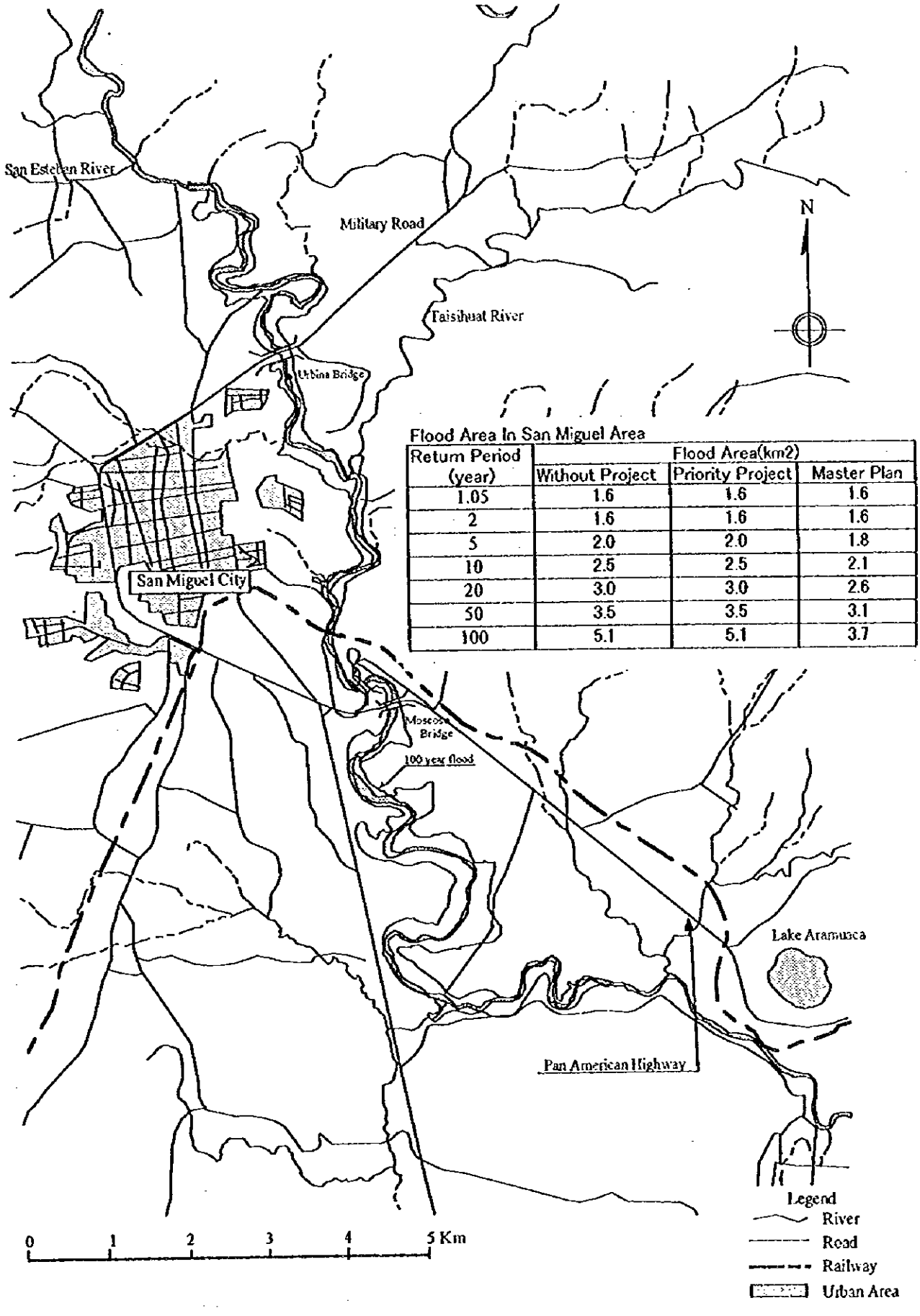
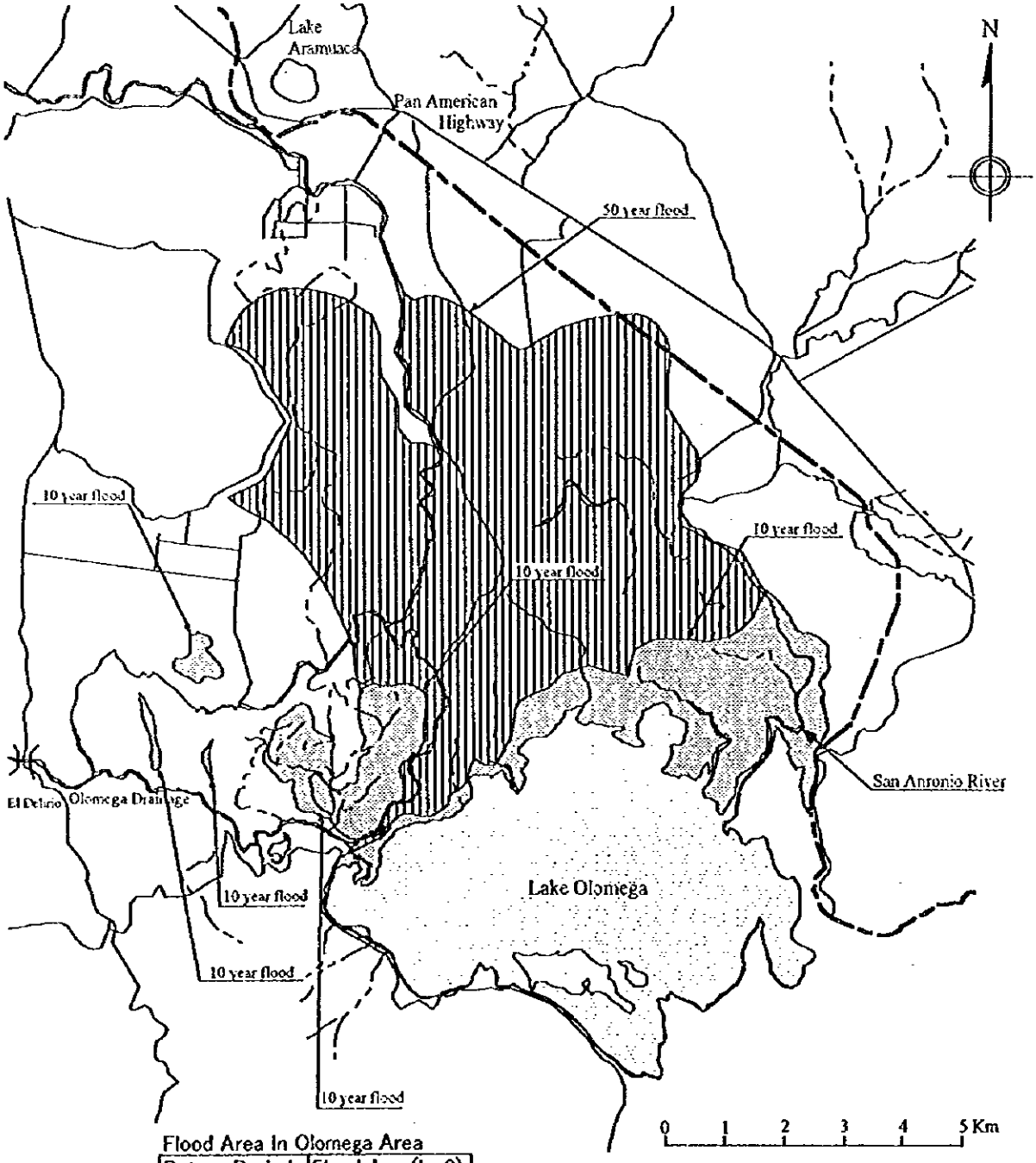


Flood Area In San Miguel Area

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

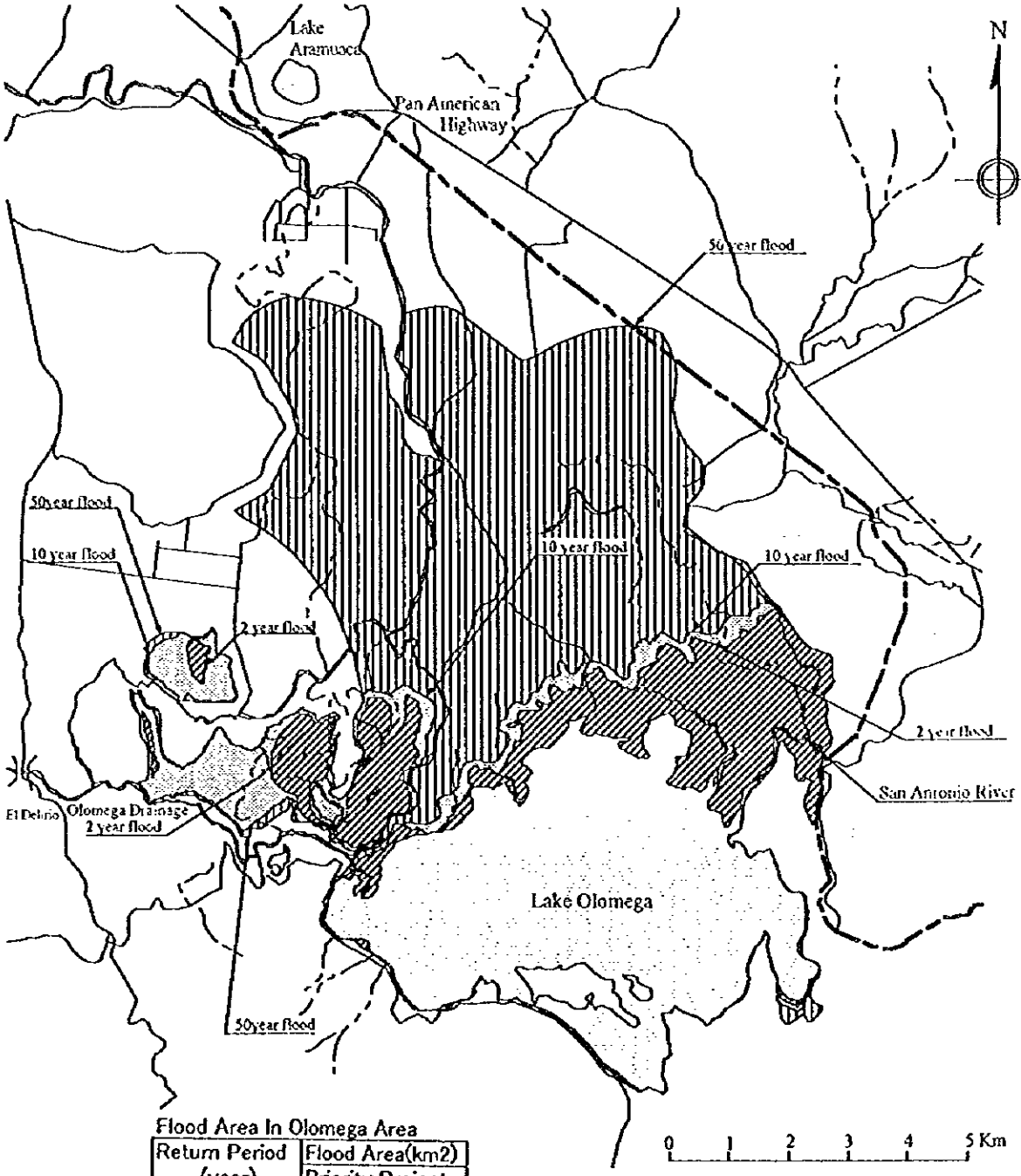
Figure 7.5 FLOOD RISK MAP IN SAN MIGUEL AREA



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

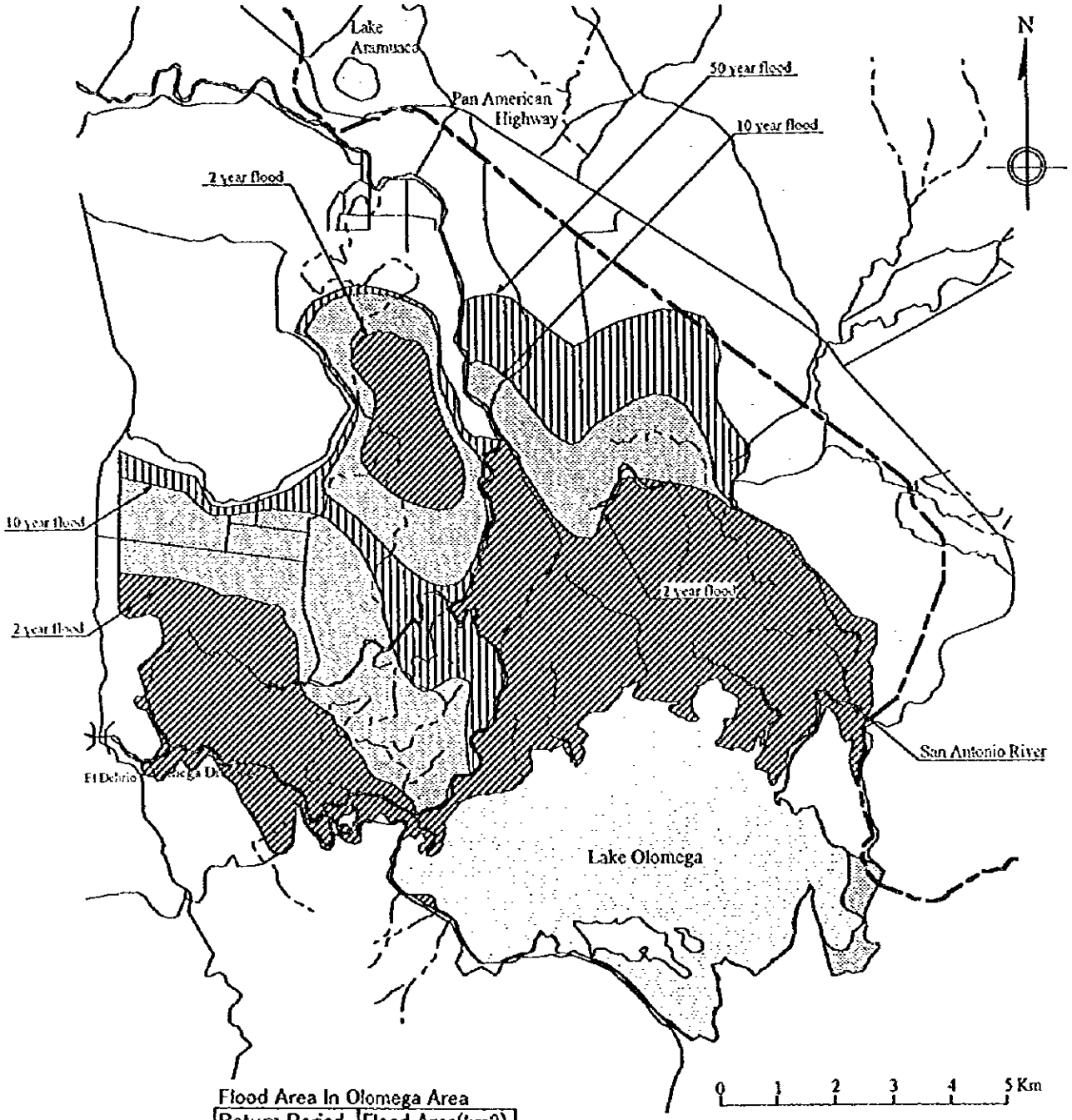
Figure 7.6 FLOOD RISK MAP IN OLOMEGA AREA OF MASTER PLAN



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

Figure 7.7 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 7.8 FLOOD RISK MAP IN OLOMEGA AREA OF WITHOUT PROJECT

