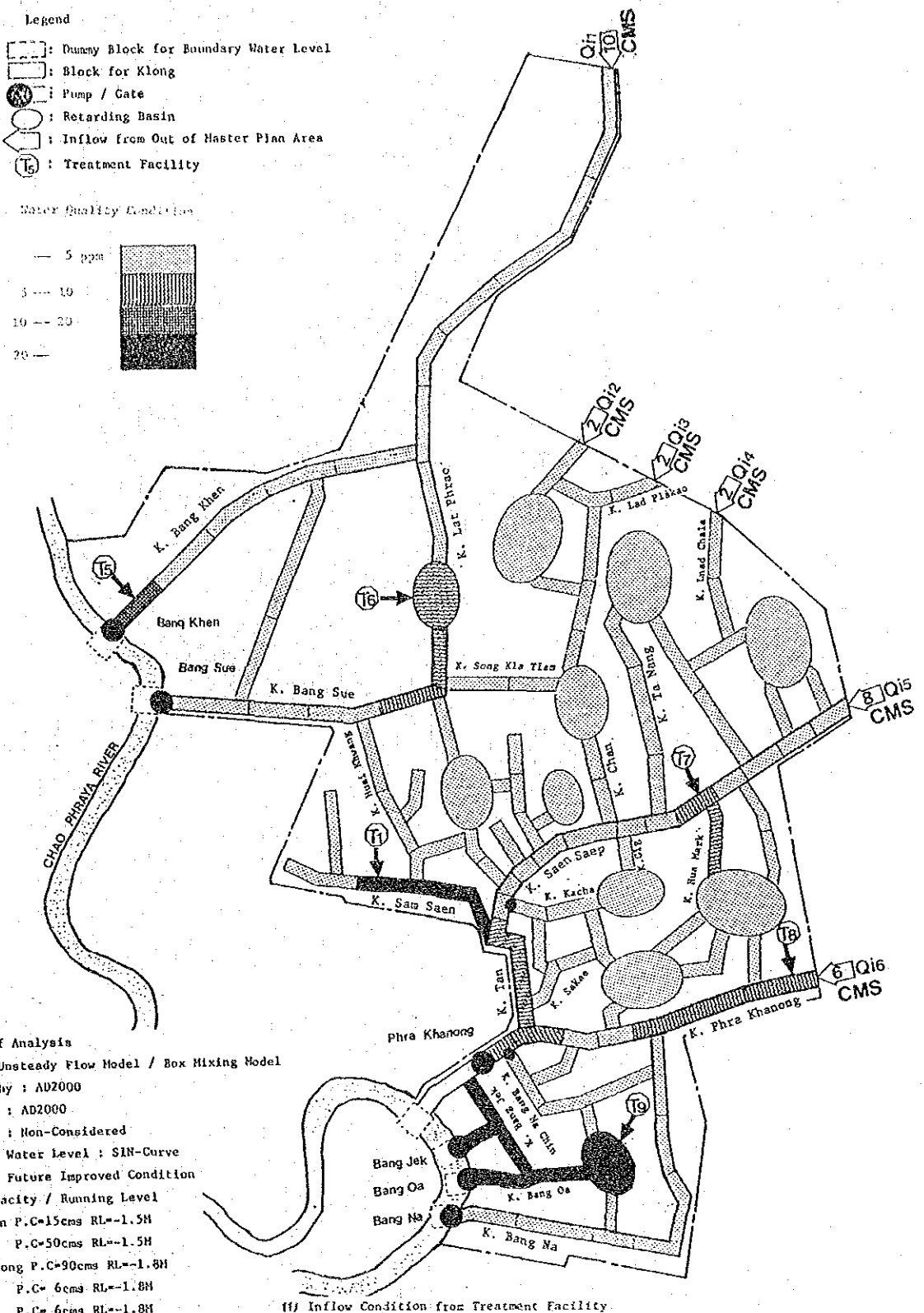

Condition of Analysis

1) Model : Unsteady Flow Model / Box Mixing Model
2) Topography : AD2000
3) Land Use : AD2000
4) Rainfall : Non-Considered
5) Boundary Water Level : SIN-Curve
6) Klongs : Future Improved Condition
7) Pump Capacity / Running Level
   - Bang Khen P.C=15cms RL=-1.5M
   - Bang Sue P.C=50cms RL=-1.5M
   - PhraKhanong P.C=90cms RL=-1.8M
   - Gig P.C= 6cms RL=-1.8M
   - Kacha P.C= 6cms RL=-1.8M
   - Bang Na Chin P.C=12cms RL=-2.0M
   - Bang Jek P.C= 6cms RL=-2.0M
   - Bang Oa P.C= 9cms RL=-2.0M
   - Bang Na P.C=30cms RL=-2.0M
8) Boundary Condition
   - Upper Stream Block 1.0 ppm
   - (Note) ppm ; part per million
9) Calculation Period : 30 hrs
10) Total Accumulated Inflow Discharge : 3,240,000 m^3

11) Inflow Condition from Treatment Facility

Treatment Facility	Daily Average Sewerage m^3/day	m^3/sec.	Treatment Type	Water Quality(ppm) Inflow	Outflow	Discharge of Load BOD t/day
T_5 Bang Khen	115,500	(1.336)	Airated Lagoon	210	53	6.12
T_6 Lat Phrao	69,200	(0.801)	Airated Lagoon	190	48	3.67
T_7 Saen Saep	197,800	(2.289)	Airated Lagoon	200	50	10.48
T_1 Sam Sen	274,700	(3.179)	Modified Airation	240	60	14.56
T_8 Phra Khanong	100,200	(1.160)	Airated Lagoon	180	45	5.31
T_9 Khled	109,600	(1.269)	Airated Lagoon	180	45	5.81
Total	867,000					45.95

Fig. M.9 ESTIMATED (BOD_5) DENSITY DUE TO FLUSHING ($70m^3$/sec INFLOW)

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

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APPENDIX N

ORGANIZATION AND MANAGEMENT

APPENDIX N ORGANIZATION AND MANAGEMENT

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Appendix N ORGANIZATION AND MANAGEMENT

In this chapter, organizational and managerial aspects of implementation and operation of the project are studied and some recommendations are presented.

1. Bangkok Metropolitan Administration (BMA)

BMA is the regional government to administer the 24 districts of Bangkok Metropolis which has an area of 1,589 km^2. The Governor and four Deputy Governors are appointed by the Cabinet and the Undersecretary by Minister of Interior while Bangkok Metropolitan Assembly is the formal body to govern BMA (Fig. N.1).

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.

2. Department of Drainage and Sewerage (DDS)

The Bureau of Drainage and Sewerage (BDS) was established in 1977 as a body separated from the Bureau of Sanitation. Because of increasing problems of flooding and waste water in the canals, BDS was established to be 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 then established a policy reinforcing its administrative powers. The number of officials at DDS is about 450, and it employs about 1,400 regular workers at present. (Table N.1) The DDS consists of four divisions and one secretary, which are divided into thirty-one sections.

Table N.1 Number of Officials and Employees of DDS

Division	Number				
	Section	Official	Regular employee	Temporary employee	Project employee
Secretary	4	45	12	1	-
Technical Diviaion	5	65	12	2	-
Drainage Control Division					
Canal Maintenance	11	180	751	127	300
Division	7	103	585	231	300
Wasts Water Treatment Division	4	59	13	8	-
TOTAL	31	452	1,373	369	600

Source: DDS Year Bank 1982

2.1 Drainage Control Division

Drainage Control Division consists of 11 sections, the largest in DDS. Before 1977, Drainage Control Division and Canal Maintenance Division were in the same bureau, Bureau of Cleaning. Despite its name, this division is in charge of sewer and drainage pipes.

(1) Sewer Maintenance Sections

There are three sections in this group, one for Thomburi area and two for Bangkok. These sections are in charge of cleaning of sediments in sewer pipes. 300 permanent labourers are employed for routine cleaning works, and during the rainy season, 300 more temporary workers are employed from March to December. Emergency operations in case of clogged pipes are also the task of these sections. Each section has two or three automobils and movable pumps.

(2) Store and Plant Section

This section is in charge of storing various materials for drain control, such as wood for flood walls, pipes, sand bags, cement etc. Manufacturing of manhole cover, made of cement or cast iron, is also taken care.

(3) Equipment and Vehicle Section

Besides materials stored in Store and Plant Section, various equipments such as pumps, trucks, cranes etc. are stored and maintained by this section.

(4) Drainage Engineering Section

This section takes care of construction and maintenance of the sewer system. There are 30 engineers, who also prepare the designs, installation and maintenance contracts for repair and construction works are placed by this section.

(5) Pumping Section

There are two large pumping stations, namely Klong Kasem Pumping Station, Rama IV Pumping Station and many smaller pumping stations. Maintenance and operation of these stations are done by three sections, one section each for the two large pumping stations and one section for small stations.

(6) Gate Control Section

Since almost all gates are controlled by Canal Maintenance Division, only a few gates are controlled.

2.2 Canal Maintenance Division

Canal Maintenance Division is in charge of drainage canals, and consists of seven sections.

(1) Survey and Planning Section

Surveying of canal conditions, design and construction supervision of cofferdams and retaining walls of the canals, and planning of maintenance projects are the major work of this section. The maintenance projects include yearly cleaning of canals, canal dredging, and construction of retaining walls.

(2) Store and Equipment Section

This section is in charge of supplying and storing of equipment, such as, dredging machinery, trucks, boats, gauging instruments and others for various maintenance works.

(3) Canal Maintenance Sections

There are four sections in charge of canal maintenance divided by the area. The tasks are dredging, collection of sediments, operation of gates at cofferdams and pumps. They employ 400 permanent labourers and 300 temporary labourers for special cleaning before the rainy season.

2.3 Technical Division

Technical Division is in charge of non-routine technical matters.

(1) Waste Water Research Section

The direct duty is to take the samples and check the quality of waste water in the canals and sewers all over the 24 districts. This section has laboratory in DDS. Besides these routine checks, a community which has an independent waste water treatment facility will request a check on the plant effluent.

(2) Planning and Project Section

This section is given an over-all planning and coordinating task.

(a) Set and draft all projects under DDS for five years following the Bangkok Development Plan

(b) Follow-up of all projects that will require government subsidy

(c) Drafting of documents requesting central government subsidy for important projects

(d) Ad-hoc work as required.

(3) Design Section

Design Section takes care of the design and preparation of tender documents for constructing gates, cofferdams, pumping stations, pump wells and other facilities under DDS except for canals and sewers which are under the Canal Maintenance and Drainage Control Division. This section is also in charge of providing technical advice for District Offices by designing water-ways within those jurisdictions.

(4) Construction Supervision Section

For construction works designed by the Design Section, this section appoints contractors by a selection committee within DDS, and supervises the work.

2.4 Waste Water Treatment Division

The function of this division is the operation and maintenance of two waste water treatment plants, the On Nooch Waste Water Treatment Plant and the Ram Inthra Waste Water Treatment Plant. This division, still under development, is expected to be expanded when treatment plant projects are implemented.

Besides these divisions, a special unit for flood fighting in case of an emergency flood occurence has been established. The function of the unit is to monitor water-levels and the installation and operation of movable pumps, sand bags and other flood-fighting activities with a 24-hour operation. The planning activities for the city core and eastern suburbs are in principle under the control of the Technical Division, but the project teams for each of the two projects are being set up within DDS with staff from relevant divisions.

As it can be seen from these statistics and activities for each division, DDS has been mainly in charge of the operation and maintenance of drainage and sewerage facilities.

3. Coordination With Other Government Authorities

Although drainage facilities under DDS play a major role in flood protection, coordination with central government authorities like RID, NEB, NESDB, finance offices, relevant BMA offices and research institutions is required. A BMA Directive Committee was established for this project to permit the Study Team have the opportunity of meeting and discussing the project with concerned offices from the central government, research institutions and BMA. (Fig. N.2) The Master Plan Area covers parts of four administrative districts, Huay Kwang, Phra Khanong, Bang Khen and Bang Kapi (Fig. N.3). Establishment of communications between residents and the authority through district offices will also help coordinating and publicizing activities.

In case of a flood control project in Japan, three kinds of committees are usually established for the purpose of coordination. These committees are directive committee, advisory committee and working committee. Each committee consists of representatives from central government, prefectural or metropolitan government and district offices. A directive committee is formed with top officials, an advisory committee is formed with officials of director level and a working committee is formed with officials of chief-of-section level.

