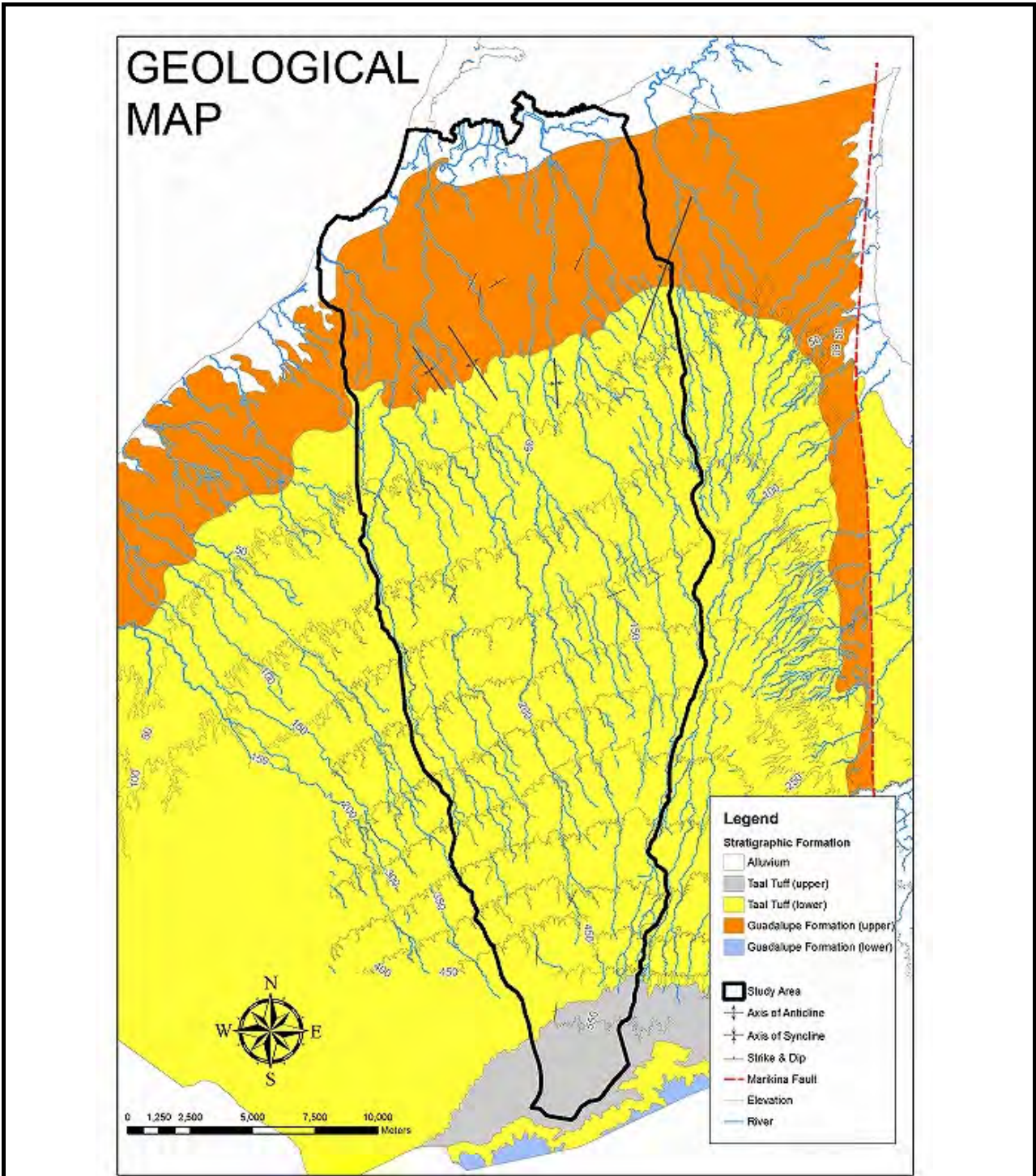


THE STUDY ON
COMPREHENSIVE FLOOD MITIGATION
FOR CAVITE LOWLAND AREA

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

図 2.5

対象河川流下能力算定結果図
(2007年土地利用状況下)

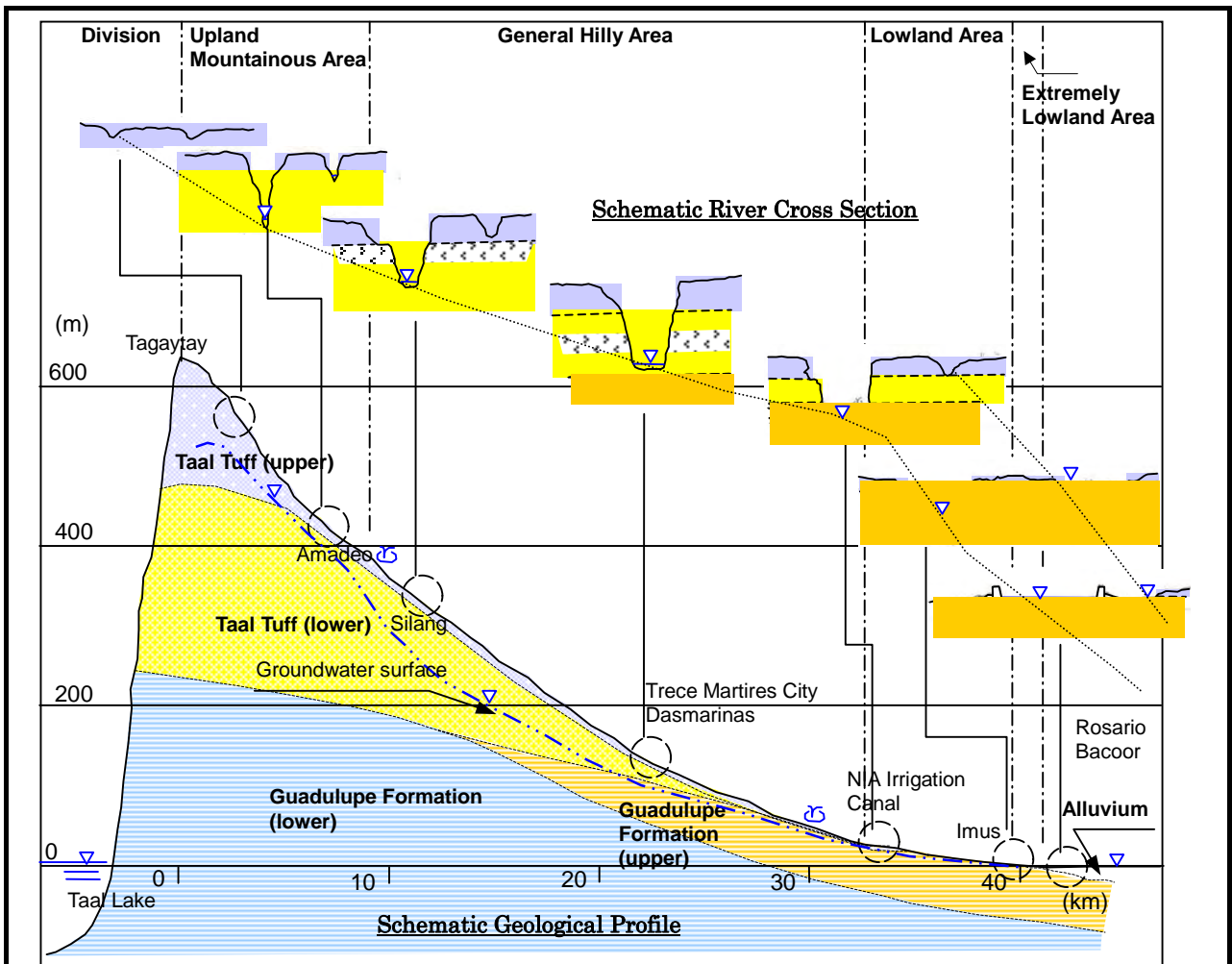


(Source: JICA Study Team)

記 : Taal Tuff (Upper) は広域に分布するが Tagaytay Ridge 周辺以外では層厚が薄いため標示していない。

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

<p>THE STUDY ON COMPREHENSIVE FLOOD MITIGATION FOR CAVITE LOWLAND AREA</p>	<p>図 2.6</p>
<p>CTI Engineering International Co., Ltd. Nippon Koei Co., Ltd</p>	<p>調査対象地域地質図</p>



Division	Upland Mountainous 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)

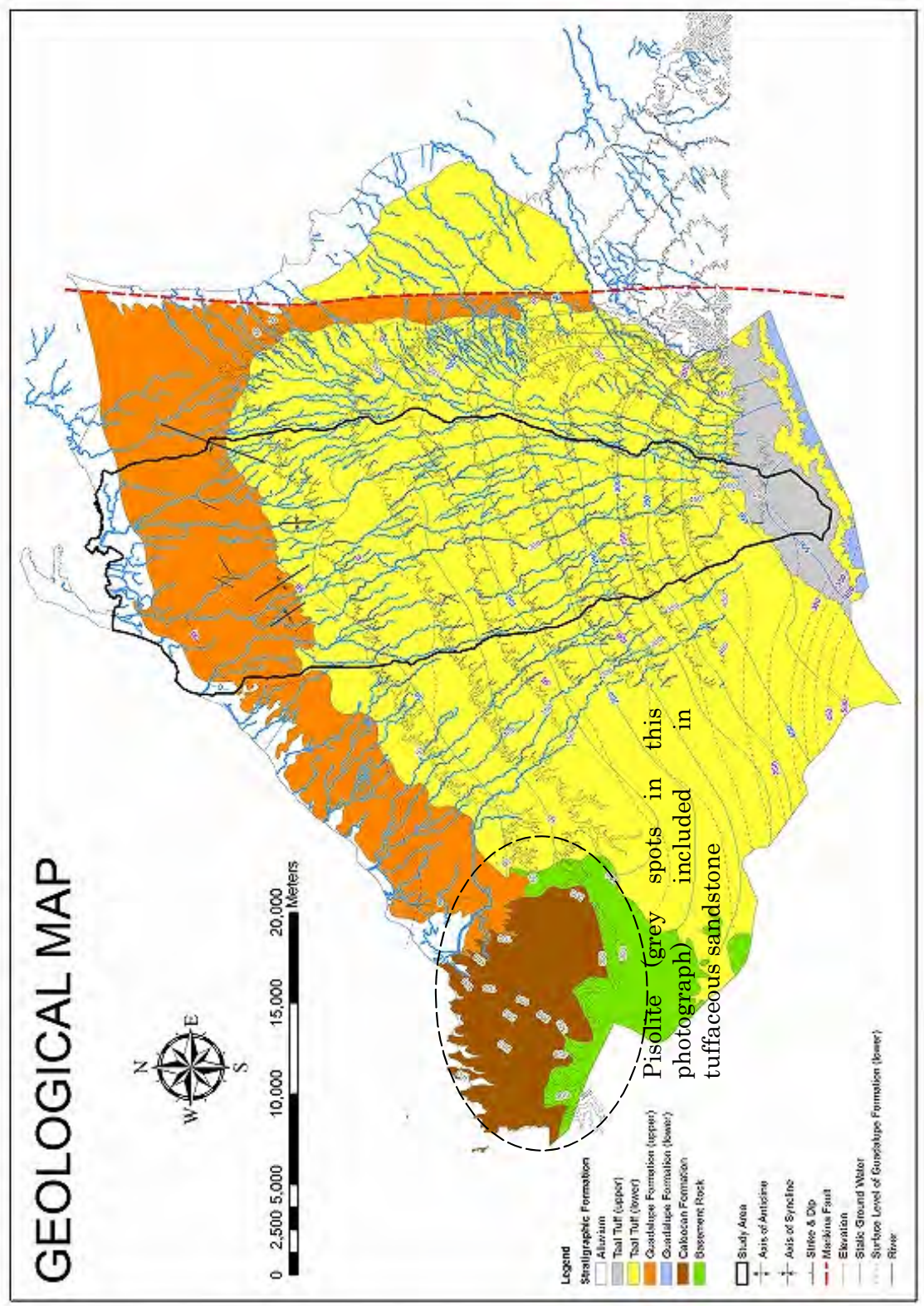
参考資料: “CAVITE (No. 3163 II)”, “SILANG (No.3162 I)” and “MENDEZ-NUNEZ (No.3162 II)” published by published by MGS in 1982, and “CAVITE WATER SUPPLY DEVELOPMENT STUDY” conducted by JICA in 1995

THE STUDY ON
COMPREHENSIVE FLOOD MITIGATION
FOR CAVITE LOWLAND AREA

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

図 2.7

調査地域の模式地質断面図
・ 模式河川横断地質断面図

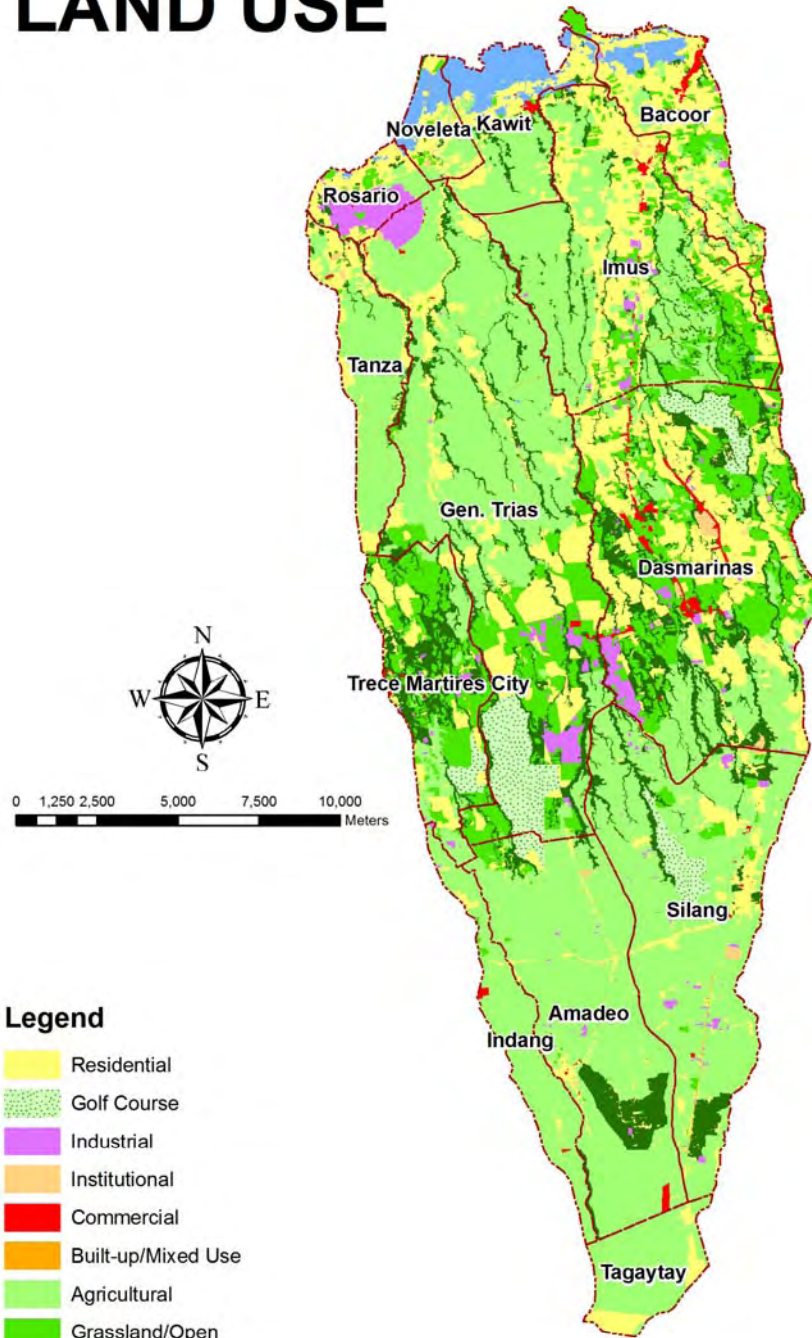


THE STUDY ON
 COMPREHENSIVE FLOOD MITIGATION
 FOR CAVITE LOWLAND AREA

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

図 2.8
 広域地質図

EXISTING LAND USE



Legend

- Residential
- Golf Course
- Industrial
- Institutional
- Commercial
- Built-up/Mixed Use
- Agricultural
- Grassland/Open
- Tree Plantation
- Water Bodies/Fishpond
- Unclassified