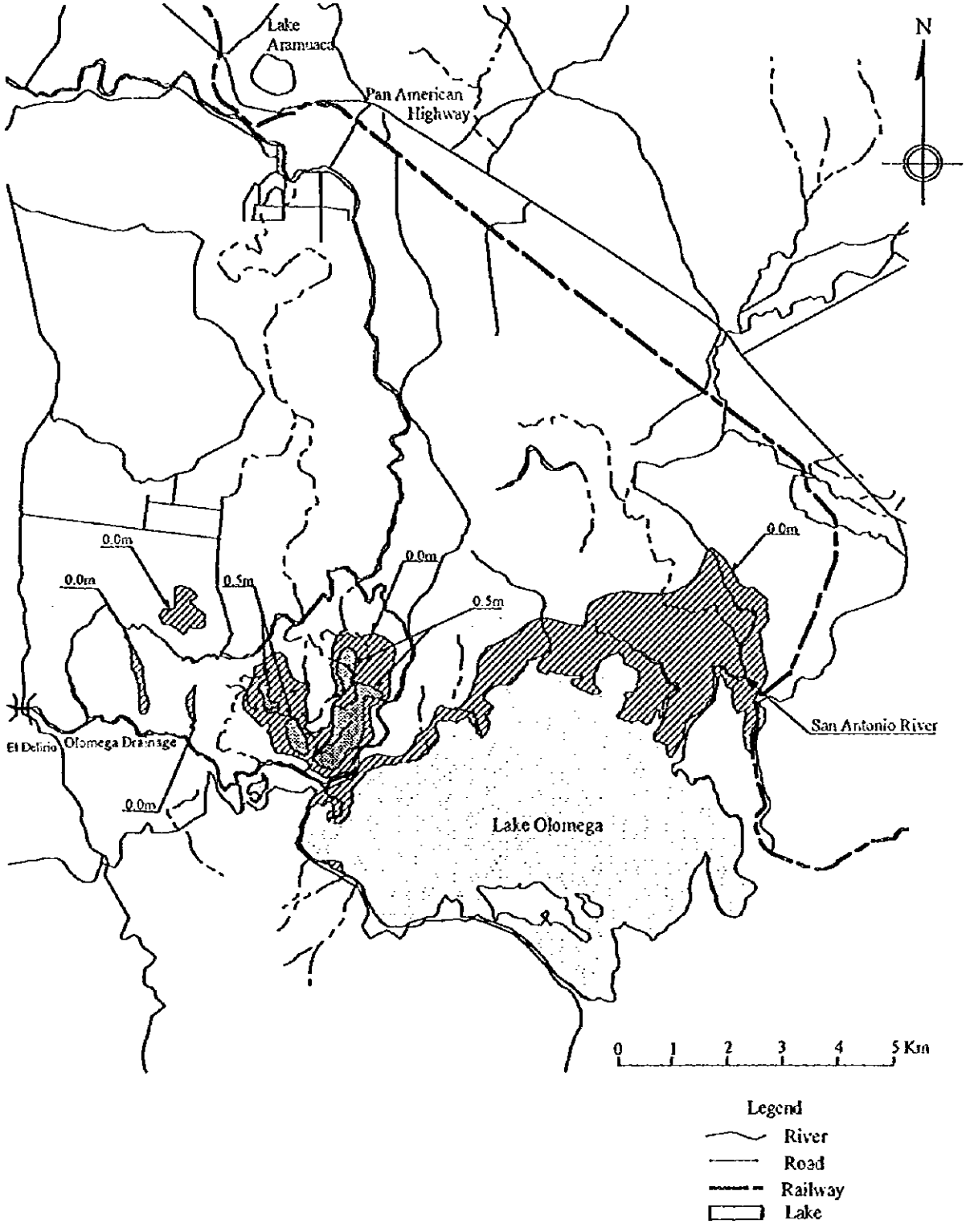


Figure 7.9 CONTOUR LINES OF INUNDATION DEPTH FOR 10 YEAR FLOOD UNDER M/P

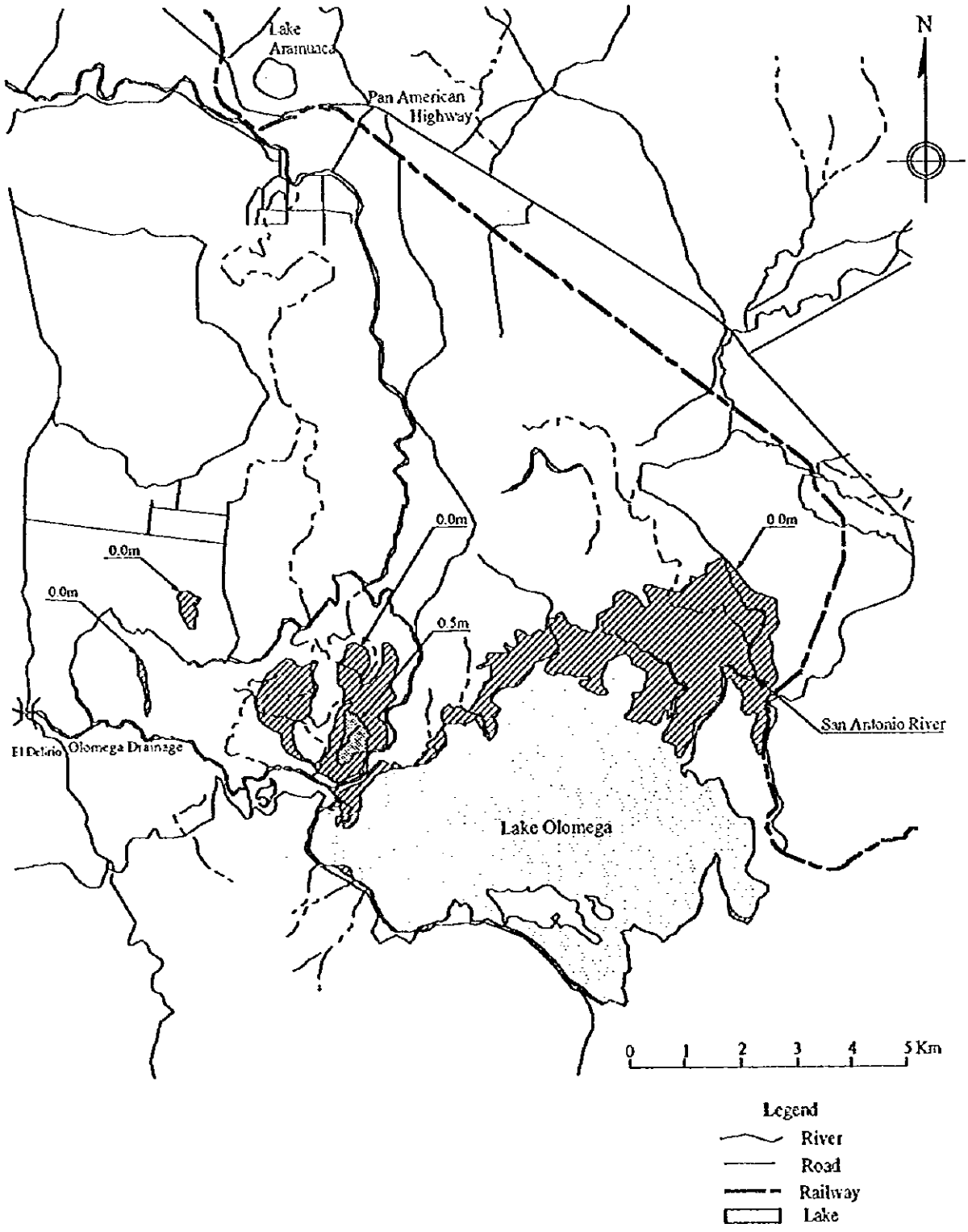


Figure 7.10 CONTOUR LINES OF INUN DATION DEPTH FOR 2 YEAR FLOOD UNDER P/P

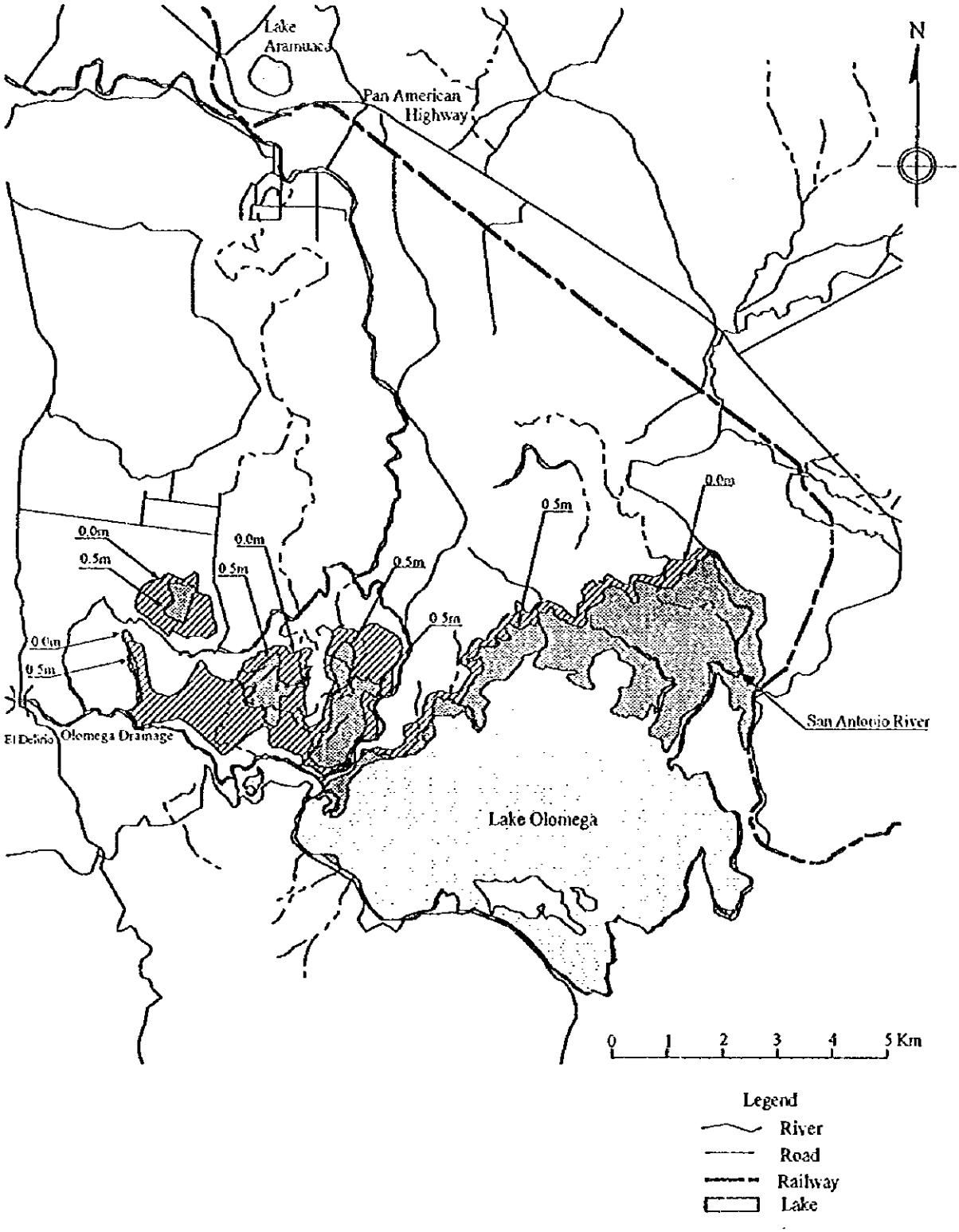


Figure 7.11 CONTOUR LINES OF INUNDATION DEPTH FOR 10 YEAR FLOOD UNDER P/P

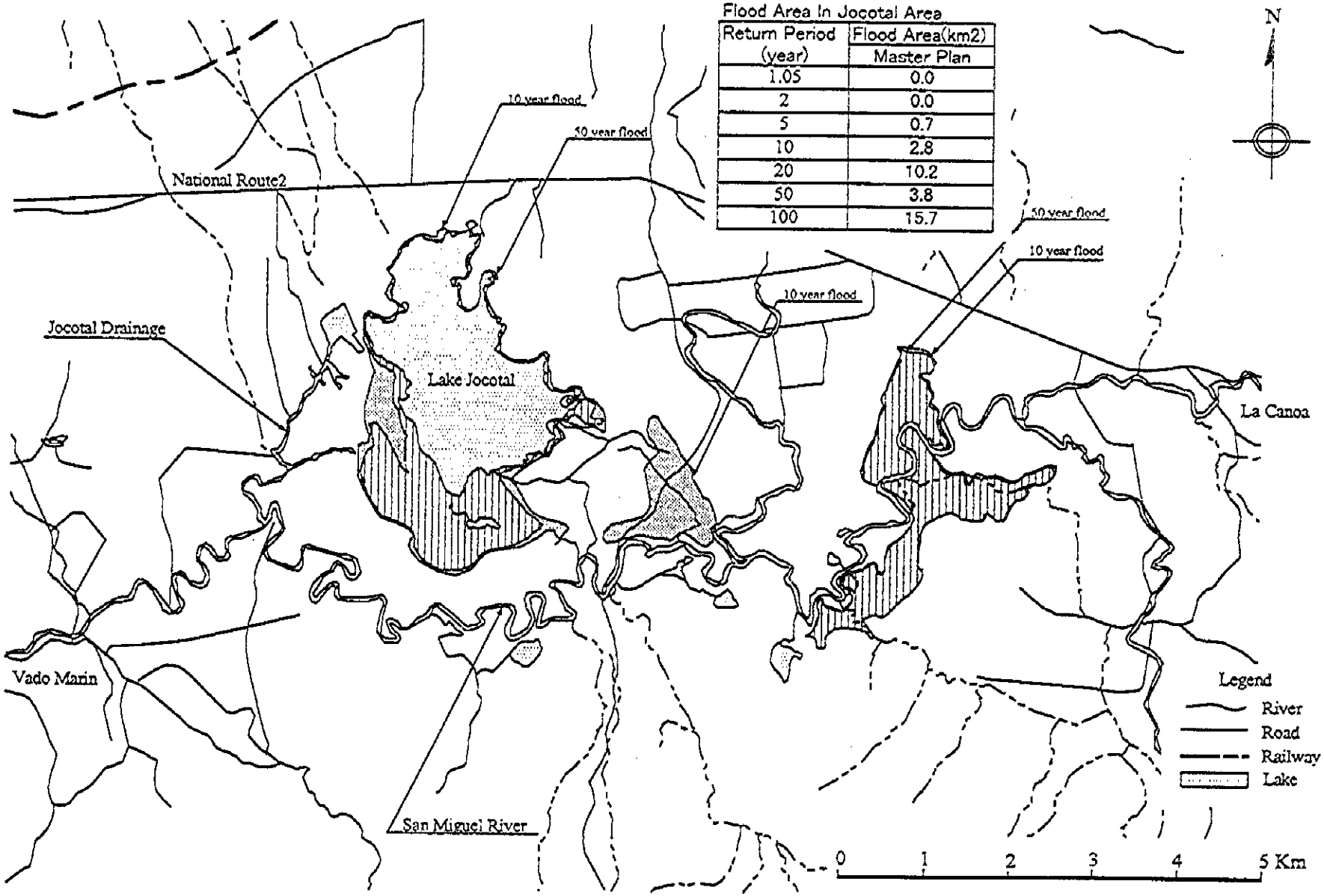


Figure 7.12 FLOOD RISK MAP IN JOCOTAL AREA OF MASTER PLAN

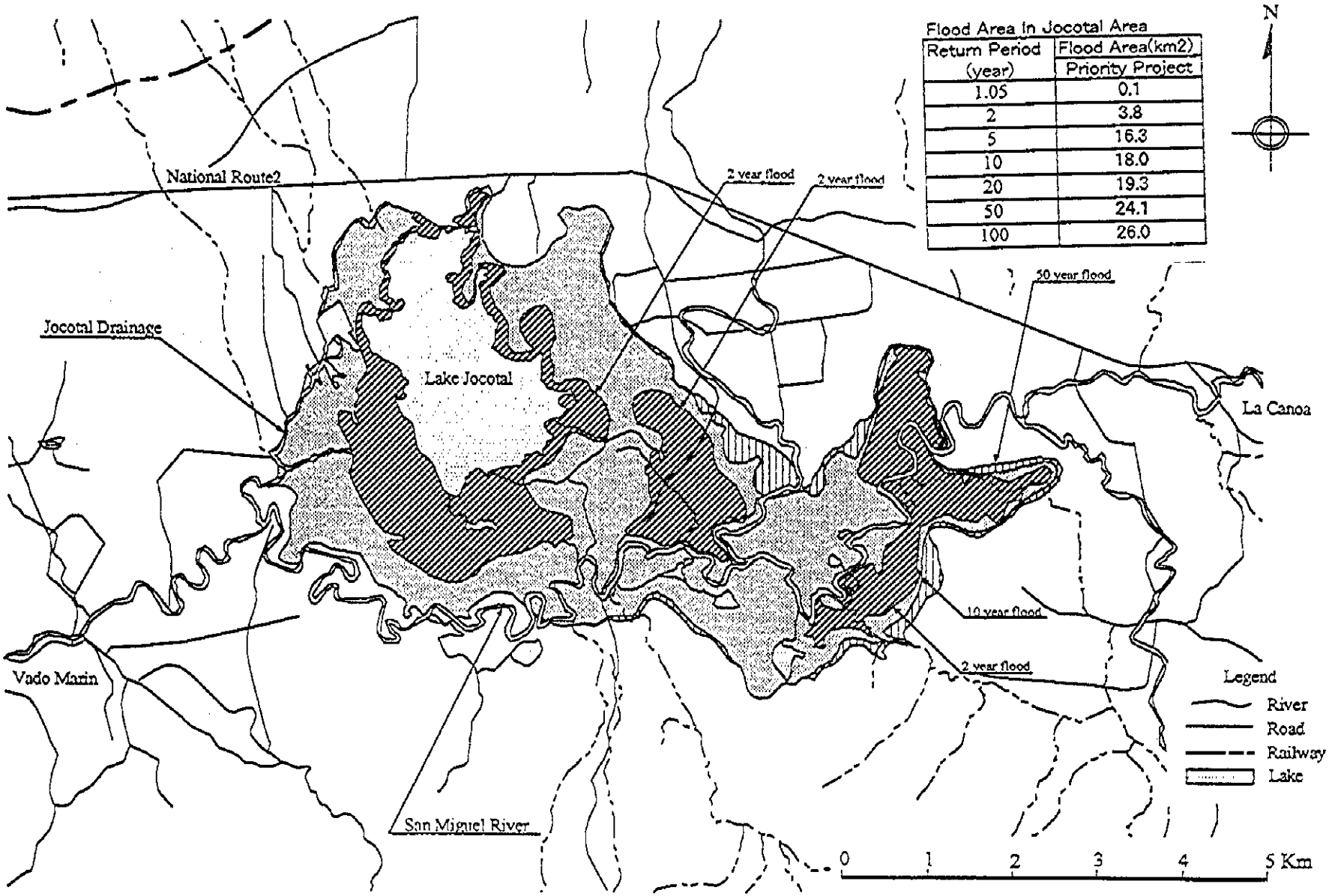


Figure 7.13 FLOOD RISK MAP IN JOCOTAL AREA OF PRIORITY PROJECT

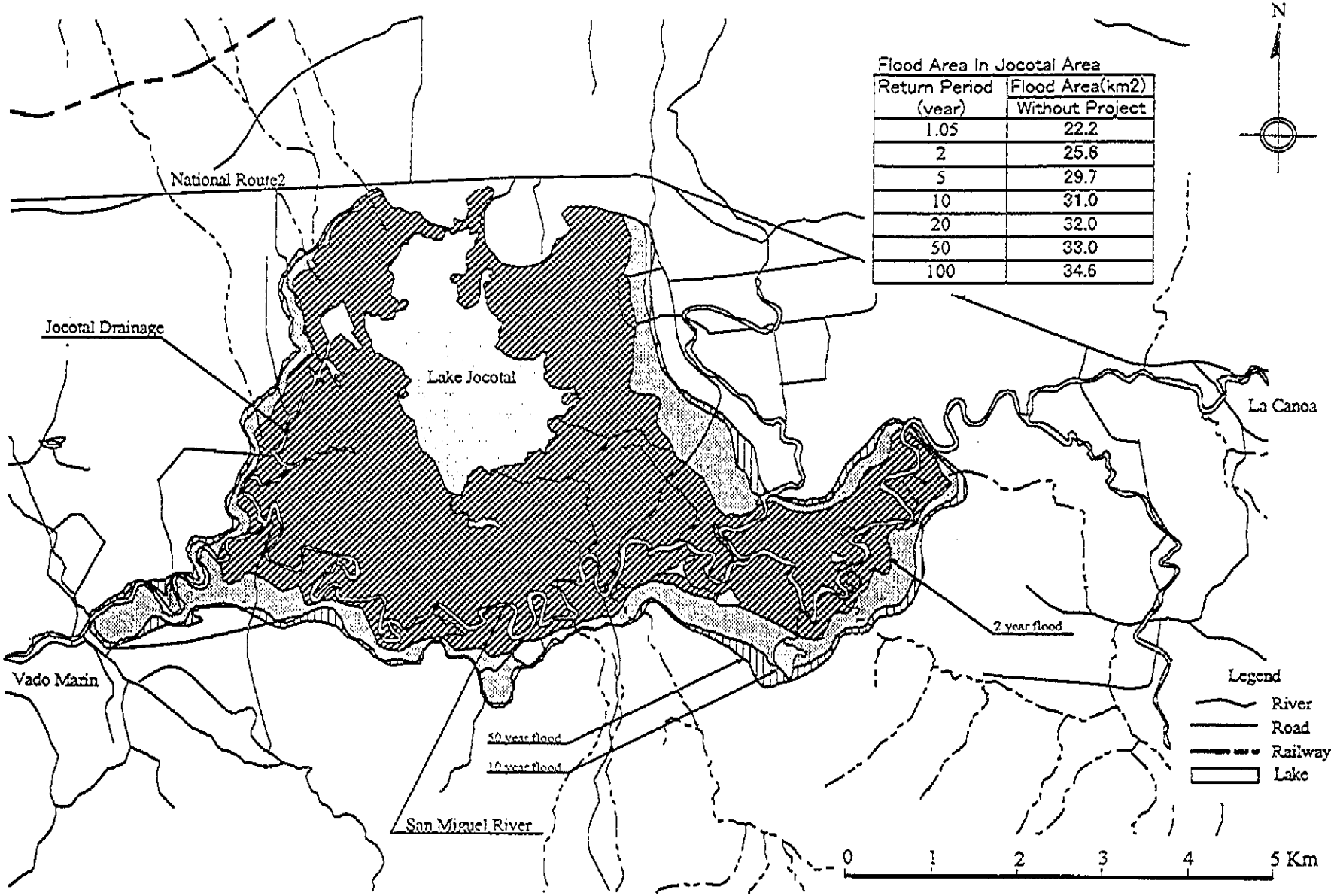


Figure 7.14 FLOOD RISK MAP IN JOCOTAL AREA OF WITHOUT PROJECT

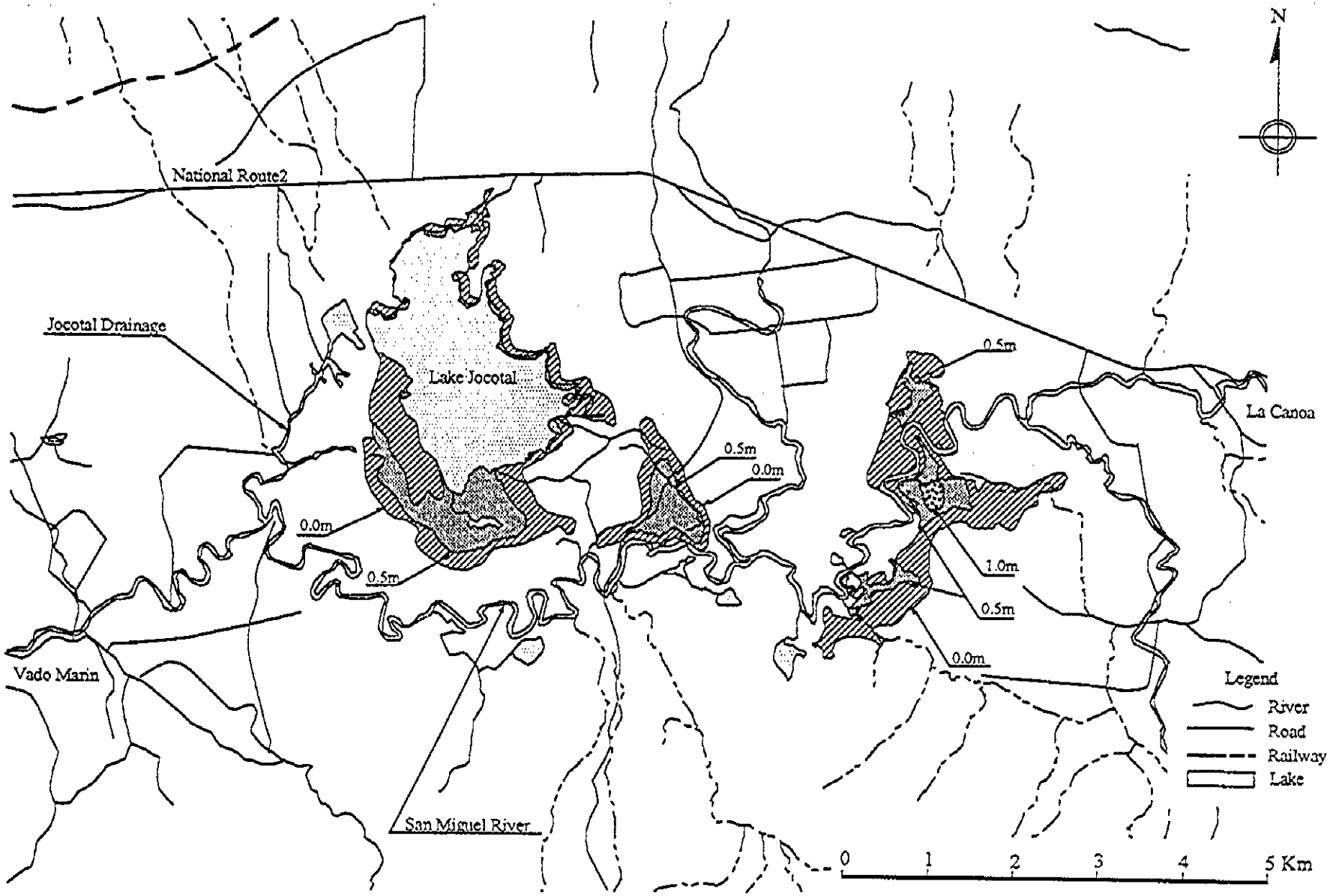


