Table 5.4.3 CONTENTS FOR SUB-BASINS IN STORAGE FUNCTION EQUATION

Sub-Basin	Constants		Lag-Time	Sub-Basin	Constants		Lag-Time
	K	P	(hr)		K	P	(hr)
B-A- 1	31.0	0.333	1.1	B-P- 1	50.0	0.333	3.2
B-A- 2	30.8	0.333	0.9	B-P- 2	30.9	0.333	0.1
B-A- 3	49.5	0.333	2.7	B-P- 3	36.6	0.333	1.6
B-A- 4	30.8	0.333	0.9	B-P- 4	44.1	0.333	2.0
B-A- 5	38.4	0.333	0.9	B-P- 5	42.2	0.333	1.3
B-A- 6	38.4	0.333	0.6	B-P- 6	45.3	0.333	2.3
B-A- 7	103.9	0.333	3.9	B-P- 7	59.3	0.333	0.4
B-A- 8	85.7	0.333	7.9	B-P- 8	62.4	0.333	4.6
B-A- 9	105.4	0.333	1.8	B-P- 9	83.6	0.333	0.6
B-A-10	135.5	0.333	7.2	B-P-10	70.0	0.333	2.0
B-A-11	119.1	0.333	4.8	B-P-11	33.0	0.333	0.9
B-A-12	49.2	0.333	4.1	B-P-12	31.5	0.333	0.4
B-A-13	31.9	0.333	0.9	B-P-13	38.9	0.333	0.9
B-A-14	51.7	0.333	4.6	B-P-14	38.3	0.333	0.6
B-A-15	55.9	0.333	1.8	B-P-15	82.2	0.333	2.5
B-A-16	124.5	0.333	5.8	B-P-16	116.9	0.333	2.7
B-A-17	85.2	0.333	4.8	B-P-17	101.1	0.333	2.3
B-A-18	49.0	0.333	3.4	B-P-18	17.6	0.333	0.0
B-A-19	70.3	0.333	1.1	B-P-19	42.0	0.333	1.8
B-A-20	47.2	0.333	3.7	B-P-20	86.4	0.333	3.0
B-A-21	30.6	0.333	1.3	B-P-21	43.4	0.333	1.8
B-A-22	42.4	0.333	2.0	B-P-22	45.9	0.333	0.4
B-A-23	70.9	0.333	1.6	B-P-23	66.4	0.333	1.3
B-A-24	101.4	0.333	0.9	B-P-24	61.6	0.333	5.3
B-A-25	101.4	0.333	3.4	B-P-25	23.5	0.333	0.0
B-A-26	89.1	0.333	3.0	B-P-26	43.8	0.333	1.3
B-A-27	85.2	0.333	4.8	B-P-27	61.1	0.333	2.0
B-A-28	46.3	0.333	3.9	B-P-28	105.8	0.333	2.5
B-A-29	110.0	0.333	4.4	B-P-29	69.9	0.333	0.9
B-A-30	17.8	0.333	0.4	B-P-30	87.7	0.333	1.8
B-A-31	45.7	0.333	3.2	B-P-31	122.3	0.333	3.2
B-A-32	39.1	0.333	2.0	B-P-32	89.3	0.333	3.2
B-A-33	115.0	0.333	5.1	B-P-33	140.0	0.333	5.1
B-A-34	38.8	0.333	2.3	B-P-34	123.3	0.333	3.2
B-A-35	116.6	0.333	5.3	B-P-35	75.3	0.333	3.9
B-A-36	76.3	0.333	5.8	B-P-36	48.3	0.333	0.1
B-A-37	39.3	0.333	1.6	B-P-37	25.7	0.333	0.4
B-A-38	33.7	0.333	1.6	B-P-38	30.9	0.333	0.4
B-A-39	122.5	0.333	5.3	B-P-39	103.1	0.333	4.4
B-A-40	92.3	0.333	2.0	B-P-40	91.7	0.333	1.8
B-A-41	129.5	0.333	3.9	B-P-41	85.2	0.333	1.3
B-A-42	166.3	0.333	9.5	B-P-42	109.8	0.333	2.7
B-A-43	103.2	0.333	1.8	B-P-43	41.7	0.333	1.3
B-A-44	117.9	0.333	2.7	B-P-44	92.9	0.333	3.4
B-A-45	118.4	0.333	4.4	B-P-45	111.6	0.333	3.7
B-A-46	91.7	0.333	1.8	B-P-46	49.4	0.333	4.4
B-A-47	115.4	0.333	2.7	B-P-47	80.4	0.333	2.0
B-A-48	132.8	0.333	4.1	B-P-48	51.0	0.333	3.7
				B-P-49	26.2	0.333	0.0
				B-P-50	74.5	0.333	1.3
				B-P-51	99.4	0.333	3.0
				B-P-52	91.7	0.333	1.8
				B-P-53	128.3	0.333	4.6
				B-P-54	128.3	0.333	4.6
				B-P-55	96.9	0.333	4.4
				B-P-56	137.2	0.333	5.6
				B-P-57	135.4	0.333	2.7
				B-P-58	109.3	0.333	1.8
				B-P-59	173.8	0.333	2.3

Note B-A-1;Sub-baisn in Apure river basin except Portuguesa river basin
B-P-1;Sub-basin in Portuguesa river basin

Table 5.4.4 CONSTANTS FOR RIVER CHANNELS IN STORAGE FUNCTION EQUATION

River Channel	Constants K	Constants P	Lag-Time (hr)	River Channel	Constants K	Constants P	Lag-Time (hr)
C - A - 1	33,342	0.366	0.1	C - P - 1	36,347	0.392	0.1
C - A - 2	174,258	0.373	0.4	C - P - 2	255,185	0.674	0.8
C - A - 3	77,958	0.386	0.2	C - P - 3	95,068	0.386	0.3
C - A - 4	73,808	0.403	0.2	C - P - 4	154,718	0.755	0.5
C - A - 5	959,462	0.793	2.8	C - P - 5	302,178	1.036	1.3
C - A - 6	764,542	1.036	2.6	C - P - 6	194,668	1.026	1.0
C - A - 7	1,981,652	1.000	6.3	C - P - 7	45,400	0.359	0.1
C - A - 8	262,428	0.539	0.6	C - P - 8	150,958	0.403	0.4
C - A - 9	1,275,534	0.854	4.7	C - P - 9	70,821	0.413	0.2
C - A - 10	264,333	0.741	0.9	C - P - 10	454,765	0.698	1.5
C - A - 11	154,960	0.710	0.5	C - P - 11	724,672	1.026	3.6
C - A - 12	112,146	0.342	0.3	C - P - 12	621,147	1.026	3.1
C - A - 13	303,169	0.677	0.9	C - P - 13	179,000	0.373	0.4
C - A - 14	124,251	0.710	0.3	C - P - 14	502,189	1.060	1.7
C - A - 15	355,910	0.919	1.2	C - P - 15	76,099	0.558	0.3
C - A - 16	959,094	1.036	2.9	C - P - 16	309,056	0.980	1.0
C - A - 17	854,355	0.815	3.3	C - P - 17	278,348	1.250	1.3
C - A - 18	468,933	1.036	1.3	C - P - 18	268,435	0.526	0.7
C - A - 19	127,934	0.333	0.3	C - P - 19	100,413	0.403	0.3
C - A - 20	924,435	0.781	3.7	C - P - 20	664,961	1.420	2.7
C - A - 21	842,774	0.815	3.9	C - P - 21	191,500	1.170	0.9
C - A - 22	399,006	1.036	1.0	C - P - 22	164,443	1.130	0.7
C - A - 23	1,094,702	0.863	4.4	C - P - 23	187,766	0.912	0.8
C - A - 24	2,029,336	1.102	5.9	C - P - 24	1,168,008	1.026	6.1
C - A - 25	1,068,566	1.736	7.8	C - P - 25	386,925	1.036	1.8
C - A - 26	3,852,399	1.167	10.1	C - P - 26	93,859	0.663	0.3
C - A - 27	668,273	1.011	3.5	C - P - 27	4,537	0.373	0.1
C - A - 28	985,333	1.036	5.2	C - P - 28	774,890	0.755	2.8
				C - P - 29	372,025	0.880	1.8
				C - P - 30	376,661	0.953	1.7
				C - P - 31	764,205	1.483	4.5
				C - P - 32	596,629	0.726	2.1
				C - P - 33	723,555	0.880	3.1
				C - P - 34	489,726	1.512	2.9
				C - P - 35	386,054	0.726	1.3
				C - P - 36	25,454	0.380	0.1
				C - P - 37	295,196	0.755	1.1
				C - P - 38	678,139	0.825	2.4
				C - P - 39	982,145	0.959	4.9
				C - P - 40	1,179,697	0.971	5.9
				C - P - 41	849,161	1.219	5.2
				C - P - 42	544,994	1.553	3.1
				C - P - 43	961,709	1.736	7.0

Note : C - A - 1 ; River channel in Apure river basin except Portuguesa river basin

C - P - 1 ; River channel in Portuguesa river basin

Table 5.4.5 SPECIFIC FLOOD RUNOFF PEAKS OF OUTFLOWS FROM DAM SPILLWAYS IN THE APURE RIVER BASIN

Dam Name	C.A. (km^2)	Effective Storage (MCM)	Flood Control Storage (MCM)	Design Flood for Spillway (m^3/s)	Maximum Outflow (m^3/s)	Dam Status
Apure River Basin						
1. La Honda	1,340	450.0	–	940 (0.70) <1	940.6	Existing
2. Sauto Domingo	420	2.6	–	3,200 (7.62)	3,250.0	"
3. Masparo	500	837.0	–	300 (0.60)	154.5	"
4. Las Cuevas	150	345.0	–	325 (2.17)	323.3	Proposed
5. Borde Seco –La Vuatosa	3,090	2,097.0	–	775 (0.25)	814.0	"
All Existing Dams	2,260	1,289.6	–			
All Dams	5,500	3,731.6	–			
Portuguesa River Basin						
6. Cabuy	44	10.6	4	80 (1.82)	165.2	Existing
7. Las Majaguas	100	303.5	41	60 (0.60)	68.5	"
8. Chachincha	940	165.0	–	760 (0.81)	629.0	"
9. La Balsa	2,700	369.0	56	60 (0.02)	68.6	"
10. Tisnados	1,490	820.8	229	486 (0.33)	448.5	"
11. Bocono-Tucupito	2,020 { 440 / 1,580	2,595.0	249	687 (1.56) 180 (0.11)	1,028.0	"
12. Yacambu	335	287.0	26	480 (1.43)	639.7	Proposed
13. Las Palmas	4,325	1,750.0	125	170 (0.04)	453.1	"
14. Mesa de Cavaca	1,377	–	–	550 (0.42)	–	"
15. Vega Honda	730	–	–	460 (0.63)	–	"
All Existing Dams	7,554	4,263.9	579	–		
All Dams	14,321	6,300.9	730	–		
All Existing Dams	9,814	5,553.5				
All Dams	19,821	10,032.5				

Note: <1 Value in parenthesis indicates specific discharge ($m^3/s/km^2$)

Table 5.4.6 FLOOD INFLOW OF EXISTING DAMS IN VENEZUELA

Dam Name	Gross Storage V ($\times 10^6 m^3$)	Gross Storage CA (km^2)	Flood Inflow Peak (m^3/s)	Spillway Capacity (m^3/s)	Retarding Effect Ratio
Green Canyon	3.20	84.0	1,777	1,478	0.83
			(21.15)	(17.60)	
Beaver Lake Dam	9.50	29.0	183	81	0.44
			(6.31)	(2.79)	
Regadera Dam	4.10	163.0	1,772	700	0.60
			(7.19)	(4.29)	
Tibble Fork Dam	0.28	93.0	137	132	0.96
			(1.47)	(1.42)	
Loud Thund Er Dam	-	18.6	346	183	0.53
			(18.60)	(9.84)	

Note : Value in parenthesis indicates specific discharge ($m^3/s/km^2$)

Table 5.4.7 RELATIONSHIP AMONG PROBABLE FLOOD RUNOFF PEAKS

Return Period	Unit	Probable Flood Runoff Peaks (1) Rio Guanare	(2) Rio Anus	((1)+(2))/2
Q2.33	m^3/s	760	1,350	-
Q5	m^3/s	1,240	1,760	-
Q10	m^3/s	1,620	2,075	-
Q25	m^3/s	2,100	2,475	-
Q50	m^3/s	2,464	2,762	-
Q100	m^3/s	2,829	3,057	-
Q10/Q100	-	(0.57)	(0.68)	(0.63)
Q25/Q100	-	(0.74)	(0.81)	(0.78)
Assumed Q20/Q100	-	-	-	(0.70)

Source : "Estudio Hydrologico del Rio Guanare En Puenta Tejeray Rio Anus en Puenta Salvaje - Estado Portuguesa"

Note : Value in parenthesis indicates ratio between probable flood runoff peaks

Table 5.4.8 VERIFIED RESULTS OF SPECIFIC FLOOD RUNOFF PEAKS

Dam Name	Catchment Area (km^2)	Calculated Peak Discharge (m^3/s)	Specific Discharge (m^3/s)	Reference q (C = 6~30)	Reference q(C = 6~30) x 0.7
Apure River Basin					
1. La Honda	1,340	1,050	0.78	0.70~3.4	(0.49~2.38)
2. Santo Domingo	420	480	1.14	1.20~6.0	(0.84~4.20)
3. Masparo	500	970	1.94	1.00~5.8	(0.70~4.06)
4. Las Cuevas	150	400	2.67	1.90~9.2	(1.33~6.44)
5. Borde Seco ≀ La Vuatosa	3,090	1,790	0.58	0.45~2.2	(0.32~1.54)
Portuguesa River Basin					
6. Cabuy	44	40	0.68	0.76~3.00	(0.53~0.21)
7. Las Majaguas	100	80	0.80	0.58~2.20	(0.41~1.54)
8. Chachincha	940	130	0.14	0.20~0.85	(0.14~0.60)
9. La Balsa	2,700	460	0.17	0.12~0.50	(0.08~0.35)
10. Tisnados	1,490	300	0.20	0.17~0.68	(0.12~0.48)
11. Bocono-Tucupito	2,020	3,670	1.82	0.56~2.80	(0.39~1.96)
12. Yacambu	335	990	2.96	1.40~6.60	(0.98~4.62)
13. Las Palmas	4,325	670	0.15	0.09~0.35	(0.06~0.25)
14. Mesa de Cavaca	1,377	1,630	1.18	0.70~3.40	(0.49~2.38)
15. Vega Honda	730	420	0.58	0.25~0.96	(0.18~0.67)

Note : C-constant in Creager's equation.
Flood runoff calculated for rainfall in 1981.

Table 5.4.9 PROBABLE DAILY MEAN DISCHARGES

(Unit: m^3/s)

Return Period	Base Point			
	Bruzual (Apure R.)	El Saman (Apure R.)	Camaguan (Portuguesa R.)	San Fernando (Apure R.)
2-Year	3,322	4,060	1,012	5,464 (4,360)
5-Year	3,821	4,625	1,182	7,133 (5,980)
10-Year	4,151	4,999	1,295	8,238 (6,880)
20-Year	4,467	5,358	1,402	9,298 (7,820)
30-Year	4,649	5,564	1,465	9,908 (8,300)
50-Year	4,876	5,822	1,542	10,670 (8,920)
80-Year	5,085	6,059	1,613	11,368 (9,460)
100-Year	5,183	6,170	1,647	11,699 (9,760)

Note : Figures in parethes are those estimated from water levels.

Data used for calculation are as follows:

(1) Bruzual 1975 - 1990

(2) El Saman 1975 - 1990

(3) Camaguan 1975 - 1990

(4) San Fernando 1975 - 1990 (Discharge), 1945 - 1992 (Water Level)

Table 7.1.1 RIVER SECTIONS AND MAJOR POINTS OF APURE RIVER

-Sections for Non-Uniform Flow Calculation -

No.	Name	Distance (km) Accumulation	Section
1	R.MOUTH	0.00	0.00
2	EL PERRO	10.47	10.47
3	EL MAMON	41.20	30.73
4	LA MACIERA	49.27	8.07
5	66.4K	66.37	17.09
6	EL SAUSAL	83.46	17.10
7	570-7(INC)	96.66	13.20
8	556-1(INC)	109.74	13.08
9	ARICHUNA	122.90	13.16
10	534-9(INC)	133.19	10.30
11	CHIREL I	143.34	10.15
12	EL JOBAL	152.48	9.13
13	EL NEGRO	170.59	18.12
14	SAN FERNANDO	180.47	9.88
15	LAS GUANOTAS	191.23	10.76
16	LAS CULATAS	195.72	4.49
17	454-2(INC)	211.91	16.19
18	CHAMIZAL	230.36	18.45
19	418-9(INC)	248.97	18.61
20	400-7(INC)	266.66	17.69
21	382-5(INC)	284.36	17.70
22	364-3(INC)	302.05	17.69
23	APURITO	319.79	17.74
24	332-2(INC)	333.89	14.10
25	EL SAMAN	348.12	14.23
26	312-4(INC)	364.24	16.12
27	296-7(INC)	380.74	16.50
28	EL CHINAL	397.07	16.33
29	258-8(INC)	412.91	15.84
30	244-9(INC)	427.07	14.16
31	BRUZUAL	442.14	15.07
32	BOCA DEL MASPARRO	453.59	11.45
33	SAN VICENTE	465.41	11.82
34	188-5(INC)	482.41	17.00
35	172-2(INC)	497.89	15.48
36	QUINTERO	514.01	16.12
37	BOCA DEL SURIPA	525.68	11.67
38	ARECOSTON DE LA TIGRA	543.82	18.14
39	114-12(INC)	557.43	13.61
40	PALMARITO	570.99	13.56
41	88-10(INC)	582.64	11.65
42	SAMANAL	593.45	10.81
43	64-8(INC)	606.91	13.46
44	50-3(INC)	620.05	13.14
45	TOTUMITO	633.36	13.31
46	HATO LA MIEL	645.79	12.43
47	ORURITA	652.99	7.20
48	PUERTO SANTOS LUZARDO	663.38	10.38
49	PUENTE REMOLINO	681.02	17.64

- Major Points of Apure River -

Points	Distance(km)
MANATI R./CON.	52.35
CHIREL R./DIV.	141.69
BOQUERONES R./DIV.	150.49
PUERTO DE SAN FERNANDO	167.30
APURITO R./DIV.	178.00
SAN FERNANDO BRIDGE	182.50
PORTUGUESA R./CON.	192.24
GUANAPARO R./CON.	201.81
YEGUAS R./CON.	207.17
GARZAS R./CON.	220.64
GARZAS R./DIV.	266.32
YEGUAS R./DIV.	272.24
GUARITICO R./CON.	370.98
PUERTO DE NUTRIAS	442.21
MASPARRO R./CON.	453.78
PAGUEY R./CON.	469.37
SURIPA R./CON.	523.60
LA TIGURA R./CON.	546.99
URIBANTE VIEJO R./CON.	660.42
PUERTO SANTOS LUZARDO	663.38
GUASDUALITO	668.81
REMOLINO BRIDGE	680.96

Table 7.3.1 BANKFUL CHANNEL CAPACITY OF APURE RIVER

No.	Section	Distance (km)	Ground Elevation (m,MSL)	Channel Capacity (m3/s)	
1	El Perro	10.47	35.37	2400	
2	El Mamon	41.20	36.56	2250	
3	La Maciera	49.27	36.79	2210	
4	El Sausal	83.46	36.53	1750	(1110)
5	Arichuna	122.90	41.21	3180	(2400)
6	Chirel 1	143.34	42.08	3030	
7	El Jobal	152.48	43.14	4260	
8	El Negro	170.59	43.00	3440	
9	San Fernando	180.47	45.19	6890	
10	Las Guanotas	191.23	45.33	4210	
11	Las Culatas	195.72	45.52	2990	
12	Chamizal	230.36	49.39	3150	(1380)
13	Apurito	319.79	61.05	3370	
14	El Saman	348.12	64.92	3820	
15	El Chinal	397.07	73.70	2500	
16	Bruzual	442.14	80.00	3810	
17	Boca del Masparro	453.59	80.86	2270	
18	San Vicente	465.41	83.00	1800	
19	Quintero	514.01	92.90	2160	
20	Boca del Suripa	525.68	93.45	1030	
21	Arecoston de la Tigra	543.82	96.10	1060	
22	Palmarito	570.99	104.04	1000	
23	Samanal	593.45	108.90	1060	
24	Totumito	633.36	118.40	900	
25	Hato la Miel	645.79	120.60	600	
26	Orurita	652.99	123.06	840	
27	Puerto Santos Luzardo	663.38	125.79	780	
28	Puente Remolino	681.02	130.70	910	

Remarks : Figure in ( ) denotes channel capacity only for the main Apure river in the anabranch reaches.

Table 7.4.1 SIGNIFICANT GRAIN SIZE (1/4)

BED MATERIAL SAMPLES

SAMPLE	d25 (mm)	d50 (mm)	d65 (mm)	d75 (mm)	sq.root (d75/d25)
M- 1	0.022	0.029	0.046	0.07	1.78
M- 2	0.023	0.054	0.084	0.11	2.19
M- 3	0.055	0.12	0.18	0.24	2.09
* M- 4	0.11	0.19	0.24	0.28	1.60
M- 5	0.029	0.053	0.07	0.086	1.72
* M- 6	0.19	0.26	0.32	0.37	1.40
M- 7	0.028	0.046	0.057	0.065	1.52
M- 8	0.014	0.04	0.061	0.082	2.42
* M- 9	0.2	0.28	0.35	0.4	1.41
M-10	-	0.002	0.009	0.03	-
M-11	0.0045	0.03	0.048	0.065	3.80
M-12	0.0016	0.018	0.038	0.059	6.07
M-13	0.041	0.091	0.13	0.016	0.62
M-14	0.002	0.012	0.031	0.043	4.64
M-15	-	0.0039	0.008	0.015	-
* M-16	0.14	0.2	0.26	0.29	1.44
M-17	-	0.0031	0.0088	0.031	-
M-18	0.012	0.058	0.12	0.18	3.87
M-19	0.41	0.9	1.9	9	4.69
M-20	0.25	0.55	0.85	1.5	2.45
M-21	0.055	0.1	0.14	0.17	1.76
M-22	4.5	20	29	37	2.87
M-23	0.2	0.68	1.2	1.7	2.92
M-24	0.13	0.35	10	23	13.30
M-25	0.64	7	23	31	6.96
M-26	0.014	0.052	0.14	1.2	9.26
M-27	20	30	39	44	1.48
M-28	0.27	0.56	0.95	3.5	3.60
* M-28A	0.2	0.33	0.45	0.56	1.67
* M-28B	0.2	0.32	0.43	0.54	1.64
M-29	0.049	0.095	0.14	0.18	1.92
M-30	0.32	2	30	55	13.11
M-31	0.26	19	33	47	13.45
M-32	0.65	13	33	47	8.50
M-33	1.2	23	37	50	6.45
M-34	0.43	0.91	2.2	4	3.05
M-35	0.0017	0.014	0.037	0.06	5.94
* M-36	0.27	0.47	0.57	0.64	1.54
* M-37	0.14	0.22	0.28	0.34	1.56
AVG.OF"*"	0.175	0.272	0.348	0.410	1.532

BORE HOLE SAMPLES

SAMPLE	d25 (mm)	d50 (mm)	d65 (mm)	d75 (mm)	sq.root (d75/d25)
P-1- 1	-	0.0074	0.0226	0.042	-
P-1- 2	0.0049	0.02	0.026	0.034	2.63
P-1- 3	-	0.003	0.006	0.0085	-
P-1- 4	-	0.0015	0.004	0.0093	-
P-1- 5	-	-	-	0.0015	-
P-1- 6	-	-	0.0011	0.0018	-
P-1- 7	-	0.0082	0.085	0.18	-
P-1- 8	-	0.028	0.14	0.2	-
* P-1- 9	0.17	0.24	0.29	0.34	1.41
* P-1-10	0.17	0.24	0.3	0.35	1.43
* P-1-11	0.095	0.19	0.24	0.29	1.75
* P-1-12	0.17	0.27	0.36	0.45	1.63
* P-1-13	0.17	0.3	0.42	0.52	1.75
* P-1-14	0.19	0.31	0.42	0.52	1.65
* P-1-15	0.16	0.27	0.37	0.44	1.66
* P-1-16	0.16	0.25	0.31	0.37	1.52
P-1-17	-	0.028	0.051	0.085	-
P-1-18	0.04	0.089	0.011	0.014	0.59
* P-1-19	0.098	0.23	0.33	0.42	2.07
* P-1-20	0.19	0.34	0.48	0.56	1.72
* P-1-21	0.12	0.23	0.32	0.4	1.83
AVG.OF"*"	0.150	0.258	0.343	0.416	1.674
P-2- 1	0.025	0.049	0.07	0.089	1.89
P-2- 2	-	0.0026	0.0061	0.012	-
P-2- 3	0.0058	0.041	0.064	0.085	3.83
* P-2- 4	0.045	0.085	0.12	0.15	1.83
* P-2- 5	0.07	0.13	0.18	0.23	1.81
* P-2- 6	0.12	0.2	0.25	0.29	1.55
* P-2- 7	0.12	0.21	0.27	0.31	1.61
P-2- 8	-	0.008	0.022	0.03	-
P-2- 9	-	0.0074	0.024	0.04	-
P-2-10	-	0.0025	0.01	0.029	-
P-2-11	-	0.0053	0.02	0.04	-
P-2-12	-	0.002	0.009	0.03	-
P-2-13	-	0.019	0.041	0.06	-
P-2-14	-	0.015	0.026	0.041	-
P-2-15	-	0.02	0.048	0.069	-
P-2-16	0.0027	0.045	0.11	0.19	8.39
P-2-17	-	0.008	0.02	0.039	-
P-2-18	-	0.008	0.025	0.041	-
P-2-19	-	0.0068	0.017	0.035	-
P-2-20	-	0.002	0.0042	0.0095	-
P-2-21	-	0.0019	0.0039	0.0075	-
AVG.OF"*"	0.082	0.147	0.195	0.236	1.700

Table 7.4.1 SIGNIFICANT GRAIN SIZE (2/4)

BORE HOLE SAMPLES

SAMPLE	d25 (mm)	d50 (mm)	d65 (mm)	d75 (mm)	sq.root (d75/d25)
P-3- 1	-	0.008	0.029	0.045	-
P-3- 2	0.0047	0.021	0.029	0.037	2.81
P-3- 3	-	0.0038	0.0076	0.013	-
P-3- 4	-	0.0016	0.0047	0.013	-
* P-3- 5	0.18	0.25	0.31	0.36	1.41
* P-3- 6	0.18	0.25	0.31	0.38	1.45
* P-3- 7	0.17	0.27	0.37	0.48	1.68
* P-3- 8	0.18	0.27	0.35	0.4	1.49
P-3- 9	-	0.0065	0.0021	0.03	-
P-3-10	-	0.025	0.043	0.062	-
* P-3-11	0.15	0.21	0.27	0.3	1.41
* P-3-12	0.075	0.18	0.22	0.27	1.90
P-3-13	-	0.0049	0.023	0.032	-
P-3-14	-	0.0058	0.023	0.032	-
P-3-15	-	0.0058	0.023	0.035	-
P-3-16	-	0.004	0.015	0.031	-
P-3-17	-	0.0058	0.022	0.035	-
P-3-18	-	0.0041	0.015	0.031	-
P-3-19	-	0.085	0.2	0.26	-
P-3-20	0.0043	0.2	0.26	0.32	8.63
* P-3-21	0.16	0.22	0.3	0.35	1.48
AVG.OF"*"	0.151	0.234	0.301	0.357	1.547
P-4- 1	0.0029	0.01	0.015	0.017	2.42
* P-4- 2	0.11	0.19	0.24	0.28	1.60
P-4- 3	0.03	0.08	0.12	0.15	2.24
P-4- 4	0.029	0.08	0.11	0.14	2.20
* P-4- 5	0.16	0.22	0.28	0.3	1.37
* P-4- 6	0.14	0.2	0.25	0.29	1.44
* P-4- 7	0.17	0.23	0.28	0.3	1.33
* P-4- 8	0.17	0.23	0.28	0.3	1.33
* P-4- 9	0.17	0.24	0.29	0.33	1.39
* P-4-10	0.19	0.26	0.32	0.37	1.40
* P-4-11	0.19	0.27	0.35	0.4	1.45
* P-4-12	0.2	0.32	0.45	0.56	1.67
* P-4-13	0.28	0.48	0.6	0.7	1.58
* P-4-14	0.28	0.48	0.6	0.7	1.58
* P-4-15	0.23	0.4	0.53	0.65	1.68
* P-4-16	0.28	0.48	0.6	0.7	1.58
* P-4-17	0.25	0.44	0.56	0.66	1.62
* P-4-18	0.37	0.57	0.7	0.8	1.47
* P-4-19	0.31	0.53	0.67	0.78	1.59
* P-4-20	0.31	0.53	0.65	0.73	1.53
* P-4-21	0.36	0.57	0.7	0.8	1.49
AVG.OF"*"	0.220	0.343	0.431	0.495	1.506

BORE HOLE SAMPLES

SAMPLE	d25 (mm)	d50 (mm)	d65 (mm)	d75 (mm)	sq.root (d75/d25)
P-5- 1	0.0013	0.025	0.053	0.084	8.04
P-5- 2	0.022	0.08	0.15	0.22	3.16
P-5- 3	0.035	0.089	0.15	0.22	2.51
* P-5- 4	0.19	0.32	0.45	0.55	1.70
P-5- 5	-	-	0.002	0.0035	-
P-5- 6	-	0.0078	0.022	0.033	-
P-5- 7	0.0074	0.039	0.055	0.07	3.08
P-5- 8	0.0089	0.044	0.059	0.07	2.80
P-5- 9	0.003	0.034	0.041	0.053	4.20
P-5-10	0.0013	0.031	0.04	0.053	6.39
* P-5-11	0.095	0.28	0.36	0.48	2.25
* P-5-12	0.18	0.35	0.44	0.55	1.75
* P-5-13	0.11	0.26	0.39	0.53	2.20
* P-5-14	0.11	0.3	0.48	0.58	2.30
* P-5-15	0.14	0.25	0.33	0.4	1.69
* P-5-16	0.11	0.2	0.27	0.31	1.68
P-5-17					-
* P-5-18	0.22	0.47	0.57	0.65	1.72
* P-5-19	0.12	0.31	0.48	0.59	2.22
* P-5-20	0.16	0.31	0.48	0.59	1.92
* P-5-21	0.18	0.4	0.52	0.61	1.84
AVG.OF"*"	0.142	0.306	0.425	0.521	1.932
P-6- 1	-	0.0049	0.015	0.025	-
P-6- 2	-	0.0012	0.0047	0.01	-
P-6- 3	-	0.0012	0.004	0.0078	-
P-6- 4	-	0.0092	0.027	0.042	-
P-6- 5	-	0.0073	0.018	0.031	-
P-6- 6	-	0.012	0.021	0.035	-
P-6- 7	0.002	0.012	0.018	0.026	3.61
P-6- 8	0.0031	0.013	0.02	0.031	3.16
P-6- 9	0.002	0.024	0.041	0.057	5.34
P-6-10(1)	-	0.019	0.04	0.057	-
P-6-10(2)	0.016	0.057	0.09	0.12	2.74
P-6-11	0.047	0.095	0.14	0.16	1.85
* P-6-12	0.18	0.26	0.33	0.39	1.47
* P-6-13	0.12	0.36	0.51	0.61	2.25
* P-6-14	0.31	0.64	0.87	1.2	1.97
* P-6-15	0.25	0.54	0.69	0.8	1.79
* P-6-16	0.21	0.38	0.5	0.59	1.68
* P-6-17	0.19	0.35	0.5	0.59	1.76
P-6-18					-
* P-6-19	0.42	0.84	1.3	1.8	2.07
* P-6-20	0.16	0.44	0.62	0.8	2.24
P-6-21					
AVG.OF"*"	0.215	0.447	0.615	0.763	1.903

Table 7.4.1 SIGNIFICANT GRAIN SIZE (3/4)

BORE HOLE SAMPLES

SAMPLE	d25 (mm)	d50 (mm)	d65 (mm)	d75 (mm)	sq.root (d75/d25)
* P-7- 1	0.085	0.14	0.19	0.24	1.68
P-7- 2	0.0031	0.018	0.034	0.045	3.81
P-7- 3	-	0.002	0.0045	0.0075	-
P-7- 4	-	0.0068	0.017	0.032	-
P-7- 5	-	0.002	0.015	0.027	-
P-7- 6	0.0085	0.076	0.11	0.14	4.06
P-7- 7	-	0.008	0.02	0.029	-
P-7- 8					
P-7- 9	0.0013	0.011	0.022	0.027	4.56
P-7-10	0.0018	0.012	0.023	0.027	3.87
P-7-11	0.0042	0.021	0.034	0.043	3.20
P-7-12	-	0.0029	0.0069	0.013	-
* P-7-13	0.055	0.095	0.12	0.13	1.54
* P-7-14	0.068	0.12	0.15	0.19	1.67
* P-7-15	0.09	0.2	0.29	0.35	1.97
* P-7-16	0.09	0.17	0.21	0.26	1.70
* P-7-17	0.099	0.2	0.31	0.44	2.11
* P-7-18	0.17	0.29	0.34	0.4	1.53
P-7-19					-
* P-7-20	0.17	0.29	0.35	0.42	1.57
* P-7-21	0.17	0.3	0.36	0.45	1.63
AVG.OF"*"	0.103	0.187	0.241	0.297	1.711
P-8- 1	0.018	0.041	0.052	0.06	1.83
P-8- 2	0.018	0.045	0.059	0.069	1.96
* P-8- 3	0.25	0.5	0.6	0.69	1.66
* P-8- 4	0.12	0.19	0.25	0.29	1.55
* P-8- 5	0.13	0.2	0.26	0.3	1.52
* P-8- 6	0.16	0.22	0.27	0.31	1.39
* P-8- 7	0.16	0.22	0.27	0.31	1.39
* P-8- 8	0.2	0.33	0.45	0.57	1.69
* P-8- 9	0.2	0.27	0.34	0.4	1.41
* P-8-10	0.2	0.32	0.45	0.56	1.67
* P-8-11	0.24	0.4	0.52	0.63	1.62
* P-8-12	0.2	0.27	0.34	0.4	1.41
P-8-13					
* P-8-14	0.2	0.3	0.38	0.45	1.50
* P-8-15	0.2	0.29	0.35	0.4	1.41
* P-8-16	0.2	0.31	0.4	0.51	1.60
* P-8-17	0.2	0.3	0.38	0.45	1.50
P-8-18	-	0.0056	0.02	0.038	-
* P-8-19	0.18	0.14	0.29	0.32	1.33
* P-8-20	0.18	0.14	0.29	0.32	1.33
* P-8-21	0.2	0.3	0.37	0.47	1.53
AVG.OF"*"	0.186	0.263	0.354	0.418	1.502