3.1 Organizations for Structural and Non-Structural Measures

The structural as well as the non-structural flood protection measures have to be studied and implemented by collaboration between the governmental organizations concerned. Especially, since for flood plain management to become effective, interdepartmental coordination is important. It is proposed for DDS to have a central flood information centre. Table N.2 indicates the essential functions by structural and non-structural measures at two levels. The activities covered by each organization is indicated on Fig. N.4.

Table N.2 Structural and Non-Structural Measures Required at National and Executing Agency Level

	National Level	Executing Agency Level
Structural	Construction, operation and maintenance of physical facilities under control of RID, Highway Railway Dept., Public works and surrounding provinces.	Construction, operation and maintenance of physical drainage facilities and emergency relief activities
Non-Structural	Land use control, Establishing building code, weather and land subsidence information covered by City Planning Division, TCPD, NEB and Meteological Dept.	Flood plain management, publicizing, forecasting and warning of flood.

3.2 Organization for Urgent Measures

As it has been explained in previous chapters, "The Committee of Flood Protection and Solution in BMA and the vicinity", the Urgent Committee, was formed in October, 1983 as a committee for implementing urgent flood protection measures. The Urgent Committee is chaired by a deputy Prime Minister and its 18 members include BMA and other ministerial level organizations. Two sub-committees have been established, one for project allocation which deals with implementation of urgent projects, the other for coordination, evaluation and publicizing activities. An additional sub-committee for non-structural measures is being considered (Fig. N.5).

The function of the Urgent Committee is defined as follows:

1) Present the long and short term plans for flood protection and solution.
2) The centre of coordination between the related governmental sections.

3) The centre of distribution and public relations about flood protection and solution in BMA and the vicinity.

4) Appoint sub-committees for assistance.

5) Execute other works as instructed by the Prime Minister.

3.3 National Flood Protection Agency

NESDB is planning a permanent flood protection agency at a national level in order to take up a long-term flood control plan for Bangkok. This was announced in October 1984, and the formation of which is still under study.

4. Recommendations for Organizational Aspect

At present, the Urgent Committee is acting as a flood protection committee at national level. However, since this organization is of a temporary nature, it will be dissolved when large flood damage is alleviated by the urgent measures. As it has been explained in previous chapters, the flood damage potential will increase annually due to land subsidence and urbanization. In order that Bangkok be provided with permanent flood protection measures, it is essential to have a permanent national-level flood protection organization within a committee or independent government agency, incorporating a similar function as the Urgent Committee. Under the national flood protection organization, structural and non-structural measures, especially flood plain management should be strengthened (Fig. N.7). The following are recommended measures for flood plain management and implementation for this project.

4.1 Flood Plain Management

(1) Strengthening Planning Function for Non-Structural Measures

Under a committee in charge of non-structural measures at national level, its agency-level organization is recommended to be established to analyze the data and give advice to the authorities concerned. For example, under the proposed Flood Protection Organization at national level, a centre for planning non-structural measures can be established at the same level as the technical centre. This planning centre should have specialists to cover the following subjects.

i) Land use planning for drainage control
ii) Study for reserving areas for rainwater retention
iii) Building code for anti flood measures
iv) Effective legislative and administrative guidances for flood plain management

The planning center is desirable to be readed by an authority on city planning, for example, from City Planning Division of BMA or TCPD. The staff should come from DDS, City Planning Division, Policy and Planning Division, institutions and other relevant offices.

(2) Setting Up Central Flood Control Information Centre

The present system for flood control and flood fighting team within DDS should be strengthened by facilitating automatic water level gauging system and radio and telephone information network. In case of flooding, this centre should obtain the water levels at key locations and with estimated precipitation information, should instruct the operation of gates and pumps in order to minimize the flood damage over the whole area.

(3) Setting Up Information Office

Educating residents of Bangkok concerning the causes, conditions and countermeasures against floods is important to enable effective measures to be implemented. The office informs the public through the media and District Office about previous flood conditions and the estimate of future flooding and severity, how the government is planning and conducting the flood protection measures, and what each resident should prepare. It was found that during the interview with residents for flood damage survey, some of them assume BMA's total responsibility for flooding, without realizing that land subsidence and urbanization are the major causes of flooding. Taxes and other financial impositions will be more readily accepted, if the residents have proper understanding to causes of flooding.

4.2 Project Implementation

At present, a project team for studying and planning this project has been set up under the Technical Division of DDS. For the implementation stage, this project team should be expanded into an organization with the same level as the divisions, with the following functions:

i) Administration and programming

ii) Design

iii) Construction supervision

The use of foreign and local consultants will be necessary to obtain the expertise necessary for efficient implementation. This team should be under the coordination of sub-committees for structural and non-structural measures at national level.

5. Operation and Management Plan

In order to govern drainage facilities in the 260 km^2-area which include 55 control gates, 10 pumping stations and 208 km-klongs, a separate office under DDS is required to take care of drainage of eastern Bangkok at the local level, for example, at Phra Kanong in the future (although the facilities belong to RID at present). The case of Koto Area Drainage Office of Tokyo Municipality can be referred here. In south-eastern part of Tokyo, there is a low land delta area called "Koto zero-metre area". The area is about 40 km^2 accommodating 700,000 residents, its elevation is from -1.5 m to 2.0 m. The area used to have severe floods caused by heavy rain and high tides, but is protected now with dykes, canals, 7 gates, two pumping stations, one navigation lock and one flushing gate. The Koto Area Drainage Office which is under Construction Bureau of Tokyo Municipality controls all these facilities besides other drainage failities in the neighbouring flood-prone areas. The Koto Area Drainage Office is equipped with telemetering system which continuously informs the water-level of 13 stations. This local office is in charge of directing each gate and pumping station for emergency oprations by analyzing all information from a telemetering board, rainfall, wind and other weather information (Fig. N.6).

For the effective management of operation and management of drainage facilities in Eastern Suburban-Bangkok, the establishment of "Eastern Suburbs Drainage Office" is proposed (Fig. N.8 and N.9).

The proposed "Eastern Suburbs Drainage Office" will consist of:

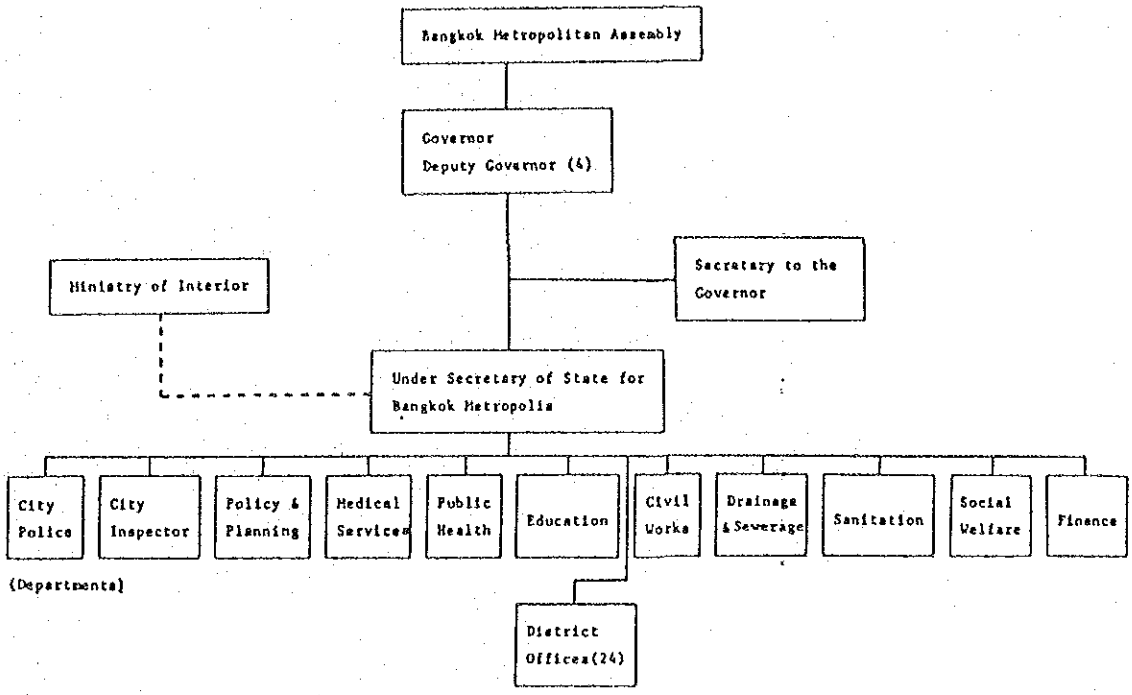
(1) Secretary General Administration (3 sections)
(2) Design Division (3 Sections)
(3) Maintenance Division (8 sections & 10 pumping stations)
(4) Construction Division (4 sections)

A special unit for emergency flood fighting will be attached similar to the DDS. The operation and maintenance and the construction sections can be split into several sections according to the size of drainage area. For operations 4 drainage facilities, the officials at each pumping station and gate are provided with an "Operations Manual" which defines the standard operations in normal, urgent and emergency situations. The operation should include not only flood-protection measures, but also the operation of facilities to maintain water levels for navigation and flushing water for water cleanliness. The key facilities should be operated on a 24-hour basis. The Eastern Suburbs Drainage Office should be in close contact with central DDS office, especially for those operations of drainage facilities adjacent to the core and surrounding areas during rainy season.

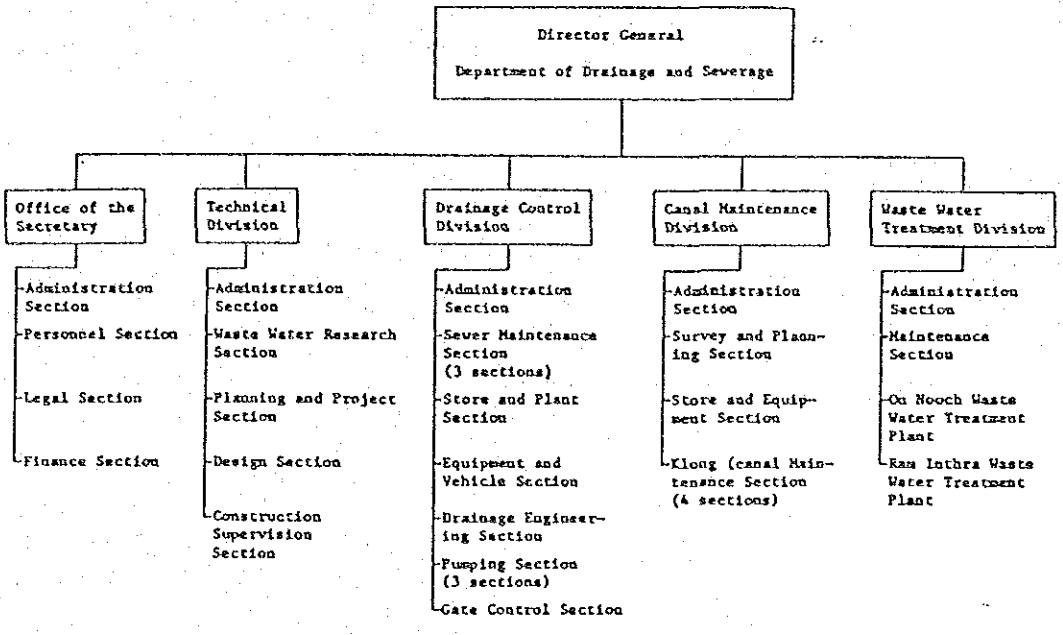
The total number of officials attached to the Eastern Suburbs Drainage Office would be 118, by assuming four to five officials are to be allocated to each of 28 sections. Its breakdown is shown on Table N.3.

