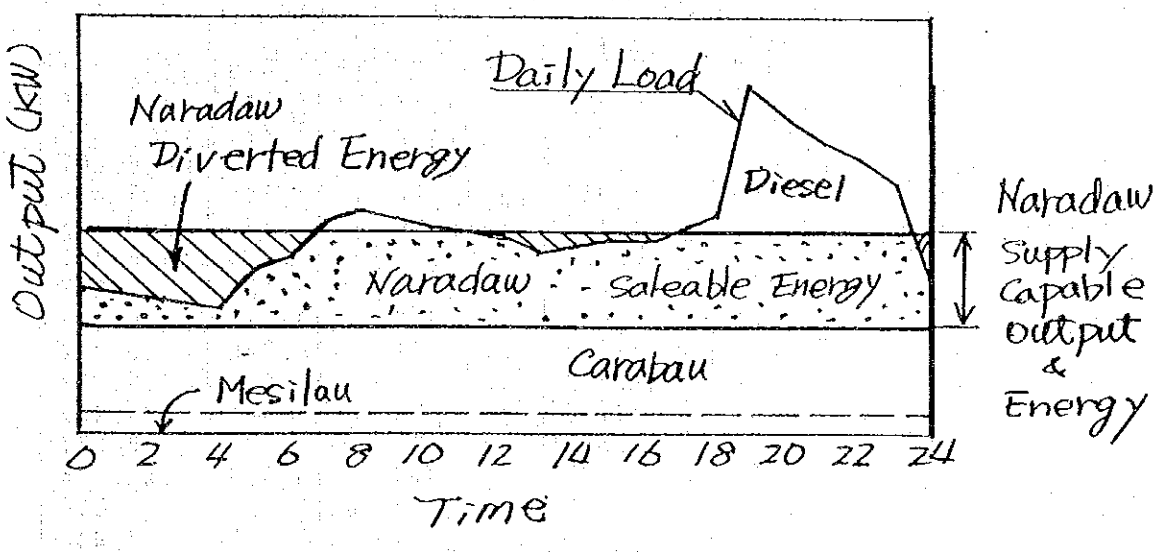
These Data relate to **Table 9-2** in Final Report.

2. Selection of Optimum Plan

(1) Saleable Energy of Alternative Plans

Saleable Energy of Mesilau & Carabau

Year	Demand		Energy Supplied (MWh)				Diesel (MWh)
	Max. Demand (kW)	Annual Energy (MWh)	Mesilau Saleable 299 kW		Carabau Saleable 2,000 kW		
			Used	Disch	Used	Disch	
1992	1,690	7,719	1,925	0	4,796	4,690	998
1993	1,920	8,921	1,925	0	5,589	3,896	1,407
1994	2,200	10,208	1,925	0	6,345	3,140	1,938
1995	2,520	11,583	1,925	0	7,036	2,449	2,622
1996	2,740	12,943	1,925	0	7,614	1,871	3,404
1997	3,020	14,267	1,925	0	8,115	1,371	4,227
1998	3,320	15,715	1,925	0	8,579	906	5,211
1999	3,640	17,201	1,925	0	8,891	594	6,385
2000	3,930	18,958	1,925	0	9,103	383	7,930
2001	4,220	20,320	1,925	0	9,213	272	9,182
2002	4,530	21,843	1,925	0	9,311	174	10,607
2003	4,880	23,494	1,925	0	9,390	95	12,179
2004	5,230	25,204	1,925	0	9,448	37	13,831
2005	5,620	27,064	1,925	0	9,485	0	15,654
2006	5,960	28,715	1,925	0	9,485	0	17,305
2007	6,310	30,467	1,925	0	9,485	0	19,057
	Total	294,622	30,805	0	131,887	19,878	



Minimum water requirement at the river between two intakes and the powerhouse is assumed to be 0.10 m³/s in total

Saleable Energy Naradaw 1,220 KW
He = 115 m

Year	Demand		Energy Supplied (MWh)			
	Max. Demand (kW)	Annual Energy (MWh)	Mesilau 299 kW		Carabau 2,000 kW	
			Used	Disch	Used	Disch
2000	3,930	18,958	1,925	0	9,103	383
2001	4,220	20,320	1,925	0	9,213	272
2002	4,530	21,843	1,925	0	9,311	174
2003	4,880	23,494	1,925	0	9,390	95
2004	5,230	25,204	1,925	0	9,448	37
2005	5,620	27,064	1,925	0	9,485	0
2006	5,960	28,715	1,925	0	9,485	0
2007	6,310	30,467	1,925	0	9,485	0
2008	6,690	32,325	1,925	0	9,485	0
2009	7,100	34,297	1,925	0	9,485	0
2010	7,590	36,585	1,925	0	9,485	0
2011	7,860	37,902	1,925	0	9,485	0
2012	8,150	39,267	1,925	0	9,485	0
2013	8,440	40,680	1,925	0	9,485	0
2014	8,740	42,145	1,925	0	9,485	0
2015	9,050	43,617	1,925	0	9,485	0
	Total	502,883	30,805	0	150,804	961

Year	Demand		Energy Supplied (MWh)			
	Max. Demand (kW)	Annual Energy (MWh)	Naradawl saleable 1,220 kW		Hydro Total	Diesel
			Used	Disch	Used	
2000	3,930	18,958	3,982	3,236	15,010	3,948
2001	4,220	20,320	4,507	2,712	15,645	4,675
2002	4,530	21,843	5,054	2,165	16,291	5,552
2003	4,880	23,494	5,582	1,637	16,897	6,597
2004	5,230	25,204	6,014	1,205	17,388	7,816
2005	5,620	27,064	6,322	896	17,733	9,331
2006	5,960	28,715	6,533	685	17,944	10,771
2007	6,310	30,467	6,710	509	18,120	12,347
2008	6,690	32,325	6,860	358	18,271	14,054
2009	7,100	34,297	6,984	234	18,395	15,902
2010	7,590	36,585	7,092	126	18,503	18,082
2011	7,860	37,902	7,140	78	18,551	19,351
2012	8,150	39,267	7,180	39	18,590	20,677
2013	8,440	40,680	7,206	13	18,616	22,064
2014	8,740	42,145	7,218	0	18,629	23,516
2015	9,050	43,617	7,218	0	18,629	24,988
	Total	502,883	101,603	13,893	283,212	219,671

64,962
166,565

Average for 25 yrs (2000 ~ 2024) 6,663

Average for 16 yrs (2000 ~ 2015) 6,350

Saleable Energy Naradaw 1,200 kW

He = 170 m

Year	Demand		Energy Supplied (MWh)			
	Max. Demand (kW)	Annual Energy (MWh)	Mesilau 299 kW		Carabau 2,000 kW	
			Used	Disch	Used	Disch
2000	3,930	18,958	1,925	0	9,103	383
2001	4,220	20,320	1,925	0	9,213	272
2002	4,530	21,843	1,925	0	9,311	174
2003	4,880	23,494	1,925	0	9,390	95
2004	5,230	25,204	1,925	0	9,448	37
2005	5,620	27,064	1,925	0	9,485	0
2006	5,960	28,715	1,925	0	9,485	0
2007	6,310	30,467	1,925	0	9,485	0
2008	6,690	32,325	1,925	0	9,485	0
2009	7,100	34,297	1,925	0	9,485	0
2010	7,590	36,585	1,925	0	9,485	0
2011	7,860	37,902	1,925	0	9,485	0
2012	8,150	39,267	1,925	0	9,485	0
2013	8,440	40,680	1,925	0	9,485	0
2014	8,740	42,145	1,925	0	9,485	0
2015	9,050	43,617	1,925	0	9,485	0
	Total	502,883	30,805	0	150,804	961

Year	Demand		Energy Supplied (MWh)			
	Max. Demand (kW)	Annual Energy (MWh)	Naradaw3 Saleable 1,200 kW		Hydro Total	Diesel
			Used	Disch	Used	
2000	3,930	18,958	4,498	3,253	15,525	3,433
2001	4,220	20,320	5,039	2,712	16,177	4,143
2002	4,530	21,843	5,597	2,154	16,834	5,009
2003	4,880	23,494	6,136	1,615	17,451	6,043
2004	5,230	25,204	6,567	1,184	17,941	7,263
2005	5,620	27,064	6,875	875	18,286	8,778
2006	5,960	28,715	7,087	664	18,498	10,217
2007	6,310	30,467	7,260	491	18,671	11,796
2008	6,690	32,325	7,408	342	18,819	13,506
2009	7,100	34,297	7,530	221	18,940	15,357
2010	7,590	36,585	7,634	117	19,045	17,540
2011	7,860	37,902	7,680	71	19,090	18,812
2012	8,150	39,267	7,716	34	19,127	20,140
2013	8,440	40,680	7,742	9	19,153	21,527
2014	8,740	42,145	7,751	0	19,161	22,984
2015	9,050	43,617	7,751	0	19,161	24,456
	Total	502,883	110,270	13,742	291,880	211,003

