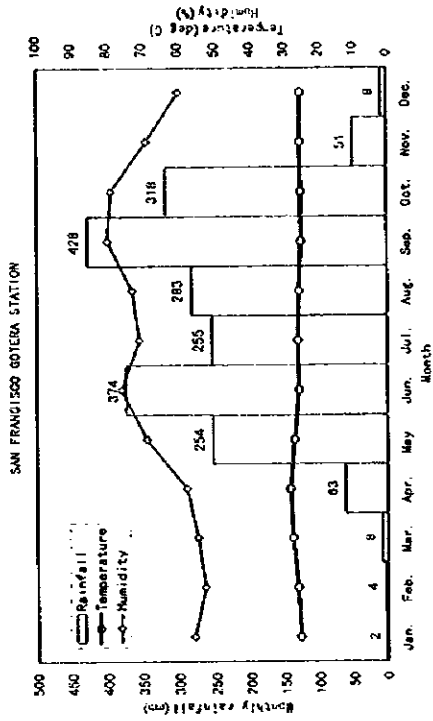


Figure M.1.1 RIVER SYSTEMS IN EL SALVADOR

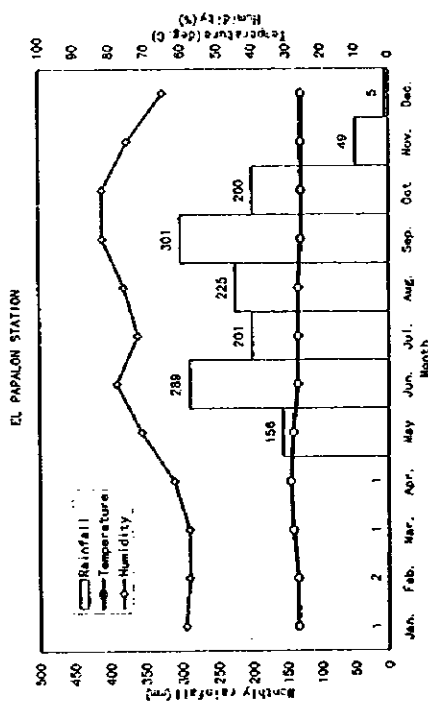




**SAN FRANCISCO COTERA STATION**

Month	Rainfall (mm)	Temperature (deg.C)	Humidity (%)	Wind velocity (km/h)	Wind direction
Jan.	2	25.8	56	3.6	N
Feb.	4	26.5	53	3	N
Mar.	8	27.9	55	3	N
Apr.	63	28.6	58	3	N
May	254	27.4	69	3	N
Jun	374	26	76	3	N
Jul	255	26.3	71	3	N
Aug.	283	25.9	73	3	N
Sep.	428	25.3	80	3	N
Oct.	318	25.4	79	3	N
Nov.	51	25.6	69	3	N
Dec.	8	25.5	60	3	N
Annual total(1)	2048	26.4	67		
Total(May-Oct)(2)	1912	28.6	80		
(2)/(1) (%)	93	25.3	53		

For temp./humid. Mean Max Min.



**EL PAPON STATION**

Month	Rainfall (mm)	Temperature (deg.C)	Humidity (%)	Wind velocity (km/h)	Wind direction
Jan	1	26.9	59	5.0	N
Feb	2	27	58	5.0	N
Mar	1	28.1	58	5.0	S
Apr.	1	29	62	5.0	S
May	156	28.2	71	3.0	S
Jun	201	26.9	78	1.0	SE
Jul	201	26.8	72	5.0	N
Aug.	225	26.7	76	5.0	N
Sep.	301	25.9	82	5.0	S
Oct.	200	25.8	82	1.0	S
Nov.	49	25.8	75	5.0	N
Dec.	5	25.8	65	5.0	N
Annual total(1)	1431	26.9	70		
Total(May-Oct)(2)	1372	29.0	82		
(2)/(1) (%)	96	25.8	58		

For temp./humid. Mean Max Min.

Figure M.I.3 CLIMATE CONDITIONS OF STUDY AREA

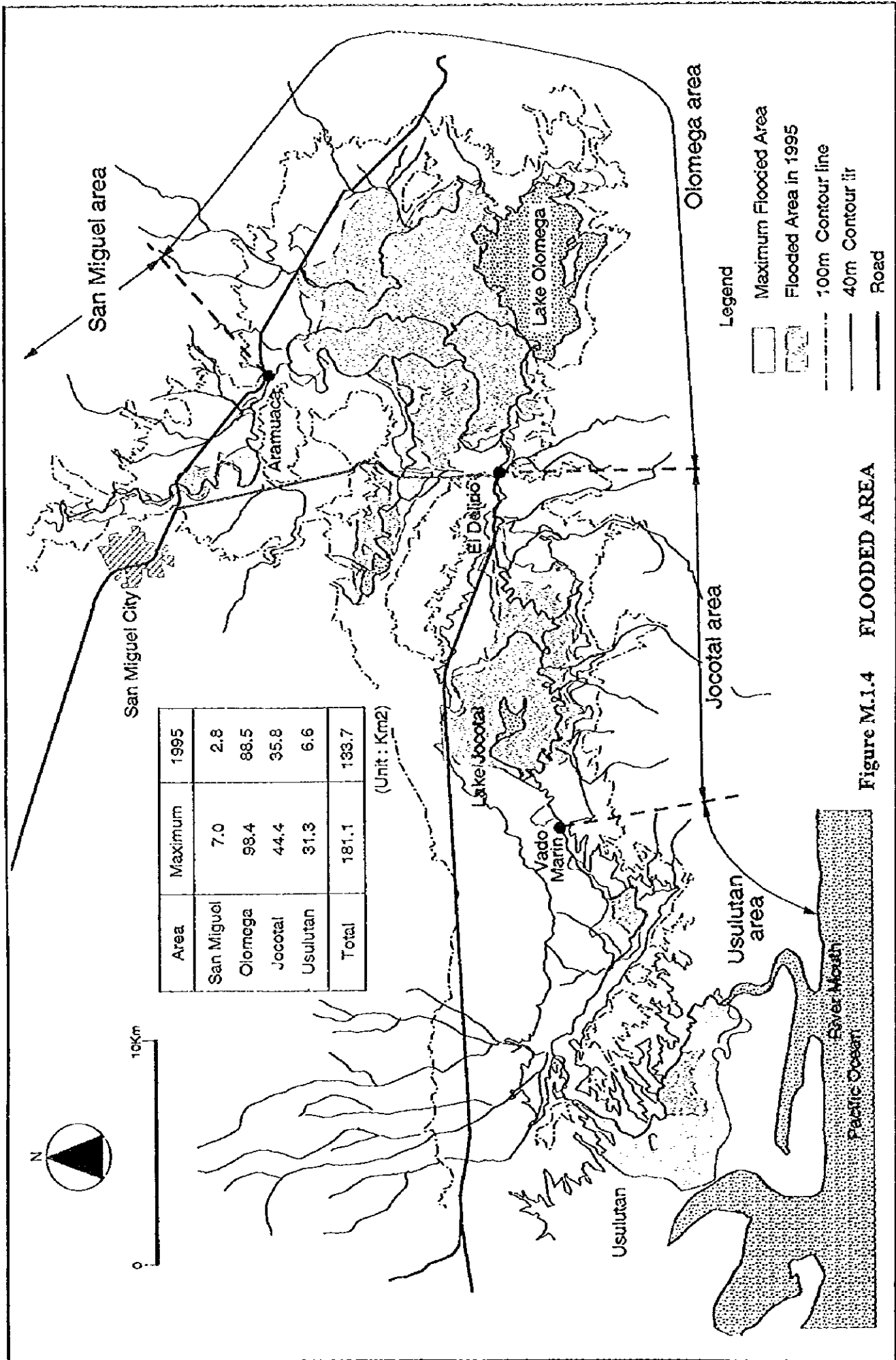
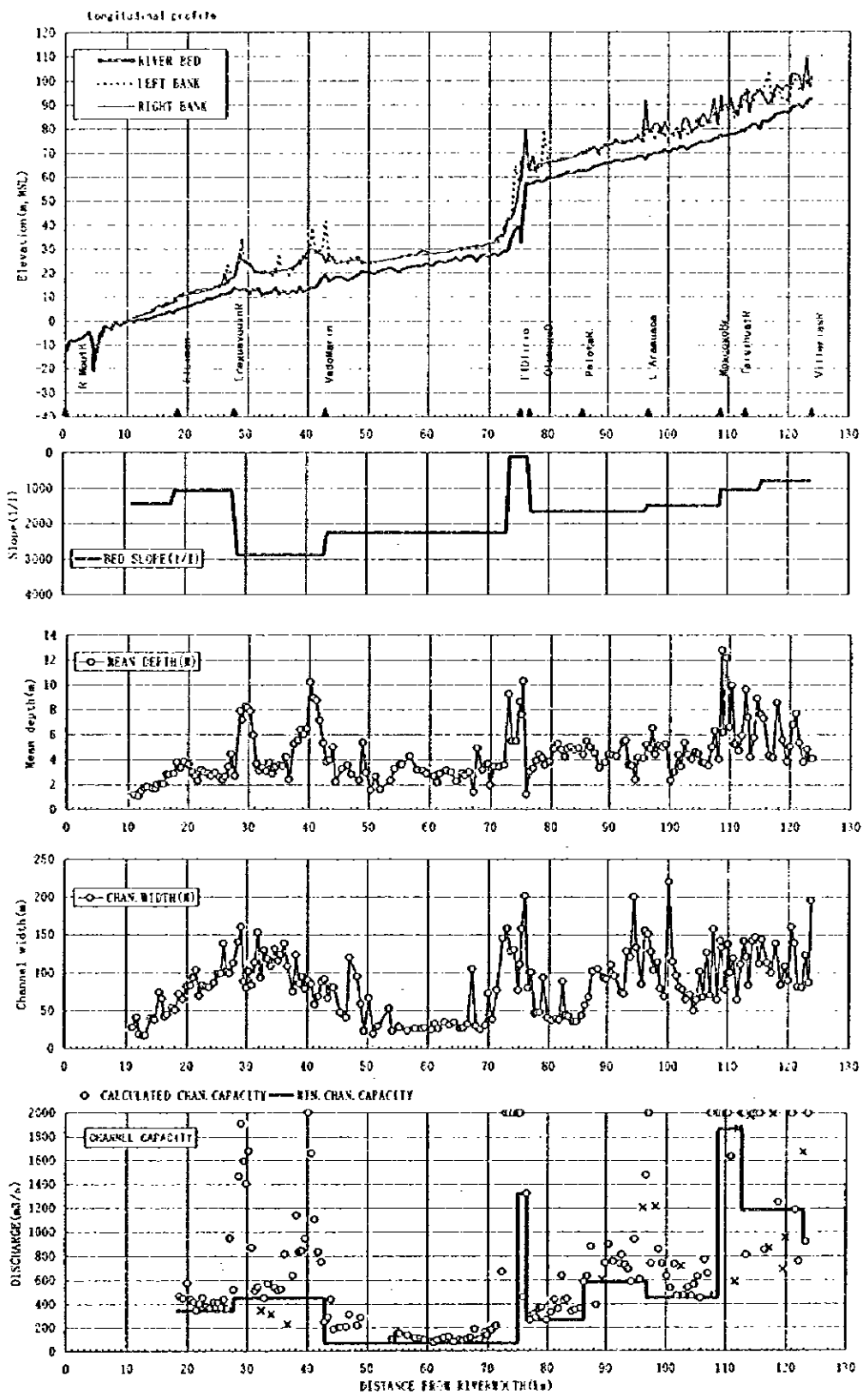


Figure M.1.4 FLOODED AREA



**Figure M.1.5 PROFILES OF EXISTING SAN MIGUEL RIVER**

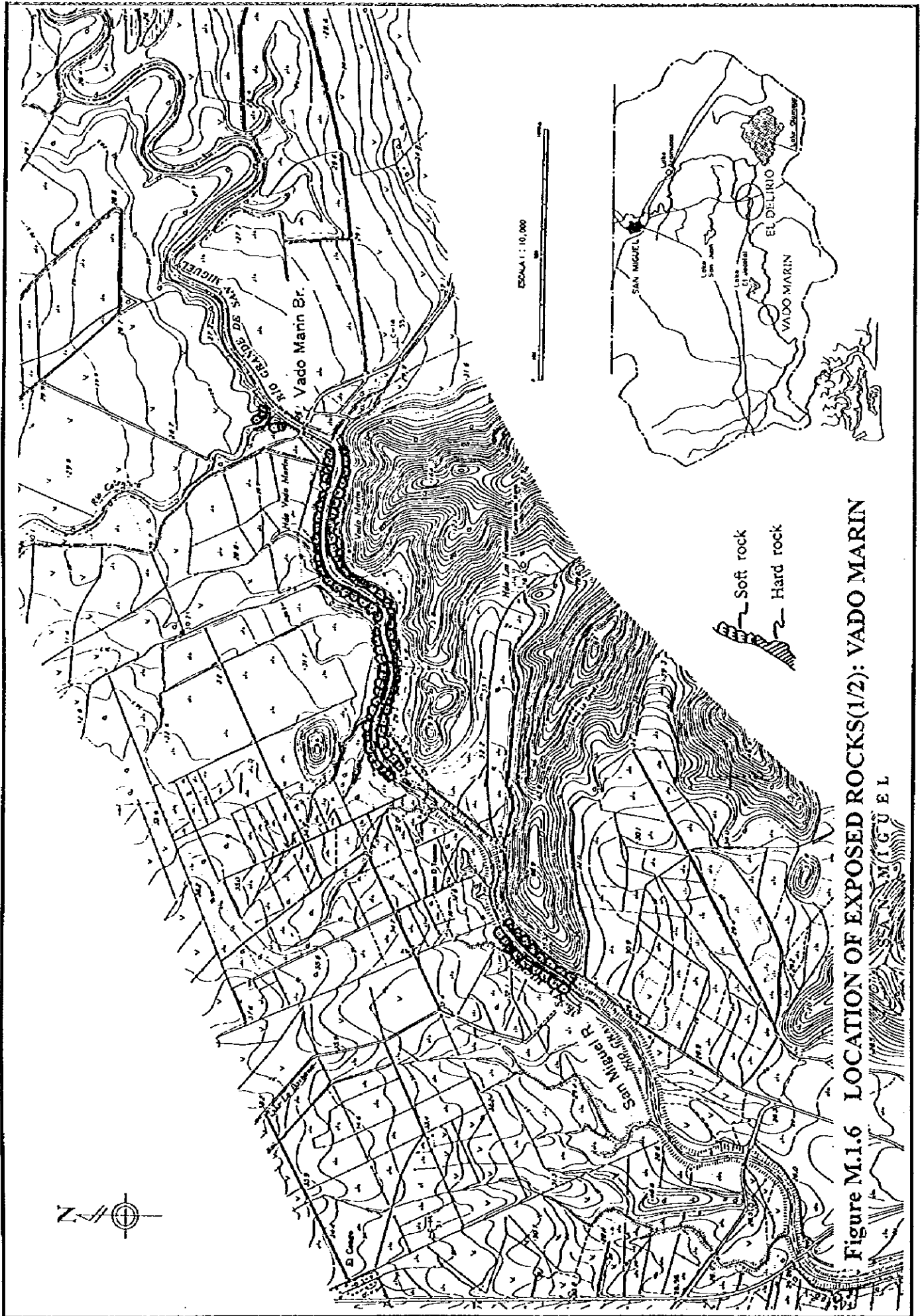


Figure M.1.6 LOCATION OF EXPOSED ROCKS(1/2): VADO MARIN

SEAN M/GUE L

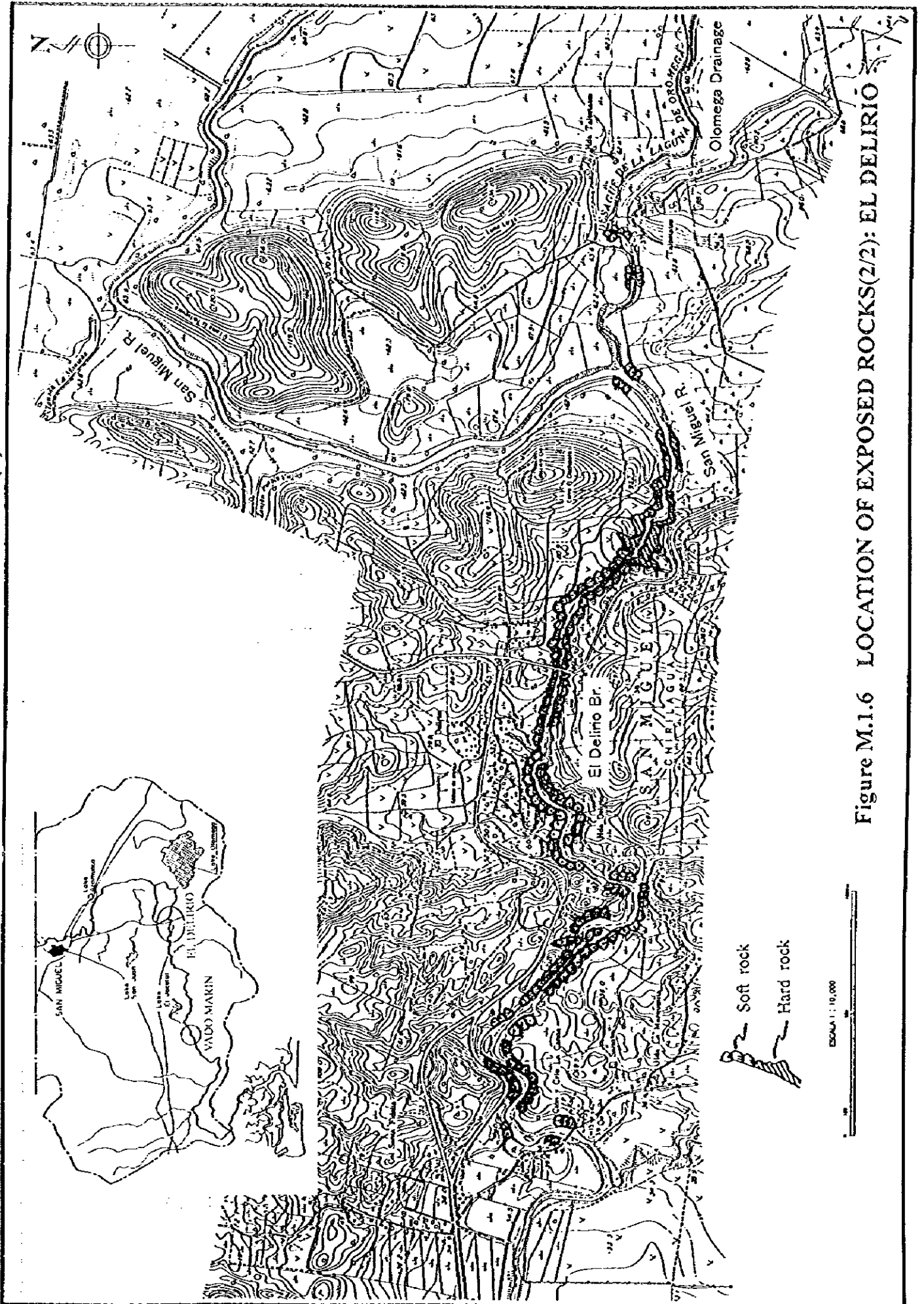
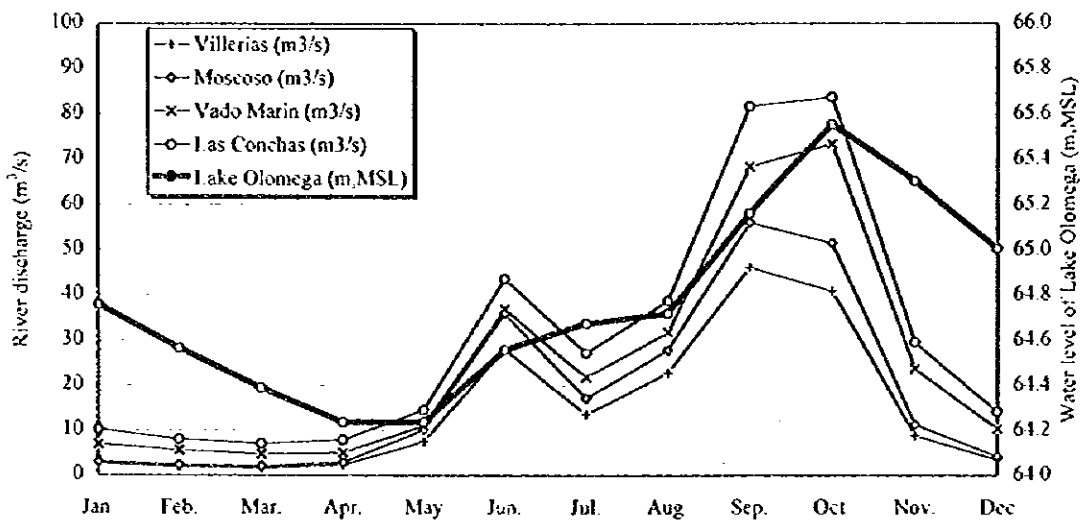
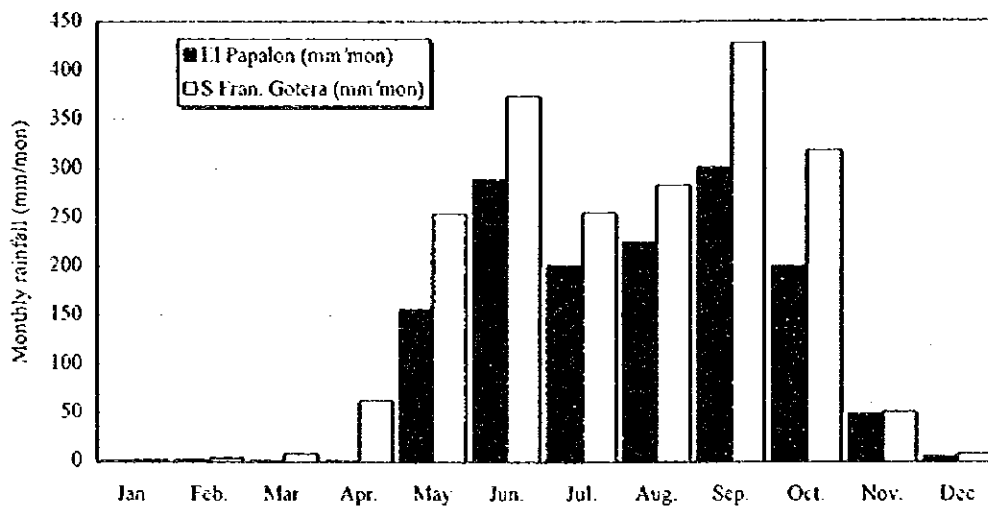


Figure M.1.6 LOCATION OF EXPOSED ROCKS(2/2): EL DELIRIO

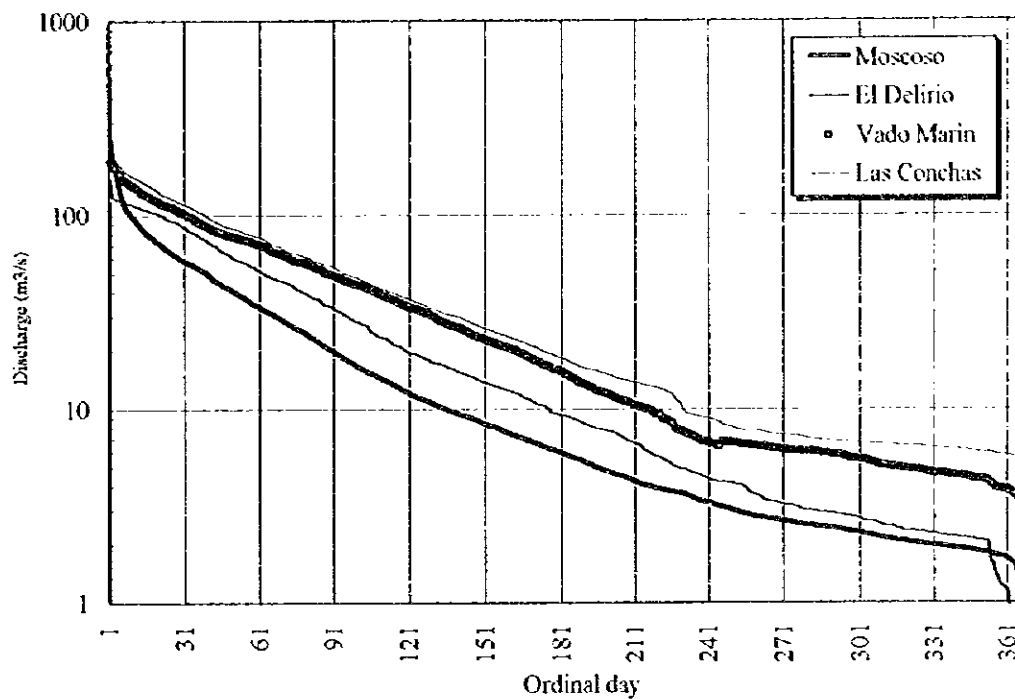


Month	Monthly rainfall		Mean discharge				Mean WL
	El Papalon (mm)	S Fran. Gotera (mm)	Villeras (m³/s)	Moscoso (m³/s)	Vado Marin (m³/s)	Las Conchas (m³/s)	Lake Olomega (m,MSL)
Jan	1	2	2.60	2.97	6.88	10.16	64.76
Feb	2	4	1.88	2.32	5.60	8.00	64.57
Mar	1	8	1.63	1.99	4.77	7.06	64.39
Apr	1	63	2.29	2.85	5.05	7.90	64.24
May	156	254	7.45	10.09	11.02	14.58	64.24
Jun	289	374	28.12	35.96	36.93	43.67	64.56
Jul	201	255	13.58	17.24	21.91	27.23	64.67
Aug	225	283	22.77	27.90	31.77	38.76	64.72
Sep	301	428	46.14	56.05	68.36	81.68	65.16
Oct	200	318	40.97	51.54	73.35	83.67	65.55
Nov	49	51	8.89	11.28	23.80	29.66	65.31
Dec	5	8	3.49	4.26	10.40	14.23	65.01

