JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

MINISTRY OF SETTLEMENT AND REGIONAL DEVELOPMENT
THE REPUBLIC OF INDONESIA

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

FINAL REPORT

COMPONENT 1B:
SALATIGA MULTIPURPOSE DAM CONSTRUCTION

VOLUME I MAIN REPORT

AUGUST 2000

CTI ENGINEERING INTERNATIONAL CO., LTD.
IN ASSOCIATION WITH
PACIFIC CONSULTANTS INTERNATIONAL
AND
PASCO INTERNATIONAL INC.

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ESTIMATE OF PROJECT COST

Price Level	:	As of July 1999		
Currency Conversion Rate	:	US$1.00	=	Rp. 6,885
		1 Yen	=	Rp. 60.39

CONSTITUTION OF THE REPORT

1. SUMMARY
2. COMPONENT A : WEST FLOODWAY/GARANG RIVER IMPROVEMENT

VOLUME I	MAIN REPORT
VOLUME II	DESIGN CRITERIA
VOLUME III	DESIGN NOTES
VOLUME IV	WORK QUANTITY CALCULATION
VOLUME V	CONSTRUCTION PLANNING
VOLUME VI	COST ESTIMATE
VOLUME VII	DATA BOOK

3. COMPONENT B : JATIBARANG MULTIPURPOSE DAM CONSTRUCTION

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VOLUME II	DESIGN CRITERIA
VOLUME III	DESIGN NOTES
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4. COMPONENT C : URBAN DRAINAGE SYSTEM IMPROVEMENT

VOLUME I	MAIN REPORT
VOLUME II	DESIGN NOTES
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PREFACE

In response to a request from the Government of the Republic of Indonesia, the Government of Japan decided to conduct the Detailed Design of Flood Control, Urban Drainage and Water Resources Development in Semarang and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. TOMIOKA Yoshiyuki of CTI Engineering International Co., Ltd. and constituted of members of CTI Engineering International Co., Ltd., Pacific Consultants International and Pasco International Inc., six times between August 1997 and June 2000. In addition, JICA set up an advisory committee, which examined the study from specialist and technical points of view.

The team held discussions with the officials concerned of the Government of Indonesia and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Indonesia for their close cooperation extended to the Team.

August 2000

Kimio Fujita
President
Japan International Cooperation Agency

August, 2000

Mr. FUJITA Kimio
President
Japan International Cooperation Agency
Tokyo, Japan

LETTER OF TRANSMITTAL

Sir:

We are pleased to submit herewith the Final Report on the Detailed Design of Flood Control, Urban Drainage and Water Resources Development in Semarang in the Republic of Indonesia.

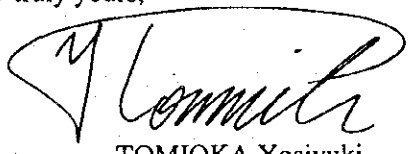
Under a contract with the Japan International Cooperation Agency, the Study was conducted by CTI Engineering International Co., Ltd., in association with Pacific Consultants International and PASCO International, Inc., during the period from August 1997 to August 2000.

This Final Report presents the results of the detailed design of the following three (3) components, which consist of (1) West Floodway/Garang River Improvement including reconstruction of Simongan Weir, (2) Construction of Jatibarang Multipurpose Dam, and (3) Urban Drainage System Improvement. It also presents the pre-qualification and contract documents, and general and technical specifications necessary for the construction stage. In the course of the Study, much attention was given to the particular issues on the present situation in Semarang, and reflected them in the proposed facilities.

We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA, the Ministry of Foreign Affairs, and the Ministry of Construction. We would also like to extend our deep appreciation to the officials concerned of the Government of the Republic of Indonesia, Jratunseluna Project Office in Semarang, the JICA Indonesia Office, the Embassy of Japan in Indonesia for their cooperation and assistance throughout our field survey.

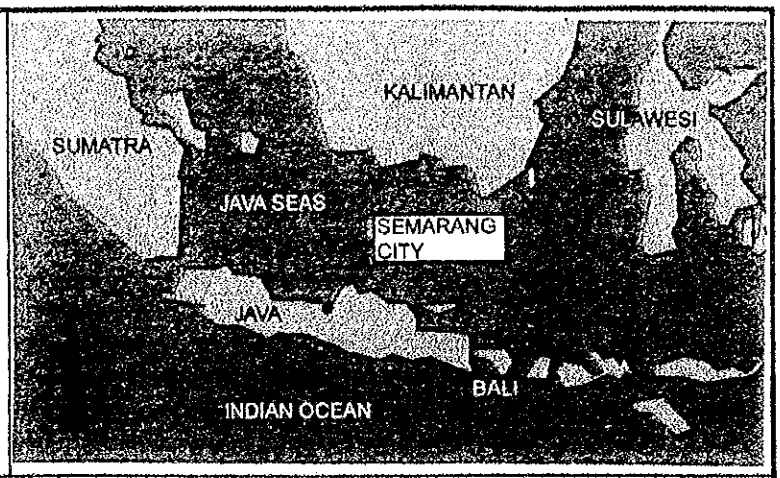
Finally, we hope that this Report will contribute to the improvement of the flood control and urban drainage facilities, and water resources development in Semarang.

Very truly yours,



TOMIOKA Yosiyuki
Team Leader
Detailed Design of Flood Control, Urban Drainage
and Water Resources Development in Semarang
in the Republic of Indonesia