69,759

180,029

Average for 25 yrs (2000 ~2024) 7,201

Average for 16 yrs (2000 ~2015) 6,892

Saleable Energy Naradaw 1,600KW

He = 170 m

Year	Demand		Energy Supplied (MWh)			
	Max. Demand (kW)	Annual Energy (MWh)	Mesilau 299 kW		Carabau 2,000 kW	
			Used	Disch	Used	Disch
2000	3,930	18,958	1,925	0	9,103	383
2001	4,220	20,320	1,925	0	9,213	272
2002	4,530	21,843	1,925	0	9,311	174
2003	4,880	23,494	1,925	0	9,390	95
2004	5,230	25,204	1,925	0	9,448	37
2005	5,620	27,064	1,925	0	9,485	0
2006	5,960	28,715	1,925	0	9,485	0
2007	6,310	30,467	1,925	0	9,485	0
2008	6,690	32,325	1,925	0	9,485	0
2009	7,100	34,297	1,925	0	9,485	0
2010	7,590	36,585	1,925	0	9,485	0
2011	7,860	37,902	1,925	0	9,485	0
2012	8,150	39,267	1,925	0	9,485	0
2013	8,440	40,680	1,925	0	9,485	0
2014	8,740	42,145	1,925	0	9,485	0
2015	9,050	43,617	1,925	0	9,485	0
	Total	502,883	30,805	0	150,804	961

Year	Demand		Energy Supplied (MWh)			
	Max. Demand (kW)	Annual Energy (MWh)	Naradaw2 Saleable 1,600 kW		Hydro Total	Diesel
			Used	Disch	Used	
2000	3,930	18,958	4,806	4,885	15,834	3,124
2001	4,220	20,320	5,446	4,245	16,585	3,735
2002	4,530	21,843	6,117	3,573	17,354	4,489
2003	4,880	23,494	6,802	2,888	18,118	5,376
2004	5,230	25,204	7,437	2,254	18,811	6,393
2005	5,620	27,064	8,044	1,646	19,455	7,609
2006	5,960	28,715	8,437	1,253	19,848	8,867
2007	6,310	30,467	8,733	957	20,144	10,323
2008	6,690	32,325	8,968	723	20,378	11,947
2009	7,100	34,297	9,157	533	20,568	13,729
2010	7,590	36,585	9,337	354	20,747	15,838
2011	7,860	37,902	9,420	271	20,830	17,072
2012	8,150	39,267	9,491	199	20,902	18,365
2013	8,440	40,680	9,555	136	20,966	19,714
2014	8,740	42,145	9,608	83	21,018	21,127
2015	9,050	43,617	9,649	41	21,060	22,557
	Total	502,883	131,009	24,041	312,618	190,265

87,210

218,219

Average for 25 yrs (2000 ~ 2024) 8,729

Average for 16 yrs (2000 ~ 2015) 8,189

Saleable Energy Naradaw 2.000KW
He = 170 m

Year	Demand		Energy Supplied (MWh)			
	Max. Demand (kW)	Annual Energy (MWh)	Mesilau 299 kW		Carabau 2,000 kW	
			Used	Disch	Used	Disch
2000	3,930	18,958	1,925	0	9,103	383
2001	4,220	20,320	1,925	0	9,213	272
2002	4,530	21,843	1,925	0	9,311	174
2003	4,880	23,494	1,925	0	9,390	95
2004	5,230	25,204	1,925	0	9,448	37
2005	5,620	27,064	1,925	0	9,485	0
2006	5,960	28,715	1,925	0	9,485	0
2007	6,310	30,467	1,925	0	9,485	0
2008	6,690	32,325	1,925	0	9,485	0
2009	7,100	34,297	1,925	0	9,485	0
2010	7,590	36,585	1,925	0	9,485	0
2011	7,860	37,902	1,925	0	9,485	0
2012	8,150	39,267	1,925	0	9,485	0
2013	8,440	40,680	1,925	0	9,485	0
2014	8,740	42,145	1,925	0	9,485	0
2015	9,050	43,617	1,925	0	9,485	0
	Total	502,883	30,805	0	150,804	961

Year	Demand		Energy Supplied (MWh)			
	Max. Demand (kW)	Annual Energy (MWh)	Naradaw4 Saleable 2,000 kW		Hydro Total	Diesel
			Used	Disch	Used	
2000	3,930	18,958	4,932	6,409	15,959	2,999
2001	4,220	20,320	5,622	5,719	16,761	3,559
2002	4,530	21,843	6,344	4,997	17,581	4,262
2003	4,880	23,494	7,080	4,261	18,395	5,099
2004	5,230	25,204	7,815	3,526	19,188	6,016
2005	5,620	27,064	8,565	2,776	19,975	7,089
2006	5,960	28,715	9,180	2,161	20,590	8,125
2007	6,310	30,467	9,707	1,634	21,117	9,350
2008	6,690	32,325	10,093	1,248	21,504	10,821
2009	7,100	34,297	10,380	961	21,791	12,506
2010	7,590	36,585	10,639	702	22,049	14,536
2011	7,860	37,902	10,753	588	22,164	15,738
2012	8,150	39,267	10,866	475	22,276	16,991
2013	8,440	40,680	10,965	376	22,376	18,304
2014	8,740	42,145	11,058	283	22,469	19,676
2015	9,050	43,617	11,133	208	22,544	21,073
	Total	502,883	145,131	36,325	326,741	176,142

102,069
247,200

Average for 25 yrs (2000 ~ 2024) 9,888

Average for 16 yrs (2000 ~ 2015) 9,071

# Saleable Energy Naradaw 2400KW
He = 170 m

Year	Demand		Energy Supplied (MWh)			
	Max. Demand (kW)	Annual Energy (MWh)	Mesilau 299 kW		Carabau 2,000 kW	
			Used	Disch	Used	Disch
2000	3,930	18,958	1,925	0	9,103	383
2001	4,220	20,320	1,925	0	9,213	272
2002	4,530	21,843	1,925	0	9,311	174
2003	4,880	23,494	1,925	0	9,390	95
2004	5,230	25,204	1,925	0	9,448	37
2005	5,620	27,064	1,925	0	9,485	0
2006	5,960	28,715	1,925	0	9,485	0
2007	6,310	30,467	1,925	0	9,485	0
2008	6,690	32,325	1,925	0	9,485	0
2009	7,100	34,297	1,925	0	9,485	0
2010	7,590	36,585	1,925	0	9,485	0
2011	7,860	37,902	1,925	0	9,485	0
2012	8,150	39,267	1,925	0	9,485	0
2013	8,440	40,680	1,925	0	9,485	0
2014	8,740	42,145	1,925	0	9,485	0
2015	9,050	43,617	1,925	0	9,485	0
	Total	502,883	30,805	0	150,804	961

Year	Demand		Energy Supplied (MWh)			
	Max. Demand (kW)	Annual Energy (MWh)	Naradaw5 Saleable 2,400 kW		Hydro Total	Diesel
			Used	Disch	Used	
2000	3,930	18,958	4,972	7,780	16,000	2,958
2001	4,220	20,320	5,700	7,052	16,839	3,481
2002	4,530	21,843	6,469	6,284	17,705	4,138
2003	4,880	23,494	7,248	5,504	18,563	4,931
2004	5,230	25,204	8,000	4,752	19,373	5,831
2005	5,620	27,064	8,788	3,965	20,198	6,866
2006	5,960	28,715	9,476	3,276	20,887	7,828
2007	6,310	30,467	10,139	2,613	21,550	8,917
2008	6,690	32,325	10,766	1,986	22,177	10,148
2009	7,100	34,297	11,245	1,507	22,655	11,642
2010	7,590	36,585	11,622	1,130	23,032	13,553
2011	7,860	37,902	11,782	970	23,193	14,709
2012	8,150	39,267	11,934	818	23,345	15,922
2013	8,440	40,680	12,061	691	23,472	17,208
2014	8,740	42,145	12,180	572	23,591	18,554
2015	9,050	43,617	12,290	462	23,701	19,916
	Total	502,883	154,671	49,362	336,281	166,602