(Discharge and water level data: May'70 to Apr'79)

Figure M.I.7 MONTHLY RAINFALL, DISCHARGE AND WATER LEVEL



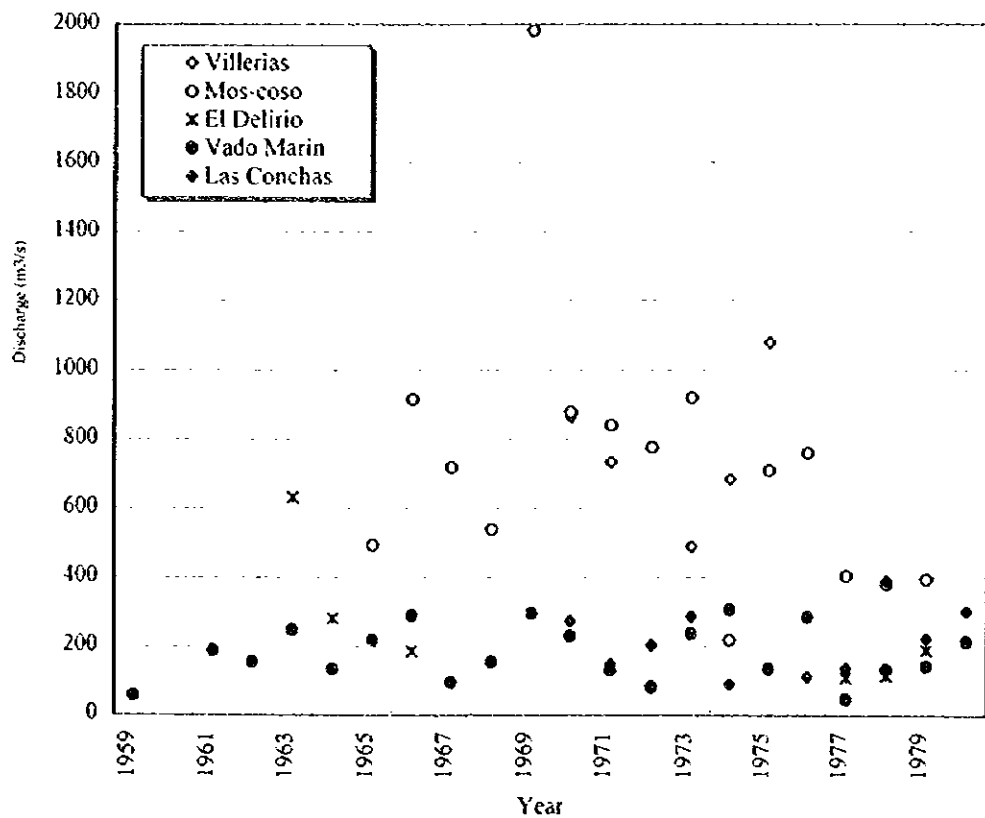


NOTE: Following period of data were used to work out average flow duration:

- Moscoso Sta :1971 through 1980
- El Delirio Sta :1966, 1978, 1980
- Vado Marin Sta :1970, 1973, 1975, 1978, 1980
- Las Conchas Sta :1970, 1973, 1975, 1978, 1980

Ordinal day	Average discharge (m <sup>3</sup> /s)				Ordinal day	Average discharge (m <sup>3</sup> /s)			
	Moscoso	El Delirio	Vado Marin	Las Conchas		Moscoso	El Delirio	Vado Marin	Las Conchas
1(Max)	246	156	189	214	21	71	101	115	130
2	199	125	182	204	22	69	100	114	127
3	169	122	175	193	23	67	96	113	127
4	152	121	165	185	24	66	95	111	125
5	130	120	163	182	25	64	95	111	123
6	120	118	154	175	26	63	94	109	121
7	110	116	151	169	27	62	93	108	120
8	107	116	148	166	28	60	92	106	117
9	102	114	144	161	29	60	89	105	116
10	98	114	141	160	30	58	88	102	115
11	95	113	139	157	35	54	81	93	107
12	91	111	138	155	40	49	73	87	98
13	89	111	132	152	50	40	60	77	86
14	85	108	129	149	60	34	52	71	78
15	82	108	128	147	70	29	46	62	67
16	79	107	125	144	80	24	39	56	60
17	78	105	124	142	95	18	31	46	50
18	77	104	121	139	185	6	9	14	17
19	74	104	120	138	275	3	3	6	7
20	73	103	118	134	355	2	2	4	6
					365(Min)	1	1	3	6

Figure M.1.8 FLOW DURATION OF SAN MIGUEL RIVER



Year	Date mm dd	Villerias (m <sup>3</sup> /s)	Date mm dd	Mos- coso (m <sup>3</sup> /s)	Date mm dd	El Delirio (m <sup>3</sup> /s)	Date mm dd	Vado Marin (m <sup>3</sup> /s)	Date mm dd	Las Concha (m <sup>3</sup> /s)
1959							10 20	58		
1960										
1961							Oct. 9	189		
1962							Sep. 27	156		
1963					Nov. 9	632	Nov. 11	248		
1964					Sep. 2	281	Sep. 4	134		
1965			Sep. 8	495			Oct. 1	219		
1966			Jun. 22	917	Jun. 22	187	Jul. 15	290		
1967			Oct. 5	720			Oct. 14	96		
1968			Sep. 8	539			Sep. 26	155		
1969			Sep. 4	1,982			Sep. 6	296		
1970	Sep. 4	866	Sep. 4	880			Oct. 5	231	Aug. 4	274
1971	Sep. 2	734	Sep. 3	842			Sep. 5	132	Oct. 21	148
1972			Oct. 8	777			Oct. 10	82	Oct. 20	203
1973	Oct. 8	490	Sep. 16	921			Oct. 26	238	Oct. 24	287
1974	Sep. 20	685	Sep. 8	218			Sep. 22	308	May 23	90
1975	Sep. 24	1,079	Sep. 24	710			Sep. 13	136		
1976			Jun. 5	761			Jun. 14	287	Oct. 10	111
1977			Jun. 16	405	Jun. 16	109	Oct. 1	48	Jun. 8	137
1978			Sep. 21	382	Aug. 28	115	Sep. 22	134	Sep. 20	390
1979			Aug. 31	395	Oct. 9	189	Sep. 15	144	Jun. 14	222
1980							Jun. 25	215	Jun. 23	302

Figure M.1.9 ANNUAL MAXIMUM DISCHARGE



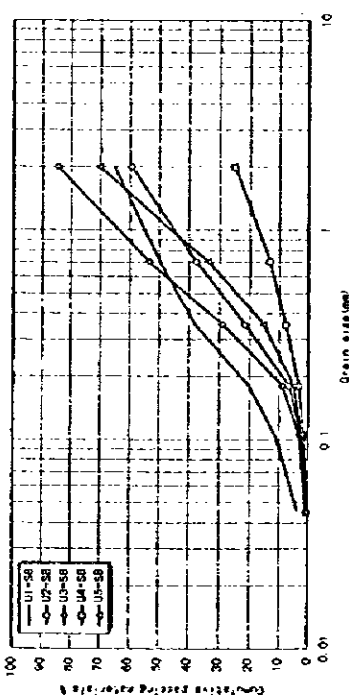
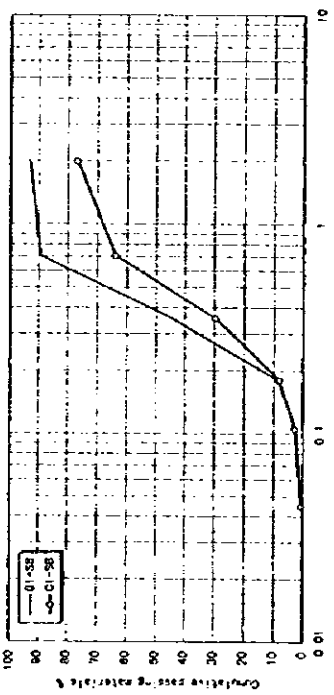
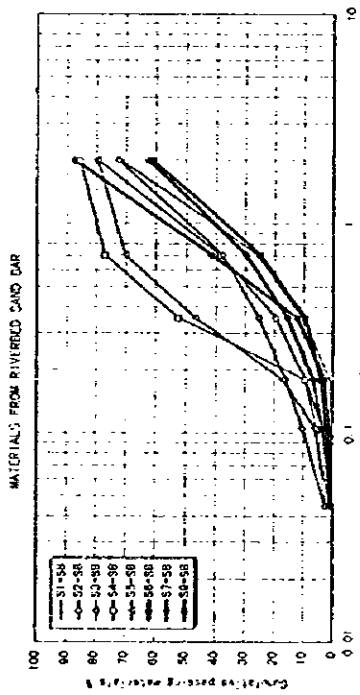
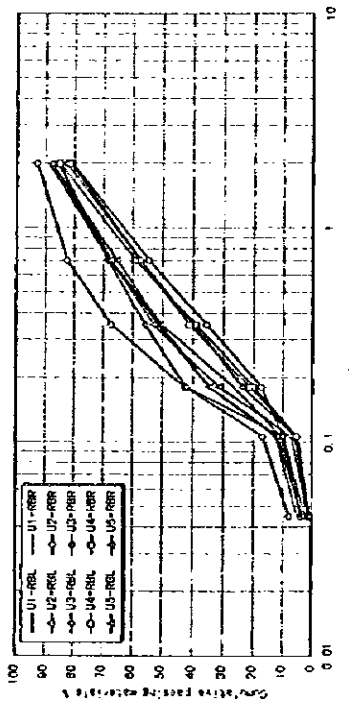
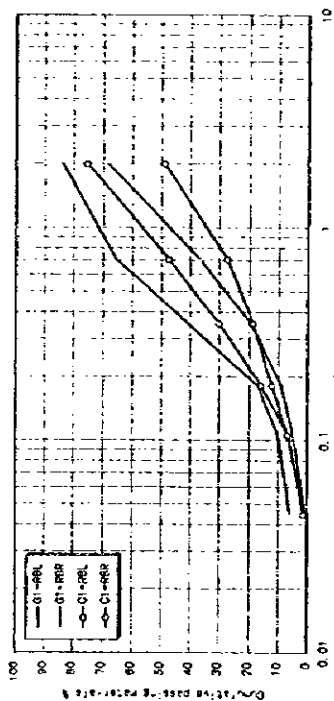
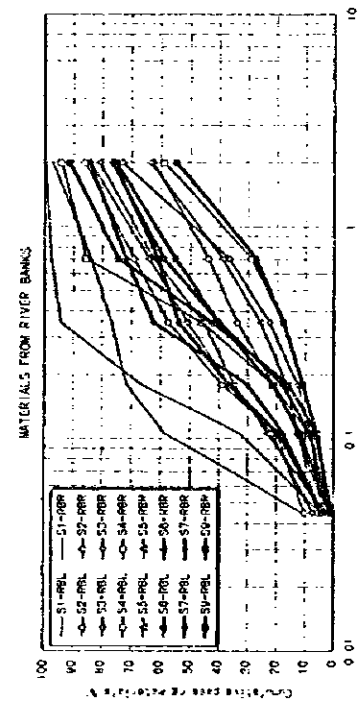
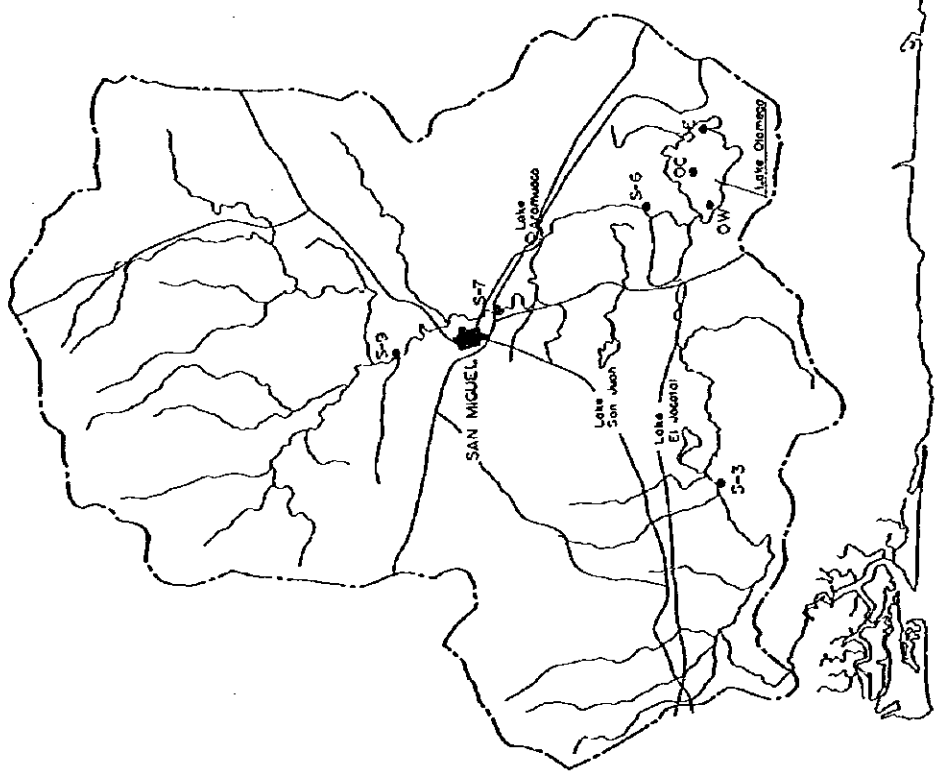
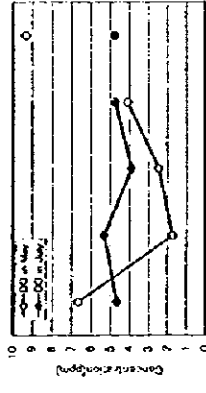
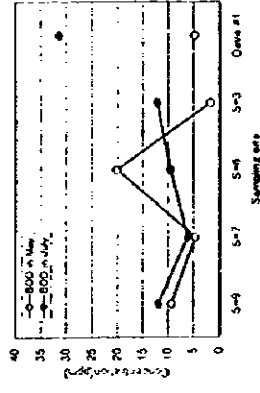
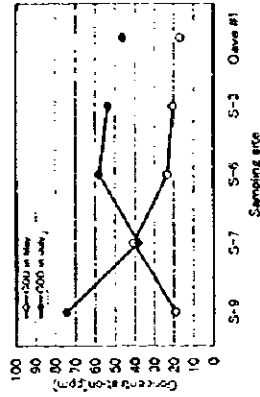
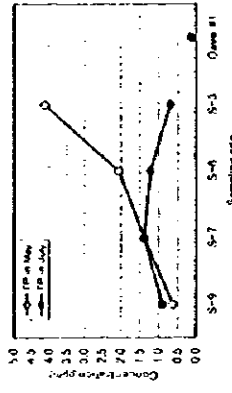
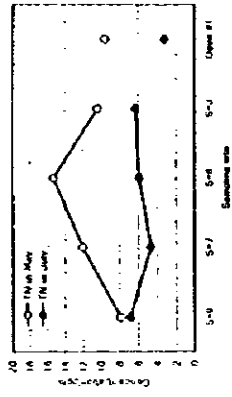


Figure M.1.11 GRADING CURVES OF RIVERBED MATERIALS



2 July, 1996 #2					
TP (ppm)	TN (ppm)	BOD (ppm)	COD (ppm)	DO (ppm)	DO (ppm)
0.91	6.96	11.63	74.36	4.57	4.57
1.38	4.71	5.17	36.46	5.33	5.33
1.22	5.90	9.50	56.20	3.92	3.92
0.70	6.20	12.17	51.63	4.75	4.75
0.11	3.22	31.46	46.44	4.78	4.78

1 May, 1996					
TP (ppm)	TN (ppm)	BOD (ppm)	COD (ppm)	DO (ppm)	DO (ppm)
0.64	7.9	9.33	19.13	6.57	6.57
1.36	12.09	4.67	40.98	1.75	1.75
2.06	15.93	20.17	23.22	2.46	2.46
4.13	10.36	1.75	20.49	4.13	4.13
0.15	9.36	4.93	16.85	9.35	9.35

Water Quality Standard (Japan)	
River (C)	10.00
Lake (C)	6.00
Industrial	0.10
Municipal-3	0.01
Irrigation	1.00
Fishery-3	0.10
	1.00
	1.00
	2.00
	2.00

Water Quality Standard (Japan)	
River (C)	10.00
Lake (C)	6.00
Industrial	0.10
Municipal-3	0.01
Irrigation	1.00
Fishery-3	0.10
	1.00
	1.00
	2.00
	2.00

(Note) #1: Cave denotes average of sites OW, OC and OE in lake Ojomega  
#2: July observation for lake Ojomega was made on 5 July, 1996

RESULT OF WATER QUALITY TEST

Figure M.1.12 WATER SAMPLING AND QUALITY TEST

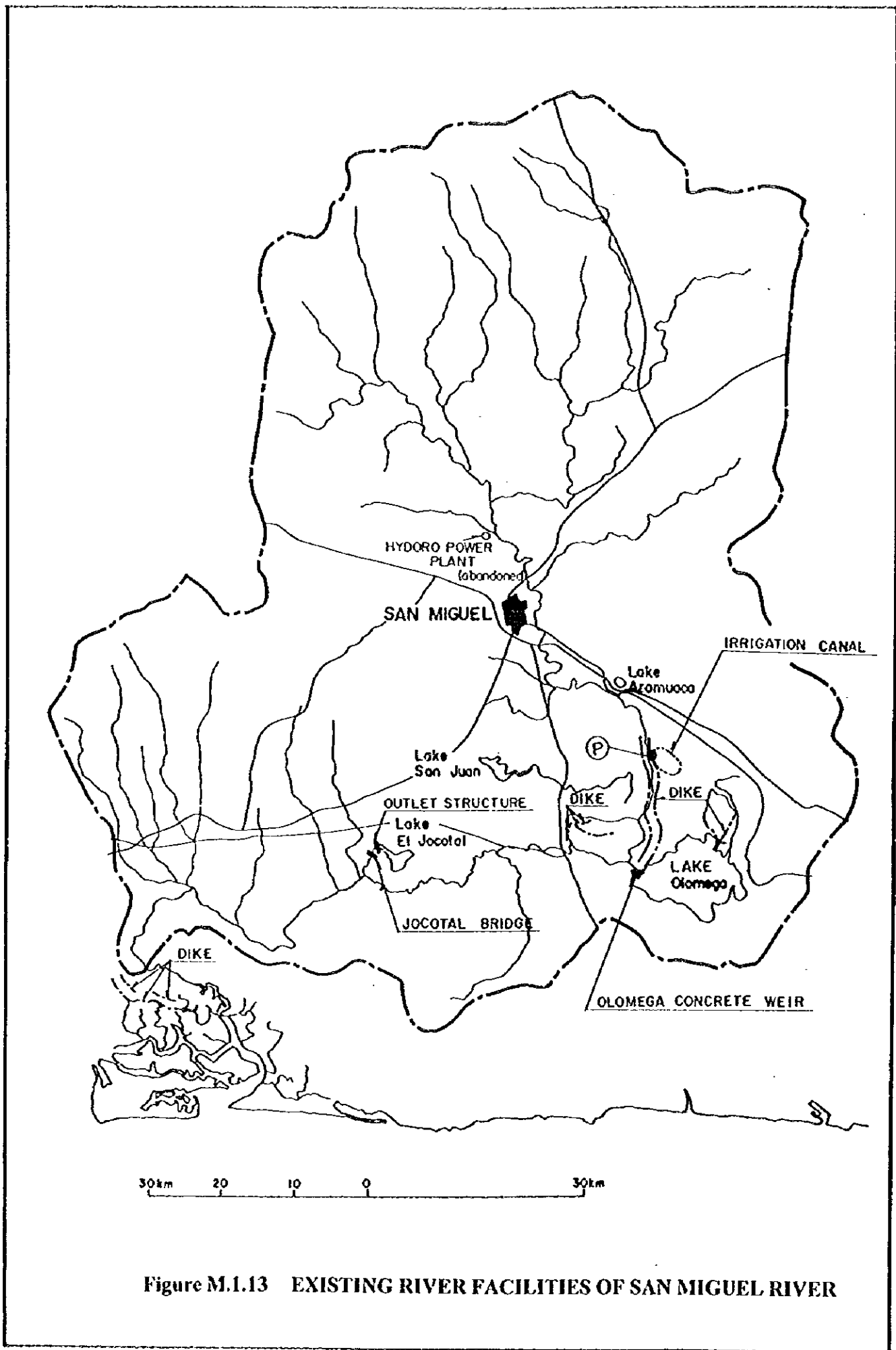
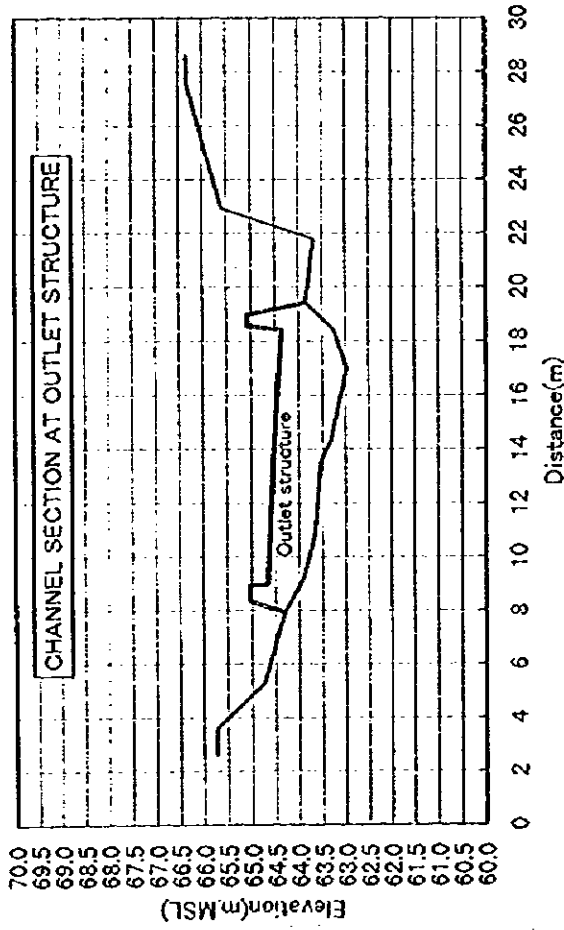
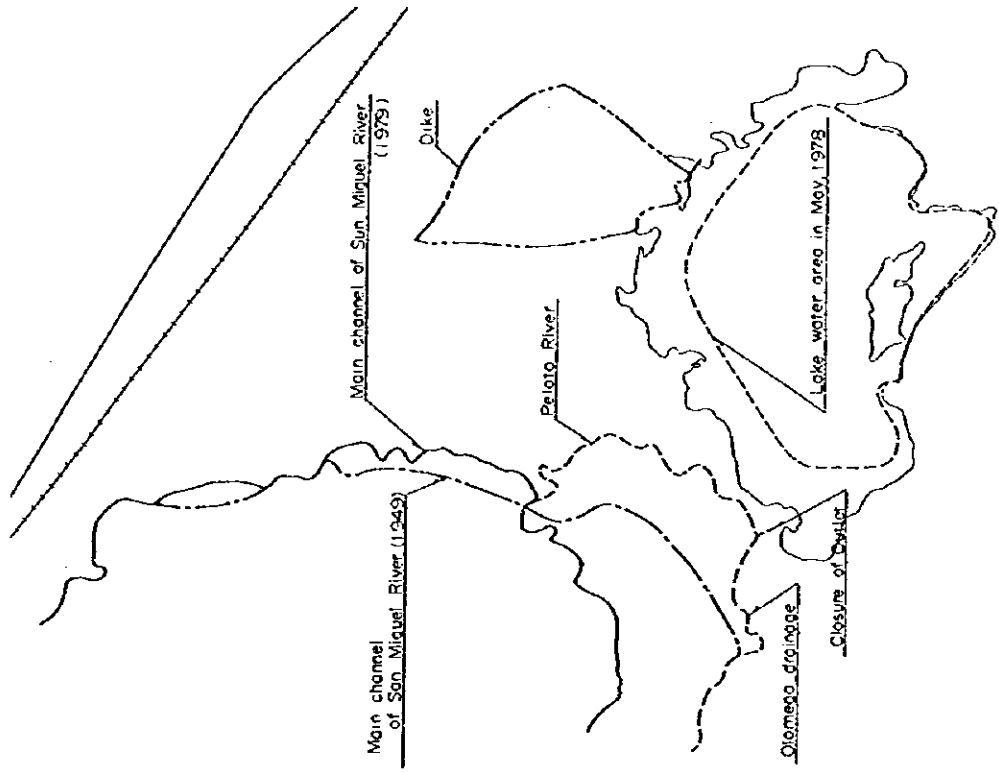


