Table 3D.19(20) INUNDATION WATER LEVEL VS. DIRECT DAMAGE (20/32)

S3

GL = EL. 4.6 m to 5.8 m

Land Use	Inundation Water Level (Maximum Water Depth)	El.4.8 m (0.2 m)	El.5.1 m (0.5 m)		El.5.6 m (1.0 m)			El.6.6 m (2.0 m)			
	Inundation Depth (m)	Shallower than 0.2	Shallower than 0.2	0.2-0.5	Shallower than 0.2	0.2 - 0.5	0.5 - 1.0	Shallower than 0.2	0.2 - 0.5	0.5 - 1.0	1.0 - 2.0
Office/Public Facilities	Area (ha)	3	2	4	0	0	6	0	0	0	6
	Unit Damage (/ha)	27000	27000	47700	27000	47700	64800	27000	47700	64800	98100
	Direct Damage (x1000$)	81	54	191	0	0	389	0	0	0	589
Ancient Area	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	13800	13800	51700	13800	51700	93900	13800	51700	93900	155500
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Urban Residential Area	Area (ha)	33	21	51	10	15	72	0	0	9	97
	Unit Damage (/ha)	5000	5000	18900	5000	18900	34200	5000	18900	34200	56700
	Direct Damage (x1000$)	165	105	964	50	284	2462	0	0	308	5500
Suburban Residential Area	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	1200	1200	4200	1200	4200	7500	1200	4200	7500	12300
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Industrial Area	Area (ha)	0	1	0	1	3	1	0	0	2	5
	Unit Damage (/ha)	9500	9500	16700	9500	16700	22700	9500	16700	22700	34300
	Direct Damage (x1000$)	0	10	0	10	50	23	0	0	45	172
Fishpond /Lake Area	Area (ha)	10	6	15	1	1	21	0	0	1	23
	Unit Damage (/ha)	410	410	680	410	680	1010	410	680	1010	1350
	Direct Damage (x1000$)	4	2	10	0	1	21	0	0	1	31
Agricultural Land	Area (ha)	3	2	4	0	1	6	0	0	1	7
	Unit Damage (/ha)	240	240	240	240	240	330	240	240	330	420
	Direct Damage (x1000$)	1	0	1	0	0	2	0	0	0	3
Green Area /Un-used Land	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	0	0	0	0	0	0	0	0	0	0
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Direct Damage Total (x1000$)	Sub-total	251	171	1166	60	335	2897	0	0	355	6294
	Total	251		1337			3292				6649

Table 3D.19(21) INUNDATION WATER LEVEL VS. DIRECT DAMAGE (21/32)

S4 GL = EL. 4.0 m to 6.7 m

Land Use	Inundation Water Level (Maximum Water Depth)	El.4.2 m (0.2 m)	El.4.5 m (0.5 m)		El.5.0 m (1.0 m)			El.6.0 m (2.0 m)			
	Inundation Depth (m)	Shallower than 0.2	Shallower than 0.2	0.2-0.5	Shallower than 0.2	0.2 - 0.5	0.5 - 1.0	Shallower than 0.2	0.2 - 0.5	0.5 - 1.0	1.0 - 2.0
Office/Public Facilities	Area (ha)	1	1	1	1	1	2	0	0	0	6
	Unit Damage (/ha)	27000	27000	47700	27000	47700	64800	27000	47700	64800	98100
	Direct Damage (x1000$)	27	27	48	27	48	130	0	0	0	589
Ancient Area	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	13800	13800	51700	13800	51700	93900	13800	51700	93900	155500
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Urban Residential Area	Area (ha)	1	1	1	1	3	2	8	12	20	6
	Unit Damage (/ha)	5000	5000	18900	5000	18900	34200	5000	18900	34200	56700
	Direct Damage (x1000$)	5	5	19	5	57	68	40	227	684	340
Suburban Residential Area	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	1200	1200	4200	1200	4200	7500	1200	4200	7500	12300
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Industrial Area	Area (ha)	1	1	1	1	3	2	1	3	3	6
	Unit Damage (/ha)	9500	9500	16700	9500	16700	22700	9500	16700	22700	34300
	Direct Damage (x1000$)	10	10	17	10	50	45	10	50	68	206
Fishpond /Lake Area	Area (ha)	6	6	9	6	9	15	1	2	3	29
	Unit Damage (/ha)	410	410	680	410	680	1010	410	680	1010	1350
	Direct Damage (x1000$)	2	2	6	2	6	15	0	1	3	39
Agricultural Land	Area (ha)	7	6	10	6	10	16	0	0	0	32
	Unit Damage (/ha)	240	240	240	240	240	330	240	240	330	420
	Direct Damage (x1000$)	2	1	2	1	2	5	0	0	0	13
Green Area /Un-used Land	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	0	0	0	0	0	0	0	0	0	0
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Direct Damage Total (x1000$)	Sub-total	46	45	92	45	163	264	50	278	755	1187
	Total	46		137			472				2270

Table 3D.19(22) INUNDATION WATER LEVEL VS. DIRECT DAMAGE (22/32)

K1 GL = EL. 6.4 m to 9.5 m

Land Use	Inundation Water Level (Maximum Water Depth)	El.6.6 m (0.2 m)	El.6.9 m (0.5 m)		El.7.4 m (1.0 m)			El.8.4 m (2.0 m)			
	Inundation Depth (m)	Shallower than 0.2	Shallower than 0.2	0.2-0.5	Shallower than 0.2	0.2 - 0.5	0.5 - 1.0	Shallower than 0.2	0.2 - 0.5	0.5 - 1.0	1.0 - 2.0
Office/Public Facilities	Area (ha)	1	1	2	4	5	3	4	6	10	12
	Unit Damage (/ha)	27000	27000	47700	27000	47700	64800	27000	47700	64800	98100
	Direct Damage (x1000$)	27	27	95	108	239	194	108	286	648	1177
Ancient Area	Area (ha)	0	0	0	4	4	0	5	6	11	8
	Unit Damage (/ha)	13800	13800	51700	13800	51700	93900	13800	51700	93900	155500
	Direct Damage (x1000$)	0	0	0	55	207	0	69	310	1033	1244
Urban Residential Area	Area (ha)	6	7	10	15	18	17	17	17	38	50
	Unit Damage (/ha)	5000	5000	18900	5000	18900	34200	5000	18900	34200	56700
	Direct Damage (x1000$)	30	35	189	75	340	581	85	321	1300	2835
Suburban Residential Area	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	1200	1200	4200	1200	4200	7500	1200	4200	7500	12300
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Industrial Area	Area (ha)	0	0	0	1	1	0	1	2	3	2
	Unit Damage (/ha)	9500	9500	16700	9500	16700	22700	9500	16700	22700	34300
	Direct Damage (x1000$)	0	0	0	10	17	0	10	33	68	69
Fishpond /Lake Area	Area (ha)	0	0	1	1	1	1	1	2	3	3
	Unit Damage (/ha)	410	410	680	410	680	1010	410	680	1010	1350
	Direct Damage (x1000$)	0	0	1	0	1	1	0	1	3	4
Agricultural Land	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	240	240	240	240	240	330	240	240	330	420
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Green Area /Un-used Land	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	0	0	0	0	0	0	0	0	0	0
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Direct Damage Total (x1000$)	Sub-total	57	62	285	248	803	777	272	952	3052	5329
	Total	57		347			1828				9605

Table 3D.19(23) INUNDATION WATER LEVEL VS. DIRECT DAMAGE (23/32)

K2 GL = EL. 5.4 m to 8.0 m

Land Use	Inundation Water Level (Maximum Water Depth)	El.5.6 m (0.2 m)	El.5.9 m (0.5 m)		El.6.4 m (1.0 m)			El.7.4 m (2.0 m)			
	Inundation Depth (m)	Shallower than 0.2	Shallower than 0.2	0.2-0.5	Shallower than 0.2	0.2 - 0.5	0.5 - 1.0	Shallower than 0.2	0.2 - 0.5	0.5 - 1.0	1.0 - 2.0
Office/Public Facilities	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	27000	27000	47700	27000	47700	64800	27000	47700	64800	98100
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Ancient Area	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	13800	13800	51700	13800	51700	93900	13800	51700	93900	155500
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Urban Residential Area	Area (ha)	17	19	27	2	11	46	3	3	4	59
	Unit Damage (/ha)	5000	5000	18900	5000	18900	34200	5000	18900	34200	56700
	Direct Damage (x1000$)	85	95	510	10	208	1573	15	57	137	3345
Suburban Residential Area	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	1200	1200	4200	1200	4200	7500	1200	4200	7500	12300
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Industrial Area	Area (ha)	14	15	20	0	17	35	1	1	0	52
	Unit Damage (/ha)	9500	9500	16700	9500	16700	22700	9500	16700	22700	34300
	Direct Damage (x1000$)	133	143	334	0	284	795	10	17	0	1784
Fishpond /Lake Area	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	410	410	680	410	680	1010	410	680	1010	1350
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Agricultural Land	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	240	240	240	240	240	330	240	240	330	420
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Green Area /Un-used Land	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	0	0	0	0	0	0	0	0	0	0
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Direct Damage Total (x1000$)	Sub-total	218	238	844	10	492	2368	25	73	137	5129
	Total	218		1082			2870				5364

Table 3D.19(24) INUNDATION WATER LEVEL VS. DIRECT DAMAGE (24/32)

K3

GL = EL. 5.6 m to 6.5 m

Land Use	Inundation Water Level (Maximum Water Depth)	El.5.8 m (0.2 m)	El.6.1 m (0.5 m)		El.6.6 m (1.0 m)			El.7.6 m (2.0 m)			
	Inundation Depth (m)	Shallower than 0.2	Shallower than 0.2	0.2-0.5	Shallower than 0.2	0.2 - 0.5	0.5 - 1.0	Shallower than 0.2	0.2 - 0.5	0.5 - 1.0	1.0 - 2.0
Office/Public Facilities	Area (ha)	0	1	0	2	3	1	0	0	0	6
	Unit Damage (/ha)	27000	27000	47700	27000	47700	64800	27000	47700	64800	98100
	Direct Damage (x1000$)	0	27	0	54	143	65	0	0	0	589
Ancient Area	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	13800	13800	51700	13800	51700	93900	13800	51700	93900	155500
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Urban Residential Area	Area (ha)	50	30	75	4	15	105	0	0	0	124
	Unit Damage (/ha)	5000	5000	18900	5000	18900	34200	5000	18900	34200	56700
	Direct Damage (x1000$)	250	150	1418	20	284	3591	0	0	0	7031
Suburban Residential Area	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	1200	1200	4200	1200	4200	7500	1200	4200	7500	12300
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Industrial Area	Area (ha)	4	2	6	0	0	8	0	0	0	8
	Unit Damage (/ha)	9500	9500	16700	9500	16700	22700	9500	16700	22700	34300
	Direct Damage (x1000$)	38	19	100	0	0	182	0	0	0	274
Fishpond /Lake Area	Area (ha)	6	3	9	0	0	12	0	0	0	12
	Unit Damage (/ha)	410	410	680	410	680	1010	410	680	1010	1350
	Direct Damage (x1000$)	2	1	6	0	0	12	0	0	0	16
Agricultural Land	Area (ha)	1	1	2	0	0	3	0	0	0	3
	Unit Damage (/ha)	240	240	240	240	240	330	240	240	330	420
	Direct Damage (x1000$)	0	0	0	0	0	1	0	0	0	1
Green Area /Un-used Land	Area (ha)	2	1	3	0	0	3	0	0	0	3
	Unit Damage (/ha)	0	0	0	0	0	0	0	0	0	0
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Direct Damage Total (x1000$)	Sub-total	291	197	1524	74	427	3851	0	0	0	7911
	Total	291		1722			4351				7911

Table 3D.19(25) INUNDATION WATER LEVEL VS. DIRECT DAMAGE (25/32)

K4

GL = EL. 4.6 m to 6.8 m

Land Use	Inundation Water Level (Maximum Water Depth)	El.4.8 m (0.2 m)	El.5.1 m (0.5 m)		El.5.6 m (1.0 m)			El.6.6 m (2.0 m)			
	Inundation Depth (m)	Shallower than 0.2	Shallower than 0.2	0.2-0.5	Shallower than 0.2	0.2 - 0.5	0.5 - 1.0	Shallower than 0.2	0.2 - 0.5	0.5 - 1.0	1.0 - 2.0
Office/Public Facilities	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	27000	27000	47700	27000	47700	64800	27000	47700	64800	98100
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Ancient Area	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	13800	13800	51700	13800	51700	93900	13800	51700	93900	155500
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Urban Residential Area	Area (ha)	9	18	13	13	13	31	1	3	17	57
	Unit Damage (/ha)	5000	5000	18900	5000	18900	34200	5000	18900	34200	56700
	Direct Damage (x1000$)	45	90	246	65	246	1060	5	57	581	3232
Suburban Residential Area	Area (ha)	1	1	1	0	0	2	0	0	0	2
	Unit Damage (/ha)	1200	1200	4200	1200	4200	7500	1200	4200	7500	12300
	Direct Damage (x1000$)	1	1	4	0	0	15	0	0	0	25
Industrial Area	Area (ha)	0	1	0	2	3	1	0	0	4	6
	Unit Damage (/ha)	9500	9500	16700	9500	16700	22700	9500	16700	22700	34300
	Direct Damage (x1000$)	0	10	0	19	50	23	0	0	91	206
Fishpond /Lake Area	Area (ha)	20	9	30	0	0	39	0	0	0	39
	Unit Damage (/ha)	410	410	680	410	680	1010	410	680	1010	1350
	Direct Damage (x1000$)	8	4	20	0	0	39	0	0	0	53
Agricultural Land	Area (ha)	5	3	8	0	0	11	0	0	0	11
	Unit Damage (/ha)	240	240	240	240	240	330	240	240	330	420
	Direct Damage (x1000$)	1	1	2	0	0	4	0	0	0	5
Green Area /Un-used Land	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	0	0	0	0	0	0	0	0	0	0
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Direct Damage Total (x1000$)	Sub-total	56	105	272	84	296	1141	5	57	672	3520
	Total	56		377			1521				4253

Table 3D.19(26) INUNDATION WATER LEVEL VS. DIRECT DAMAGE (26/32)

K5

GL = EL. 4.7 m to 5.7 m

Land Use	Inundation Water Level (Maximum Water Depth)	El.4.9 m (0.2 m)	El.5.2 m (0.5 m)		El.5.7 m (1.0 m)			El.6.7 m (2.0 m)			
	Inundation Depth (m)	Shallower than 0.2	Shallower than 0.2	0.2-0.5	Shallower than 0.2	0.2 - 0.5	0.5 - 1.0	Shallower than 0.2	0.2 - 0.5	0.5 - 1.0	1.0 - 2.0
Office/Public Facilities	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	27000	27000	47700	27000	47700	64800	27000	47700	64800	98100
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Ancient Area	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	13800	13800	51700	13800	51700	93900	13800	51700	93900	155500
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Urban Residential Area	Area (ha)	26	4	39	4	6	43	0	0	0	53
	Unit Damage (/ha)	5000	5000	18900	5000	18900	34200	5000	18900	34200	56700
	Direct Damage (x1000$)	130	20	737	20	113	1471	0	0	0	3005
Suburban Residential Area	Area (ha)	12	17	18	16	26	35	0	0	0	77
	Unit Damage (/ha)	1200	1200	4200	1200	4200	7500	1200	4200	7500	12300
	Direct Damage (x1000$)	14	20	76	19	109	263	0	0	0	947
Industrial Area	Area (ha)	15	13	22	13	22	35	0	0	0	70
	Unit Damage (/ha)	9500	9500	16700	9500	16700	22700	9500	16700	22700	34300
	Direct Damage (x1000$)	143	124	367	124	367	795	0	0	0	2401
Fishpond /Lake Area	Area (ha)	35	0	53	0	0	53	0	0	0	53
	Unit Damage (/ha)	410	410	680	410	680	1010	410	680	1010	1350
	Direct Damage (x1000$)	14	0	36	0	0	54	0	0	0	72
Agricultural Land	Area (ha)	13	1	19	1	2	20	0	0	0	23
	Unit Damage (/ha)	240	240	240	240	240	330	240	240	330	420
	Direct Damage (x1000$)	3	0	5	0	0	7	0	0	0	10
Green Area /Un-used Land	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	0	0	0	0	0	0	0	0	0	0
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Direct Damage Total (x1000$)	Sub-total	304	164	1221	163	590	2588	0	0	0	6434
	Total	304		1385			3341				6434

Table 3D.19(27) INUNDATION WATER LEVEL VS. DIRECT DAMAGE (27/32)

K6 GL = EL. 4.6 m to 6.2 m

Land Use	Inundation Water Level (Maximum Water Depth)	El.4.8 m (0.2 m)	El.5.1 m (0.5 m)		El.5.6 m (1.0 m)			El.6.6 m (2.0 m)			
	Inundation Depth (m)	Shallower than 0.2	Shallower than 0.2	0.2-0.5	Shallower than 0.2	0.2 - 0.5	0.5 - 1.0	Shallower than 0.2	0.2 - 0.5	0.5 - 1.0	1.0 - 2.0
Office/Public Facilities	Area (ha)	0	0	1	0	0	1	0	0	1	1
	Unit Damage (/ha)	27000	27000	47700	27000	47700	64800	27000	47700	64800	98100
	Direct Damage (x1000$)	0	0	48	0	0	65	0	0	65	98
Ancient Area	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	13800	13800	51700	13800	51700	93900	13800	51700	93900	155500
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Urban Residential Area	Area (ha)	0	0	0	0	0	0	0	0	1	0
	Unit Damage (/ha)	5000	5000	18900	5000	18900	34200	5000	18900	34200	56700
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	34	0
Suburban Residential Area	Area (ha)	26	36	39	54	77	75	0	6	102	206
	Unit Damage (/ha)	1200	1200	4200	1200	4200	7500	1200	4200	7500	12300
	Direct Damage (x1000$)	31	43	164	65	323	563	0	25	765	2534
Industrial Area	Area (ha)	2	2	4	1	2	6	0	3	5	9
	Unit Damage (/ha)	9500	9500	16700	9500	16700	22700	9500	16700	22700	34300
	Direct Damage (x1000$)	19	19	67	10	33	136	0	50	114	309
Fishpond /Lake Area	Area (ha)	86	48	140	9	13	188	0	0	18	210
	Unit Damage (/ha)	410	410	680	410	680	1010	410	680	1010	1350
	Direct Damage (x1000$)	35	20	95	4	9	190	0	0	18	284
Agricultural Land	Area (ha)	40	22	64	5	6	86	0	11	21	97
	Unit Damage (/ha)	240	240	240	240	240	330	240	240	330	420
	Direct Damage (x1000$)	10	5	15	1	1	28	0	3	7	41
Green Area /Un-used Land	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	0	0	0	0	0	0	0	0	0	0
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Direct Damage Total (x1000$)	Sub-total	95	87	389	79	367	982	0	78	1003	3265
	Total	95		476			1428				4345

Table 3D.19(28) INUNDATION WATER LEVEL VS. DIRECT DAMAGE (28/32)

YEN SO

GL = EL. 4.0 m to 5.5 m

Land Use	Inundation Water Level (Maximum Water Depth)	El.4.2 m (0.2 m)	El.4.5 m (0.5 m)		El.5.0 m (1.0 m)			El.6.0 m (2.0 m)			
	Inundation Depth (m)	Shallower than 0.2	Shallower than 0.2	0.2-0.5	Shallower than 0.2	0.2 - 0.5	0.5 - 1.0	Shallower than 0.2	0.2 - 0.5	0.5 - 1.0	1.0 - 2.0
Office/Public Facilities	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	27000	27000	47700	27000	47700	64800	27000	47700	64800	98100
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Ancient Area	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	13800	13800	51700	13800	51700	93900	13800	51700	93900	155500
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Urban Residential Area	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	5000	5000	18900	5000	18900	34200	5000	18900	34200	56700
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Suburban Residential Area	Area (ha)	1	0	1	1	1	1	0	0	23	3
	Unit Damage (/ha)	1200	1200	4200	1200	4200	7500	1200	4200	7500	12300
	Direct Damage (x1000$)	1	0	4	1	4	8	0	0	173	37
Industrial Area	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	9500	9500	16700	9500	16700	22700	9500	16700	22700	34300
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Fishpond /Lake Area	Area (ha)	105	95	155	114	148	250	0	0	0	512
	Unit Damage (/ha)	410	410	680	410	680	1010	410	680	1010	1350
	Direct Damage (x1000$)	43	39	105	47	101	253	0	0	0	691
Agricultural Land	Area (ha)	2	2	4	2	3	6	0	0	0	12
	Unit Damage (/ha)	240	240	240	240	240	330	240	240	330	420
	Direct Damage (x1000$)	0	0	1	0	1	2	0	0	0	5
Green Area /Un-used Land	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	0	0	0	0	0	0	0	0	0	0
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Direct Damage Total (x1000$)	Sub-total	45	39	111	48	106	262	0	0	173	733
	Total	45		150			416				906

Table D3.19(29) INUNDATION WATER LEVEL VS. DIRECT DAMAGE (29/32)