Figure 7.15 CONTOUR LINES OF INUNDATION DEPTH FOR 10 YEAR FLOOD UNDER M/P IN JOCOTAL AREA

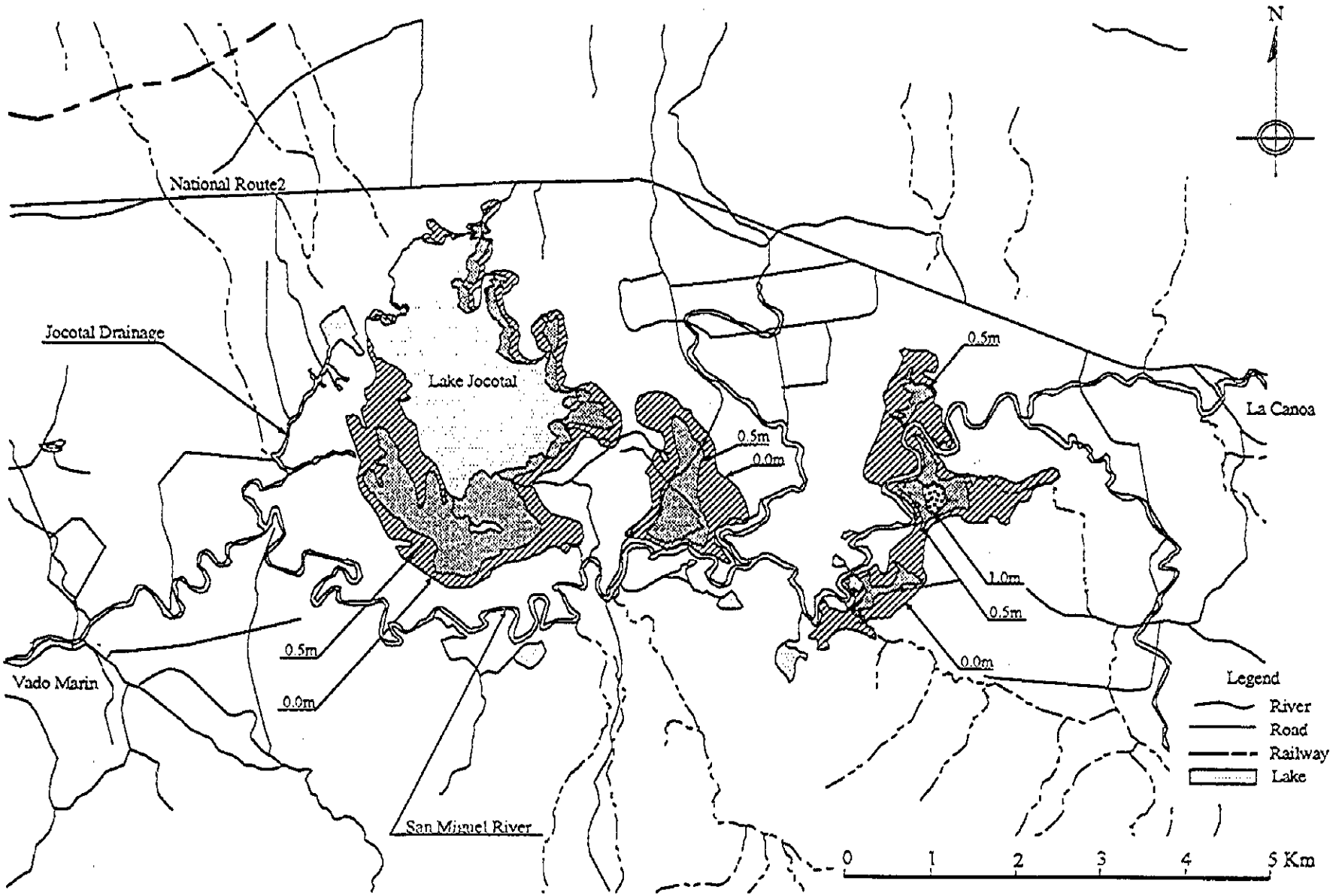


Figure 7.16 CONTOUR LINES OF INUNDATION DEPTH FOR 2 YEAR FLOOD UNDER P/P IN JOCOTAL AREA

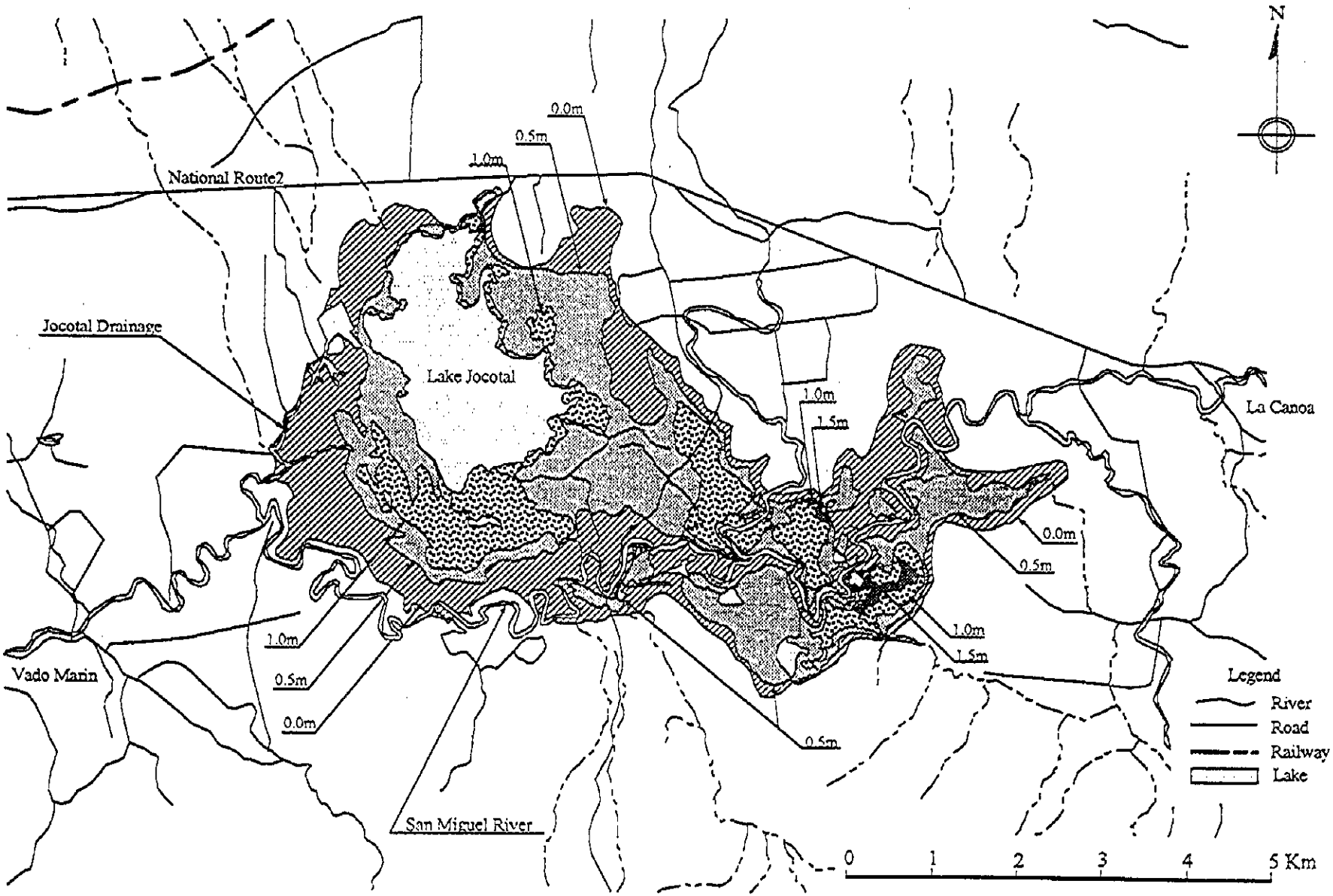


Figure 7.17 CONTOUR LINES OF INUNDATION DEPTH FOR 10 YEAR FLOOD UNDER P/P IN JOCOTAL AREA

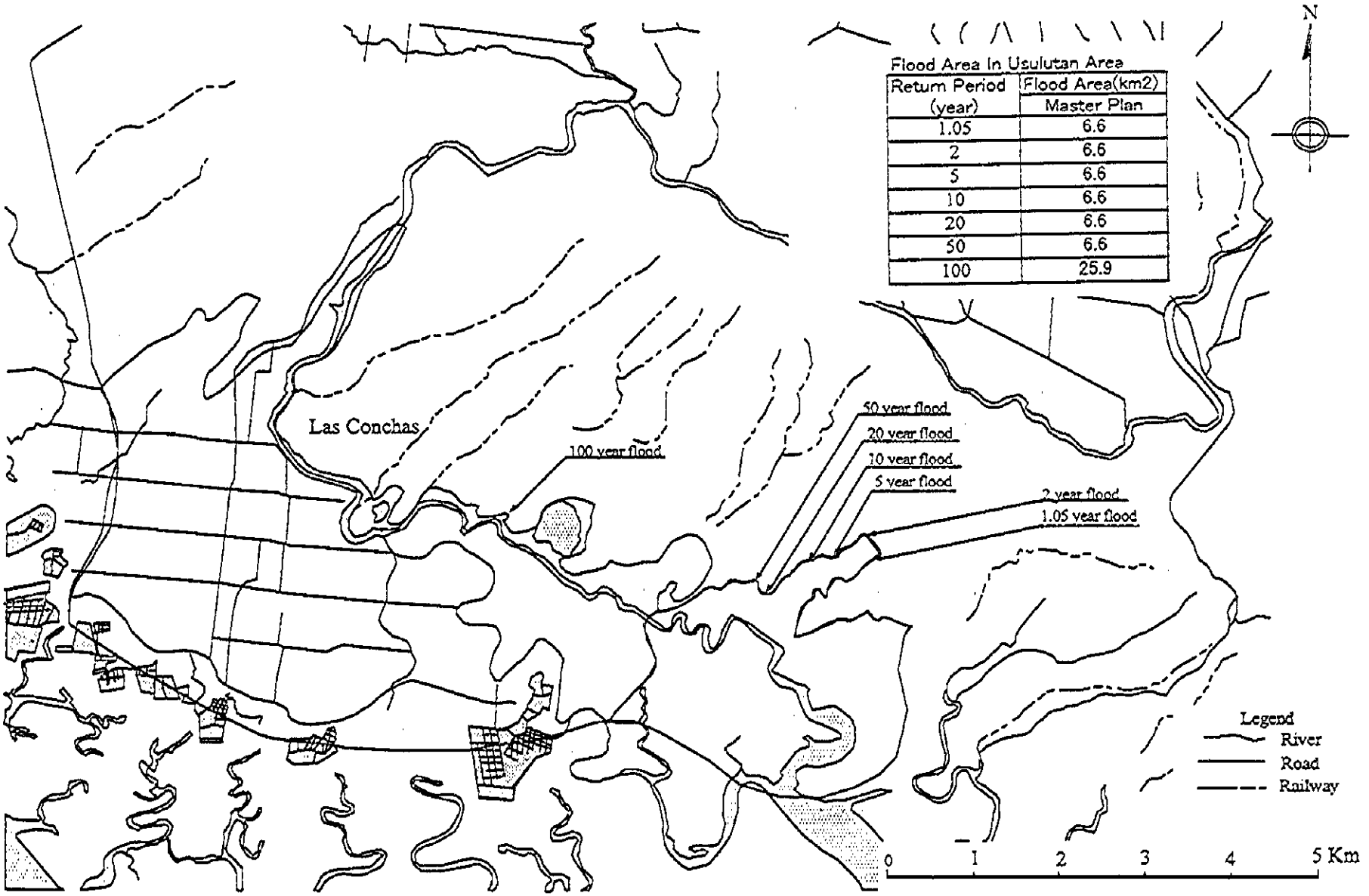


Figure 7.18 FLOOD RISK MAP IN USULUTAN AREA OF MASTER PLAN

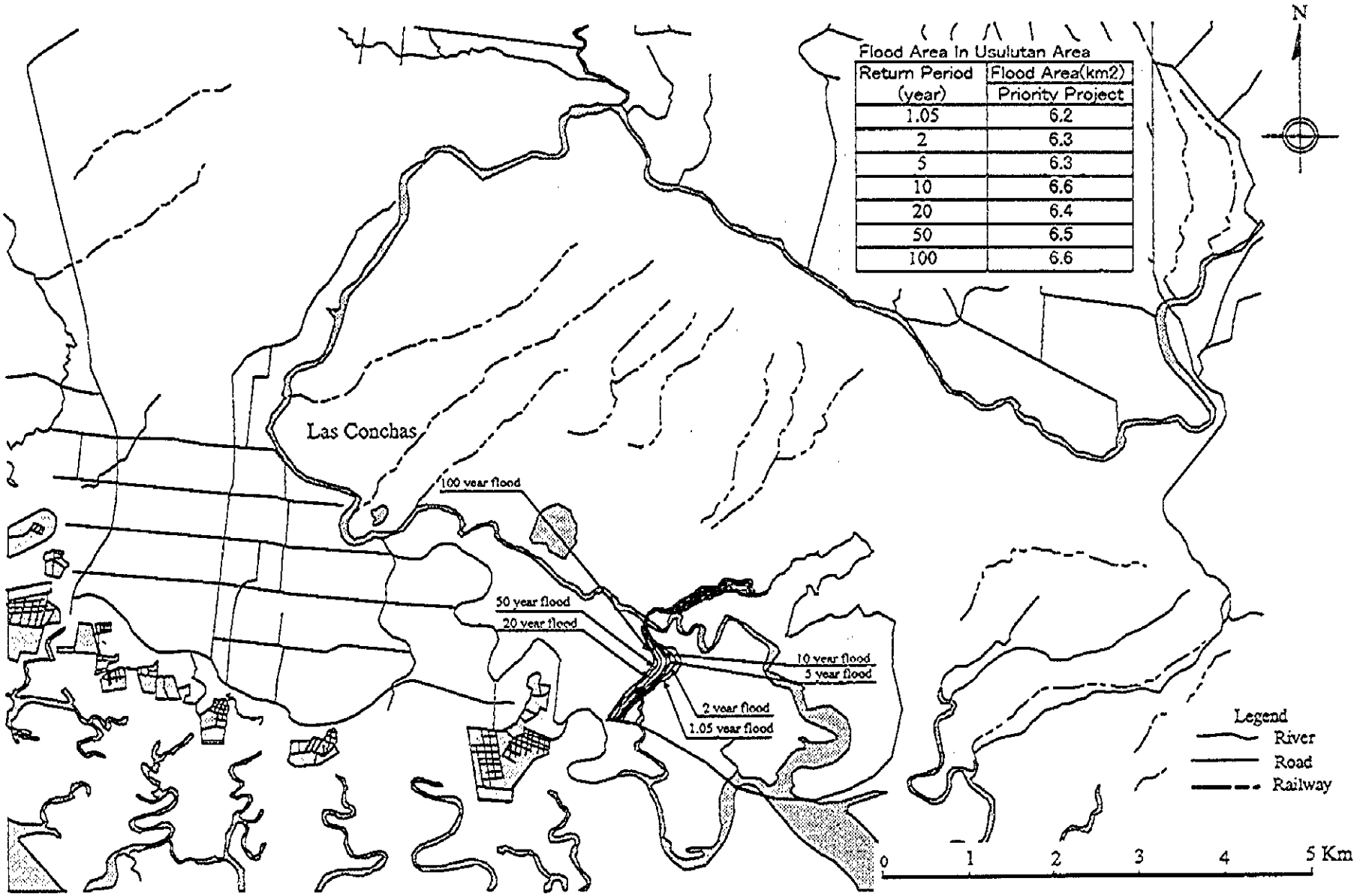


Figure 7.19 FLOOD RISK MAP IN USULUTAN AREA OF PRIORITY PROJECT

Flood Area In Usulutan Area

Return Period (year)	Flood Area(km2) Without Project
1.05	5.1
2	14.1
5	16.7
10	19.0
20	20.0
50	22.0
100	23.5

