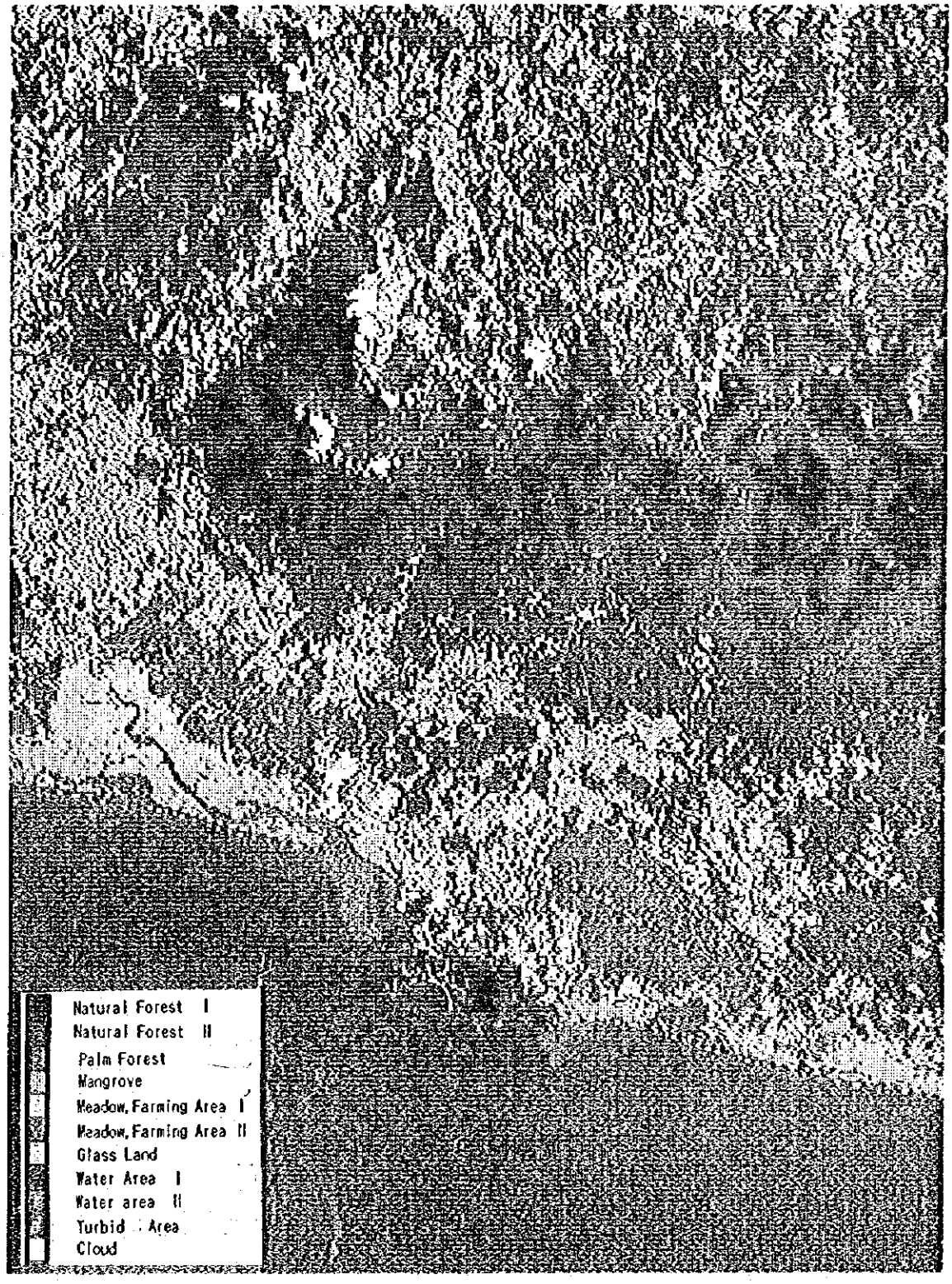


Fig. 13-22 Present Situation of Land Utilization from Land Sat Image

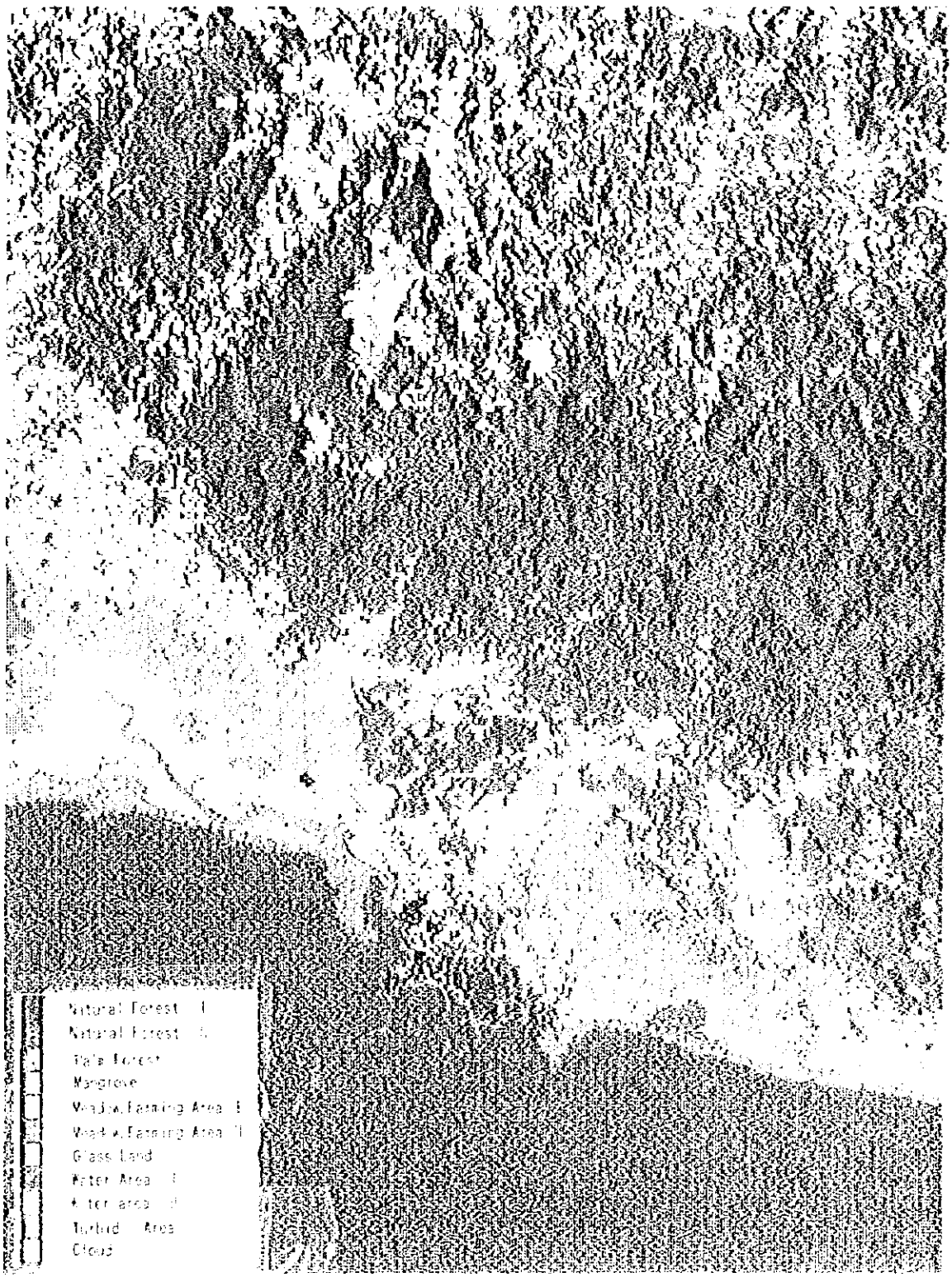


Fig. 13-22 Present Situation of Land Utilization from Land Sat Image

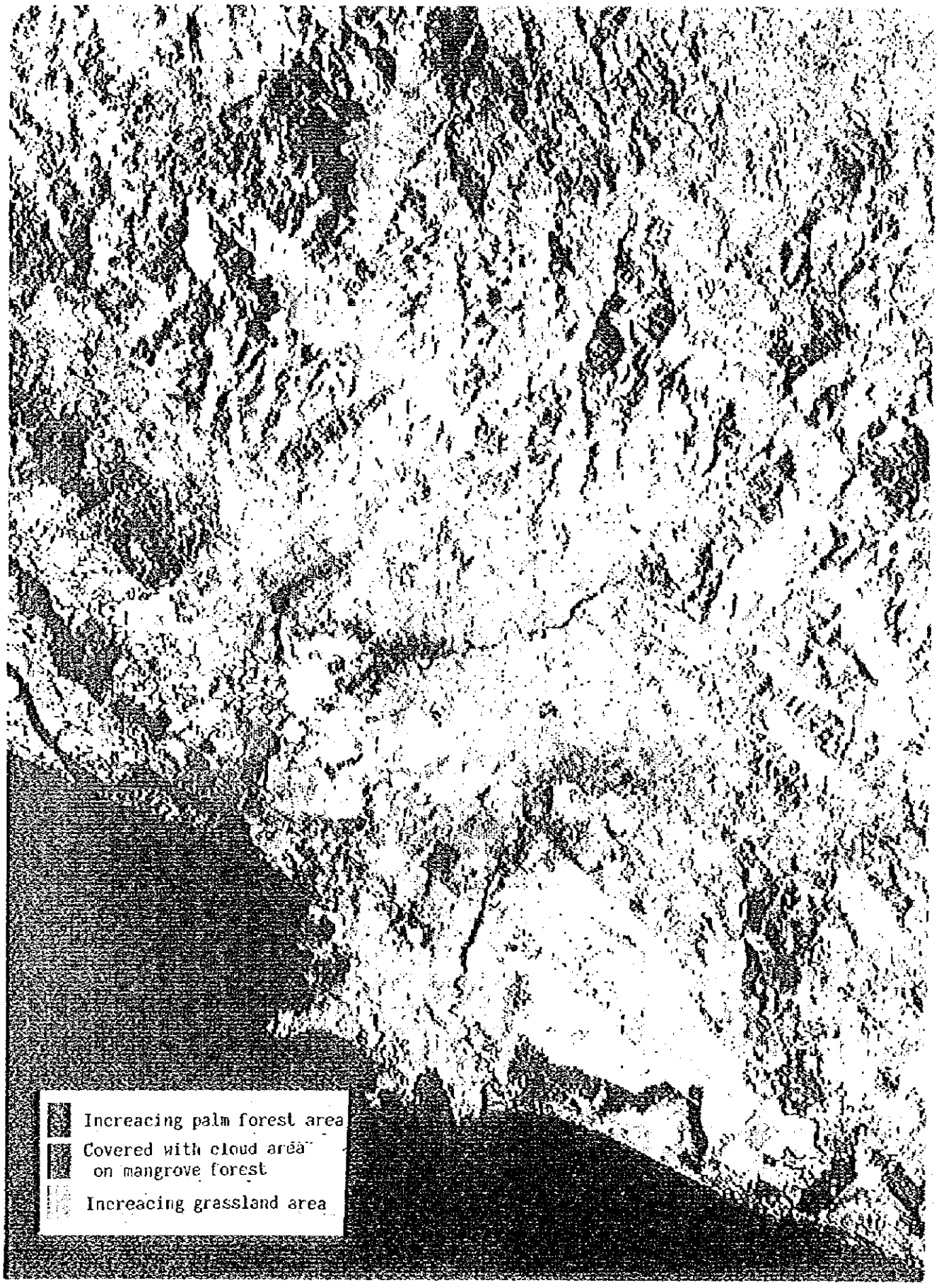


Fig. 13-23 Land Use Temporal Change (1987 - 1992)

