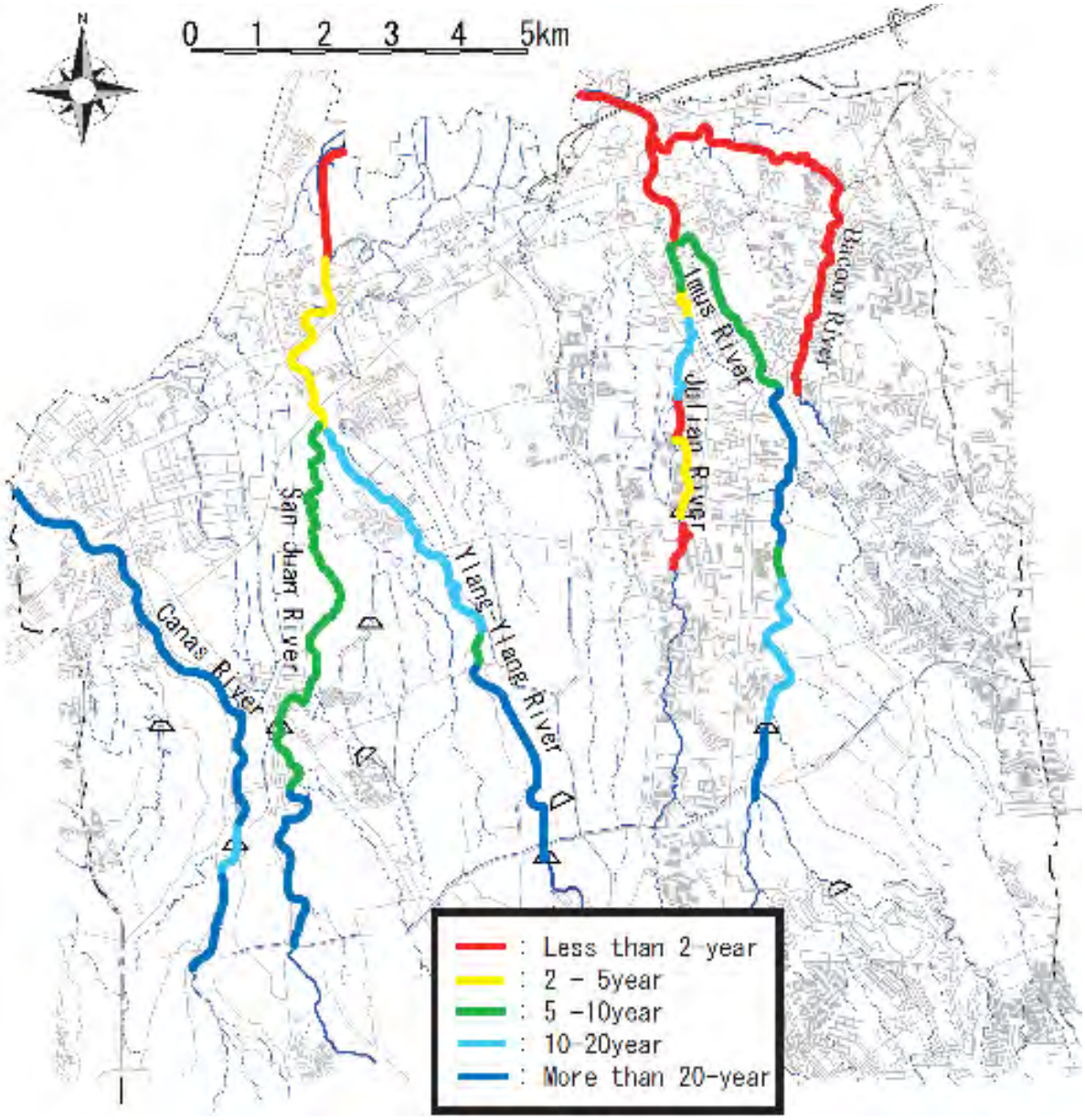
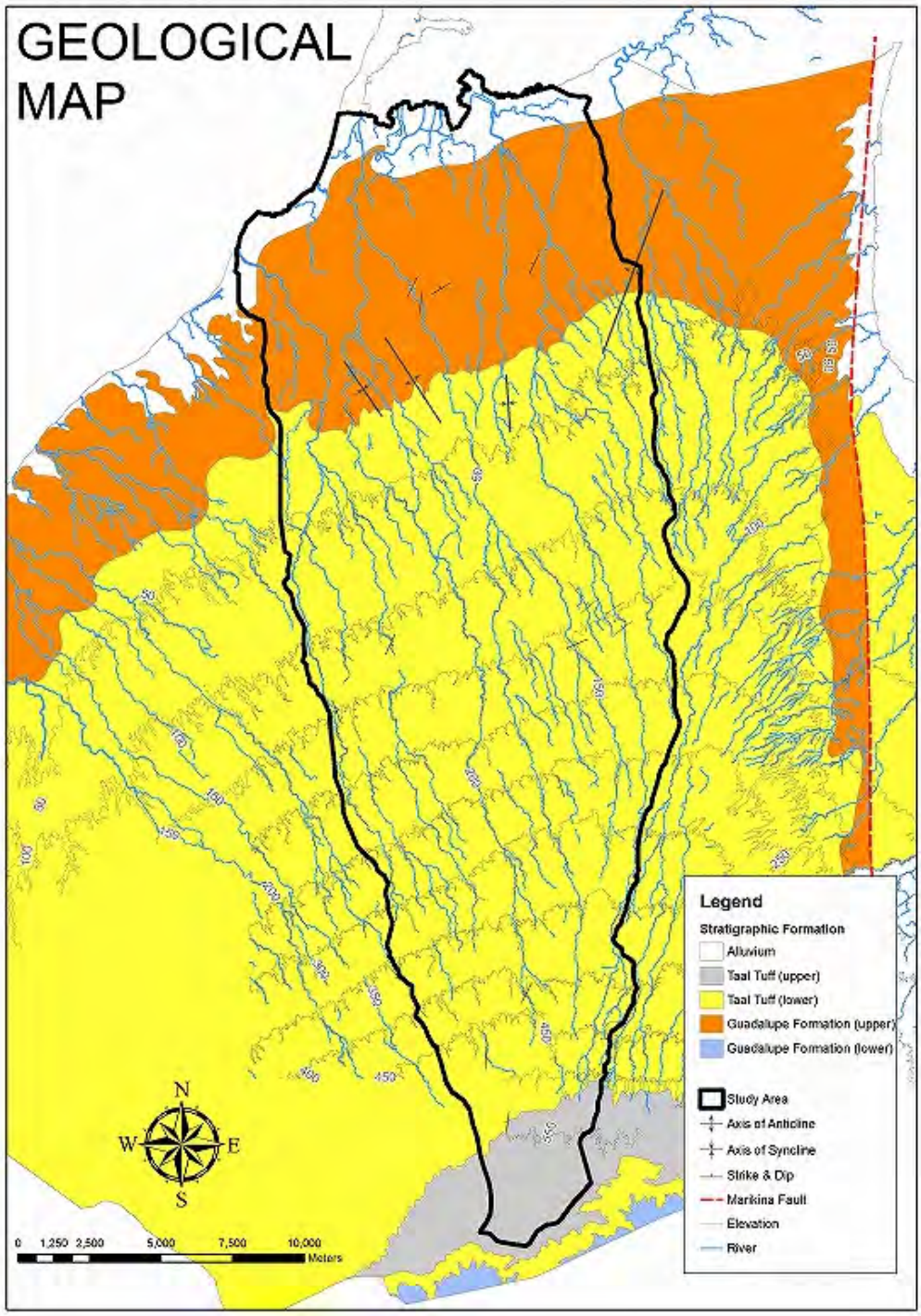


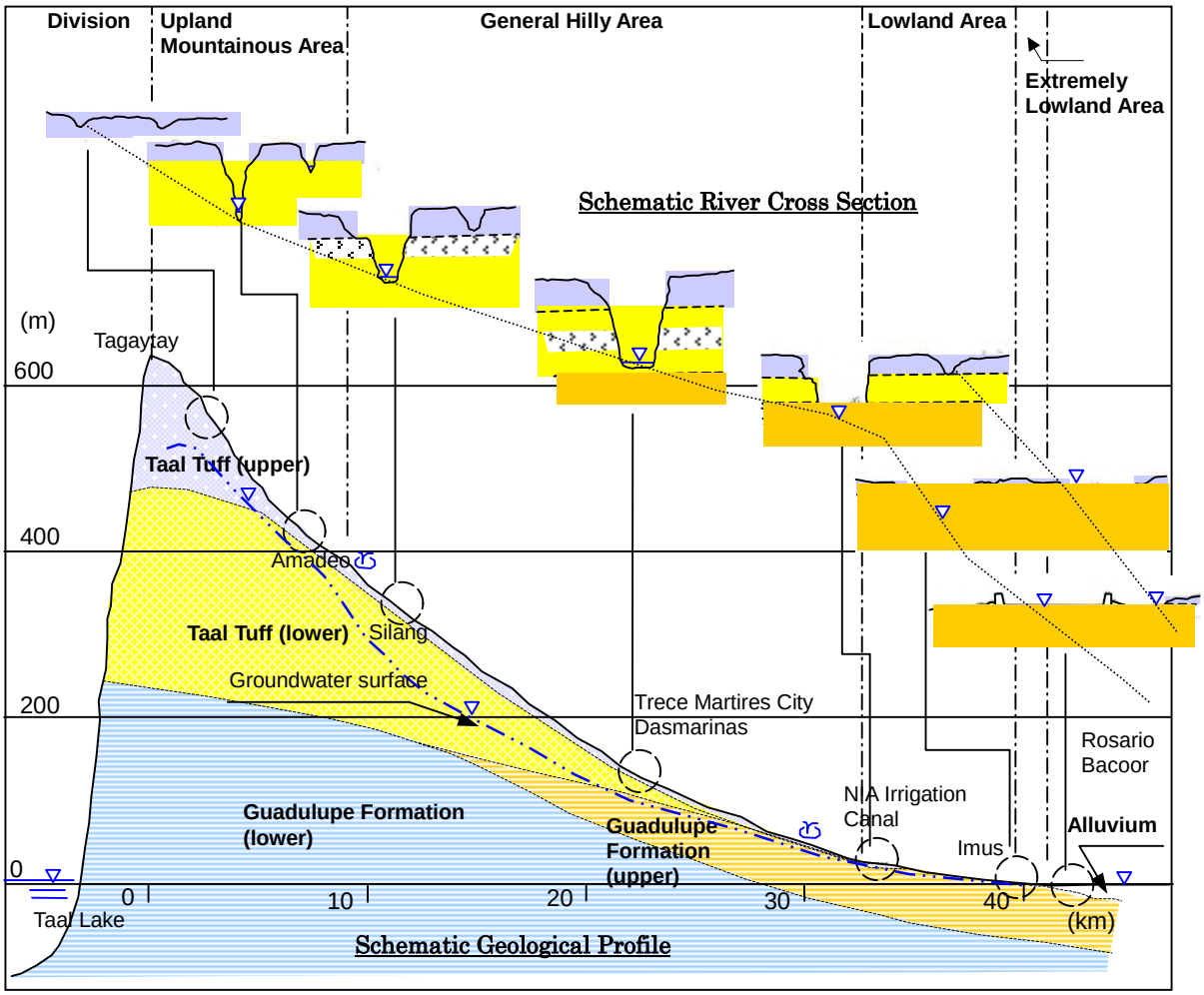
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA	Fig. 2.5 Flow Capacity of Rivers in the Study Area (in Present Land Use Condition)
CTI Engineering International Co., Ltd Nippon Koei Co., Ltd	



(Source: JICA Study Team)

Reference: "CAVITE (No. 3163 II)", "SILANG (No.3162 I)" and "MENDEZ-NUNEZ (No.3162 II)" published by published by MGS in 1982, and "CAVITE WATER SUPPLY DEVELOPMENT STUDY" conducted by JICA in 1995 (JICA, 1995)
Note: Although the Taal Tuff (upper) is unexpressed on the geological map except for Tagaytay area, it is extensively and thinly distributed on almost all of the Study Area.

THE STUDY ON COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA	Fig. 2.6
CTI Engineering International Co., Ltd. Nippon Koei Co., Ltd	Geological Map of Study Area

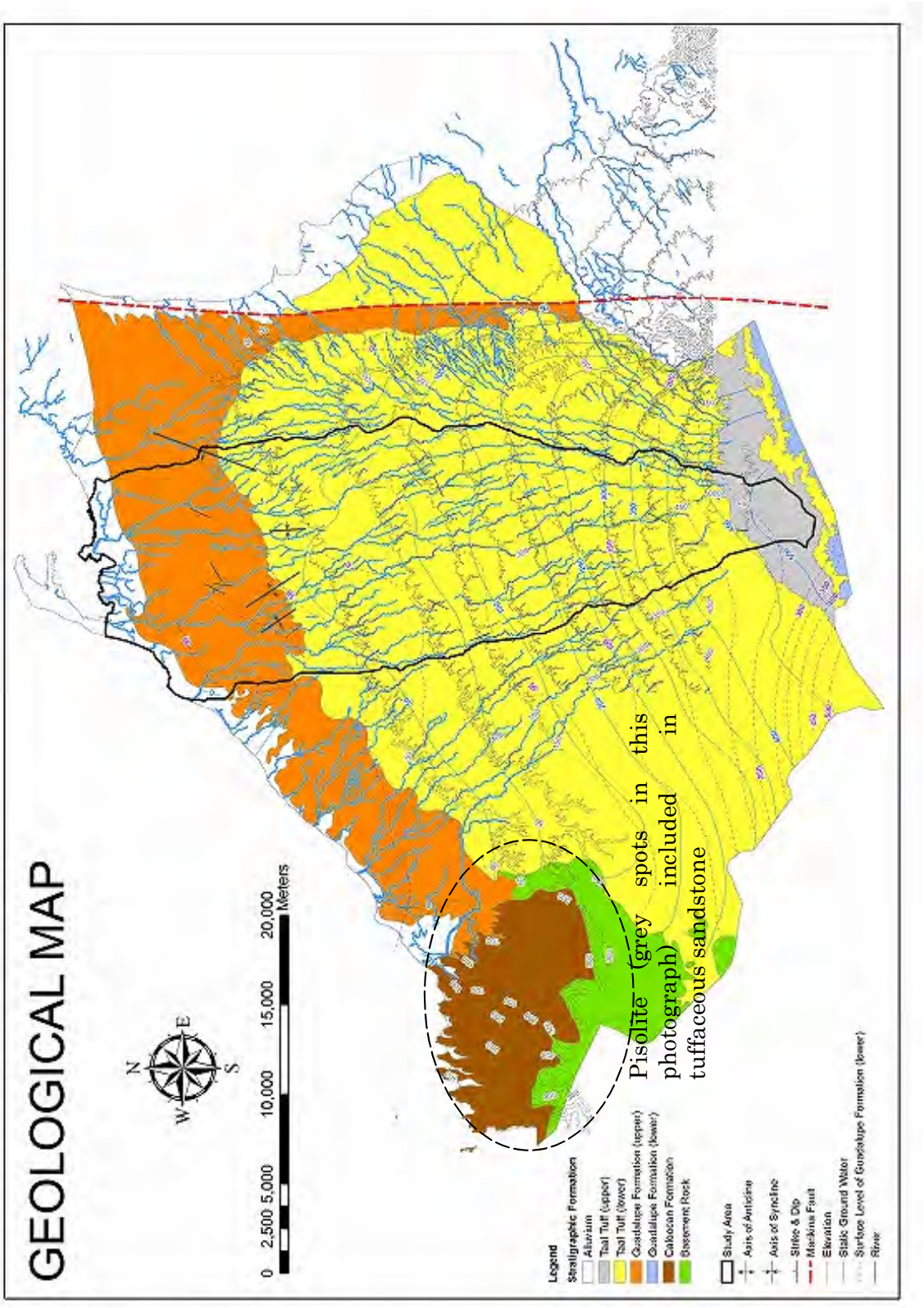


Division	Upland Mountain Area	General Hilly Area	Lowland Area	Extremely Lowland Area
1.Elevation (m)	More than 400	30-400	2-30	Less than 2
2. Ground slope (%)	More than 2	0.5-2	Less than 0.5	Almost flat
3.Topographic feature of Major Rivers				
Width of riverbed	Little	Medium	Large	Large
Height of riverbank	Low	High	Medium	Medium
4. Geology				
Top layer	Taal Tuff (upper) Very soft	Taal Tuff (upper) Very soft	Taal Tuff (upper) Very soft	Alluvium loose
Riverbed/Riverbank	Taal Tuff (upper) Very soft	Taal Tuff (lower) Moderately hard	Guadalupe F. (upper) Moderately hard	Guadalupe F. (upper) Moderately hard
5.Groundwater surface	Low-medium	Low-medium	High	High