BORE HOLE SAMPLES

SAMPLE	d25 (mm)	d50 (mm)	d65 (mm)	d75 (mm)	sq.root (d75/d25)
P-9- 1	0.043	0.08	0.1	0.12	1.67
P-9- 2	0.0021	0.0095	0.016	0.022	3.24
P-9- 3	0.055	2.7	8.4	11	14.14
P-9- 4	0.04	0.086	0.12	0.15	1.94
P-9- 5	0.028	0.071	0.093	0.11	1.98
P-9- 6	0.004	0.02	0.035	0.05	3.54
* P-9- 7	0.1	0.2	0.25	0.29	1.70
* P-9- 8	0.17	0.23	0.28	0.32	1.37
* P-9- 9	0.16	0.23	0.28	0.32	1.41
* P-9-10	0.18	0.24	0.29	0.33	1.35
* P-9-11	0.19	0.27	0.33	0.37	1.40
* P-9-12	0.16	0.22	0.27	0.3	1.37
P-9-13					
* P-9-14	0.16	0.22	0.27	0.31	1.39
P-9-15	0.0023	0.009	0.018	0.026	3.36
P-9-16	0.0021	0.0085	0.019	0.029	3.72
* P-9-17	0.08	0.12	0.15	0.2	1.58
* P-9-18	0.088	0.16	0.2	0.26	1.72
* P-9-19	0.19	0.27	0.34	0.4	1.45
* P-9-20	0.17	0.25	0.3	0.37	1.48
* P-9-21	0.15	0.25	0.34	0.4	1.63
AVG.OF"*"	0.144	0.217	0.269	0.317	1.488
P-10- 1	-	0.0016	0.0048	0.017	-
P-10- 2	-	0.0019	0.0038	0.0065	-
P-10- 3	0.004	0.024	0.037	0.047	3.43
P-10- 4	0.0017	0.021	0.037	0.049	5.37
P-10- 5	-	0.0046	0.009	0.015	-
P-10- 6	-	0.0045	0.013	0.021	-
P-10- 7	-	0.027	0.049	0.067	-
P-10- 8	-	0.013	0.037	0.055	-
P-10- 9	0.0029	0.021	0.045	0.072	4.98
P-10-10	0.037	0.08	0.1	0.12	1.80
P-10-11	0.0029	0.025	0.049	0.072	4.98
P-10-12	0.0019	0.021	0.038	0.049	5.08
P-10-13	0.0045	0.029	0.051	0.072	4.00
P-10-14	0.045	0.14	0.19	0.25	2.36
* P-10-15	0.17	0.22	0.27	0.3	1.33
* P-10-16	0.18	0.24	0.29	0.33	1.35
* P-10-17	0.17	0.23	0.28	0.32	1.37
* P-10-18	0.17	0.23	0.28	0.32	1.37
* P-10-19	0.18	0.23	0.28	0.32	1.33
P-10-20					
* P-10-21	0.12	0.21	0.27	0.31	1.61
AVG.OF"*"	0.163	0.226	0.278	0.317	1.395

Table 7.4.1 SIGNIFICANT GRAIN SIZE (4/4)

BORE HOLE SAMPLES

SAMPLE	d25 (mm)	d50 (mm)	d65 (mm)	d75 (mm)	sq.root (d75/d25)
P-11- 1	0.004	0.016	0.026	0.037	3.04
P-11- 2	0.005	0.02	0.029	0.04	2.83
P-11- 3	0.0029	0.015	0.026	0.037	3.57
P-11- 4	-	0.0015	0.011	0.03	-
P-11- 5	-	0.0022	0.015	0.031	-
P-11- 6	-	0.015	0.04	0.06	-
P-11- 7	0.015	0.089	0.19	0.28	4.32
P-11- 8	0.013	0.085	0.15	0.24	4.30
P-11- 9	0.0025	0.029	0.4	1.6	25.30
P-11-10	0.0012	0.012	0.037	0.068	7.53
P-11-11	0.075	0.13	0.19	0.23	1.75
P-11-12	0.035	0.07	0.092	0.12	1.85
P-11-13	-	0.022	0.045	0.064	-
P-11-14	-	0.036	0.065	0.12	-
* P-11-15	0.16	0.42	0.62	0.81	2.25
P-11-16	0.003	0.049	0.09	0.15	7.07
P-11-17					
* P-11-18	0.18	0.27	0.35	0.4	1.49
* P-11-19	0.16	0.27	0.35	0.4	1.58
* P-11-20	0.15	0.28	0.41	0.51	1.84
P-11-21					
AVG.OF"*"	0.162	0.304	0.420	0.507	1.791
P-12- 1	-	0.0036	0.0098	0.022	-
P-12- 2	-	0.0018	0.0046	0.01	-
P-12- 3	-	0.0012	0.004	0.009	-
P-12- 4	-	0.0012	0.0098	0.032	-
P-12- 5	-	-	0.0058	0.023	-
P-12- 6	0.0026	0.024	0.034	0.046	4.21
P-12- 7	-	0.0038	0.0091	0.018	-
P-12- 8	-	0.0036	0.0075	0.012	-
P-12- 9	-	0.0055	0.016	0.023	-
* P-12-10	0.083	0.21	0.35	0.46	2.35
* P-12-11	0.17	0.4	0.55	0.7	2.03
* P-12-12	0.17	0.28	0.4	0.5	1.71
* P-12-13	0.18	0.48	0.6	0.71	1.99
* P-12-14	0.17	0.26	0.34	0.4	1.53
* P-12-15	0.15	0.24	0.3	0.37	1.57
P-12-16	-	0.0082	0.02	0.025	-
P-12-17	0.0014	0.021	0.028	0.037	5.14
P-12-18	0.0029	0.035	0.038	0.06	4.55
P-12-19	-	0.012	0.022	0.028	-
* P-12-20	0.076	0.17	0.23	0.28	1.92
* P-12-21	0.045	0.16	0.21	0.26	2.40
AVG.OF"*"	0.118	0.257	0.350	0.433	1.939

BORE HOLE SAMPLES

SAMPLE	d25 (mm)	d50 (mm)	d65 (mm)	d75 (mm)	sq.root (d75/d25)
P-13- 1	0.002	0.016	0.03	0.042	4.58
P-13- 2	0.007	0.037	0.089	0.11	3.96
P-13- 3	0.0025	0.012	0.023	0.037	3.85
P-13- 4	0.019	0.045	0.058	0.068	1.89
P-13- 5	0.0019	0.013	0.03	0.045	4.87
P-13- 6	0.0056	0.036	0.055	0.07	3.54
P-13- 7	0.0045	0.034	0.05	0.065	3.80
P-13- 8	-	0.0046	0.014	0.023	-
P-13- 9	0.002	0.019	0.03	0.047	4.85
P-13-10	0.0022	0.017	0.025	0.033	3.87
* P-13-11	0.16	0.24	0.3	0.36	1.50
* P-13-12	0.16	0.23	0.28	0.31	1.39
* P-13-13	0.11	0.2	0.25	0.29	1.62
* P-13-14	0.11	0.2	0.25	0.29	1.62
* P-13-15	0.15	0.21	0.26	0.3	1.41
* P-13-16	0.16	0.23	0.29	0.35	1.48
P-13-17					
* P-13-18	0.05	0.17	0.22	0.27	2.32
* P-13-19	0.05	0.17	0.26	0.36	2.68
P-13-20					
* P-13-21	0.055	0.13	0.18	0.25	2.13
AVG.OF"*"	0.100	0.195	0.252	0.307	1.797
AVERAGE	0.149	0.260	0.344	0.414	1.684

Table 7.4.2 BED MATERIAL FOR SEDIMENT CALCULATION

No.	Site	d25 (mm)	d50 (mm)	d65 (mm)	d75 (mm)	$\sqrt{d75/d25}$
1	Puente Remolino	0.150	0.258	0.343	0.416	1.665
2	Totumito	0.082	0.147	0.195	0.236	1.696
3	Palmarito	0.151	0.234	0.301	0.357	1.538
	Average	0.128	0.213	0.280	0.336	1.623
4	Suripa	0.220	0.343	0.431	0.495	1.500
5	San Vicente	0.142	0.306	0.425	0.521	1.915
6	Bruzual	0.215	0.447	0.615	0.763	1.884
	Average	0.192	0.365	0.490	0.593	1.756
7	El Saman	0.103	0.187	0.241	0.297	1.698
8	Apurito	0.186	0.263	0.354	0.418	1.499
9	San Fernando	0.144	0.217	0.269	0.317	1.484
10	Arichuna	0.163	0.226	0.278	0.317	1.395
	Average	0.149	0.223	0.286	0.337	1.504
	Composition Rate	37.5%	20.0%	12.5%	30.0%	

Table 7.4.3 CHANNEL CHARACTERISTICS FOR SEDIMENT FLOW

Site		Ie	B (m)	h (m)	u* (cm/s)	tau*	u*/wo	h/d	B/h	$B^{0.2}/h$
Guasdualito	1/	3500	258	3.58	10.01	2.07	2.40	1.19E+04	72.07	14.09
Bruzual	1/	5000	415	5.07	9.97	2.05	2.39	1.69E+04	81.85	14.90
Camaguan	1/	16700	139	7.49	6.63	0.91	1.59	2.50E+04	18.56	2.65
San Feranando	1/	8500	577	7.39	9.23	1.76	2.21	2.46E+04	78.08	12.78

u*c(cm/s)	wo(cm/s)	d(cm)
1.59	4.17	0.03

FIGURES

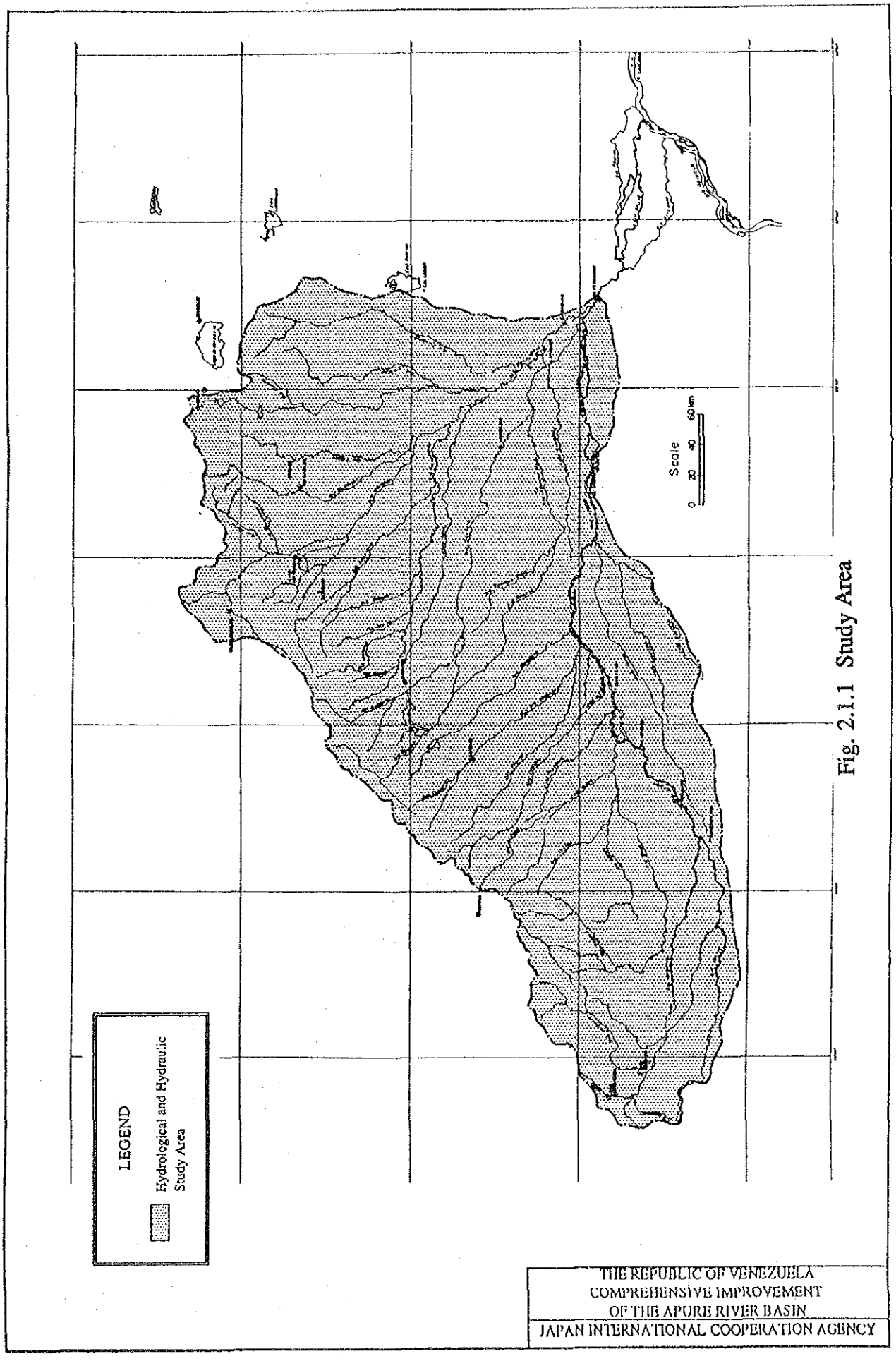

Fig. 2.1.1 Study Area

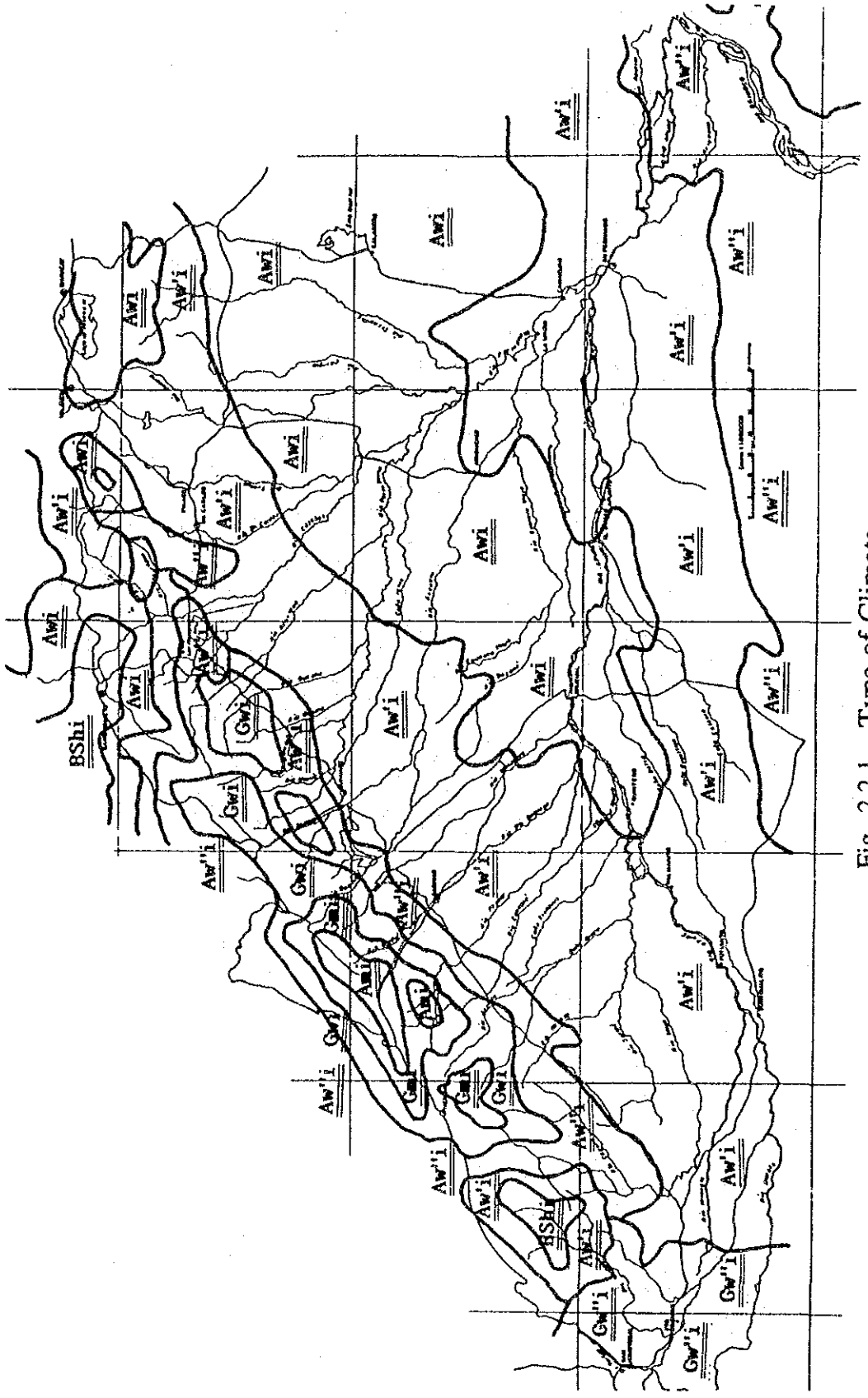

Fig. 2.2.1 Type of Climate

THE REPUBLIC OF VENEZUELA
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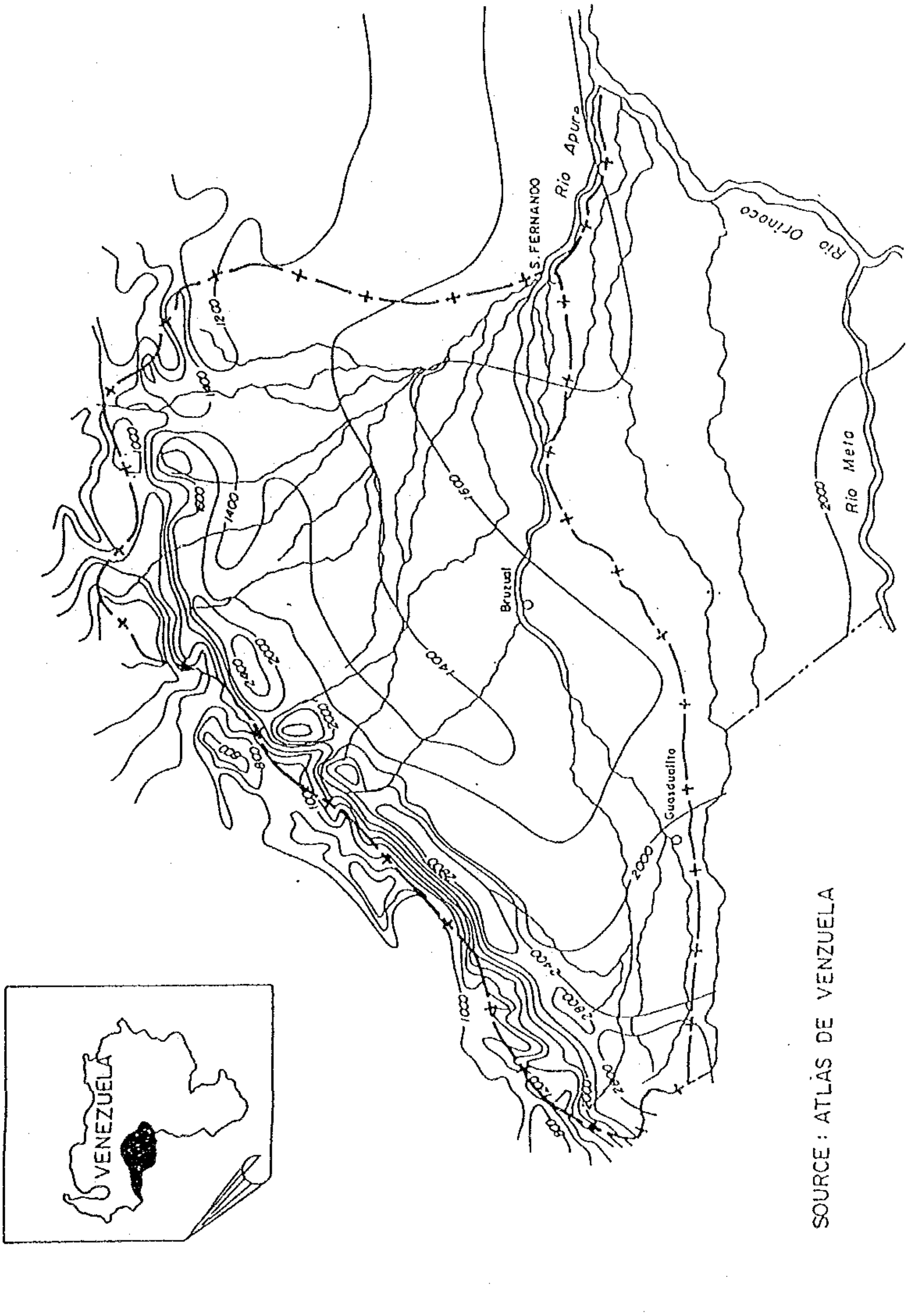

0 100 200 300 Km
SCALE

Fig. 2.2.2 Annual Isohyetal Map

THE REPUBLIC OF VENEZUELA COMPREHENSIVE IMPROVEMENT OF THE APURE RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

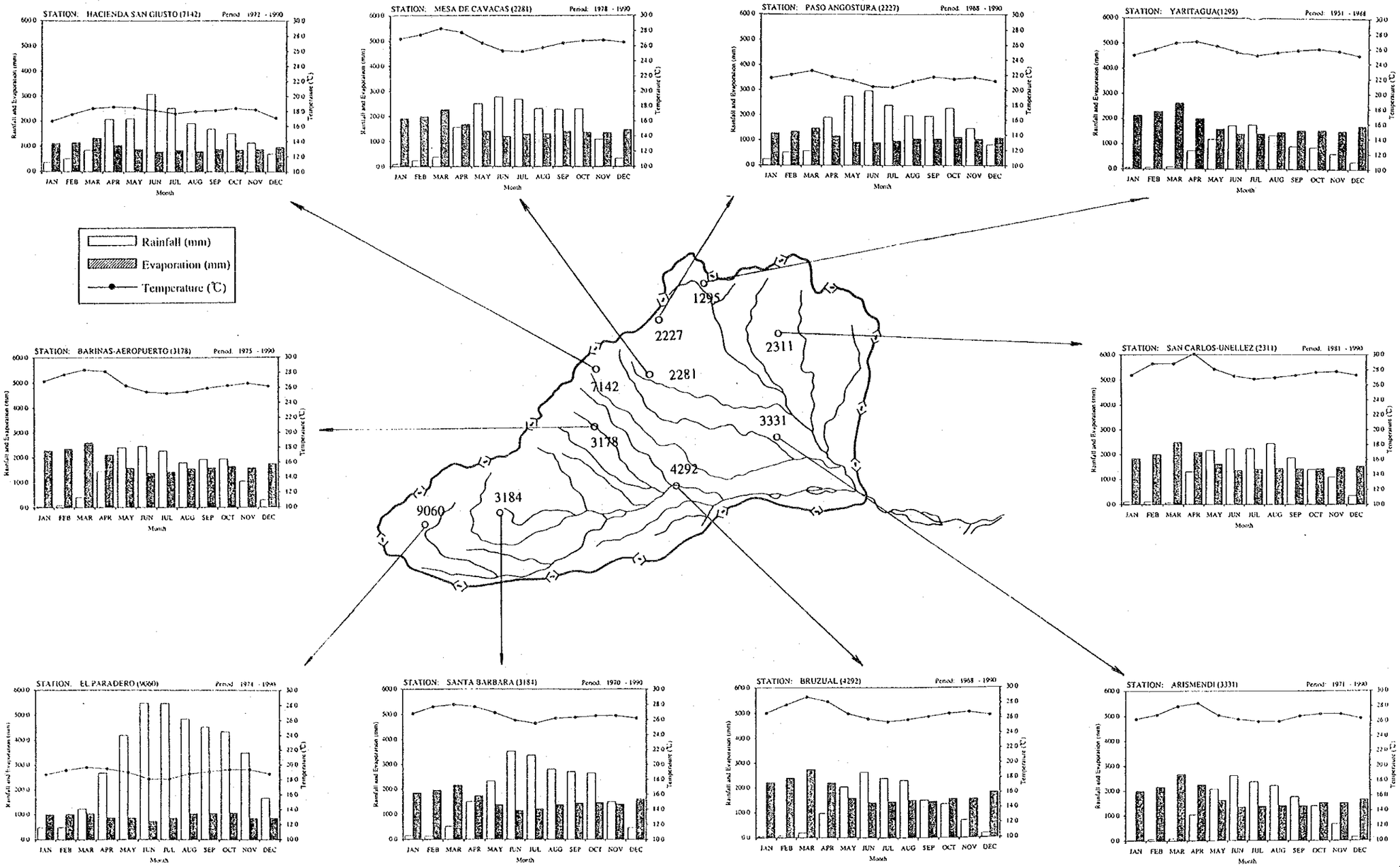

Fig. 2.2.3 Climatological Condition (1/2)

THE REPUBLIC OF VENEZUELA COMPREHENSIVE IMPROVEMENT OF THE APURE RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

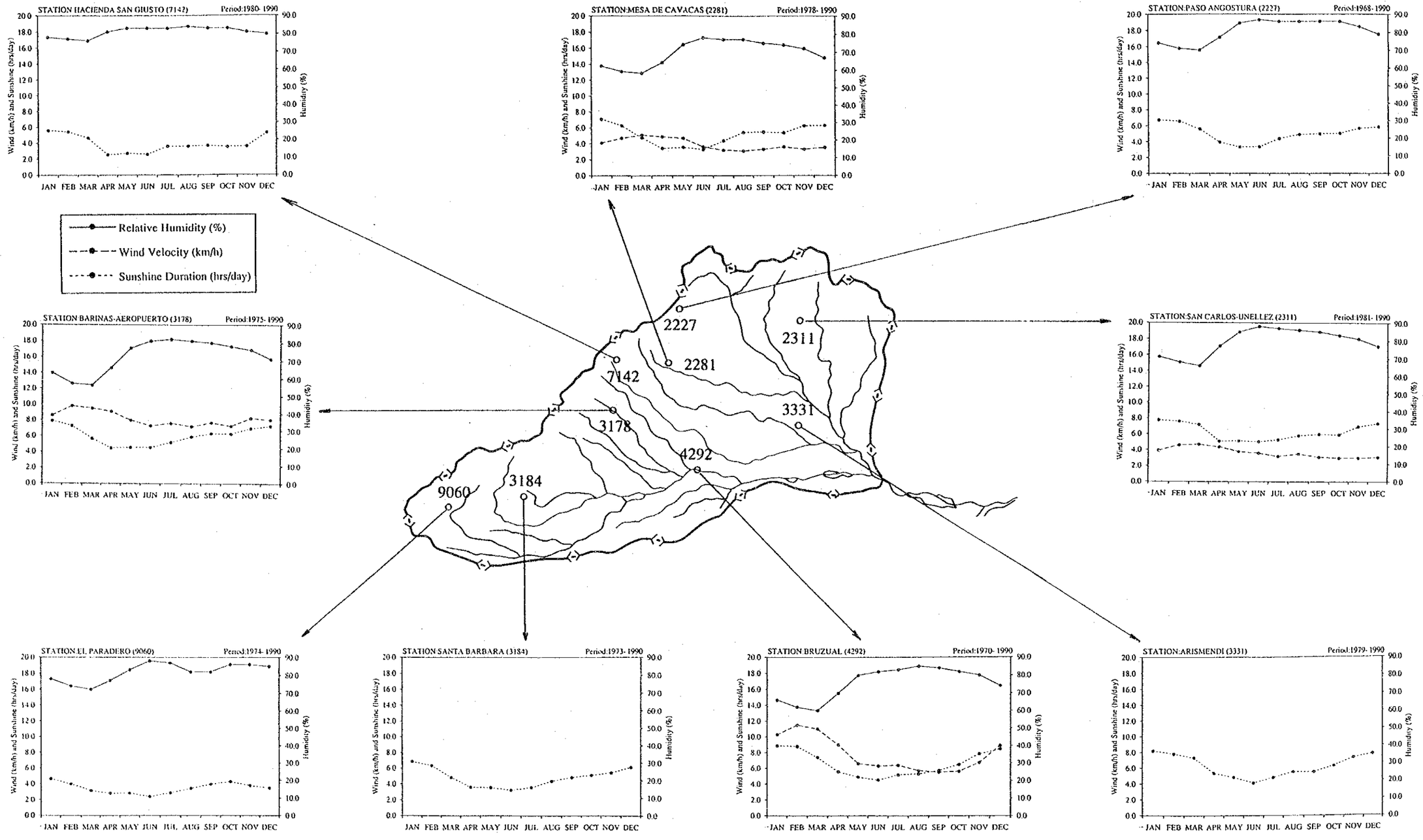

Fig. 2.2.3 Climatological Condition (2/2)

THE REPUBLIC OF VENEZUELA
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JAPAN INTERNATIONAL COOPERATION AGENCY

Legend

- o : Raingauge station
- ⊙ : Raingauge stations selected for calculation of basin mean rainfall
- ——— : Basin boundary
- - - - - - : Sub-basin boundary

Fig. 3.2.1 Location of Meteorological and Rainfall Gauging Stations

THE REPUBLIC OF VENEZUELA
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OF THE APURE RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

