No. 2

KINGDOM OF THAILAND
ROYAL IRRIGATION DEPARTMENT
MINISTRY OF AGRICULTURE AND COOPERATIVES

THE FEASIBILITY STUDY ON THE AGRICULTURAL WATER DEVELOPMENT PROJECT OF CHANTHABURI RIVER BASIN

Appendix

JUNE 1989

JAPAN INTERNATIONAL COOPERATION AGENCY

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APPENDIX-A METEOROLOGY AND HYDROLOGY

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A.1 GENERAL CLIMATE FACTOR

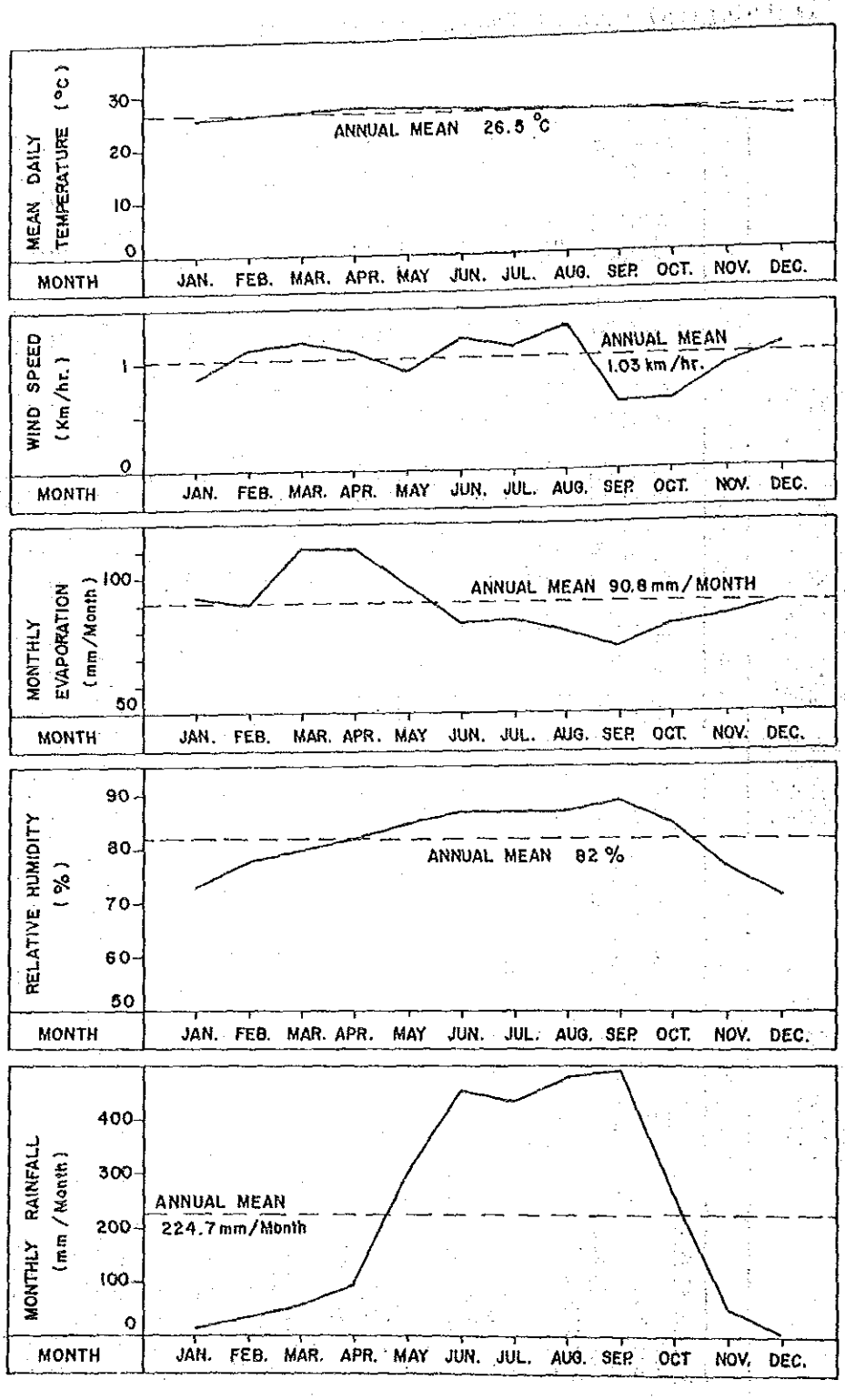
A.1.1 Climatological Data at Chanthaburi Station

STATION: CHANTHABURI
INDEX STATION: 48480
LATITUDE: 12 38' N
LONGITUDE: 102 07' E

ELEVATION OF STATION ABOVE MSL 3m.
HEIGHT OF BAROMETER ABOVE MSL 4m.
HEIGHT OF THERMOMETER ABOVE GROUND 1.25m.
HEIGHT OF WIND VANE ABOVE GROUND 12.00m.
HEIGHT OF RAINGAUGE 0.74m.

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Year
Pressure(+1000 or 900 mbs.)													
Mean	12.35	11.33	10.55	09.08	07.64	07.29	07.33	07.31	08.10	09.68	11.09	12.09	09.49
Ext. Max.	21.50	20.10	19.70	16.61	14.10	13.68	13.44	13.14	14.54	16.50	18.50	19.47	21.50
Ext. Min.	04.97	02.90	04.24	01.49	00.50	98.58	99.43	00.52	99.47	00.61	04.17	04.10	98.58
Mean Daily Range	4.37	4.29	4.28	4.11	3.80	3.27	3.23	3.38	3.85	4.07	4.06	4.10	3.90
Temperature (°C)													
Mean	25.2	26.3	27.2	27.9	27.6	27.3	27.0	26.9	26.5	26.4	26.0	25.2	26.6
Mean Max.	31.9	32.2	32.6	33.2	32.2	30.9	30.4	30.3	30.5	31.3	31.4	31.3	31.5
Mean Min.	19.9	21.8	23.0	23.8	24.4	24.5	24.3	24.3	23.9	23.3	22.1	20.5	23.0
Ext. Max.	36.3	36.6	36.5	36.8	36.8	35.3	34.0	35.5	34.3	35.6	36.0	36.0	36.8
Ext. Min.	12.0	14.8	14.8	18.8	21.8	21.3	21.4	19.0	21.2	19.5	14.8	13.7	12.0
Relative Humidity (%)													
Mean	71.5	77.4	78.3	80.8	84.8	86.0	86.2	86.6	87.9	83.9	75.9	70.5	80.9
Mean Max.	87.8	92.5	93.6	94.2	95.3	95.4	95.3	95.2	96.3	94.2	88.6	84.9	92.8
Mean Min.	49.0	56.4	59.9	61.7	68.3	72.8	73.4	74.0	73.6	66.8	58.5	51.4	63.8
Ext. Min.	27.0	30.0	30.0	40.0	47.0	51.0	55.0	53.0	48.0	38.0	34.0	27.0	27.0
Dew Point (°C)													
Mean	19.1	21.7	23.0	24.0	24.6	24.6	24.4	24.3	24.3	23.3	21.2	19.1	22.8
Evaporation (mm)													
Mean - Pan	152.3	131.5	147.4	136.9	119.5	96.9	105.3	104.5	98.8	118.1	138.0	153.0	1502.2
Cloudiness(0-10)													
Mean	4.9	6.0	6.3	6.8	8.1	8.8	8.9	9.1	8.8	7.4	5.9	4.8	7.2
Sunshine Duration (hr.)													
Mean	283.3	244.0	247.8	242.2	186.2	135.5	134.9	128.6	124.1	189.5	246.3	280.2	2442.6
Wind (knots)													
Prevailing Wind	NE	S	S	S	S	SW	SW	SW	SW	NE	NE	NE	-
Mean Wind Speed	3.0	2.0	1.7	1.6	1.4	1.9	1.8	1.9	1.1	1.9	3.6	4.0	-
Max. Wind Speed	40 N	42 E	65 S	44 SSE	40 S	40 NNE	60 S	38 S	38 WNW	40 NNE	40 NE	40 NE	65 S
Rainfall (mm)													
Mean	12.7	45.0	61.6	112.7	348.8	486.3	472.2	521.8	511.5	285.7	56.1	12.2	2926.6
Mean Rainy Days	1.8	4.7	6.0	10.6	20.9	24.9	24.2	25.9	24.9	18.1	6.2	1.5	169.7
Greatest in 24 hr	42.5	63.7	106.4	122.3	157.0	175.8	220.0	154.3	202.5	186.1	105.4	66.4	220.0
Day/Year	31/78	3/77	22/70	27/84	31/69	17/78	12/69	11/83	20/69	5/60	11/83	8/72	12/69
Number of Days With													
Haze	19.0	18.8	18.4	10.1	0.6	0.1	0.1	0.1	0.1	2.7	8.4	14.1	92.5
Fog	2.3	3.2	2.0	0.8	0.2	0.0	0.2	0.4	1.1	1.6	0.6	0.7	13.1
Thunderstorm	1.4	3.4	7.9	16.1	21.1	13.2	13.7	12.3	15.1	12.8	4.1	0.9	121.8

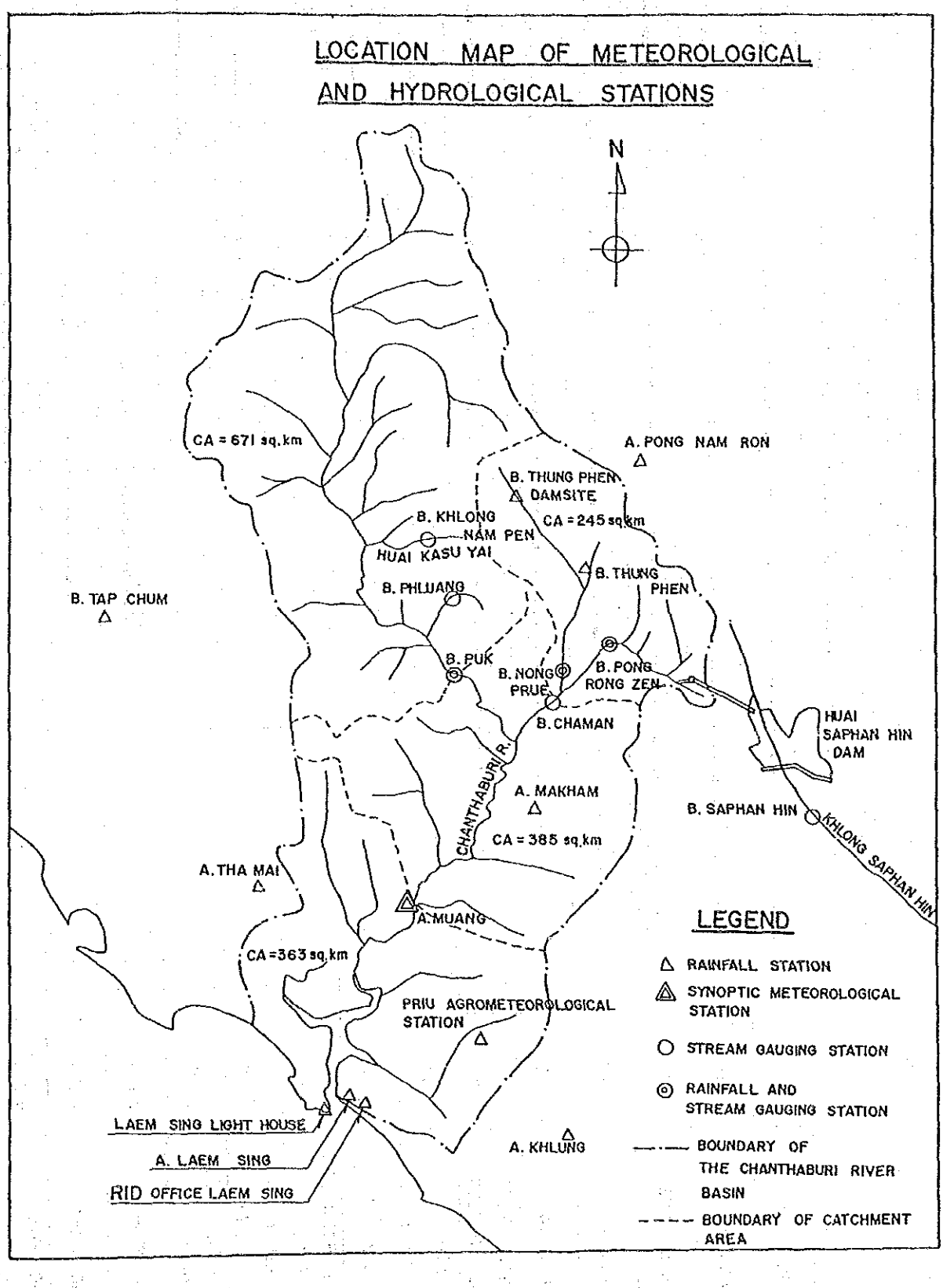
A.1.2 General Climate of Chanthaburi Province



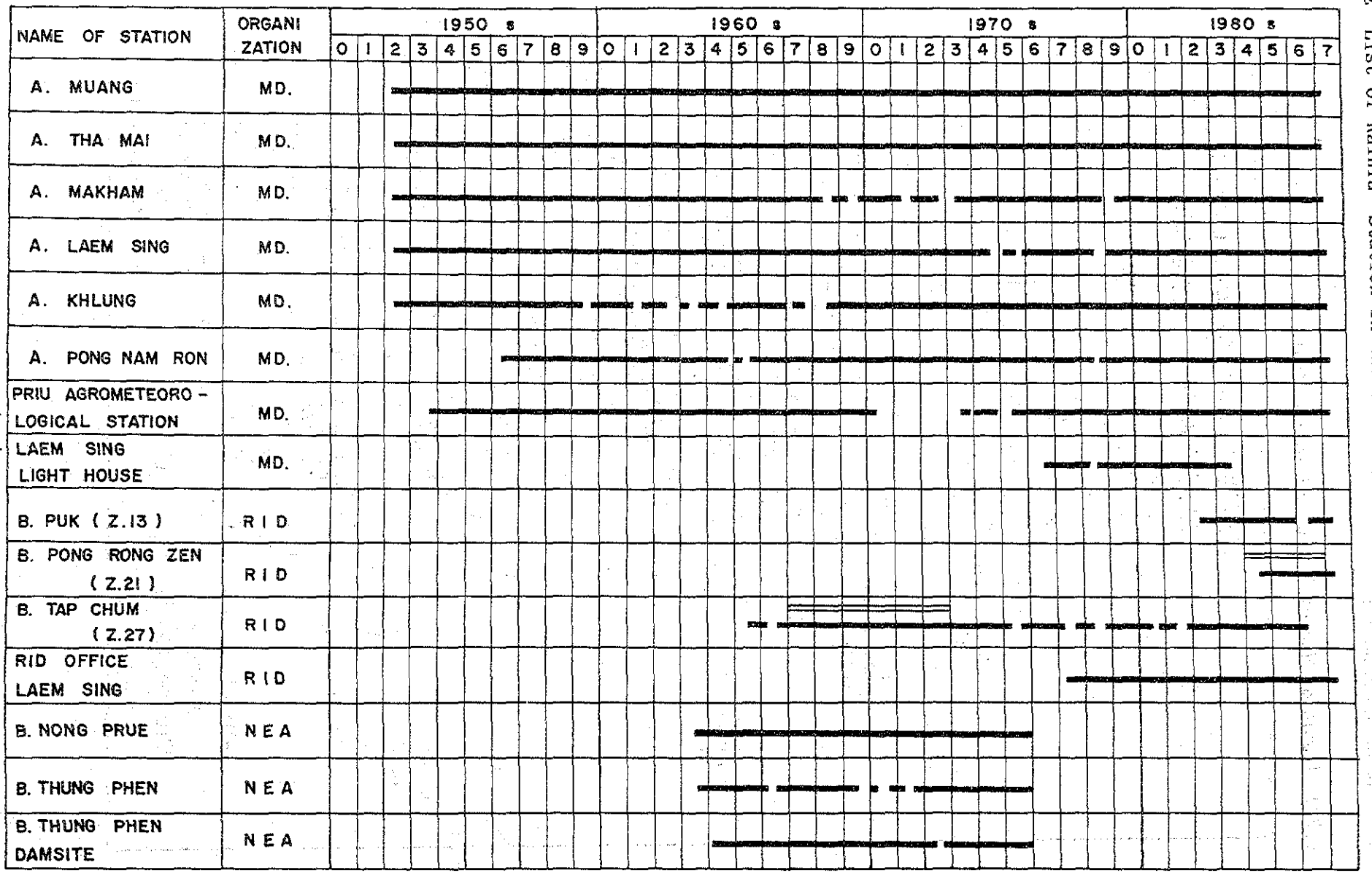
NOTE DATA SOURCE : CLIMATOLOGICAL DATA OF THAILAND FOR THE PERIOD 1952-1982
OPD (RID)

A.2 RAINFALL ANALYSIS

A.2.1 Location Map of Meteorological/Hydrological Stations



LIST OF RAINFALL STATION IN THE VICINITY OF THE STUDY AREA



MD : METEOROLOGICAL DEPARTMENT ——— : DAILY RAINFALL ═══ : HOURLY RAINFALL

A.2.2 List of Rainfa Station in the Vicinity of Study Area

A.2.3 Annual Rainfall at Various Stations

ANNUAL RAINFALL

(Unit : mm)

Year 1/	A. Makham	A. Muang	A. Tha Mai	A. Pong Nam Ron	B. Tap Chum	Priu Agro Station	A.Laem Sing	A. Khlung
1967	3,137.1	2,593.1	1,976.1	1,342.7	2,225.6	3,099.7	2,509.7	2,028.1
68	*	2,938.0	2,665.4	1,645.4	2,633.3	3,789.1	2,704.2	3,301.4
69	*	3,781.2	3,083.4	1,740.2	3,054.0	4,443.5	3,329.0	2,675.2
1970	1,109.0	3,106.5	2,514.1	1,221.4	2,527.5	*	2,622.5	2,466.1
71	*	2,293.4	1,757.4	1,382.5	2,336.8	*	2,241.8	*
72	*	1,911.9	1,604.7	2,153.4	1,885.6	*	1,587.5	1,969.8
73	1,416.4	2,415.2	2,860.8	1,787.3	2,509.6	*	2,307.7	2,384.6
74	817.4	2,784.1	2,428.8	2,131.5	2,699.5	*	*	1,644.2
75	895.8	2,736.7	2,437.5	1,995.9	*	*	1,337.2	*
76	1,338.7	2,802.5	2,241.9	1,662.5	2,133.3	3,107.2	1,368.8	1,404.4
77	881.8	2,257.2	1,386.8	1,376.4	*	2,660.5	*	1,630.2
78	*	3,028.4	2,436.4	*	*	3,330.4	*	*
79	1,837.0	2,633.1	2,408.1	1,381.3	1,400.3	2,464.4	*	1,056.4
1980	1,210.2	3,199.2	3,557.5	1,667.0	*	3,439.2	*	3,327.6
81	912.7	2,930.3	2,899.8	1,837.0	*	3,319.4	2,700.9	3,272.6
82	1,018.4	2,953.5	3,180.9	1,628.3	2,356.4	3,413.1	2,603.1	3,362.7
83	3,291.2	4,109.8	4,554.8	2,057.9	3,675.7	4,214.4	4,429.0	4,197.4
84	1,845.0	3,015.2	2,480.0	1,556.7	1,769.4	3,117.7	2,859.7	2,856.3
85	2,660.5	2,427.1	1,718.3	1,864.7	1,881.4	2,851.8	2,426.3	2,580.9
86	2,510.8	2,768.4	2,192.5	2,069.8	*	3,100.2	2,210.7	2.818.8
Mean	1,658.8	2,834.2	2,519.3	1,710.6	2,363.5	3,310.8	2.482.5	2,528.0

Note 1/: Apr. - Mar.

A.2.4 Monthly Rainfall at Various Stations

MONTHLY RAINFALL AT A. MUANG STATION

(UNIT : MM)

YEAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	ANNUAL
1967	173	231	293	414	447	471	423	16	0	33	67	24	2593
1968	185	273	728	632	559	270	125	7	16	31	30	81	2938
1969	86	543	551	925	342	846	212	39	15	2	51	170	3781
1970	69	211	745	591	729	413	176	9	71	2	69	21	3106
1971	173	364	560	274	383	300	110	10	20	0	22	78	2293
1972	169	96	429	196	222	518	93	54	80	6	6	43	1912
1973	72	301	445	398	334	440	154	131	4	0	34	101	2415
1974	231	376	81	303	730	280	594	69	11	53	26	29	2784
1975	57	245	877	272	392	374	236	51	17	0	87	129	2737
1976	105	380	168	656	475	495	315	79	0	5	68	55	2802
1977	3	292	352	394	378	489	187	35	0	79	26	23	2257
1978	78	377	513	455	621	676	284	8	0	11	3	2	3028
1979	177	297	409	675	289	620	75	24	2	0	23	40	2633
1980	51	217	845	515	733	368	267	25	3	0	94	82	3199
1981	121	371	461	608	494	572	238	40	0	0	0	26	2930
1982	136	220	697	676	560	423	139	65	10	0	0	27	2953
1983	2	578	568	478	890	605	766	165	1	16	10	32	4110
1984	256	514	631	250	536	434	200	56	18	25	23	72	3015
1985	164	262	450	413	367	375	374	20	0	0	1	0	2427
1986	81	625	650	262	461	273	298	82	1	0	16	19	2768
MEAN	120	339	523	469	497	462	263	69	13	13	33	53	2834
MAX	256	625	877	925	890	846	766	165	80	79	94	170	4110
MIN	2	96	81	196	222	270	75	7	0	0	0	0	1912

MONTHLY RAINFALL AT A. THA MAI STATION

(UNIT : MM)

YEAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	ANNUAL
1967	94	95	173	410	425	409	254	0	0	0	95	21	1976
1968	155	231	859	458	370	221	217	0	6	42	0	107	2665
1969	114	485	393	788	171	845	145	0	0	0	13	128	3083
1970	62	158	642	502	714	214	68	0	58	2	36	56	2514
1971	117	236	415	276	364	174	72	0	20	0	0	82	1757
1972	65	46	451	54	196	473	59	45	114	16	19	65	1605
1973	0	186	551	445	400	684	264	151	0	0	14	164	2861
1974	102	308	44	109	713	310	743	59	0	29	0	11	2429
1975	0	315	666	144	494	399	275	0	0	0	38	107	2437
1976	202	242	153	617	424	325	185	0	0	0	82	12	2242
1977	16	108	143	276	336	377	31	0	0	17	67	16	1387
1978	23	405	587	262	323	614	208	0	0	0	15	0	2436
1979	115	341	377	471	201	639	110	0	0	0	36	117	2408
1980	60	195	620	530	1123	565	284	30	0	0	31	120	3557
1981	203	417	418	498	487	538	192	65	0	0	14	69	2900
1982	168	317	890	729	410	518	61	64	0	0	5	18	3181
1983	0	574	691	585	858	518	1045	203	0	16	20	46	4555
1984	184	433	554	226	502	306	206	29	5	5	0	29	2480
1985	172	266	314	331	157	179	267	16	16	0	0	0	1718
1986	123	526	448	158	336	302	188	87	0	0	19	5	2192
MEAN	99	294	469	393	450	431	244	37	11	6	25	59	2519
MAX	203	574	890	788	1123	845	1045	203	114	42	95	164	4555
MIN	0	46	44	54	157	174	31	0	0	0	0	0	1387

MONTHLY RAINFALL AT A. MAKHAM STATION

(UNIT : MM)

YEAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	ANNUAL
1967	255	422	254	577	668	447	422	38	0	2	48	5	3137
1968	210	303	231	538	517	20	****	0	0	0	0	26	****
1969	0	238	255	227	****	145	****	0	0	0	0	50	****
1970	0	23	271	247	420	147	0	0	0	0	0	0	1109
1971	0	67	143	****	****	137	****	9	41	0	0	52	****
1972	99	41	284	59	165	****	****	****	****	****	****	****	****
1973	23	80	439	235	249	196	103	0	0	0	27	66	1416
1974	141	150	30	123	140	28	121	0	0	14	48	22	817
1975	0	64	458	38	179	38	38	0	0	0	0	79	896
1976	97	243	217	345	138	214	48	36	0	0	0	0	1339
1977	0	97	180	233	95	218	54	0	0	0	0	5	882
1978	48	235	115	153	180	169	33	0	0	****	****	****	****
1979	134	135	636	530	101	220	47	0	0	0	0	35	1837
1980	73	293	96	285	166	178	89	30	0	0	0	0	1210
1981	96	187	367	179	26	56	0	0	0	0	0	0	913
1982	0	0	260	229	325	177	0	0	0	0	0	27	1018
1983	0	605	520	563	850	148	441	59	0	13	33	59	3291
1984	186	504	203	98	409	288	59	10	13	4	14	58	1845
1985	251	360	555	487	351	405	200	52	0	0	0	0	2660
1986	174	440	470	265	580	303	157	47	0	0	66	8	2511
MEAN	89	224	299	285	309	186	113	15	3	2	13	27	1659
MAX	255	605	636	577	850	447	441	59	41	14	66	79	3291
MIN	0	0	30	38	26	20	0	0	0	0	0	0	817

Monthly Rainfall at Various Stations (continued)

MONTHLY RAINFALL AT A. LAEM SING STATION

(UNIT : MM)

YEAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	ANNUAL
1967	130	302	239	506	275	376	400	7	0	43	120	112	2510
1968	118	366	741	534	262	312	164	53	0	35	81	37	2704
1969	168	552	510	698	161	874	128	57	0	3	91	88	3329
1970	75	312	599	476	446	321	221	54	46	0	13	58	2622
1971	146	204	307	240	547	405	276	0	0	0	68	49	2242
1972	179	98	392	83	128	342	159	71	70	0	13	51	1587
1973	65	117	602	481	247	498	94	149	0	10	6	37	2308
1974	174	214	14	206	435	267	375	8	****	****	****	23	****
1975	11	184	336	65	343	345	****	0	0	0	38	15	****
1976	92	151	144	450	93	217	62	50	0	55	0	53	1369
1977	35	162	197	140	104	63	56	0	0	39	30	0	825
1978	150	304	421	324	224	****	****	****	****	16	195	19	****
1979	0	53	226	371	34	181	0	0	0	0	0	123	989
1980	9	112	203	152	154	221	51	0	0	0	64	37	1002
1981	97	195	365	489	569	623	137	83	0	0	79	63	2701
1982	163	63	809	508	610	313	56	82	0	0	0	0	2603
1983	0	674	572	576	1013	675	564	80	0	39	0	10	4203
1984	260	270	523	496	317	441	287	88	28	21	67	61	2860
1985	313	474	347	325	364	311	244	20	0	0	1	26	2426
1986	69	341	461	246	401	330	217	56	1	2	57	30	2211
MEAN	113	257	400	368	336	374	194	45	8	14	49	45	2264
MAX	313	674	809	698	1013	874	564	149	70	55	195	123	4203
MIN	0	53	14	65	34	63	0	0	0	0	0	0	825

MONTHLY RAINFALL AT A. KHLUNG STATION

(UNIT : MM)

YEAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	ANNUAL
1967	0	71	28	717	387	500	293	16	0	0	16	0	2028
1968	0	68	792	1129	641	264	178	9	25	82	34	78	3301
1969	95	142	412	867	155	773	133	75	0	23	0	0	2675
1970	25	161	231	867	155	789	101	75	23	0	8	31	2466
1971	0	0	54	153	327	283	106	0	0	4	51	23	1002
1972	317	94	520	100	336	297	183	122	0	0	0	0	1970
1973	25	180	666	550	204	399	147	115	0	0	45	52	2385
1974	102	51	90	146	478	294	373	60	0	43	0	7	1644
1975	5	****	****	****	****	111	206	0	24	0	0	25	****
1976	63	204	248	528	42	209	34	13	0	20	17	25	1404
1977	61	164	435	187	320	284	19	0	0	124	26	10	1630
1978	52	363	****	346	317	****	****	****	****	****	****	****	****
1979	73	98	137	195	15	101	172	51	0	0	70	144	1056
1980	90	148	828	407	817	459	240	66	13	0	222	38	3328
1981	92	277	528	631	559	651	289	185	0	0	10	51	3273
1982	228	177	704	683	690	536	193	124	0	0	27	0	3363
1983	5	476	495	577	1079	555	749	134	0	34	7	86	4197
1984	161	493	795	370	364	432	166	37	0	6	11	22	2856
1985	136	559	481	347	405	302	309	18	15	0	0	10	2581
1986	106	360	677	332	635	367	188	106	0	0	6	40	2819
MEAN	82	215	451	481	417	400	215	63	5	18	29	34	2443
MAX	317	559	828	1129	1079	789	749	185	25	124	222	144	4197
MIN	0	0	28	100	15	101	19	0	0	0	0	0	1002

MONTHLY RAINFALL AT A. PONG NAM RON STATION

(UNIT : MM)

YEAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	ANNUAL
1967	64	62	131	320	351	177	165	38	0	19	15	0	1343
1968	146	83	251	374	444	169	110	6	0	2	10	49	1645
1969	49	35	298	248	355	370	233	71	0	0	38	44	1740
1970	108	28	167	338	186	165	25	68	86	0	7	42	1221
1971	36	127	260	138	238	122	292	33	90	0	0	47	1382
1972	116	77	458	410	509	268	91	138	7	0	16	64	2153
1973	46	83	308	330	276	329	171	176	0	6	48	17	1787
1974	122	213	206	185	653	153	419	49	0	42	37	53	2131
1975	59	210	418	219	545	207	176	43	0	0	39	80	1996
1976	46	261	263	309	259	257	191	37	0	3	0	37	1662
1977	1	169	210	339	188	347	73	11	5	30	0	5	1376
1978	26	244	202	102	****	****	****	16	0	0	4	8	****
1979	79	149	300	283	238	217	64	2	0	0	1	48	1381
1980	32	213	374	313	292	163	142	33	0	0	21	82	1667
1981	109	172	382	240	360	220	206	119	0	0	15	14	1837
1982	66	166	339	387	240	263	144	24	0	0	0	0	1628
1983	3	325	267	272	375	87	405	119	0	30	13	161	2058
1984	22	216	336	88	469	229	93	20	0	11	0	73	1557
1985	53	159	551	387	188	308	166	52	0	0	0	0	1865
1986	81	584	165	174	434	418	149	20	28	0	0	17	2070
MEAN	63	179	294	273	347	235	174	54	11	7	13	42	1711
MAX	146	584	551	410	653	418	419	176	90	42	48	161	2153
MIN	1	28	131	88	186	87	25	2	0	0	0	0	1221

Monthly Rainfall at Various Stations (continued)

MONTHLY RAINFALL AT PRIU AGROMETEOROLOGICAL STATION

(UNIT : MM)

YEAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	ANNUAL
1967	151	332	348	554	425	600	502	18	0	55	63	51	3100
1968	303	333	831	882	486	486	189	15	14	75	79	97	3789
1969	154	516	656	1273	332	952	259	62	5	20	61	153	4443
1970	****	****	****	****	****	****	****	****	****	****	****	****	****
1971	****	****	****	****	****	****	****	****	****	****	****	****	****
1972	****	****	****	****	****	****	****	****	****	****	****	****	****
1973	****	****	****	****	****	****	266	****	****	20	58	164	****
1974	209	260	89	239	908	323	573	27	3	****	****	****	****
1975	****	****	768	290	450	498	312	83	75	0	91	155	****
1976	236	457	239	665	525	573	193	59	0	17	95	47	3107
1977	80	288	468	373	456	359	272	56	0	205	54	48	2660
1978	90	452	754	409	486	781	294	3	0	9	49	3	3330
1979	146	350	510	532	212	483	120	1	0	0	61	49	2464
1980	187	239	919	363	835	470	191	59	14	0	86	76	3439
1981	140	392	576	633	558	590	235	82	0	0	18	94	3319
1982	163	233	786	671	625	480	249	142	5	0	12	47	3413
1983	11	592	472	369	1000	550	1033	136	0	14	3	34	4214
1984	310	431	588	399	441	423	153	128	16	55	42	131	3118
1985	184	514	473	415	376	330	404	17	89	0	0	49	2851
1986	397	400	706	271	512	466	251	85	1	0	0	11	3100
MEAN	184	386	574	521	539	523	323	61	14	29	48	76	3311
MAX	397	592	919	1273	1000	952	1033	142	89	205	95	164	4443
MIN	11	233	89	239	212	323	120	1	0	0	0	3	2464

MONTHLY RAINFALL AT B. TAP CHUM STATION

(UNIT : MM)

YEAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	ANNUAL
1967	154	114	207	402	315	583	298	9	0	24	91	27	2226
1968	222	258	630	383	451	262	139	80	0	34	99	75	2633
1969	111	526	494	717	219	717	204	20	0	0	1	47	3054
1970	226	56	434	482	544	355	145	63	104	0	72	48	2527
1971	81	309	465	264	441	296	258	10	7	0	166	39	2337
1972	287	84	364	224	228	417	111	71	48	0	0	51	1886
1973	71	254	530	369	365	417	178	102	1	15	41	165	2510
1974	329	333	156	310	525	341	516	23	3	100	9	54	2699
1975	10	292	****	337	439	148	219	58	22	0	133	30	****
1976	48	265	161	482	511	495	92	36	0	15	11	17	2133
1977	30	****	****	171	265	****	125	2	0	94	8	****	****
1978	****	****	****	****	****	****	161	21	0	7	1	1	****
1979	181	144	242	262	164	325	33	0	5	0	26	19	1400
1980	86	310	557	284	408	****	****	0	0	0	0	27	****
1981	****	****	****	309	327	386	181	100	0	0	19	13	****
1982	129	168	557	507	353	395	130	80	6	0	0	31	2356
1983	0	616	290	860	836	380	468	141	0	0	4	79	3676
1984	6	341	342	126	279	262	249	101	0	35	23	6	1769
1985	109	269	273	367	288	350	166	51	0	0	0	7	1881
1986	****	****	****	****	****	****	****	****	****	****	****	****	****
MEAN	122	271	380	381	387	383	204	51	10	17	37	41	2363
MAX	329	616	630	860	836	717	516	141	104	100	166	165	3676
MIN	0	56	156	126	164	148	33	0	0	0	0	1	1400

A.2.5 Complemented Rainfalls at Various Stations

MONTHLY RAINFALL AT A. MAKHAM STATION

(UNIT : MM)

YEAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	ANNUAL
1967	255	422	254	577	668	447	422	38	0	2	48	5	3137
1968	210	303	231	538	517	20	97	0	0	0	0	26	1941
1969	0	238	255	227	264	145	164	0	0	0	0	50	1343
1970	0	23	271	247	420	147	0	0	0	0	0	0	1109
1971	0	67	143	211	296	137	85	9	41	0	0	52	1040
1972	99	41	284	59	165	400	72	42	62	5	5	33	1265
1973	23	80	439	235	249	196	103	0	0	0	27	66	1416
1974	141	150	30	123	140	28	121	0	0	14	48	22	817
1975	0	64	458	38	179	38	38	0	0	0	0	79	896
1976	97	243	217	345	138	214	48	36	0	0	0	0	1339
1977	0	97	180	233	95	218	54	0	0	0	0	5	882
1978	48	235	115	153	180	169	33	0	0	8	2	1	945
1979	134	135	636	530	101	220	47	0	0	0	0	35	1837
1980	73	293	96	285	166	178	89	30	0	0	0	0	1210
1981	96	187	367	179	26	56	0	0	0	0	0	0	913
1982	0	0	260	229	325	177	0	0	0	0	0	27	1018
1983	0	605	520	563	850	148	441	59	0	13	33	59	3291
1984	186	504	203	98	409	288	59	10	13	4	14	58	1845
1985	251	360	555	487	351	405	200	52	0	0	0	0	2660
1986	174	440	470	265	580	303	157	47	0	0	66	8	2511
MEAN	89	224	299	281	306	197	112	16	6	2	12	26	1571
MAX	255	605	636	577	850	447	441	59	62	14	66	79	3291
MIN	0	0	30	38	26	20	0	0	0	0	0	0	817

MONTHLY RAINFALL AT A. LAEM SING STATION

(UNIT : MM)

YEAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	ANNUAL
1967	130	302	239	506	275	376	400	7	0	43	120	112	2510
1968	118	366	741	534	262	312	164	53	0	35	81	37	2704
1969	168	552	510	698	161	874	128	57	0	3	91	88	3329
1970	75	312	599	476	446	321	221	54	46	0	13	58	2622
1971	146	204	307	240	547	405	276	0	0	0	68	49	2242
1972	179	98	392	83	128	342	159	71	70	0	13	51	1587
1973	65	117	602	481	247	498	94	149	0	10	6	37	2308
1974	174	214	14	206	435	267	375	8	9	47	23	23	1794
1975	11	184	336	65	343	345	207	0	0	0	38	15	1544
1976	92	151	144	450	93	217	62	50	0	55	0	53	1369
1977	35	162	197	140	104	63	56	0	0	39	30	0	825
1978	150	304	421	324	224	592	249	7	0	16	195	19	2504
1979	0	53	226	371	34	181	0	0	0	0	0	123	989
1980	9	112	203	152	154	221	51	0	0	0	64	37	1002
1981	97	195	365	489	569	623	137	83	0	0	79	63	2701
1982	163	63	809	508	610	313	56	82	0	0	0	0	2603
1983	0	674	572	576	1013	675	564	80	0	39	0	10	4203
1984	260	270	523	496	317	441	287	88	28	21	67	61	2860
1985	313	474	347	325	364	311	244	20	0	0	1	26	2426
1986	69	341	461	246	401	330	217	56	1	2	57	30	2211
MEAN	113	257	400	368	336	385	197	43	8	15	47	45	2217
MAX	313	674	809	698	***	874	564	149	70	55	195	123	4203
MIN	0	53	14	65	34	63	0	0	0	0	0	0	825

MONTHLY RAINFALL AT A. PONG NAM RON STATION

(UNIT : MM)

YEAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	ANNUAL
1967	64	62	131	320	351	177	165	38	0	19	15	0	1343
1968	146	83	251	374	444	169	110	6	0	2	10	49	1645
1969	49	35	298	248	355	370	233	71	0	0	38	44	1740
1970	108	28	167	338	186	165	25	68	86	0	7	42	1221
1971	36	127	260	138	238	122	292	33	90	0	0	47	1382
1972	116	77	458	410	509	268	91	138	7	0	16	64	2153
1973	46	83	308	330	276	329	171	176	0	6	48	17	1787
1974	122	213	206	185	653	153	419	49	0	42	37	53	2131
1975	59	210	418	219	545	207	176	43	0	0	39	80	1996
1976	46	261	263	309	259	257	191	37	0	3	0	37	1662
1977	1	169	210	339	188	347	73	11	5	30	0	5	1376
1978	26	244	202	102	443	481	202	16	0	0	4	8	1727
1979	79	149	300	283	238	217	64	2	0	0	1	48	1381
1980	32	213	374	313	292	163	182	33	0	0	21	82	1667
1981	109	172	382	240	360	220	206	119	0	0	15	14	1837
1982	66	166	339	387	240	263	144	24	0	0	0	0	1628
1983	3	325	267	272	375	87	405	119	0	30	13	161	2058
1984	22	216	336	88	469	229	93	20	0	11	0	73	1557
1985	53	159	551	387	188	308	166	52	0	0	0	0	1865
1986	81	584	165	174	434	418	149	20	28	0	0	17	2070
MEAN	63	179	294	273	352	247	176	54	11	7	13	42	1711
MAX	146	584	551	410	653	481	419	176	90	42	48	161	2153
MIN	1	28	131	88	186	87	25	2	0	0	0	0	1221

MONTHLY RAINFALL AT B. TAP CHUM STATION

(UNIT : MM)

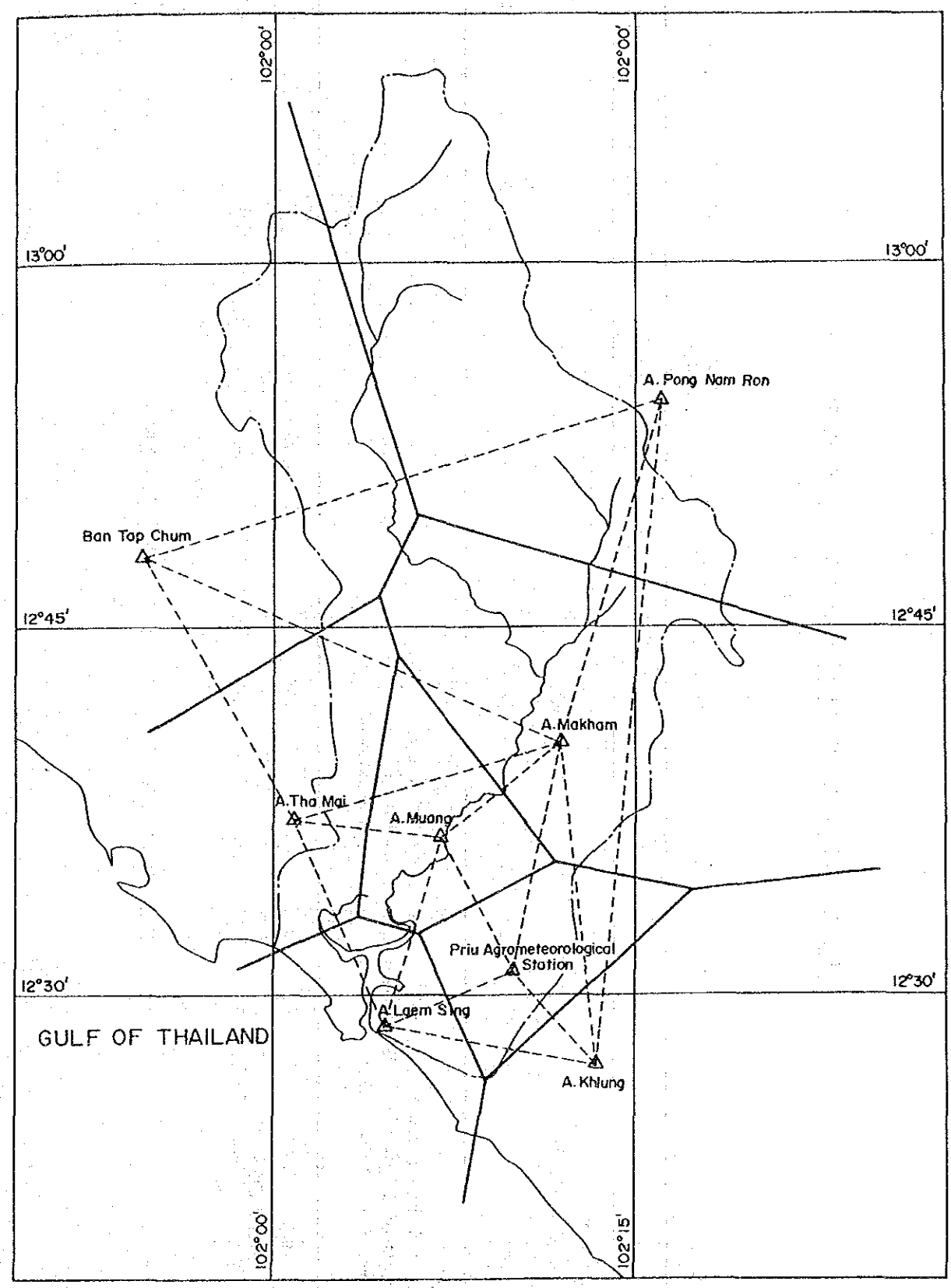
YEAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	ANNUAL
1967	154	114	207	402	315	583	298	9	0	24	91	27	2226
1968	222	258	630	383	451	262	139	80	0	34	99	75	2633
1969	111	526	494	717	219	717	204	20	0	0	1	47	3054
1970	226	56	434	482	544	355	145	63	104	0	72	48	2527
1971	81	309	465	264	441	296	258	10	7	0	166	39	2337
1972	287	84	364	224	228	417	111	71	48	0	0	51	1886
1973	71	254	530	369	365	417	178	102	1	15	41	165	2510
1974	329	333	156	310	525	341	516	23	3	100	9	54	2699
1975	10	292	746	337	439	148	219	58	22	0	133	30	2435
1976	48	265	161	482	511	495	92	36	0	15	11	17	2133
1977	30	248	300	171	265	416	125	2	0	94	8	19	1679
1978	66	321	437	387	529	575	161	21	0	7	1	1	2506
1979	181	144	242	262	164	325	33	0	5	0	26	19	1400
1980	86	310	557	284	408	313	227	0	0	0	0	27	2212
1981	103	316	392	309	327	386	181	100	0	0	19	13	2145
1982	129	168	557	507	353	395	130	80	6	0	0	31	2356
1983	0	616	290	860	836	380	468	141	0	0	4	79	3676
1984	6	341	342	126	279	262	249	101	0	35	23	6	1769
1985	109	269	273	367	288	350	166	51	0	0	0	7	1881
1986	69	532	553	223	393	233	254	69	1	0	14	16	2357
MEAN	116	288	406	373	394	383	208	52	10	16	36	39	2321
MAX	329	616	746	860	836	717	516	141	104	100	166	165	3676
MIN	0	56	156	126	164	148	33	0	0	0	0	1	1400

MONTHLY RAINFALL AT PRIU AGROMETEOROLOGICAL STATION

(UNIT : MM)

YEAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	ANNUAL
1967	151	332	348	554	425	600	502	18	0	55	63	51	3100
1968	303	333	831	882	486	486	189	15	14	75	79	97	3789
1969	154	516	656	1273	332	952	259	62	5	20	61	153	4443
1970	76	231	817	649	800	453	193	10	77	2	76	24	3408
1971	190	399	615	300	420	329	121	11	22	0	24	85	2516
1972	185	105	470	215	243	568	102	60	88	7	7	47	2096
1973	79	331	488	437	366	482	266	144	5	20	58	164	2839
1974	209	260	89	239	908	323	573	27	3	58	29	31	2750
1975	62	268	768	290	450	498	312	83	75	0	91	155	3053
1976	236	457	239	665	525	573	193	59	0	17	95	47	3107
1977	80	288	468	373	456	359	272	56	0	205	54	48	2660
1978	90	452	754	409	486	781	294	3	0	9	49	3	3330
1979	146	350	510	532	212	483	120	1	0	0	61	49	2464
1980	187	239	919	363	835	470	191	59	14	0	86	76	3439
1981	140	392	576	633	558	590	235	82	0	0	18	94	3319
1982	163	233	786	671	625	480	249	142	5	0	12	47	3413
1983	11	592	472	369	1000	550	1033	136	0	14	3	34	4214
1984	310	431	588	399	441	423	153	128	16	55	42	131	3118
1985	184	514	473	415	376	330	404	17	89	0	0	49	2851
1986	397	400	706	271	512	466	251	85	1	0	0	11	3100
MEAN	168	356	579	497	523	510	296	60	21	27	45	70	3151
MAX	397	592	919	1273	1000	952	1033	144	89	205	95	164	4443
MIN	11	105	89	215	212	323	102	1	0	0	0	3	2096

A.2.6 Thiessen Polygon



AREAL RAINFALL OF CHANTHABURI RIVER BASIN

Item	A. Muang	A. Tha Mai	A. Makham	A. Laem Sing	A. Pong Nam Ron	Priv Agro. Station	B. Tap Chum
1. Rainfall (mm/year) 1/	2,837	2,519	1,571	2,217	1,711	3,151	2,321
2. Areal Ratio by Thiessen (%)							
(1) Upstream of B. Puk	-	-	12	-	58	-	30
(2) Downstream of B. Puk	18	9	32	8	21	12	-
(3) Whole Area	11	6	24	5	35	7	12
3. Areal Rainfall 1							
(1) Upstram of B. Puk (CA= 671 sq.km)	: 1,877 mm/year						
(2) Downstream of B. Puk (CA = 993 sq.km)	: 2,154 mm/year						
(3) Whole Area (CA = 1,664 sq.km)	: 2,048 mm/year						

1/ : 1967-1986

A.2.8 Monthly Areal Rainfall at Proposed No.4 Dam Basin

MONTHLY AREAL RAINFALL AT PROPOSED NO.4 DAM BASIN

(UNIT : MM)

YEAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	ANNUAL
1967	64	62	131	320	351	177	165	38	0	19	15	0	1343
1968	146	83	251	374	444	169	110	6	0	2	10	49	1645
1969	49	35	298	248	355	370	233	71	0	0	38	44	1740
1970	108	28	167	338	186	165	25	68	86	0	7	42	1221
1971	36	127	260	138	238	122	292	33	90	0	0	47	1382
1972	116	77	458	410	509	268	91	138	7	0	16	64	2153
1973	46	83	308	330	276	329	171	176	0	6	48	17	1787
1974	122	213	206	185	653	153	419	49	0	42	37	53	2131
1975	59	210	418	219	545	207	176	43	0	0	39	80	1996
1976	46	261	263	309	259	257	191	37	0	3	0	37	1662
1977	1	169	210	339	188	347	73	11	5	30	0	5	1376
1978	26	244	202	102	443	481	202	16	0	0	4	8	1727
1979	79	149	300	283	238	217	64	2	0	0	1	48	1381
1980	32	213	374	313	292	163	142	33	0	0	21	82	1667
1981	109	172	382	240	360	220	206	119	0	0	15	14	1857
1982	66	166	339	387	240	263	144	24	0	0	0	0	1628
1983	3	325	267	272	375	87	405	119	0	30	13	161	2058
1984	22	216	336	88	469	229	93	20	0	11	0	73	1557
1985	53	159	551	387	188	308	166	52	0	0	0	0	1865
1986	81	584	165	174	434	418	149	20	28	0	0	17	2070
MEAN	63	179	294	273	352	247	176	54	11	7	13	42	1711
MAX	146	584	551	410	653	481	419	176	90	42	48	161	2153
MIN	1	28	131	88	186	87	25	2	0	0	0	0	1221

A.2.9 Monthly Areal Rainfall at Proposed No.5 Dam Basin

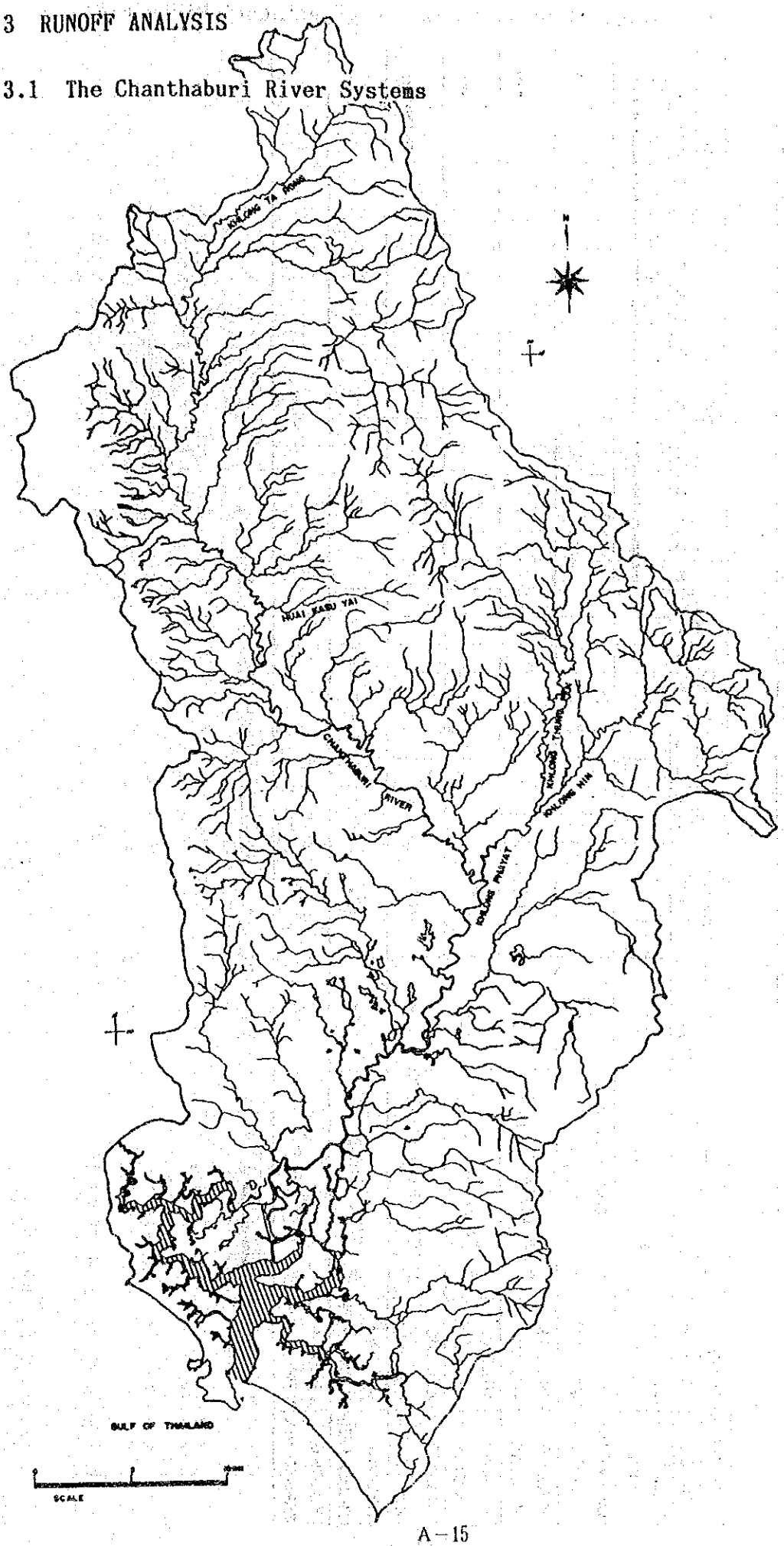
MONTHLY AREAL RAINFALL AT PROPOSED NO.5 DAM BASIN

(UNIT : MM)

YEAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	ANNUAL
1967	154	114	207	402	315	583	298	9	0	24	91	27	2226
1968	222	258	630	383	451	262	139	80	0	34	99	75	2633
1969	111	526	494	717	219	717	204	20	0	0	1	47	3054
1970	226	56	434	482	544	355	145	63	104	0	72	48	2527
1971	81	309	465	264	441	296	258	10	7	0	166	39	2337
1972	287	84	364	224	228	417	111	71	48	0	0	51	1886
1973	71	254	530	369	365	417	178	102	1	15	41	165	2510
1974	329	333	156	310	525	341	516	23	3	100	9	54	2699
1975	10	292	746	337	439	148	219	58	22	0	133	30	2435
1976	48	265	161	482	511	495	92	36	0	15	11	17	2133
1977	30	248	300	171	265	416	125	2	0	94	8	19	1679
1978	66	321	437	387	529	575	161	21	0	7	1	1	2506
1979	181	144	242	262	164	325	33	0	5	0	26	19	1400
1980	86	310	557	284	408	313	227	0	0	0	0	27	2212
1981	103	316	392	309	327	386	181	100	0	0	19	13	2145
1982	129	168	557	507	353	395	130	80	6	0	0	31	2356
1983	0	616	290	860	836	380	468	141	0	0	4	79	3676
1984	6	341	342	126	279	262	249	101	0	35	23	6	1769
1985	109	269	273	367	288	350	166	51	0	0	0	7	1881
1986	69	532	553	223	393	233	254	69	1	0	14	16	2357
MEAN	116	288	406	373	394	383	208	52	10	16	36	39	2321
MAX	329	616	746	860	836	717	516	141	104	100	166	165	3676
MIN	0	56	156	126	164	148	33	0	0	0	0	1	1400

A.3 RUNOFF ANALYSIS

A.3.1 The Chanthaburi River Systems



LIST OF HYDROLOGICAL STATIONS IN THE CHANTHABURI RIVER BASIN

RIVER SYSTEM		NAME OF STATION	CATCHMENT AREA(sq.km)	ORGANI-ZATION	1960 s										1970 s										1980 s							
RIVER	STREAM				0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7
CHANTHA-BURI	CHANTHA-BURI	B. PUK (Z.13)	671	RID																												
CHANTHA-BURI	HUAI KASU YAI	B. KHLONG NAM PEN (Z.27)	28	RID																												
KHLONG PHAYAT	KHLONG PHAYAT	B. CHAMAN (Z.14)	245	RID																												
KHLONG PHLUANG	KHLONG PHLUANG	B. PHLUANG (Z.19)	21	RID																												
KHLONG HIN DAT	KHLONG HIN DAT	B. PONG RONG ZEN(Z.21)	66	RID																												
KHLONG THUNG PENE	KHLONG THUNG PEN	B. NONG PRUE	133	NEA																												
KHLONG SAPHAN HIN	KHLONG SAPHAN HIN	B. SAPHAN HIN	75	NEA																												

: DAILY RUNOFF DISCHARGE : SUSPENDED SEDIMENT

A.3.3 Monthly Runoff at Ban Puk Station

MONTHLY RUNOFF AT B. PUK STATION

(UNIT : MCM)

YEAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	ANNUAL (MCM)	ANNUAL (MM)
1970	8.08	15.50	119.47	212.11	269.74	182.22	80.61	30.50	23.85	9.27	5.29	7.37	964.01	1437
1971	6.30	37.72	169.43	135.91	214.96	199.58	129.08	32.17	14.83	8.03	4.54	5.17	957.72	1427
1972	11.15	6.18	63.89	80.44	122.69	164.68	99.10	28.39	19.70	7.87	4.62	5.12	613.83	915
1973	3.83	18.74	94.36	193.02	162.78	195.26	121.74	44.17	15.95	8.04	7.47	9.43	874.81	1304
1974	15.66	48.95	64.02	95.82	210.82	143.08	273.97	65.23	21.69	12.15	6.95	6.24	964.58	1438
1975	3.80	14.79	197.17	171.07	273.63	141.09	159.93	48.02	15.50	6.06	5.03	3.96	1040.05	1550
1976	5.30	48.68	79.75	142.13	208.22	256.69	87.87	51.64	15.05	7.00	5.58	2.87	910.78	1357
1977	1.86	7.73	29.51	144.89	164.25	259.72	74.48	23.27	12.10	8.85	7.71	3.17	737.54	1099
1978	3.25	29.19	71.03	190.79	245.42	291.35	138.39	24.17	9.71	5.82	2.10	0.06	1011.28	1507
1979	1.09	19.92	52.54	165.17	102.29	69.88	79.33	12.06	6.73	17.91	15.12	0.87	542.91	809
1980	0.73	8.84	93.92	170.40	185.93	202.97	123.74	36.10	11.22	3.30	3.74	6.63	847.52	1263
1981	3.06	26.53	113.77	146.43	208.59	160.03	122.36	37.86	13.59	5.00	2.47	0.04	839.73	1251
1982	1.81	12.11	86.30	142.29	220.64	254.31	90.40	27.31	13.06	5.75	1.89	0.65	856.52	1276
1983	0.00	16.91	77.92	208.53	377.15	135.15	311.39	58.65	22.07	11.32	5.38	5.05	1229.52	1832
1984	6.90	45.82	200.44	82.55	201.90	154.84	161.43	30.65	10.76	7.66	4.45	3.23	910.63	1357
1985	4.39	36.65	128.13	135.27	122.23	184.99	105.39	43.37	13.02	3.90	2.66	0.00	780.00	1162
1986	1.89	147.55	143.16	160.01	311.51	263.09	91.47	27.31	9.92	1.16	0.00	0.00	1157.07	1724
MEAN	4.65	31.87	104.99	151.58	211.93	191.70	132.39	36.52	14.63	7.59	5.00	3.52	896.38	1336
MAX	15.66	147.55	200.44	212.11	377.15	291.35	311.39	65.23	23.85	17.91	15.12	9.43	1229.52	1832
MIN	0.00	6.18	29.51	80.44	102.29	69.88	74.48	12.06	6.73	1.16	0.00	0.00	542.91	809
MEAN CU.M/S	0.99	11.90	40.51	56.59	79.13	73.96	49.43	14.09	5.46	2.84	2.07	1.31	28.42	
CU.M/S /100SQ.KM	0.15	1.77	6.04	8.43	11.79	11.02	7.37	2.10	0.81	0.42	0.31	0.20	4.24	

MONTHLY MAXIMUM RUNOFF AT B. PUK STATION

(UNIT : CU.M/SEC)

YEAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	ANNUAL	MOMENTARY PEAK RUNOFF	MOMENTARY PEAK DATE
1970	6.80	10.00	90.00	142.00	200.00	113.00	71.00	18.00	17.00	5.20	2.90	5.20	200.00	229.00	AUG. 3
1971	3.80	30.00	130.00	72.00	260.00	252.00	106.00	26.00	7.40	4.20	2.10	5.80	260.00	269.00	AUG. 31
1972	8.20	2.60	104.00	75.00	73.00	163.00	66.00	16.00	20.00	4.20	2.20	6.20	163.00	163.00	SEP. 7
1973	2.40	14.00	110.00	209.00	121.00	156.00	126.00	65.00	9.20	4.40	5.20	8.30	209.00	218.00	JULY 14
1974	12.00	42.00	48.00	81.00	182.00	97.00	248.00	60.00	12.00	7.00	4.40	3.20	248.00	255.00	OCT. 11
1975	2.62	15.00	158.00	148.00	191.00	77.00	129.00	34.00	8.94	3.32	3.18	2.90	191.00	205.00	AUG. 16
1976	4.12	49.00	113.00	141.00	154.00	178.00	46.00	48.00	8.30	3.64	8.50	4.12	178.00	192.00	SEP. 14
1977	1.15	5.65	52.00	108.00	136.00	201.00	53.00	14.00	5.95	5.50	6.10	2.50	201.00	218.00	SEP. 12
1978	2.40	81.70	50.90	165.20	199.85	198.50	161.60	15.25	5.20	2.70	1.50	0.40	199.85	209.30	AUG. 2
1979	2.57	27.56	115.42	140.30	100.06	69.48	98.79	8.20	4.40	9.22	13.54	6.95	140.30	154.92	JULY 3
1980	1.12	18.27	75.36	136.70	124.38	178.47	85.81	23.31	6.42	2.45	7.08	11.39	178.47	197.42	SEP. 11
1981	2.92	28.46	161.85	127.68	123.66	169.80	81.60	21.50	8.77	2.79	1.56	0.24	169.80	196.36	SEP. 23
1982	1.98	9.34	70.82	83.80	234.00	222.00	88.60	15.00	10.02	2.83	1.40	1.40	234.00	238.50	AUG. 22
1983	0.00	66.94	70.18	240.70	265.70	104.52	202.20	39.92	12.13	6.58	3.08	13.39	265.70	279.30	AUG. 8
1984	4.10	62.46	232.31	47.08	226.67	93.33	129.82	18.60	6.20	7.70	4.85	2.75	232.31	253.00	JUNE 23
1985	7.11	25.52	113.30	117.86	64.78	158.90	58.10	25.52	8.26	2.60	7.80	0.00	158.90	162.50	SEP. 21
1986	3.45	190.85	108.50	118.85	249.90	265.09	65.75	20.50	6.00	2.03	0.00	0.00	265.09	269.01	SEP. 7
MEAN	3.93	39.96	106.10	126.72	170.94	158.65	106.90	27.58	9.19	4.49	4.43	4.40	205.55	218.19	
MAX	12.00	190.85	232.31	240.70	265.70	265.09	248.00	65.00	20.00	9.22	13.54	13.39	265.70	279.30	AUG. 8/1983
MIN	0.00	2.60	48.00	47.08	64.78	69.48	46.00	8.20	4.40	2.03	0.00	0.00	140.30	154.92	JULY 3/1979

MONTHLY MINIMUM RUNOFF AT B. PUK STATION

(UNIT : CU.M/SEC)

YEAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	ANNUAL
1970	2.50	3.00	7.80	36.00	51.00	44.00	20.00	8.20	5.80	2.60	1.70	1.70	1.70
1971	1.30	2.50	17.00	34.00	28.00	34.00	19.00	7.40	4.20	1.90	1.40	0.80	0.80
1972	2.60	1.60	1.90	14.00	23.00	35.00	17.00	8.40	4.20	2.30	1.50	0.80	0.80
1973	0.90	2.00	7.80	31.00	30.00	41.00	16.00	9.40	3.80	2.50	2.10	2.00	0.90
1974	3.20	7.00	14.00	17.00	29.00	37.00	34.00	13.00	4.80	3.00	1.80	1.65	1.65
1975	0.61	0.96	10.00	40.00	51.00	37.00	22.00	9.16	3.46	1.43	1.32	0.89	0.61
1976	0.45	4.79	14.00	13.00	48.00	50.00	24.00	8.50	3.64	1.95	0.60	0.00	0.00
1977	0.30	0.60	3.40	18.00	28.00	51.00	14.00	6.10	3.55	2.20	2.35	0.80	0.30
1978	0.30	1.00	10.40	27.20	48.90	59.30	16.00	5.20	2.70	1.60	0.10	0.00	0.00
1979	0.00	2.57	4.58	29.76	20.86	16.62	8.96	2.57	1.08	3.55	2.57	0.00	0.00
1980	0.00	0.00	4.18	26.50	46.56	38.24	24.18	6.42	2.45	0.00	0.00	0.00	0.00
1981	0.00	2.04	9.63	20.90	36.04	29.43	23.02	8.77	2.79	1.20	0.00	0.00	0.00
1982	0.00	1.98	5.88	33.50	38.05	59.48	16.20	6.42	2.83	1.40	0.10	0.00	0.00
1983	0.00	0.00	15.04	27.50	56.86	29.93	38.56	12.53	5.56	3.24	0.60	0.00	0.00
1984	1.40	2.90	28.50	15.50	15.25	36.63	19.80	6.20	2.00	1.30	0.30	0.00	0.00
1985	0.00	4.70	23.84	28.32	30.00	26.36	25.80	8.72	2.75	0.10	0.00	0.00	0.00
1986	0.00	5.40	16.30	36.00	39.50	37.05	21.70	5.85	2.03	0.00	0.00	0.00	0.00
MEAN	0.80	2.53	11.43	26.36	36.47	38.94	21.19	7.82	3.39	1.78	0.97	0.51	0.40
MAX	3.20	7.00	28.50	40.00	56.86	59.48	38.56	13.00	5.80	3.55	2.57	2.00	1.70
MIN	0.00	0.00	1.90	13.00	15.25	16.62	8.96	2.57	1.08	0.00	0.00	0.00	0.00

A.3.4 Structure of Runoff Model

ILLUSTRATION FOR RUNOFF MODEL

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MONTHLY RUNOFF TABLE
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* CHANTHABURI RIVER BASIN DEVELOPMENT PROJECT

* WHOLE AREA (C.A = 1664.2 SQKM)

(UNIT = MCM)

YEAR	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	ANNUAL
1967	97.030	187.665	226.283	457.350	486.985	381.242	389.327	94.078	47.346	23.278	29.780	40.509	2460.874
1968	60.518	255.216	429.422	532.376	515.210	196.860	174.746	91.180	43.214	26.435	30.593	35.030	2390.799
1969	51.391	171.801	420.988	551.217	314.258	555.654	199.214	133.975	52.657	23.597	20.524	31.613	2526.889
1970	69.532	88.508	335.721	414.093	468.159	261.367	137.295	79.850	83.404	43.808	20.782	33.698	2036.216
1971	43.102	102.230	337.506	240.235	332.270	226.194	208.531	111.384	54.686	47.293	30.474	28.386	1762.289
1972	89.794	102.082	338.686	250.538	326.277	408.086	153.733	105.003	97.202	46.957	21.925	27.927	1968.208
1973	48.654	98.811	394.749	369.907	309.550	381.002	229.906	123.296	79.841	34.244	23.797	47.485	2141.240
1974	101.340	230.255	174.305	186.106	550.701	214.425	459.877	102.964	51.500	38.253	35.047	33.769	2178.541
1975	45.764	93.577	565.009	205.284	442.887	223.289	213.634	109.611	57.545	25.257	32.830	49.325	2064.011
1976	64.730	223.050	243.697	439.870	333.504	369.585	141.446	132.407	59.161	25.298	24.638	25.369	2082.753
1977	19.891	77.309	204.179	317.210	237.437	348.759	147.715	89.610	41.136	28.910	35.306	21.191	1568.653
1978	32.161	174.801	346.820	242.413	427.859	493.254	234.959	89.499	40.698	19.513	14.328	11.951	2128.254
1979	42.201	108.205	415.690	451.265	224.852	317.424	150.354	64.790	29.581	12.449	9.011	22.545	1848.366
1980	42.250	151.032	438.852	362.967	423.520	282.036	202.833	106.581	50.396	21.277	16.572	48.577	2146.892
1981	56.447	191.461	424.901	352.404	372.227	300.038	206.138	112.021	68.771	28.829	16.939	14.177	2144.350
1982	52.904	92.379	441.196	472.975	399.614	325.730	158.981	96.396	56.792	23.907	9.780	14.682	2145.336
1983	7.569	353.991	455.939	515.033	745.884	302.895	616.327	167.407	72.853	35.156	25.315	40.044	3338.411
1984	66.620	359.359	412.818	193.798	428.726	317.115	215.104	91.301	52.404	26.962	20.455	33.020	2217.681
1985	60.771	270.070	531.221	414.758	318.967	356.652	249.989	112.266	65.482	28.049	11.031	7.154	2426.409
1986	43.306	484.223	421.146	252.023	484.828	366.852	221.280	121.665	69.966	29.821	12.160	23.397	2530.665
AVERAGE (MCM)	54.80	190.80	377.96	361.09	407.18	331.42	235.57	106.76	58.73	29.46	22.06	29.49	2205.34
(MM)	32.9	114.7	227.1	217.0	244.7	199.1	141.6	64.2	35.3	17.7	13.3	17.7	1325.2

STRUCTURE OF TANK MODEL
FT = 0.0280 HT =112.5MM HI = 56.2MM

AREAL RATIO BY THIESSEN

A.MUANG	A.THA MAI	A.MAKHAM	A.LAEM SING	A.PONG NAM RON	PRIU AGRO. STATION	B.TAP CHUM
11 %	6 %	24 %	5 %	35 %	7 %	12 %

****
MONTHLY RUNOFF TABLE
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* CHANTHABURI RIVER BASIN DEVELOPMENT PROJECT

* NO.4 PROPOSED DAMSITE (C.A = 70.2 SQKM)

(UNIT = MCM)

YEAR	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	ANNUAL
1967	2.492	2.073	5.784	13.769	16.461	8.239	8.571	1.907	0.745	0.373	0.996	0.258	61.668
1968	4.149	3.990	10.025	17.678	20.769	7.265	5.266	1.486	0.279	0.048	0.455	1.423	72.833
1969	0.927	2.324	12.059	11.379	15.988	17.189	9.536	5.163	0.456	0.067	1.060	1.119	77.267
1970	4.185	2.744	6.492	15.385	8.166	7.479	2.069	1.162	5.661	0.744	0.206	1.142	55.435
1971	1.540	4.367	11.819	6.243	10.761	5.639	12.651	3.458	2.397	1.890	0.272	0.489	61.526
1972	4.748	4.258	18.635	18.458	23.078	11.916	4.821	5.975	2.273	0.357	0.328	1.622	96.468
1973	3.149	3.449	12.260	14.744	12.179	14.314	8.686	8.504	1.204	0.215	0.994	1.497	81.195
1974	3.845	9.069	10.517	7.489	28.888	7.231	19.451	2.816	0.831	1.252	1.567	1.423	94.377
1975	3.381	7.289	19.149	9.610	24.681	9.035	8.697	3.226	0.764	0.113	1.204	1.251	88.401
1976	3.289	10.497	11.767	13.967	11.774	12.373	7.320	4.218	0.494	0.080	0.106	1.351	77.234
1977	0.330	5.857	8.291	15.262	8.666	15.213	5.104	1.375	0.328	0.277	1.028	0.245	61.975
1978	0.901	8.537	9.482	6.250	17.636	21.229	10.414	2.091	0.428	0.063	0.100	0.177	77.308
1979	2.046	6.454	12.400	12.761	11.041	9.329	3.860	1.843	0.306	0.045	0.038	1.195	61.319
1980	1.938	8.138	15.633	14.132	12.856	7.976	6.862	2.879	0.617	0.091	0.028	3.849	74.998
1981	3.462	7.939	17.476	9.697	16.798	9.341	9.597	5.375	2.010	0.296	0.475	0.295	82.761
1982	2.349	6.419	14.505	17.137	11.656	11.571	6.618	2.624	0.647	0.095	0.014	0.002	73.638
1983	0.008	11.442	12.500	13.083	15.608	4.038	18.726	6.337	1.019	0.738	0.875	6.057	90.431
1984	1.719	8.024	15.159	4.816	18.975	11.195	5.901	1.480	0.363	0.191	0.315	1.496	69.634
1985	2.706	5.826	24.973	16.751	8.829	14.162	8.060	2.619	1.275	0.188	0.027	0.005	85.420
1986	2.074	25.546	7.156	8.062	18.956	18.095	7.638	2.376	1.622	0.278	0.039	0.159	92.001
AVERAGE (MCM)	2.46	7.21	12.80	12.33	15.69	11.14	8.49	3.35	1.19	0.37	0.51	1.25	76.79
(MM)	35.1	102.7	182.4	175.7	223.5	158.7	121.0	47.7	16.9	5.3	7.2	17.8	1093.9

STRUCTURE OF TANK MODEL
FT = 0.0618 HT = 39.2MM HI = 19.6MM

AREAL RATIO BY THIESSEN

A.MUANG	A.THA MAI	A.MAKHAM	A.LAEM SING	A.PONG NAM RON	PRIU AGRO. STATION	B.TAP CHUM
0 %	0 %	0 %	0 %	100 %	0 %	0 %

****
MONTHLY RUNOFF TABLE
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* CHANTHABURI RIVER BASIN DEVELOPMENT PROJECT

* NO.5 PROPOSED DAMSITE (C.A = 44.5 SQKM)

(UNIT = MCM)

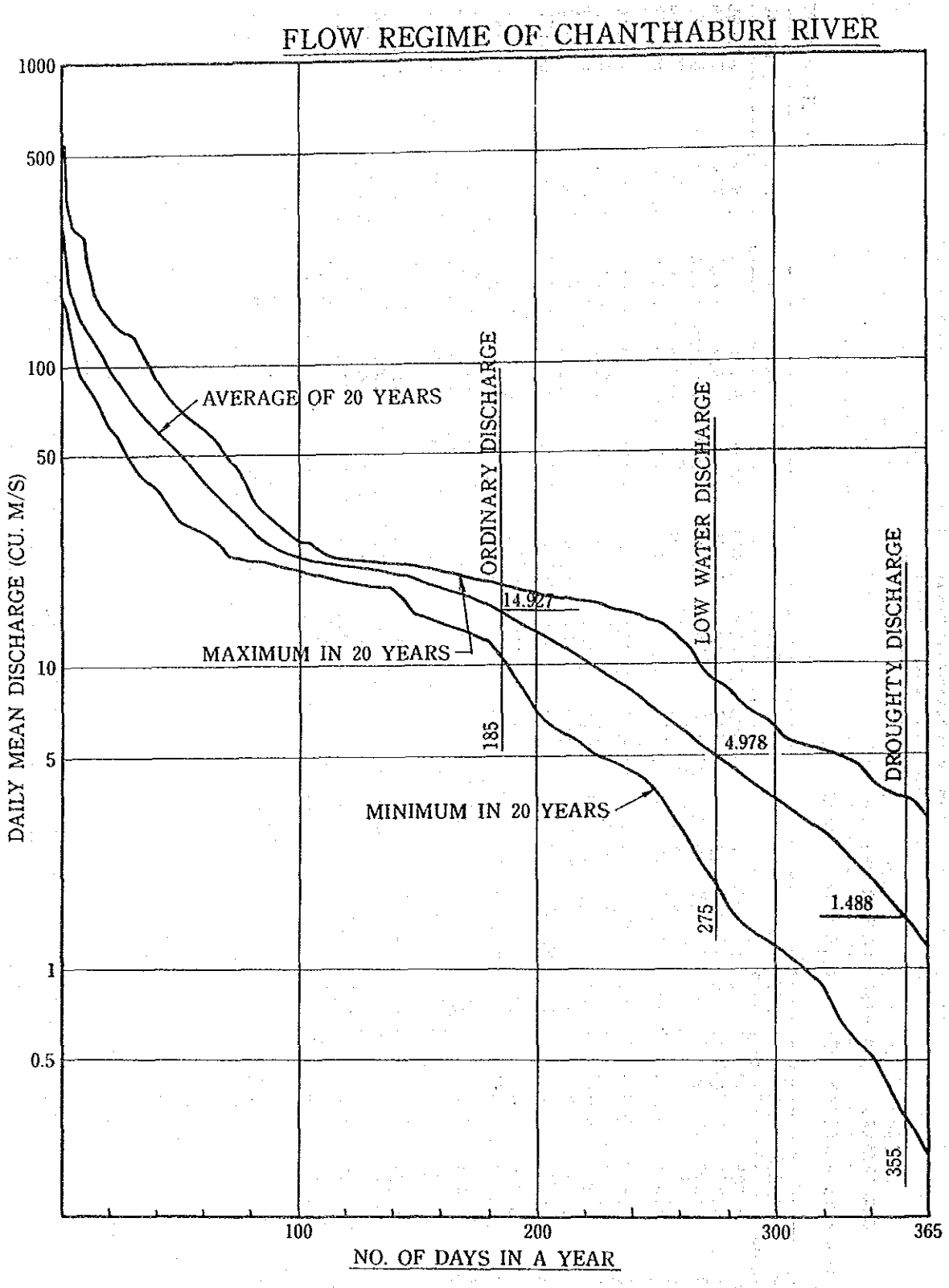
YEAR	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	ANNUAL
1967	3.989	3.247	5.330	11.524	9.161	15.486	9.632	1.091	0.179	0.224	1.924	1.549	63.335
1968	4.974	7.723	17.086	10.729	13.356	7.435	4.485	2.529	0.524	0.518	3.085	1.714	74.158
1969	3.300	12.560	15.121	20.403	6.022	20.610	5.714	1.511	0.205	0.024	0.016	0.628	86.112
1970	5.559	2.311	11.682	13.047	15.668	10.096	4.353	2.437	2.934	0.638	0.708	2.184	71.616
1971	1.517	8.773	12.942	7.890	11.784	8.877	7.368	1.364	0.243	0.145	4.119	0.734	65.757
1972	7.890	2.312	10.090	6.342	6.382	12.055	3.723	1.720	2.135	0.368	0.042	0.850	53.909
1973	1.557	7.130	14.616	10.459	10.266	11.748	5.422	3.369	0.673	0.241	1.017	3.616	70.112
1974	9.101	9.264	4.760	9.130	14.380	9.665	15.102	1.408	0.295	2.121	0.848	0.841	76.917
1975	1.038	6.900	20.974	9.503	12.593	3.990	6.687	2.290	0.981	0.149	3.000	1.036	69.140
1976	1.078	7.364	4.102	13.357	14.606	14.399	2.427	2.103	0.292	0.063	0.600	0.140	60.530
1977	0.919	5.657	8.747	5.423	7.088	11.683	4.379	0.604	0.085	2.197	0.599	0.368	47.750
1978	1.503	8.301	12.472	10.712	14.749	16.055	5.268	1.497	0.256	0.177	0.057	0.024	71.072
1979	3.703	3.997	7.034	7.378	4.765	8.485	2.674	0.293	0.151	0.024	0.510	0.554	39.567
1980	1.952	8.256	15.278	8.270	11.202	8.828	7.119	0.915	0.116	0.014	0.002	0.664	62.617
1981	1.862	8.551	11.016	8.919	9.600	10.400	6.017	2.351	1.113	0.130	0.380	0.253	60.591
1982	2.942	4.355	15.671	14.211	9.997	11.122	4.307	2.443	0.893	0.112	0.013	0.729	66.796
1983	0.138	15.715	8.374	24.150	22.620	11.515	13.644	4.674	0.368	0.043	0.050	1.284	102.576
1984	1.070	8.094	10.312	3.981	6.831	7.271	8.233	2.910	0.575	0.404	0.772	0.645	51.097
1985	1.730	7.552	8.170	10.015	8.280	9.926	4.790	2.110	0.554	0.065	0.007	0.082	53.281
1986	1.240	14.581	15.489	6.300	10.892	6.809	7.387	2.611	0.549	0.066	0.009	0.486	66.419
AVERAGE (MCM)	2.85	7.63	11.46	10.59	11.01	10.82	6.44	2.01	0.66	0.39	0.89	0.92	65.67
(MM)	64.1	171.5	257.6	237.9	247.5	243.2	144.6	45.2	14.7	8.7	20.0	20.7	1475.7