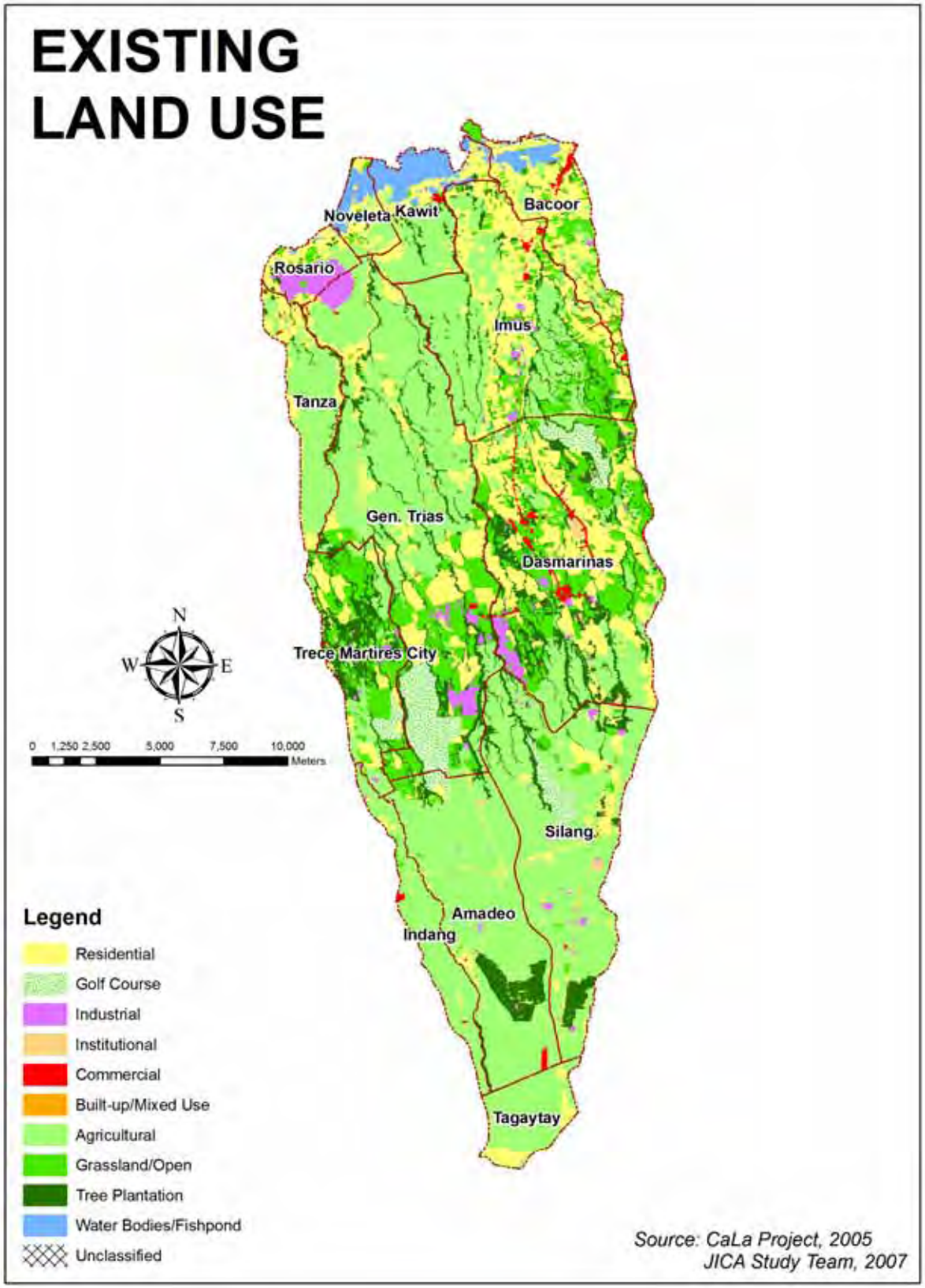
(Source: JICA Study Team)

Reference: “CAVITE (No. 3163 II)”, “SILANG (No.3162 I)” and “MENDEZ-NUNEZ (No.3162 II)” published by published by MGS in 1982, and “CAVITE WATER SUPPLY DEVELOPMENT STUDY” conducted by JICA in 1995

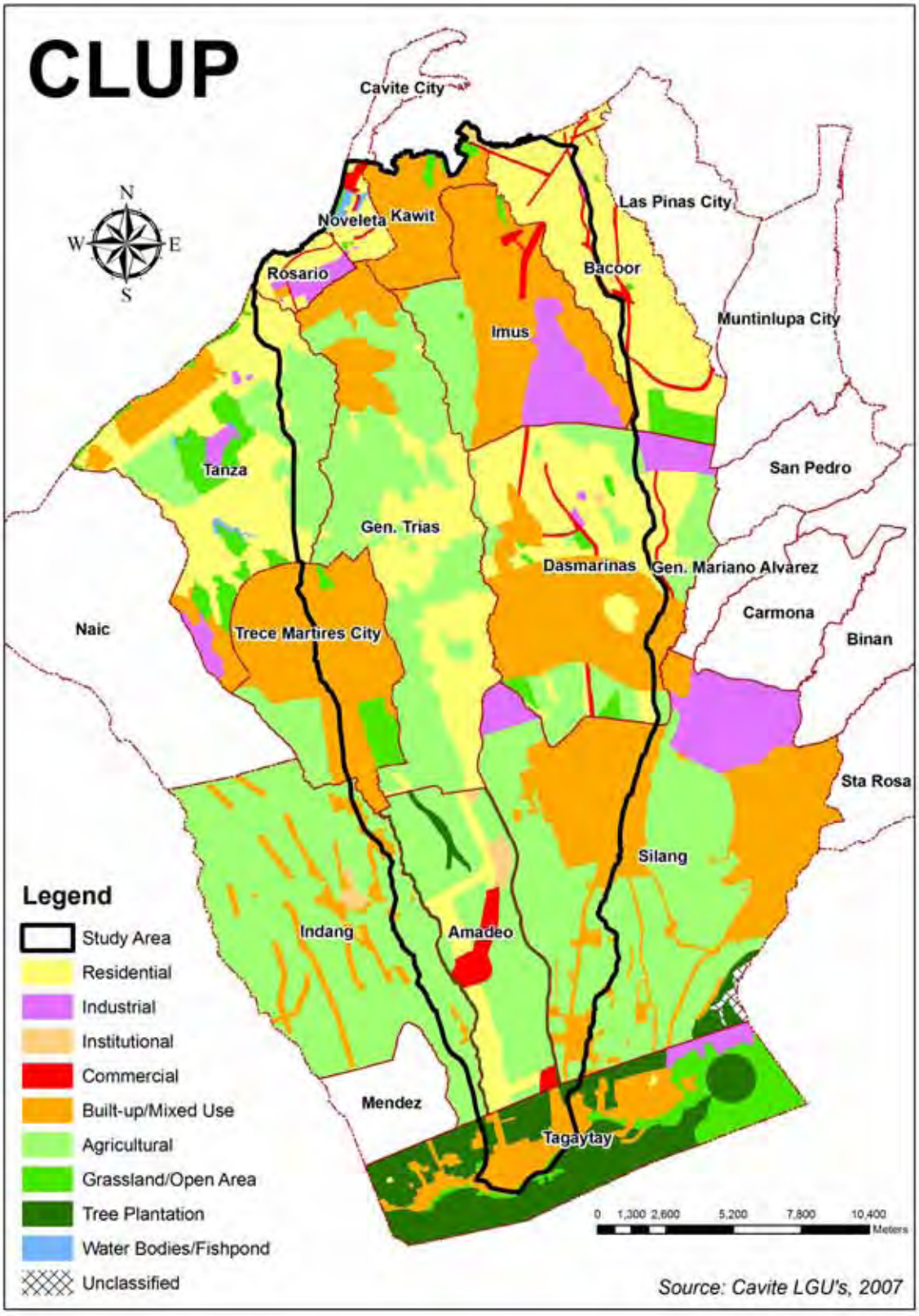
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA	Fig. 2.7
CTI Engineering International Co., Ltd. Nippon Koei Co., Ltd	Schematic Geological Profile and Cross Section of Study Area



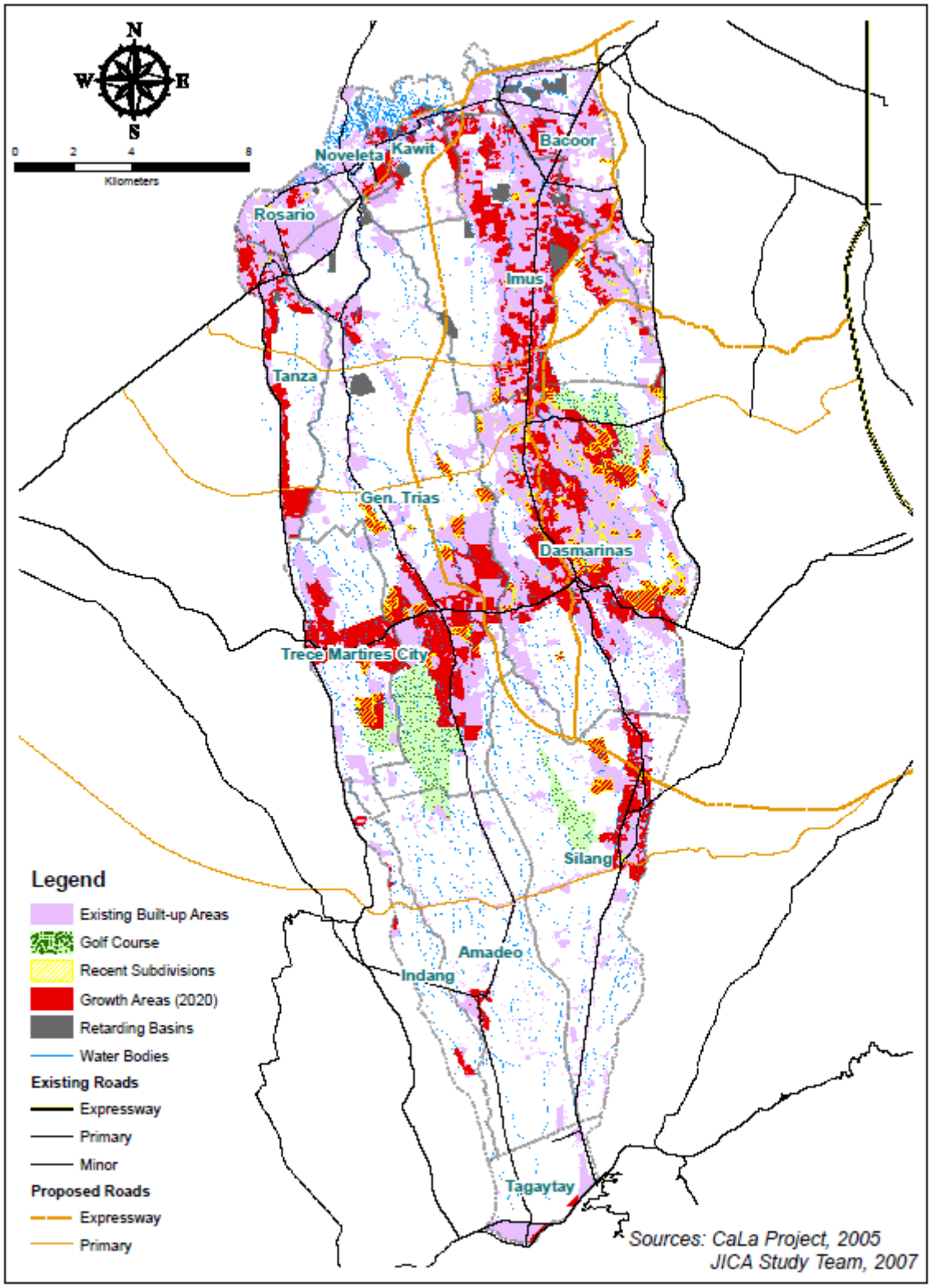
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA	Fig. 2.8 Regional Geology
CTI Engineering International Co., Ltd. Nippon Koei Co., Ltd	



THE STUDY ON COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA	Fig. 3.1
CTI Engineering International Co., Ltd. Nippon Koei Co., Ltd	Existing Land Use in the Study Area

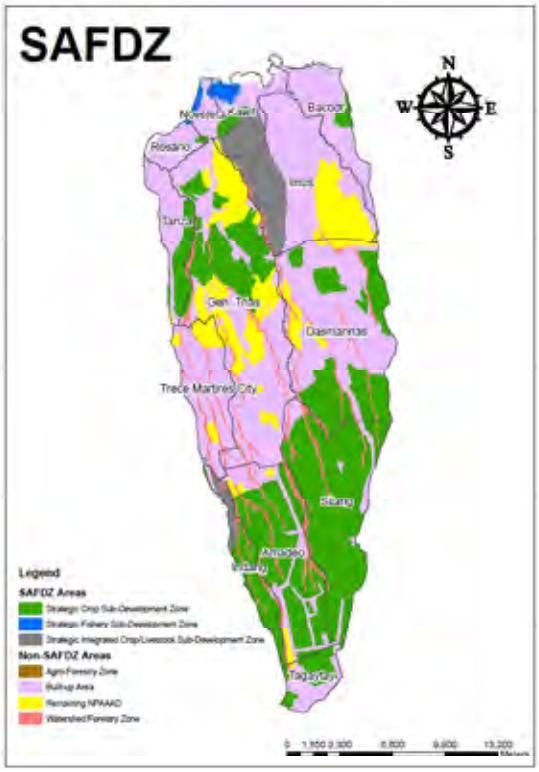


THE STUDY ON COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA	Fig. 4.1
CTI Engineering International Co., Ltd. Nippon Koei Co., Ltd	Future land Use Plan Projected by City/Municipalities