Table N.3 Number of Officials at Eastern Suburbs Drainage Office

Divisions	Number of Sections	Number of Officials
Secretary	3	12
Design Division	3	15
Maintenance Division	8	40
	10 Pumping Stations	30
Maintenance Division	4	12
Emergency Flood Fighting Unit	1	5
Total	28	118



BANGKOK METROPOLITAN ADMINISTRATION



DEPARTMENT OF DRAINAGE AND SEWERAGE

Fig. N.1 ORGANIZATION CHART OF BMA AND DDS

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

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BMA Directive Committee

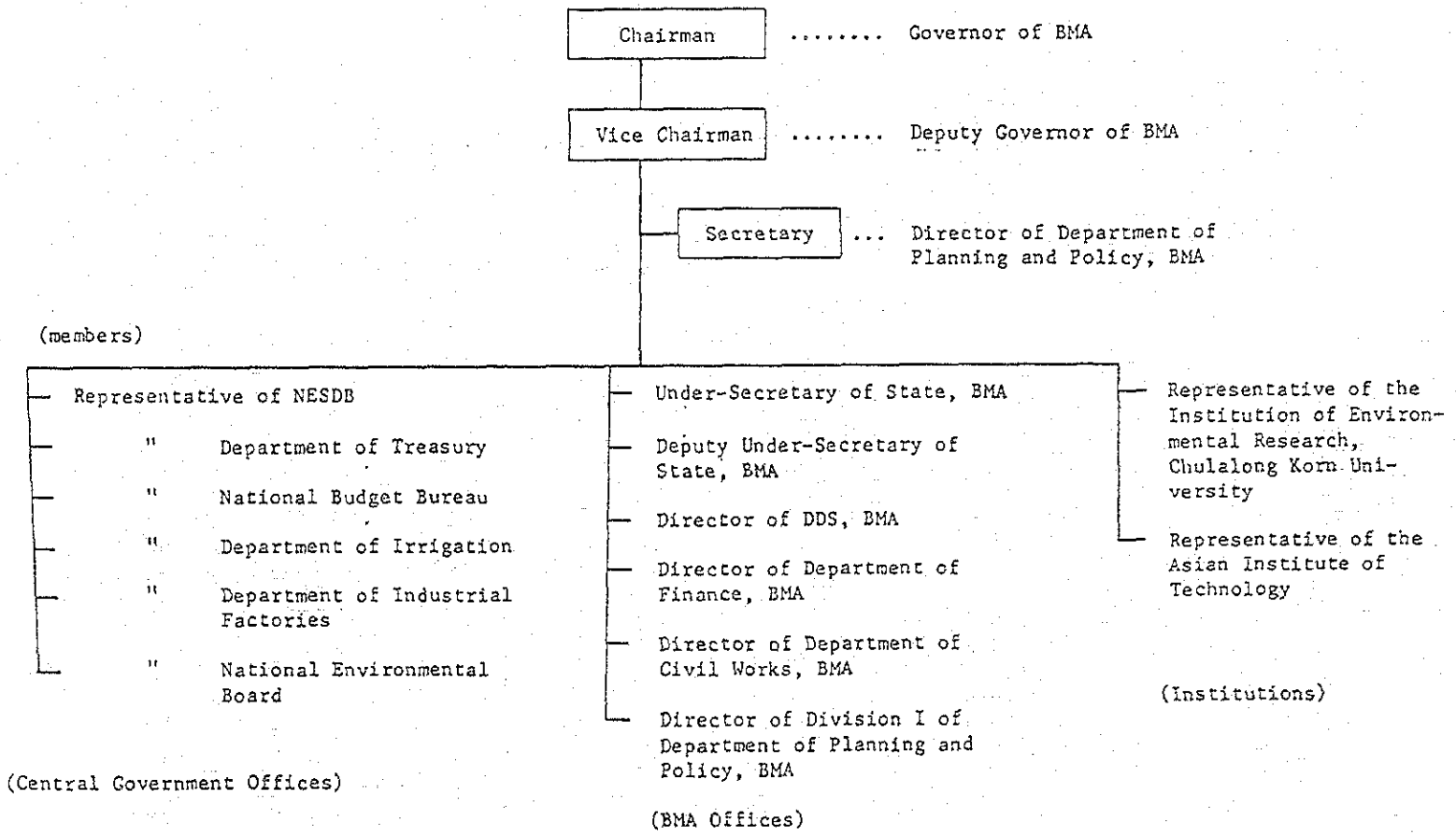

Fig. N.2	BMA DIRECTIVE COMMITTEE

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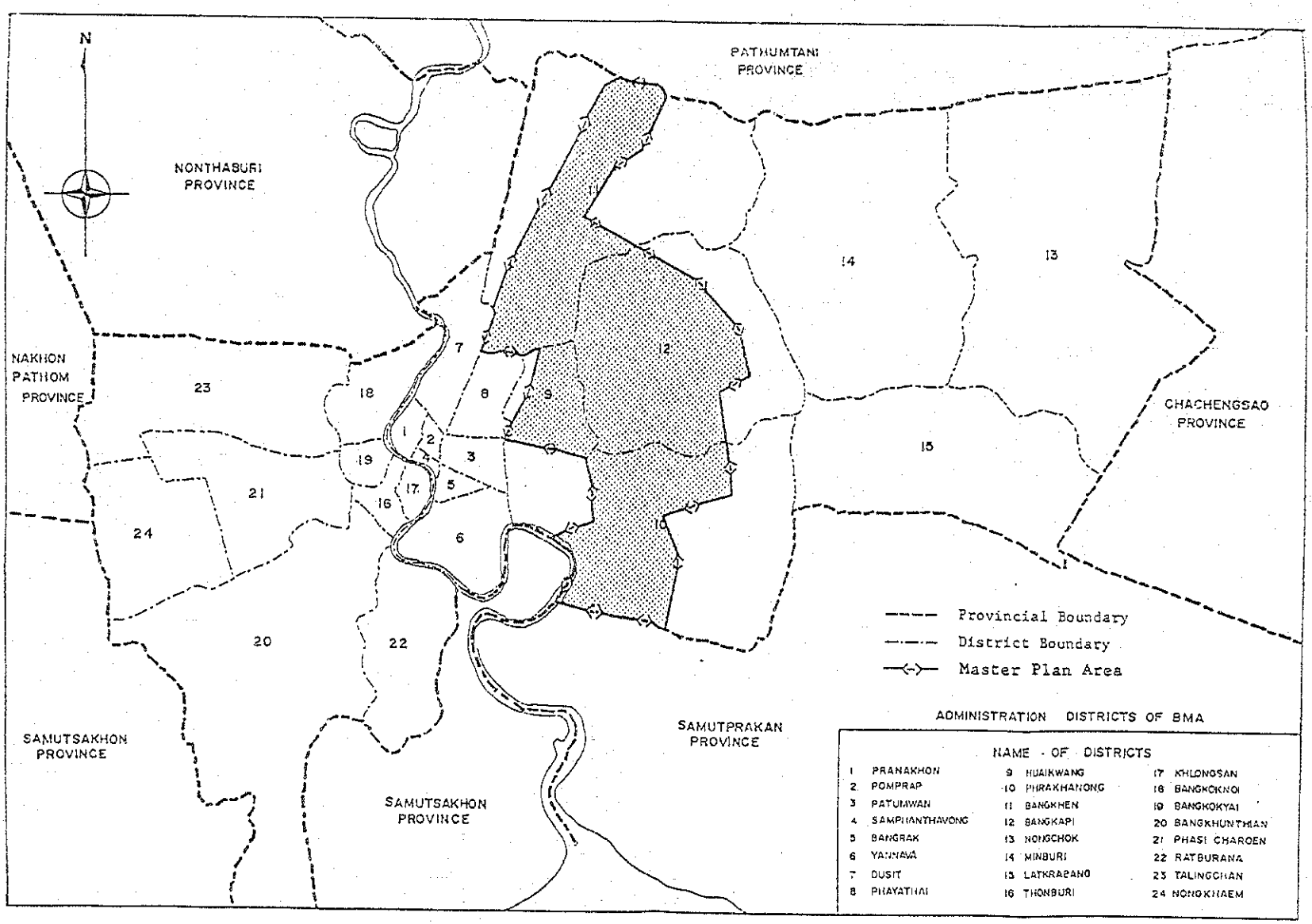

Fig. N.3 ADMINISTRATIVE DISTRICTS OF BMA

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STRUCTURAL AND NON-STRUCTURAL MEASURES COVERED BY EACH ORGANIZATION

	Names of Organization	Structural	Non-Structural
National Level	R I D	Conrtol of rivers and outer water with facilites under RID	
	T C P D		Land use control in drainage area
	Highway Dept	Utilization of highwaya as dikes	
	State Railway Dept	Utilization of railway as dikes	
	Meteorological Dept and Port Authority		Weather information for flood control
	N E B and M W W A		Land subsidence control
B M A Level	City Planning Division		Land use control in drainage area
	D P W	Utilization of roads as dikes	
	D D S	Control of drainage facilites flood-fighting operation	Flood forecasting publicizing

