TABLES

Table 7-2-1 LEGAL AND ADMINISTRATIVE FRAMEWORK ON FLOOD CONTROL, FLOOD DEFENSE AND SOLID WASTE MANAGEMENT

Major Legislation	Agency and Jurisdiction
1. Flood Control	
(a) P.D. 1067 (Water Code of the Philippines; Dec. 1976)	DPWH: ° Declaration of flood control areas. ° Promulgation of guidelines for governing flood plain management plans.
(b) E.O. 52 (Oct. 1986)	MMC: ° Transfering the responsibility for flood control and drainage in Metro Manila from MPWH (DPWH) to MMC.
(c) E.O. 124 (MPWH Reorganization Act; Jan. 1987)	DPWH: ° Planning, design, construction, operation and maintenance of flood control and drainage projects nationwide including Metro Manila.
2. Flood Defense	
(a) P.D. 78, as amended by P.D. 1149 (June 1977)	DPWH and PAGASA: ° Coordinate execution of flood forecasting and warning in major river basins.
(b) P.D. 1566 (Strengthen-Philippine Disaster Control Capability and Establishing the National Program on Community Disaster Preparedness; June 1978)	OCD: ° Coordination of the activities of various agencies relative to disaster management, as the administrative offfice of the National Disaster Coordinating Council. ° Preparation and dissemination of disaster control manuals.
3. Solid Waste Management	
(a) E.O. 5 (Solid Waste Management in Metro Manila; July 1976)	MMC: ° Management of solid waste in Metro Manila.

Table 7-2-2(1/4) FUND ALLOCATION UNDER DPWH ON FLOOD CONTROL IN METRO MANILA

Unit: million pesos

Projects	Year		
	1987	1988	1989
I. NCR Project			
° Metro Manila Drainage System Rehabilitation Projects (OECF) /1	106.9	64.6	130.7
° Metro Manila Flood Control (II) Project - Balut, Vitas and San Andres Pumping Stations (OECF)	0	14.2	109.0
° Regular Infrastructure Fund /2	51.5	94.0	91.1
° Regular Maintenance Fund /3	55.4	55.5	84.4
° Supplemental Program and Cinema Tax /4	13.6	-	-
° Metro Manila Flood Control and Drainage Project (JICA) /5	0	5.0	3.0
Total for NCR	227.4	233.3	418.2
II. PMOs Project			
° Mangahan Floodway Project assigned by Mangahan Floodway Project Office (OECF) /6	90.0	57.2	63.5
° EFCOS Project assigned by Major Flood Control Project Office (OECF) /5, /7	85.4	36.4	140.4
° Metro Manila Infrastructure Utilities and Engineering Project assigned by MMINUTE Project Office (World Bank) /5	11.2	0	30.2
Total for PMOs	186.6	93.6	234.1
Total for I & II	414.0	326.9	652.3

Note /1 : Rehabilitation of Pumping Stations.
/2 : The fund for new construction/improvement project.
/3 : The fund for maintenance/improvement of existing facilities.
/4 : The fund is coming from Cinema Tax for construction/improvement exclusively for flood control facilities, but fund for 1988 and 1989 is not yet allocated.
/5 : Foreign-assisted projects.
/6 : It is previously funded under OECF, but now purely locally funded.
/7 : Effective Flood Control & Operation System including Flood Warning & Telemetering System for Pasig-Marikina Laguna Lake Complex.

Table 7-2-2(2/4) FUND ALLOCATION UNDER DPWH ON FLOOD CONTROL IN METRO MANILA (BREAKDOWN OF REGULAR INFRASTRUCTURE FUND)

Unit: million pesos

Items	Year		
	1987	1988	1989
1. Improvement/Construction of Bank and Riverwall, etc.	33.39	29.18	28.55
2. Improvement/Construction of Drainage Main	0	0	12.32
3. Improvement/Construction of Drainage Laterals	9.10	21.61	8.20
4. Dredging of Esteros/Waterways	9.02	42.71	42.00
5. Declogging of Mains/Laterals	0	0.50	0
Total	51.51	94.00	91.07

Table 7-2-2(3/4) FUND ALLOCATION UNDER DPWH ON FLOOD CONTROL IN METRO MANILA (BREAKDOWN OF SUPPLEMENTAL PROGRAM AND CINEMA TAX)

Unit: million pesos

Items	1987 /1
1. Dredging of Major Waterways	7.77
2. Improvement of Drainage Mains	2.00
3. Improvement of Drainage Laterals	2.66
4. Payment of Acquisition of Right-of-Way	0.02
5. Emergency Works	1.10
Total	13.55

Note /1 : The fund in 1988 and 1989 is presently unknown.

Table 7-2-2(4/4) FUND ALLOCATION UNDER DPWH ON FLOOD CONTROL IN METRO MANILA
(BREAKDOWN OF REGULAR MAINTENANCE FUND)

Unit: million pesos

Drainage Facilities	Year		
	1987	1988	1989 /1
1. Dredging of Major Waterways	26.30	16.31	-
2. Desilting of Drainage Mains/ Outfalls	9.00	6.77	-
3. Declogging of Drainage Laterals	4.00	7.70	-
4. Operation and Maintenance of Malabon-Mavotas-Valenzuela (MANAVA) Projects	1.50	2.50	-
5. Operation and Maintenance of Napindan Hydraulic Control Structure	1.70	2.50	-
6. Repair of Drainage Appurtenances	0	2.50	-
7. Emergency Works	0.90	5.00	-
8. Operation and Maintenance of the Pumping Stations and Floodgates	11.95	12.23	-
Total for 1 to 7 /2	43.40	43.28	70.00
Total for 1 to 8	55.35	55.51	84.43

Note /1 : The breakdown is presently unknown.

/2 : It presents for maintainence fund excluding the one for pumping stations and flood gates.

Table 7-2-3 FUND ALLOCATION UNDER EOC OF MMC ON INFRASTRUCTURE PROJECTS INVOLVING DRAINAGE & DECLOGGING PROGRAM (1985 - 1988)

	Name of Project/ Location	Type of Works	Fund (thousand pesos)
1.	Nepa Street Tond, Manila	Concreting & Drainage System	430
2.	Dagovoy Street San Andres Bukid, Manila	Asphalting & Drainage System	550
3.	Zamora Street Pasay	Drainage System	260
4.	31st Street Pasay	Asphalting & Drainage Improvement	1,590
5.	Luna Mencias Street Mandaluyoung	Drainage Improvement & Sectional Patching	350
6.	Capt. Musui Street	Concreting & Drainage Improvement	570
7.	Gen. T. de Leon Street Valenzuela	-ditto-	500
8.	A&B Fevandes Street & Tayabas Street Tond, Manila	Asphalt Overlay & Drainage System	360
		Total	4,610

Table 7-2-4 STRUCTURAL AND SOLID WASTE PROBLEM ON O&M FOR THE FLOOD CONTROL AND DRAINAGE FACILITIES IN METRO MANILA

Problems
Structural
° Distances between covers/manholes attached to drainage mains/laterals occasionally exceed the required 20 meters to 50 meters that cause lack of efficiency.
° Some fabricated manholes/covers easily break down due to faulty design
° Open manholes/covers and damaged inlets cause clogging of drainage mains/laterals.
° Some manholes/covers are easily detached; some are hard to open for maintenance purposes.
° Gap exists between the newly constructed/remodelled lateral leading to drainage mains.
° Incorrectness in slope.
° Formworks inside the drainage mains/laterals are sometimes not properly removed after construction.
° Some underground utilities obstruct the construction or removal of drainage mains/laterals.
° Encroachments and illegal squatting in estero.
Solid Waste
° Improper disposal of garbage by people, especially near esteros located in squatter areas and markets.
° Flotable garbage, debris, and water lilies are brought down by rivers during monsoons and as a result of landslides and soil erosion.
° Scattered construction materials at a project site.

Table 7-2-5 PRESENT FUNCTION OF RELATED DIVISIONS IN NCR FOR THE FLOOD CONTROL AND DRAINAGE PROJECT

Related Division	Function
1. Planning and Design Division	Surveys, investigates and establishes the planning and priorities for infrastructures, such as rivers, esteros, drainage mains, laterals, pumping stations, floodgates, etc. including bridges, roads and buildings.
2. Flood Control and Drainage Division	Undertakes and supervises annual program for the construction, rehabilitation and maintenance of flood control and drainage projects. Coordinates with other agencies involved in solid waste collection and disposal, sanitary waste control and removal and relocation of squatters. Undertakes the operation and maintenance of the Napindan Hydraulic Control Structures.
3. Pumping Stations and Floodgates Division	Executes the operation and maintenance of the pumping stations and gates excluding Rosario Weir and Napindan Hydraulic Control Structure.
4. Material Control and Hydrology Division	Collects, analyzes and compiles hydrologic and hydrogeologic data, and provides other divisions with the necessary technical data and evaluation for flood control and drainage system. Executes laboratory/field tests on materials used in the construction and maintenance of infrastructure.

Table 7-2-6 EQUIPMENT LIST AND STATUS UNDER THE REGIONAL EQUIPMENT SERVICE OF NCR, DPWH (FOR THE MONTH OF JUNE 1988)

Equipment Type	Status /1					Total
	A	B	C	D	E	
Dredger			4		4	8
Amphidredger		9		3	2	14
Amphidozer		3				3
Survey Boat		1				1
Dredge Tender				4		4
Work Boat				3	3	6
Sewer Jet			5	1	6	12
Vacuum Cleaner	1	1		3		5
Water Pump	4	12	5	8	6	35
Dump Truck		33	7	18		58
Dragline, Bucket		1				1
Clampshell, Bucket		1				1
Crane Truck		4	1	1	1	7
Others /2	51	205	25	153	21	455
Total	56	270	47	194	43	610

Note /1 : A - Idle; Ready to Run
B - Equipment on Rental
C - Under Repair
D - Awaiting Repair
E - Unserviceable

/2 : Other equipment include Breaker, Asphalt Mixer, Concrete Mixer, Concrete Cutter, Electric Generator, Road Roller, Vehicle, etc.

Table 7-3-1 COMPOSITION OF THE PROPOSED COMMITTEE

	Composition	Present Related Responsibility	Position in Committee	Proposed Responsibility for the Committee
1.	Secretary of DPWH	Supervision of all flood control projects nationwide.	Chairman	Management, presiding and coordinating for the committee.
2.	Director-General of NEDA	Allocation of funds for flood control and drainage projects nationwide.	Member	Coordination on the fund allocation of the proposed projects and other projects.
3.	Governor of MMC	Supervision of all public service activities in Metro Manila.	-ditto-	Coordination of the proposed projects and other public affairs in Metro Manila.
4.	Undersecretary for Planning, DPWH	Supervision of the Planning Service, the Bureau of Design, and the Bureua of Research and Standards, DPWH.	-ditto-	Coordination of the proposed projects and other plans administered by DPWH.
5.	General Manager of LLDA	Identification of development programs of Laguna Lake and adjoining areas.	-ditto-	Coordination of the proposed projects and other programs in Laguna Lake and adjoining areas.
6.	President of Metro Manila Mayor's League	Supervision of public service activities in respective cities or municipalities.	-ditto-	Coordination of the proposed projects and other public affairs in the cities and municipalities concerned.

Table 7-3-2 COMPOSITION OF PROPOSED TECHNICAL WORKING GROUP (TWG)

	Composition	Present Related Responsibility	Position in Committee	Proposed Responsibility for TWG
1.	Undersecretary for Planning, DPWH	Supervision of the Planning Service, the Bureau of Design, and the Bureau of Research and Standards, DPWH.	Chairman	Management, presiding and coordination for TWG.
2.	Regional Director of DPWH-NCR	Management of DPWH-NCR and supervision of all flood control projects in Metro Manila.	Member	Coordination of the proposed projects and other programs administered by DPWH-NCR and other related regional programs under DPWH.
3.	Project Director of PMO, DPWH	Implementation of major flood control and drainage projects in Metro Manila.	-ditto-	Coordination of the proposed projects and other related programs under PMOs under DPWH.
4.	Representative of NEDA	Allocation of funds for flood control and drainage projects.	-ditto-	Coordination on the fund allocation of the proposed projects and other programs.
5.	Representative OF LLDA	Identification of development progams of Laguna Lake and adjoining areas.	-ditto-	Coordination of the proposed projects and other programs in Laguna Lake and adjoining areas.
6.	Representative of PAGASA	Meteorological information services and flood forecasting activities.	-ditto-	Coordination and cooperation on flood forecasting.
7.	Representative of OCD	Information center on flood defense and flood disaster.	-ditto-	Cooperation on flood forecasting and flood defense.
8.	Representative of MMC	Cleaning of waterways to facilitate drainage, and minor drainage programs as a part of road maintenace projects.	-ditto-	Coordination of the proposed projects and other public affairs in Metro Manila.
9.	President of Metro Manila Mayor's League*	Supervision of public service activities in respective cities or municipalities.	-ditto-	Coordination of the proposed projects and other public affairs in the cities and municipalities concerned.

* On call, case to case basis.

Table 7-3-3 RESPONSIBILITY OF PROPOSED IMPLEMENTING AGENCIES

Items	D P W H		Local /3
	NCR	PMOs	Governments
I. Planning and Design	0	0	
II. Construction	0	0	
III. Operation /1	0		
IV. Maintenance /1			
1. River	0		
2. Drainage Facilities			
(a) Estereo	0		
(b) Drainage Main/Outfall	0		
(c) Drainage Lateral /2			
- Major	0		
- Minor			0
(d) Street Gutter /2			
- Major	0		
- Minor			0

[Note]

/1: Operation and Maintenance of pumping stations, floodgates, etc., are included.

/2: Drainage laterals and street gutters are classified into two: major facilities and minor facilities. Major facilities are those connected to national level structures and/or national roads and minor facilities are those connected to local government level structures and/or secondary/tertiary roads.

/3: Local governments mean MMC and city/municipality.

0: This mark shows the execution of each item of responsibility.

Table 7-3-4 INFORMATION/DATA ON O&M OF FLOOD CONTROL AND DRAINAGE FACILITIES EXCHANGED BETWEEN DPWH-NCR AND OTHER RELATED AGENCIES

Related Agency	INFORMATION/DATA	
	From DPWH-NCR To Related Agency	From Related Agency To DPWH-NCR
PAGASA	Operation of gates and pump stations and the data on flood control facilities for the purpose of flood forecasting in cooperation with DPWH. /1	Weather/meteorological data for reference in the O&M of flood control and drainage facilities.
LLDA	Operation of gates and pump stations and the data on flood control and drainage drainage facilities for the flood defense of Laguna Lake and adjoining areas.	Development programs which may interrupt flood control and drainage activities.
OCD	Flood control data and operation of gates and pump stations for the purpose of flood defense; and, flood disaster information.	Flood disaster information with the purpose of requesting assistance of DPWH-NCR in flood protection, rescue and rehabilitation.
MMC and Cities/ Municipalities	Flood control data and operation of gates and pump stations for the purpose of flood defense of respective administrative areas.	Minor drainage programs and the situation of O&M for drainage facilities in respective administrative areas.

Note:

/1 PAGASA shall coordinate with DPWH on flood forecasting in major river basins as stipulated in P.D. 78, as amended by P.D. 1149 dated June 1977.

Table 7-3-5 STAFFING AND REQUIRED ACTIVITY FOR DESIGN AND CONSTRUCTION OF THE PROPOSED PROJECT

Position	Required Activity	Number of Staff
Project Manager	Management of all activities for the design and construction.	1
(Design and Construction Unit)		
Supervising Engineer	Supervision of all activities in the unit.	1
Senior Civil Engineer	Supervision of design and construction of rivers/channels, lakeshore dike, pump stations/gates and bridges.	4
Senior Mechanical/ Electrical Engineer	Supervision of the design and installment of machines, auxilliary equipment and accessories of the related facilities such as pump stations and flood gates.	2
Sub-total		7
(Administrative Unit)		
Senior Administrative Officer	Supervisor of all work in the unit.	1
Administrative Officer/Secretary	Administrative affairs, general clerical work, filing and accounting for the office.	1
Sub-total		2
Total		10

Table 7-3-6(1/2) STAFFING AND REQUIRED ACTIVITY FOR OPERATION AND MAINTENANCE OF THE PROPOSED PROJECT
(PROPOSED O&M DIVISION OF DPWH-NCR)

Position	Required Activity	Number of Staff
Chief Supervising Engineer /1	Supervision of all activities for the operation and maintenance of the proposed project, including the maintenance activities in the Engineering District Office.	1
(Flood/Drainage Control Unit)		
Supervising Engineer	Supervision of all activities in this unit. Study of optimum operation method of MCGS, pump stations and gates in flood season. Formulation of the technical training program of operation and maintenance for all the staff concerned.	1
Senior Hydrologist/ Civil Engineer	Hydro-meteorological data collection and analysis and flood predicition.	1
Hydrologist/ Civil Engineer	Assistant of senior hydrologist.	1
Senior Civil Engineer	Preparation of programs for the rehabilitation and maintenance of river, channels and bridges, and buildings, etc. of pump stations, gates and MCGS.	1
Civil Engineer	Assistant of senior civil engineer.	1
Senior Mechanical/ Electrical Engineer	Preparation of programs for the rehabilitation and maintenance of machines and auxilliary equipment and accessories of the pump stations and gates.	1
Mechanical/Electrical Engineer	Assistant of mechanical/electrical engineer.	1
Senior Telecommunication Engineer	Preparation of programs for the rehabilitation and maintenance of telecommunication facilities. Supervision of usual and special maintenance activities for these facilities.	1
Telecommunication Engineer	Special inspection of telecommunication facilities installed in the O&M division, covering both external and internal inspections, including the change of parts. This is carried out monthly, annually, before the flood season, and in emergency situations when an abnormal condition has been detected during the usual inspections. Usual external inspection and operation of telecommunication facilities are carried out every day.	1
Sub-total		9
(Administrative Unit) Administrative Officer/Secretary	General clerical work and accounting for the office.	2
Total		12

/1: The staff of a private company and casual employees will be hired to perform the work of assistants such as labourer, typist, guard, driver, etc.