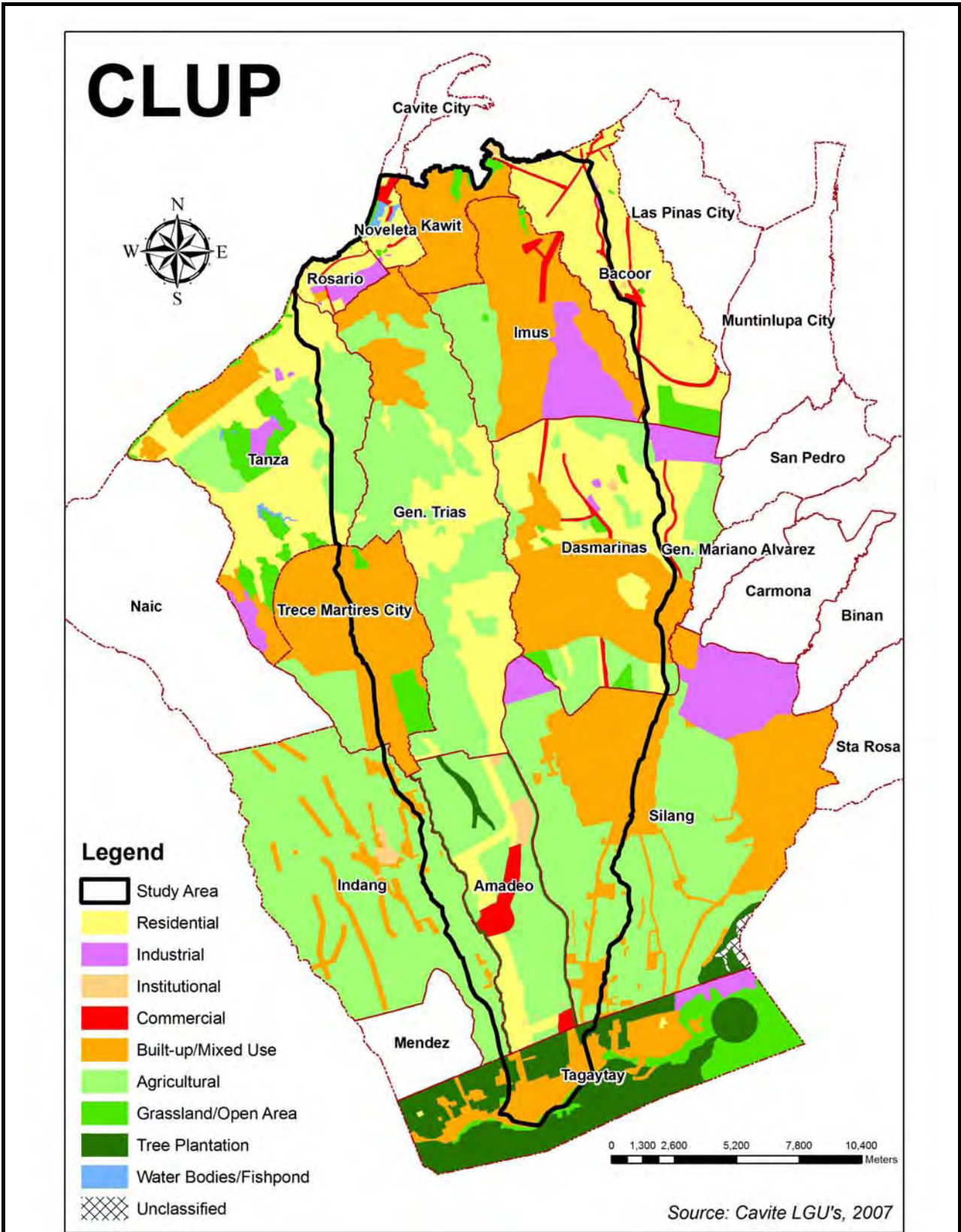
Source: CaLa Project, 2005
JICA Study Team, 2007

THE STUDY ON
COMPREHENSIVE FLOOD MITIGATION
FOR CAVITE LOWLAND AREA

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

図 3.1

調査対象地域現況土地利用図



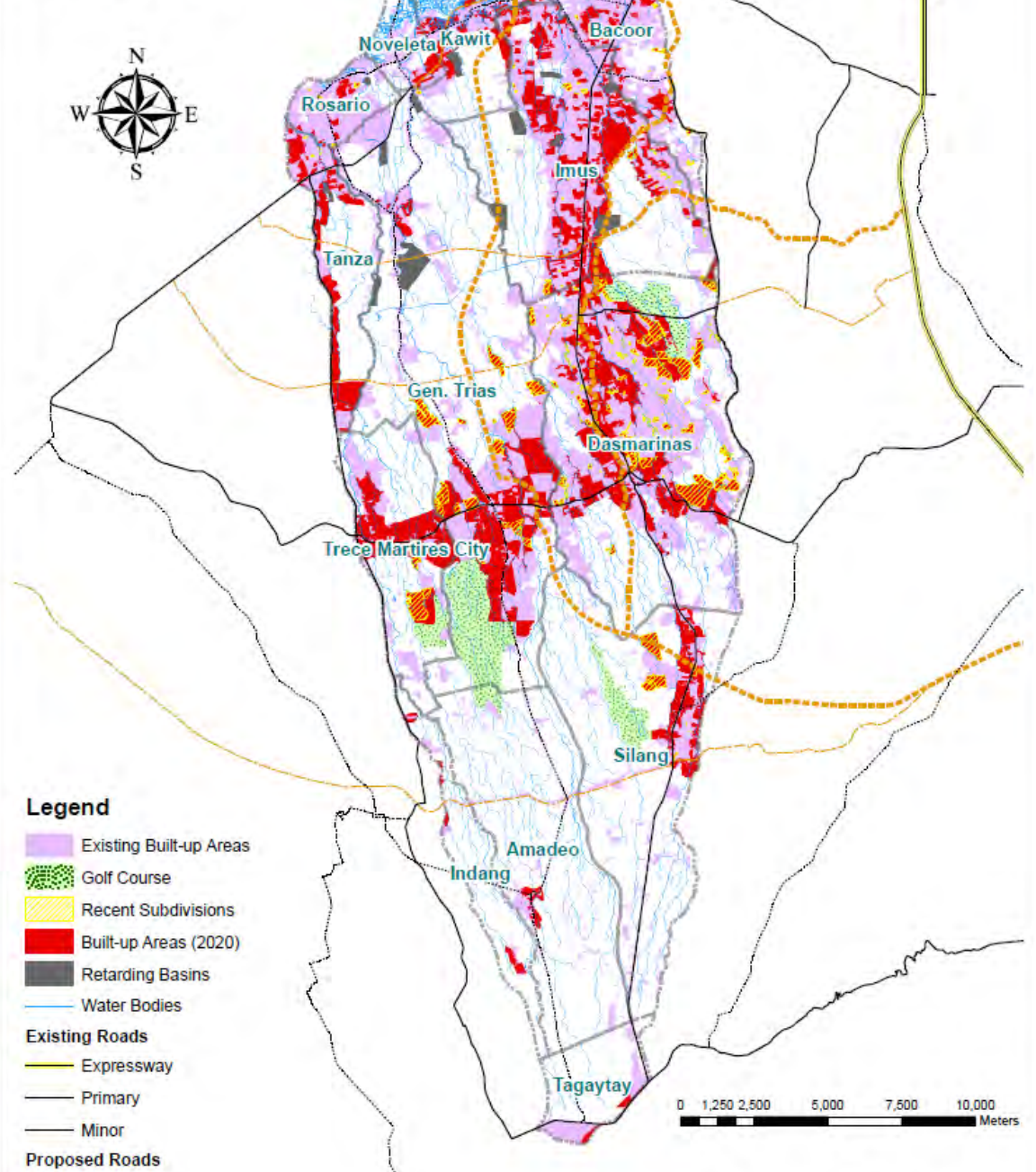
THE STUDY ON
 COMPREHENSIVE FLOOD MITIGATION
 FOR CAVITE LOWLAND AREA

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

図 4.1

市・ムニシパリティによる土地利用将来計画

PROPOSED URBAN GROWTH ZONE 2020

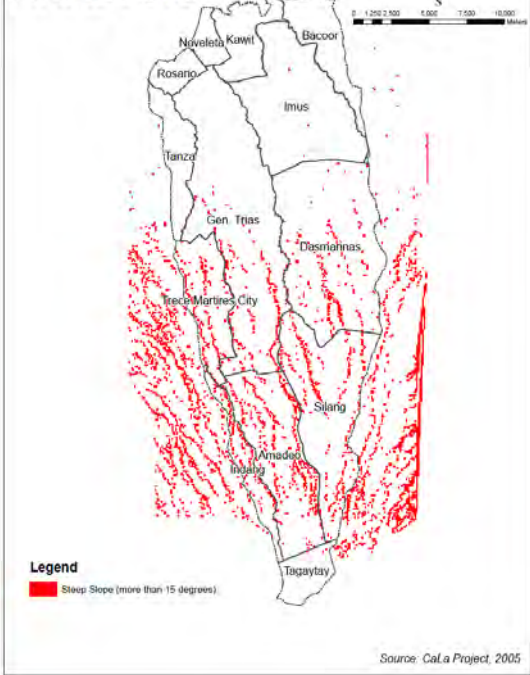


Sources: CaLa Project, 2005
JICA Study Team, 2007

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

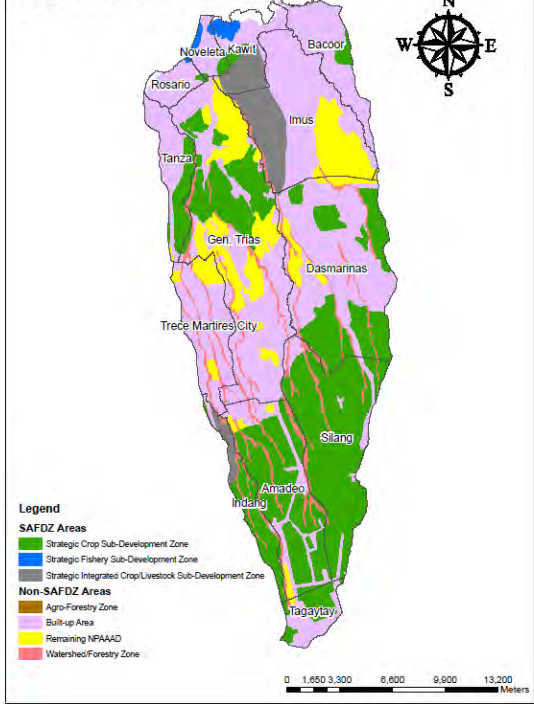
図 4.2
調査結果による対象地域将来土地利用提案図

SLOPE ANALYSIS



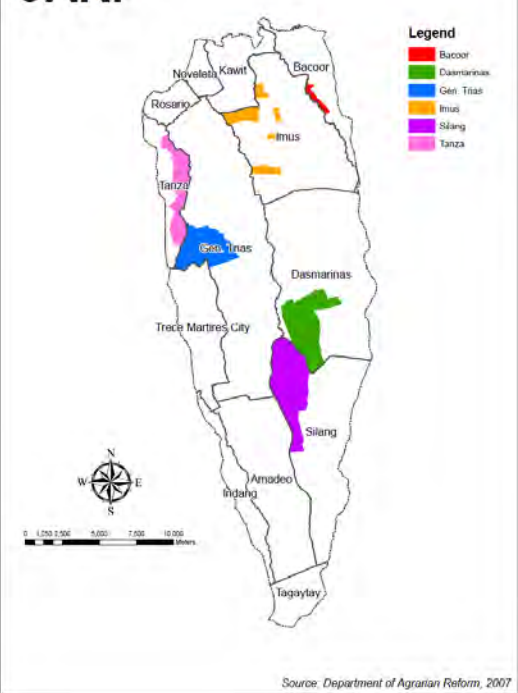
Soil Analysis Map: more than 15%, (NAMRIA)

