

附表

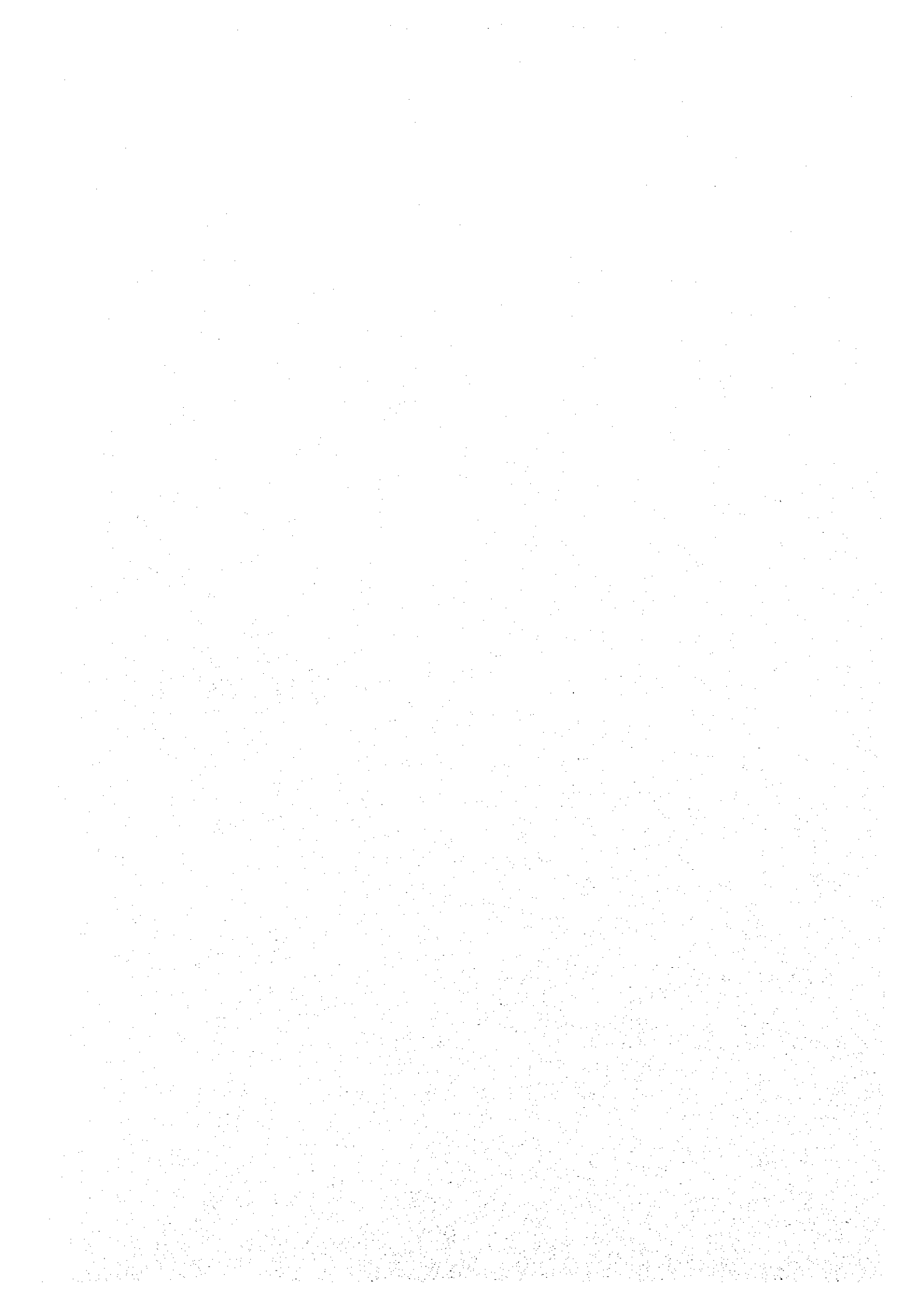


表 2.1 洪水状況の要約

Area	Geographical Features	Land Use	Flooding Condition In 1995	Cause of Flooding	Flood Damage in 1995
Upper Central Plain (Upstream of Nakhon Sawan)	Valley plain between hilly areas with gentle slope in the east and west.	Main land use: Paddy (Traditional varieties are dominant, but HYV is applied in Phitsanulok Irrigation Area protected by dikes). Major urban area: Uthairat, Phitsanulok, Sukhothai, Phichit	Inundation Area: 5,000 km ² Depth: 0.5 to 3 m Duration: 2 to 3 month (in some depression areas continued more than 3 months up to January next year)	<ul style="list-style-type: none"> • Overtopping of Yom and Nan rivers • Inland flood • Overland flow from upstream • Flash flood from upper mountainous area 	<p>Agricultural Damage More than 50% of Phitsanulok project was protected. 180,000 ha of paddy field was damaged.</p> <p>Urban Area Damage Sukho Thai, Phitsanulok, Phichit are seriously damaged.</p> <p>Infrastructure Roads, bridges, irrigation facilities including regulators and canal embankment were damaged.</p> <p>Agricultural Damage Paddy fields of 160,000 ha and 10,000 ha were damaged in Nakhon Sawan and Uthai Thani respectively.</p> <p>Urban Area Damage Nakhon Sawan and Uthai Thani were severely damaged.</p> <p>Infrastructure Damage Roads were damaged</p>
Nakhon Sawan Area (between Nakhon Sawan and Chainat)	Narrow valley plain with number of isolated mountains	Main land use: Paddy (Traditional varieties are dominant) Major urban area: Nakhon Sawan, Uthai Thani	Inundation Area: 500 km ² Depth: 0.5 to 3 m Duration: 1 to 2 month	<ul style="list-style-type: none"> • Overtopping of Chao Phraya River • Overtopping of Sakae Krang River caused by back water from Chao Phraya River • Inland flood • Overland flow from upstream 	<p>Agricultural Damage Total 190,000 ha of paddy field including 50,000 ha in Maharat Project Area was damaged.</p> <p>Urban Area Damage Chainat, Sin Buri, Angthong, Ayuthaya and Suphan Buri are severely damaged.</p> <p>Infrastructure Damage Roads, bridges, irrigation facilities including regulators and canal embankments are damaged</p> <p>Agricultural Damage 40,000 ha of paddy field and 10,000 ha of other crop fields were damaged.</p> <p>Urban Area Damage Pathum Thani, Nonthaburi, Samut Prakan are damaged.</p> <p>Infrastructure Damage Roads, irrigation facilities including regulators and canal embankments are damaged</p>
Higher Delta in Lower Central Plain (between Chainat and Ayuthaya)	Natural levees and back marshes are well developed.	Main land use: Paddy (HYV is dominant but floating rice and deep water rice are dominant in habitually inundated area). Major urban area: Chainat, Sin Buri, Angthong, Ayuthaya, Supan Buri, Lop Buri	Inundation Area: 4,600 km ² Depth: 0.5 to 4 m Duration: 2 to 3 month (in some depression areas continued more than 3 months up to January next year)	<ul style="list-style-type: none"> • Overtopping and dike breaches along Chao Phraya, Nan, Lopburi, Tha Chin, Pasak rivers • Inland flood • Overland flow from upstream 	<p>Agricultural Damage Total 190,000 ha of paddy field including 50,000 ha in Maharat Project Area was damaged.</p> <p>Urban Area Damage Chainat, Sin Buri, Angthong, Ayuthaya and Suphan Buri are severely damaged.</p> <p>Infrastructure Damage Roads, bridges, irrigation facilities including regulators and canal embankments are damaged</p> <p>Agricultural Damage 40,000 ha of paddy field and 10,000 ha of other crop fields were damaged.</p> <p>Urban Area Damage Pathum Thani, Nonthaburi, Samut Prakan are damaged.</p> <p>Infrastructure Damage Roads, irrigation facilities including regulators and canal embankments are damaged</p>
Lower Delta in Lower Central Plain (downstream of Ayuthaya)	Very flat	Main land use: Paddy (HYV rice) is main but urban areas are expanding rapidly. Major urban area: Bangkok, Pathum Thani, Nonthaburi, Samut Prakan	Inundation Area: 4,700 km ² Depth: 0.5 to 2 m Duration: 2 to 3 month	<ul style="list-style-type: none"> • Overtopping of Chao Phraya and Tha Chin rivers • Dike breach • Inland flood • Overland flow from upstream 	<p>Agricultural Damage 40,000 ha of paddy field and 10,000 ha of other crop fields were damaged.</p> <p>Urban Area Damage Pathum Thani, Nonthaburi, Samut Prakan are damaged.</p> <p>Infrastructure Damage Roads, irrigation facilities including regulators and canal embankments are damaged</p>

表 2.2 1995年洪水被害額推定値

(mil. Baht)

RIGION	HOUSES	COMMERCIAL	INDUSTRIAL	AGRICULTURE	PUBULIC	OTHERS	TOTAL
UPPER CENTRAL PLAIN	1,903	4,050	5,439	959	670	295	13,316
NAKHON SAWAN	550	1,194	2,377	186	130	57	4,495
HIGHER DELTA	2,214	7,044	8,968	1,595	1,114	491	21,428
LOWER DELTA	5,524	7,279	19,234	721	504	222	33,484
TOTAL	10,192	19,567	36,018	3,461	2,418	1,066	72,723
TOTAL(%)	(14)	(27)	(50)	(5)	(3)	(1)	(100)

表 2.3 将来開発による影響

Case	Basin Condition						Simulation Results (1995 Flood)					Remarks
	Present Condition	Urban Development	Change of Agricultural Cultivation	Land Subsidence	Dam		Flood Discharge at Nakon Sawan (m ³ /s)	Flood Discharge at Bang Sai (m ³ /s)	Water Level at Samsen (C.12) (MSL+m)	Water Level at Memorial Bridge (C.4) (MSL+m)	Total Inundation Volume (billion m ³)	
					Existing	Planned						
Reappearance of Present Condition	○						4,600	4,150	2.32	2.20	15.9	
Influence by Urban Development (Providing Ring Levee with Drainage Pump)		○			○		4,430	4,070	2.80	2.57	16.0	
Influence by Change of Agricultural Cultivation (in combination with Urban Development)		○	○		○		4,430	4,070	2.81	2.57	16.1	
Influence by Land Subsidence (in combination with Urban Development and Change of Agricultural Cultivation)		○	○	○	○		4,450	4,070	2.81	2.56	16.2	
Influence by Construction of Dam (in combination with Urban Development and Change of Agricultural Cultivation)		○	○	○	◎	○	4,110	4,000	2.77	2.53	14.7	
Influence by Construction of Loop Cut (in combination with Urban Development, Change of Agricultural Cultivation and Construction of Dam)		○	○	○	◎	○	4,110	3,980	2.62	2.45	14.1	Future Basin Condition

◎ : Actual outflow is applied for Bhumipol Dam, but Sirikit Dam outflow is assumed to be regulated with a conduit newly added after the 1995 flood according to the current operation rule, resulting in no spillage.

表 3.1 各対策案の適用性

Category	Measures	Effectiveness	Influence	Applicability	
Structural Measure	River Training	Effective only for the protection area by river training	Affect to life for people living in riverline	Applicable	
	Diversion Channel	Effective for down stream area from diversion point	Affect to people living in the area on the diversion route	Applicable, but further consultation is necessary.	
	Natural Retarding Basin	Effective for damage mitigation in down stream	Agreement from agricultural people for use of natural retarding basin	Applicable but preservation of natural retarding function is practical.	
	Artificial Retarding Basin	Effective for down stream area from retarding basin	Cause social problem for people engaged in the designated area as retarding basin	Not applicable	
	Ring Levee	Effective for flood mitigation in specific area	May cause adverse influence to the downstream.	Regarded as given condition for study.	
	Tidal Barrage with Pump	Effective for flood mitigation in downstream	Cause social and environmental problems due to clogging of river mouth.	Not applicable from economical reason as well as social and environmental aspect	
	Heightening of Flood Barrier at Bangkok	Effective for Mitigation of Flood Damage in BMA	Cause social and environmental problems for people living along the River Course	Applicable but be considered in combination with Flood Insurance	
	Non-structural Measures	Modification of Reservoir Operation Rule	Effective to mitigate flood especially in the area of upstream	This affects to water supply resulting in reduction of agriculture production and hydro-power generation.	Applicable
		Control and Guidance for Land Development	Preservation of present retarding function.	May cause issues from economic and social view point	Applicable
		Control of Ground Water	Reduction of inundation volume	May cause issues from economic view point	Applicable
		Flood Forecasting	Achievement of more precise flood forecasting	Not cause serious issue	Applicable
		Flood Fighting	Execution of more effective flood fighting	Not cause serious issue	Applicable
		Flood Recovery	Mitigation of secondary flood damage	Not cause serious issue	Applicable
Subsidy		Stabilization of life for damaged people	Not cause serious issue	Applicable but be considered in combination with Flood Insurance.	
Flood Insurance		Stabilization of life for damaged people	Not cause serious issue	Government is under study	
Watershed Management		Retarding of flood discharge and detention of low flow	Brings about favorable basin condition from environmental aspect	Government is practicing in a manner of reforestation	
Institution and Organization		Realization of more effective flood mitigation through coordination among agencies concerned.	Not cause serious issue	Government is under study	

表 3.2 洪水被害軽減の対策案の比較

Option	Safety Level		Description	Advantage and Disadvantage
	Bangkok	Pathum Thani and Nontha Buri		
(1) To maintain the present condition of Pathum Thani and Nontha Buri	125-year return period	2-3 year return period	Suspension of planned protection works by PWD	From technical, economical and environmental point of view, there may be no issues. From social point of view, inhabitants in urban areas, Pathum Thani and Nonthaburi, will not accept to maintain the present safety level in the future. The option can not cope with the situation to enhance the protection level of agricultural area in the upstream in the future.
(2) To enhance the safety level up to the allowable level	100	5	The safety level of Bangkok can be enhanced more than 100-year return period by loop cut at port. Therefore there is a room to enhance the safety level of Pathum Thani and Nontha Buri for that part.	From technical, economical and environmental point of view, there may be no issues. From social point of view, inhabitants in urban areas, Pathum Thani and Nonthaburi, will not accept to maintain the present safety level in the future. The option can not cope with the situation to enhance the protection level of agricultural area in the upstream in the future.
(3) To lower the safety level at Bangkok	50	7	The safety level of Bangkok will be reduced to 50-year return period for example, while those of Pathum Thani and Nontha Buri be enhanced to 7 year return period for example.	From technical, economical and environmental point of view, there may be no issues. From social point of view, inhabitants in urban areas, Pathum Thani and Nonthaburi, will not accept to maintain the present safety level in the future. The option can not cope with the situation to enhance the protection level of agricultural area in the upstream in the future.
(4) To narrow the protection area of Pathum Thani and Nontha Buri	100	100, and 2-3	The protection area of Pathum Thani and Nontha Buri is narrowed down to the extent in which adverse influence to Bangkok is not severe.	From technical, economical and environmental point of view, there may be no issues. From social point of view, inhabitants in urban areas may oppose delineation of protected and not protected areas in the same municipality level in the future. The option can not cope with the situation to enhance the protection level of agricultural area in the upstream in the future.
(5) To beighten the flood barrier at Bangkok	100	100	To further heighten the flood barrier at Bangkok from ongoing project.	From the technical and economical point of view, the works will not involve serious issues. From environmental and social points of view, this option will cause serious issues. The option can not cope with the situation to enhance the protection level of agricultural area in the upstream in the future.
(6) To provide diversion channel	100	100	To provide diversion channel to absorb the adverse influence.	From the technical point of view, the works will not involve serious issues. From the environmental point of view, issues derived from the option will be solved. From economical point of view, this works will require a huge burden to the country. From social point of view, this option will cause issues for land acquisition and house evacuation. This option can be used for enhancement of the safety level of agricultural areas.

