6. Center Building

Fig. G.18 shows an example of drawing of flood control center and training center building.

The construction cost is roughly estimated as Baht 25 million.

Total floor area ... 1652 sq.meter
Construction Cost = 1652 x 15,000 Baht/sq.meter = 25 Million Baht
The estimated cost is breaked down in Table G.8.

Table G.8 Cost Estimation of Flood Control Operation System

(unit: Thousand yen)

	Stage	Feasibility Stage			Future Stage					
	Descriptions \ Package	Priority Package			Second Package			Whole Package		
		Unit	Amount	Remark	Unit	Amount	Remark	Unit	Amount	Remark
(1)	MASTER STATION		(325,900)			(409,000)			(439,000)	
	1. Host Computer	1 set	40,500	Without Back up machine	1 set	81,000	With Back up Machine	1 set	81,000	
	2. Man-Machine sub-system Color Copier, 70" projector Mimic Panel, TV Camera, VTR Desk, etc	1 unit	76,000		1 unit	76,000		1 unit	76,000	
	3. Communication sub-system	1 unit	60,000		1 unit	71,000		1 unit	71,000	
	4. Application Soft Ware	1 "	100,000		1 "	120,000		1 "	150,000	
	5. Power Supply System	1 "	39,400		1 "	50,000		1 "	50,000	
	6. Cables	1 "	10,000		1 "	11,000		1 "	11,000	
(2)	SUB MASTER STATION					(297,500)			(476,000)	
	1. Computer system		—		5 sets	160,000		8 sets	256,000	
	2. Application Soft Ware		—		5 "	100,000		8 "	160,000	
	3. Power Supply System		—		5 "	25,000		8 "	40,000	
	4. Cables		—		5 "	12,500		8 "	20,000	
(3)	OUT STATIONS		(109,500)			(291,360)			(525,130)	
	1. OTU (STC-1000)	15 sets	33,750		41 sets	92,250		75 sets	168,750	
	2. Cabinet	15 sets	14,400		41 "	39,360		75 "	72,000	
	3. Water Level Gage	28 "	25,200		69 "	62,100		119 "	107,100	
	4. Rainfall Gage	13 "	3,250		31 "	7,750		61 "	15,250	
	5. OTU Soft Ware	15 "	4,500		41 "	12,300		75 "	32,500	
	6. Cable	1 unit	8,600		1 unit	24,600		1 unit	34,530	
	7. Modification of Existing panel	1 "	4,800		1 "	12,000		1 "	20,000	
	8. DC Battery charger	15 "	15,000		41 "	41,000		75 "	75,000	
(4)	OUT For RID, MD EGAT PA					(52,000)			(91,000)	
	1. OTU and Cabinet		—		4 sets	32,000		7 sets	56,000	
	2. OTU Soft Ware		—		4 "	16,000		7 "	28,000	
	3. DC Battery charge		—		4 "	4,000		7 "	7,000	
(5)	OTHERS		(190,200)			(453,500)			(656,930)	
	1. Master Station Installation		12,000		1 unit	17,000		1 unit	20,000	
	2. Sub-Master Installation		—		1 "	20,000		1 "	35,000	
	3. OTU Installation		20,000		1 "	67,500		1 "	118,130	
	4. Site Testing		60,000		1 "	160,000		1 "	180,000	
	5. Spare Parts		30,000		1 "	42,000		1 "	76,800	
	6. Test Equipments		15,000		1 "	15,000		1 "	20,000	
	7. OTU House		15,000		1 "	41,000		1 "	72,000	
	8. TOT Telephone Line		9,200		1 "	25,000		1 "	45,000	
	9. One year Maintenance		9,000		1 "	30,000		1 "	40,000	
	10. Operation Training		20,000		1 "	36,000		1 "	50,000	
(6)	Total of Initial Cost	¥ 625,600 thousand yen			¥ 1,503,360 thousand yen			¥ 2,188,060 thousand yen		
		68 Million ฿			158 Million ฿			235 Million ฿		
(7)	Operation & Maintenance									
	1. Salary of Operator	2 Memb.	0.40 M฿		3 Memb.	0.60 M฿		3 Memb.	0.60 M฿	
	2. Operating Expense (TOT.EGAT.ETC)	1 "	1.00 M฿		1 unit	3.10 M฿		1 unit	3.90 M฿	
	3. Patroling Expense	1 "	0.30 M฿		1 "	0.80 M฿		1 "	1.00 M฿	
	4. Office Work Expense	1 "	0.20 M฿		1 "	0.50 M฿		1 "	0.50 M฿	
	T O T A L		2 Million ฿ / year			5 Million ฿ / year			6 Million ฿ / year	

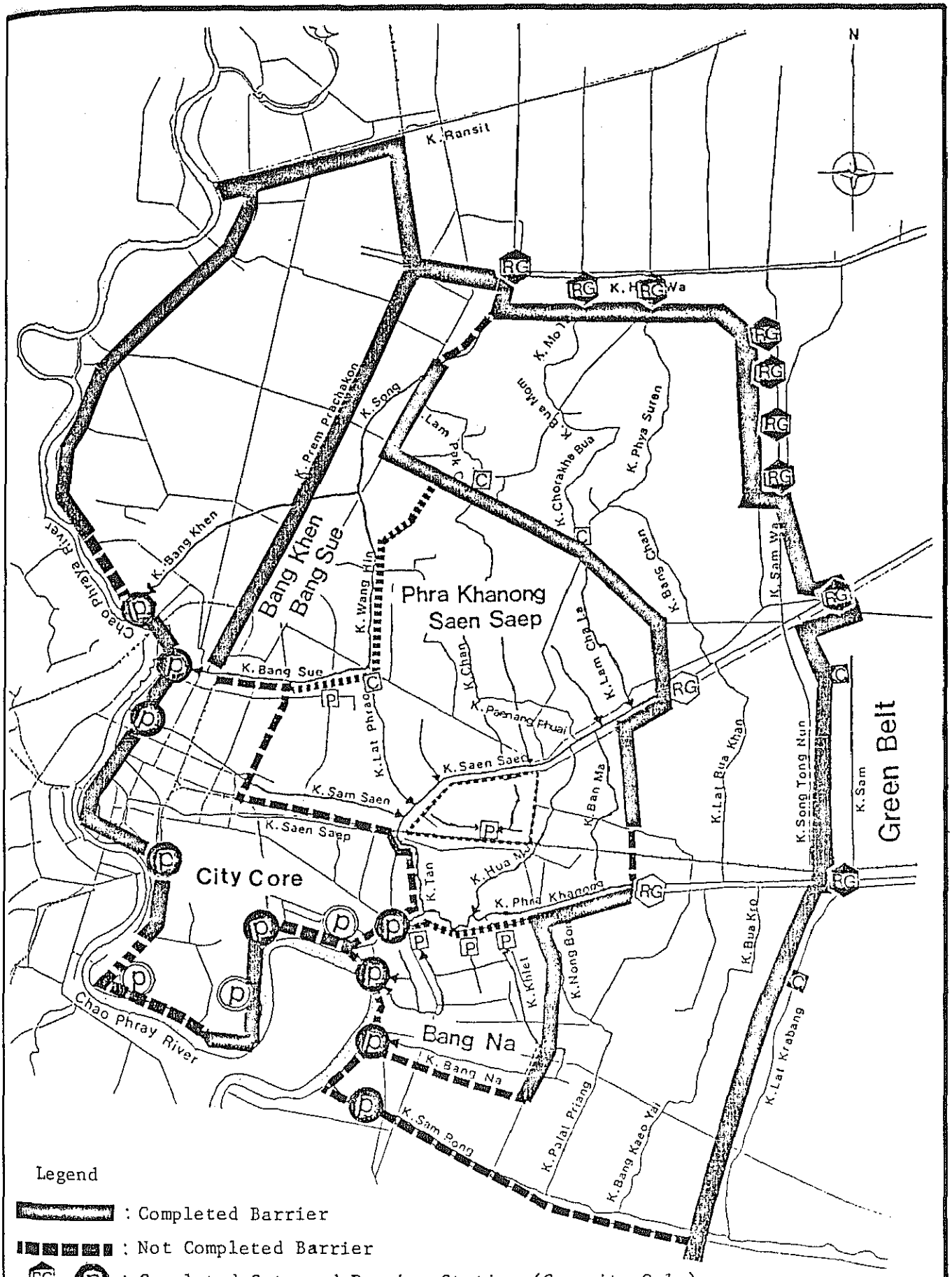
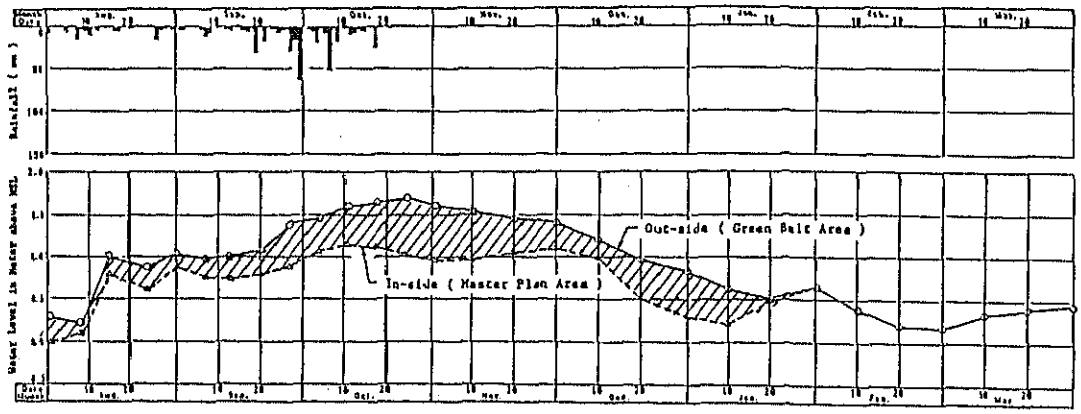


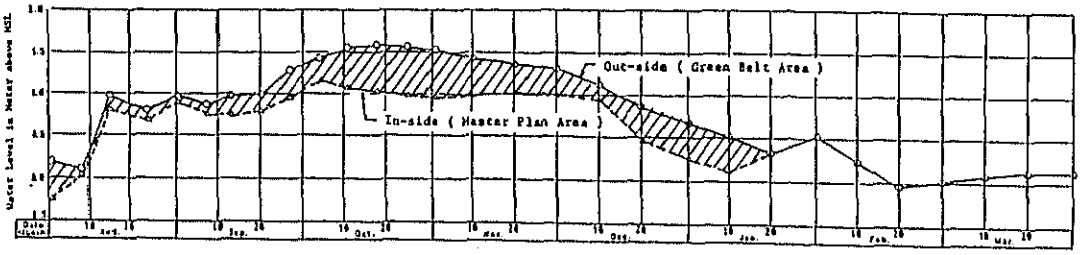
Fig. G.1 EXISTING MAIN DRAINAGE FACILITIES IN 1985

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

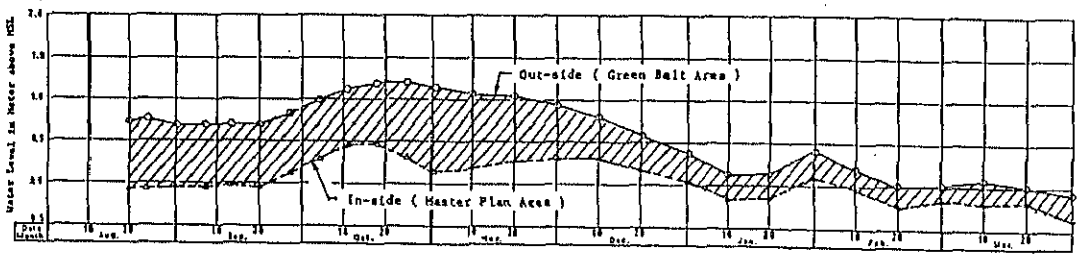
JICA 2529B.E 1986A.D



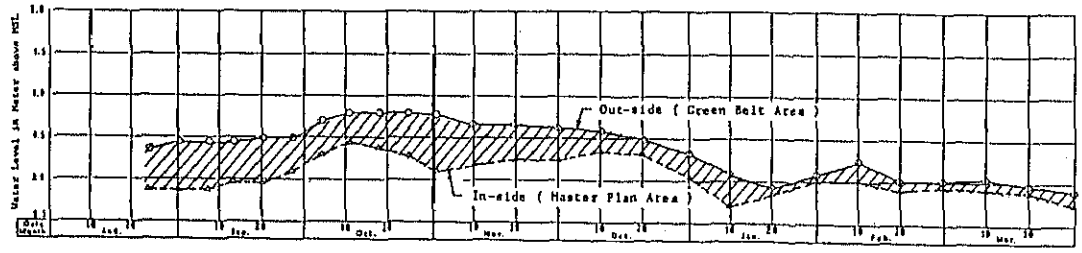
Regulator No. ① along Green Belt (K.Sai Tai)



Regulator No. ③ along Green Belt (K.Phraya Surain)

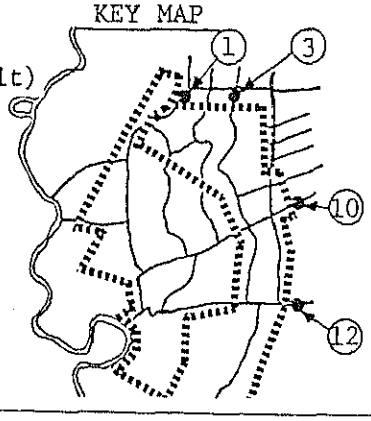


Regulator No. ⑩ along Green Belt (K.Saen Saep)



Regulator No. ⑫ along Green Belt (K.Phra Khanong)

KEY MAP



: (Effect of Green Belt)

Difference of Water level between outer and inner side of Green Belt Levee

Name of Regulator

① : K. Sai Tai

③ : K. Phraya Surain

⑩ : K. Saen Saep

⑫ : K. Phra Khanong

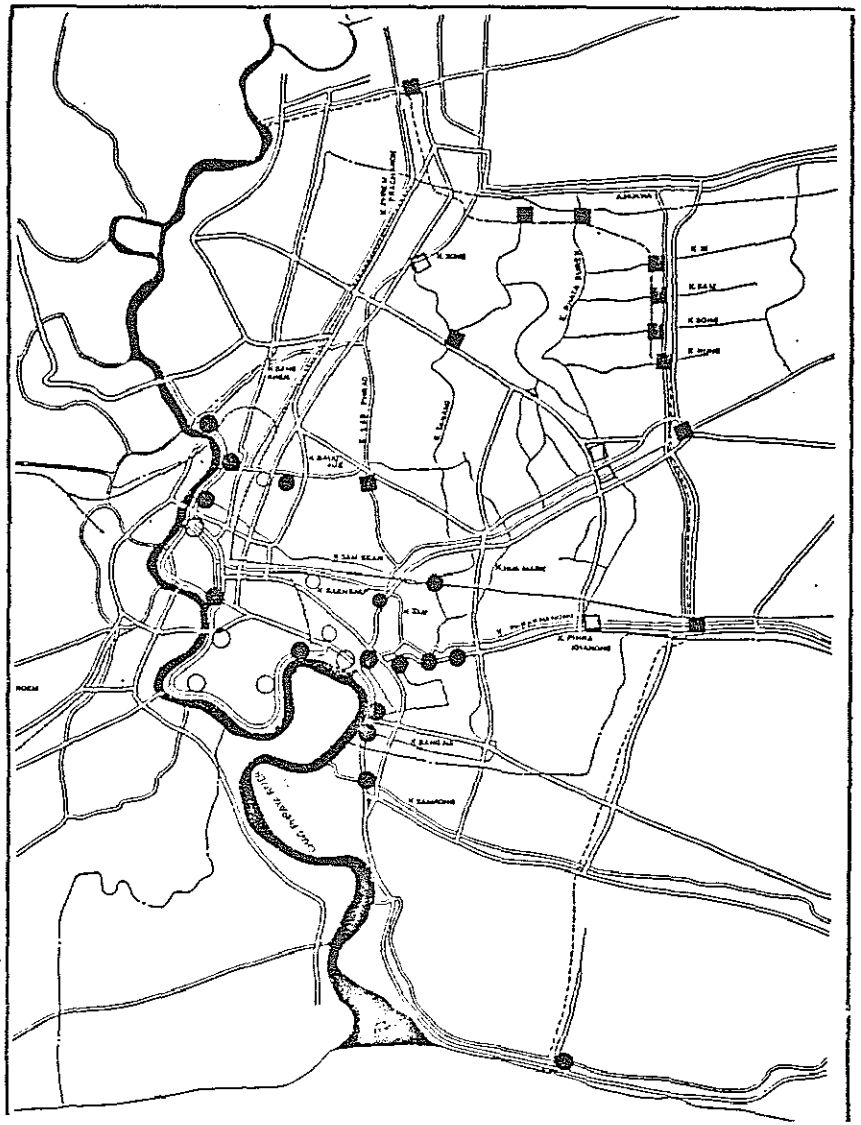
Source : R I D

Fig. G.2 HYDRAULIC EFFECT OF GREEN BELT DYKE

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E 1986A.D

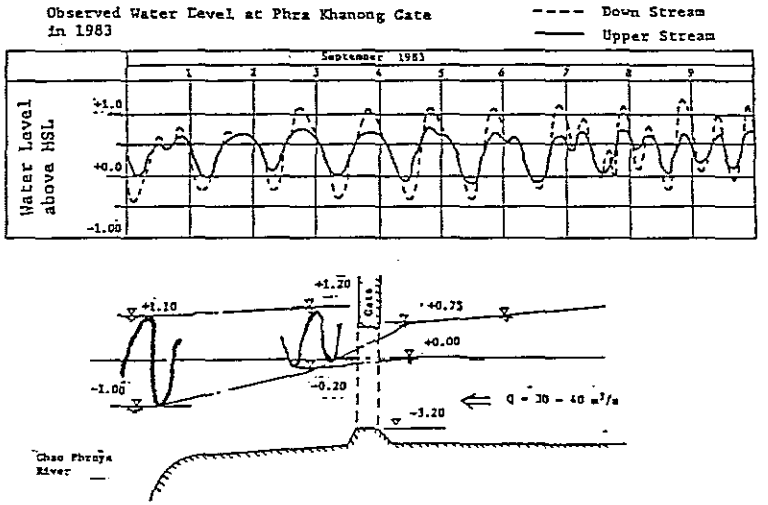
(A) Location of Existed and Planned Gate/Pumping Station



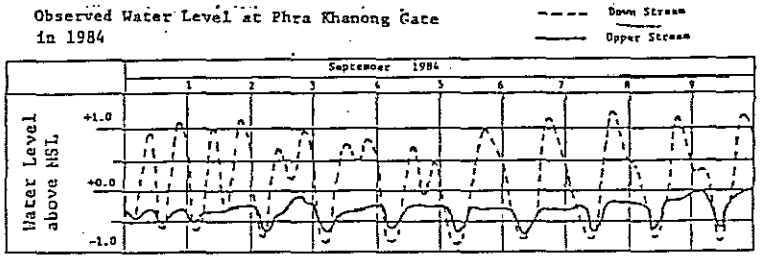
■ Existing Main Gate
□ Planned Gate
● Existing Main Pumping Station
○ Planned Pumping Station

(B) Observed Water Levels at Phrakhanog P.S

(Before Urgent Measures)



(After Urgent Measures)



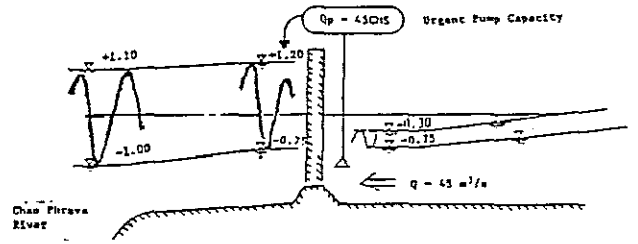
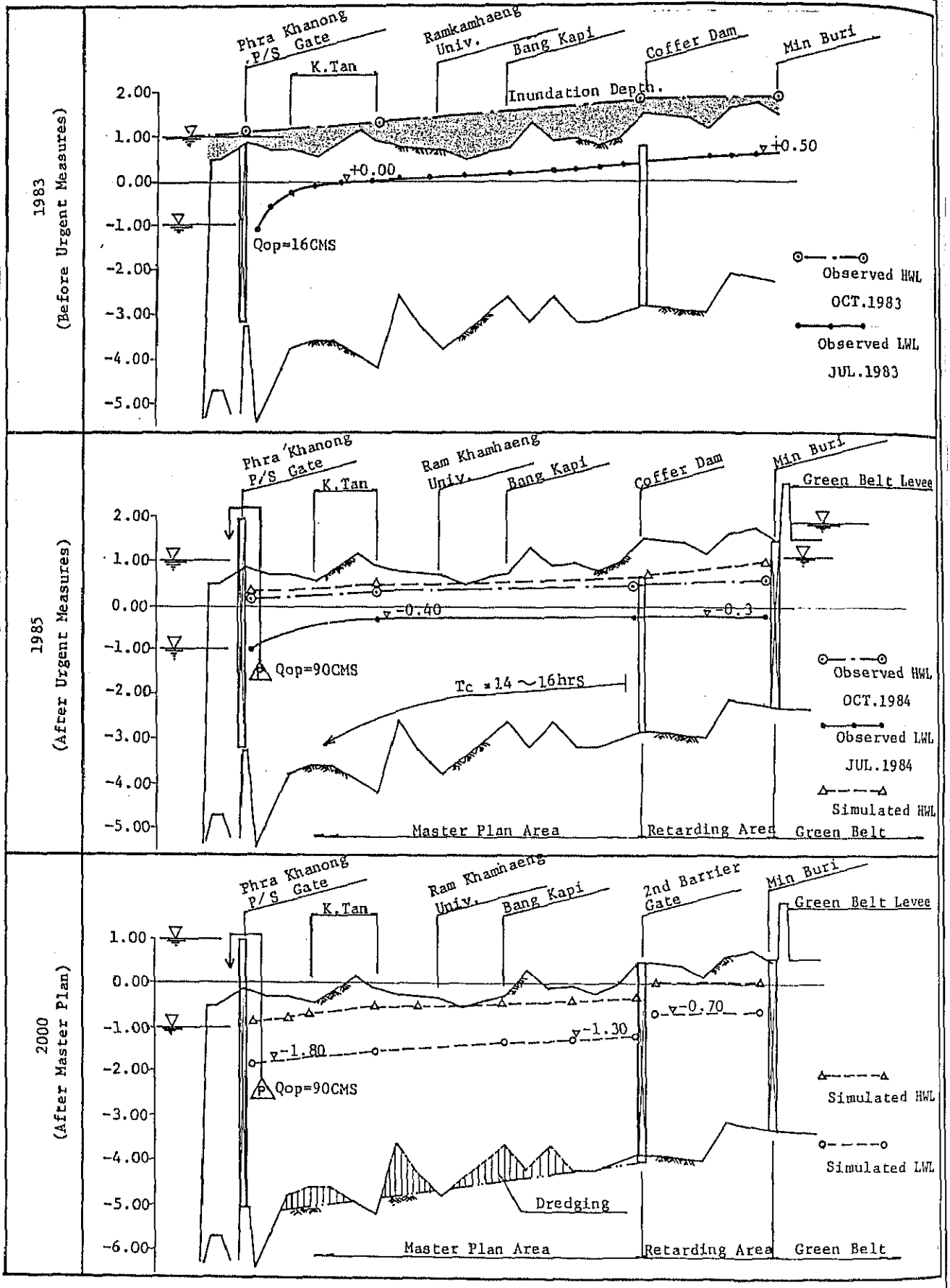