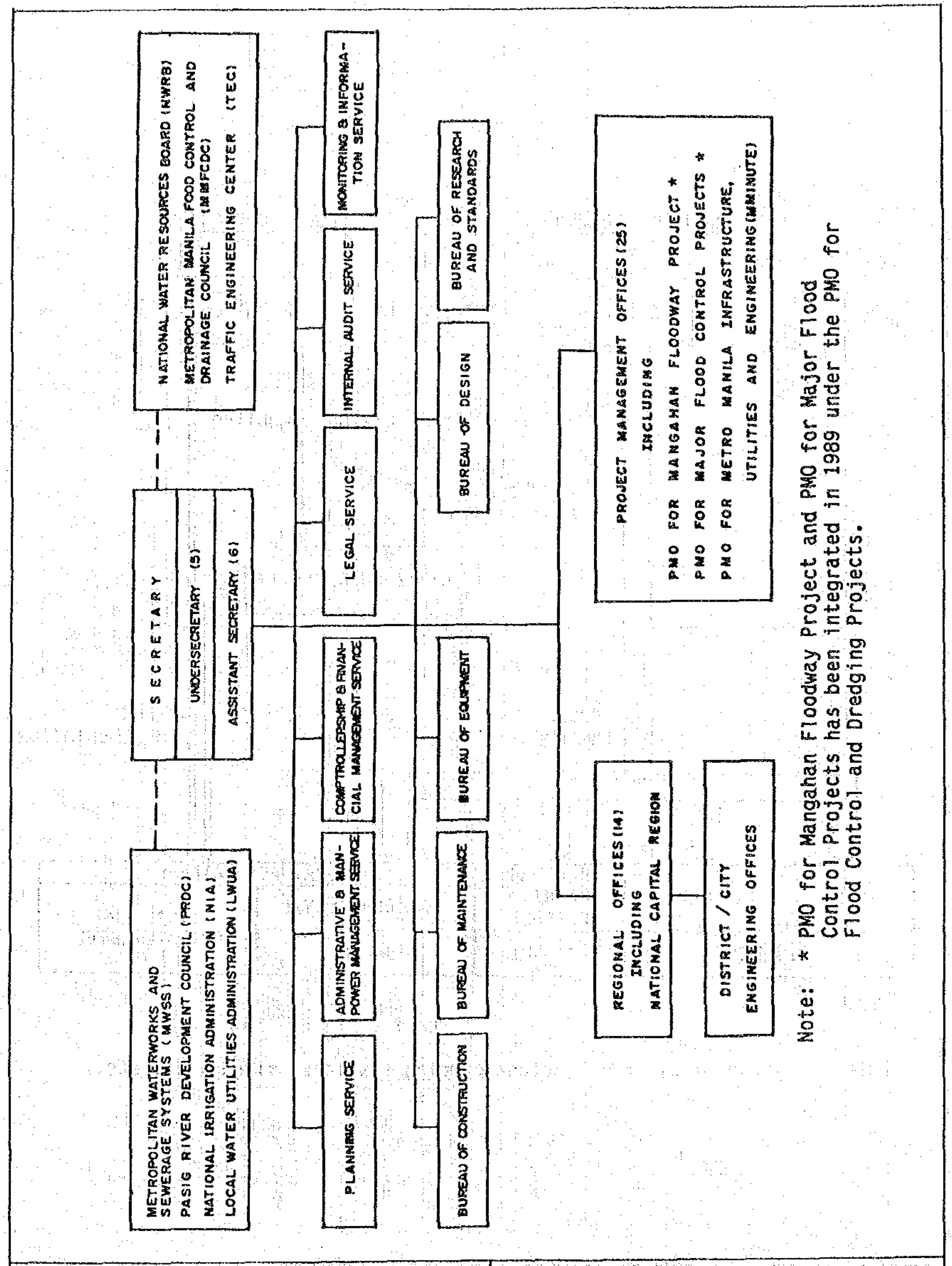
On the O&M of the Pasig-Marikina River, the dissemination of the control method of MCGS, pump stations, and gates, and flood forecasting, with the permission of Director of DPWH-NCR and top official of the flood control and drainage office in DPWH-NCR.

Table 7-3-6(2/2) STAFFING AND REQUIRED ACTIVITY FOR OPERATION AND MAINTENANCE OF THE PROPOSED PROJECT (ENGINEERING DISTRICT OFFICE DPWH-NCR)

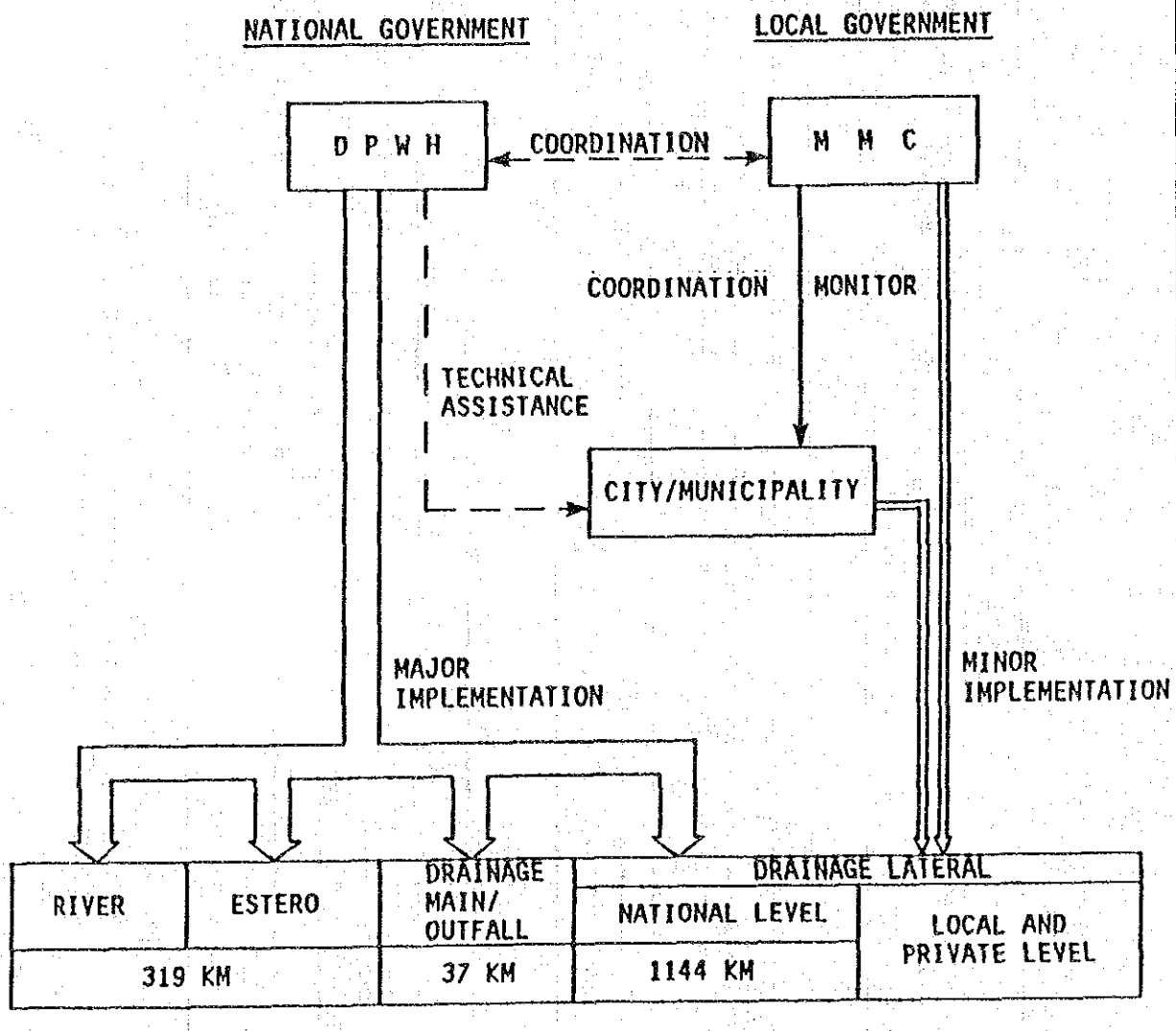
Position	Required Activity	Number of Staff
(At the Site of Engineering District Office) /1		
Senior Civil Engineer	Supervision of all maintenance activities regarding the project in the district area.	1
Civil Engineer	Inspection of river, channel, such as the condition of silting, floating garbage, squatters, river wall, embankment. This is carred out weekly, before/after the flood season, and in emergency situations like a flood disaster.	2
Mechanical/Electrical Engineer	Special inspection of machines and auxiliary equipment and accessories of the pump stations and gates, including those of MCGS, covering both external and internal inspections, including the change of parts. This is carried out monthly, annually, before the flood season, and in emergency situations when an abnormal condition has been detected during the usual inspection.	1
Telecommunication Engineer	Special inspection of telecommunication facilities installed in pump stations and gates, covering both external and internal inspections, including the change of parts. This is carried out monthly, annually, before the flood season, and in emergency situations when an abnormal condition has been detected during the usual inspection.	1
Total		5
(At the Site of MCGS) /1		
Senior Mechanical/ Electrical Engineer	Supervision of all operation and maintenance activities of MCGS.	1
Mechanical/Electrical Engineer	Daily usual inspection of mechanial, electrical and telecommunication facilities and operation of gate.	2
Civil Engineer	Daily usual inspection of the structure and surrounding condition.	1
Total		4
(At the Site of Pump Station) /1		
Mechanical/Electrical Engineer	O&M activity of the pump station. Daily usual inspection of mechanical, electrical and telecommunication facilities, including surrounding condition.	2
(At the Site of Flood Gate) /1		
Mechanic/Electrician	Operation and maintenance activity of gate. Daily usual inspection of mechanical, electrical and telecommunication facilities, including surrounding condition.	1

/1: Casual employees will be contracted to execute the assistant work such as laborer, guard, driver, etc.

FIGURES

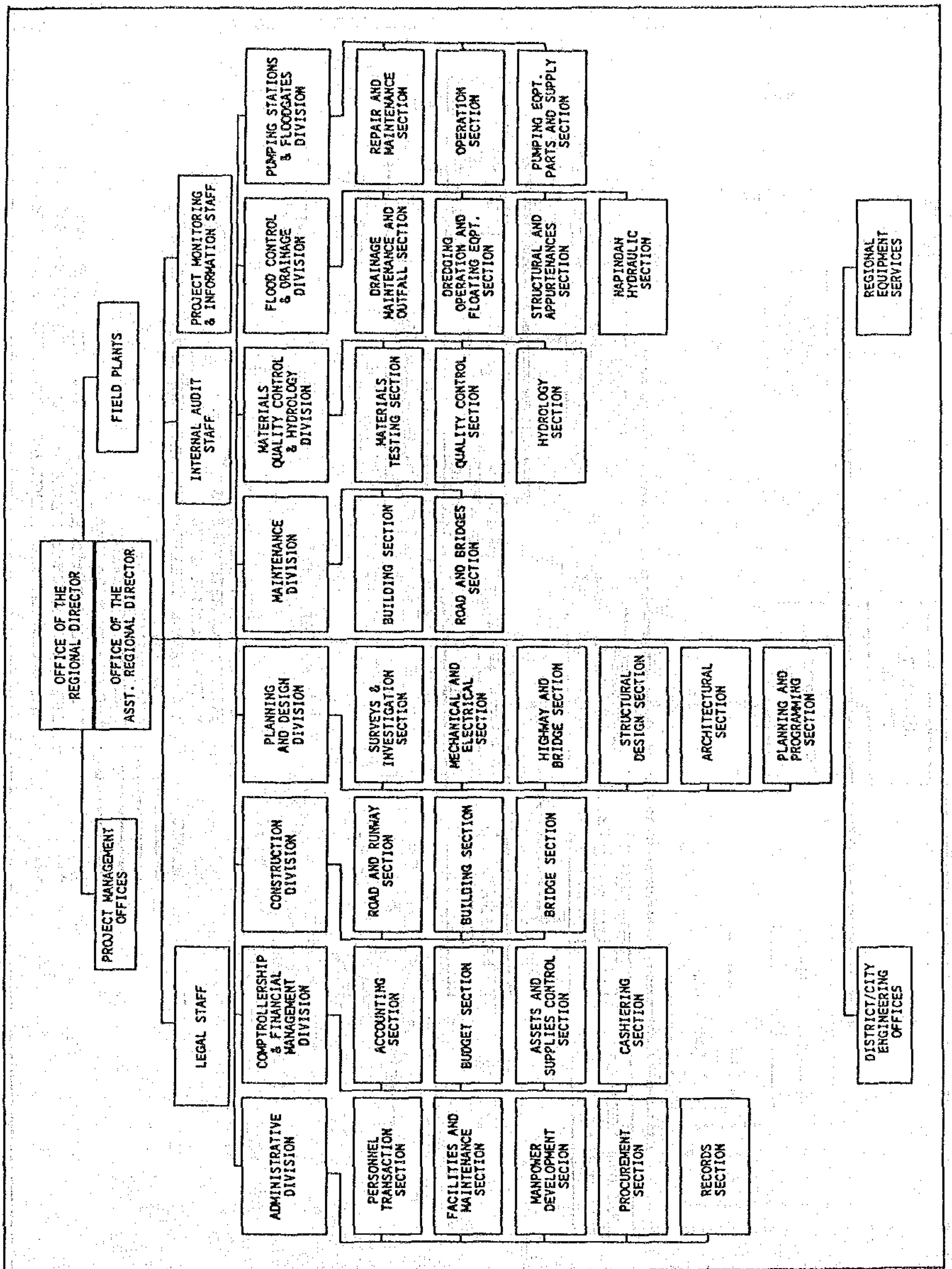


THE STUDY ON FLOOD CONTROL AND DRAINAGE PROJECT IN METRO MANILA, PHILIPPINES JAPAN INTERNATIONAL COOPERATION AGENCY	ORGANIZATION CHART OF THE DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS Fig. 3.4-1



Note: Drainage facilities include pumping stations, floodgates, etc..

THE STUDY ON FLOOD CONTROL AND DRAINAGE PROJECT IN METRO MANILA, PHILIPPINES JAPAN INTERNATIONAL COOPERATION AGENCY	DIAGRAM OF PRESENT ADMINISTRATIVE SETUP FOR WATERWAYS IN METRO MANILA Fig. 7-2-2

