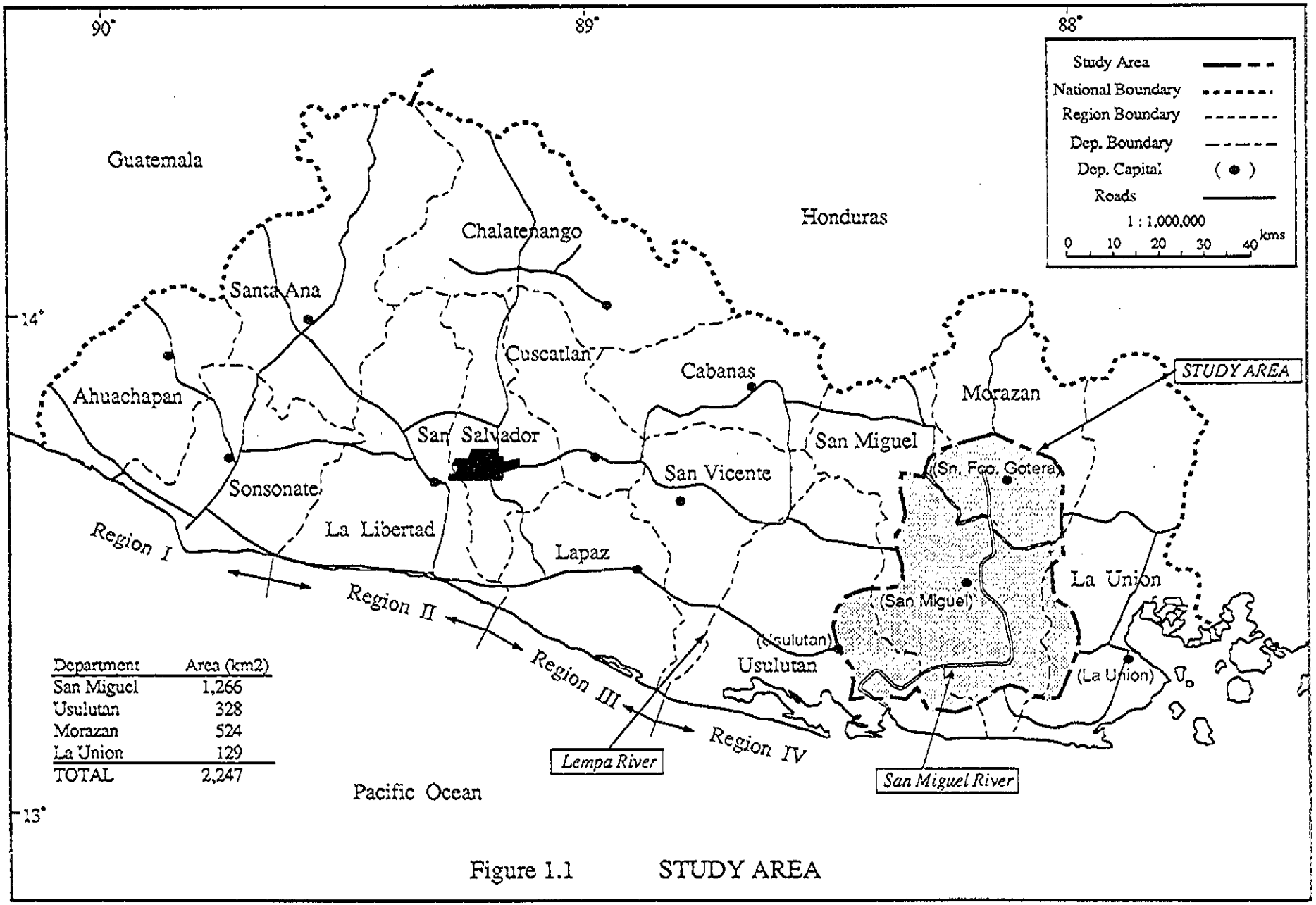
Figures



Department	Area (km2)
San Miguel	1,266
Usulutan	328
Morazan	524
La Union	129
TOTAL	2,247

Figure 1.1 STUDY AREA

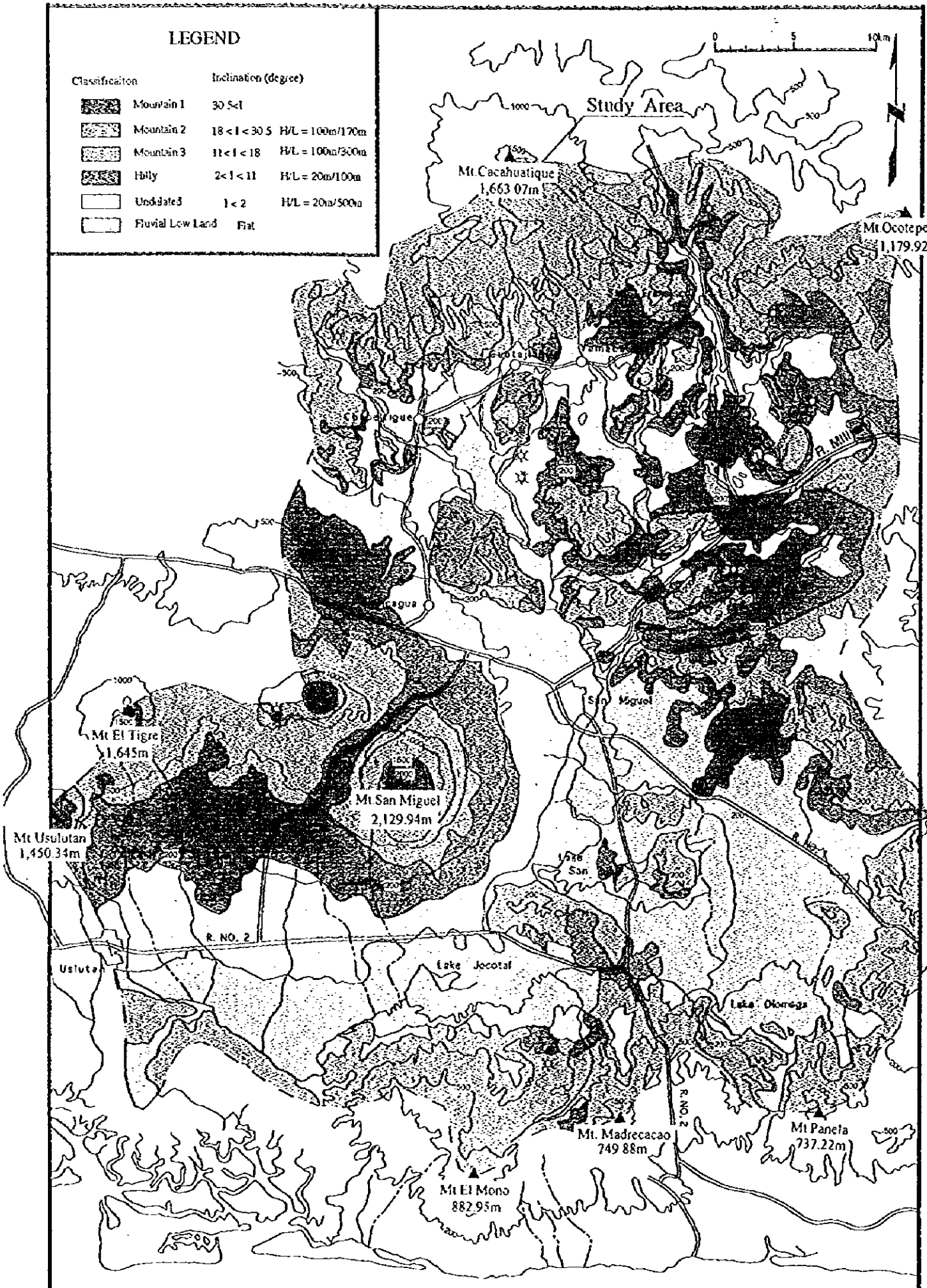


Figure.2.1 TOPOGRAPHY OF STUDY AREA

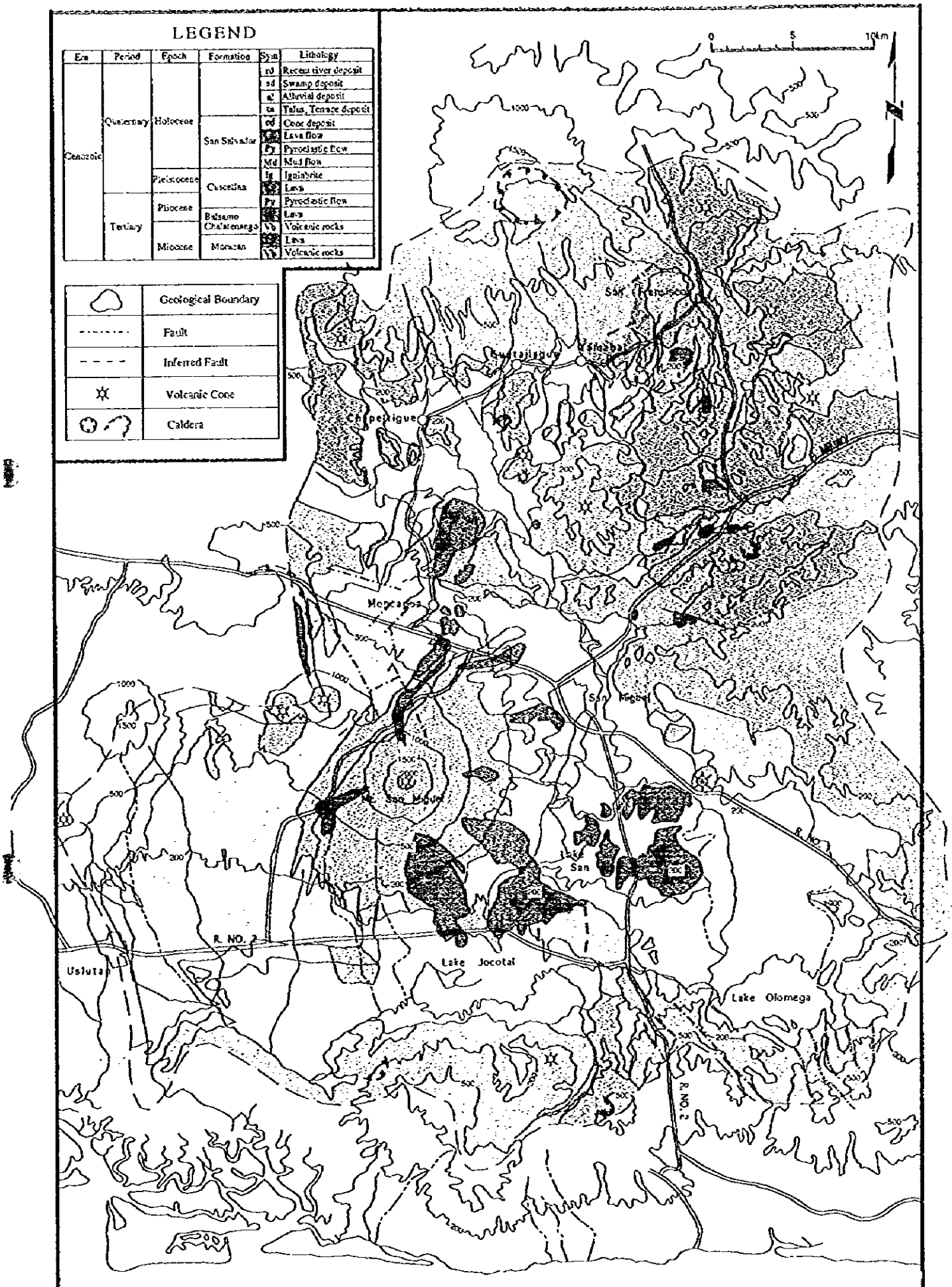


Figure 2.2 GEOLOGY OF STUDY AREA

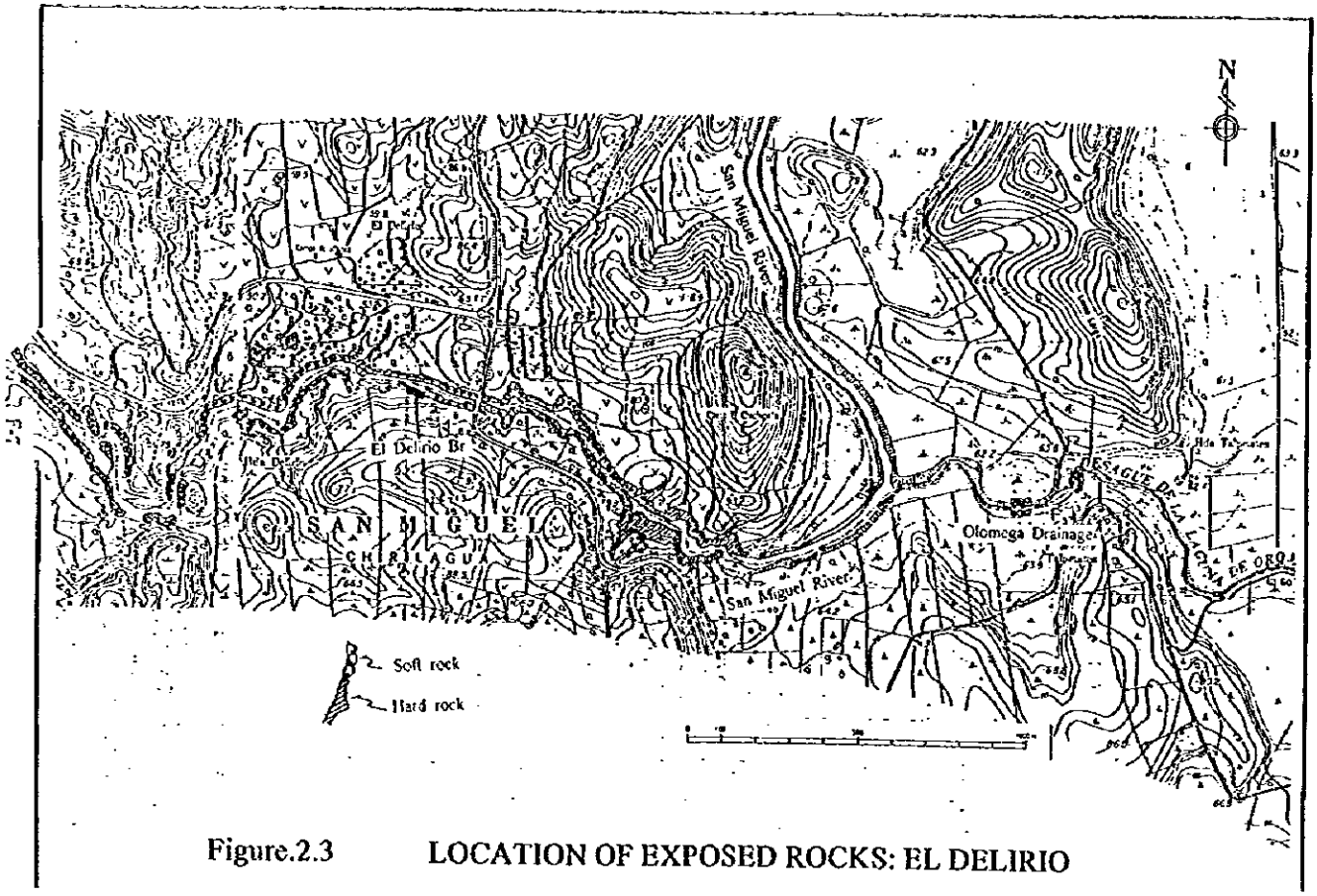


Figure.2.3 LOCATION OF EXPOSED ROCKS: EL DELIRIO

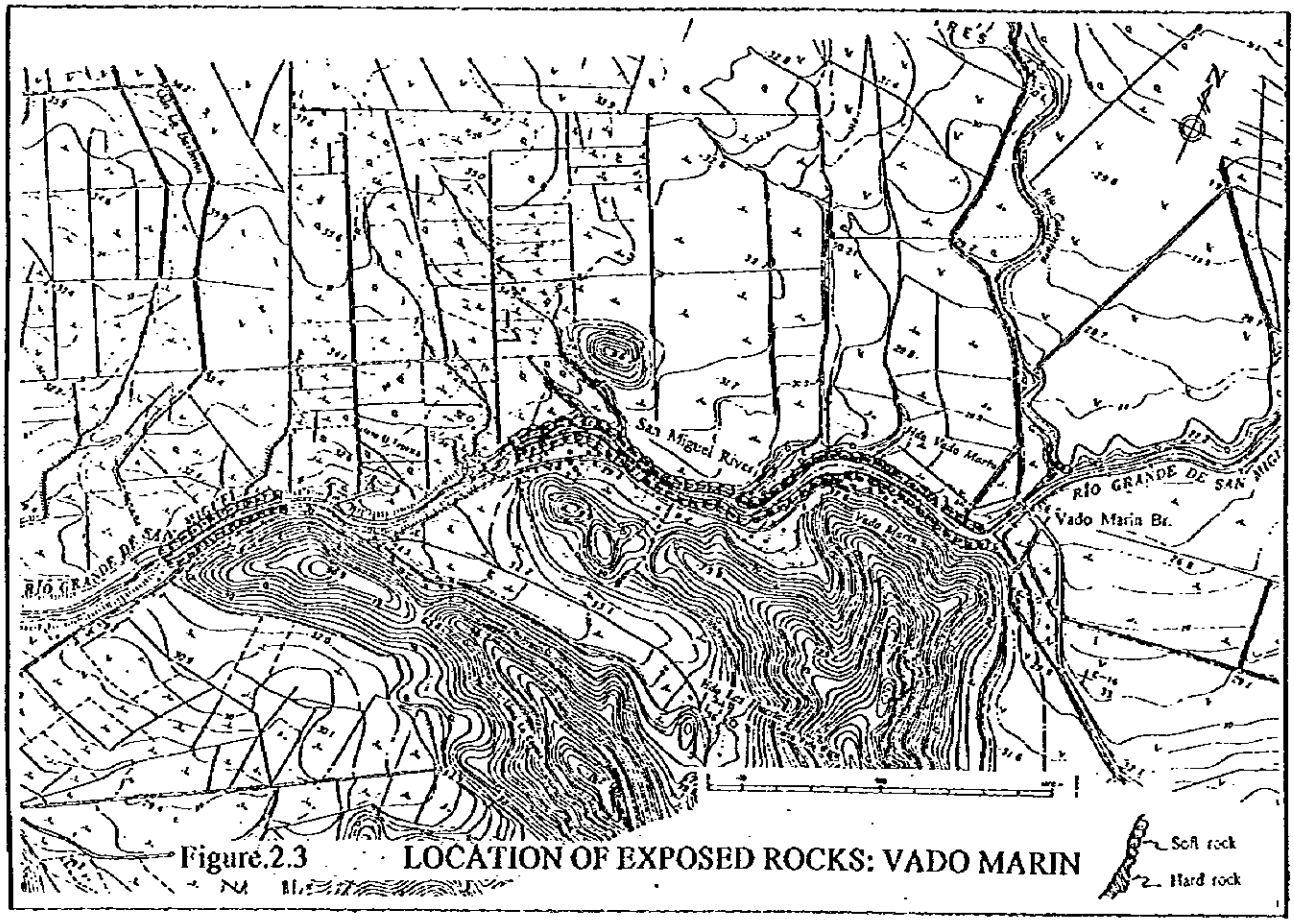
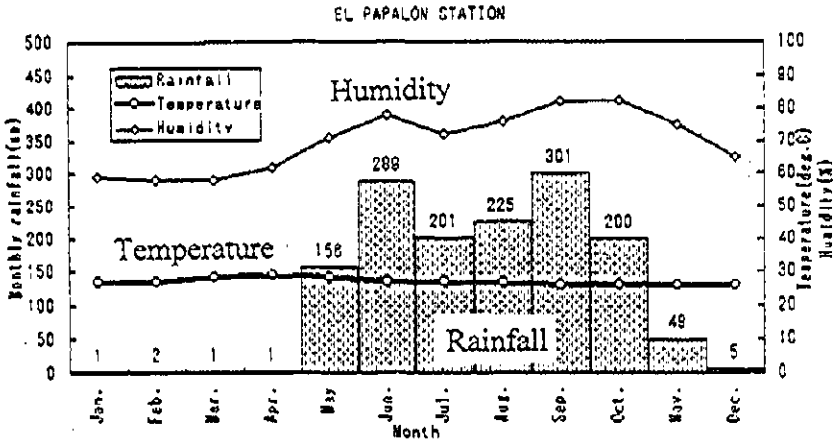
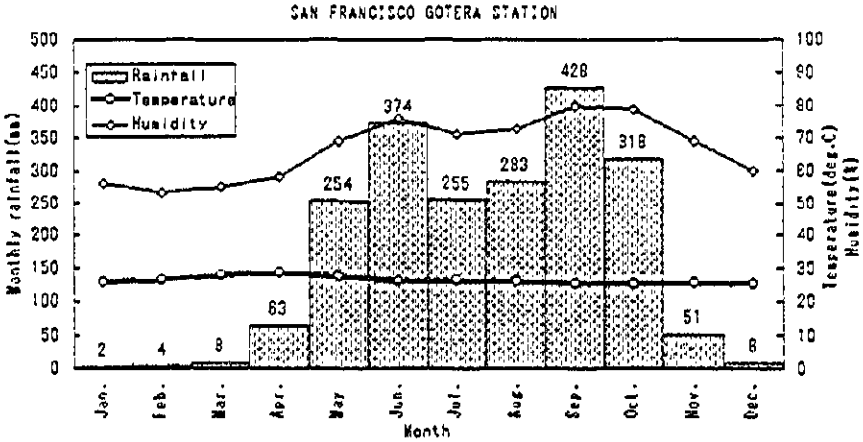


Figure.2.3 LOCATION OF EXPOSED ROCKS: VADO MARIN





EL PAPALON STATION

Month	Rainfall (mm)	Tempera-ture (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	28.3	58	5.0	S
Apr.	1	29	62	5.0	S
May	156	28.2	71	3.0	S
Jun.	289	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		Mean
Total(May-Oct)(2)	1372	29.0	82		Max.
(2)/(1) (%)	96	25.8	58		Min.

For rainfall: For temp./humid.

SAN FRANCISCO GOTERA STATION

Month	Rainfall (mm)	Tempera-ture (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		Mean
Total(May-Oct)(2)	1912	28.6	80		Max.
(2)/(1) (%)	93	25.3	53		Min.

For rainfall For temp./humid.

Figure.2.4 CLIMATE CONDITIONS OF STUDY AREA

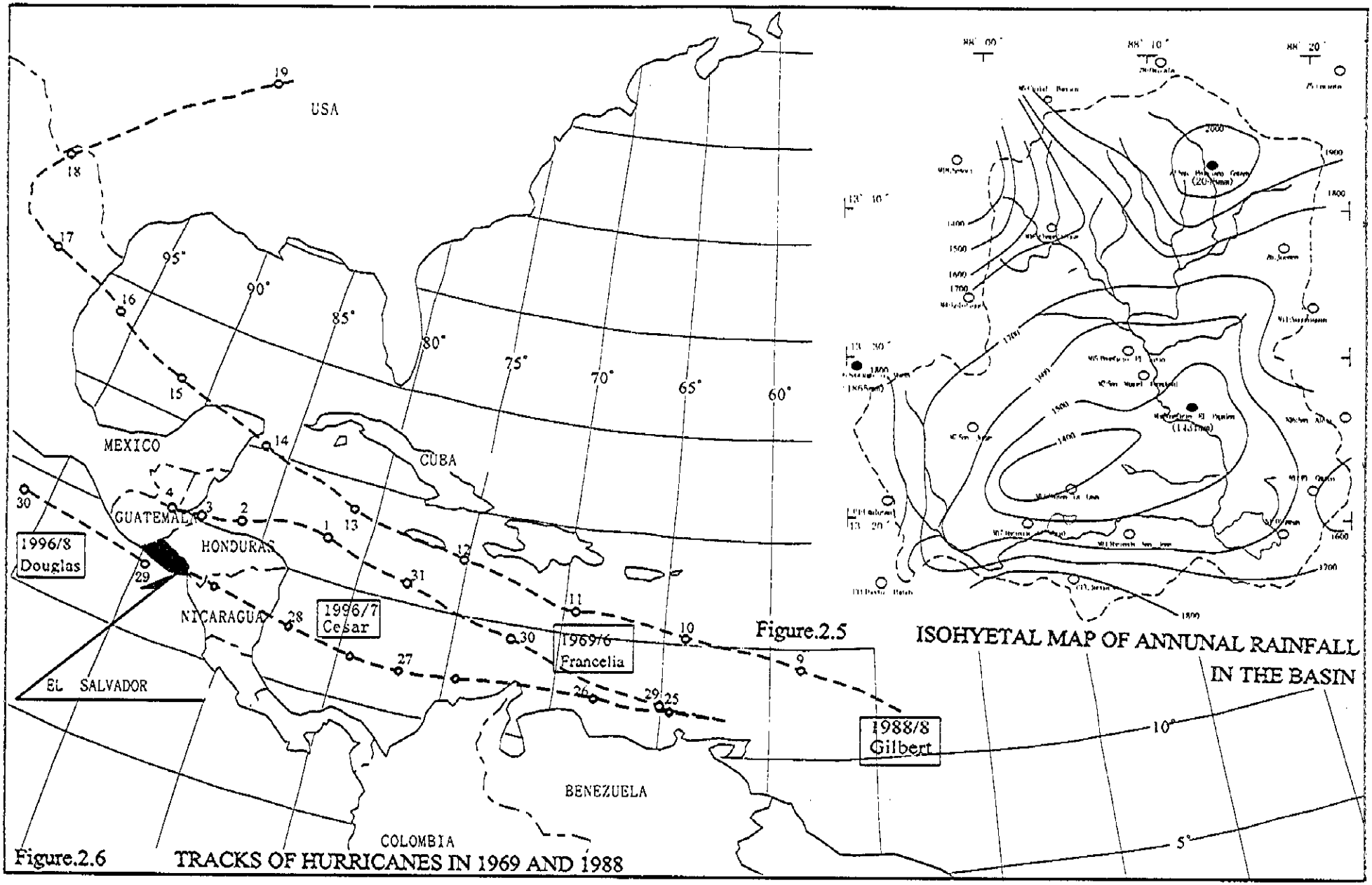


Figure.2.6 TRACKS OF HURRICANES IN 1969 AND 1988

Figure.2.5 ISOHYETAL MAP OF ANNUNAL RAINFALL IN THE BASIN

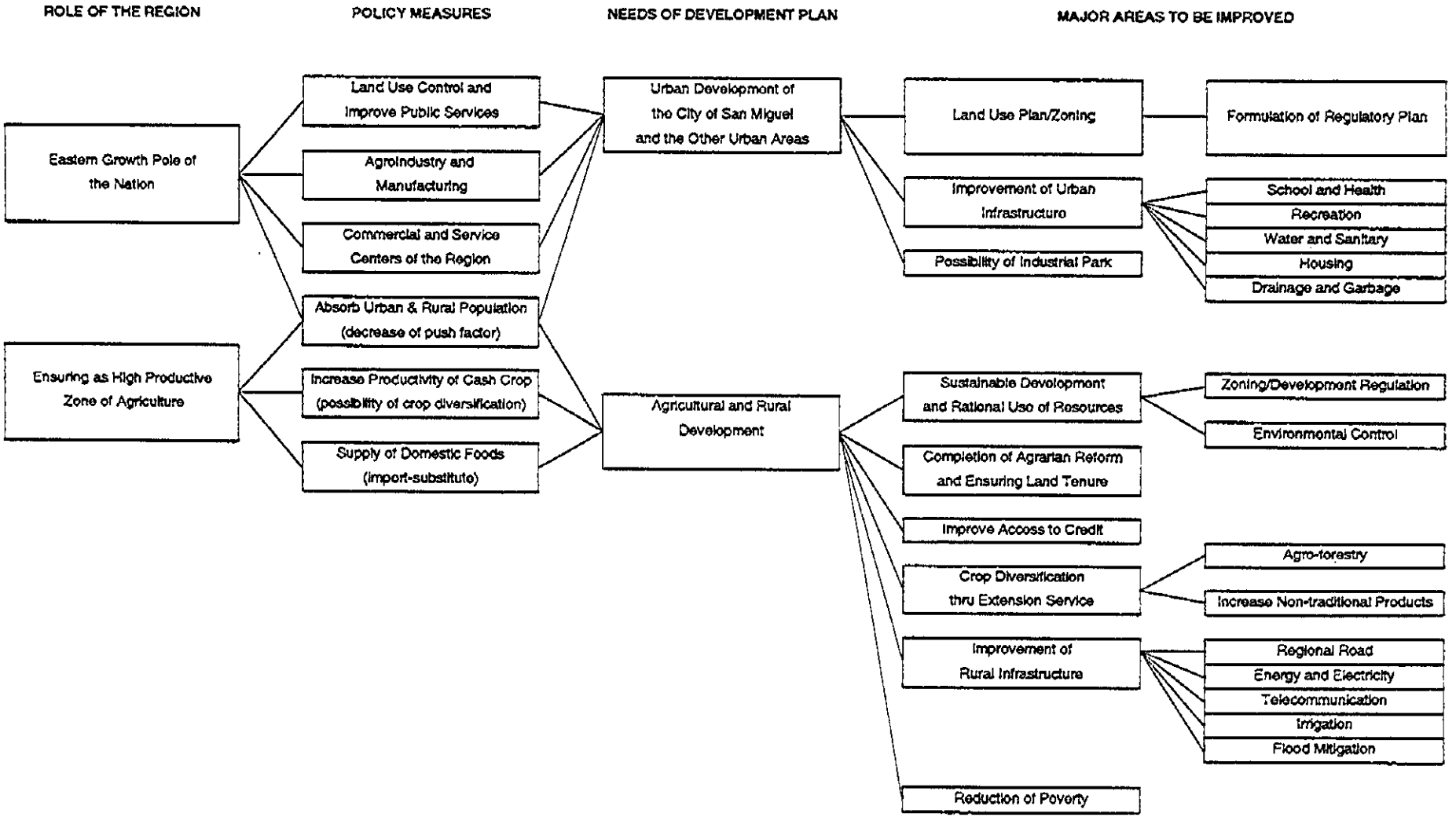


Figure.2.7 DEVELOPMENT ORIENTATION OF THE STUDY AREA

Source:MAG

Figure.2.8 PRESENT LAND USE OF STUDY AREA (1996)