GENERAL MAP



SCALE
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JAVA SEA

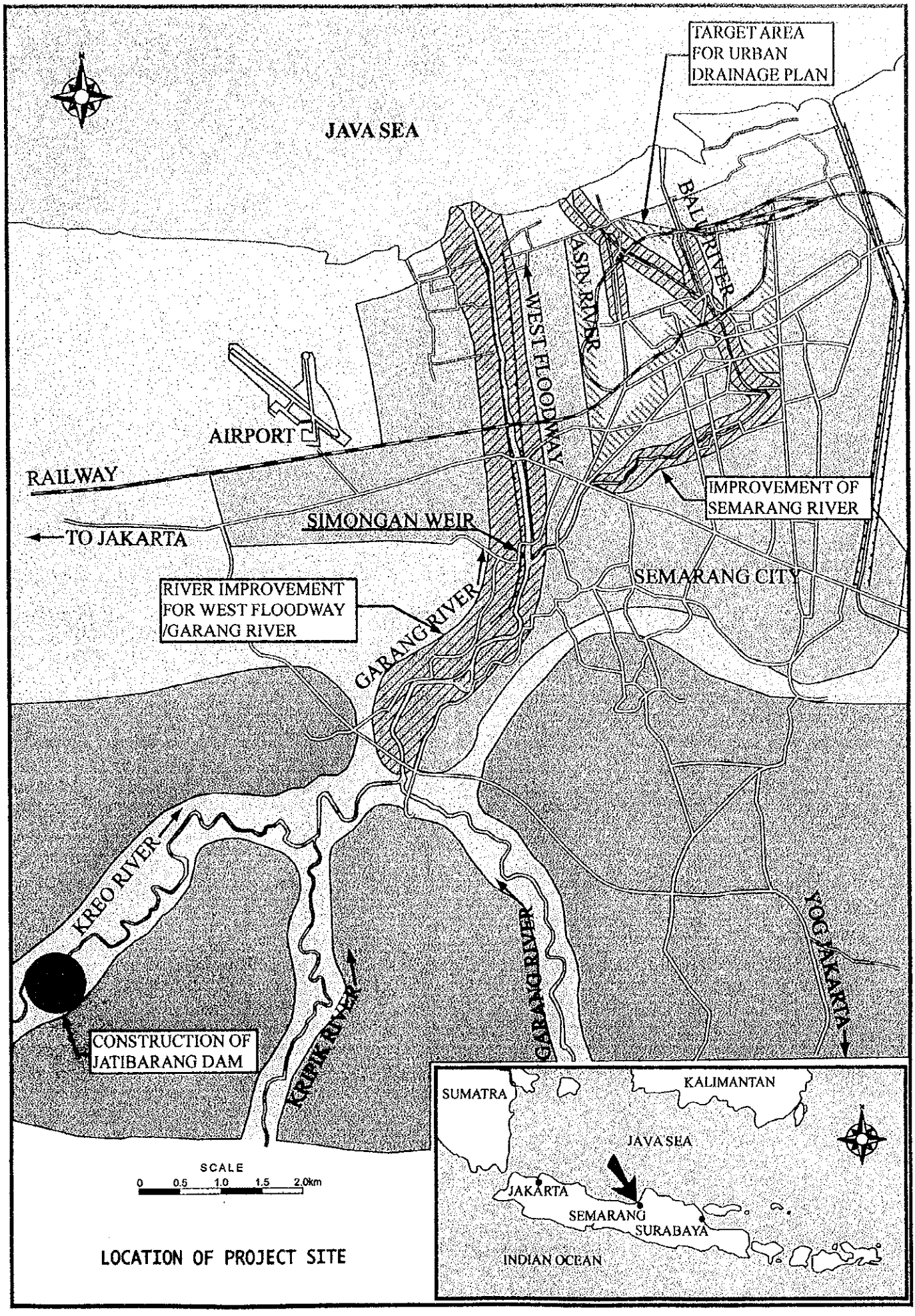
SEMARANG CITY

WEST FLOODWAY

GARANG RIVER

GARANG RIVER BASIN

INDIAN OCEAN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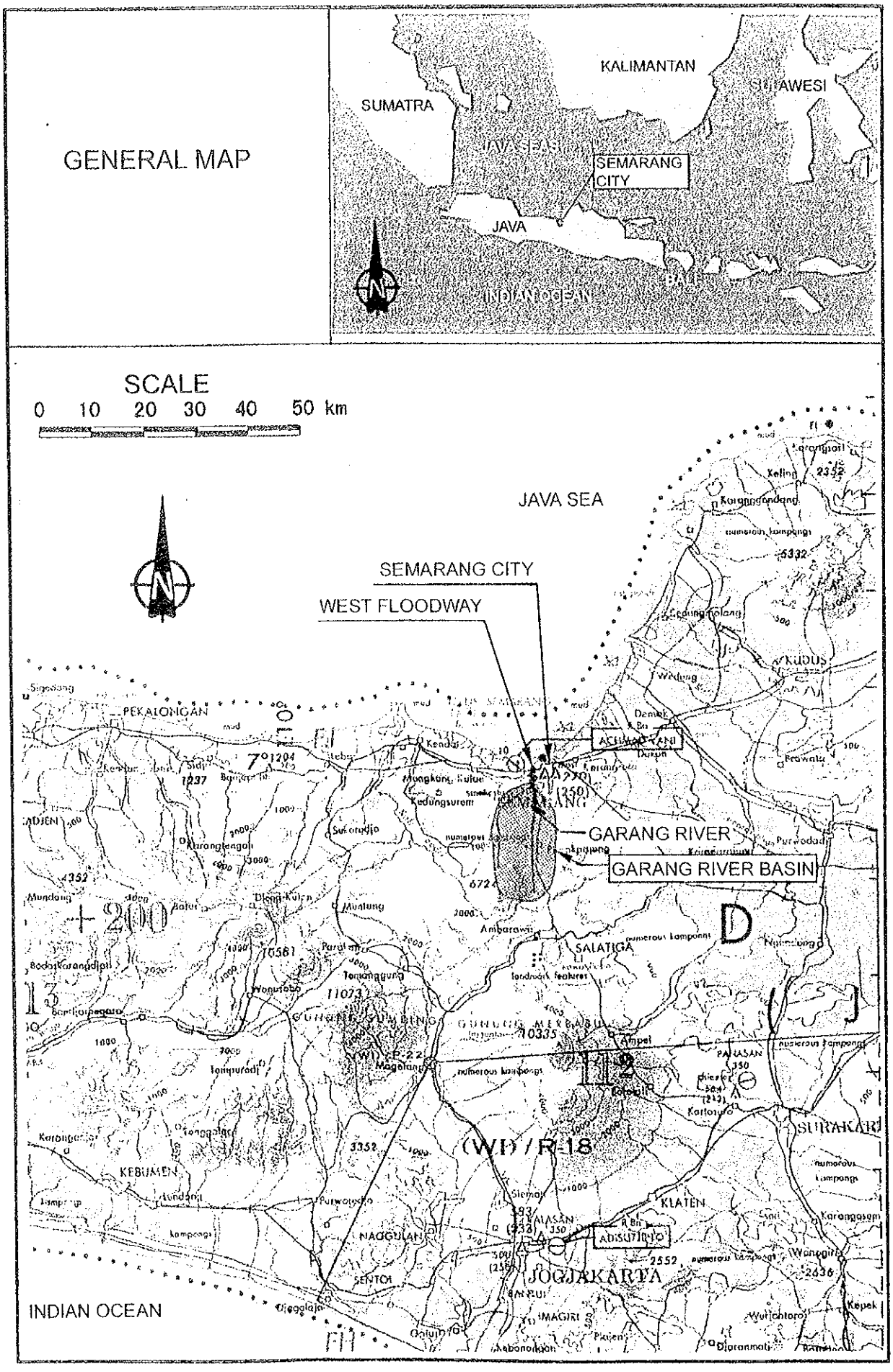
INDIAN OCEAN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SULAWESI
