地下水位，地質，透水係数等多くの要因に左右されるので，ボーリング試験を含めた広範囲な現場調査や井戸の水理試験，地下水の長期観測等の結果に待つ所が大きい。

塩水そ上防止対策の一つとしては，Pampanga 川，Labangan 放水路の下流地点に塩止め堰を建設することが考えられる。これにより上流への塩水そ上は完全に阻止できるが，多額の建設費を要する。そこで安価な手段として考えられるのが被害地を網羅する簡易水道施設の建設である。

一方将来は，Pampanga 川流域における開発計画や近接する Balog－Balog かんがい計画，UPRIIS 計画等による大量の還元水が Pampanga 川の流量を実質的に増加させるものと予想される。従って最終的には上記の手法による詳細な調査を実施し，現状を十分把握した上で将来計画も併せて，その対策を樹立することが実際的な解決方法であろうと思われる。

6.6 計画の評価

6.6.1 治水計画

治水計画の実施は，大巾に洪水被害を軽減し，計画対象地区住民の安定に寄与する。評価の結果は，表6.6.1に示す通りであるが，この表でもわかるように治水計画は技術的にも経済的にも実施可能であり，地域開発と公共の福祉のために，早期実施することが期待される。

6.6.2 かんがい計画

かんがい計画の実施は，計画対象地区内の住民に非常に大きな利益をもたらす。評価の結果は，表6.6.2に示す通りである。この表からも明らかなように，かんがい計画は技術的および経済的に実施可能であり，又，農家経済の点から見ても十分に有利であるので早期の実施が望まれる

表 1.4.1 (1) 作業監理委員，専門家およびカウンターパート

Advisory Committee

1.	Mr. Toshihiko Iwamoto	- Chairman of the Committee
2.	Mr. Ken-ichi Sasaki	- Chairman of the Committee
3.	Mr. Hideomi Ohi	- Advisor for River Engineering
4.	Mr. Hideo Tokuhiro	- Advisor for River Engineering
5.	Mr. Masakuni Kawamata	- Advisor for Irrigation
6.	Mr. Shigekazu Yoshida	- Advisor for Irrigation
7.	Mr. Hideki Abe	- Coordinator
8.	Mr. Hitonori Ono	- Coordinator
9.	Mr. Yukihisa Sakurada	- Coordinator

JICA Survey Team

1.	Mr. Tadashi Sakamoto	- Team Leader
2.	Dr. Akihiko Tsuchiya	- Senior River Engineer
3.	Mr. Tadaharu Murono	- Agro-Economist
4.	Mr. Kenjiro Onaka	- Agricultural Expert
5.	Mr. Yukinori Sano	- Irrigation Engineer
6.	Mr. Tadashi Ohori	- Irrigation Engineer
7.	Mr. Yukihiro Kawahara	- Irrigation Engineer
8.	Mr. Hiroshi Ono	- River Engineer
9.	Mr. Toshio Terashima	- River Engineer
10.	Mr. Yoshitada Ogawa	- River Engineer
11.	Mr. Kazuhiko Takebayashi	- Hydrologist
12.	Mr. Toshikatsu Imai	- Hydrologist
13.	Mr. Toshikazu Tay	- Project Economist
14.	Mr. Fumihiko Furuichi	- Project Economist
15.	Mr. Hideaki Mitsui	- Soil Mechanical Engineer
16.	Mr. Keisuke Sumikawa	- Soil Mechanical Engineer
17.	Dr. Torahiko Moritani	- Geologist
18.	Dr. Tamotsu Tomiyama	- Inland Fisheries Expert
19.	Mr. Masaru Yonai	- Survey Engineer
20.	Mr. Ryosaku Nagata	- Structual Engineer

- to be continued

表1.4.1(2) 作業監理委員，専門家およびカウンターパート

Counterpart Personnel Group

1.	Mr. Rogelio A. Flores	- Chief Counterpart, MPWH
2.	Mr. Jose C. Guanzon	- Chief Counterpart, MPWH
3.	Mr. Avelino Rivera	- Chief Counterpart, NIA
4.	Mr. Dioles Suelen	- Agro-Economist, NIA
5.	Mrs. Celester Escallera	- Economist, MPWH
6.	Mr. Leonardo T. Costa	- Agronomist, NIA
7.	Mr. William Reodica	- Irrigation Engineer, NIA
8.	Mr. Robert L. Jamilla	- River Engineer, MPWH
9.	Mrs. Sofia Santiago	- River Structural Engineer, MPWH
10.	Mr. Juanito P. Pacleb	- Senior Soil Technologist, NIA
11.	Mr. Miguel Lugue	- River Engineer, MPWH
12.	Mr. Armando Maulawin	- Irrigation Engineer, NIA
13.	Mrs. Trinidad R. Cutaran	- Sr. Hydrologist, NIA
14.	Mr. Milo Landicho	- Hydrologist, NIA
15.	Mr. Reynaldo L. Llamoso	- Hydrologist, NIA
16.	Mr. Restio V. David	- Hydraulic Engineer, MPWH
17.	Mr. Epifanio C. Gacusan	- Project Economist, NIA
18.	Mr. Rodolfs Galapan	- Soil Technologist, NIA
19.	Mr. Manuel Guiad	- Soil Technologist, NIA
20.	Mr. Danilo Fajardo	- Geologist, NIA
21.	Miss Sally Janga	- Fishery Biologist

表3.2.1 気　　象

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	ANNUAL
Mean Temperature (°C)													
San Miguel (1968 - 1979)	25.1	25.0	27.0	28.6	28.8	28.1	27.4	26.8	27.3	26.8	26.3	25.4	26.9
Baliwag (1970 - 1979)	24.1	25.1	26.2	27.4	27.4	27.7	27.2	26.9	27.0	26.7	26.4	25.5	26.5
Cabanatuan (1976 - 1979)/1	25.9	23.5	27.4	29.3	28.6	28.3	28.2	27.1	27.6	27.7	27.0	26.5	27.3
Mean Maximum Temperature (°C)													
San Miguel (1968 - 1979)	31.0	31.7	33.9	35.3	34.7	33.3	32.1	30.9	31.6	31.7	30.2	30.7	33.3
Baliwag (1970 - 1979)	29.6	29.5	31.9	33.0	32.6	32.1	31.1	29.4	31.2	30.7	30.7	29.7	31.0
Mean Minimum Temperature (°C)													
San Miguel (1968 - 1979)	18.8	19.0	20.3	21.9	23.1	23.2	22.8	23.2	22.6	22.3	21.6	20.2	21.6
Baliwag (1970 - 1979)	19.9	19.7	20.2	21.7	22.8	23.7	23.6	23.2	23.3	22.6	22.2	21.3	22.0
Mean Relative Humidity (%)													
San Miguel (1968 - 1979)/2	83.1	75.4	77.6	71.9	79.2	86.0	87.9	90.7	88.8	86.5	82.5	82.3	82.7
Cabanatuan (1976 - 1979)/1	73.1	67.8	66.1	63.1	76.8	80.4	83.8	88.0	85.6	81.9	77.9	75.6	76.7
Sunshine Hour (hr/day)													
San Miguel (1968 - 1979)	6.2	7.3	7.1	8.3	7.5	5.2	5.1	3.9	4.1	5.6	6.3	6.5	6.1
Mean Wind Speed (km/hr.)													
San Miguel (1968 - 1979)	2.7	3.1	3.2	3.1	2.2	2.0	1.7	1.6	1.4	1.7	2.6	3.4	2.4
Cabanatuan (1976 - 1979)/1	4.2	4.8	3.6	3.6	3.9	2.5	2.9	3.3	4.6	3.2	4.6	4.9	3.8
Evaporation (mm/month)													
San Miguel (1968 - 1979)	145.8	152.3	194.1	204.2	170.2	138.2	127.5	112.5	126.9	130.5	131.4	134.5	1,768.1
Baliwag (1970 - 1979)	143.5	141.1	177.6	191.1	171.4	152.2	141.3	133.0	152.4	143.3	133.7	134.3	1,815.0

/1: Data since 1949 are collected, analysis has not been completed so far

/2: Relative Humidity measured at 8:00 A.M.

表3.3.1　Cabanatuan市における降雨量（１９５１－１９７９）

(Unit: mm)

Month	Monthly Rainfall		
	Average	Maximum	Minimum
Jan.	7.4	67.3	0
Feb.	5.3	49.5	0
Mar.	10.9	69.8	0
Apr.	31.2	261.4	0
May	172.3	931.1	7.7
Jun.	262.8	590.8	64.2
Jul.	302.2	1,064.7	141.9
Aug.	406.6	622.7	213.0
Sept.	309.7	628.7	144.6
Oct.	173.4	514.1	12.2
Nov.	125.7	344.4	14.0
Dec.	52.0	197.0	0
Annual	1,868.6	2,369.5	1,338.9
Wet Season			
(May - Oct.)	1,627.0	-	-
Percent (%)	87.1	-	-

Source: PAGASA

表 3.3.2(1) 月平均河川流量

(Unit: m^3/s)

No.	Station Name	River & Catchment Area (km^2)		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual	Obser. Period (yr.)
1.	Pantabangan N.E.	Pampanga R. 890	Ave.	15.0	7.3	5.7	4.8	10.6	34.3	79.8	95.7	138.0	761.	62.9	24.2	46.2	
			Max.	31.7	16.9	12.1	10.0	20.2	63.0	177.4	120.4	281.5	135.7	260.4	45.5	281.5	10
			Min.	5.9	0	1.5	1.0	3.9	10.4	13.4	66.8	13.4	0	6.6	0	0	
2.	Bongabon N.E.	Coronel R. 718	Ave.	31.1	18.7	12.4	8.6	23.7	31.3	53.5	73.5	68.1	82.0	71.0	59.8	44.5	
			Max.	73.3	55.1	42.9	28.9	168.7	85.0	175.0	163.5	137.5	119.0	152.1	93.5	175.0	11
			Min.	3.2	0.2	0	0	0	2.1	7.1	19.1	27.3	30.9	26.6	29.4	0	
3.	Cabanatuan City N.E.	Pampanga R. 2,482	Ave.	40.7	26.6	22.4	20.9	61.5	66.3	99.2	246.6	328.2	174.0	247.7	238.1	131.0	
			Max.	73.6	33.7	42.8	41.4	189.6	97.6	131.7	435.7	382.6	299.9	615.5	866.5	866.5	8
			Min.	23.9	16.4	12.2	8.5	14.6	28.4	52.6	74.6	288.3	75.2	36.9	37.4	8.5	
4.	Gen Tinio N.E.	Chico R. 152	Ave.	2.5	1.9	1.2	1.3	5.6	8.6	20.7	25.8	21.3	16.8	14.8	5.8	10.5	
			Max.	9.7	6.3	5.5	5.7	42.8	33.7	118.5	66.8	39.9	52.0	40.7	23.4	118.5	13
			Min.	0.8	0.6	0.1	0.1	0.3	3.0	2.7	6.3	0.9	0.7	4.2	0.4	0.1	
5.	Gen Tinio N.E.	Sumacban R. 299	Ave.	18.2	14.1	15.8	10.7	13.6	17.0	31.8	29.4	31.7	784.9	47.1	34.5	87.4	
			Max.	38.9	24.7	37.3	16.3	42.5	26.9	79.0	69.9	49.3	7,559.5	85.8	72.8	7,559.5	12
			Min.	7.4	7.3	8.3	6.6	3.5	9.0	14.5	11.8	9.9	16.3	15.9	11.7	3.5	
6.	San Jose N.E.	Penaranda R. 513	Ave.	13.7	4.1	3.7	2.6	20.9	22.3	50.2	38.4	22.2	50.2	67.8	54.9	29.3	
			Max.	62.2	18.7	12.6	7.6	96.0	130.6	191.9	54.0	40.8	260.7	226.3	240.2	260.7	9
			Min.	0.7	0.2	0.2	0.2	0.2	0.5	2.8	18.7	6.0	1.1	3.1	0.6	0.2	
7.	Gaban N.E.	Penaranda R. 568	Ave.	166.8	0.8	0.4	1.4	9.0	8.2	67.7	111.9	147.7	258.9	289.0	209.8	106.0	
			Max.	1,457.2	6.1	2.7	10.1	149.1	29.5	468.8	756.8	1,015.2	1,426.0	2,105.6	1,537.3	2,105.6	10
			Min.	0	0	0	0	0	0	1.2	0.3	0.4	0	1.3	0	0	
8.	Cabiao N.E.	Pampanga R. 3,512	Ave.	127.4	52.3	42.5	30.8	89.0	145.3	230.1	387.8	452.0	250.6	253.2	146.9	184.8	
			Max.	211.3	110.9	105.9	87.3	249.2	274.2	359.9	657.5	605.2	458.5	483.0	312.1	657.5	4
			Min.	32.4	20.8	12.9	6.1	7.7	19.6	84.3	191.1	332.8	112.0	75.6	44.0	6.1	
9.	Talavera N.E.	Talavera R. 401	Ave.	12.2	10.2	11.8	12.9	13.6	18.5	19.5	25.0	23.6	21.6	16.9	14.3	16.7	
			Max.	24.6	22.8	35.9	37.7	31.4	36.8	39.0	50.0	47.5	42.5	42.0	28.5	50.0	14
			Min.	0.7	0.7	0.8	1.9	1.8	5.1	5.6	4.9	6.9	3.4	5.6	2.4	0.7	
10.	Zaragoza N.E.	Rio Chico R. 1,675	Ave.	6.7	5.6	2.2	1.3	11.7	23.2	93.9	144.3	138.5	87.7	47.2	21.4	48.6	
			Max.	41.8	30.0	11.7	10.2	125.4	79.5	233.8	314.1	243.0	256.2	406.6	133.6	406.6	18
			Min.	0.1	0	0	0	0	0	0.8	60.5	49.3	11.4	0.6	0	0	
11.	Arayat	Pampanga R. 6,532	Ave.	79.2	36.1	24.6	22.5	78.3	165.1	417.1	606.6	606.1	504.6	302.8	158.4	250.1	
			Max.	299.7	73.4	43.9	51.7	634.8	434.2	1,612.8	1,548.0	1,538.0	1,042.7	906.1	358.3	1,612.8	14
			Min.	19.6	11.3	4.8	2.8	3.2	17.2	52.6	173.0	231.9	94.7	49.2	55.4	2.8	
12.	San Miguel Bul.	Bulu R. 60	Ave.	0.1	0.1	0.1	0.1	1.2	0.5	1.2	1.5	1.8	0.8	0.8	0.4	0.7	
			Max.	0.4	0.3	0.2	0.2	4.4	0.7	4.1	3.6	4.0	2.2	1.7	0.8	4.4	7
			Min.	0	0	0	0	0	0.1	0.1	0.7	1.0	0.3	0.1	0	0	

表 3.3.2(2) 月平均河川流量

(Unit: m^3/s)

No.	Station Name	River & Catchment Area (km^2)		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual	Obser. Period (yr.)
13.	San Vicente Bul.	San Miguel R. 240	Ave.	19.5	13.5	8.1	3.2	12.8	19.9	32.5	35.5	29.9	27.8	30.7	23.6	21.3	
			Max.	55.9	35.2	31.3	17.2	42.3	71.2	126.7	105.8	72.1	67.8	56.3	62.0	126.7	13
			Min.	0.8	0.5	0.2	0.2	0	4.4	12.8	5.5	3.7	0.1	12.3	0.5	0	
14.	San Ildefonso Bul.	Garlag R. 86	Ave.	2.1	0.6	1.6	1.1	5.9	3.5	6.5	4.6	6.2	5.4	3.8	2.2	3.6	
			Max.	4.4	0.9	2.3	1.3	13.2	4.8	13.8	10.7	10.8	11.1	5.4	5.0	13.8	8
			Min.	0.1	0	0.9	0.9	1.4	2.1	0.8	0.9	3.2	1.7	1.8	0.7	0	
15.	San Rafael Bul.	Maasim R. 142	Ave.	1.6	0.8	20.0	0.3	3.5	14.4	28.0	32.2	27.2	17.2	13.9	3.6	13.6	
			Max.	5.2	2.6	215.0	0.7	31.2	32.0	130.9	78.5	81.2	43.6	46.5	10.6	215.0	11
			Min.	0.6	0.2	0.1	0	0	0.9	0.1	3.7	2.2	2.9	1.2	1.0	0	
16.	Candaba Pam.	Maasim R. 229	Ave.	4.3	2.2	1.8	1.5	5.9	10.2	20.4	25.5	18.5	16.4	10.0	7.2	10.3	
			Max.	13.0	5.4	6.1	4.5	28.6	23.6	54.2	61.1	60.0	28.5	29.3	19.6	61.1	12
			Min.	0.6	0.3	0.2	0.2	0.4	1.0	4.9	8.1	1.5	4.5	2.3	1.3	0.2	
17.	Norzagaray Bul.	Angat (below Ipo Dam) 629	Ave.	34.6	20.0	12.4	10.8	18.1	23.2	38.4	59.4	44.9	38.6	39.0	97.9	36.4	
			Max.	198.2	65.6	32.8	38.3	110.1	78.0	134.8	165.2	137.5	181.8	104.6	476.5	476.5	11
			Min.	1.4	1.0	0.2	0.1	0.1	0.1	0.9	2.4	2.7	1.5	1.4	1.4	0.1	
18.	Calumpit Bul.	Labangan R. 985	Ave.	26.2	20.2	22.4	26.0	55.5	59.7	146.8	135.8	165.9	117.1	92.7	62.1	77.5	
			Max.	94.9	31.5	34.4	37.7	212.6	132.5	674.4	293.0	508.5	353.9	216.3	151.0	674.4	15
			Min.	12.5	15.2	12.0	14.3	13.9	16.2	29.6	40.8	51.1	20.4	17.6	16.8	12.0	
19.	Bacolor Pam.	Pasig-Potrero R. 103	Ave.	3.6	4.0	4.4	4.0	7.0	2.7	8.7	5.0	3.6	2.1	7.3	2.9	4.6	
			Max.	8.9	9.3	9.3	9.3	9.3	8.7	31.6	18.9	8.7	4.8	48.1	8.6	48.1	9
			Min.	0.3	0	0	0	0.4	0.2	0.3	0.4	0.2	0.5	0.3	0.2	0	
20.	Florida-blanca Pam.	Porac R. 103	Ave.	1.3	1.3	1.4	1.5	2.4	4.5	4.8	7.1	8.2	4.0	3.1	1.9	3.5	
			Max.	2.0	2.0	1.9	2.5	7.2	11.3	8.5	17.5	20.8	8.1	7.9	4.7	20.8	8
			Min.	0.1	0.3	0.8	0.8	1.2	1.5	1.0	0.7	0.7	0.7	0.8	1.0	0.1	
21.	Florida-blanca Pam.	Gumain R. 122	Ave.	3.8	2.7	3.1	3.7	8.9	15.8	23.1	27.1	22.0	14.9	8.3	6.3	11.6	
			Max.	14.4	10.7	10.5	12.8	46.9	66.4	67.8	83.1	57.8	29.9	18.6	18.8	83.1	17
			Min.	0.1	0.3	0.7	0.1	0.7	0.7	5.6	11.6	6.6	1.5	0.2	0.2	0.1	
22.	Florida-blanca Pam.	Caulaman R. 92	Ave.	2.2	2.0	1.9	1.8	4.7	7.7	21.6	41.0	20.4	17.9	7.9	10.3	11.6	
			Max.	17.5	17.5	17.7	17.5	24.6	51.1	106.8	316.2	104.5	72.9	56.4	84.9	316.2	13
			Min.	0.4	0.2	0.2	0.1	0.1	0.1	0.4	3.7	1.9	1.5	1.0	0.7	0.1	
23.	Muñoz N.E.	Baliwag R. 208	Ave.	2.8	2.1	1.9	1.5	9.9	9.4	19.2	28.5	27.1	15.2	6.6	3.7	10.7	
			Max.	9.2	5.3	3.2	3.0	106.8	27.8	72.2	49.3	63.4	43.9	18.4	8.8	106.8	15
			Min.	0.9	0.7	0.8	0.1	0.9	1.9	4.4	10.5	8.8	3.6	1.7	1.3	0.1	
24.	Angat Bul.	Bayabas R. 69	Ave.	1.6	1.1	0.8	0.8	1.6	16.7	88.9	39.6	24.0	36.6	16.1	17.0	20.4	
			Max.	5.0	2.9	2.7	2.6	5.5	75.4	590.0	267.6	132.6	220.8	51.5	110.7	590.0	11
			Min.	0.2	0	0	0	0.1	0.4	0.5	4.1	1.3	0.7	1.0	0.4	0	

表3.3.2(3) 月平均河川流量

(Unit: m^3/s)