C

GL. = EL.5.2 m to 9.5 m

Land Use	Inundation Water Level (Maximum Water Depth)	El.5.4 m (0.2 m)	El.5.7 m (0.5 m)		El.6.2 m (1.0 m)			El.7.2 m (2.0 m)			
	Inundation Depth (m)	Shallower than 0.2	Shallower than 0.2	0.2-0.5	Shallower than 0.2	0.2 - 0.5	0.5 - 1.0	Shallower than 0.2	0.2 - 0.5	0.5 - 1.0	1.0 - 2.0
Office/Public Facilities	Area (ha)	1	0	1	6	6	1	2	9	15	13
	Unit Damage (/ha)	27000	27000	47700	27000	47700	64800	27000	47700	64800	98100
	Direct Damage (x1000$)	27	0	48	162	286	65	54	429	972	1275
Ancient Area	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	13800	13800	51700	13800	51700	93900	13800	51700	93900	155500
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Urban ResidenTial Area	Area (ha)	3	3	5	2	5	8	1	4	6	15
	Unit Damage (/ha)	5000	5000	18900	5000	18900	34200	5000	18900	34200	56700
	Direct Damage (x1000$)	15	15	95	10	95	274	5	76	205	851
Suburban Residential Area	Area (ha)	13	3	6	46	6	9	23	60	100	61
	Unit Damage (/ha)	1200	1200	4200	1200	4200	7500	1200	4200	7500	12300
	Direct Damage (x1000$)	16	4	25	55	25	68	28	252	750	750
Industrial Area	Area (ha)	0	0	0	4	0	0	2	6	9	4
	Unit Damage (/ha)	9500	9500	16700	9500	16700	22700	9500	16700	22700	34300
	Direct Damage (x1000$)	0	0	0	38	0	0	19	100	204	137
Fishpond /Lake Area	Area (ha)	0	0	0	3	0	0	1	5	8	3
	Unit Damage (/ha)	410	410	680	410	680	1010	410	680	1010	1350
	Direct Damage (x1000$)	0	0	0	1	0	0	0	3	8	4
Agricultural Land	Area (ha)	93	100	146	113	153	246	20	163	273	512
	Unit Damage (/ha)	240	240	240	240	240	330	240	240	330	420
	Direct Damage (x1000$)	22	24	35	27	37	81	5	39	90	215
Green Area /Un-used Land	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	0	0	0	0	0	0	0	0	0	0
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Direct Damage Total (x1000$)	Sub-total	80	43	202	294	443	487	111	900	2230	3232
	Total	80		245			1223				6472

Table D3.19(30) INUNDATION WATER LEVEL VS. DIRECT DAMAGE (30/32)

D

GL. = EL.4.7 m to 6.5 m

Land Use	Inundation Water Level (Maximum Water Depth)	El.4.9 m (0.2 m)	El.5.2 m (0.5 m)		El.5.7 m (1.0 m)			El.6.7 m (2.0 m)			
	Inundation Depth (m)	Shallower than 0.2	Shallower than 0.2	0.2-0.5	Shallower than 0.2	0.2 - 0.5	0.5 - 1.0	Shallower than 0.2	0.2 - 0.5	0.5 - 1.0	1.0 - 2.0
Office/Public Facilities	Area (ha)	0	6	0	7	10	6	0	33	31	23
	Unit Damage (/ha)	27000	27000	47700	27000	47700	64800	27000	47700	64800	98100
	Direct Damage (x1000$)	0	162	0	189	477	389	0	1574	2009	2256
Ancient Area	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	13800	13800	51700	13800	51700	93900	13800	51700	93900	155500
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Urban ResidenTial Area	Area (ha)	1	13	2	14	19	15	0	4	22	48
	Unit Damage (/ha)	5000	5000	18900	5000	18900	34200	5000	18900	34200	56700
	Direct Damage (x1000$)	5	65	38	70	359	513	0	76	752	2722
Suburban Residential Area	Area (ha)	3	8	4	7	11	12	0	85	68	30
	Unit Damage (/ha)	1200	1200	4200	1200	4200	7500	1200	4200	7500	12300
	Direct Damage (x1000$)	4	10	17	8	46	90	0	357	510	369
Industrial Area	Area (ha)	10	0	15	0	0	15	0	8	5	15
	Unit Damage (/ha)	9500	9500	16700	9500	16700	22700	9500	16700	22700	34300
	Direct Damage (x1000$)	95	0	251	0	0	341	0	134	114	515
Fishpond /Lake Area	Area (ha)	8	13	27	13	17	40	0	10	25	70
	Unit Damage (/ha)	410	410	680	410	680	1010	410	680	1010	1350
	Direct Damage (x1000$)	3	5	18	5	12	40	0	7	25	95
Agricultural Land	Area (ha)	95	104	238	110	160	342	0	68	202	612
	Unit Damage (/ha)	240	240	240	240	240	330	240	240	330	420
	Direct Damage (x1000$)	23	25	57	26	38	113	0	16	67	257
Green Area /Un-used Land	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	0	0	0	0	0	0	0	0	0	0
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Direct Damage Total (x1000$)	Sub-total	130	267	381	299	932	1486	0	2163	3477	6213
	Total	130		647			2717				11853

Table D3.19(31) INUNDATION WATER LEVEL VS. DIRECT DAMAGE (31/32)

M

GL. = EL.4.7 m to 7.0 m

Land Use	Inundation Water Level (Maximum Water Depth)	El.4.9 m (0.2 m)	El.5.2 m (0.5 m)		El.5.7 m (1.0 m)			El.6.7 m (2.0 m)			
	Inundation Depth (m)	Shallower than 0.2	Shallower than 0.2	0.2-0.5	Shallower than 0.2	0.2 - 0.5	0.5 - 1.0	Shallower than 0.2	0.2 - 0.5	0.5 - 1.0	1.0 - 2.0
Office/Public Facilities	Area (ha)	0	7	0	7	11	7	2	3	13	25
	Unit Damage (/ha)	27000	27000	47700	27000	47700	64800	27000	47700	64800	98100
	Direct Damage (x1000$)	0	189	0	189	525	454	54	143	842	2453
Ancient Area	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	13800	13800	51700	13800	51700	93900	13800	51700	93900	155500
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Urban ResidenTial Area	Area (ha)	0	21	0	25	41	21	15	21	55	87
	Unit Damage (/ha)	5000	5000	18900	5000	18900	34200	5000	18900	34200	56700
	Direct Damage (x1000$)	0	105	0	125	775	718	75	397	1881	4933
Suburban Residential Area	Area (ha)	1	9	2	9	15	11	12	18	27	35
	Unit Damage (/ha)	1200	1200	4200	1200	4200	7500	1200	4200	7500	12300
	Direct Damage (x1000$)	1	11	8	11	63	83	14	76	203	431
Industrial Area	Area (ha)	0	20	0	19	30	20	4	7	34	69
	Unit Damage (/ha)	9500	9500	16700	9500	16700	22700	9500	16700	22700	34300
	Direct Damage (x1000$)	0	190	0	181	501	454	38	117	772	2367
Fishpond /Lake Area	Area (ha)	32	3	49	3	4	52	1	2	5	59
	Unit Damage (/ha)	410	410	680	410	680	1010	410	680	1010	1350
	Direct Damage (x1000$)	13	1	33	1	3	53	0	1	5	80
Agricultural Land	Area (ha)	150	110	250	110	170	360	20	30	200	640
	Unit Damage (/ha)	240	240	240	240	240	330	240	240	330	420
	Direct Damage (x1000$)	36	26	60	26	41	119	5	7	66	269
Green Area /Un-used Land	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	0	0	0	0	0	0	0	0	0	0
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Direct Damage Total (x1000$)	Sub-total	50	522	102	533	1907	1880	187	741	3769	10531
	Total	50		624			4320				15227

Table D3.19(32) INUNDATION WATER LEVEL VS. DIRECT DAMAGE (32/32)

B

GL. = EL.4.5 m to 6.5 m

Land Use	Inundation Water Level (Maximum Water Depth)	El.4.7 m (0.2 m)	El.5.0 m (0.5 m)		El.5.5 m (1.0 m)			El.6.5 m (2.0 m)			
	Inundation Depth (m)	Shallower than 0.2	Shallower than 0.2	0.2-0.5	Shallower than 0.2	0.2 - 0.5	0.5 - 1.0	Shallower than 0.2	0.2 - 0.5	0.5 - 1.0	1.0 - 2.0
Office/Public Facilities	Area (ha)	1	1	1	7	10	2	13	22	16	19
	Unit Damage (/ha)	27000	27000	47700	27000	47700	64800	27000	47700	64800	98100
	Direct Damage (x1000$)	27	27	48	189	477	130	351	1049	1037	1864
Ancient Area	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	13800	13800	51700	13800	51700	93900	13800	51700	93900	155500
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Urban ResidenTial Area	Area (ha)	5	6	8	9	14	14	2	2	23	37
	Unit Damage (/ha)	5000	5000	18900	5000	18900	34200	5000	18900	34200	56700
	Direct Damage (x1000$)	25	30	151	45	265	479	10	38	787	2098
Suburban Residential Area	Area (ha)	1	1	2	11	17	3	9	12	28	31
	Unit Damage (/ha)	1200	1200	4200	1200	4200	7500	1200	4200	7500	12300
	Direct Damage (x1000$)	1	1	8	13	71	23	11	50	210	381
Industrial Area	Area (ha)	3	3	4	3	4	7	1	1	7	14
	Unit Damage (/ha)	9500	9500	16700	9500	16700	22700	9500	16700	22700	34300
	Direct Damage (x1000$)	29	29	67	29	67	159	10	17	159	480
Fishpond /Lake Area	Area (ha)	6	6	6	6	9	12	7	12	11	27
	Unit Damage (/ha)	410	410	680	410	680	1010	410	680	1010	1350
	Direct Damage (x1000$)	2	2	4	2	6	12	3	8	11	36
Agricultural Land	Area (ha)	138	150	210	62	94	360	60	12	160	516
	Unit Damage (/ha)	240	240	240	240	240	330	240	240	330	420
	Direct Damage (x1000$)	33	36	50	15	23	119	14	3	53	217
Green Area /Un-used Land	Area (ha)	0	0	0	0	0	0	0	0	0	0
	Unit Damage (/ha)	0	0	0	0	0	0	0	0	0	0
	Direct Damage (x1000$)	0	0	0	0	0	0	0	0	0	0
Direct Damage Total (x1000$)	Sub-total	117	125	329	293	908	921	399	1165	2256	5076
	Total	117		454			2122				8897

Table D 3.20(1) CALCULATION OF FLOOD DAMAGES (1/2)

Basin	Sub-Basin	Without Project														With Project							
		Return period; 1.2 years		Return period; 2 years		Return period; 5 years		Return period; 10 years		Return period; 20 years		Return period; 30 years		Return period; 50 years		Return period; 10 years		Return period; 20 years		Return period; 30 years		Return period; 50 years	
		Water level	Damage (x1000$)	Water level	Damage (x1000$)	Water level	Damage (x1000$)	Water level	Damage (x1000$)	Water level	Damage (x1000$)	Water level	Damage (x1000$)	Water level	Damage (x1000$)	Water level	Damage (x1000$)	Water level	Damage (x1000$)	Water level	Damage (x1000$)	Water level	Damage (x1000$)
To Lich River Basin	T1	7.40	0	7.43	15	7.51	75	7.80	555	8.02	1,095	8.05	1,215	8.09	1,320	7.40	0	7.41	15	7.42	15	7.44	15
	T2	5.90	0	6.01	15	6.20	660	6.35	1,305	6.50	2,205	6.59	2,835	6.70	3,645	5.90	0	6.05	15	6.10	15	6.16	480
	T3	5.80	0	5.83	15	6.02	210	6.08	870	6.15	1,215	6.19	1,425	6.23	1,620	5.80	0	5.94	15	6.01	195	6.05	585
	T4	5.80	0	5.80	0	6.01	510	6.07	765	6.15	1,020	6.20	1,170	6.27	1,425	5.80	0	5.94	405	6.02	615	6.05	705
	T5	5.80	0	5.86	15	6.04	1,620	6.11	2,235	6.18	2,835	6.23	3,645	6.28	3,450	5.80	0	5.93	570	6.01	1,170	6.06	1,830
	T6	5.90	0	6.00	1,020	6.08	1,620	6.14	2,235	6.21	2,835	6.24	3,240	6.29	3,645	5.90	0	6.00	810	6.03	1,215	6.07	1,545
	T7	5.80	0	5.82	15	5.91	300	5.99	465	6.03	1,020	6.06	1,095	6.20	1,380	5.80	0	5.82	15	5.84	135	5.87	225
	T8	4.20	15	4.60	15	5.10	45	5.50	300	5.80	765	5.90	990	6.20	1,830	4.00	0	4.57	15	5.00	30	5.06	30
	T9	4.20	15	4.60	15	5.10	45	5.50	150	5.80	270	5.90	330	6.20	480	4.00	0	4.01	15	4.07	15	4.17	15
Lu River Basin	L1	5.90	0	5.95	15	6.06	270	6.12	645	6.18	1,035	6.22	1,425	6.26	1,695	5.90	0	6.03	15	6.06	270	6.11	465
	L2	5.71	0	5.83	15	6.01	2,130	6.07	2,835	6.12	3,240	6.16	3,645	6.20	3,855	5.70	0	5.72	15	5.75	15	5.79	15
	L3	5.70	0	5.71	15	5.78	15	5.84	15	5.91	510	5.96	1,140	6.20	2,235	5.70	0	5.71	15	5.72	15	5.74	15
	L4	5.70	0	5.80	180	5.97	705	6.04	810	6.10	1,140	6.13	930	6.20	1,950	5.70	0	5.76	105	5.82	210	5.90	480
	L5	4.90	0	5.00	60	5.10	150	5.50	690	5.80	1,260	5.90	1,500	6.20	2,025	4.90	0	4.94	15	5.01	60	5.03	60
	L6	4.20	30	4.60	195	5.10	285	5.50	600	5.80	1,035	5.90	1,215	6.20	2,025	4.00	0	4.17	30	4.30	45	4.46	75
Kim Ngu River Basin	K1	6.40	0	7.01	690	7.23	1,500	7.40	2,430	7.57	3,645	7.66	4,455	7.78	5,475	6.40	0	7.00	690	7.05	855	7.12	1,035
	K2	5.40	0	5.45	15	5.55	195	5.75	885	5.95	1,740	6.02	2,130	6.20	2,940	5.40	0	5.41	15	5.41	15	5.42	15
	K3	5.60	0	5.71	15	5.87	795	5.98	1,620	6.04	2,025	6.08	2,235	6.20	3,045	5.60	0	5.69	15	5.75	15	5.82	405
	K4	4.60	0	4.64	15	5.10	525	5.50	1,950	5.80	2,835	5.90	3,090	6.20	4,455	4.60	0	4.63	15	4.67	15	4.72	45
	K5	4.70	0	4.70	0	5.10	1,290	5.50	3,450	5.80	4,860	5.90	5,475	6.20	6,885	4.70	0	4.75	15	4.80	15	4.89	405
	K6	4.60	0	4.60	0	5.10	735	5.50	2,025	5.80	3,645	5.90	3,240	6.20	2,430	4.60	0	4.76	165	4.88	450	5.00	510
Set River Basin	S1	5.99	45	6.09	165	6.22	405	6.31	690	6.41	1,020	6.46	1,215	6.52	1,500	5.90	0	6.04	60	6.08	135	6.14	210
	S2	5.30	0	5.35	15	5.50	210	5.82	1,140	6.03	2,235	6.07	2,430	6.20	2,640	5.30	0	5.37	15	5.42	30	5.49	180
	S3	4.63	0	4.81	405	5.10	1,830	5.50	3,855	5.80	5,475	5.90	5,880	6.20	7,290	4.60	0	4.70	15	4.78	210	4.89	975
	S4	4.20	75	4.60	270	5.10	855	5.50	1,695	5.80	2,430	5.90	2,835	6.20	3,855	4.00	0	4.06	15	4.11	45	4.17	60
Hoang Liet Drainage Basin	H1	4.20	90	4.60	480	5.10	1,290	5.50	2,235	5.80	3,240	5.90	3,450	6.20	4,455	4.00	0	4.11	15	4.18	75	4.27	150
	H2	4.20	270	4.60	1,050	5.10	2,640	5.50	3,855	5.80	4,860	5.90	5,070	6.20	5,880	4.00	0	4.07	150	4.12	180	4.18	255
Yen So Drainage Basin	Y	4.20	90	4.60	360	5.10	930	5.50	1,290	5.80	1,545	5.90	1,620	6.20	1,830	4.00	0	4.08	45	4.14	60	4.20	90
Total		-	630	-	5,085	-	21,840	-	41,595	-	61,035	-	68,925	-	85,260	-	0	-	5,300	-	6,120	-	10,875

Note: Damage=Direct Damage x 1.35

Table D3.20(2) CALCULATION OF FLOOD DAMAGES (2/2)

Basin	Sub-Basin	Without Project														With Project							
		Return period; 1.2 years		Return period; 2 years		Return period; 5 years		Return period; 10 years		Return period; 20 years		Return period; 30 years		Return period; 50 years		Return period; 10 years		Return period; 20 years		Return period; 30 years		Return period; 50 years	
		Water level	Damage (x1000$)	Water level	Damage (x1000$)	Water level	Damage (x1000$)	Water level	Damage (x1000$)	Water level	Damage (x1000$)	Water level	Damage (x1000$)	Water level	Damage (x1000$)	Water level	Damage (x1000$)	Water level	Damage (x1000$)	Water level	Damage (x1000$)	Water level	Damage (x1000$)
Co Nhue Drainage Basin	C	4.70	0	4.90	0	5.40	120	5.80	675	6.10	1,665	6.20	2,190	6.50	3,855	5.20	0	5.60	270	5.90	915	6.00	1,260
My Dinh Drainage Basin	D	4.60	0	4.80	75	5.30	1,320	5.70	3,750	6.00	6,885	6.10	8,505	6.40	12,960	4.70	0	5.00	360	5.10	630	5.10	630
Me Tri Drainage Basin	M	4.50	0	4.70	0	5.20	930	5.60	4,350	5.90	8,400	6.00	9,930	6.30	14,580	4.70	0	5.00	270	5.10	510	5.10	510
Ba Xa Drainage Basin	B	4.30	0	4.50	0	5.00	690	5.40	2,130	5.70	3,945	5.80	4,755	6.10	7,500	4.50	0	4.70	270	4.90	510	5.00	690
Total		-	0	-	75	-	3,060	-	10,905	-	20,895	-	25,380	-	38,895	-	0	-	1,170	-	2,565	-	3,090

Note: Damage=Direct Damage x 1.35

Table D3.21(1) CALCULATION OF ANNUAL AVERAGE BENEFIT (1/5)
- To Lich River Basin

Without - project Condition

Return Period	Flood Damage (US$1000)	Average Flood Damage (US$1000)	Expectation of Occurrence	Annual Average Flood Damage (US$1000)
1.2 years	630			
		2,858	0.333	952
2 years	5,085			
		13,463	0.300	4,039
5 years	21,840			
		31,718	0.100	3,172
10 years	41,595			
		51,315	0.050	2,566
20 years	61,035			
		64,980	0.017	1,105
30 years	68,925			
		77,093	0.013	1,002
50 years	85,260			
Total	-	-	-	12,836

With - project Condition

Return Period	Flood Damage (US$1000)	Average Flood Damage (US$1000)	Expectation of Occurrence	Annual Average Flood Damage (US$1000)
1.2 years	0			
		0	0.333	0
2 years	0			
		0	0.300	0
5 years	0			
		0	0.100	0
10 years	0			
		1,650	0.050	83
20 years	3,300			
		4,710	0.017	80
30 years	6,120			
		8,498	0.013	110
50 years	10,875			
Total	-	-	-	273

Expected Annual Average Benefit = US$ 12,563 thousand

Table D3.21(2) CALCULATION OF ANNUAL AVERAGE BENEFIT (2/5)
- Nhue River Basin, Co Nhue

Without - project Condition

Return Period	Flood Damage (US$1000)	Average Flood Damage (US$1000)	Expectation of Occurrence	Annual Average Flood Damage (US$1000)
1.2 years	0			
		0	0.333	0
2 years	0			
		60	0.300	18
5 years	120			
		398	0.100	40
10 years	675			
		1,170	0.050	59
20 years	1,665			
		1,928	0.017	33
30 years	2,190			
		3,023	0.013	39
50 years	3,855			
Total	-	-	-	189

With - project Condition

Return Period	Flood Damage (US$1000)	Average Flood Damage (US$1000)	Expectation of Occurrence	Annual Average Flood Damage (US$1000)
1.2 years	0			
		0	0.333	0
2 years	0			
		0	0.300	0
5 years	0			
		0	0.100	0
10 years	0			
		135	0.050	7
20 years	270			
		593	0.017	10
30 years	915			
		1,088	0.013	14
50 years	1,260			
Total	-	-	-	31

Expected Annual Average Benefit= US$ 158 thousand

Table D3.21(3) CALCULATION OF ANNUAL AVERAGE BENEFIT (3/5)
- Nhue River Basin, My Dinh