STRUCTURE OF TANK MODEL
FT = 0.0692 HT = 33.7MM HI = 16.8MM

AREAL RATIO BY THIESSEN

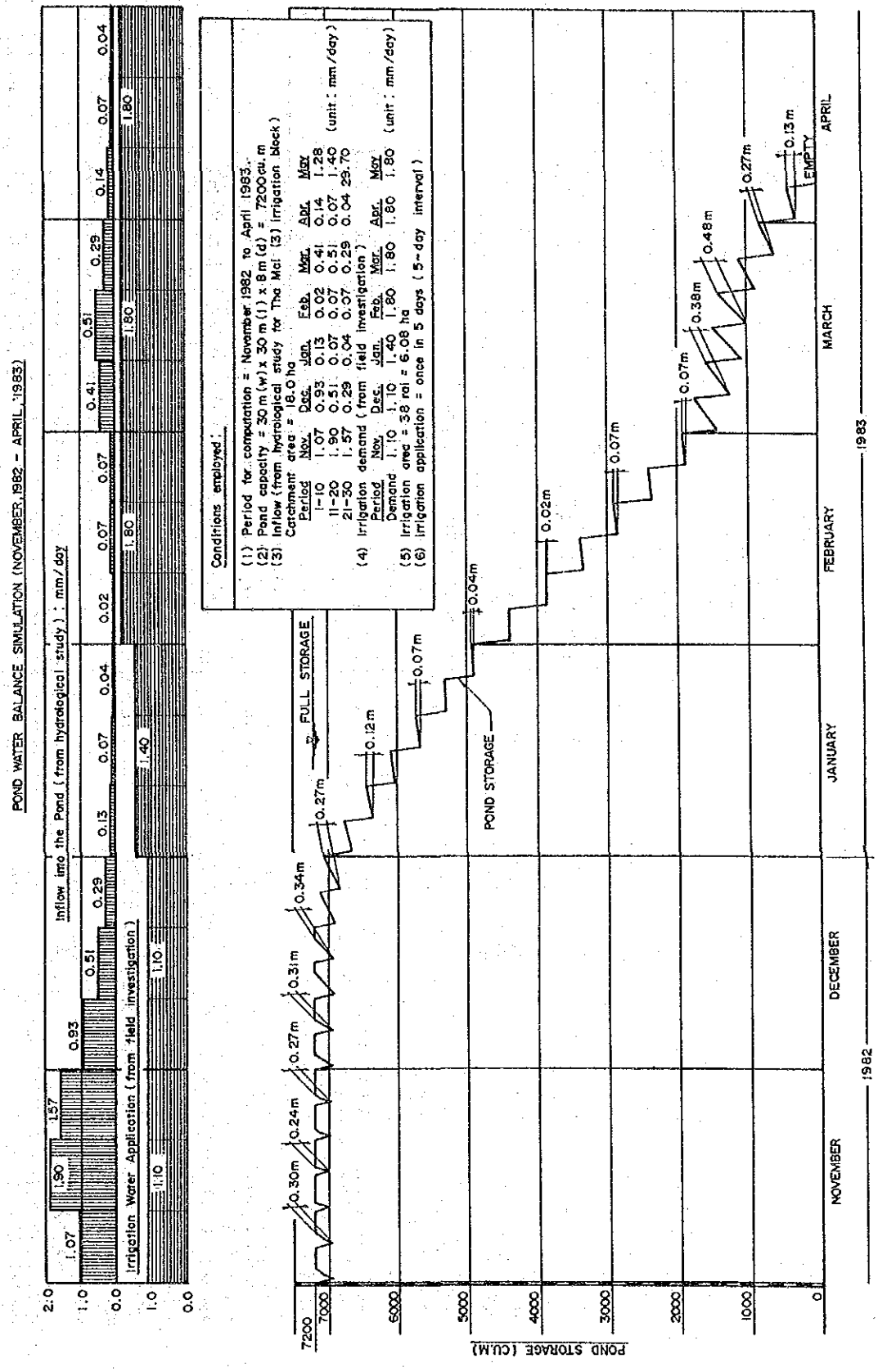
A.MUANG	A.THA MAI	A.MAKHAM	A.LAEM SING	A.PONG NAM RON	PRIU AGRO. STATION	B.TAP CHUM
0 %	0 %	0 %	0 %	0 %	0 %	100 %

A.3.8 Flow Regime of Chanthaburi River



A.4 FARMPOND WATER BALANCE

A.4.1 Water Balance of Sample Farmpond(1)



WATER BALANCE OF SAMPLE FARMPOND

Period	Inflow (cu.m)	Demand (cu.m)	Diff. (cu.m)	Storage (cu.m)	Recovery (cu.m)	(m)
Initial Condition				7200.0		
Nov.1 Irri. Period	64.2	334.4	-270.2	6929.8		
Other Period	128.4	-	128.4	7058.2	270.2→0.30m	
Nov. 2 to 5	770.4	-	770.4	7200.0		
				↓		
Nov.11 Irri. Period	114.0	334.4	-220.4	6979.6		
Other Period	228.0	-	228.0	7200.0	220.4→0.24m	
Nov.12 to 15	1368.0	-	1368.0	↓		
				↓		
Nov.21 Irri. Period	94.2	334.4	-240.2	6959.8		
Other Period	188.4	-	188.4	7148.2	240.2→0.27m	
Nov.21 to 25	1130.4	-	1130.4	7200.0		
				↓		
Dec.1 Irri. Period	55.8	334.4	-276.6	6921.4		
Other Period	111.6	-	111.6	7033.0	278.6→0.31m	
Dec.2 to 5	669.6	-	669.6	7200.0		
				↓		
Dec.11 Irri. Period	30.6	334.4	-303.8	6896.2		
Other Period	61.2	-	61.2	6957.4	303.8→0.34m	
Dec.12 to 15	367.2	-	367.2	7200.0		
				↓		
Dec.21 Irri. Period	17.4	334.4	-317.0	6883.0		
Other Period	34.8	-	34.8	6917.8	274.0→0.27m	
Dec.22 to 25	208.8	-	208.8	7157.0		
				↓		
Dec.30				7053.2		
				↓		
Jan.1 Irri. Period	7.8	425.6	-417.8	6835.4		
Other Period	15.6	-	15.6	6851.0	109.2→0.12m	
Jan.2 to 5	93.6	-	93.6	6744.6		
				↓		
Jan.10				6436.0		
				↓		
Jan.11 Irri. Period	4.2	425.6	-421.4	6014.6		
Other Period	8.4	-	8.4	6023.0	58.8→0.07m	
Jan.12 to 15	50.4	-	50.4	6073.4		
				↓		
Jan.20				5710.8		
				↓		
Jan.21 Irri. Period	2.4	425.6	-423.2	5287.6		
Other Period	4.8	-	4.8	5292.4	33.6→0.04m	
Jan.22 to 25	28.8	-	28.8	5321.2		
				↓		
Jan.30				4931.6		
				↓		
Feb.1 Irri. Period	1.2	547.2	-546.0	4385.6		
Other Period	2.4	-	2.4	4388.0	16.8→0.02m	
Feb.2 to 5	14.4	-	14.4	4402.4		
				↓		
Feb.10				3873.2		
				↓		
Feb.11 Irri. Period	4.2	547.2	-543.0	3330.2		
Other Period	8.4	-	8.4	3338.6	58.8→0.07m	
Feb.12 to 15	50.4	-	50.4	3389.0		
				↓		
Feb.20				2904.8		

Period	Inflow (cu.m)	Demand (cu.m)	Diff. (cu.m)	Storage (cu.m)	Recovery (cu.m)	(m)
Initial Condition				2904.8		
Feb.21 Irri. Period	4.2	547.2	-543.0	2361.8		
Other Period	8.4	-	8.4	2370.2	58.8→0.07m	
Feb.22 to 25	50.4	-	50.4	2420.6		
				↓		
Feb.30				1936.4		
				↓		
Mar.1 Irri. Period	24.6	547.2	-522.6	1413.8		
Other Period	49.2	-	49.2	1463.0	344.4→0.38m	
Mar.2 to 5	295.2	-	295.2	1758.2		
				↓		
Mar.10				1580.0		
				↓		
Mar.11 Irri. Period	30.6	547.2	-516.6	1063.4		
Other Period	61.2	-	61.2	1124.6	428.4→0.48m	
Mar.12 to 15	367.2	-	367.2	1491.8		
				↓		
Mar.20				1403.6		
				↓		
Mar.21 Irri. Period	17.4	547.2	-529.8	1063.4		
Other Period	34.8	-	34.8	1124.6	243.6→0.27m	
Mar.22 to 25	208.8	-	208.8	1117.4		
				↓		
Mar.30				831.2		
				↓		
Apr.1 Irri. Period	8.4	547.2	-538.8	292.4		
Other Period	16.8	-	16.8	309.2	117.6→0.13m	
Apr.2 to 5	100.8	-	100.8	410.0		
				↓		
Apr.10				0.0		
				↓		

Conditions employed:

(1) Period for computation = November 1982 to April 1983.

(2) Pond capacity = 30m(w) x 30m(l) x 8m(d) = 7200cu.m

(3) Inflow (from hydrological study for Tha Mai (3) irrigation block)
Catchment area for the pond = 18.0ha

Period	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	
1-10	1.07	0.93	0.13	0.02	0.41	0.14	1.28	
11-20	1.90	0.51	0.07	0.07	0.51	0.07	1.40	(unit: mm/day)
21-30	1.57	0.29	0.04	0.07	0.29	0.04	29.70	

(4) Irrigation demand (from field investigation)

Period	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	
Demand	1.10	1.10	1.40	1.80	1.80	1.80	1.80	(unit: mm/day)

(5) Irrigation area = 38rai = 6.08ha

ASE = 1 * DAMS = NO.4 DAM INDEPENDANT

* BY RIVER WATER: A(1,1)=27340.0 A(1,2)= 40.0 A(1,3)= 1179.7 A(1,4)= 1716.7 A(1,5)= 179.7 A(1,6)= 50.2
* BY POND WATER : A(2,1)=29450.0 A(2,2)= 13.5 A(2,3)= 1031.3 A(2,4)= 7617.7 A(2,5)= 827.0 A(2,6)= 0.0
* VM= 39.700 WS=185.0 VBMAX= 8.718 EFF= 0.70 UPOND=920.0 RAVER= 0.40 RAVEP= 0.50 QCONST= 0.000

		AT DAMS			IRRIGATED FROM RIVER				IRRIGATED FROM PONDS					W.SUPPLY		FISHERY		MAINTENANCE		BALANCE	
YEAR	MON	QINF	VOL	LOSS	QINF	QAVE	QDEM	QSUP	QINF	QAVE	VOL	QDEM	QSUP	QDEM	QSUP	QDEM	QSUP	QDEM	QSUP	SHRT	SPLS
		(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)
1967		61.7	-14.5	2.8	245.2	98.1	25.8	-6.2	420.0	210.0	-1.7	77.5	-13.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	637.1
1968		72.8	2.8	2.8	290.9	116.4	25.8	-7.7	444.8	222.4	0.0	77.7	-11.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	699.3
1969		77.3	-8.0	2.8	310.1	124.0	25.8	-7.1	497.7	248.9	1.9	77.5	-18.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	785.1
1970		55.4	12.1	2.8	225.4	90.1	25.8	-5.2	412.9	206.4	-1.9	77.5	-8.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	577.4
1971		61.5	-1.9	2.8	246.1	98.4	25.8	-5.3	348.1	174.1	0.0	77.5	-14.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	551.6
1972		96.5	-0.5	2.8	372.6	149.0	25.8	-5.0	313.7	156.8	0.0	77.7	-10.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	676.9
1973		81.2	1.2	2.8	319.1	127.6	25.8	-4.6	410.2	205.1	3.3	77.5	-13.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	699.9
1974		94.4	1.5	2.8	370.9	148.3	25.8	-2.6	416.0	208.0	-3.3	77.5	-12.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	777.0
1975		88.4	0.0	2.8	347.1	138.8	25.8	-5.0	389.9	194.9	0.0	77.5	-12.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	719.4
1976		77.2	-12.6	2.8	301.7	120.7	25.8	-7.2	373.5	186.8	0.0	77.7	-20.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	658.8
1977		62.0	0.4	2.8	242.5	97.0	25.8	-9.4	279.5	139.8	0.0	77.5	-23.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	477.6
1978		77.3	-8.3	2.8	305.9	122.4	25.8	-9.8	404.6	202.3	0.0	77.5	-25.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	690.1
1979		61.3	1.1	2.8	238.4	95.3	25.8	-9.0	318.9	159.5	0.0	77.5	-25.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	511.5
1980		75.0	9.6	2.8	295.3	118.1	25.8	-6.8	422.6	211.3	0.0	77.7	-20.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	677.0
1981		82.8	-2.0	2.8	322.4	129.0	25.8	-6.6	381.0	190.5	0.0	77.5	-18.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	682.2
1982		73.6	-3.0	2.8	291.2	116.5	25.8	-8.8	412.7	206.4	0.0	77.5	-17.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	674.4
1983		90.4	12.8	2.8	364.9	146.0	25.8	-7.3	655.8	327.9	0.8	77.5	-22.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	991.5
1984		69.6	-6.8	2.8	270.8	108.3	25.8	-7.1	368.6	184.3	-0.8	77.7	-16.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	610.3
1985		85.4	-7.7	2.8	330.4	132.2	25.8	-8.1	369.1	184.5	0.0	77.5	-21.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	686.6
1986		92.0	3.7	2.8	358.9	143.5	25.8	-7.9	424.2	212.1	0.0	77.5	-19.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	765.4
TOTAL		76.8	-20.2	2.8	302.5	121.0	25.8	-6.8	403.2	201.6	-1.7	77.6	-17.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	677.4

( ) REQUIRED RESERVOIR CAPACITIES BY YEAR (MCM)

1	20.458	2	16.458	3	24.137	4	12.737	5	13.406	6	13.881	7	13.209	8	12.215	9	11.862	10	30.990
11	26.554	12	34.741	13	31.406	14	21.823	15	23.188	16	35.675	17	19.000	18	20.627	19	30.902	20	24.204

( ) REQUIRED RESERVOIR CAPACITIES BY ORDER(MCM)

1	35.675	2	34.741	3	31.406	4	30.990	5	30.902	6	26.554	7	24.204	8	24.137	9	23.188	10	21.823
11	20.627	12	20.458	13	19.000	14	16.458	15	13.881	16	13.406	17	13.209	18	12.737	19	12.215	20	11.862

ASE = 1 * DAMS = NO.4 DAM INDEPENDANT

* BY RIVER WATER: A(1,1)=27340.0 A(1,2)= 40.0 A(1,3)= 1179.7 A(1,4)= 1716.7 A(1,5)= 179.7 A(1,6)= 50.2
* BY POND WATER : A(2,1)=29450.0 A(2,2)= 13.5 A(2,3)= 1031.3 A(2,4)= 7617.7 A(2,5)= 827.0 A(2,6)= 0.0
* VM= 39.700 WS=185.0 VBMAX= 8.718 EFF= 0.70 UPOND=920.0 RAVER= 0.40 RAVEP= 0.50 QCONST= 0.000

	WATER RELEASED FROM DAMS FOR:					WATER BALANCE		AREA IRRIGATED BY RIVER			AREA IRRIGATED BY PONDS		
YEAR	A-RIVER	A-PONDS	W.SUPPLY	FISHERY	CONST.	SPILLAGE	SHORTAGE	DEMAND	SUPPLY	RATE	DEMAND	SUPPLY	RATE
1967	6.189	13.703	0.000	0.000	0.000	53.514	0.000	25.761	6.189	0.760	77.502	13.703	0.823
1968	7.739	11.124	0.000	0.000	0.000	48.342	0.000	25.842	7.739	0.701	77.741	11.124	0.857
1969	7.097	18.945	0.000	0.000	0.000	56.406	0.000	25.761	7.097	0.725	77.502	18.945	0.756
1970	5.203	8.240	0.000	0.000	0.000	27.079	0.000	25.761	5.203	0.798	77.502	8.240	0.894
1971	5.321	14.069	0.000	0.000	0.000	41.290	0.000	25.761	5.321	0.793	77.502	14.069	0.818
1972	5.032	10.658	0.000	0.000	0.000	78.466	0.000	25.842	5.032	0.805	77.741	10.658	0.863
1973	4.554	13.219	0.000	0.000	0.000	59.458	0.000	25.761	4.554	0.823	77.502	13.219	0.829
1974	2.613	12.468	0.000	0.000	0.000	75.042	0.000	25.761	2.613	0.899	77.502	12.468	0.839
1975	4.991	12.571	0.000	0.000	0.000	68.074	0.000	25.761	4.991	0.806	77.502	12.571	0.838
1976	7.190	20.405	0.000	0.000	0.000	59.465	0.000	25.842	7.190	0.722	77.741	20.405	0.738
1977	9.405	23.747	0.000	0.000	0.000	25.692	0.000	25.761	9.405	0.635	77.502	23.747	0.694
1978	9.792	25.619	0.000	0.000	0.000	47.417	0.000	25.761	9.792	0.620	77.502	25.619	0.669
1979	8.995	25.478	0.000	0.000	0.000	22.979	0.000	25.761	8.995	0.651	77.502	25.478	0.671
1980	6.766	20.602	0.000	0.000	0.000	35.290	0.000	25.842	6.766	0.738	77.741	20.602	0.735
1981	6.625	18.142	0.000	0.000	0.000	57.254	0.000	25.761	6.625	0.743	77.502	18.142	0.766
1982	8.822	17.104	0.000	0.000	0.000	47.928	0.000	25.761	8.822	0.658	77.502	17.104	0.779
1983	7.282	22.710	0.000	0.000	0.000	44.909	0.000	25.761	7.282	0.717	77.502	22.710	0.707
1984	7.114	16.489	0.000	0.000	0.000	50.022	0.000	25.842	7.114	0.725	77.741	16.489	0.788
1985	8.056	21.565	0.000	0.000	0.000	60.688	0.000	25.761	8.056	0.687	77.502	21.565	0.722
1986	7.854	19.249	0.000	0.000	0.000	58.436	0.000	25.761	7.854	0.695	77.502	19.249	0.752
TOTAL	136.640	346.106	0.000	0.000	0.000	1017.748	0.000	515.621	136.640	0.735	1551.230	346.106	0.777

2	3	5	7	10	20	30	50	100	500
20.520	24.078	28.048	30.500	33.026	37.795	40.544	43.990	48.682	59.748

ASE = 1 * DAMS = NO.5 DAM INDEPENDANT

* BY RIVER WATER: A(1,1)= 2920.0 A(1,2)= 8.4 A(1,3)= 72.7 A(1,4)= 1514.4 A(1,5)= 42.6 A(1,6)= 3.0
* BY POND WATER : A(2,1)= 2940.0 A(2,2)= 0.0 A(2,3)= 0.0 A(2,4)= 543.3 A(2,5)= 90.1 A(2,6)= 0.0
* VM= 13.200 WS=335.0 VBMAX= 0.583 EFF= 0.70 UPOND=920.0 RAVER= 0.40 RAVEP= 0.50 QCONST= 0.000

	AT DAMS			IRRIGATED FROM RIVER				IRRIGATED FROM PONDS					W.SUPPLY		FISHERY		MAINTENANCE		BALANCE	
YEAR MON	QINF	VOL	LOSS	QINF	QAVE	QDEM	QSUP	QINF	QAVE	VOL	QDEM	QSUP	QDEM	QSUP	QDEM	QSUP	QDEM	QSUP	SHRT	SPLS
	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)
1967	63.3	-2.3	5.0	48.1	19.2	13.4	-5.6	58.2	29.1	-0.1	5.2	-0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	148.5
1968	74.2	1.8	5.0	42.1	16.8	13.4	-6.0	36.5	18.2	0.0	5.2	-1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	127.2
1969	86.1	-5.7	5.0	41.2	16.5	13.4	-7.0	25.8	12.9	0.1	5.2	-2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	135.1
1970	71.6	4.9	5.0	34.3	13.7	13.4	-6.7	21.8	10.9	-0.1	5.2	-2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	99.4
1971	65.8	0.4	5.0	31.4	12.6	13.4	-6.3	19.5	9.8	0.0	5.2	-1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	92.7
1972	53.9	-2.2	5.0	29.9	11.9	13.4	-6.3	24.5	12.2	0.0	5.2	-0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	86.8
1973	70.1	2.8	5.0	36.6	14.6	13.4	-6.1	27.0	13.5	0.2	5.2	-1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	107.0
1974	76.9	-1.9	5.0	33.6	13.4	13.4	-5.9	16.2	8.1	-0.2	5.2	-1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	105.2
1975	69.1	1.4	5.0	32.0	12.8	13.4	-6.6	17.9	9.0	0.2	5.2	-1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	93.9
1976	60.5	-5.2	5.0	32.4	13.0	13.4	-7.5	25.6	12.8	-0.2	5.2	-1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.2
1977	47.7	1.5	5.0	24.2	9.7	13.4	-7.8	16.9	8.5	0.0	5.2	-2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	63.7
1978	71.1	-2.5	5.0	32.8	13.1	13.4	-7.3	18.7	9.3	0.0	5.2	-1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	101.5
1979	39.6	-0.4	5.0	29.1	11.6	13.4	-7.5	33.9	17.0	0.0	5.2	-1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	79.4
1980	62.6	0.4	5.0	32.1	12.9	13.4	-7.4	23.5	11.8	0.0	5.2	-1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	94.2
1981	60.6	1.5	5.0	28.9	11.6	13.4	-7.0	17.8	8.9	0.0	5.2	-2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	82.3
1982	66.8	0.2	5.0	31.9	12.8	13.4	-7.3	19.8	9.9	0.0	5.2	-2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	94.7
1983	102.6	1.3	5.0	63.0	25.2	13.4	-6.4	61.1	30.6	0.2	5.2	-1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	201.6
1984	51.1	0.1	5.0	33.0	13.2	13.4	-6.6	34.4	17.2	-0.2	5.2	-1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	94.9
1985	53.3	-2.1	5.0	41.0	16.4	13.4	-6.3	49.7	24.9	0.0	5.2	-1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	122.5
1986	66.4	1.2	5.0	44.2	17.7	13.4	-6.0	46.7	23.3	0.0	5.2	-0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	132.4
TOTAL	65.7	-4.8	5.0	36.1	14.4	13.4	-6.7	29.8	14.9	-0.1	5.2	-1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	108.2

( ) REQUIRED RESERVOIR CAPACITIES BY YEAR (MCM)

1	4.822	2	3.254	3	7.830	4	3.094	5	3.720	6	4.506	7	4.488	8	4.221	9	3.194	10	8.776
11	6.340	12	9.050	13	8.975	14	8.354	15	6.879	16	8.683	17	6.392	18	5.722	19	7.982	20	6.153

( ) REQUIRED RESERVOIR CAPACITIES BY ORDER(MCM)

1	9.050	2	8.975	3	8.776	4	8.683	5	8.354	6	7.982	7	7.830	8	6.879	9	6.392	10	6.340
11	6.153	12	5.722	13	4.822	14	4.506	15	4.488	16	4.221	17	3.720	18	3.254	19	3.194	20	3.094

ASE = 1 * DAMS = NO.5 DAM INDEPENDANT

* BY RIVER WATER: A(1,1)= 2920.0 A(1,2)= 8.4 A(1,3)= 72.7 A(1,4)= 1514.4 A(1,5)= 42.6 A(1,6)= 3.0
* BY POND WATER : A(2,1)= 2940.0 A(2,2)= 0.0 A(2,3)= 0.0 A(2,4)= 543.3 A(2,5)= 90.1 A(2,6)= 0.0
* VM= 13.200 WS=335.0 VBMAX= 0.583 EFF= 0.70 UPOND=920.0 RAVER= 0.40 RAVEP= 0.50 QCONST= 0.000

	WATER RELEASED FROM DAMS FOR;					WATER BALANCE		AREA IRRIGATED BY RIVER			AREA IRRIGATED BY PONDS		
YEAR	A-RIVER	A-PONDS	W.SUPPLY	FISHERY	CONST.	SPILLAGE	SHORTAGE	DEMAND	SUPPLY	RATE	DEMAND	SUPPLY	RATE
1967	5.647	0.846	0.000	0.000	0.000	54.149	0.000	13.386	5.647	0.578	5.176	0.846	0.837
1968	5.974	1.480	0.000	0.000	0.000	59.865	0.000	13.428	5.974	0.555	5.191	1.480	0.715
1969	7.014	2.012	0.000	0.000	0.000	77.762	0.000	13.386	7.014	0.476	5.176	2.012	0.611
1970	6.748	2.465	0.000	0.000	0.000	52.476	0.000	13.386	6.748	0.496	5.176	2.465	0.524
1971	6.317	1.534	0.000	0.000	0.000	52.491	0.000	13.386	6.317	0.528	5.176	1.534	0.704
1972	6.325	0.666	0.000	0.000	0.000	44.088	0.000	13.428	6.325	0.529	5.191	0.666	0.872
1973	6.075	1.417	0.000	0.000	0.000	54.747	0.000	13.386	6.075	0.546	5.176	1.417	0.726
1974	5.923	1.096	0.000	0.000	0.000	66.718	0.000	13.386	5.923	0.558	5.176	1.096	0.788
1975	6.600	1.502	0.000	0.000	0.000	54.609	0.000	13.386	6.600	0.507	5.176	1.502	0.710
1976	7.516	1.400	0.000	0.000	0.000	51.767	0.000	13.428	7.516	0.440	5.191	1.400	0.730
1977	7.757	2.156	0.000	0.000	0.000	31.304	0.000	13.386	7.757	0.420	5.176	2.156	0.583
1978	7.258	1.941	0.000	0.000	0.000	59.348	0.000	13.386	7.258	0.458	5.176	1.941	0.625
1979	7.456	1.866	0.000	0.000	0.000	25.647	0.000	13.386	7.456	0.443	5.176	1.866	0.639
1980	7.359	1.680	0.000	0.000	0.000	48.128	0.000	13.428	7.359	0.452	5.191	1.680	0.676
1981	6.993	2.168	0.000	0.000	0.000	44.924	0.000	13.386	6.993	0.478	5.176	2.168	0.581
1982	7.318	2.606	0.000	0.000	0.000	51.638	0.000	13.386	7.318	0.453	5.176	2.606	0.496
1983	6.362	1.130	0.000	0.000	0.000	88.753	0.000	13.386	6.362	0.525	5.176	1.130	0.782
1984	6.585	1.101	0.000	0.000	0.000	38.252	0.000	13.428	6.585	0.510	5.191	1.101	0.788
1985	6.292	1.155	0.000	0.000	0.000	42.899	0.000	13.386	6.292	0.530	5.176	1.155	0.777
1986	5.976	0.770	0.000	0.000	0.000	53.433	0.000	13.386	5.976	0.554	5.176	0.770	0.851
TOTAL	133.497	30.988	0.000	0.000	0.000	1053.000	0.000	267.933	133.497	0.502	103.591	30.988	0.701

2	3	5	7	10	20	30	50	100	500
5.750	6.752	7.871	8.562	9.274	10.620	11.396	12.369	13.694	16.822

ASE = 1 * DAMS = NO.4 + NO.5 DAMS

* BY RIVER WATER: A(1,1)=30260.0 A(1,2)= 48.4 A(1,3)= 1252.4 A(1,4)= 3231.1 A(1,5)= 222.3 A(1,6)= 53.2
* BY POND WATER : A(2,1)=32390.0 A(2,2)= 13.5 A(2,3)= 1031.3 A(2,4)= 8161.0 A(2,5)= 917.1 A(2,6)= 0.0
* VM= 52.900 WS=520.0 VBMAX= 9.301 EFF= 0.70 UPOND=920.0 RAVER= 0.40 RAVEP= 0.50 QCONST= 0.000

