

表 3.2.8 ムリリップでの流量帰属とアルニンでの流量記録との差

		(Unit: m ³ /s)			
Year		1980	1981	1982	1983
Jan.	-1	27.54	42.85	54.9	21.1
	-2	48.17	22.62	53.3	20.3
	-3	66.02	33.81	34.7	11.5
Feb.	-1	34.64	33.26	61.1	27.8
	-2	55.58	27.99	38.8	17.4
	-3	91.42	16.29	38.3	38.9
Mar.	-1	40.05	60.27	48.8	41.5
	-2	32.45	33.26	54.0	20.3
	-3	27.42	13.81	25.8	28.7
Apr.	-1	15.45	11.99	38.4	30.9
	-2	33.54	19.73	40.7	18.2
	-3	29.82	19.93	31.4	18.6
May	-1	24.94	30.17	21.5	30.8
	-2	16.25	26.27	8.0	10.9
	-3	11.05	19.47	7.0	18.3
Jun.	-1	5.72	17.11	6.3	4.8
	-2	4.37	16.19	5.9	5.9
	-3	5.40	24.33	9.6	6.0
Jul.	-1	-	9.06	8.7	7.1
	-2	-	16.13	5.7	5.5
	-3	-	11.15	5.1	3.2
Aug.	-1	3.08	14.81	3.7	3.8
	-2	6.35	7.46	5.7	5.0
	-3	-	10.77	2.9	5.9
Sep.	-1	4.46	9.74	3.5	4.6
	-2	4.70	7.99	3.0	3.5
	-3	3.20	12.49	5.3	4.9
Oct.	-1	-	5.99	4.4	5.5
	-2	-	3.72	3.7	5.0
	-3	-	4.40	2.4	5.5
Nov.	-1	-	5.10	1.9	6.2
	-2	-	8.95	1.7	14.5
	-3	-	13.97	3.8	26.6
Dec.	-1	-	30.80	6.4	12.2
	-2	-	51.36	10.2	13.6
	-3	-	29.46	11.8	23.6

表

3.2.9

ジャポーンブルニンにおける利用可能水量

Unit : m³/s

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
JAN + 1	317.24	343.15	359.56	449.23	427.37	333.83	506.98	329.83	442.93	319.53
+ 2	318.36	348.12	364.96	454.13	432.26	338.73	511.88	334.73	447.83	324.43
+ 3	319.48	353.09	370.36	459.03	437.16	343.63	516.78	339.63	452.73	329.33
MEAN	319.12	347.18	367.62	454.14	437.14	343.63	516.78	339.63	452.73	329.33
FEB + 1	349.35	449.31	454.24	544.23	344.23	340.81	349.27	324.48	393.33	363.33
+ 2	350.35	454.31	459.24	549.23	349.23	345.71	354.27	329.38	398.23	368.23
+ 3	351.35	459.31	464.17	554.13	354.13	350.64	359.26	334.28	403.08	373.08
MEAN	349.83	454.22	459.19	549.13	349.13	345.71	354.27	329.38	398.23	368.23
MAR + 1	445.88	333.27	327.98	447.23	314.23	430.83	336.93	444.33	344.18	479.72
+ 2	446.88	338.27	332.98	452.23	319.23	435.73	341.83	449.23	349.08	484.62
+ 3	447.88	343.27	337.98	457.23	324.23	440.63	346.73	454.13	353.93	489.47
MEAN	445.83	333.27	327.98	447.23	314.23	430.83	336.93	444.33	344.18	479.72
APR + 1	448.29	243.36	243.71	243.42	243.36	447.64	447.64	243.36	243.36	448.29
+ 2	449.29	248.36	248.10	248.36	248.29	452.54	452.54	248.29	248.29	453.29
+ 3	450.29	253.36	253.04	253.36	253.29	457.44	457.44	253.29	253.29	458.29
MEAN	448.74	246.36	246.04	246.36	246.29	450.54	450.54	246.29	246.29	449.74
MAY + 1	368.88	319.17	321.73	314.76	316.17	327.17	324.17	329.13	313.16	321.88
+ 2	369.88	324.17	326.73	319.76	321.17	332.07	329.07	334.03	318.16	326.88
+ 3	370.88	329.17	331.73	324.76	326.17	336.97	334.07	338.99	323.16	331.88
MEAN	369.12	324.17	326.73	319.76	321.17	332.07	329.07	334.03	318.16	326.88
JUN + 1	245.70	98.44	131.34	93.48	317.23	316.23	212.81	317.63	147.44	147.23
+ 2	246.70	103.44	136.34	98.48	322.13	321.13	217.71	322.53	152.34	152.13
+ 3	247.70	108.44	141.34	103.48	327.03	326.03	222.61	327.43	157.24	157.03
MEAN	246.12	101.44	134.34	96.48	320.13	319.13	215.13	321.13	149.24	149.03
JUL + 1	87.83	78.43	78.43	87.83	87.83	87.83	87.83	87.83	87.83	87.83
+ 2	87.83	83.43	83.43	97.23	97.23	97.23	97.23	97.23	97.23	97.23
+ 3	87.83	88.43	88.43	106.63	106.63	106.63	106.63	106.63	106.63	106.63
MEAN	87.83	83.43	83.43	97.23	97.23	97.23	97.23	97.23	97.23	97.23
AUG + 1	72.93	58.43	58.43	58.43	58.43	58.43	58.43	58.43	58.43	58.43
+ 2	72.93	63.43	63.43	63.43	63.43	63.43	63.43	63.43	63.43	63.43
+ 3	72.93	68.43	68.43	68.43	68.43	68.43	68.43	68.43	68.43	68.43
MEAN	72.93	60.43	60.43	60.43	60.43	60.43	60.43	60.43	60.43	60.43
SEP + 1	87.77	47.76	47.76	47.76	47.76	47.76	47.76	47.76	47.76	47.76
+ 2	87.77	52.76	52.76	52.76	52.76	52.76	52.76	52.76	52.76	52.76
+ 3	87.77	57.76	57.76	57.76	57.76	57.76	57.76	57.76	57.76	57.76
MEAN	87.77	50.76	50.76	50.76	50.76	50.76	50.76	50.76	50.76	50.76
OCT + 1	393.88	43.29	43.29	43.29	43.29	43.29	43.29	43.29	43.29	43.29
+ 2	393.88	48.29	48.29	48.29	48.29	48.29	48.29	48.29	48.29	48.29
+ 3	393.88	53.29	53.29	53.29	53.29	53.29	53.29	53.29	53.29	53.29
MEAN	393.88	48.29	48.29	48.29	48.29	48.29	48.29	48.29	48.29	48.29
NOV + 1	374.34	34.70	34.70	34.70	34.70	34.70	34.70	34.70	34.70	34.70
+ 2	374.34	39.70	39.70	39.70	39.70	39.70	39.70	39.70	39.70	39.70
+ 3	374.34	44.70	44.70	44.70	44.70	44.70	44.70	44.70	44.70	44.70
MEAN	374.34	39.70	39.70	39.70	39.70	39.70	39.70	39.70	39.70	39.70
DEC + 1	368.36	24.39	24.39	24.39	24.39	24.39	24.39	24.39	24.39	24.39
+ 2	368.36	29.39	29.39	29.39	29.39	29.39	29.39	29.39	29.39	29.39
+ 3	368.36	34.39	34.39	34.39	34.39	34.39	34.39	34.39	34.39	34.39
MEAN	368.36	29.39	29.39	29.39	29.39	29.39	29.39	29.39	29.39	29.39

表 3.2.10 ジャボン-アルニンにおける利用可能水量(乾季・雨季別)

(Unit: MCM)

Year	Annual (Dec - Nov)	Wet Season (Dec - May)	Dry Season (Jun - Nov)
1963/64	8,176.3	5,380.6	2,795.7
64/65	5,305.9	4,438.8	867.1
65/66	6,841.7	5,813.1	1,028.6
66/67	7,011.2	6,161.2	850.0
67/68	9,883.9	6,881.0	3,002.9
68/69	8,028.3	6,817.7	1,210.6
69/70	7,275.8	6,024.1	1,251.7
70/71	8,367.5	6,126.1	2,241.4
71/72	6,360.2	5,449.1	911.1
72/73	8,482.4	6,274.8	2,207.7
73/74	7,270.2	5,512.2	1,758.0
74/75	11,336.8	8,059.8	3,277.0
75/76	7,607.5	6,394.9	1,212.6
76/77	5,098.8	4,282.0	816.8
77/78	8,217.9	5,831.1	2,386.7
78/79	8,942.2	6,951.1	1,991.1
79/80	5,345.5	4,227.5	1,118.0
80/81	7,724.1	6,091.6	1,632.5
81/82	6,942.3	6,108.8	833.5
82/83	8,383.1	6,574.0	1,809.2
Ave.	7,630.1	5,970.0	1,660.1
Max.	11,336.8	8,059.8	3,277.0
Min.	5,098.8	4,227.5	816.8

表 3.2.11 1日、3日確率雨量

NAME	C.A (SQ.KM)	2-YEAR		5-YEAR		10-YEAR		25-YEAR		50-YEAR		100-YEAR	
		1-D	3-D	1-D	3-D	1-D	3-D	1-D	3-D	1-D	3-D	1-D	3-D
P. 8	2050.	49.	83.	68.	108.	81.	129.	98.	147.	110.	162.	122.	178.
C.14	2890.	47.	82.	65.	107.	77.	124.	91.	146.	102.	162.	113.	178.
C.15	3017.	46.	88.	63.	111.	76.	127.	90.	146.	101.	161.	112.	176.
C.16	3407.	45.	84.	62.	106.	73.	121.	87.	141.	97.	153.	107.	167.
C.17	3485.	45.	82.	61.	102.	72.	115.	85.	131.	95.	144.	105.	156.
C.18	3662.	45.	82.	60.	103.	71.	117.	84.	135.	94.	148.	104.	161.
C.21	4020.	43.	81.	57.	102.	66.	117.	78.	134.	87.	147.	96.	160.
C.22	4488.	45.	86.	59.	106.	69.	119.	81.	135.	89.	147.	98.	160.
C.23	4554.	41.	80.	55.	99.	65.	112.	76.	128.	85.	140.	93.	152.
C.26	4779.	42.	81.	54.	98.	63.	109.	73.	123.	81.	134.	88.	144.
C.27	5072.	41.	78.	53.	96.	61.	108.	71.	123.	78.	135.	86.	146.
C.31	5758.	40.	77.	52.	92.	60.	103.	70.	115.	77.	125.	84.	134.
C.32	7297.	39.	77.	49.	91.	55.	100.	63.	111.	69.	119.	75.	128.
C.35	7519.	38.	75.	48.	88.	54.	97.	62.	107.	68.	116.	74.	124.
C.36	7749.	38.	75.	47.	88.	53.	97.	60.	108.	66.	117.	71.	125.
C.38	8727.	38.	76.	46.	88.	52.	96.	59.	106.	64.	114.	69.	121.
C.39	9195.	36.	71.	44.	83.	50.	90.	56.	100.	62.	107.	67.	114.
C.28	236.	69.	118.	90.	148.	103.	169.	121.	192.	133.	213.	146.	232.
C.30	686.	50.	92.	63.	110.	72.	122.	83.	140.	91.	147.	99.	158.
C.25	225.	66.	104.	81.	123.	90.	136.	103.	155.	112.	164.	121.	175.
C.13	200.	67.	113.	82.	145.	93.	167.	106.	192.	115.	212.	125.	232.
C.20	240.	59.	105.	79.	133.	92.	151.	108.	175.	120.	192.	132.	209.
P.81	1538.	55.	89.	64.	115.	72.	131.	79.	153.	88.	168.	95.	184.
C.63	1304.	56.	95.	69.	119.	78.	134.	89.	154.	97.	168.	105.	183.
C.64	1261.	56.	96.	69.	121.	77.	137.	88.	158.	96.	173.	104.	189.
C.72	590.	60.	100.	74.	130.	83.	149.	94.	170.	102.	191.	110.	209.
C.75	520.	58.	98.	71.	127.	80.	147.	92.	172.	101.	190.	109.	208.
P.76	444.	61.	101.	75.	134.	85.	156.	97.	183.	106.	204.	114.	224.
C.66	528.	61.	104.	74.	128.	83.	144.	94.	164.	103.	179.	111.	193.
C.67	112.	83.	124.	99.	164.	110.	191.	123.	226.	133.	251.	143.	276.
C.68	416.	68.	105.	85.	127.	97.	142.	112.	160.	122.	174.	133.	187.
C.69	275.	62.	108.	77.	139.	87.	159.	100.	184.	110.	203.	119.	222.
C.70	141.	83.	132.	105.	164.	120.	185.	138.	211.	152.	232.	165.	251.
C.71	73.	111.	133.	148.	206.	159.	236.	184.	273.	202.	300.	220.	328.
C.40	177.	77.	121.	103.	153.	120.	174.	141.	201.	157.	221.	172.	240.

REMARKS : 1-D --- 1-DAY PROBABLE RAINFALL (MM)
 3-D --- 3-DAY PROBABLE RAINFALL (MM)
 C.A. --- CATCHMENT AREA
 P.8 --- KARANGKATES DAM
 C.14 --- PAKEL
 C.22 --- KEDERI
 C.35 --- PLOSO
 C.38 --- LENGKONG DAM
 C.39 --- PORONG

表

3.2.12

流域貯留関数

Basin No.	Catchment Area (km ²)	K	P	T ₁	Basin No.	Catchment Area (km ²)	K	P	T ₁
1.	760.2	15		0	33.	468.2	40		1
2.	156.5	20		0	34.	176.8	40		1
3.	24.5	20		0	35.	82.8	43		1
4.	271.1	20		0	36.	53.6	43		1
5.	381.1	20		1	37.	43.6	32		0
6.	221.0	20		0	38.	77.5	40		0
7.	236.1	20		1	39.	225.9	66		1
8.	159.5	20		1	40.	159.4	55		0
9.	211.7	25		1	41.	122.8	54		1
10.	244.5	25	0.33	1	42.	18.3	24	0.33	0
11.	83.5	25		0	43.	53.5	38		0
12.	116.0	25		0	44.	81.2	38		0
13.	24.3	25		0	45.	53.8	36		0
14.	127.0	30		1	46.	58.7	30		0
15.	393.0	40		2	47.	212.2	40		1
16.	69.9	30		1	48.	91.6	38		0
17.	163.7	30		0	49.	88.3	38		0
18.	59.4	30		0	50.	234.7	60		3
19.	109.5	30		0	51.	43.4	35		0
20.	435.7	35		1	52.	143.0	25		1
21.	61.8	35		0	53.	112.0	25		1
22.	138.2	35		0	54.	275.3	40		2
23.	115.1	40		0	55.	68.3	40		1
24.	330.7	45		1	56.	73.0	30		1
25.	114.4	45		0	57.	42.5	35		0
26.	336.2	40		0	58.	27.0	20		0
27.	236.0	29		0	59.	76.3	20		0
28.	133.0	30		0	60.	61.0	20		0
29.	88.8	40		1	61.	109.6	25		0
30.	230.1	40		0	62.	183.1	20		0
31.	314.3	45		2	63.	89.5	20		0
32.	664.4	40		1					

Saturated rainfall : Rsa (= 200 mm)

Preliminary run-off coefficient : f₁ (= 0.3)

表 3.2.13 河道貯留関数

Channel No.	K	P	T ₁	Channel No.	K	P	T ₁
13.	10	0.60	1	63.	44	0.63 (Q ≤ 200)	1
14.	6.9	0.73	1		3.8	1.09 (Q > 200)	
15.	5.2	0.73	2	64.	15	0.63 (Q ≤ 200)	1
16.	9.7	0.73	1		1.3	1.20 (Q > 299)	
17.	25	0.74	1	66.	1.6	0.62 (Q ≤ 80)	
20.	35	0.60	1		5 x 10 ⁻⁵	2.98 (Q > 80)	0
21.	13	0.65 (Q ≤ 500)	1	67.	10	0.54 (Q ≤ 20)	1
	0.019	1.70 (Q ≤ 500)			3.4	0.90 (Q > 20)	
22.	37	0.58 (Q ≤ 500)		68.	3.4	0.56 (Q ≤ 80)	
	0.504	1.63 (Q > 500)			2 x 10 ⁻⁴	2.84 (Q > 80)	0
23.	7.4	0.71	0	69.	7.1	0.60 (Q ≤ 100)	1
25.	40	0.60	1		0.8	1.07 (Q > 100)	
26.	18	0.67 (Q ≤ 700)	1	70.	13	0.63 (Q ≤ 20)	1
	15	0.70 (Q > 700)			5.4	0.92 (Q > 20)	
27.	39	0.70 (Q ≤ 800)	1	72.	5.1	0.65 (Q ≤ 300)	0
	15	0.84 (Q > 800)			1.4	0.89 (Q > 300)	
30.	45	0.60	1	75.	4.1	0.64 (Q ≤ 300)	0
31.	21	0.72			7.1	0.88 (Q > 300)	
32.	0.009	1.78	0				
35.	31	0.65 (Q ≤ 800)	0				
	16	0.75 (Q > 800)					
36.	80	0.52 (Q ≤ 1000)	1				
	14	0.77 (Q > 1000)					
39.	50	0.60 (Q ≤ 1000)	1				
	22	0.72 (Q ≥ 1000)					
40.	7.5	0.76	1				
44.	1.3	0.69	0				
47.	4.7	0.68	1				
49.	24	0.72	1				
51.	14	0.69	1				

Inflow coefficient : f (= 1.0)

表 3.2.14 現況プランタス河における50年確率洪水ピーク流量

Base Point	Return Period in Year						
	2	5	10	25	50	100	
K. Kates	Inflow	760	1,250	1,460	1,880	2,180	2,480
		580	910	1,160	1,500	1,740	1,990
	Outflow	380	470	540	640	740	870
		330	390	450	520	570	630
Pakel		640	760	880	1,020	1,100	1,210
		980	1,120	1,220	1,430	1,620	1,830
Kediri		670	780	850	950	1,020	1,090
		670	720	760	820	910	1,090
Before the confluence of K. Konto		670	780	850	940	1,020	1,090
		640	700	740	830	900	1,010
After the confluence of K. Konto		870	970	1,050	1,130	1,200	1,260
		820	930	1,020	1,120	1,210	1,280
Before the confluence of K. Widas		860	960	1,050	1,120	1,190	1,250
		810	920	1,010	1,100	1,190	1,260
After the confluence of K. Widas		1,060	1,190	1,280	1,370	1,440	1,510
		1,020	1,170	1,250	1,370	1,460	1,550
Ploso		1,060	1,190	1,270	1,360	1,440	1,500
		1,020	1,150	1,230	1,330	1,420	1,500
Before the confluence of K. Brangkal		1,080	1,210	1,300	1,400	1,480	1,540
		1,050	1,170	1,260	1,370	1,460	1,540
Lengkong		1,200	1,340	1,420	1,520	1,600	1,660
		1,180	1,300	1,380	1,490	1,580	1,660
Porong		1,190	1,340	1,410	1,510	1,570	1,640
		1,200	1,300	1,380	1,490	1,570	1,650

Upper ... JAN. 1981

Lower ... MAR. 1984

表 3.2.15 現況ウイダス川における25年確率洪水ピーク流量

Jan. 6 - 8, 1981

Base Point	2	5	10	25	50	100 ^{/1}
K. Widas						
Before the confluence of K. Kedungsoko	220	290	350	410	440	470
Before the confluence of K. Brantas	310	370	400	450	480	510
K. Kedungsoko	170	250	300	390	460	530
Kuncir Retarding Basin	105	110	115	120	125	130
Ulo Retarding Basin	150	165	170	170	175	180
K. Kuncir	90	110	130	150	170	180
K. Ulo	90	120	150	210	350	470

Mar. 2 - 4, 1984

Base Point	2	5	10	25	50	100
K. Widas						
Before the confluence of K. Kedungsoko	260	340	400	440	470	510
Before the confluence of K. Brantas	270	310	350	390	450	510
K. Kedungsoko	110	160	190	240	270	300
Kuncir Retarding Basin	105	110	110	110	115	120
Ulo Retarding Basin	120	140	150	160	165	170
K. Kuncir	120	170	210	260	300	340
K. Ulo	110	150	180	220	250	280

^{/1} - Return Period in Year

表 3.2.16 スラバヤ川における流量及びB.O.D 値

	B.O.D. (mg/l)		Discharge (m ³ /s)	
	Perning	G. Sari	Mrilip	Jabon
July	15.9	1.8	11.1	49.5
	17.4	3.7		
August	7.4	7.1	13.8	43.8
	1.9	2.0		
September	1.5	1.0	14.0	35.8
	1.1	1.8		
October	2.1	1.0	11.3	34.7
	1.4	1.8		
Mean	6.1	2.5	12.6	41.0

Source : HY-53

表 3.3.1

月間平均雨量

(Unit : mm)

Name of station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Malang/Kayutangan	318	271	261	160	106	61	39	15	31	82	211	294	1,849
Blitar/Lodoyo	314	278	257	140	108	51	34	15	20	91	177	299	1,781
T.Agung/Campur Darat	216	221	201	103	101	56	61	19	39	108	121	180	1,207
Kediri/Kandat	266	246	277	169	149	43	39	17	25	62	146	270	1,709
Nganjuk/Nganjuk	250	273	266	175	134	43	27	12	8	52	166	289	1,795
Pare/Kantor Seksi	304	297	271	173	118	51	23	10	37	66	132	195	1,677
Jombang/Jombang	267	316	272	179	91	29	39	19	18	43	135	292	1,700
Mojokerto/Kantor Seksi	347	325	303	158	100	30	30	9	16	39	119	267	1,743

Malang	34 years from 1950 to 1983
Blitar	34 years from 1950 to 1983
T.Agung	34 years from 1950 to 1983
Kediri	29 years from 1955 to 1983
Nganjuk	34 years from 1950 to 1983
Pare	22 years from 1962 to 1983
Jombang	33 years from 1951 to 1983
Mojokerto	32 years from 1952 to 1983

表 3.3.2 ブランタス流域内の土地の利用可能容量による分類

Class	Definition	Soil type	Land use at present	Acreage	
				Ha	(%)
I	Very suitable for irrigated farming	Alluvial	Two crops of paddy, one crop of paddy and one upland crop of sugar cane	289,000	24.5
II	Suitable for irrigation farming, drainage is indispensable	Alluvials Grumusols Humus Gley Soils	Two crops of paddy or one crop of paddy and one upland crop	94,000	8.0
IIb	Suitable for irrigated farming of upland crops with irrigation	Latosols Mediterranean Regosols	One crop of paddy or upland crops	49,000	4.1
III	Usable for crop cultivation	Latosols Mediterranean Brown Forest soils Andosols Regosol	Upland crops, forest or waste land	192,000	16.3
IV	Unusable for crop cultivation	Mediterranean Soils Lithosols Latosols Regosols Andosols	Waste land	556,000	47.1
				1,180,000	100.0

Source : 1973 Master Plan Report

表 3.3.3 かんがい水田面積の歴史的变化

Name of Irrigation Section	(Unit : ha)			
	1970	1975	1980	1984
Malang	18,044	18,051	18,022	16,712
Kepanjen	27,361	27,359	27,429	28,294
Bilitar	30,129	31,667	35,792	34,986
Tulungagung	30,426	30,202	30,182	34,268
Kediri	29,141	29,140	29,211	29,660
Nganjuk	38,827	38,801	38,728	39,069
Jombang	24,381	23,199	24,314	24,269
Pare	19,621	19,367	19,300	19,298
Mojogagung	23,199	23,199	23,222	23,389
Mojokerto	32,431	32,324	32,217	32,024
Sidoarjo	33,417	33,077	32,609	31,601
Wonokromo (Surabaya area)	6,724	5,356	4,976	2,979
T o t a l	313,706	311,742	316,002	316,544

Source : AI62

表 3.3.4 将来かんがい計画の便益及び内部収益率

	Unit	Widas Extension		Beng	Gottan Lasari	Widas South	Lesti Left
		K. Warak Scheme	Semantok Scheme				
1. Irrigation Area	ha	950 (720)	1,300 (1,530)	3,200	4,180	6,270	2,300
2. Irrigation Benefit	$\times 10^6$ Rp/Y	1,163	1,591	3,698	3,935	5,112	2,650
3. Negative Benefit	$\times 10^6$ Rp/Y	290	100	234	-	64	-
4. Capital Cost							
Dam	$\times 10^6$ Rp/Y	5,100	45,000	5,089	22,170 ^{/1}	75,000	7,096 ^{/1}
Irrigation facilities	$\times 10^6$ Rp/Y	1,285	1,759	5,175	5,683	5,560	4,213
5. O & M Cost							
Dam	$\times 10^6$ Rp/Y	31	450	51	222 ^{/2}	750	71 ^{/2}
Irrigation facilities	$\times 10^6$ Rp/Y	32	44	129	142	139	105
Pump energy	$\times 10^6$ Rp/Y	-	-	-	28	-	227
6. B-C at DF = 12%	$\times 10^6$ Rp	- 682	-27,760	9,514	271	-39,188	4,135
7. EIRR	%	10.5 (10.8)	0.5 (0.3)	22.9	12.2	4.1	17.9

Note: Figures in parenthesis are in the case of cropping pattern of paddy-paddy-potowijo. Irrigation benefit and cost of irrigation facilities of Widas Extension Project is divided into Kdeungwarak scheme and Semantok scheme in the proportion of their irrigation areas.

^{/1} : Water exploitation cost is estimated based on Wonorejo dam construction cost

^{/2} : 1 % of water exploitation cost is taken into account

表 3.3.5 計画中のプロジェクトに関する便益及び内部収益率

	Unit	Wonorejo	Tugu	Waru-Turi		Waru-Turi Papar- Peterongan (Zone A + B)
				Waru- Jayeng	Turi- Tunggorono	
1. Irrigation Benefit	$\times 10^6$ Rp/Y	14,758	5,744	12,161	7,072	24,967
2. Negative Benefit	$\times 10^6$ Rp/Y	40	112	-	-	-
3. Capital Cost	$\times 10^6$ Rp/Y	62,921	33,702	26,013	11,531	85,341 ^{/1}
4. Recurrent Cost	$\times 10^6$ Rp/Y	264	141	523	195	925
5. Construction Period	Year	6	5	4	5	8
6. B-C at DF = 12%	$\times 10^6$ Rp	25,175	961	33,576	16,802	37,164
7. EIRR. %	%	18	12	25	27	18

^{/1} : Water cost, Rp.15,030 $\times 10^6$ is included for Papar-Peterongan area

表 3.3.6 (1) 取水口流量と必要水量の比較

Intake Area (ha)	Molek 3991			Lodoyo 10,000			Mrican ¹ 12,827			Turi-Tunggorono 9,587			
	1	2	3	1	2	3	1	2	3	1	2	3	
June	1	5.40	2.34	3.06	9.00	7.81	1.19	9.93	12.76	-4.16	6.70	5.92	0.78
	2	5.30	1.80	3.50	9.00	7.83	1.17	10.11	12.76	-3.86	6.00	9.03	-3.03
	3	5.30	2.25	3.05	9.00	7.78	1.22	9.30	12.64	-4.54	5.70	9.19	-3.49
July	1	5.50	2.31	3.19	9.00	7.07	1.93	7.62	12.34	-5.64	6.50	9.82	-3.32
	2	5.50	1.84	3.66	7.60	6.13	1.47	7.42	12.40	-5.50	5.20	9.73	-4.53
	3	5.60	2.51	3.09	6.00	5.22	0.78	8.02	11.12	-3.62	8.20	8.68	-0.48
Aug.	1	5.20	3.37	1.83	6.00	4.90	1.10	7.52	11.73	-4.73	5.80	7.83	-2.03
	2	4.60	3.44	1.16	6.00	4.23	1.77	7.32	9.30	2.47	5.70	6.39	-0.69
	3	4.30	3.45	0.85	6.00	2.70	3.30	7.42	8.53	-1.63	5.20	5.17	0.03
Sept.	1	3.90	2.71	1.19	6.00	3.73	2.27	7.42	9.98	-3.08	4.30	4.44	-0.14
	2	3.90	2.64	1.26	6.00	4.04	1.96	7.32	9.99	-3.19	5.10	3.84	1.26
	3	4.20	2.78	1.42	6.00	4.40	1.60	7.32	9.91	-3.11	3.70	4.12	-0.42
Oct.	1	3.70	2.72	0.98	6.00	2.89	3.11	7.42	9.86	-2.96	0	4.47	-4.47
	2	3.40	1.26	2.14	6.00	3.98	2.02	7.52	9.46	-2.46	1.40	4.16	-2.76
	3	3.30	2.45	0.85	6.00	3.60	2.40	7.12	0.42	6.18	3.40	3.91	-0.51
Nov.	1	3.60	2.15	1.45	6.00	3.26	2.74	6.92	7.73	-0.81	3.10	3.35	-0.25
	2	4.00	3.74	0.26	6.00	0.22	5.78	7.12	2.35	4.77	3.50	2.85	0.65
	3	3.80	2.20	1.60	6.00	2.81	3.19	6.62	0.45	6.17	3.70	2.51	1.19
Total		80.50	45.96	34.54	121.60	82.60	39.0	139.44	163.73	-24.29	83.20	105.41	-22.81

Intake Area (ha)	Jatikulon 619			Mangetan 18,203			Porong 12,339			Gottan - Etc. 4,238			
	1	2	3	1	2	3	1	2	3	1	2	3	
June	1	0.30	0.94	-0.64	23.76	13.52	9.74	17.71	8.67	9.04	0.40	1.45	-1.05
	2	0.30	0.72	-0.42	23.76	14.65	9.11	14.41	8.78	5.63	0.20	1.18	-0.98
	3	0.30	0.73	-0.43	21.66	15.57	6.09	12.81	8.86	3.95	0.30	1.23	-0.93
July	1	0.30	0.80	-0.50	19.86	15.45	4.41	10.91	8.71	2.20	0.30	1.41	-1.11
	2	0.30	0.82	-0.52	16.86	15.48	-1.38	10.51	8.73	1.78	0.20	1.38	-1.18
	3	0.30	0.80	-0.50	23.76	13.56	10.20	17.71	8.09	9.62	0.10	1.21	-1.11
Aug.	1	-	-	-	16.16	11.95	4.21	10.21	7.30	2.91	0.20	1.55	-1.35
	2	0.20	0.93	-0.73	16.16	11.10	5.06	10.41	6.44	3.97	0.20	1.60	-1.40
	3	0.30	0.91	-0.61	15.96	10.17	5.79	10.01	5.64	4.37	0.20	1.61	-1.41
Sept.	1	0.30	0.82	-0.52	11.26	10.69	0.57	9.81	5.66	1.15	0.20	1.82	-1.62
	2	0.30	0.58	-0.28	10.56	9.87	0.69	7.11	4.91	2.20	0.20	1.86	-1.66
	3	0.30	0.36	-0.06	11.16	9.09	2.07	6.31	4.77	2.54	0.20	1.93	-1.73
Oct.	1	0.30	0.16	0.14	11.06	9.42	1.64	7.81	5.96	1.85	0.20	2.06	-1.86
	2	0.30	0.07	0.23	11.26	8.16	3.10	7.71	6.00	1.71	0.20	2.05	-1.85
	3	0.30	0.08	0.22	11.26	0.35	10.91	7.01	2.81	4.20	0.20	2.04	-1.84
Nov.	1	0.30	0.08	0.22	10.56	5.79	4.77	7.50	5.17	2.33	0.70	1.87	-1.17
	2	0.30	0.10	0.20	11.36	7.88	3.48	8.10	3.23	4.87	0.70	1.75	-1.05
	3	0.10	0.10	0.00	6.66	6.23	0.43	6.10	4.94	-0.84	0.70	1.34	-0.64
Total		6.60	0.93	-4.20	272.58	182.93	89.65	178.15	114.67	63.48	5.40	29.31	-23.91

- 1 : Intake discharge
 2 : Potential water requirement
 3 : Difference

Notes: Intake discharge in Mangetan and Porong are values deducted the amounts of industrial water requirements of 1.14 m³/sec and 1.29 m³/sec, respectively.

¹ : Intake Mrican plus Banjarsari.

表 3.3.6(2) 取水口流量と必要水量の比較

Intake Area (ha)	Holek 3,991			Todoyo 10,000			Mrican/1 12,827			Turi-Tunggorono 9,587			
	1	2	3	1	2	3	1	2	3	1	2	3	
June	1	6.10	2.63	3.47	9.00	9.47	-0.47	9.90	14.23	-4.33	8.30	8.36	-0.06
	2	5.80	2.92	2.88	9.00	9.29	0.29	10.80	14.32	-3.52	8.30	8.56	-0.26
	3	5.40	3.28	2.12	9.00	8.70	0.30	10.90	14.23	-3.33	8.60	8.97	-0.27
July	1	5.50	3.54	1.96	9.00	8.64	0.36	10.30	13.68	-3.38	9.70	9.81	-0.11
	2	5.50	3.02	2.48	9.00	8.77	0.23	8.20	12.35	-4.15	7.90	9.80	-1.90
	3	4.90	3.79	1.11	9.00	8.89	0.11	7.00	11.86	-4.86	5.80	9.68	-4.08
Aug.	1	3.80	3.99	-0.19	8.40	9.40	-1.00	10.60	12.03	-1.43	4.60	10.59	-5.99
	2	3.90	3.84	0.06	8.00	8.48	-0.48	8.30	10.83	-2.53	4.00	9.72	-5.72
	3	3.60	3.53	0.07	8.00	8.30	0.30	7.50	9.07	-1.57	3.50	8.20	-4.70
Sep.	1	3.20	3.74	-0.54	8.00	6.95	1.05	8.10	9.95	-1.85	3.30	7.32	-4.02
	2	3.30	3.73	-0.43	8.00	6.18	1.82	7.20	9.88	-2.68	2.30	6.03	-3.73
	3	3.50	3.49	0.01	8.00	5.45	2.55	6.60	9.82	-3.22	2.60	4.96	-2.36
Oct.	1	3.40	2.77	0.63	8.00	3.07	4.93	7.60	9.70	-2.10	2.30	4.74	-2.44
	2	5.00	1.05	3.95	7.50	3.61	3.89	7.50	8.93	-1.43	1.10	4.54	-3.44
	3	4.10	0.81	3.29	6.50	3.29	3.21	7.60	0.44	7.16	0.30	4.37	-4.07
Total	67.00	46.13	20.87	124.40	105.49	18.91	128.1	161.32	-33.22	72.4	115.55	-43.15	

Intake Area (ha)	Jatikulon 619			Mangetan 18,203			Porong 12,339			Gortan - Etc 4,238			
	1	2	3	1	2	3	1	2	3	1	2	3	
June	1	0.10	0.73	-0.63	24.35	13.04	11.32	17.61	6.17	11.44	0.60	1.74	-1.14
	2	0.60	0.74	-0.14	25.46	12.52	12.94	18.01	7.00	11.01	0.70	1.59	-0.89
	3	0.50	0.77	-0.27	25.85	13.09	12.77	17.91	9.32	8.59	0.80	1.57	-0.77
July	1	0.50	0.84	-0.34	25.85	14.85	11.01	17.91	9.96	7.95	0.50	1.74	-1.24
	2	-	-	-	24.46	13.94	10.52	17.11	8.57	8.54	0.70	1.68	-0.98
	3	0.40	0.81	-0.41	18.76	14.85	3.90	11.91	8.87	3.06	0.50	1.44	-0.94
Aug.	1	0.30	0.95	-	15.56	14.44	1.12	9.31	9.54	-0.20	0.20	1.84	-1.64
	2	0.30	0.94	-0.64	15.66	14.79	0.87	10.01	9.73	0.28	0.50	1.86	-1.36
	3	0.30	0.89	-0.59	14.36	15.53	-1.17	9.41	9.84	-0.43	0.30	1.83	-1.53
Sep.	1	0.40	0.78	-0.38	14.36	17.30	-2.94	8.61	10.88	-2.27	0.50	2.00	-1.60
	2	0.20	0.48	-0.28	10.86	16.42	-5.56	8.31	10.31	-2.00	0.20	1.94	-1.74
	3	0.40	0.20	0.20	10.26	14.79	-4.53	7.81	9.32	-1.51	0.50	1.89	-1.39
Oct.	1	0.20	0.06	0.14	11.46	14.81	-3.35	9.01	9.36	-0.35	0.50	1.88	-1.38
	2	0.10	0.07	0.03	14.66	12.68	1.98	11.51	7.74	3.77	0.20	1.89	-1.69
	3	0.30	0.07	0.23	19.26	2.06	17.20	15.21	2.99	12.22	0.10	1.92	-1.82
Total	4.60	8.33	-3.73	271.20	205.12	66.08	189.65	129.37	60.08	6.50	26.81	-20.31	

1 : Intake discharge
2 : Potential water requirement
3 : Difference

Note : Intake discharges in Mangetan and Porong are values deducted the amount of industrial water requirement of 1.14 m³/sec and 1.29 m³/sec, respectively.

/1 : Mrican plus Banjarsari.

表 3.3.7 フラタス河から供給されるかんがい地区での水需要

(Unit: m³/sec)

	Lesti Left	Holek	Lojoyo	Mrican	Papar- Peteron- gan	Tori- Tunggo- rono	Jatim- lerek- Bunder	Gottan- Losari	Jatiku- lon	Nonok- rono	Porong	Mange- tan	Total
Jan.	1 0	0	10.53	5.21	3.43	13.46	1.34	1.44	0	0.54	3.81	5.04	44.80
	2 0	1.29	3.65	0.96	1.51	15.51	1.37	0.97	0.20	0.20	5.22	6.90	37.98
	3 0	0	13.33	9.50	0.02	13.23	1.42	0	0	0.72	0.04	0.05	38.31
Feb.	1 0	0.09	8.58	13.08	0	13.03	1.48	0	0	0	0	0	37.06
	2 0	1.47	23.56	8.30	0.16	0	0	4.19	0.73	0.07	10.66	14.00	63.14
	3 0.73	5.45	22.35	3.30	0.26	0.25	0	4.71	0.80	0.94	12.26	16.09	67.14
Mar.	1 1.07	5.33	1.76	5.37	3.60	4.67	0.65	1.08	0.22	0.59	2.65	3.51	30.45
	2 0.26	3.74	6.60	8.10	3.05	3.65	0.05	0.05	0.03	0.39	0.20	0.26	26.38
	3 1.03	4.47	6.61	11.20	3.01	3.66	0.63	2.57	0.71	1.15	8.40	11.13	54.57
Apr.	1 0.93	4.19	10.31	15.81	3.54	8.65	1.22	3.99	0.98	1.23	12.37	16.34	79.56
	2 1.76	5.89	15.91	18.29	5.34	11.58	1.57	3.64	0.97	0.84	11.67	15.44	92.90
	3 0	1.64	14.89	15.49	3.14	12.34	1.54	3.42	0.95	0.86	11.11	14.74	80.12
May	1 0.23	3.76	13.72	16.02	4.89	13.22	1.17	2.52	0.70	1.13	10.25	13.65	81.26
	2 0	2.11	12.71	18.27	6.50	10.94	1.19	2.73	0.72	0.53	10.70	14.31	80.71
	3 0.10	4.19	12.76	18.25	8.41	11.02	1.20	2.91	0.73	1.01	9.22	12.36	82.16
Jun.	1 0.14	4.06	11.39	16.04	6.86	7.60	0.85	2.89	0.72	1.05	9.41	12.65	73.66
	2 0.21	3.44	11.15	13.11	6.97	9.58	1.19	2.90	0.71	1.09	9.67	13.00	73.02
	3 1.10	3.55	10.41	10.35	5.18	7.84	1.17	2.78	0.71	1.09	9.74	13.12	67.04
Jul.	1 1.43	2.84	9.03	8.08	1.83	6.65	1.22	2.58	0.76	1.01	9.23	12.42	57.09
	2 1.10	1.65	7.92	5.74	0	5.07	1.04	1.94	0.66	0.86	8.19	11.00	45.17
	3 1.60	1.56	6.93	3.85	0	3.66	0.78	1.16	0.47	0.64	6.19	8.32	35.16
Aug.	1 1.70	1.20	6.76	4.21	0	2.90	0.64	1.05	0.44	0.47	5.63	7.54	32.54
	2 1.59	1.20	6.05	5.61	0	2.85	0.43	0.91	0.37	0.33	4.52	6.08	29.52
	3 0.63	1.64	4.38	7.04	0	3.78	0.42	1.01	0.35	0.23	3.66	4.96	28.10
Sep.	1 0.26	2.23	6.09	9.08	0	5.21	0.63	1.60	0.46	0.31	3.84	5.26	34.97
	2 0.10	2.55	6.50	9.66	0	5.89	0.77	2.17	0.49	0.47	4.51	6.25	39.36
	3 0.14	2.71	7.33	8.68	0	6.30	0.86	2.60	0.49	0.64	5.85	8.14	43.74
Oct.	1 0.24	2.29	5.47	8.06	0	5.84	0.91	3.13	0.40	0.83	8.20	11.45	46.86
	2 0.07	0.77	7.68	5.72	0	4.96	0.87	3.35	0.29	0.90	9.17	12.84	46.70
	3 0.07	2.33	7.00	0.27	0	4.00	0.66	3.32	0.18	0.13	9.75	13.64	41.35
Nov.	1 0	2.14	10.60	2.98	0	2.99	0.44	2.69	0.11	0.67	9.23	12.86	44.71
	2 0.80	3.53	4.07	7.01	0	2.20	0.30	2.19	0.09	0.22	8.19	11.32	39.92
	3 0	2.65	4.07	6.78	2.23	6.16	0.93	3.17	0.51	1.04	10.50	14.15	52.14
Dec.	1 0	2.55	16.79	11.49	4.54	4.99	0.73	3.65	0.68	0.84	11.13	14.86	72.25
	2 0	1.54	15.67	16.06	1.45	3.99	0.56	1.56	0.35	0.58	4.03	5.32	51.11
	3 0	0.02	17.44	20.29	7.82	5.65	0.79	2.35	0.56	1.08	5.81	7.68	69.49

Note : /1; The breakdown of water requirement of Lesti and Gottan-Losari is compiled in Note AI-12 & 13.