SAFDZ



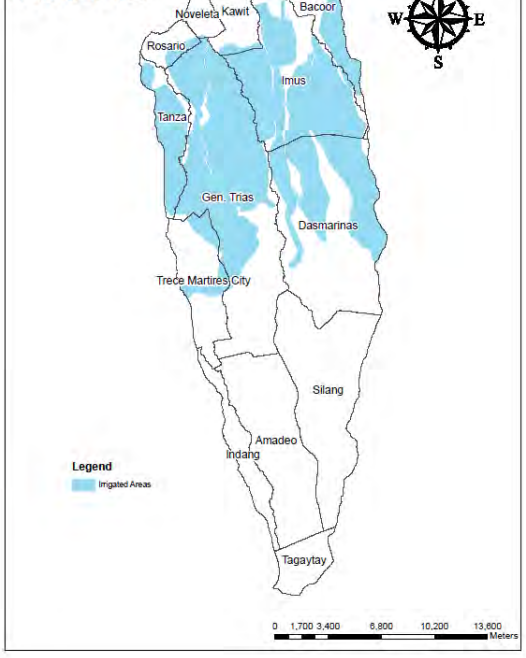
SAFDS Map (Office of the Provincial Agriculturist)

CARP



CARP Map (Agrarian Reform Office)

IRRIGATED AREAS



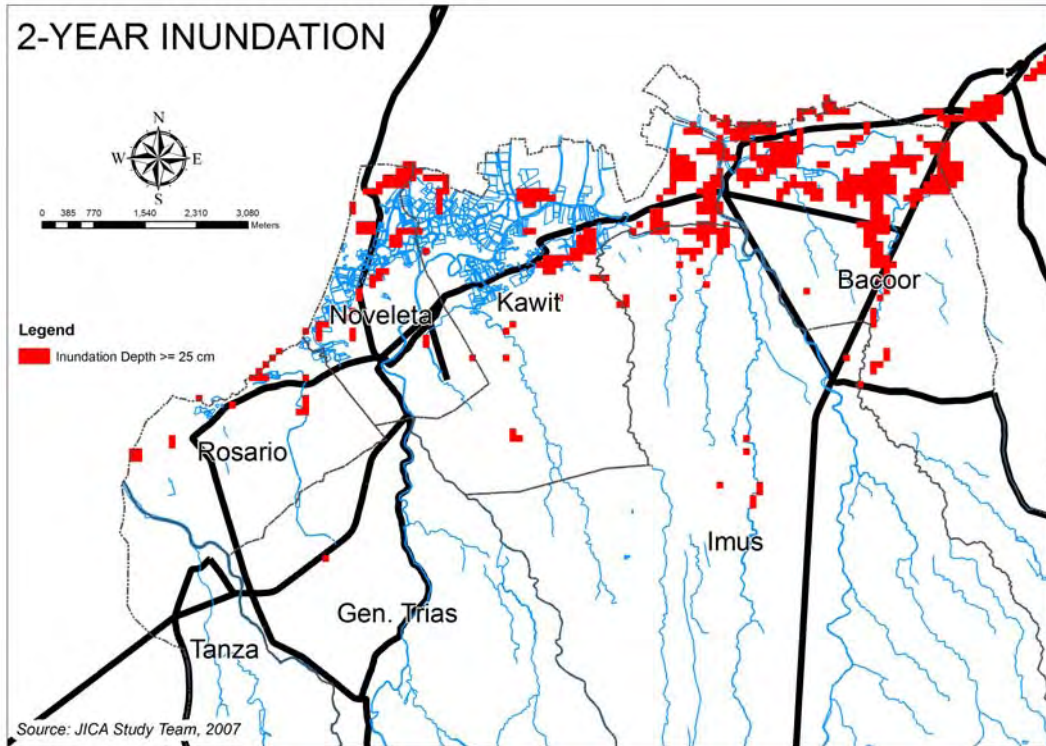
NIA Map (National Irrigation Administration, Naic)

THE STUDY ON
 COMPREHENSIVE FLOOD MITIGATION
 FOR CAVITE LOWLAND AREA

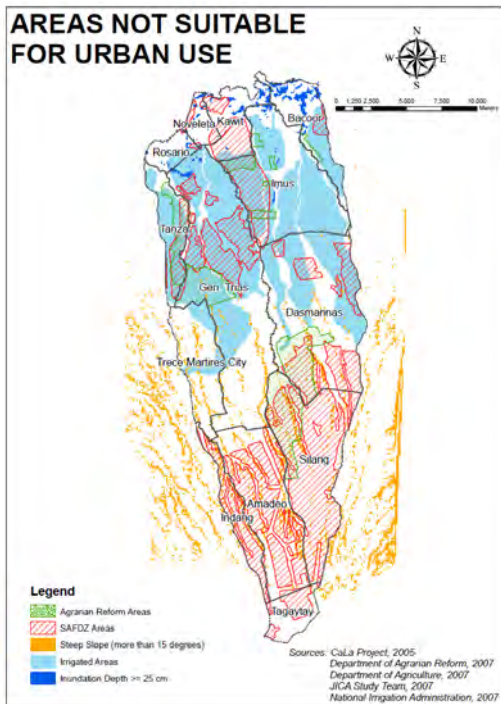
CTI Engineering International Co., Ltd.
 Nippon Koei Co., Ltd

図 4.3 (1/2)

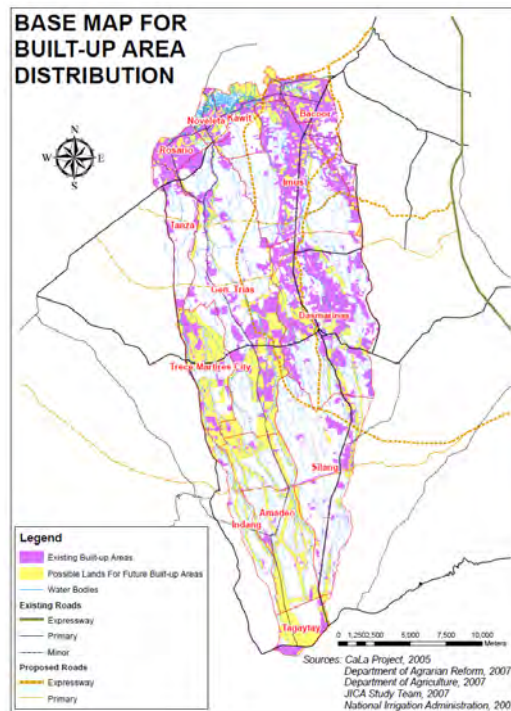
将来の開発不适当地区



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)

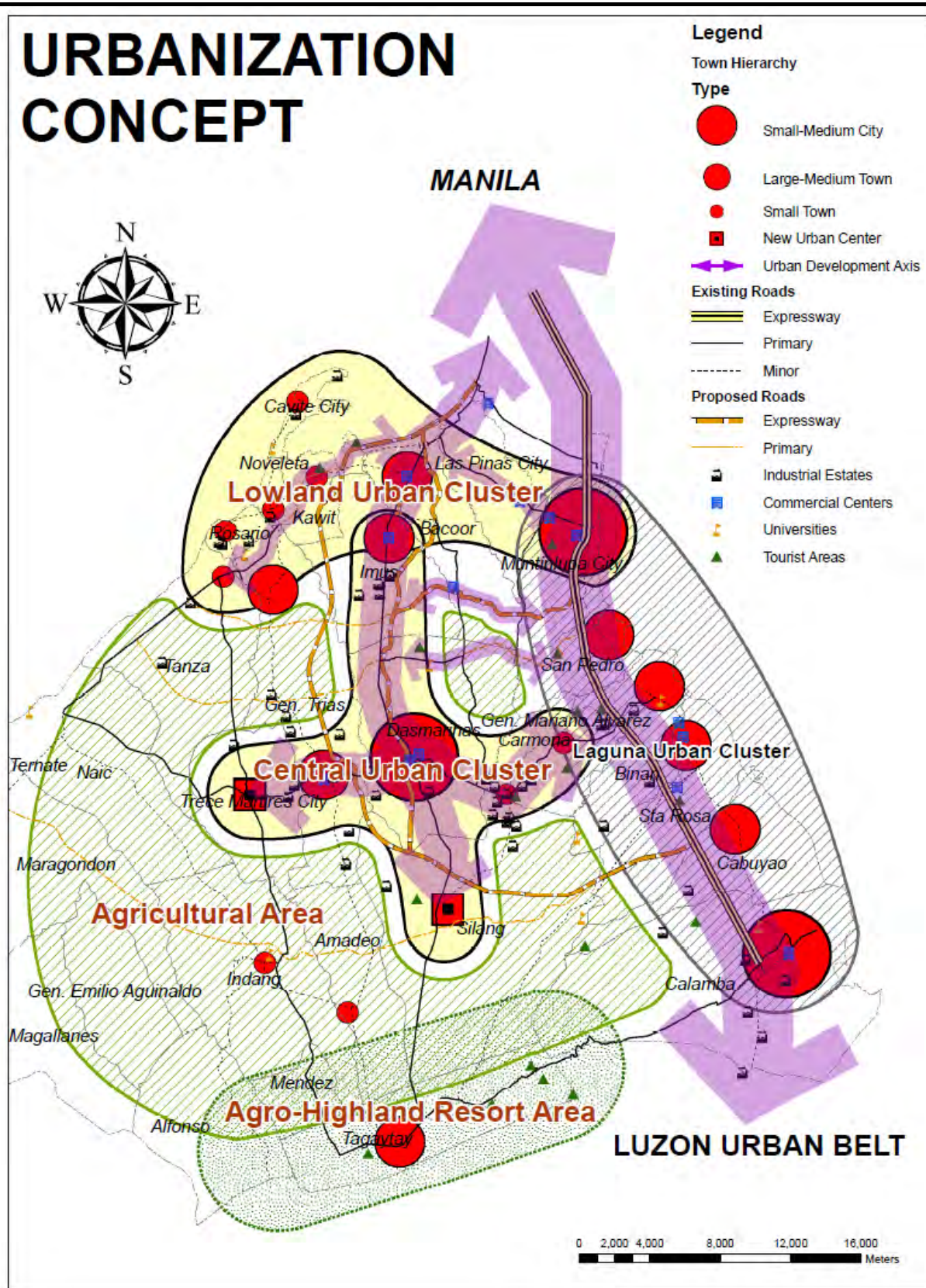
THE STUDY ON
COMPREHENSIVE FLOOD MITIGATION
FOR CAVITE LOWLAND AREA

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

図 4.3 (2/2)