Figure M.1.13 EXISTING RIVER FACILITIES OF SAN MIGUEL RIVER



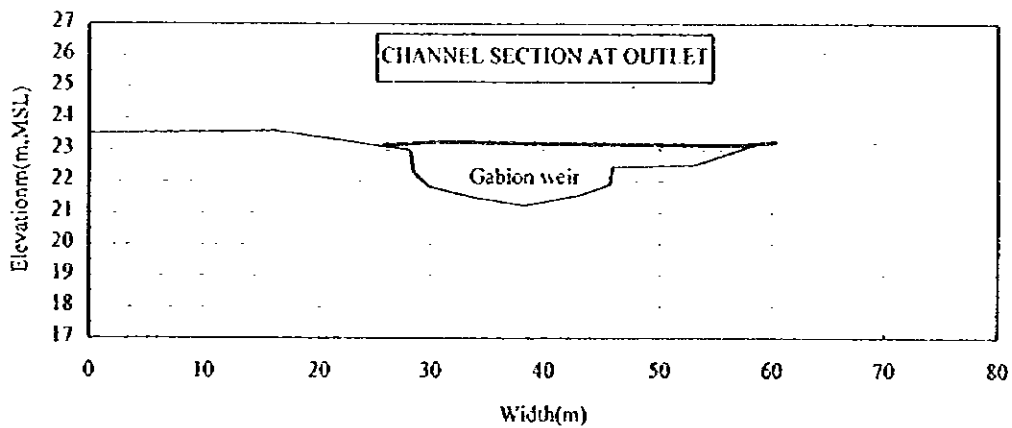
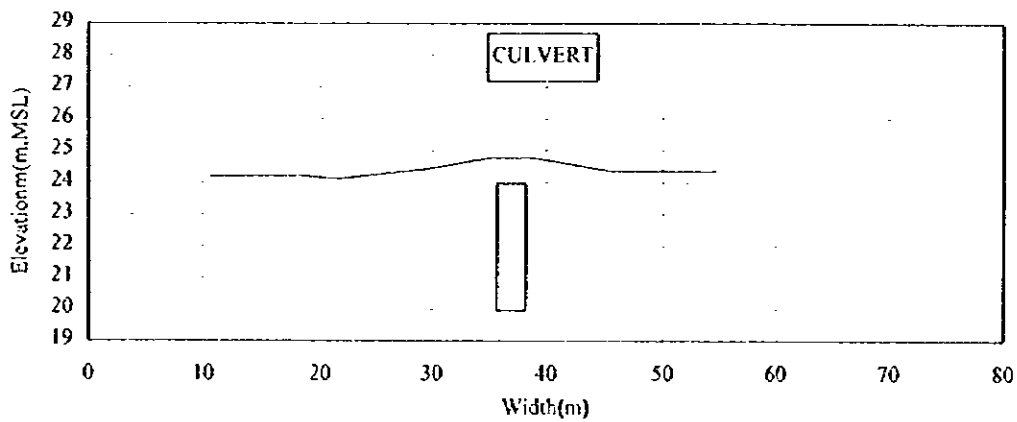
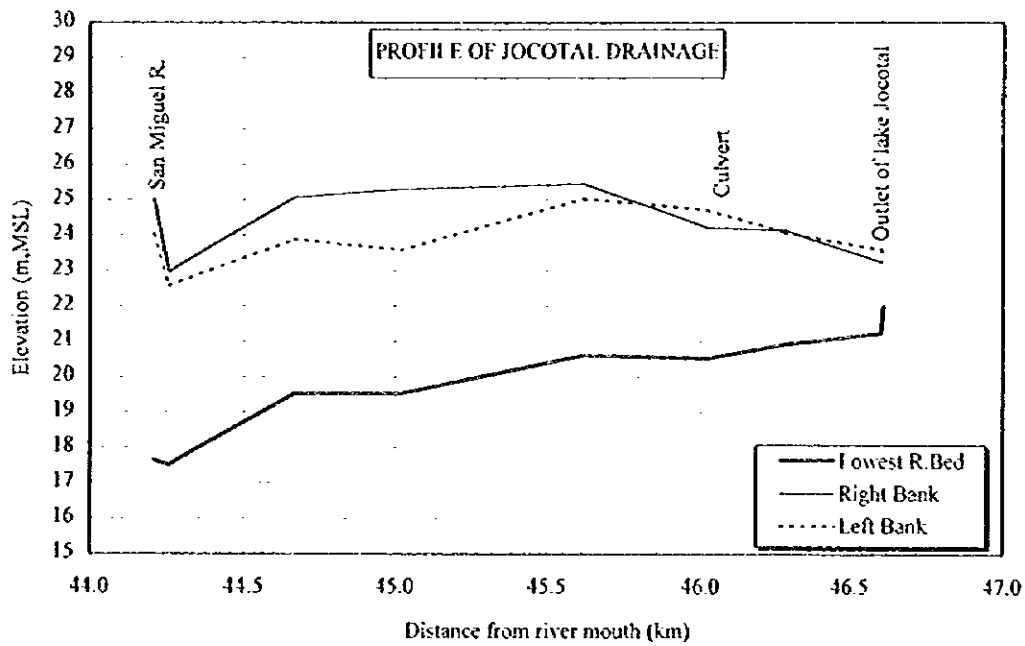
Existing section		Outlet structure	
Distance (m)	Elevation (m.MSL)	Distance (m)	Elevation (m.MSL)
2.59	65.74	7.93	64.31
3.59	65.74	8.35	65.04
5.29	64.75	8.91	65.05
7.93	64.31	8.97	64.66
9.19	63.91	13.53	64.54
10.84	63.66	18.43	64.34
13.51	63.54	18.57	65.09
14.32	63.32	18.99	65.08
16.97	62.98	19.41	63.85
18.39	63.25		
19.41	63.85		
21.78	63.68		
22.91	65.59		
27.62	66.34		
28.62	66.34		

Existing section		Outlet structure	
Distance (m)	Elevation (m.MSL)	Distance (m)	Elevation (m.MSL)
2.59	65.74	7.93	64.31
3.59	65.74	8.35	65.04
5.29	64.75	8.91	65.05
7.93	64.31	8.97	64.66
9.19	63.91	13.53	64.54
10.84	63.66	18.43	64.34
13.51	63.54	18.57	65.09
14.32	63.32	18.99	65.08
16.97	62.98	19.41	63.85
18.39	63.25		
19.41	63.85		
21.78	63.68		
22.91	65.59		
27.62	66.34		
28.62	66.34		



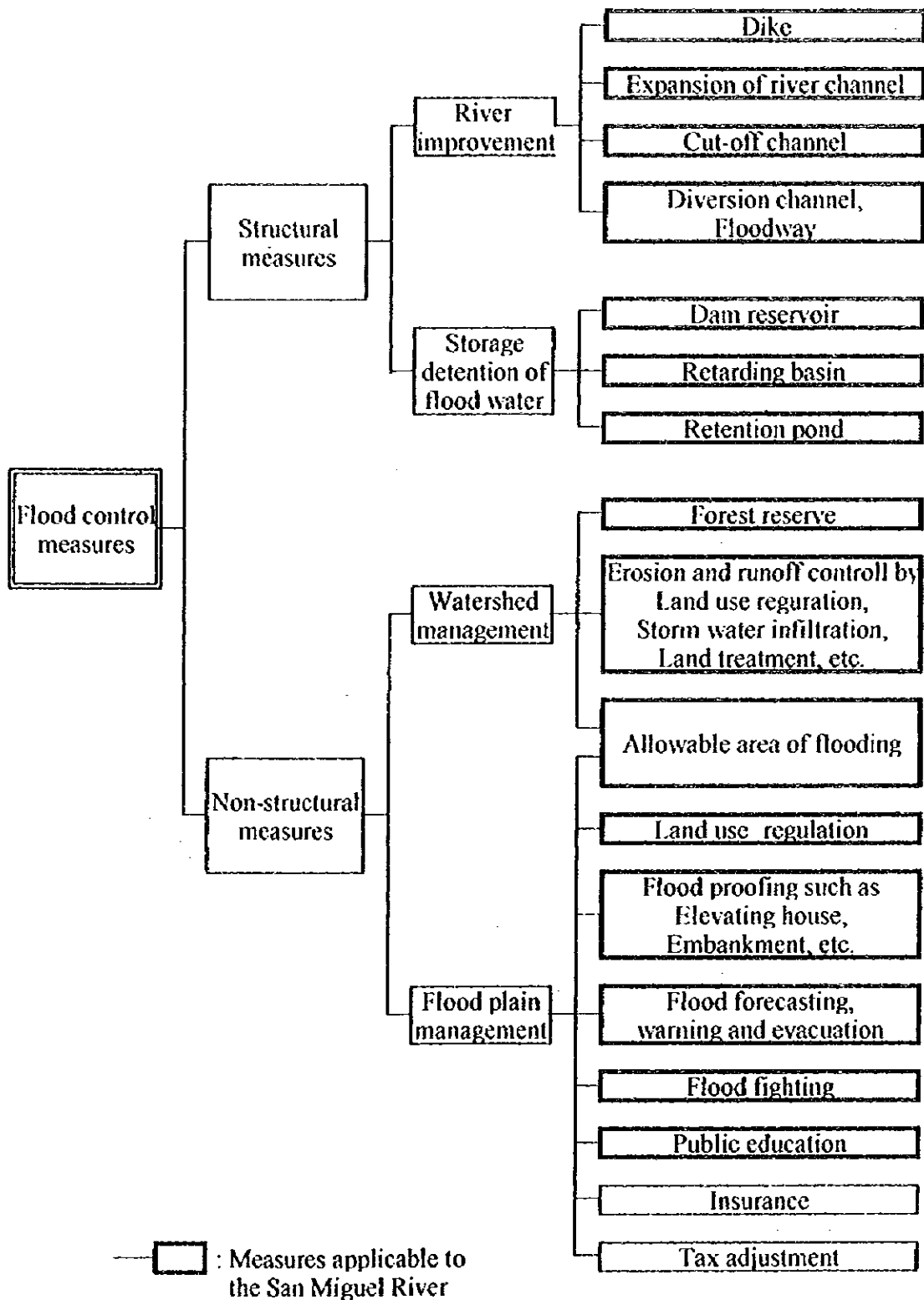
**Figure M.I.14 RIVER COURSE CHANGE AND OUTLET STRUCTURE OF LAKE OMEGEA**

RIVER COURSE CHANGE NEAR LAKE OMEGEA



**Figure M.1.15 JOCOTAL DRAINAGE AND OUTLET STRUCTURE**





**Figure M.3.1 FLOOD CONTROL MEASURES**

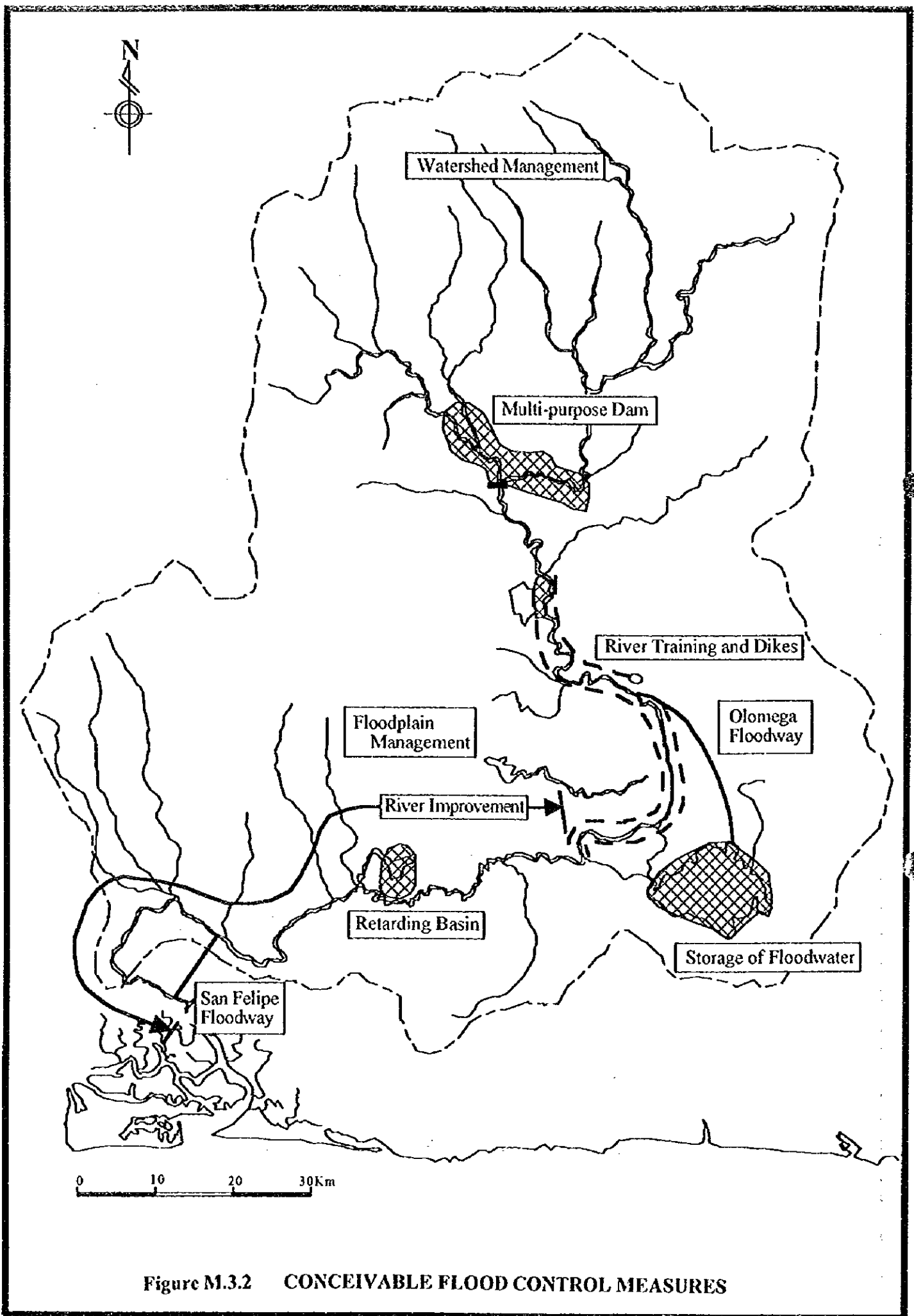
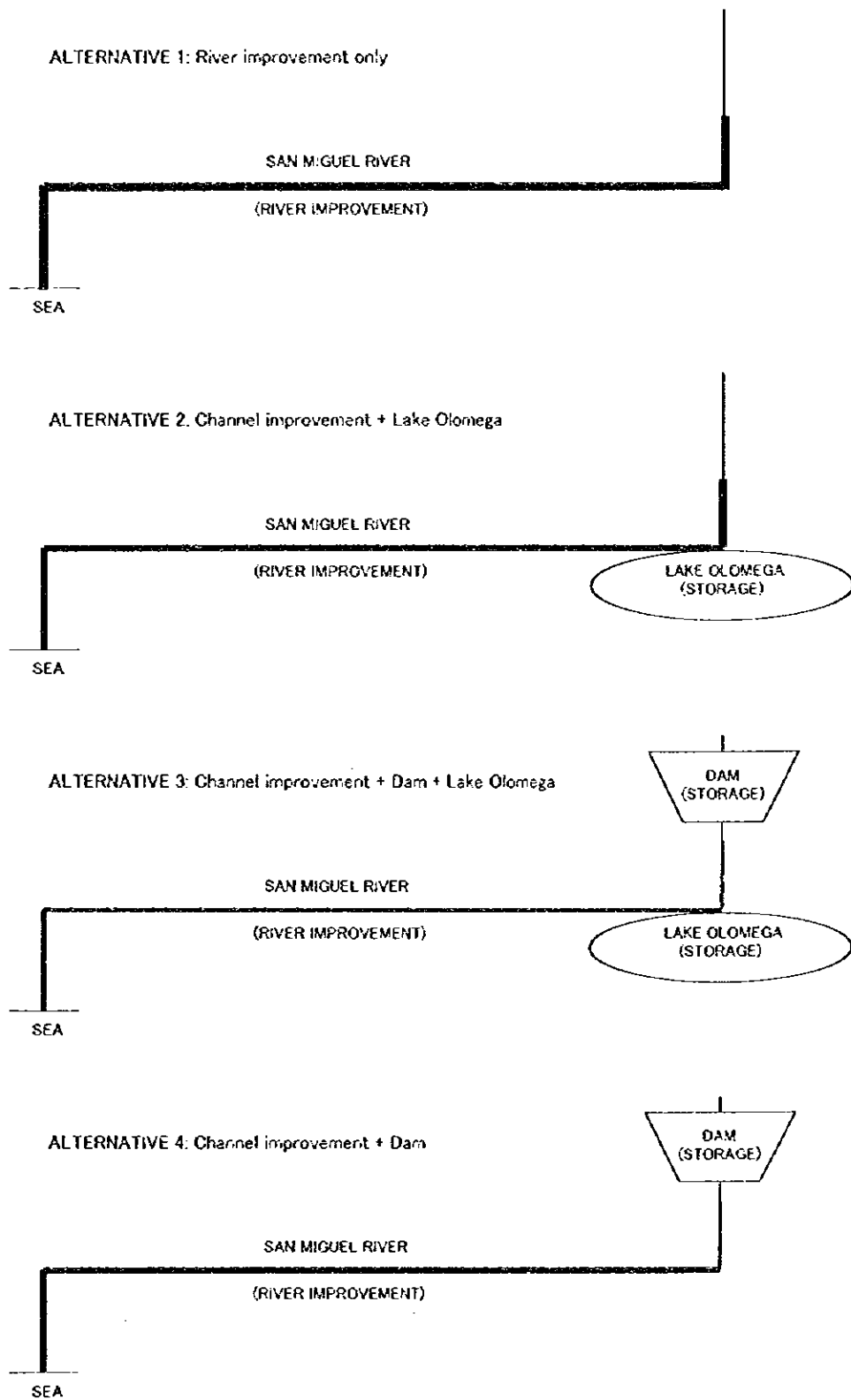


Figure M.3.2 CONCEIVABLE FLOOD CONTROL MEASURES



**Figure M.3.3 ALTERNATIVE SCHEMES FOR COMBINATION OF MEASURES**

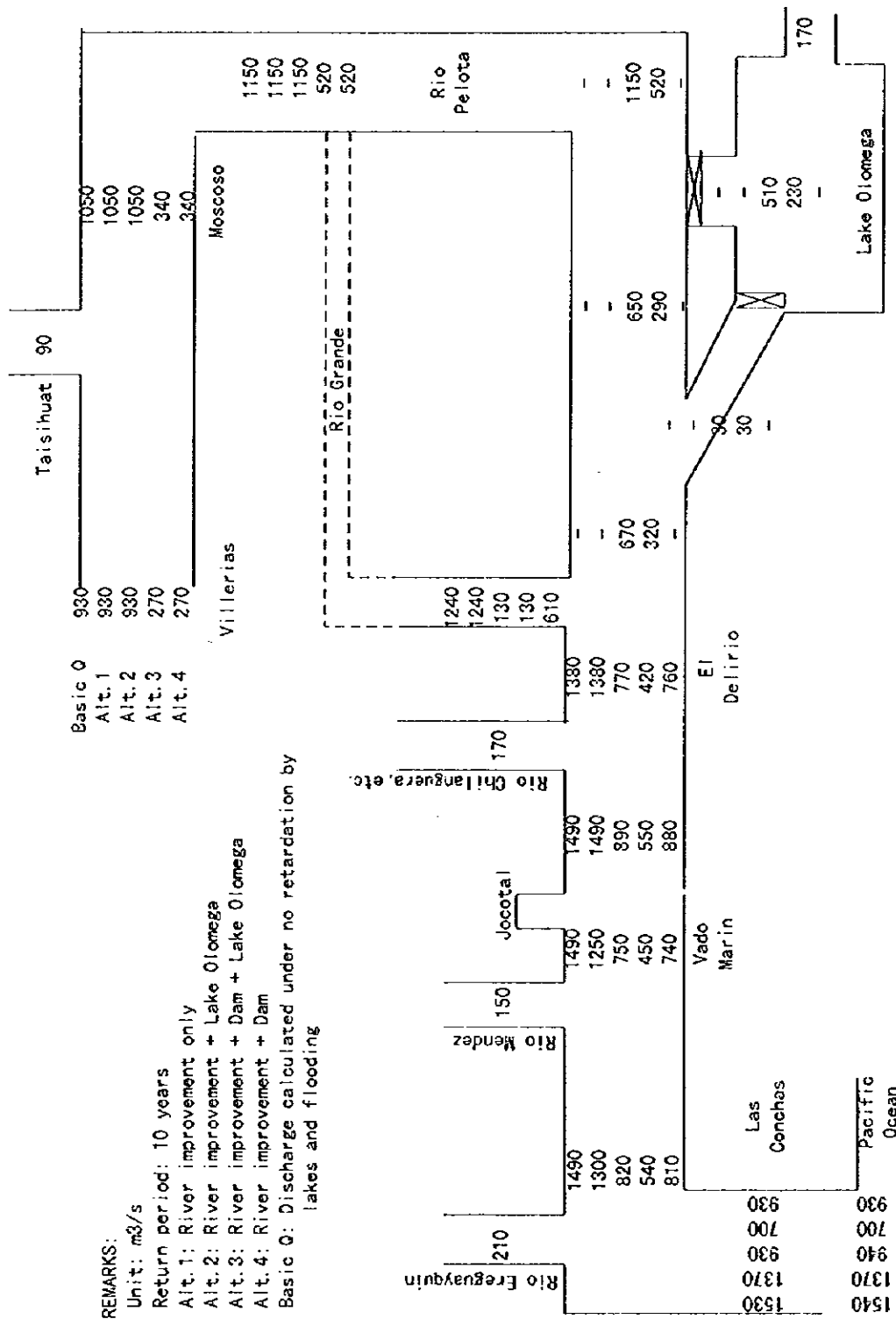


Figure M.3.4 DISCHARGE DISTRIBUTIONS FOR ALTERNATIVES  
 (COMBINATION OF MEASURES)

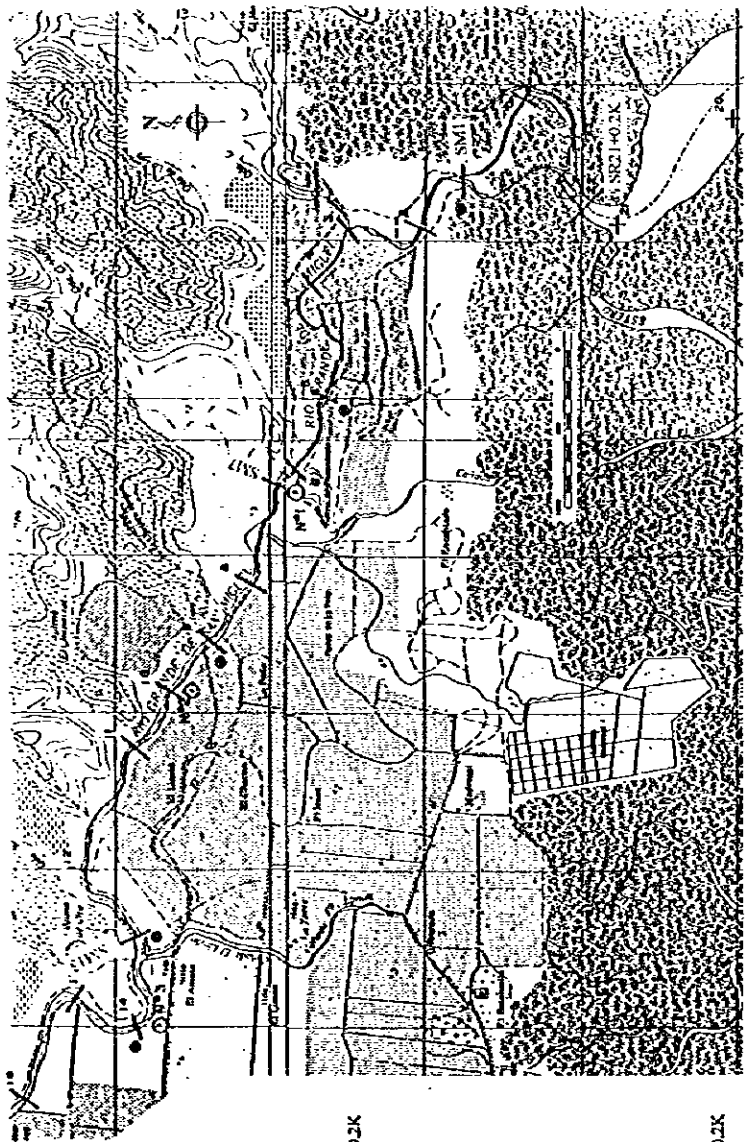
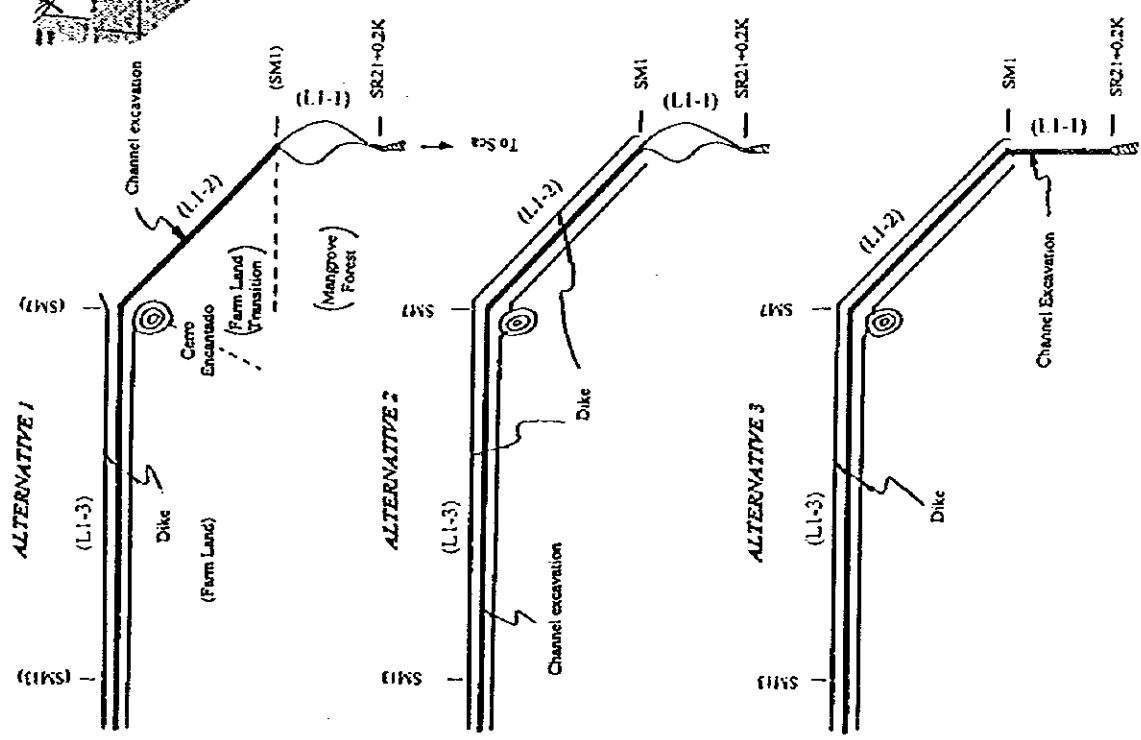