/2; Water demand of Papar-Peterongan area is increasing amount from the present demand estimated (see Note AI-17)

表 3.4.1 スラバヤ水道局の供給量及び受益者数

Month	Production 10 ³ m ³	Supply 10 ³ m ³	Nos. of Customer
Jan.	6,564	4,982	86,919
Feb.	5,947	4,592	87,220
Mar.	6,753	4,706	87,628
Apr.	6,543	4,658	83,030
May	6,846	4,900	88,311
Jun.	7,418	4,736	88,605
Jul.	8,112	5,225	89,049
Aug.	8,094	5,234	89,406
Sept.	8,340	5,554	89,846
Oct.	8,564	5,230	90,303
Nov.	8,103	5,201	90,903
Dec.	8,549	5,518	91,587
Yearly Total	89,833	60,536	

表 3.4.2 スラバヤ水道局の分類別水供給量

Customer Classification	Total Supplied			No. of Connection	Av. demand per Connection (m ³ /day)
	m ³ /month	m ³ /day	%		
Domestic					
Residential	2,566,656	85,555	49.0	73,611	1.16
Vendors	399,904	13,330	7.6	4,164	3.20
Industrial	320,517	10,684	6.1	1,711	6.24
Port Authority	14,272	475	0.3	3	158.33
Commercial	591,660	19,723	11.3	10,747	1.83
Government	991,794	33,060	18.9	2,155	15.34
Social institutions	61,911	2,063	1.2	558	3.69
Other enterprises (Sidoarjo Gempol Supply)	288,146	9,605	5.5	42	288.66
Total	5,234,860	174,495	-	92,991	-

表 MW-3.4.3

BNA 及びIKK プロジェクトが成り立つ基準

BNA Project

Town Category	Medium	Small
Population in 1990 (x 1,000)	100 - 500	20 - 100
Percent of 1990 population to be served	75 %	75 %
Domestic demand (l / c / d)		
- House connection to 1/4 of served population	200	120
- Yard connection to 1/4 of served population	100	60
- Public stand pipes, each serving 200 persons to 1/2 of served population	30	30
Total average domestic demand	90	60
Non-domestic demand (% of domestic demand)	30 %	20 %
Allowance for unaccounted water (% of total demand)	20 %	20 %

Note ; according to REPELITA IV

IKK Project

Design Population	Source Capacity (l/c)	No. of House Connection	No. of Public Tap	Population Served
For IKK using river water treatment plants as source				
3,600 - 7,200	2.5	180	9	3,600
7,201 - 12,000	5	360	18	7,200
12,001 - 16,000	7.5	540	27	10,800
16,001 - 20,000	10	720	36	14,400
For IKK using spring or deep well as water source				
3,600 - 7,200	2.5	180	9	3,600
7,201 - 14,400	5	360	18	7,200
14,401 - 20,000	10	720	36	14,400

Items	Criteria
1. Supply level of public taps	30 litres/capita/day
2. Supply level of house connections	60 litres/capita/day
3. Population served	50 % - 100 %
4. Ratio of population served by public taps and population served by house connection	50 % - 50 %
5. Water allocation for non domestic demand	5 % of domestic demand
6. Water allocation for leakage in the system and production losses	15 % of total demand
7. Maximum day factor	1.1
8. Peak factor for maximum - hour	From
9. Design group for public tap	200 capita/unit
10. Design group for house connections	10 capita/unit
11. Minimum pressure in distribution system	10 meter head
12. Design horizon distribution	5 years population
13. Design horizon transmission	10 years population

表 3.4.4 BNA 及びIKK プロジェクトの推定建設費

Town	Construction Cost Estimate Rp.10 ⁶	Population Served in	Cost per Capita. Rp.10 ³ /C	Supply Capacity L ¹ m ³ /day	Unit Cost Rp.10 ³ /m ³ /day
<u>1st Stage</u>		<u>1985</u>			
Singojari	1,211	40,800	30	4,049	299
Batu	1,016	43,700	23	4,395	231
Kepanjen	920	31,550	29	3,253	283
Tulungagung	2,271	68,000	33	6,730	337
Ngunut	893	23,000	33	3,692	346
Mojosari	637	22,850	28	2,298	277
Sidoarjo	1,865	46,200	40	4,582	407
Krian	1,277	37,200	33	2,350	374
<u>2nd Stage</u>		<u>1990</u>			
Wlingi	880	23,800	37	2,350	374
Trenggalek	830	29,200	28	2,875	289
Pare	1,590	48,450	33	4,830	329
Kertosono	1,170	32,600	36	2,070	565
		14,560	43,474		335

IKK PROJECT

Town	Construction Cost Estimate Rp.10 ⁶	Population Served in	Cost per Capita. Rp.10 ³ /C	Source Capacity (L/S)	Unit Cost Rp.10 ³ /m ³ /day
<u>1st Stage</u>		<u>1985</u>			
Malang-9 Ikks	1,100	43,200	25	30.0	467
Hojokento-6 Ikks	546	21,600	25	15.0	463
Sidoarjo-4 Ikks	543	32,400	17	22.5	307
Tulungagung-4 Ikks	534	18,000	30	12.5	544
<u>2nd Stage</u>					
Nganjuk-7 Ikks	1,080	44,600	24	32.5	423
Kediri-7 Ikks	1,254	54,000	23	37.5	426
Blitar-6 Ikks	1,083	46,800	23	32.5	424
Trenggalek-7 Ikks	1,113	33,630	33	22.5	629
Total/Average	7,253			205.0	450

表 3.4.5 インドネシア全国人口推定

Year	Population 10 ³	Annual Growth Rate %
1971	119,232	
1980	148,040.0	2.43
1985	165,153.6	2.21
1990	183,456.8	2.12
1995	202,746.3	2.02
2000	222,753.0	1.90

Source: Statistik, Indonesia, 1983

表 3.4.6 推定人口成長率

Unit: % per annum

Region including respective Kotamadya	Year									
	1971	1980	1985	1990	1995	2000	2005	2010	2015	2020
All Indonesia ^{/1}	2.43	2.21	2.12	2.02	1.90	1.83	1.65	1.52	1.38	
East Java ^{/2}	1.50	1.36	1.31	1.25	1.17	1.13	1.02	0.94	0.85	
Trenggalek	0.89	0.81	0.78	0.74	0.70	0.67	0.60	0.56	0.51	
Tulungagung	1.03	0.94	0.94	0.86	0.81	0.78	0.70	0.64	0.58	
Blitar	1.02	0.92	0.89	0.85	0.80	0.77	0.69	0.64	0.58	
Kediri	1.63	1.48	1.42	1.35	1.27	1.23	1.11	1.02	0.93	
Malang	1.74	1.58	1.52	1.45	1.36	1.31	1.18	1.09	0.99	
Sidoarjo	2.78	2.53	2.43	2.31	2.17	2.09	1.89	1.74	1.58	
Mojokerto	1.86	1.69	1.62	1.55	1.45	1.40	1.26	1.16	1.06	
Jomban	1.66	1.51	1.45	1.38	1.30	1.25	1.13	1.04	0.94	
Ngenjuk	1.46	1.33	1.27	1.21	1.14	1.10	0.99	0.91	0.83	

Note: /1 Based on Fig. 3.4.3

/2 For example, the rate of East Java in 1980-85

$$1.58\% \times 2.21\% / 2.43\% = 1.36\%$$

表 3.4.7 調査地域の人口推定

	1980	1985	1990	1995	2000	2005	2010	2015	2020
East Java	29,188,852	31,228,400	33,328,200	35,463,900	37,587,700	39,759,900	41,829,500	43,832,800	45,727,600
1 Excl. SMA 1	26,321,375	28,160,600	30,054,100	31,980,000	33,895,100	35,854,000	37,720,200	39,526,700	41,235,400
2 SMA 2	2,867,477	3,465,000	4,187,000	5,060,400	6,119,000	7,395,400	8,938,100	10,802,600	13,056,000
3 East Java 1 + 2									
Balance 3 - 1	0	-397,200	912,900	1,576,500	2,426,400	3,489,500	4,828,800	6,496,500	8,563,800
Trenggalek	564,542	587,800	611,100	634,000	656,500	678,800	699,400	719,200	737,700
- SMA		-8,300	-18,600	-31,300	-47,000	-66,100	-89,500	-118,200	-151,200
- Urban	29,318	33,200	37,500	42,500	48,000	54,400	61,500	69,600	78,700
Rural	535,224	546,300	555,000	569,200	561,500	558,300	548,400	531,400	505,800
Tulungagung	833,323	873,200	913,200	953,200	992,400	1,031,700	1,068,400	1,103,000	1,135,300
- SMA		-12,300	-27,700	-47,000	-71,000	-100,400	-136,800	-181,300	-235,800
- Urban	178,094	201,500	228,000	257,900	291,800	330,200	373,600	422,700	478,200
Rural	655,229	659,400	657,500	648,300	629,600	601,100	558,000	499,000	421,300
Blitar	1,115,761	1,168,000	1,221,000	1,273,700	1,325,500	1,377,300	1,425,500	1,471,700	1,514,900
- SMA		-16,500	-37,100	-62,800	-94,900	-134,000	-182,500	-241,900	-314,600
- Urban	141,913	160,600	181,700	205,500	232,500	263,100	297,700	336,800	381,000
Rural	973,800	990,900	1,002,200	1,005,400	998,100	980,200	945,300	893,000	819,300
Kediri	1,457,095	1,568,200	1,682,700	1,799,400	1,916,600	2,037,400	2,153,000	2,265,100	2,372,400
- SMA		-22,100	-51,100	-88,700	-137,200	-198,300	-275,600	-372,300	-492,700
- Urban	248,009	280,600	317,500	359,200	406,400	459,800	520,200	588,500	665,900
Rural	1,209,086	1,265,500	1,314,100	1,351,500	1,373,000	1,379,300	1,357,200	1,304,300	1,213,800
Malang	2,557,719	2,766,300	2,983,000	3,205,600	3,429,600	3,660,200	3,881,300	4,097,500	4,304,400
- SMA		-39,000	-90,600	-158,000	-245,500	-356,200	-496,900	-673,500	-893,900
- Urban	663,729	750,900	849,600	961,300	1,087,600	1,230,500	1,392,200	1,573,200	1,782,200
Rural	1,893,990	1,976,400	2,042,800	2,086,300	2,096,500	2,073,500	1,992,200	1,850,800	1,628,300
Sidarejo	351,181	397,900	448,700	502,900	559,900	620,900	681,900	743,300	803,900
- SMA		-5,600	-13,600	-24,800	-40,100	-60,400	-87,300	-122,200	-167,000
- Urban	55,273	62,500	70,800	80,100	90,600	102,500	115,900	131,200	148,400
Rural	295,908	329,600	364,300	398,000	429,200	458,000	478,700	489,900	488,500
Mojokerto	774,445	842,100	912,600	985,500	1,059,100	1,135,300	1,208,700	1,280,500	1,349,800
- SMA		-11,900	-27,700	-48,600	-75,800	-110,500	-154,700	-210,500	-280,300
- Urban	116,355	131,600	148,900	168,500	190,700	215,700	244,100	276,100	312,400
Rural	658,090	698,600	736,000	768,400	792,600	809,100	809,900	793,900	757,100
Jombang	941,988	1,015,300	1,091,100	1,168,500	1,246,400	1,326,300	1,402,900	1,477,400	1,548,200
- SMA		-14,300	-33,100	-57,600	-89,200	-129,100	-179,600	-242,800	-321,500
- Urban	87,832	99,400	112,400	127,200	143,900	162,800	184,200	208,400	235,800
Rural	854,156	901,600	945,600	993,700	1,013,300	1,034,400	1,039,100	1,026,200	990,900
Nganjuk	882,812	941,100	1,004,600	1,066,800	1,129,000	1,192,500	1,252,700	1,310,800	1,366,100
- SMA		-23,300	-30,500	-52,600	-80,800	-116,100	-160,400	-215,400	-283,700
- Urban	87,832	99,400	112,400	127,200	143,900	162,800	184,200	208,400	235,800
Rural	795,000	830,400	861,700	897,000	904,300	913,600	908,100	897,000	846,600
SMA	2,867,477	3,465,000	4,187,000	5,060,400	6,119,000	7,395,400	8,938,100	10,802,600	13,056,000
Urban	1,608,355	1,819,700	2,058,000	2,129,400	2,635,400	2,981,800	3,371,600	3,814,900	4,318,400
Rural	1,870,483	8,198,700	8,479,200	8,697,800	8,798,100	8,007,500	8,636,900	8,225,500	7,611,600
Total	12,346,315	13,483,400	14,250,000	16,087,600	17,552,500	19,184,700	20,948,600	22,843,000	25,046,000

表 3.4.8 1人当りの水消費量の国際比較

(Unit: l/day)

	1970								Future				GDP per Capita 1981 US\$
	Urban				Rural				Urban		Rural		
	With House Connections		With Public Standposts		Min.	Max.	With House Connections		With Public Standposts		Min.	Max.	
	Min.	Max.	Min.	Max.			Min.	Max.	Min.	Max.			
Bangladesh	45	70	15	25	10	20	70	135	25	45	25	45	140
Burma	100	180	45	100	22	60	150	220	70	120	50	100	190
India	50	270	-	-	25	100	90	270	-	-	45	130	260
Indonesia	50	150	5	20	-	-	86	150	-	100	30	60	530
Sri Lanka	170	220	30	50	20	70	170	220	30	50	20	70	300
Thailand	120	180	-	-	50	100	150	200	-	-	50	80	770
Fuji	140	260	-	-	-	-	-	270	-	-	9	90	
Korea	150	250	-	-	40	80	200	350	-	-	80	120	1,700
Malaysia	18	410	-	-	14	230	250	250	-	-	23	110	1,840
Philippines	110	540	-	-	40	110	360	1,100	-	-	180	360	790
Singapore	-	220	-	-	-	-	-	315	-	-	-	-	5,240

表 3.4.9 月間支出額別の世帯数

(1975 Constant Price)

Monthly Expendi- ture Class (Rp./Family)	1980 House- hold (100)	Share (%)	1990 House- hold (1000)	Share (%)	2000 House- hold (1000)	Share (%)
(1) Under 5,000	5.3	0.89	3.2	0.37	1.7	0.14
(2) 15,000- 10,000	33.8	5.66	24.9	2.92	16.9	1.36
(3) 10,000- 20,000	114.8	19.24	105.3	12.34	89.4	7.19
(4) 20,000- 30,000	109.0	18.25	124.0	14.52	124.1	9.98
(5) 30,000- 40,000	85.3	14.28	111.8	13.10	125.6	10.10
(6) 40,000- 50,000	62.5	10.47	88.3	10.34	122.1	9.82
(7) 50,000- 60,000	45.6	7.63	73.2	8.58	102.2	8.22
(8) 60,000- 70,000	32.5	5.44	59.6	6.08	89.1	7.17
(9) 70,000- 80,000	23.4	3.91	46.0	5.39	78.1	6.28
(10) 80,000- 90,000	18.6	3.11	36.4	4.27	65.6	5.28
(11) 90,000-100,000	13.6	2.27	30.5	3.57	53.7	4.31
(12) 100,000-120,000	18.1	3.03	43.6	5.11	85.5	6.88
(13) 120,000-140,000	11.8	1.98	28.4	3.33	63.8	5.13
(14) 140,000-160,000	6.9	1.16	20.2	2.37	48.6	3.91
(15) 160,000-180,000	4.8	0.80	15.0	1.76	36.3	2.92
(16) 180,000-200,000	3.2	0.53	9.6	1.13	26.4	2.13
(17) 200,000-250,000	4.1	0.69	15.4	1.80	44.6	3.59
(18) 250,000 and over	3.9	0.66	18.1	2.12	69.4	5.59
Total	597.2	100.00	853.5	100.00	1,243.1	100.00

Source; Surabaya Urban Development Planning Study

表 3.4.10

水 需 要

Item No.	Kind of Industries	Unit Water Demand $m^3/employees/d$	Number of Employees* (Capita)	Water Demand (m^3/d)	Demand (m^3/s)
31-(A)	Foodstuff drink, beverage, and cigarettes	1.47	165,261	242,934	2.81
32-(B)	Textiles, ready-made clothing and leathers	0.82	31,690	25,986	0.30
33-(C)	Wooden wares and furnitures	0.19	8,993	1,709	0.02
34-(D)	Paper industry, printing and publishing	6.79	7,195	48,854	0.57
35-(E)	Chemical industry and chemical goods, oil, coal, rubber goods & plastics	4.27	22,659	96,754	1.12
36-(F)	Mineral industries excluding metal goods, oil and coal	1.52	13,238	20,122	0.23
37-(G)	Basic Metal Industry	2.71	1,651	4,474	0.05
38-(H)	Metal goods, machine & tools	0.27	26,491	7,153	0.08
39-(L)	Other industries	0.46	594	273	0.01
T o t a l		-	277,772	448,263	4.92
Average Unit Water Demand per Employee				1.61 $m^3/c/d$	

* : Ref. MW 24

表 3.5.1 浸水地区における推定水深

(Unit: m)

	Return Period in Year					
	2	5	10	25	50	100
K. Brantas						
10 km	2.36	2.41	2.43	2.46	2.48	2.51
20 km	2.23	2.30	2.34	2.40	2.45	2.49
30 km	1.95	2.02	2.66	2.12	2.17	2.22
40 km	2.46	2.53	2.58	2.65	2.70	2.74
50 km	2.27	2.35	2.40	2.47	2.54	2.59
60 km	1.94	2.02	2.08	2.15	2.21	2.27
70 km	2.43	2.51	2.58	2.65	2.72	2.78
80 km	2.18	2.23	2.27	2.32	2.36	2.41
90 km	1.24	1.31	1.36	1.44	1.50	1.57
100 km	1.54	1.63	1.69	1.78	1.86	1.93
110 km	1.04	1.12	1.17	1.26	1.33	1.40
120 km	2.25	2.50	2.65	2.87	3.04	3.24
130 km	1.75	1.96	2.10	2.27	2.41	2.55
140 km	0.55	0.74	0.87	1.02	1.13	1.26
K. Widas						
5 km	1.60	1.76	1.86	1.98	2.07	2.19
10 km	1.29	1.45	1.55	1.67	1.74	1.86
15 km	1.85	2.09	2.24	2.41	2.53	2.64
20 km	0.52	0.83	1.04	2.11	1.49	1.65

表 3.5.2 土地利用及び行政区別のメッシュ数

Kab / Kodya	A	B	C	D	E	Total
Kab						
Sidoarjo	487	0	67	237	1	786
Mojokerto	261	3	0	105	0	369
Jombang	627	25	29	161	26	868
Nganjuk	788	87	39	381	12	1,307
Kediri	340	59	0	260	2	661
Tulungagung	519	159	6	503	40	1,227
Blitar	5	1	0	1	0	7
Trenggalek	37	73	7	118	26	461
Kodya						
Surabaya	106	9	16	59	0	190
Mojokerto	19	8	0	25	0	52
Kediri	44	2	0	67	0	13
Total	3,43	426	164	1,911	107	6,041

Note : A Pady field
 B Upland field
 C Fish pond
 D Residential area
 E Others
 1 mesh = 25 ha

表 3.5.3 行政区別の建物数及びその種類

Kab/Kodya	House		Factory	Commercial building	Store/hotel /restaurant	Total
	Urban	Rural				
Kab						
Sidoarjo	3150	11,502	125	1,124	471	16,327
Mojokerto	257	4,004	35	231	96	4,653
Jombang	824	6,405	61	465	224	7,989
Nganjuk	1,569	13,513	130	1,177	863	17,552
Kediri	740	10,471	49	434	309	12,003
Tulungagung	3,734	18,866	466	1,164	736	24,966
Blitar	2	31	1	1	1	36
Trenggalek	141	2,594	153	126	73	3,087
Kodya						
Surabaya	15,440	2,369	196	1,556	1,342	20,903
Mojokerto	3,839	-	63	413	319	4,634
Kediri	7,030	1,869	98	623	455	10,075
Total	36,756	71,924	1,377	7,314	4,889	122,260

表 3.5.4 被害率

Damage Rate of Buildings

	Unit: %					
	Below Floor Level	Above Floor Level				
		0-50cm	50-99	100-199	200-299	300-
House & Buildings	0.03	0.053	0.072	0.109	0.152	0.220
Household Effects		0.086	0.191	0.331	0.499	0.690
Properties of Buildings		0.180	0.314	0.419	0.539	0.632

Damage Rate of Agricultural Crops

	Unit: %											
	Less than 0.5m deep Inundation days				0.5-0.9m deep Inundation days				More than 1.0m deep Inundation days			
	1-2	3-4	5-6	7-	1-2	3-4	5-6	7-	1-2	3-4	5-6	7-
Paddy	21	30	36	50	24	44	50	71	37	54	64	74
Soybean	23	41	54	67	30	44	60	73	40	50	68	81
Peanut												
Maize	27	42	54	67	35	48	67	74	51	67	81	91

Source: Criteria for the Engineering of River and Sabo Project, Ministry of Construction, Japan

表 3.5.5

水深及び確率洪水別の浸水面積

Item	Inundation Depth	Flood Return Period					
		2	5	10	25	50	100
Paddy	0 - 0.5	4875	4300	3875	3400	3300	3140
	0.5 - 1.0	8525	7725	7450	6950	6200	5775
	more than 1.0	27475	29325	30475	32000	33125	34050
Upland	0 - 0.5	100	100	75	75	75	50
	0.5 - 1.0	675	425	350	325	225	200
	more than 1.0	2275	2575	2650	2675	2775	2525
Fish pond		2250	2250	2400	2400	2525	2525
Building	0 - 0.5	7900	7050	6475	5750	5675	5325
	0.5 - 1.0	14075	12450	12075	11325	10025	9700
	1.0 - 2.0	30050	30200	30050	30000	29875	29650
	2.0 - 3.0	12825	15650	17325	19625	21425	22850
	more than 3.0	-	-	100	250	350	425

表 3.5.6

確率洪水別の洪水被害額

Present basin development level (as of year 1984)

Return period	Brantas river		Widas river
	Up to 139 K	Up to 159 K	
2	155,099	163,888	9,528
5	159,970	169,745	11,612
10	163,997	174,354	13,652
25	169,325	181,004	15,437
50	173,440	185,600	17,513
100	178,734	191,171	19,252

Future basin development level (as of year 2000)

Return period	Brantas river		Widas river
	Up to 139 K	Up to 159 K	
2	304,671	321,543	18,902
5	314,023	332,773	22,935
10	321,703	341,570	26,923
25	332,049	354,459	30,399
50	339,986	363,306	34,421
100	350,267	373,672	37,783

表 3.5.7

年平均洪水被害

Present basin development level (as of year 1984)

Return period	Brantas river		Widas river
	Up to 139 K	Up to 159 K	
2	38,775	40,972	2,382
5	86,035	91,017	5,553
10	102,233	108,222	6,816
25	112,233	118,883	7,689
50	115,661	122,549	8,018
100	117,422	124,433	8,202

Future basin development level (as of year 2000)

Return period	Brantas river		Widas river
	Up to 139 K	Up to 159 K	
2	76,168	80,386	4,725
5	163,972	178,533	11,001
10	200,758	212,250	13,494
25	220,371	233,131	15,213
50	227,091	240,309	15,862
100	230,542	243,994	16,223

表 3.5.8 インドネシア主要河川での計画洪水及びその規模

No.	Name of River	Province	Catchment Area (km ²)	Design Flood (m ³ /s)	Specific Discharge (m ³ /s/km ²)	Return Period (yr)
1.	Cimanuk	West Java	3,006	1,440	0.48	25
2.	Serang	Central Java	937	900	0.96	25
3.	Citanduy	West Java	3,680	1,900	0.52	25
4.	Ular	North Sumatra	1,080	800	0.74	25
5.	Pemali	Central Java	1,228	1,300	1.06	25
6.	Cipanas	West Java	220	385	1.75	25
7.	Solo	Central/East Java	3,400	1,500 2,000	0.44 0.59	10 * ¹ 40 * ²
8.	Madiun	East Java	2,400	1,100 2,300	0.46 0.96	10 * ¹ 40 * ²
9.	Wampu	North Sumatra	3,840	1,320	0.34	20
10.	Arakundo	Aceh	5,495	1,800	0.33	20
11.	Kring Aceh	Aceh	1,775	1,300	0.73	20
12.	Brantas	East Java	10,000	1,350 1,500	0.135 0.15	10 * ¹ 50 * ²
13.	Bah Bolon	North Sumatra	2,776	1,220	0.44	20
14.	Walanae	South Sulawesi	3,190	2,900	0.91	20
15.	Biba	South Sulawesi	1,368	1,900	1.39	20
16.	Jenebarang	South Sulawesi	729	3,700	5.08	50
17.	Ciujung	North Banten	1,850	1,100 1,600	0.59 0.86	10 * ¹ 50 * ²
18.	Kuranji	West Sumatra	213	870 1,000	4.08 4.69	25 * ¹ 50 * ²
19.	Air Dingin	West Sumatra	131	600 700	4.58 5.34	25 * ¹ 50 * ²
20.	Marmoyo	East Java	290	230	0.79	20
21.	Surabaya	East Java	631	370	0.59	50

表 3.5.9 プラントス河における確率洪水ピーク流量

Base Point		Case No. of Scheme 1							
		1-1	1-2	2-1-1	2-1-2	2-1-3	2-2-1	2-2-2	2-2-3
K. Kates	Inflow	2,180	2,180	2,180	2,180	2,180	2,180	2,180	2,180
	Outflow	740	740	740	740	740	740	740	740
Pakel		1,620	1,620	1,330	1,430	1,530	1,330	1,430	1,530
K.Ngrowo - K.Konto		1,020	1,020	820	860	920	820	860	920
K.Kongo - K.Widas		1,210	1,210	960	1,020	1,100	960	1,020	1,100
K.Widas - K.Brangkal		1,620	1,480	1,340	1,430	1,520	1,230	1,290	1,370
Lengkong		1,730	1,600	1,460	1,550	1,640	1,350	1,410	1,490
Porong		1,700	1,570	1,430	1,510	1,610	1,320	1,370	1,460

Base Point		Case No. of Scheme 2							
		1-1	1-2	2-1-1	2-1-2	2-1-3	2-2-1	2-2-2	2-2-3
K. Kates	Inflow	2,180	2,180	2,180	2,180	2,180	2,180	2,180	2,180
	Outflow	740	740	740	740	740	740	740	740
Pakel		1,620	1,620	830	1,030	1,230	830	1,030	1,230
K.Ngrowo - K.Konto		1,500	1,500	900	910	1,100	900	910	1,100
K.Konto - K.Widas		1,310	1,310	860	860	910	860	860	910
K.Widas - K.Brangkal		1,740	1,580	1,240	1,240	1,330	970	970	1,060
Lengkong		1,870	1,710	1,380	1,380	1,470	1,110	1,110	1,200
Porong		1,830	1,670	1,390	1,390	1,420	1,120	1,120	1,150

表 3.5.10 ウィダス川における25年確率洪水ピーク流量

Base Point	Case No.		
	1	2	3
K. Widas			
Before K. Pelangkeng	450	450	450
K. Pelangkeng - K. Narembek	520	520	520
K. Ngrembek - K. Kedungsoko	590	590 (300)	590
K. Kedungsoko - K. Brantas	850	500 (270)	830
K. Kedungsoko			
Before K. Kuncir	550	200	510
K. Kuncir - K. Ulo	460	150	400
K. Ulo - K. Widas	390	390	390
K. Kuncir			
K. Kuncir Dam	180	180	0
Before Kedungsoko	260	260	170
K. Ulo	220	220 (50)	130
Retarded Volume			
Kedungsoko	$8 \times 10^6 \text{ m}^3$		
Ulo	$7 \times 10^6 \text{ m}^3$		
Widas	$12 \times 10^6 \text{ m}^3$		

Remarks: Case 1 ... Without controled retarding pond
Case 2 ... With controled retarding pond
Case 3 ... With Kuncir Flood Control Scheme on the condition of Case 1.
() ... Outflow from controled retarding pond.

表 3.5.11 建設費の比較

(Unit: Rp. 10⁶)

Scheme/Case	Mainstream			K. Widas			Grand Total
	Main	Flood diversion c.	Total	K. Widas	Retarding basin	Total	
Scheme 1 (unleveed reach upstream from 139 K : present)							
Case 1: without flood diversion channel							
Case 1-1	43,000	0	43,000	64,000	0	64,000	107,000
Case 1-2	28,400	0	28,400	49,800	10,300	60,100	88,500
Case 2: with flood diversion channel (Q = 100 m ³ /s)							
Case 2-1	18,700	12,100	26,800	64,000	0	64,000	90,800
Case 2-2	800	12,100	12,900	49,800	10,300	60,100	73,000
Scheme 2 (unleveed reach upstream from 139 K : confined by dikes)							
Case 1: without flood diversion channel							
Case 1-1	88,300	0	88,300	64,000	0	64,000	152,300
Case 1-2	78,500	0	78,500	49,800	10,300	60,100	138,600
Case 2: with flood diversion channel (Q = 400 m ³ /s)							
Case 2-1	20,400	41,200	61,600	64,000	0	64,000	125,600
Case 2-2	20,400	41,200	61,600	49,800	10,300	60,100	121,700

- Remarks: 1. Construction cost is estimated for direct construction cost for civil works, and land and building compensation.
 2. Price level in Sept. 1984 is adopted. US\$ 1 = Rp. 1030.
 3. Proposed dimensions of the flood diversion channel are as follows:
 - Total length: 10.2 km (Tunnel 5.5 km + Open channel 4.7 km)

表 3.5.12 現在価値及び内部収益率

(Unit: Rp. 10⁶)

Scheme/Case	Present development level				EIRR (%)	Future development level				EIRR (%)
	Net present value (at 12%)					Net present value (at 12%)				
	Cost	Benefit	B-C	B/C		Cost	Benefit	B-C	B/C	
Scheme 1 (unleveed reach upstream from 139 K : present)										
Case 1: without flood diversion channel										
Case 1-1	65,500	34,100	-31,400	0.52	6.2	65,500	70,000	4,500	1.07	12.7
Case 1-2	54,700	30,700	-24,000	0.56	7.0	54,700	63,300	8,600	1.16	13.4
Case 2: with flood diversion channel (Q = 100 m ³ /s)										
Case 2-1	58,100	34,100	-24,000	0.59	7.3	58,100	70,000	11,900	1.20	13.7
Case 2-2	47,800	30,700	-17,000	0.64	8.2	47,800	63,300	15,500	1.32	14.5
Scheme 2 (unleveed reach upstream from 139 K : confined by dikes)										
Case 1: without flood diversion channel										
Case 1-1	85,500	36,200	-49,300	0.43	3.8	85,500	74,700	-10,800	0.88	11.1
Case 1-2	77,000	32,800	-44,200	0.43	4.0	77,000	68,000	-9,000	0.89	11.2
Case 2: with flood diversion channel (Q = 400 m ³ /s)										
Case 2-1	73,400	36,200	-37,200	0.49	5.7	73,400	74,700	1,300	1.01	12.2
Case 2-2	69,300	32,800	-36,500	0.48	5.3	69,300	68,000	-1,300	0.98	11.9

- Remarks: 1. Construction period: 10 years
 2. Project life : 50 years after completion
 3. Discount rate : 12%
 4. O/M cost : 1% of the construction cost per annum after completion
 5. Net incremental beneficial area (Unit: ha):
 Scheme 1, Case 1-1 : 2,100 Scheme 2, Case 1-1 : 3,500
 Case 1-2 : 700 Case 1-2 : 2,100
 Case 2-1 : 2,100 Case 2-1 : 3,500
 Case 2-2 : 700 Case 2-2 : 2,100
 6. Net benefit (Negative cost): Rp. 721,000/ha per annum after completion

表 3.5.13 計画案のプロジェクト費用

(Rp. 10 ⁶)			
Item	K. Brantas (Flood diversion channel)	K. Widas	Total
I. Civil works	60,197	40,365	100,562
II. Land acquisition and building compensation	684	19,694	20,378
III. Sub total	60,881	60,059	120,940
IV. Engineering including administration			
Detailed design	6,020	4,037	10,057
Construction supervision	6,020	4,037	10,057
V. Contingency (physical)	12,040	8,073	20,113
VI. Total	84,961	76,206	161,167

Remarks: 1. Price level in Sept. 1984 is adopted. US\$ 1 = Rp. 1030.

2. The following lump sum costs are adopted to project cost estimates.

Engineering cost (incl. administration cost)

- Detailed design : 10 % of the civil works cost

- Construction supervision: 10 % of the civil works cost

Physical contingency : 20 % of the civil works cost

3. The following construction schedules are applied.

K. Widas incl. detailed design : 7 years (1986 to 1992)

K. Brantas incl. detailed design: 7 years (1991 to 1997)

4. O/M cost for the facilities after completion of the project is assumed to be annually 1 % of the civil works cost.

Flood diversion channel: Rp. 30,100 × 10⁶

K. Widas : Rp. 20,200 × 10⁶

表 3.5.14 クンチールダムが存在する場合としない場合の建設費

Item	Construction cost (Rp. 10 ⁶)	
	Scheme 1	Scheme 2
I. K. Widas	60,726	63,939
K. Widas	34,906	35,364
K. Kedungsoko	8,539	8,875
K. Ulo	8,520	10,055
K. Kuncir	8,012	8,896
Backwater levee	749	749
II. Kuncir dam	25,738	0
III. Total	86,464	63,939

- Note 1. Construction cost for each scheme is estimated for direct construction cost of civil works, and land and building compensation.
2. Price level in Sept. '84 is adopted
US\$ 1 = Rp. 1030
3. The following are considered to dam scheme
 Dam height : 44 m
 Dam type : concrete gravity
 Dam concrete volume : 310,000 m³
 Reservoir capacity : 9 × 10⁶ m³

表 3.5.15 計画案のプロジェクト費用

Item	(Rp. 10 ⁶)		
	K. Brantas (Flood diversion channel)	K. Widas	Total
I. Civil works	60,197	40,365	100,562
II. Land acquisition and building compensation	684	19,694	20,378
III. Sub total	60,881	60,059	120,940
IV. Engineering including administration			
Detailed design	6,020	4,037	10,057
Construction supervision	6,020	4,037	10,057
V. Contingency (physical)	12,040	8,073	20,113
VI. Total	84,961	76,206	161,167

- Remarks: 1. Price level in Sept. 1984 is adopted. US\$ 1 = Rp. 1030
2. The following lump sum costs are adopted to project cost estimates.
 Engineering cost (incl. administration cost)
 - Detailed design : 10 % of the civil works cost
 - Construction supervision: 10 % of the civil works cost
 Physical contingency : 20 % of the civil works cost
3. The following construction schedules are applied.
 K. Widas incl. detailed design : 7 years (1986 to 1992)
 K. Brantas incl. detailed design: 7 years (1991 to 1997)
4. O/M cost for the facilities after completion of the project is assumed to be annually 1 % of the civil works cost.
 Flood diversion channel: Rp. 30,100 × 10⁶
 K. Widas : Rp. 20,200 × 10⁶

表 3.6.1 計画砂防ダム及びシングルダム流域にあるレスティⅢダムの堆砂量

No.	Name of river	without of dam (m)	Gradient	Area (m ²)	Mean width (m)	Sediment volume (10 ⁶ m ³)
		(1)	(2)	(3)	(4)	(5) = (3)x(4)x2/3
1. Upper K. Brantas basin						
1	Brantas	70	1/222	78,000	70	3.60
2	Brantas	75	1/216	74,250	45	2.21
3	Brantas	88	1/196	64,500	60	2.55
	Amprong		1/300	77,350	50	2.55
	Bango		1/200	29,500	20	0.39
	Juli		1/193	13,650	20	0.18
3	Sub-total					5.67
	Sub-total					11.48
2. K. Lesti basin						
4	Lesti	150	1/269	83,250	80	4.40
5	Lesti	150	1/149	49,875	90	2.96
6	Lesti	70	1/84	27,750	60	1.10
	Bamban,					0.27
6	Sub-total					1.37
7	Genteng (south)	100	1/84	59,250	68	2.36
	Genteng (north)		1/84	59,250	60	2.35
7	Sub-total					4.71
8	Genteng	80	1/120	42,750	44	1.24
9	Juwak	60	1/149	48,750	35	1.13
	Sub-total					15.81
3. Lesti III dam						
	Dead storage					6.00
	Sub-total					6.00
Total						33.29

表 3.6.2 砂防ダムの推定建設費

No.	Name of River	Dam Width (m)	Construction cost (10 ⁶ Rp)	Sediment volume (10 ⁶ m ³)	Cost sediment volume (Rp/m ⁶)
		(1)	(2)	(3)	(4) = (2)/(3)
1.	Brantas	70	3,142	3.60	873
2.	Brantas	70	3,327	2.21	1,505
3.	Brantas	88	3,790	5.67	669
4.	Lesti	150	5,923	4.40	1,346
5.	lesti	150	5,923	2.96	2,001
6.	Lesti	70	3,142	1.37	2,293
7.	Genteng	100	4,186	4.71	889
8.	Genteng	80	3,502	1.24	2,824
9.	Juwok	60	2,807	1.13	2,484
Total			35,742	27.29	1,310

表 3.6.3 クルド山の流域面積

(Unit : Km²)

Basin No.	River	Plain Area	Mountainous Area	Total	Percentage
I	Lekso	66.00	27.50	93.50	4.67
II	Jari	46.35	13.25	59.60	2.98
III	Putih	68.74	8.86	77.60	3.87
IV	Abab	96.98	9.02	106.00	5.22
V	Badak	476.20	29.00	505.20	25.22
VI	Petungkobong	102.20	10.20	112.40	5.61
VII	-	174.00	-	174.00	8.69
VIII	Sukorejo	142.26	12.94	155.20	7.75
IX	Ngobo	185.55	19.25	204.80	10.22
XII	Serinjing	241.70	5.50	247.20	12.4
XI	Konto	213.20	54.38	267.58	13.36
Total		1,813.18	189.90	2,003.08	100.00

Remarks : Presented figures are the acreage of the basin area that belongs to lahar area originating from G. Kelud.

Source : WS - 04

表 3.6.4 火山溶岩物が堆積する地区での河床こう配

Elevation (m)	K.Lekso	K.Semut	K.Putih	K.Badak	G.Cedok	K.Petung-Kobong	K.Sukorejo	K.Ngobo	K.Serinjing	K.Konto
0 - 100	-	-	-	1/480 (75~100m)	1/390 (75~100m)	1/200 (75~100m)	1/188 (55~100m)	1/216 (55~100m)	1/300 (40~100m)	1/381
100 - 200	1/137.5 (160~200m)	-	1/60 (150~200m)	1/125	1/117.5	1/100	1/99	1/97.5	1/102.5	1/106
201 - 300	1/16	1/55.9 (215~300m)	1/55	1/56.5	1/50	1/50	1/41	1/43	1/42.5	1/51.5
301 - 400	1/50	1/42.5	1/40	1/42.5	1/42.5	1/37.5	1/30	1/34.5	1/29	1/45
401 - 500	1/36.5	1/32.5	1/30	1/30	1/32.5	1/27.5	1/30	1/22.5	1/21	1/30.5
501 - 600	1/31.5	1/17.5	1/22.5	1/28.5	1/25.5	1/22.5	1/15	1/18.5	1/15.5	1/64
601 - 700	1/18.5	1/20.5	1/17	1/15.5	1/11.95	1/17	1/18.5	1/12.5	1/16.5	1/10.5
701 - 800	1/15.5	1/13	1/13	1/10.5	1/7.5	-	1/17	1/8	1/13	1/10
801 - 900	1/14	1/6	1/9.5	1/9	-	-	1/13	1/8.5	1/7.5	1/7
901 - 1000	1/8	1/8.5	1/8	1/9	-	-	1/4.5	1/10	1/2.5	1/4
1001 - 1100	1/8	-	1/4	1/8	-	-	-	1/6	1/4	1/8
1101 - 1200	1/5	-	1/4	1/3.5	-	-	-	1/4.5	1/4	1/8
1201 - 1300	1/3.5	-	-	-	-	-	-	-	-	-

* Remarks : Gradient above the EL. 500 m is that for one of the Tributaries of K. Konto which originates G. Kelud.

Source : WS C4

表 3.6.5 同上地区での平均月間雨量

(mm)

Basin No.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
(I)	352	329	326	248	170	78	79	32	46	136	295	418	2,509
(II)	352	322	332	259	177	89	87	38	55	156	338	440	2,645
(III)	326	319	330	236	172	92	72	38	41	132	279	398	2,435
(IV)	319	318	323	233	175	91	66	35	32	120	250	371	2,333
(V)	319	303	326	219	167	74	56	27	23	99	199	319	2,131
(VI)	277	267	328	202	169	73	54	30	28	88	173	281	1,970
(VII)	282	275	325	210	160	67	51	26	22	73	153	259	1,903
(VIII)	304	289	387	275	185	86	65	33	26	99	246	425	2,420
(IX)	313	303	319	219	157	78	58	30	26	89	178	303	2,073
(X)	301	317	293	183	137	67	51	26	22	72	146	274	1,889
(XI)	376	364	323	190	130	62	55	25	21	88	195	322	2,151
Mean	320	310	328	225	164	78	63	31	31	105	223	346	2,224

Source : WS 04

表 3.6.6 主要5河川に及ぼす火山崩壊物の量

($10^6 m^3$)

River	Catchment Basin area (Km ²)	Flow distance (km)	Amount of volcanic debris				
			Ladu	Primary Lahar	Secondary lahar	Total	Percentage (%)
K. Semut	93.5	19.30	1.5	2.35	6.13	9.98	17.5
K. Putih	77.6	23.7	3.0	3.70	7.50	14.20	24.9
K. Badak	505.2	47.2	2.7	11.50	4.0	18.20	31.9
K. Ngobo	204.8	37.0	0.35	3.60	5.30	9.25	16.2
K. Konto	267.6	53.0	0.2	0.7	4.50	5.40	9.5
Total	1,148.7		7.75	21.85	27.43	57.03	100.0

Source : WS 04

Remarks ; (1) The amounts show those derived from G. Kelud eruption in 1966 until the end of 1966, investigated by GOI.

表 3.6.7 火山溶岩物が堆積する地区での生産土砂量と流出土砂量の比較

Name of Rivers area	Catchment area (Km ²)	Lahar volume	Falling Materials	Total volcanic	Sediment yield during 15 years			Remaining sediment volume in lahar area
					(P+S)*	(W)**	Sub-total	
Semut (I-II)	153.1	22.7	4.9	27.6	4.9	2.7(2.0)	7.6	20.0(73%)
Putih (III)	77.6	32.4	1.8	34.2	6.9	1.0(1.0)	7.9	26.3(77%)
Badak (VI-VII)	897.6	41.5	11.6	53.1	8.8	8.4(8.4)	17.2	35.9(68%)
Ngobo (VII-X)	607.2	21.1	9.4	30.5	6.1	6.1(6.1)	12.2	18.3(60%)
Konto (XI)	267.6	12.3	9.1	21.4	6.8	7.4(4.7)	14.2	7.2(34%)
Sub total	2,003.1	130.0	36.8	166.8	33.5	25.6(22.2)	59.1	107.7(65%)
Other area	5,850.9	-	33.2	33.2	-	-	33.2	-
Total	7,854.0	130.0	70.0	200.0	33.5	25.6(22.2)	92.3	107.7

Remarks : () : Sediment from lahar area
* : Bed and suspended load
** : Wash load

Source : WS - 04

表 3.6.8 15年間に亘る生産土砂量と流出土砂量の比較

Basin	BY BRUBEG (10 ⁶ m ³)					
	(1) Total volcanic product	(2) Sediment carried off to the Brantas	(3) Controllable sediment retained in tributaries	(4)=(2)+(3) Sub total	(5) Sediment to be carried off to the Brantas under proposed condition	(6)=(4)+(5) Excess over proposed amount to be arrested
Semut	27.6	4.9	7.5	12.4	0.9	11.5
Putih	34.2	6.9	10.6	17.5	0.9	16.6
Badak	53.1	8.8	13.6	22.4	4.5	17.9
Ngobo	30.5	6.1	6.9	13.0	3.0	10.0
Konto	21.4	6.8	4.1	10.9	2.3	8.6
Total	166.8	33.5	42.9	76.2	11.6	64.6

Remarks : * Bed and suspended load

Source : WS - 04

BY G. KELUD PROJECT

Name of river	Length (km)	Excess (10 ⁶ m ³)	Sediment (%)
K. Konto	40	6.54	9.90
K. Serinjing	39	0.84	1.27
K. Ngobo	37.5	9.14	13.85
K. Derno-Sukorejo	39	5.24	7.94
K. Gedog	25	1.21	1.83
K. Badak-Termas	40	18.20	27.58
K. Putih	26	13.54	20.52
K. Semut	18	7.14	10.82
K. Lekso	7	4.15	6.29
Total		66.00	100.00

Source : Information from G. Kelud Project

表 3.6.9 残存堆砂容量及び調節可能容量

(Unit: $\times 10^6 m^3$)					
Name of River	Design storage capacity (1)	Present retained (2)	Remaining storage capacity (3)	Estimated Control Volume (4)	Combined capacity (5)=(3)+(4)
K. Konto					
Lahar pocket	1.311	0.771	0.54	1.66	
Other structures	0.619	0.503	0.116	0.99	
Sub-total	1.93	1.274	0.656	2.65	3.306
K. Serinjing					
Lahar pocket	0.321	0.228	0.093	0.32	
Other structures	0.139	0.126	0.013	0.222	
Sub-total	0.46	0.354	0.106	0.542	0.649
K. Ngobo					
Lahar pocket	1.12	0.84	0.28	1.792	
Other structures	0.72	0.72	-	1.185	
Sub-total	1.84	1.56	0.28	2.977	3.257
K. Dermo - K. Sukorejo					
Check dam etc.	0.16	0.16	-	0.256	0.256
K. Gedok					
Lahar pocket	0.15	0.131	0.019	0.255	
Other structures	0.017	0.017	-	0.027	
Sub-total	0.167	0.148	0.019	0.282	0.301
K. Badak - K. Termas					
Lahar pocket	8.45	6.162	2.288	8.469	
Other structures	0.69	0.69	-	1.104	
Sub-total	9.14	6.862	2.288	9.573	11.861
K. Putih					
Lahar pocket	2.57	1.986	0.584	4.172	
Other structures	0.62	0.36	0.26	0.992	
Sub-total	3.19	2.346	0.844	5.164	6.008
K. Sumut					
Lahar pocket	1.66	1.252	0.408	2.739	
Other structures	0.57	0.317	0.163	0.912	
Sub-total	2.23	1.569	0.661	3.651	4.312
K. Lekso					
Check dam	0.29	0.29	-	0.464	0.464
Total	19.407	14.553	4.854	25.559	30.413

表 3.6.10 コント川流域上流での平均月間雨量

Month	Mean monthly rainfall (mm)
JAN.	502.45
FEB.	354.89
MAR.	364.58
APR.	209.47
MAY	136.42
JUN.	52.47
JUL.	24.96
AUG.	27.74
SEP.	54.57
OCT.	110.19
NOV.	212.78
DEC.	289.22
Total	2,339.74

Remarks : Rainfall data from 1977 to 1983

表 3.7.1 東部及び全ジャワ島における売電量と発電・電力需

Year	East Java			All Java		
	Energy sales (Gwh)	Annual growth (%)	Energy production (Gwh)	Energy sales (Gwh)	Annual growth (%)	Energy production (Gwh)
1975/76	528.6	15.0	683.0	2,498.7	26.1	2,889.9
1976/77	537.3	1.6	716.9	2,449.1	2.0	3,113.7
1977/78	580.3	8.0	775.1	2,837.3	15.9	3,588.8
1978/79	753.3	29.8	995.8	3,446.2	21.5	4,295.5
1979/80	919.0	22.0	1,262.1	4,135.1	20.0	5,153.1
1980/81	1,161.3	26.4	1,481.3	5,102.1	23.4	6,183.8
1981/82	1,475.4	27.0	1,903.0	6,209.1	21.7	7,531.3
1982/83	1,797.8	21.9	2,199.4	7,230.4	16.4	8,741.8
Average rate of annual growth		19.1			16.4	

(Source: Ref. EP-04)

PEAK DEMAND IN EAST JAVA

East Java	
Year	Peak Demand (MW)
1975/76	105
1976/77	116
1977/78	127
1978/79	171
1979/80	218
1980/81	226
1981/82	328
1982/83	389
Average rate of annual growth	
	20.6%

(Source: Ref. EP-08)

表 3.7.2 過去の電力需要推移とその将来予測

Year	East Java			All Java			
	Energy production (Gwh)	Peak demand (MW)	Installed capacity (MW)	Energy Sales (Gwh)	Energy production (Gwh)	Peak demand (MW)	Installed capacity (MW)
1977/78	-	-	229	2,837	3,751	631	1,270
1978/79	-	-	396	3,446	4,521	781	1,632
1979/80	-	-	396	4,243	5,500	952	1,852
1980/81	-	-	423	5,112	6,583	1,184	1,854
1981/82	-	-	623	65,225	7,931	1,421	2,258
1982/83	2,156	410	623	7,225	9,127	1,770	2,485
1983/84	2,735	446	628	7,927	10,574	1,851	¹ 2,679
1988/89	5,671	958	1,099	-	23,202	3,957	¹ 6,082
1993/94	10,604	1,740	-	-	42,044	6,889	-
1998/99	17,560	2,892	-	-	67,894	11,101	-
2003/04	27,356	4,446	-	-	103,381	16,861	-

(Source: Ref. EP-10)

Note: ¹ - Under construction or committed

COMPOSITION OF POWER SOURCES

(Unit: MW)

Plants	East Java			All Java		
	1983/84	1988/89 ¹	1993/94 ²	1983/84	1988/89 ¹	1993/94 ²
Hydro P.P	210.5	239.5	259.5	493.8 ³	1,745.4	2,765.4
Thermal (oil)	350.0	750.0	750.0	1,306.2	1,906.2	1,906.2
Thermal (coal)	-	-	1,600.0	-	1,600.0	4,400.0
Gas turbine	67.5	109.5	109.5	735.2	798.2	798.2
Geo-thermal	-	-	-	30.0	140.0	140.0

(Source: Ref. EP-10)

Note: ¹ - On-going projects are included

² - Planned projects are included

³ - Jatiluhur H.P.P. is included

⁴ - No retirement of plants is considered

SUMMARY OF CAPTIVE POWER

(As of 1980)

PLN's Wilayah	Captive power (KVA)			Received from PLN (KVA)
	Pure Captive	Stand-by & Others	Total	
Wilayah - XII (Jatim)	351,095	56,832	407,927	123,560
Wilayah - XIII (Jateng)	224,859	32,426	257,285	35,310
Jabar	455,061	29,542	484,603	71,603
DKI Raya	326,424	135,553	461,977	N/A
Total	781,485	118,800	1,611,792	230,473

(Source : Ref. EP-02)

表 3.8.1 カランクテス水力発電所での発生一次電力と二次電力量の比較

Year	Actual Operation			H - Q Constant		
	Peak Energy Total	Off-Peak Energy Total	Total Energy	Peak Energy Total	Off-Peak Energy Total	Total Energy
1978	190.8	318.7	509.5	190.8	329.5	520.3
1979	183.3	333.8	517.1	189.5	346.0	535.5
1980	160.4	168.5	328.9	189.9	144.3	334.2
1981	190.0	249.1	439.1	190.2	239.2	429.4
1982	159.8	225.1	384.9	185.6	230.0	415.0
1983	179.6	275.3	454.9	190.5	252.5	443.0
Total	1,063.9	1,570.5	2,634.4	1,136.5	1,541.5	2,678.0

表 3.8.2 1982年での運転方式による乾季流出流量比較

Month	Unit m^3/s	
	Actual Outflow	Outflow by HQ constant
June	43.73	40.36
July	55.91	37.60
Aug.	52.70	38.18
Sept.	43.83	39.14
Oct.	37.06	40.57
Nov.	37.10	42.88
Dec.	38.68	45.98

表 3.8.3 カランカテス及びラホール貯水池への流入量予測回帰式

	Jun	Jul.	Aug	Sept	Oct
A ₀	-11.0899638	-15.5299962	-2.87097038	-0.61494647	3.07925388
A ₁	0.0149239665	0.0525167239	0.0384507892	0.042389943	0.0313118965
A ₂	0.0297891733	0.0101756963	0.0107804442	0.005352747	0.0105785789
A ₃	0.0083712475	0.0242773289	0.169692058	0.020534444	0.01038751
A ₄	-0.0541001518	0.0124031042	-0.020504488	-0.014334763	-0.0272584739
A ₅	0.0987755701	0.0498220939	0.0459776609	0.034219894	0.0369615015
A ₆	0.169481819	0.0461714545	0.0428709541	0.010738026	0.031367007
A ₇	0.0506207894	0.0559367462	0.0027992661	-0.004698774	-0.022273360
RR	0.973412	0.963390	0.931206	0.883487	0.879276

$$Q_i = A_0 + A_1 * R_{11} + A_2 * R_{12} + A_3 * R_1 + A_4 * R_2 + A_5 * R_3 + A_6 * R_4 + A_7 * R_5$$

Where,

Q_i : Monthly runoff (mm)

A₀.....A₇ : constant

R₁₁ : monthly runoff in November

R₁₂ : monthly " in December

R₁ : " in January

R₂ : " in February

R₃ : " in March

R₄ : " in April

R₅ : " in May

RR : Correlation coefficient

表 3.8.4

既存ダムの余水ばき容量の検討

Particulars	Karangates	Lahor	Selorejo	Milingi
A. Original Design				
1. Dam Crest EL.	EL. 279.0 m	EL. 278.0 m	EL. 625.0 m	EL. 167.5 m
Core top	EL. 278.5 m	EL. 277.5 m	EL. 624.5 m	EL. 167.0 m
2. Spillway				
(1) Gated spillway				
Soil EL.	EL. 267.0 m	-	-	EL. 163.5 m
Opening width	10.0 m	-	-	10.6m x 4 nos
(2) Non-gated spillway				
Crest EL.	EL. 272.5 m	EL. 272.7 m	EL. 620.0 m	-
Crest Width	50.0 m	35 m	30 m	-
(3) Design flood				
Water level	EL. 375.5 m	EL. 275.6 m	EL. 622.8 m	EL. 164.5 m
(4) Design Flood				
Inflow (Peak)	1,540 m ³ /s	580 m ³ /s	680 m ³ /s	2,824 m ³ /s
(5) Design outflow	1,530 m ³ /s	360 m ³ /s	290 m ³ /s	2,300 m ³ /s
(without gate)	(530 m ³ /s)			
(6) Max. capacity	1,600 m ³ /s	540 m ³ /s	430 m ³ /s	3,900 m ³ /s
B. Checking				
1. 200 yr x 1.2 Flood				
(1) Inflow (peak)	3,939 m ³ /s	645 m ³ /s	818 m ³ /s	2,927 m ³ /s
(2) Outflow (peak)	1,046 m ³ /s	295 m ³ /s	280 m ³ /s	2,900 m ³ /s
(3) Highest water level ^{/1}	EL. 276.17 m	EL. 275.18m	EL. 622.78 m	EL. 163.70m
(4) Allowable water level ^{/2}	EL. 275.5 m	EL. 275.6 m	EL. 622.8 m	EL. 164.50m
2. 10,000 yr Flood				
(1) Inflow (peak)	6,241 m ³ /s	2,776 m ³ /s	2,009 m ³ /s	4,596 m ³ /s
(2) Outflow (peak)	1,764 m ³ /s	816 m ³ /s	779 m ³ /s	3,983 m ³ /s
(3) Highest water level ^{/1}	EL. 278.42 m	EL. 277.58m	EL. 625.40m	EL. 166.10 m
(4) Allowable water level ^{/3}	EL. 278.0 m	EL. 276.5 m	EL. 623.5 m	EL. 166.0 m

Notes: /1 : Water level formed by the existing spillway capacity

/2 : According to Japanese standard

/3 : 1 m from core top + 0.5 if gated.