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PEKALONGAN
KUDUS
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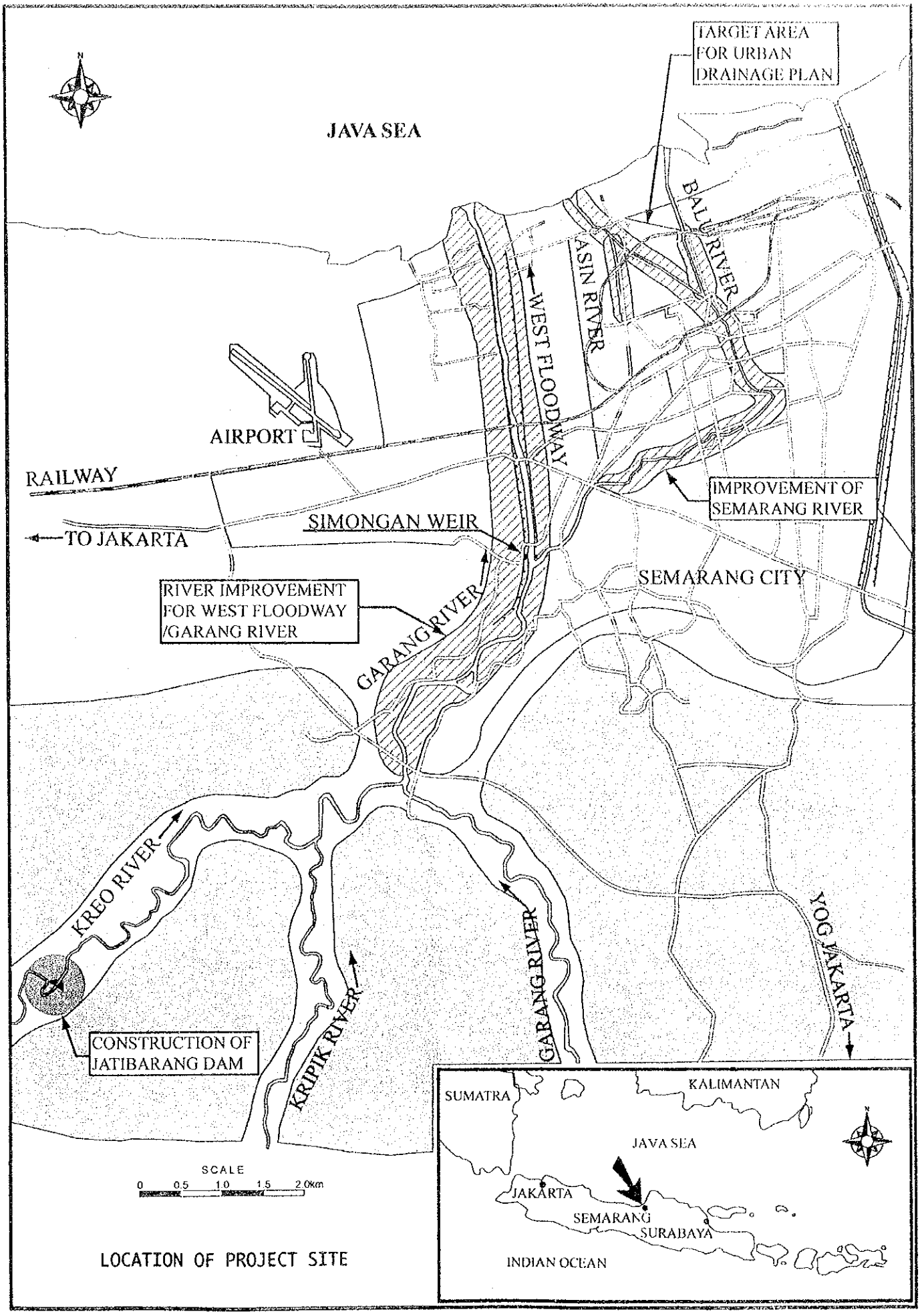
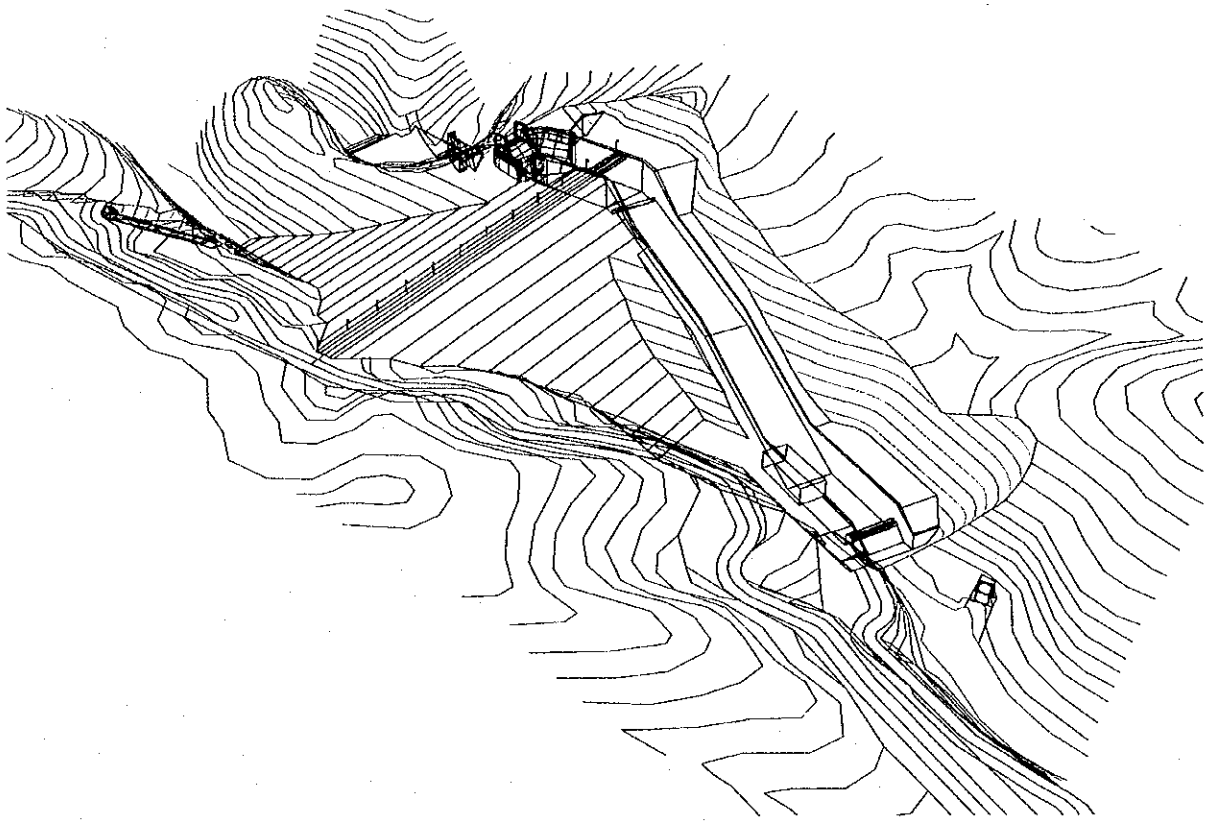
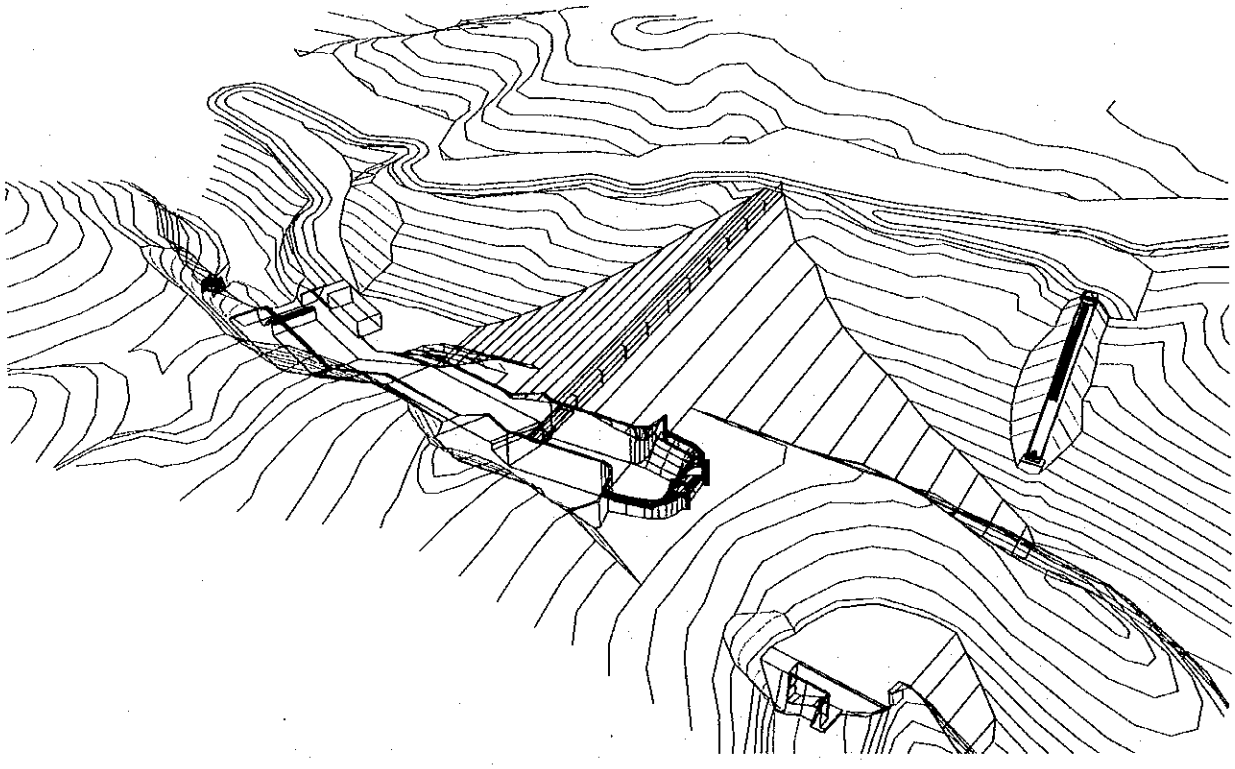
KLATEN
KEBUMEN
NAGGULAN
JOGJAKARTA
INDIAN OCEAN



