

JEPA(日本経済産業省)とJICA(国際協力機構)の共同調査(第1期)

本調査は、日本経済産業省(以下「JEPA」と称す)と国際協力機構(以下「JICA」と称す)の共同調査として実施された。本調査の結果は、両機関の共同で公表される。

調査の目的と意義

本調査の目的は、以下の通りである。

(1) 調査対象国の経済状況の把握

(2) 調査対象国の産業構造の把握

(3) 調査対象国の社会状況の把握

調査の概要

調査の実施期間は、以下の通りである。

調査の実施場所は、以下の通りである。

調査の実施者は、以下の通りである。

調査の実施に当たっては、以下の通りである。

調査の実施に当たっては、以下の通りである。

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

**DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
MINISTRY OF PUBLIC WORKS
REPUBLIC OF INDONESIA**

**THE STUDY
ON
CIUJUNG - CIDURIAN
INTEGRATED WATER RESOURCES
IN INDONESIA**

FINAL REPORT

**VOLUME I
EXECUTIVE SUMMARY**



28229

FEBRUARY 1995

**NIPPON KOEI CO., LTD.
TOKYO, JAPAN**

**THE STUDY
ON
CIUJUNG-CIDURIAN INTEGRATED WATER RESOURCES**

COMPOSITION OF REPORTS

Volume I : Executive Summary

Volume II : Main Report

Volume III : Supporting Report

1. Present Socio-economic Conditions in the Study Area
2. Hydrological Study
3. Water Resources Study
4. Preliminary Design and Environmental Investigation of Pasir Kopo Dam
5. Topographic Survey for Karian-Serpong Conveyance System
6. Geological Investigation for Karian-Serpong Conveyance System
7. Karian-Serpong Conveyance System
8. Environmental Impact Analysis
9. Construction Plan and Cost Estimate
10. Financial and Economic Analyses
11. Reference Drawings Prepared by the Previous Studies and Projects

Volume IV : Data Book

- A. Topographic Maps Produced by the Study
- B. Hydrological Data in the Ciujung and Cidurian River Basins
- C. Geotechnical Data along the Karian-Serpong Conveyance System

EXCHANGE RATE

The exchange rates used in this Study are:

Rp.2,177 = US\$ 1.00 = ¥ 100

as of August, 1994

国際協力事業団

28229

PREFACE

In response to a request from the Government of Republic of Indonesia, the Government of Japan decided to conduct a feasibility study on Ciujung-Cidurian Integrated Water Resources and entrusted the study to Japan International Cooperation Agency (JICA).

JICA sent to Indonesia a study team headed by Mr. Katsuyoshi Wada, Nippon Koei Co. Ltd., and members from Nippon Koei Co. Ltd. and Pasco International Inc., 5 times between June, 1993 and December, 1994.

The team held discussions with the officials concerned of the Government of Indonesia, and conducted field surveys at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

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

I wish to express my sincere appreciation to the officials concerned of the Government of Republic of Indonesia for their close cooperation extended to the team.

February, 1995



Kimio Fujita

President

Japan International Cooperation Agency

February, 1995

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

Dear Sir,

LETTER OF TRANSMITTAL

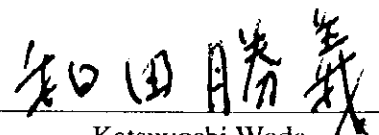
We are pleased to submit herewith the Final Report of the Feasibility Study on Ciujung-Cidurian Integrated Water Resources in Indonesia.

The Report presents the results of the Feasibility Study on Ciujung-Cidurian Integrated Water Resources comprising the Karian, Pasir Kopo, Cilawang, and Tanjung dam schemes, the Karian-Serpong conveyance system for a municipal and industrial water supply to Jabotabek and the north Banten areas and an irrigation water supply to the existing irrigation areas in the Ciujung and Cidurian river basins, and the river improvement works for the middle reaches of the Ciujung river.

The Report consists of four volumes, the Summary, Main Report, Supporting Report, and Data Book. The Summary presents main outputs of the Study. The Main Report covers all the study results including analysis of the respective disciplines. The Supporting Report gives additional and supporting information, and the Data Book provides data obtained from the basic field survey and investigations carried out in Indonesia.

We would like to express our heartfelt thanks to the personnel of your Agency, the Embassy of Japan in Indonesia, and also to officials and individuals of the Government of Indonesia for the assistance and advice extended to the Study Team. We sincerely hope that the results of this Study will contribute to the national and regional development of the country.

Yours faithfully,



Katsuyoshi Wada

Team Leader

Study on Ciujung-Cidurian
Integrated Water Resources

OUTLINE OF THE STUDY

1. Background of the Study : The study area including DKI Jakarta, Botabek, and the north Banten areas is being rapidly industrialized and urbanized. The current population of 19 million is forecasted to increase to about 50 million in 2025. In order to cope with increasing municipal and industrial (M&I) water demands, the concept of a "Balanced Water Supply", which planned to develop the water resources in the Citarum river east of DKI Jakarta and the Ciujung and Cidurian rivers in the west, was established by the Cisadane-Cimanuk Integrated Water Resources Development Study. This Study has been undertaken based on the result of their study.

The Government of Indonesia also carried out the Jabotabek Water Resources Management Study (JWRMS) in parallel with the Study in order to establish a water supply master plan incorporating the rapid economic development in the aforesaid areas. Therefore, this Study has been carried out in due consideration of the result of the JWRMS.

2. Objectives of the Study : The objectives of the Study are to work out an integrated water resources development plan comprising the Karian, Pasir Kopo, Cilawang, and Tanjung dam schemes, and the Karian-Serpong conveyance system connecting the envisaged Karian reservoir to the on-going Serpong water treatment plant for the purpose of municipal and industrial (M&I) water supply in and around the Jabotabek area and irrigation water supply to the existing irrigation areas in the Ciujung and Cidurian river basins during the time horizon till 2025.