Fig. G.3 LOCATION OF GATES AND PUMPING STATIONS AND HYDRAULIC EFFECT OF URGEN MEASURES

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E 1986A.D



note 1 Tc:Time Concentration of Stream flow from 2nd Barrier to Phra Khanong P.S
(Observed in OCT.1985)

Fig. G.4 OBSERVED AND SIMULATED WATER LEVEL IN KLONG SAEN SAEP

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E 1986A.D

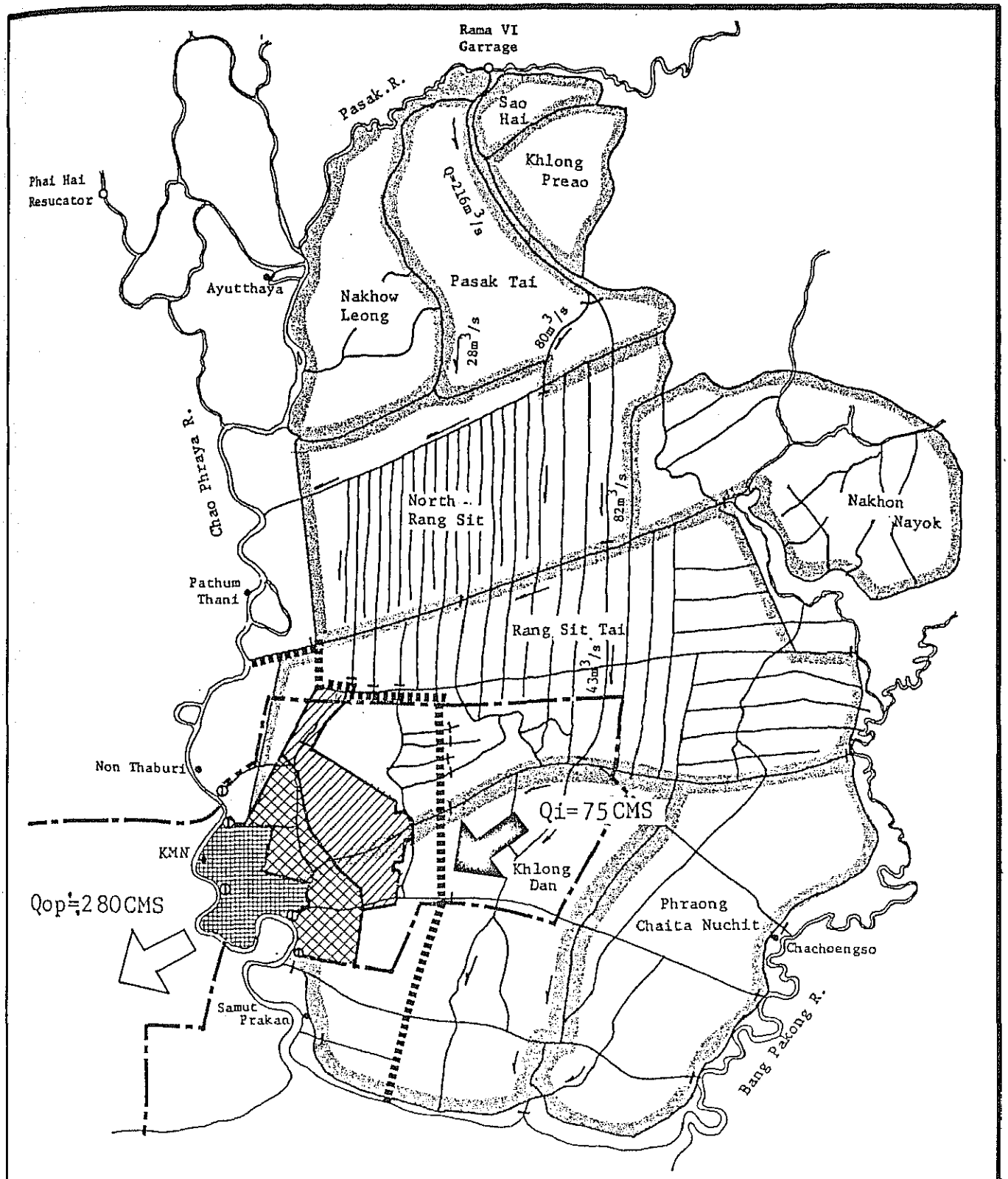
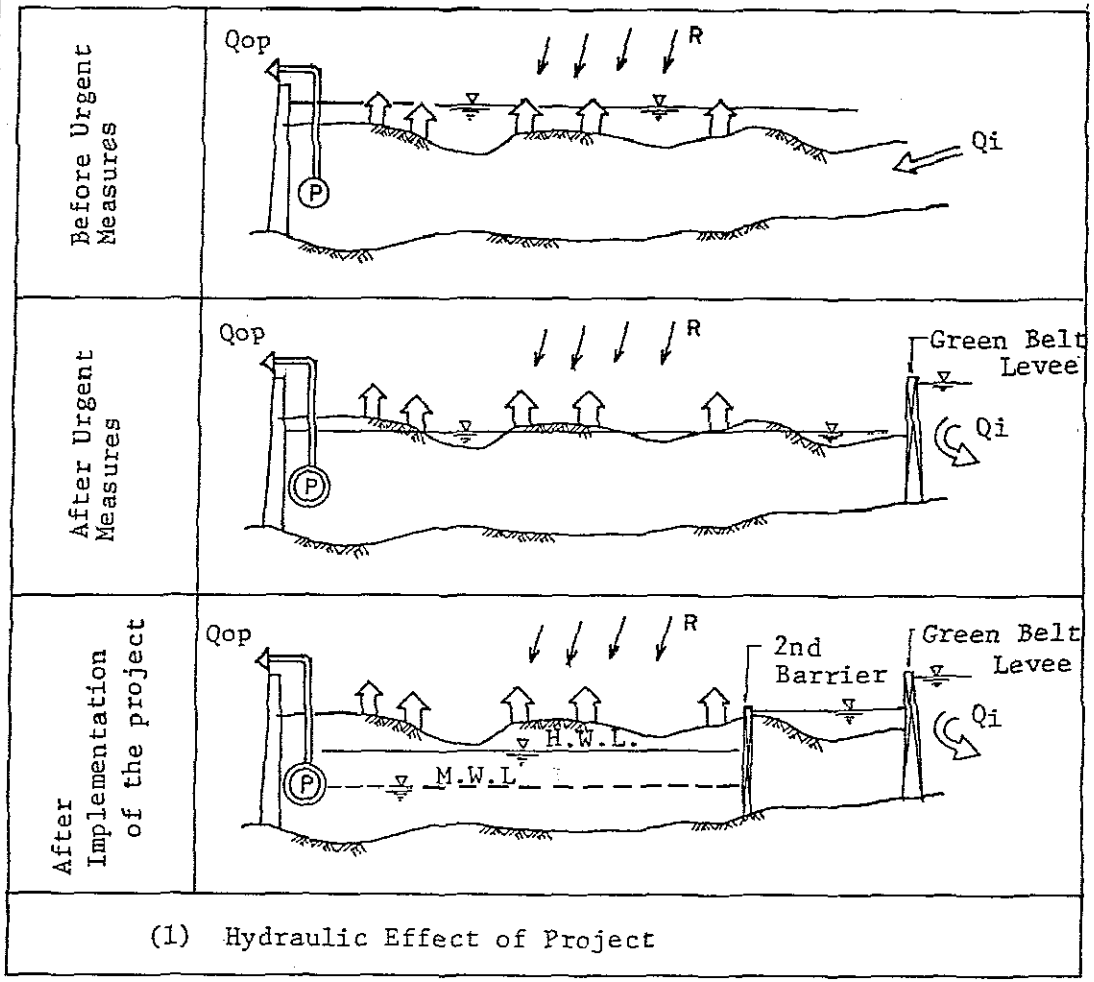


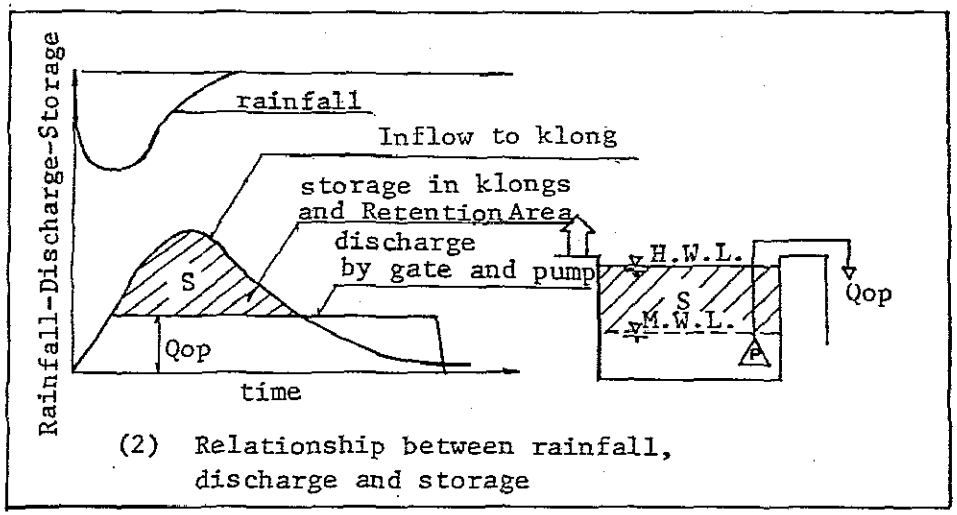
Fig. G.5 STUDY AREAS IN IRRIGATION KLONG NETWORK (RID) OF EAST BANK OF THE CHAO PHRAYA RIVER

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E 1986A.D



(1) Hydraulic Effect of Project



(2) Relationship between rainfall, discharge and storage

Legend

Qi:	Inflow from outer area
Qo:	Drain by pumping station and gate
R:	Rainfall
S:	Storage in klong and retention area
Ri:	Accumulated rainfall
H.W.L.:	High water level
M.W.L.:	Maintenance water level

Fig. G.6 CONCEPT OF RELATION OF RAINFALL-WATERLEVEL-FACILITY

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529BE 1986AD

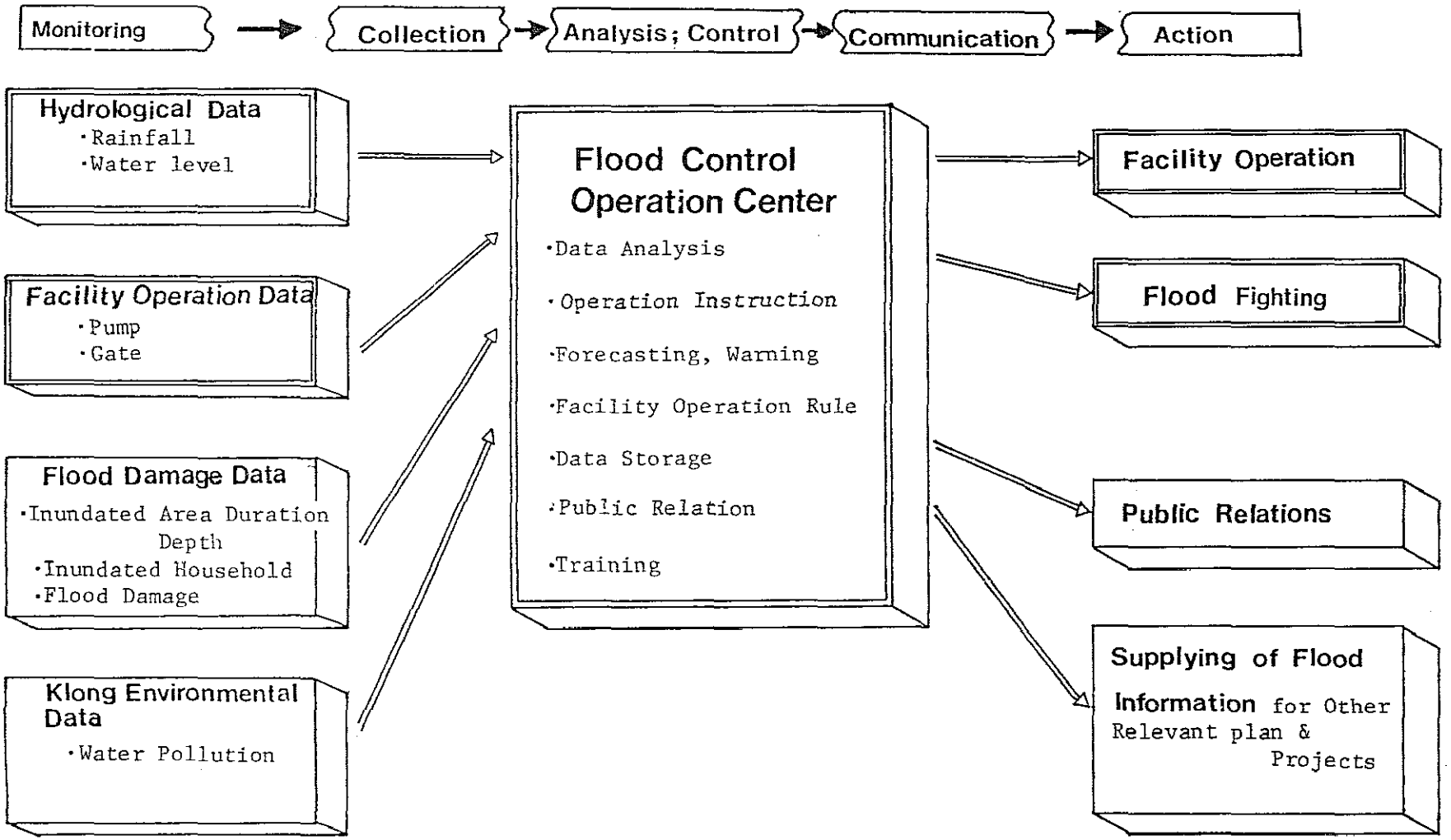
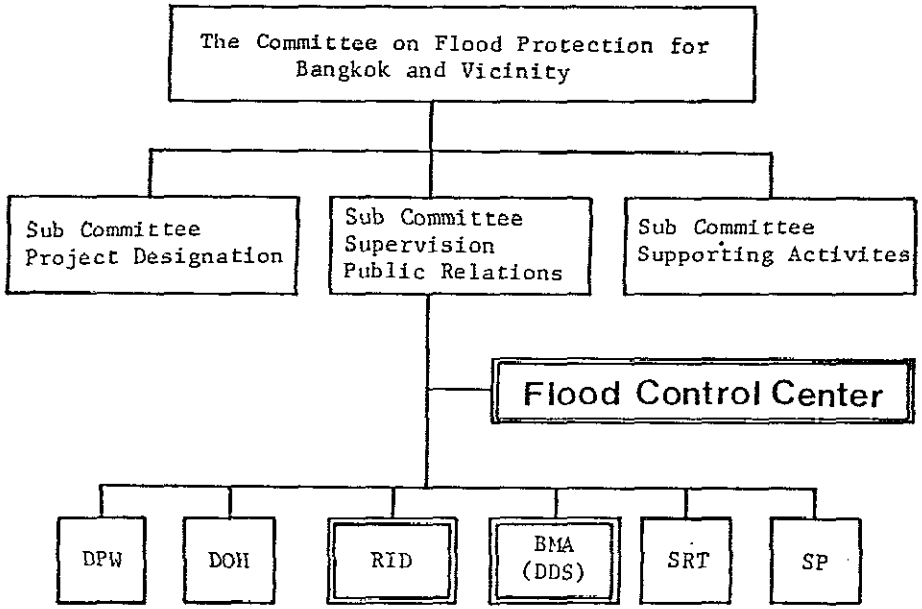


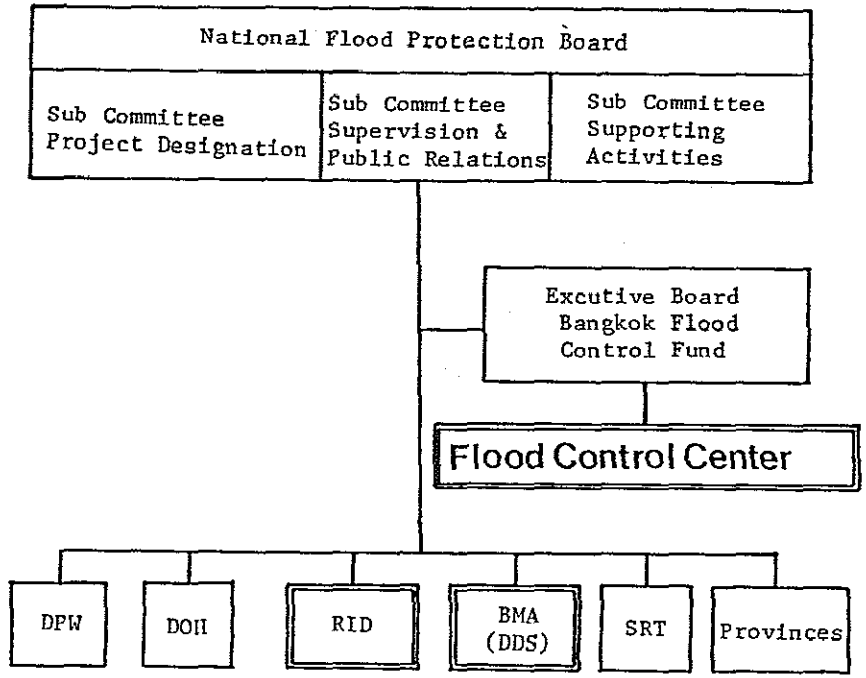
Fig. G.7 CONCEPT OF FLOOD CONTROL OPERATION SYSTEM

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E 1986A.D



PLAN A



PLAN B

Fig. G.8 INSTITUTIONAL POSITION OF THE CENTER

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

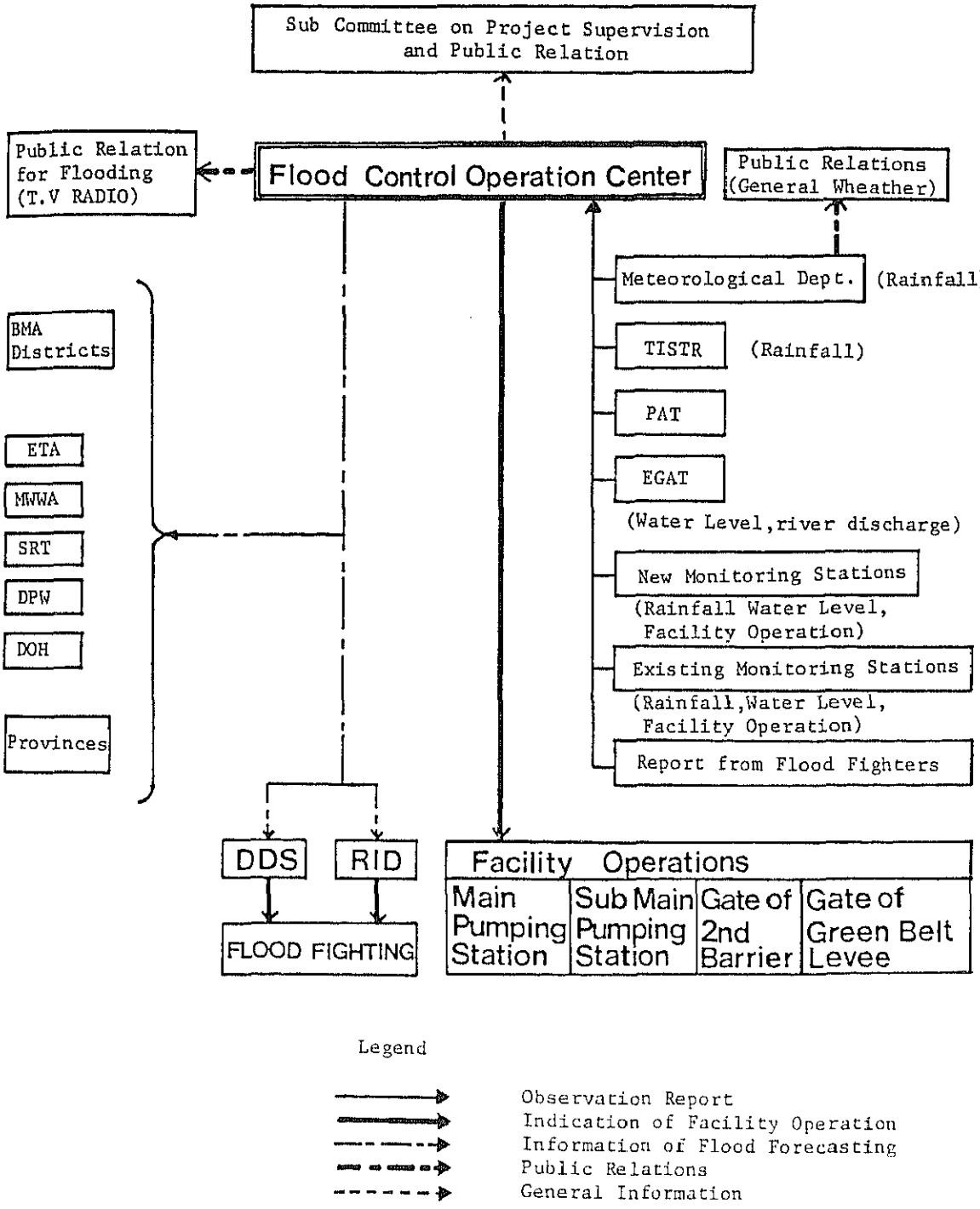


Fig. G.9 FLOW CHART OF INFORMATION FOR FLOOD CONTOROL AND OPERATION

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E 1986A.D

LEGEND

Newly Stations

- ● Rain gauge and two water level meters
- ■ Rain gauge and water level meters
- ▲ Two water level meters

Existing Stations

- ▣ Rain gauge station
- ◎ Water level gauge station

Fig. G.10 LOCATION OF MONITORING STATIONS (PRIORITY PACKAGE)

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E. 1986A.D.