Fig. N.4 STRUCTURAL AND NON-STRUCTURAL MEASURES COVERED BY EACH ORGANIZATION

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

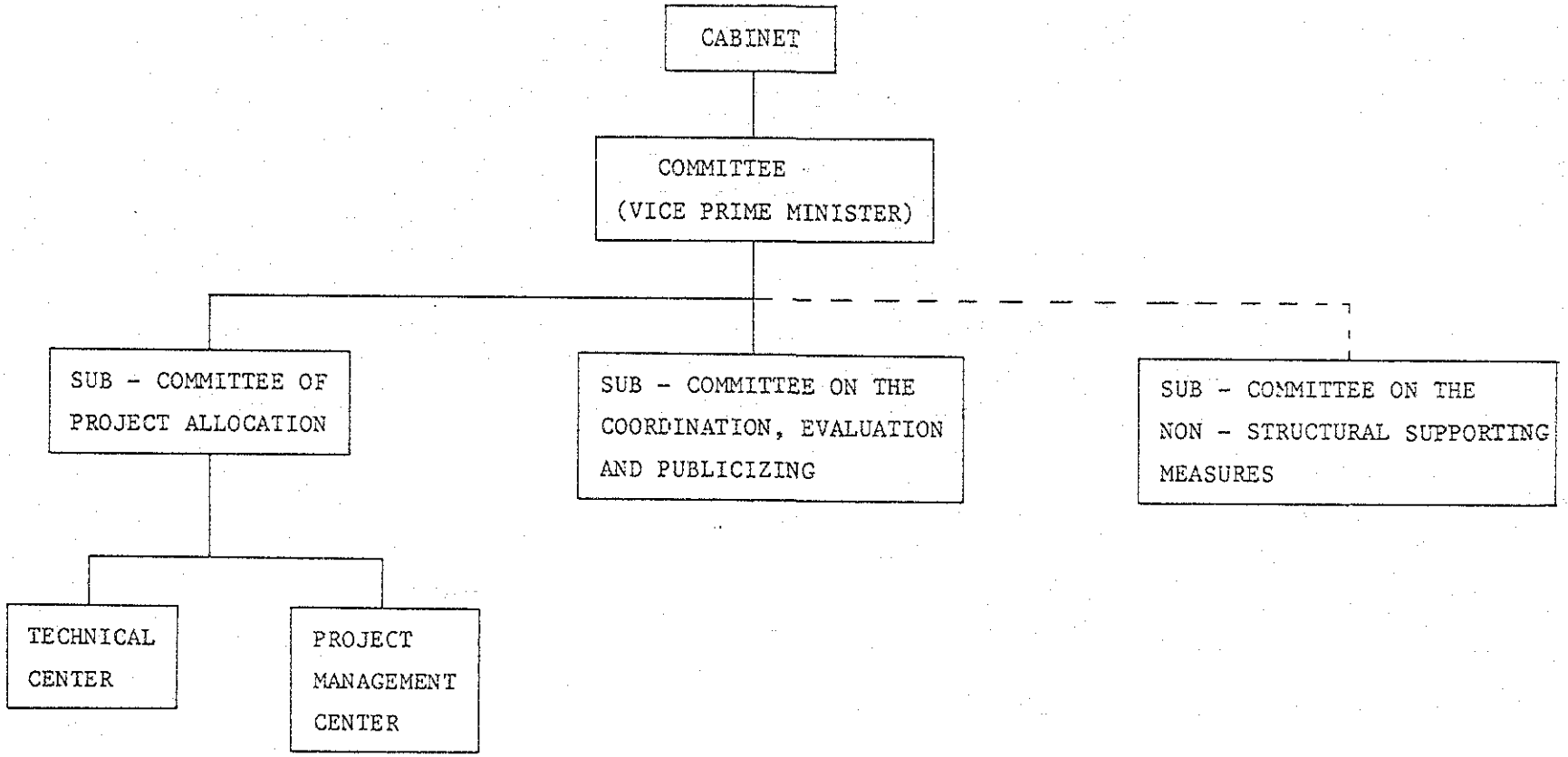

Fig. N.5 ORGANIZATION OF THE URGENT COMMITTEE

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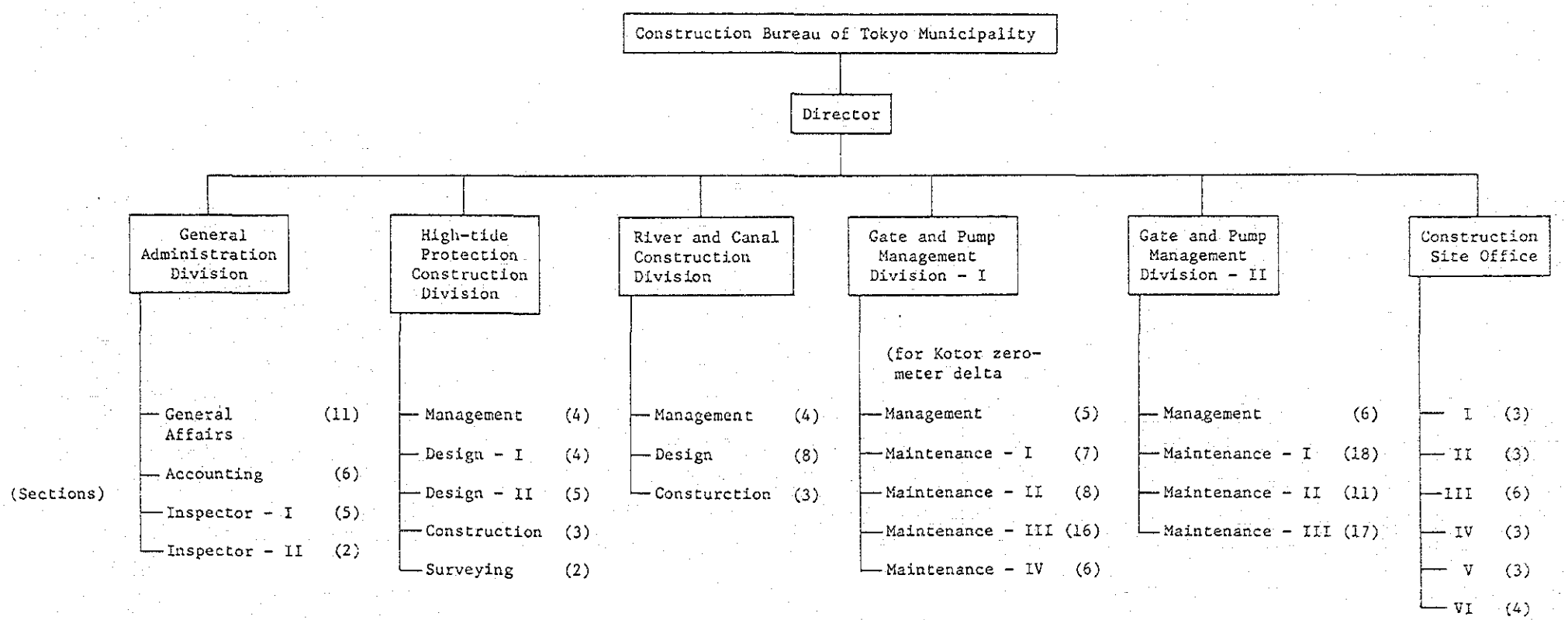

Fig. N.6 ORGANIZATION OF KOTO AREA DRAINAGE OFFICE

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

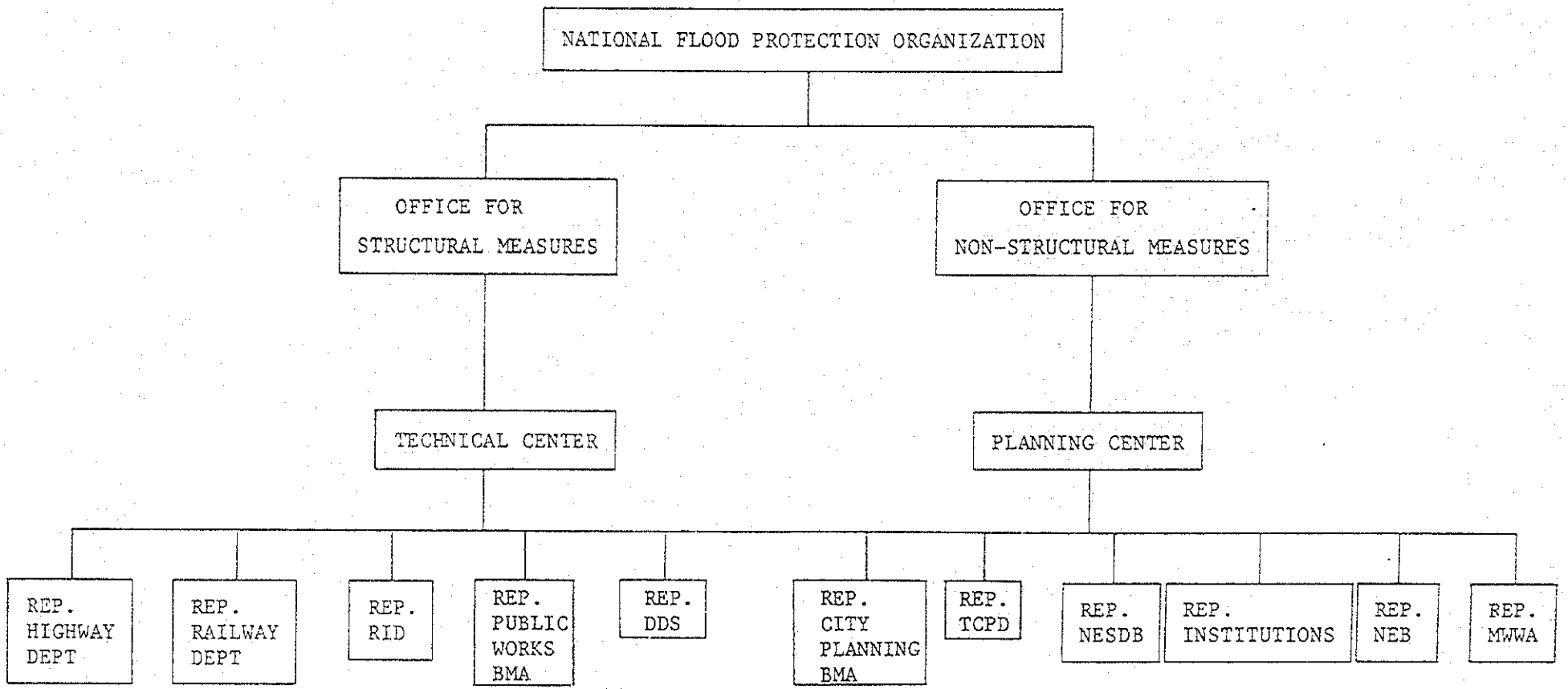

Fig. N.7 PROPOSED ORGANIZATION SCHEME (1)

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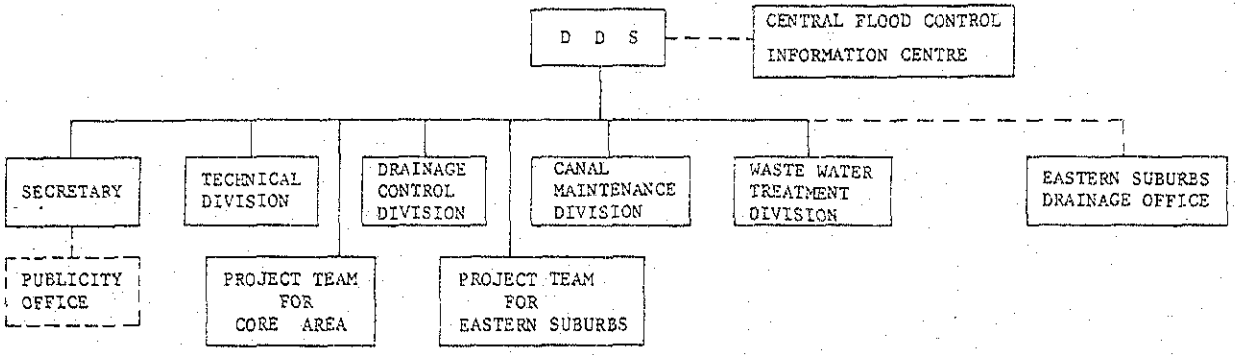

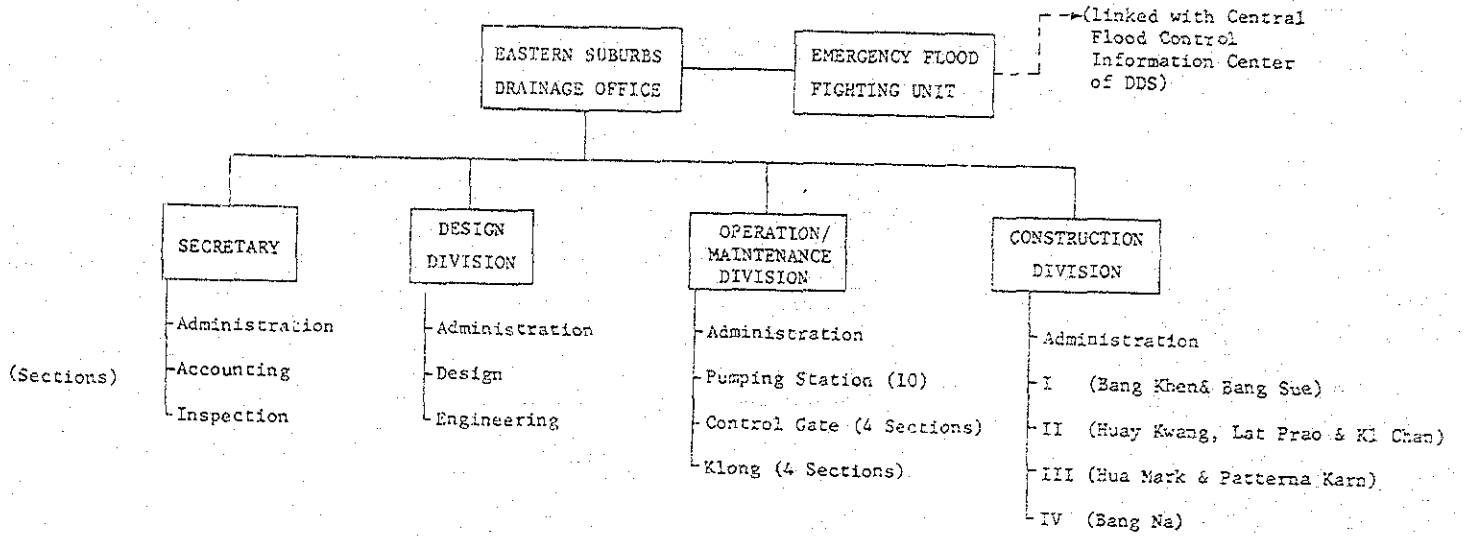

Fig. N.8 PROPOSED ORGANIZATION SCHEME (2)

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

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APPENDIX O

FINANCE

APPENDIX O FINANCE

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Appendix O FINANCE

1. Revenue and Expenditure of BMA and DDS

Revenue of BMA consists of taxes, fees, property and business revenue, subsidy from the central government and other miscellaneous revenue. (Table O.1) The largest portion is the tax revenue (68% in 1984) which consists of local taxes (13%) and taxes collected by the central government or shared tax, (55%). Within local taxes, there are four kinds of taxes:

Local Taxes

i) House and Land Tax
ii) Land Development Tax
iii) Signboard Tax
iv) Gambling Tax

House and Land Tax is charged to the owners of buildings based on property valuation of the building and attached land. Land Development Tax is collected by owners of land except for the attached land to the building subject to House and Land Tax. These are only taxes based on property valuation and their rate is the same through the kingdom. The recent study by the World Bank indicates that there is room to increase these taxes by improving collection method as well as property valuation. Amounts of taxes and fees collected by district offices are listed on Table O.2.

The shared taxes (Taxes collected by the central government agencies), are in seven items.