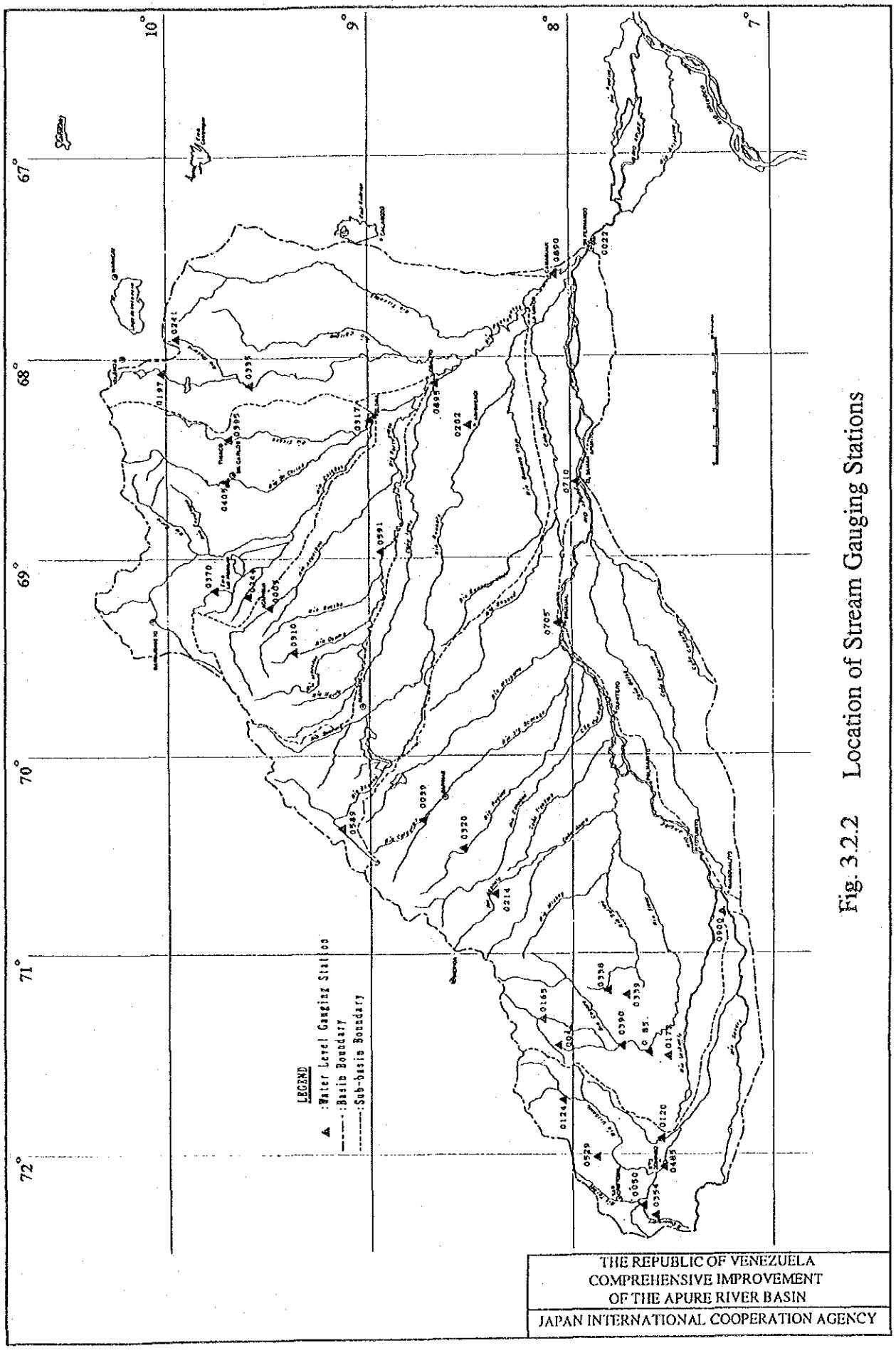


Fig. 3.2.2 Location of Stream Gauging Stations

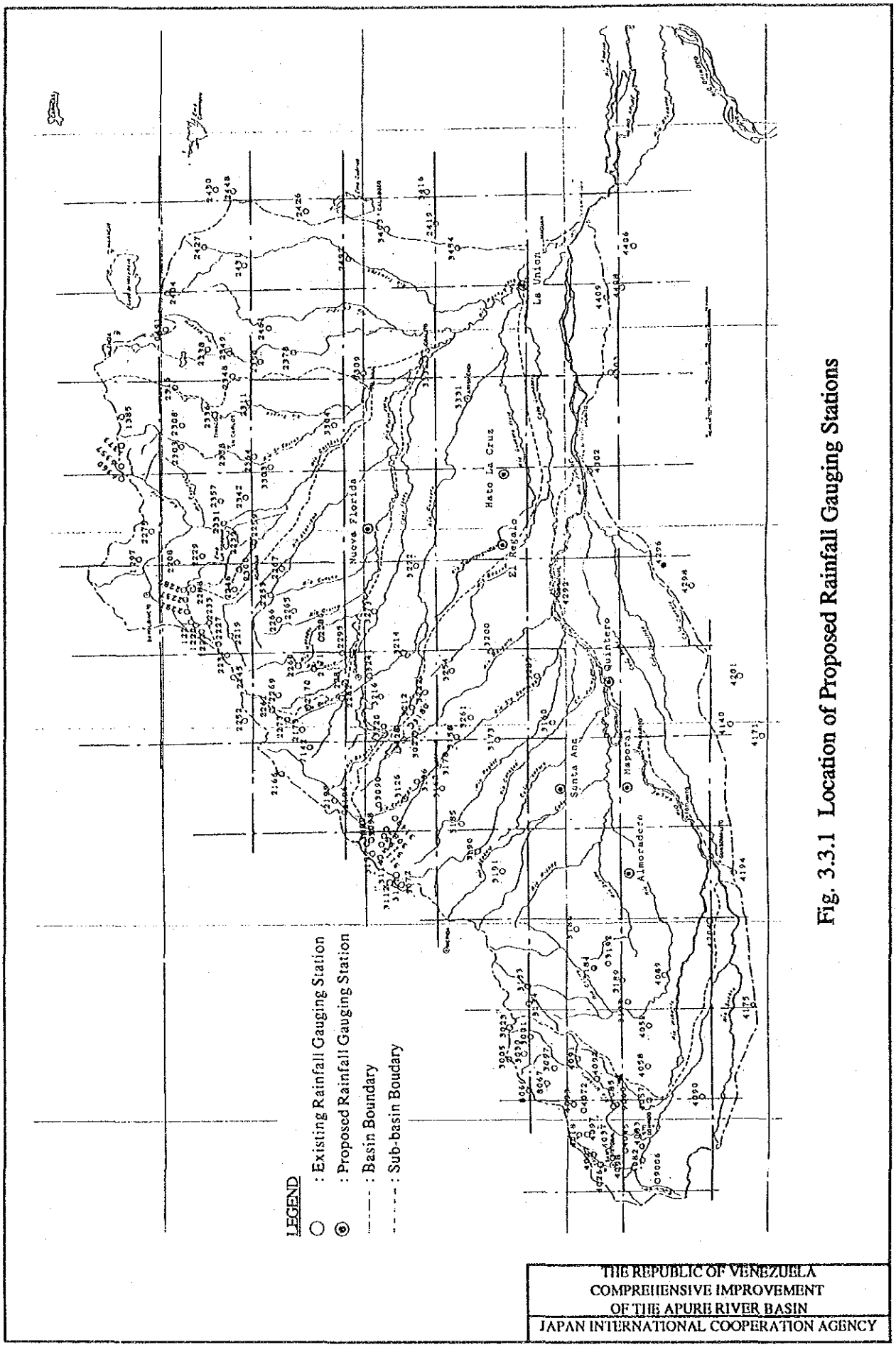


Fig. 3.3.1 Location of Proposed Rainfall Gauging Stations

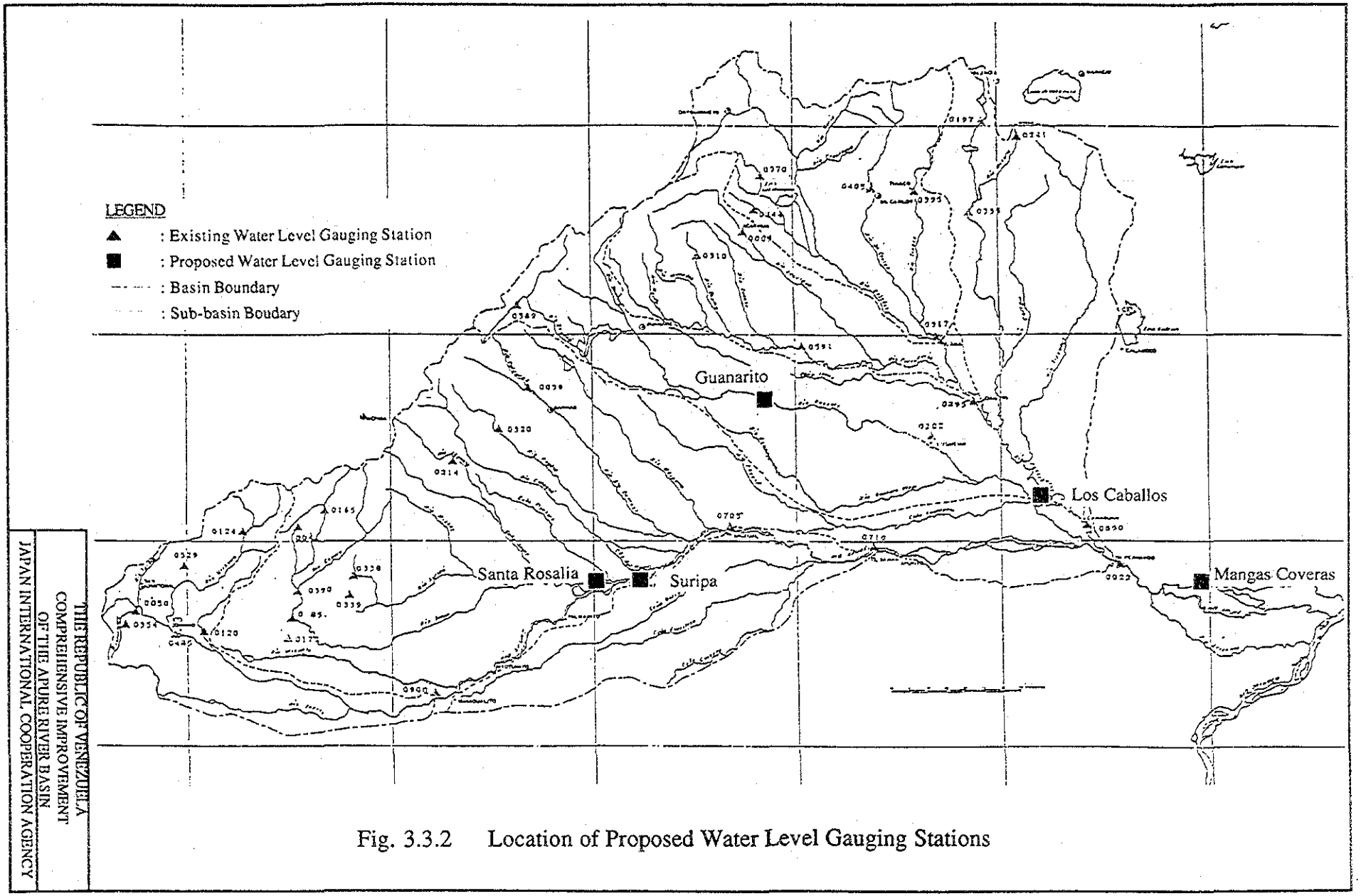


Fig. 3.3.2 Location of Proposed Water Level Gauging Stations

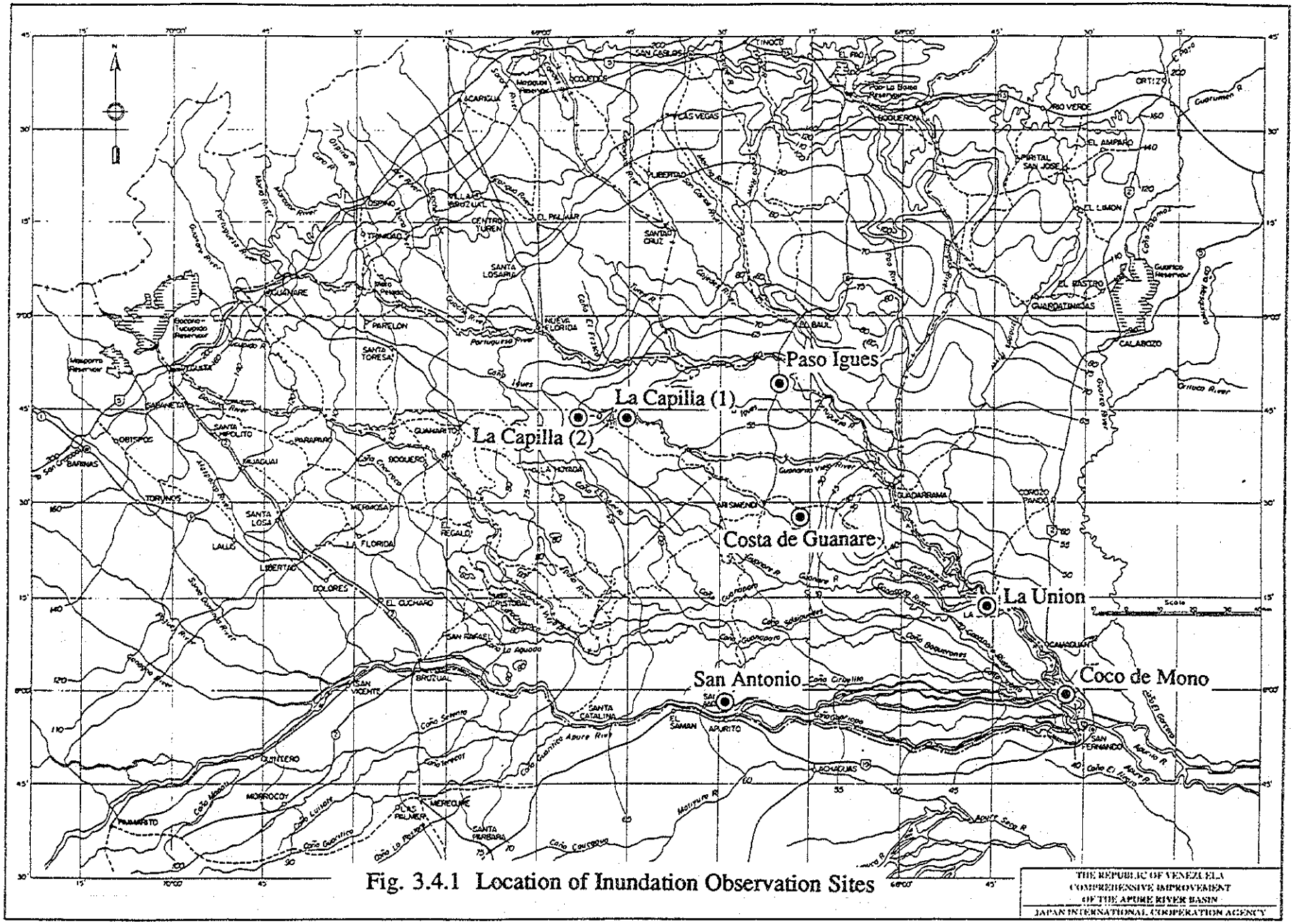
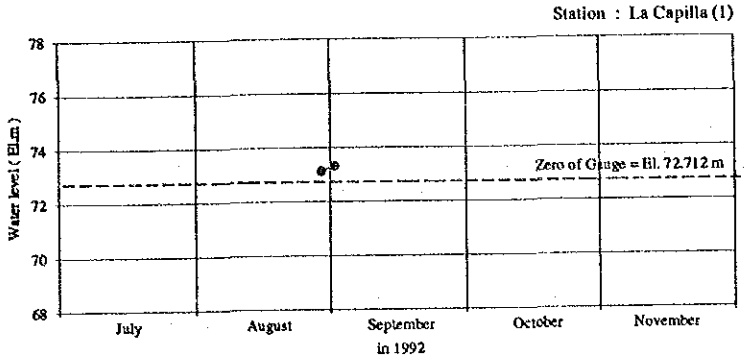
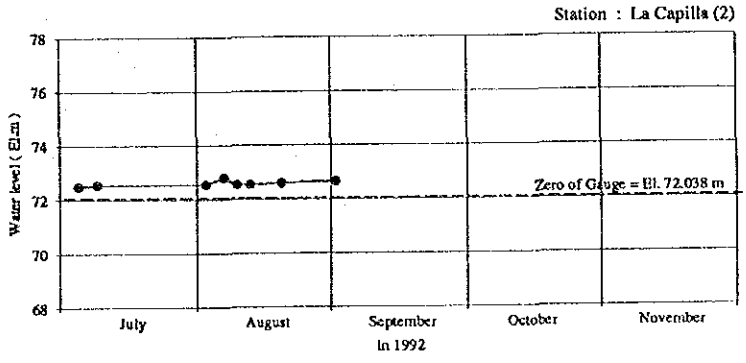


Fig. 3.4.1 Location of Inundation Observation Sites





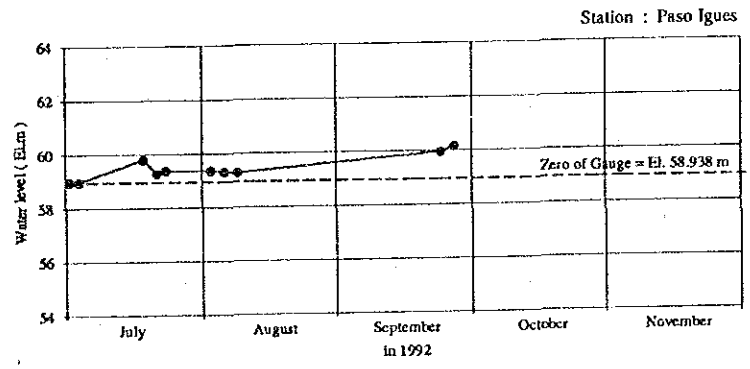


Fig. 3.4.2 Result of Inundation Observation (1/2)

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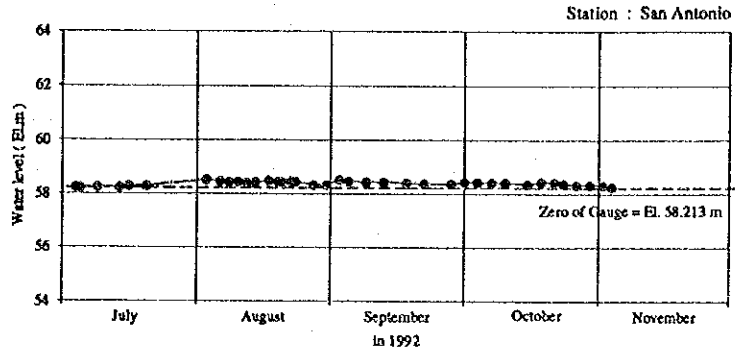

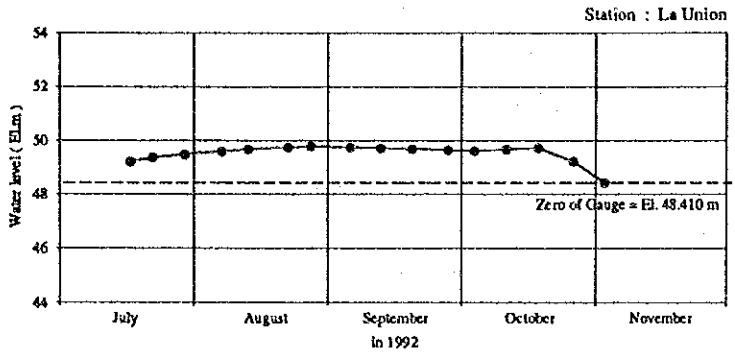

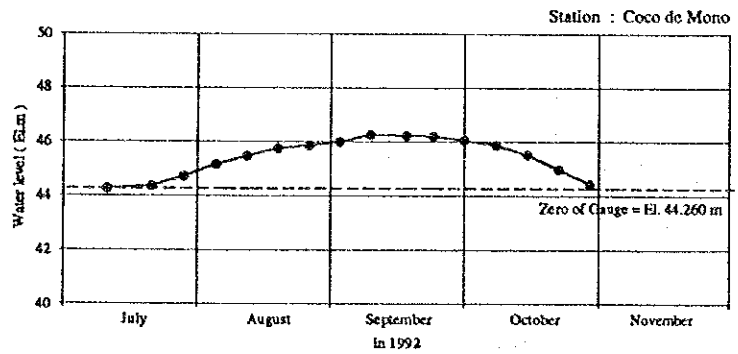

Fig. 3.4.2 Result of Inundation Observation (2/2)

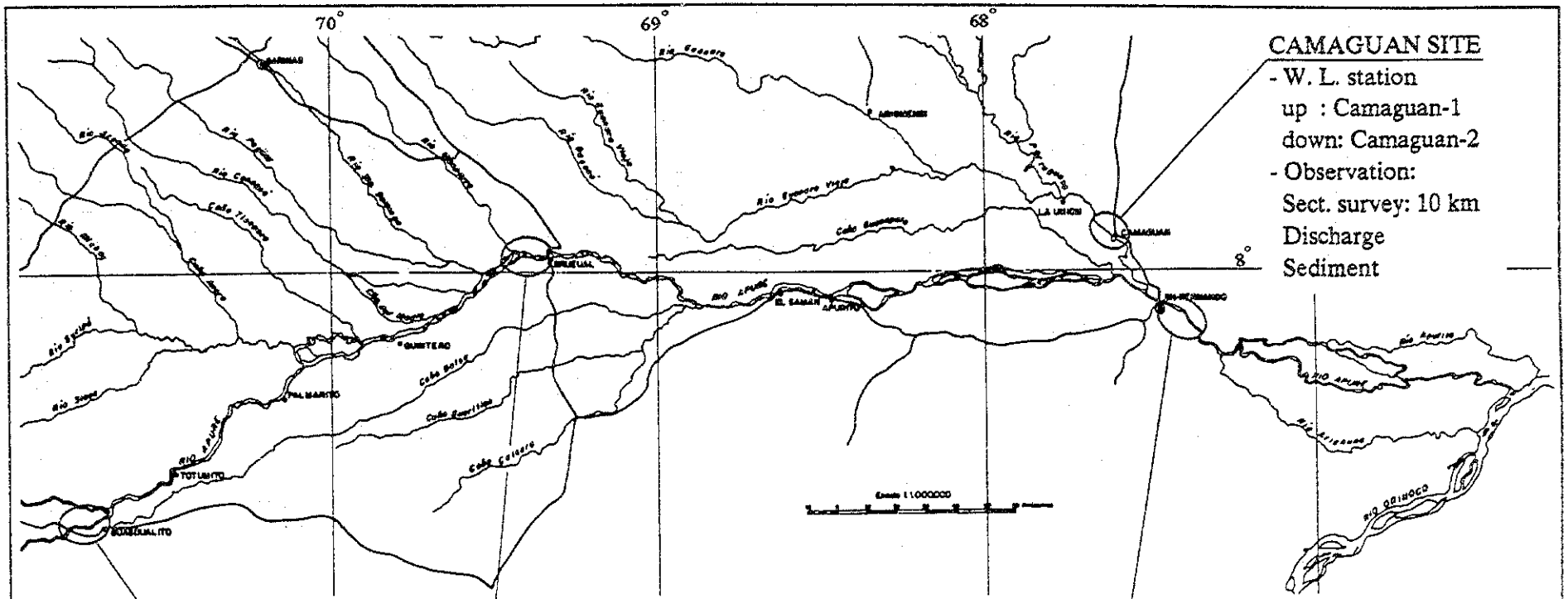

Fig. 3.5.1 Location of Channel Observation Sites

THE REPUBLIC OF VENEZUELA
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OF THE APURE RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

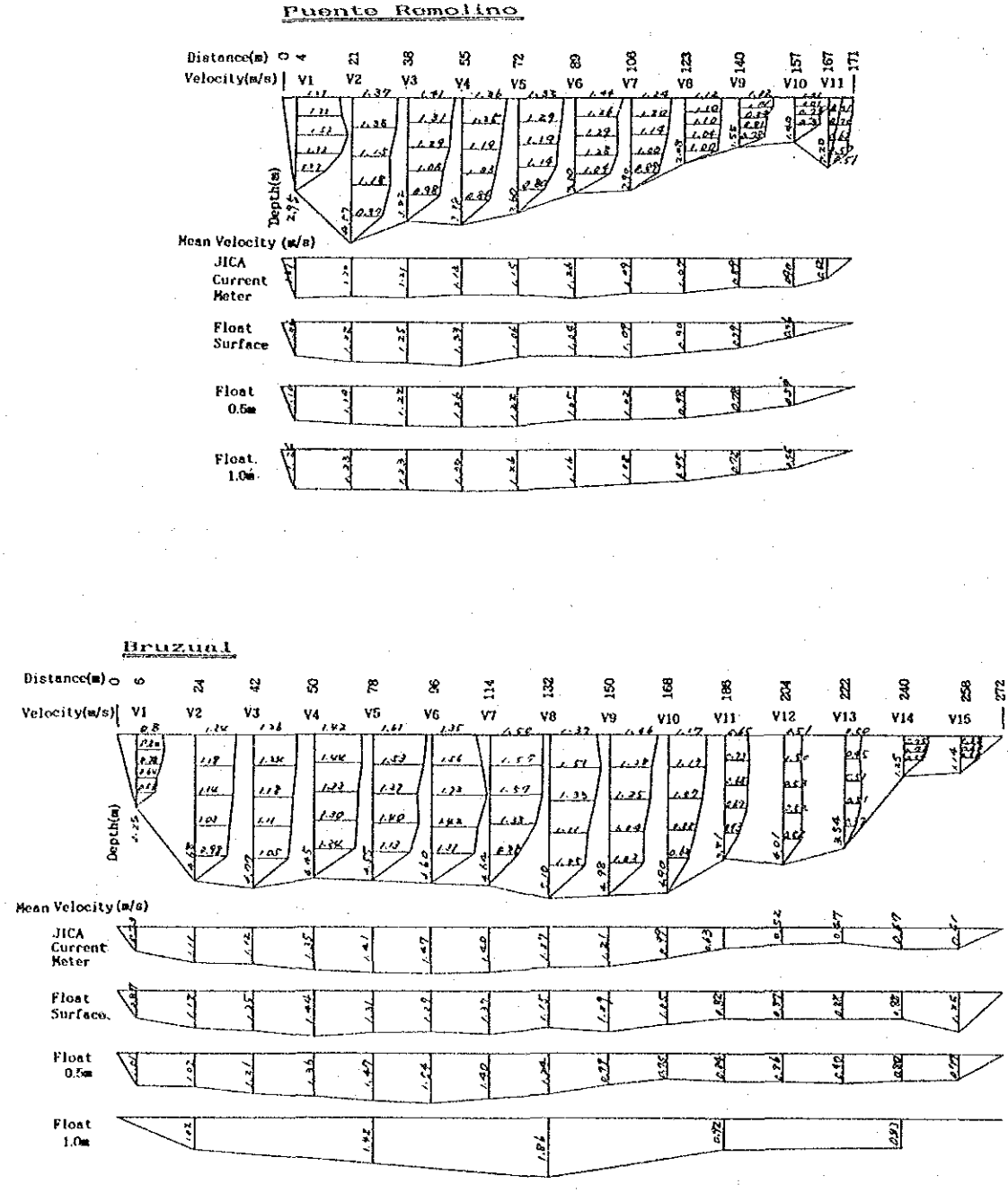


Fig. 3.5.2 Result of Discharge Measurement (1/2)

THE REPUBLIC OF VENEZUELA COMPREHENSIVE IMPROVEMENT OF THE APURE RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

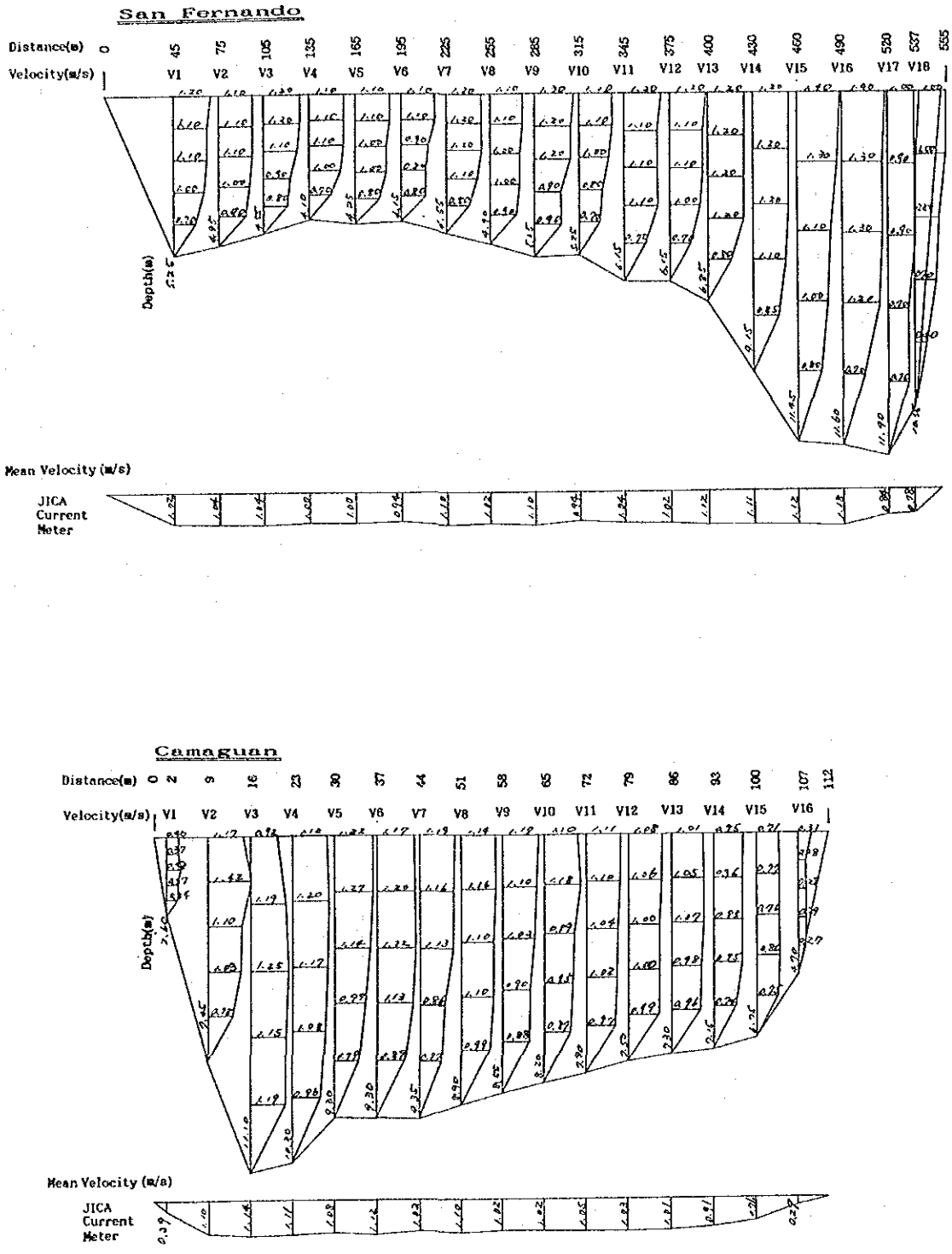
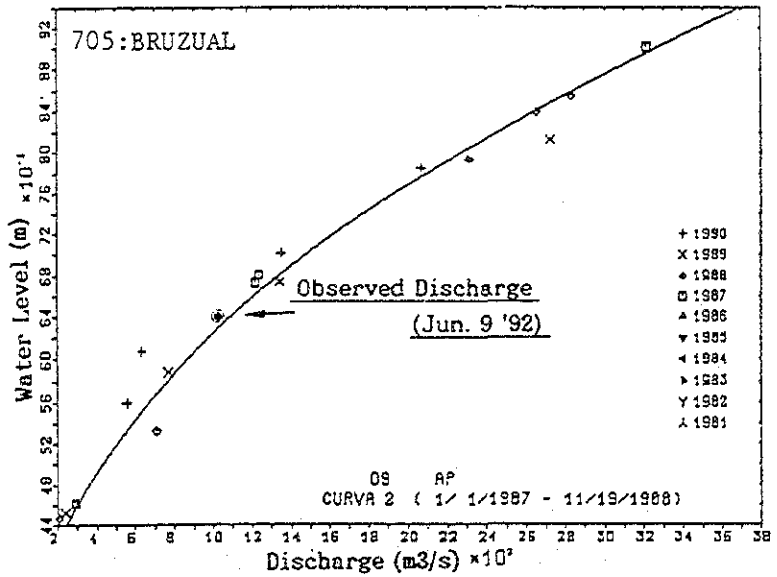
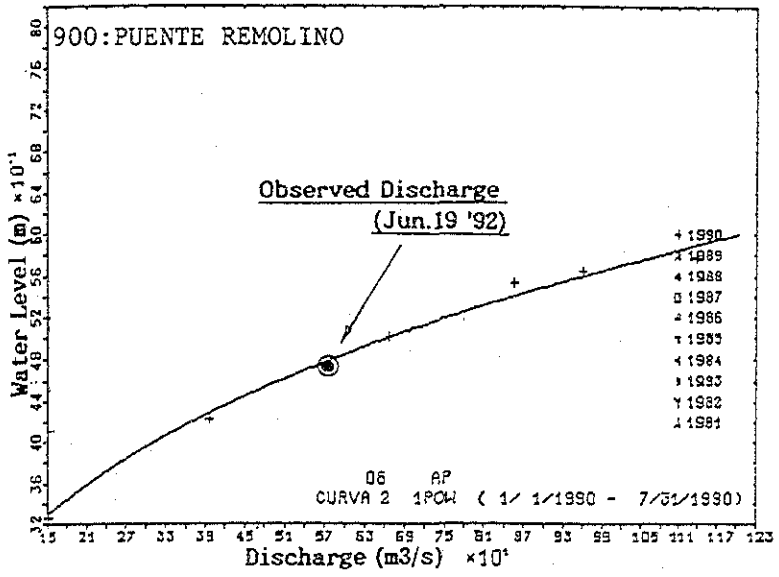
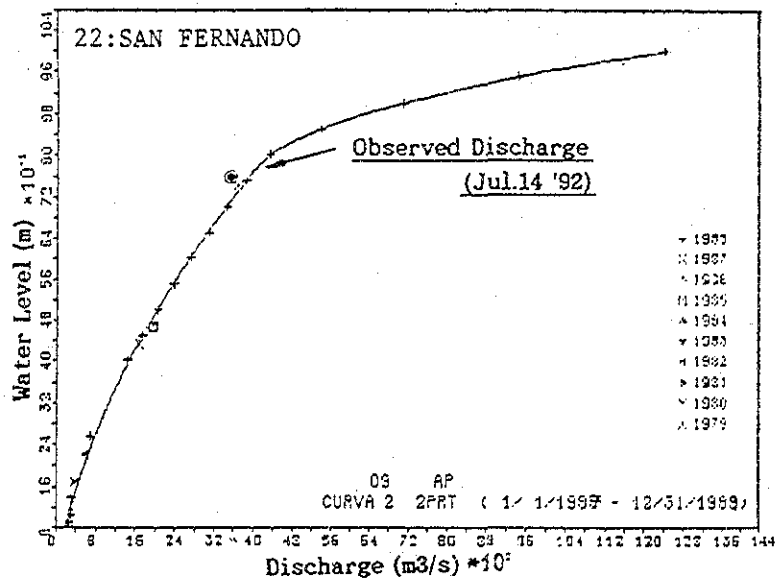


Fig. 3.5.2 Result of Discharge Measurement (2/2)

THE REPUBLIC OF VENEZUELA COMPREHENSIVE IMPROVEMENT OF THE APURE RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY







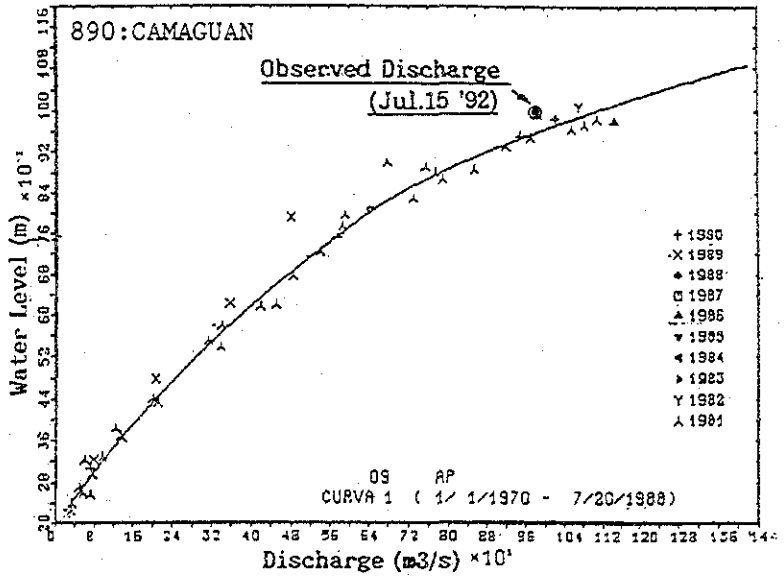


Fig. 3.5.3 Stage-Discharge Curves

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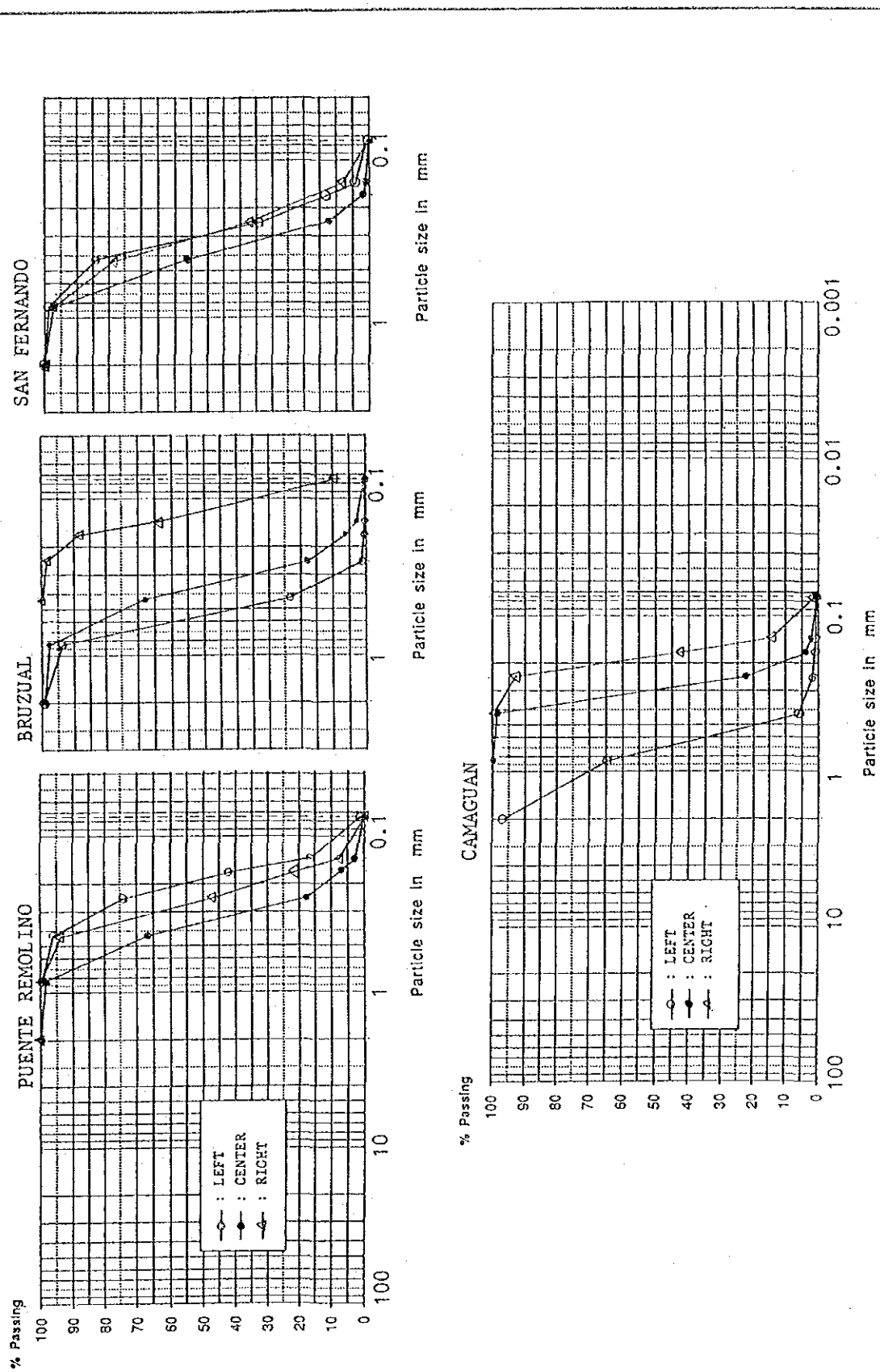

Fig. 3.5.4 Grading Curves of Sampled Bed Loads

THE REPUBLIC OF VENEZUELA COMPREHENSIVE IMPROVEMENT OF THE APURE RIVER BASIN
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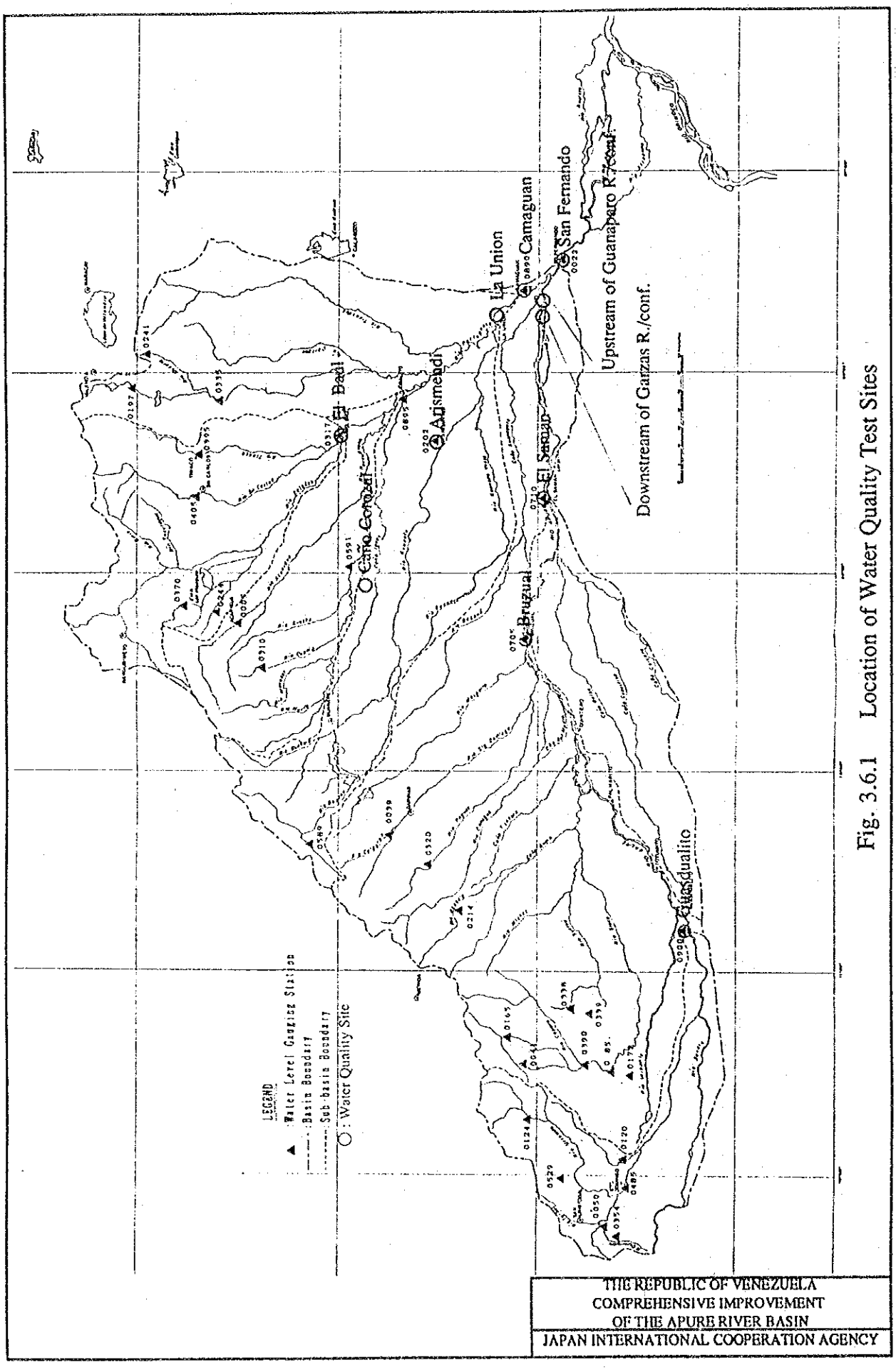