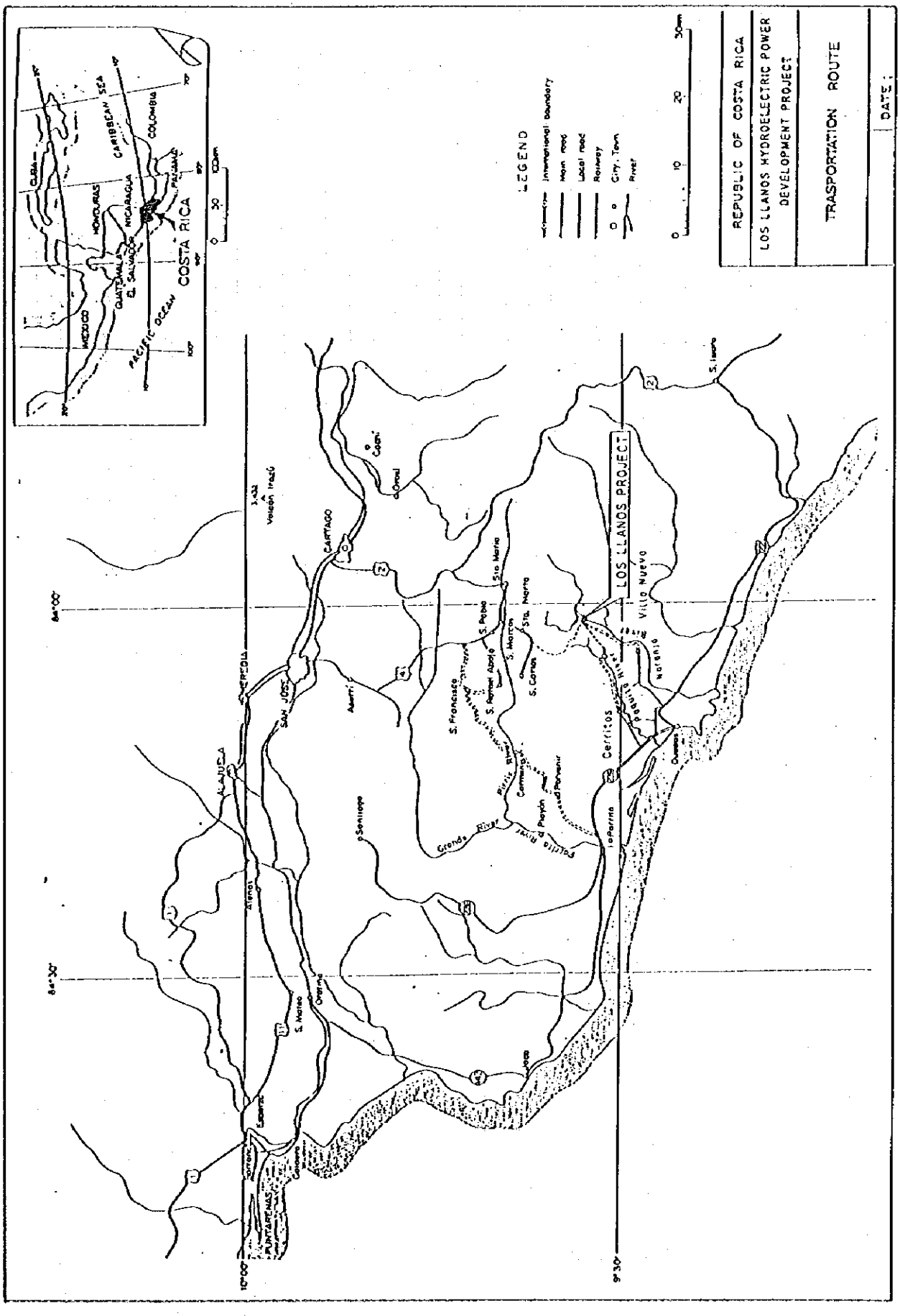


Fig. 13-24 Road Distribution in Project Area

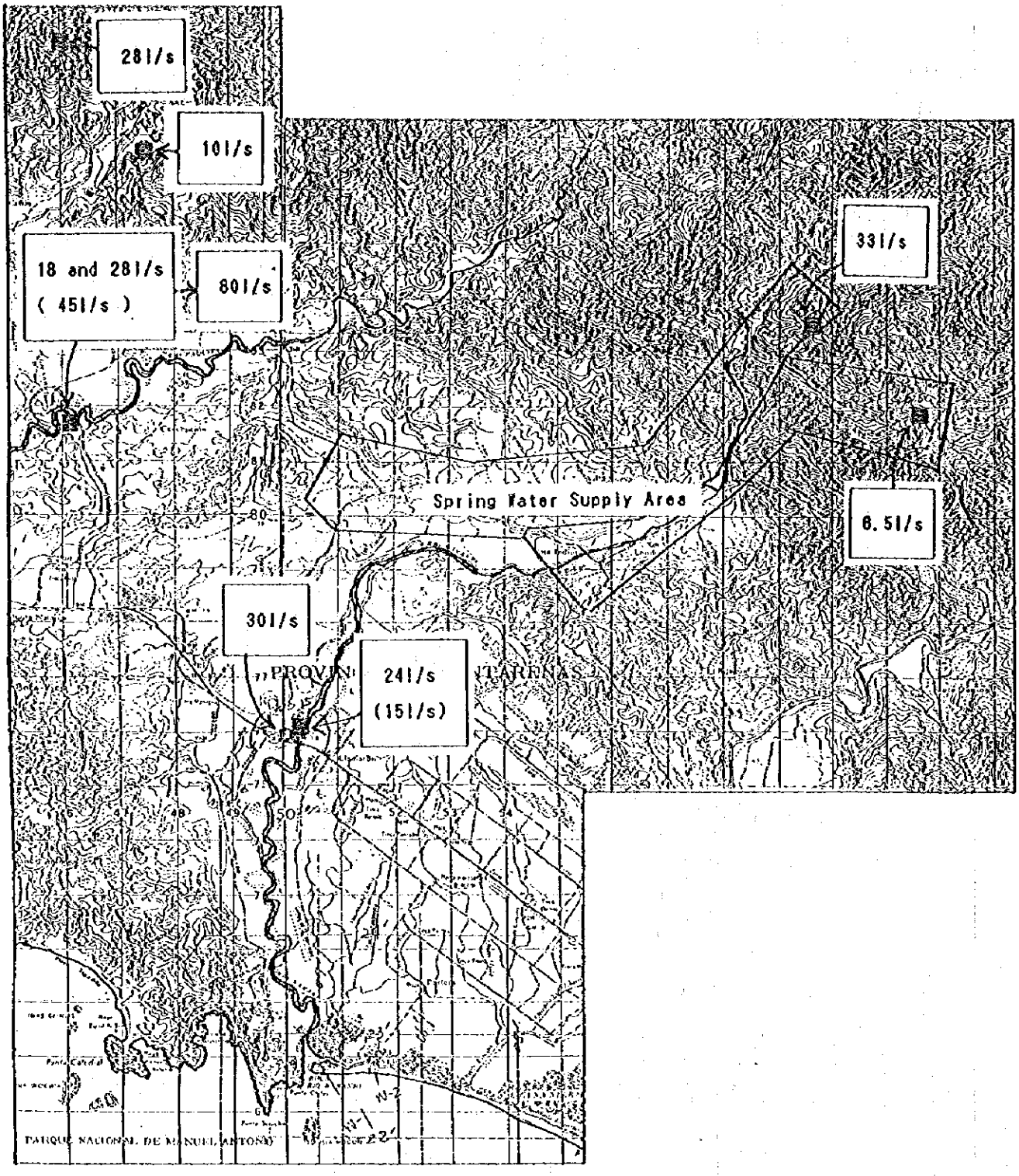


Fig. 13-25 Location of Water Sources for Potable Water

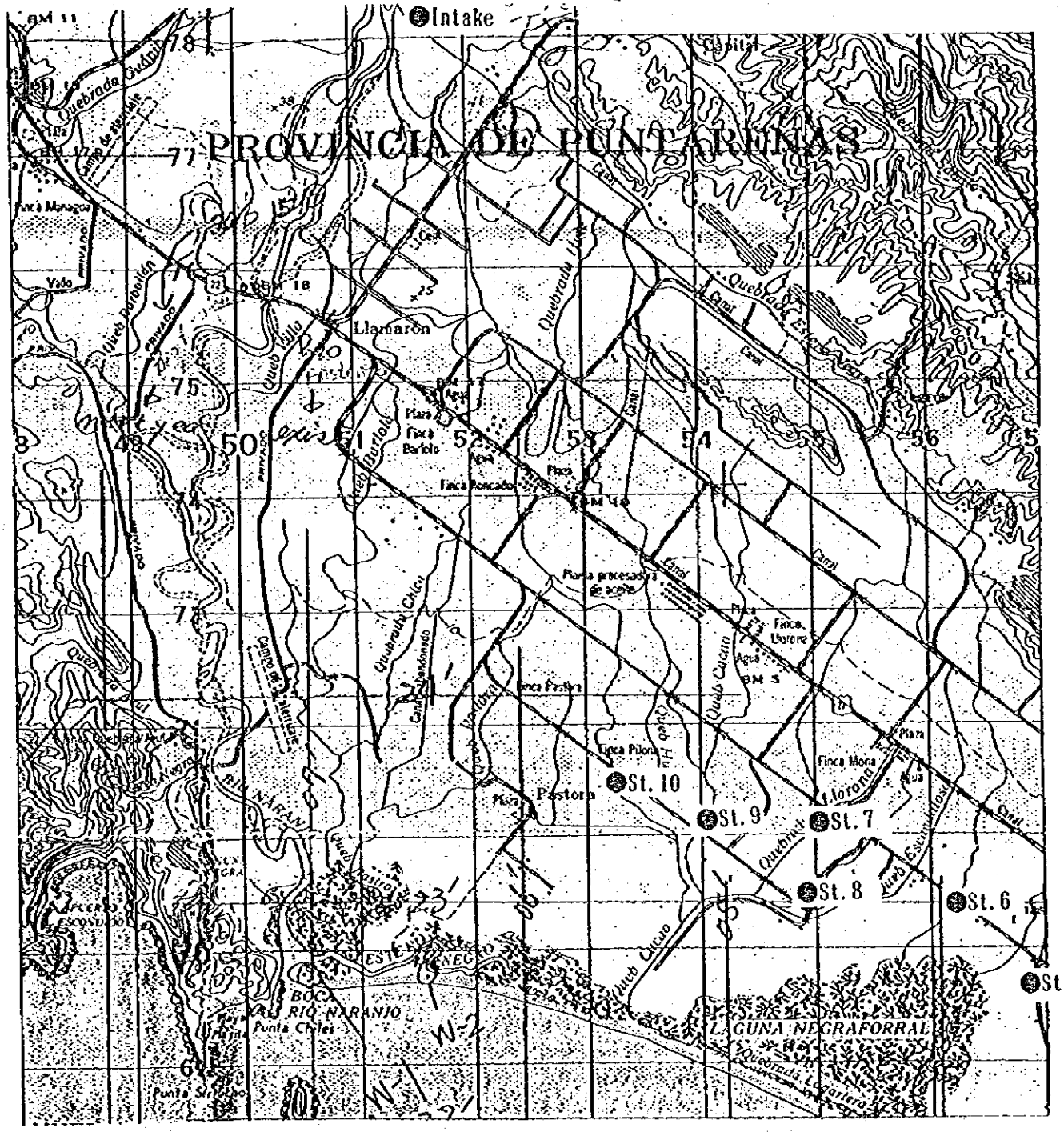


Fig. 13-26 Location of Channel Water Survey

Intake Point and St. 4 ~ St. 10

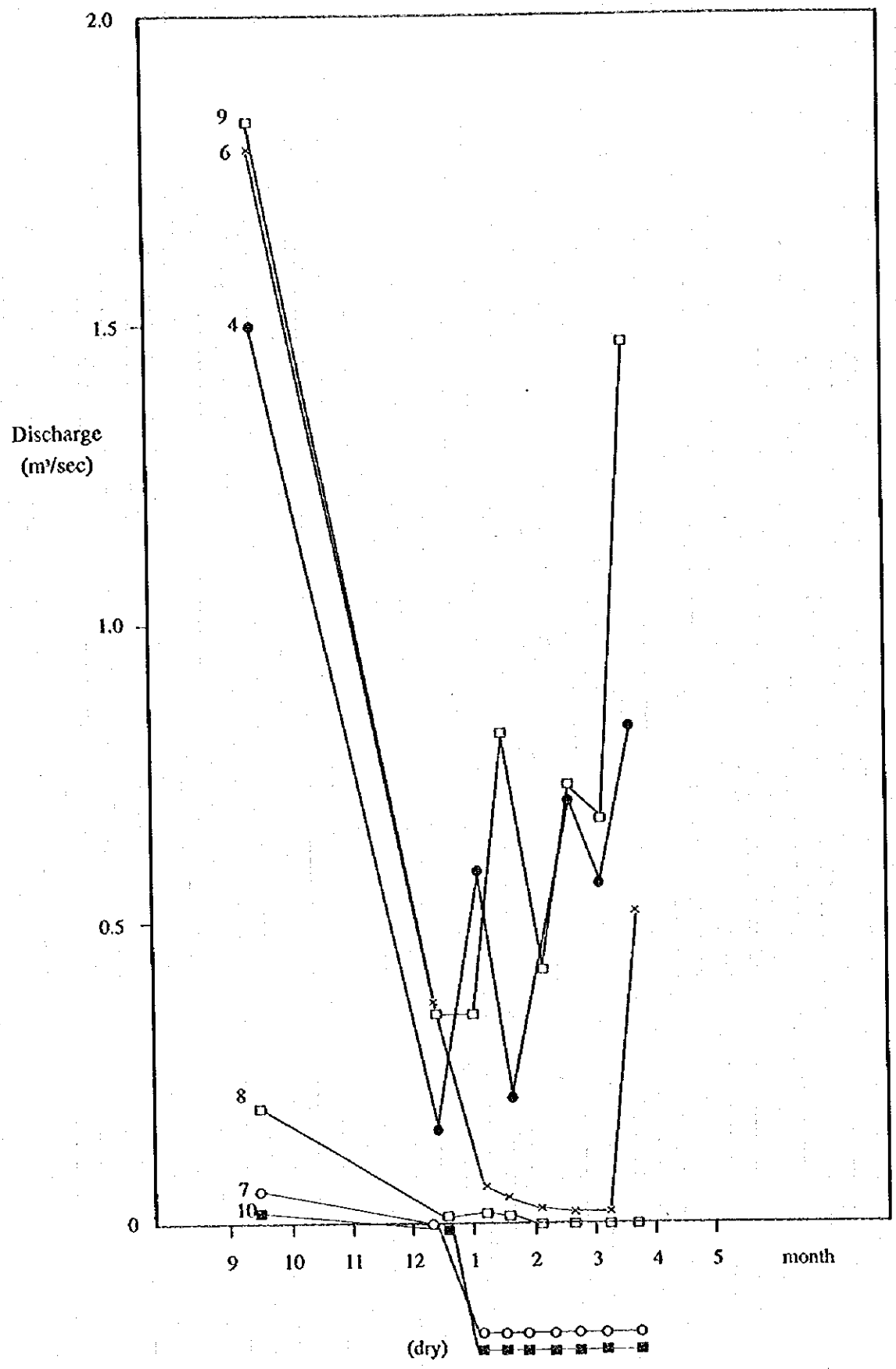


Fig. 13-27 Change of Water Discharge from Channels

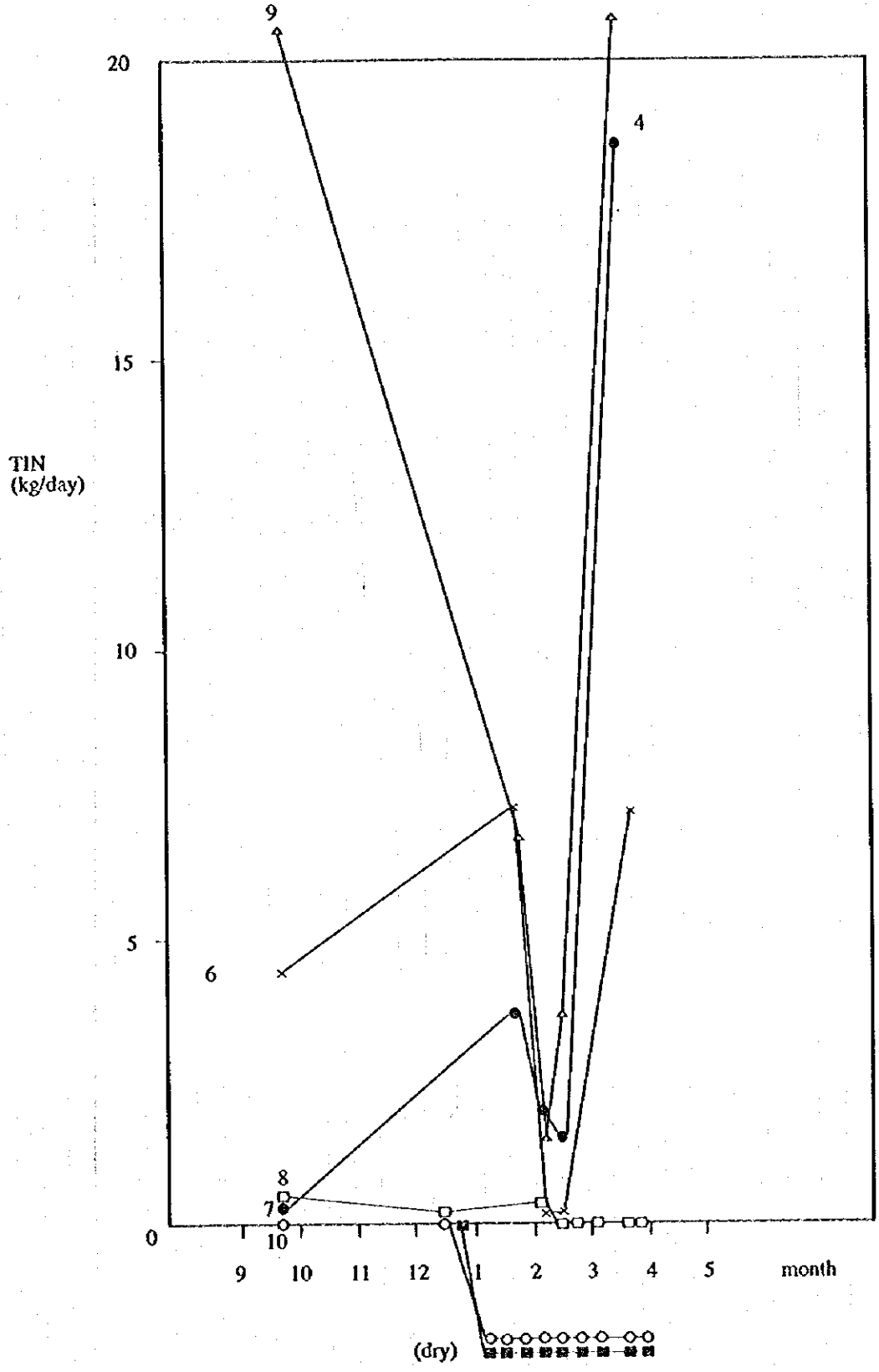


Fig. 13-28 Change of TIN Load from Channels

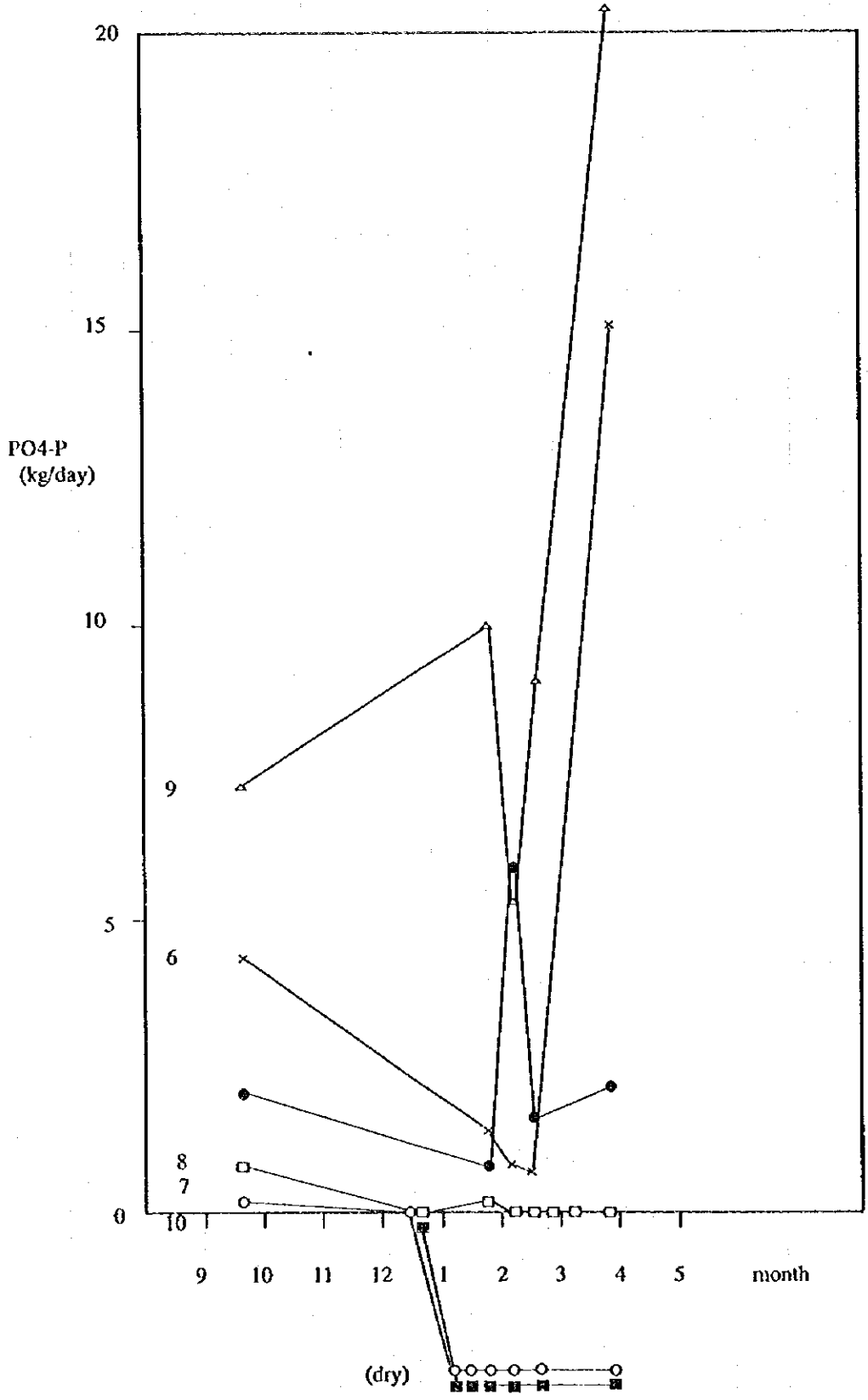


Fig. 13-29 Change of Phosphorous Load from Channels

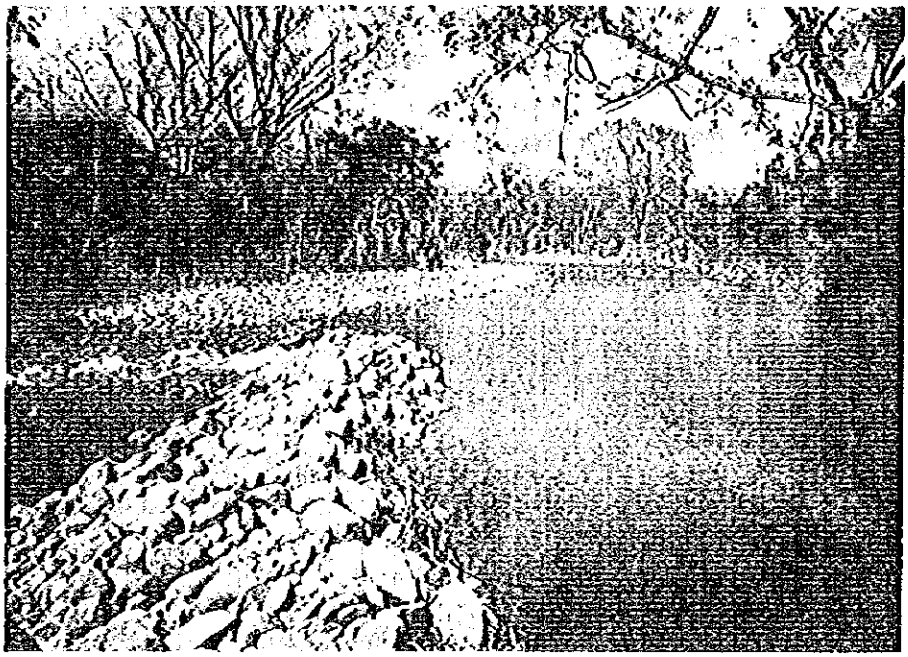


Fig. 13-30 Water Intaking to the Plantation at TOMA Point

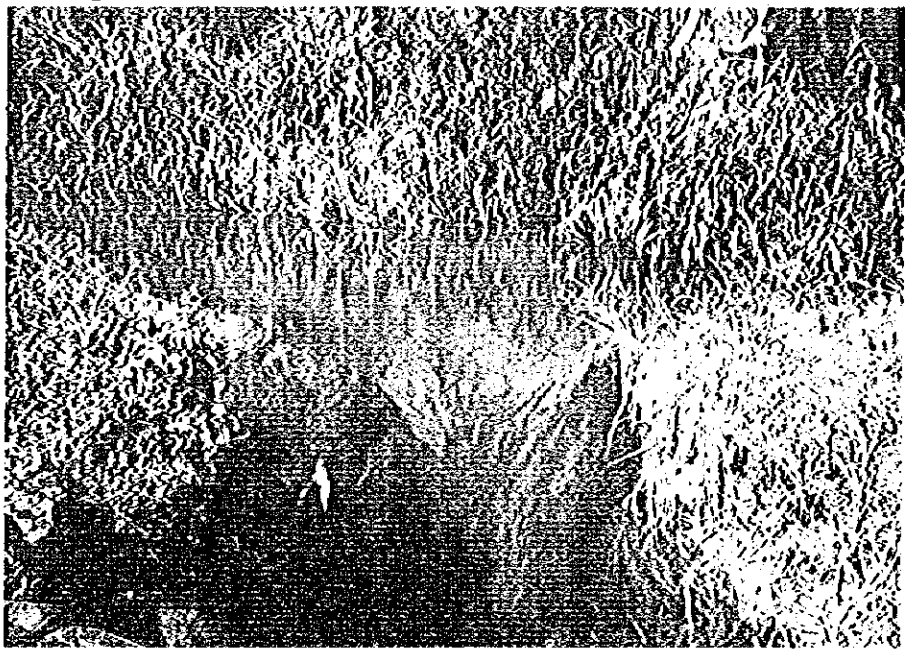


Fig. 13-31 Water Introducing to the Tributary of Channels

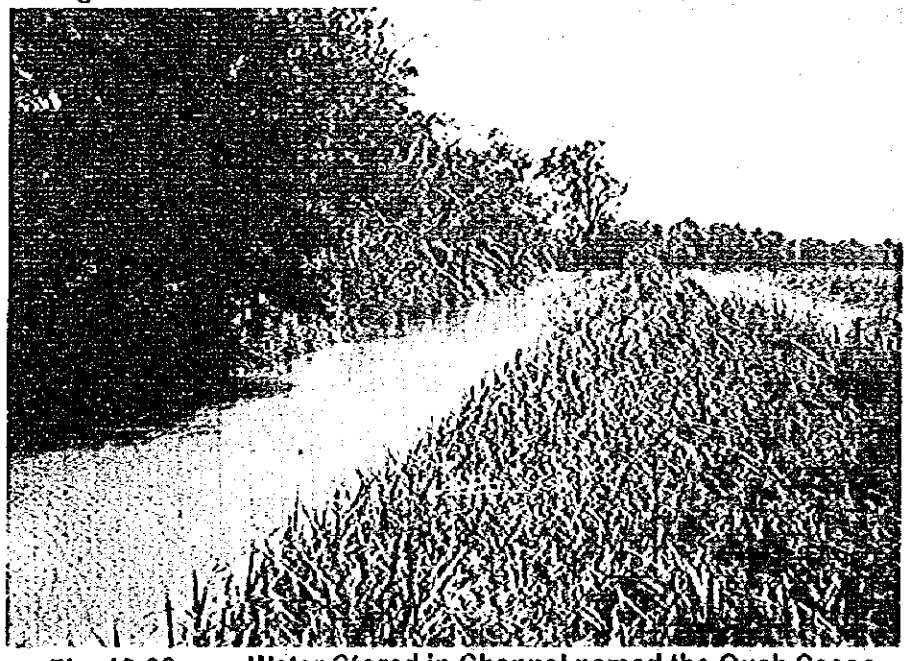


Fig. 13-32 Water Stored in Channel named the Queb Cacao

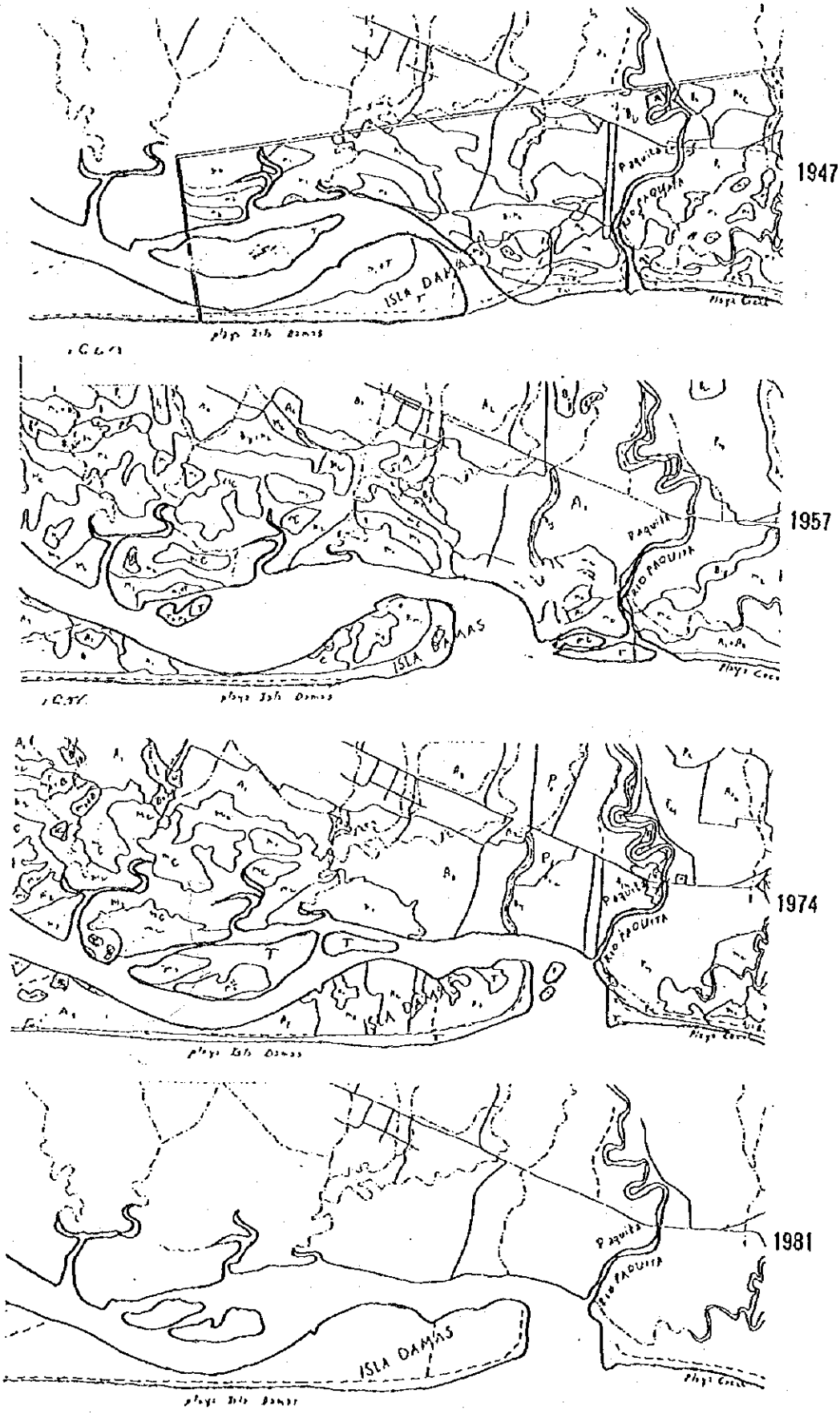
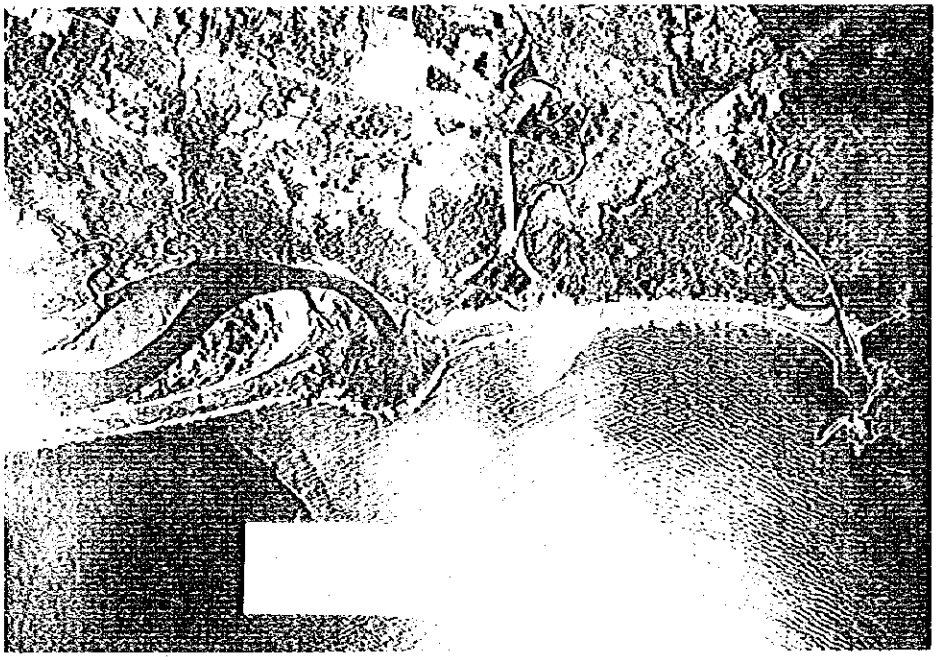


Fig. 13-33 History on Coastal Topographical Movement at Paquita River Mouth



(1953)

(1982)