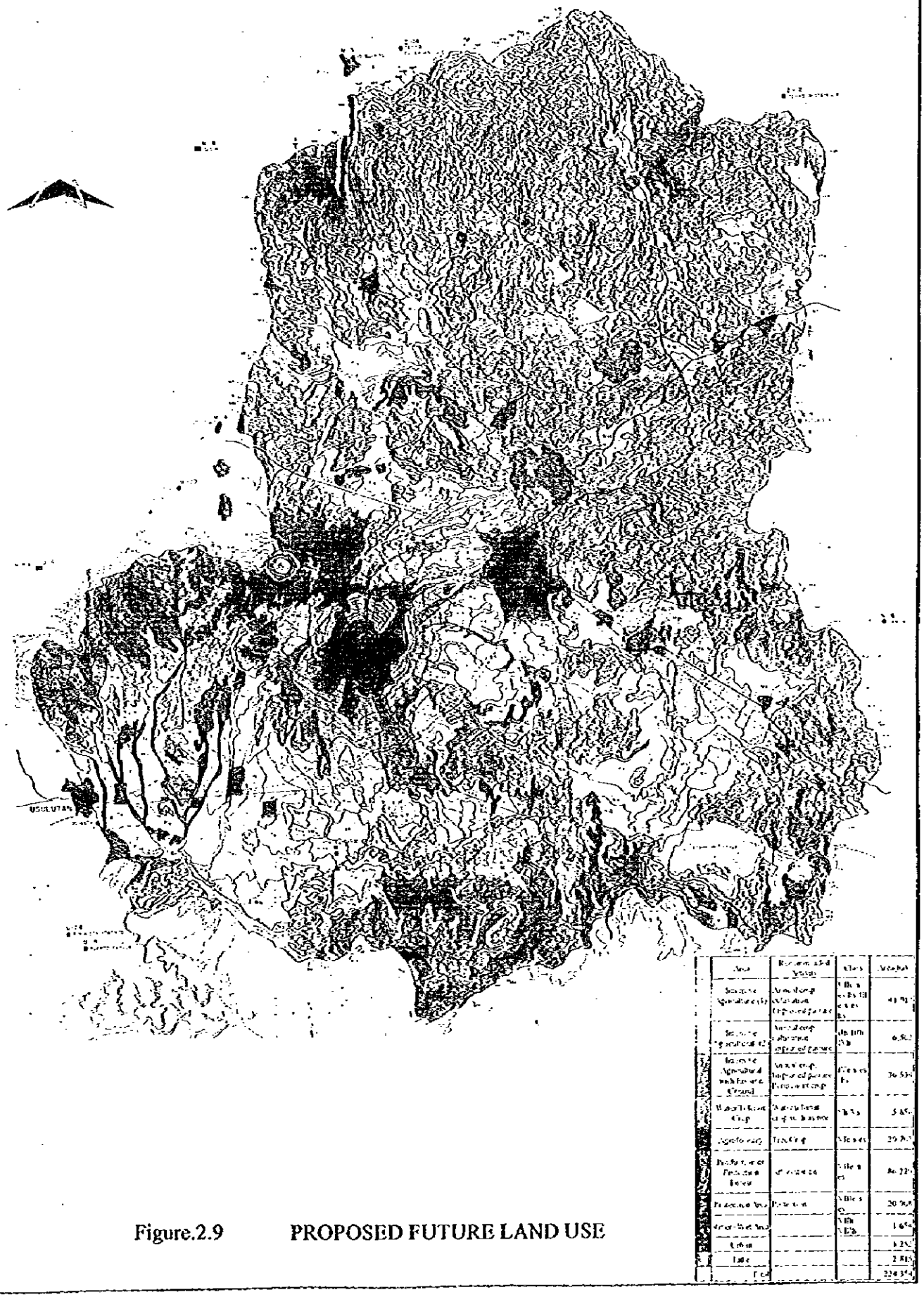


Figure.2.9 PROPOSED FUTURE LAND USE

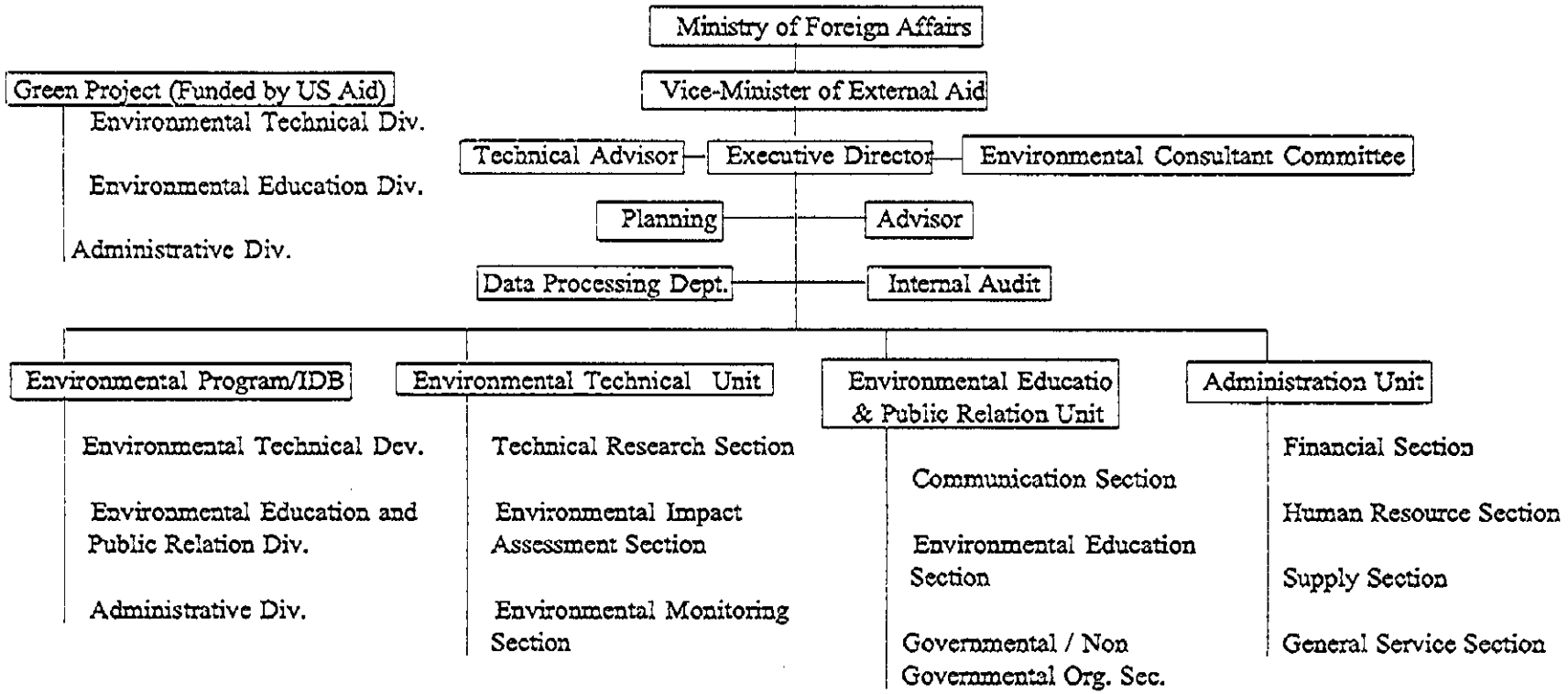


Figure.2.10 ORGANIZATION CHART OF SEMA

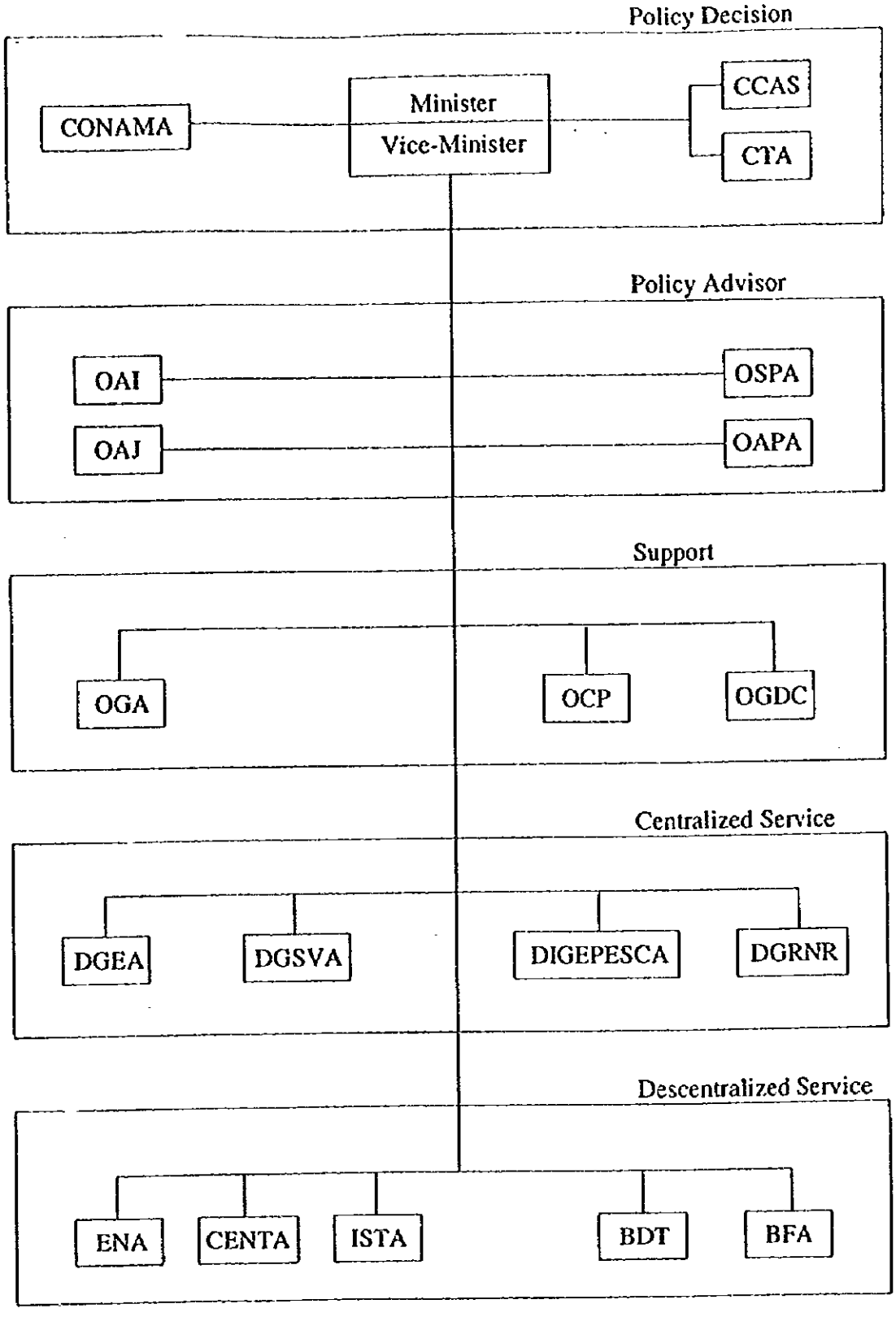


Figure.2.11 (1) ORGANIZATION CHART OF MAG

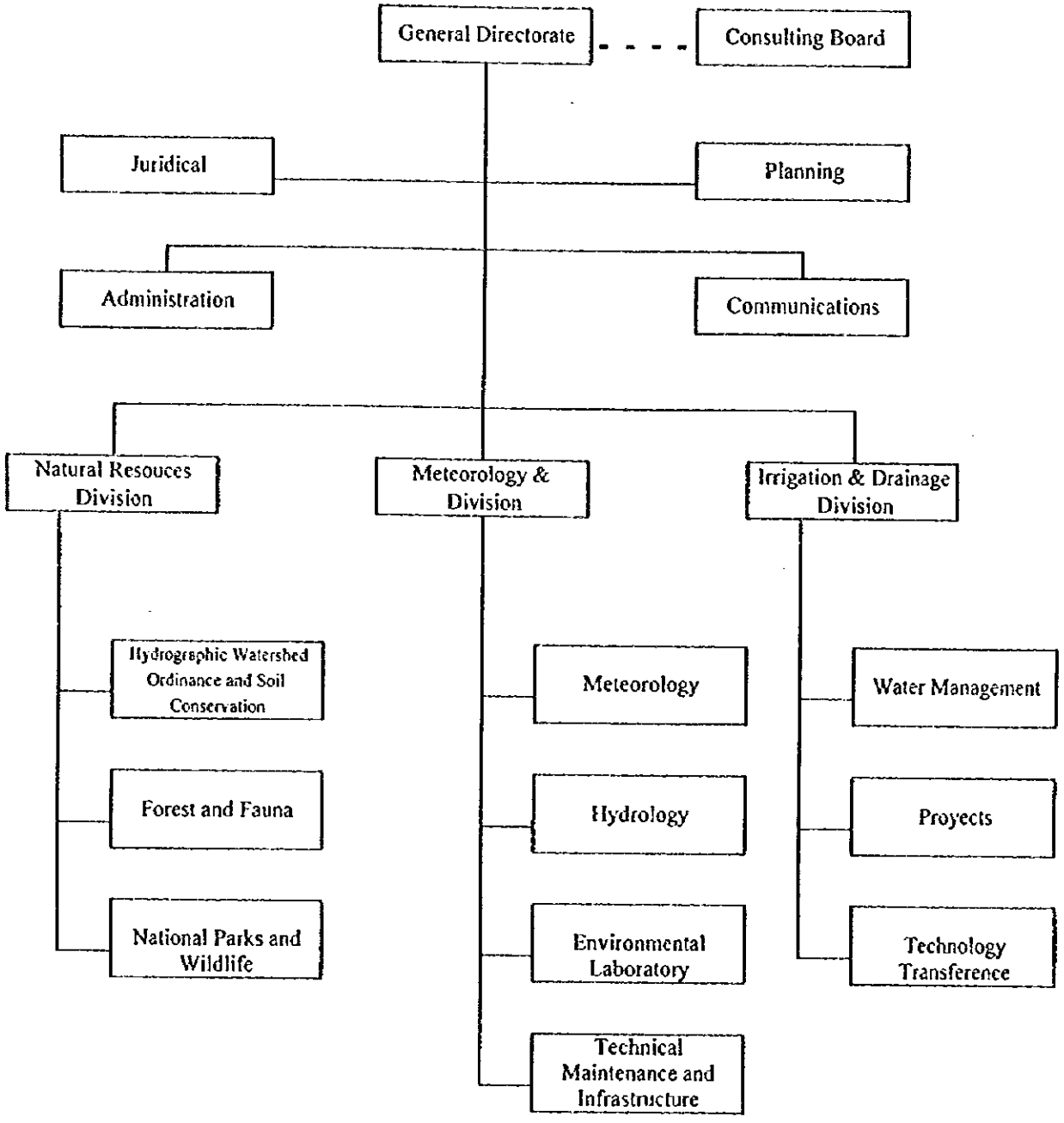


Figure.2.11 (2) ORGANIZATION CHART OF DGRNR

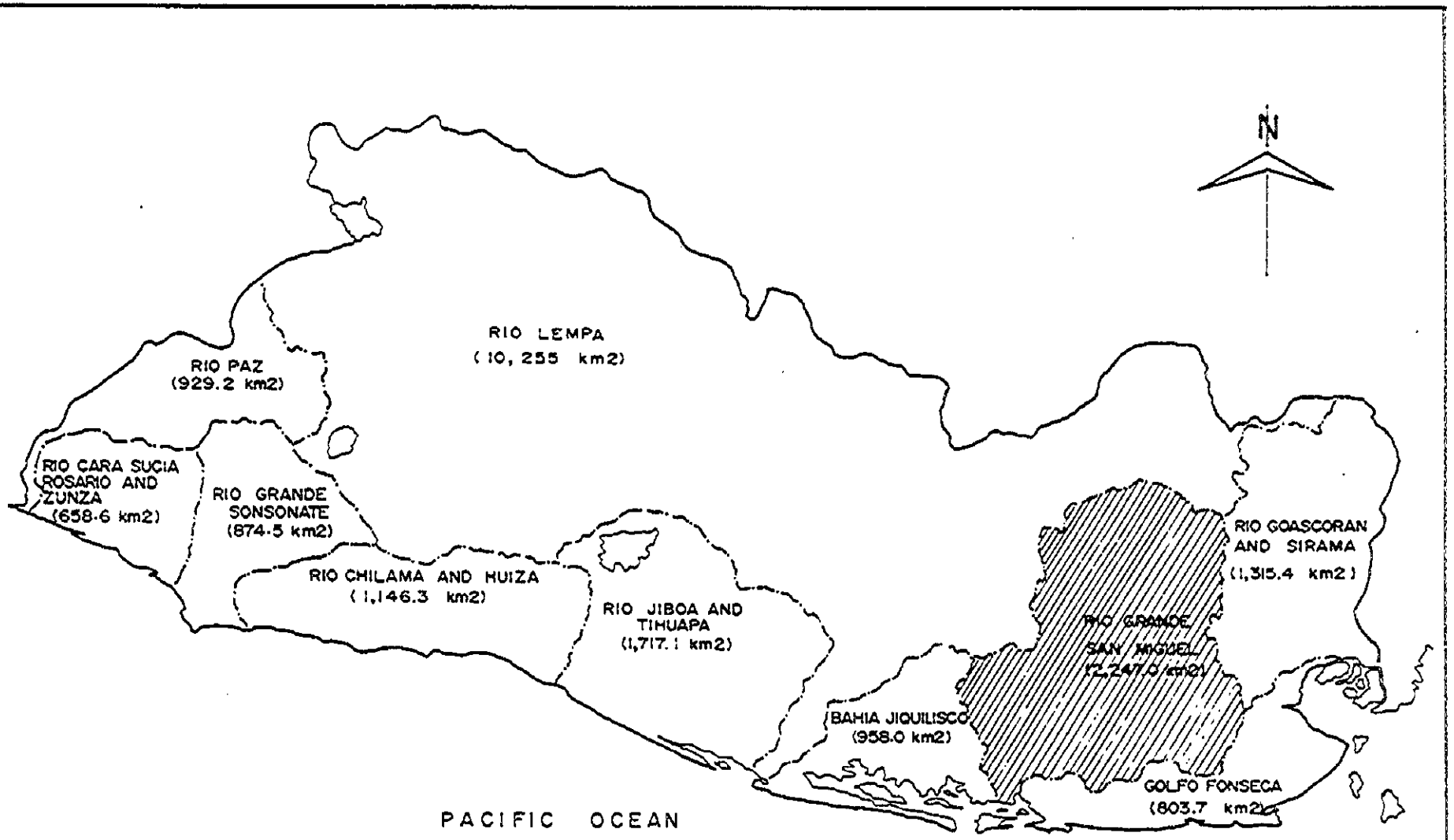


Figure.3.1 RIVER SYSTEMS IN El SALVADOR

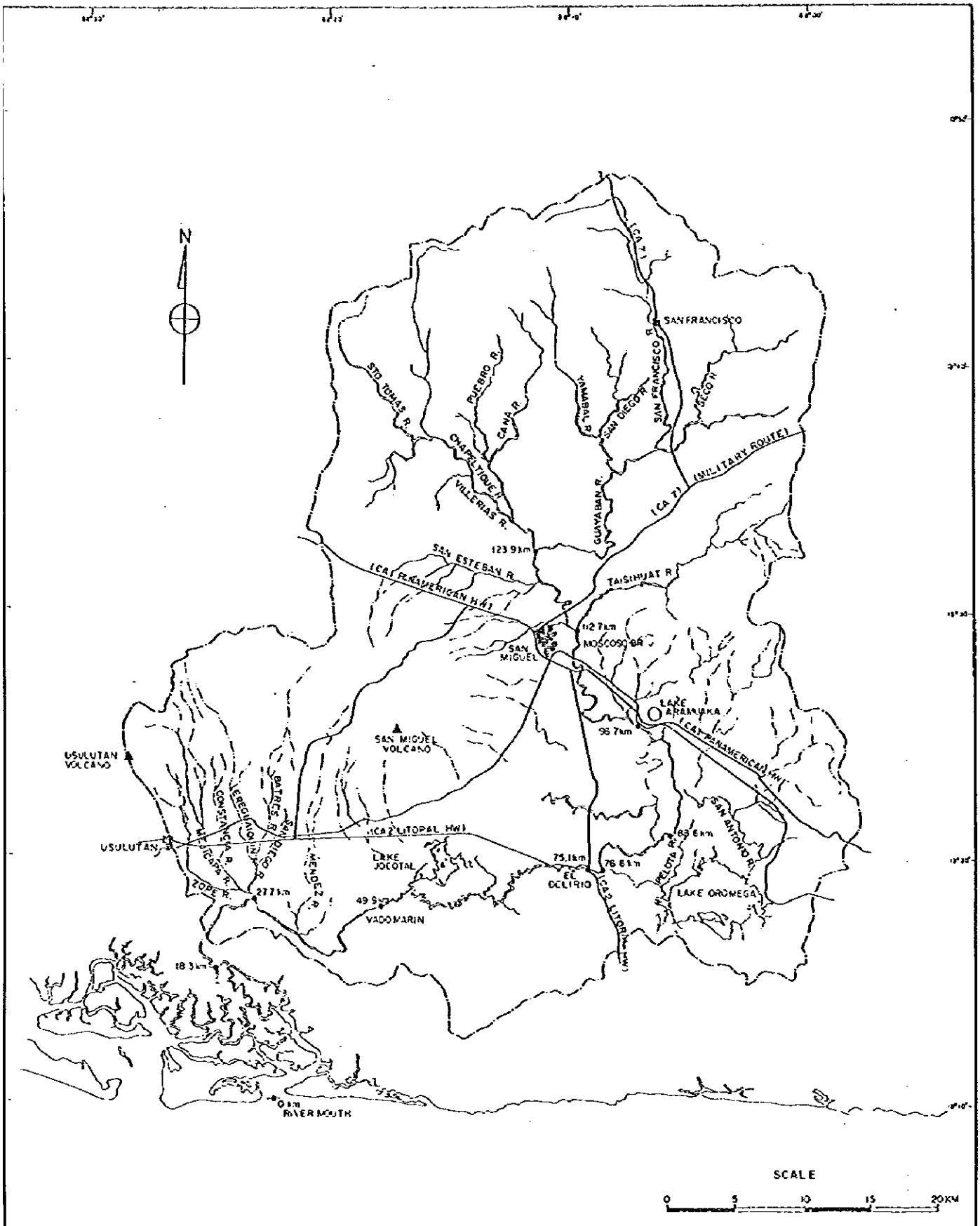


Figure.3.2 SAN MIGUEL RIVER SYSTEM

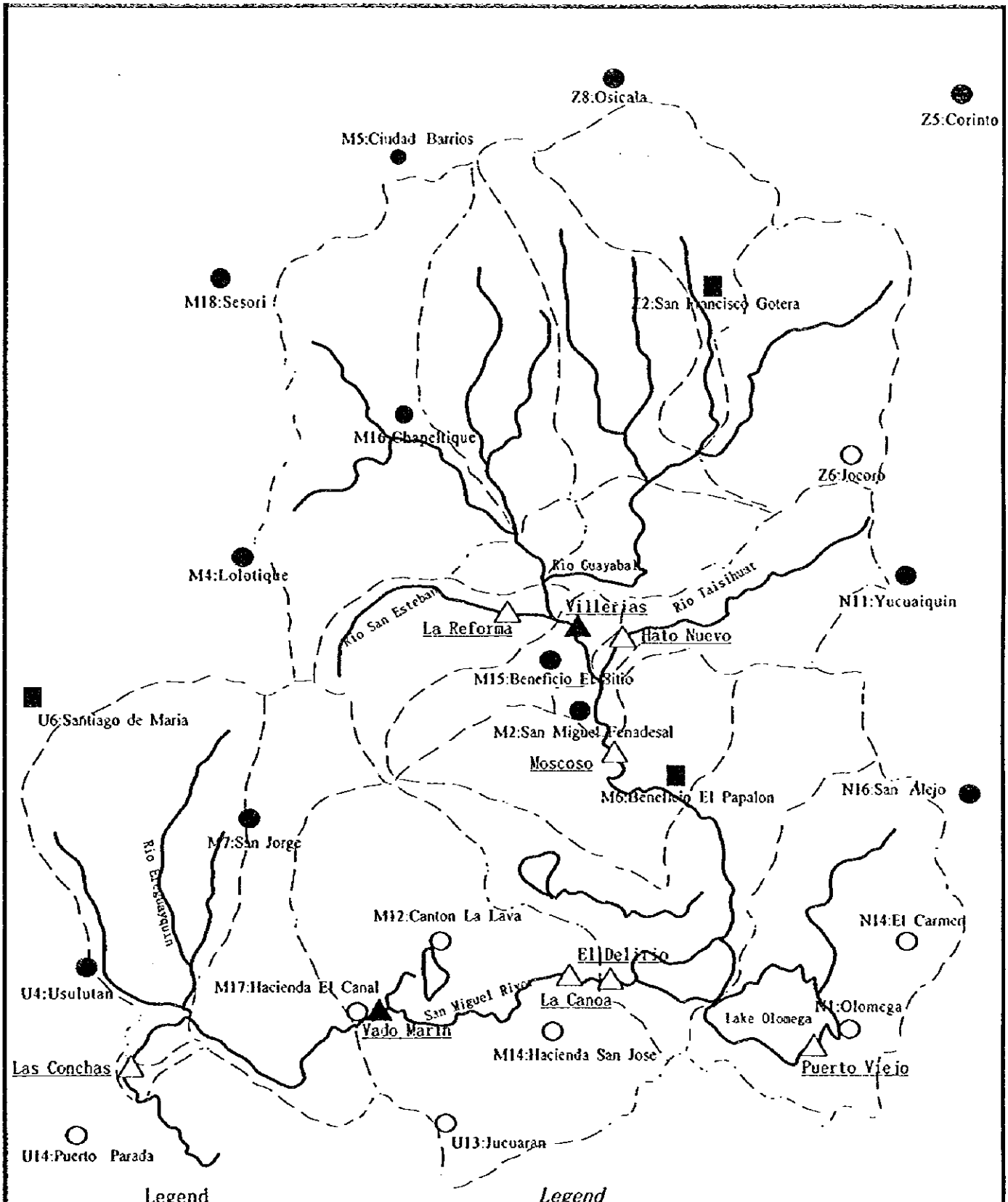


Figure.3.3 LOCATIONS OF GAUGING STATIONS

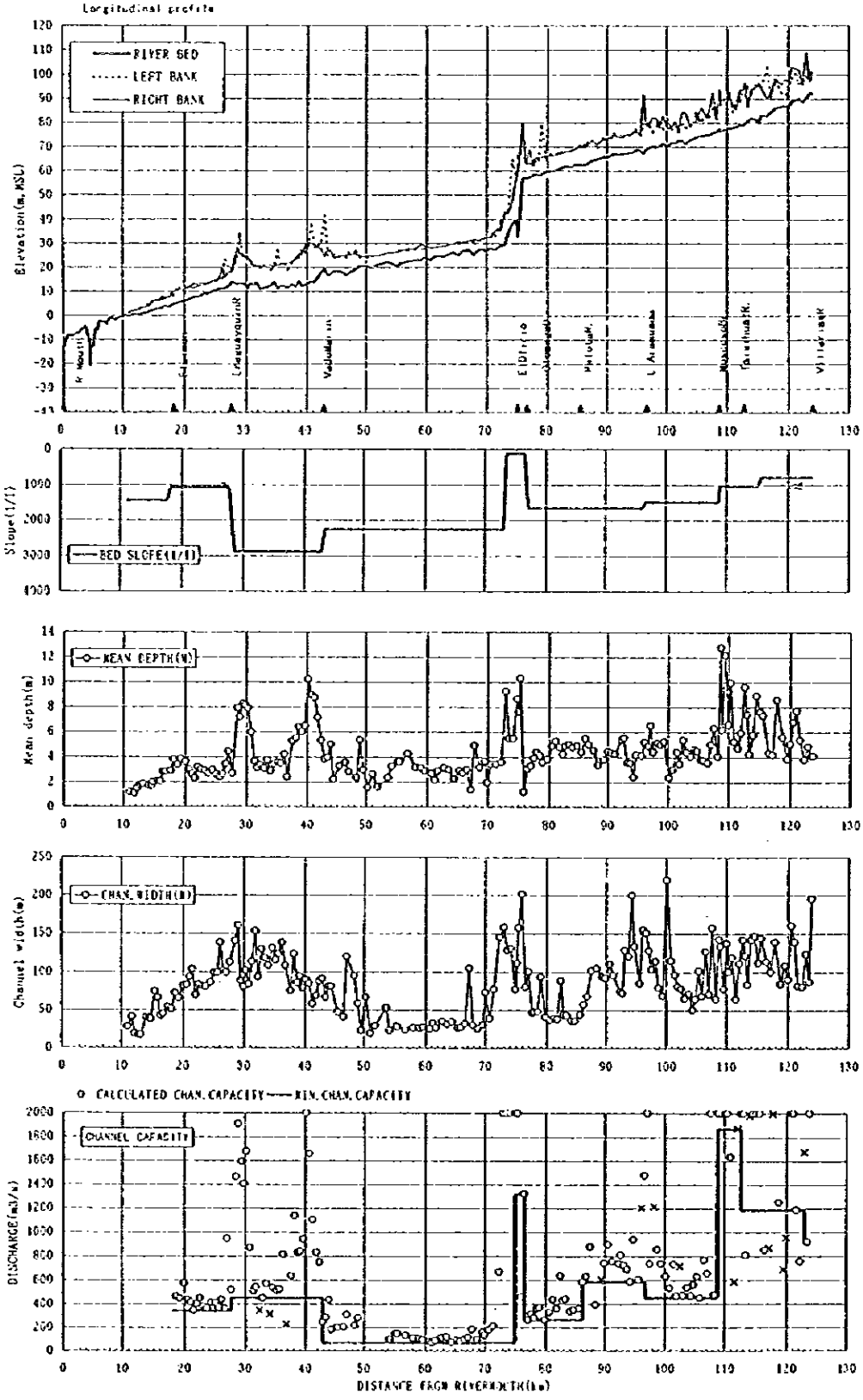
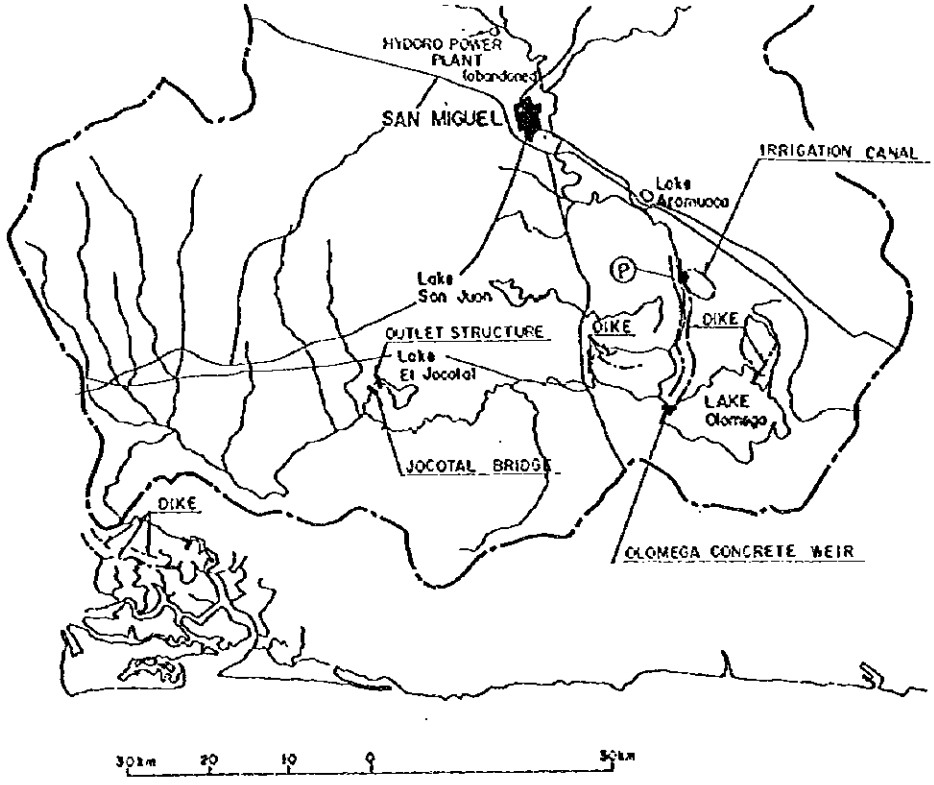
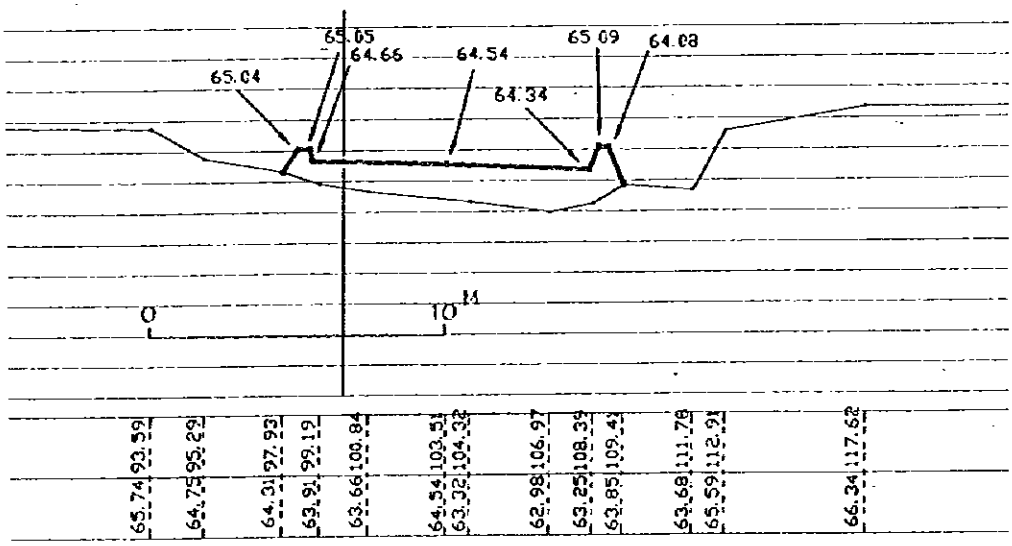


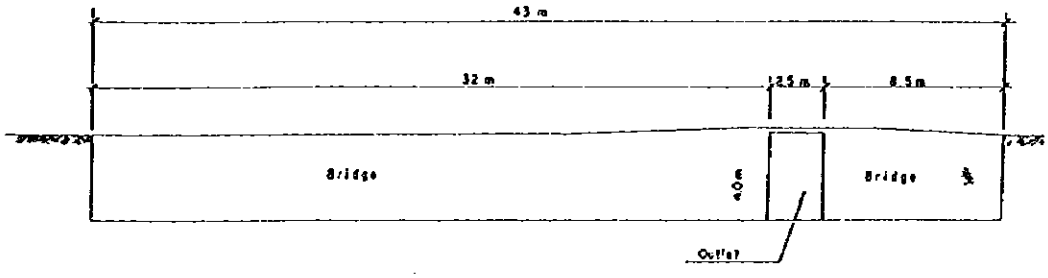
Figure 3.4 PROFILES OF EXISTING SAN MIGUEL RIVER





H. 1:200

EXISITING CONCRETE WEIR AT LAKE OLOMEGA OUTLET



EXISTING BRIDGE AT LAKE JOCOTAL OUTLET

Figure.3.5 EXISTING FLOOD CONTROL AND IRRIGARION STRUCTURES

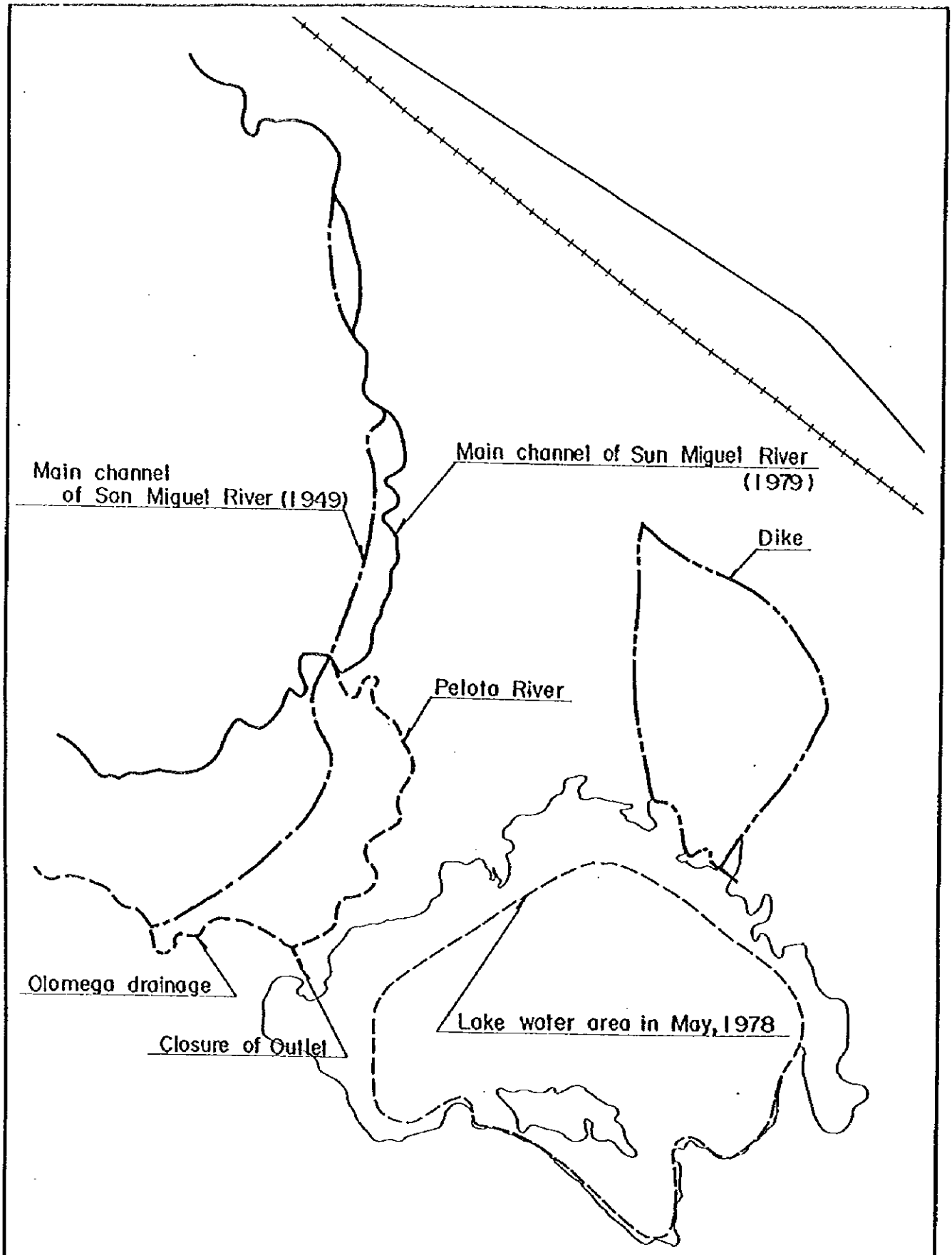


Figure.3.6 RIVER COURSE CHANGE NEAR LAKE OLOMEGA

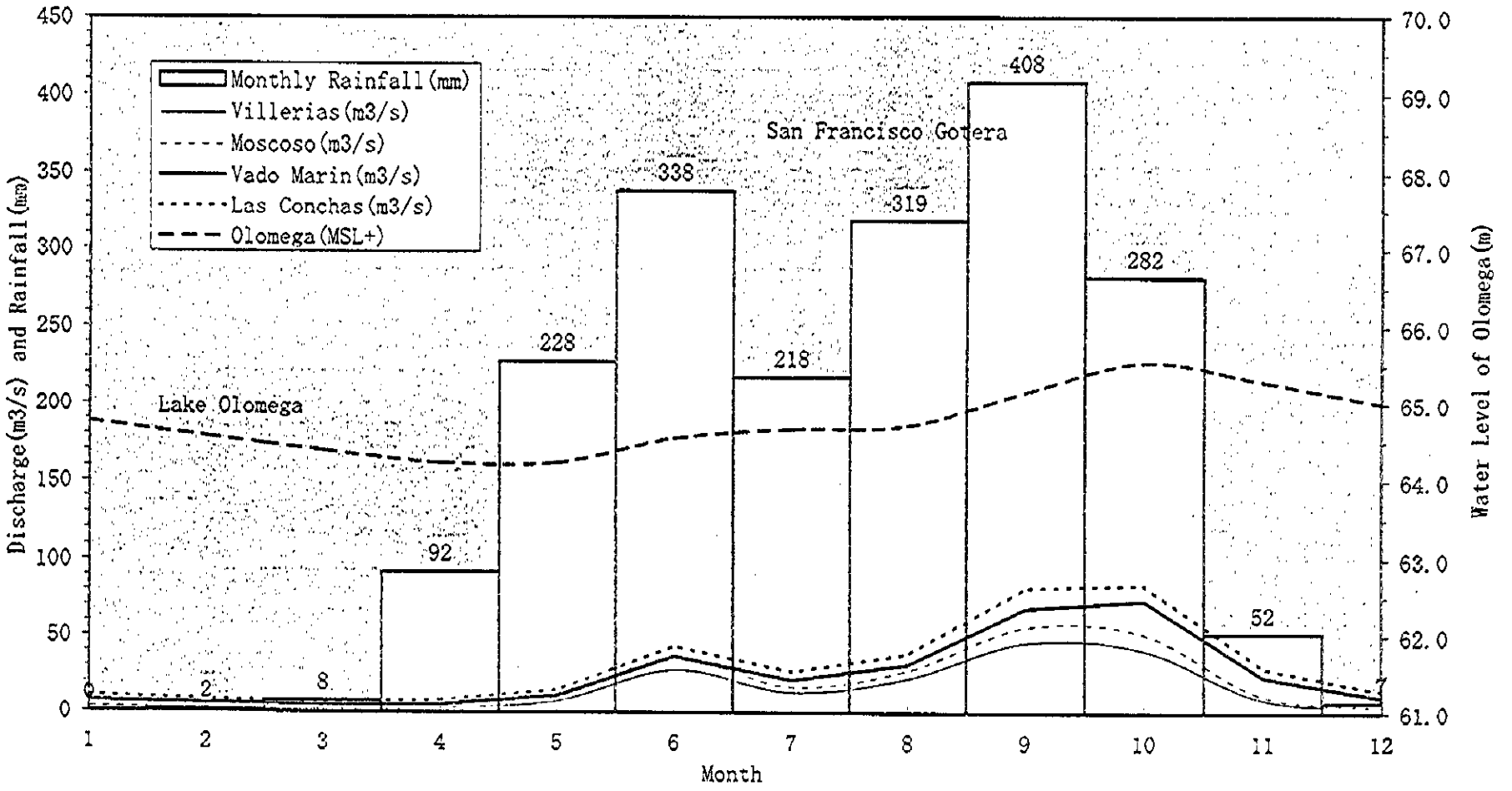
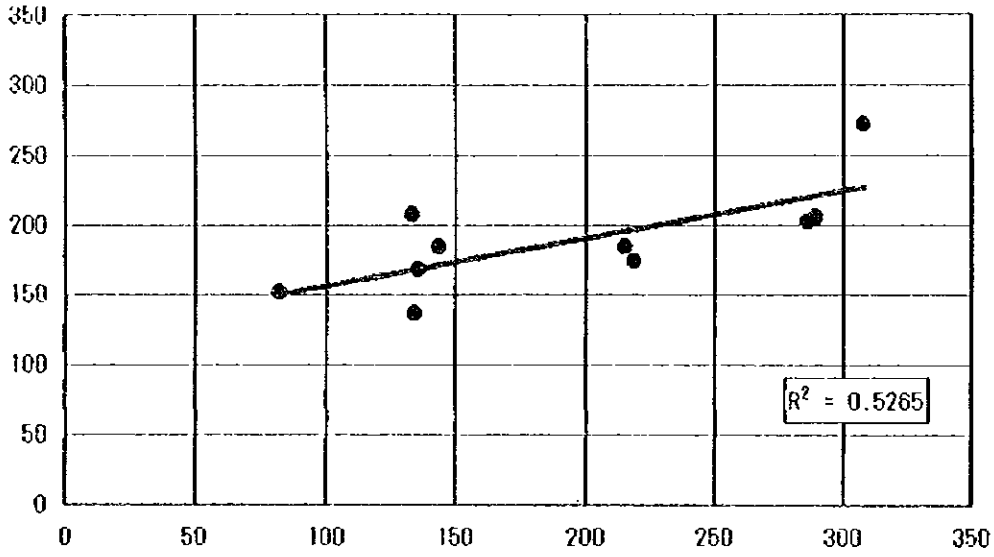
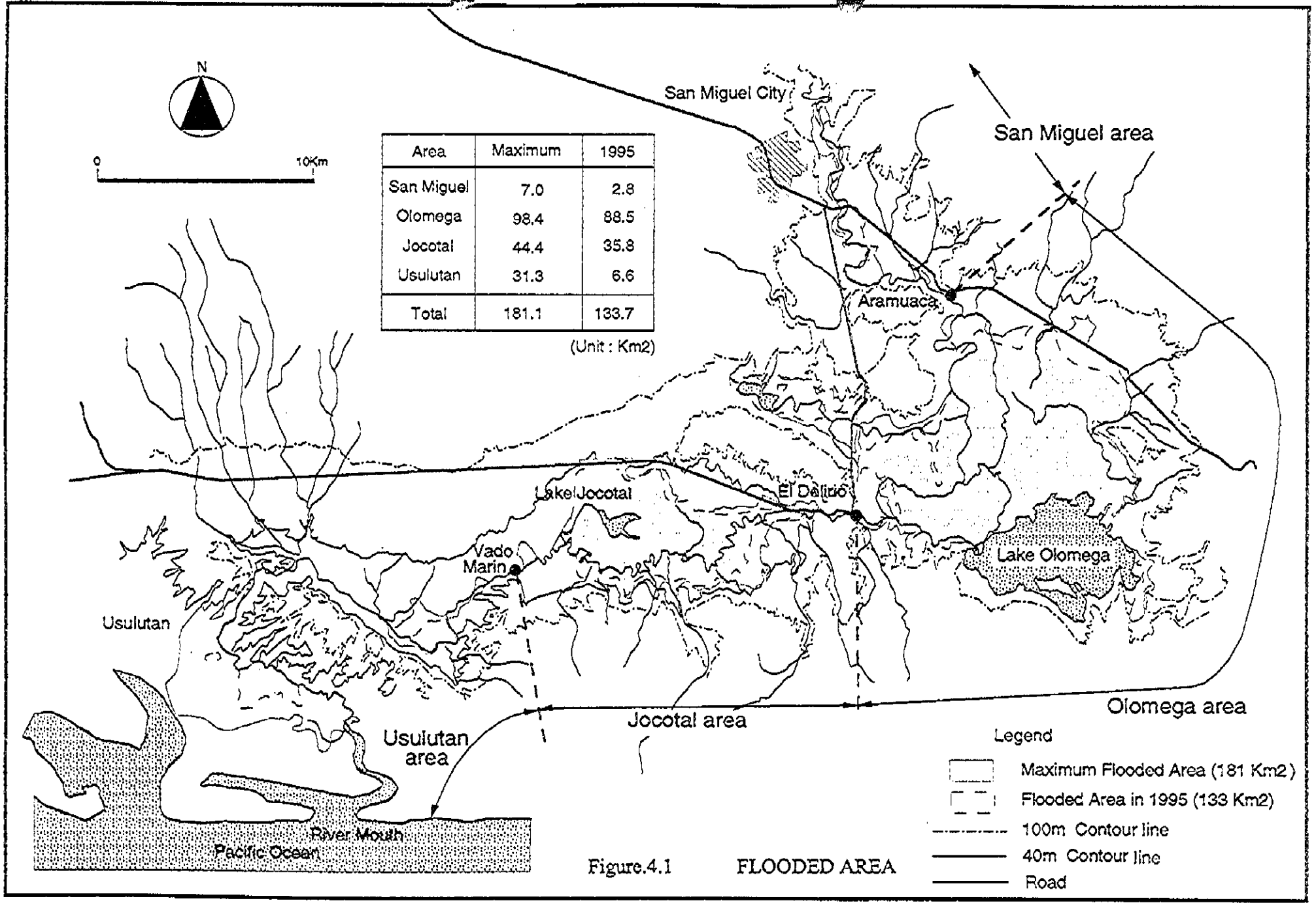


Figure.3.7 RAINFALL, DISCHARGE AND OLOMEGA LAKE WATER LEVEL (1970-1978)



Station: Vado Marin(May 1959 - 1981)								
Annual max. discharge						7-day basin rainfall		
Year	Ordinal month	Date	Hmax (m)	Qmax (m^3/s)	Ranking	Ordinal month	Date	R7 (mm)
1959	10	20	2.16	57.9	20	-	-	-
1960	-	-	-	-	-	-	-	-
1961	10	9	2.44	188.8	10	-	-	-
1962	9	27	2.59	156.0	11	-	-	-
1963	11	11	3.22	248.1	5	-	-	-
1964	9	4	2.56	134.4	15	9	2	136.7
1965	10	1	2.74	218.9	8	9	23	174.0
1966	7	15	2.84	289.8	3	7	14	205.4
1967	10	14	2.10	96.0	18	-	-	-
1968	9	26	2.40	155.0	12	-	-	-
1969	9	6	3.84	296.0	2	-	-	-
1970	10	5	3.13	230.9	7	-	-	-
1971	9	5	2.42	131.5	17	-	-	-
1972	10	10	2.03	82.0	19	9	29	152.1
1973	10	26	3.65	237.5	6	-	-	-
1974	9	22	4.22	307.9	1	9	23	271.8
1975	9	13	2.72	135.8	14	9	12	168.5
1976	6	14	3.90	286.7	4	6	13	202.6
1977	10	1	1.83	48.0	21	-	-	-
1978	9	22	2.62	133.6	16	9	25	207.2
1979	9	15	2.68	143.7	13	9	4	184.1
1980	6	25	3.14	215.2	9	6	15	184.7

Figure.3.8 ANNUAL MAXIMUM DISCHARGE AND 7-DAY BASIN RAINFALL



Area	Maximum	1995
San Miguel	7.0	2.8
Olomega	98.4	88.5
Jocotal	44.4	35.8
Usulutan	31.3	6.6
Total	181.1	133.7

(Unit : Km2)

Figure.4.1 FLOODED AREA

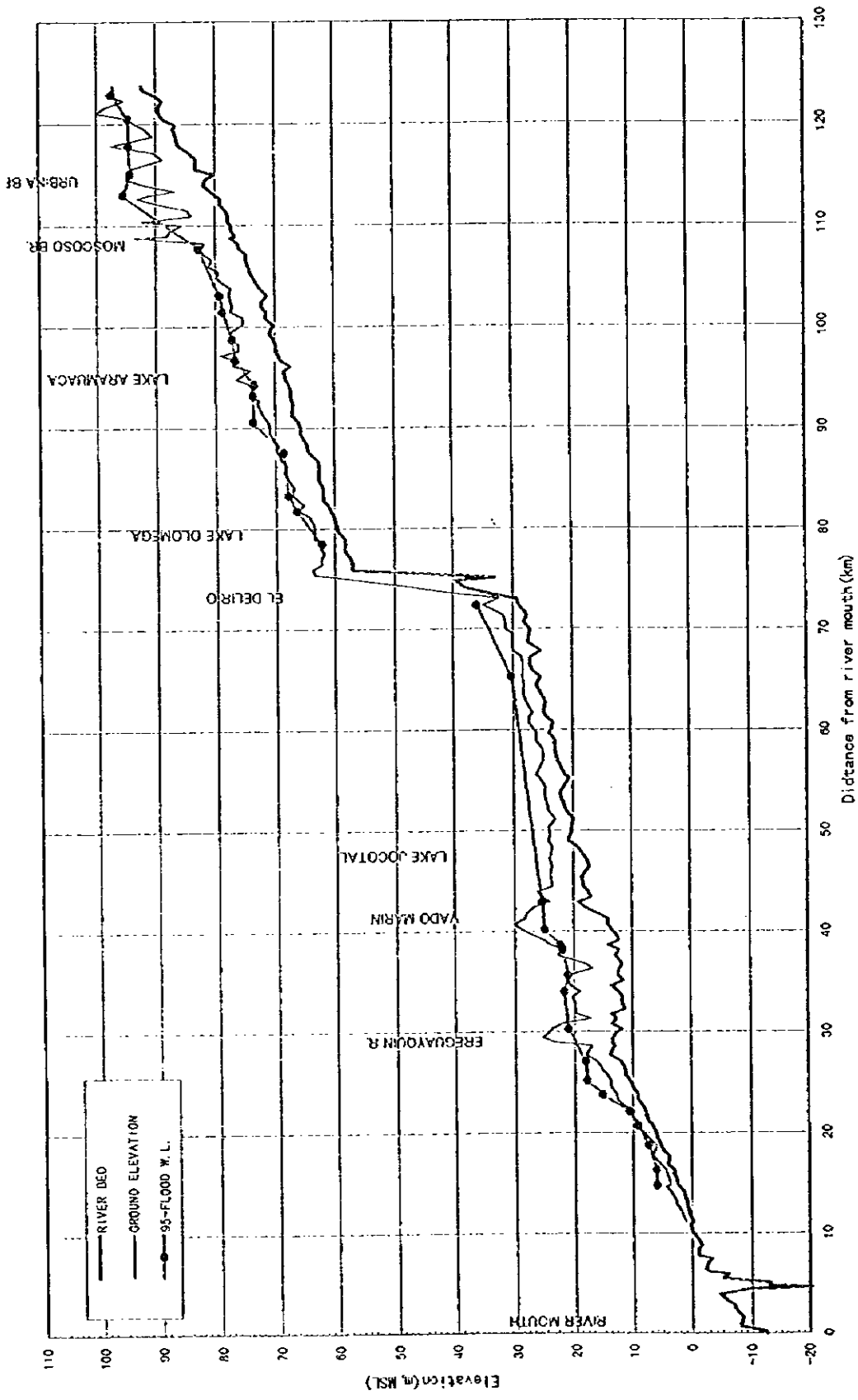
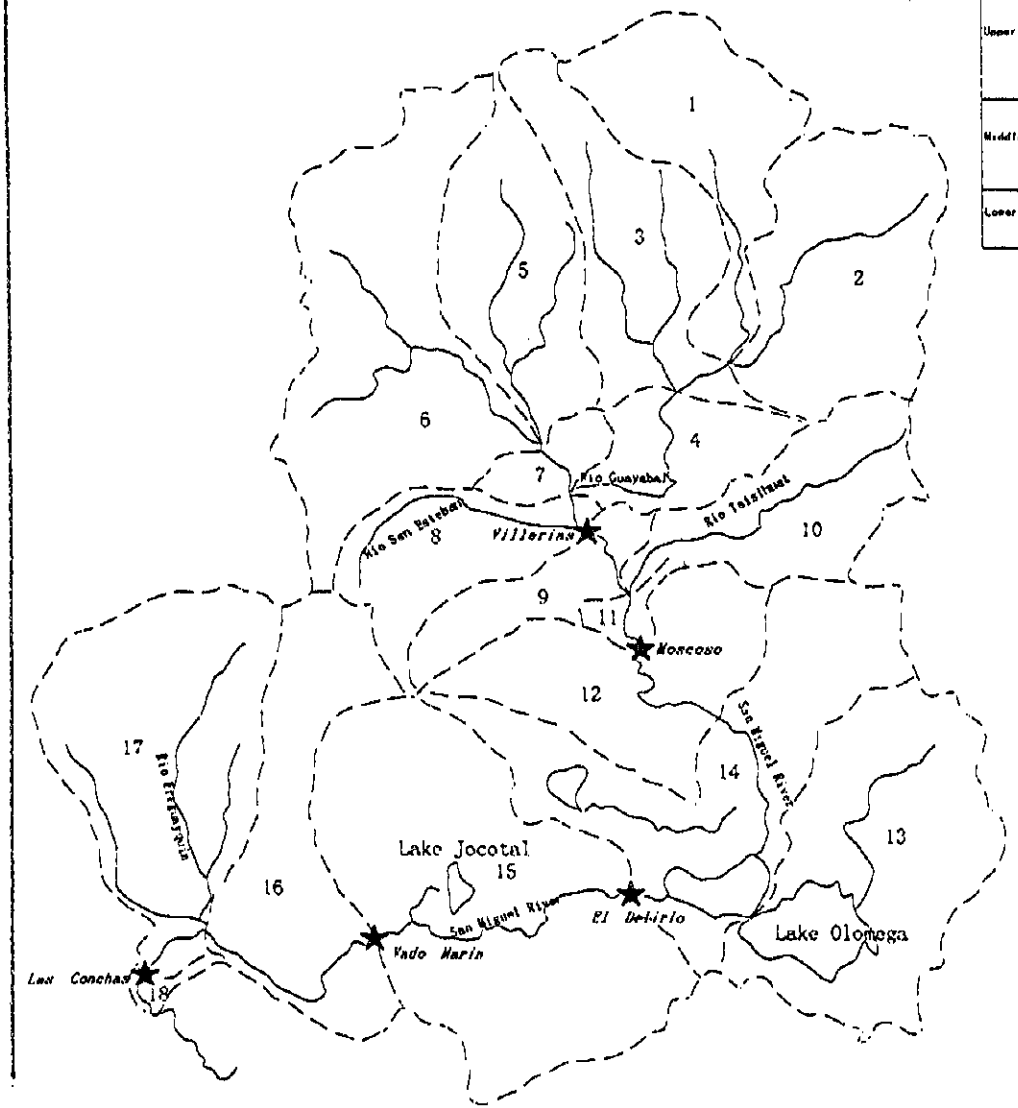


Figure.4.2 MAXIMUM WATER LEVEL OF 1995-FLOOD

Table Area of subbasins in the Study Area

Subarea	Basin Number	Location	Tributary	Area (Km2)	Accumulated Area (Km2)
Upper Basin	1		Rio San Francisco	112.6	112.6
	2		Rio Seco	153.6	266.2
	3		Rio Yanahai and Rio San Diego	128.5	394.7
	4		Rio Las Cangas	57.8	452.5
	5		Rio Villerias	121.2	573.7
	6		Rio Guayabal	227.1	800.9
	7			24.7	825.0
	8	Villerias	Rio San Esteban	85.0	910.0
	9		Rio Tarsihuat	54.0	964.0
	10			97.2	1061.2
Middle Basin	11	Moscoso		12.8	1074.0
	12	Arenoso		136.8	1210.8
	13		Lake Olomega	207.0	1417.8
	14	El Delirio		219.2	1637.0
	15	Vado Marin	Lake Jocotal	263.0	1900.0
Lower Basin	16			137.7	2037.7
	17	Las Conchas		199.9	2237.6
	18	End of Region "H"		9.2	2246.8



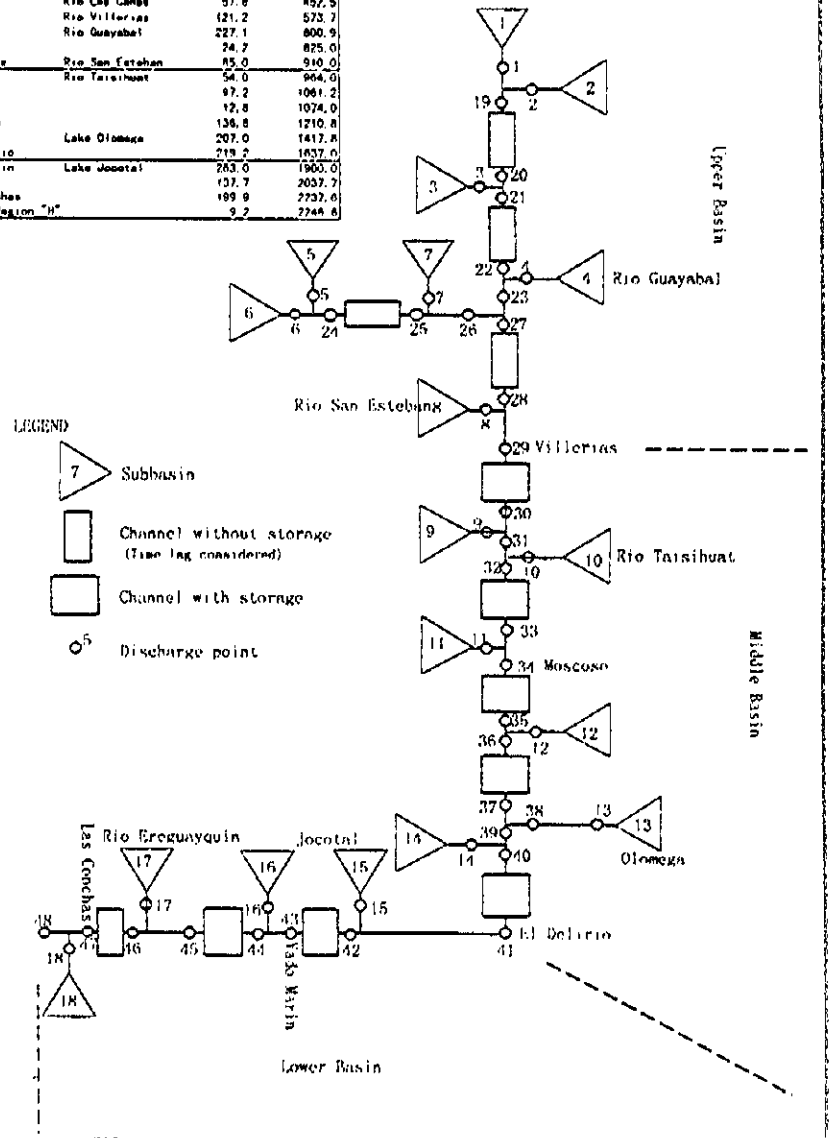
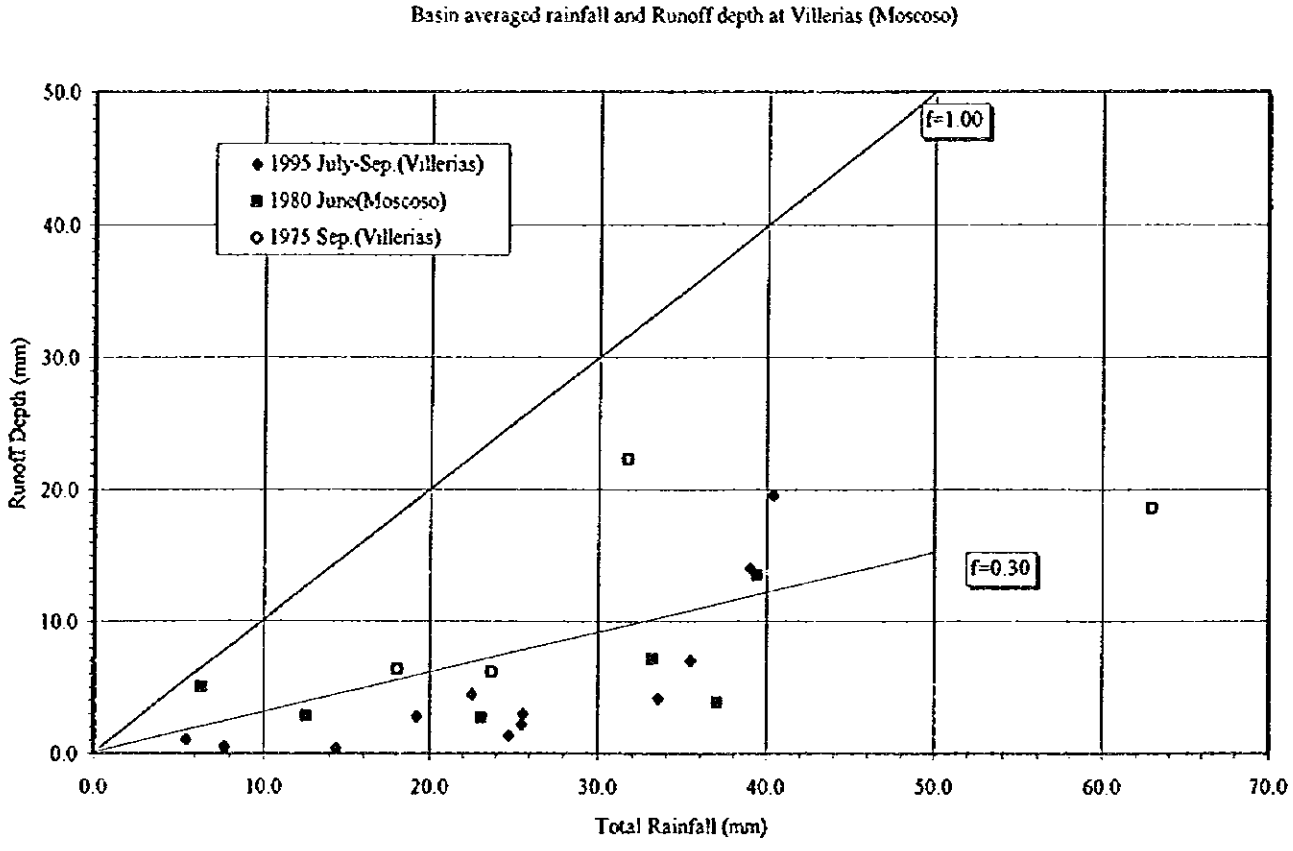