LOCATION OF PROJECT SITE



Downstream View of Jatibarang Multipurpose Dam



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TERMS AND ABBREVIATIONS

1. INDONESIAN GOVERNMENT AGENCIES AND ORGANIZATIONS

GOI	:	Government of Indonesia
BAPPENAS	:	Badan Perencanaan Pembangunan National (National Development Planning Board)
BAPPEDA	:	Badan Perencanaan Pembangunan Daerah (Provincial Development Planning Board)
BINAMARGA	:	Directorate General of Road and Bridge, Ministry of Public Works
BAPEDAL	:	Badan Pengendalian Dampak Lingkungan (Environmental Impact Assessement Board)
BPN	:	Badan Pertanahan Nasional (National Land Agency)
BPP	:	Balai Penyuluhan Pertanian (Agricultural Extension Center)
DPU	:	Departemen Pekerjaan Umum (Ministry of Public Works)
DGWRD	:	Directorate General of Water Resources Development, Ministry of Public Works
DGCK	:	Directorate General of Cipta Karya (Housing, Building and Urban Development, Ministry of Public Works)
DGRD	:	Directorate General of Research and Development, Ministry of Public Works)
DOR	:	Directorate of Rivers
DPUP	:	Dinas Pekerjaan Umum Propinsi (Provincial Public Works Services)
IHE	:	Institute of Hydraulic Engineering (Bandung)
PJKA	:	Perusahaan Jawatan Kereta Api (Railway Company, Old Name)
PERUMKA	:	Perusahaan Umum Kereta Api (Indonesian Railway Public Corporation, New Name)
PDAM	:	Perusahaan Daerah Air Minum (Water Works Company)
PMG	:	Pusat Meteorologi dan Geofisika (Center of Meteorology and Geographysics)
PLN	:	Perusahaan Listrik Negara (State Electricity Corporation)
P3SA	:	Proyek Pengembangan dan Penyelidikan Sumber-Sumber Air (Water Resources Development and Investigation Project)

2. JAPANESE GOVERNMENT / INTERNATIONAL ORGANIZATIONS

GOJ	:	Government of Japan
JICA	:	Japan International Cooperation Agency
MOC	:	Ministry of Construction, Japan
JEM	:	Japan Electric Machine Industry

ADB	:	Asian Development Bank
IBRD	:	International Bank for Reconstruction and Development (World Bank)
UNDP	:	United Nations Development Program
WMO	:	World Meteorological Organization
ASTM	:	American Society for Testing and Materials
ASME	:	American Society of Mechanical Engineer
USASI	:	United States of America Standards
IEC	:	International Electrotechnical Committee
NEMA	:	National Electrical Manufacturers Association

3. MEASUREMENT UNITS

(Length)			**(Weight)**		
mm	:	millimeter(s)	g, gr	:	gram(s)
cm	:	centimeter(s)	kg	:	kilogram(s)
m	:	meter(s)	t, ton	:	tonnage (s)
km	:	kilometer(s)			
(Area)			**(Time)**		
mm^2	:	square millimeter(s)	sec., s	:	second(s)
cm^2	:	square centimeter(s)	min	:	minute(s)
m^2	:	square meter(s)	h (hrs)	:	hour(s)
km^2	:	square kilometer(s)	d (dys)	:	day(s)
ha(has)	:	hectare(s)	y, yr(yrs)	:	year(s)
(Volume)			**(Discharge)**		
cm^3	:	cubic centimeter(s)	l, ltr	:	liter(s)
m^3	:	cubic meter(s)	EL., El.	:	Elevation

(Combined Units)