Without - project Condition

Return Period	Flood Damage (US$1000)	Average Flood Damage (US$1000)	Expectation of Occurrence	Annual Average Flood Damage (US$1000)
1.2 years	0			
		38	0.333	12
2 years	75			
		698	0.300	209
5 years	1,320			
		2,535	0.100	254
10 years	3,750			
		5,318	0.050	266
20 years	6,885			
		7,695	0.017	131
30 years	8,505			
		10,733	0.013	140
50 years	12,960			
Total	-	-	-	1,012

With - project Condition

Return Period	Flood Damage (US$1000)	Average Flood Damage (US$1000)	Expectation of Occurrence	Annual Average Flood Damage (US$1000)
1.2 years	0			
		0	0.333	0
2 years	0			
		0	0.300	0
5 years	0			
		0	0.100	0
10 years	0			
		180	0.050	9
20 years	360			
		495	0.017	8
30 years	630			
		630	0.013	8
50 years	630			
Total	-	-	-	25

Expected Annual Average Benefit= US$ 987 thousand

Table D3.21(4) CALCULATION OF ANNUAL AVERAGE BENEFIT (4/5)
- Nhue River Basin, Me Tri

Without - project Condition

Return Period	Flood Damage (US$1000)	Average Flood Damage (US$1000)	Expectation of Occurrence	Annual Average Flood Damage (US$1000)
1.2 years	0			
		0	0.333	0
2 years	0			
		465	0.300	140
5 years	930			
		2,640	0.100	264
10 years	4,350			
		6,375	0.050	319
20 years	8,400			
		9,165	0.017	156
30 years	9,930			
		12,255	0.013	159
50 years	14,580			
Total	-	-	-	1,038

With - project Condition

Return Period	Flood Damage (US$1000)	Average Flood Damage (US$1000)	Expectation of Occurrence	Annual Average Flood Damage (US$1000)
1.2 years	0			
		0	0.333	0
2 years	0			
		0	0.300	0
5 years	0			
		0	0.100	0
10 years	0			
		135	0.050	7
20 years	270			
		390	0.017	7
30 years	510			
		510	0.013	7
50 years	510			
Total	-	-	-	21

Expected Annual Average Benefit= US$ 1017 thousand

Table D3.21(5) CALCULATION OF ANNUAL AVERAGE BENEFIT (5/5)
- Nhue River Basin, Ba Xa

Without - project Condition

Return Period	Flood Damage (US$1000)	Average Flood Damage (US$1000)	Expectation of Occurrence	Annual Average Flood Damage (US$1000)
1.2 years	0			
		0	0.333	0
2 years	0			
		345	0.300	104
5 years	690			
		1,410	0.100	141
10 years	2,130			
		3,038	0.050	152
20 years	3,945			
		4,350	0.017	74
30 years	4,755			
		6,128	0.013	80
50 years	7,500			
Total	-	-	-	551

With - project Condition

Return Period	Flood Damage (US$1000)	Average Flood Damage (US$1000)	Expectation of Occurrence	Annual Average Flood Damage (US$1000)
1.2 years	0			
		0	0.333	0
2 years	0			
		0	0.300	0
5 years	0			
		0	0.100	0
10 years	0			
		135	0.050	7
20 years	270			
		390	0.017	7
30 years	510			
		600	0.013	8
50 years	690			
Total	-	-	-	22

Expected Annual Average Benefit= US$ 529 thousand

Table D4.1 SUMMARY OF COMPARISON ON POWER SOURCE AND TYPE OF PUMPS

Item		Alternative 1: Engine-drive mixed-flow horizontal-shaft pump (9 m3/s x 10 units; 2,000 mm dia.)	Alternative 2: Motor-drive mixed-flow horizontal-shaft pump (9 m3/s x 10 units; 2,000 mm dia.)	Alternative 3: Submergible pump (3 m3/s x 30 units; 1,200 mm dia.)
Pumping Station		80 m wide x 35 m long = 2,800 m2 (Foundation work is costly due to heavyness, and requirement of accuracy of the machinery.)	80 m wide x 30 m long = 2,400 m2 (Foundation work is costly due to heavyness, and requirement of accuracy of the machinery.)	120 m wide x 20 m long = 2,400 m2 (Foundation work is comparatively cheep.)
Building		Besides an operations building, a pump shed as high as nearly 10 m is necessary on the pumping station.	Besides an operations building, a pump shed as high as nearly 10 m is necessary on the pumping station.	Necessary is an operations building only.
Mechanical and Electrical Work	Applicability to Ordinary Drainage	No good	Sophisticated operations are necessary through the volumetric control of a pump.	Easy because of a large number of small pumps.
	Safty against Power Interruption	No problem	Power supply at Mai Dong substation 2.5 km away from the pumping station is quite sure. Moreover, a 50% capacity of emergency generator system will be installed. Danger is barely expected for power interruption.	
	Operation	In addition to the right, noise and vibration are expected with the pump operation.	Vacuum pump operation is inevitable prior to starting the main pumps.	Easy
	Maintenance	Frequent repairing work is expected, entailing high maintenance cost.	Easy	Repairing the insulation devices is difficult on site, hence space pumps will be provided.
Cost *1 ($ 1,000)	Initial Cost	55,300	51,400	43,600
	Oil/Electricity Charge	3,900	2,300	2,300
	Total	59,200	53,700	45,900
Construction Period		Rather long	Rather long	Shortest
Judgement		---	---	Recommended

*1 Refer to Table D4.2

Table D4.2 COST COMPARISON ON POWER SOURCE AND TYPE OF PUMPS

Item	Alternative 1: Engine-drive mixed-flow horizontal-shaft pump (9 m3/s x 10 units; 2,000 mm dia.)		Alternative 2: Motor-drive mixed-flow horizontal-shaft pump (9 m3/s x 10 units; 2,000 mm dia.)		Alternative 3: Submergible pump (3 m3/s x 30 units; 1,200 mm dia.)	
	Specifications	Cost ($ 1,000)	Specifications	Cost ($ 1,000)	Specifications	Cost ($ 1,000)
A. Civil Works		15,400		14,000		9,800
1. Reinforced concrete	29,000 m3	6,400	26,100 m3	5,700	17,300 m3	3,800
2. Steel piles, 600mm dia.	38 m x 670 pc	6,300	38 m x 600 pc	5,700	38 m x 350 pc	3,300
3. PC piles, 550mm dia.	23 m x 150 pc	600	23 m x 150 pc	600	23 m x 300 pc	1,200
4. Steel sheet piles	800 m2	200	800 m2	200	1,200 m2	300
5. Others		1,200		1,100		700
6. Miscellaneous works	5% of 1 to 5	700	5% of 1 to 5	700	5% of 1 to 5	500
B. Mechanical / Electrical Works		39,900		37,400		33,800
1. Pumps	2,000 mm x 10 units	8,400	2,000 mm x 10 units	8,400	1,200 mm x 33 units	11,000
2. Reduction gears	10 units	3,900	10 units	2,100		--
3. Engines / Motors	1,800 PS engine x 10 units	13,700	1,350 KW motor x 10 units	6,200		--
4. Electric butterfly valves	2,000 mm x 10 units	1,400	2,000 mm x 10 units	1,400	1,200 mm x 30 units	1,800
5. Flap valves	_ do _	500	_ do _	500	_ do _	500
6. Steel pipes	2,000 mm x 300 m	300	2,000 mm x 300 m	300	1,200 mm x 900 m	300
7. Crane	20 ton overhead crane	400	20 ton overhead crane	400	10 ton gantry crane	200
8. Mechanical rakes		2,500		2,500		3,000
9. Stoplogs	L.S.	900	L.S.	900	L.S.	600
10.Generators		--	9,000 KVA	3,900	9,000 KVA	3,900
11.Oil tank, etc.	L.S.	1,800	L.S.	900	L.S.	900
12.Receiving and control panels, etc.	L.S.	4,000	L.S.	7,200	L.S.	9,100
13.Electric supply facilities	L.S.	200	L.S.	900	L.S.	900
14.Miscellaneous works	5% of 1 to 13	1,900	5% of 1 to 13	1,800	5% of 1 to 13	1,600
(Total of A+B)		55,300		51,400		43,600
C. Oil / Electricity Charge *1	Diesel oil: $ 0.28/ltr x 0.2 ltr/PS x 8,000 PS x 350 hr*2 x 11	3,900	Electricity: $ 0.044/KWH x 13,500 KW x 350 hr*2 x 11	2,300	Electricity: $ 0.044/KWH x 13,500 KW x 350 hr*2 x 11	2,300
Total		59,200		53,700		45,900

*1 Rebated at a discount rate of 10% for 50 years.

*2 113.1 x 10^6 m3/90 m3/s = 350 hours

Table D4.3 FLOODGATES AND CONTROL GATES

Name	Location	Purpose	Design Discharge (m3/s)	Dimensions	Gate Type
1. Thanh Liet Floodgate	T 0.4 K	To present backwater from Nhue river and to secure natural drainage to the river.	45	12 m wide x 7 m high x 2 gates	Steel roller gate
2. Hoa Binh Floodgate	K 1.1 K	To prevent backwater through Hoa Binh channel, and to secure irrigation water to the channel.	—	5 m wide x 3 m high	- do -
3. Van Dien Floodgate	K 3.7 K	To prevent backwater through Old To Lich River, and to secure irrigation water to the river.	—	5 m wide x 3 m high	- do -
4. West Lake Control Gate (A)	T 14.6 K	To contain floodwater from the basin, and to release the water after the flood.	12	4 m wide x 3 m high x 2 gates	- do -
5. West Lake Control Gate (B)	West bank of West Lake	To contain floodwater from the basin, and to secure irrigation water to the downstream reaches.	—	3 m wide x 3 m high	- do -
6. Lu River Control Gate	L 3.2 K	To divert floodwaters toward Lu - Set floodway, and to release maintenance water to Lower Lu river when necessary.	—	3 m wide x 3 m high	- do -
7. Nghia Do Control Gate	T3.A Drainage Channel 1.6 K	To prevent backwater from Nhue river basin, and to intake irrigation water from the basin.	—	3 m wide x 3 m high	- do -

Table D4.4 LAKE IMPROVEMENT

Lake No.	Lake Name	Area (ha)	Perimeter (km)	Low Water level in Rainy Season EL (m) Present	Low Water level in Rainy Season EL (m) Proposed	Ground Level EL (m)	Dimensions of Dredging Depth *1 (m)	Dimensions of Dredging Volume (1,000 m3)	Proposed Type of Improvement *2	Characteristics Flood Control Effect	Characteristics Quality of Environment Surrounding	Characteristics Accessability	Recent Dredging by HPC
T 7	Giang Vo	8.4	1.1	5.5	3.5	6.2	2.0	168	A	Large	High	Easy	
T 8	Ngoc Khanh	4.5	0.9	5.1	3.5	5.9	1.6	72	B	Medium	Medium	Easy in future	X
T 9	Thanh Cong	6.5	1.2	4.9	3.5	6.0	1.4	91	A	Medium	High	Easy	X
T10	Hao Nam	2.8	0.5	5.2	3.5	5.8	1.7	48	B	Small	Low	Easy	
T13	Dong Da	18.6	1.8	4.7	3.5	5.6	1.2	223	B	Large	High	Possible	
T16	Nghia Do 1	5.2	0.8	5.0	3.5	6.2	1.5	78	A	Medium	High	Easy	X
L 3	Van Chuong	4.1	0.8	5.2	3.5	5.7	1.7	70	B	Medium	Low	Easy	
L 4	Tho Quang	1.5	0.6	5.3	3.5	5.6	1.8	27	B	Small	Low	Hard	
L 6	Trung Tu	5.1	0.9	4.9	3.5	5.9	1.4	71	B	Medium	High *3	Easy	
L11	Phuong Liet 1	5.6	1.2	4.5	3.5	5.3	1.0	56	C	Medium	Medium	Hard	
L12	Phuong Liet 2	1.9	0.6	4.5	3.5	5.2	1.0	19	C	Small	Low	Easy	
S 2	Bay Mau	23.1	2.0	5.0	3.5	5.9	1.5	347	A	Large	High	Easy	X
S 4	Trai Ca	4.7	1.1	4.2	3.5	5.4	0.7	33	C	Medium	Low	Hard	
S 5	Lang Tam	1.9	0.9	4.5	3.5	5.4	1.0	19	C	Small	Low	Hard	
S 7	Thanh Liet	13.2	1.4	4.3	3.5	5.0	0.8	106	C	Large	Low	Hard	
S 8	Dam Set	3.6	0.6	4.0	3.5	5.0	0.5	18	C	Small	Low	Hard	
K 3	Thanh Nhan 1	8.5	1.2	4.7	3.5	6.2	1.2	102	A	Large	Medium	Easy	
K 4	Thanh Nhan 2	4.0	0.8	4.7	3.5	6.2	1.2	48	B	Medium	Medium	Easy	
	Total	123.2	18.4	—	—	—	—	1,596	—	—	—	—	4

*1 Dredging will be done by the depth corresponding to the balance between the present and proposed normal water levels that aims to conserve the present lake use and environments.

*2 Refer to Fig. D4.11.

*3 The lake is separated from the drainage channel whose water quality is badly polluted, so that connection between them for flood control purpose is not recommended right now.

TABLE D4.5 RUNOFF COEFFICIENT AT TO LICH RIVER BASIN
(LAND USE OF T0 LICH RIVER BASIN IN 2010)

No. of River Basin	Type of Land Use								Overall Runoff Coefficient
	High Density Urban Area		General Urban Area		Park & Green		Paddy Field etc.		
	Ai (ha)	AiCi	Ai (ha)	AiCi	Ai (ha)	AiCi	Ai (ha)	AiCi	
T1	67	53.6	39	25.35	24	2.4	0	0	0.63
T2	48	38.4	325	211.25	50	5	0	0	0.60
T3	36	28.8	217	141.05	50	5	0	0	0.58
T4	0	0	97	63.05	25	2.5	0	0	0.54
T5	75	60	214	139.1	20	2	0	0	0.65
T6	21	16.8	198	128.7	10	1	0	0	0.64
T7	11	8.8	87	56.55	8	0.8	0	0	0.62
T8	3	2.4	168	109.2	53	5.3	0	0	0.52
T9	0	0	21	13.65	26	2.6	31	1.55	0.23
L1	31	24.8	162	105.3	6	0.6	0	0	0.66
L2	10	8	151	98.15	14	1.4	0	0	0.61
L3	0	0	88	57.2	2	0.2	0	0	0.64
L4	0	0	78	50.7	19	1.9	0	0	0.54
L5	0	0	59	38.35	16	1.6	0	0	0.53
L6	0	0	184	119.6	97	9.7	0	0	0.46
K1	270	216	52	33.8	12	1.2	0	0	0.75
K2	15	12	56	36.4	51	5.1	0	0	0.44
K3	25	20	91	59.15	30	3	0	0	0.56
K4	0	0	75	48.75	51	5.1	0	0	0.43
K5	0	0	216	140.4	51	5.1	10	0.5	0.53
K6	0	0	154	100.1	217	21.7	100	5	0.27
S1	87	69.6	72	46.8	30	3	0	0	0.63
S2	0	0	176	114.4	18	1.8	0	0	0.60
S3	21	16.8	85	55.25	38	3.8	0	0	0.53
S4	2	1.6	126	81.9	10	1	0	0	0.61
H1	9	7.2	160	104	66	6.6	211	10.55	0.29
H2	0	0	126	81.9	30	3	45	2.25	0.43
Y1	0	0	15	9.75	23	2.3	0	0	0.32

TABLE D4.6 (1) HYDRAULIC CALCULATION (1/4)

Max. Waste water flow m3/sec/ha	Mean Velocity	Roughness Coefficient
	0.8 m/sec	0.013

Line No.	Area Each Line (ha)	Area Accumu. (ha)	Length Each Line (m)	Length Ext. (m)	Con-Time (min)	Peak Flow P=1 years (m3/s)	Peak Flow P=2 years (m3/s)	Peak Flow P=5 years (m3/s)	Pipe Diameter (m)	Box Culvert Width (m)	Box Culvert Height (m)	E.L. (m)	Hydraulic Gradient	Velocity (m/s)	Flow Capacity (m3/s)
KS1	5.3	5.3	200	1,104	29.99	0.89	0.99	1.13	1.0				0.0025	1.51	1.19
KS2	4.6	4.6	250	1,087	29.65	0.77	0.86	0.98	1.0			7.024	0.0020	1.36	1.07
HK45	6.2	11.5	137	726	22.13	2.22	2.47	2.80		0.90	1.60	6.503	0.0038	2.07	2.98
To HK32															
KS3	3.0	3.0	300	585	19.19	0.61	0.68	0.77	0.80			7.554	0.0037	1.60	0.80
HK64	4.0	4.0	284	666	20.87	0.79	0.88	1.00		0.70	1.00	6.503	0.0037	1.63	1.14
HK32	1.5	20.0	141	1,656	41.50	2.81	3.15	3.60		0.90	1.60	6.145	0.0025	1.69	2.43
KS4									1.00				0.0025	1.53	1.20
To HK21															
KS5	5.1	5.1	300	780	23.24	0.95	1.06	1.20	1.20				0.0025	1.72	1.95
KS6	1.8	6.8	100	1,046	28.79	1.16	1.29	1.47	1.20			6.609	0.0025	1.72	1.95
HK3,29,27	8.0	8.0	720	1,480	37.83	1.18	1.33	1.51		0.90	1.30	6.318	0.0004	0.64	0.75
KS7	1.7	1.7	200	362	14.53	0.39	0.43	0.48	0.80				0.0020	1.18	0.59
KS8	0.0	10.2	300	1,708	42.57	1.41	1.59	1.81		1.30	1.00	6.318	0.0020	1.48	1.93
HK70	3.2	11.2	257	2,009	48.85	1.43	1.61	1.85		0.90	1.50	6.150	0.0007	0.84	1.14
KS9	2.7	12.9	280	2,213	53.10	1.56	1.76	2.02		1.35	1.00		0.0020	1.50	2.02
HK77	9.1	20.3	450	3,233	74.34	2.00	2.26	2.61		1.50	1.50	6.008	0.0003	0.71	1.60
HK71a	8.0	18.2	600	4,513	101.01	1.45	1.65	1.92		1.50	1.50	5.978	0.0001	0.28	0.64
HK54d	4.0	13.1	340	5,193	115.18	0.96	1.09	1.27		1.95	1.70	5.945	0.0001	0.45	1.49
To HK21												6.697			
HK11	35.3	35.3	523	3,879	87.81	3.11	3.53	4.09		0.90	1.60	6.175	0.0010	1.06	1.53
HK21	10.0	78.3	158	11,733	251.44	3.22	3.72	4.38		1.90	1.80	5.820	0.0022	2.12	6.63
HK80h	13.6	52.8	350	13,239	282.81	1.98	2.30	2.71		1.95	1.70	5.441	0.0011	1.50	4.96
HK67b	0	52.8	340	13,579	289.90	1.95	2.25	2.66		1.70	1.60	5.342	0.0003	0.73	1.98
To HB10b												7.561			
HK53	26.3	26.3	820	3,319	76.14	2.55	2.89	3.33		1.10	1.60	6.890	0.0008	0.98	1.49
HK67a	13.4	39.7	200	4,658	104.03	3.12	3.55	4.11		1.70	1.60	5.647	0.0062	3.36	9.13
To HB10a												5.914			
HK19	34.5	34.5	360	3,638	82.78	3.16	3.59	4.15		0.80	1.60	5.647	0.0007	0.87	1.11
HB10a	59.0	133.2	460	13,770	293.88	4.86	5.63	6.64		1.70	1.60	4.760	0.0019	1.87	5.09
To Kim Nhguu river												5.953			
HB24'	18.9	18.9	260	2,056	49.82	2.39	2.69	3.08		1.00	0.80	5.582	0.0014	1.07	0.85
HB10b	7.9	79.6	1030	17,336	368.17	2.44	2.84	3.36		1.70	1.60	4.760	0.0008	1.20	6.55
To Kim Nhguu river															
KS10	2.0	2.0	220	410	15.54	0.44	0.49	0.56	0.80				0.0020	1.18	0.59
KS11	3.5	18.4	260	2,770	64.71	1.98	2.23	2.57		1.35	1.20		0.0020	1.60	2.59
KS12	3.9	22.3	420	3,522	80.37	2.08	2.36	2.72		1.40	1.20		0.0020	1.62	2.72
KS13	2.0	12.2	310	2,096	50.67	1.52	1.71	1.96	1.20				0.0020	1.54	1.74
KS14	1.1	44.6	390	6,104	134.16	2.93	3.34	3.89		1.80	1.25		0.0020	1.77	3.98
KS15	0.6	45.2	210	6,361	139.53	2.88	3.29	3.84		1.75	1.25		0.0020	1.76	3.84
KS16	4.7	89.0	310	12,937	276.53	3.41	3.94	4.64		1.80	1.40		0.0020	1.85	4.66
KS17	2.6	91.6	540	13,698	292.38	3.36	3.89	4.59		1.80	1.40		0.0020	1.85	4.66
KS18	1.9	93.6	550	14,412	307.25	3.30	3.82	4.52		1.80	1.40		0.0020	1.85	4.66
To KC1												6.485			
HB14	6.0	6.0	400	967	27.14	1.05	1.17	1.33	0.40			5.326	0.0029	0.89	0.11
KS20									1.00				0.0030	1.67	1.31
KS21	5.0	11.0	550	1,945	47.51	1.43	1.61	1.84	1.20				0.0020	1.54	1.74
KC2	3.7	14.7	300	2,559	60.32	1.65	1.87	2.15		1.35	1.10		0.0020	1.55	2.30
To KC3												5.326			
HB14'	1.0	1.0	130	1,179	31.56	0.16	0.18	0.20	0.60			5.267	0.0005	0.46	0.13
									0.60			5.326	0.0005	0.49	0.14
To HB10b															
HB14''	4.8	4.8	620	1,071	29.32	0.80	0.90	1.02	0.80			5.000	0.0005	0.60	0.30
									1.20				0.0005	0.77	0.87
To HB10b															