Figure.4.3 BASIN BOUNDARY AND RUNOFF MODEL CONFIGURATION

FIG. 1 Runoff Simulation Model



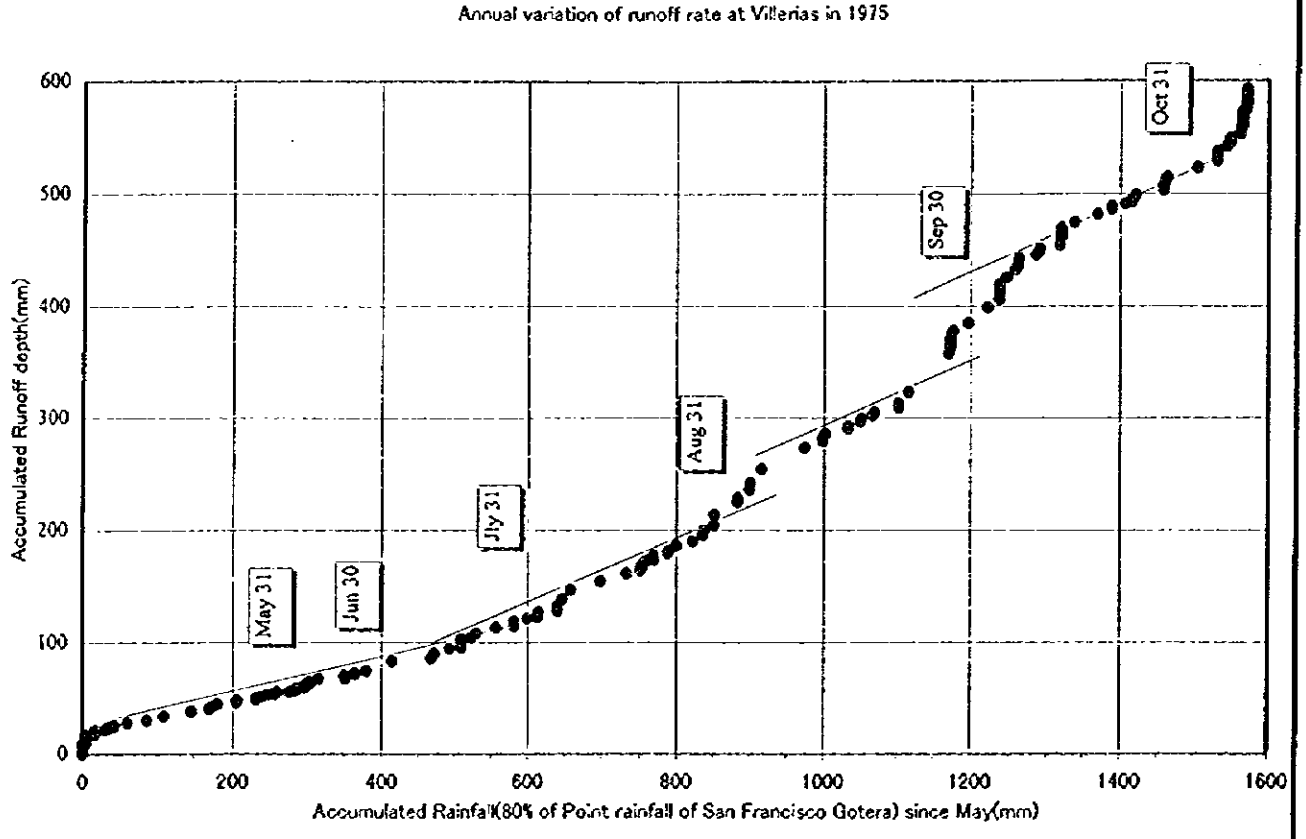
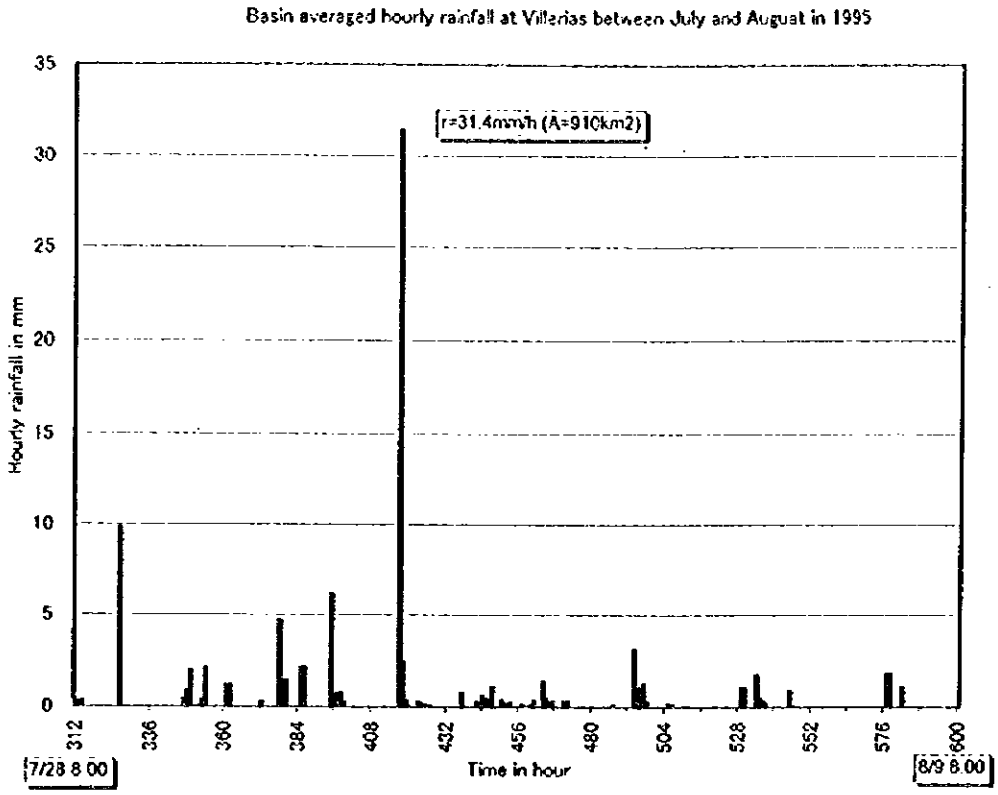


Figure.4.4 RELATIONSHIP BETWEEN RUNOFF AND BASIN RAINFALL



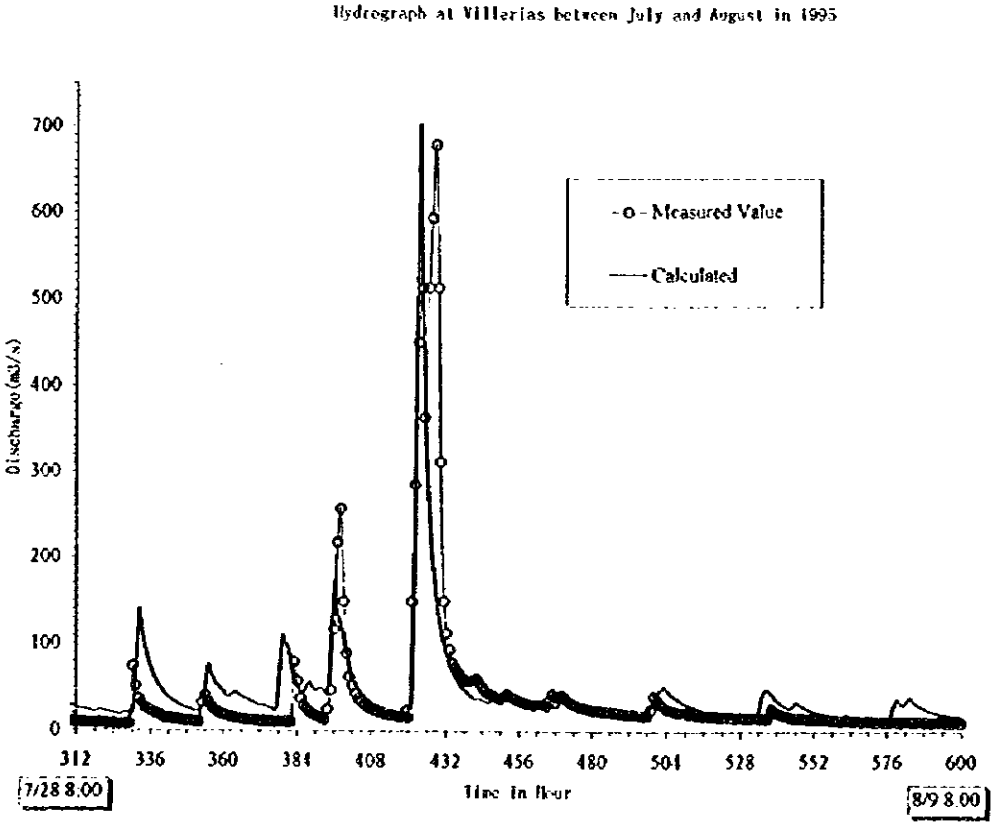
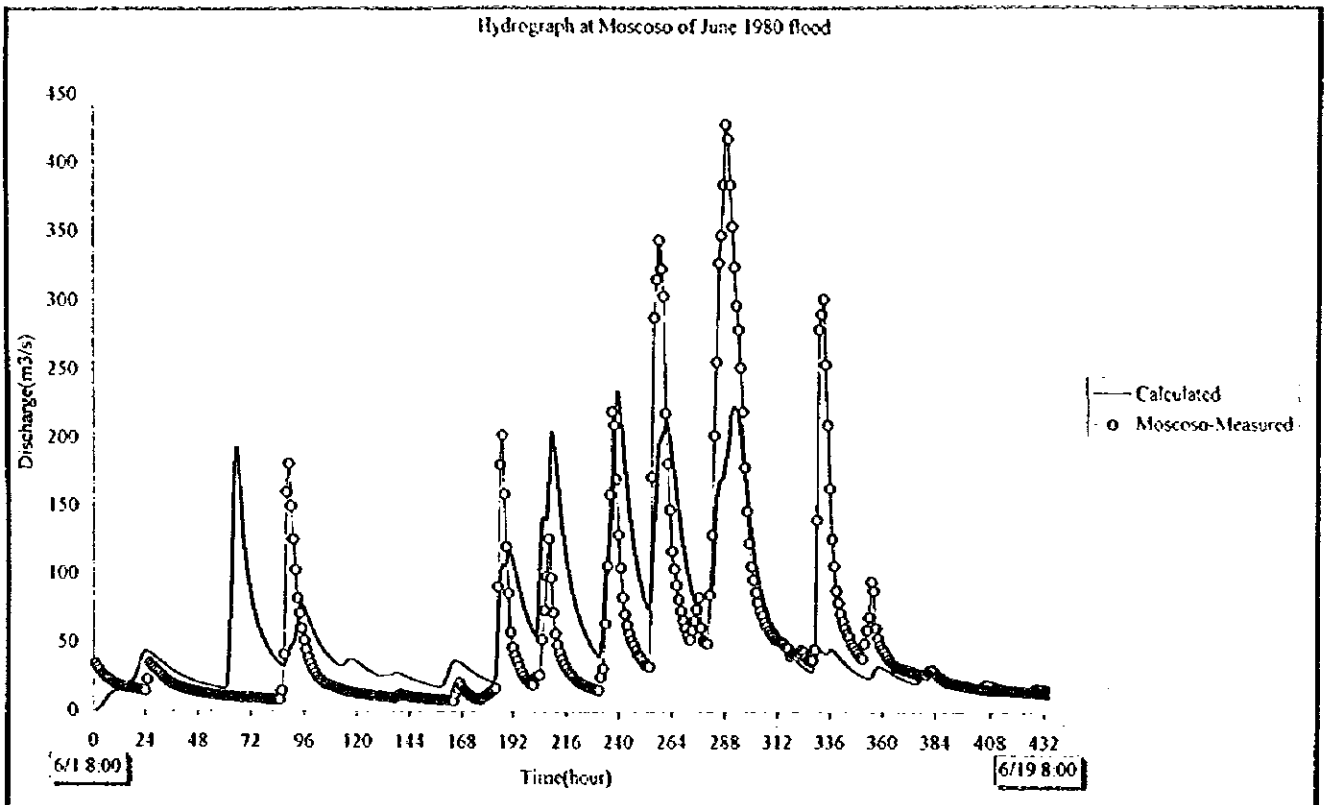


Figure.4.5 (1/2) RESULT OF RUNOFF SIMULATION (1/2)



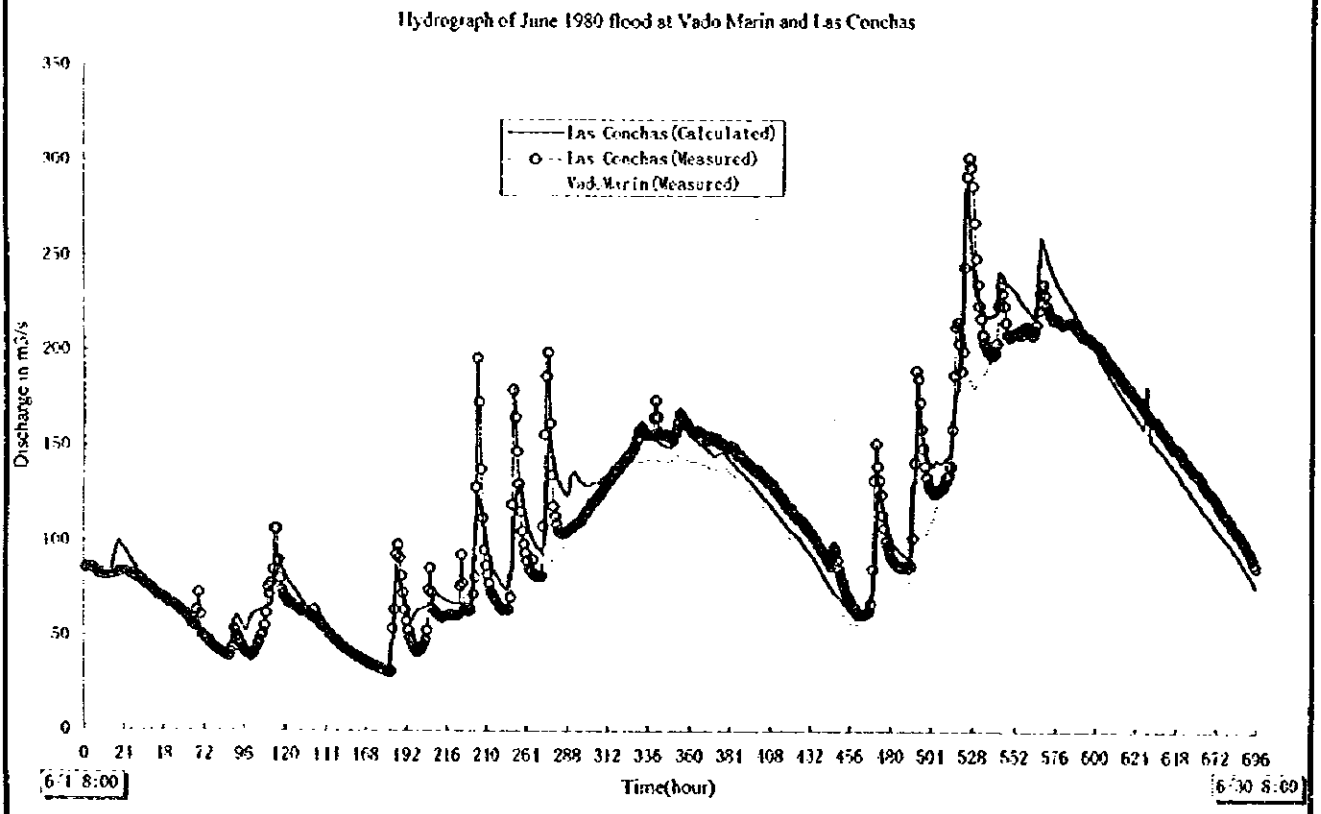
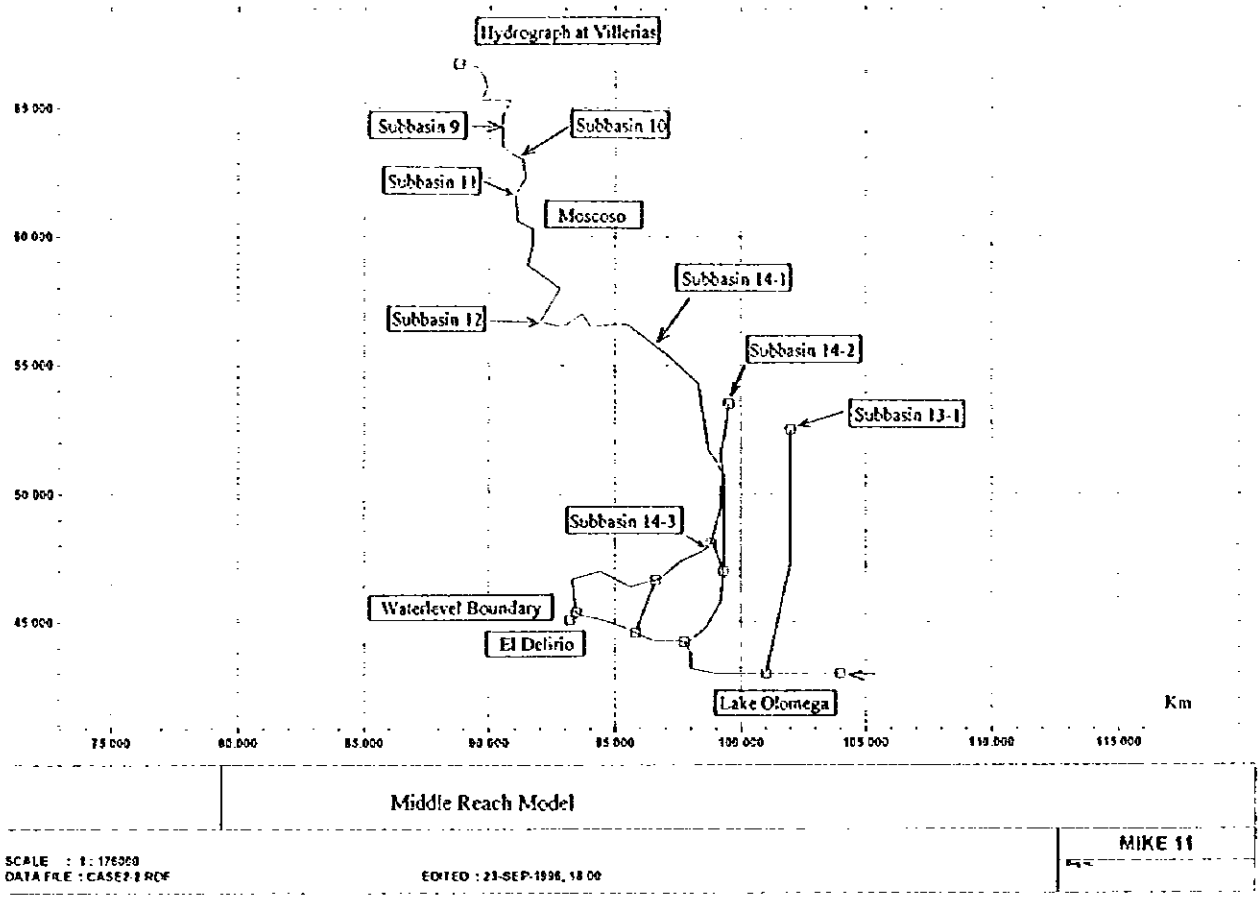


Figure.4.5 (2/2) RESULT OF RUNOFF SIMULATION (2/2)



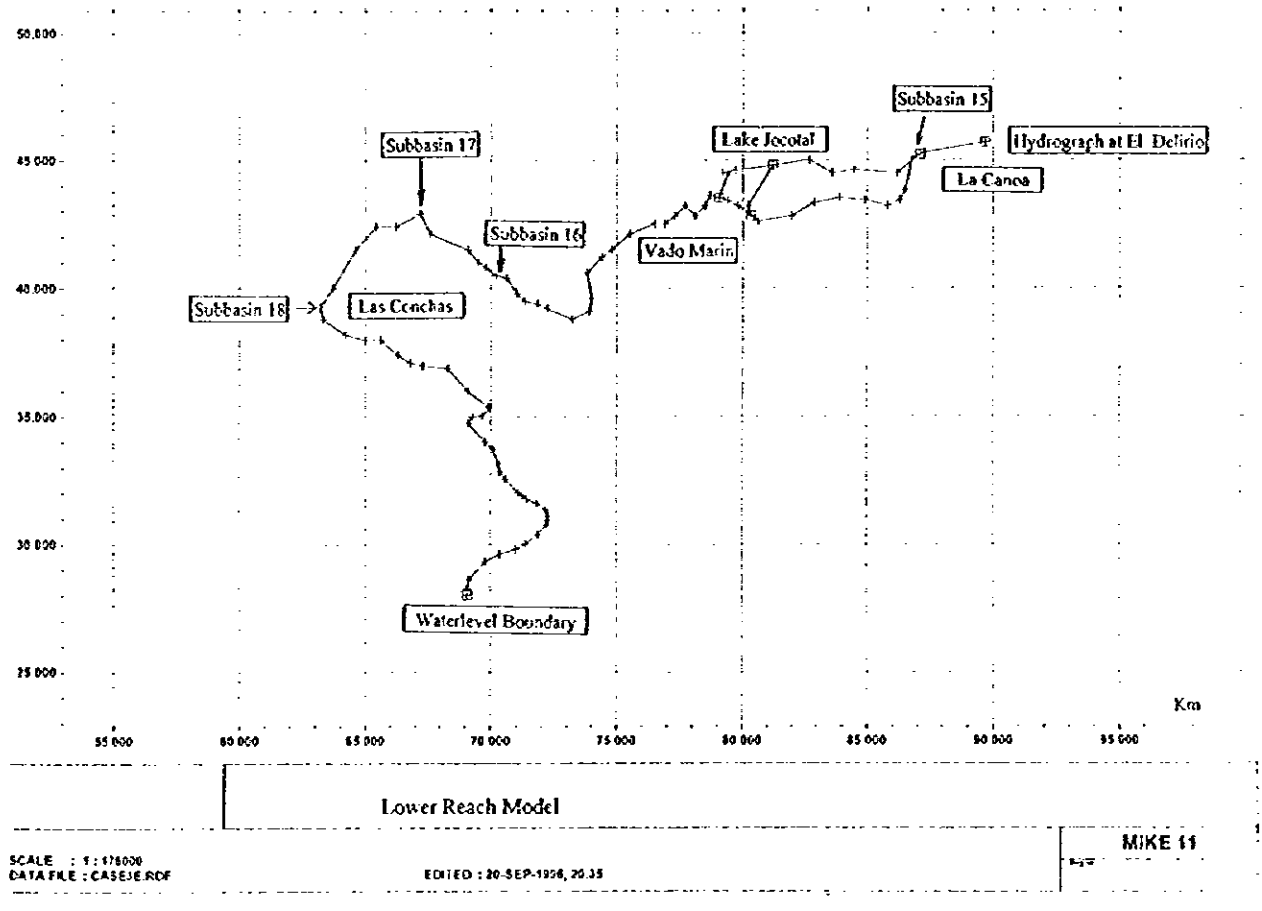
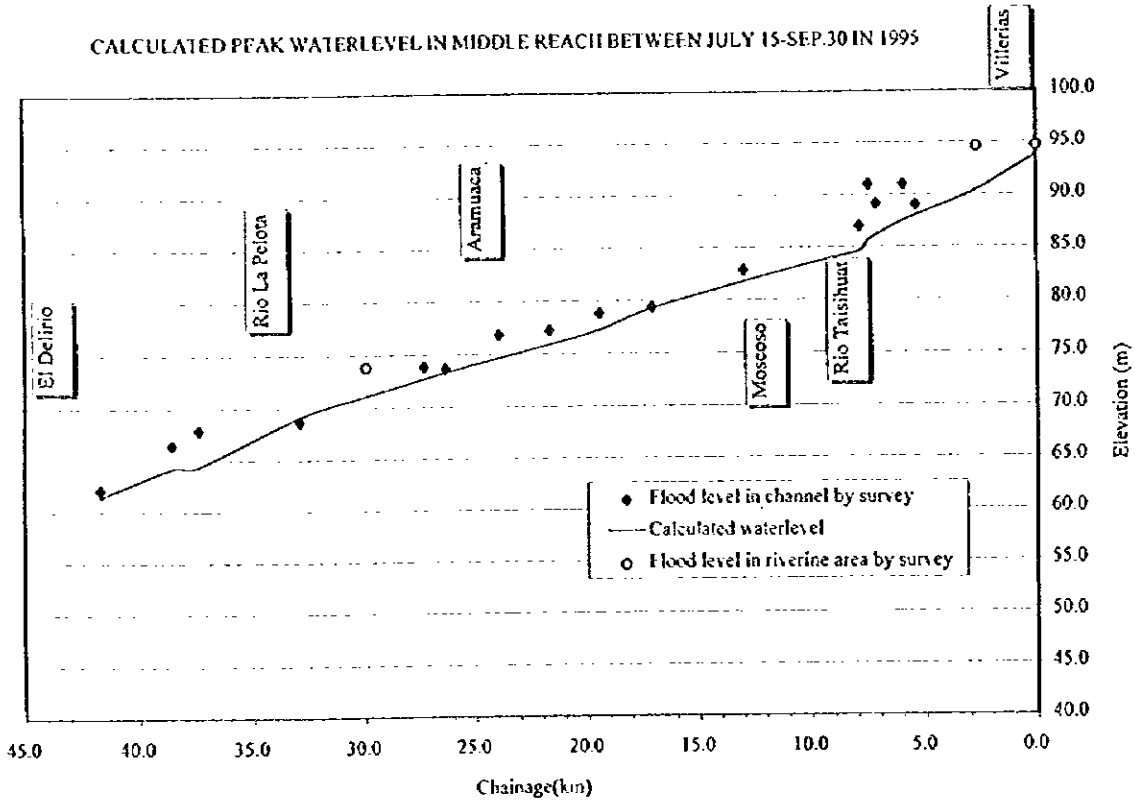


Figure.4.6 CHANNEL NETWORK FOR 1-D FLOOD SIMULATION



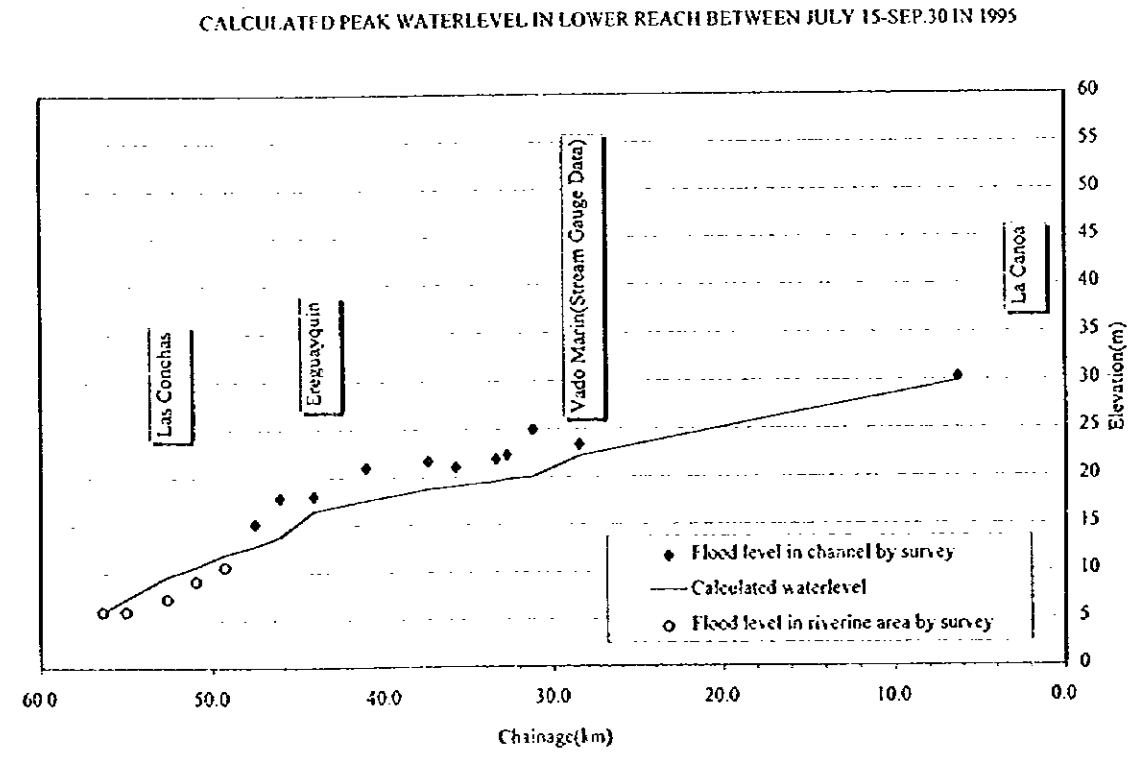


Figure.4.7 RESULTS OF FLOOD SIMULATION

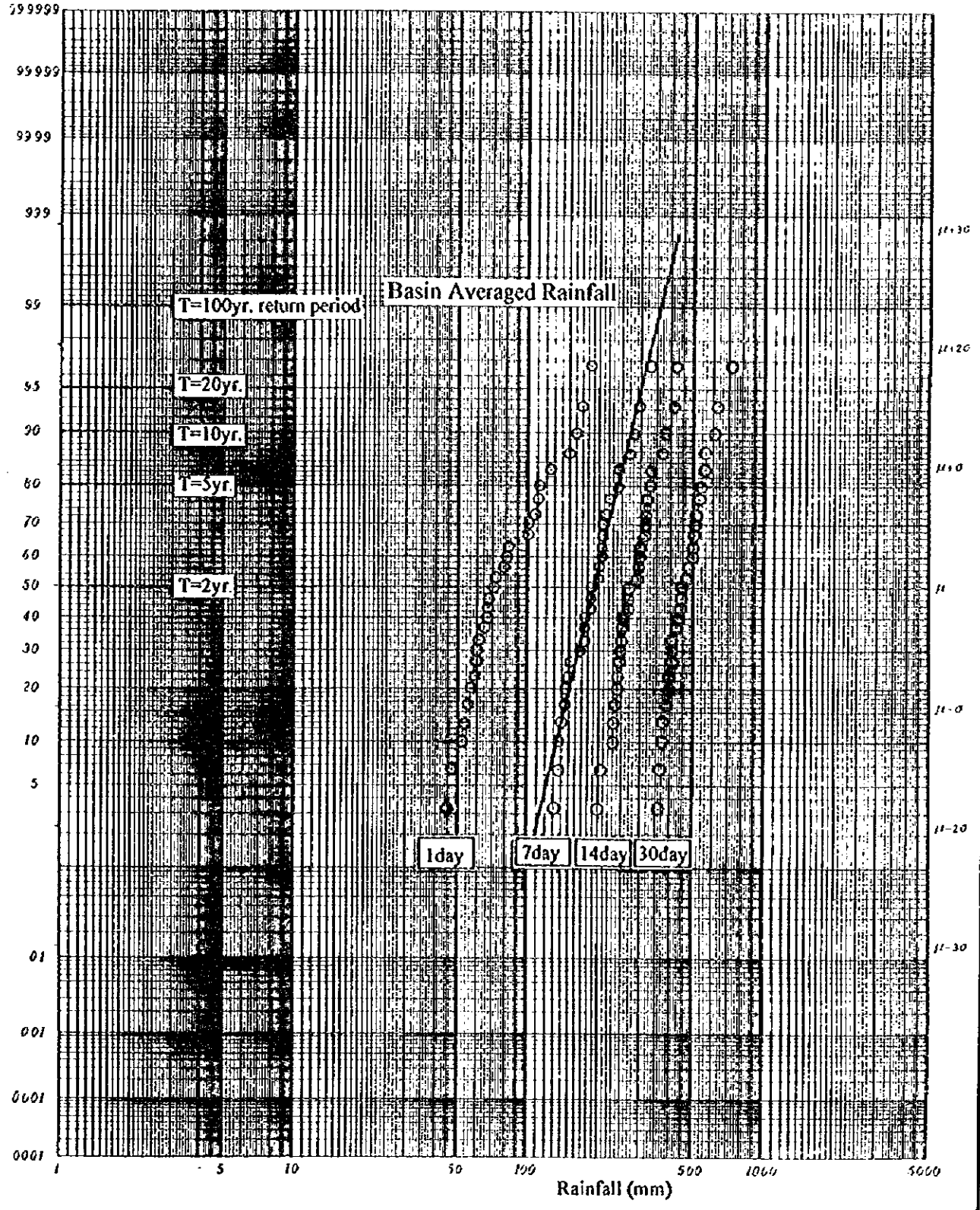
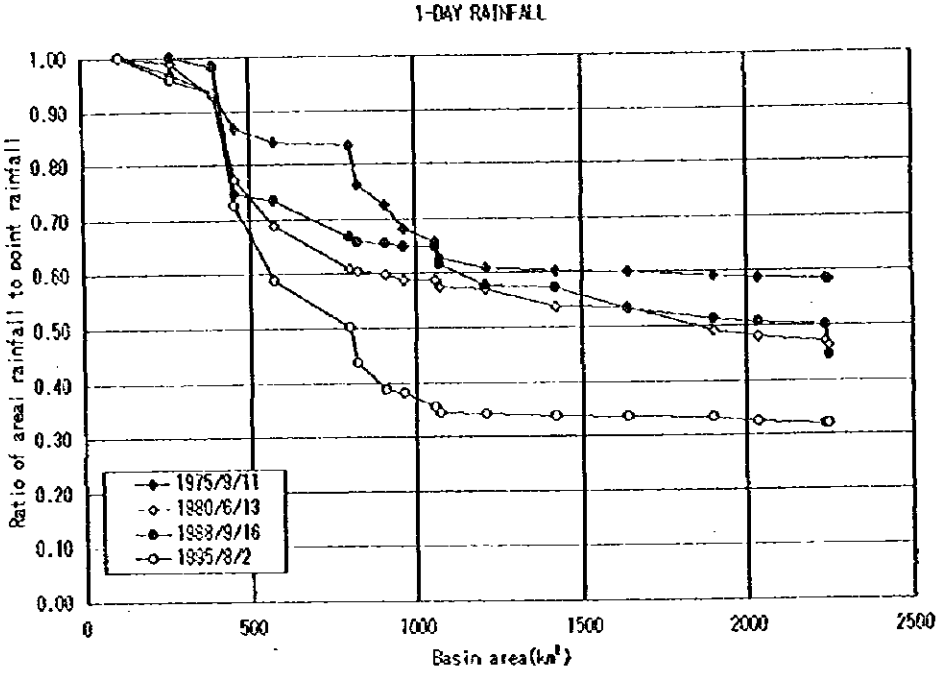


Figure.4.8 PROVABLE BASIN MEAN RAINFALL



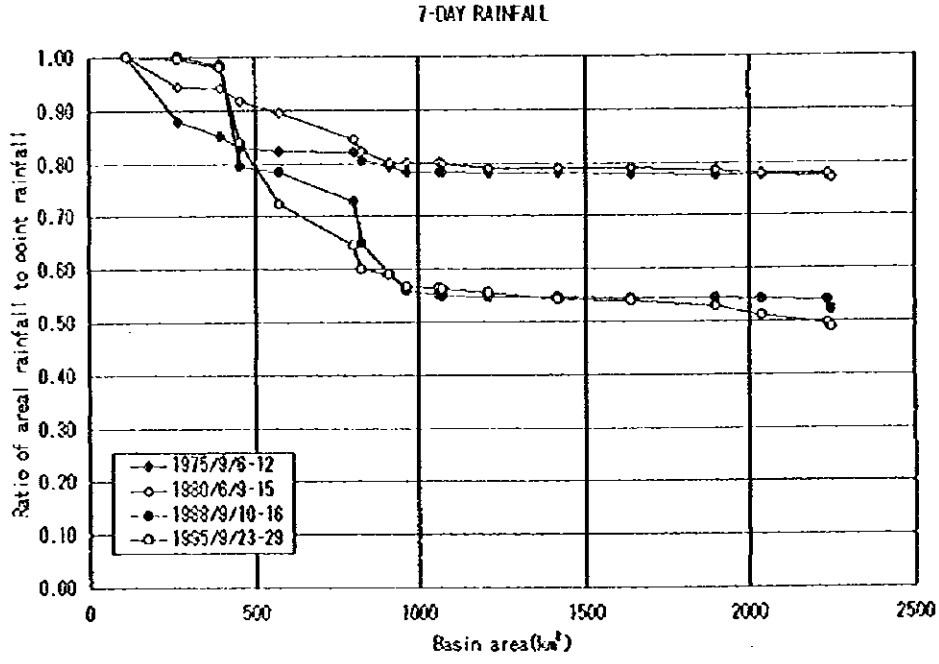


Figure.4.9 REDUCTION OF RAINFALL IN AREA

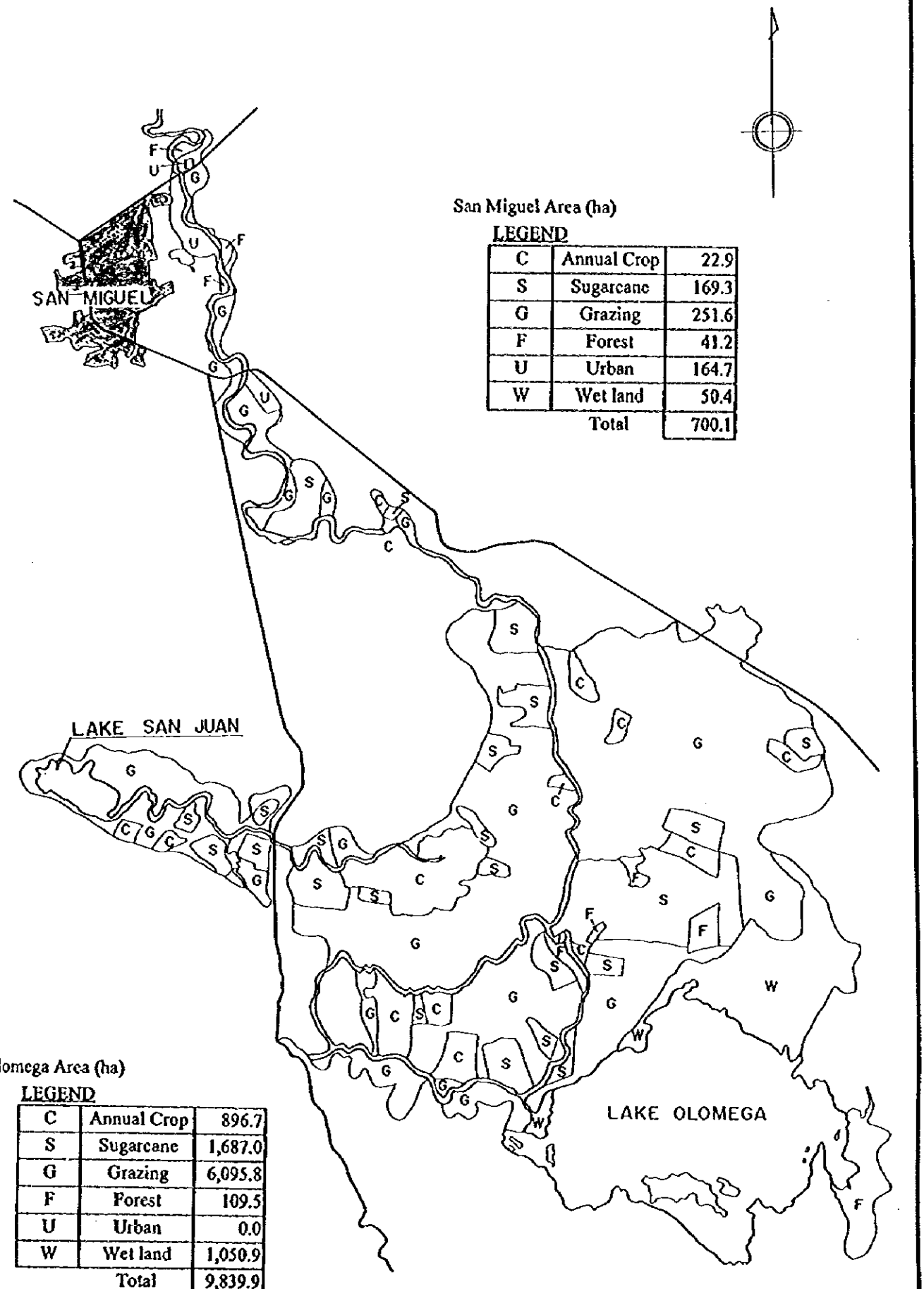
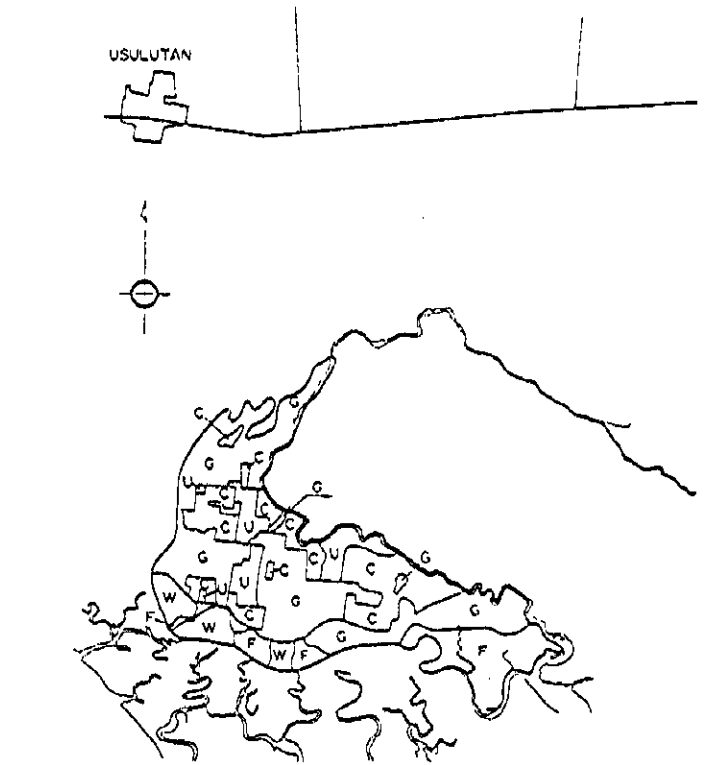


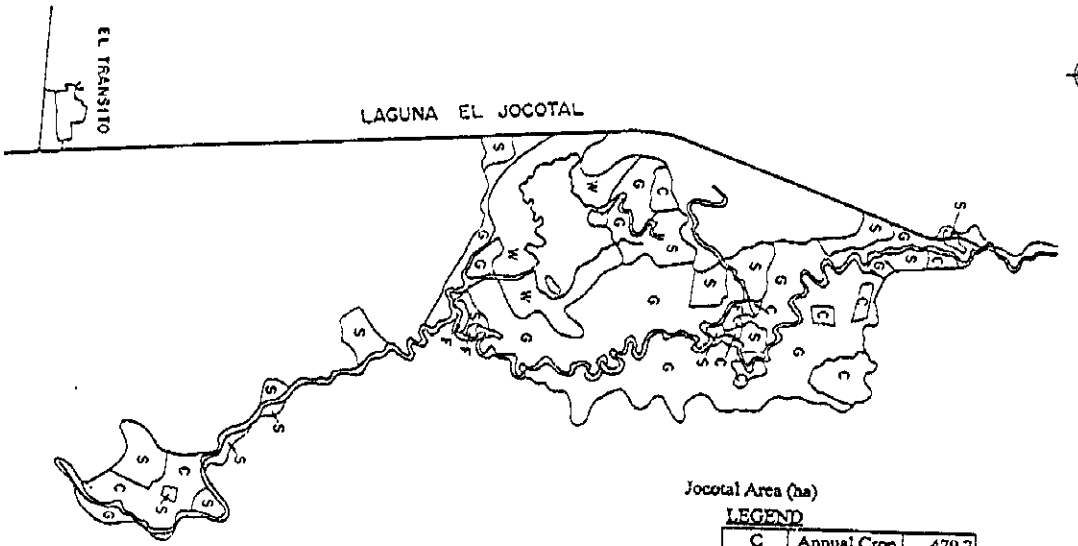
Figure.4.10 (1/2) PRESENT LAND USE OF INUNDATION AREA



Usulutan Area (ha)

LEGEND

C	Annual Crop	465.3
S	Sugarcane	325.6
G	Grazing	1,522.7
F	Forest	417.8
U	Urban	0.0
W	Wet land	398.6
	Total	3,130.0