Shared Taxes

i) Business Tax
ii) Entertainment Tax
iii) Beverage and Spirit Tax
iv) Petroleum and Petroleum Product Tax
v) Cement Tax
vi) Vehicle Tax
vii) Rice Premium Tax

These taxes are collected by various agencies such as Revenue Dept., Excise Tax Dept., Customs Dept. and Land Transport Dept., and then transfered to BMA after deducting collection cost at each agencies. The shared tax has the largest portion of BMA revenue. (55% in 1984)

The central government subsidy is provided for education and several projects, sharing 24% of BMA budget in 1984. Thus, the fund flow from the central government, shared tax and subsidies, amounts to nearly 80%, indicating a limited financial autonomy of BMA.

On expenditure side, the allocation for Drainage and Sewerage has been increasig from 277 million baht in 1982 to 387 million baht in 1983 and 752 million baht in 1984. In 1985 (Oct. 1984 to Sept. 1985), it is 895 million baht, 15% of the 6,006 million baht of BMA budget. Within the drainage and sewerage budget, the majority portion is allocated to DDS while the rest is allocated to district offices for their own flood protection measures. Table 0.3 shows breakdown of DDS budget, indicating sharp increase in flood protection related expenses. Table 0.4 indicates budget for four district offices covering the Master Plan Area, Bangkapi, Bang Khen, Phra Khanong and Huay Kwang with their drainage budget newly allocated in 1984 after 1983 flood. From these budget figures, the BMA is paying keen attention to flood protection and drainage measures, which is being executed at DDS level and also at District Office level.

2. Financial Plan

The total construction cost of 11,000 million baht has been estimated for the Master Plan. In the case of the city-core project, the whole project cost is 3,500 million baht, but because of financial constraints, the key facilities have a reduced design criteria as a "Priority Package" consisting of 2,050 million baht. In this Master Plan, the implementation schedule is divided into six stages in order to seek a realistic and financialy sound exeuction of the project.

Construction Cost by Stages

Stages	I	II	III	IV	V	VI	Total
Year	1987 1991	1992 1996	1997 2000	2001 2005	2006 2010	2011 2015	
Cost (Million Baht)	2,560	1,830	1,880	1,560	1,560	1,550	10,940

The following conditions are assumed for financial planning.

Projection period:

(1) For a financial projection, the period is assumed for 30 years (1987 - 2016).

(2) Frgm the six stages of construction, the first three stages are picked up to lay out a cash flow table:

Stages	I	II	III	Total
Year	1987 - 91	1992 - 96	1997 - 2000	
Cost (million Baht)	2,560	1,830	1,880	6,280

Expenditure (cash out-flow) side:

(1) Construction cost is spreaded evenly for each year during the construction period.

(2) Operation and Maintenance (O/M) cost is assumed as 3% of the cumulative construction cost.

(3) Loan repayment starts after the construction and its period is for 20 years, with the same amount due every year.

(4) Interest of the loan is 3.5% per year.

Revenue (cash in-flow) side:

(1) 40% of the construction cost is foreign currency, covered by foreign loan during the construction period.

(2) 30% of the construction cost (1/2 of local currency portion) is covered by subsidy by the central government.

(3) The remaining 30% of the construction cost is covered by BMA budget.

The cash-flow schedule for 30 years (project life) from 1987 until 2016 is shown on Table 0.5. The tables also give different interest rate of foreign loan to 6% and 10%.

In the first stage (฿ 2,300 million), BMA has to finance ฿ 138 million in 1987 which increases up to ฿ 219 million in 1991, the construction period of five years. From 1992, loan repayment, interest and O/M costs ฿ 147 million in 1992 which decreases to ฿ 117 million in 2001. From 2012, BMA's cost burden is only O/M cost, ฿ 69 million. The stage two (฿ 2,000 million) start from 1992 with smaller yearly cost than stage I. For stage III, since the construction period is four years by year 2,000, the annual cost for BMA is slightly higher than the stage II.

The total financial burden of BMA for these three stages would range from ฿ 138 million in 1987 to its peak of ฿ 474 million in 2000. Then the cost gradually decreases from ฿ 383 million in 2001 to ฿ 277 million in 2016 while it takes five more years to completely pay back the borrowing. (Fig. 0.1)

A differece in interest rate of foreign loan alters financial burden for BMA, the ratio of interest amount to the total BMA payments in the 30 years are:

Interest	Total interest / Total cost for BMA
3.5%	11%
6%	18%
10%	27%

These figures suggest degree of advantage in borrowing lower-interest loan.

3. Developing Financial Resources

Although the budget for drainage in BMA has been largely increasing recently, allocation of extra fund for this project might be difficult from the current BMA's financial resources. Finding a new financial source for this project is therefore desirable, and the possibilities for this are given below.

(1) Increasig the Current Tax

For House and Land Tax and Land Development Tax scheme, increasing of property valuation should be considered, since owners of land as well as commercial and industrial properties are beneficiaries of flood protection in the Bangkok area. For other Taxes, improvement of collection system should be considered. If an increase of 20% can be achieved, 200 million Baht will be available annualy, if 25% of the increase can be allocated to this project.

(2) Surcharge to Developers in the Master Plan Area

Since the Master Plan Area includes vacant areas to be developed in the future, collecting a surchage from developers who develop residential projects can be an effective tool. A similar system is adopted in Yokohama city in Japan, whereby a fund is collected by levy from house developers to plant trees to prevent environment deterioration caused by residential area development. If ฿1,000 per resident can be collected for 1.5 million new residents upto year 2,000, a total of 1,500 millon Baht will be available.

(3) Urban Development Tax

Urban Development Tax in Japan is used for developing various urban infrastructures including roads and drainage systems. This tax is levied only in the urban and suburban areas, since urban-infrastructure has to be financed in addition to the general tax revenue. This is levied on the land owner, since

the value of the land increases as urban infrastructure develops. If a 2.5 - 5% tax is imposed, about 100 million baht will be available annualy.

(4) Formation of Residents Cooperative

For development of tertiary canals, forming a cooperative by residents in the area is suggested. The procedure is that the government announces that the residents in an area agree to contribute a certain amount for tertiary canal construction, to which a subsidy will be added at some rate (e.g. 50%). By this way the budgetary burden to the government will be lessened.

According to the damage survey, residents in the flood-prone areas are willing to pay around ฿1,000 per house for flood prevention. This means part of the cost can be covered directly by beneficiaries if they are convinced that flood conditions will be improved by their participation. In the implementation program, this idea will be applied from stage IV, since the tertially canal construction are mainly after the stage III.

In developing those financial resources, the following adverse impacts are anticipated, and it requires further study for effective rate to be imposed.

(a) Inflational effect
An increase in tax rate and new tax on real estate would increase the rent of house and building which makes the living cost in Bangkok higher.

(b) Uneven development
If the developers' surcharge is too high comparing with locational advantage of the Master Plan area, urbanization speed will become slower than other areas.

(c) Cooperative Formation
Since formation of residents' cooperative is based on "willingness" of residents, some area might left without drainage pipes because of unable to form cooperatives with various reasons. Some other measures have to be considered in this case.

4. Schedule of BMA Resource Allocation

Table O.6 indicates Revenue and expenditure flow of BMA under assumptions that the proposed financial resources in the previous section are available. There are three sources, tax increase, development surchage and Urban Development Tax.

The Tax Increase is assumed that 100 million Baht is available for this project in 1987 and increases at 5% until year 2,000. This can be further increased if stage 4, 5 & 6 are to be implemented. For this calculation, however, 2.5% increase is assumed after the construction period.

The development surcharge is imposed for developers during the implementation period. 107 million Baht per year is available from 1988 to 2001.

The Urban Development Tax might be realized after 5 years of Tax Increase. Its amount is about 1/2 of the Local Tax Increase.

The project can be financed with these resources as it is shown on the table O.6 and Fig. O.1. According to the table O.6, all the deficit is cleared out in year 2014.

These figures further indicates that construction stages beyond year 2,000 can be financed by allocating more fund to the project, thus the total cost of 11,000 million Baht can be financed if foreign loan and government subsidy are also available.

Although the above analysis took rather conservation approach, it also present a "manu" that the authority has a choice in implementing stages considering difficulty in establishing new tax or fee collection system. However, since the serious flood damage potential increases annually, the effort to creating these financial resources should be taken as soon as possible.

5. Conclusion

How to finance flood protection project under tight budget of BMA has been on debate. After 1983 flood, when idea of "flood tax" to be levied on residents in flood-prone area was proposed, the idea was strongly opposed by the residents.

However, it is necessary to educate the public that the certain cost is necessary investment to maintain and increase the value of land and property by preventing more serious damages which are anticipated in the future. The administrators have to find ways to collect fund from beneficiaries. This is not limited in flood protection facilities, but common for any urban infrastructure development. In the Preliminary Study, it was indicated that tax burden for Bangkok residents is comparatively very low than that of other foreign country.

It is recommended for BMA to increase its own financial autonomy, which will induce more furid from the central government and foreign aid, so that the financial constraint would be break through.

Table 0.1 BMA ANNUAL BUDGET (1982 - 1984)

Revenue	1982 (2525)		1983 (2526)		1984 (2527)	
	฿ mill	%	฿ mill	%	฿ mill	%
1. Tax Revenue	3,224.87	68.3	3,266.00	69.8	3,732.00	68.3
(BMA Local Taxes)	(616.13)	(13.1)	656.50	(14.0)	(721.50)	(13.2)
(Shared Taxes)	(2,608.74)	(55.2)	(2,609.50)	(59.8)	(3,010.50)	(55.1)
2. Fee for Licensing & Permits	49.94	1.0	100.17	2.1	105.93	1.9
3. BMA Property Revenue	252.01	5.3	183.30	3.9	224.68	0.4
4. Business Revenue	8.90	0.2	8.90	0.2	10.30	0.2
5. Others	78.55	1.7	197.24	4.2	84.42	0.8
Sub Total	3,660.28	77.6	3,755.62	80.3	4,157.33	76.1
6. Central Government Subsidy	1,059.62	22.4	921.20	19.7	1,306.40	23.9
Total	4,719.91	100.0	4,676.82	100.0	5,463.73	100.0

Expenditure	1982 (2525)		1983 (2526)		1984 (2527)	
	฿ mill	%	฿ mill	%	฿ mill	%
1. Public Work	952.15	22.2	909.98	19.0	1,216.13	21.5
2. Education	912.26	21.3	897.03	18.5	936.12	16.6
3. Project Expenditure	738.11	17.3	624.38	13.0	598.16	10.6
4. General Administration	519.48	12.1	636.23	13.3	611.22	10.8
5. Medical & Sanitation	394.29	9.2	487.09	10.2	611.09	10.8
6. Cleaning	308.19	7.2	618.44	12.9	569.67	10.1
7. Drainage & Sewerage*	277.21	6.5	387.49	8.1	752.04	13.3
8. Social Welfare	116.60	2.7	122.55	2.6	167.13	2.9
9. Loan Repayment	7.32	0.2	3.63	0.1	2.17	0.04
10. Commerce	55.46	1.3	114.97	2.4	183.82	3.3
Total	4,281.07	100.0	4,791.79	100.0	5,647.55	100.0

* This includs budget for DDS and drainage budget for District offices

Source: BMA Document

Table 0.2 DDS ANNUAL BUDGET (1982 - 1984)

(฿ 1,000)

	1982 (2525)	1983 (2526)	1984 (2527)
A. General Administration			
1. Secretary	3,372	4,099	4,536
2. Technical Administration	3,282	3,982	4,605
B. Drainage and Sewerage			
1. Drainage Control	) 166,665	134,826	165,866
2. Sewer Cleaning		18,000	18,000
3. Klong Maintenance	) 54,017	62,201	100,995
4. Klong Improvement		4,843	7,402
5. Project Study for Thombri	-	-	1,500
6. Project for Reserving Temples	-	8,300	20,000
7. Survey of Klong Network	-	469	-
8. Waste Water Treatment	8,449	7,908	5,051
9. City Core Flood Protection Project	) 41,420	) 136,673	31,622
10. Suburban Flood Protection Project			61,000
DDS Total Budget	277,205	381,297	420,578

Source : BMA Document

Table 0.3 BUDGET FOR FOUR DISTRICT OFFIECE (1983 - 1984)

(฿ 1,000)