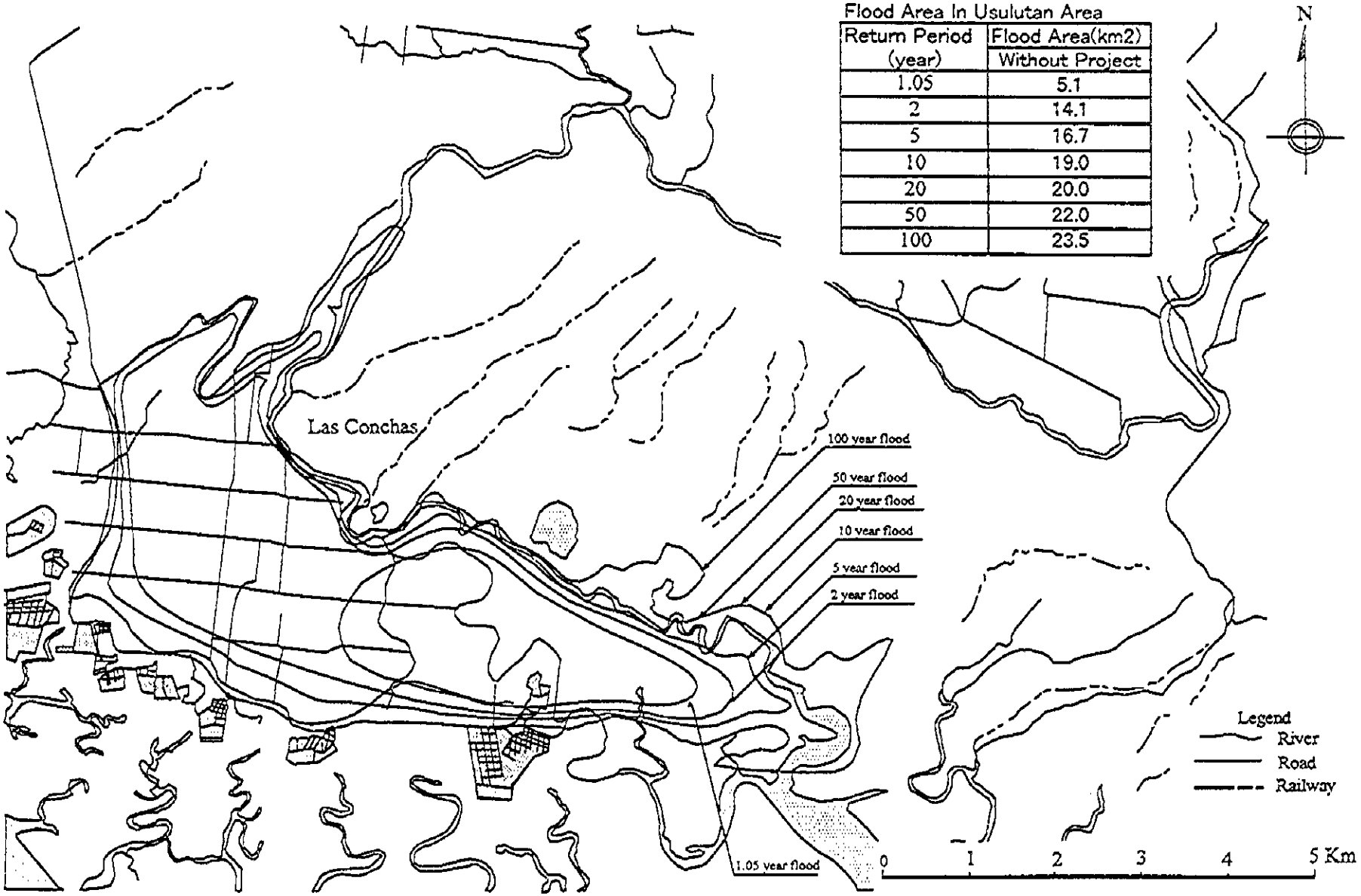


Figure 7.20 FLOOD RISK MAP IN USULUTAN AREA OF WITHOUT PROJECT

Figure 7.21 HYDROGRAPH AT MOSCOSO

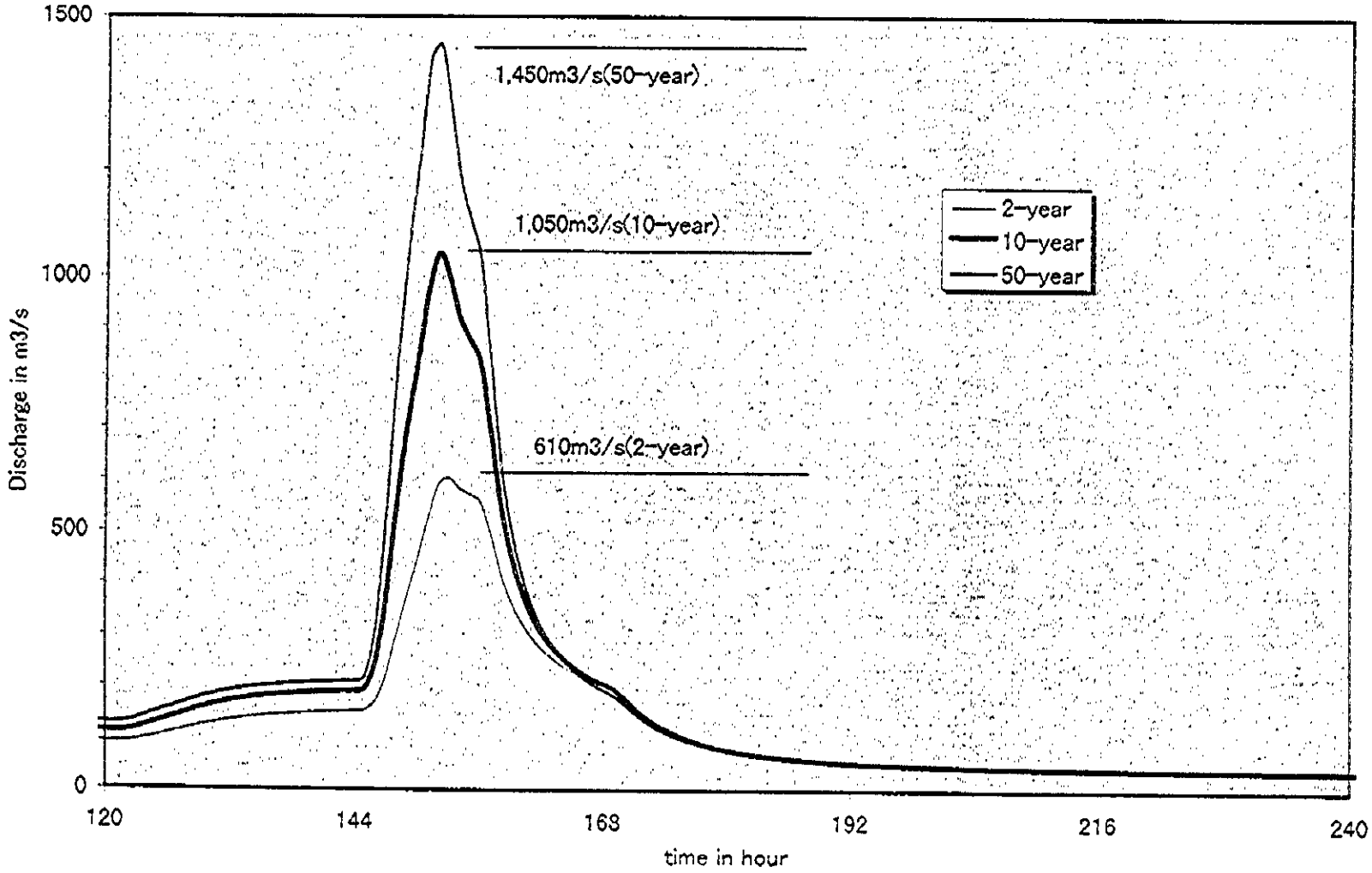


Figure 7.22 HYDROGRAPH AT EL DELIRIO UNDER M/P

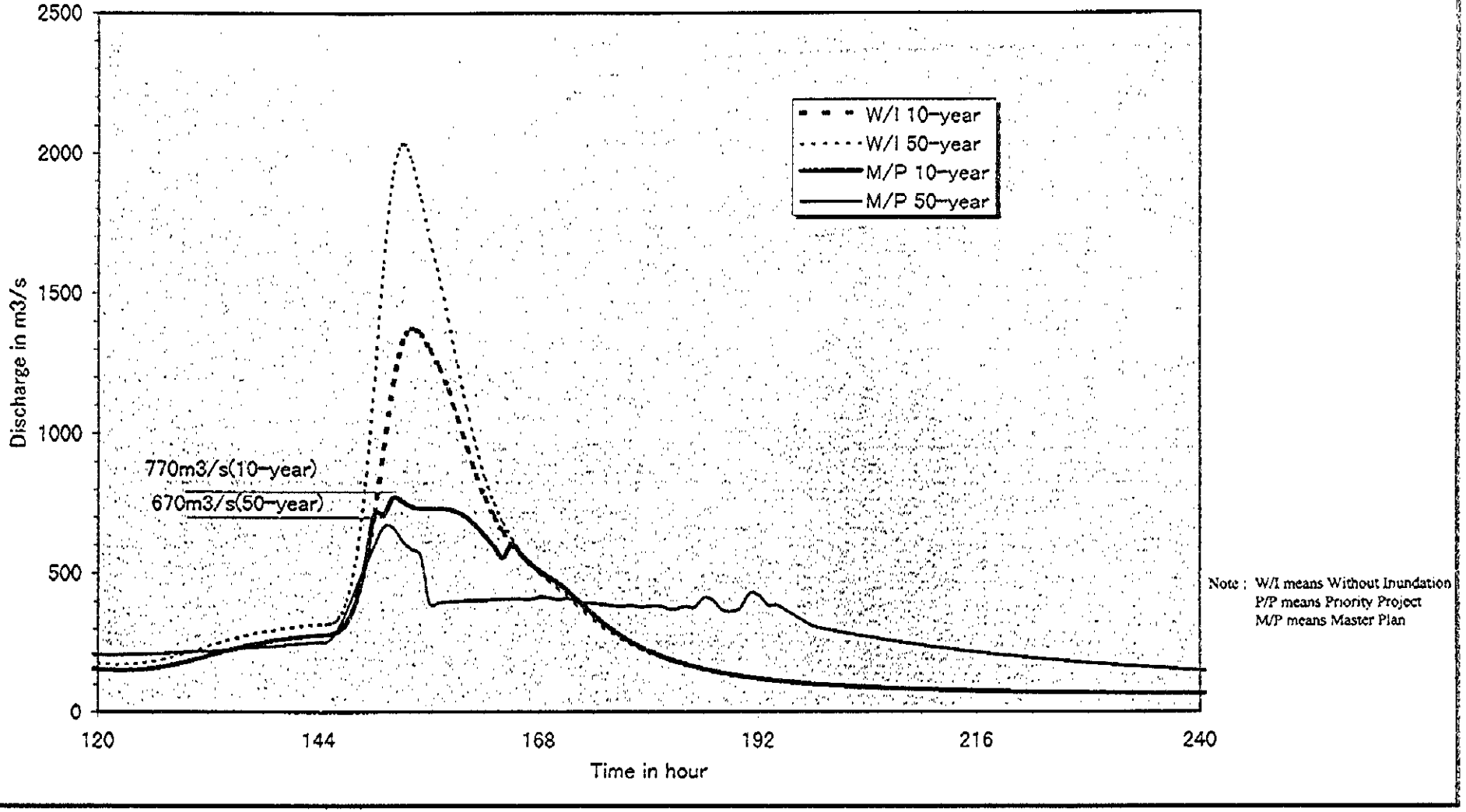


Figure 7.23 HYDROGRAPH AT VADO MARIN UNDER M/P

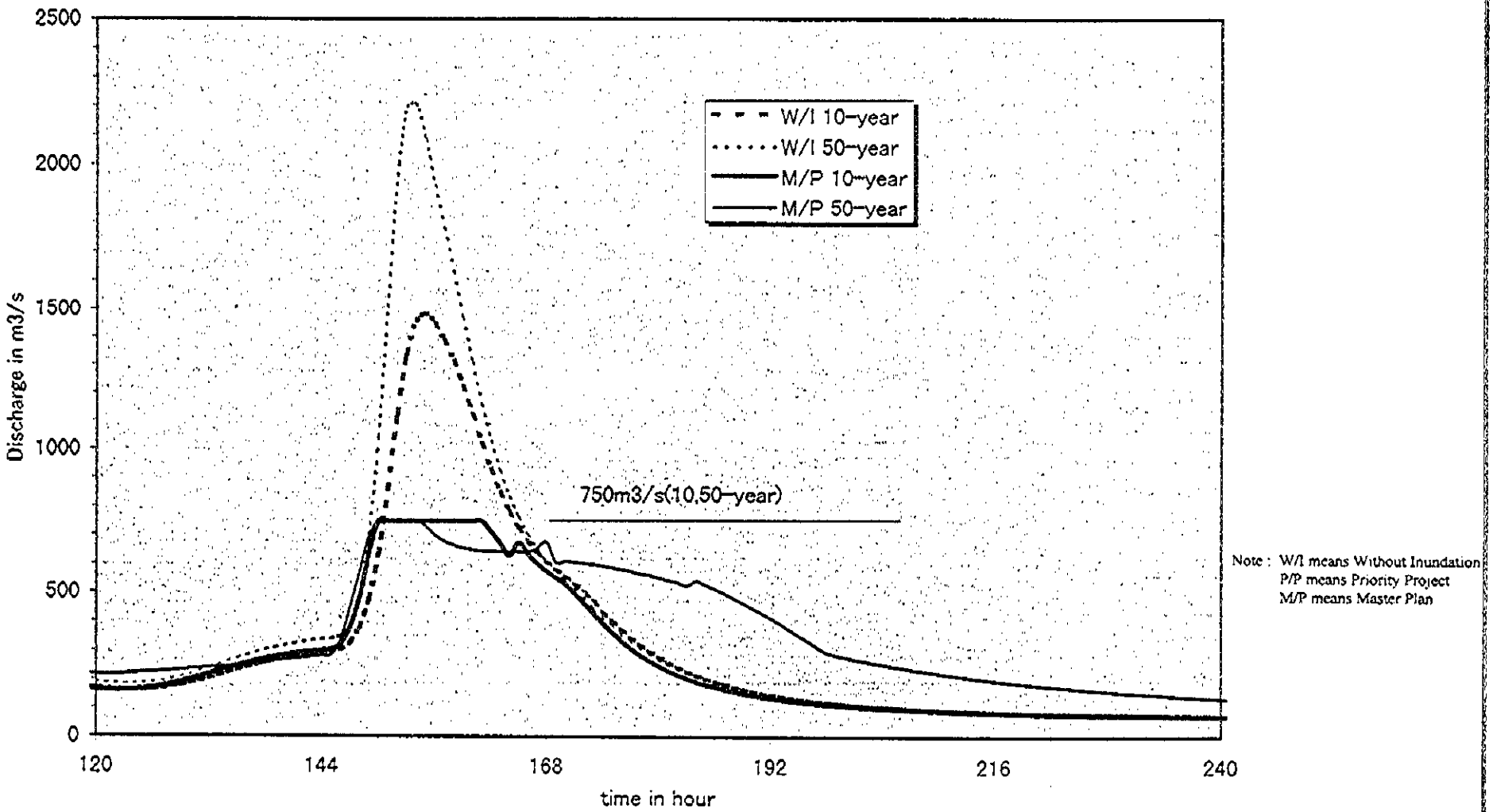


Figure 7.24 HYDROGRAPH AT LAS CONCHAS UNDER M/P

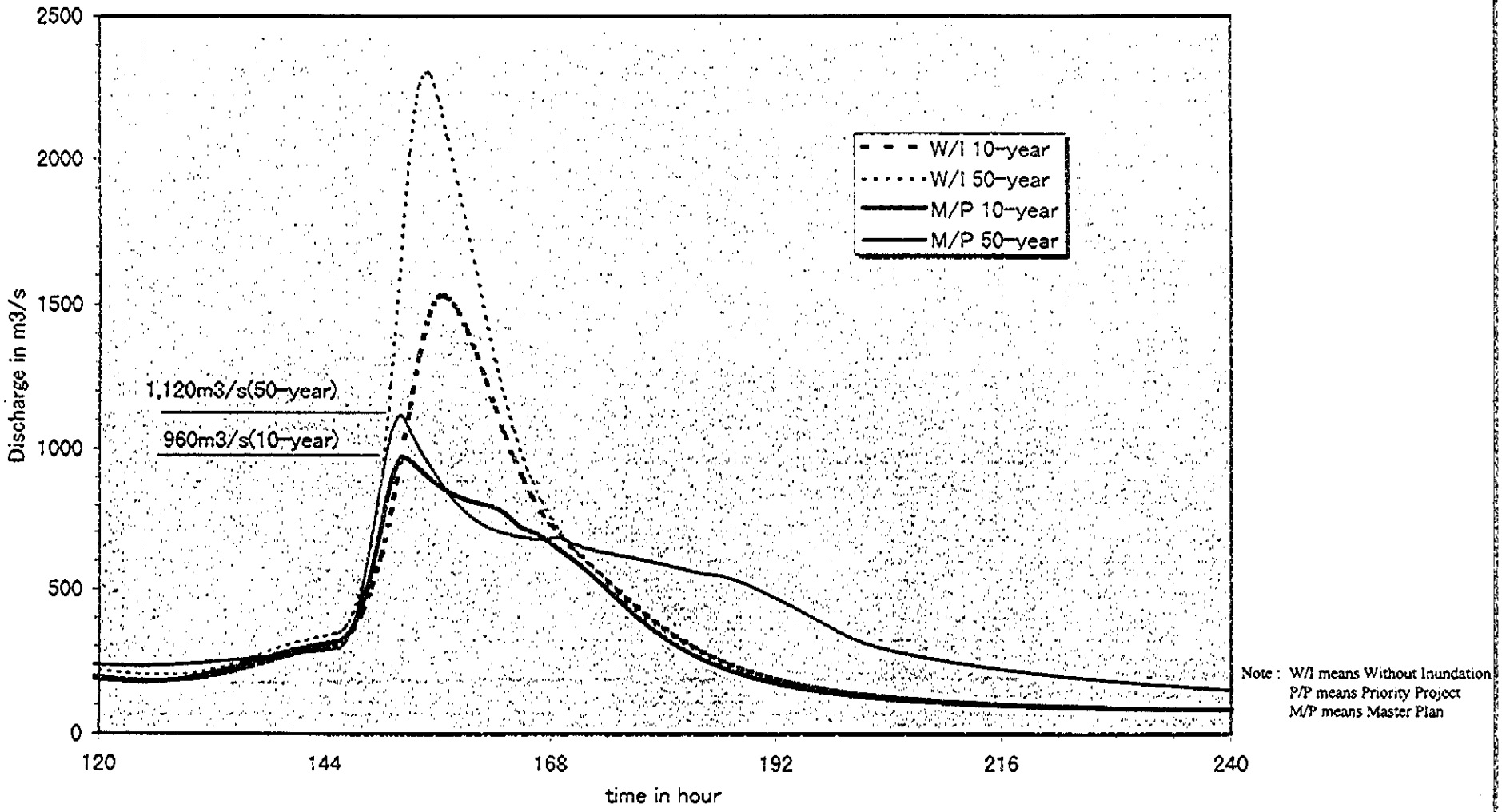


Figure 7.25 HYDROGRAPH AT EL DELIRIO UNDER P/P

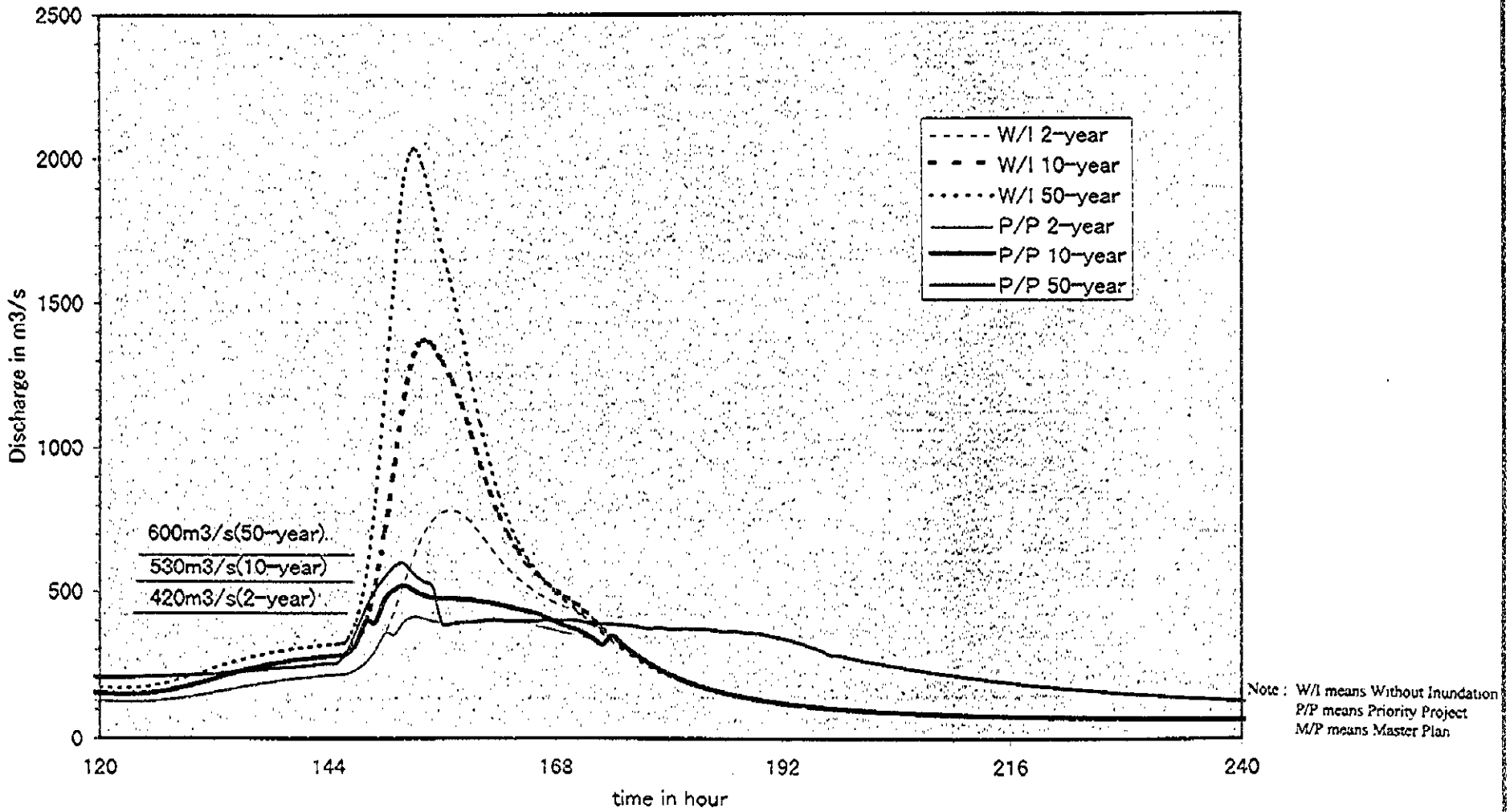


Figure 7.26 HYDROGRAPH AT VADO MARIN UNDER P/P

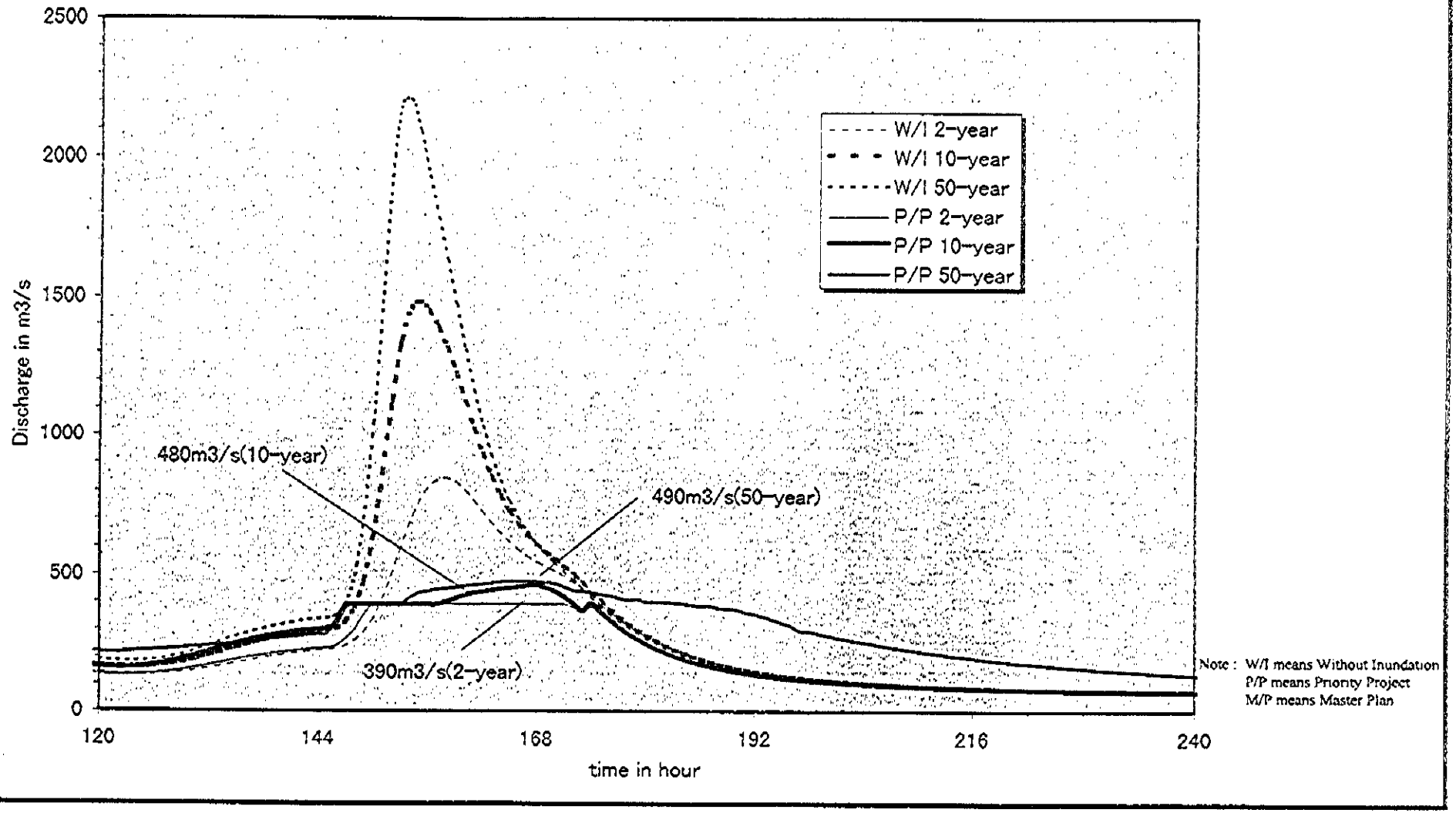
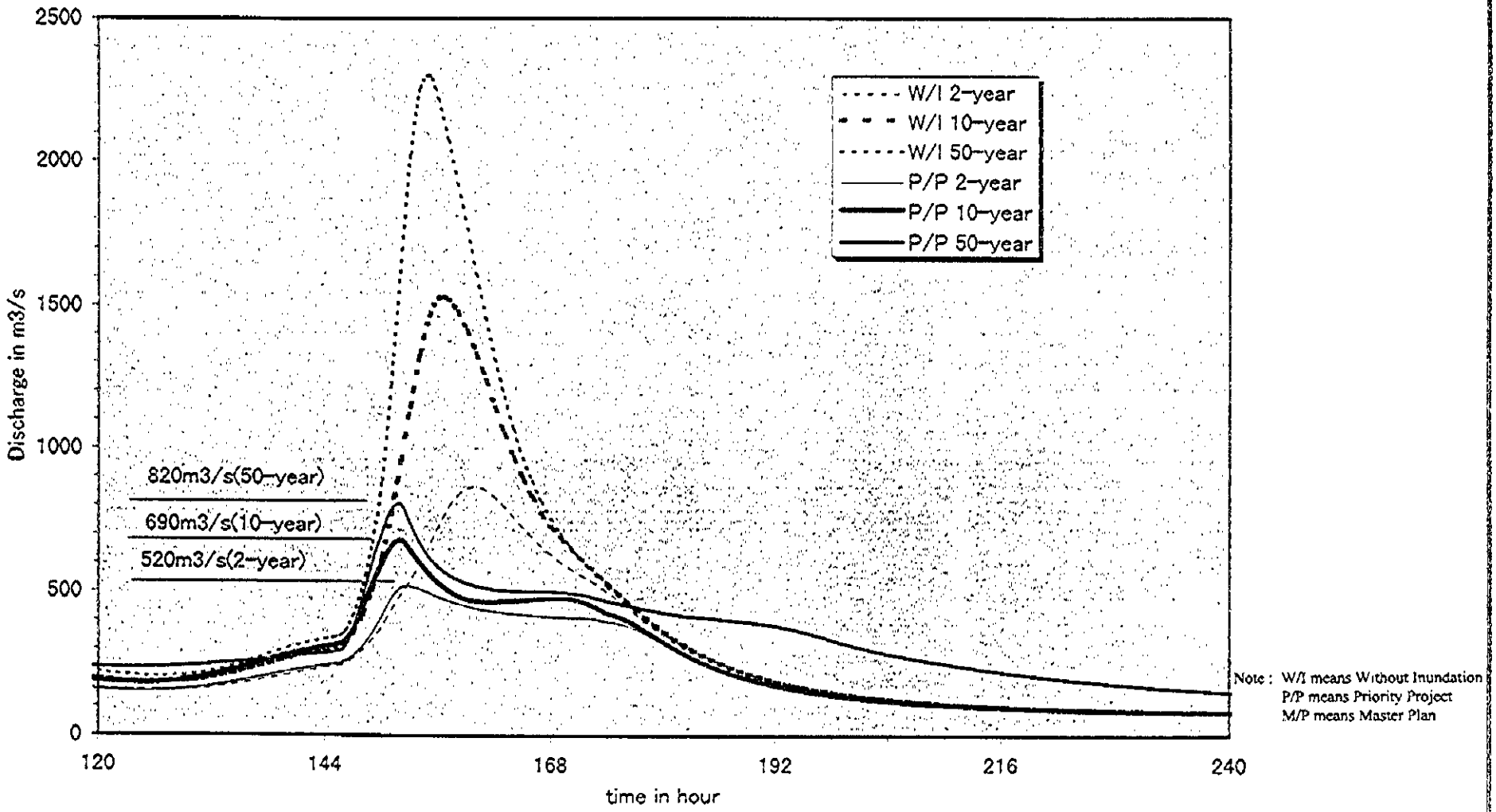


Figure 7.27 HYDROGRAPH AT LAS CONCHAS UNDER P/P



DATA BOOK

8: WATERSHED MANAGEMENT

List of Tables and Figures in Data Book 8: "WATERSHED MANAGEMENT"

Table 8.1 Sample of Direct Costs Integration estimated for the establishment and manage of a pure *Casuarina cunninghamiana** plantation (2,500 trees/ha)

Year	Task	Activity	Daily Wage/ha	Cost(US$)/ha
Year 1	PT	Cleaning	11	US$ 29.45
	PL	Hollow	15	US$ 29.45
	PL	Transport	5.9	US$ 15.58
	PL	Distribution	5.9	US$ 15.58
	PL	Plantation	5.9	US$ 15.58
	PL	Fertilization	5.9	US$ 15.58
	MT	Overgrowth cleaning	12.69	US$33.50
Year 2	MT	Replanting (10%)	12.69	US$ 33.50
	MT	Fertilization	12.69	US$ 33.50
	MT	Doble cutting	12.69	US$ 33.50
Year 3	MT	Triming	12.69	US$ 33.50
Year 5	MT	Triming	12.69	US$ 33.50
Year 6	RL	Triming (50%)		
	RL	Preparation	0.68	US$ 1.80
	RL	Marking	0.68	US$ 1.80
	RL	Felling	0.68	US$ 1.80
	RL	Branches cut off	0.68	US$ 1.80
	RL	Lodgging	0.68	US$ 1.80
	RL	Transport	0.68	US$ 1.80
TOTAL LABOR			Total	US$ 333.02

INPUTS:

Cathegory	Amount	Units	Price	Cost (US$)
Seedling	2,750.00	ea.		
Fertilizers	250.00	kg.		

Total Inputs:

* Labor and Inputs estimations are based on the management system recomended in the brocure "Casuarina in agroforestry systems" MADELEÑA/CATIE/DGF, San José Costa Rica, 1989.

PT: Soil Preparation
MT: Maintainance
PL: Plantation
RL: Triming

Table 8.2

REGIONAL SUMMARY OF YIELD AND DIRECT COST, IN US$,
IN PRODUCTION TASKS OF AUM (MULTIPLE USE TRESS), 1988-1989

		Countries - 1989				Central America		
						Total or Pondered Average		
		GT	HN	SV	CR	1989	1988	TOTAL
NURSERIES								
Number of nurseries		5	5,5	77	15,5	32	23	55*
Aver daily wages/1000 seedlings		10,5	23,2	11,8	5,4	10,4	14,5	121,1
Aveverage cost/1,000 seedlings		31,7	73	56,2	72,1	62,4	66,9	64,3
SOIL PREPARATION								
Number of tasks			5	6	51	62	23	85*
Average daily wages/ha		3/	81,2	42,8	24	30,4	38,7	32,6
Average cost ($) 2/			232,6	69,9	140,1	140,8	127,2	137,1
PLANTATION								
Number of tasks			4	5	51	60	23	83*
Average daily wages/ha		3/	19,7	23,5	34,2	29,1	27,8	28,7
Average cost ($) 2/			307,9	177,3	300,6	290,8	252	2801
MAINTAINANCE								
Number of tasks			5	5	51	61	18	79*
Average daily wage/ha	Year 1		54,1(1)	-	4/	54,1(01)	28,9	30,2
	Year 2	IT	40,2(2)	-	25,4	26,0(53)	26,5	26,1
	Year 3	WASN'T	16,8(1)	38,6(3)	10,6	12,2(55)	14,8	12,8
	Year 4	-	-	8,6	8,6(51)	13,4	9,9	
	Year 5		17,1(1)	45,9(2)	3,1	4,9(54)	-	4,9
Average cost/ha ($) 2/	Year 1		162,2	-	2/	162,2	147,2	139,5
	Year 2	IT	120,7	-	159,8	157,5	100,7	143,1
	Year 3	WASN'T	50,5	71,9	56,2	57	48,1	54,8
	Year 4	-	-	46,7	46,7	39,2	44,7	
	Year 5	42,9	100,8	14,9	18,6	-	18,6	
TRIMING								
Number of tasks		7	8	7	IT	22	13	35*
Aver. daily wage/1000 trees 1/		35,1	15,1	36,5	WASN'T	28,3	32,7	29,9
Average cost/1000 trees ($) 2/		73	40	63,3		58	86	68,4
TOTAL EXPROITATION								
Number of tasks		5	4	5	IT	14	15	29*
Aver. daily wage/1000 trees 1/		45,2	24,8	29	WASN'T	33,6	74,9	55
Average cost/1000 trees ($) 2/		76,2	132,7	50,25		83,1	120,1	102,2

1/ Information for 1,000 extracted trees

2/ Currency conversion values 14US = 4.27Q; = 2.00 L; = 6.92¢ELS; = 88.30 ¢COS.
This includes: labor and inputs. (SOURCE: ACAN-EFE, May, 1990). This costs only include direct costs of each task (Total value of labor and inputs).

3/ Tasks like soil preparation and alived borders were not included because the information correspond to pure plantations systems with seedlings in plastic bags.

4/ Labor and maintainance costs of the first year are included in the plantation costs

* It refers to the total adding of each type of task.

Table 8.3 SOIL PREPARATION: DAILY WAGES AND LABOR COSTS FOR PURE PLANTATION ACTIVITIES OF 1 Ha. WITH PLANTATION DENSITIES OF 2500, 1600 and 1111 TREES BY HECTARE.

	Labor and costs by hectare (in US$)						
	2500 trees/ha			1600 tress/ha		1111 tress/ha	
		Daily Wage	($)	Daily Wage	($)	Daily Wage	($)
	1	0.05	0.15	0.05	0.15	0.05	0.15
	21	12.60	33.27	12.60	33.27	12.60	33.27
	1	4.11	10.85	4.11	10.85	4.11	10.85
	1	0.18	0.46	0.18	0.46	0.18	0.46
	1	5.93	15.67	5.93	15.67	5.93	15.67
	1	1.44	3.80	1.44	3.80	1.44	3.80
	12	2.76	7.28	2.76	7.28	2.76	7.28