No.	Station Name	River & Catchment Area (km^2)		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual	Obser. Period (yr.)
25.	Pantabangan N.E.	Pantabangan R. 603	Ave.	13.9	10.7	10.6	6.6	21.0	16.8	44.6	46.4	42.5	31.8	18.7	18.5	23.5	
			Max.	26.1	23.2	19.7	12.8	75.0	21.5	83.3	95.1	66.9	4.3	28.9	29.3	95.1	8
			Min.	4.8	3.3	2.3	0.4	2.5	11.8	16.1	19.2	26.5	23.8	12.9	5.9	0.4	
26.	Apalit Pam.	Sulipan Cut-off Channel 7,715	Ave.	213.4	15.5	29.4	23.8	131.3	60.3	253.0	521.6	310.2	233.9	171.3	74.3	169.8	
			Max.	68.1	29.3	143.2	83.7	974.6	264.1	759.7	2,940.2	680.1	907.2	442.6	370.9	2,940.2	14
			Min.	0	0	0	0	0.3	0	4.9	29.6	7.1	1.5	1.6	0.3	0	
27.	Pulilan Bul.	Angat R. 918	Ave.	30.4	25.2	29.6	30.1	43.1	50.0	77.7	104.9	110.2	74.3	63.4	62.2	58.4	
			Max.	112.3	66.1	105.6	92.2	179.8	187.7	224.1	224.9	265.8	189.6	172.7	180.2	265.8	16
			Min.	2.5	1.2	2.6	4.6	1.7	6.7	10.4	28.2	21.5	2.6	1.9	0.1	0.1	
28.	Pasing Candaba Pam.	Pampanga R. 7,270	Ave.	46.1	46.2	48.0	43.0	101.9	128.5	290.6	468.0	541.2	376.0	276.2	166.0	211.0	
			Max.	79.0	78.0	93.1	76.1	466.8	268.2	712.4	676.2	945.7	817.4	584.4	376.8	945.7	9
			Min.	8.7	7.7	9.9	8.8	20.9	30.3	101.7	355.9	133.3	112.2	51.6	19.8	7.7	
29.	Apalit Pam.	Pampanga R. 7,714	Ave.	170.5	148.7	296.5	252.3	191.8	311.2	307.8	439.4	504.2	425.9	327.9	273.7	304.2	
			Max.	296.1	335.6	3,091.7	2,243.1	973.8	2,462.4	547.1	915.4	771.1	941.6	903.7	547.0	3,091.7	21
			Min.	116.6	111.1	117.2	116.7	109.4	145.5	149.8	220.2	330.8	214.7	126.9	120.2	109.4	

表 3.3.3(1) 月平均流量（Arayat）

Station: Arayat (Unit: m^3/s)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Mean
1965	92.2	58.5	29.1	22.1	30.8	152.0	893.6	389.4	552.7	259.6	220.3	77.6	231.1
1966	48.3	42.1	26.4	13.2	634.8	240.2	260.8	461.0	842.2	96.2	538.6	358.3	296.8
1967	117.6	41.7	29.8	20.3	16.9	215.5	233.5	1158.3	1038.4	638.0	468.9	67.7	337.2
1968	42.3	30.8	27.8	20.8	22.9	26.6	140.0	603.2	956.4	388.6	49.2	83.4	199.5
1969	34.2	21.7	13.7	13.8	14.1	36.2	156.7	727.7	390.5	213.5	68.9	55.4	146.8
1970	27.2	17.1	12.2	18.4	11.7	86.7	117.7	313.0	935.0	652.2	369.1	156.3	226.7
1971	44.4	31.1	33.5	18.7	55.3	382.0	709.9	428.1	261.7	1042.8	231.2	314.4	299.1
1972	299.7	60.5	29.4	27.6	38.6	74.3	1612.8	1538.0	594.5	94.7	107.4	63.3	382.1
1973	19.6	20.8	4.8	2.8	3.2	17.2	52.6	275.1	243.1	849.3	241.2	63.3	150.7
1974	21.5	11.3	14.6	10.5	12.0	215.3	287.9	833.9	231.9	707.7	906.1	324.1	300.0
1975	141.2	73.4	43.9	49.5	50.6	100.4	56.8	173.0	237.5	205.7	80.6	178.9	116.3
1976	157.6/1	40.1/1	21.7/2	16.5/2	624.9/2	259.9	483.4	517.4	523.9	430.7	303.3	87.1/3	290.3
1977	62.7	25.4	16.1	12.3/4	19.3/4	52.0/1	140.2/1	379.0	661.2	288.6/2	369.7/2	160.9/2	182.6
1978	88.3/2	73.7/2	37.9	51.7	48.7	162.1/2	329.6/2	700.7	1019.6	901.4	869.9/3	368.1/3	388.7
Average	85.5	39.2	24.4	21.3	113.1	144.3	391.1	607.0	606.3	483.5	344.6	168.5	252.4

/1: Estimated discharge from Bangkerohan, the Coronel River by use of correlation curue

/2: Estimated discharge from Zaragoza by use of correlation curue

/3: Estimated discharge from Bag-bag Calumpit

/4: Estimated discharge by use of interpolation curue

表3.3.3(2) 月平均流量（Zaragoza）

Station: Zaragoza (Unit: m^3/s)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Mean
1960	-	-	-	-	-	-	-	314.1	144.3	63.9	1.8	0.3	-
1961	0.3	0.2	0.2	0.1	0	31.1	219.2	138.3	160.3	44.5	0.6	0.2	49.6
1962	0.1	0.1	0.1	0.1	0	1.0	131.7	140.9	96.2	46.2	3.3	0.5	35.0
1963	0.3	0.5	0.2	0.2	0.3	79.5	109.6	143.2	203.7	17.1	2.5	0	46.4
1964	0.1	1.1	1.0	0	0.1	6.6	77.8	129.7	104.7	145.9	140.4	133.6	61.8
1965	41.8	29.9	0.3	0	0	0.4	160.7	132.4	150.5	78.5	56.4	4.4	54.5
1966	1.4	0	0	0	106.1	37.4	41.0	75.8	142.1	12.3	89.3	58.0	47.0
1967	16.1	2.9	0.9	0	0	33.1	36.3	158.4	181.0	111.7	26.5	5.4	47.7
1968	4.1	3.2	2.3	1.1	3.2	4.9	38.9	155.3	114.7	64.9	1.2	6.9	33.6
1969	2.0	2.0	1.5	1.1	2.4	19.1	159.0	59.8	66.9	37.7	3.6	4.1	30.2
1970	3.2	2.6	2.1	0	1.5	16.6	26.4	82.3	184.2	70.4	21.1	9.0	35.0
1971	6.0	5.5	1.9	0	8.9	71.6	130.2	79.9	56.2	160.2	21.1	16.7	46.9
1972	19.5	7.5	4.5	1.6	7.0	18.0	233.9	278.7	148.2	19.2	4.5	4.1	62.7
1973	2.3	0.1	0.8	0.5	2.0	3.8	8.7	75.7	64.3	147.1	15.9	6.6	27.6
1974	4.4	4.0	1.1	1.5	1.5	32.7	45.3	168.8	48.8	162.3	14.8	125.1	51.5
1975	14.5	0	0	0	4.0	8.2	13.6	29.6	40.7	35.2	13.8	30.7	16.0
1976	30.7	5.5	3.7	2.8	125.3	72.1	118.8	125.9	120.2	100.6	8.0	4.2	60.2
1977	6.6	4.4	2.7	4.6	3.4	3.0	17.2	21.1	163.1	53.6	73.5	22.3	31.2
1978	15.1	12.6	11.7	9.6	9.3	22.6	63.7	269.9	243.0	256.2	192.7	71.7	98.7
Average	9.4	4.5	1.9	1.3	15.3	25.7	90.7	135.8	128.1	85.7	36.4	26.5	46.8

表 3.3.4　San Antonio Swamp への月平均流入量の推定値

(Unit: m^3/s)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Mean
1968	10.0	7.5	6.2	4.0	6.4	8.8	70.4	281.0	207.5	117.4	8.1	18.5	62.5
1969	6.8	4.9	3.4	3.0	4.4	34.6	287.7	108.1	121.1	68.2	13.2	11.8	56.2
1970	6.9	5.0	3.8	2.6	3.1	30.0	47.8	148.9	333.4	127.5	72.2	30.7	67.7
1971	12.1	9.8	6.5	2.6	16.6	129.5	235.6	144.6	101.7	290.0	53.1	60.3	89.4
1972	61.0	15.9	8.6	5.4	12.3	32.6	523.2	504.4	268.2	34.7	19.3	12.9	117.5
1973	5.1	3.0	1.5	0.9	2.5	6.8	15.7	136.9	116.4	266.3	49.3	15.4	52.1
1974	7.4	5.6	3.1	2.9	3.1	59.2	81.9	305.4	88.3	293.7	140.4	170.1	97.8
1975	34.0	10.2	6.1	6.9	11.0	14.8	24.7	53.6	73.7	63.7	25.0	55.5	31.8
1976	55.6	9.9	6.7	5.1	226.8	130.5	214.9	227.8	217.6	182.0	43.0	7.7	111.3
1977	15.2	7.9	5.0	8.3	6.0	5.4	31.2	38.2	295.2	97.1	133.1	40.3	56.7
1978	27.3	22.8	16.9	16.8	16.0	40.9	115.3	488.5	439.7	463.6	348.7	129.8	178.1
Average	21.9	9.3	6.2	5.3	28.0	44.8	140.8	221.6	205.7	182.2	82.3	50.3	83.2

表 3.3.5　年平均流砂量の推定値

River	Site	Catchment Area (km^2)	Ave. Annual Sediment ($t/km^2/yr$)
Talavera	Talavera Br.	401	262
Rio Chico	Zaragoza Br.	1,675	134
Bamban	Bamban Br.	206	1,213
Pampanga	San Isidro Br.	3,472	685
-do-	Arayat Br.	6,532	387
-do-	Candaba Br.	7,270	163
-do-	Sulipan Br.	7,715	59

Remarks:
1. Applied daily discharges during the period (1966-1975).
2. Applying the Sato-Kikkawa-Ashida formula for bed load estimated.
3. Applying a formula for suspended load established by the Team on the basis of the Engelund-Hansen Formula.

表 3.6.1　かんがい計画地区の人口および戸数.

Municipality	Population 1975	Population 1980	Population Growth Rate 1975/80(%)	Area (ha)	Population Density (Person/km^2)	Total House-Hold	Family Size	No. of Farm	Percentage of Farm Household
A) Municipalities Related to the Project Area									
Apalit	41,283	48,264	3.17	6,147	785	7,682	6.3	2,139	22.7
Arayat	52,739	56,770	1.48	13,475	421	8,726	6.5	2,049	30.9
Candaba	48,458	52,643	1.67	20,870	252	8,086	6.5	1,857	52.4
Mexico	48,805	53,488	1.85	11,741	456	8,051	6.6	3,602	31.2
Minalin	25,428	27,326	1.45	2,908	940	4,000	6.8	1,198	25.0
San Fernando	98,382	110,423	2.34	8,119	1,360	17,358	6.4	352	7.3
San Luis	23,866	25,698	1.49	5,683	452	3,929	6.5	1,664	50.9
San Simon	21,553	23,537	1.78	5,736	410	3,682	6.4	1,838	34.5
Sta. Ana	22,595	25,342	2.32	4,596	551	4,392	5.8	984	23.9
Sto. Tomas	21,320	24,945	3.19	2,129	1,172	4,169	6.0	358	9.4
TOTAL	404,429	448,436	2.09	81,404	551	70,075	6.4	16,041	22.9
B) Project Area	94,400	104,700	2.09	14,000	750	16,390	6.4	4,600	27.4

Source: National Census and Statistic Office Region III

表 3.7.1　かんがい計画地区の現況土地利用

	Category	Area (ha)	Proportional Extent (%)
(1)	Paddy Field/1	11,500	82.2
	Rainfed area	2,300	16.5
	Irrigated area	9,200	65.7
	- double cropping of paddy	(2,300)	
	- single cropping of paddy	(6,900)	
(2)	Grass Land	100	0.7
(3)	Swampy Area	900	6.4
(4)	Village/Road/Rivers/Others/2	1,500	10.7
	Total	14,000	100.0

/1: Net area

/2: Containing the land of about 300 ha where existing canal facilities, feeder roads and farm levee are installed in the paddy field

表 3.1 0.1　かんがい計画地区の土地所有形態に関する調査結果

Farm Size (ha)	Owner Operator		Amortized Owner		Lessee		Share-tenant		Total Farm Household		Total Area		Average Farm Size (ha)
	No.	Area (ha)	No.	Area (ha)	No.	Area (ha)	No.	Area (ha)	(No.)	(%)	(ha)	(%)	
Below 0.25	1	0.18	-	-	-	-	-	-	1	0.7	0.18	0.1	0.18
0.25 - 0.75	-	-	-	-	4	2.00	-		4	2.9	2.00	0.6	0.50
0.75 - 1.25	4	4.00	5	4.96	13	13.25	-	-	22	15.7	22.21	6.5	1.01
1.25 - 1.75	4	6.00	9	13.06	14	22.80	1	1.50	28	20.0	43.36	12.6	1.55
1.75 - 2.25	2	4.00	9	17.33	9	18.70	-	-	20	14.3	40.03	11.6	2.00
2.25 - 2.75	4	10.00	2	5.00	8	20.00	-	-	14	10.0	35.00	10.2	2.50
2.75 - 3.25	3	9.00	7	20.81	9	27.25	-	-	19	13.6	57.06	16.6	3.00
3.25 - 3.75	1	3.50	3	9.50	1	3.50	1	3.50	6	4.3	20.00	5.8	3.33
3.75 - 4.25	3	12.30	2	8.00	4	16.00	-	-	9	6.4	36.30	10.6	4.03
4.25 - 4.75	-	-	4	18.25	-	-	-	-	4	2.9	18.25	5.3	4.56
4.75 - 5.25	-	-	6	30.00	2	10.00	-	-	8	5.7	40.00	11.6	5.00
5.25 - 5.75	1	5.50	1	5.50	1	5.50	-	-	3	2.1	16.50	4.8	5.50
5.75 - 6.25	-	-	1	6.00	-	-	-	-	1	0.7	6.00	1.7	6.00
6.25 - 6.75	-	-	-	-	-	-	-	-	-	-	-	-	-
Over 6.75	1	7.00	-	-	-	-	-	-	1	0.7	7.00	2.0	7.00
Total	24	61.48	49	138.41	65	139.00	2	5.00	140	100.0	343.89	100.0	2.46
Share (%)	17.1	17.9	35.0	40.2	46.5	40.4	1.4	1.5	-	-	-	-	-
Estimated value in the Irrigation Service Area	790	2,060	1,610	4,620	2,140	4,650	60	170					

表3.1 3.1 河口からの距離

(Unit: km)

Location	Distance
River Mouth	0
Bifurcation of Bebe Sn. Esteban C.O.C.	18
Bifurcation of Hagonoy River	21
Sulipan Bridge	26
Apalit	27
North Manila Expressway Br.	30
San Simon	36
San Luis	42
Candaba	50
Arayat Bridge	61
Confluence of Pampanga and Rio Chico Rivers	66
Candaba-Cabiao Floodway	71
San Isidro Bridge	86
Cabanatuan	140
Zaragosa (Rio-Chico River)	101

Note: The distance is measured along the center line of low water channel, on the map of a scale of 1:50,000

表 3.1 3.2　現況河道の流下能力

(Unit: m^3/s)

River	Stretch	Carrying Capacity (Bankful)
1. Pampanga River	River mouth - Masantol	500
	Masantol - Sulipan	2,200
	Sulipan - Candaba	1,800
	Candaba - Arayat	2,500
	Arayat - Cabiao	2,000
	Cabiao - San Isidro	2,500
2. Bebe San Esteban Channel	River mouth - Masantol	1,700
3. Hagonoy River	Hagonoy - Diversion Point	70
4. Labangan Floodway	River mouth - Calumpit	700
5. Angat River	Calumpit - Expressway Br.	900
6. Maasim River	Confluence to Pampanga R. - Bahay Pare	100
7. Candaba - Cabiao Floodway	Candaba Swamp - Diversion Point	4,000
8. San Fernando River	Sexmoan - San Fernando	200
	San Fernando - Mexico	50

表3.1 3.3　１９７９年末における現治水計画による治水工事の進捗状況

Name of Works	Completion Percentage	Completion Year
Arayat-Apalit-Masantol Setback Levee	100%	1975
Calumpit-Plaridel-Bustos Levee	100%	1975
Bebe-San Esteban Channel, Dikes, Floodgates	100%	1975
Arayat-Cabiao Ring Levee (including improvement)	80%	-
Cabiao-Candaba North Dikes	100%	1977
Cabiao-San Isidro Levee	100%	1975
Luyos-Bagong Sikat Cutoff Channel	100%	1975
San Antonio-Cabanatuan Levee	0%	-
Rio Chico River Control System	20%	-
Quitangil River Control	15%	-
Parua Floodgate	100%	1979
Pasig-Potrero River Control	75%	-
Gumain-Porac Diversion Channel	86%	-
Sapang Maragul Floodgate	100%	1979
Labangan Floodway	50%	-
Abacan River Control	20%	-

表 3.1 3.4　Pampanga 川流域の主要地点における確率高水流量

River	Station	Catchment Area (km^2)	Discharge (m^3/s) 5-yr	10-yr	20-yr	50-yr	100-yr	Remarks
Pampanga Main Stream	Cabanatuan	2,482	1,977	2,365	2,725	3,205	3,572	
	San Isidro	3,472	2,408	3,051	3,641	4,315	4,857	
	Cabiao	3,512	2,424	3,071	3,668	4,349	4,895	
	Arayat	6,532	2,349	2,731	3,068	3,451	3,734	After control by Swamp
	Sulipan	8,907	2,654	3,517	4,779	6,111	7,039	- do -
Rio Chico	Zaragoza	1,675	1,061	1,497	1,883	2,422	2,840	
	Inflow to San Antonio Swamp	3,020	1,508	2,212	2,853	3,721	4,368	Before control by Swamp
Peñaranda	Confluence to Main Stream	601	529	732	864	1,046	1,192	
Angat	Longos	895	737	1,015	1,367	2,050	2,429	
Gua-Gua	San Fernando	445	272	353	423	566	682	
	Rivermouth	945	326	470	573	774	1,004	

表 3.1 4.1　デルタ内の養漁池の洪水被害額・

Item	1976 May	1977 Nov.	1987/2 Aug.	1979 -	1980 Nov.
1. Name of Typhoon	Didang	Unding	Heling & Iling	-	Aring
2. Location of Damage Sampling	All Bulacan	All Bataan	All Bataan	-	Hagonoy Bulacan
3. Affected Area covered by Interview Survey (ha)	687	493	(901)	-	756
4. Producer's Price of Marketable Milkfish (₱/ha)	1.22	2.05	(1.43)	-	3.01
5. Fish Quantity of Damage (x 10^3 pcs)	4,849	1,223	787	-	3,609
6. Value of Damage					
to Production (x ₱10^3)	1,821	1,269	549	-	2,768
(₱/ha)	2,650	2,574	609	-	3,662
to Facilities (x ₱10^3)	367	388	122	-	171
(₱/ha)	534	787	135	-	227
to Total (x ₱10^3)	2,188	1,657	671	-	2,939
(₱/ha)	3,184	3,361	744	-	3,889

Source: Survey reports on typhoon damage to fishpond by Provincial Fishery Office, Bulacan in 1976 and 1980, Bataan in 1977 and 1978.

Remarks: /1: Based on the data obtained from interview to pond operators

/2: This data was not used for the estimation of flood damage because of its abnormally low damage compared with affected area.

表 4.1.1　1／20 高水対応の治水暫定計画の工事数量

	Unit	Stretch		Total
		Candaba Sulipan	Below Sulipan	
1. Excavation of Low-water channel				
- Length	KM	18.0	22.6	40.2
- Volume				
Pampanga R.	10^3m^3	16,590	15,890	32,480
2. Embankment of New Levee				
- Length	KM	35.3	61.7	97.0
- Volume	10^3m^3	1,700	3,620	5,320
Pampanga R.	10^3m^3	850	1,810	
Maasim R.	10^3m^3	550	-	
Bagbag R.	10^3m^3	260	340	
Angat R.	10^3m^3	40	-	
Labangan R.	10^3m^3	-	1,470	
3. Embankment of Heightening				
- Length	KM	12.8	22.8	35.6
- Volume	10^3m^3	360	990	1,350
Pampanga R.	10^3m^3	360	330	
Bebe C.O.C.	10^3m^3	-	660	
4. Embankment of Base Mound				
- Length	KM	17.6	31.2	48.8
- Volume	10^3m^3	12,420	10,440	22,860
5. Outlet				
- Type A/1	nos.	1	1	2
- Type B/2	nos.	7	7	14
- Type C/3	nos.	1	2	3
Intake of Fishpond	nos.	-	26	26
6. Revetment	KM	2.5	1.5	4
7. Bridge	place	2	-	2

Remarks: Dredged material is used for Embankment and Heightening of Pampanga R., Left of Bagbag R.