Fig. 3.6.1 Location of Water Quality Test Sites

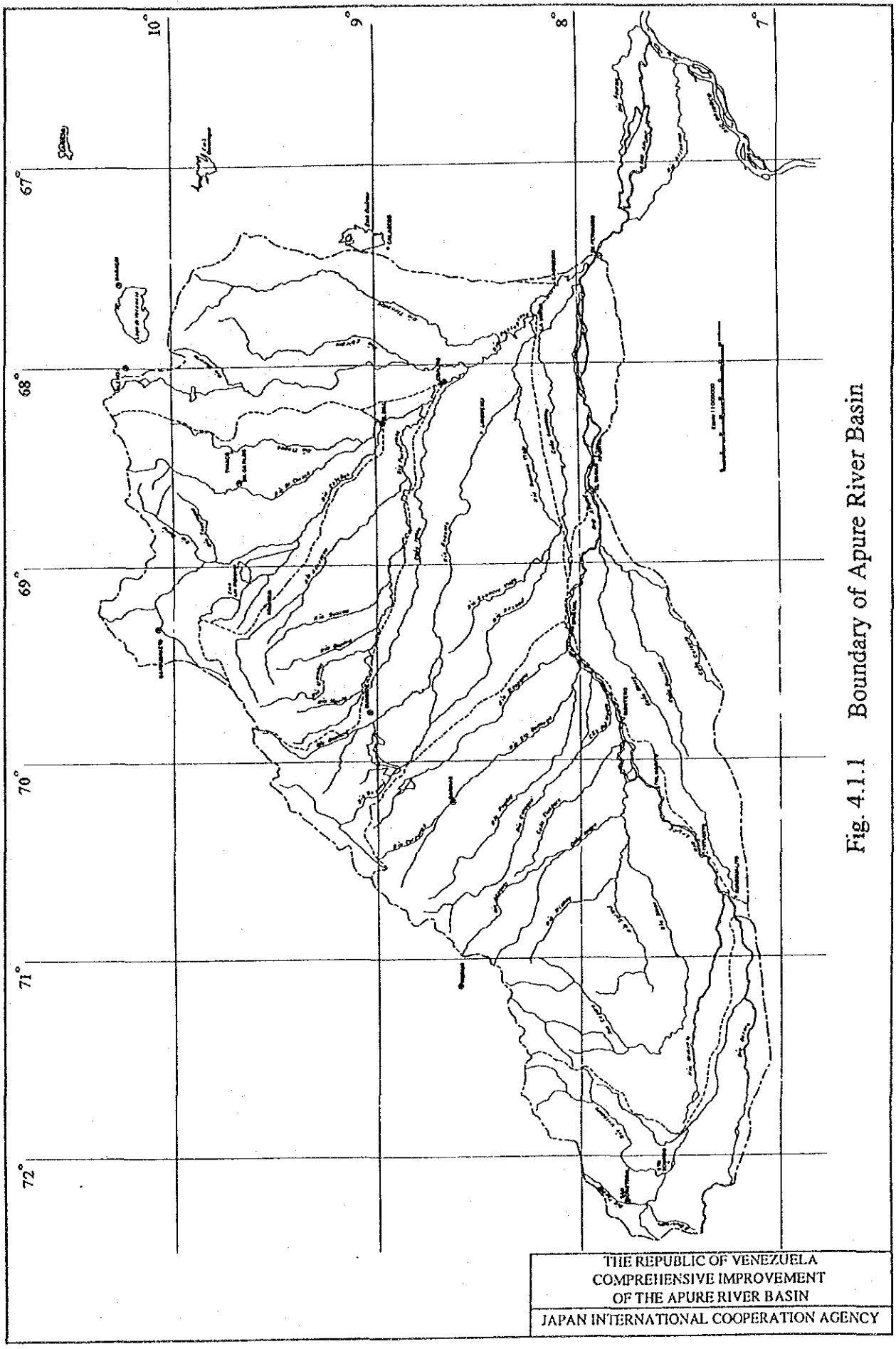

Fig. 4.1.1 Boundary of Apure River Basin

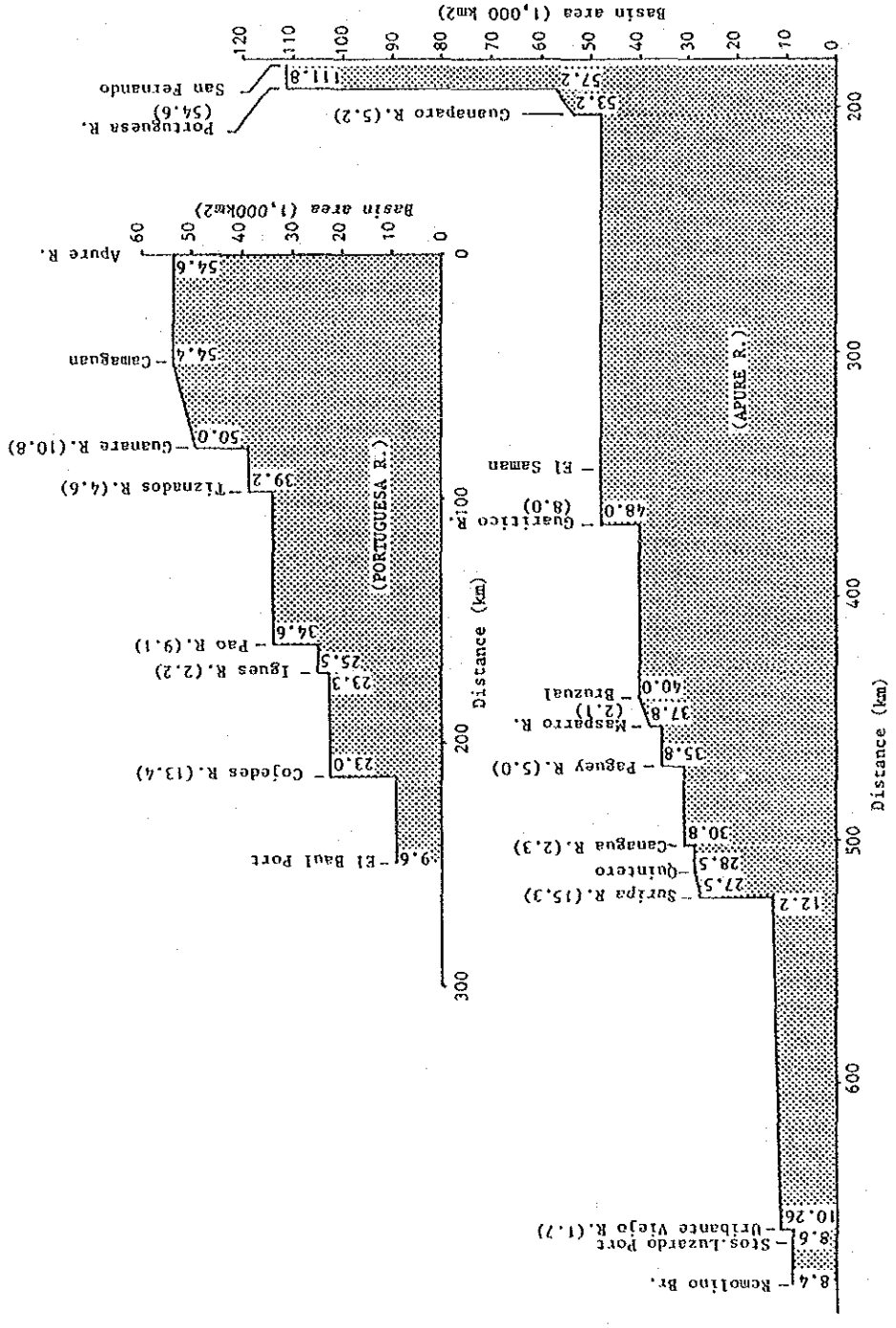

Fig. 4.1.2 Drainage Area of Apure River

THE REPUBLIC OF VENEZUELA COMPREHENSIVE IMPROVEMENT OF THE APURE RIVER BASIN
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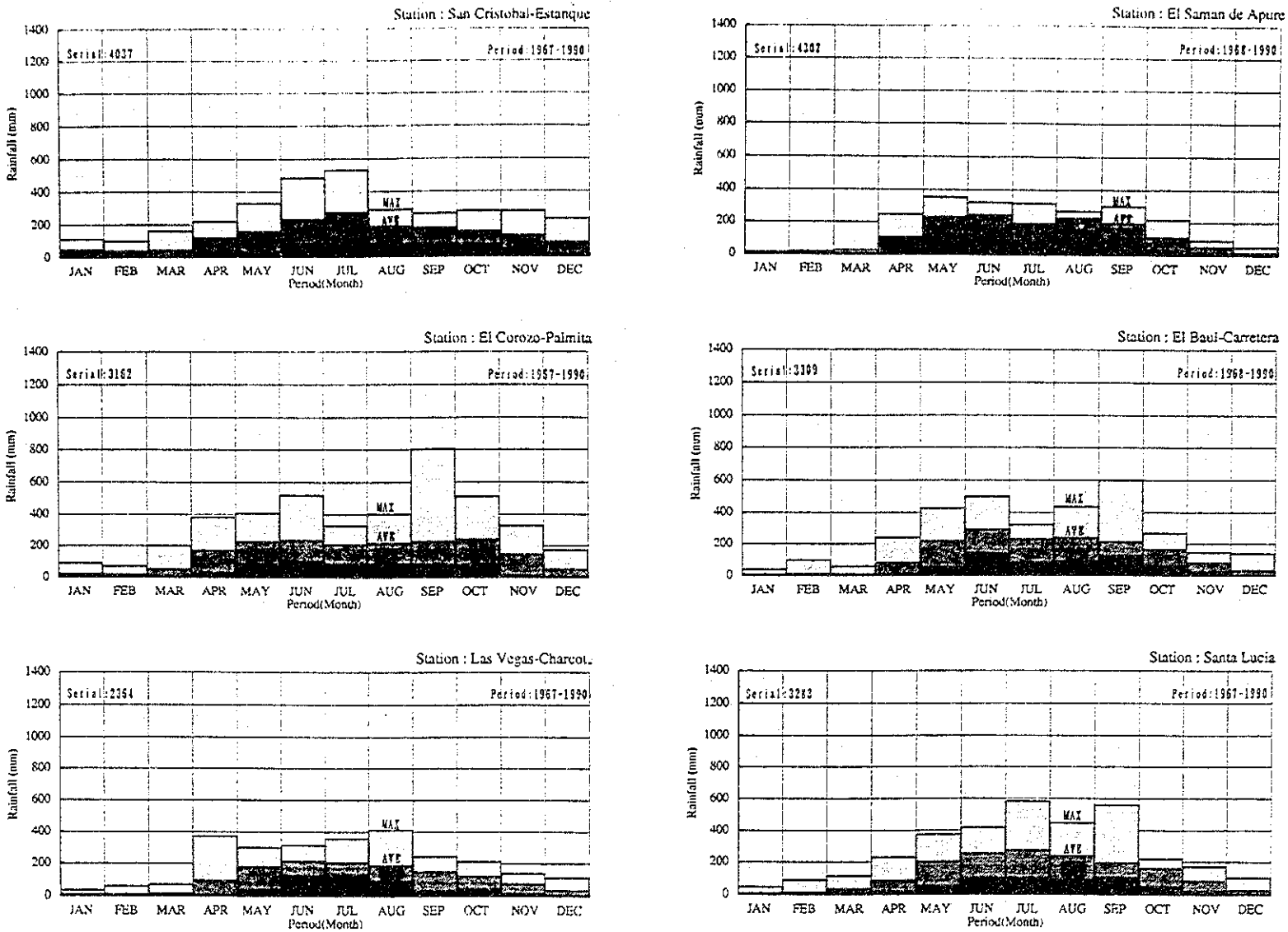


Fig. 4.2.1 Average Monthly Rainfall at Major Stations

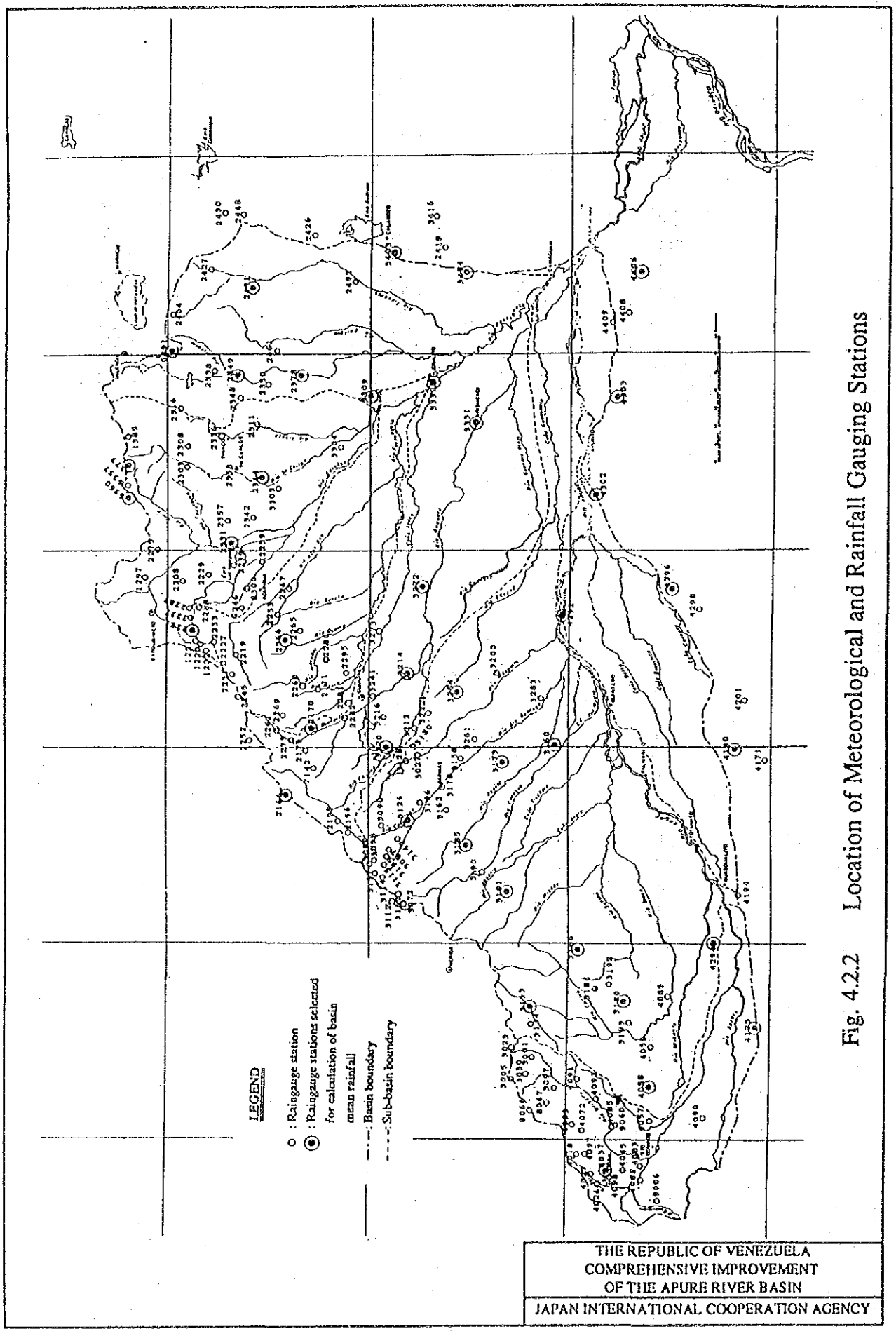
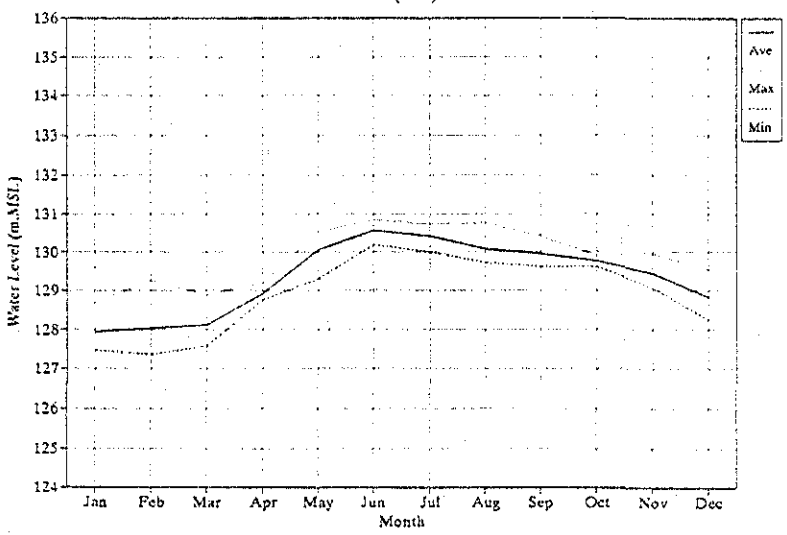
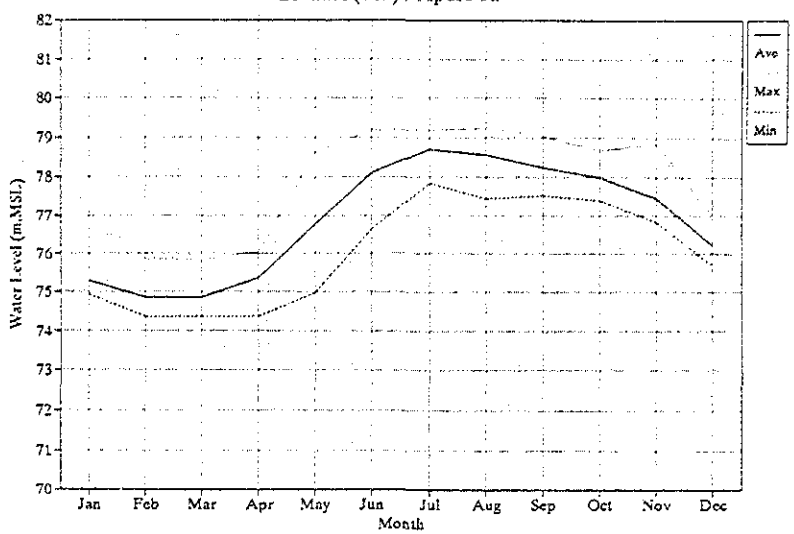


Fig. 4.2.2 Location of Meteorological and Rainfall Gauging Stations





Puente Remolino (900) / Sarare R.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.
1977	127.51	127.26	127.35	127.62	128.29	130.03	130.47	129.89	129.41	-	-	-	-
1978	-	-	-	-	-	-	-	-	-	-	-	-	-
1979	127.73	127.36	127.57	128.80	129.30	130.18	130.43	129.96	129.82	129.66	129.50	129.02	129.11
1980	-	-	-	-	-	-	-	-	-	-	-	-	-
1981	127.46	127.46	128.10	128.96	130.20	130.58	129.99	129.73	130.41	129.92	129.07	128.57	129.20
1982	127.83	128.03	127.90	129.19	130.24	130.71	130.72	129.90	129.61	129.89	129.30	128.25	129.30
1983	128.06	127.44	127.81	128.85	130.04	130.43	130.69	130.58	-	-	129.00	128.33	-
1984	127.92	-	-	-	-	-	-	-	-	-	-	-	-
1985	-	-	-	-	-	-	-	-	-	-	-	-	-
1986	-	-	-	-	-	-	-	-	-	-	-	-	-
1987	-	-	-	-	-	-	-	-	-	-	-	-	-
1988	-	-	-	-	-	-	-	-	-	-	-	-	-
1989	-	-	-	-	-	-	130.39	130.10	129.78	130.36	129.56	128.90	-
1990	128.69	129.27	128.90	128.78	130.52	130.84	130.53	130.76	129.95	129.61	129.95	129.54	129.78
Ave	127.93	128.03	128.12	128.93	130.07	130.58	130.42	130.09	129.95	129.77	129.46	128.85	129.35
Max	128.69	129.27	128.90	129.19	130.52	130.84	130.72	130.76	130.41	129.92	129.95	129.54	129.89
Min	127.46	127.36	127.57	128.78	129.30	130.18	129.99	129.73	129.61	129.61	129.07	128.25	128.91

(Gauge Level 0 m = 125.21 m.MSL)

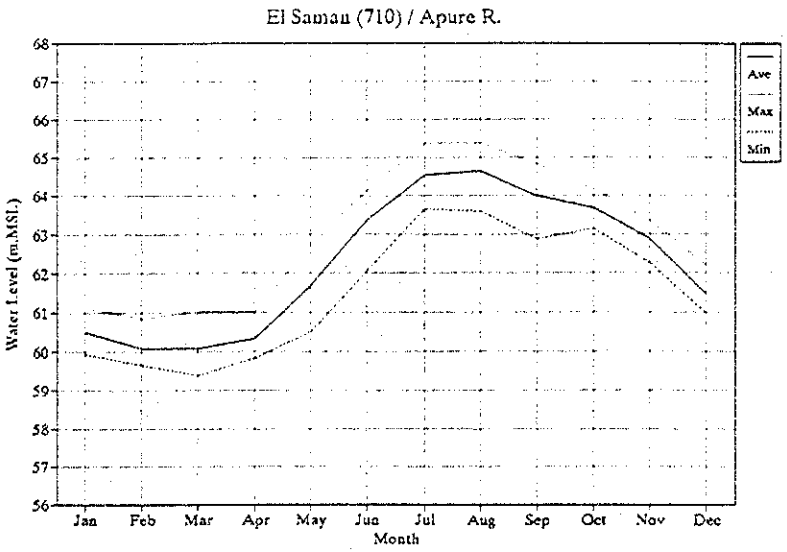
Bruzual (705) / Apure R.

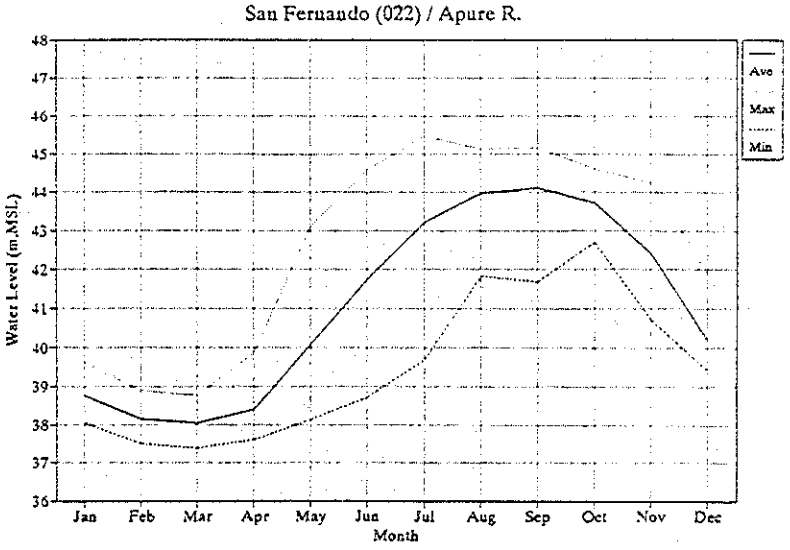
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.
1975	74.97	74.65	74.88	74.77	75.70	76.64	77.84	77.43	77.64	77.53	77.43	76.55	76.32
1976	75.57	75.14	75.83	75.74	77.00	78.13	79.10	78.84	78.01	77.39	76.82	75.85	76.95
1977	74.97	74.57	74.50	74.91	75.43	77.61	78.88	78.85	78.14	77.95	77.22	75.70	76.56
1978	74.96	74.83	74.54	75.92	76.48	78.63	78.62	78.58	78.59	77.80	77.03	76.31	76.86
1979	74.94	74.35	74.49	75.39	76.69	78.34	79.02	78.40	77.85	77.91	77.83	77.02	76.85
1980	75.63	74.87	74.51	74.97	76.84	78.39	79.00	78.65	78.11	78.20	77.33	75.74	76.85
1981	74.99	74.77	75.38	76.05	78.64	79.18	78.63	78.05	78.74	78.12	77.16	75.84	77.13
1982	75.01	74.83	74.67	75.82	77.96	78.89	79.19	78.60	78.05	77.98	76.89	75.76	76.97
1983	75.11	74.54	74.71	75.54	77.81	78.90	78.91	79.23	78.62	77.78	76.86	75.75	76.98
1984	75.26	74.99	74.38	74.57	74.99	76.74	78.33	77.97	78.39	78.39	78.02	76.48	76.55
1985	75.00	74.48	74.44	75.13	75.97	77.85	78.22	78.77	78.35	77.71	77.66	76.75	76.69
1986	75.19	74.67	74.62	75.73	76.97	78.28	79.17	78.96	79.01	78.68	78.84	76.66	77.23
1987	75.42	75.04	74.97	75.05	76.06	77.27	-	-	-	78.61	78.06	76.98	-
1988	75.61	75.06	74.62	74.70	75.34	76.63	78.17	78.87	79.18	78.88	-	-	-
1989	77.07	75.42	75.42	75.08	76.55	77.41	78.21	78.62	77.52	78.49	77.29	76.21	76.94
1990	75.57	75.88	75.77	75.85	77.63	78.64	78.65	78.74	78.20	77.72	77.87	76.81	77.26
Ave	75.29	74.86	74.87	75.38	76.76	78.12	78.70	78.55	78.23	77.98	77.65	76.23	76.87
Max	77.07	75.88	75.83	76.05	78.64	79.18	79.19	79.23	79.01	78.68	78.84	77.02	77.89
Min	74.94	74.35	74.38	74.57	74.99	76.64	77.84	77.43	77.52	77.39	76.82	75.70	76.03

(Gauge Level 0 m = 70.50 m.MSL)

Note ; Years with any lack of data were excluded for calculation of monthly Ave, Max and Min.

Fig. 4.3.1 Monthly Water Level (1/4)





El Saman (710) / Apure R.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.
1975	60.05	59.65	59.92	59.83	60.88	62.05	63.69	63.58	63.79	63.52	63.24	61.83	61.84
1976	60.83	60.15	61.03	60.64	62.53	63.66	65.38	65.57	64.13	63.15	62.26	61.18	62.53
1977	60.17	59.68	59.51	59.97	60.50	63.02	64.45	65.09	64.42	63.79	62.86	60.98	62.04
1978	59.94	59.76	59.39	61.02	61.69	64.01	64.99	64.83	64.82	63.99	62.67	61.43	62.38
1979	60.32	59.75	59.83	60.69	61.97	63.93	65.00	65.02	65.87	-	63.77	62.81	-
1980	61.05	60.07	59.56	60.11	62.22	64.02	65.21	65.02	64.19	64.18	63.32	61.42	62.53
1981	60.27	59.88	60.69	61.53	64.34	65.29	65.39	64.54	64.95	64.45	-	-	-
1982	60.55	60.28	-	-	-	-	65.37	65.22	-	-	-	-	-
1983	-	-	60.82	60.97	63.43	64.78	65.07	65.23	64.78	64.18	63.59	-	-
1984	60.61	-	-	-	63.43	64.78	65.07	65.23	64.78	64.18	63.63	61.88	-
1985	-	-	-	-	62.03	63.72	65.93	64.71	-	-	-	-	-
1986	-	-	-	-	-	-	-	-	-	-	-	-	-
1987	-	-	-	-	-	62.29	63.74	65.18	64.63	64.25	64.07	62.05	-
1988	60.45	60.06	59.54	59.69	60.47	61.89	63.57	64.49	64.76	-	-	-	-
1989	61.13	60.35	60.38	59.94	61.27	62.60	63.64	64.22	62.86	63.90	62.59	61.24	62.01
1990	60.39	60.87	60.73	60.88	62.74	64.15	64.34	64.41	63.65	63.14	63.14	62.21	62.55
Ave	60.51	60.08	60.07	60.34	61.69	63.36	64.53	64.65	63.98	63.67	62.87	61.47	62.27
Max	61.13	60.87	61.03	61.02	62.74	64.15	65.38	65.57	64.82	64.18	63.32	62.21	63.02
Min	59.94	59.65	59.39	59.83	60.50	62.05	63.64	63.58	62.86	63.14	62.26	60.98	61.49

(Gauge Level 0 m = 58.02 m.MSL)

San Fernando (022) / Apure R.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.
1967	39.33	38.45	37.82	-	39.72	41.65	43.47	44.39	44.61	43.81	41.60	39.73	-
1968	38.62	38.02	37.64	-	39.64	42.24	43.58	44.33	44.59	44.07	41.91	39.35	-
1969	38.33	37.90	37.84	38.40	-	-	-	-	-	-	-	-	-
1970	39.04	38.41	37.87	37.99	38.88	40.65	42.96	43.96	44.59	44.45	43.34	40.51	41.05
1971	39.03	38.27	38.15	38.02	39.32	40.66	41.70	43.06	43.38	42.86	41.50	39.44	40.45
1972	39.49	38.90	38.61	39.86	42.66	43.60	44.00	44.37	44.38	43.71	40.74	39.63	41.66
1973	38.59	38.06	37.79	37.74	38.78	39.27	41.46	41.84	43.08	43.77	42.43	40.06	40.24
1974	38.67	38.05	37.82	38.02	39.21	38.74	39.71	41.91	42.95	42.96	41.36	39.43	39.90
1975	38.07	37.58	37.71	37.70	38.78	40.11	42.28	42.70	43.26	43.05	42.46	40.53	40.34
1976	38.87	38.03	38.77	38.66	40.81	42.51	44.12	45.00	44.64	43.24	41.81	39.89	41.56
1977	38.79	38.24	38.06	38.41	38.83	41.61	43.34	44.22	44.67	44.13	42.81	39.88	41.08
1978	38.56	38.29	37.91	39.21	40.07	42.71	44.03	44.72	44.76	44.34	42.27	40.36	41.44
1979	38.81	38.16	38.14	38.99	40.32	42.79	44.40	44.96	44.50	43.73	43.22	41.70	41.64
1980	39.61	38.51	37.97	38.19	40.51	42.88	44.21	45.12	45.01	44.45	43.24	39.98	41.64
1981	38.42	37.97	38.72	39.34	43.10	44.56	45.47	44.97	44.81	44.60	43.35	40.10	42.12
1982	38.93	38.42	38.03	39.37	42.26	43.43	44.31	45.11	44.72	43.75	41.70	39.77	41.65
1983	38.64	37.86	38.00	38.54	41.77	43.53	44.47	44.99	45.16	44.26	42.64	39.85	41.64
1984	38.95	38.36	37.89	37.62	38.15	40.18	42.41	43.09	43.61	43.60	41.92	39.79	40.46
1985	38.32	37.50	37.39	38.03	39.10	41.12	42.40	43.40	43.89	43.18	42.71	40.67	40.64
1986	38.55	37.82	37.54	38.33	39.92	42.15	43.86	44.58	44.59	44.31	44.24	41.89	41.48
1987	39.06	38.14	37.91	38.06	39.24	40.80	42.70	43.91	44.49	44.19	43.05	40.47	41.00
1988	38.32	37.78	37.52	37.42	37.95	39.75	42.25	43.64	44.24	44.38	43.86	-	-
1989	39.15	38.16	38.25	37.70	38.90	40.81	42.03	43.11	41.71	42.72	41.23	39.45	40.27
1990	38.03	38.65	38.40	38.55	40.80	43.04	44.02	44.23	43.95	42.70	42.22	40.83	41.29
Ave	38.78	38.17	38.05	38.42	40.07	41.76	43.19	43.96	44.11	43.70	42.41	40.20	41.07
Max	39.61	38.90	38.77	39.86	43.10	44.56	45.47	45.12	45.16	44.60	44.24	41.89	42.61
Min	38.03	37.50	37.39	37.62	38.15	38.74	39.71	41.84	41.71	42.70	40.74	39.43	39.47

(Gauge Level 0 m = 36.24 m.MSL)

Note : Years with any lack of data were excluded for calculation of monthly Ave, Max and Min.

Fig. 4.3.1 Monthly Water Level (2/4)

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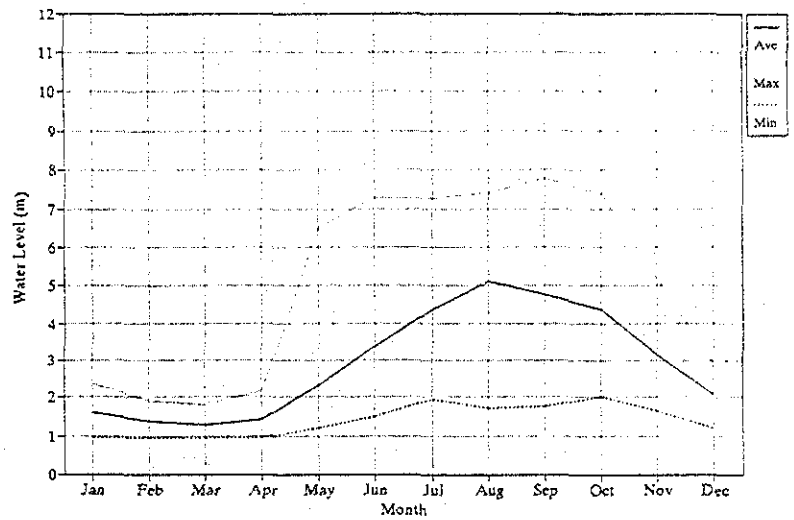
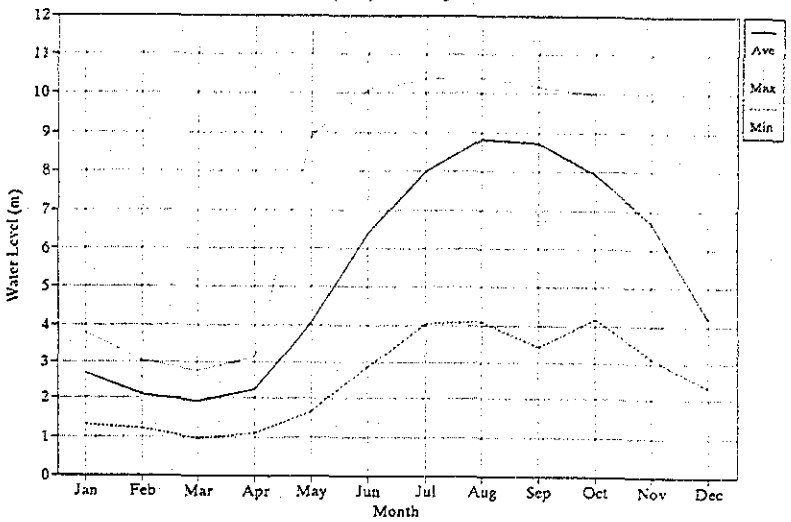




El Baul (317) / Cojedes R.