将来の開発不適當地区

URBANIZATION CONCEPT

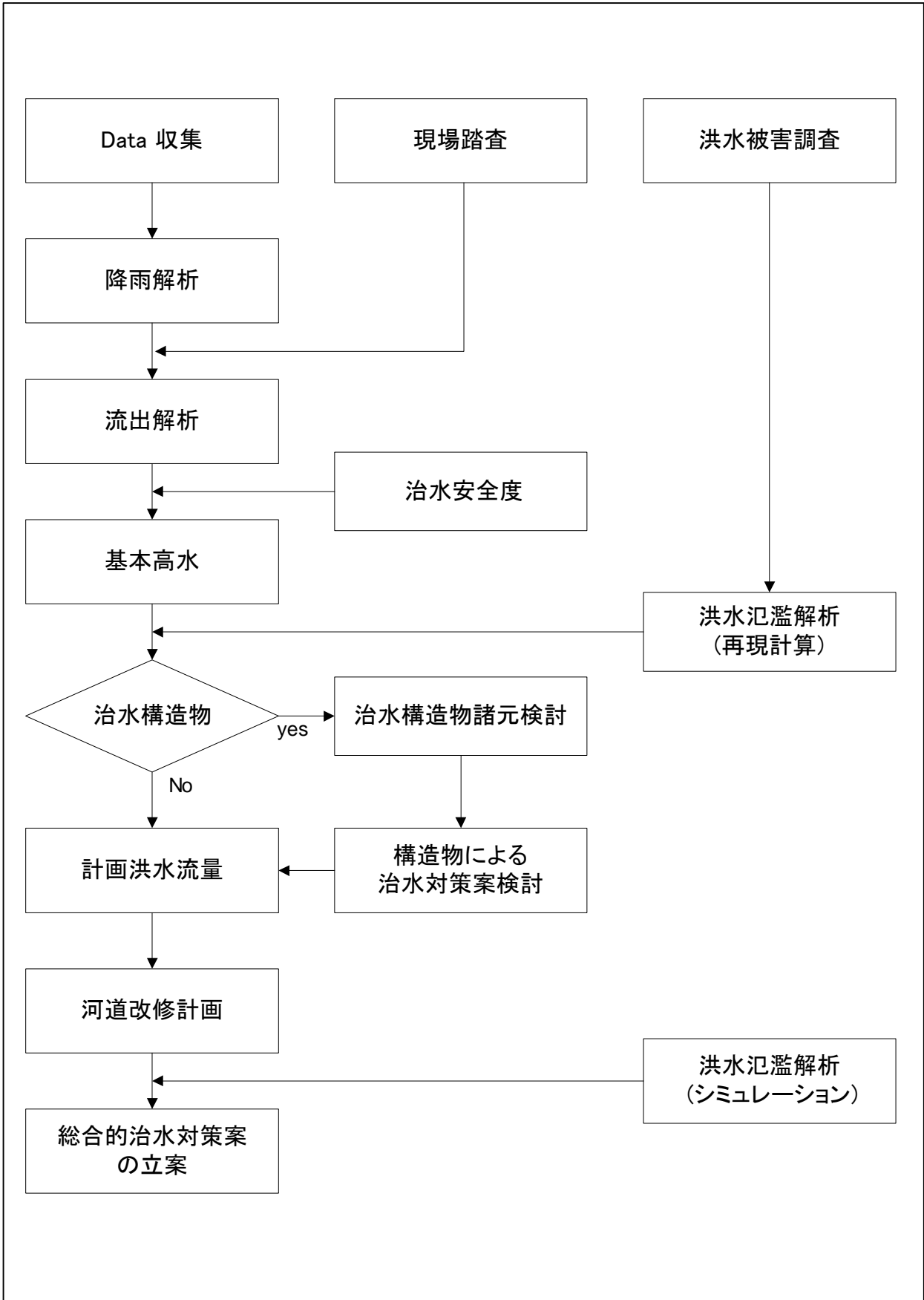


THE STUDY ON
COMPREHENSIVE FLOOD MITIGATION
FOR CAVITE LOWLAND AREA

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

図 4.4

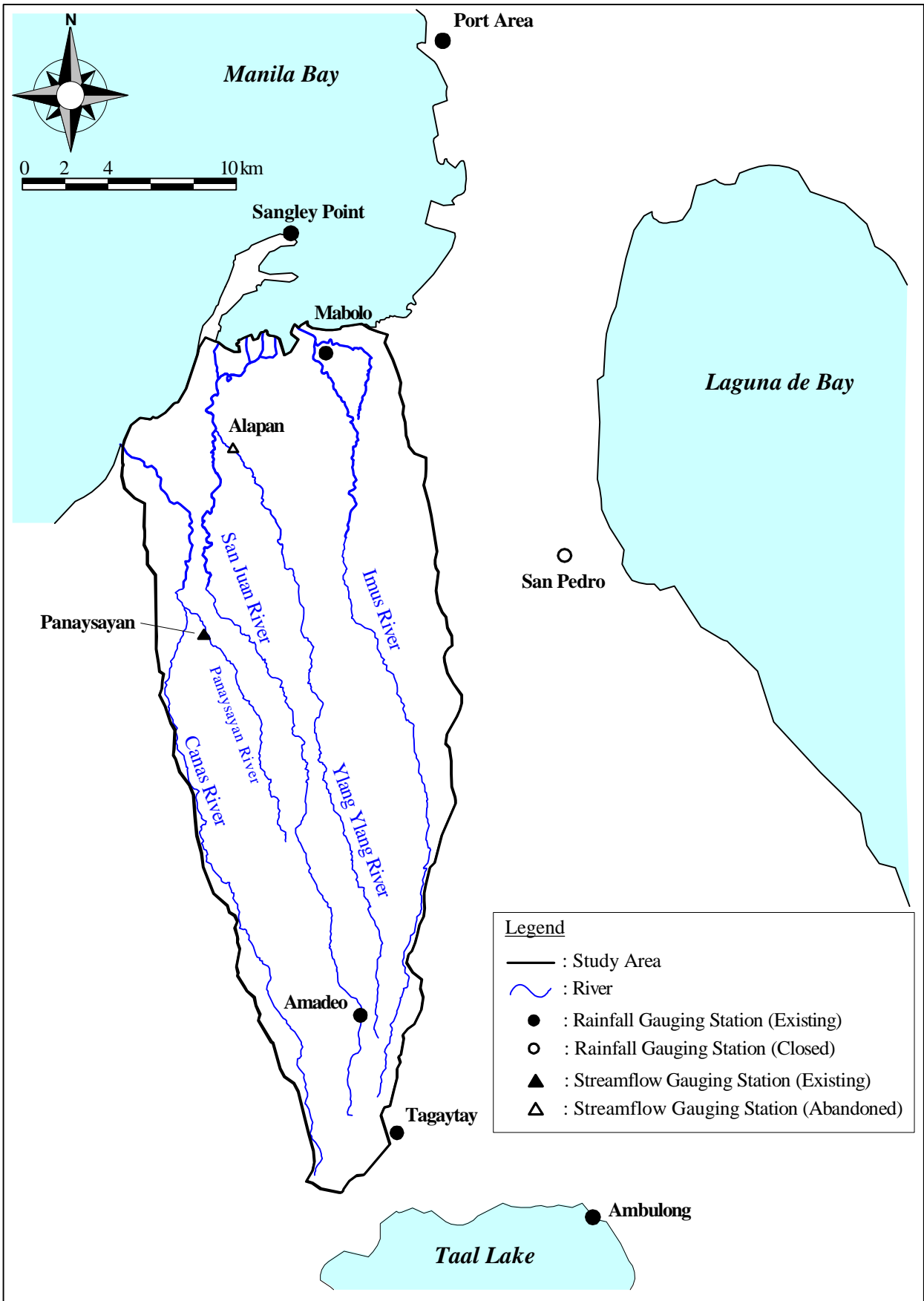
カビテ州による調査対象地域の都市化構想



THE STUDY ON
 COMPREHENSIVE FLOOD MITIGATION
 FOR CAVITE LOWLAND AREA

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

図 5.1
 水文解析フローチャート

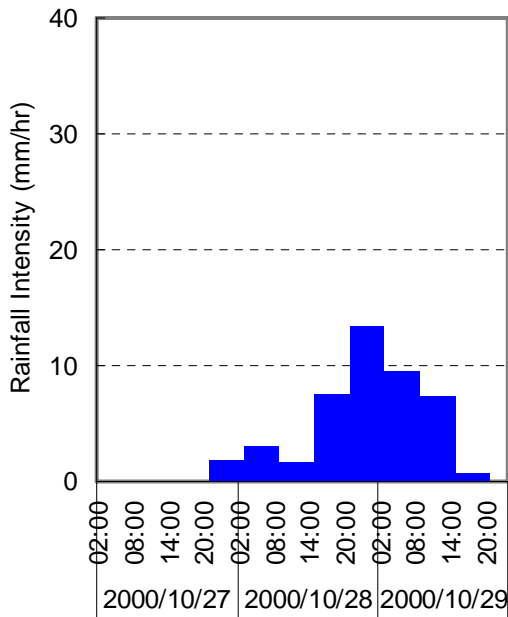


THE STUDY ON
 COMPREHENSIVE FLOOD MITIGATION
 FOR CAVITE LOWLAND AREA

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

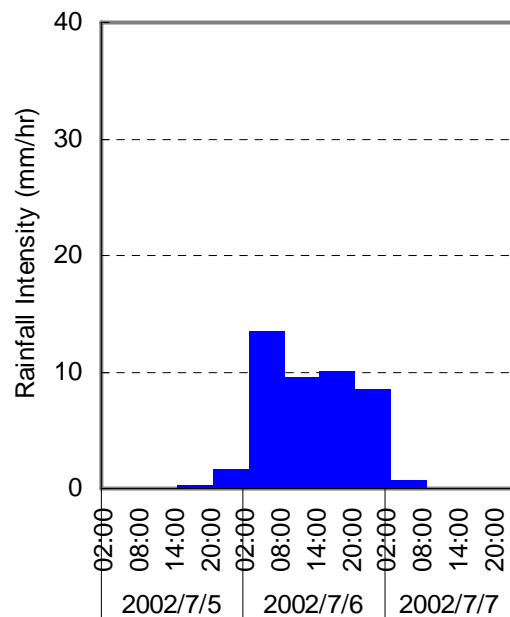
図 5.2
 雨量観測所および水位・流量観測所位置図

Typhoon Reming in October 2000



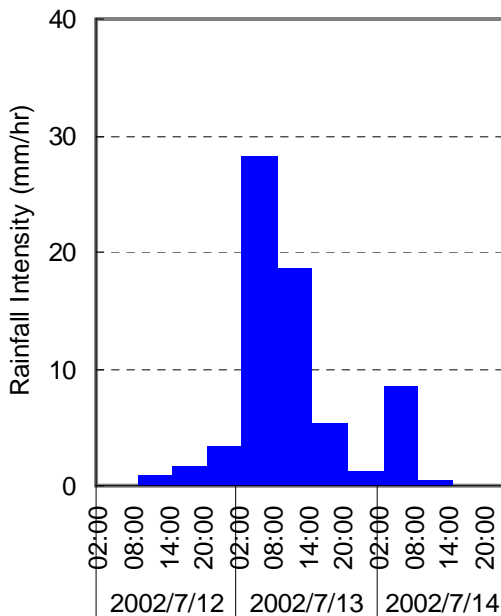
Philippine Standard Time (PST)

Typhoon Gloria in July 2002



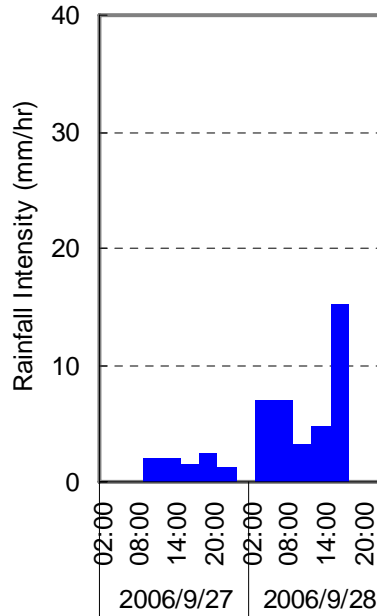
PST

Typhoon Inday in July 2002



PST

Typhoon Milenyo in September 2006



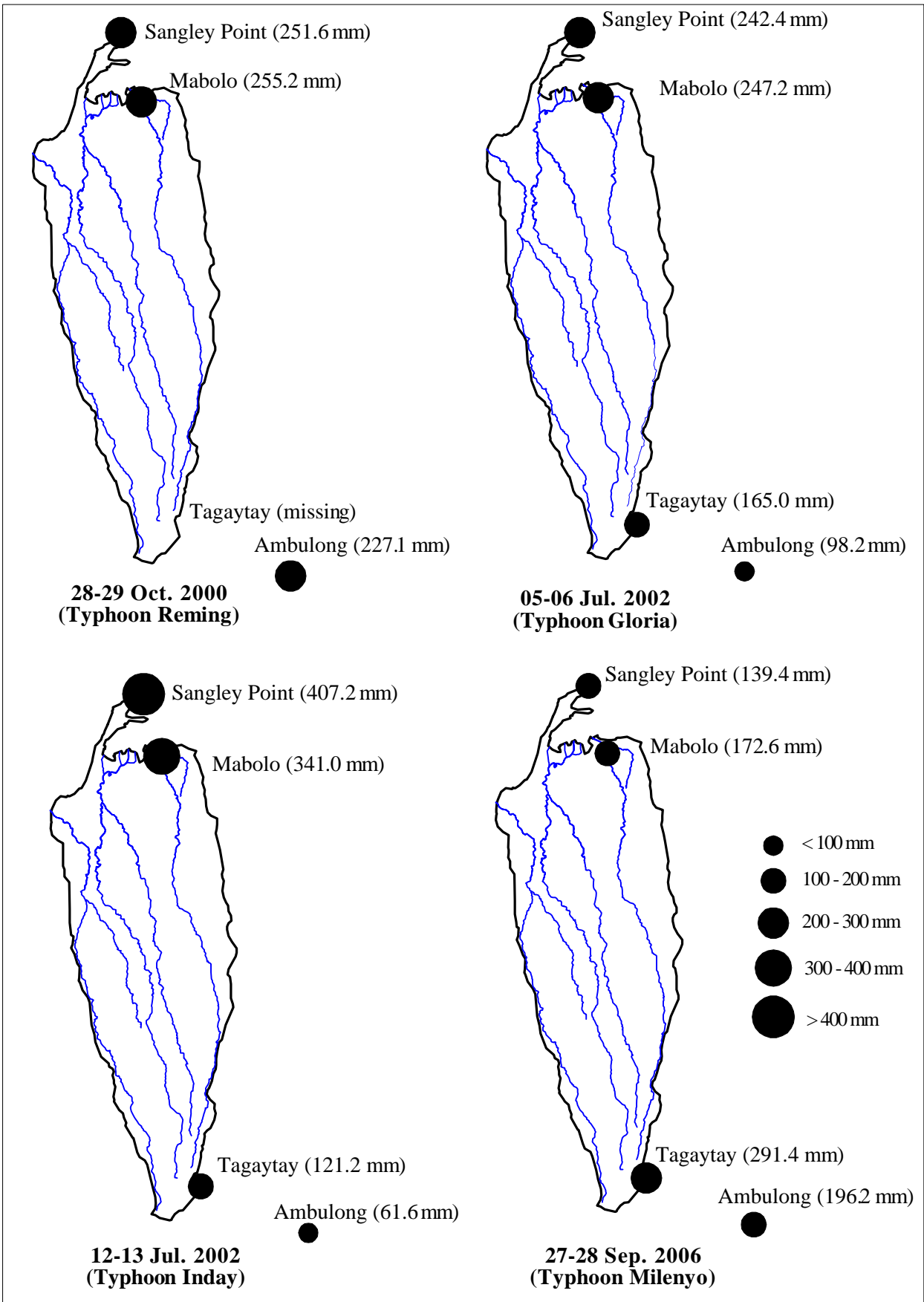
PST

THE STUDY ON
COMPREHENSIVE FLOOD MITIGATION
FOR CAVITE LOWLAND AREA

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

図 5.3

2000年、2002年、2006年の主要4台風による
Sangley Point観測所の観測雨量

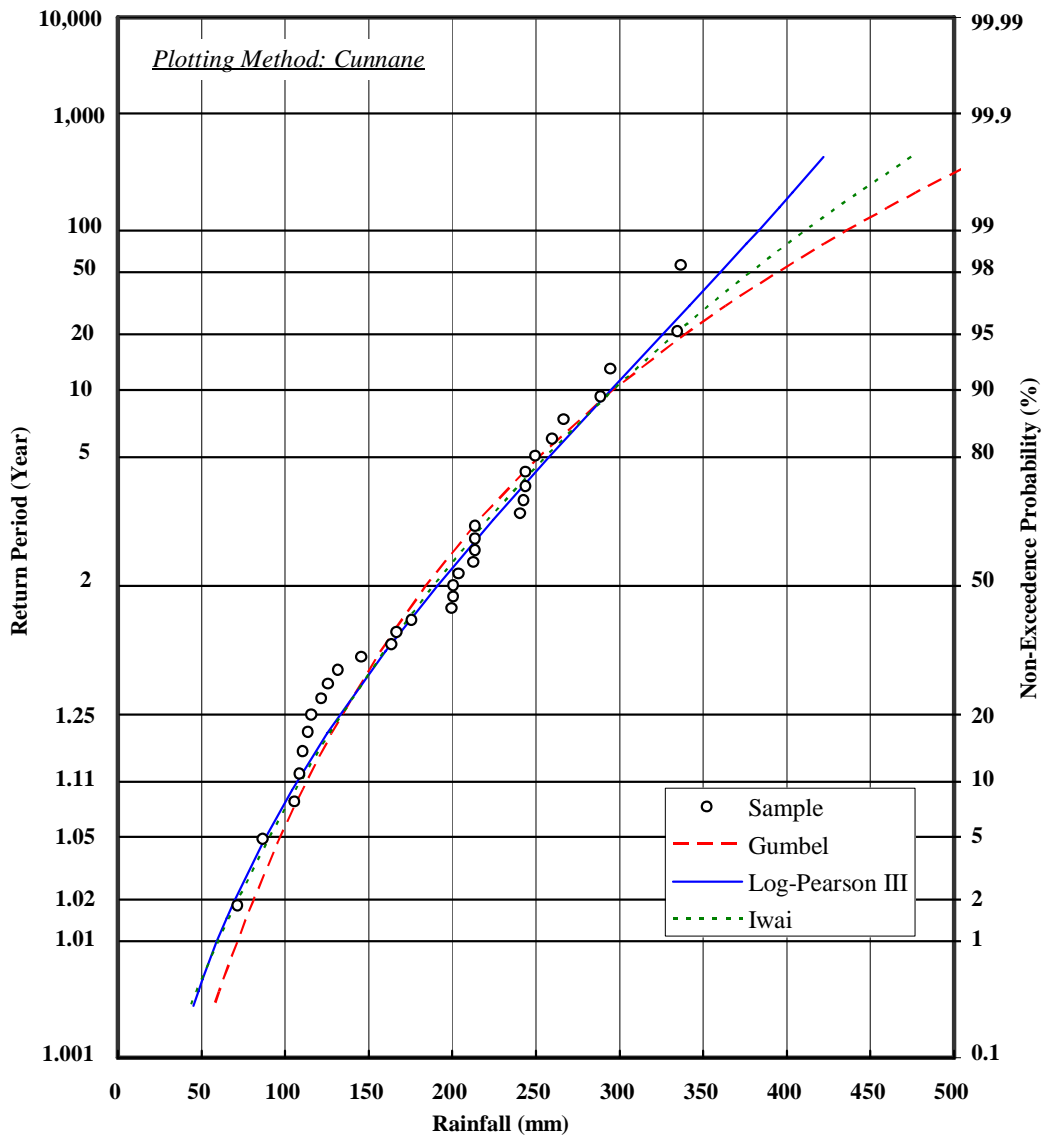


THE STUDY ON
 COMPREHENSIVE FLOOD MITIGATION
 FOR CAVITE LOWLAND AREA

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

図 5.4

2000年、2002年、2006年の主要4台風による
 2日雨量の地域分布



(Unit: mm)