114,768

269,439

Average for 25 yrs (2000 ~ 2024) 10,778

Average for 16 yrs (2000 ~ 2015) 9,667

2. Selection of Optimum Plan
(2) Cash Flow of Benefit and Cost of Alternative Plans

Input Data : Naradaw P= 1,220 kW

Year of Start (n=0)	1997

(Thousand M$)

	n	Year	Naradaw Invest.	Diesel Invest.	Diesel kWh	Year
Const.	0	1997	1,060	0		1997
Const.	1	1998	6,360	349		1998
Const.	2	1999	3,180	349		1999
Opera.	3	2000	159	35	3,982	2000
Opera.	4	2001			4,507	2001
Opera.	5	2002			5,054	2002
Opera.	6	2003			5,582	2003
Opera.	7	2004			6,014	2004
Opera.	8	2005			6,322	2005
Opera.	9	2006			6,533	2006
Opera.	10	2007			6,710	2007
Opera.	11	2008			6,860	2008
Opera.	12	2009			6,984	2009
Opera.	13	2010			7,092	2010
Opera.	14	2011			7,140	2011
Opera.	15	2012			7,180	2012
Re-Const	16	2013		349 + 35	7,206	2013
Re-Const	17	2014		349 + 35	7,218	2014
Opera.	18	2015			7,218	2015
Opera.	19	2016			7,218	2016
Opera.	20	2017			7,218	2017
Opera.	21	2018			7,218	2018
Opera.	22	2019			7,218	2019
Opera.	23	2020			7,218	2020
Opera.	24	2021			7,218	2021
Opera.	25	2022			7,218	2022
Opera.	26	2023			7,218	2023
Opera.	27	2024	159	35	7,218	2024
			(2)	(3)		

(Narada) * 1,000 M$

(1) Const. cost	10,600	*		→(2)
(2) O & M Cost	159	*	= (1) X 0.015 = 159	→(2)
(3) Energy ~~generated~~ supply capable	7.2	*	X 10^6 kWh	
(4) Firm power	400	kW		

(Diesel)

(5) Inst. capacity	500	kW	= (4) X 1.25 = 400 X 1.25 = 500	
(6) Const. cost	698	*	= (5) X 1,395 M$/kW	→(3)
(7) O & M cost	35	*	= (6) X 0.05	→(3)
(8) Fuel cost	1,260	*	= (3) X 0.97 X 0.18 M$/kWh 0.175	→(4)

Benefit Cost Ratio Calculation : Naradaw P= 1,220 kW

(Thousand M$)

Year	n	1/1.1 n	Cost Stream Naradaw		Benefit Stream Alternative (Diesel)			
			Invest.	C Value	Invest.	Fuel	Total	B Value
1997	0	1.000	1,060	1,060	0	0	0	0
1998	1	0.909	6,360	5,782	349	0	349	317
1999	2	0.826	3,180	2,628	349	0	349	288
2000	3	0.751	159	119	35	697	732	550
2001	4	0.683	159	109	35	789	824	563
2002	5	0.621	159	99	35	884	919	571
2003	6	0.564	159	90	35	977	1,012	571
2004	7	0.513	159	82	35	1,052	1,087	558
2005	8	0.467	159	74	35	1,106	1,141	532
2006	9	0.424	159	67	35	1,143	1,178	500
2007	10	0.386	159	61	35	1,174	1,209	466
2008	11	0.350	159	56	35	1,201	1,236	433
2009	12	0.319	159	51	35	1,222	1,257	401
2010	13	0.290	159	46	35	1,241	1,276	370
2011	14	0.263	159	42	35	1,250	1,285	338
2012	15	0.239	159	38	35	1,257	1,292	309
2013	16	0.218	159	35	384	1,261	1,645	358
2014	17	0.198	159	31	384	1,263	1,647	326
2015	18	0.180	159	29	35	1,263	1,298	233
2016	19	0.164	159	26	35	1,263	1,298	212
2017	20	0.149	159	24	35	1,263	1,298	193
2018	21	0.135	159	21	35	1,263	1,298	175
2019	22	0.123	159	20	35	1,263	1,298	159
2020	23	0.112	159	18	35	1,263	1,298	145
2021	24	0.102	159	16	35	1,263	1,298	132
2022	25	0.092	159	15	35	1,263	1,298	120
2023	26	0.084	159	13	35	1,263	1,298	109
2024	27	0.076	159	12	35	1,263	1,298	99
		Total		10,663				9,029

B/C	0.85
B-C	-1,633

Input Data : Naradaw P= 1,200 kW

Year of Start (n=0) 1997

(Thousand M$)

	n	Year	Naradaw Invest.	Diesel Invest.	Diesel kWh	Year
Const.	0	1997	1,020	0		1997
Const.	1	1998	6,120	488		1998
Const.	2	1999	3,060	488		1999
Opera.	3	2000	153	49	4,498	2000
Opera.	4	2001			5,039	2001
Opera.	5	2002			5,597	2002
Opera.	6	2003			6,136	2003
Opera.	7	2004			6,567	2004
Opera.	8	2005			6,875	2005
Opera.	9	2006			7,087	2006
Opera.	10	2007			7,260	2007
Opera.	11	2008			7,408	2008
Opera.	12	2009			7,530	2009
Opera.	13	2010			7,634	2010
Opera.	14	2011			7,680	2011
Opera.	15	2012			7,716	2012
Re-Const	16	2013		488+49	7,742	2013
Re-Const	17	2014		488+49	7,751	2014
Opera.	18	2015			7,751	2015
Opera.	19	2016			7,751	2016
Opera.	20	2017			7,751	2017
Opera.	21	2018			7,751	2018
Opera.	22	2019			7,751	2019
Opera.	23	2020			7,751	2020
Opera.	24	2021			7,751	2021
Opera.	25	2022			7,751	2022
Opera.	26	2023			7,751	2023
Opera.	27	2024	153	49	7,751	2024
			(2)	(3)		

(Narada) * 1,000 M$

(1) Const. cost 10,200 * → (2)

(2) O & M Cost 153 * = (1) X 0.015 → (2)

(3) Energy ~~generated~~ supply capable 7.8 * 10^6 kWh

(4) Firm power 560 kW

(Diesel)

(5) Inst. capacity 700 kW = (4) X 1.25 = 560 X 1.25 = 700

(6) Const. cost 976 * = (5) X 1,395 M$/kW → (3)

(7) O & M cost 49 * = (6) X 0.05 → (3)

(8) Fuel cost 1,365 * = (3) X 0.97 X 0.18 M$/kWh → (4)
0.175

Benefit Cost Ratio Calculation : Naradaw P= 1,200 kW

(Thousand M$)

Year	n	1/1.1 n	Cost Stream Naradaw Invest.	Cost Stream Naradaw C Value	Benefit Stream Alternative (Diesel) Invest.	Fuel	Total	B Value
1997	0	1.000	1,020	1,020	0	0	0	0
1998	1	0.909	6,120	5,564	488	0	488	444
1999	2	0.826	3,060	2,529	488	0	488	403
2000	3	0.751	153	115	49	787	836	628
2001	4	0.683	153	105	49	882	931	636
2002	5	0.621	153	95	49	979	1,028	639
2003	6	0.564	153	86	49	1,074	1,123	634
2004	7	0.513	153	79	49	1,149	1,198	615
2005	8	0.467	153	71	49	1,203	1,252	584
2006	9	0.424	153	65	49	1,240	1,289	547
2007	10	0.386	153	59	49	1,271	1,320	509
2008	11	0.350	153	54	49	1,296	1,345	472
2009	12	0.319	153	49	49	1,318	1,367	435
2010	13	0.290	153	44	49	1,336	1,385	401
2011	14	0.263	153	40	49	1,344	1,393	367
2012	15	0.239	153	37	49	1,350	1,399	335
2013	16	0.218	153	33	537	1,355	1,892	412
2014	17	0.198	153	30	537	1,356	1,893	375
2015	18	0.180	153	28	49	1,356	1,405	253
2016	19	0.164	153	25	49	1,356	1,405	230
2017	20	0.149	153	23	49	1,356	1,405	209
2018	21	0.135	153	21	49	1,356	1,405	190
2019	22	0.123	153	19	49	1,356	1,405	173
2020	23	0.112	153	17	49	1,356	1,405	157
2021	24	0.102	153	16	49	1,356	1,405	143
2022	25	0.092	153	14	49	1,356	1,405	130
2023	26	0.084	153	13	49	1,356	1,405	118
2024	27	0.076	153	12	49	1,356	1,405	107
		Total		10,260				10,143