Speed/Velocity

cm/sec, cm/s	:	centimeter per second
m/sec, m/s	:	meter per second
km/hr, km/h	:	kilometer per hour

Stress

kgf/cm^2	:	kilogram per square centimeter
tf/m^2	:	ton per square meter
N/mm^2	:	newton per square millimeter
Mpa	:	mega pascal

Discharge

ltr/sec, l/s	:	liter per second
m^3/sec, m^3/s	:	cubic meter per second
m^3/yr, m^3/y	:	cubic meter per year

(Note : Other combined units may be constructed similarly as above)

Electricity

MW	:	megawatt	GW	:	gegawatt
MWh	:	megawatt hour	GWh	:	gegawatt hour
kV	:	kilovolt			

4. MONETARY TERMS

¥	:	Japanese Yen
US$	:	United States Dollar
Rp.	:	Indonesian Rupiah

5. INDONESIAN TERMS

JKT	:	Jakarta
Jawa	:	Java
Propinsi	:	Province
Kabupaten, Kab.	:	District (Regency)
Kotamadya, Kodya	:	Municipality
Kecamatan, Kec.	:	Sub-District
Desa	:	Village (Rural Area)
Kampung, Kp.	:	Village (Rural Area)
Kelurahan	:	Village (Urban Area)
Kali, Sungai	:	River
Gunung	:	Mountain
Rawa	:	Swamp
Danau	:	Lake
Laut	:	Sea
PT.	:	Incorporated or Limited
PPT	:	Panitia Pembebasan Tanah (Land Acquisition Committee)
KOMPUS	:	Komisi Pusat (Central Committee for Environmental Impact Assessment)
KA-ANDAL	:	Terms of Reference of Environmental Impact Statement
ANDAL	:	Environmental Impact Statement
RKL	:	Environmental Management Plan

RPL	:	Environmental Monitoring Plan
AMDAL	:	Environmental Impact Assessment
BPPM2	:	Semarang Port Bench Mark
SPB	:	Semarang Peil Baru (New Semarang Level)
TTG	:	Tanda Tinggi Geodesi (National Bench Mark)

6. OTHERS

JRATUNSELUNA PROJECT : Water Resources Development Projects for Jragung, Tuntang, Serang, Lusi and Juwana Rivers

SSUDP	:	Semarang and Surakarta Urban Development Program
IUIDP	:	Integrated Urban Infrastructures Development Program
SWL	:	Surcharge Water Level
DFWL	:	Design Flood Water Level
PMP	:	Probable Maximum Precipitation
PMF	:	Probable Maximum Flood
EIRR	:	Economic Internal Rate of Return
JIS	:	Japanese Industrial Standard
USASI	:	United States of America Standards
SWR	:	Shadow Wage Rate
CIF	:	Cost, Insurance and Freight
VAT	:	Value Added Tax.

CHAPTER 1

INTRODUCTION

CHAPTER 1 INTRODUCTION

1.1 Background

Semarang City, the capital of Central Java Province, had the population of 1,250,000 in 1996. The city and its surrounding areas suffer almost every year from floods in rainy seasons and from shortage of water supply in dry seasons. The problem of water shortage will be aggravated further in the future due to the recent trend of population concentration in the urban area.

To mitigate these chronic economic problems and to enhance the economic development and stabilization of people's livelihood, appropriate measures are indispensable for Semarang City and its surrounding areas. To this end, the Government of Indonesia requested technical assistance from the Government of Japan.

In response to the request of the Government of Indonesia, the Government of Japan dispatched a study team through the Japan International Cooperation Agency (JICA) to formulate a master plan and to carry out a feasibility study on the selected priority projects from 1992 to 1993. The study was named as "The Master Plan on Water Resources Development and Feasibility Study for Urgent Flood Control and Urban Drainage in Semarang City and Suburbs". (refer to Fig. 1.1.1)

In the final report of the above study, three priority projects were proposed from the viewpoint of economic viability and urgent necessity of project realization. The proposed priority projects are:

(1) West Floodway/Garang River Improvement (including reconstruction of Simongan Weir);

(2) Construction of Jatibarang Multipurpose Dam on Kreo River; and,

(3) Urban Drainage System Improvement.

For the urgent realization of the proposed priority projects, the Government of Indonesia requested further technical assistance from the Government of Japan in 1996. JICA then decided to dispatch another study team to carry out the detailed design of the priority projects, and the study is named as "The Detailed Design of Flood Control, Urban Drainage and Water

Resources Development in Semarang in the Republic of Indonesia" (hereinafter referred to as "the Study").

1.2 Objectives of the Study

The objectives of the Study are: to carry out the detailed design (D/D) of the following three (3) components of the Study, which consist of (1) West Floodway/Garang River Improvement, (2) Construction of Jatibarang Multipurpose Dam, and (3) Urban Drainage System Improvement, and to pursue transfer of technical knowledge to the counterpart personnel in the course of the Study.

1.3 Study Area

The study area is administratively covered by Semarang City and Semarang Regency (Kabupaten) in Central Java Province, and is topographically included in Garang river basin and the central area of Semarang City. (refer to Fig. 1.3.1)

1.4 Description of Project Component; Jatibarang Multipurpose Dam Construction

Previous Study

In the Master Plan Study formulated under the JICA Study mentioned above in 1993, potential damsites were investigated to formulate the flood master plan and water resources development master plan in the study area. Four (4) damsites including Jatibarang Multipurpose Dam were identified from the viewpoint of development possibility.

Among the flood control master plans for the six (6) objective rivers, the highest value of EIRR was given to the flood control plan for West Floodway/Garang River located in the densely populated urban area. It was selected as a priority project. The optimum plan was composed of the West Floodway/Garang River improvement and the flood regulation by Jatibarang Multipurpose Dam. On the other hand, the water supply capacity of Jatibarang Reservoir was also required as a priority project for the water resources development master plan to meet the incremental water demand in Semarang City.

Consequently, Jatibarang Multipurpose Dam Construction was recommended to be a priority project as a multipurpose dam on flood control and water resources development because of the high cost efficiency as well as minimum natural and social impacts, especially the non-existence of residential houses to be evacuated in the reservoir area.

Necessity of the Project

West Floodway/Garang River passes through the urban area of Semarang City, the largest city and the center of economic and social development in Central Java Province. The urban area of Semarang City is expanding year by year with the rapid urbanization and, correspondingly, the damage inflicted by river floods has become more serious, hampering development and giving adverse environmental impacts to the area.

In January 1990, West Floodway/Garang River was flooded by torrential rain, which was equivalent to almost 100-year return period and bringing 47 casualties.

For Garang River, the river improvement works focusing on earth dike and floodwall construction were almost completed in accordance with a 10 to 25-year return period floods. West Floodway presently has capacity of discharges that correspond to only 2 to 3 year return period. Still, fear of flood has not been overcome because of the potential high flood level of the channel. In addition, the possibility of recurrence of flood overflow of the river channel like the one in 1990 is still high.