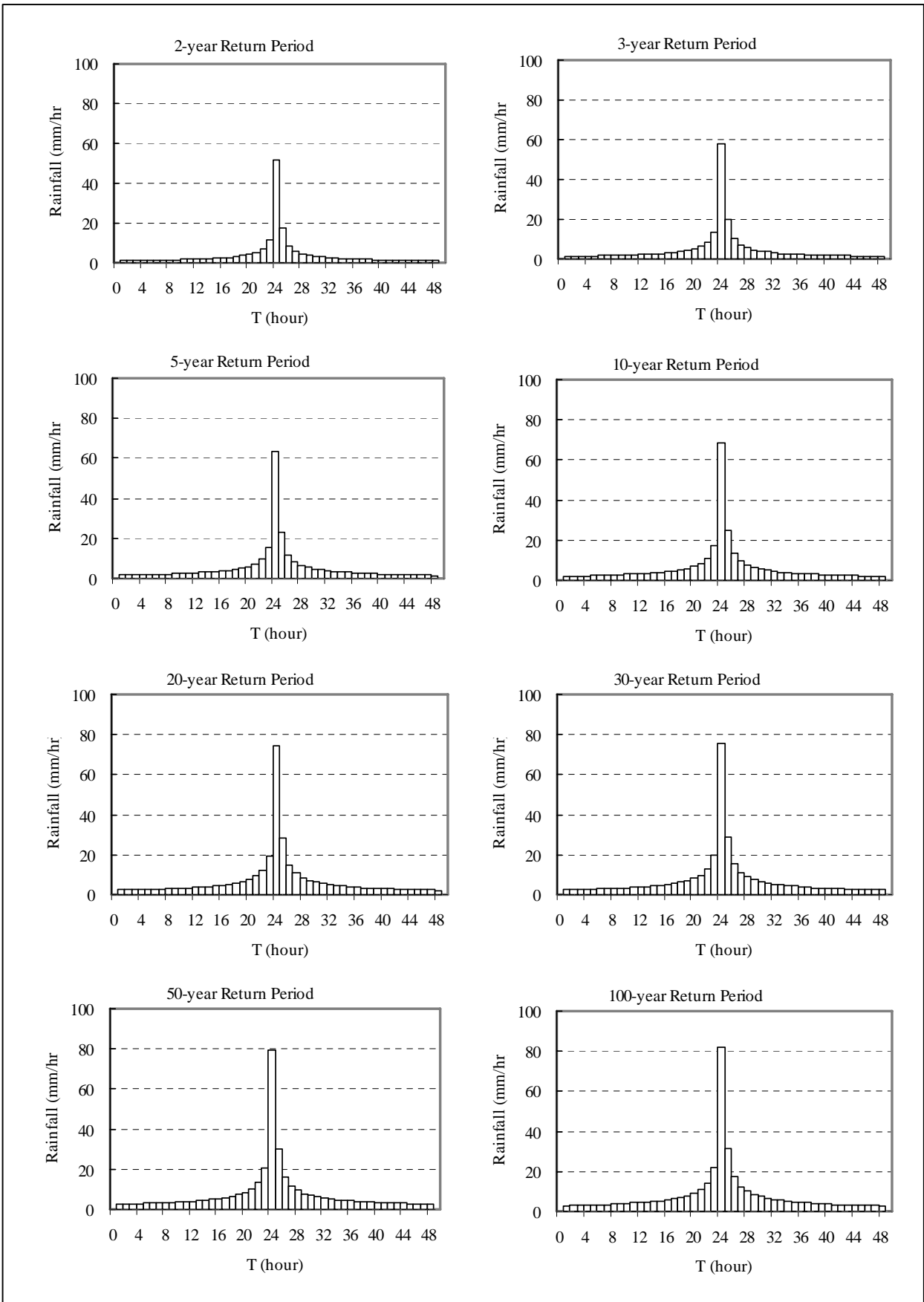
Return Period (year)	Gumbel	Log-Pearson III	Iwai
2	184	191	188
3	216	224	221
5	251	258	255
10	296	295	296
20	339	326	333
30	363	342	353
50	394	360	378
80	422	376	400
100	436	383	411
150	460	395	430
200	477	404	443
Correlation	0.970	0.987	0.981