	AT DAMS			IRRIGATED FROM RIVER				IRRIGATED FROM PONDS					W.SUPPLY		FISHERY		MAINTENANCE		BALANCE	
YEAR	MON	QINF	VOL	LOSS	QINF	QAVE	QDEM	QSUP	QINF	QAVE	VOL	QDEM	QSUP	QDEM	QSUP	QDEM	QSUP	QDEM	QSUP	SHRT	SPLS
		(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)	(MCM)
1967		125.0	-16.3	7.8	293.3	117.3	39.1	-11.1	478.2	239.1	-1.9	82.7	-14.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	785.0
1968		147.0	4.6	7.8	333.0	133.2	39.3	-12.4	481.3	240.6	0.0	82.9	-12.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	826.6
1969		163.4	-13.6	7.8	351.3	140.5	39.1	-12.7	523.5	261.8	2.0	82.7	-20.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	920.1
1970		127.1	16.5	7.8	259.7	103.9	39.1	-8.9	434.6	217.3	-2.0	82.7	-10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	677.3
1971		127.3	-0.5	7.8	277.5	111.0	39.1	-9.9	367.6	183.8	0.0	82.7	-15.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	643.3
1972		150.4	-3.3	7.8	402.4	161.0	39.3	-8.7	338.1	169.1	0.0	82.9	-11.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	764.2
1973		151.3	4.5	7.8	355.6	142.3	39.1	-8.3	437.2	218.6	3.5	82.7	-14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	806.5
1974		171.3	-0.4	7.8	404.5	161.8	39.1	-6.3	432.1	216.1	-3.5	82.7	-13.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	882.2
1975		157.5	1.5	7.8	379.1	151.6	39.1	-8.6	407.8	203.9	0.0	82.7	-13.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	813.3
1976		137.8	-18.6	7.8	334.1	133.6	39.3	-12.7	399.1	199.6	0.0	82.9	-22.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	759.6
1977		109.7	2.1	7.8	266.6	106.7	39.1	-16.0	296.4	148.2	0.0	82.7	-25.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	541.0
1978		148.4	-11.2	7.8	338.8	135.5	39.1	-16.0	423.2	211.6	0.0	82.7	-27.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	792.0
1979		100.9	1.8	7.8	267.5	107.0	39.1	-14.6	352.8	176.4	0.0	82.7	-27.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	589.7
1980		137.6	10.2	7.8	327.4	131.0	39.3	-11.7	446.1	223.1	0.0	82.9	-22.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	770.9
1981		143.4	-1.9	7.8	351.4	140.5	39.1	-11.4	398.9	199.4	0.0	82.7	-20.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	765.8
1982		140.4	-2.9	7.8	323.1	129.2	39.1	-14.0	432.4	216.2	0.0	82.7	-18.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	769.2
1983		193.0	14.4	7.8	428.0	171.2	39.1	-13.0	716.9	358.4	1.1	82.7	-23.8	0.0	0.0	0.0	0.0	0.0	0.0	0.01	192.7
1984		120.7	-6.9	7.8	303.8	121.5	39.3	-12.4	403.0	201.5	-1.1	82.9	-17.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	705.4
1985		138.7	-9.7	7.8	371.4	148.6	39.1	-12.8	418.8	209.4	0.0	82.7	-22.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	809.0
1986		158.4	5.2	7.8	403.0	161.2	39.1	-12.8	470.9	235.4	0.0	82.7	-20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	897.5
TOTAL		142.5	-24.4	7.8	338.6	135.4	39.2	-11.7	433.0	216.5	-1.9	82.7	-18.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	785.6

( ) REQUIRED RESERVOIR CAPACITIES BY YEAR (MCM)

1	23.466	2	18.875	3	31.531	4	15.662	5	14.557	6	18.079	7	16.704	8	14.481	9	13.147	10	39.117
11	31.843	12	43.641	13	38.468	14	28.062	15	29.781	16	44.210	17	24.912	18	25.558	19	38.513	20	29.677

( ) REQUIRED RESERVOIR CAPACITIES BY ORDER(MCM)

1	44.210	2	43.641	3	39.117	4	38.513	5	38.468	6	31.843	7	31.531	8	29.781	9	29.677	10	28.062
11	25.558	12	24.912	13	23.466	14	18.875	15	18.079	16	16.704	17	15.662	18	14.557	19	14.481	20	13.147

ASE = 1 * DAMS = NO.4 + NO.5 DAMS

* BY RIVER WATER: A(1,1)=30260.0 A(1,2)= 48.4 A(1,3)= 1252.4 A(1,4)= 3231.1 A(1,5)= 222.3 A(1,6)= 53.2
* BY POND WATER : A(2,1)=32390.0 A(2,2)= 13.5 A(2,3)= 1031.3 A(2,4)= 8161.0 A(2,5)= 917.1 A(2,6)= 0.0
* VM= 52.900 WS=520.0 VBMAX= 9.301 EFF= 0.70 UPOND=920.0 RAVER= 0.40 RAVEP= 0.50 QCONST= 0.000

	WATER RELEASED FROM DAMS FOR;					WATER BALANCE		AREA IRRIGATED BY RIVER			AREA IRRIGATED BY PONDS		
YEAR	A-RIVER	A-PONDS	W.SUPPLY	FISHERY	CONST.	SPILLAGE	SHORTAGE	DEMAND	SUPPLY	RATE	DEMAND	SUPPLY	RATE
1967	11.139	14.451	0.000	0.000	0.000	107.870	0.000	39.147	11.139	0.715	82.677	14.451	0.825
1968	12.356	12.603	0.000	0.000	0.000	109.618	0.000	39.269	12.356	0.685	82.932	12.603	0.848
1969	12.661	20.314	0.000	0.000	0.000	136.174	0.000	39.147	12.661	0.677	82.677	20.314	0.754
1970	8.874	9.996	0.000	0.000	0.000	83.854	0.000	39.147	8.874	0.773	82.677	9.996	0.879
1971	9.872	15.271	0.000	0.000	0.000	94.851	0.000	39.147	9.872	0.748	82.677	15.271	0.815
1972	8.700	11.062	0.000	0.000	0.000	126.038	0.000	39.269	8.700	0.778	82.932	11.062	0.867
1973	8.309	14.335	0.000	0.000	0.000	116.379	0.000	39.147	8.309	0.788	82.677	14.335	0.827
1974	6.347	13.564	0.000	0.000	0.000	144.007	0.000	39.147	6.347	0.838	82.677	13.564	0.836
1975	8.568	13.662	0.000	0.000	0.000	125.987	0.000	39.147	8.568	0.781	82.677	13.662	0.835
1976	12.678	21.956	0.000	0.000	0.000	113.879	0.000	39.269	12.678	0.677	82.932	21.956	0.735
1977	15.963	25.903	0.000	0.000	0.000	57.932	0.000	39.147	15.963	0.592	82.677	25.903	0.687
1978	15.992	27.435	0.000	0.000	0.000	108.384	0.000	39.147	15.992	0.591	82.677	27.435	0.668
1979	14.644	27.344	0.000	0.000	0.000	49.250	0.000	39.147	14.644	0.626	82.677	27.344	0.669
1980	11.699	22.038	0.000	0.000	0.000	85.812	0.000	39.269	11.699	0.702	82.932	22.038	0.734
1981	11.424	20.130	0.000	0.000	0.000	105.877	0.000	39.147	11.424	0.708	82.677	20.130	0.757
1982	14.005	18.657	0.000	0.000	0.000	102.894	0.000	39.147	14.005	0.642	82.677	18.657	0.774
1983	12.964	23.840	0.000	0.000	0.000	133.977	0.000	39.147	12.964	0.669	82.677	23.840	0.712
1984	12.421	17.502	0.000	0.000	0.000	89.839	0.000	39.269	12.421	0.684	82.932	17.502	0.789
1985	12.842	22.204	0.000	0.000	0.000	105.552	0.000	39.147	12.842	0.672	82.677	22.204	0.731
1986	12.838	19.989	0.000	0.000	0.000	112.583	0.000	39.147	12.838	0.672	82.677	19.989	0.758
TOTAL	234.296	372.255	0.000	0.000	0.000	2110.756	0.000	783.551	234.296	0.701	1654.820	372.255	0.775

2	3	5	7	10	20	30	50	100	500
25.155	29.822	35.081	38.354	41.743	48.185	51.924	56.632	63.082	78.446

A.6 Flood Analysis

A.6.1 Probable Storm Rainfall

From storm rainfall record of Amphoe Muang Meteorological Station, probable one day, two-day consecutive and three-day consecutive rainfalls are analyzed as under:

Return Period	Max. Daily	Max. Consecutive Rainfall	
		2-Days	3-Days
(year)	(mm)	(mm)	(mm)
10	187	284	321
20	205	310	350
50	228	340	385
100	244	362	410
200	261	383	434
500	282	410	464

Above storm rainfalls are decomposed into hourly elements, based on the observed pattern of hourly rainfall collected during May 8 to 10, 1986, at Ban Pong Rong Zen (Z.21) Station.

Design Storm Rainfall

Time (hour)	Observed Rainfall (mm)	Probability (Return Period) 1/10 (mm)	1/20 (mm)	1/50 (mm)	1/100 (mm)	1/200 (mm)	1/500 (mm)
0	0	0	0	0	0	0	0
2	5.8	23.8	25.8	29.0	30.9	32.9	34.8
4	0.2	0.8	0.9	1.0	1.1	1.1	1.2
6	0.4	1.6	1.8	2.0	2.1	2.3	2.4
8	0.8	3.3	3.6	4.0	4.3	4.5	4.8
10	1.5	6.2	6.7	7.5	8.0	8.5	9.0
12	0.1	0.4	0.4	0.5	0.5	0.6	0.6
14	0.2	0.8	0.9	1.0	1.1	1.1	1.2
16	1.1	1.3	1.4	1.4	1.5	1.6	1.7
18	16.6	18.9	20.5	21.8	23.0	23.8	24.9
20	23.5	26.8	29.0	30.9	32.5	33.7	35.3
22	3.7	4.2	4.6	4.9	5.1	5.3	5.6
24	1.2	1.4	1.5	1.6	1.7	1.7	1.8
26	0.1	0.1	0.1	0.1	0.1	0.1	0.2
28	0.1	0.1	0.1	0.1	0.1	0.1	0.2
30	11.9	13.5	14.7	15.6	16.5	17.0	17.9
32	1.2	1.4	1.7	1.6	1.7	1.7	1.8
34	2.5	2.8	3.1	3.3	3.5	3.6	3.8
36	20.2	23.0	24.9	26.6	28.0	28.9	30.3
38	3.1	3.5	3.8	4.1	4.3	4.4	4.7
40	0.6	1.1	1.2	1.3	1.4	1.5	1.6
42	57.9	102.0	111.9	124.4	133.2	142.4	153.9
44	16.5	29.1	31.9	35.5	38.0	40.6	43.9
46	3.5	6.2	6.8	7.5	8.1	8.6	9.3
48	3.8	6.7	7.3	8.2	8.7	9.3	10.1
50	0.8	1.4	1.5	1.7	1.8	2.0	2.1
52	8.1	14.3	15.7	17.4	18.6	19.9	21.5
54	3.5	6.2	6.8	7.5	8.1	8.6	9.3
56	4.5	7.9	8.7	9.7	10.3	11.1	12.0
58	0.9	1.6	1.7	1.9	2.1	2.2	2.4
60	1.5	2.6	2.9	3.2	3.4	3.7	4.0
62	4.5	7.9	8.7	9.7	10.3	11.1	12.0
Daily Distribution							
- First Day	9.0	37	40	45	48	51	54
- Second Day	85.2	97	105	112	118	122	128
- Third Day	106.1	187	205	228	244	261	282
Total	200.3	321	350	385	410	434	464

A.6.2 Unit Hydrograph at Proposed Damsites

(1) Watershed Parameters

Item	Proposed Damsite	
	Khlong Ta Liu	Khlong San Sai
1. Catchment Area (A: sq.km)	70.2	44.5
2. Length of the Lngest Water Course (L: km)	12.0	8.0
3. Length of Stream Channel (Lc: km)	5.0	4.5
4. Overall Slope of the Longest Water Course (S)	0.0867	0.0088
5. Watershed Parameter (LxLc/sq.rt(S))	204.0	384.0
tp (hour)	4.4	4.8
k1	3.736	1.701
tlog	561.253	1043.196
qp (cu.m/sec)	4.14	2.43

(2) Dimensionless Unit Hydrograph

Dimensionless unit hydrographs are given in the next page.

A.6.3 Design Flood Hydrograph

Design flood hydrographs, which are 500 year probable for the proposed Khlong Ta Liu dam and 200 year probable for the Khlong San Sai dam, are calculated as given in the following page.

A.6.4 Flood Routing Analysis

Giving an appropriate effective size of spillway of 90 m and 63 m, respectively for the Khlong Ta Liu and Khlong San Sai dams, computation of flood routing was made as shown in the following pages.

Unit Hydrograph at Proposed damsites

Dimensionless Unit Hydrograph		Khlong Ta Liu (No.4) Dam Unit Hydrograph				Khlong San Sai (No.5) Dam Unit Hydrograph			
		1.1 hr Increment		2 hr Increment		1.2 hr Increment		2 hr Increment	
t/tp	q/qp	t tp=4.44	q qp=4.14	t	q	t tp=4.80	q qp=2.43	t	q
0	0.0	0	0	0	0	0	0	0	0
0.25	0.028	1.1	0.116	2	0.74	1.2	0.068	2	0.37
0.50	0.212	2.2	0.878	4	3.69	2.4	0.515	4	1.95
0.75	0.704	3.3	2.915	6	2.98	3.6	1.711	6	2.00
1.00	1.000	4.4	4.140	8	1.90	4.8	2.430	8	1.27
1.25	0.824	5.5	3.411	10	1.36	6.0	2.002	10	0.91
1.50	0.597	6.6	2.472	12	1.04	7.2	1.451	12	0.69
1.75	0.483	7.7	2.000	14	0.84	8.4	1.174	14	0.56
2.00	0.394	8.8	1.631	16	0.67	9.6	0.957	16	0.46
2.25	0.332	9.9	1.374	18	0.53	10.8	0.807	18	0.37
2.50	0.285	11.0	1.180	20	0.43	12.0	0.693	20	0.30
2.75	0.247	12.1	1.023	22	0.35	13.2	0.600	22	0.25
3.00	0.221	13.2	0.915	24	0.29	14.4	0.537	24	0.21
3.25	0.196	14.3	0.811	26	0.24	15.6	0.476	26	0.17
3.50	0.173	15.4	0.716	28	0.19	16.8	0.420	28	0.14
3.75	0.153	16.5	0.633	30	0.16	18.0	0.372	30	0.12
4.00	0.134	17.6	0.555	32	0.13	19.2	0.326	32	0.10
4.25	0.119	18.7	0.493	34	0.11	20.4	0.289	34	0.08
4.50	0.106	19.8	0.439	36	0.09	21.6	0.258	36	0.07
4.75	0.095	20.9	0.393	38	0.07	22.8	0.231	38	0.06
5.00	0.085	22.0	0.352	40	0.06	24.0	0.207	40	0.05
5.25	0.077	23.1	0.319	42	0.04	24.2	0.187	42	0.04
5.50	0.069	24.2	0.286	44	0.03	26.4	0.168	44	0.03
5.75	0.062	25.3	0.257	46	0.01	27.6	0.151	46	0.02
6.00	0.054	26.4	0.224	48	0.0	28.8	0.131	48	0.02
6.25	0.048	27.5	0.199			30.0	0.117	50	0.01
6.50	0.042	28.6	0.174			31.2	0.102	52	0.0
6.75	0.039	29.7	0.161			32.4	0.095		
7.00	0.034	30.8	0.141			33.6	0.083		
7.25	0.031	31.9	0.128			34.8	0.075		
7.50	0.028	33.0	0.116			36.0	0.068		
7.75	0.026	34.1	0.108			37.2	0.063		
8.00	0.023	35.2	0.095			38.4	0.056		
8.25	0.021	36.3	0.087			39.6	0.051		
8.50	0.018	37.4	0.075			40.8	0.044		
8.75	0.016	38.5	0.066			42.0	0.039		
9.00	0.014	39.6	0.058			43.2	0.034		
9.25	0.012	40.7	0.050			44.4	0.029		
9.50	0.010	41.8	0.041			45.6	0.024		
9.75	0.008	42.9	0.033			46.8	0.019		
10.00	0.006	44.0	0.025			48.0	0.015		
10.25	0.004	45.1	0.017			49.2	0.010		
10.50	0.002	46.2	0.008			50.4	0.005		
10.75	0.001	47.3	0.004			51.6	0.002		
11.00	0.0	48.4	0.0			52.8	0		

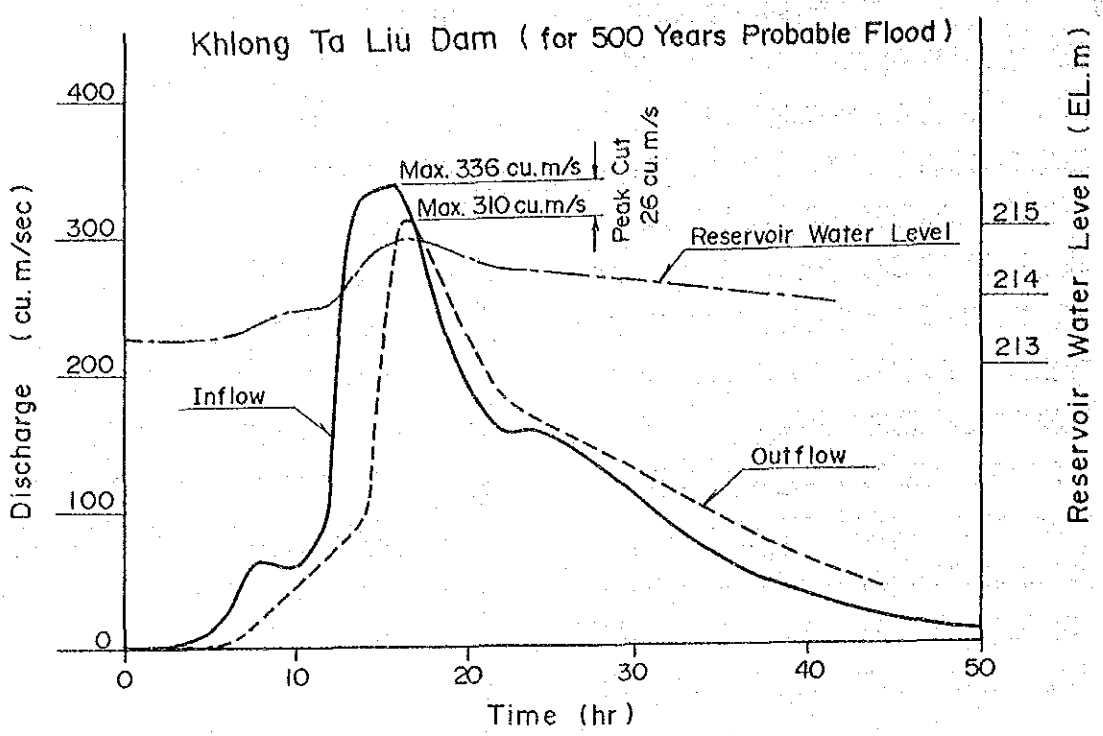
CALCULATION OF DESIGN FLOOD HYDROGRAPH AT KHLONG TA LIU DAM (500-YEAR FLOOD)

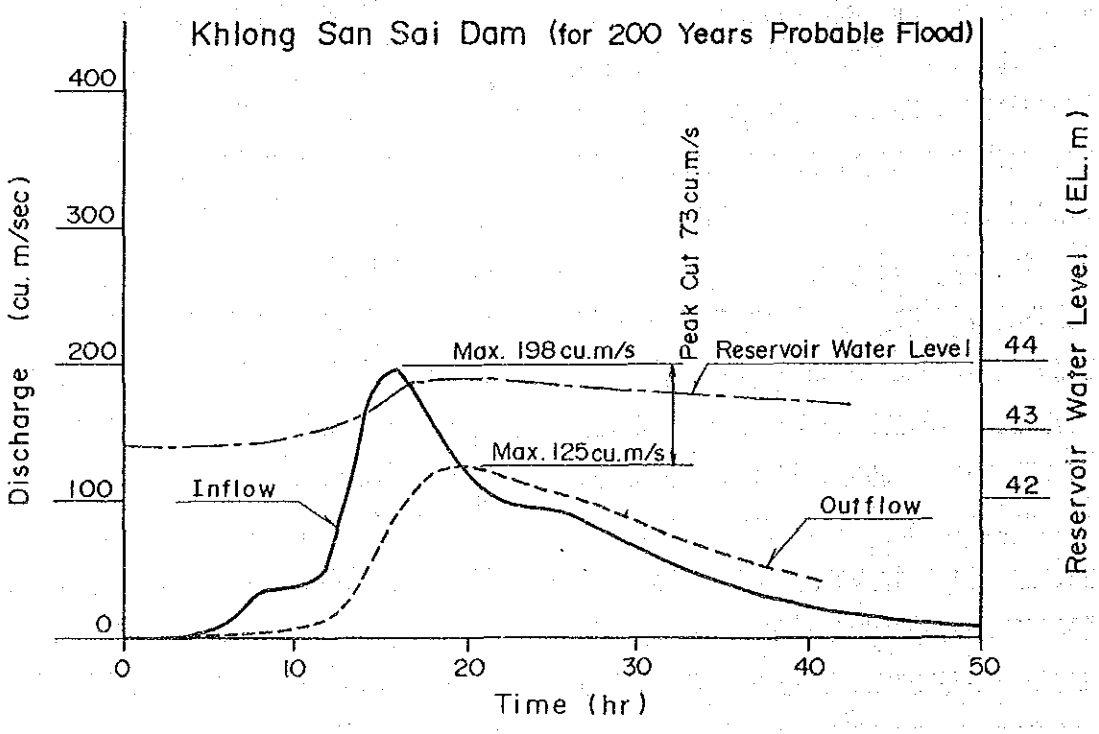
TIME (HR)		2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	TOTAL INFLOW
RAINFALL(MM)		34.8	1.2	2.4	4.8	9.0	0.6	1.2	1.7	24.9	35.3	5.6	1.8	0.2	0.2	17.9	1.8	3.8	30.3	4.7	1.6	153.9	43.9	9.3	10.1	2.1	21.5	9.3	12.0	2.4	4.0	
HR	CUM/S																															(CUM/S)
2	0.74	12.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	3.69	64.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	2.98	51.9	2.2	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	1.90	33.1	1.8	4.4	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	1.36	23.7	1.1	3.6	8.9	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	1.04	18.1	0.8	2.3	7.2	16.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.84	14.6	0.6	1.6	4.6	13.4	1.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.67	11.7	0.5	1.2	3.3	8.5	0.9	2.2	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.53	9.2	0.4	1.0	2.5	6.1	0.6	1.8	3.0	9.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	0.43	7.5	0.3	0.8	2.0	4.7	0.4	1.1	2.5	46.0	13.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	0.35	6.1	0.3	0.6	1.6	3.8	0.3	0.8	1.6	37.2	65.1	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	0.29	5.0	0.2	0.5	1.3	3.0	0.3	0.6	1.1	23.7	52.6	10.3	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	0.24	4.2	0.2	0.4	1.0	2.4	0.2	0.5	0.9	17.0	33.5	8.3	5.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	0.19	3.3	0.1	0.3	0.8	1.9	0.2	0.4	0.7	13.0	24.0	5.3	2.7	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0.16	2.8	0.1	0.3	0.7	1.6	0.1	0.3	0.6	10.5	18.4	3.8	1.7	0.2	0.3	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7
32	0.13	2.3	0.1	0.2	0.6	1.3	0.1	0.3	0.4	8.4	14.8	2.9	1.2	0.1	0.2	33.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7
34	0.11	1.9	0.1	0.2	0.5	1.1	0.1	0.2	0.4	6.6	11.8	2.3	0.9	0.1	0.1	26.6	5.3	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.8
36	0.09	1.6	0.1	0.2	0.4	0.9	0.1	0.2	0.3	5.4	9.4	1.9	0.8	0.1	0.1	17.0	2.7	6.9	11.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	65.0
38	0.07	1.2	0.1	0.1	0.3	0.7	0.1	0.1	0.2	4.4	7.6	1.5	0.6	0.1	0.1	12.2	1.7	5.6	56.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	59.2
40	0.06	1.0	0.0	0.1	0.3	0.6	0.0	0.1	0.2	3.6	6.2	1.2	0.5	0.1	0.1	9.3	1.2	5.6	45.2	8.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	99.1
42	0.04	0.7	0.0	0.1	0.2	0.5	0.0	0.1	0.2	3.0	5.1	1.0	0.4	0.0	0.1	7.5	0.9	2.6	28.8	6.9	2.9	56.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	330.3
44	0.03	0.5	0.0	0.1	0.2	0.4	0.0	0.1	0.1	2.4	4.2	0.8	0.3	0.0	0.0	6.0	0.8	2.0	20.6	4.4	2.4	283.9	16.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	336.3
46	0.01	0.2	0.0	0.0	0.1	0.3	0.0	0.1	0.1	2.0	3.4	0.7	0.3	0.0	0.0	4.7	0.6	1.6	15.8	3.2	1.5	229.3	80.9	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	250.4
48	0.00	0.0	0.0	0.0	0.1	0.3	0.0	0.1	0.1	1.6	2.8	0.5	0.2	0.0	0.0	3.8	0.5	1.3	12.7	2.4	1.1	146.2	65.3	17.2	3.7	0.0	0.0	0.0	0.0	0.0	0.0	193.9
50	0.00	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.1	1.4	2.3	0.4	0.2	0.0	0.0	3.1	0.4	1.0	10.2	2.0	0.8	104.6	41.7	13.9	18.6	0.8	0.0	0.0	0.0	0.0	0.0	157.0
52	0.00	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	1.1	1.9	0.4	0.1	0.0	0.0	2.6	0.3	0.8	8.0	1.6	0.7	80.0	29.8	8.8	15.0	3.9	8.0	0.0	0.0	0.0	0.0	158.9
54	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	1.6	0.3	0.1	0.0	0.0	2.1	0.3	0.7	6.5	1.2	0.5	64.6	22.8	6.3	9.6	3.2	39.7	3.4	0.0	0.0	0.0	144.9
56	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	1.2	0.3	0.1	0.0	0.0	1.7	0.2	0.5	5.3	1.0	0.4	51.6	18.4	4.8	6.9	2.0	32.1	17.2	4.4	0.0	0.0	129.5
58	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.1	0.2	0.1	0.0	0.0	1.4	0.2	0.5	4.4	0.8	0.3	40.8	14.7	3.9	5.3	1.4	20.5	13.9	22.1	0.9	0.0	105.5
60	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.7	0.2	0.1	0.0	0.0	1.2	0.1	0.4	3.6	0.7	0.3	33.1	11.6	3.1	4.2	1.1	14.6	8.8	17.8	4.4	1.5	87.0
62	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.1	0.1	0.0	0.0	1.0	0.1	0.3	2.9	0.6	0.2	26.9	9.4	2.5	3.4	0.9	11.2	6.3	11.4	3.6	7.4	69.0
64	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.8	0.1	0.2	2.4	0.4	0.2	22.3	7.7	2.0	2.7	0.7	9.0	4.8	8.1	2.3	5.9	54.7
66	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.1	0.2	2.0	0.4	0.2	18.5	6.4	1.6	2.2	0.6	7.2	3.9	6.2	1.6	5.8	43.6
68	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.1	0.2	1.7	0.3	0.1	14.6	5.3	1.3	1.8	0.5	5.7	3.1	5.0	1.2	2.7	35.5
70	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.1	0.1	1.4	0.3	0.1	12.3	4.2	1.1	1.5	0.4	4.6	2.5	4.0	1.0	2.1	28.8
72	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.1	1.1	0.2	0.1	10.0	3.5	0.9	1.2	0.3	3.8	2.0	3.2	0.8	1.7	