B/C	0.99
B-C	-118

Cash Flow of Benefit and Cost

Input Data : Naradaw P= 1,600 kW

Year of Start (n=0) 1997

(Thousand M$)

	n	Year	Naradaw Invest.	Diesel Invest.	Diesel kWh	Year
Const.	0	1997	1,150	0		1997
Const.	1	1998	6,900	488		1998
Const.	2	1999	3,450	488		1999
Opera.	3	2000	173	49	4,806	2000
Opera.	4	2001			5,446	2001
Opera.	5	2002			6,117	2002
Opera.	6	2003			6,802	2003
Opera.	7	2004			7,437	2004
Opera.	8	2005			8,044	2005
Opera.	9	2006			8,437	2006
Opera.	10	2007			8,733	2007
Opera.	11	2008			8,968	2008
Opera.	12	2009			9,157	2009
Opera.	13	2010			9,337	2010
Opera.	14	2011			9,420	2011
Opera.	15	2012		49	9,491	2012
Re-Const	16	2013		488+49	9,555	2013
Re-Const	17	2014		488+49	9,608	2014
Opera.	18	2015		49	9,649	2015
Opera.	19	2016			9,690	2016
Opera.	20	2017			9,690	2017
Opera.	21	2018			9,690	2018
Opera.	22	2019			9,690	2019
Opera.	23	2020			9,690	2020
Opera.	24	2021			9,690	2021
Opera.	25	2022			9,690	2022
Opera.	26	2023			9,690	2023
Opera.	27	2024	173	49	9,690	2024
			(2)	(3)		

(Narada) * 1,000 M$

(1) Const. cost 11,500 * _____ (2)

(2) O & M Cost 173 * = (1) X 0.015 (2)

(3) Energy ~~generated~~ supply capable 9.7 * X 10^6 kWh

(4) Firm power 560 kW

(Diesel)

(5) Inst. capacity 700 kW = (4) X 1.25 = 560 X 1.25 = 700

(6) Const. cost 976 * = (5) X 1,395 M$/kW (3)

(7) O & M cost 49 * = (6) X 0.05 (3)

(8) Fuel cost 1,698 * = (3) X 0.97 X 0.18 M$/kWh (4)
0.175

Benefit Cost Ratio Calculation : Naradaw P= 1,600 kW

(Thousand M$)

Year	n	1/1.1 n	Cost Stream Naradaw		Benefit Stream Alternative (Diesel)			
			Invest.	C Value	Invest.	Fuel	Total	B Value
1997	0	1.000	1,150	1,150	0	0	0	0
1998	1	0.909	6,900	6,273	488	0	488	444
1999	2	0.826	3,450	2,851	488	0	488	403
2000	3	0.751	173	130	49	841	890	669
2001	4	0.683	173	118	49	953	1,002	684
2002	5	0.621	173	107	49	1,070	1,119	695
2003	6	0.564	173	98	49	1,190	1,239	700
2004	7	0.513	173	89	49	1,301	1,350	693
2005	8	0.467	173	81	49	1,408	1,457	680
2006	9	0.424	173	73	49	1,476	1,525	647
2007	10	0.386	173	67	49	1,528	1,577	608
2008	11	0.350	173	61	49	1,569	1,618	567
2009	12	0.319	173	55	49	1,602	1,651	526
2010	13	0.290	173	50	49	1,634	1,683	487
2011	14	0.263	173	46	49	1,649	1,698	447
2012	15	0.239	173	41	49	1,661	1,710	409
2013	16	0.218	173	38	537	1,672	2,209	481
2014	17	0.198	173	34	537	1,681	2,218	439
2015	18	0.180	173	31	49	1,689	1,738	313
2016	19	0.164	173	28	49	1,696	1,745	285
2017	20	0.149	173	26	49	1,696	1,745	259
2018	21	0.135	173	23	49	1,696	1,745	236
2019	22	0.123	173	21	49	1,696	1,745	214
2020	23	0.112	173	19	49	1,696	1,745	195
2021	24	0.102	173	18	49	1,696	1,745	177
2022	25	0.092	173	16	49	1,696	1,745	161
2023	26	0.084	173	15	49	1,696	1,745	146
2024	27	0.076	173	13	49	1,696	1,745	133
		Total		11,572				11,699

B/C	1.01
B-C	127

Input Data : Naradaw P= 2,000 kW

Year of Start (n=0) 1997

(Thousand M$)

	n	Year	Naradaw Invest.	Diesel Invest.	Diesel kWh	Year
Const.	0	1997	1,310	0		1997
Const.	1	1998	7,860	488		1998
Const.	2	1999	3,930	488		1999
Opera.	3	2000	197	49	4,932	2000
Opera.	4	2001			5,622	2001
Opera.	5	2002			6,344	2002
Opera.	6	2003			7,080	2003
Opera.	7	2004			7,815	2004
Opera.	8	2005			8,565	2005
Opera.	9	2006			9,180	2006
Opera.	10	2007			9,707	2007
Opera.	11	2008			10,093	2008
Opera.	12	2009			10,380	2009
Opera.	13	2010			10,639	2010
Opera.	14	2011			10,753	2011
Opera.	15	2012			10,866	2012
Re-Const	16	2013		488+49	10,965	2013
Re-Const	17	2014		488+49	11,058	2014
Opera.	18	2015			11,133	2015
Opera.	19	2016			11,341	2016
Opera.	20	2017			11,341	2017
Opera.	21	2018			11,341	2018
Opera.	22	2019			11,341	2019
Opera.	23	2020			11,341	2020
Opera.	24	2021			11,341	2021
Opera.	25	2022			11,341	2022
Opera.	26	2023			11,341	2023
Opera.	27	2024	197	49	11,341	2024
			(2)	(3)		

(Narada) * 1,000 M$

(1) Const. cost 13,100 * _(2)

(2) O & M Cost 197 * = (1) X 0.015 _(2)

(3) Energy ~~generated~~ supply capable 11.3 * X 10^6 kWh

(4) Firm power 560 kW

(Diesel)

(5) Inst. capacity 700 kW = (4) X 1.25 = 560 X 1.25 = 700

(6) Const. cost 976 * = (5) X 1,395 M$/kW _(3)

(7) O & M cost 49 * = (5) X 0.05 _(3)

(8) Fuel cost 1,978 * = (3) X 0.97 X 0.18 M$/kWh _(4)
0.175

Benefit Cost Ratio Calculation : Naradaw P= 2,000 kW

(Thousand M$)

Year	n	1/1.1^n	Cost Stream Naradaw		Benefit Stream Alternative (Diesel)			
			Invest.	C Value	Invest.	Fuel	Total	B Value
1997	0	1.000	1,310	1,310	0	0	0	0
1998	1	0.909	7,860	7,145	488	0	488	444
1999	2	0.826	3,930	3,248	488	0	488	403
2000	3	0.751	197	148	49	863	912	685
2001	4	0.683	197	135	49	984	1,033	705
2002	5	0.621	197	122	49	1,110	1,159	720
2003	6	0.564	197	111	49	1,239	1,288	727
2004	7	0.513	197	101	49	1,368	1,417	727
2005	8	0.467	197	92	49	1,499	1,548	722
2006	9	0.424	197	84	49	1,607	1,656	702
2007	10	0.386	197	76	49	1,699	1,748	674
2008	11	0.350	197	69	49	1,766	1,815	636
2009	12	0.319	197	63	49	1,817	1,866	594
2010	13	0.290	197	57	49	1,862	1,911	553
2011	14	0.263	197	52	49	1,882	1,931	508
2012	15	0.239	197	47	49	1,902	1,951	467
2013	16	0.218	197	43	537	1,919	2,456	534
2014	17	0.198	197	39	537	1,935	2,472	489
2015	18	0.180	197	35	49	1,948	1,997	359
2016	19	0.164	197	32	49	1,985	2,034	333
2017	20	0.149	197	29	49	1,985	2,034	302
2018	21	0.135	197	27	49	1,985	2,034	275
2019	22	0.123	197	24	49	1,985	2,034	250
2020	23	0.112	197	22	49	1,985	2,034	227
2021	24	0.102	197	20	49	1,985	2,034	206
2022	25	0.092	197	18	49	1,985	2,034	188
2023	26	0.084	197	17	49	1,985	2,034	171
2024	27	0.076	197	15	49	1,985	2,034	155
		Total		13,181				12,758