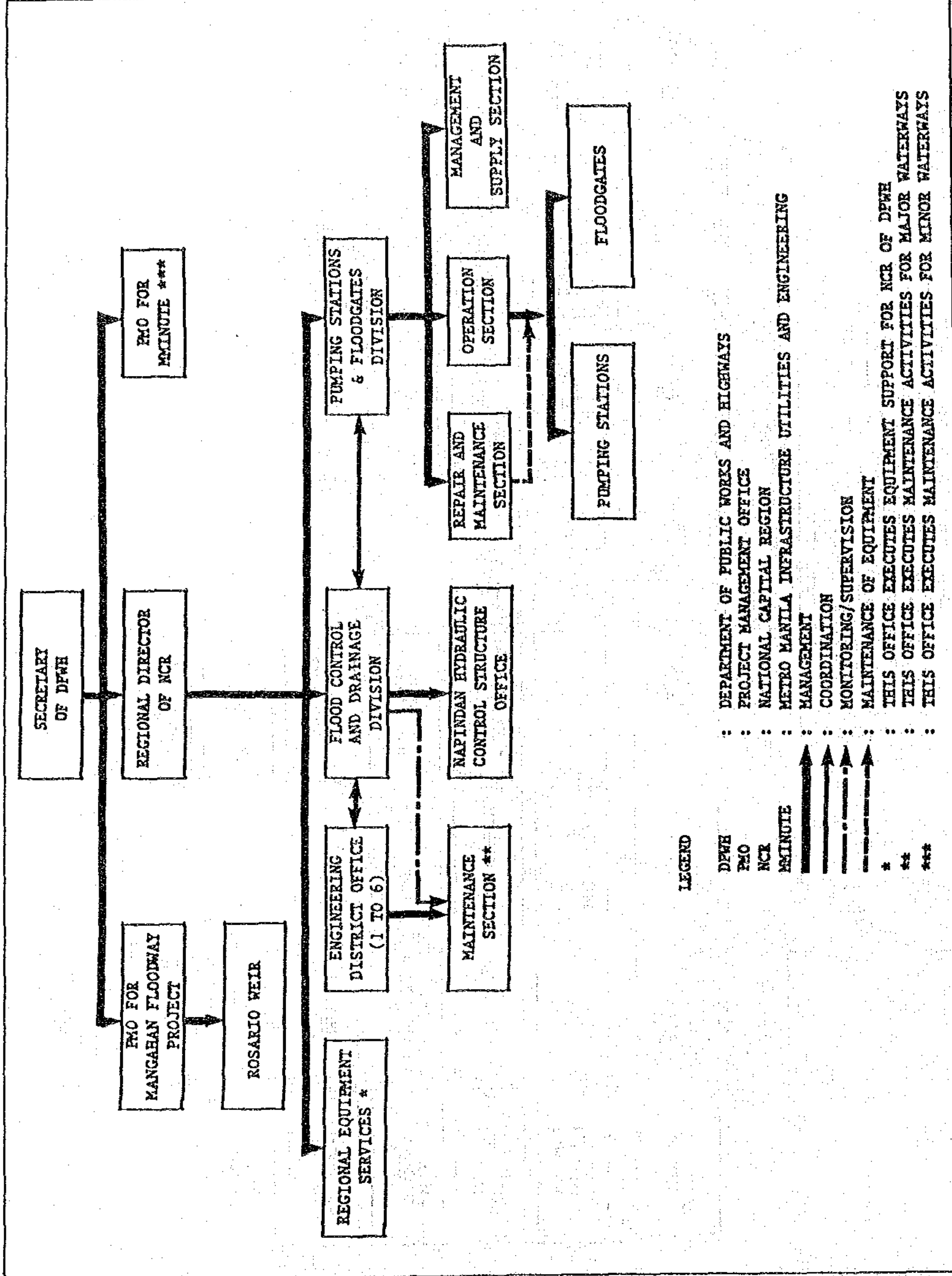


THE STUDY ON FLOOD CONTROL AND DRAINAGE PROJECT IN METRO MANILA, PHILIPPINES

JAPAN INTERNATIONAL COOPERATION AGENCY

ORGANIZATIONAL CHART OF THE DPWH NATIONAL CAPITAL REGION

Fig. 7-2-3

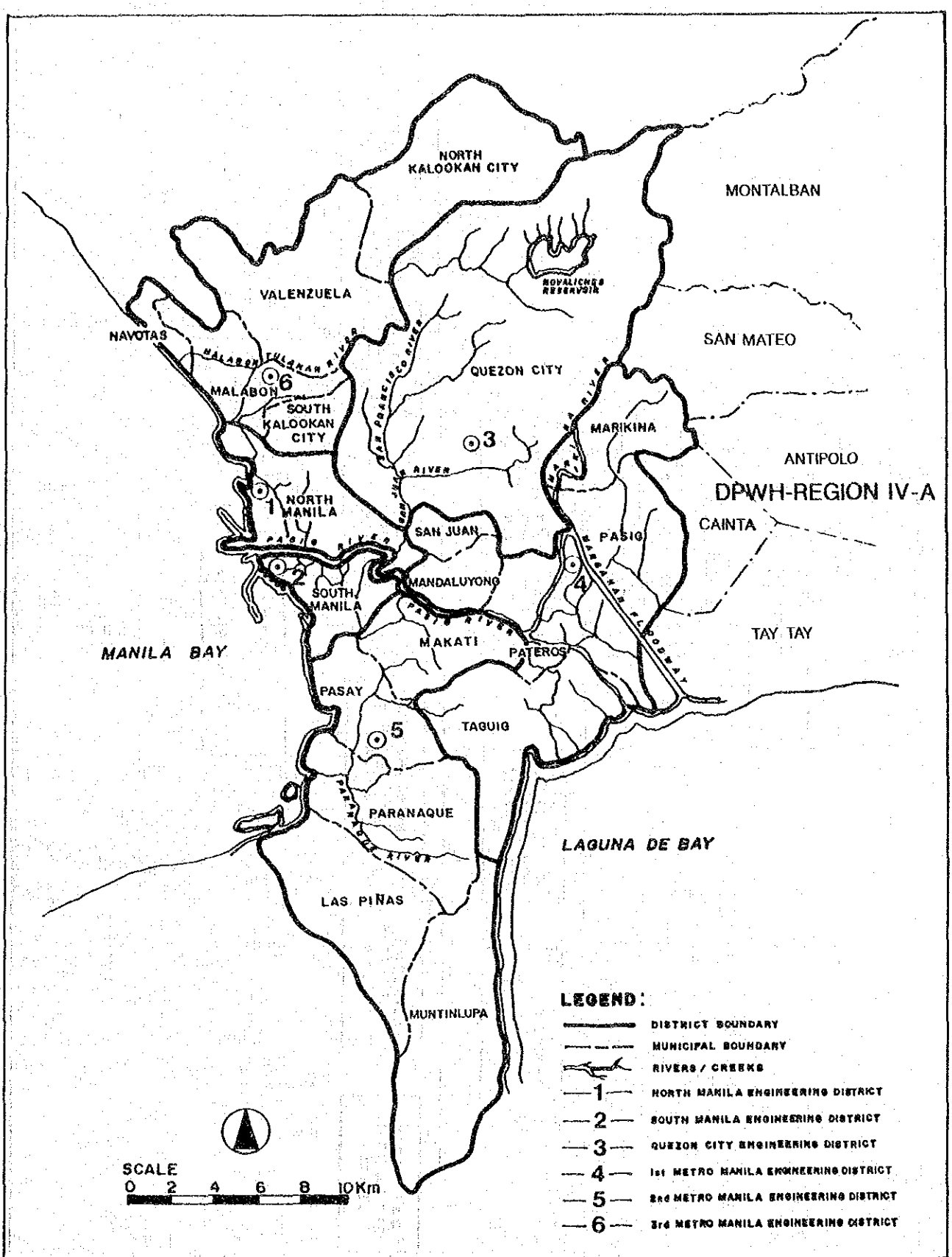


THE STUDY ON FLOOD CONTROL AND DRAINAGE PROJECT IN METRO MANILA, PHILIPPINES

JAPAN INTERNATIONAL COOPERATION AGENCY

ADMINISTRATIVE DIAGRAM OF METRO MANILA FLOOD CONTROL FACILITIES UNDER DPWH

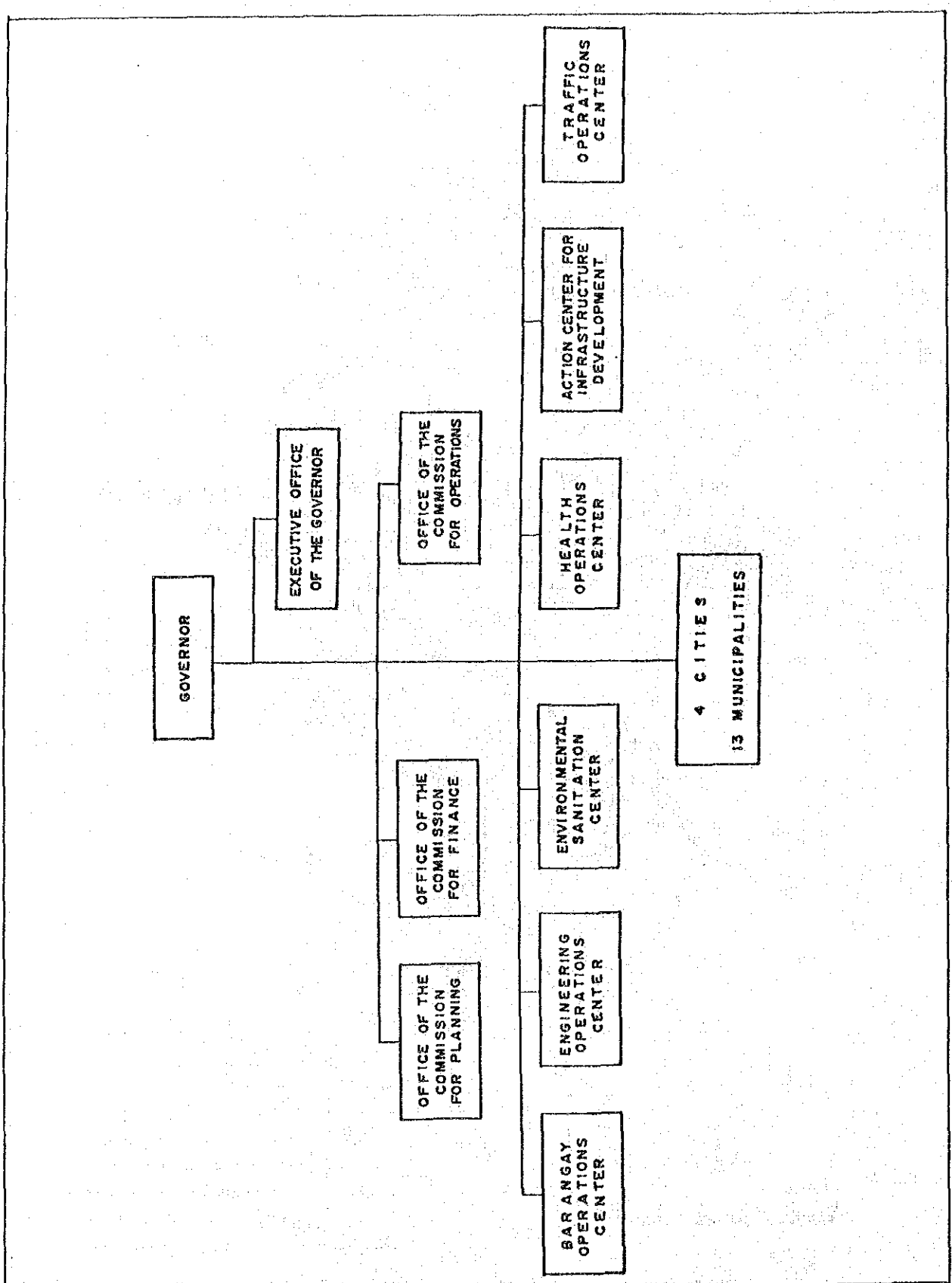
Fig. 7-2-4



THE STUDY ON FLOOD CONTROL AND DRAINAGE PROJECT IN METRO MANILA, PHILIPPINES

JAPAN INTERNATIONAL COOPERATION AGENCY

LOCATION MAP OF ENGINEERING DISTRICT OFFICES UNDER THE NATIONAL CAPITAL REGION, DPWH Fig. 7-2-5

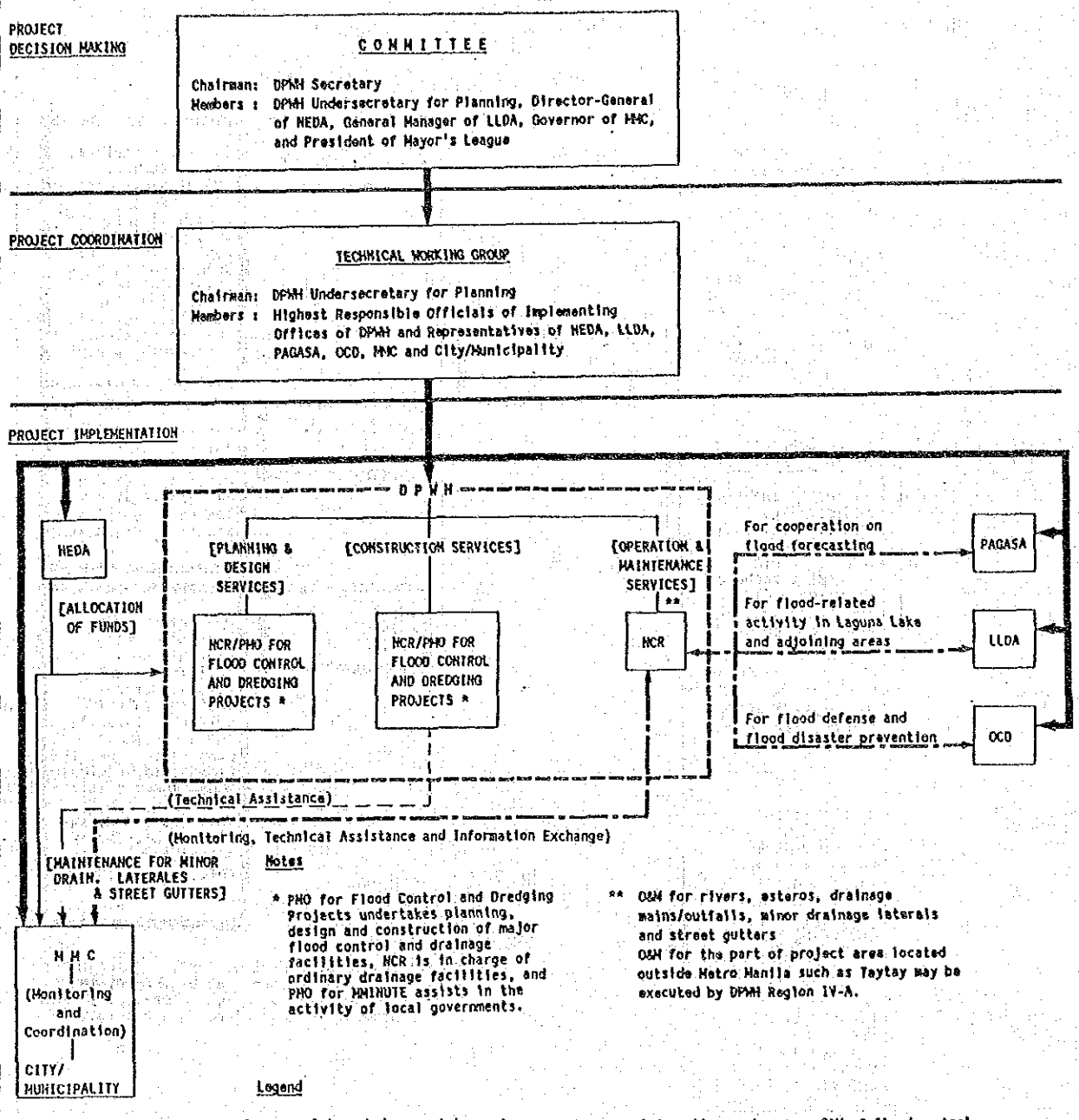


THE STUDY ON FLOOD CONTROL AND DRAINAGE PROJECT IN METRO MANILA, PHILIPPINES

JAPAN INTERNATIONAL COOPERATION AGENCY

ORGANIZATION CHART OF THE METROPOLITAN MANILA COMMISSION

Fig. 7-2-6

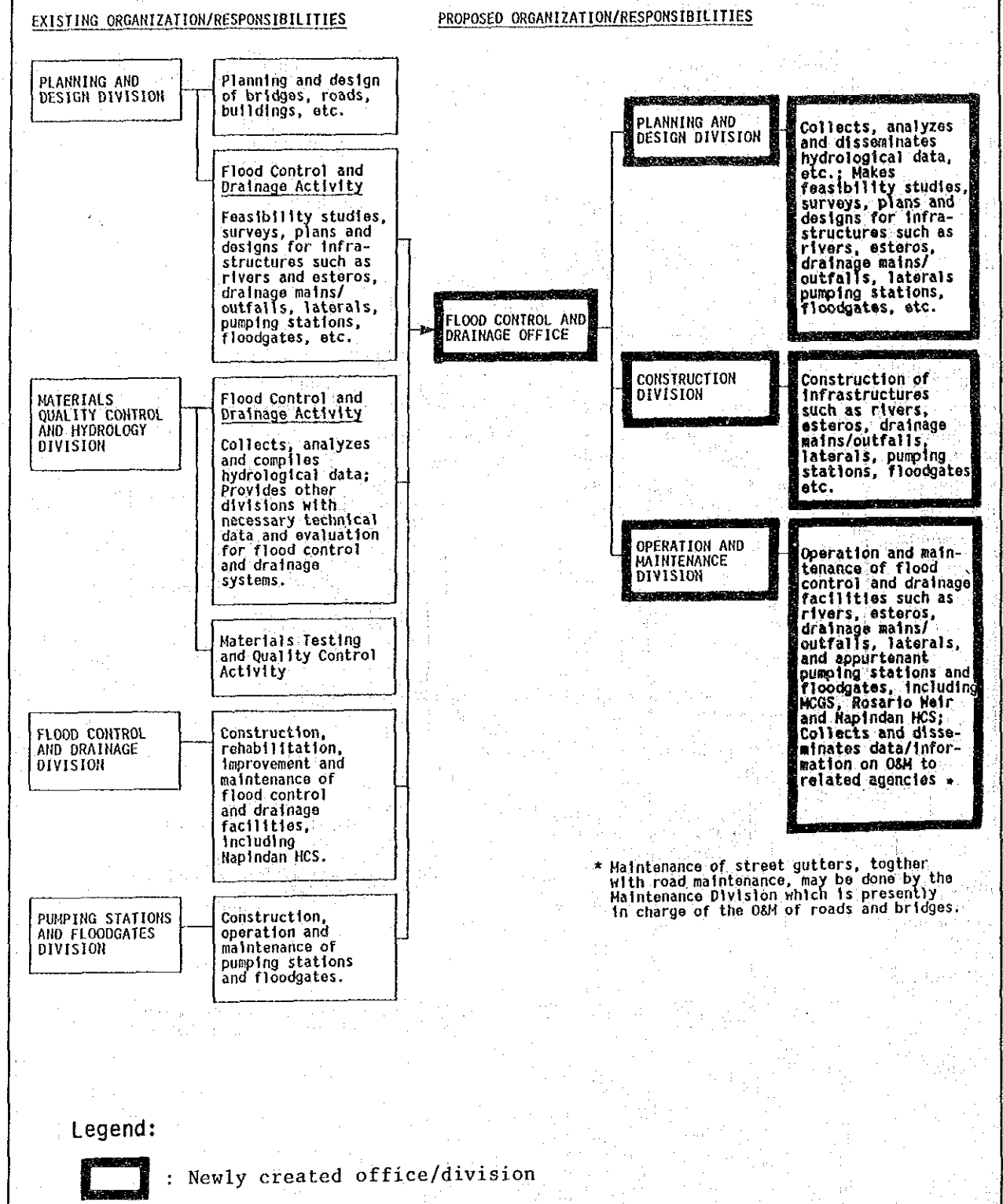


THE STUDY ON FLOOD CONTROL AND DRAINAGE PROJECT IN METRO MANILA, PHILIPPINES

JAPAN INTERNATIONAL COOPERATION AGENCY

DIAGRAM OF PROPOSED ORGANIZATION OF FLOOD CONTROL AND DRAINAGE PROJECT IN METRO MANILA

Fig. 7-3-1



THE STUDY ON FLOOD CONTROL AND DRAINAGE PROJECT IN METRO MANILA, PHILIPPINES JAPAN INTERNATIONAL COOPERATION AGENCY	PROPOSED ORGANIZATIONAL SETUP OF FLOOD CONTROL AND DRAINAGE ACTIVITIES IN DPWH-NCR Fig. 7-3-2

APPENDIX

FLOOD CONTROL AND FLOOD FORECASTING SYSTEM IN JAPAN

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LIST OF TABLES

LIST OF FIGURES

An outline of flood control and flood forecasting system in Japan is herein made, through the presentation of those of Yodo River, which may be useful in the formulation of the flood control and drainage project in Metro Manila. The organization chart of the Government of Japan is presented in Fig. 7-A-1.

1. LEGAL AND ADMINISTRATIVE FRAMEWORK

The legal and administrative framework regarding flood control and flood forecasting system in Japan is described hereinafter.

Flood Control

The fundamental law of the river administration is the River Law which makes clear the idea of comprehensive administration of rivers performed for public purpose, involving both the flood control and water utilization aspects. Other related laws are enumerated in Table 7-A-1.

In accordance with the River Law, rivers are classified as follows: The river basins that are of major importance from the standpoint of land conversation and national economy are designated as Class A river basins. The rivers in the Class A river basins are designated as Class A rivers. The administration of such rivers is performed by the Minister of Construction.

However, the Minister of Construction may, with regard to the section of a Class A river he designates, make the prefectural governor perform part of the administration. The matters entrusted to the prefectural governor will be matters other than the basic plan of work execution, disposal of water rights exceeding a fixed scale, etc.

There are no cases where Class A and Class B rivers coexist in one river system. The number of rivers designated Class A and Class B in 1987 is presented as follows:

Category	Number of River Basins	Number of Rivers	Total Length (km)
Class A Rivers	109	117	86,586
Class B Rivers	2,666	6,826	35,279

River administration facilities mean dams, weirs, sluices, levees, revetments, groundsills and other facilities which have the effect of increasing public benefits brought about by the running water of rivers or of eliminating or decreasing public loss.

All facilities having such functions are river administration facilities, and no action such as approval, designation, etc. is required for them. However, with regard to facilities built by a person other than the river administrator, even if they have such functions, they cannot be river administration facilities without the consent of the person who administers such facilities.

The land of river areas can of course be a subject of ownership and other rights. However, because of the public nature of rivers, naturally there are restrictions within the limits of necessity on the exercise of rights concerning the land within river areas. Concretely, there will be restrictions as may be provided for by regulations based on the River Law.

As for the running water of rivers, private control is impossible because of its nature, so naturally it cannot be a subject of private rights even though there is no special provision concerning it.

Flood forecasting in Japan is executed by both the Ministry of Construction and the Meteorological Agency under the Ministry of Transport in accordance with the Flood Defense Law and the Meteorological Service Law (refer to Table 7-A-2). In accordance with the Flood Defense Law, the Minister of Construction and the Director-General of the Meteorological Agency are held jointly responsible for flood forecasting on rivers running through two or more prefectures, or those having a large catchment area where flood might cause serious damage to the national economy as a whole designated by

the Minister of Construction and the Minister of Transport (17 river basins, refer to Table 7-A-3). In other rivers, flood forecasting is executed by the Meteorological Agency (refer to Table 7-A-2). The flood forecasting system in the former important rivers is discussed in the following paragraphs.

According to the Basic Agreement on Flood Forecasting issued jointly by the Ministry of Construction and the Meteorological Agency which was concluded to assure smooth implementation of joint activities, the regional construction bureau or the local construction office under the Ministry of Construction and the district meteorological observatories under the Meteorological Agency execute flood forecasting jointly. For its part, the regional construction bureau or the local construction office undertakes the drafting of flood forecast depending on the administrative situation of the rivers and the judgment from hydrological conditions; while, the district meteorological observatory performs its part of drafting flood forecast depending primarily on the judgment from the meteorological conditions. In accordance with the Flood Defense Law, the flood forecast is promptly transmitted through the dissemination network, as exemplarily shown in Fig. 7-A-2, to offices such as the prefectural government, the press and other information media, and other parties concerned.

Under the Flood Defense Law, the Minister of Construction is held responsible in issuing flood defense warning with regard to rivers, lakes and/or seacoasts where flood or storm tide might cause damage to the national economy as a whole (refer to Table 7-A-2). Rivers in 108 river basins have been designated by the Minister of Construction (refer to Table 7-A-4) and flood defense warning on the others are executed by the prefectural government concerned and the Meteorological Agency (refer to Table 7-A-2).

The flood defense warning by the Regional Construction Bureau or the Local Construction Office of the Ministry of Construction is transmitted to the prefectural government concerned which, in turn, transmits the information to the local governments of the cities, towns and villages, and/or the flood defense administrators, through the dissemination network as exemplarily shown in Fig. 7-A-3. Under the

Disaster Countermeasures Law, the officials of prefectural governments, mayors, heads of towns and villages, and/or the flood defense administrators are authorized to issue advices and/or instructions to the people concerned for evacuation from their habitation to prevent any possible loss of life and property due to the anticipated flood. In case the mayor or the head of the town/village is not able to do so, the local police authorities are entitled to execute this job as proxy.