Fig. 13-34 Aerophotogrphs of Paquita River Mouth from 1953 to 1982

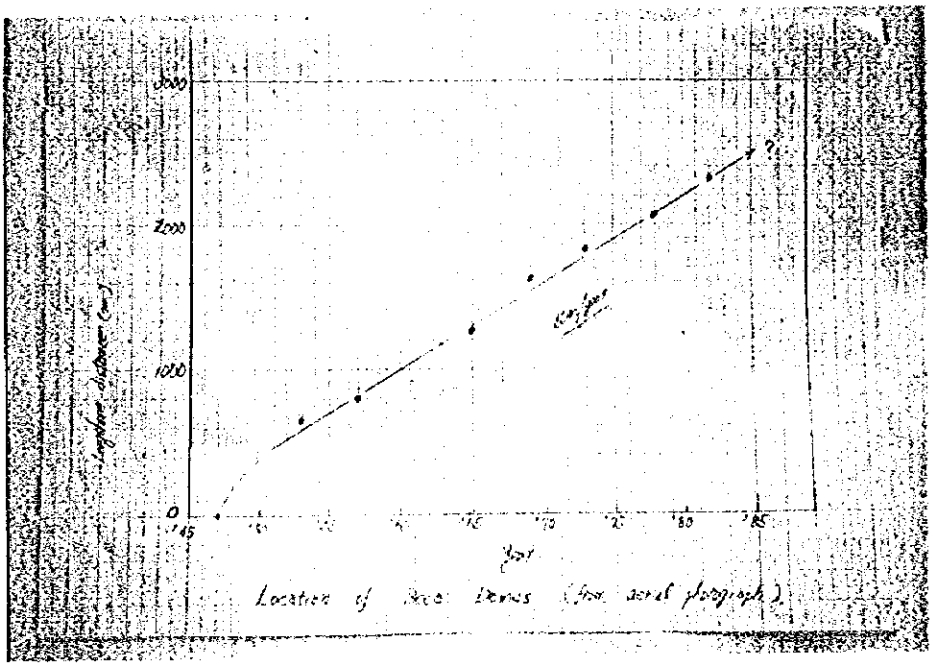


Fig. 13-35 Movement of Damas Sand Bank from 1947

Fig. 13-36 Current Situation of Playa Coast near Quepos City

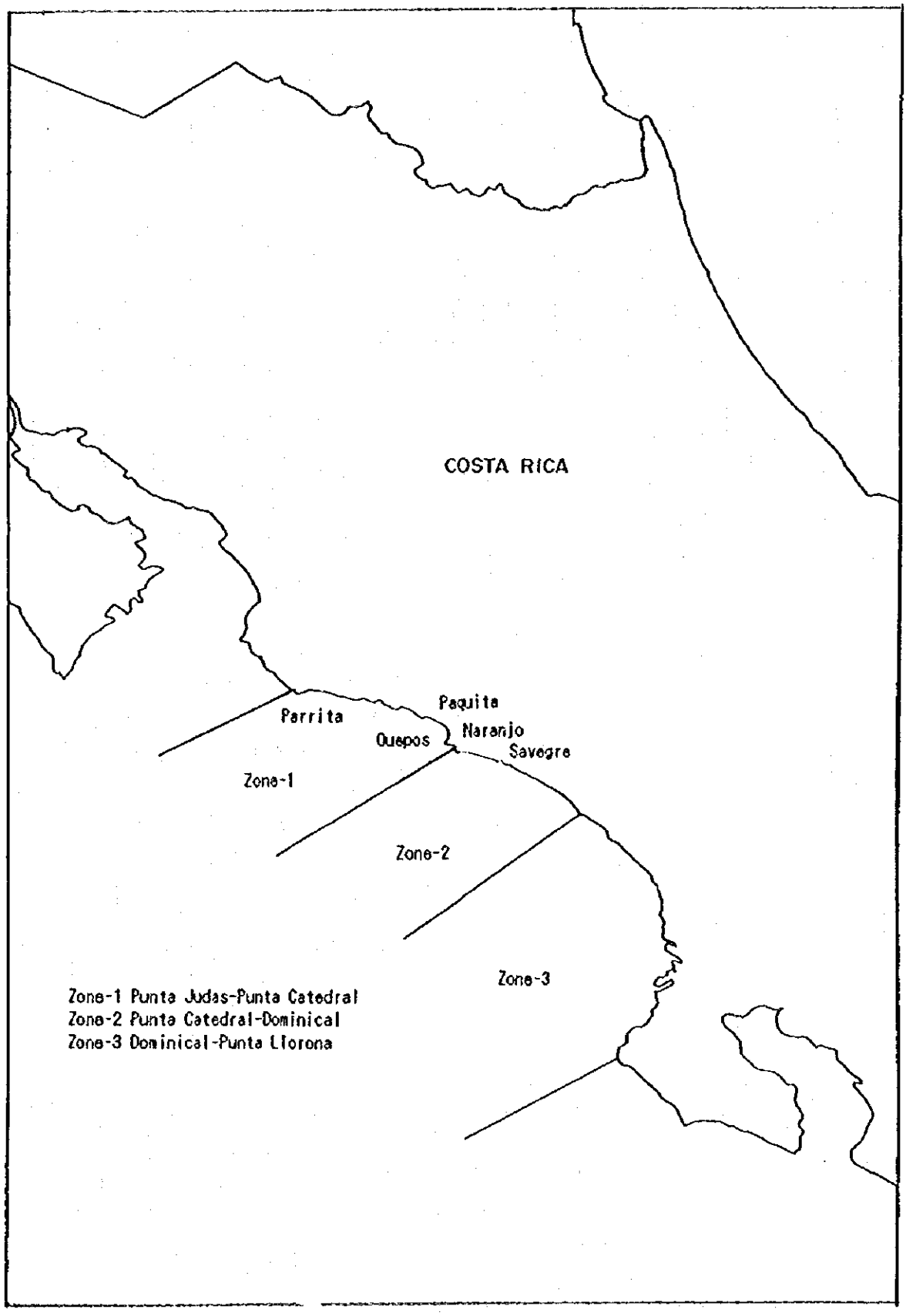


Fig. 13-37 Fishing Ground in Quepos Area

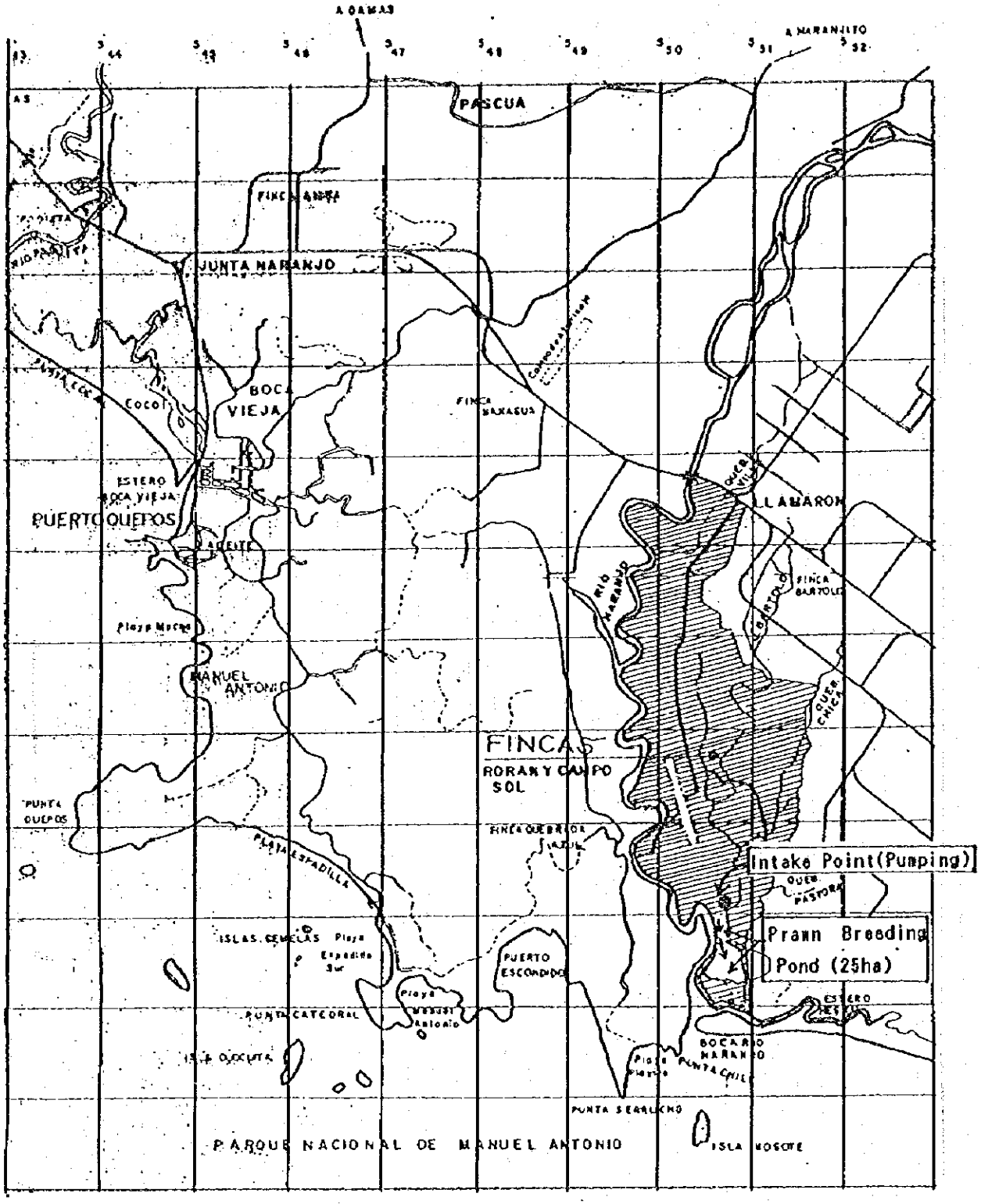
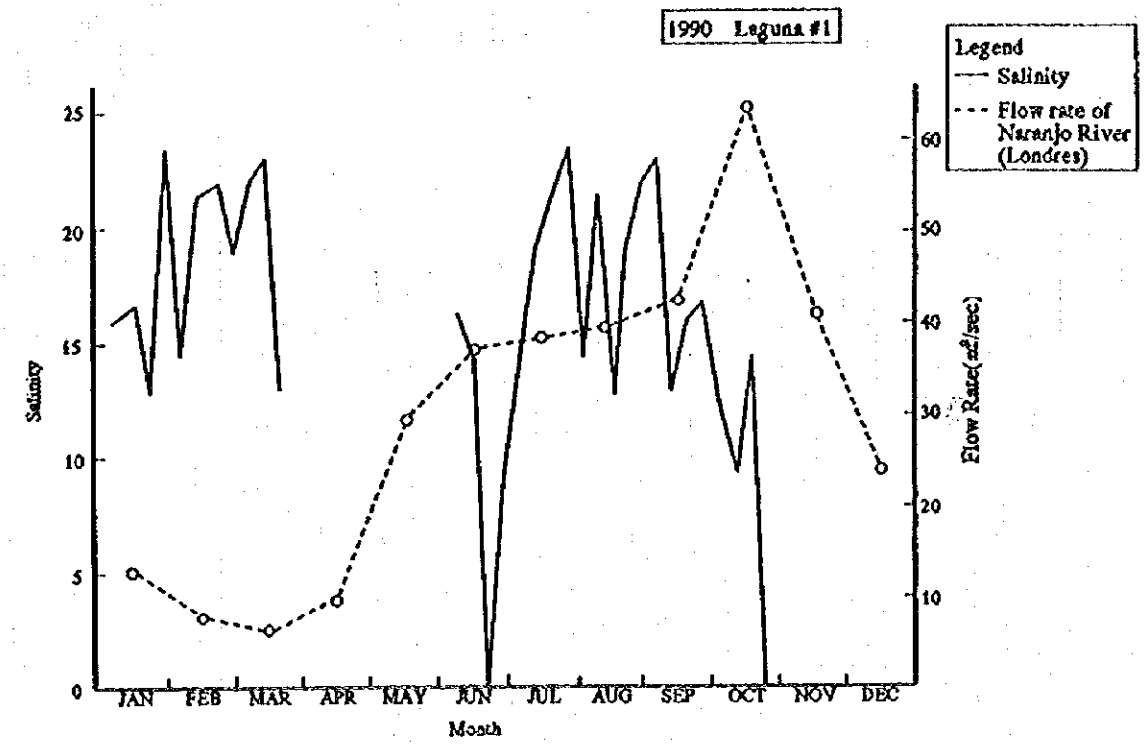


Fig. 13-38 Location of Prawn Breeding Pond near Naranjo River



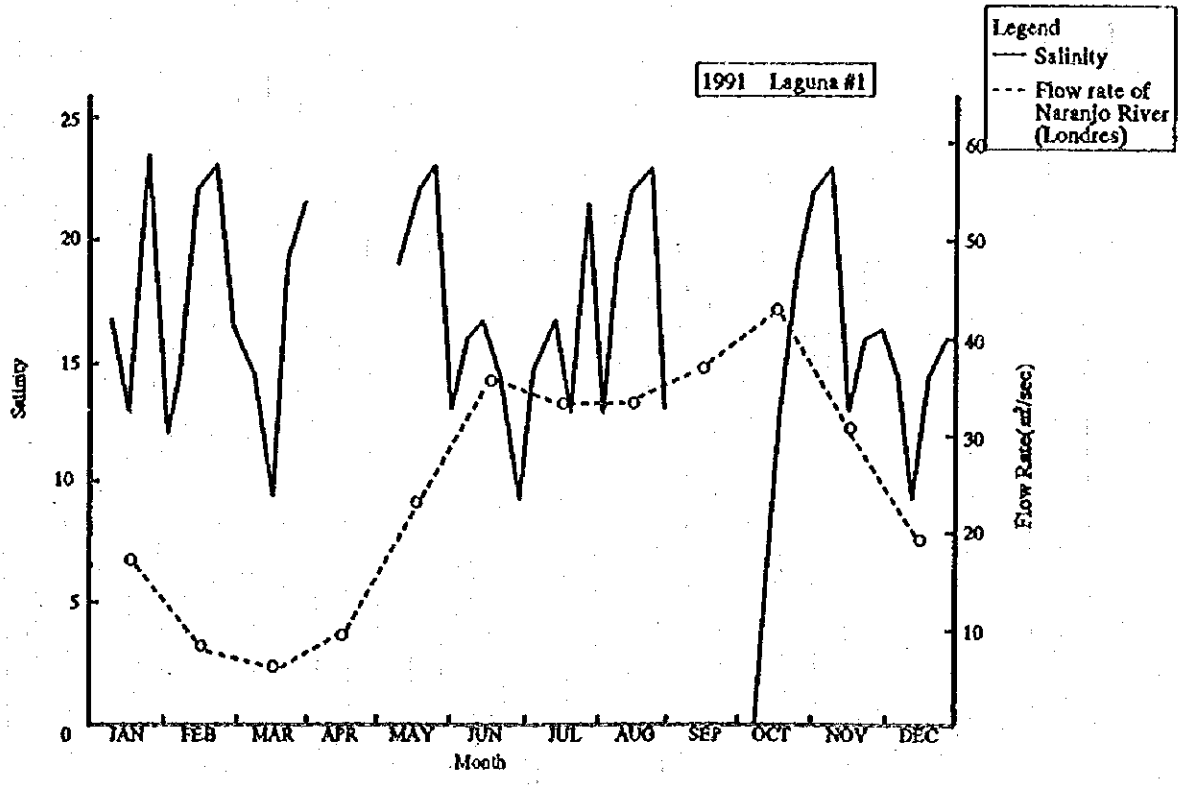


Fig. 13-39 (a) Seasonal Salinity Change Record at Shrimp Breeding Pond

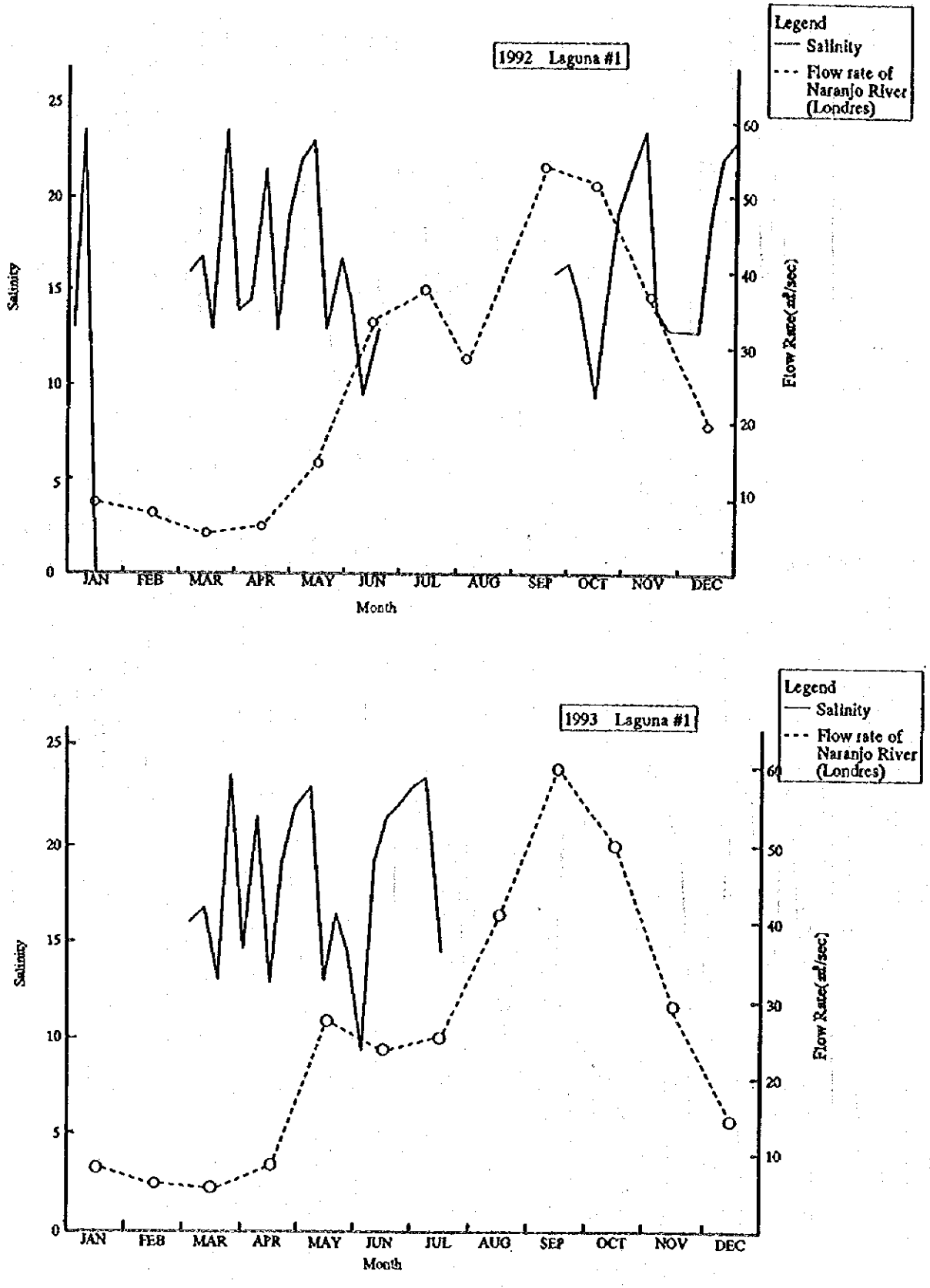


Fig. 13-39 (b) Seasonal Salinity Change Record at Shrimp Breeding Pond

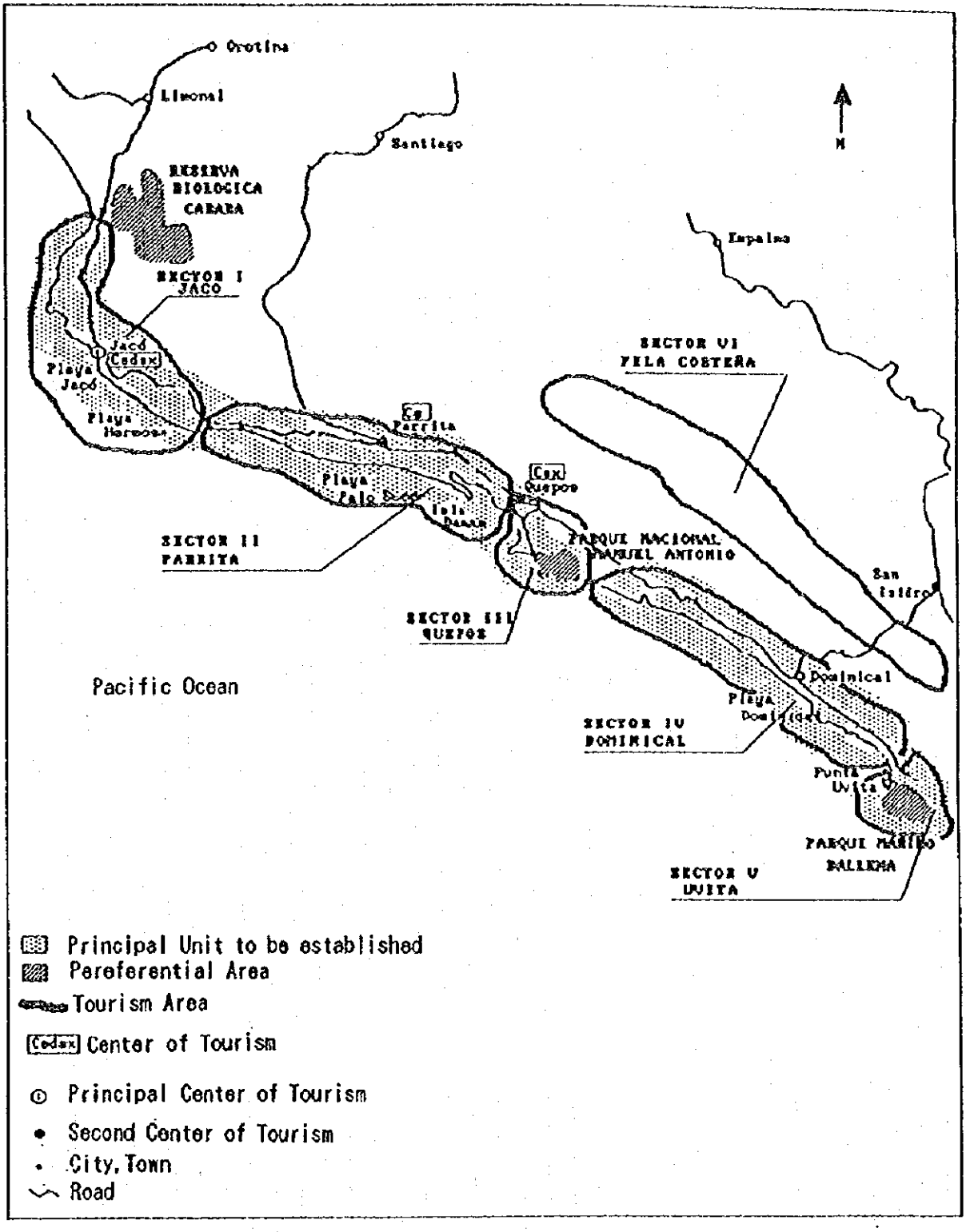
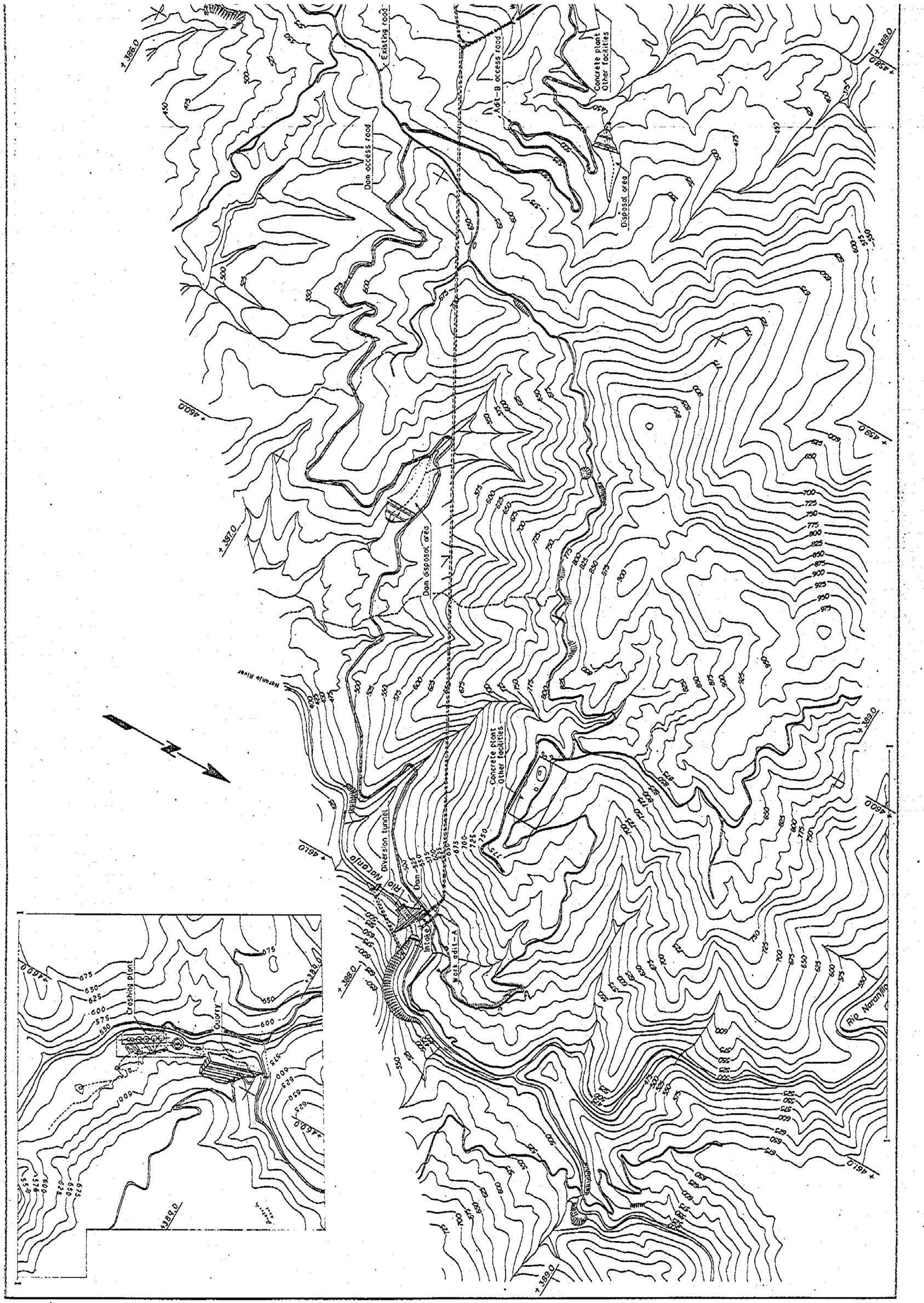
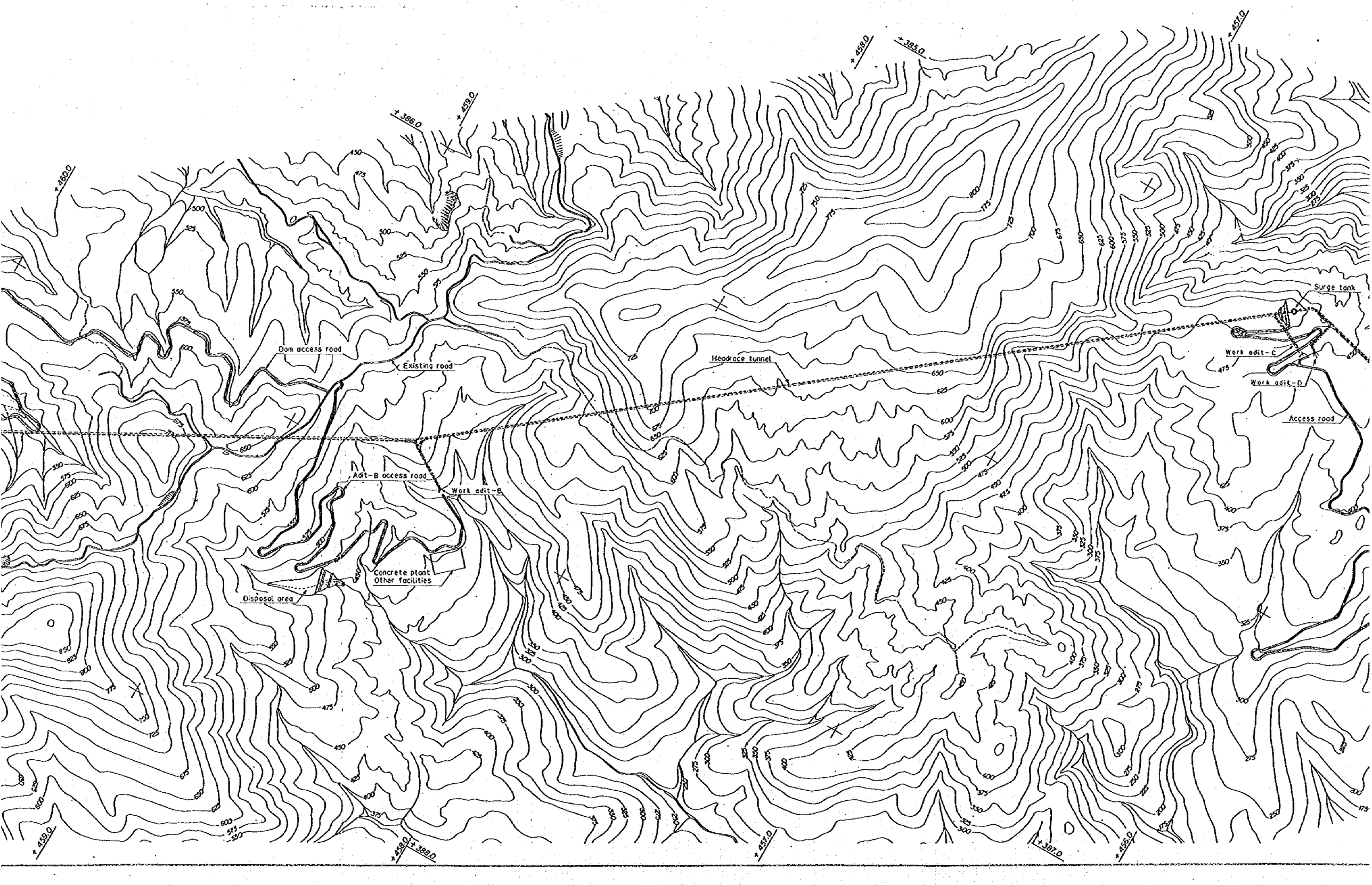
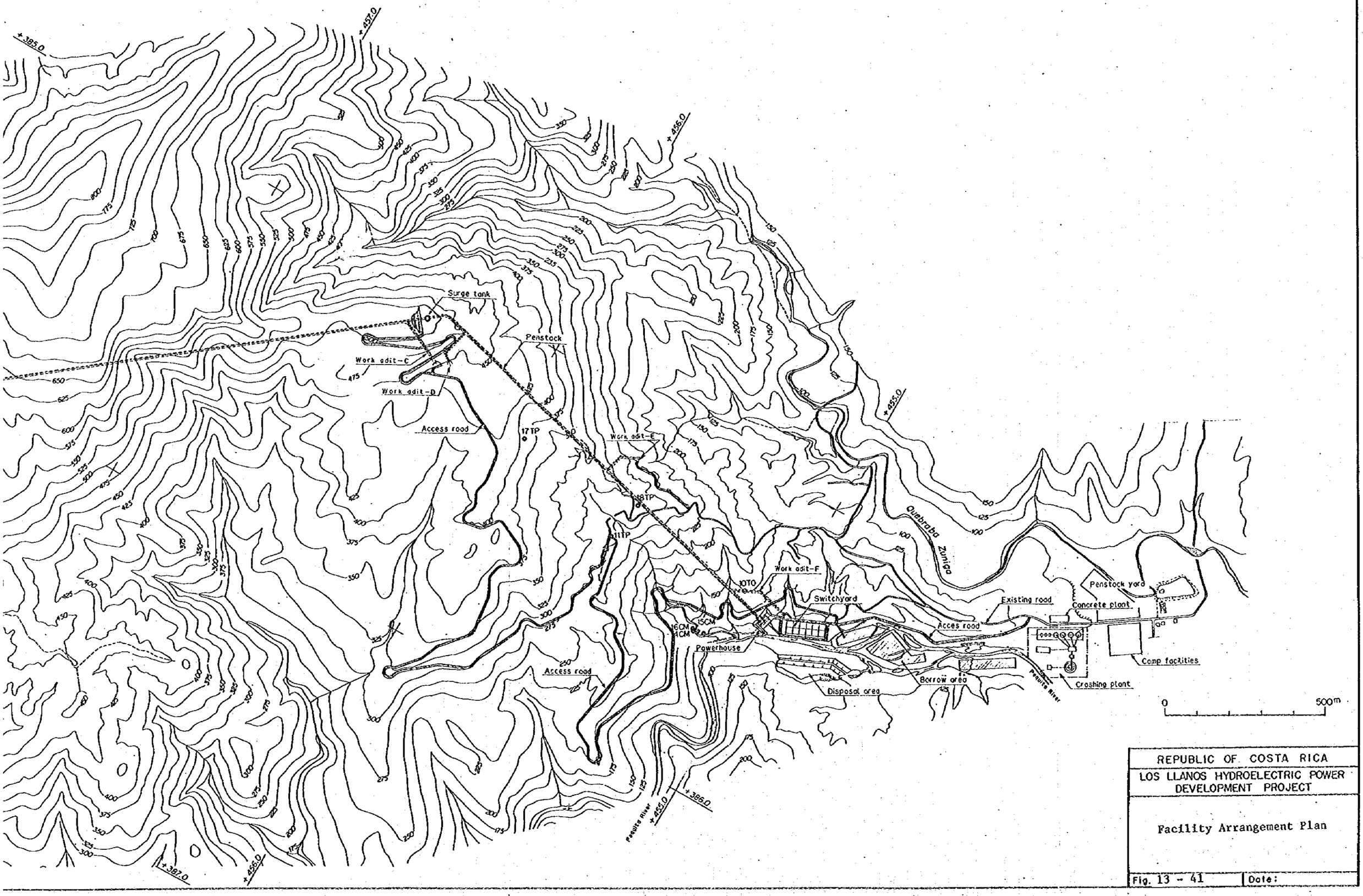


