TABLE E.8.10 (1/2) RESULTS OF HYDRODYNAMIC SIMULATION : EXISTING CONDITION

Canal	Location		Maximum Discharges and Water Levels for Different Cases (Closed Canal System without any Southern Canal)											
	ID	From Mouth	1A			2A			2B			2C		
			-Q	+Q	W.L.	-Q	+Q	W.L.	-Q	+Q	W.L.	-Q	+Q	W.L.
		(km)	(m3/s)	(m3/s)	(EL.m)	(m3/s)	(m3/s)	(EL.m)	(m3/s)	(m3/s)	(EL.m)	(m3/s)	(m3/s)	(EL.m)
Tau Hu	T1	12.175	-32	1	1.73	-31	12	1.66	-33	12	1.72	-37	12	1.50
	T2	11.120	-26	2	1.74	-28	7	1.68	-25	7	1.73	-27	7	1.50
	T3	9.935	-86	1	1.82	-86	5	1.76	-84	5	1.80	-83	5	1.57
	T4	8.930		111	1.83	-32	110	1.76	-32	114	1.80	-32	117	1.58
	T5	7.930	-5	40	1.69	-16	39	1.62	-16	44	1.66	-16	43	1.47
	T6	6.650	-40	10	1.72	-41	14	1.63	-40	13	1.71	-40	13	1.51
	T7	6.260	-14	16	1.74	-15	19	1.65	-14	18	1.73	-14	13	1.55
	T8	5.155	-5	34	1.71	-24	51	1.61	-24	58	1.70	-24	58	1.52
	T9	3.320	-6	120	1.50	-47	113	1.45	-47	124	1.48	-47	132	1.39
Ben Nghe	B1	3.000	-17	14	1.46	-23	18	1.41	-22	18	1.44	-24	18	1.37
	B2	1.970	-14	22	1.43	-30	24	1.41	-30	28	1.43	-30	26	1.36
	B3	0.940	-13	59	1.39	-40	53	1.36	-40	67	1.37	-40	64	1.34
	B4	0.000	-13	94	1.32	-55	86	1.32	-55	107	1.32	-55	108	1.32
Doi - Te	D1	12.756	-1	3	1.73	-6	3	1.66	-5	6	1.72	-5	6	1.50
	D2	12.450	-1	35	1.73	-22	33	1.66	-22	39	1.72	-22	53	1.50
	D3	11.450	-2	40	1.73	-43	42	1.66	-43	51	1.71	-43	53	1.49
	D4	10.285	-3	108	1.71	-79	101	1.64	-79	124	1.69	-79	128	1.47
	D5	9.270	-4	146	1.69	-98	144	1.62	-97	171	1.66	-98	174	1.46
	D6	8.550	-4	233	1.67	-146	221	1.61	-146	262	1.64	-146	275	1.46
	D7	7.560	-4	317	1.64	-199	299	1.57	-199	356	1.61	-199	377	1.43
	D8	6.040	-4	321	1.56	-230	301	1.50	-230	369	1.53	-230	393	1.41
	D9	4.250	-4	422	1.48	-310	387	1.43	-310	486	1.46	-310	522	1.38
	D10	3.900	-4	438	1.48	-308	403	1.43	-308	501	1.46	-308	550	1.37
	D11	2.055	-4	439	1.37	-362	400	1.35	-361	527	1.36	-361	581	1.34
	D12	0.000	-4	440	1.32	-428	418	1.32	-427	562	1.32	-427	614	1.32
Connecting Canals	N1	0.210	-4	96	1.66	-28	91	1.60	-28	99	1.64	-28	105	1.45
	N2	0.215	-4	92	1.69	-28	92	1.62	-28	94	1.66	-28	98	1.47
	N3	0.215	-4	66	1.73	-10	63	1.67	-10	70	1.72	-10	67	1.49
Max. W.L. at Junction with Lo Gom (EL. m)			1.89			1.83			1.87			1.65		

Canal	Location		Maximum Discharges and Water Levels for Different Cases (Open Canal System Linked with Southern Canals)															
	ID	From Mouth	3A			3B			4A			4B			4C			
			-Q	+Q	W.L.	-Q	+Q	W.L.	-Q	+Q	W.L.	-Q	+Q	W.L.	-Q	+Q	W.L.	
		(km)	(m3/s)	(m3/s)	(EL.m)	(m3/s)	(m3/s)	(EL.m)	(m3/s)	(m3/s)	(EL.m)	(m3/s)	(m3/s)	(EL.m)	(m3/s)	(m3/s)	(EL.m)	
Tau Hu	T1	12.175	-47	13	1.45	-51		1.35	-50	19	1.38	-49	19	1.43	-53	19	1.41	
	T2	11.120	-39	13	1.49	-43		1.40	-46	17	1.38	-42	17	1.47	-40	17	1.44	
	T3	9.935	-89	9	1.61	-89		1.53	-89	12	1.49	-88	12	1.59	-89	12	1.54	
	T4	8.930		107	1.63	-10	108	1.56	-19	106	1.52	-19	109	1.61	-19	112	1.56	
	T5	7.930		28	1.49	-9	27	1.41	-10	26	1.38	-10	30	1.48	-10	31	1.45	
	T6	6.405	-29	9	1.63	-30		1.57	-28	17	1.48	-29	16	1.61	-28	16	1.58	
	T7	4.880		57	1.61	-14	37	1.55	-24	53	1.45	-24	60	1.58	-24	65	1.55	
	T8	3.320		117	1.41	-11	117	1.34	-39	107	1.34	-41	120	1.38	-40	130	1.35	
Ben Nghe	B1	3.000	-36	32	1.39	-56		1.33	-67	49	1.34	-56	49	1.37	-49	49	1.35	
	B2	1.520		32	1.39	-29	1	1.35	-62	62	1.34	-62	57	1.36	-62	58	1.33	
	B3	0.000		78	1.32	-33	57	1.32	-76	83	1.32	-76	112	1.32	-76	123	1.32	
Doi - Te	D1	12.756	-42	112	1.42		135	1.31	-57	142	1.39	-57	130	1.40	-57	133	1.40	
	D2	12.450	-65	30	1.45	-84		1.35	-93	36	1.38	-82	37	1.43	-76	37	1.41	
	D3	11.450	-65	30	1.47	-84		1.38	-98	41	1.37	-83	42	1.45	-69	42	1.42	
	D4	10.285	-11	34	1.47	-45		1.39	-81	58	1.37	-69	58	1.46	-48	58	1.43	
	D5	9.270		48	1.47	-36	23	1.39	-84	88	1.37	-70	76	1.46	-70	72	1.44	
	D6	8.550		133	1.47	-33	116	1.39	-108	119	1.37	-108	159	1.45	-108	177	1.43	
	D7	7.560	-10	223	1.45	-32	206	1.37	-152	173	1.36	-158	237	1.43	-157	280	1.40	
	D8	6.040		163	1.42	-73	116	1.35	-221	211	1.35	-221	225	1.40	-221	242	1.37	
	D9	4.250	-26	266	1.40	-83	214	1.33	-290	274	1.34	-290	309	1.37	-290	373	1.35	
	D10	3.900		303	1.40	-52	271	1.33	-257	237	1.34	-265	312	1.37	-264	389	1.34	
	D11	2.055		305	1.34	-225		1.33	-640	599	1.33	-640	617	1.34	-640	658	1.33	
	D12	0.000		305	1.32	-225		1.32	-689	632	1.32	-689	650	1.32	-689	691	1.32	
Connecting Canals	N1	0.210	-11	97	1.47		97	1.39	-22	90	1.37	-25	100	1.45	-25	108	1.43	
	N2	0.215		101	1.48	-3	102	1.40	-20	100	1.37	-25	102	1.46	-24	106	1.44	
	N3	0.215		58	1.49	-2	55	1.40	-5	50	1.38	-7	60	1.47	-7	62	1.44	
Southern Canals	XC	0.615	-43	67	1.41		100	1.31	-73	119	1.36	-73	100	1.38	-73	66	1.39	
	OL	0.550	-178	2	1.39		297	1.30	-365	389	1.33	-344	349	1.35	-344	349	1.33	
Max. W.L. at Junction with Lo Gom (EL. m)			1.70			1.63			1.60			1.68			1.62			

TABLE E.8.10 (2/2) RESULTS OF HYDRODYNAMIC SIMULATION : EXISTING CONDITION

Canal	Location		Velocities for Different Cases (Closed Canal System without any Southern Canal)							
	ID	From Mouth	1A		2A		2B		2C	
			-v	+v	-v	+v	-v	+v	-v	+v
		(km)	(m/s)	(m/s)	(m/s)	(m/s)	(m/s)	(m/s)	(m/s)	(m/s)
Tau Hu	T1	12.175	-0.21	0.01	-0.21	0.30	-0.22	0.30	-0.26	0.30
	T2	11.120	-0.16	0.01	-0.17	0.16	-0.15	0.16	-0.18	0.16
	T3	9.935	-0.56		-0.58	0.06	-0.56	0.06	-0.61	0.07
	T4	8.930		0.53	-0.22	0.54	-0.22	0.56	-0.22	0.61
	T5	7.930	-0.03	0.29	-0.19	0.28	-0.19	0.34	-0.19	0.36
	T6	6.650	-0.42	0.13	-0.46	0.32	-0.42	0.30	-0.46	0.30
	T7	6.260	-0.14	0.19	-0.20	0.25	-0.20	0.27	-0.20	0.23
	T8	5.155	-0.03	0.28	-0.27	0.27	-0.26	0.32	-0.26	0.35
	T9	3.320	-0.01	0.18	-0.08	0.17	-0.08	0.19	-0.08	0.21
Ben Nghe	B1	3.000	-0.03	0.02	-0.05	0.05	-0.05	0.05	-0.05	0.05
	B2	1.970	-0.11	0.18	-0.33	0.23	-0.33	0.26	-0.33	0.21
	B3	0.940	-0.13	0.57	-0.57	0.53	-0.56	0.73	-0.56	0.83
	B4	0.000	-0.04	0.33	-0.29	0.42	-0.29	0.42	-0.29	0.53
Doi - Te	D1	12.756		0.02	-0.12	0.05	-0.12	0.05	-0.12	0.05
	D2	12.450		0.12	-0.20	0.15	-0.20	0.15	-0.20	0.18
	D3	11.450	-0.01	0.12	-0.25	0.16	-0.25	0.18	-0.25	0.20
	D4	10.285	-0.01	0.38	-0.64	0.44	-0.64	0.51	-0.64	0.56
	D5	9.270	-0.01	0.27	-0.28	0.27	-0.27	0.34	-0.28	0.36
	D6	8.550		0.42	-0.39	0.40	-0.39	0.50	-0.39	0.55
	D7	7.560	-0.01	0.59	-0.52	0.56	-0.52	0.68	-0.52	0.77
	D8	6.040	-0.01	0.64	-0.64	0.60	-0.64	0.77	-0.64	0.87
	D9	4.250	-0.01	0.78	-0.79	0.72	-0.79	0.94	-0.79	1.08
	D10	3.900	-0.01	0.40	-0.38	0.38	-0.38	0.48	-0.38	0.56
	D11	2.055	-0.01	0.54	-0.56	0.50	-0.56	0.69	-0.56	0.80
	D12	0.000	-0.01	0.44	-0.50	0.42	-0.50	0.59	-0.50	0.68
Connecting Canals	N1	0.210	-0.03	0.43	-0.25	0.43	-0.25	0.45	-0.25	0.51
	N2	0.215		0.50	-0.32	0.58	-0.32	0.58	-0.31	0.61
	N3	0.215	-0.02	0.38	-0.21	0.37	-0.21	0.41	-0.21	0.45
Maximum Velocity along Tau Hu - Ben Nghe			-0.71	1.24	-0.73	1.25	-0.72	1.31	-0.78	1.55

Canal	Location		Velocities for Different Cases (Open Canal System Linked with Southern Canals)									
	ID	From Mouth	3A		3B		4A		4B		4C	
			-v	+v	-v	+v	-v	+v	-v	+v	-v	+v
		(km)	(m/s)	(m/s)	(m/s)	(m/s)	(m/s)	(m/s)	(m/s)	(m/s)	(m/s)	(m/s)
Tau Hu	T1	12.175	-0.32	0.09	-0.36		-0.37	0.33	-0.34	0.33	-0.41	0.33
	T2	11.120	-0.25	0.08	-0.29		-0.31	0.18	-0.27	0.17	-0.30	0.17
	T3	9.935	-0.64	0.07	-0.66		-0.66	0.11	-0.64	0.11	-0.69	0.11
	T4	8.930		0.55	-0.05	0.56	-0.15	0.56	-0.15	0.56	-0.15	0.61
	T5	7.930		0.22	-0.06	0.21	-0.12	0.21	-0.12	0.25	-0.12	0.28
	T6	6.405	-0.31	0.10	-0.33		-0.33	0.22	-0.31	0.21	-0.31	0.21
	T7	4.880		0.35	-0.08	0.35	-0.32	0.34	-0.34	0.38	-0.33	0.41
	T8	3.320		0.18	-0.01	0.18	-0.07	0.17	-0.08	0.19	-0.07	0.21
Ben Nghe	B1	3.000	-0.07	0.06	-0.11		-0.14	0.10	-0.11	0.10	-0.11	0.10
	B2	1.520		0.23	-0.22	0.01	-0.64	0.55	-0.64	0.52	-0.64	0.51
	B3	0.000		0.27	-0.12	0.20	-0.34	0.58	-0.34	0.58	-0.34	0.59
Doi - Te	D1	12.756	-0.20	0.52		0.66	-0.45	0.71	-0.47	0.62	-0.46	0.69
	D2	12.450	-0.25	0.12	-0.33		-0.38	0.19	-0.32	0.20	-0.31	0.20
	D3	11.450	-0.21	0.10	-0.27		-0.33	0.15	-0.27	0.15	-0.23	0.15
	D4	10.285	-0.04	0.13	-0.18		-0.43	0.27	-0.43	0.27	-0.43	0.27
	D5	9.270		0.09	-0.07	0.05	-0.19	0.18	-0.19	0.16	-0.19	0.16
	D6	8.550		0.25	-0.06	0.22	-0.29	0.23	-0.28	0.31	-0.28	0.37
	D7	7.560		0.43	-0.06	0.40	-0.40	0.34	-0.40	0.47	-0.40	0.58
	D8	6.040		0.33	-0.15	0.24	-0.60	0.47	-0.60	0.49	-0.60	0.54
	D9	4.250		0.50	-0.15	0.40	-0.72	0.57	-0.72	0.60	-0.72	0.74
	D10	3.900		0.28	-0.05	0.26	-0.33	0.25	-0.33	0.30	-0.33	0.38
	D11	2.055		0.38	-0.28		-0.88	0.83	-0.88	0.85	-0.88	0.91
	D12	0.000		0.30	-0.22		-0.73	0.70	-0.73	0.72	-0.73	0.76
Connecting Canals	N1	0.210	-0.05	0.46		0.47	-0.20	0.44	-0.21	0.48	-0.21	0.53
	N2	0.215		0.59	-0.02	0.62	-0.28	0.61	-0.28	0.61	-0.27	0.68
	N3	0.215		0.37	-0.02	0.37	-0.20	0.34	-0.20	0.40	-0.20	0.45
Southern Canals	XC	0.615	-0.24	0.38		0.58	-0.44	0.72	-0.44	0.58	-0.44	0.52
	OL	0.550	-0.37			0.63	-0.83	0.89	-0.78	0.89	-0.78	0.89
Maximum Velocity along Tau Hu - Ben Nghe			-0.81	0.76	-0.84	0.77	-0.91	0.87	-0.91	0.91	-0.91	0.96

TABLE E.8.11 (1/2) RESULTS OF HYDRODYNAMIC SIMULATION : PROPOSED CONDITION

Canal	Location		Maximum Discharges and Water Levels for Different Cases (Closed Canal System without any Southern Canal)														
	ID	From Mouth (km)	1A			1B			2A			2B			2C		
			-Q (m3/s)	+Q (m3/s)	W.L. (EL.m)	-Q (m3/s)	+Q (m3/s)	W.L. (EL.m)	-Q (m3/s)	+Q (m3/s)	W.L. (EL.m)	-Q (m3/s)	+Q (m3/s)	W.L. (EL.m)	-Q (m3/s)	+Q (m3/s)	W.L. (EL.m)
Tau Hu	T1	12.175	-17	1	1.66	-17	1	1.65	-20	7	1.61	-19	8	1.65	-19	8	1.44
	T2	11.120	-17	1	1.66	-17	1	1.65	-36	14	1.61	-36	17	1.65	-36	17	1.44
	T3	9.935	-77	17	1.67	-77	18	1.65	-82	20	1.61	-76	19	1.66	-68	19	1.44
	T4	8.930		121	1.64		122	1.63	-72	119	1.58	-72	130	1.63	-72	135	1.42
	T5	7.930	-18	85	1.62	-19	91	1.60	-74	81	1.56	-74	97	1.61	-74	102	1.41
	T6	6.650	-24	43	1.60	-9	59	1.58	-55	55	1.54	-55	65	1.59	-55	59	1.41
	T7	6.260	-4	53	1.60	-7	71	1.58	-60	62	1.53	-60	74	1.58	-60	70	1.41
	T8	5.155	-4	91	1.57	-6	111	1.55	-76	86	1.50	-76	108	1.56	-76	112	1.41
	T9	3.320	-6	142	1.47	-6	161	1.47	-101	127	1.42	-101	156	1.45	-101	168	1.37
Ben Nghe	B1	3.000	-6	65	1.42	-6	66	1.42	-98	68	1.38	-98	90	1.41	-98	89	1.36
	B2	1.970	-6	99	1.39	-5	100	1.39	-113	92	1.36	-113	125	1.39	-113	129	1.35
	B3	0.940	-5	137	1.34	-4	138	1.34	-122	124	1.33	-122	164	1.34	-122	175	1.33
	B4	0.000	-5	172	1.32	-4	173	1.32	-137	157	1.32	-137	203	1.32	-137	220	1.32
Doi - Te	D1	12.756	-1	5	1.66	-1	5	1.65	-11	5	1.61	-11	6	1.66	-11	6	1.44
	D2	12.450		18	1.66		18	1.65	-8	16	1.61	-8	18	1.65	-8	17	1.44
	D3	11.450	-1	24	1.66		24	1.65	-33	23	1.61	-33	26	1.65	-33	25	1.44
	D4	10.285	-16	100	1.65	-16	100	1.63	-68	96	1.59	-68	114	1.63	-68	118	1.42
	D5	9.270	-16	139	1.63	-15	139	1.61	-88	133	1.57	-88	159	1.61	-88	164	1.41
	D6	8.550		196	1.62		191	1.60	-122	190	1.56	-122	221	1.60	-122	232	1.41
	D7	7.560	-10	292	1.59	-8	273	1.57	-197	277	1.53	-197	326	1.57	-197	345	1.40
	D8	6.040	-9	294	1.52	-7	275	1.52	-238	278	1.47	-237	338	1.50	-237	362	1.38
	D9	4.250	-13	433	1.45	-12	435	1.45	-379	401	1.40	-378	508	1.43	-377	548	1.36
	D10	3.900	-24	371	1.44	-23	372	1.44	-296	344	1.40	-295	427	1.42	-295	466	1.36
	D11	2.055	-29	372	1.36	-30	374	1.36	-360	342	1.34	-359	449	1.35	-359	499	1.34
	D12	0.000	-36	373	1.32	-34	374	1.32	-424	355	1.32	-423	484	1.32	-423	533	1.32
Connecting Canals	N1	0.210	-19	108	1.61	-17	93	1.59	-42	101	1.55	-42	109	1.59	-42	116	1.40
	N2	0.215	-7	63	1.63	-10	59	1.61	-17	65	1.57	-17	65	1.61	-17	65	1.42
	N3	0.215	-29	79	1.66	-29	79	1.65	-5	75	1.61	-5	80	1.65	-5	81	1.43
Max. W.L. at Junction with Lo Gom (EL. m)			1.69			1.67			1.63			1.67			1.44		

Canal	Location		Maximum Discharges and Water Levels for Different Cases (Open Canal System Linked with Southern Canals)														
	ID	From Mouth (km)	3A			3B			4A			4B			4C		
			-Q (m3/s)	+Q (m3/s)	W.L. (EL.m)	-Q (m3/s)	+Q (m3/s)	W.L. (EL.m)	-Q (m3/s)	+Q (m3/s)	W.L. (EL.m)	-Q (m3/s)	+Q (m3/s)	W.L. (EL.m)	-Q (m3/s)	+Q (m3/s)	W.L. (EL.m)
Tau Hu	T1	12.175	-61	31	1.46	-78		1.36	-87	41	1.38	-76	41	1.44	-68	41	1.41
	T2	11.120	-34	31	1.47	-70		1.38	-82	45	1.37	-70	46	1.45	-55	46	1.42
	T3	9.935	-98	31	1.48	-100		1.40	-104	42	1.37	-95	42	1.47	-96	42	1.44
	T4	8.930		100	1.48	-24	98	1.40	-68	96	1.37	-68	106	1.47	-68	106	1.44
	T5	7.930		48	1.47	-26	42	1.39	-67	55	1.37	-67	63	1.45	-67	66	1.43
	T6	6.405	-35	29	1.48	-41		1.41	-67	61	1.36	-67	57	1.46	-67	52	1.43
	T7	4.880		56	1.47	-28	50	1.40	-80	73	1.35	-80	79	1.44	-40	83	1.41
	T8	3.320		115	1.40	-27	110	1.34	-93	95	1.34	-93	122	1.37	-93	150	1.35
Ben Nghe	B1	3.000		91	1.39	-79		1.33	-194	191	1.34	-194	175	1.36	-194	175	1.34
	B2	1.520		96	1.36	-79	2	1.33	-208	204	1.33	-208	201	1.34	-208	203	1.33
	B3	0.000		149	1.32	-78	59	1.32	-226	224	1.32	-226	250	1.32	-226	275	1.32
Doi - Te	D1	12.756	-58	114	1.43		143	1.31	-80	136	1.38	-80	137	1.40	-80	129	1.40
	D2	12.450	-53	31	1.46	-64		1.36	-69	39	1.38	-61	40	1.44	-60	40	1.41
	D3	11.450	-53	32	1.46	-64		1.38	-73	45	1.38	-65	45	1.45	-53	45	1.42
	D4	10.285	-2	33	1.47	-39		1.39	-72	65	1.37	-60	63	1.45	-52	63	1.43
	D5	9.270		54	1.47	-32	28	1.39	-79	97	1.37	-79	95	1.45	-79	90	1.43
	D6	8.550		114	1.46	-33	97	1.39	-111	116	1.37	-111	143	1.44	-111	158	1.42
	D7	7.560	-9	219	1.45	-33	203	1.38	-147	166	1.36	-148	229	1.43	-148	277	1.40
	D8	6.040		158	1.42	-78	113	1.37	-239	217	1.35	-239	233	1.40	-239	249	1.37
	D9	4.250	-31	265	1.40	-103	211	1.33	-361	324	1.34	-361	356	1.37	-361	405	1.35
	D10	3.900		231	1.39	-26	265	1.33	-193	211	1.34	-192	265	1.37	-192	271	1.34
	D11	2.055		291	1.34	-212		1.33	-620	567	1.33	-620	584	1.34	-620	621	1.33
	D12	0.000		292	1.32	-213		1.32	-662	596	1.32	-662	617	1.32	-662	654	1.32
Connecting Canals	N1	0.210	-28	113	1.46	-4	113	1.38	-31	100	1.36	-31	112	1.44	-31	120	1.42
	N2	0.215	-3	76	1.47	-8	80	1.39	-17	81	1.37	-17	81	1.45	-17	74	1.43
	N3	0.215	-7	53	1.47	-8	40	1.39	-2	32	1.37	-2	55	1.45	-2	61	1.43
Southern Canals	XC	0.615	-48	65	1.41		98	1.31	-81	121	1.35	-80	103	1.38	-80	71	1.38
	OL	0.550	-204		1.39		296	1.30	-420	411	1.33	-392	399	1.35	-392	399	1.33
Max. W.L. at Junction with Lo Gom (EL. m)			1.51			1.43			1.39			1.50			1.47		

TABLE E.8.11 (2/2) RESULTS OF HYDRODYNMIC SIMULATION : PROPOSED CONDITION

Canal	Location		Velocities for Different Cases (Closed Canal System without any Southern Canal)									
	ID	From Mouth	1A		1B		2A		2B		2C	
			-v	+v	-v	+v	-v	+v	-v	+v	-v	+v
		(km)	(m/s)	(m/s)	(m/s)	(m/s)	(m/s)	(m/s)	(m/s)	(m/s)	(m/s)	(m/s)
Tau Hu	T1	12.175	-0.08		-0.08		-0.13	0.06	-0.13	0.06	-0.13	0.06
	T2	11.120	-0.08	0.01	-0.08		-0.27	0.14	-0.27	0.14	-0.27	0.14
	T3	9.935	-0.35	0.09	-0.35	0.09	-0.49	0.18	-0.49	0.18	-0.49	0.18
	T4	8.930		0.54		0.55	-0.52	0.54	-0.52	0.59	-0.51	0.68
	T5	7.930	-0.07	0.34	-0.07	0.37	-0.44	0.34	-0.44	0.42	-0.44	0.47
	T6	6.650	-0.12	0.23	-0.03	0.27	-0.45	0.31	-0.45	0.40	-0.45	0.42
	T7	6.260	-0.02	0.29	-0.03	0.32	-0.49	0.35	-0.49	0.45	-0.49	0.47
	T8	5.155	-0.02	0.39	-0.02	0.40	-0.52	0.37	-0.52	0.51	-0.52	0.57
	T9	3.320	-0.03	0.73	-0.03	0.70	-0.79	0.66	-0.79	0.83	-0.79	1.00
Ben Nghe	B1	3.000	-0.02	0.25	-0.02	0.25	-0.55	0.29	-0.55	0.39	-0.55	0.42
	B2	1.970	-0.03	0.44	-0.02	0.44	-0.74	0.43	-0.74	0.62	-0.74	0.71
	B3	0.940	-0.02	0.61	-0.02	0.61	-0.81	0.56	-0.81	0.81	-0.81	0.97
	B4	0.000	-0.01	0.30	-0.01	0.30	-0.33	0.28	-0.33	0.38	-0.33	0.46
Doi - Te	D1	12.756	-0.01	0.02		0.03	-0.08	0.05	-0.08	0.05	-0.08	0.05
	D2	12.450		0.06		0.07	-0.06	0.06	-0.06	0.06	-0.05	0.07
	D3	11.450		0.08		0.08	-0.16	0.08	-0.16	0.09	-0.16	0.09
	D4	10.285	-0.07	0.36	-0.06	0.36	-0.47	0.36	-0.47	0.45	-0.47	0.52
	D5	9.270	-0.03	0.25	-0.03	0.26	-0.22	0.26	-0.22	0.32	-0.22	0.34
	D6	8.550		0.36		0.35	-0.32	0.35	-0.32	0.42	-0.32	0.47
	D7	7.560	-0.02	0.55	-0.02	0.52	-0.52	0.53	-0.52	0.63	-0.52	0.71
	D8	6.040	-0.02	0.59	-0.02	0.55	-0.67	0.56	-0.67	0.69	-0.67	0.81
	D9	4.250	-0.02	0.80	-0.02	0.80	-0.98	0.75	-0.98	0.98	-0.98	1.15
	D10	3.900	-0.02	0.34	-0.02	0.35	-0.37	0.32	-0.37	0.41	-0.37	0.48
	D11	2.055	-0.04	0.46	-0.04	0.46	-0.55	0.42	-0.55	0.59	-0.55	0.69
	D12	0.000	-0.04	0.37	-0.03	0.37	-0.50	0.36	-0.50	0.51	-0.50	0.59
Connecting Canals	N1	0.210	-0.07	0.38	-0.06	0.34	-0.29	0.37	-0.29	0.39	-0.29	0.44
	N2	0.215	-0.03	0.28	-0.04	0.26	-0.18	0.29	-0.18	0.28	-0.18	0.30
	N3	0.215	-0.11	0.28	-0.11	0.28	-0.05	0.27	-0.05	0.29	-0.05	0.32
Maximum Velocity along Tau Hu - Ben Nghe			-0.36	0.73	-0.36	0.70	-0.81	0.66	-0.81	0.83	-0.81	1.00