Under the circumstances, the flood control project composed of construction of Jatibarang Multipurpose Dam and improvement of West Floodway/Garang River has been given higher priority for implementation.

On the other hand, Semarang City and suburbs is suffering from the chronic shortage of water supply during dry season, particularly, municipal water supply. The problem regarding the water supply situation is aggravated by the rapid urbanization. Furthermore, recently land subsidence is progressing in the coastal and central area of Semarang City, which is supposed to be caused by excess ground water exploitation by commercial and industrial sectors. The land subsidence is affecting the economical activities and it should be stopped urgently. To stop the land subsidence, water source shall be changed from ground water to river water compulsorily.

Under these circumstances, Jatibarang Multipurpose Dam is indispensable for the water supply master plan and much expected to be implemented urgently.

Features of Jatibarang Multipurpose Dam

Jatibarang Multipurpose Dam planned on Kreo River is located in the southwest of Semarang City at about 13 km upstream from the confluence of Garang River. The damsite is situated

near the city park of Goa Kreo. The reservoir area, which has the catchment area of 53.0 km^2, belongs to four (4) different villages (Kelurahan) such as Kedungpane and Jatibarang on the left bank and Kandri and Jatirejo on the right bank. (refer to Fig. 1.4.1)

Jatibarang Multipurpose Dam will primarily function flood control, public water supply of Semarang City and hydropower generation. It should have a function to reduce a 100-year probable flood with the peak discharge of 1,010 m^3/s to 790 m^3/s in the downstream from the confluence. The discharge secured by Jatibarang Multipurpose Dam consists of the intake water for municipal water supply of 2.04 m^3/s and the maintenance flow of 0.65 m^3/s. The municipal water supply of 2.04 m^3/s includes 0.58 m^3/s for present use and 1.46 m3/s for newly developed. The maintenance flow of 0.65 m^3/s includes 0.5 m3/s for Semarang River and 0.15 m^3/s for a left irrigation channel of Simongan Weir. The hydropower generation is carried out subordinately using the released water necessary for water supply to Semarang City.

For the purposes mentioned above, Jatibarang Multipurpose Dam will create a reservoir of 126 ha with a gross storage capacity of 20,400,000 m^3 at the Surcharge Water Surface Elevation 151.8 m. The effective storage capacity between EL. 136.0 m and EL. 151.8 m is 13,600,000 m^3. Main facilities consist of main dam, spillway, outlet facilities, diversion facilities, access roads, hydropower station and dam management complex.

1.5 Scope of the D/D Study

The D/D Study for the three (3) components mentioned above was commenced in August 1997 and is scheduled to be completed in July 2000 with submission of the final reports for all components. Before the completion of the final reports, the draft final reports are to be prepared and submitted at the end of March 2000.

The D/D Study is divided into two phases, namely Phase 1 in which Definitive Plan was formulated and Phase 2 in which Detailed Design including hydraulic and structural analysis, preparation of drawings, establishment of construction planning, cost estimate and preparation of Prequalification and Tender Documents was conducted. The flow of work is as illustrated in Fig. 1.5.1, and the details of scope of works are as outlined below.

Definitive Plan

The main study items of "Definitive Plan" are as follows:

(1) Data Collection and Compilation,

(2) Review of Feasibility Study,
(3) Aerophotograph/Mapping, Topographic and River Survey,
(4) Geological and Soil Mechanics Survey,
(5) Environmental/Social Impact Analysis, RKL, RPL and River Basin Management Plan,
(6) Formulation of Basic Plan,
(7) Basic Design,
(8) Preliminary Construction Plan and Cost Estimate,
(9) Socioeconomic Evaluation, and
(10) Preparation of Project Implementation Program.

Detailed Design

The detailed design works include the following items as

(1) Preparation of Design Criteria,
(2) Detailed Design Work (Hydraulic and Structural Analysis and Drawings),
(3) Work Quantity Calculation,
(4) Establishment of Construction Plan,
(5) Cost Estimate,
(6) Establishment of Operation and Maintenance Plan,
(7) Establishment of Organization and Institution Plan, and
(8) Preparation of Prequalification, Tender Documents and Tender Drawings.

Prequalification and tender documents are prepared after the preparation of the detailed designs, and the tender documents includes the following:

(1) Prequalification Document
(2) Invitation to Bids,
(3) Instructions to Bidders,
(4) Forms of Bid,
(5) Form of Contract,
(6) Specimens of Various Bonds,
(7) Bill of Quantities,
(8) General Conditions of Contract,
(9) Special Conditions of Contract,
(10) General Specifications,
(11) Technical Specifications, and
(12) Tender Drawings.