	105	11.15	29.45	7.14	18.85	4.96	13.09
	11	12.95	34.18	8.29	21.88	5.75	15.19

Table 8.4 **PRINCIPAL SPECIES FOR REFORESTATION IN THE BASIN OF RIO GRANDE DE SAN MIGUEL**

COMMON NAME	SCIENTIFIC NAME	ALTITUDE (mosl)
Laurel	*Cordia alliodora*	0 - 1,000
Chaquiro	*Colubrina ferruginosa*	0 - 1,200
Leucaena	*Leucaena leucocephala*	0 - 700
Madrecacao	*Gliricidia sepium*	0 - 900
Memble	*Poeppigia procera*	0 - 900
Maquilishuat	*Tabebuia rosea*	0 - 800
Cedro	*Cedrela mexicana*	0 - 1,000
Caulote	*Guazuma ulmifolia*	0 - 1,000
Carbón	*Mimosa tenuiflora*	0 - 800
Paraíso	*Melia azederach*	0 - 800
Cortez Blanco	*Roseodendron*	0 - 800
Conacaste	*Enterolobium cyclocarpum*	0 - 900
Almendro de Río	*Andira inirmis*	500 - 1,000
Caoba	*Switenia humilis*	100 - 1,000
CONIFERAS		
Pino Caribe	*Pinus carbaea*	500 - 1,500
Pino Ocote	*Pinus oocarpa*	800 - 1,600
Ciprés	*Cupressus lusitanica*	1,300 - 3,300

Prepared by
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Table 8.5 PRINCIPAL EXOTIC SPECIES THAT MAY BE USED FOR REFORESTATION IN THE BASIN OF RIO GRANDE DE SAN MIGUEL

COMMON NAME	SCIENTIFIC NAME	ALTITUDE (mosl)
Teca	*Tectona grandis*	0 - 800
Cemaldulensis	*Eucalyptus camaldulensis*	500 - 1,400
Neem	*Azadirachta indica*	500 - 1,000
Eucalipto Citriodora	*Eucalyptus citriodura*	500 - 1,000
Flor Amarilla	*Cassia siamea*	500 - 1,000
Melina	*Gmelina arborea*	0 - 800
Mangium	*Acacia mangium*	500 - 1,000
Eucalipto	*Eucalyptus grandis*	500 - 1,000
Eucalipto	*Eucalyptus tereticornis*	500 - 1,000
Eucalipto	*Eucalyptus saligna*	500 - 1,000

Prepared by
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FOREST SERVICE
D.G.R.N.R., M.A.G.

DATA BOOK

9: RESULT OF SURVEY

List of Table and Figures in Data Book 9: "RESULT OF SURVEY"

Table 9.1 LIST OF RIVER CROSS SECTIONS(1/2)

SAN MIGUEL RIVER

NO	INTERVAL (km)	0 DISTANCE(km)	NO	INTERVAL (km)	ACCUMULATED DISTANCE(km)	NO	INTERVAL (km)	ACCUMULATED DISTANCE(km)	NO	INTERVAL (km)	ACCUMULATED DISTANCE(km)
0	10.52	10.52	51	0.40	36.32	101	0.30	66.82	151	0.60	95.32
1	0.70	11.22	52	0.40	36.72	102	0.30	67.12	152	0.50	95.82
2	0.40	11.62	53	0.40	37.12	103	0.50	67.62	153	0.60	96.42
3	0.40	12.02	54	0.40	37.52	104	0.50	68.12	154	0.50	96.92
4	0.40	12.42	55	0.50	38.02	105	0.60	68.72	155	0.50	97.42
5	0.80	13.22	55	0.60	38.62	106	0.50	69.22	156	0.50	97.92
6	0.50	13.72	57	0.50	39.12	107	0.60	69.82	157	0.50	98.42
7	0.20	13.92	58	0.50	39.62	108	0.50	70.32	158	0.10	98.52
8	0.60	14.52	58A	0.20	39.82	109	0.50	70.82	159	0.50	99.02
9	0.40	14.92	59	0.30	40.12	110	0.70	71.52	160	0.50	99.52
10	0.40	15.32	60	0.50	40.62	111	0.80	72.32	161	0.40	99.92
11	0.40	15.72	61	0.50	41.12	112	0.60	72.92	162	0.50	100.42
12	0.90	16.62	62	0.80	41.92	113	0.50	73.42	163	0.60	101.02
13	0.60	17.22	63	0.80	42.72	114	0.50	73.92	164	0.50	101.52
14	0.50	17.72	64	0.50	43.22	115	0.40	74.32	165	0.60	102.12
15	0.40	18.12	65	1.00	44.22	116	0.50	74.82	166	0.20	102.32
16	0.70	18.82	66	0.50	44.72	117	0.70	75.52	167	0.30	102.62
17	0.50	19.32	67	0.50	45.22	118	0.60	76.12	168	0.50	103.12
18	0.40	19.72	68	0.45	45.67	119	0.90	77.02	169	0.50	103.62
19	0.40	20.12	68A	0.20	45.87	120	0.50	77.52	170	0.50	104.12
20	0.50	20.62	69	0.45	46.32	121	0.70	78.22	171	0.50	104.62
21	0.50	21.12	70	0.60	46.92	122	0.70	78.92	172	1.00	105.62
22	0.60	21.72	71	0.80	47.72	123	0.70	79.62	173	0.60	106.22
23	0.50	22.22	72	0.30	48.02	124	0.80	80.42	174	0.60	106.82
24	0.70	22.92	73	0.40	48.42	125	0.60	81.02	175	0.80	107.62
25	0.50	23.42	74	1.50	49.92	126	0.60	81.62	176	0.60	108.22
26	0.40	23.82	75	0.40	50.32	127	0.60	82.22	177	0.50	108.72
27	0.50	24.32	76	1.00	51.32	128	0.30	82.52	178	0.50	109.22
28	0.50	24.82	77	1.00	52.32	129	0.70	83.22	179	0.50	109.72
29	0.40	25.22	78	0.60	52.92	130	0.80	84.02	180	0.50	110.22
30	0.50	25.72	79	0.50	53.42	131	0.60	84.62	181	0.40	110.62
31	0.80	26.52	80	1.00	54.42	132	0.50	85.12	182	0.60	111.22
32	0.70	27.22	81	0.50	54.92	133	0.50	85.62	183	0.50	111.72
33	0.50	27.72	82	0.40	55.32	134	0.60	86.22	184	0.30	112.02
34	0.30	28.02	83	0.65	55.97	135	0.50	86.72			
35	0.30	28.32	83A	0.15	56.12	136	0.60	87.32			
36	0.50	28.82	84	0.40	56.52	137	0.50	87.82			
37	0.50	29.32	85	0.90	57.42	138	0.50	88.32			
38	0.40	29.72	86	0.90	58.32	139	0.60	88.92			
39	0.50	30.22	87	0.50	58.82	140	0.50	89.42			
40	0.50	30.72	88	0.50	59.32	141	0.50	89.92			
41	0.50	31.22	89	0.60	59.92	142	0.60	90.52			
42	0.40	31.62	90	0.60	60.52	143	0.60	91.12			
43	0.60	32.22	91	0.60	61.12	144	0.50	91.62			
44	0.40	32.62	92	0.60	61.72	145	0.50	92.12			
45	0.40	33.02	93	0.50	62.22	146	0.60	92.72			
46	0.60	33.62	94	0.50	62.72	147	0.50	93.22			
47	0.50	34.12	95	0.60	63.32	148	0.50	93.72			
48	0.80	34.92	96	0.80	64.12	149	0.50	94.22			
49	0.50	35.42	97	0.60	64.72	150	0.50	94.72			
50	0.50	35.92	98	0.60	65.32						
			99	0.60	65.92						
			100	0.60	66.52						