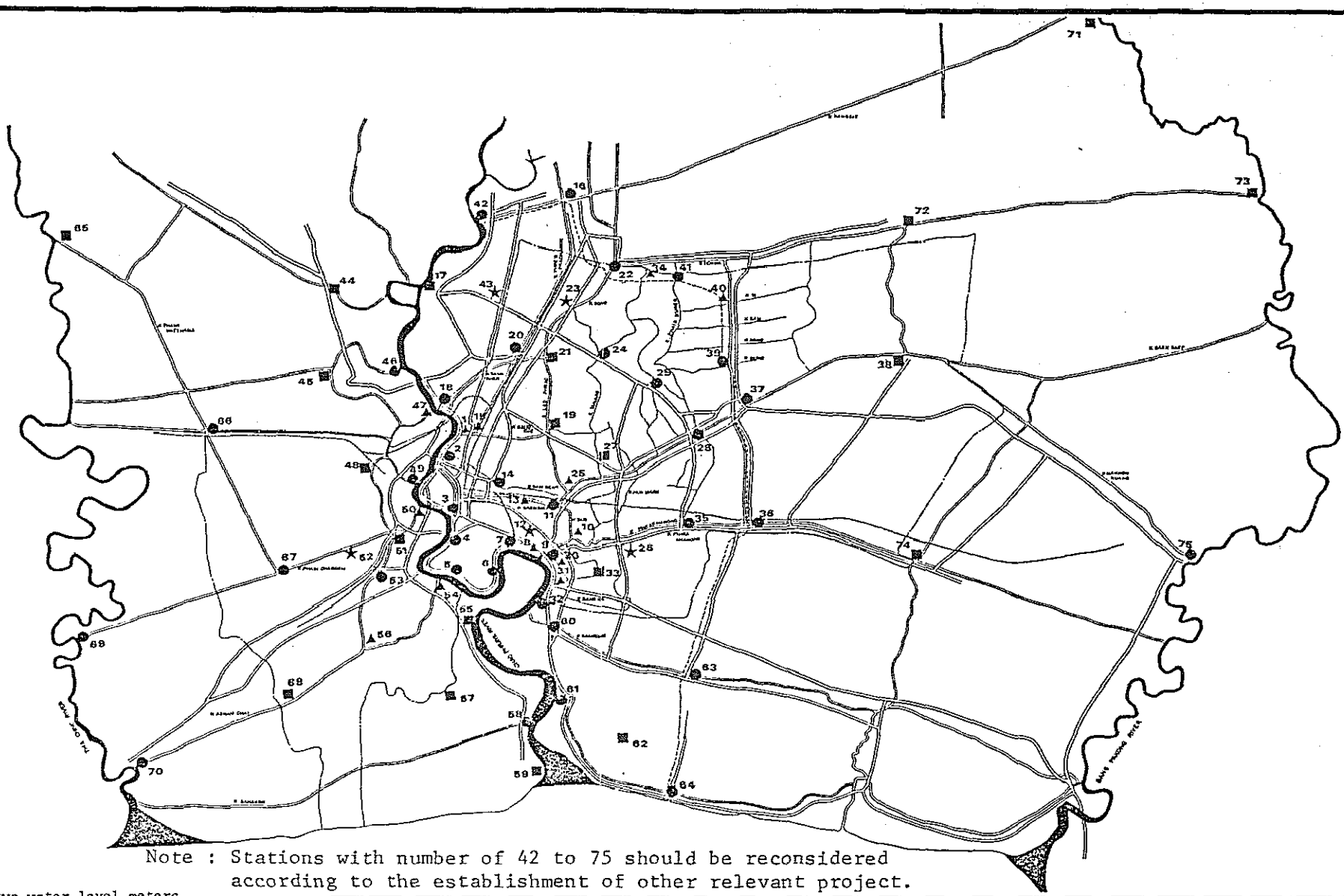
LEGEND

- ● Rain gauge and two water level meters
- ■ Rain gauge and water level meter
- ▲ Two water level meters
- ★ Rain gauge

Fig. G.11 LOCATION OF MONITORING STATIONS (SECOND PACKAGE)

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E 1986A.D



LEGEND

- Rain gauge and two water level meters
- Rain gauge and water level meter
- Two water level meters
- Rain gauge

Note : Stations with number of 42 to 75 should be reconsidered according to the establishment of other relevant project.

Fig. G.12 LOCATION OF MONITORING STATIONS (WHOLE PACKAGE)

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

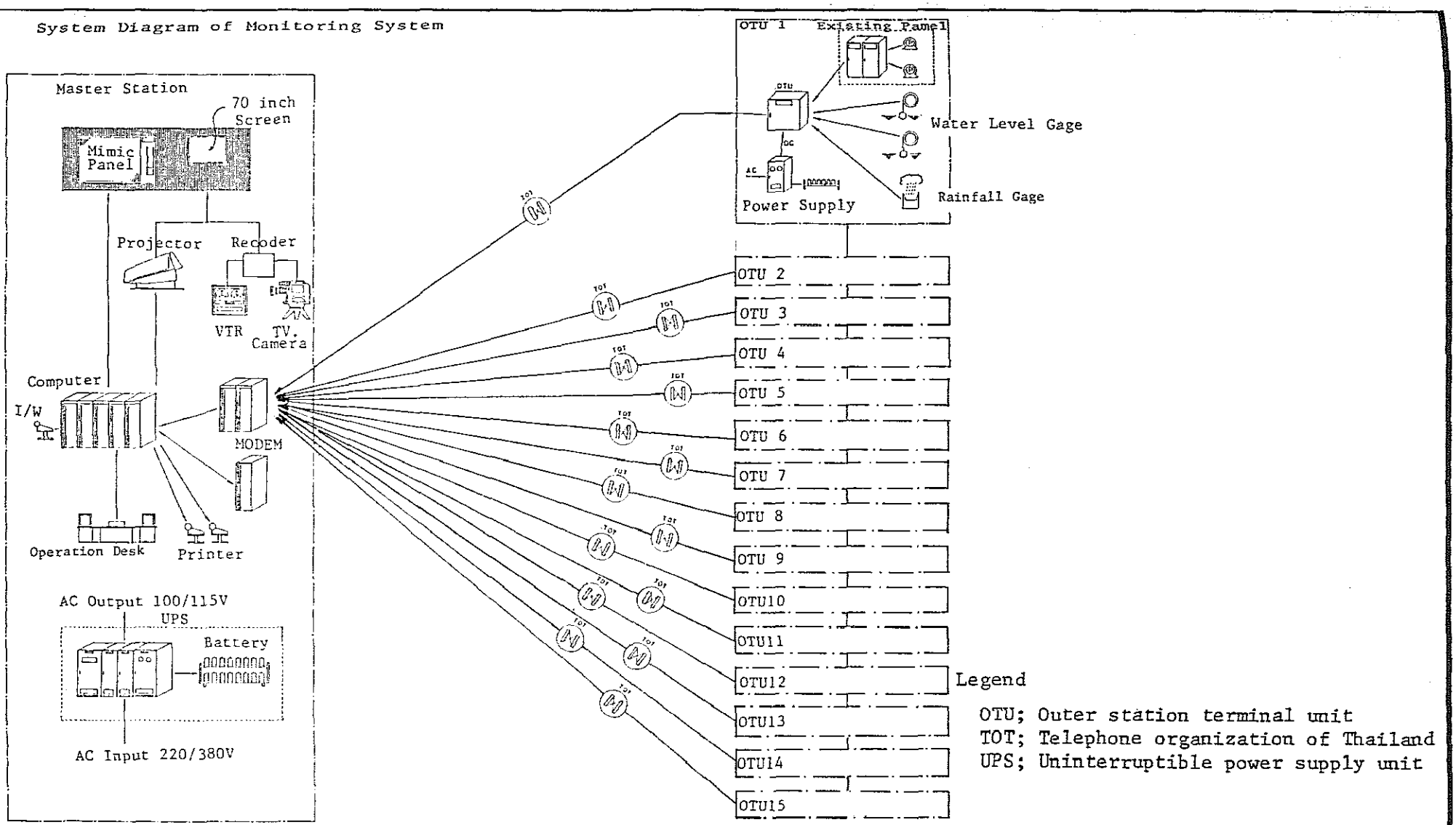


Fig. G.13 SYSTEM DIAGRAM OF MONITORING SYSTEM (PRIORITY PACKAGE)

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E 1986A.D

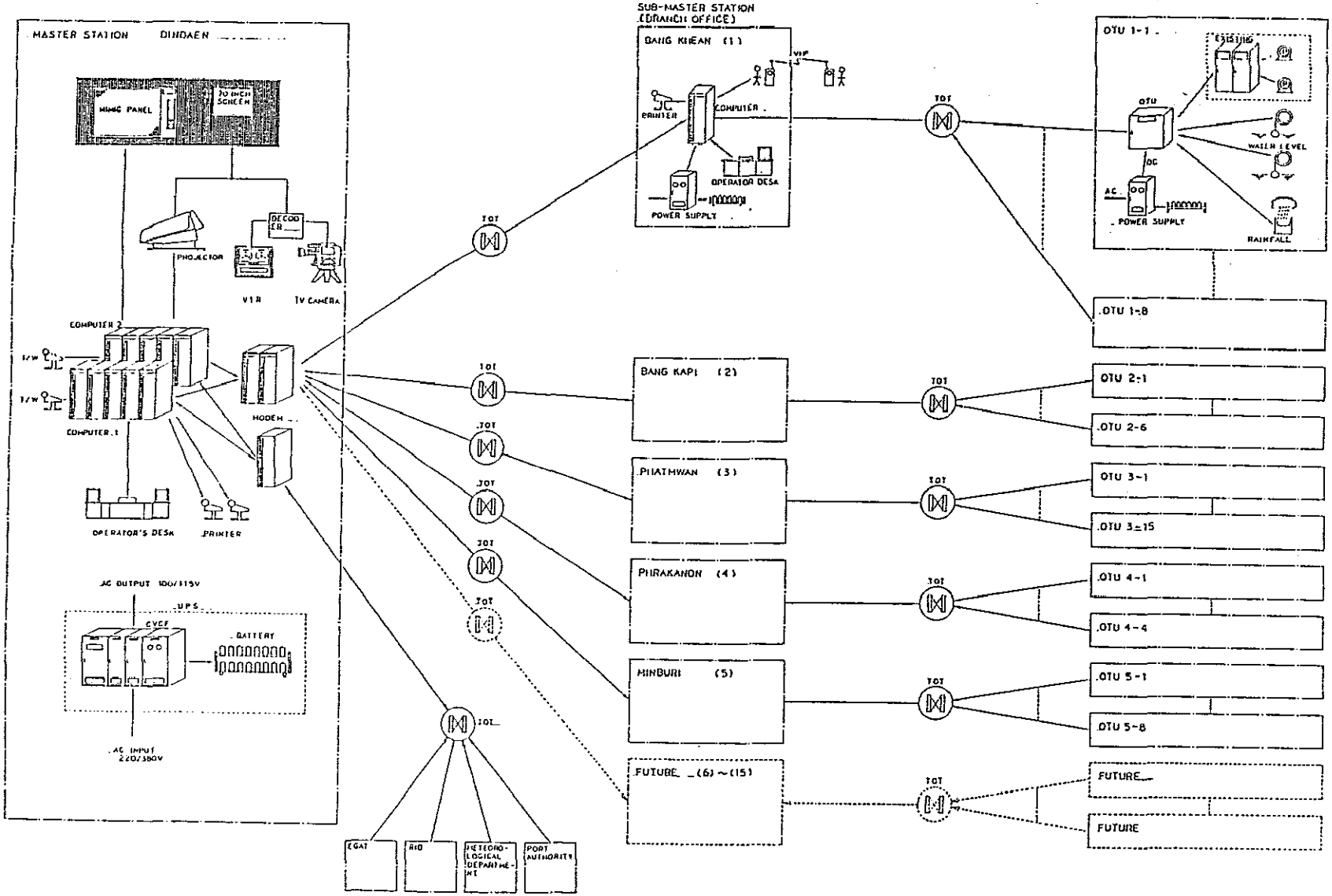
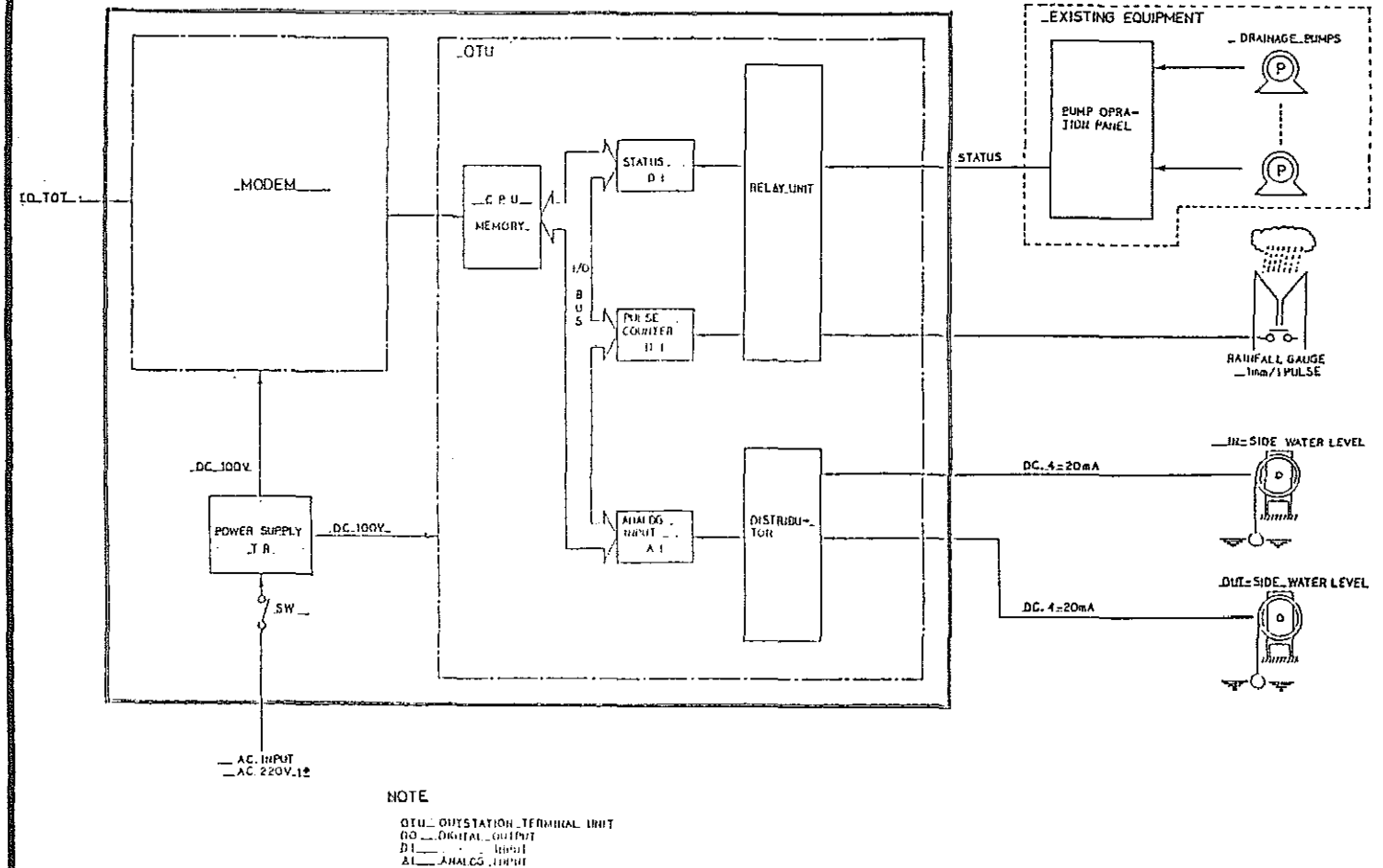


Fig. G.14 SYSTEM DIAGRAM OF MONITORING SYSTEM (WHOLE PACKAGE)

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

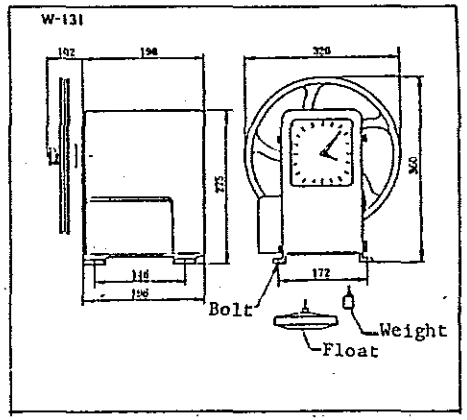
(1) Block Diagram of Outer Station Terminal Unit (OTU)



NOTE

OTU : OUTSTATION TERMINAL UNIT
DO : DIGITAL OUTPUT
DI : DIGITAL INPUT
AI : ANALOG INPUT

(2) Water Level Gage (Sample)



(3) Rainfall Gage (Sample)

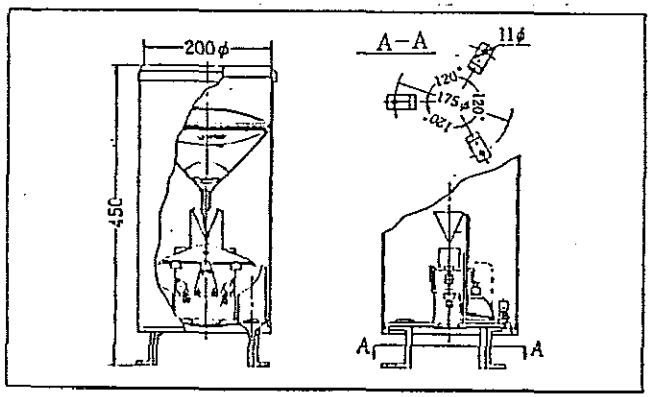


Fig. G.15 SYSTEM DIAGRAM OF OUTER STATION

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E 1986A.D

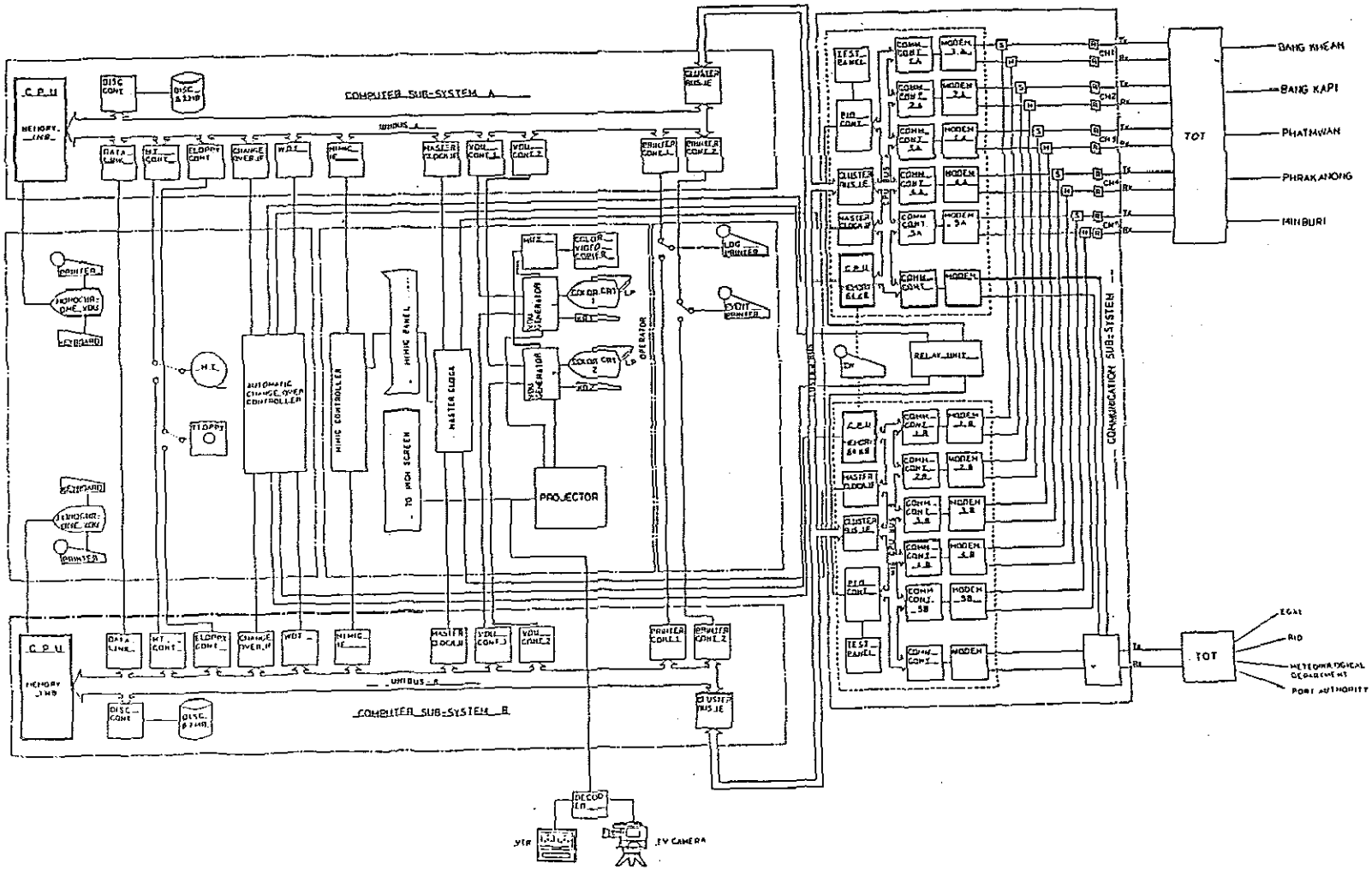
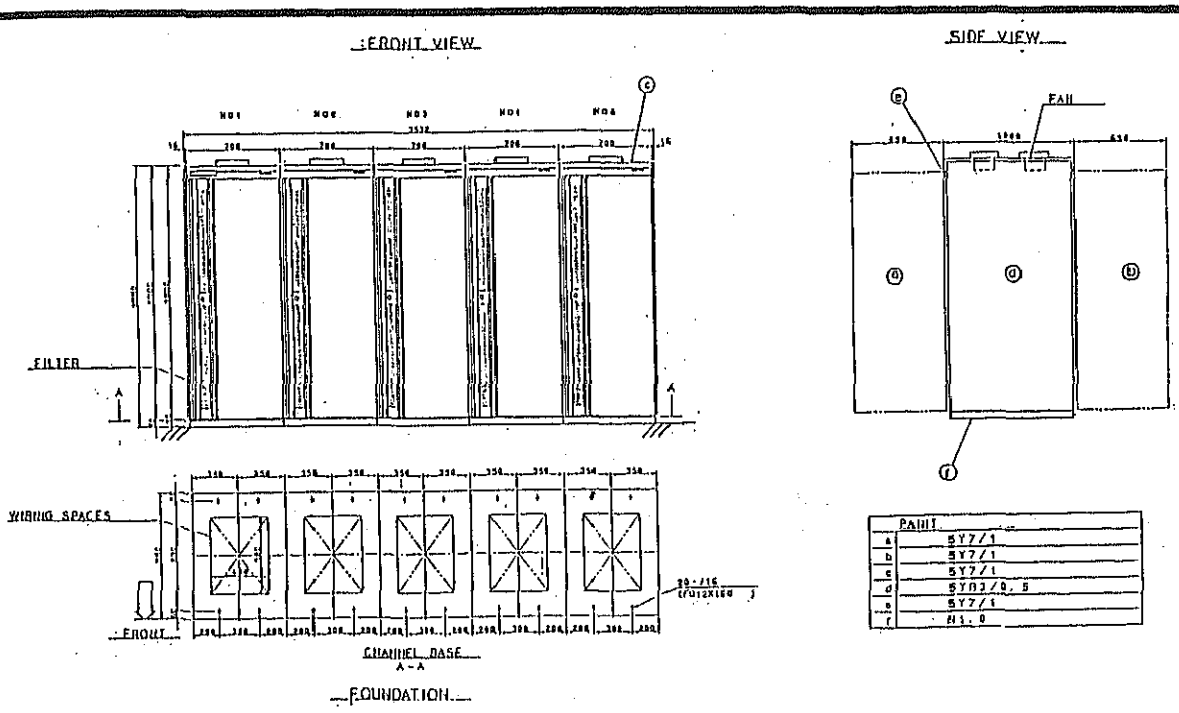
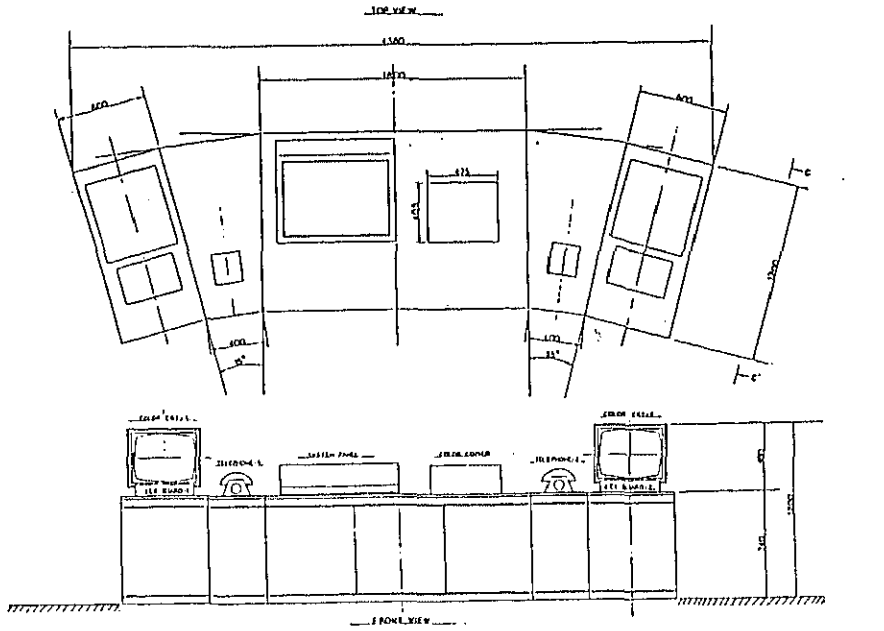