/1 Size of Culvert: W - 5 m, H - 4.5 m, L - 42 m, 3 cell and w/sluice gate

/2 Size of Culvert: W - 2.5 m, H - 2.5 m, L - 48 m, 2 cell and w/flap & sluice gate

/3 Size of Culvert: W - 2.5 m, H - 2.5 m, L - 48 m, 1 cell and w/flap & sluice gate

表 4.2.1　最適かんがい計画の検討

Parameters / Alternative Plans	Irrigation Service Area (ha)	San Antonio Reservoir Plan						Pampanga Pump Plan	
		Dam Axis		Maintaining Nat'l Flood Retent'n Volume in Swamp		Dead Capacity Utilization			
		Down-Stream	Upper Stream	Dam Capacity Increase	Downstream Improvement	No Use	Used by Pump	Return Flow	Present Flow
1	36,000	0	-	0	-	0	-	-	-
2	36,000	0	-	0	-	-	0	-	-
3	36,000	0	-	-	0	0	-	-	-
4	36,000	0	-	-	0	-	0	-	-
5	26,700	0	-	0	-	0	-	-	-
6	26,700	0	-	0	-	-	0	-	-
7	26,700	0	-	-	0	0	-	-	-
8	26,700	0	-	-	0	-	0	-	-
9	36,700	-	0	-	0	0	-	-	-
10	27,700	-	0	0	-	0	-	-	-
11	27,700	-	0	-	0	0	-	-	-
12	20,000	-	0	0	-	0	-	-	-
13	20,000	-	0	-	0	0	-	-	-
14	38,200	-	-	-	-	-	-	0	-
15	11,000	-	-	-	-	-	-	-	0

表 4.2.2　かんがい計画地区の土地利用計画

(Unit: ha)

Present Condition		Future Condition	
Item	Area	Item	Area
Rainfed	2,300	Irr. paddy field/1	2,000
		Right of way/2	200
		Rainfed area/3	100
Irr. paddy field	9,200	Irr. paddy field/1	8,100
		Right of way/2	800
		Irr. land/3	300
Grassland	100	Irr. paddy field/1	100
Swampy area	900	Irr. paddy field	800
		Right of way/2	100
Village/Road/Rivers/ Others	1,500	Village/Road/Rivers/ Others	1,500
Total Total	14,000		14,000

Remarks: /1: Irrigateo land under the project

/2: The right of way for the land where new irrigation facilities are installed.

/3: The rainfed and irrigated land where are not contained in the project.

表4.2.3　水稲の耕種法

1.	Varieties	IR series
2.	Growing period	130 days
3.	Amount of seed	60 kgs
4.	Nursery period	15 - 20 days
5.	Area of nursery fed	1/20 - 1/25 of paddy field
6.	Land preparation	One times of ploughing, and 3 times of hallowing-leveling
7.	Planting method	Transplanting
8.	Planting density	30 cm x 15 cm, 3 seedlings per hill
9.	Planting depth	Within 3 cm from the surface
10.	Fertilization	
	Nursery bed	2 kgs of N/ha
	Paddy field	- 68 kgs of N/ha and 20 kgs of P/ha for wet season paddy - 88 kgs of N/ha and 20 kgs of P/ha for dry season paddy
	Time in paddy field	
	All P	Basic dressing
	35% of N	Basic dressing at transplanting time
	25% of N	First top dressing at two weeks after transplanting time
	40% of N	2nd top dressing in the late period of a young panicle formation stage
11.	Application of chemicals	2 ℓ/ha
12.	Weeding	Two time about 25th and 50th day after

表 4.2.4　想定水稲単位収量

(Unit: ton/ha)

Item	Without Project	With Project
1) Paddy		
Irrigated land		
Wet season paddy	2.36	4.5
Dry season paddy	2.62	5.0
Rainfed land		
Wet season paddy	2.07	-
2) Mongo beans	0.4	0.4

表 4.2.5　かんがい計画地区の想定作物生産量

(Unit: ton of paddy)

Item	with Project	Without Project	Increment Diversion Dam Scheme
1) Paddy	104,500/1	25,100	75,300
Irrigated land			
Wet season paddy	49,500	13,000	36,500
Dry season paddy	55,000	12,100	42,900
Rainfed land			
Wet season paddy	0	4,100	-4,100
2) Mongo beans	0	300	-300

Remarks: /1: equivalent to 54,200 tons of milled rice

表4.2.6　１０日平均流量（Arayat）

(Unit: m^3/s)

		1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
Jan.	1	115.8	54.5	163.1	46.8	36.7	32.7	56.1	739.3	23.2	27.7	151.8	223.1	77.9	81.7
	2	83.8	40.5	88.5	41.6	36.1	28.3	42.0	114.2	19.4	21.3	109.1	159.9	64.7	91.1
	3	79.3	50.1	102.8	38.8	30.1	23.1	33.9	68.8	16.5	16.1	160.8	96.0	47.2	91.7
Feb.	1	85.0	46.7	48.1	35.8	28.4	20.7	31.6	78.9	23.8	12.3	101.1	56.6	32.3	87.6
	2	47.9	41.7	39.8	29.8	19.1	16.2	32.2	66.0	22.4	11.2	59.3	37.6	23.1	72.4
	3	38.6	37.1	36.5	28.2	16.5	13.7	28.8	34.1	15.0	10.2	56.4	24.5	19.8	57.8
Mar.	1	32.9	32.7	36.8	28.1	13.6	12.9	22.9	25.4	6.7	19.8	42.8	27.4	17.8	33.2
	2	26.9	26.1	27.7	32.7	14.6	11.4	53.7	26.7	5.0	13.5	40.7	23.3	15.8	37.9
	3	25.2	20.9	23.0	23.0	12.9	12.4	24.9	35.4	2.9	10.9	47.7	15.2	14.6	42.3
Apr.	1	22.0	17.7	19.6	22.3	14.6	20.2	21.7	34.8	2.6	8.7	43.8	13.4	13.5	47.3
	2	19.6	12.3	18.4	20.1	16.1	20.1	19.0	25.6	3.5	7.5	43.2	23.3	12.2	52.0
	3	24.6	9.6	23.0	19.9	10.8	14.9	15.3	22.4	2.4	15.2	61.4	12.8	11.1	56.9
May	1	36.2	11.4	15.6	22.6	9.4	11.3	64.3	21.0	2.1	18.2	44.5	15.8	10.1	59.5
	2	22.6	127.1	17.8	21.2	15.8	11.1	54.2	23.1	4.1	7.7	41.6	28.6	9.2	44.8
	3	33.2	1,663.1	17.4	24.6	16.9	12.8	48.0	68.6	3.4	10.3	64.4	1,720.7	36.9	42.5
Jun.	1	198.9	417.6	275.8	28.1	22.4	24.8	278.9	73.1	4.4	42.8	117.5	277.0	46.1	113.2
	2	123.7	144.6	282.3	25.3	60.9	133.9	507.3	79.5	19.2	538.7	81.5	244.5	39.0	153.2
	3	133.5	158.6	88.3	26.3	25.4	101.3	359.9	70.2	28.1	64.3	102.1	255.4	70.8	220.0
Jul.	1	471.9	131.9	159.7	46.4	29.7	75.1	304.4	704.0	19.8	40.3	84.8	969.2	89.1	169.1
	2	1,195.5	300.6	174.1	36.9	43.6	188.5	711.8	2,070.8	92.4	199.3	41.2	280.0	92.9	307.7
	3	1,002.6	341.9	354.6	318.7	375.0	92.1	1,076.8	2,022.7	46.3	666.3	45.5	226.7	231.4	495.5
Aug.	1	622.5	38.2	1,149.2	399.0	1,318.0	177.8	583.4	1,897.2	45.5	145.1	62.3	336.6	364.9	281.3
	2	328.3	631.1	1,224.6	463.0	778.0	290.0	590.7	1,438.9	144.3	1,102.4	240.1	642.0	336.4	662.3
	3	233.1	322.7	1,106.2	916.3	144.4	456.9	139.0	1,301.5	602.8	1,216.0	212.5	568.6	430.5	1,117.0
Sep.	1	293.4	598.1	1,073.5	1,365.5	284.3	1,429.5	195.6	566.1	372.0	336.2	150.6	394.8	640.2	1,087.0
	2	588.8	1,437.1	902.5	855.9	585.7	1,032.5	263.0	728.0	219.0	253.5	202.5	524.9	726.8	896.0
	3	776.0	491.4	1,069.8	647.9	301.0	342.9	326.5	489.3	138.3	106.0	359.4	651.9	616.5	1,075.9
Oct.	1	483.0	108.3	647.4	829.7	339.5	405.4	354.8	189.9	354.8	95.4	159.0	559.5	500.3	1,030.0
	2	235.1	68.6	696.5	261.6	207.5	933.9	1,730.2	57.4	1,496.2	974.6	84.0	376.2	242.0	1,074.9
	3	78.9	39.4	576.3	103.0	104.4	620.5	596.9	42.1	710.8	1,021.7	358.7	363.1	138.1	626.9
Nov.	1	365.2	85.5	889.0	53.9	43.2	500.0	125.5	160.7	64.6	1,323.6	173.7	367.3	110.0	1,727.3
	2	209.3	171.2	402.9	42.7	33.0	215.6	119.3	94.8	63.8	990.1	41.9	347.2	111.6	475.4
	3	86.6	1,359.3	114.9	51.0	130.4	391.8	488.7	66.6	595.1	404.6	26.3	195.4	887.6	407.1
Dec.	1	65.6	740.1	83.2	171.8	50.5	243.7	445.1	97.9	94.8	345.3	41.9	98.2	221.7	429.6
	2	91.1	166.7	65.2	48.8	76.2	136.5	219.3	63.1	63.7	391.1	98.7	94.4	131.6	375.1
	3	76.3	203.2	55.9	34.5	41.0	94.9	282.0	32.0	34.4	243.8	376.3	70.4	132.4	305.9
Average		231.5	296.8	337.2	199.2	144.7	226.4	296.1	378.4	149.4	298.1	116.0	309.4	176.9	396.4

表4.2.7　かんがい計画の事業費

(Unit: ₱10⁶)

Item	Foreign Currency	Peso Currency	Total
1. Direct Construction Cost	(146.43)	(160.53)	(306.96)
(1) Diversion Dam	86.00	63.97	149.97
(2) Irrigation Facilities	25.19	33.40	58.59
(3) Drainage Facilities	28.44	42.88	71.32
(4) Farm Road	6.15	6.64	12.79
(5) On-Farm Development	0.65	13.64	14.29
2. Cost for O&M Facilities	4.10	4.50	8.60
3. Compensation Cost for Land Acquisition	-	33.00	33.00
4. Engineering Cost	22.10	12.30	34.40
Sub-Total	172.63	210.33	382.96
5. Physical Contingency	19.17	30.37	49.54
Total	191.80	240.70	432.50
6. Price Contingency	64.70	130.90	195.60
Grand Total	256.50	371.60	628.10

表 6.5.1　Pampanga 川の塩水そ上距離とそ上期間
（1968～1978年の平均値）

Channel Condition	Discharge Condition			
	Present		Irrigation Project /1	
	Intruded Distance (km)	Affected Period (day)	Intruded Distance (km)	Affected Period (day)
1. At Channel Bottom				
a. Existing Channel	22.7	145	28.9	156
b. Improved Channel /2 (Basic Plan)	29.6	163	32.7	173
c. Improved Channel /3 (Stepwise Plan)	26.9	157	30.5	169
d. Improved Channel /4 (First Phase, Stepwise Plan)	24.6	153	29.1	167
2. At 1 m below Water Surface				
a. Existing Channel	1.3	138	2.3	155
b. Improved Channel (Basic Plan)	2.5	149	3.4	161
c. Improved Channel (Stepwise Plan)	2.2	146	3.2	161
d. Improved Channel (First Phase, Stepwise Plan)	1.8	146	2.8	159

Remarks /1: Diversion dam scheme of irrigation project.
/2: Improved channel by basic flood control plan with 100-yr design flood.
/3: Improved channel by stepwise flood control plan with 20-yr design flood.
/4: Improved channel by first phase, stepwise plan corresponding 10-yr flood.

表 6.6.1　1／20 高水対応の治水暫定計画の評価とその効果

Item	Stepwise Plan with 20-Year Design Flood
1. Internal Rate of Return	10.8%
2. Average Annual Benefit	₱91,900,000
3. Construction Cost	
Economic Cost	₱639,800,000
Financial Cost	₱796,900,000
Local Currency	₱413,500,000
Foreign Currency	₱383,400,000
4. Annual O&M Cost	₱4,000,000
5. Decrease in Inundation Area	19,000 ha
6. Increase of Paddy Production	14,800 tons/yr
7. Decrease in Inundated House	13,400 houses
8. Employment Opportunity during Construction Period	1,500,000 man-days
9. Increase of Fish Production	2,400 tons/yr

表6.6.2　かんがい計画の評価とその効果

Item	
1. Internal Rate of Return (%)	15.4
2. Irrigation Benefit (₱10^6)	98.4
3. Cosntruction Cost (₱10^6)	
- Economic	356.2
- Financial	432.5
- Financial with price contingency	628.1
4. Annual O&M Cost (₱10^6)	4.0
5. Irrigation Service Area (ha)	
- Wet Season	11,000
- Dry Season	11,000
6. Annual Incremental Rice Production (ton)	47,000
7. Employment Opportunity (10^6 man-days)	
- Construction Period	1.9
- Annual Increase Due to Farm Activities	1.5
8. Incremantal Net Reserve for Typical Farm (₱/household)	3,369
9. Irrigation Fee (₱/household)	545
10. Balance between 8 and 9 (₱/household)	2,824
11. Potentiality for Fisheries Development	to be expected
12. Paddy Field to be Submerged (ha)	100

図 3.3.1　平均年雨量による等雨量線図

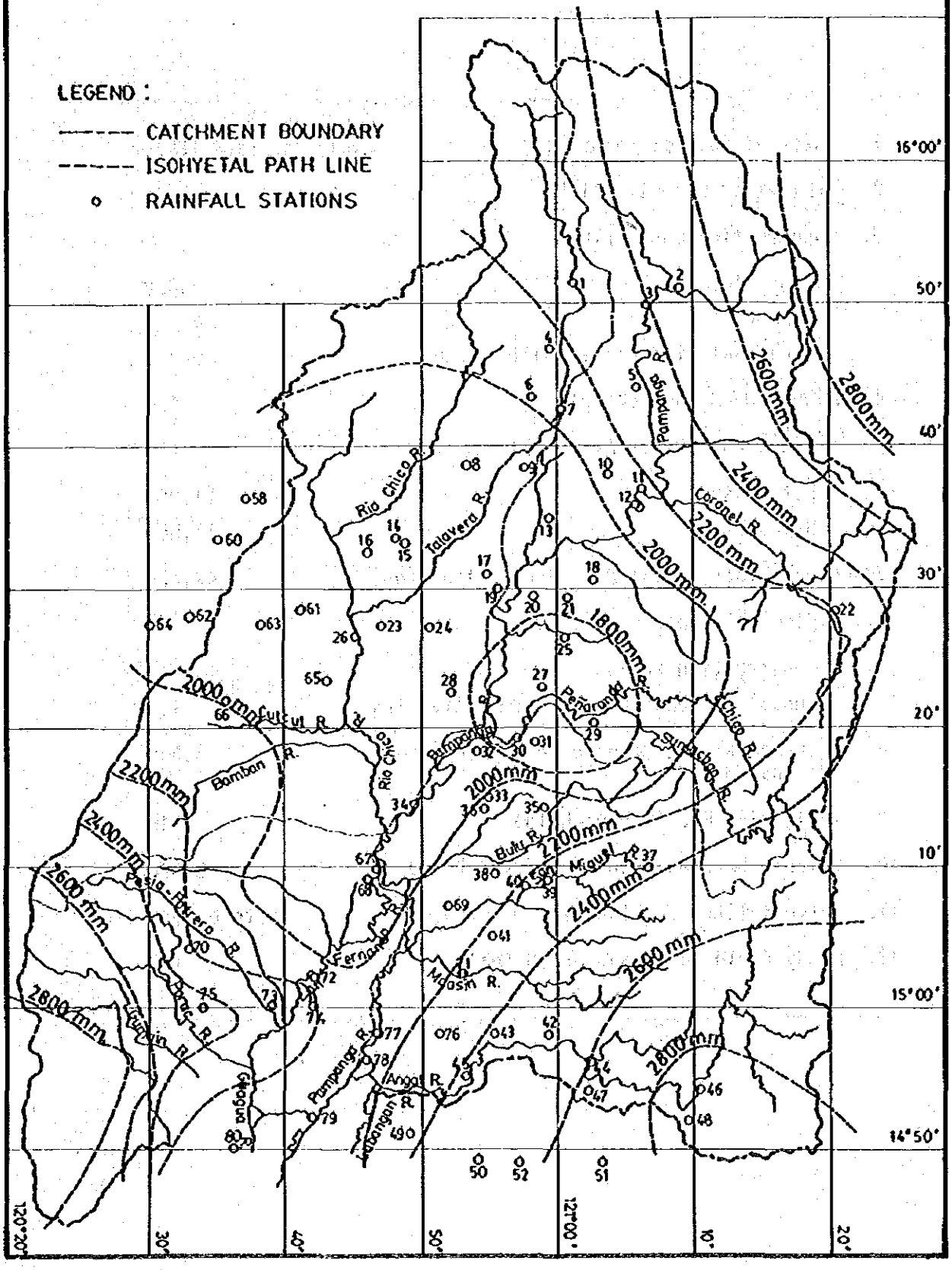


図 3.3.2　月平均流量図

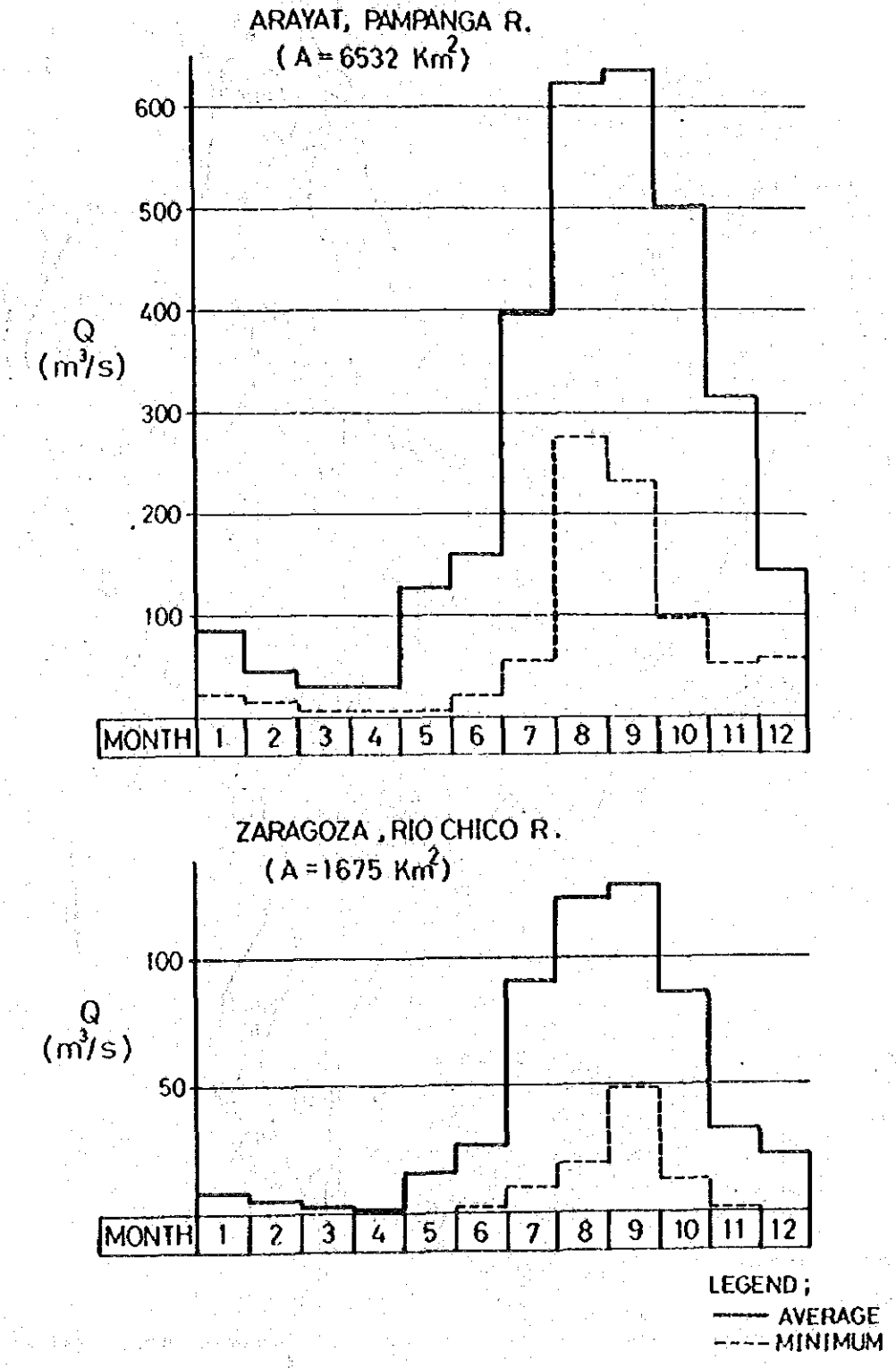

ARAYAT, PAMPANGA R.
(A=6532 Km²)
600
500
400
300
200
100
Q
(m³/s)
MONTH 1 2 3 4 5 6 7 8 9 10 11 12
ZARAGOZA, RIO CHICO R.
(A=1675 Km²)
100
50
Q
(m³/s)
MONTH 1 2 3 4 5 6 7 8 9 10 11 12
LEGEND;
AVERAGE
MINIMUM