Fig. 13-40 Tourism Development Plan at Puntarenanse Area


Dam access road
Existing road
Adt-B access road
Concrete plant
Other facilities
Disposal area
Dam disposal area
Norquio River
Diversion tunnel
Rio Norquio
Dam
Intake
Work adit-A
Rio Naranjillo
Crushing plant
Quarry
+ 460.0
+ 389.0
+ 397.0
+ 455.0


Dam access road
Existing road
Headrace tunnel
Surge tank
Work adit-C
Work adit-D
Access road
Adit-B access road
Work adit-B
Concrete plant
Other facilities
Disposal area
+460.0
+459.0
+386.0
+459.0
+458.0
+385.0
+457.0
+459.0
+458.0
+388.0
+457.0
+387.0
+456.0



REPUBLIC OF COSTA RICA

LOS LLANOS HYDROELECTRIC POWER DEVELOPMENT PROJECT

Facility Arrangement Plan

Fig. 13 - 41 | Date:

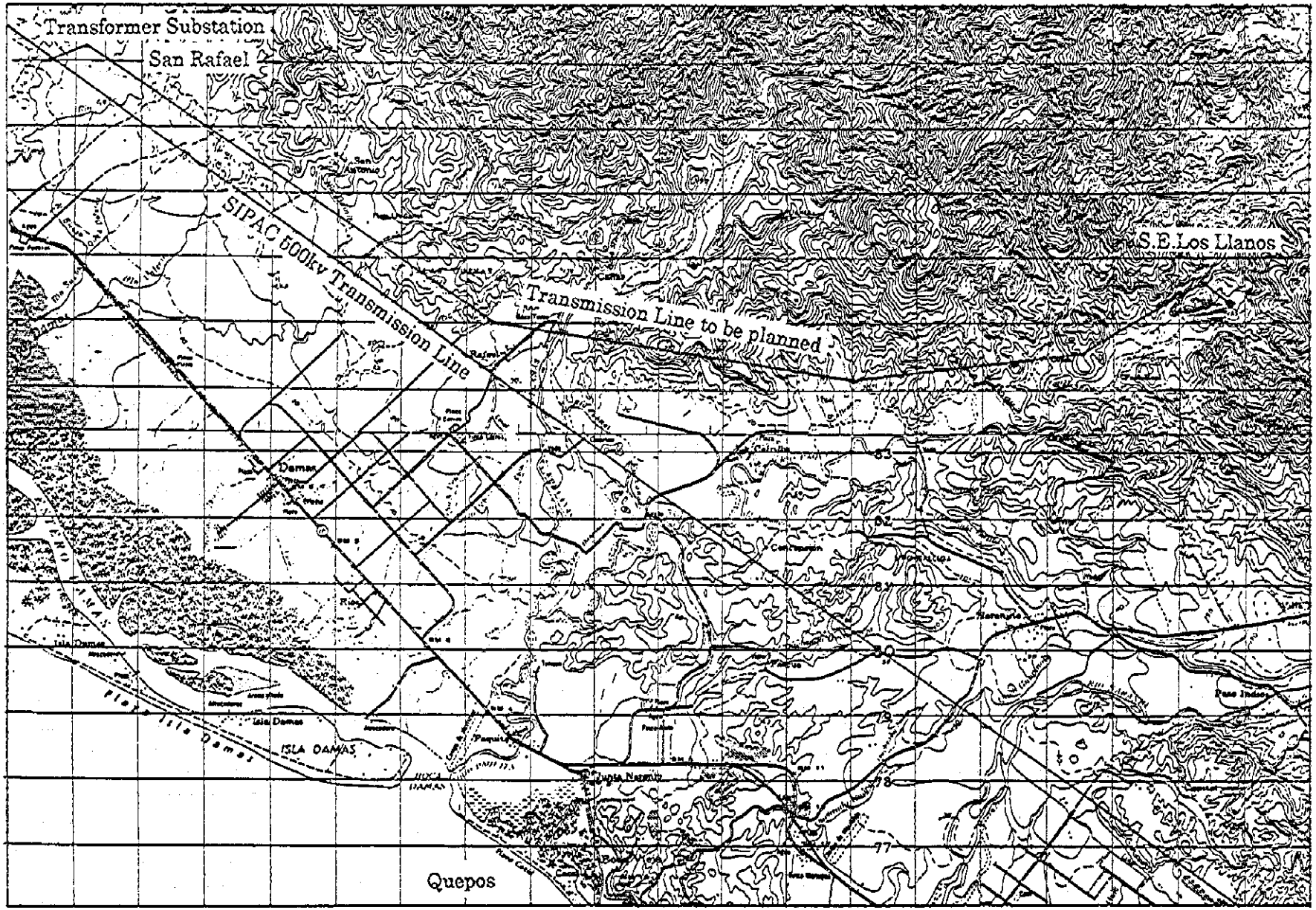
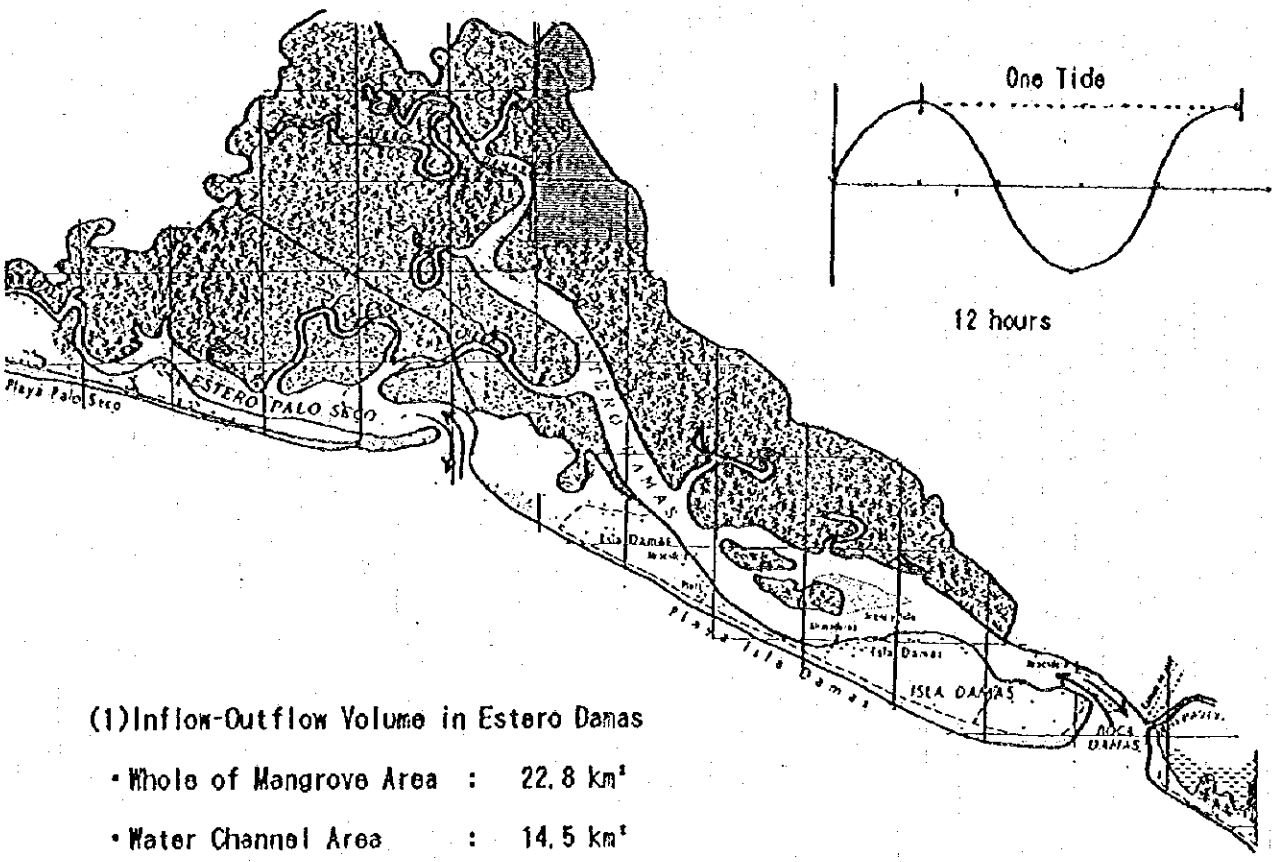


Fig. 13-42 Transmission Route



(1)Inflow-Outflow Volume in Estero Damas

- Whole of Mangrove Area : 22.8 km²
- Water Channel Area : 14.5 km²

Depth : 3 m ..... Volume : 43,500,000 m³

- Shallow Mangrove Area : 8.3 km²

Depth : 0.3m ..... Volume : 2,475,000 m³

T. volume : 46,000,000 m³

One Tide : 12 hours

.....

Approximate : 3,800,000 m³/ h

: 1060 m³/sec

(2)Volume of Water to be increased by Project

- Maximum Monthly Mean : Without Project : 45 m³/sec

With Project 69 m³/sec

Volume to be increased 24 m³/sec

(3)Ratio(%) to be affected to Damas Mouth by Project

(2)/(1) ×100= 2 %

Fig. 13-43 Influential Ratio of water to be increased by project to the erosion in the mouth of BOCA DAMAS

Fig. 13-44 Diffusion Area of Paquita River Water to Sea

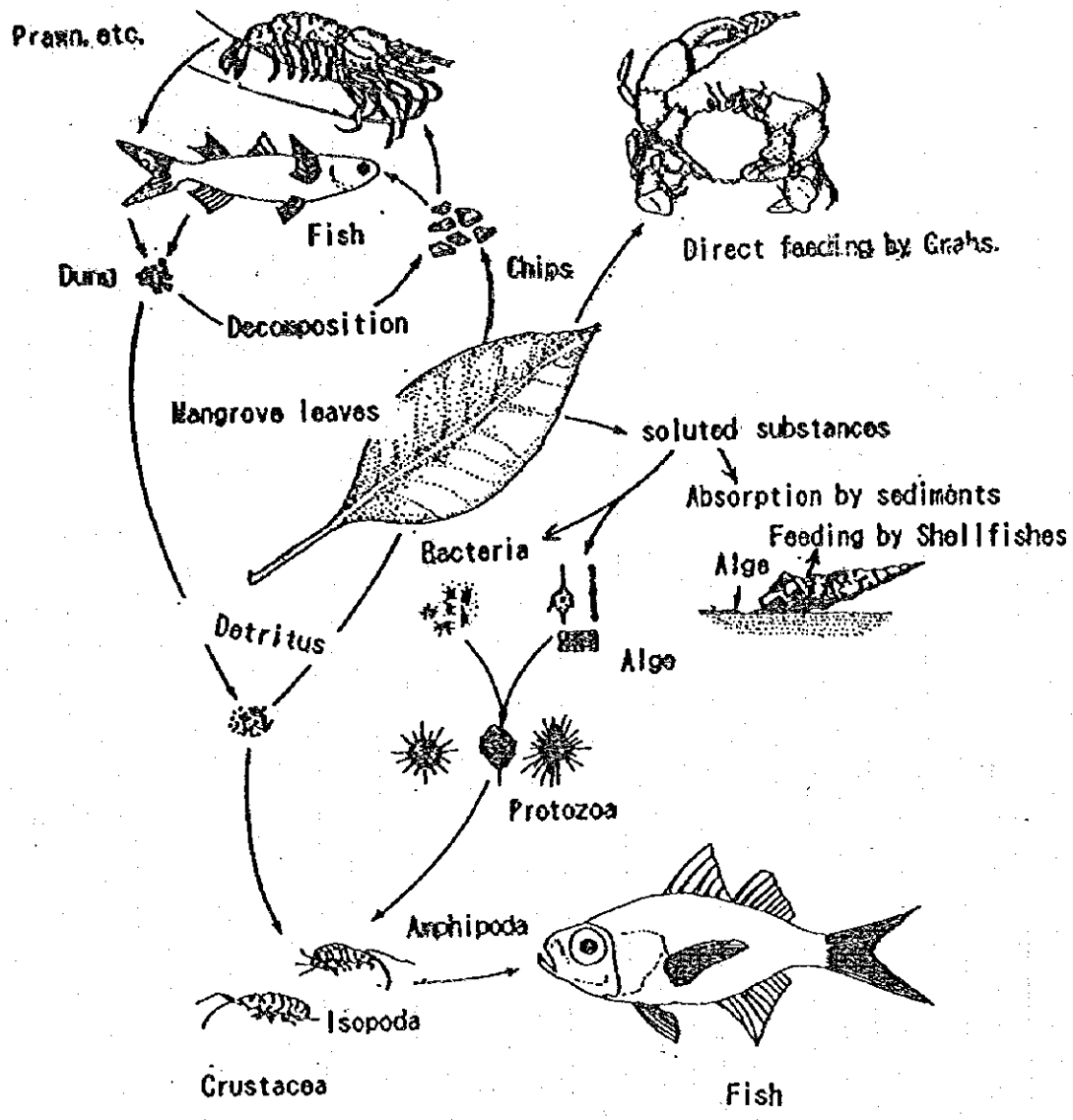
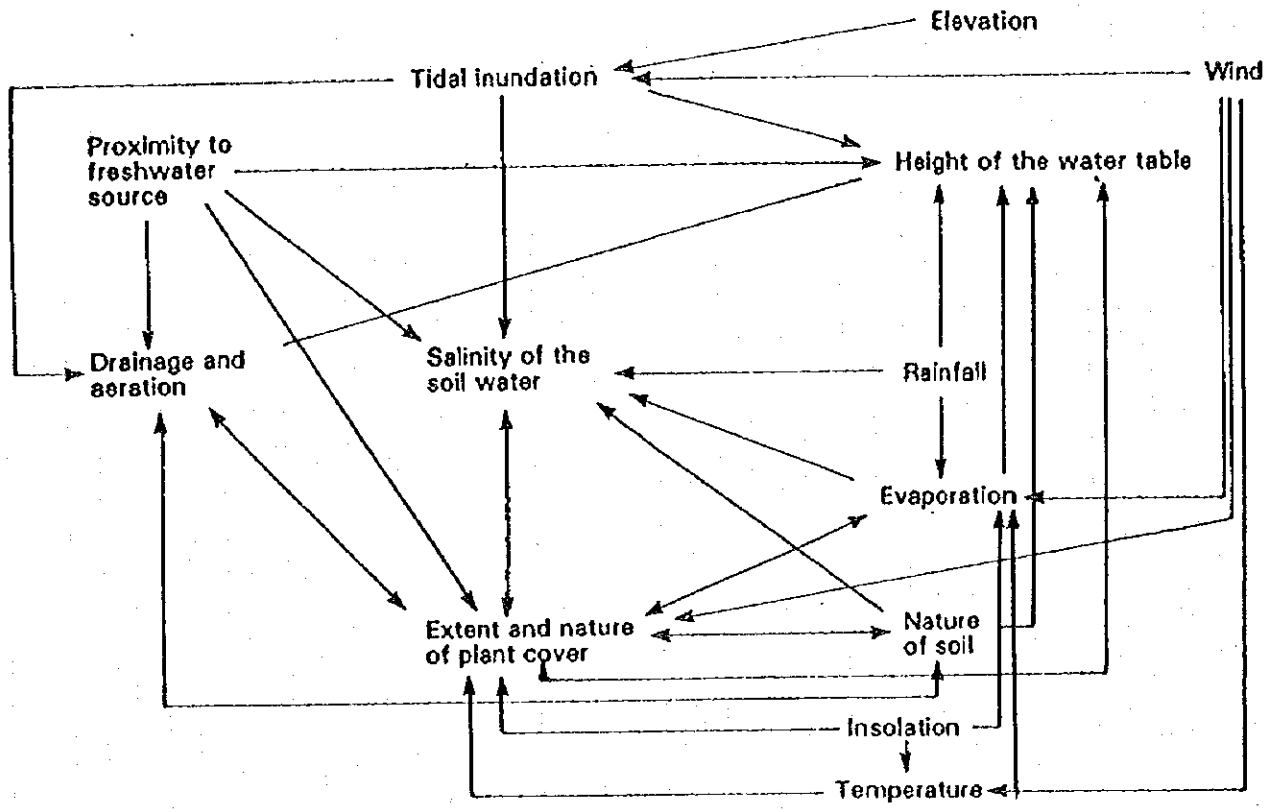


Fig. 13-45 Supply of Organic Matter form Mangrove Leaves and Food Chains



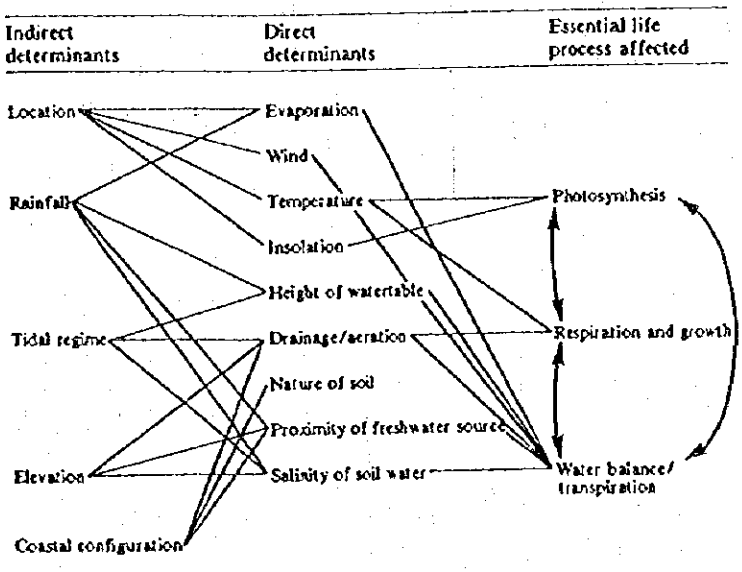


Fig. 13-46 **Interrelationships between major Physico-Chemical Factors and the Extent and Nature of the Mangrove Plant Cover**

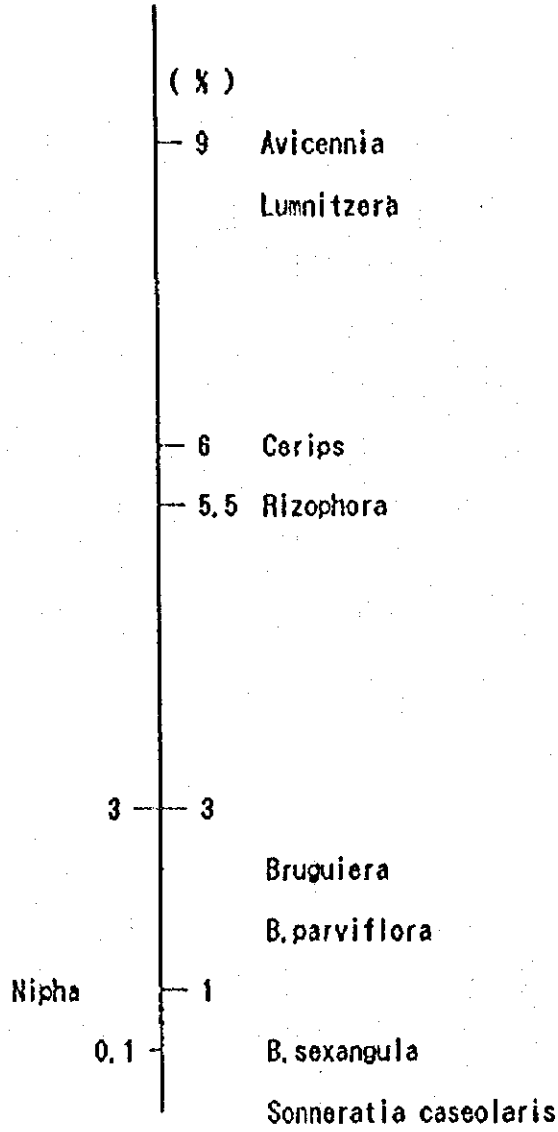
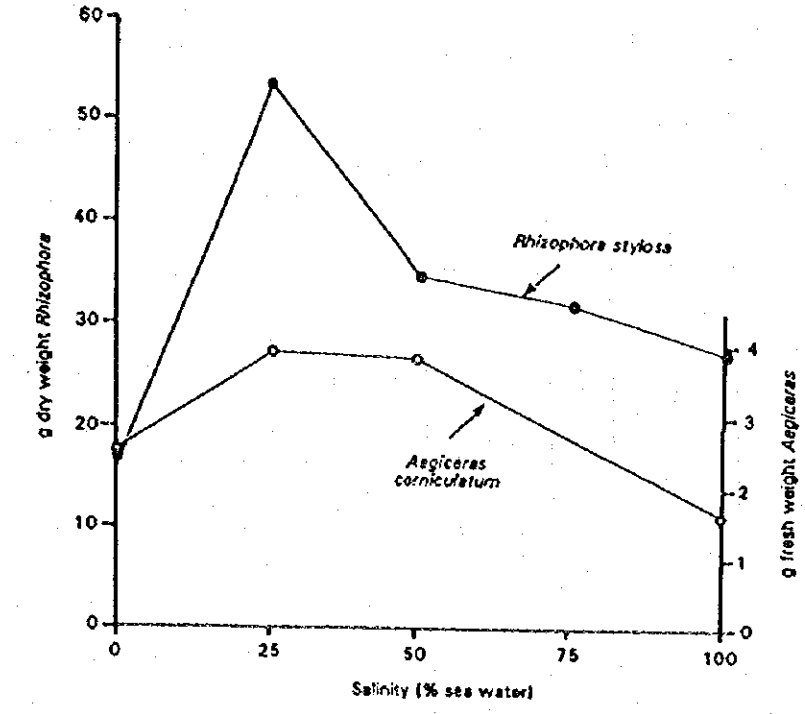


Fig. 13-47 Scale on Salinity Tolerance



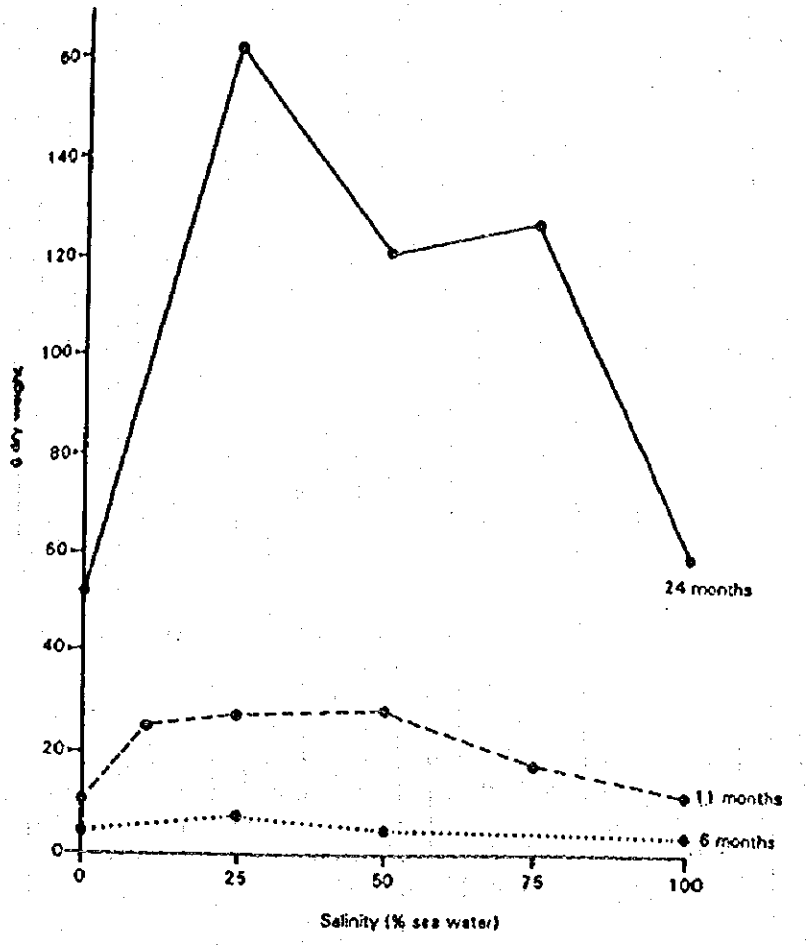


Figure 20 Growth (measured as grams of dry weight per plant) of *Avicennia marina* at various seawater concentrations over varying periods (24 months – B. Clough; 11 months – Downton 1982; 6 months – C.D. Field).