表 3.8.5(1) 将来ダムプロジェクトの概要

Storage Type Dam

River Name	Name of Dam	Catchment Area km ²	HML/LVL EL.m	Storage Gross/Net x 10 ³ m ³	Embankment x 10 ³ m ³	Storage Efficiency	Data Topo Geo.
Brantas	Kali Lanang	85	720	50,180	6,790	6.3	1/50,000
			677.5	42,900			No
Amprong	Lojing	54	750	21,900	1,560	11.9	1/2,500
			720	17,300			No
	Tumpang	62	750	26,000	6,320	4.1	1/2,500
			670	25,600			No
Genteng	Genteng I	160	436	86,000	2,240	31.3	1/2,500
			408.5	70,000			Available
Ngrowo	Klotok ^{/1}	33	200	33,100			1/50,000
			165	31,200			Available
K.Konto	Konto I	66	1,055	31,000	3,350	4.8	1/50,000
			1,038	16,000			No
			Konto II	169			980
944	43,500	No					
	Konto III	189	885	116,000	16,930	6.8	1/5,000
			772	114,500			No
			Kuncir, al IV	70			471
423	47,000	Available					
Widas	Kedungwarak	32	170	57,600	79	712	1/2,500
			152	55,950			Available
			Semantok	61			96.5
80	40,000	No					
	Babadan	^{/2}	175	99,700	6,970	12.9	1/50,000
				89,700			No
Beng	Beng	134	73	160,000	720	209.8	1/50,000
			50	150,000			No

Remarks

^{/1} : Dam and reservoir is in the limestone area. Countermeasures against leakage from reservoir will be costly. Then high storage efficiency is disregarded.

^{/2} : Adjustable by trans-basin.

表 3.8.5(2)

将来ダムプロジェクトの概要

Channel Type Dam

River Name	Name of Dam	Catchment Area km ²	HWL/ LWL El. m	Storage Gross/Net x10 ³ m ³	Hydropower		Embank 10 ³ Energy/Vol	Data Topo Geo
					Head/Q 90 m/ m ³ /s	MW/GWh		
Brantas	Malang	518	417.5	7,550	21.7	6.7	96	1/2500
			407.5	4,040	7.7	13.0	135	No
	Tambaksari	738	395	2,870	19.2	8.4	55	1/2500
			375	1,610	11.0	16.3	296	No
	Lumbansari	842	375	6,000	28.5	14.2	88	1/2500
			365	3,290	12.5	27.7	315	No
	Blobo	851	347.5	1,993	14.2	7.2	112	1/2500
			337.5	1,508	12.7	13.9	124	No
	Kepanjen	912	317.5	1,490	19.7	8.3	38	1/2500
			307.5	1,130	10.6	15.8	415	Available
Jitu	Jitu I	48	540	180	38.3	1.1	5	1/2500
			535	115	0.7	2.1	420	No
	Jitu II	94	500	1,990	18.3	1.0	88	1/2500
			495	882	1.4	2.0	23	No
	Jitu III	156	462.5	1,765	15.8	1.5	96	1/2500
			457.5	584	2.3	2.8	29	No
Amprong	Amprong	333	447.5	1,600	16.8	3.4	72	1/2500
			442.5	989	5.0	6.4	89	No
Bango	Bango	175	450	1,250	10.8	1.1	18	1/2500
			445	568	2.6	2.2	122	No
Lesti	Lesti I	80	462.5	1,980	1.58	0.9	24	1/2500
			457.5	1,080	1.5	2.7	113	No
	Lesti II	148	397.5	4,040	20.8	2.2	202	1/2500
			392.5	959	2.7	6.6	33	Available
	Lesti III	355	342.5	8,530	20.8	5.4	44	1/2500
			337.5	2,535	6.5	15.8	359	Available
	Lesti IV	417	322.5	6,110	20.8	6.3	196	1/2500
			317.5	1,880	7.6	18.5	94	No
Genteng	Genteng II	170	365	2,700	21.0	15.3	107	1/2500
			353	713	10.0	15.3	143	Available
Metro	Metro	236	312.5	2,300				1/2500
			302.5	1,040	3.5			Available

表 3.8.6

水の単位価値

(1) VALUE OF IRRIGATION WATER

Case I : Irrigated Paddy ——— Non-irrigated Polowijo

Required irrigation water : 1,350 mm
12,600 m³/ha

Primary Profit

Irrigated paddy Rp. 1,028 x 10³

Non-irrigated polowijo Rp. 162 x 10³
(Gottan-Losari)

Rp. 868 x 10³

Value of irrigation water

$$\text{Rp. } 868 \times 10^3 / 12,600 = \text{Rp. } 69 / \text{m}^3$$

Case II : Irrigated - Polowijo - Non-irrigated Polowijo

Required irrigation water : 300 mm
3,000 m³/ha

Primary profit

Irrigated polowijo Rp. 371 x 10³/ha

Non-Irrigated polowijo Rp. 162 x 10³/ha

Rp. 209 x 10³/ha

Value of irrigation water

$$\text{Rp. } 209 \times 10^3 / 3000 = \text{Rp. } 70 / \text{m}^3$$

Value of Irrigation Water on an Average = Rp. 70 / m³

(2) ALLOWABLE MAXIMUM RAW WATER COST

1. Umbulan Spring Project^{/1} (Capacity 3m³/s)

Capital Cost ; Pipeline	Rp. 135 x 10 ⁹
Transmission Pump	Rp. 5.52 x 10 ⁹
Total	Rp. 140.52 x 10 ⁹

表 3.8.7(1) プロジェクトの便益及び内部収益率

Unit	Genteng I	Kali Konto II	Babañan	Kuncir	Semantok	
POSITIVE BENEFIT						
1. Water Supply						
Effective storage	x10 ⁶ m ³	70	63	84	22.5	40
Benefit	Rp. 10 ⁶ /Y	7,000	6,300	8,400	2,250	4,000
2. Hydropower						
Installed capacity	MW	18.6	62	9.4	4.3	-
Annual energy	Gwh	54.9	207.4	28.1	28.3	-
Capacity benefit	Rp. 10 ⁶ /Y	1,082	3,608	547	250	-
Energy benefit	Rp. 10 ⁶ /Y	6,640	25,086	3,399	3,423	-
3. Sediment control						
Downstream reservoir		K. Kates	Selorejo			
Dead storage	x10 ⁶ m ³	16	10			
Total benefit	Rp. 10 ⁶	1,600	1,000			
Annual benefit	Rp. 10 ⁶ /Y	32	20			
4. Flood control						
Total Positive Benefit	Rp. 10 ⁶ /Y	14,742	35,014	11,799	5,923	4,000
NEGATIVE BENEFIT						
1. Land						
Reservoir area	ha	410	220	250	128	350
Land cost	Rp. 10 ⁶ /Y	205	110	188	64	263
2. Pump up						
Installed capacity	MW	-	-	-	-	-
Annual energy	Gwh	-	-	-	-	-
Capacity cost	Rp. 10 ⁶ /Y	-	-	-	-	-
Energy cost	Rp. 10 ⁶ /Y	-	-	-	-	-
Total Negative Benefit	Rp. 10 ⁶ /Y	205	10	188	64	263
NET BENEFIT	Rp. 10 ⁶ /Y	14,549	34,904	12,158	5,859	3,737
CAPITAL COST						
Dam and Power	Rp. 10 ⁶	91,102	202,741	140,111	75,083	73,167
Pump & Pipeline	Rp. 10 ⁶					
Irrigation	Rp. 10 ⁶				(5,560)	
Total	Rp. 10 ⁶	91,102	202,741	140,111	75,083	73,161
CONSTRUCTION PERIOD	Years	4	5	4	4	4
ANNUAL O & M COST	Rp. 10 ⁶ /Y	911	2,027	1,401	751	732
B-C at D.F. = 12%	Rp. 10 ⁶	2,745	10,459	-49,597	-30,036	-39,660
EIRR	%	12.4	12.7	6.6	5.8	2.9

表 3.8.7(2) プロジェクトの便益及び内部収益率

	Unit	Kedungvarak	Beng	Lumbangsari	Kepanjen
POSITIVE BENEFIT					
1. Water Supply					
Effective storage	$\times 10^6 \text{ m}^3$	54	150	-	-
Benefit	Rp. $10^6/\text{Y}$	5,400	15,000	-	-
2. Hydropower					
Installed capacity	MW	0.7	12	10.8	6
Annual energy	Gwh	3.0	10.4	46.9	32.5
Capacity benefit	Rp. $10^6/\text{Y}$	-	-	629	349
Energy benefit	Rp. $10^6/\text{Y}$	363	1,258	5,670	3,931
3. Sediment control					
Downstream reservoir					
Dead storage	$\times 10^6 \text{ m}^3$				
Total benefit	Rp. 10^6				
Annual benefit	Rp. $10^6/\text{Y}$				
4. Flood control					
Total Positive Benefit	Rp. $10^6/\text{Y}$	5,763	16,253	6,299	4,280
NEGATIVE BENEFIT					
1. Land					
Reservoir area	ha	640	1,300	Not provided	Not provided
Land cost	Rp. $10^5/\text{Y}$	480	975		
2. Pump up					
Installed capacity	MW	7.7	5.9		
Annual energy	Gwh	27.6	21.5		
Capacity cost	Rp. $10^6/\text{Y}$	1,581.6	1,211.9		
Energy cost	Rp. $10^6/\text{Y}$	662.4	516.0		
Total Negative Benefit	Rp. $10^6/\text{Y}$	2,244	2,702.9		
NET BENEFIT	Rp. $10^6/\text{Y}$	3,039	13,555.1	6,299	4,280
CAPITAL COST					
Dam and Power	Rp. 10^6	5,894	34,909	343,926	20,712
Pump & Pipeline	Rp. 10^6	35,609	21,219		
Irrigation	Rp. 10^6		5,175		
Total	Rp. 10^6	41,503	61,303	343,926	20,712
CONSTRUCTION PERIOD	Years	4	4	4	4
ANNUAL O & M COST	Rp. $10^6/\text{Y}$	415	610	339	207
B-C at D.F. = 12%	Rp. 10^6	-17,653	21,694	5,663	5,745
EIRR	%	5.3	16.6	14.2	15.6

表 3.8.8. ウィダス流域開発代替案の概要

- I. Flood Control Plan (1) River channel improvement
 (2) Floodway
 (3) Retarding basin
 (4) Combination of the above component

II. Dam/Irrigation Plan	Irri. Area (ha)	Dam Scheme		Dam Volume (10 ⁶ m ³)	Effective Storage (10 ⁶ m ³)	IRR (%)
		HWL/LWL (m)	Dam Height (m)			
(1) Kuncil dam scheme						
(1.1) Dam and irrigation	6,270	446/418	100	6.85	22.5	4.1
(1.2) Dam and water supply	-	446/418	100	6.85	22.5	5.8
(2) Kedung Warak dam scheme						
(2.1) Dam and irrigation						
(a) 950 ha	950 (ppm)	164.5/152	26.5	0.14	28.0	10.5
(b) 720 ha	720 (ppm)	164.5/152	26.5	0.14	28.0	10.8
(2.2) Dam and water supply						
(a) With pump-up	-	170/152	32.0	0.22	54.0	5.3
(b) Without pump-up*	(950)	164.5/152	26.5	0.14	28.0	11.8
(3) Semantok						
(3.1) Dam and irrigation						
(a) 1,300 ha (2,250 + 950 ha)	1,300	89.8	36.3	2.70	16.9	0.5
(b) 1,530 ha (2,250 - 720 ha)	1,530	92.4	38.9	3.40	24.4	0.3
(3.2) Dam and water supply	-	96.5/80	43.0	5.28	40.0	2.9

*: Four years among 5 years for irrigation, and one year for water supply

表 3.10.1 ジャボン-ブルニンでの利用可能水量

(Unit: MCM)

Year	Annual (Dec - Nov)	Wet Season (Dec - May)	Dry Season (Jun - Nov)
1963/64	8,176.3	5,380.6	2,795.7
64/65	5,305.9	4,438.8	867.1
65/66	6,841.7	5,813.1	1,028.6
66/67	7,011.2	6,161.2	850.0
67/68	9,883.9	6,881.0	3,002.9
68/69	8,028.3	6,817.7	1,210.6
69/70	7,275.8	6,024.1	1,251.7
70/71	8,367.5	6,126.1	2,241.4
71/72	6,360.2	5,449.1	911.1
72/73	8,482.4	6,274.8	2,207.7
73/74	7,270.2	5,512.2	1,758.0
74/75	11,336.8	8,059.8	3,277.0
75/76	7,607.5	6,394.9	1,212.6
76/77	5,098.8	4,282.0	816.8
77/78	8,217.9	5,831.1	2,386.7
78/79	8,942.2	6,951.1	1,991.1
79/80	5,345.5	4,227.5	1,118.0
80/81	7,724.1	6,091.6	1,632.5
81/82	6,942.3	6,108.8	833.5
82/83	8,383.1	6,574.0	1,809.2
Ave.	7,630.1	5,970.0	1,660.1
Max.	11,336.8	8,059.8	3,277.0
Min.	5,098.8	4,227.5	816.8

表 3.10.2 クロオ川流域からの還元水量

Unit : m³/s

	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Ave.
<u>1982</u>							
Return flow	3.29	2.38	1.71	1.99	2.02	1.88	2.21
Run-off	7.59	4.75	3.35	2.02	1.24	1.10	3.34
Total	10.88	7.13	5.06	4.01	3.26	2.98	5.55
Total volume = 87.7 MCM							
<u>1965</u>							
Return flow	3.29	2.38	1.71	1.99	2.02	1.88	2.21
Run-off	6.21	4.41	2.98	1.74	1.16	1.74	3.04
Total	9.50	6.79	4.69	3.73	3.18	3.62	5.25
Total volume = 82.9 MCM							
<u>1970</u>							
Return flow	3.29	2.38	1.71	1.99	2.02	1.88	2.21
Run-off	28.77	7.72	5.21	3.89	2.57	20.00	11.26
Total	32.06	10.10	6.92	5.88	4.59	21.88	13.47
Total volume = 212.9 MCM							
<u>1974</u>							
Return flow	3.29	2.38	1.71	1.99	2.02	1.88	2.21
Run-off	10.79	7.22	7.93	6.37	58.49	77.62	28.01
Total	14.08	9.60	9.64	8.36	60.51	79.50	30.22
Total volume = 477.8 MCM							

表 3.10.3 プラタス河流域かんがい面積の変化

Lodoyo - Tulungagung Irrigation

Name of Irrigation section	1975	1984	Increase	
			(ha)	(%)
Blitar	31,667	34,986	3,319	10.5
Tulungagung	30,202	34,268	4,066	13.5

Source: ANNEX - AI

Wonokromo Section in Surabaya Delta

Year	Irrigation area (ha)	Source
1964	6,831	WR - 02
1965	6,831	WR - 02
1966	6,805	WR - 02
1967	6,791	WR - 02
1968	6,775	WR - 02
1969	6,775	WR - 02
1970	6,729	WR - 02
1971	6,729	WR - 02
1975	5,356	WR - 04
1976	5,223	WR - 04
1977	4,976	WR - 04
1978	4,819	WR - 04
1979	4,581	WR - 04
1980	4,411	WR - 04
1984	2,989	AI - 2

(Ref. Fig. WR - 1.2)

表 3.10.4 かんがい用水需要

Present : Authorized (Wet season paddy + dry season paddy)
+ Polowijo + Sugarcane

Unit : MCM							
Irrigation Area	June	July	Aug.	Sept.	Oct.	Nov.	Total
Molek	7.72	4.45	3.57	6.47	4.86	7.19	34.26
Lodoyo	28.47	21.23	15.23	17.21	18.01	16.19	116.34
Mrican	34.13	15.60	15.18	23.69	11.47	14.49	114.56
Turitunggorono	21.62	13.60	8.56	15.03	13.13	9.76	81.70
Jatimlerek-Bunder	2.16	2.11	1.21	1.95	2.17	1.44	11.04
Gottan etc.	2.58	2.78	3.46	4.61	5.49	4.29	23.21
Jatikulon	1.51	1.43	1.02	1.24	0.77	0.61	6.58
Wonokromo	2.10	1.56	0.69	1.23	1.72	1.67	8.88
Porong	19.47	16.22	10.07	12.11	24.27	24.12	106.26
Mangetan	21.09	17.38	11.50	16.89	33.95	33.12	133.93
	140.76	96.36	70.49	100.43	115.84	112.88	636.76

Future project : Authorized (Wet season + dry season paddy)
+ Polowijo + Sugarcane

Unit : MCM							
Irrigation Area	June	July	Aug.	Sept.	Oct.	Nov.	Total
Lesti left	1.25	3.70	3.07	0.43	0.33	0.68	9.46
Papar-Peterongan	16.43	1.58	0	0	0	1.93	19.94
Gottan etc.	4.82	2.24	0	0.95	3.26	2.67	13.94
Groundwater	39.12	22.12	35.62	51.22	31.31	48.42	227.81
	61.62	29.64	38.69	52.60	34.90	53.70	271.15

Unauthorized dry season paddy

Unit : MCM							
Irrigation Area	June	July	Aug.	Sept.	Oct.	Nov.	Total
Molek	1.82	0.92	0.06	0	0	0	2.80
Jatimlerek-Bunder	0.61	0.58	0.10	0	0	0	1.29
Jatikulon	0.34	0.26	0.02	0	0	0	0.62
Wonokromo	0.78	0.66	0.22	0	0	0	1.66
Porong	5.42	4.72	2.18	0.15	0	0	12.47
Mangetan	12.39	10.79	4.98	0.34	0	0	28.50
	21.36	17.93	7.56	0.49	0	0	47.34

表 3.10.5(1) 将来水需要 (1985)

Item	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Average
<u>Domestic water</u>	<u>9.52</u>	<u>9.52</u>	<u>9.52</u>	<u>9.52</u>	<u>9.52</u>	<u>9.52</u>	<u>9.52</u>
SMA domestic							
surface w.	5.57	5.57	5.57	5.57	5.57	5.57	5.57
spring w.	-	-	-	-	-	-	-
SMA social							
surface w.	0.36	0.36	0.36	0.36	0.36	0.36	0.36
SMA commercial							
surface w.	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Other domestic							
ground w.	2.54	2.54	2.54	2.54	2.54	2.54	2.54
Other S/C							
ground w.	0.70	0.70	0.70	0.70	0.70	0.70	0.70
<u>City water</u>	<u>15.00</u>	<u>15.00</u>	<u>15.00</u>	<u>15.00</u>	<u>15.00</u>	<u>15.00</u>	<u>15.00</u>
<u>Irrigation water</u>	<u>62.83</u>	<u>42.96</u>	<u>29.42</u>	<u>38.93</u>	<u>43.25</u>	<u>43.55</u>	<u>43.41</u>
Authorized :	(54.30)	(35.97)	(26.32)	(38.65)	(43.25)	(43.55)	(40.26)
Paddy							
surface w.	41.30	23.85	7.10	0.78	1.00	18.27	15.31
Polowijo/ sugar cane							
surface w.	13.00	12.12	19.22	37.87	42.25	25.28	24.95
Future :							
Paddy							
surface w.							
ground w.							
Polowijo/ sugar cane							
surface w.							
ground w.							
Unauthorized:							
surface w.	(8.53)	(6.99)	(3.10)	(0.28)	(0.00)	(0.00)	(3.15)
<u>Industrial water</u>	<u>7.68</u>	<u>7.68</u>	<u>7.68</u>	<u>7.32</u>	<u>5.22</u>	<u>4.22</u>	<u>6.64</u>
Authorized :	(6.10)	(6.10)	(6.10)	(5.74)	(3.64)	(2.64)	(5.06)
SMA industry							
surface w.	3.57	3.57	3.57	3.21	1.98	1.98	2.98
Other industry							
surface w.	2.53	2.53	2.53	2.53	1.66	0.66	2.08
Future :	(1.58)	(1.58)	(1.58)	(1.58)	(1.58)	(1.58)	(1.58)
SMA industry							
surface w.	1.58	1.58	1.58	1.58	1.58	1.58	1.58
Other industry							
surface w.	-	-	-	-	-	-	-
<u>Fishery</u>	<u>13.54</u>	<u>13.54</u>	<u>13.54</u>	<u>13.54</u>	<u>13.54</u>	<u>0.00</u>	<u>11.32</u>

表 3.10.5(2) 将来水需要 (1990)

Item	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Average
<u>Domestic water</u>	<u>12.70</u>	<u>12.70</u>	<u>12.70</u>	<u>12.70</u>	<u>12.70</u>	<u>12.70</u>	<u>12.70</u>
SMA domestic							
surface w.	5.80	5.80	5.80	5.80	5.80	5.80	5.80
spring w.	1.70	1.70	1.70	1.70	1.70	1.70	1.70
SMA social							
surface w.	0.43	0.43	0.43	0.43	0.43	0.43	0.43
SMA commercial							
surface w.	0.48	0.48	0.48	0.48	0.48	0.48	0.48
Other domestic							
ground w.	3.45	3.45	3.45	3.45	3.45	3.45	3.45
Other S/C							
ground w.	0.84	0.84	0.84	0.84	0.84	0.84	0.84
<u>City water</u>	<u>15.00</u>	<u>15.00</u>	<u>15.00</u>	<u>15.00</u>	<u>15.00</u>	<u>15.00</u>	<u>15.00</u>
<u>Irrigation water</u>	<u>86.31</u>	<u>53.73</u>	<u>43.60</u>	<u>59.13</u>	<u>56.28</u>	<u>64.26</u>	<u>60.40</u>
Authorized :	(54.30)	(35.97)	(26.32)	(38.65)	(43.25)	(43.55)	(40.26)
Paddy							
surface w.	41.30	23.85	7.10	0.78	1.00	18.27	15.31
Polowijo/ sugar cane							
surface w.	13.00	12.12	19.22	37.87	42.25	25.28	24.95
Future :	(23.77)	(11.06)	(14.45)	(20.29)	(13.03)	(20.71)	(17.15)
Paddy							
surface w.	6.85	1.35	0.00	0.00	0.00	1.42	1.58
ground w.	10.56	5.78	2.66	1.98	0.00	14.94	5.93
Polowijo/ sugar cane							
surface w.	1.83	1.45	1.15	0.53	1.34	0.61	1.15
ground w.	4.53	2.48	10.64	17.78	11.69	3.74	8.47
Unauthorized:	(8.24)	(6.70)	(2.83)	(0.19)	(0.00)	(0.00)	(3.00)
<u>Industrial water</u>	<u>7.91</u>	<u>7.91</u>	<u>7.91</u>	<u>7.55</u>	<u>5.45</u>	<u>5.45</u>	<u>6.87</u>
Authorized :	(6.10)	(6.10)	(6.10)	(5.74)	(3.64)	(2.64)	(5.06)
SMA industry							
surface w.	3.57	3.57	3.57	3.21	1.98	1.98	2.98
Other industry							
surface w.	2.53	2.53	2.53	2.53	1.66	0.66	2.08
Future :	(1.81)	(1.81)	(1.81)	(1.81)	(1.81)	(1.81)	(1.81)
SMA industry							
surface w.	1.81	1.81	1.81	1.81	1.81	1.81	1.81
Other industry							
surface w.	-	-	-	-	-	-	-
<u>Fishery</u>	<u>13.54</u>	<u>13.54</u>	<u>13.54</u>	<u>13.54</u>	<u>13.54</u>	<u>0.00</u>	<u>11.32</u>

表 3.10.5(3) 将来水需要 (2000)

Item	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Average
<u>Domestic water</u>	<u>21.85</u>	<u>21.85</u>	<u>21.85</u>	<u>21.85</u>	<u>21.85</u>	<u>21.85</u>	<u>21.85</u>
SMA domestic	surface w. 11.56	11.56	11.56	11.56	11.56	11.56	11.56
	spring w. 2.20	2.20	2.20	2.20	2.20	2.20	2.20
SMA social	surface w. 0.62	0.62	0.62	0.62	0.62	0.62	0.62
SMA commercial	surface w. 0.90	0.90	0.90	0.90	0.90	0.90	0.90
Other domestic	ground w. 5.41	5.41	5.41	5.41	5.41	5.41	5.41
Other S/C	ground w. 1.16	1.16	1.16	1.16	1.16	1.16	1.16
<u>City water</u>	<u>surface w. 15.00</u>	<u>15.00</u>	<u>15.00</u>	<u>15.00</u>	<u>15.00</u>	<u>15.00</u>	<u>15.00</u>
<u>Irrigation water</u>	<u>86.31</u>	<u>53.73</u>	<u>43.60</u>	<u>59.13</u>	<u>56.28</u>	<u>64.26</u>	<u>60.40</u>
Authorized :	(54.30)	(35.97)	(26.32)	(38.65)	(43.25)	(43.55)	(40.26)
Paddy	surface w. 41.30	23.85	7.10	0.78	1.00	18.27	15.31
Polowijo/ sugar cane	surface w. 13.00	12.12	19.22	37.87	42.25	25.28	24.95
Future :	(23.77)	(11.06)	(14.45)	(20.29)	(13.03)	(20.71)	(17.15)
Paddy	surface w. 6.85	1.35	0.00	0.00	0.00	1.42	1.58
	ground w. 10.56	5.78	2.66	1.98	0.00	14.94	5.93
Polowijo/ sugar cane	surface w. 1.83	1.45	1.15	0.53	1.34	0.61	1.15
	ground w. 4.53	2.48	10.64	17.78	11.69	3.74	8.47
Unauthorized:	surface w. (8.24)	(6.70)	(2.83)	(0.19)	(0.00)	(0.00)	(3.00)
<u>Industrial water</u>	<u>10.80</u>	<u>10.80</u>	<u>10.80</u>	<u>10.44</u>	<u>8.34</u>	<u>7.34</u>	<u>9.76</u>
Authorized :	(6.10)	(6.10)	(6.10)	(5.74)	(3.64)	(2.64)	(5.06)
SMA industry	surface w. 3.57	3.57	3.57	3.21	1.98	1.98	2.98
Other industry	surface w. 2.53	2.53	2.53	2.53	1.66	0.66	2.08
Future :	(4.70)	(4.70)	(4.70)	(4.70)	(4.70)	(4.70)	(4.70)
SMA industry	surface w. 4.70	4.70	4.70	4.70	4.70	4.70	4.70
Other industry	surface w. -	-	-	-	-	-	-
<u>Fishery</u>	<u>surface w. 13.54</u>	<u>13.54</u>	<u>13.54</u>	<u>13.54</u>	<u>13.54</u>	<u>0.00</u>	<u>11.32</u>

表 3.10.5(4) 将来水需要 (2010)

Item	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Average
<u>Domestic water</u>	<u>34.24</u>	<u>34.24</u>	<u>34.24</u>	<u>34.24</u>	<u>34.24</u>	<u>34.24</u>	<u>34.24</u>
SMA domestic	surface w. 20.31	20.31	20.31	20.31	20.31	20.31	20.31
	spring w. 2.20	2.20	2.20	2.20	2.20	2.20	2.20
SMA social	surface w. 0.91	0.91	0.91	0.91	0.91	0.91	0.91
SMA commercial	surface w. 1.73	1.73	1.73	1.73	1.73	1.73	1.73
Other domestic	ground w. 7.52	7.52	7.52	7.52	7.52	7.52	7.52
Other S/C	ground w. 1.57	1.57	1.57	1.57	1.57	1.57	1.57
<u>City water</u>	<u>surface w. 15.00</u>	<u>15.00</u>	<u>15.00</u>	<u>15.00</u>	<u>15.00</u>	<u>15.00</u>	<u>15.00</u>
<u>Irrigation water</u>	<u>86.31</u>	<u>53.73</u>	<u>43.60</u>	<u>59.13</u>	<u>56.28</u>	<u>64.26</u>	<u>60.40</u>
Authorized :	(54.30)	(35.97)	(26.32)	(38.65)	(43.25)	(32.55)	(40.26)
Paddy	surface w. 41.30	23.85	7.10	0.78	1.00	18.27	15.31
Polowijo/ sugar cane	surface w. 13.00	12.12	19.22	37.87	42.25	25.28	24.95
Future	(23.77)	(11.06)	(14.45)	(20.29)	(13.03)	(20.71)	(17.15)
Paddy	surface w. 6.85	1.35	0.00	0.00	0.00	1.42	1.58
	ground w. 10.56	5.78	2.66	1.98	0.00	14.94	5.93
Polowijo/ sugar cane	surface w. 1.83	1.45	1.15	0.53	1.34	0.61	1.15
	ground w. 4.53	2.48	10.64	17.78	11.69	3.74	8.47
Unauthorized :	surface w. (8.24)	(6.70)	(2.83)	(0.19)	(0.00)	(0.00)	(3.00)
<u>Industrial water</u>	<u>13.87</u>	<u>13.87</u>	<u>13.87</u>	<u>13.51</u>	<u>11.41</u>	<u>10.41</u>	<u>12.83</u>
Authorized :	(6.10)	(6.10)	(6.10)	(5.74)	(3.64)	(2.64)	(5.06)
SMA industry	surface w. 3.57	3.57	3.57	3.21	1.98	1.98	2.98
Other industry	surface w. 2.53	2.53	2.53	2.53	1.66	0.66	2.08
Future :	(7.77)	(7.77)	(7.77)	(7.77)	(7.77)	(7.77)	(7.77)
SMA industry	surface w. 7.77	7.77	7.77	7.77	7.77	7.77	7.77
Other industry	surface w. -	-	-	-	-	-	-
<u>Fishery</u>	<u>13.54</u>	<u>13.54</u>	<u>13.54</u>	<u>13.54</u>	<u>13.54</u>	<u>0.00</u>	<u>11.32</u>

表 3.10.5(5) 将来水需要 (2020)

Item	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Average
<u>Domestic water</u>	<u>53.51</u>	<u>53.51</u>	<u>53.51</u>	<u>53.51</u>	<u>53.51</u>	<u>53.51</u>	<u>53.51</u>
SMA domestic							
surface w.	35.06	35.06	35.06	35.06	35.06	35.06	35.06
spring w.	2.20	2.20	2.20	2.20	2.20	2.20	2.20
SMA social							
surface w.	1.33	1.33	1.33	1.33	1.33	1.33	1.33
SMA commercial							
surface w.	3.24	3.24	3.24	3.24	3.24	3.24	3.24
Other domestic							
surface w.	9.60	9.60	9.60	9.60	9.60	9.60	9.60
Other S/C							
ground w.	2.08	2.08	2.08	2.08	2.08	2.08	2.08
<u>City water</u>	<u>15.00</u>	<u>15.00</u>	<u>15.00</u>	<u>15.00</u>	<u>15.00</u>	<u>15.00</u>	<u>15.00</u>
<u>Irrigation water</u>	<u>86.31</u>	<u>53.73</u>	<u>43.60</u>	<u>59.13</u>	<u>56.28</u>	<u>64.26</u>	<u>60.40</u>
Authorized :	(54.30)	(35.97)	(26.32)	(38.65)	(43.25)	(43.55)	(40.26)
Paddy							
surface w.	41.30	23.85	7.10	0.78	1.00	18.27	15.31
Polowijo/ sugar cane							
surface w.	13.00	12.12	19.22	37.87	42.25	25.28	24.95
Future :	(23.77)	(11.06)	(14.45)	(20.29)	(13.03)	(20.71)	(17.15)
Paddy							
surface w.	6.85	1.35	0.00	0.00	0.00	1.42	1.58
ground w.	10.56	5.78	2.66	1.98	0.00	14.94	5.93
Polowijo/ sugar cane							
surface w.	1.83	1.45	1.15	0.53	1.34	0.61	1.07
ground w.	4.53	2.48	10.64	17.78	11.69	3.74	8.47
Unauthorized:							
surface w.	(8.24)	(6.70)	(2.83)	(0.19)	(0.00)	(0.00)	(3.00)
<u>Industrial water</u>	<u>19.46</u>	<u>19.46</u>	<u>19.46</u>	<u>19.10</u>	<u>17.00</u>	<u>16.00</u>	<u>18.42</u>
Authorized :	(6.10)	(6.10)	(6.10)	(5.74)	(3.64)	(2.64)	(5.06)
SMA industry							
surface w.	3.57	3.57	3.57	3.21	1.98	1.98	2.98
Other industry							
surface w.	2.53	2.53	2.53	2.53	1.66	0.66	2.08
Future :	(13.36)	(13.36)	(13.36)	(13.36)	(13.36)	(13.36)	(13.36)
SMA industry							
surface w.	13.36	13.36	13.36	13.36	13.36	13.36	13.36
Other industry							
surface w.	-	-	-	-	-	-	-
<u>Fishery</u>	<u>13.54</u>	<u>13.54</u>	<u>13.54</u>	<u>13.54</u>	<u>13.54</u>	<u>0.00</u>	<u>11.32</u>

表 3.10.6 将来水需要に対して不足する水量

Unit : MCM

Year	Demand	1985	1990	2000	2010	2020
1964		81.2	253.3	359.0	495.2	714.3
1965		441.0	813.4	1,003.0	1,247.4	1,640.5
1966		315.1	651.9	841.5	1,085.9	1,479.0
1967		458.1	830.5	1,020.1	1,264.5	1,657.6
1968		28.5	104.8	168.8	264.9	462.0
1969		235.6	532.4	711.7	942.7	1,314.3
1970		237.2	524.2	693.0	910.7	1,274.7
1971		164.2	346.1	462.2	623.5	885.5
1972		401.7	769.4	959.0	1,203.4	1,596.5
1973		38.6	163.4	275.8	437.3	731.1
1974		55.3	259.2	399.7	604.0	932.6
1975		6.7	60.0	113.9	213.9	408.1
1976		287.1	611.4	789.7	1,020.8	1,392.4
1977		491.3	863.7	1,053.2	1,297.7	1,690.8
1978		65.2	187.5	275.4	409.3	668.8
1979		143.0	330.3	459.7	639.6	946.8
1980		413.9	763.7	942.9	1,174.0	1,545.6
1981		154.7	340.0	479.0	689.6	1,039.7
1982		474.6	847.0	1,036.6	1,281.0	1,674.1
1983		171.4	361.1	490.3	668.0	974.8

表 3.10.7(1) ジャボン-ブルニンでの水収支

WATER BALANCE AT JABON-ETC		DEMAND=2000		YEAR=1970		UNITS		DEM(S/S)		VOL(CHM)																		
	DOMES (SHA)	DOMES (RURAL)	CITY-Y (SHA)	PADDY (AUTHO)	SUGAR+ POLOWO (AUTHO)	INDUSTRY (AUTHO)	PADDY N-IRRI (UN-A)	N-IRRI (G-W)	N-IRRI (S-W)	INDUSTRY (FUTURE)	FISHERY	TOTAL DEMAND	AVAILA BLE-S	SURPLUS /DEFICIT														
JUN - 1	15.25	6.57	15.00	95.90	12.80	6.10	6.17	15.09	2.78	4.70	13.54	149.88	252.01	82.13														
- 2	15.25	6.57	15.00	92.46	13.15	6.10	6.25	15.09	2.16	4.70	13.54	149.23	244.50	-21.97														
- 3	15.25	6.57	15.00	37.55	15.00	6.10	6.50	15.09	6.10	4.70	13.54	143.16	100.85	-42.31														
MEAN												147.08	166.12	-21.04														
JUL - 1	15.25	6.57	15.00	51.83	12.54	6.10	7.94	6.26	4.32	4.70	13.54	126.47	88.54	-37.93														
- 2	15.25	6.57	15.00	24.24	12.01	6.10	6.71	6.26	1.98	4.70	13.54	114.39	80.10	-34.29														
- 3	15.25	6.57	15.00	16.23	11.83	6.10	5.27	6.26	1.84	4.70	13.54	104.59	67.01	-37.58														
MEAN												119.87	75.88	-43.99														
AUG - 1	15.25	6.57	15.00	16.92	15.11	6.10	4.20	13.30	1.10	4.70	13.54	107.15	69.64	-37.51														
- 2	15.25	6.57	15.00	6.73	17.15	6.10	2.10	13.30	1.18	4.70	13.54	104.28	64.58	-39.70														
- 3	15.25	6.57	15.00	3.96	22.30	6.10	1.60	13.30	0.43	4.70	13.54	102.93	52.56	-50.37														
MEAN												104.33	62.26	-42.07														
SEP - 1	15.25	6.57	15.00	1.96	22.23	5.74	0.56	19.76	0.26	4.70	13.54	133.55	70.50	-63.05														
- 2	15.25	6.57	15.00	0.39	21.17	5.74	0.0	19.76	0.30	4.70	13.54	129.70	56.20	-73.50														
- 3	15.25	6.57	15.00	0.0	42.90	5.74	0.0	19.76	0.34	4.70	13.54	124.24	31.10	-93.14														
MEAN												119.91	31.21	-88.70														
OCT - 1	15.25	6.57	15.00	0.09	44.66	5.64	0.0	11.69	1.30	4.70	13.54	116.42	61.91	-54.51														
- 2	15.25	6.57	15.00	0.34	44.99	5.64	0.0	11.69	1.37	4.70	13.54	117.07	46.70	-70.37														
- 3	15.25	6.57	15.00	2.42	37.38	5.64	0.0	11.69	1.35	4.70	13.54	111.72	42.05	-69.67														
MEAN												114.74	53.28	-61.46														
NOV - 1	15.25	6.57	15.00	4.54	35.53	2.64	0.0	16.61	0.42	4.70	0.0	107.55	34.18	-73.37														
- 2	15.25	6.57	15.00	15.01	23.47	2.64	0.0	16.61	1.23	4.70	0.0	102.72	40.23	-62.49														
- 3	15.25	6.57	15.00	31.65	18.63	2.64	0.0	16.61	4.04	4.70	0.0	114.96	134.13	24.17														
MEAN												108.41	51.61	-56.80														
VOL IN D-S														240.6	103.9	237.2	242.0	394.3	10.0	47.3	227.8	43.3	74.3	179.0	1870.1	1253.7	-616.4	
VOL OF DEFICIT IN DRY SEASON *																												-693.0

WATER BALANCE AT JABON-ETC		DEMAND=2000		YEAR=1974		UNITS		DEM(S/S)		VOL(CHM)																		
	DOMES (SHA)	DOMES (RURAL)	CITY-Y (SHA)	PADDY (AUTHO)	SUGAR+ POLOWO (AUTHO)	INDUSTRY (AUTHO)	PADDY N-IRRI (UN-A)	N-IRRI (G-W)	N-IRRI (S-W)	INDUSTRY (FUTURE)	FISHERY	TOTAL DEMAND	AVAILA BLE-S	SURPLUS /DEFICIT														
JUN - 1	15.25	6.57	15.00	95.90	12.80	6.10	4.17	15.09	2.78	4.70	13.54	149.88	201.51	51.63														
- 2	15.25	6.57	15.00	92.46	13.15	6.10	4.25	15.09	2.16	4.70	13.54	149.23	120.03	-29.20														
- 3	15.25	6.57	15.00	37.55	15.00	6.10	6.50	15.09	6.10	4.70	13.54	143.16	103.32	-39.84														
MEAN												147.41	144.62	-2.79														
JUL - 1	15.25	6.57	15.00	51.83	12.54	6.10	7.94	6.26	4.32	4.70	13.54	126.47	93.66	-32.81														
- 2	15.25	6.57	15.00	24.24	12.01	6.10	6.71	6.26	1.98	4.70	13.54	114.39	85.40	-28.99														
- 3	15.25	6.57	15.00	16.23	11.83	6.10	5.27	6.26	1.84	4.70	13.54	104.59	65.99	-38.60														
MEAN												119.87	82.40	-37.47														
AUG - 1	15.25	6.57	15.00	16.92	15.11	6.10	4.20	13.30	1.10	4.70	13.54	107.15	65.35	-41.80														
- 2	15.25	6.57	15.00	6.73	17.15	6.10	2.10	13.30	1.18	4.70	13.54	104.28	72.15	-32.13														
- 3	15.25	6.57	15.00	3.96	22.30	6.10	1.60	13.30	0.43	4.70	13.54	102.93	65.43	-37.50														
MEAN												104.33	74.02	-30.31														
SEP - 1	15.25	6.57	15.00	1.96	22.23	5.74	0.56	19.76	0.26	4.70	13.54	133.55	70.50	-63.05														
- 2	15.25	6.57	15.00	0.39	21.17	5.74	0.0	19.76	0.30	4.70	13.54	129.70	67.18	-62.52														
- 3	15.25	6.57	15.00	0.0	42.90	5.74	0.0	19.76	0.34	4.70	13.54	124.24	42.53	-81.71														
MEAN												119.91	66.66	-53.25														
OCT - 1	15.25	6.57	15.00	0.09	44.66	5.64	0.0	11.69	1.30	4.70	13.54	116.42	116.33	-0.09														
- 2	15.25	6.57	15.00	0.34	44.99	5.64	0.0	11.69	1.37	4.70	13.54	117.07	101.15	-15.92														
- 3	15.25	6.57	15.00	2.42	37.38	5.64	0.0	11.69	1.35	4.70	13.54	111.72	92.49	-19.23														
MEAN												114.74	102.97	-11.77														
NOV - 1	15.25	6.57	15.00	4.54	35.53	2.64	0.0	16.61	0.42	4.70	0.0	107.55	104.37	-3.18														
- 2	15.25	6.57	15.00	15.01	23.47	2.64	0.0	16.61	1.23	4.70	0.0	102.72	224.14	121.42														
- 3	15.25	6.57	15.00	31.65	18.63	2.64	0.0	16.61	4.04	4.70	0.0	114.96	246.91	131.95														
MEAN												108.41	144.11	35.70														
VOL IN D-S														240.6	103.9	237.2	242.0	394.3	10.0	47.3	227.8	43.3	74.3	179.0	1870.1	1754.0	-116.1	
VOL OF DEFICIT IN DRY SEASON *																												-349.7