Canal	Location		Velocities for Different Cases (Open Canal System Linked with Southern Canals)									
	ID	From Mouth	3A		3B		4A		4B		4C	
			-v	+v	-v	+v	-v	+v	-v	+v	-v	+v
		(km)	(m/s)	(m/s)	(m/s)	(m/s)	(m/s)	(m/s)	(m/s)	(m/s)	(m/s)	(m/s)
Tau Hu	T1	12.175	-0.28	0.14	-0.37		-0.43	0.21	-0.36	0.21	-0.33	0.21
	T2	11.120	-0.25	0.15	-0.34		-0.42	0.24	-0.36	0.25	-0.36	0.25
	T3	9.935	-0.47	0.15	-0.48		-0.51	0.23	-0.45	0.23	-0.48	0.23
	T4	8.930		0.46	-0.12	0.47	-0.42	0.46	-0.42	0.50	-0.42	0.53
	T5	7.930		0.20	-0.11	0.18	-0.36	0.25	-0.36	0.27	-0.36	0.31
	T6	6.405	-0.18	0.15	-0.22		-0.47	0.37	-0.47	0.33	-0.47	0.33
	T7	4.880		0.25	-0.13	0.22	-0.52	0.37	-0.52	0.38	-0.51	0.42
	T8	3.320		0.60	-0.15	0.59	-0.74	0.52	-0.74	0.65	-0.74	0.83
Ben Nghe	B1	3.000		0.35	-0.30		-1.04	0.84	-1.03	0.78	-1.03	0.77
	B2	1.520		0.43	-0.36	0.01	-1.15	1.11	-1.15	1.10	-1.15	1.08
	B3	0.000		0.26	-0.14	0.10	-0.44	0.47	-0.44	0.50	-0.44	0.57
Doi - Te	D1	12.756	-0.27	0.53		0.68	-0.42	0.81	-0.42	0.73	-0.42	0.73
	D2	12.450	-0.20	0.12	-0.25		-0.28	0.17	-0.24	0.17	-0.24	0.17
	D3	11.450	-0.17	0.10	-0.21		-0.26	0.16	-0.21	0.16	-0.17	0.16
	D4	10.285	-0.01	0.13	-0.15		-0.35	0.29	-0.35	0.28	-0.35	0.28
	D5	9.270		0.10	-0.06	0.05	-0.19	0.20	-0.19	0.20	-0.19	0.20
	D6	8.550		0.21	-0.06	0.19	-0.26	0.23	-0.26	0.28	-0.26	0.33
	D7	7.560		0.42	-0.06	0.40	-0.43	0.33	-0.43	0.45	-0.43	0.55
	D8	6.040		0.32	-0.16	0.23	-0.67	0.49	-0.67	0.51	-0.67	0.55
	D9	4.250		0.49	-0.20	0.40	-0.95	0.68	-0.94	0.71	-0.94	0.81
	D10	3.900		0.22	-0.02	0.25	-0.27	0.21	-0.27	0.25	-0.26	0.27
	D11	2.055		0.36	-0.26		-0.84	0.79	-0.84	0.81	-0.84	0.86
	D12	0.000		0.29	-0.21		-0.70	0.66	-0.70	0.68	-0.70	0.72
Connecting Canals	N1	0.210	-0.11	0.41	-0.02	0.42	-0.24	0.38	-0.23	0.41	-0.23	0.45
	N2	0.215	-0.01	0.34	-0.04	0.37	-0.11	0.37	-0.11	0.37	-0.11	0.35
	N3	0.215	-0.03	0.20	-0.03	0.15	-0.02	0.12	-0.02	0.21	-0.02	0.24
Southern Canals	XC	0.615	-0.28	0.37		0.57	-0.51	0.76	-0.51	0.67	-0.51	0.67
	OL	0.550	-0.43			0.63	-0.96	1.01	-0.90	1.01	-0.90	1.01
Maximum Velocity along Tau Hu - Ben Nghe			-0.47	0.60	-0.49	0.59	-1.21	0.52	-1.21	0.65	-1.21	0.83

TABLE E.8.12 SEWERS FOR THANH DA DRAINAGE AREA

Catchment ID	Sub-Catchment ID	Sub-Catchment Acc Area (ha)	Sewer Dimensions Length (m)	Sewer Dimensions Diameter (mm)	Sewer Dimensions Slope (‰)	Hydraulic Properties Velocity (m/s)	Hydraulic Properties Discharge (m³/s)	Sewer Inverts Upstream (EL m)	Sewer Inverts Downstream (EL m)	Ground Levels Upstream (EL m)	Ground Levels Downstream (EL m)	Earth Covers Upstream (EL m)	Earth Covers Downstream (EL m)
TD 1	*TD 1-1*	*0.98*	*138*	*1,000*	*1.1*	*1.0*	*0.8*	*-0.50*	*-0.65*	*1.5?*	*1.60*	*0.92*	*1.10*
	TD 1-2	*2.09*	*130*	*1,000*	*1.1*	*1.0*	*0.8*	*-0.65*	*-0.80*	*1.60*	*1.6?*	*1.10*	*1.32*
TD 2	TD 2	2.81	147	1,000	1.7	1.2	1.0	-0.65	-0.90	1.52	1.51	1.02	1.26
TD 3	*TD 3-1*	*1.65*	*73*	*1,000*	*1.3*	*1.1*	*0.9*	*-0.50*	*-0.59*	*1.38*	*1.33*	*0.73*	*0.82*
	TD 3-2	*2.14*	*98*	*1,000*	*1.3*	*1.1*	*0.9*	*-0.59*	*-0.71*	*1.33*	*1.40*	*0.82*	*0.96*
	TD 3-3	*2.68*	*28*	*1,000*	*1.3*	*1.1*	*0.9*	*-0.71*	*-0.73*	*1.40*	*1.43*	*0.96*	*1.03*
	TD 3-4	*2.89*	*41*	*1,200*	*1.3*	*1.2*	*1.4*	*-0.73*	*-0.80*	*1.43*	*1.40*	*0.83*	*0.85*
	TD 3-5	*3.48*	*76*	*1,200*	*1.3*	*1.2*	*1.4*	*-0.80*	*-0.90*	*1.40*	*1.51*	*0.83*	*1.06*
	TD 3-6	*6.61*	*42*	*1,200*	*1.3*	*1.2*	*1.4*	*-0.90*	*-0.95*	*1.51*	*1.53*	*1.06*	*1.13*
TD 4	TD 4-1	7.66	46	1,200	1.2	1.2	1.4	-1.00	-1.06	1.43	1.36	1.68	1.07
	TD 4-2	7.90	36	1,200	1.2	1.2	1.4	-1.06	-1.10	1.36	1.50	1.07	1.25
	TD 4-3	8.28	84	1,200	1.2	1.2	1.4	-1.10	-1.20	1.50	1.40	1.25	1.25
	TD 4-4	9.83	216										
	TD 4-5	10.14	58	1,200	1.2	1.2	1.4	-1.20	-1.27	1.43	1.23	1.25	1.15
	TD 4-6	10.37	67	1,200	1.2	1.2	1.4	-1.27	-1.35	1.23	1.23	1.15	1.23
TD 5	TD 5	0.83	*134* (47 m new)	800	1.1	0.9	0.4	-0.80	-0.95	1.46	1.40	1.31	1.40
TD 6	*TD 6-1*	*0.99*	*74*	*800*	*1.6*	*1.0*	*0.5*	*-0.85*	*-0.97*	*1.26*	*1.26*	*1.16*	*1.28*
	TD 6-2	3.72	70	1,000	1.6	1.2	1.0	-0.97	-1.10	1.26	1.34	1.08	1.29
	TD 6-3	*4.15*	*78*	*900*	*1.6*	*1.1*	*0.7*	*-1.10*	*-1.20*	*1.34*	*1.34*	*1.39*	*1.49*
TD 7	TD 7	2.44	136	1,000	0.9	0.9	0.7	-0.84	-0.97	1.41	1.26	1.10	1.09
TD 8	*TD 8-1*	*0.55*	*53*	*1,000*	*1.1*	*1.0*	*0.8*	*-0.60*	*-0.66*	*1.75*	*1.70*	*1.20*	*1.21*
	TD 8-2	*0.91*	*75*	*1,000*	*1.1*	*1.0*	*0.8*	*-0.66*	*-0.74*	*1.70*	*1.65*	*1.21*	*1.24*
	TD 8-3	*1.15*	*45*	*1,000*	*1.1*	*1.0*	*0.8*	*-0.74*	*-0.79*	*1.65*	*1.60*	*1.24*	*1.24*
	TD 8-4	*1.65*	*49*	*1,000*	*1.1*	*1.0*	*0.8*	*-0.79*	*-0.85*	*1.60*	*1.54*	*1.24*	*1.24*
	Total		1,994										

Existing Sewer

TABLE E.8.13 HYDROLOGICAL CALCULATION FOR THANH DA DRAINAGE AREA

Catchment ID	Sub-Catchment ID	Sub-Catchment Acc Area (ha)	Runoff Coeff	T_{inlet} (min)	V_{flow} (m/s)	L_{flow} (min)	T_{flow} (min)	T_{conc} (min)	Rain Int (mm/hr)	Red Fact	Peak R.O. (m³/s)	HD Model: Sub-Catchment Area (ha)	HD Model: Time of Concentration (min)
TD 1	TD 1-1	0.98	0.8	5	1.0	138	2	7	137	1.0	0.3	0.98	7
	TD 1-2	2.09	0.8		1.0	130	2	9	132	1.0	0.6	1.10	7
TD 2	TD 2	2.81	0.8	5	1.2	147	2	9	132	1.0	0.8	0.73	7
TD 3	TD 3-1	1.65	0.8	5	1.1	73	1	6	139	1.0	0.3	1.65	6
	TD 3-2	2.14	0.8		1.1	98	2	8	136	1.0	0.6	1.09	6
	TD 3-3	2.68	0.8		1.1	28	0	8	135	1.0	0.8	0.54	7
	TD 3-4	2.89	0.8		1.2	41	1	9	133	1.0	0.9	0.21	7
	TD 3-5	3.48	0.8		1.2	76	1	10	131	1.0	1.0	0.52	8
	TD 3-6	6.64	0.8		1.2	42	1	10	130	1.0	1.9	0.35	7
TD 4	TD 4-1	7.66	0.8	5	1.2	45	1	6	140	1.0	2.4	0.11	6
	TD 4-2	7.99	0.8		1.2	36	1	6	139	1.0	2.4	0.24	7
	TD 4-3	8.28	0.8		1.2	84	1	7	136	1.0	2.5	0.38	6
	TD 4-4	9.89	0.8									1.61	7
	TD 4-5	10.14	0.8		1.2	58	1	8	135	1.0	3.0	0.25	6
	TD 4-6	10.37	0.8		1.2	67	1	9	132	1.0	3.1	0.24	6
TD 5	TD 5	0.83	0.8	5	0.9	134	3	8	136	1.0	0.3	0.83	6
TD 6	TD 6-1	0.99	0.8	5	1.0	74	1	6	139	1.0	0.3	0.99	6
	TD 6-2	3.72	0.8		1.2	70	1	7	137	1.0	1.1	0.29	6
	TD 6-3	4.15	0.6		1.1	76	1	8	134	1.0	1.2	0.42	7
TD 7	TD 7	2.44	0.8	5	0.9	135	2	7	136	1.0	0.7	0.76	6
TD 8	TD 8-1	0.35	0.8	5	1.0	53	1	6	140	1.0	0.2	0.55	7
	TD 8-2	0.91	0.8		1.0	75	1	7	137	1.0	0.3	0.36	6
	TD 8-3	1.15	0.8		1.0	45	2	8	135	1.0	0.3	0.24	6
	TD 8-4	1.66	0.8		1.0	49	1	9	133	1.0	0.5	0.51	7
TD G	TD G		0.3									0.41	8
TD R	TD R		1.0									0.44	23
						Total						15.37	

TABLE E.8.14 SEWERS FOR BEN ME COC 1 DRAINAGE AREA

Drainage Area	Catchment ID	Sub-Catchment ID	Sub-Catchment Acc. Area (ha)	Sewer Dimensions Length (m)	Sewer Dimensions Diameter (mm)	Sewer Dimensions Slope (‰)	Hydraulic Properties Velocity (m/s)	Hydraulic Properties Discharge (m3/s)	Sewer Inverts Upstream (EL. m)	Sewer Inverts Downstream (EL. m)	Ground Levels Upstream (EL. m)	Ground Levels Downstream (EL. m)	Earth Covers Upstream (EL. m)	Earth Covers Downstream (EL. m)
East	BM1E.1	BM1E.1-1	3.55	374	1,000	1.2	1.1	0.8	-0.80	-1.25	1.56	1.35	1.21	1.45
		BM1E.1-2	6.38	337	1,200	1.2	1.2	1.4	-1.25	-1.66	1.35	1.40	1.25	1.71
		BM1E1.1-3	16.11	281	1,500	1.2	1.4	2.5	-1.66	-2.00	1.40	1.84	1.41	2.19
	BM1E.2	BM1E1.2	7.20	382	1,200	1.3	1.3	1.4	-1.15	-1.66	1.45	1.40	1.25	1.71
	BM1E.3	BM1E.3-1	2.87	333	900	1.2	1.0	0.6	-0.80	-1.21	1.56	1.25	1.31	1.41
		BM1E.3-2	10.97	646	1,500	1.2	1.4	2.5	-1.21	-2.00	1.45	2.07	1.01	2.42
	BM1E.4	BM1E.4	4.52	88	1,100	1.3	1.2	1.1	-1.89	-2.00	1.84	1.84	2.48	2.59
West	BM1W.1	BM1W.1-1	3.46	367	900	1.0	0.9	0.6	-0.65	-1.03	1.40	1.50	1.00	1.48
		BM1W.1-2	9.04	464	1,200	1.0	1.1	1.3	-1.03	-1.51	1.50	1.70	1.18	1.86
		BM1W.1-3	15.81											
		BM1W.1-4	23.23	469	1,800	1.0	1.4	2.9	-1.51	-2.00	1.70	1.83	1.26	1.88
	BM1W.2	BM1W.2-1	5.54	467	1,000	1.2	1.5	3.7	-0.95	-1.52	1.40	1.18	1.20	1.55
		BM1W.2-2	10.47	399	1,200	1.2	1.2	1.4	-1.52	-2.00	1.18	1.94	1.35	2.59
Total				4,607										

TABLE E.8.15 HYDROLOGICAL CALCULATION FOR BEN ME COC 1 DRAINAGE AREA

Runoff Calculation for Sewer Flow using Rational Method														HD Model Parameters	
Drainage Area	Catchment ID	Sub-Catchment ID	Sub-Catchment Acc. Area (ha)	Catchment Properties Runoff Coeff.	Tinlet (min.)	Vflow (m/s)	Lflow (min.)	Tflow (min.)	Tconc. (min.)	Runoff Calculation (2 Year R.P.) Rain Int. (mm/hr)	Red. Fact.	Peak R.O. (m3/s)		Sub-Catchment Area (ha)	Time of Concentration (min.)
East	BM1E.1	BM1E.1-1	3.55	0.8	5	1.1	374	6	11	128	1.0	1.0		3.55	9
		BM1E.1-2	6.38	0.8		1.2	337	11	21	108	1.0	1.5		2.83	9
		BM1E1.1-3	16.11	0.8		1.4	281	14	35	87	1.0	3.1		2.53	9
	BM1E.2	BM1E1.2	7.20	0.8	5	1.3	382	5	10	130	1.0	2.1		7.20	10
	BM1E.3	BM1E.3-1	2.87	0.8	5	1.0	333	6	11	129	1.0	0.8		2.87	9
		BM1E.3-2	10.97	0.8		1.4	646	13	24	103	1.0	2.5		8.10	10
	BM1E.4	BM1E.4	4.52	0.8	5	1.2	88	1	6	139	1.0	1.4		4.52	10
West	BM1W.1	BM1W.1-1	3.46	0.7	5	0.9	367	7	12	127	1.0	0.9		3.46	9
		BM1W.1-2	9.04	0.7		1.1	464	14	25	101	1.0	1.8		5.58	11
		BM1W.1-3	15.81											6.77	9
		BM1W.1-4	23.23	0.7		1.5	469	19	44	77	1.0	3.5		7.42	11
	BM1W.2	BM1W.2-1	5.54	0.7	5	1.1	467	7	12	125	1.0	1.3		5.54	11
		BM1W.2-2	10.47	0.7		1.2	399	13	25	101	1.0	2.1		4.93	10
	BM1W.3	BM1W.3		0.7										3.69	10
	BM1.R	BM1.R		1.0										1.93	74
Total														70.92	

TABLE E.8.16 SEWERS FOR BEN ME COC 2 DRAINAGE AREA

Drainage Area	Catchment ID	Sub-Catchment ID	Sub-Catchment Acc. Area (ha)	Sewer Dimensions Length (m)	Sewer Dimensions Diameter (mm)	Sewer Dimensions Slope (‰)	Hydraulic Properties Velocity (m/s)	Hydraulic Properties Discharge (m3/s)	Sewer Inverts Upstream (EL m)	Sewer Inverts Downstream (EL m)	Ground Levels Upstream (EL m)	Ground Levels Downstream (EL m)	Earth Covers Upstream (EL m)	Earth Covers Downstream (EL m)
North	BM2N.1	BM2N.1-1	4.21	542	1,000	1.1	1.0	0.8	-1.00	-1.60	1.34	1.03	1.19	1.48
		BM2N.1-2	2.62	207	800	1.4	1.0	0.5	-1.00	-1.30	1.31	1.03	1.36	1.38
		BM2N.1-3	8.46	250	1,500	1.1	1.3	2.3	-1.60	-1.87	1.05	1.08	1.00	1.30
		BM2N.1-4	2.96	205	900	1.2	1.0	0.6	-0.95	-1.20	1.30	1.08	1.20	1.23
		BM2N.1-5	12.04	116	1,500	1.1	1.3	2.3	-1.87	-2.00	1.08	1.13	1.30	1.48
	BM2N.2	BM2N.2-1	3.66	382	900	1.1	1.0	0.6	-0.95	-1.38	1.48	1.66	1.38	1.99
		BM2N.2-2	8.34	345	1,200	1.1	1.2	1.3	-1.38	-1.76	1.66	1.11	1.69	1.52
		BM2N.2-3	11.95	214	1,500	1.1	1.3	2.4	-1.76	-2.00	1.11	1.13	1.22	1.48
South	BM2S.1	BM2S.1-1	4.71	564	1,000	1.0	1.0	0.8	-0.90	-1.46	1.34	1.33	1.09	1.64
		BM2S.1-2	*2.82*	*250*	*600*	*1.8*	*0.9*	*0.3*	*-0.65*	*-1.10*	*1.30*	*1.31*	*1.20*	*1.66*
		BM2S.1-3	4.29	130	1,000	1.2	1.0	0.8	-1.10	-1.25	1.31	1.33	1.26	1.43
		BMS2.1-4	10.42	254	1,500	1.0	1.3	2.2	-1.46	-1.71	1.33	1.31	1.14	1.37
		BM2S.1-5	2.39	170	800	1.5	1.0	0.5	-0.85	-1.10	1.30	1.31	1.20	1.46
		BM2S.1-6	13.90	148	1,800	1.0	1.4	3.6	-1.71	-1.85	1.31	1.38	1.07	1.28
	BM2S.2	BM2S.2-1	4.54	331	1,000	1.2	1.0	0.8	-1.05	-1.44	1.48	1.46	1.38	1.75
		BM2S.2-2	8.06	184	1,500	1.2	1.4	2.4	-1.44	-1.65	1.46	1.38	1.25	1.38
	BM2S.1+2	BM2S.1&2	21.96	164	2,000	0.9	1.5	4.8	-1.85	-2.00	1.38	1.38	1.08	1.23
		Total		4,456										

Existing Sewer

TABLE E.8.17 HYDROLOGICAL CALCULATION FOR BEN ME COC 2 DRAINAGE AREA

Drainage Area	Catchment ID	Sub-Catchment ID	Sub-Catchment Acc. Area (ha)	Catchment Properties Runoff Coeff.	Catchment Properties Tinlet (min.)	Catchment Properties Vflow (m/s)	Catchment Properties Lflow (min.)	Catchment Properties Tflow (min.)	Catchment Properties Tconc. (min.)	Runoff Calculation (2 Year R.P.) Rain Int. (mm/hr)	Runoff Calculation (2 Year R.P.) Red. Fact.	Runoff Calculation (2 Year R.P.) Peak R.O. (m3/s)	HD Model Parameters Sub-Catchment Area (ha)	HD Model Parameters Time of Concentration (min.)
North	BM2N.1	BM2N.1-1	4.21	0.7	5	1.0	542	9	14	122	1.0	1.0	4.21	8
		BM2N.1-2	2.62	0.7	5	1.0	207	3	8	134	1.0	0.7	2.62	8
		BM2N.1-3	8.46	0.7		1.3	250	3	12	127	1.0	2.1	1.63	7
		BM2N.1-4	2.96	0.7	5	1.0	205	3	8	134	1.0	0.8	2.96	8
		BM2N.1-5	12.04	0.7		1.3	116	1	13	123	1.0	2.9	0.62	7
	BM2N.2	BM2N.2-1	3.66	0.7	5	1.0	382	7	12	127	1.0	0.9	3.66	10
		BM2N.2-2	8.34	0.7		1.2	345	5	17	116	1.0	1.9	4.68	9
		BM2N.2-3	11.95	0.7		1.3	214	3	19	111	1.0	2.6	3.61	10
South	BM2N.1	BM2S.1-1	4.71	0.7	5	1.0	564	10	15	120	1.0	1.1	4.71	9
		BM2S.1-2	2.82	0.7	5	0.9	250	5	10	131	1.0	0.7	2.82	7
		BM2S.1-3	4.29	0.7		1.0	130	2	12	127	1.0	1.1	1.47	7
		BMS2.1-4	10.42	0.7		1.3	254	3	18	113	1.0	2.3	1.42	7
		BM2S.1-5	2.39	0.7	5	1.0	170	3	8	135	1.0	0.6	2.39	8
		BM2S.1-6	13.90	0.7		1.4	148	2	10	131	1.0	3.5	1.09	7
	BM2S.2	BM2S.2-1	4.54	0.7	5	1.0	331	5	10	130	1.0	1.1	4.54	9
		BM2S.2-2	8.06	0.7		1.4	184	2	13	125	1.0	2.0	3.52	9
	BM2N.1+2	BM2S.1&2	21.96	0.7		1.5	148	2	14	121	1.0	5.2		
						Total							45.95	

TABLE E.8.18 REQUIRED PUMP CAPACITY STORAGE VOLUME OF RETARDING POND

Area Item	Thanh Da	Ben Me Coc (1)			Ben Me Coc (2)
		West	East	Total	
Drainage Area (ha)	15.4	38.3	32.6	70.9	46.0
Specific Pump Capacity (m3/s/km2)	2.1	2.1	2.1	2.1	2.1
Specific Storage Volume (m3/km2)	69,000	69,000	69,000	69,000	69,000
Required Pump Capacity (m^3/s)	0.32	0.80	0.68	1.49	0.97
Required Strage Volume (m^3)	10,626	26,427	22,494	48,921	31,740
(1) Storage Volume of Temporary Inundation (m3)	3,003	6,894	5,868	12,762	8,280
(2) Storage Volume of Retarding Pond (m3)	7,623	19,533	16,626	36,159	23,460
Proposed Retarding Pond Area (m^2)	4,050	19,000	19,000	19,000	12,400
Proposed H.W.L. of Retarding Pond (m above MSL	0.9	0.9	0.9	0.9	0.9
Proposed L.W.L. of Retarding Pond (m above MSL	-1.0	-0.2	-0.2	-1.0	-1.0
Effective Storage Depth of Retarding Pond (m)	1.9	1.1	1.1	1.9	1.9
Effective Storage Volume of Retarding Pond (m3)	7,695	20,900	20,900	36,100	23,560

Note: Almost 15% of pump drainage area including roads and streets is allowed to have temporary inundation at below 12 cm in depth under the non-flood damage condition.