Fig. 13-48 Growth of Avicennia Marina at various Sea Water Concentration

13-51

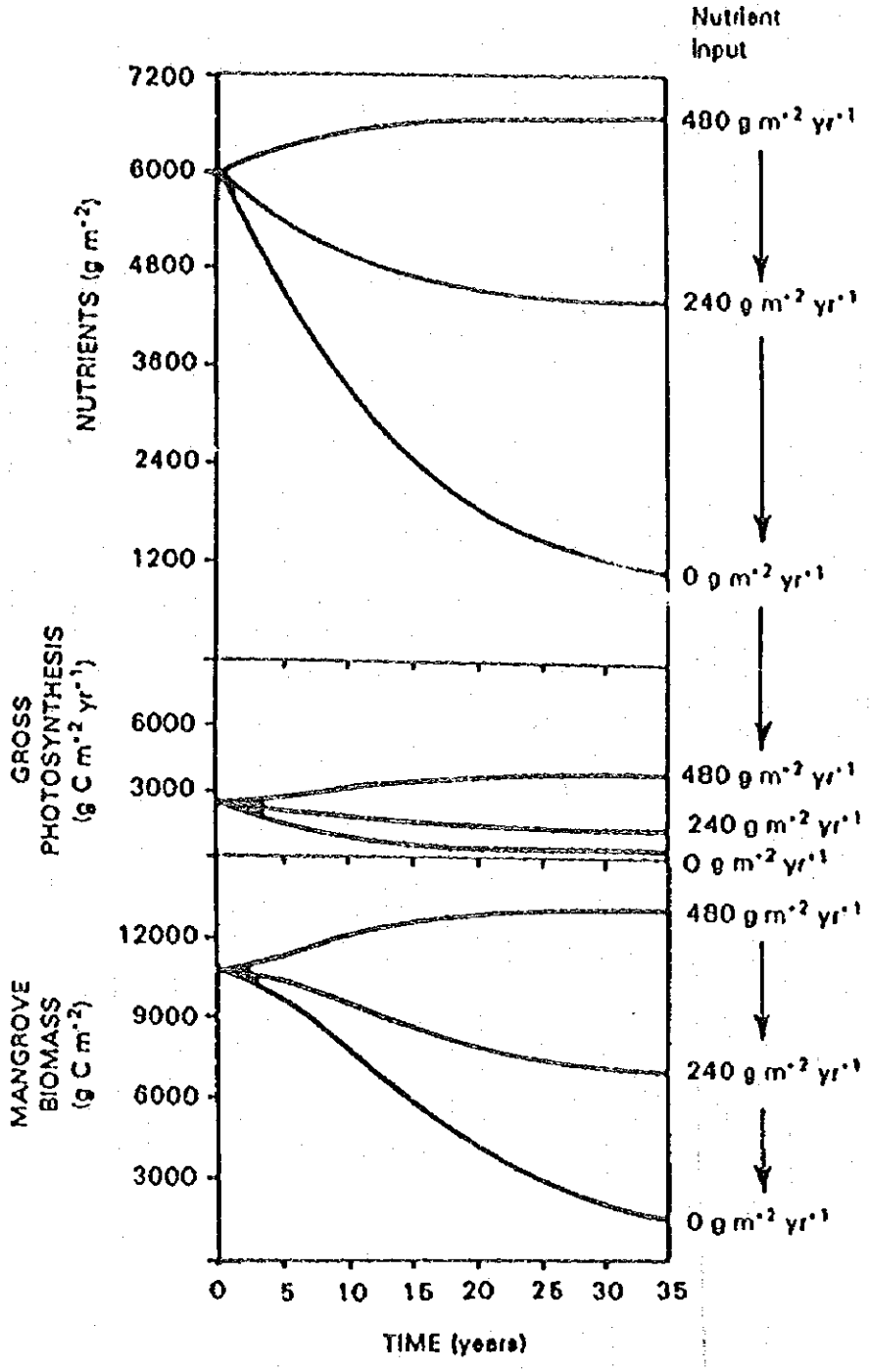


Figure 24 Results of model simulation of Florida mangrove ecosystem. Rates of gross photosynthesis and level of nutrients in system with initial conditions of high nutrient level, mean rates of metabolism and three rates of nutrient input. The response in the mangrove biomass of the system is shown for the same conditions (after Lugo, Sell and Snedaker 1976).

Fig. 13-49 Results on Model Simulation of Florida Mangrove Ecosystems

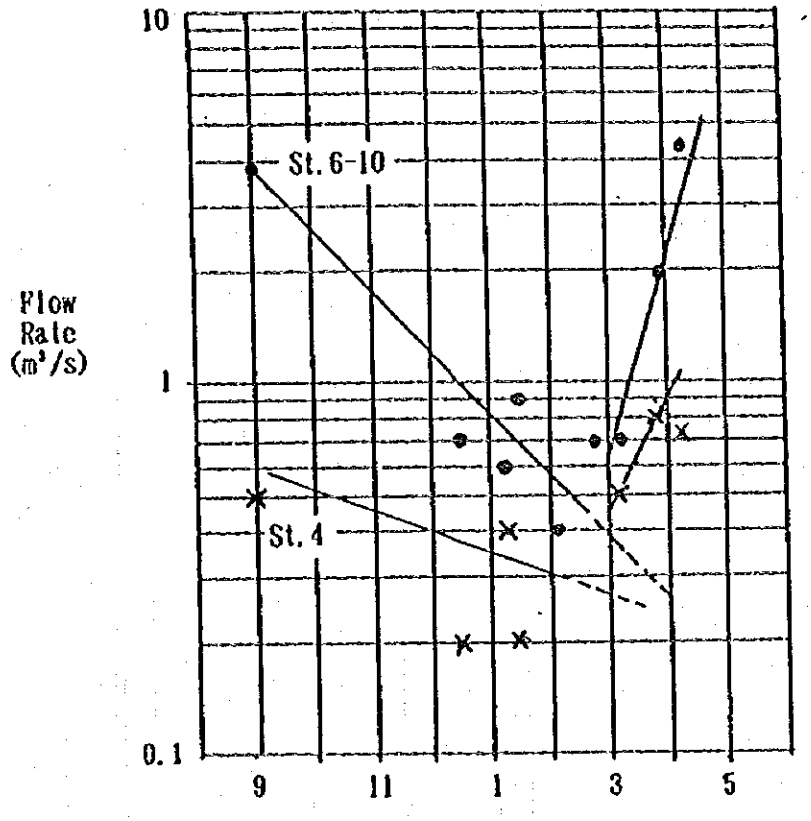


Fig. 13-50 Water Flow changes at St.4 and from Channels in plantation

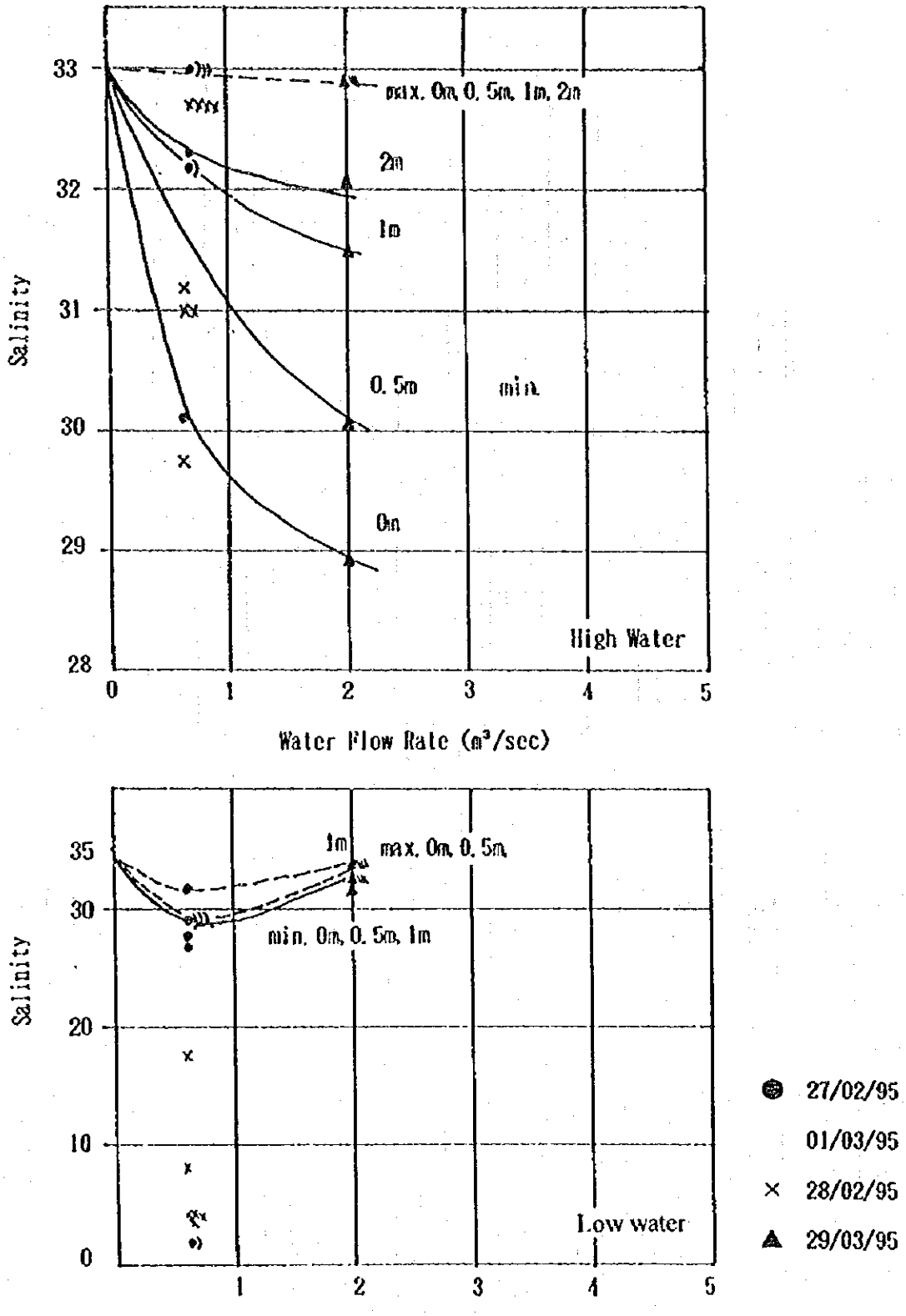


Fig. 13-51 Relationships between Salinity in Estero Negro and Water Flow Rate from Channel

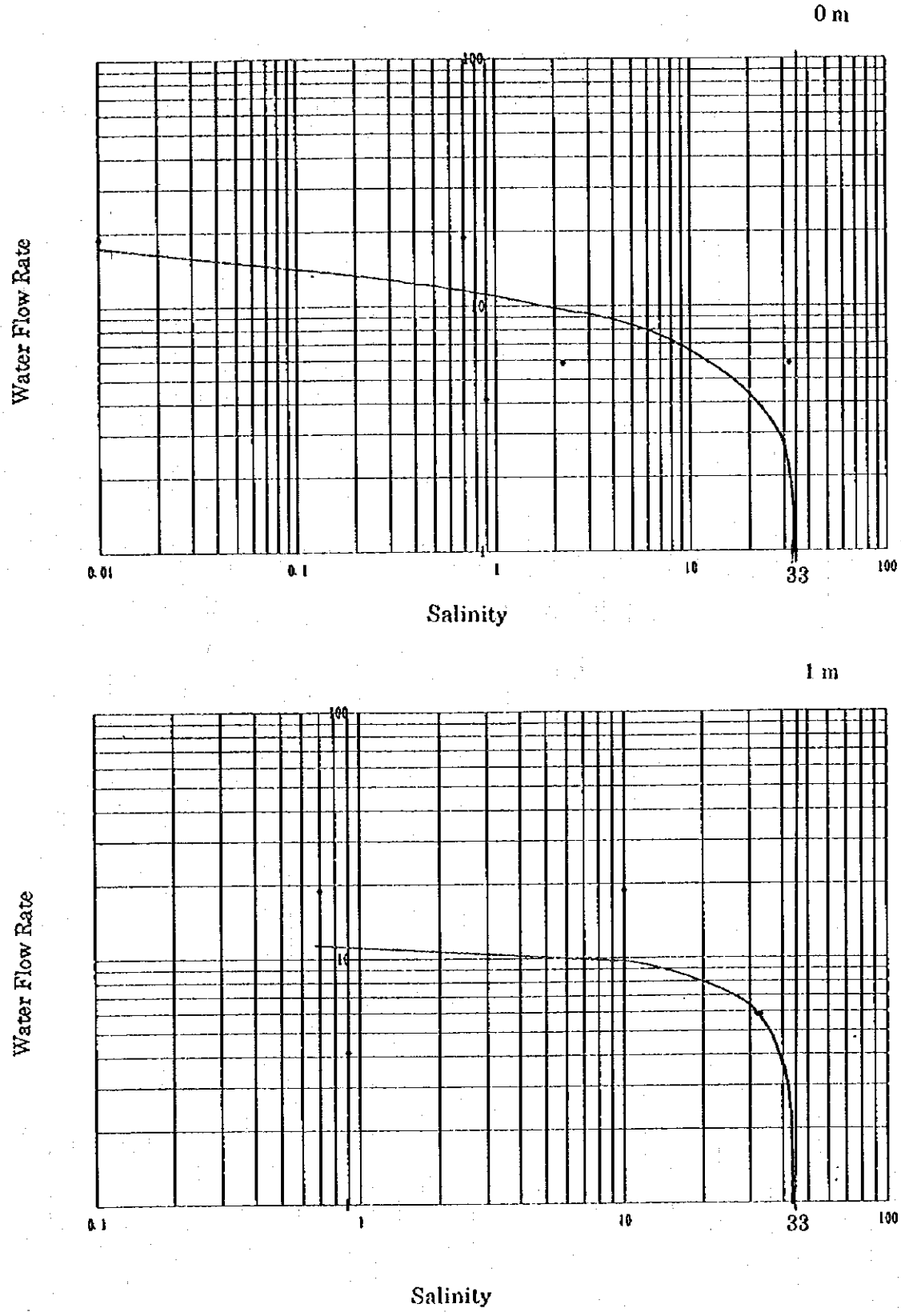
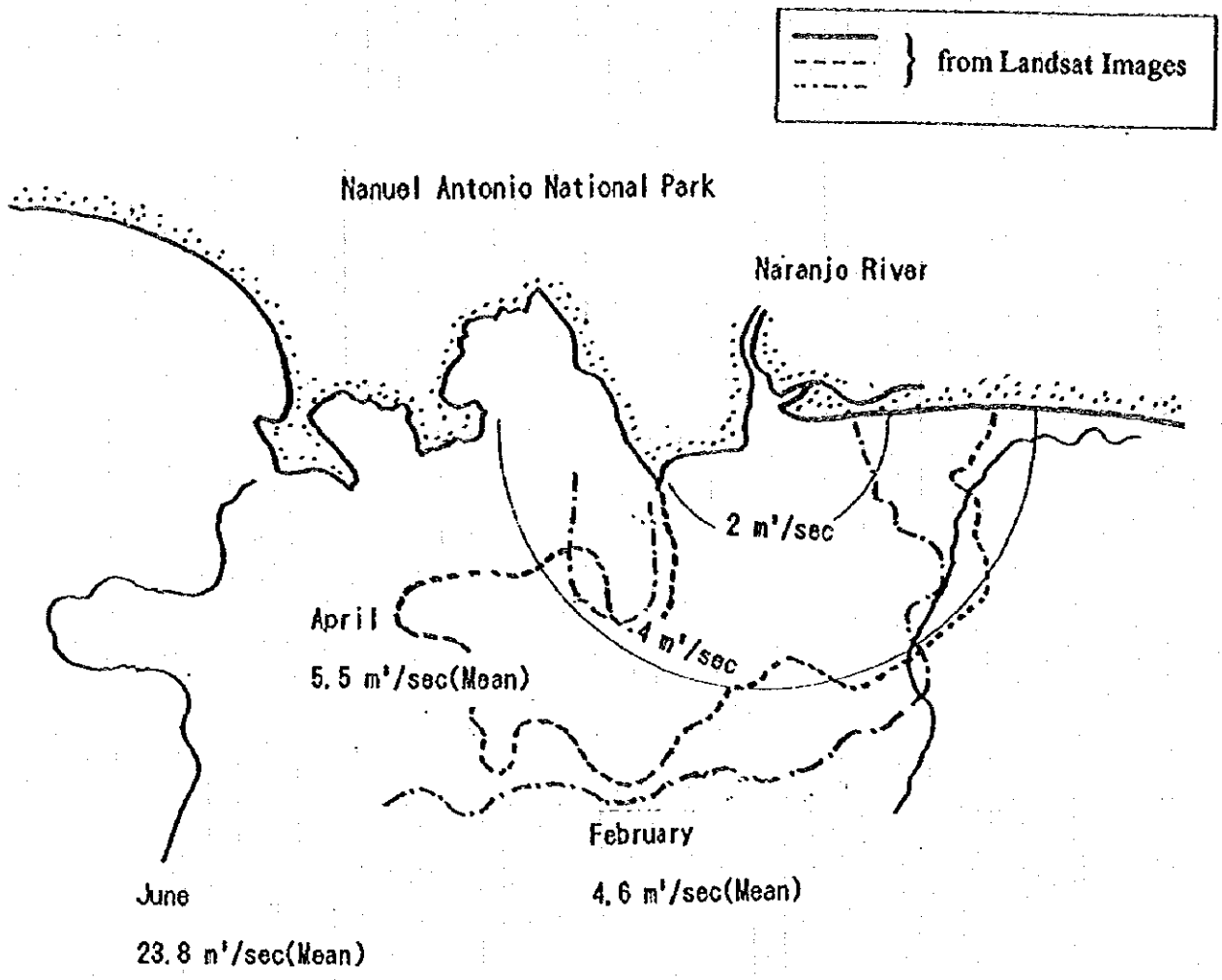


Fig. 13-52 **Relationships between Salinity in Naranjo River Mouth and Water Flow rate at Londres Point**



1 m³/sec(86400 m³/day) r = 935 m

2 m³/sec(172800 m³/day) r = 1430 m

4 m³/sec(350000 m³/day) r = 2190 m

Fig. 13-53 Diffusion of River Water from Naranjo River

Table 13-1 Monthly Records of Precipitation (from ICE)

mm

Month	Baltolo	llorona	Naranjillo
1	70.3	72.2	124.3
2	30.6	38.8	119.4
3	71.0	71.3	131.2
4	157.2	161.4	387.6
5	423.9	426.2	827.8
6	412.2	399.7	803.0
7	451.4	442.3	738.9
8	523.3	528.7	880.3
9	553.3	599.1	909.8
10	641.6	647.2	1026.7
11	398.8	387.9	515.5
12	149.7	145.4	204.5
Annual	3876.3	3916.7	6634.7

* Bartolo,Llorona : 1970-1989
Naranjillo : 1981-1991
** ICE (1993)

Table 13-2 Detailed Data of Precipitation

(Baltolo) (mm)

Year	1	2	3	4	5	6	7	8	9	10	11	12	Annual
1941	5.1	77.5	20.3	170.7	266.4	116.1	489.0	451.4	589.0	319.0	345.4	187.7	3,037.6
1942	0.0	11.7	190.5	217.9	593.6	646.4	217.9	369.1	435.1	1,093.7	607.6	58.9	4,442.4
1943	91.7	0.0	0.0	102.9	374.7	369.6	271.8	423.4	283.2	793.8	387.4	92.7	3,191.2
1944	31.8	0.0	30.2	278.9	318.5	504.7	415.8	509.3	561.8	619.0	191.3	109.5	3,570.8
1945	160.8	0.0	3.8	264.7	442.0	359.2	393.2	375.7	252.2	678.4	314.5	153.9	3,398.4
1946	98.6	0.0	0.0	35.1	374.9	131.3	156.7	162.3	412.8	619.3	350.8	216.2	2,558.0
1947	19.6	0.0	ND	ND	ND	449.3	832.9	315.2	364.7	826.5	384.3	273.6	3,466.1
1948	60.2	ND	28.7	ND	ND	323.6	332.7	355.6	604.5	506.5	403.4	111.8	2,727.0
1949	45.7	4.6	19.6	170.4	495.6	485.6	732.3	614.4	373.4	816.6	242.6	304.8	4,305.6
1950	62.2	6.4	65.5	101.6	285.8	564.1	425.5	468.6	398.5	564.4	423.7	172.2	3,538.5
1951	84.3	30.7	3.0	84.6	267.2	300.7	585.2	317.5	332.5	381.0	254.3	88.1	2,729.1
1952	10.9	6.4	30.0	117.9	548.4	566.2	368.8	571.5	369.8	573.5	342.1	132.6	3,638.1
1953	130.8	11.4	0.0	221.5	549.9	350.5	271.8	273.1	464.8	449.6	442.0	214.6	3,380.0
1954	5.1	40.6	36.6	135.9	571.8	525.8	378.5	397.5	464.8	936.2	303.5	98.6	3,894.9
1955	53.3	2.5	0.0	78.7	440.7	487.2	840.7	492.5	442.7	1,528.6	808.0	723.1	5,898.0
1956	183.4	ND	27.7	161.8	545.1	420.1	369.6	556.3	527.1	1,077.2	744.5	87.6	4,700.4
1957	12.7	0.0	0.0	42.4	465.3	369.3	503.2	405.6	207.8	461.0	309.9	83.3	2,860.5
1958	79.2	12.7	120.9	188.5	396.7	425.5	395.2	590.0	510.0	321.1	398.8	201.9	3,640.5
1959	88.6	28.4	17.8	85.9	295.4	528.8	486.4	424.4	407.2	601.7	328.4	22.1	3,315.1
1960	54.6	33.8	49.5	98.6	420.9	289.8	486.7	646.4	317.5	1,392.7	358.9	30.5	4,179.9
1961	41.1	56.6	28.4	167.9	175.0	464.8	463.6	614.7	555.0	414.3	444.0	189.5	3,614.9
1962	0.0	0.8	6.1	264.7	503.9	665.2	410.7	260.4	670.1	654.1	152.4	191.0	3,779.4
1963	97.8	36.8	2.0	157.7	190.0	404.9	540.3	324.1	371.1	719.3	581.7	45.5	3,471.2
1964	26.4	19.8	47.8	300.2	279.9	688.8	401.6	720.6	428.2	730.8	481.1	150.9	4,276.1
1965	110.5	29.5	6.4	34.3	210.1	296.2	381.0	293.6	539.0	618.0	194.3	150.4	2,863.3
1966	78.5	49.8	142.2	151.1	688.6	518.7	472.2	617.5	487.9	815.8	167.1	292.6	4,482.0
1967	63.2	19.6	63.5	166.9	309.9	632.5	596.4	516.1	703.8	357.6	704.1	420.6	4,554.2
1968	120.9	142.7	41.7	127.3	384.5	544.6	423.2	645.9	475.7	150.3	374.7	84.6	3,516.1
1969	15.3	72.6	46.8	128.0	455.0	423.8	210.4	505.0	410.9	1,077.3	464.9	156.0	3,966.0
1970	185.9	104.5	157.6	159.9	377.8	452.7	639.8	919.6	625.2	778.7	281.4	206.5	4,889.6
1971	116.9	3.8	112.0	92.1	557.4	610.0	351.6	543.8	684.5	538.7	240.7	44.0	3,895.5
1972	242.9	0.0	39.4	62.3	473.6	58.1	275.1	341.6	408.6	271.1	380.1	161.7	2,714.5
1973	9.1	14.8	51.8	139.3	445.6	51.8	478.4	901.9	341.5	698.7	401.5	101.9	3,636.3
1974	180.5	0.0	105.9	150.4	623.5	470.7	481.4	429.6	589.7	1,148.2	309.0	44.7	4,533.6
1975	46.4	57.9	ND	137.5	639.5	389.8	609.1	395.4	770.9	425.7	1,023.4	425.7	4,921.3
1976	24.4	0.0	0.0	217.4	340.6	921.7	361.9	419.6	587.8	657.9	272.3	145.5	3,949.1
1977	30.2	49.5	97.3	97.3	186.4	461.0	546.9	491.5	556.0	281.9	482.9	96.8	3,377.7
1978	3.8	19.3	61.1	178.1	652.4	344.9	601.1	759.0	371.1	839.2	413.6	110.6	4,354.2
1979	58.4	22.7	123.0	183.9	459.2	444.3	284.8	609.4	409.6	833.2	238.7	79.5	3,746.7
1980	213.9	16.0	3.8	250.7	341.3	455.4	411.3	366.3	732.7	603.9	466.2	158.9	4,020.4
1981	0.0	92.4	16.4	537.0	650.2	608.4	517.8	704.2	372.6	562.6	608.0	144.2	4,813.8
1982	80.4	19.0	74.4	176.1	563.3	188.7	353.2	288.0	654.5	424.5	92.9	27.2	2,942.2
1983	3.7	8.5	ND	42.4	76.5	186.2	191.0	243.5	355.4	268.6	378.0	122.2	1,876.0
1984	71.4	22.6	22.7	138.6	383.5	402.3	297.2	382.0	672.5	792.0	539.3	56.3	3,780.4
1985	13.7	7.1	23.0	78.6	346.4	408.7	393.9	560.8	859.6	1,365.4	255.5	347.9	4,660.6
1986	0.0	3.1	22.8	177.7	565.9	278.2	381.2	356.6	562.2	699.9	286.6	47.7	3,381.9
Total	3,113.9	1,136.1	1,940.2	6,875.4	18,532.9	19,586.2	20,029.0	21,930.5	22,515.5	31,287.5	18,175.8	7,366.1	172,489.1
PROM	67.7	25.8	45.1	156.3	421.2	425.8	435.4	476.8	489.5	680.2	395.1	160.1	3,778.9
D.S	62.5	31.9	47.8	88.5	147.3	170.9	150.5	166.6	144.9	307.7	178.8	127.9	759.8