表 3.3 マスタープランの対策

Area	Alternative-1		Alternative2-1		Alternative2-2	
	Non-structural Measures	Structural Measures	Non-structural Measures	Structural Measures	Non-structural Measures	Structural Measures
Upper Central Plain	Modification of Reservoir Operation	Ring Levee for Urban Area by PWD	Same as Alternative-1	Same as Alternative-1	Same as Alternative-1	Same as Alternative-1
	Rule					
	Land Use Control and guidance					
	Flood Forecasting Warning System					
	Flood Fighting					
	Disaster Recovery					
Nakon Sawan Area	Subsidy and Flood Insurance	Ring Levee for Urban Area by PWD	Same as Alternative-1	Same as Alternative-1	Same as Alternative-1	Same as Alternative-1
	Modification of Reservoir Operation					
	Rule					
	Land Use Control and guidance					
	Flood Forecasting Warning System					
	Flood Fighting					
Higher Delta in Lower Central Plain	Disaster Recovery	River Improvement Distribution System Improvement Ring Levee for Urban Area by PWD	Same as Alternative-1	Same as Alternative-1	Same as Alternative-1	Same as Alternative-1
	Subsidy and Flood Insurance					
	Modification of Reservoir Operation					
	Rule					
	Land Use Control and guidance					
	Flood Forecasting Warning System					
Lower Delta in Lower Central Plain	Flood Fighting	Partial Protection of Pathum Thani and Nonthaburi Drainage System Improvement	Same as Alternative-1	Heightening of Flood Barrier at Bangkok Drainage System Improvement	Same as Alternative-1	Construction of Flood Diversion Drainage System Improvement
	Disaster Recovery					
	Subsidy and Flood Insurance					
	Modification of Reservoir Operation					
	Rule					
	Land Use Control and guidance					
Control of Ground Water Extraction						
Flood Forecasting Warning System						
Flood Fighting						
Disaster Recovery						
Subsidy and Flood Insurance						

表 3.4 排水域の特性

Study Area	Division of Area	Name of Project Area	Features of the Drainage Area						
			Catchment Area (km ²)	Slope Gradient	Main Drainage Outlet	Drainage Capacity of pump (m ³ /s)	Possibility to receive flood water from Rivers	Flood Damage Magnitude (based on interview)	Main Land Use
Upper Delta	Northern Part surrounded by Thachin and Noi Rivers	Borommathad, Samdhuk, Chanasutr, Yamane and Phak Hai, etc.	1,850	1/4,000	Thachin and Noi Rivers	24	Less Possibility	Not so serious	HYV
	Area surrounded by Noi and Chao Phraya Rivers	Borommathad, Yamane and Phak Hai, Bang Bai	930	1/4,000	Noi and Chao Phraya Rivers	-	Chao Phraya River	Relatively Serious due to overflow from river	HYV, F/R and DWR
	Area surrounded by Chao Phraya and Lop Buri Rivers	Maharat and Khok Katiem	500	1/5,000	Chao Phraya and Lop Buri Rivers	-	Chao Phraya and Lop Buri Rivers	Relatively serious due to overflow from rivers	F/R and DWR
	Area surrounded by Lop Buri and Pasak Rivers	Khok Katiem and Roeng Rang	530	1/5,000	Lop Buri and Pasak Rivers	-	Lop Buri and Pasak Rivers	Serious	F/R and HYV
Lower Delta	East Bank Area	Nakhon Luang, Pasak Tai, Rangsit Nua, Rangsit Tai, Khlong Dan and Phra Ong Chai Ya Nuchit	4,374	1/50,000	Chao Phraya, Nakhon Nayok and Bang Pakon Rivers and Sea	507.5	Chao Phraya and Pasak Rivers	Serious	HYV and Fruits Tree
	West Bank Area	Chao Ched Bang Yeehon, Phrayahantue, Phrayapimol and Pasicharoen	2,385	1/60,000	Chao Phraya and Thachin Rivers and Sea	116	Chao Phraya and Tha Chin Rivers	Serious	HYV and Fruits Tree

表 3.5 排水上の主な問題 (Yes* : Yes, but not so severe)

Study Area	Division of Area	Name of Project Area	Main Cause of Flood			Drainage Condition			Main Issue
			Local Rainfall	Water from Upstream Area	Overflow From Rivers	Drainage System	Collection of Water to Outlet	Continuation of Higher Water Level at Outlet	
Higer Delta	Northern Part surrounded by Thachin and Noi Rivers	Borommathad	Yes *	No	No	Fair	Good	Not much	Drainage problem may not be severe in general, but due to water from upstream area, it is serious in the downstream project area.
		Samdhuk	"	Yes *	"	"	"	"	
		Chanasut	"	Yes	"	"	"	"	
		Phak Hai	"	"	"	"	"	"	
	Area surrounded by Noi and Chao Phraya Rivers	Borommathad	Yes *	no	Yes	Fair	Good	Yes	Drainage problem may not be severe in general, but it is very serious when overflow from rivers occurs
		Yamance	"	Yes	"	"	"	"	
		Phak Hai	"	"	"	"	"	"	
		Bang Bai	"	no	"	"	"	"	
		Maharat	Yes *	no	Yes	Fair	Good	Yes	
		Khok Katiem	"	"	"	"	"	"	
		Khok Katiem	Yes *	no	Yes	Fair	Good	Yes	
		Roeng Rang	"	Yes	"	"	"	"	
Lower Delta	East Bank Area	Nakhon Luang	Yes *	No	Yes	Fair	Fair	Yes	Drainage issue is emphasized with the following points: difficulty of collection of inundation water, continuation of higher water level at outlet, overflow from rivers and water from upstream area
		Pasak Tai	"	"	No	"	"	"	
		Rangsit Nua	"	Yes*	"	Good	Poor	"	
		Rangsit Tai	"	"	"	"	"	"	
		Khlong Dan	"	Yes	Yes	Poor	"	"	
		Phra Ong Chai Ya Nuchit	"	"	"	"	"	"	
		Chao Ched Bang	Yes *	no	Yes	Fair	Fair	Yes	
		Yechon	"	"	"	"	"	"	
		Phrayahantue	"	Yes*	"	Poor	Poor	"	
		Phrayapimol	"	"	"	"	"	"	
		Pashicharoen	"	Yes	"	"	"	"	

表 3.6 排水システム改善の実施優先順位

Study Area	Priority	Division of Area	Priority	Name of Project Area	Priority
Higer Delta	2	Norhtern Part surrounded by Thachin and Noi Rivers	2-4	Borommathad	2-4-4
				Samdhuk	2-4-3
				Chanasut	2-4-2
				Phak Hai	2-4-1
		Area surrounded by Noi and Chao Phraya Rivers	2-3	Borommathad	2-3-4
				Yamane	2-3-3
				Phak Hai	2-3-2
		Area surrounded by Chao Phraya and Lop Buri	2-1	Maharat	2-1-2
				Khok Katiem	2-1-2
		Area surrounded by Lop Buri and Pasak Rivers	2-2	Khok Katiem	2-2-2
				Roeng Rang	2-2-1
		Lower Delta	1	East Bank Area	1-1
Pasak Tai	1-1-6				
Rangsit Nua	1-1-4				
Rangsit Tai	1-1-3				
Khlong Dan	1-1-1				
Phra Ong Chai Ya Nuchit	1-1-2				
West Bank Area	1-2			Chao Ched	1-2-4
				Bang Yeehon	1-2-3
				Phrayahantue	1-2-2
				Phraypimol	1-2-1
		Pashicharoen	1-2-1		

表 4.1 代表5洪水での治水効果

Name of dam	Operation Case	Reductin of inundation Volume (million m3)					
		1975 flood	1981 flood	1983 flood	1995 flood	1996 flood	Average
Bhumibol	Without(Present Operation)	3,436	342	1,615	3,681	918	1,998
	Proposed Operation	4,477	342	1,615	3,773	956	2,232
Sirikit	Without(KEN project proposed)	2,323	348	113	2,725	506	1,180
	Proposed Operation	2,813	348	113	3,510	506	1,458
Pasak	Without(without Operation)	0	0	0	0	0	0
	Proposed Operation(Case-1)	175	0	0	288	51	103
	Proposed Operation(Case-2)	370	0	0	587	109	213
	Proposed Operation(Case-3)	438	0	0	695	129	252

表 4.2 対策実施に関係する機関

Category	Measures		Agencies concerned	Present Situation	Issues	Remarks
	Measures	Measures				
Non-structural Measures	Land use control and Guidance		DTCP, Local Government, LDD	Currently executing	Needs to strengthen	Additional Legal arrangement is necessary
	Modification of Operation Rule		EGAT, RID	Newly introduced	Coordination is necessary	-
	Control of Ground Water Sunction		DMR	Currently executing	Need to strengthen	-
	Flood Forecasting		EGAT, RID, BMA, MED	Currently executing	Need to improve	ONWRC is to establish a flood forecasting system.
	Flood Fighting		Civil Defence, BMA, RID and Provincial Gov.	Currently executing	Coordination is necessary	-
	Disaster Recovery		RID, BMA, PWD, Provincial Gov. and Min. of Health	Currently executing	Coordination is necessary	-
	Subsidy		MOAC, RID	Currently executing	Need to strengthen	-
	Flood Insurance		MOAC, RID	Newly introduced	-	To be introduced in 8th Agricultural Development Plan
	Watershed Management		RFD	Currently Executing	Need to strengthen	-
	Structural Measures	Preservation of Retarding Area with Flood Mitigation*		RID	Currently Executing	Need to improve
River Improvement			RID	Currently Executing	Need to improve	
Heightening of Flood Barrier at Bangkok			BMA	Currently Executing	Need to improve	
Construction of Diversion			RID, BMA and PWD	Newly introduced	Coordination is necessary	

*: Distribution system and drainage system improvement in the agricultural area

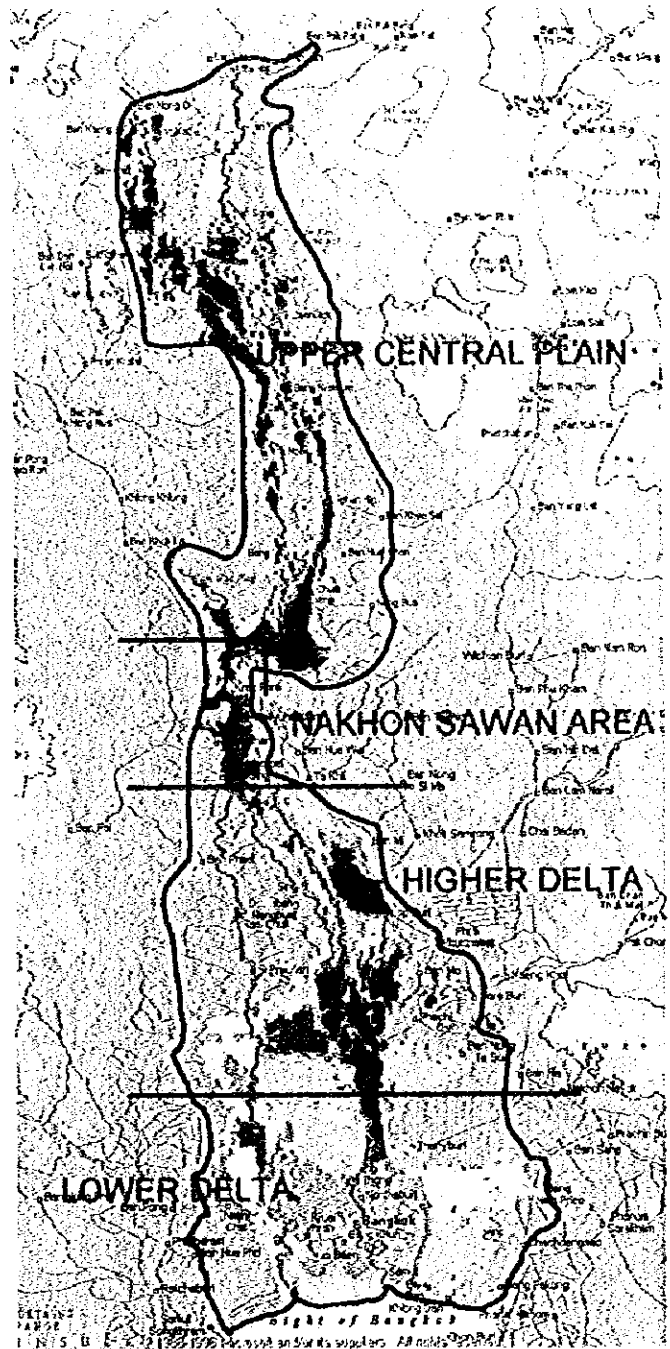
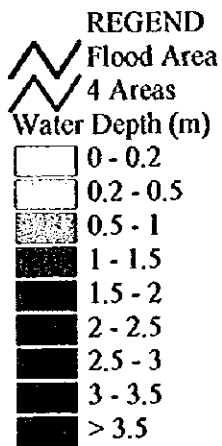
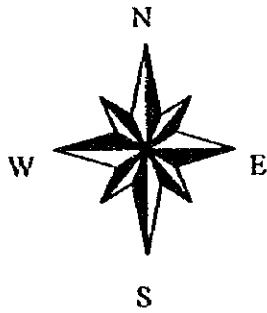
表 4.3 諸外国における河川流域管理状況

Countries	Governmental Frame Work		Existence of Special River Management Organization	Existence of River Management Law	Classification of Rivers	Responsibility of Flood Mitigation		
	Centralization	Decentralization				Central Gov.	Local Gov.	Local Communities
Japan	Yes, but toward to decentralization	-	-	River Law	Class-A Class-B Equivalent Rivers	Yes - Yes	- Yes Yes	- - -
USA	-	Yes	Mississippi River Commission, Tennessee Valley	Flood Control Act, Water Code	Large Scale Rivers Other Rivers	Provision of Flood Insurance -	- Yes	- -
UK	Yes	-	National River Authority	Water Act	Major River Minor River	- -	- Yes (IDBs)	- Yes(NRA) -
France	-	At present decentralization has settled down.	River Basin Committee	Civil Code	Six major basin Other Rivers	No existence*	- Yes	- -
Germany	-	Yes	-	Federal Water Management Act	Federal Channel and Class-1 Class-2 and 3	- -	Yes -	- Yes
Netherlands	Yes	-	Water Board		Major River the Other River	Planning -	Implementation and management Yes	- -
People's Republic of China	Yes	-	River Basin Authority	Water Law and Flood Protection Law	Seven Major Rivers Other Rivers	Yes -	- Yes	- -
Kingdom of Thailand	Yes	-	No organization at present but river basin committee is under process	No law at present but Water Resources Act is under process	25 river basins	Yes (Agricultural Area and Major Urban areas)	Yes (BMA)	- -

*: No existence for flood mitigation, but for water management, River Basin Committee has been set up.

付図

SIMULATED FLOOD MAP IN 1995



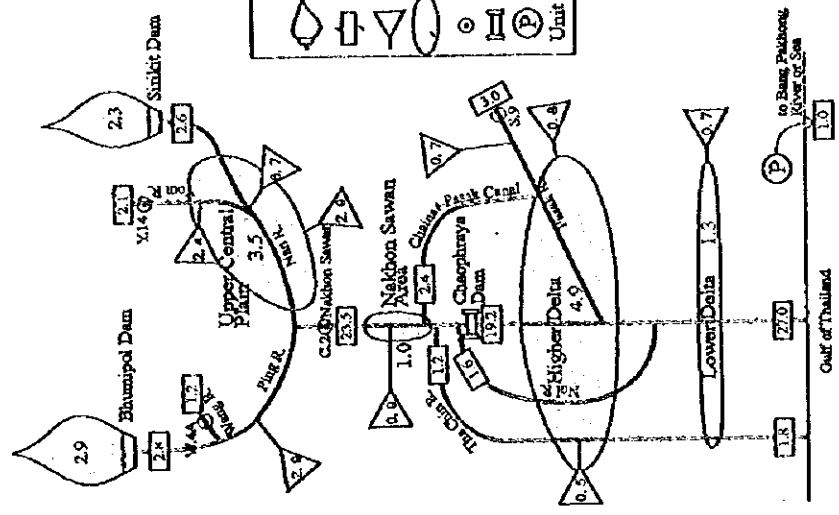
STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAOPHIRAYA RIVER BASIN

