TABLE F.2.2 (1) EXISTING FLOOD AND DEBRIS CONTROL FACILITIES

A. Drainage Canal/

River/Canal (RV)	Location (LO)	Length(m) (LN)	Dimension(DM)				Construction(CO)		Remarks (RM)
			B1(m)	B2(m)	H1(m)	S	Agency(A)	Date(D)	
Canal Montanuela Cuabanos	C1	5.000	5,00	14,00	3,00	1,50	C.V.S	1992	
Canal Copen-Higuero Cuabanos	C2	11.390	21,00	28,50	2,50	1,50	C.V.S	1992	
		5.000	10,00	18,25	2,75	1,50	SECOPT	1990	
Canal San Roque Cuabanos	C3	690	21,00	28,50	2,50	1,50	C.V.S	1992	
		3.810					SECOPT	N.A	
Canal San Roque	C4	6.500	15,00	20,00	2,50	1,00	SECOPT	1992	
Canal Cotepe	C5	4.000	22,00	28,00	2,00	1,50	SECOPT	1990	

B.Embankment/

River/Canal /etc. (RV)	Location (LO)	Length(m) (LN)	Dimension(DM)				Construction(CO)		Remarks (RM)
			B1(m)	H(m)	S1	S2	Agency(A)	Date(D)	
Rio Chamelecon	E1	1.800	2,5	3,0/3,5	2	1,5	TELA R.C	*1930	
	E2	37.800	2,5	3,0/3,5	2	1,5	TELA R.C	*1930	
	E3	6.200	2,5	3,0/3,5	2	1,5	TELA R.C	1988	
	E4	5.500	2,5	3,0/3,5	2	1,5	TELA R.C	1988	
	E5	2.760	4	5,1	2	2	SECOPT	1991	
Rio Choloma	Ec1	3.000	3,0/4,0	3,0/4,0	2	2	SECOPT	1991	
	Ec2	1.000	3,5	2,5	3	2	SECOPT	1975	
	Ec3	1.000	4,5/6,0	2,5	3	3	SECOPT	1975	
Rio Blanco-Canal San Roqe	Eb1	1.000	2,5	3,5	1,5	1,5	SECOPT	1969	
	Eb2	1.000	2	2	1,5	1,5	Private	1970	
	Eb3	3.940	10	3,8	5	3	MUNICIP.	1978	
	Eb4	4.365	10	4	5	3	MUNICIP.	1978	
		3.425	10	4	3	3	SECOPT	1978	
	Eb5	2.400	5	2	3	3	MUNICIP.	1978	
	Eb6	3.400	5	2	3	3	MUNICIP.	1978	
Rio El Sauce	Es1	1.800	2	1,5	2	2	MUNICIP.	1978	
	Es2	5.000	10	4	2	2	SECOPT	1992	
		13.500	10	2,0/4,0	3	3	MUNICIP.	1977	
	Es3	11.890	10	3,0/4,0	3	3	MUNICIP.	1977	
	Es4	5.590	10	3,0/4,0	3	3	MUNICIP.	1977	
	Es5	6.300	10	2,0/4,0	3	3	MUNICIP.	1977	
Rio El Sauce(viejo)-Chotepe	Ev1	7.000	3,5/4,0	3,0/4,0	2	2	SECOPT	1979/1992	
	Ev2	2.800	3	3	2	2	SECOPT	1979	
	Ev3	2.200	10	1,8/4,3	5	5	MUNICIP.	1977	
	Ev4	700	10	4,0/4,2	5	5	MUNICIP.	1977	
Lima Airport	Ea	11.500	4	4	2	2	SECOPT	1981/1990	

Note/Nota:

1.(RV):River/Canal
2.(LO):Location/
3.(LN):Length/
4.(DM): Dimension/
5.(CO):Construction/
(A):Agency/
(D):Date/
C.V.S:Commission Sula Valley
MUNICIP.:Municipality of SanPedro Sula
TELA R.C:TELA Railway Company
6.(RM):Remarks/

:* Approximately

TABLE F.2.2 (2) EXISTING FLOOD AND DEBRIS CONTROL FACILITIES

C. Sabo Dam

River/Canal (RV)	Location (LO)	Elevation (EL)	Dimension(DM)		Construction(CO)		Remarks (RM)
			L(m)	H(m)	Agency(A)	Date(D)	
Rio La Jutosa	SD1	274	84	11	SECOPT	1984	

D. Water Intake

River/Canal (RV)	Location (LO)	Elevation (EL)	Dimension(DM)		Construction(CO)		Remarks (RM)
			L(m)	H(m)	Agency(A)	Date(D)	
Rio Santa Ana	W1	N.A	15	3,5	MUNICIP.	N.A	
Rio Piedras	W2	N.A	21,6	3,5	MUNICIP.	N.A	

E. River Crossing Roads (Concrete)/DISPERSION WORK

River/Canal (RV)	Location (LO)	Elevation (EL)	Dimension(DM)			Construction(CO)		Remarks (RM)
			L(m)	B(m)	H(m)	Agency(A)	Date(D)	
Rio Choloma	Rc1	N.A	9,1	5,5	0,6	Patronato	1990	
Rio Blanco	Dp1	N.A	56	1,6	1,2	MUNICIP.	1978	
Rio Zapotal	Rz1	N.A	46	8,4	0,8	MUNICIP.	1978	
Rio El Sause	Rs1	N.A	38,6	8,1	1,8	MUNICIP.	1977	
Rio Santa Ana	Ra1	N.A	50	4	0,6	MUNICIP.	1977	
	Ra2	N.A	20	9	0,6	MUNICIP.	1977	
	Ra3	N.A	24	4.2	0.65	MUNICIP.	1977	
Rio Piedras	Rp1	N.A	38	8	0,6	MUNICIP.	1992	
	Rp2	N.A	34,5	9,3	0,8	MUNICIP.	1977	

Note/Nota:

1.(RV):River/Canal
2.(LO):Location/
3.(LN):Length/
4.(DM): Dimension/
5.(CO):Construction/
(A):Agency/
(D):Date/
C.V.S:Commission Sula Valley
MUNICIP.:Municipality of SanPedro Sula
TELA R.C:TELA Railway Company
6.(RM):Remarks/
7.N.A:Data is not Available
8.Choloma .M:Choloma Municipality

TABLE F.2.3 (1) WATER LEVEL CALCULATION FOR PROBABLE DISCHARGE

1)Rio Choloma (UNIT:EL.M)

STA.km	Distance(m)	100-YEAR	50-YEAR	30-YEAR	10-YEAR	5-YEAR	2-YEAR
*11.25	0	12.00	12.00	12.00	12.00	12.00	12.00
12.23	750	13.55	13.30	13.14	12.74	12.47	12.11
13.08	850	15.61	15.45	15.33	15.00	14.71	14.15
14.28	1200	19.52	19.37	19.25	18.90	18.57	17.84
15.28	1000	21.90	21.73	21.60	21.23	20.90	20.28
16.28	1000	25.52	25.37	25.25	24.91	24.61	23.64
17.08	800	28.66	28.49	28.36	28.01	27.69	27.02
18.28	1200	32.05	31.89	31.77	31.44	31.15	30.78
*19.08	800	36.10	35.78	35.55	34.84	34.17	32.73
19.58	500	39.43	39.07	38.80	38.07	37.45	36.40
20.08	500	42.34	42.10	41.89	41.39	40.92	40.11
20.58	500	45.17	44.89	44.65	44.01	43.37	42.04
21.08	500	48.59	48.26	47.97	47.24	46.55	45.23
21.78	700	54.24	53.94	53.68	53.04	52.44	51.30
22.08	500	57.52	57.25	57.01	56.42	55.86	54.84
22.58	500	61.42	61.24	61.09	60.70	60.34	59.64
*22.98	400	65.96	65.81	65.66	65.31	64.97	64.33

Note: *

1) Sta 11.25 :Junction of Canal San Roqe
2) Sta 19.08 :Road Bridge (Sabo Control Point)
3) Sta 22.98 :Junction of Tributaries (Sub -Control Point)

(UNIT:M3/S)

STA.	100-YEAR	50-YEAR	30-YEAR	10-YEAR	5-YEAR	2-YEAR
11.25-19.08	890	790	720	530	380	150
19.08-22.98	690	620	560	420	300	120

TABLE F.2.3 (2) WATER LEVEL CALCULATION FOR PROBABLE DISCHARGE

2) CANAL SAN ROQUE - RIO BLANCO (UNIT:EL.M)

STA.	Distance	100-YEAR	50-YEAR	30-YEAR	10-YEAR	5-YEAR	2-YEAR
CANAL SAN ROQUE							
*0	0	12.00	12.00	12.00	12.00	12.00	12.00
1.00	1000	13.00	12.80	12.66	12.36	12.19	12.03
2.10	1100	13.46	13.22	13.04	12.63	12.35	12.06
3.20	1100	13.96	13.70	13.49	12.97	12.58	12.11
4.10	900	14.33	14.04	13.82	13.25	12.79	12.17
5.00	900	14.71	14.41	14.17	13.54	13.02	12.24
5.70	700	15.01	14.71	14.46	13.83	13.29	12.41
6.40	700	15.43	15.13	14.88	14.22	13.66	12.63
Qda San Agustin : No Data available Sta.6.4~9.8 (Assumed Cross Section B=60m)							
6.40	0	15.43	15.13	14.88	14.22	13.66	12.63
8.00	1600	16.05	15.75	15.50	14.88	14.33	13.30
9.00	1000	18.50	18.28	18.10	17.66	17.24	16.49
9.80	800	22.66	22.47	22.30	21.86	21.44	20.53
9.80	0	22.66	22.47	22.30	21.86	21.44	20.53
10.30	500	24.77	24.53	24.32	23.79	23.24	21.99
10.80	500	26.38	26.14	25.93	25.41	24.89	23.78
11.30	500	29.04	28.74	28.48	27.83	27.20	25.87
11.80	500	31.44	30.96	30.57	29.62	28.77	27.11
12.30	500	32.96	32.64	32.38	31.75	31.19	30.00
12.80	500	37.05	36.65	36.32	35.48	34.61	32.94
13.07	270	37.64	37.24	36.90	36.09	35.33	33.83
13.57	500	44.20	43.78	43.42	42.59	41.76	40.15
*14.07	500	48.53	48.16	47.87	47.19	46.67	45.74
(LAGUNA EL CARMEN)							
18.90	0	48.00	48.00	48.00	48.00	48.00	48.00
19.70	800	51.46	51.35	51.26	51.05	50.87	50.43
20.50	800	56.16	56.04	55.93	55.64	55.36	54.77
21.40	900	59.51	59.37	59.24	58.94	58.67	58.08
22.40	1000	62.95	62.77	62.61	62.21	61.80	60.64
*23.45	1050	65.30	65.15	65.03	64.77	64.51	63.80
24.45	1000	69.62	69.48	69.37	69.11	68.85	68.18
25.45	1000	75.33	75.19	75.03	74.70	74.38	73.60

PROBABLE DISCHARGE DISTRIBUTION

(UNIT:M3/S)

STA.	100-YEAR	50-YEAR	30-YEAR	10-YEAR	5-YEAR	2-YEAR
0.00-6.40	1250	1110	1000	730	520	200
6.40-9.80	1000	890	800	590	420	160
9.80-14.07	880	780	700	520	370	140
18.90-21.40	740	660	590	440	320	120
21.40-25.45	680	600	540	410	300	110

Note: *

1) Sta 0.00 :Junction of Rio Choloma
2) Sta 14.07 :Outlet of Lake El Carmen
3) Sta 23.45 :Near the Road Bridge (Subo Control Point)

TABLE F.2.3 (3) WATER LEVEL CALCULATION FOR PROBABLE DISCHARGE

3) Rio El Sauce (UNIT:EL.M)

STA.	Distance(m)	100-YEAR	50-YEAR	30-YEAR	10-YEAR	5-YEAR	2-YEAR
*0	0	26.00	26.00	26.00	26.00	26.00	26.00
1.60	1200	27.11	26.78	26.64	26.36	26.19	26.03
2.80	1200	27.60	27.18	27.00	26.61	26.34	26.05
3.90	1100	28.37	27.93	27.74	27.30	26.92	26.29
4.90	1000	29.66	29.28	29.11	28.70	28.33	27.58
5.90	1000	31.39	31.12	31.00	30.71	30.45	29.87
6.90	1000	33.01	32.79	32.68	32.40	32.12	31.56
7.90	1000	35.61	35.47	35.41	35.26	35.12	34.73
8.50	600	39.04	38.87	38.80	38.60	38.40	37.88
9.00	500	41.49	41.19	41.01	40.59	40.18	39.37
9.75	750	43.55	43.28	43.15	42.83	42.54	41.88
10.75	1000	47.63	47.35	47.21	46.84	46.52	45.73
11.55	800	49.26	48.96	48.81	48.43	48.09	47.25
*12.6	1050	52.90	52.66	52.52	52.19	51.88	51.12
13.55	950	56.00	55.71	55.56	55.18	54.83	54.07
*14.6	1050	58.90	58.54	58.38	57.98	57.62	56.78

PROBABLE DISCHARGE DISTRIBUTION

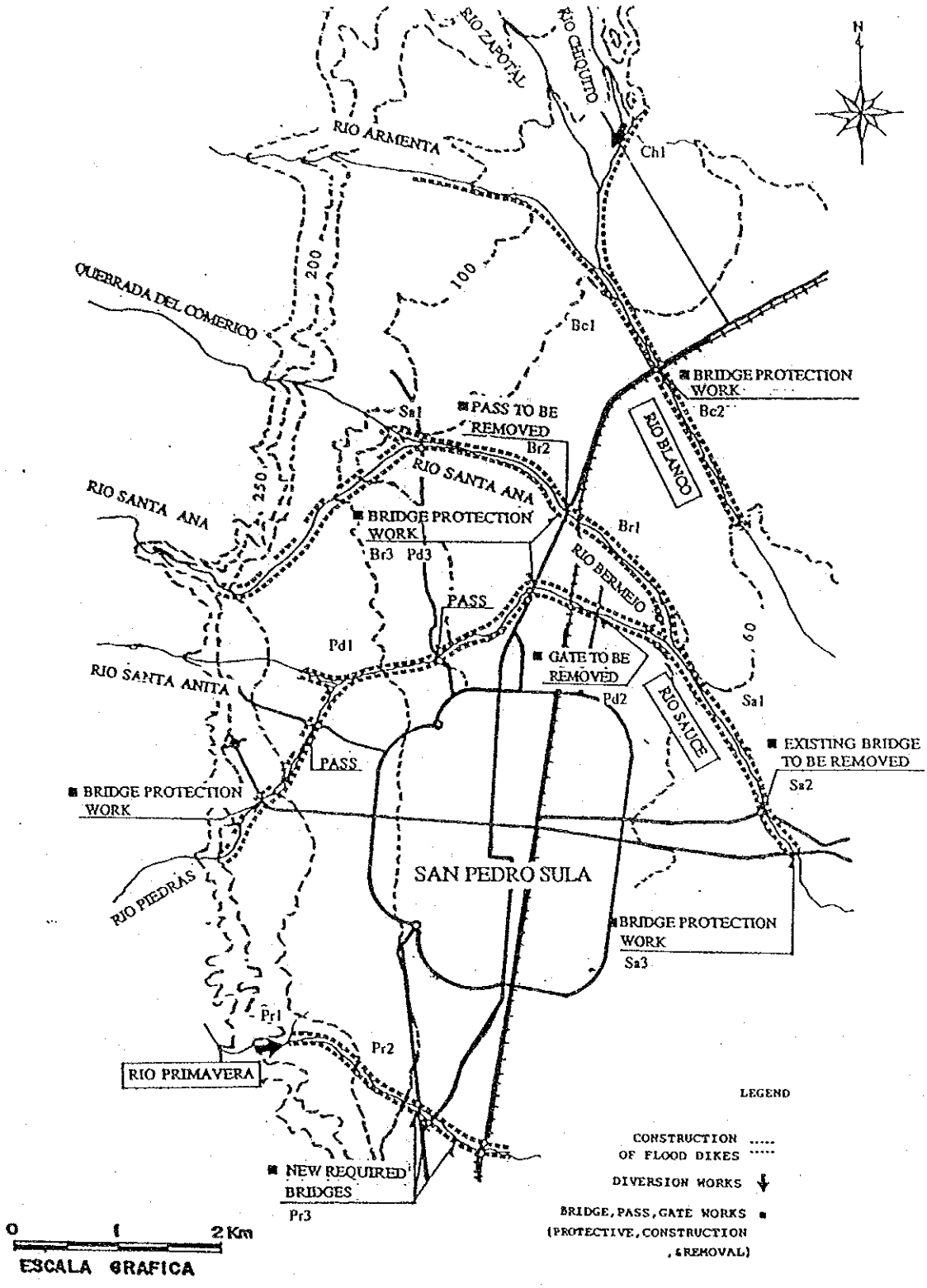
(UNIT:M3/S)

STA.	100-YEAR	50-YEAR	30-YEAR	10-YEAR	5-YEAR	2-YEAR
0.00	1480	1310	1180	860	610	230
1.60-12.60	890	790	710	530	380	140
12.60-14.60	690	610	530	410	300	110

Note: *

1) Sta 0.00 :Junction of Rio Chamelecon
2) Sta 12.60 :Road crossing
3) Sta 14.6 :Junction of Tributaries

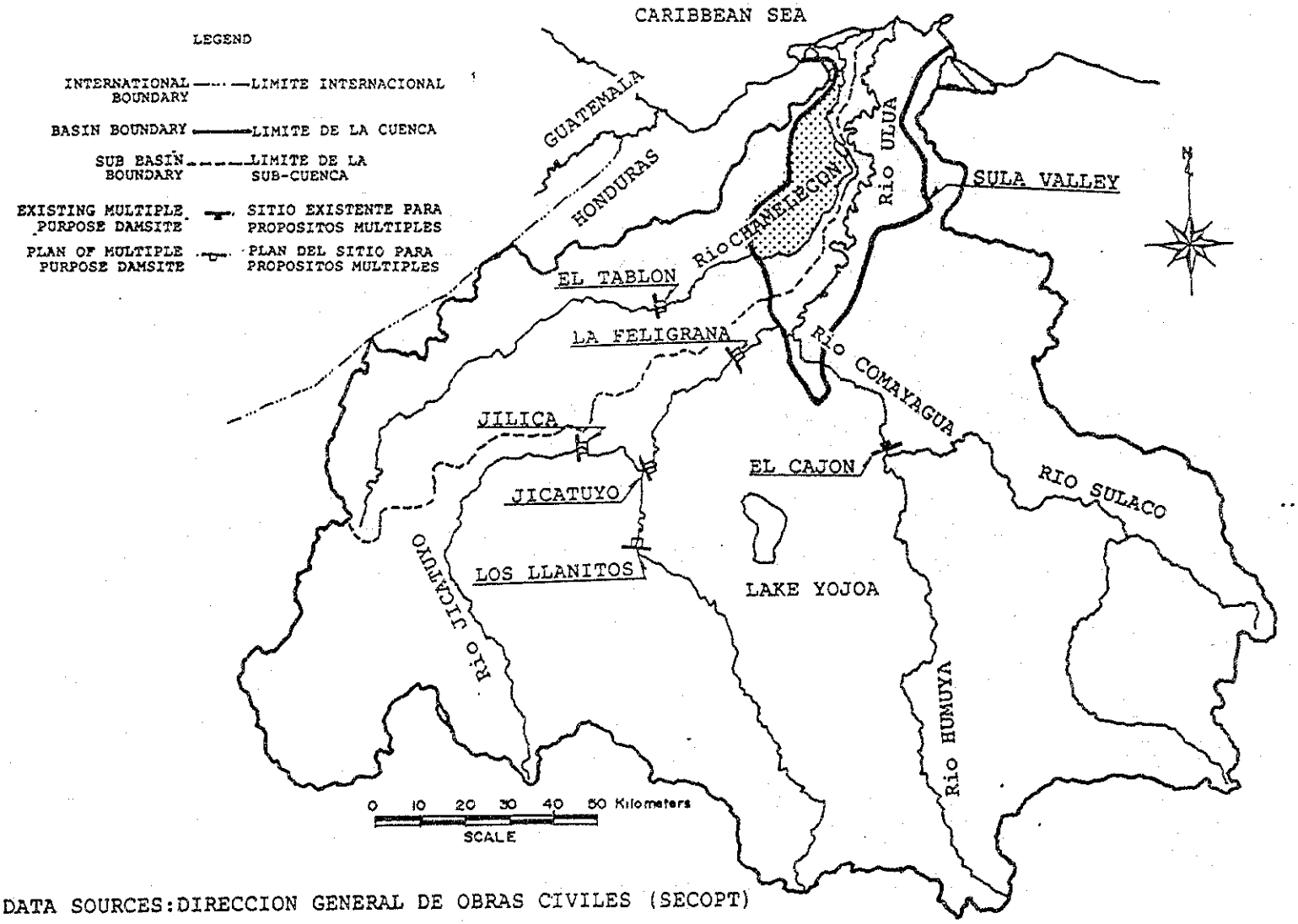
FIGURES



SOURCES: RIVER TRAINING AND FLOOD CONTROL PROTECTION STUDY BY SIR WILLIAM HALCROW & PARTNERS (1975)

RECOMMENDED PROJECT WORKS

FIG. F.2.1 RECOMMENDED PROJECT WORKS BY SIR WILLIAM HALCROW & PARTNERS (1975)



DATA SOURCES: DIRECCION GENERAL DE OBRAS CIVILES (SECOPT)
TRIBUTARY BASINS OF THE SULA VALLEY

FIG.F.2.2 RECOMMENDED DAM PLANS OF THE HARZA-CINSA STUDY (1979)

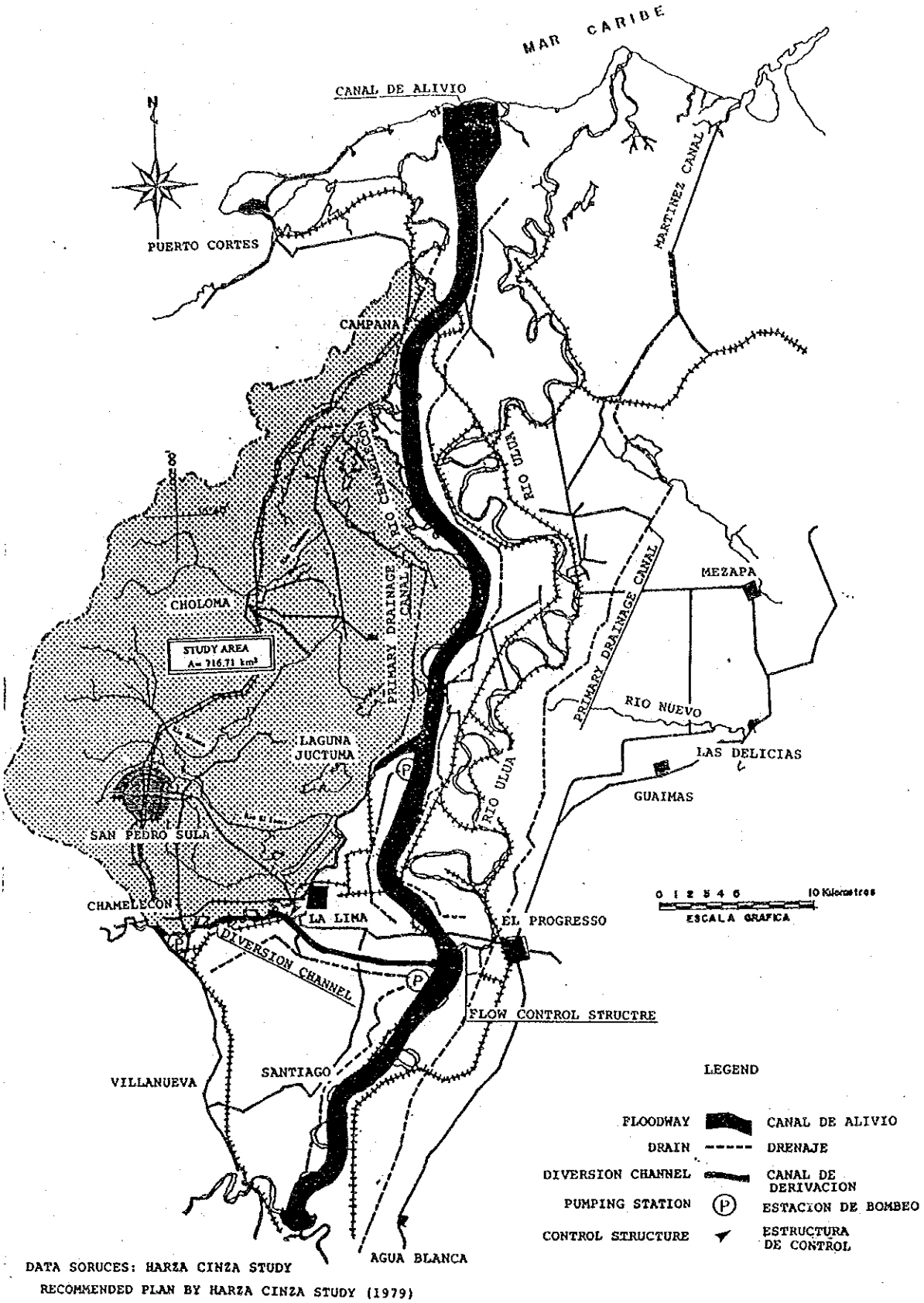


FIG.F.2.3 RECOMMENDED FLOODWAY AND DRAINAGE PLAN BY HARZA-CINSA STUDY (1979)