図 3.4.1　かんがい計画地区の土壌および土地分級図

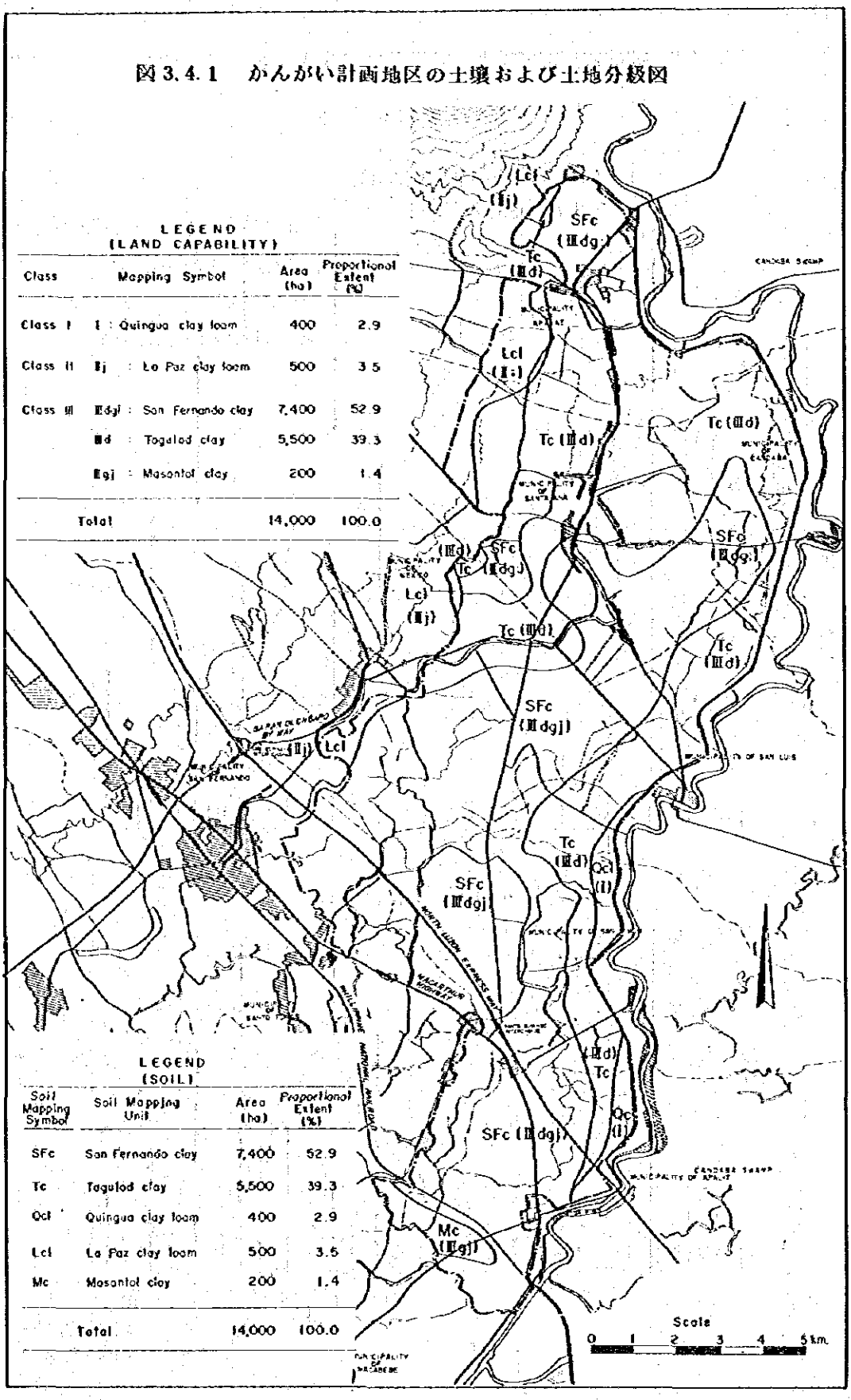


図 3.7.1　かんがい計画地区の現況土地利用図

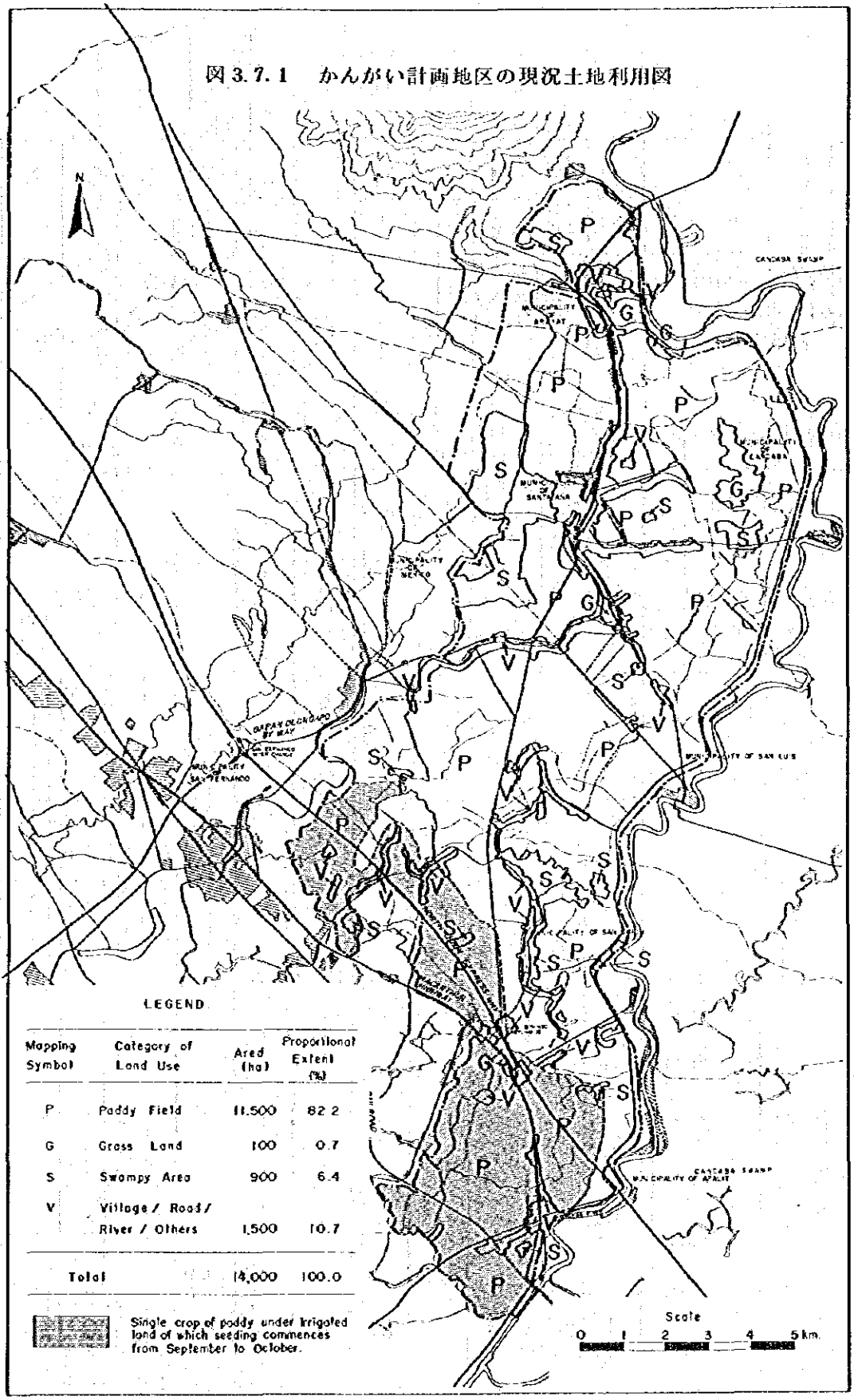


図3.7.2　現況作付体系

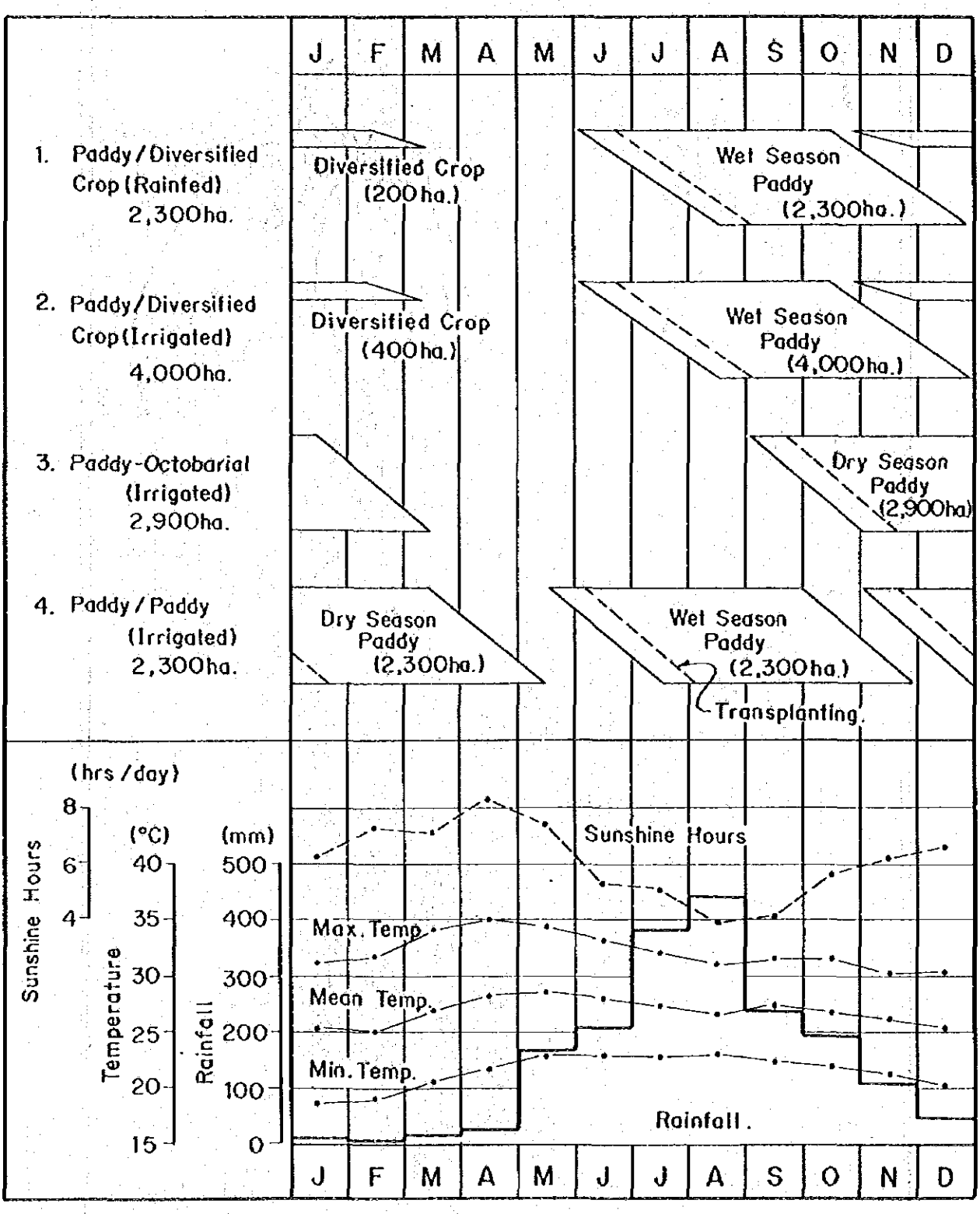
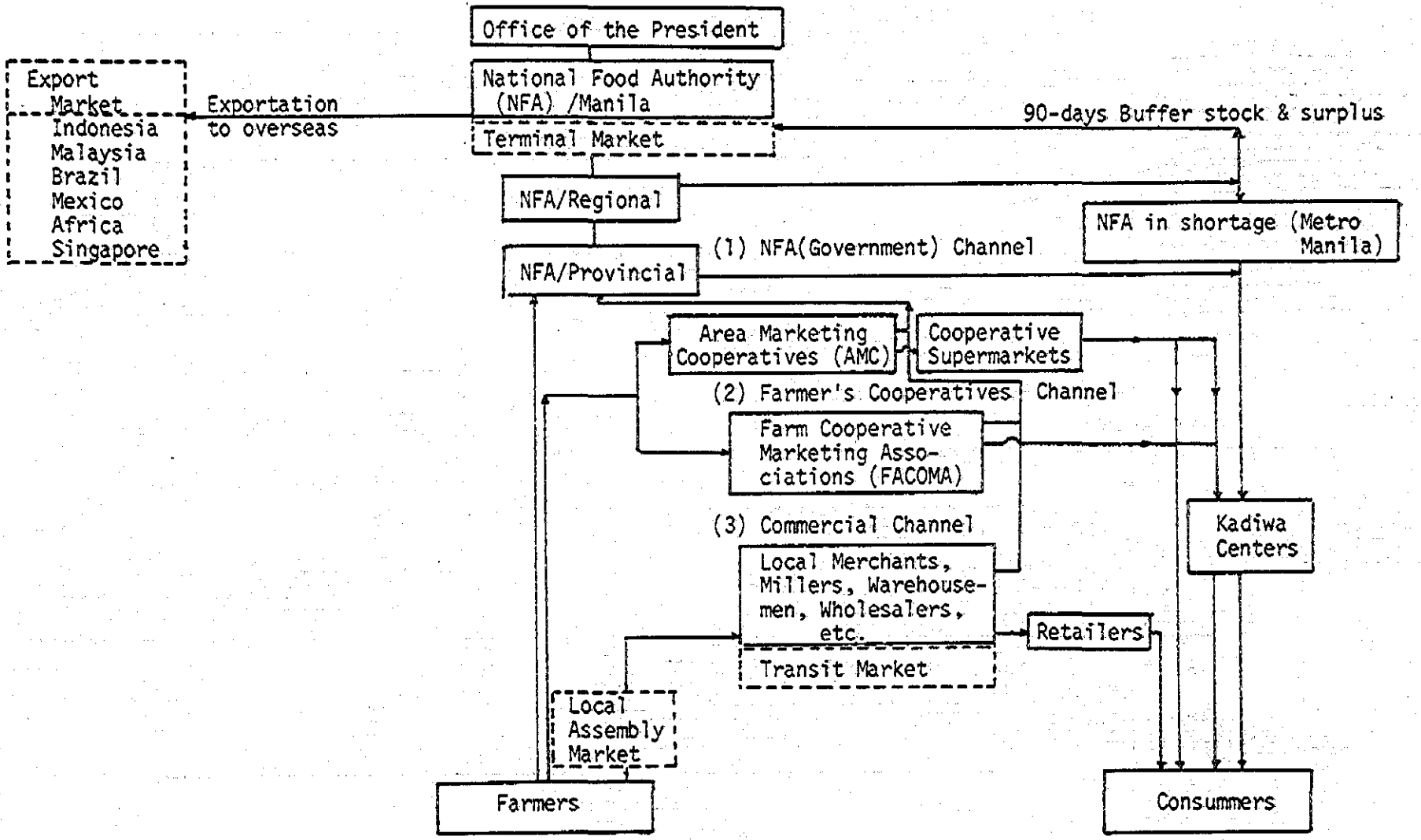
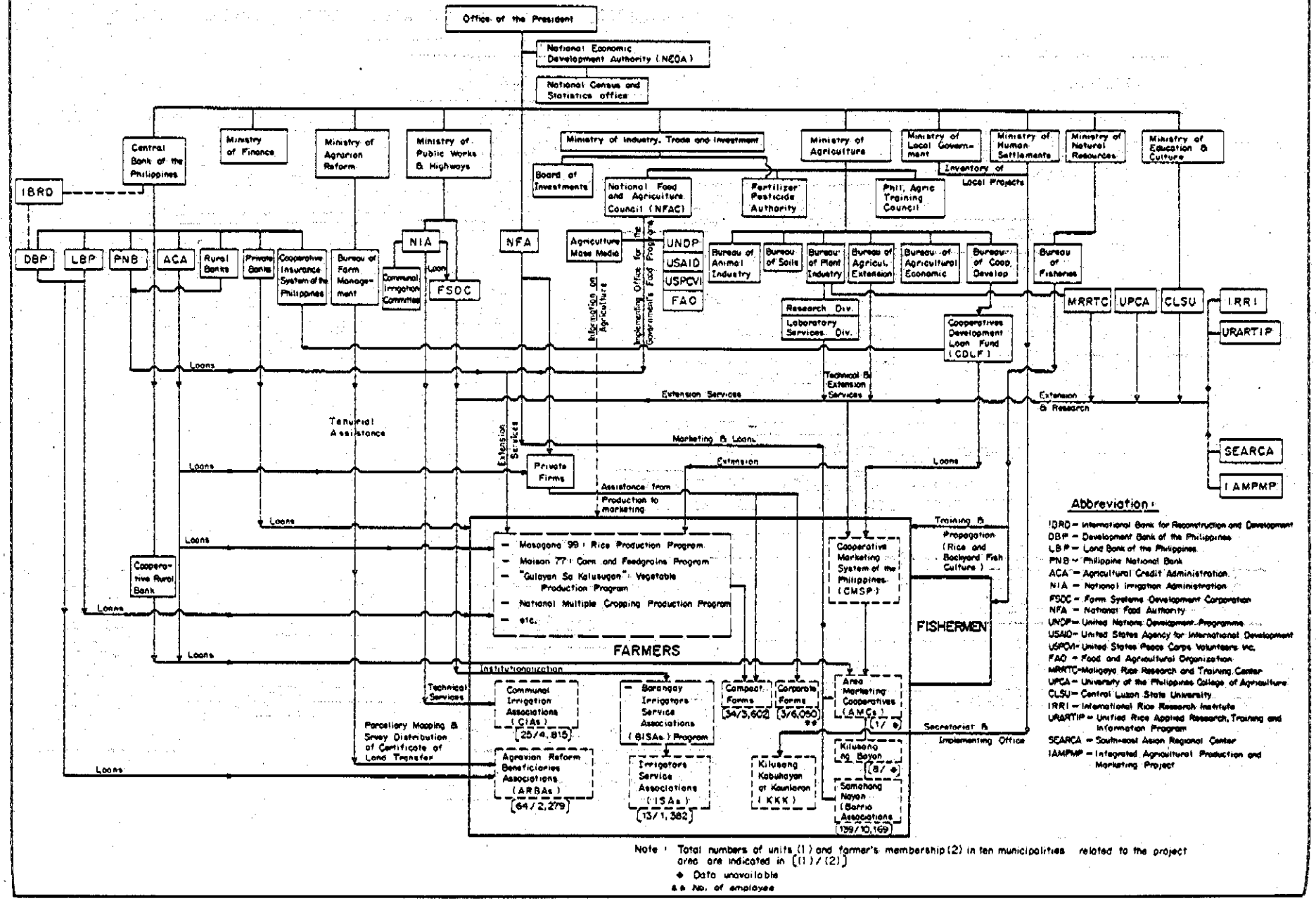

J F M A M J J A S O N D
1. Paddy / Diversified Crop (Rainfed) 2,300ha.
Diversified Crop (200ha.)
Wet Season Paddy (2,300ha.)
2. Paddy/Diversified Crop (Irrigated) 4,000ha.
Diversified Crop (400ha.)
Wet Season Paddy (4,000ha.)
3. Paddy-Octobarial (Irrigated) 2,900ha.
Dry Season Paddy (2,900ha)
4. Paddy / Paddy (Irrigated) 2,300ha.
Dry Season Paddy (2,300ha.)
Wet Season Paddy (2,300ha.)
Transplanting.
(hrs / day)
Sunshine Hours
8
6
4
(°C)
Temperature
40
35
30
25
20
15
(mm)
Rainfall
500
400
300
200
100
0
Sunshine Hours
Max. Temp.
Mean Temp.
Min. Temp.
Rainfall.
J F M A M J J A S O N D

図 3.1 1.1　米および籾の流通経路



Source: National Food Authority, Statistics Department, Manila

図 3.1 2.1 農業および食糧開発計画に関する政府の開発組織



Note : Total numbers of units (1) and farmer's membership (2) in ten municipalities related to the project area are indicated in [(1) / (2)]