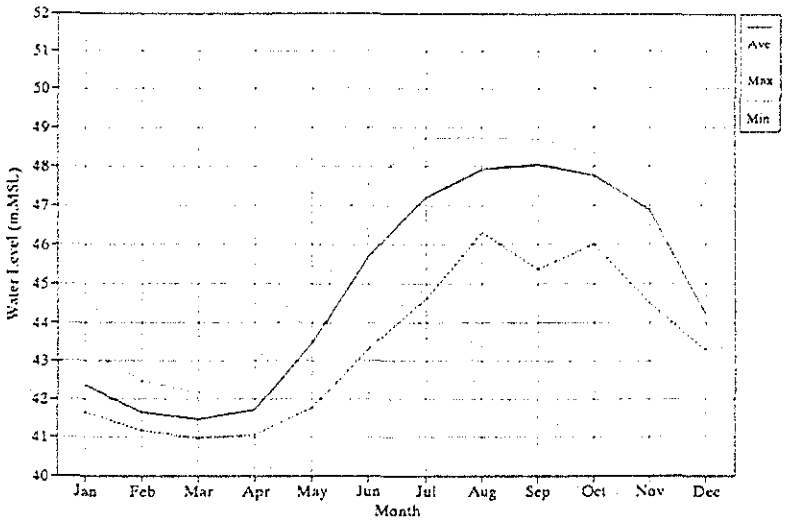
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.
1975	1.25	1.17	1.17	1.18	1.44	1.69	2.19	3.38	4.16	4.47	3.85	2.95	2.41
1976	1.86	1.39	1.23	1.37	2.52	5.02	7.04	6.06	3.65	3.75	2.94	1.94	3.23
1977	1.54	1.41	1.40	1.37	1.59	2.24	3.37	4.83	5.22	3.71	3.86	2.02	2.71
1978	-	-	-	-	-	-	-	-	-	-	-	-	-
1979	-	-	-	-	-	-	-	-	-	-	-	-	-
1980	2.34	1.83	1.60	1.62	2.56	4.02	6.21	7.12	6.70	5.27	3.42	2.32	3.75
1981	1.85	1.72	1.80	2.13	6.52	7.29	6.86	7.42	7.78	7.39	4.50	2.67	4.83
1982	2.18	1.90	1.61	2.15	2.93	5.59	4.73	5.80	4.27	4.51	2.63	2.17	3.37
1983	1.79	1.49	1.43	1.78	3.55	6.78	7.27	7.18	6.40	4.44	3.96	2.52	4.05
1984	1.87	1.51	1.29	1.30	1.48	1.69	2.27	4.97	5.29	5.43	2.71	2.07	2.66
1985	1.51	1.28	1.13	1.13	1.45	1.51	2.43	3.08	3.59	3.61	2.94	1.70	2.11
1986	1.22	1.03	1.00	0.97	1.49	2.89	4.57	4.93	4.22	3.47	5.20	2.34	2.97
1987	1.45	1.29	1.14	1.07	2.22	2.79	4.75	4.83	4.57	3.29	1.85	1.62	2.56
1988	1.07	1.00	1.66	1.24	1.21	1.68	2.81	4.83	6.73	5.22	2.88	1.99	2.64
1989	1.61	1.23	1.24	1.16	1.27	1.65	1.92	1.72	1.77	2.00	1.65	1.22	1.54
1990	0.95	0.96	0.97	1.44	1.86	2.37	4.53	5.42	2.69	2.56	2.01	1.24	2.28
Ave	1.61	1.37	1.29	1.42	2.29	3.39	4.38	5.11	4.77	4.37	3.17	2.06	2.94
Max	2.34	1.90	1.80	2.15	6.52	7.29	7.27	7.42	7.78	7.39	5.20	2.95	5.00
Min	0.95	0.96	0.97	0.97	1.21	1.51	1.92	1.72	1.77	2.00	1.65	1.22	1.40

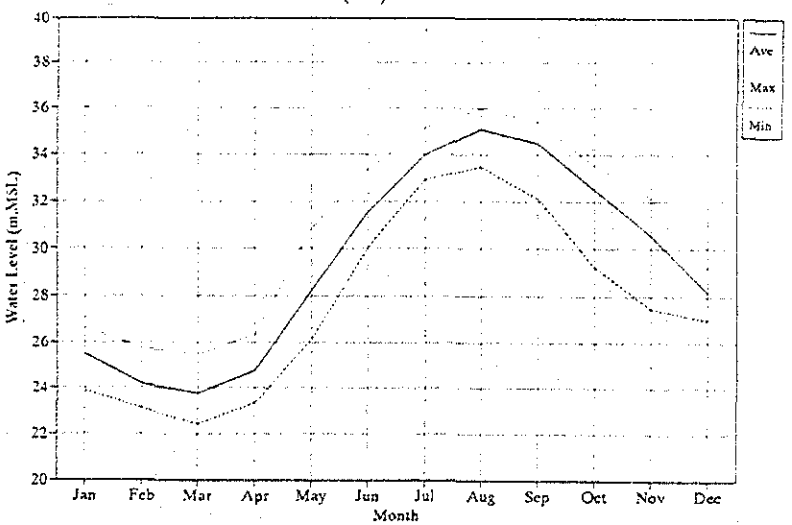
Jobalito (895) / Portuguesa R.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.
1975	2.08	1.78	1.72	1.68	3.05	4.31	5.63	7.33	8.41	8.22	7.45	5.10	4.73
1976	2.83	2.10	1.87	2.07	5.63	8.52	10.26	10.17	7.99	6.14	4.97	3.22	5.68
1977	2.32	2.00	1.93	1.86	2.75	5.07	7.46	8.86	9.20	8.14	7.61	3.57	5.06
1978	-	-	-	-	-	-	-	-	-	-	-	-	-
1979	2.34	1.79	1.78	2.66	3.92	8.39	9.78	9.70	9.46	7.48	7.13	5.04	5.79
1980	3.33	2.32	1.86	1.91	4.61	7.81	9.76	10.00	9.80	8.79	7.04	3.77	5.92
1981	2.55	2.25	2.58	3.16	8.94	10.08	9.93	9.85	9.83	9.03	7.78	4.10	6.67
1982	3.24	2.45	1.89	3.05	5.19	8.36	9.26	9.84	8.84	6.83	5.12	3.79	5.66
1983	2.36	1.57	1.11	2.91	6.44	9.72	10.35	10.38	10.16	8.67	8.00	4.76	6.35
1984	3.67	2.73	2.25	2.48	2.61	3.54	4.91	8.52	9.59	9.91	7.24	4.98	5.20
1985	2.90	2.51	2.06	2.05	2.71	3.96	6.12	7.57	8.72	8.63	7.58	4.37	4.91
1986	2.79	2.21	2.09	2.27	4.14	8.05	9.94	10.17	9.35	9.96	9.92	6.52	6.45
1987	3.78	3.04	2.75	2.67	4.39	5.32	8.21	9.41	9.19	8.57	5.48	3.94	5.56
1988	2.68	2.37	2.19	2.20	2.07	2.97	5.47	7.50	9.21	8.03	5.92	3.75	4.53
1989	2.04	1.32	1.48	1.20	1.66	2.87	4.06	4.11	3.45	4.19	3.15	2.31	2.65
1990	1.31	1.21	0.97	1.24	3.17	6.68	8.81	8.97	7.67	6.26	5.90	3.54	4.64
Ave	2.68	2.08	1.90	2.22	4.09	6.38	8.00	8.83	8.72	7.92	6.69	4.18	5.31
Max	3.78	3.04	2.75	3.16	8.94	10.08	10.35	10.38	10.16	9.96	9.92	6.52	7.42
Min	1.31	1.21	0.97	1.10	1.66	2.87	4.06	4.11	3.45	4.19	3.15	2.31	2.53

Note ; Years with any lack of data were excluded for calculation of monthly Ave, Max and Min.

Fig. 4.3.1 Monthly Water Level (3/4)





Camaguan (890) / Portuguesa R.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.
1975	41.35	40.87	40.93	40.86	41.92	43.32	45.31	46.61	47.59	47.64	46.73	44.31	43.95
1976	42.06	41.14	41.09	41.23	44.08	46.91	48.14	48.41	48.16	46.93	45.47	42.70	44.69
1977	41.65	41.18	41.01	41.06	41.76	44.48	46.76	47.70	48.13	47.99	47.52	43.56	44.40
1978	41.65	41.37	40.99	41.94	43.30	46.43	48.03	48.31	48.30	48.15	46.32	43.50	44.86
1979	41.97	41.29	41.19	42.84	44.03	46.73	48.33	48.40	48.33	47.87	47.35	45.23	45.30
1980	43.35	41.99	41.39	41.55	43.96	46.85	48.16	48.74	48.52	48.25	47.66	43.94	45.35
1981	42.09	41.62	42.17	42.07	45.73	47.31	48.72	48.42	48.41	48.33	47.94	44.02	45.57
1982	42.83	41.68	41.17	41.69	44.23	46.12	48.06	48.65	48.34	47.47	45.47	44.12	44.99
1983	42.74	41.97	41.62	42.04	45.02	47.53	48.31	48.66	48.69	48.17	47.46	44.08	45.52
1984	43.18	42.33	42.04	41.88	42.16	43.33	44.63	47.13	47.98	48.13	47.52	44.19	44.54
1985	42.20	41.48	41.17	41.43	42.55	43.79	45.48	46.82	47.89	47.86	47.57	44.46	44.39
1986	42.46	41.69	41.35	41.60	43.71	47.17	48.14	48.37	48.33	48.29	48.26	46.87	45.52
1987	43.09	42.46	42.12	42.24	43.48	44.75	46.82	47.81	48.16	48.14	46.57	44.09	44.98
1988	42.20	41.69	-	-	40.07	41.74	45.09	-	-	-	-	-	-
1989	42.76	41.99	42.11	41.75	42.37	43.99	44.93	46.51	45.38	46.02	44.51	43.28	43.78
1990	41.96	41.83	41.60	41.73	43.94	46.96	48.34	48.45	48.32	47.49	46.50	44.93	45.17
Ave	42.36	41.66	41.46	41.71	43.48	45.71	47.21	47.92	48.04	47.78	46.86	44.22	44.87
Max	43.35	42.46	42.17	42.84	45.73	47.53	48.72	48.74	48.69	48.53	48.26	46.87	46.14
Min	41.65	41.18	40.99	41.06	41.76	43.33	44.63	46.51	45.38	46.02	44.51	43.28	43.34

(Gauge Level 0 m = 38.54 m,MSL)

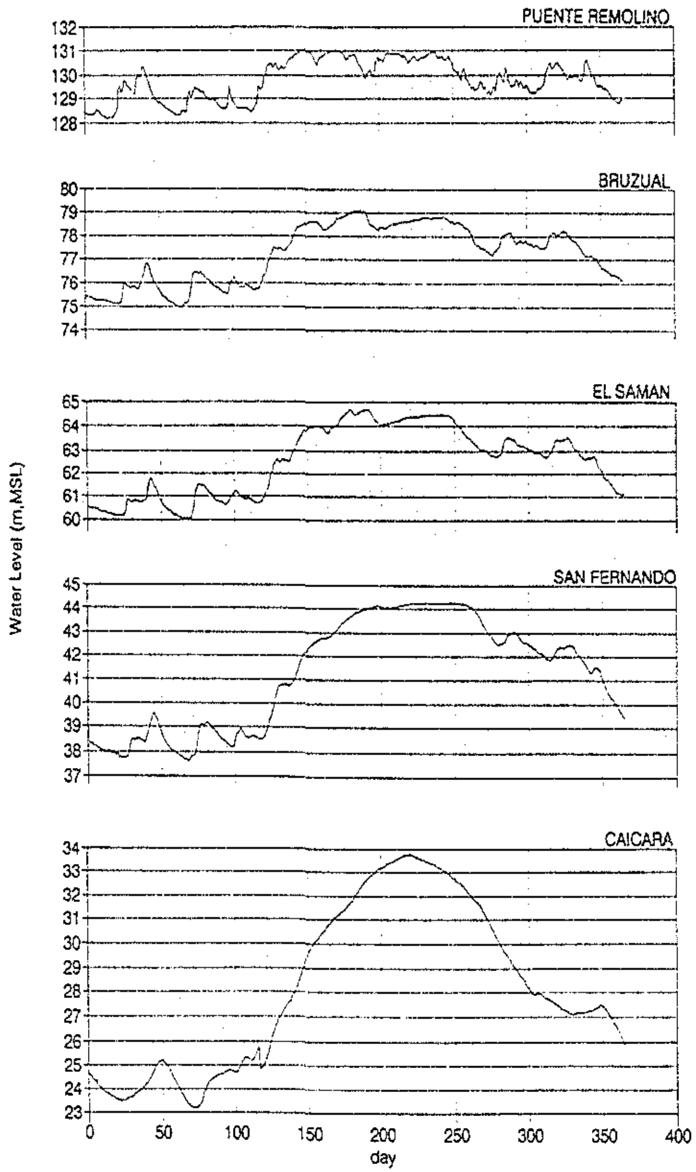
Note ; Years with any luck of data were excluded for calculation of monthly Ave, Max and Min.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.
1977	23.59	22.22	-	23.11	24.83	30.00	33.29	34.50	33.76	31.96	30.56	27.41	-
1978	24.52	23.73	-	25.65	29.38	32.27	34.62	35.00	34.43	32.72	30.64	28.56	-
1979	24.96	23.10	22.75	25.15	28.90	31.99	34.83	35.28	34.28	32.37	31.55	29.10	29.52
1980	26.12	23.87	22.40	23.39	28.43	32.14	35.13	35.97	35.37	33.46	31.35	27.77	29.62
1981	25.09	25.56	25.26	25.20	30.60	33.41	35.69	36.14	35.14	-	30.36	27.58	-
1982	25.75	24.32	24.00	26.35	30.85	33.39	34.82	35.79	35.21	32.84	30.12	27.85	30.11
1983	25.78	23.93	23.91	25.05	30.56	32.69	34.32	35.71	35.42	33.54	30.81	28.23	30.00
1984	26.60	25.74	25.48	24.94	27.09	30.35	32.96	34.30	34.33	33.01	30.56	27.88	29.44
1985	25.53	23.82	23.17	23.31	26.15	30.79	33.45	34.88	35.27	33.14	30.37	28.39	29.02
1986	25.02	24.09	24.31	24.92	26.48	30.02	33.66	35.29	34.09	32.73	32.13	29.18	29.33
1987	25.53	24.21	24.06	24.63	27.96	29.87	32.25	-	34.25	32.74	30.23	27.56	-
1988	24.77	23.66	22.69	22.95	24.75	28.56	31.84	33.75	33.35	32.00	-	28.26	-
1989	-	24.26	24.06	23.91	26.25	30.35	32.23	32.79	31.69	30.59	28.87	26.55	-
1990	23.84	24.57	23.86	25.04	27.55	30.89	32.96	33.50	32.15	29.23	27.48	26.99	28.17
Ave	25.46	24.18	23.74	24.77	28.25	31.53	34.02	35.09	34.52	32.54	30.55	28.17	29.40
Max	26.60	25.74	25.48	26.35	30.85	33.39	35.13	35.97	35.42	33.54	32.13	29.18	30.82
Min	23.84	23.10	22.40	23.31	26.15	30.02	32.96	33.50	32.15	29.23	27.48	26.99	27.59

(Gauge Level 0 m = 18.98 m,MSL)

Note ; Years with any luck of data were excluded for calculation of monthly Ave, Max and Min.

Fig. 4.3.1 Monthly Water Level (4/4)



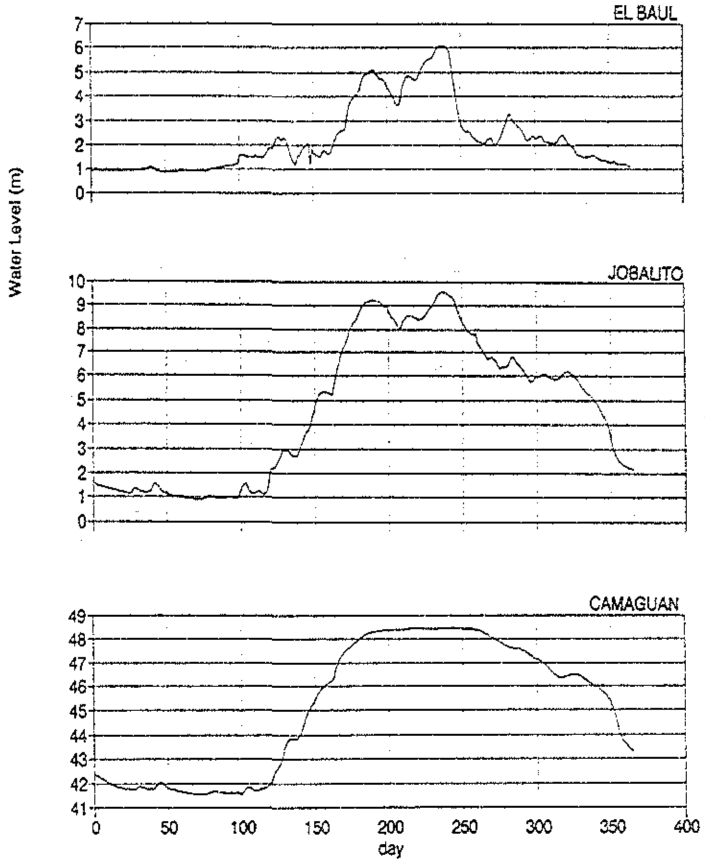


Fig. 4.3.2 Daily Water Level in 1990

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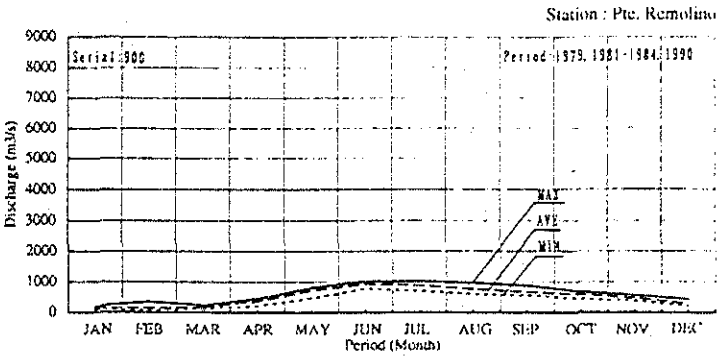
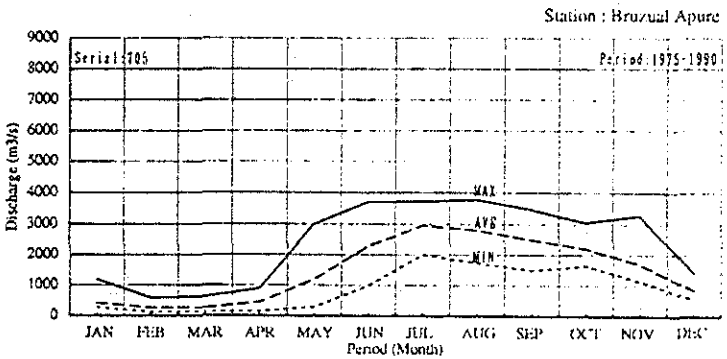
JAPAN INTERNATIONAL COOPERATION AGENCY





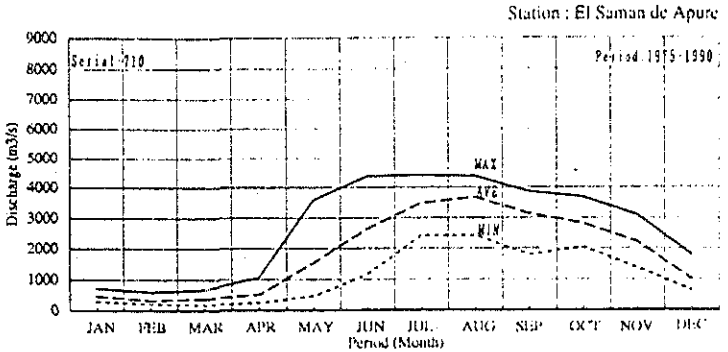
Station: Puente Remolino de Sarare (900)
(Unit : m3/s)

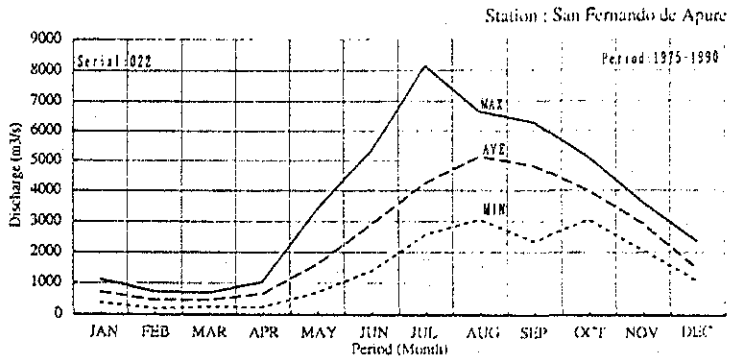
YEAR	JAN	FEB	MAR	ALR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVE
1979	121	82	105	361	469	789	894	701	654	587	529	390	474
1981	92	99	191	436	793	958	713	610	882	681	412	271	512
1982	139	170	153	452	811	1022	1023	676	570	673	466	214	531
1983	174	93	144	361	738	893	1010	959			380	227	498
1984	148												148
1990	209	354	244	212	823	982	831	938	576	440	571	431	551
AVE	140	176	173	365	724	938	865	731	671	595	495	327	
MAX	209	354	244	452	823	1022	1023	938	882	681	571	431	
MIN	92	82	105	212	469	789	713	610	570	440	412	214	

Station: Bruzual de Apure (705)
(Unit : m3/s)

YEAR	JAN	FEB	MAR	ALR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVE
1975	278	190	253	222	561	1111	2123	1718	1899	1797	1719	899	1064
1976	501	332	622	594	1350	2466	3594	3247	2306	1671	1232	632	1546
1977	280	171	155	271	518	1917	3299	3263	2417	2208	1536	566	1383
1978	274	238	164	697	1001	3012	3013	2924	2930	2072	1398	902	1552
1979	279	125	158	487	1180	2663	3478	2716	2116	2166	2086	1412	1572
1980	538	249	156	327	1267	2728	3455	3015	2378	2480	1680	580	1571
1981	284	221	444	892	3006	3703	2992	2312	3114	2400	1535	625	1794
1982	297	240	201	650	2228	3323	3716	2949	2313	2238	1306	594	1671
1983	322	164	214	524	2104	3323	3341	3774	2979	2031	1318	569	1722
1984	375	288	131	145	298	1219	2626	2230	2686	2694	2292	1046	1335
1985	292	150	146	343	724	2141	2504	3151	2675	1968	1917	1197	1434
1986	351	194	182	585	1354	2590	3689	3407	3472	3063	3272	1143	1942
1987	438	299	285	305	804	1585			2375	1970	1152		1024
1988	490	290	177	196	379	985	1997	2614	2918	2621			1267
1989	1199	408	405	294	990	1421	2036	2396	1501	2273	1353	745	1252
1990	391	595	557	565	1607	2397	2416	2486	2034	1647	1760	1054	1459
AVE	404	255	271	471	1299	2430	3020	2828	2487	2193	1743	854	
MAX	1199	595	622	892	3006	3703	3716	3774	3472	3063	3272	1412	
MIN	274	125	131	145	298	1111	2036	1718	1501	1647	1232	566	

Fig. 4.3.3 Monthly Discharge (1/4)





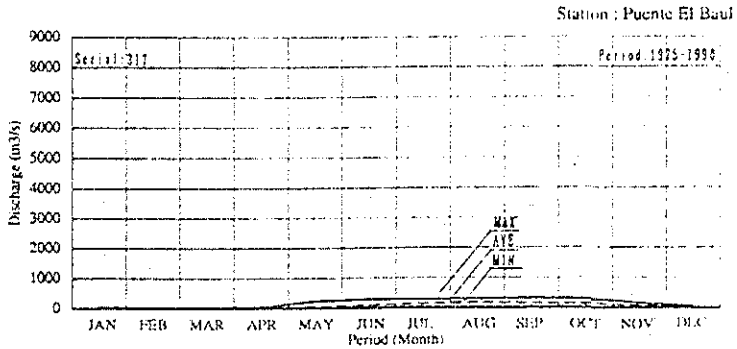
Station: El Saman de Apure (710)
(Unit : m3/s)

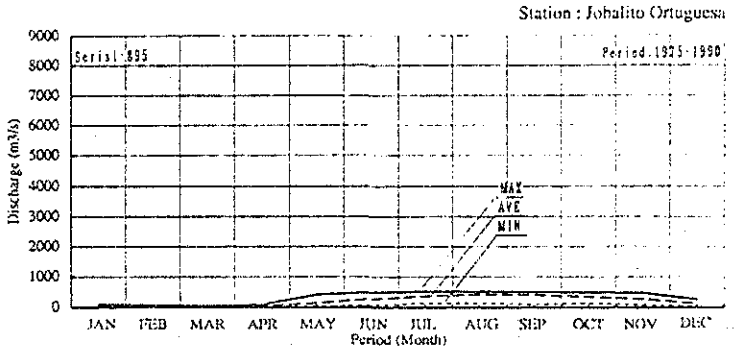
YEAR	JAN	FEB	MAR	ALR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVE
1975	314	222	284	262	610	1240	2531	2419	2608	2361	2116	1083	1338
1976	580	342	676	524	1547	2536	4393	4372	2985	2034	1372	740	1842
1977	349	228	196	305	520	1959	3301	4023	3271	2616	1801	659	1602
1978	288	249	180	711	1016	2867	3917	3721	3710	2821	1668	902	1838
1979	395	242	264	582	1204	2769	3924	3951	2692		2598	1796	1856
1980	694	322	205	389	1357	2866	4172	3943	3015	3010	2203	869	1920
1981	380	276	548	1064	3184	4276	4396	3388	3858	3302	2555	634	2322
1982	478	384			3595	4369	4189						2603
1983			581	673	2309	3666	4004	4200	3663	2997	2442		2726
1984	496				2303	3667	4003	4198	3663	3003	2478	1153	2774
1985					1270	2549	2756	3575					2538
1987					1115	1379	2622	4130	3505	3080	2900	1255	2498
1988	440	319	203	237	452	1164	2424	3333	3636	3682	3099		1726
1989	722	401	416	284	861	1601	2480	3057	1800	2729	1611	785	1396
1990	417	608	565	597	1755	2954	3178	3248	2504	2032	2032	1238	1761
AVE	468	331	384	517	1356	2537	3546	3521	2969	2613	1930	864	
MAX	722	608	676	1064	3184	4276	4396	4372	3858	3302	2555	1238	
MIN	288	222	180	262	520	1240	2480	2419	1800	2032	1372	634	

Station : San Fernando de Aure (22)
(Unit : m3/s)

YEAR	JAN	FEB	MAR	ALR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVE
1975	391	196	249	245	710	1393	2766	3066	3488	3324	2893	1511	1686
1976	751	376	700	651	1799	2946	4394	6243	5252	3473	2449	1262	2525
1977	707	464	385	538	746	2320	3554	4421	5258	4280	3146	1276	2258
1978	602	483	325	930	1363	3084	4209	5389	5473	4678	2773	1532	2570
1979	720	429	423	822	1512	3142	4798	6104	4867	3873	3460	2373	2710
1980	1118	580	348	454	1630	3211	4487	6655	6283	4779	3493	1333	2864
1981	540	349	682	1035	3376	5308	8154	6160	5590	5102	3612	1388	3441
1982	778	540	385	1002	2752	3622	4609	6638	5429	3891	2388	1209	2770
1987	901	533	453	504	1009	1796	3061	4023	4811	4319	3369	1629	2201
1988	603	405	260	292	467	1260	2735	3780	4400	4600	3974		2071
1989	949	541	572	379	868	1805	2575	3356	2363	3067	2068	1095	1637
1990	500	735	640	689	1830	3310	4110	4382	4100	3048	2701	1832	2323
AVE	723	475	469	659	1600	2903	4247	5131	4810	3985	2941	1495	
MAX	1118	735	700	1035	3376	5308	8154	6655	6283	5102	3612	2373	
MIN	391	196	249	245	710	1393	2575	3066	2363	3048	2068	1095	

Fig. 4.3.3 Monthly Discharge (2/4)





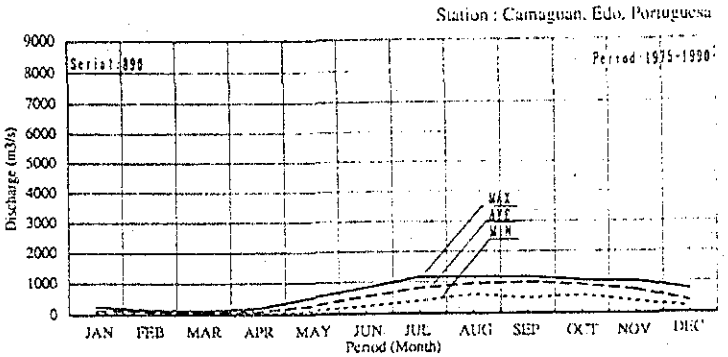
Station : Puente El Baul de Cojedes (317)
(Unit : m3/s)

YEAR	JAN	FEB	MAR	ALR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVE
1975	12	9	9	10	18	26	45	93	125	138	113	74	56
1976	32	16	11	16	57	164	278	219	104	107	74	35	93
1977	21	17	17	16	23	47	91	155	174	106	112	38	68
1980	50	31	23	24	59	119	230	282	256	181	93	49	117
1981	32	27	30	43	248	293	265	302	328	301	145	63	173
1982	44	34	24	43	73	194	150	203	170	140	61	44	95
1983	30	19	18	30	99	262	293	286	238	138	116	57	132
1984	33	20	13	13	19	26	48	161	180	184	65	41	67
1985	20	13	8	8	19	21	54	80	100	101	74	27	44
1986	11	5	4	4	20	72	156	160	128	186	173	52	81
1987	18	13	8	6	46	68	151	155	136	88	32	25	62
1988	6	5	6	11	11	26	69	158	257	176	71	37	69
1989	24	11	12	9	13	25	35	28	29	38	25	11	22
1990	3	3	4	18	33	61	141	184	65	59	38	15	52
AVE	24	16	13	18	53	100	143	176	161	139	85	41	
MAX	50	34	30	43	248	293	293	302	328	301	173	74	
MIN	3	3	4	4	11	21	35	28	29	38	25	11	

Station : Jobalito de Portugresa (895)
(Unit : m3/s)

YEAR	JAN	FEB	MAR	ALR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVE
1975	44	34	32	31	85	145	214	316	384	371	322	184	180
1976	74	45	37	45	214	391	511	505	358	242	178	91	224
1977	53	41	39	36	73	184	322	414	437	366	332	109	201
1979	54	34	34	69	125	385	477	472	455	324	304	181	243
1980	97	54	37	39	160	347	476	493	479	410	297	117	250
1981	62	51	64	94	421	499	487	482	481	426	348	132	296
1982	92	58	37	85	189	382	441	481	413	285	187	118	231
1983	55	21	14	83	262	474	518	520	504	402	359	166	281
1984	112	70	51	60	65	106	175	391	464	487	311	180	206
1985	77	53	44	42	69	126	241	331	404	398	333	147	189
1986	72	49	45	51	137	361	488	505	447	490	487	271	284
1987	117	83	70	67	149	197	371	452	437	395	207	126	223
1988	68	55	48	49	44	81	204	326	438	360	220	118	168
1989	43	19	25	13	31	76	132	132	102	137	90	54	71
1990	19	16	10	17	90	277	411	421	337	249	228	109	182
AVE	69	46	39	52	141	269	365	416	409	356	281	140	
MAX	117	83	70	94	421	499	518	520	504	490	487	271	
MIN	19	16	10	13	31	76	132	132	102	137	90	54	

Fig. 4.3.3 Monthly Discharge (3/4)



Station : Camaguan Saman Gacha de Portuguesa (890)
(Unit : m3/s)

YEAR	JAN	FEB	MAR	ALR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVE
1975	65	29	33	27	115	249	475	660	840	852	676	356	365
1976	126	49	45	56	330	710	985	1065	993	708	500	185	479
1977	91	52	39	43	103	379	679	869	983	944	826	284	441
1978	90	67	37	117	246	628	955	1033	1030	989	626	266	508
1979	117	61	53	201	322	692	1039	1060	1040	914	791	465	563
1980	250	119	68	66	318	703	993	1174	1101	1017	863	321	583
1981	128	88	136	129	532	779	1166	1067	1066	1042	934	325	616
1983	188	118	88	126	441	834	1033	1146	1156	993	820	331	606
1984	232	149	123	109	134	247	393	752	941	983	846	346	438
1985	138	76	51	72	170	296	497	696	916	908	839	377	420
1986	162	94	65	86	293	757	986	1053	1041	1027	1020	751	611
1987	223	162	130	141	267	405	691	896	991	984	683	331	492
1988	138	93	74										102
1989	191	119	130	98	155	318	429	606	485	567	384	243	310
1990	116	105	86	97	317	731	1043	1076	1039	820	633	432	541
AVE	151	92	77	98	267	553	812	940	973	911	746	358	
MAX	250	162	136	201	532	834	1166	1174	1156	1042	1020	751	
MIN	65	29	33	27	103	247	393	606	485	567	384	185	

Fig. 4.3.3 Monthly Discharge (4/4)

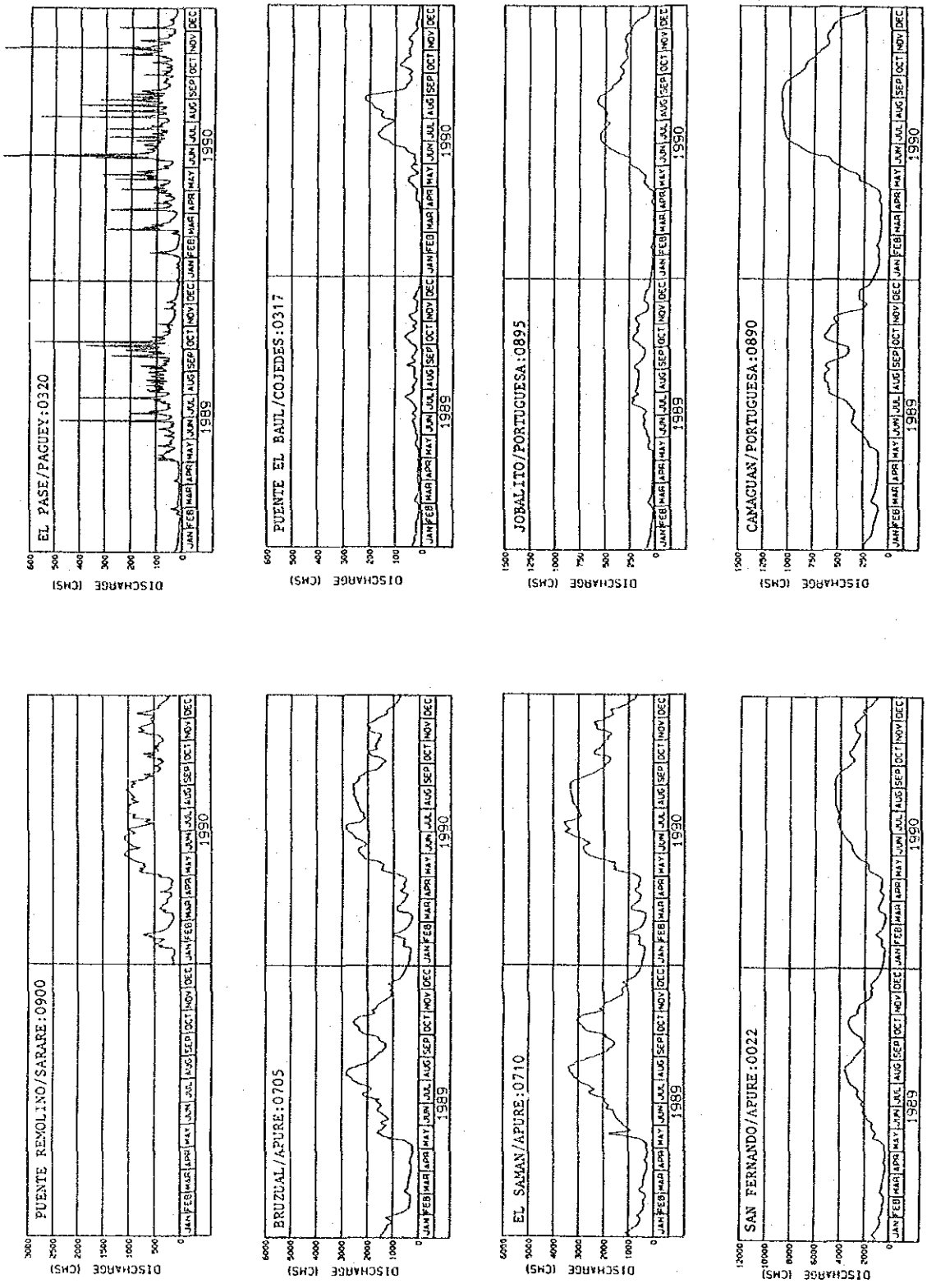


Fig. 4.3.4 Daily Discharge in 1989 /1990

THE REPUBLIC OF VENEZUELA COMPREHENSIVE IMPROVEMENT OF THE APURE RIVER BASIN
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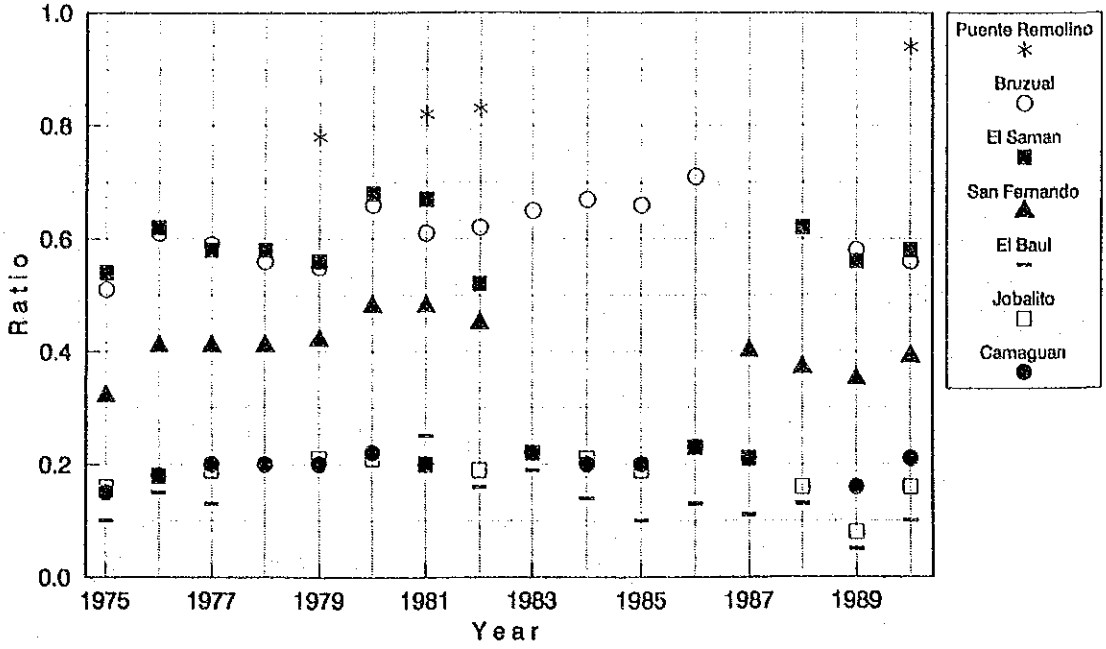