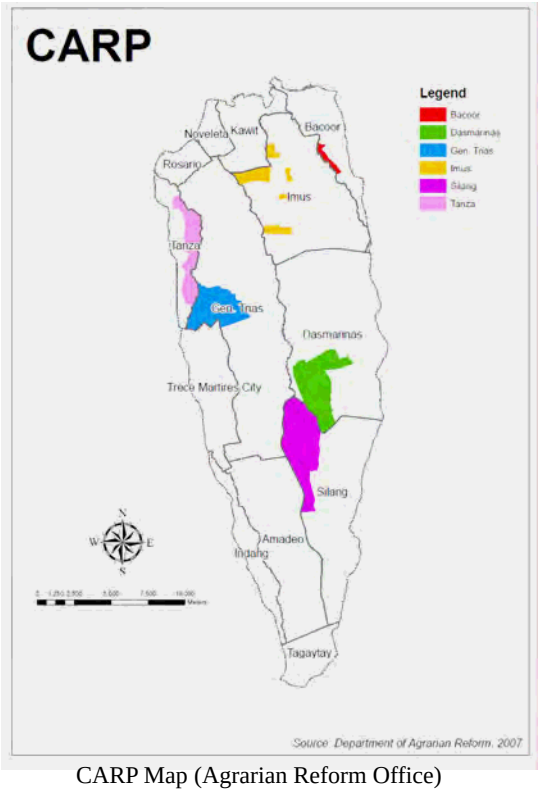


THE STUDY ON COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA	Fig. 4.2 Proposed Land Use Plan
CTI Engineering International Co., Ltd. Nippon Koei Co., Ltd	

Soil Analysis Map: more than 15%, (NAMRIA)



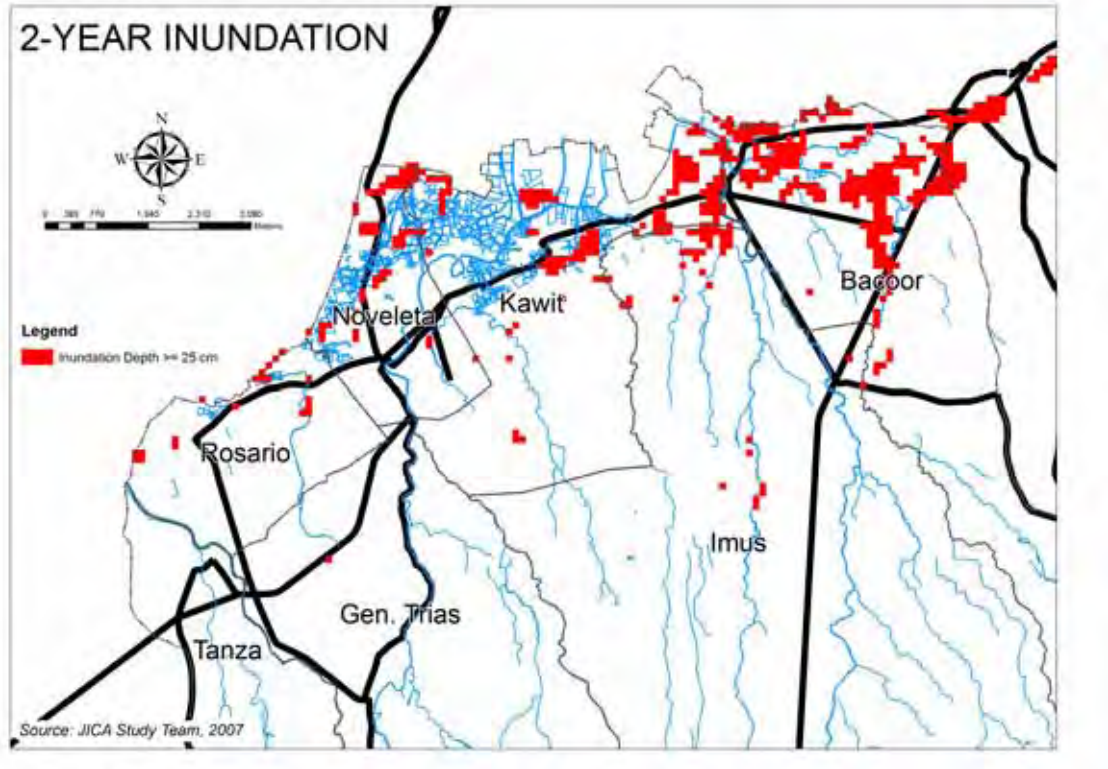
SAFDS Map (Office of the Provincial Agriculturist)



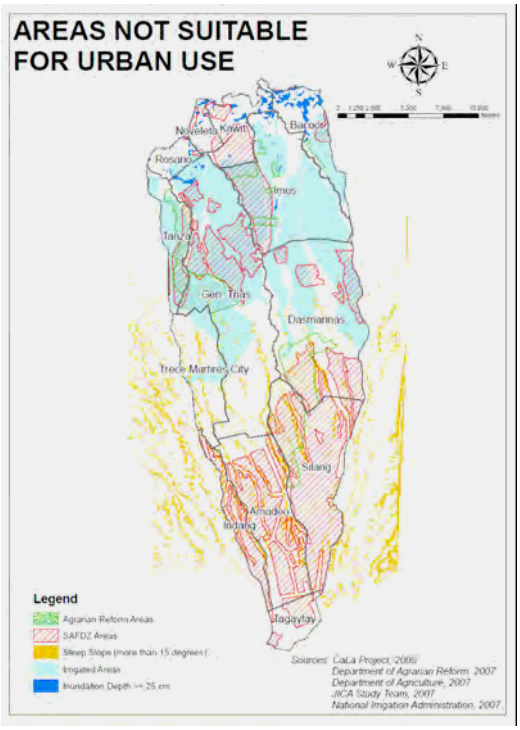
CARP Map (Agrarian Reform Office)

NIA Map (National Irrigation Administration, Naic)

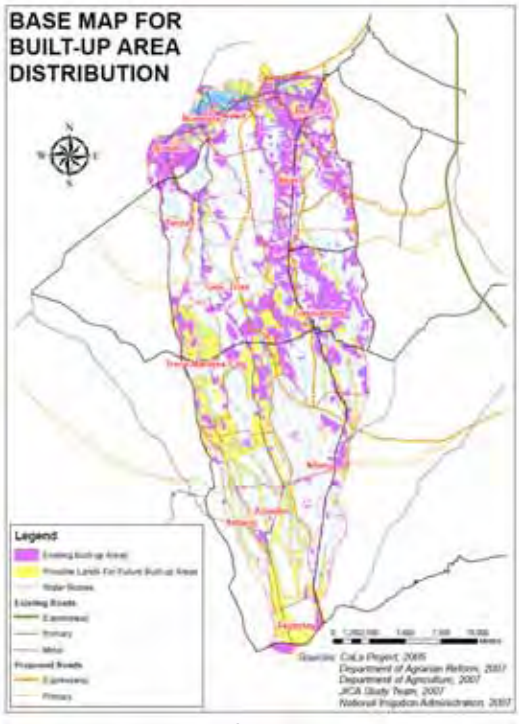
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA	Fig. 4.3 (1/2)
CTI Engineering International Co., Ltd. Nippon Koei Co., Ltd	Area not Suitable for Future Built-up Area



Inundation Map 2-yr, (JICA Study Team)

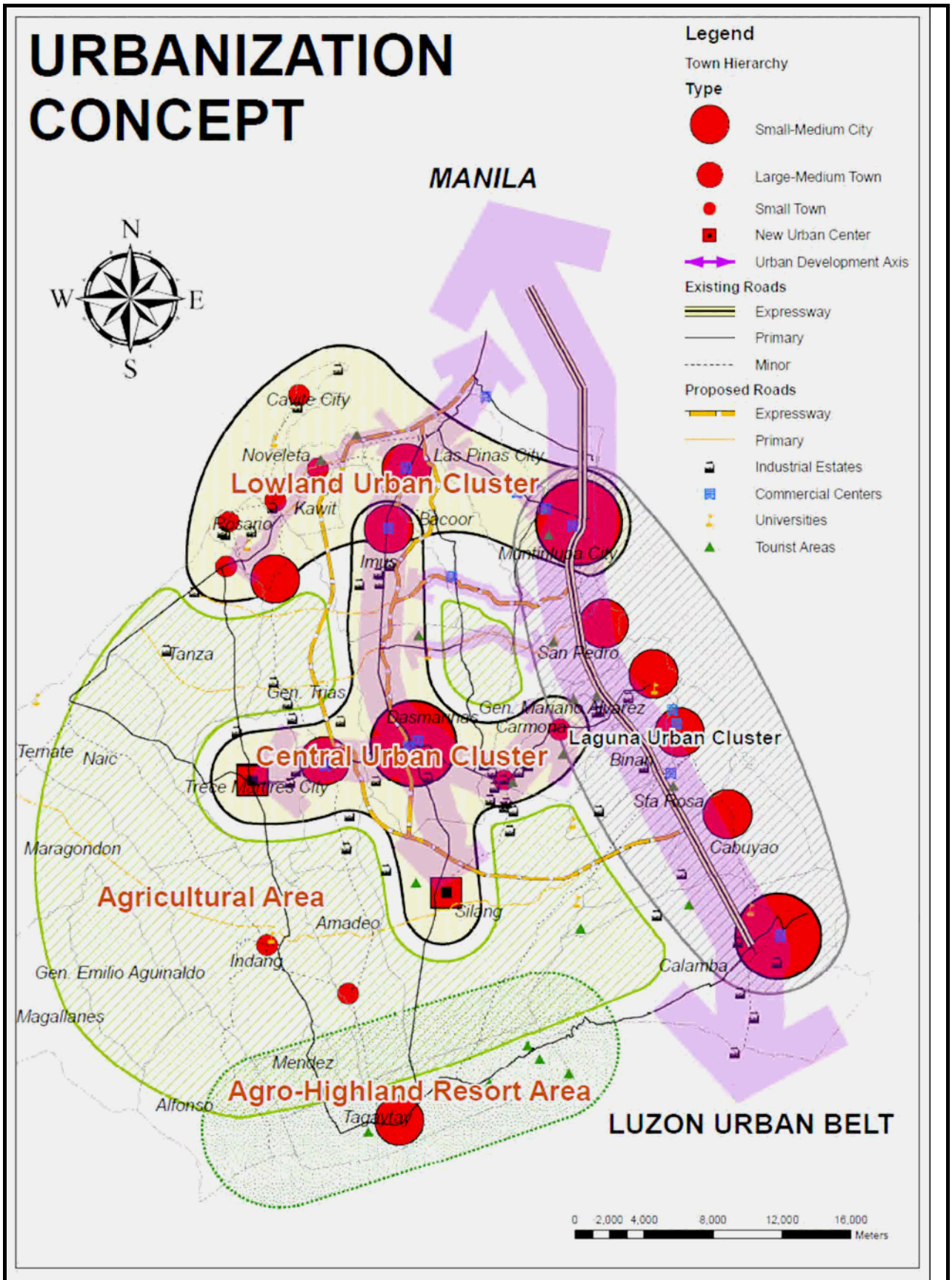


Map of Area not Suitable for Urban Use
(Overlay of above information)

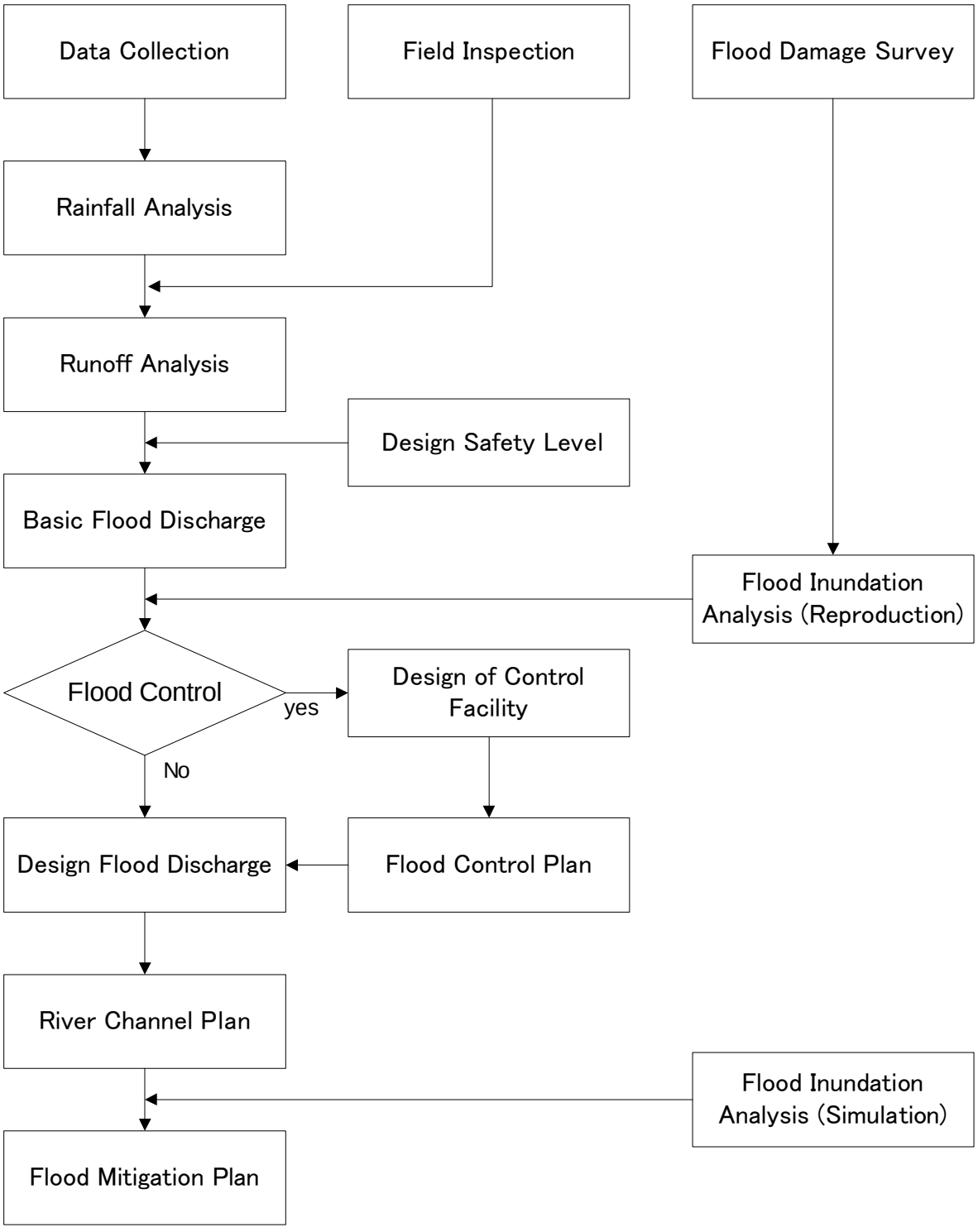


NIA Map
(National Irrigation Administration, Naic)