◆ Data unavailable

** No. of employee

図3.1 3.1　Pampanga川およびPasag（Guagua）川流域一般図

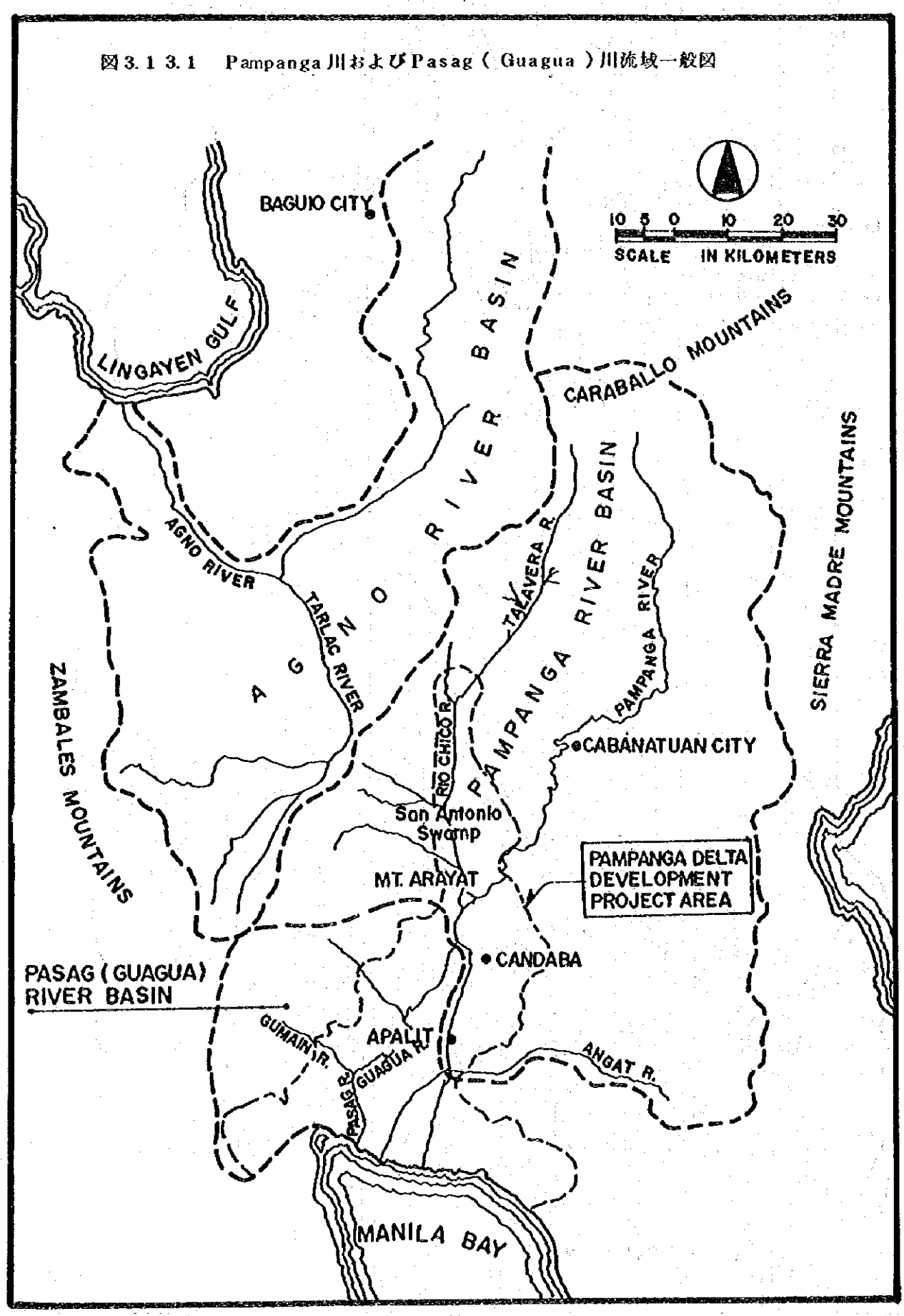


図 3.1 3.2　Pampanga 川および Pasag（Guagua）川流域分割図

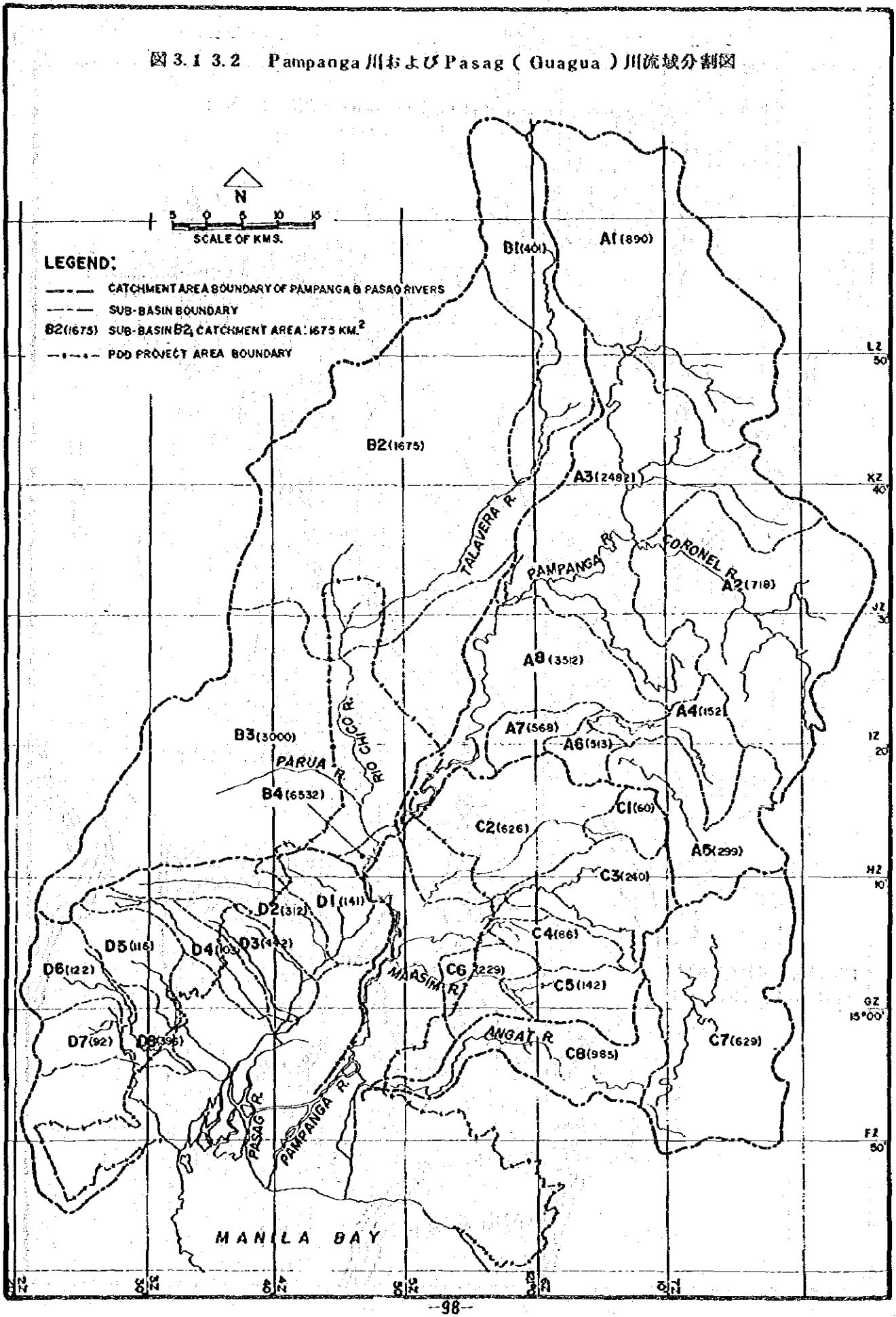


図 3.1 3.3　Pampanga川およびRio－Chico川縦断図

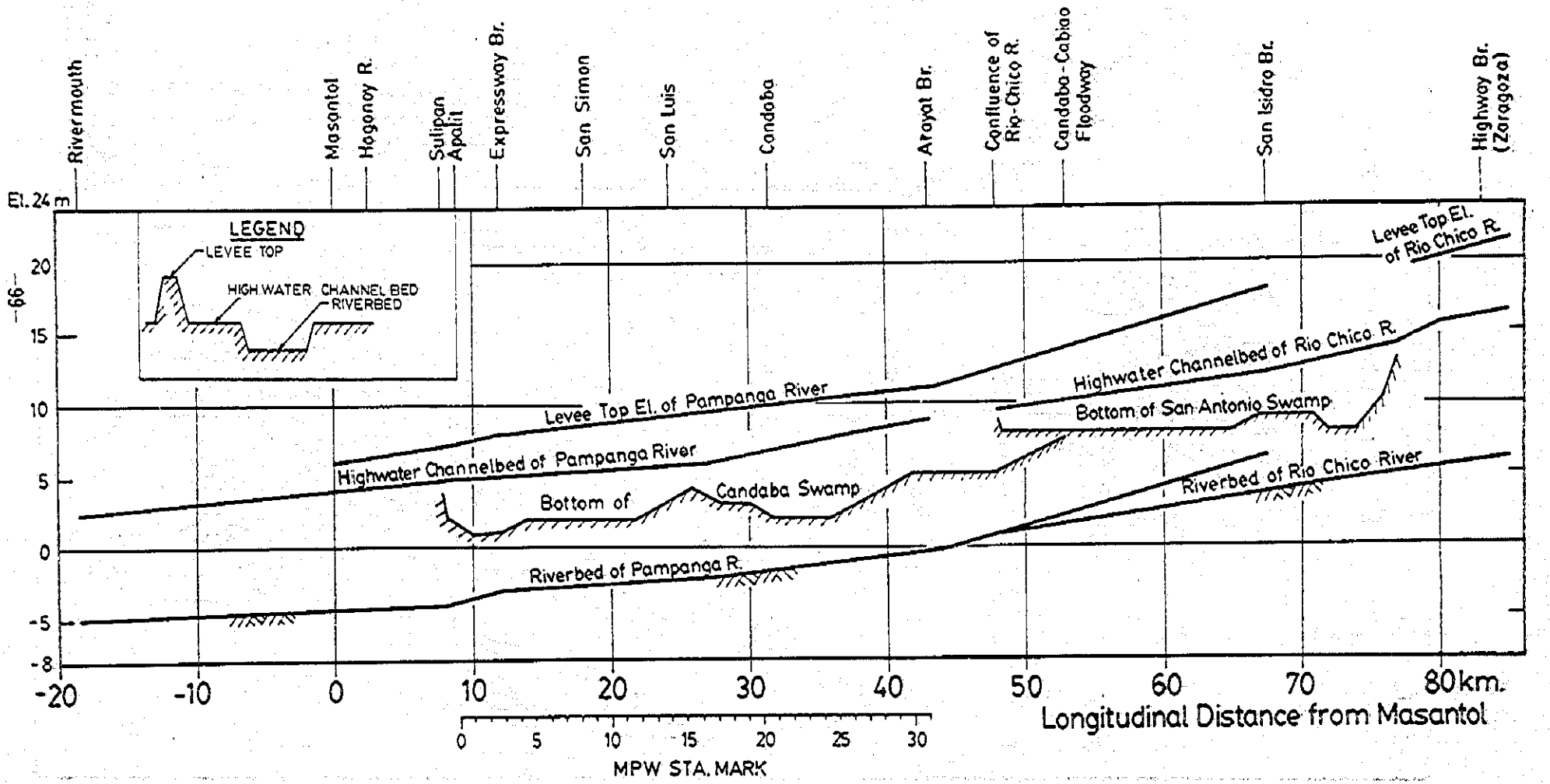


図 3.1 3.4　現治水計画高水流量配分図

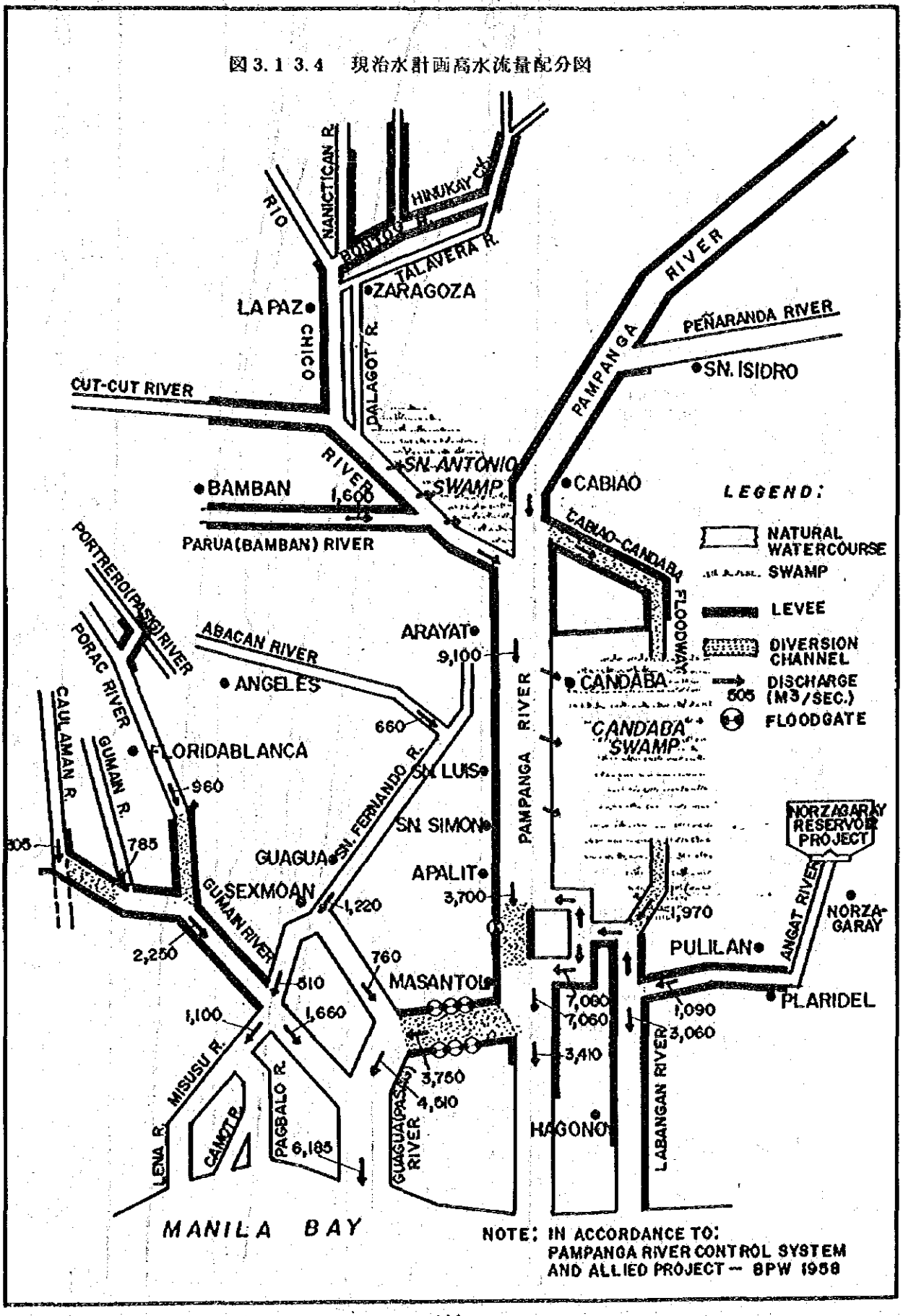


図 3.1 3.5　Pampangaデルタ内の現治水計画および改修工事進捗状況図