B/C	0.97
B-C	-423

Input Data : Naradaw P= 2,400 kW

Year of Start (n=0) 1997

(Thousand M$)

	n	Year	Naradaw Invest.	Diesel Invest.	Diesel kWh	Year
Const.	0	1997	1,430	0		1997
Const.	1	1998	8,580	488		1998
Const.	2	1999	4,290	488		1999
Opera.	3	2000	215	49	4,792	2000
Opera.	4	2001			5,700	2001
Opera.	5	2002			6,469	2002
Opera.	6	2003			7,248	2003
Opera.	7	2004			8,000	2004
Opera.	8	2005			8,788	2005
Opera.	9	2006			9,476	2006
Opera.	10	2007			10,139	2007
Opera.	11	2008			10,766	2008
Opera.	12	2009			11,245	2009
Opera.	13	2010			11,622	2010
Opera.	14	2011			11,782	2011
Opera.	15	2012			11,934	2012
Re-Const	16	2013		488+49	12,061	2013
Re-Const	17	2014		488+49	12,180	2014
Opera.	18	2015			12,290	2015
Opera.	19	2016			12,752	2016
Opera.	20	2017			12,752	2017
Opera.	21	2018			12,752	2018
Opera.	22	2019			12,752	2019
Opera.	23	2020			12,752	2020
Opera.	24	2021			12,752	2021
Opera.	25	2022			12,752	2022
Opera.	26	2023			12,752	2023
Opera.	27	2024	215	49	12,752	2024
			(2)	(3)		

(Narada) * 1,000 M$

(1) Const. cost 14,300 * → (2)

(2) O & M Cost 215 * = (1) X 0.015 → (2)

(3) Energy ~~generated~~ supply capabe 12.8 * X 10^6 kWh

(4) Firm power 560 kW

(Diesel)

(5) Inst. capacity 700 kW = (4) X 1.25 = 560 X 1.25 = 700

(6) Const. cost 976 * = (5) X 1,395 M$/kW → (3)

(7) O & M cost 49 * = (6) X 0.05 → (3)

(8) Fuel cost 2,240 * = (3) X 0.97 X 0.18 M$/kWh → (4)
0.175

Benefit Cost Ratio Calculation : Naradaw P= 2,400 kW

(Thousand M$)

Year	n	1/1.1^n	Cost Stream Naradaw		Benefit Stream Alternative (Diesel)			
			Invest.	C Value	Invest.	Fuel	Total	B Value
1997	0	1.000	1,430	1,430	0	0	0	0
1998	1	0.909	8,580	7,800	488	0	488	444
1999	2	0.826	4,290	3,545	488	0	488	403
2000	3	0.751	215	162	49	839	888	667
2001	4	0.683	215	147	49	998	1,047	715
2002	5	0.621	215	133	49	1,132	1,181	733
2003	6	0.564	215	121	49	1,268	1,317	744
2004	7	0.513	215	110	49	1,400	1,449	744
2005	8	0.467	215	100	49	1,538	1,587	740
2006	9	0.424	215	91	49	1,658	1,707	724
2007	10	0.386	215	83	49	1,774	1,823	703
2008	11	0.350	215	75	49	1,884	1,933	678
2009	12	0.319	215	69	49	1,968	2,017	643
2010	13	0.290	215	62	49	2,034	2,083	603
2011	14	0.263	215	57	49	2,062	2,111	556
2012	15	0.239	215	51	49	2,088	2,137	512
2013	16	0.218	215	47	537	2,111	2,648	576
2014	17	0.198	215	43	537	2,132	2,669	528
2015	18	0.180	215	39	49	2,151	2,200	396
2016	19	0.164	215	35	49	2,232	2,281	373
2017	20	0.149	215	32	49	2,232	2,281	339
2018	21	0.135	215	29	49	2,232	2,281	308
2019	22	0.123	215	26	49	2,232	2,281	280
2020	23	0.112	215	24	49	2,232	2,281	255
2021	24	0.102	215	22	49	2,232	2,281	232
2022	25	0.092	215	20	49	2,232	2,281	210
2023	26	0.084	215	18	49	2,232	2,281	191
2024	27	0.076	215	16	49	2,232	2,281	174
		Total		14,388				13,470

B/C	0.94
B-C	-919

Re

2. Selection of Optimum Plan

(3) Construction Cost of Alternative Plans

Naradaw 1,220KW
He = 115m

OPTIMIZATION AT NARADAW

01. Plan

Installed Capacity	1,220 KW	Net head	115 m
Maximum discharge	1.33 m3/s		
Construction Cost	10,600,000 M$		

02. Layout

			(weir ~ pond)	(Pond ~ surge tank)
(1) Intake M.R.	Concrete type			
L.R.	Concrete type			
(2) L.P. Conduit M.R.	L(m)	320 (1.1×290m)	640 (1.1×585)	
	D(m)	0.6 (0.8√0.49)	0.7 (0.8√0.78)	
(3) Conduit L.R.	L(m)	2,440 = 1.1 × 2,220m		
	D(m)	0.7 = 0.8√Q = 0.8√0.84 = 0.73		
(4) Head Pond	(m3)	2,000 = $\frac{400-250}{6\times 115^m} \times 2.5^h \times 3{,}600^s \times 1.4$		
(5) Surge Tank	D (m)			
(6) Penstock	D (m)	0.8 = 0.65√Q = 0.65√1.33 = 0.75		
	L (m)	495 = $\sqrt{l^2+h^2} = \sqrt{480^2+(9925-852)^2}$		
(7) Power Station				
(8) Access Roads	km	3.2		
Improv.	km	3.2		
(9) Turb./Generator	Type	Tango Impulse/3φ Synchronous Generator x 2 units		
	RPM			
	V			
(10) Transformer	KVA	1,800 x 1 unit, 3φ, 0 A		
	High (V)	11,000		
	Low (V)	3,300		
(11) Trans. Lines	Type	Steel post		
	Size	HAL 0.166 sq. in.		
	KV	11		
	L (km)	1.0		

Note: D = Diameter, L = Length, V = Voltage
M.R. = Mesilau River L.R. = Liwagu River

(12) Spillway	L(m)	495	= Penstock
	D(m)	0.7	

Naradaw 1,220 KW
He=115 m

Summary of Coasts (Unit 1,000 M$)

(1)	Establishment	400	= P<1,000 KW 350,000 $, P≥1,000 KW 400,000 $
(2)	Div Weir/Intake	490	M.R = 374 × $\sqrt{D_1 \times Q_1}$ = 374 × $\sqrt{0.6 \times 0.49}$ = 203 L.R = 374 × $\sqrt{D_2 \times Q_2}$ = 374 × $\sqrt{0.7 \times 0.84}$ = 287
(3)	L. P. Condult	2,518	M.R = L 320 640 m @ 650 750 (D 0.6) (D 0.7 m) L.R = L 2,440 m @ 750 (D 0.7 m)
(4)	Head Pond	500	= V 2,000 m³ @ 250 $/m³
(5)	Surge Tank	90	
(6)	Penstock	658	= L 495 m @ 1,330 Pen (D 0.8 m)
(7)	Spillway	371	= L 495 m @ 750 L.P (D 0.7 m)
(8)	Power Station	227	= 770 (P$\sqrt{He}$)$^{0.6}$ = 770 × (1,220 × $\sqrt{115}$)$^{0.6}$
(9)	Access Roads	516	Power St. 0.8 km @ 120,000 $/km = 96 Pipe 2.4 km @ 120,000 = 288 Const 1.0 1.2 km @ 60,000 = 132
(10)	Turb./Generator Transformer/etc	2,942	= 107 · (P / $\sqrt{He}$)$^{0.7}$ = 107 (1,220 / $\sqrt{115}$)$^{0.7}$
(11)	Trans. Lines	43	= L 1 km @ 43,000 $/km
(12)	Sub Total	8,755	