2. FLOOD CONTROL AND FLOOD FORECASTING SYSTEM IN THE YODO RIVER

2.1 General Description of the Yodo River

The Yodo River Basin is a first-class river basin of Japan, covering an area of 8,240 km^2 in six prefectures - Osaka, Kyoto, Hyogo, Shiga, Nara and Mie. The basin has a total population of 9.2 million. Until 280 years ago, the Yodo River, together with the Yamato River flowing just south of it, had formed a greater basin. (Refer to Fig. 7-A-4).

The upper river basin of the Yodo River consists of basins of the Uji River (central tributary), the Kizu River (tributary on Yodo's left bank) and the Katsura River (tributary on Yodo's left bank). These tributaries meet one another in the southwestern part of the Kyoto Basin to form the Yodo River, which flows through the Osaka Plain into Osaka Bay. The Yodo River has two branch rivers: the Kanzaki River on its right bank the Ohkawa River (Old Yodo River) on its left bank. The Uji River finds its water source in Lake Biwa.

Lake Biwa is often referred to as a huge natural reservoir with its lake area of 680 km^2, catchment area of 3,848 km^2, maximum depth of 103.6 m and pondage of 27.5 billion tons. Lake Biwa stabilizes the flow regime of the Yodo River, helps flood control, supplies irrigation water, and provides indispensable water resources to the Keihanshin (Kyoto-Osaka-Kobe) District. Furthermore, Lake Biwa is a virtual storehouse of abundant biological resources and natural environment.

The Kizu River basin has a catchment area of 1,647 km^2. Along its tributary, the Nabari River, three multi-purpose dams have been

constructed for flood control and water resources development. In the midstream basin of the Kizu River are Ueno Basin and Iwakura Ravine having natural flood controlling functions.

Along the Katsura River with catchment area of 1,152 km^2 lie Kameoka Basin and Hozu Ravine where water retarding phenomena are often observed.

The Osaka Plain, through which the Yodo Mainstream flows, is an alluvial plain formed by repeated floods of the Yodo and Yamato rivers. A number of cities including Osaka, Neyagawa and Hirakata are located in this plain. As a result of land subsidence caused by excessive pumping up of underground water, the ground level of Osaka City is remarkably lower than the water stage of rivers during floods. (Refer to Fig. 7-A-5.)

Geologically, the Uji River Basin and the Lake Biwa Basin are formed of paleozoic strata and granite. The upstream basin of the Kizu River is formed of granite, while its downstream basin has a distribution of tertiary formation. A major portion of the Katsura River Basin has paleozoic strata.

2.2 Flood Control

Pursuant to the River Law, a major portion of the Yodo River Basin lies within the jurisdiction of the Ministry of Construction (refer to Fig. 7-A-6). The control of the specified portion is entrusted to the governor of the prefecture. (Refer to Fig. 7-A-4.)

The control by the national government is actually carried out by seven extension offices of the Kinki Regional Construction Bureau, as shown in Fig. 7-A-7, and the control ranges from administration such as permission on the use of water and land of the river and the limitation and prohibition of acts which may affect the river to actual river improvement works and maintenance of river-controlling facilities. The extension office has several stations within its jurisdiction for the purpose of most proper and efficient river management.

Furthermore, the Water Resources Development Public Corporation, on behalf of the national government which serves as river administrator,

constructs, reconstructs and controls dams such as Takayama Dam, Lake Biwa, pursuant to the Water Resources Development Promotion Act and the Water Resources Development Public Corporation Act.

The method of administration for the specified portion by governors of related prefectures is similar to that by national government. Civil engineering offices -- extensions of the civil engineering divisions of prefectural governments -- are in charge of the control of such portions.

In the field of discharge control, the Yodo River Dams Integrated Control Office plays a vital role for comprehensive control and utilization of the dams constructed in the Yodo River system, by supplying information on high water and low water discharges indispensable for integrated discharge control. Each organ engagted in river administration is responsible for water quality control, forming a communication network throughout the entire Yodo River Basin.

Control of floods is shared by river courses and flood-controlling facilities such as dams, as illustrated in Fig. 7-A-8. The design flood discharge at Hirakata Datum Point is set at 17,000 m^3/sec, and the design high water discharge after control by dams, etc., is set at 12,000 m^3/sec.

2.3 Flood Forecasting System

Generally, flood forecasting system consists of the hydrological data collection and flood prediction, flood discharge control, and the dissemination and warning of predicted flood data.

Hydrological Data Collection and Flood Prediction

Hydrological data collection and flood prediction are effectively executed by the Yodo River Dams Intergrated Control Office under the Kinki Regional Construction Bureau, Ministry of Construction, through integrated communication systems such as the river information system. (Refer to Fig. 7-A-9.)

In the river information system, telemeters are installed to observe water stage and water quality of each river, water stage, inflow

and discharge of each dam, and rainfall and snowfall in each basin, to keep track of the meteorological and hydrological data in the Yodo River Basin.

These hydrological data gathered at each observation station are sent to competnet office via microwave lines used exclusively by the Ministry of Construction, and further transmitted automatically to the Yodo River Dams Integrated Control Office.

In the operation/processing system, all the hydrological information collected is processed by the large electronic computer for filing. The same electronic computer is used for forecasting typhoon courses and rainfall in the event of flood. It simulates flood runoff at datum points in the Uji, Kizu and Katsura rivers, and the Yodo mainstream, thereby estimating possible flood waveform.

In the event of drought, the computer simulates low water runoff based on the storage volumes of Lake Biwa and the dams in the river basin and long-term precipitation forecast released by the Meteorological Agency, in order to calculate ideal discharges from Lake Biwa and the dams. (Refer to Fig. 7-A-10.)

The system to send processed discharge control information is composed of the large electronic computer at the Yodo River Dams Integrated Control Office, and CRT display terminals installed in the Kinki Regional Construction Bureau, the extension offices in the Yodo River Basin, and dam control offices belonging to the Water Resources Development Public Corporation, all of which are connected to form an on-line network.

Precipitation across the Kinki District is automatically measured by radar rain gauges every 5 minutes, and the data are immediately sent to the Yodo River Dams Integrated Control Office. These data are then converted into rainfall intensity with the use of a special-purpose computer, and further processed into graphic information specially designed for control of rivers, dams and roads, so that it can be projected in the CRT display terminal in each office.

In addition to the aforesaid information, various meteorological data collected by the Meteorological Agency are regularly sent to the

Yodo River Dams Integrated Control Office via facsimile lines, so that they can be used as indispensable data for precipitation forecast.

Flood Discharge Control

The facilities for artificial and large-scale control of flood runoff in the Yodo River Basin include Setagawa Weir and Amagase Dam in the jurisdiction of the Ministry of Construction and the three dams on the Kizu River controlled by the Water Resources Development Public Corporation.

These dams are all multi-purpose dams. During the flood period (June 16 to October 15), the water stage of each dam is reduced to the limited water stage to always secure sufficient flood control capacity.

When flood becomes eminent, for example, with the approach of a typhoon, Amagase Dam begins preliminary discharge in order to preclude inundation in the urban areas in its downstream region, by increasing its flood control capacity and improving flood controlling capability to such an extent that it will not affect water utilization.

In the event of flood, these dams and weirs are, in principle, operated separately in accordance with the rules predetermined pursuant to the River Law. Meanwhile, the Yodo River Dams Integrated Control Office simulates the possible condition based on the predicted typhoon course, precipitation forecast and flood runoff forecast, to work out a flood control plan for the dams in the Yodo River Basin. If it is necessary to minimize flood damage by organic coordinated operations of individual dams, the office instructs three dams managed by the Water Resources Development Public Corporation to carry out integrated control.

When the water stage at Hirakata Datum Point rises over the warning water stage, integrated control of Setagawa Weir on the Uji River and Amagase Dam is carried out to control flood effectively with the ultimate goal of reducing peak discharge in the Yodo mainstream immediately below the confluence of the three tributatries.

In the event of flood, the discharge capabilities of branch rivers in the urban areas in the middle and downstream of the Yodo River drop

drastically with the rise of the water stage of the Yodo River, generating the danger of damage caused by difficulties of internal drainage. To prevent this, it is necessary to operate the sluices and internal drainage pumps to possibly mitigate inundation damage.

Flood Warning

According to the Flood Defense Law, flood forecast shall be issued jointly by the Director of the Kinki Regional Construction Bureau (on behalf of the Minister of Construction) and the Director of the Osaka Regional Meteorological Observatory (on behalf of the Director General of the Meteorological Agency), and made known to the general public with the cooperation of the mass media. (Refer to Fig. 7-A-2.)

Flood defense activities such as flood defense engineering works, alert system and evacuation are carried out by flood defense control organizations (cities, towns, villages and flood defense cooperative). In accordance with the flood defense plan worked out by the governor of the related prefecture pursuant to the Law.

Flood defense warnings on which flood defense activities are based are issued by the Ministry of Construction for the portion of the river basin under direct control of the ministry, and by the competent prefecture for other portions.

For smooth management of these works related to flood defense, all the organs concerned hold a conference every year before the beginning of the flood season, to discuss key locations to be defended, checking of river control facilities such as embankment, and checking of the communication network.

Table 7-A-1(1/4) JAPANESE LAWS ON RIVER ADMINISTRATION

Law	Contents
River	
° River Law	1964 (Enactment) This law deals with the prevention of disasters caused by floods, high tides, etc., by the comprehensive management of rivers. It also deals with the use of river water and the keeping of river maintenance flow.
Emergency Countermeasures against Erosion and Flooding	
° Law concerning Anti-Erosion and Anti-Flood Special Measures	1960 This law established the 5-Year Plan for Erosion and Sedimentation Control Projects in mountain areas and the 5-year Plan for Flood Control Projects to expedite the implementation of erosion and flood control projects.
° Flood Control Special Accounting Law	1960 This law established a special account in the national treasury for the clear accounting of government funds for flood control projects and multipurpose dam construction works.
Flood Defense	
° Flood Defense Law	1948 This law stipulates the flood fighting requirements such as flood fighting system, flood forecasting and flood warning system, dispatching of flood fighting brigades, and the financing of these activities. Local municipalities are primarily responsible for flood fighting works.
° Flood Defense Association Law	1908 This law stipulates the formation of flood defense associations to carry out activities not dealth with by local municipalities due to special reasons.

Table 7-A-1(2/4) JAPANESE LAWS ON RIVER ADMINISTRATION

Law	Contents
Sabo Works	
° Sabo Law	1897 This law deals with erosion and sediment control works in upstream regions, the method of allocating project cost, and the restrictions on activities within designated areas.
Landslide Prevention	
° Landslide Prevention Law	1958 This law deals with the implementation procedure of landslide protection works, method of allocating project cost, and restrictions on activities within the landslide prevention area to obviate or mitigate damage caused by landslide and coal-sludge collapse.
Protection of Steeply Sloped Land	
° Land Concerning Disaster Prevention due to Collapse of Steeply Sloped Land	1969 This law designates steeply sloped lands liable to collapse and stipulates the restrictions on harmful activities within the area, the compensation for losses caused by recommendations or orders, the procedure to carry out steep slope collapse prevention works, and the methods of allocating budget for the protection of lives due to the collapse of steep slopes.
Seacoast Protection	
° Seacoast Law	1956 This law designates the seacost administrator, the coastal preservation areas, and the method of allocating expenditures for work aimed at protecting the coast and its hinterland from damage caused by tidal waves, high tides, etc.

Table 7-A-1(3/4) JAPANESE LAWS ON RIVER ADMINISTRATION

Law	Contents
Natural Disaster Prevention	
° Law Concerning National Liability for Expenditures on Public Utilities for Natural Disaster Relief Projects	1951 This law stipulates the ratio of national liability in the rehabilitation of public utilities which have suffered from a natural disaster. The ratio is determined according to the financial capability of local authorities.
° Law Concerning Financial Aid for Relief from Severe Natural Disasters	1962 This law stipulates the special financial aid to local authorities by the national government when severe natural disasters occur.
Dam and Water Resources Development	
° Special Multipurpose Dam Law	1957 This law stipulates special river laws in connection with the construction and administration of multipurpose dams.
° Water Resources Development Public Corporation Law	1961 This law established the Water Resources Development Public Corporation and its functions, and stipulates the allocation of expenditures to implement water resources development projects based on the Water Resources Development Basic Plan.
° Law Concerning Special Measures for Solving Problems at Water Resources Development Project Areas	1973 This law stipulates the special measures for improving the environmental and industrial foundations to attain stable living conditions and promote the welfare of inhabitants in areas where basic conditions will vary as a results of the construction of dams, etc.

Table 7-A-1(4/4) JAPANESE LAWS ON RIVER ADMINISTRATION

Law	Contents
Reclamation	
° Law Concerning Reclamation of Public Water Surface Area	1921 This law stipulates the licensing requirements for the reclamation of public water surfaces, the restrictions on the disposal of reclaimed land, and the restrictions on the change of use of reclaimed land.
Canal	
° Canal Law	1913 This law stipulates the licensing requirements for the construction of canals, the approval of the design and permission to commence canal transportation.
Sand and Gravel Extraction	
° Sand and Gravel Extraction Law	1968 This law stipulates the registration requirements for sand and gravel entrepreneurs, the approval of extracting plans, and issuance of other kinds of control to prevent disasters that may arise from sand and gravel extraction and contribute to the sound development of sand and gravel entrepreneurs.

Table 7-A-2 OUTLINE OF FLOOD FORECASTING AND FLOOD DEFENSE WARNING IN JAPAN

Particulars	Executive Agency (issuer)	Legal Provision	Rivers, Lakes & Seacoast	Contents	Addresses of Information
FLOOD FORECASTING	Director-General of Japan Meteorological Agency and Minister of Construction (jointly)	• Art. 10, Par. 2, Flood Defense Law • Art. 14-2, Par. 2, Meteorological Service Law	Rivers running through more than two prefectures and/or those have large catchment area where flood inundation might cause serious damage to the national economy as a whole, designated by the Minister of Construction upon consultation with the Minister of Transport. (17 river basins out of Class A river basins)	When flooding is likely to occur, to indicate its conditions including water level or discharge (flood warning and/or flood information).	• Prefectural Governors concerned • Press and other information media • Organizations and agencies prescribed under Art. 7, Item 4, Meteorological Service Law Enforcement Order, including Nippon Telegraph and Telephone Corporation
	Director-General of Japan Meteorological Agency	• Art. 10, Par. 1, Flood Defense Law		When flood and/or high tide is likely to occur under meteorological conditions, to indicate its conditions.	• Minister of Construction • Prefectural Governors concerned • Press and other information media
	Japan Meteorological Agency	• Art. 13, Par. 1, Meteorological Service Law • Art. 4, the same law Enforcement Order		Meteorological advisories and warnings for the general public (inundation advisory, flood warning and/or flood warning).	• Press and other information media • Organizations and agencies prescribed under Art. 7, Item 1, Meteorological Service Law Enforcement Order, including Nippon Telegraph and Telephone Corporation
FLOOD DEFENSE WARNING	Minister of Construction	• Art. 10-4, Par. 1, Flood Defense Law	Rivers, lakes or seacoasts where flood inundation or storm tide might cause damage to the national economy as a whole, designated by the Minister of Construction. (108 river basins out of Class A river basins)	Warning for flood defense activities (standby, preparation, mobilization, instruction, etc.).	• Prefectural Governors concerned --> Flood Defense Administrators --> Flood Defense Corps
	Prefectural Governor	-ditto-	Rivers, lakes or seacoasts where flood inundation and storm tide might cause a considerable degree of damage, designated by the Prefectural Governor, excluding those designated by the Minister of Construction.	-ditto-	• Flood Defense Administors --> Flood Defense Corps
	Japan Meteorological Agency	• Art. 14-2, Par. 1, Meteorological Service Law • Art. 6, the same law Enforcement Order		Meteorological advisories and warnings for flood defense activities (meteorological advisory, meteorological warning, high tide advisory, high tide warning, flood advisory and/or flood warning).	• Press and other information media • Organizations prescribed under Art. 7, Item 3, Meteorological Service Law Enforcement Order, including the Ministry of Construction, Prefectural Government, etc.

Table 7-A-3(1/2) RIVERS DESIGNATED FOR FLOOD FORECASTING IN JAPAN

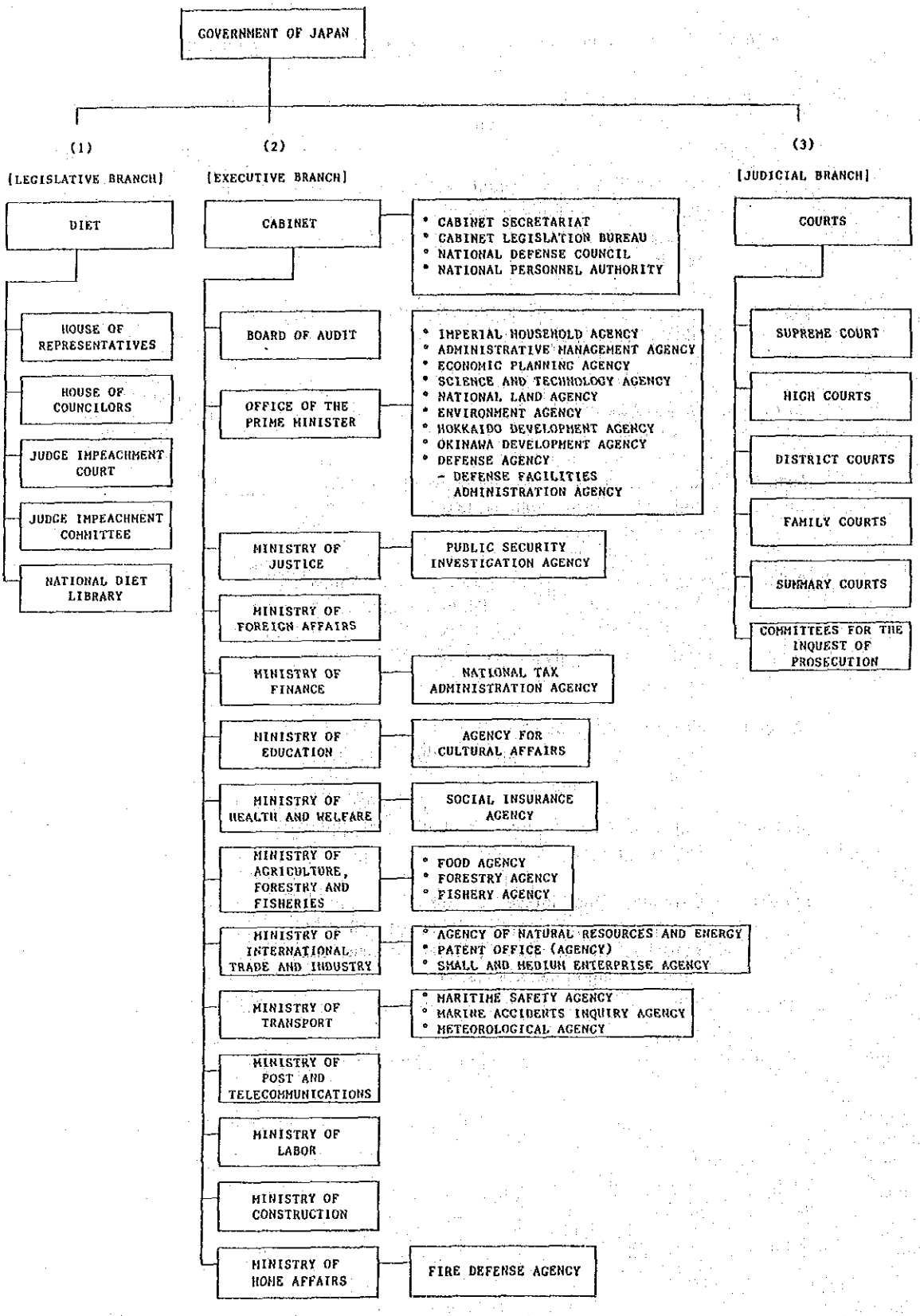
River Basin	River Name	Section
Chikugo	Chikugo River	From Esonoshuku Bridge to the sea
Ota	Ota River	From Kabe-cho, Hiroshima City to the sea
Yoshino	Yoshino River	From Ikeda Town to the sea
Kino	Kino River	From Funato, Iwade Town to the sea
Yamato	Yamato River	From Kashiwara City to the sea
Yodo	Yodo River	From Uji City to the sea
	Lake Biwa	Circumference of the Lake
	Kizu River	From Kamo Town to its confluence with Yodo River
	Katsura River	Section under the jurisdiction of the Minister of Construction
Yura	Yura River	-ditto-
Kiso	Kiso River	From Imawatari Weir to the sea
	Ibi River	From Ibigawa Town to the sea
	Nagara River	Section under the jurisdiction of the Minister of Construction
	Neo River	-ditto-
Tenryu	Tenryu River	Between Chuo Bridge and Koya Bridge; From Kashima, Tenryu City to the sea
Tone	Tone River	From Yattajima, Isesaki City to the sea
	Watarase River	Between Ashikaga City and its confluence with Tone River
	Kinu River	Between Kinu Bridge and its confluence with Tone River
	Kokai River	Between Mitsukaido City and its confluence with Tone River
	Edo River	Entire reach (excluding the Old Edo River)
Ara	Ara River	From Kumagaya City to the sea (excluding the Old Ara River)