CII ENGINEERING CO LTD., & INA CORPORATION

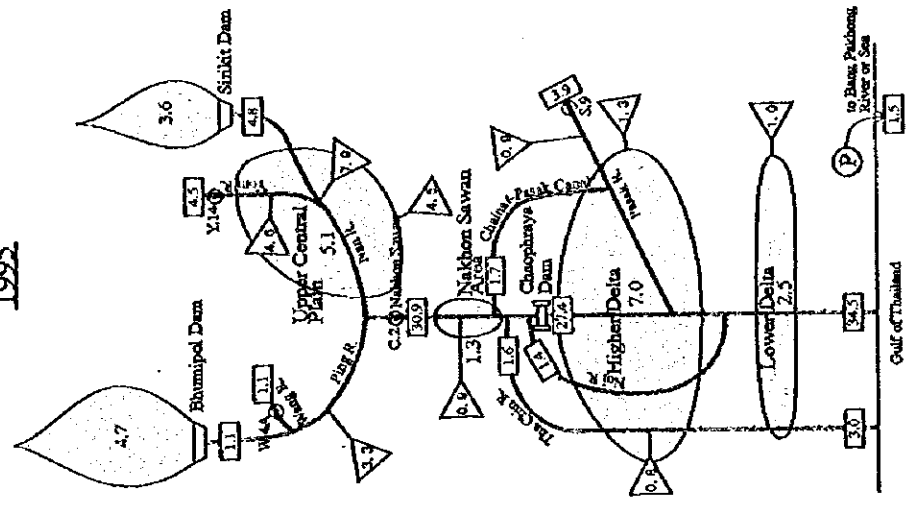
図 2.1

1995 洪水再現氾濫域図

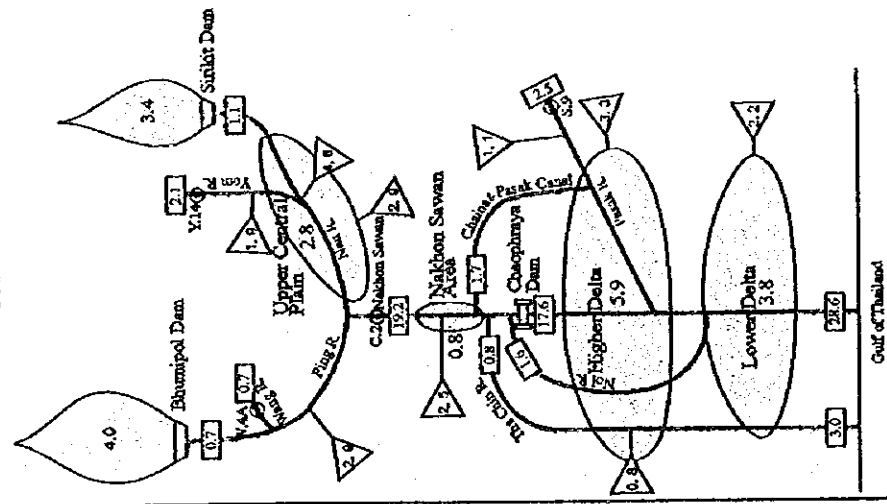
1996



1995



1983



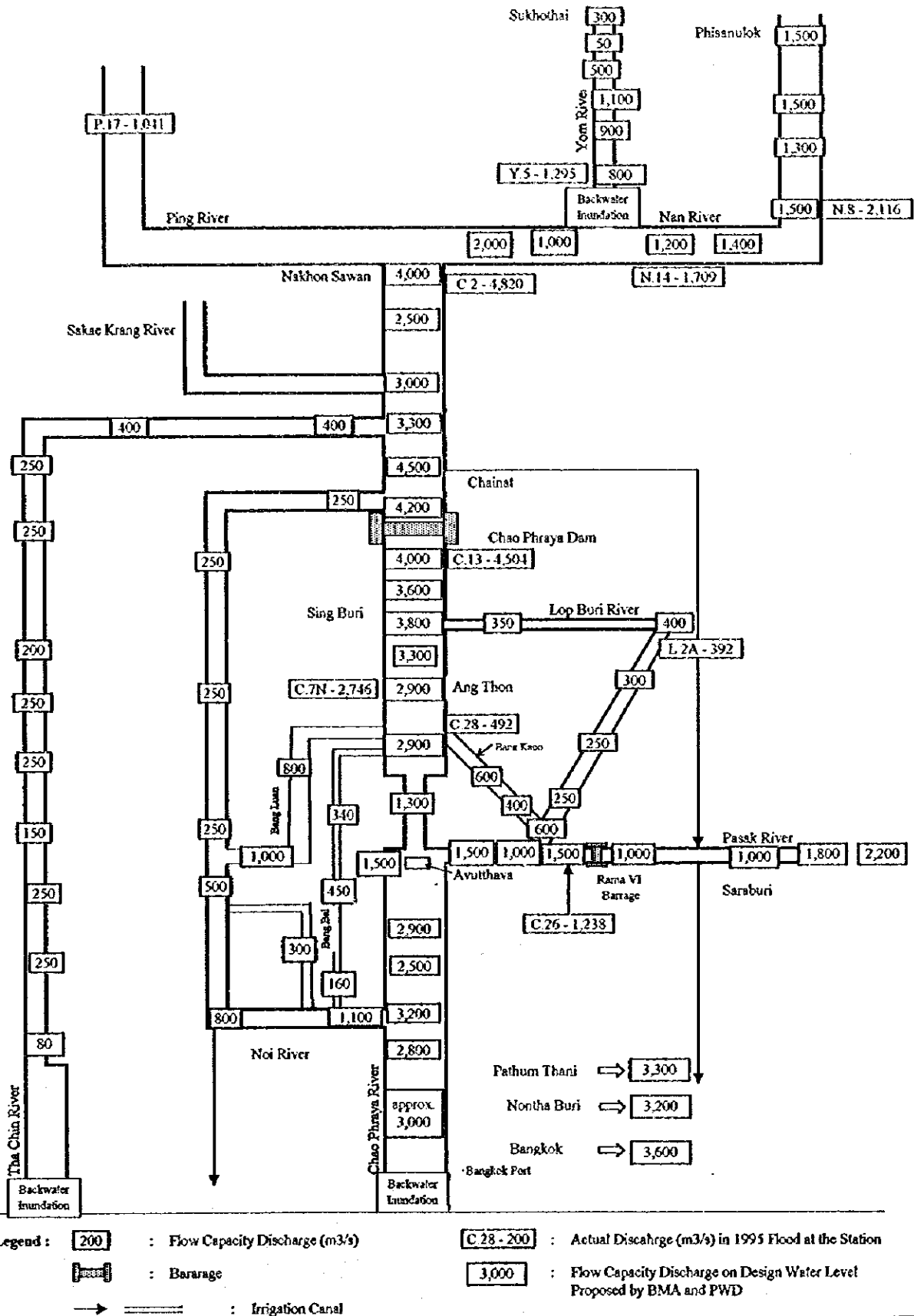
STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD AND INA CORPORATION

図 2.2

7月から12月までの洪水収支バランス

Flow Capacity of Present River Condition in Chao Phraya River Basin in High Tide

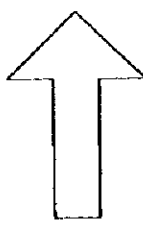


STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

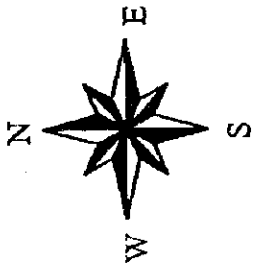
CTI ENGINEERING CO., LTD AND INA CORPORATION

図 2.3
現河道流下能力

Projected Landuse in 2018



Landuse in 1994



- Landplan
- Field Crops
 - Fish Pond
 - Forest
 - Fruit Trees
 - Grass
 - Rice
 - Swamp
 - Unknown
 - Urban
 - Vegetables Flowers



Data Source : MOAC

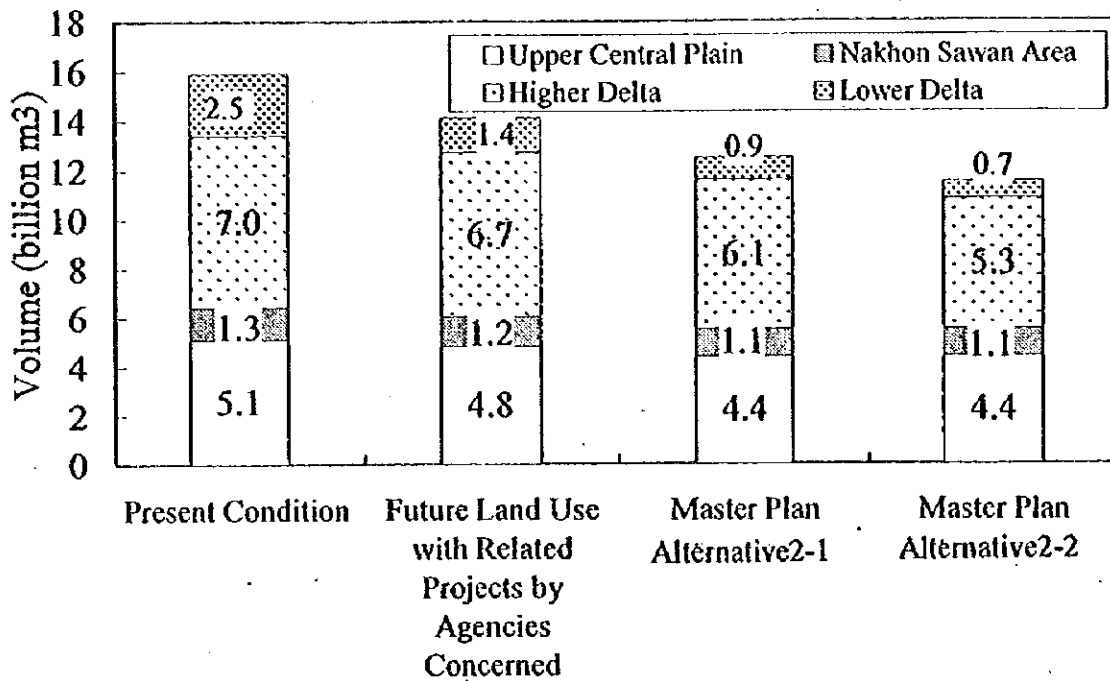
Note : This future land use is projected in the Study, based on the recent trend of land use change and the urban development plans by DTFC and PWD

STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

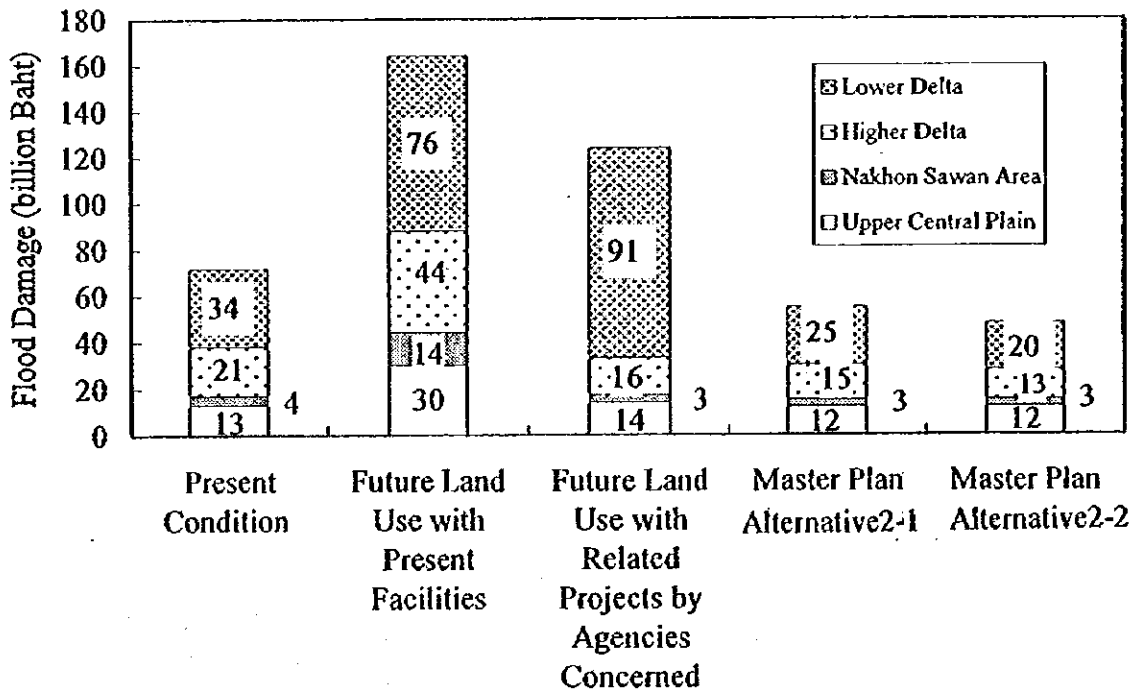
CTI ENGINEERING CO.,LTD AND INA CORPORATION

図 2.4
将来土地利用の予測

Inundation Volume in 1995 Flood



Flood Damage in 1995 Flood

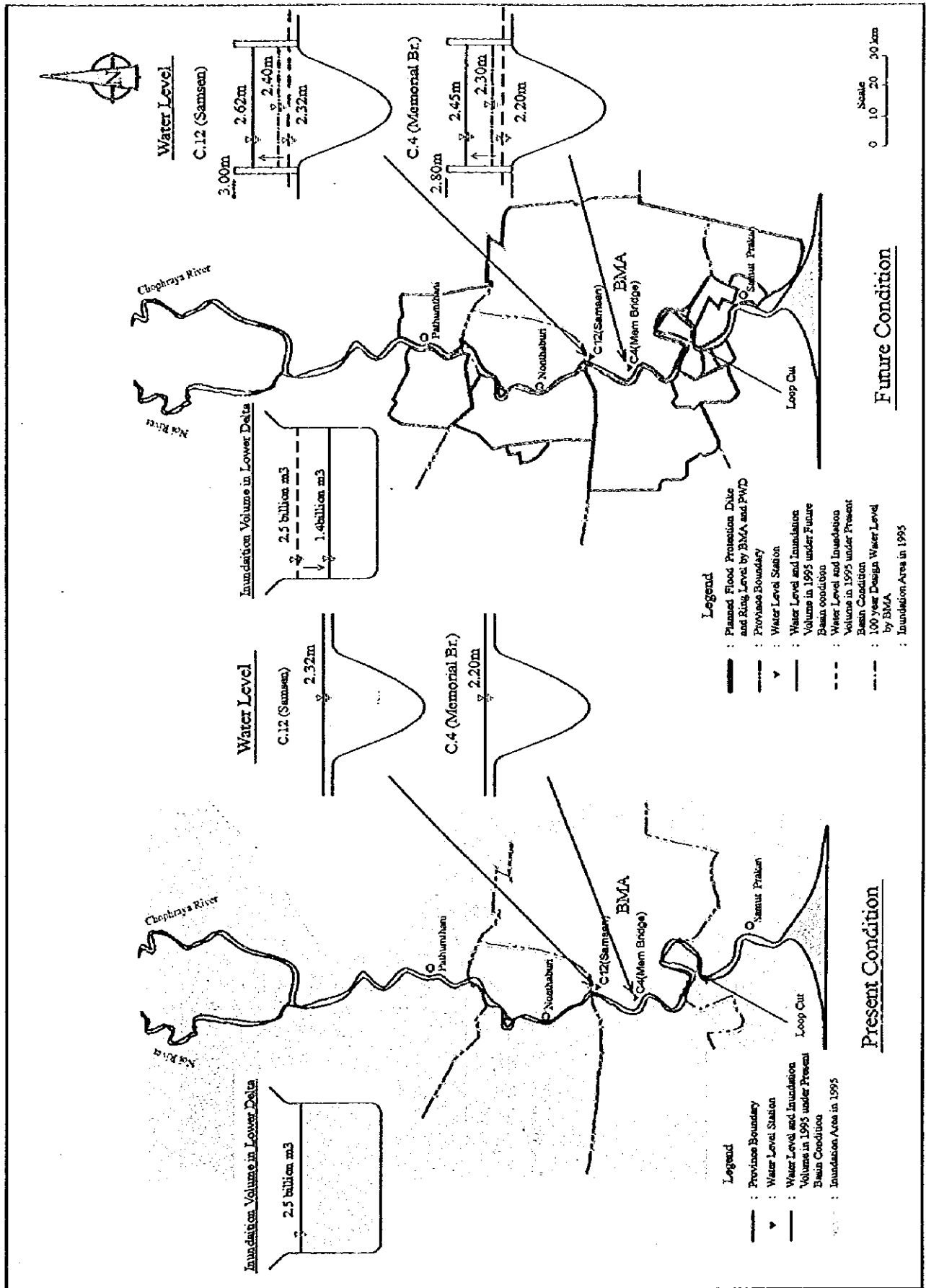


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図 2.5

氾濫量及び洪水被害の変化



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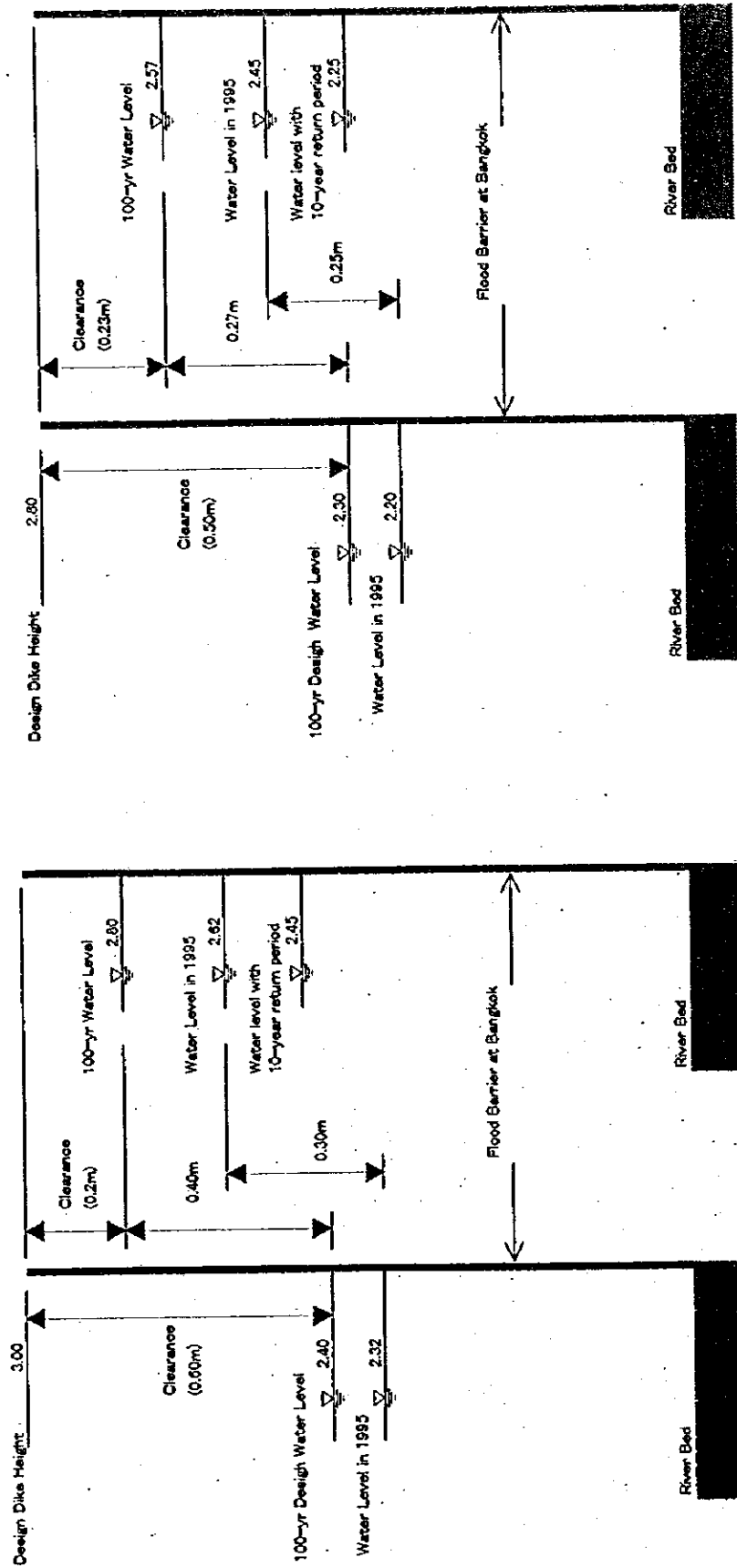
図 2.7
 ノンタプリ・パトンタニの洪水対策
 によるバンコク水位の上昇