表 3.10.7(2) ジャボン-ブルニンでの水取支

WATER BALANCE AT JABON+ETC		DEMAND+2000		YEAR+1982		UNIT: (CM ³ /S)		VOL(MCM)																		
	DOHES (SHA)	DOHES (RURAL)	CITY-W (SHA)	PADY (AIHO)	SUGAR+ POLONJO (AIHO)	INDUSTRY (AIHO)	PADY N-IRRIG (UN-A)	N-IRRIG (G-W)	N-IRRIG (S-W)	INDUSTRY (FUTURE)	FISHERY	TOTAL DEMAND	AVAILA BLE-B	SURPLUS /DEFICIT												
JUN - 1	13.23	6.37	15.00	43.90	12.40	6.10	4.37	13.09	4.74	4.70	13.34	149.21	92.62	-56.59												
- 2	13.23	6.37	15.00	42.44	13.13	6.10	4.25	13.03	4.16	4.70	13.34	149.23	82.74	-66.49												
- 3	13.23	6.37	15.00	37.53	13.04	6.10	4.30	13.01	4.10	4.70	13.34	143.24	75.77	-67.49												
MEAN												147.44	83.43	-64.04												
JUL - 1	13.23	6.37	15.00	31.83	12.54	6.10	7.96	8.24	4.72	4.70	13.34	124.47	68.82	-55.65												
- 2	13.23	6.37	15.00	24.24	12.01	6.10	4.44	4.26	1.96	4.70	13.34	114.59	63.83	-50.76												
- 3	13.23	6.37	15.00	14.23	11.83	6.10	5.27	4.26	1.44	4.70	13.34	104.59	53.83	-50.76												
MEAN												114.47	61.84	-52.64												
AUG - 1	13.23	6.37	15.00	10.92	12.81	6.10	4.20	13.30	1.70	4.70	13.34	107.15	54.07	-53.08												
- 2	13.23	6.37	15.00	4.73	14.13	6.10	2.84	13.30	1.16	4.70	13.34	104.24	52.91	-51.32												
- 3	13.23	6.37	15.00	3.94	22.30	6.10	1.40	13.30	0.63	4.70	13.34	102.93	45.32	-57.61												
MEAN												104.73	51.23	-53.50												
SEP - 1	13.23	6.37	15.00	1.96	32.23	5.74	0.34	19.74	0.26	4.70	13.34	115.55	47.62	-67.93												
- 2	13.23	6.37	15.00	0.39	28.47	5.74	0.0	19.74	0.30	4.70	13.34	119.74	45.33	-74.41												
- 3	13.23	6.37	15.00	0.0	42.90	5.74	0.0	19.74	0.44	4.70	13.34	124.26	43.34	-80.92												
MEAN												119.91	45.44	-74.47												
OCT - 1	13.23	6.37	15.00	0.09	44.44	3.44	0.0	11.44	1.30	4.70	13.34	116.42	41.51	-74.91												
- 2	13.23	6.37	15.00	0.34	44.99	3.44	0.0	11.44	1.37	4.70	13.34	117.07	39.83	-77.24												
- 3	13.23	6.37	15.00	2.42	37.38	3.44	0.0	11.44	1.35	4.70	13.34	111.72	35.89	-75.83												
MEAN												114.94	38.47	-76.47												
NOV - 1	13.23	6.37	15.00	1.34	35.33	2.44	0.0	14.44	0.82	4.70	0.0	107.53	37.07	-70.46												
- 2	13.23	6.37	15.00	13.01	23.47	2.44	0.0	14.44	1.23	4.70	0.0	102.73	35.89	-66.84												
- 3	13.23	6.37	15.00	31.43	16.43	2.44	0.0	14.44	4.06	4.70	0.0	114.94	34.89	-80.05												
MEAN												109.41	35.93	-73.48												
VOL IN D-S													210.8	103.9	237.2	242.0	394.3	40.0	47.3	227.1	43.3	74.3	179.0	1870.1	433.3	-1036.6
VOL OF DEFICIT IN DRY SEASON =																								-1036.6		

WATER BALANCE AT JABON+ETC		DEMAND+2000		YEAR+1985		UNIT: (CM ³ /S)		VOL(MCM)																		
	DOHES (SHA)	DOHES (RURAL)	CITY-W (SHA)	PADY (AIHO)	SUGAR+ POLONJO (AIHO)	INDUSTRY (AIHO)	PADY N-IRRIG (UN-A)	N-IRRIG (G-W)	N-IRRIG (S-W)	INDUSTRY (FUTURE)	FISHERY	TOTAL DEMAND	AVAILA BLE-B	SURPLUS /DEFICIT												
JUN - 1	13.23	6.37	15.00	43.90	12.40	6.10	4.17	13.09	4.74	4.70	13.34	149.48	90.44	-59.04												
- 2	13.23	6.37	15.00	42.44	13.13	6.10	4.25	13.03	4.16	4.70	13.34	149.23	82.74	-66.49												
- 3	13.23	6.37	15.00	37.53	13.04	6.10	4.30	13.01	4.10	4.70	13.34	143.24	75.77	-67.49												
MEAN												147.44	83.43	-64.04												
JUL - 1	13.23	6.37	15.00	31.83	12.54	6.10	7.96	8.24	4.72	4.70	13.34	124.47	70.42	-54.05												
- 2	13.23	6.37	15.00	24.24	12.01	6.10	4.44	4.26	1.96	4.70	13.34	114.59	65.83	-48.76												
- 3	13.23	6.37	15.00	14.23	11.83	6.10	5.27	4.26	1.44	4.70	13.34	104.59	54.83	-49.76												
MEAN												114.47	63.43	-51.04												
AUG - 1	13.23	6.37	15.00	10.92	12.81	6.10	4.20	13.30	1.70	4.70	13.34	107.15	54.07	-53.08												
- 2	13.23	6.37	15.00	4.73	14.13	6.10	2.84	13.30	1.16	4.70	13.34	104.24	52.91	-51.32												
- 3	13.23	6.37	15.00	3.94	22.30	6.10	1.40	13.30	0.63	4.70	13.34	102.93	45.32	-57.61												
MEAN												104.73	52.37	-52.36												
SEP - 1	13.23	6.37	15.00	1.96	32.23	5.74	0.34	19.74	0.26	4.70	13.34	115.55	47.62	-67.93												
- 2	13.23	6.37	15.00	0.39	28.47	5.74	0.0	19.74	0.30	4.70	13.34	119.74	45.33	-74.41												
- 3	13.23	6.37	15.00	0.0	42.90	5.74	0.0	19.74	0.44	4.70	13.34	124.26	43.34	-80.92												
MEAN												119.91	45.44	-74.47												
OCT - 1	13.23	6.37	15.00	0.09	44.44	3.44	0.0	11.44	1.30	4.70	13.34	116.42	41.51	-74.91												
- 2	13.23	6.37	15.00	0.34	44.99	3.44	0.0	11.44	1.37	4.70	13.34	117.07	39.83	-77.24												
- 3	13.23	6.37	15.00	2.42	37.38	3.44	0.0	11.44	1.35	4.70	13.34	111.72	35.89	-75.83												
MEAN												114.94	38.47	-76.47												
NOV - 1	13.23	6.37	15.00	1.34	35.33	2.44	0.0	14.44	0.82	4.70	0.0	107.53	37.07	-70.46												
- 2	13.23	6.37	15.00	13.01	23.47	2.44	0.0	14.44	1.23	4.70	0.0	102.73	35.89	-66.84												
- 3	13.23	6.37	15.00	31.43	16.43	2.44	0.0	14.44	4.06	4.70	0.0	114.94	34.89	-80.05												
MEAN												109.41	35.93	-73.48												
VOL IN D-S													210.1	103.9	237.2	242.0	394.3	40.0	47.3	227.1	43.3	74.3	179.0	1870.1	437.1	-1003.0
VOL OF DEFICIT IN DRY SEASON =																								-1003.0		

表 3.12.1 (1) インパクトマトリックス (RRM)

Sector	Dam Development	Flood Control	Agriculture and Irrigation	Sediment Control (watershed Management)	Water Utility (Water Allocation)	The Others
A. Non-renewable Resources						
1. Geological features	-	-	-	-	-	-
2. Mineral resources	-	-	-	-	-	-
3. Topography	Erosion at the quarries around Karangkates dam	-	-	-	-	-
4. Soil	-	-	Soil devastation due to multiple paddy harvests and deficiency of nutritious elements	-	-	-
5. Sedimentation	Sedimentation in Karangkates reservoir	-	Erosion due to cultivation at the slope of the mountain side	-	-	-
6. Climate including hydrology	-	-	-	-	-	-

表 3.12.1 (2) インパクトマトリックス (RRM)

Sector	Dam Development	Flood Control	Agriculture and Irrigation	Sediment Control (Watershed Management)	Water Utility (Water Allocation)	The Others
7. Archaeology and historical remains	-	-	-	-	-	-
B. Renewable Resources						
1. Air	-	-	-	-	-	Air pollution in Surabaya area
2. Water	* Water hyacinth in Wlingi reservoir	* Blockings of inland drainage by the diking	* Water shortage induced by developments Effect of fertilizers and agricultural chemicals	* Decreases of available water by reforestation	-	* Worsening of water quality in Surabaya area
3. Land use pattern	-	-	-	-	-	-
4. Forest, including hydro-function	* Forest reduction due to the emergence of reservoirs and quarries	-	Over cultivation at the slope of the mountain side	-	-	-
5. Native flora	-	-	- do -	-	-	-
6. Native fauna	-	-	-	-	-	-
7. Public works facilities	-	-	-	-	-	-

表 3.12.1 (3) インパクトマトリックス (RRM)

Sector	Dam Development	Flood Control	Agriculture and Irrigation	Sediment Control (Watershed Management)	Water Utility (Water Allocation)	The Others
C. Technology						
1. Construction methods	-	-	-	-	-	-
2. Operating rule of reservoir	-	-	-	-	-	-
3. Externalities to agriculture	-	-	-	-	-	-
4. Externalities to small scale industry, home industry and handicrafts	-	-	-	-	-	-
5. Externalities to medium and large scale industry	-	-	-	-	-	-
6. Externalities to everyday life and activities	-	-	-	-	-	-
D. Human Environment						
1. Demography	-	-	-	-	-	-
2. Economic activities	-	-	-	-	-	-

表 3.12.1 (4) インパクトマトリックス (RRM)

Sector	Dam Development	Flood Control	Agriculture and Irrigation	Sediment Control (Watershed Management)	Water Utility (Water Allocation)	The Others
3. Land tenure relations	-	-	-	-	-	-
4. Food production	-	-	-	-	-	-
5. Other agricultural production	-	-	-	-	-	-
6. Health	-	-	-	-	-	* Effect of worsening water quality on the health
7. Other social infrastructures education, productive skills, Community institutions, etc.	-	-	-	-	-	-
8. Anthropology and culture, including incidence of urbanization	-	-	-	-	-	-
9. The others	-	-	-	-	-	Bad smell due to the worsening of water quality Dumpings to the river

LEGEND * Environmental problems induced by the master plan in 1973.

表 4-1 資金運用計画 (1/2)

SECTOR	ACTION PROGRAM/PROJECT	REVENUE- PRESENT ESTIMATED STATUS COST	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Date: x 10 ⁶ Rp, 1984 constant price			
																			1996	2000		
AGRICULTURE & IRRIGATION	AI-1 Vanjuyang-Turi-Tungroso	R/Y D/D	41,289	7,273	12,184	12,342	6,240	3,250														
	AI-2 East Java Irrigation Rehabil- itation	R/Y U/C	272,330	19,691	19,143	17,850	16,646	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	
	AI-3 Ledoyo-Pulungagung Irrigation	R/Y U/C	6,408	3,224	2,271	913																
	AI-4 PZAT Kediri-Ngunjuk	R/Y U/C	8,789	2,373	2,692	1,812	1,912															
	AI-5 East Java Groundwater	R/Y D/D	75,395	586	966	1,063	7,980	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	
	AI-6 Merisan Barrage	R/Y D/D	(21,900)	(1,500)	(2,250)	(2,625)	(1,125)	(1,200)	(1,200)	(1,200)	(1,200)	(1,200)	(1,200)	(1,200)	(1,200)	(1,200)	(1,200)	(1,200)	(1,200)	(1,200)	(1,200)	(1,200)
	AI-7 Pagar-Paterangan	R/Y P/S	(22,262)	(3,916)	(6,560)	(6,445)	(3,291)	(1,750)														
	AI-8 Voneveto	P/R D/D	16,218					5,405	5,405	5,408												
	AI-9 Tugu	P/R P/S	8,323					1,665	2,497	2,497	2,497	2,497	2,497	2,497	2,497	2,497	2,497	2,497	2,497	2,497	2,497	2,497
	AI-10 Vidan Extension	M/S M/S	3,045					1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	
	AI-11 Beag	M/S M/S	5,175					1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	
	AI-12 Lestak-left	M/S M/S	(4,215)					(843)	(1,264)	(1,264)	(1,264)	(1,264)	(1,264)	(1,264)	(1,264)	(1,264)	(1,264)	(1,264)	(1,264)	(1,264)	(1,264)	
	AI-13 Gotesan-Lomari	M/S M/S	(5,683)																			
DOMESTIC & INDUSTRIAL WATER	M-1 Push Back from Ngrero River Basin	P/R P/S	8,798		2,639	3,320	2,639															
	M-2 Karangpilang Treatment Works Stage 1 (3 m ³ /sec)	P/R P/S	16,191	1,633	7,340	5,583	1,635															
	M-3 Karangpilang Treatment Works Stage 2 & 3 (4 m ³ /sec)	M/S M/S	57,360			1,070	6,687	4,984	2,664	6,687	10,720	7,365	5,736	5,736	5,736	5,736	5,736	5,736	5,736	5,736	5,736	
	M-4 Uloban Spring Development	M/S P/S	110,000					22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000	
	M-5 Urban	M/S M/S	62,695		2,471	2,471	2,471	2,471	2,471	4,633	4,633	4,633	4,633	4,633	4,633	4,633	4,633	4,633	4,633	4,633	4,633	
	M-6 SPA	M/S M/S	261,637					19,688	19,688	19,688	19,688	19,688	19,688	19,688	19,688	19,688	19,688	19,688	19,688	19,688	19,688	
	M-7 Rural C	M/S M/S	27,060		2,338	2,338	2,338	2,338	2,338	1,625	1,625	1,625	1,625	1,625	1,625	1,625	1,625	1,625	1,625	1,625	1,625	
FLOOD CONTROL	PC-1 Middle Reach River Improvement (2nd Stage)	P/R U/C	57,617	8,327	8,056	7,261	4,679	2,030														
	PC-2 Tulungagung Drainage	P/R U/C	10,350	6,900	3,450																	
	PC-3 E. Surabaya (2nd Stage)	R/Y D/D	62,338	6,254	12,508	12,502	12,507	12,507	12,507	12,507	12,507	12,507	12,507	12,507	12,507	12,507	12,507	12,507	12,507	12,507	12,507	
	PC-4 Vidan Flood Control & Drainage	M/S M/S	76,200					15,240	15,240	15,240	15,240	15,240	15,240	15,240	15,240	15,240	15,240	15,240	15,240	15,240	15,240	
	PC-5 Ledoyo Riverbank Scheme	M/S M/S	85,000																			
WATERBOD MANAGEMENT	VS-1 G. Kelud	R/Y U/C	94,019	4,525	5,115	6,210	6,169	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	
	VS-2 Upstream of E. Brantas	M/S M/S	35,270	1,575	4,410	4,790	3,895	1,675	4,510	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	2,835	
	VS-3 Reforestatio- (K.Brantas/K.Konto/K.Ngrovo)	M/S M/S	19,500			1,900	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	

表 4-1 資金運用計画 (2/2)

SECTOR	ACTION PROGRAM/PROJECT	RECENT PRESENT ESTIMATED																	1984 constant price
		ENGINE STATUS COST																	
		1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000		
ELECTRIC POWER	EP-1 Sanggruh	P/R	U/C	79,186	30,137	40,704	7,852	473											
	EP-2 Lest I III	P/R	P/S	12,749	1,775	2,550	3,825	2,549											
	EP-3 South Jalungagung	P/R	D/D	41,164	2,403	8,297	12,332	15,347	2,765										
	EP-4 Veanrejo	P/K	D/D	12,724				4,241	4,242										
	EP-5 Tugu	P/R	D/D	1,572						786	786								
	EP-6 Bang	M/S	M/S	14,063						4,219	5,625	4,219							
	EP-7 K.Keate II	M/S	M/S	38,488						7,698	11,546	11,546	7,698					(4,336) (5,768) (4,336)	
	EP-8 Gantang I	M/S	M/S	(14,420)															
	EP-9 Lumbangari	M/S	M/S	(14,030)															
	EP-10 Kepanjeng	M/S	M/S	(10,077)															
DAM DEVELOPMENT	DP-1 Veanrejo Dam	P/R	D/D	76,658	3,833	3,833	19,165	19,165	19,165	7,664									
	DP-2 Tugu Dam	P/R	Pre P/S	40,029			4,003	8,006	12,009	8,006	8,003								
	DP-3 Kedungwaruk Dam	M/S	M/S	7,894			1,768	2,358	1,768										
	DP-4 Bang	M/S	M/S	42,066			8,413	12,620	12,620	8,413									
	DP-5 K.Keate II	M/S	M/S	211,926			21,193	42,385	42,385	21,193									
	DP-6 Gantang I	M/S	M/S	(68,396)															
AQUA-CULTURE	AP-1 Breklib Water Fish Feed Stage 1	M/S	M/S	(66,640)						(6,664)	(6,664)	(6,664)	(6,664)	(6,664)	(6,664)	(6,664)	(6,664)		
	AP-2 Breklib Water Fish Feed Stage 2	M/S	M/S	(66,640)						(6,664)	(6,664)	(6,664)	(6,664)	(6,664)	(6,664)	(6,664)	(6,664)		
WATER MANAGE- MENT SYSTEM	VM-1 Flood Prevention System	P/R	U/S	5,266	1,935	3,211													
	VM-2 Water Management System, Stage 1	M/S	M/S	11,706						685	1,166	1,113	3,878	4,864					
	VM-3 " " Stage 2	M/S	M/S	6,502									588	2,067	2,593	1,254			
	VM-4 " " Stage 3	M/S	M/S	5,870											59	3,597	1,405	609	
TOTAL COST OF CERTAIN PROJECTS			2,005,870	91,752	126,656	99,932	111,798	141,876	140,660	134,403	118,779	164,025	153,025	139,990	151,815	149,991	110,455	88,717	52,207
CONTINGENCY (15%)			300,881	23,763	18,998	14,990	16,770	21,281	20,909	20,160	17,817	24,603	22,955	20,999	22,772	22,498	16,568	13,308	7,983
TOTAL			2,306,751	105,515	145,654	114,922	128,568	163,157	160,300	154,563	136,595	188,629	175,990	160,989	174,587	172,490	127,023	102,025	61,188
TOTAL COST OF UNCERTAIN PROJECTS			227,821	5,416	8,810	9,270	4,516	2,950	1,200	7,864	8,707	9,128	8,706	22,719	41,706	45,599	34,278		
CONTINGENCY (15%)			34,175	812	1,322	1,391	677	443	180	1,180	1,100	1,369	1,366	3,500	3,408	6,256	6,834	5,142	
TOTAL			261,996	6,228	10,132	10,661	5,193	3,393	1,380	9,044	9,044	10,497	10,497	26,127	47,962	52,393	39,420		
GRAND TOTAL			2,568,747	111,743	155,786	125,583	133,761	166,550	161,680	162,148	144,181	198,642	186,487	171,486	184,599	198,116	174,985	154,417	100,608

Note: Project stated in parenthesis is of uncertainty in the implementation.

Legend: Column in reference, P/R/ Project Report, P/Y/ Repalita-IV, M/S/ Master Plan Study.

Column in present status, Pre P/S/ Pre-feasibility Study Stage, P/S/ Feasibility Study Stage, D/D/ Detailed Design Stage, U/C/ Under Implementation.

(-) : Fund allocated in 30% of the total cost estimated for potential water demand.

表 4-2 代替買金運用計圖

		Unit: Rp x 10 ⁶ 1984 constant price																			
		Total Cost	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00			
AGRICULTURE & IRRIGATION	AI-1	Varujayeng-Turi-Tengerono	41,289	7,273	12,184	12,342	6,240	3,250		9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000		
	AI-2	East Java Irrigation Rehabilitation	144,663	9,846	9,571	8,925	8,323	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	
	AI-3	Lodoyo-Tulungagung Irrigation	6,408	3,224	2,271	213															
	AI-4	P2AT, Kediri-Nganjuk	8,789	2,373	2,692	1,812	1,912														
	AI-5	East Java Groundwater	49,805	586	966	1,063	3,990	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	
	AI-6	Wonorejo	16,214				5,405	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600
	AI-7	Vidaa Extension	3,045				1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	
	AI-8	Bang	5,176																		
	AI-9	Tugu	8,323																		
DOMESTIC & INDUSTRIAL WATER	NV-1	Push Back From Ngrono Basin	8,798			2,639	3,520	2,639													
	NV-2	Karangpilang Treatment Works 1	16,191	1,633	7,340	5,583	1,635														
	NV-3	" Works 2 & 3	57,360			1,070	6,687	4,984	2,669	6,687	4,984	7,335	5,736	5,736	5,736	5,736	5,736	5,736	5,736	5,736	
	NV-4	Umbulan Spring Development	110,000			22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000	
	NV-5	Urban water	45,665			1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	
	NV-6	SMA	202,120																		
	NV-7	Rural	27,060			2,338	2,338	2,338	2,338	2,338	2,338	2,338	2,338	2,338	2,338	2,338	2,338	2,338	2,338	2,338	
FLOOD CONTROL	FC-1	Middle Reach River Improvement 2	38,317	8,327	8,056	7,961	7,264	4,679	2,030												
	FC-2	Tulungagung drainage	10,350	6,900	3,450																
	FC-3	K. Surabaya (2nd Stage)	62,538		6,254	12,508	12,508	6,253	6,253	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254	6,254	
	FC-4	Vidaa Flood Control & Drainage	76,200																		
WATERSHED MANAGEMENT	VS-1	G. Kelud	94,019	4,525	5,115	6,210	6,169	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000		
	VS-2	Upstream of K. Brantas	35,270		1,575	4,410	4,730	1,895	1,675	4,510	2,835	2,095	2,095	1,575	1,575	1,400	1,400	1,750	1,750		
	VS-3	Reforestation (K. Brantas/K. Konto/K. Ngrono)	19,500			1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	
HYDRO-POWER	EP-1	Sunggurub	79,186	30,157	40,704	7,892	473														
	EP-2	Leati III	12,750	1,275	2,550	2,550	3,825	2,550													
	EP-3	South Tulungagung	41,164		2,403	8,297	12,352	15,347	2,765												
	EP-4	Wonorejo	12,724																		
	EP-5	Bang	14,063																		
	EP-6	Tugu	1,572																		
DAM DEVELOPMENT	NP-1	Wonorejo Dam	76,658	3,833	3,833	3,833	19,165	19,165	19,165	7,664											
	NP-2	Kedungwarak Dam	5,894							1,768	2,358	1,768	1,768	1,768	1,768	1,768	1,768	1,768			
	NP-3	Bang Dam	42,066																		
	NP-4	Tugu Dam	40,029																		
	NP-5	K. Konto II Dam	63,578																		
WATER MANAGEMENT SYSTEM	WN-1	Flood Forecasting System	5,266	2,955	3,311																
	WN-2	Water Management System	11,706																		
	WN-3	" Stage 1	6,502																		
	WN-4	" Stage 2 " Stage 3	5,670																		
TOTAL COST			1,505,600	81,907	116,466	91,089	98,867	118,402	103,897	90,102	83,941	90,424	86,649	82,682	74,531	80,343	81,792	90,689	103,464		
CONTINGENCY (15%)			225,840	12,286	17,470	13,663	14,830	17,760	15,585	13,515	12,591	13,561	13,297	12,402	11,180	12,051	12,269	13,603	15,464		
GRAND TOTAL			1,731,440	94,193	133,936	104,752	113,697	136,162	119,482	103,617	96,532	103,988	101,946	95,084	85,711	92,394	94,061	104,292	118,984		

付 図

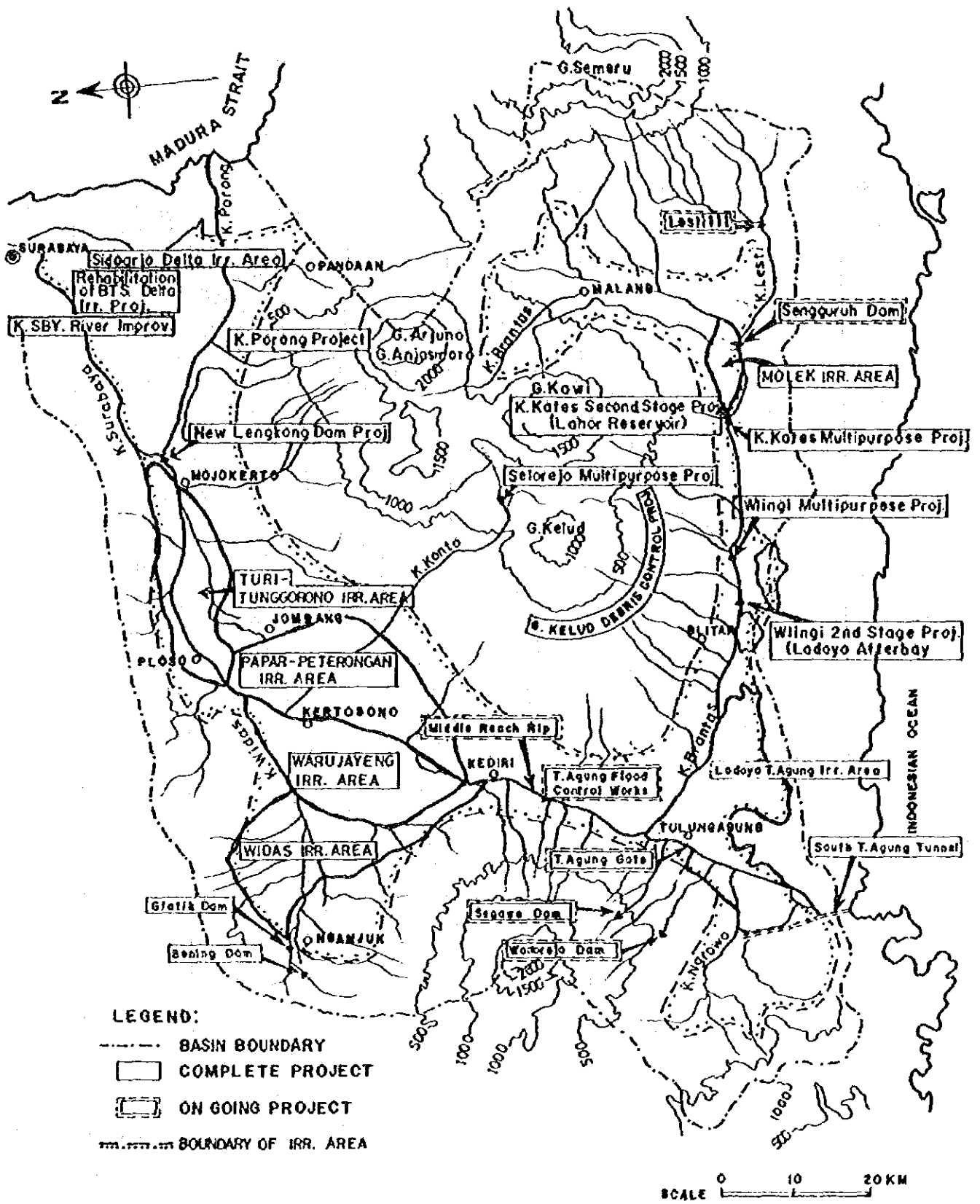


図 2.2.1 既存プロジェクト位置図

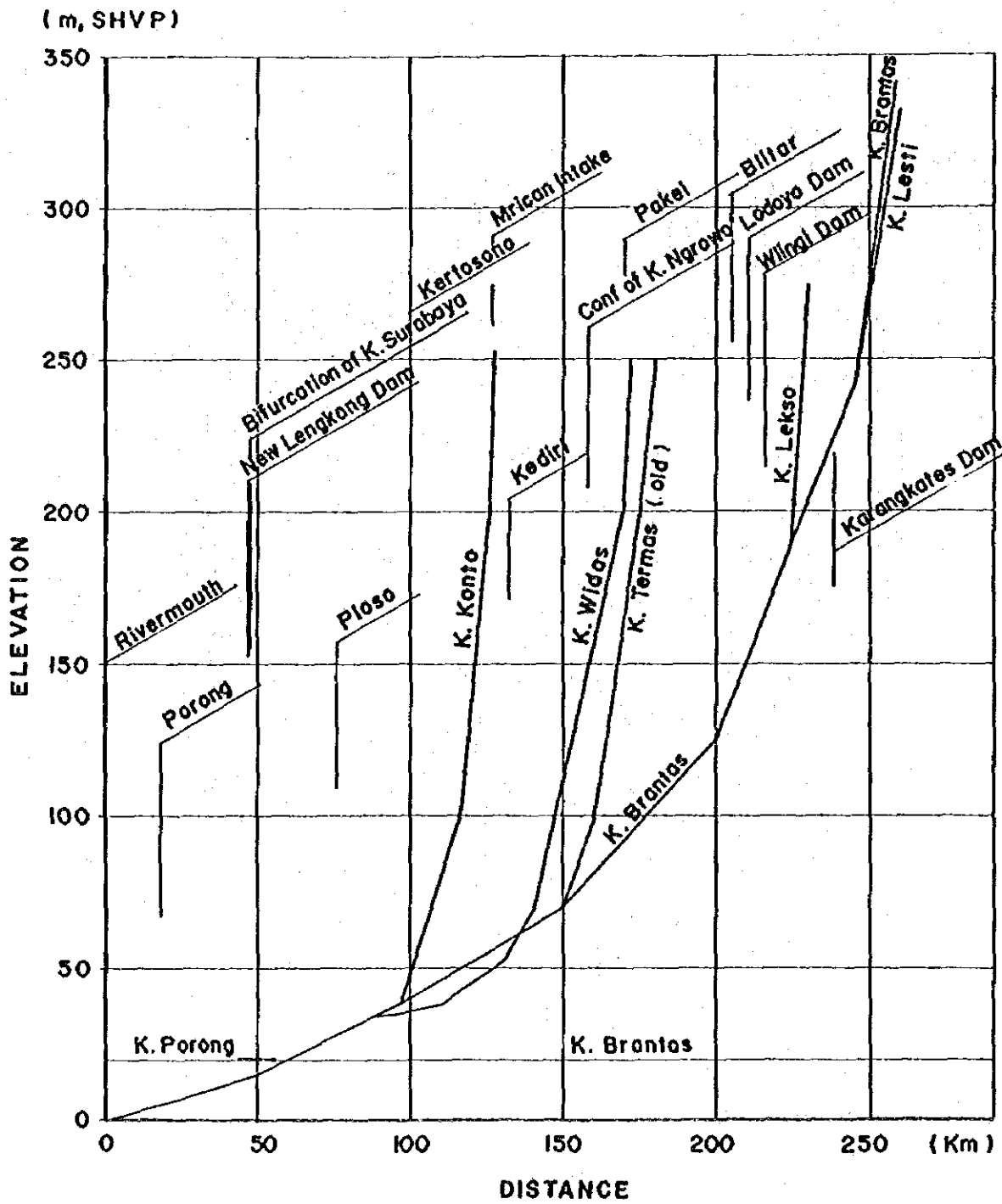


図 2.2.2 ブランタス河及び主要支川、河川縦断図

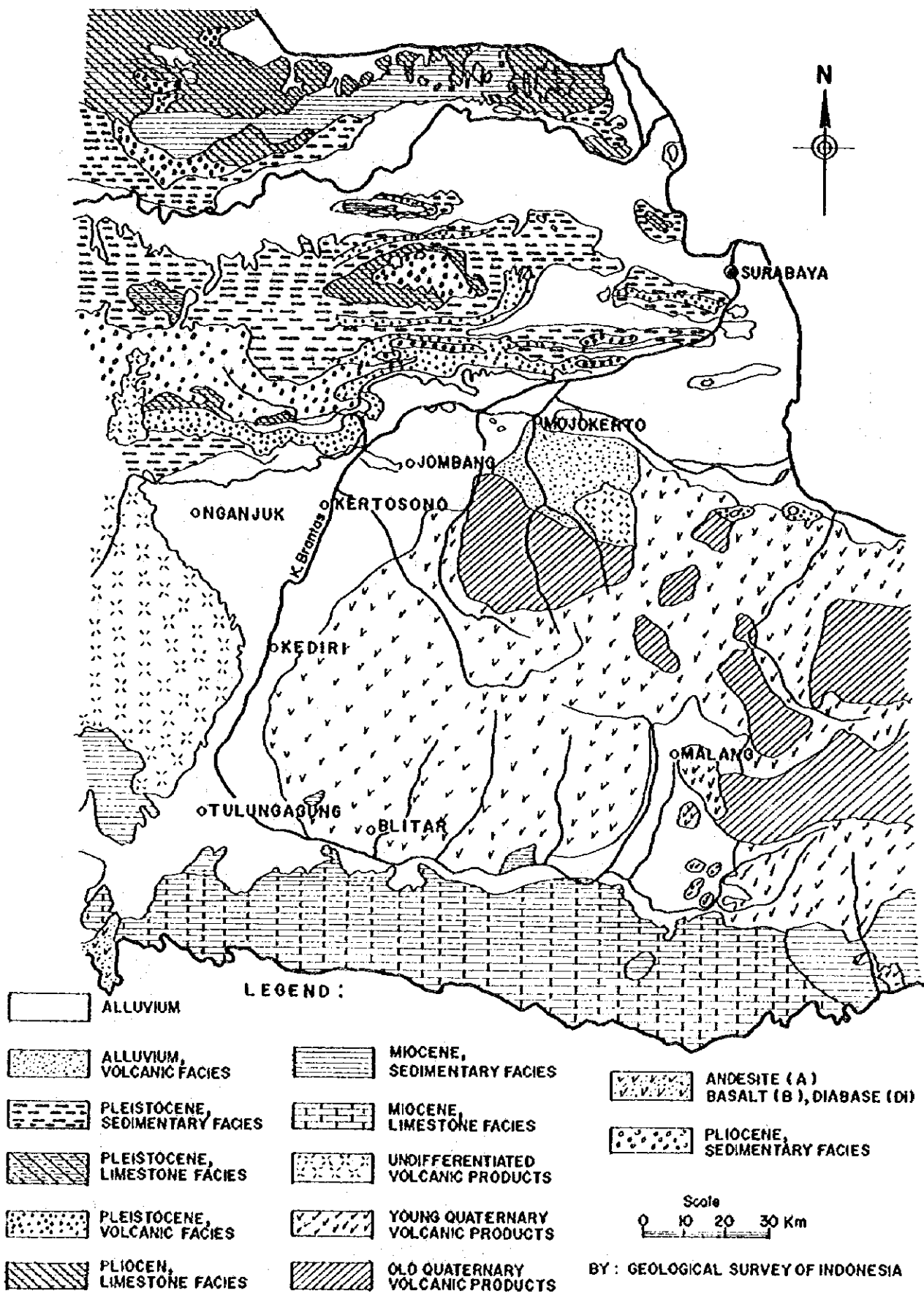


图 2.2.3 勃朗特河流域地质图

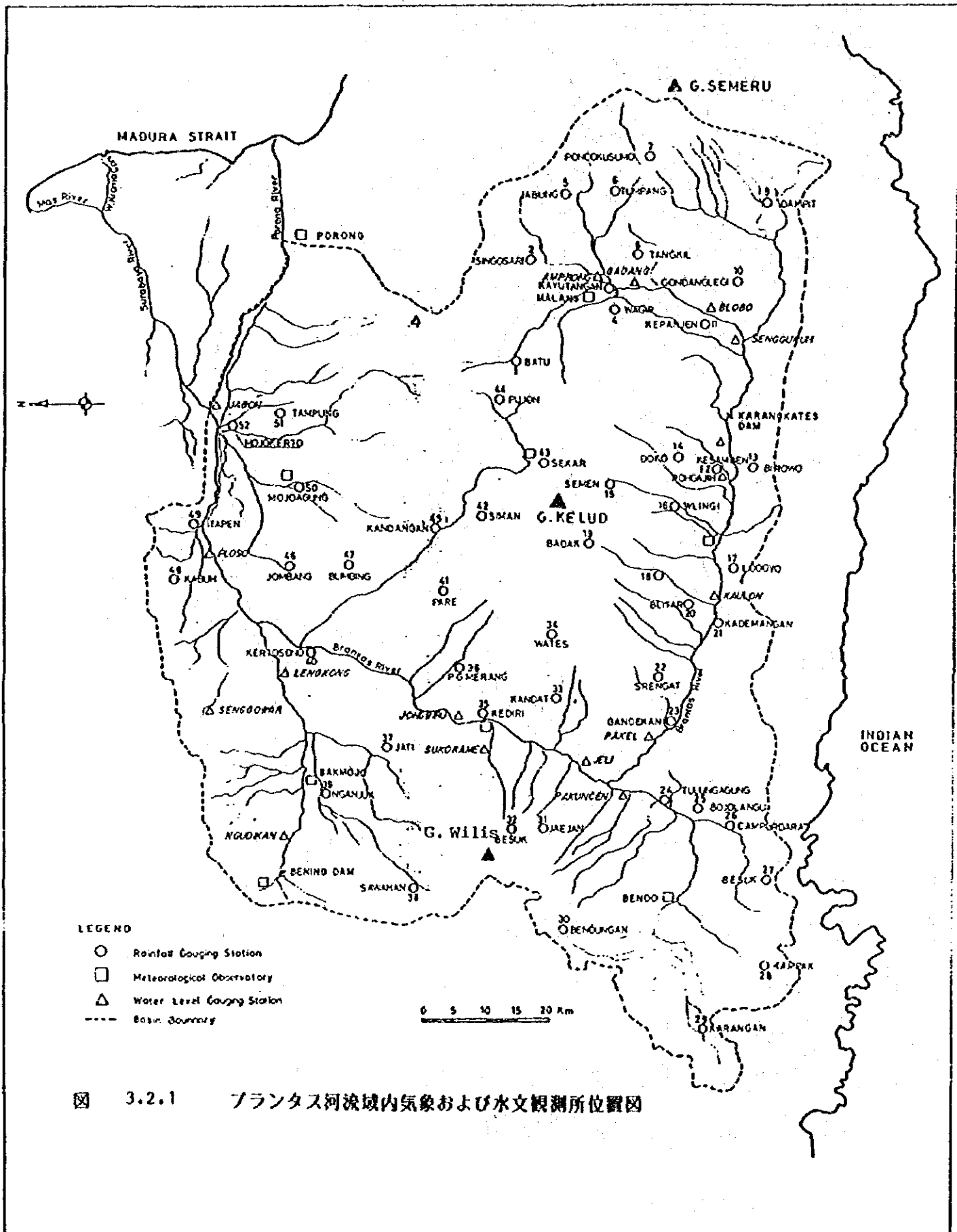


図 3.2.1 ブランタス河流域内気象および水文観測所位置図

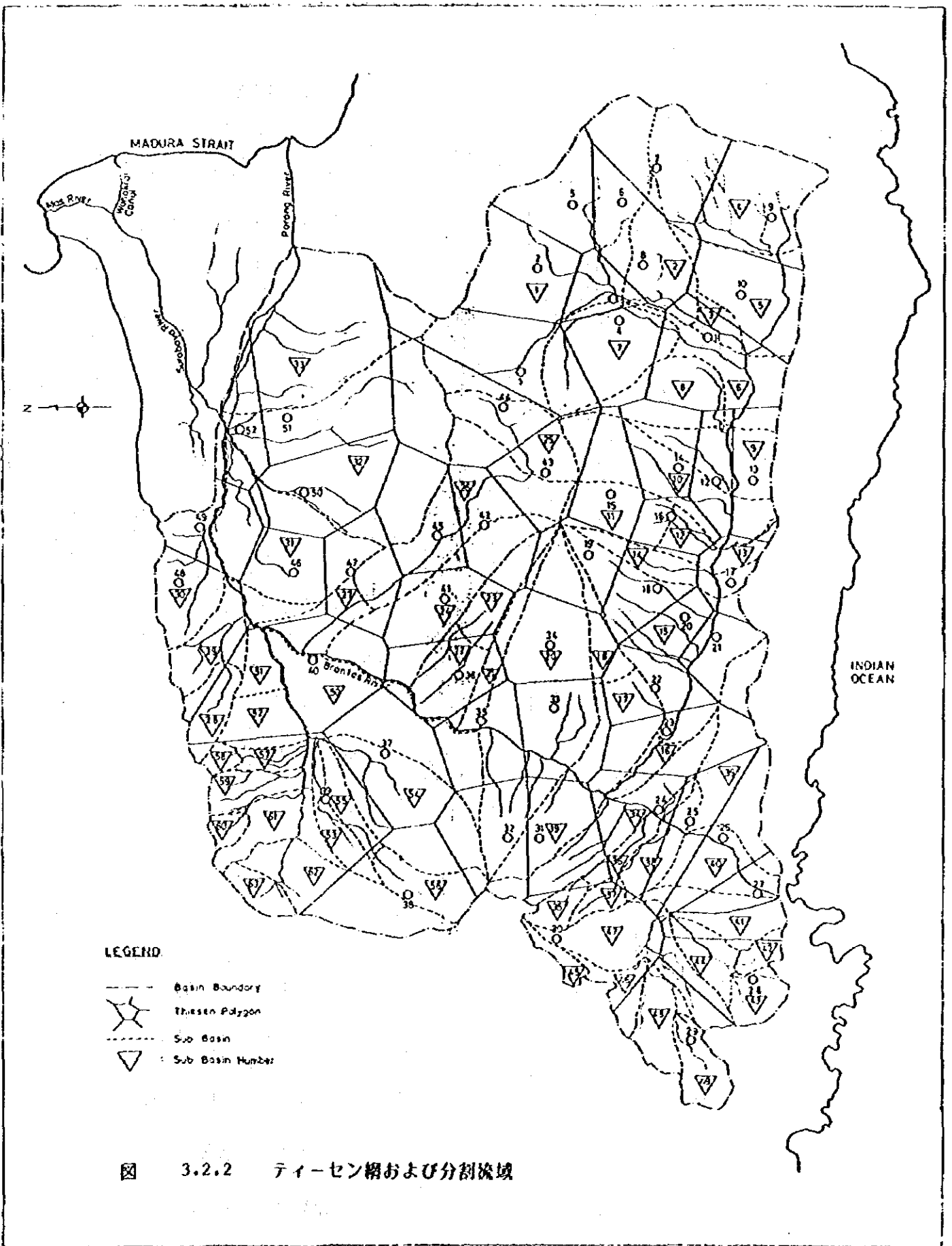
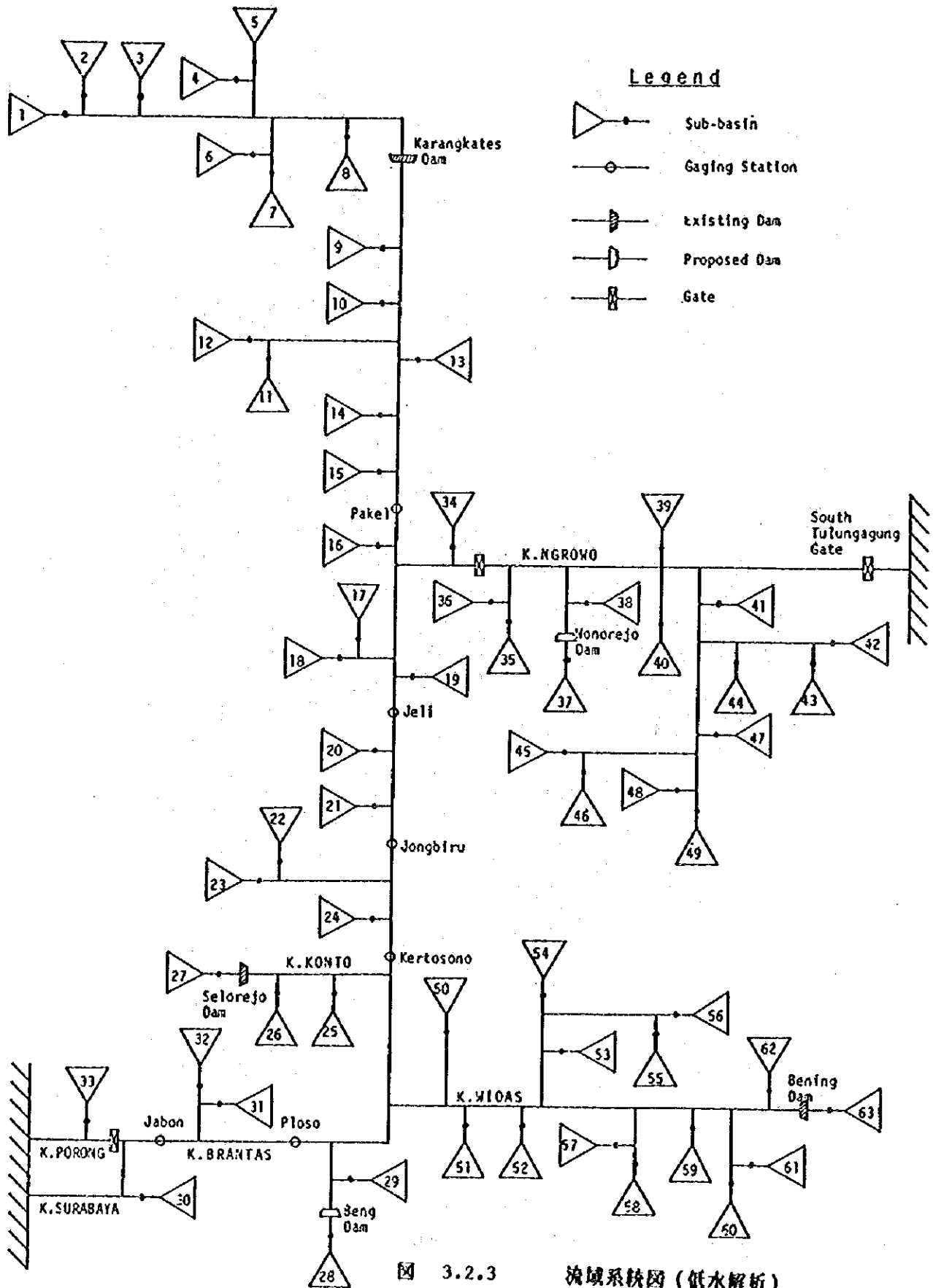