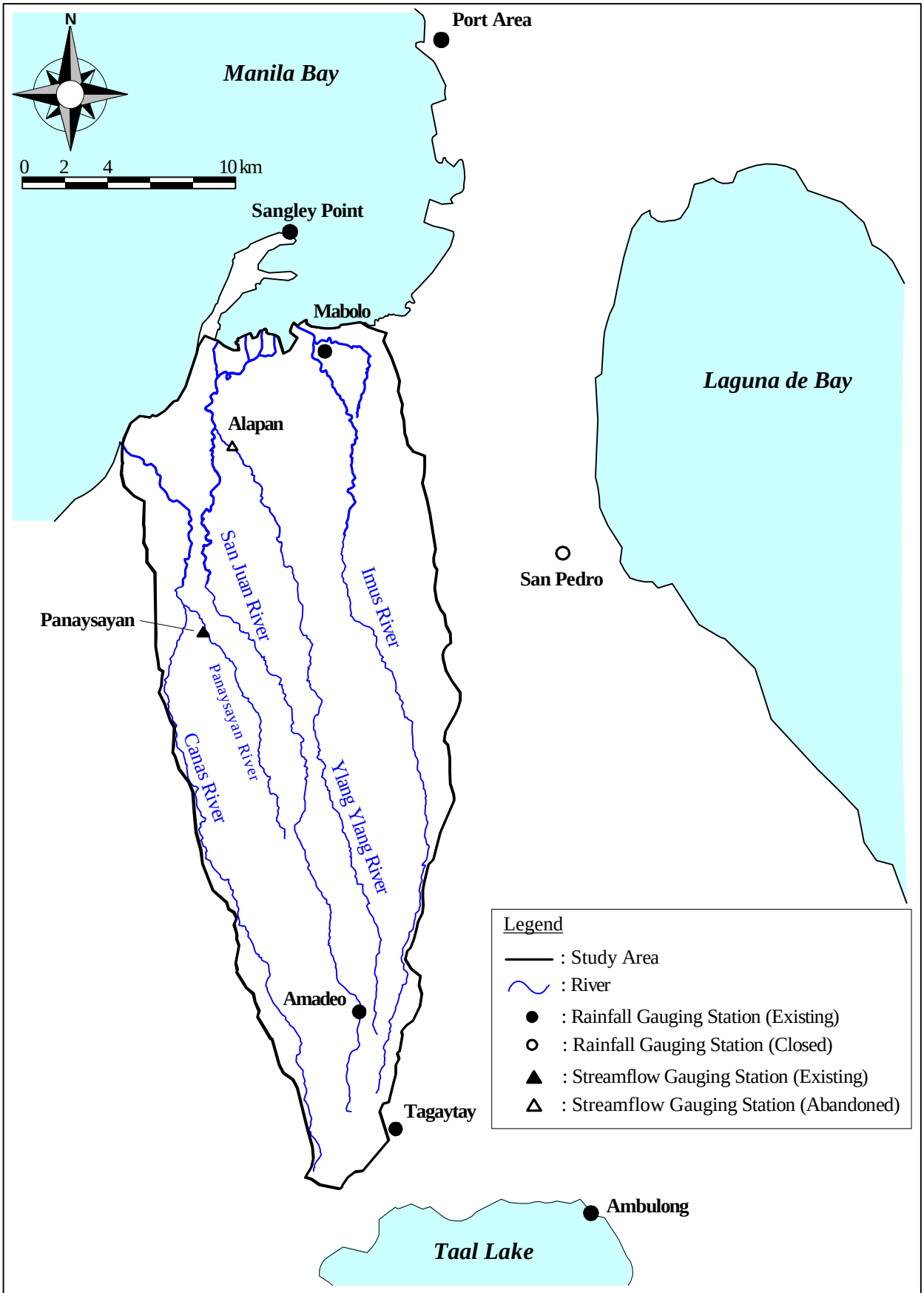
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA	Fig. 4.3 (2/2) Area not Suitable for Future Built-up Area
CTI Engineering International Co., Ltd. Nippon Koei Co., Ltd	



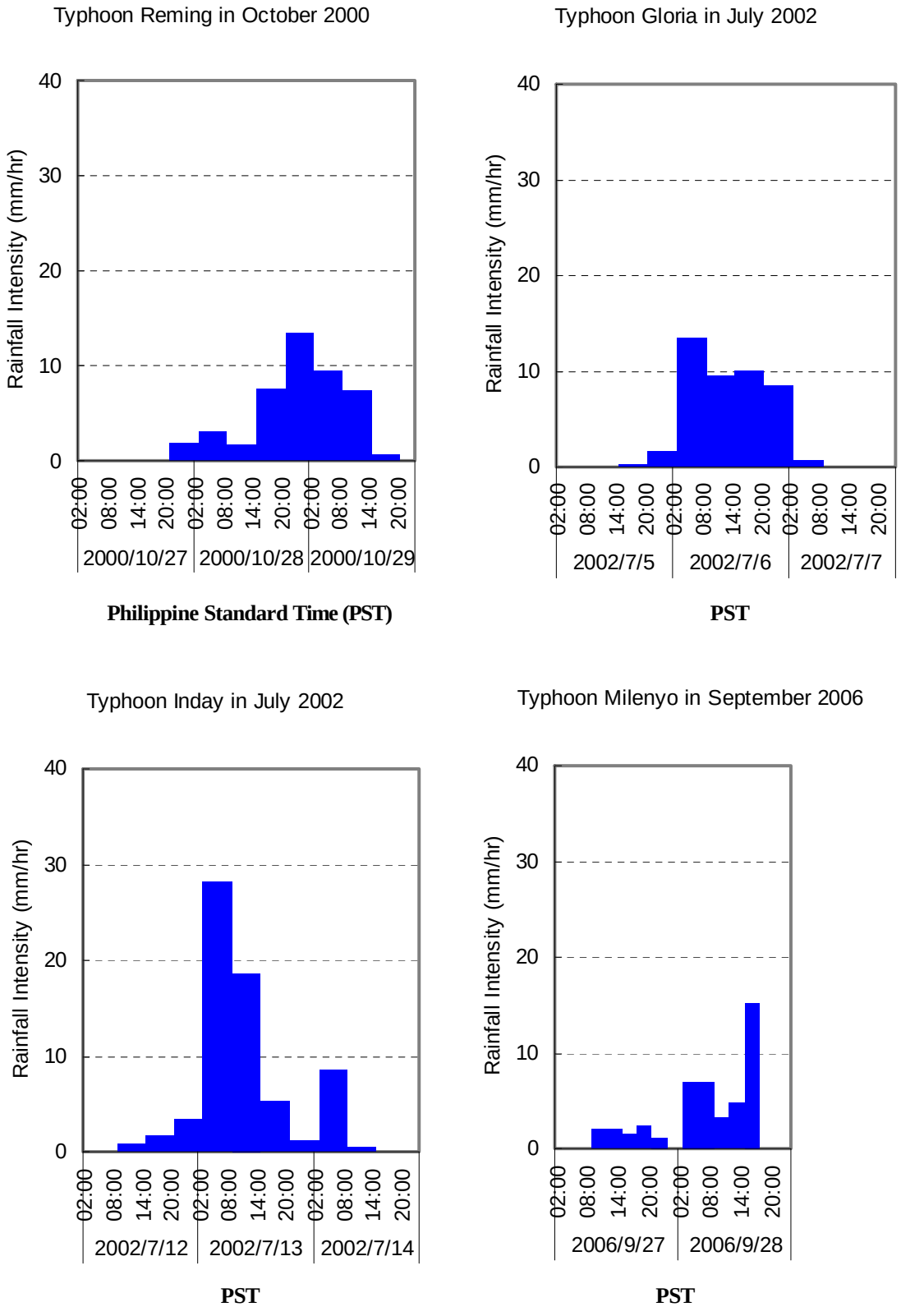
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA	Fig. 4.4 Principal Concept of Urbanization in the Study Area
CTI Engineering International Co., Ltd. Nippon Koei Co., Ltd	



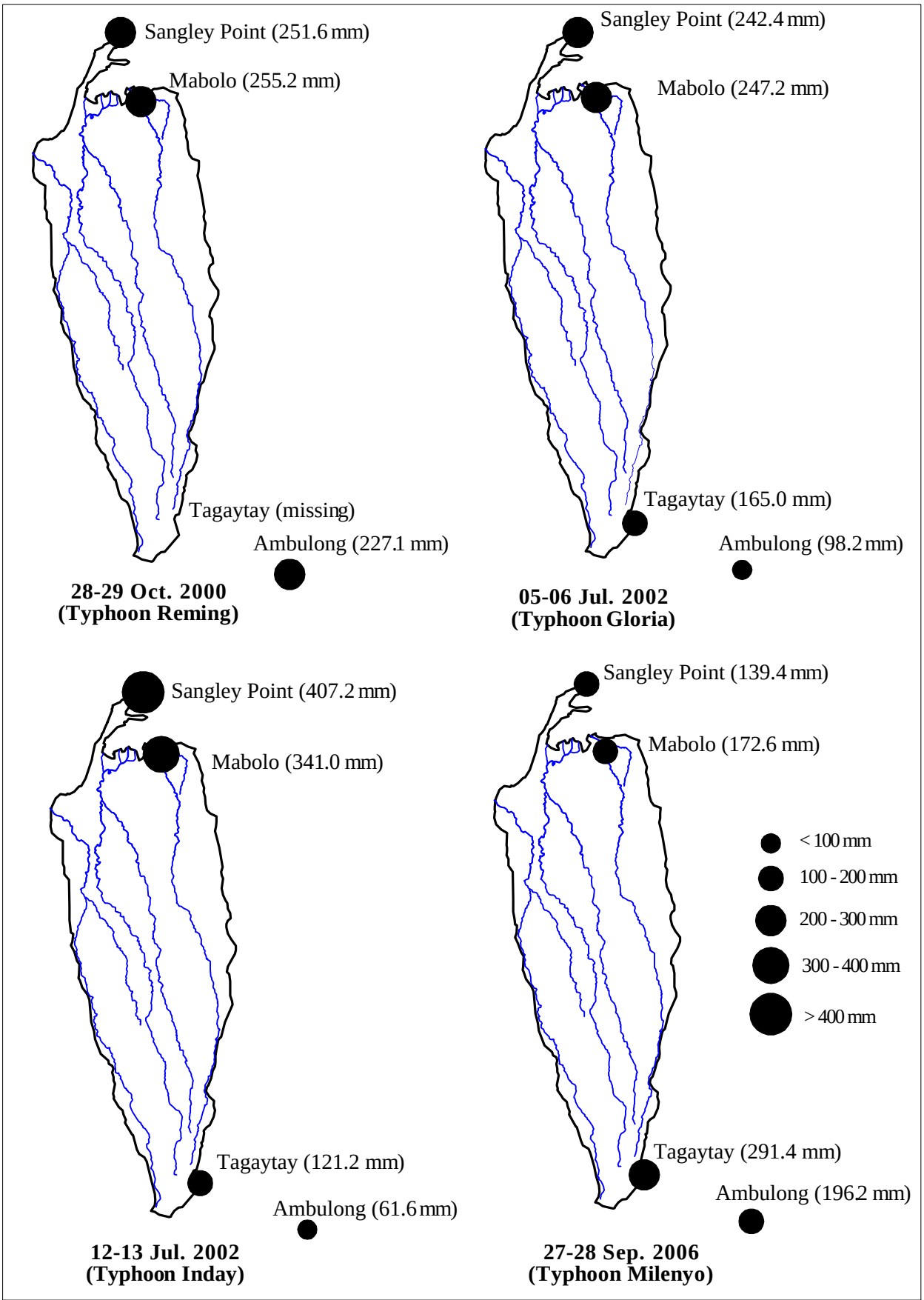
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA	Fig. 5.1
CTI Engineering International Co.,Ltd. Nippon Koei Co., Ltd	Flowchart of Hydrological Analysis



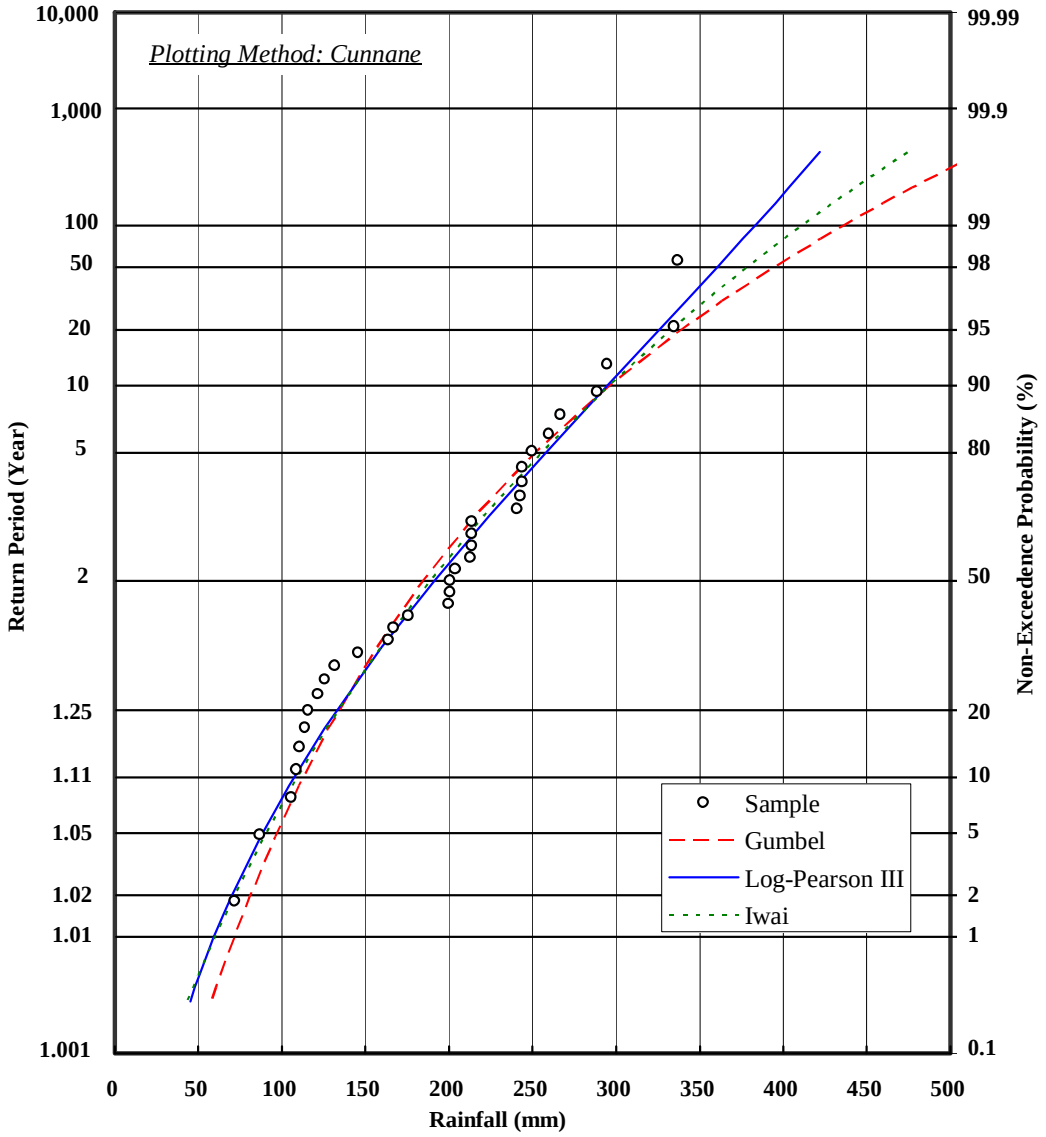
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA	Fig. 5.2 Location of Rainfall and Streamflow Gauging Stations
CTI Engineering International Co.,Ltd. Nippon Koei Co., Ltd.	



THE STUDY ON COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA	Fig. 5.3 Hyetograph at Sangley Point Station during Four Typhoons in 2000, 2002 and 2006
CTI Engineering International Co.,Ltd. Nippon Koei Co., Ltd.	



THE STUDY ON COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA	Fig. 5.4 Distribution of 2-day Rainfall during Four Typhoons in 2000, 2002 and 2006
CTI Engineering International Co.,Ltd. Nippon Koei Co., Ltd.	