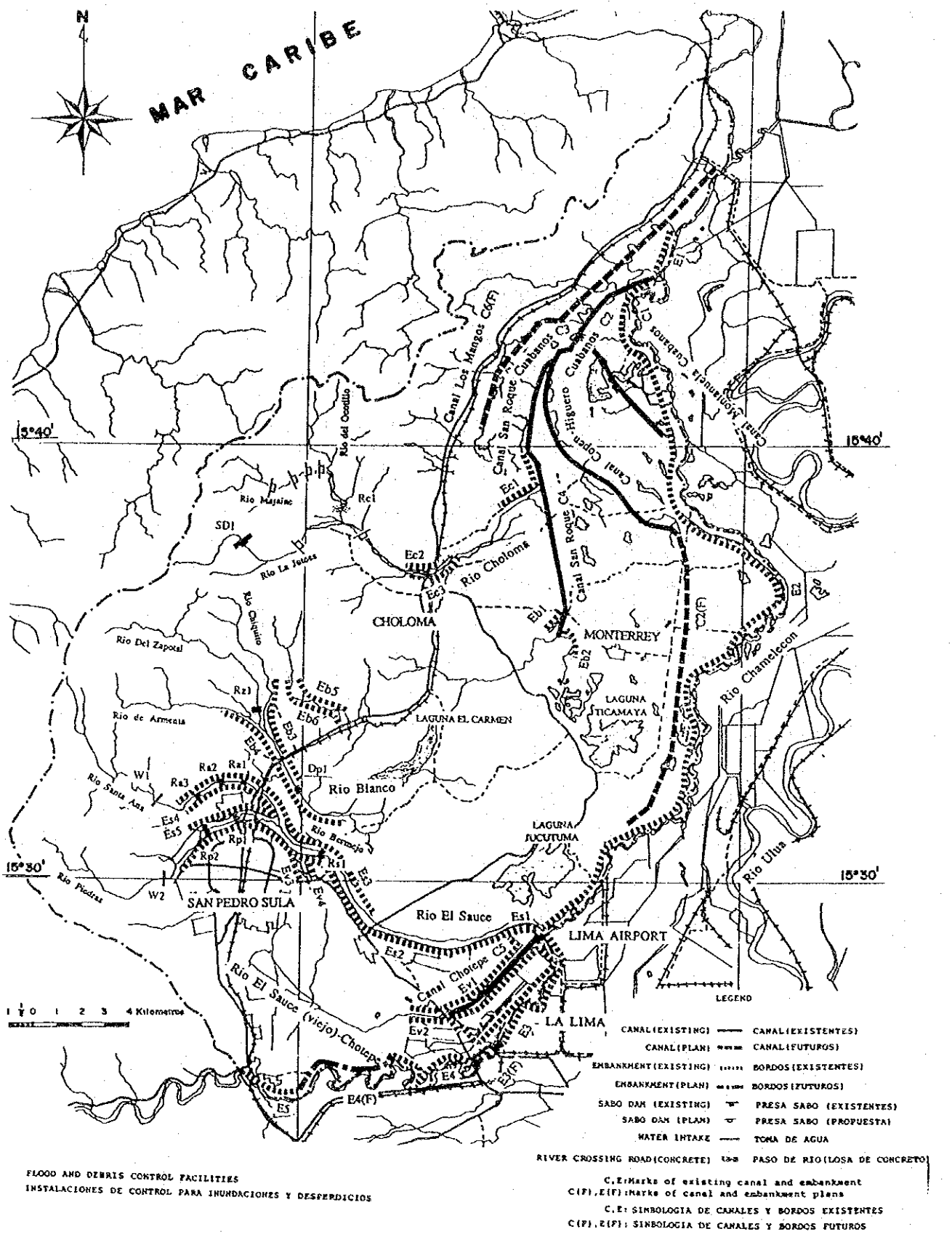


FIG. F.2.4 EXISTING FLOOD CONTROL FACILITIES AND FACILITIES PLANS

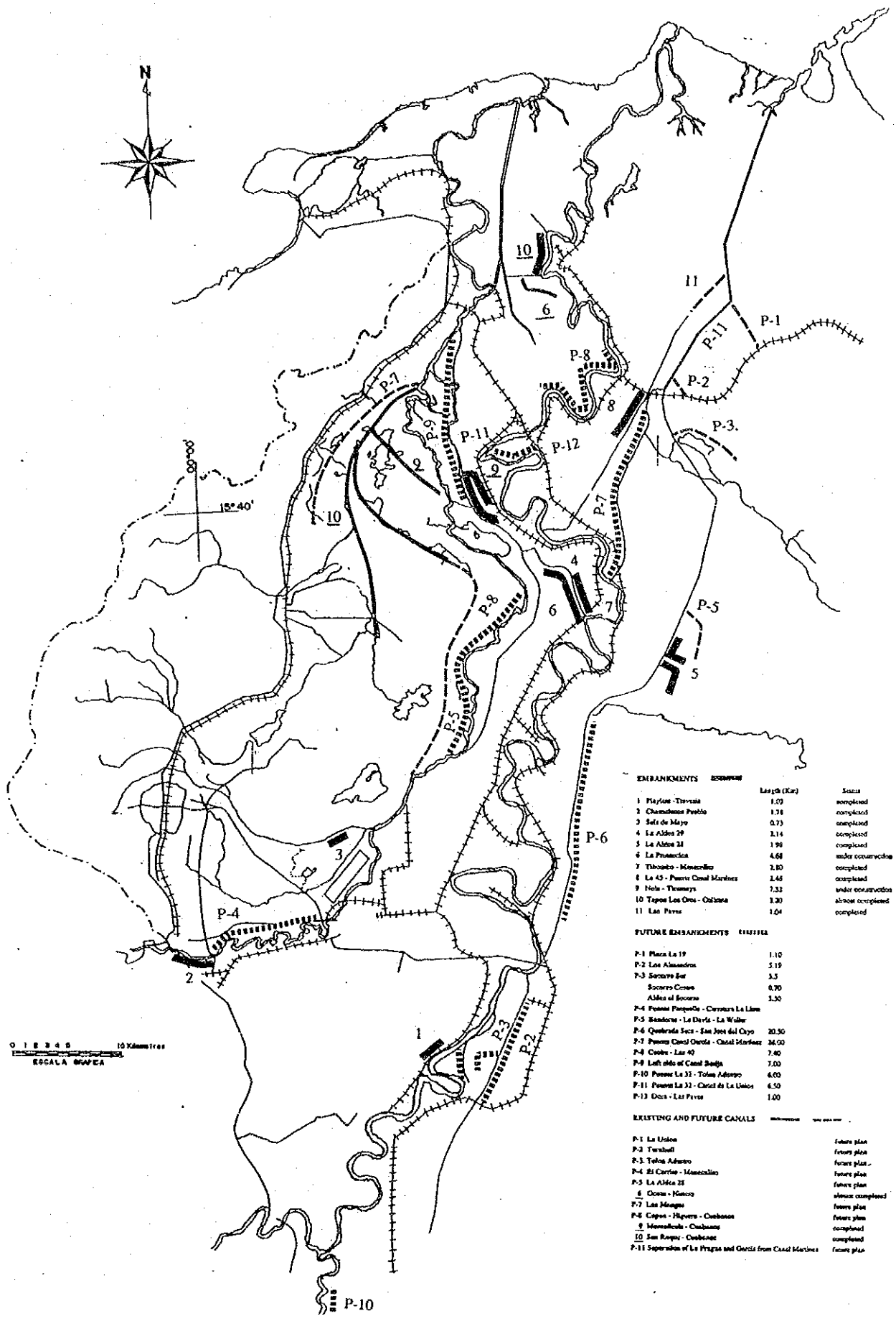


FIG. F.2.5 PROJECTS UNDER SULA VALLEY COMMITTEE

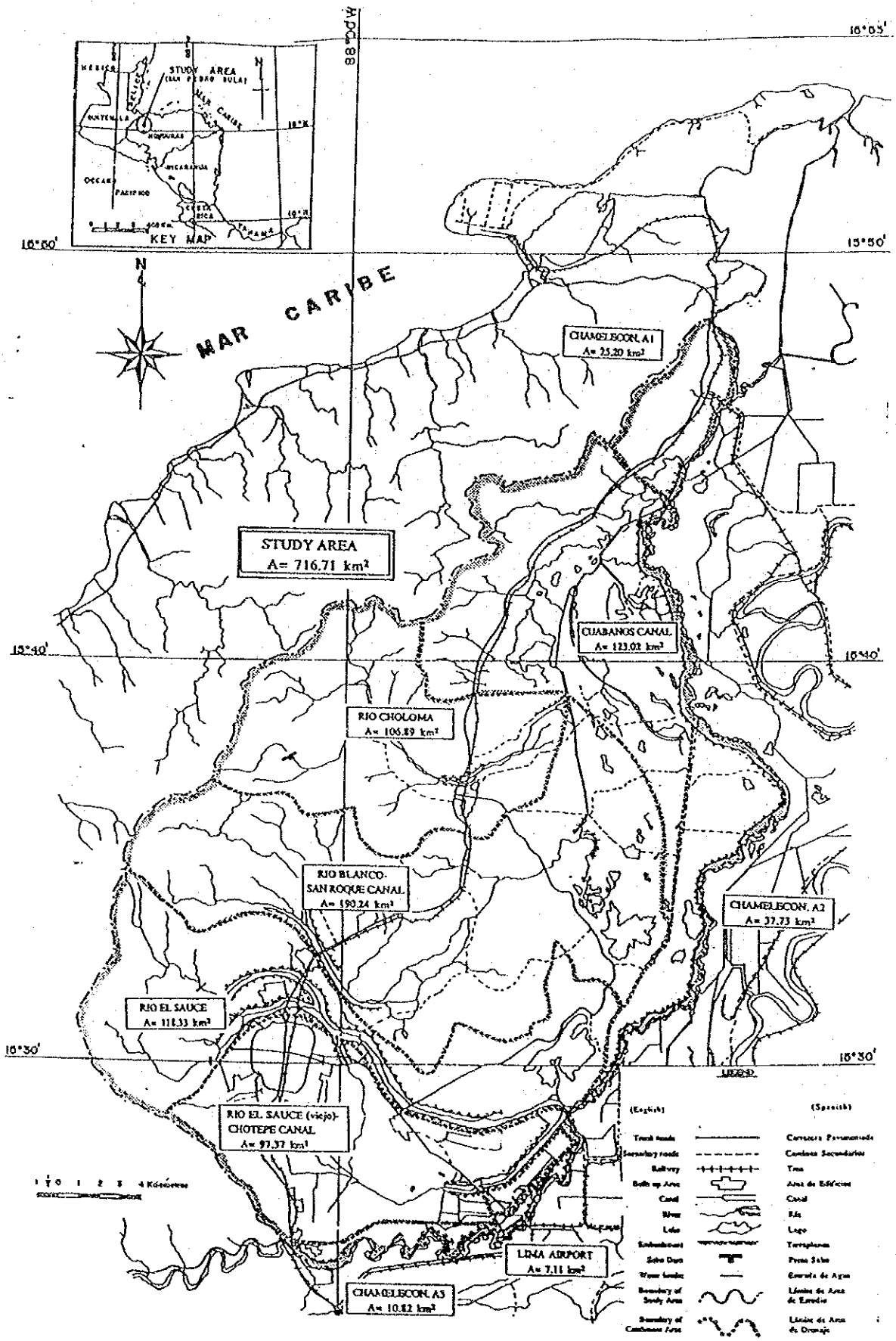


FIG. F.2.6 RIVER SYSTEM OF THE STUDY AREA

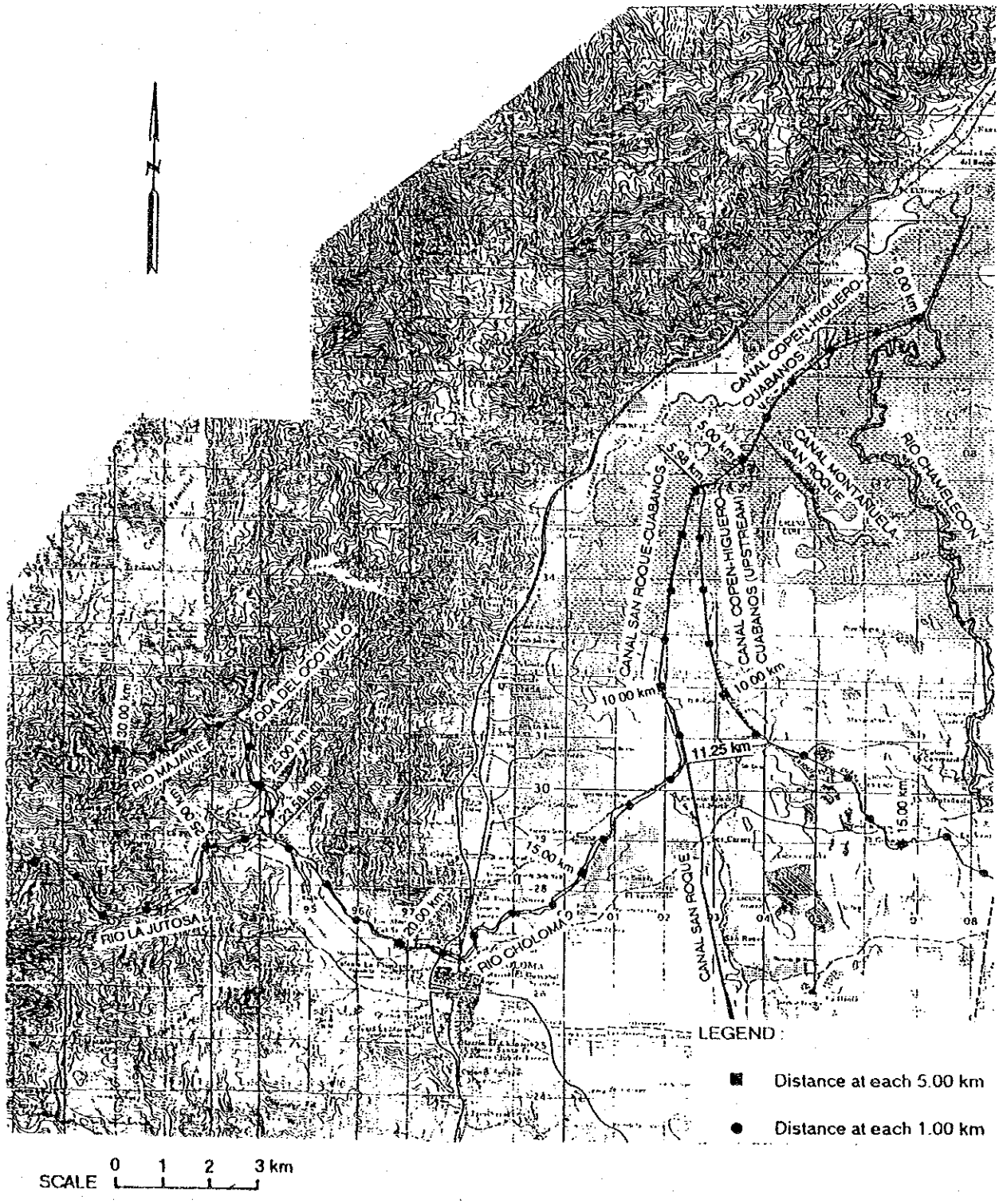


FIG. F.2.7 (1) RIVER SYSTEM OF THE RIO CHOLOMA AND THE DOWNSTREAM CANALS

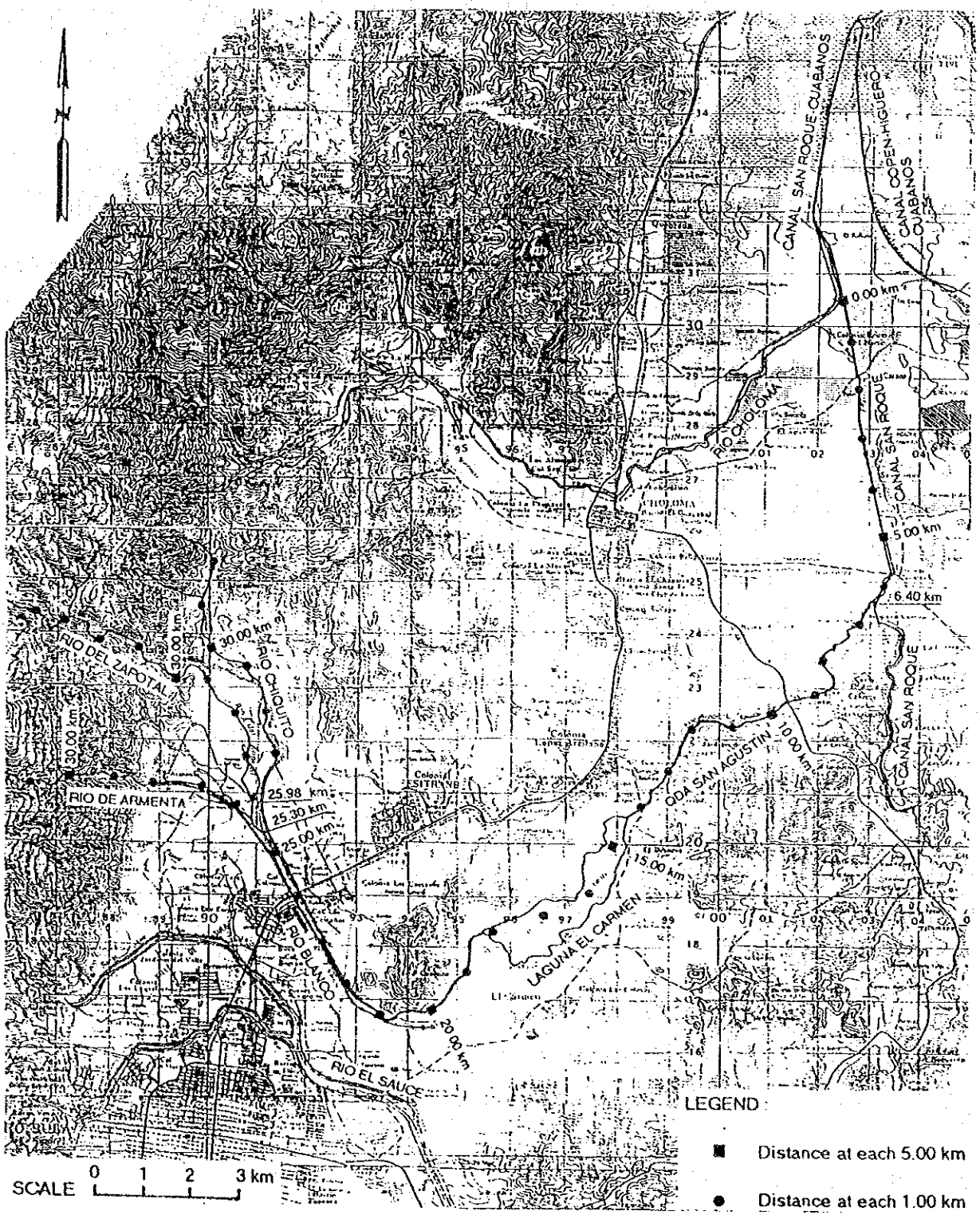


FIG. F.2.7 (2) RIVER SYSTEM OF THE RIO BLANCO AND THE CANAL SAN ROQUE

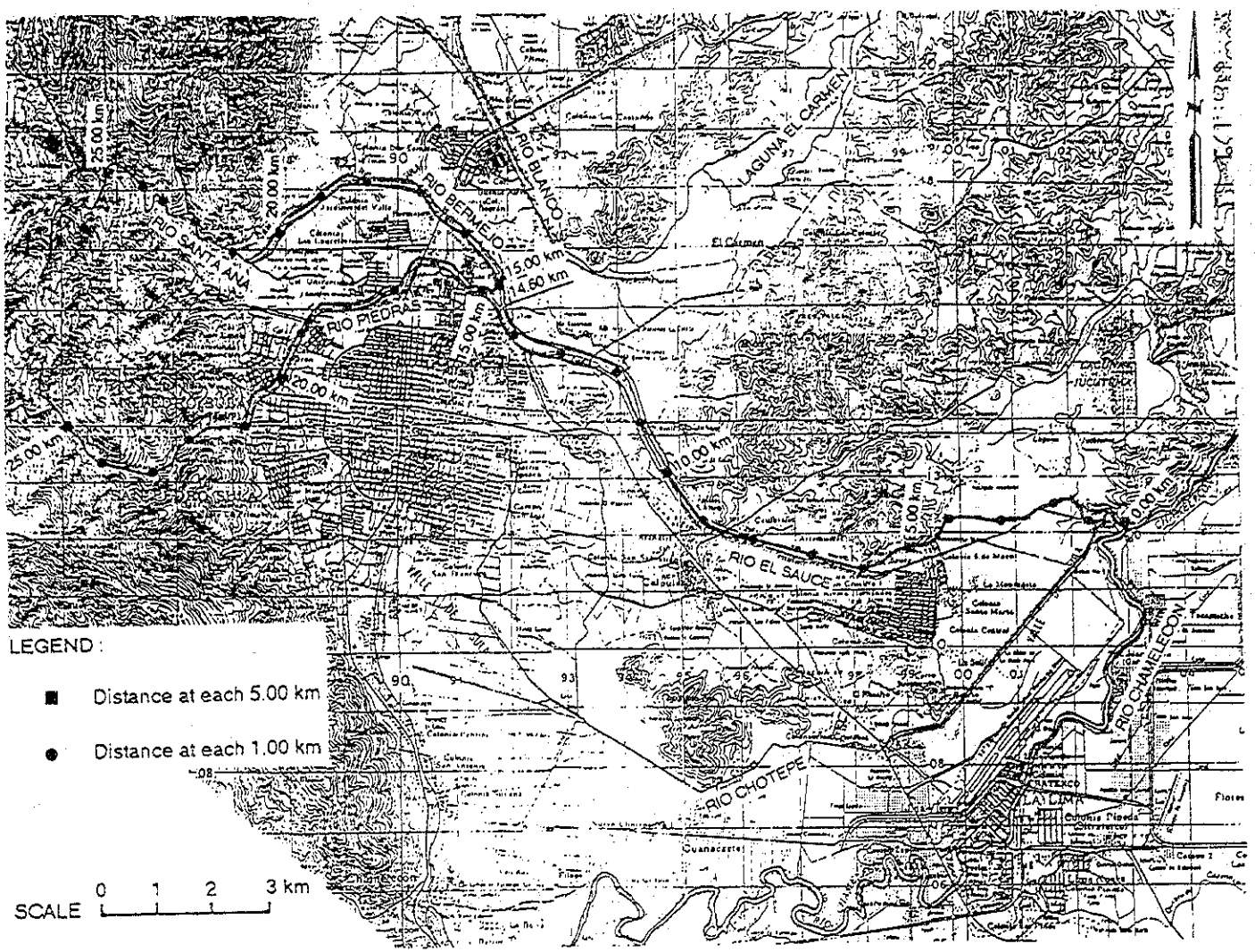


FIG. F.2.7 (3) RIVER SYSTEM OF THE RIO EL SAUCE

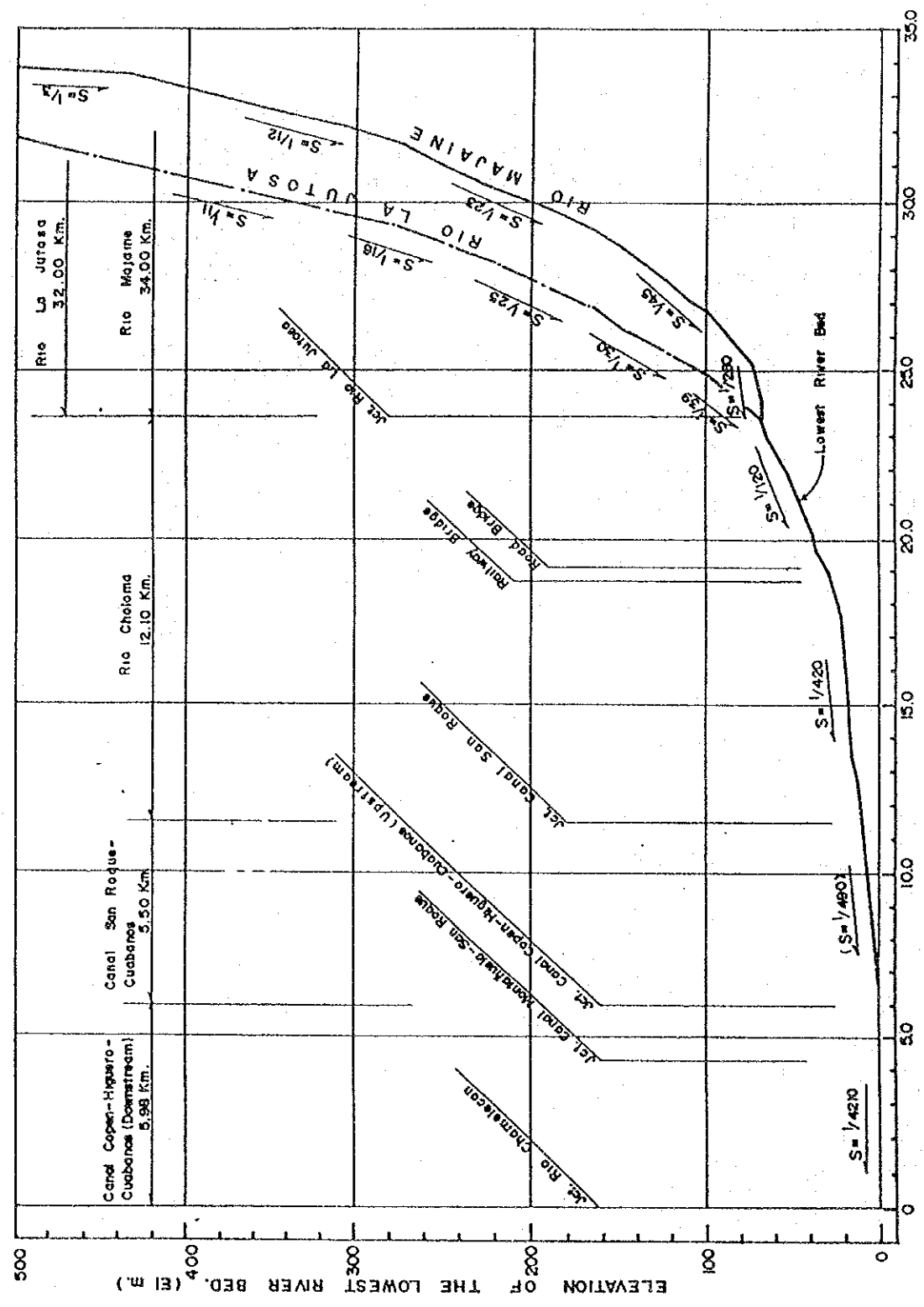


FIG. F.2.8 (1) LONGITUDINAL PROFILE OF THE RIO CHOLOMA AND THE DOWNSTREAM CANALS

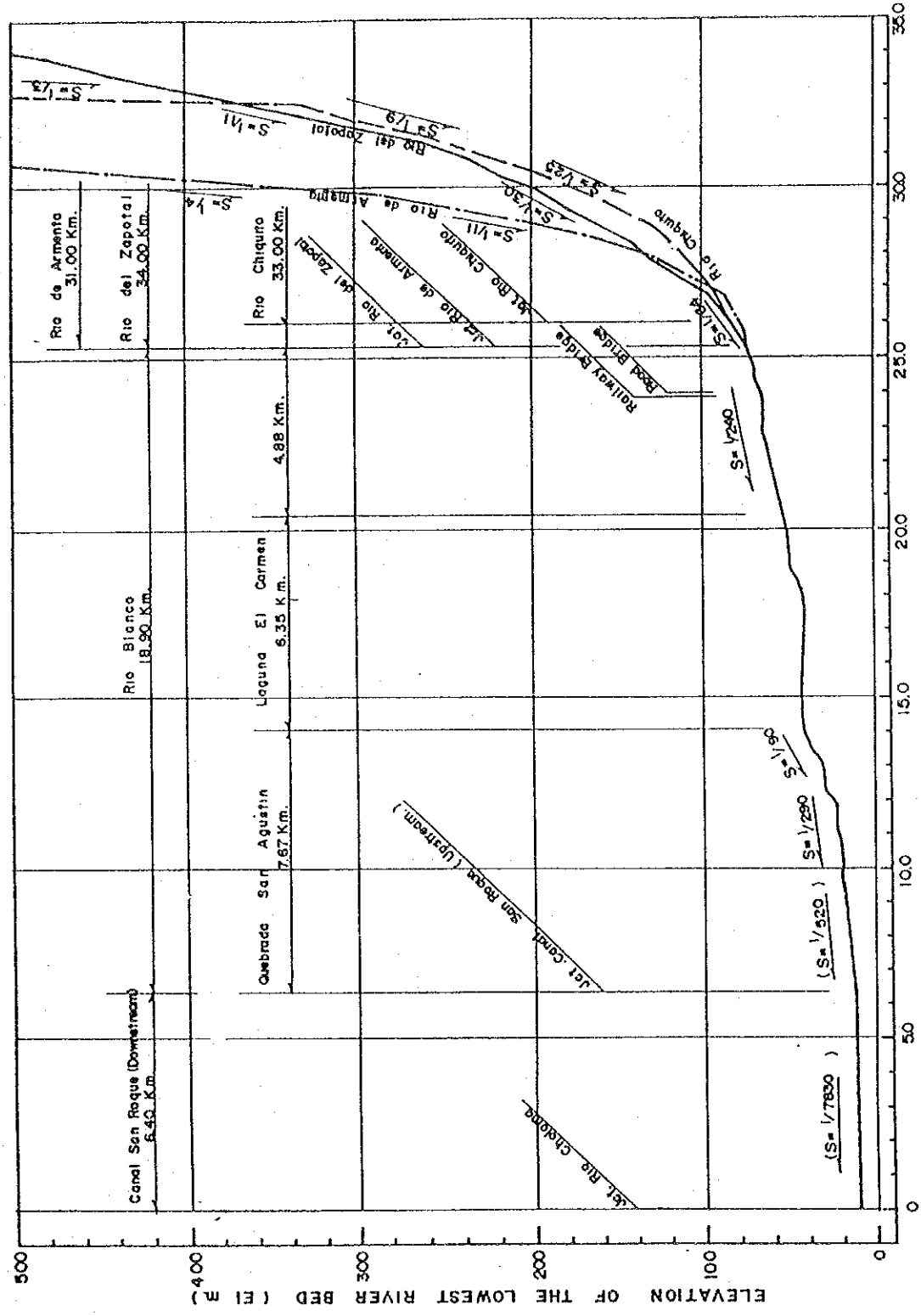