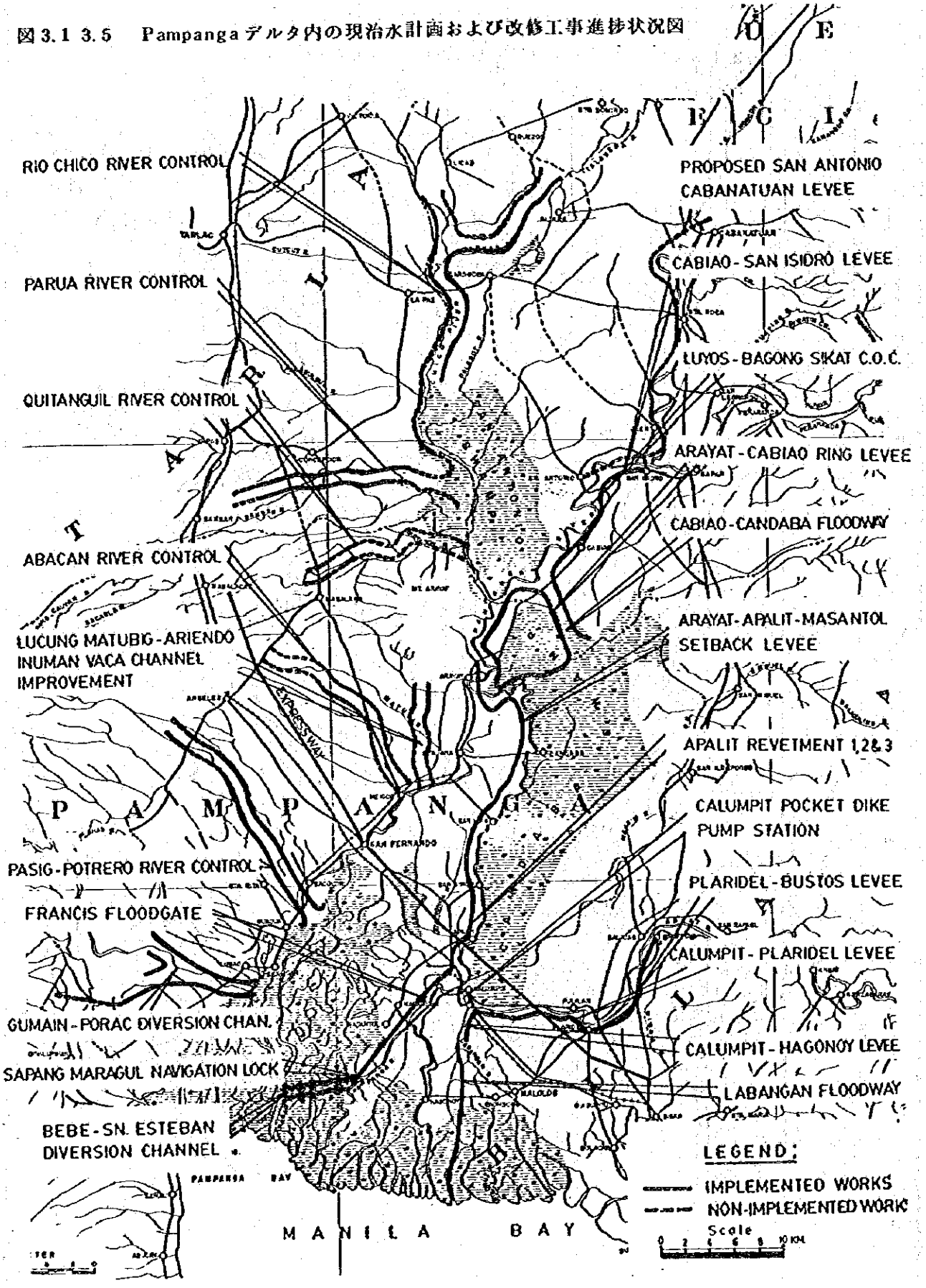


図3.1 3.6　洪水はん濫区域と代表的洪水はん濫の流向

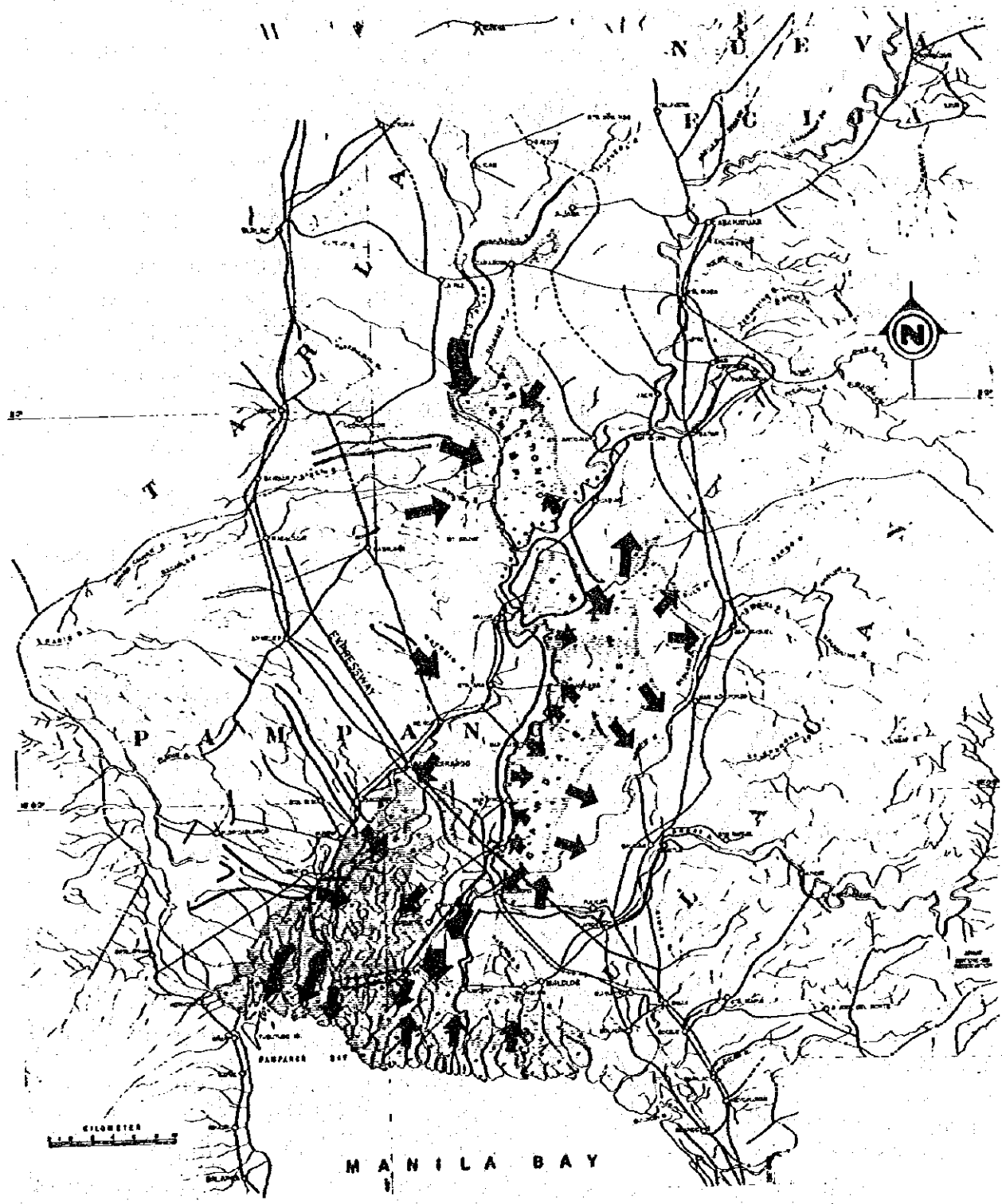


図 4.1.1　治水計画案の概念図

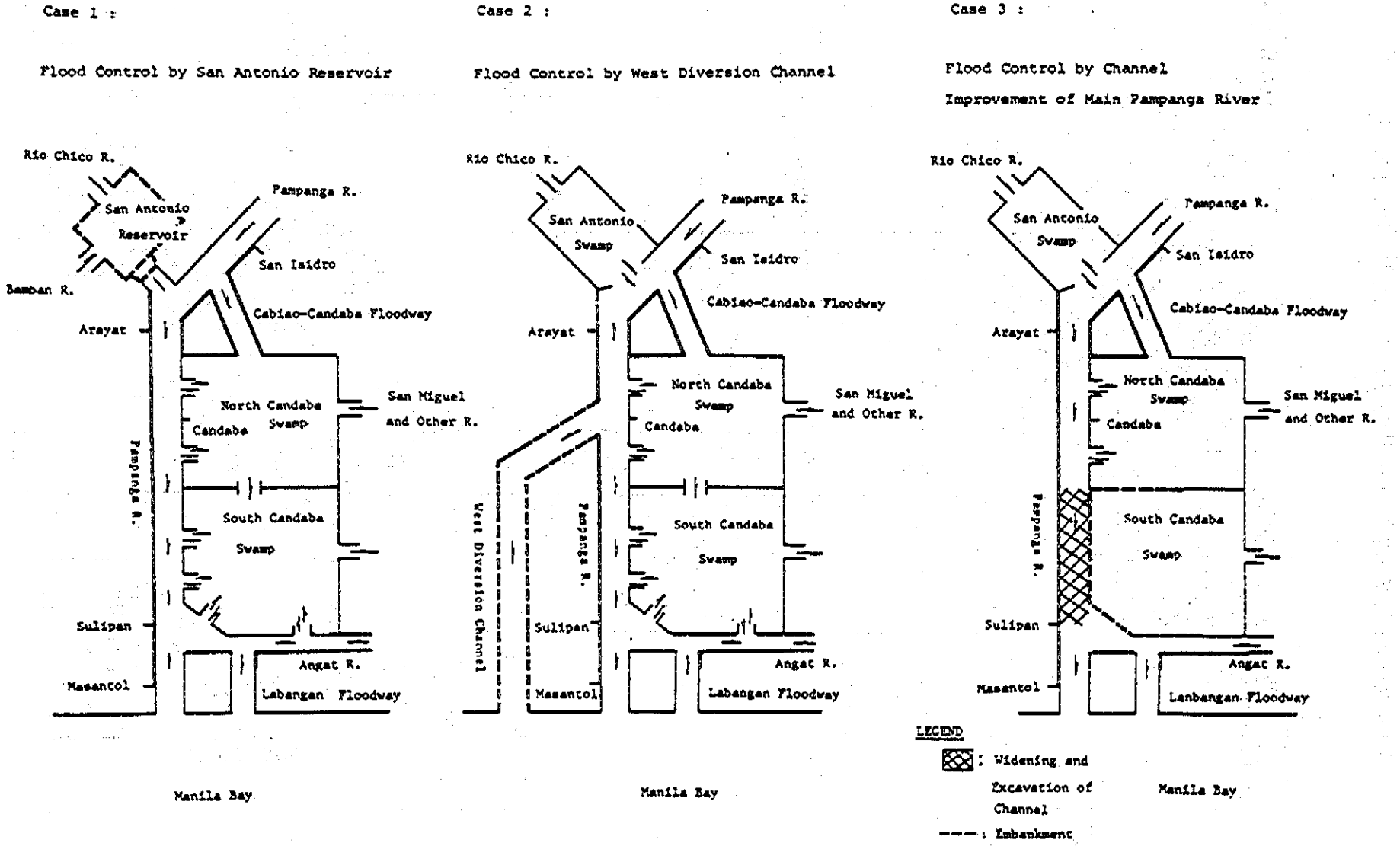


図 4.1.2　治水基本計画（ 1／100 高水対応 ）高水流量配分図

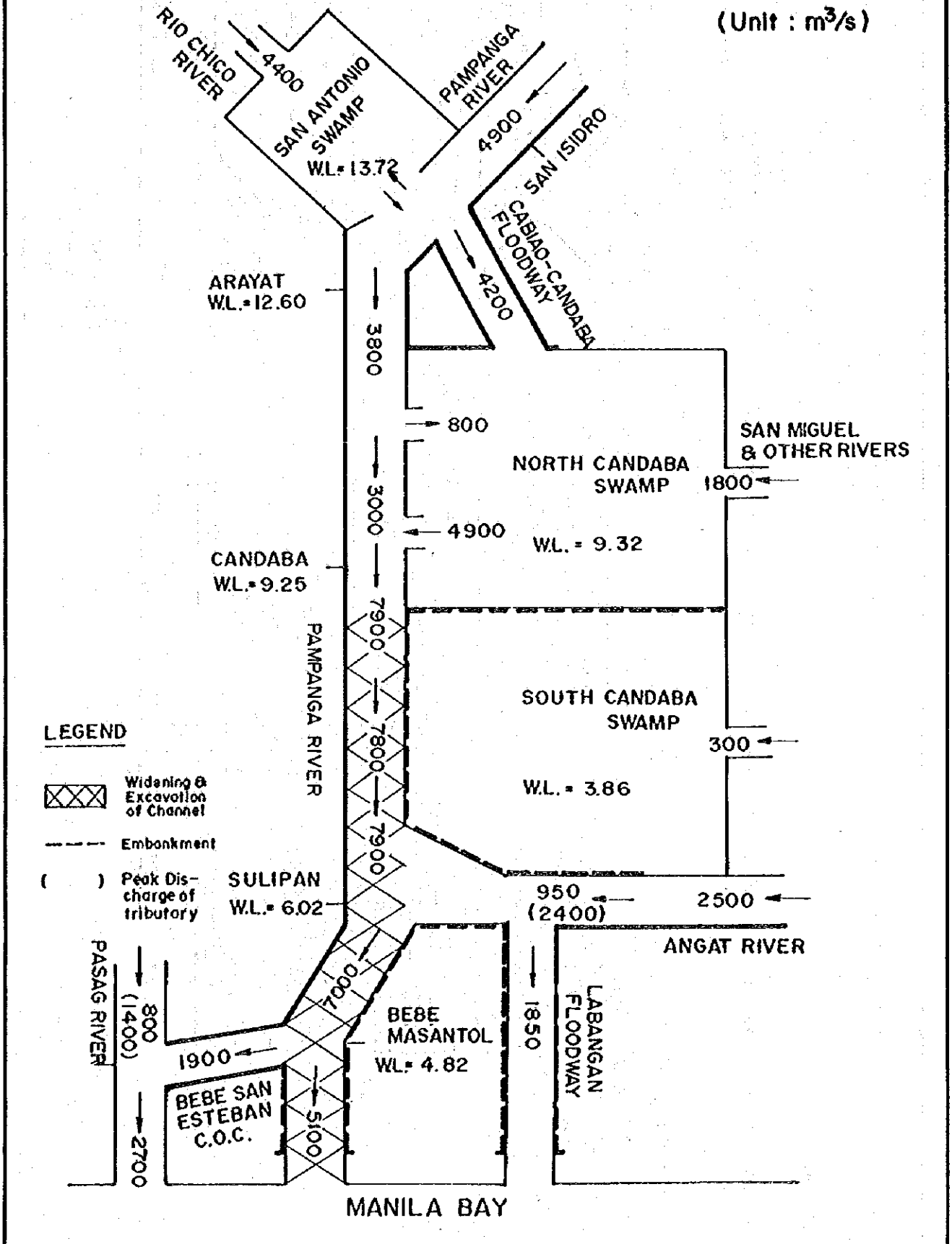


図4.1.3　治水暫定計画（1／20高水対応）高水流量配分図

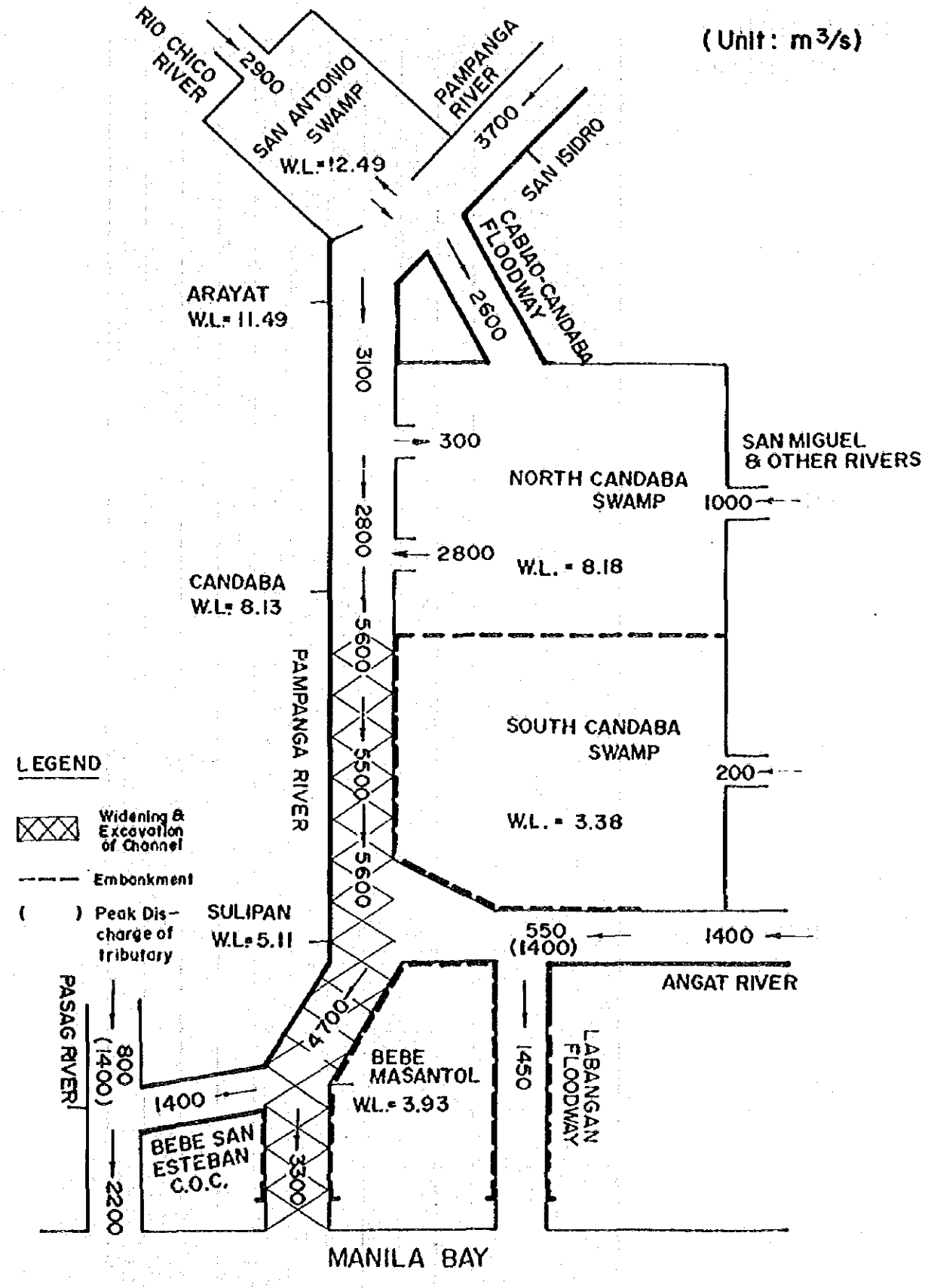
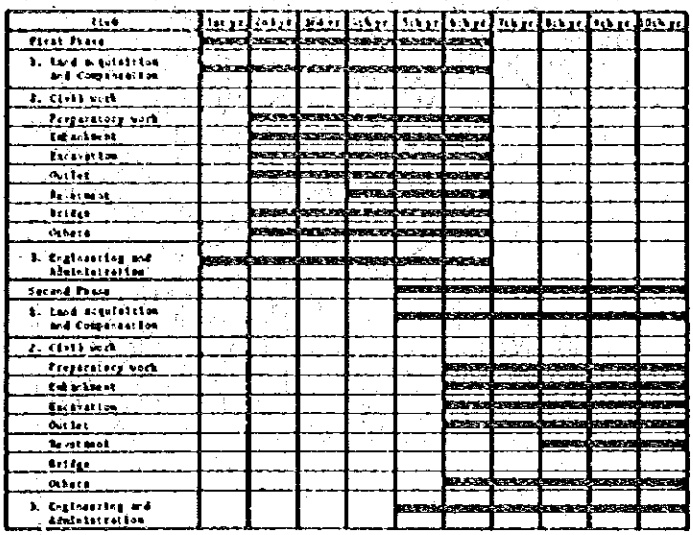
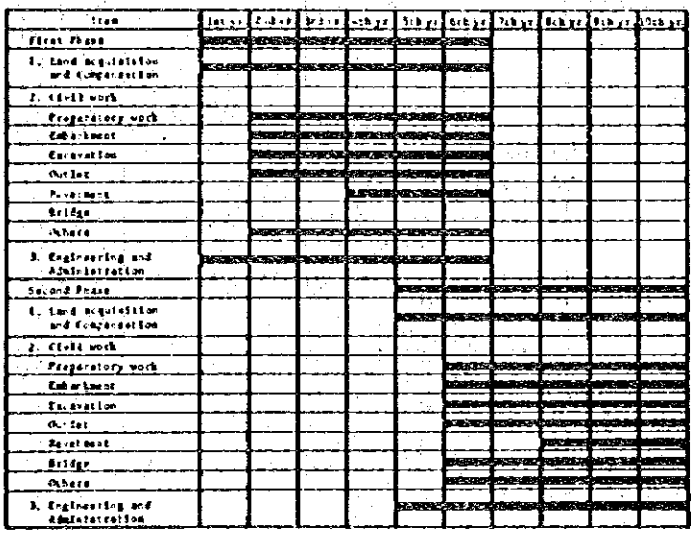