Table 7-A-3(2/2) RIVERS DESIGNATED FOR FLOOD FORECASTING IN JAPAN

River Basin	River Name	Section
Shinano	Shinano River	Between Ojiya City and its Okozu diversion point
	Okozu Diversion Channel	Entire reach
Agano	Agano River	From Maoroshi, Gosen City to the sea
Abukuma	Abukuma River	Three sections in Fukushima Prefecture and one section in Miyagi Prefecture
Mogami	Mogami River	Between the Matsukawa-Shirakawa Confluence and Shirataka Town, and from Sagae City to the sea
Kitakami	Kitakami River	From Yugaose Bridge to the sea (excluding the Old Kitakami River)
Ishikari	Ishikari River	From Ishikarigawa Bridge to the sea

Table 7-A-4 RIVERS DESIGNATED FOR FLOOD DEFENSE WARNING IN JAPAN

Region	River Basin	Total
Hokkaido	Teshio, Shokotsu, Yubetsu, Tokoro, Abashiri, Rumoi, Ishikari, Shiribetsu, Shiribeshi-Toshibetsu, Mu, Saru, Kushiro and Tokachi	13
Tohoku	Iwaki, Mabuchi, Kitakami, Naruse, Natori, Abukuma, Yoneshiro, Omono, Koyoshi, Mogami and Aka	11
Kanto	Kuji, Naka, Tone, Ara, Tama, Tsurumi, Sagami and Fuji	8
Hokuriku	Ara, Agano, Shinano, Seki, Hime, Kurobe, Joganji, Jinzu, Sho, Oyabe, Tedori and Kakehashi	12
Chubu	Kano, Abe, Oi, Kiku, Tenryu, Toyo, Yahagi, Shonai, Kiso, Suzuka, Kumozu, Kushida and Miya	13
Kinki	Yodo, Yamato, Maruyama, Kako, Kino, Shingu, Kuzuryu, Kita, Yura and Ibo	10
Chugoku	Tenjin, Hino, Sendai, Hii, Asahi, Takahashi, Yoshii, Gono, Takatsu, Ashida, Ota, Oze and Saba	13
Shikoku	Hiji, Shigenobu, Yoshino, Naka, Doki, Monobe, Niyodo and Watari	8
Kyushu	Chikugo, Yabe, Matsuura, Rokkaku, Kase, Honmyo, Onga, Yamaguni, Oita, Ono, Bansho, Kikuchi, Shira, Midori, Kuma, Gokase, Omaru, Oyodo, Sendai and Kimotsuki	20
	Total	108



THE STUDY ON FLOOD CONTROL AND DRAINAGE PROJECT IN METRO MANILA, PHILIPPINES

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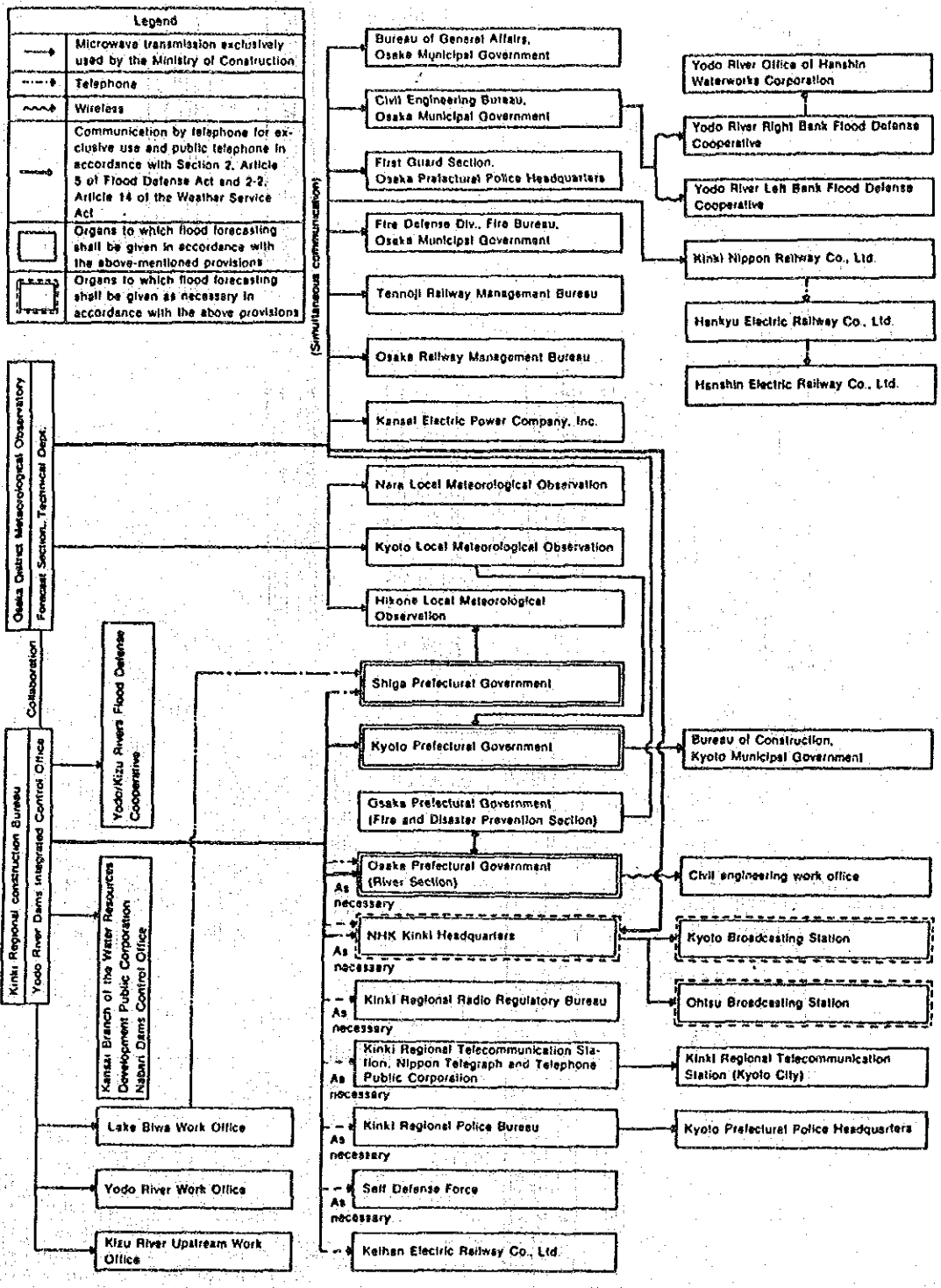
ORGANIZATION CHART OF THE GOVERNMENT OF JAPAN

Fig. 7-A-1



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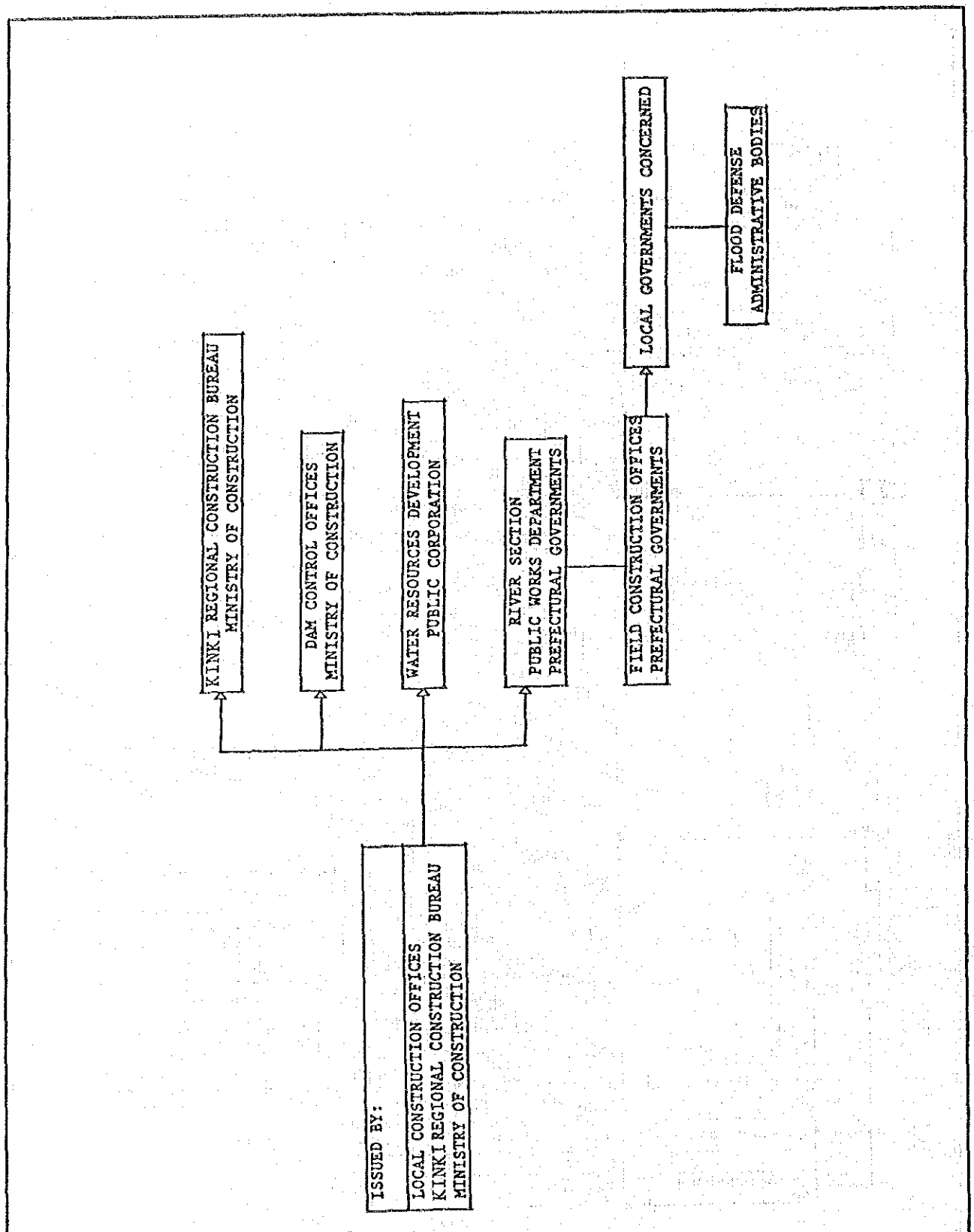
FLOW CHART OF FLOOD FORECASTING FOR THE YODO RIVER Fig. 7-A-2



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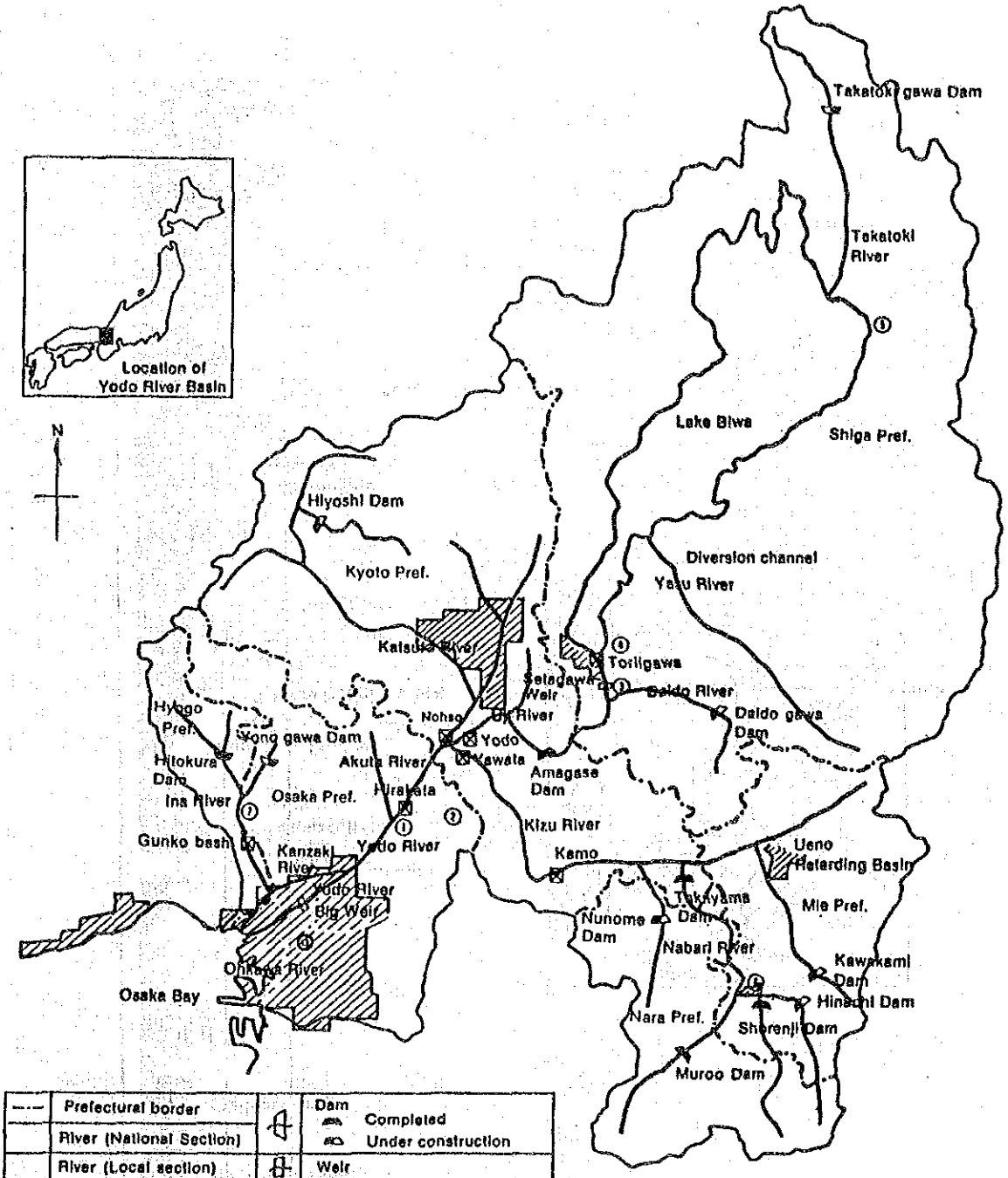
DISSEMINATION NETWORK OF FLOOD DEFENSE WARNING IN THE YODO RIVER BASIN

Fig. 7-A-3



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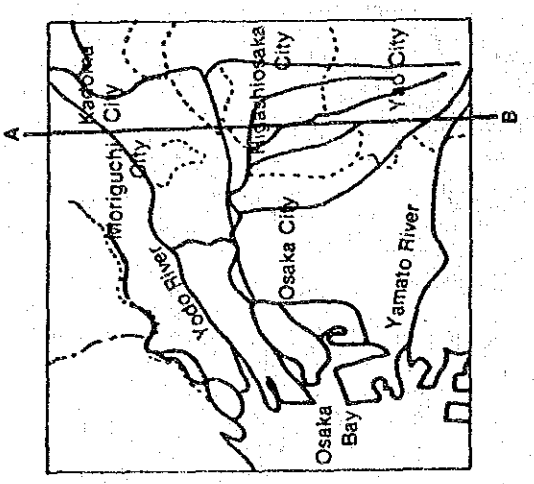
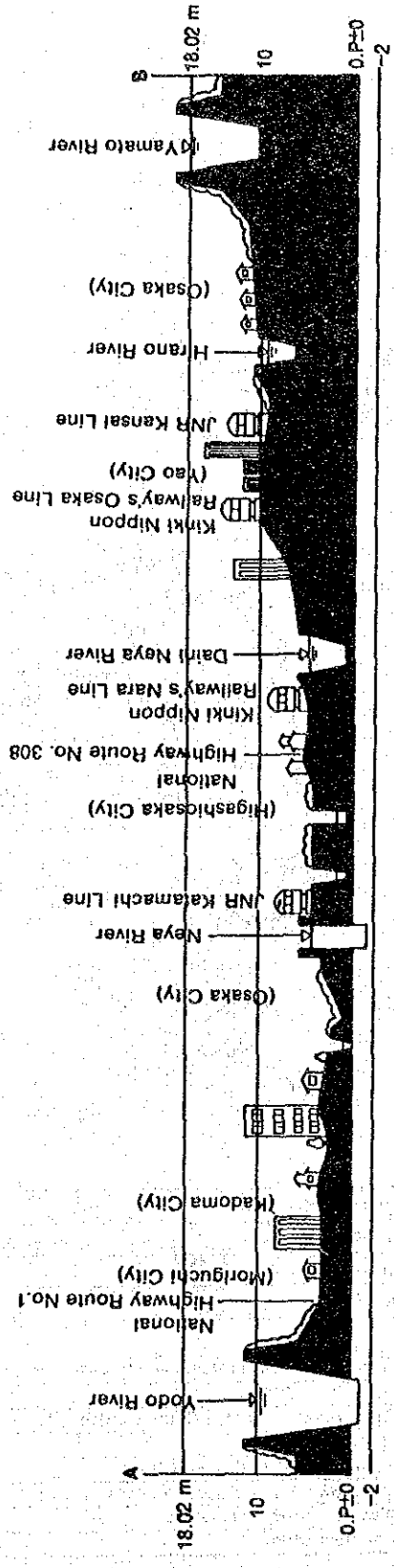
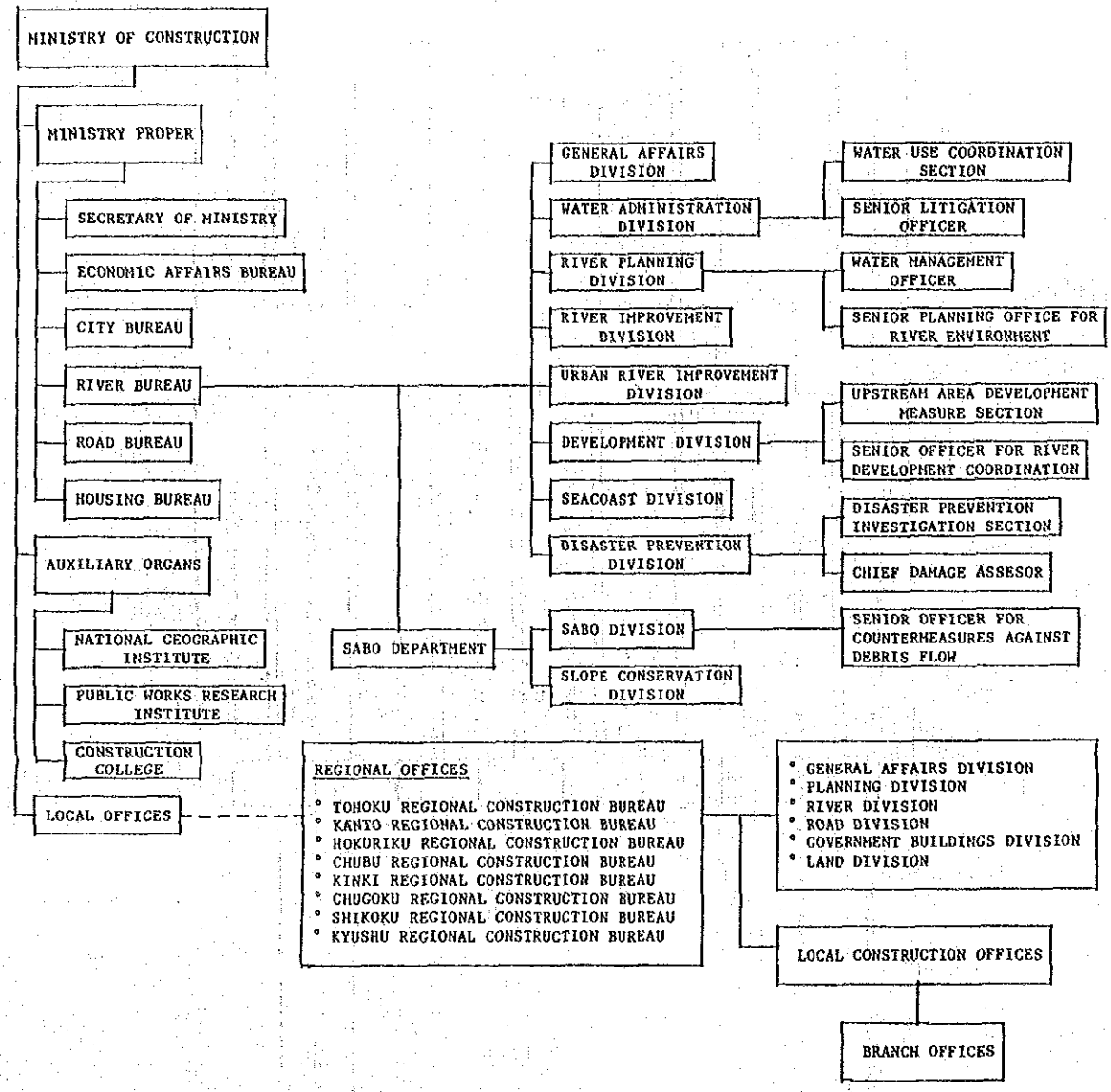
THE YODO RIVER BASIN