FIG. F.2.8 (2) LONGITUDINAL PROFILE OF THE RIO BLANCO AND THE CANAL SAN ROQUE

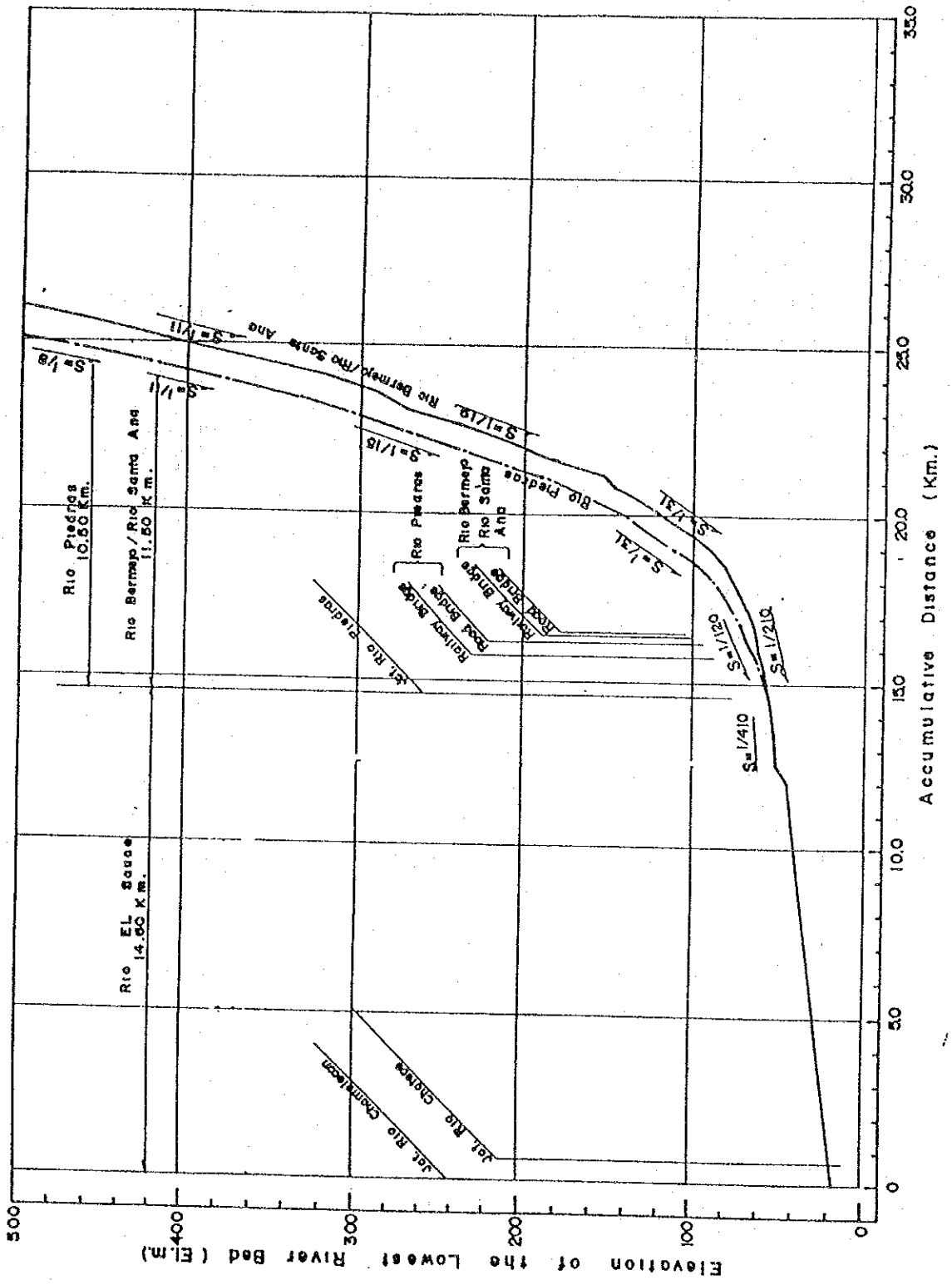


FIG. F.2.8 (3) LONGITUDINAL PROFILE OF THE RIO EL SAUCE

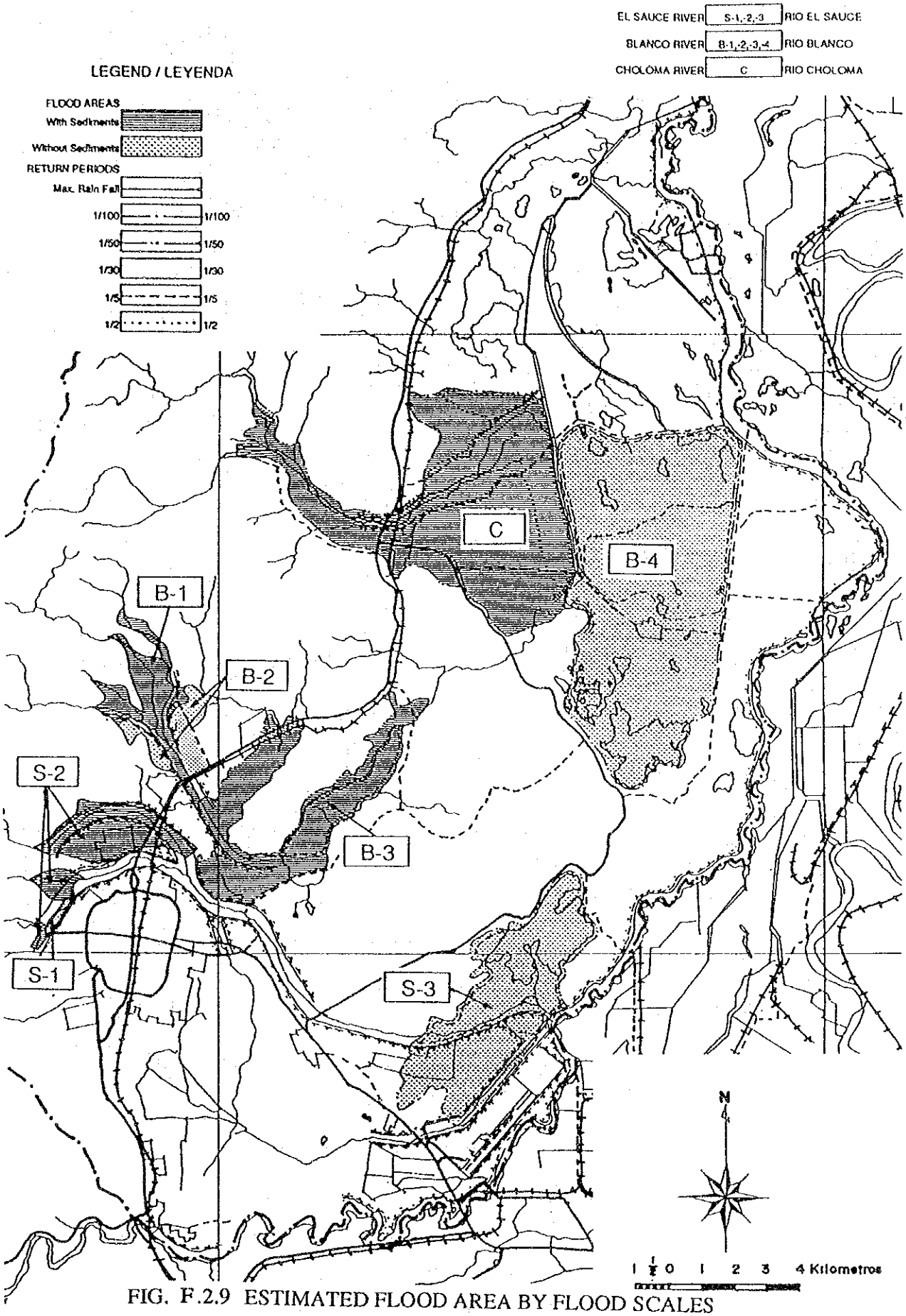


FIG. F.2.9 ESTIMATED FLOOD AREA BY FLOOD SCALES

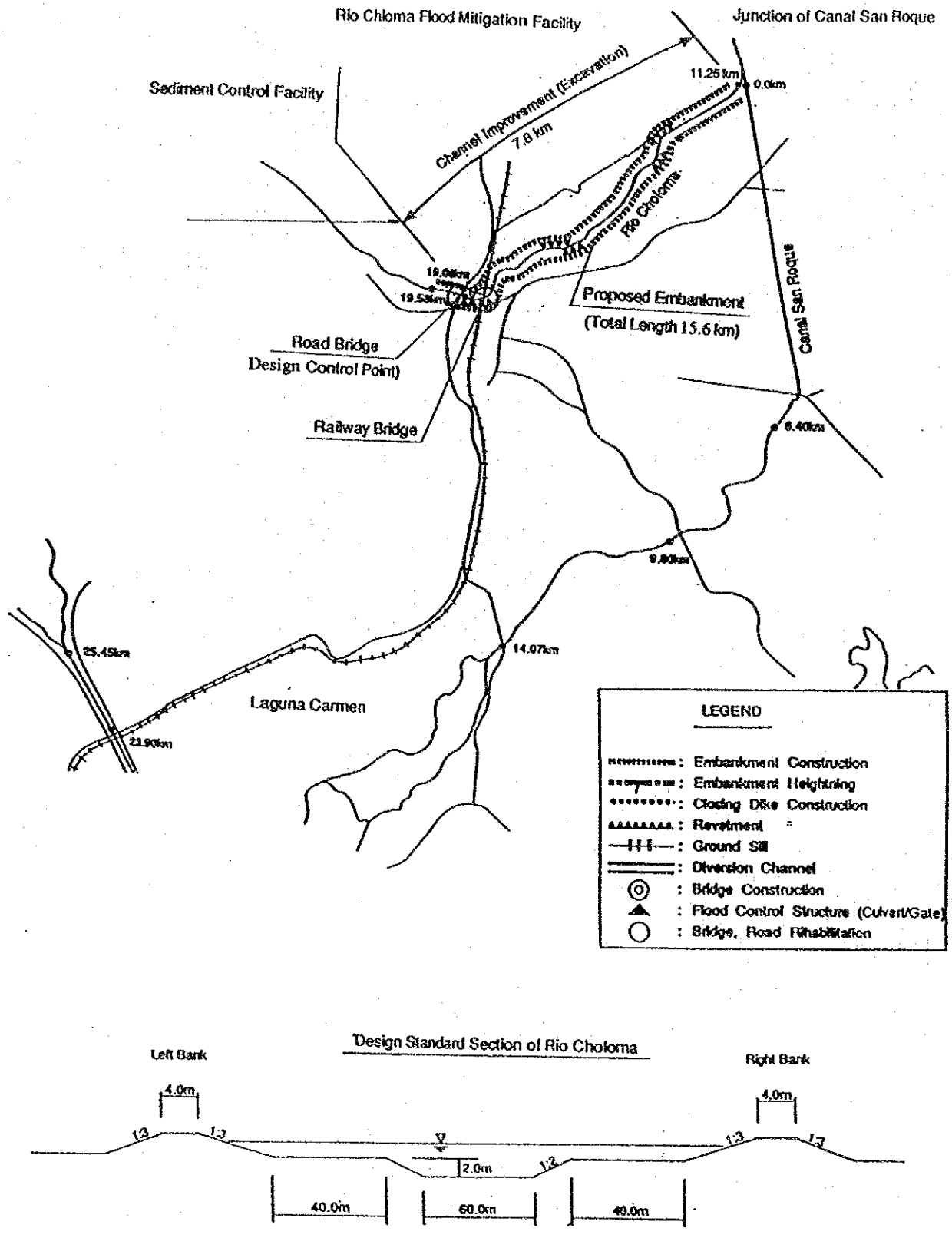


FIG. F.2.10 PROPOSED FLOOD MITIGATION FACILITIES AND DESIGN CROSS SECTION OF THE RIO CHOLOMA

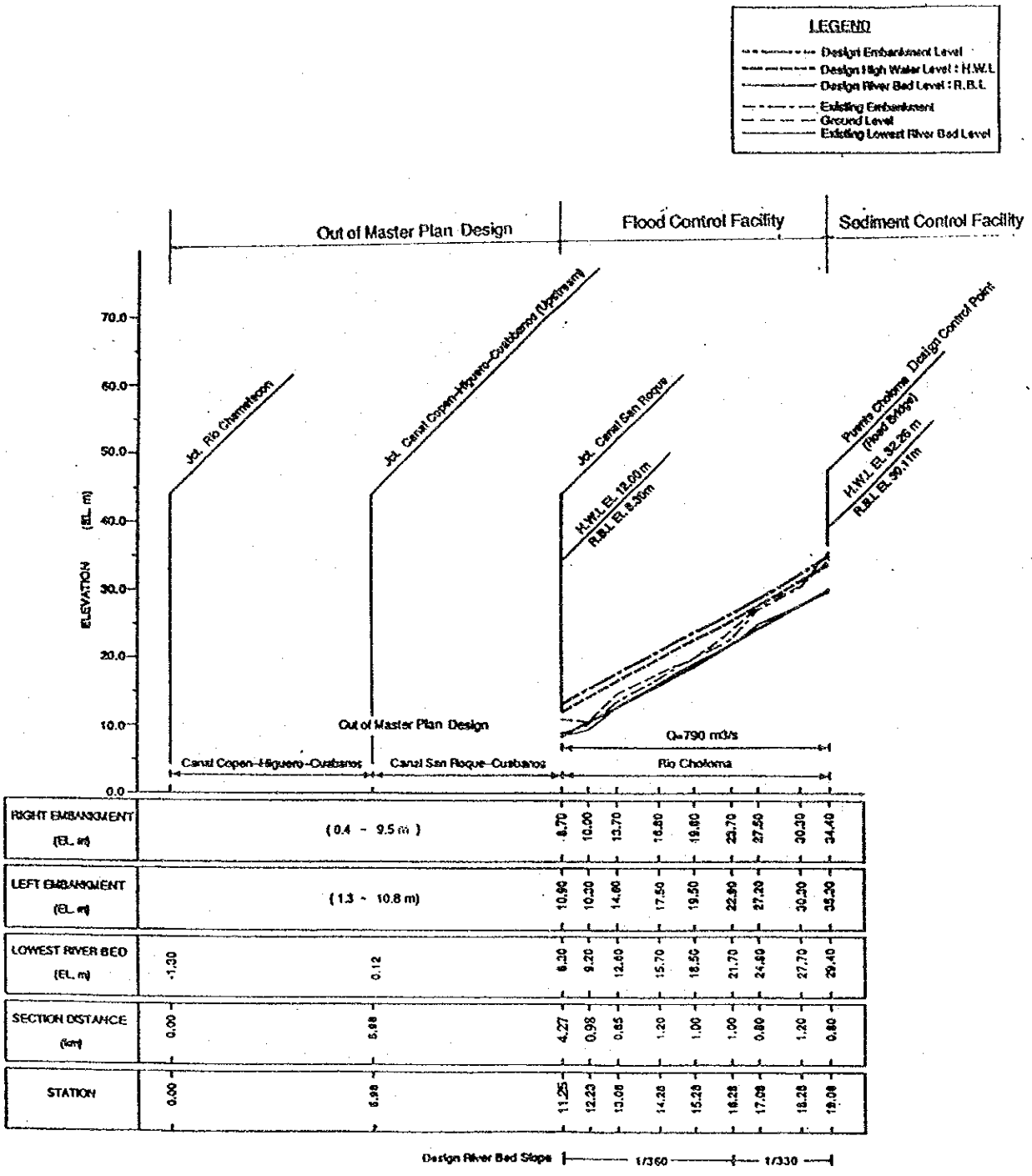
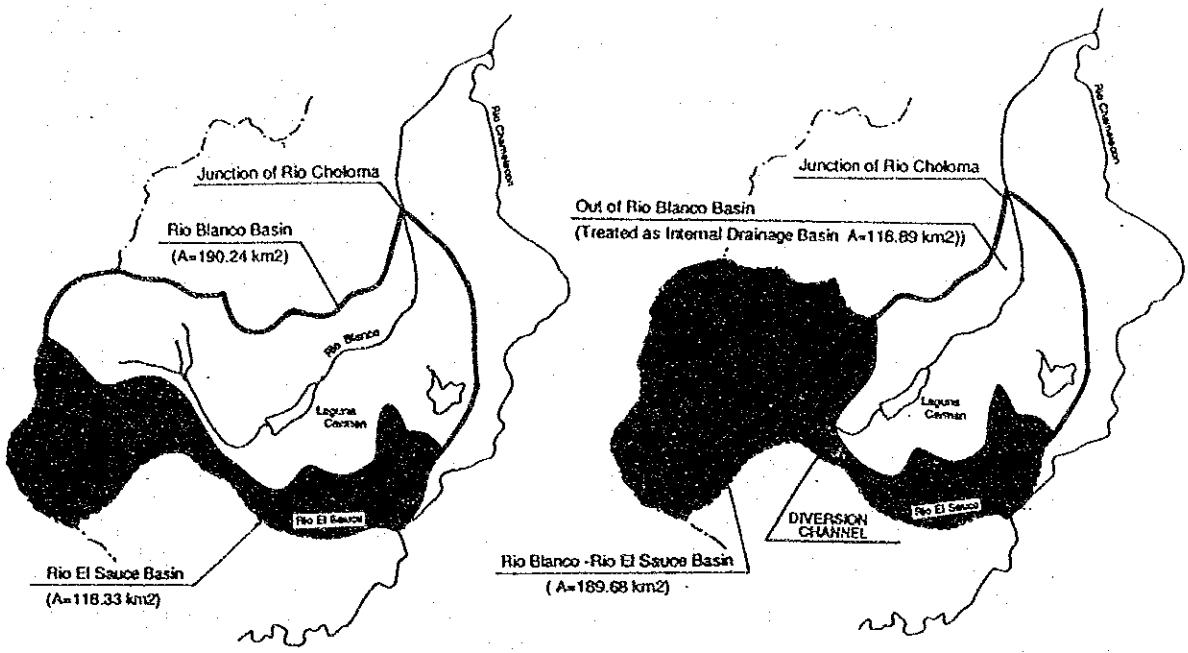


FIG. F.2.11 DESIGN LONGITUDINAL SECTION OF THE RIO CHOLOMA



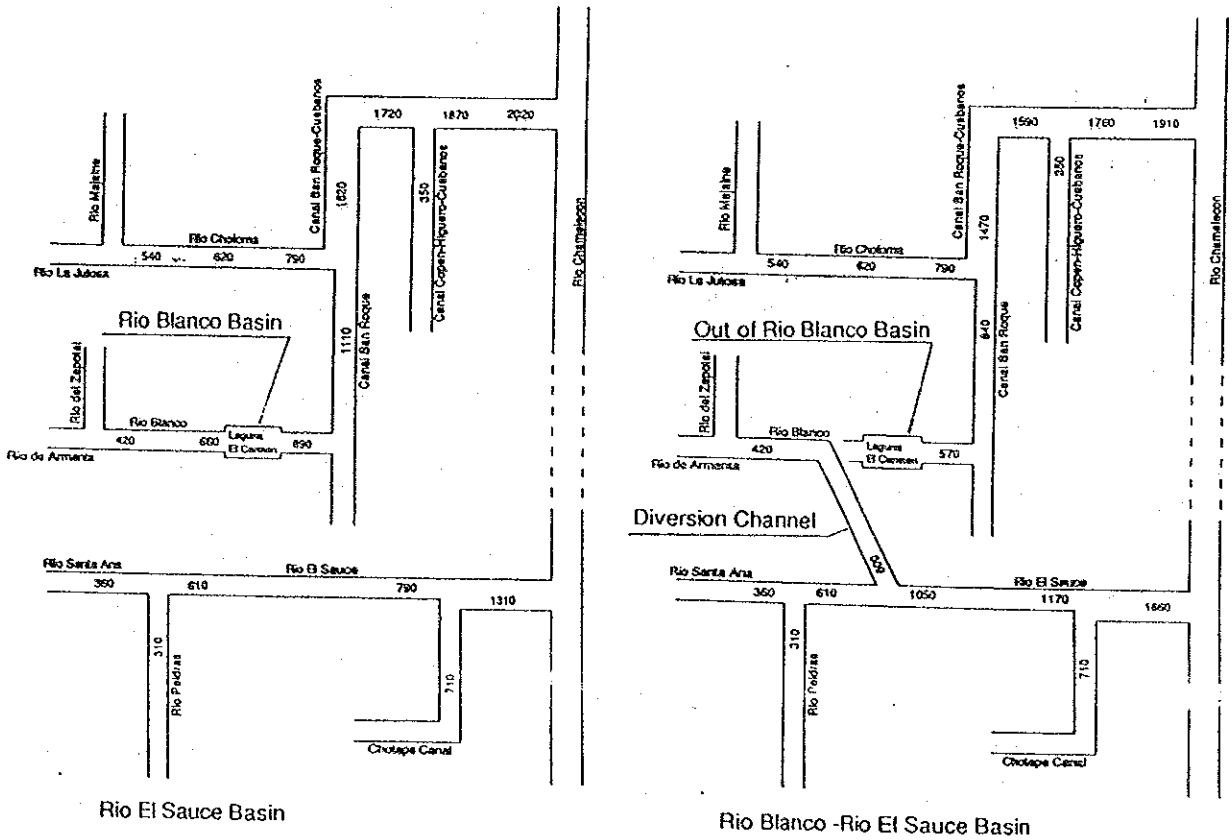


FIG. F.2.12 MAIN FEATURE OF RIVER SYSTEM OF ALTERNATIVES

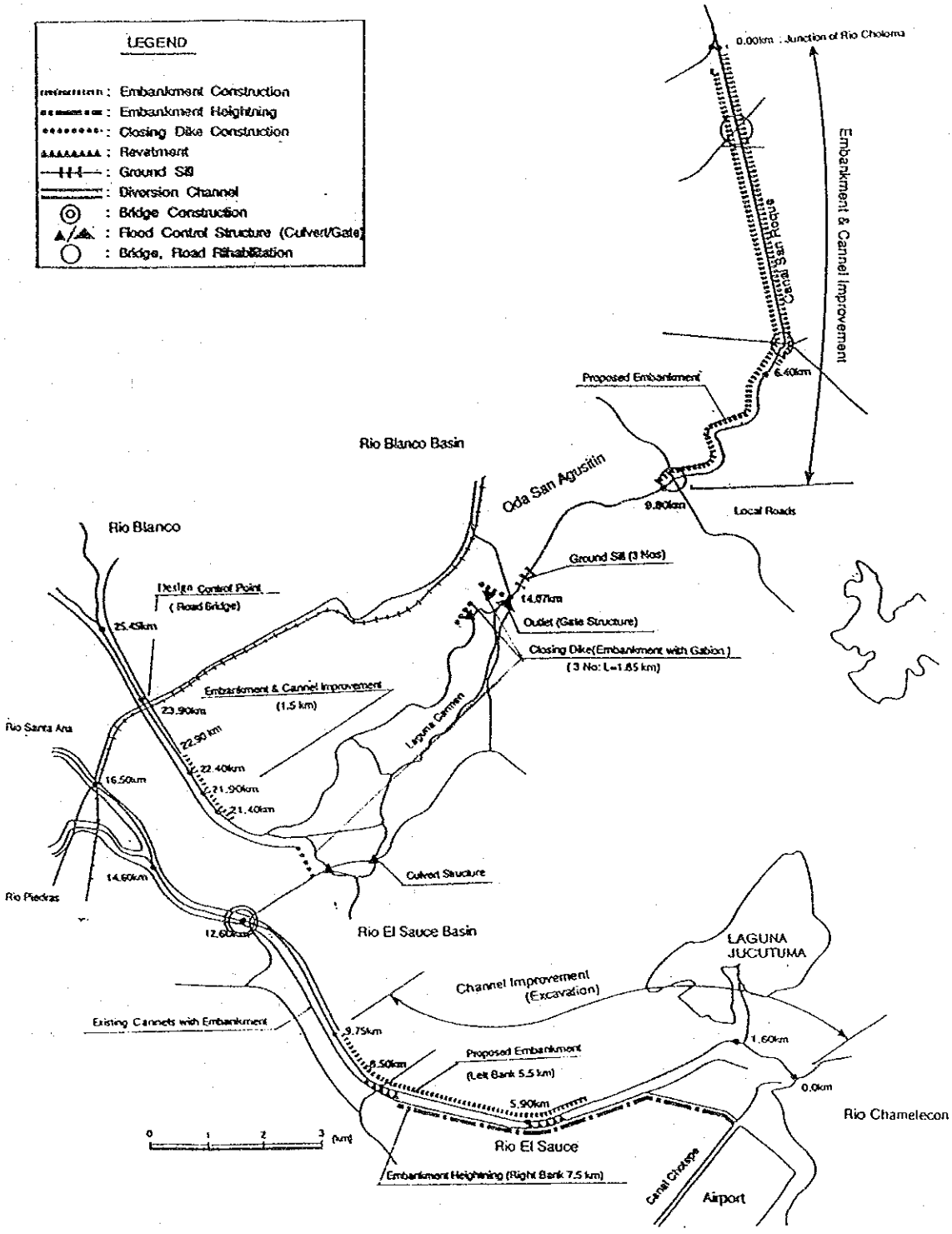


FIG. F.2.13 PROPOSED FLOOD MITIGATION FACILITIES OF THE RIO BLANCO AND EL SAUCE (ALTERNATIVE 1)