3. The Study Area : The Study covered the north Banten and Jabotabek areas with a total area of 9,489 km², as shown in Figure A.

4. Outline of the Proposed Plan : The JWRMS recommended the development of the water resources in the Ciujung and Cidurian river basins for the M&I water supply to Serang, Tangerang, and DKI Jakarta and irrigation water supply to the existing Ciujung and Rancasumur areas. The water supply master plan established by JWRMS also proposed to develop and manage the water resources with flexibility, to cope with changes in the future water demands. Therefore, the JWRMS provided two scenarios, A and C, for the future water demand projection and water resources development. The scenario A adopted the trend projection in population, economic development, and water use condition. While, the scenario C assumed a higher economic development and well planned spatial distribution of the population and water resources management and development, especially on groundwater use which has induced such problems as land subsidence and water pollution by its over-abstraction in and around DKI Jakarta.

The Study reviewed the master plan through water demand and supply balance analysis to evaluate potential surface water resources in the Ciujung and Cidurian river basins, incorporating the Karian, Pasir Kopo, Cilawang and Tanjung dam schemes and Karian-Serpong water conveyance system. Based on the result of the analysis, the water resources development plan was established, as illustrated in Figure B, in order to meet the projected M&I water demands in Serang, Tangerang, and DKI Jakarta during the time horizon till 2025 under the condition that the irrigation water requirement is satisfied in the drought with a return period of less than 5 years, but restricted for the severer droughts. The water supply to DKI Jakarta was planned to be commenced from 2015, as shown in the Figure B.

The route of the Karian-Serpong Conveyance System (KSCS) connecting the Karian reservoir with the Serpong water treatment plant (refer to Figure C) was optimized in terms of the lowest construction cost, applying two kinds of conveyance methods; a gravity type between the Karian reservoir and Parungpanjang; and a pressure type between Parungpanjang to the Serpong water treatment plant. The KSCS was planned to be implemented in stages in order to minimize over-investment and to accord with the water resources development plan, as shown in Figure D.

The river improvement plan for the middle reaches of the Ciujung river between the existing Pamarayan weir and Rangkasbitung was established by the feasibility study on the Karian multi-purpose dam construction project, 1985. The Study also identified the necessity and urgency of the aforesaid river improvement works since the objective area is being urbanized and its flood damage potential is rapidly increasing. Therefore, the Study recommends to implement this river improvement plan urgently.

The main features of the proposed dams, KSCS, and the river improvement works are given in Table A.

5. Project Cost : The project cost was estimated as given in Table B under the following assumptions and conditions:

- 1) Basic price level was set at August, 1994
- 2) The exchange rate of Yen 1.00 to Rp.21.77 in August 1994 was applied.
- 3) The unit prices for the work items, construction material, and equipment were estimated by dividing into foreign and local currency portions, and by using the Indonesian Rupiah currency.
- 4) The project cost comprises construction cost, land acquisition and compensation costs including preparation of the resettlement area, engineering service costs, administration costs, value added tax, physical and price contingencies, and interest during construction.

6. Project Evaluation

6.1 Economic evaluation : The economic benefit and construction cost required for the economic evaluation were estimated under the following conditions:

- 1) The economic benefit of raw water supply for municipal and industrial (M&I) water use was assumed to be a return obtained by the current water tariff. The raw water price in the current water tariff was evaluated at 60 % of the tariff referring to the result of analysis on raw and treated water prices made by the JWRMS.
- 2) The economic benefit of the river improvement works was assumed to be given as the effect of reduction in annual mean flood damage to assets in the flood protection area under the present socio-economic conditions.
- 3) The economic cost was converted from the financial cost by applying the adjustment factors for the major work items.
- 4) The economic project life of 50 years was applied for the economic analysis.
- 5) The basic price level for cost and benefit estimates was set at the end of August 1994.
- 6) The exchange rates of foreign currencies were Yen 1.00 to Rp. 21.77 and US dollar \$ 1.00 to Rp. 2,177 as of August, 1994.

The Economic Internal Rate of Return (EIRR) was worked out for the first phase development and full development phases and indicated a high economic viability for both, as follows:

Works	(%)			
	First Phase Development		Full Development	
	Scenario A	Scenario C	Scenario A	Scenario C
Water Supply	16.1	20.2	21.7	24.2
River Improvement			13.4	
Water Supply + River Improvement	16.0	19.8	21.3	23.7

The unit raw water prices were also estimated for the proposed dam schemes and KSCS based on their financial costs and the M&I water demands to be supplied, assuming a discount rate of 9 %. The result is given as follows:

Works	(Rp. per m ³)	
	Scenario A	Scenario C
First phase development	360	267
Full development	265	283

Comparing the above unit raw water prices with the estimated raw water price of about Rp. 600 per m³ included in the current water tariff, it is indicated that the proposed dam schemes and KSCS have a high viability also in financial aspect.

6.2 Environmental Impact Analysis : Relocation of the local residents in the affected areas by the proposed schemes was identified to be one of the significant issues dominating the feasibility of the schemes among the environmental impacts. Relocation of the households and population required in the implementation of the proposed schemes was estimated, as follows.

Project Components	Scenario A				Scenario C			
	Area (ha)	Kam-pong	House-hold	Popu-lation	Area (ha)	Kam-pong	House-hold	Popu-lation
Karian	1,740	26	2,055	12,124	1,740	26	2,055	12,124
Cilawang	1,056	16	639	3,706	1,056	16	639	3,706
Tanjung	-	-	-	-	2,487	28	2,469	15,060
Pasir Kopo	640	11	846	3,810	920	18	1,781	8,020
KSCS	260	16	117	632	260	16	117	632
River Improvt.	71	16	98	578	71	16	98	578
Total	3,767	85	3,755	20,850	6,534	120	7,159	40,120

It was identified through an interview survey for about 10 % of local residents of the affected population, that most local residents living in the affected area could agree to resettlement on the assumption to move to adjacent areas. From this view point, there are available areas near the Karian and Pasir Kopo damsites, but not near the Tanjung and Cilawang reservoir areas in the neighbouring kecamatans and kabupatens.