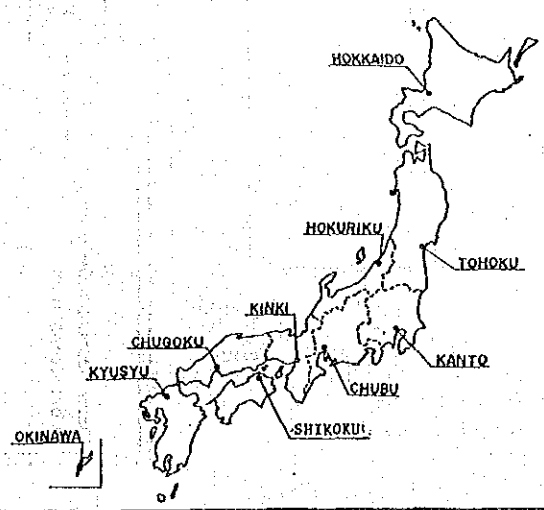
Fig. 7-A-4





THE STUDY ON FLOOD CONTROL AND DRAINAGE PROJECT IN METRO MANILA, PHILIPPINES JAPAN INTERNATIONAL COOPERATION AGENCY	SECTIONAL VIEW FROM THE YODO RIVER TO THE YAMATO RIVER Fig. 7-A-5





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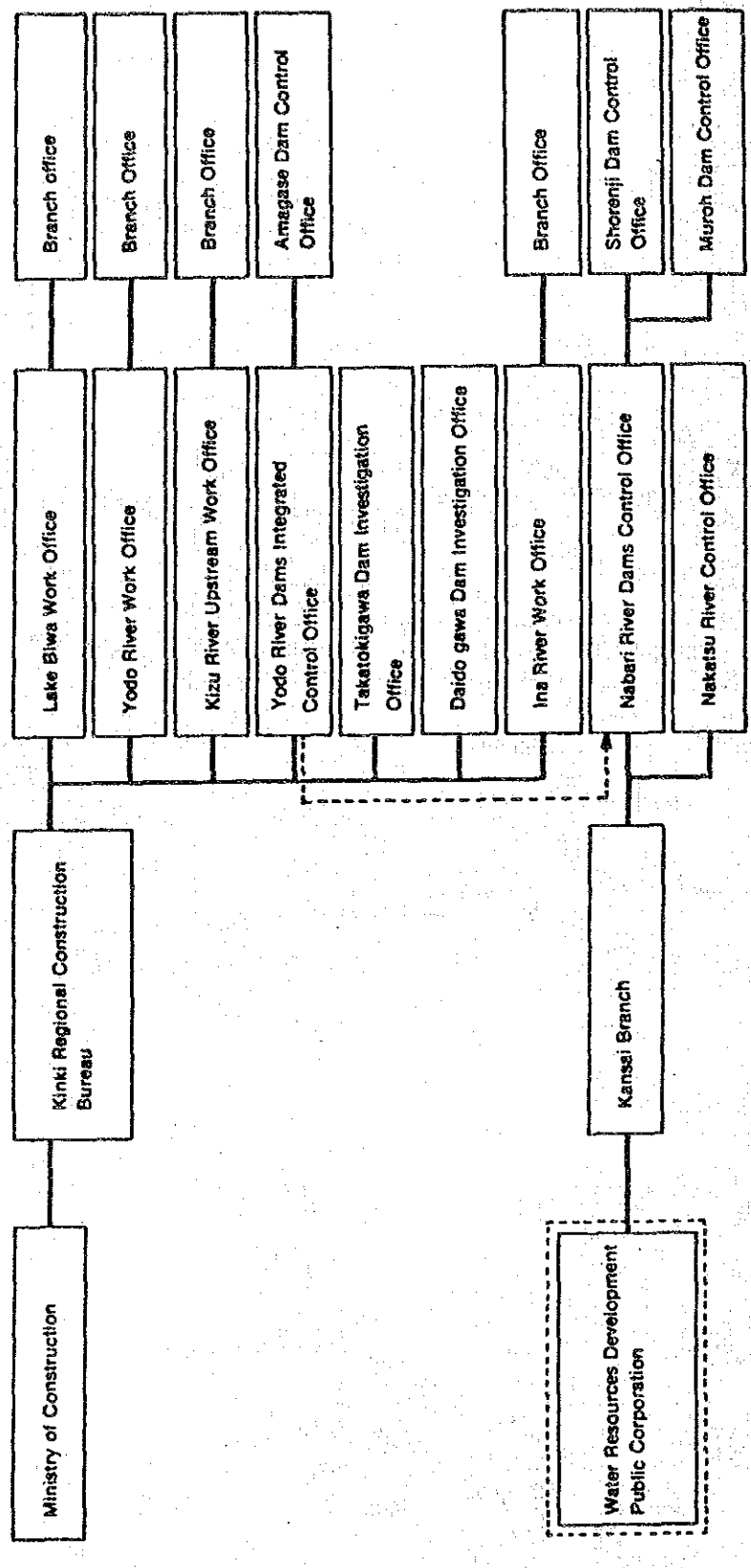
ORGANIZATION CHART OF THE MINISTRY OF CONSTRUCTION, JAPAN Fig. 7-A-6



THE STUDY ON FLOOD CONTROL AND DRAINAGE PROJECT IN METRO MANILA, PHILIPPINES

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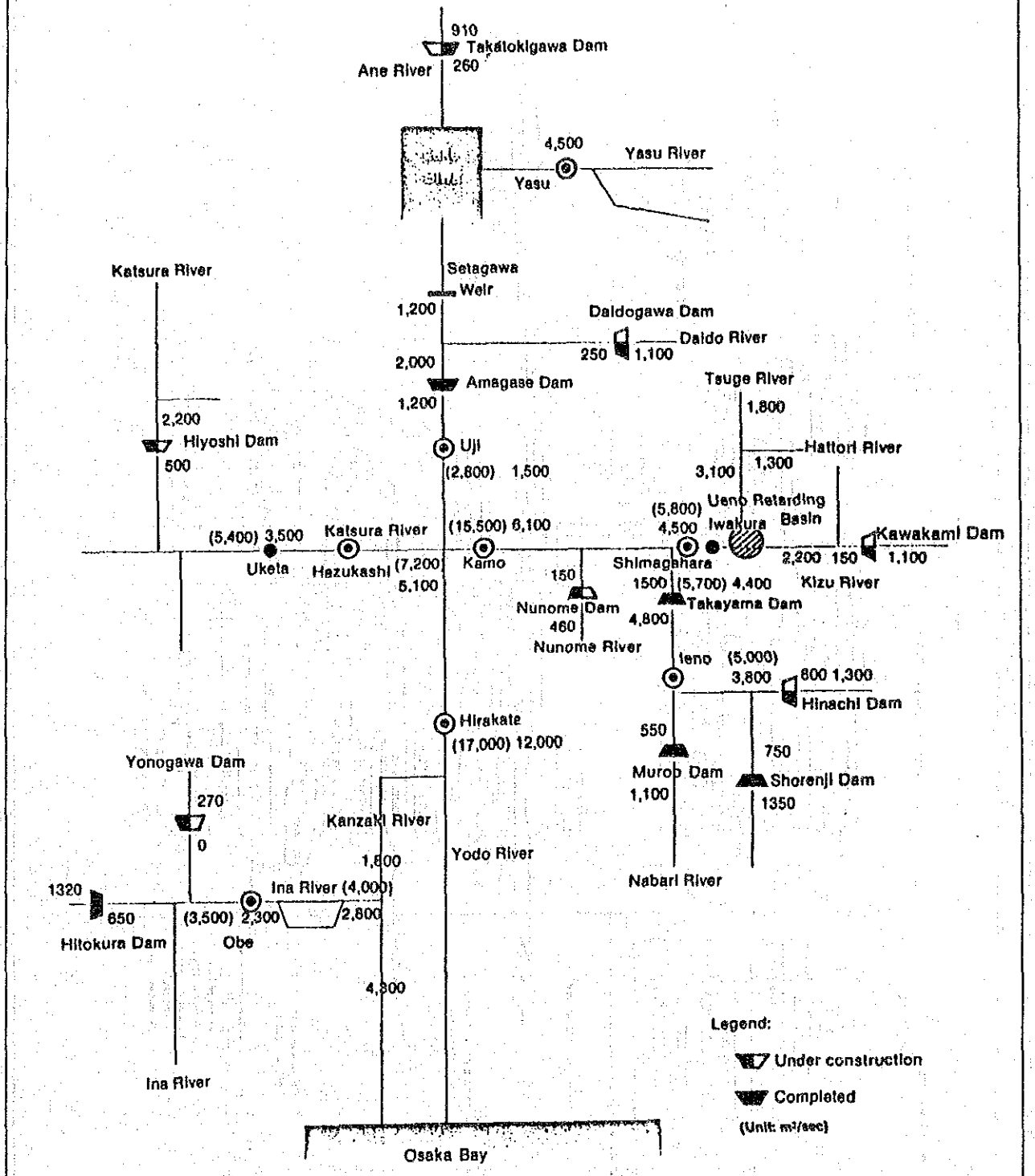
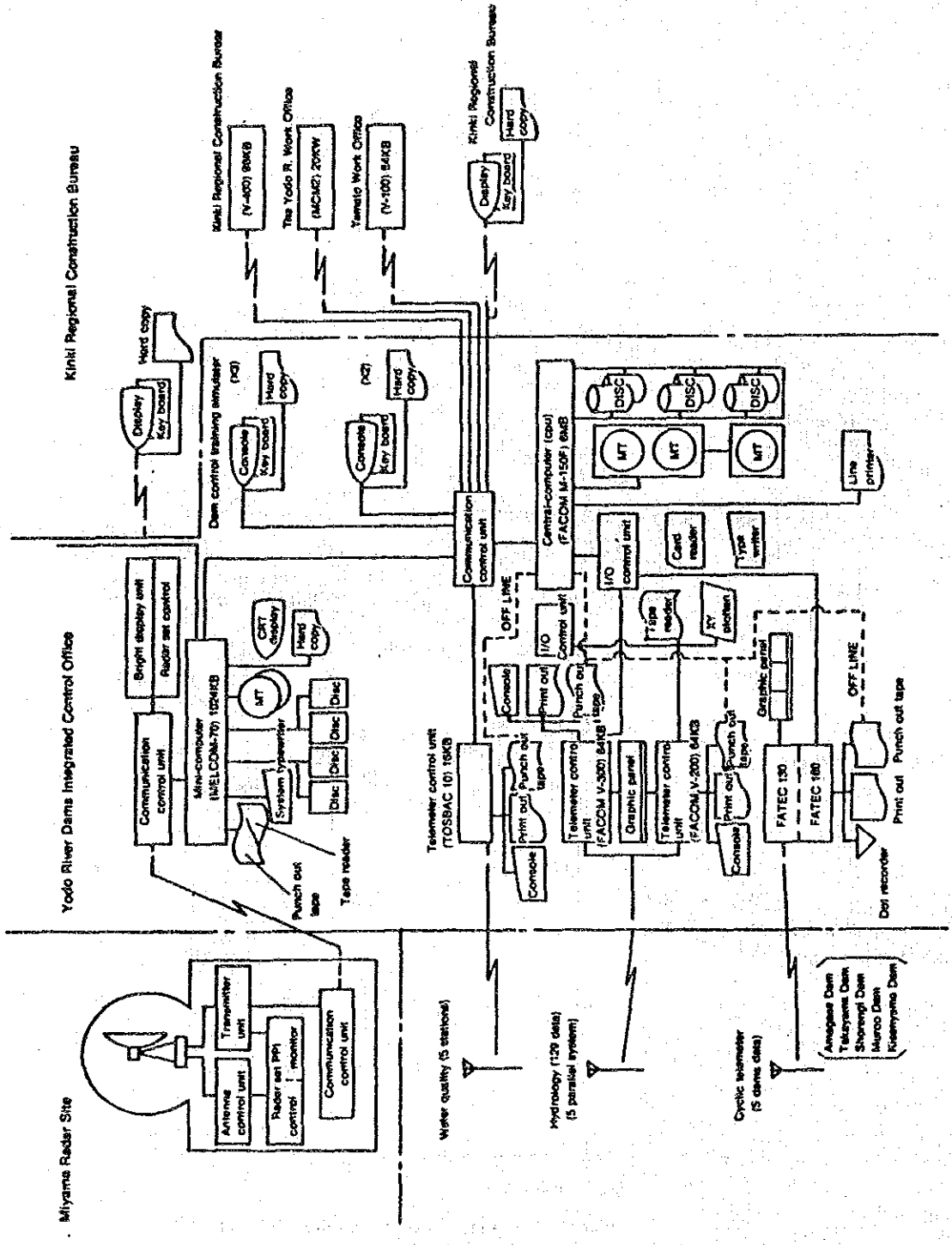
ORGANIZATION CHART OF THE MOC KINKI REGIONAL CONSTRUCTION BUREAU AND THE WRDPC KANSAI BRANCH Fig. 7-A-7



Notes) 1. The above data are taken as of March 1983.
2. The unit is m³/sec.
3. The figure without parentheses shows design high water discharge. The figure in the parentheses shows basic high water discharge.

THE STUDY ON FLOOD CONTROL AND DRAINAGE PROJECT IN METRO MANILA, PHILIPPINES JAPAN INTERNATIONAL COOPERATION AGENCY	SCHEMATIC DIAGRAM OF DESIGN HIGH WATER DISCHARGE IN THE YODO RIVER SYSTEM Fig. 7-A-8



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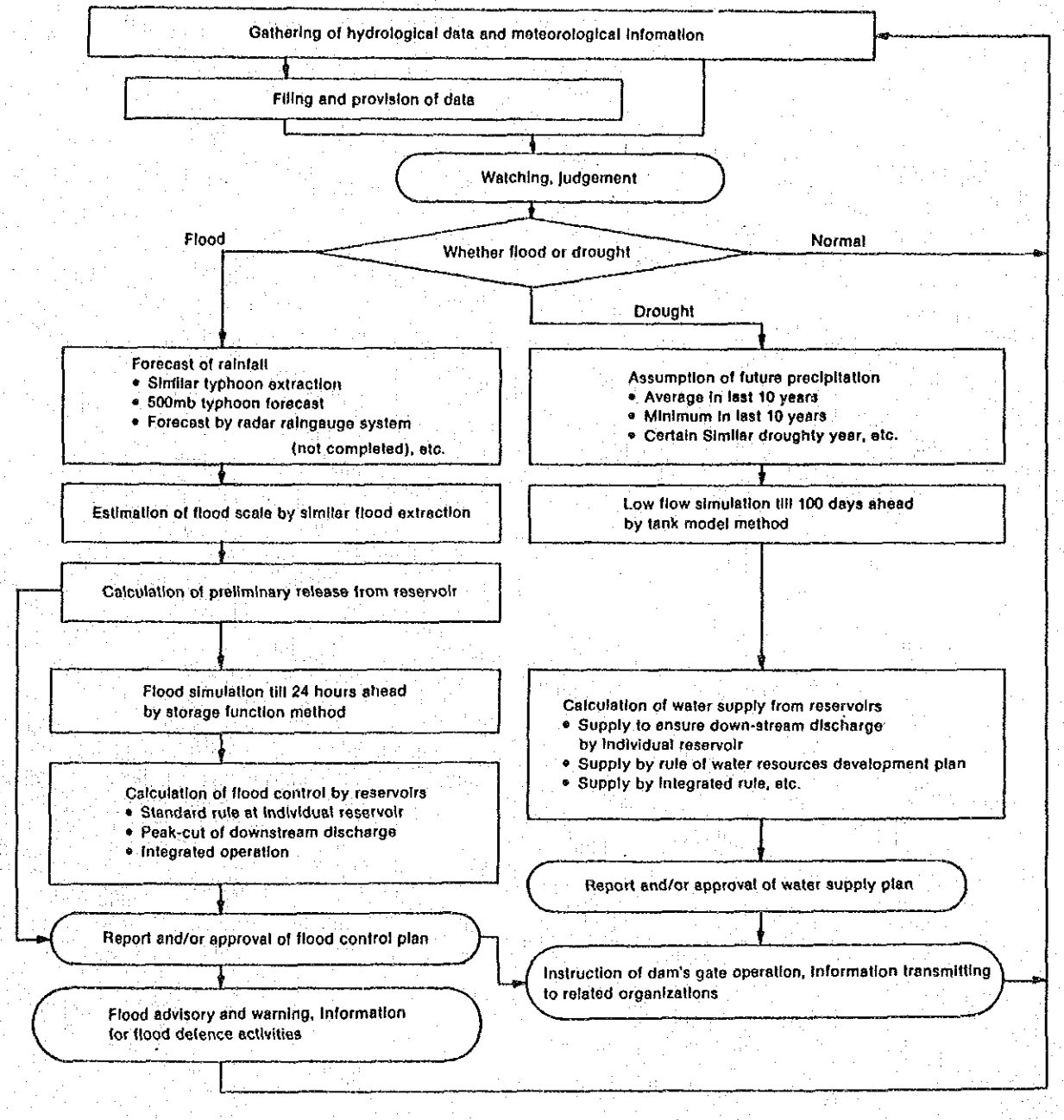
SYSTEM CHART OF DATA GATHERING AND PROCESSING Fig. 7-A-9



THE STUDY ON FLOOD CONTROL AND DRAINAGE PROJECT IN METRO MANILA, PHILIPPINES

JAPAN INTERNATIONAL COOPERATION AGENCY

FLOW CHART OF RIVER FLOW CONTROL ACTIVITIES Fig. 7-A-10

VIII. ENVIRONMENTAL IMPACTS

SUPPORTING REPORT

VIII. ENVIRONMENTAL IMPACTS

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1. BASELINE OF THE ENVIRONMENTAL STUDY

1.1 Objectives of the Environmental Study

The objectives of the Environmental Study on the Metro Manila Flood Control and Drainage Project (the Project) are as follows:

- To identify project impacts that are expected to cause effects on the environment.
- To evaluate the magnitude/significance of the environmental impacts.
- To determine on whether or not the projects are acceptable from the environmental point of view.