FIGURES

CHAPTER 1

INTRODUCTION

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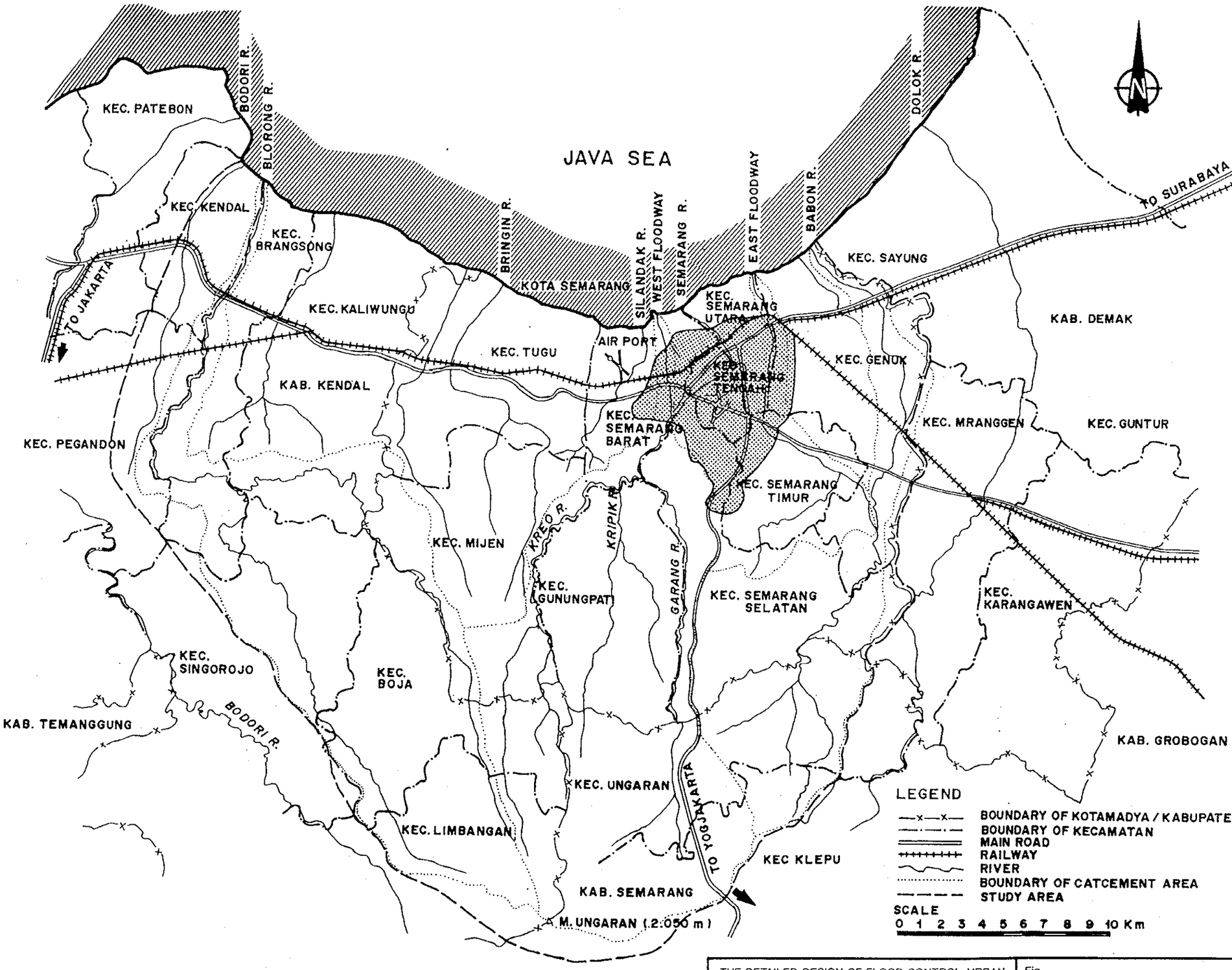
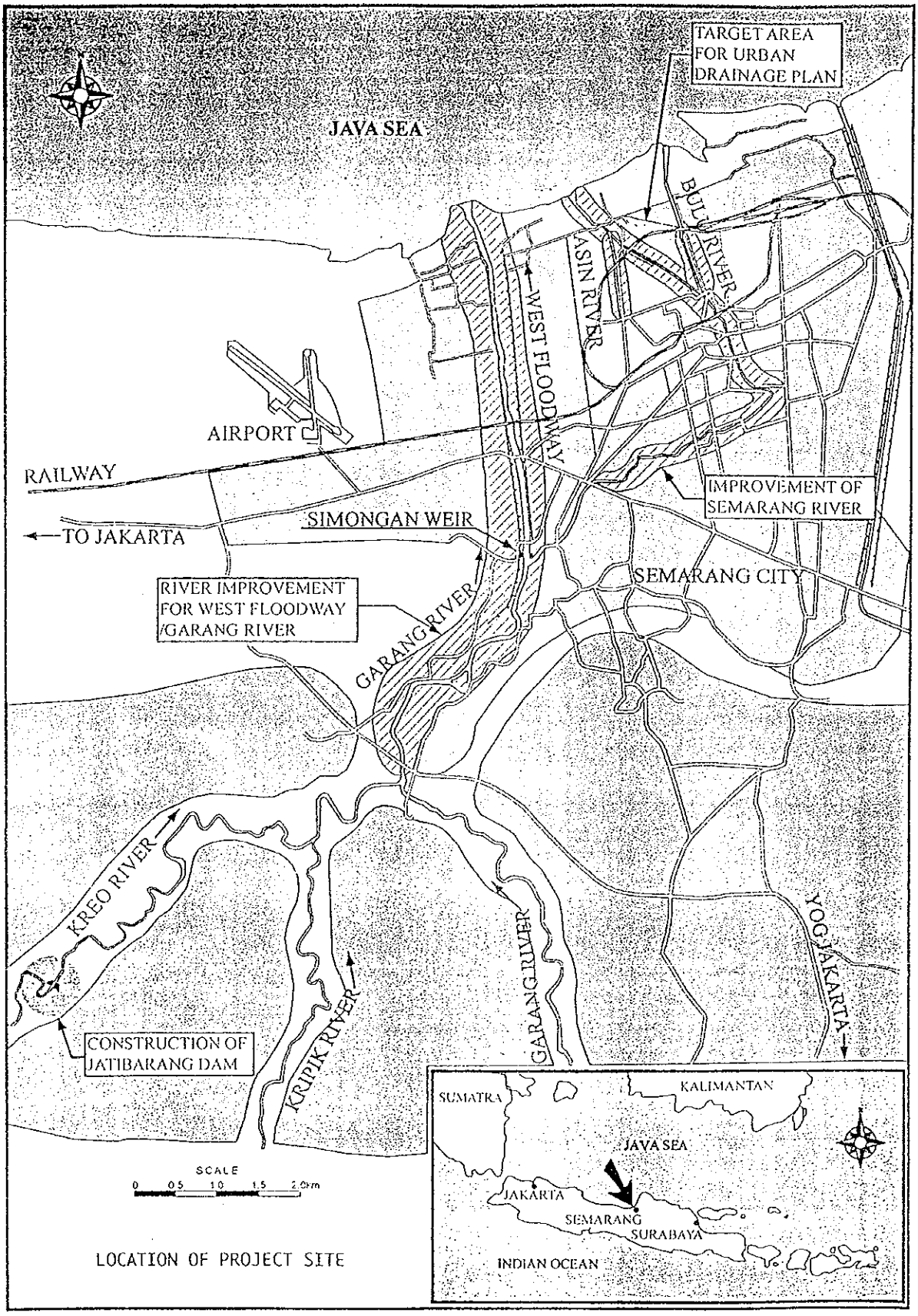
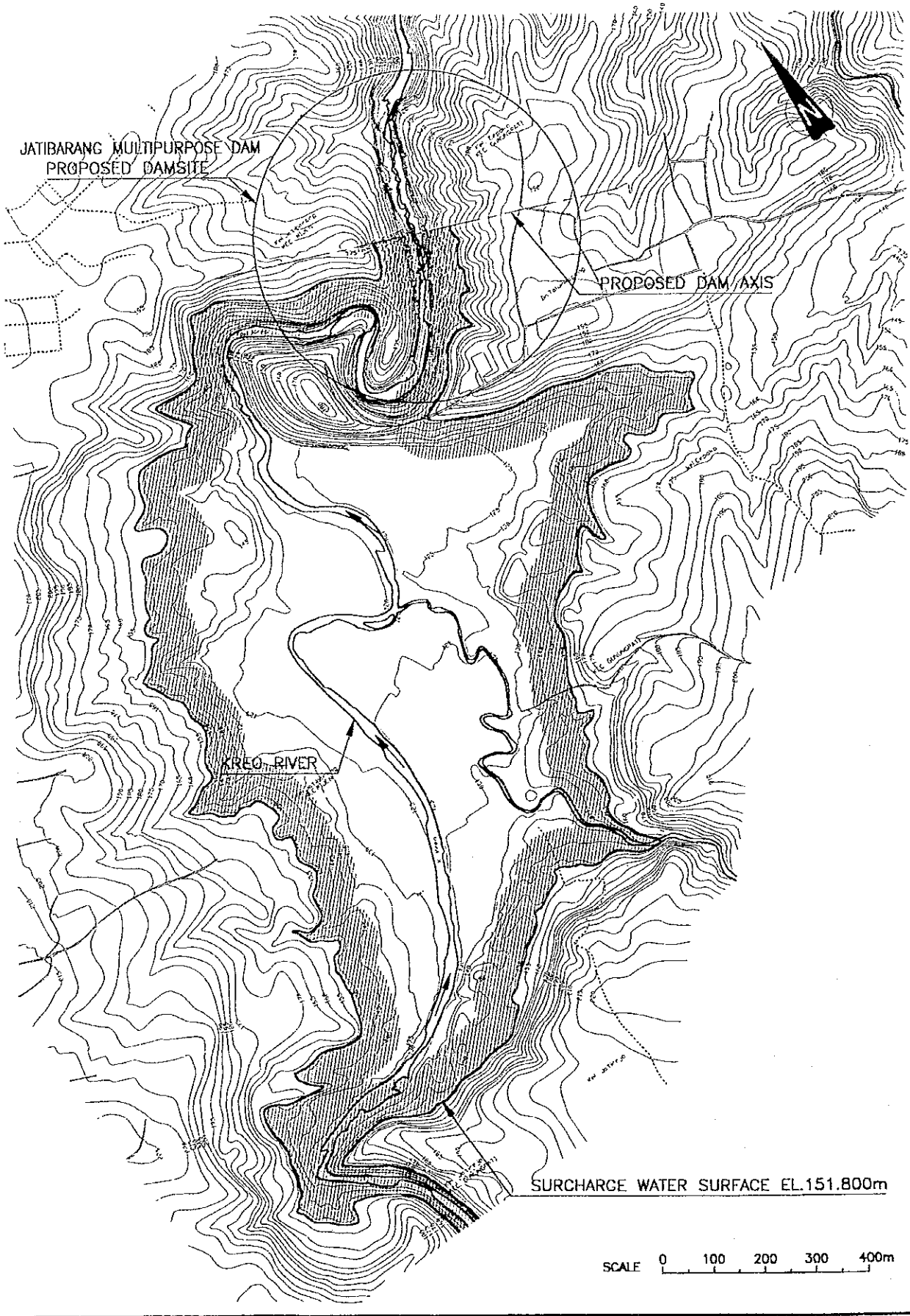
Chapter 1