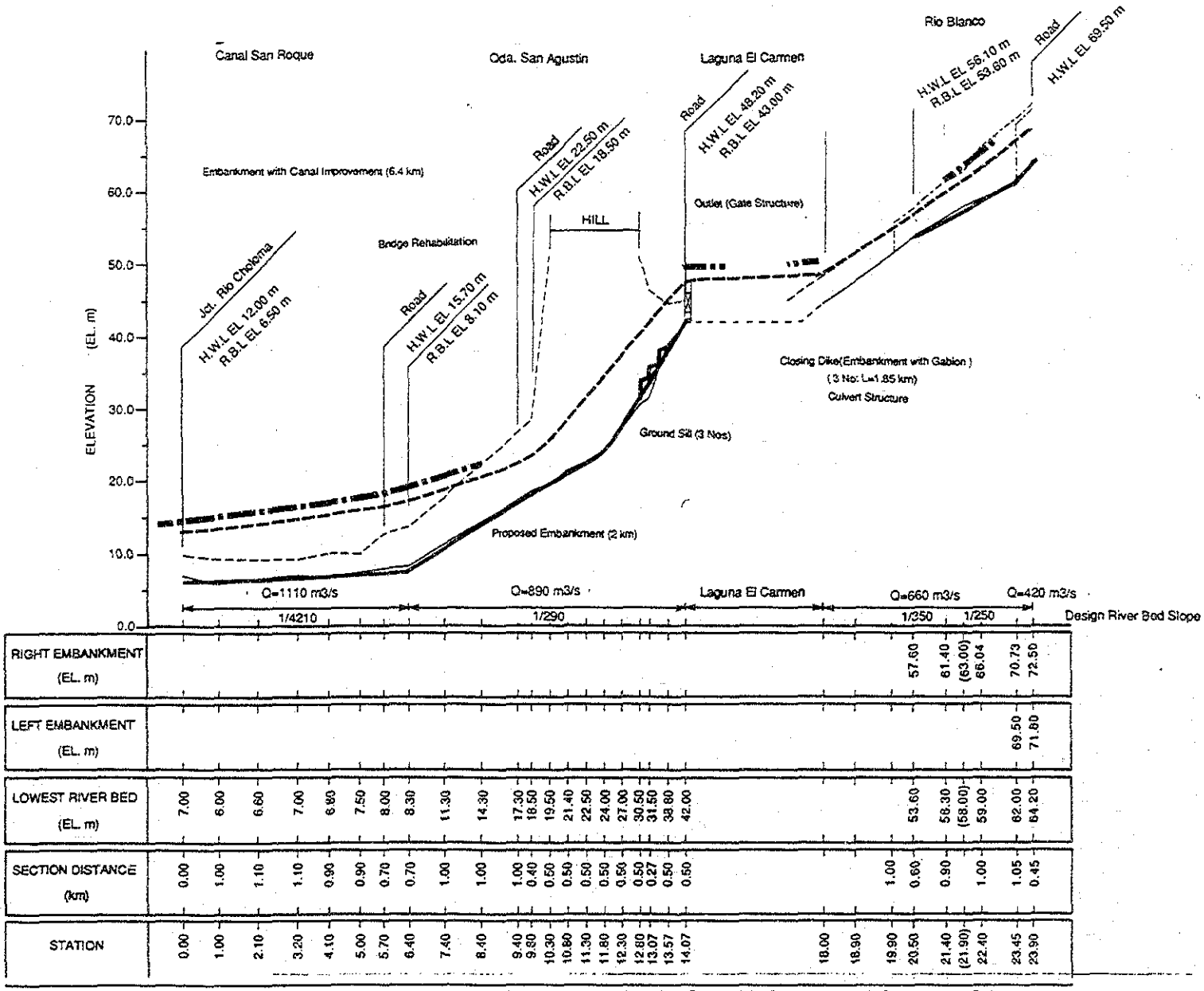
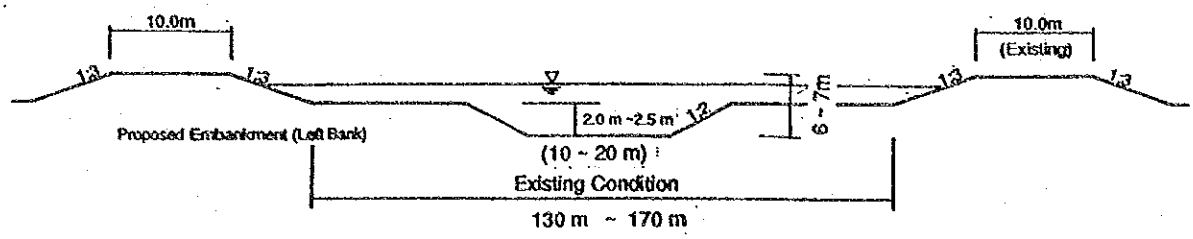
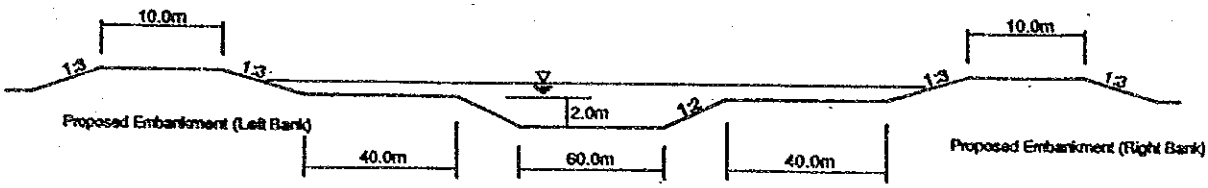


FIG. F.2.14 DESIGN LONGITUDINAL SECTION OF THE RIO BLANCO (ALTERNATIVE 1)

1). Rio Branco (Upper Reach)

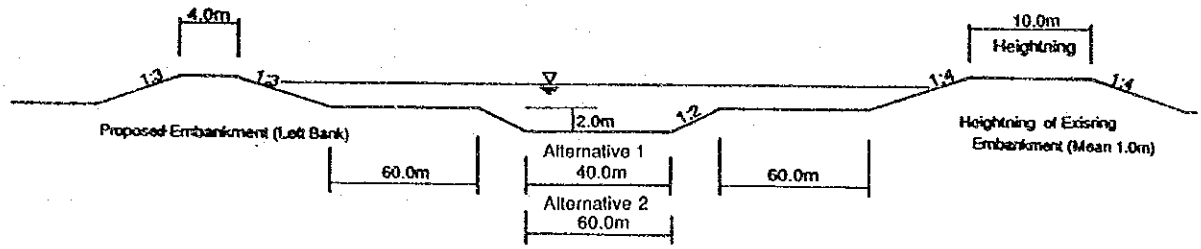


2).Diversion Channel (Alternative 2)



3).Rio El Sauce

*Rio El Sauce (down Reach)



*Rio El Sauce (Upper Reach)

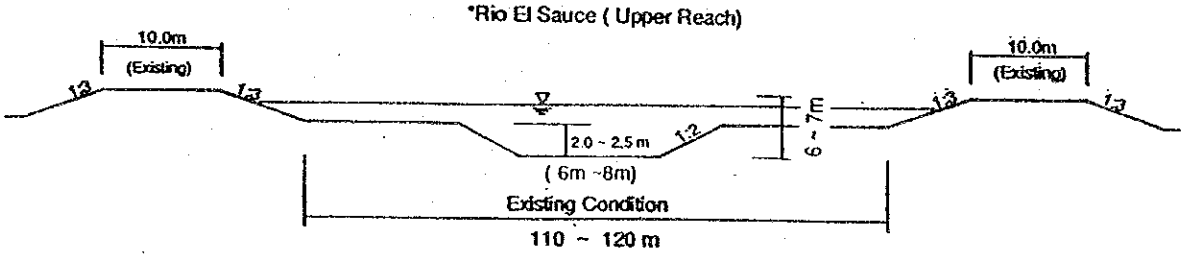


FIG. F.2.15 STANDARD DESIGN SECTION OF THE RIO BLANCO AND THE RIO EL SAUCE (ALTERNATIVE 1 AND ALTERNATIVE 2)

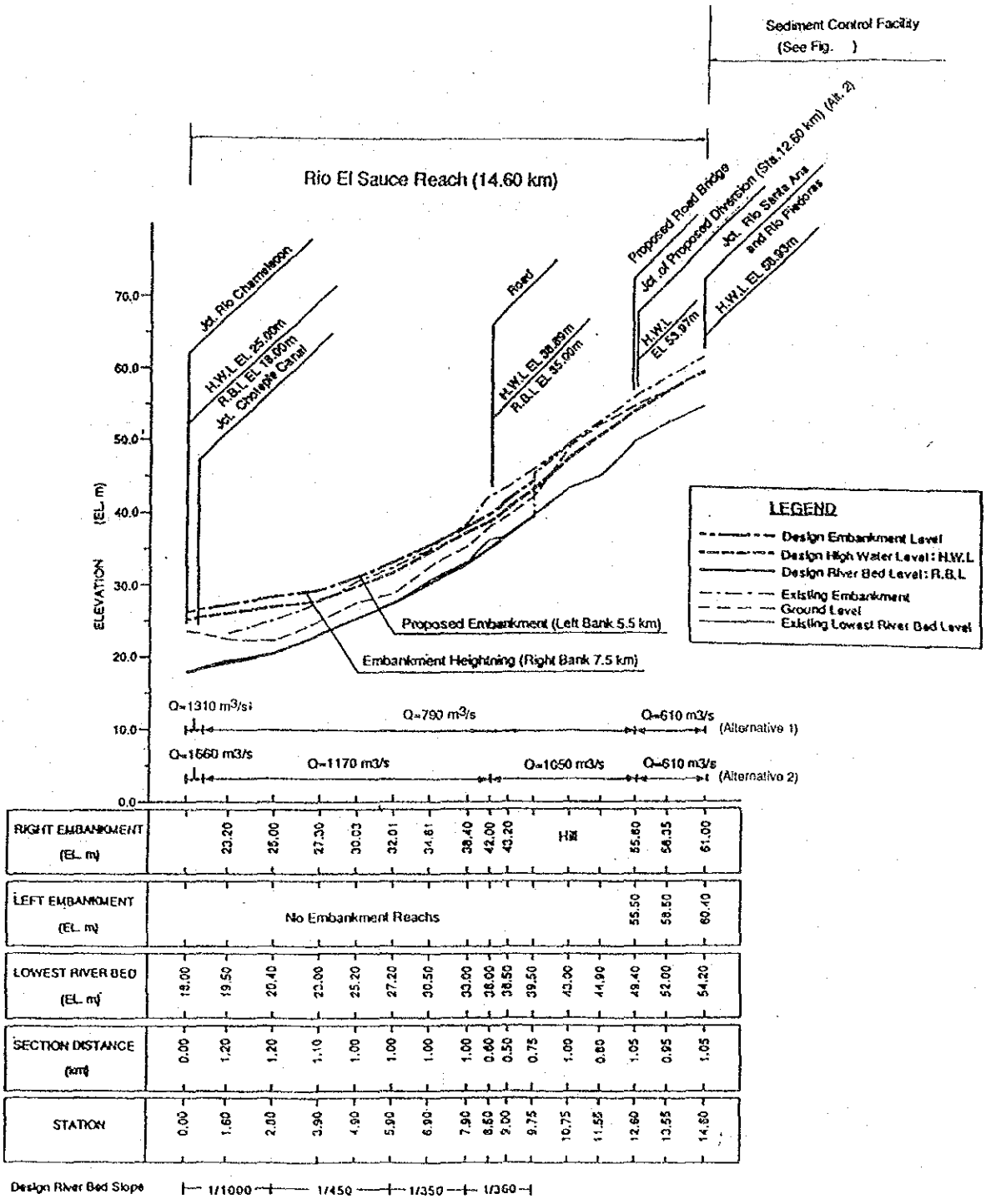
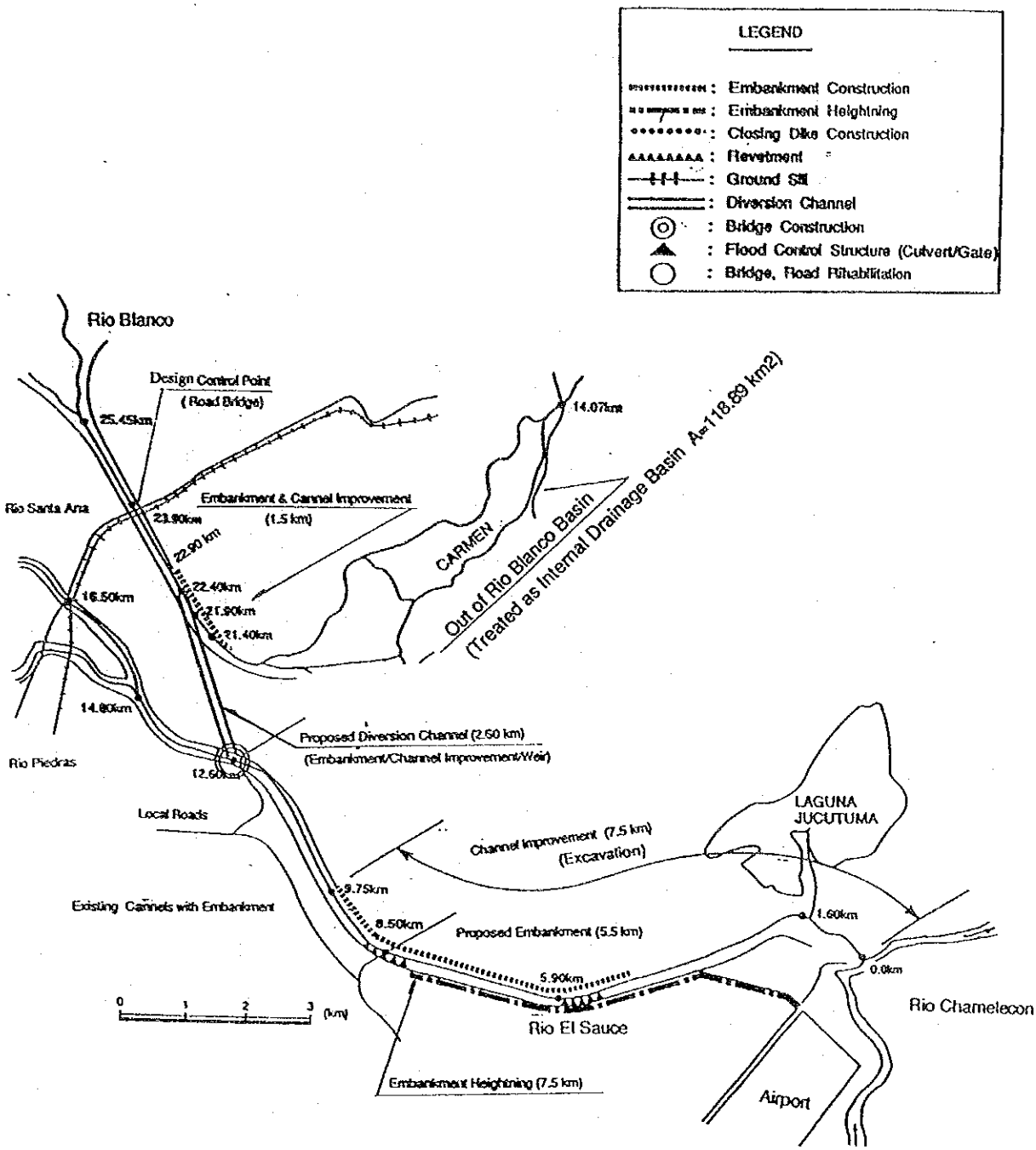


FIG. F.2.16 DESIGN LONGITUDINAL SECTION OF THE RIO BLANCO AND THE RIO EL SAUCE (ALTERNATIVE 1 AND ALTERNATIVE 2)



Rio Blanco -Rio El Sauce Basin
(A=189.68 km2)

FIG. F.2.17 PROPOSED FLOOD MITIGATION FACILITIES OF THE RIO BLANCO AND THE RIO EL SAUCE (ALTERNATIVE 2)

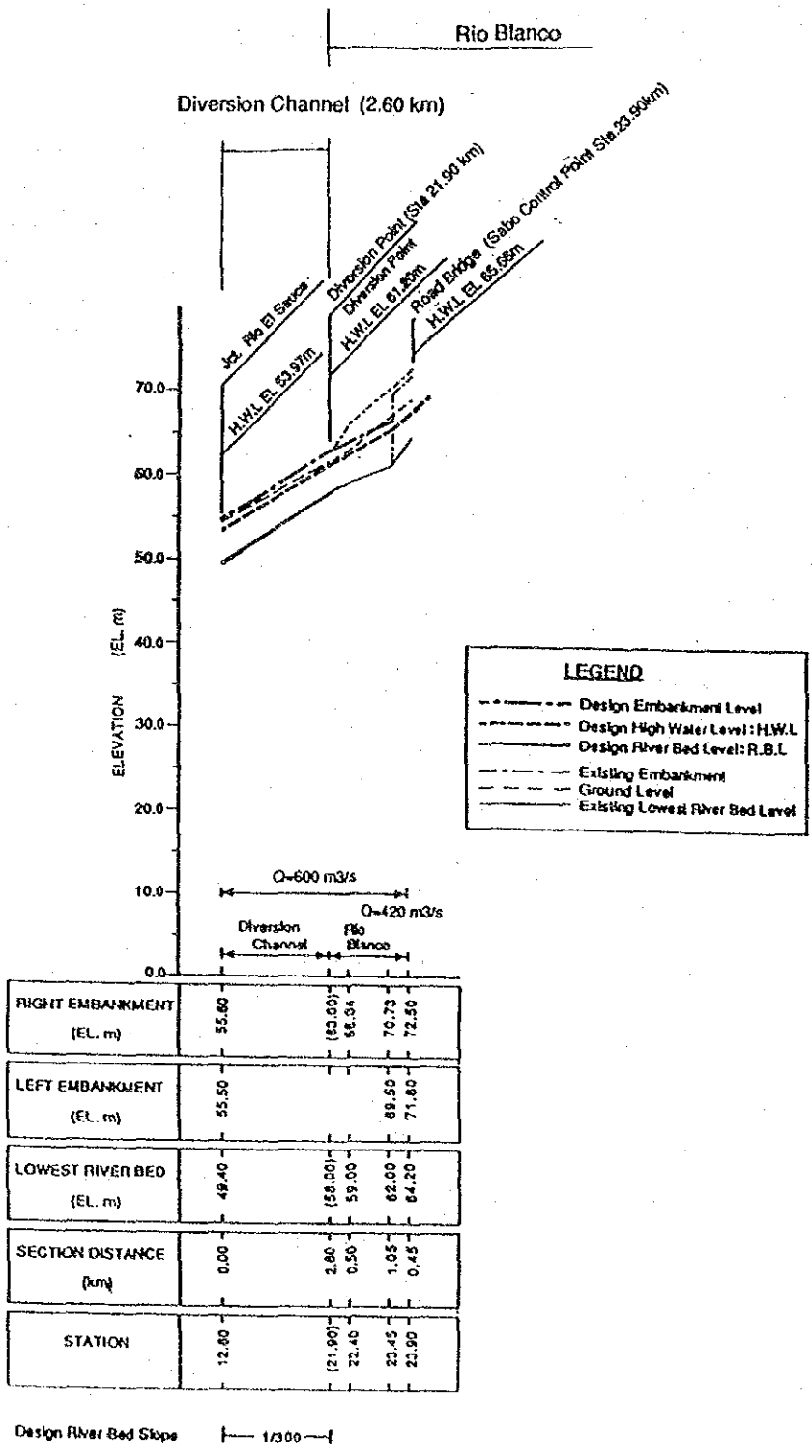


FIG. F.2.18 DESIGN LONGITUDINAL SECTION OF DIVERSION CHANNEL

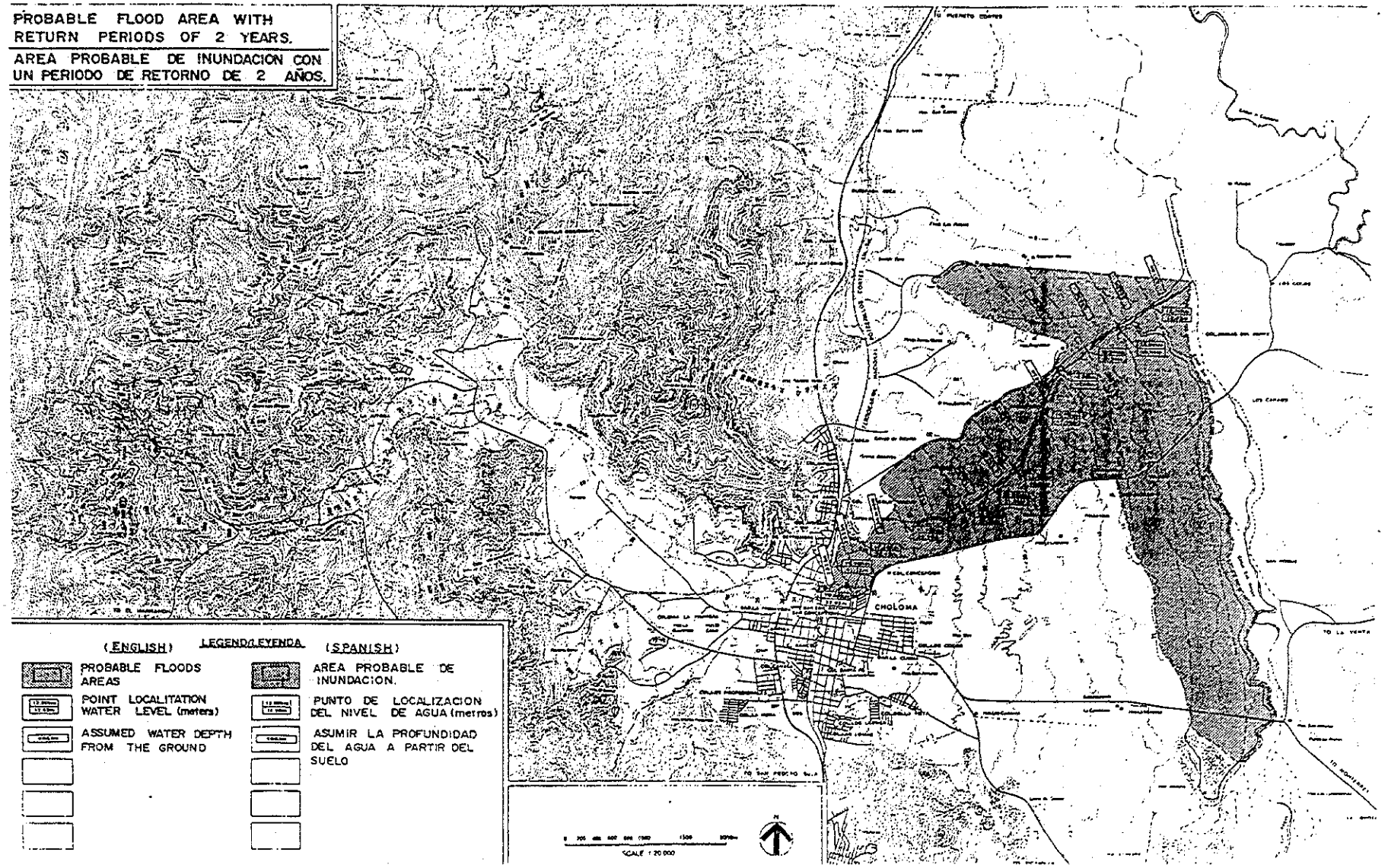


FIG.F.3.1 (1) ESTIMATED FLOOD AREAS (2-YEAR RETURN PERIOD)

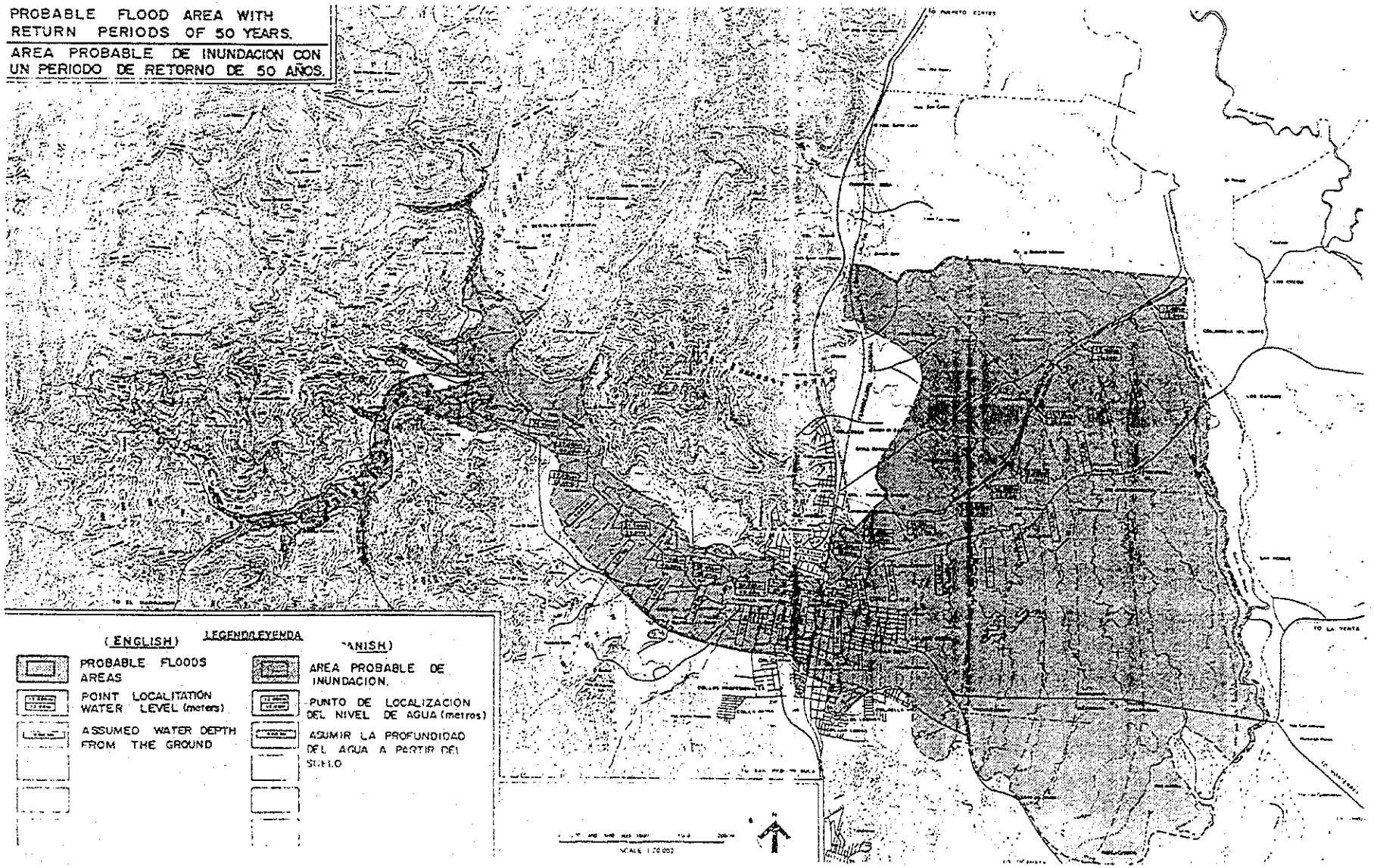


FIG.F.3.1 (2) ESTIMATED FLOOD AREA (50-YEAR RETURN PERIOD)