CALCULATION OF DESIGN FLOOD HYDROGRAPH AT KHLONG SAN SAI DAM (200-YEAR FLOOD)

TIME (HR)		2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	TOTAL INFLOW
RAINFALL(MM)		32.9	1.1	2.3	4.5	8.5	0.6	1.1	1.6	23.8	33.7	5.3	1.7	0.1	0.1	17.0	1.7	3.6	28.9	4.4	1.5	142.4	40.6	8.6	9.3	2.0	19.9	8.6	11.1	2.2	3.7	
HR	CUM/S																															(CUM/S)
2	0.37	6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	1.95	32.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	2.00	32.9	1.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	1.27	20.9	1.1	2.2	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0.91	15.0	0.7	2.3	4.4	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	0.69	11.3	0.5	1.4	4.5	8.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.56	9.2	0.4	1.0	2.9	8.5	0.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.46	7.6	0.3	0.8	2.1	5.4	0.6	1.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.37	6.1	0.3	0.6	1.6	3.9	0.4	1.1	1.5	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	0.30	4.9	0.2	0.5	1.3	2.9	0.3	0.7	1.6	23.2	6.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	0.25	4.1	0.2	0.4	1.0	2.4	0.2	0.5	1.0	23.8	32.8	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	0.21	3.5	0.1	0.3	0.8	2.0	0.2	0.4	0.7	15.1	33.7	5.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	0.17	2.8	0.1	0.3	0.7	1.6	0.1	0.3	0.5	10.8	21.4	5.3	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	0.14	2.3	0.1	0.2	0.6	1.3	0.1	0.3	0.4	8.2	13.3	3.4	1.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0.12	2.0	0.1	0.2	0.5	1.1	0.1	0.2	0.4	6.7	11.6	2.4	1.1	0.1	0.1	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
32	0.10	1.6	0.1	0.2	0.4	0.9	0.1	0.2	0.3	5.5	9.4	1.8	0.8	0.1	0.1	16.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3
34	0.08	1.3	0.1	0.1	0.3	0.7	0.1	0.1	0.2	4.4	7.7	1.5	0.6	0.1	0.1	17.0	1.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.6
36	0.07	1.2	0.0	0.1	0.3	0.6	0.0	0.1	0.2	3.6	6.2	1.2	0.5	0.0	0.1	10.8	1.7	3.5	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.7
38	0.06	1.0	0.0	0.1	0.2	0.5	0.0	0.1	0.2	3.0	5.0	1.0	0.4	0.0	0.0	7.8	1.1	3.6	28.2	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.6
40	0.05	0.8	0.0	0.1	0.2	0.4	0.0	0.1	0.1	2.5	4.2	0.8	0.3	0.0	0.0	5.9	0.8	2.3	28.9	4.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	52.8
42	0.04	0.7	0.0	0.1	0.2	0.3	0.0	0.1	0.1	2.0	3.5	0.7	0.3	0.0	0.0	4.8	0.6	1.6	18.4	4.4	1.4	26.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	165.6
44	0.03	0.5	0.0	0.1	0.1	0.3	0.0	0.1	0.1	1.7	2.9	0.6	0.2	0.0	0.0	3.9	0.5	1.2	13.2	2.8	1.5	138.9	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	197.9
46	0.02	0.3	0.0	0.0	0.1	0.3	0.0	0.0	0.1	1.4	2.4	0.5	0.2	0.0	0.0	3.2	0.4	1.0	10.0	2.0	0.9	142.4	39.6	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	152.6
48	0.02	0.3	0.0	0.0	0.1	0.2	0.0	0.0	0.1	1.2	2.0	0.4	0.1	0.0	0.0	2.6	0.3	0.8	8.1	1.5	0.7	90.4	40.6	8.4	1.7	0.0	0.0	0.0	0.0	0.0	0.0	118.0
50	0.01	0.2	0.0	0.0	0.1	0.2	0.0	0.0	0.1	1.0	1.7	0.3	0.1	0.0	0.0	2.1	0.3	0.7	6.7	1.2	0.5	64.8	25.8	8.6	9.1	0.4	0.0	0.0	0.0	0.0	0.0	95.6
52	0.00	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.8	1.3	0.3	0.1	0.0	0.0	1.8	0.2	0.5	5.4	1.0	0.4	49.1	18.5	5.5	9.3	1.9	3.7	0.0	0.0	0.0	0.0	92.9
54	0.00	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.7	1.2	0.2	0.1	0.0	0.0	1.4	0.2	0.4	4.3	0.8	0.3	39.9	14.0	3.9	5.9	2.0	19.4	1.6	0.0	0.0	0.0	88.0
56	0.00	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.6	1.0	0.2	0.1	0.0	0.0	1.2	0.1	0.4	3.6	0.7	0.3	32.8	11.4	3.0	4.3	1.2	19.9	8.4	2.0	0.0	0.0	78.9
58	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.8	0.2	0.1	0.0	0.0	1.0	0.1	0.3	3.0	0.6	0.2	26.3	9.2	2.4	3.2	0.9	12.7	8.6	10.8	0.4	0.0	88.4
60	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.7	0.1	0.1	0.0	0.0	0.9	0.1	0.3	2.5	0.5	0.2	21.4	7.5	2.0	2.6	0.7	9.1	5.5	11.1	2.2	0.7	66.1
62	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.5	0.1	0.0	0.0	0.0	0.7	0.1	0.2	2.0	0.4	0.2	17.8	6.1	1.6	2.1	0.6	6.9	3.9	7.0	2.2	3.6	54.7
64	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.1	0.0	0.0	0.0	0.6	0.1	0.2	1.7	0.3	0.1	15.0	5.1	1.3	1.7	0.5	5.6	3.0	5.0	1.4	3.7	44.6
66	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.1	0.0	0.0	0.0	0.5	0.1	0.1	1.4	0.3	0.1	12.1	4.3	1.1	1.4	0.4	4.6	2.4	3.8	1.0	2.3	35.4
68	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.4	0.1	0.1	1.2	0.2	0.1	10.0	3.5	0.9	1.2	0.3	3.7	2.0	3.1	0.8	1.7	28.6
70	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.1	1.0	0.2	0.1	8.5	2.8	0.7	1.0	0.2	3.0	1.6	2.5	0.6	1.3	23.8
72	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.1	0.9	0.2	0.1	7.1	2.4	0.6	0.8	0.2	2.5	1.3	2.0	0.5	1.0	19.7

RESERVOIR WATER LEVEL DURING FLOOD





MAXIMUM OVERFLOW AT KHLONG TA LIU DAM (FOR 500 YEARS PROBABLE)
(EFFECTIVE LENGTH OF SPILLWAY = 90.0 M)

TIME	INFLOW	WATER LEVEL	OVERFLOW DEPTH	OUTFLOW	TIME	INFLOW	WATER LEVEL	OVERFLOW DEPTH	OUTFLOW	TIME	INFLOW	WATER LEVEL	OVERFLOW DEPTH	OUTFLOW
(HR)	(CUM/S)	(EL.M)	(M)	(CUM/S)	(HR)	(CUM/S)	(EL.M)	(M)	(CUM/S)	(HR)	(CUM/S)	(EL.M)	(M)	(CUM/S)
0.0	0.0	213.50	0.0	0.0	9.6	60.40	213.87	0.37	39.82	19.2	216.50	214.74	1.24	250.22
0.2	0.10	213.50	0.0	0.0	9.8	59.80	213.88	0.38	41.39	19.4	210.90	214.72	1.22	244.72
0.4	0.10	213.50	0.0	0.0	10.0	59.20	213.89	0.39	42.85	19.6	205.20	214.70	1.20	239.24
0.6	0.20	213.50	0.0	0.0	10.2	63.20	213.90	0.40	44.45	19.8	199.60	214.68	1.18	233.78
0.8	0.30	213.50	0.0	0.0	10.4	67.20	213.91	0.41	46.27	20.0	193.90	214.66	1.16	228.37
1.0	0.30	213.50	0.00	0.0	10.6	71.20	213.92	0.42	48.30	20.2	190.20	214.64	1.14	223.17
1.2	0.40	213.50	0.00	0.0	10.8	75.20	213.94	0.44	50.52	20.4	186.50	214.63	1.13	218.22
1.4	0.50	213.50	0.00	0.00	11.0	79.20	213.95	0.45	52.93	20.6	182.80	214.61	1.11	213.47
1.6	0.50	213.50	0.00	0.00	11.2	83.20	213.96	0.46	55.51	20.8	179.10	214.60	1.10	208.89
1.8	0.60	213.50	0.00	0.00	11.4	87.20	213.98	0.48	58.26	21.0	175.50	214.58	1.08	204.46
2.0	0.70	213.50	0.00	0.00	11.6	91.20	214.00	0.50	61.16	21.2	171.80	214.57	1.07	200.16
2.2	1.10	213.50	0.00	0.01	11.8	95.20	214.01	0.51	64.21	21.4	168.10	214.55	1.05	195.97
2.4	1.50	213.50	0.00	0.01	12.0	99.10	214.03	0.53	67.62	21.6	164.40	214.54	1.04	191.87
2.6	1.90	213.50	0.00	0.02	12.2	122.30	214.06	0.56	72.59	21.8	160.70	214.52	1.02	187.85
2.8	2.30	213.50	0.00	0.04	12.4	145.40	214.10	0.60	79.44	22.0	157.00	214.51	1.01	183.97
3.0	2.70	213.51	0.01	0.06	12.6	168.50	214.15	0.65	88.13	22.2	157.20	214.50	1.00	180.52
3.2	3.10	213.51	0.01	0.09	12.8	191.60	214.20	0.70	98.61	22.4	157.40	214.49	0.99	177.56
3.4	3.50	213.51	0.01	0.12	13.0	214.70	214.26	0.76	110.83	22.6	157.60	214.48	0.98	175.01
3.6	3.90	213.51	0.01	0.17	13.2	237.80	214.32	0.82	124.73	22.8	157.80	214.47	0.97	172.81
3.8	4.30	213.51	0.01	0.22	13.4	261.00	214.38	0.88	140.22	23.0	158.00	214.46	0.96	170.92
4.0	4.70	213.51	0.01	0.28	13.6	284.10	214.45	0.95	157.20	23.2	158.10	214.46	0.96	169.29
4.2	6.30	213.52	0.02	0.38	13.8	307.20	214.52	1.02	175.54	23.4	158.30	214.45	0.95	167.90
4.4	7.90	213.52	0.02	0.51	14.0	330.30	214.59	1.09	194.74	23.6	158.50	214.45	0.95	166.70
4.6	9.50	213.53	0.03	0.68	14.2	330.90	214.65	1.15	212.67	23.8	158.70	214.44	0.94	165.68
4.8	11.20	213.53	0.03	0.90	14.4	331.50	214.70	1.20	228.71	24.0	158.90	214.44	0.94	164.79
5.0	12.80	213.54	0.04	1.17	14.6	332.10	214.74	1.24	242.95	24.2	157.50	214.44	0.94	163.87
5.2	14.40	213.54	0.04	1.51	14.8	332.70	214.78	1.28	255.52	24.4	156.10	214.43	0.93	162.90
5.4	16.00	213.55	0.05	1.91	15.0	333.30	214.82	1.32	266.57	24.6	154.70	214.43	0.93	161.87
5.6	17.60	213.56	0.06	2.37	15.2	333.90	214.85	1.35	276.24	24.8	153.30	214.43	0.93	160.81
5.8	19.20	213.57	0.07	2.91	15.4	334.50	214.87	1.37	284.69	25.0	151.90	214.42	0.92	159.70
6.0	20.80	213.58	0.08	3.53	15.6	335.10	214.89	1.39	292.06	25.2	150.50	214.42	0.92	158.56
6.2	25.30	213.59	0.09	4.31	15.8	335.70	214.91	1.41	298.48	25.4	149.10	214.41	0.91	157.39
6.4	29.70	213.60	0.10	5.29	16.0	336.30	214.92	1.42	303.89	25.6	147.70	214.41	0.91	156.20
6.6	34.10	213.62	0.12	6.49	16.2	327.70	214.93	1.43	307.50	25.8	146.30	214.40	0.90	154.98
6.8	38.50	213.63	0.13	7.91	16.4	319.10	214.94	1.44	309.30	26.0	144.90	214.40	0.90	153.74
7.0	42.90	213.65	0.15	9.56	16.6	310.50	214.93	1.43	309.54	26.2	143.30	214.39	0.89	152.47
7.2	47.30	213.67	0.17	11.46	16.8	302.00	214.93	1.43	308.46	26.4	141.80	214.39	0.89	151.17
7.4	51.80	213.69	0.19	13.61	17.0	293.40	214.92	1.42	306.25	26.6	140.20	214.38	0.88	149.83
7.6	56.20	213.71	0.21	16.01	17.2	284.80	214.91	1.41	303.10	26.8	138.70	214.38	0.88	148.48
7.8	60.60	213.73	0.23	18.66	17.4	276.20	214.90	1.40	299.14	27.0	137.20	214.37	0.87	147.12
8.0	65.00	213.75	0.25	21.51	17.6	267.60	214.88	1.38	294.52	27.2	135.60	214.37	0.87	145.74
8.2	64.40	213.77	0.27	24.32	17.8	259.00	214.86	1.36	289.32	27.4	134.10	214.36	0.86	144.35
8.4	63.80	213.79	0.29	27.00	18.0	250.40	214.84	1.34	283.72	27.6	132.60	214.35	0.85	142.94
8.6	63.30	213.81	0.31	29.54	18.2	244.80	214.83	1.33	278.05	27.8	131.00	214.35	0.85	141.52
8.8	62.70	213.82	0.32	31.93	18.4	239.10	214.81	1.31	272.42	28.0	129.50	214.34	0.84	140.09
9.0	62.10	213.84	0.34	34.15	18.6	233.50	214.79	1.29	266.82					
9.2	61.50	213.85	0.35	36.20	18.8	227.80	214.77	1.27	261.26	MAXIMUM OVERFLOW				
9.4	60.90	213.86	0.36	38.09	19.0	222.20	214.75	1.25	255.74	16.42HR		214.94	1.44	309.75

MAXIMUM OVERFLOW AT KHLONG SAN SAI DAM (FOR 200 YEARS PROBABLE)
(EFFECTIVE LENGTH OF SPILLWAY = 63.0 M)

TIME	INFLOW	WATER LEVEL	OVERFLOW DEPTH	OUTFLOW	TIME	INFLOW	WATER LEVEL	OVERFLOW DEPTH	OUTFLOW	TIME	INFLOW	WATER LEVEL	OVERFLOW DEPTH	OUTFLOW
(HR)	(CUM/S)	(EL.M)	(M)	(CUM/S)	(HR)	(CUM/S)	(EL.M)	(M)	(CUM/S)	(HR)	(CUM/S)	(EL.M)	(M)	(CUM/S)
0.0	0.0	42.80	0.0	0.0	9.6	36.00	42.94	0.14	6.31	19.2	131.80	43.80	1.00	125.06
0.2	0.0	42.80	0.0	0.0	9.8	36.30	42.95	0.15	6.84	19.4	128.40	43.80	1.00	125.21
0.4	0.10	42.80	0.0	0.0	10.0	36.60	42.96	0.16	7.38	19.6	124.90	43.80	1.00	125.19
0.6	0.10	42.80	0.0	0.0	10.2	38.20	42.96	0.16	7.96	19.8	121.50	43.79	0.99	125.01
0.8	0.10	42.80	0.0	0.0	10.4	39.80	42.97	0.17	8.57	20.0	118.00	43.79	0.99	124.67
1.0	0.10	42.80	0.0	0.0	10.6	41.50	42.98	0.18	9.21	20.2	115.80	43.79	0.99	124.22
1.2	0.20	42.80	0.0	0.0	10.8	43.10	42.99	0.19	9.89	20.4	113.50	43.79	0.99	123.68
1.4	0.20	42.80	0.0	0.0	11.0	44.70	43.00	0.20	10.60	20.6	111.30	43.78	0.98	123.07
1.6	0.20	42.80	0.0	0.0	11.2	46.30	43.01	0.21	11.36	20.8	109.00	43.78	0.98	122.37
1.8	0.30	42.80	0.0	0.0	11.4	47.90	43.02	0.22	12.17	21.0	106.80	43.77	0.97	121.60
2.0	0.30	42.80	0.0	0.0	11.6	49.60	43.03	0.23	13.02	21.2	104.50	43.77	0.97	120.76
2.2	0.50	42.80	0.0	0.0	11.8	51.20	43.04	0.24	13.91	21.4	102.30	43.76	0.96	119.85
2.4	0.70	42.80	0.0	0.0	12.0	52.80	43.05	0.25	14.87	21.6	100.00	43.76	0.96	118.88
2.6	0.90	42.80	0.00	0.0	12.2	64.10	43.06	0.26	16.06	21.8	97.80	43.75	0.95	117.85
2.8	1.10	42.80	0.00	0.00	12.4	75.40	43.08	0.28	17.54	22.0	95.60	43.75	0.95	116.78
3.0	1.30	42.80	0.00	0.00	12.6	86.60	43.10	0.30	19.31	22.2	95.30	43.74	0.94	115.74
3.2	1.50	42.80	0.00	0.00	12.8	97.90	43.12	0.32	21.41	22.4	95.00	43.74	0.94	114.73
3.4	1.70	42.80	0.00	0.00	13.0	109.20	43.14	0.34	23.84	22.6	94.70	43.73	0.93	113.75
3.6	1.90	42.80	0.00	0.01	13.2	120.50	43.17	0.37	26.61	22.8	94.50	43.73	0.93	112.82
3.8	2.10	42.80	0.00	0.01	13.4	131.70	43.20	0.40	29.74	23.0	94.20	43.72	0.92	111.92
4.0	2.30	42.80	0.00	0.01	13.6	143.00	43.23	0.43	33.24	23.2	93.90	43.72	0.92	111.05
4.2	3.20	42.80	0.00	0.02	13.8	154.30	43.26	0.46	37.13	23.4	93.70	43.71	0.91	110.21
4.4	4.00	42.80	0.00	0.03	14.0	165.60	43.29	0.49	41.37	23.6	93.40	43.71	0.91	109.40
4.6	4.80	42.81	0.01	0.04	14.2	168.80	43.33	0.53	45.78	23.8	93.10	43.70	0.90	108.62
4.8	5.60	42.81	0.01	0.06	14.4	172.00	43.36	0.56	50.30	24.0	92.90	43.70	0.90	107.86
5.0	6.50	42.81	0.01	0.09	14.6	175.30	43.39	0.59	54.90	24.2	92.40	43.70	0.90	107.12
5.2	7.30	42.81	0.01	0.12	14.8	178.50	43.42	0.62	59.58	24.4	91.90	43.69	0.89	106.40
5.4	8.10	42.81	0.01	0.15	15.0	181.70	43.46	0.66	64.32	24.6	91.40	43.69	0.89	105.68
5.6	8.90	42.81	0.01	0.20	15.2	185.00	43.49	0.69	69.13	24.8	90.90	43.68	0.88	104.97
5.8	9.70	42.82	0.02	0.25	15.4	188.20	43.52	0.72	73.97	25.0	90.40	43.68	0.88	104.29
6.0	10.60	42.82	0.02	0.32	15.6	191.50	43.55	0.75	78.86	25.2	90.00	43.68	0.88	103.61
6.2	12.90	42.82	0.02	0.40	15.8	194.70	43.58	0.78	83.77	25.4	89.50	43.67	0.87	102.93
6.4	15.20	42.83	0.03	0.50	16.0	197.90	43.61	0.81	88.67	25.6	89.00	43.67	0.87	102.28
6.6	17.50	42.83	0.03	0.63	16.2	193.40	43.63	0.83	93.30	25.8	88.50	43.66	0.86	101.64
6.8	19.80	42.84	0.04	0.79	16.4	188.90	43.66	0.86	97.60	26.0	88.00	43.66	0.86	100.99
7.0	22.10	42.84	0.04	0.98	16.6	184.30	43.68	0.88	101.55	26.2	87.10	43.66	0.86	100.35
7.2	24.40	42.85	0.05	1.21	16.8	179.80	43.70	0.90	105.15	26.4	86.20	43.65	0.85	99.68
7.4	26.80	42.86	0.06	1.48	17.0	175.30	43.71	0.91	108.43	26.6	85.30	43.65	0.85	99.01
7.6	29.10	42.86	0.06	1.78	17.2	170.70	43.73	0.93	111.36	26.8	84.40	43.65	0.85	98.34
7.8	31.40	42.87	0.07	2.13	17.4	166.20	43.74	0.94	113.96	27.0	83.50	43.64	0.84	97.64
8.0	33.70	42.88	0.08	2.52	17.6	161.70	43.75	0.95	116.24	27.2	82.60	43.64	0.84	96.94
8.2	34.00	42.89	0.09	2.94	17.8	157.10	43.76	0.96	118.20	27.4	81.60	43.63	0.83	96.24
8.4	34.30	42.89	0.09	3.37	18.0	152.60	43.77	0.97	119.87	27.6	80.70	43.63	0.83	95.52
8.6	34.60	42.90	0.10	3.82	18.2	149.10	43.78	0.98	121.29	27.8	79.80	43.62	0.82	94.79
8.8	34.90	42.91	0.11	4.30	18.4	145.70	43.78	0.98	122.47	28.0	78.90	43.62	0.82	94.07
9.0	35.10	42.92	0.12	4.78	18.6	142.20	43.79	0.99	123.42					
9.2	35.40	42.92	0.12	5.28	18.8	138.80	43.79	0.99	124.17	MAXIMUM OVERFLOW				
9.4	35.70	42.93	0.13	5.79	19.0	135.30	43.79	0.99	124.71	19.37HR		43.80	1.00	125.25

A.7 Sediment Estimation

A.7.1 Sediment Estimation

The annual average value of suspended sediment load observed at Ban PukStation is 52,500 ton/year, as summarized in A.7.2.

Brown's experimantal formula is used to estimate specific sediment discharge including bed load at Ban Puk Station.

$$q_B = 10\left[\frac{U_*^2}{\left(\frac{\sigma}{\rho} - 1\right) \times g \times d}\right]^2$$

where, d = grain size in (m)
qB = sediment load in (cu.m/sec/m)
U_* = friction velocity in (m/sec)
σ = dnsity in (ton/cu.m) = 2.65
ρ = density of water = 1.0 ton/cu.m
g = 9.8 m/sec/sec

The following empirical formula was used to estimate the grain size which would move when the critical tractive force is worked:

$$d = 15.88 \times (\sqrt{i})^b$$

$$b = \log_{10}(\sqrt{i})^{-2.5} - 3.367$$

Assuming that the longitudinal slope of river channel in the middle reaches is 1/500, d = 16mm was obtained from the above equations. From the daily runoff record of Ban Puk station for the period 1967 to 1986, number of the day when the average daily runoff discharge exceeds 50 cu.m/sec. is counted as about 50 days, with average discharge and the standard deviation at 100.8 and 49.0 cu.m/sec., respectively. Design flood discharge of 125 cu.m/sec/ (=100.8 + 49.0/2) was hence applied to estimate the total sediment load from the river basin. Using Manning's formula;

$$I_e = \frac{Q^2 \times n^2}{h^{10/3} \times B^2} = 0.00281$$

$U^* = sq.rt(gHI_e) = 0.203$ m/sec.

$q_B = 0.000824$ cu.m/sec./m

$Q_B = 0.0247$ cu.m/sec.

Thus, the annual total sediment load during the flood period is;
0.0247 x 86,400 sec x 50 days = 106,704 cu.m,
Then, specific sediment discharge is;
106,704/671 = 160 cu.m/sq.km/year

SUSPENDED SEDIMENT AT B. PUK STATION

(Unit : ton)

Year	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Annual
1978	6	770	2,074	13,154	19,926	25,309	8,216	243	41	16	3	0	69,758
1979	2	237	2,291	9,095	3,898	1,910	3,208	67	23	138	115	5	20,989
1980	1	106	3,905	9,711	10,360	13,439	5,270	526	56	6	16	37	43,433
1981	7	388	5,882	8,079	13,272	10,038	5,005	548	82	12	4	0	43,317
1982	3	69	3,078	6,328	17,985	20,736	3,092	294	77	16	2	1	51,681
1983	0	537	2,137	14,353	36,143	5,543	26,042	1,156	180	52	15	34	86,192
1984	23	1,193	15,627	2,315	16,054	7,561	8,813	374	52	32	14	7	52,065
Average	5	472	4,999	9,005	16,806	12,077	8,521	458	73	39	24	12	52,491
Ratio(%)	(0)	(1)	(10)	(17)	(32)	(23)	(16)	(1)	(0)	(0)	(0)	(0)	(100)

APPENDIX-B. TOPOGRAPHY AND GEOLOGY

APPENDIX-B TOPOGRAPHY AND GEOLOGY

LIST OF CONTENTS

B.1. Topography and Geology of No.1 Damsite

B.1.1. Topography

It is a large gentle slope 800 m to 900 m wide between both abutments that characterized topography of the damsite.

Right abutment is a mountain side of a ridge 195 m to 240 m in elevation which diverges from a mass of mountains like a plateau about 500 m in elevation. This ridge has some branch-ridges with a few cols.

Left abutment is a side of massive mountains with summits over 1,000 m in elevation.

Slopes of both abutments show about 20 degrees in gradient.

The gentle slope between both abutments dips with three to five degrees from piedmont of left abutment to the Khlon Ta Rong river in which flows along right side of the valley. There are a few streamlets crossing the gentle slope which originate in mountains of left abutment.

The Khlong Ta Rong river is 10 to 15 m wide and 143 m in elevation around the proposed dam axis.

Natural forest covers the damsite and area around.

B.1.2. Geology

Right abutment consists of phyllitic sandstone and slaty shale of gray, light brown and light greenish brown colour. They are moderate in hardness, however easily broken along schistosity with a light blow by hammer applied. Heavily weathered earthy zone is poorly developed. Schistosity trends N25°-40°E in strike and 35°-50°W in dip. Outcrops are seen in relatively many places.

Slate may be dominant in the branch-ridges with a few cols.