Future Basin Condition

Present Condition

Future Basin Condition

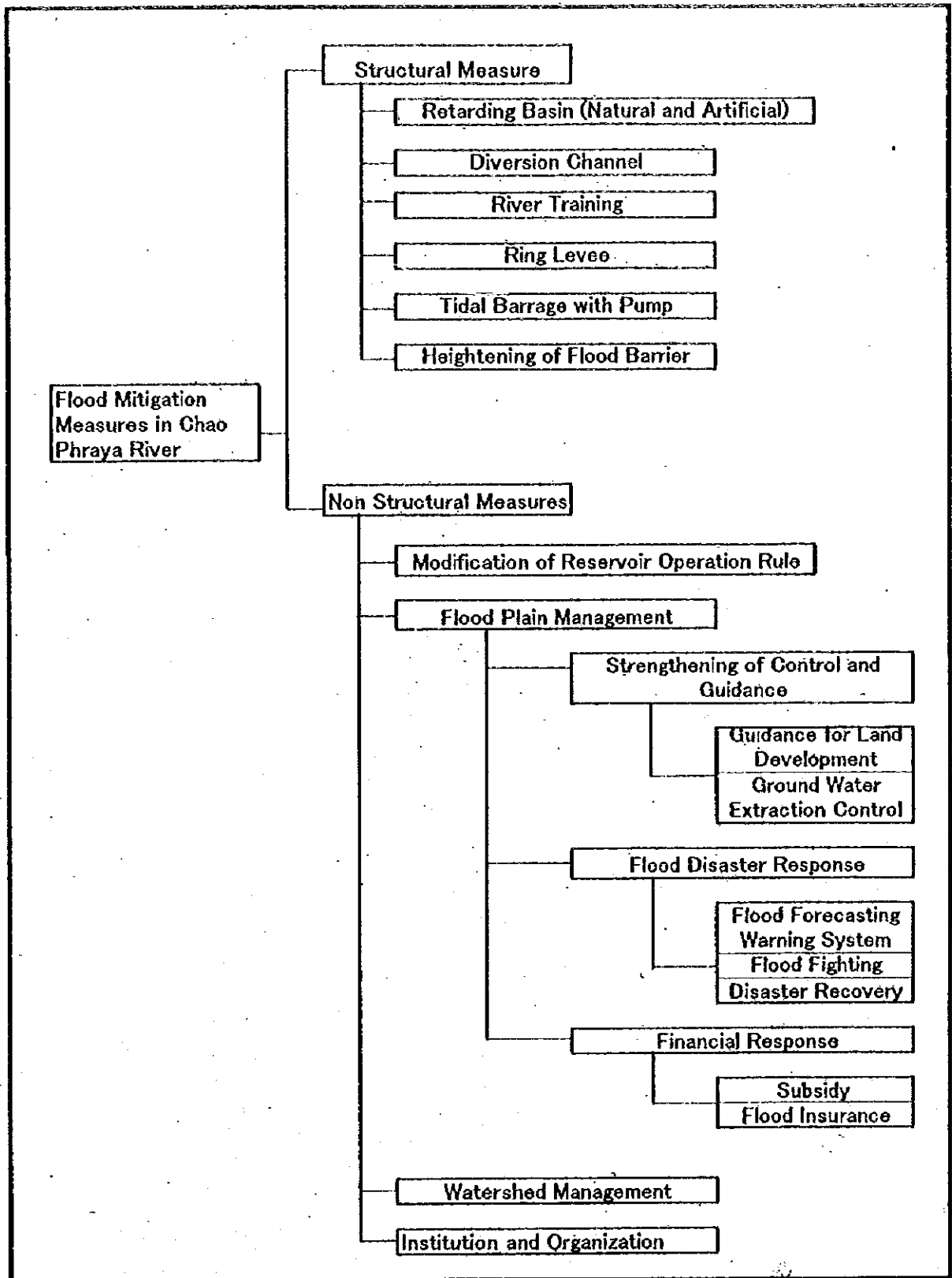
Present Condition



Memorial Bridge (C.4)

Samsen (C.12)

unit : (m MSC)

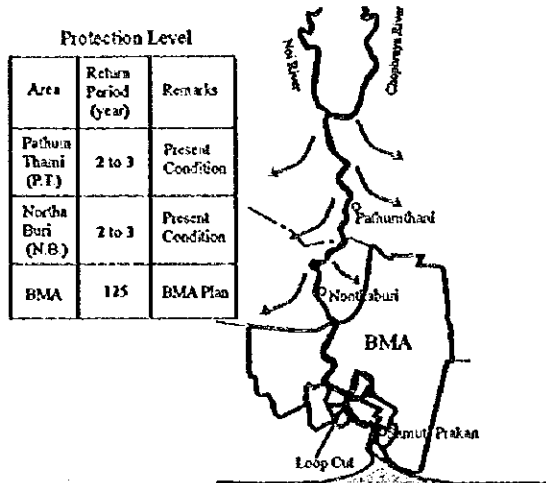


STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

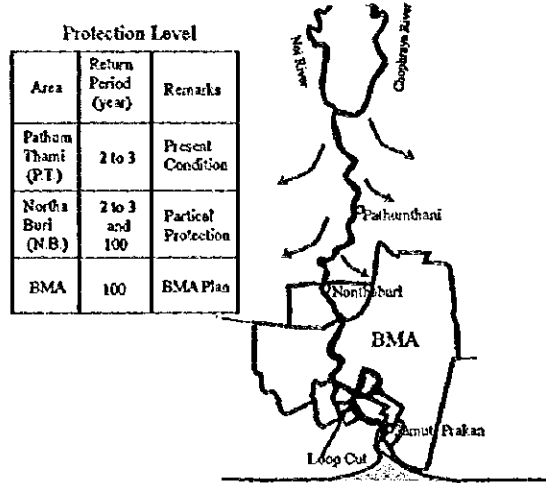
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図 3.1

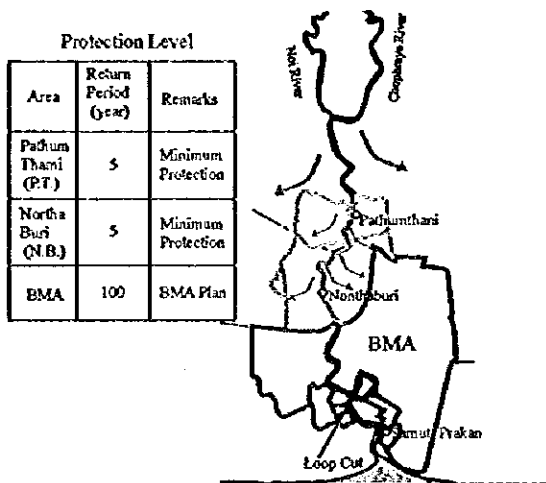
チャオプラヤ川流域総合洪水対策の考えられる案



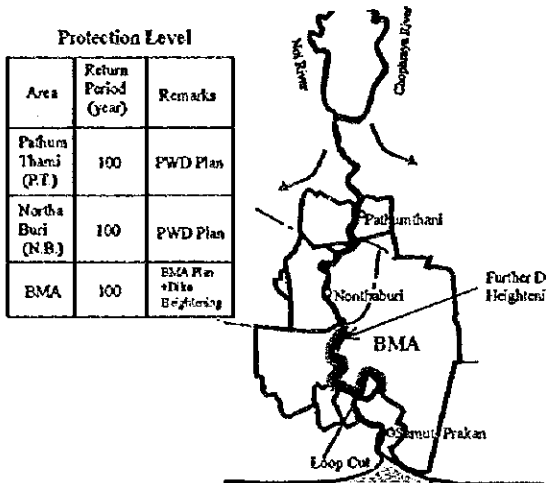
Option 1: Suspension of P.T. & N.B. Protection Works



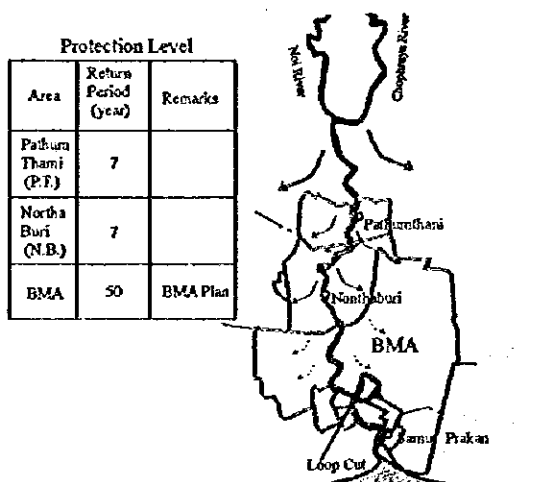
Option 4: Partial Protection of N.B.



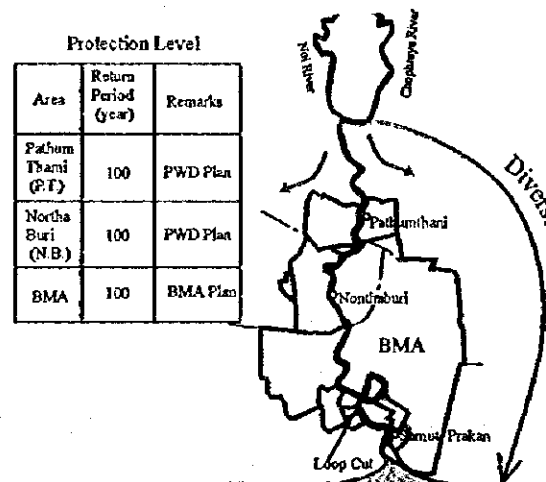
Option 2: Minimum Protection of P.T. & N.B.



Option 5: 100-year Protection of P.T. & N.B. with Further Dike Heightening in BMA



Option 3: Lowering of Protection Level in BMA with Higher Protection in P.T. & N.B.



Option 6: 100-year Protection of P.T. & N.B. with Diversion Channel

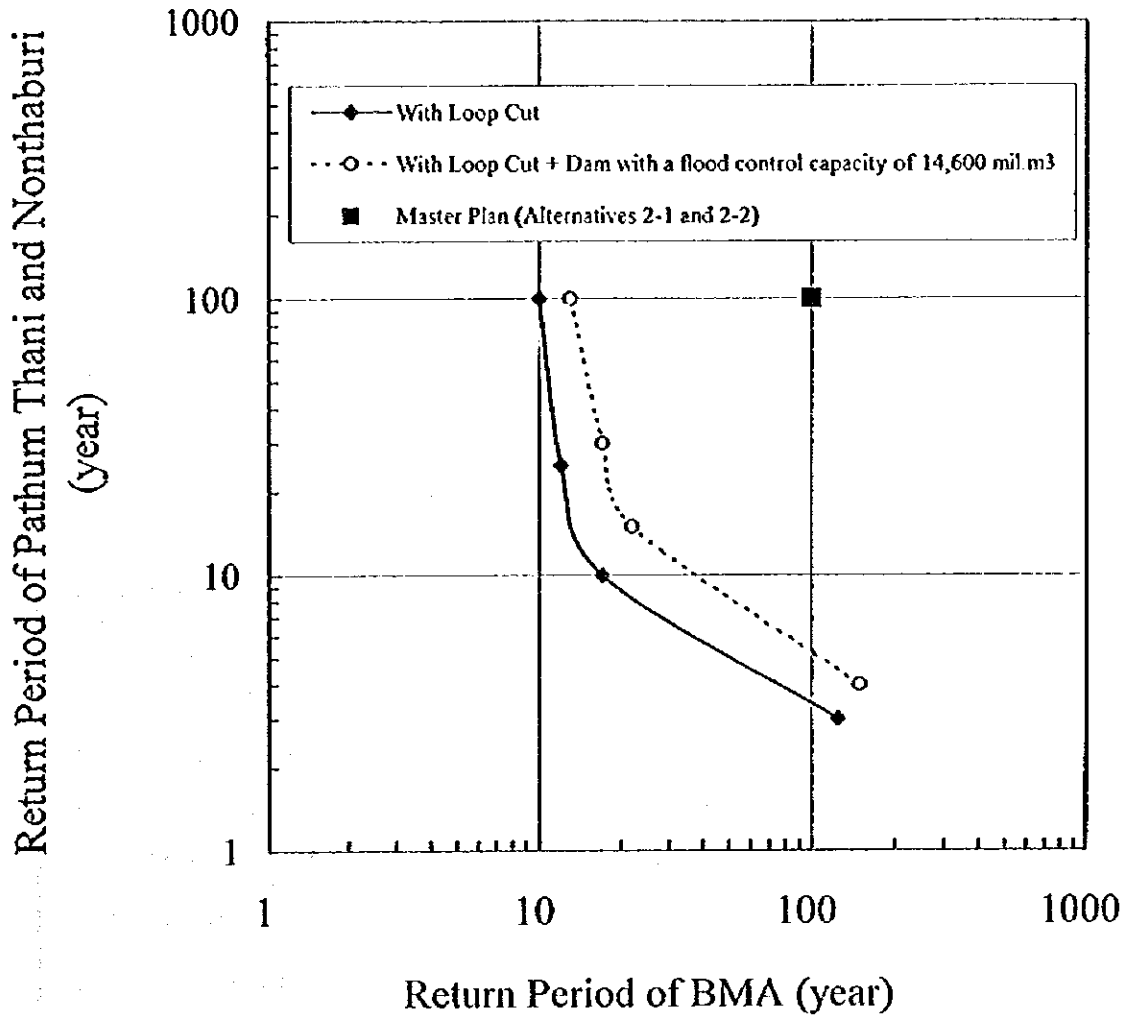
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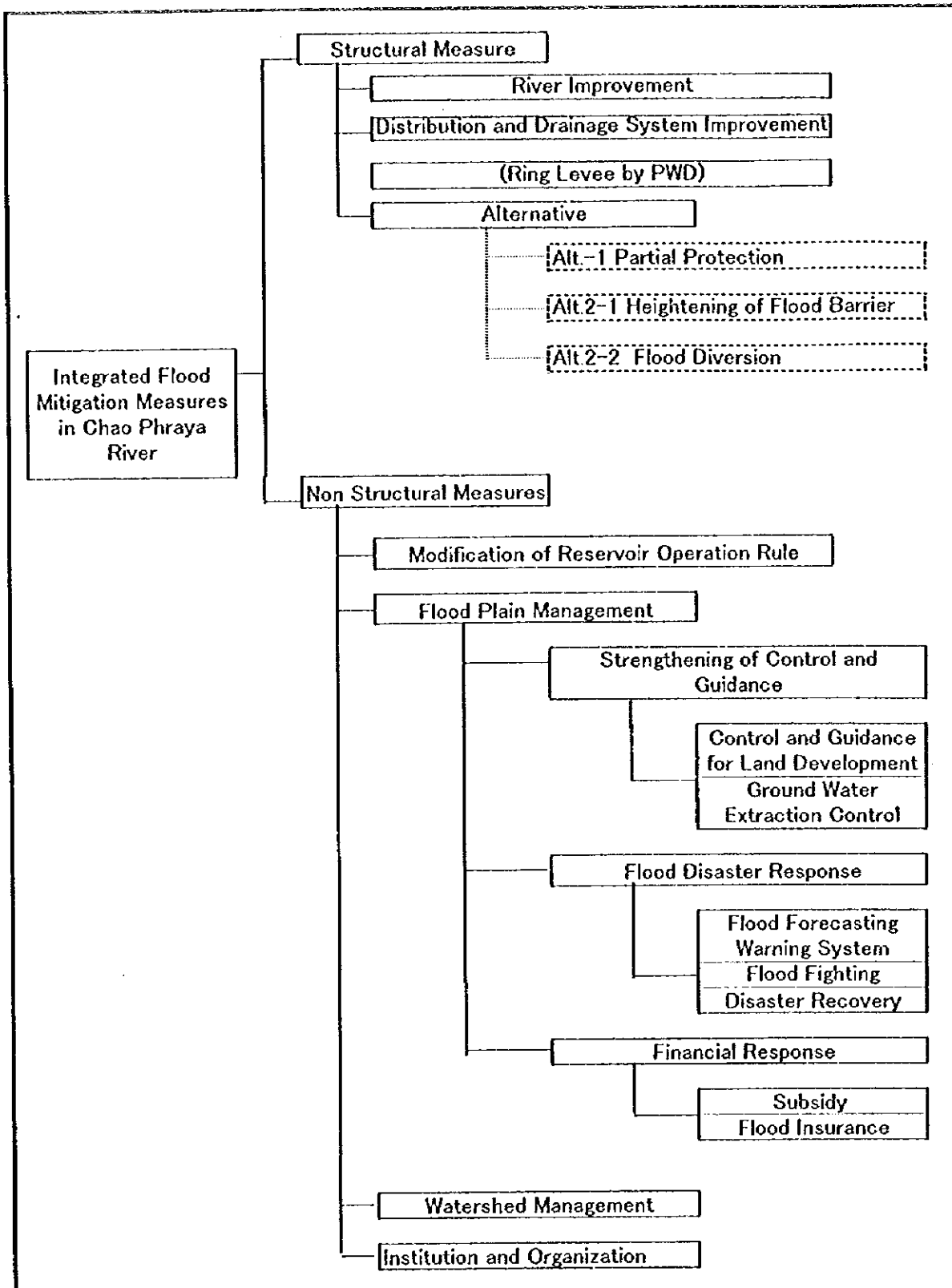
図 3.2

バンコク・ノンタブリ・パトントン
洪水対策案の組み合わせ

Relationship of Protection Level between BMA and Pathum Thani & Nonthaburi



Note : BMA Area is assumed to have been protected by the flood barrier dike which is currently under construction.