Fig. G.16 SYSTEM DIAGRAM OF MASTER STATION

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529BE 1986AD





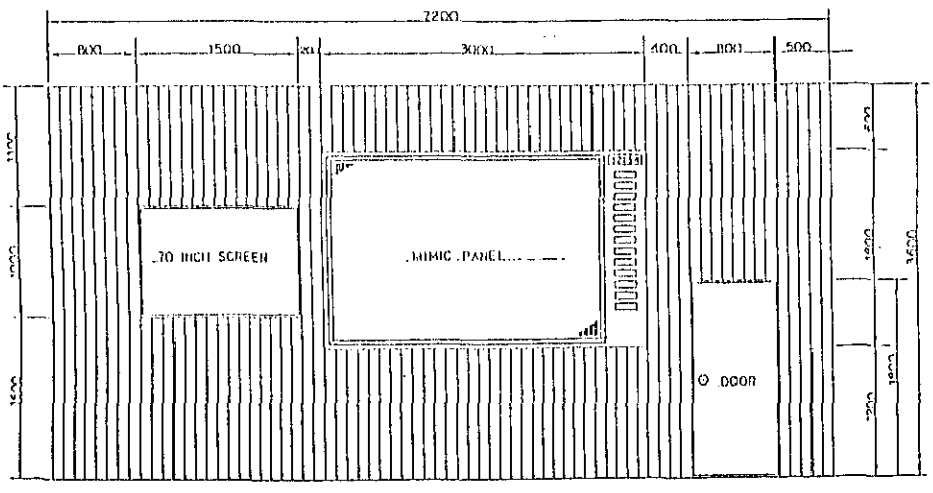
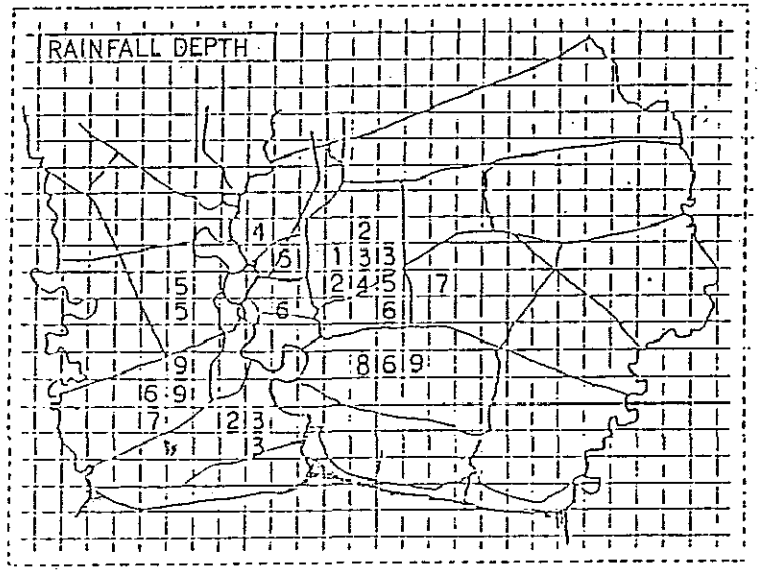
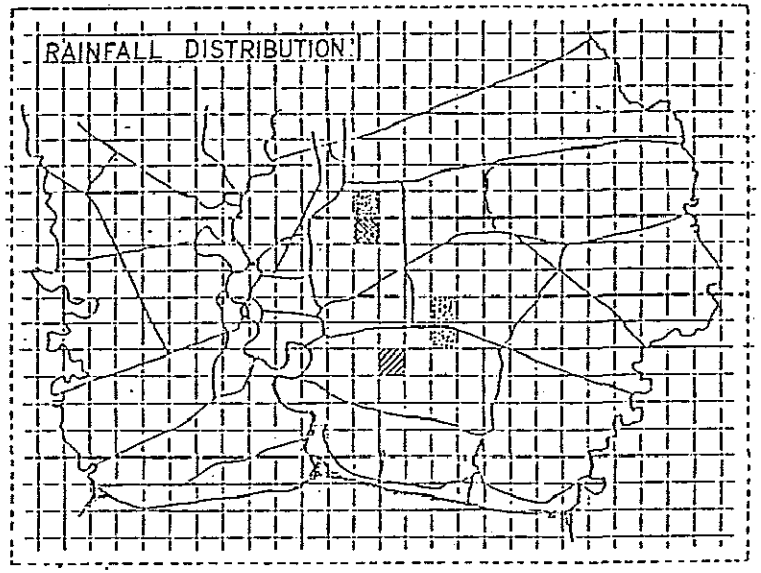


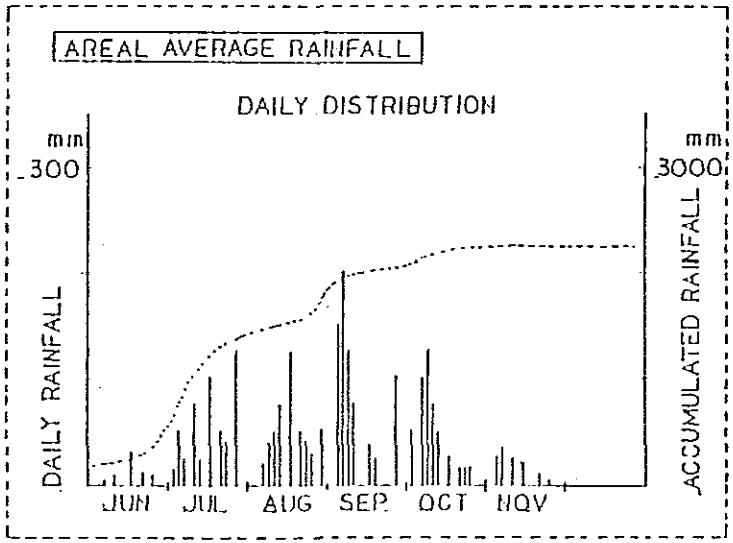
Fig. G.17 LAYOUT OF HOST COMPUTER, OPERATION DESK AND INFORMATION PANEL

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E 1986A.D







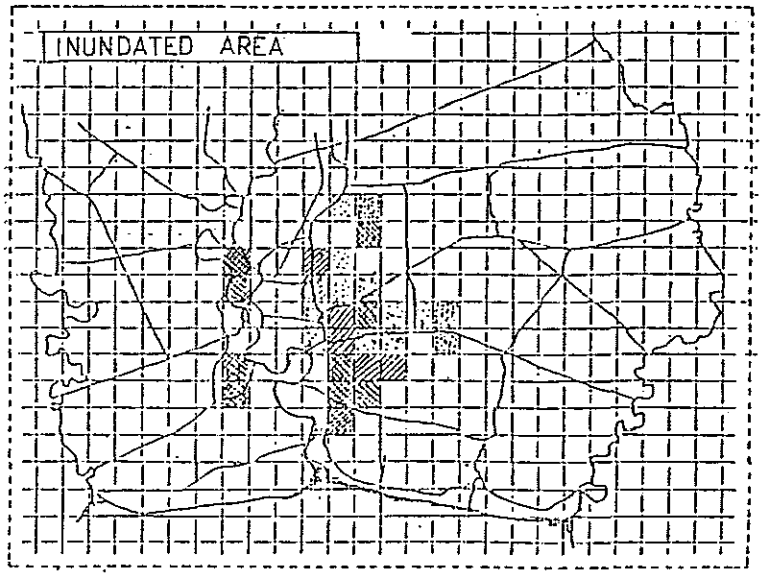
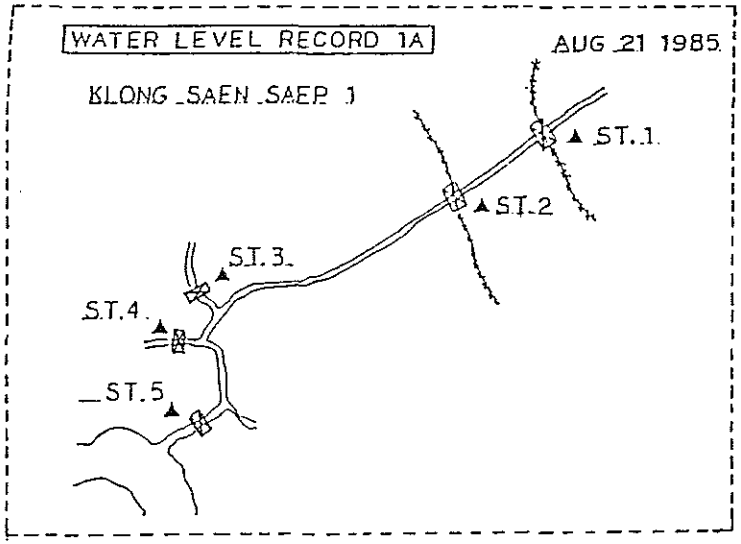
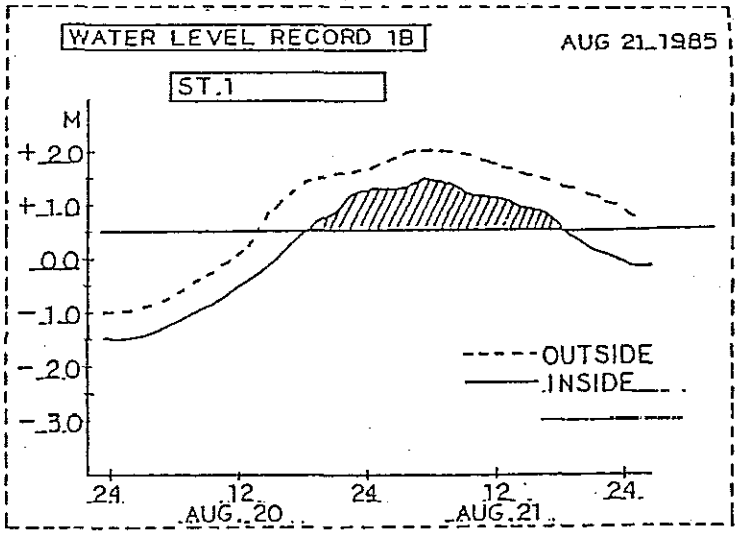
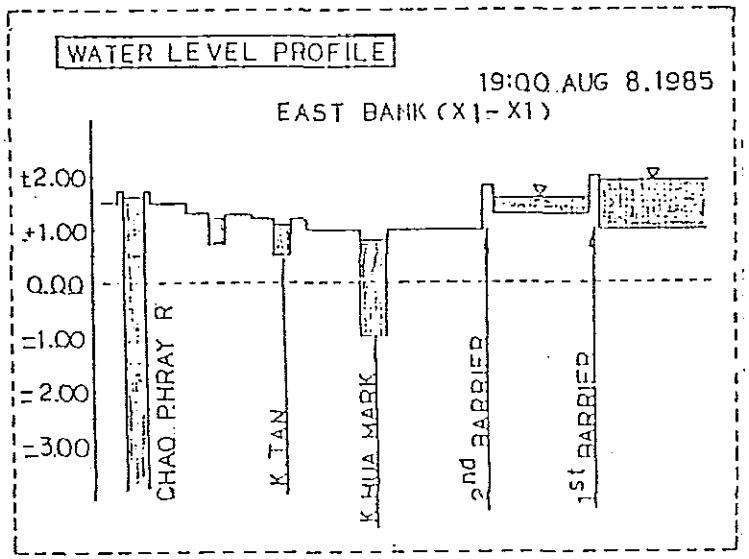


Fig. G.18 EXAMPLES OF DISPLAY FUNCTIONS -(1)

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK







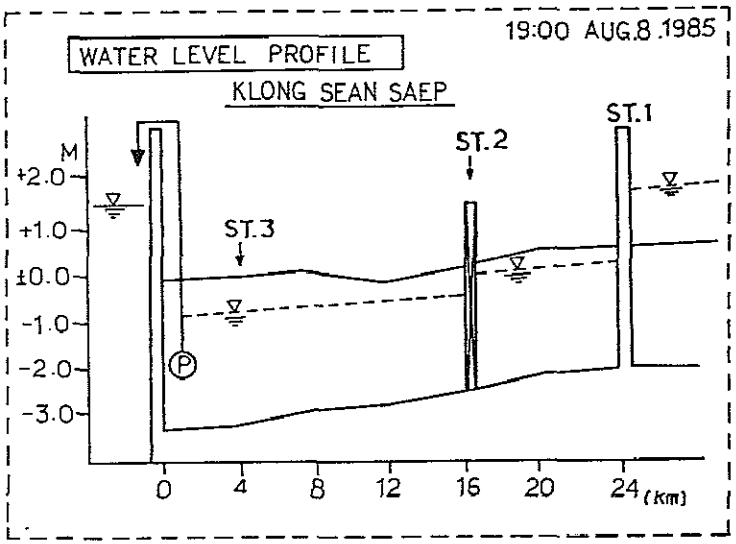
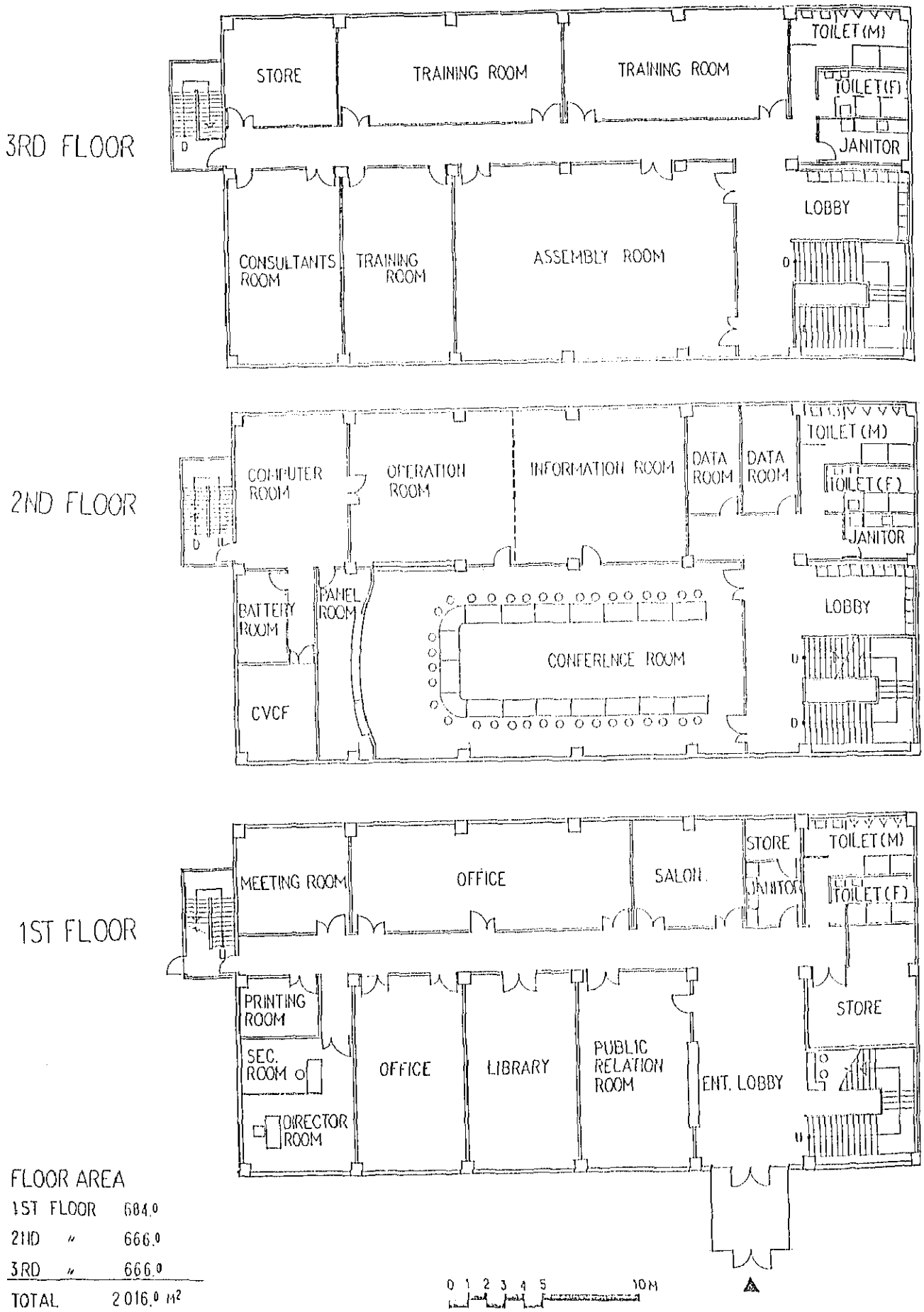


Fig. G.19 EXAMPLES OF DISPLAY FUNCTIONS-(2)

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E 1986A.D



FLOOR AREA

1ST FLOOR	684.0	
2ND "	666.0	
3RD "	666.0	
TOTAL	2016.0	m^2

Fig. G.20 EXSAMPLE OF FLOOD CONTROL CENTER AND TRAINING CENTER BUILDING

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APPENDIX H

INSTITUTIONAL/ORGANIZATIONAL ASPECT

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APPENDIX H INSTITUTIONAL/ORGANIZATIONAL ASPECT

Following the previous studies of the Master Plan and the Interim Report of 1985, this chapter in this volume contains the findings and recommendations for institutional aspect.

1. General

In the summer of 1983, Bangkok had experienced the severe flood being inundated in nearly 450 square kilometers of the eastern suburbs, even some area left under water for three months.

In order not to bring about the repetition of this kind of big flood disaster in the region, it's likely to be necessary and urgent to step into the institutional and organizational arrangement.

Hence, analysis on the current framework and recommendation for institutional aspect are presented in this chapter so that future works on the flood protection program and the Project in the study area could be best managed with efficiency and effectiveness.

Specifically speaking, the concept of institutional aspect is supposed to have two aspects, ie;

- institutional arragements: framework in which those relevant organizaitons are involved, and
- individual organizations themselves

At the outset of our study in Bangkok, the preoccupied view of the administration of the flood protection project in the whole Bangkok Metropolitan Region was that it should be accomlished beyong the existing administrative framework, the idea which comes from the World Bank and Asian Development Bank reports basically. In these reports, they pointed out the inadequate institutional/organizational frame work at present, which has led to strong suggestion for the establishment of a more integrated and powerful managerial organization, able to control and utilize all resources necessary for the implementation of the program. It was further implied that such an agency would have greater performance than the existing committee-executing agencies structure, which could be dessolved at any time; that it would be quicker acting, because it would be able to take executive decisions, and that it would provide with better financial and management control than the current system of fragmented responsibilities.

Back again to the former aspect of the discussion, it is to be stressed in this report that the " Bangkok Flood Control Fund " typed central managerial and coordinating organization is dealt as given, and accordingly no consideration in its technical specification is paid. In other words, analysis is limited in terms of allocation of roles and functions among organizations concerned for an efficient Project implementation.

Also it is to be emphasized in reference to the latter point that the study only aims at an investigation and presentation of necessary and sufficient solutions of institutional and organizational aspect with technical specifications respectively. That is, the study takes the stance of " value-free " as to whether or not those resources in need in Project implementation are recruited / financed from outside.

The study was undertaken in the midst of changing circumstances, but central projection of the flood protection scheme must inevitably rest upon certain fixed presumption. The study team had to therefore bring together the key presumption which are presented above to deal with the main topics and issues covered by this part. Therefore this report might be studied as " possitive " analysis rather than " normative " analysis.

The key institutional and organizational proposals which are presented are briefly that:

1) In compliance with those recommendations in the Master Plan of March '85, ie:

I. structural measure at the project level:

1) the project body with function of;

- administration
- design
- construction and planning
- operation and maintenance

of the drainage facilities and emergency relief activities

II. Non-structural measures at the regional and the Project level

1) Flood Plain Management
2) Flood Control Operation Center

The study team presented the following recommendations respectively.

1. institutional strengthning of DDS
2. mobilization of the Sub-Committee on Supporting Activities
3. establishing the Flood Control Operation Center

2) In accordance with the Project implementation schedule which is to be referred in chapter 5, 41 staff in total are required as a minimum for Project implementation.

3) Anticipated total costs are;

- Strengthening of DDS	:	2.6 - 3.8 million Baht
- Promotion of sub-committee	:	0.44 - 0.53 million Baht
- Flood control operation centre	:	1.5 - 2.0 million Baht
in total		4.54 - 6.33 million Baht

2. Current Institutional Framework

2.1 Introduction

Institutional framework and organizations involved in the scheme are described in order to understand how the arrangements for the project are to be made. Firstly, those organizations and their functions and roles are briefly presented so that total framework of the scheme and inter-relationship between the organizational units are visualized in mind. Next follows the description of those relevant units which are currently involved in the administration, flood control protection and development activities in the area.

Finally comes the institutional constraints whose understanding is of essential and binding to determine the institutional arrangement appropriate for the project.

2.2 Present Institutional Framework

At present time, there involved almost fifty organizational units in flood control scheme in and around Metropolitan Bangkok, being divided into three level, ie;

1) policy and major decision making level

   - the Cabinet
   - The national flood protection committee

2) planning, monitoring, coordination and public relations level

   - sub-committees of the national committee
   - central government authorities such as;
     the National Economic and Social development Board (NESDB)
     the Department of Technical and Economic Cooperation (DTEC)
     the Budget Bureau

3) executing agencies level

Bangkok Metropolitan Administration (BMA)

- BMA department agencies ; principally DDS and others
- Government department agencies ; Royal Irrigation Department (RID) in major and others
- local municipalities
- others

Institutional framework as a whole is shown in Figure H.1, 2.

2.3 Superordinate Level

Bangkok and its vicinities flood control committee and the sub-committees

The National Flood Protection Committee (the Urgent Committee) came into the stage of national flood protection scheme for the first time in October, 1983 and have benefitted a lot on behalf of national coordinating and monitoring figure for the existing organizations in concern.