However, the Tangerang area near the Tanjung and Cilawang reservoirs has been and is being rapidly urbanized and industrialized. Taking into account the introduction of these dam schemes after 2014 or 2015, there is a high possibility that life style, living standards, and income levels of the local residents will have changed drastically from the present situation, requiring other resettlement concepts in future.

In order to successfully implement the proposed schemes and to carry out resettlement during the time horizon till 2025, the establishment of an organization, the Environmental Monitoring and Management Unit (EMMU), under the executing body is of the paramount importance and therefore, proposed so as to; 1) continuously monitor socio-economic changes and resettlers' requirement in the affected areas; 2) establish a realistic resettlement concept which should satisfy the resettlers' requirements; and 3) effectively carry out the resettlement of local residents well in advance of commencement of the respective development works.

7. Proposed Action Program : The proposed action plan for the Ciujung-Cidurian integrated water resources development project is illustrated in Figure E.

First Step : Implementation of the Karian dam scheme, the first phase of the Karian-Serpong conveyance system (KSCS I) and the river improvement works along the middle reaches of the Ciujung river.

Second Step : Review and updating study of the water resources development plan incorporating the results of the population census in 2000 and data relevant to water demand including performance of the first step development. The study will provide an optimum scale of the Pasir Kopo dam and a development scenario in the third step.

8. Recommendations

- (1) It is identified that the first step development consisting of the Karian dam schemes, the KSCS -I with a length of 36.5 km from the Ciuyah tunnel to the envisaged Parungpanjang water treatment plant, and the river improvement works along the Ciujung river are urgent in terms of water demand and supply balance, and flooding in the study area. It is also revealed that the first phase development work has a high economic viability. Therefore, it is strongly recommended to proceed with the necessary procedures for executing these works urgently.
- (2) The Karian dam scheme and KSCS I are planned to provide raw water for M&I water use in Serang and Tangerang. In order to supply treated water to water users in these areas, it is necessary for proceeding the first step development to coordinate with the water supply agencies such as Chipta Karya, and PDAMs in Tangerang and Serang. Therefore, it is recommended to establish a necessary coordination system with the related agencies for the M&I water supply.
- (3) In order to successfully execute the resettlement of local residents in the affected area, it is recommended that the environmental monitoring and management unit (EMMU) be established at the project office at Pandeglang, under the DGWRD.

Table A MAIN FEATURES OF THE PROJECT COMPONENTS

Main Features	Karian Dam	Pasir Kopo Dam		Cilawang Dam	Tanjung Dam
		A	C		
I. Dam scheme					
1) Catchment area (km ²)	288	172	172	93	280
2) Dam type	Rockfill	Rockfill	Rockfill	Rockfill	Rockfill
3) Dam crest level (EL. m)	72.5	97.0	106.5	81.0	60.5
4) Flood high water level (EL.m)	69.9	94.2	103.7	78.5	59.5
5) Normal high water level	67.5	90.5	100.5	75.6	56.5
6) Low water level	46.0	80.0	80.0	66.5	50.0
7) Dam height (m)	60.5	52.0	61.5	36.0	35.5
8) Reservoir area (ha)	1,740	640	920	1,056	2,487
9) Effective storage volume (mil. m ³)	219.0	44.5	112.6	62.0	120.0
10) Embankment volume of main dam (mil. m ³)	1.23	0.42	0.70	0.42	8.39
11) Design flood discharge (PMF)					
a) Inflow	3,400	3,300	3,300	1,700	3,098
b) Outflow	2,670	1,760	1,430	1,230	727
12) Spillway gate					
a) Type	Radial gate	overflow type	overflow type	Radial gate	overflow type
b) Nos.	2			2	
c) Height	12.5			9.5	
d) Width	12.5			9.0	
13) Side overflow spillway weir (m)	50.0	125.0	125.0	20.0	-
14) Flood control volume against 10-year probable flood (mil. m ³)	33.5	-	-	-	-
Main Features	Description				
II. Karian-Serpong conveyance system					
1) Length (km)					
a) KSCS I	36.5				
b) KSCS II	19.3				
c) KSCS III	11.9				
d) Cilawang canal	17.1				
e) Tanjung canal	4.3				
2) Type of conveyance					
a) KSCS I&II and Cilawang & Tanjung Canal	gravity conveyance				
b) KSCS III	pumping-up and pipeline				
3) Maximum flow capacities (m ³ /s)					
a) KSCS I	12.4				
b) KSCS II	13.8				
c) KSCS III	6.0				
d) Cilawang canal	4.1				
e) Tanjung canal	9.7				
III. River improvement works					
1) River length to be improved (km)	18.20				
2) Improvement method	Provision of river dredging, short-cut channel (4 km) and flood dyke				
3) Design discharge					
a) Design scale	10-year probable flood discharge				
b) Design discharge	1,100 m ³ /s with retardation of flood peak discharge in the Karian reservoir				
4) Earth work volume					
a) Embankment volume (mil. m ³)	0.60				
b) Excavation volume (mil. m ³)	1.40				
c) Dredging volume (mil. m ³)	0.67				

Table B FINANCIAL COST FOR CIUJUNG-CIDURIAN INTEGRATED WATER RESOURCES DEVELOPMENT

First Phase Development (Unit : million Rp)