図 3.2.2 ティーセン網および分割流域



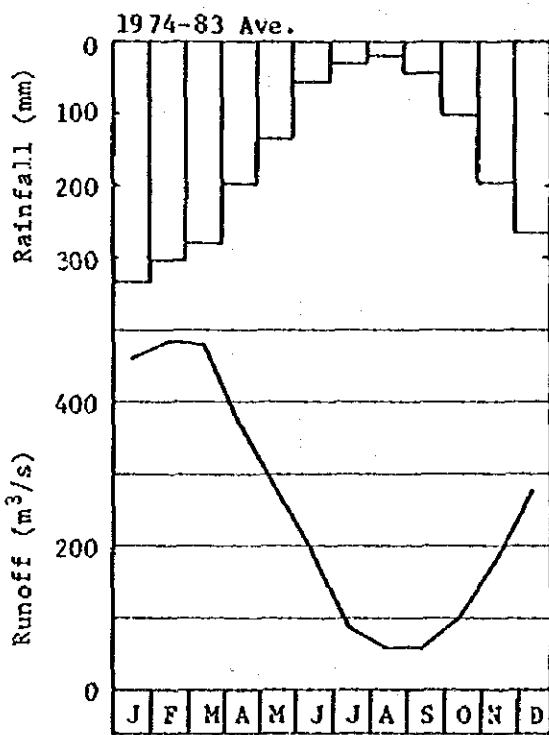
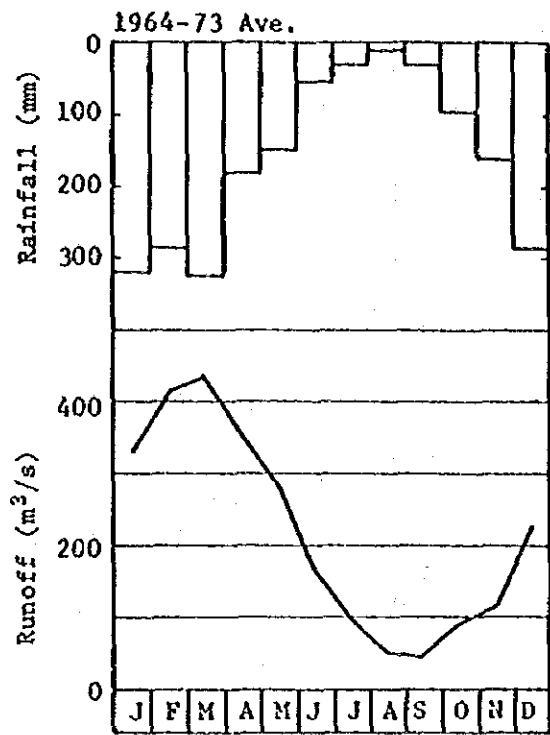
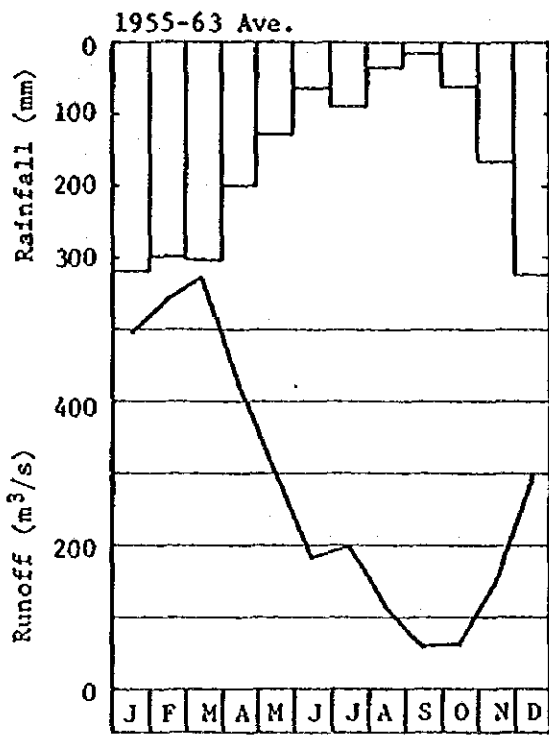
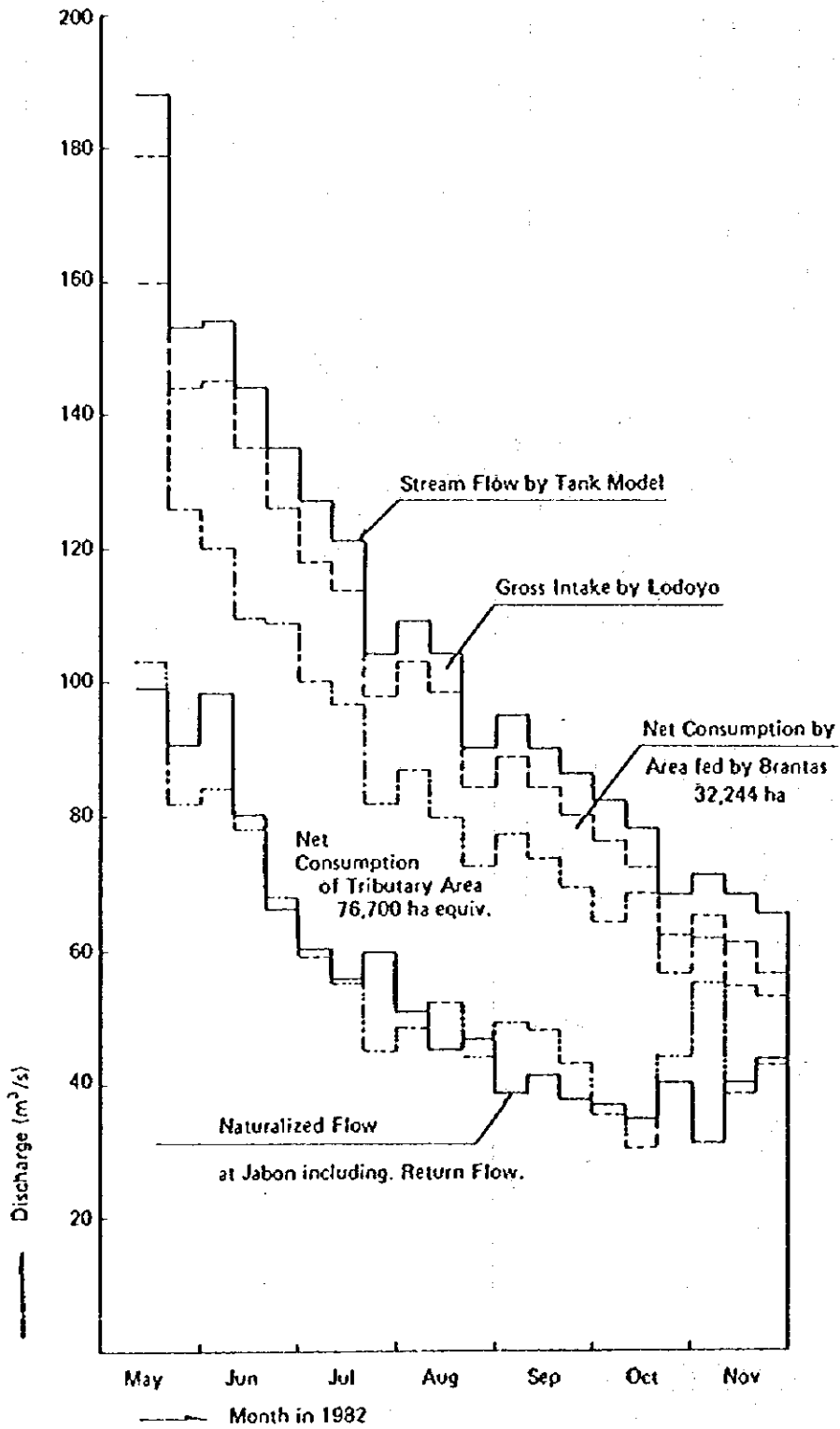


図 3.2.4 ジャボン地点の雨量および流量



☒ 3.2.5 ジャボン地点における自然流量（原水戻し）と推定流量との関係

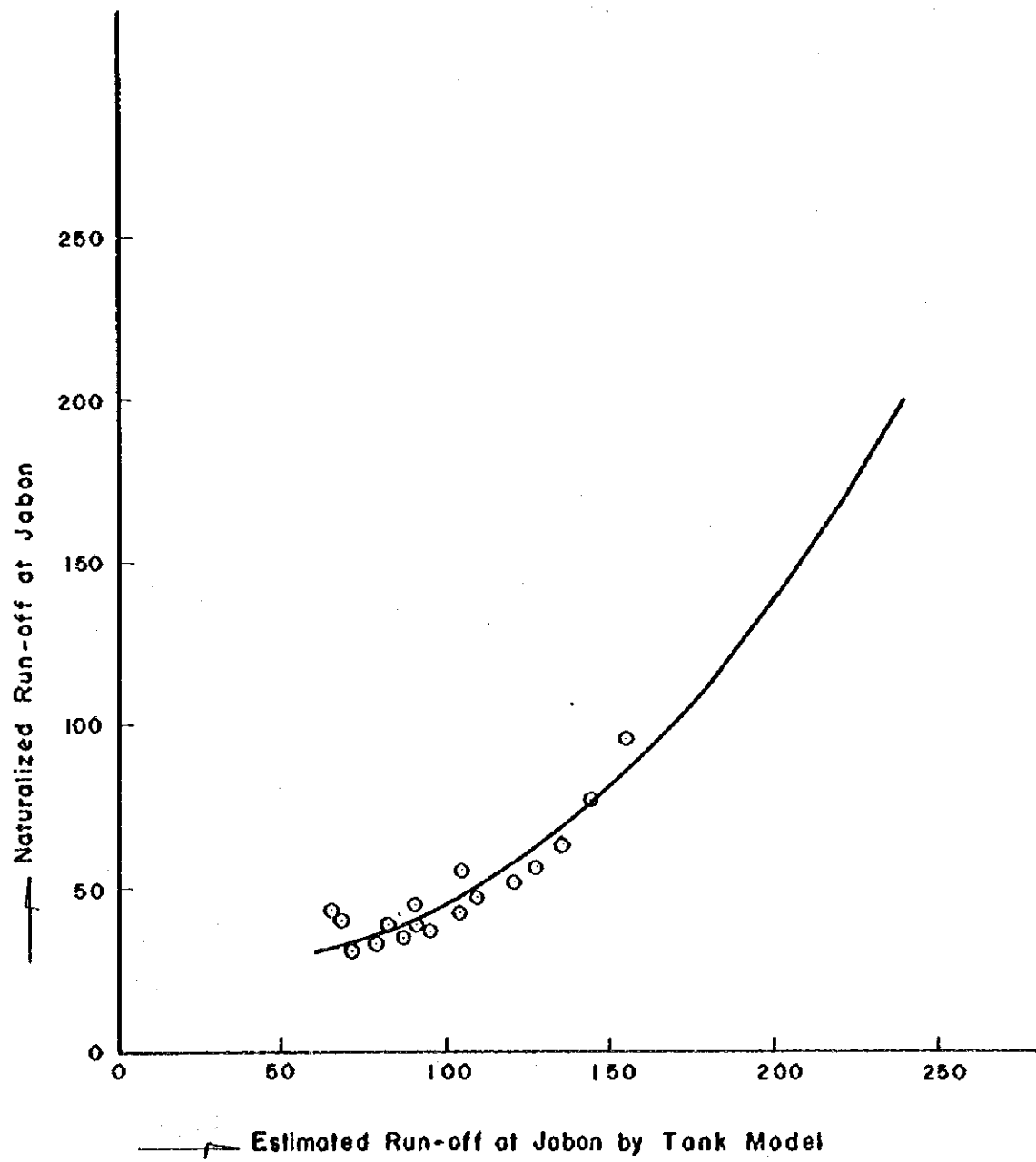


図 3.2.6 タンクモデルによる推定流量と自然流量（原水戻し）との関係

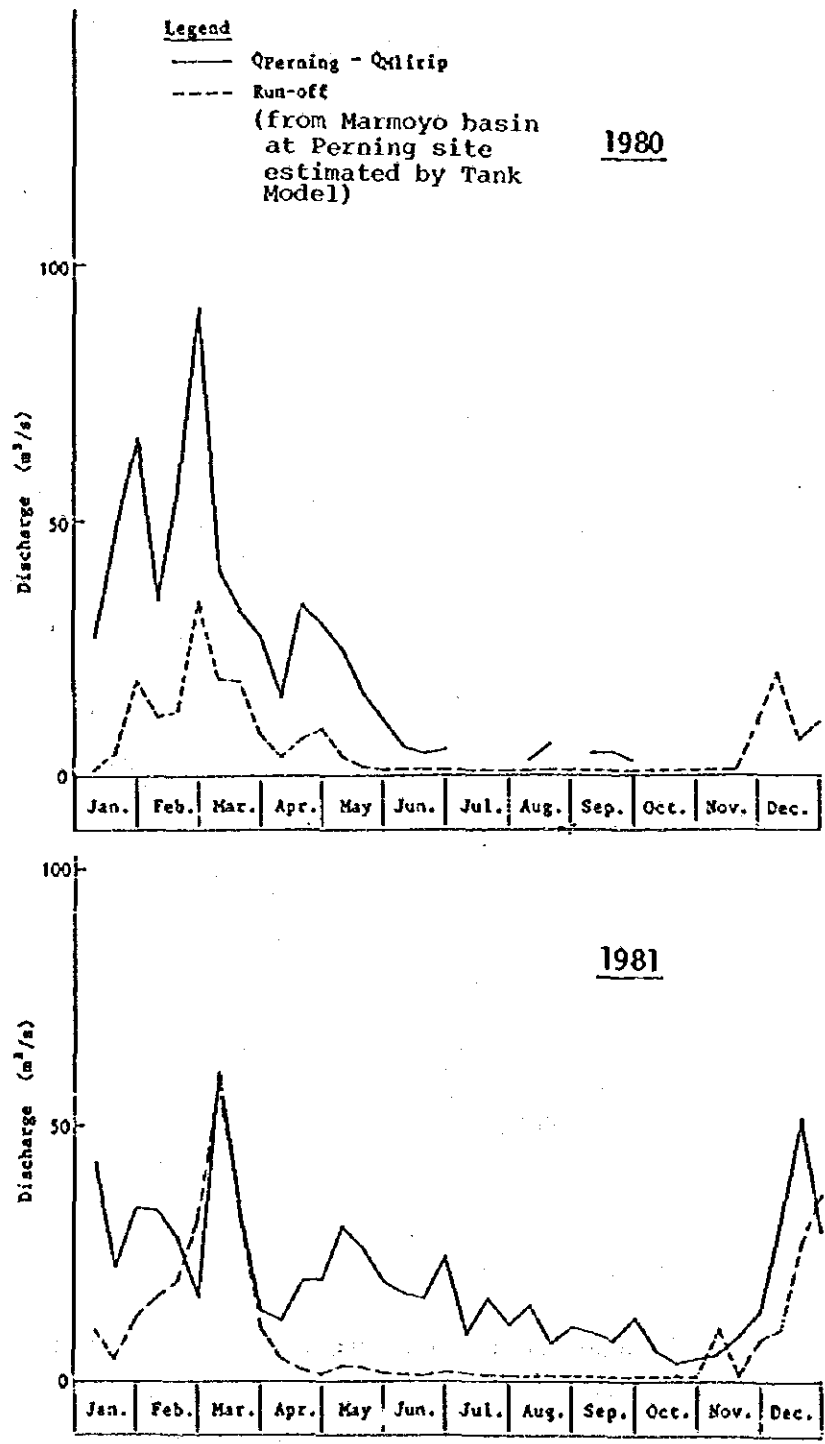


図 3.2.7(1) プルニン地点流量 (マルモヨ川-ワトゥダコンサイホン-ゲデック水門流量)

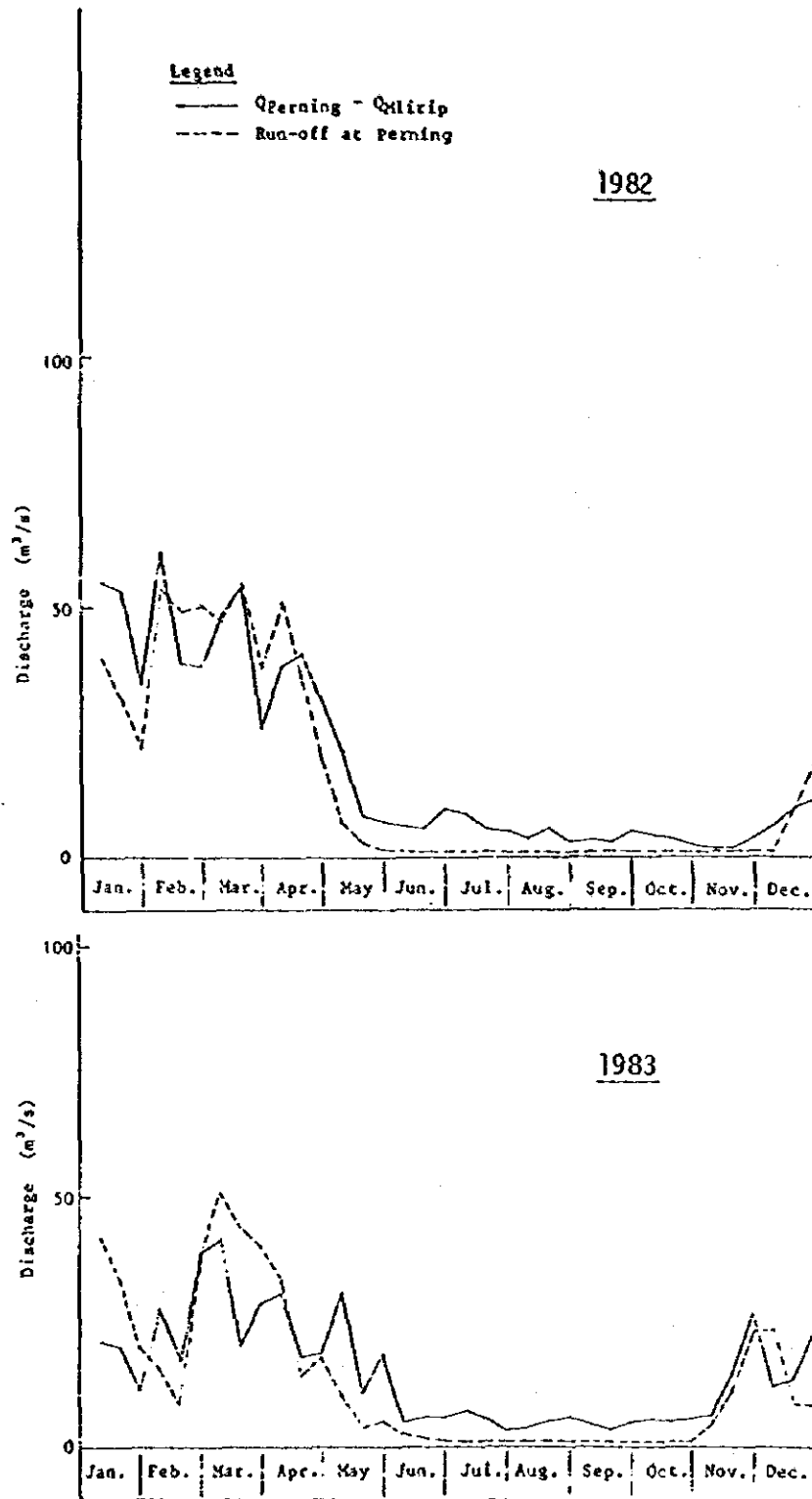


図 3.2.7(2) プルニン地点流量 (マルモヨ川-ワトゥダコンサイホン-ゲデック水門流量)

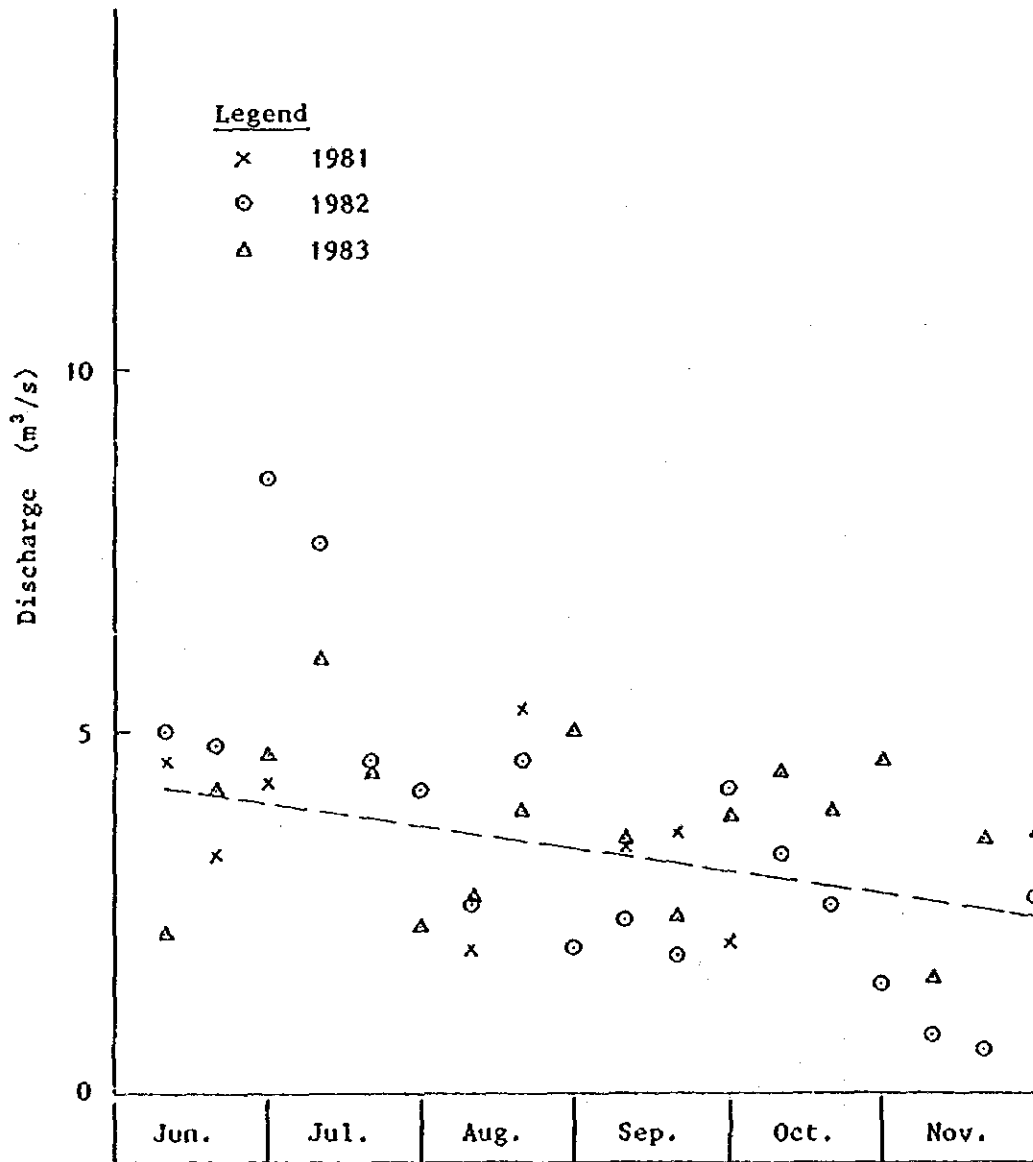
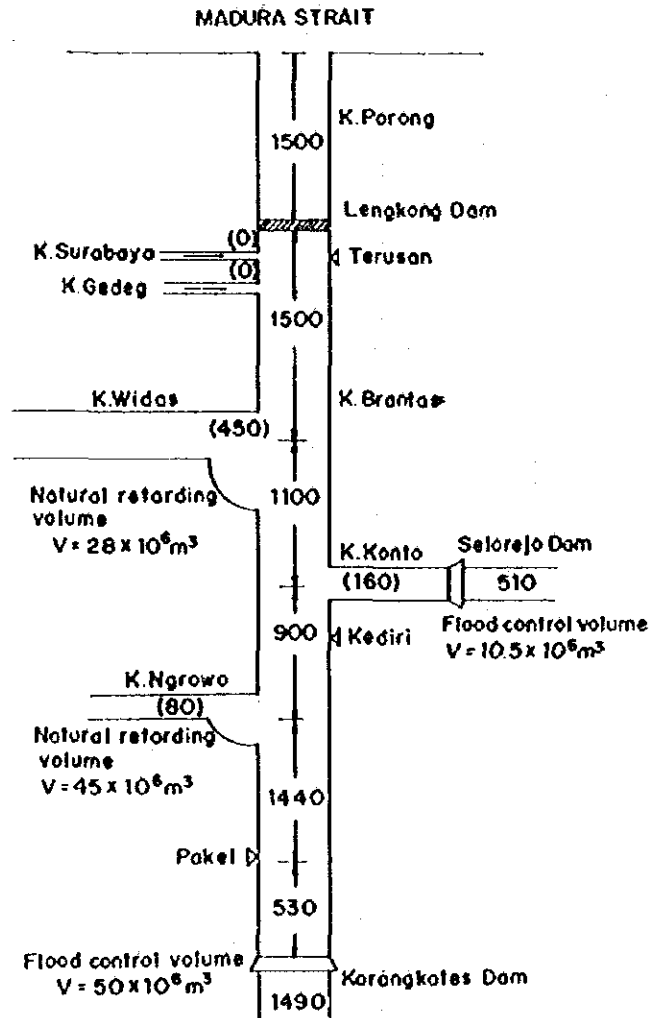
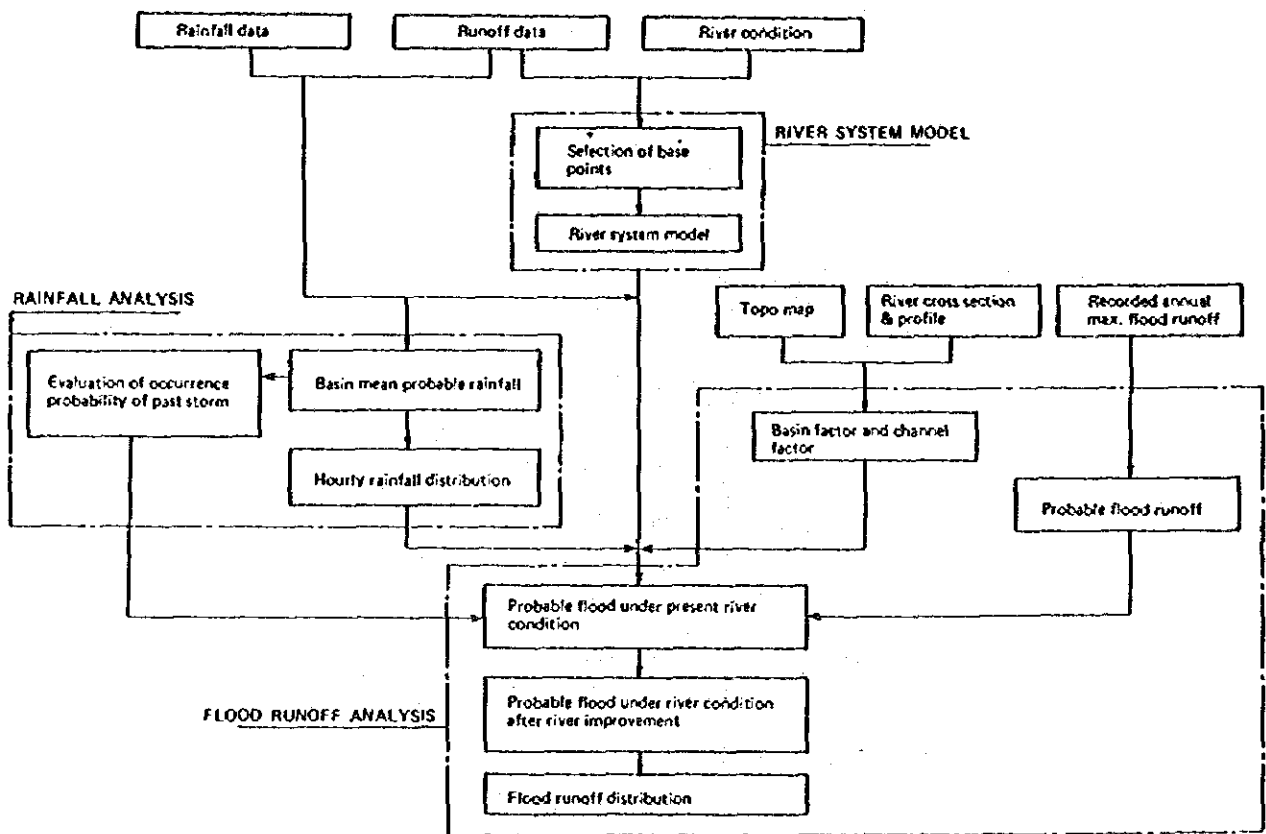


図 3.2.8 ゲデック水門とワトゥダコン・サイホンを通過する推定流量



Proposed by
The Brantas River Basin Development Plan
1973 Master Plan

图 3.2.9 洪水流量配分



GENERAL FLOW CHART OF FLOOD ANALYSIS

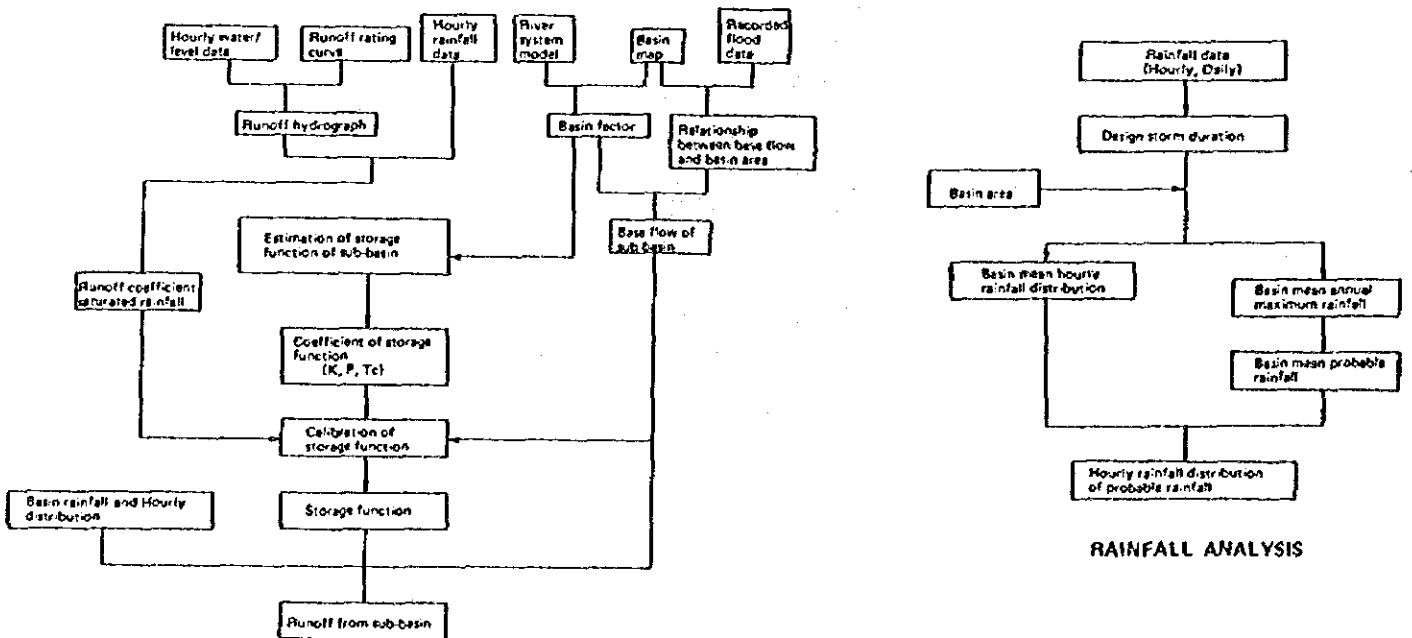


図 3.2.10 洪水解析手順フローチャート

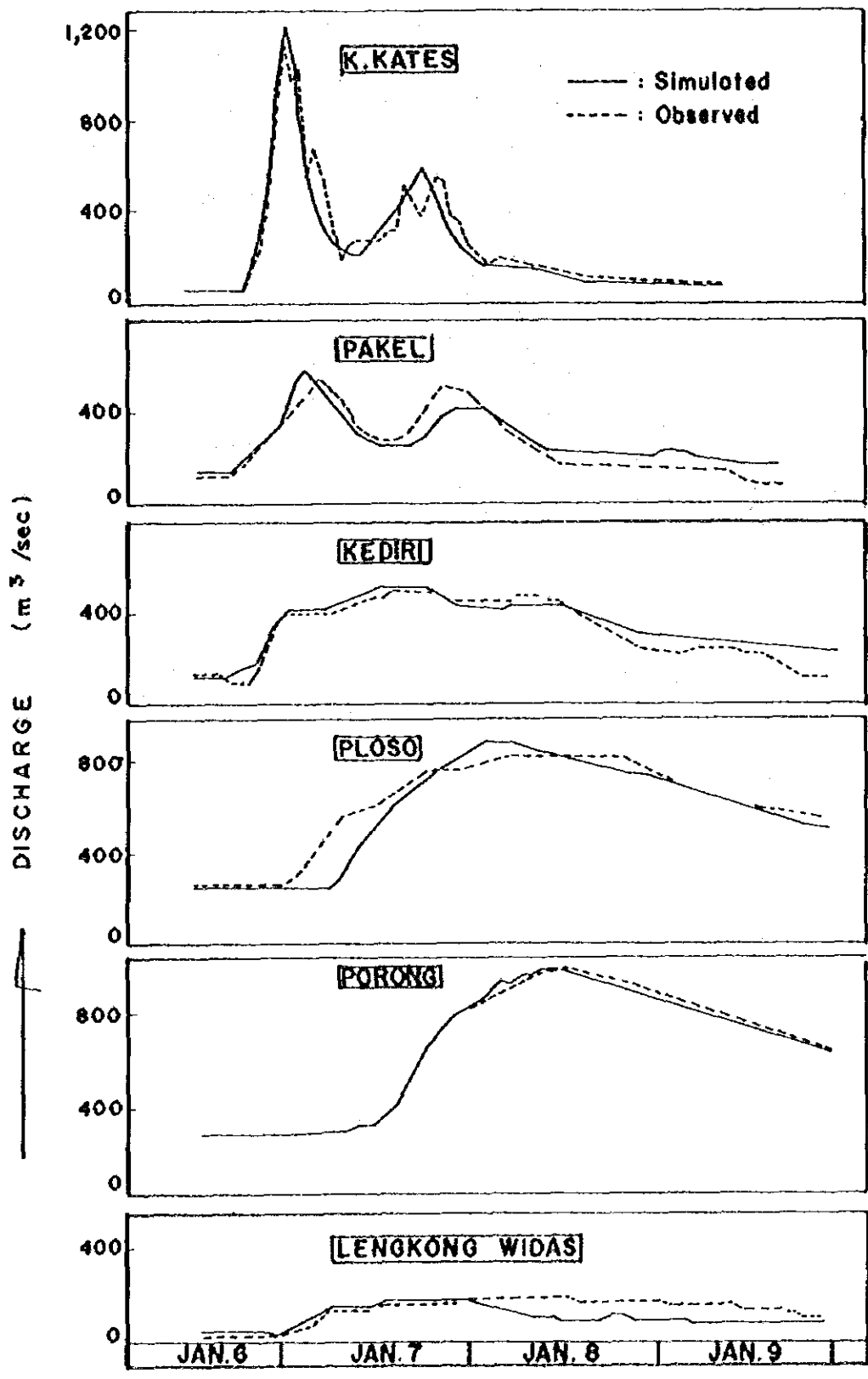


図 3.2.11 (1) 洪水ハイドログラフ 1984年5月2日~5日

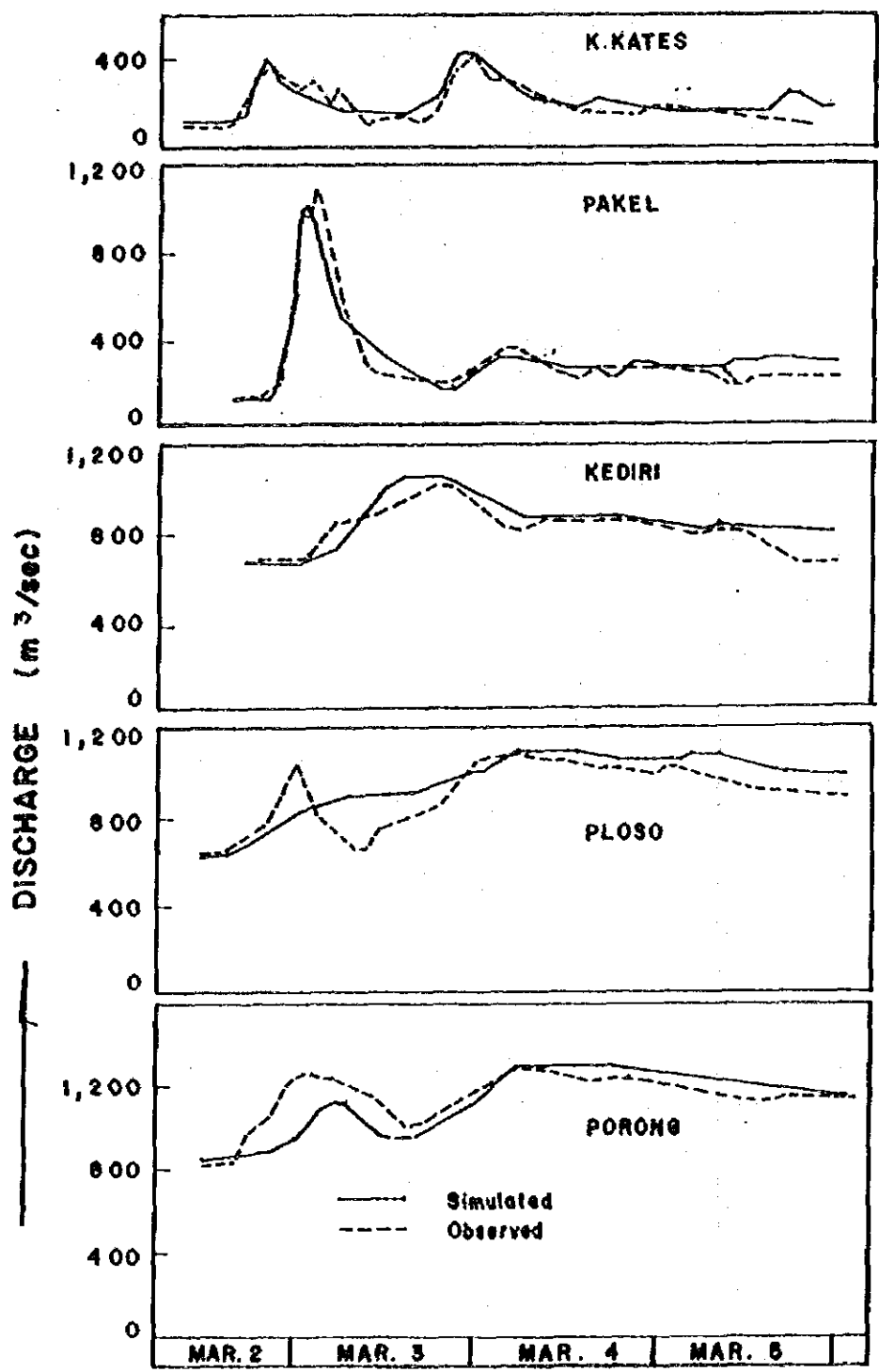
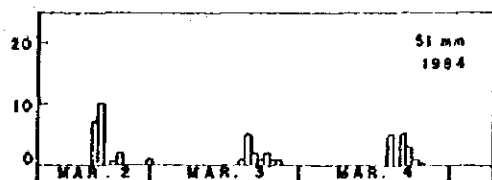
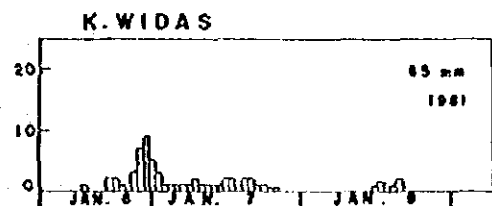
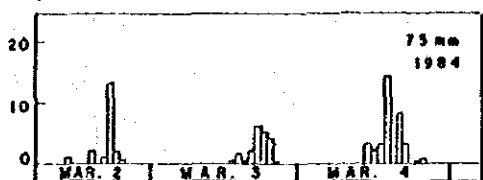
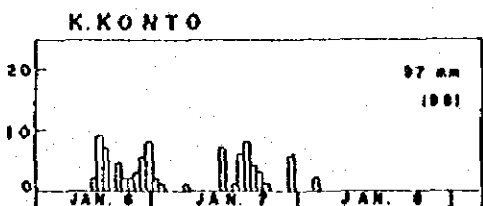
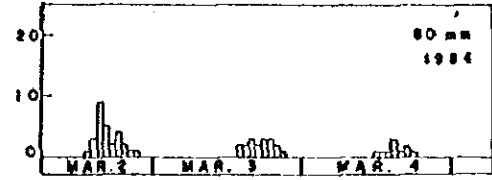
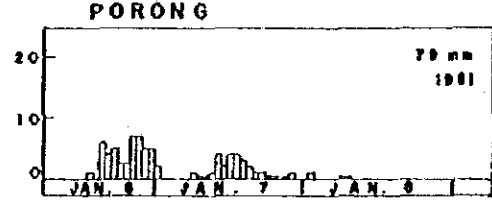
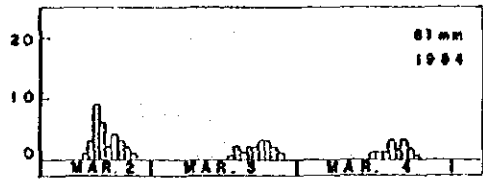
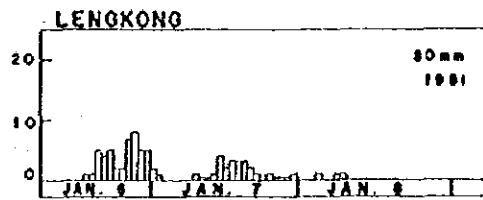
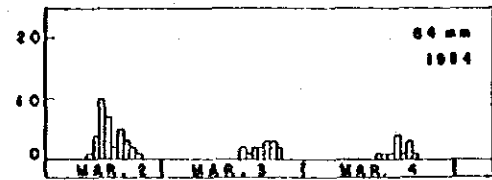
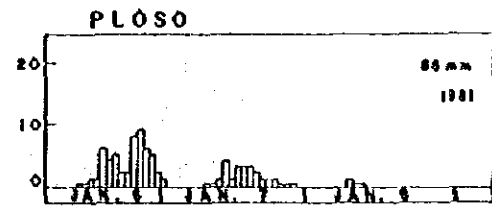
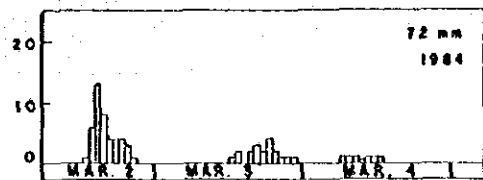
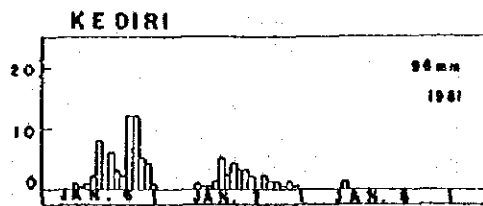
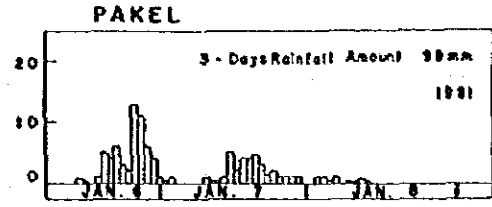
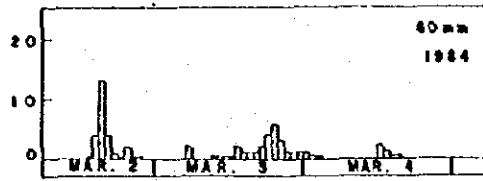
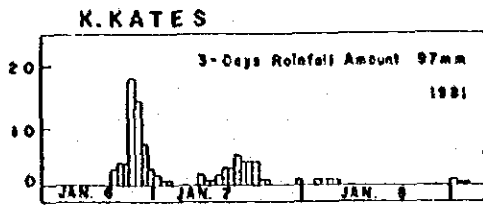