THE STUDY ON
COMPREHENSIVE FLOOD MITIGATION
FOR CAVITE LOWLAND AREA

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

図 5.5

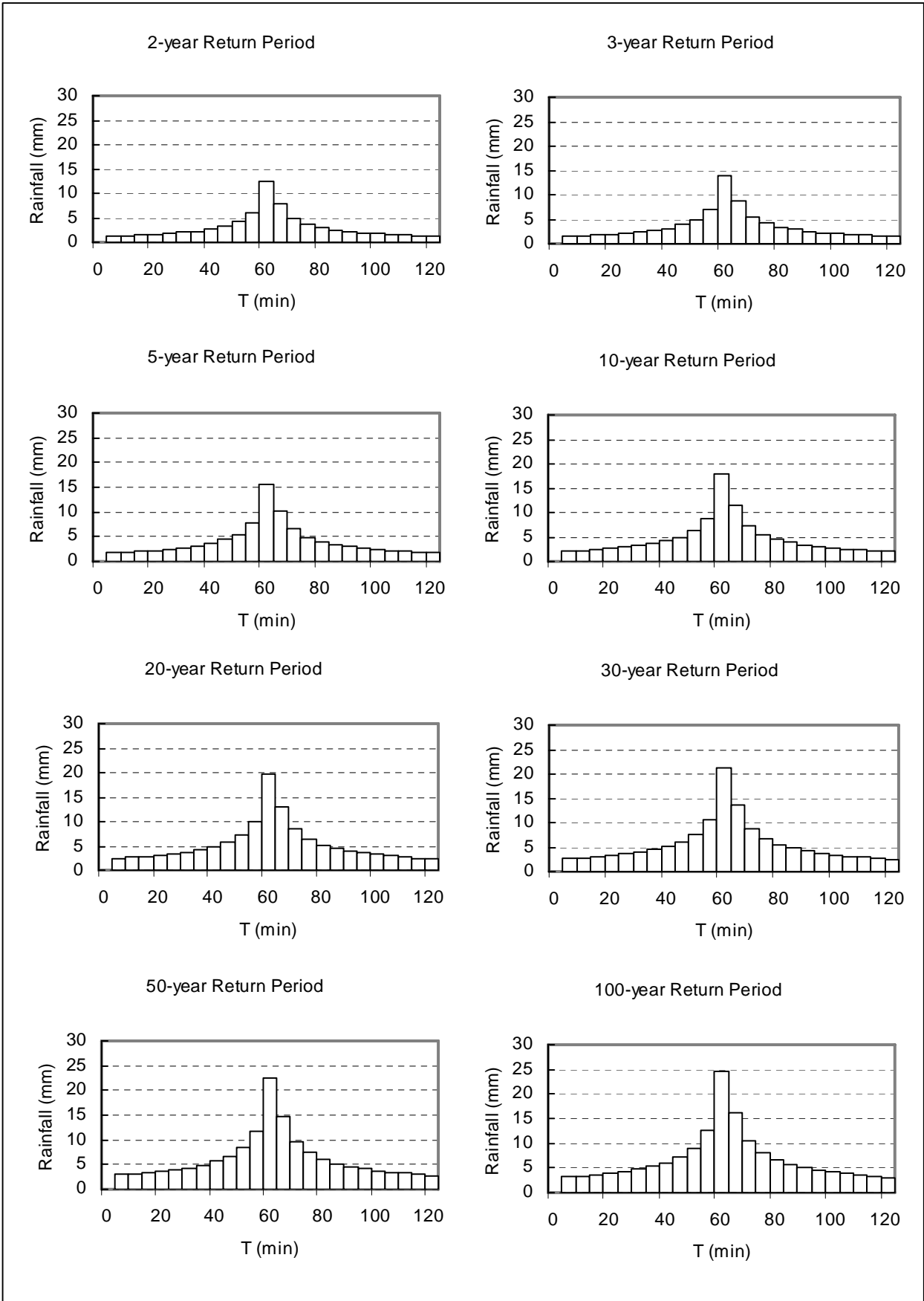
流域平均2日雨量に対する統計解析結果



THE STUDY ON
 COMPREHENSIVE FLOOD MITIGATION
 FOR CAVITE LOWLAND AREA

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

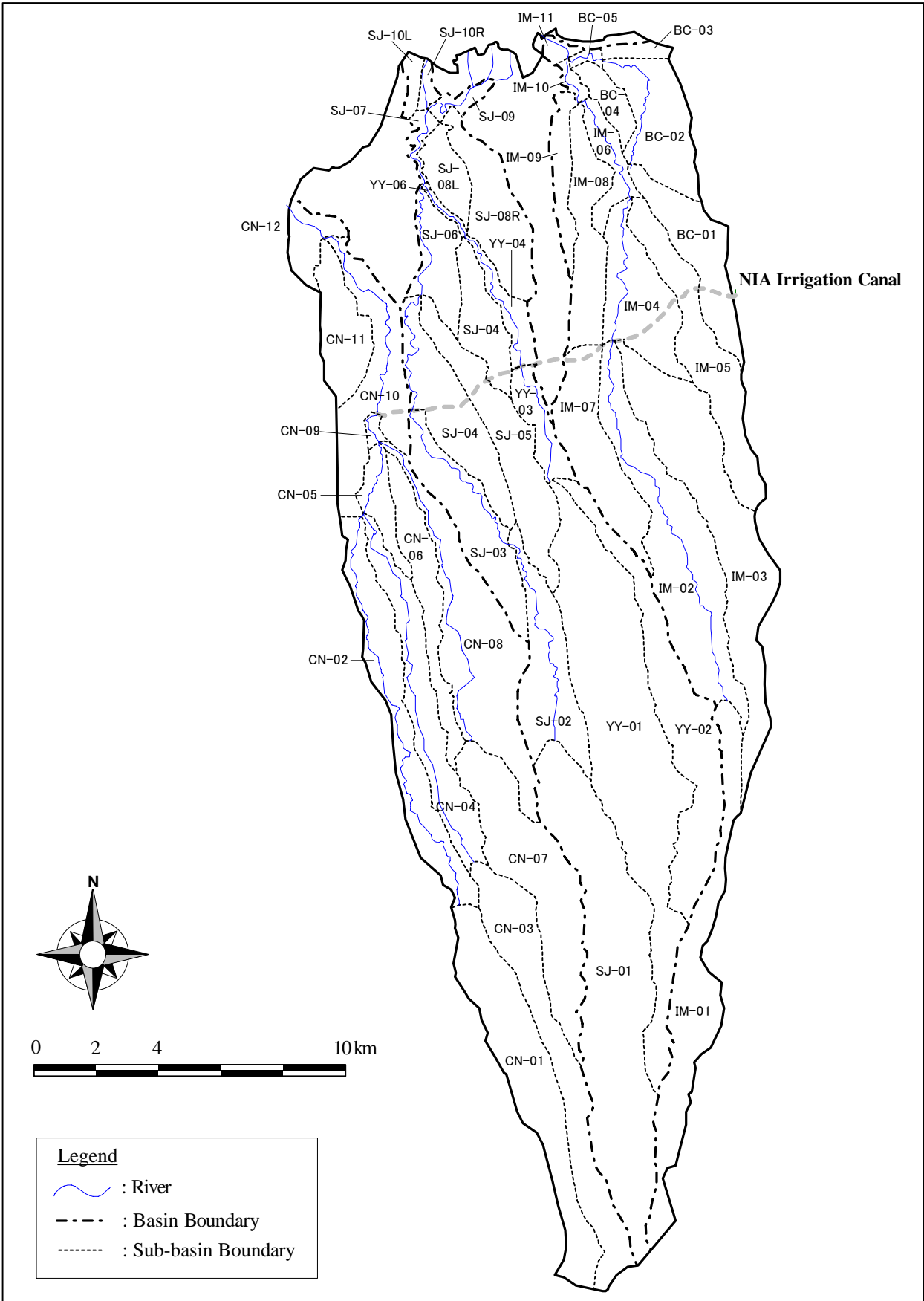
図 5.6
 長時間降雨に対する計画降雨



THE STUDY ON
 COMPREHENSIVE FLOOD MITIGATION
 FOR CAVITE LOWLAND AREA

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

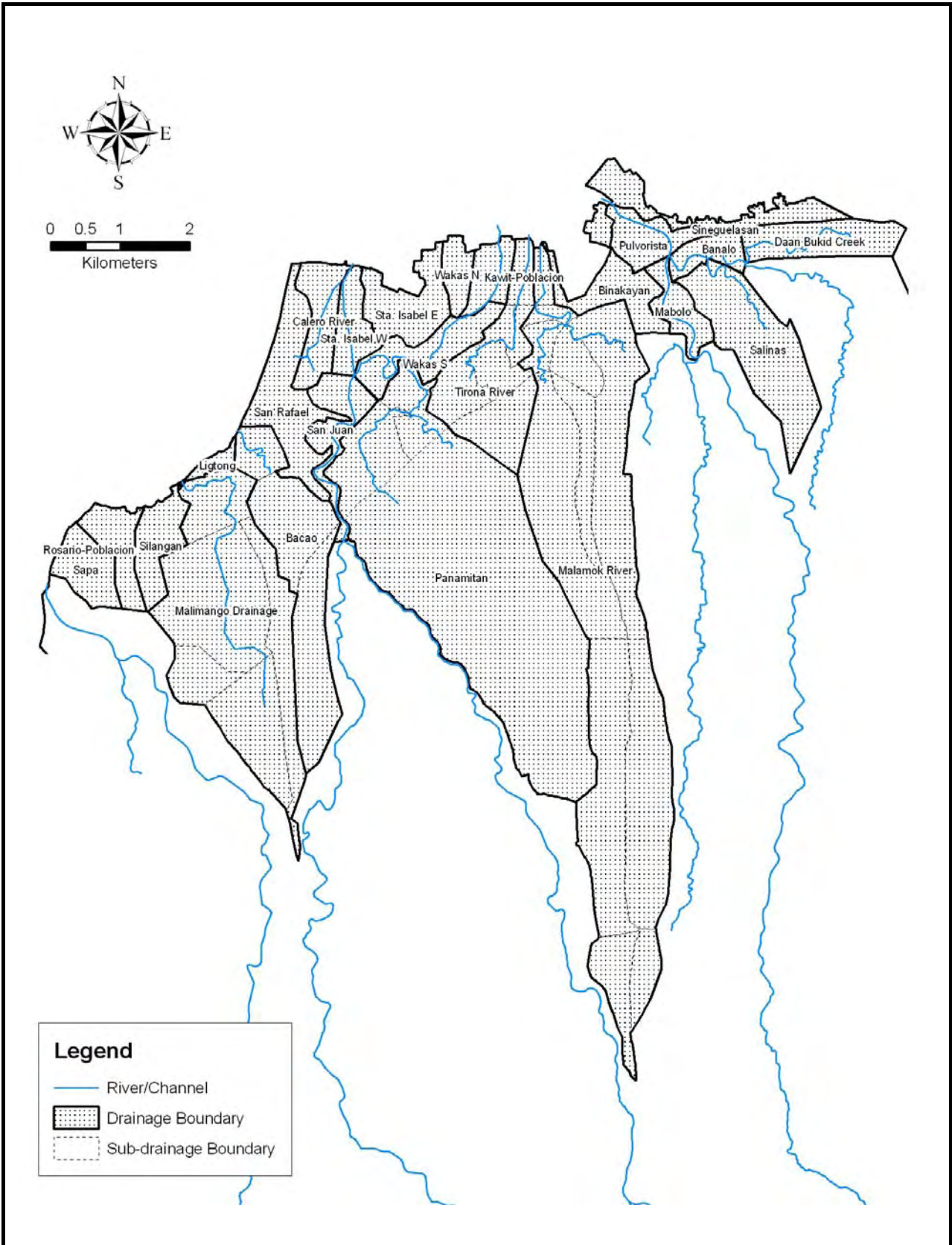
図 5.7
 短時間降雨に対する計画降雨



THE STUDY ON
 COMPREHENSIVE FLOOD MITIGATION
 FOR CAVITE LOWLAND AREA

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

図 5.8
 主要3河川流域に対する流域分割

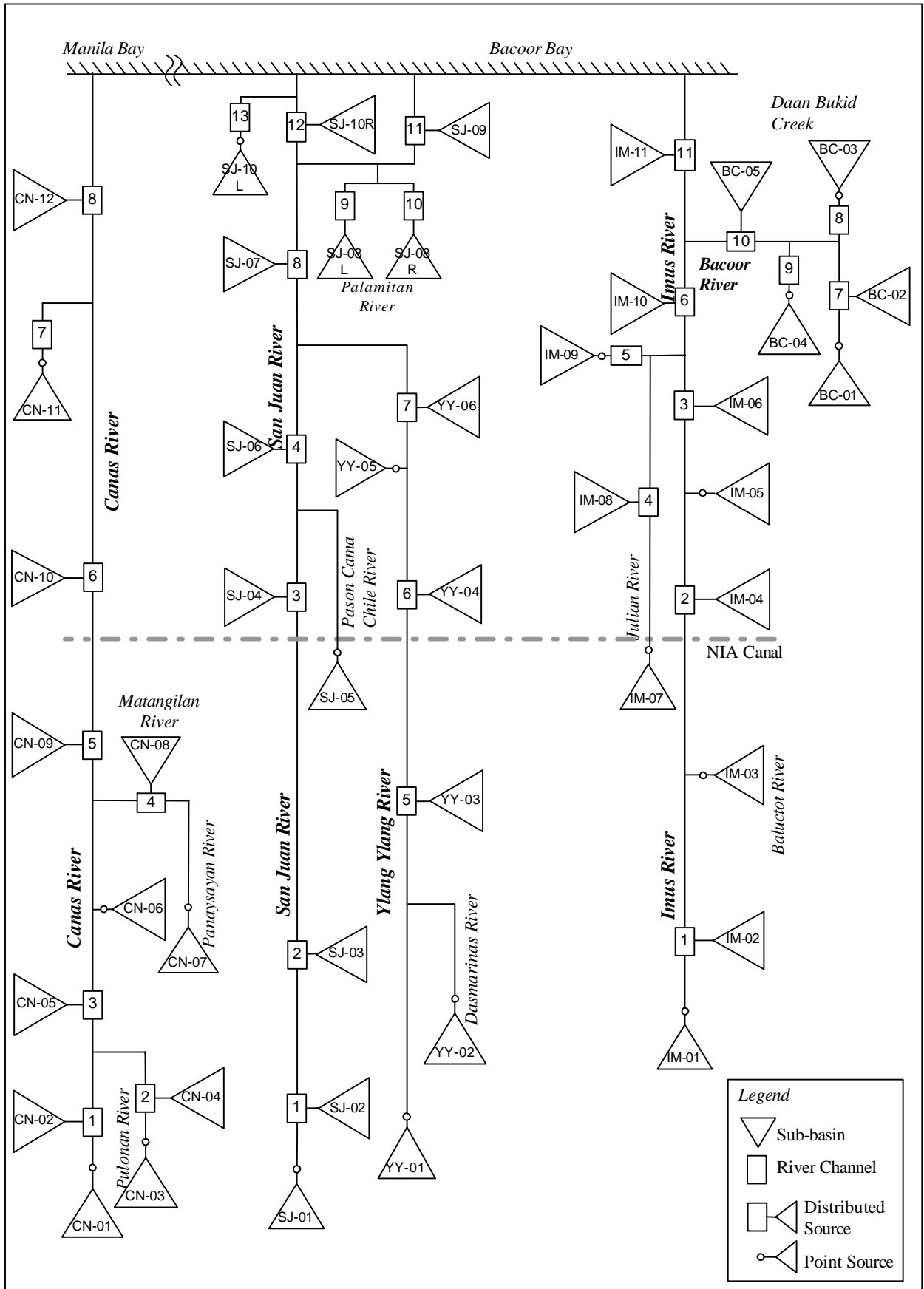


THE STUDY ON
 COMPREHENSIVE FLOOD MITIGATION
 FOR CAVITE LOWLAND AREA

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

図 5.9

内水対象地域に対する流域分割

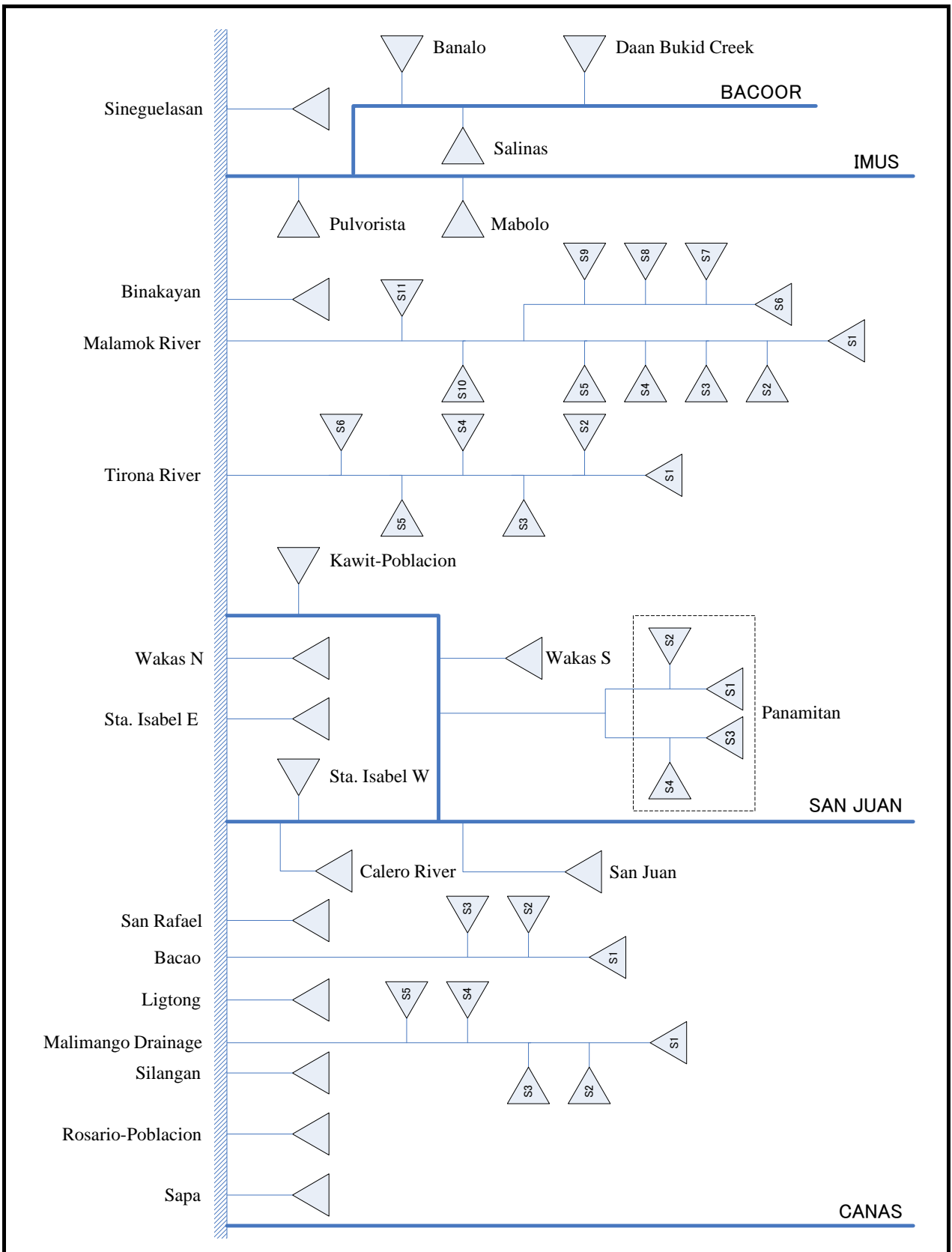


THE STUDY ON
COMPREHENSIVE FLOOD MITIGATION
FOR CAVITE LOWLAND AREA

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

図 5.10

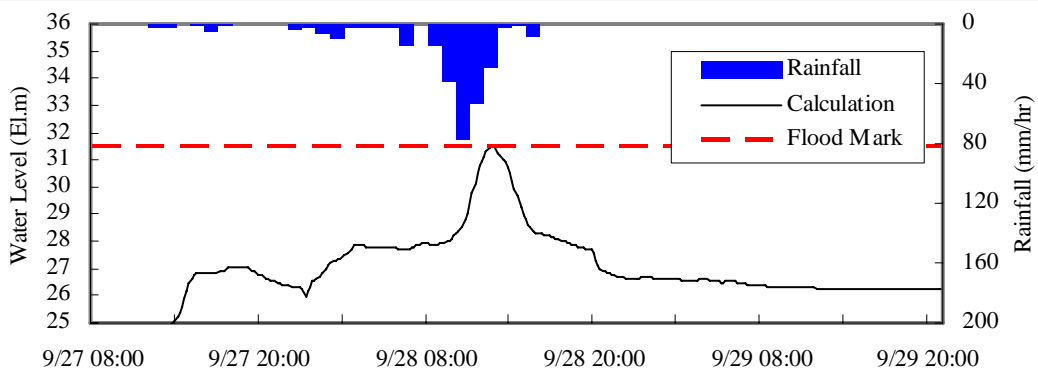
河川の流出系統図



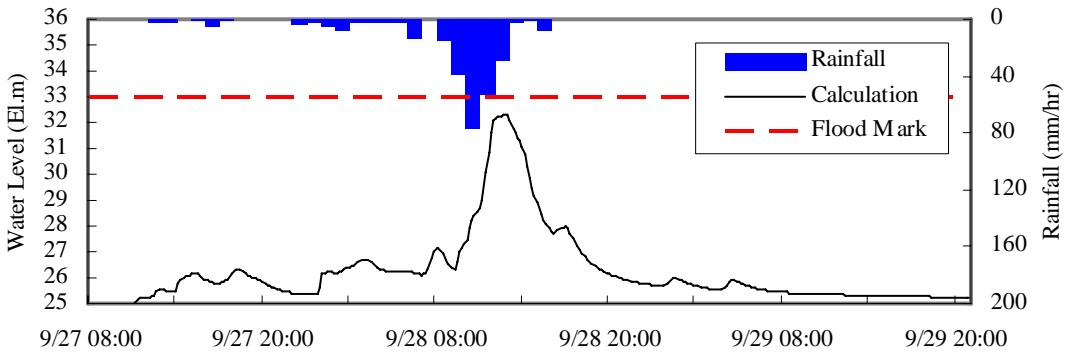
THE STUDY ON
 COMPREHENSIVE FLOOD MITIGATION
 FOR CAVITE LOWLAND AREA

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

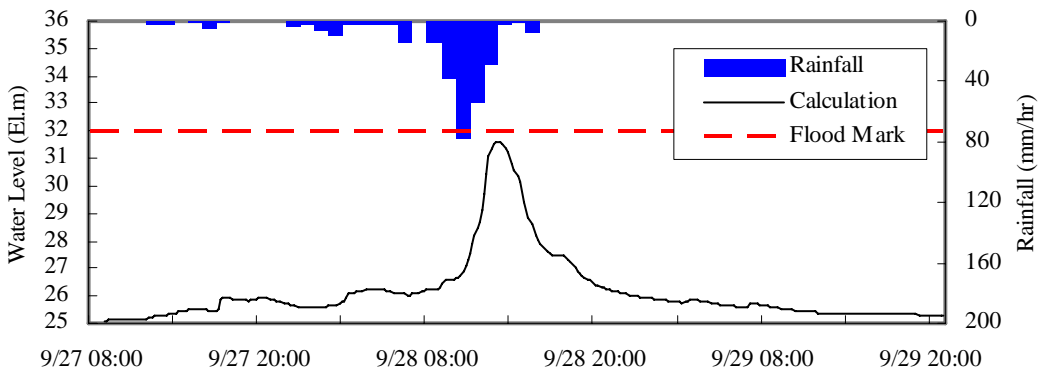
図 5.11
 内水河川の排水系統図



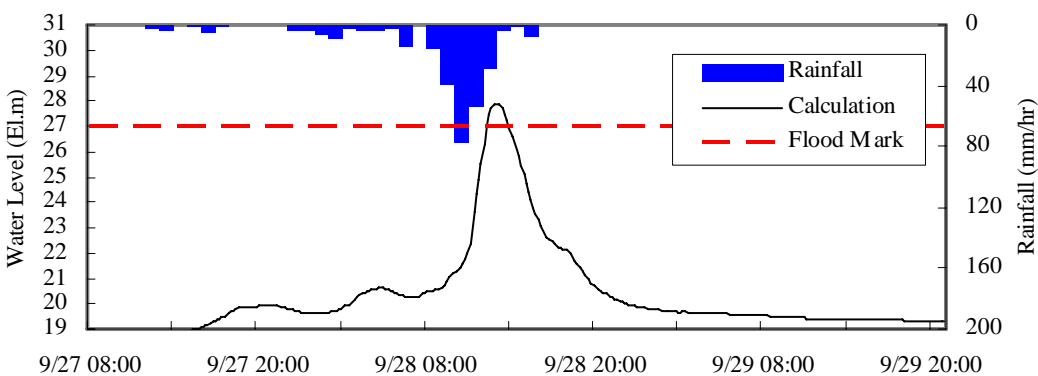
(1) Imus River (at NIA Canal)