Description	Karian Dam		Ciyah Tunnel		KSCS I		River Improvement		Total	
	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC
I. Basic Cost										
1) Preparatory Works	11,032	7,266	469	205	10,703	8,799	2,659	2,541	24,863	18,811
2) Civil Works	87,765	34,892	10,277	4,383	97,002	59,854	17,862	11,392	212,906	110,521
3) Metal Works	11,390	1,266	2,021	225	1,894	211	0	0	15,305	1,702
4) Engineering Service	15,426	3,908	1,787	433	15,344	6,198	2,873	1,254	35,430	11,793
5) Administration	0	7,681	0	879	0	8,923	0	1,723	0	19,205
6) Compensation Cost	0	58,714	0	0	0	6,266	0	1,926	0	66,906
7) Tax (PPN)	0	17,295	0	1,980	0	20,001	0	3,858	0	43,133
Sub-total	125,613	131,021	14,554	8,105	124,943	110,251	23,394	22,694	288,504	272,072
II. Contingency										
1) Physical Contingency	12,561	13,102	1,455	811	12,494	11,025	3,503	3,404	30,014	28,342
2) Price Escalation	21,647	53,483	2,738	4,506	22,728	57,850	4,061	11,144	51,173	126,982
Sub-total	34,208	66,585	4,193	5,316	35,222	68,875	7,563	14,548	81,187	155,324
III. Interest During Construction	14,946	0	1,534	0	13,813	0	2,869	0	33,162	0
Total	174,767	197,606	20,281	13,422	173,978	179,127	33,826	37,242	402,853	427,396
Grand Total (FC+LC)		372,373		33,703		353,105		71,068		830,249

Second Phase Development (IIA) in Scenario A (Unit : million Rp)

Description	Posir Kopo Dam		Cilawang Dam		KSCS II&III Cilawang Canal		Total	
	FC	LC	FC	LC	FC	LC	FC	LC
I. Basic Cost								
1) Preparatory Works	5,936	3,255	10,217	5,154	8,763	7,602	24,916	16,011
2) Civil Works	43,704	19,573	33,116	13,926	89,475	55,635	166,295	89,134
3) Metal Works	9,185	1,021	7,483	831	49,941	5,549	66,609	7,401
4) Engineering Service	8,236	2,146	7,114	1,792	20,745	6,191	36,095	10,129
5) Administration	0	4,134	0	3,536	0	10,848	0	18,518
6) Compensation Cost	0	20,138	0	25,226	0	1,270	0	46,634
7) Tax (PPN)	0	9,306	0	7,963	0	24,390	0	41,659
Sub-total	67,061	59,573	57,930	58,429	168,924	111,485	293,915	229,486
II. Contingency								
1) Physical Contingency	6,706	5,957	5,793	5,843	16,892	11,149	29,391	22,949
2) Price Escalation	17,890	50,692	15,454	49,719	45,064	94,866	78,408	195,277
Sub-total	24,596	56,649	21,247	55,562	61,956	106,015	107,799	218,226
III. Interest During Construction	8,228	0	7,578	0	16,998	0	32,804	0
Total	99,884	116,222	86,756	113,990	247,879	217,500	434,518	447,712
Grand Total (FC+LC)		216,106		200,746		465,378		882,230

Second Phase Development (IIC) in Scenario C (Unit : million Rp)

Description	Posir Kopo Dam		Tanjung Dam		Cilawang Dam		KSCS II&III Tanjung Canal		Cilawang Canal		Total	
	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC
I. Basic Cost												
1) Preparatory Works	5,936	3,255	27,531	14,590	10,217	5,154	7,741	7,371	6,708	4,977	58,133	35,347
2) Civil Works	55,063	19,573	265,468	107,442	33,116	13,926	78,946	46,846	25,136	17,730	457,729	205,517
3) Metal Works	11,860	1,021	2,352	261	7,483	831	49,828	5,537	269	30	71,792	7,680
4) Engineering Service	10,200	2,146	41,349	17,121	7,114	1,792	19,112	5,378	4,496	2,046	82,272	28,484
5) Administration	0	4,835	0	20,882	0	3,536	0	9,813	0	2,743	0	41,810
6) Compensation Cost	0	33,579	0	89,246	0	25,226	0	1,512	0	171	0	149,734
7) Tax (PPN)	0	10,905	0	47,611	0	7,963	0	22,076	0	6,139	0	94,695
Sub-total	83,059	75,315	336,700	297,154	57,930	58,429	155,627	98,533	36,609	33,836	669,926	563,267
II. Contingency												
1) Physical Contingency	8,306	7,532	33,670	29,715	5,793	5,843	15,563	9,853	3,661	3,384	66,993	56,327
2) Price Escalation	22,158	64,088	87,009	246,096	15,454	49,719	83,845	9,766	28,792	175,903	472,540	472,540
Sub-total	30,464	71,620	120,679	275,812	21,247	55,562	57,079	93,698	13,427	32,176	242,896	528,867
III. Interest During Construction	10,159	0	54,960	0	7,578	0	15,639	0	3,145	0	91,481	0
Total	123,682	146,935	512,339	572,965	86,756	113,990	228,345	192,231	53,180	66,012	1,004,302	1,092,134
Grand Total (FC+LC)		270,617		1,085,304		200,746		420,577		119,192		2,096,436