Name of District	1983 (2526)	1984 (2527)
Bang Kapi		
Drainage	-	38,055
Others	37,088	27,125
Total	37,088	65,180
Bang Khen		
Drainage	-	49,500
Others	60,047	34,931
Total	60,047	84,431
Phrakanong		
Drainage	-	35,089
Others	67,287	55,937
Total	67,287	91,026
Huai Kwang		
Drainage	-	13,837
Others	26,600	18,436
Total	26,600	32,273
All 24 Districts		
Drainage	6,193	331,462
Others	667,746	592,607
Total	673,939	924,069

Source : BMA Documents

Table 0.4 TAX & FEE COLLECTED BY DISTRICT OFFIECE OF BMA

Year 1982

Item	District	House & Land Tax	Land Development Tax	Sign Board Tax	Solid Waste Collection Fee	Sewage Transport Fee
1.	PHA NA KRON	26,515	1,542	2,049	1,057	621
2.	DUSIT	19,175	5,637	1,185	1,019	829
3.	PRA YA THAI	36,050	7,615	4,285	1,366	1,013
4.	*BANG KHEN	22,329	9,754	2,876	344	785
5.	*HUYKWANG	15,969	8,126	1,315	298	488
6.	*BANGKAPI	12,109	12,339	1,670	406	813
7.	MINBURI	2,409	1,851	103	170	13
8.	NONG CHOK	639	1,484	19	27	2
9.	PRATHUMWAN	46,746	3,694	5,210	1,199	432
10.	PROMPRAB	20,144	836	2,468	732	287
11.	BANGRAK	52,643	2,301	4,638	959	438
12.	YANNAWA	38,563	8,675	1,367	1,658	926
13.	SAMPANTHAWONG	14,841	297	2,816	741	202
14.	*PHRAKANONG	79,937	18,529	4,742	2,185	1,311
15.	LADKRABANG	1,135	1,844	78	166	13
16.	THONGBURI	16,746	1,600	879	625	489
17.	KLONGSAN	11,383	1,071	590	512	416
18.	BANGKOK NOI	19,908	2,131	879	607	784
19.	BANGKOK YAI	5,622	975	283	541	271
20.	PRASRICHAROEN	8,292	2,568	517	352	282
21.	BANGKUNTHIEN	7,312	2,755	312	264	247
22.	TALINGCHAN	547	1,731	21	21	39
23.	NONGKAEM	2,100	1,440	66	63	37
24.	RADBURANA	11,704	2,356	371	540	178
	TOTAL	472,827	101,162	38,750	15,863	10,930

* Districts covering the Master Plan Area

Source : BMA Documents

CONSTRUCTION STAGE 1 COST 2560 IMPLEMENTATION SCHEDULE (1) INTEREST RATE 3.5 %

YEAR	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
CASH IN BMA	154	176	199	221	244	164	162	160	158	157
SUB	154	154	154	154	154	0	0	0	0	0
LOAN	205	205	205	205	205	0	0	0	0	0
TOTAL	512	535	557	580	602	164	162	160	158	157
CASH OUT CON	512	512	512	512	512	0	0	0	0	0
O/M	0	15	31	46	61	77	77	77	77	77
LOAN	0	0	0	0	0	51	51	51	51	51
INT	0	7	14	22	29	36	34	32	30	29
TOTAL	512	535	557	580	602	164	162	160	158	157
CUM CON COST	512	1024	1536	2048	2560	2560	2560	2560	2560	2560
CUM LOAN AMT	205	410	614	819	1024	1024	1024	1024	1024	1024
CUM LOAN REP	0	0	0	0	0	51	102	154	205	256
CUM LOAN BAL	205	410	614	819	1024	973	922	870	819	768
CUM BMA FIN	154	330	528	750	993	1157	1319	1479	1638	1795

YEAR	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
CASH IN BMA	155	153	151	150	148	146	144	142	141	139
SUB	0	0	0	0	0	0	0	0	0	0
LOAN	0	0	0	0	0	0	0	0	0	0
TOTAL	155	153	151	150	148	146	144	142	141	139
CASH OUT CON	0	0	0	0	0	0	0	0	0	0
O/M	77	77	77	77	77	77	77	77	77	77
LOAN	51	51	51	51	51	51	51	51	51	51
INT	27	25	23	22	20	18	16	14	13	11
TOTAL	155	153	151	150	148	146	144	142	141	139
CUM CON COST	2560	2560	2560	2560	2560	2560	2560	2560	2560	2560
CUM LOAN AMT	1024	1024	1024	1024	1024	1024	1024	1024	1024	1024
CUM LOAN REP	307	358	410	461	512	563	614	666	717	768
CUM LOAN BAL	717	666	614	563	512	461	410	358	307	256
CUM BMA FIN	1949	2103	2254	2403	2551	2697	2841	2983	3124	3263

YEAR	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
CASH IN BMA	137	135	133	132	130	77	77	77	77	77
SUB	0	0	0	0	0	0	0	0	0	0
LOAN	0	0	0	0	0	0	0	0	0	0
TOTAL	137	135	133	132	130	77	77	77	77	77
CASH OUT CON	0	0	0	0	0	0	0	0	0	0
O/M	77	77	77	77	77	77	77	77	77	77
LOAN	51	51	51	51	51	0	0	0	0	0
INT	9	7	5	4	2	-0	-0	-0	-0	-0
TOTAL	137	135	133	132	130	77	77	77	77	77
CUM CON COST	2560	2560	2560	2560	2560	2560	2560	2560	2560	2560
CUM LOAN AMT	1024	1024	1024	1024	1024	1024	1024	1024	1024	1024
CUM LOAN REP	819	870	922	973	1024	1024	1024	1024	1024	1024
CUM LOAN BAL	205	154	102	51	-0	-0	-0	-0	-0	-0
CUM BMA FIN	3400	3535	3668	3800	3930	4006	4083	4160	4237	4314

Table 0.5 (1)

CASH FLOW TABLE

STAGE I

CONSTRUCTION STAGE 2 COST 1830 — IMPLEMENTATION SCHEDULE (II) — INTEREST RATE 3.5 %

YEAR	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
CASH IN BMA	0	0	0	0	0	110	126	142	158	174
SUB	0	0	0	0	0	110	110	110	110	110
LOAN	0	0	0	0	0	146	146	146	146	146
TOTAL	0	0	0	0	0	366	382	398	414	430
CASH OUT CON	0	0	0	0	0	366	366	366	366	366
O/M	0	0	0	0	0	0	11	22	33	44
LOAN	0	0	0	0	0	0	0	0	0	0
INT	0	0	0	0	0	0	5	10	15	20
TOTAL	0	0	0	0	0	366	382	398	414	430
CUM CON COST	0	0	0	0	0	366	732	1098	1464	1830
CUM LOAN AMT	0	0	0	0	0	146	293	439	586	732
CUM LOAN REP	0	0	0	0	0	0	0	0	0	0
CUM LOAN BAL	0	0	0	0	0	146	293	439	586	732
CUM BMA FIN	0	0	0	0	0	110	236	378	536	710

YEAR	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
CASH IN BMA	117	116	115	113	112	111	109	108	107	106
SUB	0	0	0	0	0	0	0	0	0	0
LOAN	0	0	0	0	0	0	0	0	0	0
TOTAL	117	116	115	113	112	111	109	108	107	106
CASH OUT CON	0	0	0	0	0	0	0	0	0	0
O/M	55	55	55	55	55	55	55	55	55	55
LOAN	37	37	37	37	37	37	37	37	37	37
INT	26	24	23	22	20	19	18	17	15	14
TOTAL	117	116	115	113	112	111	109	108	107	106
CUM CON COST	1830	1830	1830	1830	1830	1830	1830	1830	1830	1830
CUM LOAN AMT	732	732	732	732	732	732	732	732	732	732
CUM LOAN REP	37	73	110	146	183	220	256	293	329	366
CUM LOAN BAL	695	659	622	586	549	512	476	439	403	366
CUM BMA FIN	827	943	1058	1171	1283	1394	1503	1611	1718	1824

YEAR	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
CASH IN BMA	104	103	102	100	99	98	97	95	94	93
SUB	0	0	0	0	0	0	0	0	0	0
LOAN	0	0	0	0	0	0	0	0	0	0
TOTAL	104	103	102	100	99	98	97	95	94	93
CASH OUT CON	0	0	0	0	0	0	0	0	0	0
O/M	55	55	55	55	55	55	55	55	55	55
LOAN	37	37	37	37	37	37	37	37	37	37
INT	13	12	10	9	8	6	5	4	3	1
TOTAL	104	103	102	100	99	98	97	95	94	93
CUM CON COST	1830	1830	1830	1830	1830	1830	1830	1830	1830	1830
CUM LOAN AMT	732	732	732	732	732	732	732	732	732	732
CUM LOAN REP	403	439	476	512	549	586	622	659	695	732
CUM LOAN BAL	329	293	256	220	183	146	110	73	37	0
CUM BMA FIN	1928	2031	2133	2233	2332	2430	2527	2622	2716	2809

Table 0.5 (2)

CASH FLOW TABLE

STAGE II

CONSTRUCTION STAGE 3 COST 1890 — IMPLEMENTATION SCHEDULE (1) — INTEREST RATE 3.5 %

YEAR	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
CASH IN BMA	0	0	0	0	0	0	0	0	0	0
SUB	0	0	0	0	0	0	0	0	0	0
LOAN	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0
CASH OUT CON	0	0	0	0	0	0	0	0	0	0
O/M	0	0	0	0	0	0	0	0	0	0
LOAN	0	0	0	0	0	0	0	0	0	0
INT	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0
CUM CON COST	0	0	0	0	0	0	0	0	0	0
CUM LOAN AMT	0	0	0	0	0	0	0	0	0	0
CUM LOAN REP	0	0	0	0	0	0	0	0	0	0
CUM LOAN BAL	0	0	0	0	0	0	0	0	0	0
CUM BMA FIN	0	0	0	0	0	0	0	0	0	0

YEAR	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
CASH IN BMA	142	163	183	204	121	120	118	117	116	114
SUB	142	142	142	142	0	0	0	0	0	0
LOAN	189	189	189	189	0	0	0	0	0	0
TOTAL	473	493	514	535	121	120	118	117	116	114
CASH OUT CON	473	473	473	473	0	0	0	0	0	0
O/M	0	14	28	43	57	57	57	57	57	57
LOAN	0	0	0	0	38	38	38	38	38	38
INT	0	7	13	20	26	25	24	22	21	20
TOTAL	473	493	514	535	121	120	118	117	116	114
CUM CON COST	473	945	1418	1890	1890	1890	1890	1890	1890	1890
CUM LOAN AMT	189	378	567	756	756	756	756	756	756	756
CUM LOAN REP	0	0	0	0	38	76	113	151	189	227
CUM LOAN BAL	189	378	567	756	718	680	643	605	567	529
CUM BMA FIN	142	304	488	692	813	932	1051	1168	1283	1398

YEAR	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
CASH IN BMA	113	112	110	109	108	106	105	104	102	101
SUB	0	0	0	0	0	0	0	0	0	0
LOAN	0	0	0	0	0	0	0	0	0	0
TOTAL	113	112	110	109	108	106	105	104	102	101
CASH OUT CON	0	0	0	0	0	0	0	0	0	0
O/M	57	57	57	57	57	57	57	57	57	57
LOAN	38	38	38	38	38	38	38	38	38	38
INT	19	17	16	15	13	12	11	9	8	7
TOTAL	113	112	110	109	108	106	105	104	102	101
CUM CON COST	1890	1890	1890	1890	1890	1890	1890	1890	1890	1890
CUM LOAN AMT	756	756	756	756	756	756	756	756	756	756
CUM LOAN REP	265	302	340	378	416	454	491	529	567	605
CUM LOAN BAL	491	454	416	378	340	302	265	227	189	151
CUM BMA FIN	1511	1622	1733	1842	1950	2056	2161	2265	2367	2468

Table 0.5 (3)

CASH FLOW TABLE

STAGE III

Table 0.5 (4)