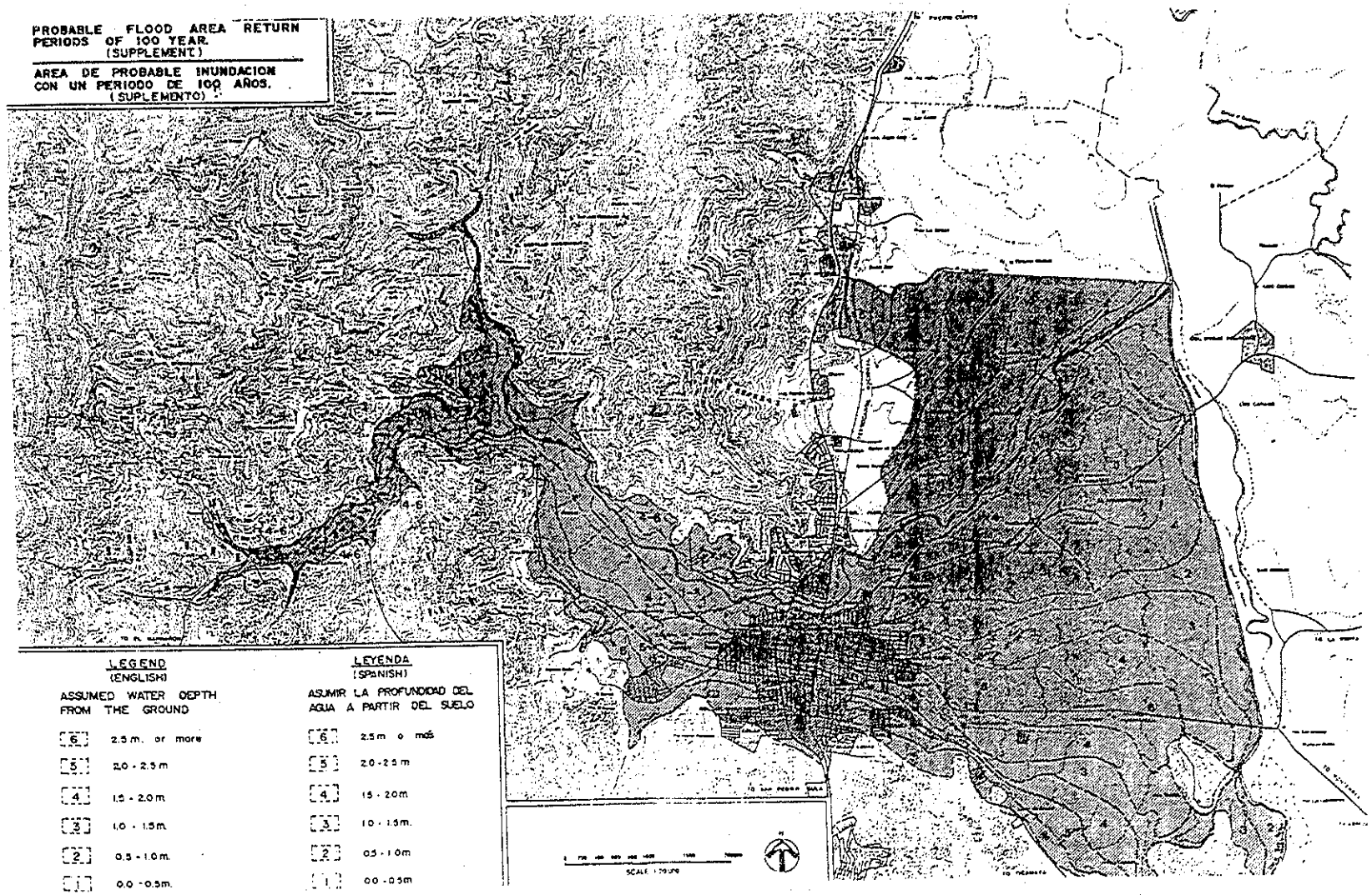
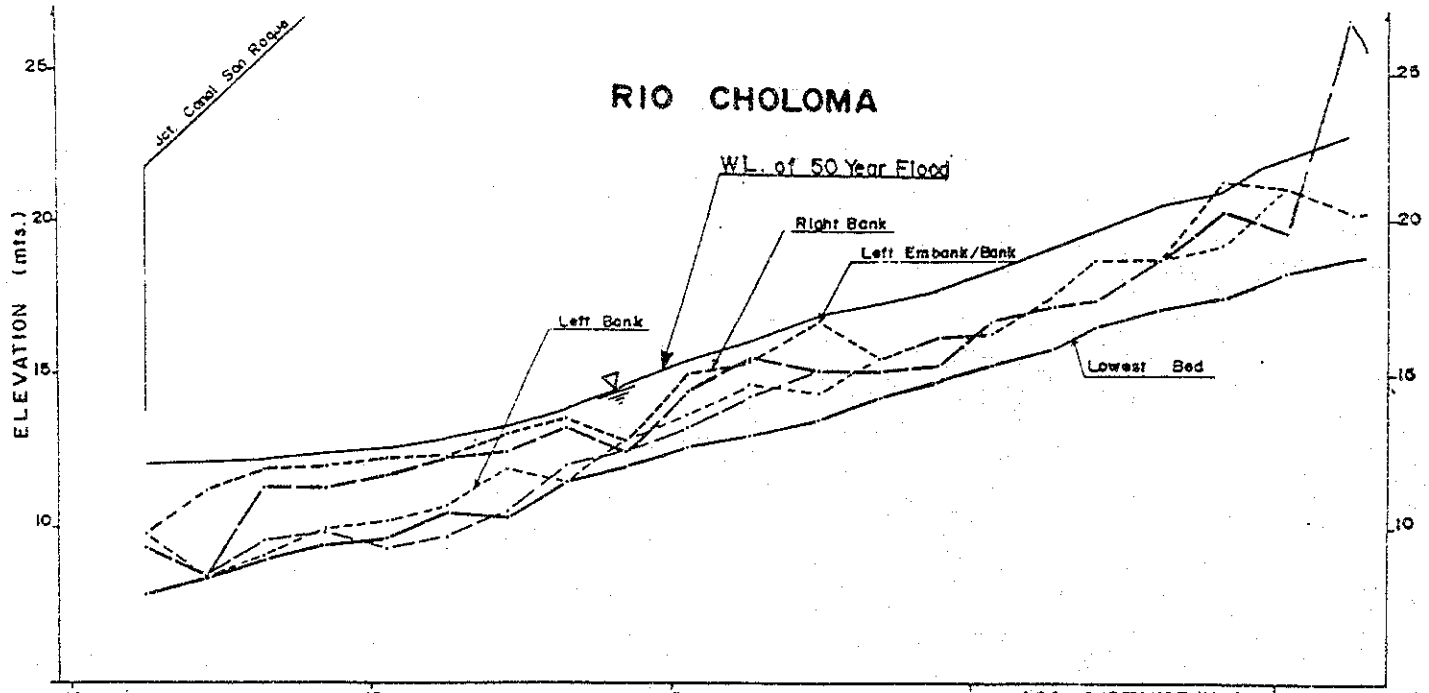
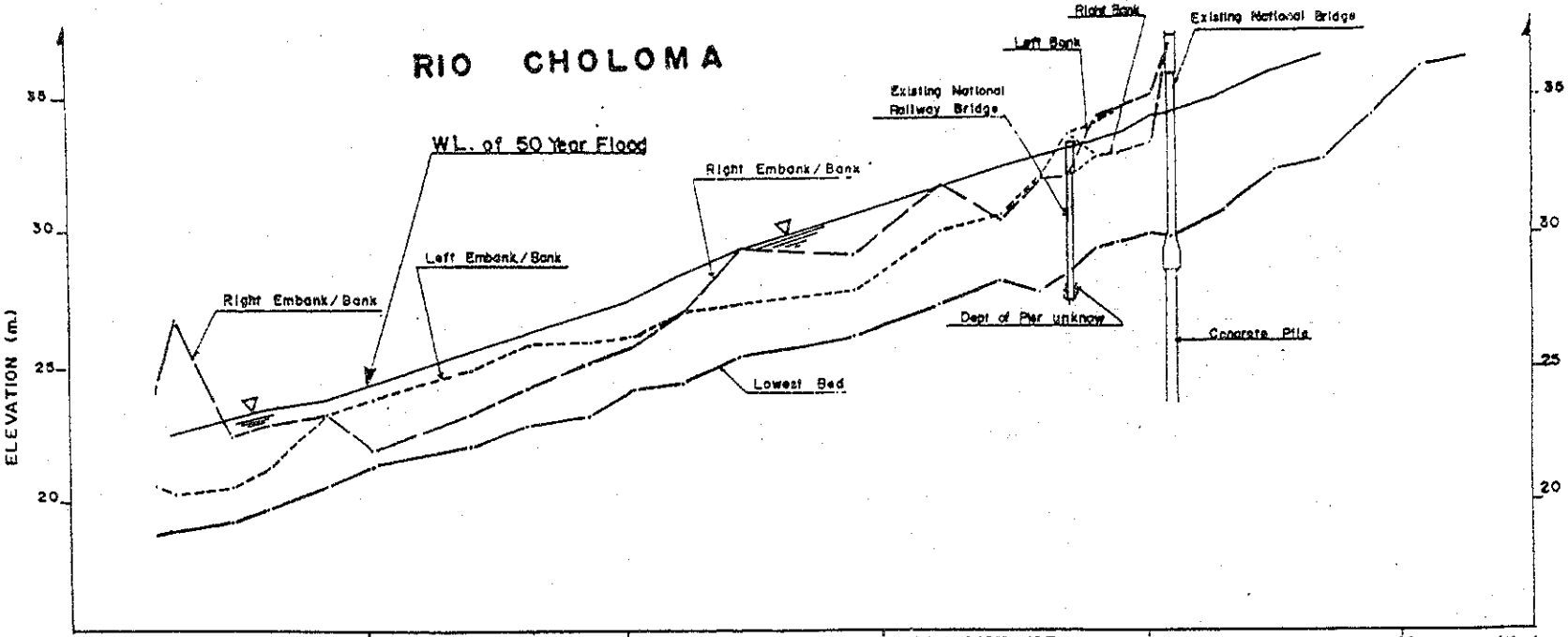


FIG.F.3.1 (3) ESTIMATED FLOOD AREA (100-YEAR RETURN PERIOD)



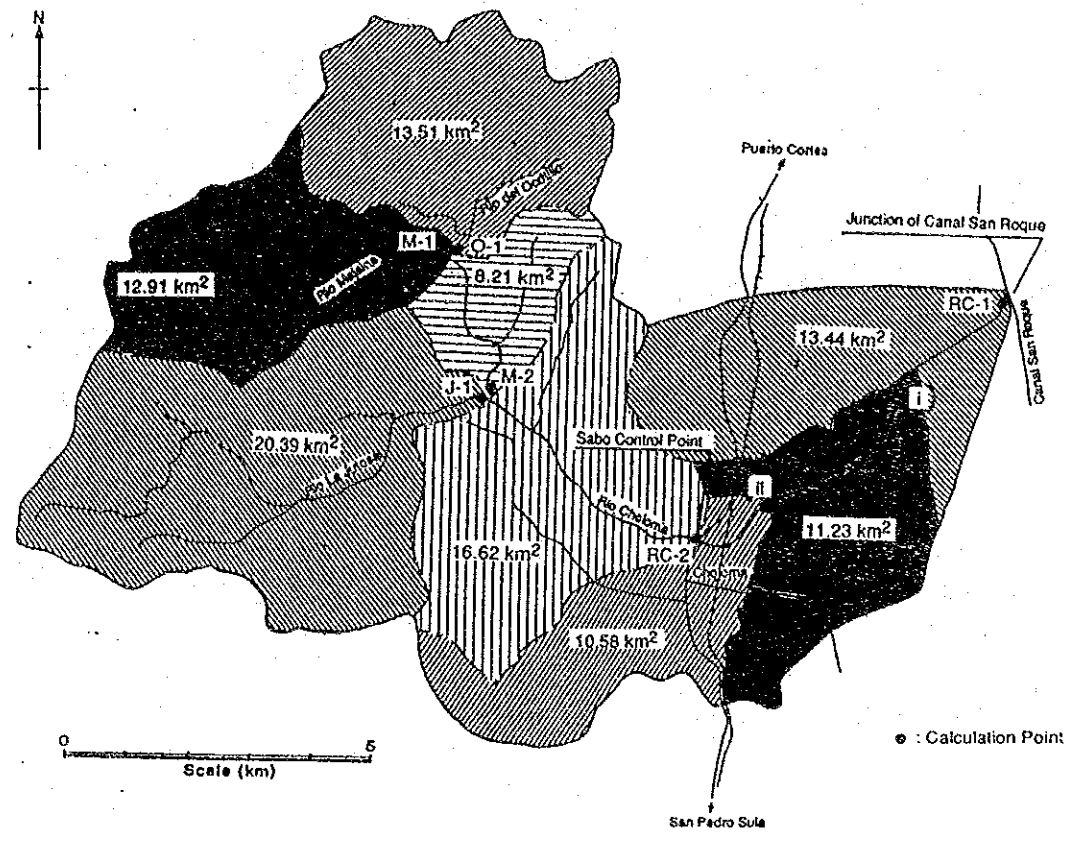
SECT.	ACC. DIST. (Km)	DIST. (Km)	LOWEST BED Elv.(m)	LEFT BANK Elv.(m)	LEFT EMB. Elv.(m)	RIGHT BANK Elv.(m)	RIGHT EMB. Elv.(m)
CH-001	11.230	0.000	7.80	9.70	-	9.30	-
CH-002	11.450	0.200	8.50	8.50	11.20	8.40	-
CH-003	11.650	0.200	8.90	9.00	11.90	8.50	11.30
CH-004	11.850	0.200	8.40	9.80	12.00	8.60	11.30
CH-005	12.050	0.200	9.60	10.20	12.30	9.30	11.70
CH-006	12.250	0.200	10.49	10.70	12.35	9.70	12.30
CH-007	12.450	0.200	10.30	11.90	13.10	10.50	12.50
CH-008	12.650	0.200	11.50	11.45	13.60	12.05	13.30
CH-009	12.850	0.200	12.00	12.80	14.70	12.00	-
CH-010	13.050	0.200	12.69	13.70	13.00	13.30	14.50
CH-011	13.250	0.200	13.05	14.70	13.40	14.30	13.52
CH-012	13.480	0.230	13.80	14.40	16.65	13.10	-
CH-013	13.685	0.205	14.30	16.50	-	15.10	-
CH-014	13.885	0.200	14.80	16.20	-	15.26	-
CH-015	14.070	0.230	15.30	16.35	-	16.70	-
CH-016	14.280	0.210	15.90	17.75	-	17.25	-
CH-017	14.410	0.130	16.59	18.70	-	17.45	-
CH-018	14.620	0.210	17.15	18.70	-	18.70	-
CH-019	14.820	0.200	17.50	18.15	21.30	20.20	-
CH-020	15.030	0.210	18.30	21.40	-	19.60	-
CH-021	15.250	0.220	18.74	23.20	-	26.50	-

FIG. F.3.2 (1) PROFILE OF THE RIO CHOLOMA (EXISTING)



SECT.	ACC. DIST (Km)	DIST. (Km)	LOWEST BED Elev.(m)	LEFT BANK Elev.(m)	LEFT EMB. Elev.(m)	RIGHT BANK Elev.(m)	RIGHT EMB. Elev.(m)
CH-021	15.250	0.220	18.74	20.10	-	26.90	-
CH-022	15.470	0.220	19.10	20.50	-	22.40	-
CH-023	15.610	0.140	18.60	21.25	-	22.90	-
CH-024	15.840	0.230	20.50	23.10	-	25.35	-
CH-025	16.020	0.180	21.30	23.90	-	21.90	-
CH-026	16.360	0.340	22.20	25.00	-	25.80	-
CH-027	16.600	0.240	22.90	26.00	-	24.80	-
CH-028	16.940	0.340	23.50	26.10	-	25.90	-
CH-029	17.010	0.170	24.30	26.80	-	26.00	-
CH-030	17.210	0.200	24.00	27.20	-	27.20	-
CH-031	17.440	0.230	25.50	27.90	-	25.80	-
CH-032	17.870	0.430	26.30	28.00	-	26.30	-
CH-033	18.210	0.340	27.50	30.10	-	31.80	-
CH-034	18.440	0.230	28.35	30.70	-	32.92	-
CH-035	18.600	0.160	27.85	32.40	-	32.00	32.00
CH-036	18.705	0.105	28.80	33.70	33.70	32.00	32.00
CH-037	18.804	0.101	28.50	32.90	34.40	32.80	34.30
CH-038	18.885	0.081	28.70	32.80	34.90	33.00	34.70
CH-039	19.006	0.121	30.00	33.20	35.20	33.30	36.10
CH-040	19.080	0.074	29.80	37.00	38.00	37.10	37.90
CH-041	19.280	0.200	30.90				
CH-042	19.480	0.200	32.30				
CH-043	19.680	0.200	32.70				
CH-044	19.880	0.200	34.40				
CH-045	20.080	0.200	34.80				
CH-046	20.280	0.200	34.70				

FIG. F.3.2 (2) PROFILE OF THE RIO CHOLOMA (EXISTING)