Figure M.3.5 ALTERNATIVE SCHEMES FOR LOWER END OF IMPROVEMENT

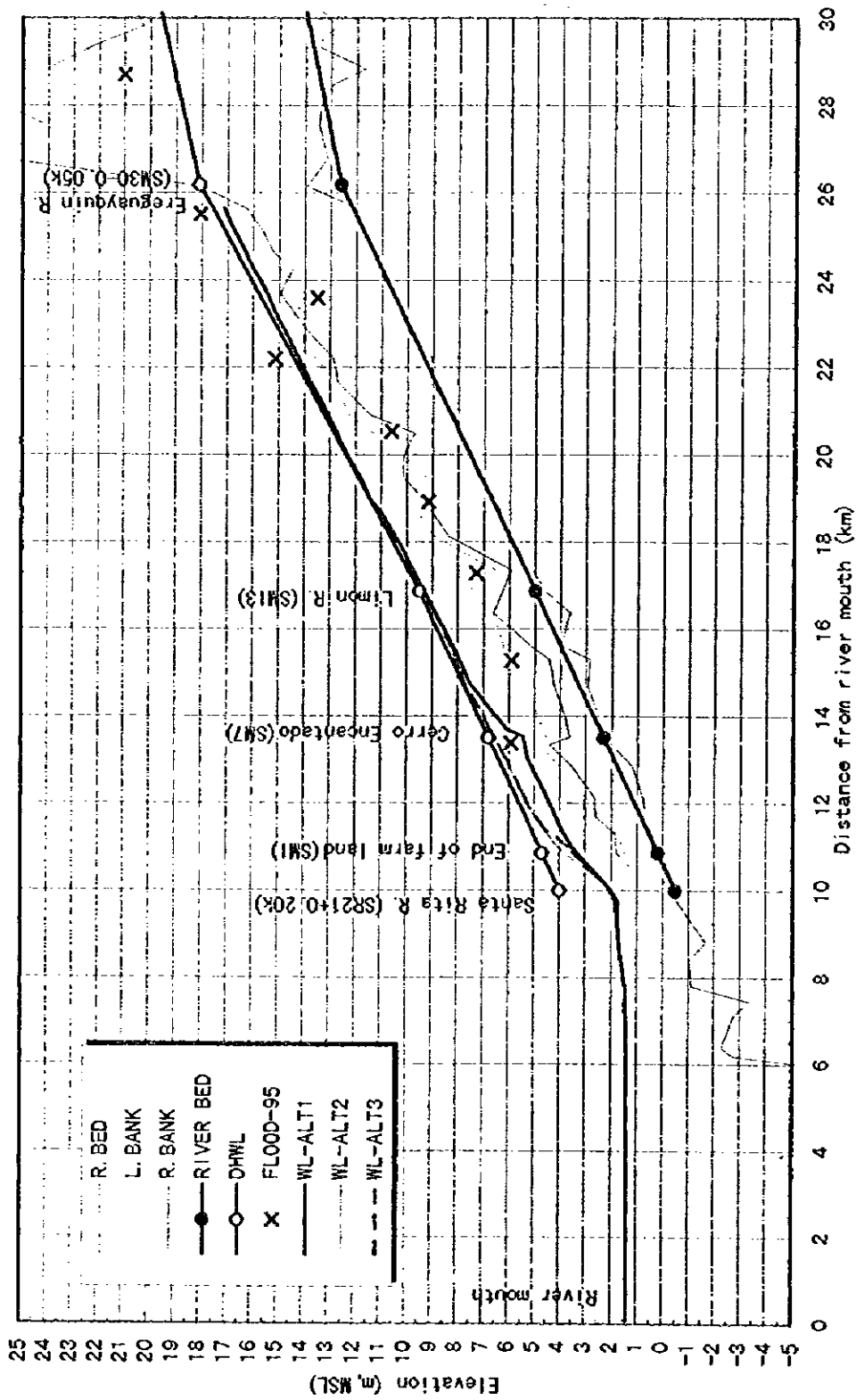


Figure M.3.6 SURFACE PROFILES CALCULATED FOR ALTERNATIVES

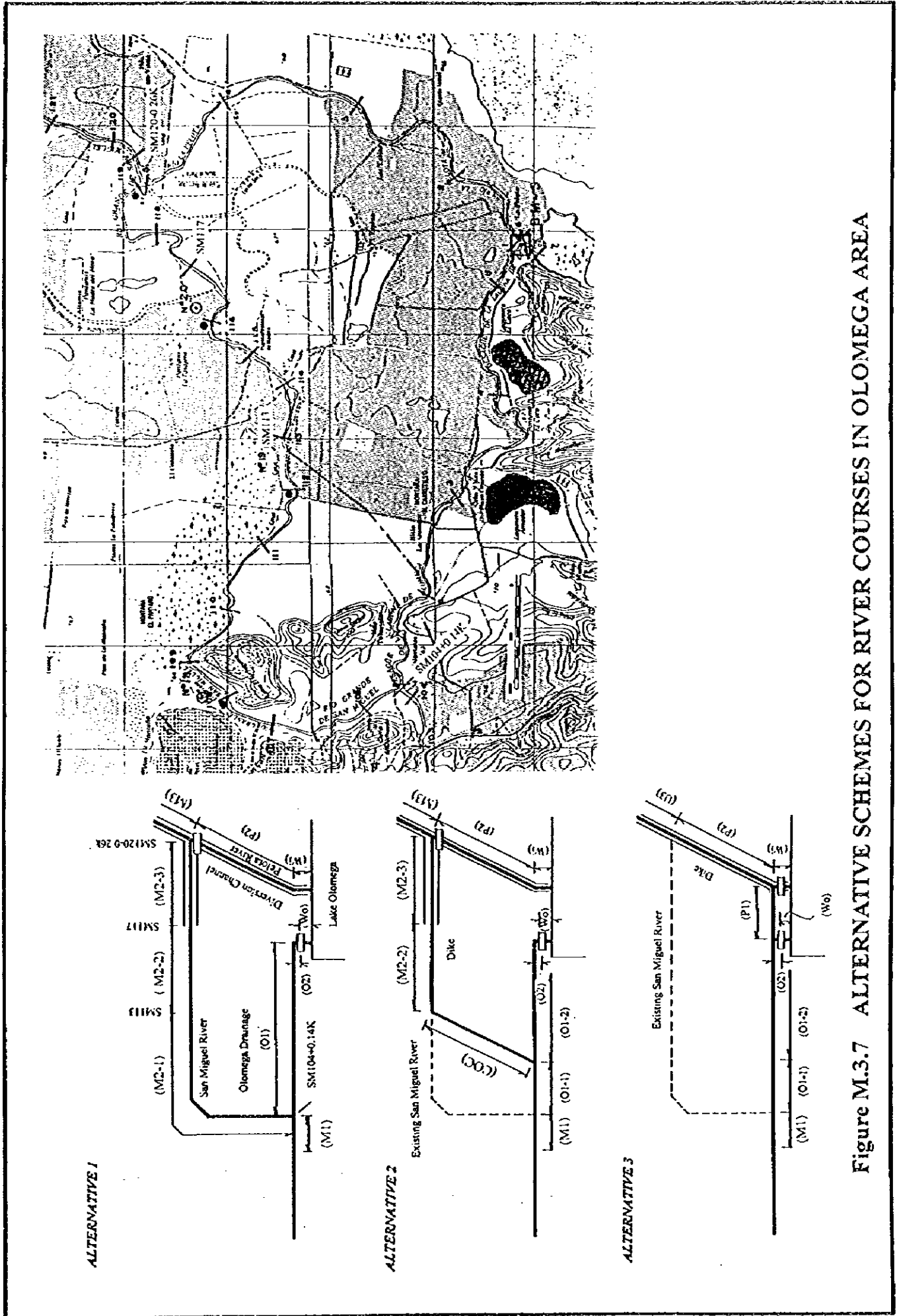
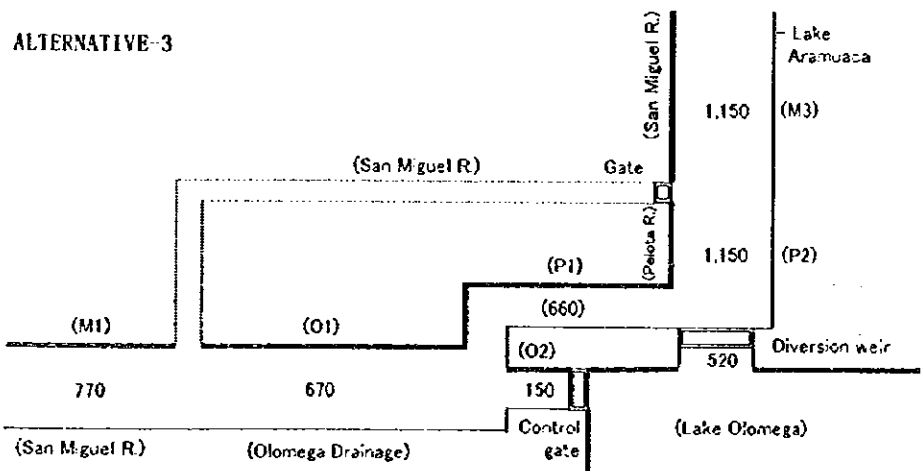
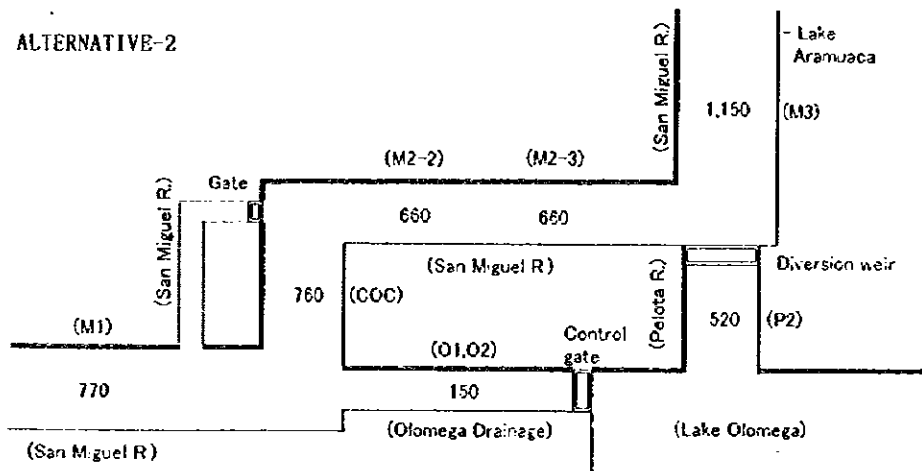
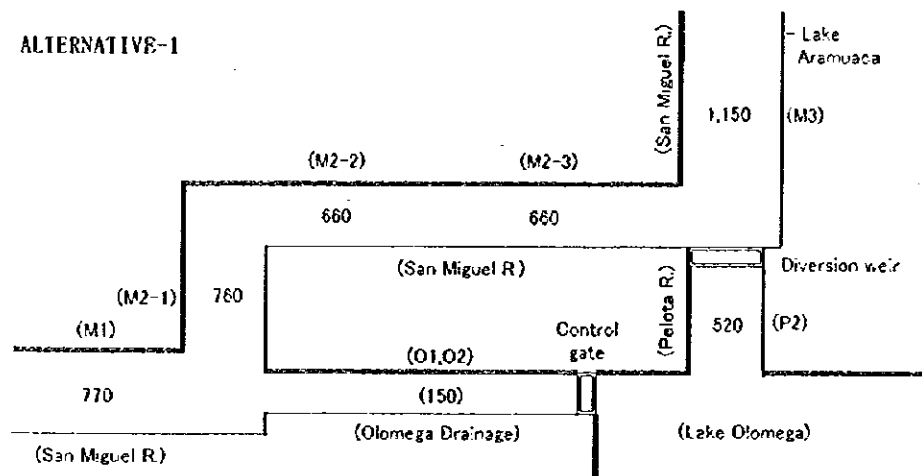


Figure M.3.7 ALTERNATIVE SCHEMES FOR RIVER COURSES IN OMEGA AREA



**Figure M.3.8 DISCHARGE DISTRIBUTION FOR ALTERNATIVES (RIVER COURSE IN OLOMEGA AREA)**



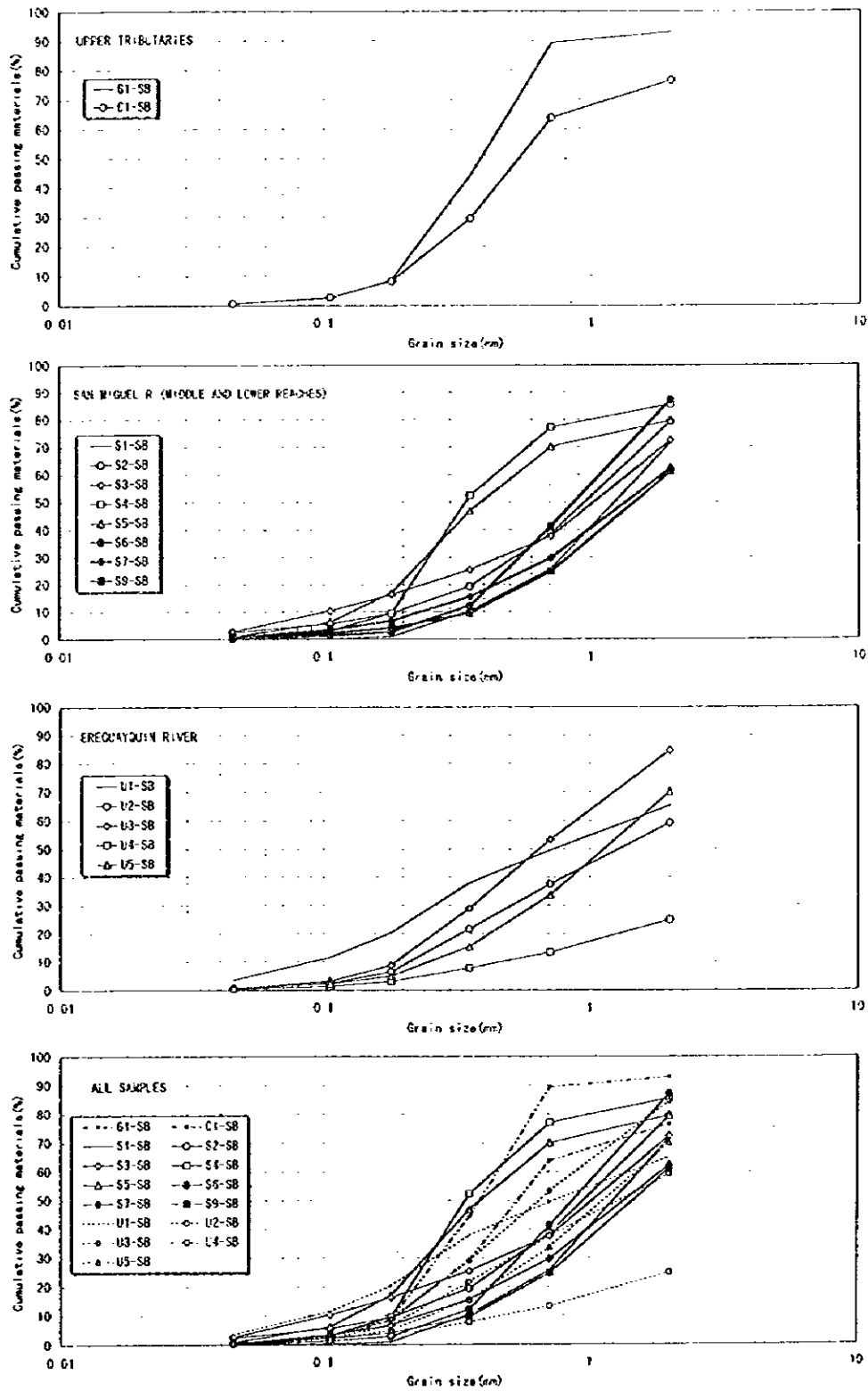
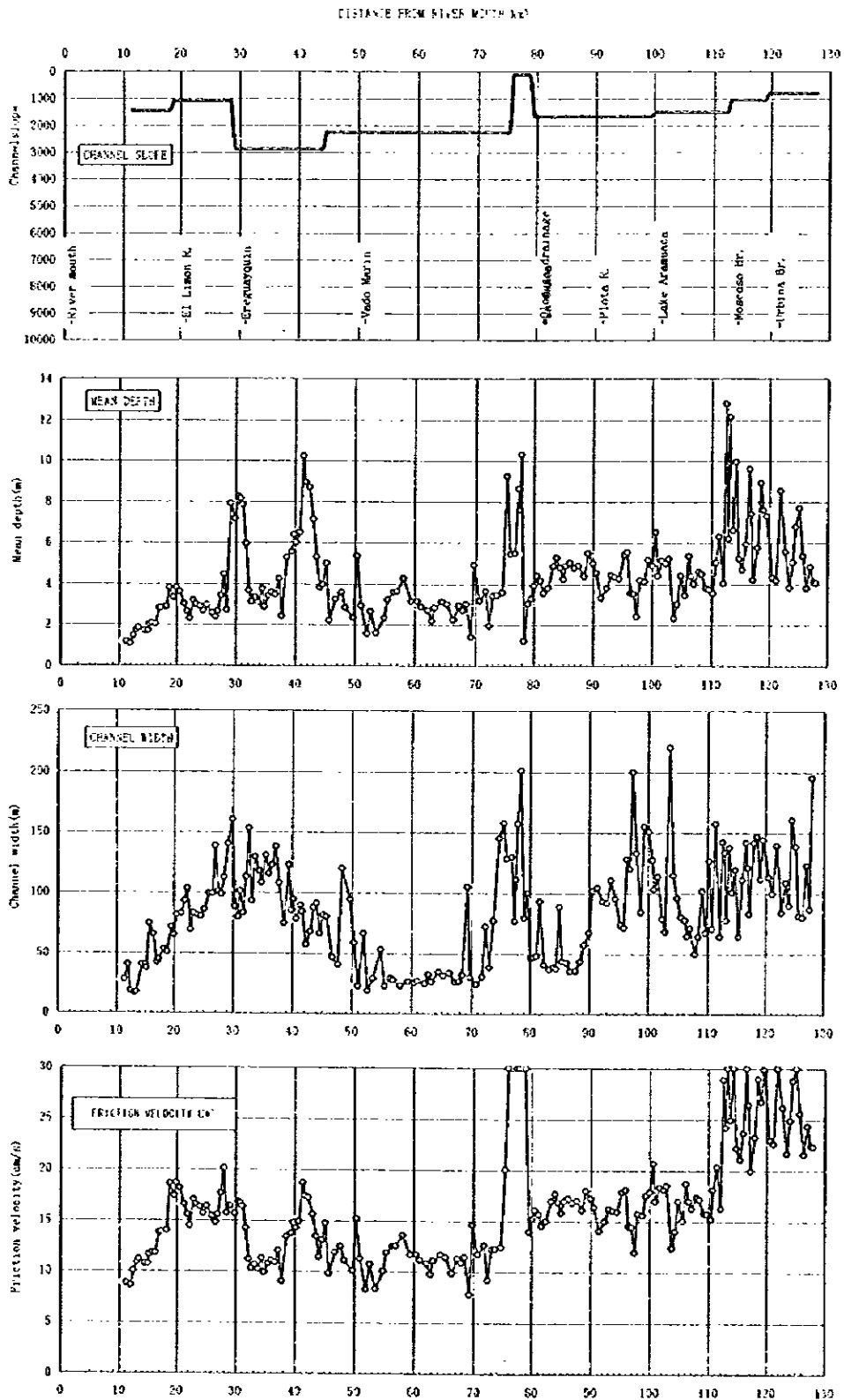
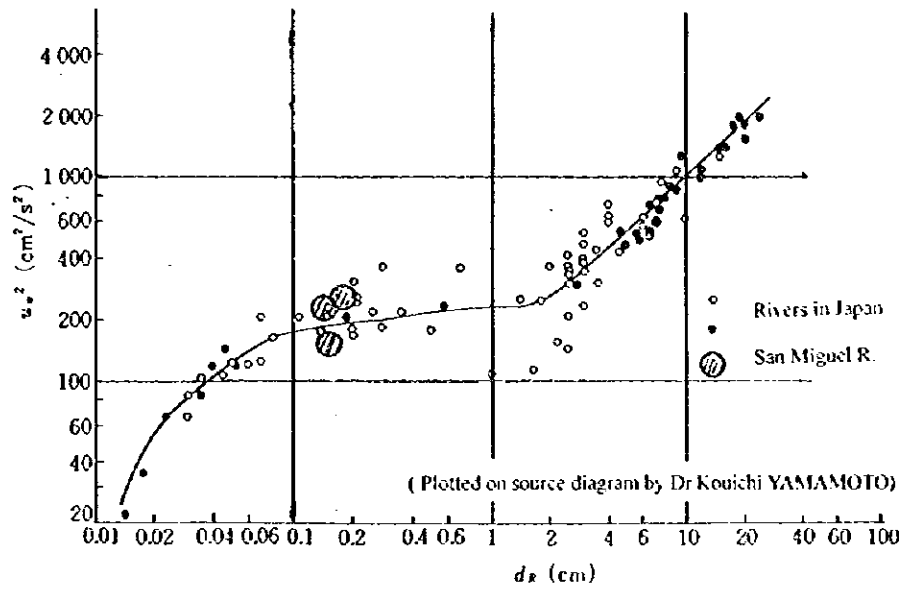


Figure M.3.9 GRADING CURVES OF SAND BAR MATERIALS



**Figure M.3.10 SEDIMENT FLOW CHARACTERISTICS OF EXISTING CHANNEL**

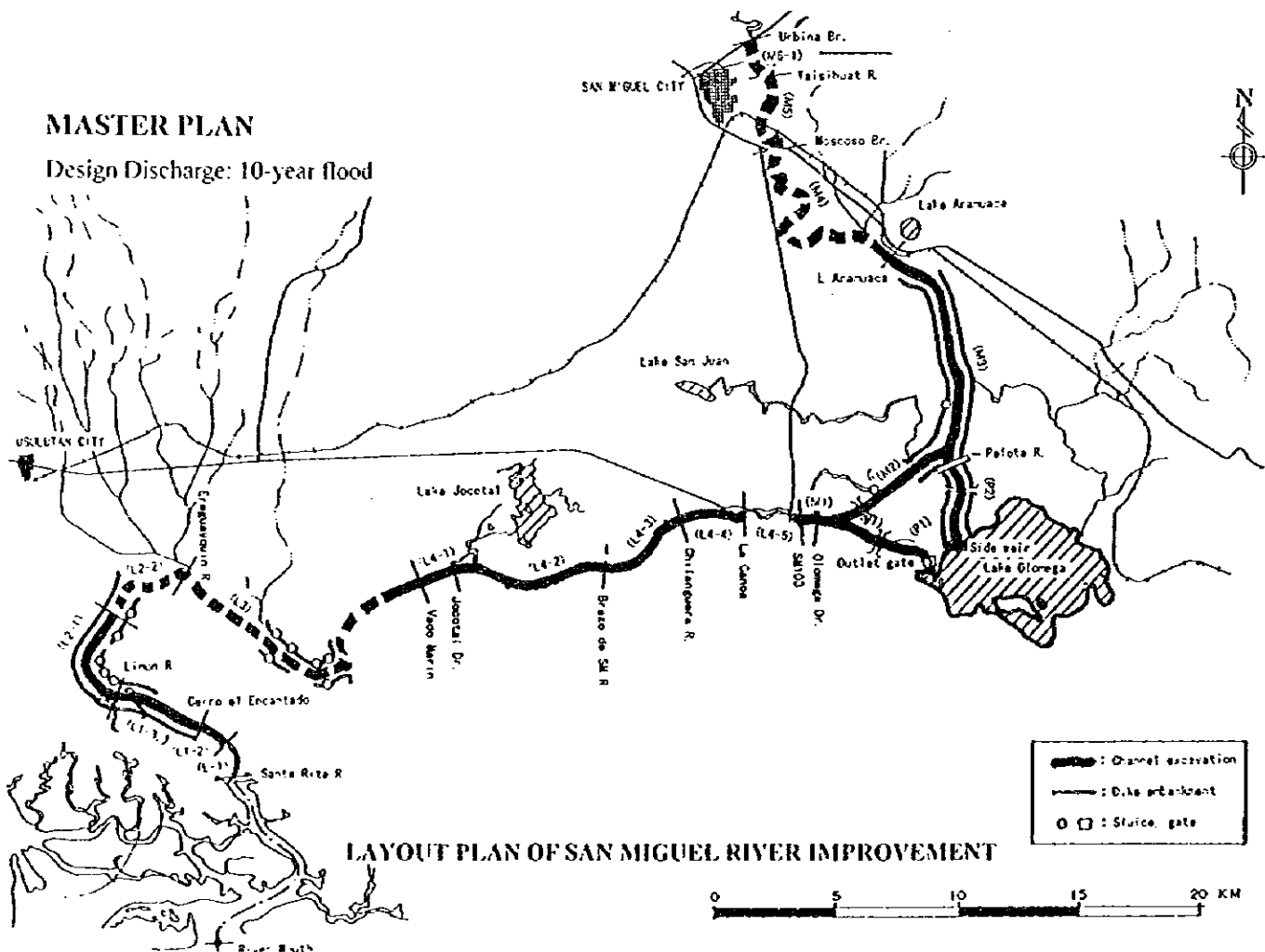
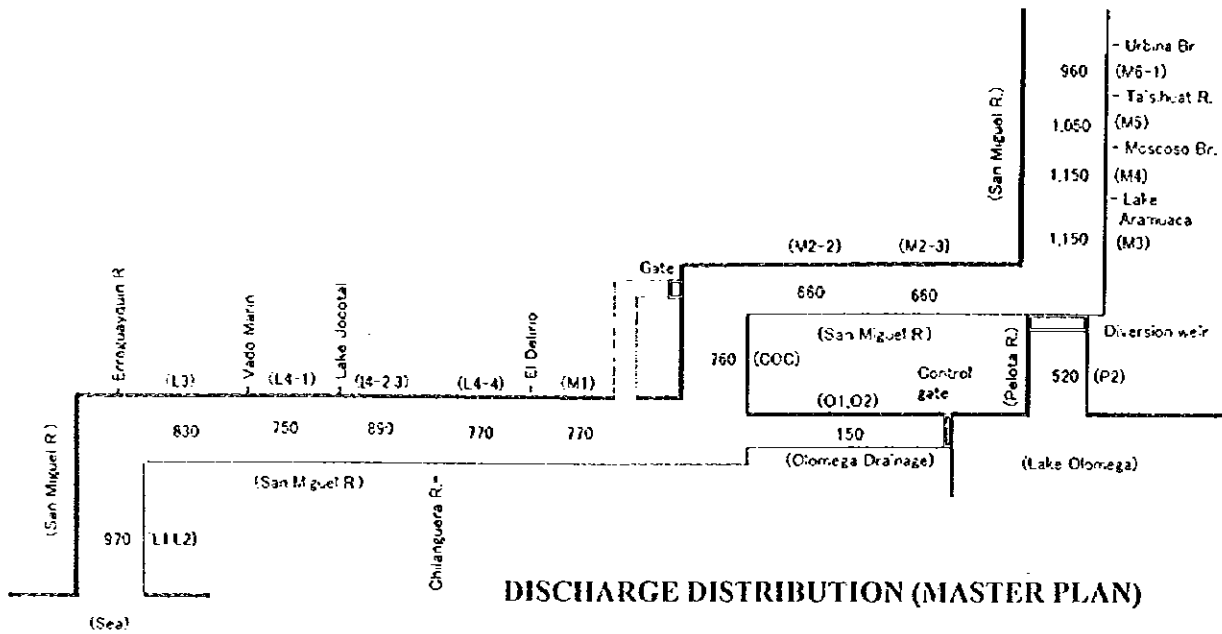
RELATIONSHIP BETWEEN  $U_*^2$  AND  $d_R$  OF RIVERS IN JAPAN