Currently three sub-committees are working on their assignments in the following manner;

- project designation for flood protection
  project and budget allocation for structural drainage facilitating programs

- project supervision and public relations
  coordinating, evaluating in project implementation phase and publicizing activities for enlightment

- supporting activities for flood protection
  majoring in non-structural flood plain management and related activities

2.4 Executing Agency Level

Bangkok Metropolitan Administration (BMA)

BMA, a semi-autonomous regional administrative body, governs its 24 districts within the area, covering over 1589 km^2 with the employee of around 37000. Though the BMA had long been under strong influence of the Ministry of Interior, the Governor was elected by the people in November, 1985 for the first time in its history. And hence, this political improvement might lead the BMA, under cooperation with the BMA Assembly etc., to the strong leadership with complete view and comprehensive approach toward solving the flood protection problems.

Various municipal services - police, medical, health, education, sanitation, social welfare, roads, canals and drainage - are provided by BMA through 11 departments and 24 district offices. The public services such as water supply, mass transportation, expressway, housing and electricity are provided by "Authorities" which are public enterprises under the central government.

Department of Drainage and Sewerage (DDS)

The Bureau of Drainage and Sewerage (BDS) was established in 1977 as a body separate from the Bureau of Sanitation. Because of increasing problems of flooding and waste water in canals, BDS was established, charged with the direct responsibility for storm drainage, flood protection and sewage disposal. BDS changed its name to the Department of Drainage and Sewerage (DDS) in 1981 and established a policy reinforcing its administrative powers. With the Office of the Secretary and other four divisions; Technical, Drainage Control, Canal Maintenance and Waste Water Treatment, the DDS currently employes about 450 officials and around 1400 regular employees as well as another 800 and more temporary employees.

Under given responsibilities of;

- storm drainage
- flood protection, and
- sewage disposal

the specific scope of work assigned to each division is as follows;

- The Office of Secretary : general administrative matters including finance, legal aspect, personnel and so forth.
- The Technical Division : project planning, design and construction, research on waste water in Bangkok
- The Drainage Control Division : drainage system, control of gates, survey and maintenance of sewer system, pump stations, control the transport and maintenance equipments.
- The Canal Maintenance Division : canal dredging, garbage and weed control, the flood preventin control mapping and checking of the canal boundaries, the tender preparation and construction supervision of maintenance works, materials and equipments for maintenance of canals
- The Waste Water Treatment Division : control and maintenance of waste water treatment plants

Both the organization charts of the BMA and the DDS are shown in the Figure H.4.

2.5 Other Relevant Organizations

Although the drainage facilities under DDS play a major role with respect to the flood protection scheme in the area, coordination with other relevant organizations both in terms of structural and non-structural measures is requested.
The relevant major organizations are;

1) RID:
   technical assistance and construction work of the embankments in the Metropolitan region, rural irrigation throughout Thailand, control of the Chao Phraya river water level through its drainage facilities (pumping stations, gates) and so forth

2) Districts - Huay Kwang, Phra Khanong, Bang Khen and Bang Kapi:
   construction of small klongs and other drainage facilities

3) Department of Public Works, Min. of Interior:
   construction of road, embankments, building, drains and pumping stations

4) The Royal Highway Department of the Ministry of Communications:
   construction of roads

5) State Railways of Thailand:
   construction of railways

6) The Army:
   relief operations at the time of flood

7) The Police:
   rendering Public Disaster Relief services

8) The Electricity Generating Authority of Thailand (EGAT):
   controling the major dams

9) The Metropolitan Water Works Authority (MWA):
   surface water and ground water supply

10) The Hydrographic Department:
reporting the tidal level off the mouth and in the River

11) The Meteorological Department:
forecasting weather and rain fall conditions and supervision of the storms

12) The Budget Bureau:
allocation of the government fund for the flood protection projects

13) The Department of Technical and Economic Cooperation:
external relations, specifically in terms of international assistance from abroad

Assignments of the typical organizations are packed in a figure 9.2.

2.6 *Institutional shortcomings / Constrains*

With these big corps involved, multiplicity and overlapping of responsibilities of the different organizations is the tremendous feature in the current institutional arrangements. Although the Urgent Committee is particularly powerful and influential, its existence is of temporary basis and has no assurance for full-time, permanant activities. In other words, the comprehensive flood protection scheme and program should be set out with the eyes on long-term planning.

BMA and DDS both are also suffering under lack of autonomy, fragmented responsibilities, partial fulfillment of resources such as capital, personnels, facilities in its disposable, resulting in institutional in efficiency and mulfunction of the comprehensive anti-flood system and construction prcedure.

Constraints, whether or not they are binding to effective and efficient operations in the scheme, under which these organizations are suffering are specifically summerised hereinafter;

1) BMA

- lack of autonomy in administrative procedure
  BMA is currently under strong control of the Ministry of Interior by law and hence, problems concerning, for example, finance, personnel, budgeting etc. are most likely to be proceeded through this " superordinate " ministry.

- Red-tapism
  in practice, the functions as an autonomous administrative body being hampered accordingly, political and administrative procedure take long time to go in spite of many splended, highly sophiscated officials on work.

new governor elected

In November 1985, the new governor of BMA is to be elected by the people for the first time in its history, which might lead BMA and its structure toward autonomy-oriented efficient administrative body.

2) DDS

- lack of resources
  against current tendency for DDS to become predominatly the central figure in flood protection scheme as more and more major drainage works have been committed and completed, resources such as the budget, personnel or other are in lack.

  Especially those superb administrators who are to be in charge of planning of the Department's objective, inter - relationship between the DDS and other relevant organizations, as well as coordination and allocation of resources, work load and assignments among divisions in the Department are desparately in need comparing to those existing excellent engineers with high experlise and experiences.

- lack of coordinations among divisions
  Though each divisions are doing great in their job assignments with limited resources individually, lack of coordination is of essential to its mulfunction. Those problems such as duplication of construction design and supervision, baised workload which enforces each divisions engaged in day-to-day routine jobs.
  As of the budgeting procedure of the DDS, the Technical Division contacts directly the BMA and have little feed-back system in the Department.

3. Recommendations for Organizational Aspect

3.1 Introduction

Prior to the detailed description of the recommendations, the policy or guideline which led the team's proposals are to be cleard in the following;

1) emphasis is placed on preventive measures to curtail the flood disaster and in the sense of structural construction, operation and maintenance. Also urban planning measures (Flood Plain Management) to control and minimize the damage, social and economic losses once flood got taken place are given priority instead of stress being laid only on corrective measures.

2) scope, role and authority of varous agencies at each level in the present institutinal framework are studied as possible so that proper coordination and efficient project implementation is achieved.

3) guideline is formulated for promotion of the existing organizations and to support for research functions within the proposed units which deals with preventin and mitigation of flood control problems in and around the study area, as well as for promotion of environmental awareness and public relation activities for general public.

4) in policy formulation, the integration of qualitative and quantitative consideration is attempted in as possible to make a balance between environmental improvement and socio-economic development in the area concerned.

In compliance with those recommendations in the Master Plan of March 1985, ie;

I. structural measure at the project level:
   1) the project implementing body with function of;
      - administration
      - design
      - construction and planning
      - operation and maintenance

      of the drainage facilities and emergency relief activities

II. Non-structural measures at the regional and the Project level

   1) Flood Plain Management
   2) Flood Control Operation Center

the study team presented the following recommendations respectively.

1. institutional strengthening of DDS
2. mobilization of the Sub-Committee on Supporting Activities
3. establishing the Flood Control Operation Center

In the remainder of this section, details of the recommendations are set out respectively.

3.2 Institutional strengthening of DDS

In order to operate drainage facilities in the 260 km^2 of the area, which includes 4 gates, 5 pumping stations, 100 km of klongs, 433 km drainage pipes/box culvert and the barriers of 5.1 km as well, the DDS is predominantly to become a central figures to shoulder those required functions and to implement the Project as

more and more major drainage works have been completed and flood control structure committted. While significant construction assistance and drainage facilities operation is currently given by the Royal Irrigation Department (RID), this strategy of placing operation/maintenance resposibility on DDS requires a range of substantial institutional strengthening within its structure.

In order to gear up the department's activities at the margin and to be engaged in the Project area with the additional scope of work, it is proposed for the DDS to be prepared within the right sort of staffing and finance in the following:

Staffing in total 55 (including supporting staffs):
(refer to Tables H. 1,2)

Project Function	Sub-Function (Section)	Personnel
1) Construction Phase :	(1988-1991)	41
* Project Manager		(1)
* Administration		(13)
	- Head	1
	- General Administration	3
	- Planning	3
	- Finance	3
	- Personnel	3
* Design		(10)
	- Head	1
	- Design	5
	- Engineering	4
* Construction Supervision		(17)
	- Head	1
	- Electric	3
	- Mechanics	3
	- Civil Engineering (I) (Pumping Station, Gates)	5
	- Civil Engineering (II) (Klongs, Barriers)	5

2)	Operation and Maintenance Phase (1989-)	14
	* Project Manager	(1)
	* Deputy Manager	(1)
	* Administration	(3)
	- General Administration	2
	- Finance	1
	* Operation and Maintenance	(9)
	- Operation	3
	- Maintenance	3
	- Repair and Construction	3

The numbers and the amount of the budget proposed hereinwith are the minimum requirements to implement the Project, being formulated on the basis of expected workload and capability of the DDS officials observed.

Table H.1 Estimated Personnel Requirement for an Optimum Project Implementation

Phase	Project Function	Section	$C_1 - C_2$	$C_3 - C_4$	$C_5 - C_7$	$C_8 - C_{11}$	Section Total	Project Function Total
Construction Phase (1988 - 1991)	Administration	Administration	2	1	1	1	3 + 1	13 + 1
		Planning	2	1			3	
		Finance	2	1			3	
		Personnel	2	1			3	
	Design	Design	4	1	1		5 + 1	10
		Engineering	3	1			4	
	Construction Supervision	Electricity	2	1	1		3 + 1	17
		Mechanic	2	1			3	
		Civil Engineering (I)	4	1			5	
		Civil Engineering (II)	4	1			5	
Operation and Maintenance Phase (1992 -)	Administration	General Administration	1	1	1	1	2 + 1	13 + 1
		Finance	1				1	
	Operation and Maintenance	Operation	2	1			3	
		Maintenance	2	1			3	
		Repair and Construction	2	1			3	
Total			35	14	4	2	53	55

Table H.2 Comparison of the numbers of DDS staffs between in current and required for project implementation

Civil Servants	Current Man Power of DDS	Number of staffs needed for the Project
Senior level Officer	2	2
Engineer/Administrator	10	4
Technical/Administrative Assistant	81	14
Technician	93	21
Supporting staff	265	14
Total	451	55

Scope of work

1) Administration-General administrative matters and planing the construction, operation and maintenance, programs, finance, budget disbursement, externa. relations, personnel policy and so forth.

2) Design -Design engineering specifications, hydraulic analysis and supervision of all design works relating to the construction.
-project coordination among parties concerned. Preparation of contract documents and supervise the engineering consultancy services

3) Construction -Supervising all works related to construction, operation, monitoring, controling all the relevant machines, equipments, plants.

4) Operation and Maintenance
-Manage all the works regarding operation and maintenance and the repair, additional construction of the facilities in the target area.
-preparation of contract documents for the sake of operation and maintenance.

Table H.3 Qualifications and Job Description of the Officials (1)

Project Function	Position	Qualification		Job Description, Responsibilities
		Degree	Work Experience	
Administration	Senior Administrator	Bachelor of Science in Business Administration	10 years or more	To be responsible for all general administrative matters and to assist The Project manager in decision making in every aspect of the project implementation
	Project Administrator	B.S. in Business Administration	8 years or more	Assisting Senior Administrator in general administration and also managing external relations and project procurement
	Planning Officer	B.A. in Political Science, Economics or Business Administration	8 years or more	To perform sound Project implementation planning and coordination if necessary in and among DDS and other organizations.
	Finance Officer	B.S. in Business Administration	5 years or more	Loan administration and reimbursement for the flood protection project
	Personnel Officer	B.S. in Business Administration or B. of Liberal Arts	5 years or more	Recruitment of new staff and administration of personnel assignments
	Assistant/ Typist	High School Diploma	2 years or more	day to day routine works including assisting superordinate officers in typing, cash accounting, recording and so forth.
Design	Project Manager	B.S. in Engineering	15 years or more	Responsible for all aspects of the project implementation in terms of construction phase. Control and management of all resources in the Project and liaison with the DDS (Deputy) Director General is also the assignment
	Engineer	B.S. in Civil or Structural Engineering	8 years or more	Designs engineering specifications. Hydraulic Analysis. Supervision of design engineers and draftsman

Table H.3 Qaulifications and Job Description of the Officials (2)

Project Function	Position	Qualification		Job Description, Responsibilities
		Degree	Work Experience	
Design	Engineer	B.S. in C.E. or S.E.	5 years or more	Preparation of plans and designs for construction improvement and repair of facilities, including house connections
	Engineer	B.S. in Civil or Structural Engineering	8 years or more	Project coordination between the DDS, consultants and contructors. Also engineering, making contruct documents, consultants, contructors evaluations are assigned
	Technical Assistant/ Technician	High School Diploma	2 years or more	Assist design engineer (as drawings and other miscellaneous work)
Construction Supervision	Engineer	B.S. in Electric Engineering	8 years or more	To be engaged in construction, monitoring and controling electric equipments, system in the project
	Engineer	B.S. in Mechanical Engineering	8 years or more	All works relating to construction supervision of pumping stations,and gates in the Project procedure.
	Engineer	B.S in Civil Engineering	3 years or more	Supervision of all construction work of sewerage or drainage facilities, and inspectors
	Technical Assistant/ Technician	High School Diploma	2 years or more	Inspection of equipment and materials for construction, according to technical specifications
Operation and Maintenance	Project Manager	B.S. in Engineering	15 years or more	To take all decision making and control management in/of the Project operation and maintenance procedure
	Administrator	B.S. in Business Administration	8 years or more	Assisting Senior Administrator and taking care of general administration, personnel, project implemention procedure and so forth are in the range of duties

Table H.3 Qaulificationf and Job Description of the Officials (3)

Project Function	Position	Qualification		Job Description, Responsibilities
		Degree	Work Experience	
Operation and Maintenance	Finance Officer	B.S. in Business Administration	8 years or more	Loan administration, daily cash accounts ,budget reinbursement are assigned
	Assistant/ Typist	High School Diploma	2 years or more	Assist superordinate officers in day to day routine works, typing etc.
	Engineer	B.S. in Structural Engineering	5 years or more	All activities for operation and maintenance (O & M) of the sewerage and drainage systems, supervising laborors
	Engineer	B.S. in Mechanical Engineering	5 years or more	O & M of treatment plant and pumping stations, including control and repair of cleaning machines and trucks and maintenance equipment
	Engineer	B.S. in Electrical Engineering	5 years or more	Control, monitoring and repair of all electrical equipment required on treatment plant and pumping station. Safekeeping of all maintenance equipment.
	Chemist	B.S. in Chemistry	3 years or more	Management and provision of laboratory services for regular monitoring tests concerning quantity and quality of klong water
	Laboratory Assistant	High School Diploma	3 years or more	Collection of water samples and water quality examination of drains and klongs under the direction of the Chemist
	Technical Assistant/ Technician	High School Diploma	8 years or more	All work related to O & M and supervising laborers

Budget Model

1) Office expences in total : 2.6-3.8 million Baht.

2) Personnel Budget : 2.1-3.1 million Baht.

Table H.4 Office Budget Model

(Thousand Baht)

Personnel Expense	
Salaries	2,162 - 3,097
Living cost	54.1 - 77.4
Meeting fee	6.5 - 9.3
Travelling fee (officers)	60.5 - 86.7
Children allowance	19.5 - 27.9
Children's education allowance	21.6 - 31.0
Medical care allowance	173.0 - 247.8
Transportation fees	4.3 - 6.2
	2,501.5 - 3,583.3
Administrative expenses	
Office rental fee	13.0 - 18.6
Postal & telephone	10.9 - 15.5
Stationeries & Printing	8.6 - 12.4
Maintenance fee (Office equipments)	6.5 - 9.3
Car expense (gasoline & repair)	43.2 - 61.9
Office equipment & miscellaneous	2.2 - 3.1
Electricity & Water Supply	43.2 - 61.9
Miscellaneous	5.0 - 7.1
Car equipment	0.1 - 0.2
Printing for public relations	0.2 - 0.3
	132.9 - 190.3
Depreciation	
Office Equipment	6.1 - 8.7
Vehicle	6.1 - 8.7
	12.2 - 17.4
Total	2,646.6 - 3,791

Table H.5

Personnel Expense Model

Civil Servants	Monthly wage rate	Number of personnel	Total yearly wage
C_1 - C_2	2,250 - 3,500 ฿/M	35	945,000 - 1,470,000
C_3 - C_4	3,500 - 5,000 ฿/M	14	588,000 - 840,000
C_5 - C_7	7,600 - 8,900 ฿/M	4	364,800 - 427,200
C_8 - C_{11}	11,000 - 15,000 ฿/M	2	264,000 - 360,000
Total		55	2,161,800 - 3,097,200

Those members enlisted above are the minimum/optimum number being engaged in the project implementation at each phase. Accordingly in does not necessarily imply that the same persons are to be appointed at the different phase of the project.

The "Eastern Suburbs Drainage Office", which was once proposed in the Master Plan of '85, may be dropped off, that comes out on the basis of;

1) Duplications of duties with existing organizatons
   Currently those functions which are expected to be borne by the " Office " are well carried by the DDS, the RID in majority. Accordingly there left little justification, or rather counter-productive to set up the new organization of the same category at this moment.

2) High administrative cost
   It seems unlikely to be realistic to no pay attention on cost performance in setting another administrative body, especially in case where there already exist several organizations which are functionally equivalent to the new unit.

   Regarding this high cost in administration, one example implies this in such a way that the Tax Mapping Project in Bangkok from 1980 throu 1984 collected total revenue increase of around 6.3 million Baht against its total cost of 8.1 million Baht.

3) Institutional rearrangement
   The "Eastern Suburbs Drainage Office" which took after the Koto Area Drainage Office of Tokyo Municipality could fully function in the comprehensive flood control scheme in prospect where institutional rearrangement is well organized and allocation of responsibilities and resources are well coordinated among parties concerned.

While the whole institutional rearrangement including set up of new central manage and coordinate organization such as " Bangkok Flood Control Fund " is under consideration, it would be efficient and effective to rely on the existing capable organizations, at least temporarilly.

Additional remark on the " Koto Area Drainage Office "

The Koto Area Drainage Office of Tokyo Municipality is referred here as an example of the "office". In southeastern Tokyo, there is a low land delta area called "Koto zerometer area". The area is about 40 km^2 accommodating 700,000 residents, and its elevation is from -1.5 m to +2.0 m. The area used to suffer severe flooding caused by heavy rain and high tide. It is protected now with dykes, canals, 7 gates, two pumping stations, one navigation lock and one flushing gate. The Koto Area Drainage Office, one navigation lock and one flushing gate. The Koto Area Drainage Office, which is under the Construction Bureau of Tokyo Municipality, controls all these facilities and other drainage facilities in the neighbouring floodprone areas.

3.3 Mobilization of the Sub-Committee on Supporting Activities

Whereas it has come to the attention of the government that flood preventive non-structural measures also should be stressed and given priority in stead of emphasis being too much laid on structural, corrective measures, these preventive urban planning, non-structural measures such as:

- Land use planning with respect to drainage control
- Rainwater retention areal study
- Building codes for anti-flood construction
- Guidelines for flood plain management

also should be enlightened.

Reflecting those good job which have been done so far by the Sub-committee on project designation and its Secretary, the Sub-committee in charge of non-structural measures is also to be assisted by its own Secretariate with the following staffing and the scope of work (see also the Table H.6).

5 Secretariate staffs (including supporting staff) and the scope of work:

1) Mannagerial Officer (1)	...	Director General or Deputy Director General of DDS could concurrent this post.
2) Engineer	...	management, planning, design, coordination among organizations concerned, supervising individual floodplain management program.
3) Draftsman Secretary	...	assisting superordinate officers in draft, day to day routine office work etc.

- Draft non-structural measures some like the Land Use Plain Map for approval by the Committee and permanently commit in the public relations activities in this concern

- Monitor and evaluate all the projects implemented in the past and report to the Committee for future improvement

- Request the foreign consultants in the various aspects of non-structural policy and measures implementation

- Coordinating works between Government agencies, State enterprises and possibly private organizations on matters concerning flood preventing measures and its applications

- In performance of above-mentioned duties, the Sub-Committee on Supporting Activities may entrust the Secretariate with the operation or submission of recommendations to the Sub-Committee for further proceedings.

Director of this Secretariate office is to be taken over by the Director General of DDS, a member of the Sub-Committee, or Deputy Director General of DDS who is the secretary of the Sub-Committee.

Table H.6 Qualification and Job Description of the Officers

Function	Position	Qualifications		Job Description Responsibilities
		Degree	Work Experience	
Secretariate to the Sub-Committee	Managerial Officer	B.S. in Sanitary or Civil Engineering or in Urban Design	13 years or more	To be responsible for the overall management operations of the Secretariate Office and to propose , to report the planning and results to the Sub-Committee
	Engineer (Senior Level)	B.S. in Sanitary, Civil Engineering or in Urban Design	8 years or more	To perform sound flood plain management planning and coordination among relevant organizations. Supervising and following up the individual project implemented by executing organization(s) and report occasionally to the head.
	Design Engineer	B.S. in Sanitary, Civil Engineering or in Urban Design	5 years or more	Assisting managerial officer and engineer to prepare plan and design for the flood plain management
	Draftman	High School Diploma	3 years or more	To assist design engineer in preparing drawing and other miscellaneous works
	Secretary, typist	High School Diploma	2 years or more	Routine work, assisting the managerial officer in day to day administrative works

- Budget Model

1) Office maintenance : 0.44-0.53 million Baht.
2) Personnel Direct Cost : 0.36-0.43 million Baht.

Table H.7 Budget Model

(Thousand Baht)

Personnel Expense			
Salaries	361	-	431
Living cost	9	-	11
Meeting fee	1	-	1.3
Travelling fee (officers)	10	-	12
Children allowance	3	-	4
Children's education allowance	3	-	4
Medical care allowance	29	-	34
Transportation fees	0.7	-	0.8
	416.7	-	498.1
Administrative expenses			
Office rental fee	2	-	3
Postal & telephone	2	-	3
Stationeries & Printing	1	-	1.8
Maintenance fee (Office equipments)	1	-	1.8
Car expense (gasoline & repair)	7	-	9
Office equipments & miscellaneous	0.5	-	1
Electricity & Water Supply	7	-	9
Miscellaneous	1	-	1.8
Car equipment	0.5	-	1
	22	-	31.4
Depreciation			
Office Equipment	1	-	1.8
Vehicle	1	-	1.8
	2	-	3.6
Total	440.7	-	533.1

Table H.8 Secretariate to the Non-Stractural Sub-Committee Budget Model (Personnel)

Civil Servants	Monthly wage rate	Number of personnel	Total yearly wage
C_1 - C_2 Secretary, draftsman	2,250 - 3,500 ฿/M	2	54,000 - 84,000
C_3 - C_4 Coordinator	3,500 - 5,000 ฿/M	1	84,000 - 60,000
C_5 - C_7 Project engineer	7,600 - 8,900 ฿/M	1	91,200 - 106,800
C_8 - C_{11} Director	11,000 - 15,000 ฿/M	1	132,000 - 180,000
Total	-	5	361,200 - 430,800

- Regarding the budgeting and disbursement, this group has little authority and responsibility since this group deals with software aspect of the Project and works on site is respectively done by the executing agency in concern.