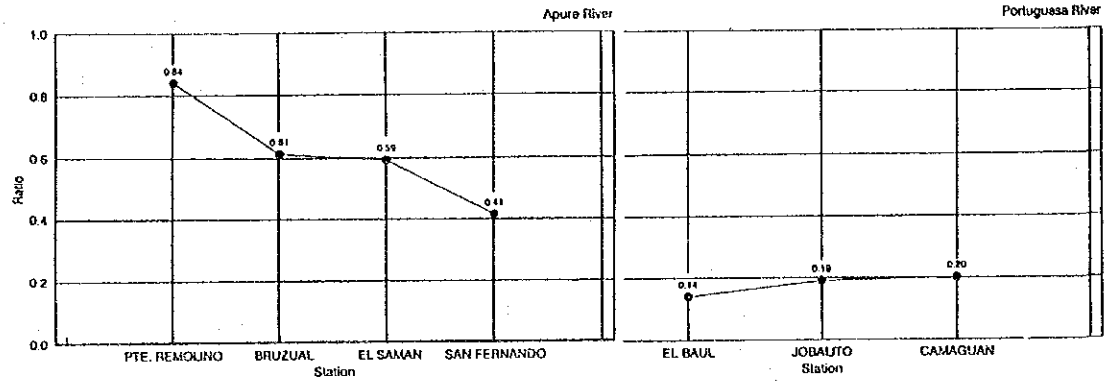

YEAR	REMOLINO (900)	BRUZUAL (705)	EL SAMAN (710)	S.FERNANDO (022)	EL BAUL (317)	JOBALITO (895)	CAMAGUAN (890)
1975	-	0.51	0.54	0.32	0.10	0.16	0.15
1976	-	0.61	0.62	0.41	0.15	0.18	0.18
1977	-	0.59	0.58	0.41	0.13	0.19	0.20
1978	-	0.56	0.58	0.41	-	-	0.20
1979	0.78	0.55	0.56	0.42	-	0.21	0.21
1980	-	0.66	0.68	0.48	0.22	0.21	0.22
1981	0.82	0.61	0.67	0.48	0.25	0.20	0.20
1982	0.83	0.62	0.52	0.45	0.16	0.19	-
1983	-	0.65	-	-	0.19	0.22	0.22
1984	-	0.67	-	-	0.14	0.21	0.20
1985	-	0.66	-	-	0.10	0.19	0.20
1986	-	0.71	-	-	0.13	0.23	0.23
1987	-	-	-	0.40	0.11	0.21	0.21
1988	-	-	0.62	0.37	0.13	0.16	-
1989	-	0.58	0.56	0.35	0.05	0.08	0.16
1990	0.94	0.56	0.58	0.39	0.10	0.16	0.21
AVERAGE	0.84	0.61	0.59	0.41	0.14	0.19	0.20

Fig. 4.4.1 Annual Runoff Ratio

THE REPUBLIC OF VENEZUELA
COMPREHENSIVE IMPROVEMENT
OF THE APURE RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

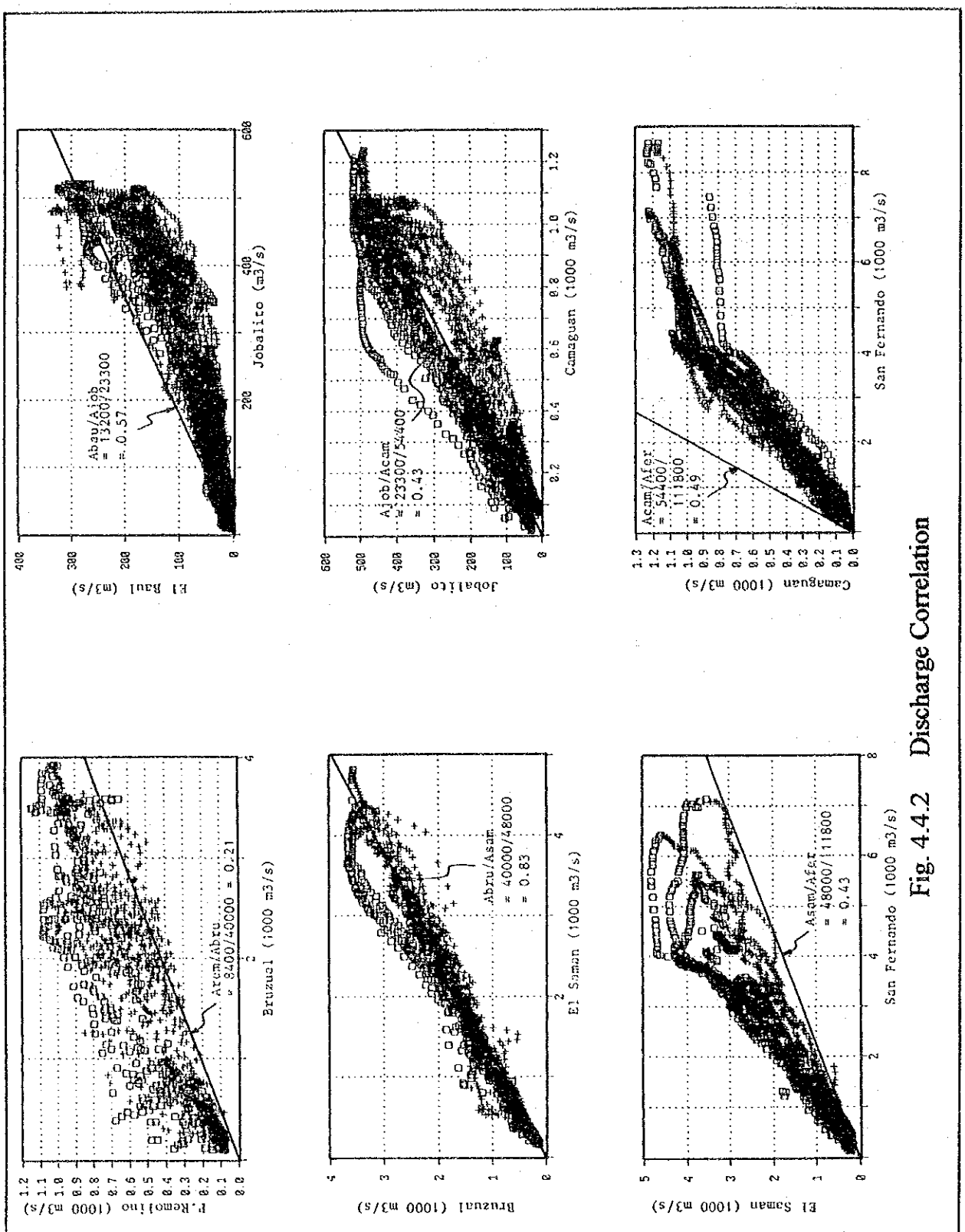

Fig. 4.4.2 Discharge Correlation

THE REPUBLIC OF VENEZUELA COMPREHENSIVE IMPROVEMENT OF THE APURE RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

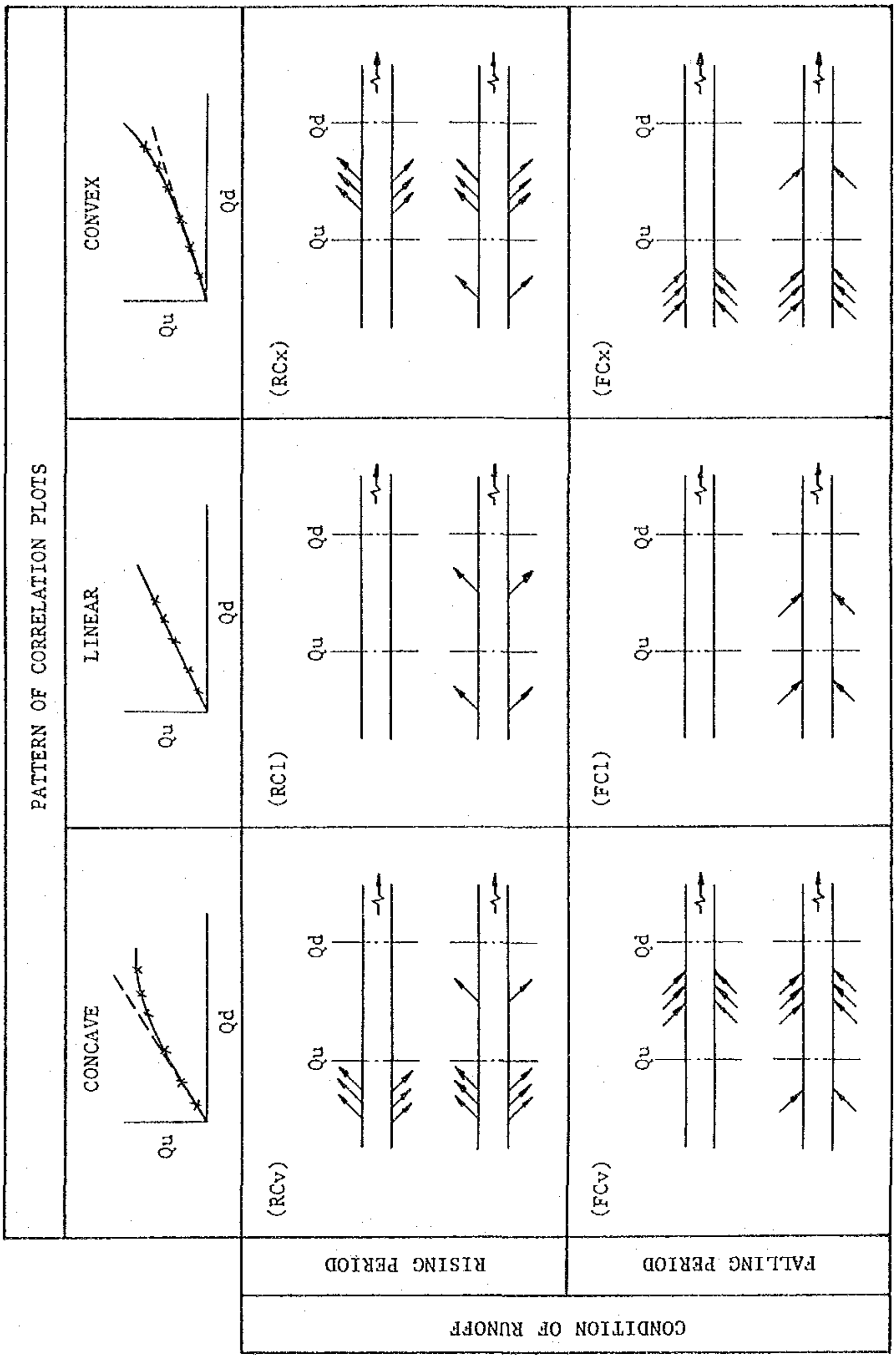

Fig. 4.4.3 Patterns of Discharge Correlation

THE REPUBLIC OF VENEZUELA
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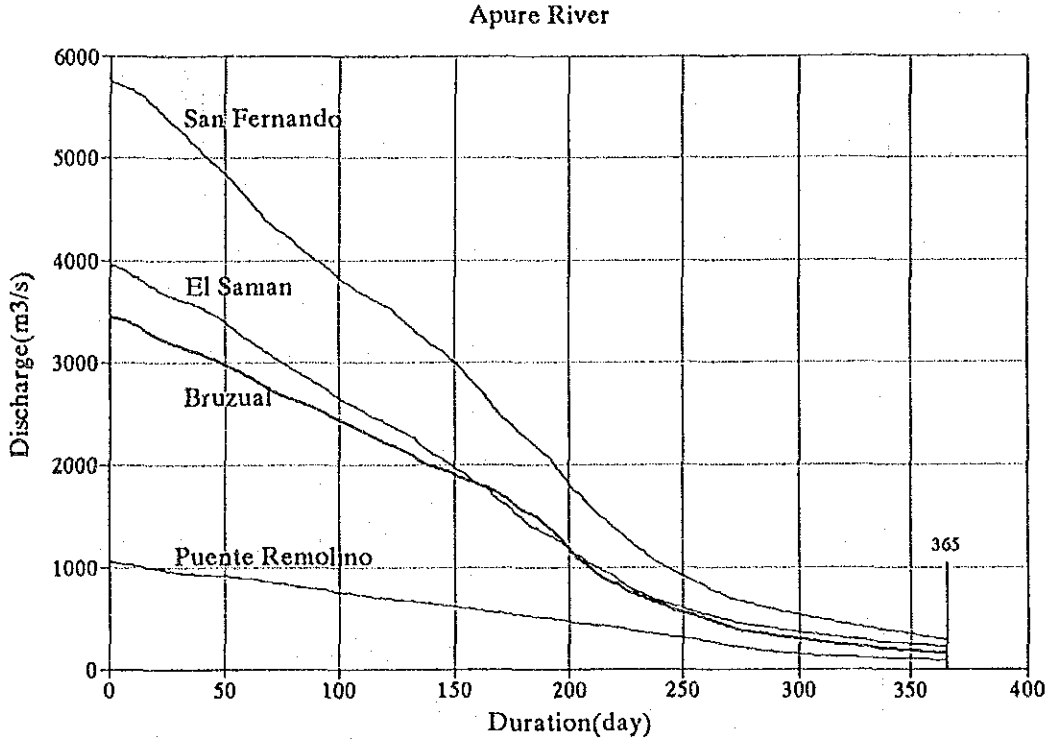
JAPAN INTERNATIONAL COOPERATION AGENCY



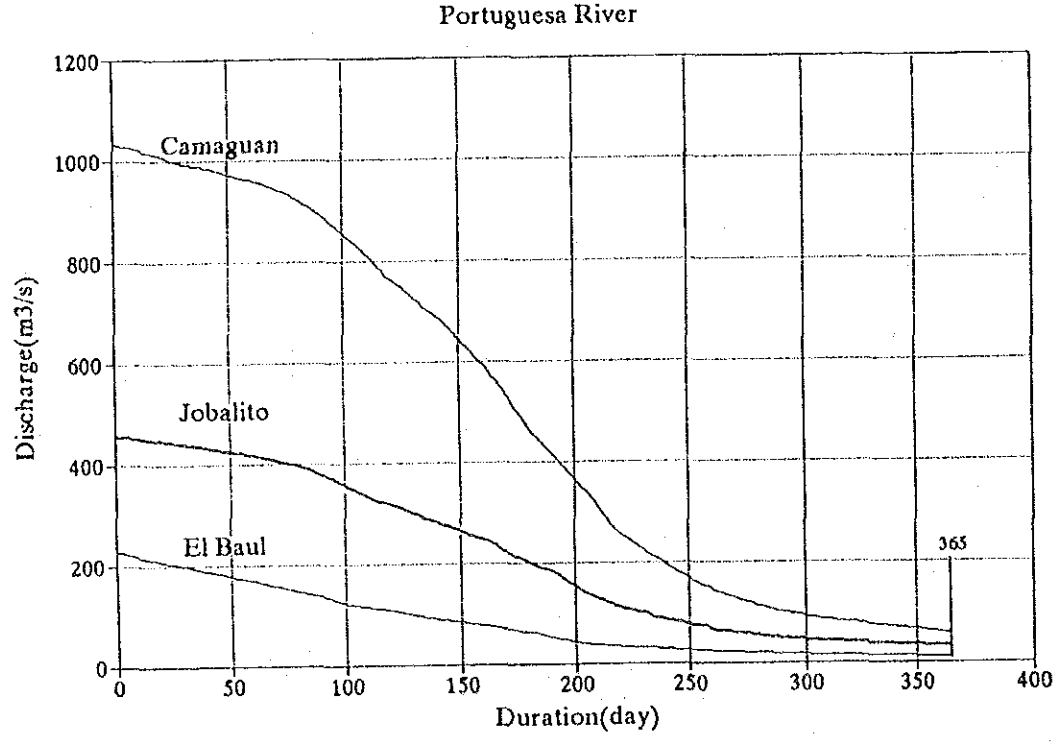


Fig. 4.4.4 Average Flow Duration

THE REPUBLIC OF VENEZUELA COMPREHENSIVE IMPROVEMENT OF THE APURE RIVER BASIN
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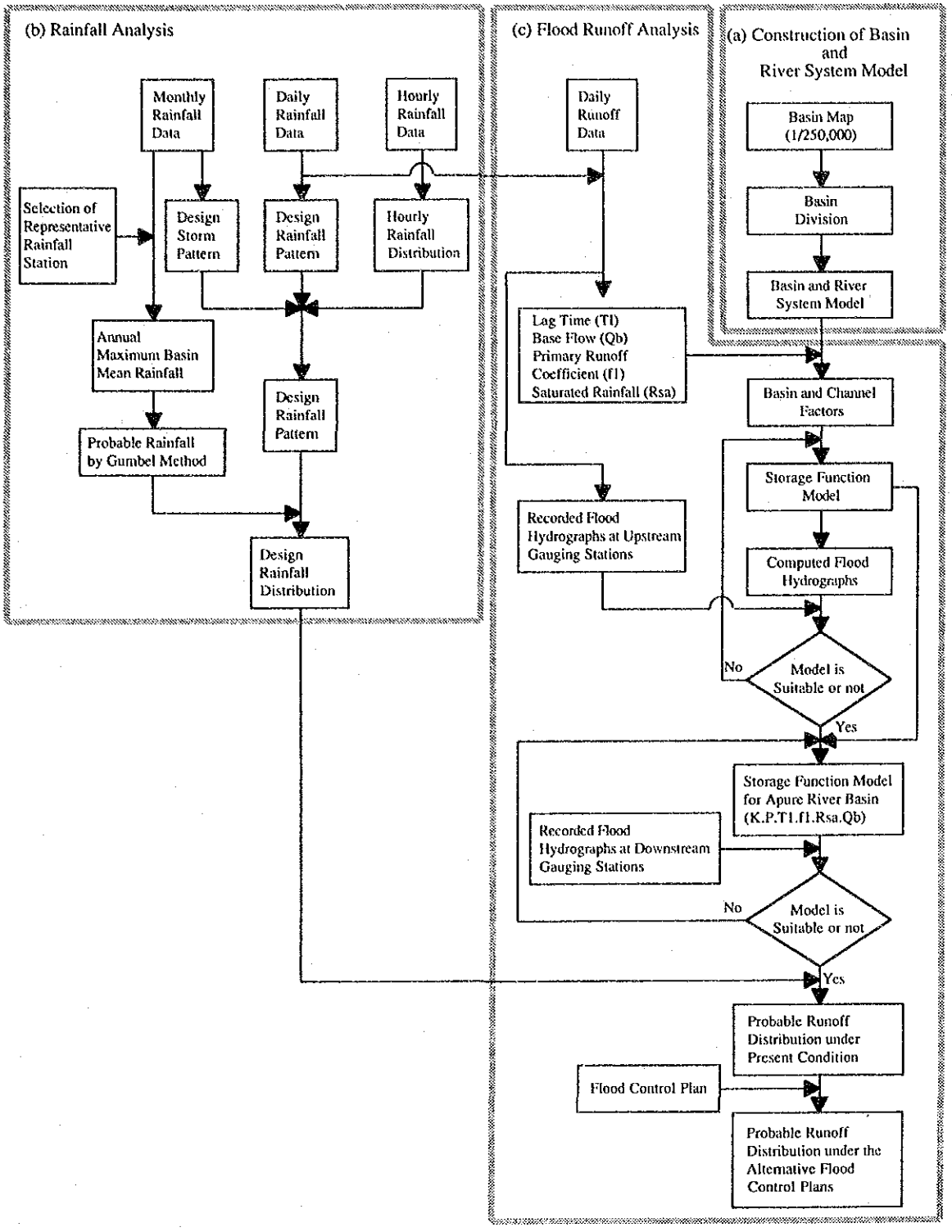

Fig. 5.1.1 Flow Chart of Flood Runoff Analysis

THE REPUBLIC OF VENEZUELA COMPREHENSIVE IMPROVEMENT OF THE APURE RIVER BASIN JAPAN INTERNATIONAL COOPERATION AGENCY

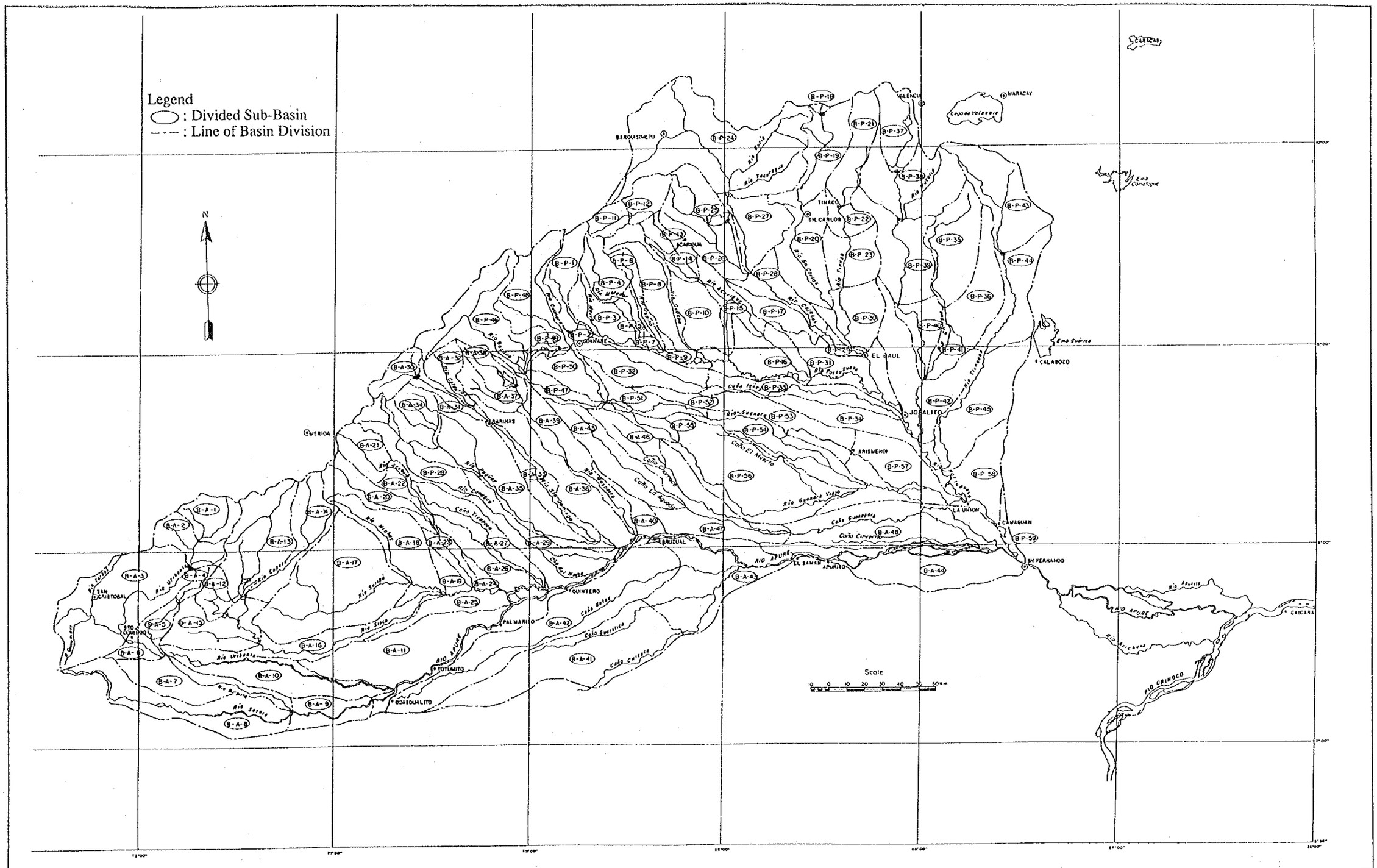

Fig. 5.2.1 Basin Division of Apure River Basin

THE REPUBLIC OF VENEZUELA
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OF THE APURE RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

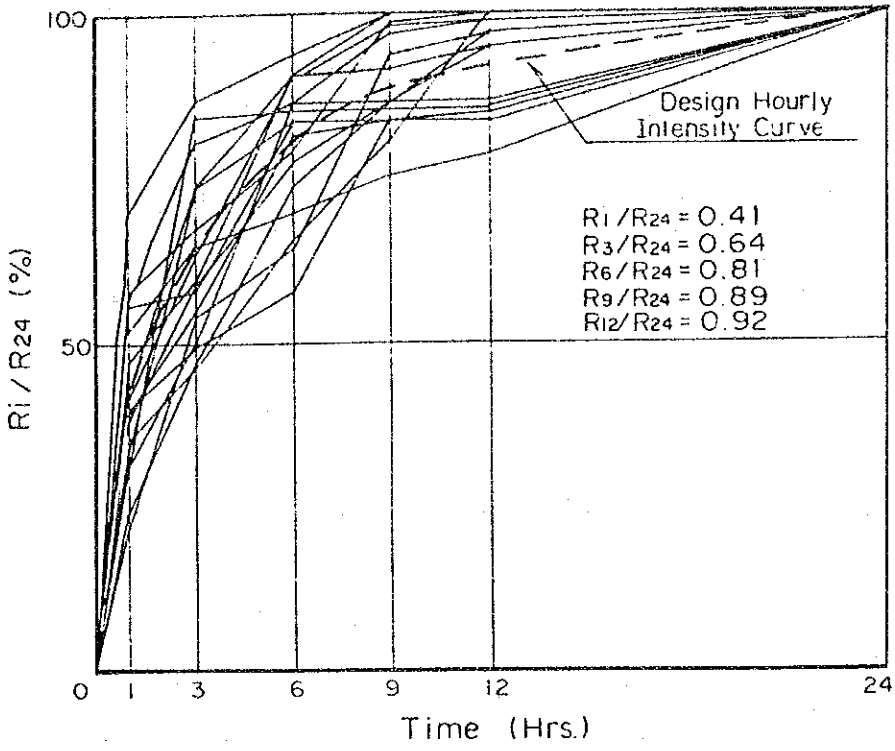

Fig. 5.3.1 Design Hourly Intensity Curve

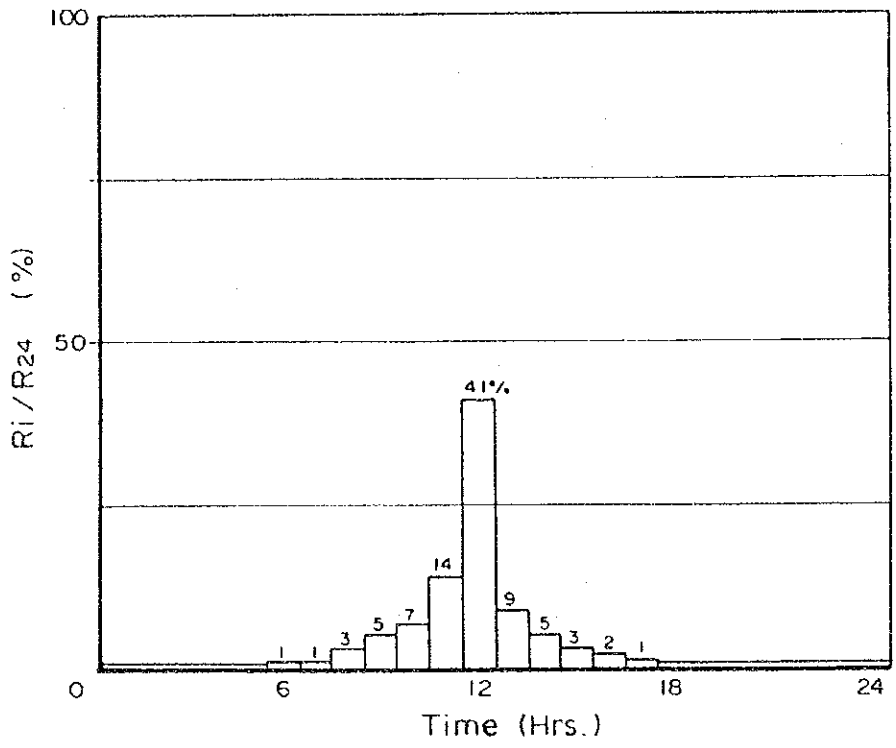

Fig. 5.3.2 Design Hourly Rainfall Distribution

THE REPUBLIC OF VENEZUELA COMPREHENSIVE IMPROVEMENT OF THE APURE RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

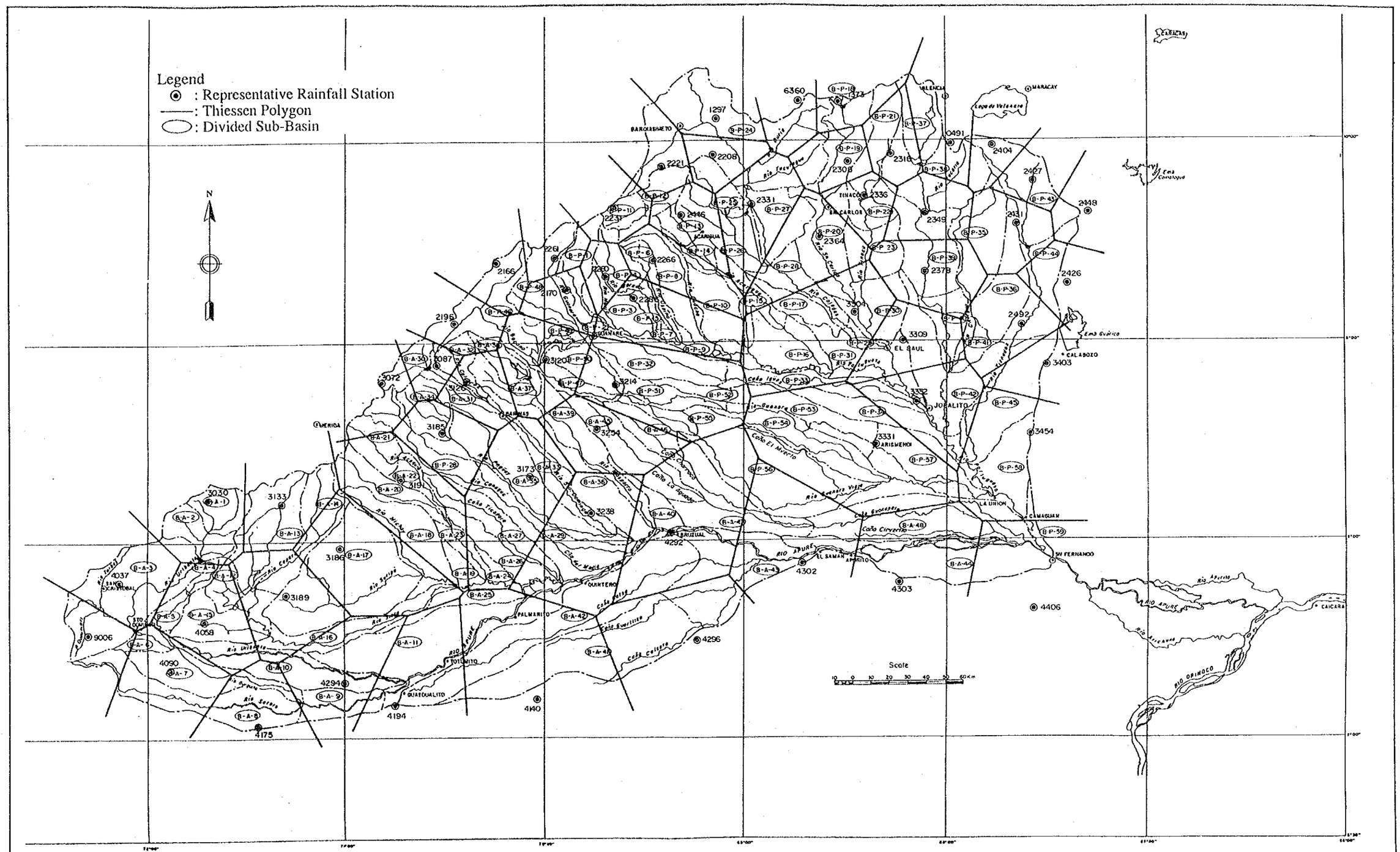

Fig. 5.3.3 Representative 61 Rainfall Stations for Basin Mean Rainfall (from April to November)

THE REPUBLIC OF VENEZUELA
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OF THE APURE RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

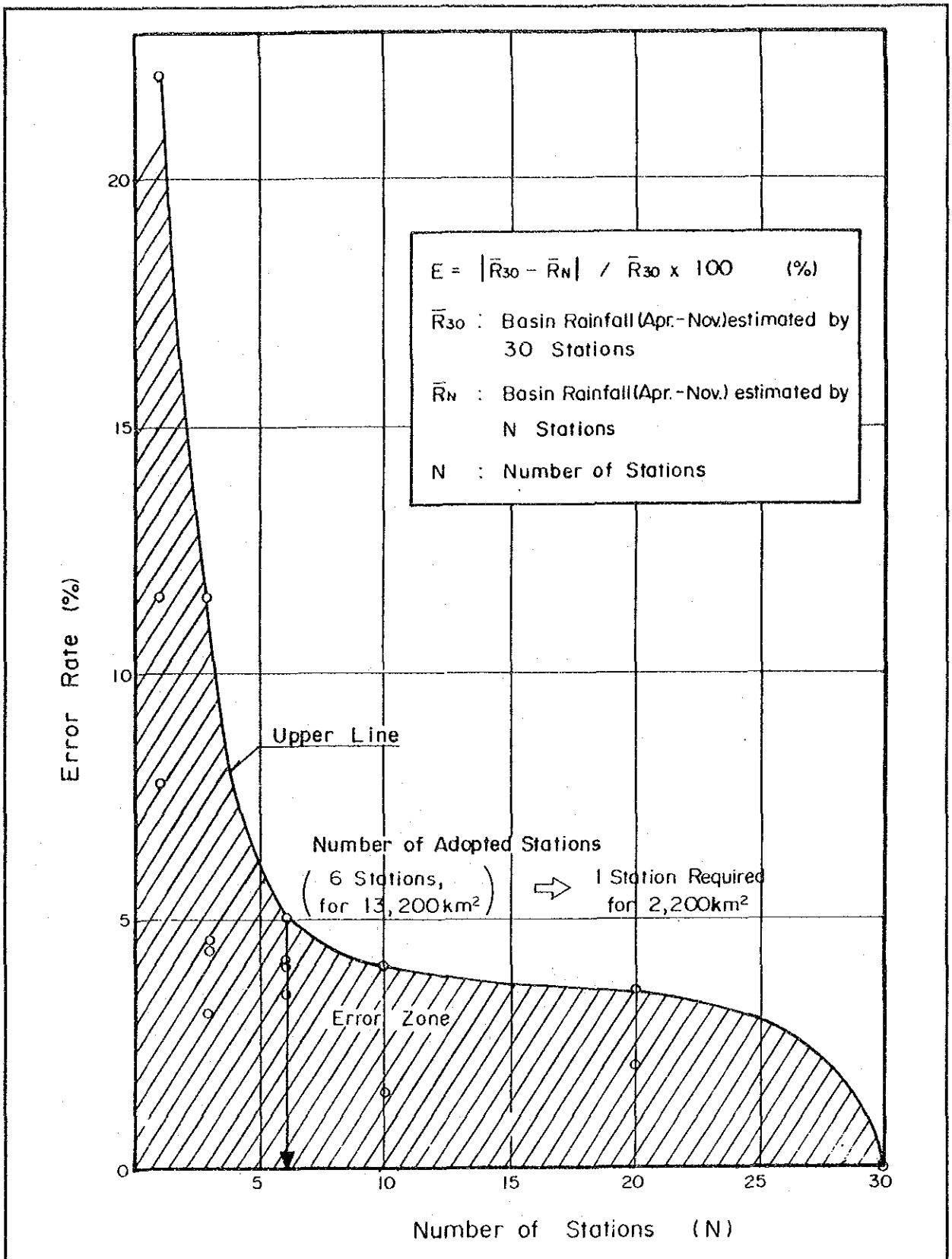

Fig. 5.3.4 Relationships between Number of Stations and Accuracy of Basin Mean Rainfall