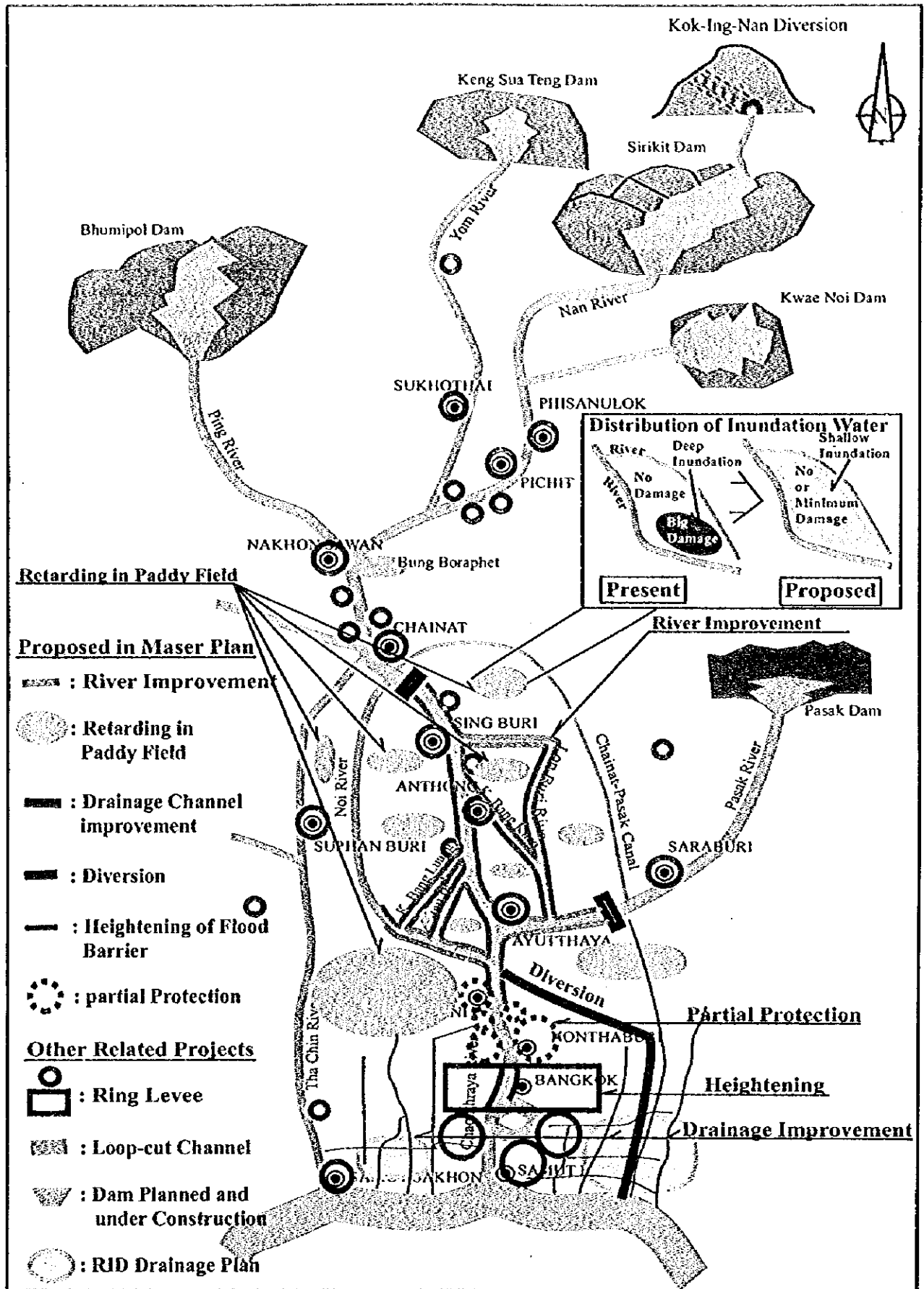


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図3.4

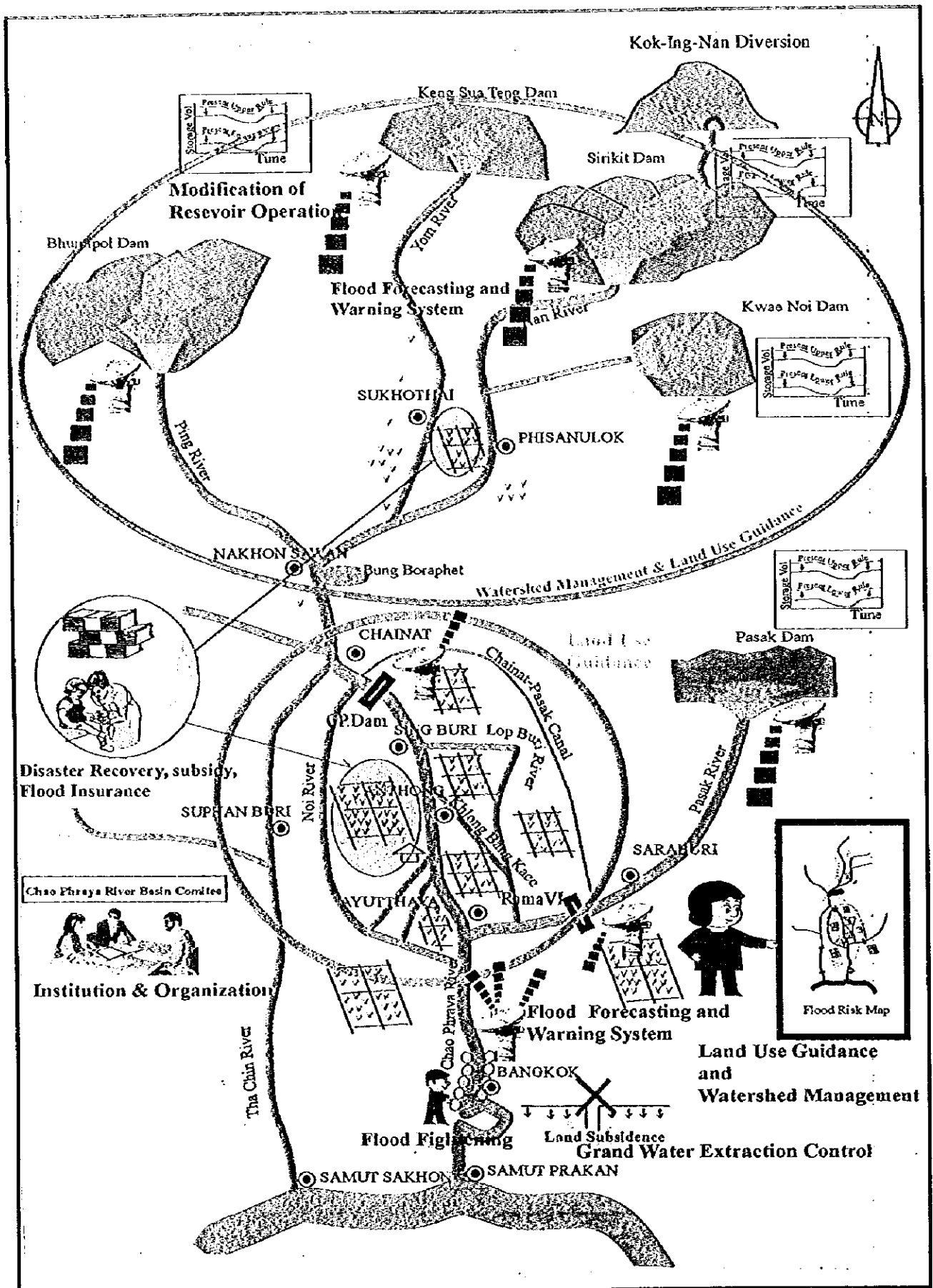
マスタープランの各対策案の構成



STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

図 3.5
マスタープランの概要(構造物対策)

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図 3.6

マスタープランの概要(非構造物対策)

Project Components	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Non-Structural Measure Control and Guidance of Land use																					
Modification of Operation Rule																					
Control of Grandwater Suction																					
Flood Forecasting																					
Flood Fighting																					
Disaster Recovery																					
Subsidy																					
Flood Insurance																					
Watershed Management																					
Institution and Organization																					
Structural Measures																					
Retarding in Paddy Field Distribution System Improvement																					
Drainage Improvement																					
River Improvement																					

.....: Study Period
 ———: Implementation Period

STUDY ON INTEGRATED PLAN FOR FLOOD

MITIGATION IN CHAO PHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD AND INA CORPORATION

図 3.7 (1/3)

マスタープランの実施計画 (Alternative-1)

Project Components	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Non-Structural Measure																					
Control and Guidance of Land use																					
Modification of Operation Rule																					
Control of Grandwater Suction																					
Flood Forecasting																					
Flood Fighting																					
Disaster Recovery																					
Subsidy																					
Flood Insurance																					
Watershed Management																					
Institution and Organization																					
Structural Measures																					
Retarding in Paddy Field Distribution System Improvement																					
Drainage Improvement																					
River Improvement																					
Heightening of Flood Barrier in Bangkok																					

.....: Study Period
 ———: Implementation Period

STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD AND INA CORPORATION

図 3.7 (2/3)

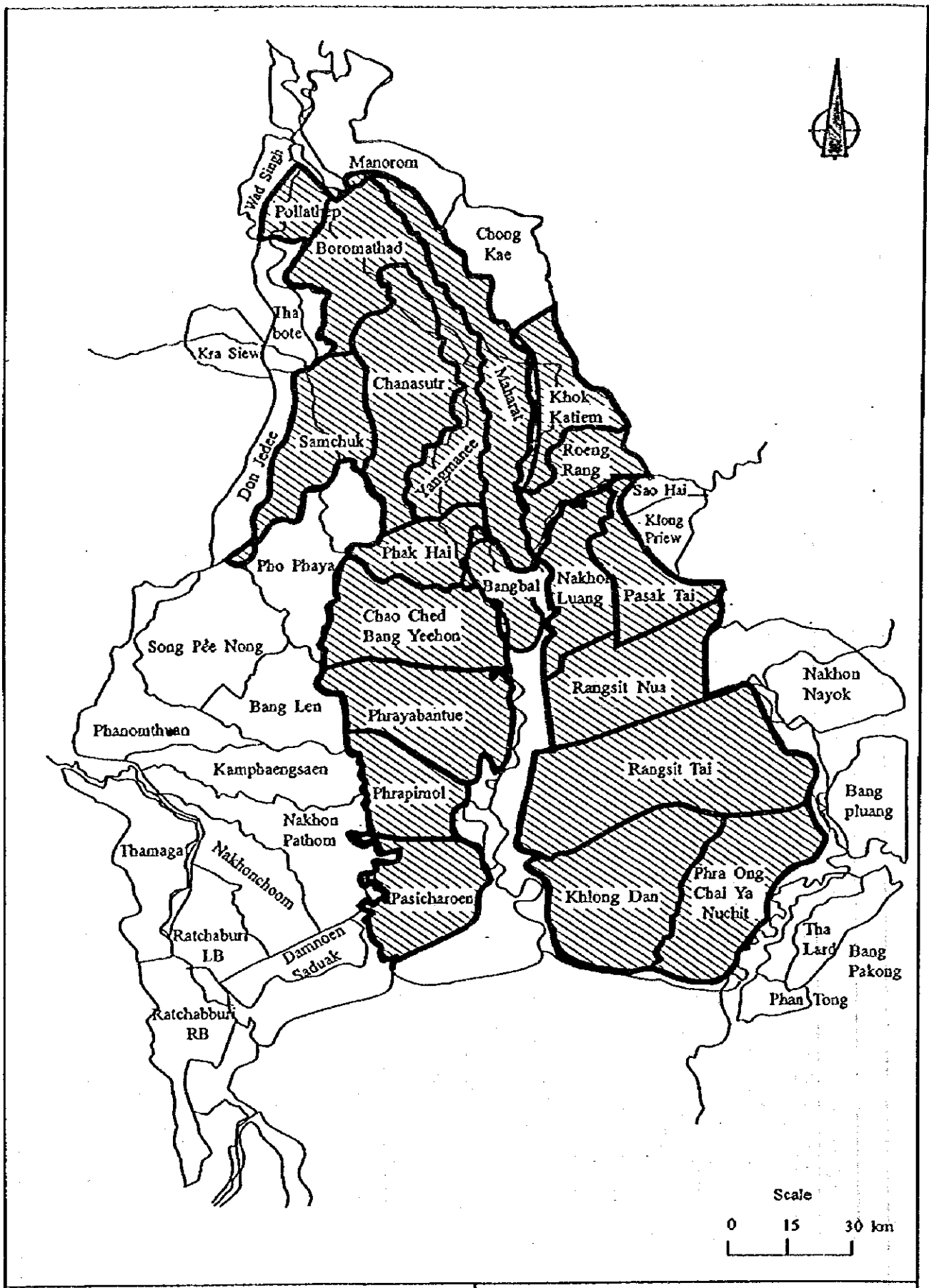
マスタープランの実施計画 (Alternative-2-1)

Project Components	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Non-Structural Measure																					
Control and Guidance of Land use																					
Modification of Operation Rule																					
Control of Groundwater																					
Suchon																					
Flood Forecasting																					
Flood Fighting																					
Disaster Recovery																					
Subsidy																					
Flood Insurance																					
Watershed Management																					
Institution and Organization																					
Structural Measures																					
Retarding in Paddy Field																					
Distribution System Improvement																					
Drainage Improvement																					
River Improvement (Stage-1)																					
River Improvement (Stage-2)																					
Diversion Channel (Stage-1)																					
Diversion Channel (Stage-2)																					