TABLE E.8.19 (1/2) COMPARISON OF DRAINAGE PUMP TYPE ALTERNATIVES

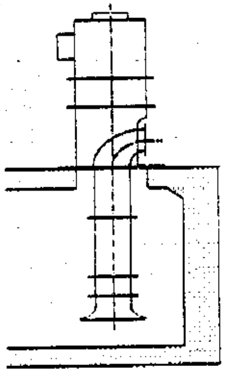
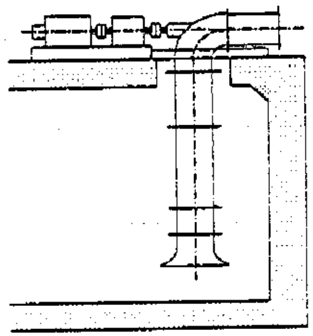
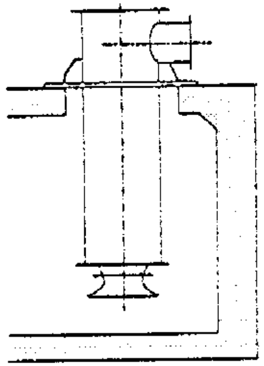
ITEM \ PUMP TYPE	Alternative 1 Vertical Shaft Axial Flow Pump		Alternative 2 Horizontal Shaft Axial Flow Pump		Alternative 3 Submersible Motor Pump	
1. Pump Specifications Main Pump Bore x Capacity x Head Quantity Revolution Efficiency Motor Weight per Unit		Vertical Shaft Axial Flow Pump ϕ 400 x 0.35 [m³/s] x 3.5 [m] 1 980 [rpm] 80 [%] 18.5 [kW] 2500 [kgf]		Horizontal Shaft Axial Flow Pump ϕ 500 x 0.35 [m³/s] x 3.5 [m] 1 700[rpm] 81 [%] 18.5 [kW] 1000 [kgf]		Submersible Motor Pump ϕ 400 x 0.35 [m³/s] x 3.5 [m] 1 970 [rpm] 80 [%] 18.5 [kW] 600 [kgf] (pump & motor)
2. Installation Layout						
3. Other Equipment Discharge Valve Flap Valve Pipe Electrical Equipment Crane Aux. Equipment		1 (ϕ 400 Motor-driven Butterfly) ϕ 500 ϕ 500, ϕ 600 1 Set (Electrical Panels) 1 (Manual, 5 ton) None		1 (ϕ 500 Motor-driven Butterfly) ϕ 600 ϕ 500, ϕ 600 1 Set (Electrical Panels) 1 (Manual, 3 ton) 2 Vacuum Pumps & piping		None ϕ 500 ϕ 400, ϕ 500 1 Set (Electrical Panels) 1 (Manual, 1 ton) None
4. Area of Civil and Superstructure	2	Area of pump room is little smaller than Horizontal shaft model. However, the superstructure is much higher than other types.	3	Pump room is little larger than others' because of the motor installation. The height of the building is less than half of Vertical shaft pump's.	4	Both the area of pump room and the height of superstructure is smallest among three.
5. Weight of Pump Facilities	2	Due to the largest weight of pump itself, the total facility is the heaviest among three.	3	Intermediate weight.	4	Although the pump itself is very light comparing others, civil work weight is little less than others
6. Installation of Equipment	1	The installation requires well trained technicians with special pump installation skills for leveling and shaft alignment.	2	The installation is easier than vertical type. However, it still requires well trained technicians with special pump installation skills for leveling and shaft alignment.	5	The installation is the easiest among those three.
7. Operation	4	Pump can be easily started because impeller is always submerged in the water.	2	Priming by vacuum pump is necessary when the main pump is started. The starting process, however, can be automated to ease the operation complexity.	4	Pump can be easily started because impeller is always submerged in the water.
8. Vibration and Noise	3	Higher vibration and noise are expected than submergible motor pump whose motor is installed under water. The environmental effects are acceptable because the motor is installed on fixed foundation in a closed concrete building while pump is under water.	2	Higher level of vibration and noise are expected than submergible motor pump whose motor is installed under water. The level is acceptable level because both pump and motor are installed on the fixed foundation in a closed concrete building.	5	Vibration and noise are the lowest among three because all main components are placed under water.

TABLE E.8.19 (2/2) COMPARISON OF DRAINAGE PUMP TYPE ALTERNATIVES

ITEM \ PUMP TYPE	Alternative 1 Vertical Shaft Axial Flow Pump		Alternative 2 Horizontal Shaft Axial Flow Pump		Alternative 3 Submersible Motor Pump	
9. Daily Maintenance	2	Operating condition is hardly checked directly because most of rotating parts such as pump bearing are submerged in water.	4	Operating condition can be checked directly because all the rotating components, including the motor, are above the water.	2	Operating condition cannot be checked directly because all the components, including the motor, are submerged in water.
10. Overhaul	1	Overhaul is difficult because vertical shaft with some submerged baring requires special skill and well-trained technicians. Lifting up the pump itself is a lot of work.	4	The easiest maintenance ability is expected because both motor and pump is above the water level. Overhaul is easily performed with its horizontal-separate casing structure.	3	Overhaul is easy by lifting up the pump and motor unit.
11. Life Span	4	Longer device life, comparing with submergible pumps, can be expected because the motor unit is free from suction water contact. By employing some anti-erosion and or non-metal materials, the pump life can be enhanced.	5	The longest life among three is expected because both the motor unit and pump itself are always above the suction water level.	2	A long life span cannot be expected. Submergible pumps are generally used for short-time or temporally stations. Leakage may occur because motor unit and pump itself are always in the suction water.
12. Reliability	4	If the periodically check and maintenance are carried out, long life operation and higher reliability are expected.	4	If the periodically check and maintenance are carried out, long life operation and higher reliability are expected.	2	Because of possible leakage into the motor unit due to the temperature changes caused by intermittent operation, it has the lowest reliability.
13. Achievements for the Same Type	5	There are many cases of adoptions in the past for same type of projects.	5	There are many cases of adoptions in the past for same type of projects.	4	Although there are some cases of adoption of submersible motor pump for the long-term or permanent pumping stations, there are no or very few examples of the pumping stations with the large-size submersible motor pump treating seawater contamination.
14. Initial Cost 1) Pump and Mechanical Equipment	2	Most expensive because of the heaviest and the most complicated pump structure.	3	Intermediate. Vacuum pump must be installed in order to prime the main pump when it is started.	5	Lowest price.
2) Electrical Equipment	4	Same as others'	3	Same as others' (Strictly speaking, it costs a couple of percent higher than others because of extra electrical facilities for the priming vacuum pump.)	4	Same as Plan 1.
3) Civil and Superstructure	2	Most expensive. To reserve enough lift for a crane for maintenance, the superstructure is much higher than others'.	3	Intermediate. Due to the motor installation, the superstructure has to be a little larger in longitudinal dimension.	4	Least expensive. Thanks for much lighter weight of pump unit, civil cost is reduced comparing with other pumps.
15. Running Cost	4	Intermediate energy cost.	5	Most efficient in electric energy consumption due to the highest pump efficiency.	4	Same as Plan 1.
16. Maintenance Cost	2	The highest maintenance cost is predicted because there are many consumable parts.	4	The lowest maintenance cost is expected because both motor and pump is above the water level. Overhaul is easily performed with its horizontal-separate casing structure.	3	Intermediate maintenance cost.
17. Evaluation	42	**Not recommended.** Due to the highest initial cost, this type of pomp is not strongly recommended for a project with limited budget.	52	**Not recommended.** With higher reliability, longer life expectancy, and high efficiency in the long run, however initial cost is high including civil cost.	55	**Most Recommended.** Although low reliability and short life expectancy, initial cost is lowest. This type should be considered as the first choice for this project.

TABLE E.8.20 MAJOR EQUIPMENT LIST OF PUMPING STATION

Item \ Pumping Station	Thanh Da P.S.		Ben Me Coc (1) (East) P.S.		Ben Me Coc (1) (West) P.S.		Ben Me Coc (2) P.S.	
Pump ①	0.35m3/s×3.5m 400DSZ3(18.5kw)	1	0.35m3/s×3.7m 400DSZ3(18.5kw)	2	0.80m3/s×3.7m 600DSZ3(37kw)	1	0.70m3/s×3.7m 600DSZ3(37kw)	1
Pump ②							0.35m3/s×3.7m 400DSZ3(18.5kw)	1
Flap valve ①	φ500mm	1	φ500mm	2	φ900mm	1	φ750mm	1
Flap valve ②							φ500mm	1
Pipe	φ400mm	1	φ400mm	1	φ750mm	1	φ600mm φ400mm	1 1
Crane	1 ton	1	1 ton	1	2 ton	1	1 ton	1
Panels etc.								
*H.V. incoming panel		1		1		1		1
*H.V. receiving panel		1		1		1		1
*Transformer Panel		1		1		1		1
*L.V. Motor Panel		1		2		1		1
*Aux. Panel		1		1		1		1
*Local Control Panel		1		1		1		1
*Instruments		1		1		1		1
Stop log for discharge pit	W1.4 m x H3.1 m	1	W2.6 m x H3.8 m	1	W2.1 m x H3.8 m	1	W3.6 m x H3.2 m	1
Stop log for suction pit	W1.5 m x H3.1 m	1	W2.6 m x H3.6 m	1	W2.1 m x H3.6 m	1	W3.6 m x H3.2 m W2.0 m x H3.2 m	1 1
Bar screen	W1.5 m x H3.1 m	1	W2.6 m x H3.6 m	1	W2.1 m x H3.6 m	1	W3.6 m x H3.2 m	1
Gate for gravity flow	W1.0 m x H1.0 m W1.2 m x H1.2 m W1.4 m x H1.4 m	1 1 2	W1.5 m x H1.5 m W2.0 m x H2.0 m (W1.4 m x H1.8 m) (W1.2 m x H1.2 m) (W1.3 m x H1.3 m)	1 1 (2) (1) (1)	W1.6 m x H1.6 m W2.0 m x H2.0 m	1 1	W1.3 m x H1.3 m W1.5 m x H1.5 m W1.8 m x H1.8 m	1 1 2
Outdoor space for power receiving panels	W 4.7 m x D 4.7 m	1	W4.7 m x D4.7 m	1	W4.7 m x D4.7 m	1	W4.7 m x D4.7 m	1

Note: Figures in parenthesis show dimension and number of control gate.

TABLE E.8.21 HYDRODYNAMIC SIMULATION RESULTS OF PUMP DRAINAGE SYSTEMS

Model Cases		Drainage Systems				Pump Characteristics				Reservoir Characteristics		
Case	Sub-Case	Name	Category	Area Sub-Drainage (ha)	Area Total (ha)	Capacity (m3/s)	Start Level* (EL. m)	Stop Level** (EL. m)	Operation Time (hr:mm)	Area (m2)	Initial (Low) Water Level (EL. m)	Maximum (High) Water Level (EL. m)
1	1	Thanh Da	Phase I	15.37	15.37	0.35	-0.80	0.80	3:55	4,050	-1.00	0.90
2	2A	Ben Me Coc 1 - East	Phase I	32.57	70.92	0.70	0.00	0.80	3:57	19,000	-0.20	0.83
	2B	Ben Me Coc 1 - East + West	Phase II (including Phase I)	70.92		1.50	-0.80	0.80	4:03	19,000	-1.00	0.95
3	3	Ben Me Coc 2 - North + South	Phase I	45.95	45.95	1.05	-0.80	0.80	4:12	12,375	-1.00	0.85

* : Refers to internal water level at reservoir.
** : Refers to external water level at outlet.

Note :
- For all cases, 5-year rainfall as derived from Mass Curve analysis has been applied.
- For Thanh Da, at the outlets, dynamic water level with crest level of EL. +1.32 m has been applied.
- For Ben Me Coc 1 and 2, at the outlets, dynamic water level with crest level of EL. +1.50 m has been applied.
- Flap gates (non-return valves) have been set up at all the outlets.

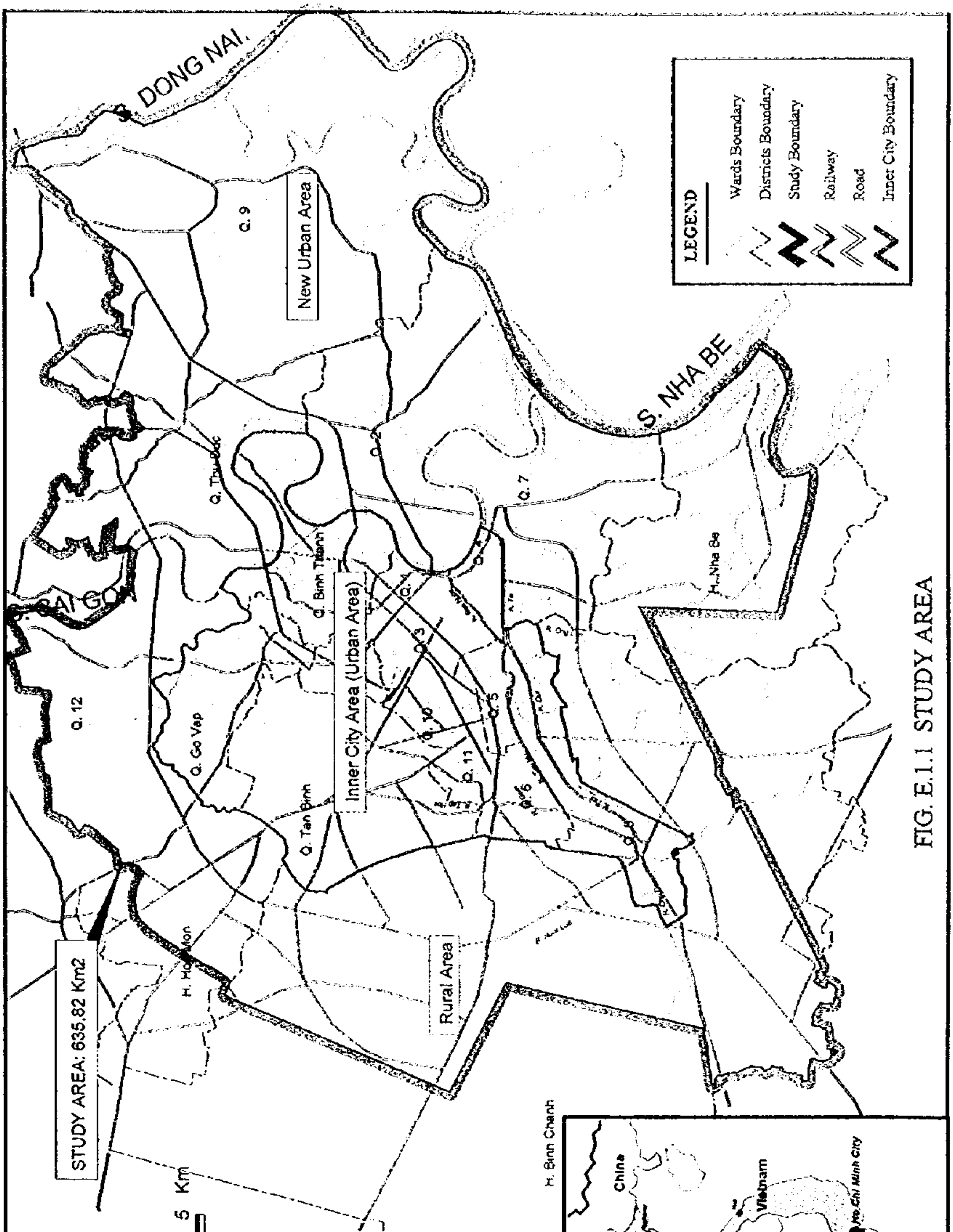


FIG. E.1.1 STUDY AREA

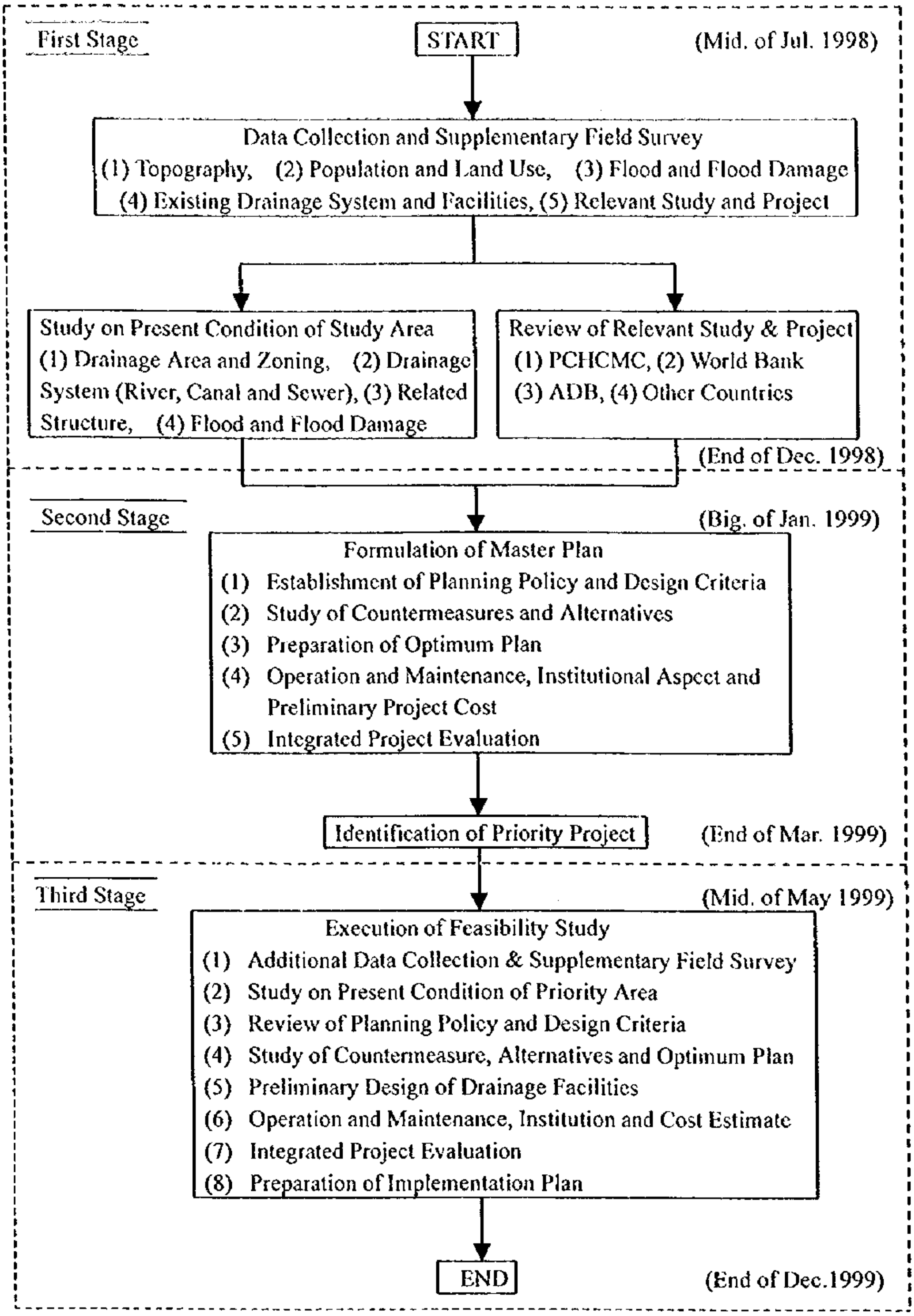


FIG.E.1.2 FLOW CHART OF THE STUDY ON URBAN DRAINAGE IMPROVEMENT

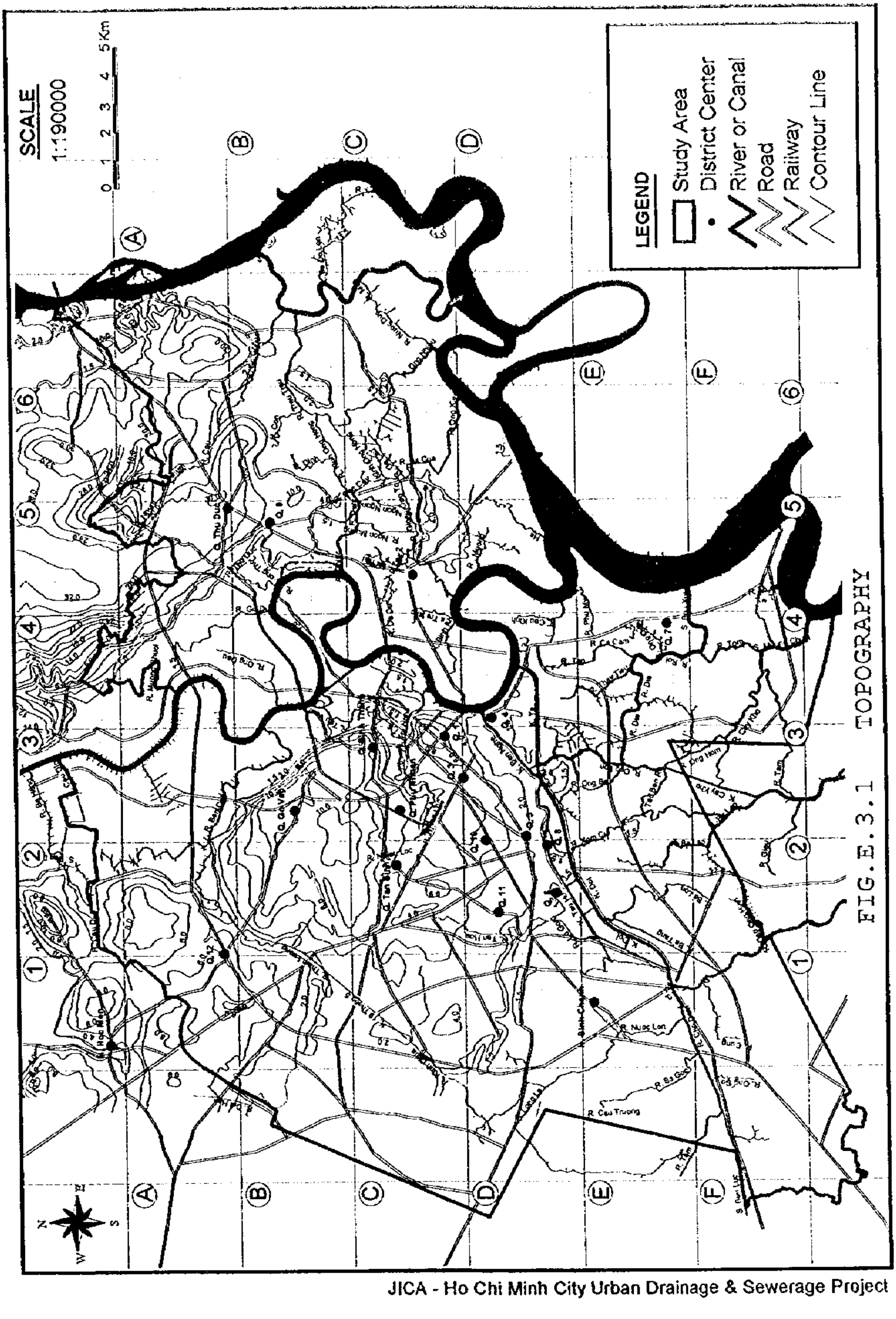


FIG.E.3.1 TOPOGRAPHY

JICA - Ho Chi Minh City Urban Drainage & Sewerage Project

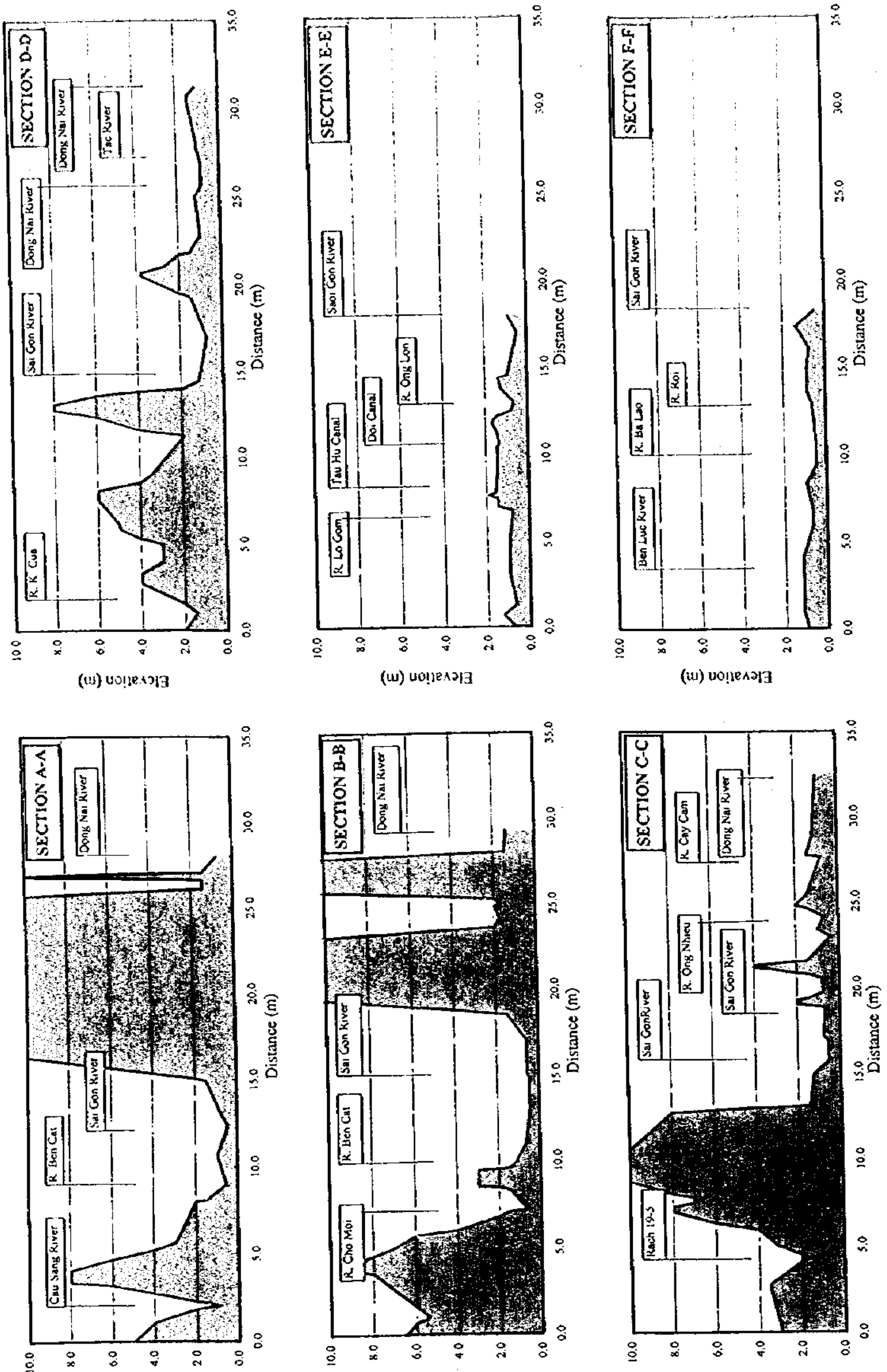


FIG. E.3.2 (1/2) CROSS SECTION OF THE STUDY AREA (EAST TO WEST)