THE REPUBLIC OF VENEZUELA
COMPREHENSIVE IMPROVEMENT OF THE APURE RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

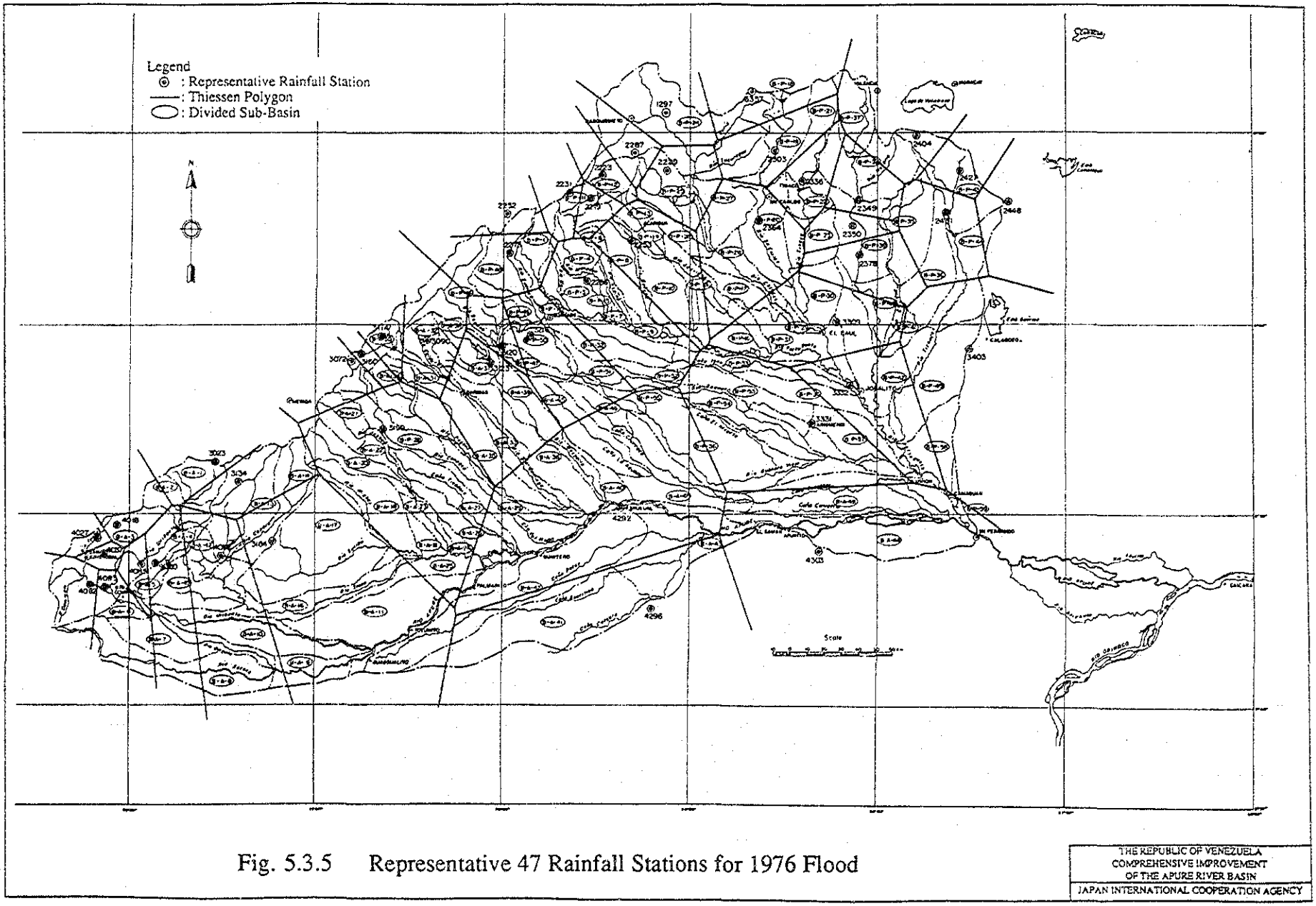

Fig. 5.3.5 Representative 47 Rainfall Stations for 1976 Flood

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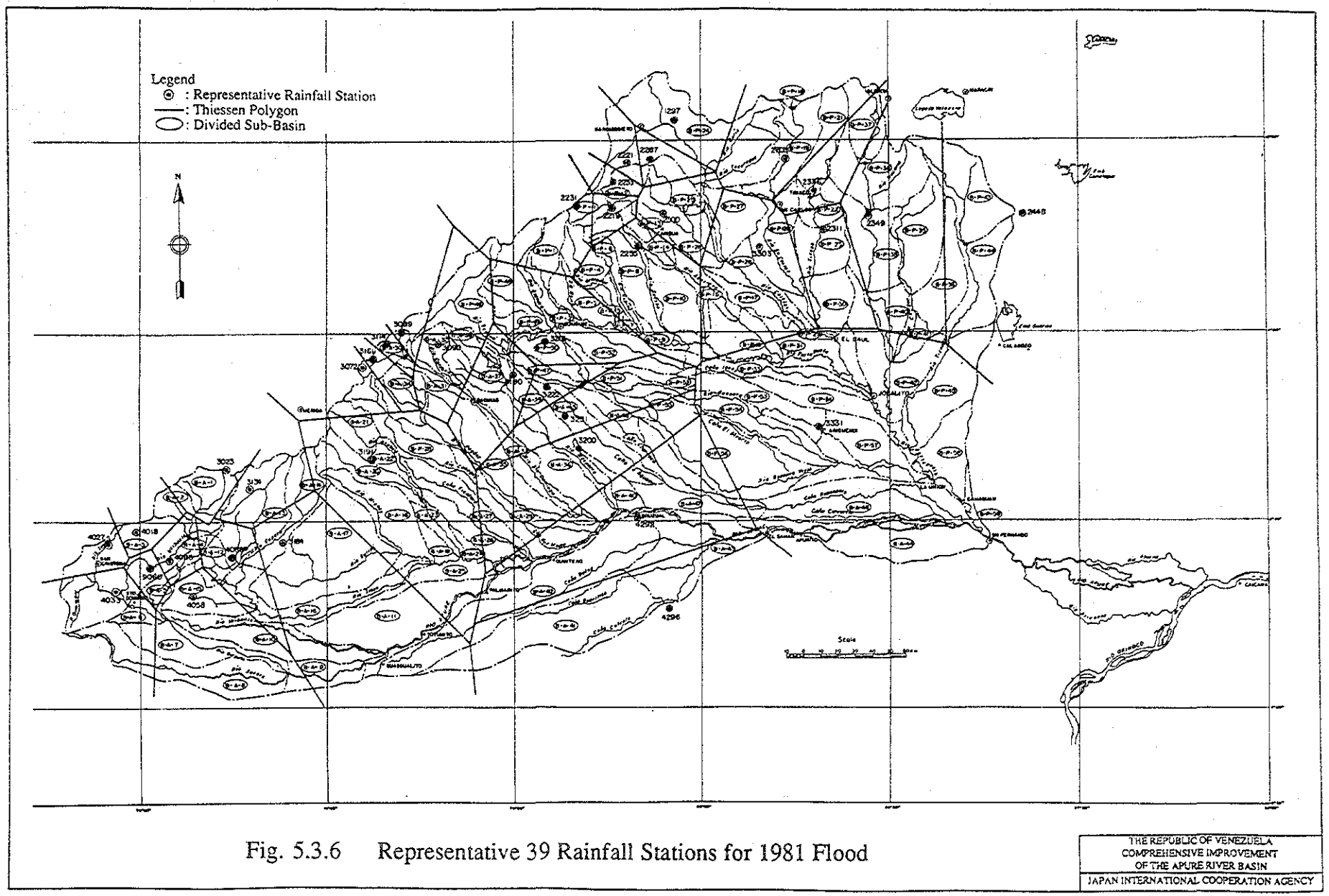

Fig. 5.3.6 Representative 39 Rainfall Stations for 1981 Flood

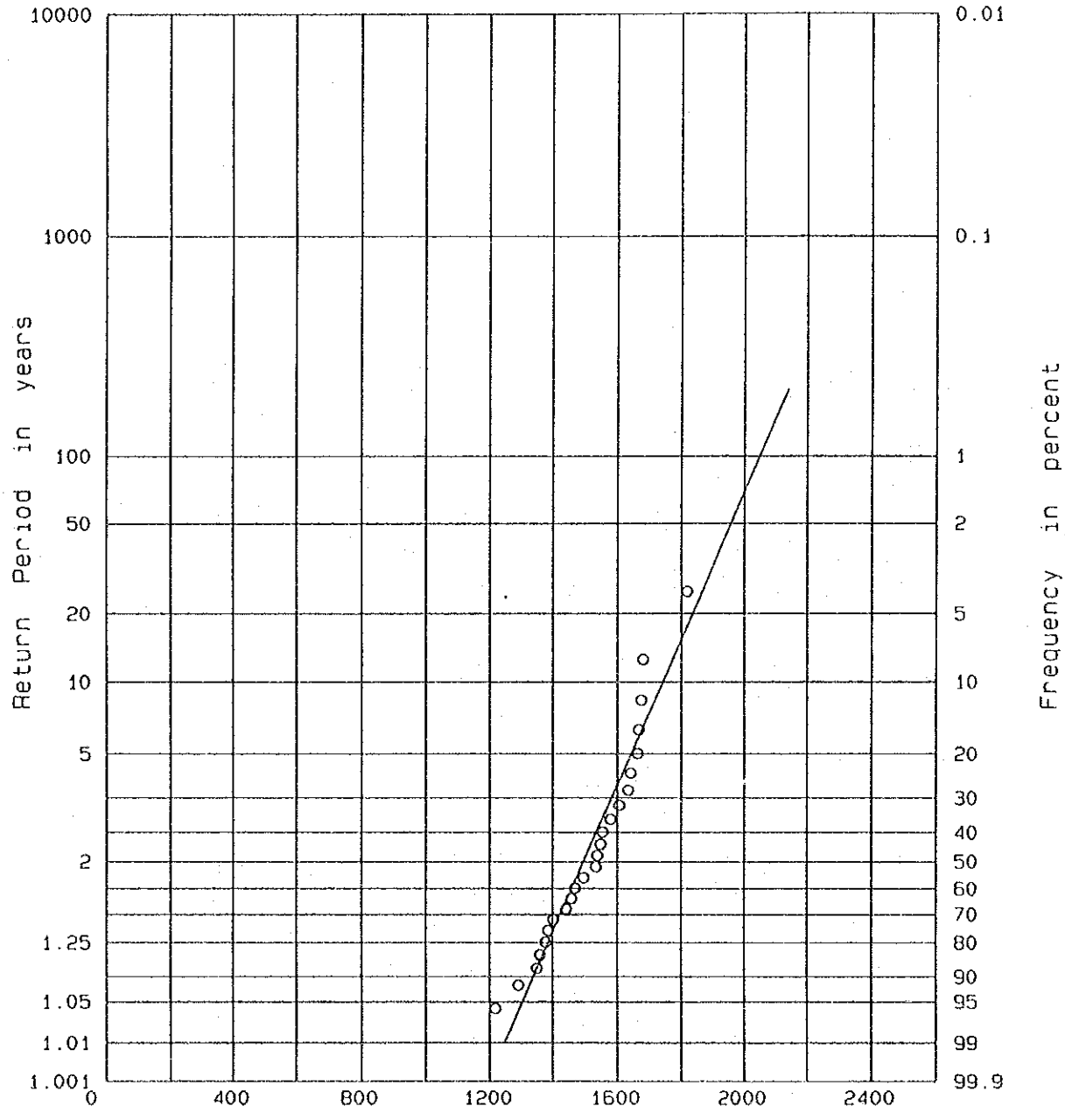

Fig. 5.3.7 Frequency Curve of 8-month Basin Mean Rainfall at San Fernando

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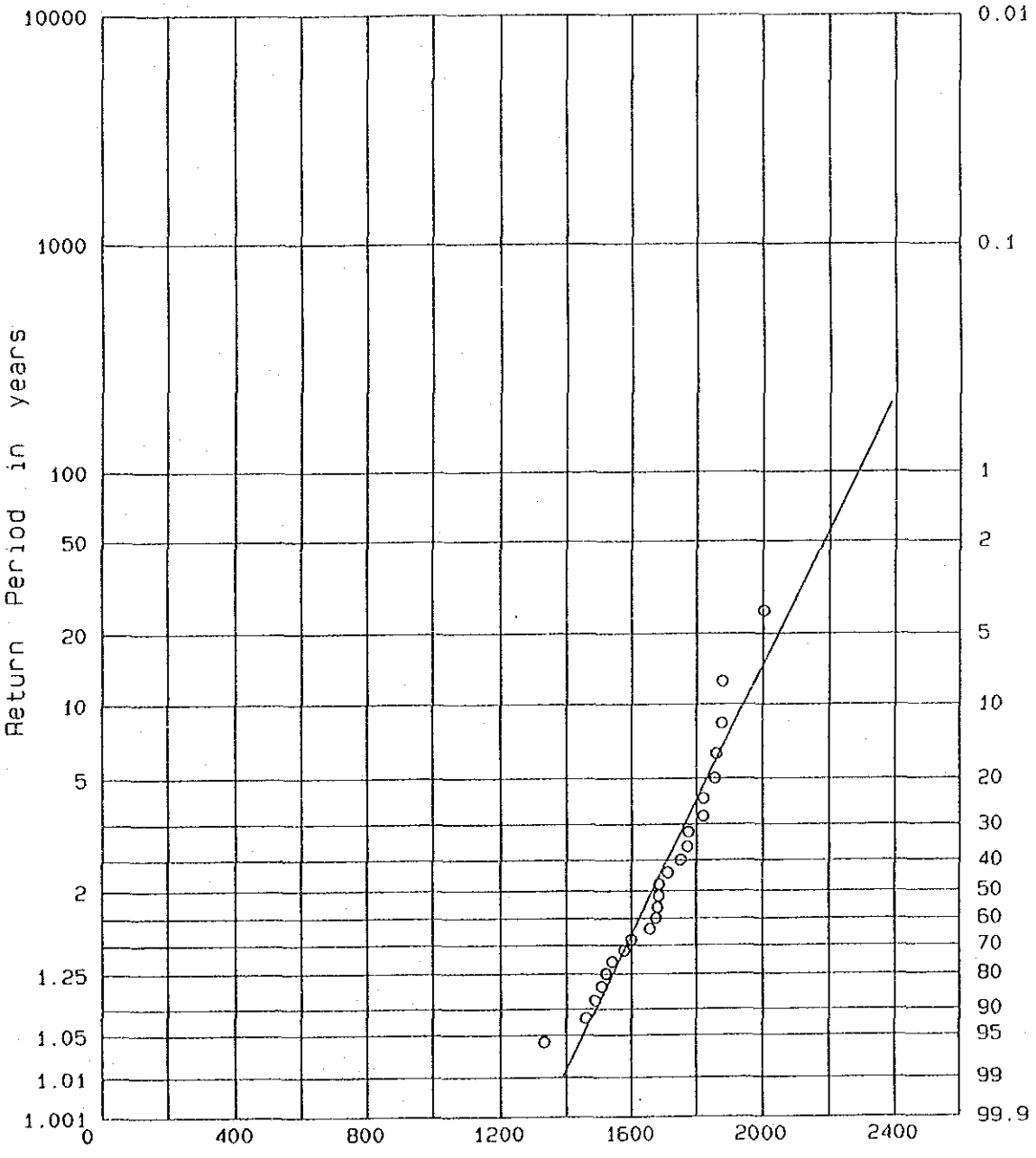

Fig. 5.3.8 Frequency Curve of 8-month Basin Mean Rainfall at El Saman

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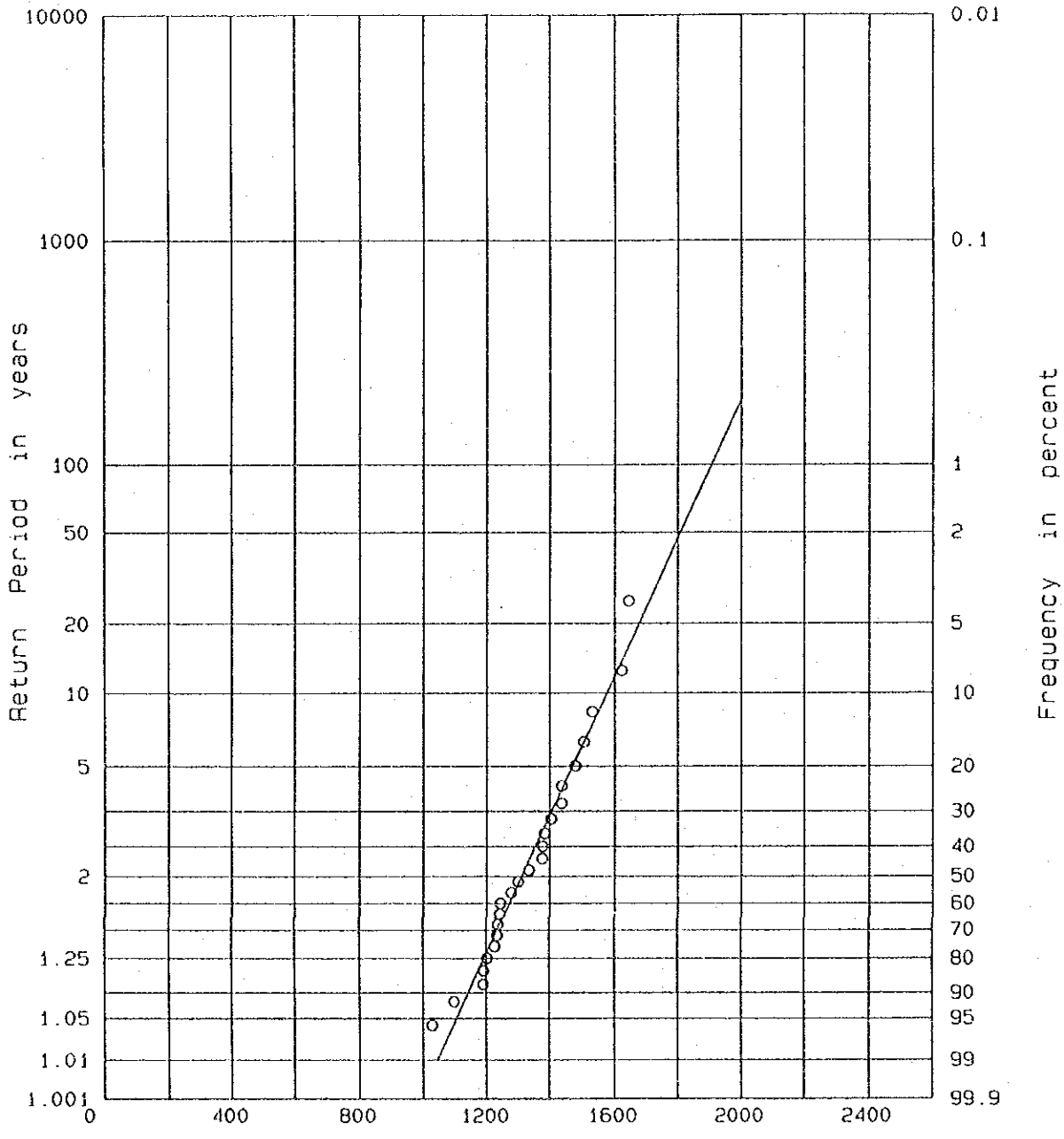

Fig. 5.3.9 Frequency Curve of 8-month Basin Mean Rainfall at Camaguan

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JAPAN INTERNATIONAL COOPERATION AGENCY

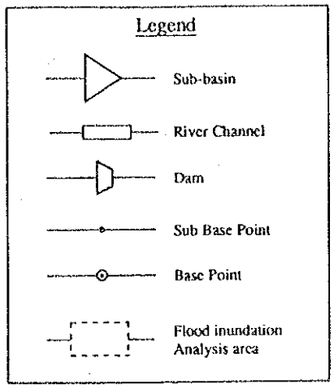

Fig. 5.4.1 Schemetic Diagram of the Basin and River Channel Model

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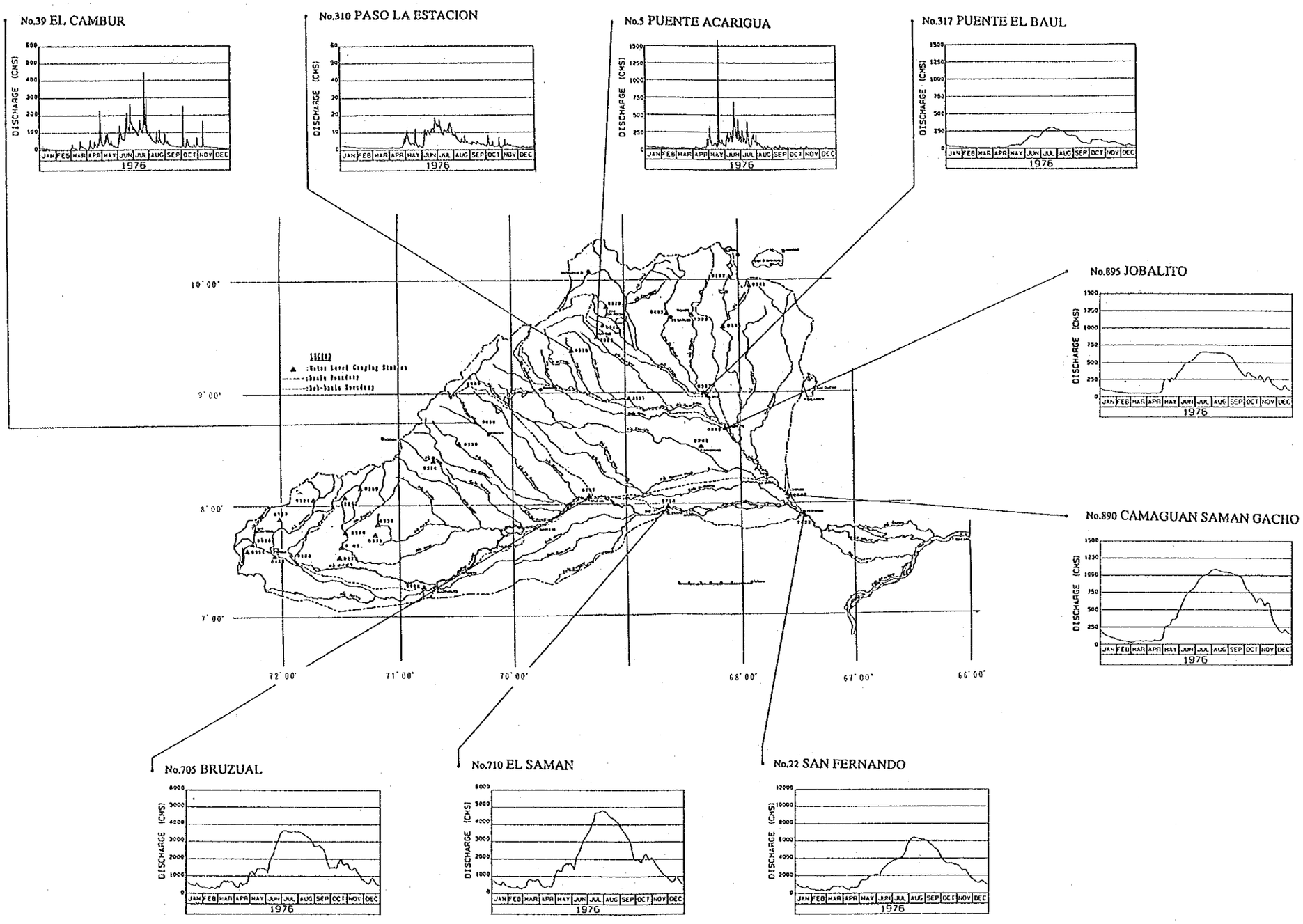

Fig. 5.4.2 Observed Hydrographs of 1976 Flood in Apure River Basin

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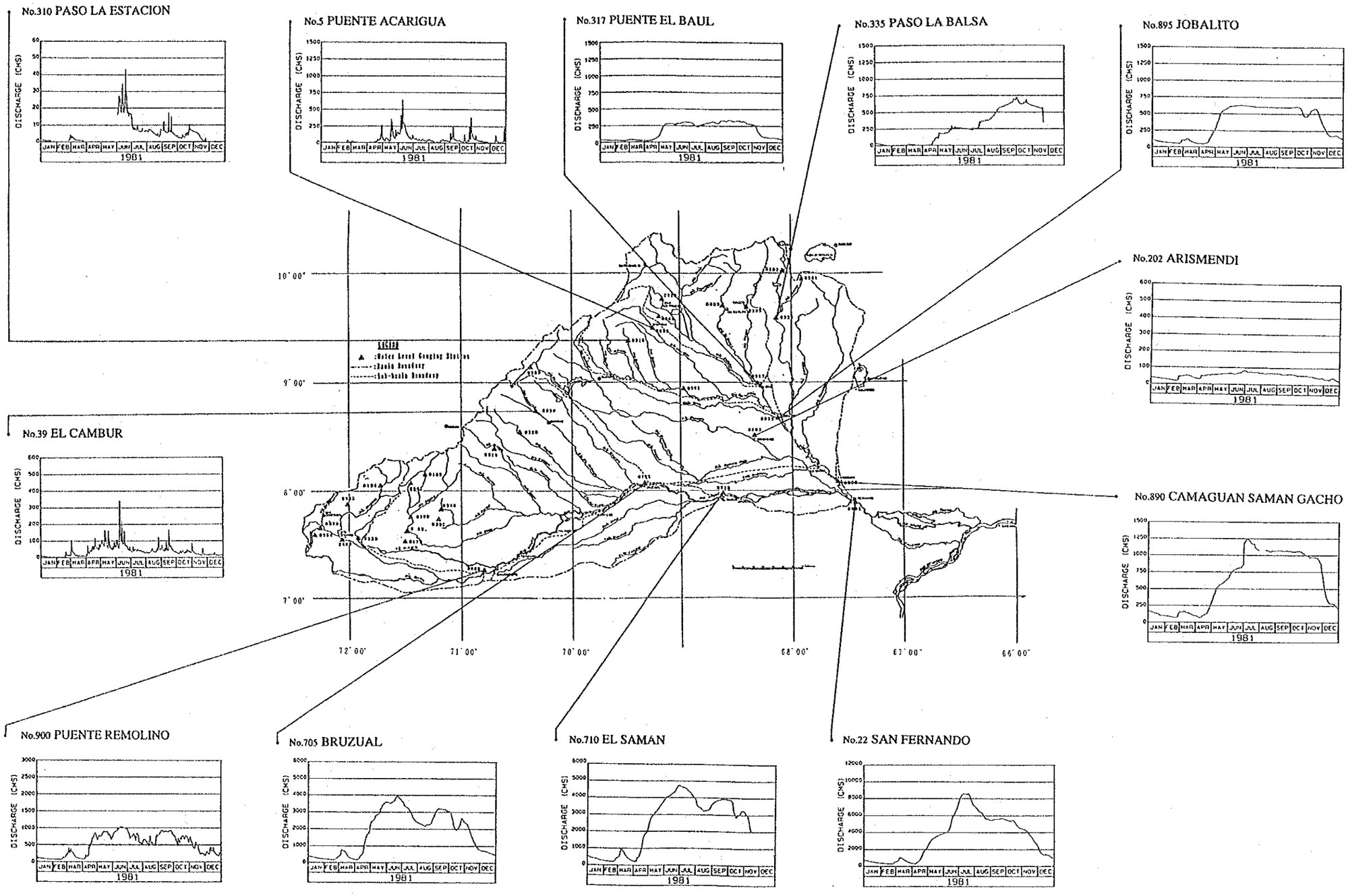

Fig. 5.4.3 Observed Hydrographs of 1981 Flood in Apure River Basin

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OF THE APURE RIVER BASIN
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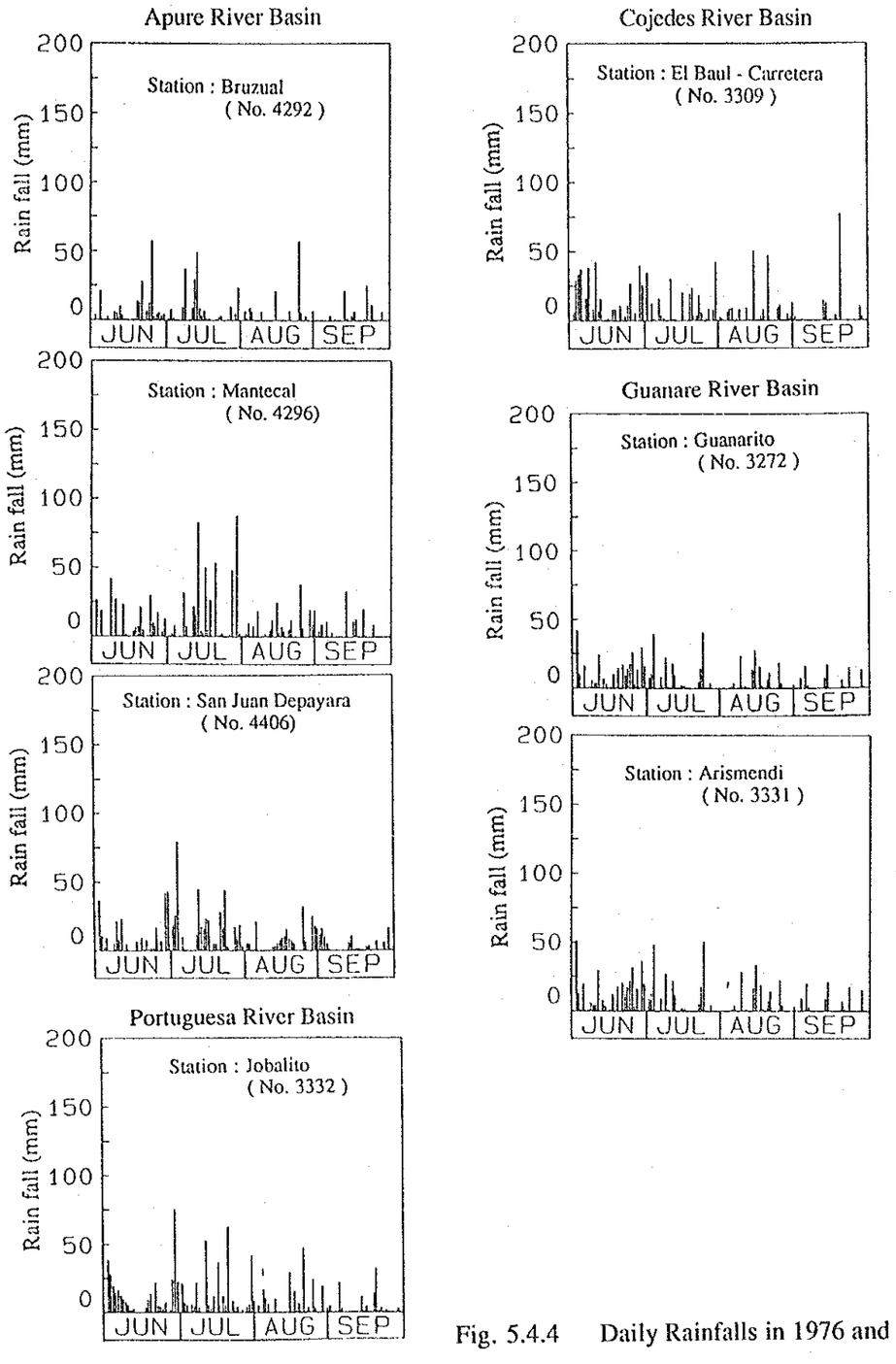
(1) Year : 1976



(2) Year : 1981

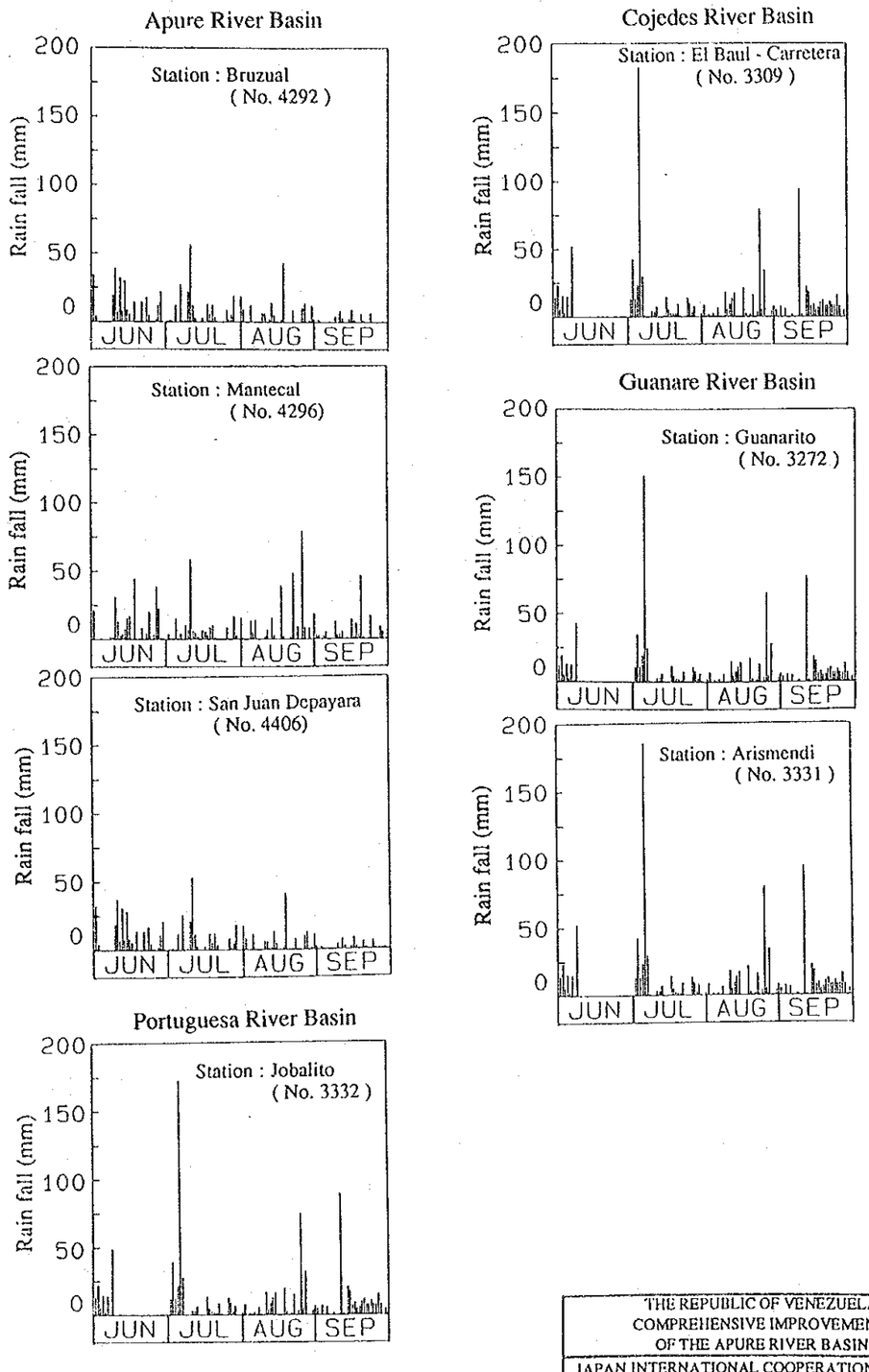


Fig. 5.4.4 Daily Rainfalls in 1976 and 1981 at Major Stations

Fig. 5.4.5 List of Water Level Gauging Stations for Flood Study

No.	St. No.	Station Name	Catchment Area (km2)	Year																						Selection Criteria				Selected	Remarks
				70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	(a)	(b)	(c)	(d)		
1	0005	Acarigua	970							○	○	○	○	○	○	○	○	○	○	○	○	○				○	○	○	○	○	
2	0022	San Fernando	111,800						○	○	○	○	○	○	○	○					○	○	○	○			○	○	○	○	○	Effective to Pond Model
3	0039	El Cambur	480	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○			○	○	○	○	○	
4	0050	Puente Junin	400						○	○													○	○			○		○			Data reliability is low
5	0120	Puente Doradas	630					○	○	○	○		○	○	○	○	○	○	○	○	○	○	○	○			○	○	○	○	○	
6	0124	Puente El Molino	660							○	○		○				○	○	○	○	○	○	○	○			○	○	○	○	○	
7	0172	Puente Navay	500										○	○	○	○	○	○					○	○			○		○			Data reliability is low
8	0202	Arismendi	1,290											○	○												○		○			Data reliability is low
9	0214	Puente La Acequia	478						○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○			○	○	○			No rainfall data is available.
10	0310	Paso La Acequia	200						○	○	○		○	○	○	○											○		○			Catchment area is small
11	0317	El Baul	13,200						○	○	○			○	○	○	○	○	○	○	○	○	○	○			○	○	○	○	○	
12	0320	El Paso	880						○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○			○	○	○	○	○	
13	0335	La Balsa Dam	2,700											○	○	○	○	○	○	○							○					
14	0338	La Balsera	300										○	○	○	○	○	○	○	○	○	○	○	○			○	○	○			Catchment area is small
15	0339	Puente Suripa	200		○	○	○	○	○		○		○	○	○	○	○	○	○	○	○	○	○	○			○	○	○			Catchment area is small
16	0395	Tinaco	650							○	○			○		○	○	○	○		○	○	○	○			○	○	○	○	○	
17	0405	San Carlos	1,490							○	○		○	○	○	○	○	○	○	○	○	○	○	○			○	○	○	○	○	
18	0485	Sto.Domingo	4,005					○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○			○	○				Data reliability is low
19	0589	La Cavita	300																				○	○					○			Data reliability is low
20	0591	Nueva Florida	5,210																				○						○			Data reliability is low
21	0687	El Tambo	320																				○	○								Data reliability is low
22	0705	Bruzual	40,000						○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○			○	○	○	○	○	
23	0710	El Saman	48,000						○	○	○	○	○	○	○	○	○	○	○		○	○	○	○			○	○	○	○	○	Effective to Pond Model
24	0890	Camaguan	54,400						○	○	○	○	○	○	○		○	○	○	○	○	○	○	○			○	○	○	○	○	Effective to Pond Model
25	0895	Jobalito	23,300						○	○	○		○	○	○	○	○	○	○	○	○	○	○	○			○	○	○	○	○	Effective to Pond Model
26	0900	Guasdualito	8,400										○		○	○	○	○						○			○		○	○		

Note:

Selection criteria (a) : Flood hydrograph in 1976 or 1981 is available.