----- : Study Period
 ===== : Implementation Period

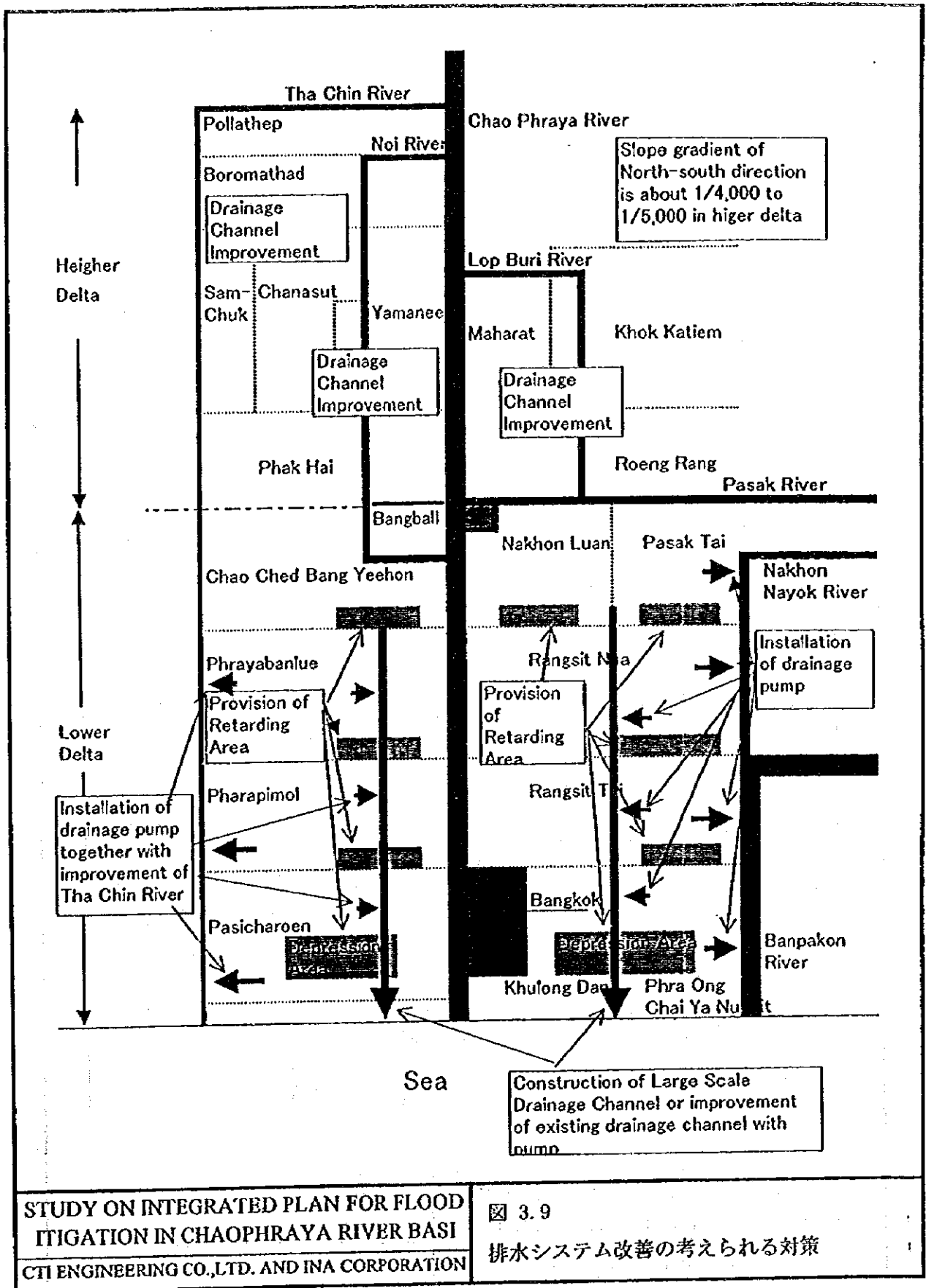
STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN
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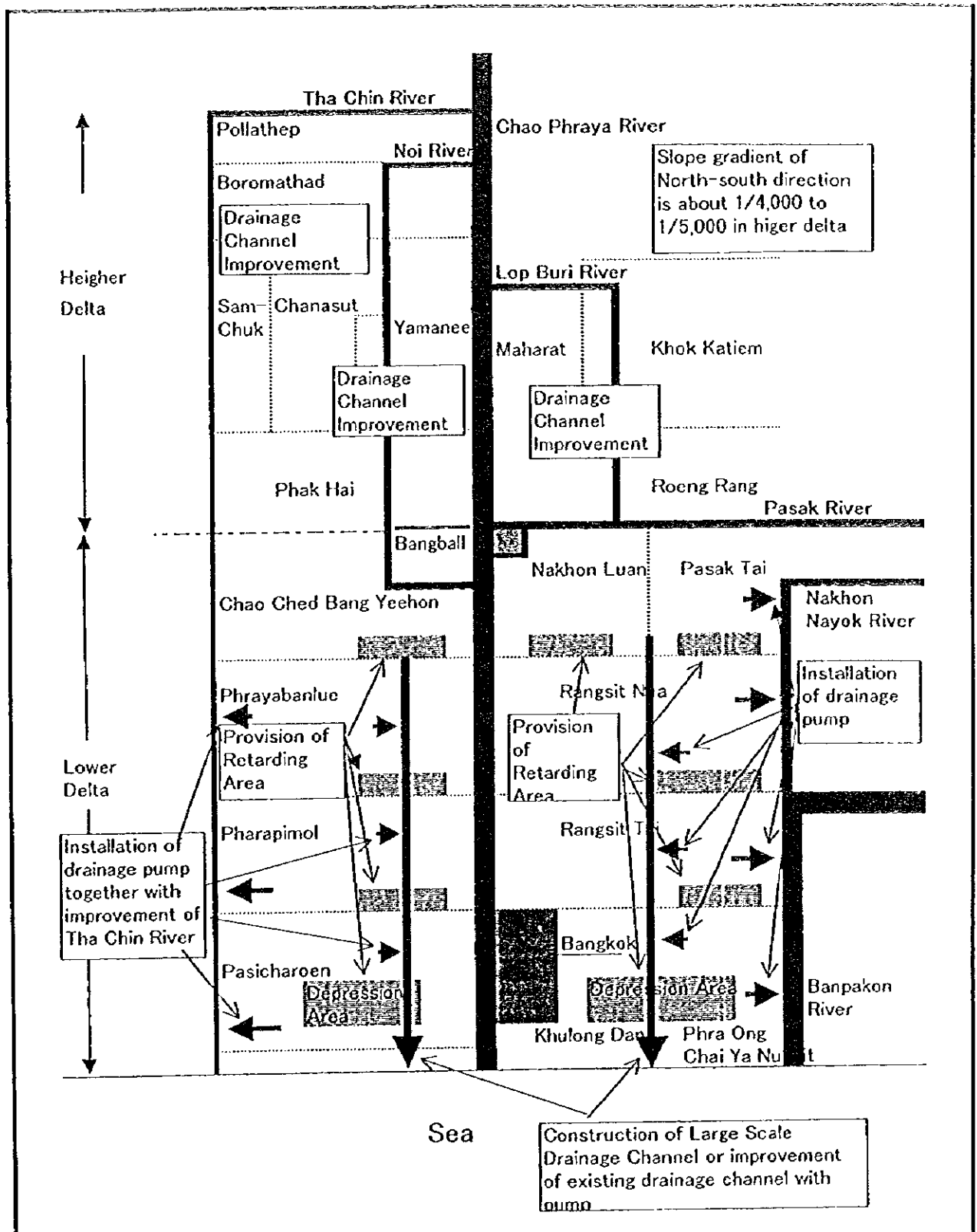
図 3.7 (3/3)
 マスタープランの実施計画 (Alternative-2-2)



STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN
 CTE ENGINEERING CO., LTD AND INA CORPORATION

図 3.8
 排水システム改善の対象域





STUDY ON INTEGRATED PLAN FOR FLOOD
MITIGATION IN CHAOPHRAYA RIVER BASIN
CTI ENGINEERING CO.,LTD. AND INA CORPORATION

図 3.9
排水システム改善の考えられる対策

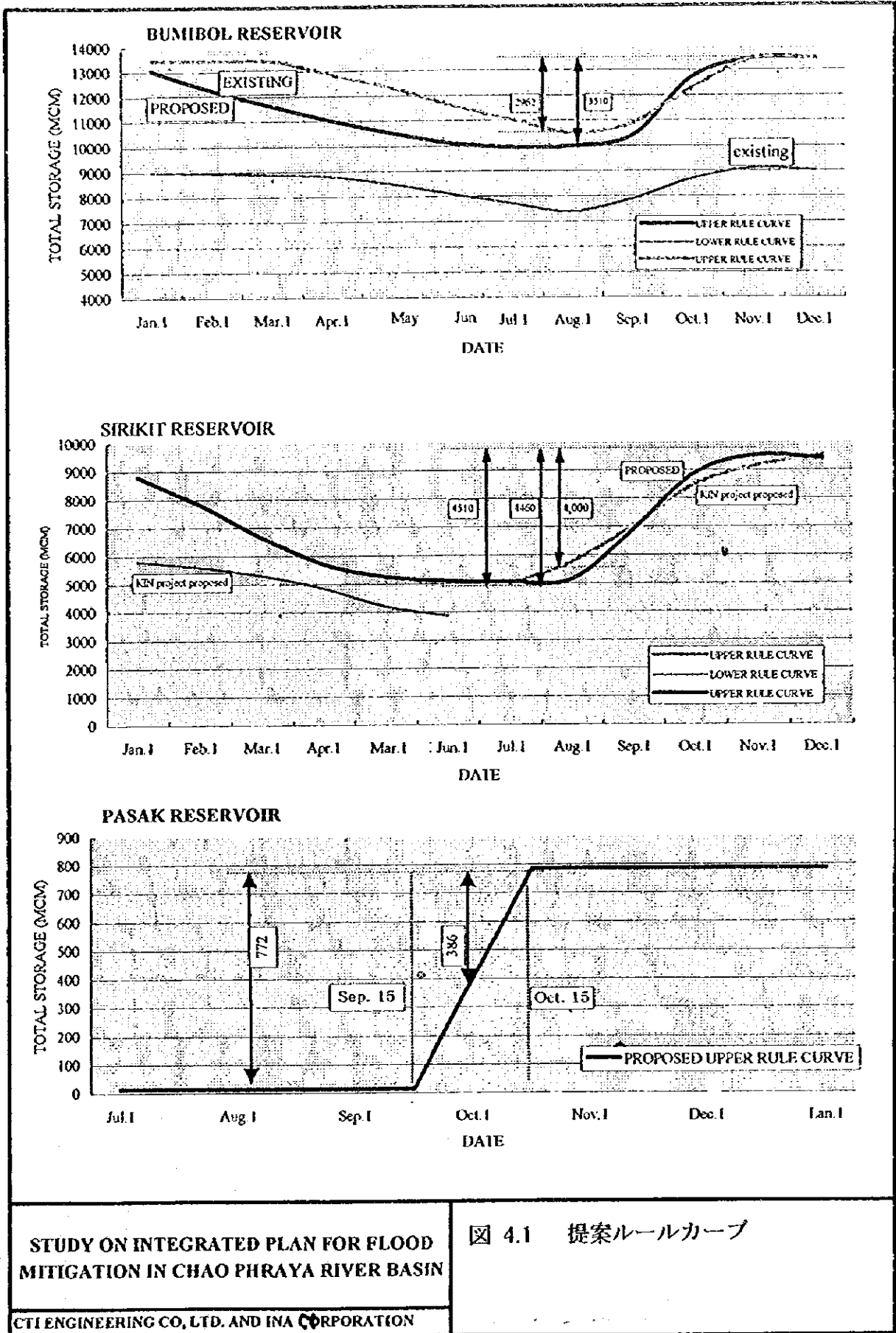
Study Area	Division of Area	Name of Project Area	Priority	Implementation Schedule				
				1998-2000	2001-2005	2006-2010	2011-2015	2016-2018
Upper Delta	Northern Part surrounded by Thachin and Noi Rivers	Boremathad	2-4-4					
		Samdhuk	2-4-3					
		Chanasut	2-4-2					
		Phak Hai	2-4-1					
	Area surrounded by Noi and Chao Phraya Rivers	Boremathad	2-3-4					
		Yamanoo	2-3-3					
		Phak Hai	2-3-2					
		Bang Eai	2-3-1					
		Maharat	2-1-2					
		Khok Katiem	2-1-1					
Lower Delta	Area surrounded by Chao Phraya and Lop Buri	Khok Katiem	2-2-2					
		Roeng Rang	2-2-1					
		Nakhon Luang	1-1-5					
		Pasak Tai	1-1-6					
	East Bank Area	Rangsit Nua	1-1-4					
		Rangsit Tai	1-1-3					
		Khlong Dan	1-1-1					
		Phra Ong Chai	1-1-2					
		Ya Nuchit	1-2-4					
		Chao Ched	1-2-3					
West Bank Area	Phrayahantue	1-2-2						
	Phraypimol	1-2-1						

STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAOPHRAYA RIVER BASIN

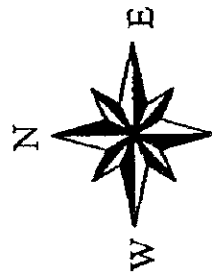
図 3.10

排水システム改善の優先度

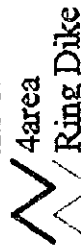
GTI ENGINEERING CO.,LTD. AND INA CORPORATION



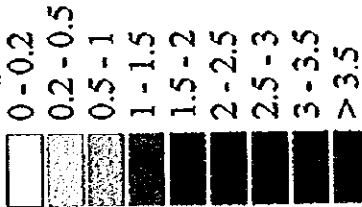
Note:
 i) The return period(T) was estimated for the inundation volume.
 ii) Urban areas to be protected by future ring dikes were excluded from the flood mapping.



LEGEND



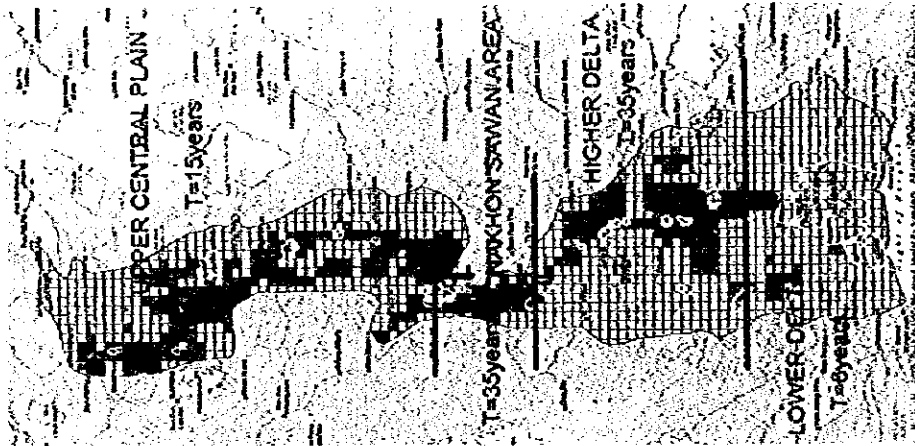
Water Depth(m)



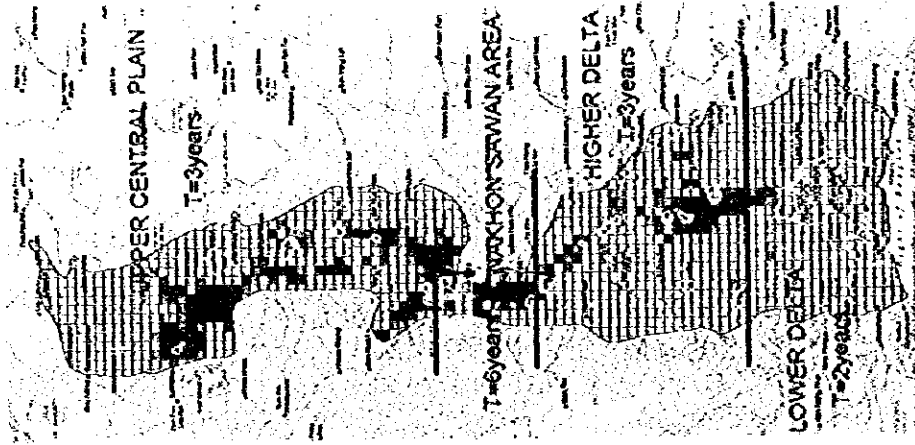
1983



1995



1996

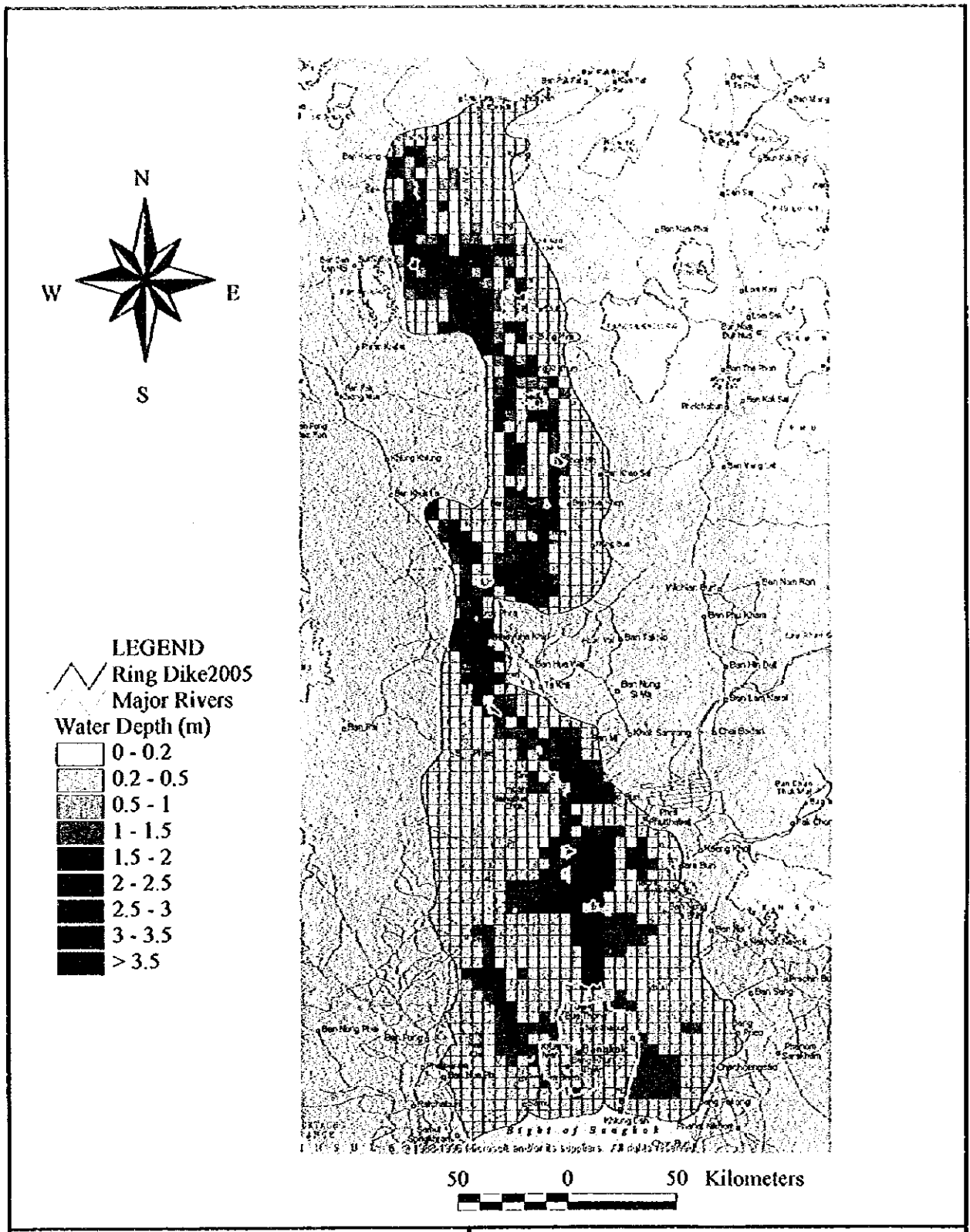


STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAOPHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD & INA CORPORATION