図 4.1.4　治水工事スケジュール

Alternative - 1



Alternative - 2



Alternative - 3

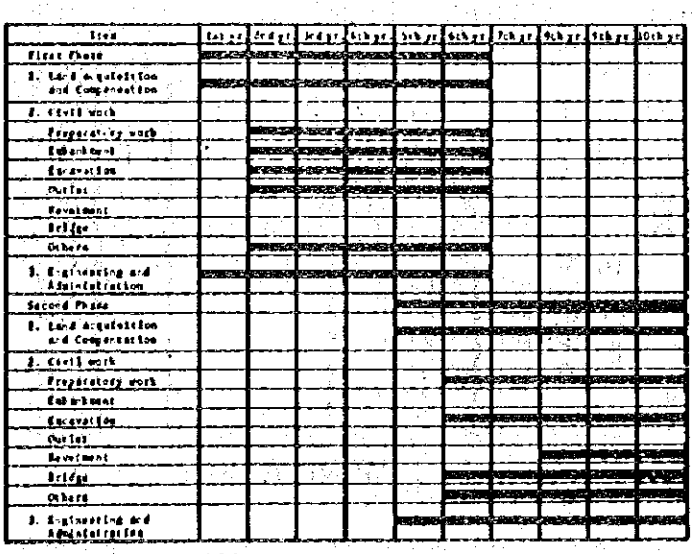


図 4.1.5(1) 高水流量配分図（第1期，工事計画案－1）

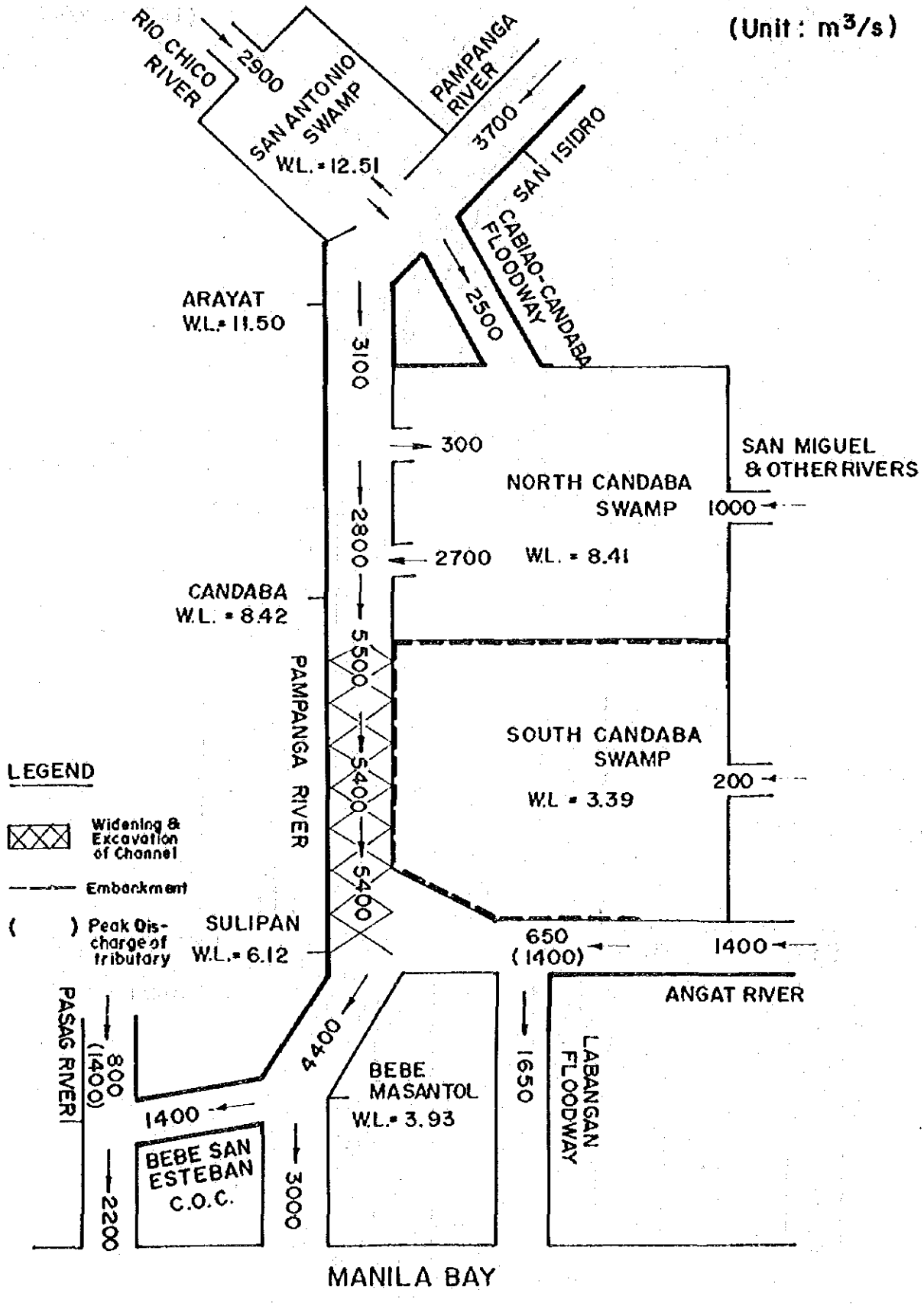


図 4.1.5(2) 高水流量配分図（第1期，工事計画案－2）

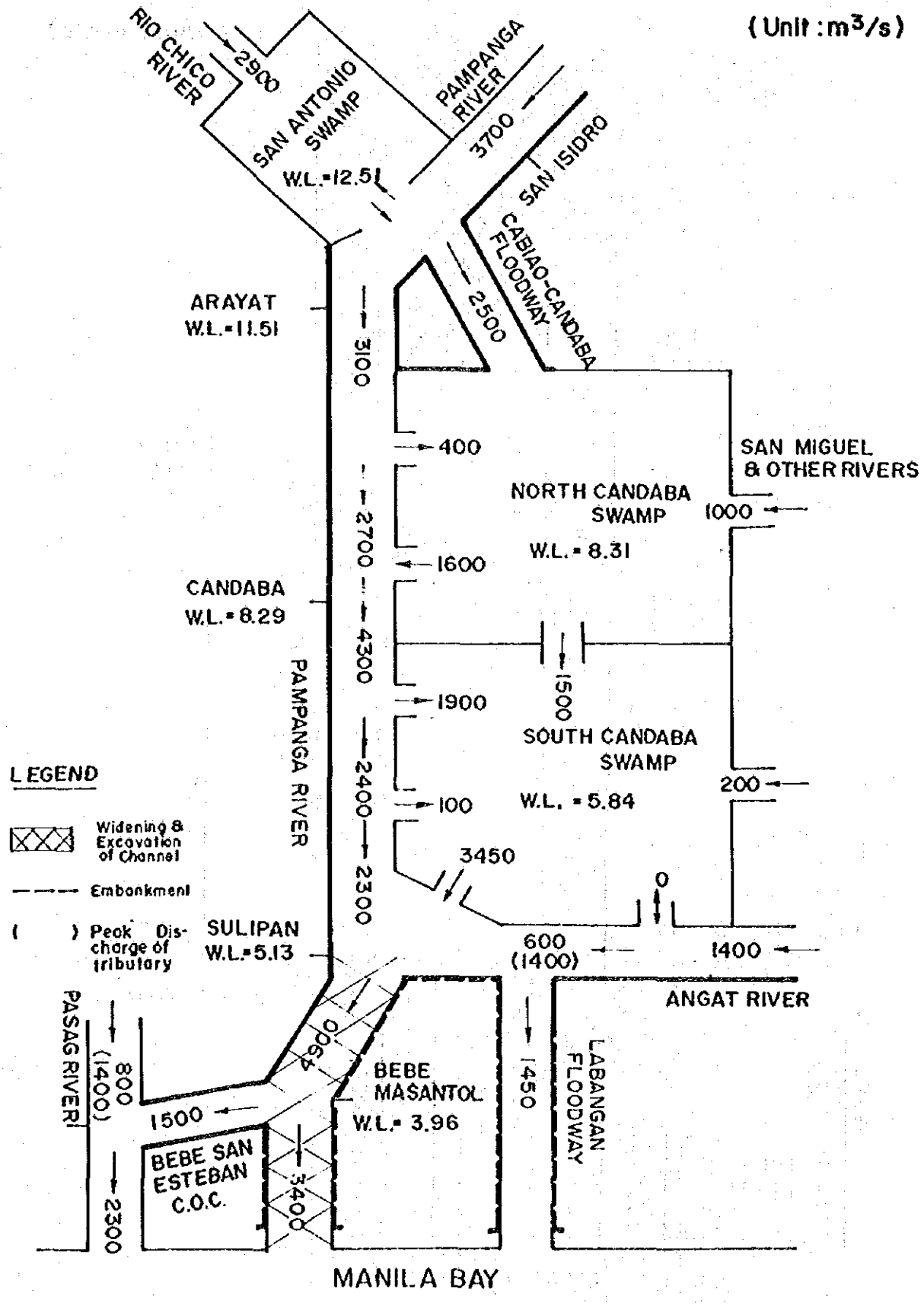


図 4.1.5(3) 高水流量配分図（第1期，工事計画案－3）

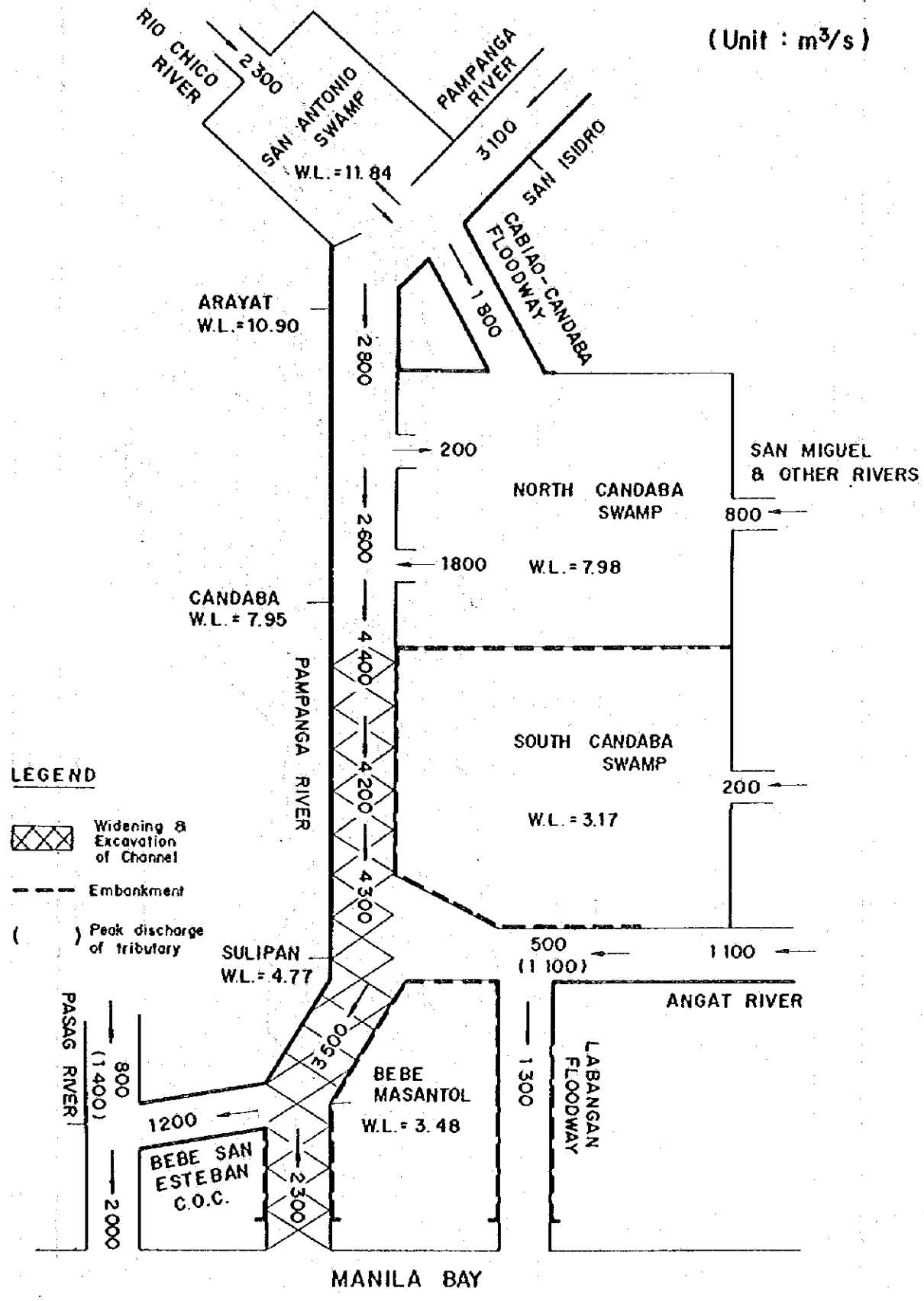


図 4.2.1　かんがい計画概要図

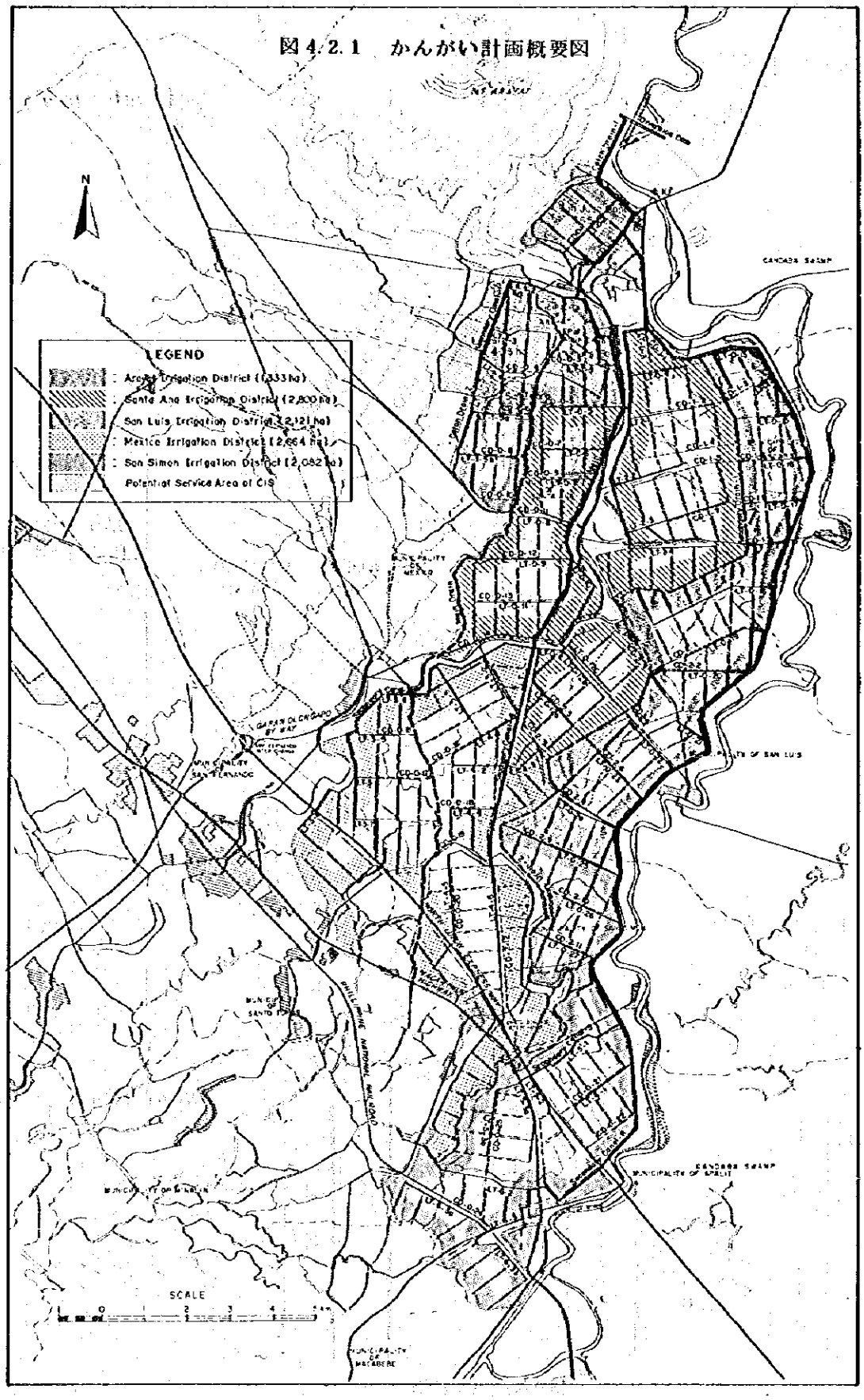


図 4.2.2　計画作付体系

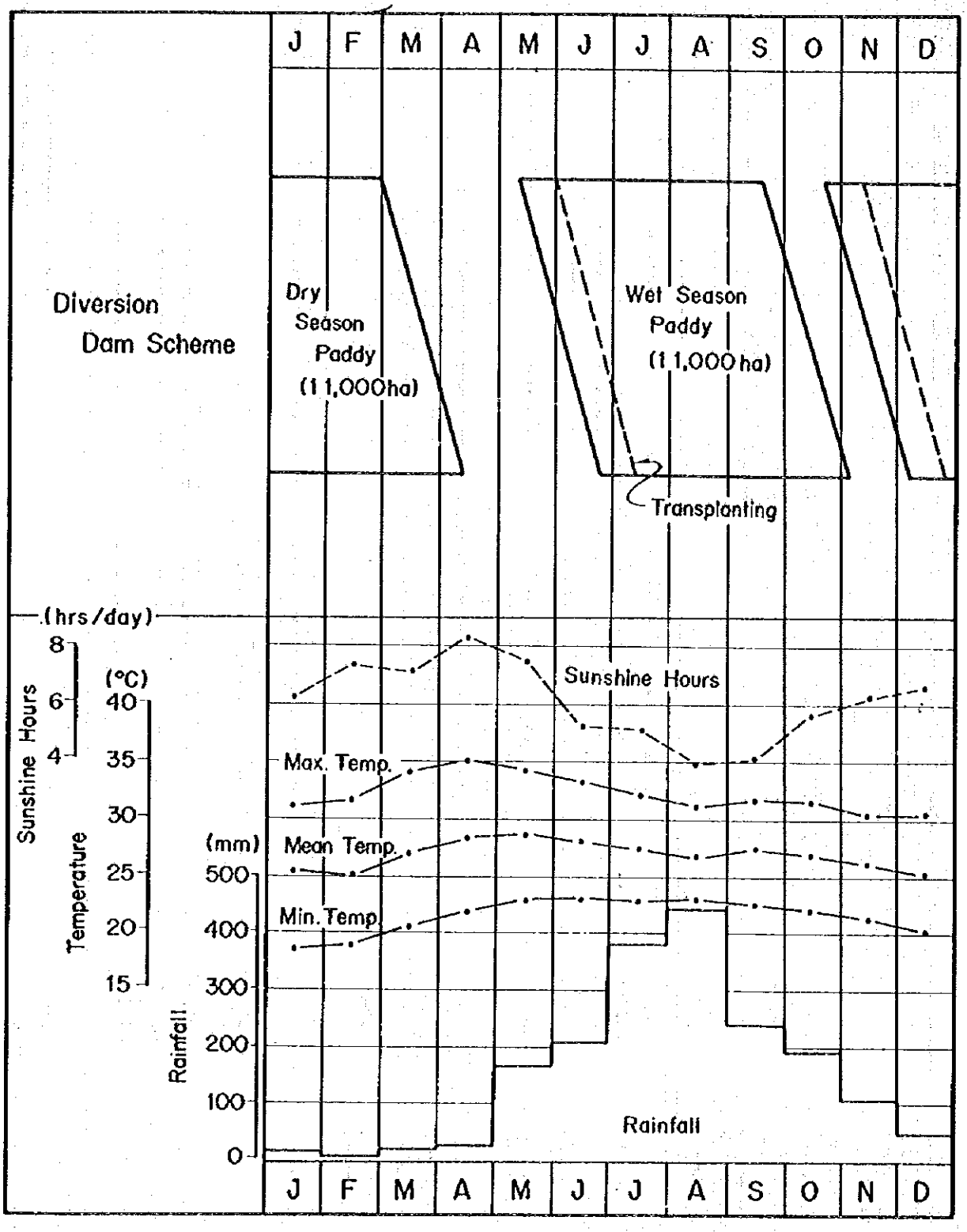

J F M A M J J A S O N D
Diversion
Dam Scheme
Dry
Season
Paddy
(11,000ha)
Wet Season
Paddy
(11,000ha)
Transplanting
(hrs/day)
8
6
4
Sunshine Hours
(°C)
40
35
30
25
20
15
Temperature
Sunshine Hours
Max. Temp.
Mean Temp.
Min. Temp.
(mm)
500
400
300
200
100
0
Rainfall
Rainfall
J F M A M J J A S O N D