Selection criteria (b) : Long period data (around 10 years) is available, and there is a few lack of data (Reliability of data is considered to be high).

Selection criteria (c) : No effect of existing dam/reservoir is expected.

Selection criteria (d) : Reliable rainfall data in and around the water level gauging basin is available.

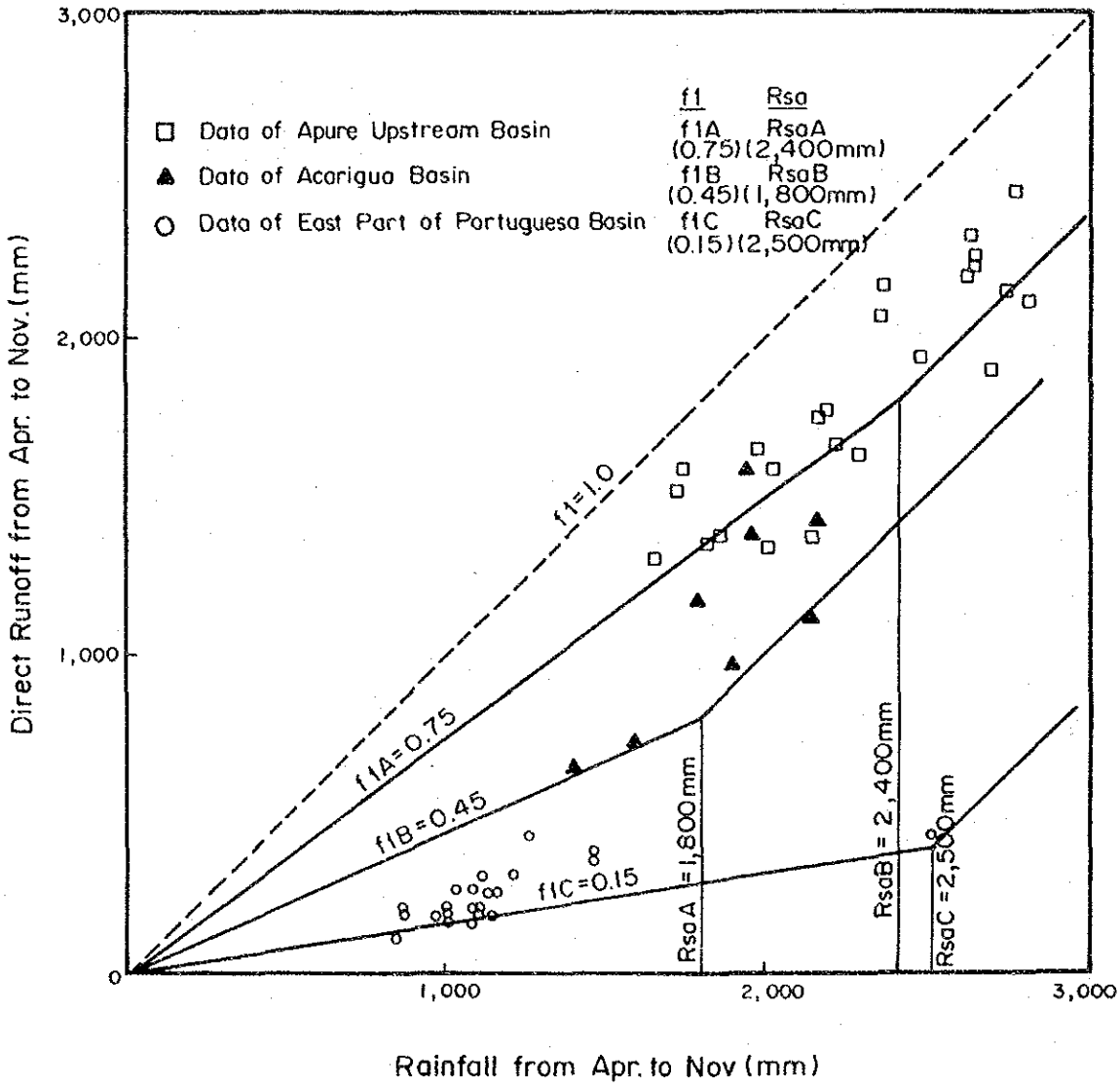


Fig. 5.4.6 Primary Runoff Coefficient (f1) and Saturated Rainfall (Rsa)

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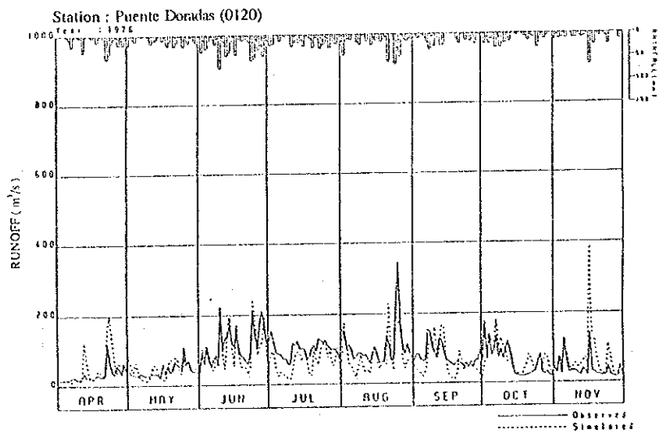
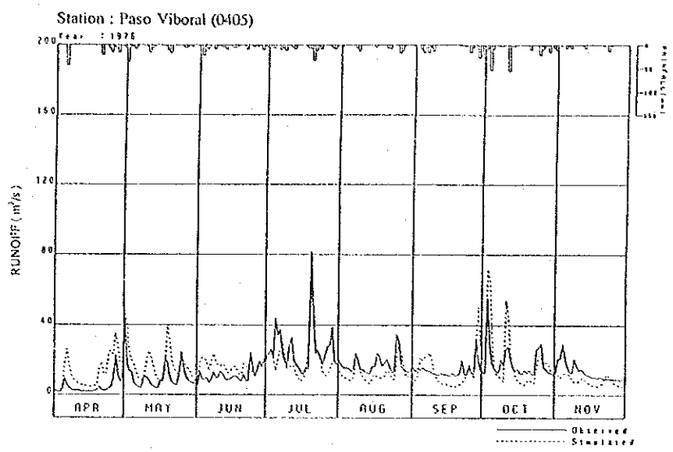
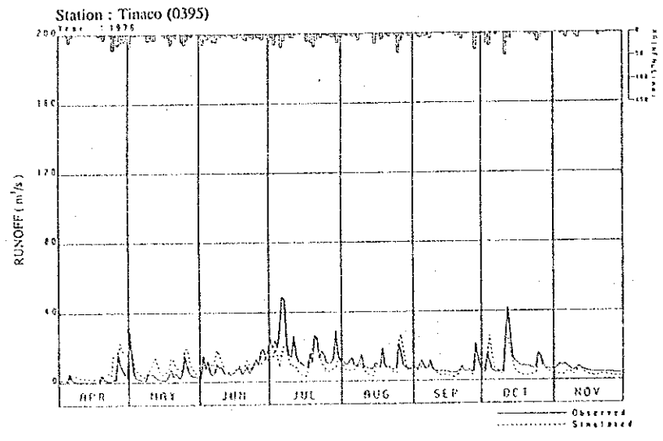






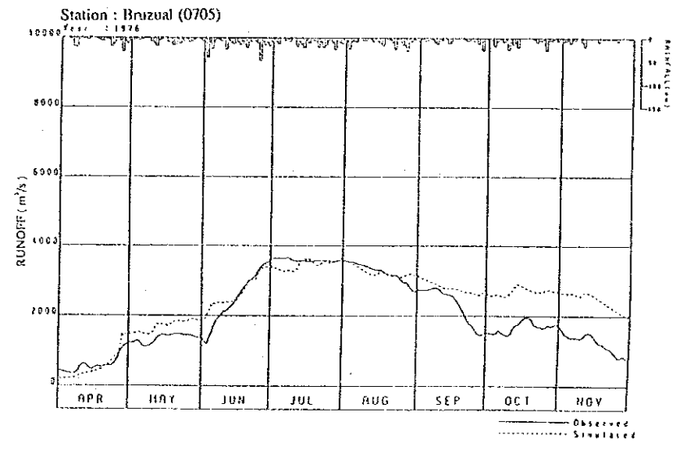
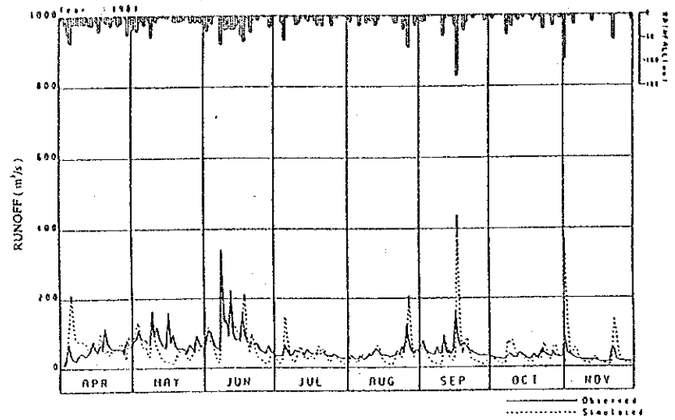
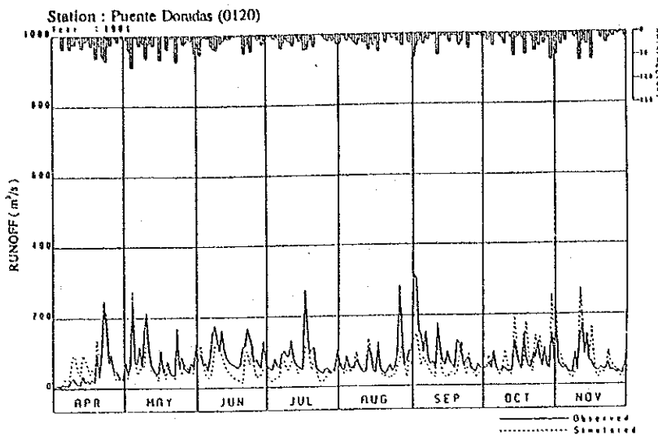


Fig. 5.4.7 Observed and Simulated Hydrographs in 1976

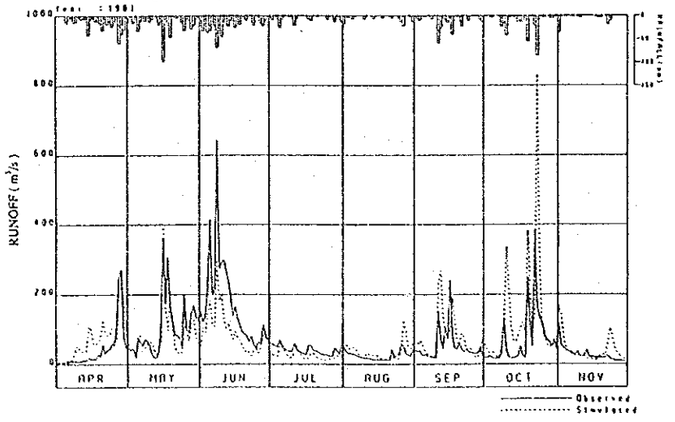
Station : El Cambur (0039)



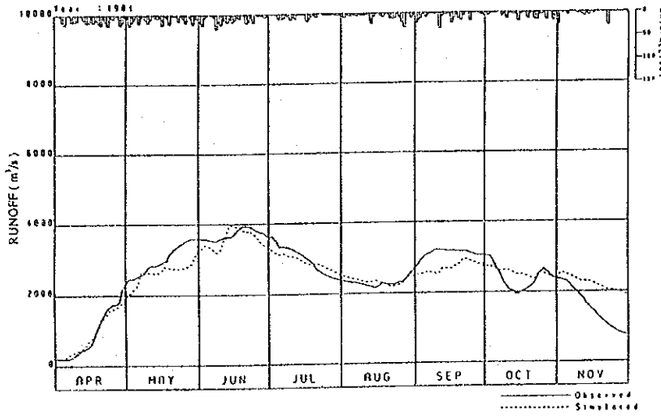
Station : Puente Dondas (0120)



Station : Acarigua (0005)



Station : Bruzual (0705)



Station : El Baul (0317)

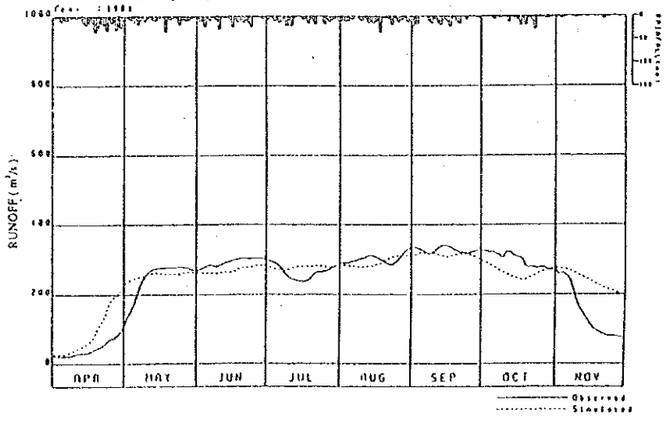


Fig. 5.4.8 Observed and Simulated Hydrographs in 1981

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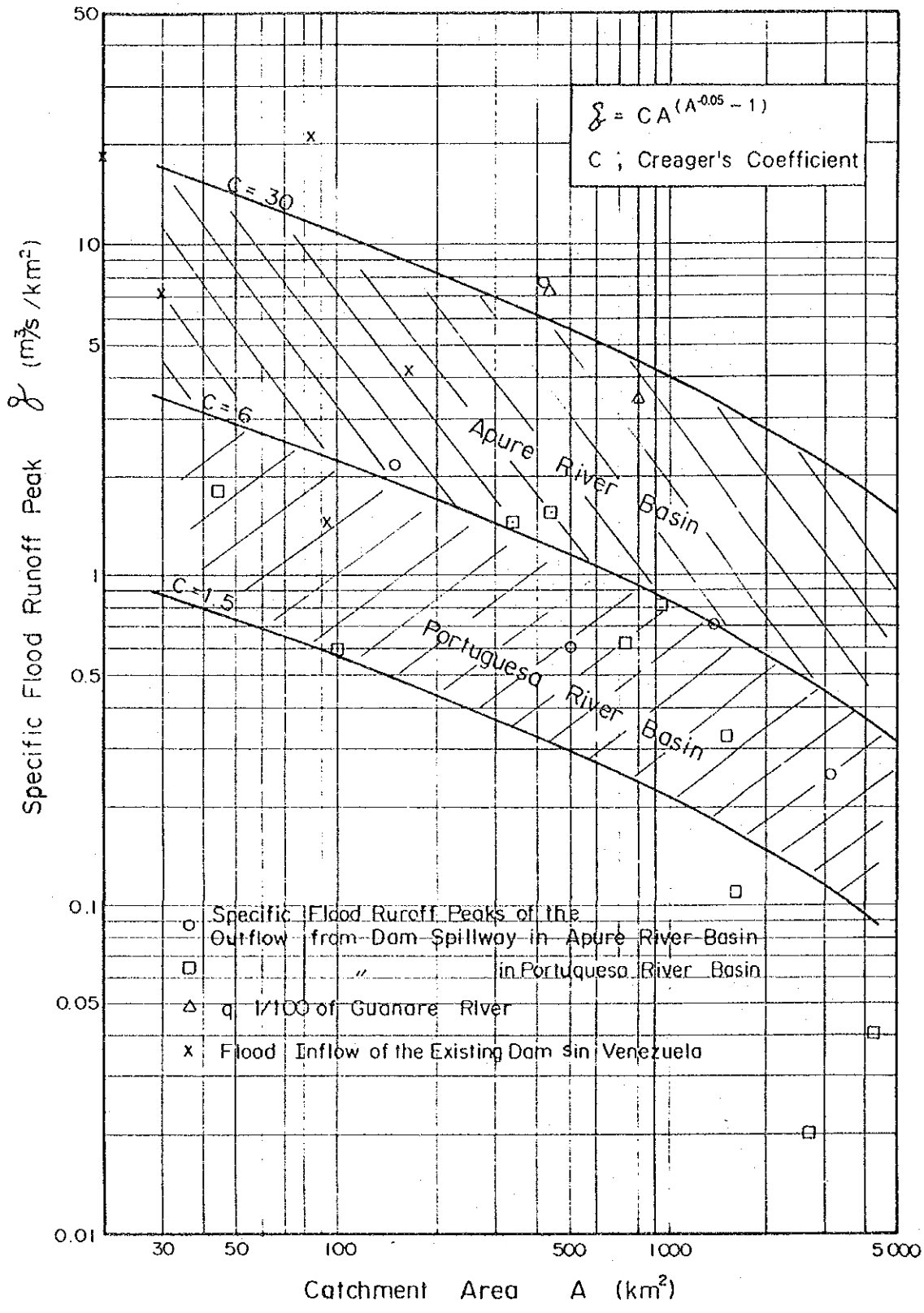

Fig. 5.4.9 Specific Flood Runoff Peaks

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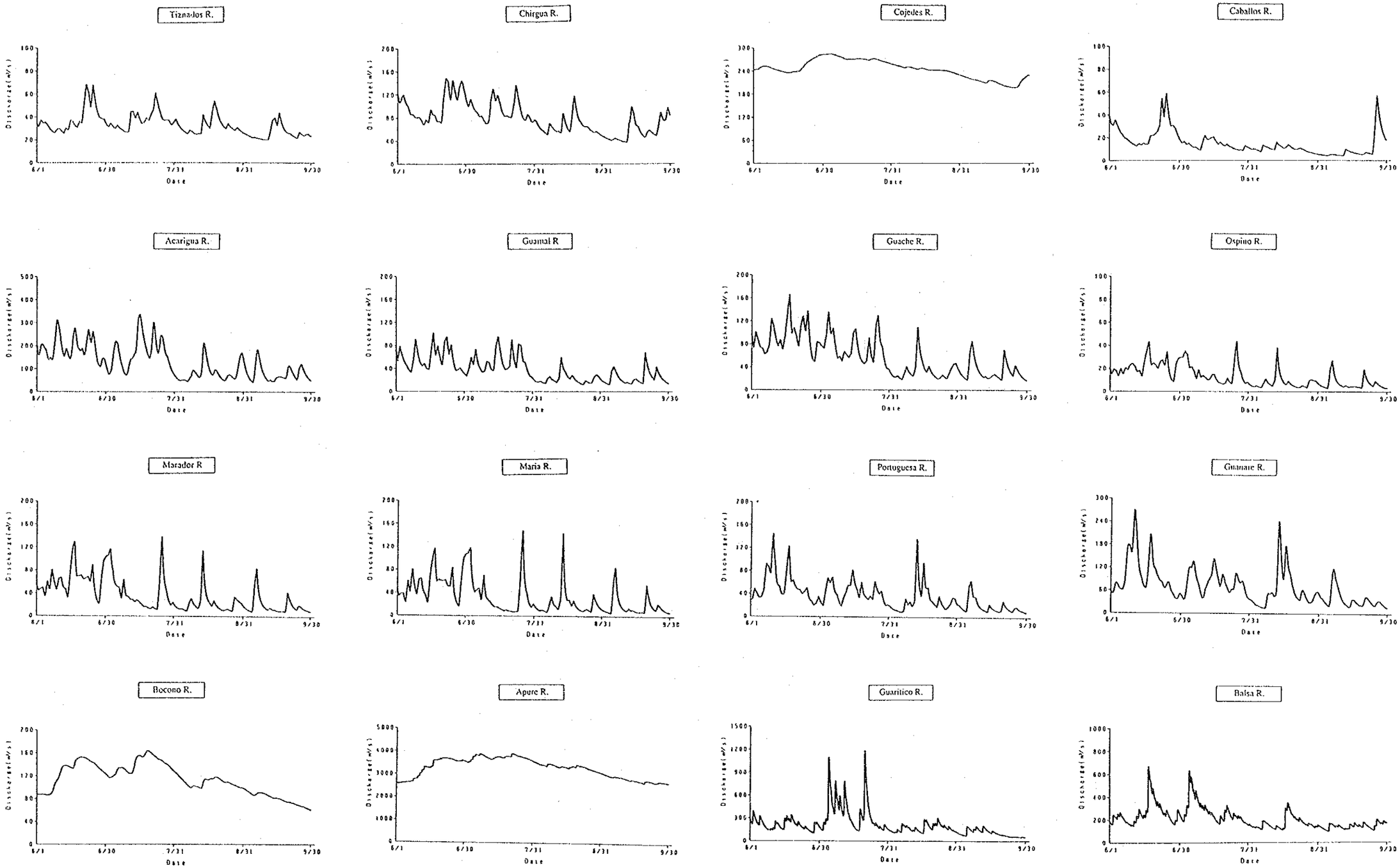

Fig. 5.4.10 Flood Hydrographs of Inflow Rivers for Pond Model Method (Flood in 1976)

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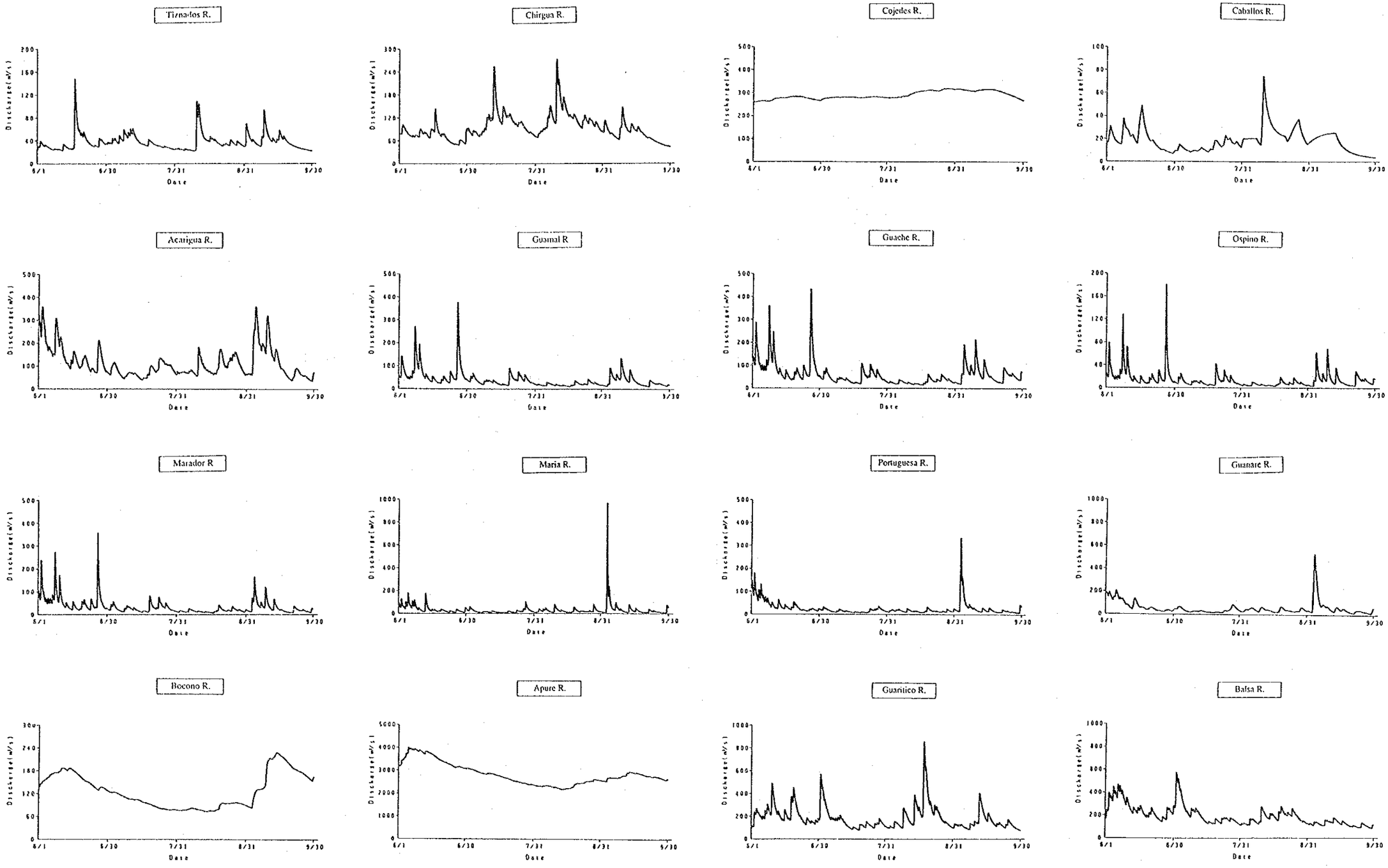

Fig. 5.4.11 Flood Hydrographs of Inflow Rivers for Pond Model Method (Flood in 1981)

THE REPUBLIC OF VENEZUELA COMPREHENSIVE IMPROVEMENT OF THE APURE RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

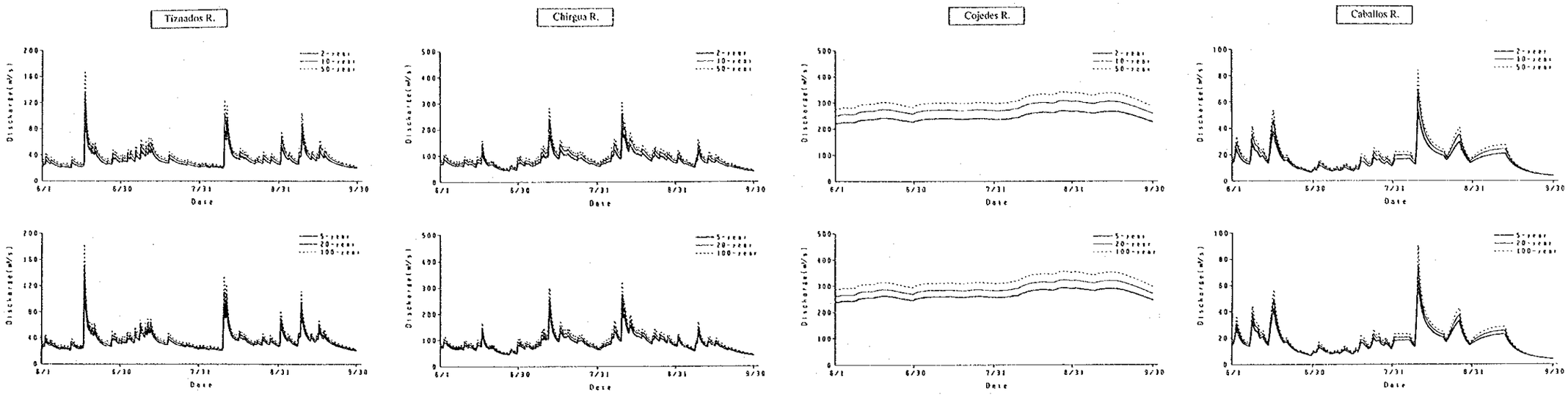

Fig. 5.4.12 Probable Flood Hydrographs of Inflow Rivers for Pond Model Method (1/2)

THE REPUBLIC OF VENEZUELA COMPREHENSIVE IMPROVEMENT OF THE APURE RIVER BASIN
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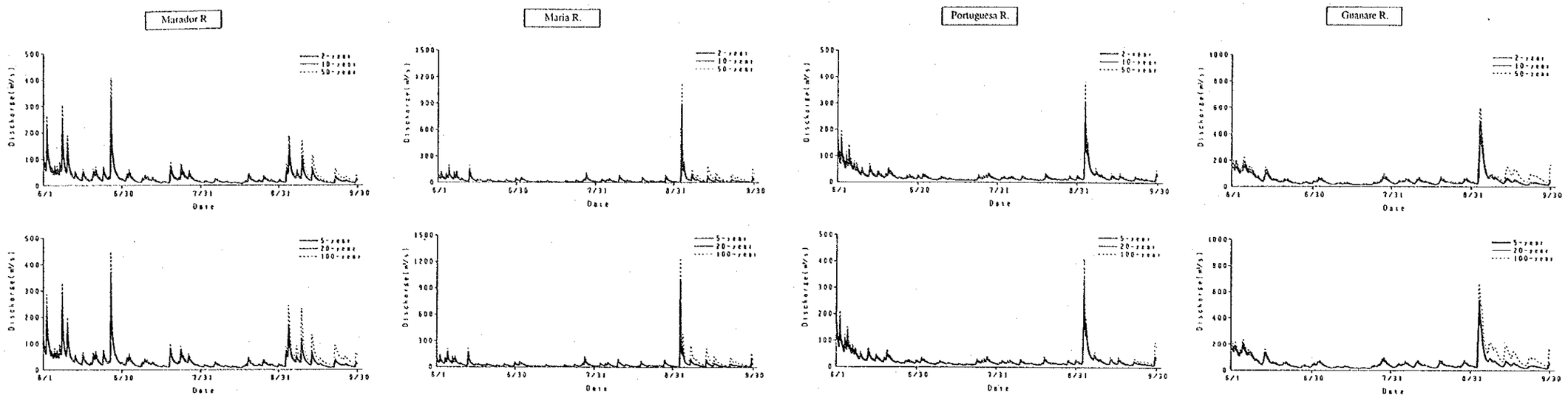

Fig. 5.4.12 Probable Flood Hydrographs of Inflow Rivers for Pond Model Method (2/2)

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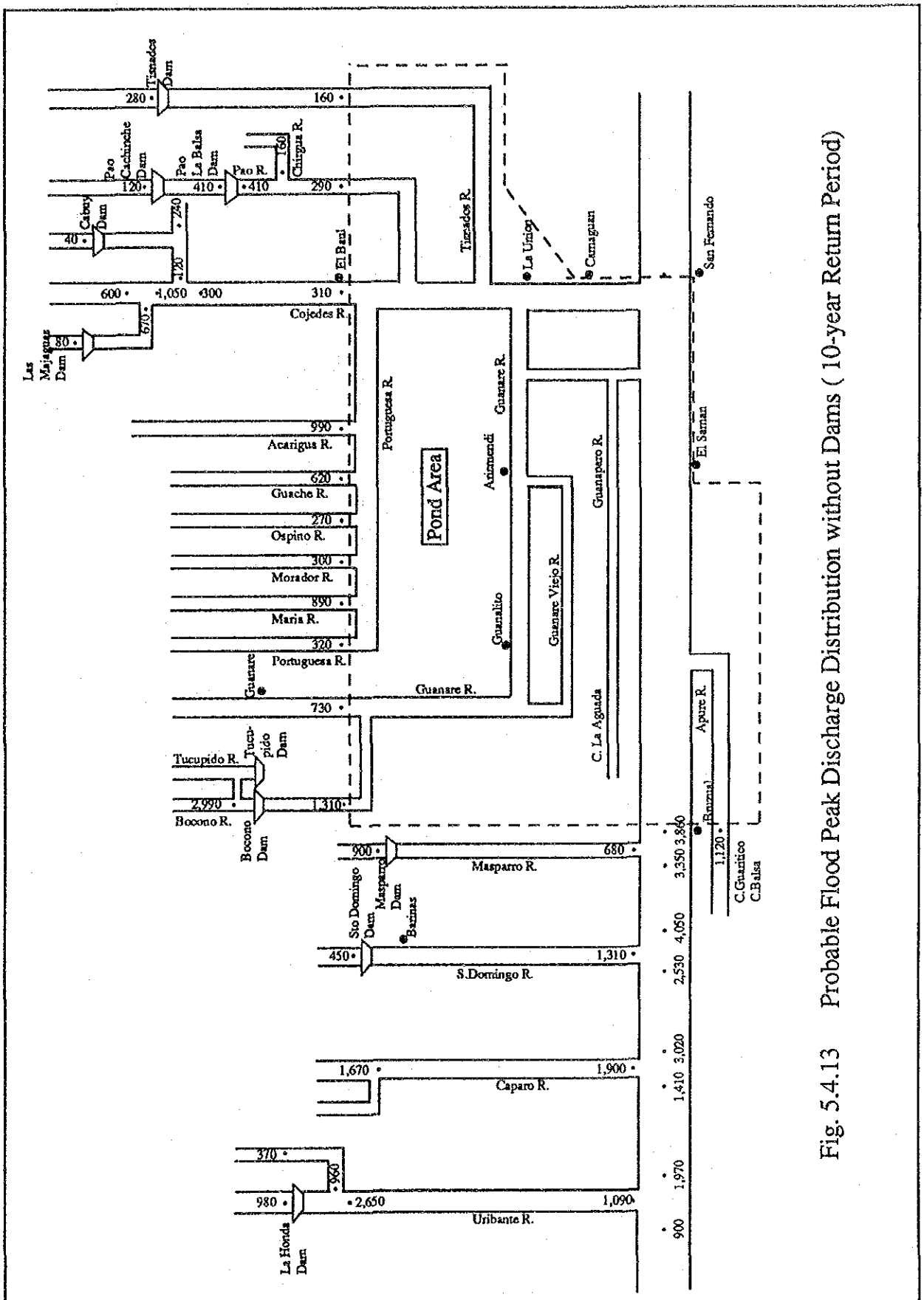

Fig. 5.4.13 Probable Flood Peak Discharge Distribution without Dams (10-year Return Period)

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