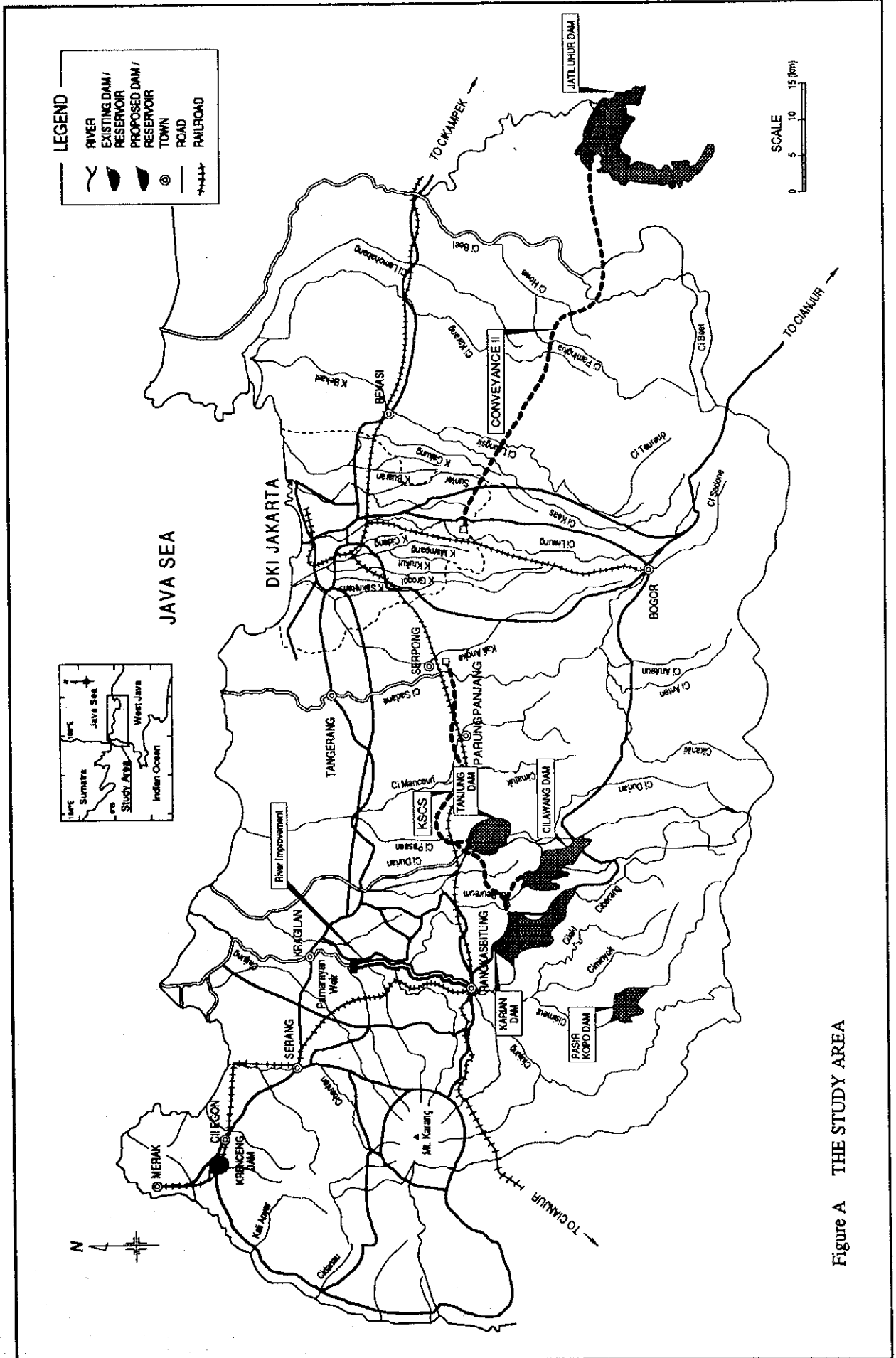
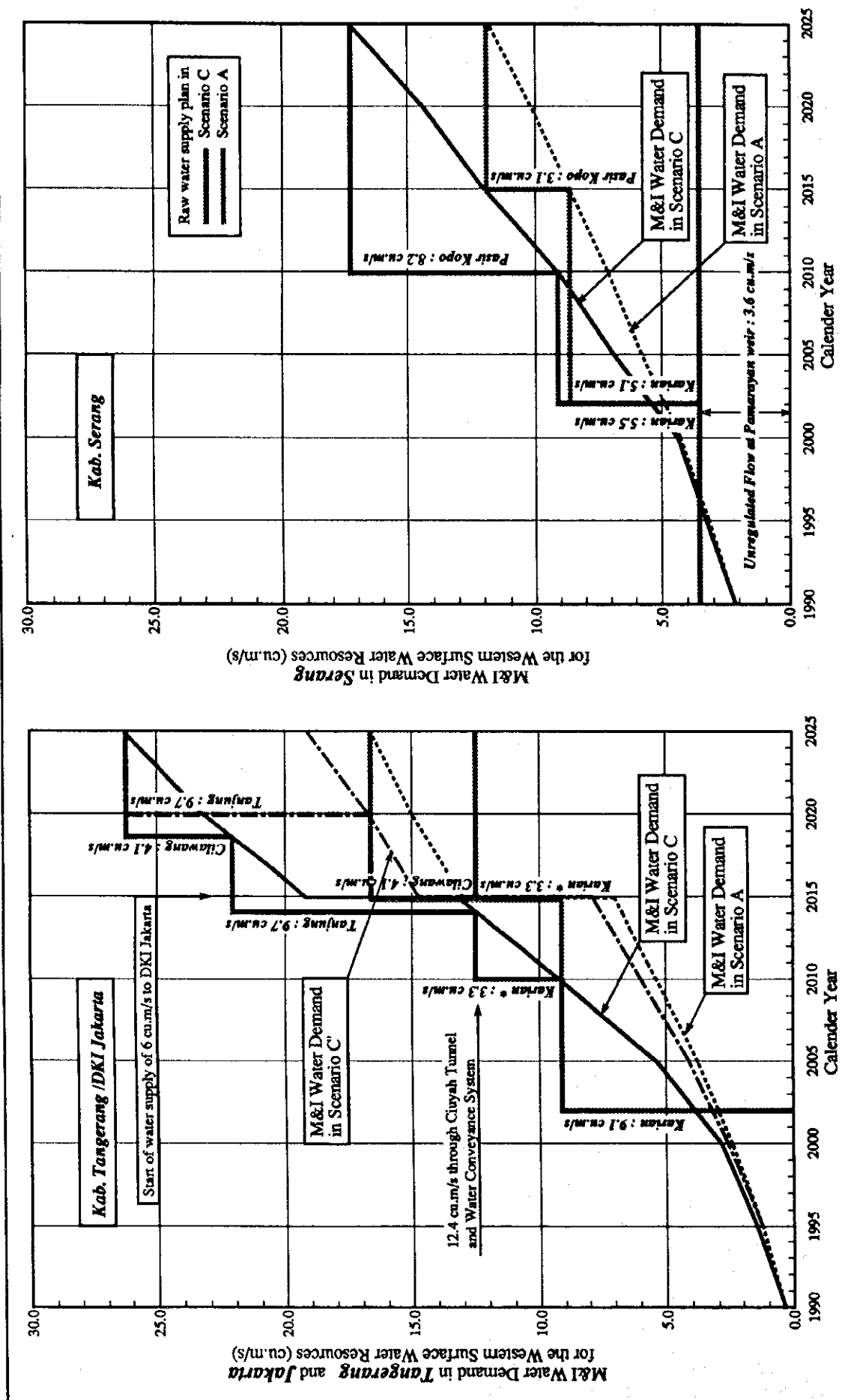