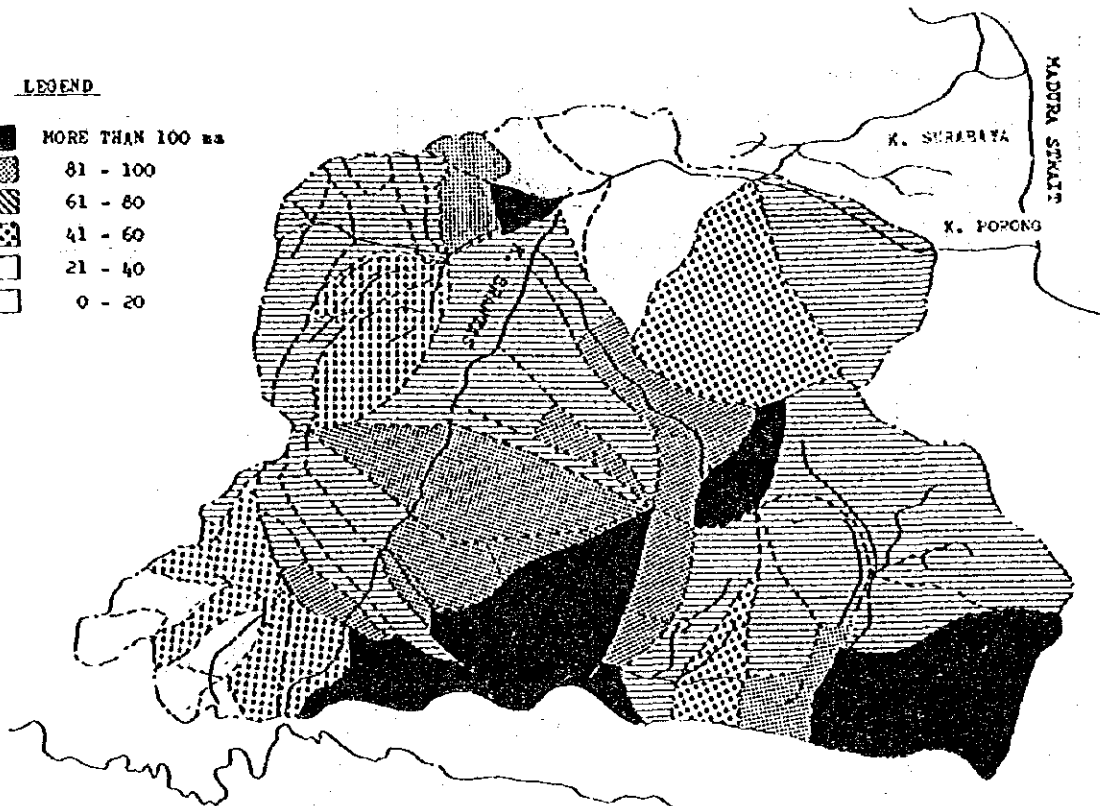
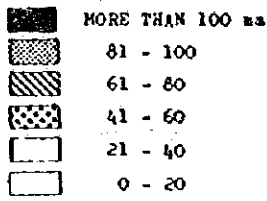
図 3.2.11 (2) 洪水ハイドログラフ 1984年5月2日~5日



UNIT: RAINFALL (mm)

図 3.2.12 流域内平均時間雨量分布

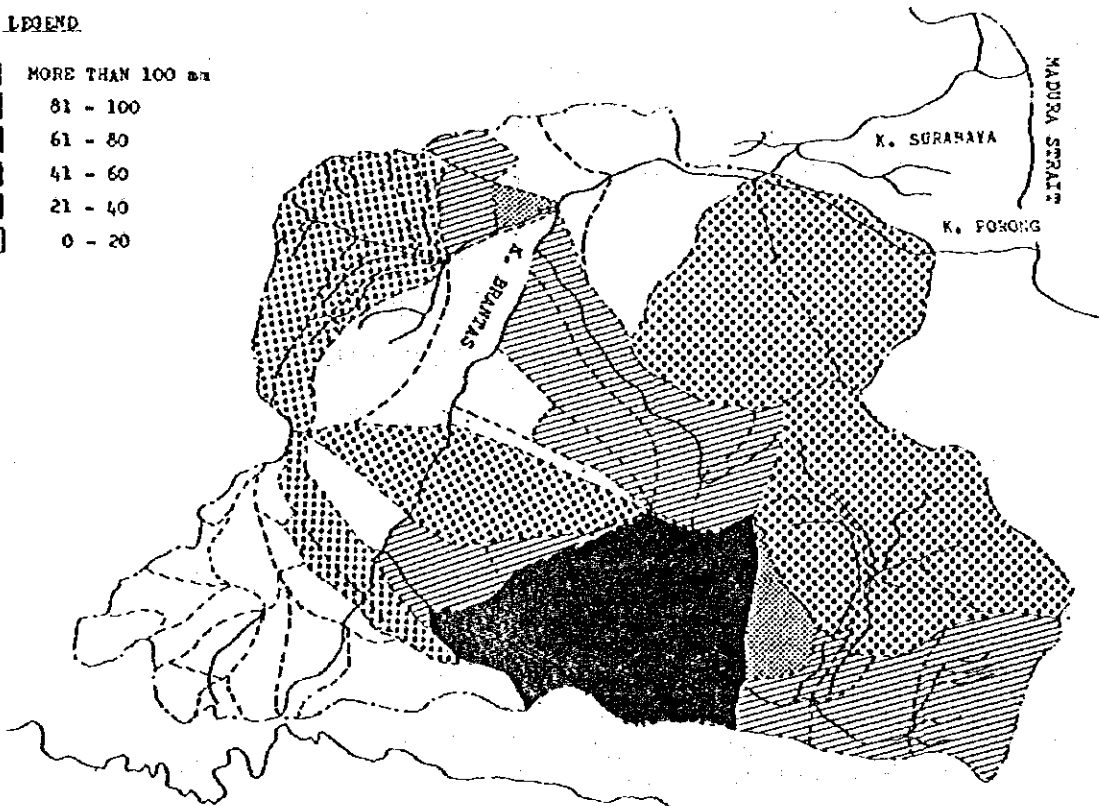
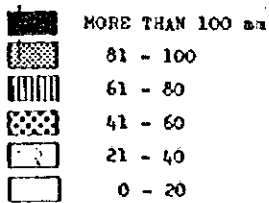
LEGEND



INDONESIAN OCEAN

3-DAY RAINFALL IN SUB-BASIN ON JAN. 6-8, 1981

LEGEND



INDONESIAN OCEAN

3-DAY RAINFALL IN SUB-BASINS ON MAR. 2-4, 1984

図 3.2.13 1981年1月及び1984年3月の豪雨時、3日雨量

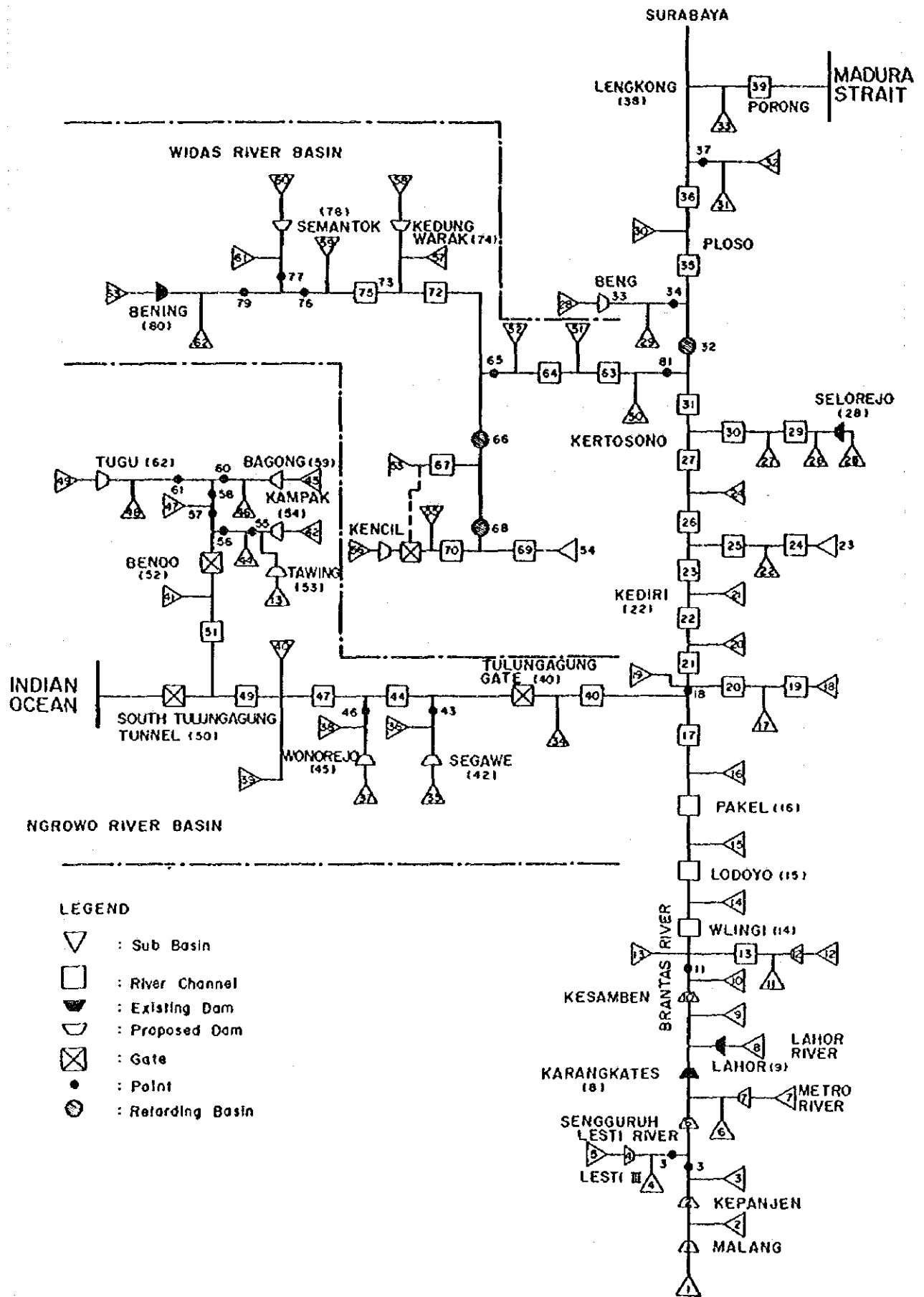


图 3.2.14 流域系统图 (高水解析)

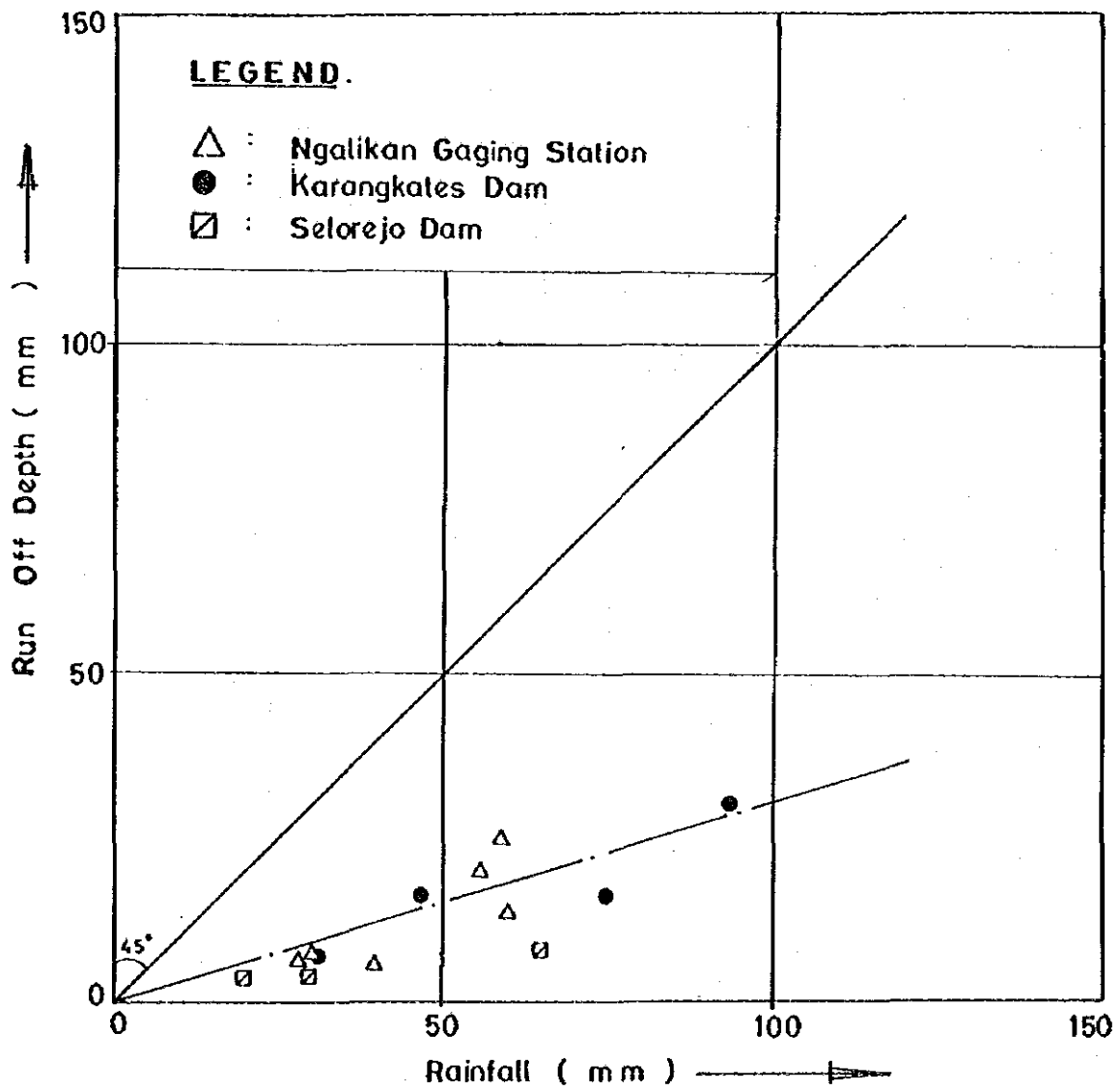


図 3.2.15 洪水時の雨量と流出深の関係

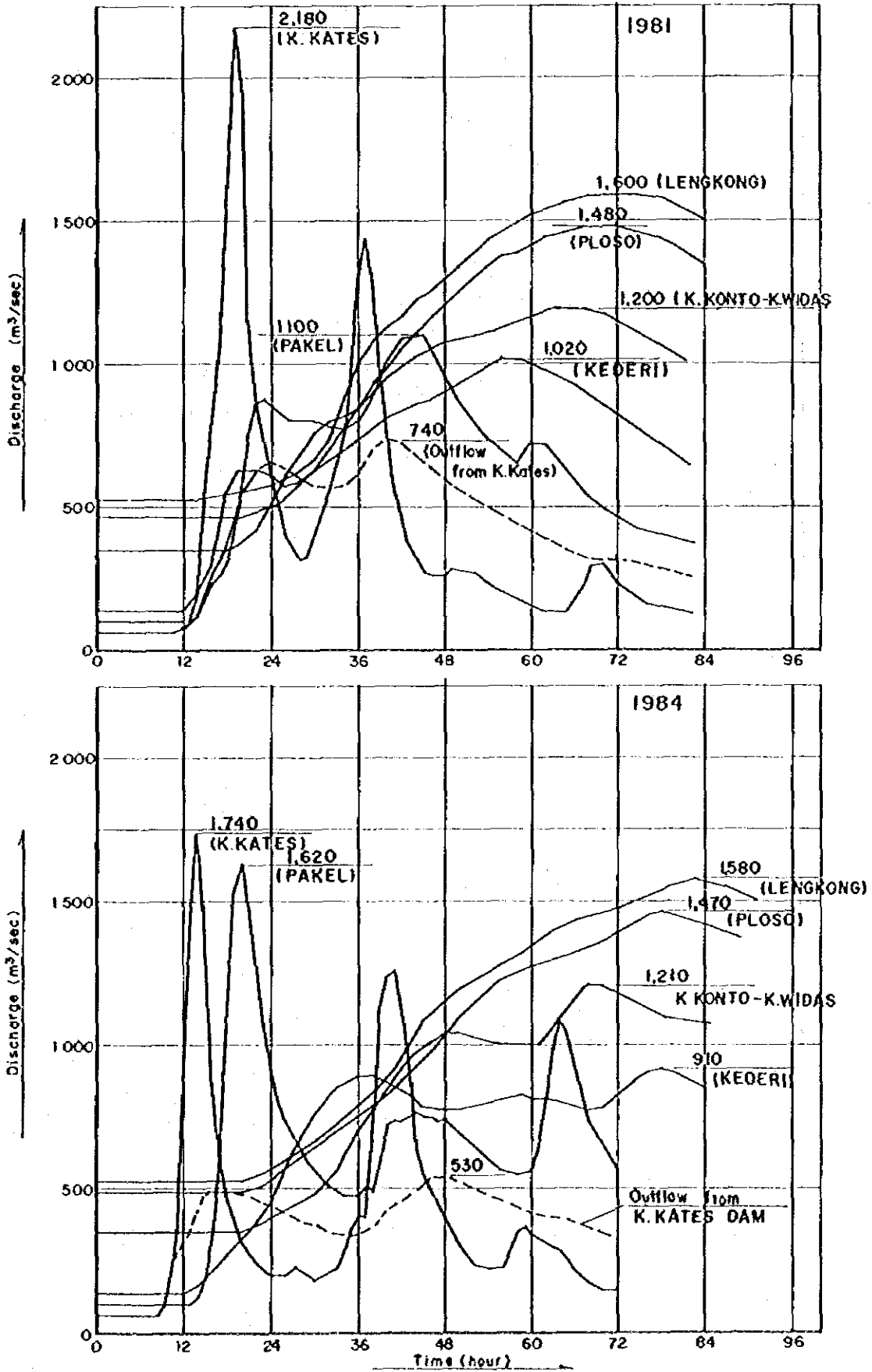


図 3.2.16 現況ブランタス河での50年確率洪水ハイドログラフ

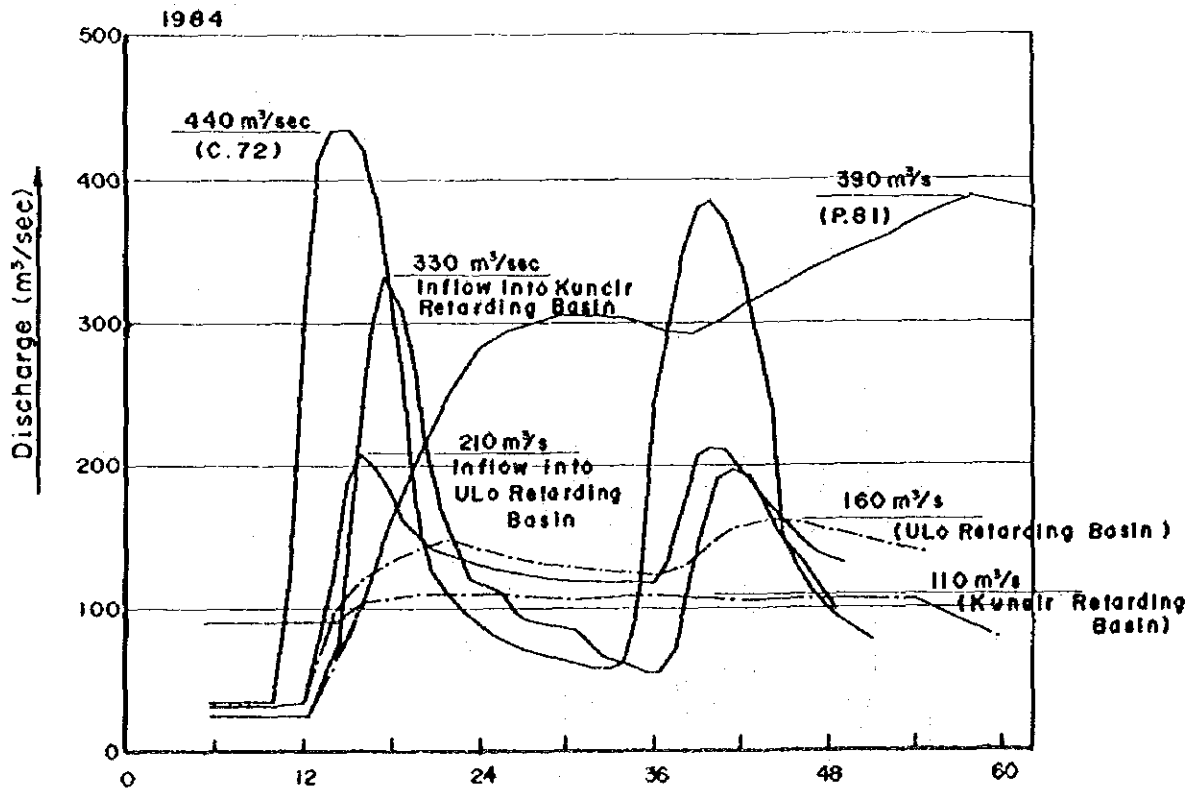
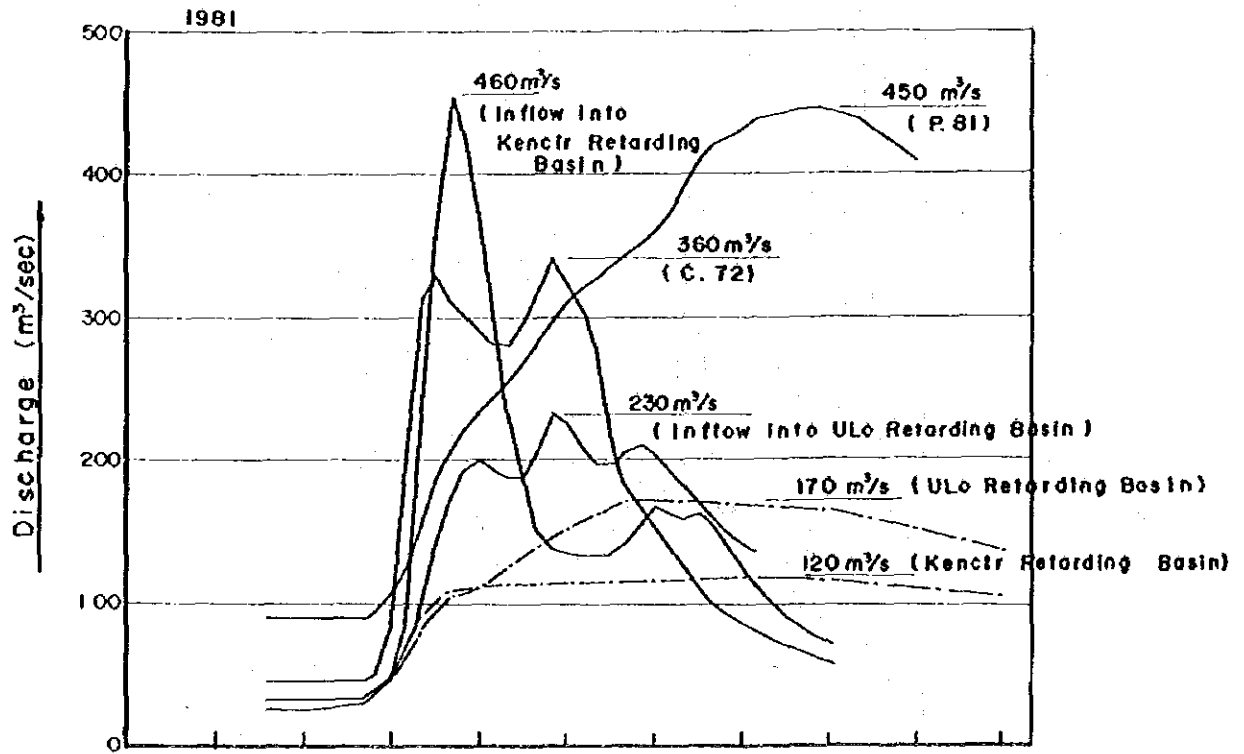


図 3.2.17 現況ウィダス川での25年確率洪水ハイドログラフ

Source : HY52

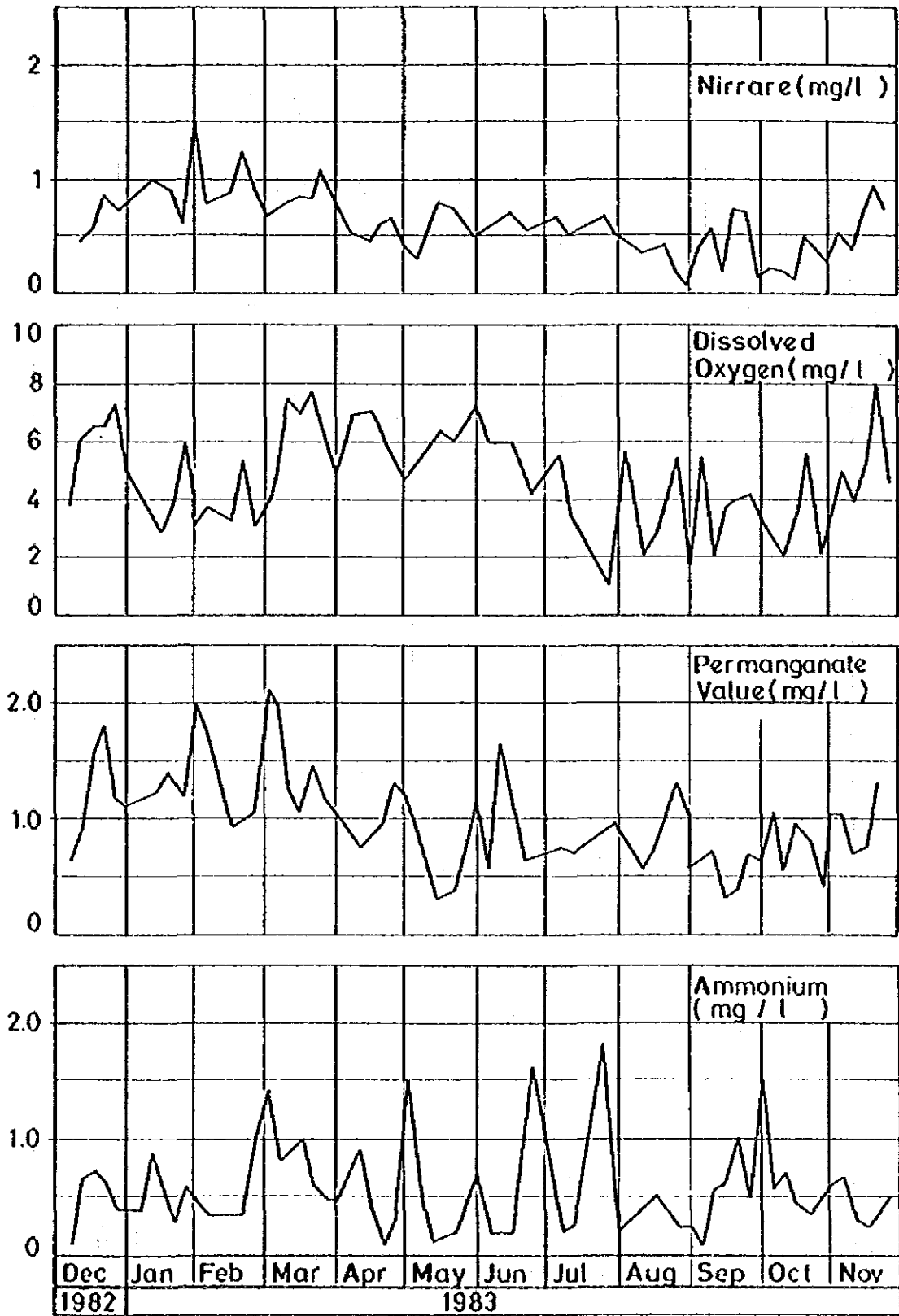


図 3.2.18 グヌンサリ・ダム地点水質の年変動

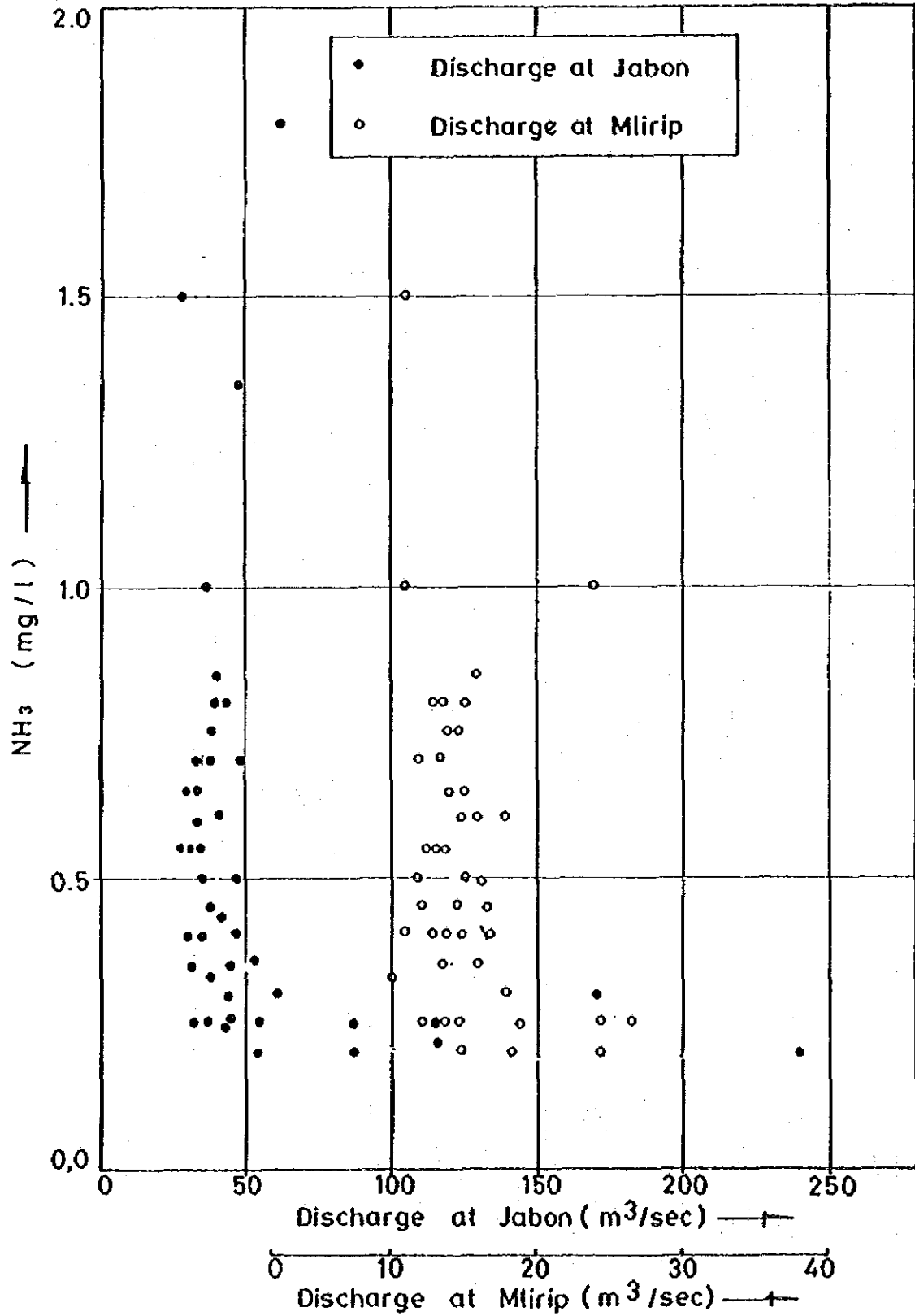
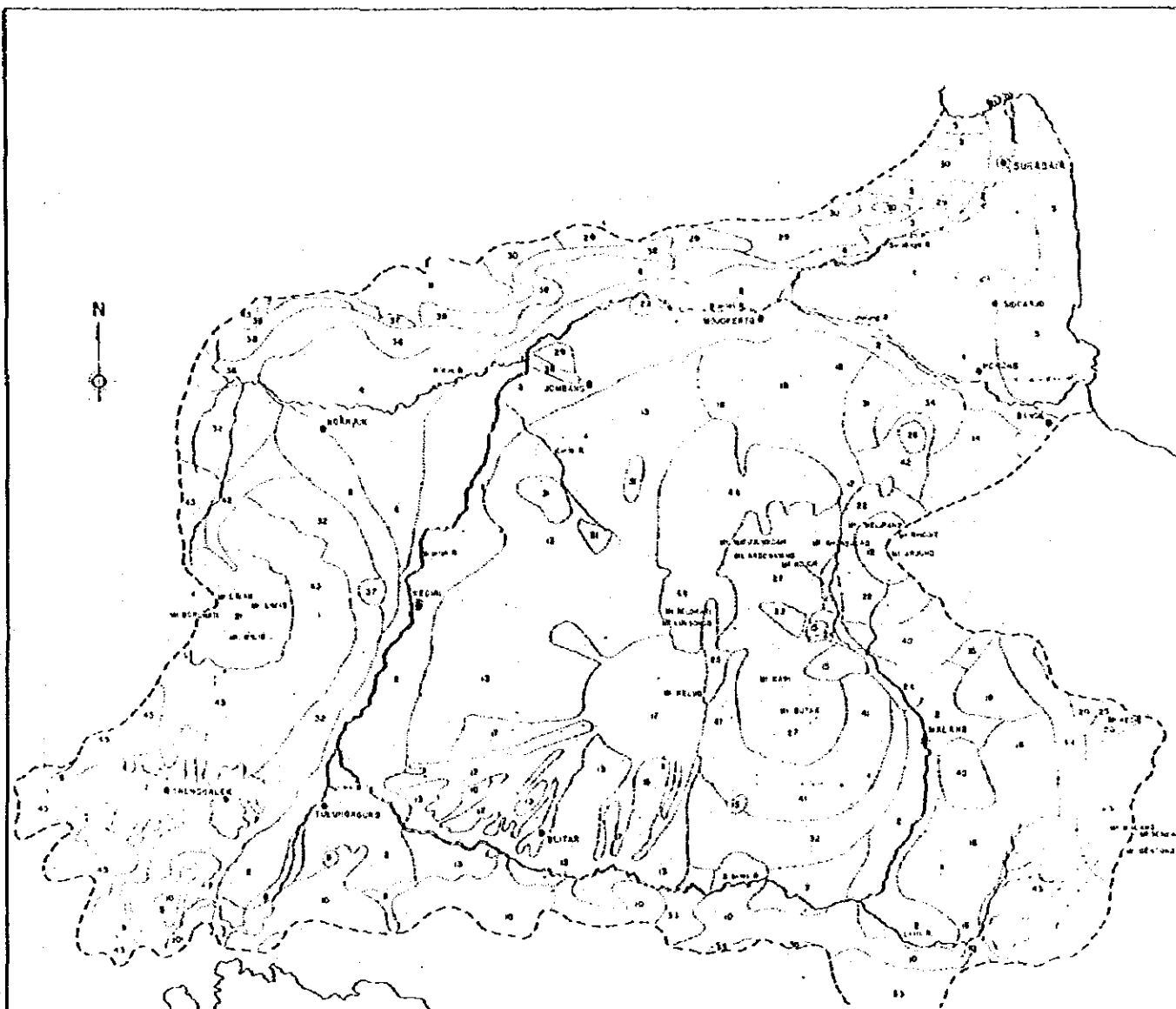


図 3.2.19 水質と流量の関係



ALLUVIAL

- 1 Grey Alluvial
- 2 Grey / Greyish brown Alluvial
- 4-3 Grey Dark Alluvial
- 5-7 Dark grey hydromorphic Alluvial

INDO CHINESE

- 8 Humic grey

LITHOLOSSIL

- 9 Lithosol
- 10 Association of Lithosol / Reddish Brown Mediterranean soil
- 11 Complex of Lithosol, Med / Rendzhe

REGOSOLS

- 12 Yellowish brown Regosol
- 13 Greyish brown Regosol
- 14 Greyish brown Regosol

- 15-16 Brown Regosol
- 17 Greyish regosol / Lithosol
- 18 Yellow brown regosol / Lithosol

NON-CALCAREOUS BROWN FOREST SOILS

- 19 Brown forest soil

ANDOSOLS

- 20 Association of gray and soil / gray regosol
- 21-22 Association of yellowish brown and soil / yellowish brown regosol
- 23 Brown and soil
- 24 Association of brown and soil / humic grey B
- 25 Association of brown and soil / brown regosol
- 26 Complex of yellowish grey and soil / Lithosol
- 27 Complex of brown and soil / Lithosol

GRUMJZOL

- 28 Grey grumusol
- 29-30 Dark grey grumusol

MEDITERRANEAN

- 31 Association of brown mediterranean / grey grumusol
- 32-33 Brown reddish brown mediterranean / grey grumusol
- 34 Association of reddish brown mediterranean / grey grumusol
- 35 Reddish brown mediterranean
- 36 Association of reddish brown mediterranean / grey grumusol
- 37-38 Complex of brown mediterranean / Lithosol

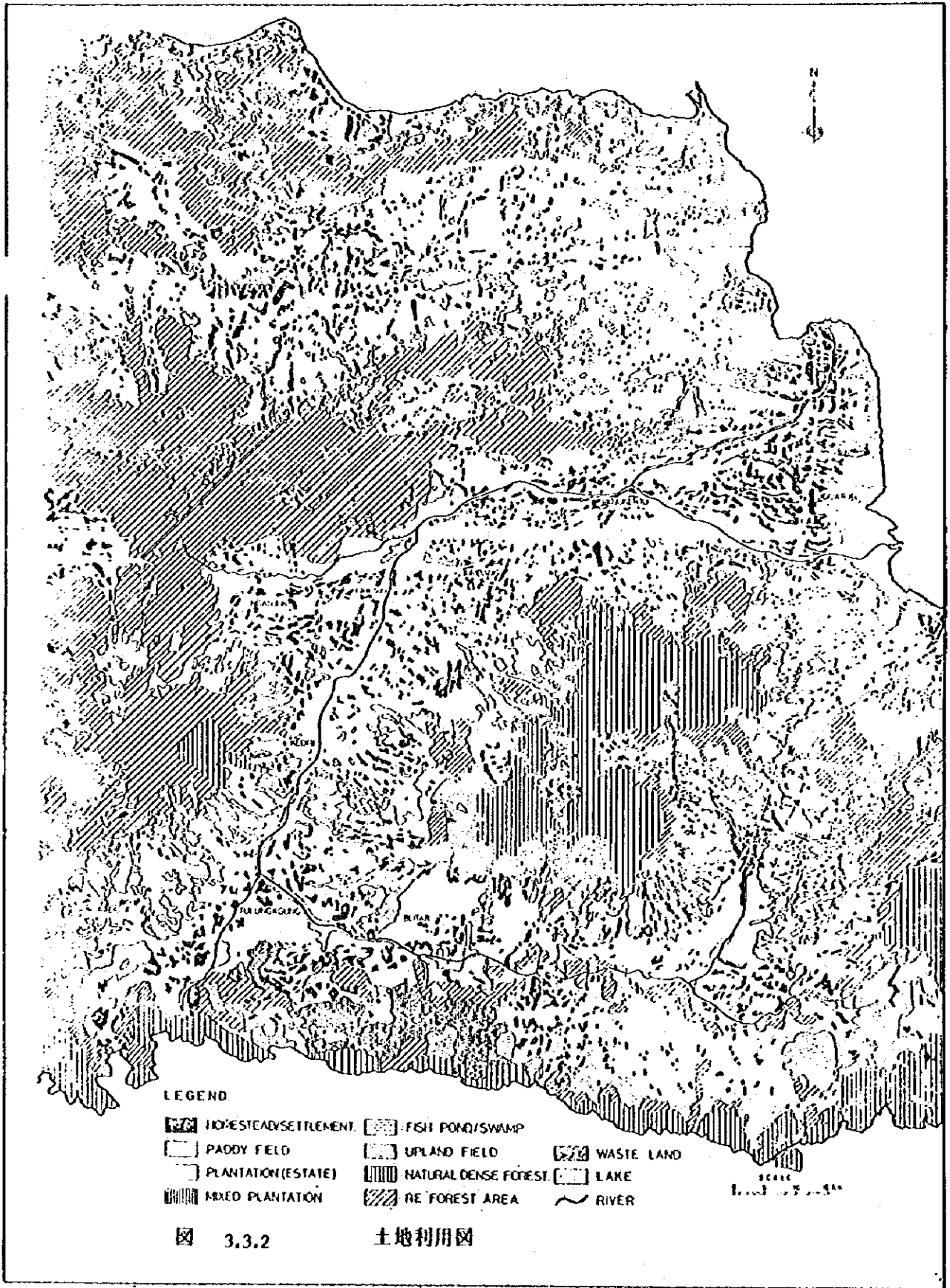
AREOSOL

- 40 Brown forest soil
- 41 Association of brown forest / brown regosol
- 42 Association of brown forest / grey regosol
- 43-44 Reddish brown forest soil
- 45 Complex reddish brown forest soil / Lithosol