Table 13-3 Monthly Average Inflow at Los Llanos Site

Catchment Area : 143.7 km^2
Q2802= 1.04128 * Q2801 ^ 0.81483 r = 0.95 Q95%(347th.day) = 3.91 m^3/s
Unit : m^3/s

Year	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Average
1971	25.32	36.54	26.57	36.09	41.78	32.31	23.17	11.72	10.91	6.24	4.61	8.19	21.98
1972	16.27	13.97	13.59	16.35	18.83	25.27	21.37	12.35	6.42	4.70	4.30	6.16	13.35
1973	11.20	24.67	22.53	30.33	33.95	38.43	19.52	15.51	14.40	6.90	4.93	6.10	19.12
1974	16.24	26.10	17.97	20.05	26.29	34.88	20.47	9.24	6.11	4.63	4.58	5.25	15.99
1975	16.79	18.55	19.61	24.69	30.63	30.51	27.14	12.85	7.50	4.49	3.59	4.08	16.78
1976	9.07	14.71	11.92	12.78	20.09	23.82	15.99	8.66	5.38	4.32	3.94	4.64	11.31
1977	9.34	14.56	11.02	21.06	23.54	27.46	22.17	11.27	5.98	4.47	4.23	8.99	13.67
1978	12.42	19.47	19.73	22.81	26.74	30.42	21.08	11.62	6.89	5.05	4.52	7.46	15.74
1979	17.92	19.44	18.13	21.06	28.31	30.33	20.79	11.91	8.53	5.67	4.20	6.23	16.12
1980	13.20	18.52	18.76	18.92	21.26	24.46	26.42	12.68	7.83	5.62	5.05	8.65	15.11
1981	24.89	27.85	18.99	23.74	18.59	23.72	20.60	10.05	8.52	5.57	5.63	7.11	16.34
1982	19.45	14.59	14.67	14.71	18.03	21.30	12.62	6.49	4.50	4.27	4.95	5.47	11.81
1983	7.33	13.93	11.26	14.17	22.53	27.05	26.73	14.58	8.24	6.95	5.92	6.05	13.73
1984	17.48	21.79	24.60	20.57	24.57	27.75	22.79	9.32	5.02	3.86	3.16	3.62	15.44
1985	11.25	17.10	17.64	23.74	26.41	32.10	22.71	16.98	7.86	4.74	3.73	4.83	15.83
1986	13.31	17.77	17.10	15.02	18.16	25.98	17.37	8.66	5.30	3.99	3.30	5.12	12.61
1987	13.67	15.66	19.59	23.22	18.08	19.43	15.37	9.41	5.71	4.00	3.48	4.02	12.71
1988	11.15	18.94	19.80	27.91	35.41	31.86	15.89	8.84	5.73	3.53	2.80	3.64	15.52
1989	12.09	14.23	14.45	20.48	27.57	22.30	16.91	15.68	8.22	5.28	4.68	6.39	14.03
1990	16.25	19.67	20.17	20.38	21.96	29.29	21.14	13.70	10.81	5.62	4.33	6.29	15.87
1991	13.12	18.96	18.02	17.99	19.65	22.15	16.88	11.40	6.35	5.49	3.79	4.32	13.24
1992	6.94	17.92	20.11	15.77	26.67	25.86	19.43	11.70	5.84	4.59	4.12	5.35	13.69
1993	16.89	19.13	17.16	19.18	29.06	22.28	14.14	9.65	6.09	4.76	4.03	3.93	13.90
Total	331.59	444.07	413.39	481.02	578.11	628.96	460.70	264.27	168.14	114.74	97.87	131.89	343.87
Average	14.42	19.31	17.97	20.91	25.14	27.35	20.03	11.49	7.31	4.99	4.26	5.73	14.95
Min.	6.94	13.93	11.02	12.78	18.03	19.43	12.62	6.49	4.50	3.53	2.80	3.62	11.31
Max.	25.32	36.54	26.57	36.09	41.78	38.43	27.14	16.98	14.40	6.95	5.92	8.99	21.98

Table 13-4 (a) Monthly Average Inflow at Londres Station

Catchment Area : 210.2 km^2 Annual Precipitation 6577 mm

Unit : m^3/s

Year	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Average
1971	52.03	81.67	54.12	78.14	93.66	68.19	45.26	19.67	18.03	9.03	6.22	12.77	44.95
1972	29.57	24.29	23.50	29.56	35.06	50.45	40.98	20.96	9.35	6.37	5.71	9.31	23.86
1973	18.86	48.85	44.02	66.24	72.33	84.06	36.84	27.63	25.39	10.27	6.75	8.81	37.68
1974	29.44	52.49	33.26	38.29	52.86	74.67	39.01	14.70	8.79	6.26	6.18	7.36	30.31
1975	31.18	34.58	36.85	49.12	64.47	63.20	55.53	21.89	11.38	6.02	4.59	5.40	32.16
1976	14.89	25.84	19.99	21.80	38.24	47.18	28.73	13.55	7.51	5.75	5.17	6.31	19.64
1977	15.18	25.92	18.15	40.62	46.52	55.82	42.85	18.75	8.57	6.00	5.63	15.32	24.95
1978	21.15	36.61	37.02	44.36	53.83	63.39	40.44	19.42	10.19	6.94	6.08	11.61	29.37
1979	33.13	36.60	33.46	40.57	58.43	63.63	39.92	20.00	13.44	8.02	5.55	9.23	30.31
1980	22.85	34.75	35.52	35.34	40.81	48.28	53.11	21.58	11.95	7.93	6.96	13.86	27.74
1981	49.45	56.93	35.41	46.78	34.60	46.50	39.64	16.21	13.26	7.84	7.96	10.64	30.56
1982	37.02	25.59	25.89	25.87	33.55	40.85	21.44	9.46	6.04	5.68	6.83	7.69	20.60
1983	11.17	24.28	18.62	24.80	43.63	54.65	54.27	25.81	12.71	10.33	8.45	8.80	24.79
1984	32.61	42.00	48.60	38.97	48.55	56.26	44.47	14.86	6.90	5.00	3.91	4.70	29.03
1985	18.86	31.10	32.48	46.97	52.97	67.82	44.53	31.11	12.02	6.44	4.79	6.63	29.79
1986	24.30	32.65	31.08	26.52	33.48	51.99	31.67	13.55	7.39	5.21	4.13	7.16	22.46
1987	23.68	28.00	36.74	45.21	33.26	36.45	27.42	14.98	8.08	5.21	4.42	5.30	22.54
1988	18.62	35.86	37.28	56.83	77.21	67.31	28.70	13.88	8.14	4.48	3.38	4.74	29.83
1989	20.32	24.89	25.28	38.83	55.92	43.08	30.66	28.18	12.68	7.35	6.33	9.43	25.27
1990	29.32	36.89	38.27	38.70	42.23	60.35	40.56	23.75	17.73	7.95	5.75	9.20	29.37
1991	22.55	35.38	33.16	33.42	36.92	42.84	30.78	19.12	9.20	7.71	4.88	5.75	23.59
1992	10.43	33.18	37.96	28.14	53.85	51.66	36.38	19.70	8.31	6.11	5.83	8.57	25.01
1993	27.18	23.56	25.20	40.86	59.83	50.03	28.62	14.34	8.20	5.33	4.95	7.03	24.70
Total	593.79	831.91	761.86	935.94	1162.21	1288.66	881.81	443.10	255.26	157.23	130.45	195.62	638.50
Average	25.82	36.17	33.12	40.69	50.53	56.03	38.34	19.27	11.10	6.84	5.67	8.51	27.76
Min.	10.43	23.56	18.15	21.80	33.26	36.45	21.44	9.46	6.04	4.48	3.38	4.70	19.64
Max.	52.03	81.67	54.12	78.14	93.66	84.06	55.53	31.11	25.39	10.33	8.45	15.32	44.95

Table 13-4 (b) Results on Water Flow rate Measurement (1994-1995)

m^3/sec

Date	Los LLanos	Londres	Brujo
14/04/94	2.80	4.70	
27/04/94	3.05	6.20	
11/05/94	4.30	9.10	
08/06/94	8.00	15.30	
13/07/94	13.60	37.90	
31/08/94	18.30	30.30	
14/09/94	28.30	49.30	
30/11/94	14.60	28.80	
14/12/94	8.80	15.20	2.51
05/01/95	6.45	8.67	1.67
19/01/95	4.97	7.10	1.13
02/02/95	4.77	6.73	1.44
09/03/95	3.03	4.15	0.44
22/03/95	4.01	5.84	
05/04/95	4.60	12.20	5.44

Table 13-5 Water Quality at P.H. Los Llanos Point

(mg/l)

items*	ph	DO	BOD	PO_4-P	NO_3-N
Max.	7.95	11.80	2.22	0.59	0.99
Min.	7.35	7.96	0.32	0.10	0.08
Mean	7.70	8.65	0.96	0.20	0.47

*1992-5samples,1993-12samples.

Table 13-6 Water Quality of Paquita River

(mg/l)

Month	ph	DO	BOD	PO_4-P	NO_3-N
September	7.26	7.77	0.70	0.42	0.02

Table 13-7 · Concentration of Nutrients and BOD in river Water (mg/l)

Date/Items	Brujo	SP.LLanos	Londres	Paquita
02-09/02/95				
BOD	1.900	1.170	1.300	0.220
PO_4-P	0.070	0.070	0.060	0.090
T-P	0.110	0.140	0.090	0.180
O-P	0.040	0.070	0.030	0.090
NH_4-N	0.003	0.007	0.017	0.019
NO_2-N	0.004	0.012	0.008	0.007
NO_3-N	<0.001	<0.001	<0.001	0.002
TIN	0.007	0.019	0.025	0.028
15-22/02/95				
BOD	0.640	-	1.720	1.000
PO_4-P	0.110	-	0.070	0.090
T-P	0.120	-	0.110	0.120
O-P	0.010	-	0.040	0.030
NH_4-N	0.012	-	0.018	0.032
NO_2-N	0.005	-	0.007	0.009
NO_3-N	0.001	-	<0.001	<0.001
TIN	0.018	-	0.025	0.041
29/03/95				
BOD	0.590	0.540	0.770	1.900
PO_4-P	0.090	<0.01	0.070	0.090
T-P	0.070	0.130	0.120	0.150
O-P	-	0.130	0.050	0.060
NH_4-N	<0.001	0.063	0.003	<0.001
NO_2-N	<0.001	0.004	0.002	0.001
NO_3-N	0.001	<0.001	<0.001	0.001
TIN	0.001	0.067	0.005	0.002
27/04/95				
BOD	0.660	0.070	0.680	0.400
PO_4-P	0.100	0.060	0.100	0.130
T-P	0.160	0.130	0.170	0.310
O-P	0.060	0.070	0.070	0.180
NH_4-N	0.062	0.073	0.064	0.087
NO_2-N	0.001	<0.001	0.001	<0.001
NO_3-N	0.001	<0.001	0.001	<0.001
TIN	0.064	0.073	0.066	0.087
28/06/95				
BOD	-	1.400	1.360	-
PO_4-P	-	0.160	0.110	-
T-P	-	0.270	0.260	-
O-P	-	0.110	0.150	-
NH_4-N	-	<0.001	<0.001	-
NO_2-N	-	0.002	0.001	-
NO_3-N	-	0.001	0.001	-
TIN	-	0.003	0.002	-

Table 13-8 Groundwater Level Change and Water Quality

Station	Date	Time	WaterLevel(m)	Cl(mg/l)	NO_3-N(mg/l)	PO_4-P(mg/l)
W-1	21/2	9:45	2.45	1,250.00	5.70	0.050
W-2	21/2	10:50	2.46	790.00	2.12	0.002
W-3	21/2	12:00	2.35	10.30	0.06	1.220
W-4	21/2	12:50	2.56	6.42	-0.01	0.110
W-5	21/2	14:10	2.37	0.12	ND	0.020
W-6	21/2	15:40	4.84	1.16	-0.01	0.310
W-1	28/3	12:30	2.72	4,200.00	ND	ND
W-2	28/3	13:35	2.18	2,100.00	ND	ND
W-3	28/3	14:30	2.15	10.00	0.20	ND
W-4	28/3	16:30	2.25	3.90	0.40	ND
W-5	28/3	16:55	2.90	1.20	1.10	ND
W-6	28/3	17:20	4.90	1.50	3.00	ND
W-1	26/4	15:45	2.52			
W-2	26/4	16:00	2.23			
W-3	26/4	16:30	1.25			
W-4	26/4	16:55	1.56			
W-5	26/4	17:25	2.55			
W-6	26/4	17:50	4.00			

notes:Water levels are relative value measured from top of wells.

Table 13-9 Fish Species Found at Naranjo and Paquita River

Species	Naranjo	Paquita	Remarks
Poecillidae			
Poecilia gilli	○	○	Altitude10～1220m
Pocilliopsis turrubatrensis		○	Altitude0～120m
Eleotridae			
Gobiomorus maculatus	○	○	Altitude0～115m
Hemieleotris latifasciatus	○	○	Altitude5～110m
Dormitator latifrons	○		Altitude0～30m
Gobiidae			
Awaous transandeanus	○	○	Altitude0～120m
Hemulidae			
Pomadasys batanus	○	○	Altitude0～640m
Cichidae			
Cichlasoma longimanus	○	○	Altitude0～100m
Cichlasoma sp.		○	Altitude0～100m
Cichlasoma seiboklii	○	○	Altitude10～840m
Characidae			
Astyanax fasciatus	○	○	Altitude0～100m
Brycon behreae	○	○	Altitude10～640m
Cheirodon terrabae	○	○	Altitude10～680m
Roeboides ilseae	○	○	Altitude10～660m
Mugilidae			Only living in river mouth and Estero Negro
Mugil cephalus	○		
Lutijanidae			
Lutjanus movemfasciatus	○		
Lutjanus argentiventris	○		
Centropomidae			
Centropomus robalito	○		

*May 1995.

Table 13-10 Classification of Sea Turtle Landing Site

	Area	Species	Priority
1	PIRO	POR CONFIRMAR	3
2	CARATE	POR CONFIRMAR	3
3	MADRIGAL	POR CONFIRMAR	3
4	DOMINICAL	NINGUNA	4
5	BARU	L.o.	2
6	HATILLO	POR CONFIRMAR	2
7	SAVEGRE	POR CONFIRMAR	2
8	MATAPALO	POR CONFIRMAR	2
9	MANUEL ANTONIO	L.o., CH.a.	3
10	PALO SECO	L.o., D.c.	3
1	ESTERILLOS	POR CONFIRMAR	2
12	PUNTA MALA	L.o.	2
13	HERMOSA SUR	D.c.	2
14	CURU	POR CONFIRMAR	3
15	MUERTO	POR CONFIRMAR	3
16	POCHOTE	POR CONFIRMAR	3
17	TAMBOR	POR CONFIRMAR	3
18	MONTEZUMA	POR CONFIRMAR	4
19	COCAL	POR CONFIRMAR	3
20	MAL PAIS	POR CONFIRMAR	3
21	CALETA	POR CONFIRMAR	2
22	COYOTE	L.o.	2
23	JAVILLA	L.o.	2
24	BEJUCO	POR CONFIRMAR	4
25	ISLITA	POR CONFIRMAR	2
26	CAMARONAL	POR CONFIRMAR	2
27	CARRILLO	NINGUNA	4
28	SAMARA	NINGUNA	4
28	GARZA	NINGUNA	4
29	GUIONES	NINGUNA	4
30	NOSARA	POR CONFIRMAR	3
31	SAN JUANILLO	POR CONFIRMAR	3
32	JUNQUILLAL	POR CONFIRMAR	3
33	AVELLANAS	L.o., D.c.	2
34	LANGOSTA	L.o., D.c.	1
35	TAMARINDO	POR CONFIRMAR	4
36	GRANDE	L.o, D.c.	1
37	REAL	CH.a.	2
38	NOMBRE DE JESUS	L.o., CH.a., D.c.	1

L olivacea C agassizi D coriacea E imbricata

Table 13-11 Endangered Species of Tree

Family	Species	General Name
A. Grade (A)		
Bignoniaceae	*Tabebuia guayacán*	guayacán
Boraginaceae	*Cordia gerascanthus*	laurel negro
Caesalpiniaceae	*Copaifera sp (*)*	camíbar
	Mora oleifera	alcornoque
	Tachigalia versicolor	pellejode toro
Caryocaraceae	*Anthodiscus sp (*)*	ajo negro
	Caryocar costaricense	ajo
Fabaceae	*Myroxylon balsamum*	bálsamo chirraco
	Paramachaerium gruberi	sangrillo
Humiriaceae	*Humiriastrum diguense var. costaricense (.)*	níspero lorito
	Vantanea barbourii (+)	chiricano
Juglandaceae	*Oreomunnea pterocarpa (+)*	gavilán
Lauraceae	*Caryodaphnopsis burgueri (+)*	cocobola
Lecythidaceae	*Couratari scott-mori*	cachimbo
	Lecythis ampla	olla de mono jícaro
Meliaceae	*Swietenia humilis*	caoba
Mimosaceae	*Parkia pendula*	tamarindo de montaña
	Pithecelobium pseudo-tamarindus	cashá
Moraceae	*Batocarpus costaricensis*	ojoche macho
	Brosimun costaricanum (+)	ojoche
Podocarpaceae	*Podocarpus guatemalensis*	ciprecillo, pinillo
Zygophyllaceae	*Guaiacum sanctum*	guayacán real
B. Grade (B)		
Anacardiaceae	*Astronium graveolens*	ron ron
Caesalpiniaceae	*Copaifera aromatica*	camíbar

(Continua)

	Cynometra hemitomophylla (+)	guapinol negro
	Peltogyne purpurea	nazareno
	Prioria copaifera	cativo
Fabaceae	*Dalbergia retusa*	cocobolo
	Platymiscium pleiostachyum	cristóbal
	Platymiscium polystachyum	cachimbo cristóbal
	Dussia macroprophyllata	sangregao
Fagaceae	*Quercus brenesii*	roble
	Quercus oocarpa	roble
	Quercus tonduzii (+)	roble
Lecythidaceae	*Cowatari panamensis*	cachimbo
Meliaceae	*Cedrela tonduzii (+)*	cedro dulce
Mimosaceae	*Lysiloma divaricatum*	quebracho
Olacaceae	*Minquartia guianensis*	manú
Sapotaceae	*Mastichodendron capiri var. tempisque*	tempisque
Theaceae	*Pelliciera rizophorae*	mangle piñuela
Vochysiaceae	*Quelea aff paraensis*	masicarán areno

C. Grado (C)

Fagaceae	*Quercus costaricensis*	roble negro
Magnoliaceae	*Magnolia poasana (+)*	magnolia
Podocarpaceae	*Podocarpus oleifolius*	cipresillo
	Prumnopitys standleyi (+)	cipresillo

(+) Especies Endémicas
(*) Especies nuevas para el país (?)
(.) Subespecie endémica

FUENTE: PROGRAMA DE PATRIMONIO NATURAL, FUNDACION NEOTROPICA

Preparado por: Quírico Jiménez M. Revisado por: Luis J. Poveda
Nelson Zamora V.
Pablo E. Sánchez

Table 13-12 Flora in the Premontane Rain Forest (bp-P) Region

Speecies	Common Name
Schyzolobium parahybum	Gallonazo
Symphonia globulifera	Cerillo
Albizzia carbonaria	Carboncillo
Calophyllum brasiliense	Cedro maria
Persea sp	Aquacaton
Ocotea sp	Ira
Protium Costaricensis	Copal
Brosimum allicastrum	Ojoche
	Escobillo
Cecropia obtusifolia	Guarumo
Croton gossypifolious	Tarqua
	Guabo colorado
Inga oerstediana	Guaba
Dendropanax arboreus	Fosforillo
Oreopanax xalapensis	Papayillo
Trema micrantha	Capulin
Heliocarpus appendiculatus	Burio
Pourouma aspera	Chumico
Piper nodosum	Rabo raton
Vismia ferryginea	Achotillo
Brosimum utile	Baco
Carapa quianensis	Caobilla
Garapa sp	Cedro macho
Dilodendron costaricense	Comenegro
Lonchocarpus sp	Chaperno
	Colpalchi de montana
Virola sp	Fruta dorada
	Golondrino
Ficus sp	Higueron
Guarea sp	Ocora
Batocarpus costaricensis	Ojoche macho
Hieronyma alchorneoides	Pilon
Nectandra sp	Quizarra
Pterocarpus hayesii	Sangrillo
Sapium sp	Yos
Pouteria sp	Zapotillo
Schyzolobium parahybum	Gallinazo
Symphonia globulifera	Cerillo
Albizzia	Carbonallo
Cedrela salvadorensis	Cedro maria
Persea sp	Aquacaton
Octoea sp	Ira
Mora megistoperma	Mora
Brosimun alicastrum	Ojoche
Cecropia obtusifolia	Guarumo
Croton draco	Tarqua

Table 13-13 Flora in the Tropical West Forest (bmh-t) Region

Species	Common Name
Simaruba glauca	Aceituno
Rollinia	Anonillo
Lonchocarpus sp	Chaperno
Phoebe sp	Aquacatillo
Ocotea Stenoneura	Quizarra amarillo
Brosimum utile	Baco
Luehea seemannii	Guacimo colorado
	Escobillo
Cupania glabra	Cascua
Ficus sp	Chilamate
Spondras mombin	Jobo
Croton niveus	Colpatchi
Batocarpus costaricensis	Ojoche macho
Pouteria viridis	Zapote
Chrysophyllum panamense	Caimito
Tabebuia rosea	Roble sabana
Ceiba pentandra	Ceiba
Delonix regia	Malinche
Croton sp	Targua
Gliricidia sepium	Madero negro
Erythrina costaricensis	Poro
Goethalsia meiantha	Guacimo blanco
Ochroma lagopus	Balsa
Tabebuia chrysantha	Corteza
Minquartia quianensis	Manu
Platymiscium polystachyum	Cristobal
Peltogyne purpurea	Nazareno
Albizzia carbonaria	Carboncillo
Vochysia quatemalensis	Mayo
Hieronyma alchorneoides	Pilon
Cedrela odorata	Cedro amargo
Schyzolobium parahybum	Gallinazo
Carapa quianensis	Caobilla
Terminalia amazonia	Amarillon
Viltex cooperi	Cuajada
Cassia grandis	Carao
Anacardium excelsum	Espavel
Inga sp	Guaba
Diphysa robinoides	Guachipelin
Psidium sp	Guayaba
Zanthoxylum panamense	Lagartillo
Ficuz	Higueron
Cordia alliodora	Laurel
Bombacopsis pochota	Pochote
Hymenaea courbaril	Guapinol
Virola sebifera	Fruta dorada
Trema micrantha	Capulin
Piper sp	Piper
Cecropia insignis	Guarumo
Heliocarpus sp	Burio
Sapium aucuparium	Yos
Protium costaricensis	Copal
Dendropanax arboreus	Fosforillo

Table 13-14 Trees existing in the Reservoir Area

Species	Common Name	Grade
Brosimum utile	Baco	
Carapa guianensis	Caobilla	
Guarea sp.	Cedro macho	
Dilodendron costaricense	Comenegro	
Lonchocarpus sp.	Chaperno	
	Copalchi de montana	
Virola sp.	Fruta dorada	
	Glondrino	
Ficus sp.	Higueron	
Guarea sp.	Ocora	
Batocarpus costariensis	Ojoche macho	A
Hieronyma alchorneoides	Pilon	
Nectandra sp.	Quizarra	
Prterocarpus hayesii	Sangrillo	
Sapium sp.	Yos	
Pouteria sp.	Zapotillo	

*Grade of Tree Species is categorized by the preciousness from rank A(quite important)to C(important).