TABLE D4.6 (2) HYDRAULIC CALCULATION (2/4)

Max. Waste water flow m3/sec/ha	Mean Velocity 0.8 m/sec	Roughness Coefficient 0.013

Line No.	Area Each Line (ha)	Area Accumu. (ha)	Length Each Line (m)	Length Ext. (m)	Con-Time (min)	Peak Flow P=1 years (m3/s)	Peak Flow P=2 years (m3/s)	Peak Flow P=5 years (m3/s)	Pipe Diameter (m)	Box Culvert Width (m)	Box Culvert Height (m)	E.L. (m)	Hydraulic Gradient	Velocity (m/s)	Flow Capacity (m3/s)
HB23	1.0	1.0	180	272	12.66	0.23	0.26	0.29	0.60			5.175	0.0007	0.57	0.16
HB33	4.0	4.9	250	859	24.90	0.90	1.00	1.14	0.80			5.171	0.0000	0.11	0.05
To KC3(Tran Khat Chan channele)															
KS19	5.5	5.5	260	778	23.20	1.03	1.15	1.30	1.20				0.0020	1.54	1.74
KC1	3.4	102.4	320	15,796	336.08	3.37	3.91	4.62		1.80	1.40		0.0020	1.85	4.66
KC3	2.5	119.5	140	18,704	396.67	3.46	4.02	4.77		1.85	1.40		0.0020	1.86	4.82
KC4	9.0	128.6	100	19,571	414.73	2.68	3.12	3.71		1.90	1.40		0.0020	1.88	4.99
To Thanh Nhan Lake(K3)															
KS22	4.8	4.8	150	601	19.53	0.97	1.07	1.21	1.20				0.0020	1.54	1.74
KC5	4.4	9.2	400	1,375	35.65	1.40	1.56	1.79	1.20				0.0020	1.54	1.74
To Kim Nguu River (K.C)												5.921			
HK66	5.4	5.4	480	988	27.59	0.78	0.87	0.99		1.16	0.72	5.199	0.0015	1.09	0.91
SS3	0.8	6.2	200	1,256	33.17	0.82	0.92	1.05	1.20				0.0020	1.54	1.74
SS4	6.3	12.5	590	2,382	56.62	1.22	1.38	1.59	1.20				0.0020	1.54	1.74
To SS5															
SS1	6.3	6.3	340	934	26.45	0.93	1.04	1.18	1.10				0.0020	1.45	1.38
SS2	13.2	19.4	570	2,622	61.61	1.81	2.04	2.35		1.40	1.10		0.0020	1.57	2.42
SS5	5.0	39.8	1520	7,873	171.02	1.84	2.10	2.46		1.45	1.10		0.0020	1.59	2.53
To Set River(S.B)															
HK80-a,b	0.8	0.8	120	196	11.08	0.17	0.18	0.21		0.80	0.80	5.152	0.0004	0.52	0.33
HK85	1.5	2.3	350	669	20.94	0.37	0.41	0.47		1.80	1.00	4.950	0.0006	0.81	1.14
HK85'	0.7	3.0	200	929	26.35	0.44	0.49	0.56		2.40	1.15	4.862	0.0004	0.86	2.37
To SS5												5.669			
HK80c	8.5	8.5	270	1,078	29.45	1.20	1.34	1.53		0.58	0.61	4.919	0.0028	1.14	0.40
HK80e	13.8	13.8	320	1,631	40.98	1.64	1.84	2.10	0.80			4.919	0.0030	1.45	0.73
HK79	7.2	29.5	370	3,691	83.89	2.25	2.55	2.95		1.50	1.05		0.0010	1.07	1.46
SS6									1.20			4.869	0.0010	1.09	1.23
HK79'	13.2	42.7	320	6,061	133.28	2.36	2.70	3.14		2.10	1.40	4.255	0.0019	1.89	5.56
HK79''	8.8	51.5	300	7,109	155.11	2.55	2.93	3.41		1.50	1.40	4.000	0.0009	1.14	4.78
To Bay Mau lake															
												5.700			
HK43	0.7	0.7	740	810	23.88	0.12	0.13	0.15	0.60			5.200	0.001	0.56	0.16
HK43'	0.5	1.2	750	1,601	40.35	0.15	0.16	0.19	0.80			4.552	0.001	0.77	0.39
To Bay Mau lake												5.894			
HB15	33.6	33.6	650	3,842	87.04	2.50	2.84	3.28	1.00			4.810	0.002	1.25	0.98
SS7									1.20				0.003	1.89	2.13
HB15'	34.7	68.3	1070	7,862	170.78	3.16	3.62	4.23	1.50			2.700	0.002	1.78	3.14
SS8									1.00				0.003	1.67	1.31
To SC2												5.056			
HK2	17.4	17.4	510	2,163	52.06	1.80	2.03	2.33		2.37	1.84	3.300	0.003	2.91	12.69
SC2	4.0	89.7	530	10,897	234.03	3.26	3.78	4.44		1.80	1.40	3.300	0.002	1.85	4.66
To S.B(Set River)												5.253			
HB9	2.9	2.9	40	316	13.57	0.57	0.63	0.71	0.60			5.074	0.004	1.45	0.41
SC1	10.9	13.8	720	1,965	47.93	1.50	1.69	1.94	1.20				0.003	1.89	2.13
To S.B(Set River)												6.400			
B20	4.4	4.4	350	768	23.00	0.70	0.78	0.88	0.60			6.138	0.001	0.59	0.17
B27	14.8	19.2	340	2,366	56.29	1.89	2.13	2.45		0.85	0.85	5.532	0.002	1.09	0.67
W1.1	6.95	11.4	300	1,659	41.56	1.34	1.50	1.72	1.20				0.003	1.78	2.01
W1.2									1.20				0.003	1.89	2.13
To Truc Bach												7.233			
B21	12.1	7.9	590	1,740	43.24	0.91	1.02	1.17		1.40	0.70	5.891	0.002	1.37	1.24
To Truc Bach												6.454			
B21'	3.7	3.7	45	397	15.26	0.70	0.77	0.87	0.80			6.173	0.006	2.08	1.04
To Truc Bach												6.696			
B51	3.0	3.0	130	415	15.65	0.56	0.62	0.70	0.80			6.210	0.004	1.61	0.81
To Truc Bach												7.991			
B53	1.5	1.5	180	323	13.72	0.29	0.32	0.37	0.80			5.033	0.016	3.37	1.69
To Truc Bach															

TABLE D4.6 (3) HYDRAULIC CALCULATION (3/4)

Max. Waste water flow	Mean Velocity	Roughness Coefficient
m3/sec/ha	0.8 m/sec	0.013

Line No.	Area Each Line (ha)	Area Accumu. (ha)	Length Each Line (m)	Length Ext. (m)	Con-Time (min)	Peak Flow P=1 years (m3/s)	Peak Flow P=2 years (m3/s)	Peak Flow P=5 years (m3/s)	Pipe Diameter (m)	Box Culvert Width (m)	Box Culvert Height (m)	E.L. (m)	Hydraulic Gradient	Velocity (m/s)	Flow Capacity (m3/s)
												8.208			
B9'	14.2	14.2	135	1,484	37.92	1.76	1.97	2.26	0.80			6.545	0.012	2.92	1.47
TS1									0.80				0.012	2.88	1.45
B28-a'	10.8	30.9	730	3,132	72.25	2.60	2.95	3.40		1.48	1.25	6.178	0.001	0.79	1.13
TS2										1.50	1.30		0.002	1.60	2.40
B28-a	7.6	38.5	700	4,478	100.29	2.60	2.96	3.43		1.49	1.25	5.868	0.000	0.74	1.07
T3										1.50	1.30		0.002	1.60	2.40
To B28-c												6.609			
HK26	5.8	5.8	350	901	25.77	0.88	0.98	1.11		0.90	1.10	6.484	0.000	0.38	0.19
B23	7.1	7.1	450	1,121	30.35	0.99	1.10	1.25	0.60			6.484	0.002	0.89	0.25
B28-b'	5.3	18.2	700	3,175	73.14	1.52	1.72	1.98		1.55	1.67	6.125	0.001	0.94	2.03
To B28-b												7.540			
B8	13.1	13.1	450	1,697	42.35	1.53	1.72	1.97	0.60			6.631	0.002	0.98	0.28
TS5									1.20				0.002	1.54	1.74
B17	10.3	10.3	450	1,430	36.79	1.30	1.46	1.66	0.80			6.484	0.002	1.18	0.59
TS6									1.00				0.002	1.37	1.07
B28-b	32.4	74.0	750	9,802	211.21	2.92	3.36	3.94		1.55	1.67	5.869	0.001	1.19	2.57
B28-c	26.4	138.9	520	17,045	362.10	3.62	4.21	4.99		2.00	1.80	5.530	0.001	1.19	4.30
TS4									1.00				0.002	1.37	1.07
To T1.A(Thuy Khue Channel)												7.402			
HK68	9.1	9.1	530	1,395	36.05	1.20	1.34	1.53		1.00	1.20	6.705	0.001	1.17	1.41
To B31												7.540			
B23'	9.4	9.4	520	1,408	36.34	1.22	1.37	1.57	0.60			6.620	0.002	0.91	0.26
B31	4.9	23.4	400	3,619	82.40	1.86	2.11	2.44		1.02	0.96	6.082	0.001	1.11	1.09
TS7										1.40	1.12		0.001	1.12	1.75
To B31"												6.620			
B31'	6.2	6.2	650	1,239	32.81	0.86	0.96	1.09		1.40	1.12	5.999	0.001	1.09	1.71
To D13'												6.631			
B8'	13.1	13.1	550	1,797	44.43	1.54	1.73	1.98	0.80			6.082	0.001	0.83	0.42
TS8									1.20				0.002	1.54	1.74
B31"	2.4	38.9	250	5,870	129.29	2.27	2.59	3.02		1.02	0.96	5.999	0.000	0.55	0.54
TS9										2.00	1.25		0.001	1.29	3.22
To D13"															
B1	7.0	7.0	220	887	25.49	1.10	1.23	1.39	0.60				0.001	0.69	0.19
TS10									1.00				0.002	1.37	1.07
D13"	14.1	66.2	580	9,777	210.69	2.70	3.11	3.65		1.10	1.05	5.626	0.001	1.07	1.18
TS11										2.80	1.05		0.001	1.24	2.47
D13	26.0	92.2	400	12,387	265.07	3.16	3.65	4.30		3.12	1.65	4.608	0.003	3.05	14.88
To TS.C(Nam Yen Lang Channel)												4.988			
D2	7.1	7.1	200	875	25.22	1.12	1.25	1.42	0.80			4.608	0.002	1.15	0.58
TS12									1.00				0.002	1.37	1.07
To TS.C(Nam Yen Lang Channel)															
												4.988			
D1	2.9	2.9	246	517	17.77	0.52	0.58	0.65	0.60			4.771	0.001	0.64	0.18
	5.2	8.1	134	1,093	29.77	1.17	1.31	1.49		1.8	1.2	4.635	0.001	1.24	2.68
TS13	2.9	11.0	230	1,569	39.69	1.37	1.53	1.75		1.8	1.2		0.001	1.23	2.66
TS14	13.0	13.0	230	1,460	37.42	1.67	1.87	2.14	1				0.002	1.37	1.07
TS15	1.75	1.8	250	416	15.67	0.34	0.37	0.42	0.8				0.002	1.18	0.59
TS16	11.6	11.6	170	1,269	33.43	1.58	1.77	2.02	1				0.002	1.37	1.07
TS17	11.1	11.1	250	1,305	34.18	1.50	1.68	1.92	1				0.002	1.37	1.07
TS18	3.1	3.1	200	495	17.30	0.57	0.64	0.72	0.8				0.002	1.18	0.59
TS19	15.1	15.1	250	1,688	42.16	1.83	2.05	2.35		1.4	1.1		0.002	1.57	2.42
TS20	11.4	11.4	170	1,253	33.10	1.57	1.76	2.00		1.3	1.1		0.002	1.53	2.19
To TS.C(Nam Yen Lang Channel)															

TABLE D4.6 (4) HYDRAULIC CALCULATION (4/4)

Max. Waste water flow	Mean Velocity	Roughness Coefficient
m3/sec/ha	0.8 m/sec	0.013

Line No.	Area Each Line (ha)	Area Accumu. (ha)	Length Each Line (m)	Length Ext. (m)	Con-Time (min)	Peak Flow P=1 years (m3/s)	Peak Flow P=2 years (m3/s)	Peak Flow P=5 years (m3/s)	Pipe Diameter (m)	Box Culvert Width (m)	Box Culvert Height (m)	E.L. (m)	Hydraulic Gradient	Velocity (m/s)	Flow Capacity (m3/s)
												5.440			
D17	2	2	400	590	19.29	0.35	0.39	0.45	0.80			4.370	0.003	1.36	0.68
TS28	2	4	320	1,060	29.50	0.58	0.65	0.74	1.00			4.370	0.002	1.37	1.07
TS21	5.9	5.9	200	761	22.84	0.97	1.08	1.23	1.00			4.370	0.002	1.37	1.07
TC3	6.2	6.2	500	1,024	28.33	0.92	1.02	1.17	1.00			4.370	0.002	1.37	1.07
TC4	9.8	9.8	500	1,330	34.71	1.31	1.47	1.67	1.20			4.370	0.002	1.54	1.74
TS22	8.5	8.5	200	1,010	28.04	1.28	1.42	1.62	1.20			4.370	0.002	1.54	1.74
TS23	6.5	6.5	200	814	23.97	1.04	1.16	1.32	1.00			4.370	0.002	1.37	1.07
TS24	7.7	7.7	200	935	26.47	1.19	1.33	1.51	1.20			4.370	0.002	1.54	1.74
TS25	8.5	8.5	200	1,010	28.04	1.28	1.42	1.62	1.20			4.370	0.002	1.54	1.74
TS26	16.8	16.8	200	1,795	44.39	1.97	2.21	2.53	1.20			4.370	0.002	1.54	1.74
TS27	3.3	3.3	200	509	17.60	0.60	0.66	0.75	1.00			4.370	0.002	1.37	1.07
To T5.B(Nam Yen Lang Channel)												4.850			
D39	24.0	24.0	750	3,028	70.09	2.13	2.40	2.77	1.50			3.970	0.001	1.37	2.42
TC4	31.6	31.6	280	3,284	75.42	2.67	3.03	3.49		1.5	1.35		0.002	1.73	3.49
To T5.A(Nam Yen Lang Channel)												4.970			
D29	2.7	2.7	1130	1,388	35.91	0.36	0.40	0.46	0.80			3.670	0.001	0.89	0.45
TS29	6.6	6.6	180	807	23.81	1.07	1.19	1.35	1.00				0.002	1.37	1.07
TS30	8.1	8.1	180	950	26.78	1.24	1.38	1.57	1.20				0.002	1.54	1.74
TS31	5.9	5.9	170	733	22.27	0.99	1.10	1.25	1.00				0.002	1.37	1.07
TS32	14.4	14.4	170	1,536	38.99	1.81	2.03	2.32		1.3	1.2		0.002	1.58	2.47
TS33	10.4	10.4	230	1,219	32.40	1.45	1.62	1.85	1.20				0.002	1.54	1.74
TS34	13.3	13.3	260	1,526	38.79	1.68	1.89	2.16		1.2	1.2		0.002	1.54	2.22
TS35	14.6	14.6	200	1,589	40.11	1.82	2.04	2.33		1.3	1.2		0.002	1.58	2.47
To T5.A(Nam Yen Lang Channel)															
D14	0.8	0.8	226	304	13.34	0.17	0.19	0.21	0.80			5.093	0.004	1.66	0.84
LS2	3.8	3.8	450	813	23.94	0.63	0.70	0.79	1.00			5.093	0.002	1.37	1.07
LC4	4.8	9.5	280	1,807	44.64	1.12	1.26	1.44	1.20				0.002	1.54	1.74
D10	2.9	2.9	122	395	15.23	0.57	0.63	0.71	0.80			4.602	0.004	1.67	0.84
LC3	4.0	6.8	400	1,131	30.56	0.99	1.11	1.26	1.20				0.002	1.54	1.74
LC1	6.0	15.6	400	970	27.21	2.41	2.69	3.05		1.5	1.3		0.002	1.70	3.32
LC2	2.4	18.0	200	1,374	35.63	2.42	2.71	3.09		1.5	1.4		0.002	1.75	3.67
LS3	3.8	3.8	300	658	20.70	0.66	0.73	0.83	1.00			5.093	0.002	1.37	1.07
LS4	3.6	3.6	180	522	17.88	0.67	0.74	0.84	1.00			5.093	0.002	1.37	1.07
To L3 (Van Chuong Lake)												5.041			
D15	7.3	7.3	198	895	25.65	1.16	1.30	1.47	0.80			4.762	0.001	0.99	0.50
LS1									1.00				0.002	1.37	1.07
D12	2.3	2.3	292	507	17.57	0.42	0.47	0.53	0.80				0.001	0.83	0.42
To L1(Giam Lake)												4.050			
D46	15.9	15.9	180	1,687	42.15	1.94	2.18	2.50	0.60			3.750	0.002	0.89	0.25
To DS1															
D7a	13.2	13.2	600	1,854	45.63	1.55	1.74	1.99	0.60				0.002	0.97	0.27
LS9									1.00				0.002	1.37	1.07
DS1	0.0	38.2	83	5,161	114.51	2.47	2.81	3.27		1.6	1.4		0.002	1.78	4.00
LS5	2.6	2.6	350	592	19.34	0.46	0.51	0.58	0.80				0.003	1.44	0.72
LS7	3.3	3.3	200	514	17.70	0.61	0.68	0.77	1.00				0.002	1.37	1.07
LS8	3.3	9.2	150	1,536	39.01	1.17	1.31	1.50	1.20				0.002	1.54	1.74
To L1A															
D7b	2.8	2.8	400	664	20.84	0.48	0.54	0.61	0.60				0.002	0.97	0.27
D21	1.4	4.1	308	1,101	29.93	0.61	0.68	0.77	0.80				0.002	1.18	0.59
LS6			200						0.80				0.002	1.18	0.59
LS10	17.3	17.3	450	2,094	50.62	1.91	2.15	2.46		1.3	1.2		0.002	1.58	2.47
LS11	13.9	13.9	300	1,616	40.66	1.73	1.94	2.22		1.3	1.1		0.002	1.53	2.19
LS12	8.4	8.4	200	993	27.69	1.28	1.42	1.62	1.20				0.002	1.54	1.74
LC5	2.6	52.2	500	5,424	120.00	3.27	3.72	4.33		1.8	1.4		0.002	1.85	4.66
LS13	3.7	3.7	270	622	19.95	0.66	0.73	0.83	1.00				0.002	1.37	1.07
LS14	10.4	10.4	300	1,288	33.83	1.44	1.61	1.83		1.20	1.10		0.002	1.50	1.98
LS15	13.5	13.5	400	1,683	42.05	1.66	1.86	2.13		1.30	1.20		0.002	1.58	2.47
To L1A															