Figure A THE STUDY AREA



Note : Karian with a symbol of "*" means incremental discharge from the Karian dam to Karian-Serpong Conveyance System and decrease of water supply amount for Serang. The decreased discharge is planned to be replaced by the Pastir Kopo dam.

Figure B RAW WATER SUPPLY PLAN FOR MUNICIPAL AND INDUSTRIAL USE IN SERANG, TANGERANG AND DKI JAKARTA

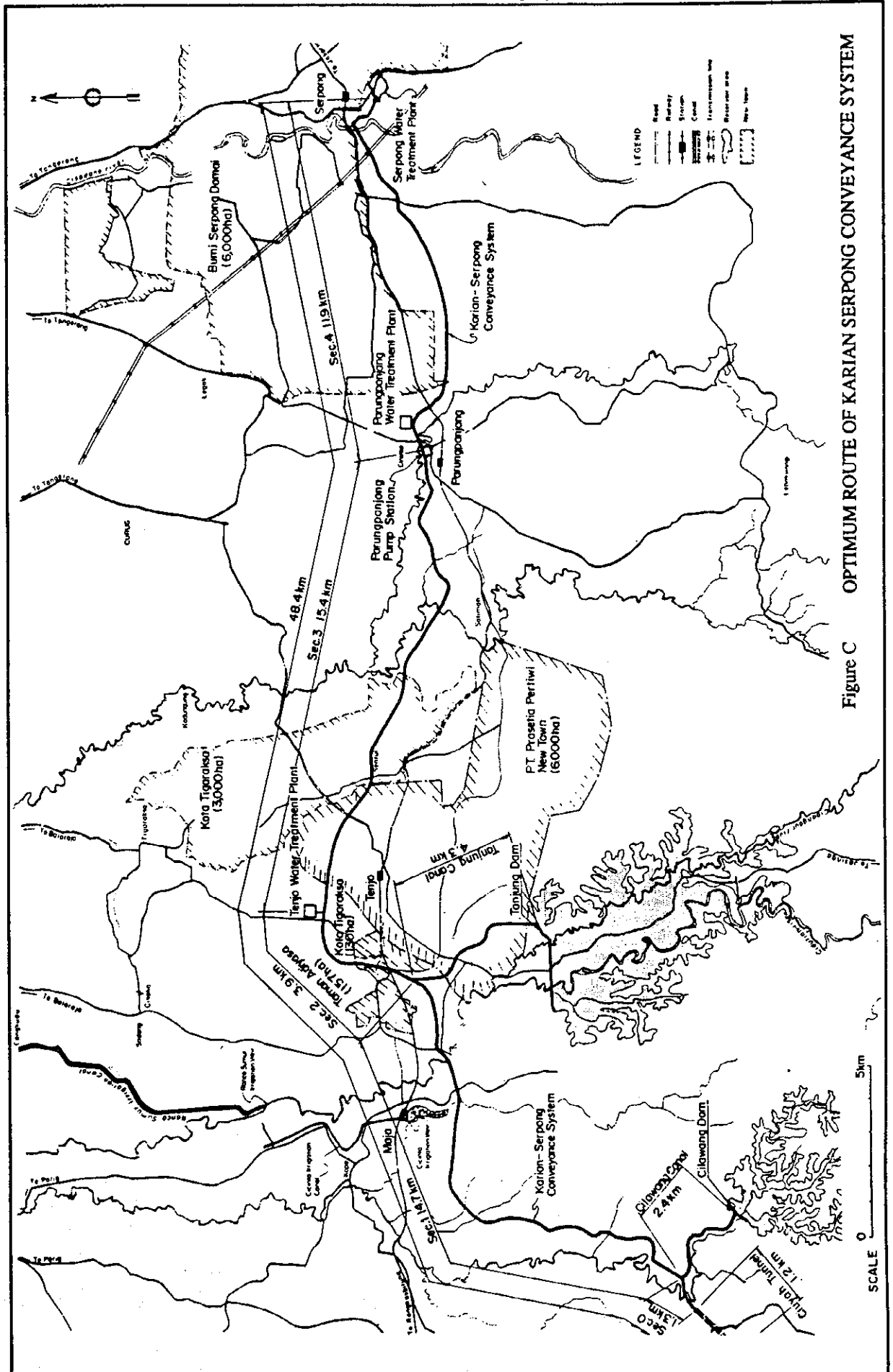


Figure C OPTIMUM ROUTE OF KARIAN SERPONG CONVEYANCE SYSTEM

Figure D PROPOSED PHASING DEVELOPMENT PLAN OF KSCS

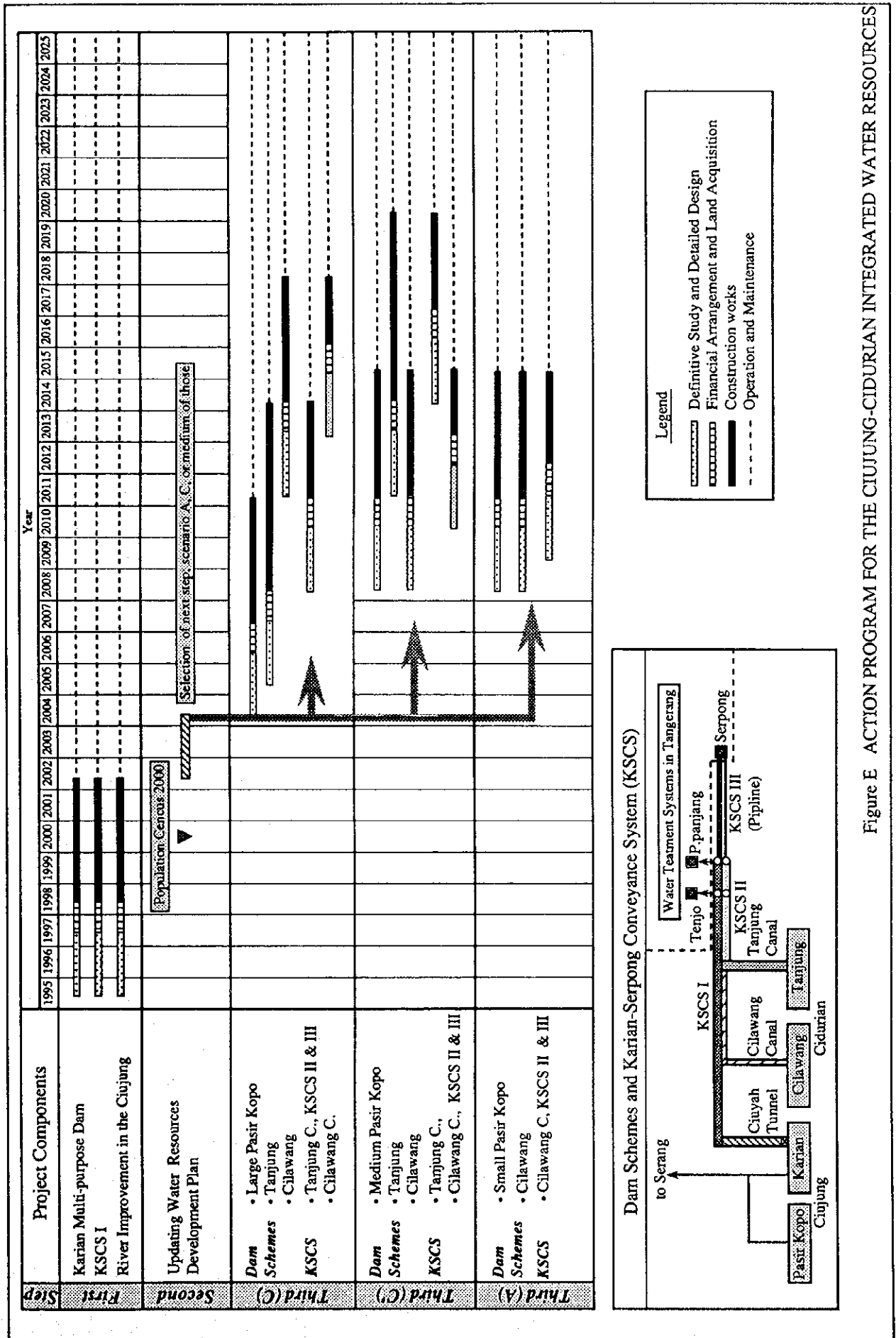


Figure E ACTION PROGRAM FOR THE CIUJUNG-CIDURIAN INTEGRATED WATER RESOURCES

**THE STUDY
ON
CIUJUNG-CIDURIAN INTEGRATED WATER RESOURCES**

VOLUME 1 : EXECUTIVE SUMMARY

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EXECUTIVE SUMMARY

1. INTRODUCTION

The Government of the Republic of Indonesia requested technical assistance from the Government of Japan in December 1991 for a study on the Ciujung-Cidurian integrated water resources. In response to the request, the Government of Japan decided to conduct the study on Ciujung-Cidurian Integrated Water Resources Development and the Japan International Cooperation Agency (JICA) made a preliminary investigation. The scope of work for the assistance was agreed between the Government of the Republic of Indonesia and JICA in December 1992.

The study on the Ciujung-Cidurian Integrated Water Resources (the Study) has been undertaken since June 1993 in collaboration with the consulting firm, PT. Indra Karya, dispatched as a counterpart team from the Directorate General of Water Resources Development (DGWRD), Ministry of Public Works. The objectives of the Study are to work out water allocation for the purpose of municipal and industrial water supply in and around the Jabotabek area during the time horizon till 2025, to conduct a feasibility study on a water conveyance system connecting the Karian reservoir with Serpong water treatment plant under construction, to update the existing development plan for the Karian, Pasir Kopo, Cilawang, and Tanjung dam schemes taking into account the present socio-economic situation, and to transfer relevant planning and designing technologies to the Indonesian counterpart personnel in the course of the Study.