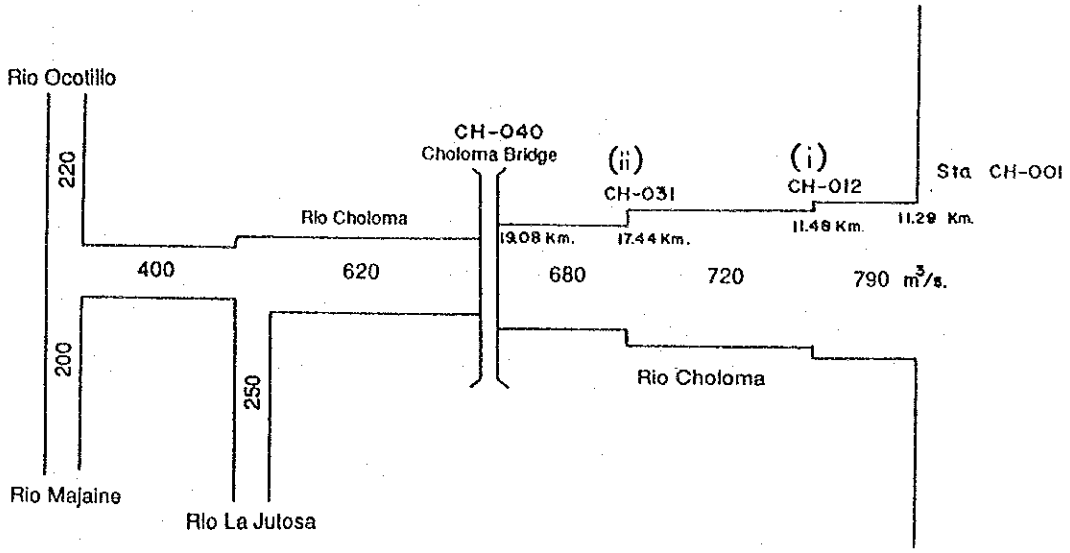


FIG. F.3.3 DESIGN DISCHARGE DISTRIBUTION

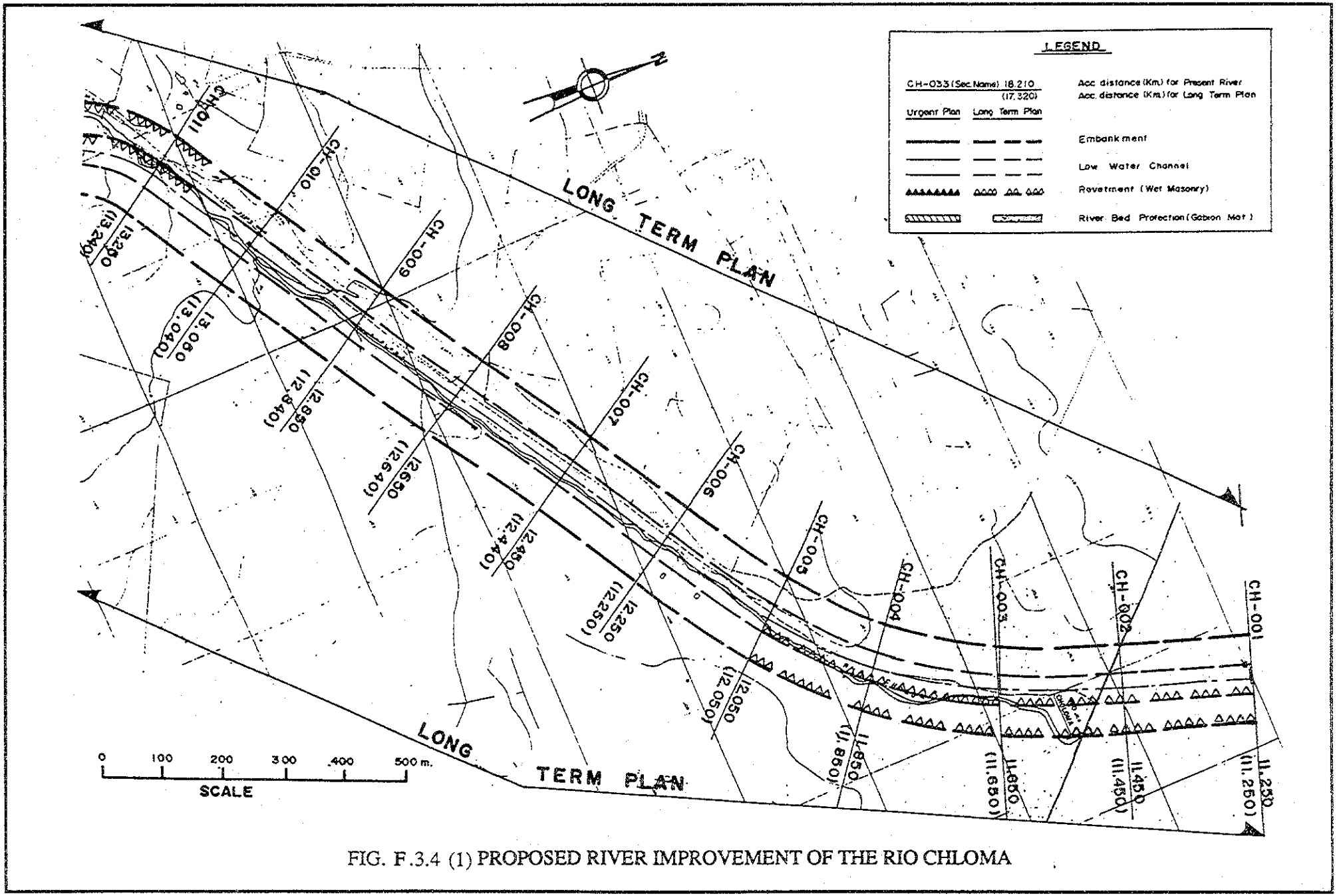


FIG. F.3.4 (1) PROPOSED RIVER IMPROVEMENT OF THE RIO CHLOMA

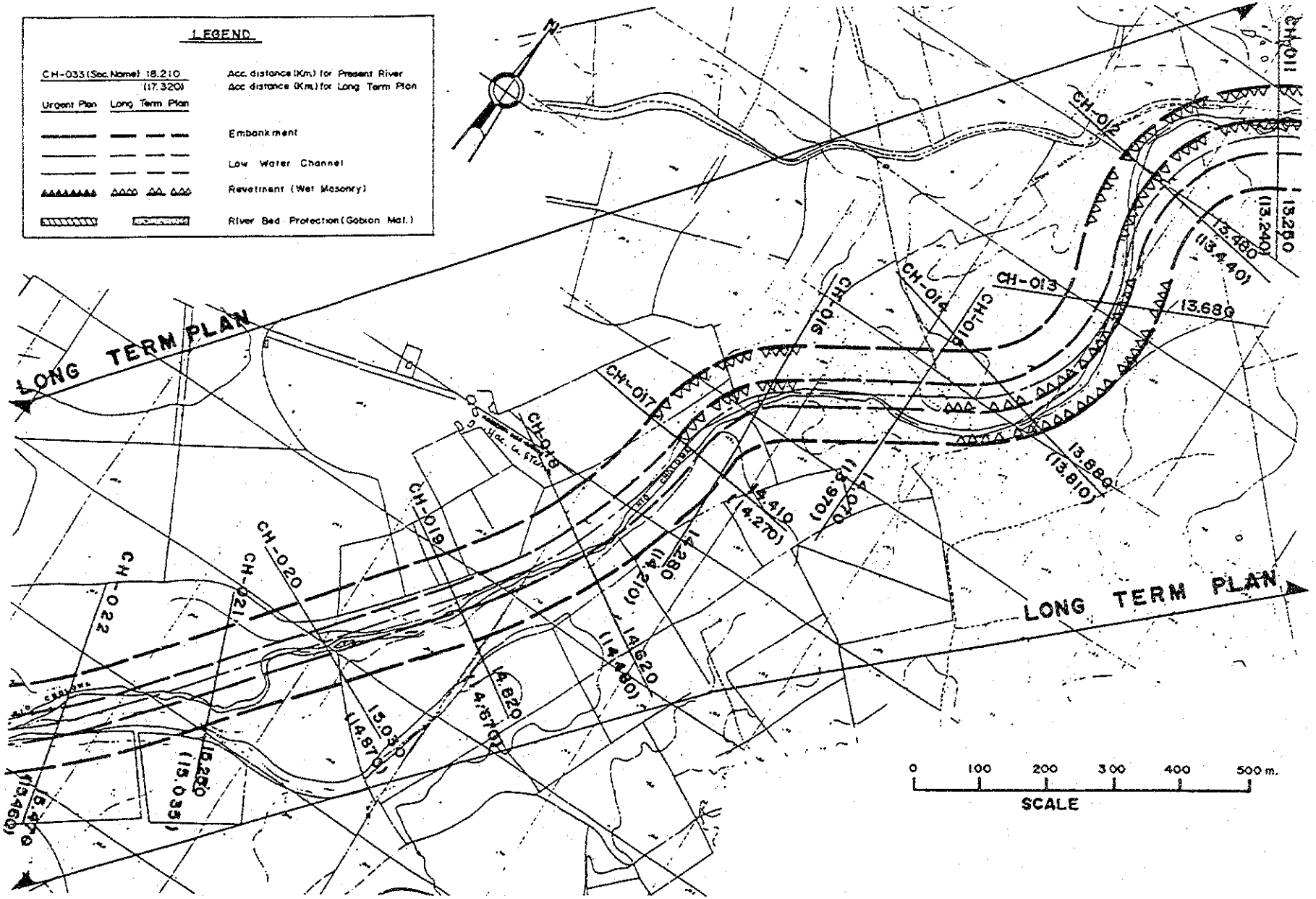


FIG. F.3.4 (2) PROPOSED RIVER IMPROVEMENT OF THE RIO CHOLOMA

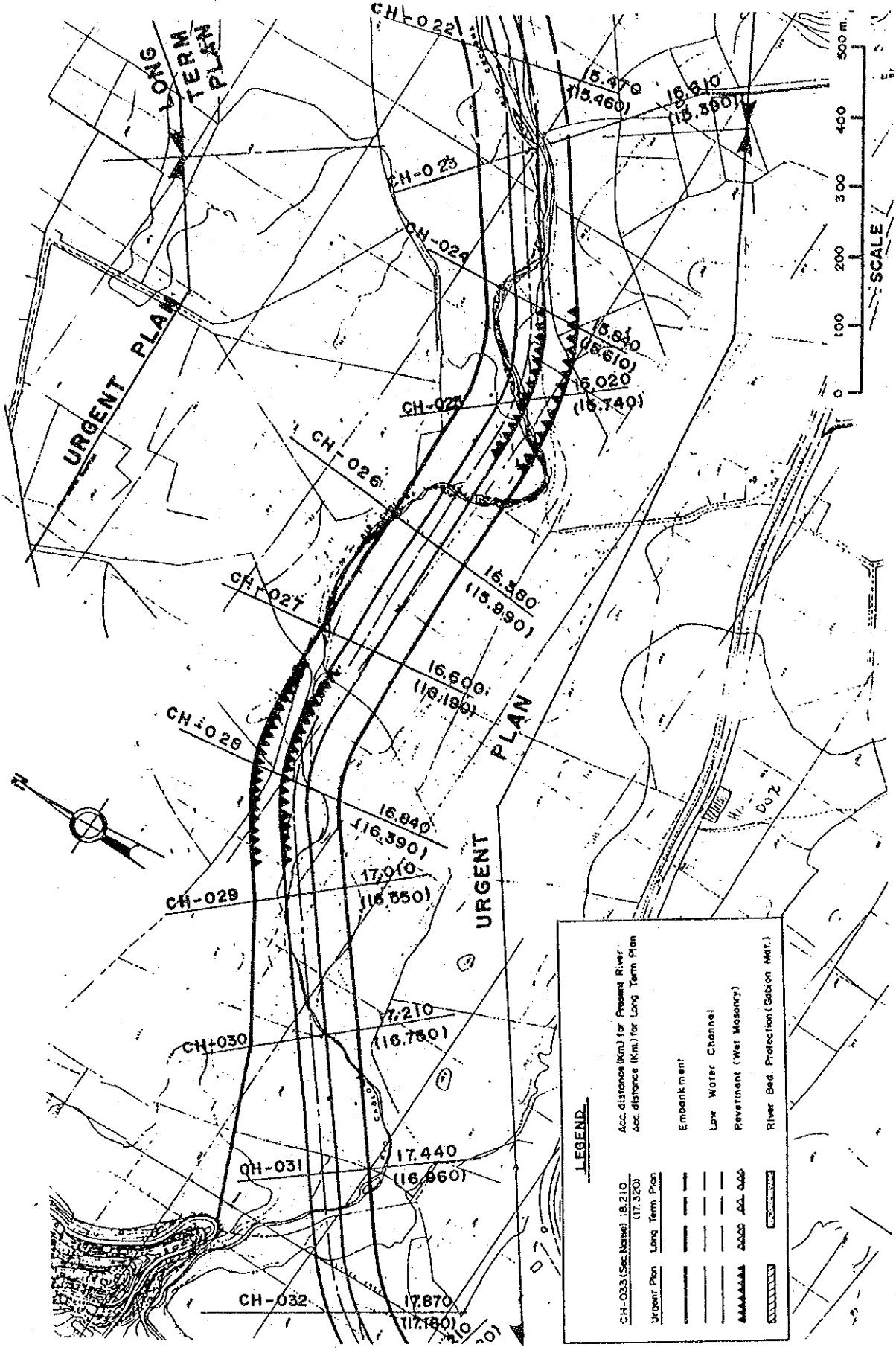


FIG. F 3.4 (3) PROPOSED RIVER IMPROVEMENT OF THE RIO CHOLOMA

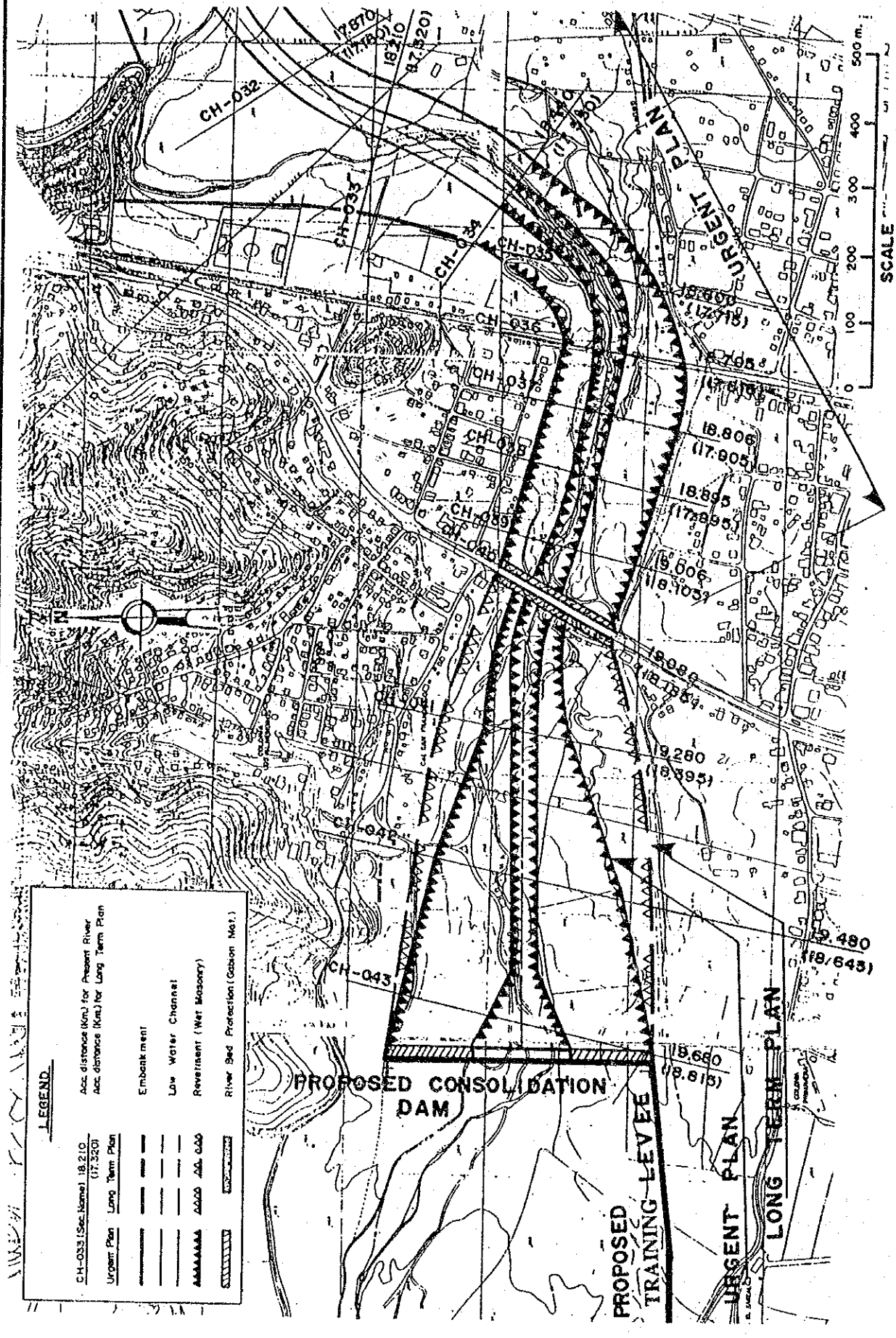
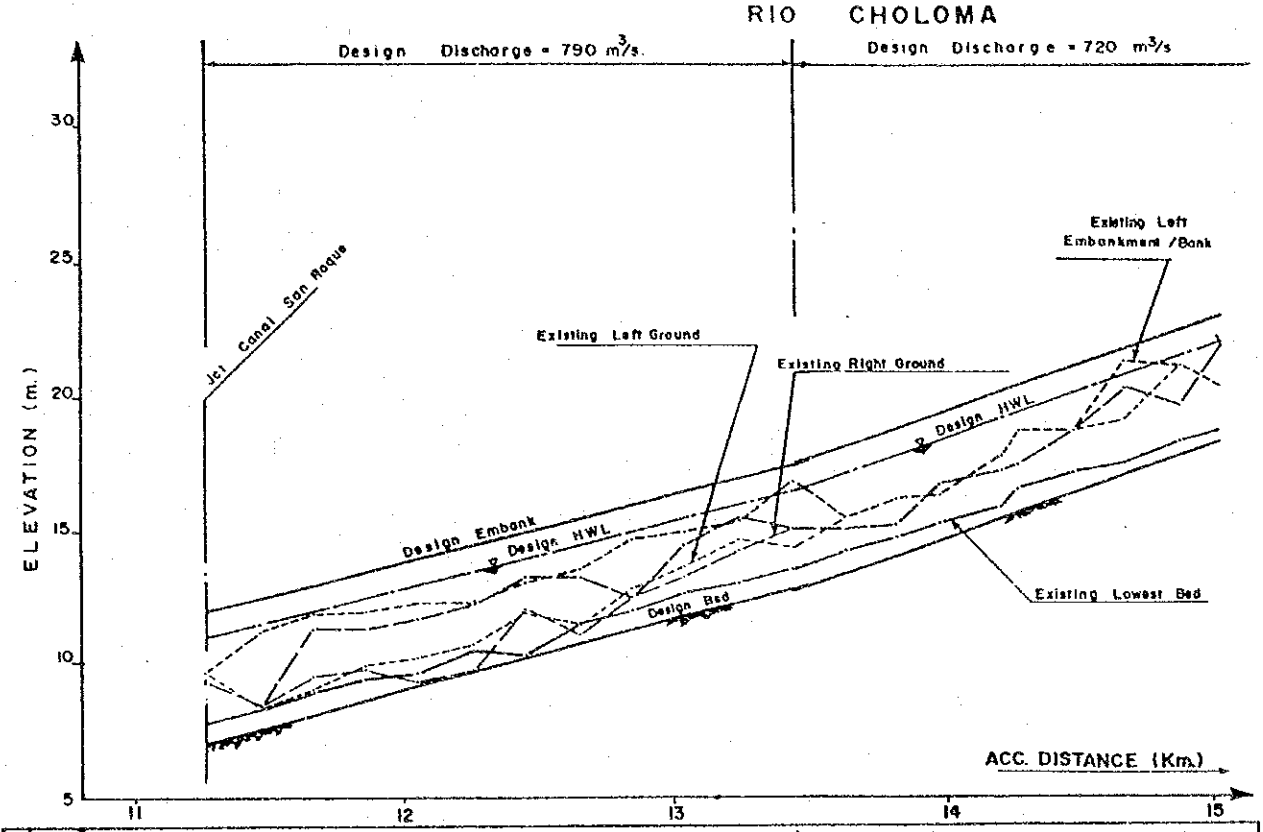
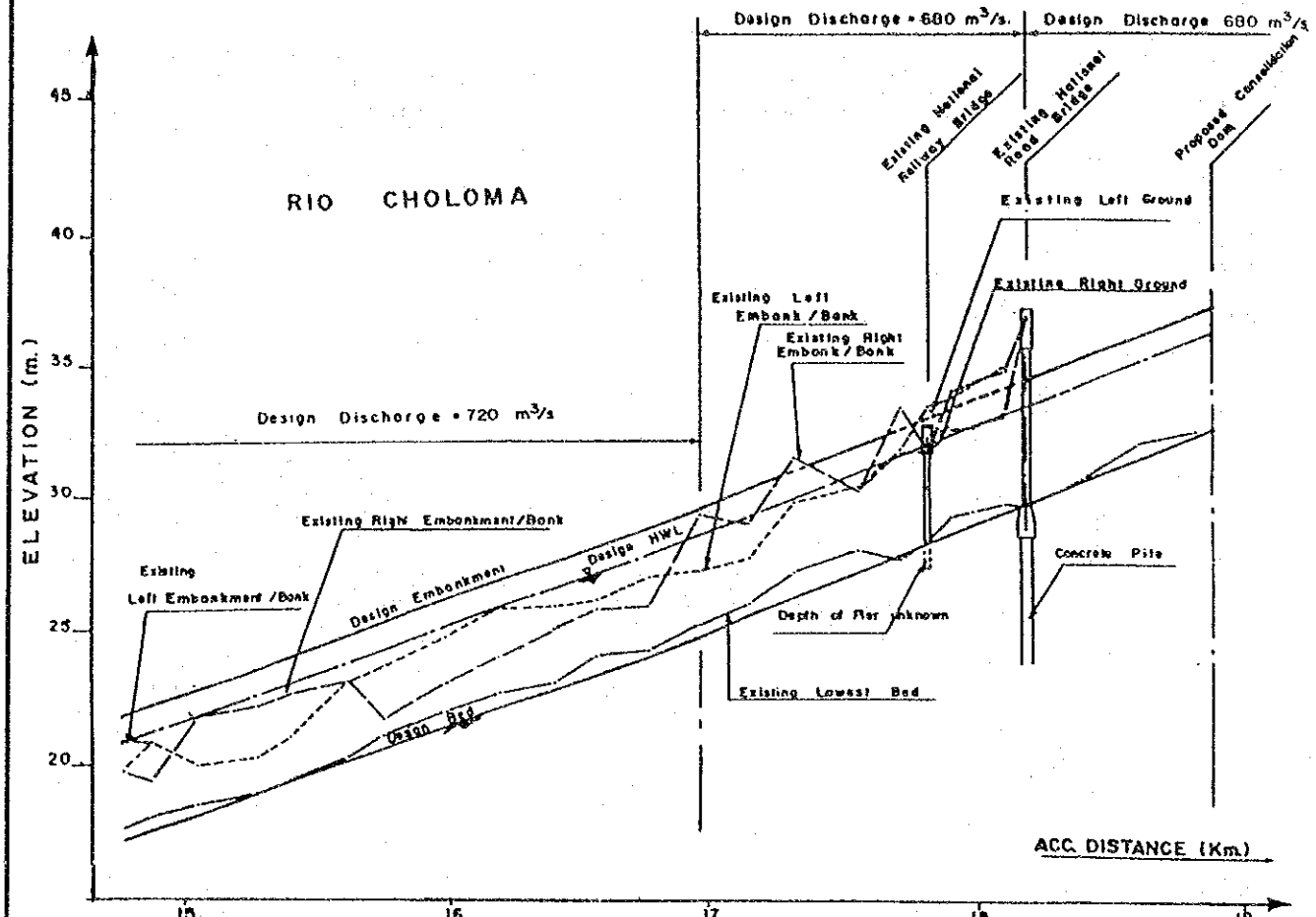


FIG. F.3.4 (4) PROPOSED RIVER IMPROVEMENT OF THE RIO CHOLOMA



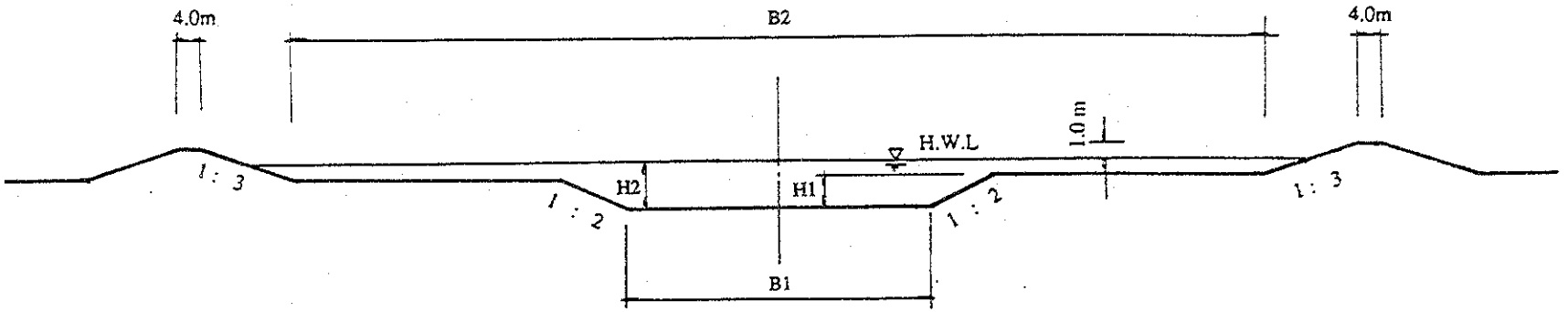
Sector	Design Acc Dist Km	Design Dist Km	EXISTING Lowest Bed El. m.	Left Ground El. m.	Left Emb. El. m.	Right Ground El. m.	Right Emb. El. m.	PROPOSED Design Bed El. m.	Design HWL El. m.	Design Emb. El. m.	Design Bed Slope
CH-001	11.250	0.000	7.80	9.70	-	9.30	-	7.00	11.00	12.00	
CH-002	11.450	0.200	8.30	8.30	11.20	8.40	-	7.53	11.50	12.50	
CH-003	11.650	0.200	8.90	9.00	11.90	9.50	11.30	8.06	12.00	13.00	
CH-004	11.850	0.200	9.40	9.80	12.00	9.80	11.90	8.59	12.51	13.51	
CH-005	12.050	0.200	9.60	10.20	12.30	9.30	11.70	9.12	13.01	14.01	
CH-006	12.250	0.200	10.49	10.70	12.35	9.70	12.30	9.65	13.51	14.61	
CH-007	12.440	0.190	10.30	11.90	13.10	10.30	12.50	10.15	13.99	14.89	
CH-008	12.640	0.200	11.50	11.45	13.80	12.05	13.30	10.68	14.49	15.49	
CH-009	12.840	0.200	12.00	12.90	14.70	12.50	-	11.21	14.99	15.99	
CH-010	13.040	0.200	12.69	13.70	15.00	13.20	14.50	11.74	15.50	16.50	
CH-011	13.240	0.200	13.05	14.70	15.40	14.30	15.52	12.27	16.00	17.00	
CH-012	13.440	0.200	13.60	14.40	16.85	15.10	-	12.80	16.50	17.50	
CH-013	13.630	0.190	14.30	15.50	-	15.10	-	13.46	17.16	18.16	
CH-014	13.810	0.180	14.80	16.20	-	15.25	-	14.08	17.79	18.79	
CH-015	13.970	0.160	15.30	16.35	-	16.75	-	14.64	18.35	19.35	
CH-016	14.210	0.240	15.90	17.75	-	17.25	-	15.47	19.19	20.19	
CH-017	14.270	0.060	16.59	18.70	-	17.45	-	15.98	19.40	20.40	
CH-018	14.480	0.210	17.16	18.70	-	18.70	-	16.40	20.13	21.13	
CH-019	14.670	0.190	17.50	19.15	21.30	20.30	-	17.06	20.80	21.80	
CH-020	14.875	0.205	18.30	21.10	-	19.60	-	17.77	21.51	22.51	

FIG. F.3.5 (1) DESIGN PROFILE OF THE RIO CHOLOMA



Section	Design Acc. Dist Km	Design Dist Km	EXISTING Lowest Bed El.m.	EXISTING Left Ground El.m.	EXISTING Left Emb. El.m.	EXISTING Right Ground El.m.	EXISTING Right Emb. El.m.	PROPOSED Design Bed El.m.	PROPOSED Design HWL El.m.	PROPOSED Design Emb. El.m.	PROPOSED Design Bed Slope
CH-020	14.675	0.205	18.30	21.10	—	19.60	—	17.77	21.51	22.51	
CH-021	14.880	0.160	18.74	20.20	—	22.00	—	18.33	22.07	23.07	
CH-022	15.260	0.225	19.10	20.50	—	22.40	—	19.11	22.86	23.86	
CH-023	15.390	0.130	19.60	21.25	—	22.90	—	19.56	23.31	24.31	
CH-024	15.610	0.220	20.50	23.30	—	23.35	—	20.32	24.08	25.08	
CH-025	15.740	0.130	21.30	23.90	—	21.90	—	20.77	24.54	25.54	
CH-026	15.990	0.250	22.20	25.00	—	23.30	—	21.84	25.41	26.41	
CH-027	16.190	0.200	22.90	26.00	—	24.30	—	22.33	26.11	27.11	
CH-028	16.380	0.200	23.30	26.10	—	26.30	—	23.02	26.80	27.81	
CH-029	16.550	0.160	24.30	26.30	—	26.00	—	23.58	27.37	28.37	
CH-030	16.750	0.200	24.50	27.20	—	27.10	—	24.27	28.07	29.07	
CH-031	16.960	0.210	25.50	27.50	—	29.50	—	25.00	28.80	29.80	
CH-032	17.160	0.200	26.30	28.20	—	29.30	—	25.81	29.60	30.60	
CH-033	17.325	0.165	27.50	30.10	—	31.80	—	26.46	30.24	31.24	
CH-034	17.550	0.230	28.30	30.70	—	30.50	—	27.39	31.18	32.18	
CH-035	17.715	0.165	27.80	32.10	—	32.00	33.70	28.05	31.82	32.82	
CH-036	17.815	0.100	28.60	33.70	—	32.00	34.10	28.46	32.22	33.22	
CH-037	17.905	0.090	28.60	32.50	—	32.80	34.80	28.82	32.58	33.58	
CH-038	17.995	0.090	29.70	32.90	—	33.00	34.70	29.18	32.94	33.94	
CH-039	18.105	0.110	30.00	33.50	35.20	33.30	36.10	29.63	33.38	34.38	
CH-040	18.185	0.080	29.80	37.00	37.00	37.10	37.10	29.95	33.70	34.70	
CH-041	18.395	0.210	30.90	—	—	—	—	30.80	34.64	35.64	
CH-042	18.605	0.210	32.30	—	—	—	—	31.60	35.36	36.38	
CH-043	18.815	0.210	32.70	—	—	—	—	32.60	36.22	37.22	
								32.78	36.60	37.60	

FIG. F.3.5 (2) DESIGN PROFILE OF THE RIO CHOLOMA



1. STANDARD DESIGN CROSS SECTION OF THE LONG TERM PLAN

STATION	ACC. DISTANCE (km)	B1 (m)	B2 (m)	H1 (m)	H2 (m)
CH-001 to CH-012	11.250 to 13.440	50.00	158.00	2.00	3.97 to 3.70
CH-012 to CH-019	13.440 to 14.670	40.00	138.00	2.00	3.70 to 3.74
CH-019 to CH-040	14.670 to 18.185	40.00	130.00 to 180.00	2.50	3.74 to 3.75
CH-040 to No.1 Consolid. Dam	18.185 to 18.815	40.00	180.00 to 360.00	2.50	3.75

2. STANDARD DESIGN CROSS SECTION OF THE URGENT PLAN

STATION	ACC. DISTANCE (km)	B1 (m)	B2 (m)	H1 (m)	H2 (m)
CH-023 to CH-040	15.390 to 18.185	40.00	130.00 to 180.00	2.50	3.74 to 3.75
CH-040 to No.1 Consolid. Dam	18.185 to 18.815	40.00	90.00 to 290.00	2.50	3.75

FIG. F.3.6 (1) DESIGN CROSS SECTION OF THE RIO CHOLOMA

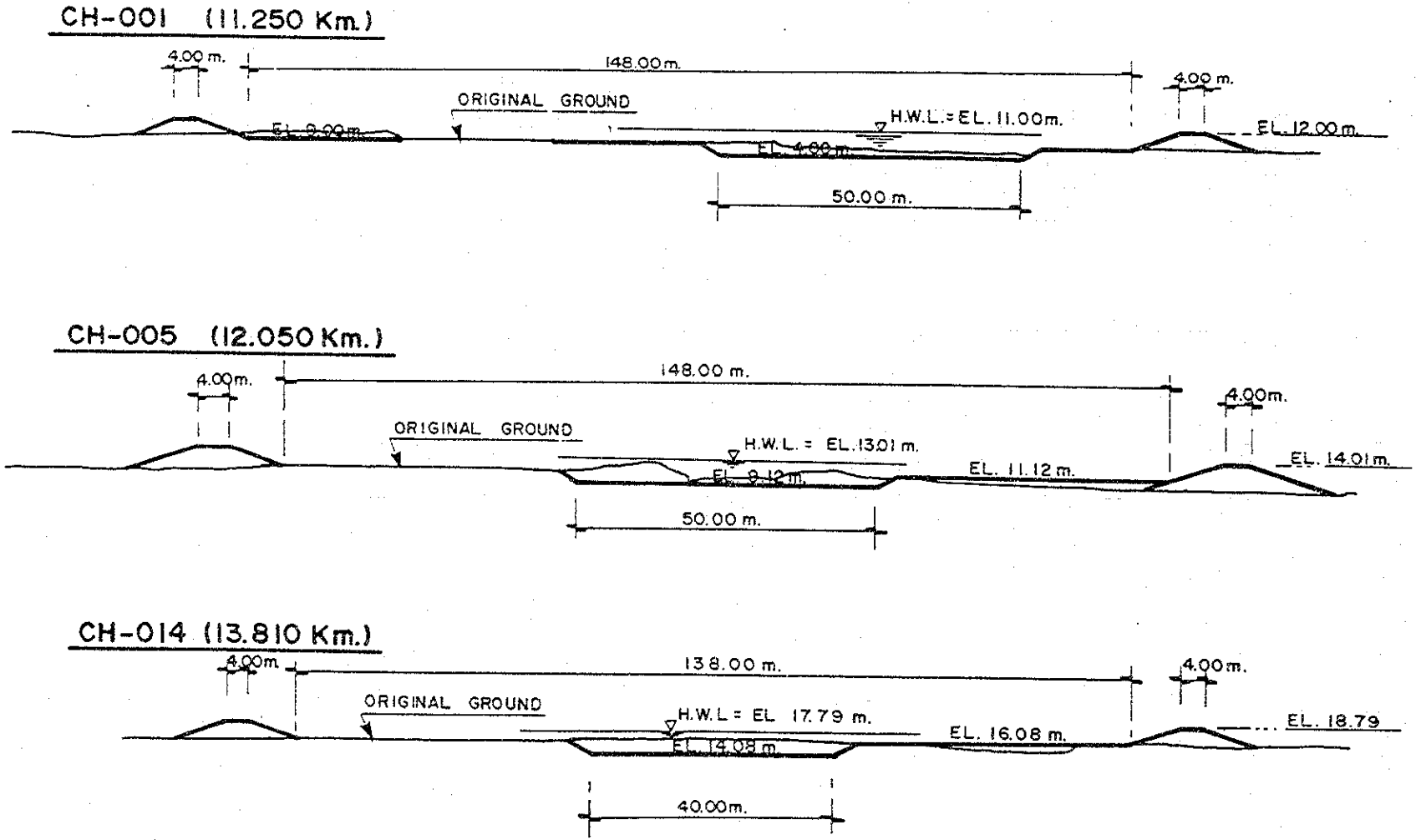
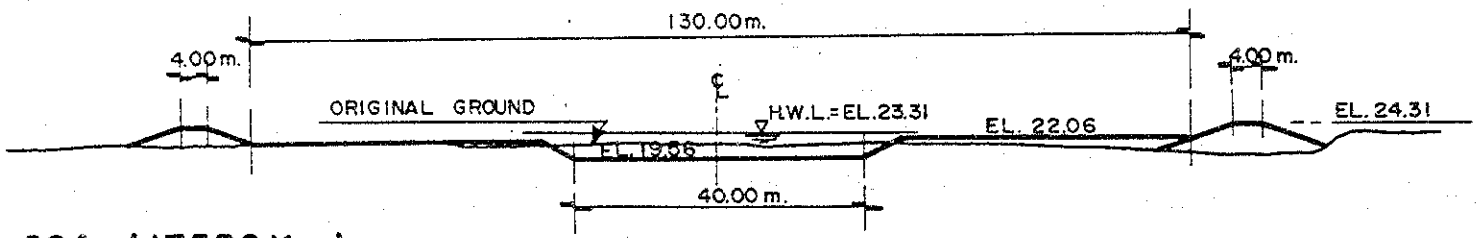
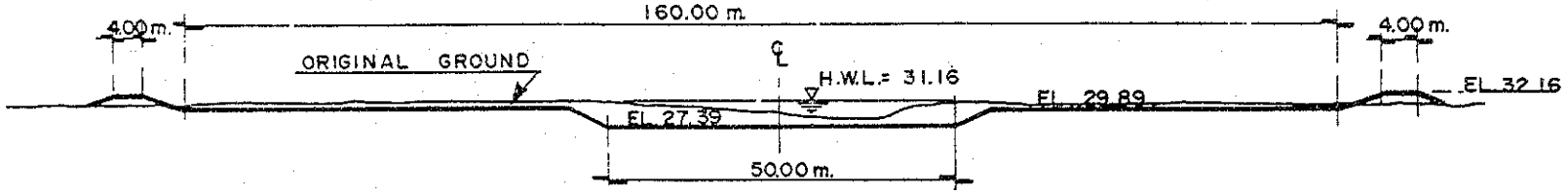


FIG. F.3.6 (2) DESIGN CROSS SECTION OF THE RIO CHOLOMA

CH-023 (15.390 Km.)