TABLE D4.7 WORK QUANTITIES OF SEWER REHABILITATION AND CONSTRUCTION

Work Item	Unit	STAGE 1 Work Quantity	STAGE 2 Work Quantity
1. West Lake Basin (930 ha)		(W1:80 ha)	(W2:850 ha)
1.1 Rehabilitation of Existing Combined System			
(1) Pipe			
D 1000	m	260	0
D 800	m	480	0
D 600	m	1,200	0
(2) Box Culvert			
1.3*1.2 m	m3	400	0
1.2 Sewer Converted from Open Channel			0
1.3 Newly Installed Separate Sewer			
(1) Trunk Sewer			
D 1000	m	0	1,900
D 1200	m	0	930
(2) Secondary Sewer			
D 900	m	0	700
D 800	m	0	1,000
D 700	m	0	1,300
D 600	m	0	1,700
D 500	m	0	2,000
(3) Box Culvert			
1.3*1.2 m	m3	0	900
1.5*1.2 m	m3	0	3,760
2. To Lich River Basin (2000 ha)		(T1:130 ha &T5a:194 ha)	(T2,T3,T4,T5b, T6,T7,T8 & T9)
2.1 Rehabilitation of Existing Combined System			
(1) Pipe			
D 1200	m	630	1,100
D 1000	m	420	740
D 800	m	4,720	8,280
D 600	m	3,150	5,520
(2) Box Culvert			
1.5*1.30 m	m3	1,470	2,580
2.8*1.05	m3	350	620
2.2 Sewer Converted from Open Channel			
1.60*1.2 m	m3	0	7,780
1.45*1.0 m	m3	0	2,570
2.3 Newly Installed Separate Sewer			
(1) Trunk Sewer			
D 1000	m	0	7,800
D 1200	m	0	5,244
(2) Secondary Sewer			
D 900	m	0	2,700
D 800	m	0	4,100
D 700	m	0	5,400
D 600	m	0	6,800
D 500	m	0	8,200
(3) Box Culvert			
1.5*1.2 m	m3	0	3,669
1.8*1.2 m	m3	0	15,218
3. Upper Lu River Basin (587 ha)		(L1:215 ha)	(L2, L3 & L4)
3.1 Rehabilitation of Existing Combined System			
(1) Pipe			
D 1200	m	720	0
D 1000	m	480	0
D 800	m	3,180	0
D 600	m	2,120	0
(2) Box Culvert			
1.3*1.2 m	m3	1,690	0
1.3*1.1 m	m3	410	0
3.2 Sewer Converted from Open Channel			
1.8*1.4 m	m3	4,180	0
1.5*1.4 m	m3	1,670	0
3.3 Newly Installed Separate Sewer			
(1) Trunk Sewer			
D 1000	m	0	2,200
D 1200	m	0	1,520
(2) Secondary Sewer			
D 900	m	0	900
D 800	m	0	1,400
D 700	m	0	1,900
D 600	m	0	2,300
D 500	m	0	2,800
(3) Box Culvert			
1.5*1.5 m	m3	0	1,260
2.0*2.0 m	m3	0	5,200
4. Lower Lu River Basin (433 ha)			
4.1 Rehabilitation of Existing Combined System			
4.2 Sewer Converted from Open Channel			
4.3 Newly Installed Separate Sewer			
(1) Trunk Sewer			
D 1000	m	0	2,600
D 1200	m	0	1,672
(2) Secondary Sewer			
D 900	m	0	1,100
D 800	m	0	1,600
D 700	m	0	2,100
D 600	m	0	2,700
D 500	m	0	3,200
(3) Box Culvert			
1.2*1.2 m	m3	0	3,076

Work Item	Unit	STAGE 1 Work Quantity	STAGE 2 Work Quantity
5. Set River Basin (710 ha)		(S1:217 ha)	(S2,S3 & S4)
5.1 Rehabilitation of Existing Combined System			
(1) Pipe			
D 1200	m	620	0
D 1000	m	420	0
D 800	m	2,750	0
D 600	m	1,830	0
(2) Box Culvert			
1.8*1.4 m	m3	2,080	0
5.2 Sewer Converted from Open Channel			
1.80*1.40 m	m3	0	3,600
1.60*1.25 m	m3	0	1,890
1.25*1.15 m			
5.3 Newly Installed Separate Sewer			
(1) Trunk Sewer			
D 1000	m	0	3,500
D 1200	m	0	2,250
(2) Secondary Sewer			
D 900	m	0	1,400
D 800	m	0	2,200
D 700	m	0	2,900
D 600	m	0	3,600
D 500	m	0	4,300
(3) Box Culvert			
1.4*1.2 m	m3	0	1,944
2.20*1.55 m	m3	0	8,065
6. Kim Ngưu River Basin (K1:347 ha)		(K1:347 ha)	(K2,K3, K4 & K5)
6.1 Rehabilitation of Existing Combined System			
(1) Pipe			
D 1200	m	2,390	0
D 1000	m	1,600	0
D 800	m	4,790	0
D 600	m	3,190	0
(2) Box Culvert			
1.8*1.4 m	m3	7,980	0
1.5*1.5 m	m3	0	0
6.2 Sewer Converted from Open Channel			
1.9*1.4 m	m3	480	2,400
1.8*1.4 m	m3	540	680
1.4*1.2 m	m3	1,000	0
6.3 Newly Installed Separate Sewer			
(1) Trunk Sewer			
D 1000	m	0	8,400
D 1200	m	0	5,550
(2) Secondary Sewer			
D 900	m	0	3,500
D 800	m	0	5,200
D 700	m	0	7,000
D 600	m	0	8,700
D 500	m	0	10,500
(3) Box Culvert			
1.5*1.5 m	m3	0	6,210
2.0*2.0 m	m3	0	16,800
7. Hoang Liet Drainage Basin			
7.1 Rehabilitation of Existing Combined System			
7.2 Sewer Converted from Open Channel			
7.3 Newly Installed Separate Sewer			
(1) Trunk Sewer			
D 1000	m	0	4,700
D 1200	m	0	3,060
(2) Secondary Sewer			
D 900	m	0	1,900
D 800	m	0	2,900
D 700	m	0	3,900
D 600	m	0	4,900
D 500	m	0	4,900
(3) Box Culvert			
1.2*1.2 m	m3	0	5,590
8. Yen So Drainage Basin			
8.1 Rehabilitation of Existing Combined System			
8.2 Sewer Converted from Open Channel			
8.3 Newly Installed Separate Sewer			
(1) Trunk Sewer			
D 1000	m	0	360
D 1200	m	0	160
(2) Secondary Sewer			
D 900	m	0	100
D 800	m	0	200
D 700	m	0	200
D 600	m	0	300
D 500	m	0	300
(3) Box Culvert			
1.2*1.2 m	m3	0	330

Table D4.8 (1) WORK ITEMS OF 1ST AND 2ND STAGE PROJECTS (1/2)

Item	First Stage Project	Second Stage Project
1- Yen So Pumping Station		
(1) Pumping Station	Q = 45 m3/s	Q = 45 m3/s
(2) Inlet Structure	B = 200 m	--
(3) Inlet Channel	L = 1,200 m	--
(4) Ordinary Drainage Channel	L = 1,900 m	--
(5) Outlet Sluiceway	A = 30 m2	A = 30 m2
(6) Outlet Channel	L = 1,600 m	--
2- Yen So Regulating Reservoir		
(1) Regulating Reservoir	A = 203ha (130ha)	--
(2) Yen So Channel	L = 3,400 m	--
(3) Spoil Bank	A = 40 ha	--
3- Linh Dam and Dinh Cong Lakes		
(1) Linh Dam Channel	L = 1,000 m	--
(2) Linh Dam Lake	--	A = 107 ha
(3) Dinh Cong Channel	--	L = 400 m
(4) Dinh Cong Lake	--	A = 25 ha
4- Floodgates and Control Gates	7 places	--
5- River Improvement		
(1) To Lich and Lower Lu River System	L = 22.1 km (Lower Lu = 3.2km)	--
(2) Set and Upper Lu River System	L = 7.5 km (Upper Lu = 3.1km)	--
(3) Kim Nguu River System	L = 3.4 km	--
6- Drainage Channel Improvement		
(1) To Lich and Lower Lu River Basin	Bridges/Box Culverts (21 places)	Channel Works (L = 16.4 km) and Bridge/Box Culverts (24 places)
(2) Set and Upper Lu River Basin	Bridges/Box Culverts (13 places)	Channel Works (L = 3.7 km) and Bridge/Box Culverts (2 places)
(3) Kim Nguu River Basin	Bridges/Box Culverts (20 places)	Channel Works (L = 10.7 km) and Bridge/Box Culverts (1 places)

Table D4.8 (2) WORK ITEMS OF 1ST AND 2ND STAGE PROJECTS (2/2)

Item	First Stage Project	Second Stage Project
7- Lake Improvement		
(1) Lake Dredging	4 lakes	14 lakes
(2) Lake Conservation	Aeration in 2 lakes as a pilot project	Overall environmental measures for 11 lakes
8- Sewer Rehabilitation and Construction		
(1) West Lake Basin	Rehabilitation	New construction
(2) To Lich River Basin	Rehabilitation	Rehabilitation/ New construction
(3) Lower Lu River Basin	—	New construction
(4) Hoang Liet Drainage Basin	—	New construction
(5) Set River Basin	Rehabilitation	New construction
(6) Upper Lu River Basin	Rehabilitation/ New construction	New construction
(7) Kim Nguu River Basin	Rehabilitation/ New construction	New construction
(8) Yen So Drainage Basin	—	New construction
9- Equipment Supply for Cleanup of Drainage Channels and Sewers	Grab bucket excavator, water jet cleaner, etc.	—

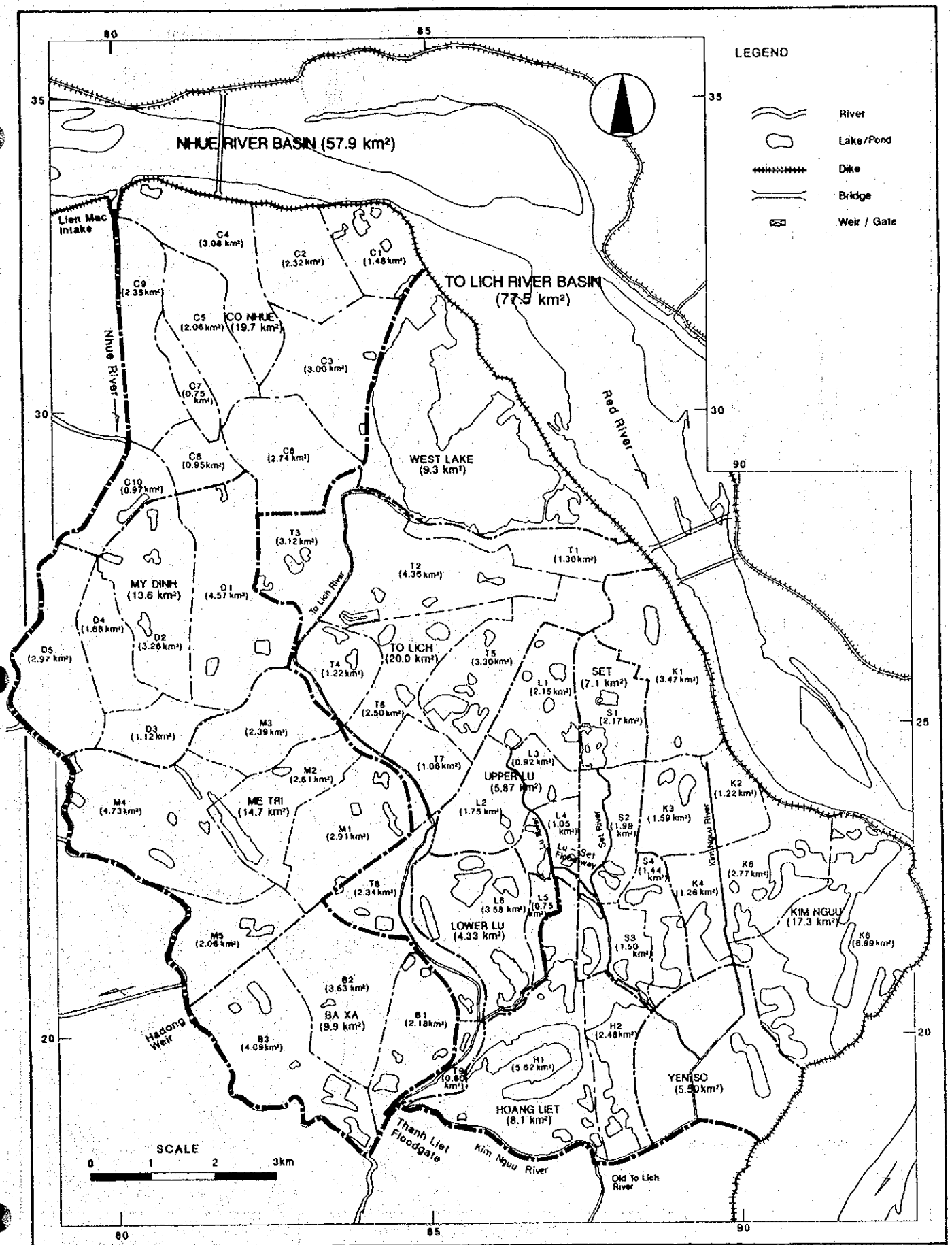

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Fig. D 2 . 1
WATERSHEDS

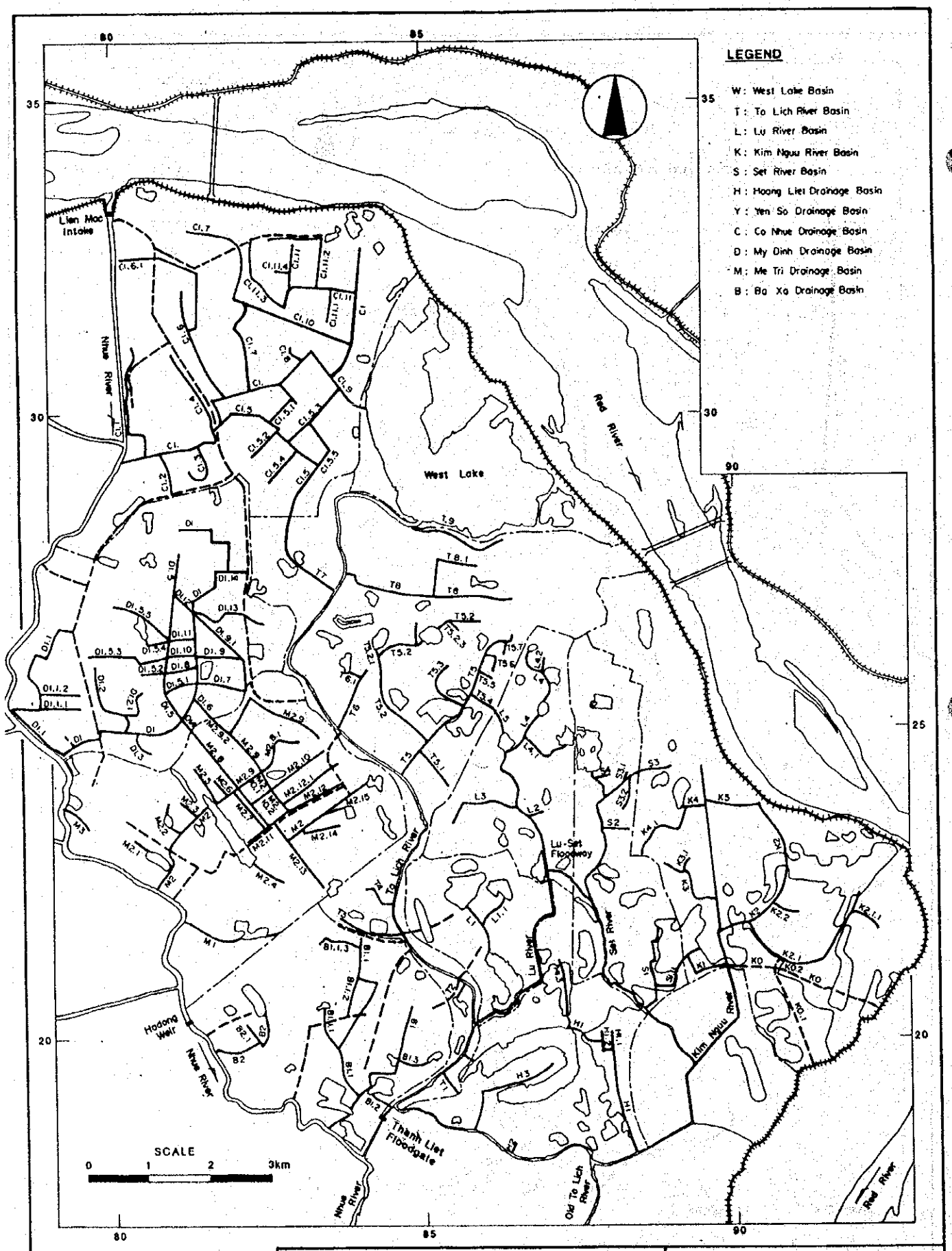

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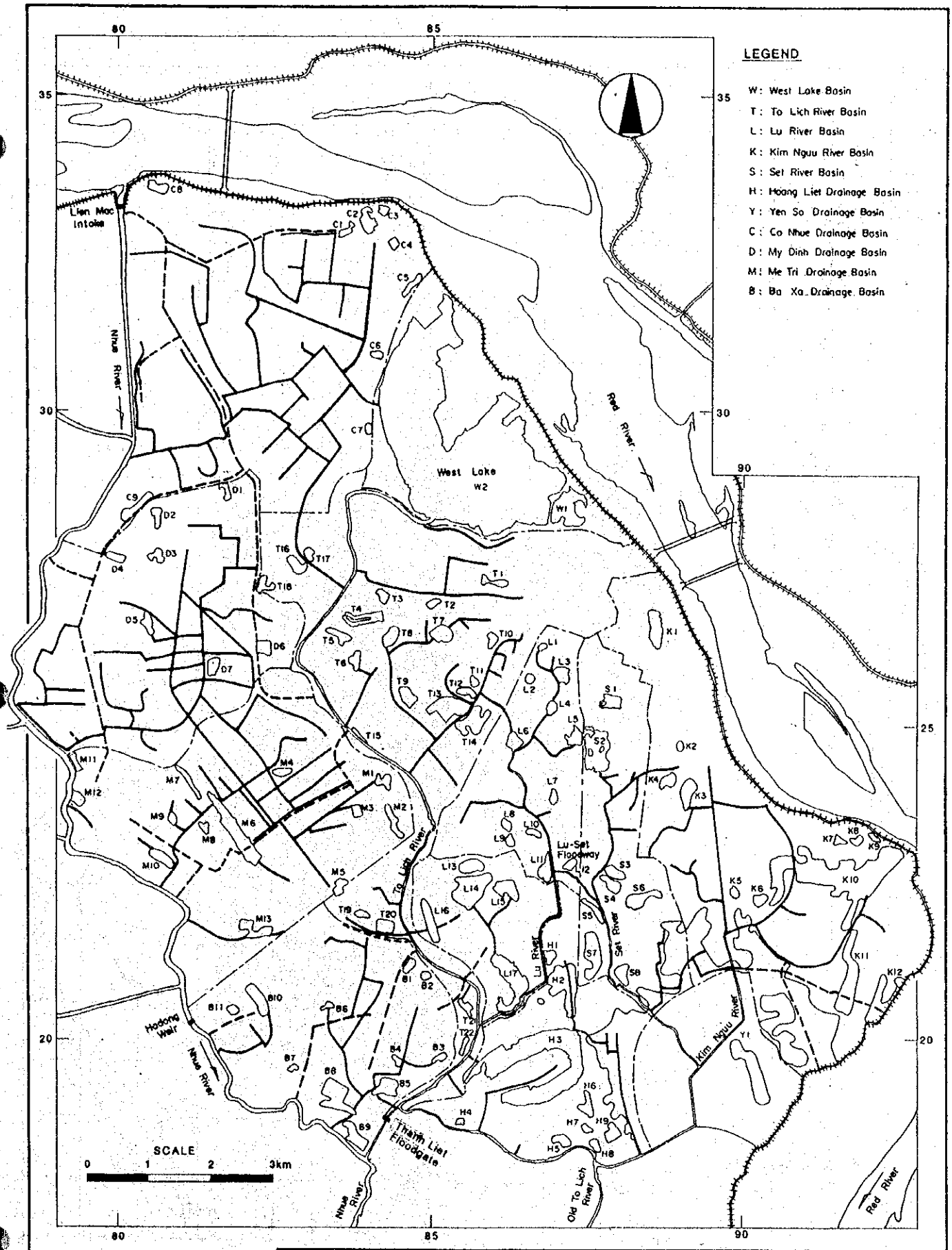
Fig. D 2 . 2
EXISTING RIVER, DRAINAGE AND IRRIGATION CHANNELS



SOCIALIST REPUBLIC OF VIET NAM THE STUDY ON URBAN DRAINAGE AND WASTEWATER DISPOSAL SYSTEM IN HANOI CITY JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. D 2 . 3 EXISTING LAKES AND PONDS