(2) Ylang Ylang River (at NIA Canal)



(3) San Juan River (at NIA Canal)



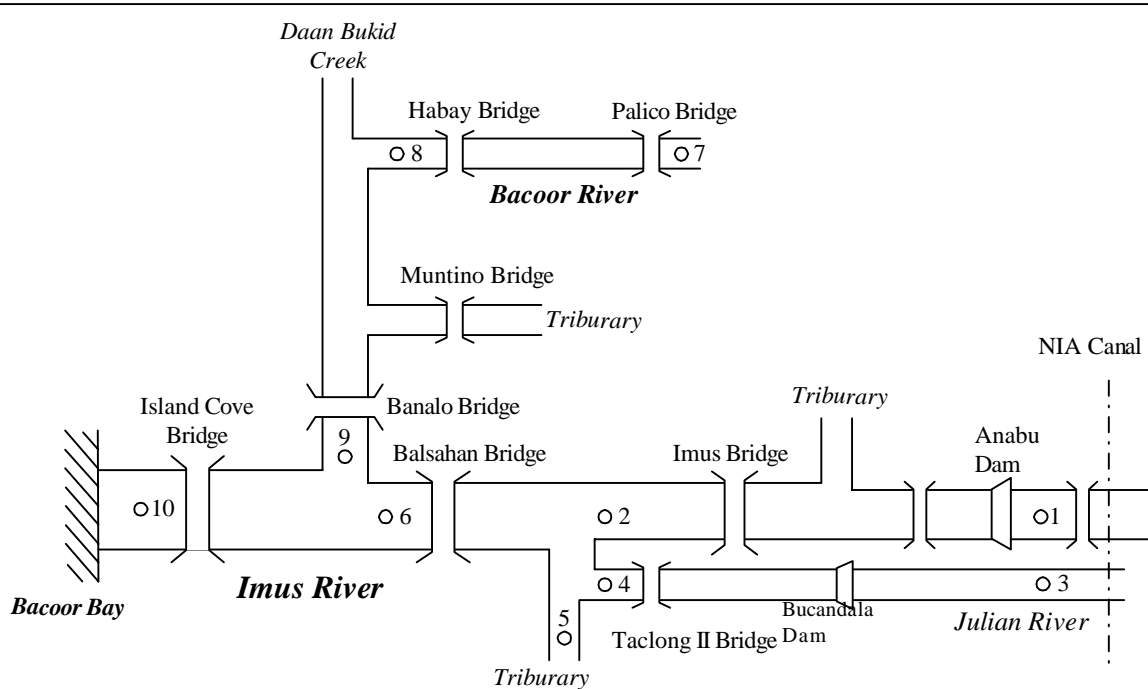
(4) Canas River (at NIA Canal)

THE STUDY ON
COMPREHENSIVE FLOOD MITIGATION
FOR CAVITE LOWLAND AREA

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

図 5.12

2006年洪水に対する洪水流出モデルの
検証結果



Present Land Use

Point No.	Peak Discharge for Each Return Period (m ³ /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 (m ³ /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)**

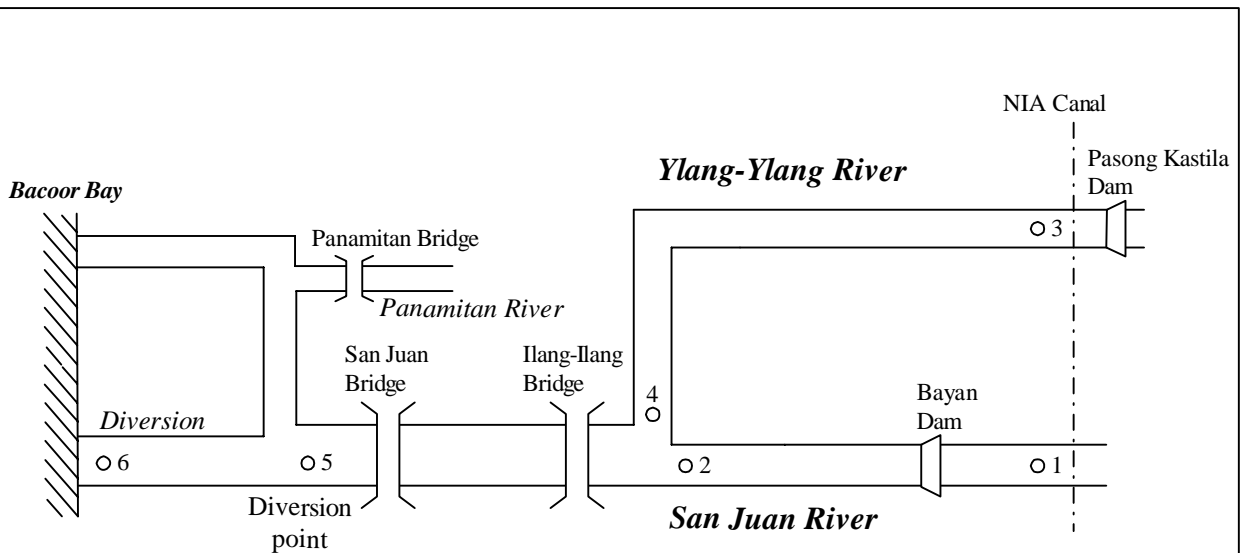
Point No.	Peak Discharge for Each Return Period (m ³ /s)							
	2-year	3-year	5-year	10-year	20-year	30-year	50-year	100-year
1	250	290	350	430	550	650	700	800
2	320	380	480	600	750	850	950	1,000
3	90	100	120	140	160	190	200	210
4	140	170	200	240	230	310	330	350
5	25	30	35	40	45	60	60	65
6	470	550	700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

☒ 5.13

Imus川における基本高水流量



Present Land Use

Point No.	Peak Discharge for Each Return Period (m ³ /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 (m ³ /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)

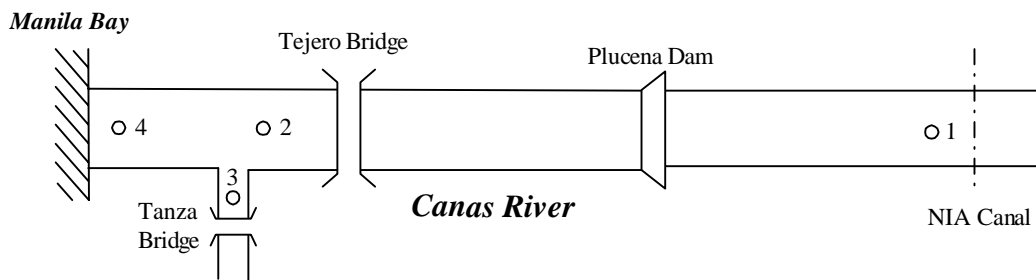
Point No.	Peak Discharge for Each Return Period (m ³ /s)							
	2-year	3-year	5-year	10-year	20-year	30-year	50-year	100-year
1	130	160	220	340	460	550	600	700
2	190	240	320	450	600	650	750	850
3	220	250	300	430	600	700	750	850
4	220	260	320	440	600	700	750	850
5	340	420	600	850	1,100	1,200	1,400	1,500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

THE STUDY ON
COMPREHENSIVE FLOOD MITIGATION
FOR CAVITE LOWLAND AREA

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

☒ 5.14

San Juan川における基本高水流量



Present Land Use

Point No.	Peak Discharge for Each Return Period (m ³ /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 (m ³ /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)

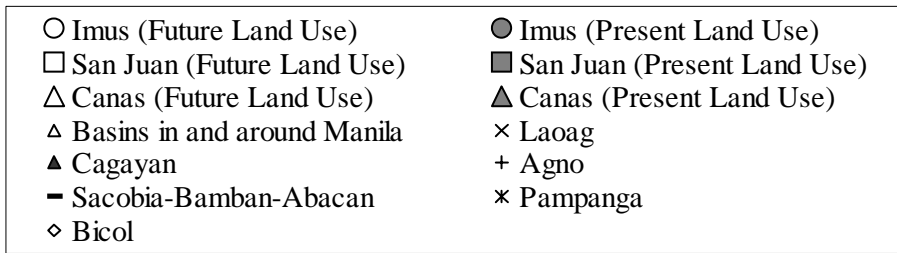
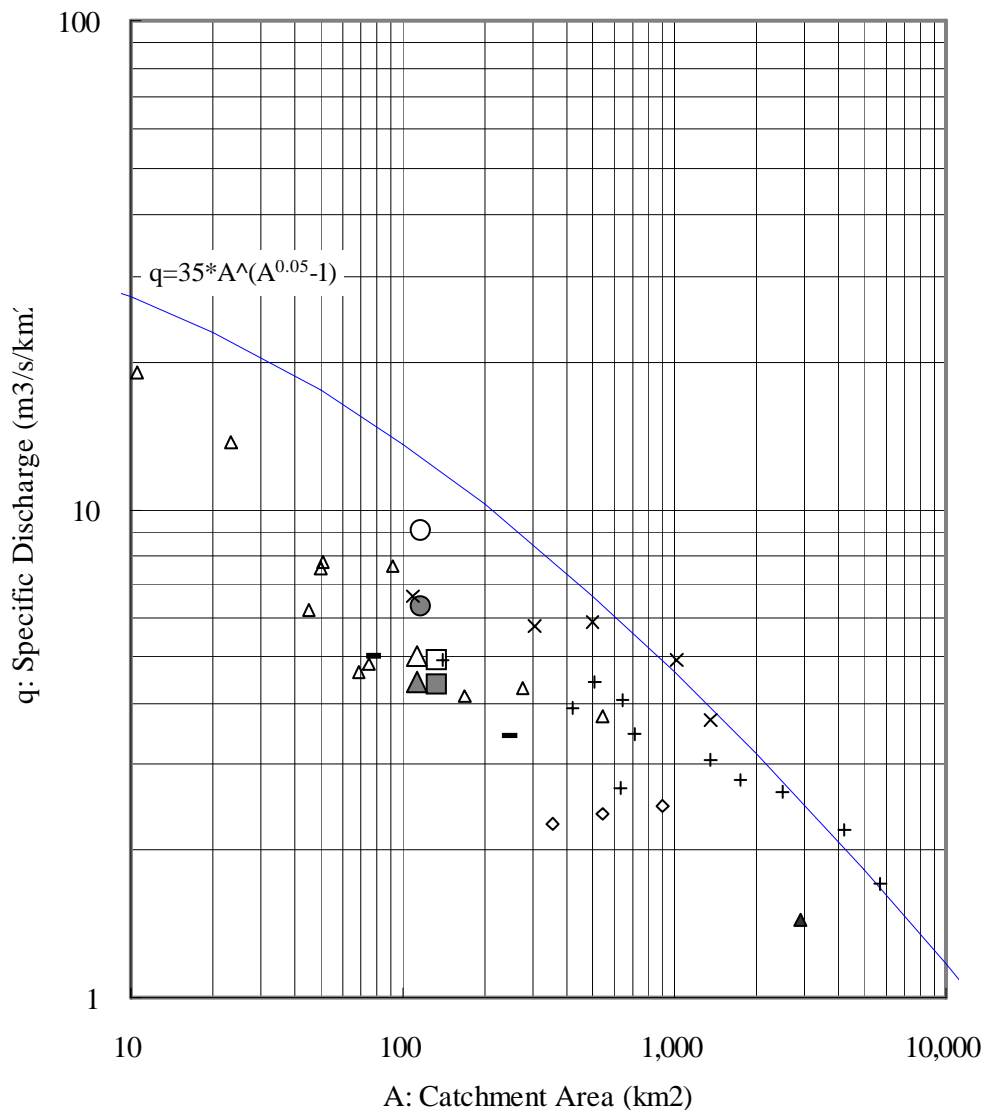
Point No.	Peak Discharge for Each Return Period (m ³ /s)							
	2-year	3-year	5-year	10-year	20-year	30-year	50-year	100-year
1	240	300	440	700	950	1,100	1,200	1,400
2	250	320	480	750	1,000	1,100	1,300	1,400
3	30	35	40	60	75	90	100	110
4	270	340	550	800	1,100	1,200	1,400	1,500

THE STUDY ON
COMPREHENSIVE FLOOD MITIGATION
FOR CAVITE LOWLAND AREA

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

図 5.15

Canas川における基本高水流量



Source:

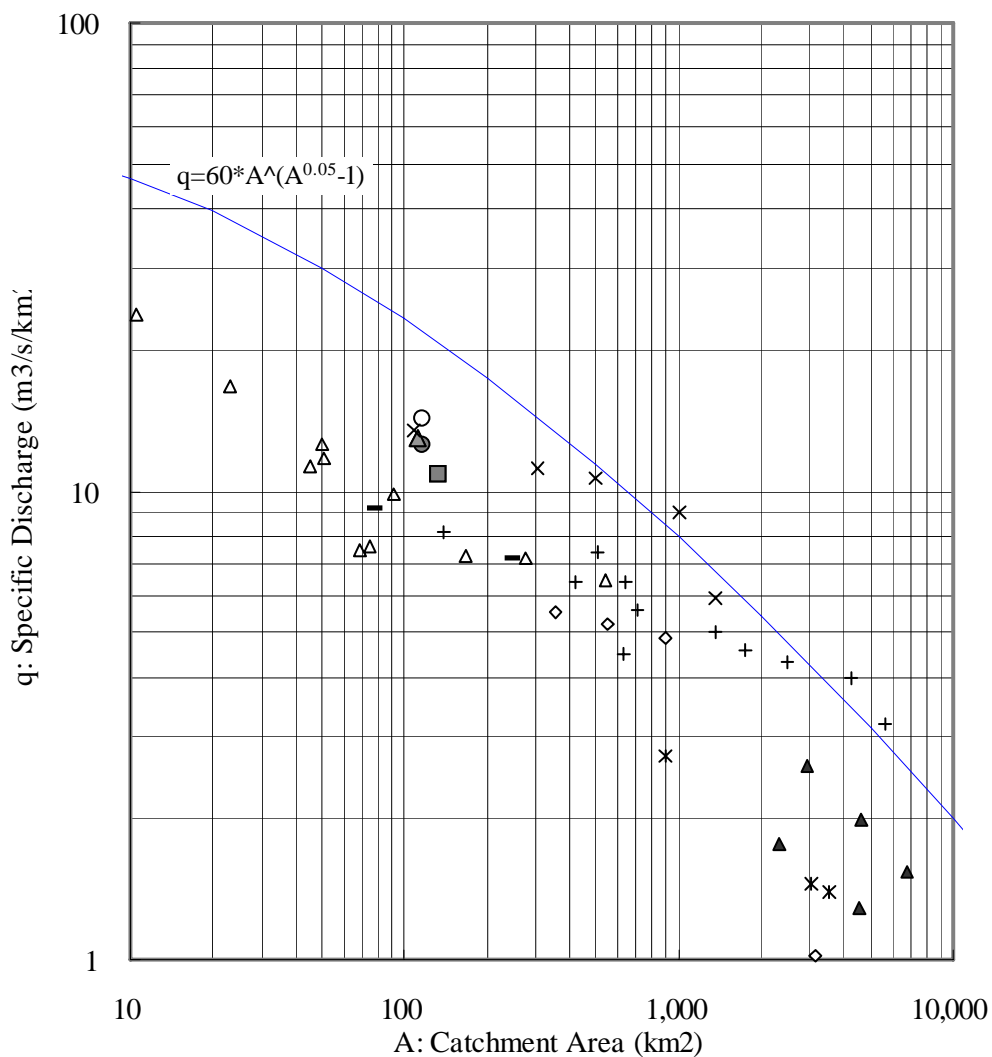
- 1) Basins in and around Manila: The Study on Flood Control and Drainage Project in Metro Manila, Vol. 2, Supporting Report, 1990, JICA
- 2) Basins in the Luzon Island: Study for the Preparation of Flood Control Manual for Department of Public Works and Highways Technical Standards and Guidelines, Final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

THE STUDY ON
COMPREHENSIVE FLOOD MITIGATION
FOR CAVITE LOWLAND AREA

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

図 5. 16

ルソン島の他流域との比流量の比較
(5年確率洪水)



○ Imus (Future Land Use)	● Imus (Present Land Use)
□ San Juan (Future Land Use)	■ San Juan (Present Land Use)
△ Canas (Future Land Use)	▲ Canas (Present Land Use)
△ Basins in and around Manila	× Laoag
▲ Cagayan	+ Agno
— Sacobia-Bamban-Abacan	* Pampanga
◇ Bicol	

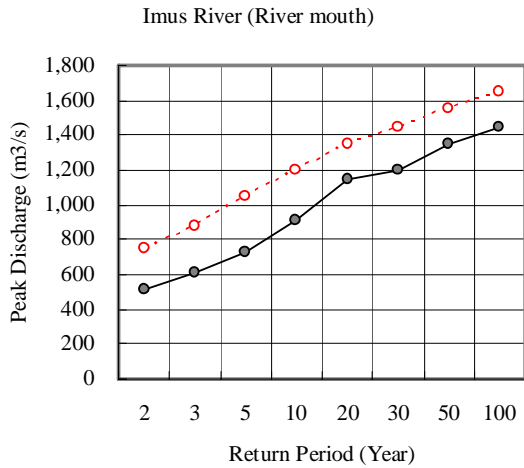
Source:

- 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, Volume I, March 2003, JICA, DPWH

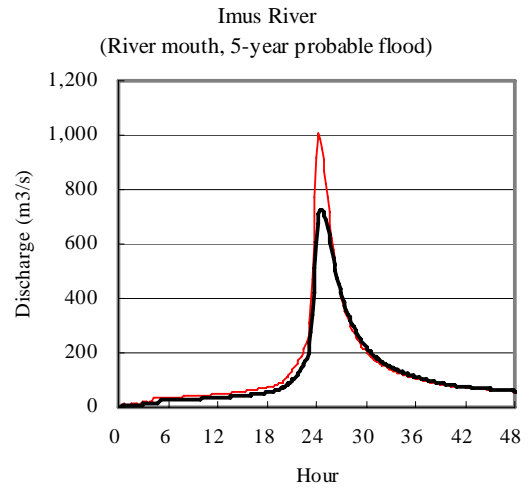
THE STUDY ON
COMPREHENSIVE FLOOD MITIGATION
FOR CAVITE LOWLAND AREA

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

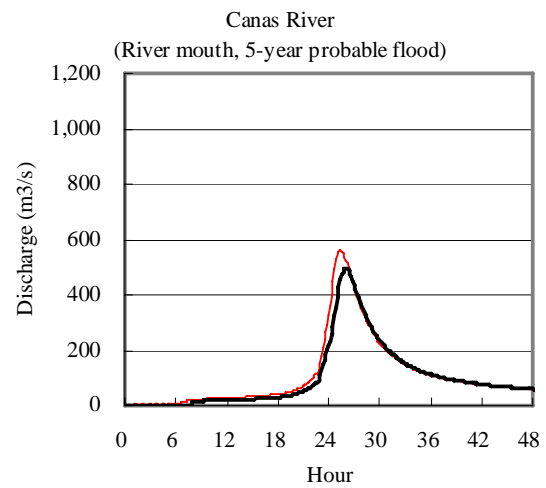
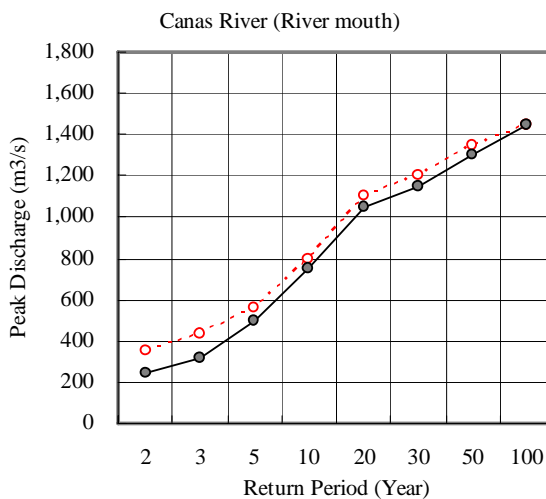
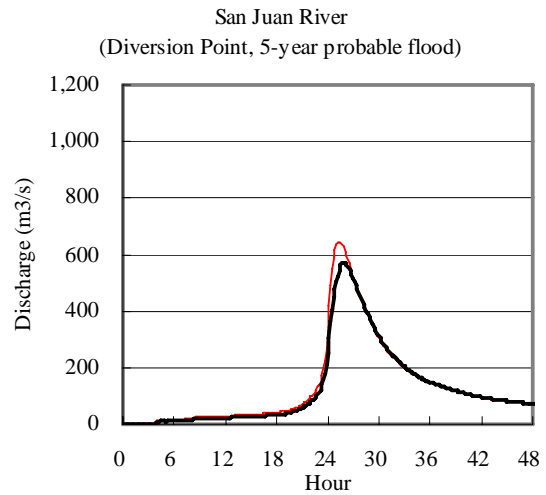
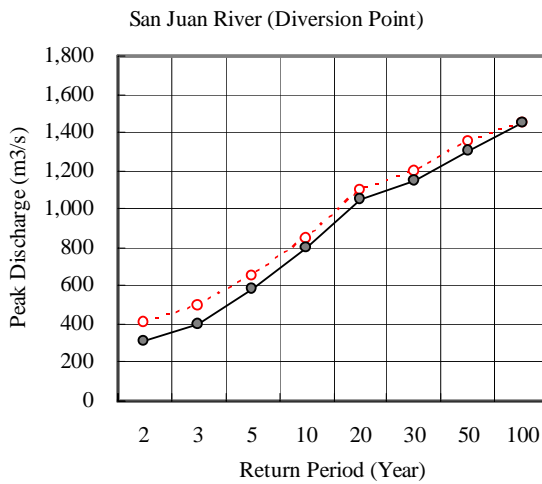
図 5.17
ルソン島の他流域との比流量の比較
(100年確率洪水)



---○--- Future Land Use —●— Present Land Use



— Future Land Use — Present Land Use

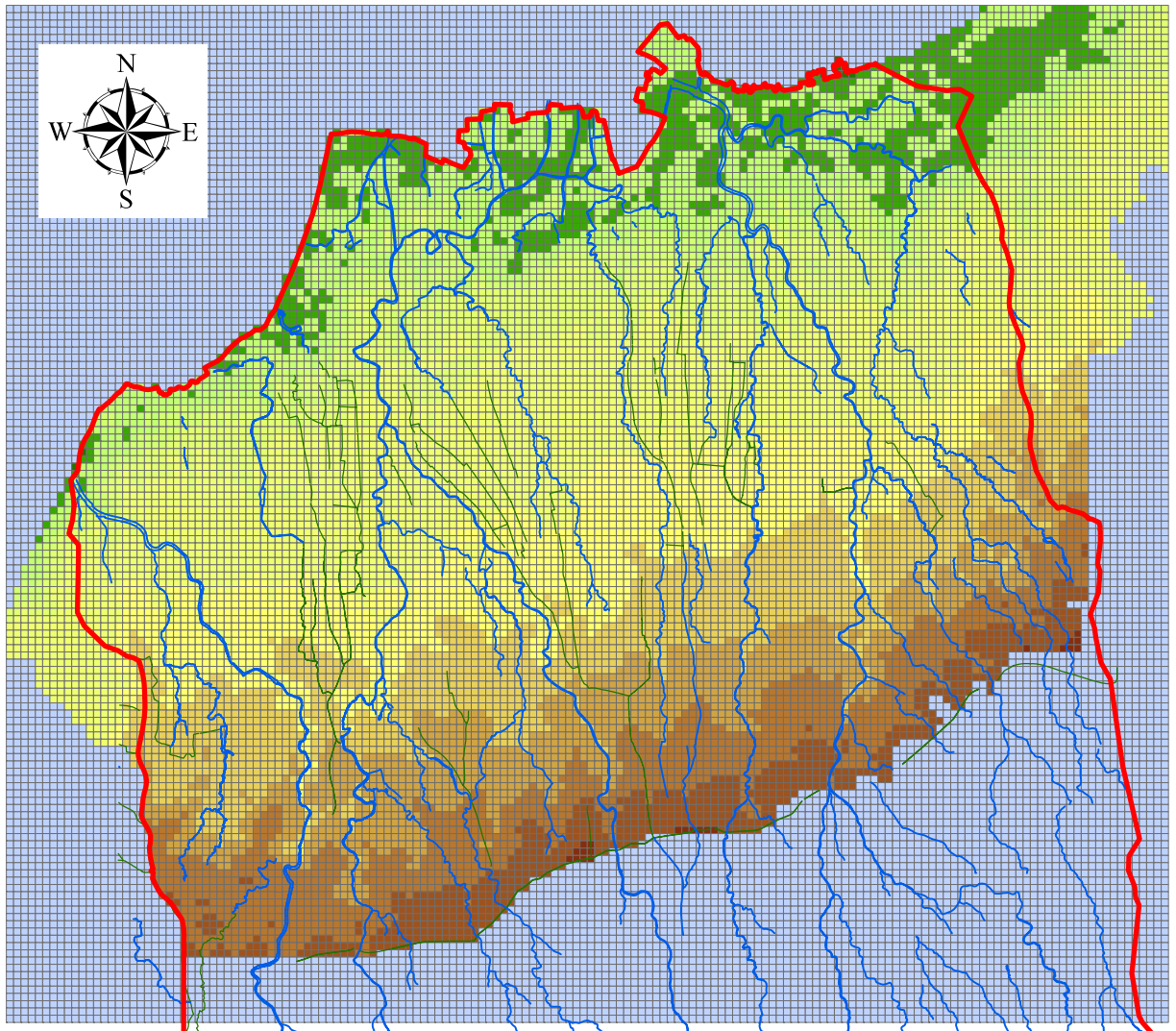


THE STUDY ON
COMPREHENSIVE FLOOD MITIGATION
FOR CAVITE LOWLAND AREA

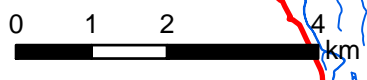
CTI Engineering International Co.,Ltd.
Nippon Koei Co., Ltd

図 5.18

都市化による流出量の増大



- Legend**
- Project Area
 - less than 0m
 - 0 - 1m
 - 1 - 2m
 - 2 - 3m
 - 3 - 5m
 - 5 - 10m
 - 10 - 15m
 - 15 - 20m
 - 20 - 25m
 - 25 - 30m
 - 30 - 35m
 - 35 - 40m
 - out of target area



THE STUDY ON
COMPREHENSIVE FLOOD MITIGATION
FOR CAVITE LOWLAND AREA

JAPAN INTERNATIONAL COOPERATION AGENCY

図 5.19
作成した100mメッシュによるDEM