图 4.2

実績氾濫図

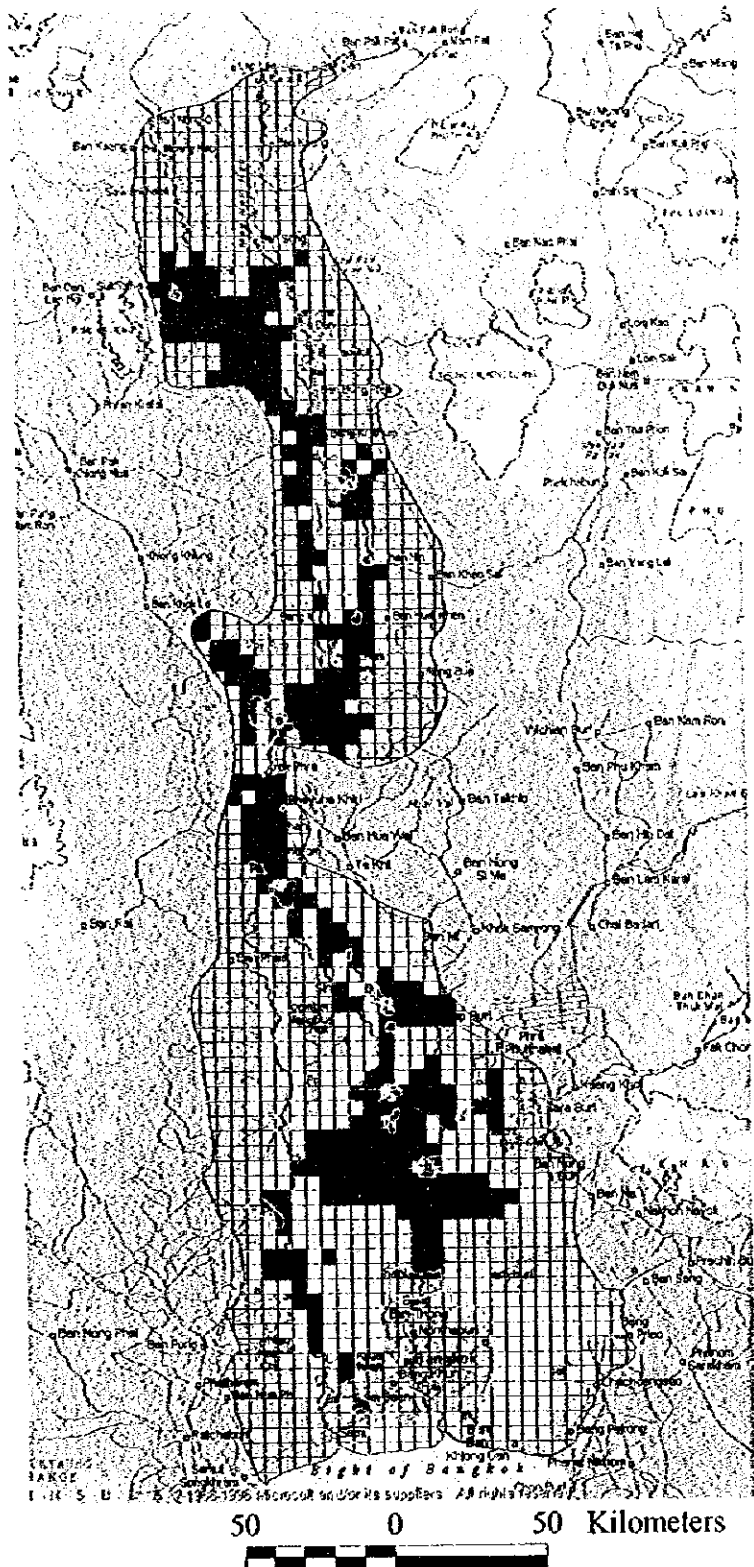
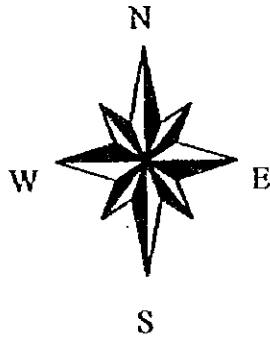







STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAOPHYARA RIVER BASIN

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図 4.3
3洪水(1983,1995,1996)の
最大洪水深図

Flood Potential Map

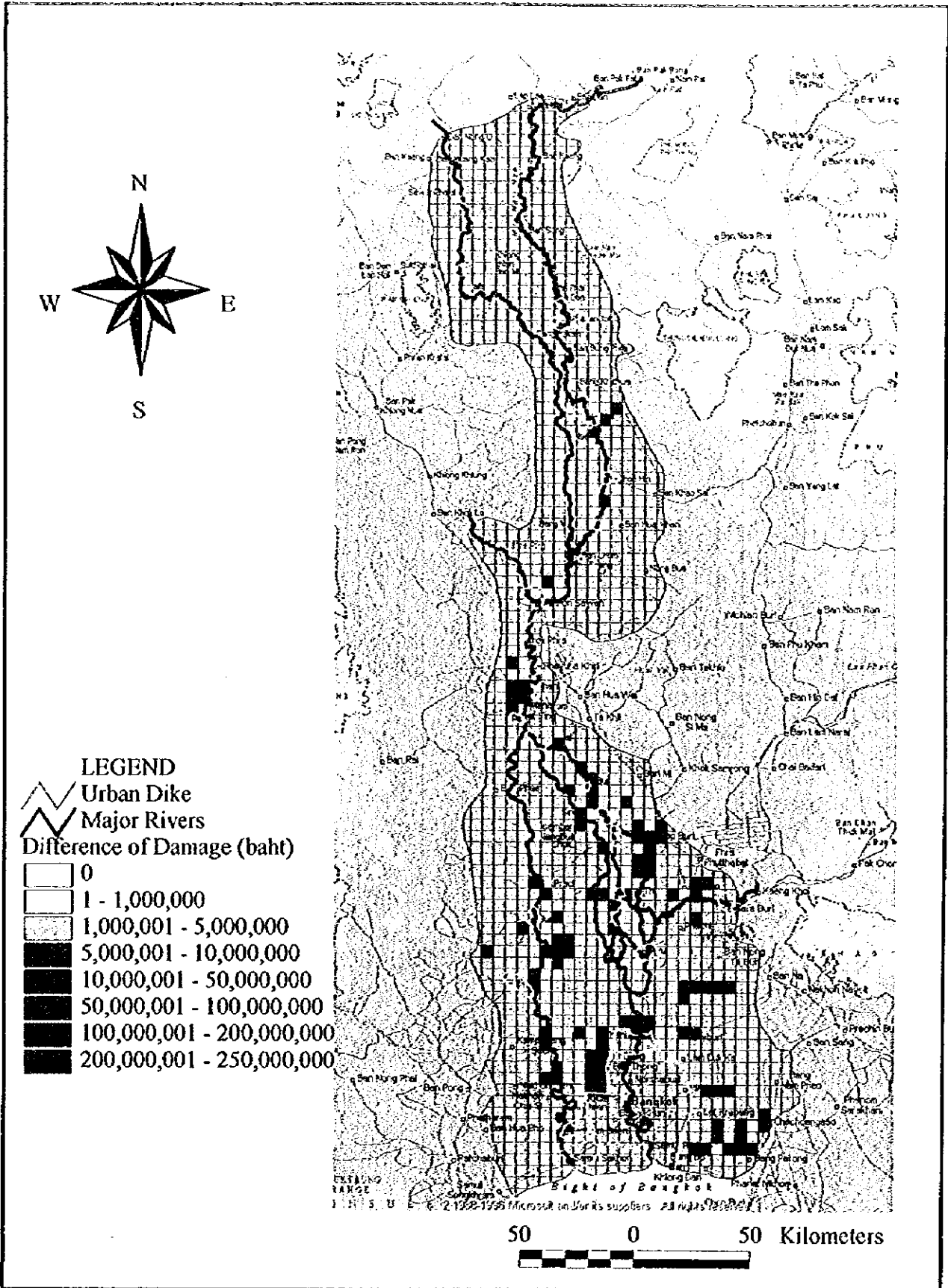


- LEGEND**
-  Urban Dike
 -  Major Rivers
 - Flood Potential**
 -  Low
 -  Middle
 -  High

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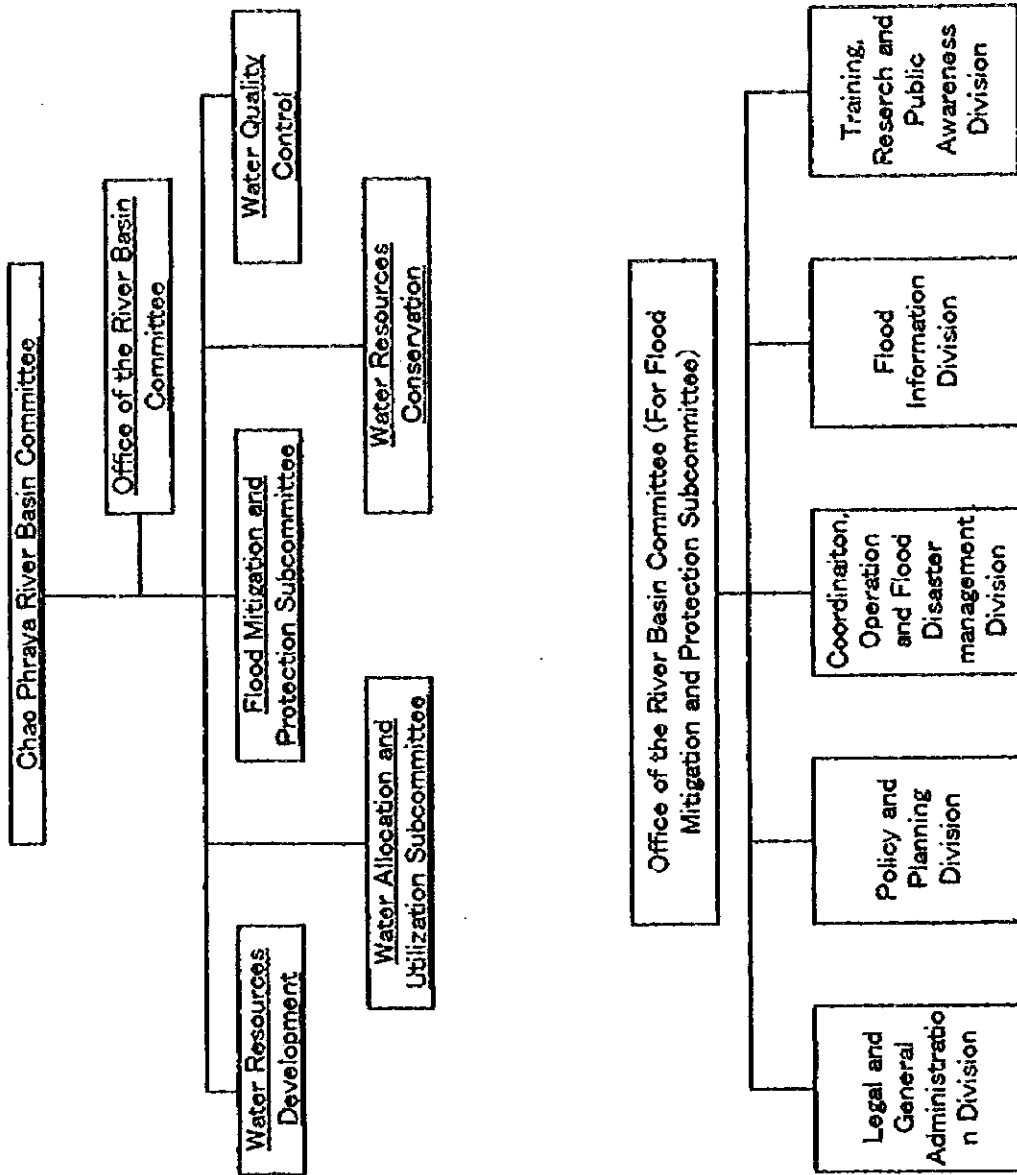
図 4.4
氾濫ポテンシャル図



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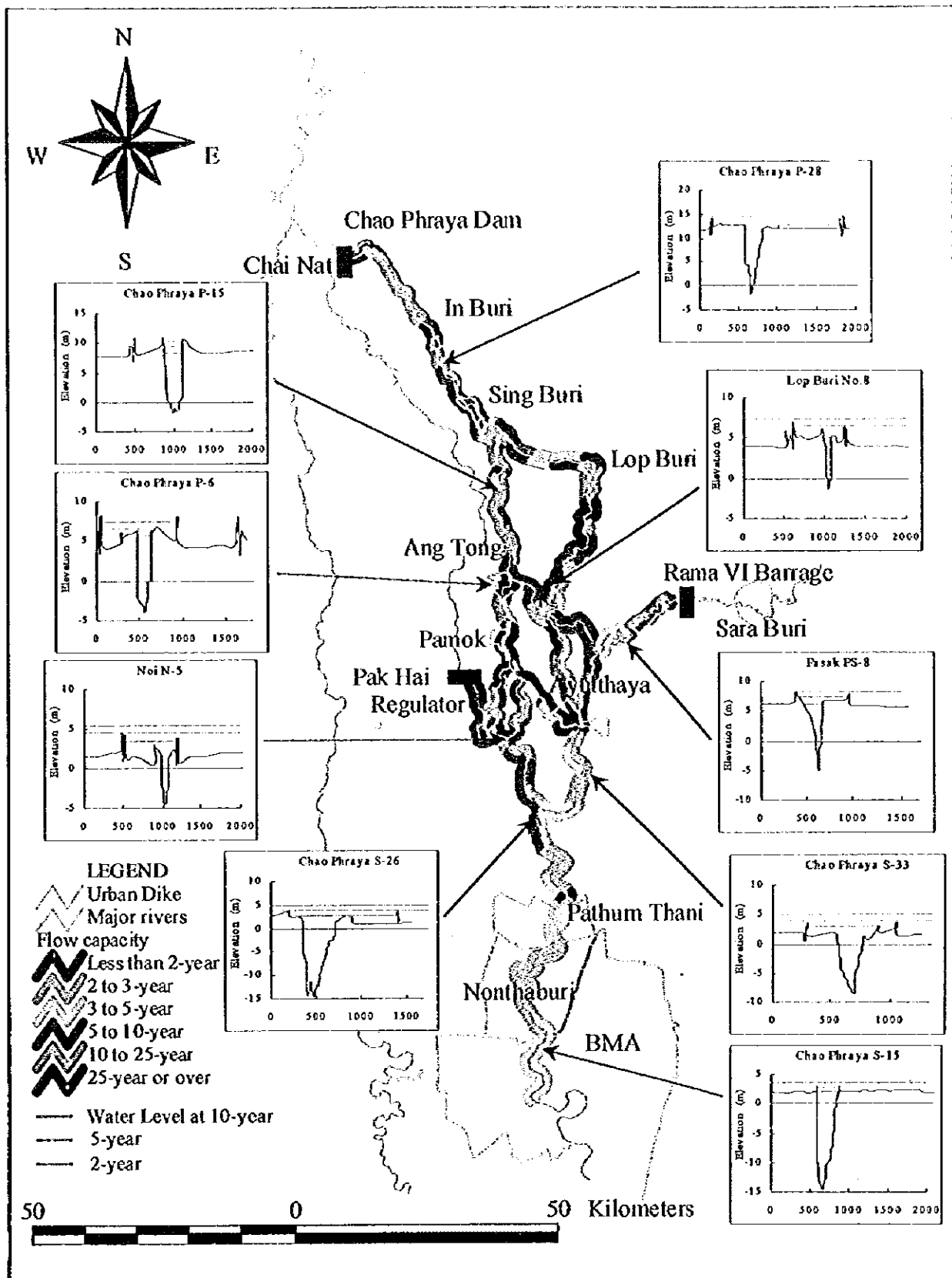
図 4.5
洪水被害額変化図



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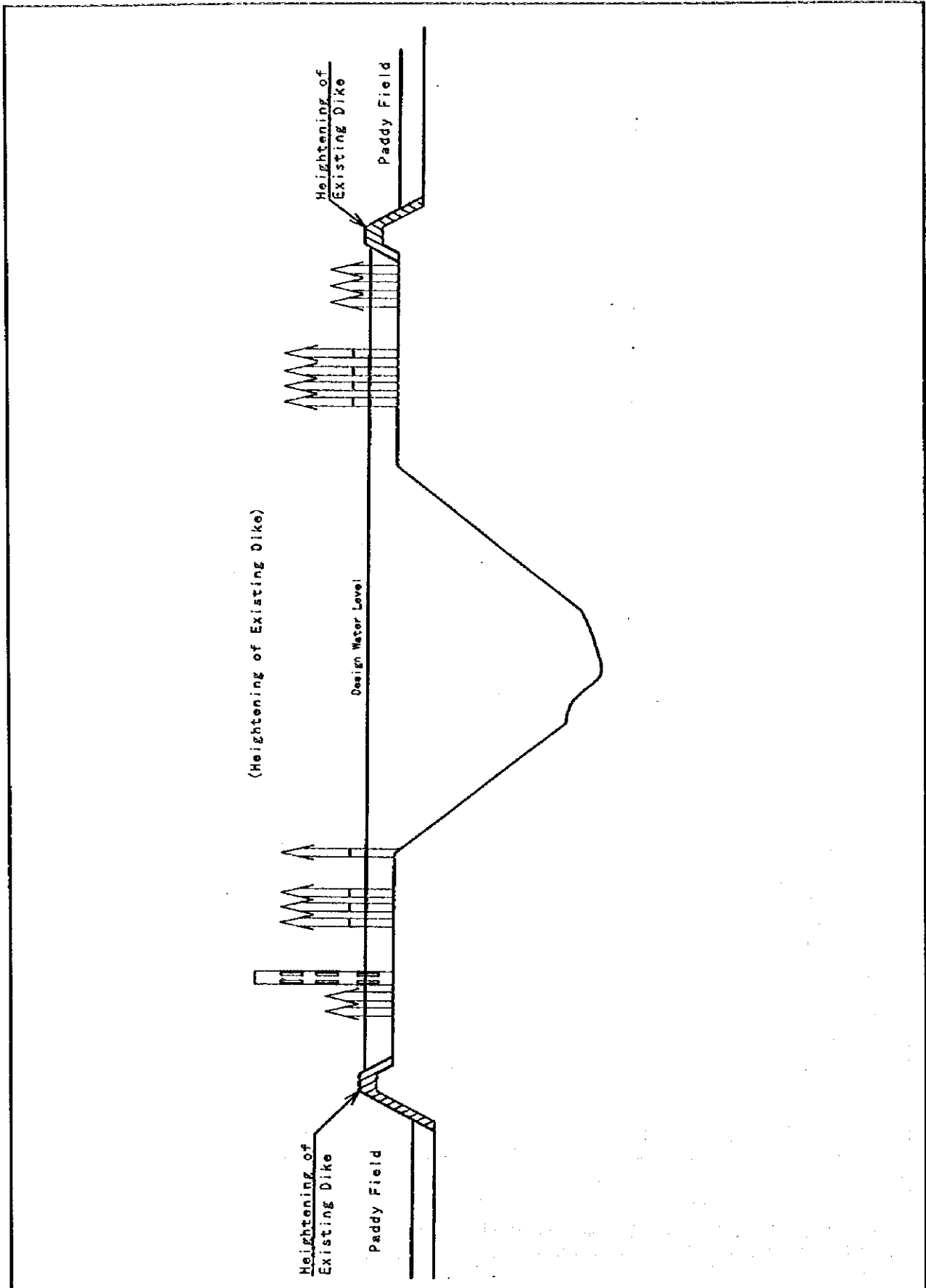
図 4.6 河川流域委員会及び幹事局の組織



STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

図 4.7 現流下能力図と水位横断面図

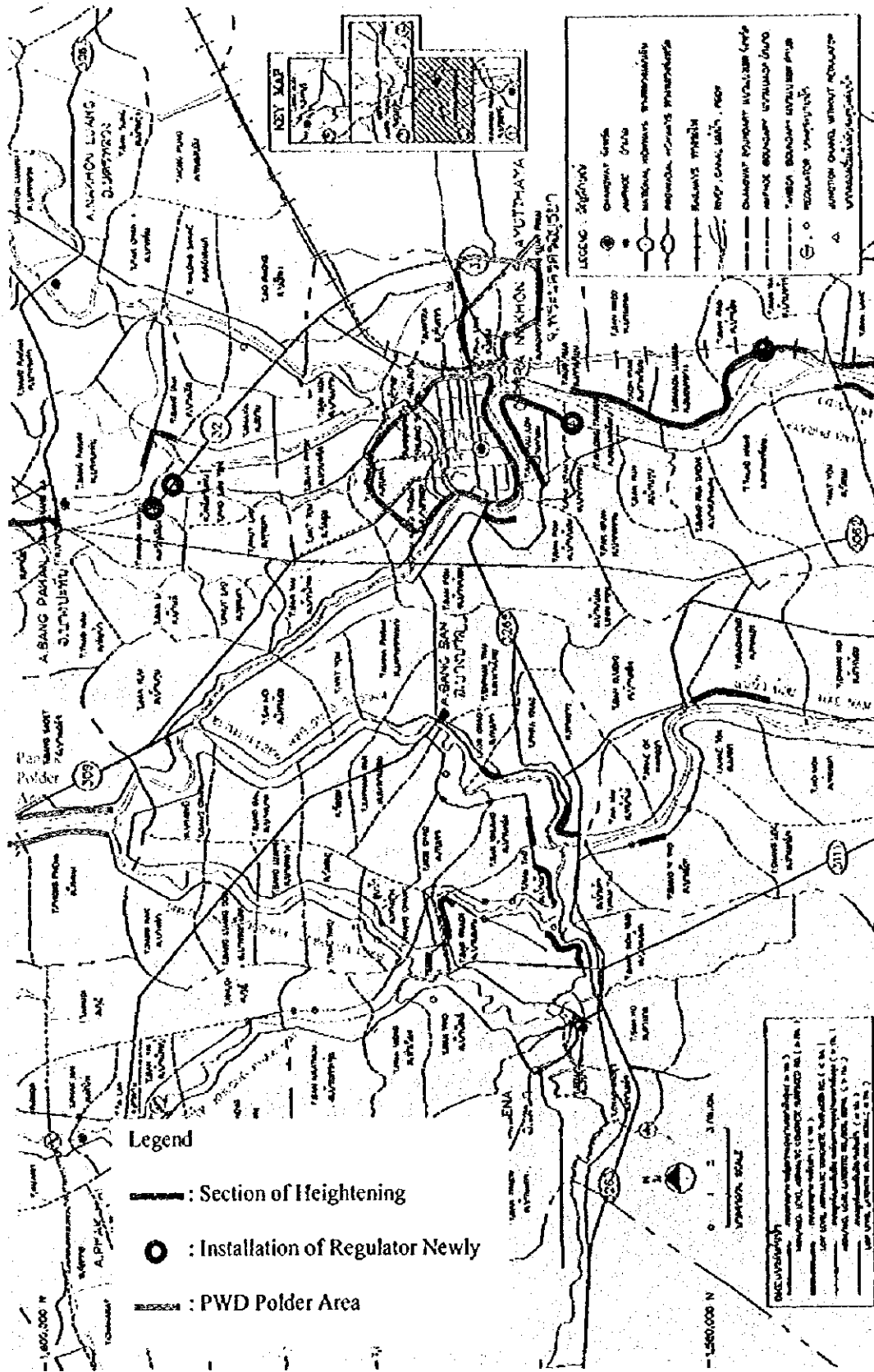
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図 4.8
典型的な横断面図

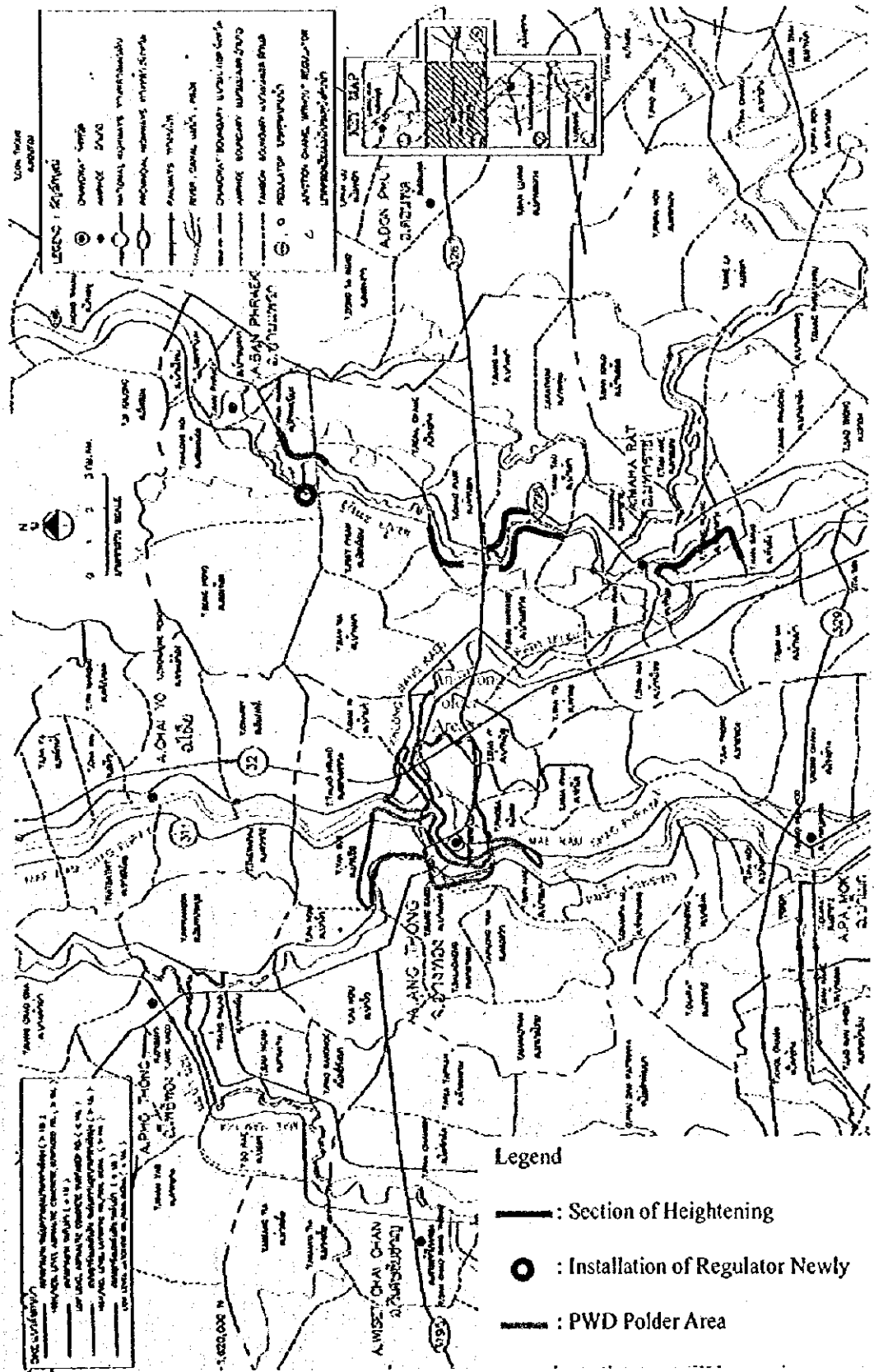


STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

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图 4.9 (2/3)

堤防改修位置图



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CTI ENGINEERING CO., LTD AND INA CORPORATION

図 4.9 (3/3)
堤防改修図

Project Components	1998	1999	2000	2001	2002	2003	2004	2005
Non-Structural Measure								
Control and Guidance of Land use	
Modification of Operation Rule	
Institution and Organization
Structural Measures								
River Improvement	

..... : Study Period

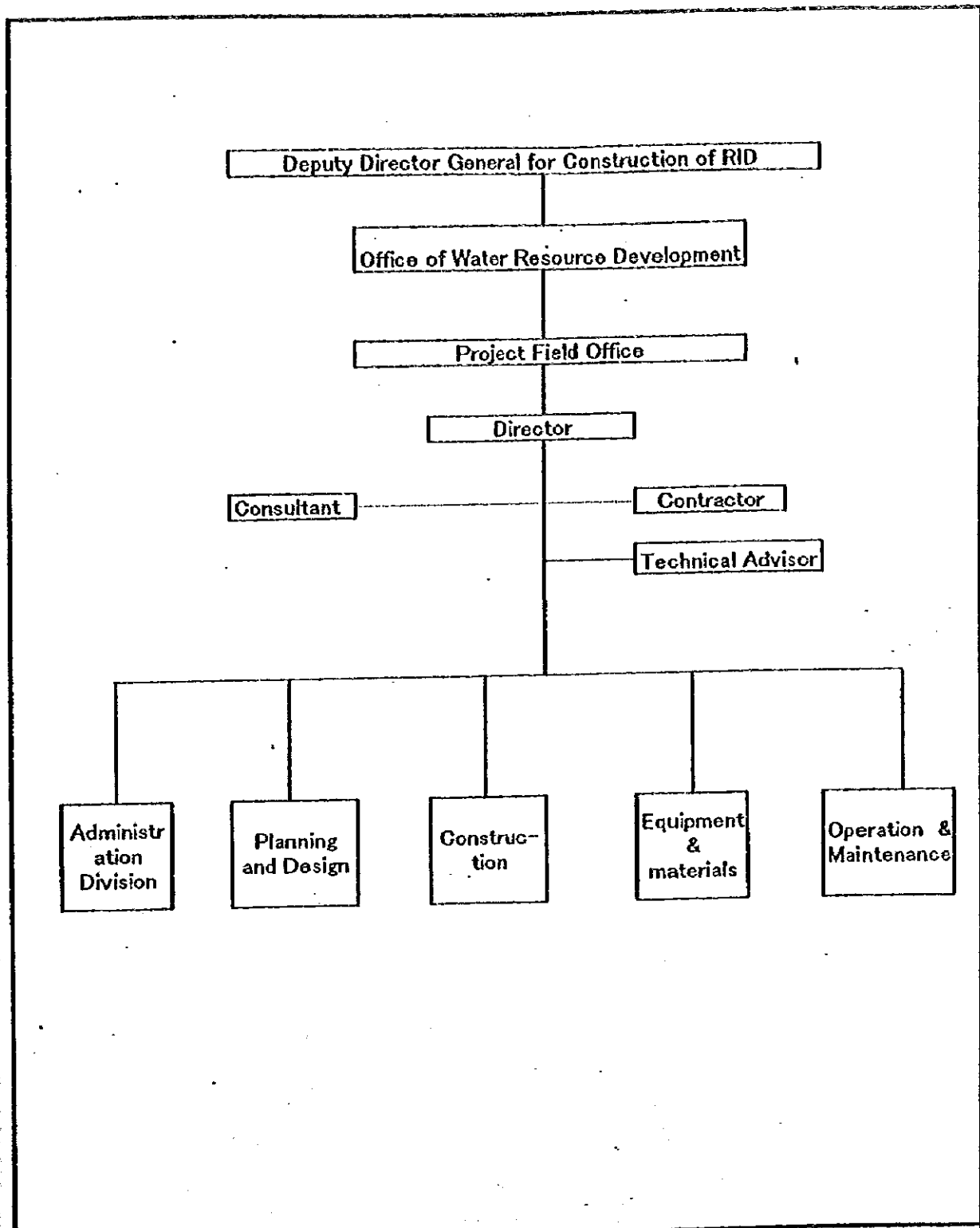
—— : Construction

- . - . : Operation

STUDY ON INTEGRATED PLAN FOR FLOOD
MITIGATION IN CHAO PHRAYA RIVER BAS.
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☒ 4.10

緊急対策実施スケジュール

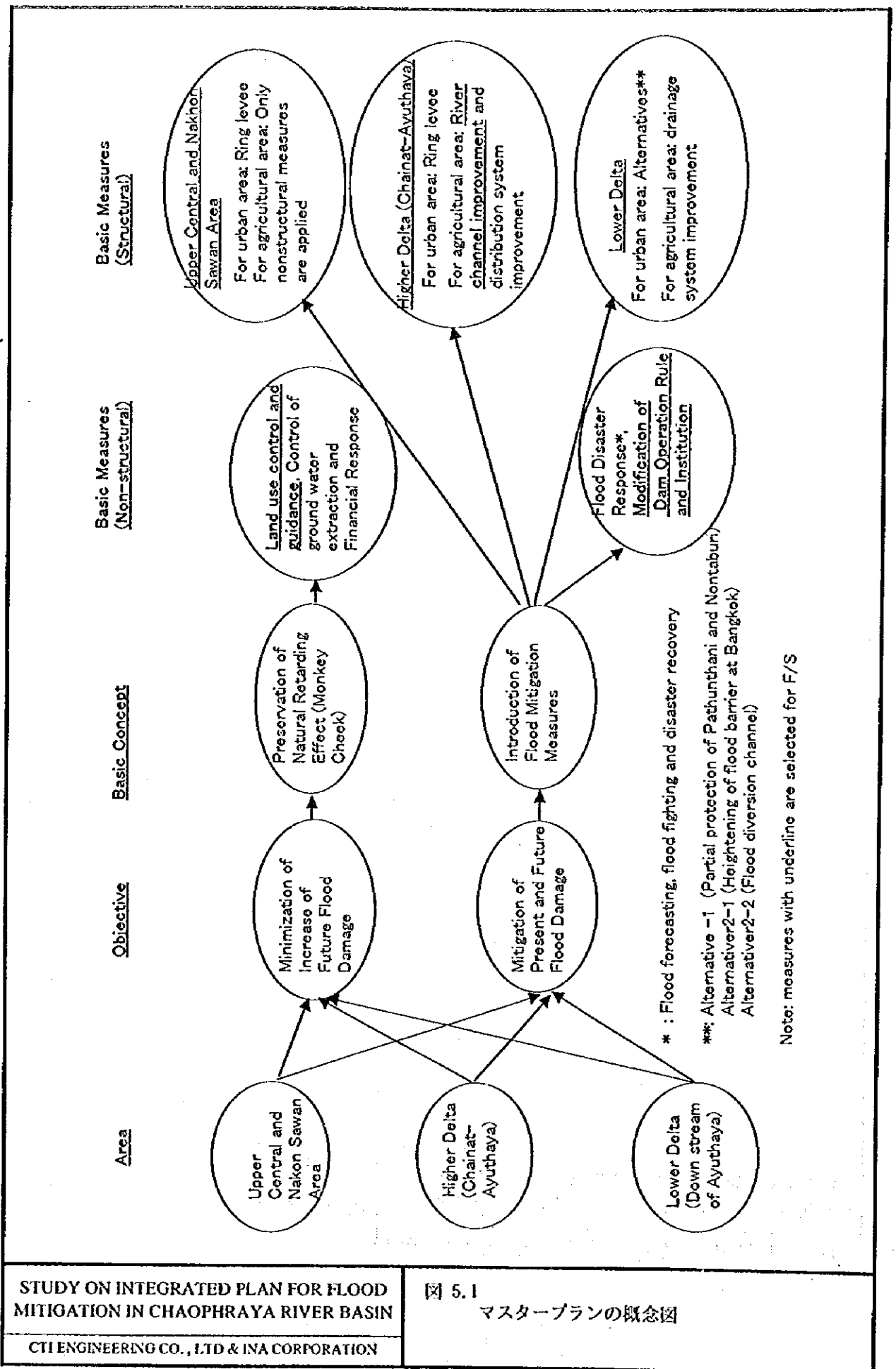


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図 4.11

河川改修実施のための組織



STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAOPHRAYA RIVER BASIN

図 5.1 マスタープランの概念図