BANK-FULL FRICTION VELOCITY OF EXISTING SAN MIGUEL RIVER

Strech			Bank-full $U_*$		Bank-full $U_*^2$		$d_{50}$ (mm)
From	To	Code	(cm/s)	(Ave.)	(cm <sup>2</sup> /s <sup>2</sup> )	(Ave.)	
Santa Rita R.	El Limon R.	L1	11		129	203	1.52
El Limon R.	Ereguayquin R.	L2	17		277		
Ereguayquin R.	Vado Marin	L3	14	12	182	144	1.53
Vado Marin	Jocotal Drainage	L4-1	12		148		
Jocotal Drainage	Brazo de S.M.	L4-2	11		129		
Brazo de S.M.	Chiranguera R.	L4-3	11		122		
Chiranguera R.	La Canoa	L4-4	12		137		
La Canoa	Olomega Draina	L4-5,M1	62		3806		
Olomega Draina	Pelota R.	M2	16	16	259	265	1.70
Pelota R.	Lake Aramuaca	M3	16		252		
Lake Aramuaca	Moscoso Br.	M4	17		288		
Moscoso Br.	Taisihuat R.	M5	26	26	684	666	
Taisihuat R.	Urbina Br.	M6-1	26		662		
Urbina Br.	SM184	M6-2	26		652		

Figure M.3.11 FRICTION VELOCITY AND GRAIN SIZE



**Figure M.4.1 DESIGN DISCHARGE DISTRIBUTION AND LAYOUT PLA (MASTER PLAN)**

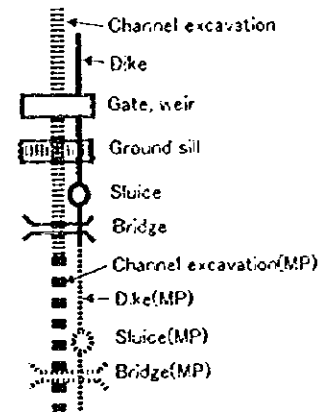


Figure M.4.2 DESIGN ALIGNMENT OF SAN MIGUEL RIVER(1/11)

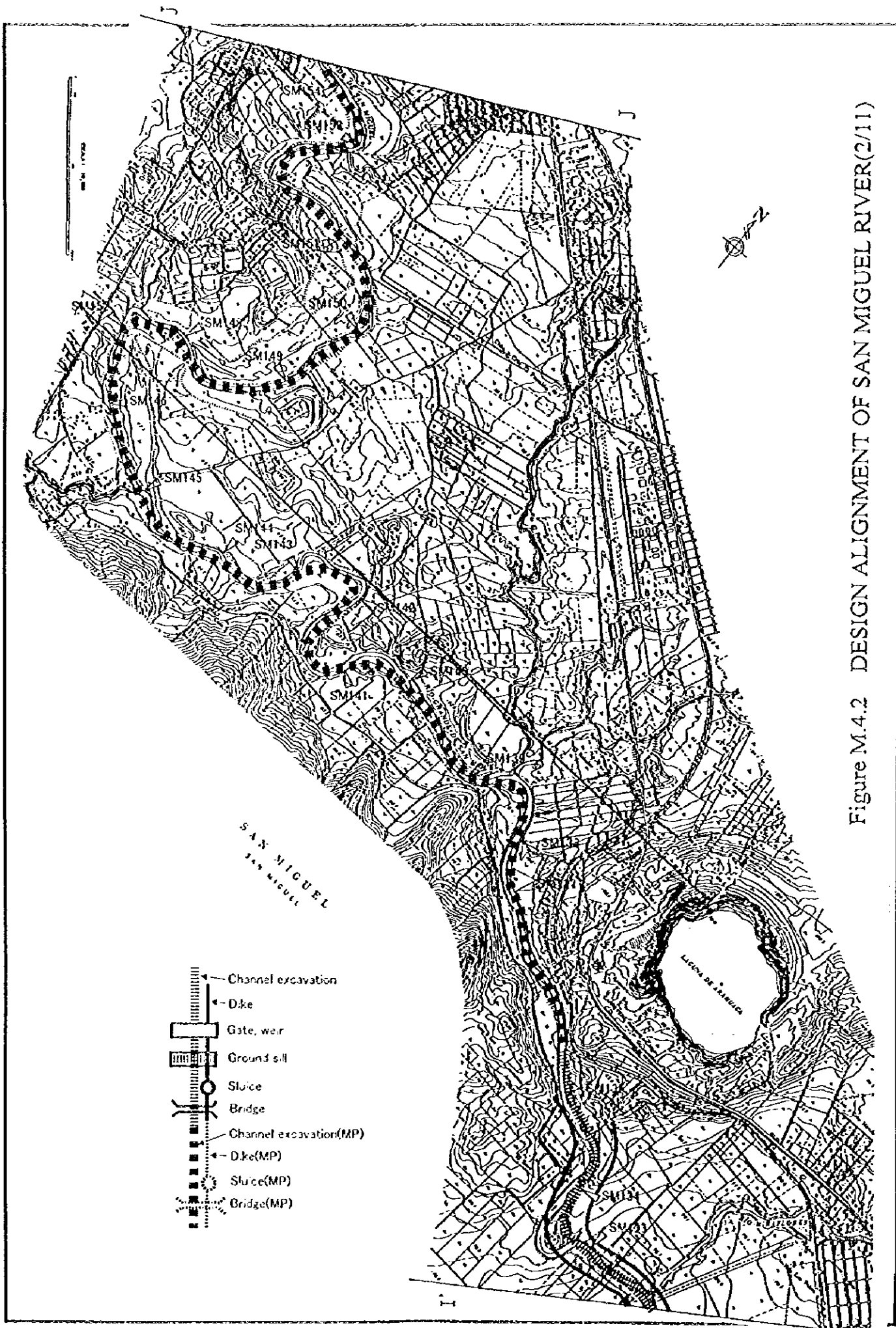


Figure M.4.2 DESIGN ALIGNMENT OF SAN MIGUEL RIVER(2/11)

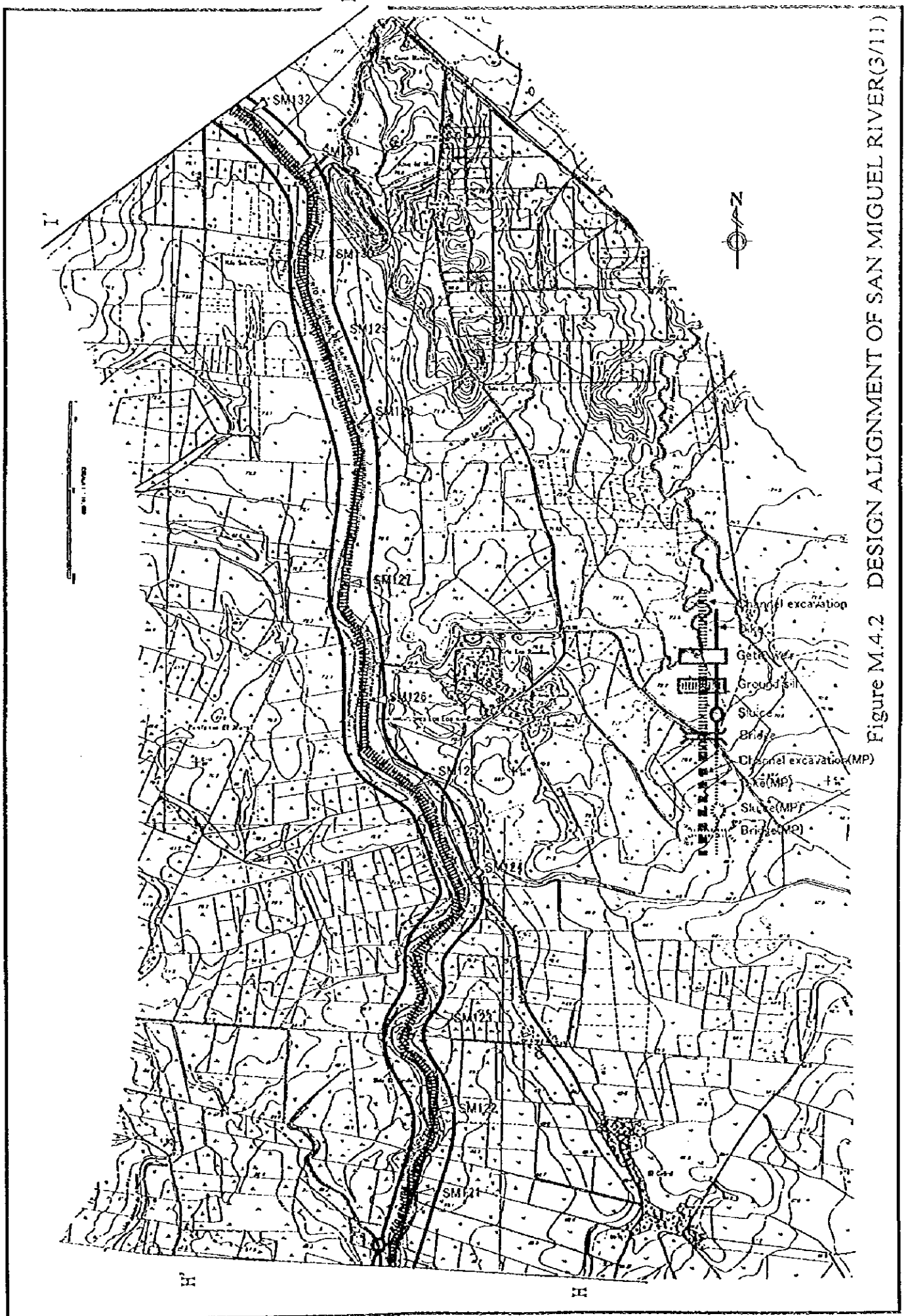


Figure M.4.2 DESIGN ALIGNMENT OF SAN MIGUEL RIVER(S/11)

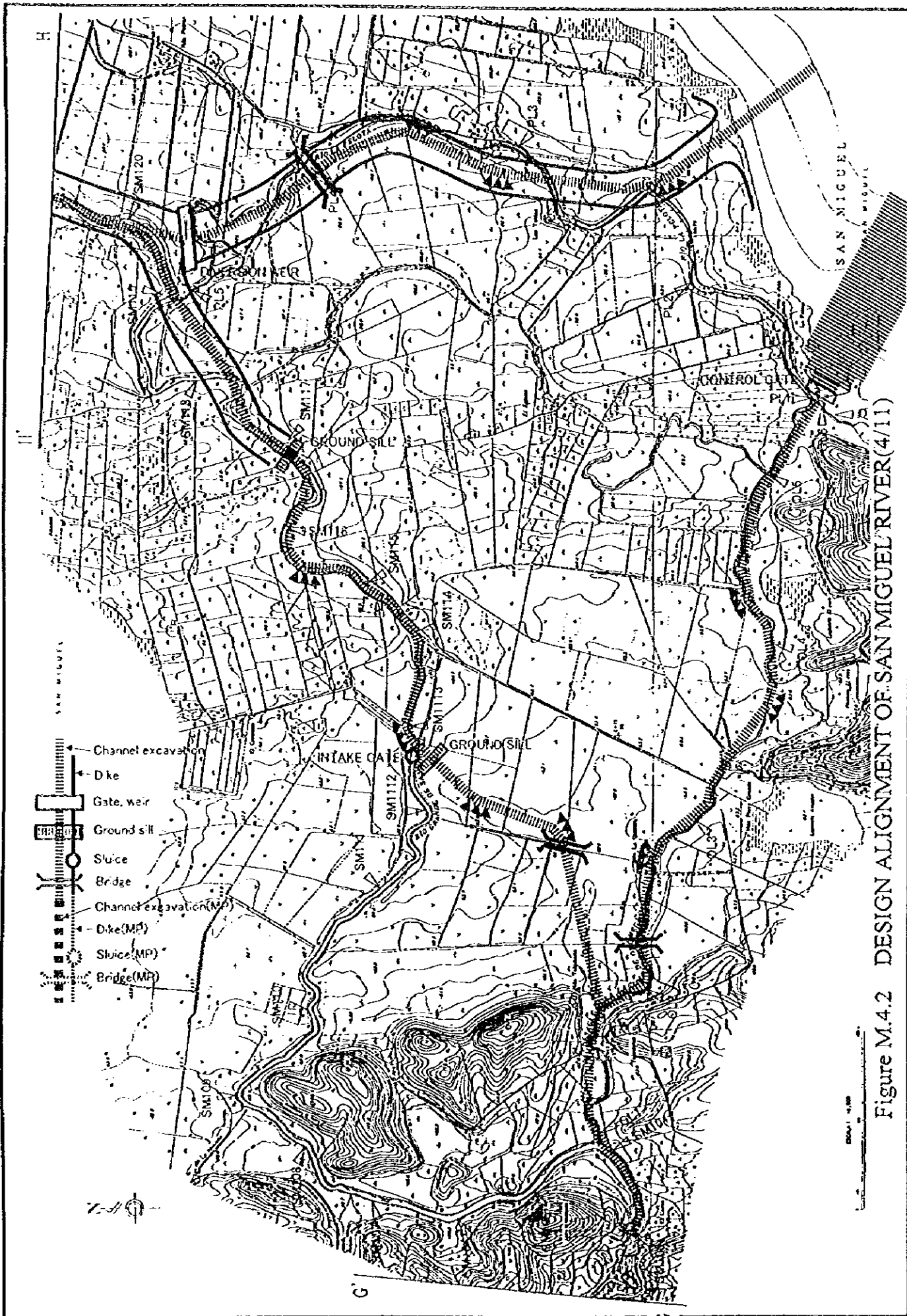


Figure M.4.2 DESIGN ALIGNMENT OF SAN MIGUEL RIVER(4/11)



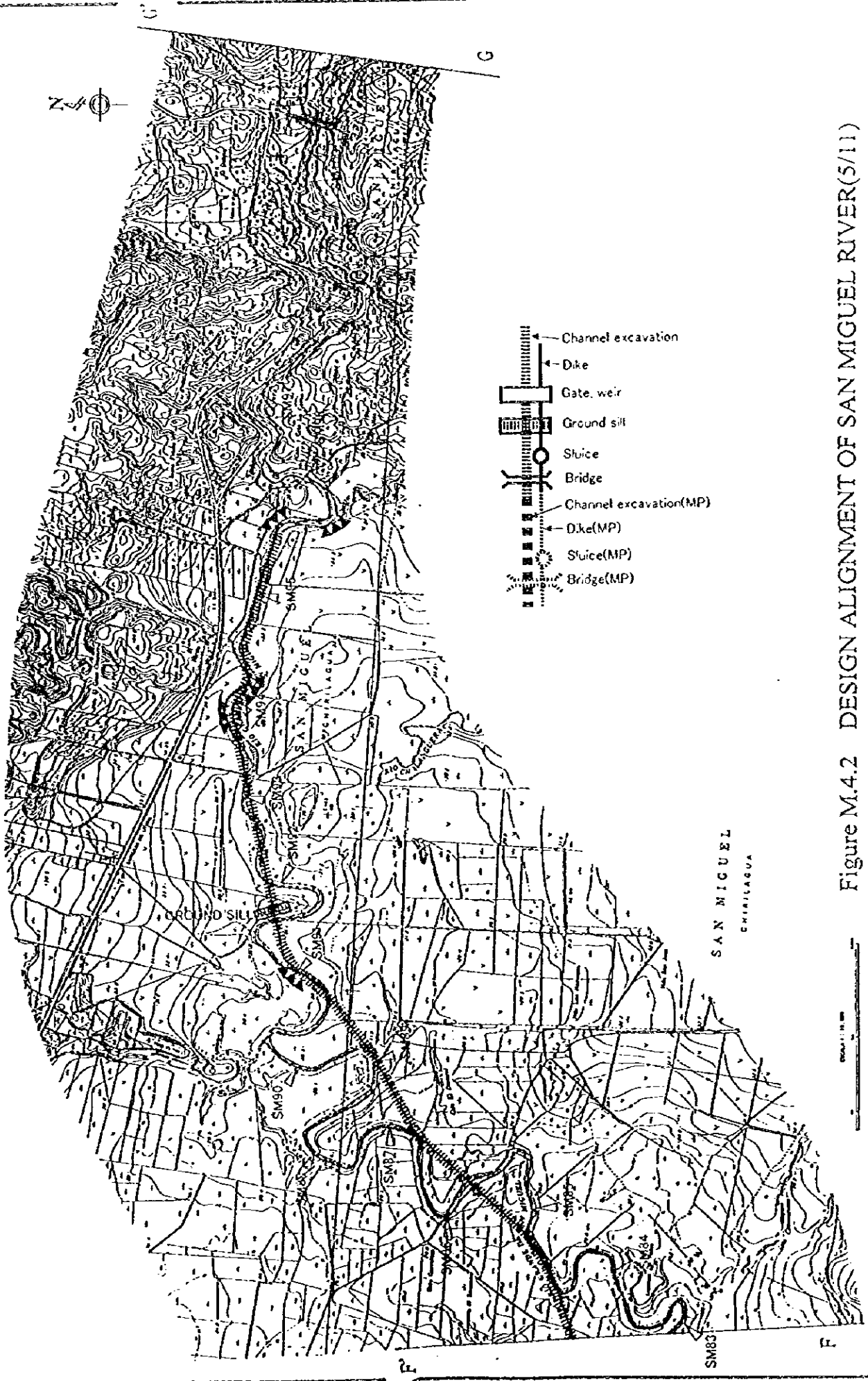


Figure M.4.2 DESIGN ALIGNMENT OF SAN MIGUEL RIVER(5/11)

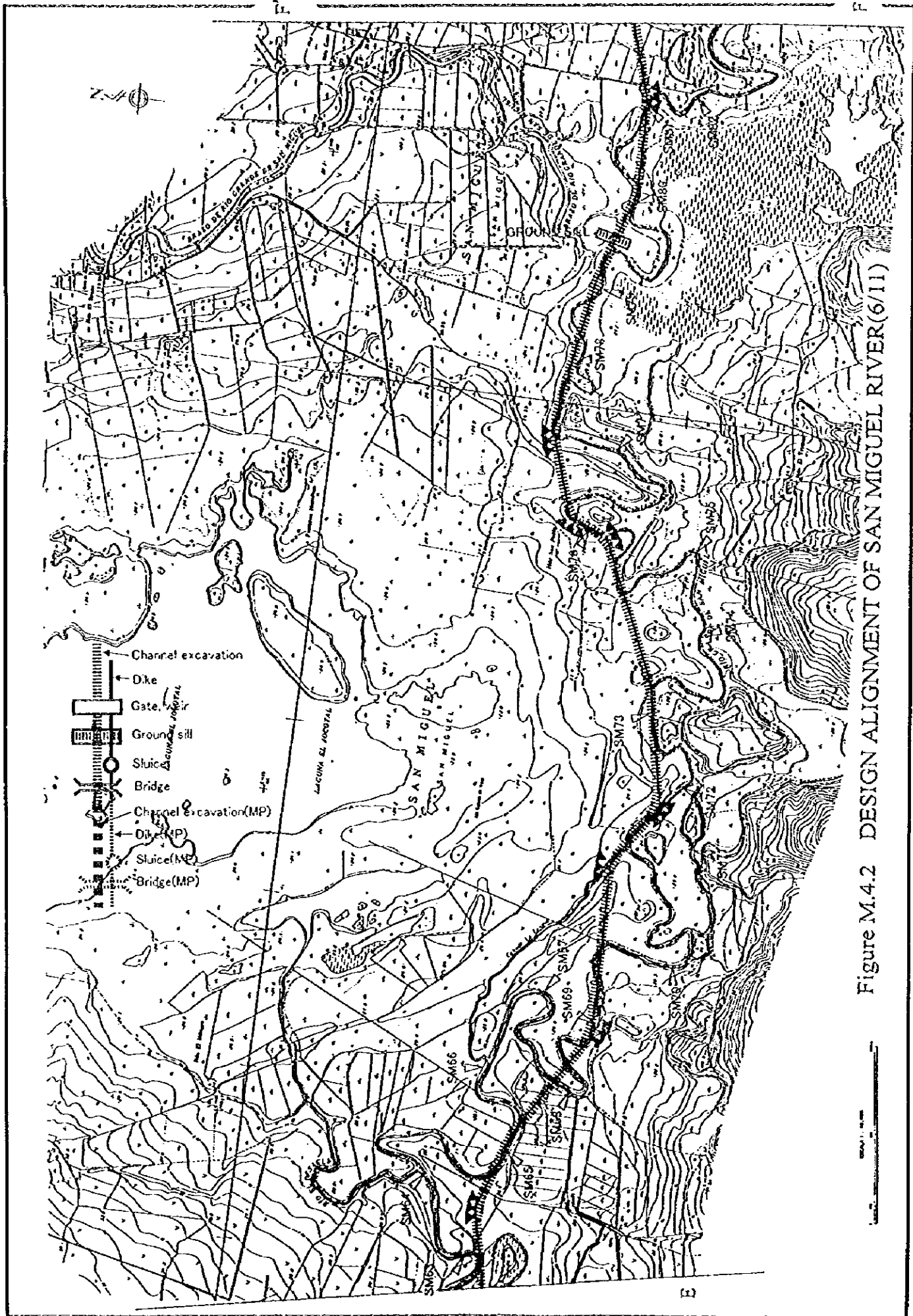


Figure M.4.2 DESIGN ALIGNMENT OF SAN MIGUEL RIVER(6/11)

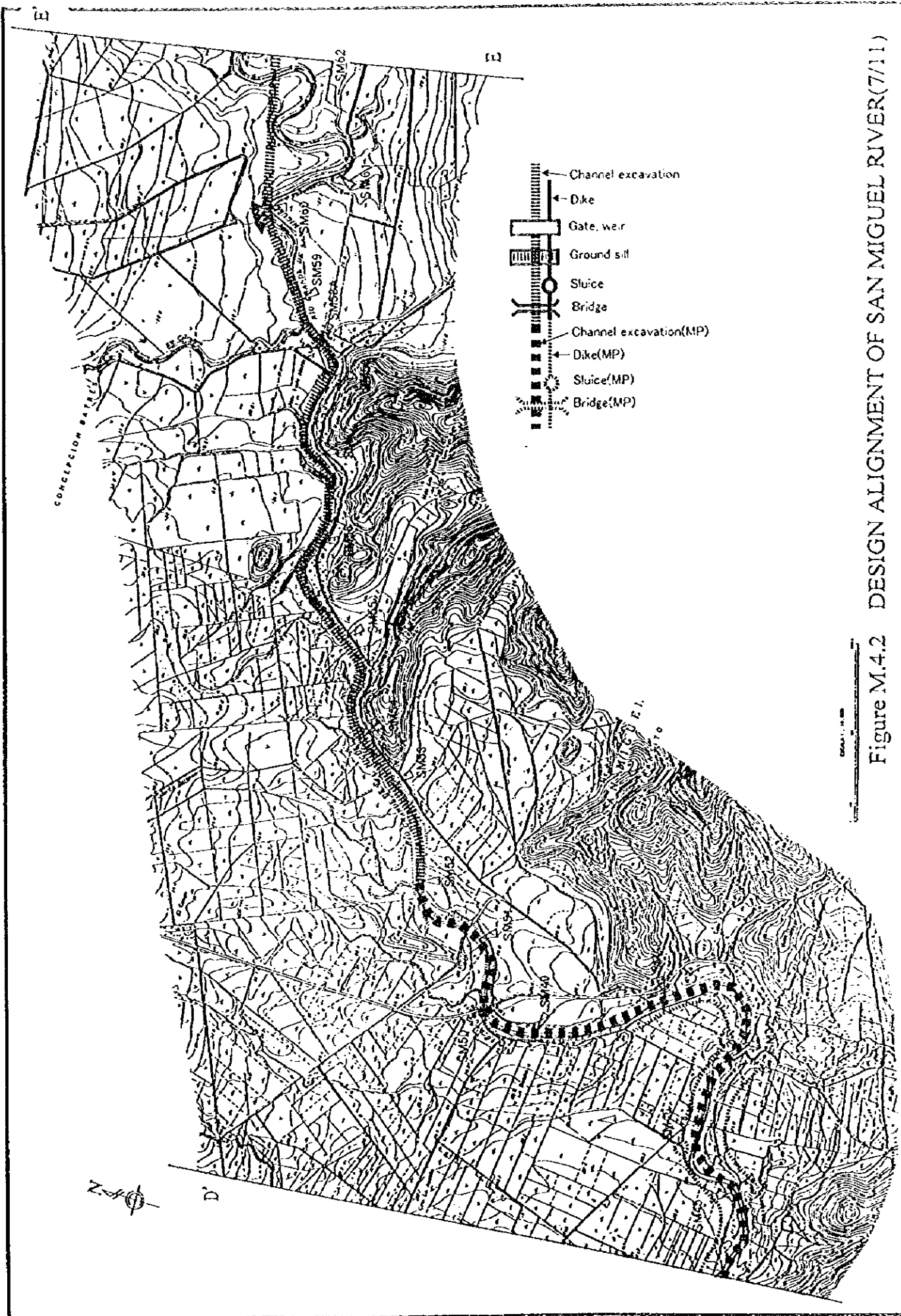


Figure M.4.2 DESIGN ALIGNMENT OF SAN MIGUEL RIVER(7/11)