図 4.2.3　かんがい計画実施スケジュール

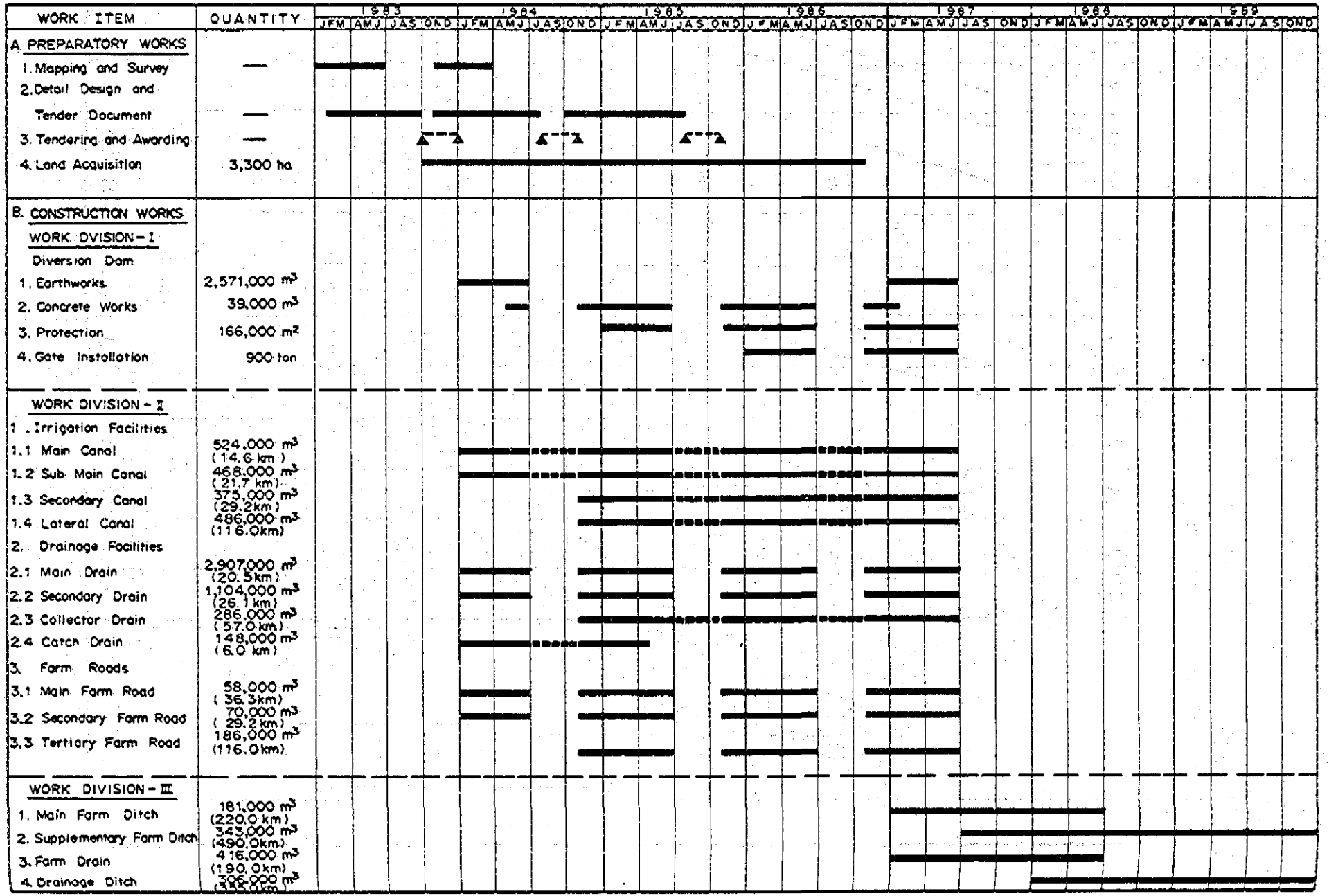


図 5.1.1　Pampanga川治水事業の現況運営組織図

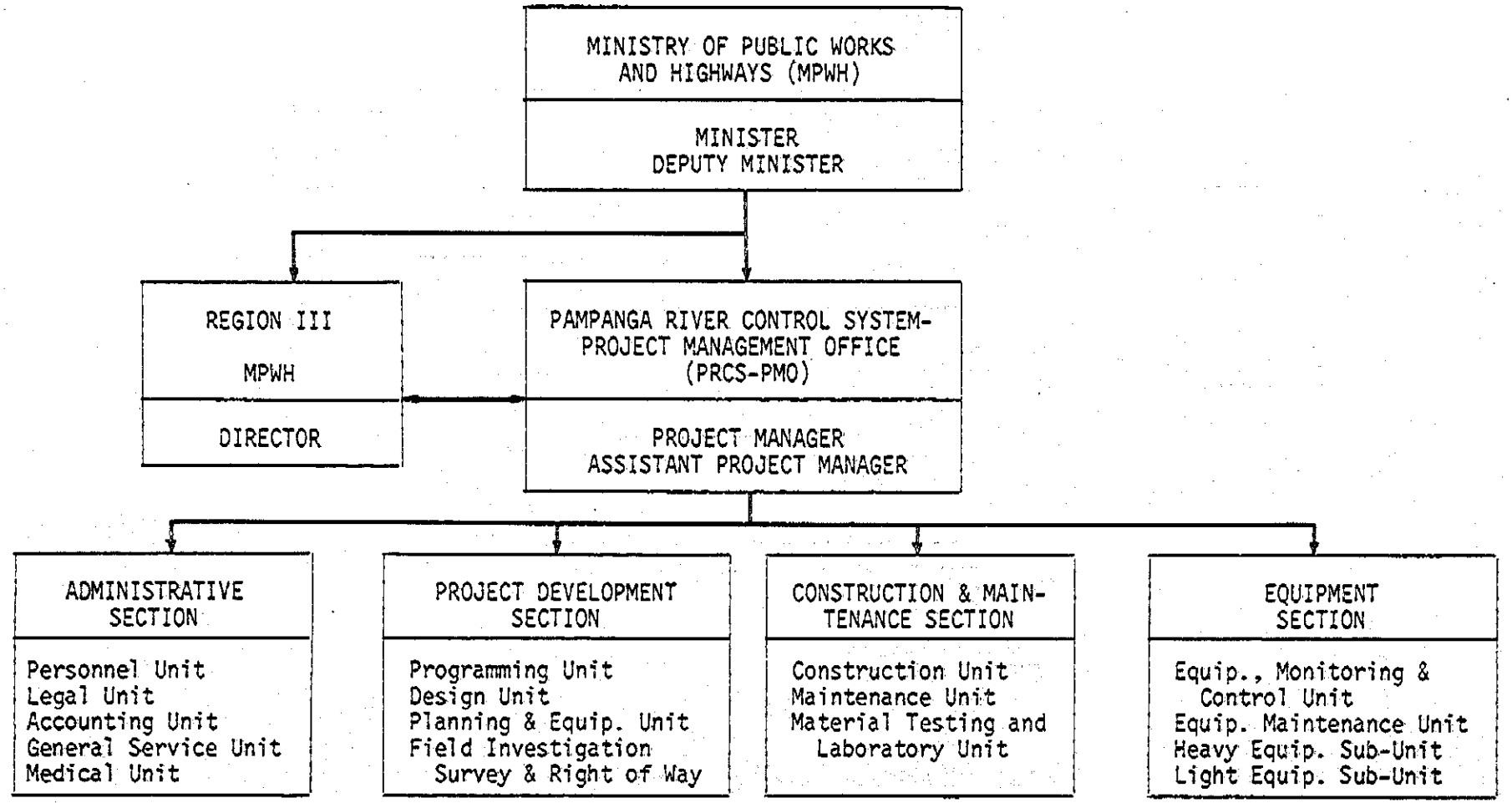


図 5.1.2　治水事業実施段階の組織図

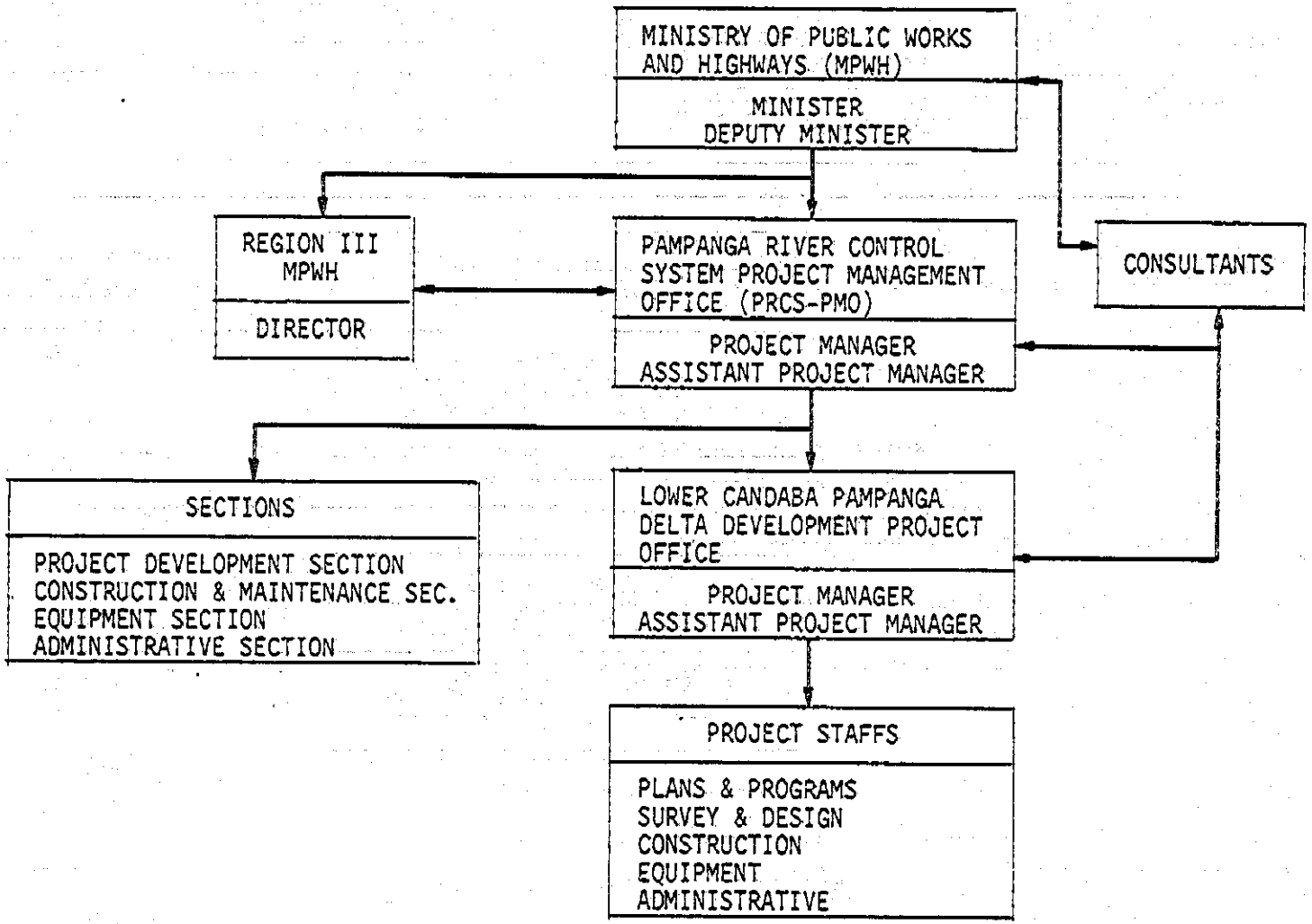
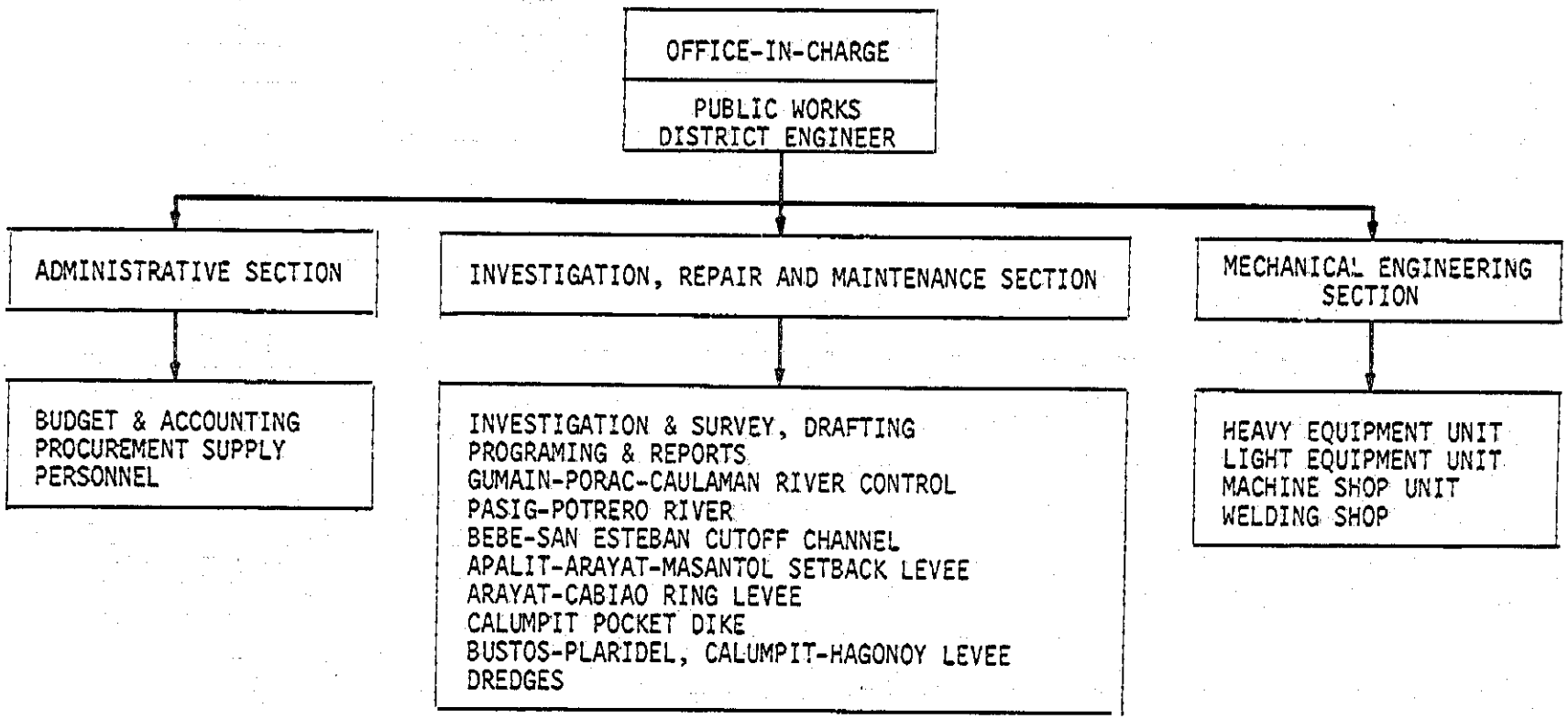


図 5.1.3　Pampanga川水防団組織図



LEGEND: Flood Stages along Pampange River-Mobilization of Personnel

Stage - I, Bank levee: All heads only will patrol their respective assignment
Stage - II, Bank overflow: All heads and one aide will patrol their respective assignment
Stage - III, Arnedo Dike overflow: All personnel will patrol their respective assignment

図 5. 2. 1　かんがい計画の施工段階における組織図

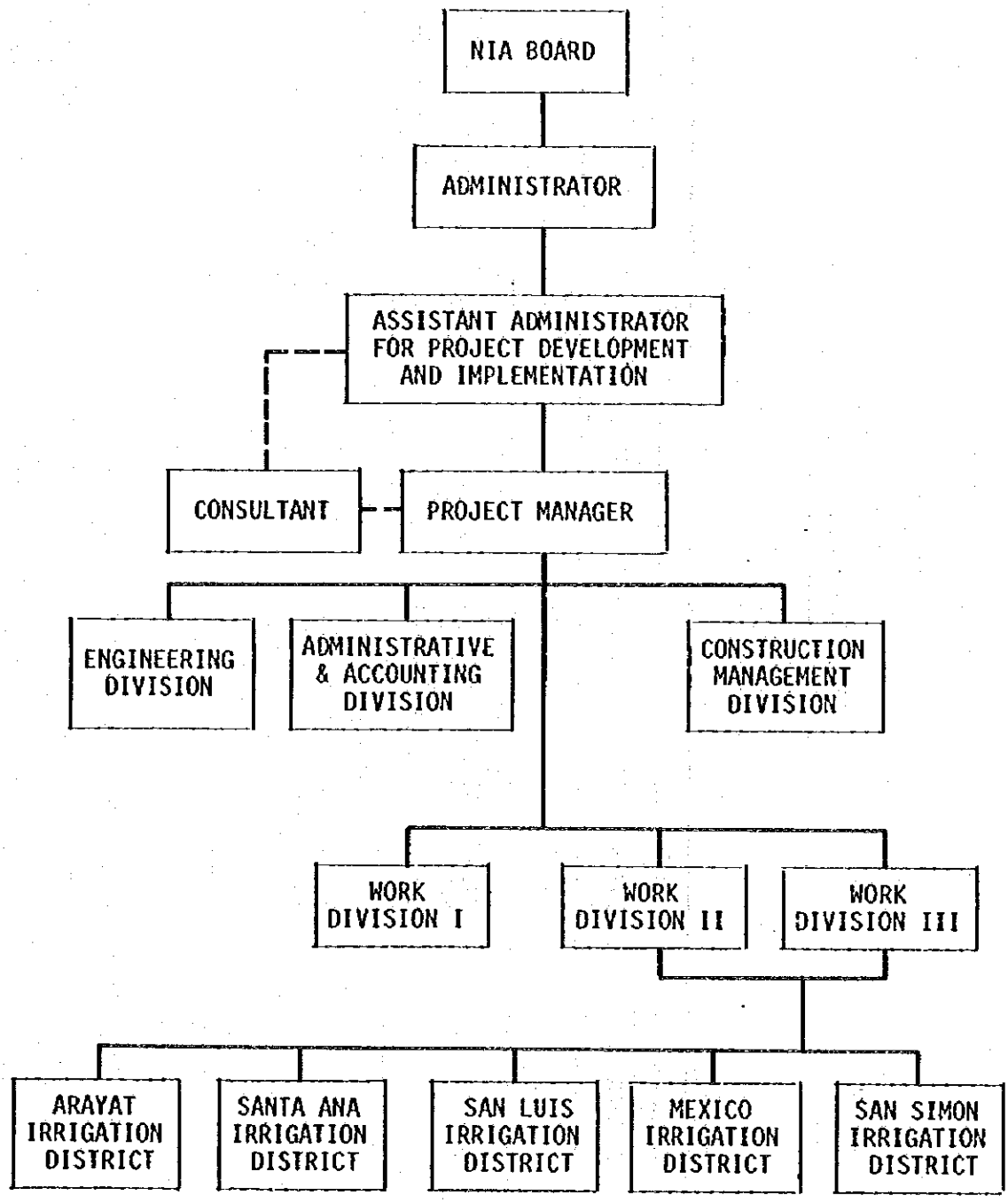


図 5.2.2　かんがい計画の維持・運営組織

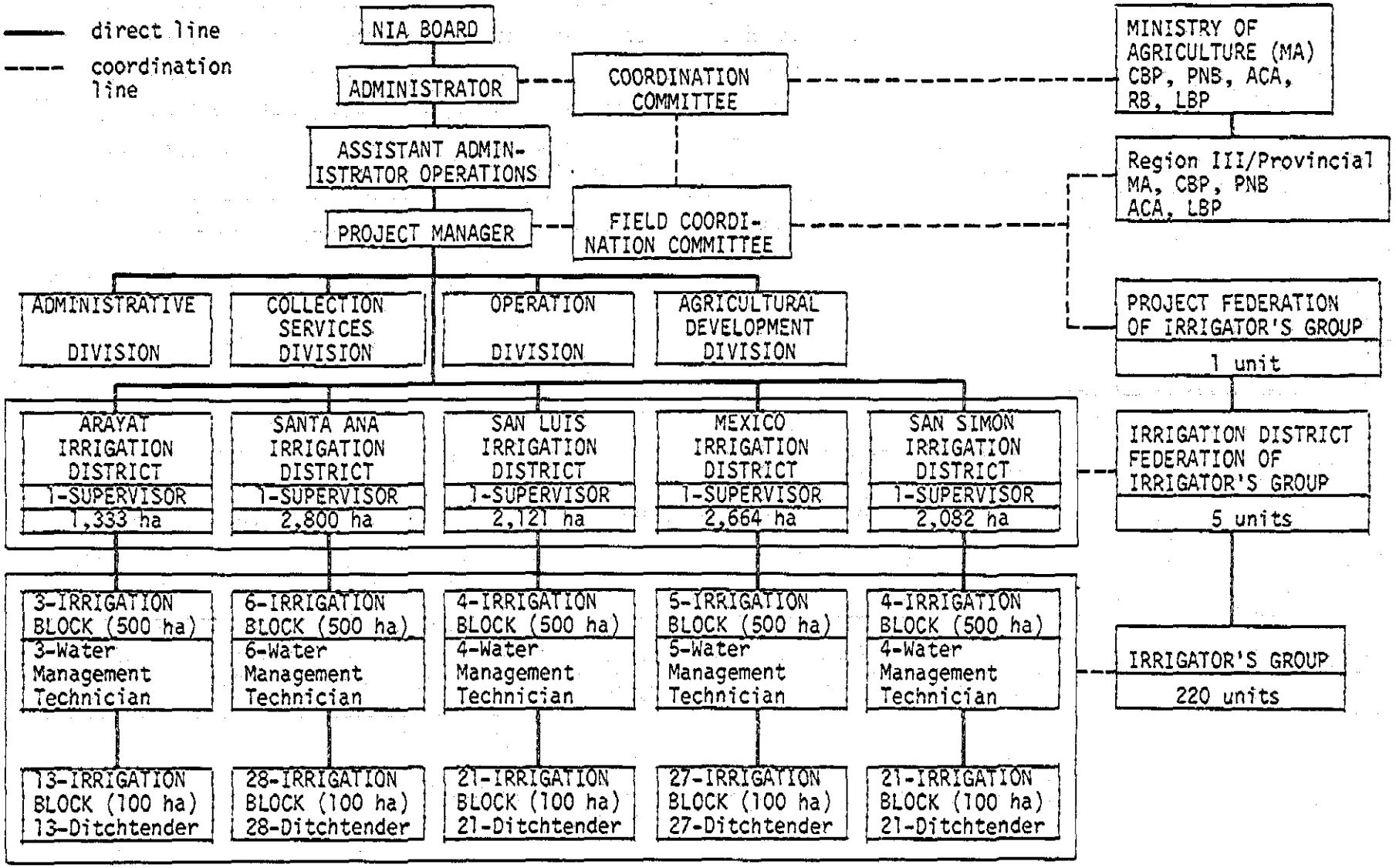
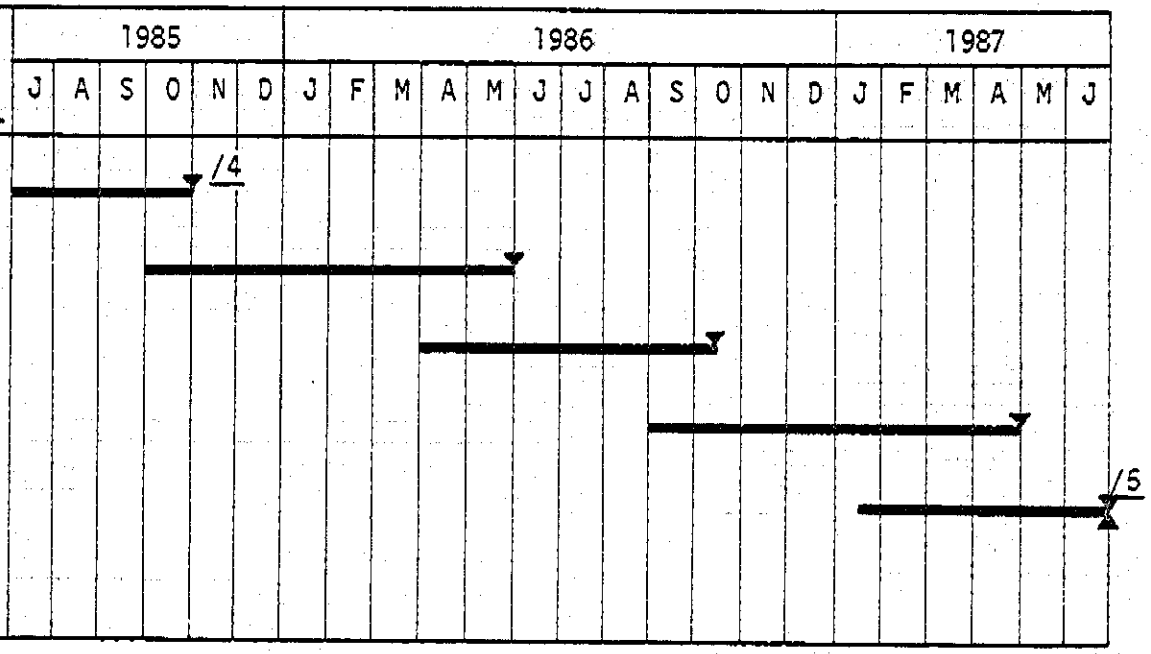


図 5.2.3 農民組織の設立計画

Name of Irrigation District	Command Area (ha)	No. of Farm Households (No.) /2	No. of IG (No.) /3
Arayat	1,333	557	27
Santa Ana	2,800	1,170	56
San Luis	2,121	887	43
Mexico	2,664	1,114	53
San Simon	2,082	872	41
Total	11,000	4,600	220



/1: Parcellary map necessary for setup of irrigator's group will be conducted for the entire irrigation service area (11,000 ha) during period of April, 1984 to June, 1985. Design of farm ditch and farm drain will be done in parallel with irrigator's group setup for each irrigation district

/2: Estimated number of farm households in Irrigation District

/3: Estimated number of irrigator's group in Irrigation District

/4: Establishment of irrigation district federation of irrigator's groups

/5: Establishment of project federation of irrigator's groups