- Manpower requirements

  The key issue to effective operation of floodplain management seems to be the director of this workforce who has strong leadership, capable of commanding respect of various sectoral personnel, and obtaining the support in need from higher level government officials.

  A few staff is to be under command of this Secretariate chief to work in the committee in coordinating work planning, monitoring and communications as well as routine office work. In this feasibility study, full-time, C-5 level assisting staff is presented to follow up on the needs and responsibilities of the Secretariate Office under the chief.

  The rest of the supporting staffs to the chief comprise of three regular employees of a coordinator, a secretary and a draftsman.

  This would be the minimum requirement for the Secretariate.

3.4 Flood Control Operation Center

To carry out the effective and efficient anti-flood operation and information system, both soft and hard ware, will be the most important tool for the successful implementation of the project. With emphasis on this information and operation dissemination function, the flood control operation center is proposed to set up under the Sub-committee with the scope of work in such a way that:

1) centralize the drainage facilities (pumping stations, gates, klongs and so forth control and management through the on-line tele-metering information network system.

2) increase reliability of data collected to operate those drainage facilities at the time of flood.

3) increase and utilise large capacity of flood-related information and data of meteorology, hydrology, flood damage, facility operation and others.

4) preparation of the " Operation Manual and Code " engaged in public.

5) training the workers in charge of the drainage facilities operation.

Director and Deputy Director of the Center would be appointed from the high officials of the DDS because of the Center's close cooperation with the Flood Control Center in the DDS, at least at the initial stage of the Center's operation.

Scope of Work, Personnel required (Table H.9)

1) Scope of Work:

1) Administration - general administration matters including finance, budget plan, personnel policy and so forth

2) Planning - development of system engineering for the total project complementation, preparation of drainage facilities operation, data strage and employee training for fluent operation of machine equipments at a time of flood.

3) Information - flood information and operational orders to each drainage facility spots and stations as well as ordinary Public Relation.

4) Technical Research - development of system engineering for data storage, date processsing, collection of data and analysis, forecasting.

5) Monitoring - computer operation, system maintenance and inspection of the facilities in the target area.

Table H.9 Qualification and Job Description of the Staff Members (1)

Function	Position	Qualifications		Job Description/ Responsibilities
		Degree	Work Experience	
Monitoring	Engineer	M.S. or B.S. in Electrical Engineering and/or Hydraulic Engineering	8 years or more	To be responsible for all activities in this section including supervising subordinate engineers, safe keeping of all equipments
	Engineer	B.S. in Electrical Engineering	5 years or more	To be engaged in control, monitoring and repairing of electronic, electric equipments
	Inspector	High School Diploma	2 years or more	To inspect the field facilities and electric and electronic equipments in the center to be in conformance with technical specification
Technical Research	Engineer	B.S. in Hydraulic Engineering with practical knowledge on computor programing	5 years or more	To collect and analyse the data through computor works. Laboratory service of regular monitoring tests concerning flood protection and damage is included
Information	Engineer	B.S. in Hydraulic Engineering	5 years or more	Instruction of flood protection tactics through the information system as a time of flood Public relation is also included in the scope.
Planning	Engineer	B.S. in Electrical Engineering with working knowledge on soft ware of the computor	8 years or more	To design the system of flood control information system as a whole. Supervision of all activities in the section is included as well.

Table H.9 Qaulification and Job Description of the Staff Members (2)

Function	Position	Qualifications		Job Description Responsibilities
		Degree	Work Experience	
Planning	Engineer	B.S. in Electrical Engineering	5 years or more	To manage and maintain planning and data storage function of this sector. Preparation of the "Manual for equipment operation" is in the scope, too.
	Training Officer	B.S. in Electrical Engineering	3 years or more	All activities with regard to the staff members so that newly recruited rookies can get engaged in their duties and operate the equipments in the earliest opportunity
Administration	Administrative Officer	B.S. in Business Administrattion or B.A. in Political Science	8 years or more	To be responsible for all activities including personnel policy of the center and for reporting to superordinate officer occasionally
	Accounting Officer	B.S. in Business Administration	3 years or more	To be engaged in day to day cash flow administration in close relation with the administrative Officer.
	Secretary	High School Diploma	2 years or more	Day to day routine works including assisting superordinate officer in typing, cash accounting job, recording all the files.

Personnel and Office Budget Model

1) Personnel ..... Total 20 staffs including the Director and the Deputy Director (supporting staff included)

2) Budget model ... Total budget of the center (except the cost of handware and its maintenance, replacement cost) - would be 1.5 - 2.0 million ฿.

Personnel cost would be somewhere around 1.2 - 1.5 million ฿

Table H.10 Budget Model

(Thousand Baht)

Personnel Expense	
Salaries	1,220 - 1,620
Living cost	30.5 - 40.5
Meeting fee	3.7 - 4.9
Travelling fee (officers)	35 - 45.4
Children allowance	11 - 14.6
Children's education allowance	12.2 - 16.2
Medical care allowance	97.6 - 129.6
Transportation fees	2.4 - 3.2
	1,412.4 - 1,874.4
Administrative expenses.	
Office rental fee	7.3 - 9.7
Postal & telephone	6.1 - 8.1
Stationeries & Printing	4.9 - 6.5
Maintenance fee (Office equipments)	3.7 - 4.9
Car expense (gasoline & repair)	24.4 - 32.4
Office equipment & miscellaneous	1.2 - 1.6
Electricity & Water Supply	24.4 - 32.4
Miscellaneous	2.8 - 3.7
Car equipment	0.1 - 0.2
Advertisement & printing	0.1 - 0.2
	75 - 99.7
Depreciation.	
Office Equipment	3.4 - 4.5
Vehicle	3.4 - 4.5
	6.8 - 9
Total	1,494.2 - 1,983.1

Table H.11 Budget Model

Civil Servants	Monthly wage rate	Number of personnel	Total yearly wage
C_1 - C_2	2,250 - 3,500 ฿/M	3	81,000 - 126,000
C_3 - C_4	3,500 - 5,000 ฿/M	10	420,000 - 600,000
C_5 - C_7	7,600 - 8,900 ฿/M	5	456,000 - 534,000
C8 - C_{11}	11,000 - 15,000 ฿/M	2	264,000 - 360,000
TOTAL	-	20	1,221,000 - 1,620,000

The Center is also assigned to utilise its data for environmental conservation program, that is, low water management and planning for klong water quality control etc. at the time of dry season as well.

Highly sophisticated computerized tele-metering information and operational system is to strengthen its work efficiency and to widen the range of jobs in cooperation with other flood control information systems equipped in those relevant organizations some like RID, EGAT, and Meteorological Department in certain future time.

The Eastern Suburbs Drainage Office which was recommended with its establishment in the Master Plan of 1985, has been dropped off from the proposal in the Feasibility Study on the basis that;

i) Currently these functions of planning, design, construction and operation/maintenance are carried out mainly by DDS and RID, which have done a lot of good job, and hence, there left little justification to set up the new orgoanization of the same category.

ii) Since the flood protection scheme is in the midst of the changing circumstances with the idea of the Bangkok Central Flood Control Fund, it is to be more efficient to consider all the framework and organizations involved with the long term strategy and firmly established policy. Setting up of the new organization is not surely too late after that.

3.5 Staffing Schedule

In accordance with the Project implementation schedule which is to be referred in chapter 5, 36 - 40 staffs in total (excluding technicians and supporting staffs) are to be required in compliance with assignments in Project implementation in the following (see the Table H. 12, 13);

1) 1987 (the year in which the detail design would take place)
12 staffs besides lower level officials;
in total 20 staffs within the range from the senior level officer to the clerk typist.

2) 1988 (the first year of construction)
18 of staffs, 38 in total are to be required for the project implementation.

3) 1989 (the second year of construction)
6, the rest of senior and intermediate officals and in total 18 out of 80 staffs (technician, supporting staff included) in need is additionally requested.

4) 1990 (the third year of construction)
the rest of 4 staff is input into the project this year.

Table H.12 Staffing Schedule from 1987 and on

Project Function	Job Description	1987	1988	1989	1990	1991	1992 -	Total
Administration Planning Design Construction Supervision	Senior Officer	1						1
	Engineer/Administrator	2	1					3
	Technical Assistant	2	4	4				10
	Technician		5	8	4			17
	Supporting staff	6	4					10
	Total	11	14	12	4	-	-	41
Operation and Maintenance	Senior Officer		1	-				1
	Engineer/Administrator		1	-				1
	Technical Assistant		2	2				4
	Technician		2	2				4
	Supporting staff		2	2				4
	Total	-	8	6	-	-	-	14
Flood Control Operation Center	Engineer (Senior level)	2						2
	Engineer	2	3					5
	Technical Assistant		6					6
	Technician		4					4
	Supporting staff		3					3
	Total	4	16					20
Flood Plain Management	Engineer (Senior level)	1						1
	Engineer	1						1
	Technical Assistance	1						1
	Technician	1						1
	Clerk, Typist Supporting staff	1						1
	Total	5						5
	Grand Total	20	38	18	4			80

Table H.13 Total Staffing Schedule

Civil Servants	1987	1988	1989	1990	
Senior level Officer	4	1			5
Engineer/Administrator	5	5			10
Technical Assistant	3	12	6		21
Technician	1	11	10	4	26
Supporting staff	7	9	2		18
Total	20	38	18	4	80

4. Consultancy Services

In the view of the consultancy services, technical assistance will be required in the following;

- institutional and managerial advisory services
  (mainly relating to institutional strengthening of DDS and Flood Plain management)

- set up of the computerized operational, information center
  (in compliance with the Flood Control Operation Center)

Specification of specialist advisors in terms of their main activities, duration of assistance, main responsibilities, qualifications and experience are presented. The majoy field of assistance covered are;

- Financial and managerial evaluation and planning

- Operation performance and program monitoring

- Financial reporting system

- Public Relations

- Unti-flood operations information system

- System engineering of the computer both in terms of soft and hard ware

Activity : Planning and Financial, managerial evaluation

Duration : Upto five years

Responsibilities

- to plan, design, co-ordinate and manitor long range (5 to 7 years) and operating plans (1 to 2 years) with implementing agencies

- to set up management financial and economic evaluation system for the flood protection program in and around Bangkok, covering infrastructure and project impacton society and economy

- to prepare consolidated and integrated reports on overall progress and performance of the programme

- to transfer technical and practical experience to counterparts on the job training

Qualifications and experience

- college degree in economics, business administration

- cooperate (financial) planner, administrator from the public or private sector

- 5 to 7 years' experience operating at a senior level

Activity : Operation performance and program monitoring

Duration : Upto five years

Responsibilities

- to design systems for monitoring the implementation and operational performance of individual projects, groups of like projects and the program as a whole

- to determine performance goals for individual projects, groups of like projects and the program as a whole

- to specify operational performance measure for monitoring implementation and performance

- to set up reporting systems that are compatible to related financial reporting systems

Qualifications and experience

- Industrial engineering degree

- a broad range of experience in the public or private sectors

- 5 to 7 years' experience operating at a senior level

Activity : Financial reporting systems

Duration : Upto three years

Responsibilities

- to design and implement a consolidated central financial reporting system

- to design and implement an efficient and effective system for financial accounting systems for reporting on individual project implementation at the executing agency, preparing consolidated reports, preparing management reports for submission to subordinate organization(s)

- to transfer through direct training technical and practical experience to counterparts

Qualifications and experience

- Accountancy qualification, university degree level

- financial and accounting reporting for construction works, in the public or private sector

- 5 to 7 years' experience in directly relevant position

Activity : Flood Operation and Information System

Duration : Upto five years

Responsibilities

- working closely with the specialists in
  - financial and managerial evaluation and monitoring
  - operation performance and program monitoring
  - financial reporting systems

  to set up computerised management information systems

- to determine the flexbility and scope of spare capacity in the unit's computer capacity to assist implementing agencies

- to maintain nd develop efficient and effective systems

- to transfer through direct training technical and practical experience to counterparts

Qualfications and experience

- Bachelor or Master degree in computer science

- wide experience in computer systems application for management information systems (financial and non-financial)

- 5 years' experience t a senior level, being responsible for an operation unit

Activity : Public relations

Duration : Upto five years

Responsibilities

- to prepare a range of publicrelations materials for responding to information requests and for generating interest from local and foreign investors
- to organize and synchronize study tours of the flood control project sites, facilities on request
- to brief visitors on the flood protection program
- to transfer through direct training technical and practical experience to counterparts

Qualfications and experience

- Communications or related degree
- broad experience in public/external relations in the private or government sector; knowledgeable of media
- 5 years' direct experience

Table H.14 Government Offiers Payment (Baht)

No.	PC_1	PC_2	PC_3	PC_4	PC_5	PC_6	PC_7	PC_8	PC_9	PC_{10}	PC_{11}
1	1.255	2,205	2,765	3,745	4,945	6,935	8,475	9,385	10,365	11,415	12,535
2	1,325	2,345	2,905	3,955	5,205	7,285	8,895	9,875	10,855	11,975	13,095
3	1,395	2,485	3,115	4,165	5,465	7,635	9,385	10,365	11,415	12,535	13,695
4	1,470	2,625	3,325	4,425	5,745	8,055	9,875	10,855	11,975	13,095	14,295
5	1,545	2,765	3,535	4,685	6,025	8,475	10,365	11,415	12,535	13,695	14,935
6	1,620	2,905	3,745	4,945	6,305	8,895	10,855	11,975	13,095	14,295	15,575
7	1,695	3,115	3,955	5,205	6,585	9,385	11,415	12,535	13,695	14,935	16,275
8	1,740	3,325	4,165	5,465	6,935	9,875	11,975	13,095	14,295	15,575	16,975
9	1,865	3,535	4,425	5,745	7,285	10,365	12,535	13,695	14,935	16,275	17,745
10	1,950	3,745	4,685	6,025	7,635	10,855	13,095	14,295	14,575	16,975	
11	2,065	3,955	4,945	6,305	8,055	11,415					
12	2,205	4,165	5,205	6,585	8,475	11,975					
13	2,345	4,425	5,465	6,935	8,895	12,534					
14	2,485	4,685	5,745	7,285	9,385						
15	2,625										
16	2,765										
17	2,905										
18	3,115										
19	3,325										
20	3,535										

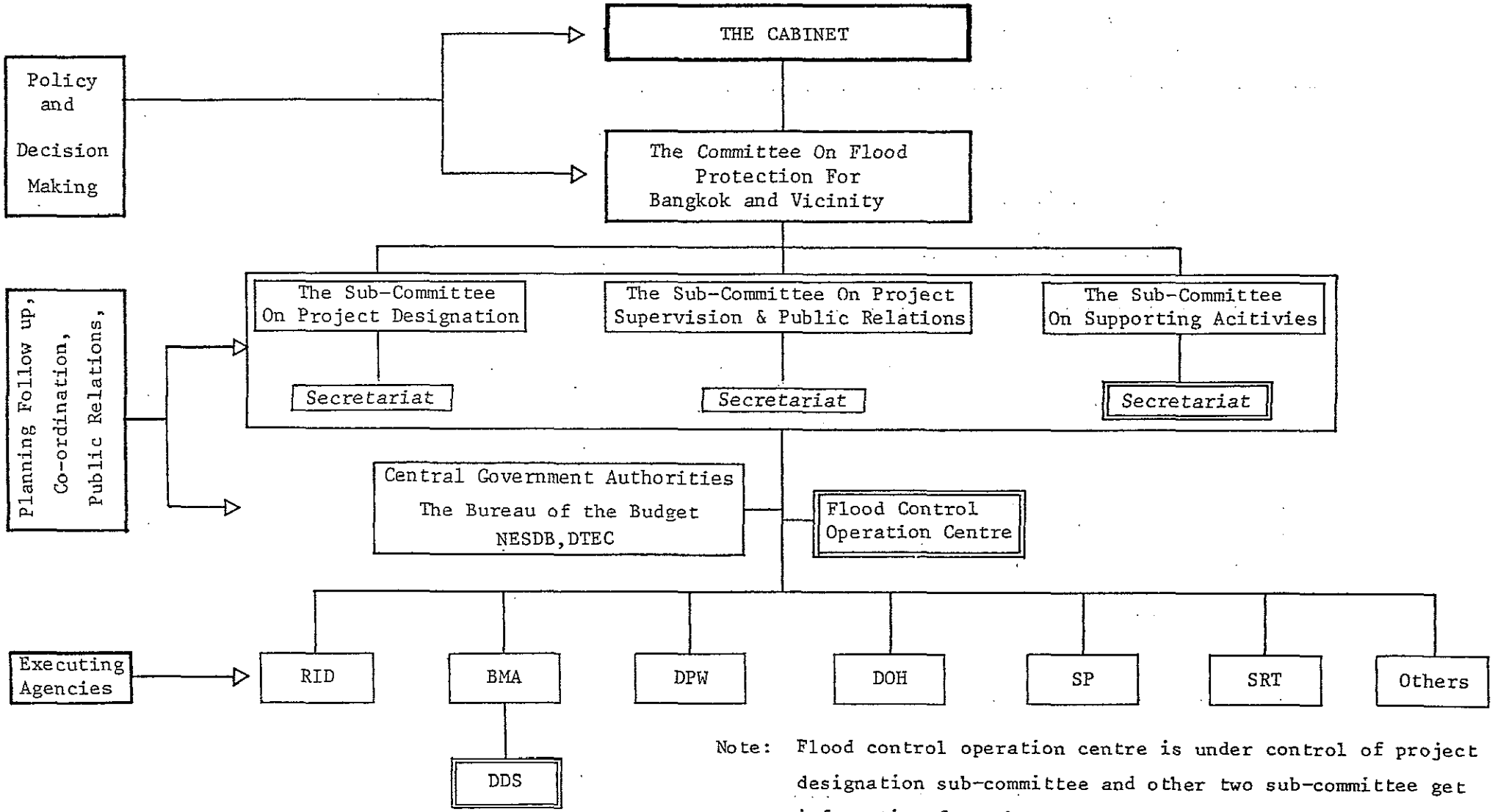

Fig. H.1 INSTITUTIONAL FRAMEWORK FOR THE PROJECT IMPLEMENTATION IN THE AREA

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

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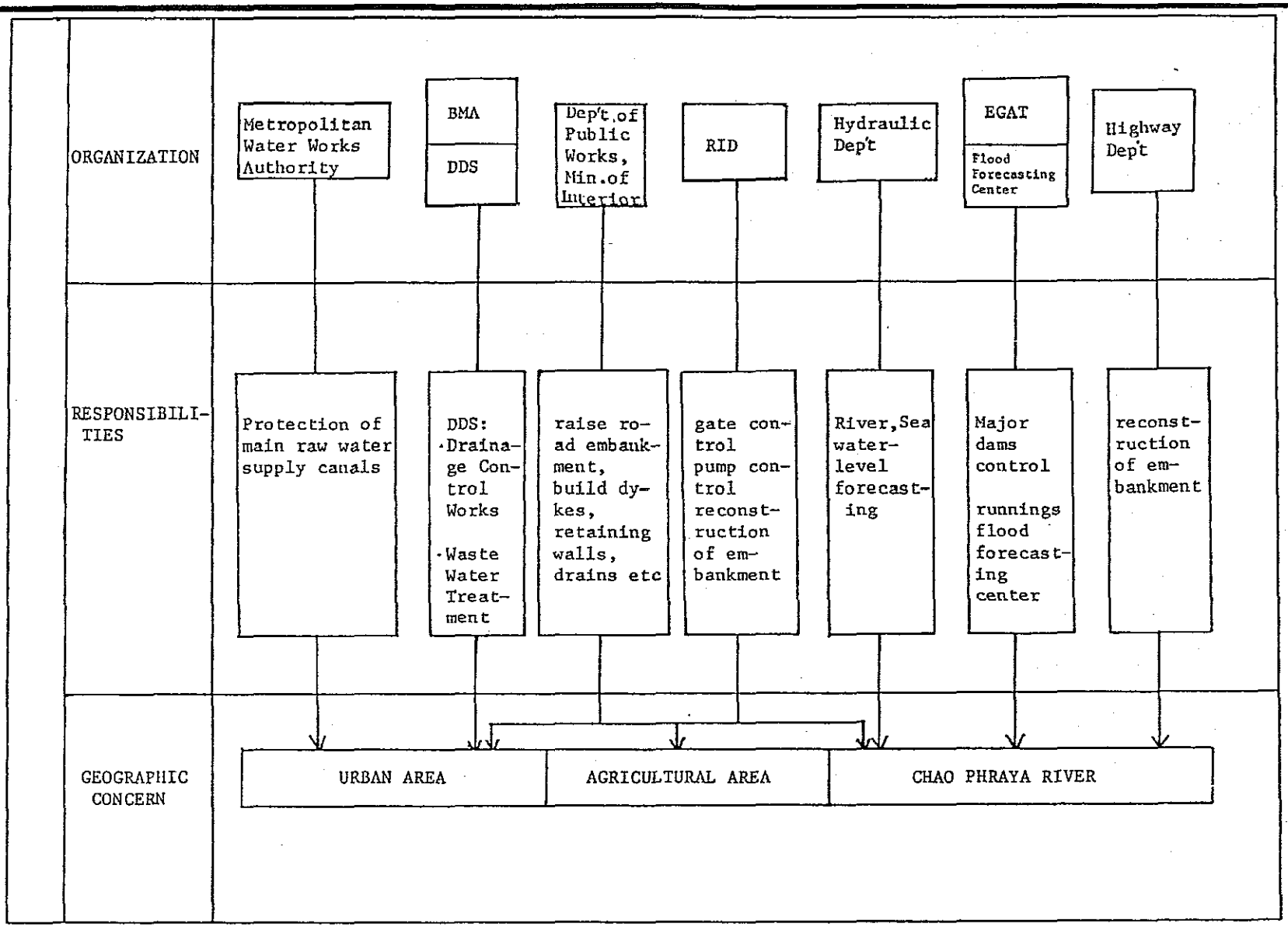