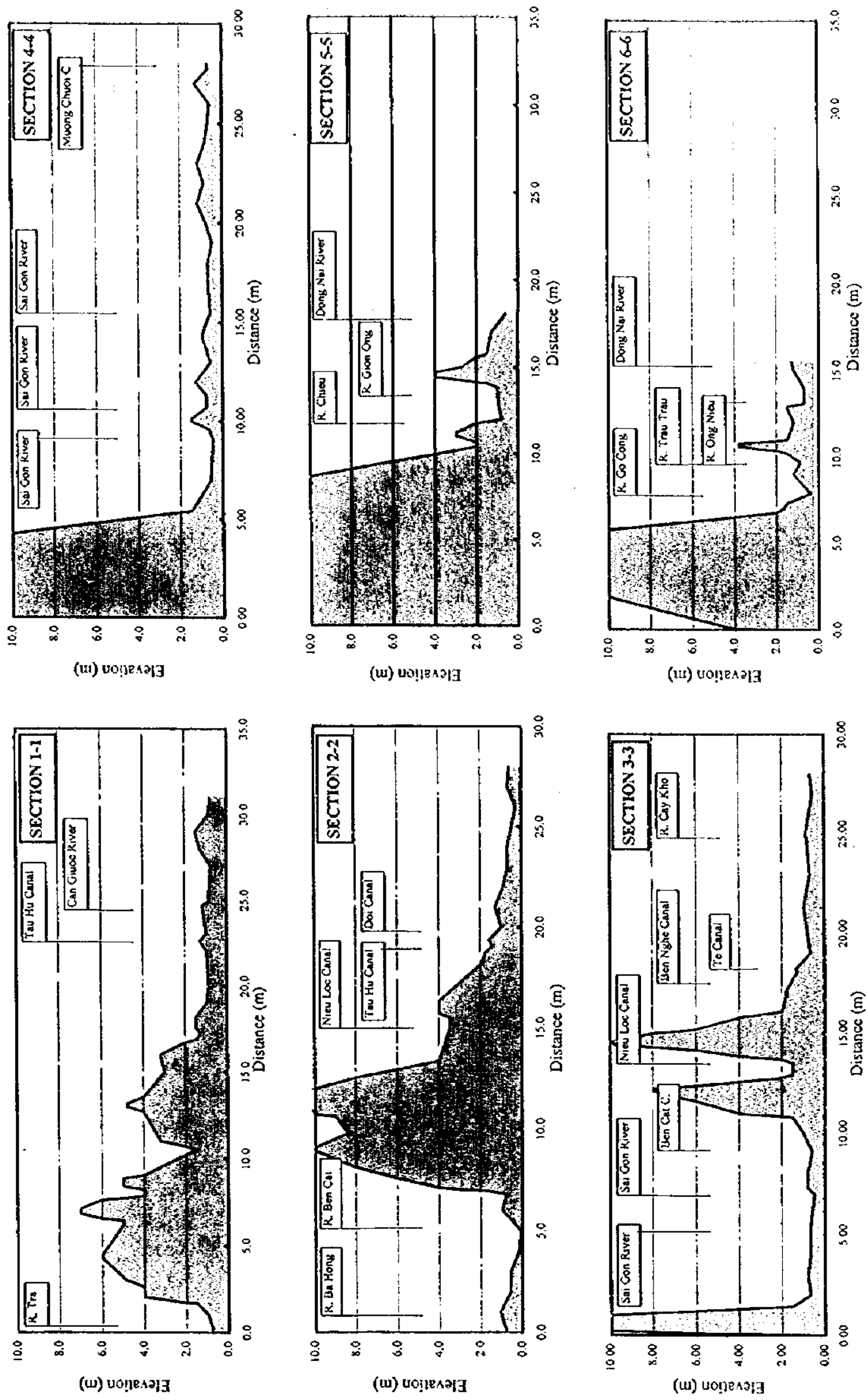


FIG. E.3.2 (2/2) CROSS SECTION OF THE STUDY AREA (NORTH TO SOUTH)

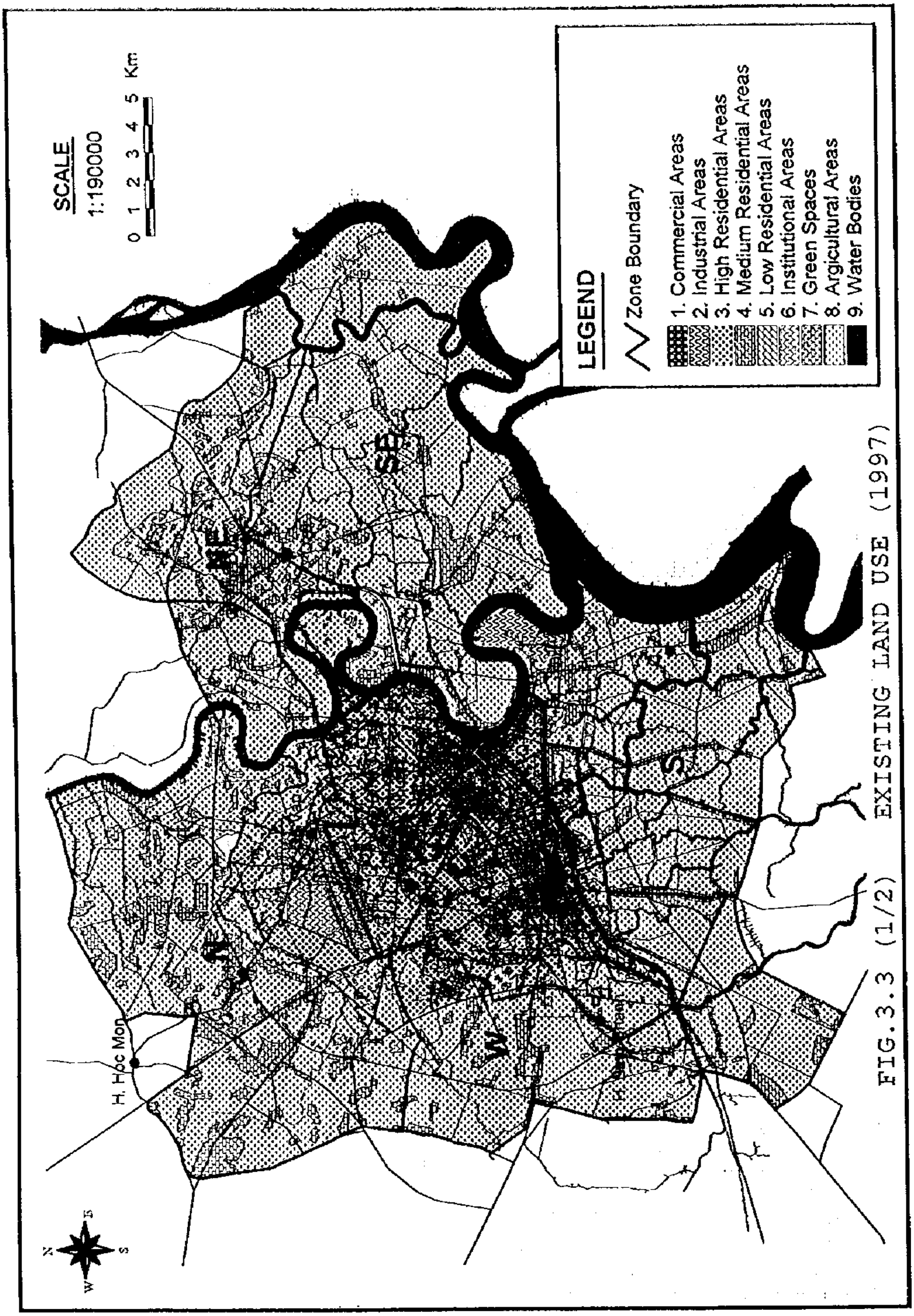


FIG.3.3 (1/2) EXISTING LAND USE (1997)

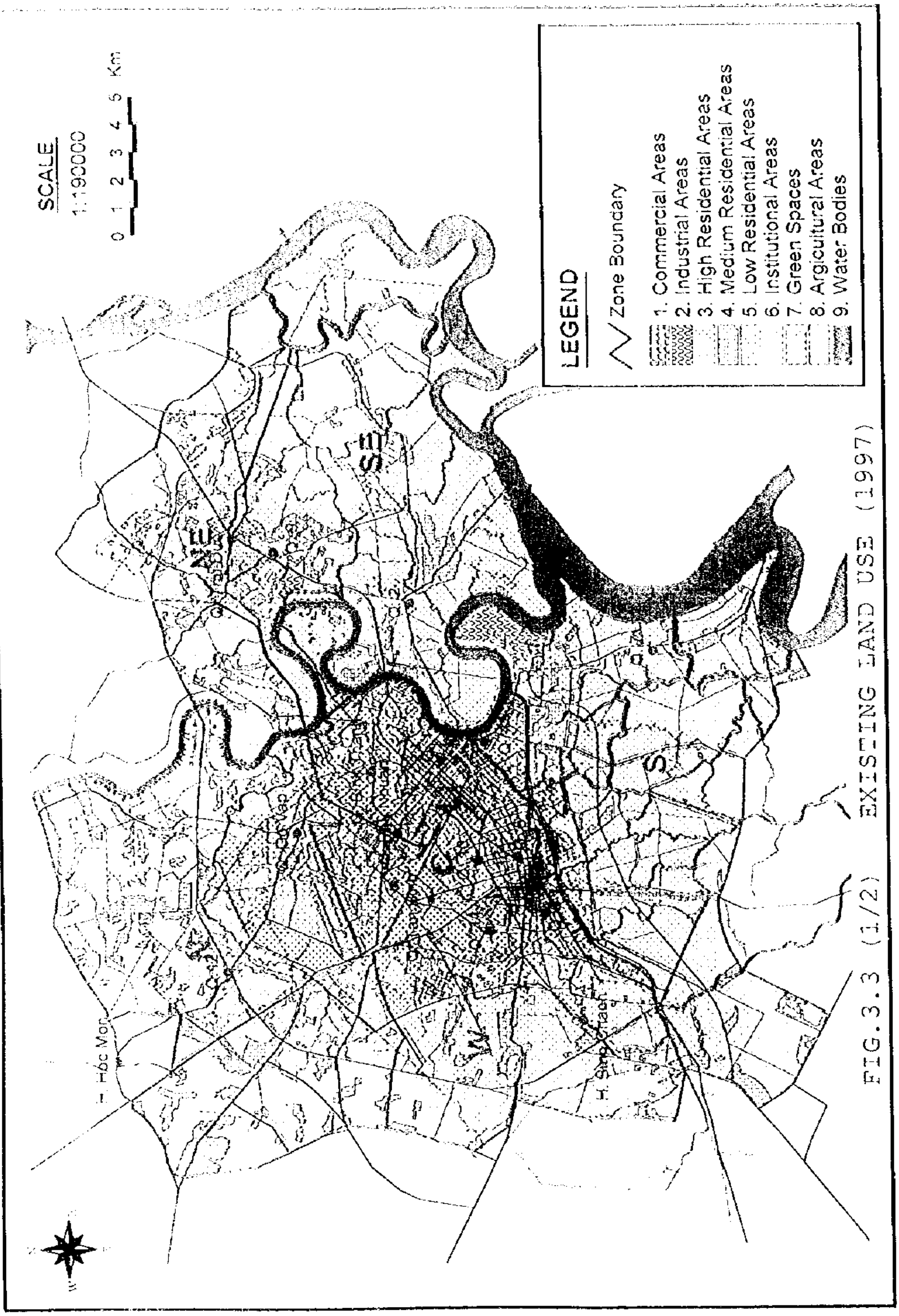


FIG.3.3 (1/2) EXISTING LAND USE (1997)

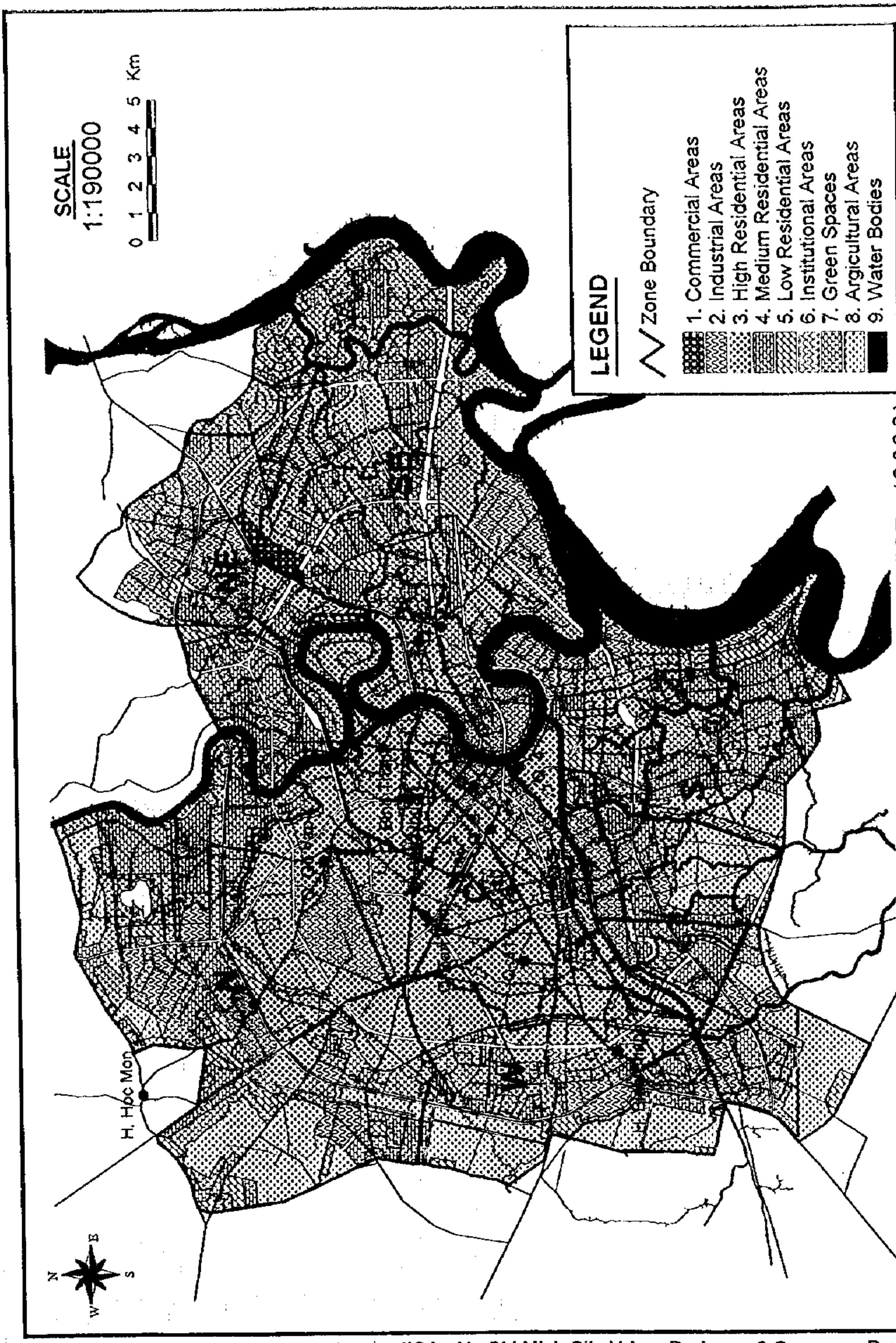


FIG.E.3.3 (2/2) FUTURE LAND USE (2020)

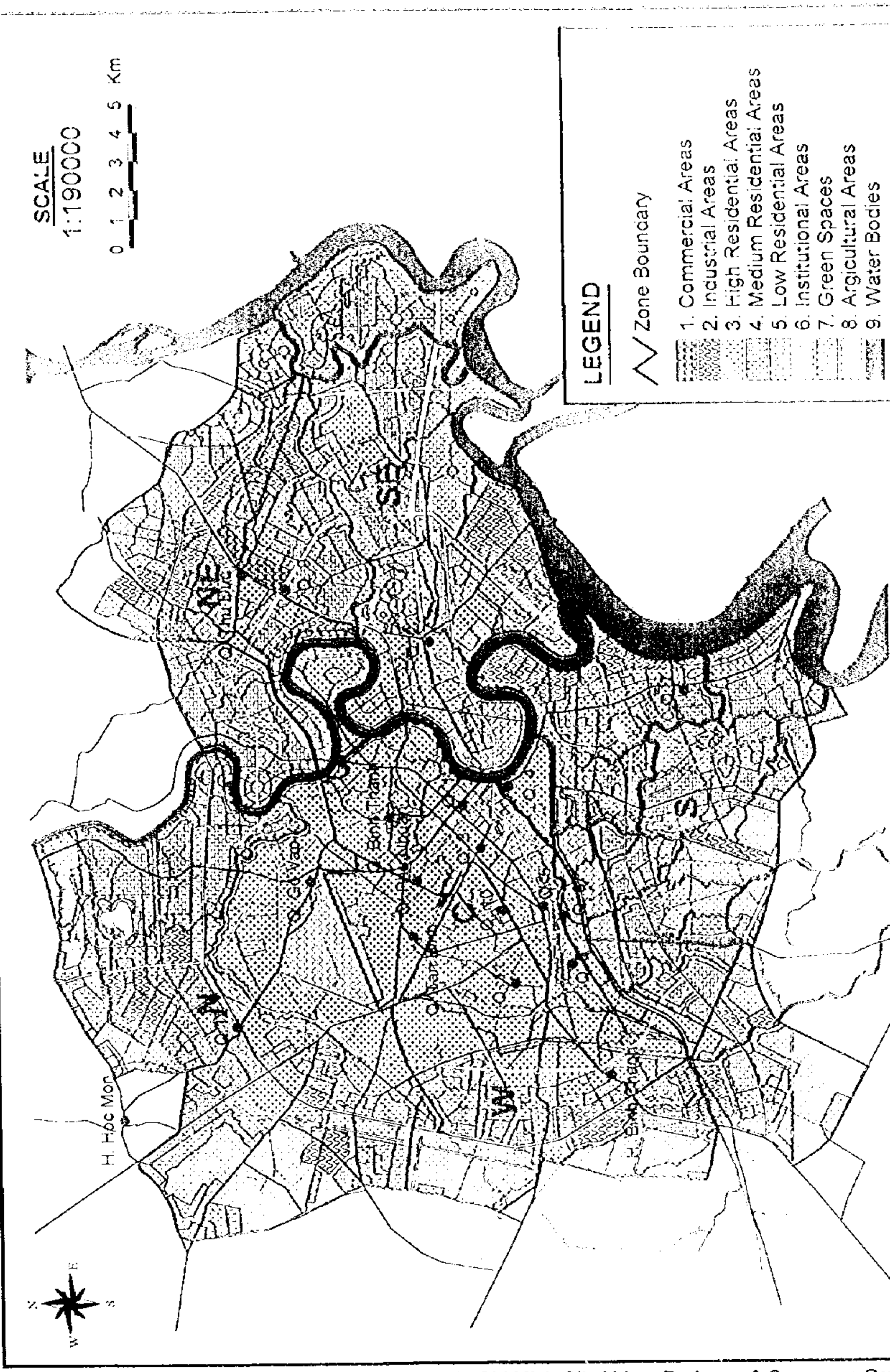


FIG. E.3.3 (2/2) FUTURE LAND USE (2020)