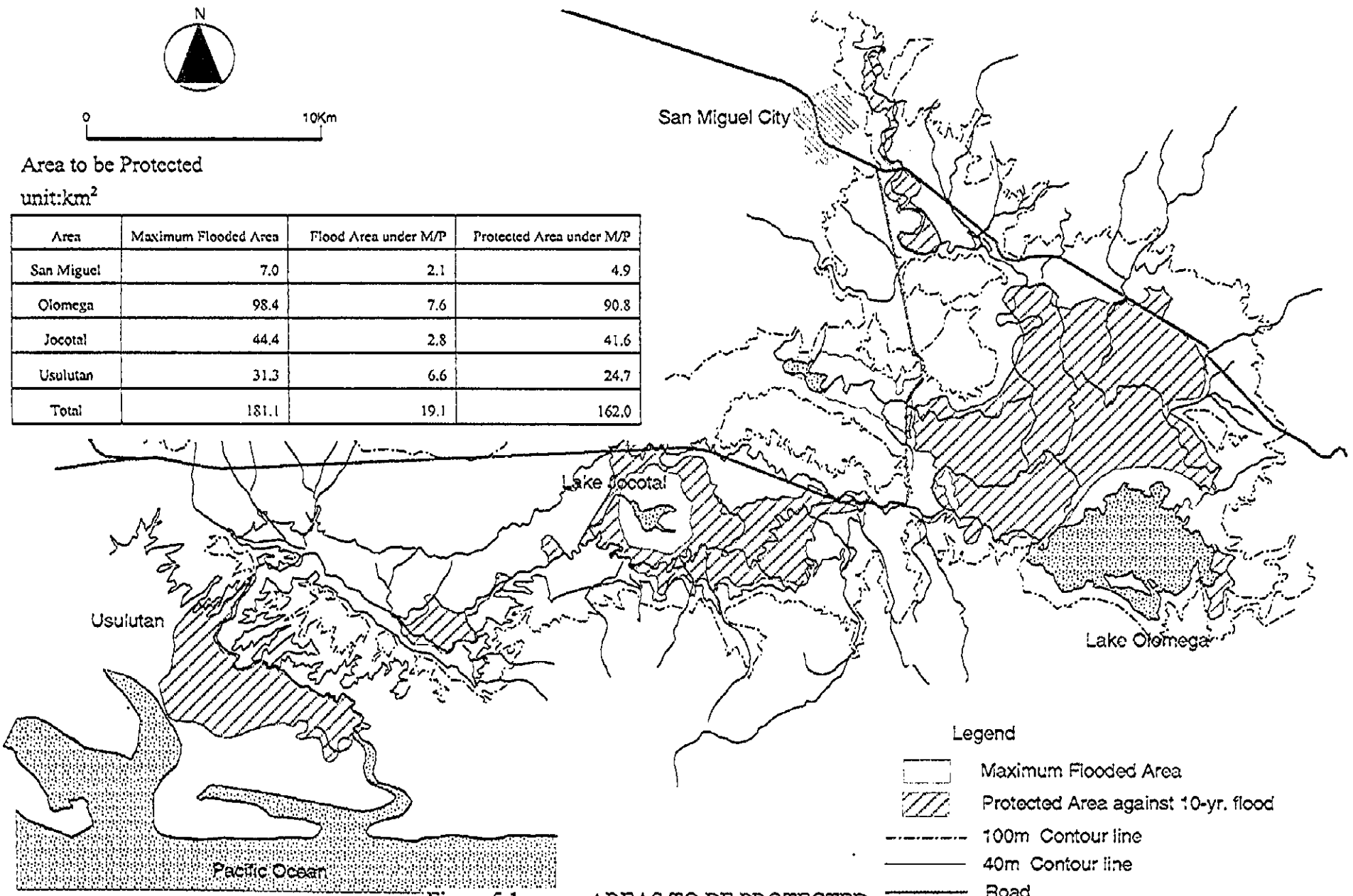


Jocotal Area (ha)

LEGEND

C	Annual Crop	479.7
S	Sugarcane	701.6
G	Grazing	2,446.7
F	Forest	36.0
U	Urban	0.0
W	Wet land	774.1
	Total	4,438.1

Figure.4.10 (2/2) PRESENT LAND USE OF INUNDATION AREA

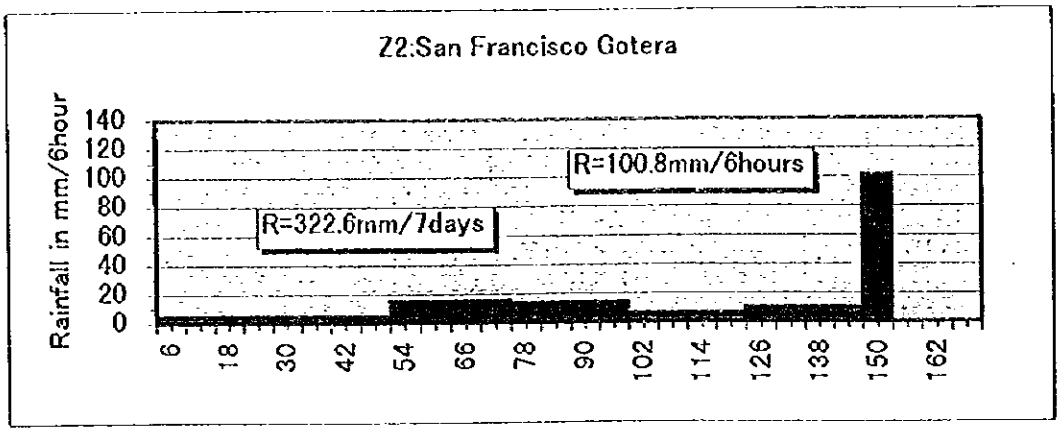


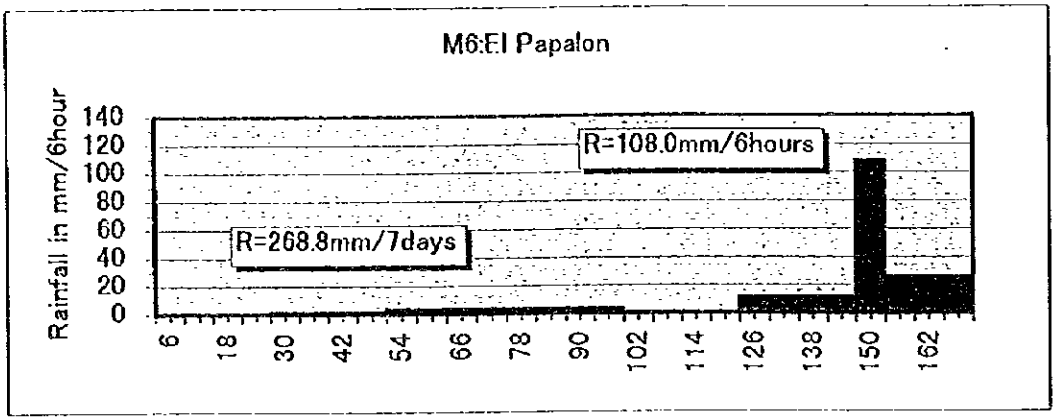
Area to be Protected

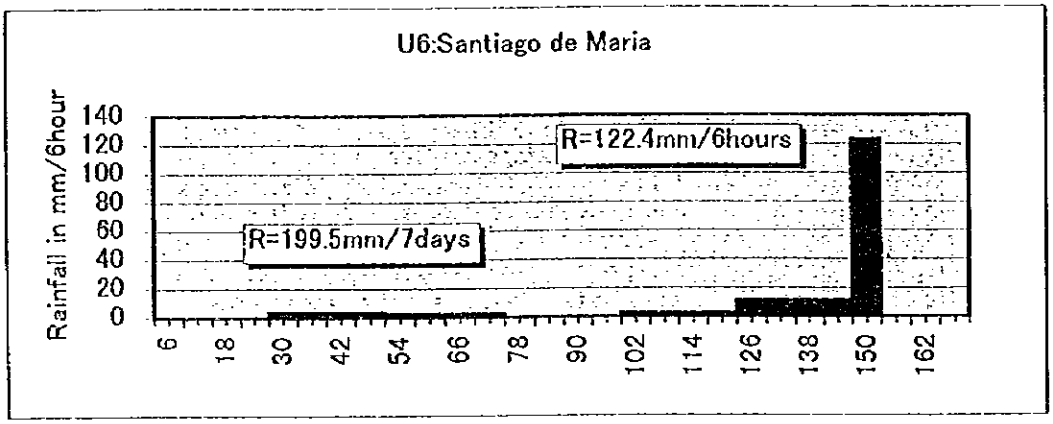
unit:km^2

Area	Maximum Flooded Area	Flood Area under M/P	Protected Area under M/P
San Miguel	7.0	2.1	4.9
Olomega	98.4	7.6	90.8
Jocotal	44.4	2.8	41.6
Usulutan	31.3	6.6	24.7
Total	181.1	19.1	162.0

Figure.5.1 AREAS TO BE PROTECTED







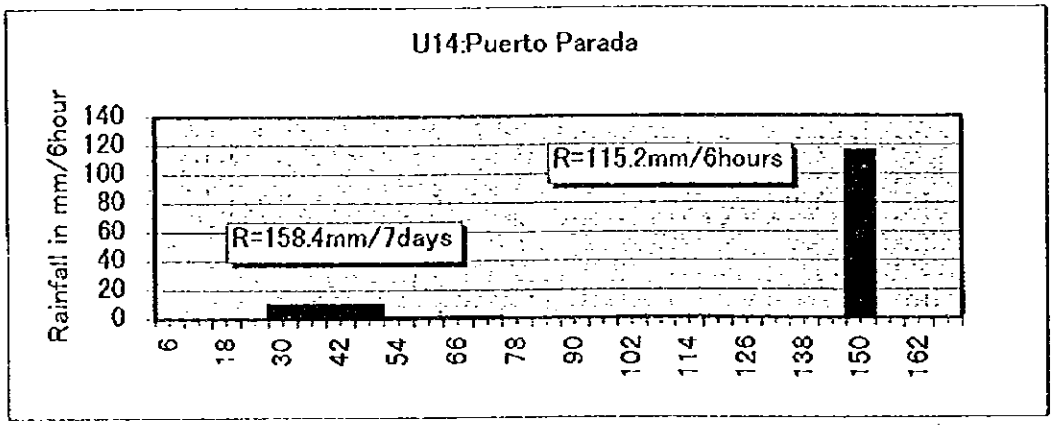


Figure.5.2 DESIGN RAINFALL FOR 10-YEAR RETURN PERIOD

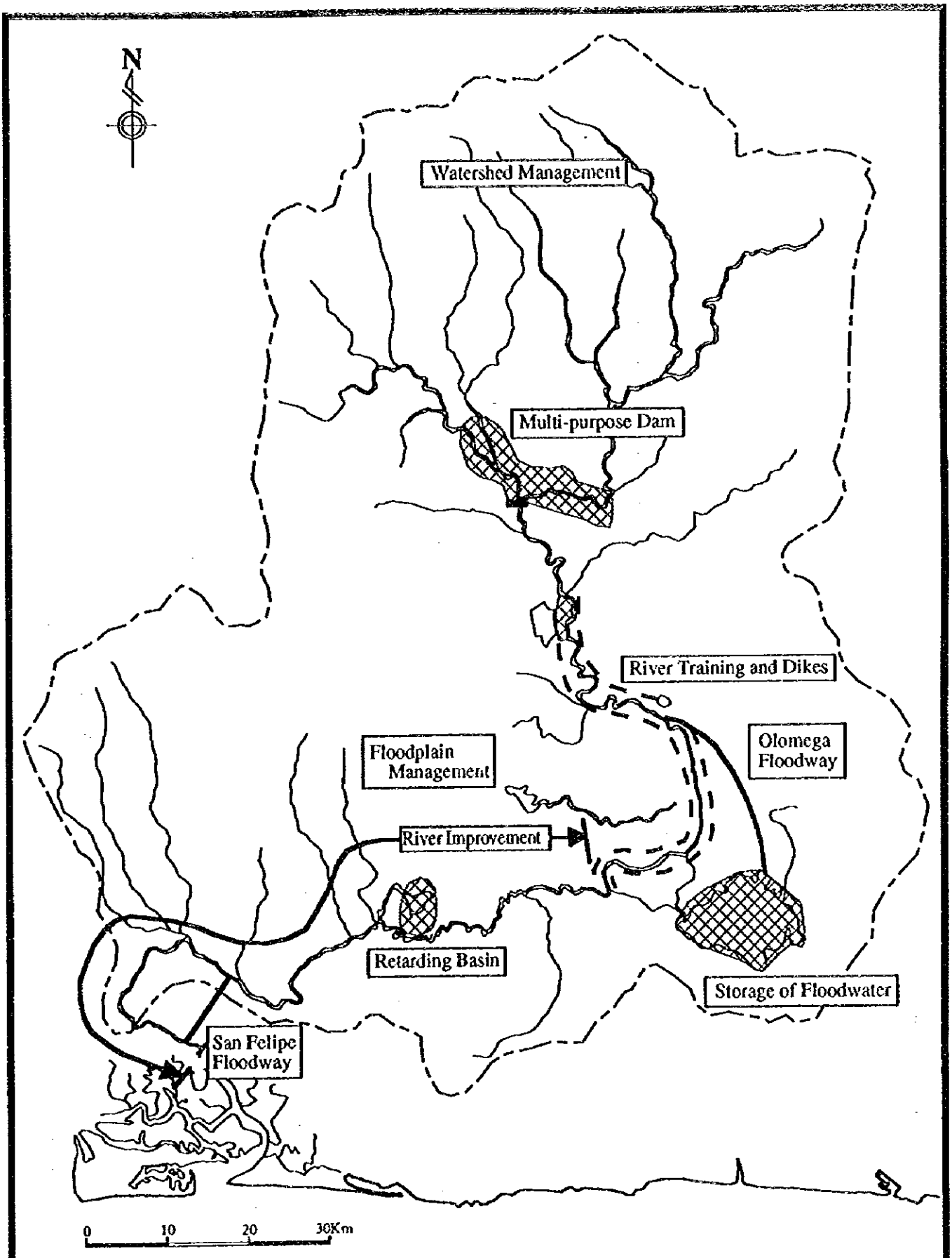


Figure.5.3 CONCEIVABLE FLOOD CONTROL MEASURES

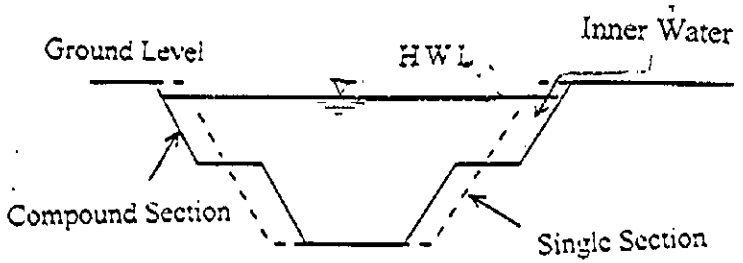
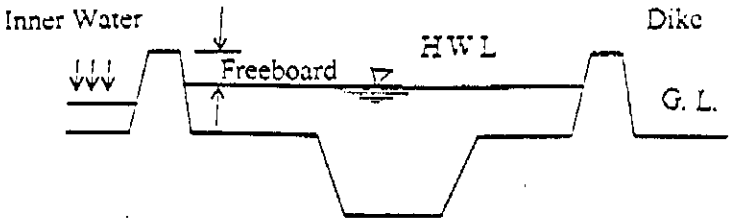
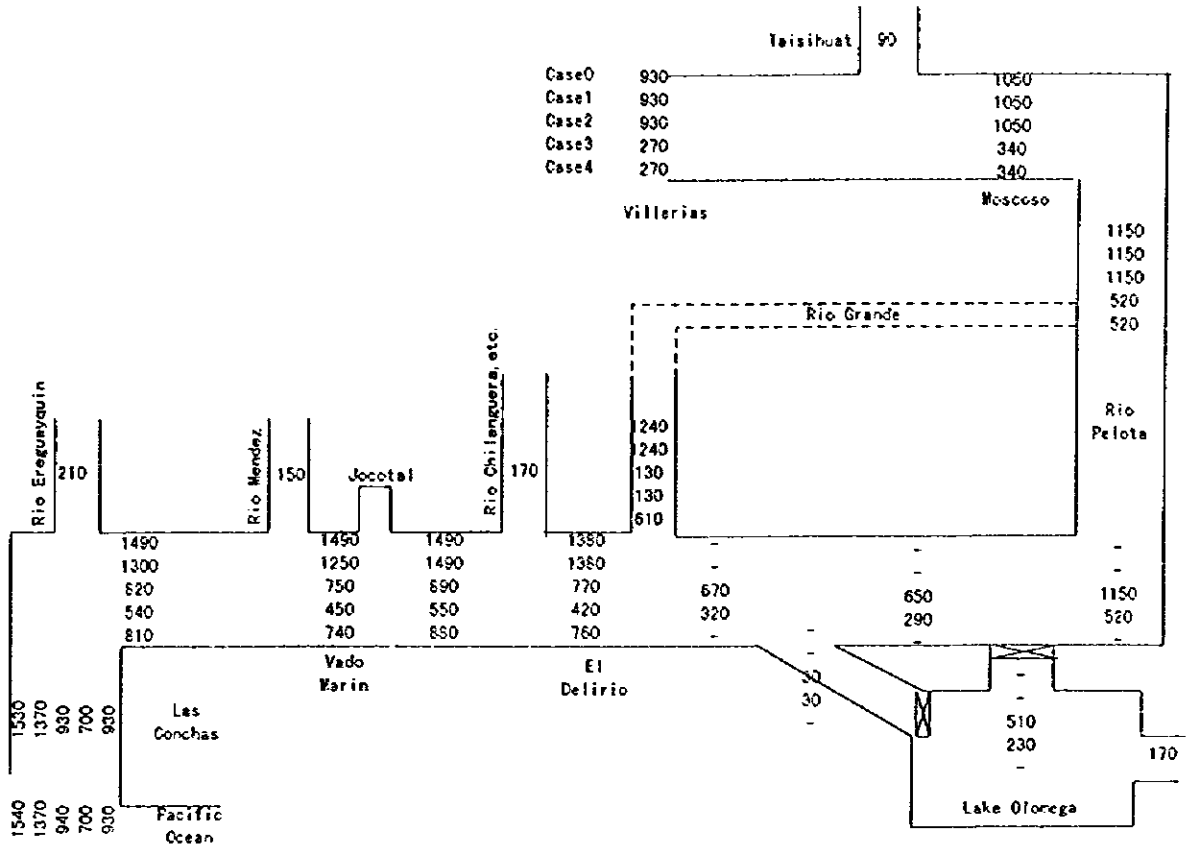
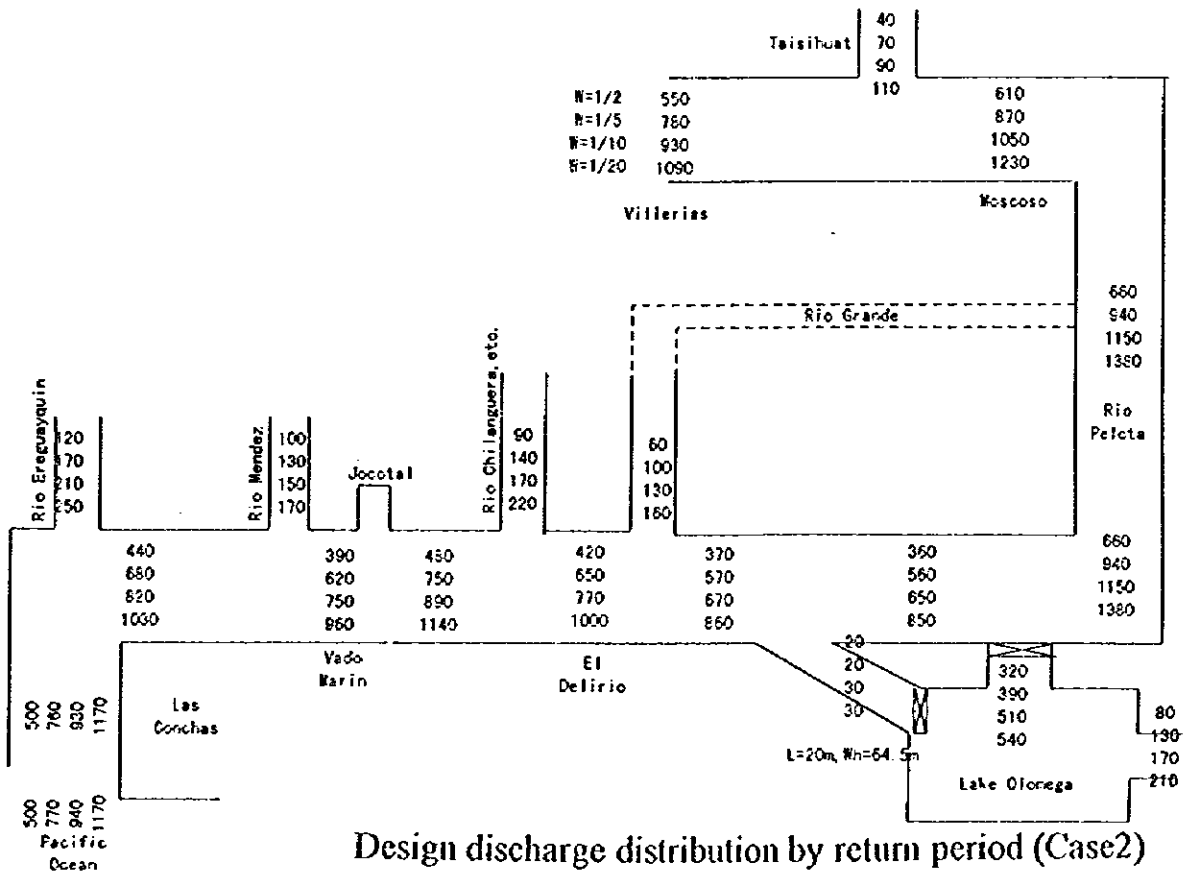
Dredging / Excavation Method	Diking Method
 * H W L (Design Flood Level) shall be lower than the ground level	 * H W L+Freeboard is required
1. Inner water can be drained by gravity flow. 2. Damage by flood larger than the designed one would not increase so much. 3. Construction cost is high but width of land acquisition cost is small. 4. Inconvenient for water intake due to low river-bed. 5. River mouth sedimentation is problem if dredged deeply.	1. Inner water cannot be drained by gravity. Dike for tributary or pumping station would be required. 2. Dangerous when larger flood comes. 3. Small in construction cost and large in land acquisition cost 4. Convenient for water intake 5. No problem with river mouth sedimentation

Figure.5.4 COMPARISON OF RIVER IMPROVEMENT METHOD

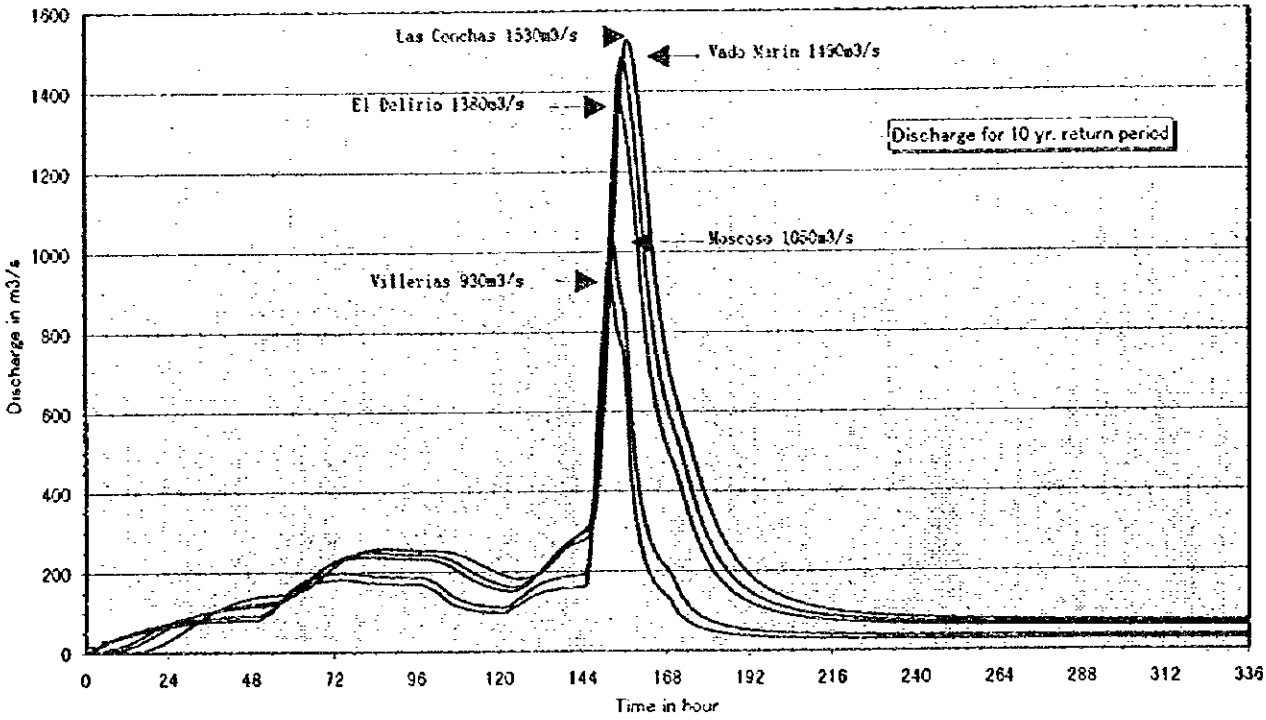


Design discharge distribution for 10-yr. (unit:m3/s)



Design discharge distribution by return period (Case2)

Figure.5.5 DESIGN DISCHARGE DISTRIBUTION FOR ALTERNATIVE SCHEMES



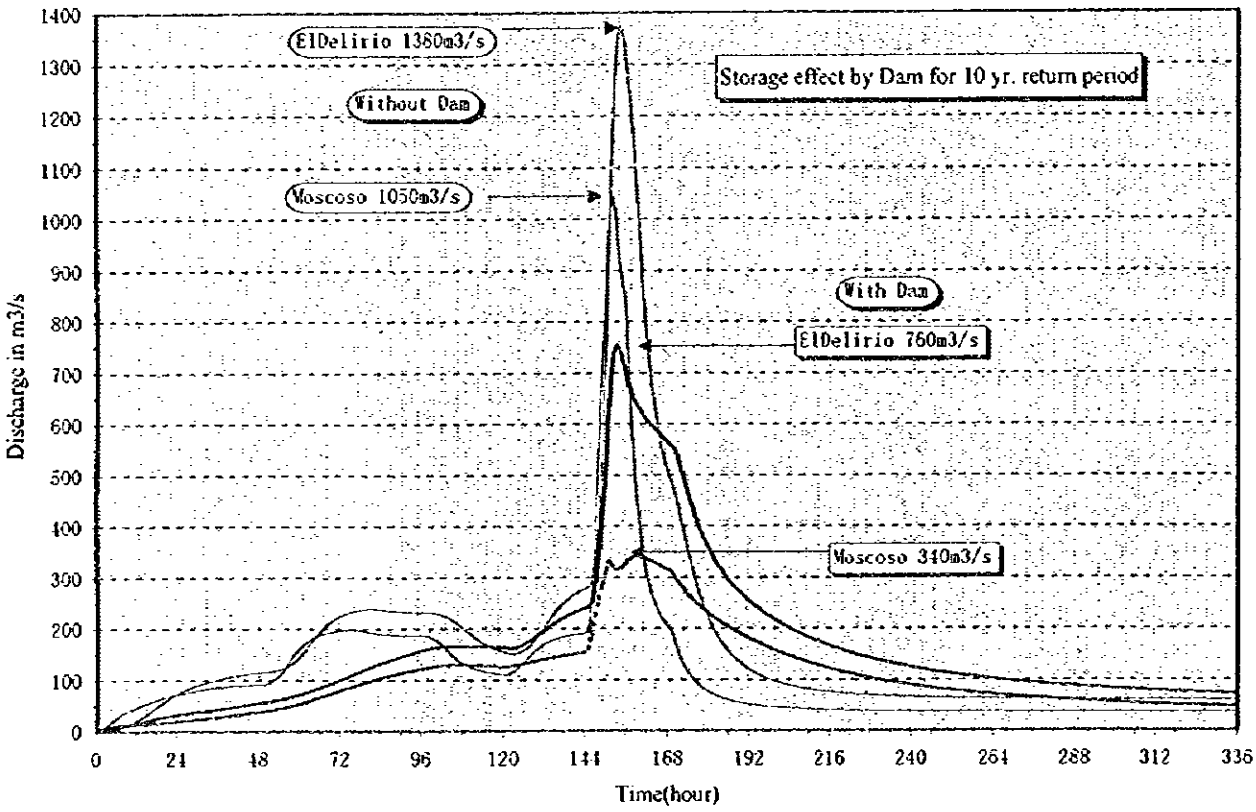
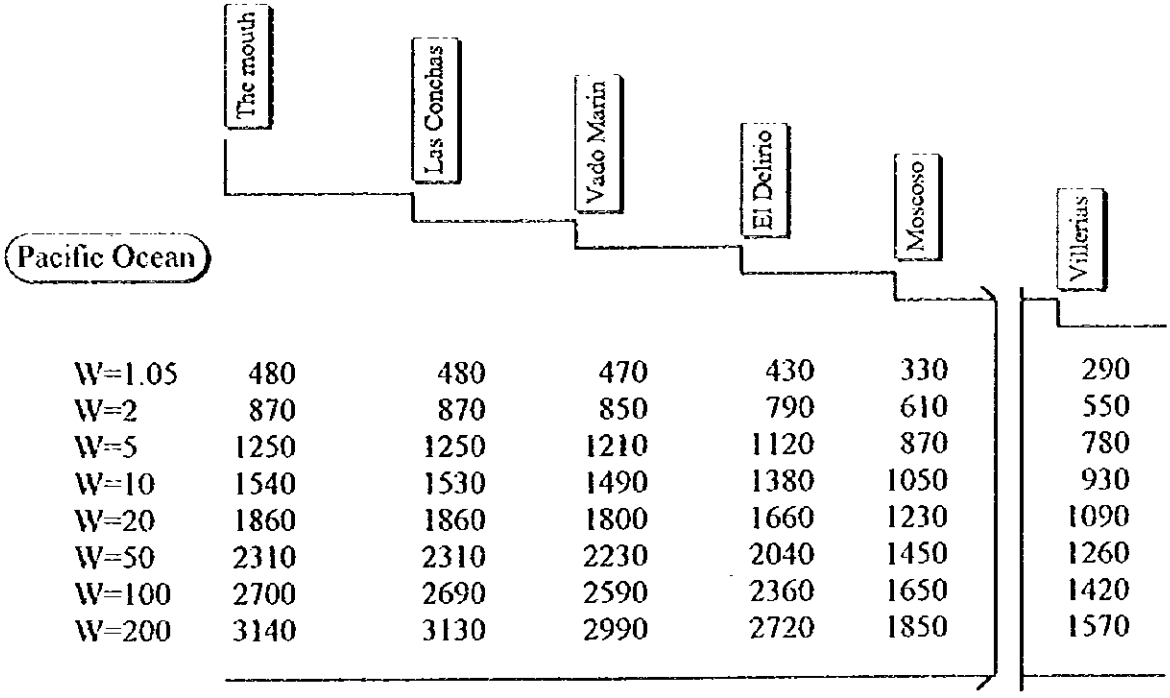
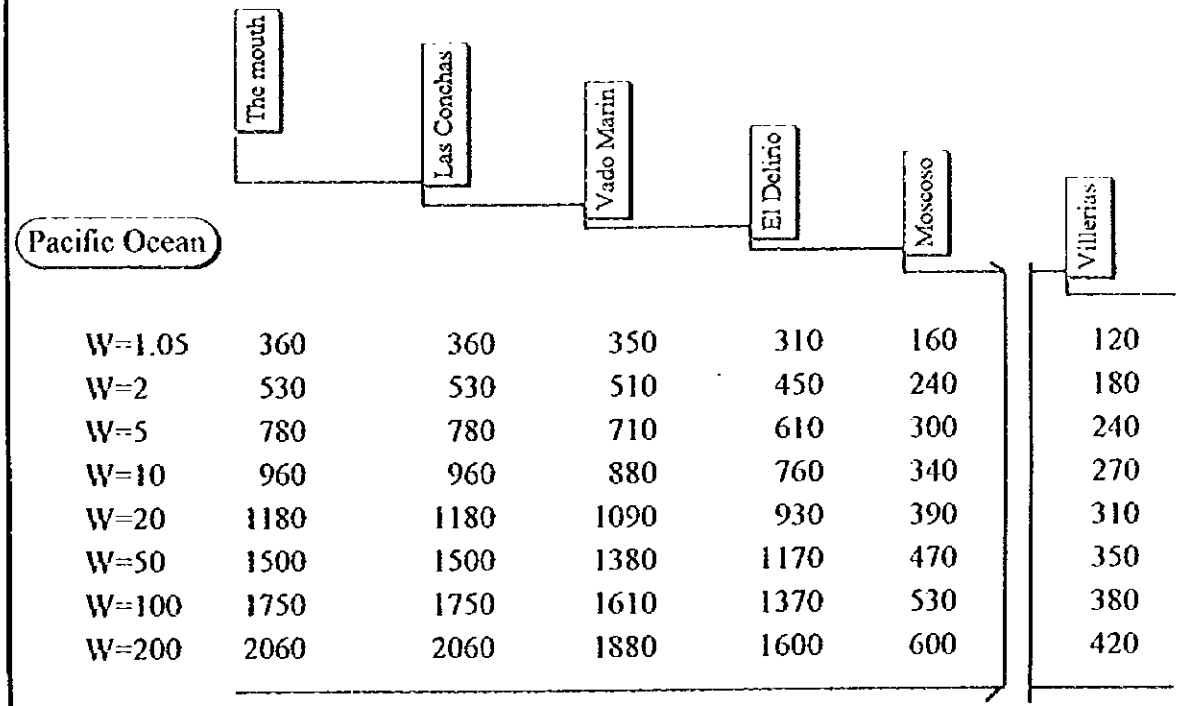


Figure.5.6 DESIGN HYDROGRAPH FOR 10-YEAR RETURN PERIOD



W=1.05	480	480	470	430	330	290
W=2	870	870	850	790	610	550
W=5	1250	1250	1210	1120	870	780
W=10	1540	1530	1490	1380	1050	930
W=20	1860	1860	1800	1660	1230	1090
W=50	2310	2310	2230	2040	1450	1260
W=100	2700	2690	2590	2360	1650	1420
W=200	3140	3130	2990	2720	1850	1570

Discharge Distribution without inundation(unit; m3/s)



W=1.05	360	360	350	310	160	120
W=2	530	530	510	450	240	180
W=5	780	780	710	610	300	240
W=10	960	960	880	760	340	270
W=20	1180	1180	1090	930	390	310
W=50	1500	1500	1380	1170	470	350
W=100	1750	1750	1610	1370	530	380
W=200	2060	2060	1880	1600	600	420

Discharge Distribution with Dam (unit; m^3/s)

Figure.5.7 PROBABLE DISCHARGE DISTRIBUTION

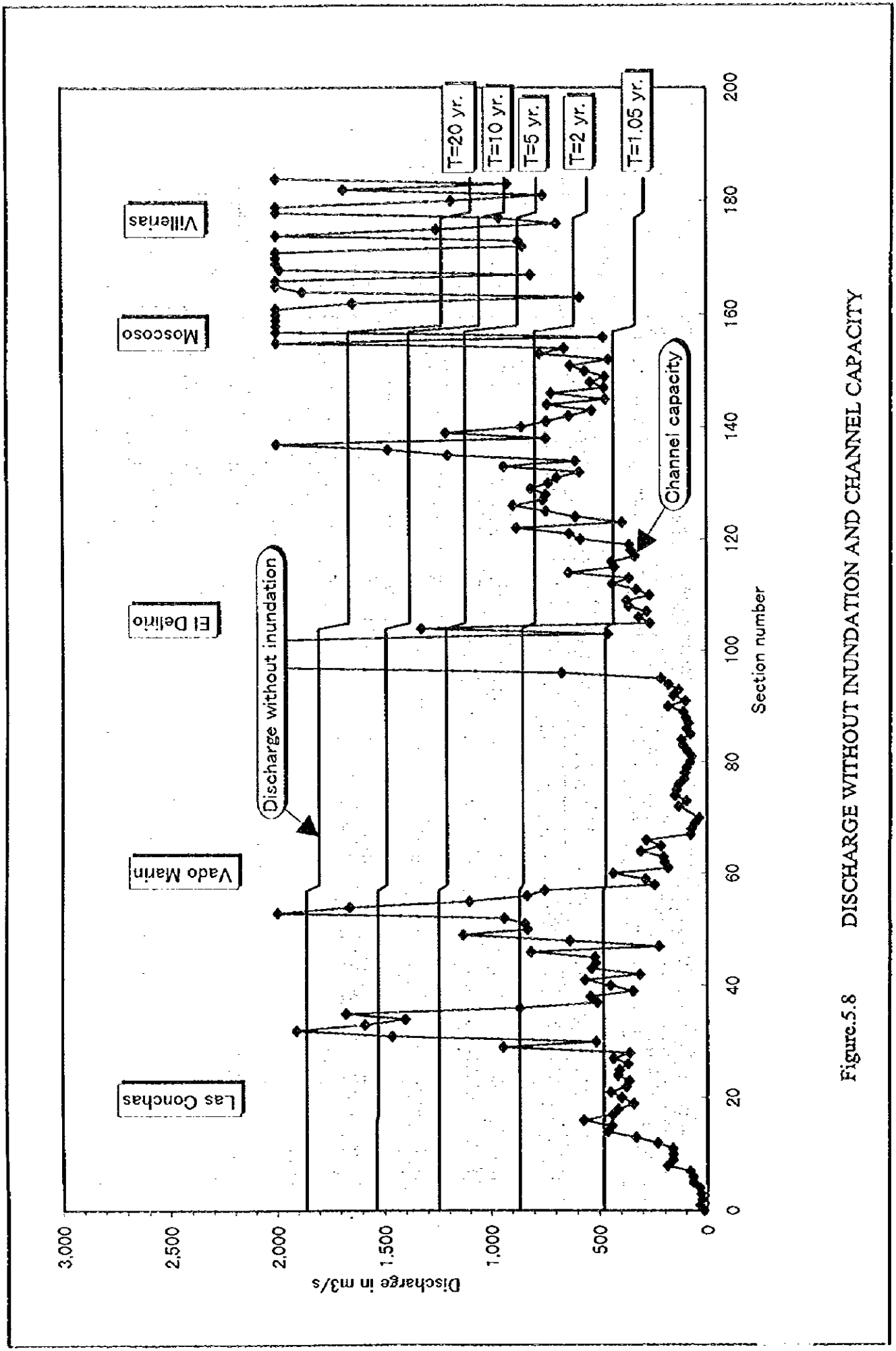
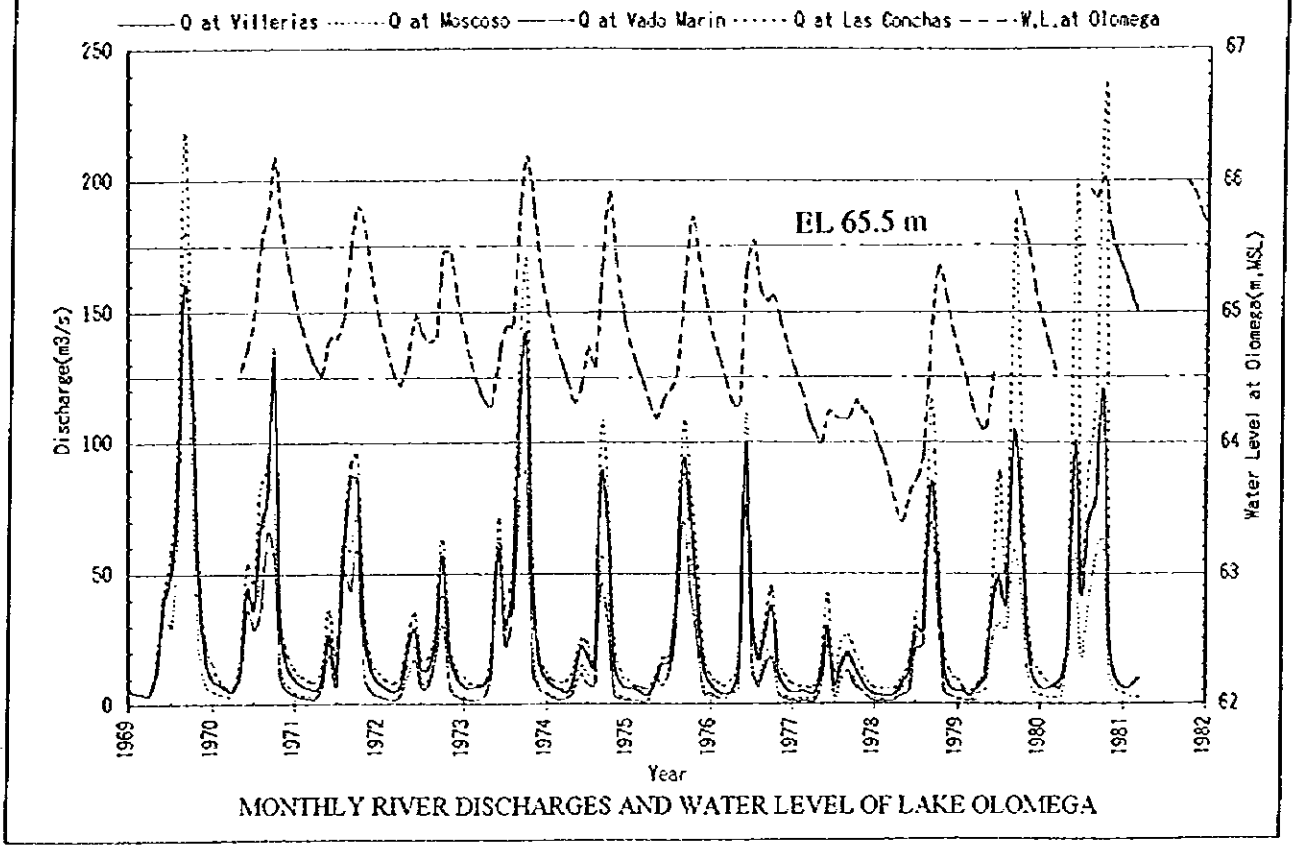


Figure.5.8 DISCHARGE WITHOUT INUNDATION AND CHANNEL CAPACITY



MONTHLY RIVER DISCHARGES AND WATER LEVEL OF LAKE OLOMEGA

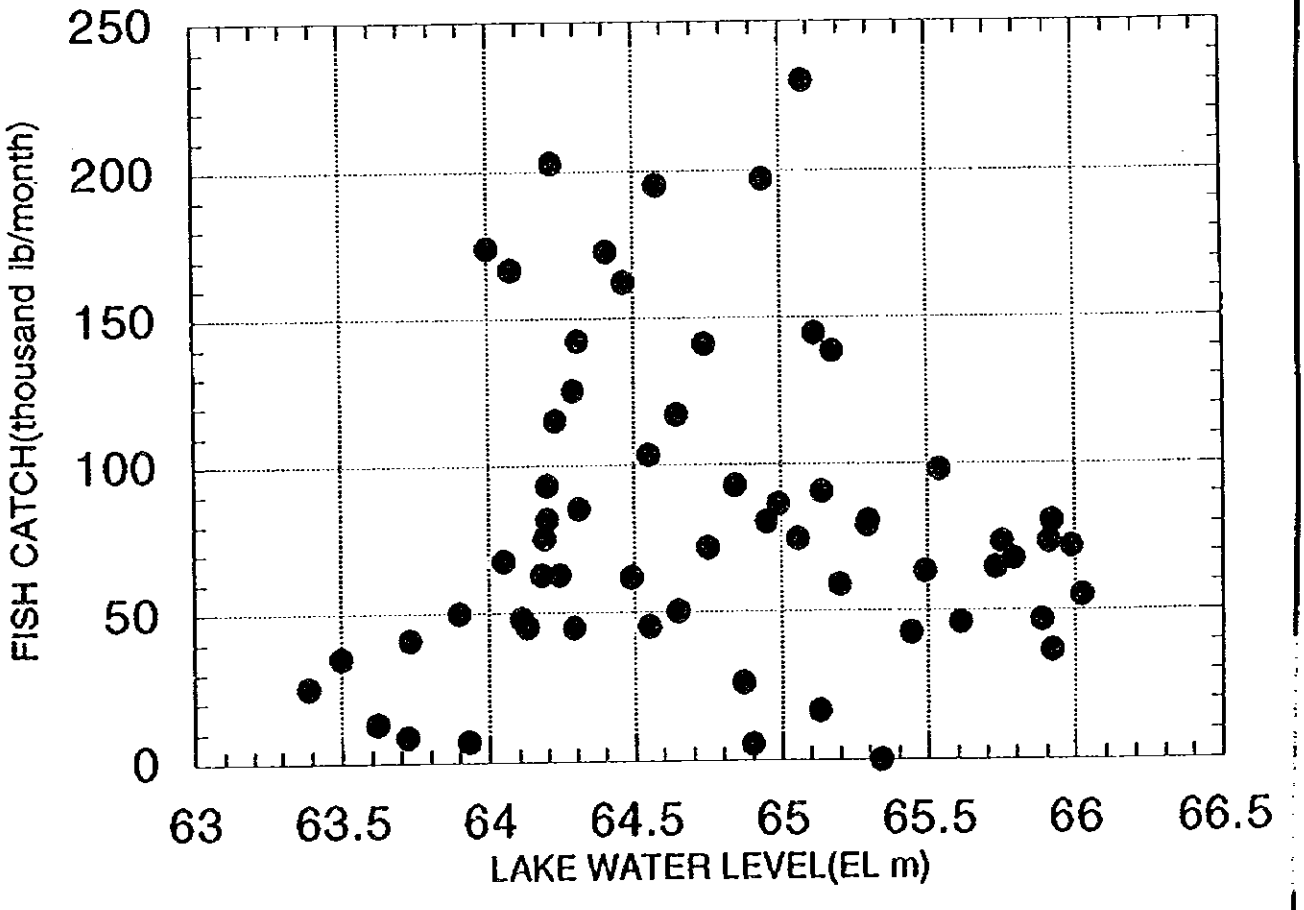


Figure.5.9 LAKE WATER LEVEL AND FISH CATCH (LAKE OLOMEGA)

WATER EL (m)	AREA (km2)	VOLUME (m.c.m.)	V ACC. (m.c.m)
61.5	0.00	0.00	0.00
62.0	0.07	0.02	0.02
62.5	4.49	1.14	1.16
63.0	13.00	4.37	5.53
63.5	18.67	7.92	13.45
64.0	20.06	9.68	23.13
64.5	23.11	10.79	33.92
65.0	30.94	13.51	47.44
65.5	32.26	15.80	63.23
66.0	34.88	16.78	80.02