Fig. H.2 CURRENT FLOOD CONTROL-RELATED ORGANIZATIONS AND RESPECTIVE RESPONSIBILITIES

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

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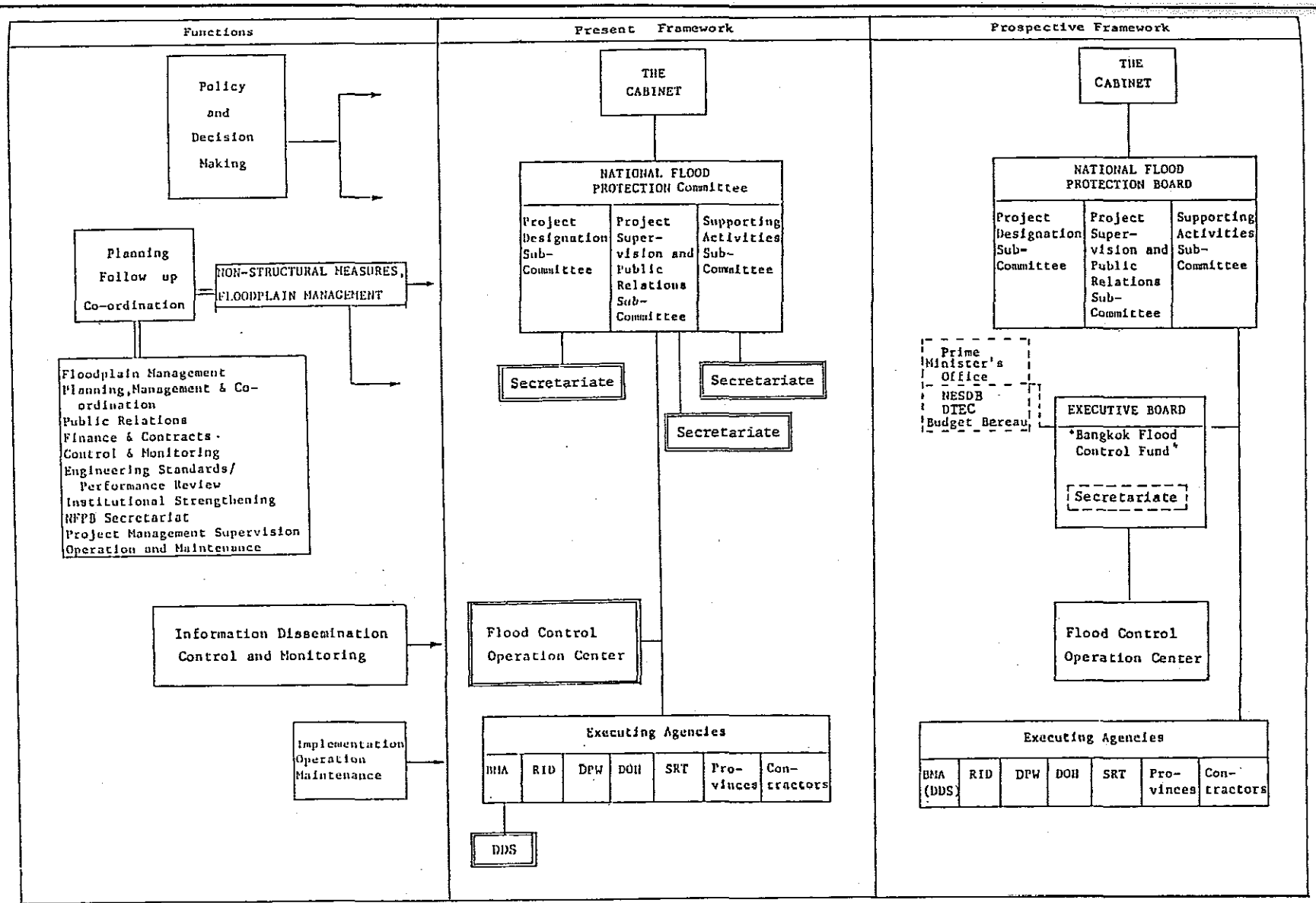

Fig. H.3 PROPOSED AND PROSPECTIVE INSTITUTIONAL FRAMEWORK

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

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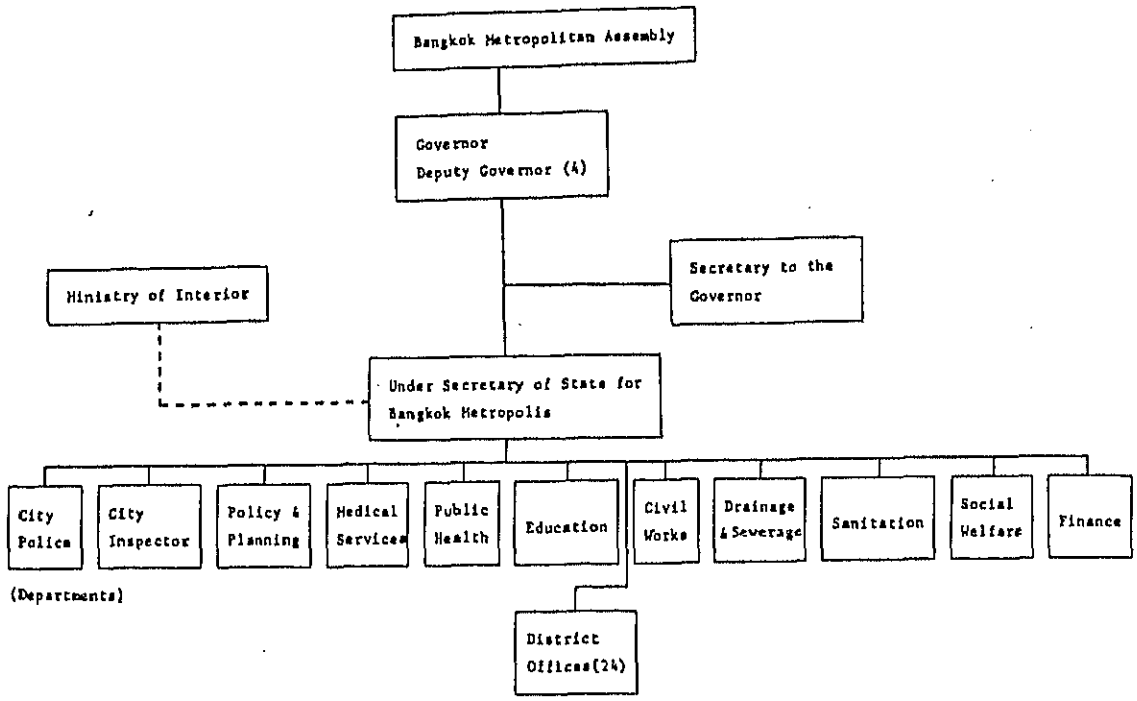
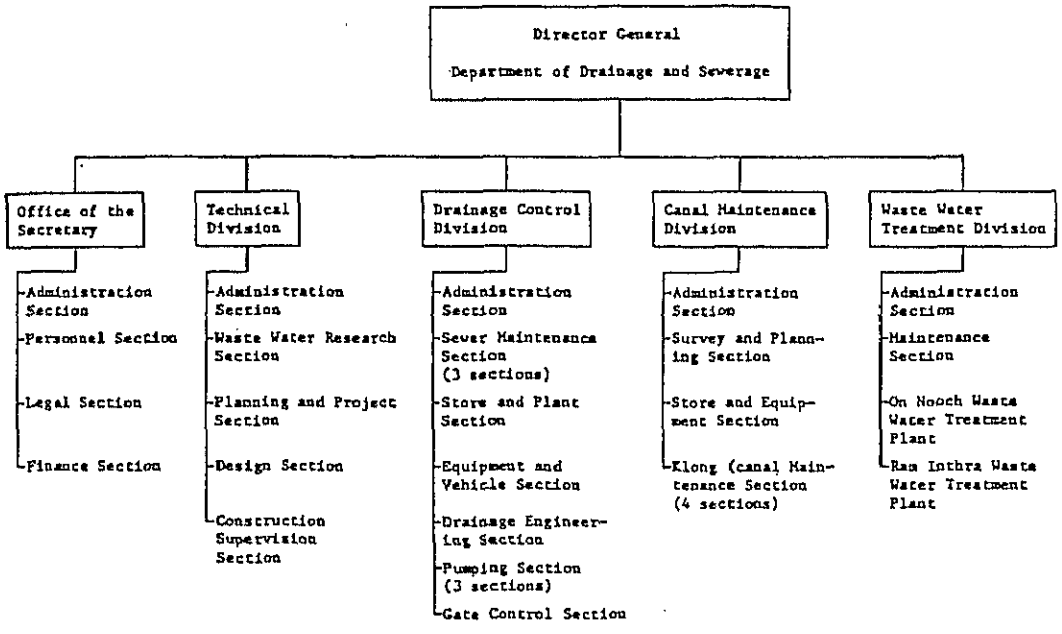
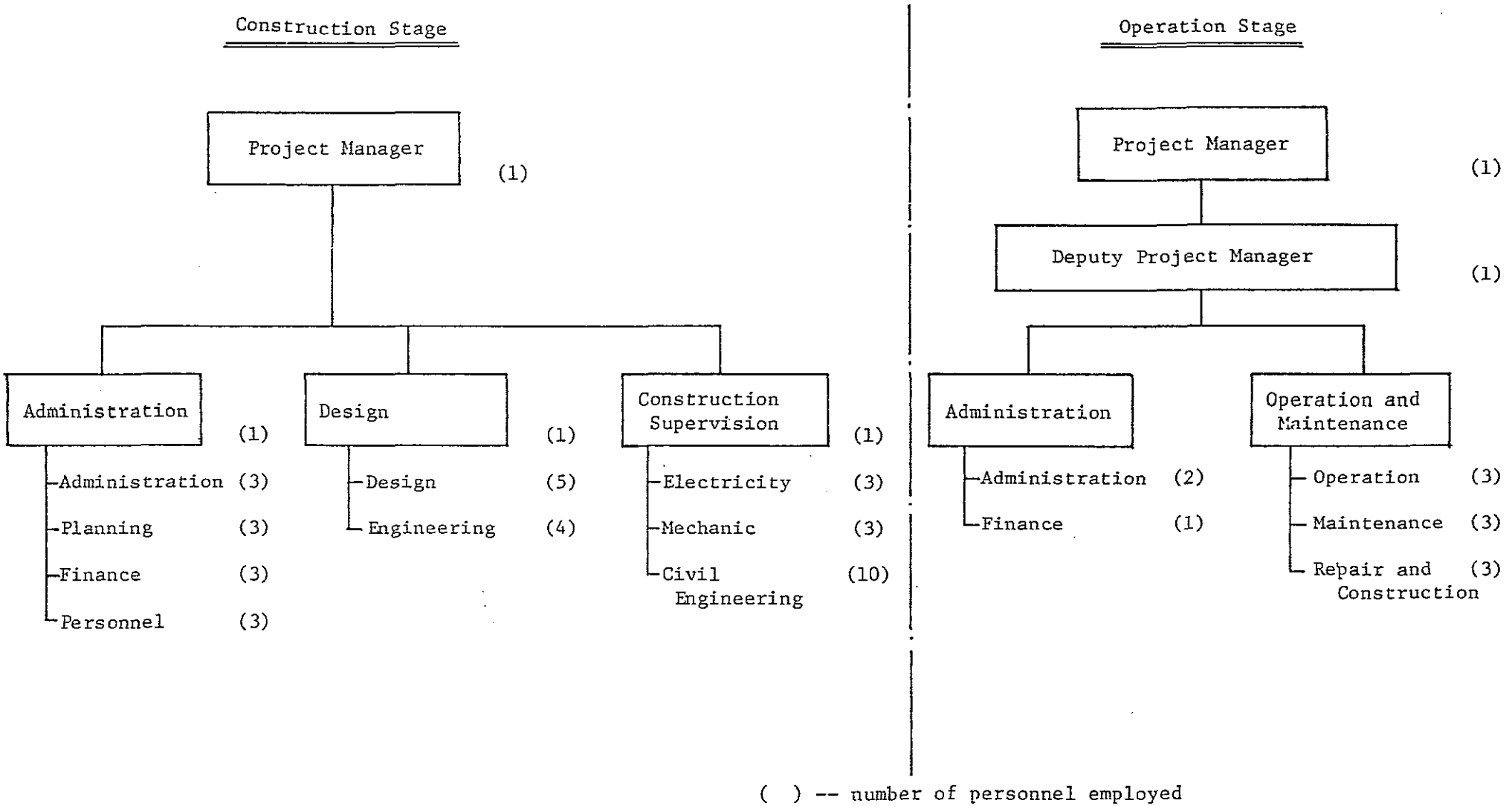


BANGKOK METROPOLITAN ADMINISTRATION



DEPARTMENT OF DRAINAGE AND SEWERAGE

Fig. H.4 ORGANIZATION CHART OF BMA AND DDS



( ) -- number of personnel employed

Fig. H.5 PROJECT ORGANIZATION BY ITS ACTIVITIES

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

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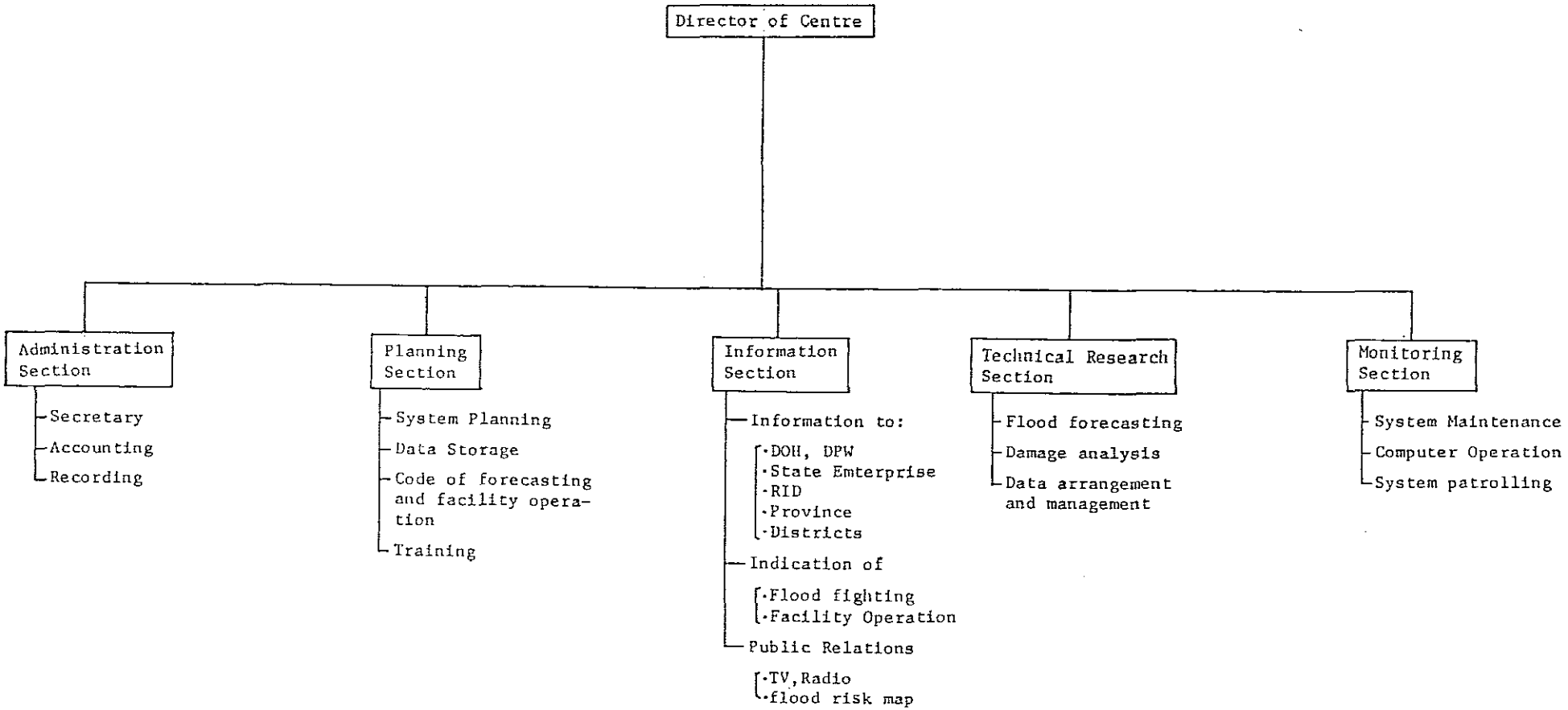

Fig. H.6 ORGANIZATION CHART OF THE FLOOD CONTROL OPERATION CENTER

FEASIBILITY STUDY ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

JICA 2529B.E 1986A.D

APPENDIX I

FINANCIAL PLAN AND EVALUATION

APPENDIX I FINANCIAL PLAN AND EVALUATION

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APPENDIX I FINANCIAL PLAN AND EVALUATION

1. An Analysis of Tax Reveues

1.1 General

The Gross National Product of Thailand in 1984 was Baht 960,405 million, while the tax revenue at national level in the same year was Baht 136,246 million. The ratio of the latter to the former is 14.2%. Looking back over the past several years, GNP has grown at an average annual rate of 5.1%, whereas national tax revenue has increased at the annual rate of 6.4% in real terms.

The ratio of national tax revenue to GNP is lower in the country than in Japan and Western countries, where it ranges from 25% to 40%. The efforts to raise the ratio are being made although the tempo is less than expected. The situation concerned is different from country to country, and a simple, unqualified comparison is unwarranted. However, the difference is big enough to convince us that there is much room for the government to raise tax revenue. It can be done by improving tax collection, reinforcing tax base and raising tax rates.

Supposing the GNP of the country grows at the average annual rate of 5% (the same rate is preliminarily adopted in the Sixth Plan.) from now on up to the year 2000 and the ratio of national tax revenue to GNP is 20% in the year 2000, then it results that an average yearly increase of national tax revenue will be at the rate of 7.2% in real terms. At the minimum, national tax revenue can be expected to increase at the same rate as the growth rate of national economy.

Turning to Bangkok Metropolis which has direct bearings upon the team's study, it has been found that the Gross Regional Domestic Product (GRDP) of Bangkok has grown these several years at an annual rate by 2% more than the growth rate of national economy probably due to migration of population into the region. So, supposing the urbanization of the Metropolis continues at a somewhat slower pace than heretofore, it can be assumed that the GRDP will grow at the

rate of, say, 6% per annum. Regarding the tax revenue at BMA level, it has been revealed that it has increased at an average annual rate of 10.0% in real terms for the past several years.

The ratio of BMA tax revenue to the GRDP of Bangkok Metropolis has been more or less 1.6%. In Japan the ratio of local tax revenue to GNP is in the range of 8%. The difference in the two levels leads us to think that Bangkok citizens are under-taxed. Supposing the ratio of BMA tax revenue to the GRDP is 4% in the year 2000, it follows that the average annual increase rate of the revenue will be 14.8% in real terms. Because of the relative smallness of BMA tax revenues (around 3% of national tax revenues) it can be reasonably expected that they will increase in the years to come at the same rate as in these several years.

1.2 Tax Revenue of BMA

Total amount of BMA revenue budget in 1985 is Baht 6,006 million as shown in Table I.2(1). Out of it, 79.3% is fixed revenue and the remaining 20.7% is government subsidy. Tax revenue occupies 90.2% of the fixed revenue. Therefore, it occupies 71.5% of the total revenue budget.

Tax revenue is composed of BMA local tax and shared tax, and their respective shares are 19.2% and 80.8%. Their respective shares in the total revenue budget are 13.7% and 57.8%. Shared tax which is primarily national tax raised by the central government and transferred in part to BMA comprizes a major part of tax revenue and total revenue budget.

As shown in Table I.2 (2) BMA local tax is virtually composed of two taxes, namely house and buildings tax and development tax. Also, shared tax is practically consisted of two taxes, namely business tax and vehicle tax. Business tax is a major source of tax revenue, occupying 63.4% of shared tax and 51.2% of total tax revenue in 1985. Potential sources of funds for capital raising and cost recovery for the Project can be found among the above four taxes.

TABLE I.1 (1)

STATISTICS ON ECONOMY AND TAX REVENUE 1975 TO 1979

unit: Baht million; bracketed figures: growth rate

Item	1975	1976	1977	1978	1979	Ave.
1. Economy						
1) GDP, Current	298,816 (-)	337,635 (13.0%)	393,030 (16.4%)	477,341 (21.5%)	564,431 (18.2%)	(17.2%)
2) GNP, Current	298,597 (-)	336,374 (12.7%)	391,016 (16.2%)	473,629 (21.1%)	556,779 (17.6%)	(16.9%)
3) GDP, Constant	403,743 (-)	441,228 (9.3%)	473,354 (7.3%)	529,094 (11.8%)	564,431 (6.7%)	(8.7%)
4) GNP, Constant	405,288 (-)	441,480 (8.9%)	472,914 (7.1%)	526,306 (11.3%)	556,779 (5.8%)	(8.3%)
5) GDP, Deflator	-	3.4%	8.5%	8.7%	10.8%	7.8%
6) GRDP, Current	70,797 (-)	81,721 (15.4%)	100,139 (22.5%)	122,387 (22.2%)	150,791 (23.2%)	(20.8%)
7) GRDP, Constant	95,735 (-)	106,846 (11.6%)	120,633 (12.9%)	135,614 (12.4%)	150,791 (11.2%)	(12.0%)
2. Tax Revenue						
1) Nat'l, Current	34,409 (-)	37,875 (10.1%)	47,286 (24.8%)	54,530 (15.3%)	66,656 (22.5%)	(18.0%)
2) Nat'l, Constant	46,408 (-)	49,415 (6.5%)	56,839 (15.0%)	60,290 (6.1%)	66,656 (10.6%)	(9.5%)
3) BMA, Current	1,219 (-)	1,282 (5.2%)	1,519 (18.5%)	1,784 (17.4%)	1,866 (4.6%)	(11.2%)
4) BMA, Constant	1,665 (-)	1,694 (1.7%)	1,830 (9.2%)	1,977 (8.0%)	1,866 (-5.6%)	(2.9%)
3. Ratio Index						
1) 2.1)/1.1)	11.5%	11.2%	12.0%	11.4%	11.8%	-
2) 2.1)/1.2)	11.5%	11.3%	12.1%	11.5%	12.0%	-
3) 2.3)/2.1)	3.5%	3.4%	3.2%	3.3%	2.8%	-
4) 2.3)/1.6)	1.7%	1.6%	1.5%	1.5%	1.2%	-

Note: Constant*=at 1979 prices; GRDP**=GRDP of Bangkok Metropolis

Sources: Economic Monthly Report, Bank of Thailand; Fiscal Policy and Planning Division, BMA; Statistical Yearbook of Thailand

TABLE I.1 (2)

STATISTICS ON ECONOMY AND TAX REVENUE 1979 TO 1984

unit: Baht million; bracketed figures: growth rate

Item	1979	1980	1981	1982	1983	1984	Ave.
1. Economy							
1) GDP,Current	556,401	684,930	786,166	846,136	924,254	991,752	-
	(-)	(23.1%)	(14.8%)	(7.6%)	(9.2%)	(7.3%)	(12.3%)
2) GNP,Current	546,255	672,440	764,379	819,760	898,884	960,405	-
	(-)	(23.1%)	(13.7%)	(7.2%)	(9.7%)	(6.8%)	(11.9%)
3) GDP,Constant*	556,401	588,672	625,759	651,415	689,197	730,549	-
	(-)	(5.8%)	(6.3%)	(4.1%)	(5.8%)	(6.0%)	(5.6%)
4) GNP,Constant*	546,255	575,753	603,389	625,111	665,118	701,034	-
	(-)	(5.4%)	(4.8%)	(3.6%)	(6.4%)	(5.4%)	(5.1%)
5) GDP Deflator	-	16.4%	8.0%	3.4%	3.2%	1.2%	6.3%
6) GRDP**,Current	174,127	212,779	245,158	281,317	-	-	-
	(-)	(22.2%)	(15.2%)	(14.7%)	(-)	(-)	(17.3%)
7) GRDP**,Constant*	174,127	182,800	195,016	216,421	-	-	-
	(-)	(5.0%)	(6.7%)	(11.0%)	(-)	(-)	(7.5%)
2. Tax Revenue							
1) Nat'l,Current	73,637	88,473	100,906	105,076	129,062	136,246	-
	(-)	(20.1%)	(14.1%)	(14.1%)	(22.8%)	(5.6%)	(13.1%)
2) Nat'l,Constant*	73,637	75,978	80,269	80,812	96,160	100,341	-
	(-)	(3.2%)	(5.6%)	(0.7%)	(19.0%)	(4.3%)	(6.4%)
3) BMA,Current	1,866	2,164	2,663	3,225	3,290	4,088	-
	(-)	(16.0%)	(23.1%)	(21.1%)	(2.0%)	(24.3%)	(17.0%)
4) BMA,Constant*	1,866	1,859	2,118	2,481	2,453	3,012	-
	(-)	(0.0%)	(13.9%)	(17.1%)	(-1.1%)	(22.8%)	(10.0%)
3. Ratio Index							
1) 2.1)/1.1)	13.2%	12.9%	12.8%	12.4%	14.0%	13.7%	-
2) 2.1)/1.2)	13.4%	13.2%	13.2%	12.8%	14.4%	14.2%	-
3) 2.3)/2.1)	2.5%	2.5%	2.6%	3.1%	2.6%	3.0%	-
4) 2.3)/1.6)	1.7%	1.6%	1.6%	1.6%	-	-	-