The Jabotabek Water Resources Management Study (JWRMS) was carried out in order to formulate a water supply master plan, duplicating the study duration and the study area. To maintain consistency with the master plan, the Study has been undertaken in due consideration of the results of the JWRMS.

This Final Report describes all the results of the studies and investigations made by the Study in order to achieve the objectives. This Final Report comprises four (4) volumes. Volume I is the executive summary which briefs the main outcome of the Study. Volume II is the main report to discuss the general of the water resources development plan in the Ciujung and Cidurian river basins. Volume III is the supporting report describing the engineering works in detail, and Volume IV is a data book which contains the collected hydrological data, topographic maps produced by the Study, and geotechnical data obtained by the investigation works of the Study.

2. THE STUDY AREA

2.1 Topography

The Study area with an area of 9,489 km², shown in Figure 1, is situated between the east longitude of 105° 48' and 107° 28' and the south latitude of 5° 50' and 7° 10'. The northern and western parts of the study area are bounded by the Java Sea and the southern part is divided by a mountain range with an altitude of 1,300 m to 2,200 m. The Ciujung and Cidurian river basins, which are the objective rivers of water resources development by the Study, are located at the western part of the study area and originate in the southern mountainous area with an altitude of about 2,000 m. The Ciujung and Cidurian river basins have a catchment area of 1,850 km² and 865 km², respectively. The envisaged Karian and Pasir Kopo dam sites are located in the Ciujung river basin, and the Cilawang and Tanjung dam sites are in the Cidurian river basin.