Table 13-15 Plant Types at Dam Site (from ICE)

Family	Species
Papilionaceae	Platymiscium sp.
	Myroxilon balsamun
Bibnobiaceae	Tabebuia chrisantha
	Jacaranda copala
Mimosaceae	Acacia sp.
	Pentaclethra macroloba
Melastomaceae	Miconia sp.
Maraceae	Cecropia sp.
	Ficus sp.
Bombacaceae	Ochroma sp.
Anacardiaceae	Mangifera indica
Boraginaceae	Cordia alliodora
	Cordia nitida
Caesalpiniaceae	Cassia emarginata L.
	Swartzia panamensis
Lauraceae	Ocotea sp.
Myraceae	Psidium guajava L.
Helioconiaceae	Heliconia sp.
Cyatheaceae	Cyathea arborea
Palmae	Prestoea allenii
Simaroubaceae	Simarouba sp.
Loranthaceae	Phoradendrum sp.
Bromeliaceae	Tillandsia sp.
Euphorbiaceae	Croton gossypifalius
Gramineae	Pennisetum purpureum
Cyperaceae	Cyperus sp.
Piperaceae	Piper sp.
Proteaceae	Roupala sp.
Cunoniaceae	Winmannia sp.
Burseraceae	Tetragastris sp.

*Underline shows the Species protected from their extinction.

Table 13-16 Plant Type at Power House Point (from ICE)

Family	Species
	Myriocarpa longipes
	Inga fagifolia(?)
	Inga tonduzii
	Inga quaternata
	Inga densiflora
Piperaceae	Piper biauritum
	Piper arboreum
	Piper auritum
	Piper biseriatum
	Piper colonense
	Piper nudifolium
Helioconiaceae	Heliconia sp.
Mimosaceae	Acacia melanoceros
	Genipa americans
Cyatheaceae	Cyathea sp.
	Geichonia sp.
	Heliotropus sp.
Combretaceae	Terminalia oblonga
Naraceae	Cecropia obtusifolia
Lauraceae	Cassia biflora
Leguminosae	Pithecollobium longifolium(?)
	Pithecollobium sp.
Gramineae	Gynerium sagittatum
Araceae	Anthurium acutifolium
	Anthurium bronesii
	Anthurium grandifolium
Bromeliaceae	Tillandsia sp.
Tpocynaceae	Thevetia ahouai
	Pilea costaricensis
	Pilea donnell-smithi
	Pilea angustifolia
Urticaceae	Boehmeria aspera
Begoniaceae	Begonia multinervia
Solanaceae	Solanum americanum
	Solanum torvum
Meliaceae	Guarea grandifolia
Meliaceae	Trichilia adolfi
	Hoffmania bullata
	Hoffmania psychitriifolia
	Witheringia solanaceae
	Witheringia sp.
Myrtaceae	Psidium sp.
Mytraceae	Euginia sp.
	Hanelia sp.
	Pentagonia sp.
Rubiaceae	Psychotria angustifolia
	Psychotria macrophylla
	Psychotria elata
	Psychotria pilosa
	Sarcorcharis naranjoana
Caesalpiniaceae	Cassia pallida
	Irartea durissima
Palmae	Chamaedorea pinnatifrons
Rutaceae	Zanthoxylum panamense
Piperaceae	Peperonia alata

(Continue)

Piperaceae	Peperomia costaricensis
	Peperomia cyclophylla
	Peperomia lignescens
	Peperomia saligna
	Urera baccifera .
	Urera caracasana
Lauraceae	Cassia sp.
	Ocotea sp.
	Nectandra salicifolia
Acanthaceae	Aphelandra tengua bobis
	Aphelandra sp.
	Justicia metalica
	Justicia oersredii
	Justicia urophylla
	Justicia sp.
Euphorbiaceae	Croton draco
	Croton gossipifolius
	Croton punctatus
	Croton xalapensis
Euphorbiaceae	Spathiphyllum friedrichstalii
	Spathiphyllum wendlandi
	Tourneffortia sp.
	Gouannia lupuloides
	Baunnia guianensis
Leguminosae	Calliandra grandifolia(?)
Moraceae	Cecropia insignis
	Cecropia peltata
Moraceae	Pourona bicolor
	Vismia ferruginea
Araceae	Dieffenbachia sp.
Maraceae	Ficus sp.
Leguminosae	Machaerium arboreum
Leguminosae	Erythrina sp.
	Elaphoglosum sp.
	Thelypterium sp.
	Xanthosoma robustum
	Stenmadenia donell-smithi
	Clibadium sp.
	Tabernaemontana sp.
	Ruadgea sp.
Guttiferae	Clusia sp.
Lythraceae	Cuphea cartagensis
	Columnea sp.
Bombacaceae	Ochroma lagopus
Proteaceae	Protea sp.
Amaranthaceae	Iresine altissima
	Posoqueria latifolia
Moraceae	Ficus colubrinae
	Ficus hartwergii
	Ficus macbridei
	Ficus ovalis
	Mikania banisteriae

Table 13-17 Salinity of Water at Quepos Mangrove Area

Station	Q-a		Q-b		Q-c		Q-d		Q-e	
Date	1955.03.07									
Time	0800		0755		0615		0825		0655	
Items	T	S	T	S	T	S	T	S	T	S
Depth(m)	2		2.5		3		3		3	
0m	29.4	32.55	29.4	32.55	29.4	32.6	29.4	32.45	29.4	32.0
1m	29.4	32.55	29.3	32.55	29.4	32.55	29.4	32.56	29.4	32.54
2m	29.4	32.55	29.0	32.65	29.4	32.6	29.4	32.56	29.4	32.61
3m			29.3	32.65	29.5	32.6	29.4	32.65	29.4	32.61

Table 13-18 Salinity of Water at Savegre Mangrove Area

Station	S-1		S-2		S-3		S-4		S-5	
Date	1995.02.25									
Time	11:40		12:03		12:15		12:30		12:43	
Item	T	S	T	S	T	S	T	S	T	S
0m	27.1	1	30.7	31.8	31	32.7	31.8	32.79	32	32.3
0.5m	29.8	28	30.7	32	31	32.75	31.4	32.85		
1m	32.3	32.47								
2m	31.4	32.62								
Depth(m)	2.7		1		1		0.9		0.6	
Time	14:13									
Item	T	S	T	S	T	S	T	S		
0m	27.9	8	32	32	32	32.15	33	32.74		
0.5m	28.3	11.6	32	32.1			32.4	32.3		
1m	30	23.8								
2m										
Depth(m)	2		1		0.5		1.3			
Time	16:25									
Item	T	S								
0m	29.3	5.5								
0.5m	30	12.1								
1m										
2m										
Depth(m)	0.9									

Table 13-19 Fauna Found at Dam Site (from ICE)

Manmals,Aves	Species
Mammals	
Cebidae	Alouatta palliata
Scluridae	Sciurus sp.
Didelphidae	Didelphis marsupialis
Dasypodidae	Dasypus novemcinctus
Procyonidae	Proycon sp.
	Nasua narica
Dasyproctidae	Aqouti paca
	Dasyprocta puntacta
Mustelidae	Eira barbara
Aves	
Fringilidae	Sporophila americana
Tyrannidae	Tyrannus melancholicus
Psittacidae	Aratinga sp.
Accipitridae	Buteo sp.
	Elanoides forficatus
Tharaupidae	Chlorophonia sp.
	Euphonia hirundinacea
Cuculidae	Crotophaga sp.
Hirundinidae	Notiocnelidon cyanoieuca
Cathartidae	Coragyps atratus
Columbidae	Columbina passerina
Turdidae	Turdus grayi
Ardeidae	Bubulcus ibis

*Underline shows the Species protected from their extinntion.

Table 13-20 Species of Fish and Reptiles Found at Dam Site (from ICE)

Reptiles,Fish	Species
Reptiles	
Iguanidae	Iguana Iguana
	Analis insignes
	Ctenosaura similis
Telidae	Amebia undulata
Elapidae	Micrurus nigrocintus
Viperidae	Bothrops nummifer
Colubridae	Imantodes cenchoa
	Spilotes pullatus
Viperidae	Bothrops asper
Boldae	Boa constrictor
Fish	
Mugilidae	Agonostomus monticola
Cichilidae	Cichlasoma sp.
Poecilidae	Poecilia sp.
Characidae	Brycon sp.

*Underline shows the Species protected from their Extinction.

Table 13-21 Type of Insects at Dam Site (from ICE)

Insect	Species
Zygoptera	Caballitos del diablo
Anisoptera	Libelulas pipilachos
Dermapteros	Tijeretas
Heteropera	Chinches
Apocrita	Abejas-hormigas-avispas
Coleopteros	Escarabajos
Rnopalocera	Mariposas
Cyclorrhapha	Moscas
Salatatoris	Saltamontes grillos
Blattaria	Cucarahas
Phasmida	Insectos palo

Table 13-22 Industrial situation in related County

Area	First	Second	Third (1987)	Others	Industrial 1992	Industrial 1994	Commecial 1992	Commecial 1994
Costa Rica	31.4	19.9	38.3	10.4	0.88	0.82	30.0	30.6
Trrazu (Enterprise)	69.1	8.7	19.4	2.7	0.43	1.08	41.8 (Coopesantos)	28.8
Aguirre Enterprize	52.5	10.0	24.7	12.8	1.58	1.33	32.5 (I.C.E)	26.1

*Unit : %

Table 13-23 Socio-economical indicator of Aquirre and Parrita County

Indicator	Maximun level	Subject area
Population density	20	16.20
Socio-economical indicator	20	5.75
Residencial organization	10	5.30
Land utilization situation	10	1.53
Land development means	15	12.87
Land development situation	15	5.77
Inflastructure	10	1.07

Source : MAG,SEPSA,MIDEPLAN,IICA(1993)

Table 13-24 SIS Rank of Aguirre and Parrita County

County	District	Rank
Aguirre	Quepos	5.13
	Savegre	9.13
Parrita	Naranjito	8.63
	Pattita	8.00

*SIS value:
SIS rank: 1-highest value, 10-lowest value.
Source: MIDEPLAN, SISD (1991),Comparison between 1973 and 1984.

Table 13-25 Change of Agricultural Production

Crops	1990	1991	1992	1993	1994
Permanent					
Palm	11,602,500	12,285,000	12,967,500	13,377,000	13,650,000
Achiote	136	145	164	263	454
Vanilla	182	196	224	224	280
Pepper	960	1,000	1,080	1,180	1,200
Cacao	770	980	10,850	1,155	1,260
Annual					
Rice	323,454	323,454	363,878	377,332	434,000
Maize	2,868	3,156	3,156	3,156	3,168
Kidney bean	18,729	19,967	23,087	26,207	27,269
Biannual					
Papaya	1,800	2,400	2,800	3,600	10,000
Banana	2,200	2,200	2,288	2,376	3,520
Pine	840	893	924	945	1,050
Total	11,954,439	12,639,391	13,375,951	13,793,438	14,132,201

*Unit : 1000 Colones.

Table 13-26 Agricultural Production at Down Stream Area in Naranjo River Basin

Crops	Area(ha)	Total tones	Total colones
Permanent			
Palm	6,500		13,650,000
Achiote	5		454
Vanilla	2		280
Pepper	2		1,200
Cacao	10		1,260
Annual			
Rice	1,550		434,000
Maize	80		3,128
Kidney bean	520		27,269
Biannual			
Papaya	5		10,000
Banana	11		3,520
Pine	1		1,050
Total	8,686		14,132,161

*Date is in 1994. Unit of total colones in this table is 1,000 colones

Table 13-27 Outline of Local Community at Project Area

District	Population	Industry	Traffic	Service water	Utilization of rivers	Remarks
San Joequin	60 persons with 23 families(25 elementary school pupils). The population increases temporarily during the harvest period of coffee.	Agriculture – The coffee is main product. Cacao was the main product 8 years ago, but has shifted to coffee.	There are 10 cars in the village. The traffic volume is 5 to 10 cars daily.	The water is taken in the gravity method using a hose from the 2 km upper stream side apart from the school. This water is supplied by the county.	No utilization of river.	Hearing from the school teachers.
Naranjo						The traffic convenience is bad,and we gave up visiting this district. According to a teacher named San Joequin,this village is of small households consisting of 6 families,and is a small community of only 2 resident families. The remaining 4 families live in this district seasonally.
Sante Celilia	Residents are only 22 persons of 3 families. Additional 4 families have their houses in this district and come to their homes from time to time. The population temporarily increases during the coffee harvest period.	Agriculture(coffee plantation)	1 or 2 cars daily. The number of cars increases only during the harvest season.	Every household takes water using a hose from a spring. (Gravity system).		
Napoles	133 persons with 31 families. 22 primary school pupils.	The coffee is the main production in the industry. In addition,they produces a small amount of sugar millet and a small amount of vegetables for self consumption.	20 to 30 cars pass the road daily. Private Jeeps are used or movement of habitants.	There is a spring apart by 1.5km, and AYA built up the water service supply system which is managed the village.	Fishing as a hobby by the inhabitants, who catch MACHOCA,RONCAD or MACHIN,etc. from Rio Naranjillo.	Hearing survey from the primary school teachers.
Naranjillo	The population of about 120 persons with 20 families. The same families are consecutively living and there is no inflow of new population.	There is an agriculture. 1.Coffee, 2.Cattle breeding(Being used for meat and milk. For information, it is said that the cattle for milk at the high land and the cattle for meat at low land are being bred). 3. Achiole(the natural dye for dying the rice, macaroni, spaghetti into red color)	This district has 10 to 11 cars.	Each individual takes water using a hose from the spring in the farm field.(The common possession also exist in these water services).		Hearing survey from the neighbor farmers.

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District	Population	Industry	Traffic	Service water	Utilization of rivers	Remarks
Paso Real	About 100 persons with 14families because 1 family consists of 7 persons. The population decreased as compared with that in 5 years ago. There was no electric service 10 years ago when 2 to 3 families went out, but they didn't come back even after the electric service was started since then.	The main industries are agriculture and stock raising, stock living, and the agriculture produce Achiote, corn and kidney beans. The Achiote is sold through the church, but because the unit price has risen this year, marking a nice record.	Stock raising traders have 2 cars.	Each of household has its own spring.	The river is used for recreation and bathing.	The road is bad and the access to this village was difficult, and we encountered the collapse of road in the midway to this village, and also the cut off of road due to the fall of rocks and needed many hours to reach there. The hearing survey was taken from the primary school teachers.
Londres	There are 1500 persons including those of neighborhood. 150 houses are located at the center. 60 to 80 persons or 20 families are increasing every year at the locations whose conditions are looked naice. The sight seeing visitors come to this district at the week end. During the dry season, about more than 2,000 persons may come to this area for sending the camping life from San Marcos.	The main industry in stock living and agriculture, but because the topography is complex, the stock living is much more than the agriculture. The agriculture produces mainly the kidney beans, and partially produce the Achiote and corn (for self consumption). The jobless people go to Manual Antonios and the like to find the job.	About more than 20 cars of peddlers come daily from Monday to Friday. The sight seeing visitors come to this area at the week end. The number of cars owned by town is 26 cars at the center and 32 to 33 cars in total.	The water is taken from the mountain ridge called "Nara", and group-controlled. The water shortage is coused during the dry season as the population has increased, and the people must go to Naranjo River to scoop the water. As a plan, they plan to instal a large water supply system. But at Sahalo,Bigajual Arribe, and Bigajual Abajo, each family takes water from Nara can not be utilized because of the slope. The water comes out of well if drilled by about 10 m depth. Further, Avegrada Arroyo utilizes the spring water	During the dry season, the river ship flowing down to LLAMAROW from the Londres bridge has sight seeing visitors in object. The play fishing is partially being done but not so prosperous.	Londres includes many areas.Namely 1.Bupnos Airos al Sureste. 2.Sahalo, 3.Bigajual Arribe, 4.Bigajual Abajo, 5. El Negro, 6.Carro Nava, and 7.Avegrade Arroyo This town has the history for about 50 years.
Naranjio	The number of household is from 100 to 150, and the population is from 600 to 650 person. The number of primary school pupile is 120. The population has slightly increased in the past 5 years.	The main industry is stock living and agriculture, and the former is more prosperous. The agriculture produces the fruits (Ryoukan, Orange) for self consumption, and also the kidney beans and corn, However, many persons go to Manuel Antonio and Quepos for their waorks.	About 50 cars pass through the road although this news in not so much sure. There are 25 to 26 cars in the town. The bus convenience is nice, and there are about 7 bus services between Queps and Naranjito.	Spring water from the high land is utilized but tends to be lack. Because the Nara water controller was living in the neighborhood, we asked him a question how much of money the household has to pay, it costs 200 Colones per month (there is no water service meter) and that money is applied to the water control. The spring water volum is measured by the water service bureau of San Jose. (AYA), but he didn't know the measured result.	The river is utilized for such recreation as fishing and bathing.	

District	Population	Industry	Traffic	Service water	Utilization of rivers	Remarks
Esquipulas	The population of about 50 persons with 10 families including 18 primary school pupils. The population remains almost unchanged though there is the entry and exist of persons due to the immigration. Such a case can be thought that a landlord sells a land and the other people settle there.	The main industry is theh agriculture which produces the kidney beans,corns,Achiote,Guyaba,platano,adzuki beans, and the other crops for self consumption. (The latitude is too low for the coffee plantation). In addition, they produce the foliage plants, vanilla, etc. The folreigners are many as the landlord (American, Italian, Japanease). In addition, the sight seeing business can be imagined.	The traffic volume of around 8 cars per day on the average, with 5 to 8 cars on the week day and 10 to 15 cars on the end of week days. The village holds one car, but there are bus service to Quepos 3 times a day, at 6 AM, 12 noon and 6 PM. The fee is 86 Colones one way .Though iti is commonly in the other villages, it semmed to us that the persons having no car goes to the town by walk, on a horse and by the riding together on another person's car (paying some money).	The same spring is commonly used among Naranjito, Villa Nueva and Esquipulas, This is the water service supply only to the colonies.	The river is used for fishing, river ship flowng down, recreation area, and also bathing during the summer season. The fish that can be caught are Machaca, Mochin, Canearou species of river shrimp). A landlord (a foreigner ?) has a plan to do the recreation for the purpose of the sight seeing (walking, eating lunch, etc.), and it is adde that a tourist visited the village 2 to 3 weeks ago. The future development is still unknown.	Hearing survey from the primary school teachers.
Villa Nueva	About 300 persons with 150 families (including the households without any children). The number of primary school children is about 50 persons. The population has been gradually increasing since 10 years ago.	The agriculture is the main industry. They produce the pine apples, oranges, and mamon chino. The sales are entrusted to the cars going to San Jose. The pasturing also exists but is less in production volume. There are many people having the agricultural land but going to Quepos for their work. (Employees at hotels and store clerks).	The daily traffic is about 20 cars per day. This is because there are many peddlers from Quepos. The town has 5 to 6 car owners are foreigners in many cases. The said number of cars include the number of taxis. The persons in the town going to another large town must ride together on another person's car, or utilize a bus, The buses start this town 4 times a day at 5, 9 AM, 12 noon and 5 PM, and go up to the upper stream 3 times out of them. (The people of Esquipulas use this bus). The road passed just one or 1.5 years ago, and before it, they had to walk or utilize a horse.	Water is taken from the same water source as that of Esquipulas.	The river is used for fishing (2 to 3 fish per person at most) or recreation wahen the water is clear during dry season (January to April and December to February ?). The river is not utilized during the rainey season.	1.This coloney has a history of about 10 years and is not written on the map. 2.We don't hear about any new development plan but it seems to us that a foreigner plans it. In other words,the forigner is planing to buy the land for utilizing it to the sight seeing purpose.

Table 13-28 Urbarization degree and occupational situation

Category	Grade(%)of urbanization(1984)	Occupation 1973	1984
Costa Rica	44.5		
Trrazu	11.1		
•Total population		7,542	8,845
•Population more than 12 years		4,536(60.1)	6,176(69.8)
•Inactive popula.		2,376(52.4)	3,092(50.1)
•Active popula.		2,160(47.6)	3,084(49.9)
Occupatinal		2,036(94.3)	2,959(95.9)
Unemployed		123(5.7)	125 (4.1)
•Occupational and suspending		2,089	3,049
Salaried man		1,020(48.8)	1,605(52.6)
Private enterprise		643 (30.8)	981 (32.2)
Employer		32 (1.5)	60 (2.0)
Dependent family		394(18.9)	403 (13.2)
S.Marcos	18.0		
S.Lorenzo	0.0		
S.Carlos	0.0		
Aguirre	33.0		
•Total population		14,437	13,319
•Population more than 12 years		8,517(58.8)	9,032(67.8)
•Inactive popula.		4,324(50.8)	4,576(50.7)
•Active popula.		4,193(49.2)	4,456(49.3)
Occupatinal		3,948(94.2)	4,020(90.2)
Unemployed		245 (5.8)	436(9.8)
•Occupational and suspending		4,077	4,366
Salaried man		2,905(71.3)	3,187(73.0)
Private enterprise		778(19.1)	765 (17.5)
Employer		6(0.1)	142 (3.3)
Dependent family		388(9.5)	272 (6.2)
Quepos	47.0		
Savegre	0.0		
Naranjito	0.0		

Table 13-29 Attainment degree related to social needs Aquirre and Parrita

Items	Aguierre	Parrita
Hygeine(Nourishment)	middle	middle
Education	slightly low	quite low
Housing	low	slightly low
Fundamental needs	middle	middle
Migration to urban area	-12.00	-4.0
Unemployment rate in relation to economical population	10.0%	7.0%
Temporary unemployment rate	16.0%	15.0%
Agricaltural area	76.7%	83.3%
Fundamental needs	65.5%	38.0%

Source : MIDEPLAN,SISD(1991)

Table 13-30 Outline of Palm Plantation

Items	Contents of hearing survey
Business starting year	1958
Area	3,500 ha
Number of employees	350 persons (at present), 600 persons (at the prosperous period).
Irrigation area	600 ha
Water sampling position and water volume	· One location at 2 m^3/sec from Naranjo River. · there is the additional plan of 0.5 m^3/sec in 1966. · There is the irrigation plan to the south end area of plantation from the Savegre River in the year of 1996.
Water sampling period and method	The water shall be taken by installing a stone accumulated weir on the side of river during the dry season (December to April). The water volume flowing into the plantation increases during the rainy season.
Effects of irrigation	· The quality of non-irrigated area is worse than that of irrigated area. · Young trees require especially much water. · The entire area can not be irrigated because of the shortage in budget.
Production volume	· The old trees require the water of 12 tons/y/ha, while the young trees require 26 tons/y/ha. · Almost no harvest for 30 years in the south half of the plantation.
Production amount	The old trees produce the amount of $325/ha/y while the young trees the amount of $650/ha/y.
Structural ratio	The old trees occupy 70% while the young trees the remaining 30%.
Disaster from flood	No disaster because the water decreases soon though there is the flood. No damage even in case of the 130 mm/5 hours.
Fertilizer	Using a small volume of 3 kinds of Roundup, Goal and Galant. Using Dipel as the insecticides.
Wells	There are 3 wells inside the plantation, for their use to the palm factory service water and the inhabitants' potable water. The drain water from the palm factory is stored once in a pond, and is released to the irrigation water channel via the sewage disposal facilities.
Mangrove	Because the mangrove forest located between the plantation and the sea coast is of privately owned land, the mangrove is deforested and shrunk for the rice paddy crop.