(Unit: mm)

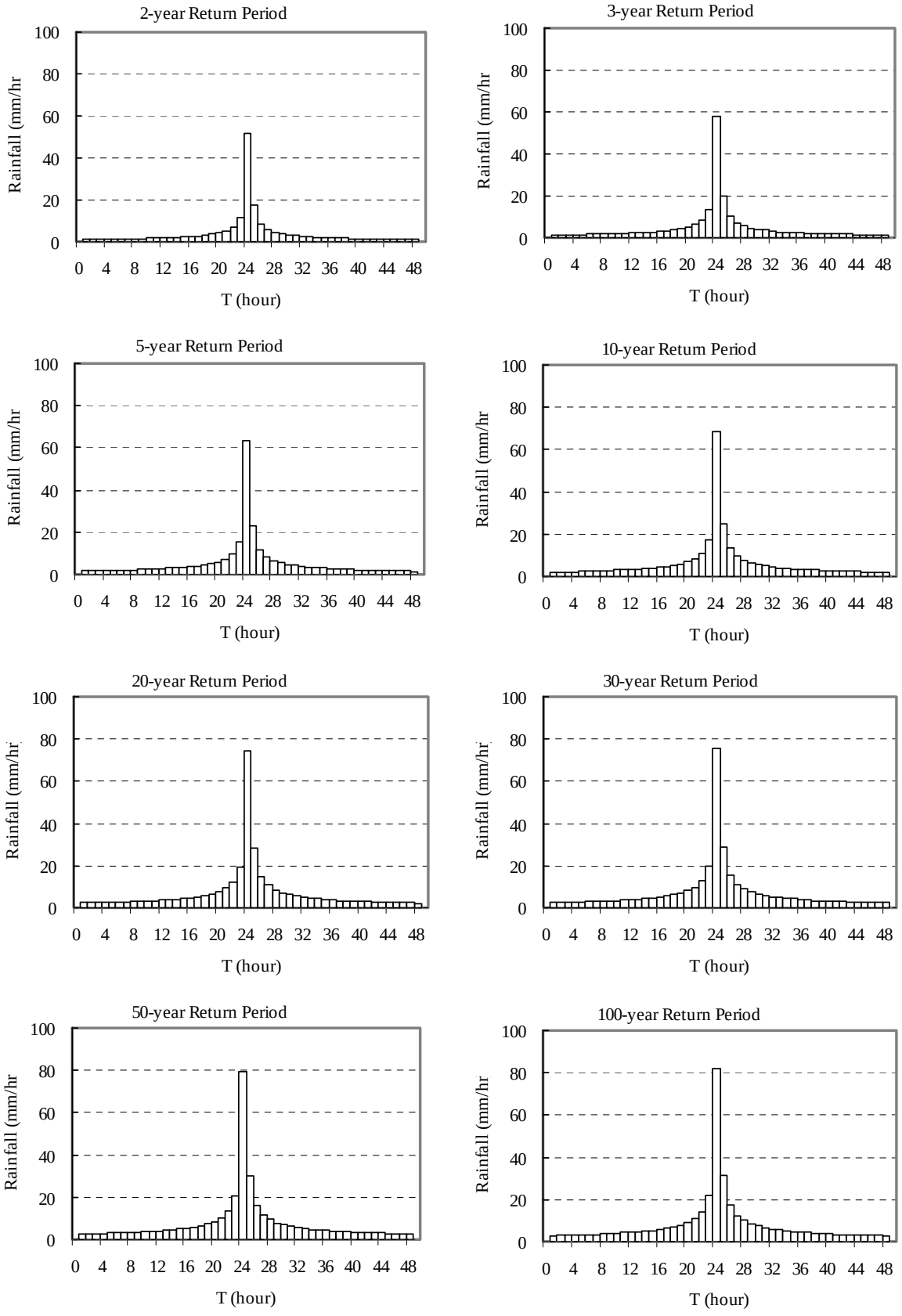
Return Period (year)	Gumbel	Log-Pearson III	Iwai
2	184	191	188
3	216	224	221
5	251	258	255
10	296	295	296
20	339	326	333
30	363	342	353
50	394	360	378
80	422	376	400
100	436	383	411
150	460	395	430
200	477	404	443
Correlation	0.970	0.987	0.981

THE STUDY ON
COMPREHENSIVE FLOOD MITIGATION
FOR CAVITE LOWLAND AREA

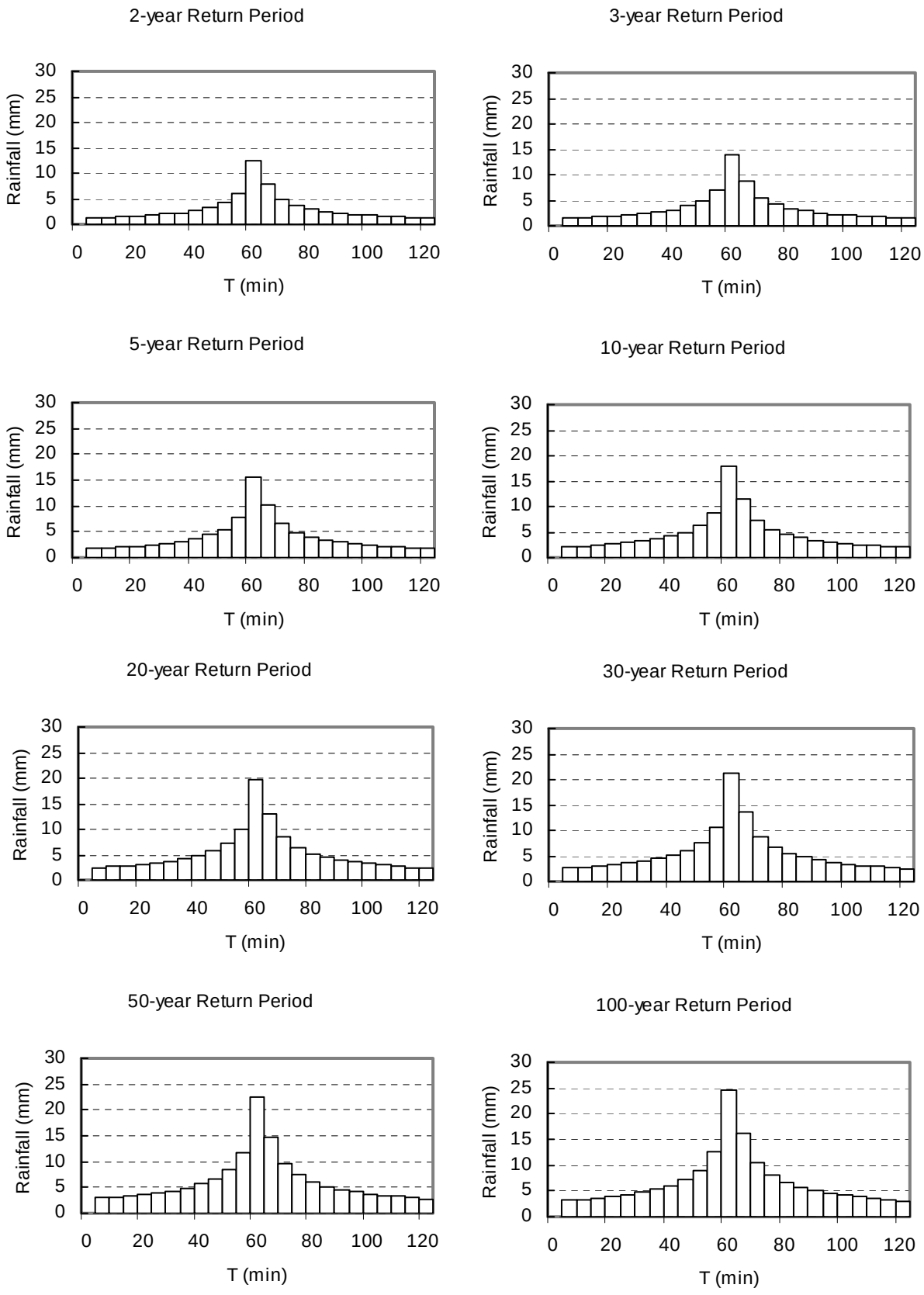
CTI Engineering International Co.,Ltd.
Nippon Koei Co., Ltd.

Fig. 5.5

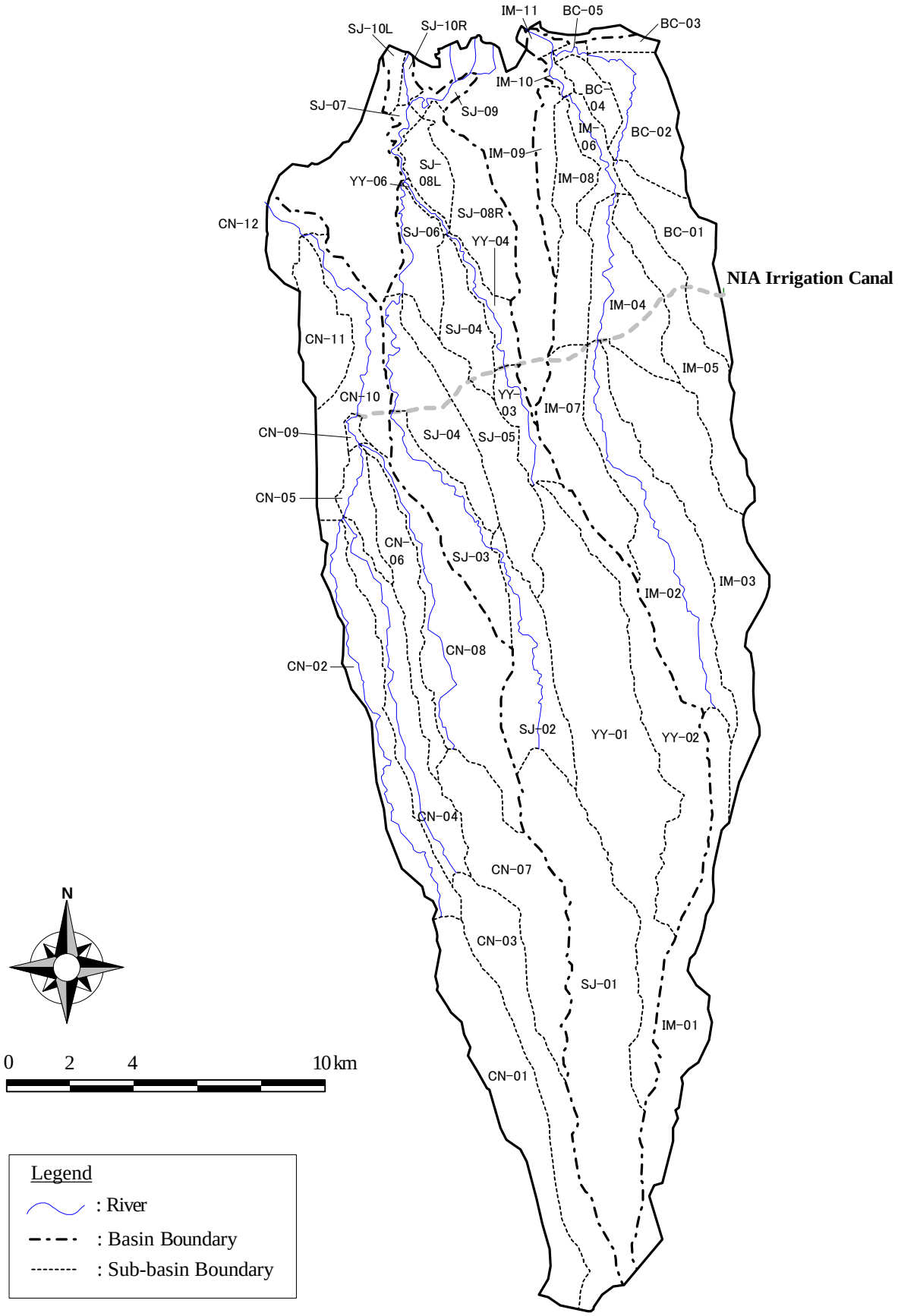
Results of Frequency Analysis on Basin Mean 2-day Rainfall



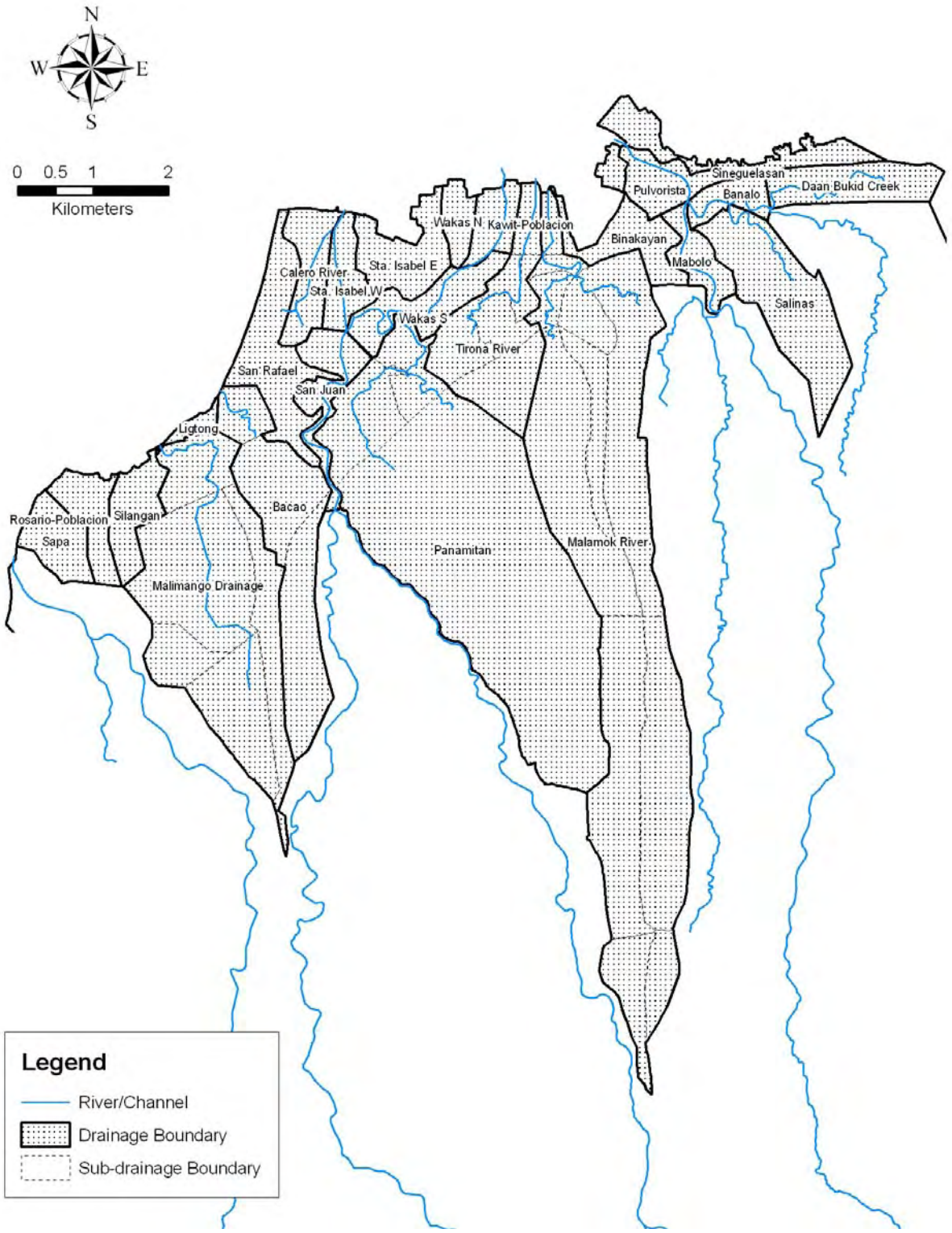
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA	Fig. 5.6 Design Storm of Long Duration Rainfall
CTI Engineering International Co.,Ltd. Nippon Koei Co., Ltd.	