1.2 Guidelines for Environmental Impact Assessment in the Philippines

1.2.1 Legal Framework

The environmental impact assessment (EIA) system in the Philippines has been established by the government pursuant to the following legislations:

- Presidential Decree No. 1151 (1977), The Philippine Environmental Policy.
- Presidential Decree No. 1586 (1978), Establishing an Environmental Impact Statement System Including Other Environmental Management Related Measures and for Other Purposes.
- Proclamation No. 2146 (1981), Proclaiming Certain Areas and Types of Projects as Environmentally Critical and Within the Scope of the Environmental Impact Statement System Established Under Presidential Decree No. 1586.

In accordance with these legislations, projects planned by any governmental agency or private firm which fall within the definition of Environmentally Critical Project (ECP), or which will be located within

an Environmentally Critical Area shall be requested to prepare an Environmental Impact Statement (EIS) in order to obtain an Environmental Compliance Certificate (ECC) issued by the Environmental Management Bureau (EMB), formerly the National Environmental Protection Council (NEPC).

1.2.2 Guideline for EIA of the Department of Public Works and Highways

Pursuant to the legislations mentioned above, the then Ministry of Public Works (now, Department of Public Works and Highways) issued Ministry Order No. 72, Series of 1972, known as the DPWH Guideline for EIA. In principle, this guideline shall apply to projects planned by DPWH, which are categorized as ECP, or which will be located within ECA. The definition of ECP and ECA of DPWH are as follows:

(1) Environmentally Critical Project (ECP)

(a) Major dam: a dam with a structure height of more than 15 meters and/or a volume of storage exceeding 50 million cubic meters built across a watercourse to confine/impound/keep back or regulate flowing water.

(b) Major power plants, whether fossil-fueled, nuclear-fueled, hydroelectric, or geothermal.

(c) Major reclamation project: refers to any large scale activity which will involve the filling or draining of an area larger than one hectare along foreshore areas, marshes, swamps, lakes and rivers.

(d) Major roads and bridges: roads and bridges which will traverse a highly developed urban area, and significantly affect traffic flow.

(2) Environmentally Critical Area (ECA)

(a) All areas declared by law as national parks, watershed reserves, wildlife preserves and sanctuaries.

(b) Areas set aside as aesthetic potential tourist spots.

(c) Areas which constitute the habitat for any endangered or threatened species ofindigenous Philippine wildlife.

(d) Areas of unique historic, archaeological or scientific interest.

(e) Areas which are traditionally occupied by cultural communities or tribes.

(f) Areas frequently visited and/or hard-hit by natural calamities.

(g) Areas with critical slopes.

(h) Areas classified as prime agricultural lands.

(i) Recharge areas of acquifers.

(j) Water bodies characterized by one or any combination of the following conditions:

- tapped for domestic purposes.
- within the controlled and/or protected areas declared by appropriate authorities.
- which support wildlife and fishery activities.

(k) Mangrove areas characterized by one or any combination of the following conditions:

- with primary pristine and dense young growth.
- adjoining mouth of major river systems.
- near or adjacent to traditional productive fry or fishing grounds.
- which act as natural buffers against shore erosion strong winds and storm floods.
- on which people are dependent for livelihood.

(1) Coral reefs characterized by one or any combination of the following conditions:

- with 50% and above live coralline cover.
- spawning and nursery grounds for fish.
- which act as natural breakwater of coastlines.

2. DESCRIPTION OF THE ENVIRONMENT IN THE STUDY AREA

2.1 Land Use

Metro Manila which encompasses 4 cities and 13 municipalities, has an area of about 65,600 ha. It is the economic and political center of the Philippines and now has a highly urbanized land use condition. The rapid expansion of Metro Manila mainly due to the pressure of urbanization brought about by a lot of migrants from other provinces has accelerated the conversion of agricultural land to residential and commercial areas. At present, about 50% of the total area of the National Capital Region (NCR) is occupied by residential, commercial and industrial areas. On the other hand, the watershed area of the Marikina River is mainly covered by grassland and forest land.

2.2 Slope and Erosion

The study area is essentially a coastal zone of flat and low-lying terrain running north-south along Manila Bay, which receives runoff from a number of river drainage basins; the Pasig-Marikina, Tullahan and Parañaque rivers, etc. It is widely covered by nearly level slopes ranging from 0-3%, and there are no areas strongly susceptible to erosion. (Refer to Fig. 8-2-1.)

2.3 Water Quality

2.3.1 Water Quality in Major River Channel

In the study area, there are four major rivers; namely the Pasig-Marikina River, the Malabon-Tullahan River, the South

Parañaque-Las Piñas River and the Baho-Buli River. Due to the continuing expansion of physical structures and population, these rivers suffer from deteriorating water quality. Thus, these rivers are now highly polluted mainly by domestic sewage and industrial wastewater.

The water quality of these rivers has been monitored by the National Pollution Control Commission (NPCC, it was reorganized into the Environmental Management Bureau under the Department of Environment and Natural Resources in 1986), and the data have been filed since 1982. The location of principal monitoring stations and the water quality data of those stations are shown on Table 8-2-1 and Fig. 8-2-2.

In the Philippines, the classification of surface water is made to establish a basis for maintaining the quality of water bodies and to preserve their present and future usage. At present, the following designation was set for the major rivers in Metro Manila. The classification and water quality criteria are shown in Table 8-2-2.

- Pasig River : Class C
- San Juan River : Class C
- Marikina River (Upstream of Rosario Monitoring Station) : Class A
- Marikina River (Downstream of Rosario Monitoring Station) : Class C
- Paranaque River : Class C
- Zapote River : Class C
- Laguna Lake : Class C

(1) Pasig River

The Pasig River, which flows from east to west through the center of Metro Manila, is about 20 km in length from the outlet of Laguna Lake to its mouth at Manila Bay. In the Pasig River, there are four major water quality stations; namely Bambang, Guadalupe, Lambingan and Jones.

The Pasig River has been classified as Class "C" water body which is intended for the propagation and growth of aquatic life by the

Government of Philippines. However, the average concentration of water quality of the river during the period from 1982 to 1987 has shown high contaminated conditions, especially organic pollution. For example, the average of annual mean values of BOD in the rainy season from 1982 from 1982 to 1987 are more than 20 mg/l only, except for Bambang, and DO are less than 5 mg/l at all monitoring stations. In the dry season, the concentration of BOD shows about 30 mg/l, slightly higher than that of the rainy season.

(2) Marikina River

The upper most area of the Marikina River is designated Class "A" and the lower is Class "C". The water quality at Montalban, which is located at the most upper area among three major monitoring stations, shows very clean and uncontaminated conditions mainly due to little discharge of domestic sewage and to active self-purification under the anaerobic conditions. However, the concentration at the downstream stations becomes high and shows considerably contaminated condition of the river water. The average of annual mean values of BOD is about 20 mg/l, and it is almost the same as that at Guadalupe in Pasig River. There is no considerable difference in BOD between the dry season and the rainy season.

(3) San Juan River

San Juan River is one of the tributaries of the Pasig River and it has heavily contaminated condition conditions. The annual mean values of DO in the rainy season at four monitoring stations are almost 0 mg/l, and the concentration of BOD is about 50-60 mg/l, nearly two or three times higher than that of Pasig River. Moreover, BOD values in the dry season are about 70-80 mg/l, considerably higher than those of the rainy season. Therefore, it is considered that the water in the San Juan River is almost under the anaerobic condition all year long, and it is very hard to attain the compliance of Class "C".

(4) Malabon-Tullahan River

The Malabon-Tullahan River is a 26 km long waterway that runs from the La Mesa Reservoir in Novaliches emptying into Manila Bay. The continuous and indiscriminate dumping of all kind of wastes to the river has resulted in murky water with a foul odor, heavy siltation and extinction of aquatic life. Now this river is the most polluted in Metro Manila especially at the middle reach area. The average concentration of DO in the rainy season is almost 0 mg/l, and BOD is about 40-50 mg/l at North Expressway, MacArthur Highway and Governor Pascual. In the dry season, the river shows heavier contaminated condition, BOD is almost 60 mg/l, compared with the rainy season. At present, there is no classification in this river.

(5) Buli-Baho-Mahaba River

The Buli, Baho and Mahaba rivers which flow into the Laguna Lake, are located in the east side of the Mangahan Floodway. At present, there are no data related to water quality of the rivers. Water quality is currently considered to be in heavily deteriorated condition due to the discharge of untreated wastewater to the rivers as determined from the interview survey and field reconnaissance by the Study Team.

(6) South Parañaque-Las Piñas River

The South Parañaque River flows from the southern part of Estero Tripa de Gallina to Manila Bay, and the Las Piñas River joins the South Parañaque River and the Zapote River in the low-lying area adjacent to the seashore. The water quality at the monitoring stations which are located near Manila Bay, show the relatively clear condition than those of the inland area. Although the South Parañaque River and the Zapote River are both designated the water bodies of Class "C", the concentration of BOD of the South Parañaque River is about 30-40 mg/l, and it is higher than the criteria of Class "C". Though the values of BOD in the dry season are higher than those of the rainy season, the difference is not so big.

2.3.2 Water Quality in Drainage Channel

Water Quality Survey

Esteros and creeks in Metro Manila have contributed to drain the inland water to rivers and Manila Bay, and to reduce flood damage, especially in the high populated low land areas. However, those are now heavily polluted by domestic and industrial waste water and all sorts of garbage.

Since no water quality monitoring has been conducted in estero and creeks, there are no available data related to the water quality of estero and creeks. Therefore, a water sampling and water quality analysis in esteros and creeks in Metro Manila were conducted twice by the Study Team.

The first sampling and analysis was carried out on February 16, 1988 during the dry season, and the second on September 27, 1988 during the rainy season. The following 12 sampling sites were selected to grasp the existing water quality conditions. The analysis of the samples were conducted by the laboratory of LLDA. The water quality items are Water Temparature, PH, Turbidity, Electric Conductivity, Suspended Solids, DO and BOD. The location of sampling sites is shown on Fig. 8-2-3.

Sampling Site		Estero
St. 1	C.M. Recto	San Lazaro,
St. 2	C.M. Recto	Magdalena,
St. 3	P. Casal Ext.	San Miguel,
St. 4	Legarda	Sampaloc,
St. 5	R. Magsaysay	Valencia,
St. 6	Paz Mendoza Guanzon	Concordia,
St. 7	M. Roxas	Santa Clara,
St. 8	Quirino	Paco,
St. 9	South Superhighway	Makati,
St.10	Buendia	Tripa de Gallina,
St.11	EDSA	Tripa de Gallina,
St.12	Blumentritt	Aglipay,

Water Quality Conditions

The results of the water quality investigation are shown in Table 8-2-3 and Fig. 8-2-4. The water quality of estero and creeks is quite different in the rainy season and the dry season. In the rainy season, the mean concentration of BOD in estero is about 13 mg/l, which is lower than that of the Pasig River. On the other hand, heavily polluted conditions, the mean concentration of BOD is about 70 mg/l, can be found during the dry season, especially Estero de Binondo, Estero de Magdalena, Estero de Lazalo, Estero de Valencia, Estero de Concordia, Estero de Pandacan, Estero de Paco and Estero Tripa de Gallina. mainly due to diminishing flash out and dilution effects of polluted water in estero.

2.3.3 Water Quality in the Laguna Lake

The Laguna Lake is a shallow, average water depth is about 3 m, and immediately inland lake from Metro Manila. It serves as a natural detention reservoir for discharges from Pasig River, Marikina River and the surrounding tributaries of the lake. At present, the lake is mainly used for fishery, navigation and limited irrigation. The water from the lake runs through the only one outlet named Napindan River.

The Napindan Hydraulic Control Structure (NHCS) must be mentioned as one of notable things related to the water quality of the Lake. NHCS is located on the Napindan River just upstream of the Marikina-Napindan junction essentially for protection of lake water quality, navigation and flood control.

The LLDA is undertaking water quality monitoring program at 4 monitoring stations on the Lake. The water quality data of recent 6 years are shown on Table 8-2-4. The current lake water quality is rather clean conditions with high concentration of DO (7-8 mg/l) and low of BOD (2-3 mg/l), and it complies with the designated criteria of Class "C".

2.4 Water Use and Watershed Reserve

The water of the Marikina River was used for domestic water supply by the Metropolitan Waterworks and Sewerage System (MWSS) from the Wawa Dam through the Montalban Aqueduct, Marikina Pumping Station No. 1 and No. 2 to the Balara Treatment Plant. These were abandoned, however, and there are no other water use in the Pasig-Marikina river system.

At present, there is only one watershed reserve in the study area; namely, the Marikina watershed reserve. This covers an area of about 27,250.22 ha and is considered a significant reserve for Metro Manila because of its functions as aquifer recharge and erosion protection.

2.5 Fauna and Flora

Since the study area is widely covered by residential, commercial and agricultural areas, it has rather poor wildlife conditions. The natural vegetation which consists of the primary and secondary forests is mainly distributed in the mountainous areas such as the uppermost part of the Marikina watershed area. However, the continuous deterioration of forests due to logging operations and shifting cultivation, as well as the growing human settlement, has changed the forest lands to the grasslands which are commonly dominated by "Cogon" (Imperata cylindrica) and "Talahib" (Saccharum spontaneoum).

In general, fauna depend on a condition of flora. Therefore, the study area also has very poor animal life. At present, any endangered species and scientifically important indigenous species are not reported yet. Moreover, the water quality pollution in the major river channels accelarates the degradation of aquatic animals.

2.6 Aesthetic and Academic Potential Spots

2.6.1 Historical and Archaelogical Potential Spots

Metro Manila is rich in historical heritage. It can be said that the history of Manila is the history of the Philippines. Manila was a Malay settlement trading with Chinese and Annamese junks when its

documented history began in the twelfth century. However, Manila has led a far from placid existence. After Legazpis' conquest it was assaulted by a succession of Chinese warlords, Dutch and Portuguese fleets, and a British occupation force. It was occupied by the Japanese in 1942 and retaken by the United States force in 1945.

The following have been declared by the National Museum as archaeological sites in the Study area.

- Napindan, Taguig, Rizal
- Sideroad Bakery, Taguig
- Bagong Bayan, Taguig
- Bicutan, Taguig, Rizal
- Mario Santos Property, Sta Ana, Taytay, Rizal

2.6 2 Tourism Spots

Metro Manila also has notable tourist attractions. There are famous tourism spots in the Philippines, including the old churches, and a lot of domestic and foreign tourists visit there. The following are the major tourism spots in Metro Manila.

- American Cemetery
- Malacanang Palace
- Nayong Pilipino
- Rizal Park
- Cultural Center Complex
- Manila Zoological Gardens
- Paco Park
- Quiapo
- Avenida Carriedo
- Escolta
- Chinatown

2.7 Economic Activites

2.7.1 Forestry

In the study area, no forestry activities are now conducted. While, in the uppermost areas of the Marikina River, there is the Marikina watershed reserve, which covers an area of about 27,250.22 ha, and several reforestation programs have been carried out by the Bureau of Forest Development (BFD).

2.7.2 Fishery

Fishery activities can be found in Manila Bay and the Laguna Lake. The most predominant fishery activity is conducted in the Laguna Lake. The lake is now more popularly known for its fishpens, and which has become an industry within a span of 10 years from its introduction in 1971. The high productivity levels per unit area compared to the conventional brackishwater culture in the country make the fish culture in pens a unique and highly profitable fish farming operation in the area.

The fishery of the lake is the most important economic activity, which provides food and livelihood of fishermen and thier families around the lake. Fish catches on the lake consist of Tilapia and Milkfish which represent about 80 % of the fish harvests. (Refer to Table 8-2-5.)

2.7.3 Mining

Mining activities in the study area are mainly conducted in the watershed area of the Marikina River, and there are no mining activities in Metro Manila. Principal mineral resources are aggregate and construction materials, chert, iron, copper and gold.

2.7.4. Inland Navigation

In Metro Manila, there are 4 major ports; namely, North Harbor, Pasig River, South Harbor and the Manila International Port. Among them, North Harbor and Pasig River contribute to domestic shipping and the others to foreign shipping activites. As for inland navigation in the study area, one of the most important routes is the line from the Manila Bay to the Laguna Lake through the Pasig River and the Napindan River. A lot of boats and barges pass through NHCS to transport oil, factory products and comodities. Other river channels are not generally used for water transportation, however, the Malabon-Navotas River is also important to navigation because of the many fish landing places and shipyards.

2.8 Cultural Minorities and Squatters

In the study area, which is almost highly urbanized, no settled areas of cultural minorities and tribes are found even in the surrounding area of the proposed Marikina Dam.

Metro Manila is presently industrialized and urbanized offering high employment opportunities resulting to a population increase in the past decade from 3.97 million in 1970 to 4.97 million in 1975 to 5.93 million in 1980, with an annual average increase rate of 4.61% during the first half decade (1970-1975) to 3.58% during the second. Squatter settlements grew up rapidly within the Metro Manila area. They were occupying both government owned and private land. Most of them are located in and around riverbanks and esteros.

The government declared about 245 proclaimed areas for priority development to uplift the way of living of those barangays considered as depressed areas. Distribution of depressed areas are shown in Fig. 8-2-5.

2.9 Public Health

According to the data from the Department of Health, gastro-enteritis continues to be the number one cause of morbidity and mortality in the study area. As for the water-born parasitic diseases, schistosomiasis is non-existent in the study area because of the absence of the intermediate host, Oncomelania quadrasi. However, malaria is still found in this area though the incidences have declined. So, several malaria control programs are conducted to effectively eliminate the disease.