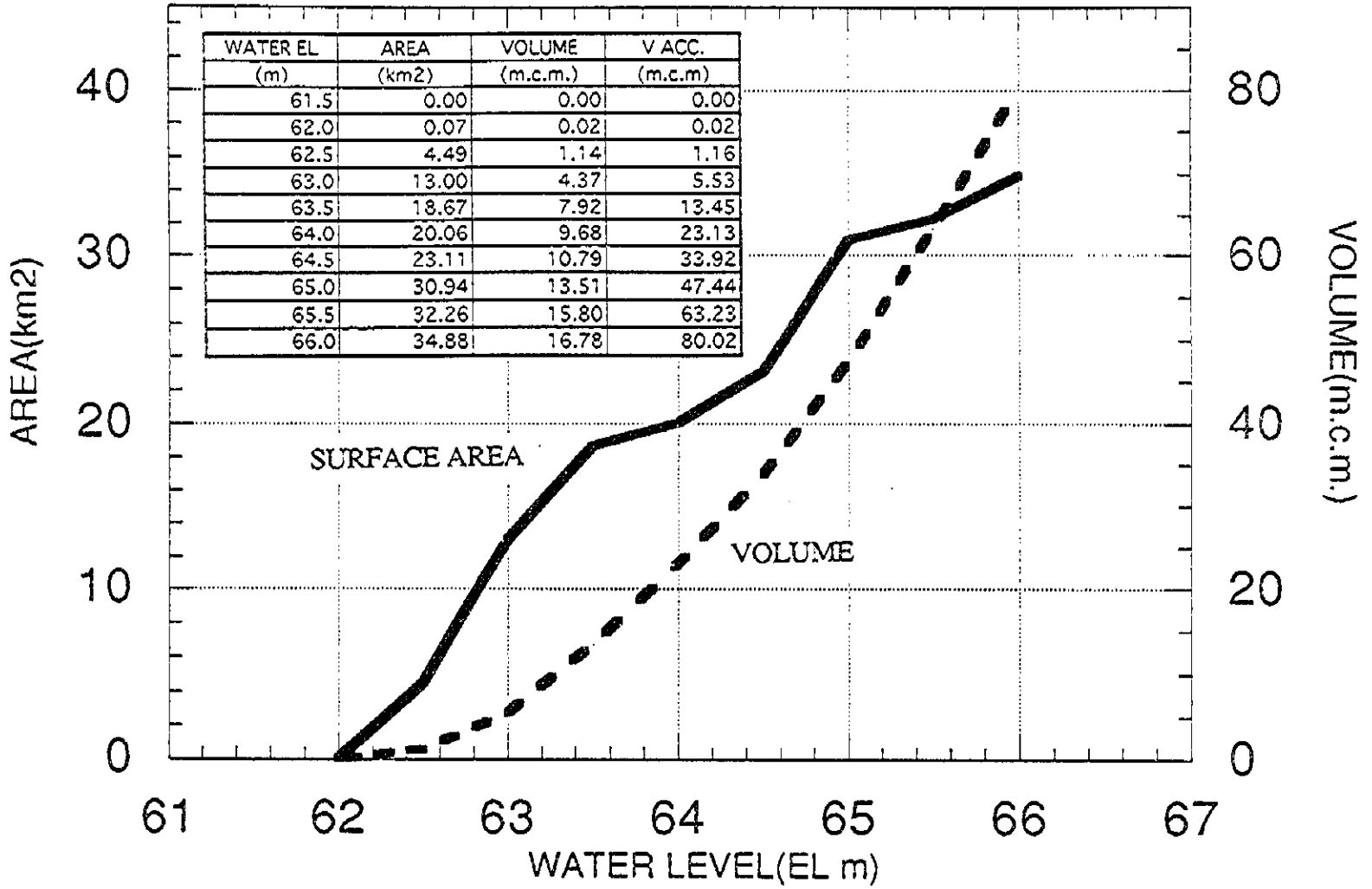


Figure.5.10 WATER LEVEL-AREA-VOLUME RELATIONSHIP (LAKE OLOMEGA)

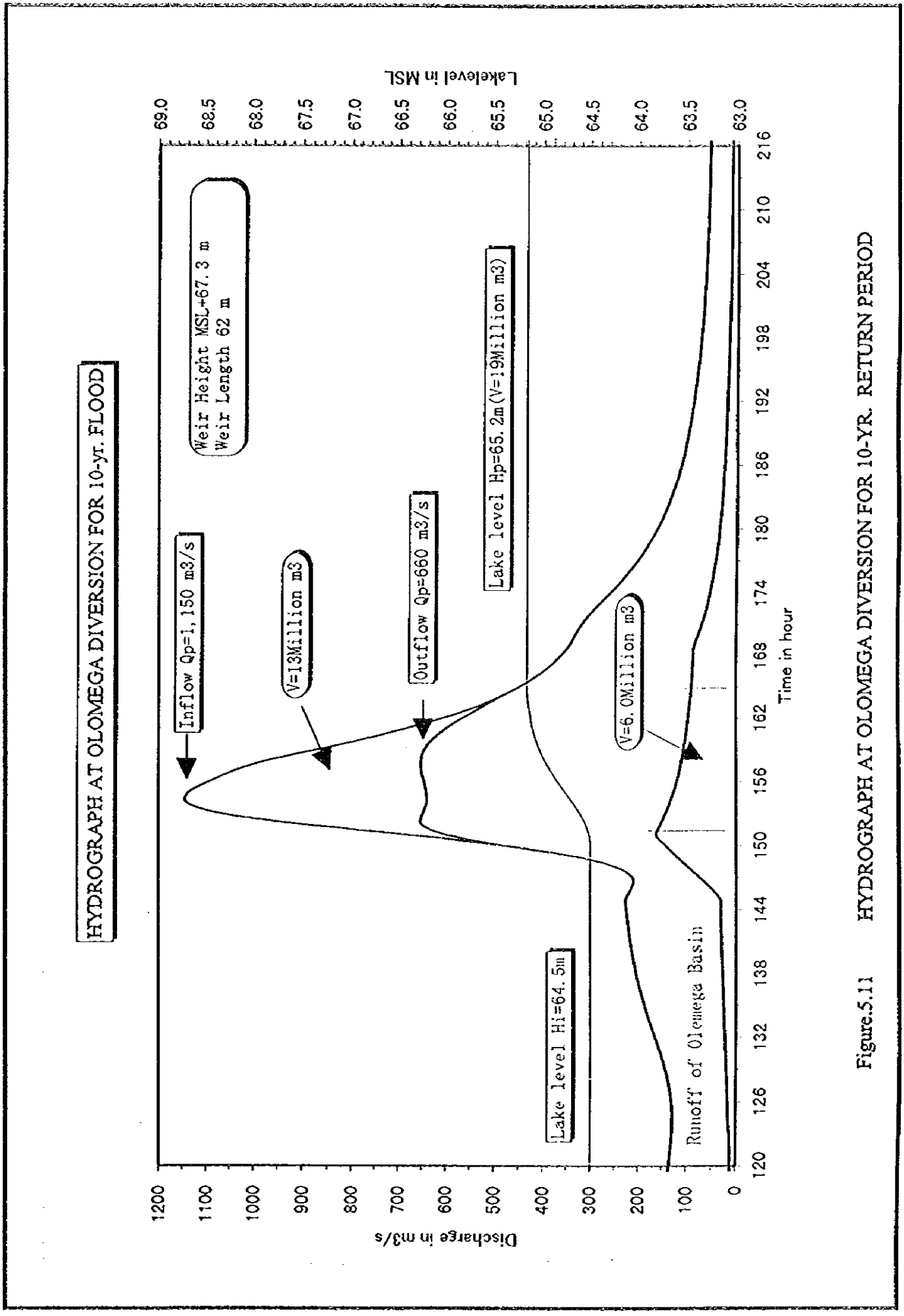


Figure.5.11 HYDROGRAPH AT OLOMEGA DIVERSION FOR 10-YR. RETURN PERIOD

Flood Area by Return period and Design level

San Miguel Area — Channel capacity (Pelota-Vado Marin)

Return period as external force	Existing	T=2yr.	T=5yr.	T=10yr.
1.05	1.6	1.6	1.6	1.6
2	1.6	1.6	1.6	1.6
5	2.0	2.0	2.0	1.8
10	2.5	2.5	2.5	2.1
20	3.0	3.0	3.0	2.6
50	3.5	3.5	3.5	3.1
100	5.1	5.1	5.1	3.7

U

Vado Marin Area — Channel capacity (Pelota-Vado Marin)

Return period as external force	Existing	T=2yr.	T=5yr.	T=10yr.
1.05	0.2	0	0	0
2	0.4	0	0	0
5	0.8	0	0	0
10	1.2	0	0	0
20	1.7	0	0	0
50	2.7	0	0	0
100	3.4	0	0	0

L

Olomega Area — Channel capacity (Pelota-Vado Marin)

Return period as external force	Existing	T=2yr.	T=5yr.	T=10yr.
1.05	25.3	0.0	-	0.0
2	41.5	9.2	-	0.0
5	54.5	14.0	9.2	4.6
10	69.4	15.5	9.6	7.6
20	78.0	17.5	14.0	10.0
50	83.7	55.4	55.4	55.4
100	88.9	59.1	-	59.1

M

Usulutan Area — Channel capacity (Pelota-Vado Marin)

Return period as external force	Existing	T=2yr.	T=5yr.	T=10yr.
1.05	5.1	6.2	-	6.6
2	14.1	6.3	-	6.6
5	16.7	6.3	6.6	6.6
10	19.0	6.6	6.6	6.6
20	20.0	6.4	6.6	6.6
50	22.0	6.5	6.6	6.6
100	23.5	6.6	-	25.9

Jocotal Area — Channel capacity (Pelota-Vado Marin)

Return period as external force	Existing	T=2yr.	T=5yr.	T=10yr.
1.05	22.2	0.1	-	0.0
2	25.6	3.8	-	0.0
5	29.7	16.3	9.0	0.7
10	31.0	18.0	12.0	2.8
20	32.0	19.3	19.0	10.2
50	33.0	24.1	10.0	3.8
100	34.6	26.0	-	15.7

L

Total Area — Channel capacity (Pelota-Vado Marin)

Return period as external force	Existing	T=2yr.	T=5yr.	T=10yr.
1.05	54.4	7.8	-	8.2
2	83.2	20.9	-	8.2
5	103.7	38.6	26.8	13.7
10	123.1	42.6	30.7	19.1
20	134.7	46.2	42.6	29.4
50	144.9	89.5	75.5	68.9
100	155.5	96.8	-	104.4

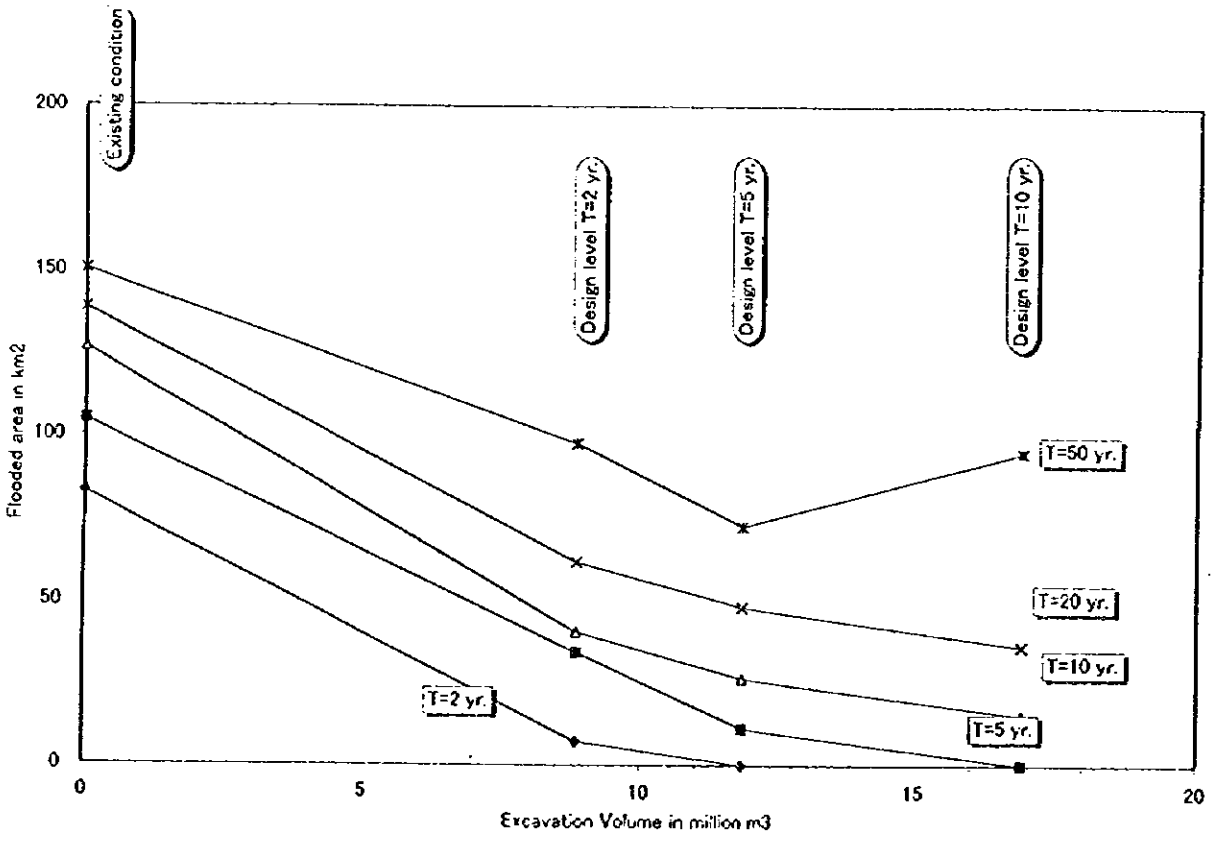


Figure.5.12 RELATION BETWEEN FLOOD AREA AND EXCAVATION VOLUME

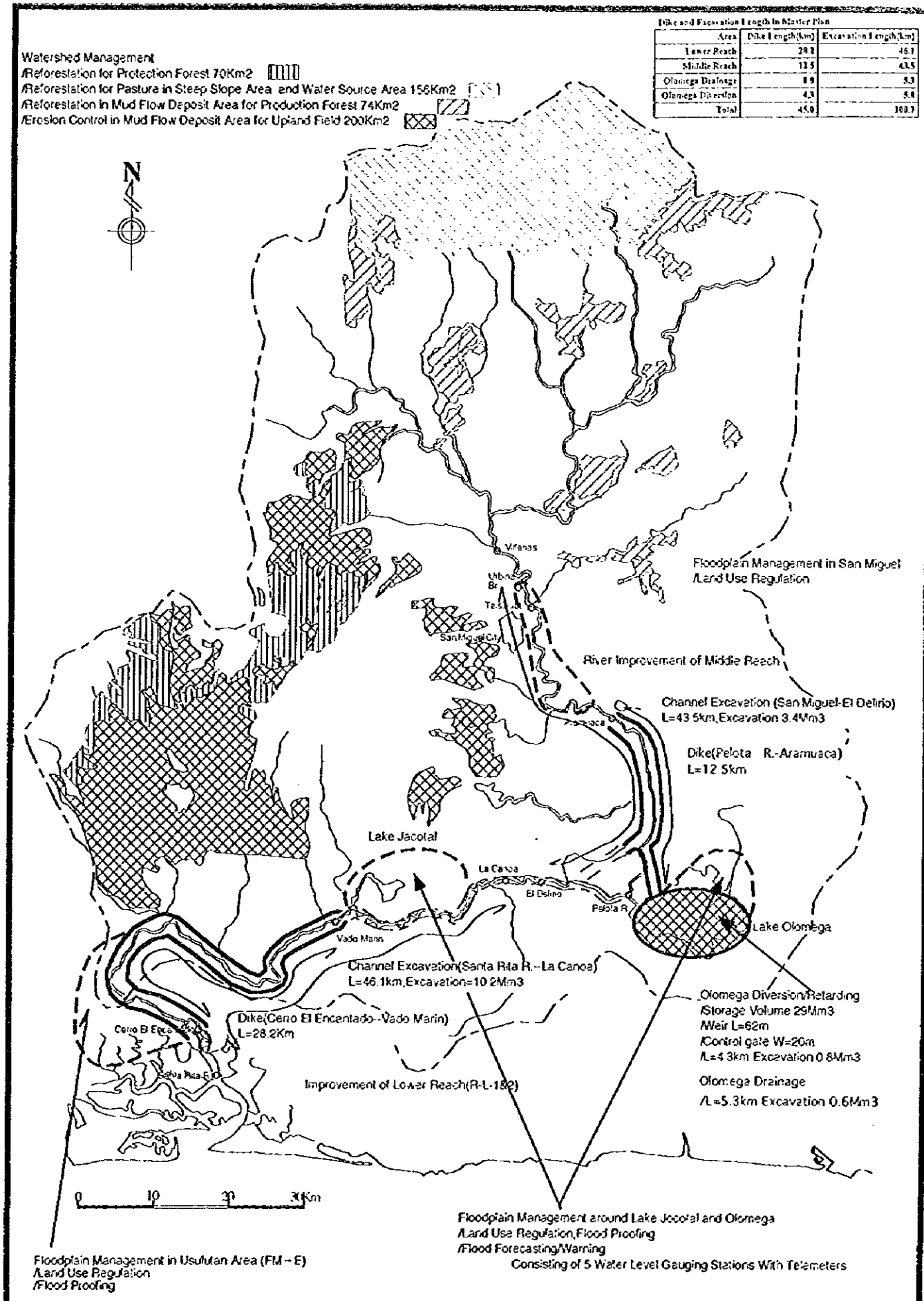
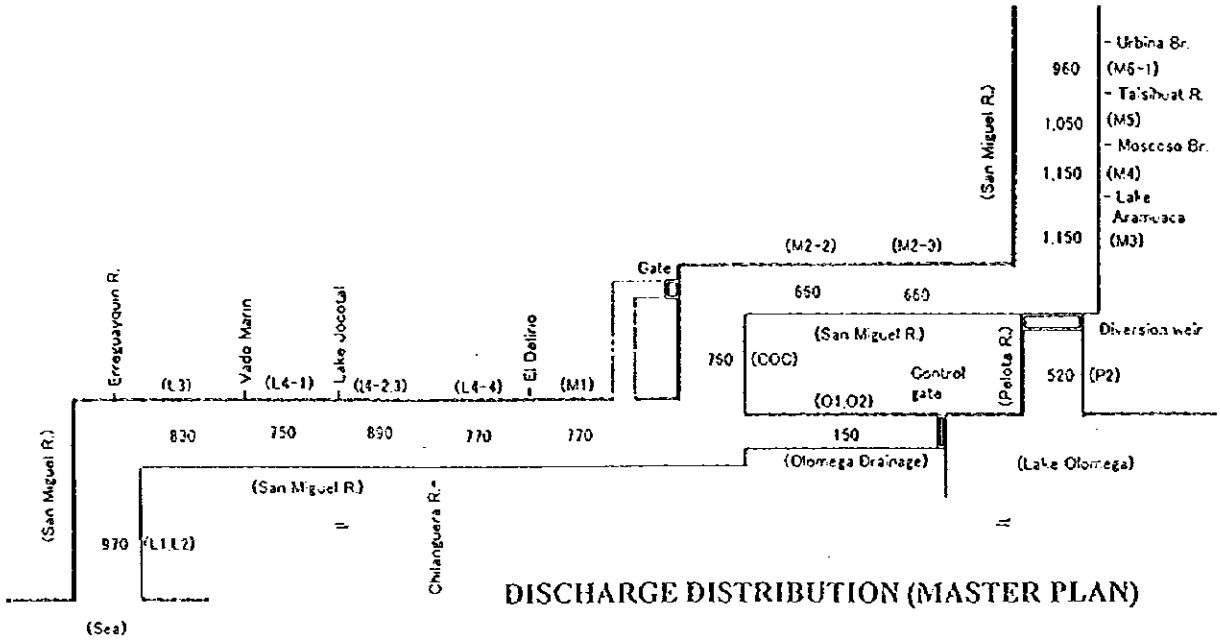
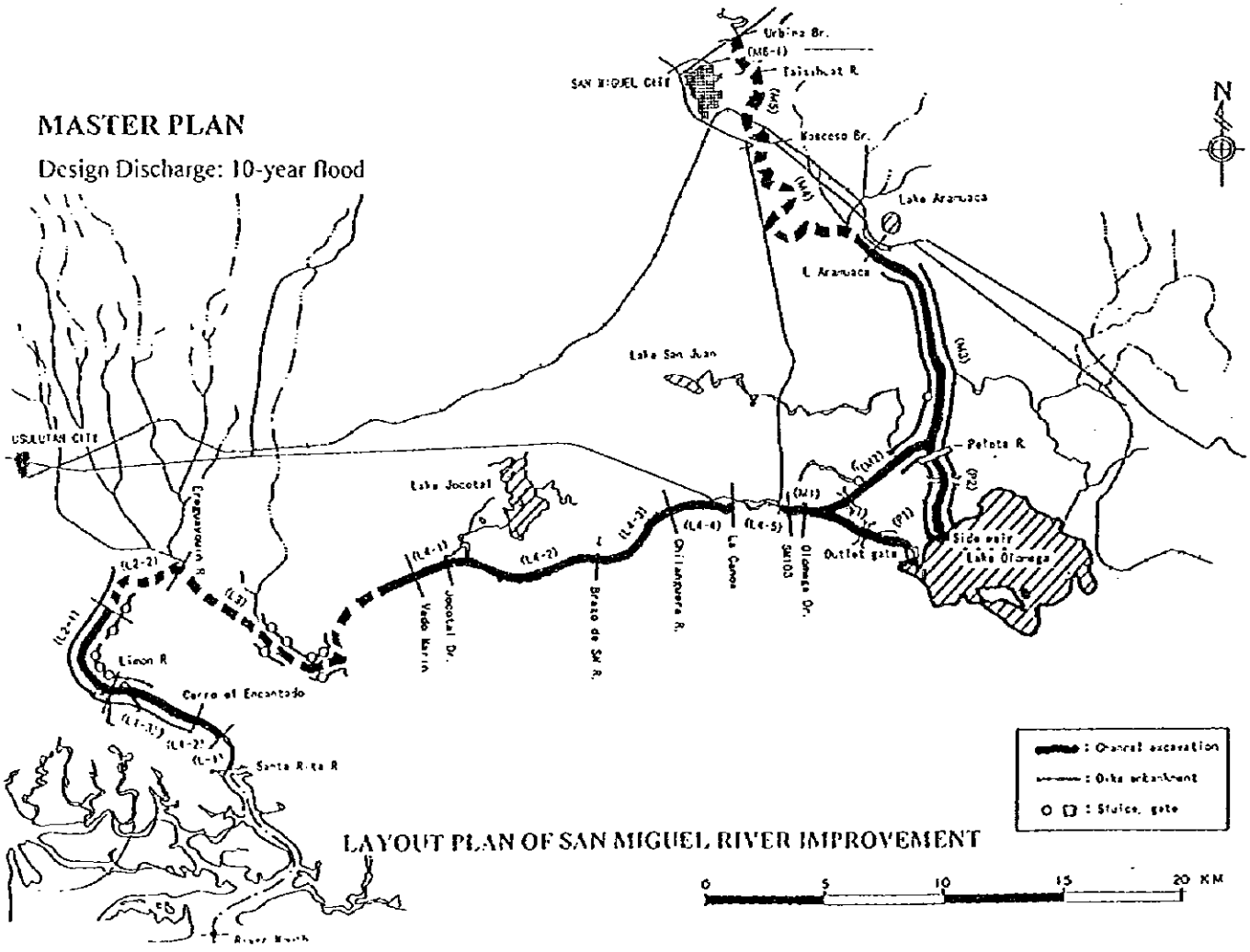


Figure 5.13 GENERAL LAYOUT OF FLOOD CONTROL MASTER PLAN



DISCHARGE DISTRIBUTION (MASTER PLAN)



LAYOUT PLAN OF SAN MIGUEL RIVER IMPROVEMENT

Figure 5.14 DESIGN DISCHARGE DISTRIBUTION AND LAYOUT PLAN(MASTER PLAN)

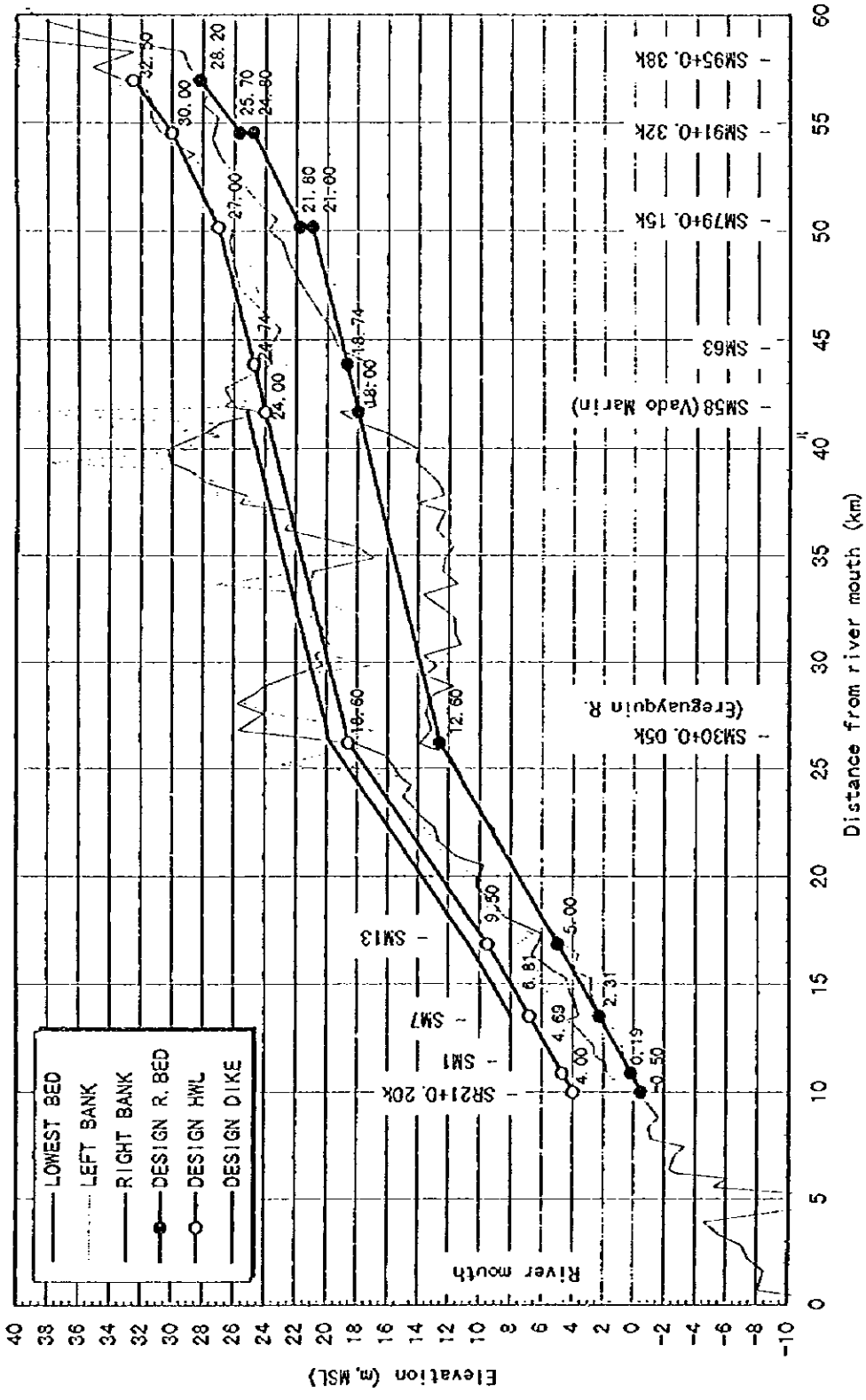


Figure 5.15(1/3) DESIGN CHANNEL PROFILE(1/3): LOWER REACHES

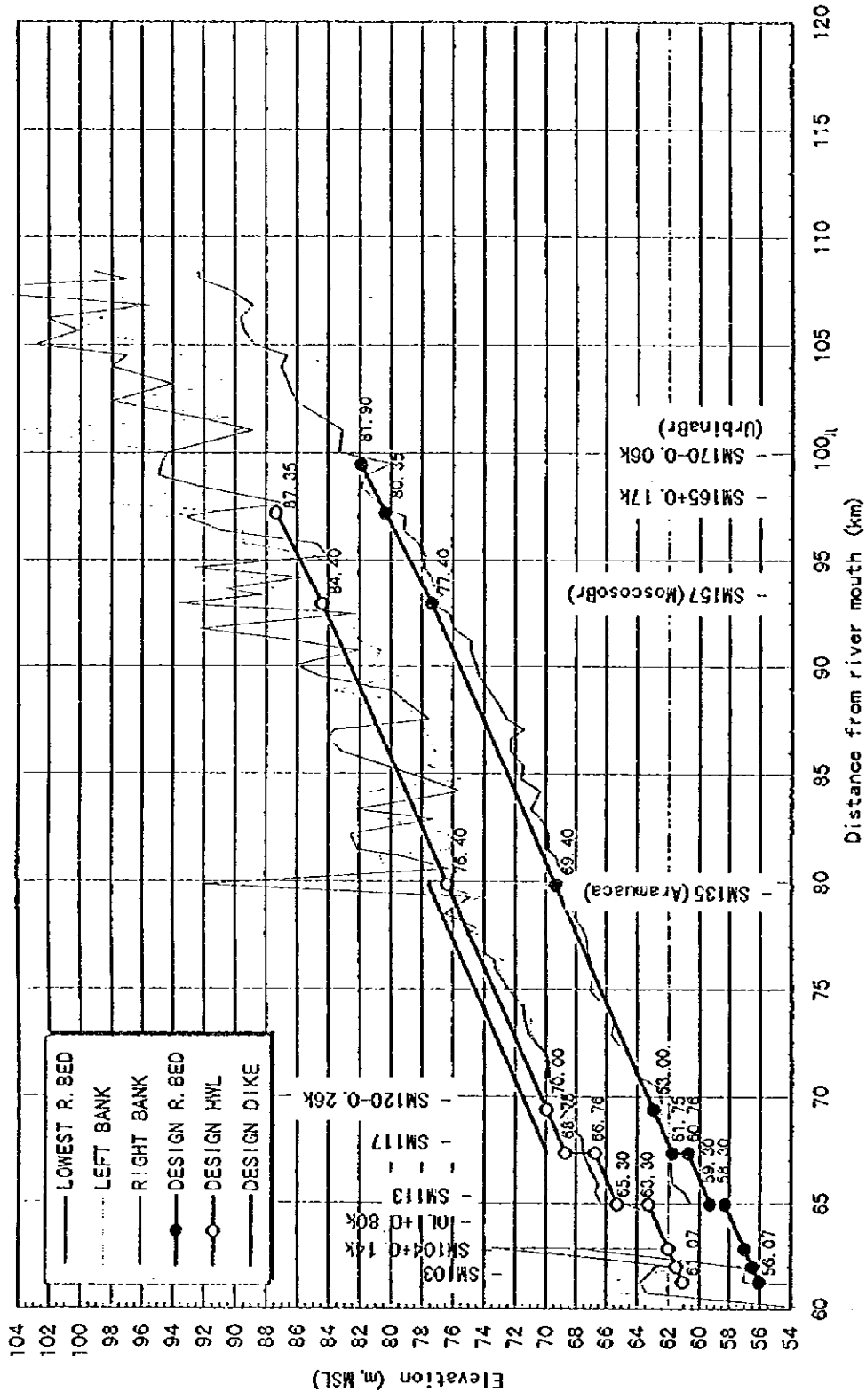


Figure 5.15(2/3) DESIGN CHANNEL PROFILE(2/3): MIDDLE REACHES

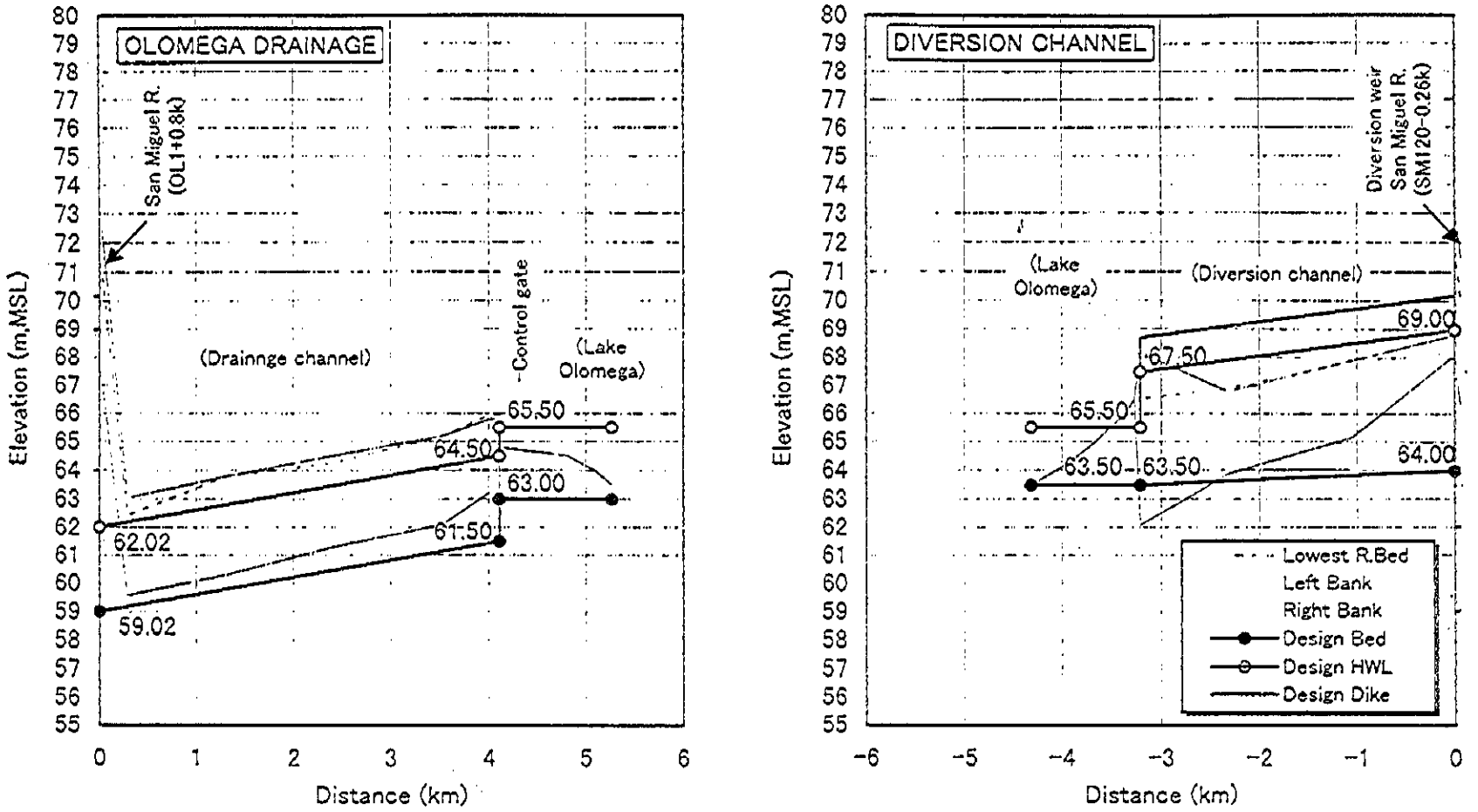


Figure 5.15(3/3) DESIGN CHANNEL PROFILE(3/3)

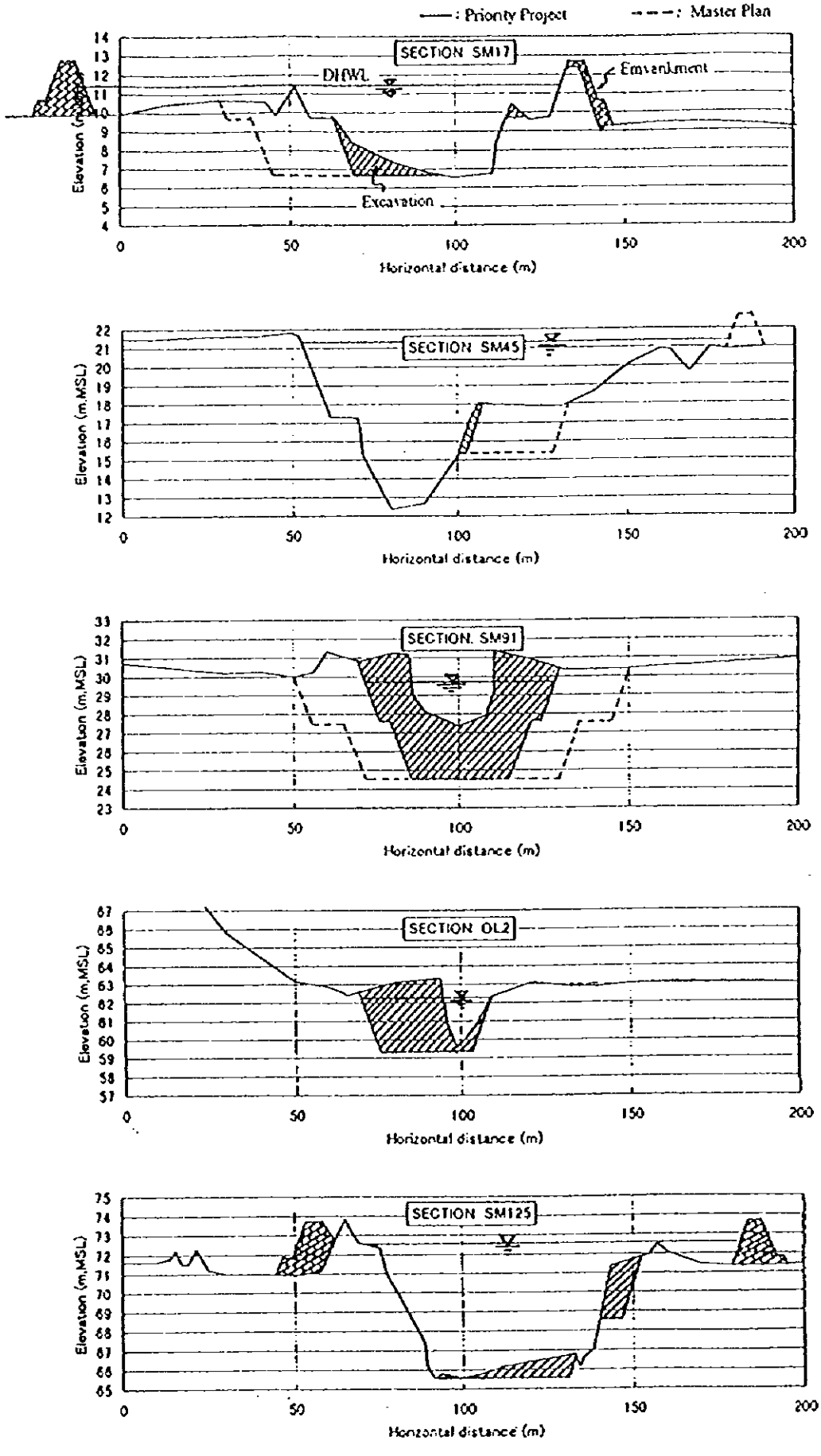


Figure.5.16 REPRESENTATIVE CROSS SECTIONS OF PROPOSED SAN MIGUEL RIVER

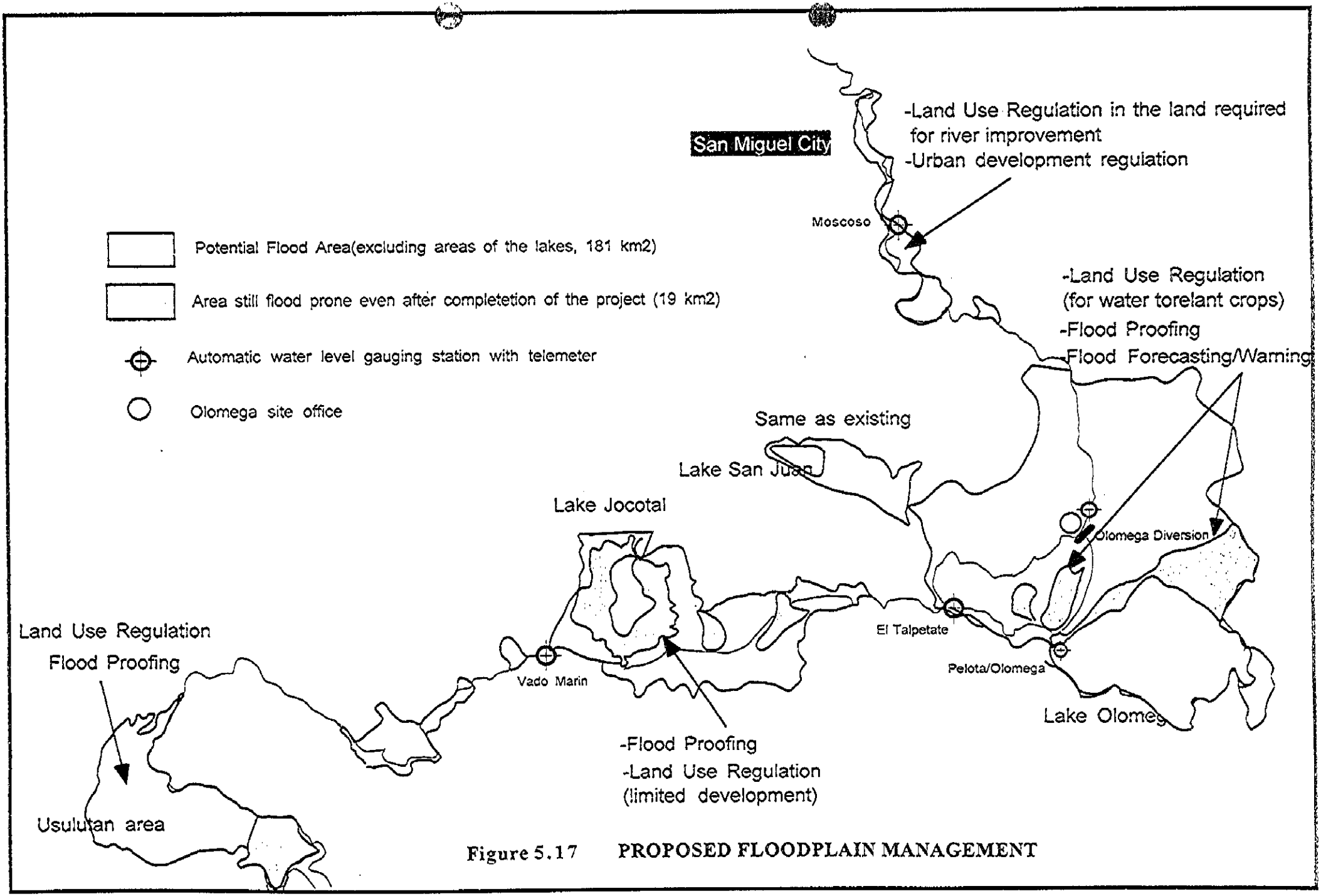
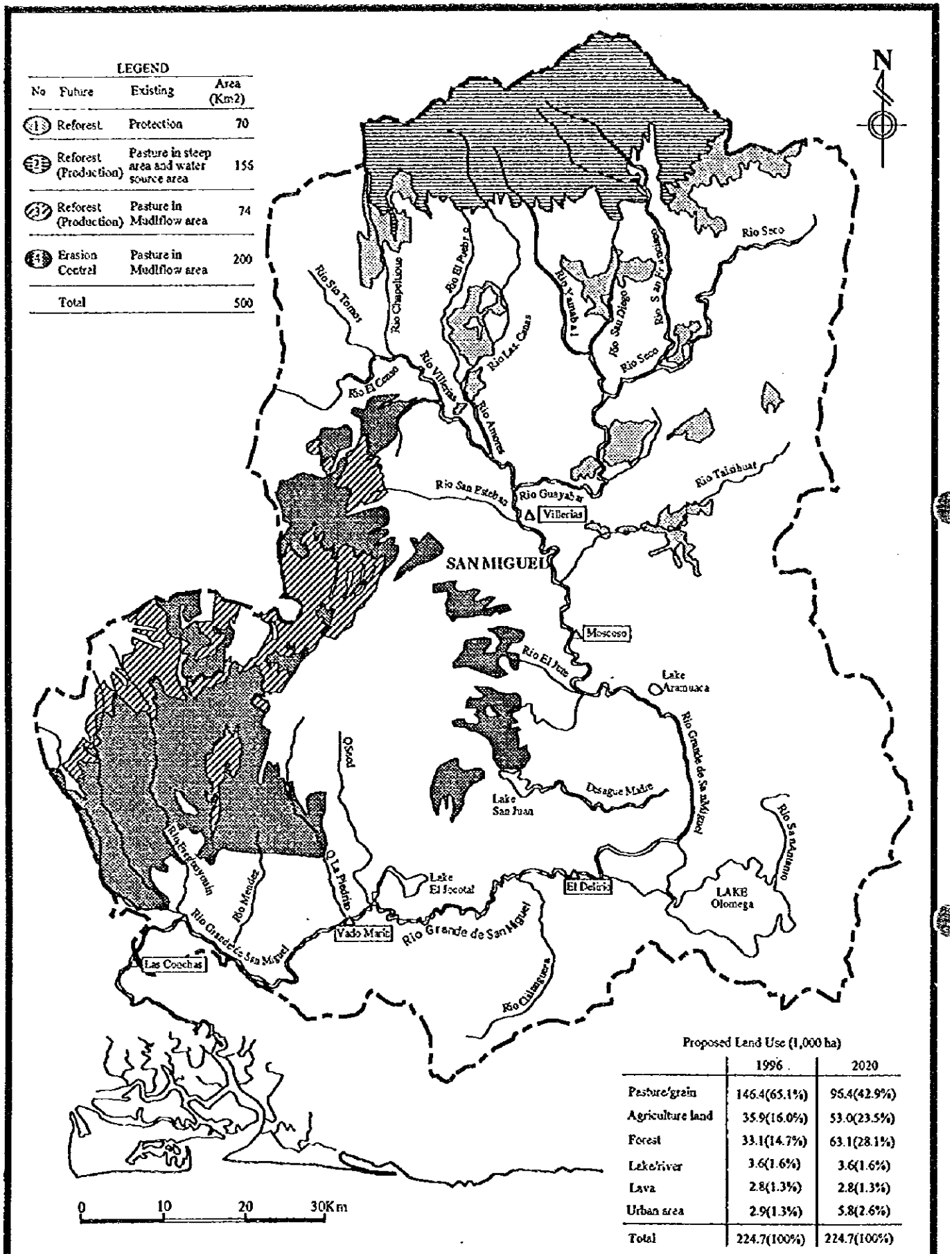


Figure 5.17 PROPOSED FLOODPLAIN MANAGEMENT



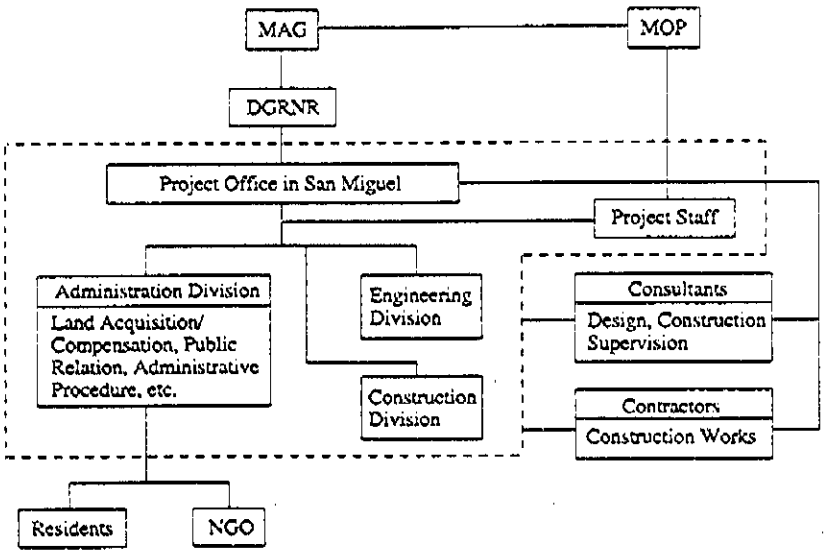
Proposed Land Use (1,000 ha)

	1996	2020
Pasture/grain	146.4(65.1%)	95.4(42.9%)
Agriculture land	35.9(16.0%)	53.0(23.5%)
Forest	33.1(14.7%)	63.1(28.1%)
Lake/river	3.6(1.6%)	3.6(1.6%)
Lava	2.8(1.3%)	2.8(1.3%)
Urban area	2.9(1.3%)	5.8(2.6%)
Total	224.7(100%)	224.7(100%)