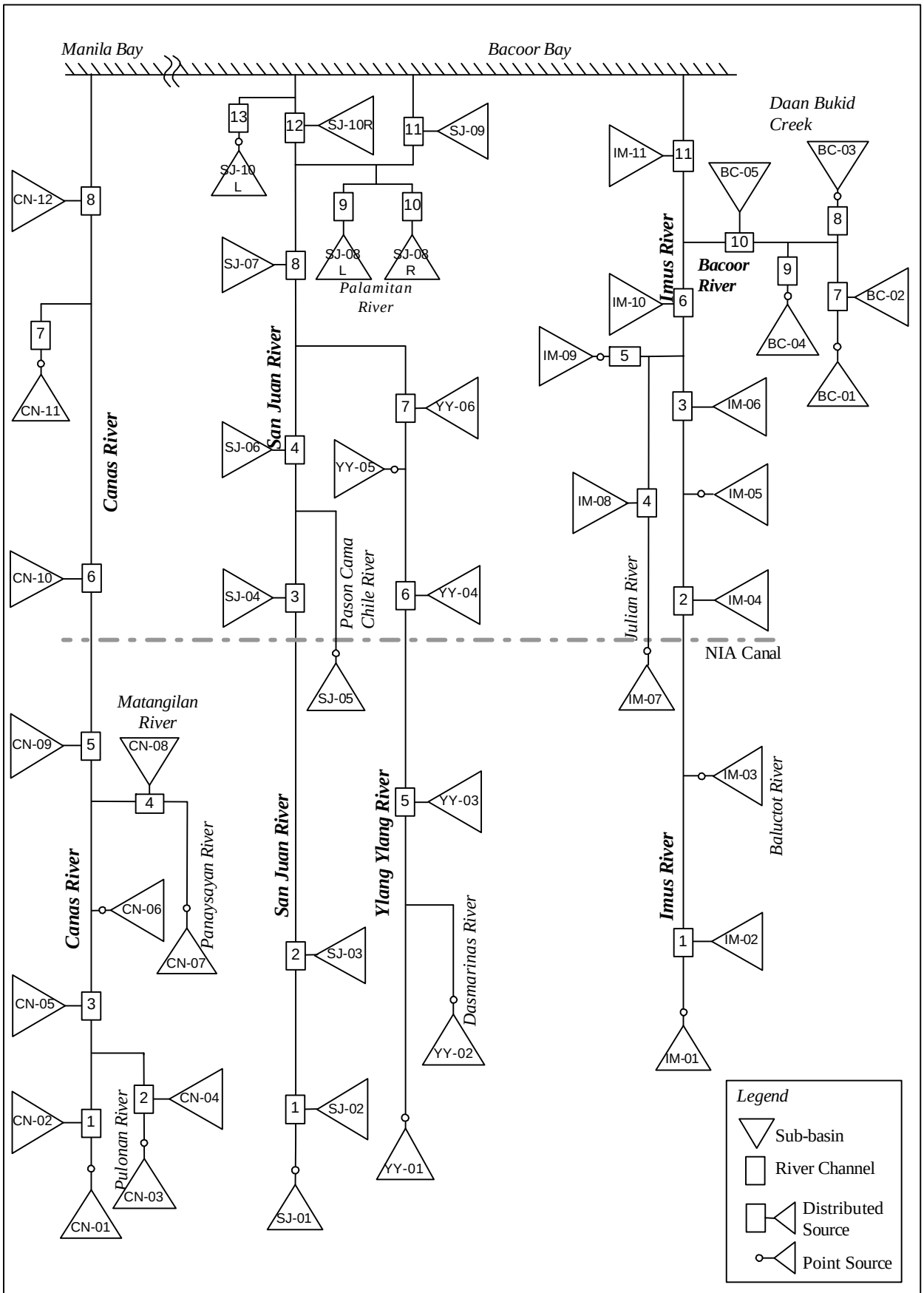
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA	Fig. 5.7 Design Storm of Short Duration Rainfall
CTI Engineering International Co.,Ltd. Nippon Koei Co., Ltd.	



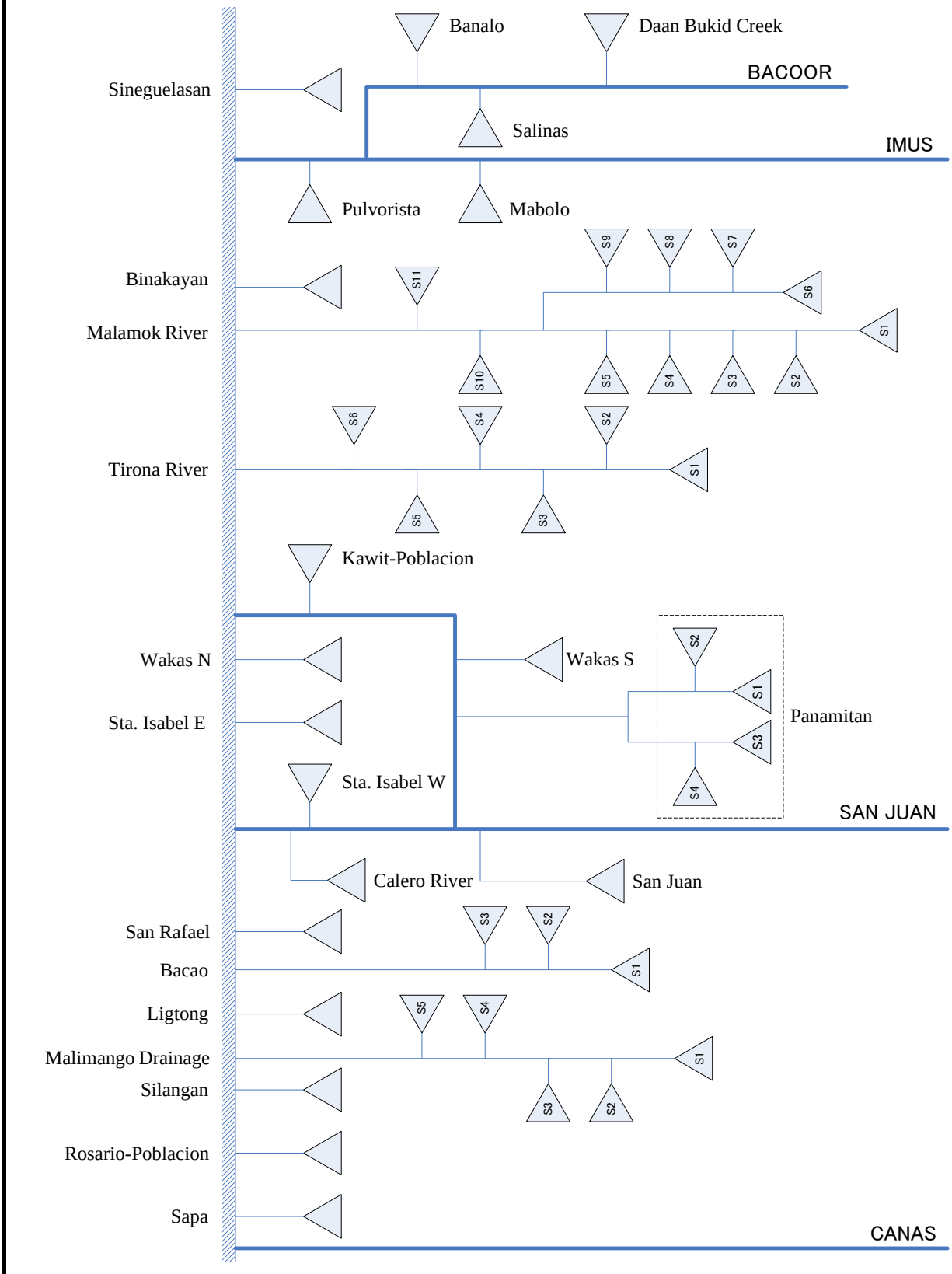
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA	Fig. 5.8 Basin Subdivision for Three MajorRivers
CTI Engineering International Co.,Ltd. Nippon Koei Co., Ltd.	



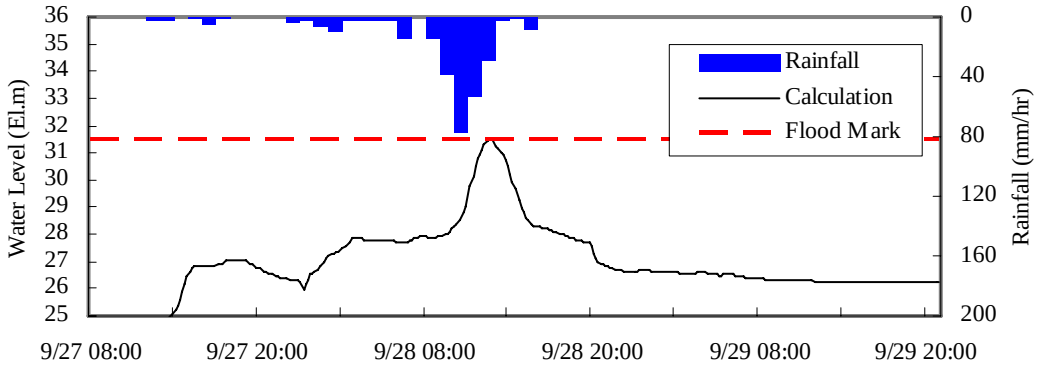
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA	Fig. 5.9
CTI Engineering International Co., Ltd. Nippon Koei Co., Ltd	Basin Subdivision for Drainage Area



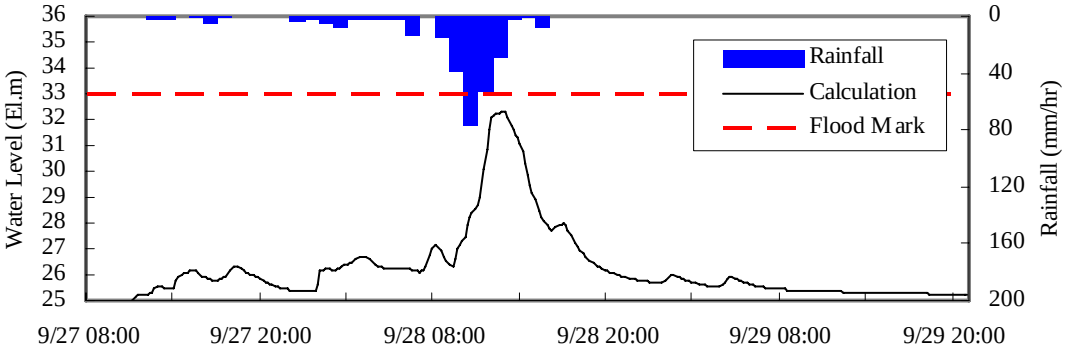
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA	Fig. 5.10 Schematic Diagram of Flood Routing Model
CTI Engineering International Co.,Ltd. Nippon Koei Co., Ltd	



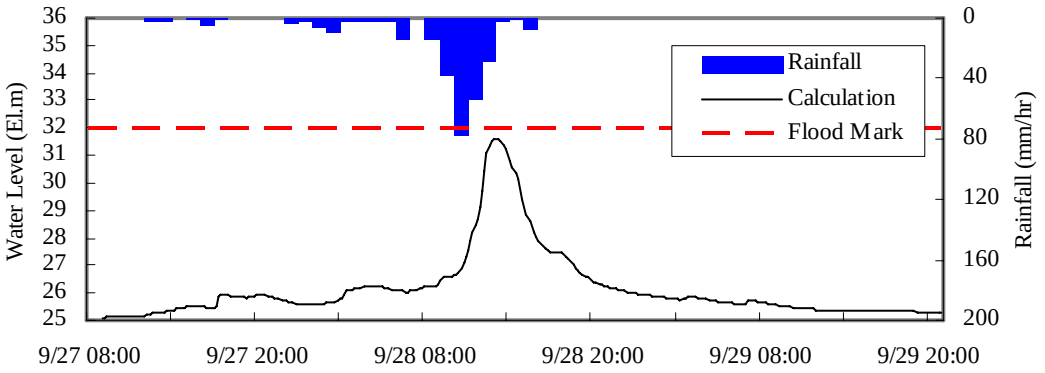
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA	Fig. 5.11
CTI Engineering International Co., Ltd. Nippon Koei Co., Ltd	Schematic Diagram of Drainage Area



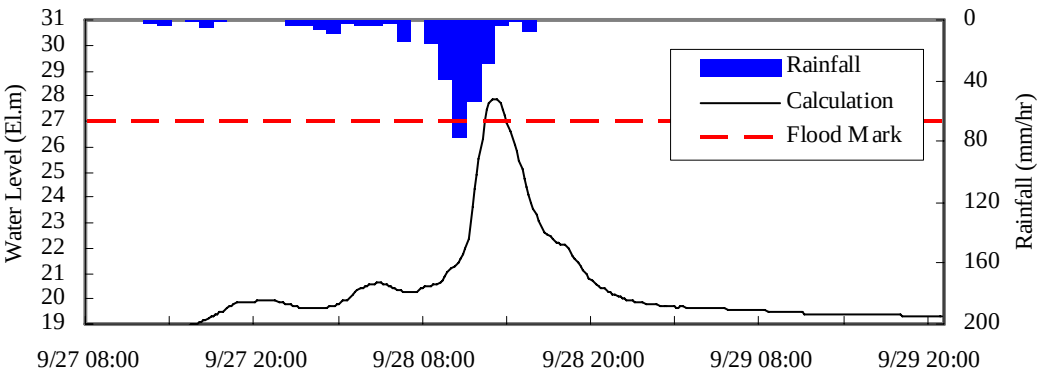
(1) Imus River (at NIA Canal)



(2) Ylang Ylang River (at NIA Canal)

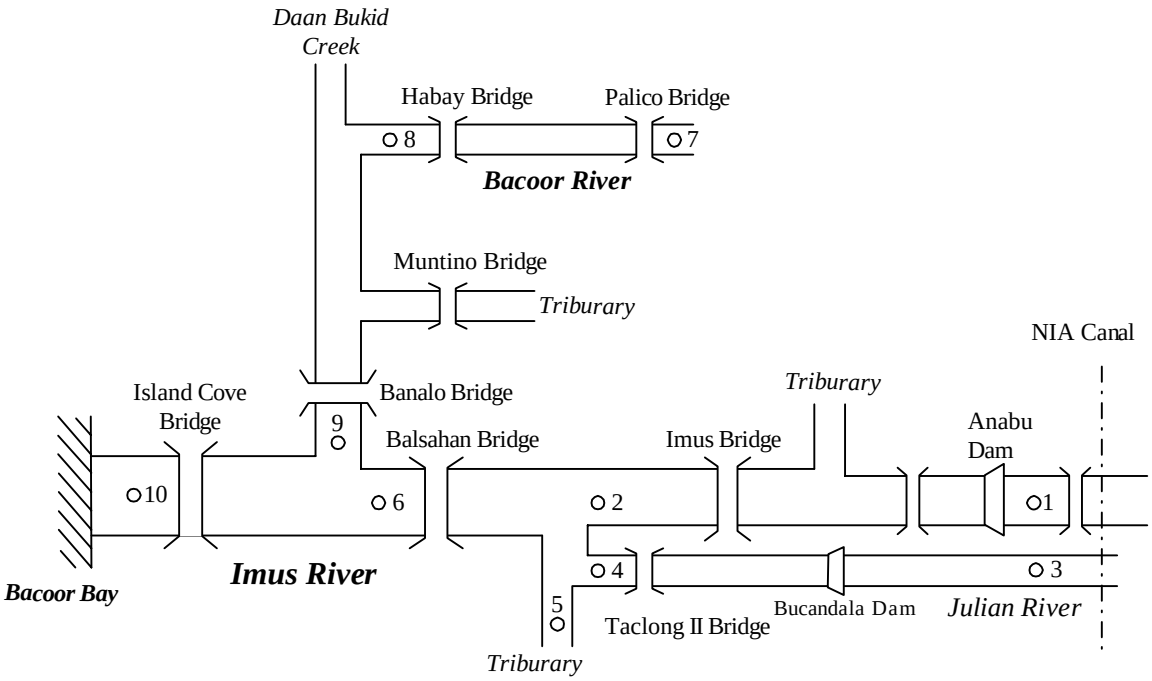


(3) San Juan River (at NIA Canal)