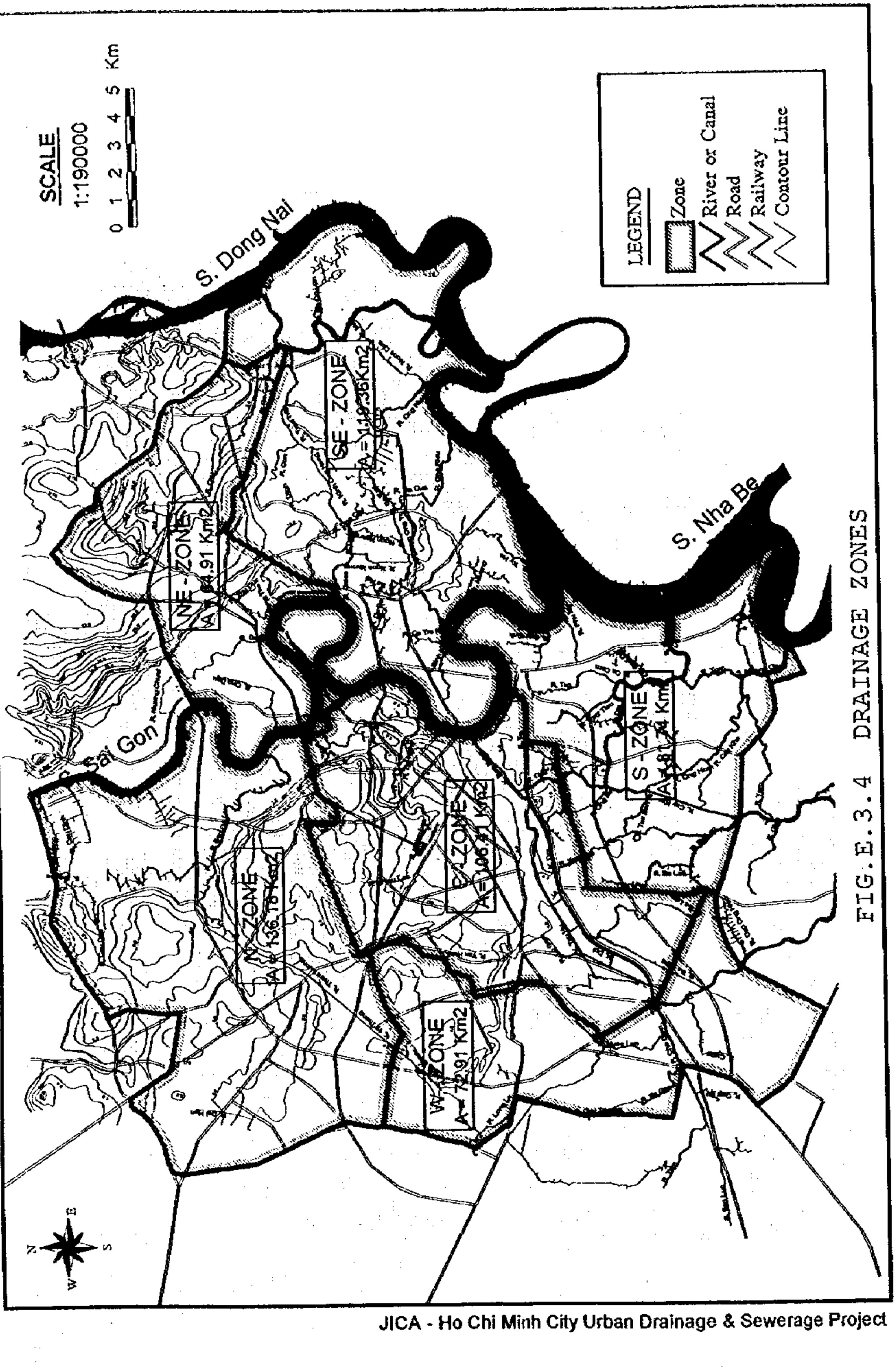


FIG.E.3.4 DRAINAGE ZONES

JICA - Ho Chi Minh City Urban Drainage & Sewerage Project

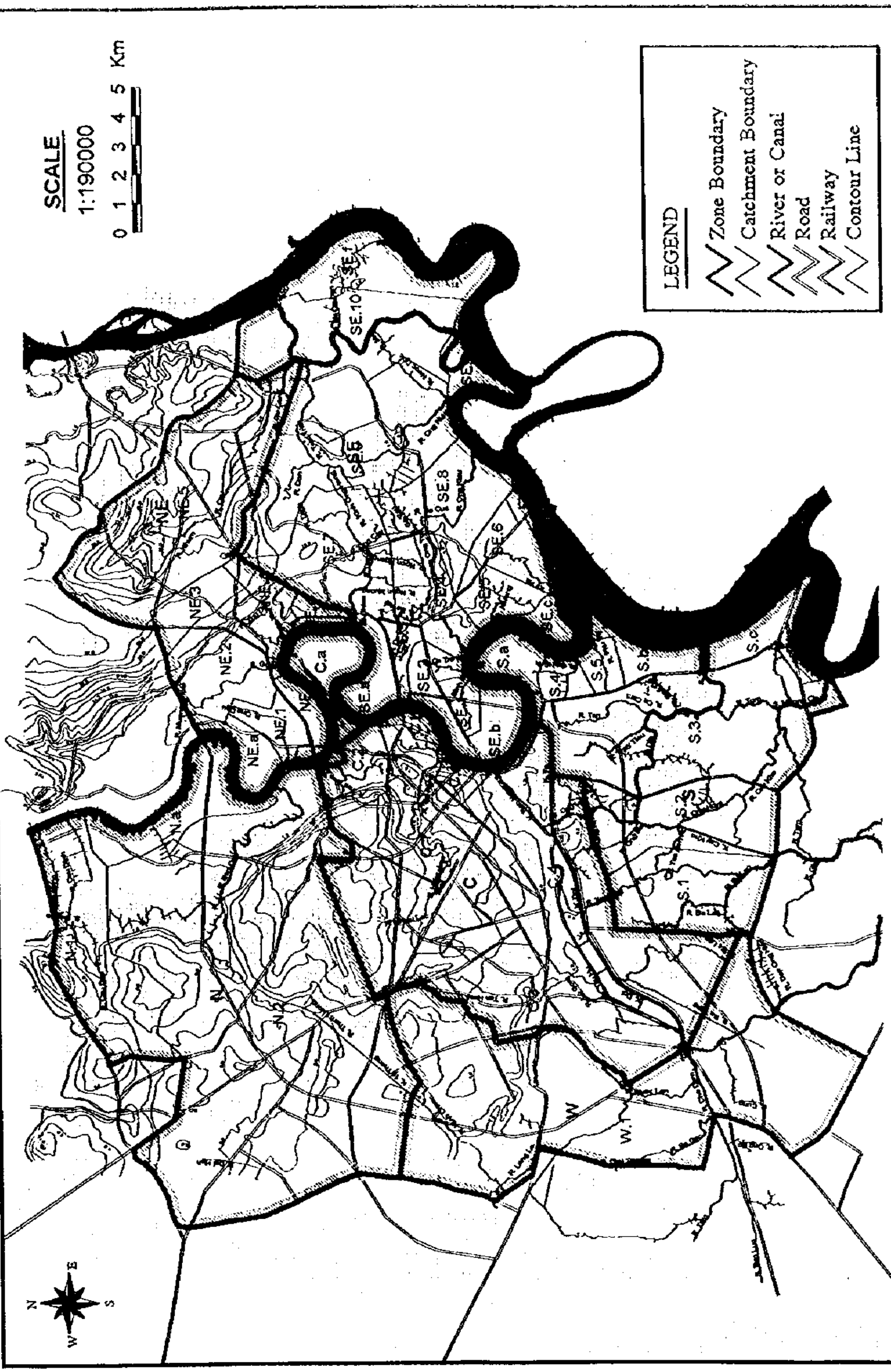


FIG.E.3.5 CATCHMENT AREA AND CANAL SYSTEM

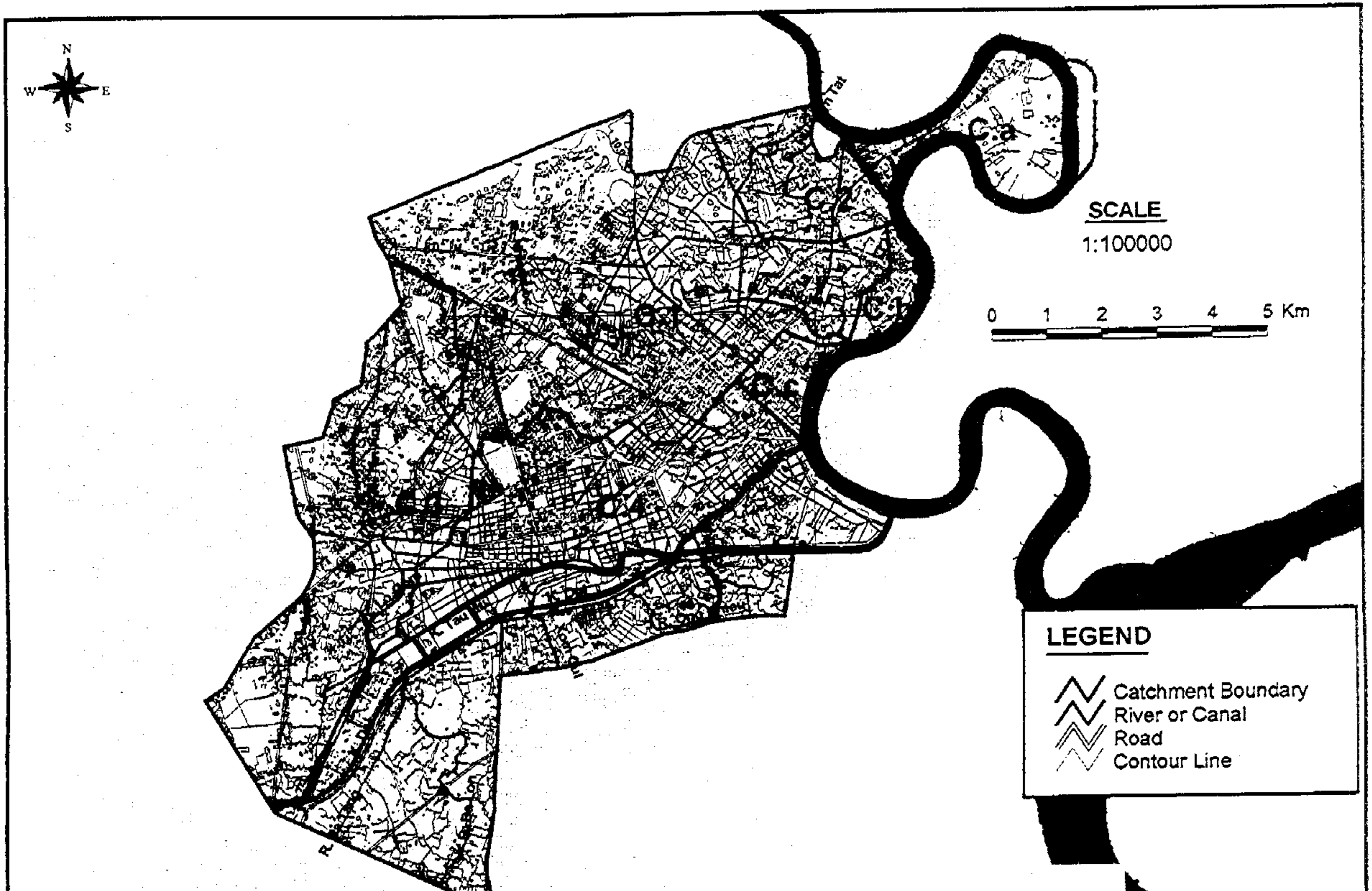


Fig. E.3.6 (1/5) Canal system of Central City Drainage Zone

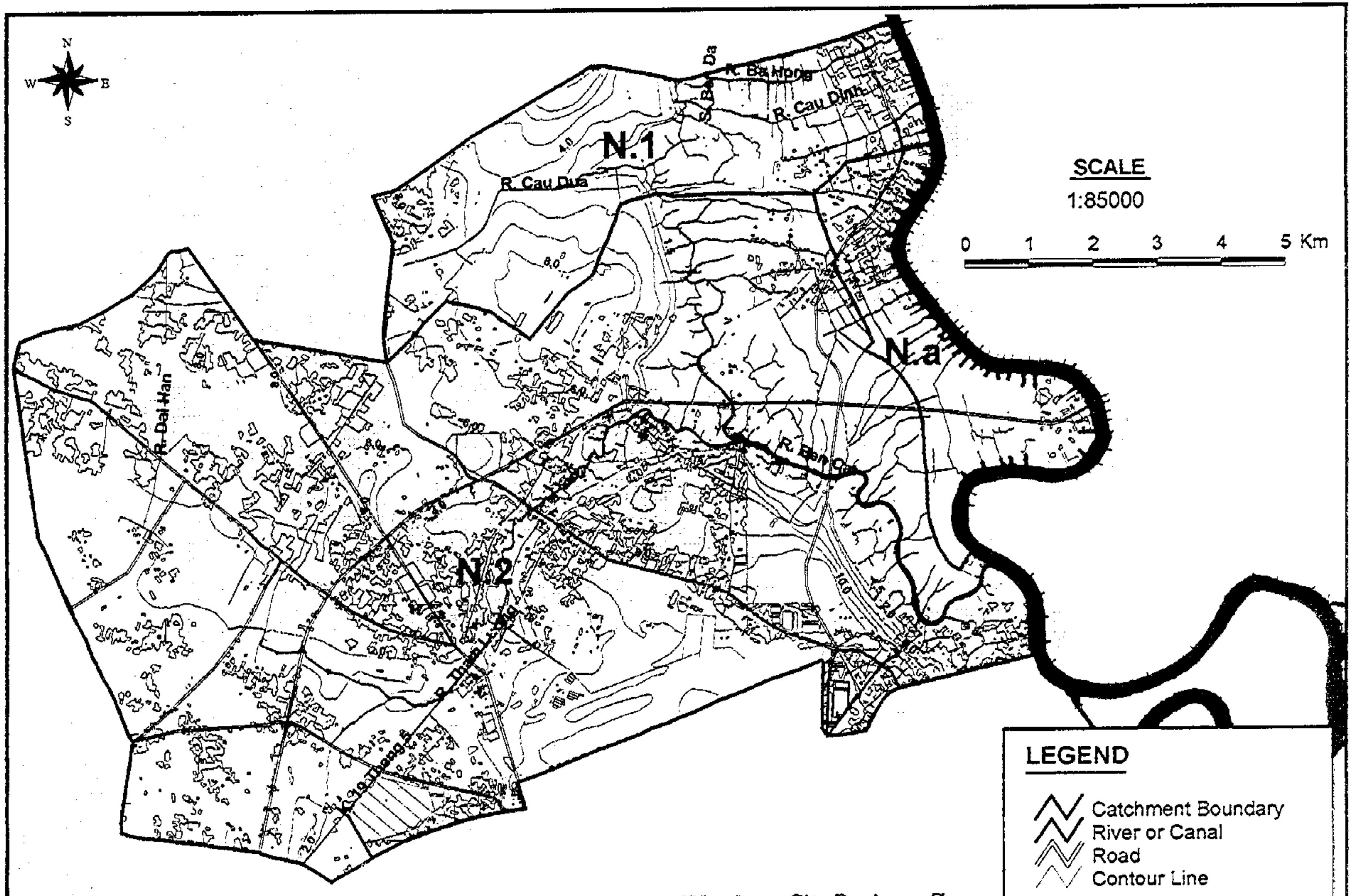


Fig. E.3.6 (2/5) Canal system of Northern City Drainage Zone

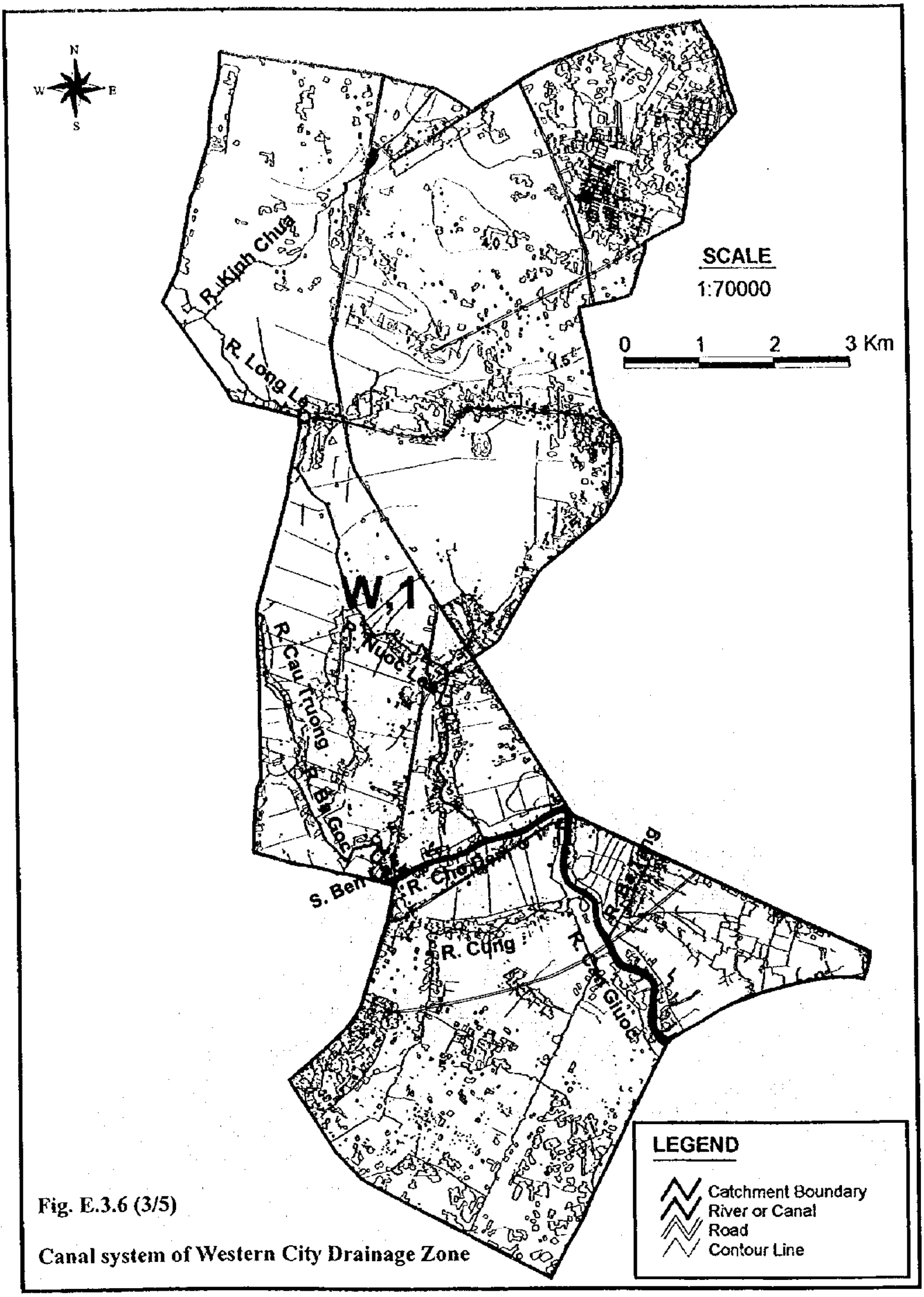
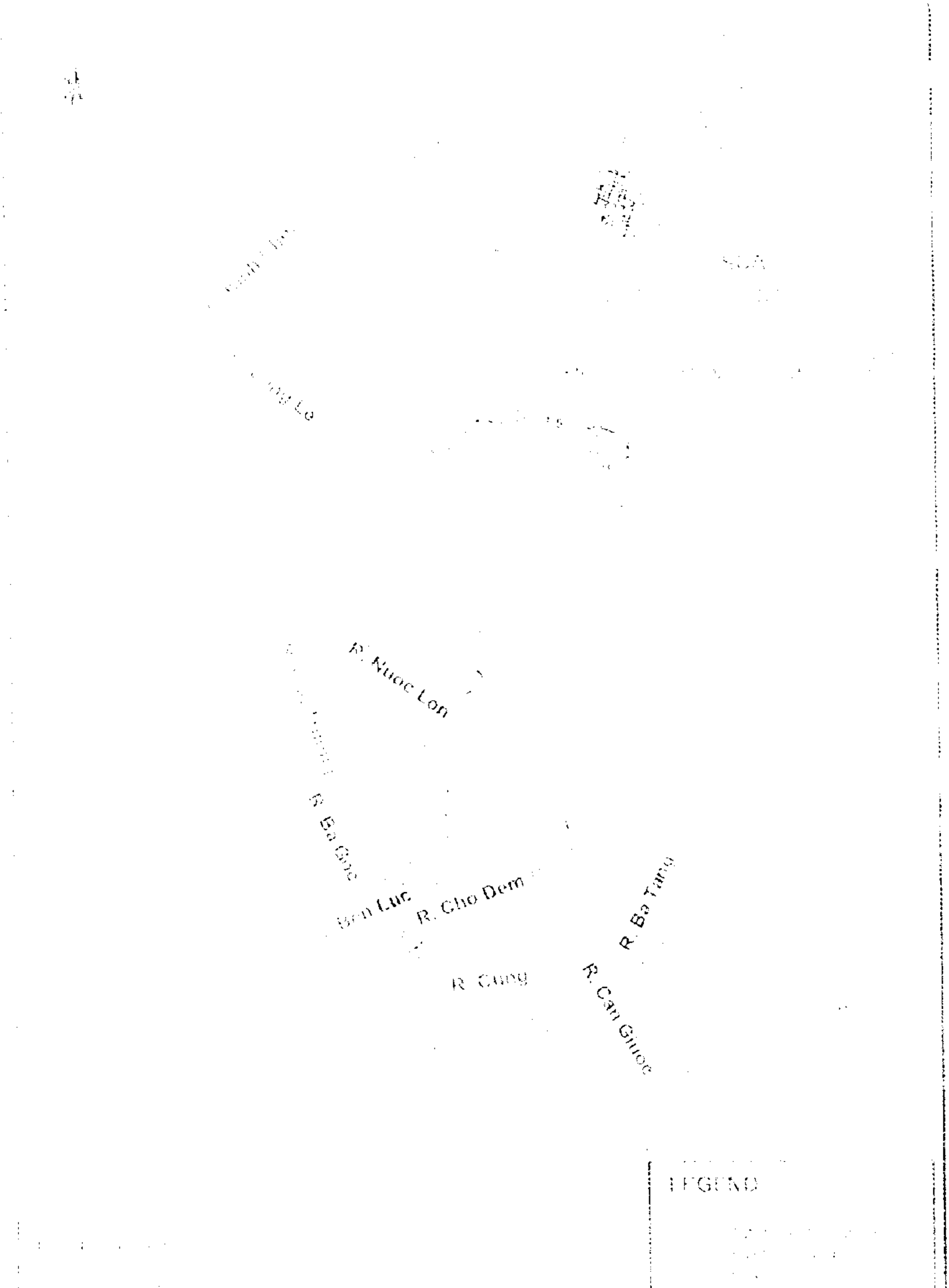


Fig. E.3.6 (3/5)

Canal system of Western City Drainage Zone



[illegible] of West City Drainage Zone

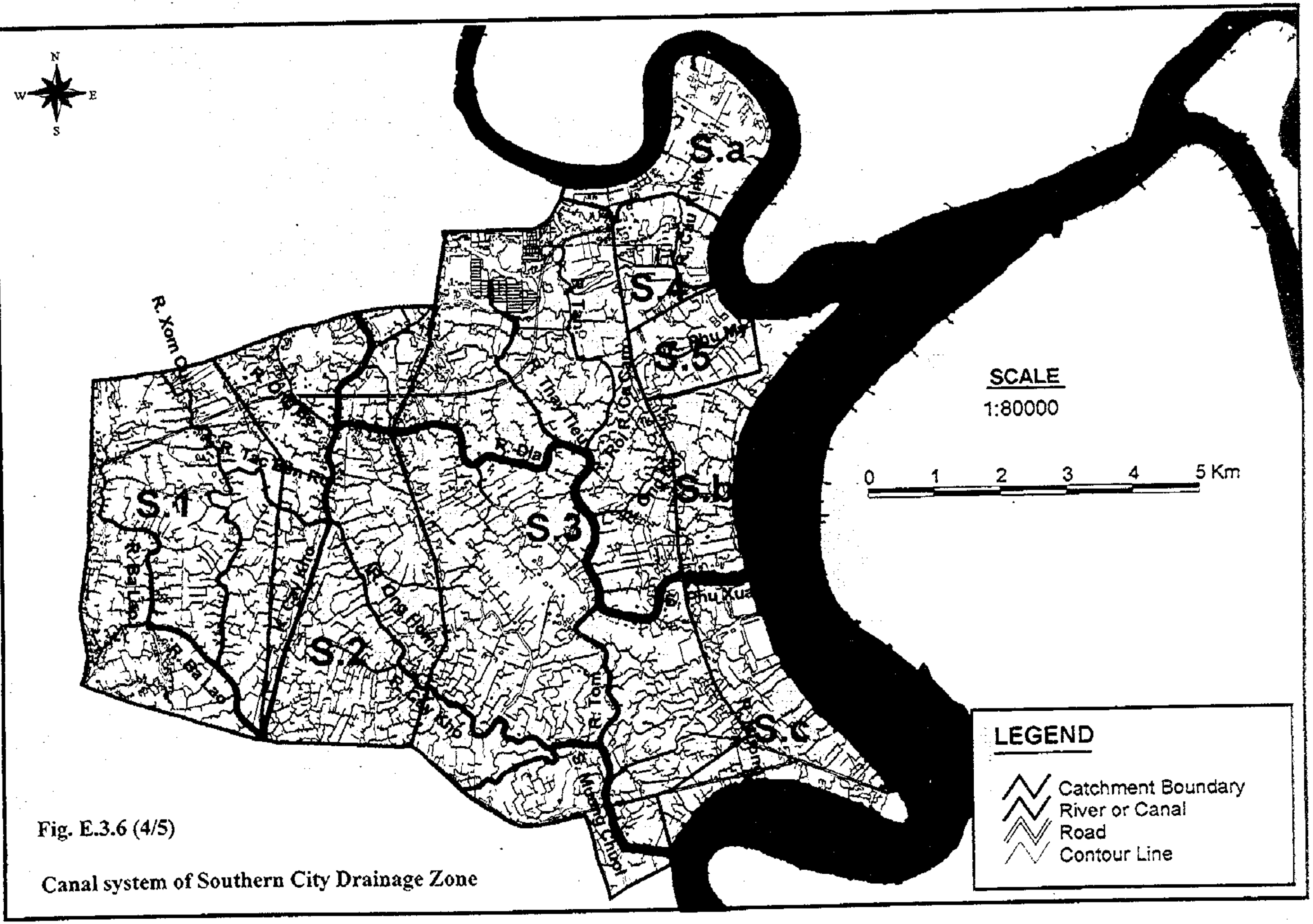
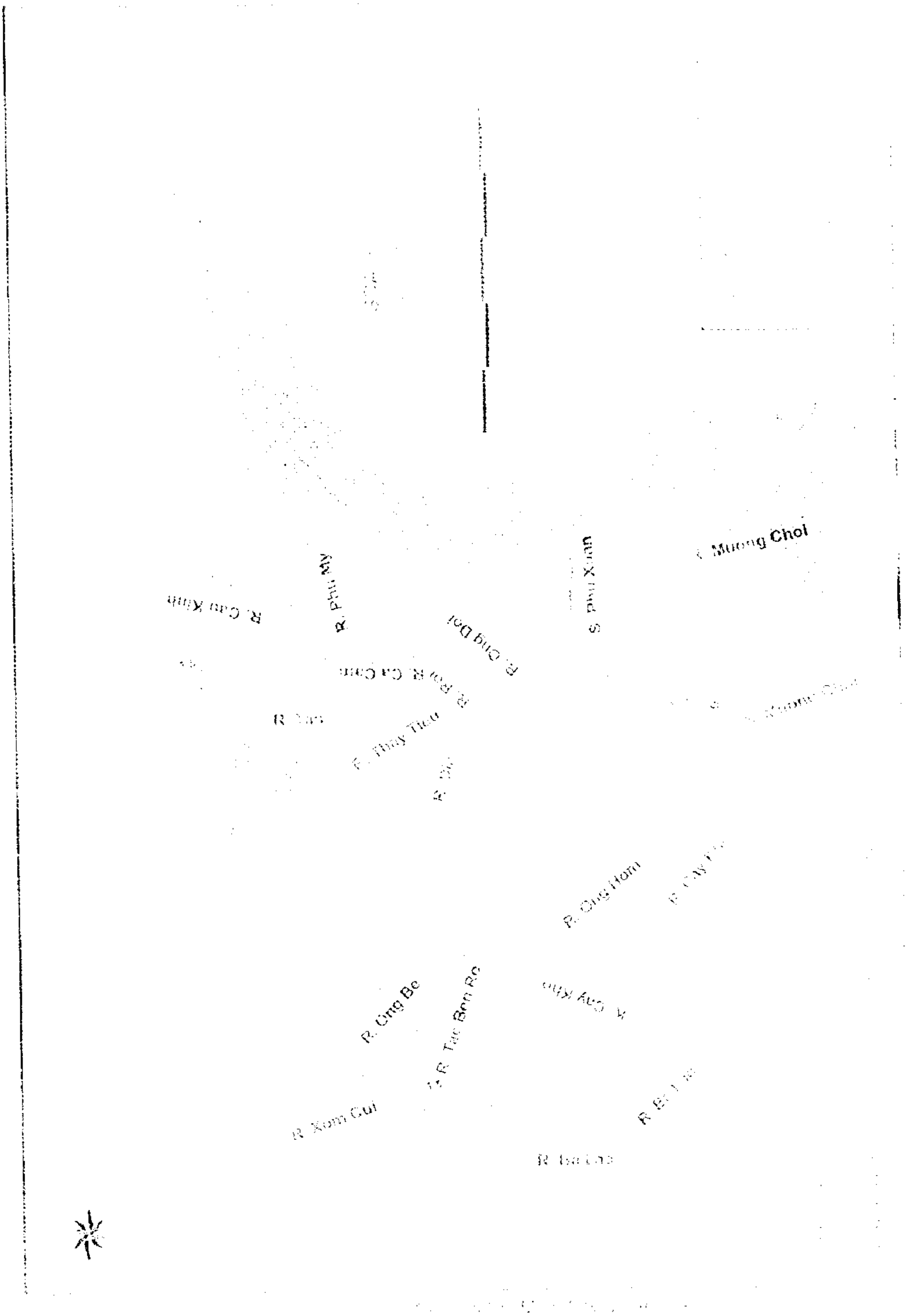


Fig. E.3.6 (4/5)