* Palma Tica Office
** African Palm (Elaeis guiannensis)

Table 13-31 Composition of Water Quality of Channels

St.		Na	Ca	Mg	Cl	SO_4	HCO_3
Well		0.30	1.38	0.61	0.11	0.21	1.89
Toma	(1)	0.16	0.01	0.38	0.01	0.08	1.05
	(2)	-	-	-	-	-	-
	(3)	0.16	0.01	0.49	0.02	0.16	1.29
	(4)	0.16	0.01	0.50	0.02	0.17	1.66
	(5)	0.17	0.02	0.46	0.03	0.23	1.46
St.4	(1)	0.66	0.04	0.49	0.28	0.18	1.96
	(2)	64.00	1.34	2.04	71.00	6.27	2.34
	(3)	103.00	3.82	3.88	129.00	10.60	2.33
	(4)	88.00	2.52	3.00	115.00	10.60	2.34
	(5)	151.00	6.51	5.20	180.00	18.50	1.92
St.6	(1)	0.18	0.04	0.31	0.03	0.07	0.97
	(2)	0.30	0.06	0.65	0.07	0.06	2.23
	(3)	0.22	0.05	0.55	0.06	0.12	1.69
	(4)	0.28	0.06	0.60	0.11	0.09	1.87
	(5)	0.20	0.10	0.62	0.09	1.00	1.19
St.7	(1)	0.80	0.03	0.85	0.27	0.20	3.56
	(2)	-	-	-	-	-	-
	(3)	-	-	-	-	-	-
	(4)	-	-	-	-	-	-
	(5)	-	-	-	-	-	-
St.8	(1)	0.61	0.04	0.48	0.03	0.12	2.38
	(2)	0.21	0.05	0.51	0.05	0.10	2.39
	(3)	0.20	0.05	0.52	0.03	0.10	1.57
	(4)	0.02	0.05	0.52	0.05	0.10	1.63
	(5)	0.17	0.04	0.39	0.06	0.11	1.17
St.9	(1)	0.25	0.02	0.66	0.06	0.09	2.20
	(2)	0.22	0.03	0.71	0.04	0.09	2.07
	(3)	0.19	0.02	0.67	0.03	0.09	1.85
	(4)	0.23	0.18	0.65	0.08	0.12	1.31
	(5)	0.16	0.19	0.33	0.11	0.12	1.51
St.10	(1)	0.13	0.03	0.37	0.01	0.06	1.50
	(2)	-	-	-	-	-	-
	(3)	-	-	-	-	-	-
	(4)	-	-	-	-	-	-
	(5)	-	-	-	-	-	-

*Date : (1)-00/09/94, (2)-25/01//95, (3)-01/02/95, (4)-15/02/95, (5)-22/03/95

Table 13-32 Concentration of Nutrients and BOD in Channel Water

Date/Items	TOMA	St.4	St.6	St.7	St.8	St.9	St.10
20/09/94							
Flow Rate	0.200	0.510	1.790	0.050	0.200	1.830	0.030
PO_4-P	0.052	0.049	0.029	0.044	0.055	0.047	0.026
T-P	0.129	0.099	0.077	0.128	0.131	0.067	0.082
O-P	0.077	0.050	0.048	0.084	0.076	0.020	0.053
NO_3-N	0.090	<0.01	0.030	0.040	0.030	0.520	0.010
T-N	0.427	0.362	0.491	0.577	0.641	0.773	0.326
15/12/94							
Flow Rate	dry	0.150	0.360	0.000	0.000	0.340	0.000
06/01/95							
Flow Rate	dry	0.590	0.050	dry	0.040	0.330	dry
18-19/01/95							
Flow Rate	1.440	0.200	0.030	dry	0.010	0.810	dry
25/01/95							
PO_4-P		0.050	0.500		0.170	0.150	
T-P		1.030	0.700		0.900	0.280	
O-P		0.980	0.200		0.730	0.130	
NH_4-N		0.319	0.223		0.195	0.085	
NO_2-N		0.019	0.012		0.070	0.008	
NO_3-N		0.005	<0.001		<0.001	0.001	
TIN		0.214	0.235		0.202	0.094	
01-02/02/95							
Flow Rate	1.240	0.380	0.020	dry	0.000	0.420	dry
BOD	0.760	3.020	1.000		1.570	0.630	
PO_4-P	0.090	0.180	0.430		0.280	0.150	
T-P	0.150	0.490	0.610		0.490	0.280	
O-P	0.060	0.310	0.180		0.210	0.130	
NH_4-N	0.042	0.046	0.043		0.073	0.037	
NO_2-N	0.009	0.010	0.009		0.009	0.003	
NO_3-N	<0.001	0.005	<0.001		<0.001	0.001	
TIN	0.051	0.061	0.052		0.082	0.041	
15/02/95							
BOD	0.630	2.900	2.300		1.900	1.300	
PO_4-P	0.060	0.060	0.400		0.180	0.700	
T-P	0.120	0.550	0.640		0.430	0.980	
O-P	0.060	0.490	0.240		0.250	0.280	
NH_4-N	0.032	0.036	0.024		0.089	0.079	
NO_2-N	0.003	0.011	0.008		0.005	0.020	
NO_3-N	<0.001	0.006	0.001		0.001	0.002	
TIN	0.035	0.047	0.033		0.095	0.101	
22/02/95							
Flow Rate	?	?	0.020	dry	0.000	0.720	dry

	(1.7)	0.700 Backward		dry	0.000	(1.8)	dry
08/03/95							
Flow Rate	1.440	0.530	0.020	dry	0.000	0.660	dry
23/03/95							
Flow Rate	1.460	0.820	0.520	dry	0.000	1.480	dry
22/03/95							
BOD	0.680	2.070	1.040		1.450	4.600	
PO_4-P	0.100	0.030	0.340		0.240	1.290	
T-P	0.350	0.150	0.610		0.560	2.140	
O-P	0.250	0.150	0.270		0.320	0.850	
NH_4-N	0.033	0.156	0.121		0.068	0.518	
NO_2-N	0.003	0.022	0.037		0.013	0.035	
NO_3-N	0.001	0.017	0.002		0.001	0.005	
TIN	0.037	0.195	0.160		0.082	0.558	
06/04/95	1.520	0.700	1.220	dry	0	3.170	dry
19/04/95							
BOD	1.240	8.80?	2.440		2.720	5.160	
PO_4-P	0.070	0.120	0.090		0.300	0.650	
T-P	0.150	0.380	0.220		0.540	0.940	
O-P	0.080	0.260	0.130		0.240	0.290	
NH_4-N	0.036	0.116	0.089		0.066	0.119	
NO_2-N	0.004	0.015	0.031		0.002	0.011	
NO_3-N	<0.001	0.002	0.001		0.001	0.004	
TIN	0.040	0.133	0.121		0.069	0.134	
10/05/95							
BOD	0.440	1.360	4.480		1.760	2.070	
PO_4-P	0.210	0.270	0.260		0.280	2.020	
T-P	0.370	1.010	0.650		0.480	2.350	
O-P	0.160	0.740	0.390		0.200	0.330	
NH_4-N	0.029	0.012	0.056		0.020	0.075	
NO_2-N	0.008	0.012	0.016		0.007	0.025	
NO_3-N	0.006	<0.001	<0.001		0.001	0.001	
TIN	0.043	0.024	0.072		0.028	0.101	

Table 13-33 Water Flow Rate and Nutrient Load in Channels

Date/Items	TOMA	St.4	St.6	St.7	St.8	St.9	St.10
20/09/94							
Water Flow Rate	0.20	0.51	1.79	0.05	0.20	1.83	0.03
PO_4-P	0.86	2.16	4.49	0.19	0.95	7.43	0.07
TIN(NO_3-N)	1.56	0.44	4.63	4.17	0.52	82.80	0.03
15/12							
Water Flow Rate	dry	0.15	0.36	0	0	0.34	0
06/01							
Water Flow Rate	dry	0.59	0.05	dry	0.04	0.33	dry
18-19/01/95							
Water Flow Rate	1.44	0.2	0.03	dry	0.01	0.81	dry
25/01							
PO_4-P		0.86	1.3	dry	0.15	10.5	dry
TIN		3.70	7.16	dry	0.17	6.58	dry
01-02/02							
Water Flow Rate	1.24	0.38	0.02	dry	0	0.42	dry
PO_4-P	0.96	5.90	0.74	dry	0	5.44	dry
TIN	5.46	2.00	0.09	dry	0	1.49	dry
15/02							
PO_4-P	?	1.79	0.69	dry	0	9.07	dry
TIN	?	1.54	0.06	dry	0	3.67	dry
22/02							
Water Flow Rate	? (1.7)	? (0.7)	0.02 (Backwa rd)	dry (dry)	0 (0)	0.72 (1.8)	dry (dry)
08/03							
Water Flow Rate	1.44	0.53	0.02	dry	0	0.66	dry
23/03							
Water Flow Rate	1.46	0.82	0.52	dry	0	1.48	dry
22/03							
PO_4-P	?	2.13	15.3	dry	0	165	dry
TIN	?	13.8	7.2	dry	0	71.4	dry
06/04/95	1.52	0.70	1.22	dry	0	3.17	dry
19/04							
Water Flow Rate	?	?	?	?	?	?	?
PO_4-P							
TIN							
10/05							
Water Flow Rate	?	91	1.19	dry	0	0.7	?
PO_4-P		21.7	26.7	dry		122	
TIN		1.89	7.4	dry		6.11	

* [dry] means no water in channel. [0] means the condition under no flow.

** Load Unit : kg/day, Flow Rate : m^3/sec.

*** ( ) on the water flow rate shows the volume by rough estimation.

Table 13-34 Agricultural Production at Cerritos Village

Crops	Area(ha)	Total colones
Permanent		
Palm	100	210,000
Annual		
Rice	170	47,600
Maize	3	119
Kidney bean	2	105
Biannual		
Papaya	5	8,000
Banana	5	1,600
Pine	1	1,050
Total	286	268,474

*Unit of total colones is 1,000 colones.

Table 13-35 Catch in Fishing Zone (1993)

Itemst	Zone 1	Zone 2	Zone 3	Total(%)
Large S.	328	64	536	928(0.12)
Small S.	40419	17893	29925	88237(11.9)
Separate	20602	4059	38259	62920(8.5)
Chatarra	93410	9728	48569	151707(20.4)
Agria-Cola	10178	2834	3381	16393(2.2)
Cabrilla	24156	4389	43995	72540(9.8)
Pargo Seda	1415	1717	8906	12038(1.6)
Dorado	70936	2982	41173	115091(15.5)
Marlin B.	7082	80	2191	9353(1.3)
Marlin R.	4265	275	2767	7307(1.0)
Treacher	22035	0	9824	31859(4.3)
Pez Vera	0	0	0	0(0.0)
Pez Espada	1133	0	6001	7134(1.0)
T.P.E(1)	295959	44021	235527	575507(77.4)
Sardina	1398	7	59	1464(0.2)
Atun	6416	350	10580	17346(2.3)
T.Pela.(2)	7814	357	10639	18810(2.5)
Cazon	26442	7203	30361	64006(8.6)
Posta	34209	2915	31708	68832(9.3)
Maco	2140	484	1557	4181(0.6)
T.Ti.(3)	62791	10602	63626	137019(18.4)
A.P(1,2,3)	366564	54980	309792	731336(98.3)
Camaron B.	0	0	0	0(0.0)
Camaron C.	0	0	0	0(0.0)
Camaron R.	0	0	0	0(0.0)
Camaron F.	0	0	0	0(0.0)
Camaron Ca.	0	0	0	0(0.0)
Camaron Re.	0	0	0	0(0.0)
Camaron T.	0	0	0	0(0.0)
T.C.(4)	0	0	0	0(0.0)
Lang Pacifica	0	0	0	0(0.0)
Lang Caribe	0	0	0	0(0.0)
T.Langosta(5)	0	0	0	0(0.0)
Calamar	1825	108	744	2677(0.4)
Pulpo	0	0	0	0(0.0)
Pianguas	316	0	2885	3201(0.4)
Cambute	0	0	0	0(0.0)
T.M.(6)	2141	108	3629	5878(0.8)
B.T.(4,5,6)	2141	108	3629	5878(0.8)
Aleta Tiburon	3631	167	2963	6761(0.9)
C.T.Otros(7)	3631	167	2963	6761(0.9)
Sum	372336(50.1)	55255(7.4)	316384(42.5)	743975(100.0)

Table 13-36 Catch in Fishery at Quepos Area (Big Boat: 1993)

Items*	1	2	3	4	5	6	7	8	9	10	11	12	Total
Large S.	0	0	0	1	0	0	0	0	0	0	6	0	7
Small S.	447	3341	4676	2206	5685	3245	3124	1271	1530	2119	1671	2279	31594
Separate	1899	6499	4181	485	7218	4365	3687	2444	3592	4362	4534	5011	48277
Chatarra	3154	11406	14918	5868	8853	4687	5781	5301	7255	8309	10659	11154	97345
Agria-Cola	443	1004	927	92	67	76	52	122	293	219	82	11	3388
Cabrilla	0	32	28	0	110	80	244	0	27	207	76	2	806
Pargo Seda	0	0	27	0	0	0	0	0	0	0	0	0	27
T.P.E(1)	5943	22282	24757	8652	21933	12453	12888	9138	12697	15216	17028	18457	181444
Sardina	0	0	3000	0	0	0	0	0	0	0	0	0	3000
Atun	45	79	58	0	0	0	0	30	0	36	23	0	271
T.Pela.(2)	45	79	3058	0	0	0	0	30	0	36	23	0	3271
Cazon	32	14	160	48	1948	675	709	71	181	212	241	17	4308
Posta	0	46	109	139	293	310	1018	539	266	253	98	39	3110
Maco	176	347	171	155	0	0	0	0	0	0	0	0	849
T.Ti.(3)	208	407	440	342	2241	958	1727	610	447	465	339	56	8267
A.P(1,2,3)	6196	22768	28255	8994	24174	13438	14615	9778	13144	15717	17390	18513	192982
Camaron B.	935	2818	1744	809	688	520	516	579	3302	2773	3441	5558	23683
Camaron C.	949	632	935	162	797	4	44	0	0	65	199	7	3794
Camaron R.	5113	14569	28060	22440	28778	21222	22540	20364	11622	7820	5767	10810	199105
Camaron F.	1287	5485	3677	5549	4410	15225	17351	10262	10366	18642	13491	10562	118307
Camaron Ca.	0	790	5137	22321	25154	0	15624	14262	1439	36043	3863	0	124633
Camaron Re.	0	0	0	0	363	0	0	0	192	0	1460	241	2256
Camaron T.	1363	1736	330	1218	237	968	2468	4515	10955	11808	12157	10341	58094
T.C.(4)	9647	26028	41883	52499	60427	37039	58543	49982	37876	77151	40378	37519	529872
Calamar	0	0	0	0	0	0	0	0	0	0	43	0	43
Pianguas	0	0	0	0	0	0	0	0	0	0	0	0	0
T.M.(6)	0	0	0	0	0	0	0	0	0	0	43	0	43
B.T.(4,5,6)	9647	26028	41883	52499	60427	37939	58543	49982	37876	77151	40421	37519	529915
Sum	15843	48796	70138	61493	84601	51377	73158	59760	51020	92868	57811	56032	722897

*Large S= , Small S= , Separate= , Chatarra=Diversas Agri-Cola=Micropogon altipinnis, Cynoscion jamaicensis, Cabrilla=Epinephelus sp. , Pargo Seda=Lutjanus jordani, Centropomus , sp., Dorado=Coryphaena hippurus, Marlin(1)=Makaria indica, Marlin(2)=Tetrapturus audax, Makaria mazara, Treacher= Alopias supersiliosus, Pez Espada=Makaria sp., Sardina=Opisthonema oglinum, Atun=Thunnus albacares, Cazon=Carcharkinus leucas-C. limbatus, Posta=Sphyrnidae , Charcharinidae, Maco=Alpidae, Camaron TiTi=Xiphopenaus riveti , Calamar=Loligo spp., Pianguas=Andara tuberculosa, Aleta, Aleta Tiburon= , Camaron B. = Penaeus vannamei, Camaron C. =Penaeus californiensis, Camaron R. =Penaeus occidentalis, Camaron F. =Solenocera agasizii, Camaron Ca. =Heterocarpus vicarius, Camaron Re. =

13-90

Table 13-37 Catch in Fishery at Quepos Area (Small Boat: 1993)

Items#	1	2	3	4	5	6	7	8	9	10	11	12	Total
Large S.	74	147	92	218	122	273	1062	447	9	94	0	164	2702
Small S.	17679	20849	18758	12559	7032	11360	20999	11344	752	10297	1669	4225	137521
Separate	9929	9505	12298	14551	11824	4809	6007	4591	2686	7013	4381	5875	93473
Chatarra	20716	36410	27835	32519	22064	12162	27179	12252	4937	12893	4953	1587	215507
Agria-Cola	2747	2965	3012	4714	1746	1207	5821	2175	80	1812	23	57	26359
Cabrilla	8805	17562	13967	15079	11310	5819	5696	7034	3984	11263	6127	9487	116133
Pargo Seda	118	2073	6997	1938	792	229	3	158	412	312	11136	11823	35871
Dorado	13331	14424	27798	30582	19305	9649	18913	11098	3322	10327	3921	7726	170394
Marlin(1)	210	377	115	1864	5025	1759	5888	2761	1519	920	687	161	21286
Marlin(2)	128	579	900	3013	1955	729	941	680	478	1470	1589	379	12841
Treacher	182	2252	8589	5975	8305	6556	8421	8237	3158	6119	4673	1361	63828
Pez espada	292	6329	467	12	0	36	149	17	0	16	22	0	7337
T.P.E(1)	74211	113473	120718	123022	89480	54588	101079	60792	21337	62536	39181	42835	903252
Sardina	1100	246	28	20	70	0	13	0	0	55	0	0	1532
Atun	1965	2530	4291	3240	1807	3510	664	505	1538	193	263	151	20657
T.Pela.(2)	3065	2776	4319	3260	1877	3510	677	505	1538	248	263	151	22189
Cazon	5444	15100	5710	12946	7704	17103	17309	20390	11862	15572	9128	9311	147579
Posta	3959	12085	8215	21458	14389	8723	15725	6439	2577	8366	5247	5723	112900
Maco	747	984	1653	52	744	0	1275	272	0	93	43	0	5863
T.Ti.(3)	10150	28169	15576	34456	22837	25826	34309	27101	14439	24031	14418	15038	266350
A.P(1,2,3)	87426	144418	140813	160738	114194	83924	136065	88398	37314	88815	53862	58024	1191791
Camaron titi	0	0	0	0	0	0	0	0	0	29	0	0	29
T.C.(4)	0	0	0	0	0	0	0	0	0	29	0	0	29
Calamar	0	1185	163	617	537	173	151	123	0	0	0	0	2949
Pianguas	750	757	316	746	96	521	537	3483	320	5333	512	985	14374
T.M.(6)	750	1942	479	1381	633	694	688	3606	320	5333	512	985	17323
B.T.(4,5,6)	750	1942	479	1381	633	694	688	3606	320	5362	512	985	17352
Aleta.T	108	662	2116	1842	1112	919	82	1785	0	1	0	0	8627
C.T.O.(7)	108	662	2116	1842	1112	919	82	1785	0	1	0	0	8627
Sum	88284	147022	143208	163961	115939	85537	136835	93789	37643	92178	54374	59009	1217770

#Large S= , Small S= , Separate= , Chatarra=Diversas
Agri-Cola=Micropogon altipinnis, Cynoscion jamaicensis, Cabrilla=Epinephelus sp.
, Pargo Seda=Lutjanus jordani, Centropomus , sp., Dorado=Coryphaena hippurus,
Marlin(1)=Makaria indica, Marlin(2)=Tetrapturus audax, Makaria mazara, Treacher=
Alopias supersiliosus, Pez Espada=Makaria sp., Sardina=Opisthonema oglinum,
Atun=Thunnus albacares, Cazon=Carcharkinus leucas-C. limbatus, Posta=Sphyrnidae
, Charcharinidae, Maco=Alpidae, Camaron TiTi=Xiphopenaus riveti
, Calamar=Loligo spp., Pianguas=Andara tuberculosa, Aleta.
Aleta Tiburon= , Camaron B.= Penaeus vannamei, Camaron C.=Penaeus
californiensis, Camaron R.=Penaeus occidentalis, Camaron P.=Solenocera agasizii,
Camaron Ca.=Heterocarpus vicarius, Camaron Re.=

Table 13-38 Scale of Work

Items	Description	Civil Works	
Care of River			
Diversion Tunnel	D=6.0 m, L=225 m	Tunnel Ex. Lining conc.	8,800 m3 2,200 m3
Cofferdam	Upsteam H=20.5 m Downstream H=11.5 m	Concrete Concrete	3,400 m3 1,200 m3
Dam	Concrete gravity dam H=62.4 m, L=114.0 m	Excavation Concrete	58,100 m3 89,200 m3
Power Intake	Inclined type Qmax. =27 m3/sec	Excavation Concrete	9,250 m3 1,000 m3
Headrace Tunnel	Pressure tunnel Qmax. =27 m3/sec D=3.1 m, L=5540 m	Tunnel Ex. Lining conc.	69,200 m3 24,600 m3
Surge Tank	Restric Oriffice type Shaft D=8.0 m	Shaft Ex. Lining conc.	3,700 m3 1,100 m3
Penstock	Embedded type D=3.1～2.2 m L=1540*1 Line D=1.25 m L= 26*2 Lines	Tunnel Ex. Lining conc.	19,500 m3 10,900 m3
Powerhouse	Outdoor type W=21 m*L=39 m*H28.5 m	Excavation Concrete	60,200 m3 6,800 m3
Tailrace	Open channel W=20 m, L=43 m	Excavation Concrete	1,400 m3 2,200 m3
Switchyard	Out door type 20 m*120 m	Excavation Concrete	9,300 m3 6,200 m3

Table 13-39 Main equipment to be used

1. Equipment for Dam Construction

Name	Specification	Power (ps)	Weight (ton)	Number
Excavation works				
Bull dozer	20～30 ton class	160～290	20～40	4
Wheel loader	Bucket 2 m3	155	12.4	4
Dump truck	20～30 ton class	290～430	20～30	8
Crawler drill	Drifter 180 kg Air consump. 17m3/min		5.1	2
Leg drill	Jack 40 kg class Air consump. 3 m3/min		0.04	8
Compressor	Discharge 21 m3/min	195	4.1	2
Water pump	Discharge 0.5 m3/min	3.7 KW	0.2	2
Concrete works				
1) Quarry				
Bull dozer	30 ton class	290	40	2
Wheel loader	Bucket 2 m3	155	12.4	4
Dump truck	30 ton class	430	27	3
Crawler drill	Drifter 180 kg Air consump. 17m3/min			
Compressor	Discharge 9 m3/min	75 KW	2.6	1
Water pump	Discharge 0.5 m3/min	3.7 KW	0.2	1

Name	Specification	Power (ps)	Weight (ton)	Number
2) Crashing plant (50～130 ton/hr)				
Joe crasher	Entrance 100x120 cm	130 KW	90	1
Corn crasher	Mantle 130 cm	95 KW	29	2
Rod mill	Drum 210x360 cm	190	55	1
Vib. feeder		5	3	3
Apron feeder	150x400 cm	8	21	1
Belt-conveyer, others				1
Water pump	Q-4 m3/min, h=30 m	37	0.75	3
3) Batching plant (60～100 m3/hr)				
Mixer	Autmation, Forced mixing type 1.5 m 60 m3/hr	82 KW	63.4	1
Cement silo	500 ton	0.75KW	38	2
Water pump	Q-4 m3/sec, h=30 m	37 KW	0.75	2
4) Transportation (60 m3/hr)				
Truck mixer	3.0 m3	220	7.4	5
Incline	3.0 m3			1
5) Placing (60 m3/hr)				
Diesel car	6 ton class	78	6	2
Dolly	Capa. 3 m3	--	4.5	2
Cable crane	One tower swing Capa. 13.5 ton	514 KW	303	1
	Fixed type Capa. 3 ton	67 KW	33	1

Name	Specification	Power (ps)	Weight (ton)	Number
Bucket	Capa. 3 m3	--	--	2
Vibrator	LS			
Water pump	Capa. 2 m3/min	110KW	1	2
6) Cooling works				
Cooling plant	Refrigerating plant Capa. 200 JRT	180 KW	5.4	1
7) Grouting works				
Boring machine	Capa. 27 m/min	5 KW	0.3	2
Grout pump	Capa. 30-70 lt/min	3.7 KW	0.2	2
Grout mixer	Mixer 200 liter	2·	0.2	2

2. Equipment for Headrace Tunnel (For half section of the tunnel btween Adit B and Adit-C)

Name	Specification	Power (ps)	Weight (ton)	Number
Excavation Works				
(1) Drilling works				
Drill jambo, 2 booms, Rail type				
Air driving	Drifter 90 kg	49.3	7.0	1
Compressor	Stationary type 22 m3/hr	125 KW	--	1
(2) Mucking works				
Tractor loader, Rail type Air driving	Bucket 0.35m3	18.0	8.5	1
Train loader	Capa. 15 m3 Gauge 762 or 914mm	18 ps/or 24 KW	16.8	1
Cherry picker				1
(3) Transportation works (Inside of the tunnel)				
Battry car	10 ton car	54.4 KW	12.4	2
Torlley	Capa. 4.5 m3	--	3.2	5
Chiplar				1
(4) Supporting works				
Shotcrete	Capa. 4 m3/hr	30.0	0.6	1
Concrete plant (NATM)	Portable type Capa. 10 m3/hr	20.4 KW	7.5	1
(5) Transportation works (Outside of the tunnel)				
Dump truck	Capa. 11 ton	240.00	11.00	2
(6) Disporsal area				
Bull dozer	Capa. 20 ton	160.00	16.20	1

Name	Specification	Power (ps)	Weight (ton)	Number
Lining concrete works				
Concrete plant	Capa. 10 m3/hr Tilting mixer	7.5 KW	7.4	1
Cement silo	Capa. 50 ton	0.75 KW	6.2	1
Concrete pump	Capa. 10 m3/hr	22 KW	1.4	1
Agitator car	Capa. 3 m3/hr	11 KW	4.0	1
Crashing plant	Capa. 120m3/hr	Common use		1
Consolidation grouting works (Around Tunne).				
Drilling	Boring machine	10.0	0.44	1
Grout pump				1
Grout mixer				1
Mortar injection works (Gap between lining conc. and rock)				
Grout pump	0.8-1.2 m3/hr	25.0	3.1	1
Grout mixer	---			1