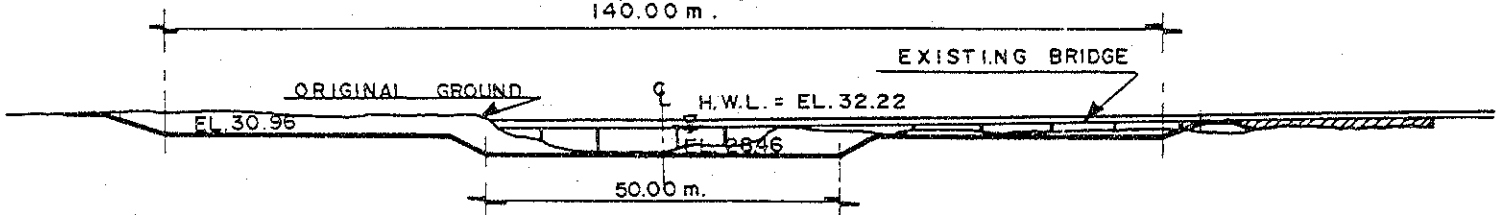


CH-024 (17.550 Km.)



Note: Design river width is wider than the typical section because of severe curve.

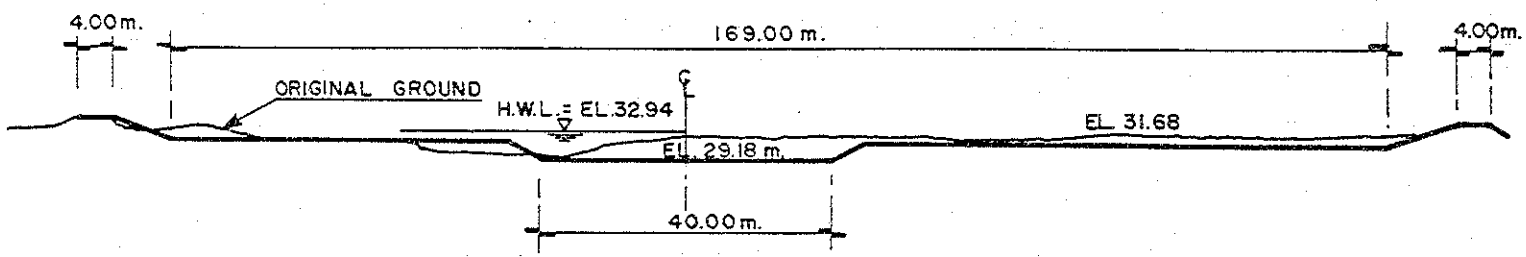
CH-036 (17.815 Km. : National Railway Bridge)



Note: 1.) Design river width is wider than the typical section because of the bridge.
2) Heightening or reconstruction of the bridge will be necessary.

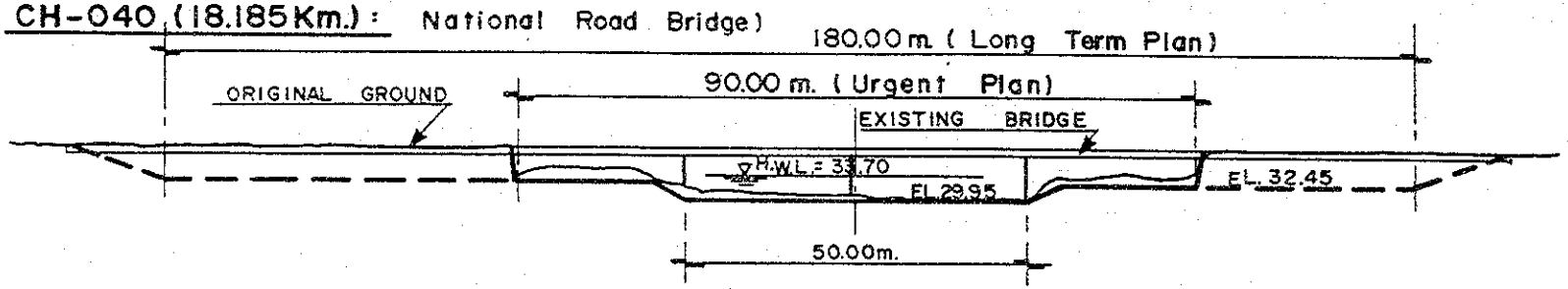
FIG. F.3.6 (3) DESIGN CROSS SECTION OF THE RIO CHOLOMA

CH-038 (17.795 Km.)



Note: Width of the high water channel is same as the existing width.

CH-040 (18.185Km.): National Road Bridge)



Note: 1.) Design river width is wider than the typical section because of the bridge and the existing embankments.

CH-042 (18.605 Km.)

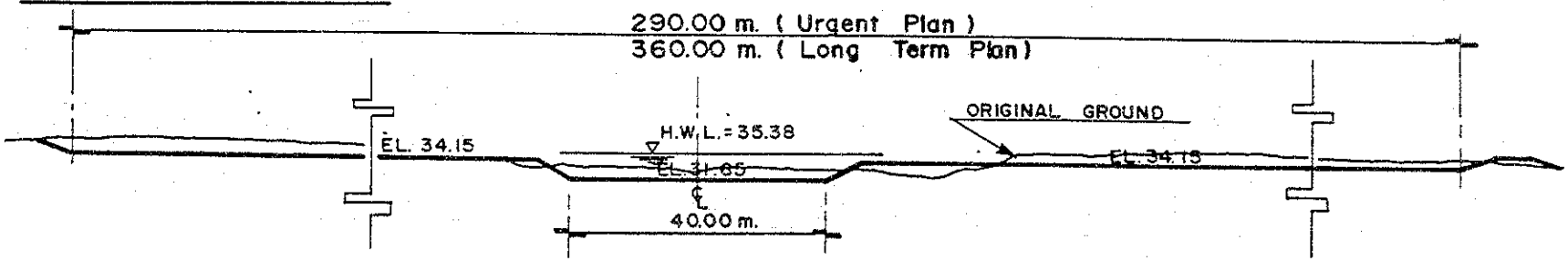


FIG. F.3.6 (4) DESIGN CROSS SECTION OF THE RIO CHOLOMA

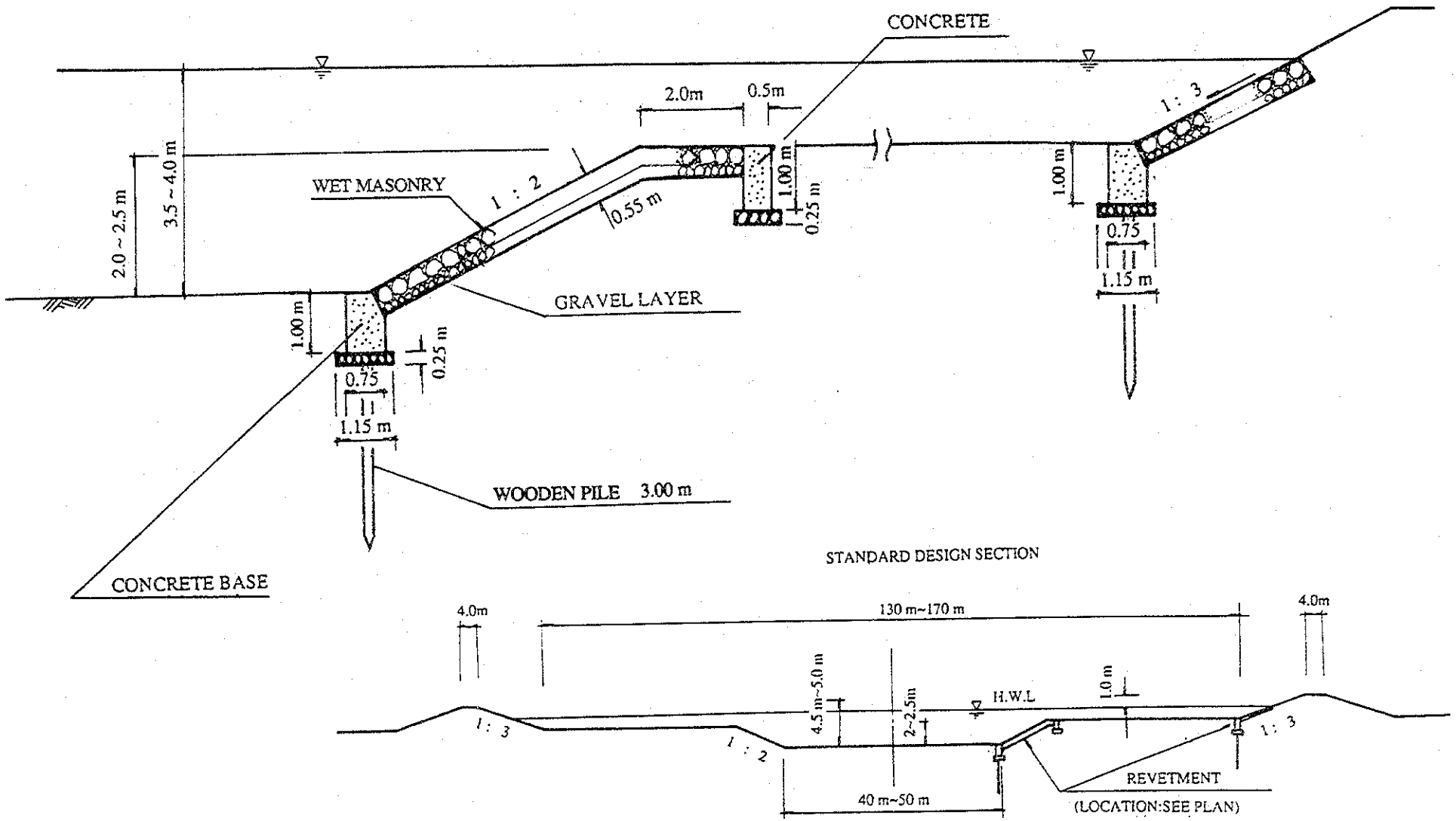
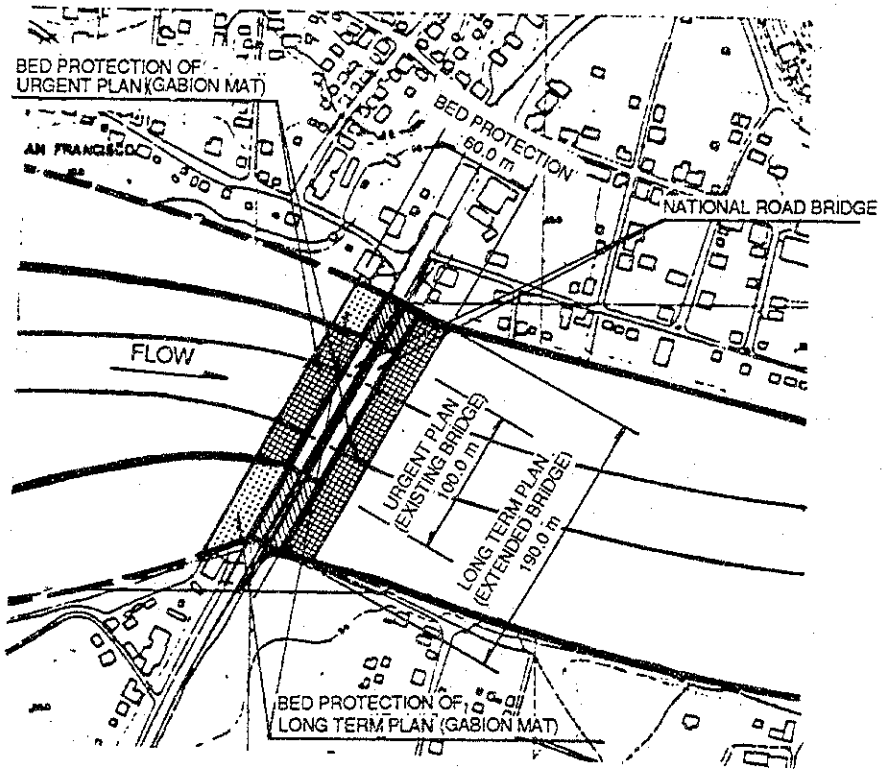
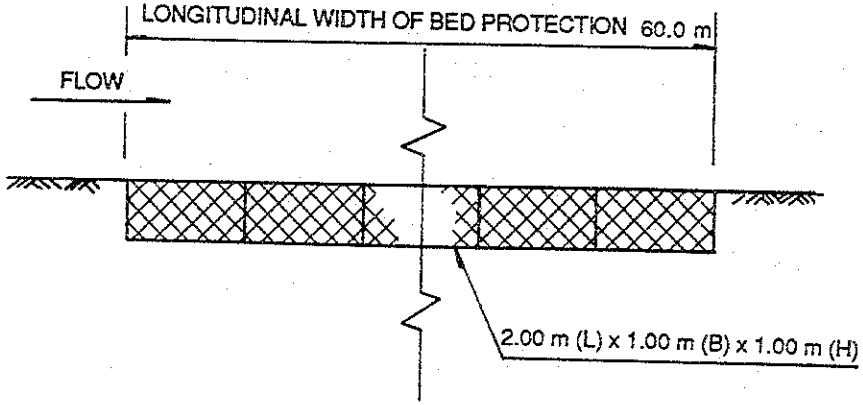


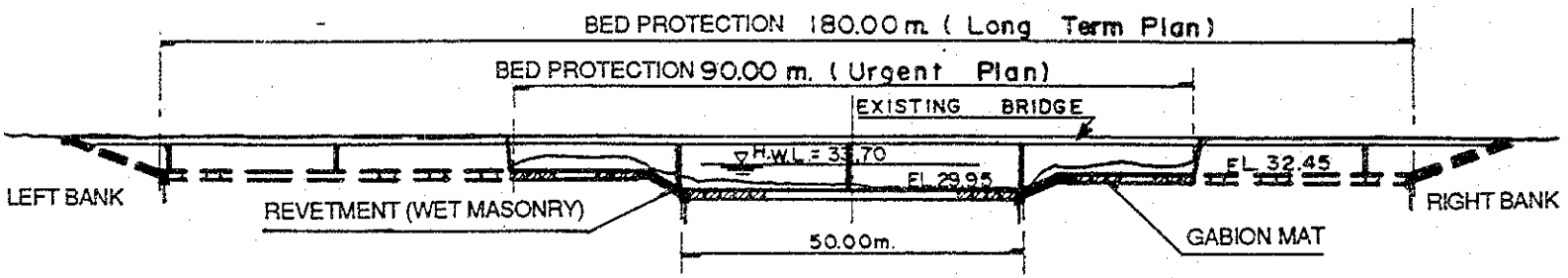
FIG. F.3.7 STANDARD REVETMENT SECTION (WET MASONRY WITH COBLE STONE)



PLAN



GABION OF BED PROTECTION



CROSS SECTION

FIG. F.3.8 PROPOSED ROAD BRIDGE REHABILITATION WORKS

JICA

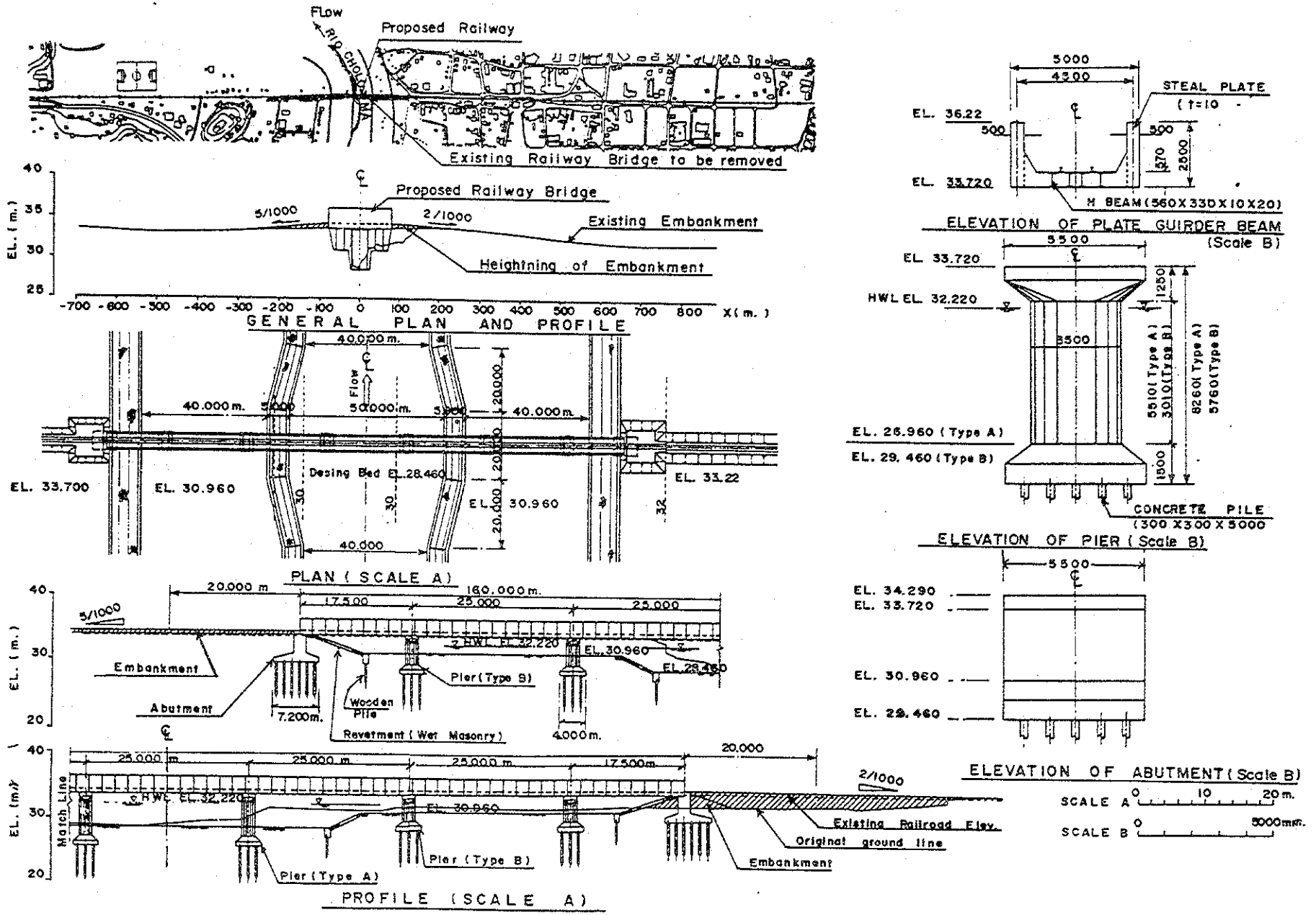


FIG. F.3.9 PROPOSED RAILWAY BRIDGE RECONSTRUCTION

SUPPORTING G
CONSTRUCTION PLAN
AND COST ESTIMATION

SUPPORTING REPORT G CONSTRUCTION PLAN AND COST ESTIMATION

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LIST OF TABLES

SUPPORTING REPORT G CONSTRUCTION PLAN AND COST ESTIMATION

1 GENERAL

This report deals with the construction plan, construction schedule and cost estimate of the master plan and the urgent plan that is identified in the feasibility study.

The construction works consist of sediment and flood control works such as check dams, consolidation dams, training levees, revetment and embankment. The construction schedule and cost estimation are based on the preliminary design of the proposed facilities in the master plan and the urgent plan.

2 CONSTRUCTION PLAN

2.1 Basic Conditions

In the master plan, the proposed facilities for each river are planned to be executed within ten years according to their priority orders. However, in the urgent plan the proposed facilities are planned to be implemented within two or three years.

The construction of the urgent facilities are planned to be carried out by contractors selected through international tenders.

The major construction works are planned to be carried out by applying heavy equipment due to required qualities of works. The earth work is planned to be carried out mainly by construction machinery in combination with manpower. While the concrete work is planned to be carried out by mixing plant.

2.2 Major Construction Work

The major construction works consist of the followings:

(1) Sediment Control work

- Check dam
- Consolidation dam
- Training levee

(2) Flood Mitigation Work

- Embankment

- Revetment
- Protection work
- Rehabilitation work

3 COST ESTIMATION

3.1 Basic Condition

3.1.1 Component of Project Cost

The project cost will be composed of direct cost, indirect cost and contingency as follows:

(1) Direct cost

- Construction cost

(2) Indirect cost

- Land acquisition and compensation,
- Administration cost,
- Engineering service Cost.

(3) Contingency

- Physical contingency,

3.1.2 Price Level

The unit cost and price are estimated based on the prevailing market price in June 1993 in Honduras Lempiras in and around the project area. Traded goods are valued on the basis of their international border prices in 1992/1993.

3.1.3 Mode of Contract

The construction works will be contracted to general contractors through international tenders.

3.1.4 Currency Portion

The costs are divided into foreign currency portion and local currency portion as follows:

(1) Foreign currency portion (F.C.)

- Imported goods,
- Overhead of contractor,
- Expense of expatriate personnel.

(2) Local currency portion (L.C.)

- Equipment and materials available in the local market,
- Land acquisition and compensation cost,
- Expense of local personnel,
- Overhead of local firms,
- Tax and tariff.

The each component of unit costs are as follows:

Particular	F.C. (%)	L.C. (%)
(a) Labor cost	0	100
(b) Equipment cost	100	0
(c) Material		
-Fuel	100	0
-Cement	25	75
-Ready mixed concrete	15	85
-Binding Wire	100	0
-Re-bar	50	50
-Structure steel	100	0
-Steel Plate	50	50
-Pine plywood	10	90
-Others	0	100

3.1.5 Exchange Rate

The exchange rates of foreign currencies applied are those in June 1993 as follows:

Lps. 6.2 = US$ 1.0 = Yen 110.0

3.1.6 Indirect Cost

(1) Land acquisition and compensation cost

The cost is based on prevailing market price.

(2) Administration cost

Five (5.0) percent of base construction cost.

(3) Engineering service cost

Ten (10.0) percent of base construction cost plus contingency.

3.1.7 Contingency

Physical contingency is estimated to be twenty (20) percent of base construction cost.

3.1.8 Unit Price

The unit prices of material, labor and land, are estimated based on prevailing market prices referring the data collected from SECOPT and other agencies concerned. The unit costs of the construction works are divided into foreign currency portion and local currency portion based on the current data applied to similar projects. The unit prices use in this study are shown in *Tables* G. 3.1~G. 3.3

3.1.9 Operation and Maintenance Cost

OM cost consist of routine OM costs and civil works. The cost is estimated to be one (1.0) percent of base construction cost.

3.2 Construction Cost

3.2.1 Basis of Cost Estimate

The construction cost consists of mobilization and demobilization, preparatory works, main works and miscellaneous works. They are estimated as follows:

(1) Mobilization and Demobilization

Eight (8.0) percent of the main construction cost is applied for the project.

(2) Preparatory Works

Ten (10.0) percent of the main construction cost is applied for the project.