CASH FLOW TABLE

TOTAL OF STAGE I,II & III

TOTAL COST 6280

YEAR	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
CASH IN BMA	154	176	199	221	244	274	288	302	317	331
SUB	154	154	154	154	154	110	110	110	110	110
LOAN	205	205	205	205	205	146	146	146	146	146
TOTAL	512	535	557	580	602	530	544	558	573	587
CASH OUT CON	512	512	512	512	512	366	366	366	366	366
O/M	0	15	31	46	61	77	88	99	110	121
LOAN	0	0	0	0	0	51	51	51	51	51
INT	0	7	14	22	29	36	39	43	46	49
TOTAL	512	535	557	580	602	530	544	558	573	587
CUM CON COST	512	1024	1536	2048	2560	2926	3292	3658	4024	4390
CUM LOAN AMT	205	410	614	819	1024	1170	1317	1463	1610	1756
CUM LOAN REP	0	0	0	0	0	51	102	154	205	256
CUM LOAN BAL	205	410	614	819	1024	1119	1214	1310	1405	1500
CUM BMA FIN	154	330	528	750	993	1267	1555	1857	2174	2505

YEAR	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
CASH IN BMA	414	431	449	467	381	376	372	367	363	359
SUB	142	142	142	142	0	0	0	0	0	0
LOAN	189	189	189	189	0	0	0	0	0	0
TOTAL	745	762	780	798	381	376	372	367	363	359
CASH OUT CON	473	473	473	473	0	0	0	0	0	0
O/M	132	146	160	174	188	188	188	188	188	188
LOAN	88	88	88	88	126	126	126	126	126	126
INT	53	56	60	63	67	62	58	53	49	45
TOTAL	745	762	780	798	381	376	372	367	363	359
CUM CON COST	4863	5335	5808	6280	6280	6280	6280	6280	6280	6280
CUM LOAN AMT	1945	2134	2323	2512	2512	2512	2512	2512	2512	2512
CUM LOAN REP	344	432	519	607	733	858	984	1110	1235	1361
CUM LOAN BAL	1601	1702	1804	1905	1779	1654	1528	1402	1277	1151
CUM BMA FIN	2918	3350	3799	4266	4647	5023	5395	5762	6125	6484

YEAR	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
CASH IN BMA	354	350	346	341	337	281	279	276	273	271
SUB	0	0	0	0	0	0	0	0	0	0
LOAN	0	0	0	0	0	0	0	0	0	0
TOTAL	354	350	346	341	337	281	279	276	273	271
CASH OUT CON	0	0	0	0	0	0	0	0	0	0
O/M	188	188	188	188	188	188	188	188	188	188
LOAN	126	126	126	126	126	74	74	74	74	74
INT	40	36	31	27	23	18	16	13	11	8
TOTAL	354	350	346	341	337	281	279	276	273	271
CUM CON COST	6280	6280	6280	6280	6280	6280	6280	6280	6280	6280
CUM LOAN AMT	2512	2512	2512	2512	2512	2512	2512	2512	2512	2512
CUM LOAN REP	1486	1612	1738	1863	1989	2063	2138	2212	2286	2361
CUM LOAN BAL	1026	900	774	649	523	449	374	300	226	151
CUM BMA FIN	6838	7188	7534	7875	8211	8493	8771	9047	9320	9591

CONSTRUCTION STAGE 1 COST 2560 — INTEREST RATE 3.5 %

YEAR	1987 - 1991	1992 - 1996	1997 - 2000	2001 - 2006	2007 - 2011	2012 - 2016	TOTAL
CASH IN BMA	154 - 244	164 - 157	155 - 150	148 - 139	137 - 130	77 - 77	4314
SUB	154 - 154	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	768
LOAN	205 - 205	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	1024
TOTAL	512 - 602	164 - 157	155 - 150	148 - 139	137 - 130	77 - 77	6106
CASH OUT CON	512 - 512	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	2560
O/M	0 - 61	77 - 77	77 - 77	77 - 77	77 - 77	77 - 77	2074
LOAN	0 - 0	51 - 51	51 - 51	51 - 51	51 - 51	0 - 0	1024
INT	0 - 29	36 - 29	27 - 22	20 - 11	9 - 2	-0 - -0	448
TOTAL	512 - 602	164 - 157	155 - 150	148 - 139	137 - 130	77 - 77	6106

CONSTRUCTION STAGE 2 COST 1830 — INTEREST RATE 3.5 %

YEAR	1987 - 1991	1992 - 1996	1997 - 2000	2001 - 2006	2007 - 2011	2012 - 2016	TOTAL
CASH IN BMA	0 - 0	110 - 174	117 - 113	112 - 106	104 - 99	98 - 93	2809
SUB	0 - 0	110 - 110	0 - 0	0 - 0	0 - 0	0 - 0	549
LOAN	0 - 0	146 - 146	0 - 0	0 - 0	0 - 0	0 - 0	732
TOTAL	0 - 0	366 - 430	117 - 113	112 - 106	104 - 99	98 - 93	4090
CASH OUT CON	0 - 0	366 - 366	0 - 0	0 - 0	0 - 0	0 - 0	1830
O/M	0 - 0	0 - 44	55 - 55	55 - 55	55 - 55	55 - 55	1208
LOAN	0 - 0	0 - 0	37 - 37	37 - 37	37 - 37	37 - 37	732
INT	0 - 0	0 - 20	26 - 22	20 - 14	13 - 8	6 - 1	320
TOTAL	0 - 0	366 - 430	117 - 113	112 - 106	104 - 99	98 - 93	4090

CONSTRUCTION STAGE 3 COST 1890 — INTEREST RATE 3.5 %

YEAR	1987 - 1991	1992 - 1996	1997 - 2000	2001 - 2006	2007 - 2011	2012 - 2016	TOTAL
CASH IN BMA	0 - 0	0 - 0	142 - 204	121 - 114	113 - 108	106 - 101	2468
SUB	0 - 0	0 - 0	142 - 142	0 - 0	0 - 0	0 - 0	567
LOAN	0 - 0	0 - 0	189 - 189	0 - 0	0 - 0	0 - 0	756
TOTAL	0 - 0	0 - 0	473 - 535	121 - 114	113 - 108	106 - 101	3791
CASH OUT CON	0 - 0	0 - 0	473 - 473	0 - 0	0 - 0	0 - 0	1890
O/M	0 - 0	0 - 0	0 - 43	57 - 57	57 - 57	57 - 57	992
LOAN	0 - 0	0 - 0	0 - 0	38 - 38	38 - 38	38 - 38	605
INT	0 - 0	0 - 0	0 - 20	26 - 20	19 - 13	12 - 7	304
TOTAL	0 - 0	0 - 0	473 - 535	121 - 114	113 - 108	106 - 101	3791

TOTAL COST 6280 — INTEREST RATE 3.5 %

YEAR	1987 - 1991	1992 - 1996	1997 - 2000	2001 - 2006	2007 - 2011	2012 - 2016	TOTAL
CASH IN BMA	154 - 244	274 - 331	414 - 467	381 - 359	354 - 337	281 - 271	9591
SUB	154 - 154	110 - 110	142 - 142	0 - 0	0 - 0	0 - 0	1884
LOAN	205 - 205	146 - 146	189 - 189	0 - 0	0 - 0	0 - 0	2512
TOTAL	512 - 602	530 - 587	745 - 798	381 - 359	354 - 337	281 - 271	13987
CASH OUT CON	512 - 512	366 - 366	473 - 473	0 - 0	0 - 0	0 - 0	6280
O/M	0 - 61	77 - 121	132 - 174	188 - 188	188 - 188	188 - 188	4274
LOAN	0 - 0	51 - 51	88 - 88	126 - 126	126 - 126	74 - 74	2361
INT	0 - 29	36 - 49	53 - 63	67 - 45	40 - 23	18 - 8	1073
TOTAL	512 - 602	530 - 587	745 - 798	381 - 359	354 - 337	281 - 271	13987

Table 0.5 (5)

CAHS FLOW TABLE

STAGE I, II & III, 3.5%

FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK CASH FLOW TABLE

CONSTRUCTION STAGE 1 COST 2560 INTEREST RATE 6 %

YEAR	1987 -	1991	1992 -	1996	1997 -	2000	2001 -	2006	2007 -	2011	2012 -	2016	TOTAL
CASH IN BMA	154 -	264	189 -	177	174 -	165	162 -	146	143 -	131	77 -	77	4634
SUB	154 -	154	0 -	0	0 -	0	0 -	0	0 -	0	0 -	0	768
LOAN	205 -	205	0 -	0	0 -	0	0 -	0	0 -	0	0 -	0	1024
TOTAL	512 -	623	189 -	177	174 -	165	162 -	146	143 -	131	77 -	77	6426
CASH OUT CON	512 -	512	0 -	0	0 -	0	0 -	0	0 -	0	0 -	0	2560
O/M	0 -	61	77 -	77	77 -	77	77 -	77	77 -	77	77 -	77	2074
LOAN	0 -	0	51 -	51	51 -	51	51 -	51	51 -	51	0 -	0	1024
INT	0 -	49	61 -	49	46 -	37	34 -	18	15 -	3	-0 -	-0	768
TOTAL	512 -	623	189 -	177	174 -	165	162 -	146	143 -	131	77 -	77	6426

CONSTRUCTION STAGE 2 COST 1830 INTEREST RATE 6 %

YEAR	1987 -	1991	1992 -	1996	1997 -	2000	2001 -	2006	2007 -	2011	2012 -	2016	TOTAL
CASH IN BMA	0 -	0	110 -	189	135 -	129	127 -	116	113 -	105	102 -	94	3058
SUB	0 -	0	110 -	110	0 -	0	0 -	0	0 -	0	0 -	0	549
LOAN	0 -	0	146 -	146	0 -	0	0 -	0	0 -	0	0 -	0	732
TOTAL	0 -	0	366 -	445	135 -	129	127 -	116	113 -	105	102 -	94	4339
CASH OUT CON	0 -	0	366 -	366	0 -	0	0 -	0	0 -	0	0 -	0	1830
O/M	0 -	0	0 -	44	55 -	55	55 -	55	55 -	55	55 -	55	1298
LOAN	0 -	0	0 -	0	37 -	37	37 -	37	37 -	37	37 -	37	732
INT	0 -	0	0 -	35	44 -	37	35 -	24	22 -	13	11 -	2	549
TOTAL	0 -	0	366 -	445	135 -	129	127 -	116	113 -	105	102 -	94	4339

CONSTRUCTION STAGE 3 COST 1890 INTEREST RATE 6 %

YEAR	1987 -	1991	1992 -	1996	1997 -	2000	2001 -	2006	2007 -	2011	2012 -	2016	TOTAL
CASH IN BMA	0 -	0	0 -	0	142 -	218	140 -	129	126 -	117	115 -	106	2686
SUB	0 -	0	0 -	0	142 -	142	0 -	0	0 -	0	0 -	0	567
LOAN	0 -	0	0 -	0	189 -	189	0 -	0	0 -	0	0 -	0	756
TOTAL	0 -	0	0 -	0	473 -	549	140 -	129	126 -	117	115 -	106	4009
CASH OUT CON	0 -	0	0 -	0	473 -	473	0 -	0	0 -	0	0 -	0	1890
O/M	0 -	0	0 -	0	0 -	43	57 -	57	57 -	57	57 -	57	992
LOAN	0 -	0	0 -	0	0 -	0	38 -	38	38 -	38	38 -	38	605
INT	0 -	0	0 -	0	0 -	34	45 -	34	32 -	23	20 -	11	522
TOTAL	0 -	0	0 -	0	473 -	549	140 -	129	126 -	117	115 -	106	4009

TOTAL COST 6280 INTEREST RATE 6 %

YEAR	1987 -	1991	1992 -	1996	1997 -	2000	2001 -	2006	2007 -	2011	2012 -	2016	TOTAL
CASH IN BMA	154 -	264	299 -	366	451 -	512	428 -	391	383 -	353	294 -	276	10857
SUB	154 -	154	110 -	110	142 -	142	0 -	0	0 -	0	0 -	0	1084
LOAN	205 -	205	146 -	146	189 -	189	0 -	0	0 -	0	0 -	0	2512
TOTAL	512 -	623	555 -	622	782 -	843	428 -	391	383 -	353	294 -	276	14453
CASH OUT CON	512 -	512	366 -	366	473 -	473	0 -	0	0 -	0	0 -	0	6280
O/M	0 -	61	77 -	121	132 -	174	188 -	188	188 -	188	188 -	188	4274
LOAN	0 -	0	51 -	51	88 -	88	126 -	126	126 -	126	74 -	74	2561
INT	0 -	49	61 -	84	91 -	108	114 -	77	69 -	39	31 -	14	1838
TOTAL	512 -	623	555 -	622	782 -	843	428 -	391	383 -	353	294 -	276	14453