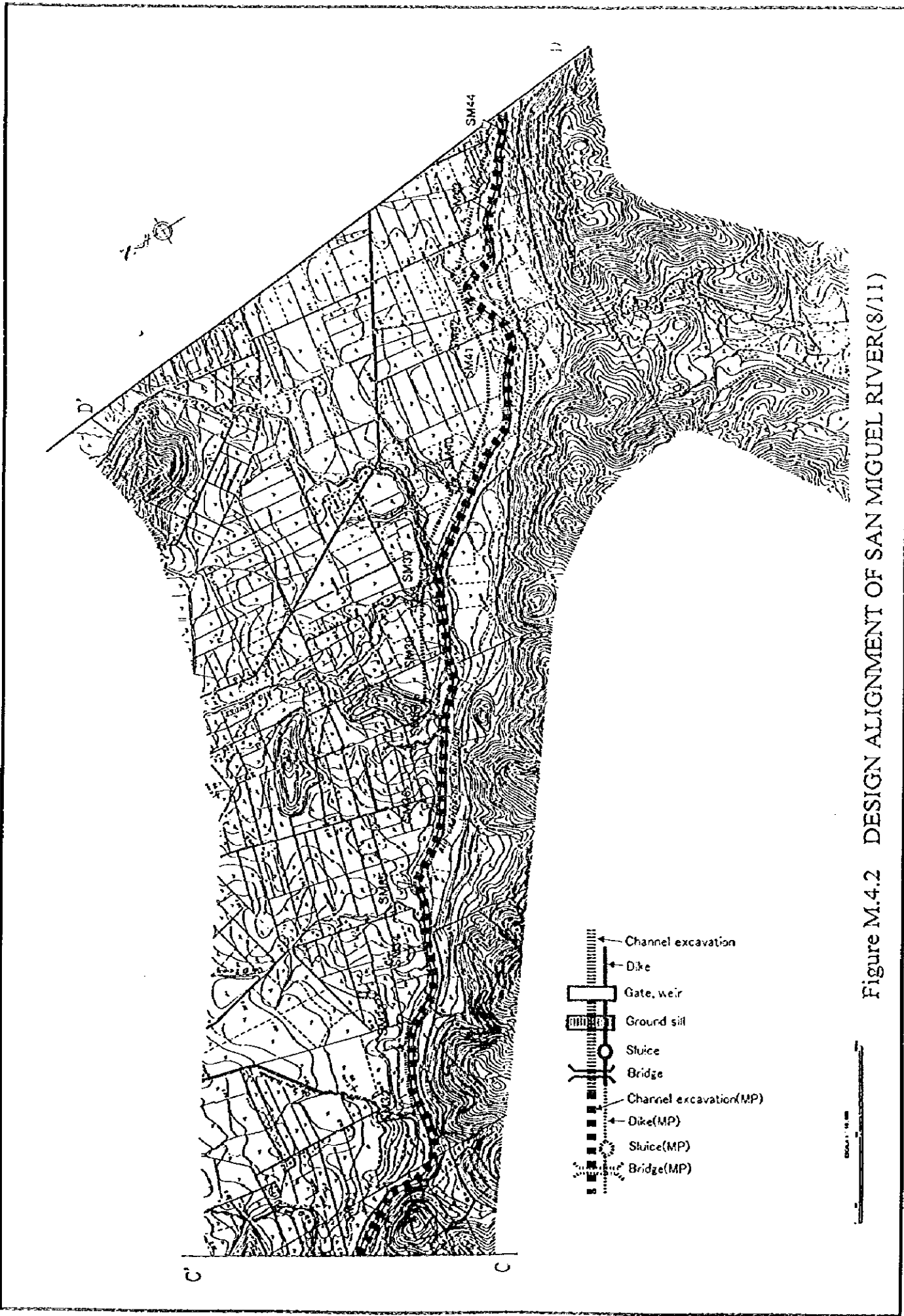


Figure M.4.2 DESIGN ALIGNMENT OF SAN MIGUEL RIVER(8/11)

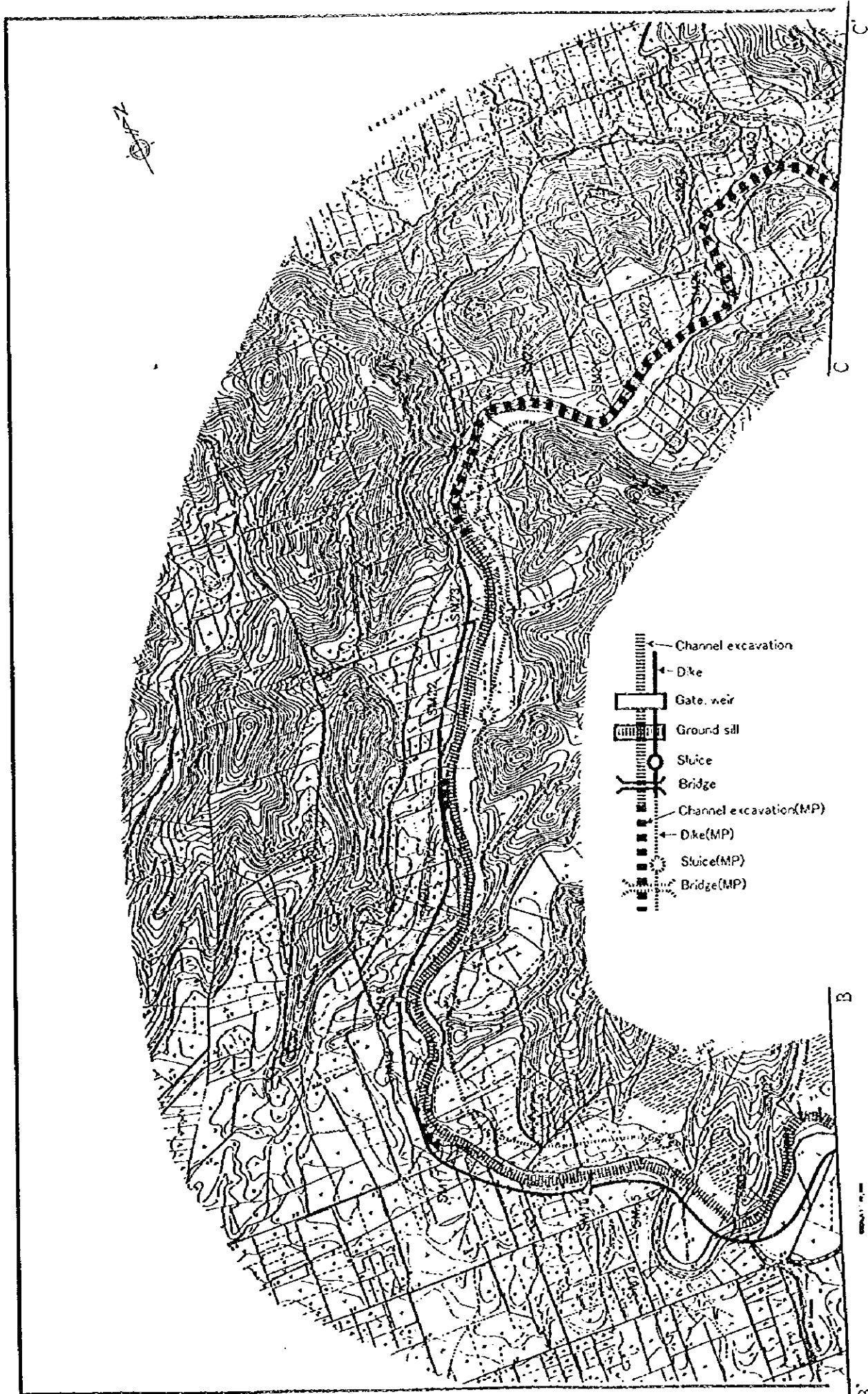


Figure M.4.2 DESIGN ALIGNMENT OF SAN MIGUEL RIVER(9/11)

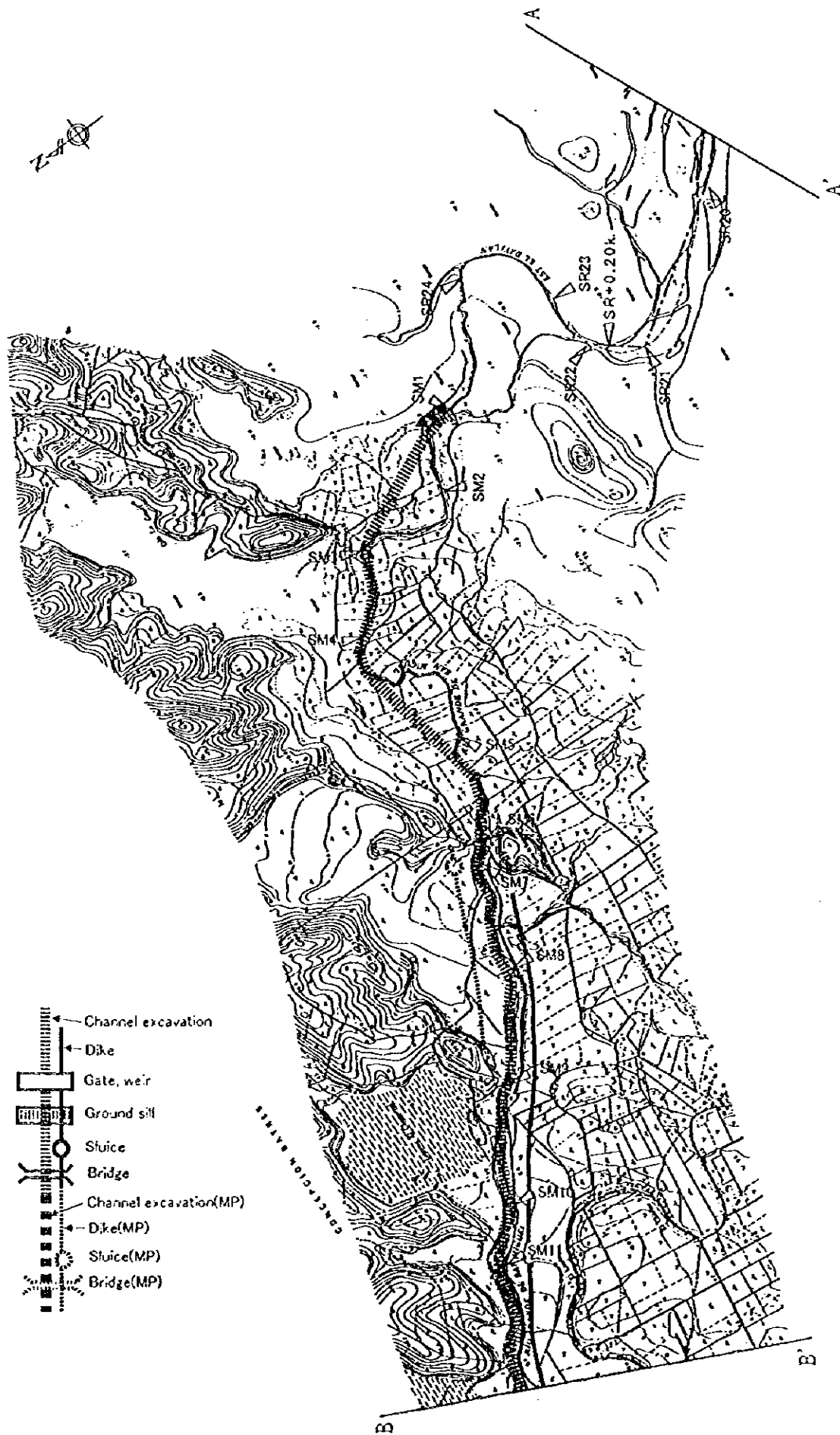


Figure M.4.2 DESIGN ALIGNMENT OF SAN MIGUEL RIVER(10/11)



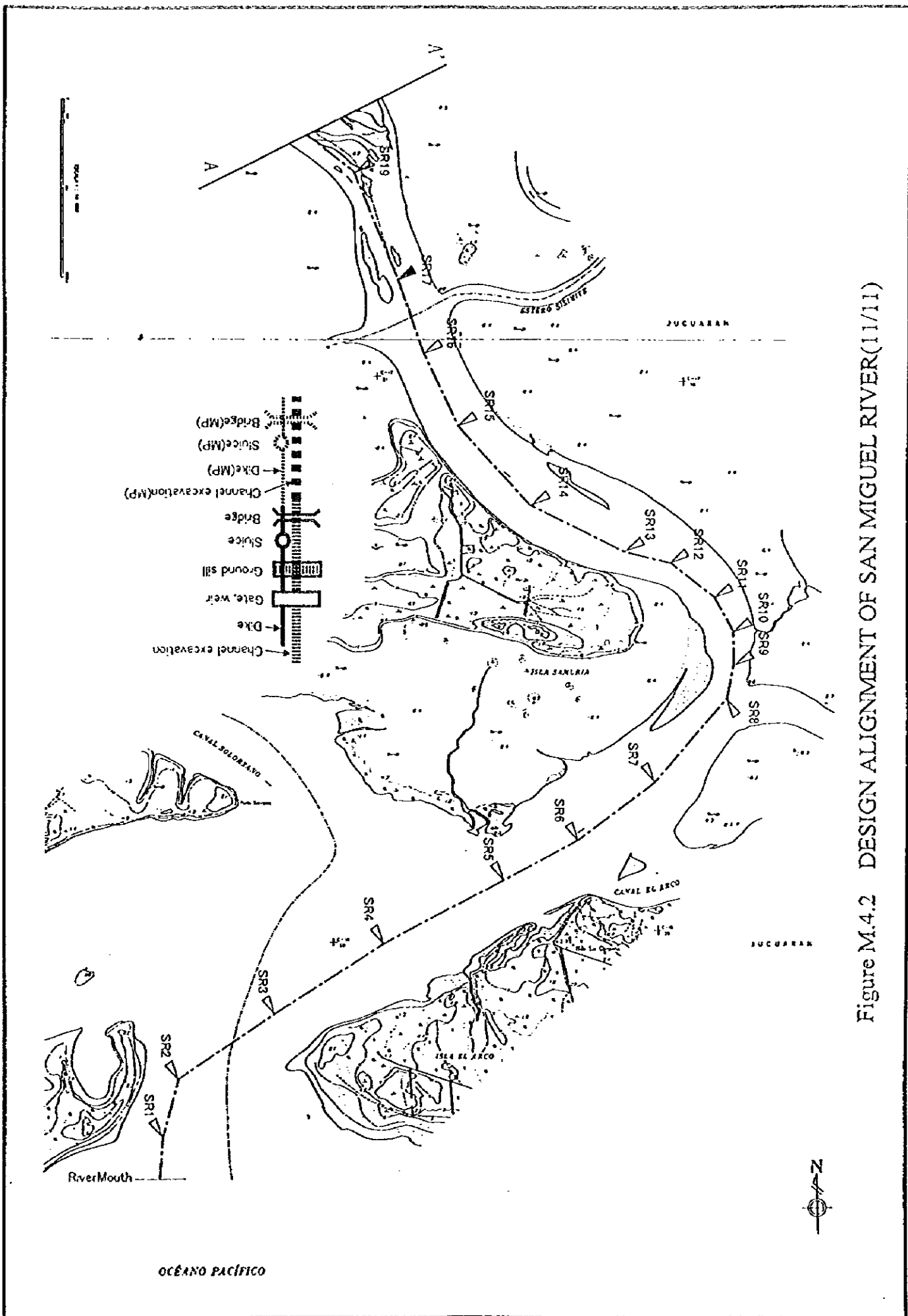


Figure M.4.2 DESIGN ALIGNMENT OF SAN MIGUEL RIVER(1/11)

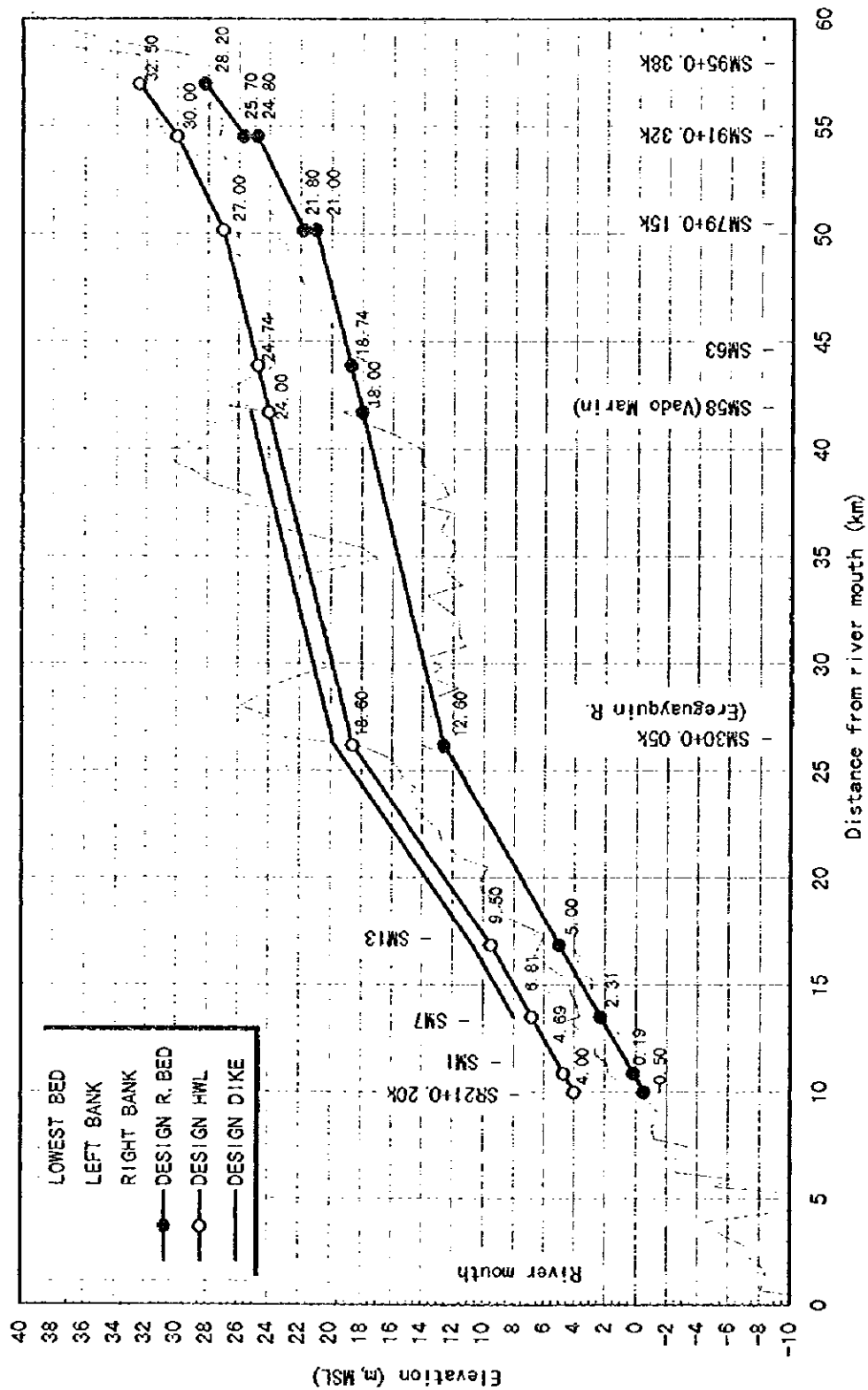


Figure M.4.3 DESIGN CHANNEL PROFILE(1/3): LOWER REACHES



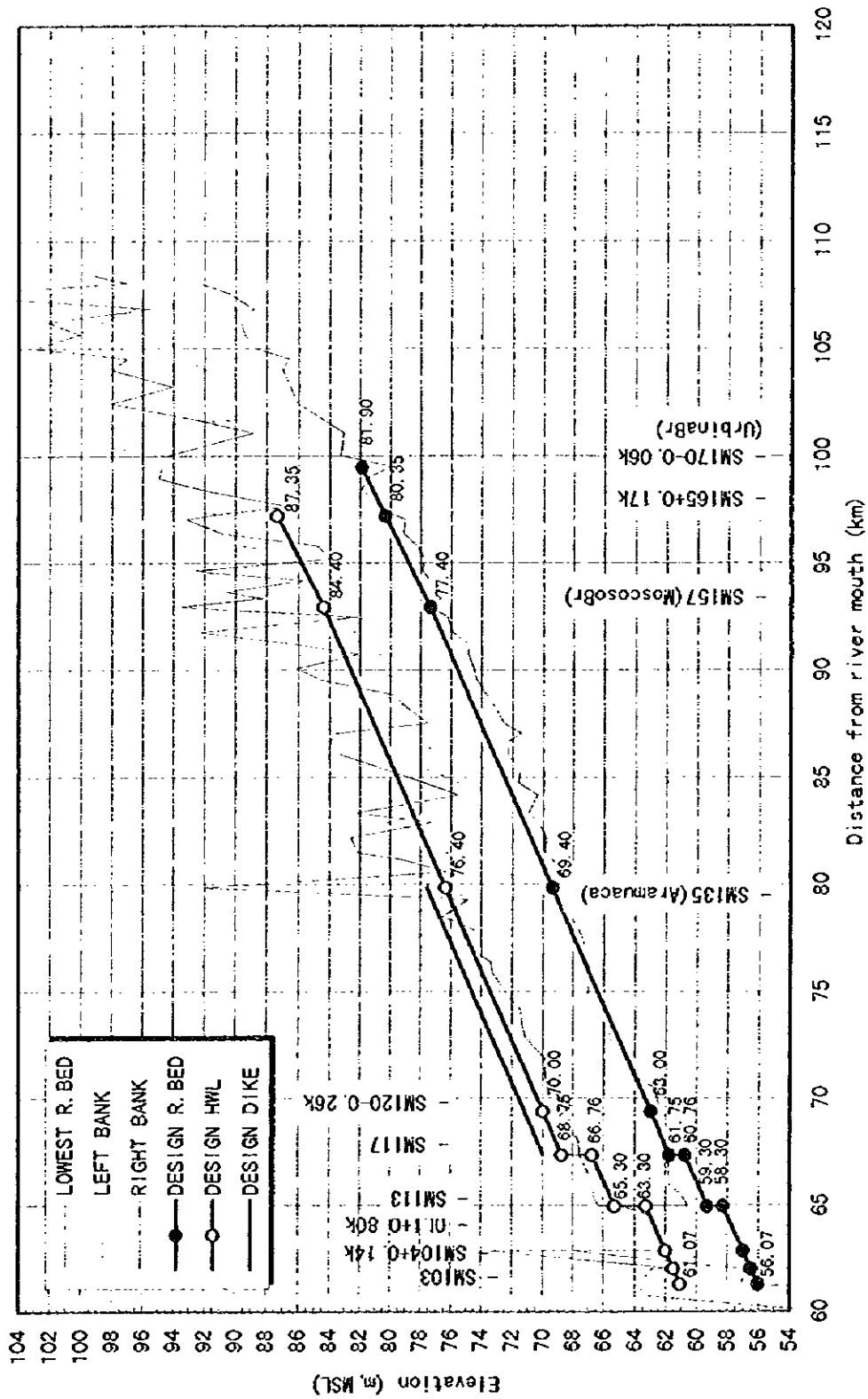


Figure M.4.3 DESIGN CHANNEL PROFILE(2/3): MIDDLE REACHES

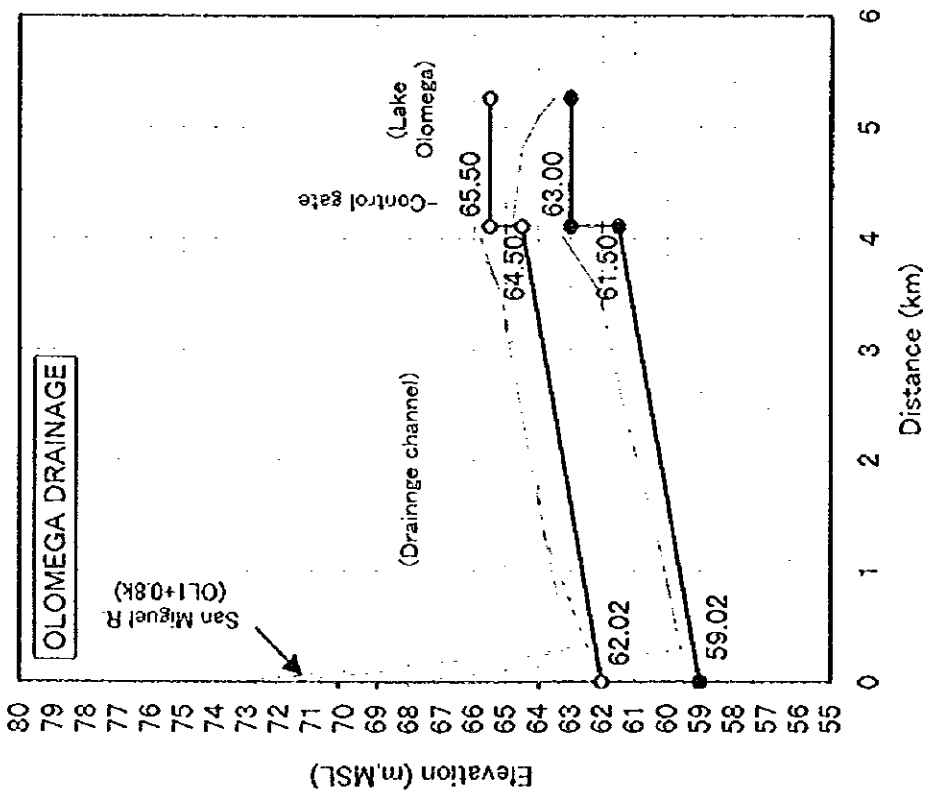
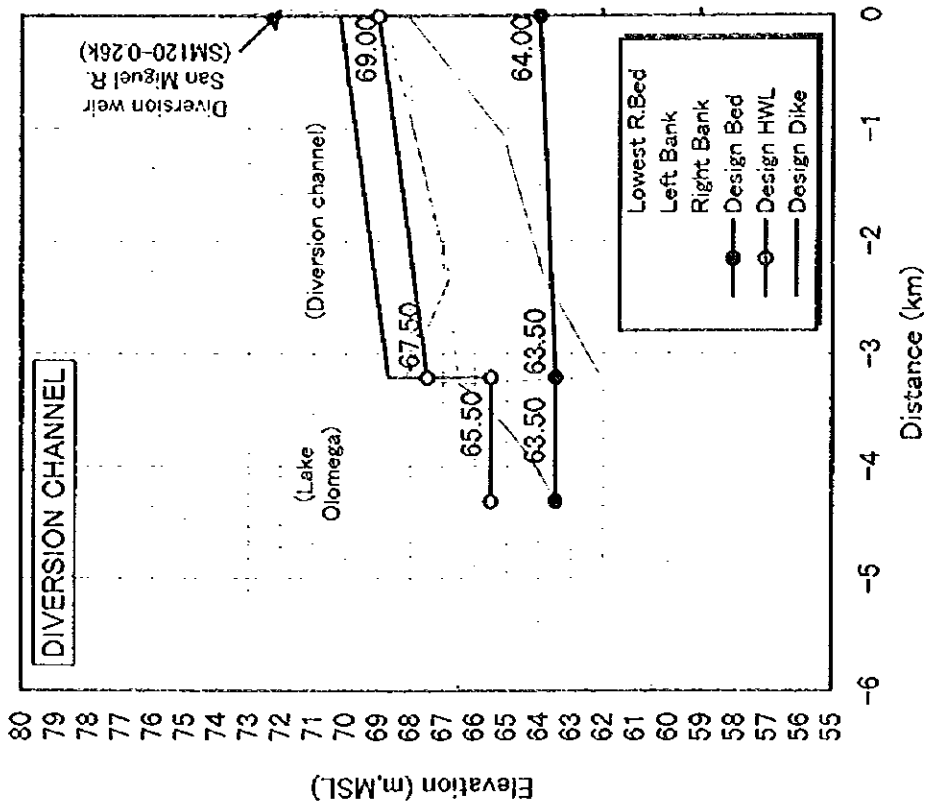