JOCOTAL DRAINAGE

84			confluence of San Miguel River
	INTERVAL	ACCUMULATED DISTANCE	
1	1.00	44.22	from the river mouth of San Miguel River

OLOMEGA DRAINAGE

104			confluence of San Miguel River
	INTERVAL	ACCUMULATED DISTANCE	
1	0.20	68.32	from the river mouth of San Miguel River
2	1.00	69.32	
3	1.20	70.52	
4	1.60	72.12	
5	1.00	73.12	
6	0.50	73.62	
7	0.10	73.72	

Table 9.1 LIST OF RIVER CROSS SECTIONS(2/2)

PELOTA RIVER

5			confluence of Olomega Drainage
	INTERVAL	ACCUMULATED DISTANCE	
1	1.00	74.12	from the river mouth of San Miguel River
2	1.50	75.62	
3	1.30	76.92	
4	1.20	78.12	
5	0.10	78.22	

TAISIHUAT RIVER

165			confluence of San Miguel River
	INTERVAL	ACCUMULATED DISTANCE	
1	0.20	102.32	from the river mouth of San Miguel River
2	0.60	102.92	
3	0.50	103.42	

VILLERIAS RIVER

184			confluence of San Miguel River
	INTERVAL	ACCUMULATED DISTANCE	
1	0.20	112.22	from the river mouth of San Miguel River
2	0.50	112.72	
3	0.60	113.32	

GUAYABAL RIVER

184			confluence of San Miguel River
	INTERVAL	ACCUMULATED DISTANCE	
1	0.20	112.22	from the river mouth of San Miguel River
2	0.60	112.82	
3	0.60	113.42	

SAN MIGUEL RIVER (SUPPLEMENTARY SURVEY)

	No.102	67.12	
NAME	DISTANC	ACCUMULATED DISTANCE	
300	0.30	67.42	from the river mouth of San Miguel River
362	0.35	67.48	
371	0.37	67.49	
380	0.38	67.50	
386	0.39	67.51	
424	0.42	67.54	
439	0.44	67.56	
609	0.61	67.73	
617	0.62	67.74	
1117	1.12	68.24	
1135	1.14	68.26	

OLOMEGA DRAINAGE (SUPPLEMENTARY SURVEY)

	OL1	68.32	
NAME	DISTANC	ACCUMULATED DISTANCE	
300	0.30	68.62	from the river mouth of San Miguel River
490	0.49	68.81	
550	0.55	68.87	
650	0.65	68.97	
655	0.66	68.98	
735	0.74	69.06	
955	0.96	69.28	

JOCOTAL DRAINAGE (SUPPLEMENTARY SURVEY)

	N064	43.22	
NAME	DISTANC	ACCUMULATED DISTANCE	
50	0.05	43.27	from the river mouth of San Miguel River
450	0.45	43.67	
810	0.81	44.03	
2390	2.39	45.61	
2395	2.40	45.62	where the weir is located