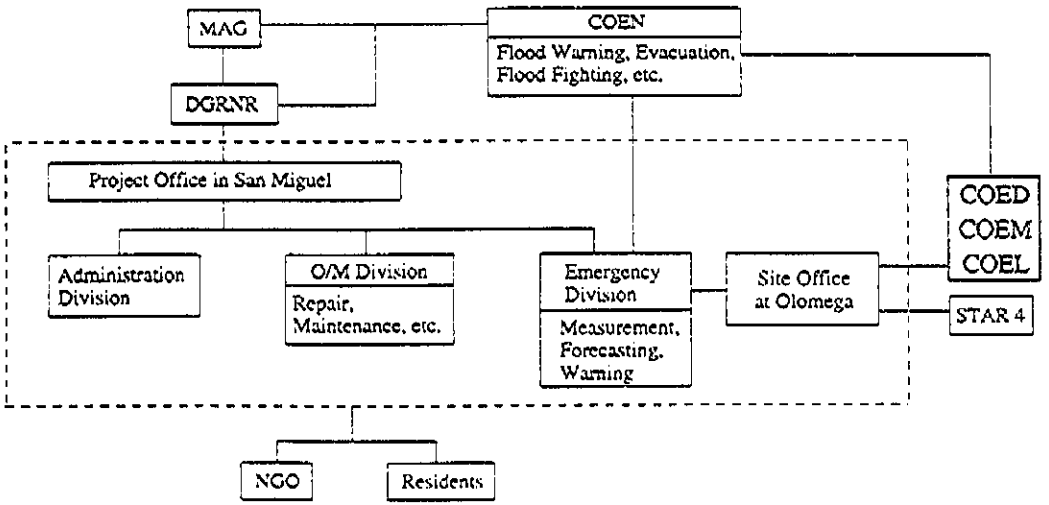
Figure.5.18 PROPOSED WATERSHED MANAGEMENT

Proposed Organization for Structural Measures

(1) Design/Construction Stage



(2) Operation/Management Stage



Proposed Organization for Nonstructural Measures

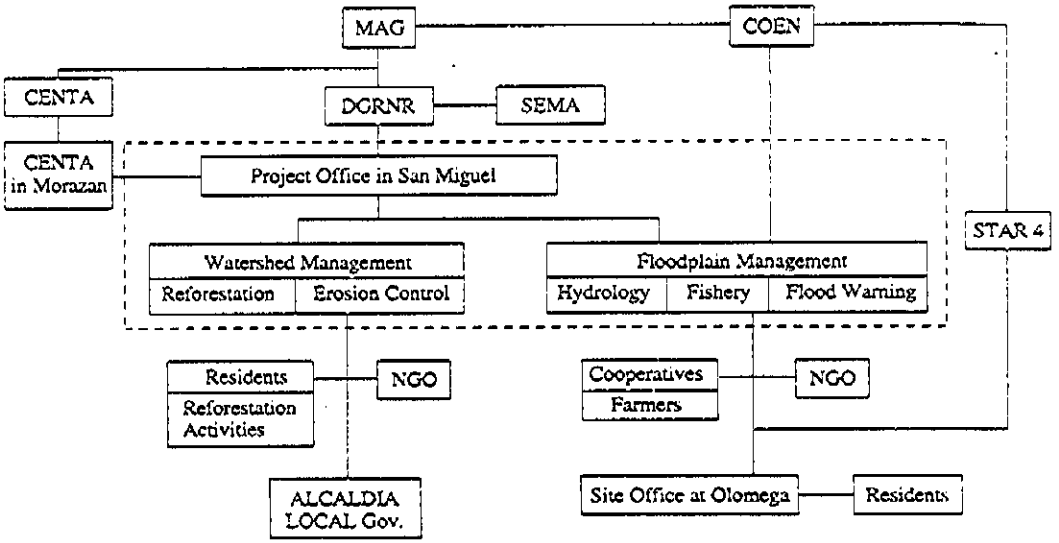
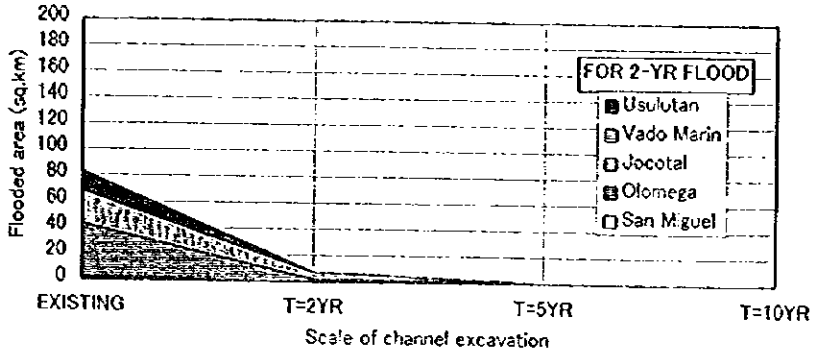
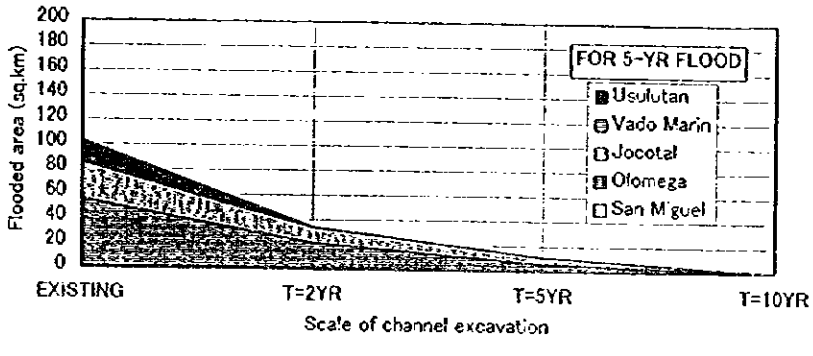


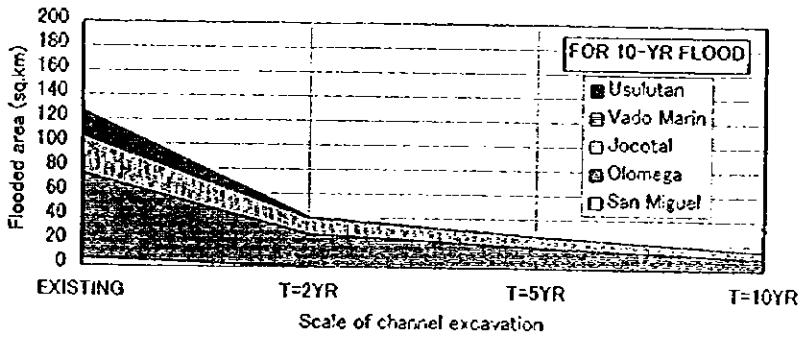
Figure.5.19 PROPOSED ORGANIZATION

	Desenption	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	-	2020
Structural Measures (Stage 1:Priority Project)	1. Loan Process(1)															
	2.Detailed Design(1)															
	3. Land Acquisition(1)															
	4.Tendering (1)															
	5. Construction to cope with 2-year flood															
Structural Measures (Stage 2:Rest of Master Plan)	6.Feasibility Study															
	7. Loan Process(2)															
	8.Detailed Design(2)															
	9.Land Acquisition(2)															
	10.Tendering (2)															
	11.Construction to cope with 10-year flood															
Non-structural Measures	1.Floodplain Management															
	Landuse Regulation/Flood Proofing															
	Flood Forecasting/Warning															
	Education to the residents															
	2.Watershed Management															
	Reforestation															
	Erosion Control															

Figure.5.20 PROJECT IMPLEMENTATION SCHEDULE







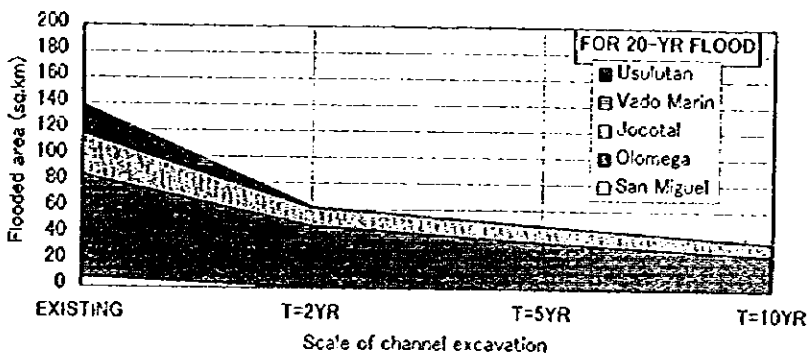
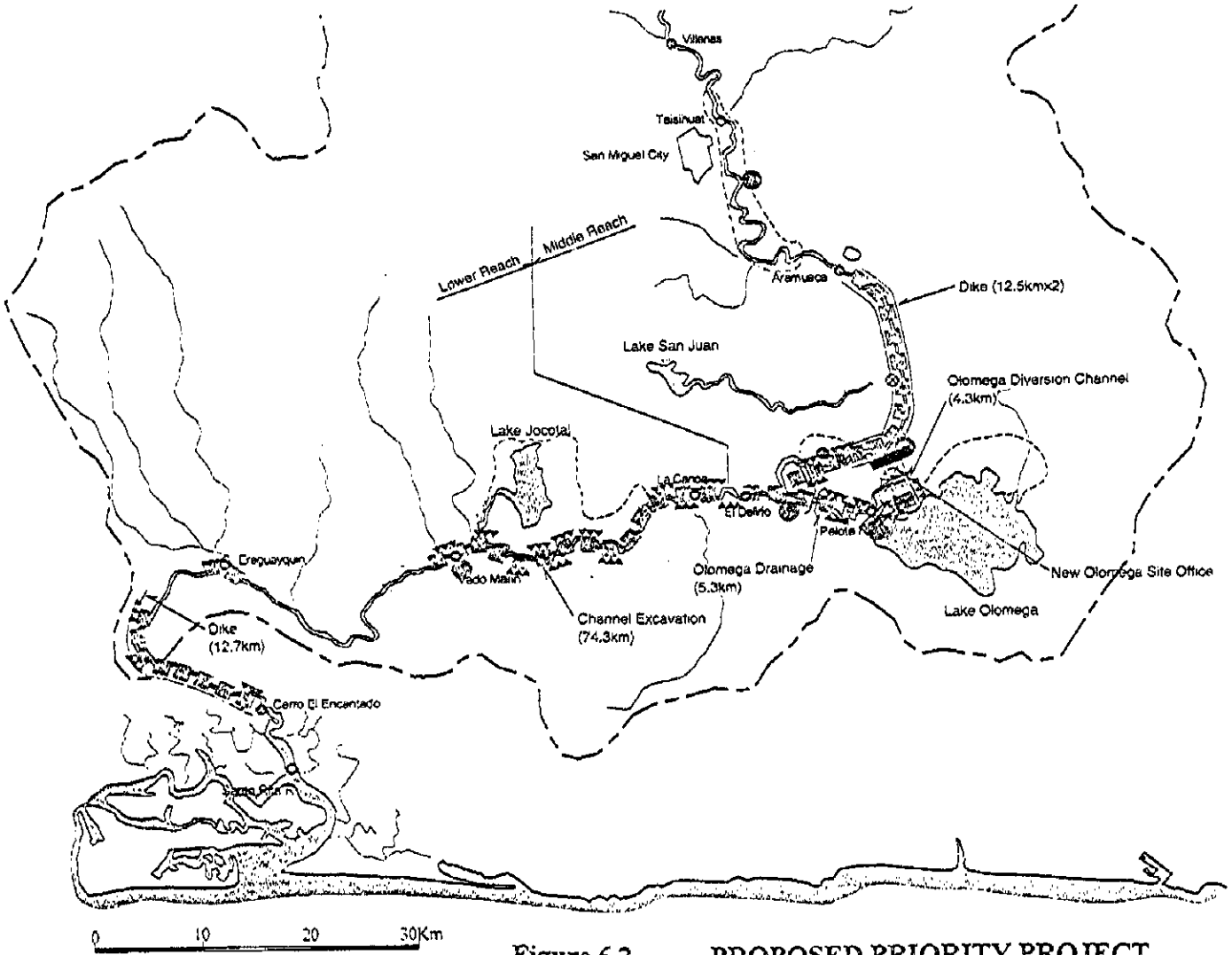


Figure 6.1 RELATIONSHIP BETWEEN CHANNEL EXCAVATION AND FLOOD AREA

Proposed Priority Project



Dike and Excavation Length

Area	Dike Length(km)	Excavation Length(km)
Lower Reach	12.7	46.1
Middle Reach	12.5	18.6
Olomega Drainage	0.0	5.3
Olomega Diversion	4.3	4.3
Total	29.5	74.3

Proposed Project Works

ITEM	AMOUNT
1. Structural Measures	
Earth Excavation	7,883,000 m³
Rock Excavation	152,000 m³
Embankment	1,173,000 m³
Revetment	6,000 m
Diversion Weir	1 place
Control Gate	1 place
Drainage Sluice	1 place
Ground Sill	229 m
Intake Gate	1 place
Bridge	3 places
Rural Road	2,640 m
Land Acquisition	6.76 km2
Compensation	20 houses
2. Non-structural Measures	
Automatic Water Level Station	5 places
Telemetering System	1 unit
Floodplain Management	3 places

Legend

- San Miguel River
- Catchment Boundary
- Maximum Flooded Area
- Dike
- Channel Excavation
- Revetment
- Olomega Diversion Weir
- Olomega Control Gate
- Automatic Water Level Station
- New Olomega Site Office
- Area for Floodplain Management
- Bridge
- Ground Sill
- Drainage Sluice
- Intake Gate

Figure 6.2 PROPOSED PRIORITY PROJECT

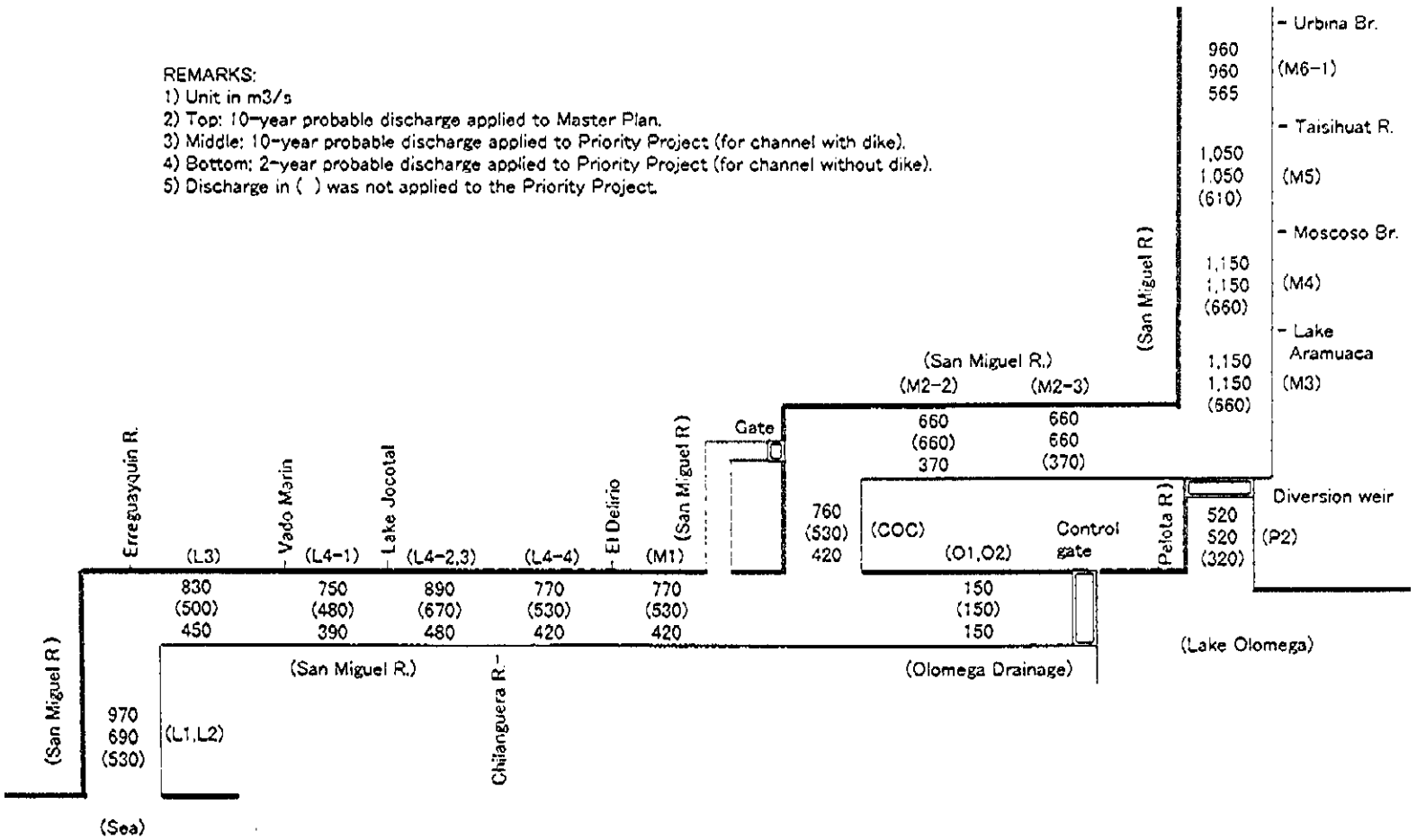
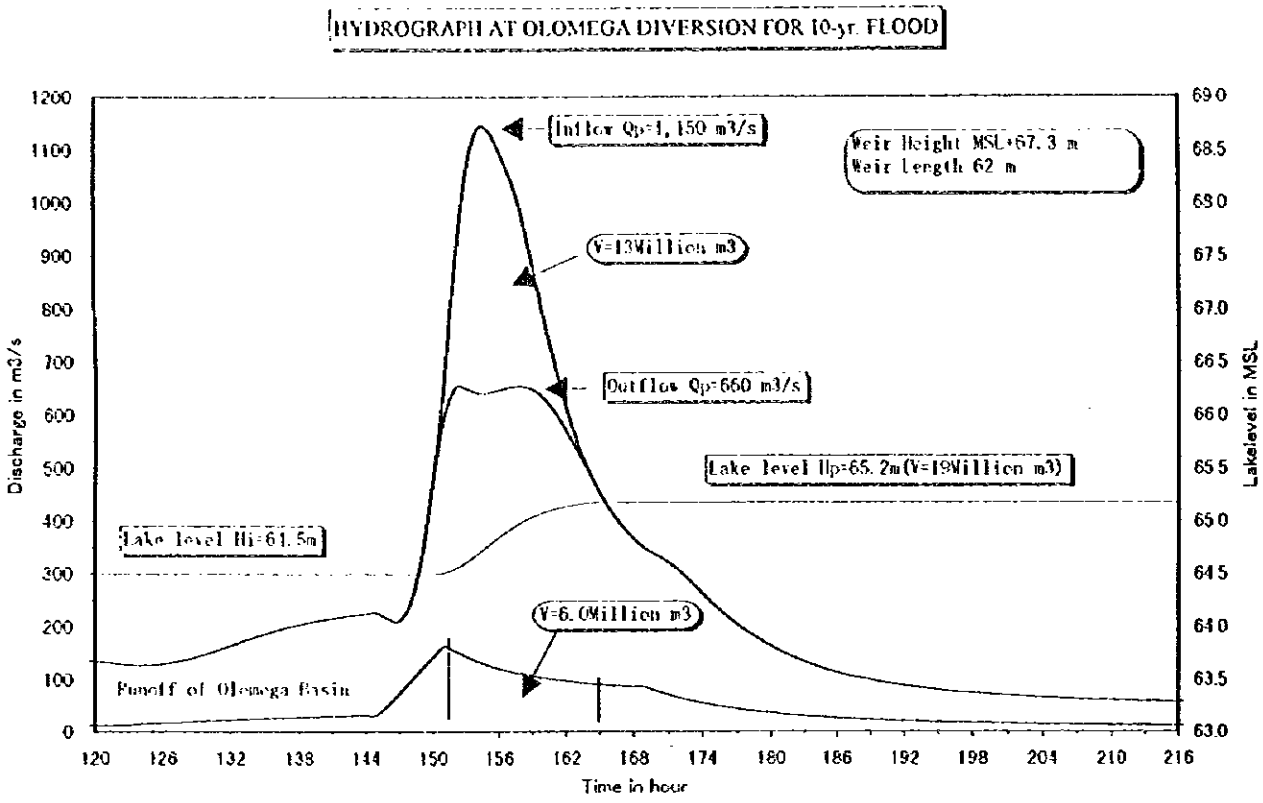


Figure 6.3 DESIGN DISCHARGE DISTRIBUTION FOR P/P AND M/P



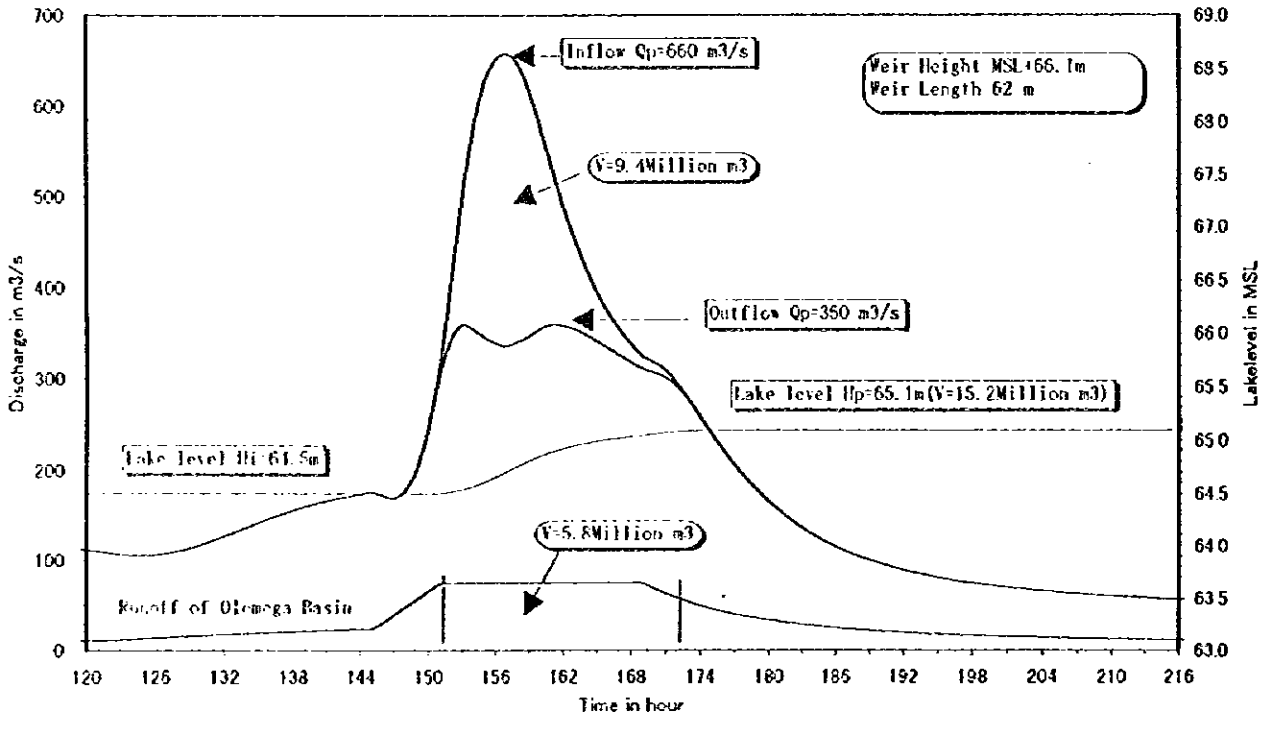
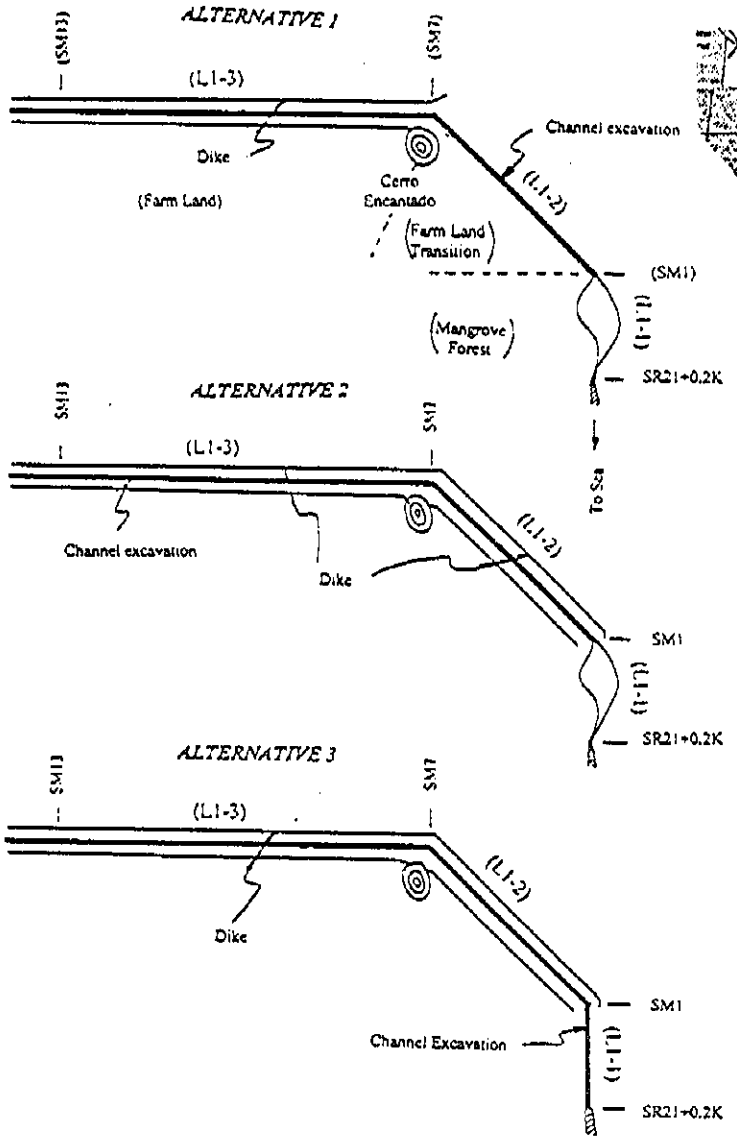


Figure 6.4 HYDROGRAPH OF LAKE OLOMEGA INFLOW



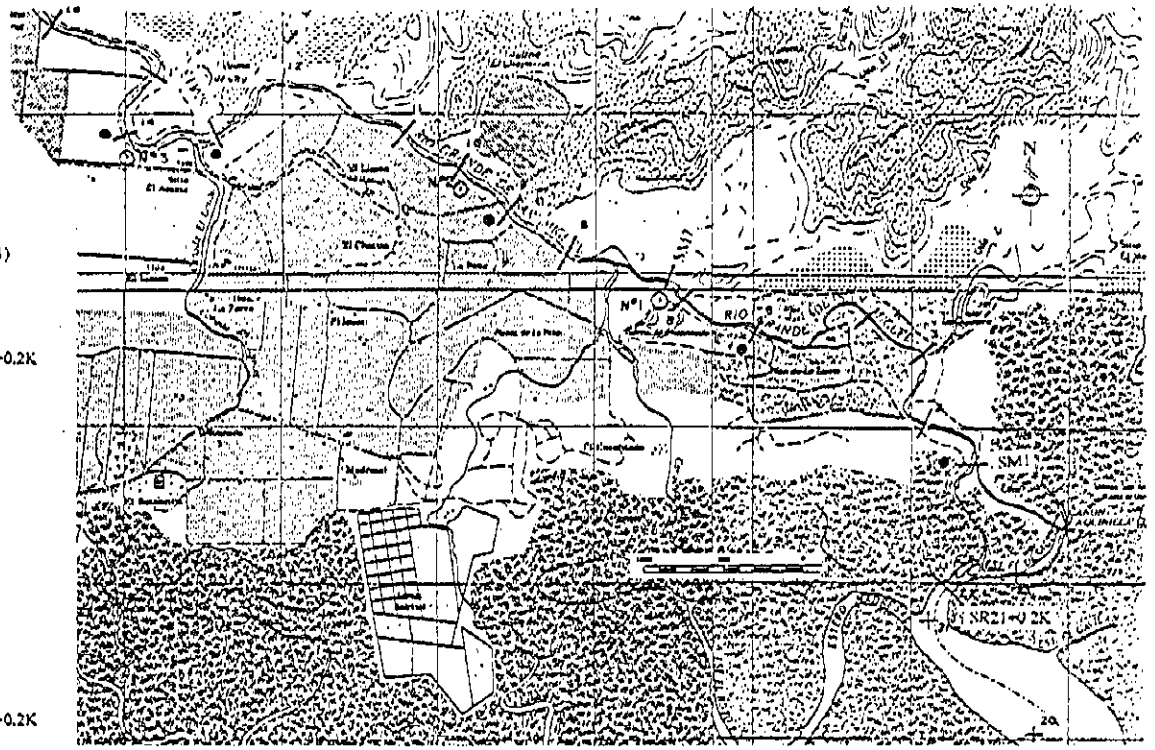
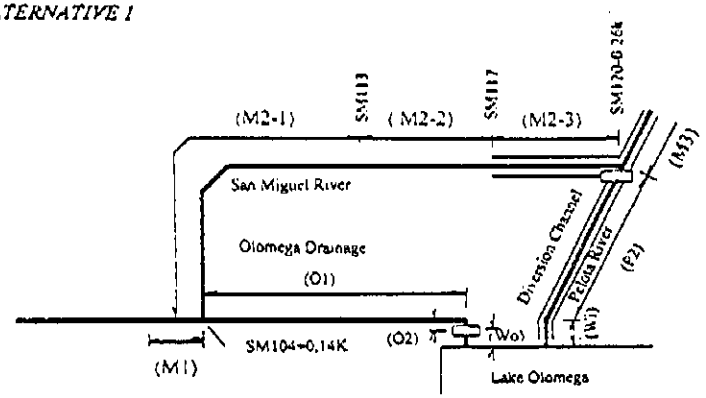
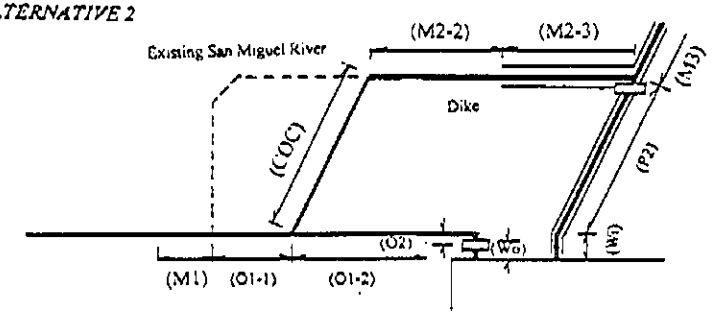


Figure 6.5 ALTERNATIVE SCHEMES FOR LOWER END OF IMPROVEMENT

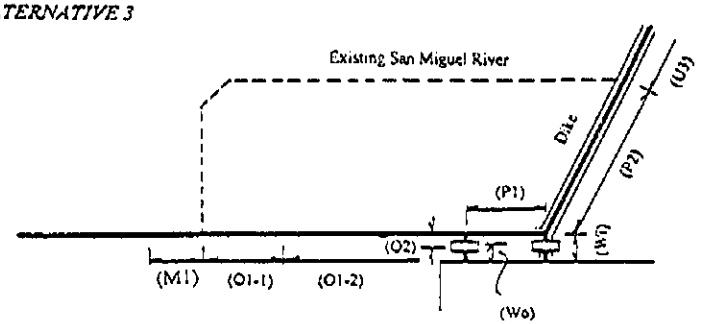
ALTERNATIVE 1



ALTERNATIVE 2



ALTERNATIVE 3



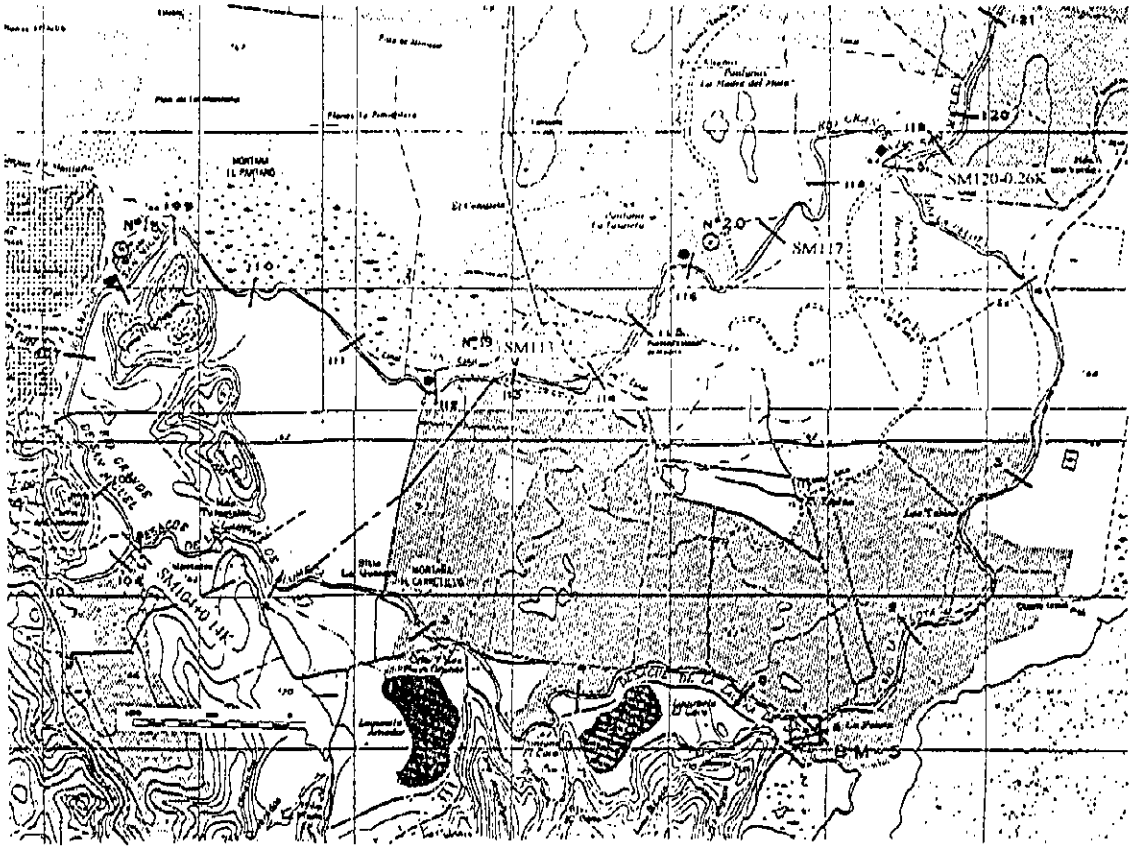


Figure 6.6 ALTERNATIVE SCHEMES FOR RIVER COURSES IN OLOMEGA AREA

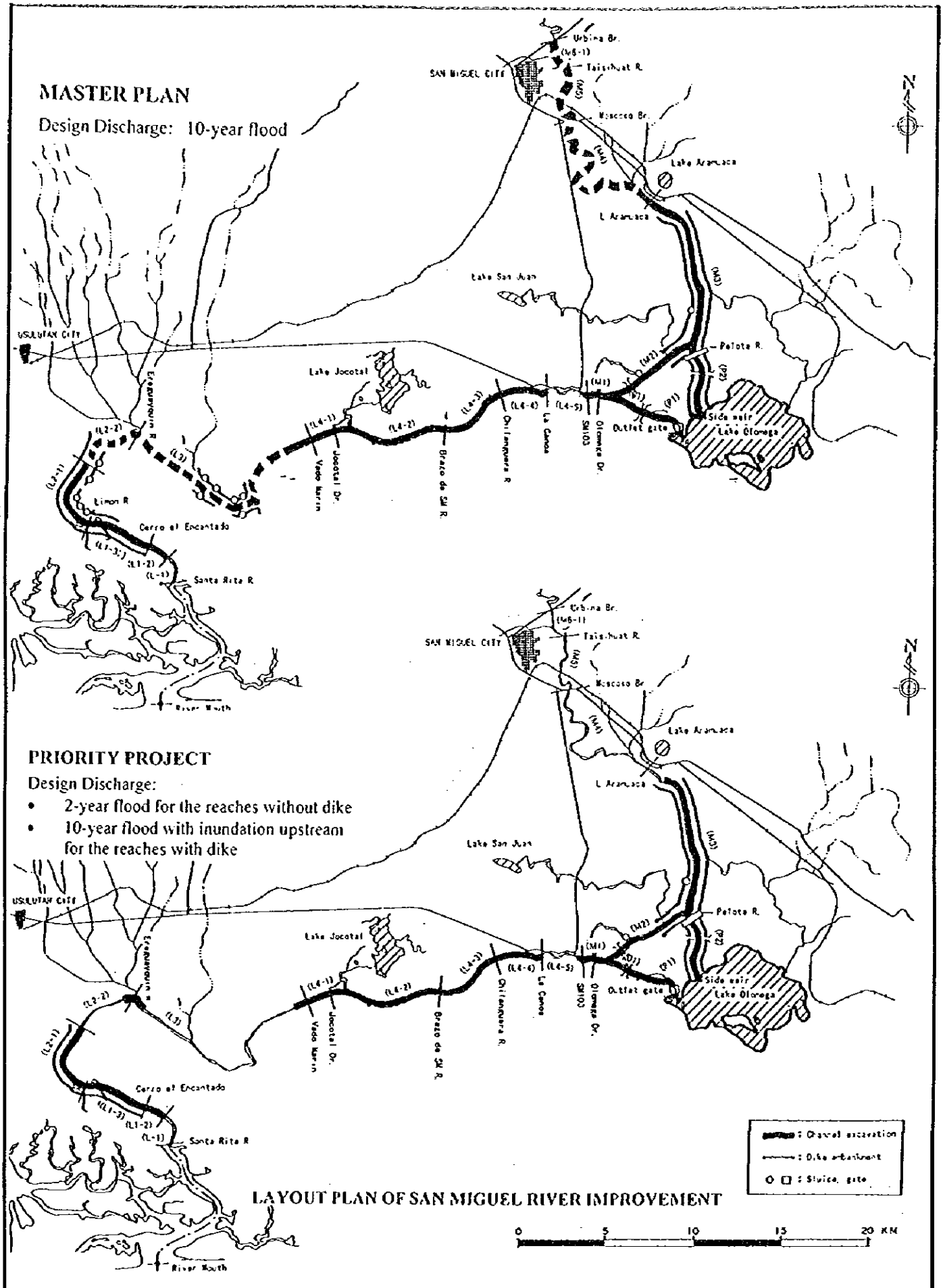


Figure 6.7 LAYOUT PLAN FOR IMPROVEMENT OF SAN MIGUEL RIVER

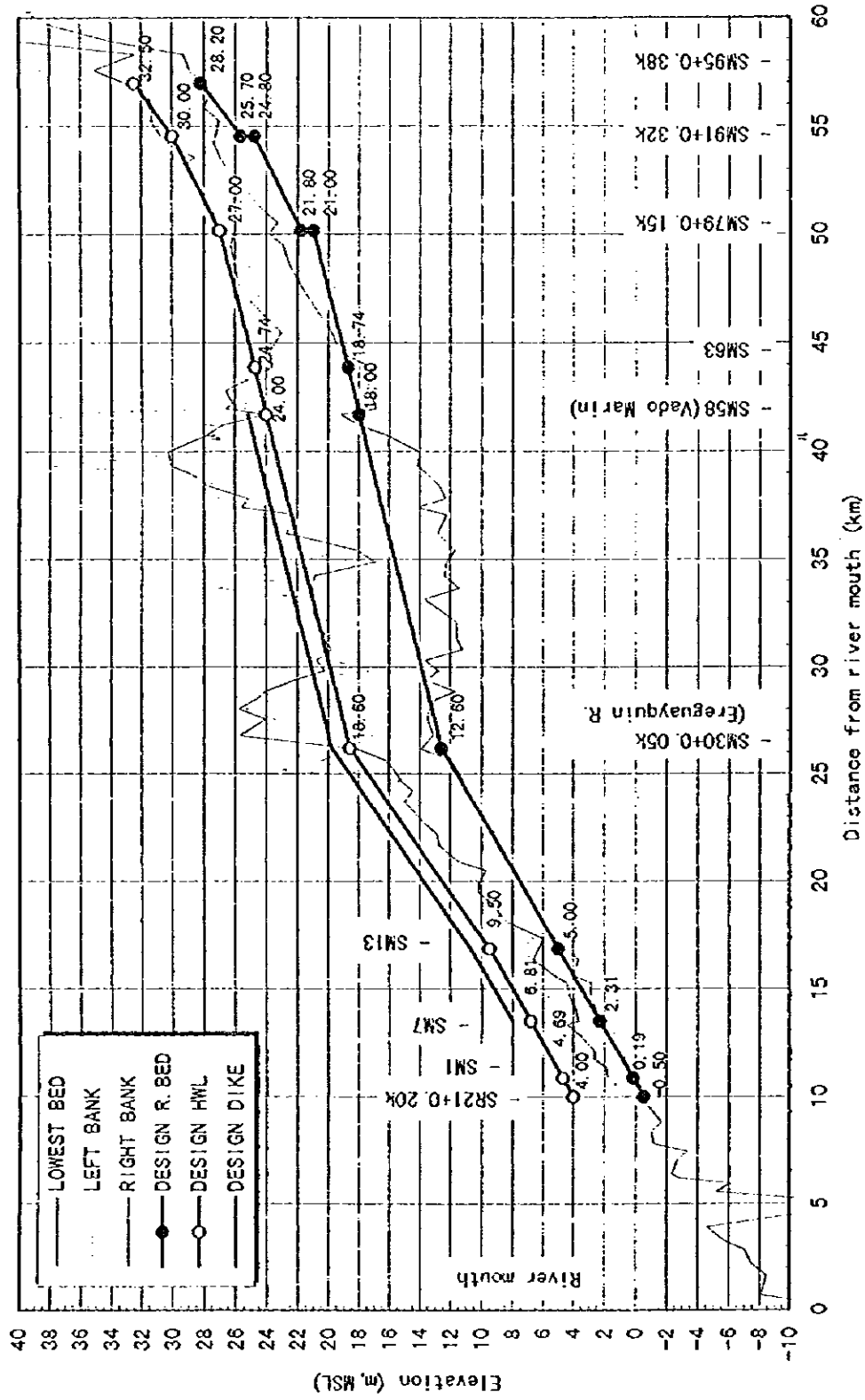


Figure 6.8(1/3) DESIGN CHANNEL PROFILE(1/3): LOWER REACHES

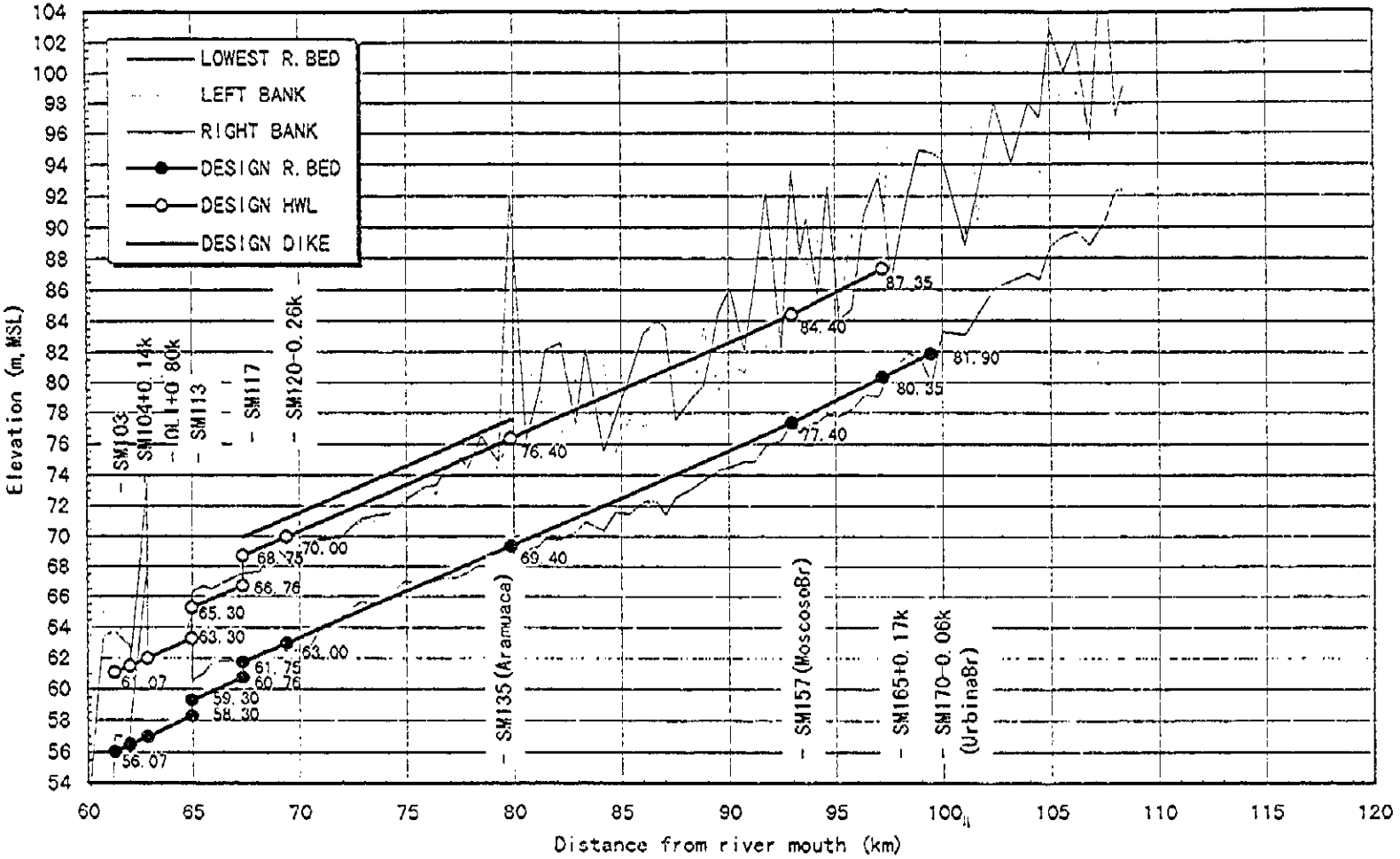
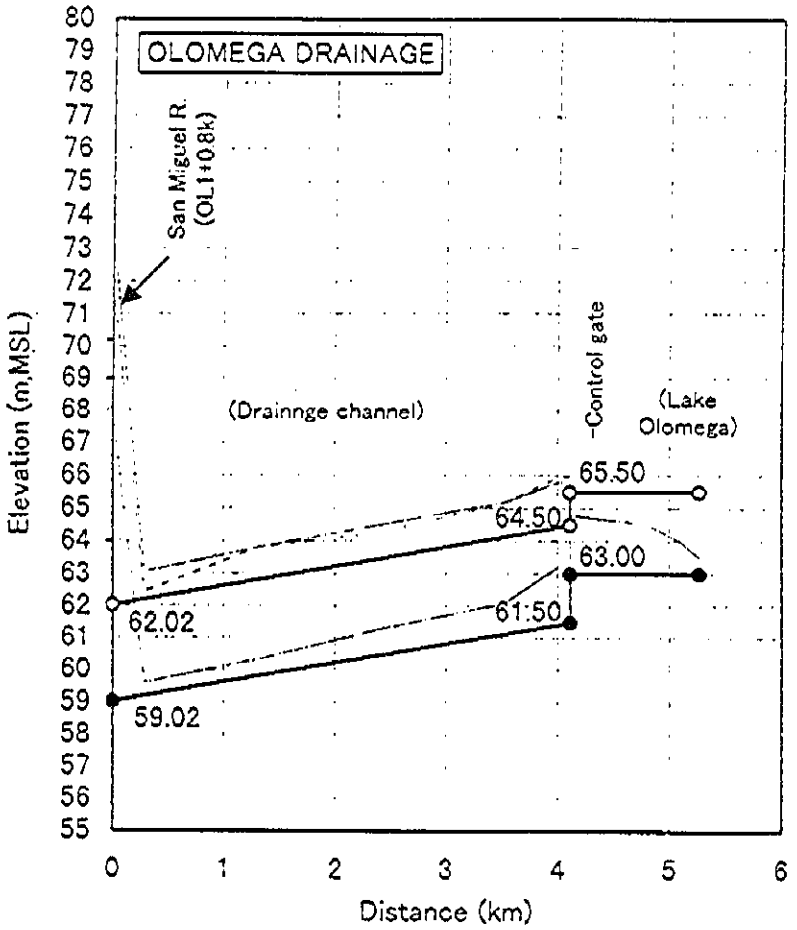