Establishment	400	
Civil	5,413	
Mech/Electr.	2,942	
Contingencies	1,313	= 0.15 × (~~Esta+Civil~~ (12)) = 0.15 × (8,755)
Engineering	554	= 5.5% × (above cost) = 0.055 × 10,068
Total	10,622	≒ 10,600 × 10³ M$

1 M$ = 0.38 US$ = 54 ¥

Naradaw 1,200KW
He = 170m

OPTIMIZATION AT NARADAW

1. Plan
   Installed Capacity P = 1,200 KW Net head = 169 m → 170 m
   Maximum discharge Q = 0.89 m3/s
   Construction Cost 10,200,000 M$

2. Layout

(1) Intake M.R.	Concrete type			
L.R.	Concrete type			
(2) L.P. Conduit M.R.	L (m)	1,000	= 1.1ℓ = 1.1 × 910	
	D_1 (m)	0.6	= $0.8\sqrt{Q_1}$ = $0.8\times\sqrt{0.40}$ =	0.506
L.P. (3) Conduit L.R.	L (m)	2,890	= 1.1 ℓ = 1.1 × 2,630	
	D_2 (m)	0.6	= $0.8\sqrt{Q_2}$ = $0.8\times\sqrt{0.49}$ =	0.56
(4) Head Pond	(m3)	2,000		
(5) Surge Tank	D (m)	–		
(6) Penstock	D (m)	0.7	= $0.65\sqrt{Q}$ = $0.65\times\sqrt{0.89}$ =	0.613
(7) Power Station	L (m)	805	= $\sqrt{\ell^2+h^2}$ = $785^2+\sqrt{(1,030-852)^2}$	
			Structual steel supperstructure	
(8) Access Roads	km	4.69		
Improv.	km	1.2		
(9) Turb./Generator	Type	Targo Impulse/3ϕ Synchronous Generator x 2 units		
	RPM			
	V			
(10) Transformer	KVA	x 1 unit, 3ϕ, 0 A		
	High (V)	11,000		
	Low (V)	3,300		
(11) Trans. Lines	Type	Steel post		
	Size	HAL 0.166 sq. in.		
	KV	11		
	L (km)	1.0		

Note: D = Diameter, L = Length, V = Voltage
M.R. = Mesilau River L.R. = Liwagu River

(12) Spillway	L (m)	210	= 1.1 ℓ = $1.1\times\sqrt{180^2+(1030-980)^2}$	
	D (m)	0.7	= $0.65\sqrt{Q}$ = $0.65\times\sqrt{0.89}$ =	0.613

Re

Naradaw 1,200KW
He = 170 m

Summary of Coasts (Unit 1,000 M$)

(1)	Establishment	400	= P<1,000 KW 350 $, P≥1,000 KW 400,000 $
(2)	Div Weir/Intake	386	M.R = 374 × $\sqrt{D_1 \times Q_1}$ = 374 × $\sqrt{0.6 \times 0.40}$ = 183 L.R = 374 × $\sqrt{D_2 \times Q_2}$ = 374 × $\sqrt{0.6 \times 0.49}$ = 203
(3)	L. P. Condult	2,529	M.R = L 1,000 m @ 650 (D_1 0.6m) L.R = L 2,890 m @ 650 (D_2 0.6m)
(4)	Head Pond	500	= V 2,000 m³ @ 250 $/m³
(5)	Surge Tank	-	
(6)	Penstock	982	= L 805 m @ 1220 Pen (D 0.7 m)
(7)	Spillway	158	= L 210 m @ 750 L.P (D 0.7 m)
(8)	Power Station	253	= 770 (P $\sqrt{He}$)^0.6 = 770 × (1,200 × $\sqrt{169}$)^0.6
(9)	Access Roads	635	Power St. 0.8 km @ 120,000 $/km = 96 Pipe 3.89 km @ 120,000 = 467 Const 1.2 km @ 60,000 = 72
(10)	Turb./Generator Transformer/etc	2,541	= 107 ($\frac{P}{\sqrt{He}}$)^0.7 = 107 ($\frac{1,200}{\sqrt{169}}$)^0.7
(11)	Trans. Lines	43	= L 1 km @ 43,000 $/km
(12)	Sub Total	8,427	

8486

Establishment	400	
Civil	5,486	
Mech/Electr.	2,541	
Contingencies	1,264	= 0.15 × (~~Estab+Civil~~ 12) = 0.15 × (8,427)
Engineering	533	= 5.5% × (above cost) = 0.055 × 9,691
Total	10,224	= 10,200 × 10³ M.$

1 M$ = 0.38 US$ = 54 ¥

Naradaw 1,600 KW
He = 170m

OPTIMIZATION AT NARADAW

1. Plan
   Installed Capacity 1,600 KW Net head 169 m → 170 m
   Maximum discharge 1.18 m3/s → 1.2 m3/s
   Construction Cost 11,500,000 M$

2. Layout
   (1) Intake M.R. Concrete type Water level 1,036 m
   L.R. Concrete type Water level 1,048 m

   (2) L.P. Conduit M.R. L(m) 1,000 = 1.1ℓ = 1.1 × 910
   D(m) 0.6 = 0.8√Q = 0.8×√0.48 = 0.55

   (3) Conduit L.R. L(m) 2,890 = 1.1 ℓ = 1.1 × 2.630
   D(m) 0.7 = 0.8√Q = 0.8×√0.70 = 0.669

   (4) Head Pond (m3) 2,000

   (5) Surge Tank D (m) –

   (6) Penstock D (m) 0.8 = 0.65√Q = 0.65×√1.18 = 0.706
   L (m) 805 = √(ℓ²+h²) = 785² + (1,030−852)²

   (7) Power Station Structual steel supperstructure

   (8) Access Roads km 4.69
   Improv. km 1.2

   (9) Turb./Generator Type Targo Impulse/3ϕ Synchronous Generator x 2 units
   RPM
   V

   (10) Transformer KVA x 1 unit, 3ϕ, O A
   High (V) 11,000
   Low (V) 3,300

   (11) Trans. Lines Type Steel post
   Size HAL 0.166 sq. in.
   KV 11
   L (km) 1.0

Note: D = Diameter L = Length, V = Voltage
M.R. = Mesilau River L.R. = Liwagu River

(12) Spillway L (m) 210 = 1.1 ℓ = 1.1×√(180² + (1030−980)²)
D (m) 0.7 = 0.65√Q = 0.65×√1.18 = 0.706

Re

Naradaw 1,600KW
He = 170m

Summary of Coasts (Unit 1,000 M$)

(1)	Establishment	400	= P<1,000 KW 250,000 $, P≥1,000 KW 300,000 $ + 100,000
(2)	Div Weir/Intake	463	M.R = 374 × √(D×Q) = 374 × √(0.6×0.48) = 201 L.R = 374 × √(D×Q) = 374 × √(0.7×0.70) = 262
(3)	L. P. Condult	2,818	M.R = L 1,000 m @ 650 (D0.6 m) L.R = L 2,890 m @ 750 (D0.7 m)
(4)	Head Pond	500	= V 2,000 m³ @ 250 $/m³
(5)	Surge Tank	–	
(6)	Penstock	1,071	= L 805 m @ 1,330 Pen (D0.8 m)
(7)	Spillway	158	= L 210 m @ 750 L.P (D0.7 m)
(8)	Power Station	300	= 770 (P√He)^0.6 = 770 × (1,600 × √169)^0.6
(9)	Access Roads	635	Power St. 0.8 km @ 120,000 $/km = 96 Pipe 3.89 km @ 120,000 = 467 Const 1.2 km @ 60,000 = 72
(10)	Turb./Generator Transformer/etc	3,108	= 107 (P / √He)^0.7 = 107 (1,600 / √169)^0.7
(11)	Trans. Lines	43	= L 1 km @ 43,000 $/km
(12)	Sub Total =	9,496	

Establishment	400	
Civil	5,988	
Mech/Electr.	3,108	
Contingencies	1,424	= 0.15 × (~~Esta+Civil~~ (12)) = 0.15 × (9,496)
Engineering	601	= 5.5% × (above cost) = 0.055 × 10,920
Total	11,521	= 11,500 × 10³ M$