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 1.1.1 STUDY AREA FOR MASTER PLAN
JAPAN INTERNATIONAL COOPERATION AGENCY	



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 1.3.1 STUDY AREA FOR DETAILED DESIGN
JAPAN INTERNATIONAL COOPERATION AGENCY	

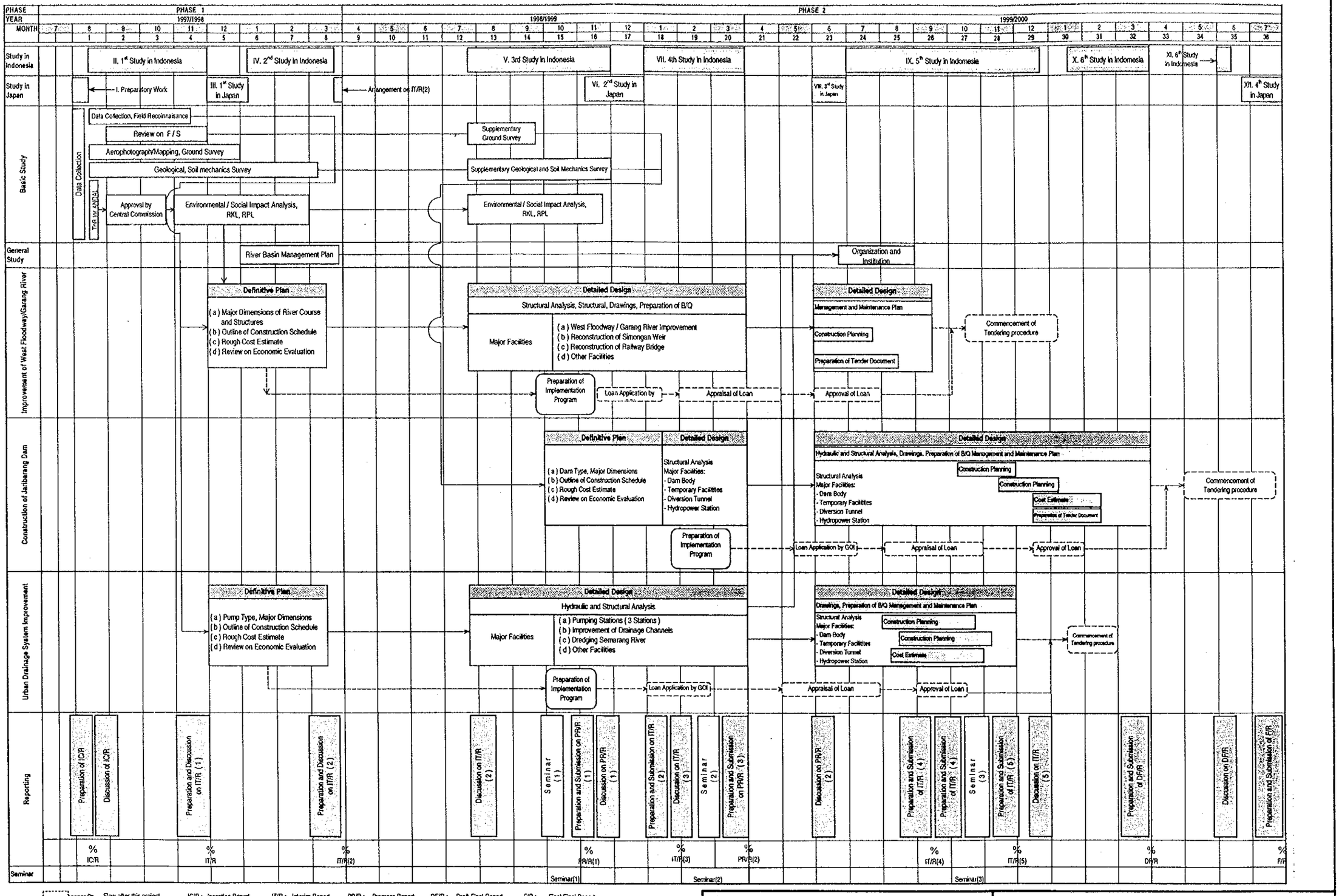


THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 1.4.1

LOCATION OF PROSED DAMSITE AND RESERVOIR AREA MAP



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 1.5.1
STUDY FLOWCHART FOR THE DETAILED DESIGN