Figure M.4.3 DESIGN CHANNEL PROFILE(3/3)

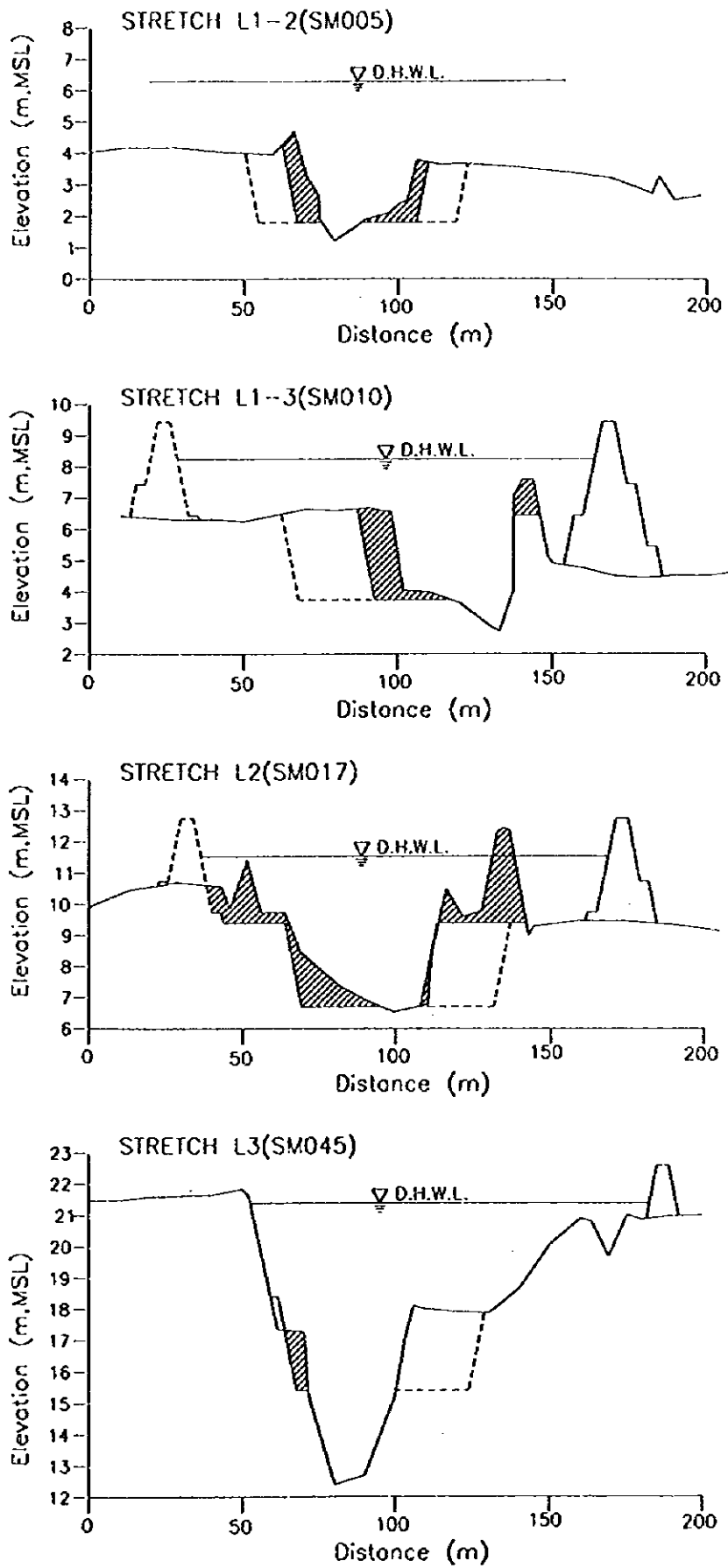


Figure M.4.4 REPRESENTATIVE DESIGN CHANNEL SECTION (1/5)

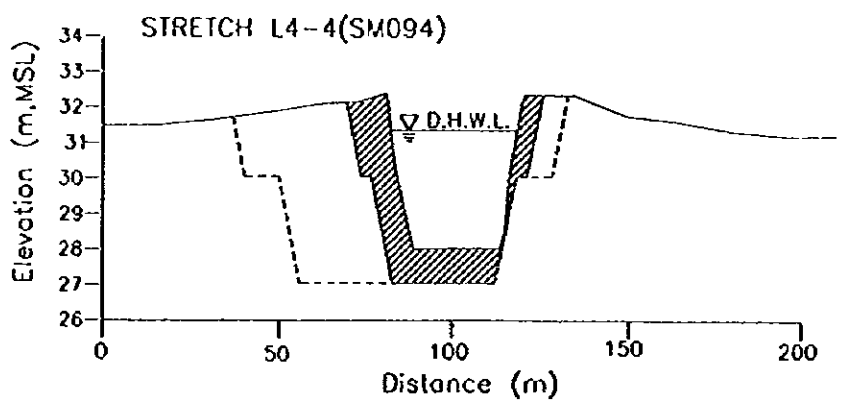
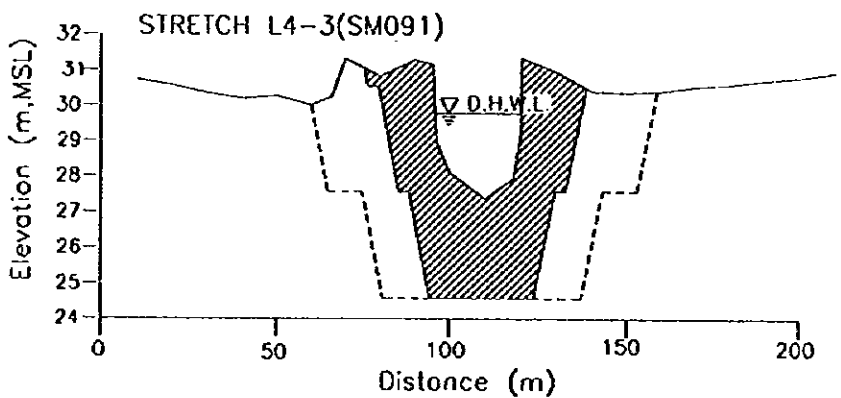
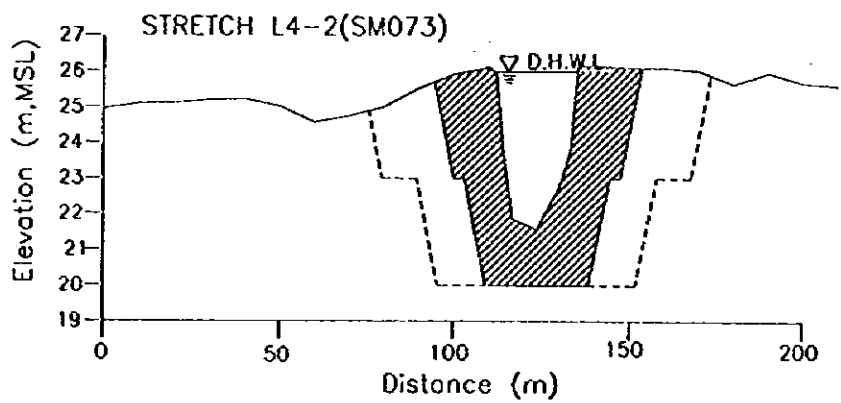
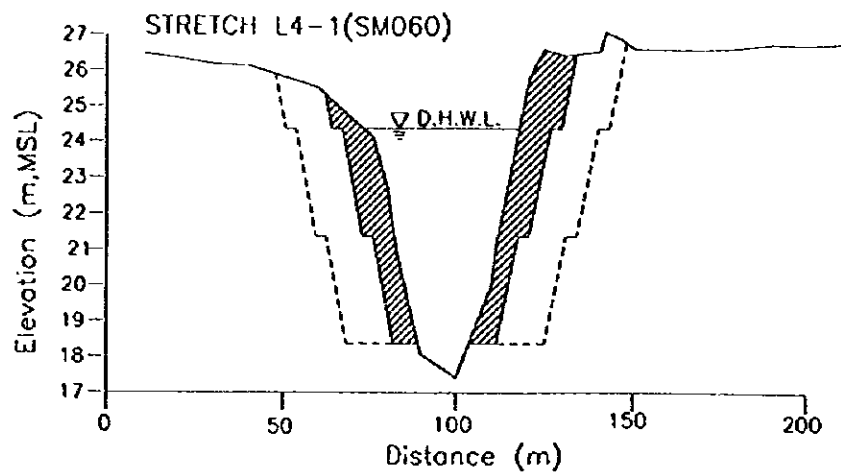


Figure M.4.4 REPRESENTATIVE DESIGN CHANNEL SECTION (2/5)

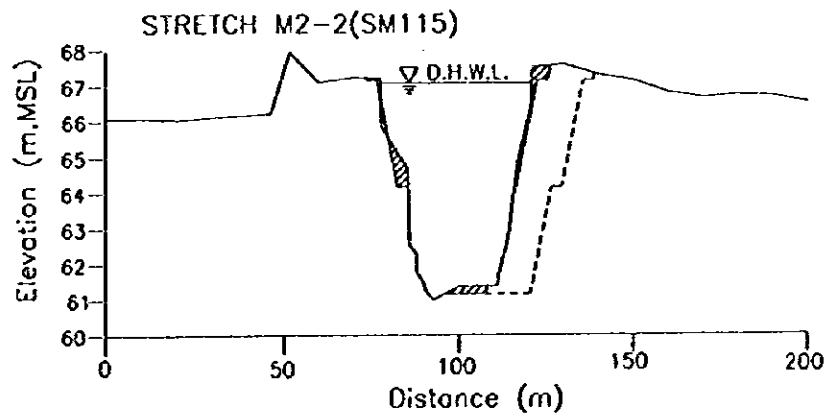
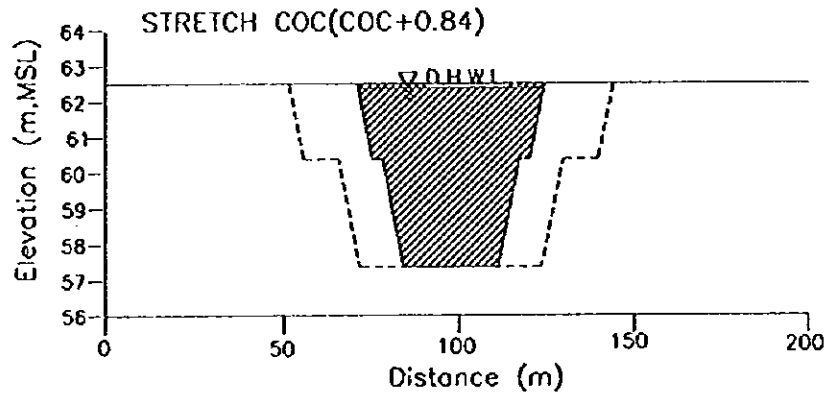
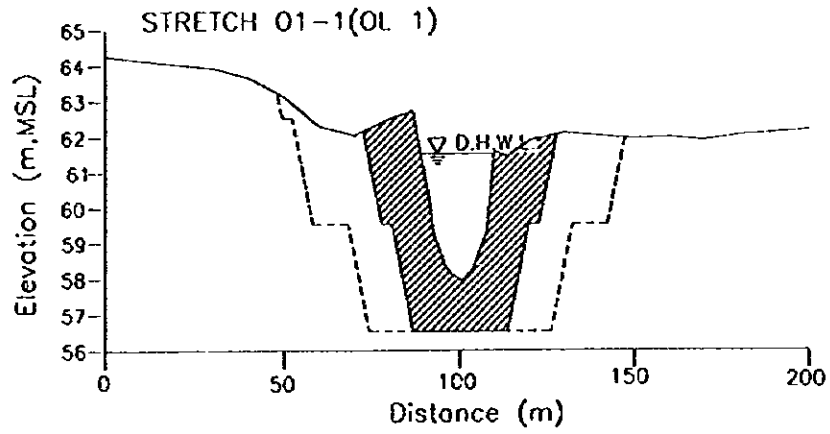
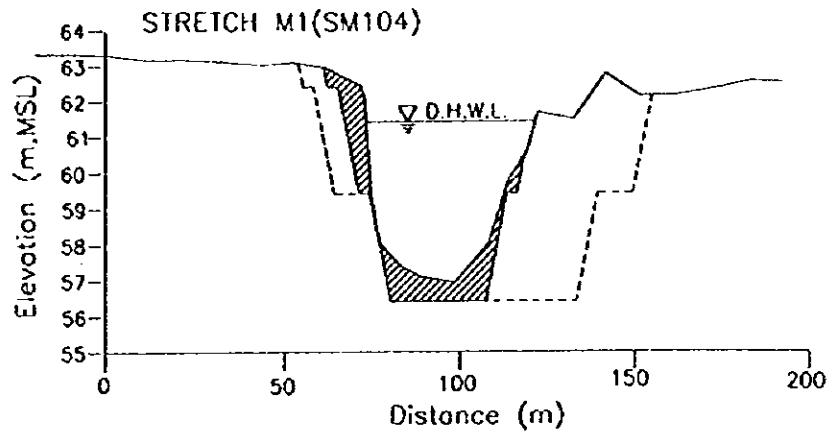


Figure M.4.4 REPRESENTATIVE DESIGN CHANNEL SECTION (3/5)

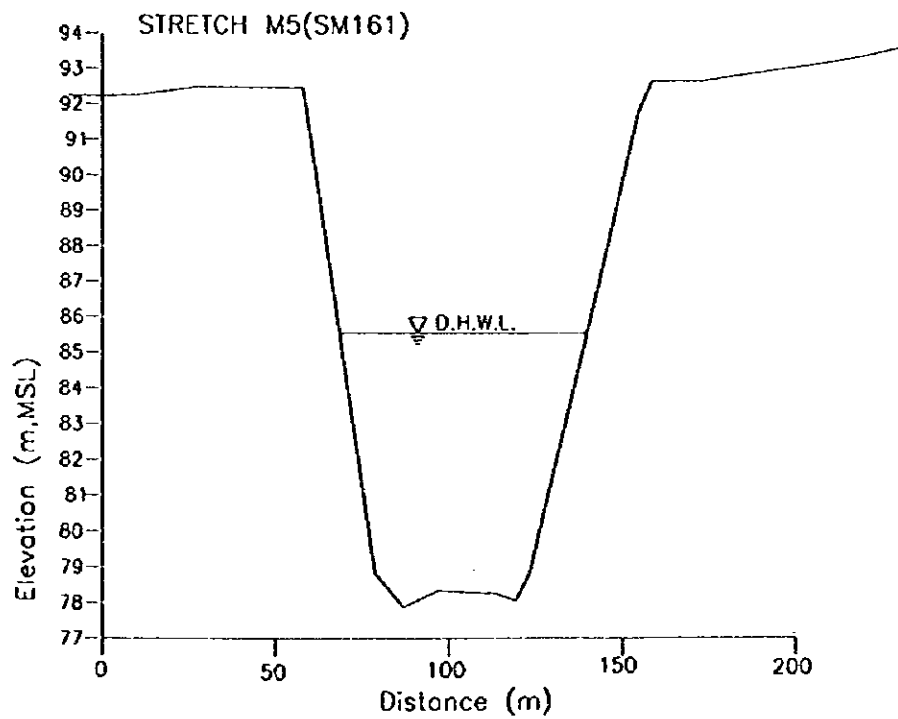
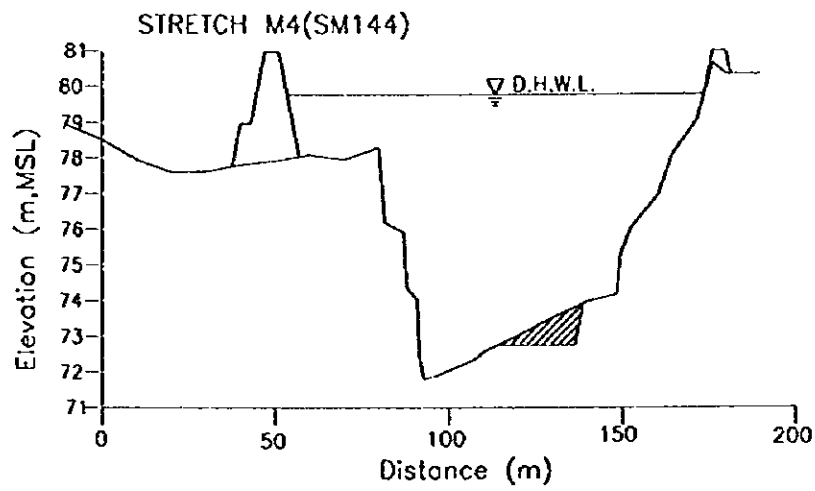
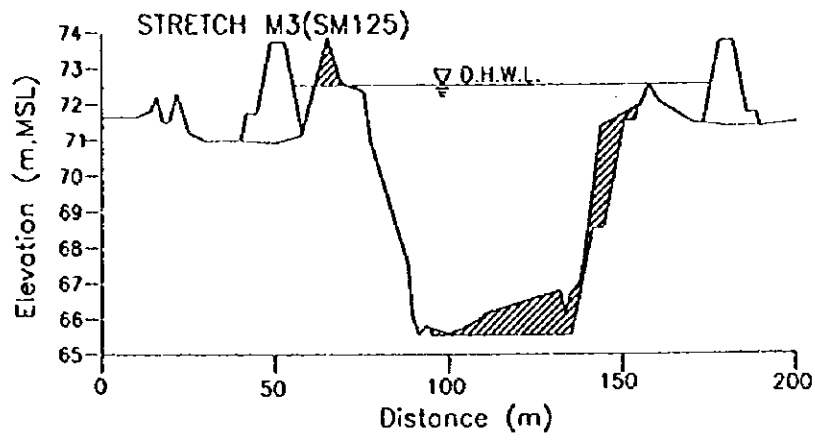


Figure M.4.4 REPRESENTATIVE DESIGN CHANNEL SECTION (4/5)

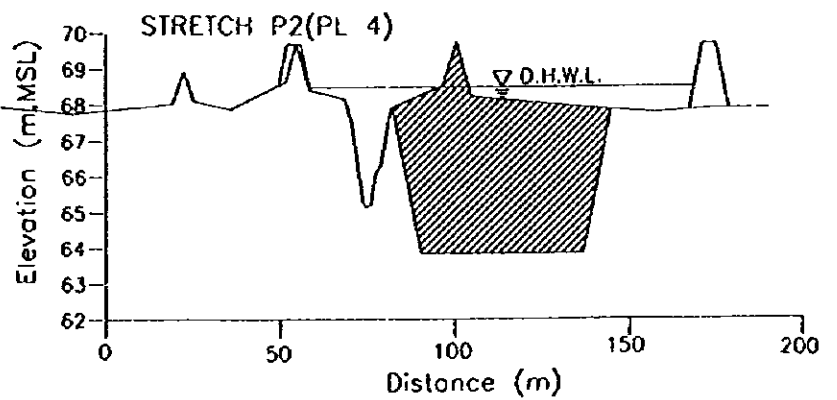
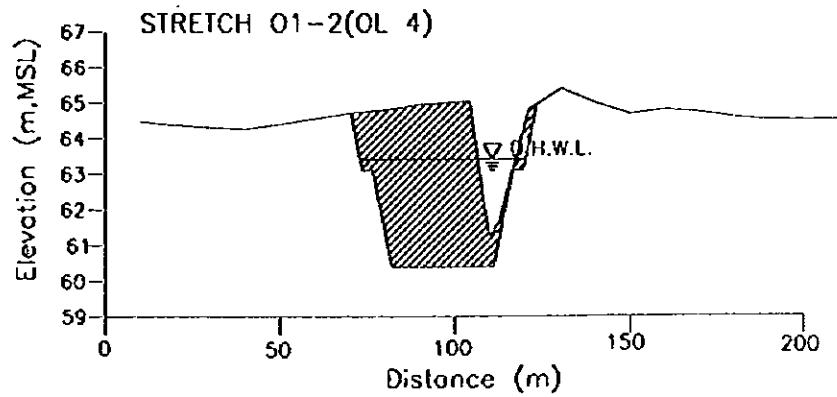
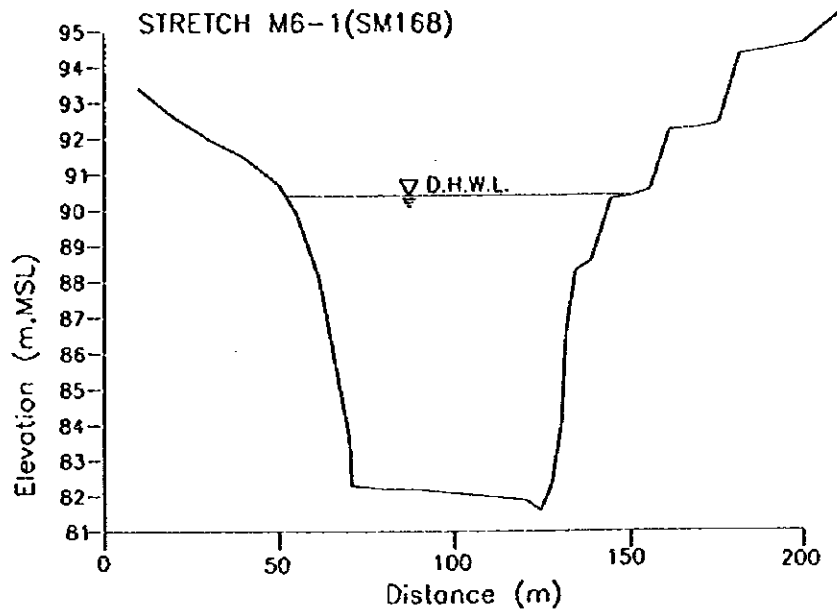


Figure M.4.4 REPRESENTATIVE DESIGN CHANNEL SECTION (5/5)