Canal system of Southern City Drainage Zone


R. Phu My
R. Cau Kinh
R. Ong Doi
S. Phu Xuan
Muong Choi
R. Thay Tieu
R. Ong Hom
R. Ong Be
R. Tac Bon Ro
R. Xom Gui

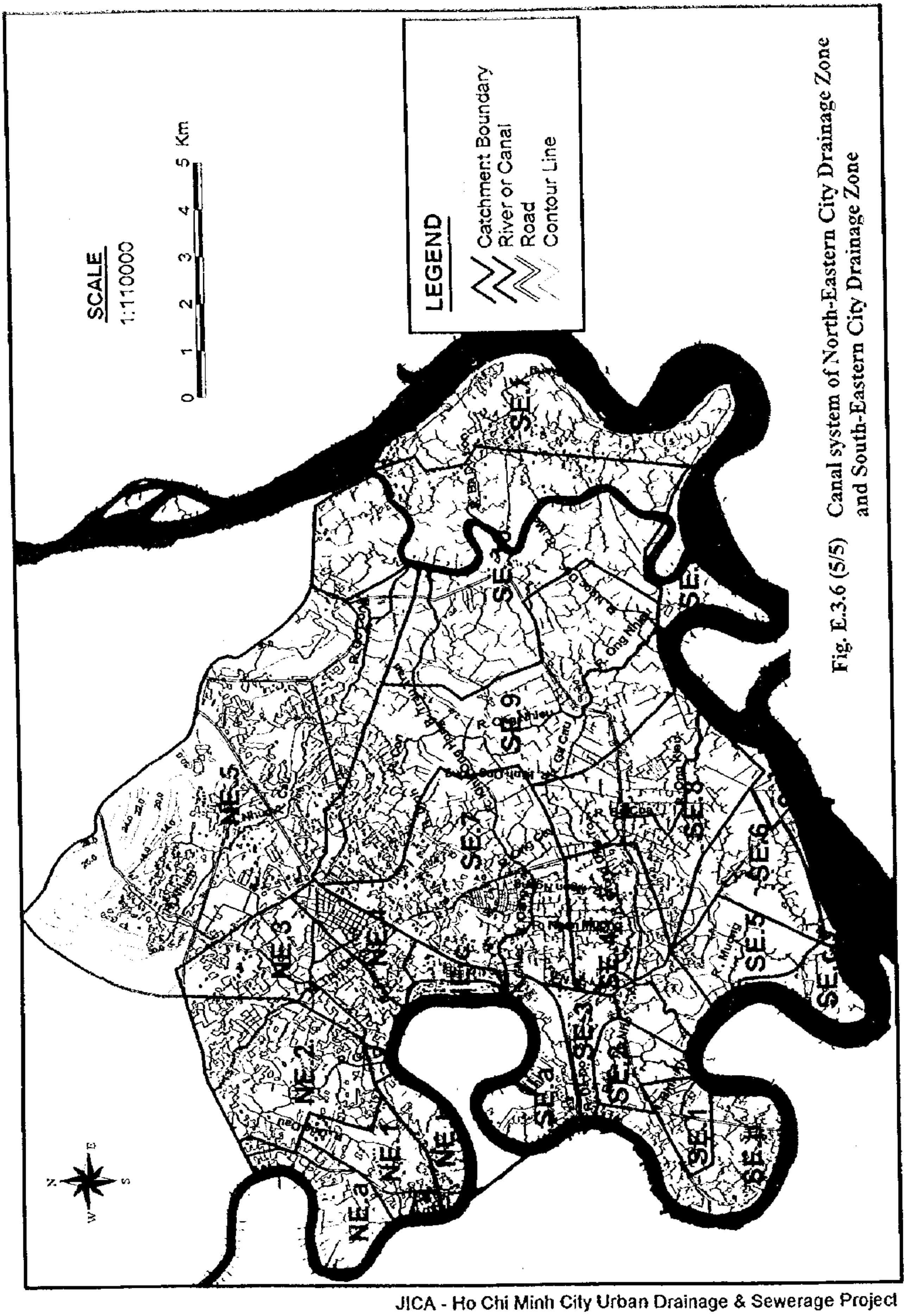
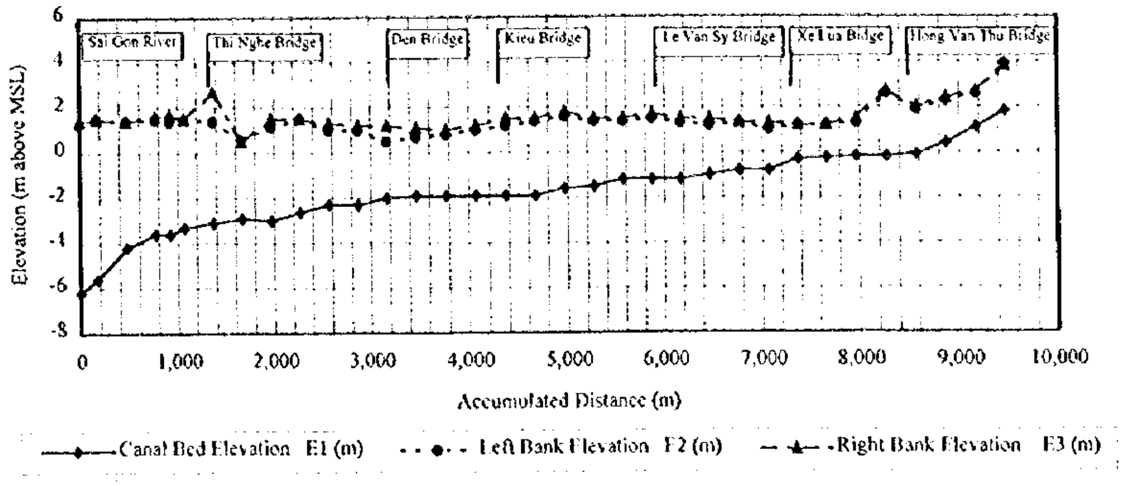
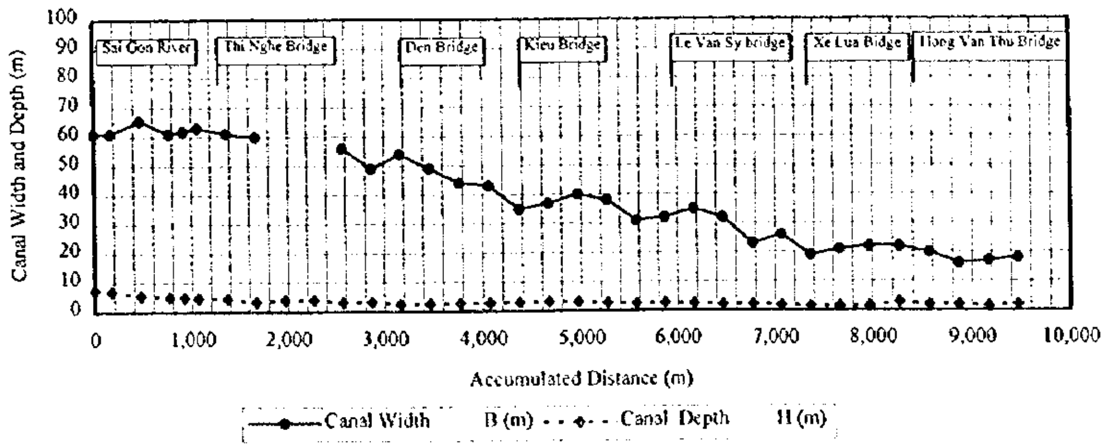


Fig. E.3.6 (5/5) Canal system of North-Eastern City Drainage Zone and South-Eastern City Drainage Zone

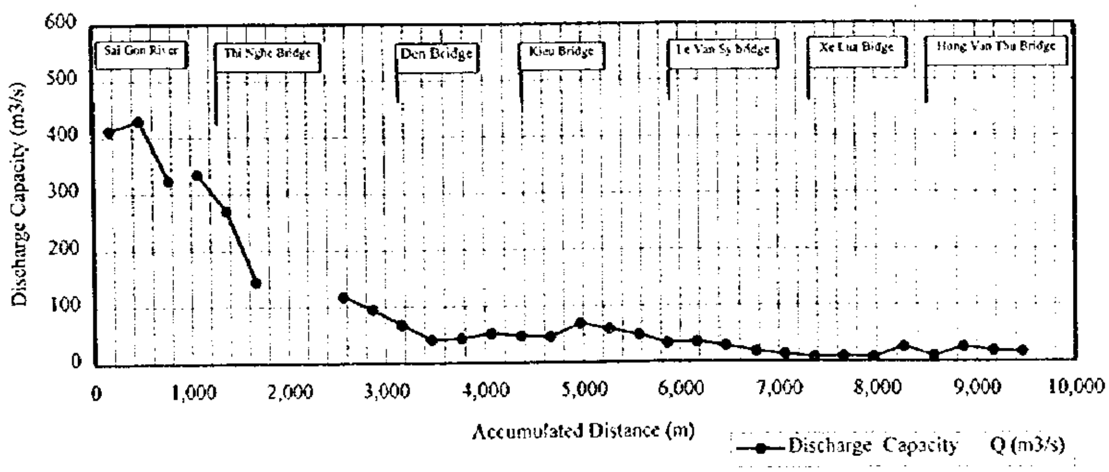
PROFILE



CANAL WIDTH AND DEOTH

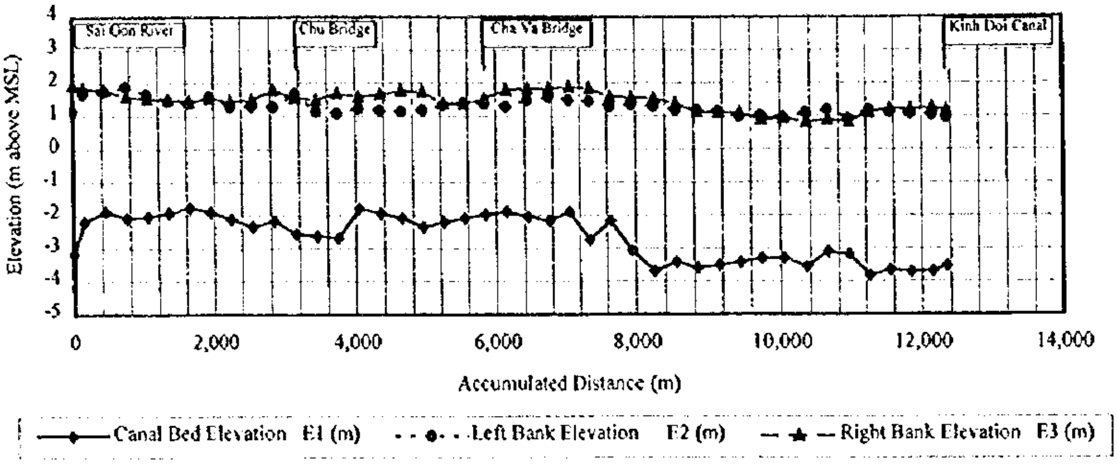


DISCHARGE CAPACITY

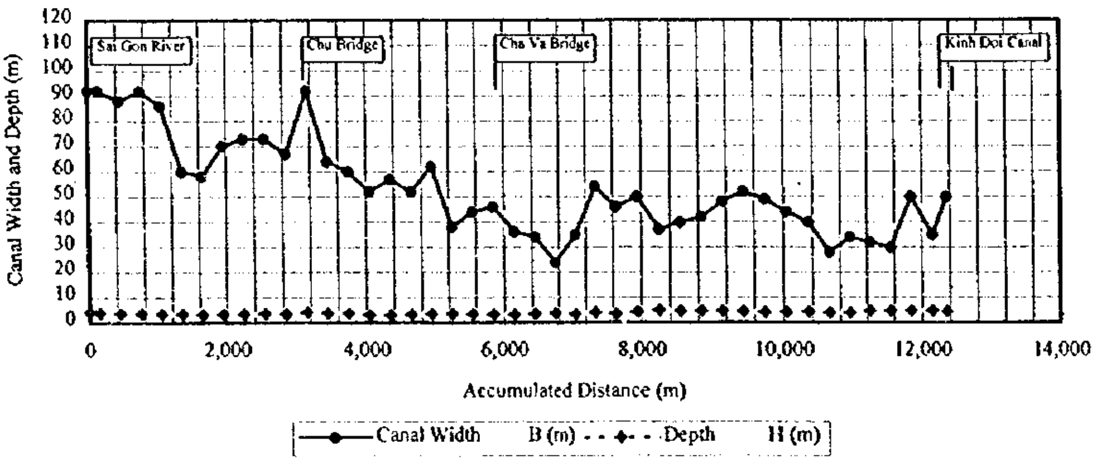


FIF. E.3.7 (1/6) HYDRAULIC CHARACTERISTIC AND DISCHARGE CAPACITY OF EXISTING NHIEU LOC - THI NGHE CANAL

PROFILE



CANAL WIDTH AND DEPTH



DISCHARGE CAPACITY

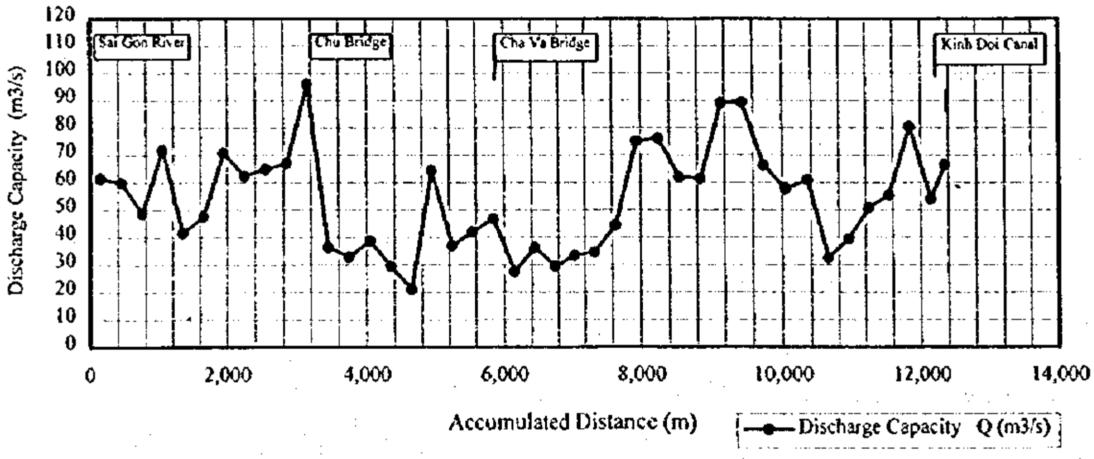
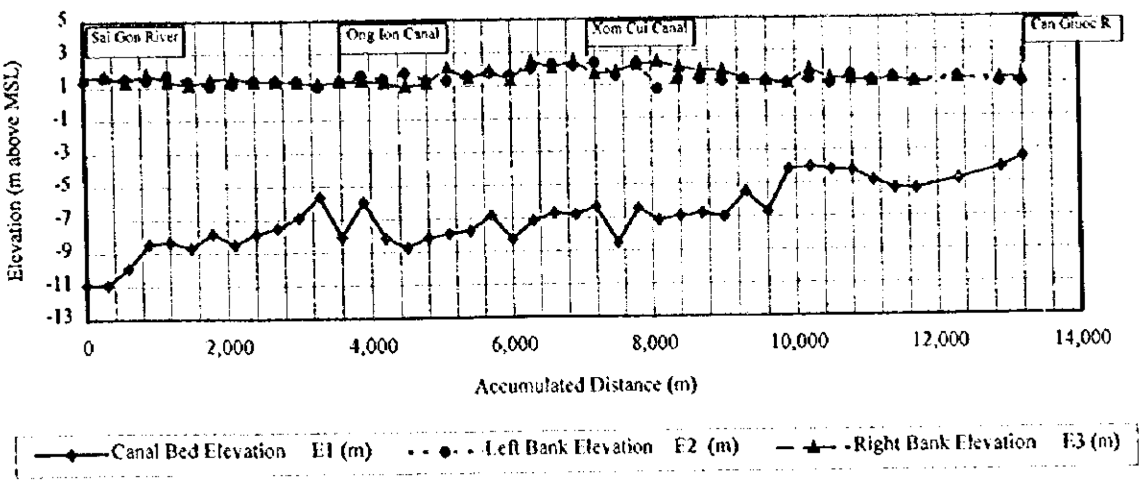
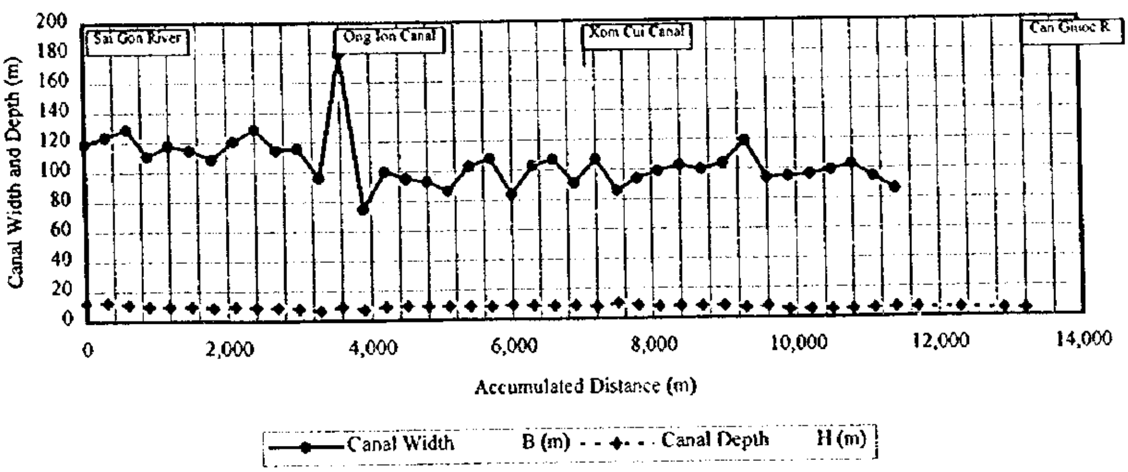


FIG. E.3.7 (2/6) HYDRAULIC CHARACTERISTIC AND DISCHARGE CAPACITY OF EXISTING TAU HU - BEN NGHE CANAL

PROFILE



CANAL WIDTH AND DEPTH



DISCHARGE CAPACITY

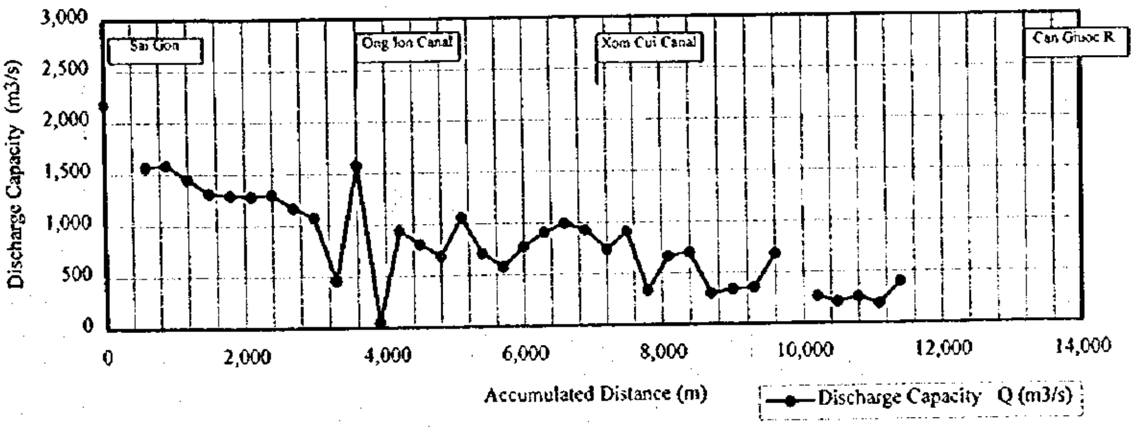
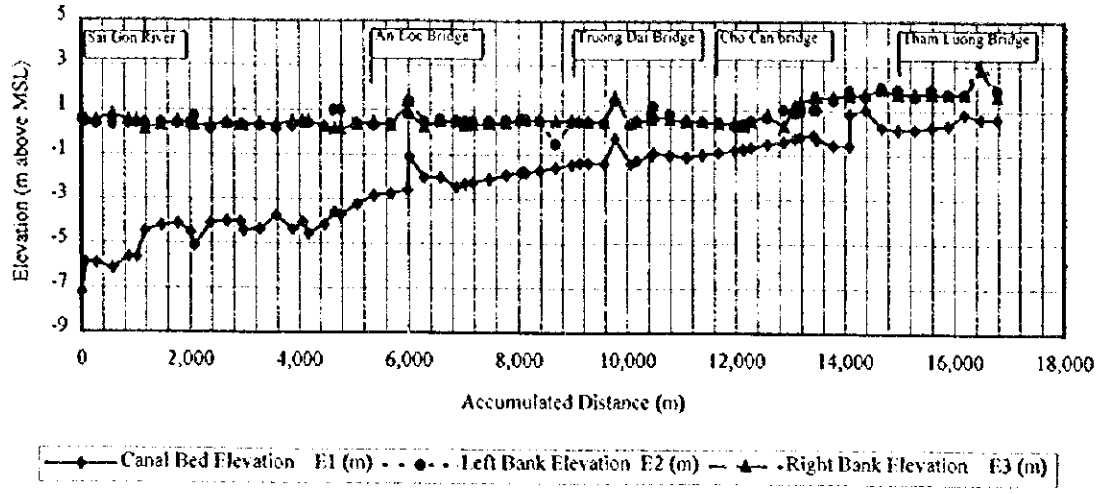
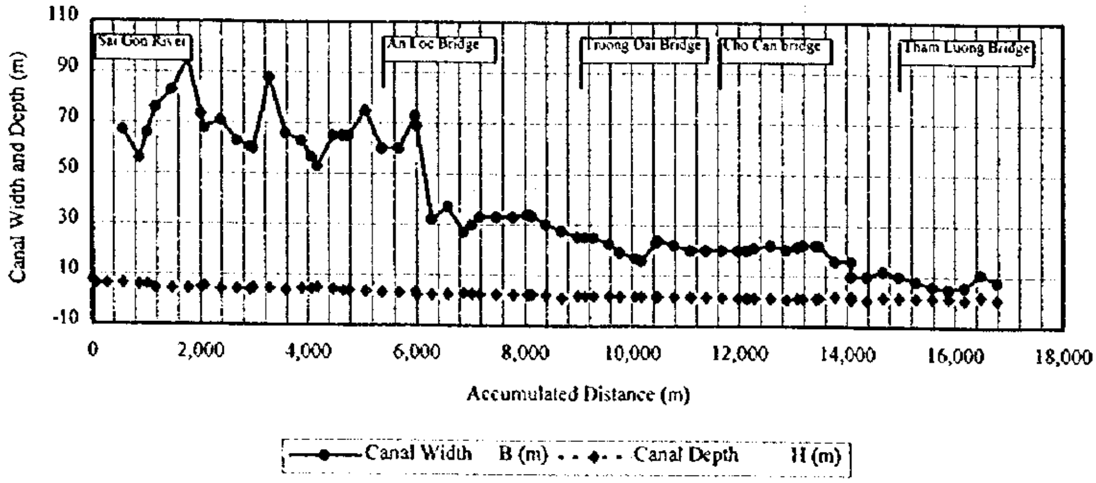


FIG. E.3.7 (3/6) HYDRAULIC CHARACTERISTIC AND DISCHARGE CAPACITY OF EXISTING DOI - TE CANAL

PROFILE



CANAL WIDTH AND DEPTH



DISCHARGE CAPACITY

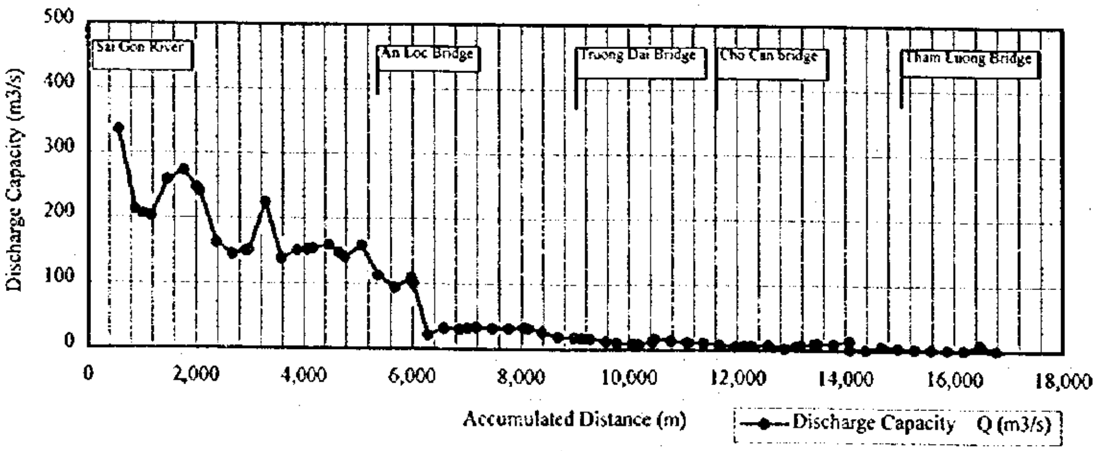
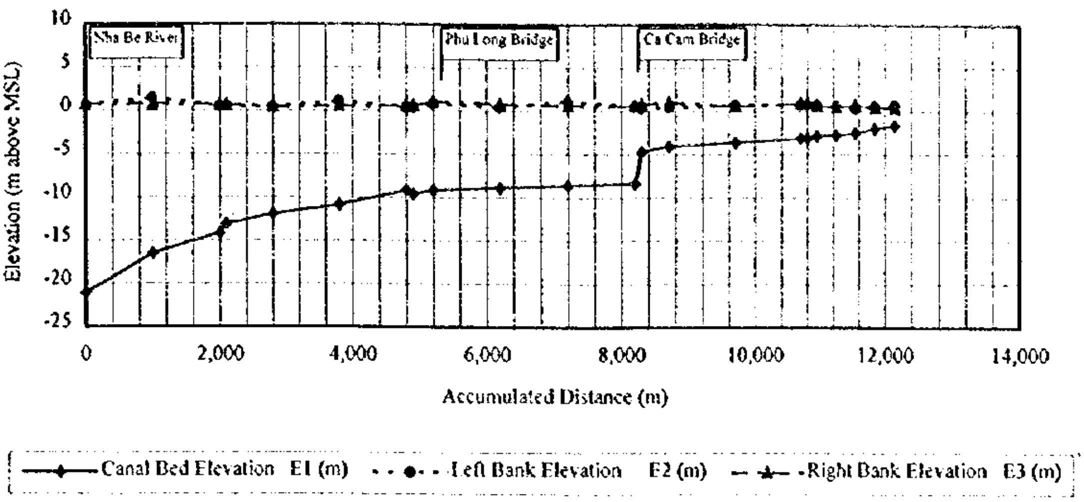
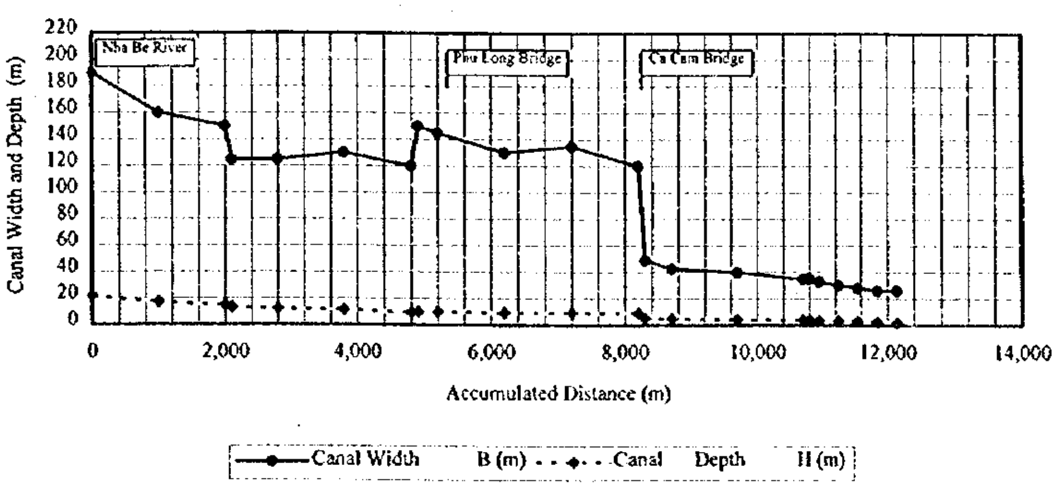