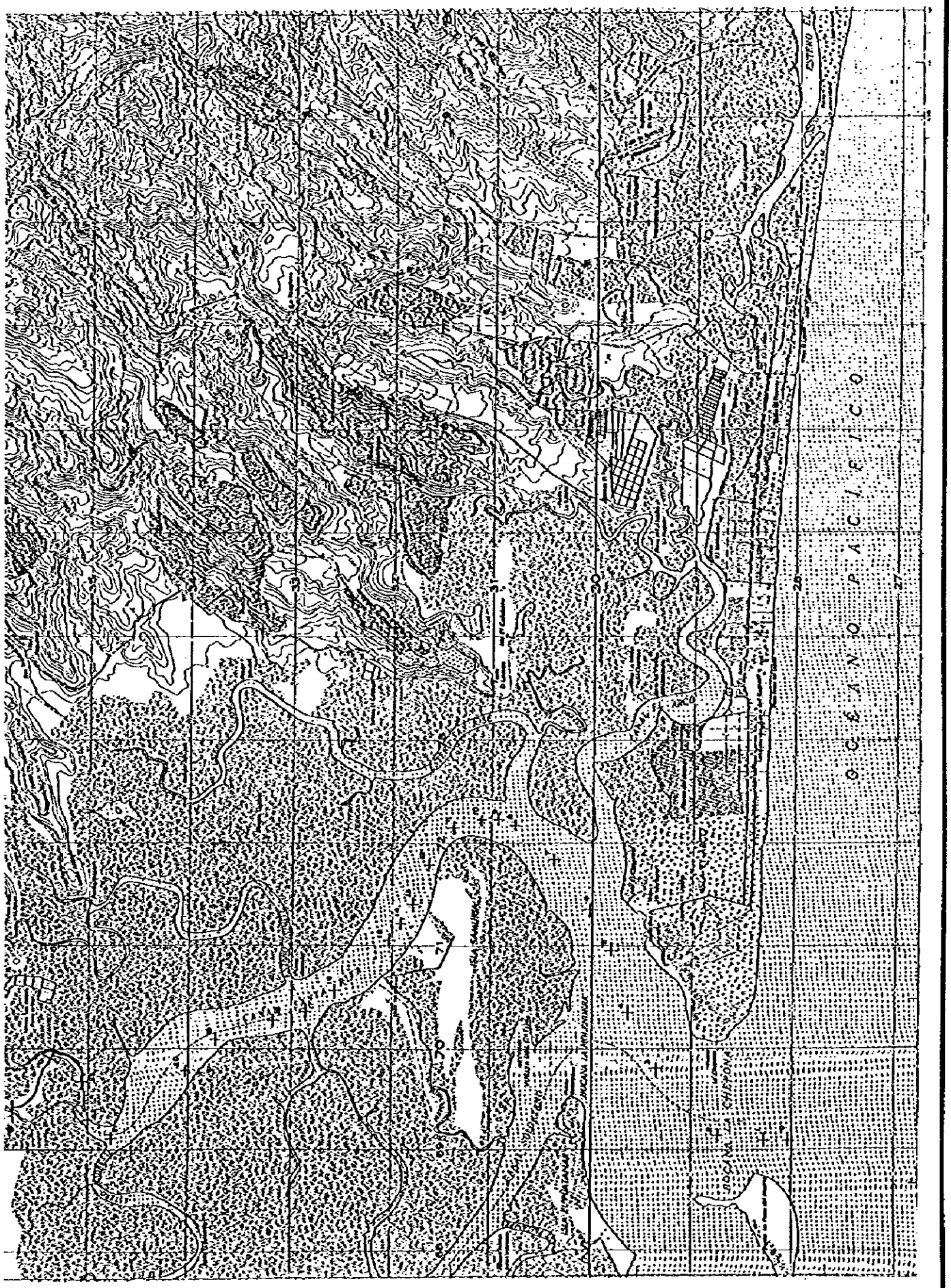

Figure 9.1 (1/8) LOCATION OF RIVER CROSS SECTIONS

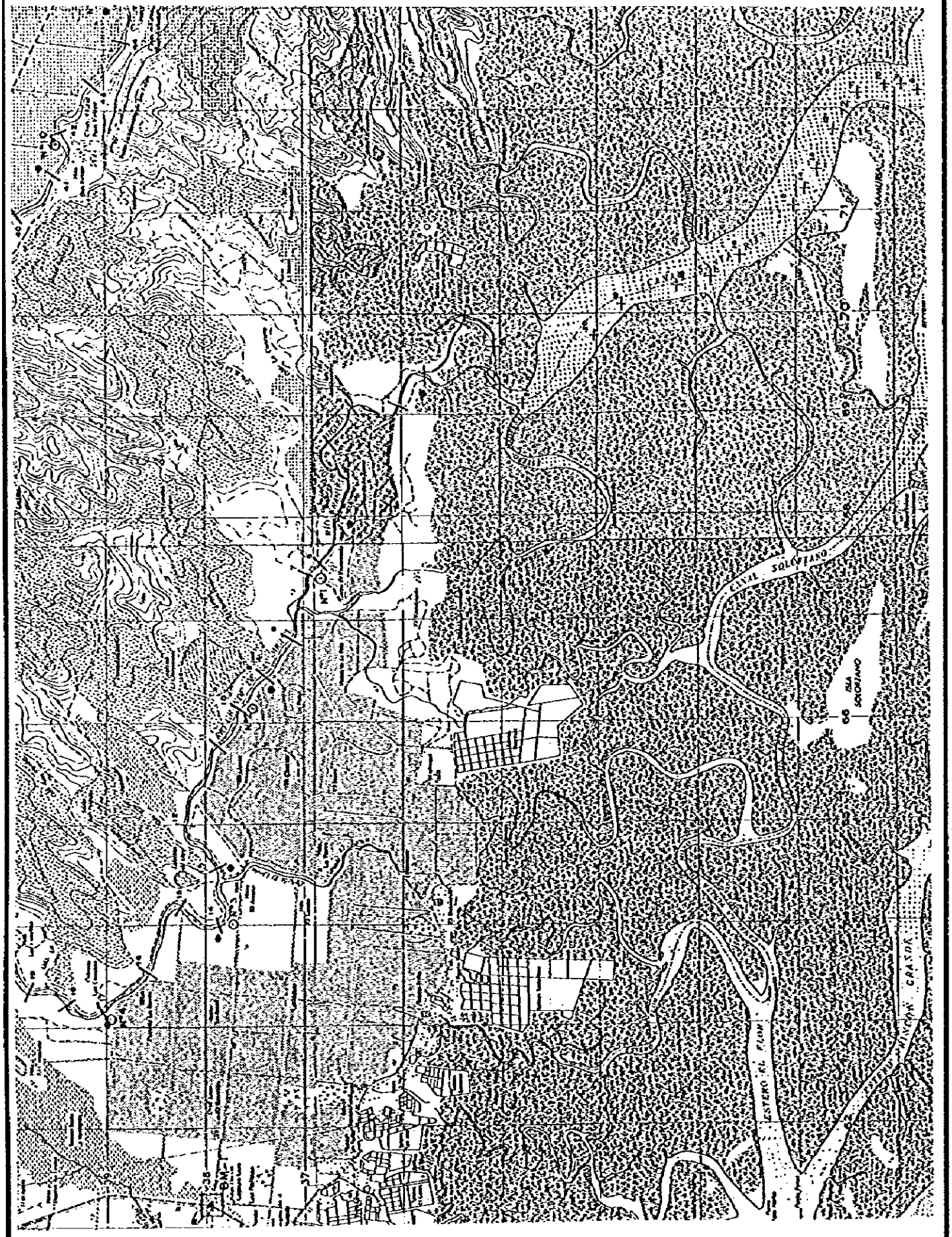

Figure 9.1 (2/8) LOCATION OF RIVER CROSS SECTIONS

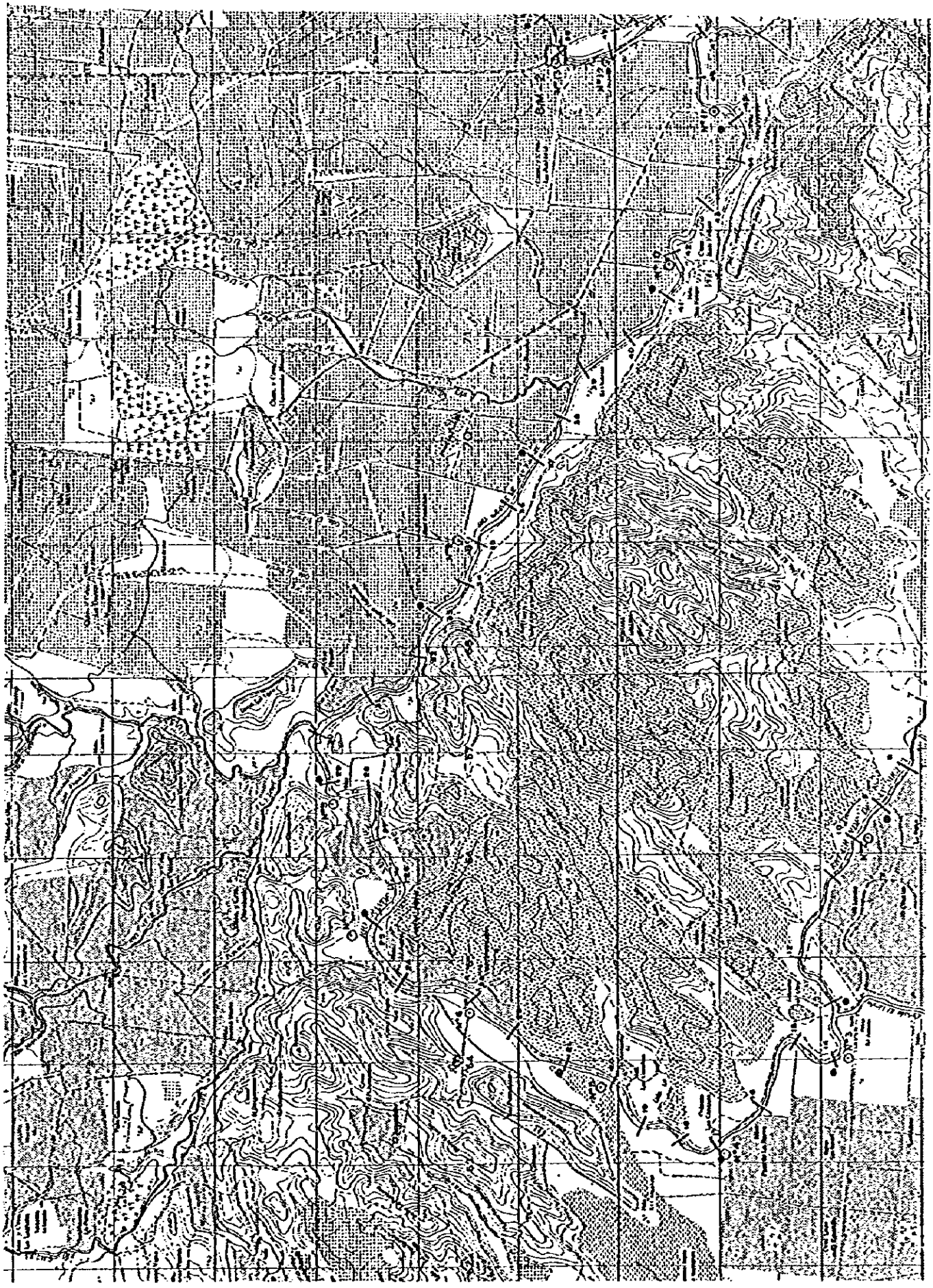

Figure 9.1 (3/8) LOCATION OF RIVER CROSS SECTIONS

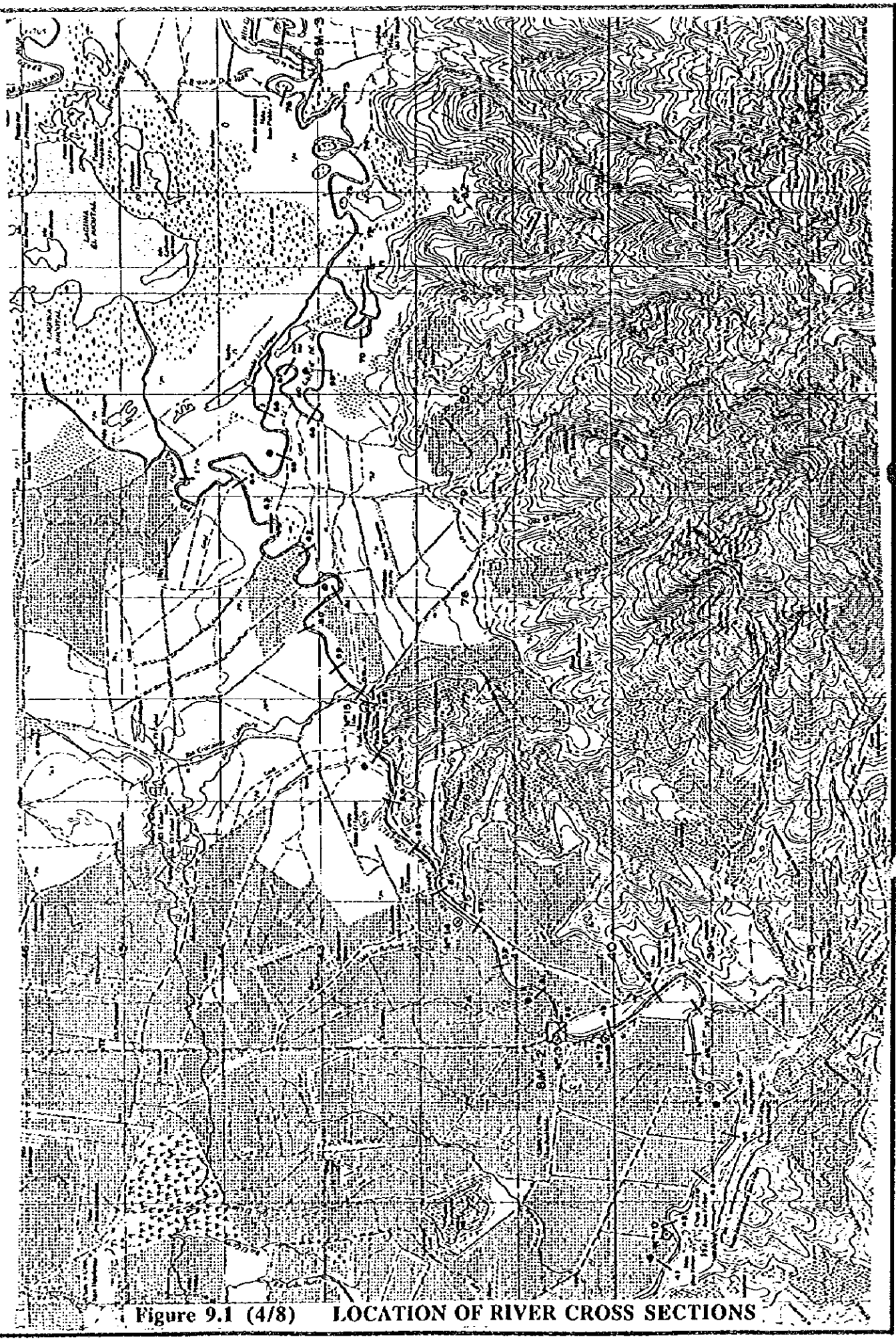

Figure 9.1 (4/8) LOCATION OF RIVER CROSS SECTIONS

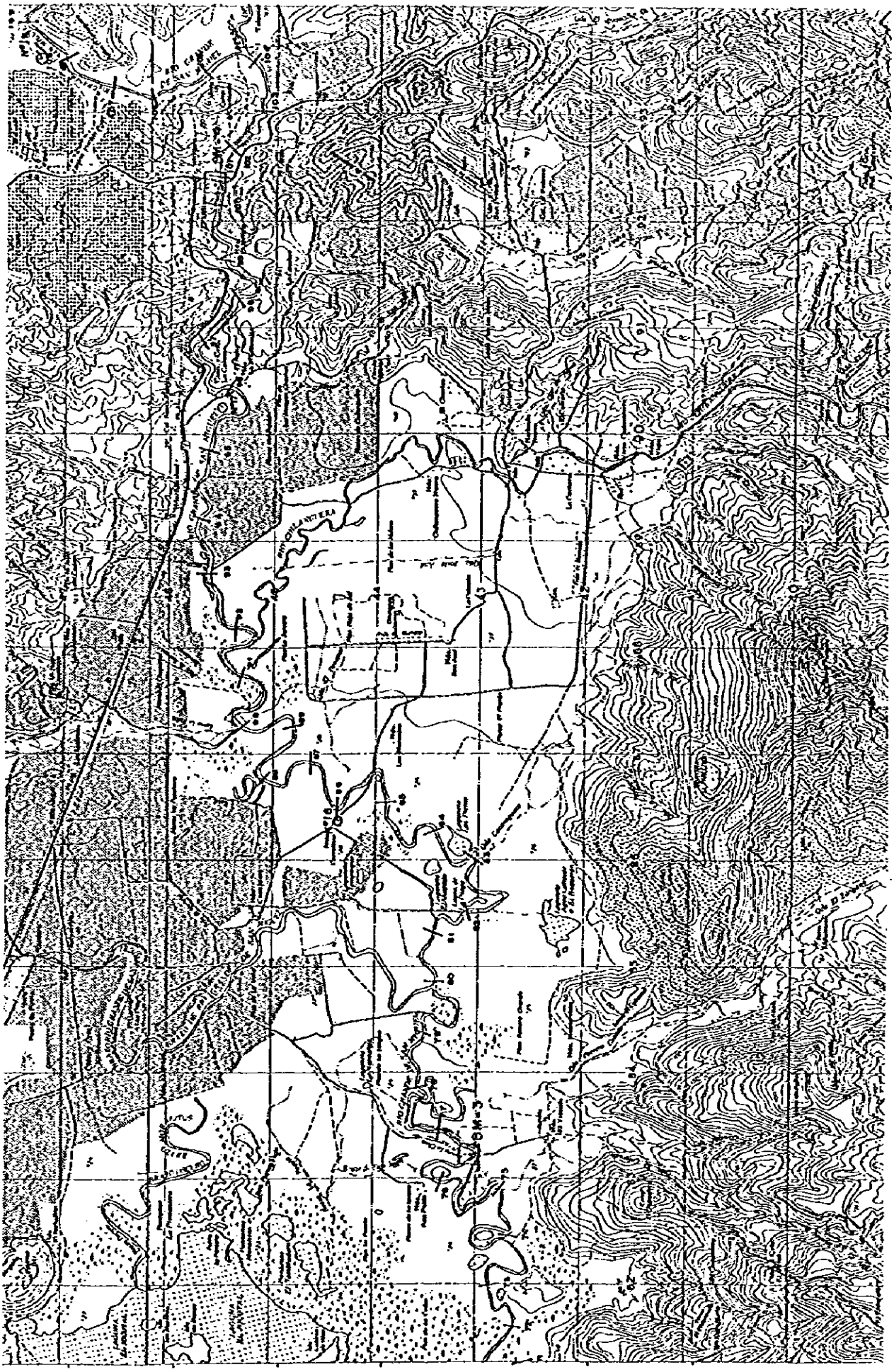

Figure 9.1 (5/8) LOCATION OF RIVER CROSS SECTIONS

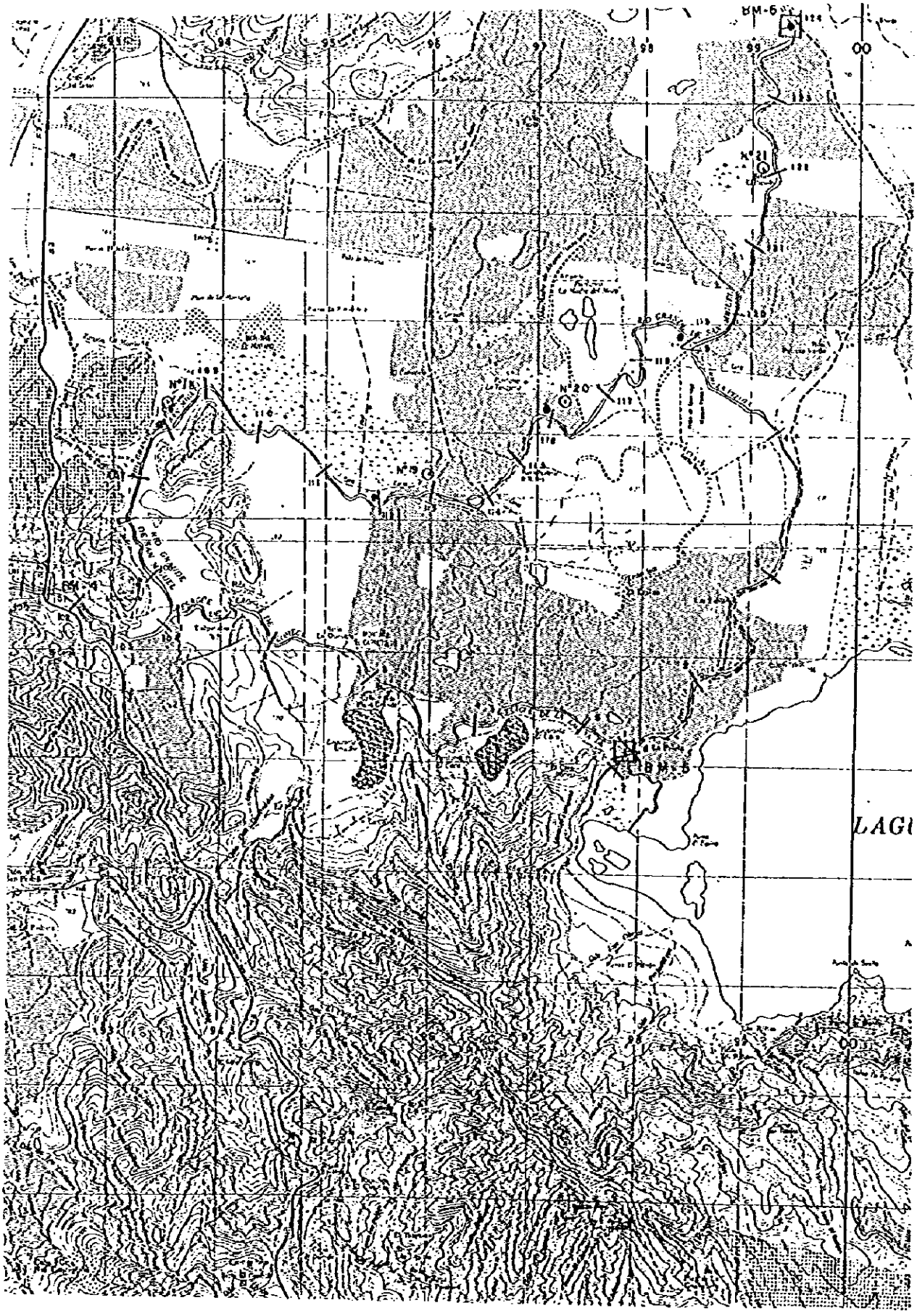

Figure 9.1 (6/8) LOCATION OF RIVER CROSS SECTIONS

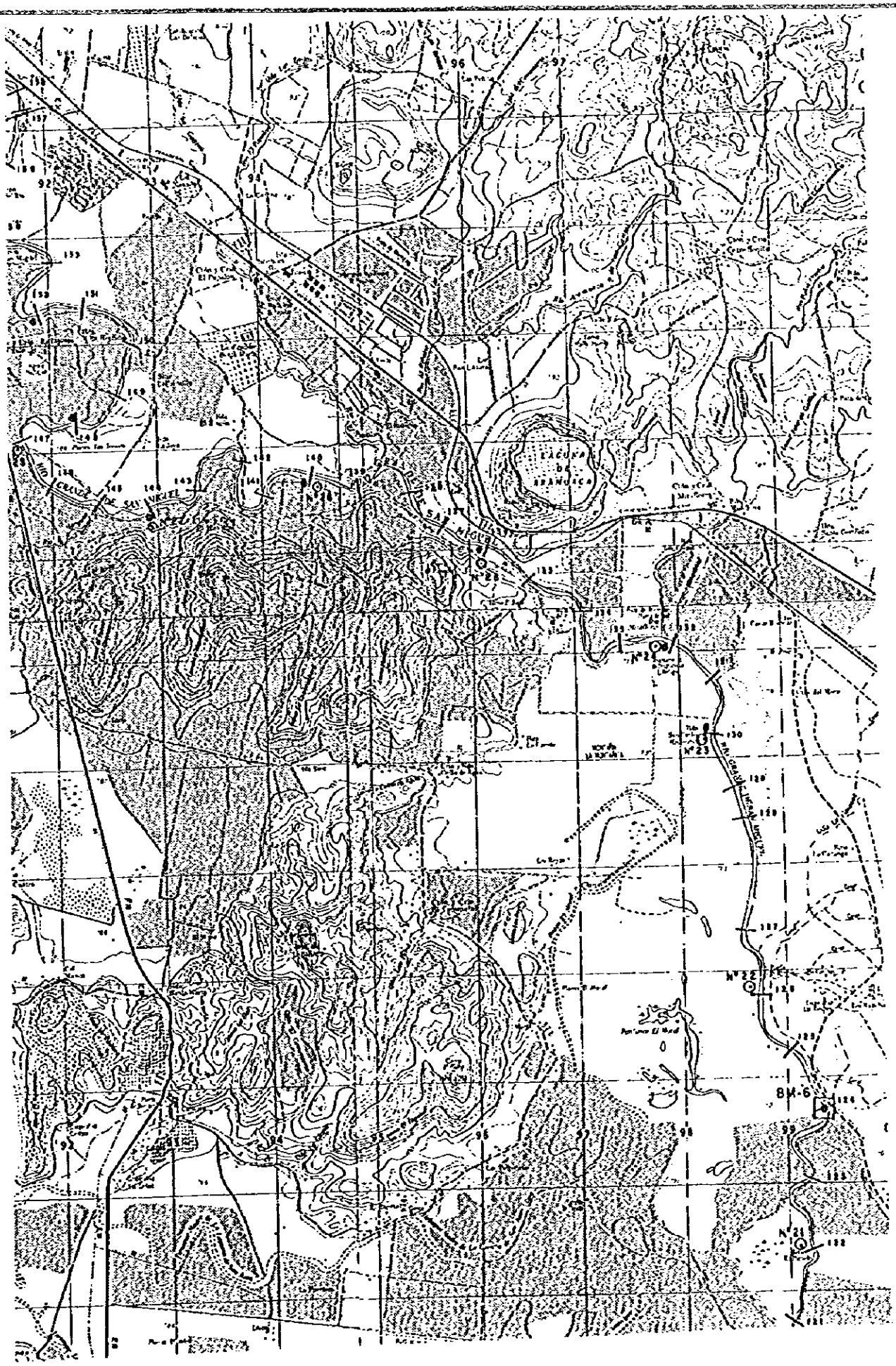

Figure 9.1 (7/8) LOCATION OF RIVER CROSS SECTIONS

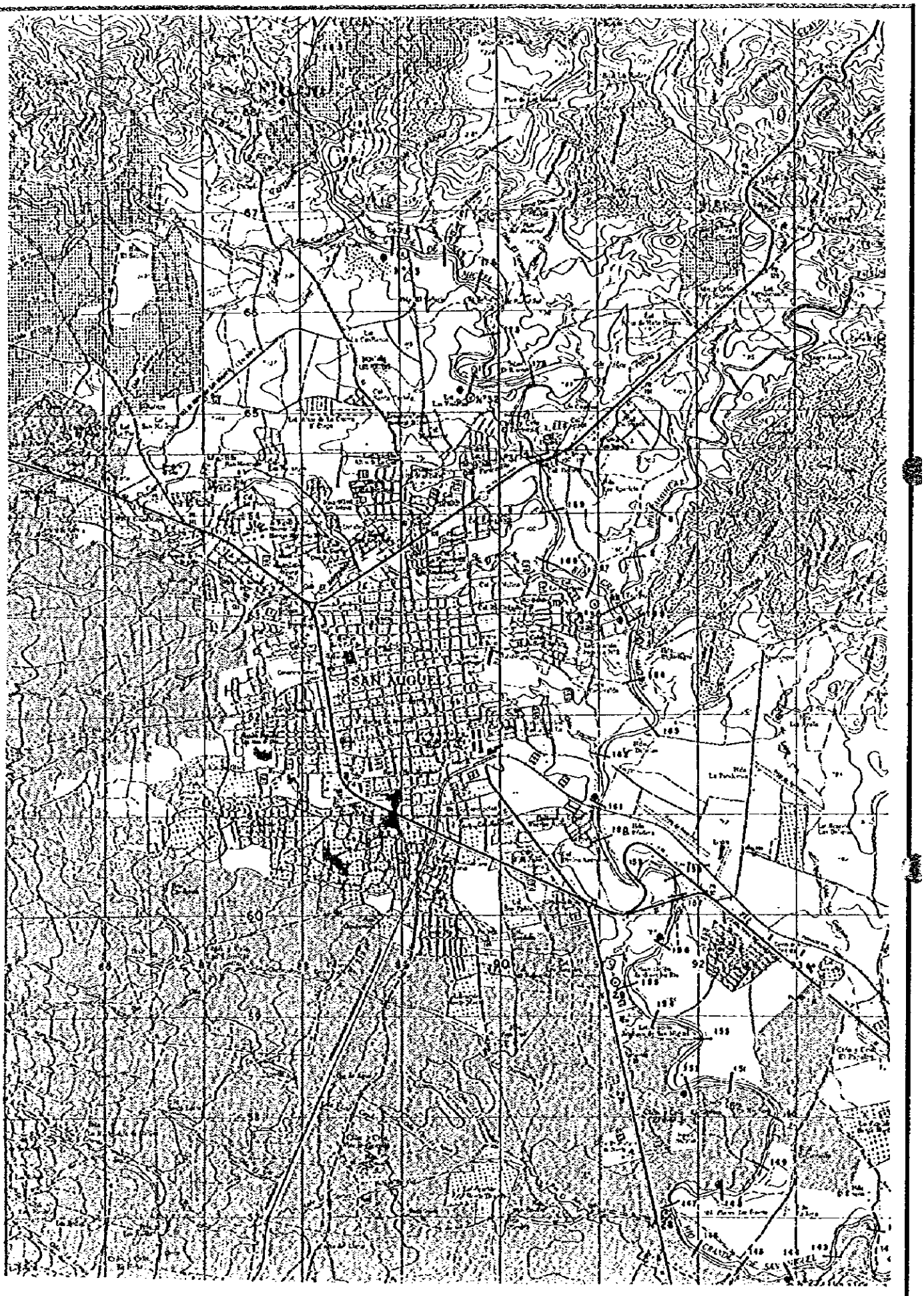

Figure 9.1 (8/8) LOCATION OF RIVER CROSS SECTIONS

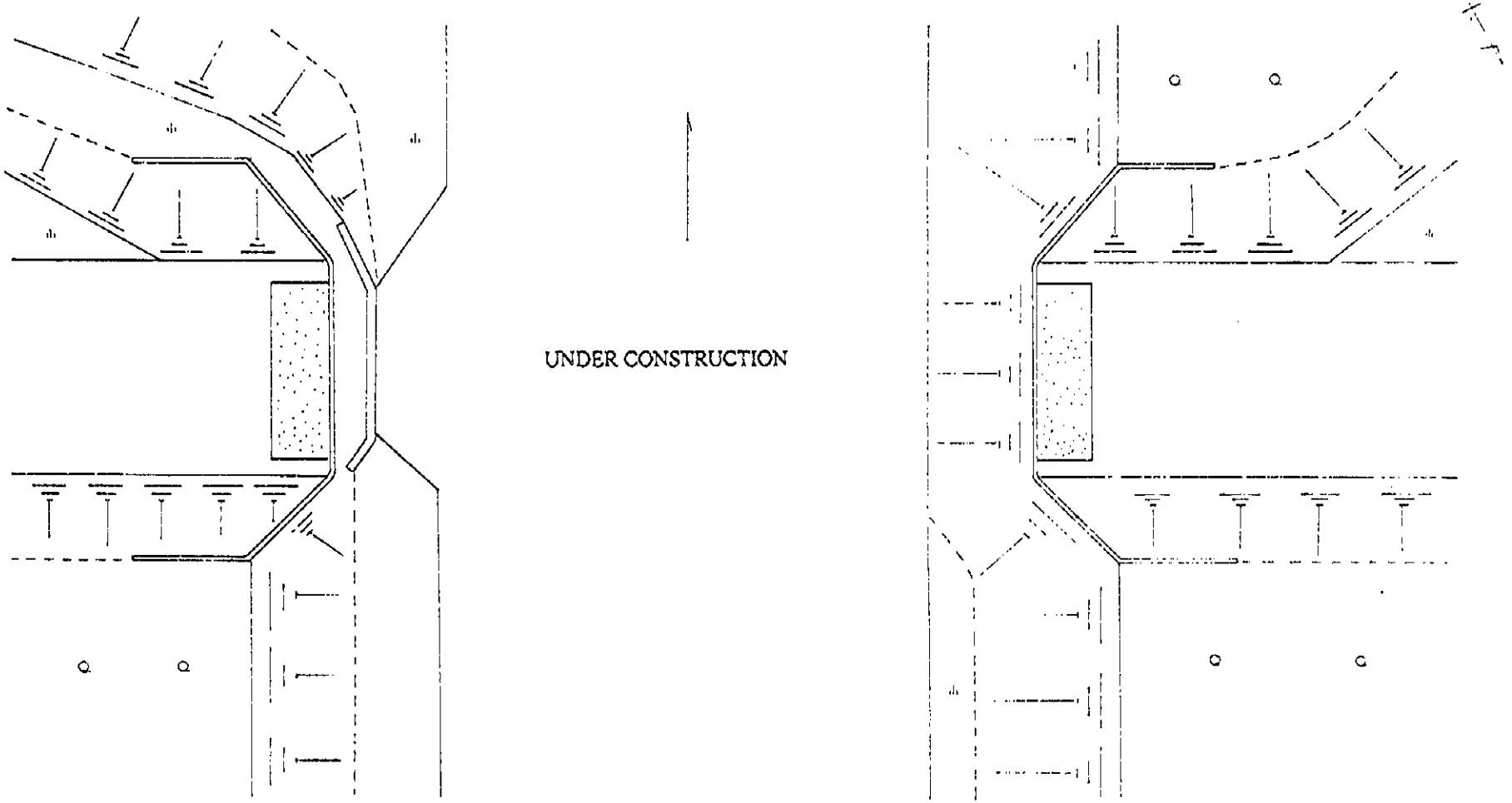

Figure 9.2 VADO MARIN BRIDGE (1/2)

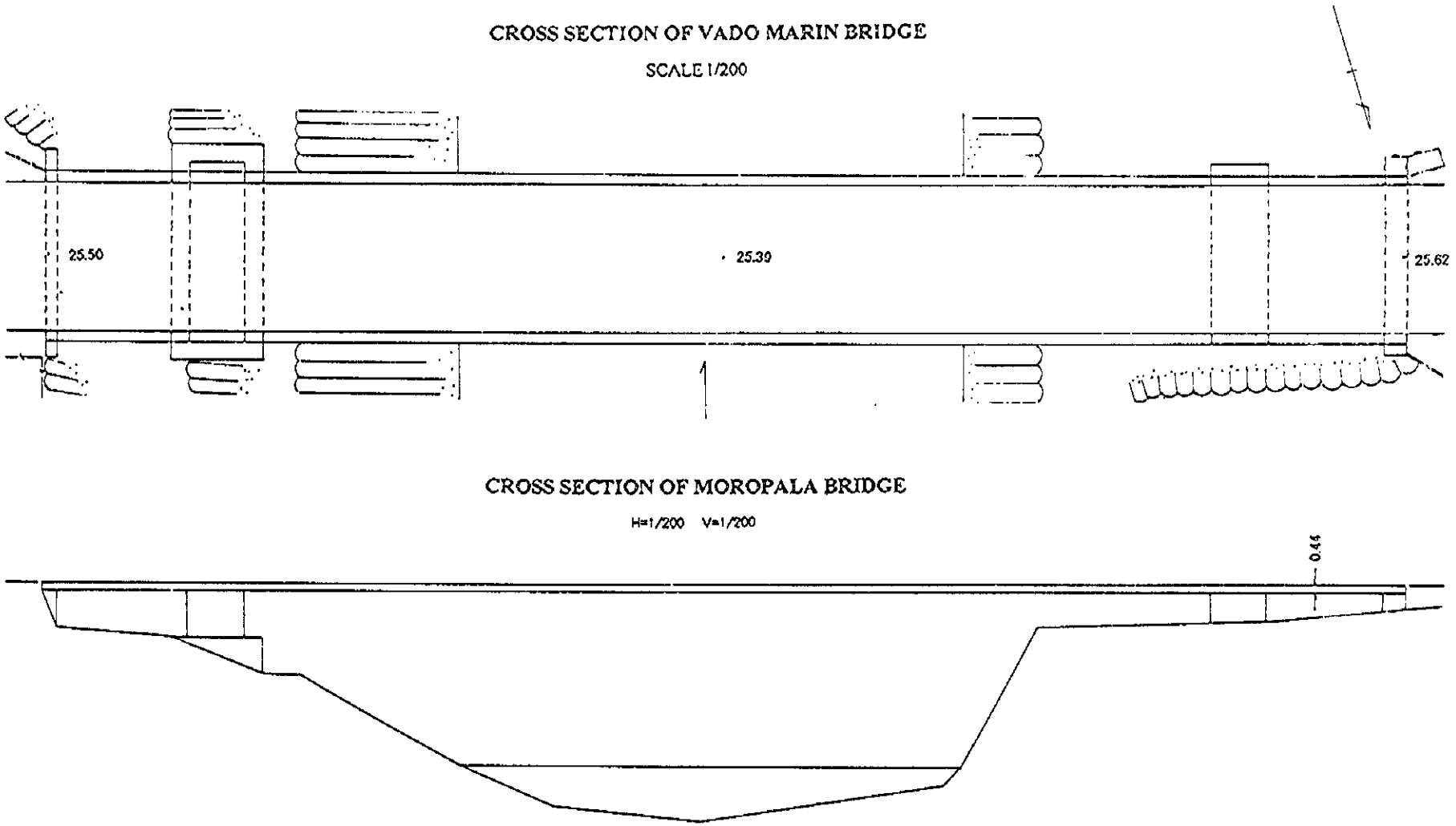

Figure 9.2 VADO MARIN BRIDGE (2/2)