Note: Constant*=at 1979 prices; GRDP**=GRDP of Bangkok Metropolis

Sources: Economic Monthly Report, Bank of Thailand; Fiscal Policy and Planning Division, BMA; Statistical Yearbook of Thailand

TABLE I.2 (1) BMA ANNUAL BUDGET (1983-1985)

- REVENUE -

(Baht million; %)

Item	1983		1984		1985	
1. Tax Revenue	3,266.00	69.8	3,732.00	58.8	4,294.10	71.5
(BMA Local Tax)	(656.50)	(14.0)	(721.50)	(11.4)	(824.50)	(13.7)
(Shared Taxes)	(2,609.50)	(59.8)	(3,010.50)	(47.4)	(3,469.60)	(57.8)
2. Fee for Licencing & Permits	100.17	2.1	105.93	1.7	119.53	2.0
3. BMA Property Revenue	183.31	3.9	224.69	3.5	255.65	4.3
4. Business Revenue	8.90	0.2	10.30	0.2	8.80	0.1
5. Others	197.25	4.2	84.42	1.3	84.88	1.4
Sub-Total	3,755.63	80.3	4,157.34	65.5	4,762.96	79.3
6. Central Government Subsidy	921.20	19.7	2,189.13	34.5	1,243.07	20.7
Total	4,676.83	100.0	6,346.47	100.0	6,006.03	100.0

Source: BMA Document

TABLE I.2 (2) BMA ANNUAL BUDGET (1983-1985)

- BREAKDOWN OF TAX REVENUE -

(Baht million; %)

Item	1983		1984		1985	
1. BMA Local Tax	656.50	20.1	721.50	19.3	824.50	19.2
(House and Buildings Tax)	(585.85)	(17.9)	(560.00)	(15.0)	(660.00)	(15.4)
(Development Tax)	(103.83)	(3.2)	(110.00)	(2.9)	(110.00)	(2.6)
(Other Taxes)	(33.18)	(1.0)	(51.50)	(1.4)	(54.50)	(1.2)
2. Shared Tax	2,609.50	79.9	3,010.50	80.7	3,469.60	80.8
(Business Tax)	(1,454.81)	(44.5)	(1,925.00)	(51.6)	(2,200.00)	(51.2)
(Vehicle Tax)	(887.81)	(27.2)	(866.00)	(23.2)	(1,026.10)	(23.9)
(Other Taxes)	(266.88)	(8.2)	(219.50)	(5.9)	(243.50)	(5.7)
Total	3,266.00	(100.0)	3,732.00	(100.0)	4,294.10	(100.0)

Source: BMA Document

TABLE I.2 (3) BMA ANNUAL BUDGET (1983-1985)

- EXPENDITURE -

(Baht million; %)

Item	1983		1984		1985	
1. Public Work	894.5	18.8	1,350.2	20.9	1,339.8	21.4
2. Education	884.9	18.6	986.8	14.9	1,007.9	16.1
3. Project Expenditure	618.1	13.0	569.7	8.8	778.1	12.4
4. General Administration	381.3	8.0	1,330.3	20.0	715.3	11.4
5. Medical & Sanitation	624.4	13.1	717.9	11.1	707.9	11.3
6. Cleaning	632.7	13.3	611.2	9.5	639.3	10.2
7. Drainage & Sewerage*	486.3	10.2	611.1	9.4	610.7	9.8
8. Social Welfare	115.0	2.4	183.8	2.8	253.7	4.1
9. Loan Repayment	122.4	2.5	167.1	2.6	207.1	3.3
10. Commerce	3.6	0.1	2.2	0.0	-	-
Total	4,763.2	100.0	6,530.3	100.0	6,259.8	100.0

* This includes budget for DDS and drainage budget for District offices.

Source: BMA Document

TABLE I.2 (4) BMA ANNUAL BUDGET (1983-1985)

- DDS BUDGET -

(Baht thousand)

Item	1983	1984	1985
A. General Administration			
1. Secretary	4,099	4,536	6,264
2. Technical Administration	3,982	4,605	22,841
B. Drainage and Sewerage			
1. Drainage Control	134,826	165,866	179,883
2. Sewer Cleaning	18,000	18,000	-
3. Klong Maintenance	62,201	100,995	143,178
4. Klong Improvement	4,843	7,402	-
5. Project Study for Thomburi	-	1,500	-
6. Project for Preserving Temples	8,300	20,000	45,000
7. Survey of Klong Network	469	-	224
8. Waste Water Treatment	7,908	5,051	4,882
9. City Core Flood Protection Project	136,673	31,622	40,008
10. Suburban Flood Protection Project		61,000	-
DDS Total Budget	381,297	420,578	442,280

Source: BMA Document

It is said that the two local taxes are at present not efficiently and effectively practised. To rectify the situation reinforcement of tax base centering on tax mapping and creation of tax rolls is in progress. It is expected that it will be completed in two years, and revenue from these sources will increase by 30% at the least once it is completed. The GRDP of Bangkok Metropolis has been assumed to grow at the average annual rate of 6%. Then, the natural increase rate of BMA tax and other revenues can be assumed to be the same. Based on these things Table I.3 has been made. The figures from the year 2000 are assumed to be the same with those in 2000.

2. Financial Plan

2.1 Project Cost

The total cost for the construction of flood protection and drainage facilities during the First Stage Programme period is estimated at Baht 2,655 million. Out of it, foreign exchange component works out at Baht 1,261 million or 47.5% and the balance of Baht 1,394 million or 52.5% is local currency component. Regarding the financial sources of local component, the study team assumes 2 cases.

In Case I it is assumed that Baht 1,394 million will be equally split between BMA and the central government, Baht 697 million (26.25%) deriving from BMA coffer and another Baht 697 million (26.25%) being transferred from national coffer. BMA will disburse Baht 11 to 236 million annually over the 5 year implementation period 1987 to 1991.

In Case II it is supposed that the local portion will be entirely shouldered by BMA in the form of self-financing. That is to say, it will be met by the BMA's own budget. In this case Baht 23 to 472 million will be annually appropriated over the 5 year implementation period. Refer to Tables I.4 and I.5.

TABLE I.3 TWO COMPONENTS OF BMA REVENUE INCREASE

(at 1985 prices) (Baht million)

Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
N.ICR	388	412	436	463	490	520	551	584	619	656	696	737	782	828
MBLZ	302	320	339	360	381	404	428	454	482	510	541	573	611	644
TTL	690	732	775	823	871	924	979	1,038	1,101	1,166	1,237	1,310	1,393	1,472

Note: N.ICR=natural increase of BMA revenue
MBLZ =mobilization of existing local taxes
TTL =total

Table I.4 PROJECT COST

(Baht million)

Item	Total	1987	1988	1989	1990	1991
Project Cost	2,655	46	825	825	805	154
F/C	1,261	23	450	353	372	63
L/C	1,394	23	375	472	433	91
50% of L/C	697	11	188	236	217	45

Note: F/C = Foreign Component, L/C = Local Component

Table I.5 TWO CASES ON SOURCES OF LOCAL COMPONENT

(Baht million)

Sources	Case I	Case II
Govt. Grant	697	-
BMA Self-Finance	697	1,394

2.2 Operation and Maintenance Cost, and Replacement Cost.

To operate and maintain the Project facilities Baht 42 million will be annually required, the facility-wise breakdown of which is as shown in Table I.7(1). In addition as replacement cost of flood control equipment Baht 129 million are to be required every 15 years, the equipment-wise breakdown of which is as shown in Table I.7(2). The direct construction cost which means the project cost minus engineering/supervision fees and contingencies is estimated at Baht 2,270 million. So, annual O/M cost corresponds to 1.85% of the direct construction cost. (Hereinafter, O/M/R stands for operation, maintenance and replacement.)

2.3 Annual Costs for Capital, Repayment and O/M/R

Supposing the prices increase for both foreign and local components by 5% annually, Table I.4 will be converted to Table I.6.

Table I.6 PROJECT COST AT CURRENT PRICES

(Baht million)

Item	Total	1987	1988	1989	1990	1991
Project Cost	3,242	51	955	1,003	1,027	206
F/C	1,534	25	521	429	475	84
L/C	1,708	26	434	574	552	122
50% of L/C	854	13	217	287	276	61

The lending terms on foreign loans are assumed to be the annual interest rate of 3.5% and the repayment period of 30 years with the grace period of 10 years. Under the above-mentioned conditions annual costs over the entire repayment period for Case I and II will be as shown in Table I.8(1) and I.8(2) respectively. Figures corresponding to the two table are shown in Figure I.1(1) and I.1(2).

In Case I, the cumulative annual cost composed of capital, O/M and repayment costs during the 5 year implementation period comes to Baht 923 million which correspond to 2.0% of the projected cumulative annual budget of BMA during the same period. In the peak year of 1990 the annual cost reaches Baht 290 million which correspond to 2.9% of the projected annual budget of BMA in the same year. From 1992 onwards the share of the annual cost of the Project in the annual budget of BMA is estimated to be below 1%. At the end of the repayment period of 34 years BMA will have paid the cumulative cost of Baht 3,351 million of which Baht 697 million (20.8%), Baht 1,078 million (32.2%) and Baht 1,576 million (47.0%) account for capital, repayment and O/M/R costs, respectively.

Table I.7(1) ANNUAL O/M COST

(Baht Million)

No.	Facilities	Amount
1.	Klongs	35.8
2.	Pumping Stations	2.7
3.	Gates	0.5
4.	Pipes and Box Culverts	0.3
5.	Barriers	0.3
6.	Flood Control Operation Center	2.0
	Total	41.6 (≒42)

Note: For further details refer to APPENDIX E.

Table I.7(2) REPLACEMENT COST

(Baht Million)

No.	Equipment	Volume	Purchasing Cost	Installation Cost	Total
1.	Pumps	-	47.0	9.4	56.4
2.	Gates	324	19.0	3.8	22.8

3. Electronic and Other Equipment in Flood Control Operation Center

(Thousand Yen)

Description	Unit	Amount
(1) Master Station		
1. Host Computer	1 set	40,500
2. Man-Machine Sub-System Color Copier, 70" Projector, Mini Panel, TV Camera, VTR Desk, etc.	1 unit	76,000
3. Communication Sub-System	1 unit	60,000
4. Power Supply System	1 unit	39,400
5. Cables	1 unit	10,000
(2) Out Station		
1. OTU (STC-1000)	15 sets	33,750
2. Cabinet	15 sets	14,400
3. Water Level Gauge	28 sets	25,200
4. Rainfall Gauge	13 sets	3,250
5. Cable	1 unit	8,600
6. DC Battery Charger	1 unit	15,000
(3) Others		
1. Master Station Installation		12,000
2. OTU Installation		20,000
3. Site Testing		60,000
4. Spare Parts		30,000
5. One Year Maintenance		10,000
Total		458,100

458,100 Thousand Yen = Baht 49.4 Million

Grand Total: Baht 128.6 (≒129) Million

Table I.8(1) ANNUAL COSTS FOR CAPITAL, REPAYMENT AND O/M/R

(at 1985 prices unless otherwise specified) (Baht Million)

Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
CPTL	11.0	188.0	236.0	217.0	45.0	0.0	0.0	0.0	0.0	0.0
RP.F*	0.9	19.1	34.1	50.8	53.7	53.7	53.7	53.7	53.7	53.7
RP.L*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S-TTL*	0.9	19.1	34.1	50.8	53.7	53.7	53.7	53.7	53.7	53.7
S-TTL	0.8	16.5	28.1	39.8	40.1	38.2	36.4	34.6	33.0	31.4
O/M/R	0.0	6.7	19.8	33.0	40.9	42.0	42.0	42.0	42.0	42.0
TTL	11.8	211.2	283.9	289.8	126.0	80.2	78.3	76.6	75.0	73.4
BMA	7,390	8,120	8,942	9,836	10,820	11,902	13,092	14,401	15,841	17,425
RATIO	0.2%	2.6%	3.2%	2.9%	1.2%	0.7%	0.6%	0.5%	0.5%	0.4%

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
CPTL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RP.F*	55.0	81.0	101.5	123.5	125.2	122.5	119.8	117.1	114.5	111.8
RP.L*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S-TTL*	55.0	81.0	101.5	123.5	125.2	122.5	119.8	117.1	114.5	111.8
S-TTL	30.6	42.9	51.3	59.4	57.4	53.4	49.8	46.4	43.1	40.1
O/M/R	42.0	42.0	42.0	42.0	42.0	42.0	171.0	42.0	42.0	42.0
TTL	72.6	84.9	93.2	101.4	99.3	95.4	220.8	88.3	85.1	82.1
BMA	19,168	21,085	23,193	25,512	27,830	30,149	32,468	34,787	37,106	39,425
RATIO	0.4%	0.4%	0.4%	0.4%	0.4%	0.3%	0.7%	0.3%	0.2%	0.2%

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
CPTL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RP.F*	109.1	106.4	103.7	101.0	98.3	95.7	93.0	93.0	87.6	84.9
P.L *	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S-TTL*	109.1	106.4	103.7	101.0	98.3	95.7	93.0	90.3	87.6	84.9
S-TTL	37.3	34.6	32.2	29.8	27.7	25.6	23.7	21.9	20.3	18.7
O/M/R	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0
TTL	79.3	76.6	74.2	71.8	69.7	67.6	65.7	63.9	62.3	60.7
BMA	41,744	44,063	46,382	48,701	51,020	53,339	55,658	57,977	60,296	62,615
RATIO	0.2%	0.2%	0.2%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%

Year	2017	2018	2019	2020
CPTL	0.0	0.0	0.0	0.0
RP.F*	81.0	52.3	29.1	4.4
RP.L*	0.0	0.0	0.0	0.0
S-TTL*	81.0	52.3	29.1	4.4
S-TTL	17.0	10.4	5.5	0.8
O/M/R	42.0	171.0	42.0	42.0
TTL	59.0	181.4	47.5	42.8
BMA	64,934	67,253	69,572	71,891
RATIO	0.1%	0.3%	0.1%	0.1%

NOTE: CPTL=capital cost; RP.F*=repayment cost on foreign loan at current prices; RP.L*=repayment cost on local loans at current prices; S-TTL*=sub-total at current prices; S-TTL=sub-total; O/M/R=operation, maintenance & replacement cost; TTL=total; BMA=total revenue budget of BMA; RATIO=ratio of TTL TO BMA

TABLE I.8(2) ANNUAL COSTS FOR CAPITAL,REPAYMENT AND O/M/R

(at 1985 prices unless otherwise specified) (Baht Million)

Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
CPTL	23.0	375.0	472.0	433.0	91.0	0.0	0.0	0.0	0.0	0.0
RP.F*	0.9	19.1	34.1	50.8	53.7	53.7	53.7	53.7	53.7	53.7
RP.L*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S-TTL*	0.9	19.1	34.1	50.8	53.7	53.7	53.7	53.7	53.7	53.7
S-TTL	0.8	16.5	28.1	39.8	40.1	38.2	36.4	34.6	33.0	31.4
O/M/R	0.0	6.7	19.8	33.0	40.9	42.0	42.0	42.0	42.0	42.0
TTL	23.8	398.2	519.9	505.8	172.0	80.2	78.3	76.6	75.0	73.4
BMA	7,390	8,129	8,942	9,836	10,820	11,902	13,092	14,401	15,841	17,425
RATIO	0.3%	4.9%	5.8%	5.1%	1.6%	0.7%	0.6%	0.5%	0.5%	0.4%

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
CPTL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RP.F*	55.9	81.0	101.5	123.5	125.2	122.5	119.8	117.1	114.5	111.8
RP.L*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S-TTL*	55.0	81.0	101.5	123.5	125.2	122.5	119.8	117.1	114.5	111.8
S-TTL	30.6	42.9	51.3	59.4	57.4	53.4	49.8	46.4	43.1	40.1
O/M/R	42.0	42.0	42.0	42.0	42.0	42.0	171.0	42.0	42.0	42.0
TTL	72.6	84.9	93.2	101.4	99.3	95.4	220.8	88.3	85.1	82.1
BMA	19,168	21,085	23,193	25,512	27,830	30,149	32,468	34,787	37,106	39,425
RATIO	0.4%	0.4%	0.4%	0.4%	0.4%	0.3%	0.7%	0.3%	0.2%	0.2%

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
CPTL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RP.F*	109.1	106.4	103.7	101.0	98.3	95.7	93.0	90.3	87.6	84.9
RP.L*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S-TTL*	109.1	106.4	103.7	101.0	98.3	95.7	93.0	90.3	87.6	84.9
S-TTL	37.3	34.6	32.2	29.8	27.7	25.6	23.7	21.9	20.3	18.7
O/M/R	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0
TTL	79.3	76.6	74.2	71.8	69.7	67.6	65.7	63.9	62.3	60.7
BMA	41,744	44,063	46,382	48,701	51,020	53,339	55,658	57,977	60,296	62,615
RATIO	0.2%	0.2%	0.2%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%

Year	2017	2018	2019	2020
CPTL	0.0	0.0	0.0	0.0
RP.F*	81.0	52.3	29.1	4.4
RP.L	0.0	0.0	0.0	0.0
S-TTL*	81.0	52.3	29.1	4.4
S-TTL	17.0	10.4	5.5	0.8
O/M/R	42.0	171.0	42.0	42.0
TTL	59.0	181.4	47.5	42.8
BMA	64,934	67,253	69,572	71,891
RATIO	0.1%	0.3%	0.1%	0.1%

NOTE: CPTL=capital cost; RP.F*=repayment cost on foreign loan at current prices; RP.L*=repayment cost on local loans at current prices; S-TTL*=sub-total at current prices; S-TTL=sub-total; O/M/R=operation, maintenance & replacement cost; TTL=total; BMA=total revenue budget of BMA; RATIO=ratio of TTL TO BMA

In Case II, the cumulative annual cost during the 5 year implementation period comes to Baht 1,620 million which correspond to 3.6% of the projected cumulative annual budget of BMA during the same period. In the peak year of 1989 the annual cost reaches Baht 520 million which correspond to 5.8% of the projected annual budget of BMA in the same year. From 1992 onwards the share of the annual cost of the Project in the annual budget of BMA is estimated to be below 1%. At the end of the repayment period BMA will have paid the cumulative cost of Baht 4,048 million, of which Baht 1,394 million (34.4%), Baht 1,078 million (26.6%) and Baht 1,576 million (39.0%) account for capital repayment and O/M/R costs, respectively.

3. Capital Raising and Cost Recovery

3.1 Comparative Position of the Project

Energetic infrastructure development programs in the Bangkok Metropolitan Region is under consideration for the 6th Five-Year Plan period, a summary of which is shown in Table I.9(1). Out of the total required amount of Baht 102,952 million 84.7% is earmarked for transportation and housing sectors. The appropriation to flood control sector is Baht 6,753 million or 6.6%, of which Baht 2,655 million or 39.3% (2.6% of the total) are meant for the Project. In terms of the financial sources private sector and foreign loan combined account for 79.8%. Self-financing by BMA amounts to Baht 3,954 million or 3.8% of the total.

Year-wise, sector-wise breakdown of Baht 3,954 million and comparative positions of broken down items vis-a-vis forecasted capital expenditure of BMA are shown in Table I.9(2) and Figure I.2. In forecasting capital expenditure of BMA, it is assumed that the expenditure will be 30% of the forecasted total budget of BMA. Appropriation to infrastructure projects during the 6th five-year plan period occupies 29.2% of the projected capital expenditure during the same period. Out of Baht 3,954 million flood control peojects account for Baht 1,602 million or 40.5% (11.8% of capital expenditure). Out of Baht 1,602 million the Project (Case I) occupies Baht 697 million or 43.5% (5.1% of capital expenditure).

Table I.9(1) FINANCIAL NEED OF INFRANSTRUCTURE PROJECTS IN 6TH FIVE-YEAR PLAN

(Baht Million)

No.	Item	BMA	Control Govt.	Foreign Loan	State Enterprises	Domestic Loan	Private	Total	Share
1.	Flood Control								
	1) City Core Phase I	427	428	855	-	-	-	1,500	1.5%
	2) City Core Phase II	18	17	53	-	-	-	88	0.1%
	3) Eastern Suburban Phase I	697	697	1,261	-	-	-	2,655	2.6%
	4) Others	460	460	1,380	-	-	-	2,300	2.2%
	Sub Total	1,602	1,602	3,549	-	-	-	6,753	6.6%
2.	Water Supply	-	1,011	5,606	-	2,404	-	9,021	8.8%
3.	Transportation	2,000	8,607	17,147	459	-	12,325	40,538	39.4%
4.	Housing	352	352	4,326	1,331	998	39,281	46,640	45.3%
	Total	3,954	11,572	30,628	1,790	3,402	51,606	102,952	100.0%
	Share	3.8%	11.2%	29.7%	1.7%	3.3%	50.1%	100.0%	-

Source : "BMR Study", Interim Report;
JICA Study

TABLE I.9(2) BMA EXPENDITURE FOR INFRASTRUCTURE PROJECTS IN 6TH FIVE-YEAR PLAN

(Baht million)

No.	Item	Code	1983	1984	1985	1986	Total
1.	Flood Protection						
		(B)	395	467	347	352	1,561
2.	Land Use and Traffic		1,062	1,043	769	427	3,301
3.	Total (1.+2.)	(C)	1,457	1,510	1,116	779	4,862
4.	Capital Expenditure of BMA	(D)	2,406	2,492	1,974	1,555	8,427
5.	(B)/(D)		16.4%	18.7%	17.6%	22.6%	18.5%
6.	(C)/(D)		60.6%	60.6%	56.5%	50.1%	57.7%

No.	Item	Code	6TH FIVE YEAR PLAN PERIOD 1987	1988	1989	1990	1991	Total
1.	Flood Control							
	1) City Core Phase I		176	174	62	15	-	427
	2) City Core Phase II		-	-	-	-	18	18
	3) Eastern Suburban Phase I	(A)	11	188	236	217	45	697
	4) Others		44	28	41	162	185	460
	Sub-Total	(B)	231	390	339	394	248	1,602
2.	Transportation		426	497	455	364	258	2,000
3.	Housing		71	71	70	70	70	352
4.	Total (1.+2.+3.)	(C)	728	958	864	828	576	3,954
5.	Capital Expenditure of BMA	(D)	2,217	2,439	2,683	2,951	3,246	13,536
6.	(A)/(D)		0.5%	7.7%	8.8%	7.4%	1.4%	5.1%
7.	(B)/(D)		10.4%	16.0%	12.6%	13.4%	7.6%	11.8%
8.	(C)/(D)		32.8%	39.3%	32.2%	28.1%	17.7%	29.2%

Note: Up to 1986=At current prices; From 1987=At 1985 prices

Source: Up to 1986=BMA Document; From 1987="BMR Study", Interim Report & JICA Estimation