FIG. E.3.7.(4/6) HYDRAULIC CHARACTERISTIC AND DISCHARGE CAPACITY OF EXISTING RACH DAI HAN - THAM LUONG - BEN CAT CANAL

PROFILE



CANAL WIDTH AND DEPTH



DISCHARGE CAPACITY

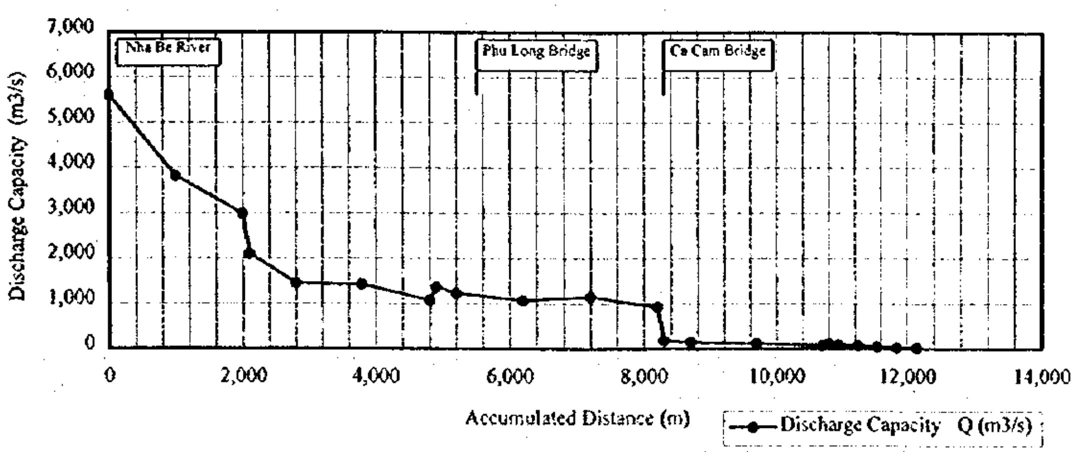
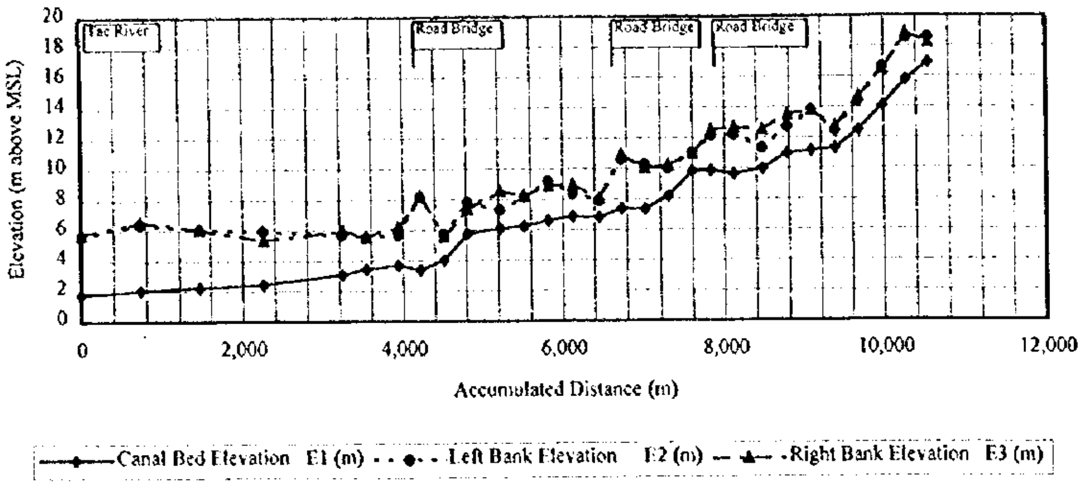
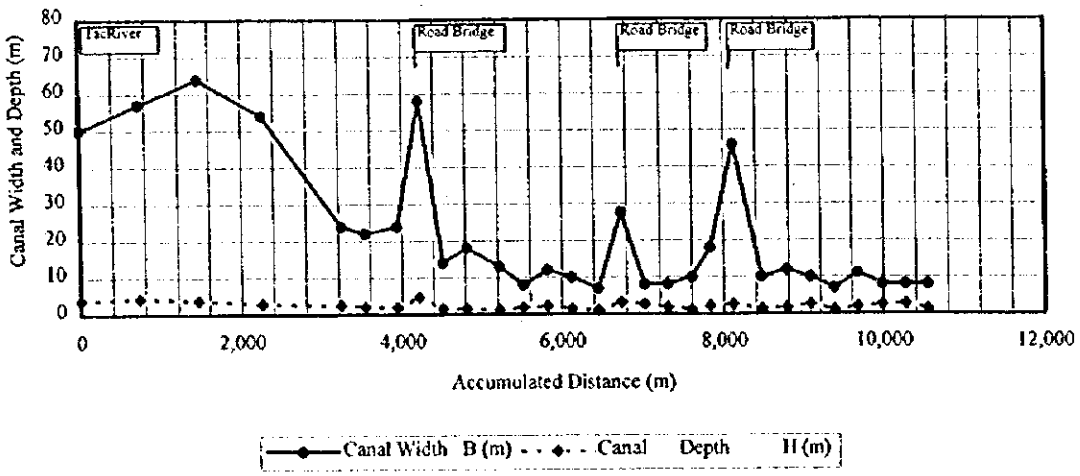


FIG. E.3.7 (5/6) HYDRAULIC CHARACTERISTIC AND DISCHARGE CAPACITY OF EXISTING R. TAN - R. CA CAM - R. ROI - R. TOM - MUONG CHUOI CANAL

PROFILE



CANAL WIDTH AND DEPTH



DISCHARGE CAPACITY

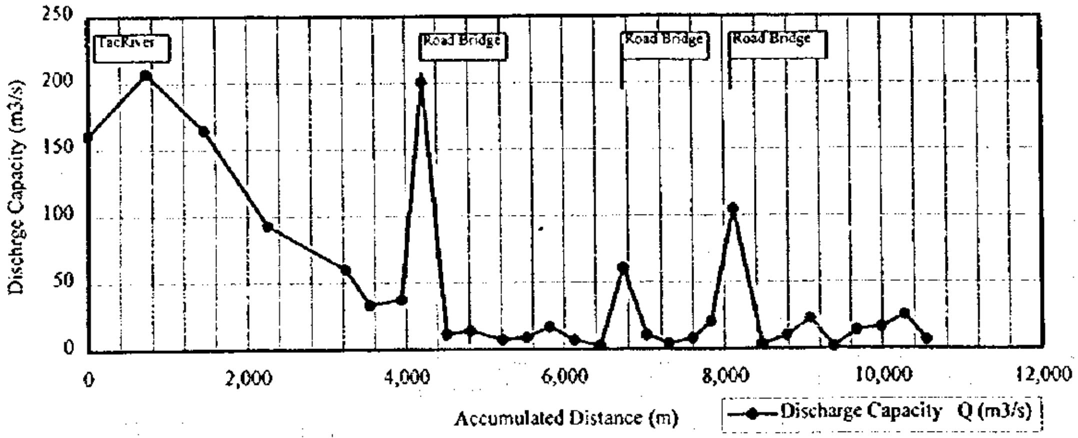


FIG. E.3.7 (6/6) HYDRAULIC CHARACTERISTIC AND DISCHARGE CAPACITY OF EXISTING RACH NHUM - RACH CAU - RACH GO CONG CANAL

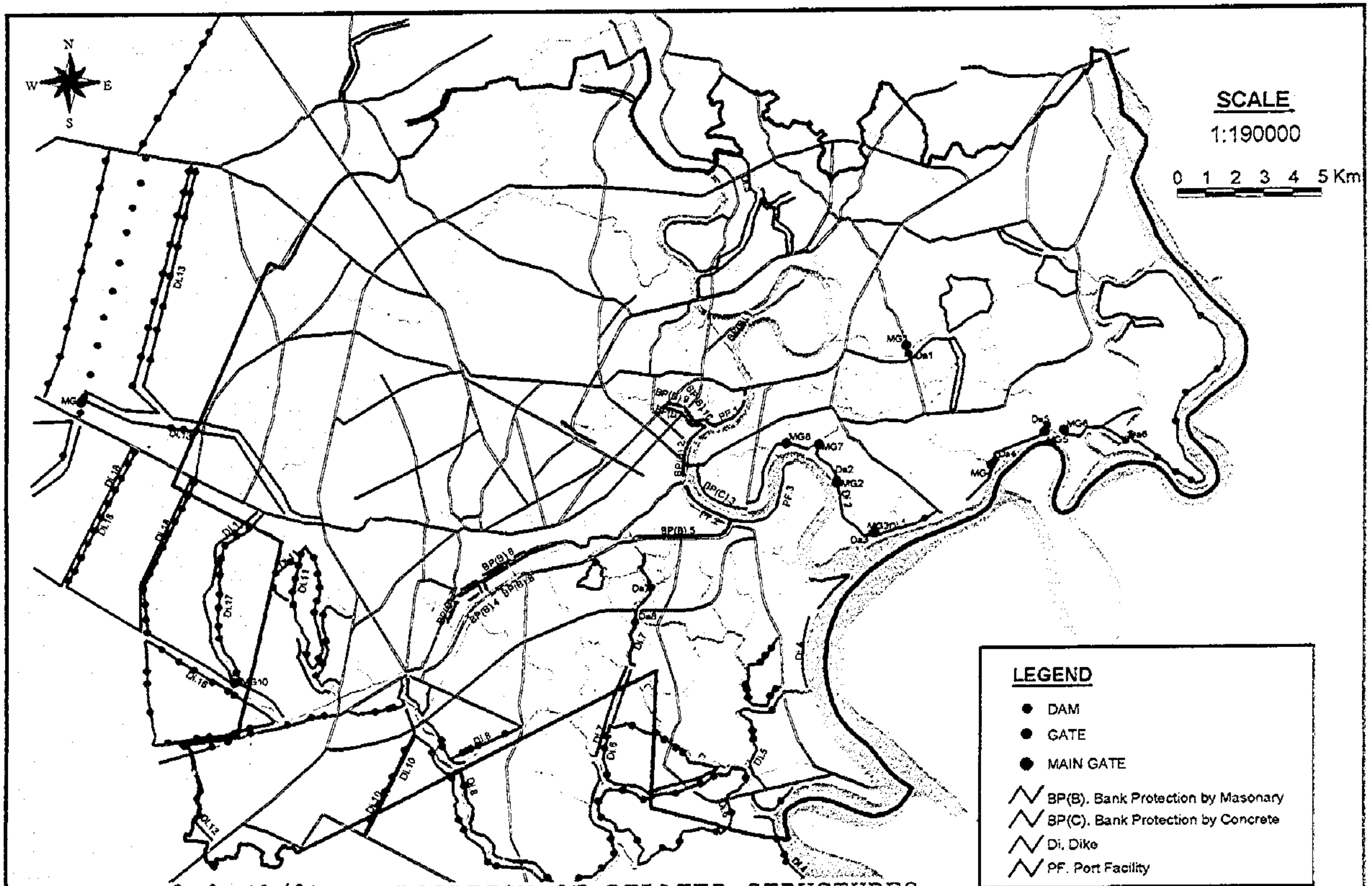


FIG.E.3.8 (1/2) LOCATION OF RELATED STRUCTURES
(PORT, EMBANKMENT, DAM, GATE, BANK PROTECTION)

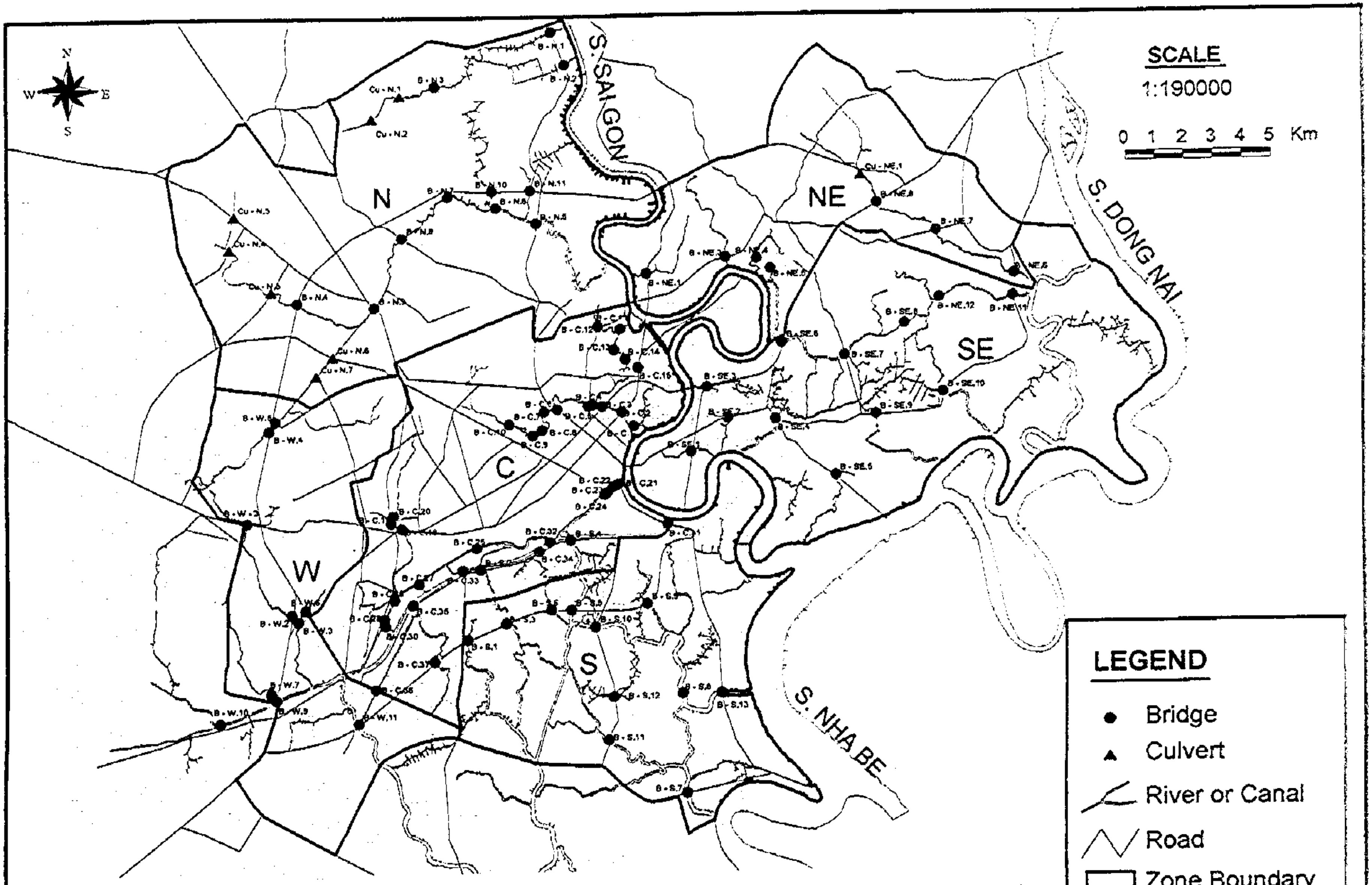


FIG.E.3.8 (2/2) LOCATION OF RELATED STRUCTURES (BRIDGE and CULVERT)