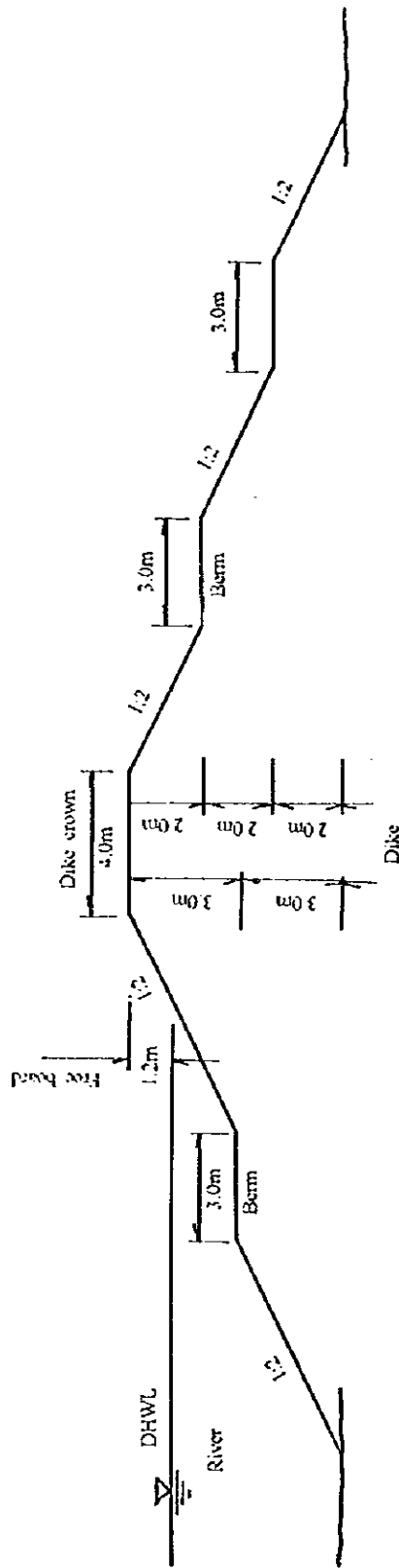
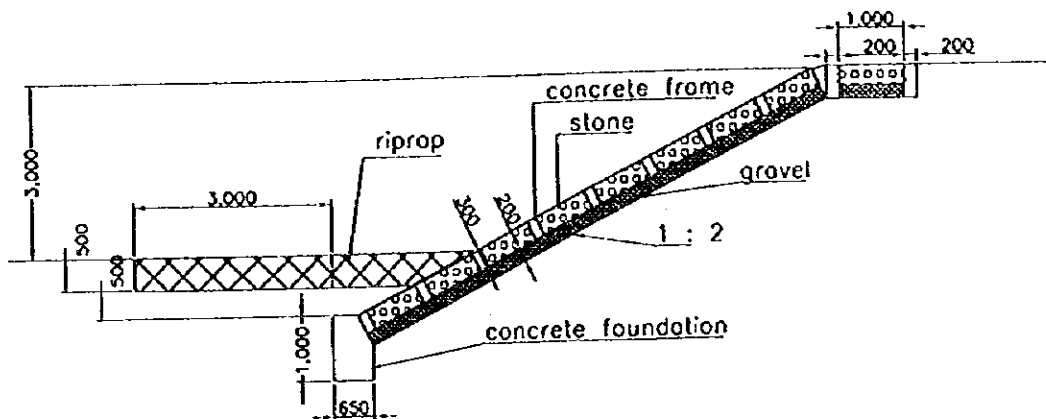
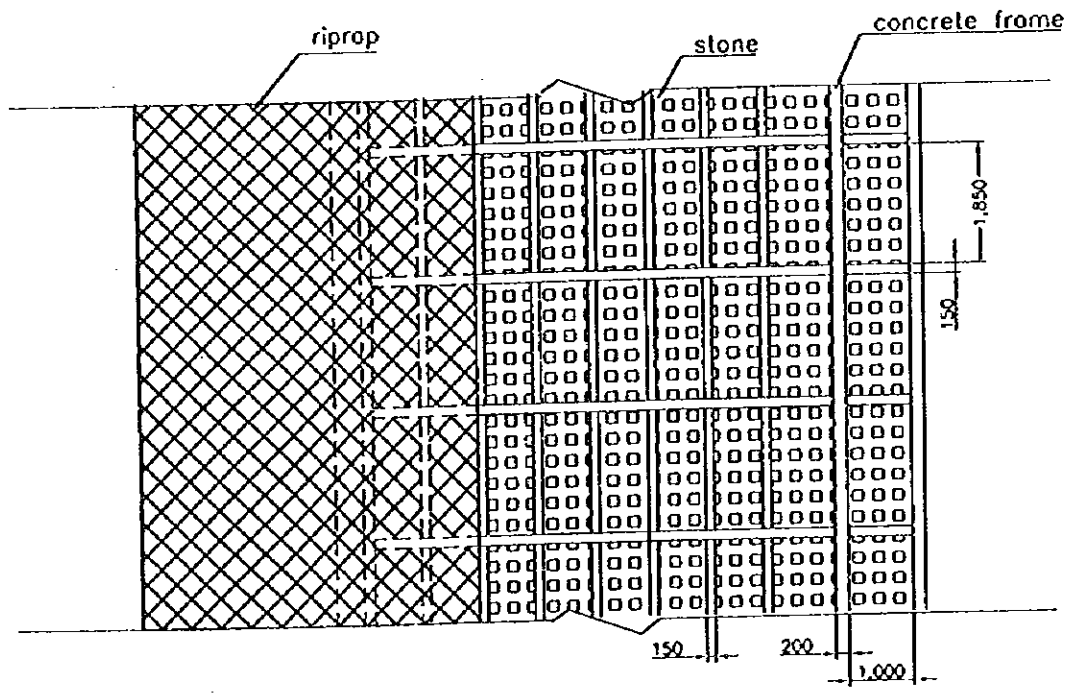


Figure M.4.5 STANDARD DIKE SECTION



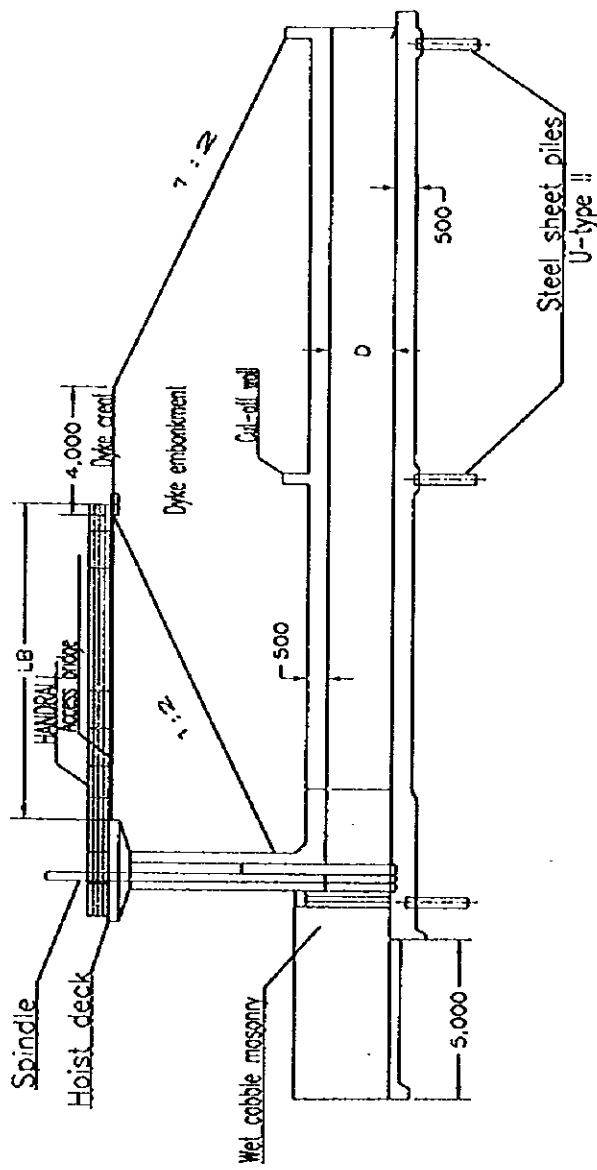


PROFILE

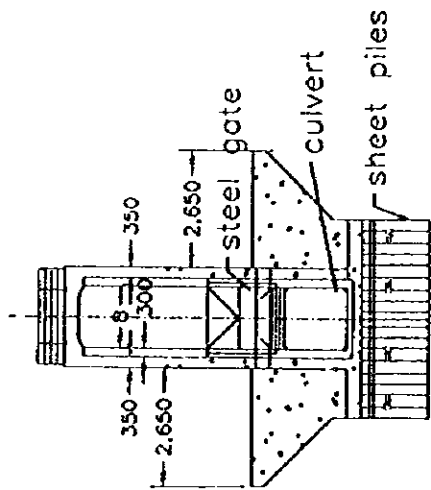


PLAN

Figure M.4.6 STANDERD DESIGN OF REVETMENT WORKS



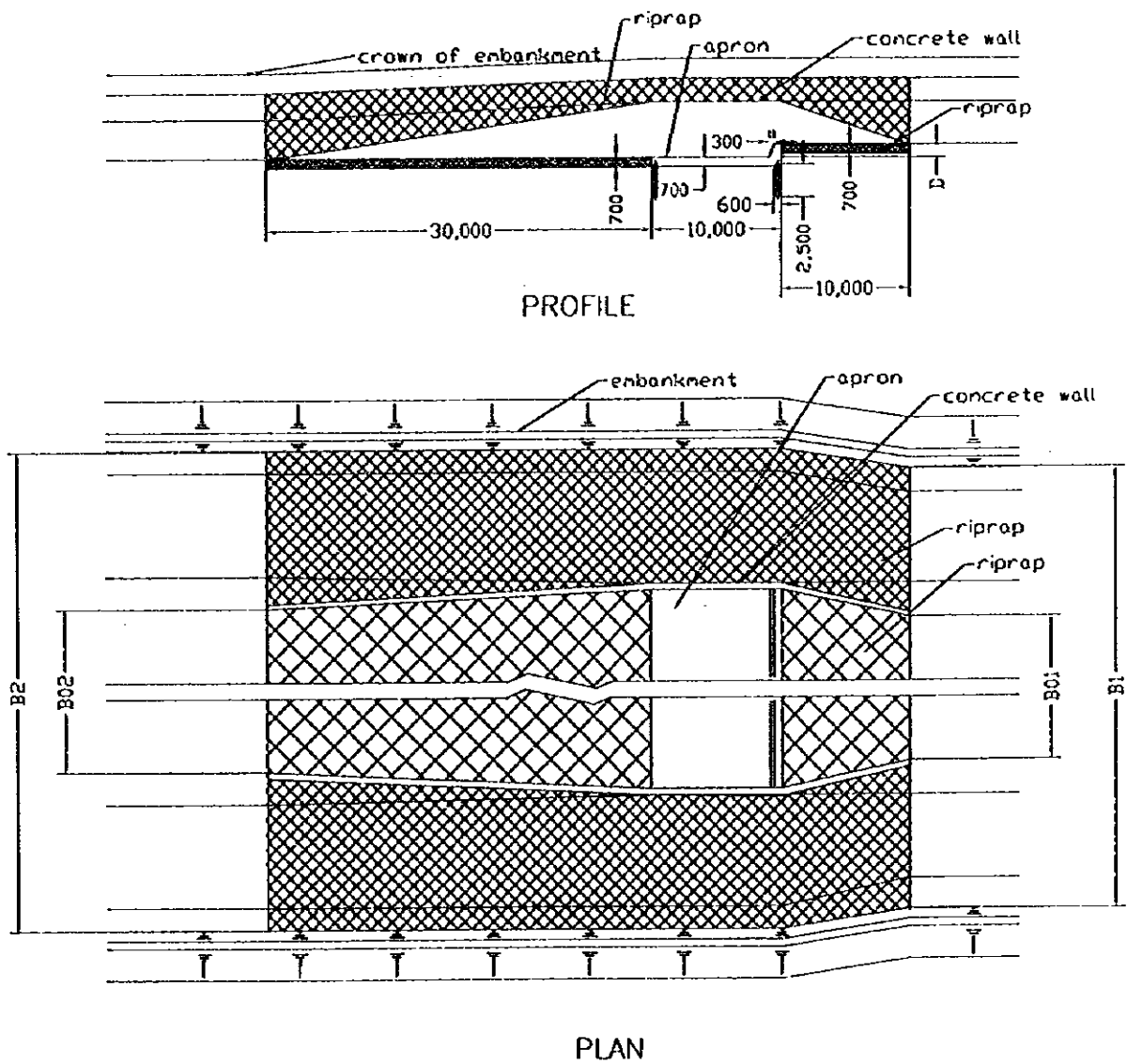
PROFILE



SECTION

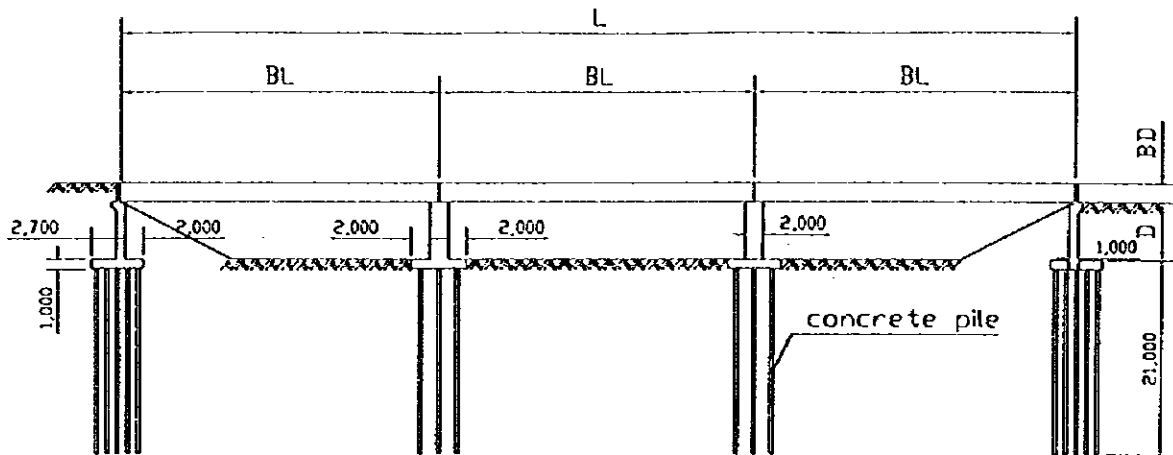
Sluice name	Type	Width (m)	Height (m)
S6,S8,S9,S10,S12,S14	A	1.25	1.25
S1,S2,S5,S7,S11,S16	B	1.75	1.75
S3,S13	C	2.50	2.50

Figure M.4.7 STANDERD DESIGN OF DRAINAGE SLUICE

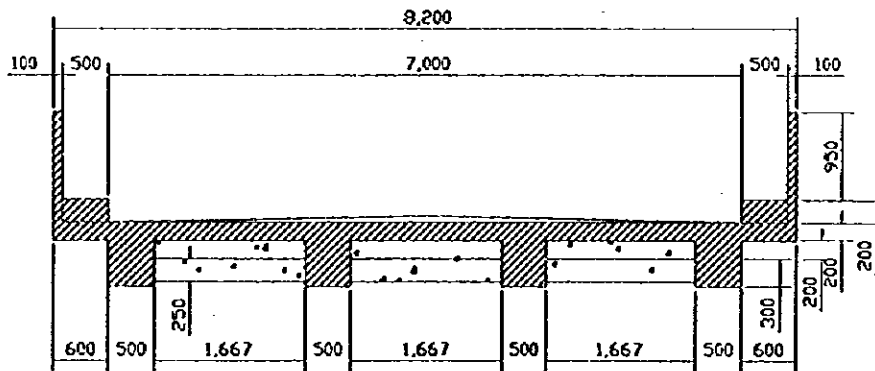


Ground sill	B1 (m)	B01 (m)	B2 (m)	B02 (m)	D (m)
G1	130	56	130	56	0.8
G2	125	56	130	56	0.9
G3	105	29	125	52	1.0
G4	95	16	105	29	1.0

Figure M.4.8 STANDARD DESIGN OF GROUND SILL



PROFILE



SECTION

Bridge name	L (m)	BL (m)	BD (m)	D (m)
COC Br.	90	30	1.50	6.20
Drainage Ch. Br.	40	-	2.05	4.20
Div. Ch. .Br	105	35	1.85	5.20

Figure M.4.9 STANDERD DESIGN OF BRIDGE

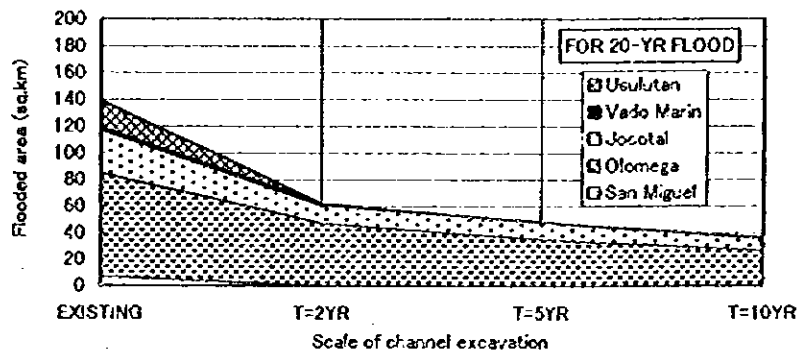
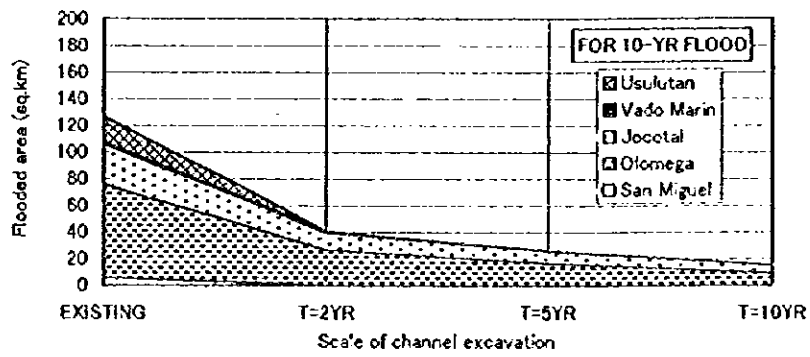
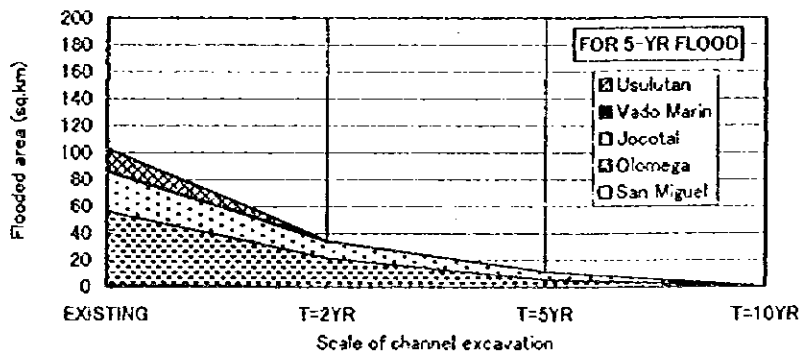
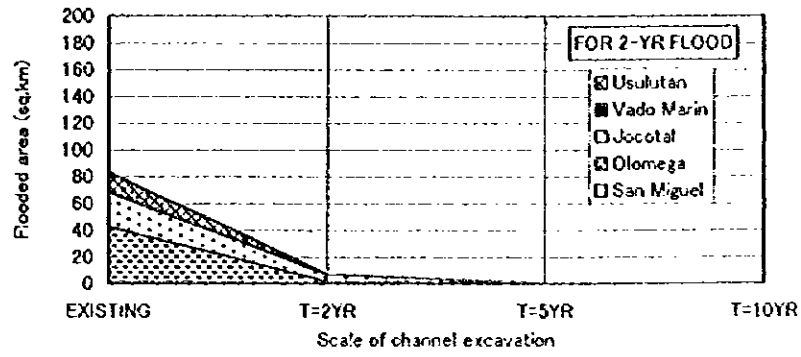
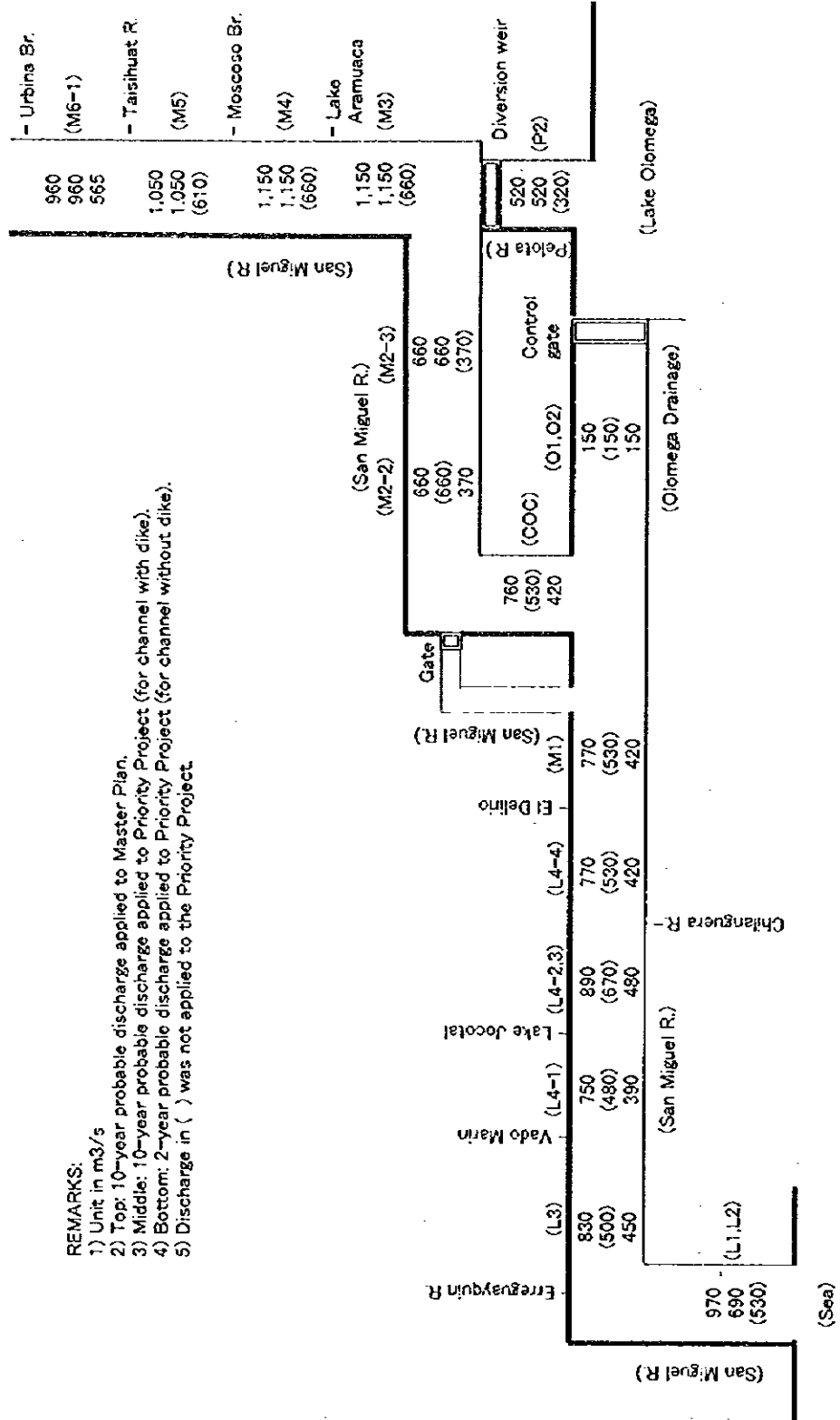


Figure M.4.10 CHANNEL EXCAVATION AND INUNDATED AREA



**REMARKS:**

- 1) Unit in m<sup>3</sup>/s
- 2) Top: 10-year probable discharge applied to Master Plan.
- 3) Middle: 10-year probable discharge applied to Priority Project (for channel with dike).
- 4) Bottom: 2-year probable discharge applied to Priority Project (for channel without dike).
- 5) Discharge in ( ) was not applied to the Priority Project.

**Figure M.5.1 DESIGN DISCHARGE DISTRIBUTION**

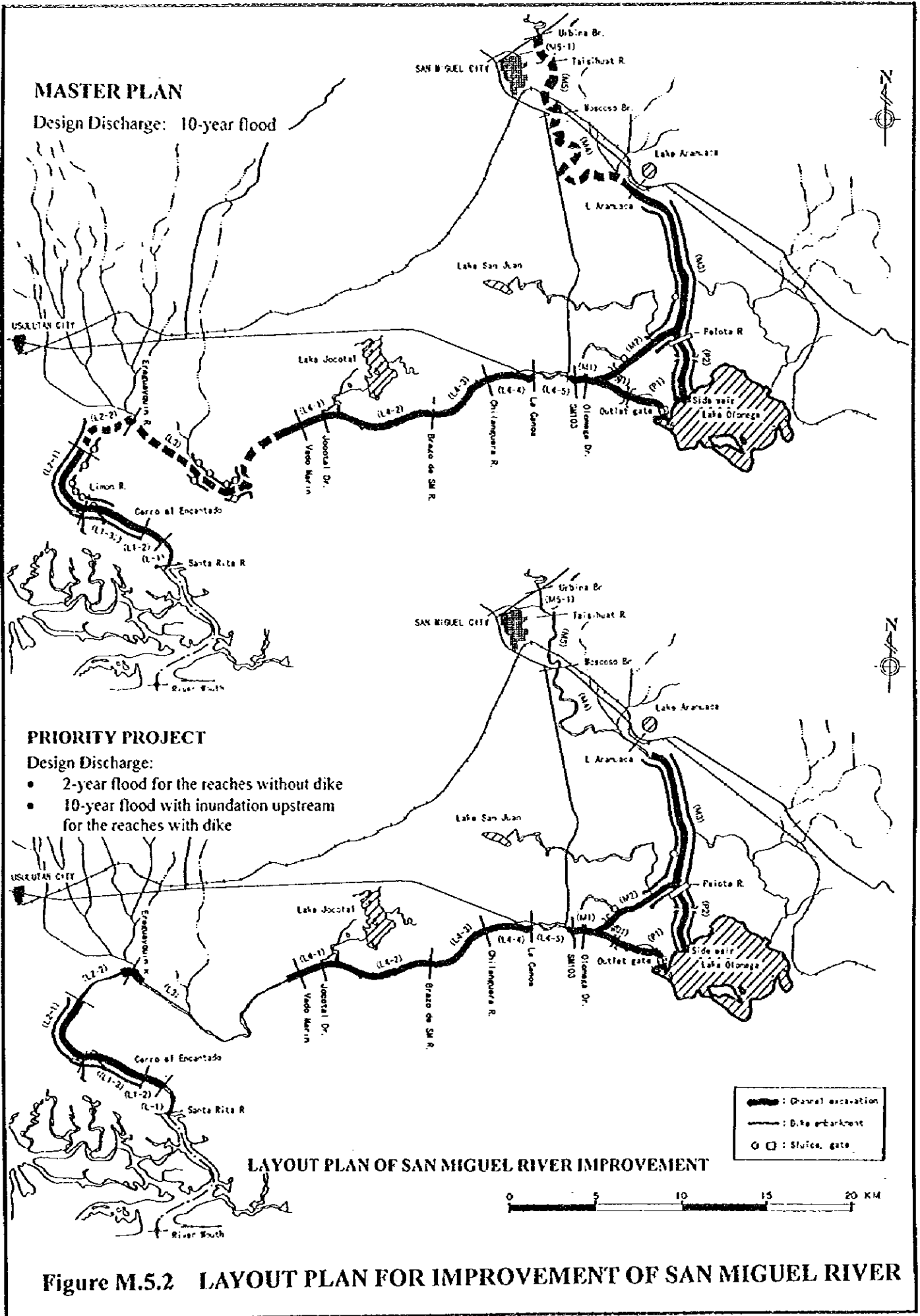


Figure M.5.2 LAYOUT PLAN FOR IMPROVEMENT OF SAN MIGUEL RIVER