Figure 6.8(2/3) DESIGN CHANNEL PROFILE(2/3): MIDDLE REACHES



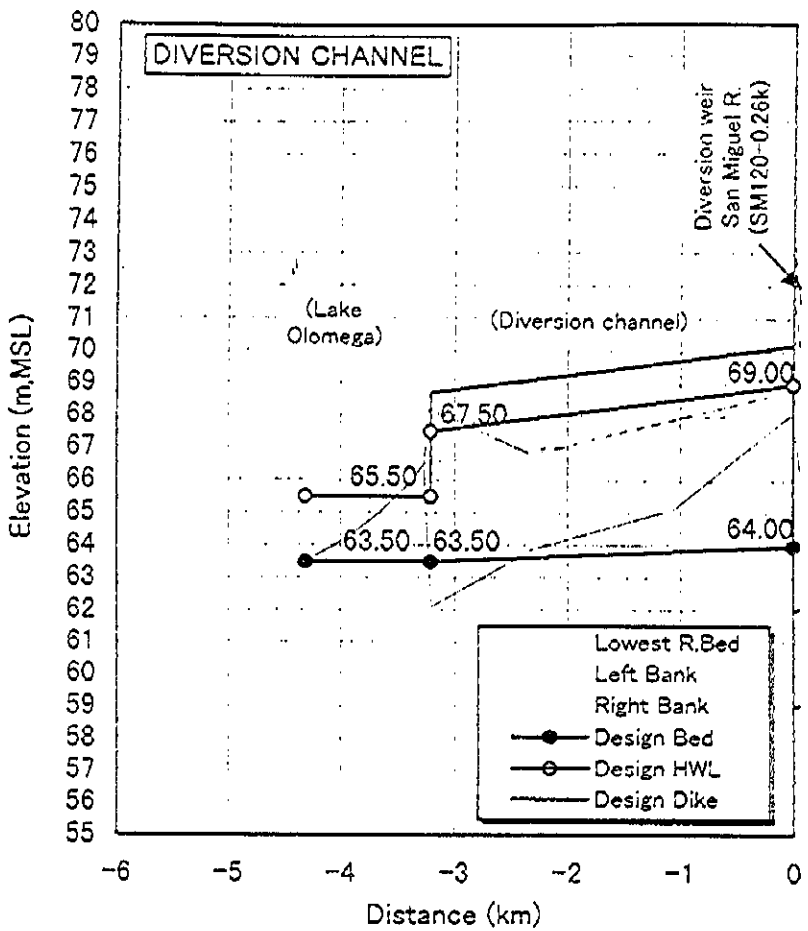


Figure 6.8(3/3) DESIGN CHANNEL PROFILE(3/3)

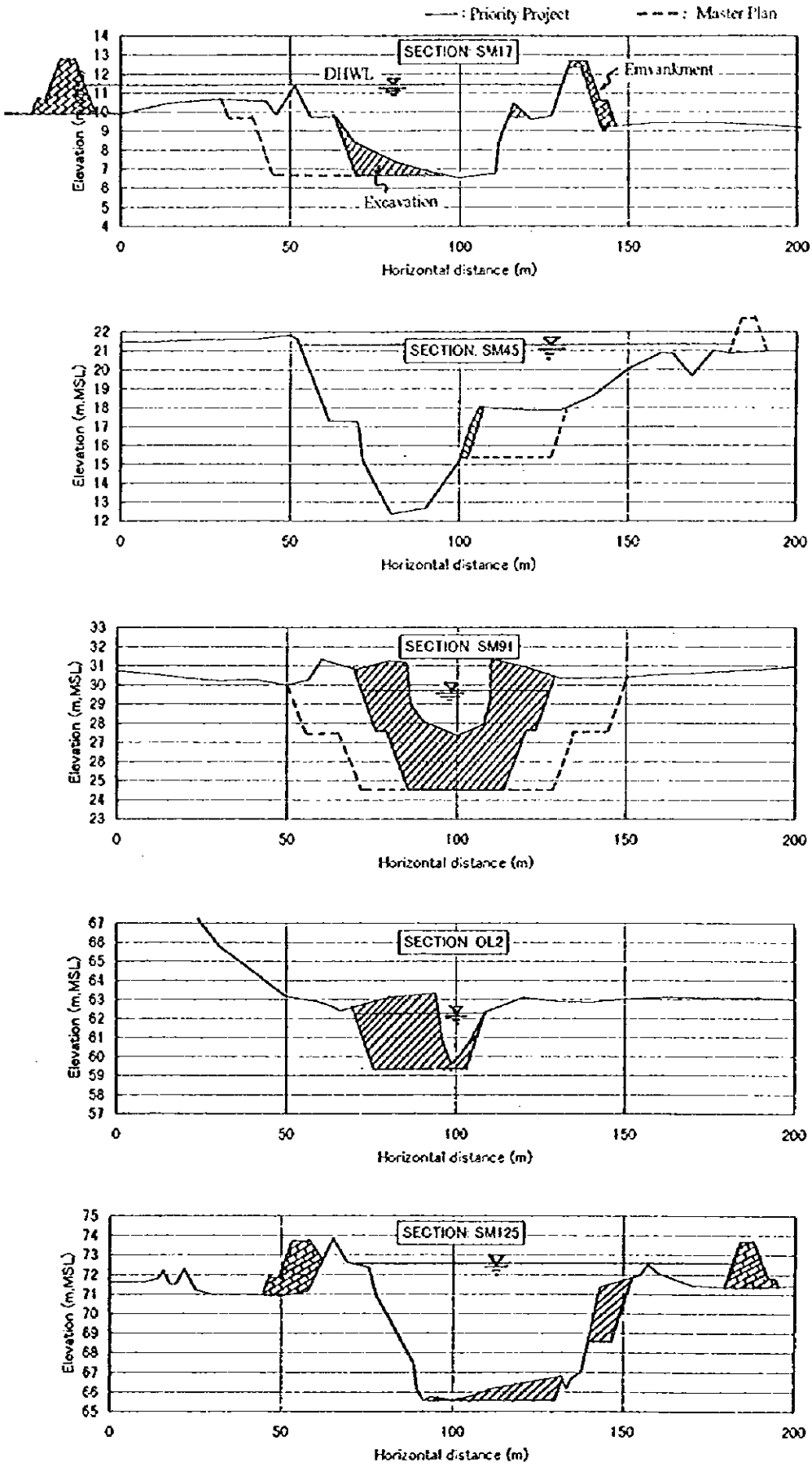


Figure 6.9 REPRESENTATIVE SECTIONS OF PROPOSED SAN MIGUEL RIVER

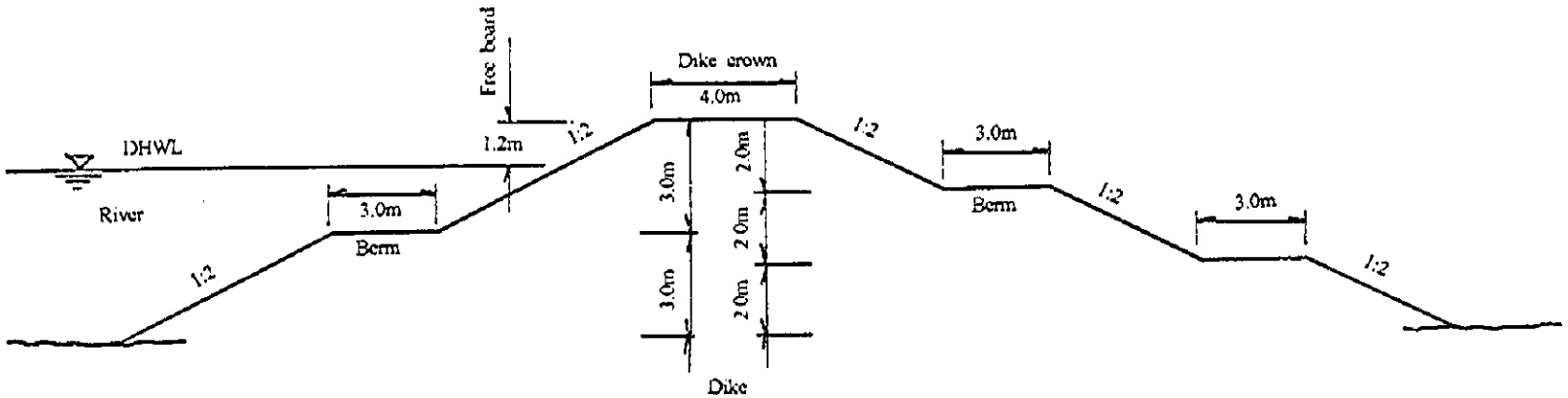


Figure 6.10 STANDARD DESIGN DIKE SECTION

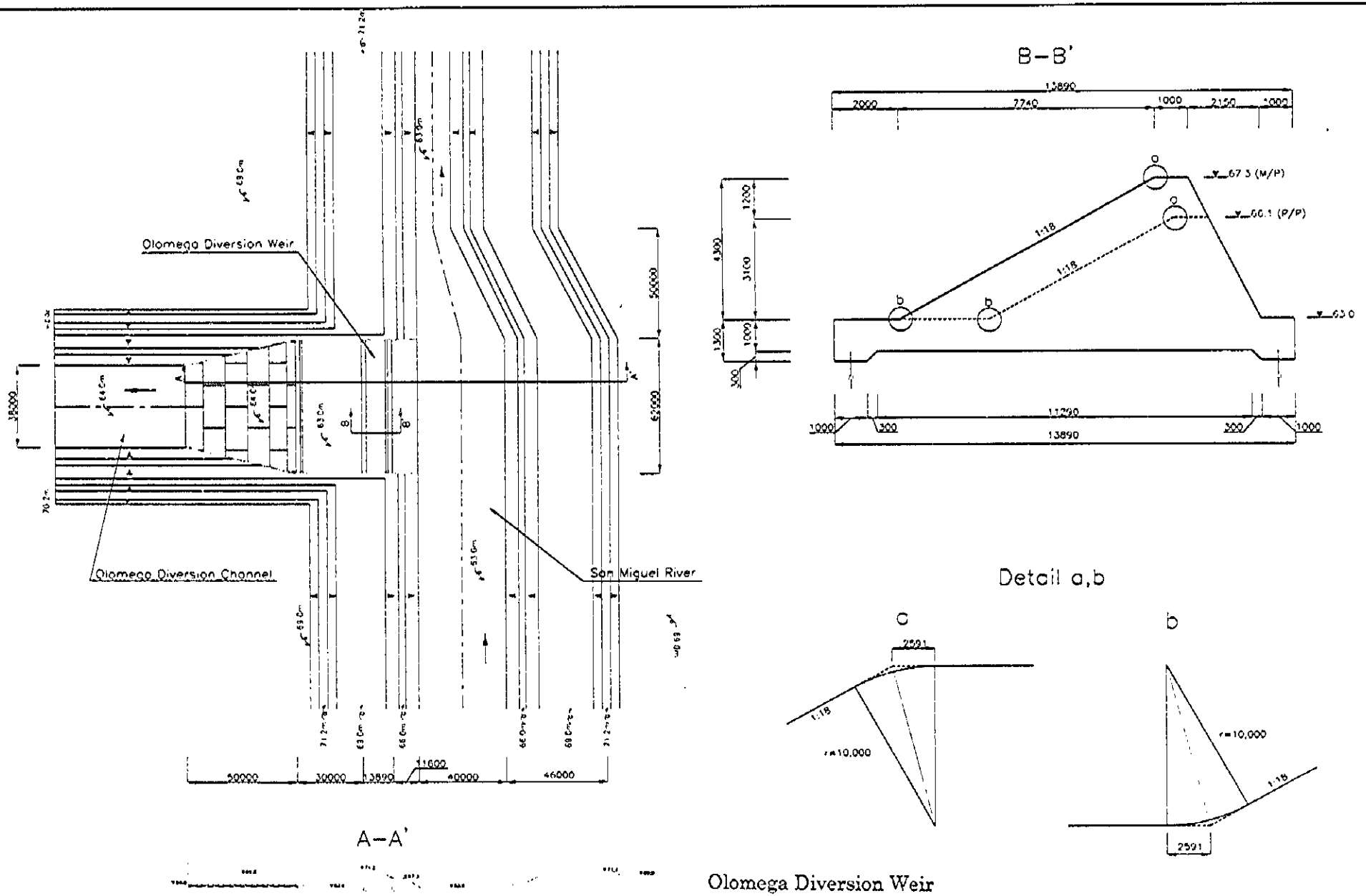


Figure 6.11(1/2) Preliminary Design of Facilities

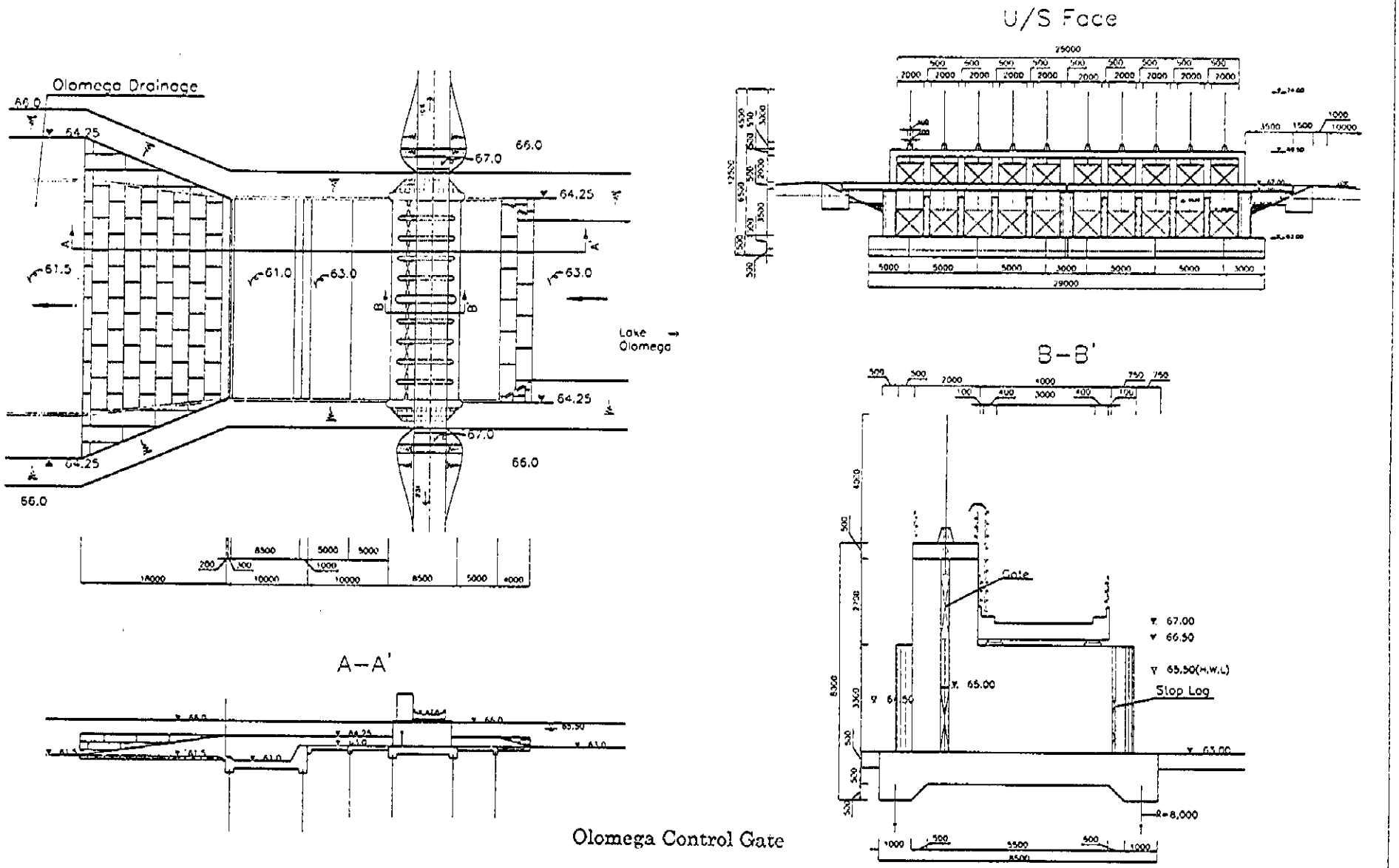
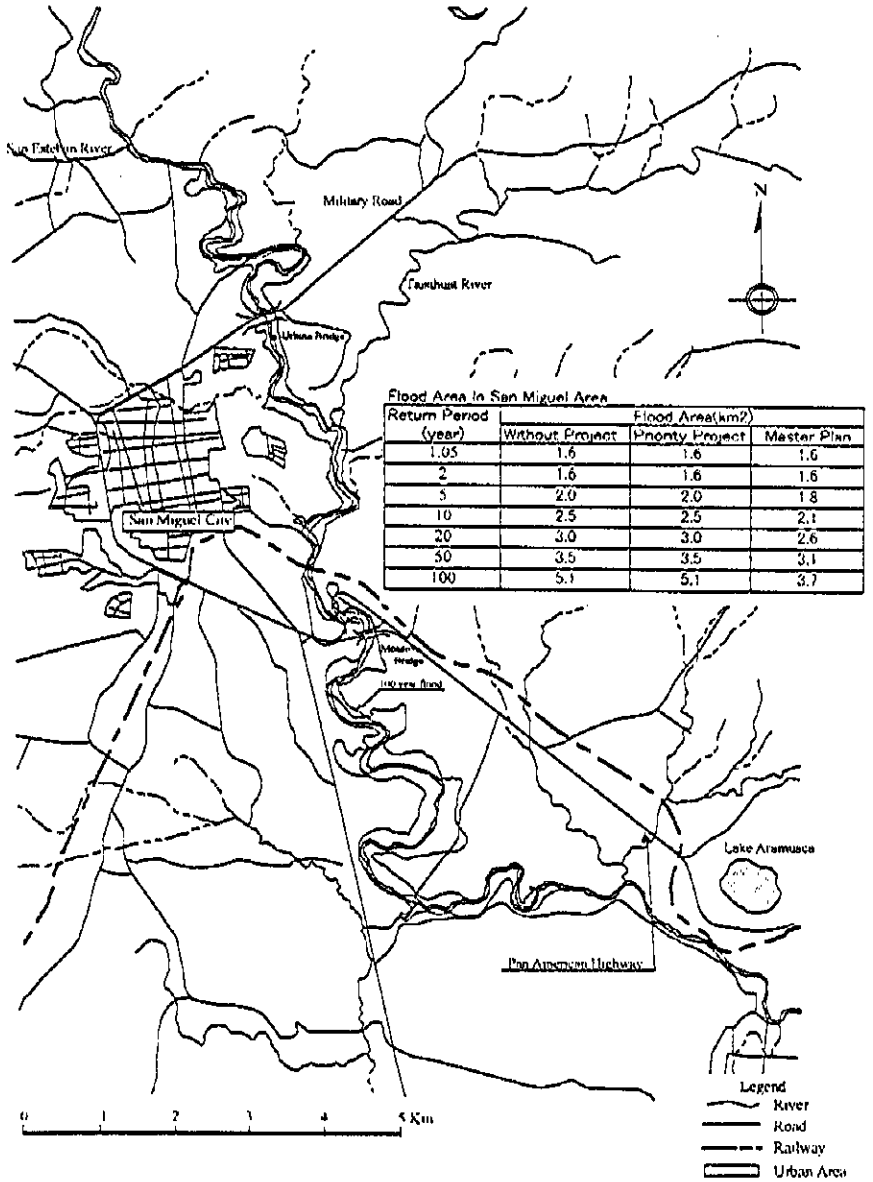


Figure 6.11(2/2) Preliminary Design of Facilities



Flood Area in San Miguel Area

Return Period (year)	Flood Area(km2)		
	Without Project	Priority Project	Master Plan
1.05	1.6	1.6	1.6
2	1.6	1.6	1.6
5	2.0	2.0	1.8
10	2.5	2.5	2.1
20	3.0	3.0	2.6
50	3.5	3.5	3.1
100	5.1	5.1	3.7

FLOOD RISK MAP IN SAN MIGUEL AREA

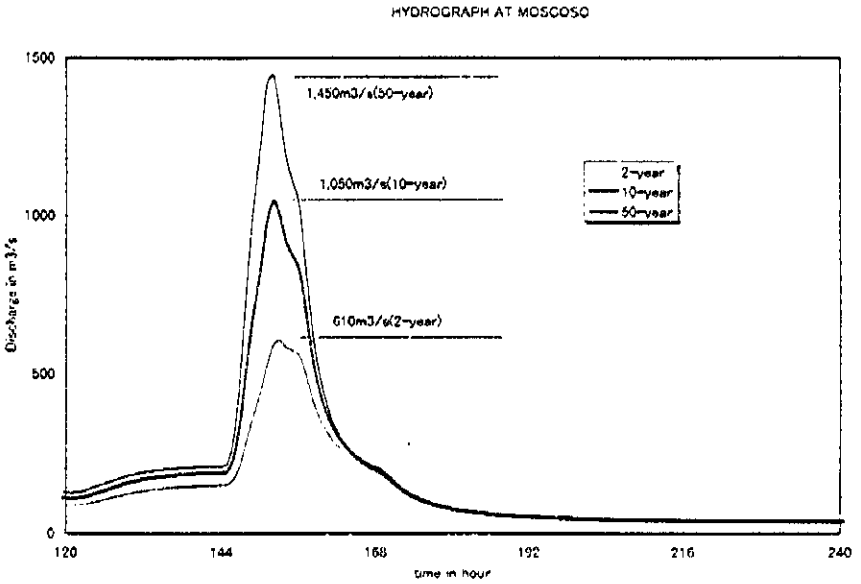
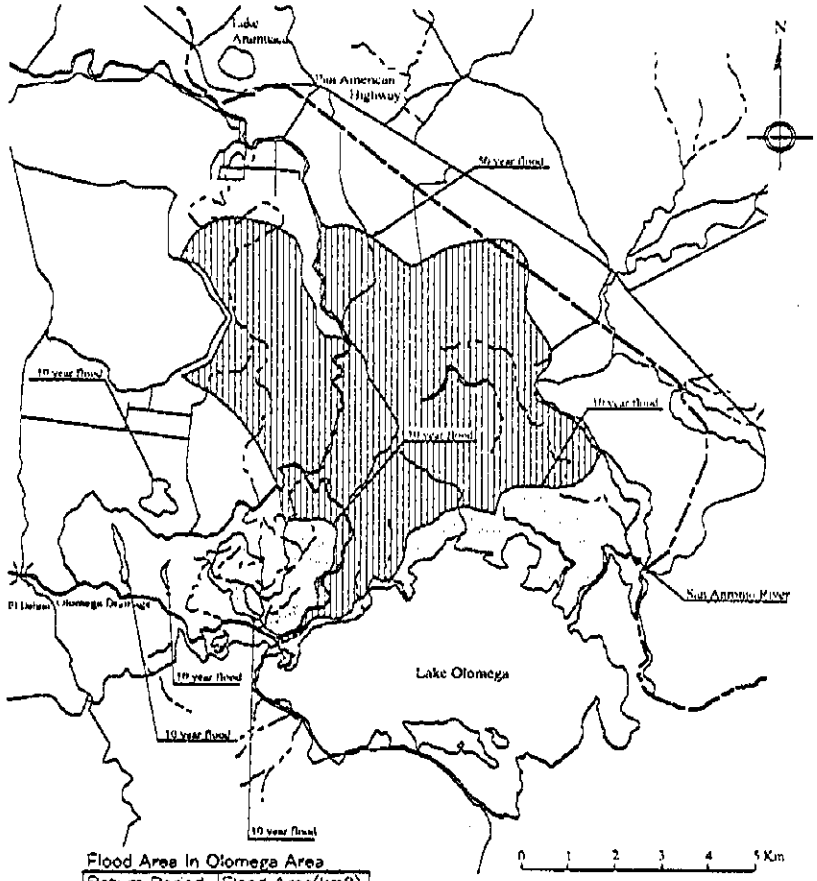


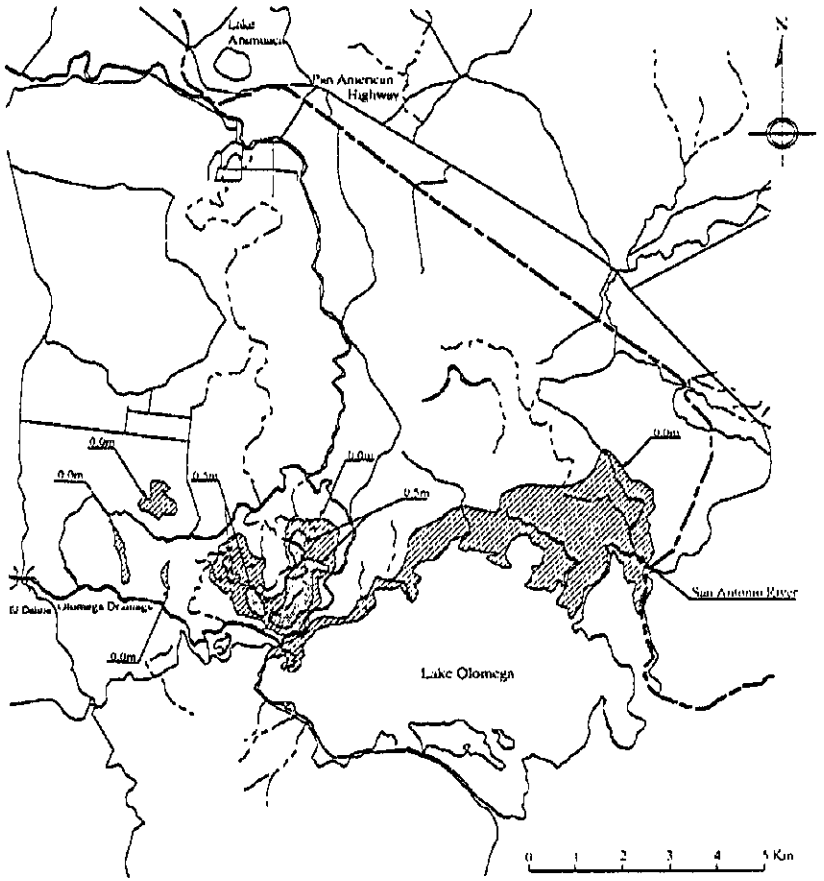
Figure 6.12(1) FLOOD RISK MAP IN SAN MIGUEL AREA



Flood Area In Olomega Area

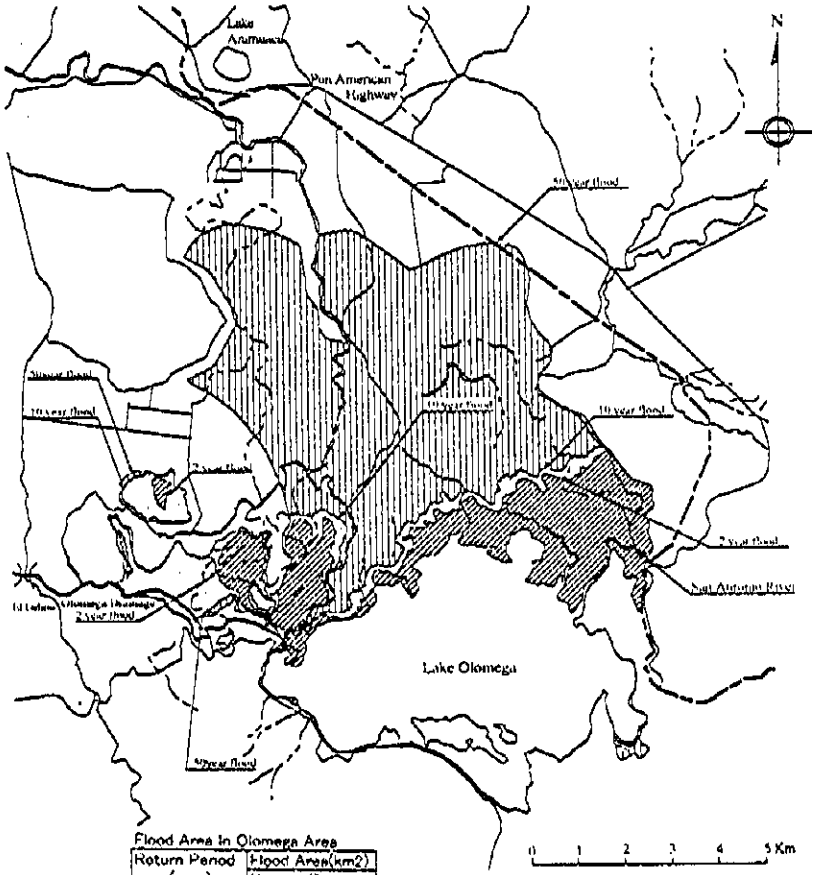
Return Period (year)	Flood Area(km2) Master Plan
1.05	0.0
2	0.0
5	4.6
10	7.6
20	10.0
50	55.4
100	59.1

FLOOD RISK MAP IN OLOMEGA AREA OF MASTER PLAN



CONTOUR LINES OF INUNDATION DEPTH
FOR 10 YEAR FLOOD UNDER M/P

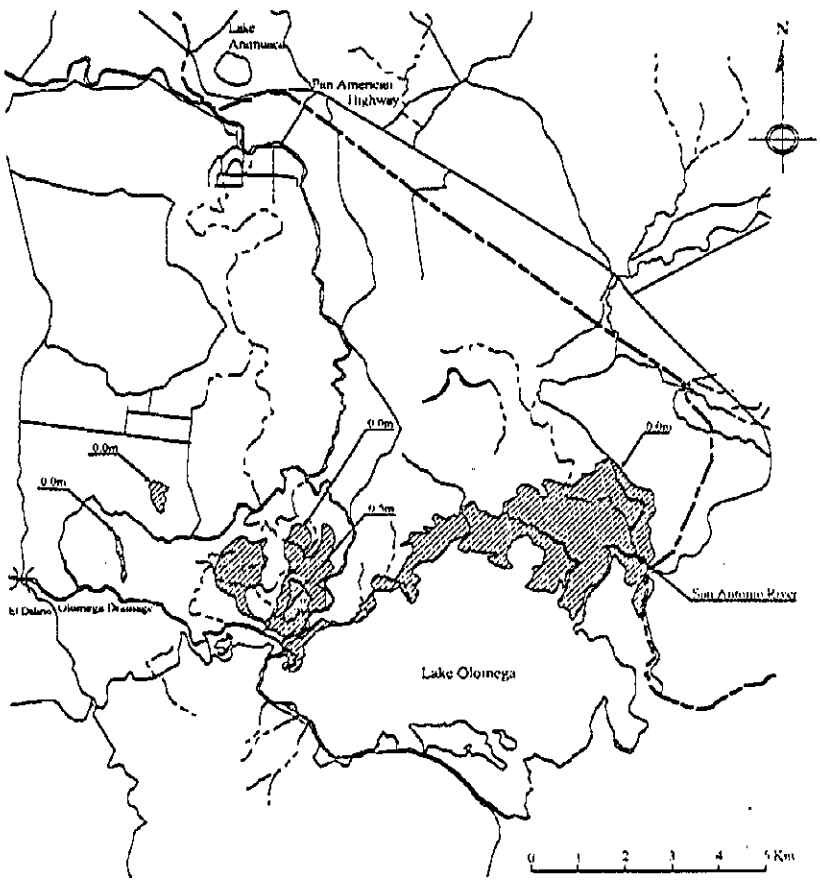
Figure 6.12(2) FLOOD RISK MAP IN OLOMEGA AREA OF MASTER PLAN



Flood Area in Olomega Area

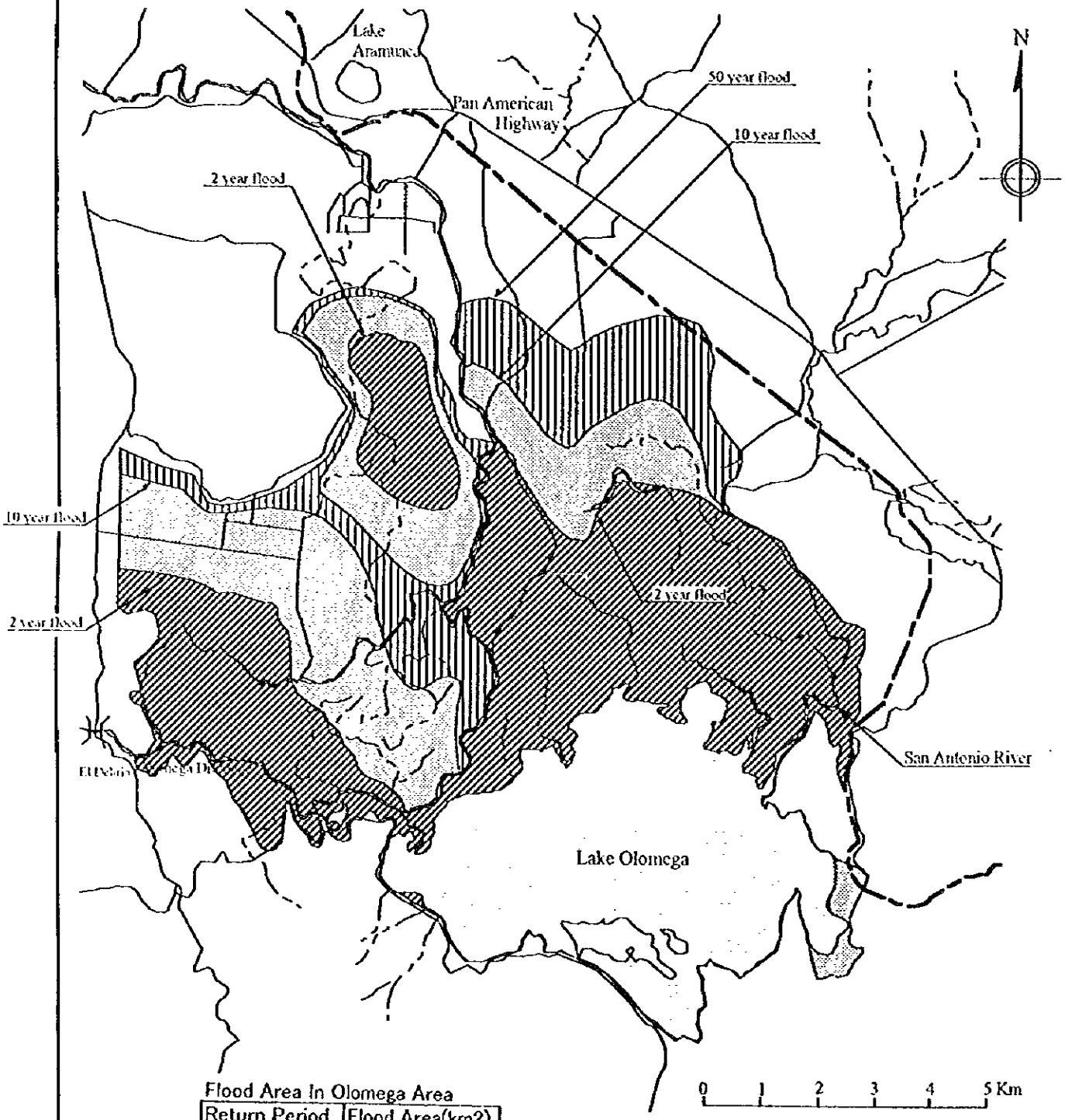
Return Period (year)	Flood Area(km2) Priority Project
1.05	0.0
2	9.2
5	14.0
10	15.5
20	17.5
50	55.4
100	59.1

FLOOD RISK MAP IN OLOMEGA AREA OF PRIORITY PROJECT



CONTOUR LINES OF INUN DATION DEPTH
FOR 2 YEAR FLOOD UNDER P/P

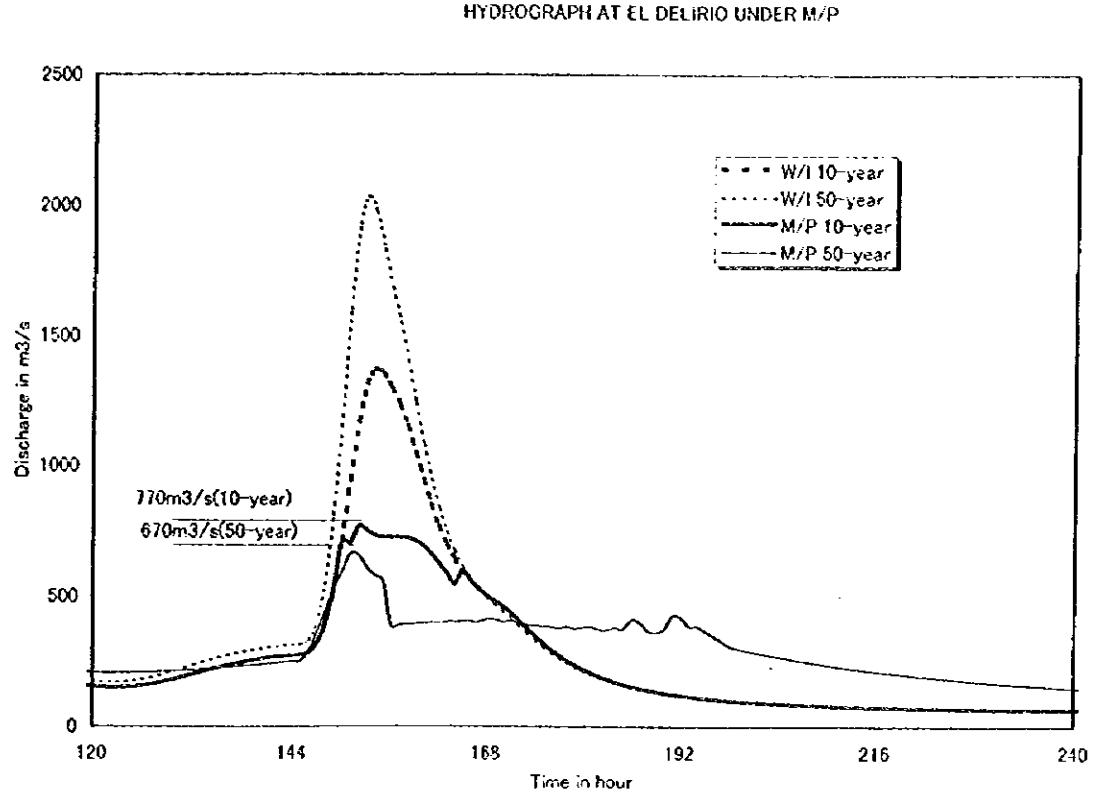
Figure 6.12(3) FLOOD RISK MAP IN OLOMEGA AREA OF PRIORITY PROJECT



Flood Area In Olomega Area

Return Period (year)	Flood Area(km2) Without Project
1.05	25.3
2	41.5
5	54.5
10	69.4
20	78.0
50	83.7
100	88.9

Figure 6.12(4) FLOOD RISK MAP IN OLOMEGA AREA OF WITHOUT PROJECT



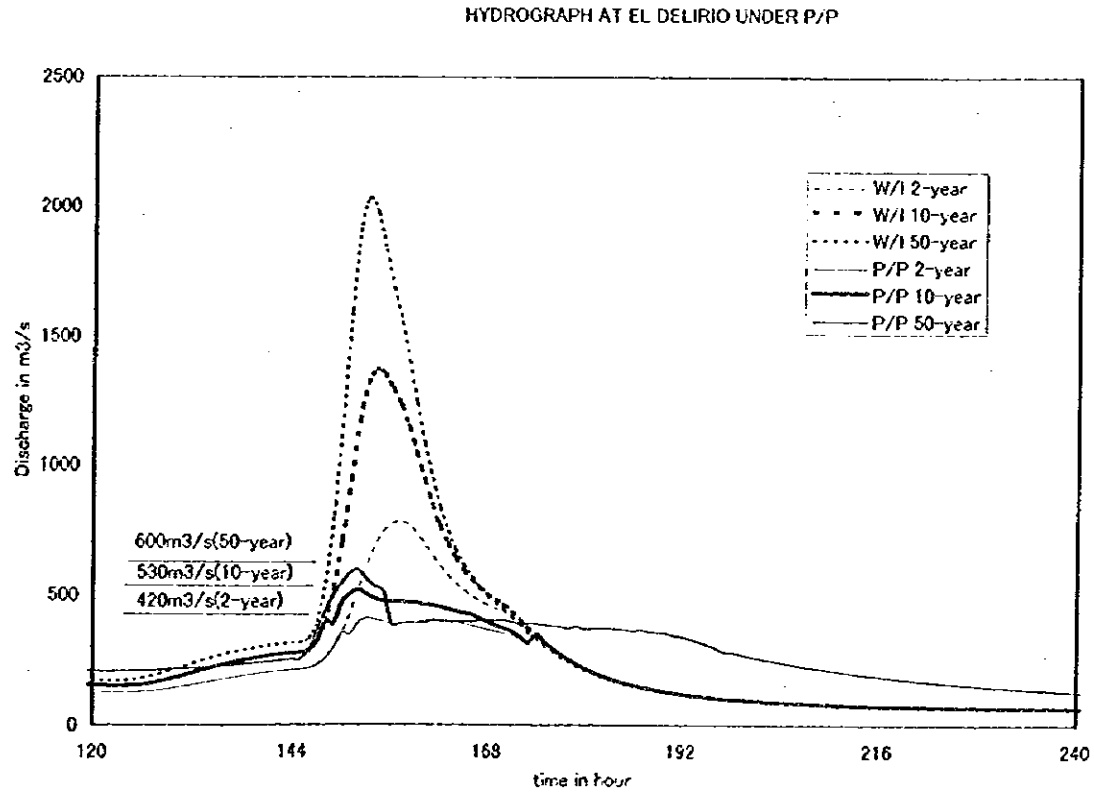
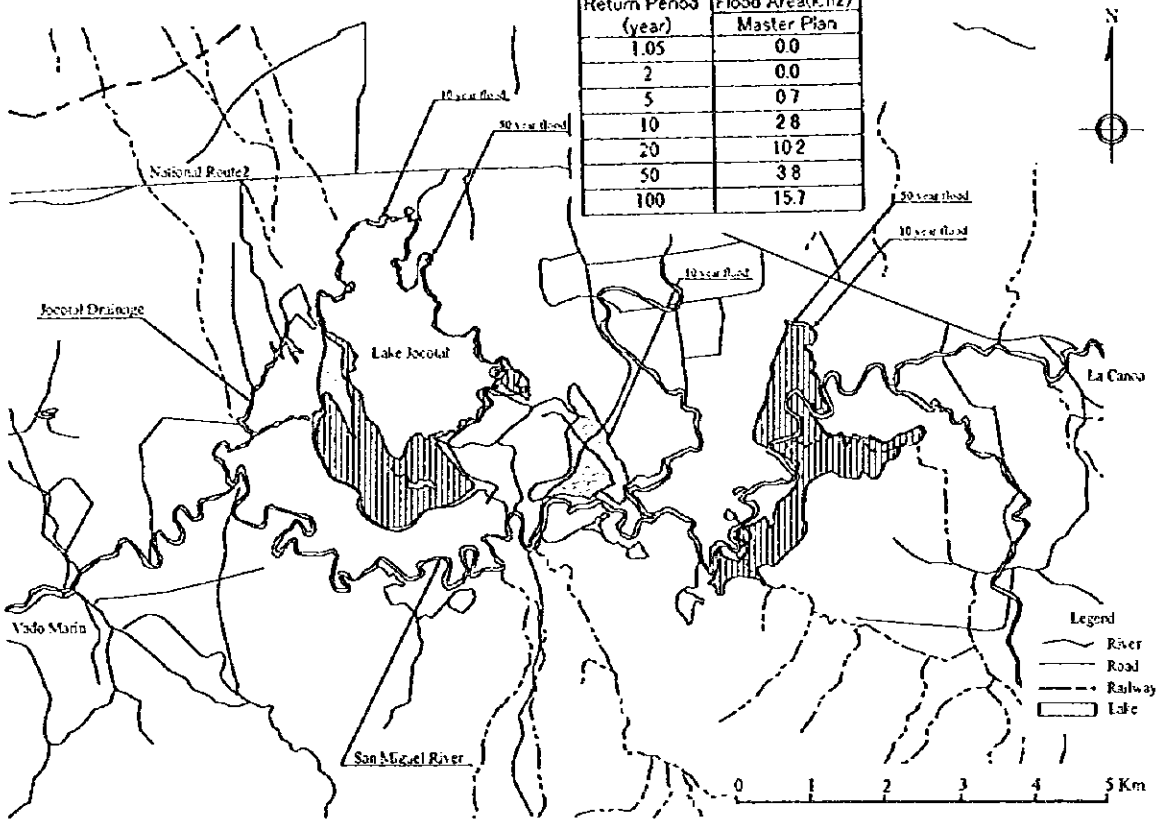