SOURCE: Soil Research Institute, Bogor, IRI

図 3.3.1

ブランタス河流域の土壤



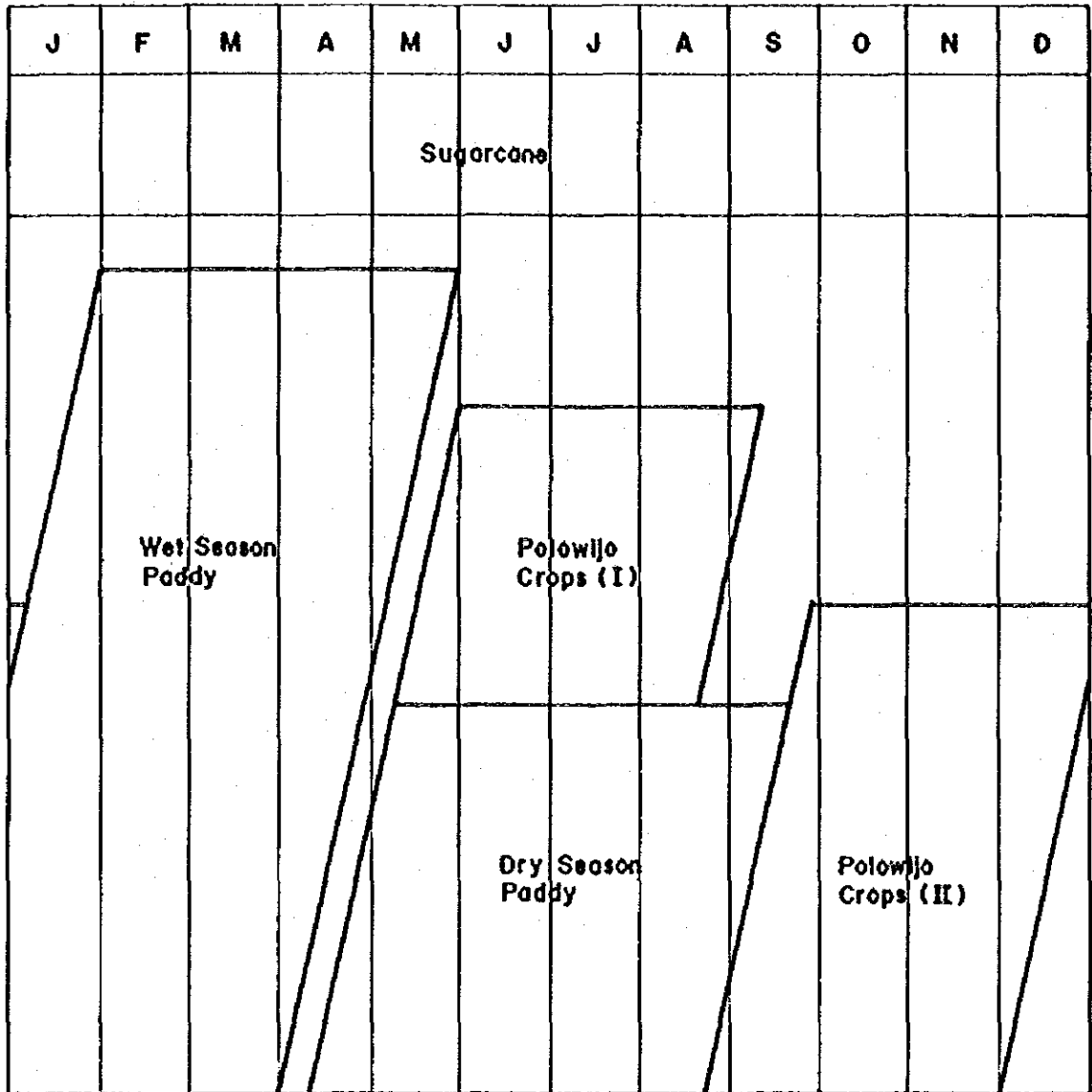


図 3.3.3 フラタス河流域内現況作付形態

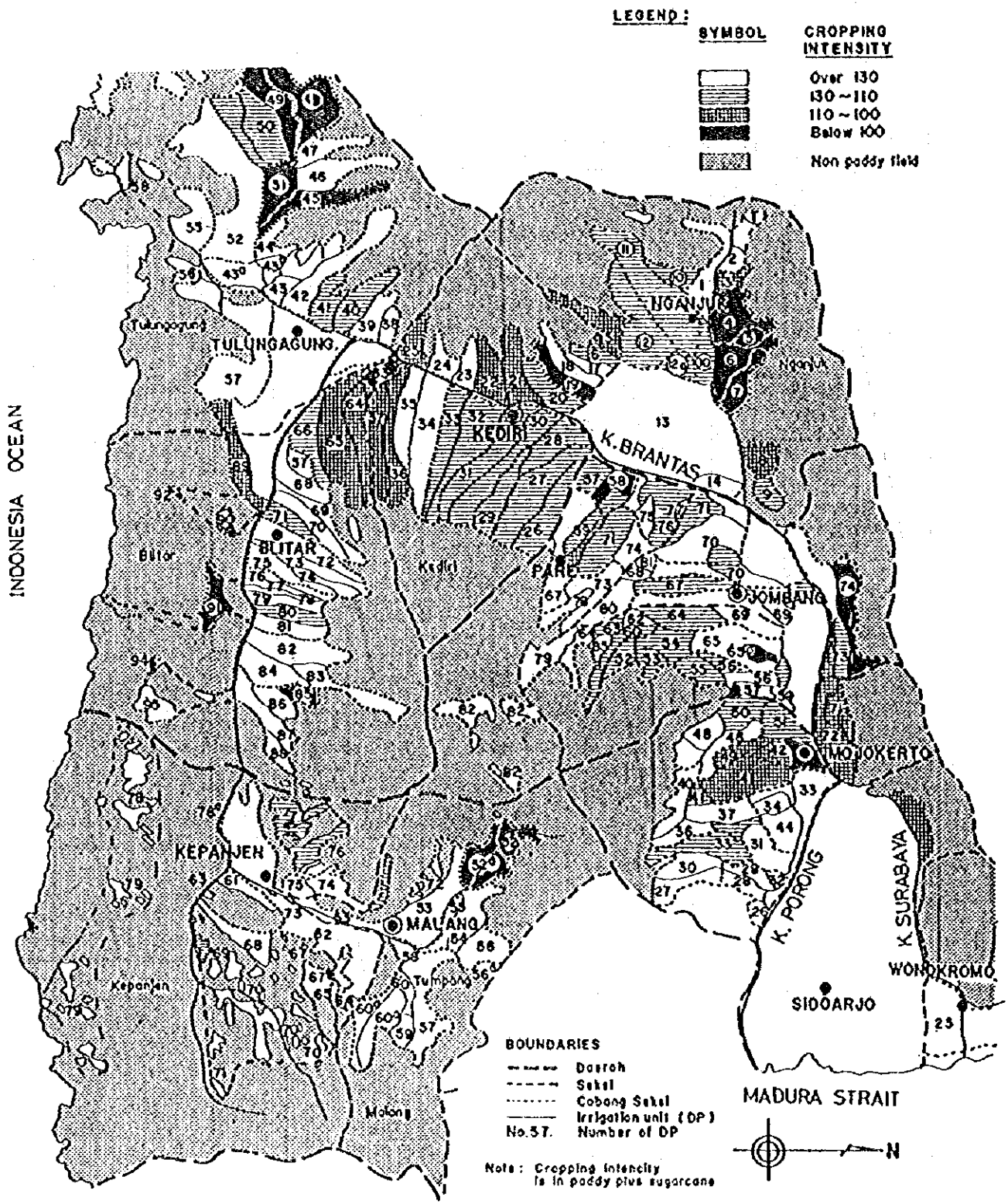
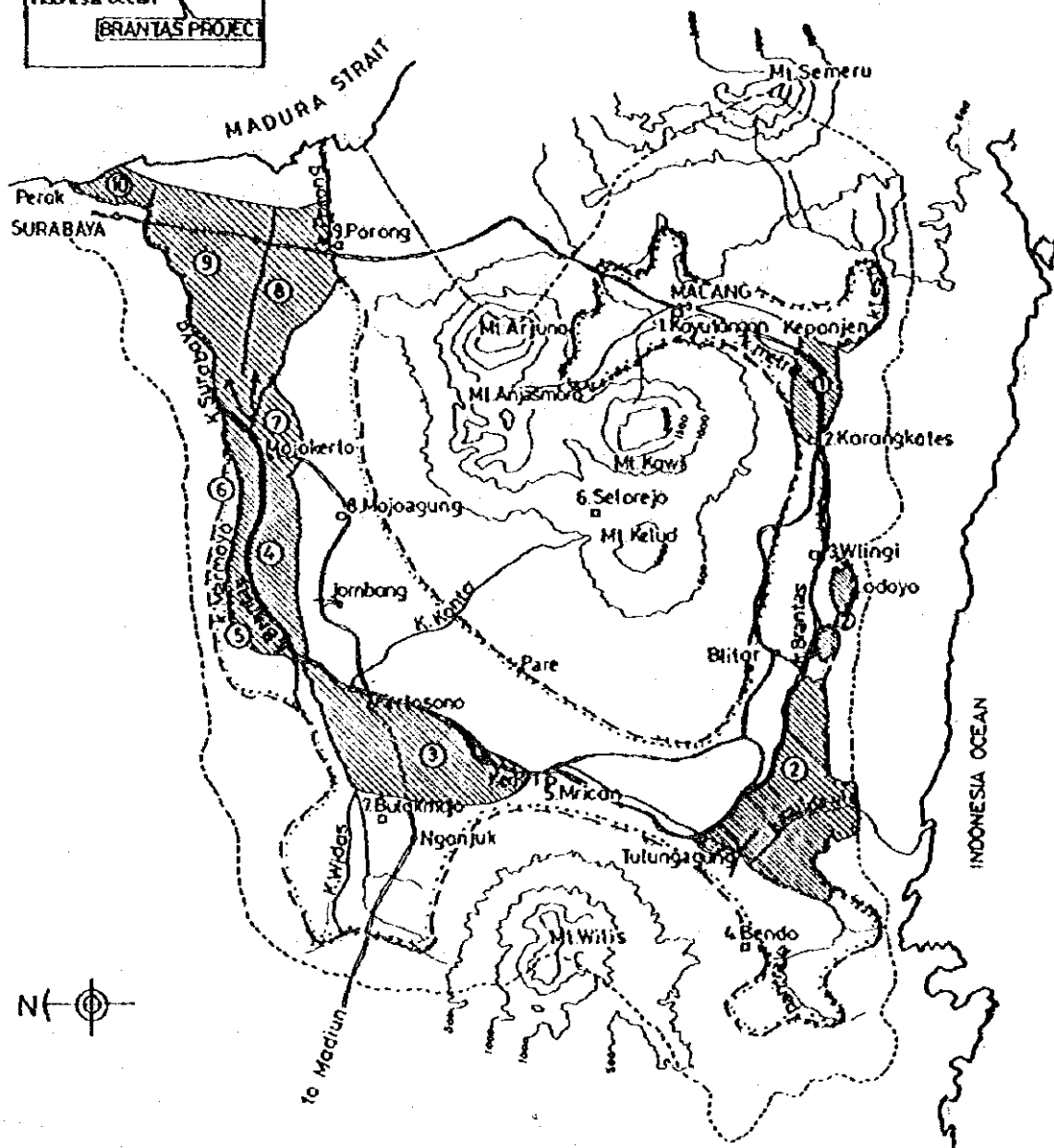
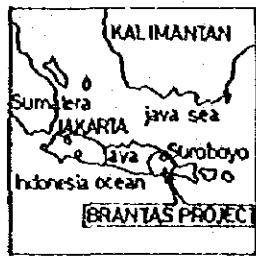
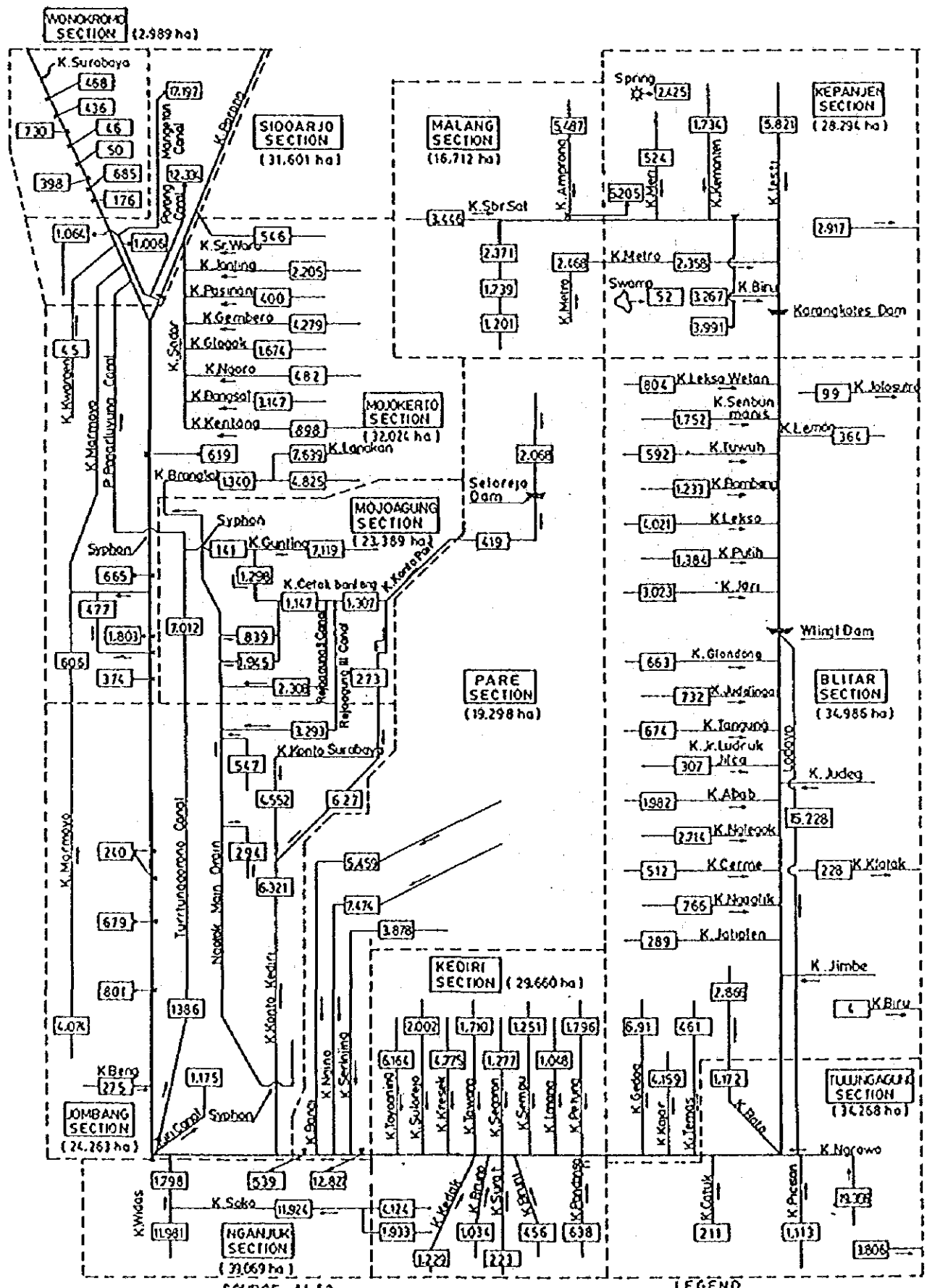


図 3.3.4 低作付率地区の分布



- | | |
|----------------------|-------------------|
| ① Molek | ⑥ Gollan - Losari |
| ② Lodoyo | ⑦ Jatikulon |
| ③ Warujayeng | ⑧ Porong |
| ④ Turi - Tunggorono | ⑨ Mangelan - Voor |
| ⑤ Jalimerek - Bunder | ⑩ Wonokromo |

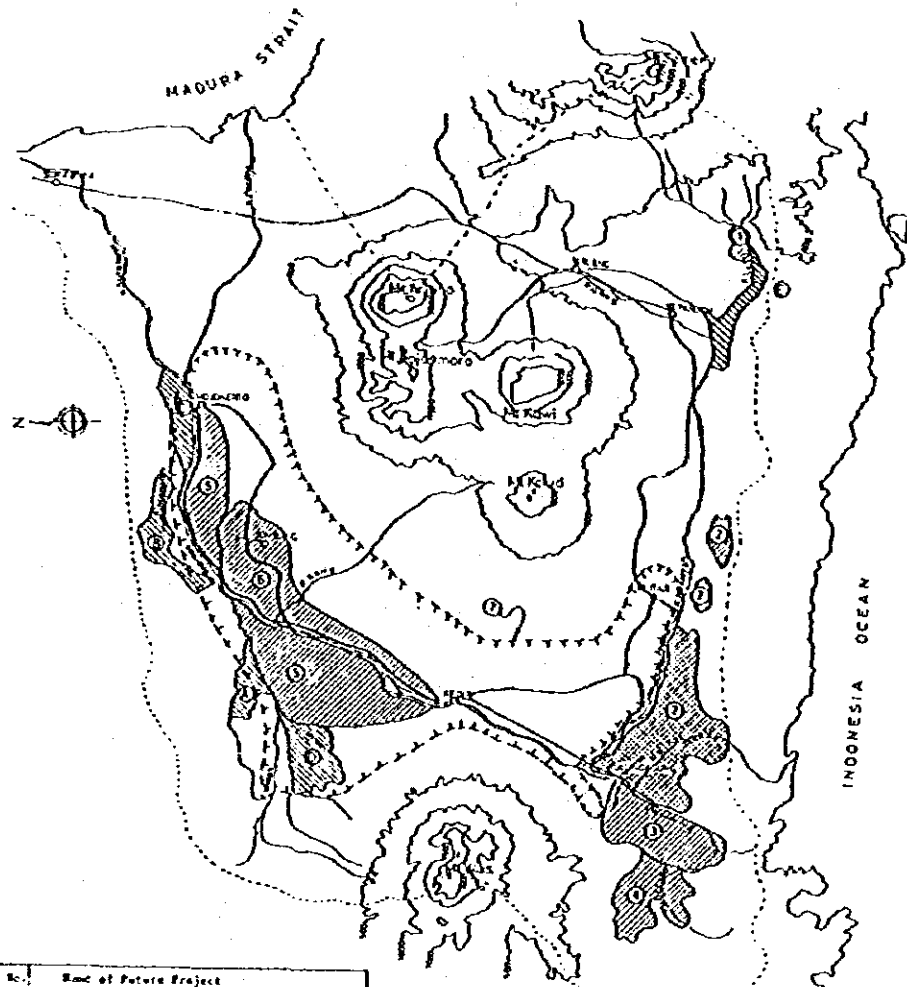
図 3.3.5 ブランタス河流域のかんがい地区



SOURCE : AI.52

- LEGEND
- ▭ Acreage of irrigated land
 - River or canal
 - - - Boundary of section
 - ◀ Intake

図 3.3.6 かんがい地図



No.	Name of Future Project
1	Vidau Reclamation Project
2	Bong Irrigation Project
3	Cotton-Losari Irrigation Project
4	Vidau South Irrigation Project
5	Seak Left bank Irrigation Project

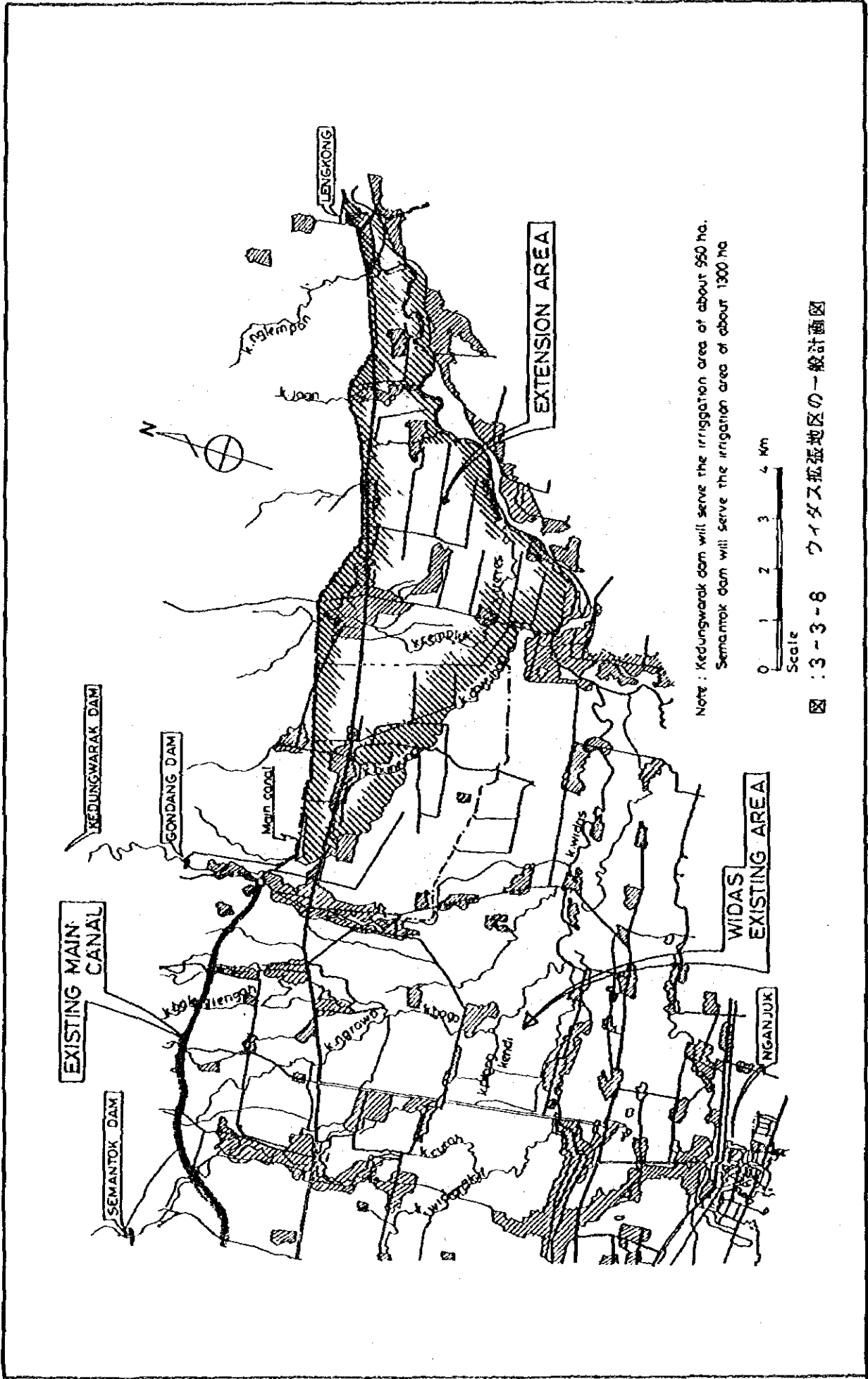
No.	Name of Project	Stage
1	Seak Irrigation Project	Pre - F/S
2	Lodaya Irrigation Project	Const.
3	Munczjo Dam and Irrigation Project	D/D
4	Krengalah Irrigation Project	F/S
5	Varajayang-Tusi Tunggarono Project	D/D
6	Pajat-Peterongan Irrigation Project	F/S
7	East Java Ground Water Project	
8	East Java Rehabilitation Project	Const.

Legend	
[Hatched Box]	Future Project (1, 2, 3, 4, 5)
[Cross-hatched Box]	On-going Project (6, 7)
[Dotted Box]	Studied Project (8, 9, 10, 11)
[Dashed Line]	East Java Ground Water Project (7)

Note: 1) Pre-F/S : Pre-Feasibility Study
 F/S : Feasibility Study
 D/D : Detail Design
 Const. : Construction

2) The East Java Rehabilitation Project covers all irrigation areas except Lodaya, Varajayang, Tusi-Tunggarono and Brantas Delta

図 3.3.7 実施中および将来かんがいプロジェクト位置図



Note: Kedungwarak dam will serve the irrigation area of about 950 ha.
 Semantok dam will serve the irrigation area of about 1300 ha.

Scale
 0 1 2 3 4 Km

図 : 3-3-6 ワイダス拡張地区の一般計画図

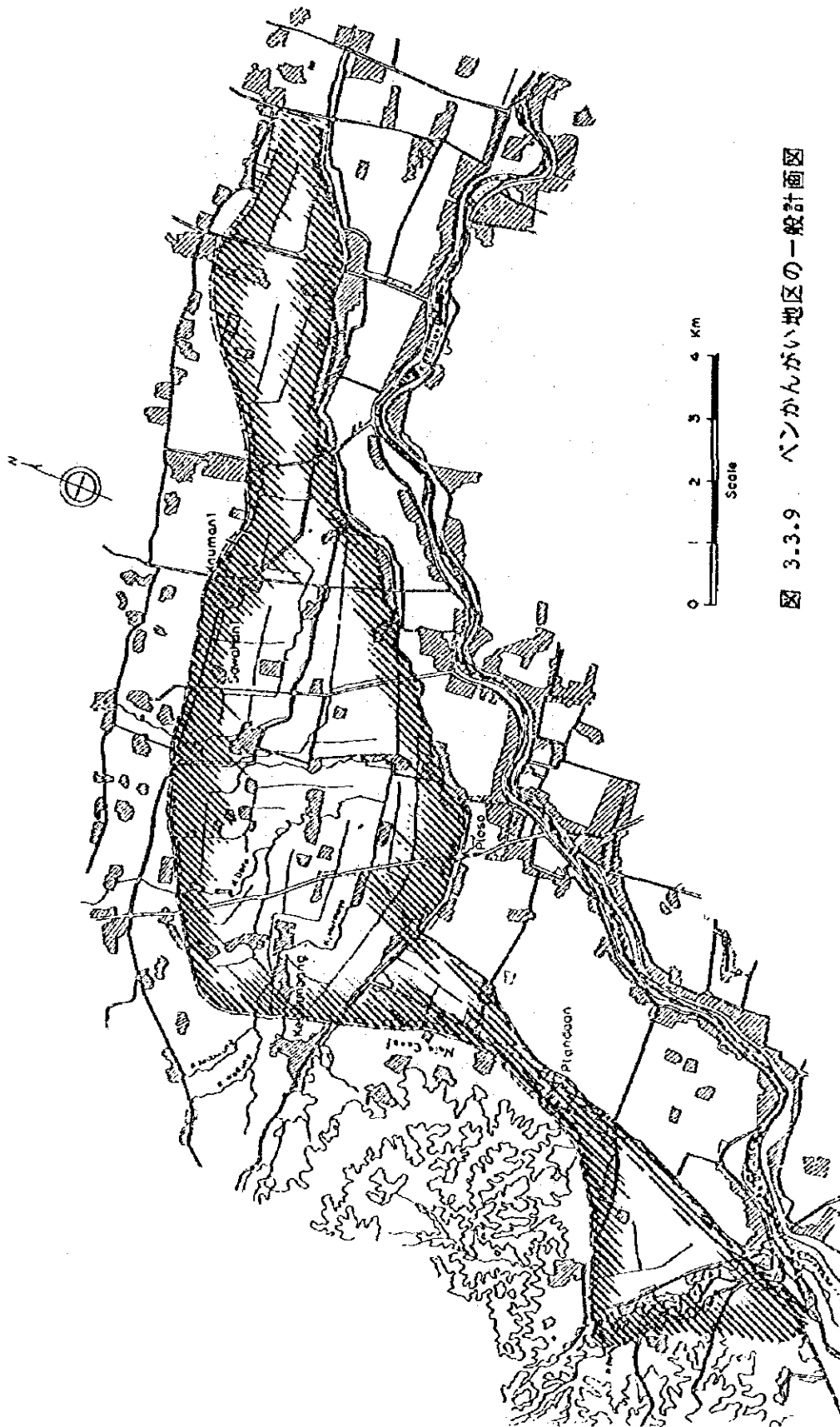


図 3.3.9 バンかんがい地区の一般計画図

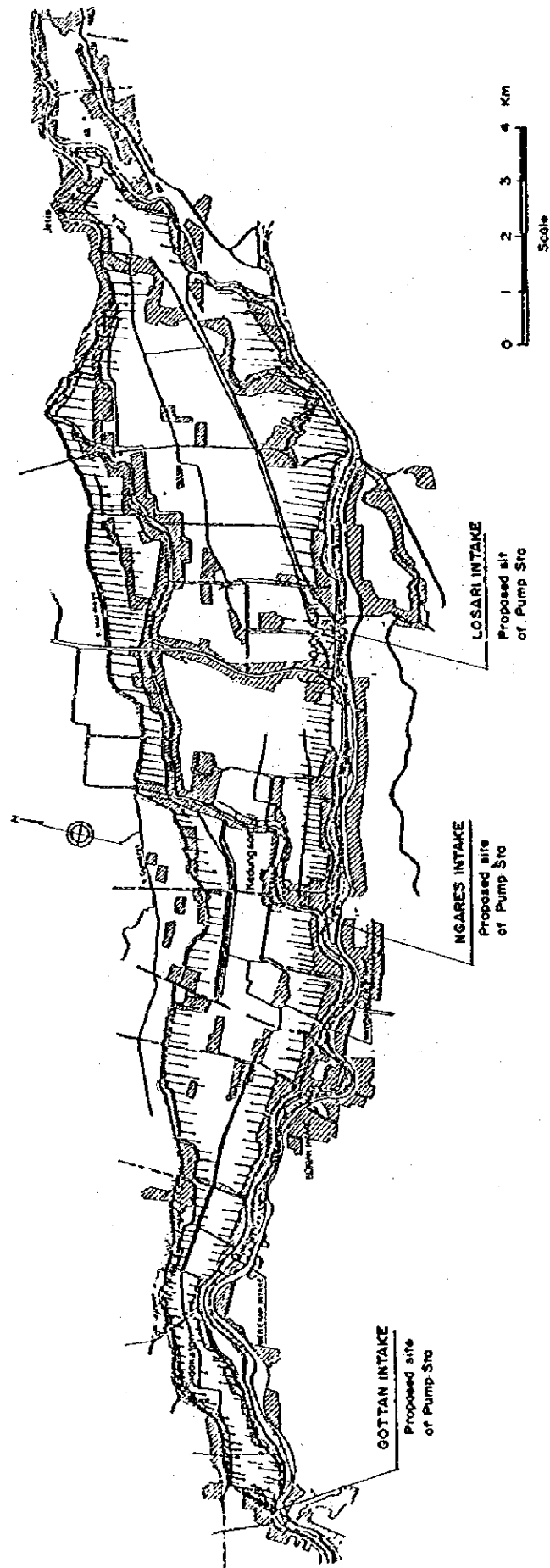


図 3.3.10 ゴタンーロザリかんがい地区の一般計画図

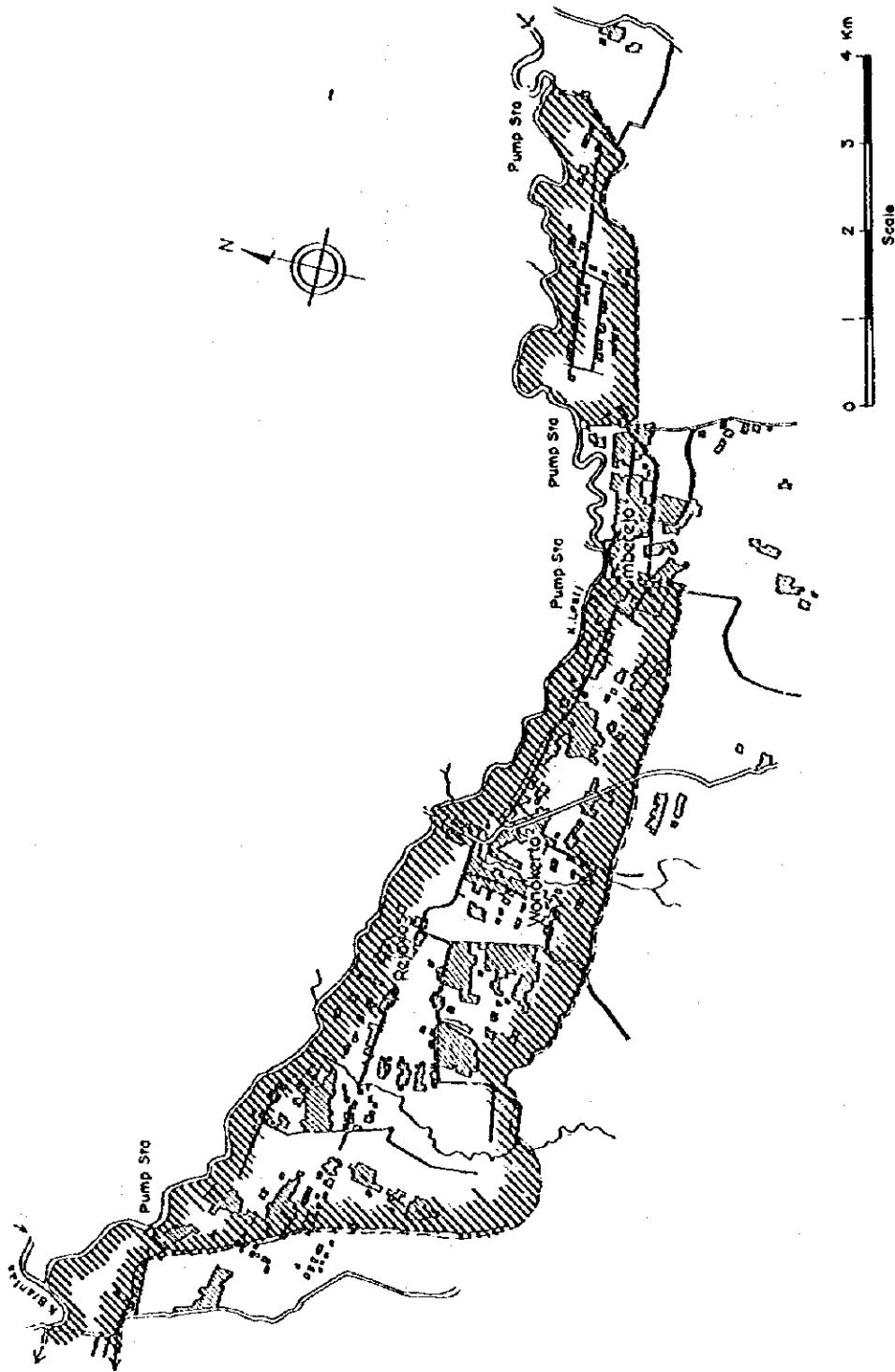


図 3.3.11(1) レステイ左岸かんがい地区の一般計画図
(Up-stream)

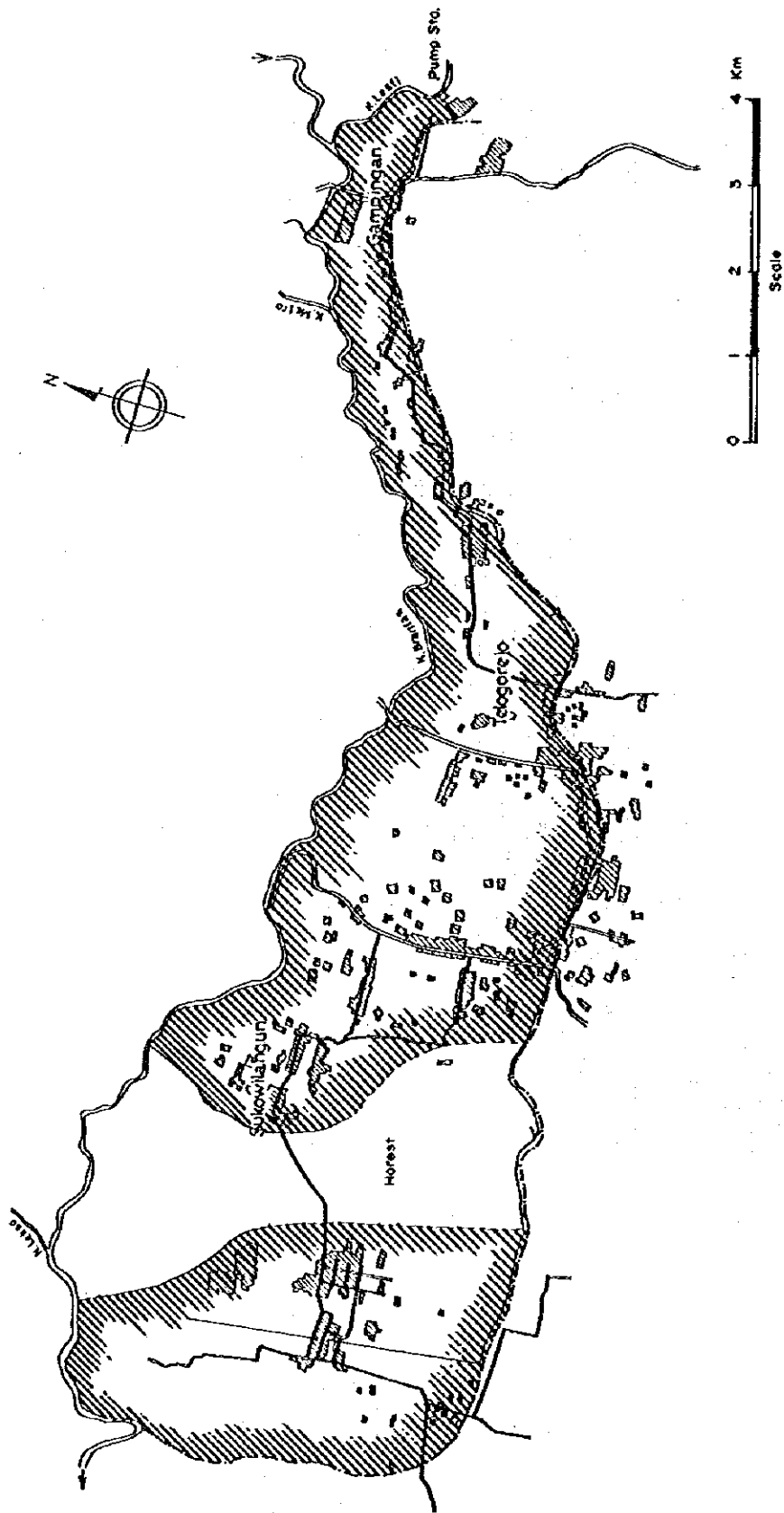


図 3.3.11(2) レステイ左岸かんがい地区の一般計画図
(Down-stream)

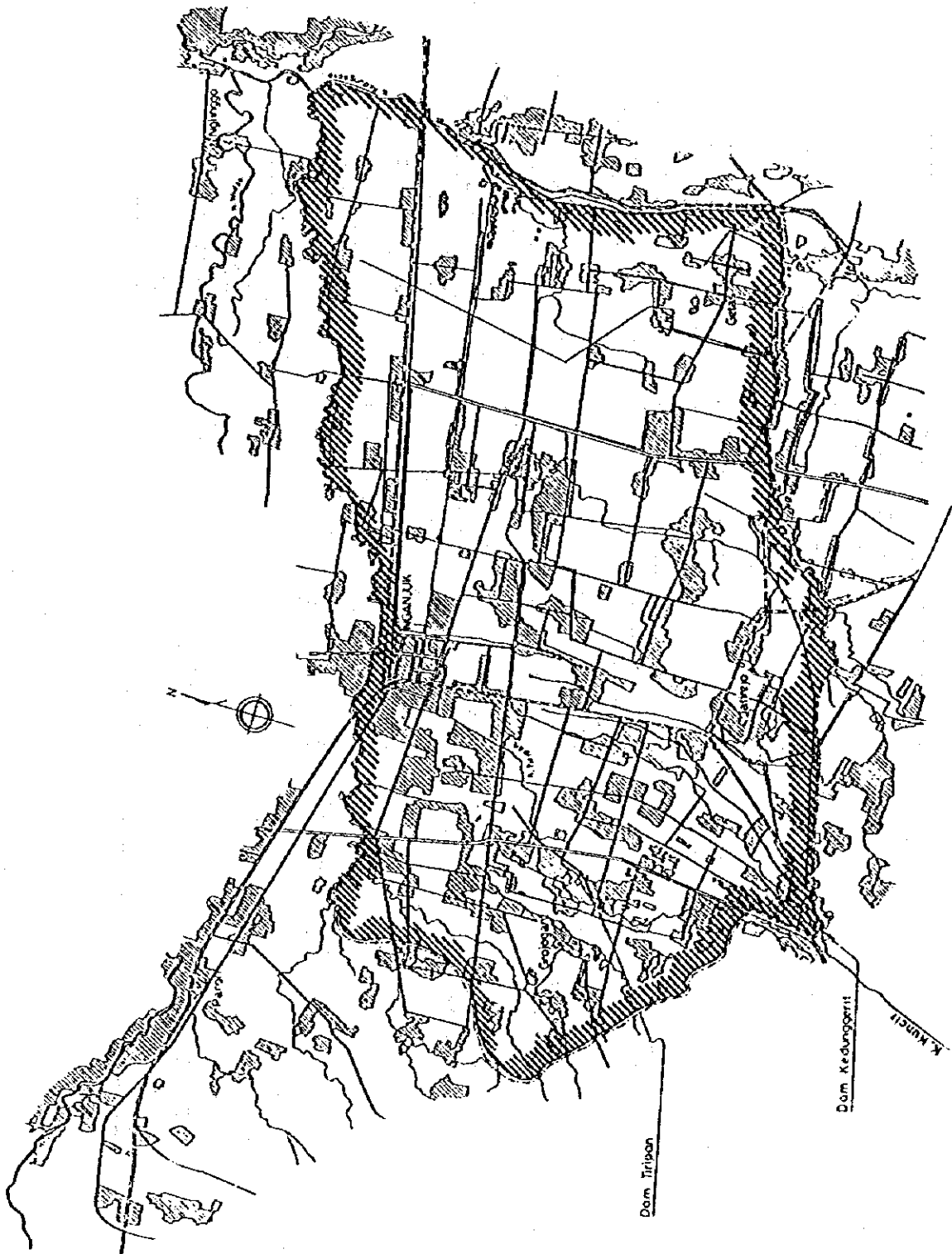
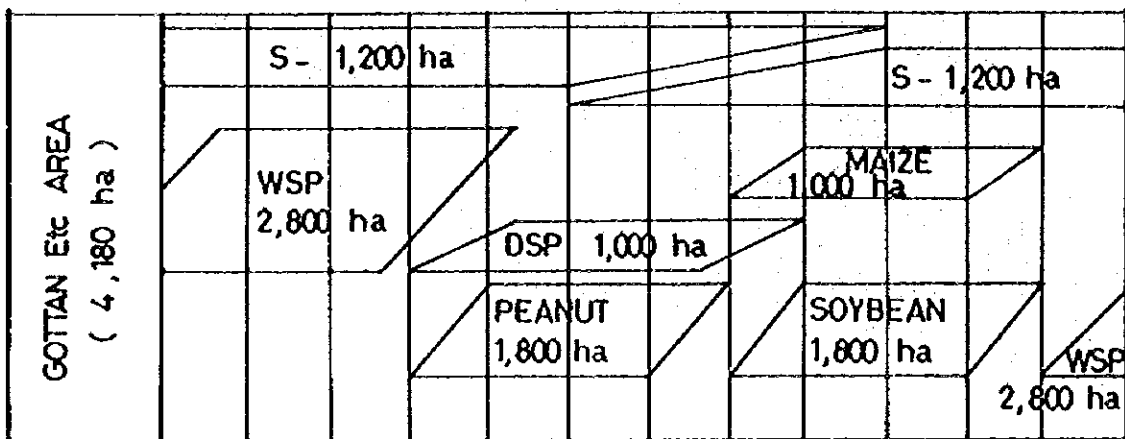
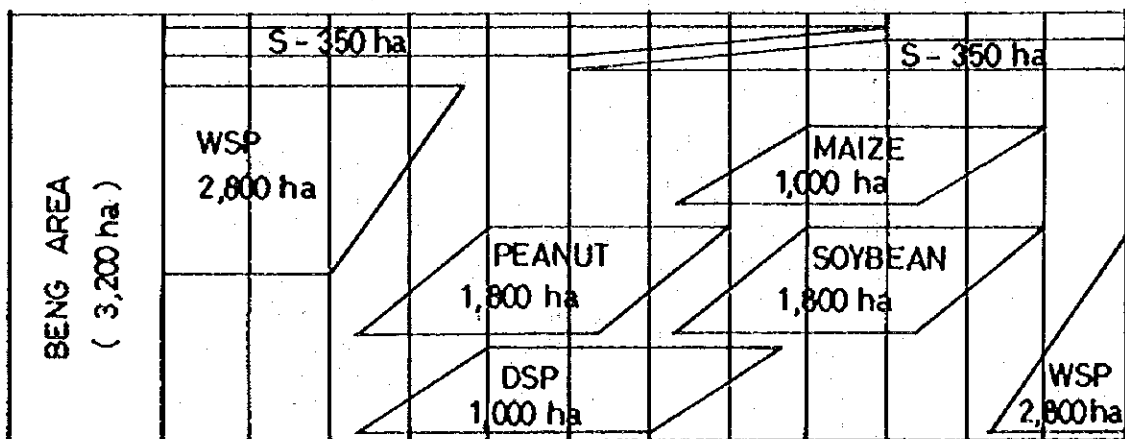
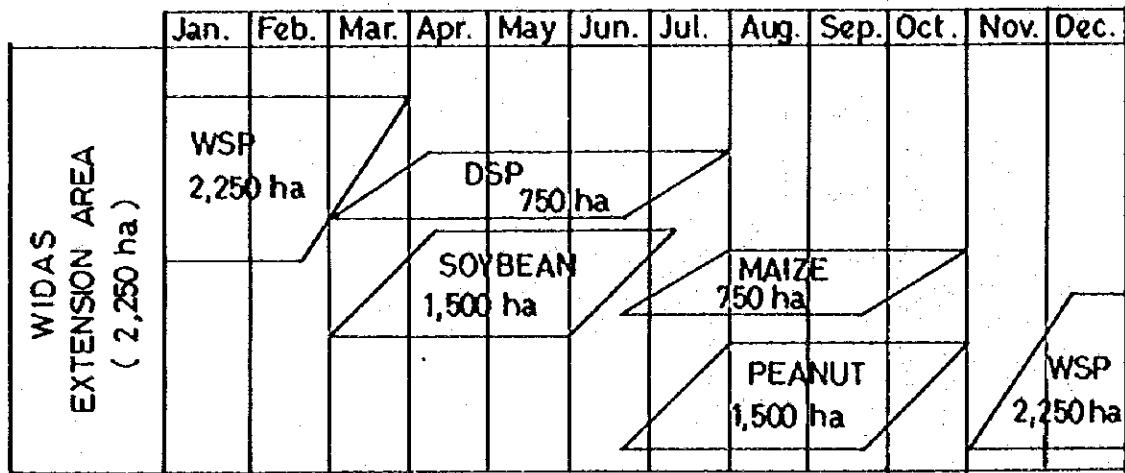
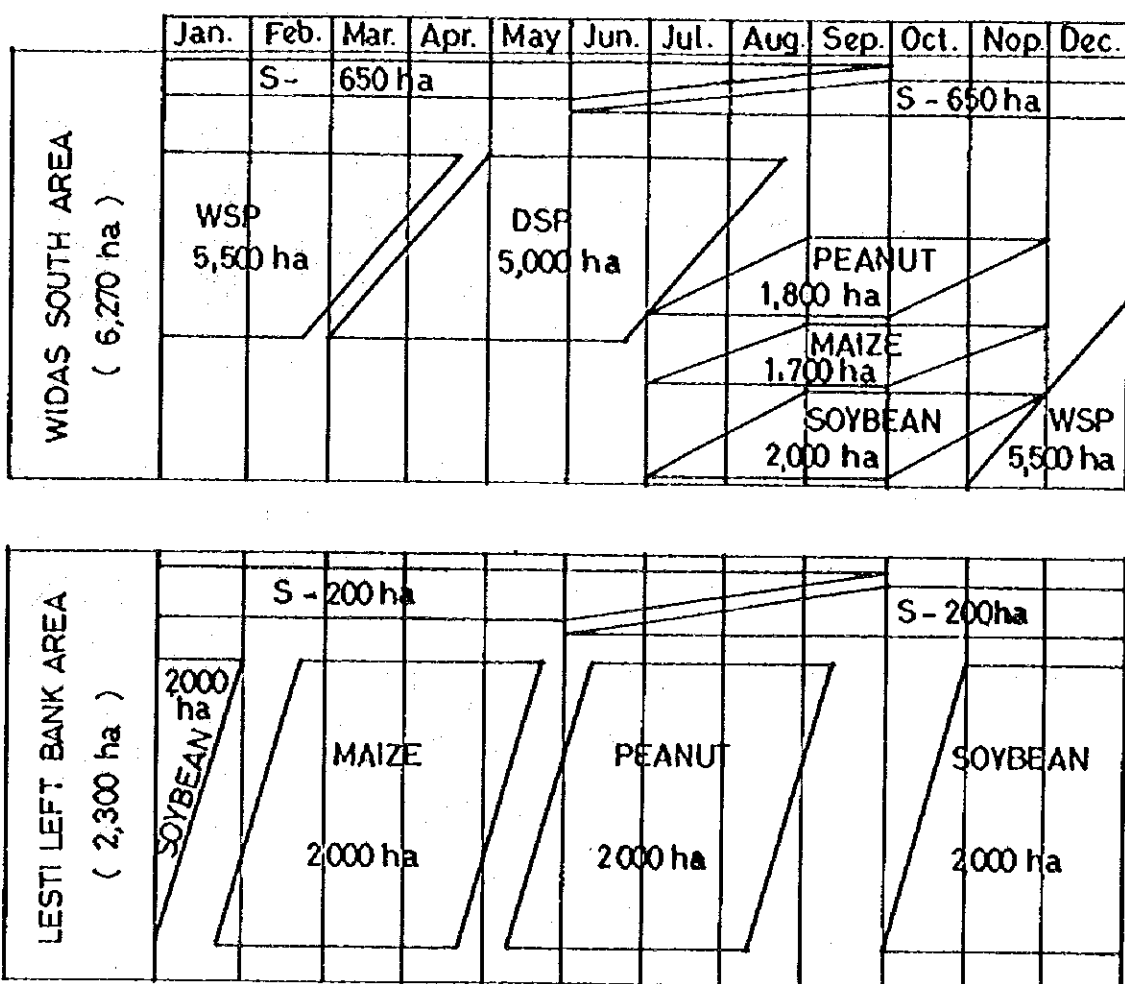