Left abutment around the planned dam axis is composed of very hard massive shale of dark purplish colour judging from boulders scattered around, though outcrop is rarely found. However, soft massive sandstone of light gray colour and fine-grained was found at an outcrop which is located 300 m downward from the dam axis, and it is probable that the sandstone composes foundation of dam to some extent.

It is presumed that unconsolidated gravel layers cover basement rock in the area of gentle slope between both abutment, judging from outcrops along streamlets and characteristics of topography. The gravel layers comprise hard shale with granite. The size varies from pebble to boulder. It is estimated that thickness of the layers is more than five meters in average and reaches to ten meters or more in maximum.

Though it is unknown what kind of rock underlie the gravel, it is presumed that there lies relatively softer rock considering absence of remnant hill resistant to weathering.

A fracture zone must exist along the valley judging from straight shape of the valley, and difference of topography and geology between on left and right abutments.

According to a geological map 1:250,000 scaled, named 'BANTDAMBANG' published by Geological Survey Division, Department of Mineral Resources, Ministry of Industry, above mentioned rocks that underlie the damsite belong to Pong Nam Rom Formation of Triassic age. It is also found on the same geological map that a fault along the valley and another which runs from area downstream of left bank meet each other near the damsite.

B.2. Topography and geology of No.2 Damsite

B.2.1. Topography

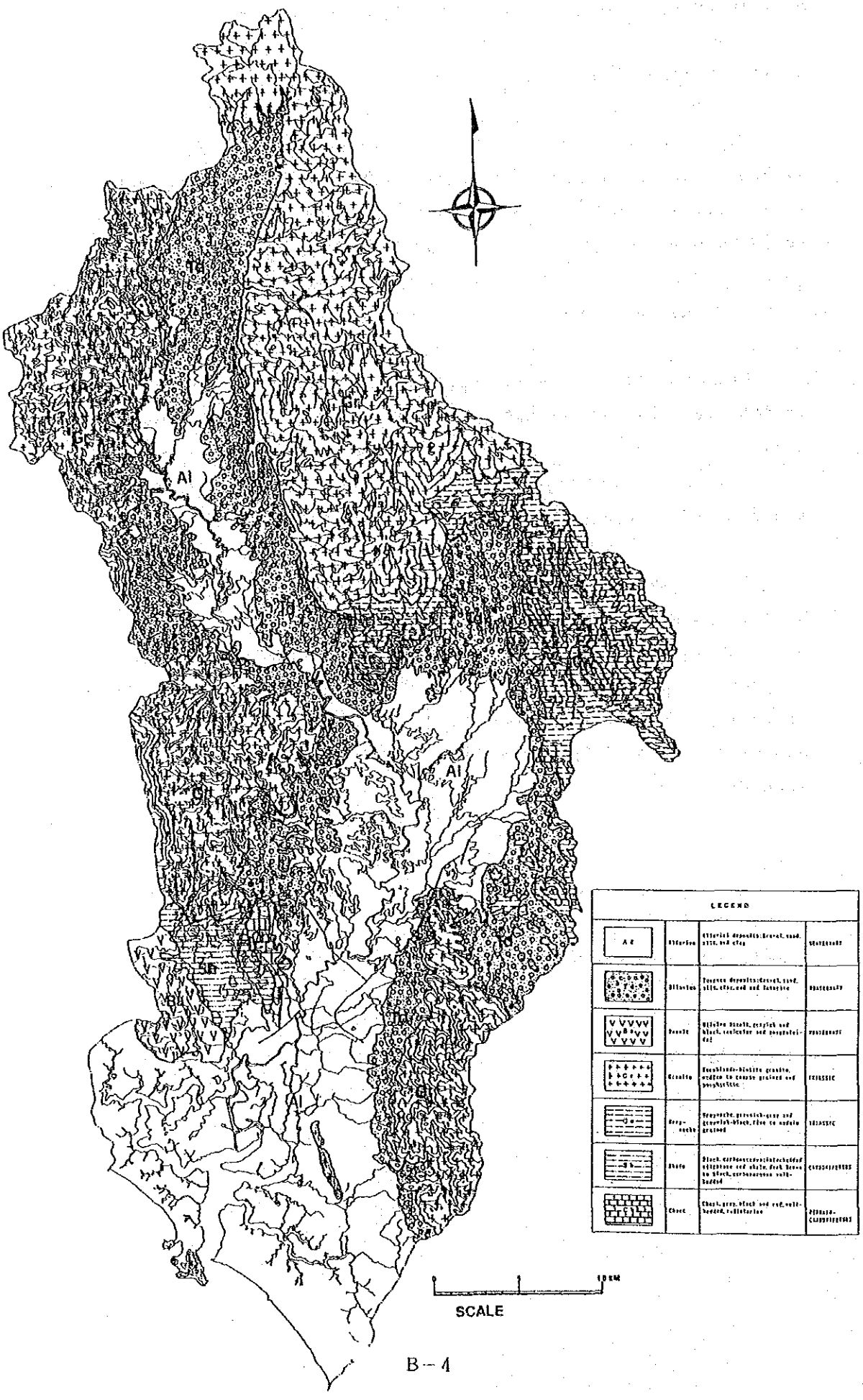
This damsite is located in hilly area with tops 70 to 80 m in elevation and with gentle slope two to four degree in gradient. Two small rivers five to ten meter wide and meandering within a belt 30 to 50 m in width flows down through the damsite and meet each other just downstream of damsite. The riverbed near the planned dam axis shows around 50 m in elevation.

The damsite and the area around damsite are cultivated with fruits trees and pepper along the rivers and with cassava on the hill.

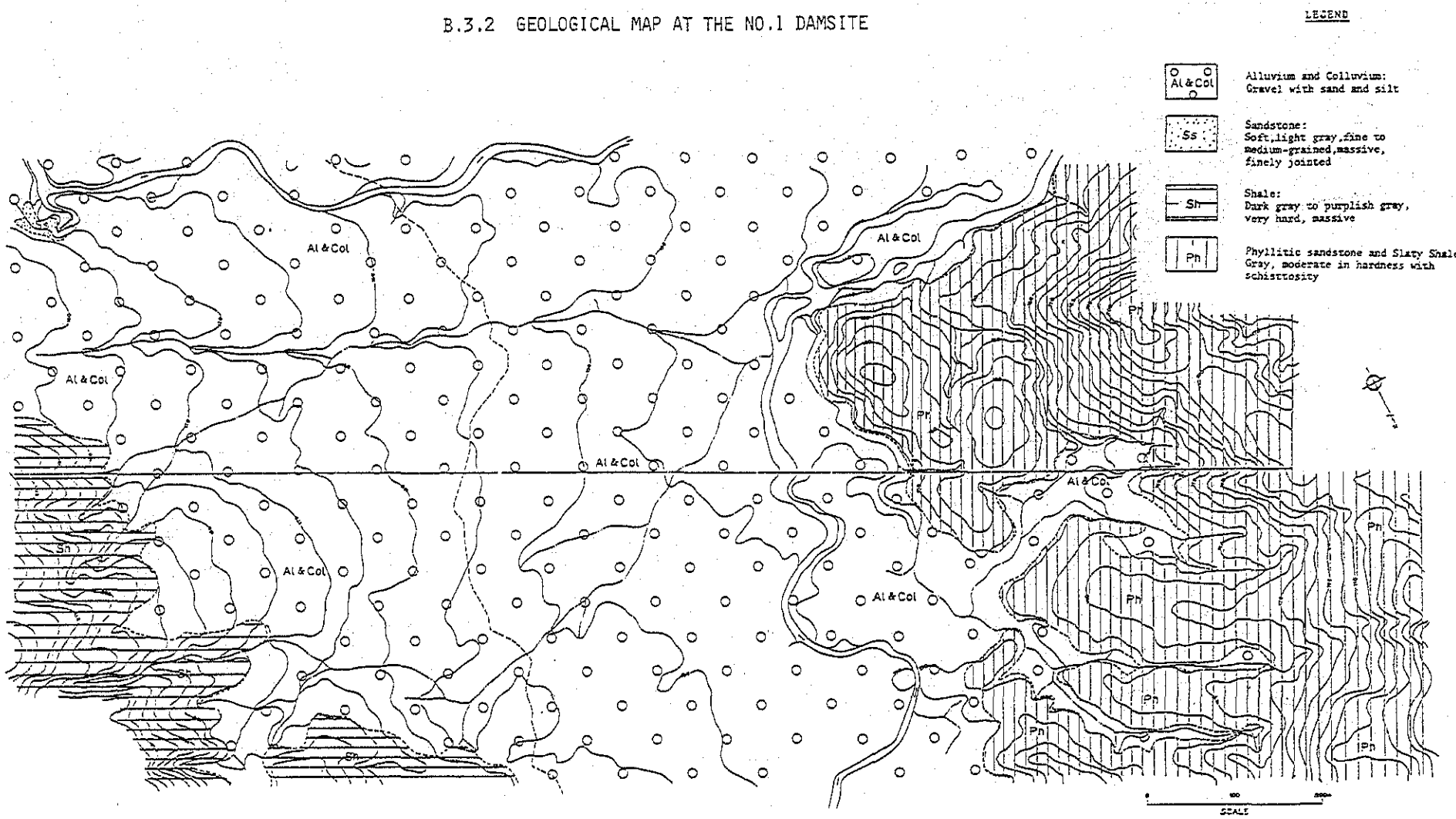
B.2.2. Geology

The damsite and nearby area are underlain by weathered granite except the area along river beds where river deposit lies. The area has sandy surface and soils like laterite are poorly developed. It is presumed that weathered granite which has already become sandy or is easily resolved into sands by a light blow spreads widely in the subsurface part with considerable thickness, maybe reaching more than ten meters.

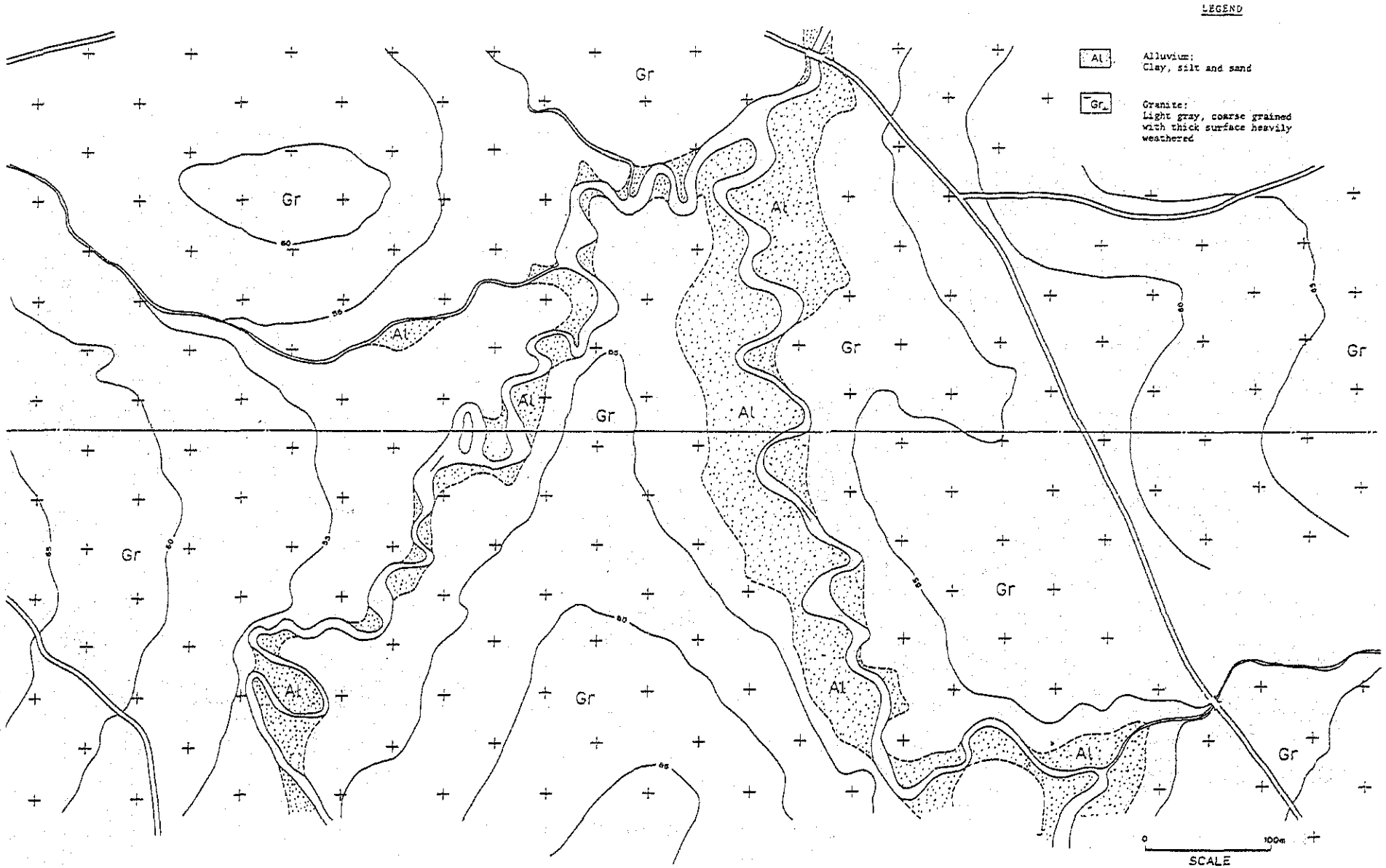
B.3.1 GEOLOGICAL MAP AT THE WHOLE BASIN



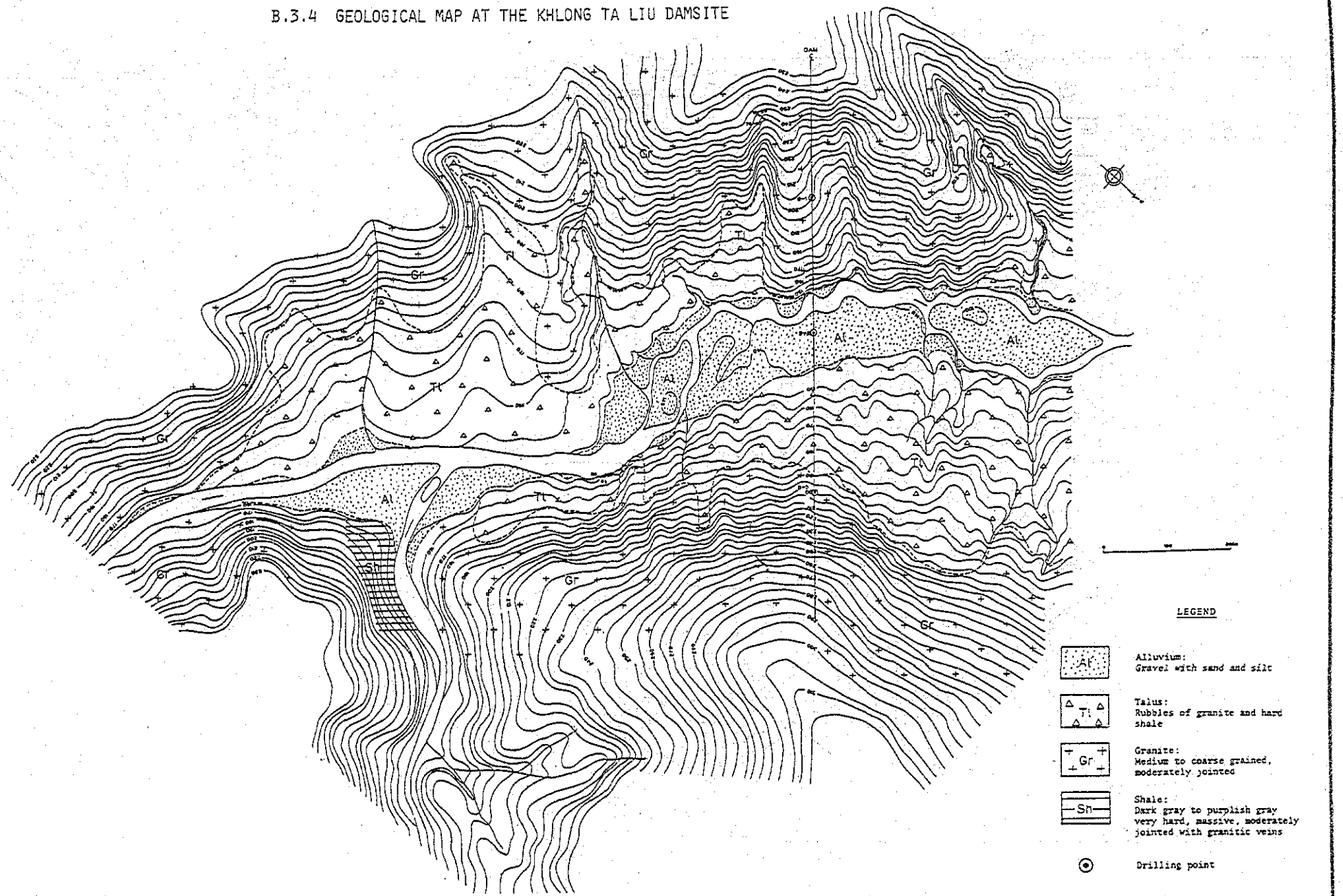
B.3.2 GEOLOGICAL MAP AT THE NO.1 DAMSITE



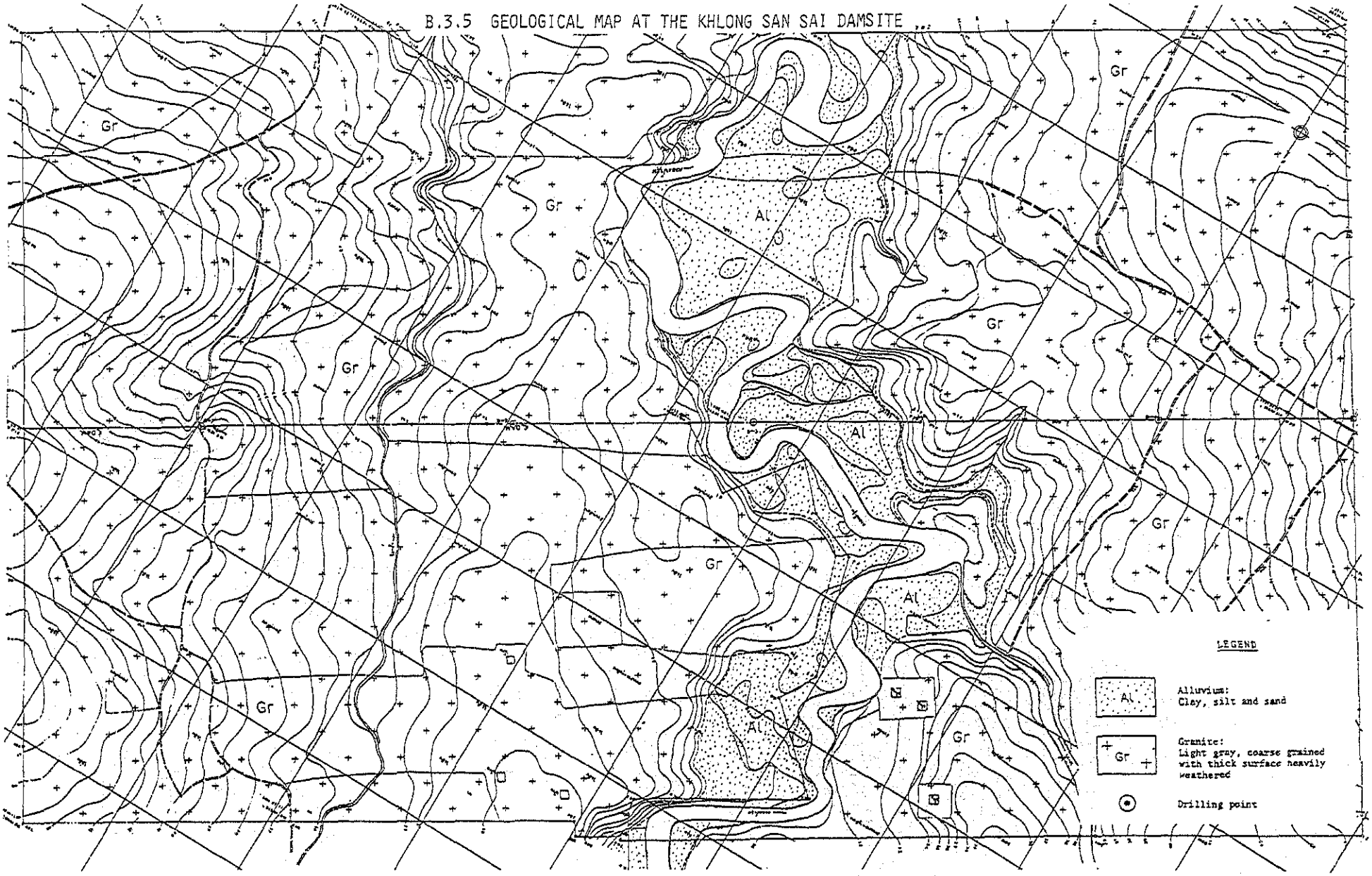
B.3.3 GEOLOGICAL MAP AT THE NO.2 DAMSITE



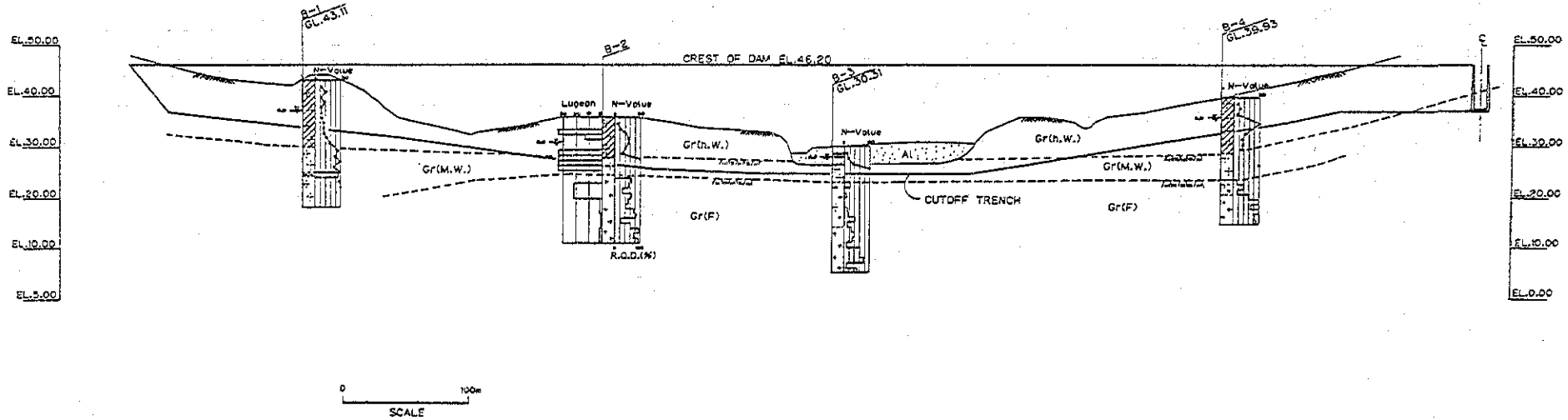
B.3.4 GEOLOGICAL MAP AT THE KHLONG TA LIU DAMSITE



B.3.5 GEOLOGICAL MAP AT THE KHLONG SAN SAI DAMSITE



B.3.6 GEOLOGICAL PROFILE ALONG THE DAM AXIS AT THE KHLONG SAN SAI DAMSITE



LEGEND

Al : Alluvium
Gr : Granite
(h.w.) : Heavily weathered
(M.W.) : Moderately weathered
(F) : Slightly weathered or Fresh

B.4.1. Borehole Log of B-1 at the Khlong San Sai Damsite

PROJECT				SITE	Khlong San Sai Damsite
HOLE NO.	B-1	LOCATION	Left Abutment	GROUND ELEV.	EL.43.11
TOTAL DEPTH	22.0 m	DIP(ANGLE FROM HORIZ.)	Vertical	COMMENCED	COMPLETED
WATER LEVEL	GL.-5.95	FOREMAN		LOGGED BY	CHECKED BY

DATE	ELEVATION (m)	DEPTH (m)	THICKNESS (m)	GRAPHIC LOG	CLASSIFICATION	DESCRIPTION	N-VALUE 10 30 50 / R.Q.D.(%) 0 40 80	LUGEON VALUE 10 20 30 40	NOTES ON WATER LOSSES AND LEVELS, CASING, CEMENTING AND OTHER DRILLING CONDITIONS
						0.00 to 13.00 m Heavily weathered granite			
	41.11	2.00	2.00			0.00 to 2.00 m Laterite, brown, compact crystals and iron concretions; wet in the basal 50 cm	N=13		
	39.11	4.00	2.00		Heavily Weathered Granite	2.00 to 4.00 m Sandy-clay, light yellow to white with brown spots; texture of granite is recognized	20		
						4.00 to 13.00 m Clay, a little sandy light brown to white soft to compact; texture of granite is clearly recognized, feldspars changed to white clay, quartz and a little amount of mica remain unchanged	13		
		WL 5.95▽					19		
							12		
							12		
							13		
							16		R.S.
							16		
							17		
							22		
	30.11	13.00	9.00				29		
						13.00 to 22.00 m: Moderately weathered granite	45		
						13.00 to 18.00 and 18.90 to 20.45 m: Light gray to light brown, easily decomposed sands	40		
					Moderately Weathered Granite		50		
						18.00 to 18.90 m: Light gray, hard, almost fresh	3		
							50		
		18.00				20.45 to 22.00 m: Sandy cuttings	RQD 90%		W.
		18.90					48		R.S.
							50		
	21.11	22.00	9.00						W

Notes: R.S.: Core recovered using Reynore's sampler
W. : Core recovered using core tube with water supplied

B.4.2. Borehole Log of B-2 at the Khlong San Sai Damsite

PROJECT					SITE		
HOLE NO.	B-2	LOCATION	Left Abutment			GROUND ELEV.	———
TOTAL DEPTH	25.0 m	DIP(ANGLE FROM HORIZ.)	Vertical	COMMENCED		COMPLETED	
WATER LEVEL	GL.-5.00	FOREMAN		LOGGED BY		CHECKED BY	

DATE	ELEVATION (m)	DEPTH (m)	THICKNESS (m)	GRAPHIC LOG	CLASSIFICATION	DESCRIPTION	N-VALUE 10 30 50 / R.Q.D.(%) 0 40 80	LUGEON VALUE 10 20 30 40	NOTES ON WATER LOSSES AND LEVELS, CASING, CEMENTING AND OTHER DRILLING CONDITIONS
		2.50	2.50		Heavily weathered granite	0.00 to 25.00 m : Granite 0.00 to 8.00 m : Heavily weathered 0.00 to 2.50 m : Clayey sand; find-grained,brown,moist	N=6 10 21 27 26 20 15 50	0.0	81
		3.50	1.00			2.50 to 3.50 m : Sandy clay;with medium plasticity brown,moist			
		4.00	0.50			3.50 to 4.00 m : Clayey sand;fine- to medium-sized, brown,moist		13	
		WL.5.00				4.00 to 5.50 m : Sandy clay; same as 2.50 to 3.50 m			R.S.
		5.50	1.50			5.00 to 6.15 m : Clayey sand;fine-coarse sized,brown		0.0	
		6.15	0.65			6.15 to 8.00 m : Silty sand;fine to coarse sized,brown			300
		8.00	1.85			8.00 to 11.30 m : Moderately weathered decomposed granite gray			59
					Moderately weathered Granite				190
						11.30 to 12.00m : Lightly weathered 12.00 to 25.00m : Slightly weathered light gray,coated with clay along joint planes;joint dips 50 - 80 - 90 degree			41
		11.30	3.30					2.2	
		12.00	0.70		Lighty W.G.				
							RQD 66%		
							52		
							31	22	
							61		
							53		W
					Granite		42	1.5	
							77		
							56		
							25	1.0	
							60		
							94		
							70	1.8	
							93		
		25.00	13.00						