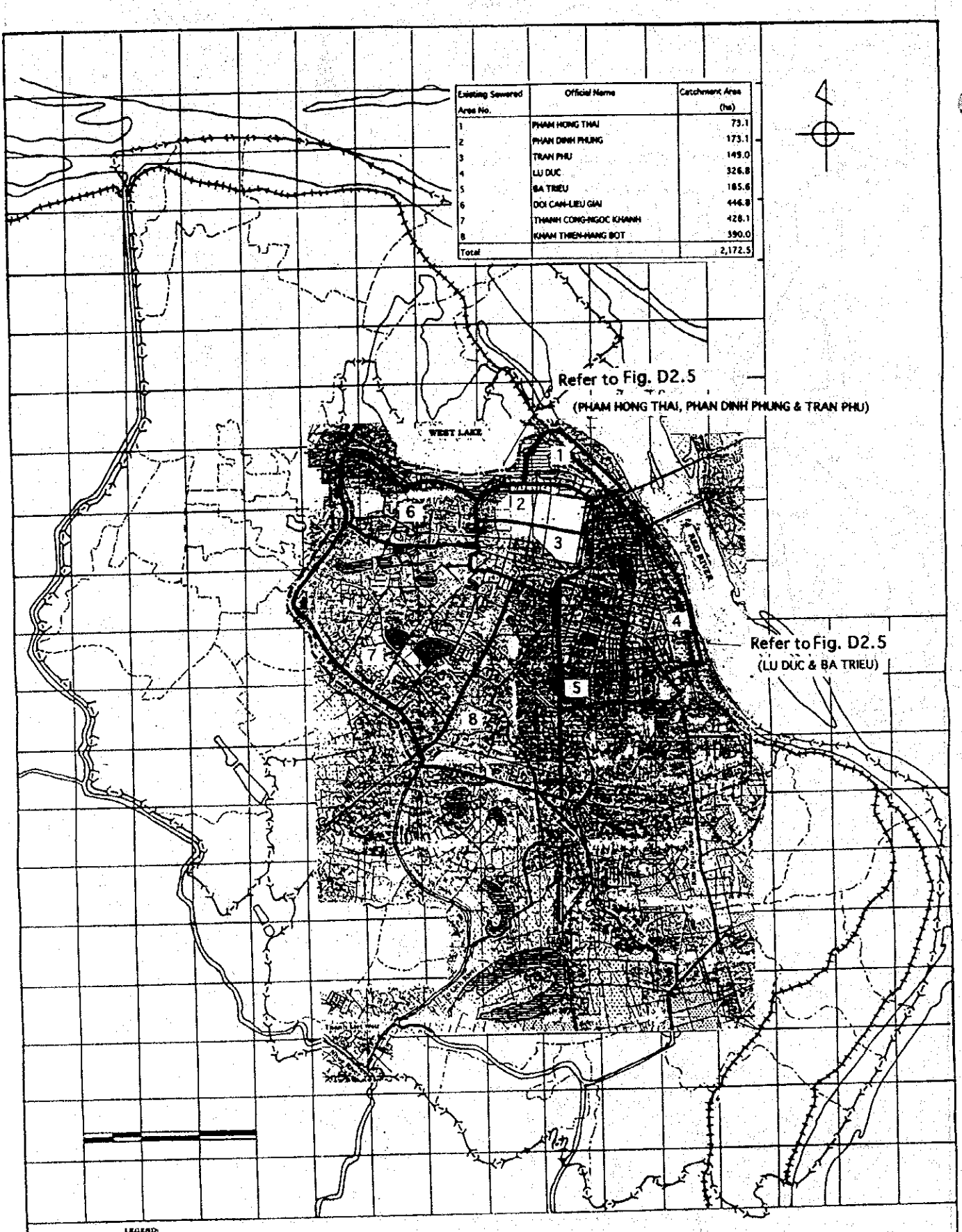

Existing Sewered Area No.
Official Name
Catchment Area (ha)
1 PHAM HONG THAI 73.1
2 PHAN DINH PHUNG 173.1
3 TRAN PHU 149.0
4 LU DUC 326.8
5 BA TRIEU 185.6
6 DOI CAN-LIEU GIAI 446.8
7 THANH CONG-NGOC KHANH 428.1
8 KHAM THIEN-HANG BOT 390.0
Total 2,172.5
Refer to Fig. D2.5
(PHAM HONG THAI, PHAN DINH PHUNG & TRAN PHU)
Refer to Fig. D2.5
(LU DUC & BA TRIEU)
WEST LAKE
RED RIVER
LEGEND:
Existing Sewers (Location Approximate)
Sewer Outlets
Canals (only main canals shown)
Rivers (4 main rivers)
Lakes and ponds
Red River Dyke
URBAN AREA
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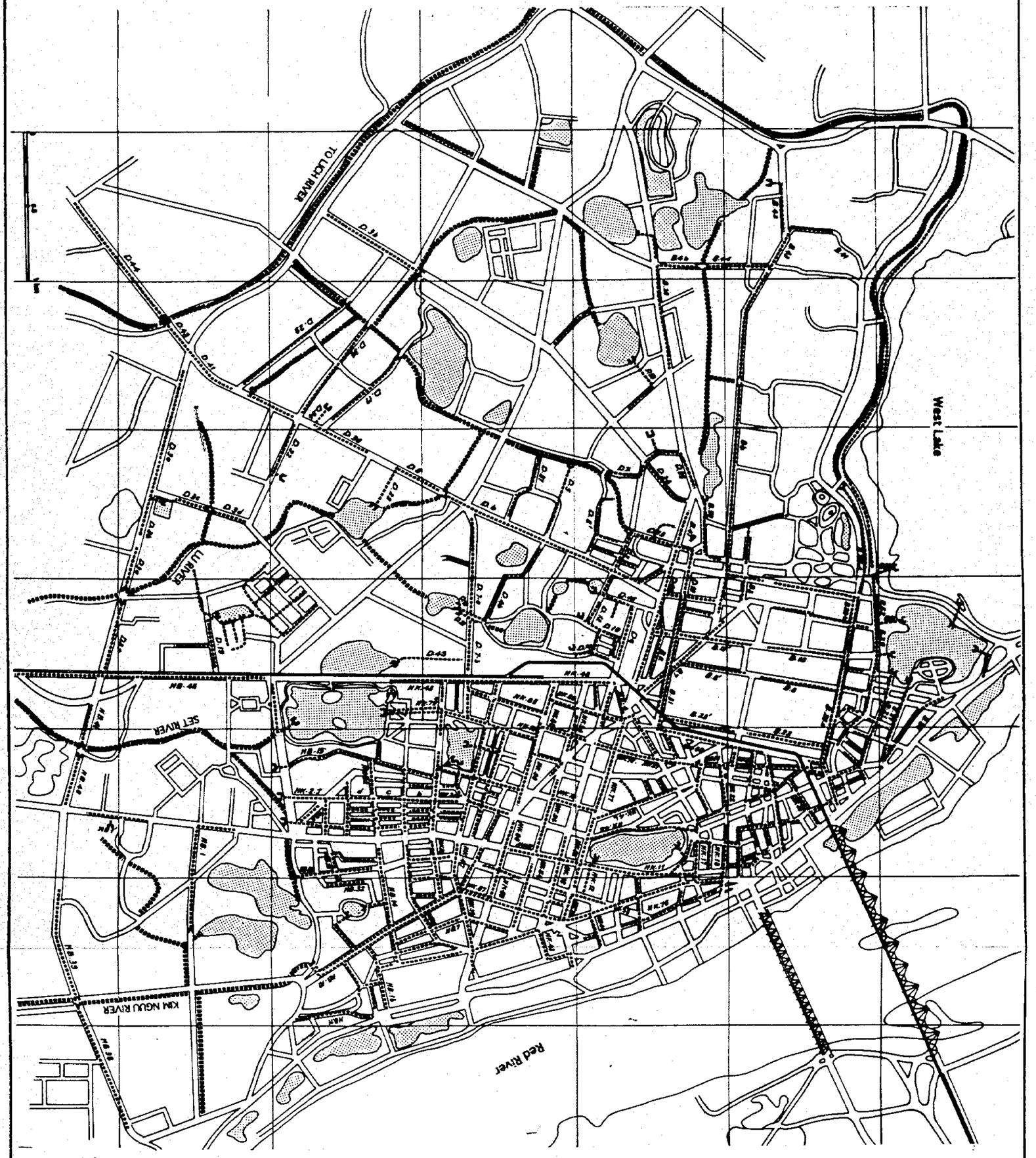
Fig.D2.4
EXISTING COMBINED SEWER SYSTEM



SOCIALIST REPUBLIC OF VIET NAM THE STUDY ON URBAN DRAINAGE AND WASTEWATER DISPOSAL SYSTEM IN HANOI CITY JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. D 2 . 5 DETAILED EXISTING COMBINED SEWER SYSTEM

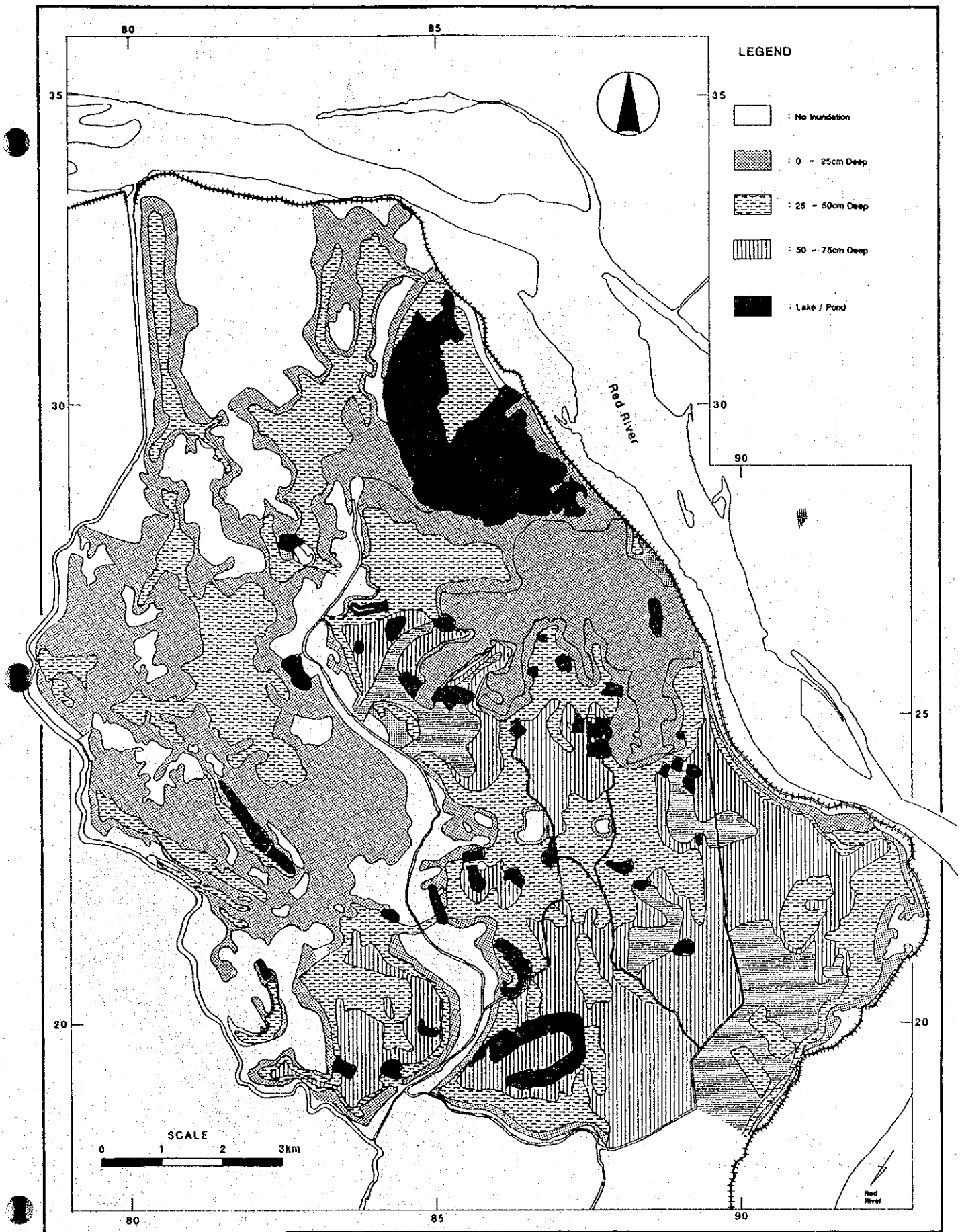


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Fig. D 2 . 6
YEAR 1984 FLOOD MAP

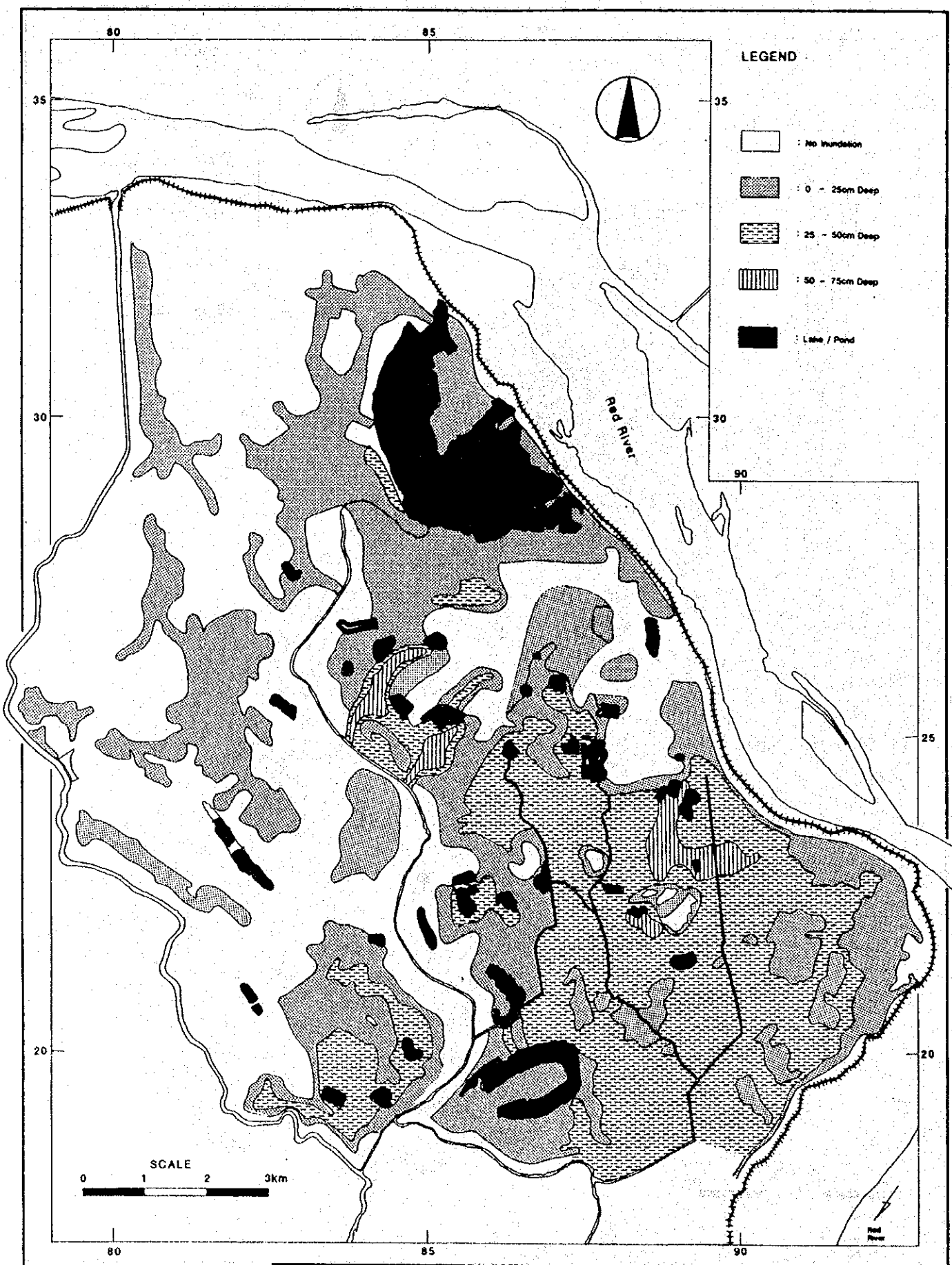

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Fig D 2 . 7
YEAR 1989 FLOOD MAP

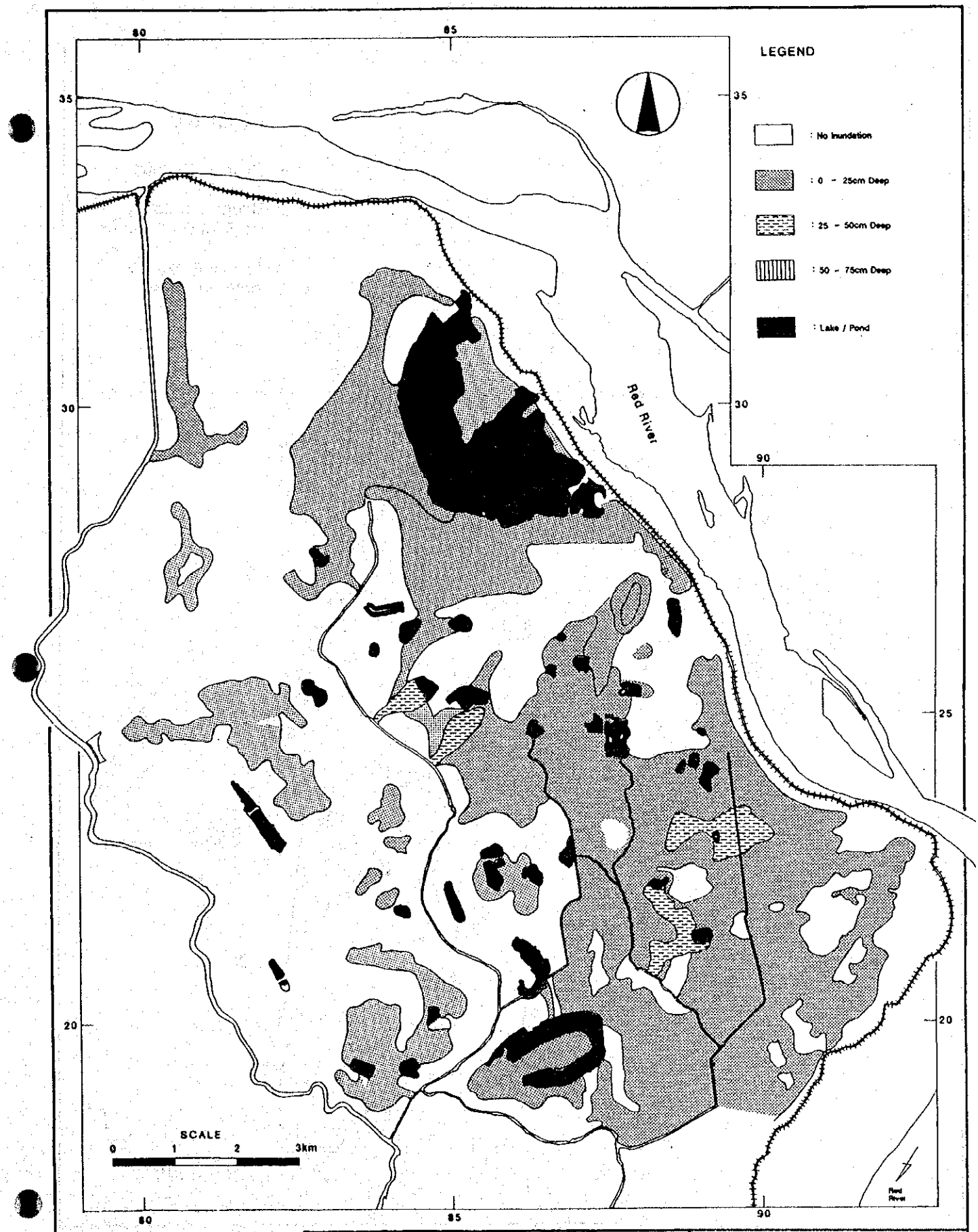

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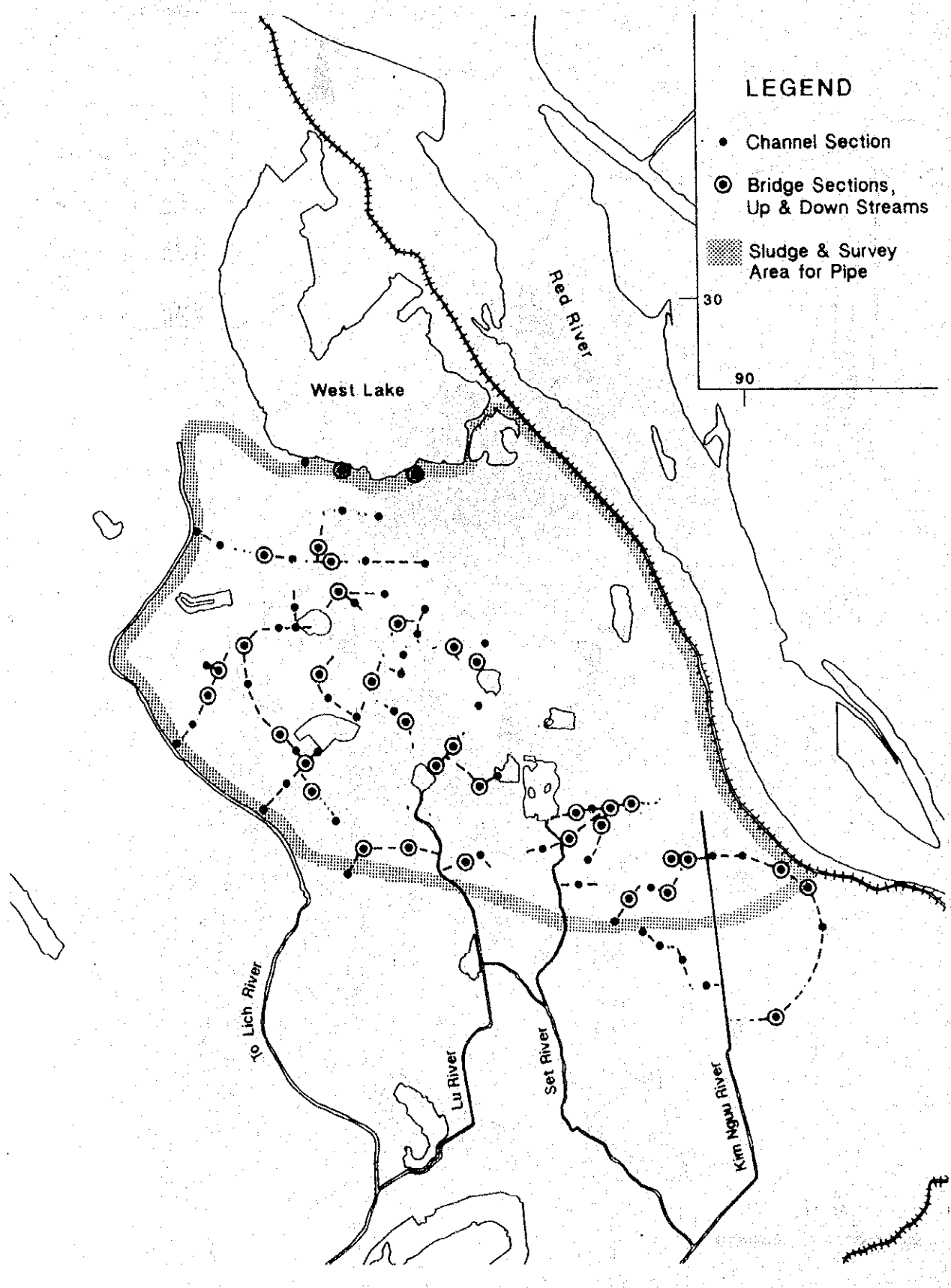
Fig. D 2 . 8
ANNUAL FLOOD MAP