図 3.3.12 ウィダス南強震地区の一般計画図



LEGEND : WSP = Wet season paddy
 DSP = Authorized dry season paddy
 S = Sugarcane
 POL = Polowijo

图 3.3.13 (1) 計画作付体系



LEGEND: WSP = Wet season paddy
 DSP = Authorized dry season paddy
 S = Sugarcane
 POL = Polowijo

NOTE : Irrigation water is not to be supplied for polowijo crops in Widas south area due to shortage of storage capacity of the reservoir proposed in the K. Kuncir

図 3.3.13 (2) 計画作付体系

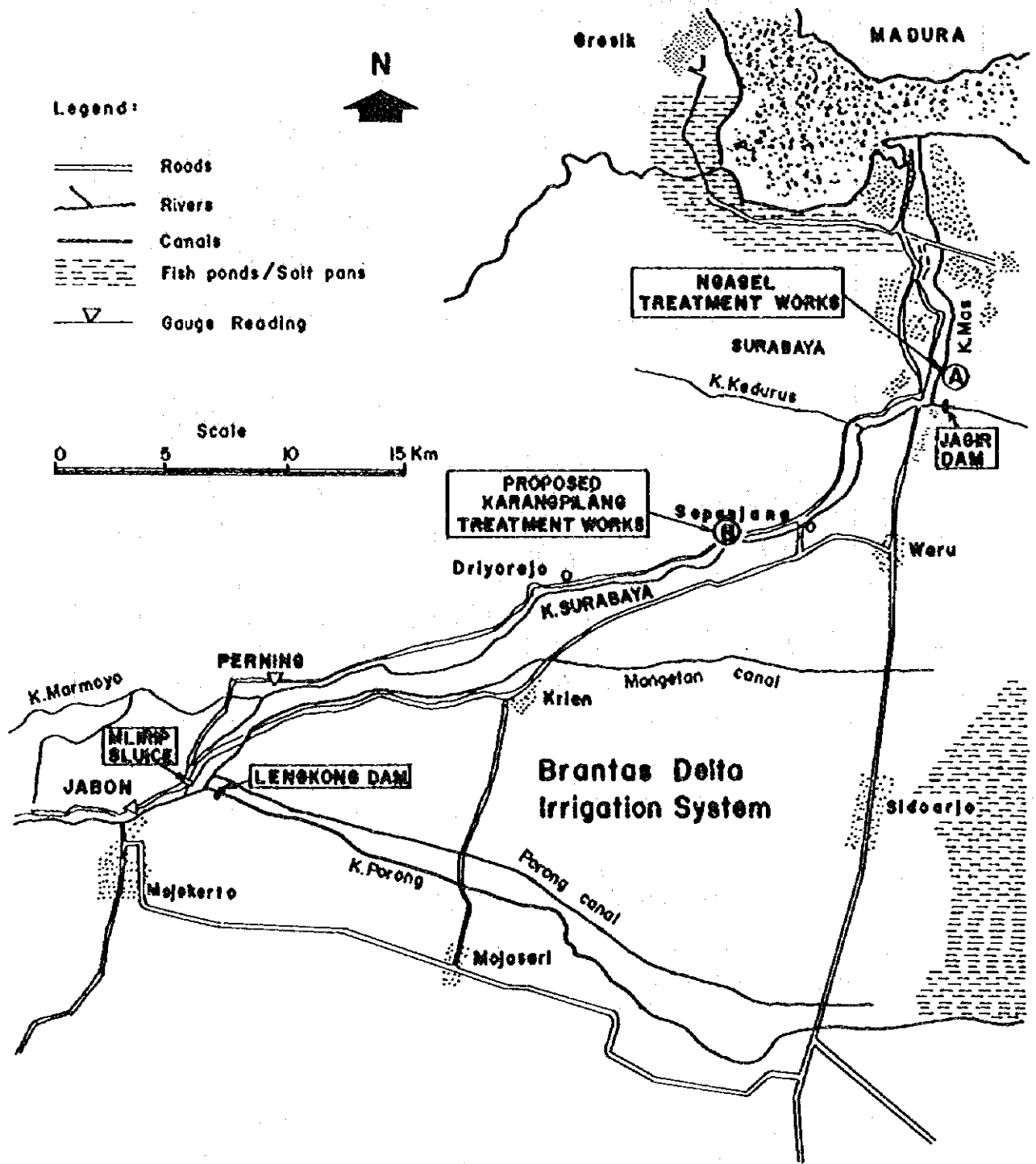
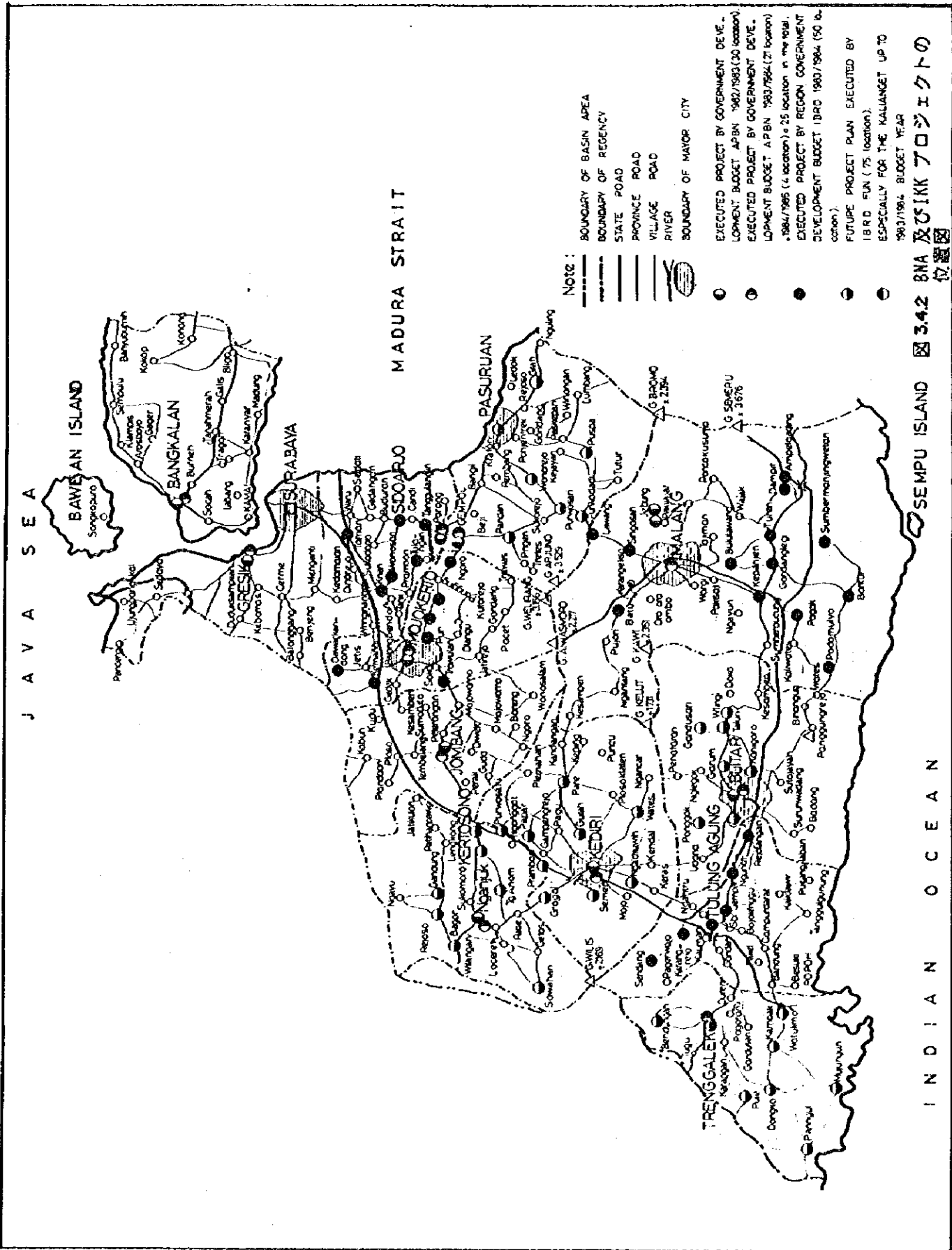


図 3.4.1 既設ガゼル浄水場および計画カランプラン浄水場位置図



INDIAN OCEAN 3.4.2 BNA 及び BIKK プロジェクトの位置図

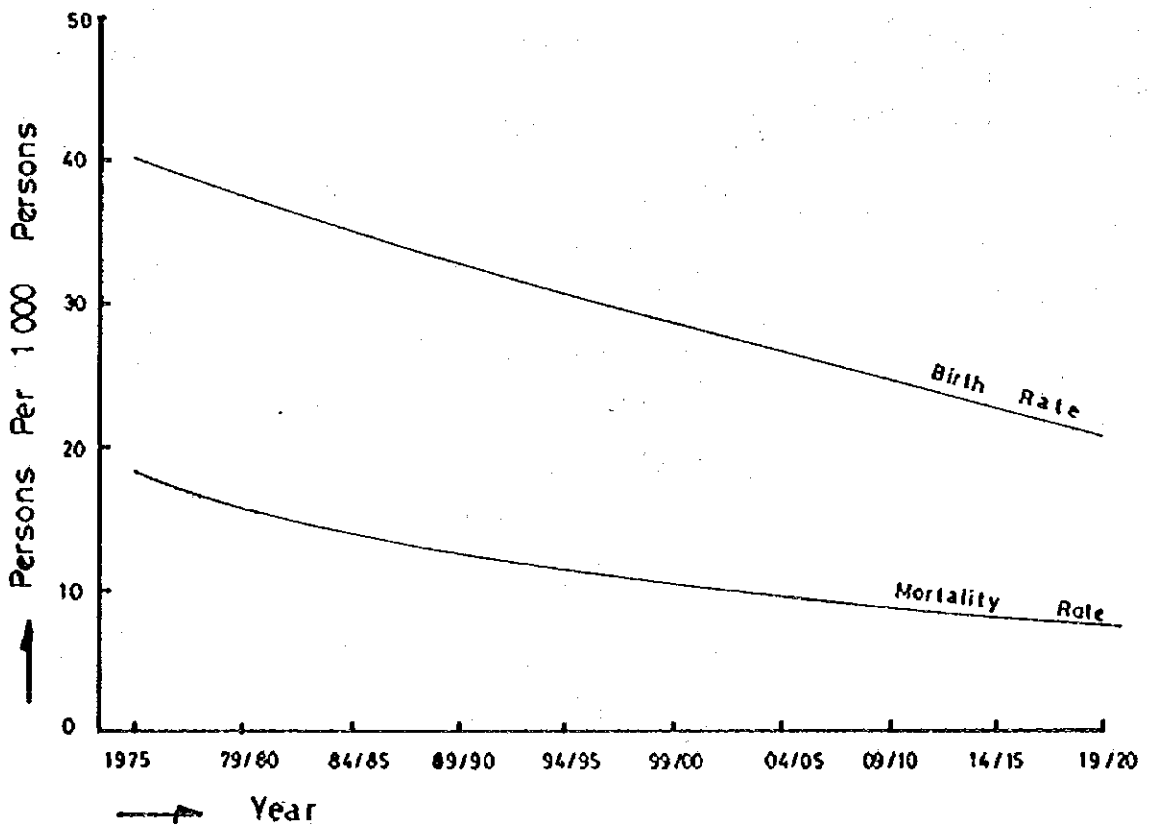
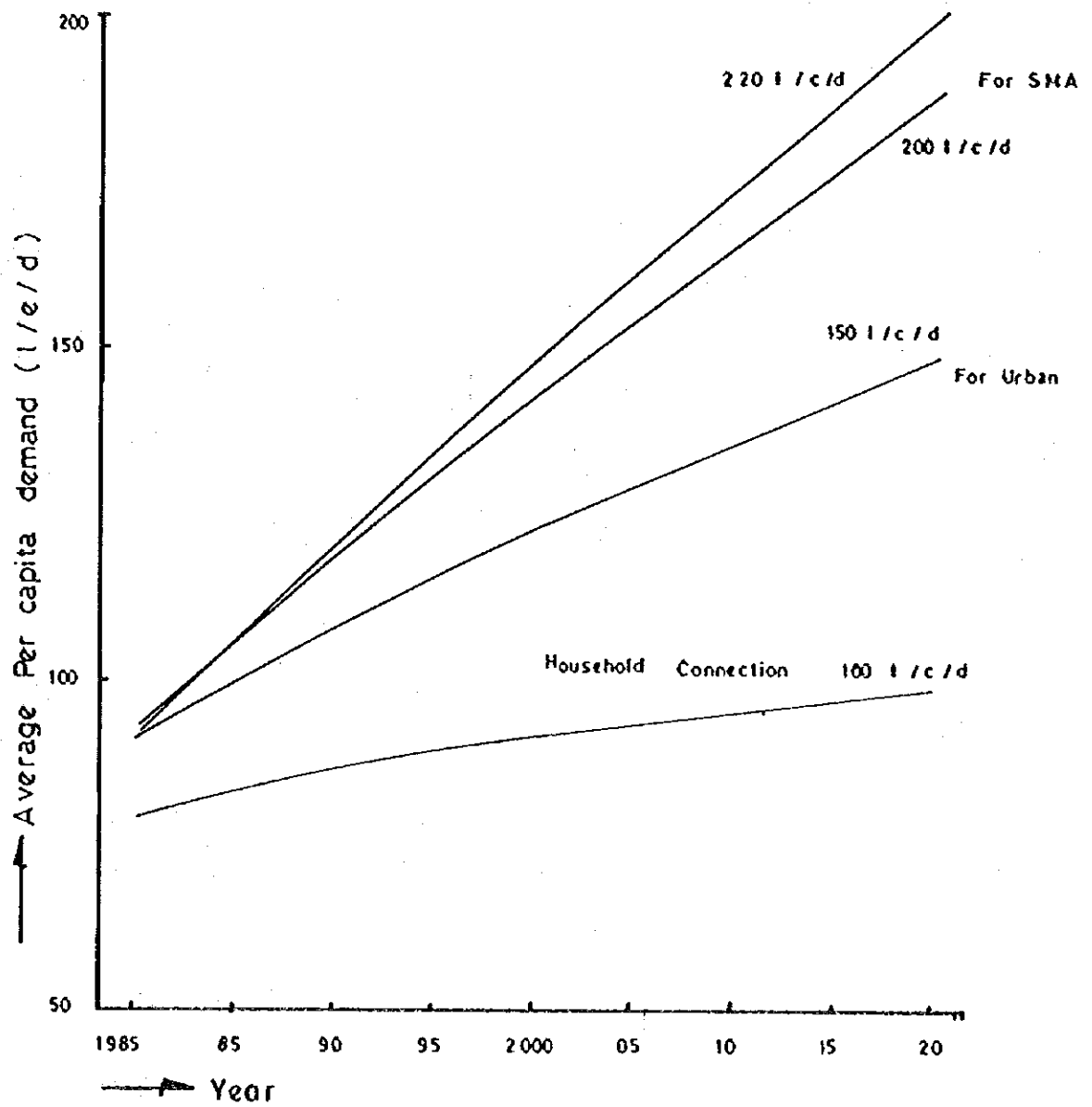
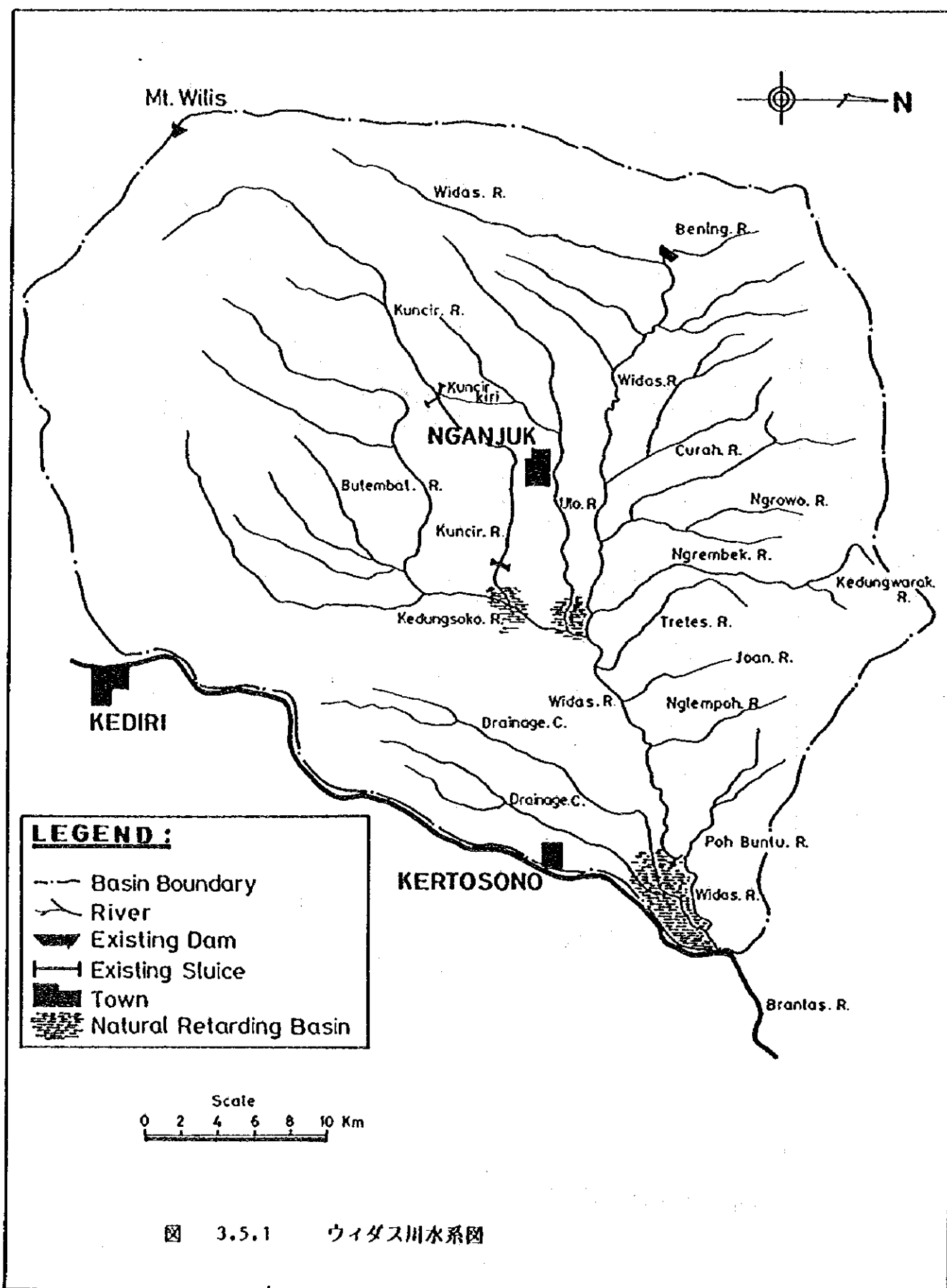
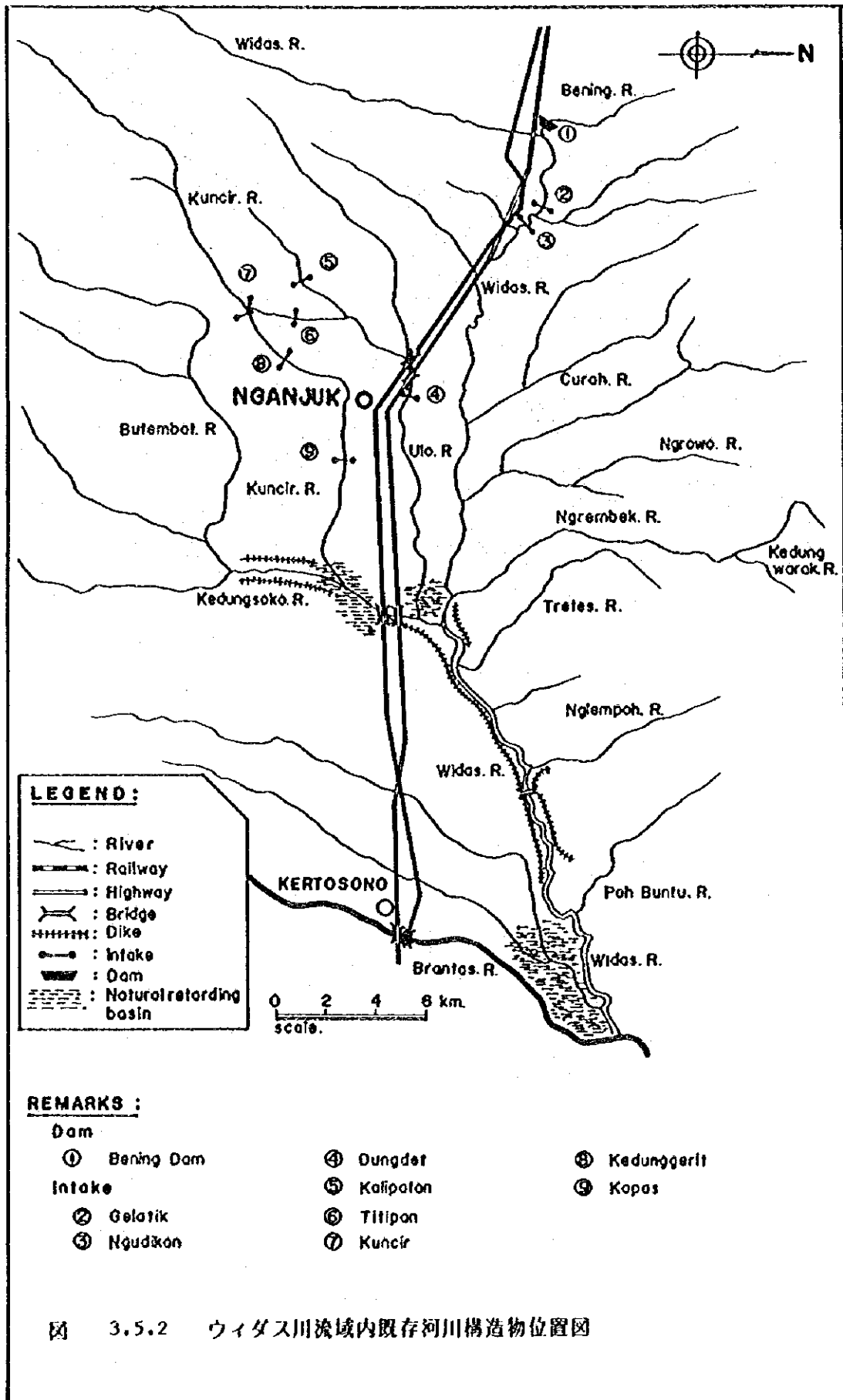


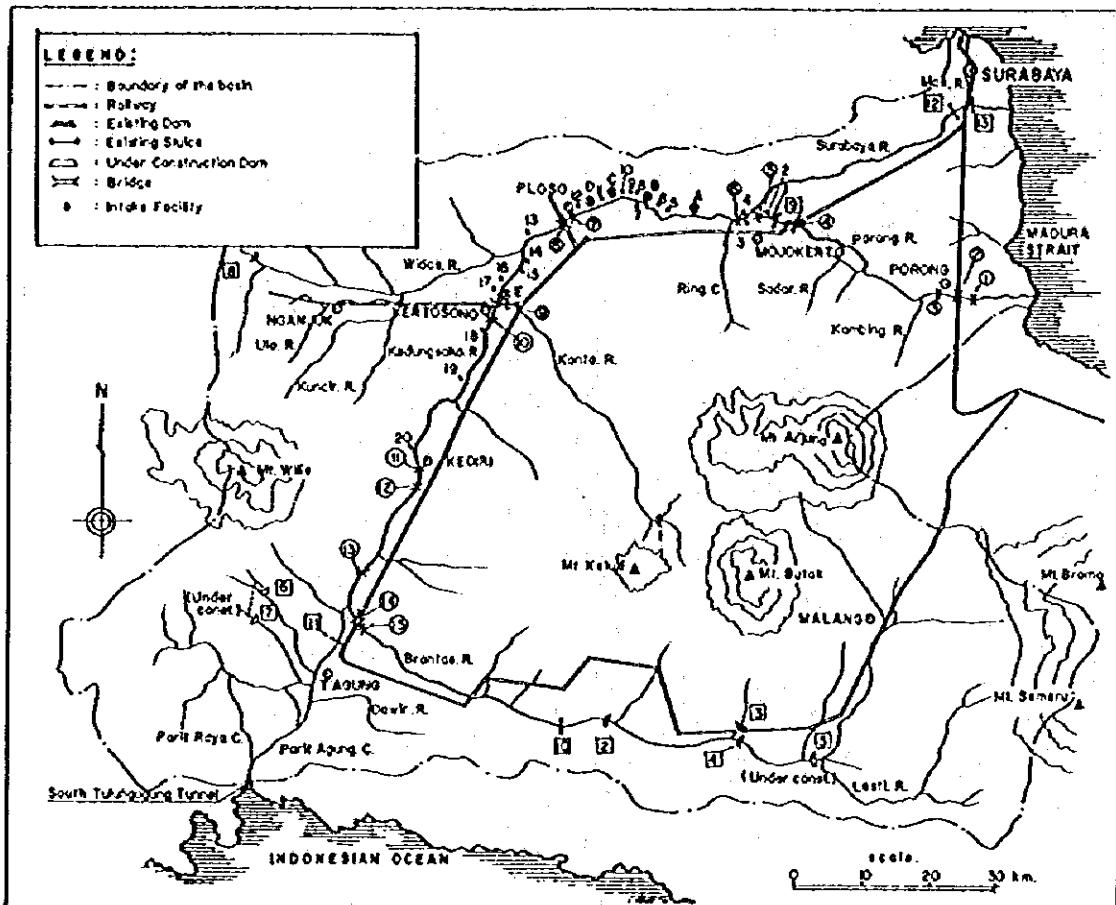
図 : 3.4.3 インドネシアの出生及び死亡率



図：3.4.4. 1人当り生活用水需要







REMARKS :

Dam

- ① Setorejo
- ② Wingo
- ③ Leher
- ④ Karangbata
- ⑤ Sanggaruh
- ⑥ Begawa
- ⑦ Wonorejo
- ⑧ Bening

Sulca:

- ⑨ New Langkong
- ⑩ Ledaya
- ⑪ Tubungpung

Bridge

- ⑫ - (H)
- ⑬ Parang (R)
- ⑭ Parang (H)
- ⑮ - (R)
- ⑯ New Mojokerto (H)
- ⑰ Mojokerto (H)
- ⑱ Piaso (H)
- ⑲ Piaso (R)
- ⑳ Kartosono (R)

Intake:

- 1 Voor II
- 2 Voor I
- 3 Jethulen

- ⑳ Kartosono (H)
- ㉑ Kediri (H)
- ㉒ New Kediri (H)
- ㉓ Jati (T)
- ㉔ - (R)
- ㉕ - (H)

Note:

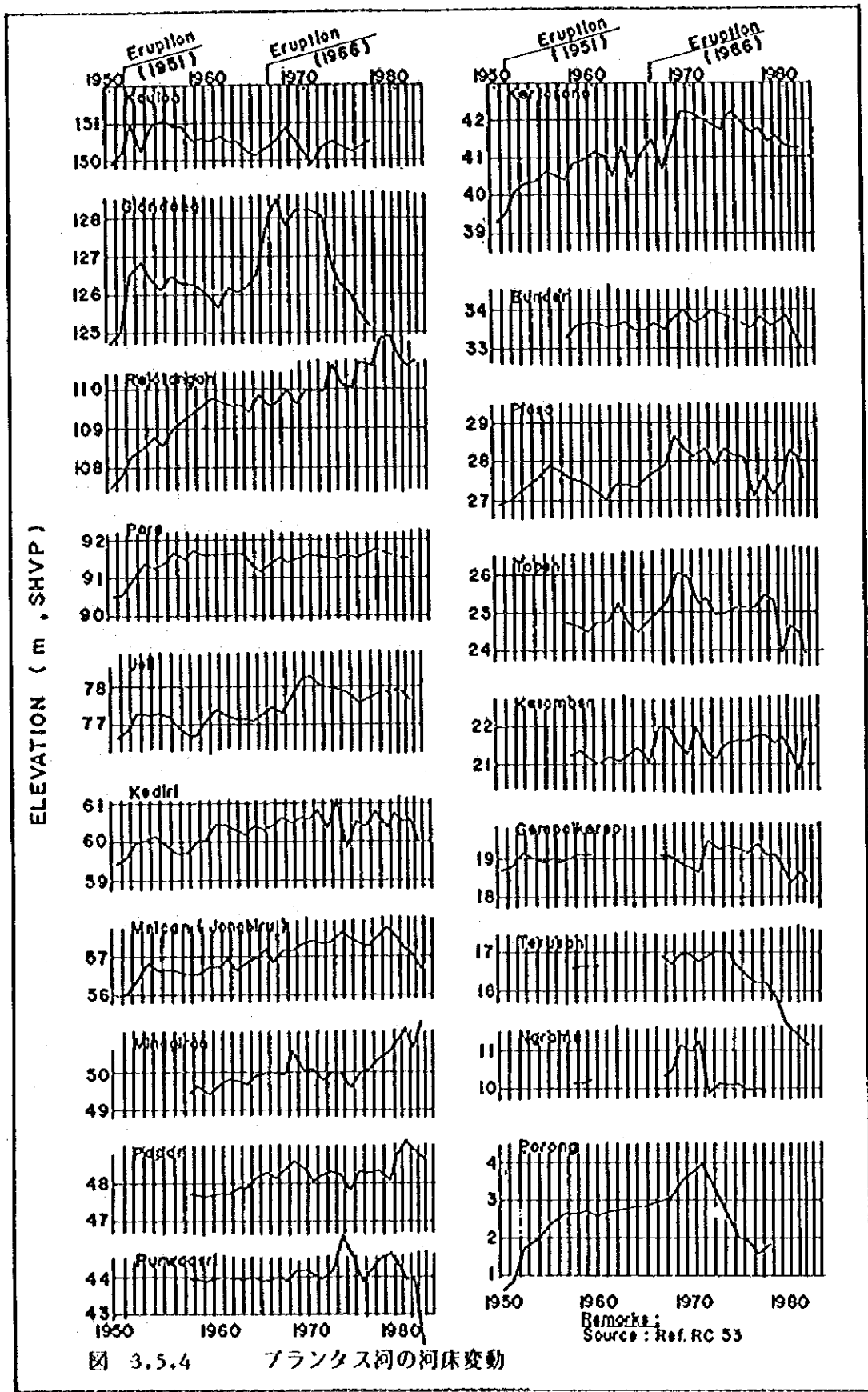
- R: Railway
- H: Highway
- T: Trolley

- 4 Mirip
- 5 Lessor
- 6 Gedak
- 7 Solawuh
- 8 Kedungari
- 9 Walempinggr
- 10 Kedon
- 11 Bekon
- 12 Gatan
- 13 Jattimarak
- 14 Tunggorono

Pumping station

- A. Ajinomoto
- B. Gempohstep
- C. Menturus
- D. Yapan
- E. Bunder

図 3.5.3 ポロン川及びプランタス河における既存河川構造物位置図



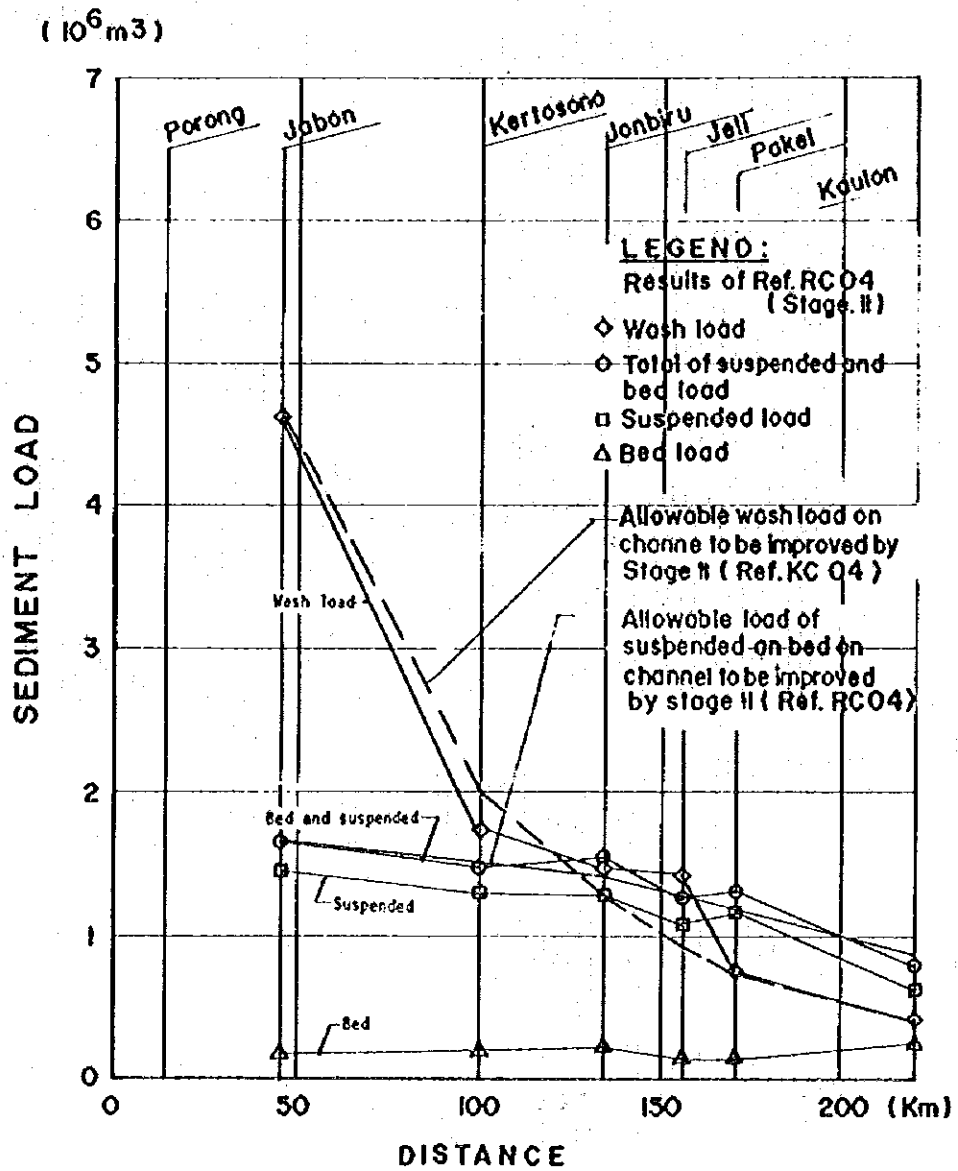


図 3.5.5 (1) ブランタス河流砂量
 (Design river channel section)

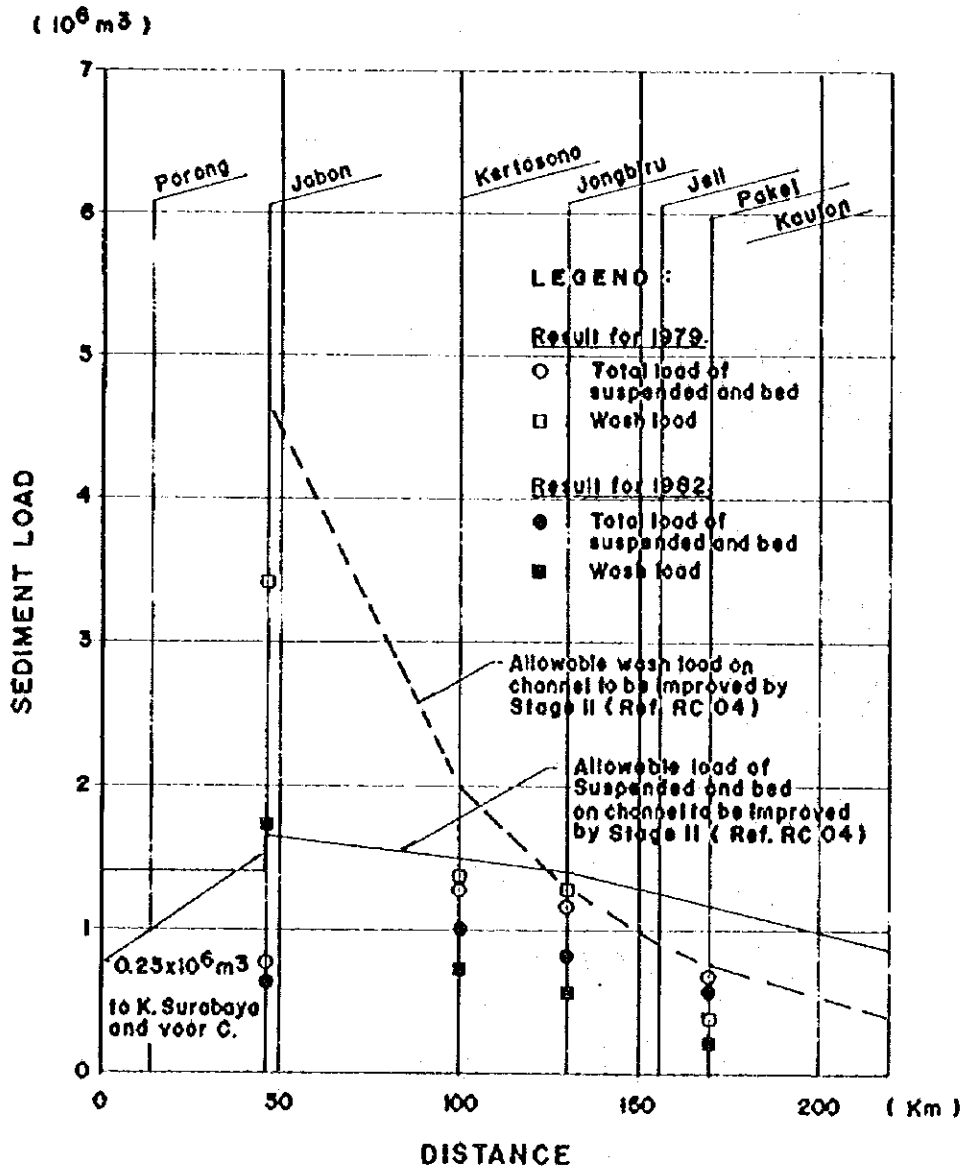


図 3.5.5 (2) ブランタス河床砂量 (Existing river channel)

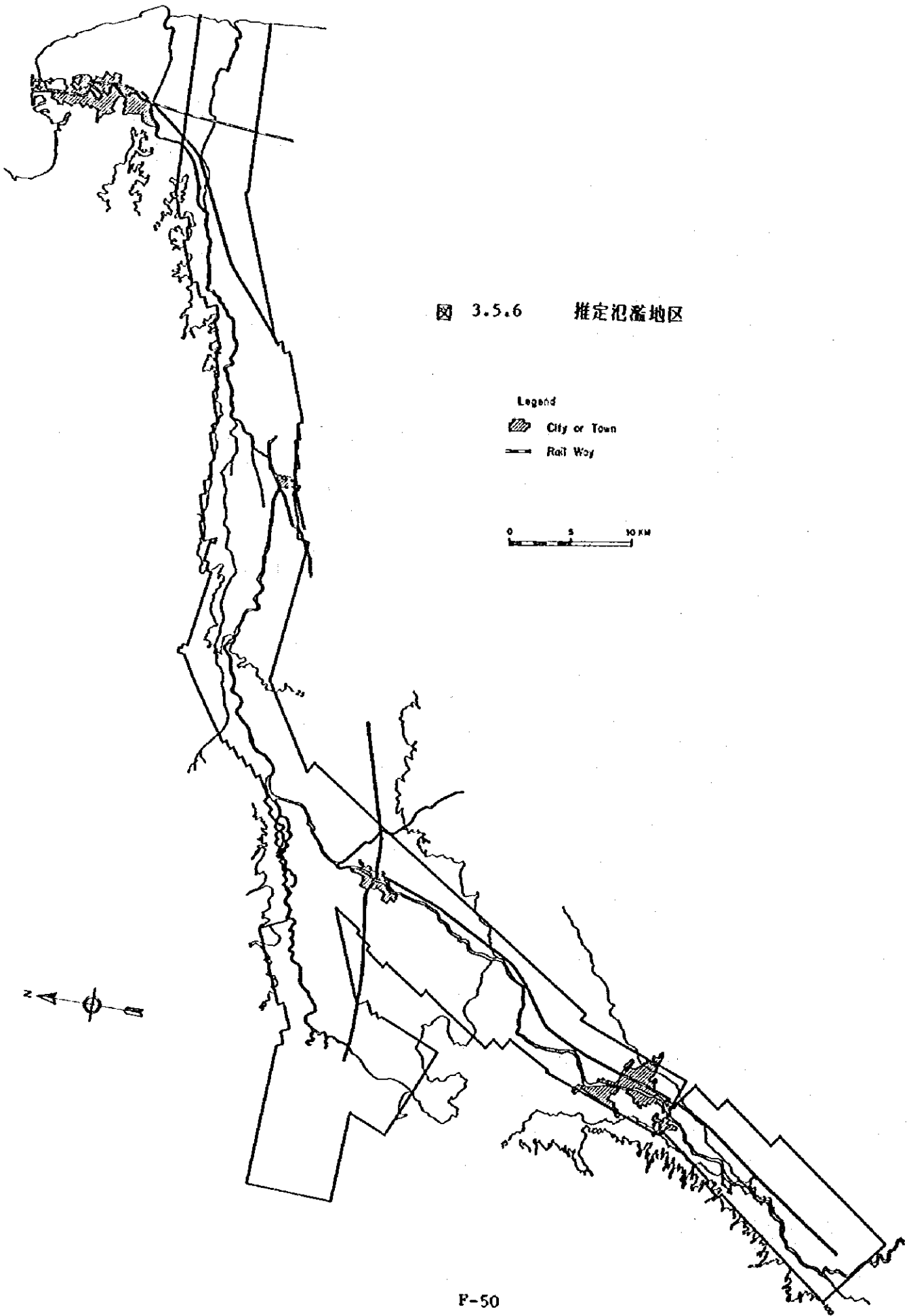


图 3.5.6 推定氾濫地区

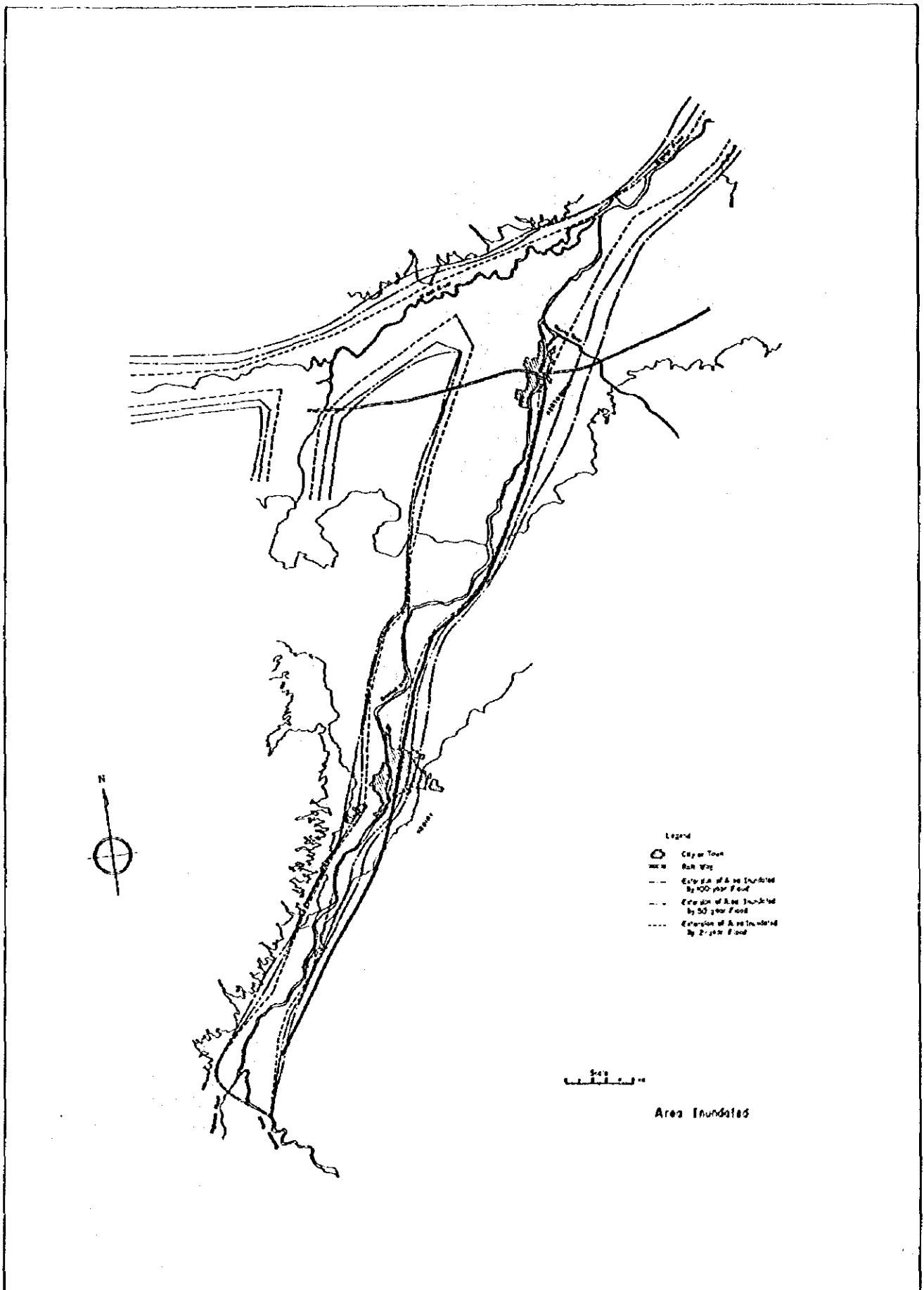


図 3.5.7 (1) 確率洪水による想定氾濫地区