Notes: R.S.: Core recovered using Reynord's sampler

W : Core recovered using core tube with water supplied

B.4.3. Borehole Log of B-3 at the Khlong San Sai Damsite

PROJECT				SITE	Khlong San Sai Damsite
HOLE NO.	B-3	LOCATION	Near the main-river	GROUND ELEV.	EL.30.31
TOTAL DEPTH	25.0 m	DIP(ANGLE FROM HORIZ.)	Vertical	COMMENCED		COMPLETED	
WATER LEVEL	GL.-2.15	FOREMAN		LOGGED BY		CHECKED BY	

DATE	ELEVATION (m)	DEPTH (m)	THICKNESS (m)	GRAPHIC LOG	CLASSIFICATION	DESCRIPTION	N-VALUE 10 30 50 / R.Q.D.(%) 0 40 80	LUGEON VALUE 10 20 30 40	NOTES ON WATER LOSSES AND LEVELS, CASING, CEMENTING AND OTHER DRILLING CONDITIONS
	29.01	1.30	1.30		Alluvium	0.00 to 1.00 m: Alluvium 0.00 to 1.30 m: Silty sand, brown, fine-grained, very soft, with grass roots	N=0		
	28.16	2.15	0.85		▽WL 2.15	1.30 to 2.15 m: Sandy clay, light brown to yellowsh brown very soft, wet.with fine sand	9		R.S.
	26.81	3.50	1.35		Moderately Weathered Granite	2.15 to 3.50 m: Sand, light brown, a little clayer, coarse to very coarse-grained loose, with fragments of quartz vein	10 50		
	23.31	7.00	3.50		Lightly Weathered Granite	3.50 to 25.00m; Granite 3.50 to 7.00 m: Moderately weathered yellosh gray, easily decomposed to sand; half of feldspars changed to white clay 7.00 to 16.00m: lightly weathered, with less 50% core recovery feldspars a little changed to clay	RQD (core recovery) =0 29) 0 3 22(30) 0 (23) 10(54) 0 (12) 0 30) 13(40 15(37 44(76) 12(50		
	14.31	16.00	9.00		Granite	16.00 to 25.00m: Almost fresh, light gray, hard, coarse-grained with pinkish potassium feldspars with tight cracks dipping 50 to 70 degrees from horizontal, not contaminated by iron	39(69) 42(86) 34(89) 10(90) 67(100) 63(100) 78(90) 10(65)		W
	5.31	25.00	9.00				53(53)		

Notes: R.S: Core recovered using Reynord's sampler
W : Core recovered using core tube with water supplied

B.4.4. Borehole Log of B-4 at the Khlong San Sai Damsite

PROJECT				SITE	Khlong San Sai Damsite
HOLE NO.	B-4	LOCATION	Right Abutment	GROUND ELEV.	EL.39.93
TOTAL DEPTH	25.0 m	DIP(ANGLE FROM HORIZ.)	Vertical	COMMENCED	COMPLETED
WATER LEVEL	GL.-3.85	FOREMAN		LOGGED BY	CHECKED BY

DATE	ELEVATION (m)	DEPTH (m)	THICKNESS (m)	GRAPHIC LOG	CLASSIFICATION	DESCRIPTION	N-VALUE 10 30 50 / R.Q.D.(%) 0 40 80	LUGEON VALUE 10 20 30 40	NOTES ON WATER LOSSES AND LEVELS, CASING, CEMENTING AND OTHER DRILLING CONDITIONS
	37.43	2.50	2.50		Heavily Weathered Granite	0.00 to 25.00 m: Granite 0.00 to 11.00 m: Heavily weathered granite 0.00 to 2.50 m: Sandy-clay or calyer sand, gray and brown, with iron concretions sand medium size	N=8, 12, 8		
		WL 3.85 ▽				2.50 to 5.50 m: Clayer sand, light ... gray to light brown with trace of iron concretions, with fragments of quartz vein	28, 50		R.S
	34.43	5.50	3.00			5.50 to 11.00 m: Sandy clay, light brown, brown, white and light gray, soft texture of a granite is clearly recognize feldspars changed to white clay quartz an a little amount of mica remain unchange	24, 17, 18, 15		
	28.93	11.00	5.50		Moderately Weathered Granite	11.00 to 16.00 m: Moderately weathered gray, coarse to very coarse grained, easily decomposed to sands with white clayer feldspars			W
						16.00 to 19.00 m: *Lightly weathered* with less 40% core recovery; feldspars a little changed to clay	50		R.S W
	23.93	16.00	5.00		Lightly Weathered Granite	19.00 to 25.00 m: Almost fresh, light gray, hard, coarse-grained, with tight diagonal cracks, with almost no contamination of iron	0(0 core recovery) 15(16 40(40 15(30 63(75) 100(100) 70(100) 100(100) 86(100) 90(100)		R.S
	20.93	19.00	3.00						W
					Granite				
	14.93	25.00	6.00						

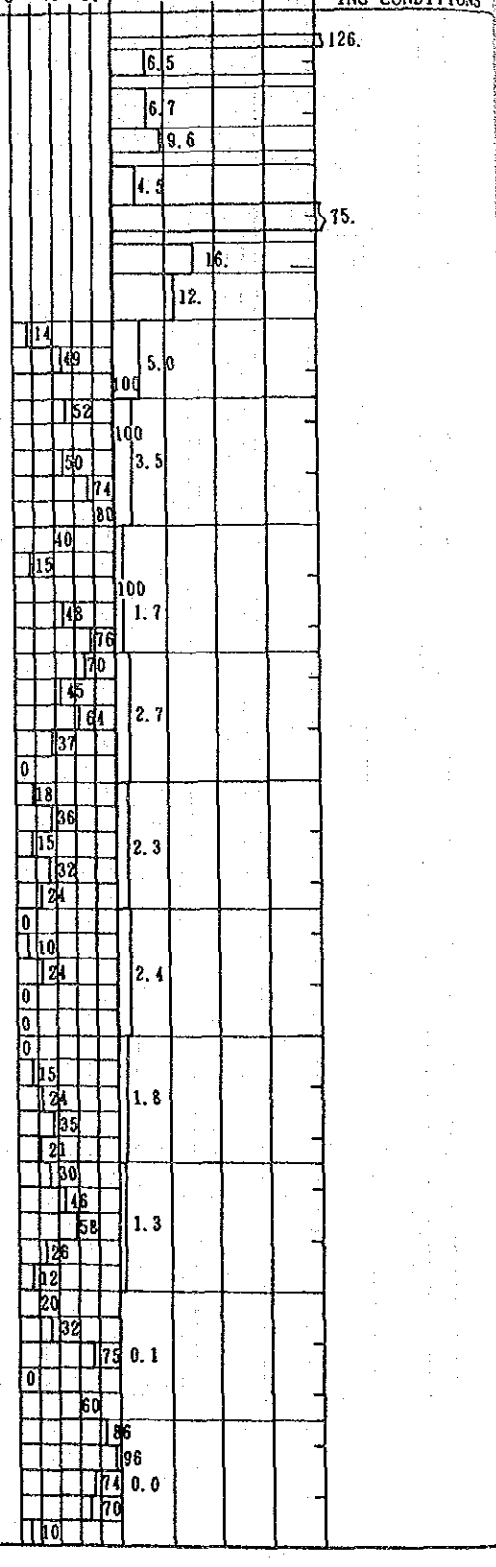
Notes: R.S.: Core recovered using Reynold's sampler
W: Core recovered using core tube with water supplied

B.4.5 Borehole Log of B-1 at the Khlong Ta Liu Damsite (Cont'd)

PROJECT				SITE	
HOLE NO.	B-1	LOCATION	Left abutment	GROUND ELEV.	
TOTAL DEPTH	80.0m	DIP(ANGLE FROM HORIZ.)	Vertical	COMMENCED	COMPLETED
WATER LEVEL	GL.-19.60	FOREMAN		LOGGED BY	CHECKED BY

DATE	ELEVATION (m)	DEPTH (m)	THICKNESS (m)	GRAPHIC LOG	CLASSIFICATION	DESCRIPTION
		2.00	2.00		Talus deposit	0.00 to 2.00m Talus deposit: Silty sand with cobble and boulder.
		10.15	8.15		Heavily weathered granite	2.00 to 10.15m Heavily weathered granite: Yellowish brown, medium to coarse grained, soft, crumble; penetrated sample.
		12.00	1.85		Highly weathered granite	10.15 to 12.00m Highly weathered granite: Brownish gray, stained with Fe-oxide; crumble core.
		19.60 ▽			Granite	12.00 to 80.00m Granite: Light gray, medium to coarse grained; biotite and hornblende contained; joints stained with Fe-oxide (13.50-24.00m, 27.00-28.00m, 40.00-41.00m), coated with chlorite (20.00-22.00m, 25.00-30.00m, 42.00-46.00m, 54.00-55.00m, 58.00-80.00m), coated with clay; joint dip 15-20, 30, 45, 60, 70, 85-90 degrees.

N-VALUE 10 30 50 | R.Q.D.(%) 0 40 80 | LUGEON VALUE 10 20 30 40 | NOTES ON WATER LOSSES AND LEVELS, CASING, CEMENTING AND OTHER DRILLING CONDITIONS



B.4.5 Borehole Log of B-1 at the Khlong Ta Liu Damsite

PROJECT				SITE			
HOLE NO.	B-1	LOCATION	Left abutment			GROUND ELEV.	
TOTAL DEPTH	80.0m	DIP(ANGLE FROM HORIZ.)	Vertical	COMMENCED		COMPLETED	
WATER LEVEL	GL.-19.60	FOREMAN		LOGGED BY		CHECKED BY	

DATE	ELEVATION (m)	DEPTH (m)	THICKNESS (m)	GRAPHIC LOG	CLASSIFICATION	DESCRIPTION	N-VALUE 10 30 50 / R.Q.D.(%) 0 40 80	LUGEON VALUE 10 20 30 40	NOTES ON WATER LOSSES AND LEVELS, CASING, CEMENTING, AND OTHER DRILLING CONDITIONS
					Granite		90 0 22 32 24 28 12 10 62 67 27 85 36 65 45 64 80 38 73 22	0.3 0.3 0.4 0.0	
		80.00	68.00						

B.4.6. Borehole Log of B-2 at the Khlong Ta Liu Damsite (Cont'd)

PROJECT				SITE	
HOLE NO.	B-2	LOCATION	Side of riverbed	GROUND ELEV.	EL.143.34
TOTAL DEPTH	91.0 m	DIP(ANGLE FROM HORIZ.)	Vertical	COMMENCED	COMPLETED
WATER LEVEL	GL.-3.10	FOREMAN		LOGGED BY	CHECKED BY

DATE	ELEVATION (m)	DEPTH (m)	THICKNESS (m)	GRAPHIC LOG	CLASSIFICATION	DESCRIPTION	N-VALUE 10 30 50 / R.Q.D.(%) 0 40 80	LUGEON VALUE 10 20 30 40	NOTES ON WATER LOSSES AND LEVELS, CASING, CEMENTING AND OTHER DRILLING CONDITIONS
		0.60			Alluvium	0.00 to 8.00 m : Alluvium 0.00 to 0.60 m : Silty sand;fine-grained,brown,dry 0.60 to 8.00 m : Gravel;cobble to boulder sized granite and meta-sandstone 8.00 to 26.00m : Meta-sandstone (thermally metamorphosed sandstone) greenish gray,massive well-cemented,brittle with gravelly caves and calcite veinlets joint dipping in 5-15-35			270 690 470 520 190 130 72 51
		NL 3.10							
	135.34	8.00	8.00						
					Meta-sandstone			1.8 1.6 0.0 0.0	
	117.34	26.00	18.0						
					Granite	26.00 to 91.00 m : Granite (Hornblende biotite ganite),light gray, medium to coarse-grained,mostly moderate to hard in hardness(but soft at 37 to 40 m,44 to 45, 56 to 57,59 to 66 and 76 to 77 m), coloured minerals partly altered to chlorite,with calcite and clay coated joint dipping 15-25-35-40-45-65-75 and 90 degree		0.0 3.9 0.0 0.0 0.0 0.0 1.0 0.0	

B.4.6. Borehole Log of B-2 at the Khlong Ta Liu Damsite

PROJECT				SITE			
HOLE NO.	B-2	LOCATION	Side of riverbed			GROUND ELEV.	EL.143.34
TOTAL DEPTH	91.0 m	DIP(ANGLE FROM HORIZ.)	Vertical	COMMENCED		COMPLETED	
WATER LEVEL	GL.-3.10	FOREMAN		LOGGED BY		CHECKED BY	

DATE	ELEVATION (m)	DEPTH (m)	THICKNESS (m)	GRAPHIC LOG	CLASSIFICATION	DESCRIPTION	N-VALUE 10 30 50 / R.Q.D.(%) 0 40 80	LUGEON VALUE 10 20 30 40	NOTES ON WATER LOSSES AND LEVELS, CASING, CEMENTING AND OTHER DRILLING CONDITIONS
	52.34	91.0	65.0		Granite		0, 33, 0, 6, 0, 0, 0, 0, 36, 57, 71, 97, 26, 0, 0, 0, 0, 0, 27, 0, 29, 0, 0, 19, 0, 0, 10, 28, 57, 60, 64	0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0	

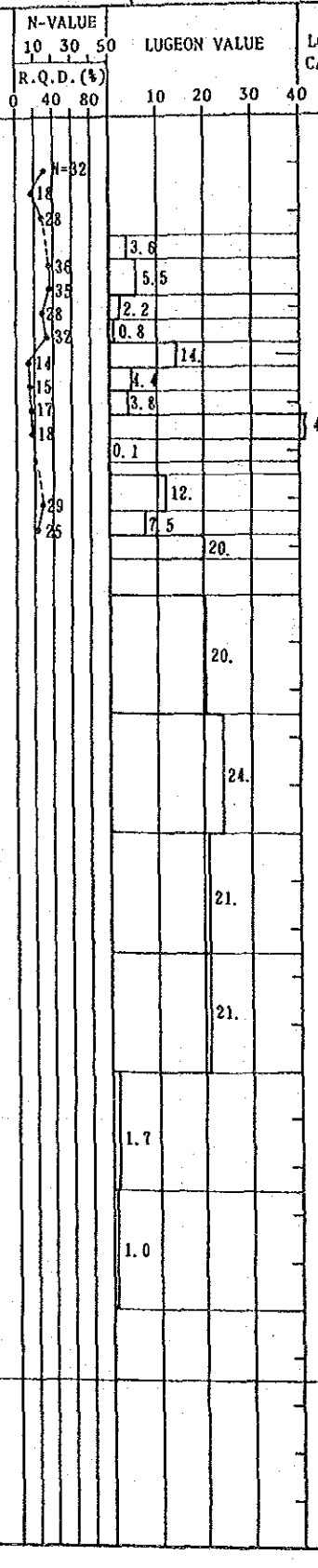
B.4.7 Borehole Log of B-3 at the Khlong Ta Liu Damsite

PROJECT		SITE			
HOLE NO.	B-3	LOCATION	Right abutment	GROUND ELEV.	EL. 200.17
TOTAL DEPTH	53.0m	DIP(ANGLE FROM HORIZ.)	Vertical	COMMENCED	COMPLETED
WATER LEVEL	GL.-11.60	FOREMAN		LOGGED BY	CHECKED BY

DATE	ELEVATION (m)	DEPTH (m)	THICKNESS (m)	GRAPHIC LOG	CLASSIFICATION	DESCRIPTION
	194.17	6.00	6.00		Talus deposit	0.00 to 6.00m Talus deposit: Silty sand to sandy silt with cobble and boulder; yellowish brown to brown, moist;roots in the upper part.
					Heavily weatherd granite	6.00 to 19.00m Heavily weathered granite: Silty sand to sandy silt with remnant rocks;almost no plasticity fines contained;brown to yellowish brown, moist.
			11.60 ▽			
	181.17	19.00	13.00			
	179.17	21.00	2.00		Granite	19.00 to 21.00m Granite
					Meta-sandstone	21.00 to 27.30m Meta-sandstone
	172.87	27.30	6.30			
	172.17	28.00	0.70		Granite	27.30 to 28.00m Granite
					Meta-sandstone	28.00 to 32.34m Meta-sandstone
	167.83	32.34	4.34			
					Granite	32.34 to 36.10m Granite
	164.07	36.10	3.76			
					Meta-sandstone	36.10 to 36.50m Meta-sandstone
	163.67	36.50	0.40			
					Granite	36.50 to 46.80m Granite
	153.37	46.80	10.30			
					Meta-sandstone	46.80 to 53.00m Meta-sandstone
	147.17	53.00	6.20			

Granite:
Slightly to moderately weathered, light gray, hard, jointed with dips 10 to 20, and 40 to 90 degrees;xenolith of meta-sandstone contained;joint planes stained with Fe-oxide or coated with chlorite and clay.

Meta-sandstone:
Slightly to moderately weathered, light gray to brownish gray, hard, fine grained, bedded to massive; bedding dip 75 degrees; jointed with various angles; joints stained with Fe-oxide and coated with calcite.



NOTES ON WATER LOSSES AND LEVELS, CASING, CEMENTING AND OTHER DRILLING CONDITIONS

B.5. Recommendation

The following survey and test are recommended in order to obtain more detail data before the implementation as pre-engineering.

B.5.1 Storage Dam

(1) Khlong San Sai Dam

1) Topo-survey

Topo-map of spillway	:	Scale 1:1000
Torp-map of borrow area	:	Scale 1:1000

2) Drilling of Borehole

Dam axis	:	2 No. x 25 m = 50 m
Spillway axis	:	3 No. x 25 = 75
Outlet axis	:	2 No. x 25 = 50
Total		175 m

3) Borrow Area Investigation

Test pits at the borrow area should be excavated by Backhoe in order to grasp the conservative quantity and take samples for material test.

Number of test pit is planned about 50 places on the 100 m interval grid.

4) Material Test

Ten (10) representative samples for laboratory test should be taken from test pits and the following impervious material test should be conducted.

Items of Test	Standard of Test
a) Physical test	
Moisture content test	ASTM D2216
Specific gravity test	ASTM D854
Grain size analysis test	ASTM D422
Liquid limit test	ASTM D424
Plastic limit test	ASTM D427
Shrinkage limit test	ASTM D427
b) Mechanical test	
Compaction test	ASTM D698
Permeability test	ASTM D2434
Consolidation test	ASTM D2435
Triaxial compressive strength test	ASTM D2850 (C-U) & (U-U)

Notes: * Physical test is applied for ten (10) samples.
* Mechanical test is applied for five (5) samples selected from among ten (10) samples.

(2) Khlong Ta Liu Dam

1) Topo-survey

Topo-map of the right abutment and downstream area at the damsite should be added from the result of damsite reconnaissance.

The range is as follows;

Right abutment: Additional survey 200 m to the mountain side more than EL. 250 m

Downstream area: Range of 400 m to 800 m from the dam center

Scale is 1:1000

Borrow area and Quarry site: Scale 1:1000

2) Geological Survey

a) Drilling of borehole

Dam axis : 4 No. x 50 m = 200 m

Notes: 1 borehole at the riverbed among 4 boreholes should be conducted by drilling of inclined degree 60.

100 m upstream at the riverbed from dam center
: 1 No. x 50 m = 50 m

100 m downstream at the riverbed from dam center
: 4 No. x 30 m = 120 m

Diversion tunnel center: Inlet
1 No. x 20 m = 20 m
Outlet
1 No. x 30 m = 30 m

Quarry site : 2 No. x 50 m = 100 m

Total = 570 m

b) Seismic exploration

Dam axis	:	1 line	1,000 m
300 m upstream to dam axis	:	1 line	800 m
300 m downstream parallel to dam axis	:	1 line	800 m
Along the river right angle to dam axis	:	1 line	1,000 m
Route of spillway center	:	3 lines	900 m
Quarry site	:	1 line	400 m
Total			4,900 m

3) Borrow Area Investigation

The purpose is same as Item 3) of the Khlong San Sai dam. Number of test pit is planned about 100 places on the 100 m interval grid.

Semi-pervious material investigation should be conducted by excavation of five (5) test pits of 5 m depth.

4) Material Test

Twenty (20) representative samples for laboratory test should be taken from test pits concerning impervious material.

Semi-pervious material takes five (5) samples from test pits at the quarry site.

Pervious material (Rock) sample uses cores obtained from by drilling works. Number of sample planned ten (10) samples.

Testing items of each material are as follows;

Testing items of impervious material is same as items of the Khlong San Sai Dam. Where, physical test is applied for twenty (20) samples. Mechanical test is applied for ten (10) samples selected from among twenty (20) samples.

Semi-pervious material test

Items of Test	Standard of Test
a) Physical test	
Moisture content test	ASTM D2216
Specific gravity test	ASTM D854
Grain size analysis test	ASTM D422
b) Mechanical test	
Compaction test (Large size mold)	ASTM D698
Permeability test (ditto)	ASTM D2434
Triaxial compressive strength test (Large size specimen)	ASTM D2850 (C-U)

Rock Material test

Absorption & Bulk density	ASTM C97
Sodium sulfate soundness	ASTM C88
Compressive strength	ASTM D2938

B.5.2 Irrigation Facilities

(1) Diversion Dam

1) Topo-survey

Damsite Scale: 1: 500 Area: 15,000 m^2

2) Survey of longitudinal and cross section of the river

The range is 1.0 km to upstream and downstream from the dam axis

Scale: 1: 1000

3) Drilling of borehole

Dam axis : 2 No. x 15 m = 30 m

(2) Main Pipeline

1) Topo-survey

At the place of crossing point on the Chanthaburi river

Scale: 1: 500 Area: 20,000 m^2

2) Route survey

Main pipeline L=115 km Scale: Vertical 1: 200
Horizontal 1: 1000

3) Geological survey

a) Test-pit : 70 No. x 5 m = 350 m

b) Drilling of borehole : 2 No. x 20 m= 40 m

At the place of crossing point on the Chanthaburi river

(3) Regulating reservoir (3 places)

1) Topo-survey : 3 places x 10,000 = 30,000 m^2

2) Drilling of borehole

Reservoir : 3 No/place x 15 m = 45 m

(4) Pumping Facilities (3 places)

1) Topo-survey : 3 places x 5,000 = 15,000 m^2

2) Route survey L= 9.3 km Scale: Vertical 1:200
Horizontal 1:1000

3) Drilling borehole

Pumping station : 3 No/place x 15 m = 45 m

APPENDIX-C. FILL MATERIALS

APPENDIX-C FILL MATERIALS

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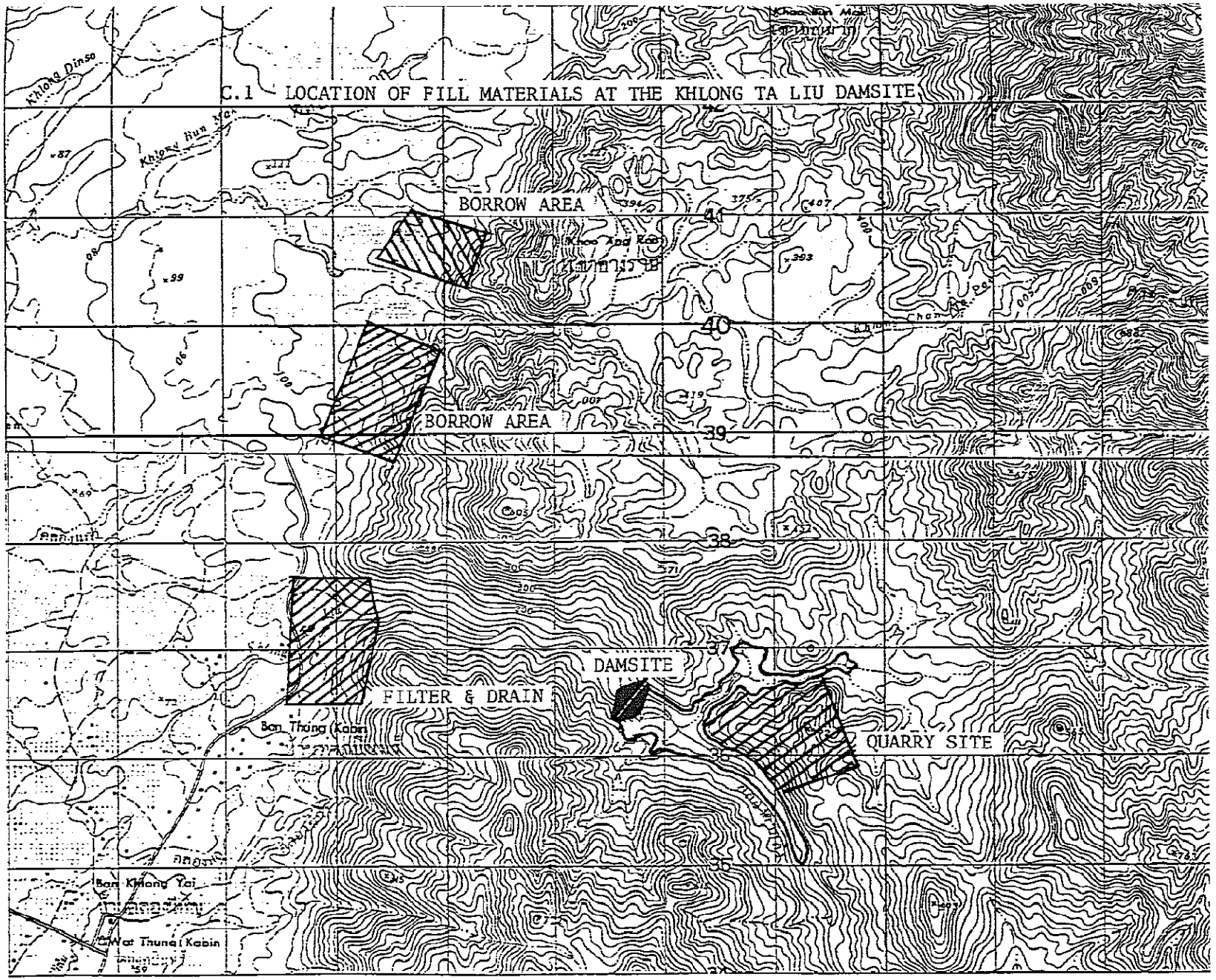

C.1 LOCATION OF FILL MATERIALS AT THE KHLONG TA LIU DAMSITE