SOCIALIST REPUBLIC OF VIET NAM THE STUDY ON URBAN DRAINAGE AND WASTEWATER DISPOSAL SYSTEM IN HANOI CITY JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. D 2 . 9 LOCATION MAP OF SEDIMENTATION SURVEY

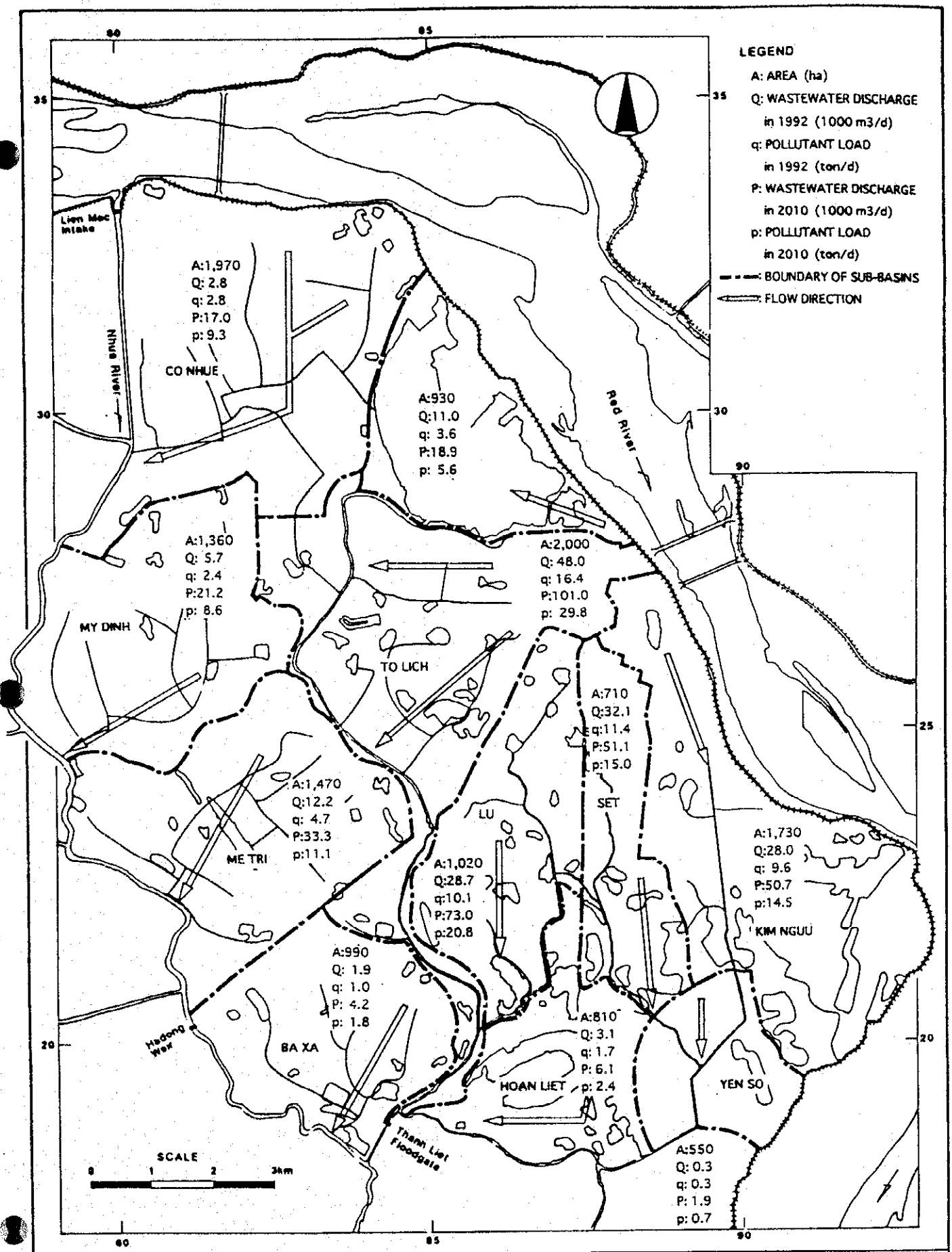


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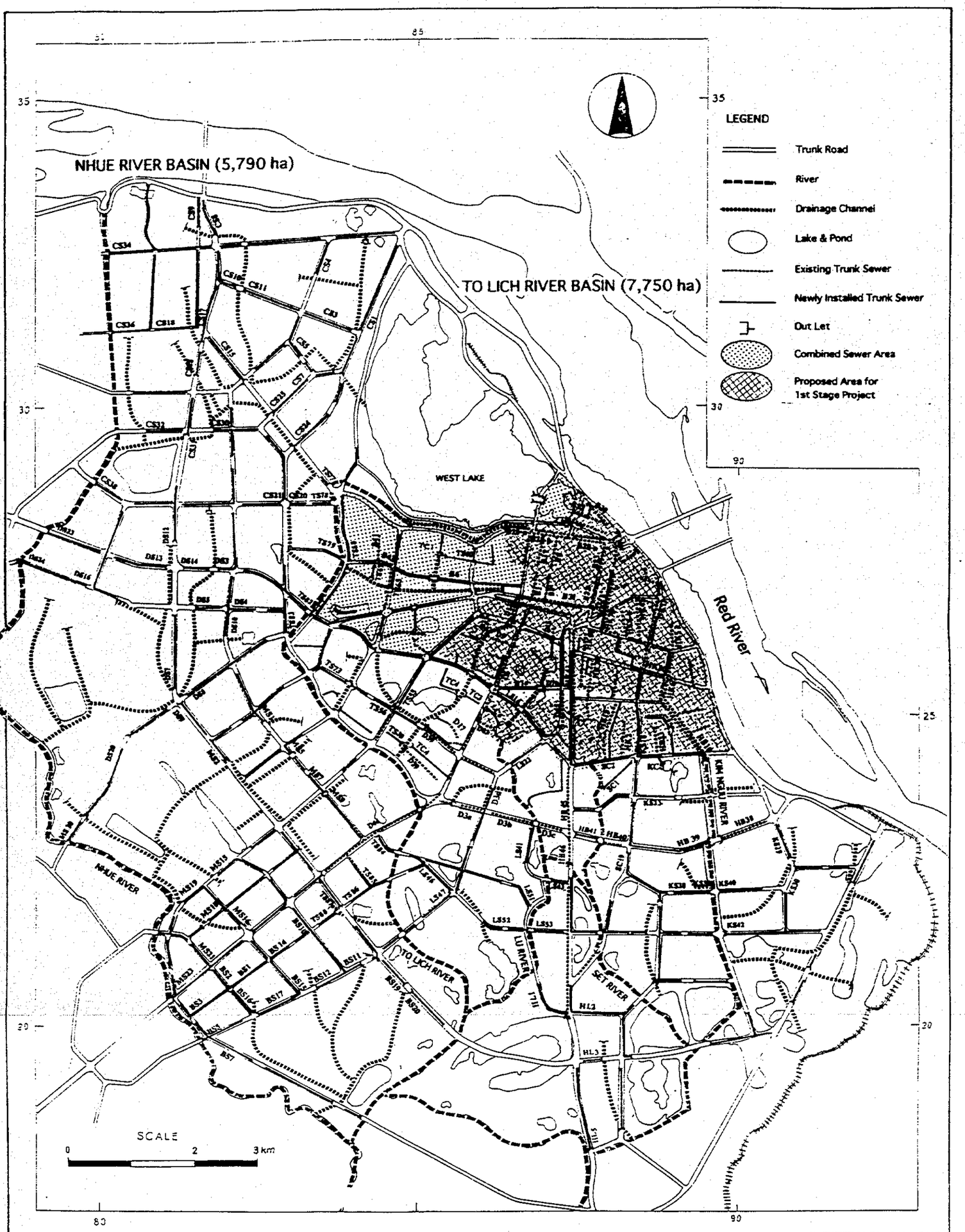
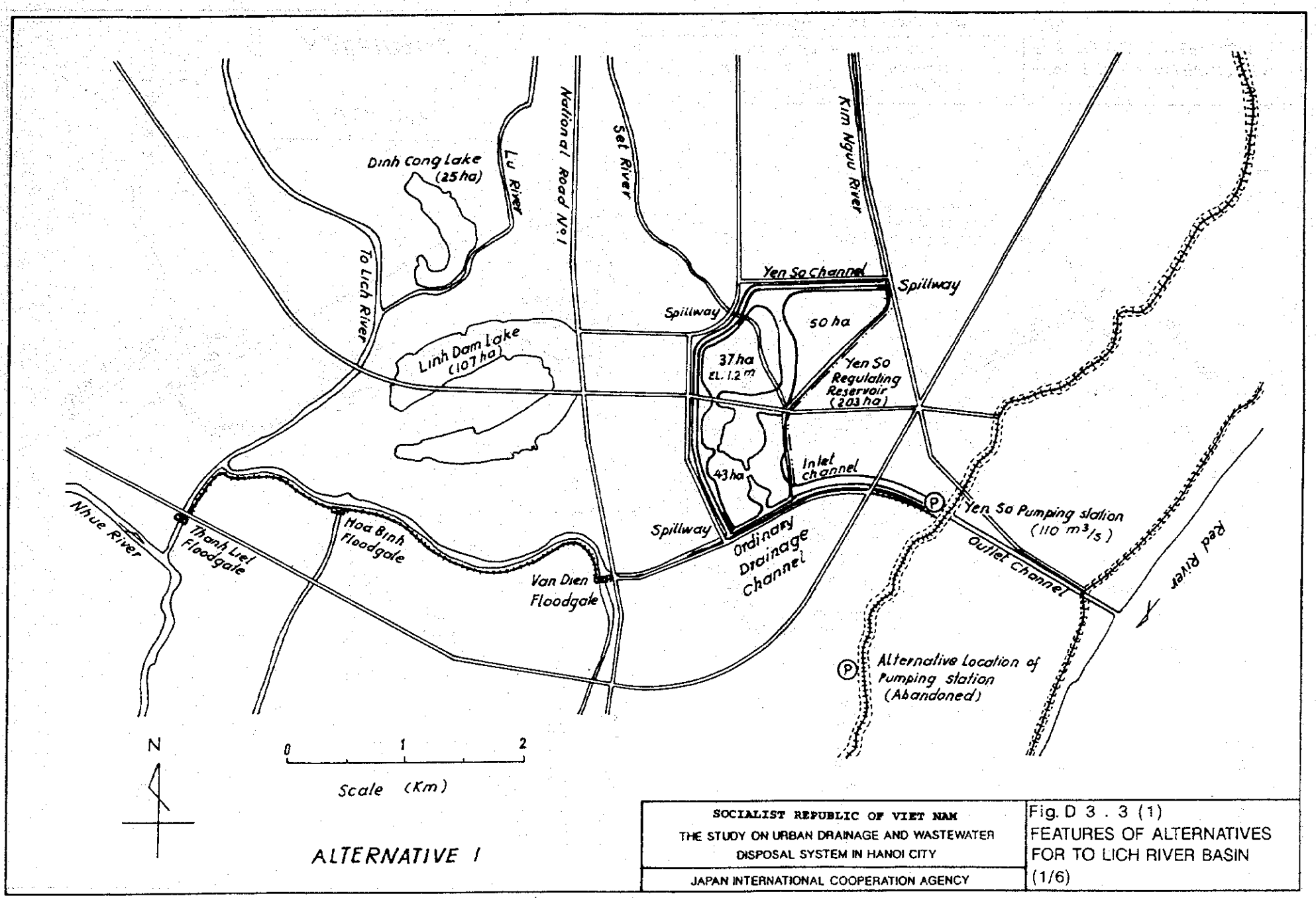
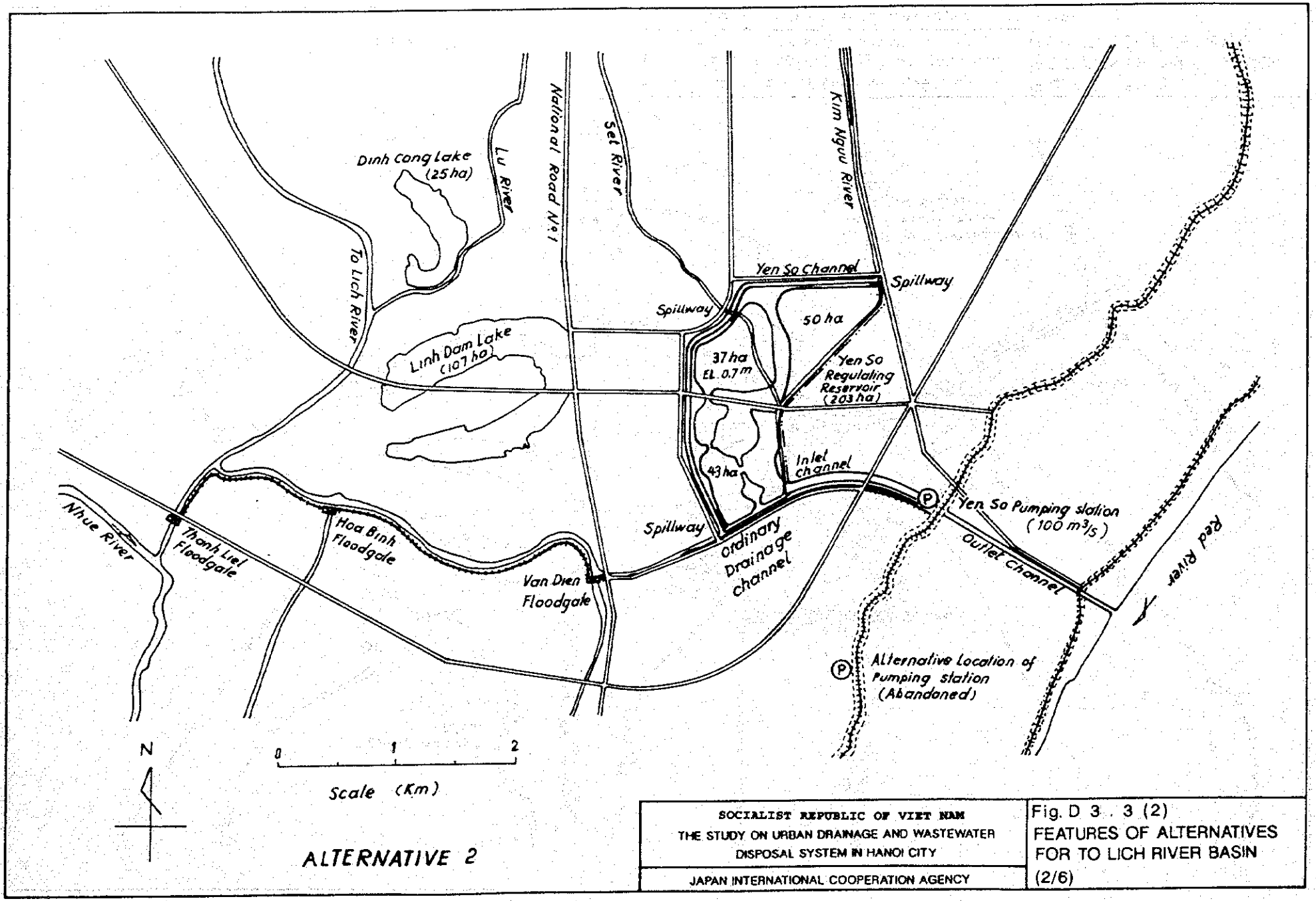
Fig. D 3 . 1 RIVER BASINS



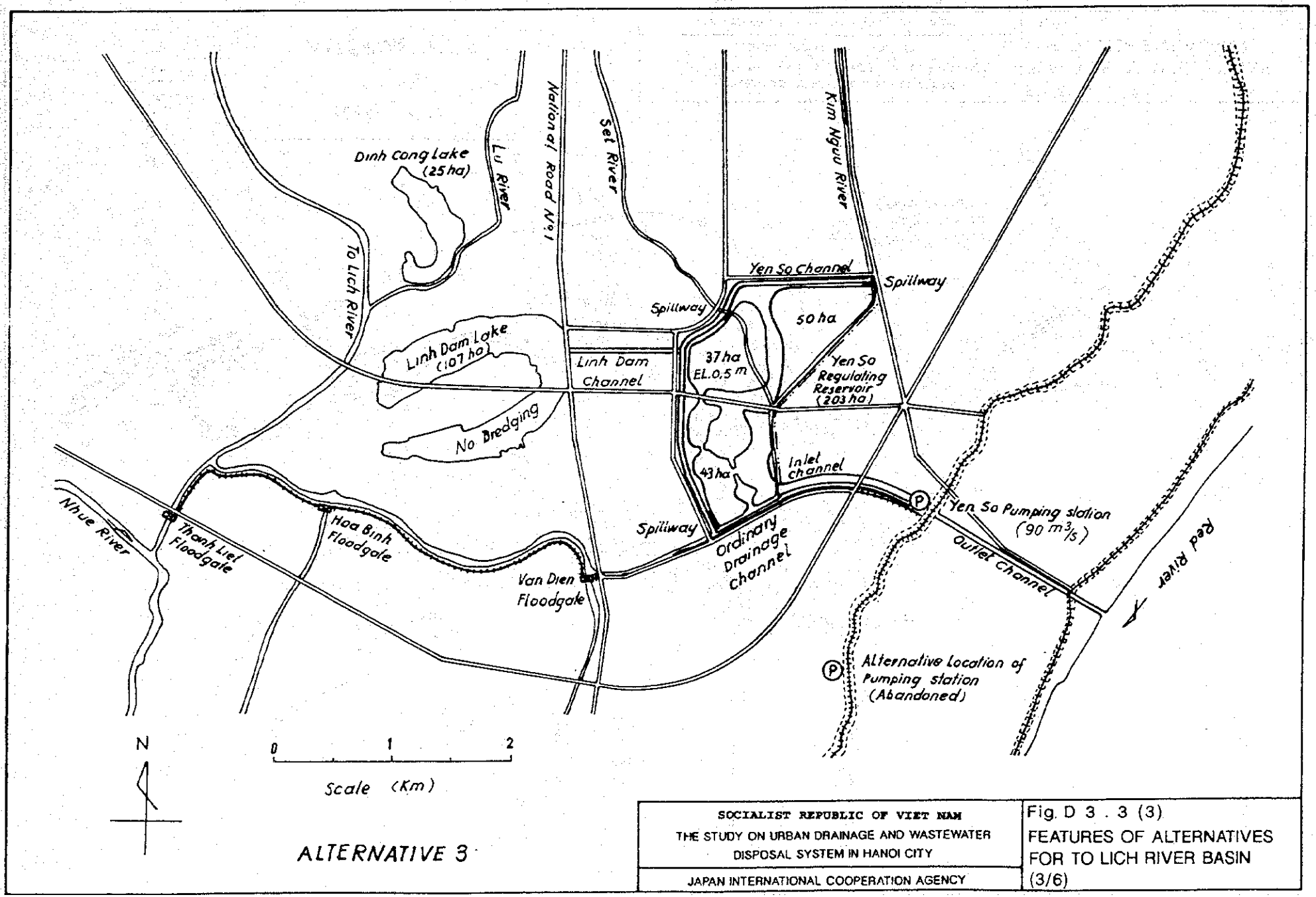
SOCIALIST REPUBLIC OF VIET NAM THE STUDY ON URAINAGE AND WASTEWATER DISPOSAL SYSTEM IN HANOI CITY JAPAN INTERNATIONAL COOPERETION AGENCY	Fig. D 3 . 2 LAYOUT PLAN OF URBAN DRAINAGE SYSTEM