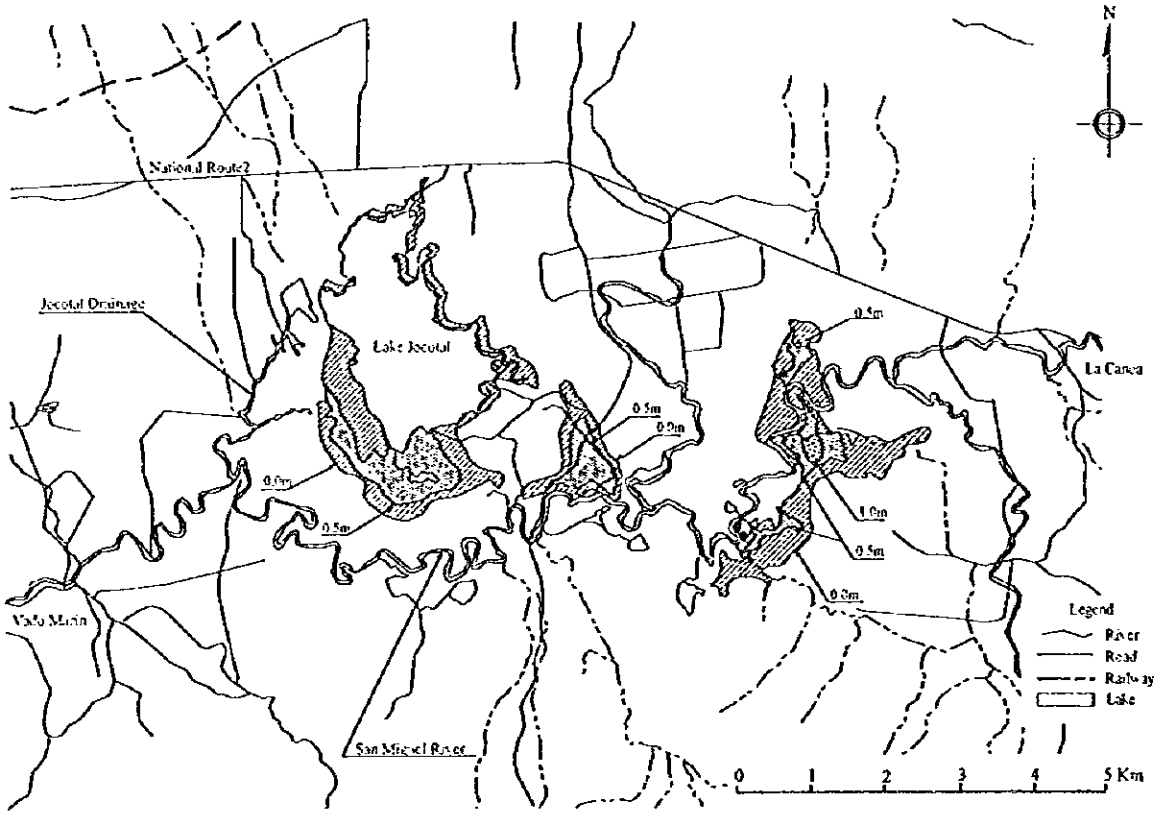
Figure 6.12(5) HYDROGRAPH AT EL DELIRIO OF M/P AND P/P

Flood Area In Jocotal Area

Return Period (year)	Flood Area(km2) Master Plan
1.05	0.0
2	0.0
5	0.7
10	2.8
20	10.2
50	3.8
100	15.7



FLOOD RISK MAP IN JOCOTAL AREA OF MASTER PLAN

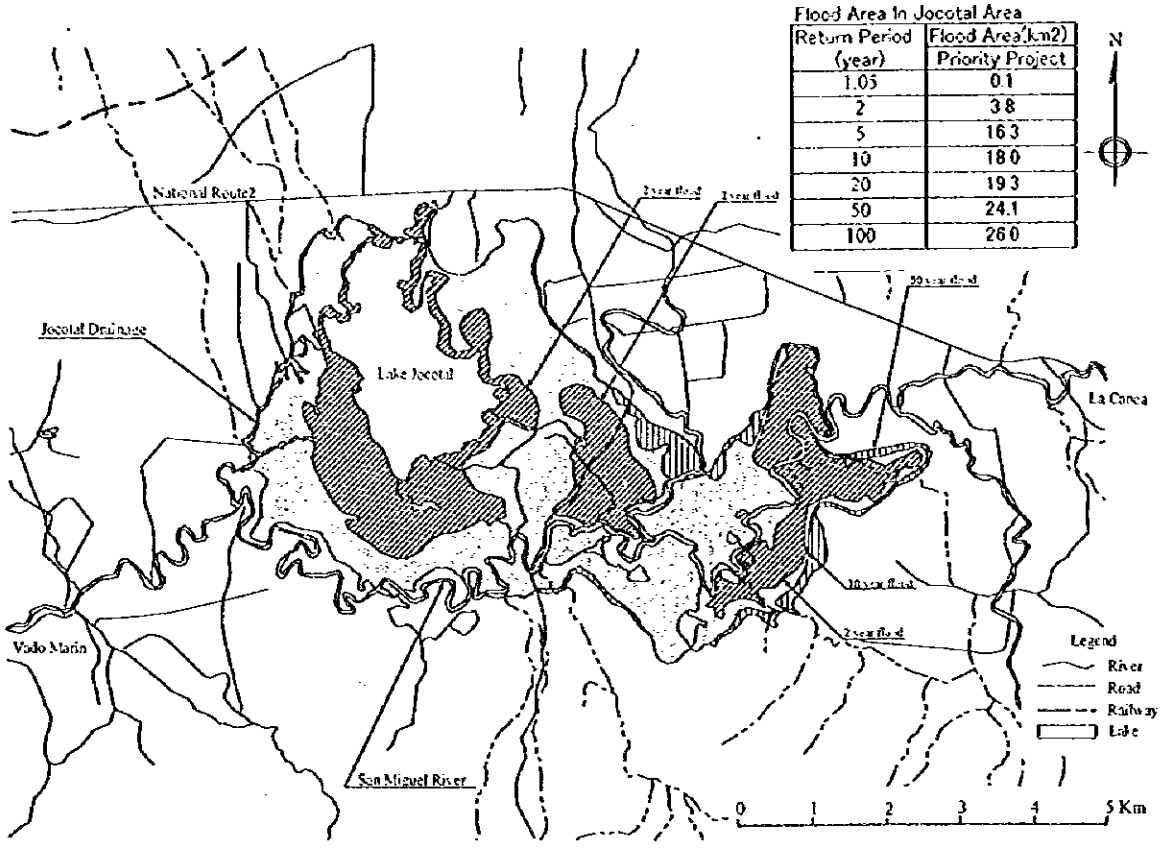


CONTOUR LINES OF INUNDATION DEPTH FOR 10 YEAR FLOOD UNDER M/P IN JOCOTAL AREA

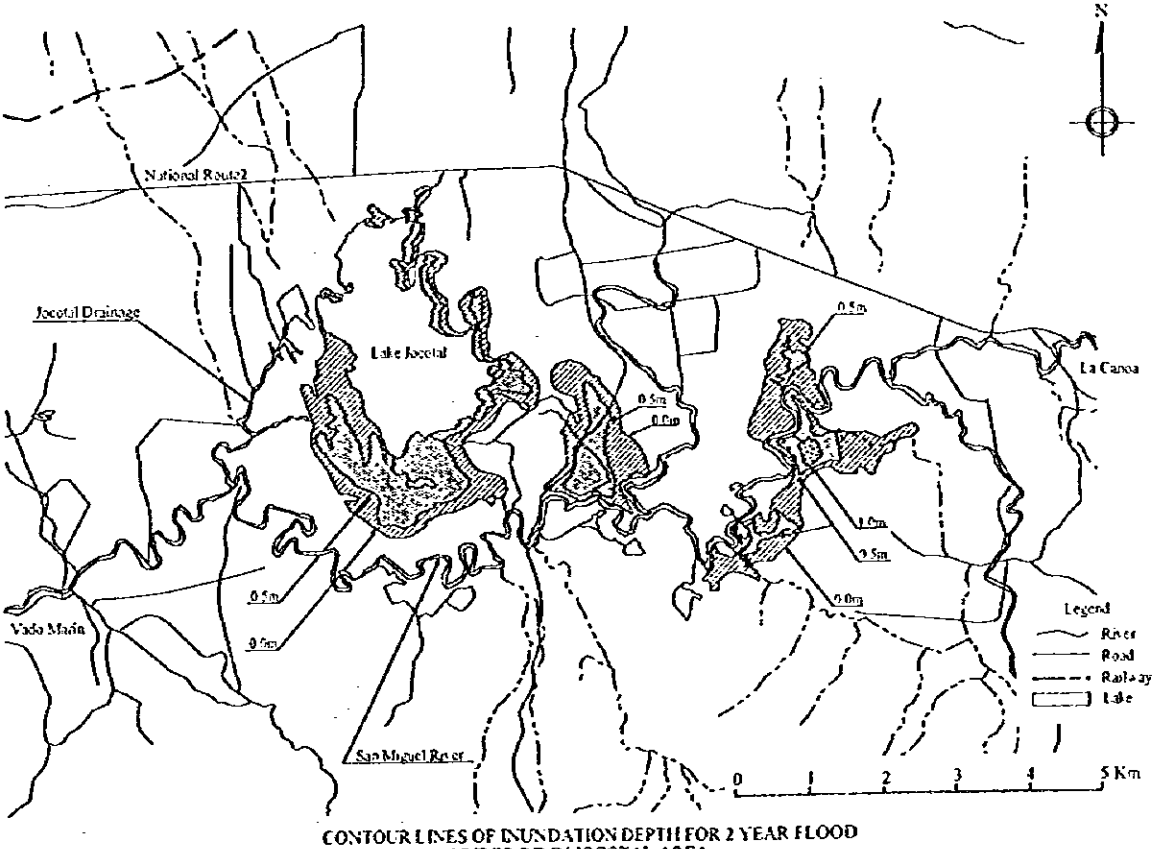
Figure 6.12(6) FLOOD RISK MAP IN JOCOTAL AREA OF MASTER PLAN

Flood Area in Jocotal Area

Return Period (year)	Flood Area(km2) Priority Project
1.05	0.1
2	3.8
5	16.3
10	18.0
20	19.3
50	24.1
100	26.0



FLOOD RISK MAP IN JOCOTAL AREA OF PRIORITY PROJECT



CONTOUR LINES OF INUNDATION DEPTH FOR 2 YEAR FLOOD UNDER P/P IN JOCOTAL AREA

Figure 6.12(7) FLOOD RISK MAP IN JOCOTAL AREA OF PRIORITY PROJECT

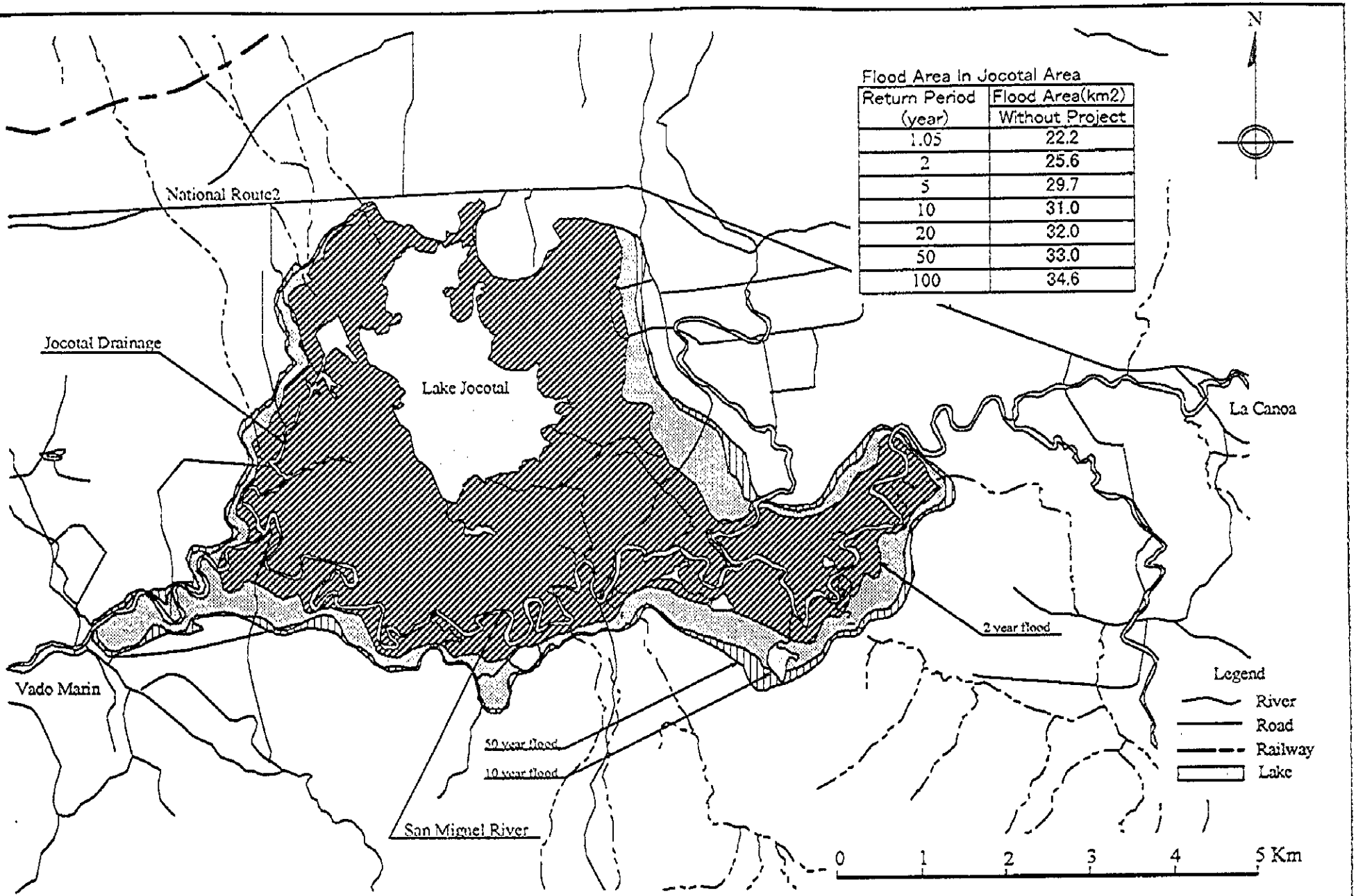
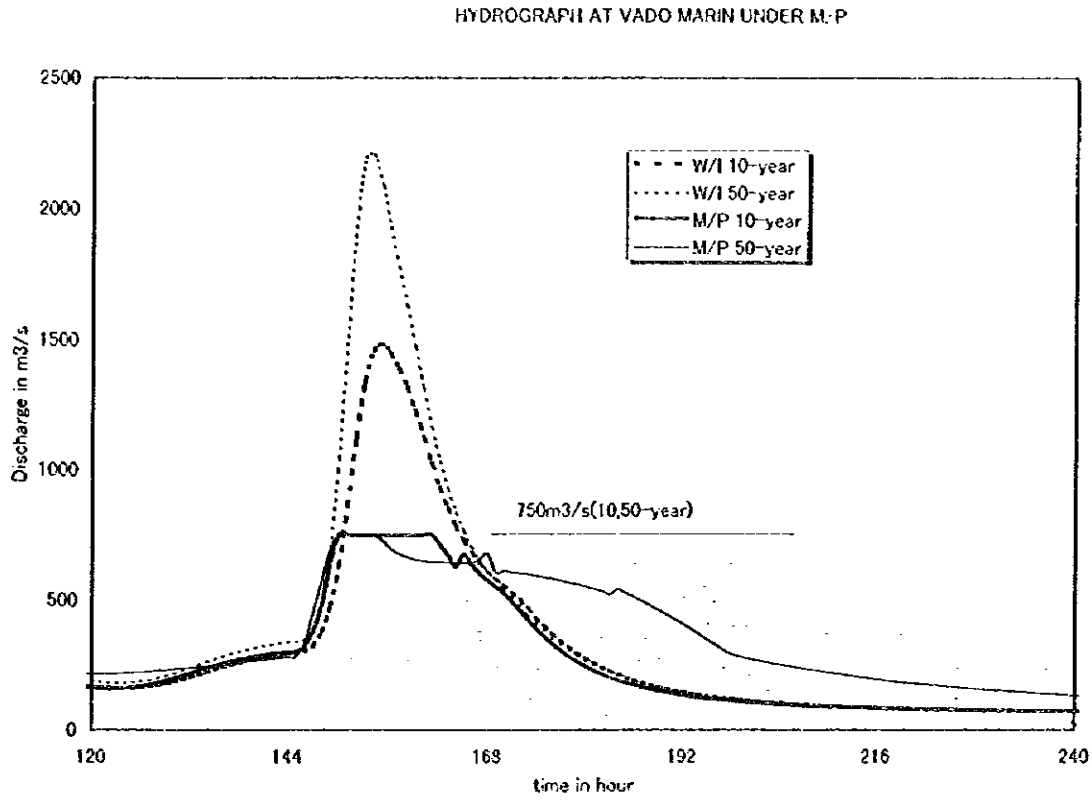


Figure 6.12(8) FLOOD RISK MAP IN JOCOTAL AREA OF WITHOUT PROJECT



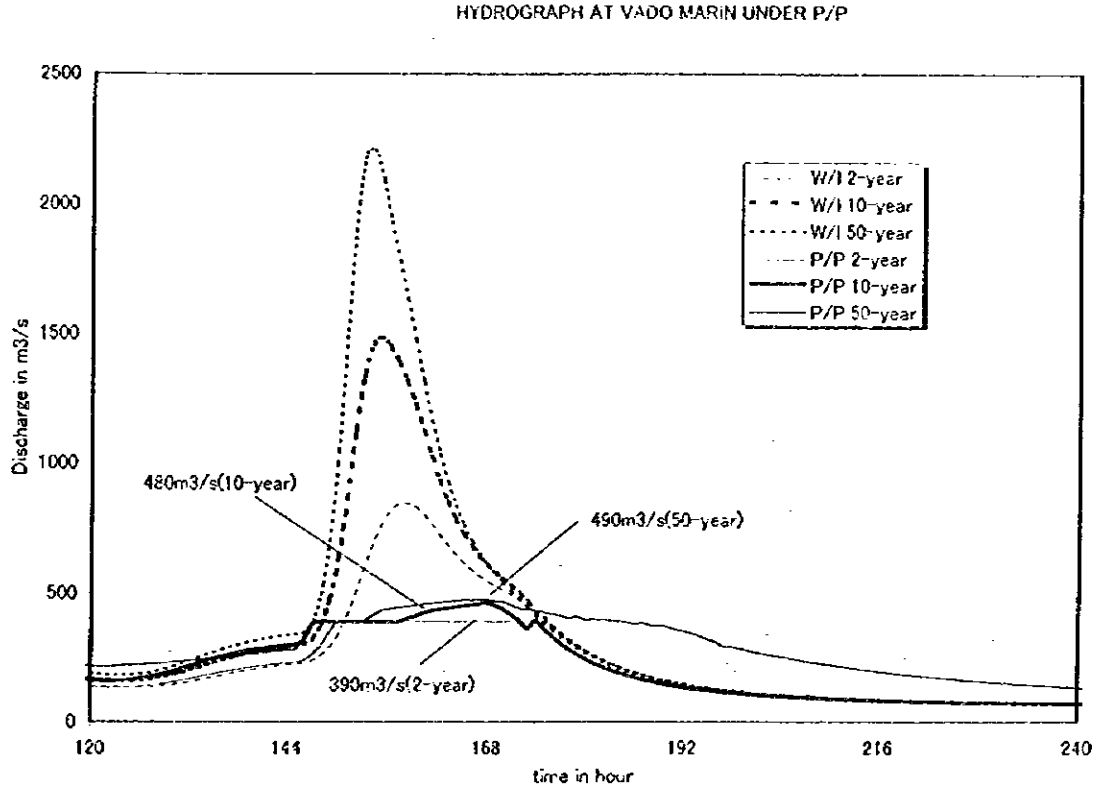
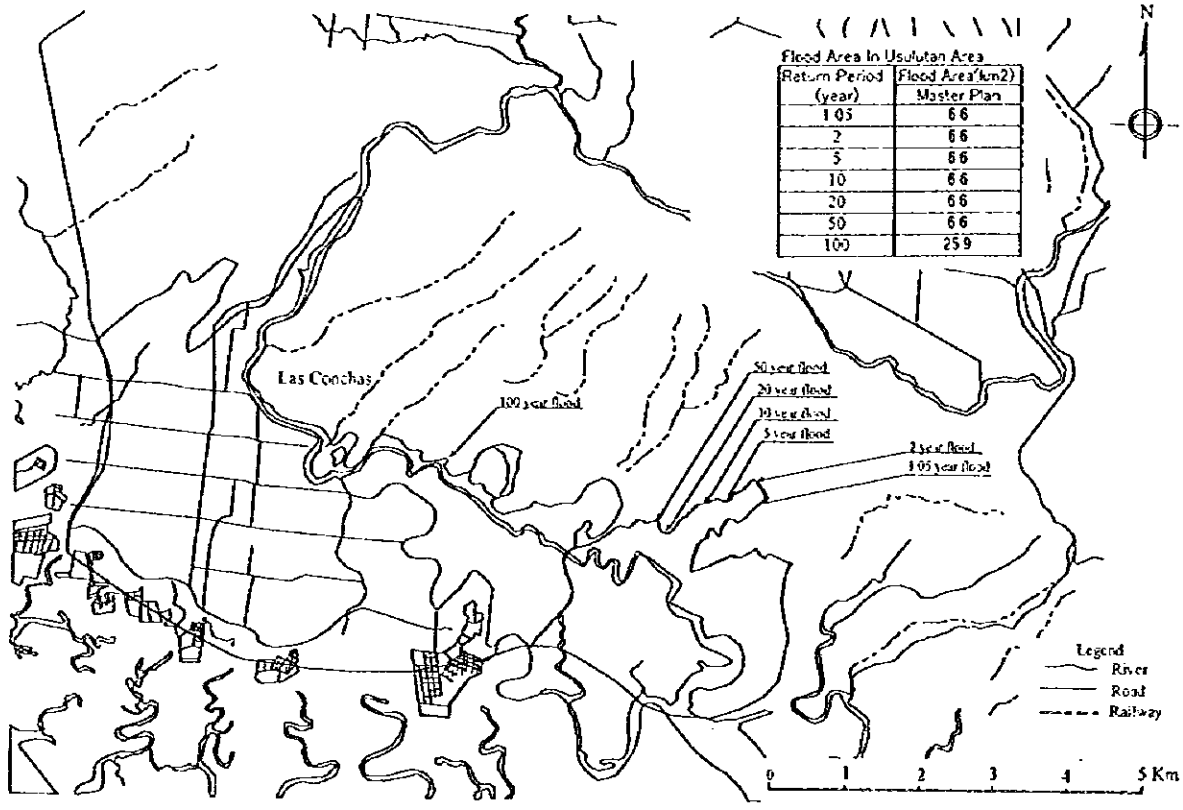
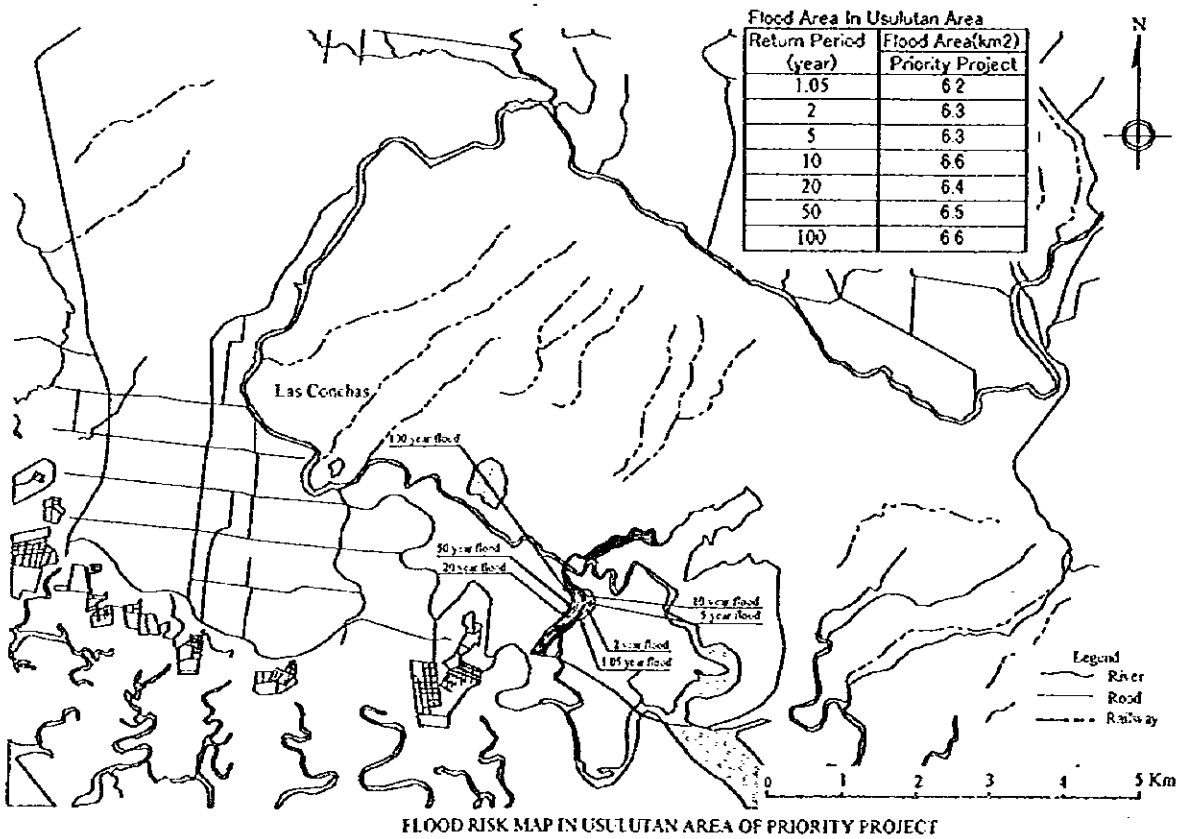


Figure 6.12(9) HYDROGRAPH AT VADO MARIN OF M/P AND P/P



FLOOD RISK MAP IN USULUTAN AREA OF MASTER PLAN



FLOOD RISK MAP IN USULUTAN AREA OF PRIORITY PROJECT

Figure 6.12(10) FLOOD RISK MAP IN USULUTAN AREA OF M/P AND P/P

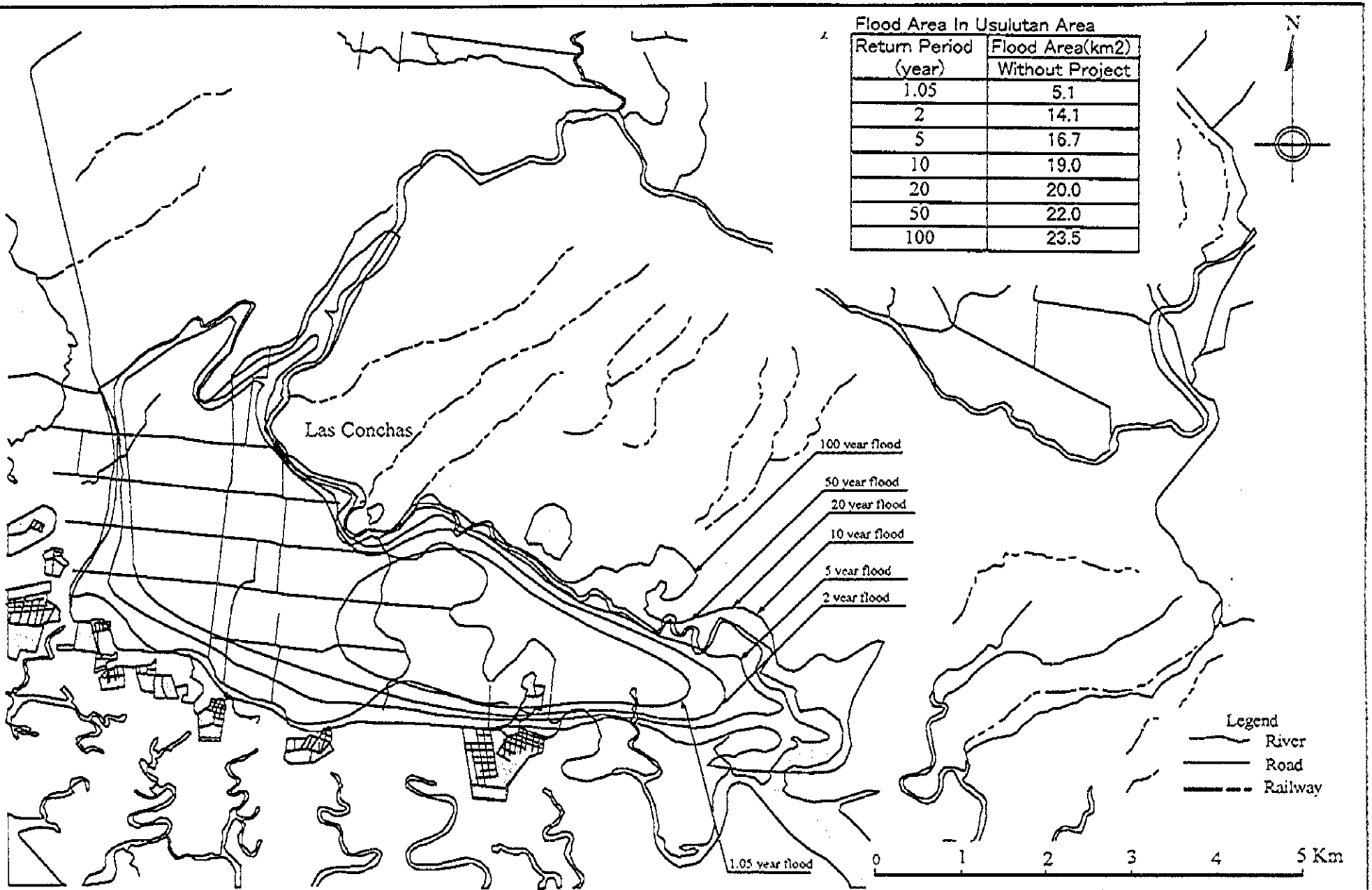
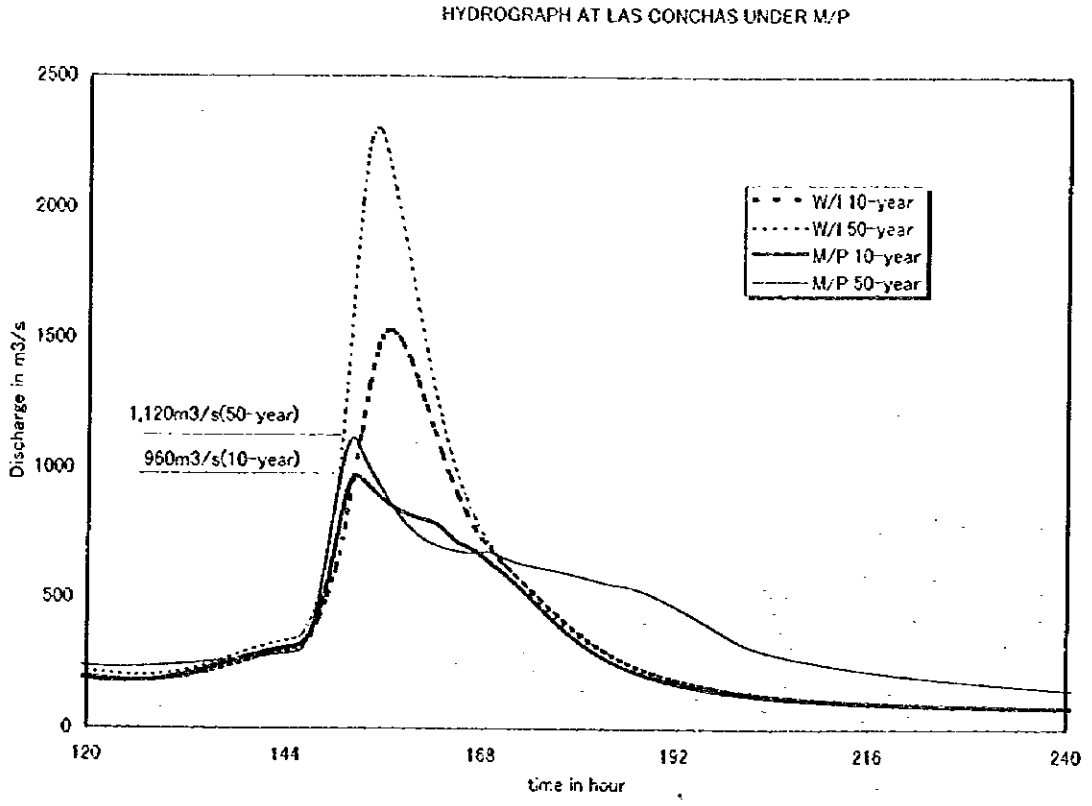


Figure 6.12(11) FLOOD RISK MAP IN USULUTAN AREA OF WITHOUT PROJECT



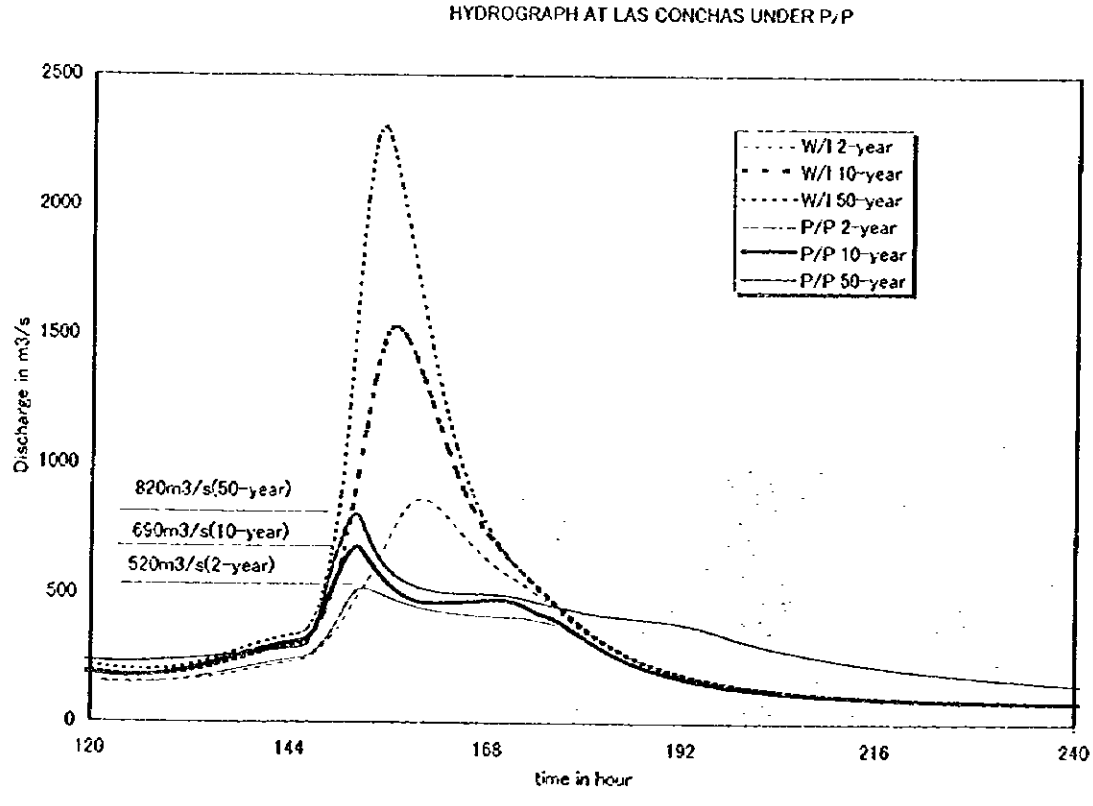


Figure 6.12(12) HYDROGRAPH AT LAS CONCHAS OF M/P AND P/P

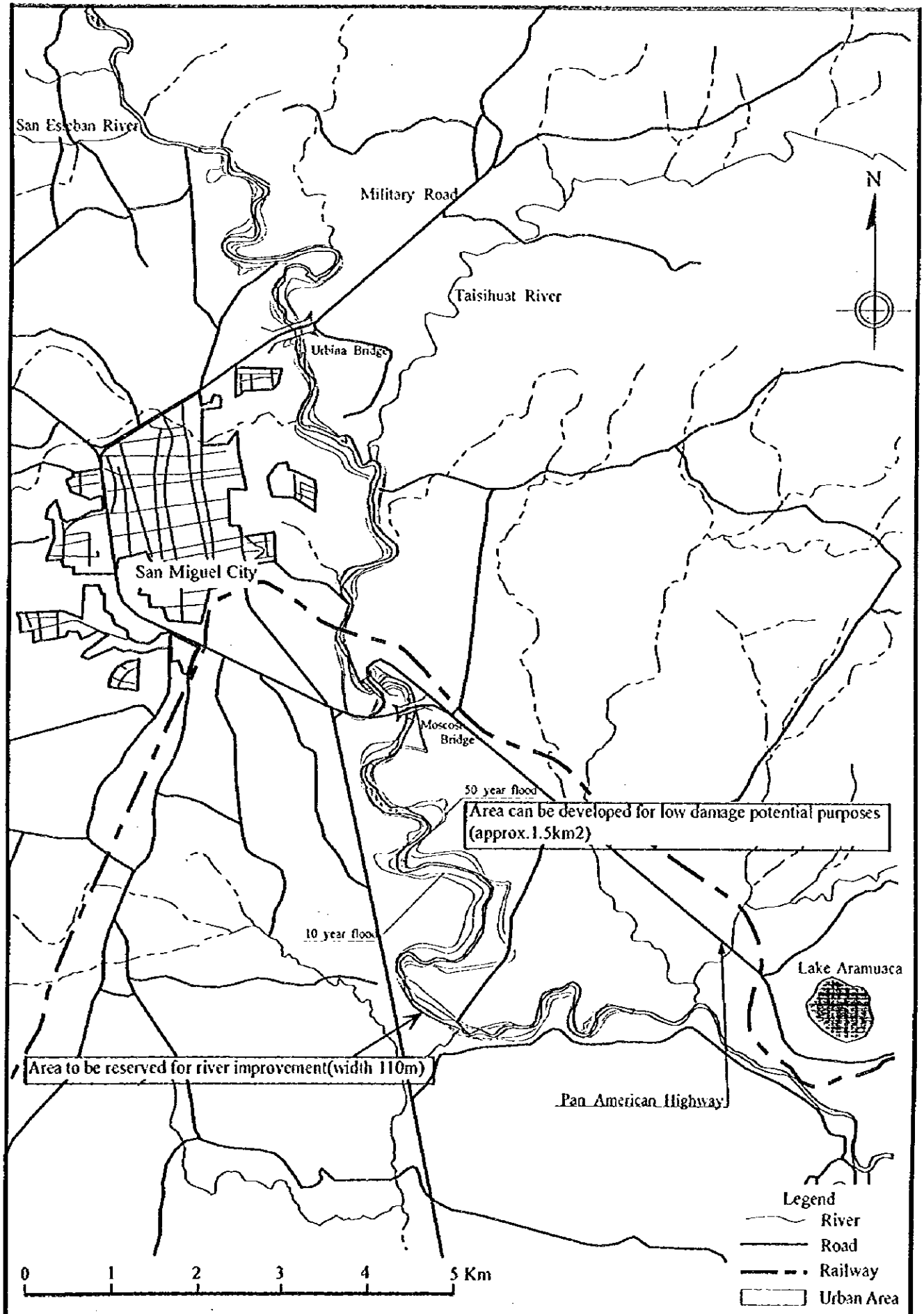


Figure 6.13(1/3) PROPOSED FLOODPLAIN MANAGEMENT(SAN MIGUEL AREA)

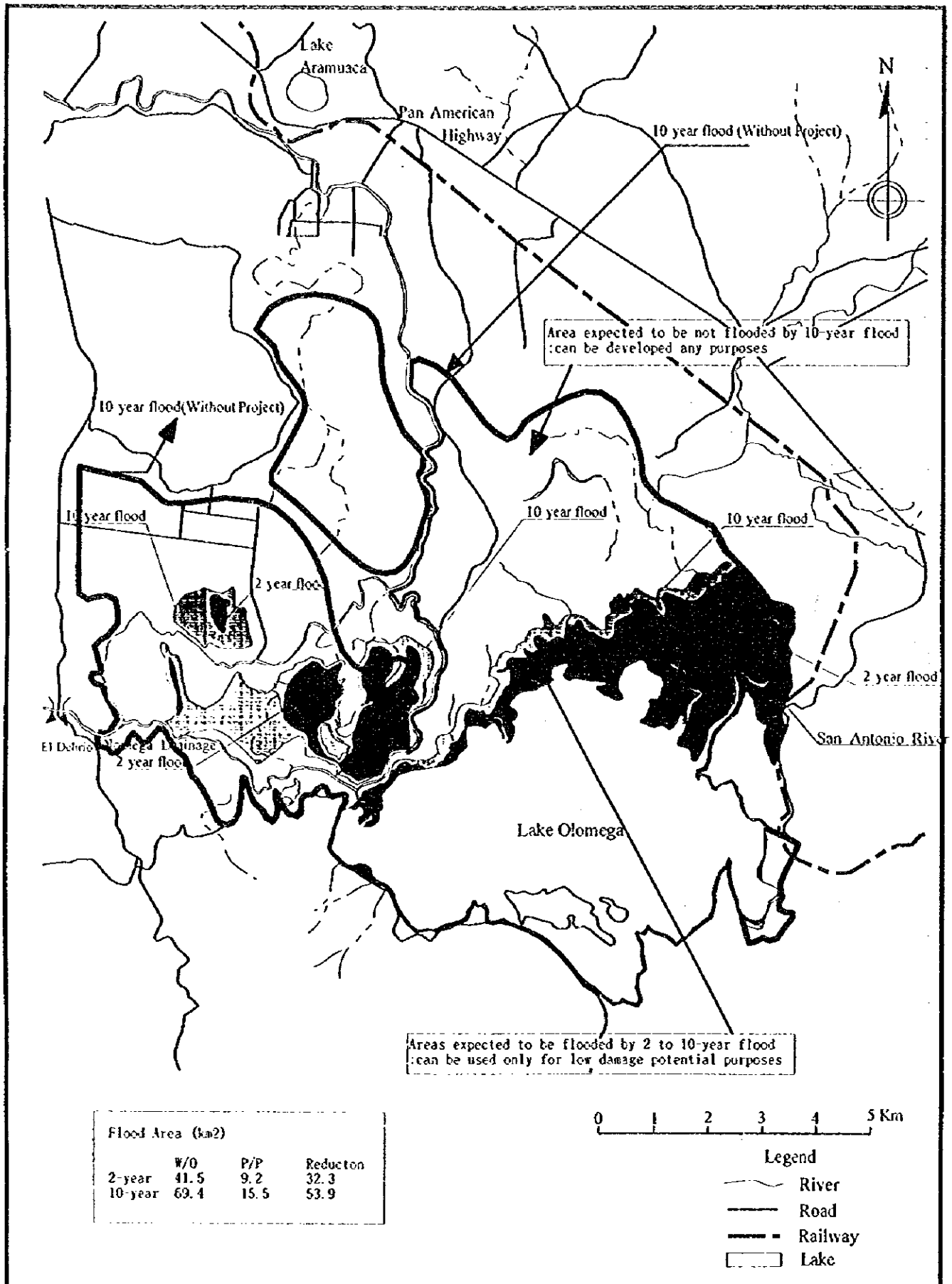


Figure 6.13(2/3) PROPOSED FLOODPLAIN MANAGEMENT(OLOMEGA AREA)

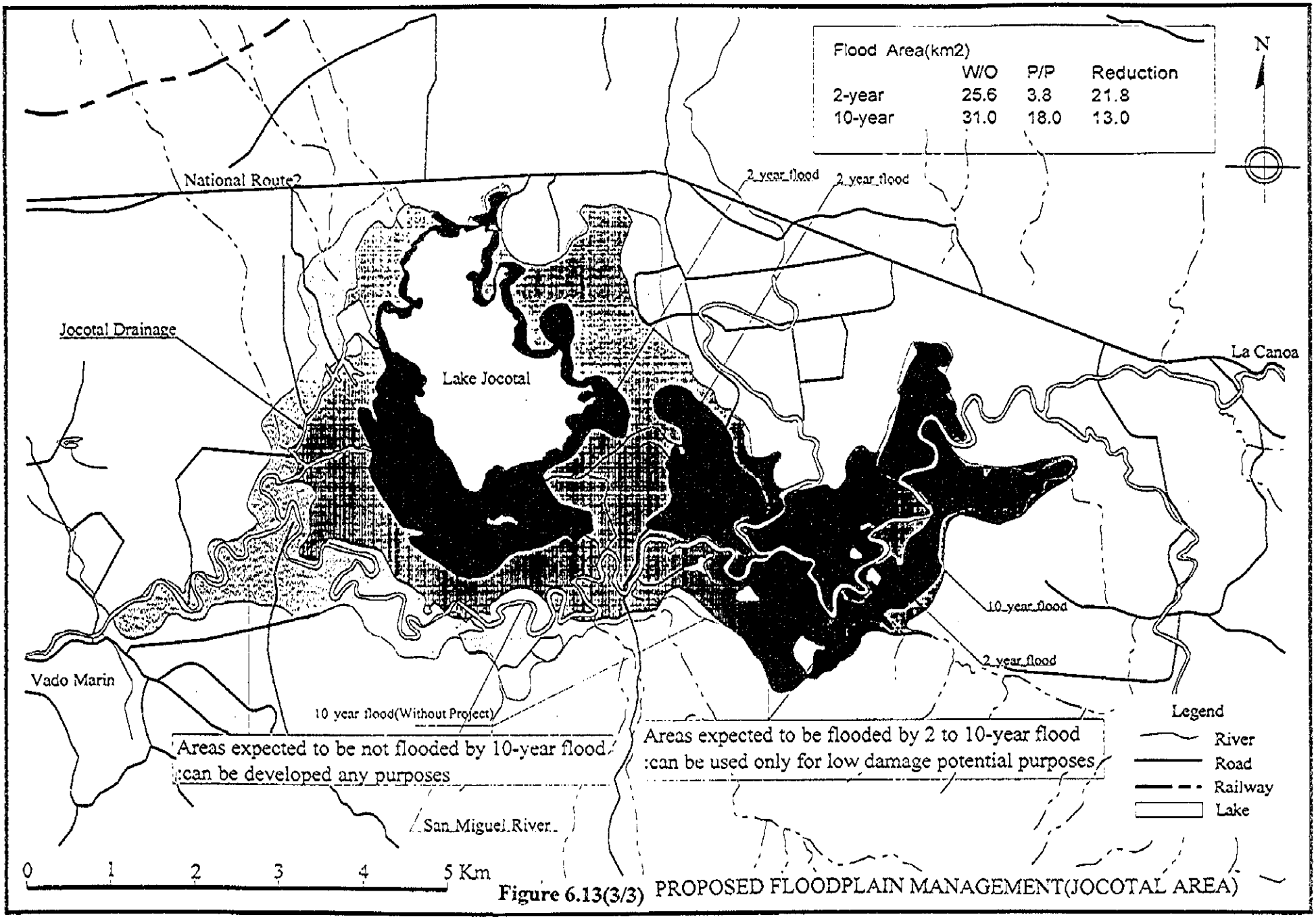


Figure 6.13(3/3) PROPOSED FLOODPLAIN MANAGEMENT(JOCOTAL AREA)

	Description	1998	1999	2000	2001	2002	2003	2004	2005
Structural Measures	1. Loan Process								
	2.Detailed Design								
	3. Land Acquisition								
	4.Tendering								
	5. Construction to cope with 2-year flood								
	Improvement of Lower Reach								
	Diversion and Retarding in Lake Olomega								
	Improvement of Middle Reach								
Non-structural Measures (Floodplain Management)	1.Land Use Regulation/Flood Proofing								
	2.Flood Forecasting/Warning								
	Design and Install of Waterlevel Gauges								
	3.Education to the residents								

Figure 6.14 IMPLEMENTATION SCHEDULE