Table 0.5 (6)

CASH FLOW TABLE

STAGE I, II & III, 6%

FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK CASH FLOW TABLE

CONSTRUCTION STAGE 1 COST 2560 INTEREST RATE 10 %

YEAR	1987 -	1991	1992 -	1996	1997 -	2000	2001 -	2006	2007 -	2011	2012 -	2016	TOTAL
CASH IN BMA	154 -	297	230 -	210	205 -	189	184 -	159	154 -	133	77 -	77	5146
SUB	154 -	154	0 -	0	0 -	0	0 -	0	0 -	0	0 -	0	768
LOAN	205 -	205	0 -	0	0 -	0	0 -	0	0 -	0	0 -	0	1024
TOTAL	512 -	655	230 -	210	205 -	189	184 -	159	154 -	133	77 -	77	6938
CASH OUT CON	512 -	512	0 -	0	0 -	0	0 -	0	0 -	0	0 -	0	2560
O/M	0 -	61	77 -	77	77 -	77	77 -	77	77 -	77	77 -	77	2074
LOAN	0 -	0	51 -	51	51 -	51	51 -	51	51 -	51	0 -	0	1024
INT	0 -	82	102 -	82	77 -	61	56 -	31	26 -	5	-0 -	-0	1280
TOTAL	512 -	655	230 -	210	205 -	189	184 -	159	154 -	133	77 -	77	6938

CONSTRUCTION STAGE 2 COST 1830 INTEREST RATE 10 %

YEAR	1987 -	1991	1992 -	1996	1997 -	2000	2001 -	2006	2007 -	2011	2012 -	2016	TOTAL
CASH IN BMA	0 -	0	110 -	212	165 -	154	150 -	132	128 -	113	110 -	95	3684
SUB	0 -	0	110 -	110	0 -	0	0 -	0	0 -	0	0 -	0	549
LOAN	0 -	0	146 -	146	0 -	0	0 -	0	0 -	0	0 -	0	732
TOTAL	0 -	0	366 -	468	165 -	154	150 -	132	128 -	113	110 -	95	4685
CASH OUT CON	0 -	0	366 -	366	0 -	0	0 -	0	0 -	0	0 -	0	1830
O/M	0 -	0	0 -	44	55 -	55	55 -	55	55 -	55	55 -	55	1208
LOAN	0 -	0	0 -	0	37 -	37	37 -	37	37 -	37	37 -	37	732
INT	0 -	0	0 -	59	73 -	62	59 -	40	37 -	22	18 -	4	915
TOTAL	0 -	0	366 -	468	165 -	154	150 -	132	128 -	113	110 -	95	4685

CONSTRUCTION STAGE 3 COST 1890 INTEREST RATE 10 %

YEAR	1987 -	1991	1992 -	1996	1997 -	2000	2001 -	2006	2007 -	2011	2012 -	2016	TOTAL
CASH IN BMA	0 -	0	0 -	0	142 -	241	170 -	151	147 -	132	129 -	113	3033
SUB	0 -	0	0 -	0	142 -	142	0 -	0	0 -	0	0 -	0	567
LOAN	0 -	0	0 -	0	189 -	189	0 -	0	0 -	0	0 -	0	756
TOTAL	0 -	0	0 -	0	473 -	572	170 -	151	147 -	132	129 -	113	4356
CASH OUT CON	0 -	0	0 -	0	473 -	473	0 -	0	0 -	0	0 -	0	1890
O/M	0 -	0	0 -	0	0 -	43	57 -	57	57 -	57	57 -	57	992
LOAN	0 -	0	0 -	0	0 -	0	38 -	38	38 -	38	38 -	38	605
INT	0 -	0	0 -	0	0 -	57	76 -	57	53 -	38	34 -	19	869
TOTAL	0 -	0	0 -	0	473 -	572	170 -	151	147 -	132	129 -	113	4356

TOTAL COST 6280 INTEREST RATE 10 %

YEAR	1987 -	1991	1992 -	1996	1997 -	2000	2001 -	2006	2007 -	2011	2012 -	2016	TOTAL
CASH IN BMA	154 -	297	340 -	422	511 -	584	506 -	442	429 -	379	315 -	285	11483
SUB	154 -	154	110 -	110	142 -	142	0 -	0	0 -	0	0 -	0	1884
LOAN	205 -	205	146 -	146	189 -	189	0 -	0	0 -	0	0 -	0	2512
TOTAL	512 -	655	596 -	678	842 -	915	504 -	442	429 -	379	315 -	285	15979
CASH OUT CON	512 -	512	366 -	366	473 -	473	0 -	0	0 -	0	0 -	0	6280
O/M	0 -	61	77 -	121	132 -	174	188 -	188	188 -	188	188 -	188	4274
LOAN	0 -	0	51 -	51	88 -	88	126 -	126	126 -	126	74	74	2361
INT	0 -	82	102 -	140	150 -	180	190 -	128	115 -	65	52 -	23	3064
TOTAL	512 -	655	596 -	678	842 -	915	504 -	442	429 -	379	315 -	285	15979

Table 0.5 (7)

CASH FLOW TABLE

STAGE I, II & III, 10%

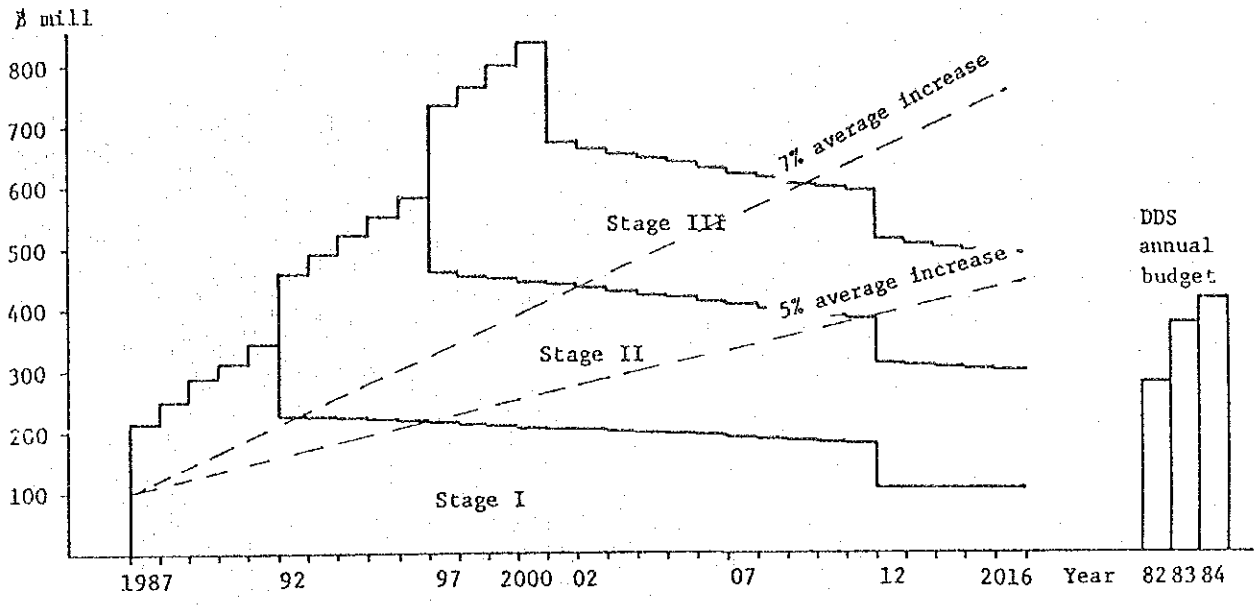
Table 0.6 Revenue and Expenditure Flow for BMA

(million Baht)

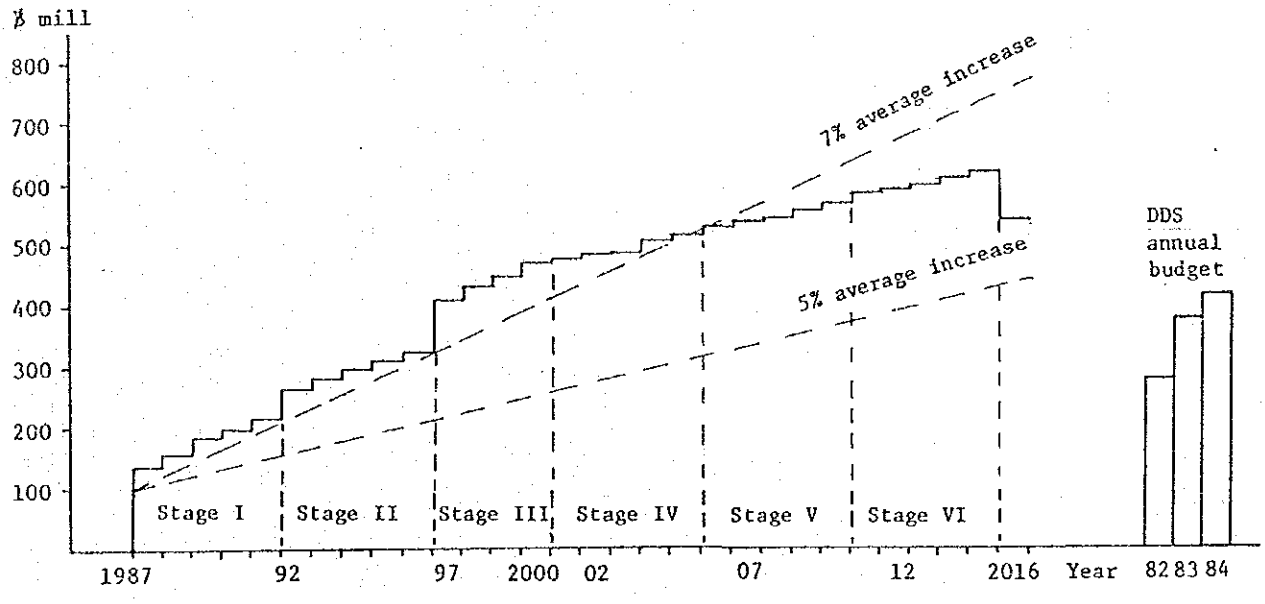
Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Revenue										
(1) Tax Increase	100	105	110	115	121	127	134	140	147	155
(2) Dev. Surcharge	-	107	107	107	107	107	107	107	107	107
(3) Urb. Dev. Tax	-	-	-	-	-	64	67	70	74	78
Total Revenue	100	212	217	222	228	298	308	317	328	340
Expenditure for BMA	138	158	178	199	219	267	283	299	315	331
Balance	-38	54	39	23	9	31	25	18	13	9
Cum. Balance	-38	16	55	78	87	118	143	161	174	183

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Revenue										
(1) Tax Increase	162	171	179	188	194	199	205	212	218	224
(2) Dev. Surcharge	107	107	107	107	107	-	-	-	-	-
(3) Urb. Dev. Tax	81	86	90	94	97	100	103	106	109	112
Total Revenue	350	364	376	389	398	299	308	318	327	336
Expenditure for BMA	417	436	455	474	383	379	374	370	365	361
Balance	-67	-72	-79	-85	15	-80	-66	-52	-38	-25
Cum. Balance	116	44	-35	-120	-105	-185	-251	-303	-341	-366

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Revenue										
(1) Tax Increase	231	238	245	253	260	268	276	284	293	302
(2) Dev. Surcharge	-	-	-	-	-	-	-	-	-	-
(3) Urb. Dev. Tax	116	119	123	127	130	134	138	142	147	151
Total Revenue	347	357	368	380	390	402	414	426	440	453
Expenditure for BMA	357	352	348	343	339	289	286	283	280	277
Balance	-10	5	20	37	51	113	128	143	160	176
Cum. Balance	-376	-371	-351	-314	-263	-150	-22	121	281	457



Implementation Schedule 1 (Completion by 2000)



Implementation Schedule 2 (Completion by 2015)

Fig. 0.1 CASH FLOW SCHEDULE OF BMA FOR ALL STAGES

MASTER PLAN ON FLOOD PROTECTION/DRAINAGE PROJECT IN EASTERN SUBURBAN-BANGKOK

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