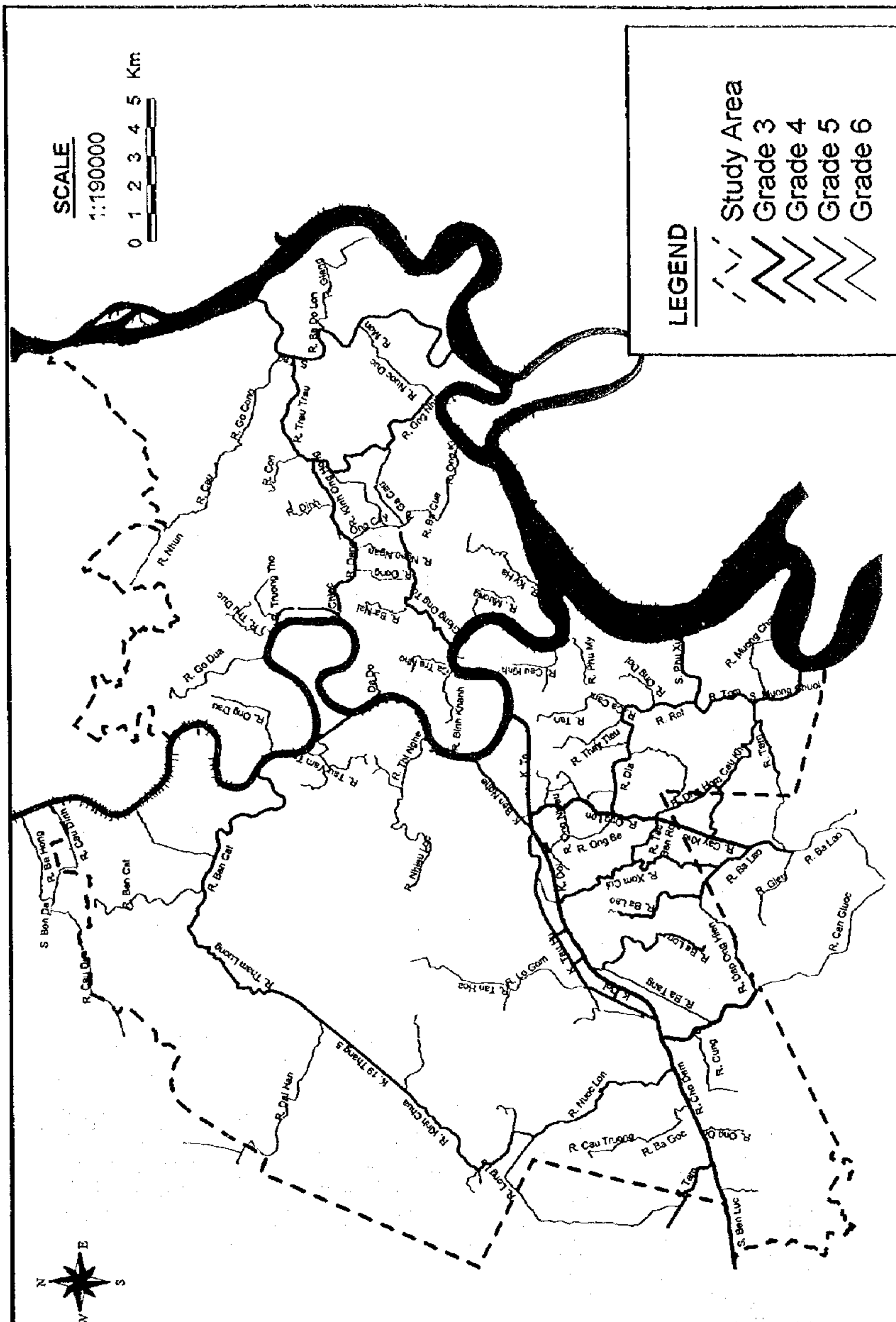


FIG.E.3.9 NAVIGABLE CANALS IN THE STUDY AREA

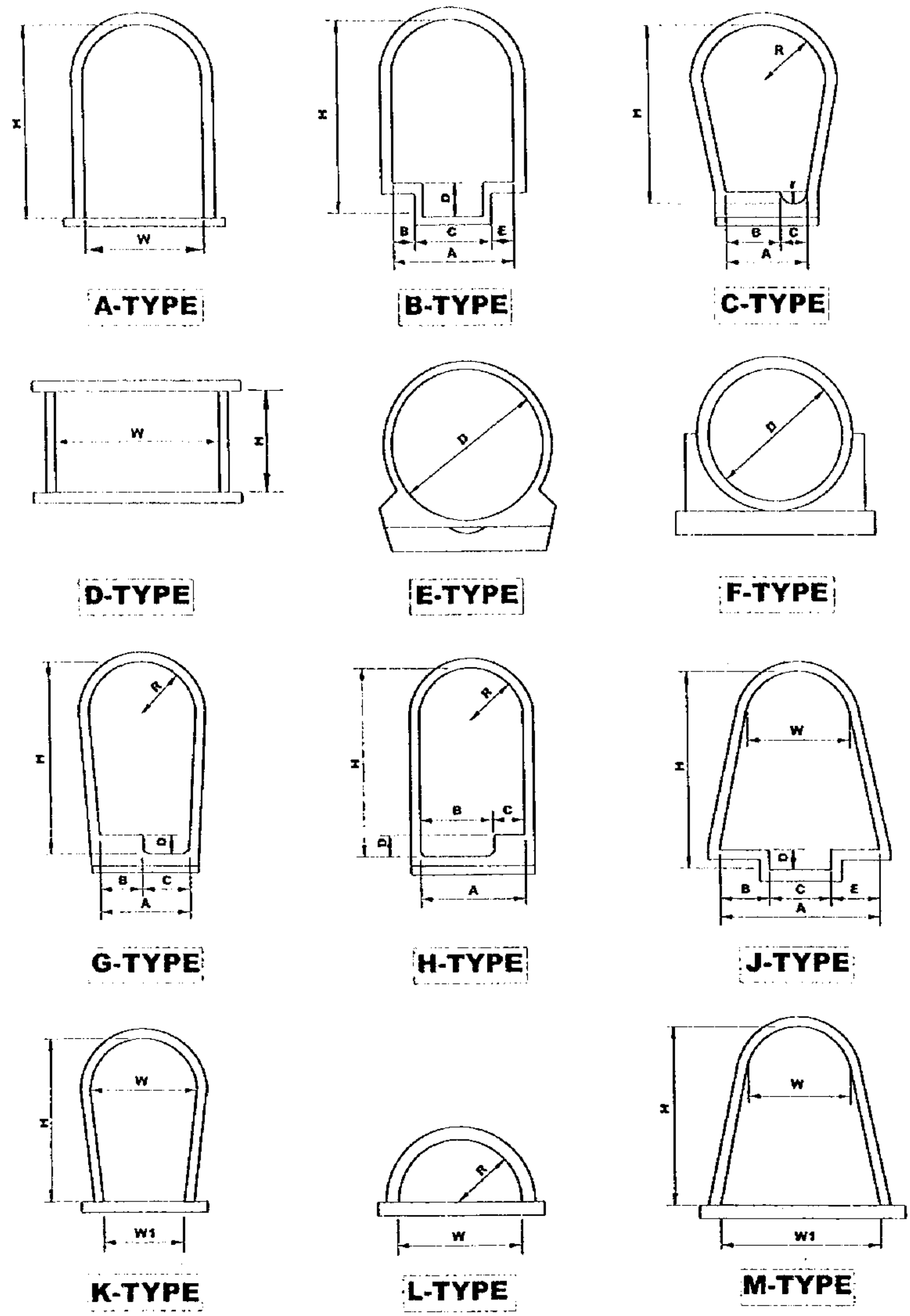


FIG. E.3.10 TYPICAL CROSS-SECTION
OF EXISTINGDRAINAGE PIPE

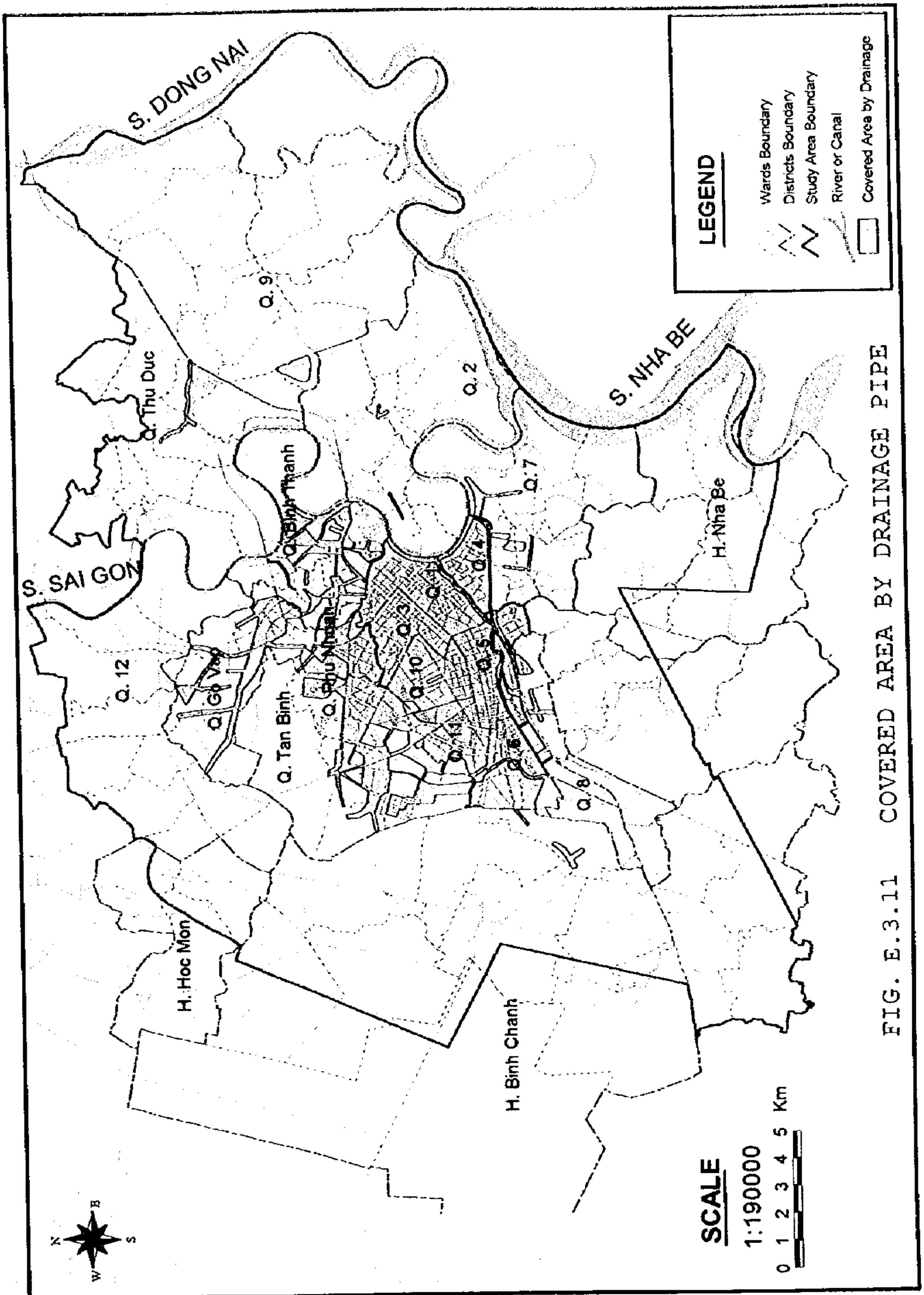


FIG. E.3.11 COVERED AREA BY DRAINAGE PIPE

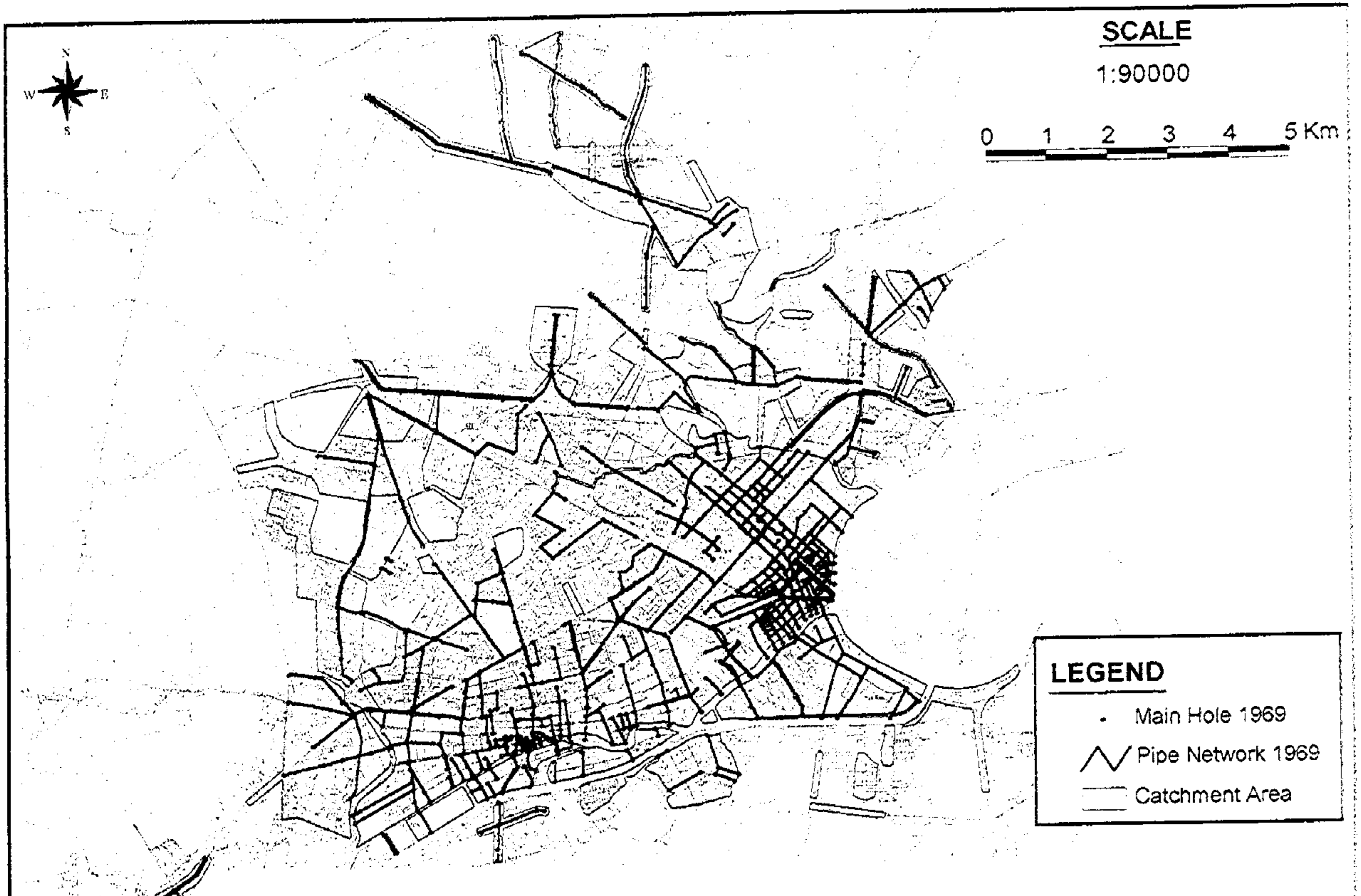


FIG.E.3.12 EXISTING MAIN DRAINAGE PIPE NETWORK

Table E.3.17 Existing Combined Sewer Having Insufficient Discharge Capacity

Line no	Section Upstream	Section Downstream	Road Name	Length (m)	Diameter / Sewer Type (mm)
1	U73A_1	U73B_1	NGUYEN TAT THAN	1,480	800
1	U73B_1	Ben Nghe Canal	ditto	724	800
		Sub total		2,204	
3	55B_1	55C_1	Cong Quynh	182	F-5
3	147A_1	145B_1	Tran Hung Dao	192	F-5
3	145AA_1	145BA_1	ditto	173	F-5
3	145B_1	145BA_1	ditto	33	A-2
3	145BA_1	55C_1	ditto	46	A-2
3	55C_1	Ben Nghe Canal	Huynh Quang Tien	613	E-3
		Sub total		1,139	
4	51_1	134B_1	Nguyen Dieu	147	F-5
4	134B_1	Ben Nghe Canal	Tran Binh Trong	362	F-3
5	49_1	253_1	Le Hong Phong	391	F-5
5	253_1	50B_1	Hung Vuong	298	F-5
5	50B_1	50EA_1	Tran Binh TRong	932	M-1
6	140A_1	47_1	Dien Bien Phu	714	F-5
6	141A_1	47B-1	Dien Bien Phu	714	F-5
7	142_1	63DB_1	Dien Bien Phu	926	F-5
		Sub total		4,464	
8	117A_1	Hun Bang	Trinh Hoai Duc	724	A-8
9	106A_1	Ben Nghe Canal	Hau Giang	1,108	F-5
9	9A_178B_1	Lo Gom Canal	Minh Phung	183	F-3
10	4AA_2	Lo Gom Canal	Hung Vuong	1,108	K-7
11	112E_1	Lo Gom Canal	Hung Vuong	107	F-5
11	112D_1	Lo Gom Canal	Phu Lam	152	F-3
11	112E_1	Lo Gom Canal	Hung Vuong	1,233	F-5
13	2A_1	2B_1	Minh Phung	641	F-5
		Sub total		5,256	
14	U40_1_1	Lo Gom Canal	Huong Lo 14	356	800
14	U40_2A1	Lo Gom Canal	ditto	483	800
14	U40_2C1	Lo Gom Canal	ditto	339	800
		Sub total		1,178	
15	U4BA_1	U4AA_1	Quang Trung	38	600
15	U4BB_1	U4AB_1	ditto	321	800
		Sub total		359	
		Total		14,620	

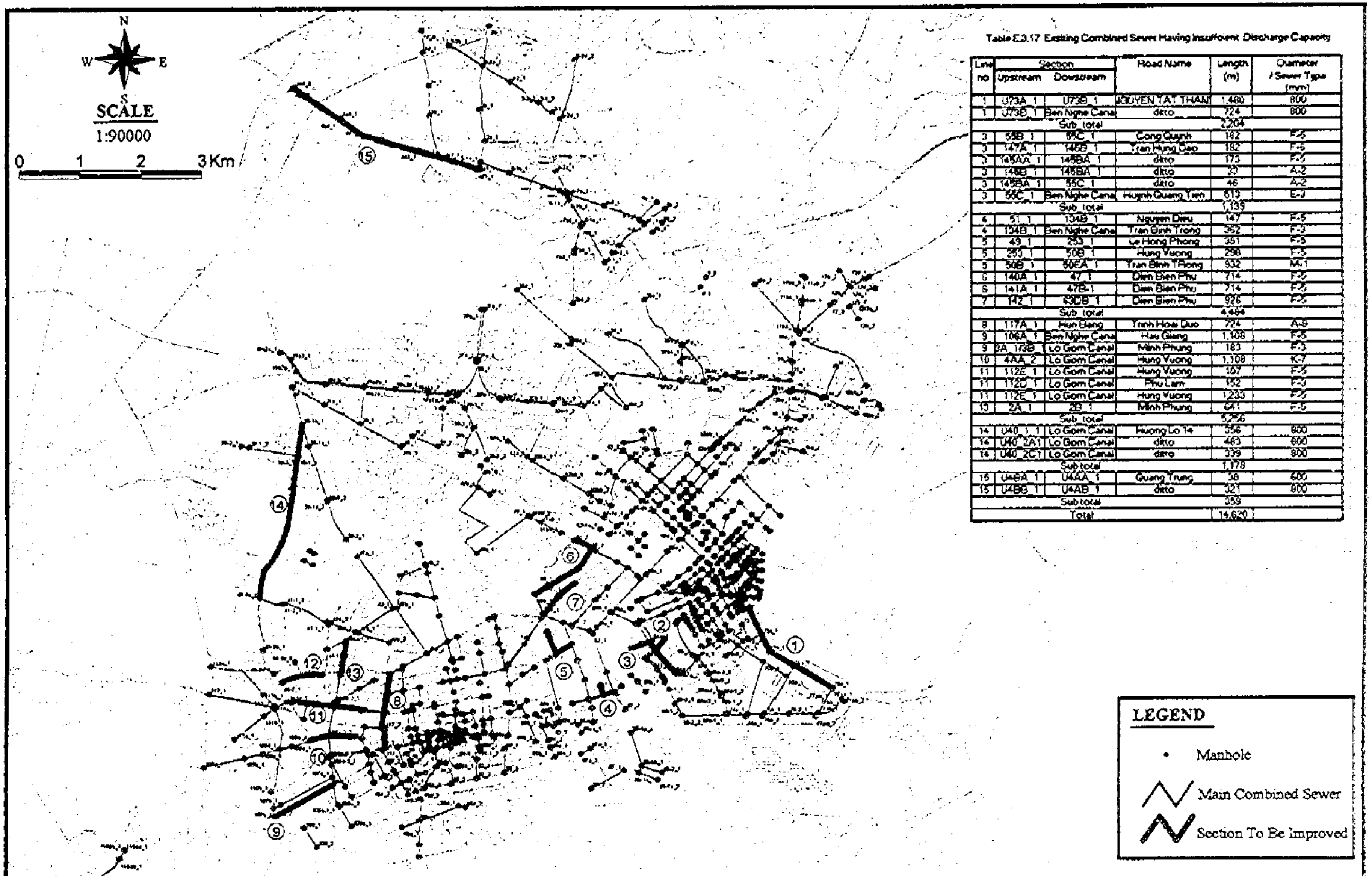


FIG. E.3.13 LOCATION OF EXISTING COMBINED SEWER HAVING INSUFFICIENT DRAINAGE CAPACITY

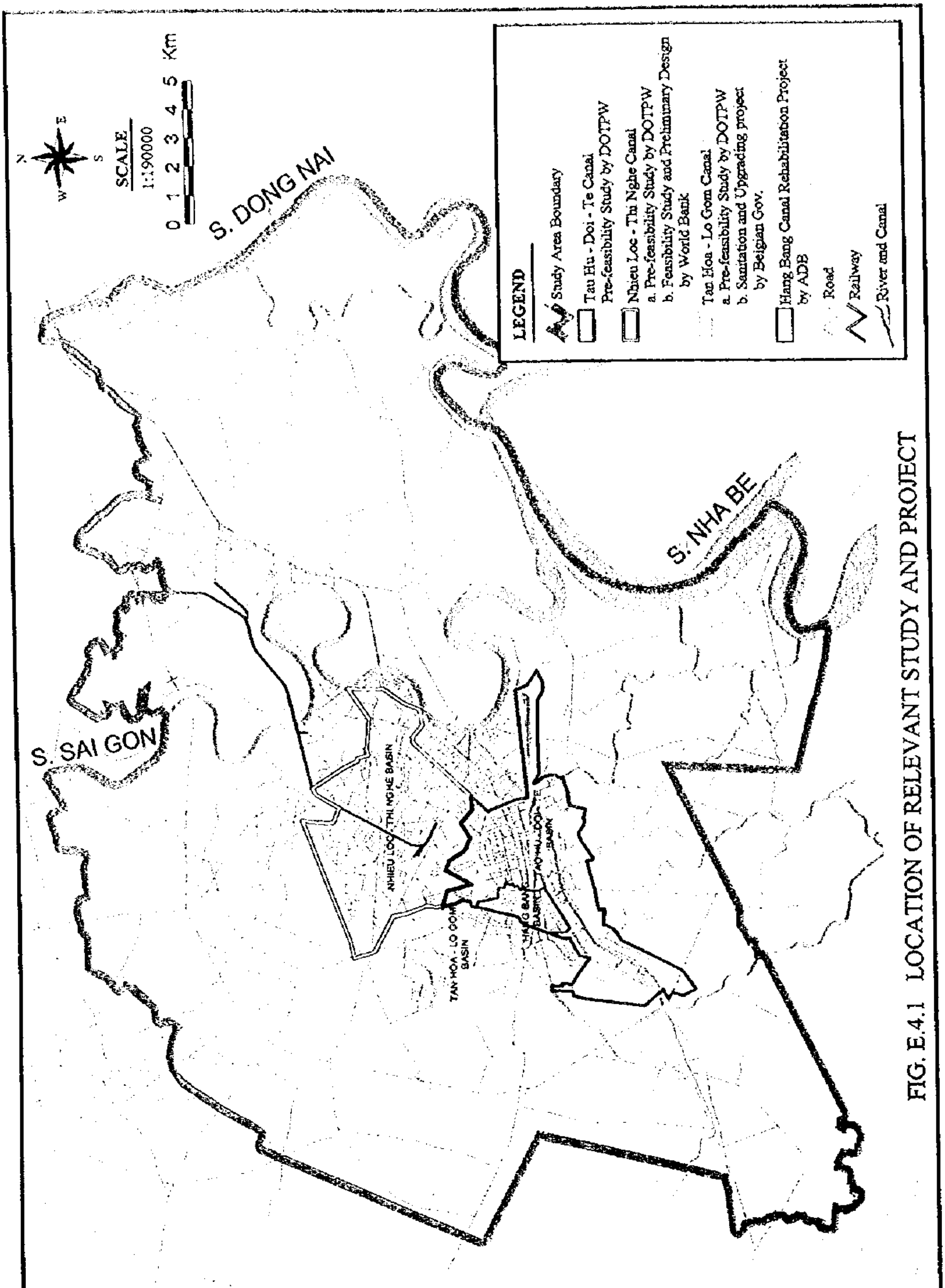


FIG. E.4.1 LOCATION OF RELEVANT STUDY AND PROJECT

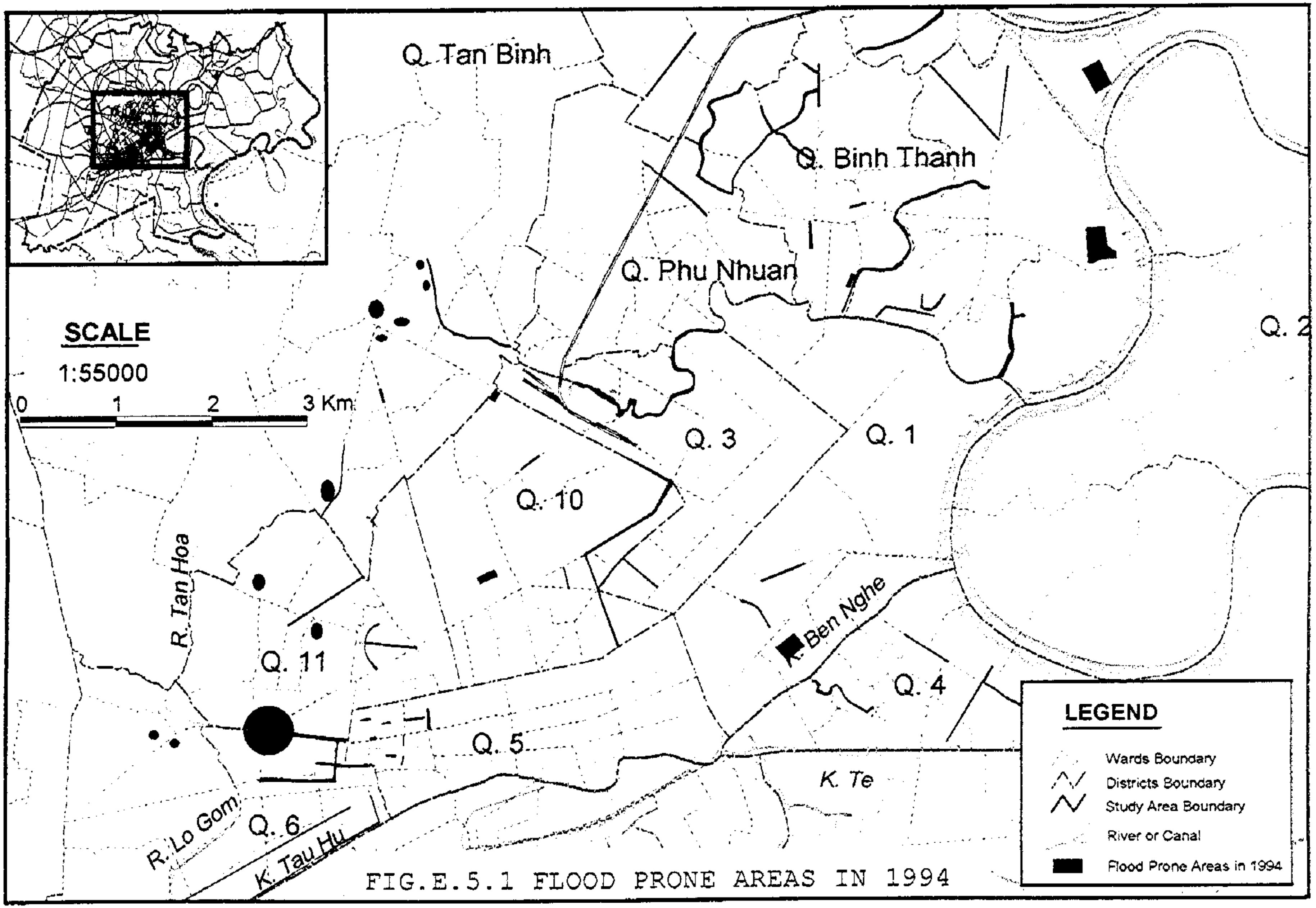


FIG.E.5.1 FLOOD PRONE AREAS IN 1994

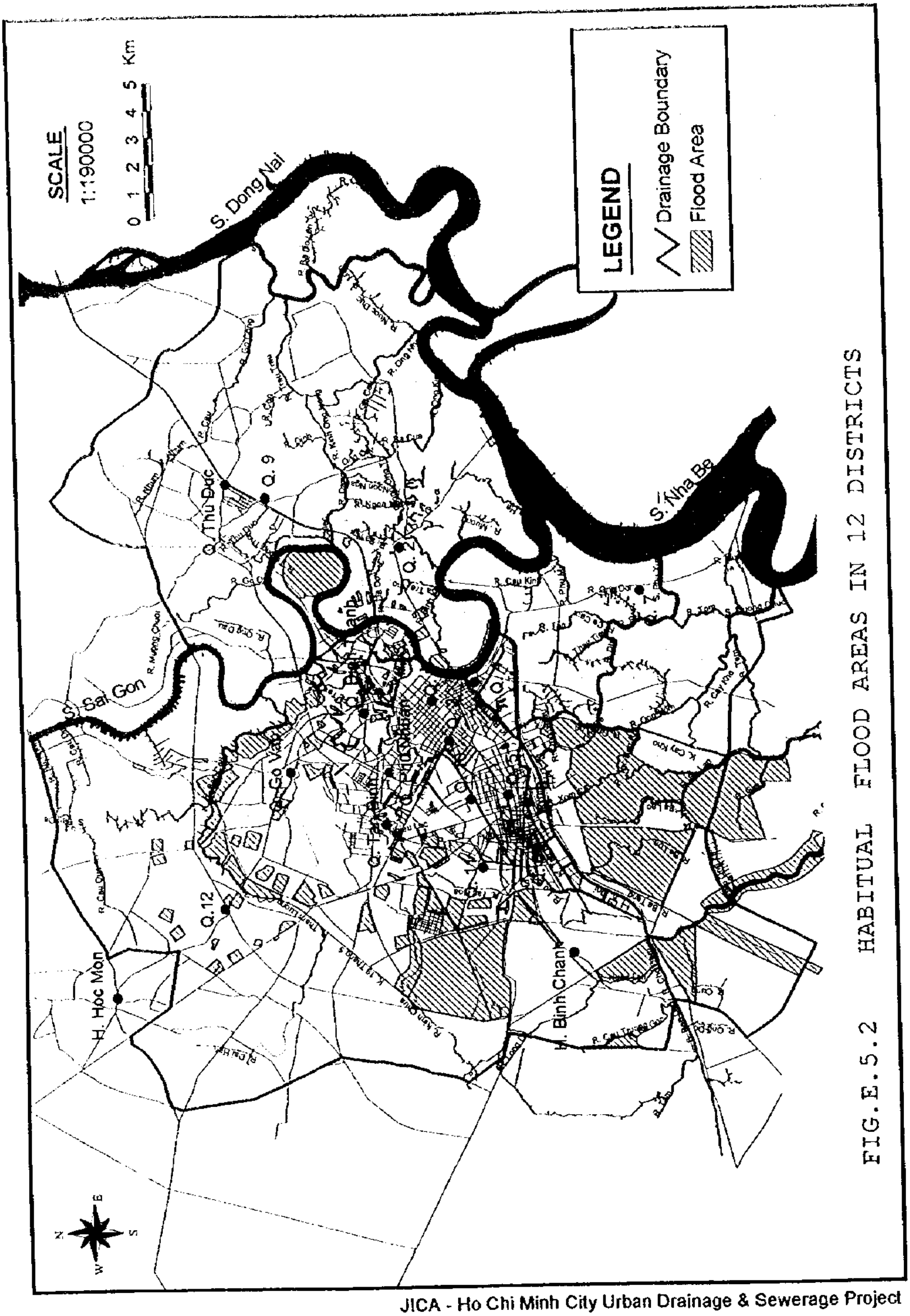


FIG.E.5.2 HABITUAL FLOOD AREAS IN 12 DISTRICTS

JICA - Ho Chi Minh City Urban Drainage & Sewerage Project

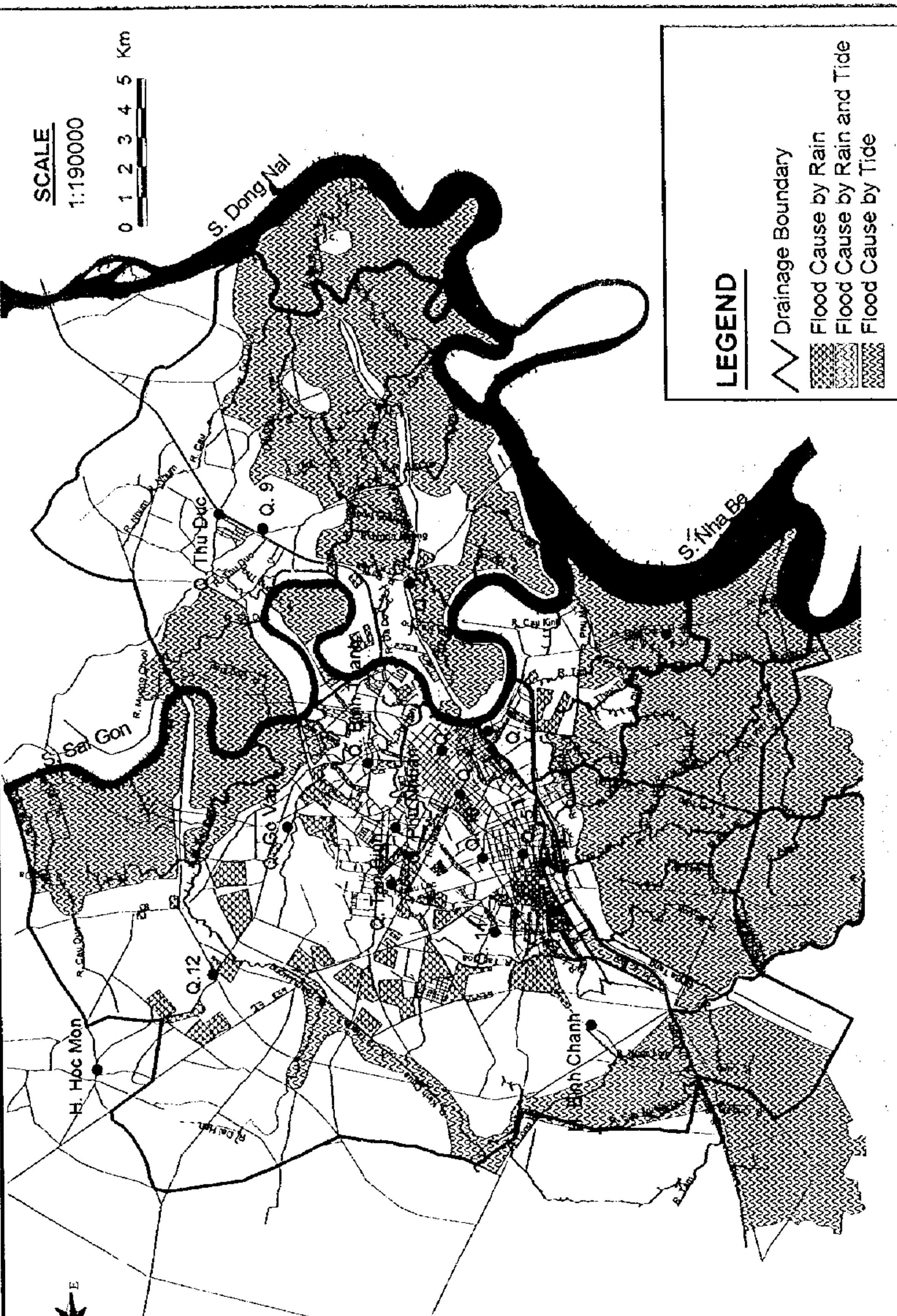


FIG.E.5.3 HABITUAL FLOOD IN THE STUDY AREA