(4) Canas River (at NIA Canal)

THE STUDY ON COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA	Fig. 5.12 Verification Results of Flood Runoff Model for the 2006 Flood
CTI Engineering International Co.,Ltd. Nippon Koei Co., Ltd	



Present Land Use

Point No.	Peak Discharge for Each Return Period (m3/s)							
	2-year	3-year	5-year	10-year	20-year	30-year	50-year	100-year
1	200	240	310	420	550	600	650	700
2	270	320	430	600	750	750	850	950
3	80	90	100	120	150	160	170	180
4	130	150	170	210	240	250	280	300
5	25	30	30	40	45	45	50	50
6	400	470	600	750	950	1,000	1,100	1,200
7	65	75	85	100	120	130	140	150
8	130	150	170	190	230	240	260	270
9	140	160	180	210	240	250	270	290
10	550	650	750	950	1,200	1,200	1,400	1,500

Future Land Use

Point No.	Peak Discharge for Each Return Period (m3/s)							
	2-year	3-year	5-year	10-year	20-year	30-year	50-year	100-year
1	310	370	430	500	600	650	700	800
2	410	470	600	700	800	850	950	1,000
3	130	140	160	170	190	190	200	210
4	200	230	260	280	310	310	330	350
5	40	45	50	50	55	60	60	65
6	650	750	850	1,000	1,200	1,200	1,300	1,400
7	80	90	110	120	130	140	150	160
8	150	170	190	220	250	260	280	290
9	160	180	210	230	270	280	300	320
10	750	900	1,100	1,200	1,400	1,500	1,600	1,700

Future Land Use (with on-site flood regulation pond)

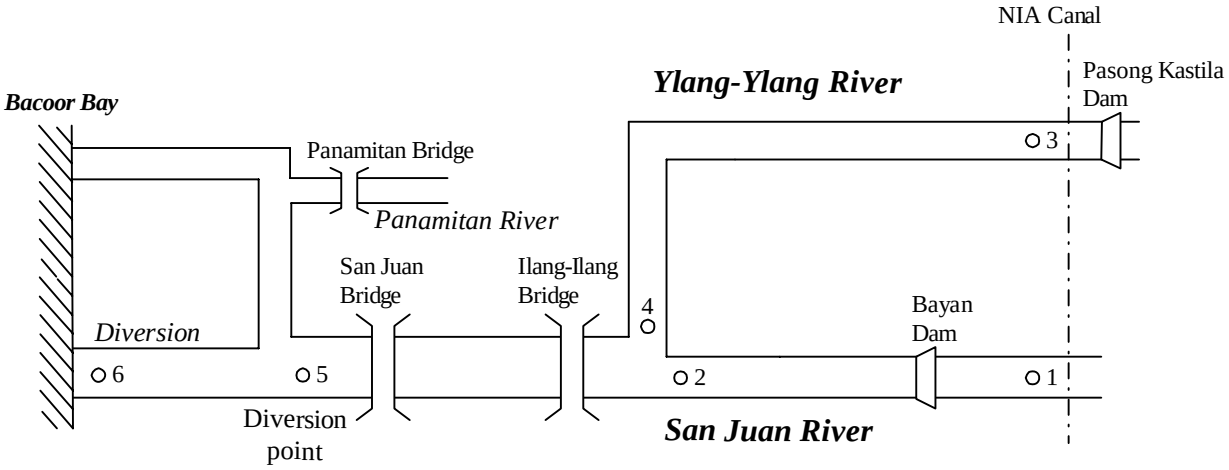
Point No.	Peak Discharge for Each Return Period (m3/s)							
	2-year	3-year	5-year	10-year	20-year	30-year	50-year	100-year
1	250	290	350	430	550	650	700	800
2	320	380	480	600	750	850	950	1,000
3	90	100	120	140	160	190	200	210
4	140	170	200	240	230	310	330	350
5	25	30	35	40	45	60	60	65
6	470	550	700	850	1,000	1,200	1,300	1,400
7	70	80	90	110	130	140	150	160
8	130	150	170	200	230	260	280	290
9	140	160	190	210	250	280	300	320
10	600	700	850	1,000	1,200	1,500	1,600	1,700

THE STUDY ON
COMPREHENSIVE FLOOD MITIGATION
FOR CAVITE LOWLAND AREA

CTI Engineering International Co.,Ltd.
Nippon Koei Co., Ltd

Fig. 5.13

Probable Discharge Distribution of Imus River Basin



Present Land Use

Point No.	Peak Discharge for Each Return Period (m3/s)							
	2-year	3-year	5-year	10-year	20-year	30-year	50-year	100-year
1	120	150	220	330	450	500	600	650
2	180	220	320	440	600	650	750	800
3	190	230	280	410	600	650	700	800
4	190	230	290	420	600	650	700	800
5	320	400	600	800	1,100	1,200	1,300	1,500
6	270	330	470	650	850	900	1,100	1,200

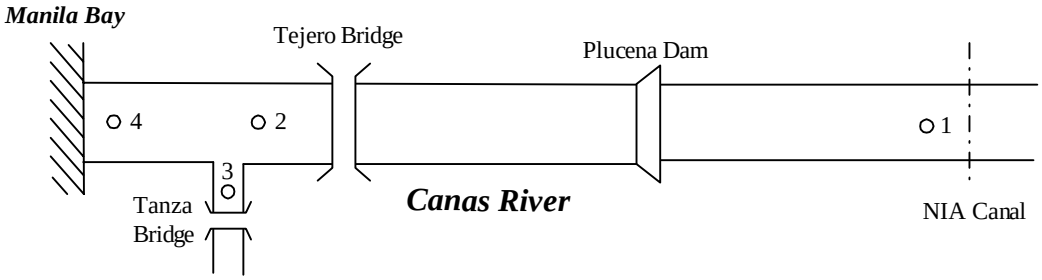
Future Land Use

Point No.	Peak Discharge for Each Return Period (m3/s)							
	2-year	3-year	5-year	10-year	20-year	30-year	50-year	100-year
1	160	190	230	350	470	550	600	700
2	220	270	340	460	600	650	750	850
3	270	320	370	490	650	700	750	850
4	270	320	380	490	650	700	750	850
5	410	500	650	850	1,100	1,200	1,400	1,500
6	340	410	550	700	850	950	1,100	1,200

Future Land Use (with on-site flood regulation pond)

Point No.	Peak Discharge for Each Return Period (m3/s)							
	2-year	3-year	5-year	10-year	20-year	30-year	50-year	100-year
1	130	160	220	340	460	550	600	700
2	190	240	320	450	600	650	750	850
3	220	250	300	430	600	700	750	850
4	220	260	320	440	600	700	750	850
5	340	420	600	850	1,100	1,200	1,400	1,500
6	290	350	480	650	850	950	1,100	1,200

THE STUDY ON COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA	Fig. 5.14 Probable Discharge Distribution of San Juan River Basin
CTI Engineering International Co.,Ltd. Nippon Koei Co., Ltd	



Present Land Use

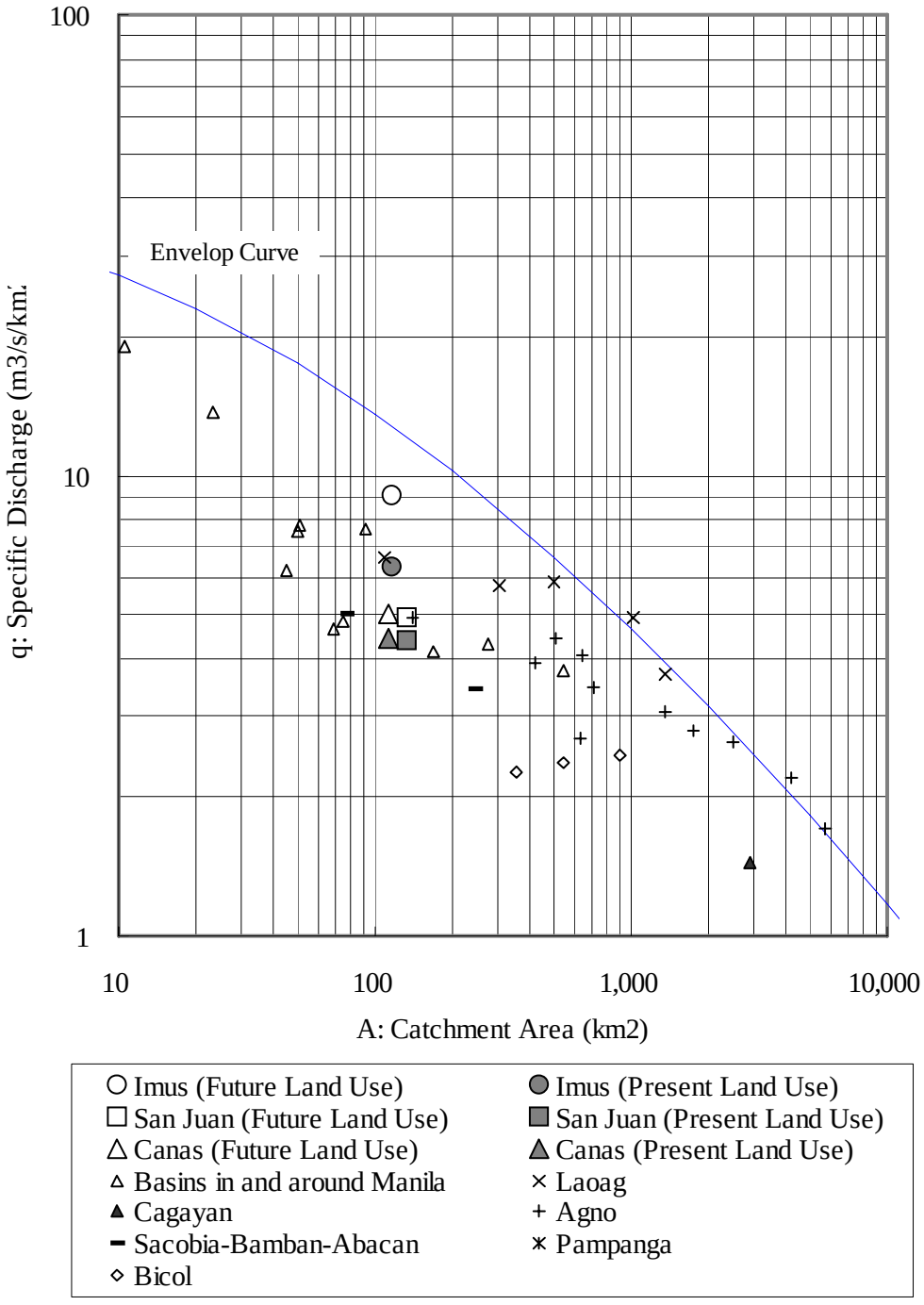
Point No.	Peak Discharge for Each Return Period (m3/s)							
	2-year	3-year	5-year	10-year	20-year	30-year	50-year	100-year
1	210	270	430	700	950	1,100	1,200	1,300
2	230	290	470	700	1,000	1,100	1,300	1,400
3	30	35	40	55	75	80	85	95
4	240	320	500	750	1,100	1,200	1,300	1,500

Future Land Use

Point No.	Peak Discharge for Each Return Period (m3/s)							
	2-year	3-year	5-year	10-year	20-year	30-year	50-year	100-year
1	310	380	480	750	1,000	1,100	1,200	1,400
2	330	400	550	750	1,000	1,100	1,300	1,400
3	45	50	55	70	85	90	100	110
4	350	440	600	800	1,100	1,200	1,400	1,500

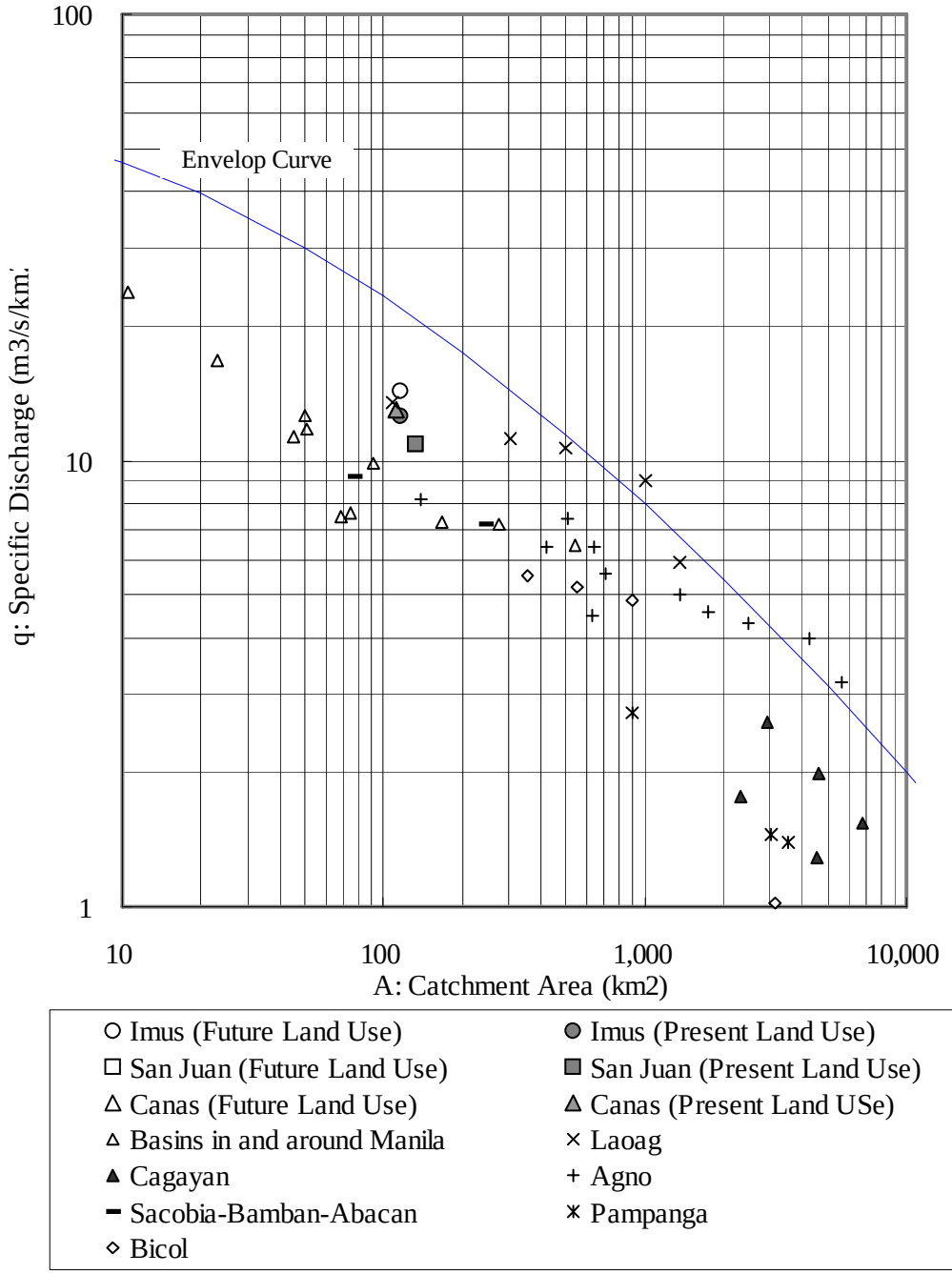
Future Land Use (with on-site flood regulation pond)