(3) Cost of Main Work

The cost of the main works is estimated on the bill of quantities prepared based on the preliminary design of each structure. However the indirect costs such as site expenses and overhead are estimated by percentage to base construction cost as follows;

- The site expense is estimated to be fifteen (15) percent of the construction cost of the main works.
- The overhead and profit are estimated to be ten (10) percent of the construction cost of the main works.
- The cost for the miscellaneous works is estimated to be ten (10) percent of the construction cost of the main works.

The unit construction cost of general items are summarized in *Table* G. 3.4. .Their breakdown are shown in *Tables* G. 3.5~G. 3.8.

3.2.2 Basic Conditions for Major Works

(1) Banking for embankment

Banking materials are excavated from river course or nearby the embankment. For excavation and banking, heavy construction machinery i.e. back hoe, bulldozer and dump tracks are used.

(2) Concrete work

Most materials are to be procured at the site. For placing concrete, mixing plants, truck mixers, truck cranes and concrete buckets are used.

(3) Revetment (wet masonry)

Wet masonry works for revetment are carried out mainly by manpower. Truck crane is used for the transportation and lifting the materials.

(4) Sheet Pile Driving

For the driving work of sheet piles, crawler crane with diesel hammer/vibration hammer is used

3.2.3 Unit Construction Cost

The unit construction cost is estimated by applying the unit prices of labor, construction materials and equipment. The unit construction cost is composed of construction cost, site expenses, overhead and profit including tax. The unit construction costs of general items are summarized in *Tables* G. 3.4~G. 3.10.

3.3 Project Cost

3.3.1 Master Plan

The total project cost of each river is estimated as follows:

(1) Rio Choloma Lps. 483 million (*Table* G. 3.11)

(2) Rio Blanco Lps. 497 million (*Table* G. 3.12)

(3) Rio El Sauce Lps. 293 million (*Table* G. 3.13)

(4) Rio Blanco / El Sauce Lps. 575 million (*Table* G. 3.14)

The construction costs against different flood frequencies and their disbursement schedules are estimated based on a tentative schedule of ten years for economic evaluation.

The construction costs of the project against different flood frequencies are estimated for the Rio Choloma and shown in *Tables* G. 3.15~G. 3.19. Their disbursement schedules are shown in *Tables* G. 3.20~G. 3.24.

The construction costs of the projects against a 50 year flood return period are estimated for the three projects (the Rio Blanco, the Rio El Sauce, and the Rio Blanco/Rio El Sauce and their disbursement schedules are shown in *Tables* G. 3.25~G. 3.30.

3.3.2 Feasibility Study on the Rio Choloma

For the Rio Choloma a long term and an urgent project are studied. The total project costs are estimated as follows:

(1) The long term plan Lps. 502 million (*Table* G. 3.31)

(2) The urgent plan Lps. 142 million (*Table* G. 3.32)

Their construction cost of the project against a 50 year flood frequency is estimated and shown in *Table* G. 3.33. The disbursement schedules of the long term plan and the

project against a 50 year flood frequency are for economic evaluation and shown in *Tables* G. 3.34 and G. 3.35.

TABLES

TABLE G.3.1 UNIT PRICE OF TYPICAL MATERIAL

Unit:Lp (1993,June Price)

Item	Description	Unit	Price (Lp)	Foreign Portion (%)	Local Portion (%)
Binding Wire		kg	7	100	0
Plain Steel Bar		kg	3	50	50
Deformed Bar		kg	3	50	50
River Sand	for Concrete	m3	65	0	100
Pit Sand		m3	35	0	100
Artificial Gravel		m3	70	0	100
Cobble Stone		m3	40	0	100
Cement		ton	345	25	75
Ready mixed Concrete	170 kg/m3	m3	320	15	85
Ready mixed Concrete	220 kg/m3	m3	330	15	85
Ready mixed Concrete	240 kg/m3	m3	340	15	85
Pine Plywood		m3	3,400	10	90
Timber (Low Class)	High Class	m3	1,568	0	100
Timber (High Class)	Low Class	m3	1,334	0	100
Iron Plate		kg	4	50	50
Gasoline		Ltr	2	100	0
Diesel Oil		Ltr	2	100	0

TABLE G.3.2 LABOR WAGES

Unit:Lp (1993,June Price)

Type of Labour	Labour Wages	Remarks
1 Foreman	75.00	Per 8 hrs
2 Skilled Labor	25.00	" "
3 Common Labour	20.00	" "
4 Operator(Machine)	50.00	" "
5 Assistant Operator	25.00	" "
6 Electrician	35.00	" "
7 Mechanic	35.00	" "
8 Driver	25.00	" "
9 Steel Worker	35.00	" "
10 Concrete Worker	25.00	" "
11 Carpenter	30.00	" "
12 Mason	30.00	" "
13 Welder	30.00	" "
14 Scaffolder	30.00	" "

TABLE G.3.3 LAND COST

Unit:Lp/m2 (1993,June Price)

Area		Official Price		Market Price		Remarks
		Urban Area	Rural Area	Urban Area	Rural Area	
Choloma	Max	50	1	*75	**1.0	
	Common	18	0	*27	**0.5	
	Min	10	0	*15	**0.4	
San Pedro Sula	Max	850	1	1500	1.2	
	Common	100	1	150	0.7	
	Min	5	0	8	0.01	
La Lima	Max	110	1	*165	**0.7	
	Common	37	1	*56	**0.7	
	Min	5	0	*8	**0.1	

Note:
1)*: Assumed Price :Official Pricex1.5
2)**: Assumed Price :Official Pricex1.2
3) Common Price in Market Price is to be used for Cost Estimate

TABLE G.3.4 SUMMARY OF UNIT CONSTRUCTION COST

Unit:Lp (1993,June Price)

	Work Items	Description	Unit	Price	Foreign Portion (%)	Local Portion (%)	Remarks	
1	Excavation Work	Sandy Soil	m3	11	92	8	For River Works	Ref,Table11.5(1),Code38
2	Banking Work (L=200m)	" "	m3	25	92	8	" "	Ref,Table11.5(1),Code38-1
3	Spoiling Work (L=1000m)	" "	m3	28	92	8	" "	Ref,Table11.5(1),Code42
4	Filling Work	" "	m3	24	92	8	" "	Ref,Table11.5(1),Code39
5	Excavation for Foundation	Sand/Gravel	m3	39	94	6	For Debris Levee	Ref,Table11.5(1),Code40
6	" "	Rock/Coble	m3	244	96	4	For Sabo Dam	Ref,Table11.5(1),Code7
7	Sodding Work		m2	8	0	100		Ref,Table11.5(1),Code16
8	Gabion Work	Cobble Stone	m3	156	54	46		Ref,Table11.5(2),Cuc10
9	Wet Maisonry (Revetment)	Cobble With Conc.	10 m2	1,700	13	87		Ref,Table11.5(2),Code37
10	Flood Control Strctures							
	1) Box Culvert	Concrete	m3	2,722	44	56	Incld.form work,et	Ref,Table11.6(1),Cuc15
	2) Gate A	Steel	m2.	15,000	95	5		Ref,Table11.6(2)
	3) Gate B	Steel	m2	13,000	95	5		Ref,Table11.6(2)
	4) Bridges (Concrete Type	Slab,Etc	m2	6,937	37	63	Incld. pier ,etc	Ref,Table11.6(1),Cuc16
	5) Weir Type Structure	Concrete	m3	1,035	77	23	Incld.form work,et	Ref,Table11.6(1),Cuc19
	6) Consolidation Dam	Boulder Concrete	m3	752	79	21	" "	Ref,Table11.6(1),Cuc20
11	Debris Control Structure							
	1) Check Dam (Sabo Dam)	Boulder Concrete	m3	1,100	62	38	Incld.form work,et	Ref,Table11.7(1)
12	Steel Sheet Pile	Type II	m2	1,150	99	1		Ref,Table11.5(2),Code32-1
		Type III	m2	1,450	99	1		Ref,Table11.5(2),Code32-2

Note:
1.Conc.:Concrete
2.Exca. :Excavation

TABLE G.3.5 UNIT COST OF EARTH WORKS AND SODDING

Code 38 Excavation (sandy soil)100 m^3

Item	Unit	Qty	Unit Price L/C (Lps.)	Unit Price F/C (Lps.)	Estimate L/C (Lps.)	Estimate F/C (Lps.)	Total (Lps.)
0.6 m^3 Backhoe	hour	3.14	16.73	256.40	52.51	804.77	857.28
Common Labor	man	1.50	20.00	0.00	30.00	0.00	30.00
Total					82.51	804.77	887.28
Unit Price					0.83	8.05	8.87
Unit Cost					1.03	10.06	11.09
L/C : F/C					0.09	0.91	1.00

Code 38-1 Banking(sandy soil)100 m^3-Transport. & Compac.(L=200m)

Item	Unit	Qty	Unit Price L/C (Lps.)	Unit Price F/C (Lps.)	Estimate L/C (Lps.)	Estimate F/C (Lps.)	Total (Lps.)
11 t Dump Truck	hour	6.23	4.86	191.1	30.28	1190.37	1220.64
15t . Bulldozer	hour	2.32	17.19	311.59	39.88	722.89	762.77
Common Labor	man	1.50	20.00	0.00	30.00	0.00	30.00
Total					100.16	1913.25	2013.41
Unit Price					1.00	19.13	20.13
Unit Cost					1.25	23.92	25.17
L/C : F/C					0.05	0.95	1.00

Code 42 Spoiling (0.60m^3 backhoe+11t dump truck L:1km) (river works)

Item	Unit	Qty	Unit Price L/C (Lps.)	Unit Price F/C (Lps.)	Estimate L/C (Lps.)	Estimate F/C (Lps.)	Total (Lps.)
11t Dump truck	hour	7.69	4.86	191.07	37.38	1469.77	1507.15
15t Bulldozer	hour	2.22	17.19	311.59	38.20	692.42	730.62
Common labor	L.S.	0.50	20.00	0.00	10.00	0.00	10.00
Total					85.58	2162.19	2247.78
Unit Price					0.86	21.62	22.48
Unit cost					1.07	27.03	28.10
L/C : F/C					0.04	0.96	1.00

Code 39 Filling (bulldozer:L=60m) 100 m^3 (river works)

Item	Unit	Qty	Unit Price L/C (Lps.)	Unit Price F/C (Lps.)	Estimate L/C (Lps.)	Estimate F/C (Lps.)	Total (Lps.)
15t Bulldozer	hour	3.43	17.19	311.59	58.89	1067.45	1126.34
15t Bulldozer	hour	2.32	17.19	311.59	39.86	722.44	762.30
Common labor	L.S.	3.00	20.00	0.00	60.00	0.00	60.00
Total					158.75	1789.90	1948.64
Unit Price					1.59	17.90	19.49
Unit Cost					1.98	22.37	24.36
L/C : F/C					0.08	0.92	1.00

Code 40 Excavation and pushing (swamp bulldozer:L=60m) 100 m^3 (river works)

Item	Unit	Qty	Unit Price L/C (Lps.)	Unit Price F/C (Lps.)	Estimate L/C (Lps.)	Estimate F/C (Lps.)	Total (Lps.)
16t Bulldozer	hour	6.47	17.24	316.25	111.59	2047.06	2158.65
13t Bulldozer	hour	3.17	16.64	250.98	52.73	795.40	848.13
Foreman	m/d	1.00	75.00	0.00	75.00	0.00	75.00
Common labor	L.S.	3.00	20.00	0.00	60.00	0.00	60.00
Total					299.33	2842.46	3141.78
Unit Price					2.99	28.42	31.42
Unit Cost					3.74	35.53	39.27
L/C : F/C					0.10	0.90	1.00

Code 16 Sodding on slope 100 m^2

Item	Unit	Qty	Unit Price L/C (Lps.)	Unit Price F/C (Lps.)	Estimate L/C (Lps.)	Estimate F/C (Lps.)	Total (Lps.)
Turf	sq.m	100.0	0.50	0.00	50.00	0.00	50.00
Forman	m/d	1.0	75.00	0.00	75.00	0.00	75.00
Common labor	m/d	24.00	20.00	0.00	480.00	0.00	480.00
Miscellaneous	L.S.				21.20	0.00	21.20
Total					626.20	0.00	626.20
Unit Price					6.26	0.00	6.26
Unit Cost					7.83	0.00	7.83
L/C : F/C					1.00	0.00	1.00

TABLE G.3.6 (1) UNIT COST OF REVETMENT, GABION AND SHEET PILE WORKS

Code 37 - 1 Concrete Base of Revetment(H=1.25m, T=0.5m, L=1.0m)

Item	Unit	Qty	Unit Price L/C (Lps.)	Unit Price F/C (Lps.)	Estimate L/C (Lps.)	Estimate F/C (Lps.)	Total (Lps.)
Excavation	cu.m	0.95	7.88	25.6	7.49	24.33	31.82
Concrete	cu.m	0.28	176.85	76.44	49.52	21.40	70.92
Cobblestone	cu.m	0.14	70.00	0.00	9.80	0.00	9.80
Form	sq.m	1.10	40.72	10.5	44.79	11.58	56.38
Filling gravel	cu.m	0.53	65.00	0.00	34.45	0.00	34.45
Foreman	m/d	0.10	75.00	0.00	7.50	0.00	7.50
Common labor	m/d	1.14	20.00	0.00	22.80	0.00	22.80
Total					176.35	57.32	233.66
Unit cost					220.43	71.64	292.08
L/C : F/C					0.75	0.25	1.00

Code 37 - 2 Concrete diaphram foot for Rvetment (H=1.25m, T=0.5 - 0.75m, L=1.0m)

Item	Unit	Qty	Unit Price L/C (Lps.)	Unit Price F/C (Lps.)	Estimate L/C (Lps.)	Estimate F/C (Lps.)	Total (Lps.)
Excavation	cu.m	3.47	33.78	14.0	117.22	48.68	165.90
Concrete	cu.m	0.34	176.85	76.44	60.13	25.99	86.12
Cobblestone	cu.m	0.15	70.00	0.00	10.50	0.00	10.50
Form	sq.m	1.15	40.72	10.5	46.83	12.11	58.94
Foreman	m/d	0.02	75.00	0.00	1.50	0.00	1.50
Common labor	m/d	0.52	20.00	0.00	10.40	0.00	10.40
Total					246.57	86.78	333.36
Unit cost					308.22	108.48	416.70
L/C : F/C					0.74	0.26	1.00

Code 37 - 3 Wet masonry with cobble for Revetment (H=5.1m, Slope length=13.4m/m)

Item	Unit	Qty	Unit Price L/C (Lps.)	Unit Price F/C (Lps.)	Estimate L/C (Lps.)	Estimate F/C (Lps.)	Total (Lps.)
Excavation	cu.m	7.37	42.23	17.5	311.24	129.27	440.50
Concrete	cu.m	0.44	176.85	76.44	77.81	33.63	111.45
Cobblestone	cu.m	3.19	70.00	0.00	223.30	0.00	223.30
Pit sand	cu.m	2.01	35.00	0.00	70.35	0.00	70.35
Mason	m/d	4.82	30.00	0.00	144.72	0.00	144.72
Common labor	m/d	5.63	20.00	0.00	112.56	0.00	112.56
Total					939.98	162.90	1102.88
Unit cost					1174.97	203.63	1378.60
L/C : F/C					0.85	0.15	1.00

Code 37 Revetment (per 201sq.m)

Item	Unit	Qty	Unit Price L/C (Lps.)	Unit Price F/C (Lps.)	Estimate L/C (Lps.)	Estimate F/C (Lps.)	Total (Lps.)
Diaphram wall	m	15.00	220.43	71.64	3306.49	1074.67	4381.16
Foot wall	m	15.00	308.22	108.48	4623.26	1627.18	6250.44
Wet masonry	m	14.00	1174.97	203.63	16449.63	2850.81	19300.44
Others	L.S.	1.00			4400.00	0.00	4400.00
Total	sq.m	201.00			28779.38	5552.66	34332.04
Unit cost	sq.m	1.00			143.18	27.03	170.21
L/C : F/C					0.87	0.13	1.00

TABLE G.3.6 (2) UNIT COST OF REVETMENT, GABION AND SHEET PILE WORKS

Cuc 10 Gablon(box type)2.00m-1.00m-1.00m

Item	Unit	Qty	Unit price L/C (Lps.)	Unit price F/C (Lps.)	Estimate L/C (Lps.)	Estimate F/C (Lps.)	Total (Lps.)
Gablon	ps	1.00	0.00	133.92	0.00	133.92	133.92
Cobble	cu.m	1.80	40.00	0	72.00	0.00	72.00
Common labor	m/d	2.20	20.00	0.00	44.00	0.00	44.00
Total					116.00	133.92	249.92
Unit cost					145.00	167.40	312.40
Unit cost		1 cm3			72.50	83.70	156.20
L/C : F/C					0.46	0.54	1.00

Code 32 - 1 Sheet pile II type L=4m, Width=40cm (N<22, 30kw vibrohammer)

Item	Unit	Qty	Unit Price L/C (Lps.)	Unit Price F/C (Lps.)	Estimate L/C (Lps.)	Estimate F/C (Lps.)	Total (Lps.)
Sheet pile	m	4.00	0.00	323.14	0.00	1292.54	1292.54
30kw vib.hammer	hrs	0.15	0.88	121.14	0.13	18.21	18.34
25-27t Craw.crane	hrs	0.15	19.06	397.16	2.86	59.69	62.56
10t Truck crane	hrs	0.15	17.31	205.66	2.60	30.91	33.51
100KVA Generter	hrs	0.15	6.02	79.36	0.90	11.93	12.83
Formman	m/d	0.02	75.00	0.00	1.76	0.00	1.76
Scaffolder	m/d	0.14	30.00	0.00	4.23	0.00	4.23
Common labor	m/d	0.07	20.00	0.00	1.41	0.00	1.41
Subtotal					13.90	1413.28	1427.18
Misccelaneous	L.S.				0.42	42.40	71.36
Total					14.32	1455.7	1498.5
Unit cost	m	0.40			17.90	1819.60	1837.50
Unit cost	m2	1.00			11.19	1137.25	1148.43
L/C : F/C					0.01	0.99	1.00
							say 1,150/m2

Code 32 - 2 Sheet pile III type L=4m, Width=40cm (N<22, 30kw vibrohammer)

Unit cost	m2	1.00			14.10	1433.92	1448.03
L/C : F/C					0.01	0.99	1.00
							say 1,450/m2

TABLE G.3.7 (1) COMPOUND UNIT COST OF FLOOD CONTROL STRUCTURE

Cuc 15 Concrete box culvert 3-3-10m-2 L=10m

Item	Unit	Qty	Unit price L/C (Lps.)	Unit price F/C (Lps.)	Estimate L/C (Lps.)	Estimate F/C (Lps.)	
Concrete	cu.m	62.00	186.84	79.44	11584.08	4925.28	16509.36
Foundation work	cu.m	13.00	149.5	0	1943.50	0.00	1943.50
Wooden form	sq.m	199.00	101.40	12.70	20178.60	2527.30	22705.90
Supporting	cu.m	180.00	69.26	15.11	12466.80	2719.80	15186.60
Deformed bar	kg	5580.00	2.06	1.64	11466.90	9123.30	20590.20
Steel wire 4mm	kg	37.20	0.00	7.32	0.00	272.30	272.30
Concrete pile 5m	ps	25.00	999.64	1015.00	24991.00	25375.00	50366.00
Excavation	cu.m	65.00	33.78	14.03	2195.70	911.95	3107.65
Banking	cu.m	130.00	2.25	26.75	292.50	3477.50	3770.00
Subtotal					85119.08	49332.43	134451.51
Others					340.48	197.33	6722.58
Total					85459.56	49529.76	141174.09
Unit price					1378.38	798.87	14117.41
Unit cost					1722.98	998.58	2721.56
L/C : F/C					0.56	0.44	1.00

Cuc 16 T beam bridge (L=10m, W=5.5m) (design load 20 ton)

Item	Unit	Qty	Unit price L/C (Lps.)	Unit price F/C (Lps.)	Estimate L/C (Lps.)	Estimate F/C (Lps.)	
Concrete abutment (H=5m, W=5.5m)							
Concrete	cu.m	85.30	176.85	76.44	15085.31	6520.33	21605.64
Foundation work	cu.m	13.00	149.50	0	1943.50	0.00	1943.50
Wooden form	sq.m	145.20	77.50	11.60	11253.00	1684.32	12937.32
Supporting	cu.m	35.00	62.06	3.81	2172.10	133.35	2305.45
Deformed bar	kg	300.72	2.06	1.64	617.98	491.68	1109.66
Steel wire 4mm	kg	1.50	0.00	7.32	0.00	10.98	10.98
Concrete pile 5m	ps	33.00	999.64	1015.00	32988.12	33495.00	66483.12
Excavation	cu.m	52.00	33.78	14.03	1756.56	729.56	2486.12
Banking	cu.m	52.50	2.25	26.75	118.13	1404.38	1522.50
Subtotal					65934.69	44469.59	110404.28
2 Abutments					131869.38	88939.19	220808.57
T-Beam bridge(L=10m, W=5.5m)							
Concrete(rein.)	cu.m	51.48	186.84	79.44	9618.52	4089.57	13708.09
Deformed bar	kg	7722.00	2.06	1.64	15868.71	12625.47	28494.18
Steel wire 4mm	kg	38.61	0.00	7.32	0.00	282.63	282.63
Wooden form	sq.m	147.20	101.40	12.70	14926.08	1869.44	16795.52
Supporting	cu.m	220.00	69.26	15.11	15237.20	3324.20	18561.40
Subtotal					55650.51	22191.31	77841.82
Newel post(4 post) H=1.3m, W=0.6M							
Concrete	cu.m	1.88	176.85	76.44	332.48	143.71	476.19
Wooden form	sq.m	12.40	40.72	10.53	504.93	130.57	635.50
Foundation work	cu.m	1.52	149.50	0	227.24	0.00	227.24
Subtotal					1064.65	274.28	1338.93
Handrail L=10m, H=0.8m							
Concrete(rein.)	cu.m	2.60	186.84	79.44	485.78	206.54	692.33
Deformed bar	kg	780.00	2.06	1.64	1602.90	1275.30	2878.20
Steel wire 4mm	kg	3.90	0.00	7.32	0.00	28.55	28.55
Wooden form	sq.m	32.00	40.72	10.53	1303.04	336.96	1640.00
Subtotal					3391.72	1847.35	5239.08
Total	sq.m	55.00			191976.26	113252.13	305228.39
per 1 sq.m	sq.m	1.00			3490.48	2059.13	5549.61
Unit cost	sq.m	1.00			4363.10	2573.91	6937.01
L/C : F/C					0.63	0.37	1.00

TABLE G.3.7 (2) COMPOUND UNIT COST OF FLOOD CONTROL STRUCTURE

Cuc 19 Small reinforced concrete structure 1.0 m^3 (steel bar=40kg/cu.m)
(Pier,etc.)

Item	Unit	Qty	Unit price L/C (Lps.)	Unit price F/C (Lps.)	Estimate L/C (Lps.)	Estimate F/C (Lps.)	Total (Lps.)
Concrete(rein.)	cu.m	1.00	186.84	79.44	186.84	79.44	266.28
Deformed bar	kg	40.00	2.06	1.64	82.20	65.40	147.60
Wooden form	sq.m	2.66	101.40	12.70	269.72	33.78	303.51
Foundation work	cu.m	0.50	149.50	0	74.75	0.00	74.75
Excavation	cu.m	0.75	33.78	14.03	25.34	10.52	35.86
Total					638.85	189.14	827.99
Unit cost					798.56	236.43	1034.99
L/C : F/C					0.77	0.23	1.00

Cuc 20 Weir Type structure 1.0 m^3 (steel bar=5kg/cu.m)
(Gravity type abutment, etc.))

Item	Unit	Qty	Unit price L/C (Lps.)	Unit price F/C (Lps.)	Estimate L/C (Lps.)	Estimate F/C (Lps.)	Total (Lps.)
Concrete(rein.)	cu.m	1.00	186.84	79.44	186.84	79.44	266.28
Deformed bar	kg	5.00	2.06	1.64	10.28	8.18	18.45
Wooden form	sq.m	1.60	101.40	12.70	162.24	20.32	182.56
Foundation work	cu.m	0.50	149.50	0	74.75	0.00	74.75
Excavation	cu.m	1.25	33.78	14.03	42.23	17.54	59.76
Total					476.33	125.47	601.80
Unit cost					595.41	156.84	752.25
L/C : F/C					0.79	0.21	1.00

TABLE G.3.8 UNIT PRICE OF SLUICE GATE

US$ 1.0 = Lps 6.2 = \ 110.0 in June 1993

Code	a	b	n*Hw	2.4(a*a+b*b)	D/E	SQRT(ABS(Fn))	t(cm)	W(ton)	\1,000	Unit Price \1000/m^2	Unit Price Lps.(m^2)	
G 060	60	60	0.00024	17280	1.389E-08	0.000117851	0.42	0.01	230	639	38,333	
G 080	80	80	0.00024	30720	7.813E-09	8.83883E-05	0.57	0.03	282	441	26,438	
G 100	100	100	0.00024	48000	5E-09	7.07107E-05	0.71	0.06	390	390	23,400	
G' 125	125	100	0.00024	61500	3.902E-09	6.24695E-05	0.78	0.09	435	348	20,880	
G 125	125	125	0.00024	75000	3.2E-09	5.65685E-05	0.88	0.12	503	322	19,315	
G' 150	150	100	0.00024	78000	3.077E-09	5.547E-05	0.83	0.11	490	327	19,600	
G' 150	150	125	0.00024	91500	2.623E-09	5.12148E-05	0.96	0.16	595	317	19,040	
G 150	150	150	0.00024	108000	2.222E-09	4.71405E-05	1.06	0.21	632	281	16,853	Mean
G' 175	175	150	0.00024	127500	1.882E-09	4.33861E-05	1.14	0.26	680	259	15,543	15000/m2
G 175	175	175	0.00024	147000	1.633E-09	4.04061E-05	1.24	0.33	782	255	15,321	
G" 175	175	200	0.00024	169500	1.416E-09	3.76288E-05	1.32	0.41	815	233	13,971	
G' 200	200	150	0.00024	150000	1.6E-09	0.00004	1.20	0.32	790	263	15,800	
G" 200	200	175	0.00024	169500	1.416E-09	3.76288E-05	1.32	0.41	836	239	14,331	Mean
G 200	200	200	0.00024	192000	1.25E-09	3.53553E-05	1.41	0.50	886	222	13,290	13000/m2

Note: Formula(Bach's)

t = a * b * SQRT (ABS(Fn))

t : gate skin plate thichness (cm)
a : rectanglar shorter side length (cm)
b : rectanglar longer side length (cm)
SQRT (ABS(Fn)) : value of square root on Fn
Fn : f*Hw / { 2*Tsa*(a*a+b*b) }
f : pressure factor 0.8
Hw : hydraulic pressure 0.0003 ton/cm^2
(water depth h=3m)
Tsa : allowable tensile stress 1.2 ton/cm^2