1 M$ = 0.38 US$ = 54 ¥

Naradaw 2,000 KW
He = 170 m

OPTIMIZATION AT NARADAW

1. Plan
   Installed Capacity $P_=$ 2,000 KW Net head $He_=$ 169 → 170 m
   Maximum discharge $Q_=$ 1.48 m3/s
   Construction Cost , 00,000 M$

2. Layout

(1) Intake M.R.	Concrete type			
L.R.	Concrete type			
(2) L.P. Conduit M.R.	L(m)	1,000	= 1.1 ℓ = 1.1 × 910	
	D_1(m)	0.7	= $0.8\sqrt{Q_1}$ = $0.8\times\sqrt{0.57}$	= 0.604
(3) Conduit L.R.	L(m)	2,890	= 1.1 ℓ = 1.1 × 2,630	
	D_2(m)	0.8	= $0.8\sqrt{Q_2}$ = $0.8\times\sqrt{0.91}$	= 0.763
(4) Head Pond	(m3)	2,000		
(5) Surge Tank	D (m)	–		
(6) Penstock	D (m)	0.9	= $0.65\sqrt{Q}$ = $0.65\times\sqrt{1.48}$	= 0.791
(7) Power Station	L (m)	805	= $\sqrt{\ell^2+h^2}$ = $785^2+\sqrt{(1,030-852)^2}$	
			Structual steel supperstructure	
(8) Access Roads	km	4.69		
Improv.	km	1.2		
(9) Turb./Generator	Type	Targo Impulse/3ϕ Synchronous Generator × 2 units		
	RPM			
	V			
(10) Transformer	KVA		× 1 unit, 3ϕ, 0 A	
	High (V)	11,000		
	Low (V)	3,300		
(11) Trans. Lines	Type	Steel post		
	Size	HAL 0.166 sq. in.		
	KV	11		
	L (km)	1.0		

Note: D = Diameter, L = Length, V = Voltage
M.R. = Mesilau River L.R. = Liwagu River

(12) Spillway	L (m)	210	= 1.1 ℓ = $1.1\times\sqrt{180^2+(1030-980)^2}$
	D (m)	0.8	= $0.65\sqrt{Q}$ = $0.65\times\sqrt{1.48}$ = 0.791

Re

Naradaw 2,000 KW
He = 170 m

Summary of Coasts (Unit 1,000 M$)

(1)	Establishment	500	= P<1,000 KW 350 $, P≥1,000 KW 400 $ (P2 2,000, 500)
(2)	Div Weir/Intake	555	M.R = 374 × √(D1×Q1) = 374 × √(0.7×0.57) = 236 L.R = 374 × √(D1×Q1) = 374 × √(0.8×0.91) = 319
(3)	L. P. Condult	3,235	M.R = L 1,000 m @ 750 (D1 0.7m) L.R = L 2,890 m @ 860 (D2 0.8m)
(4)	Head Pond	500	= V 2,000 m³ @ 250 $/m³
(5)	Surge Tank		
(6)	Penstock	1,143	= L 805 m @ 1,420 Pen (D 0.9 m)
(7)	Spillway	181	= L 210 m @ 860 L.P (D 0.8 m)
(8)	Power Station	343	= 770 (P√He)^0.6 = 770 × (2,000 × √169)^0.6
(9)	Access Roads	635	Power St. 0.8 km @ 120,000 $/km = 96 Pipe 3.89 km @ 120,000 = 467 Const 1.2 km @ 60,000 = 72
(10)	Turb./Generator Transformer/etc	3,634	= 107 (P / √He)^0.7 = 107 (2,000 / √169)^0.7
(11)	Trans. Lines	43	= L 1 km @ 43,000 $/km
(12)	Sub Total	10,769	

Establishment	500	
Civil	6,635	
Mech/Electr.	3,634	
Contingencies	1,615	= 0.15 × (~~Estat Civil~~ 12) = 0.15 × (10,769)
Engineering	681	= 5.5% × (above cost) = 0.055 × 12,384
Total	13,065	= 13,100 × 10³ M$

1 M$ = 0.38 US$ = 54 ¥

Naradaw 2,400 KW
He = 170 m

OPTIMIZATION AT NARADAW

1. Plan
   Installed Capacity P = 2,400 KW Net head He = 169 m → 170 m
   Maximum discharge Q = 1.78 m3/s
   Construction Cost , 00,000 M$

2. Layout

(1) Intake M.R.	Concrete type			
L.R.	Concrete type			
(2) L.P. Conduit M.R.	L(m)	1,000	= 1.1ℓ = 1.1 × 910	
	D_1(m)	0.7	= $0.8\sqrt{Q}$ = $0.8\times\sqrt{0.65}$	= 0.64
(3) Conduit L.R.	L(m)	2,890	= 1.1 ℓ = 1.1 × 2,630	
	D_2(m)	0.9	= $0.8\sqrt{Q}$ = $0.8\times\sqrt{1.13}$	= 0.85
(4) Head Pond	(m3)	2,000		
(5) Surge Tank	D (m)	—		
(6) Penstock	D (m)	1.0	= $0.65\sqrt{Q}$ = $0.65\times\sqrt{1.78}$	= 0.867
(7) Power Station	L (m)	805	= $\sqrt{\ell^2+h^2}$ = $785^2+\sqrt{(1,030-852)^2}$	
			Structual steel superstructure	
(8) Access Roads	km	4.69		
Improv.	km	1.2		
(9) Turb./Generator	Type	Targo Impulse/3ϕ Synchronous Generator x 2 units		
	RPM			
	V			
(10) Transformer	KVA	x 1 unit, 3ϕ, O A		
	High (V)	11,000		
	Low (V)	3,300		
(11) Trans. Lines	Type	Steel post		
	Size	HAL 0.166 sq. in.		
	KV	11		
	L (km)	1.0		

Note: D = Diameter, L = Length, V = Voltage
M.R. = Mesilau River, L.R. = Liwagu River

(12) Spillway	L (m)	210	= 1.1 ℓ = $1.1\times\sqrt{180^2+(1030-980)^2}$	
	D (m)	0.9	= $0.65\sqrt{Q}$ = $0.65\times\sqrt{1.78}$	= 0.867

Re

Naradaw 2,400 KW

Summary of Coasts (Unit 1,000 M$)

(1)	Establishment	500	= P<1,000 KW 350,000 $, P≥1,000 KW 400,000 $ P≥2,000 KW 500
(2)	Div Weir/Intake	629	M.R = 374 × √(D×Q₁) = 374 × √(0.7×0.65) = 252 L.R = 374 × √(D₂×Q₂) = 374 × √(0.9×1.13) = 377
(3)	L. P. Condult	3,553	M.R = L 2,000 m @ 750 (D₁ 0.7m) L.R = L 2,890 m @ 970 (D₂ 0.9m)
(4)	Head Pond	500	= V 2,000 m³ @ 250 $/m³
(5)	Surge Tank	—	
(6)	Penstock	1,224	= L 805 m @ 1,520 Pen (D 1.0 m)
(7)	Spillway	204	= L 210 m @ 970 L.P (D 0.9 m)
(8)	Power Station	383	= 770 (P√He)^0.6 = 770 × (2,400 × √169)^0.6
(9)	Access Roads	635	Power St. 0.8 km @ 120,000 $/km = 96 Pipe 3.89 km @ 120,000 = 467 Const 1.2 km @ 60,000 = 72
(10)	Turb./Generator Transformer/etc	4,128	= 107 (P / √He)^0.7 = 107 (2,400 / √169)^0.7
(11)	Trans. Lines	43	= L 1 km @ 43,000 $/km
(12)	Sub Total =	11,799	

Establishment	500	
Civil	7,171	
Mech/Electr.	4,128	
Contingencies	1,770	= 0.15 × (~~Esta+Civil~~ 12) = 0.15 × (11,799)
Engineering	746	= 5.5% × (above cost) = 0.055 × 13,569
Total	14,315	= 14,300 × 10³ M$

1 M$ = 0.38 US$ = 54 ¥

3. Calculation Data for Commissioning Year in Chapter 9

3 Calculation Data for Comissioning Year

Related to the Following Benefit Cost Ratio

Benefit Cost Ratio of Naradaw Scheme

(In Case of Carabaw Two Units)

Commissioning Year	Saleable Energy (GWh)	Construction Cost (1,000 M$)	Benefit/Cost
2000	7.4	11,500	1.01
2001	7.8	11,500	1.05
2003	8.6	11,500	1.12

Note (1) Saleable energy is an average for 10 years from each commissioning year.