Point No.	Peak Discharge for Each Return Period (m3/s)							
	2-year	3-year	5-year	10-year	20-year	30-year	50-year	100-year
1	240	300	440	700	950	1,100	1,200	1,400
2	250	320	480	750	1,000	1,100	1,300	1,400
3	30	35	40	60	75	90	100	110
4	270	340	550	800	1,100	1,200	1,400	1,500



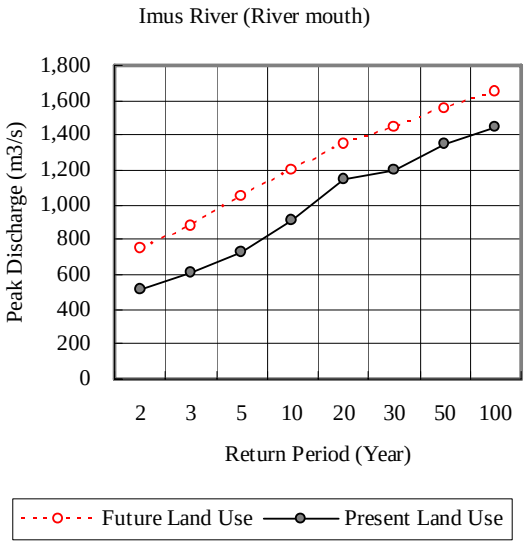
Source:
1) Basins in and around Manila: The Study on Flood Control and Drainage Project in Metro Manila, Vol. 2, Supporting Report, 1990, JICA
2) Basins in the Luzon Island: Study for the Preparation of Flood Control Manual for Department of Public Works and Highways Technical Standards and Guidelines, Final Report, Main Report, Vol ume I, March 2003, JICA, DPWH

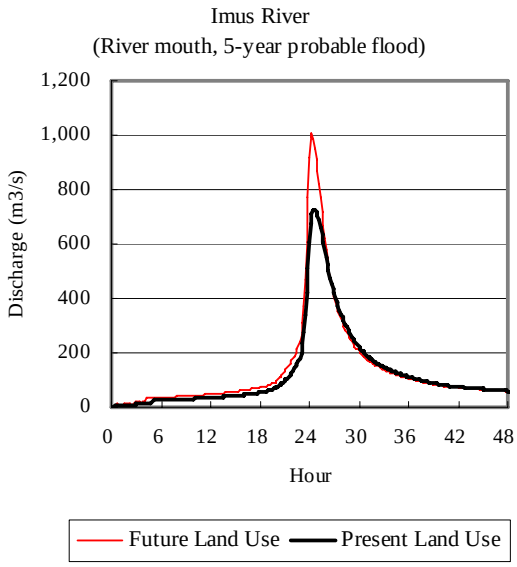
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA	Fig. 5.16 Comparison of Specific Discharge with Other River Basins in the Luzon Island (5-year probable flood)
CTI Engineering International Co.,Ltd. Nippon Koei Co., Ltd	

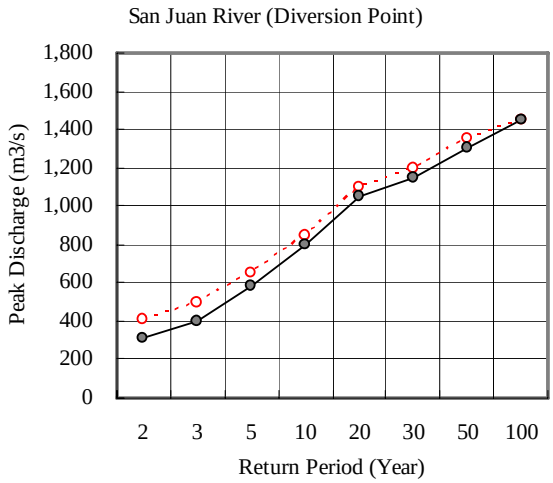


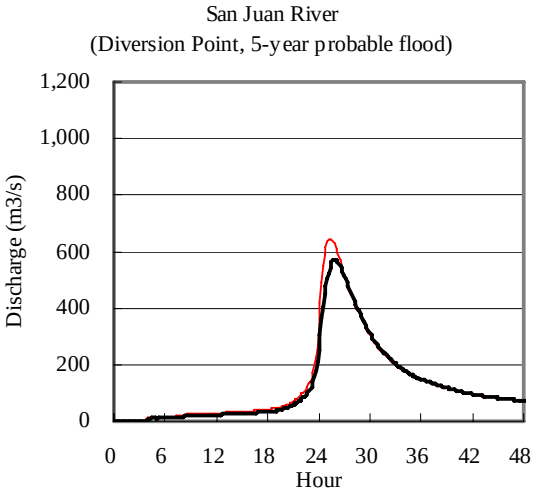
Source:
1) Basins in and around Manila: The Study on Flood Control and Drainage Project in Metro Manila, Vol. 2, Supporting Report, 1990, JICA
2) Basins in the Luzon Island: Study for the Preparation of Flood Control Manual for Department of Public Works and Highways Technical Standards and Guidelines, Final Report, Main Report, Vol ume I, March 2003, JICA, DPWH

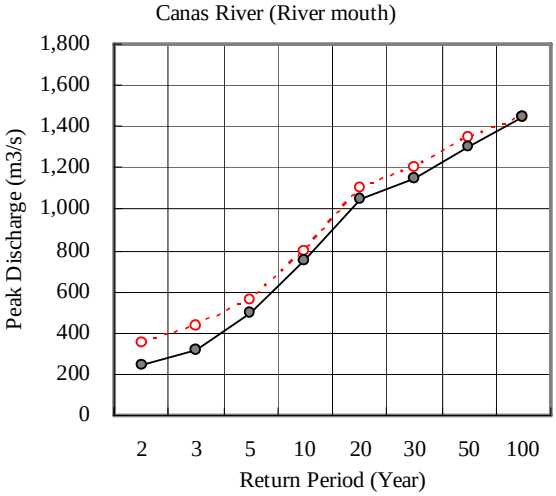
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA	Fig. 5.17 Comparison of Specific Discharge with Other River Basins in the Luzon Island (100-year probable flood)
CTI Engineering International Co.,Ltd. Nippon Koei Co., Ltd	

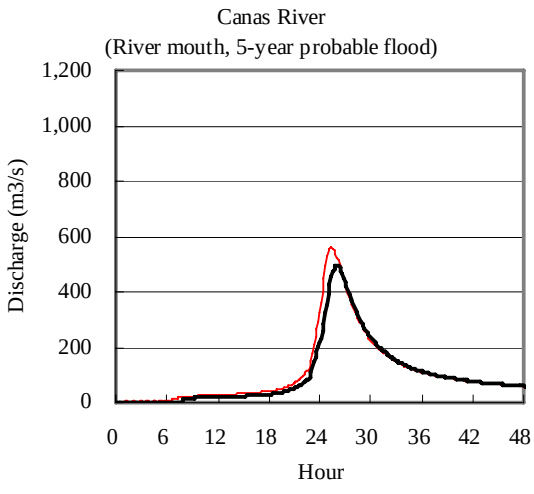




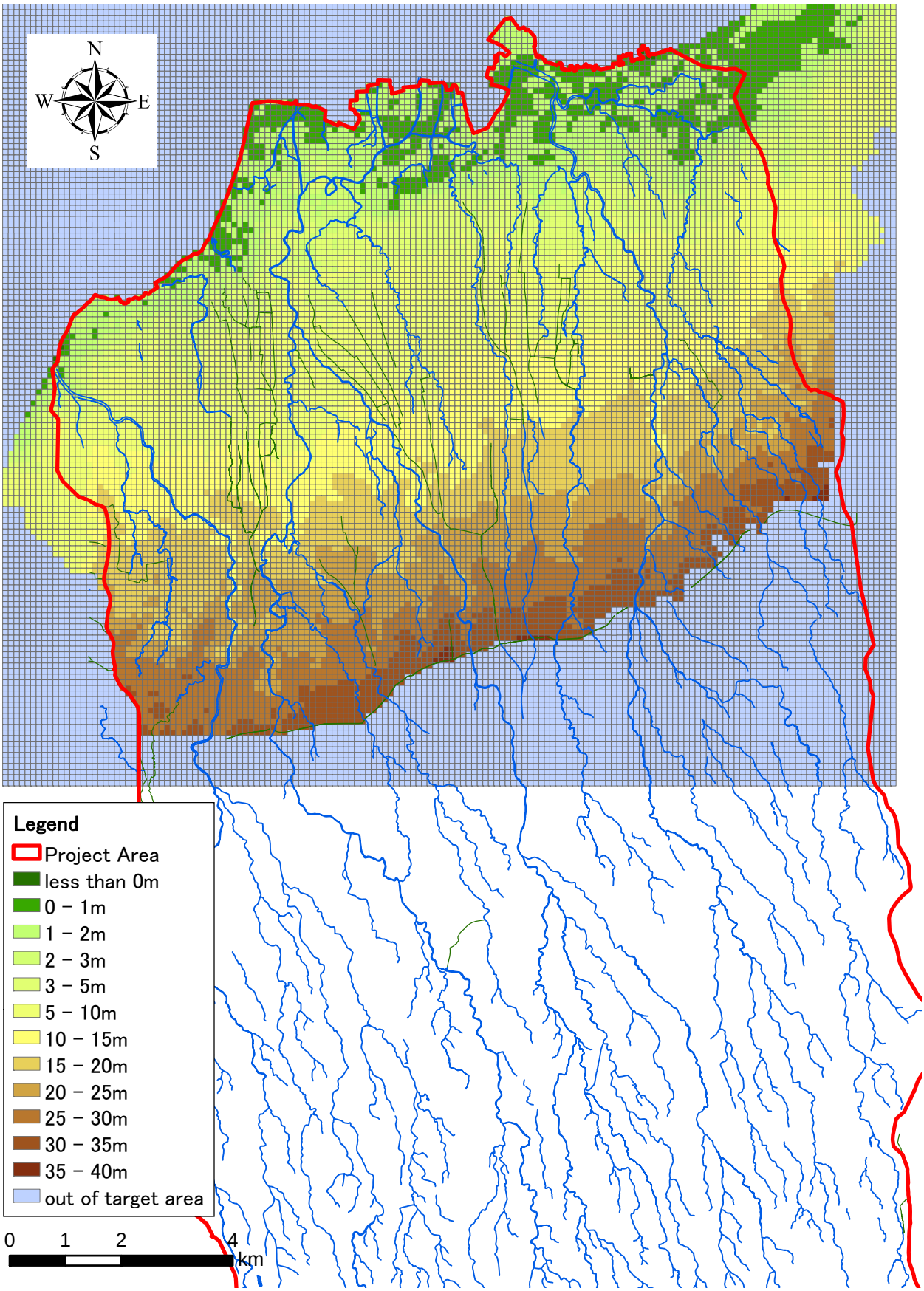




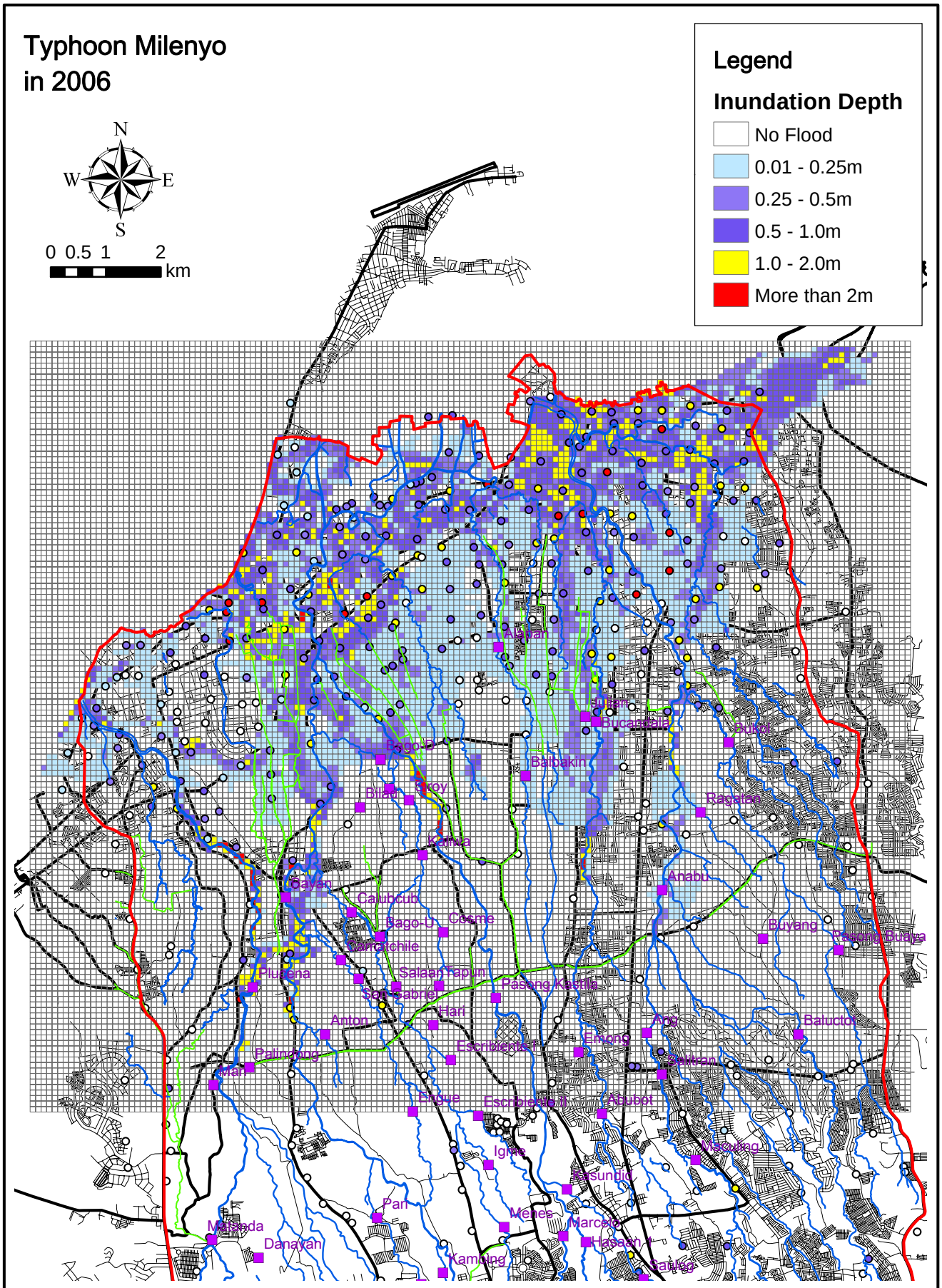




THE STUDY ON COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA	Fig. 5.18 Increase in Runoff Discharge by Urbanization
CTI Engineering International Co.,Ltd. Nippon Koei Co., Ltd	



THE STUDY ON COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA	Fig. 5.19 Generated DEM by 100m Scaled Mesh
JAPAN INTERNATIONAL COOPERATION AGENCY	



THE STUDY ON COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA	Fig. 5.20 Reproduction of Flood of Typhoon Milenyo in 2006
JAPAN INTERNATIONAL COOPERATION AGENCY	