3. ENVIRONMENTAL IMPACT ASSESSMENT (EIA) OF THE PROJECT

3.1 Methodology of EIA

To attain the objectives mentioned in Section 1, screening and scoping approach and checklist method are applied in this Environmental Study. Checklist method is a very useful initial tool in recognizing and identifying the impacts and also for evaluation of impacts based on the description of magnitude or significance of the impacts. These methods also comply with the guidelines prepared by the Government of the Philippines (GOP).

Items of Checklist are selected by the Study Team taking into consideration of the features of the Project and the guidelines prepared by the GOP and ADB. (See Table 8-3-1.)

3.2 Result of EIA for the Master Plan

3.2.1 River Flood Control Works

The result of EIA for the river flood control works is summarized in Table 8-3-2.

(1) Pasig-Marikina River

The river flood control works in the Pasig-Marikina River consist of river improvement works, Marikina Control Gate Structure (MCGS) and Marikina Dam. As for the river improvement works, two environmental

effects such as aesthetics and landscape, and prevention of accessibility are expected to be caused mainly by construction of parapet walls. However, the significance of these impacts is considered low because the proposed improvement works would be limited only to reconstruction works to retain the original functions of the existing structures and facilities. Moreover, the works such as revetment and bank reconstruction would contribute to provide more preferable scenery of Metro Manila by improving the landscape directly and by imparing drainage indirectly.

The major expected environmental problems caused by MCGS are impairment of navigation and inundation of land. At present, however, navigation boats can be seldom found around the construction site. Also, the gate is usually opened and it is closed only during the flooding period. While, by using the original flood control capacity of the Mangahan Floodway by the construction of MCGS, the water level of the Laguna Lake would rise by only 15 cm even when the design discharge with a 100-year return period flows down. On the other hand, the Mangahan Floodway and the improvement works for the Napindan channel would contribute to reduce the lake water stage by 35 cm in case of a 40-year return period of the Laguna Lake water stage.

As for water quality, no drastic change is expected because the gate would be normally opened both in the dry season and the rainy season. Therefore, serious effects may not be expected from MCGS.

The Marikina Dam is expected to have relatively significant impacts to the environment compared with other flood control works. Problems related to resettlement and land acquisition should be noted because more than 600 families need to be resettled. Thus, the proper resettlement and compensation program should be prepared for the people to be affected.

According to the existing soil erosion map prepared by the National Water Resources Council in 1983, the catchment area of the dam is widely covered by moderate sheet erosion area (where 25-50% of original surface soil is eroded) and by no sheet erosion area. However, the existing river channels are under stable condition and the concentration of

suspended solids (SS) during October to December in 1953, attached at that report is only 146 mg/l in average at Wawa Dam, and the proposed dam in this Project has the single purpose of flood control. Therefore, significant effects may not be considered. As for the erosion problems during construction stage, it could be reduced by taking proper construction methods and facilities.

As for water quality issues such as eutrophication and prolonging turbidity, the dam may not cause serious environmental impacts because it has a small storage volume and has very short retention period (storage volume/annual inflow), and water would be stored only in the flooding period.

(2) Other Rivers

Since the project area for river flood control works are located in the highly urbanized area, evacuation and replacement issues are expected by the proposed works. Although this type of replacement usually does not accompany with the problems related to earning activities or economic activities, evacuation of the people who live along the rivers, might be squatters, is a very sensitive matter in the Philippines. Therefore, careful attention should be paid to cope with this problem. In general, no significant effects could be considered by the implementation of flood control works except for evacuation problems.

3.2.2 Drainage Improvement Works

The result of EIA for the drainage improvement works is summarized in Table 8-3-3.

Evacuation is the most significant problem for almost all drainage improvement works for the same reasons as the river flood control works. Impairment of navigation would also be expected by the works of ring dike and lakeshore dike. Since there are many shipyards and landing places in the Malabon-Navotas area, ensuring the navigation routes and the landing places of fishery products is very important.

The construction of lakeshore dike along the Laguna Lake may obstruct the accessibility of the local people who catch fish or small

shellfish. Also, since the Laguna Lake is one of the tourism spots which has beautiful scenery in the Philippines, proper design should be taken to avoid drastic change of the natural landscape of the Laguna Lake.

The water quality of BOD in the drainage channel is about 12.6 mg/l in average in the rainy season. This value is lower than those of average BOD concentration of all major rivers to which the flood water would be drained in the rainy season (refer to Table 8-3-4). Pollution load of BOD is also expected quite small compared with the load in the major rivers because of the great difference of the volume of water flow.

The water quality of the drainage channel of Malabon-Nabotas may deteriorated mainly due to obstruction of water flow by installation of flood control gates. However, the gates would be normally opened and be closed only during flooding period, so the impact can be considered tentative. Therefore, serious water quality deterioration may not be caused by discharging from the drainage channel.

3.3 Result of EIA for the Priority Projects

The following projects are selected as the priority projects:

- Drainage improvement of East and West of Mangahan;
- Drainage improvement of Malabon-Navotas area; and
- River improvement of the Pasig-Marikina downstream of Mangahan (excluding San Juan River).

Since the several environmental effects which are expected to be caused by the priority projects mentioned above were identified through the initial EIA in the previous section, more detailed consideration is carried out hereunder.

3.3.1 Drainage Improvement in East and West of Mangahan

Construction of the proposed lakeshore dike may decrease by about 1.5% the surface area of Laguna Lake. The water volume of this decreased area corresponds to only 0.8 cm over the surface water level at EL 12.5 m. Thus, the effect of this impact is not considered significant. Moreover, the improvement of the Napindan River is planned to be implemented simaltaneously, so rising of the lake water level could be reduced earlier compared with the condition of without the project.

As for the other problems, the significance of impacts can be reduced by taking countermeasures such as installation of gates to the existing major navigation routes, minimizing the dike height and attachment of gentle slope to the dike, and preparation of well-planned resettlement and evacuation programs. Therefore, no crucial environmental problem may be caused by the proposed drainage improvement in East and West of Mangahan. Movever, it is considered that no further environmental study would be necessary.

3.3.2 Drainage Improvement in Malabon-Navotas

The major environmental problems which may be caused by the proposed drainage improvement in Malabon-Nabotas are impairment of navigation, evacuation and water quality deteriolation.

In the Malabon-Navotas area, navigation is very important, so the gates are planned to be located apart from the existing major shipyards to avoid the impairment of navigation. Moreover, navigation locks are installed to the gate structure. Therefore, no serious effects are considered by the works.

Evacuation issues may be caused by channel improvement and construction of ring dike because there are several settlement areas along the existing river channels. Thus, a well-planned resettlement program should be prepared.

As mentioned in the previous section, water quality deterioration due to the reduction of capacity of inflow and outflow of river flow may

not be significant because of the gate operation which would be open, except in the flooding period. Therefore, no crucial environmental problems related to the proposed works are expected.

3.3.3 Pasig-Marikina River

The major components of the proposed flood control works in the Pasig-Marikina River are the river improvement works such as excavation, revetment and parapet wall, and the Marikina Control Gate Structure (MCGS). The Marikina Dam which is expected to cause relatively significant effects on the environment is not included in this priority project.

As already mentioned in the previous section, no significant effect would be caused by the proposed works of both the river improvement and the MCGS. Therefore, it is considered that the proposed priority project would not cause serious environmental effects.

4. CONCLUSION

Through the EIA for the Project, it can be concluded that no serious environmental effect is expected and the proposed Master Plan and the priority projects may be acceptable from the viewpoint of environment.

TABLES

Table 8-2-1(1/5) WATER QUALITY IN MAJOR RIVER CHANNELS

Year	Water Temp. (°C)	pH	Turbidity (NTU)	DSS (mg/l)	DO (mg/l)	BOD (mg/l)
PASIG RIVER (PS)						
PS-1 Bambang						
1982	29.0	7.5	88	3,206	4.6	9.4
1983	29.0	7.6	118	1,081	3.1	9.6
1984	-	7.5	49	453	2.6	9.8
1985	30.0	7.4	48	368	-	16.8
1986	-	7.4	15	5,263	-	10.0
1987	29.0	7.3	-	-	3.6	23.4
Mean	29.3	7.5	64	2,074	3.5	13.2
PS-2 Guadalupe						
1982	29.0	7.5	112	3,023	3.6	12.4
1983	29.0	7.5	67	2,086	0.0	40.4
1984	-	7.2	48	417	0.6	18.3
1985	30.0	7.3	44	812	-	16.0
1986	-	7.5	17	5,910	-	11.3
1987	29.0	7.3	-	-	3.4	22.6
Mean	29.3	7.4	58	2,450	1.9	20.2
PS-3 Lambingan						
1982	29.0	7.8	102	3,276	3.2	10.5
1983	29.0	7.6	50	4,891	0.6	36.4
1984	-	7.3	54	1,026	0.5	36.6
1985	30.0	7.4	46	343	-	14.8
1986	-	7.5	12	6,913	-	11.3
1987	29.0	7.3	-	-	2.5	25.0
Mean	29.3	7.5	53	3,290	1.7	22.4
PS-4 Jones						
1982	29.0	7.6	156	6,141	1.4	20.2
1983	29.0	7.6	53	14,754	0.0	46.4
1984	-	7.2	30	4,624	0.5	35.3
1985	30.0	7.3	41	5,642	-	34.8
1986	-	7.6	15	9,253	-	4.7
1987	29.0	7.5	-	-	0.9	31.0
Mean	29.3	7.5	59	8,083	0.7	28.7

Table 8-2-1(2/5) WATER QUALITY IN MAJOR RIVER CHANNELS

Year	Water Temp. (°C)	pH	Turbidity (NTU)	DSS (mg/l)	DO (mg/l)	BOD (mg/l)
SAN JUAN RIVER (SJ)						
SJ-1 Congressional						
1982	30.0	7.6	29	213	3.9	16.0
1983	28.0	7.5	101	250	1.1	33.7
1984	28.0	8.3	27	265	0.0	-
1985	28.0	7.6	19	212	3.3	49.4
1986	29.0	7.5	21	303	-	50.7
1987	30.0	7.5	-	-	3.7	36.1
Mean	28.8	7.7	39	249	2.4	37.2
SJ-2 Dario Creek						
1982	30.0	7.3	80	446	0.4	66.5
1983	29.0	7.4	113	371	1.0	37.6
1984	28.0	8.1	56	340	0.0	-
1985	29.0	7.4	43	242	2.3	85.0
1986	29.0	7.2	25	260	-	38.0
1987	30.0	7.3	-	-	2.3	121.1
Mean	29.2	7.5	63	332	1.2	69.6
SJ-3 Quezon Boulevard						
1982	31.0	7.5	69	300	0.0	59.0
1983	28.0	7.5	134	314	0.0	56.6
1984	28.0	7.4	68	310	0.0	-
1985	29.0	7.4	33	257	0.9	65.2
1986	29.0	7.5	20	257	-	69.7
1987	29.0	7.3	-	-	2.7	95.6
Mean	29.0	7.4	65	288	0.7	69.2
SJ-4 Sanchez						
1982	30.0	7.5	51	392	0.0	58.9
1983	29.0	7.4	71	418	0.0	54.4
1984	28.0	7.6	88	345	0.0	-
1985	29.0	7.5	25	270	0.3	58.3
1986	29.0	7.6	19	263	-	66.7
1987	29.0	7.4	-	-	1.0	54.0
Mean	29.0	7.5	51	338	0.3	58.5

Table 8-2-1(3/5) WATER QUALITY IN MAJOR RIVER CHANNELS

Year	Water Temp. (°C)	pH	Turbidity (NTU)	DSS (mg/l)	DO (mg/l)	BOD (mg/l)
MARIKINA RIVER (MK)						
MK-1 Montalban						
1982	28.0	7.8	56	227	9.1	1.2
1983	29.0	8.3	21	191	9.9	1.8
1984	29.0	8.1	35	164	6.0	1.7
1985	28.0	7.9	19	180	9.3	2.3
1986	28.0	7.9	74	235	6.3	3.6
1987	29.0	8.2	-	-	8.8	2.3
Mean	28.5	8.0	41	199	8.2	2.2
MK-2 Rosario						
1982	28.0	8.1	75	294	5.3	10.2
1983	30.0	7.7	28	334	1.5	19.8
1984	31.0	7.4	71	226	1.7	10.1
1985	30.0	7.6	14	500	0.0	21.0
1986	28.0	7.7	73	215	2.6	13.0
1987	29.0	7.6	-	-	1.8	22.0
Mean	29.3	7.7	52	314	2.2	16.0
MK-3 Vargas						
1982	28.0	7.9	37	412	4.0	15.7
1983	29.0	8.0	33	574	1.9	19.0
1984	33.0	6.2	189	300	2.0	19.1
1985	30.0	7.6	21	417	0.0	25.0
1986	-	8.0	12	3,300	0.0	20.0
1987	29.0	7.5	-	-	1.6	28.4
Mean	29.8	7.5	58	1,001	1.6	21.2

Table 8-2-1(4/5) WATER QUALITY IN MAJOR RIVER CHANNELS

Year	Water Temp. (°C)	pH	Turbidity (NTU)	DSS (mg/l)	DO (mg/l)	BOD (mg/l)
MALABON-TULLAHAN RIVER (MT)						
MT-1 Gulod						
1982	30.0	7.8	63	225	6.9	10.3
1983	29.0	7.6	264	348	3.2	29.2
1984	-	7.5	21	195	1.6	24.0
1985	29.0	7.7	65	2,278	5.3	13.6
1986	29.0	7.3	-	245	4.5	15.5
1987	29.0	7.5	-	-	3.8	29.9
Mean	29.2	7.6	103	658	4.2	20.4
MT-2 North Expressway						
1982	30.0	7.6	49	280	1.9	42.0
1983	29.0	7.1	171	398	0.6	61.5
1984	-	7.2	46	303	0.0	22.0
1985	29.0	7.4	29	253	1.1	49.2
1986	29.0	7.6	-	207	0.0	69.3
1987	29.0	7.0	-	-	1.2	117.2
Mean	29.2	7.3	74	288	0.8	60.2
MT-3 MacArthur Highway						
1982	30.0	7.2	43	705	0.5	96.5
1983	30.0	7.2	126	1,773	0.3	55.9
1984	-	7.2	69	1,650	0.0	90.0
1985	29.0	7.2	35	378	0.5	48.4
1986	29.0	7.7	-	898	0.0	44.5
1987	29.0	7.0	-	-	0.0	130.1
Mean	29.4	7.3	68	1,081	0.2	77.6
MT-4 Governor Pascual						
1982	32.0	7.9	58	5,090	2.1	42.3
1983	30.0	7.4	144	15,775	0.0	62.0
1984	-	7.2	29	13,700	0.0	40.0
1985	29.0	7.3	37	8,168	0.5	39.0
1986	29.0	7.7	-	5,225	0.0	37.5
1987	29.0	7.4	-	-	1.9	47.3
Mean	29.8	7.5	67	9,592	0.8	44.7
MT-5 Malabon						
1982	29.0	7.5	34	6,817	2.8	25.1
1983	29.0	7.5	85	30,100	0.0	26.3
1984	29.0	7.4	24	24,488	0.0	30.0
1985	-	7.3	34	11,477	2.5	28.7
1986	29.0	7.9	13	18,345	1.3	29.3
1987	-	-	-	-	-	-
Mean	29.0	7.5	38	18,245	1.3	27.9

Table 8-2-1(5/5) WATER QUALITY IN MAJOR RIVER CHANNELS

Year	Water Temp. (°C)	pH	Turbidity (NTU)	DSS (mg/l)	DO (mg/l)	BOD (mg/l)
PARAÑAQUE-LAS PIÑAS (PL)						
PL-1 Aurora Tramo						
1982	31.0	7.5	49	4,282	0.0	46.0
1983	29.0	7.6	45	4,340	0.9	25.9
1984	28.0	8.1	20	1,500	0.0	-
1985	29.0	7.4	18	3,803	0.0	56.1
1986	29.0	7.4	17	815	1.0	32.8
1987	29.0	7.6	-	-	0.0	54.7
Mean	29.2	7.6	30	2,948	0.4	43.1
PL-2 MIA Road						
1982	30.0	7.7	50	10,806	4.5	24.4
1983	29.0	7.6	48	10,382	0.5	31.0
1984	28.0	8.3	33	9,900	0.0	-
1985	30.0	7.4	22	5,066	0.0	37.7
1986	29.0	7.5	22	9,733	-	29.5
1987	29.0	7.6	-	-	1.1	47.8
Mean	29.2	7.7	35	9,177	1.2	34.1
PL-3 Parañaque Bridge						
1982	30.0	7.7	35	20,374	8.1	10.4
1983	30.0	7.7	34	27,178	4.1	9.1
1984	28.0	7.8	24	46,900	0.0	-
1985	30.0	7.4	17	21,671	1.5	23.5
1986	29.0	7.7	58	16,688	-	13.7
1987	29.0	7.7	-	-	4.3	12.3
Mean	29.3	7.7	34	26,562	3.6	13.8
PL-4 Zapote Bridge						
1982	29.0	7.7	135	21,495	1.6	16.0
1983	31.0	7.7	171	22,452	3.6	12.2
1984	-	-	-	-	-	-
1985	30.0	7.4	23	21,397	1.8	23.2
1986	28.0	7.9	100	16,105	2.8	8.1
1987	-	-	-	-	-	-
Mean	29.5	7.7	107.3	20,362	2.5	14.9

Source: Study by NPCC

Table 8-2-2 PARAMETERS OF WATER QUALITY CRITERIA

Quality Parameter	Fresh Surface Water					
Class	AA	A	B	C	D	E
Color, Units		75	50	50		
Temperature °C		30	30	3(e)	3(e)	
Transparency			(c)	(c)	(c)	
Dissolved Oxygen		5	5	5	3	2
5-day BOD at 20°C		10	15	20		
Total Dissolved Solids				1,000	1,000	
Total Solids	(a)	(a)		2,000	2,000	
pH	(a)	6.5-8.5	6.5-8.5	6.5-8.5	6.0-8.5	5.0-9.0
Coliform, MPN/100 mℓ	50	5,000	1,000	5,000		
Phenolic substances	(a)	(a)	0.002	0.02		

Remarks: 1. (a) National standars for Drinking Water in the Philippines.
(b) Shall not be present in concentration to cause deleterious or abnormal biotic growth.
(c) Secchi Disk shall be visible at a minimum depth of one (1) meter.
(d) Recommended maximum concentration for irrigating citrus is 0.075 mg/ℓ.
(e) Rise in temperature.

2. All values are maximum permissible except for Dissolved Oxygen which is minimum permissible.

3. All units in mg/ℓ except those indicated.

4. Water usage and classification of fresh surface water:

Classifications	Best usage
- Class AA	For source of public water supply. This class is intended primarily for water having watersheds which are uninhabited and otherwise protected and which require only approved disinfection in order to meet the National Standards for Drinking Water (NSDW) of the Philippines.
- Class A	For source of water supply that will require complete treatment (coagulation, sedimentation, filtration and disinfection) in order to meet the NSDW.
- Class B	For primary contact recreation.
- Class C	For the propagation and growth of fish and other aquatic resources.
- Class D	For agriculture, irrigation, livestock watering and industrial cooling and processing.
- Class E	For navigational use.

Source : Rules & Regulations of the National Pollution Control Commission (1978), Section 69, Table 1 - NPCC Water Quality Criteria (1978)