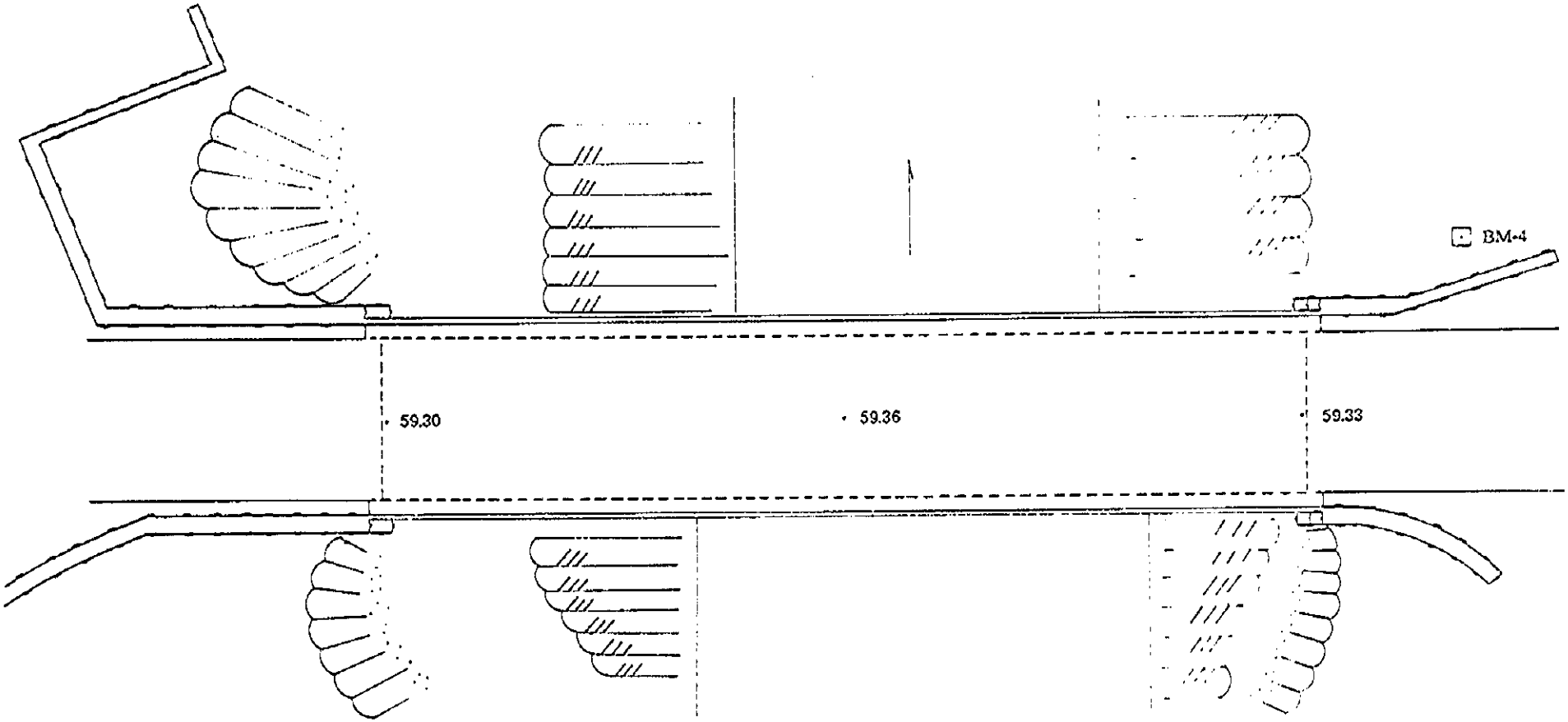

Figure 9.3 EL DELIRIO BRIDGE (1/2)

CROSS SECTION OF EL DELIRIO BRIDGE

H=1/200 V=1/200

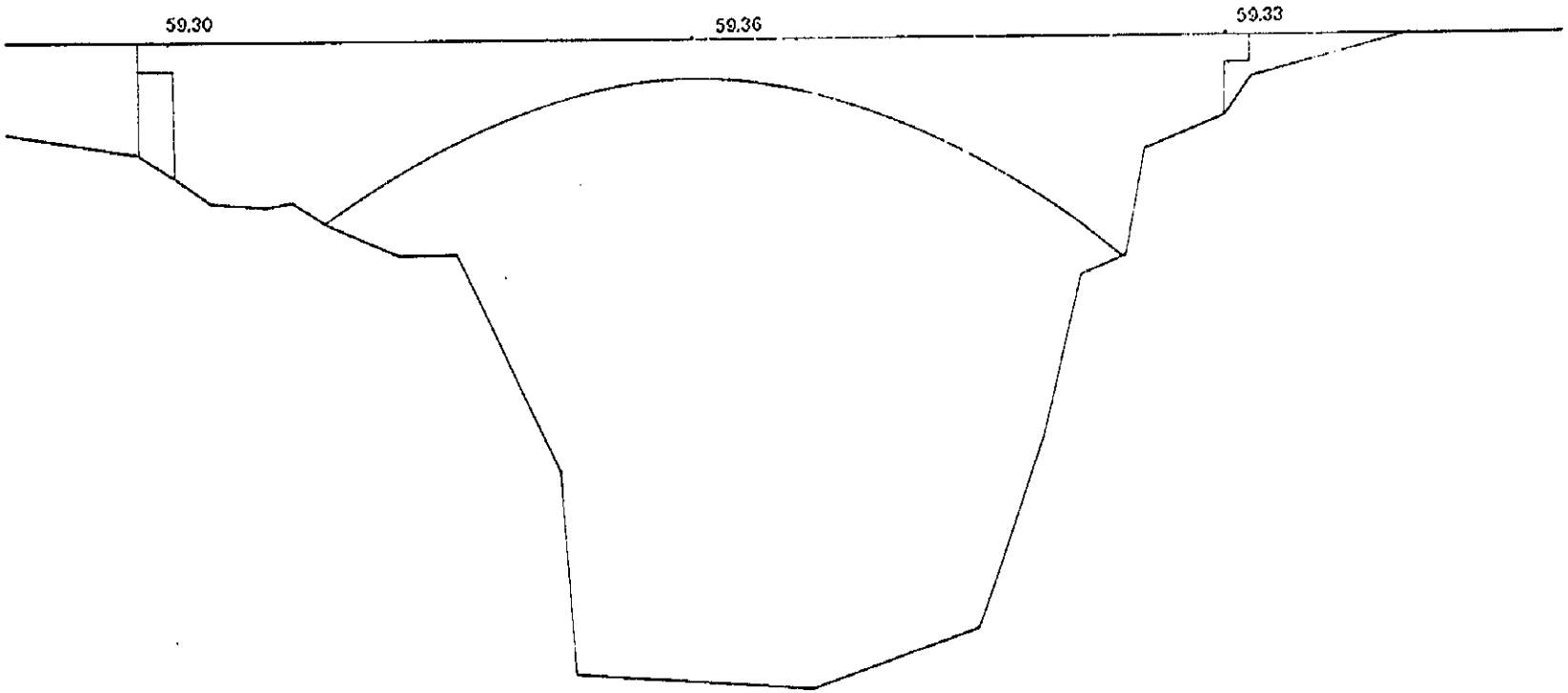

Figure 9.3 EL DELIRIO BRIDGE (2/2)

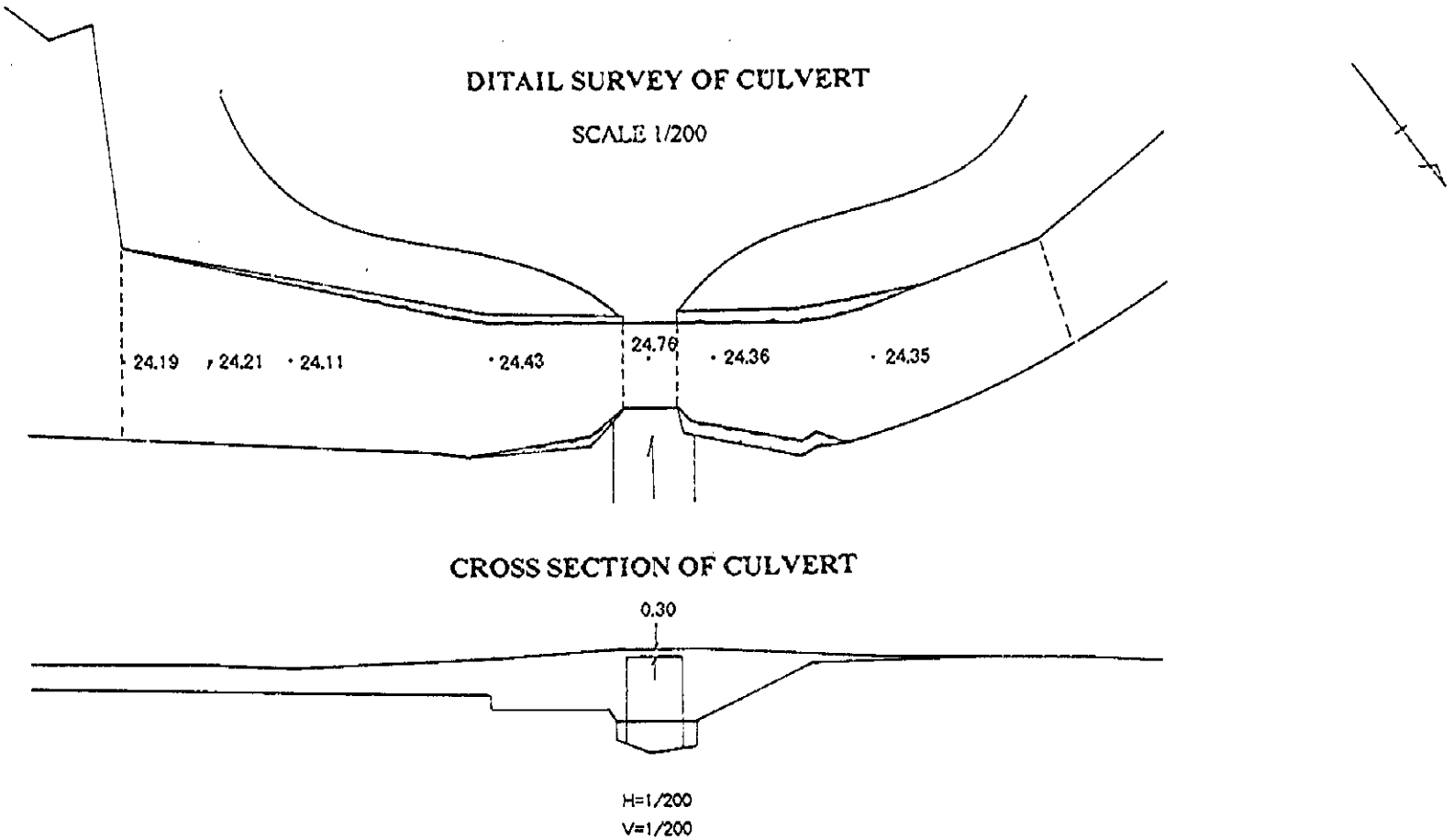

Figure 9.4 JOCOTAL DRINAGE CULVERT (1/2)

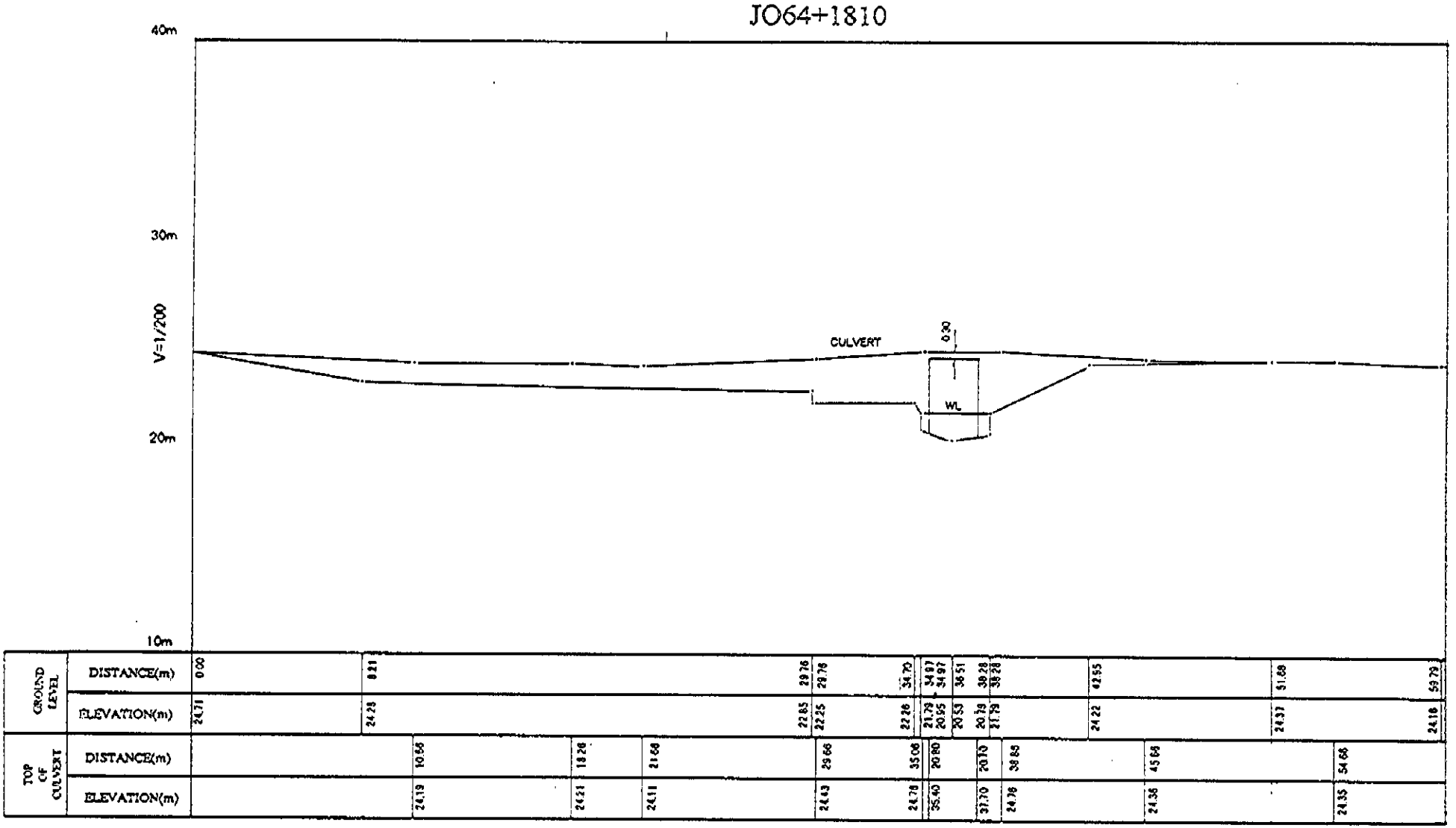

Figure 9.4 JOCOTAL DRAINAGE CULVERT (2/2)

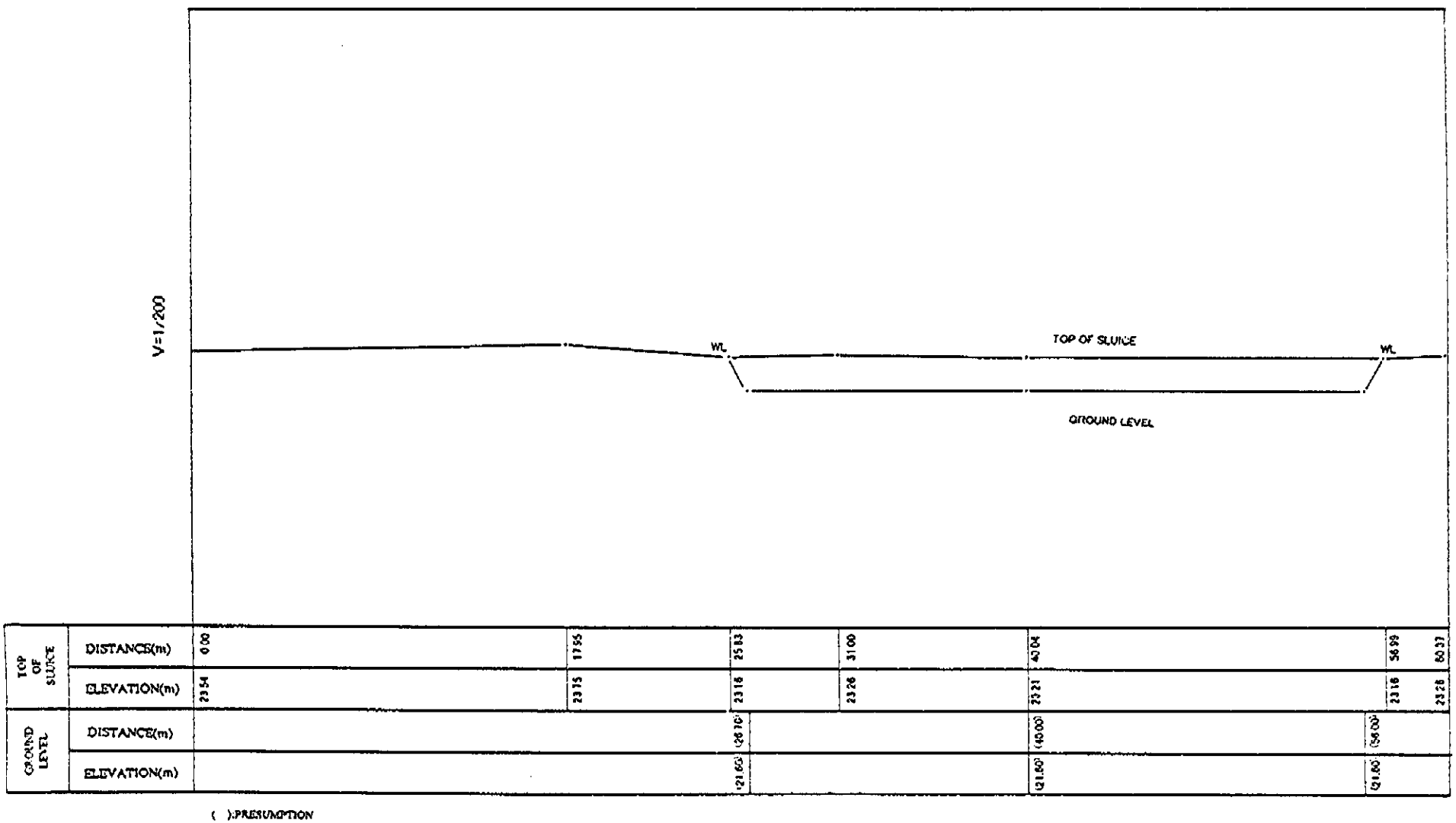

Figure 9.5 JOCOTAL DRAINAGE WEIR (GABION)