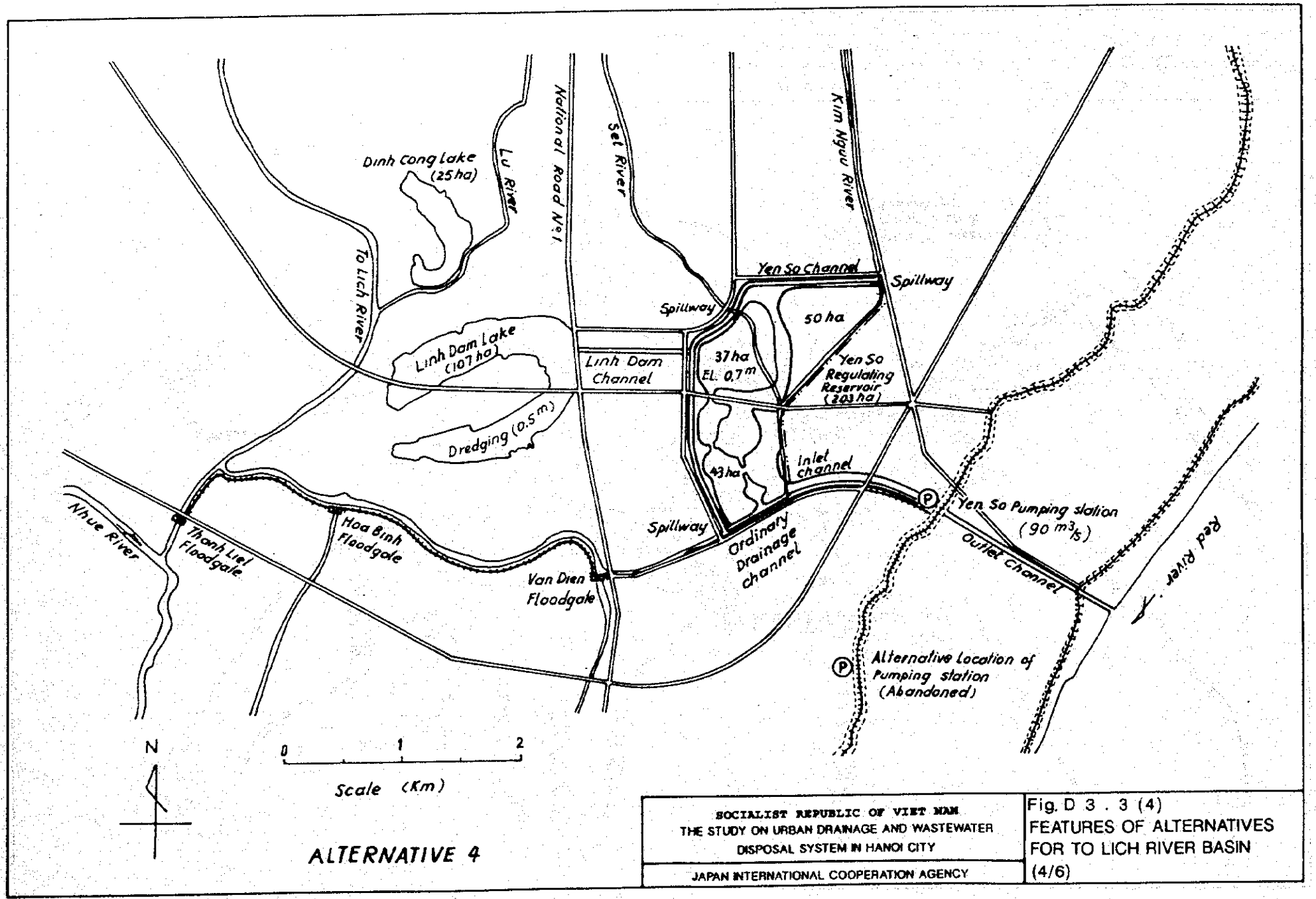
SOCIALIST REPUBLIC OF VIET NAM THE STUDY ON URBAN DRAINAGE AND WASTEWATER DISPOSAL SYSTEM IN HANOI CITY JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. D 3 . 3 (1) FEATURES OF ALTERNATIVES FOR TO LICH RIVER BASIN (1/6)



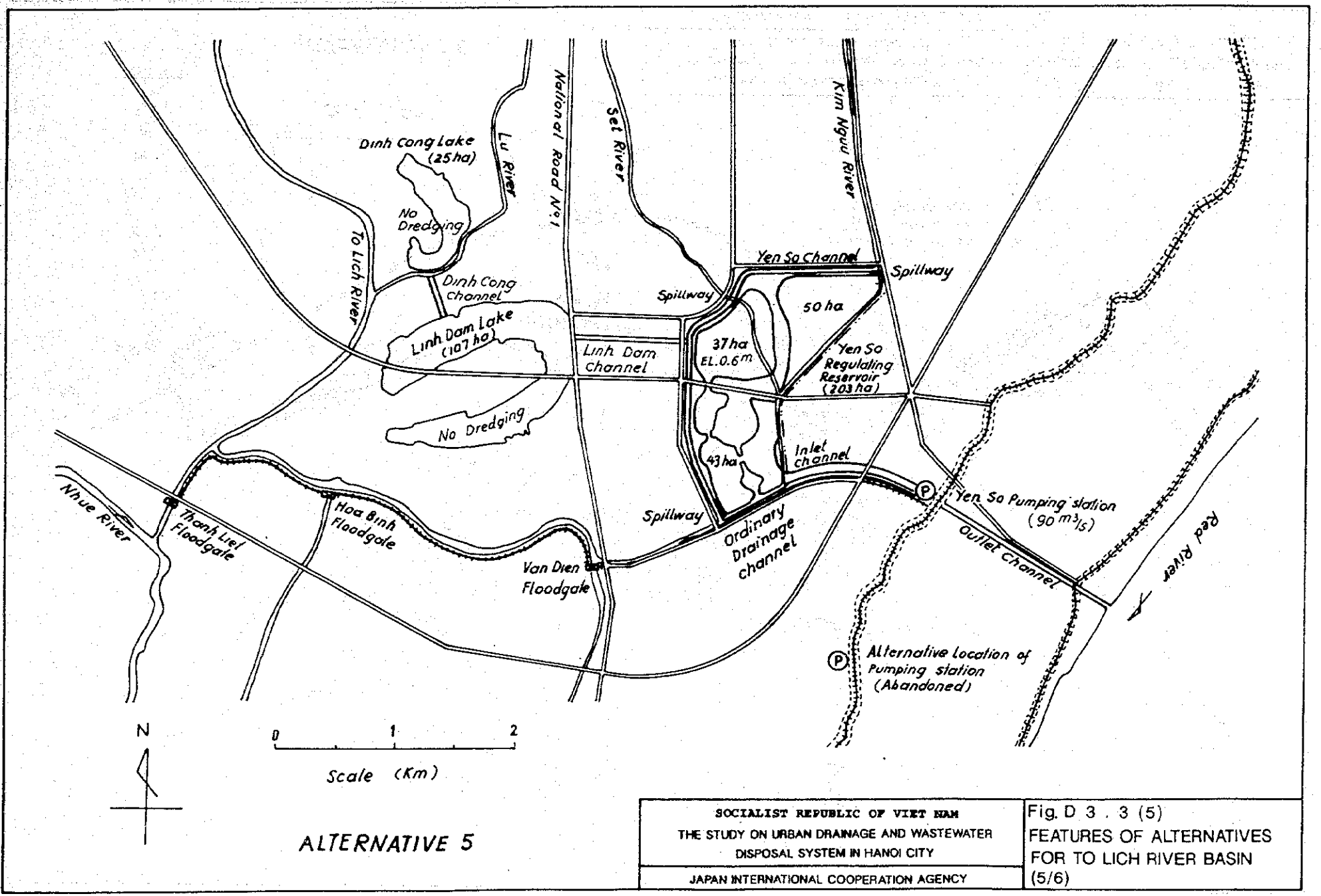
SOCIALIST REPUBLIC OF VIET NAM THE STUDY ON URBAN DRAINAGE AND WASTEWATER DISPOSAL SYSTEM IN HANOI CITY JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. D 3 . 3 (2) FEATURES OF ALTERNATIVES FOR TO LICH RIVER BASIN (2/6)



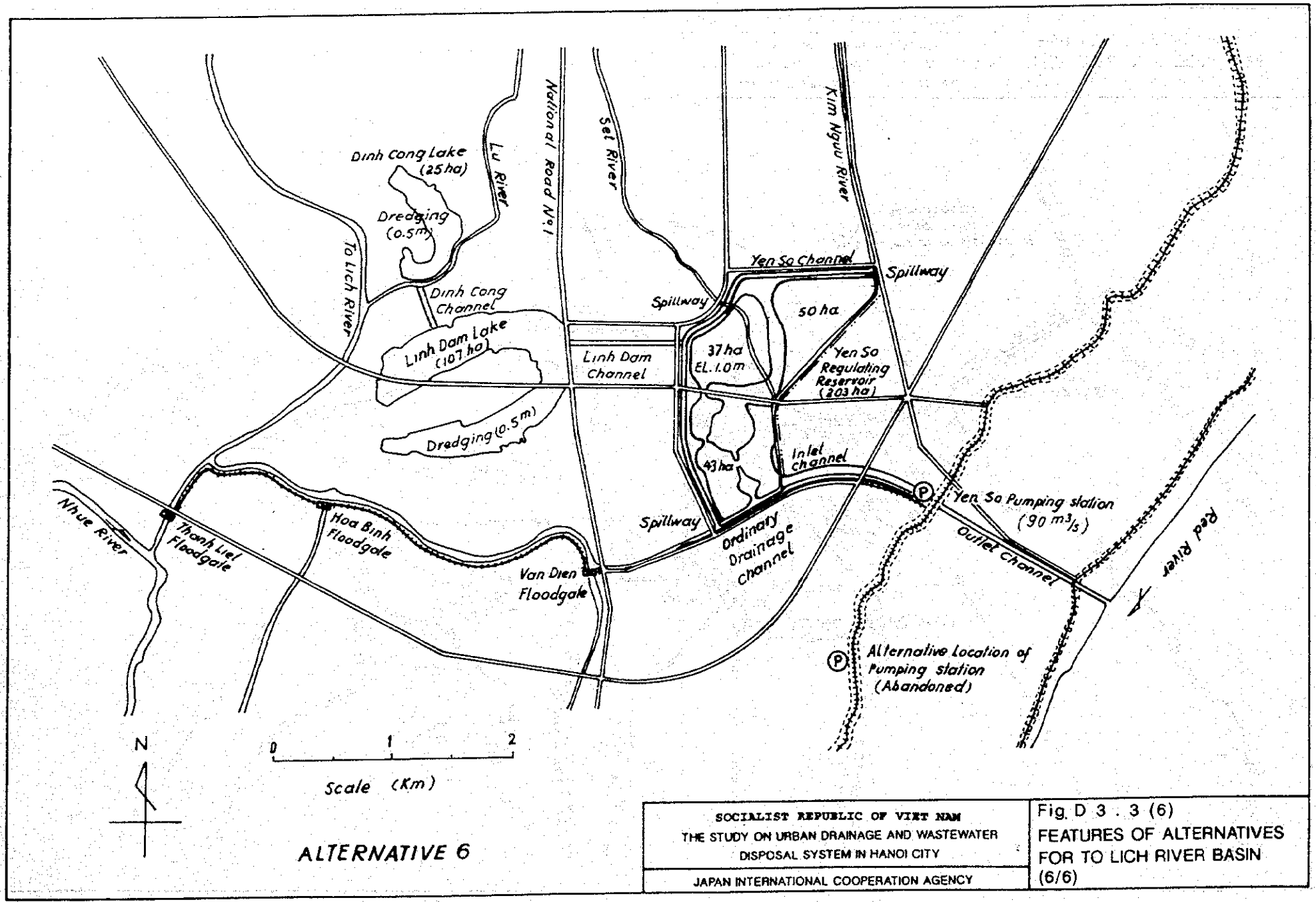
SOCIALIST REPUBLIC OF VIET NAM THE STUDY ON URBAN DRAINAGE AND WASTEWATER DISPOSAL SYSTEM IN HANOI CITY JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. D 3 . 3 (3) FEATURES OF ALTERNATIVES FOR TO LICH RIVER BASIN (3/6)



SOCIALIST REPUBLIC OF VIET NAM THE STUDY ON URBAN DRAINAGE AND WASTEWATER DISPOSAL SYSTEM IN HANOI CITY JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. D 3 . 3 (4) FEATURES OF ALTERNATIVES FOR TO LICH RIVER BASIN (4/6)



SOCIALIST REPUBLIC OF VIET NAM THE STUDY ON URBAN DRAINAGE AND WASTEWATER DISPOSAL SYSTEM IN HANOI CITY JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. D 3 . 3 (5) FEATURES OF ALTERNATIVES FOR TO LICH RIVER BASIN (5/6)



SOCIALIST REPUBLIC OF VIET NAM THE STUDY ON URBAN DRAINAGE AND WASTEWATER DISPOSAL SYSTEM IN HANOI CITY JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. D 3 . 3 (6) FEATURES OF ALTERNATIVES FOR TO LICH RIVER BASIN (6/6)

Most Economical Combination within Each Alternative

Alternative	Pump Capacity (m^3/s)	Regulation Reservoir (130ha)		Cost ($ 10^6)	Remarks
		Volume ($10^6 m^3$)	Bottom Elevation (m)		
1	110	3.60	0.7	121.1	Existing Condition
2	100	4.20	0.2	116.5	City Lake Dredging
3	90	4.51	0.0	118.2	Use of Linh Dam Lake
4	90	4.25	0.2	119.1	
5	90	4.38	0.1	116.8	Use of Linh Dam & Dinh Cong
6	90	3.87	0.5	112.5	

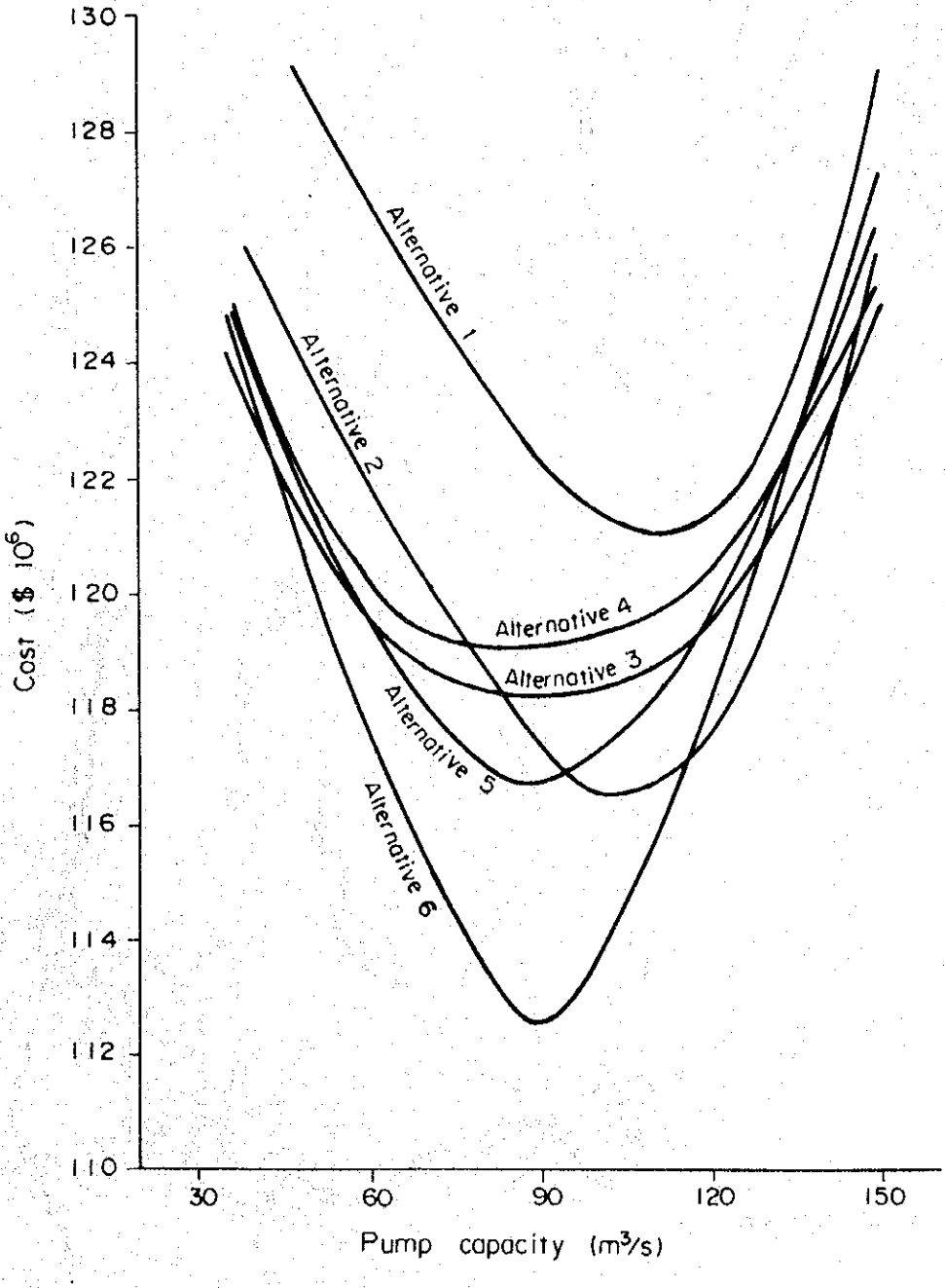


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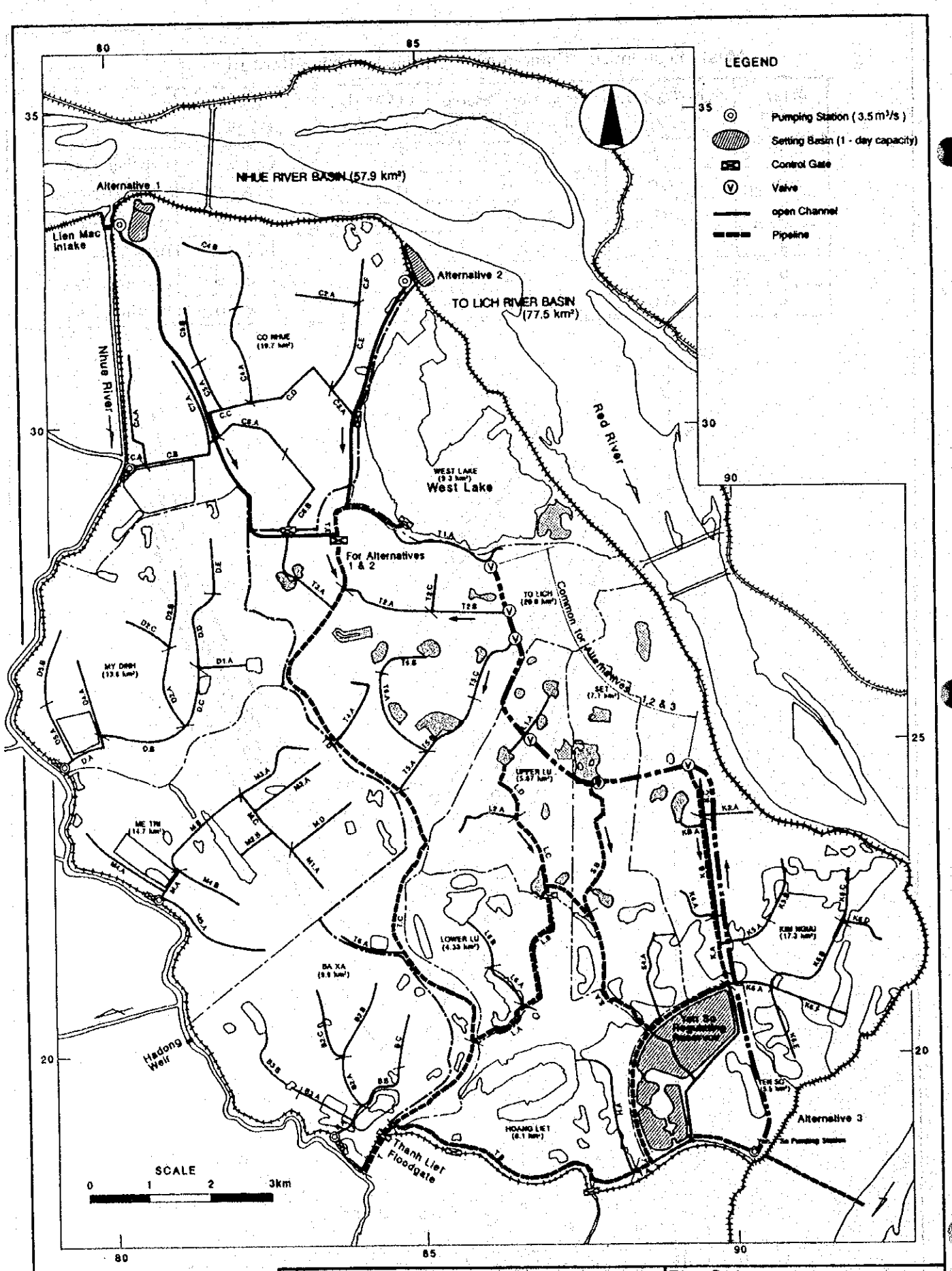
Fig. D 3.4
PUMP CAPACITY VS. COST CURVE



SOCIALIST REPUBLIC OF VIET NAM THE STUDY ON URBAN DRAINAGE AND WASTEWATER DISPOSAL SYSTEM IN HANOI CITY JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. D 3 5 ALTERNATIVE ROUTES FOR INTRODUCTION OF FLUSHING WATER