(2) Minimum river maintenance water is assumed to be 0.1 m^3/s in total.

(3) Construction cost of M$11,500,000 is simply estimated for the purpose of the optimization only.

Benefit Cost Ratio of Naradaw Scheme

(In Case of Carabau One Unit)

Commissioning Year	Saleable Energy (GWh)	Construction Cost (1,000 M$)	Benefit/Cost
1996	7.1	11,500	0.98
1997	7.7	11,500	1.03
2000	8.9	11,500	1.15

Note; same as the note mentioned above.

Calculation Criterion * 1,000 M$

(1) Const. cost	11,500	*	
(2) O & M Cost	173	*	= (1) X 0.015
(3) Energy (Supply capable)	9.7	*	X 10^6 kWh
(4) Firm power	560	kW	
(Diesel)			
(5) Inst. capacity	700	kW	= (4) X 1.25 = 560 x 1.25 = 700
(6) Const. cost	976	*	= (5) X 1,395 M$/kW
(7) O & M cost	49	*	= (6) X 0.05
(8) Fuel cost	1,698	*	= (3) X 0.99 X 0.18 M$/kWh (0.175)

Input Data : Naradaw P= 1.600 kW

Year of Start (n=0) 2000

(Thousand M$)

	n	Year	Naradaw Invest.	Diesel Invest.	Diesel kWh	Year
Const.	0	2000	1.150	0		2000
Const.	1	2001	6.900	488		2001
Const.	2	2002	3.450	488		2002
Opera.	3	2003	173	49	6.802	2003
Opera.	4	2004			7.437	2004
Opera.	5	2005			8.044	2005
Opera.	6	2006			8.437	2006
Opera.	7	2007			8.733	2007
Opera.	8	2008			8.968	2008
Opera.	9	2009			9.157	2009
Opera.	10	2010			9.337	2010
Opera.	11	2011			9.420	2011
Opera.	12	2012			9.491	2012
Opera.	13	2013			9.555	2013
Opera.	14	2014			9.608	2014
Opera.	15	2015		49	9.649	2015
Re-Const	16	2016		488+49	9.691	2016
Re-Const	17	2017		488+49	9.691	2017
Opera.	18	2018		49	9.691	2018
Opera.	19	2019			9.691	2019
Opera.	20	2020			9.691	2020
Opera.	21	2021			9.691	2021
Opera.	22	2022			9.691	2022
Opera.	23	2023			9.691	2023
Opera.	24	2024			9.691	2024
Opera.	25	2025			9.691	2025
Opera.	26	2026			9.691	2026
Opera.	27	2027	173	49	9.691	2027

Benefit Cost Ratio Calculation : Naradaw P= 1.600 kW

In case of Carabau 2×1000 kW

(Thousand M$)

Year	n	1/1.1^n	Cost Stream Naradaw Invest.	Cost Stream Naradaw C Value	Benefit Stream Alternative (Diesel) Invest.	Fuel	Total	B Value
2000	0	1.000	1.150	1.150	0	0	0	0
2001	1	0.909	6.900	6.273	488	0	488	444
2002	2	0.826	3.450	2.851	488	0	488	403
2003	3	0.751	173	130	49	1.190	1.239	931
2004	4	0.683	173	118	49	1.301	1.350	922
2005	5	0.621	173	107	49	1.408	1.457	904
2006	6	0.564	173	98	49	1.476	1.525	861
2007	7	0.513	173	89	49	1.528	1.577	809
2008	8	0.467	173	81	49	1.569	1.618	755
2009	9	0.424	173	73	49	1.602	1.651	700
2010	10	0.386	173	67	49	1.634	1.683	649
2011	11	0.350	173	61	49	1.649	1.698	595
2012	12	0.319	173	55	49	1.661	1.710	545
2013	13	0.290	173	50	49	1.672	1.721	499
2014	14	0.263	173	46	49	1.681	1.730	456
2015	15	0.239	173	41	49	1.689	1.738	416
2016	16	0.218	173	38	537	1.696	2.233	486
2017	17	0.198	173	34	537	1.696	2.233	442
2018	18	0.180	173	31	49	1.696	1.745	314
2019	19	0.164	173	28	49	1.696	1.745	285
2020	20	0.149	173	26	49	1.696	1.745	259
2021	21	0.135	173	23	49	1.696	1.745	236
2022	22	0.123	173	21	49	1.696	1.745	214
2023	23	0.112	173	19	49	1.696	1.745	195
2024	24	0.102	173	18	49	1.696	1.745	177
2025	25	0.092	173	16	49	1.696	1.745	161
2026	26	0.084	173	15	49	1.696	1.745	146
2027	27	0.076	173	13	49	1.696	1.745	133
		Total		11.572				12.939

B/C	1.12
B-C	1.367

Input Data : Naradaw P= 1.600 kW

Year of Start (n=0) 1998

(Thousand M$)

	n	Year	Naradaw Invest.	Diesel Invest.	Diesel kWh	Year
Const.	0	1998	1.150	0		1998
Const.	1	1999	6.900	488		1999
Const.	2	2000	3.450	488		2000
Opera.	3	2001	173	49	5.446	2001
Opera.	4	2002			6.117	2002
Opera.	5	2003			6.802	2003
Opera.	6	2004			7.437	2004
Opera.	7	2005			8.044	2005
Opera.	8	2006			8.437	2006
Opera.	9	2007			8.733	2007
Opera.	10	2008			8.968	2008
Opera.	11	2009			9.157	2009
Opera.	12	2010			9.337	2010
Opera.	13	2011			9.420	2011
Opera.	14	2012			9.491	2012
Opera.	15	2013		49	9.555	2013
Re-Const	16	2014		488+49	9.608	2014
Re-Const	17	2015		488+49	9.649	2015
Opera.	18	2016		49	9.691	2016
Opera.	19	2017			9.691	2017
Opera.	20	2018			9.691	2018
Opera.	21	2019			9.691	2019
Opera.	22	2020			9.691	2020
Opera.	23	2021			9.691	2021
Opera.	24	2022			9.691	2022
Opera.	25	2023			9.691	2023
Opera.	26	2024			9.691	2024
Opera.	27	2025	173	49	9.691	2025

Benefit Cost Ratio Calculation : Naradaw P= 1.600 kW

In case of Carabau 2 × 1000 KW

(Thousand M$)

Year	n	1/1.1^n	Cost Stream Naradaw Invest.	Cost Stream Naradaw C Value	Benefit Stream Alternative (Diesel) Invest.	Fuel	Total	B Value
1998	0	1.000	1.150	1.150	0	0	0	0
1999	1	0.909	6.900	6.273	488	0	488	444
2000	2	0.826	3.450	2.851	488	0	488	403
2001	3	0.751	173	130	49	953	1.002	753
2002	4	0.683	173	118	49	1.070	1.119	765
2003	5	0.621	173	107	49	1.190	1.239	770
2004	6	0.564	173	98	49	1.301	1.350	762
2005	7	0.513	173	89	49	1.408	1.457	748
2006	8	0.467	173	81	49	1.476	1.525	712
2007	9	0.424	173	73	49	1.528	1.577	669
2008	10	0.386	173	67	49	1.569	1.618	624
2009	11	0.350	173	61	49	1.602	1.651	579
2010	12	0.319	173	55	49	1.634	1.683	536
2011	13	0.290	173	50	49	1.649	1.698	492
2012	14	0.263	173	46	49	1.661	1.710	450
2013	15	0.239	173	41	49	1.672	1.721	412
2014	16	0.218	173	38	537	1.681	2.218	483
2015	17	0.198	173	34	537	1.689	2.226	440
2016	18	0.180	173	31	49	1.696	1.745	314
2017	19	0.164	173	28	49	1.696	1.745	285
2018	20	0.149	173	26	49	1.696	1.745	259
2019	21	0.135	173	23	49	1.696	1.745	236
2020	22	0.123	173	21	49	1.696	1.745	214
2021	23	0.112	173	19	49	1.696	1.745	195
2022	24	0.102	173	18	49	1.696	1.745	177
2023	25	0.092	173	16	49	1.696	1.745	161
2024	26	0.084	173	15	49	1.696	1.745	146
2025	27	0.076	173	13	49	1.696	1.745	133
		Total		11.572				12.162

B/C 1.05

B-C 590