The route of the Karian-Serpong water conveyance system, which is planned to connect the Karian reservoir with the Serpong treatment plant currently under construction, lies in the southern hilly area with an altitude of 30 m to 60 m, along an existing railway line. The water conveyance route crosses the Cibeureum, Cidurian, Cimatuk, Cimanceuri and Cisadane rivers on the way to Serpong water treatment plant.

2.2 Geology

Geological features in the study area are generally classified into alluvial of Holocene, terrace deposit of Pleistocene, tuffaceous sedimentary rocks of Pliocene to Miocene, and southern volcanoes of Miocene. The sedimentary formations of Miocene to Pleistocene are divided into several formations which are superposed monoclinally from south to north and from lower to upper horizons. They are mainly composed of fine to coarse tuffaceous sandstone and pumice tuffs with interbedding of lapilli tuffs which belong to the Genteng formation of Pliocene in this study area. The southern volcanic mountains were formed by basalt, volcanic breccia and andesite, which are erupted and/or intruded along the faulting zones in Miocene.

The Karian-Serpong conveyance route is planned to be aligned through the four (4) portions; 1) Genteng formation; 2) Banten tuff; 3) Bojongmanik formation; 4) Quarternary volcanics; and 5) alluvial plains.

2.3 Meteorological and Hydrological Conditions

The study area belongs to typical humid tropical zone and the weather patterns are characterized by the monsoons. The wet season is generally defined as the period from November to April and the dry season from May to October. The mean annual rainfalls in

the Ciujung and Cidurian river basins range from 4,000 mm in the mountainous area to 1,500 mm in the coastal area.

According to the runoff data at Rangkasbitung in the Ciujung river basin and Kopomaja in the Cidurian river basin for the period from 1970 to 1993, the runoff data at the envisaged dam sites and the existing weir sites were estimated by using a ratio of the catchment area and the annual rainfall at the Pamarayan weir, Rancasumur weir, and the envisaged dam sites to these key gauges. The annual mean runoff at these sites are given as follows:

Sites	River Basin	Catchment Area (km ²)	Annual Mean Rainfall (mm)	Annual Mean Runoff (m ³ /s)
Pamarayan weir	Ciujung	1,451	2,957	97.8
Rangkasbitung	Ciujung	1,383	2,988	94.2
Karian dam	Cibeurang	288	3,498	23.0
Pasir Kopo dam	Cisimeut	172	3,101	12.2
Rancasumur weir	Cidurian	376	3,445	25.3
Kopomaja	Cidurian	304	3,553	21.1
Cilawang dam	Cibeureum	93	3,558	6.5
Tanjung dam	Cidurian	280	3,673	20.1

According to the estimated runoff data at the aforesaid sites, the drought discharges are also estimated for 24 years. Among these, the lowest daily mean discharges in the drought years are as follows:

Sites	River Basin	Catchment Area (km ²)	(unit:m ³ /s)				
			1972	1977	1982	1983	1991
Pamarayan weir	Ciujung	1451	2.4	7.9	3.4	4.5	5.0
Rangkasbitung	Ciujung	1383	2.3	7.6	3.3		4.8
Karian dam	Cibeurang	288	0.6	1.9	0.8	1.1	1.2
Pasir Kopo dam	Cisimeut	172	0.3	1.0	0.4	0.6	0.6
Rancasumur weir	Cidurian	376	1.0	2.8	0.8	1.8	0.1
Kopomaja	Cidurian	304	0.8	2.3	0.7	1.5	0.1
Cilawang dam	Cibeureum	93	0.3	0.7	0.2	0.5	0.03
Tanjung dam	Cidurian	280	0.8	2.2	0.7	1.4	0.1

The probable drought discharge with a return period of 10 years was estimated by the frequency analysis at 3.6 m³/s at the Pamarayan weir and 1.1 m³/s at the Rancasumur weir.

2.4 Socio-economic Condition

The study area is administratively covered by six (6) kabupatens in the West Java Province and DKI Jakarta. The study area is mainly divided into four (4) categories for land use; 1) a settlement area of 1,763 km² including an industrial area currently developing; 2) paddy fields of 3,335 km²; 3) upland crops of 3,688 km²; and 4) state forest and other areas of 703 km² as of 1991. The total population in the study area was 19 million in 1990 with a high growth rate of around 4 % and is forecasted to be around 50 million in 2025.

Gross Regional Domestic Products (GRDP) in West Java Province and Kabupatens in the study area are given in the following table, and the industrial sector rapidly developing in the study area shares more than 30 % of GRDP:

(trillion Rp.)									
Indonesia	West Java	Jabotabek					North Banten		
		Jakarta	Kota. Bogor	Kab. Bogor	Kab. Tange- rang	Kab. Bekasi	Kab. Serang	Kab. Lebak	Kab. Pande- glang
113	17.8	13.7	0.2	1.4	1.3	0.8	1.1	0.3	0.3
(7.1)	(8.3)	(7.3)	(7.0)	(9.5)	(10.8)	(8.5)	(11.9)	(13.0)	(6.5)

3. WATER RESOURCES DEVELOPMENT PLAN

3.1 Water Demand

The JWRMS projected the future water demand in the municipal and industrial (M&I) and irrigation sectors during the time horizon till 2025 under three (3) scenarios; scenario A in trend projection, scenario B in low economic development, and scenario C in high economic development. In the scenario C, the JWRMS also assumed the diversification of the current main water source for the M&I water supply from groundwater to surface water in order to solve the problems induced by the over-abstraction of groundwater in and around DKI Jakarta, and the reduction of the existing irrigation areas due to expansion of the existing residential areas to support the increasing population.

The Study reviewed the projected water demand as well as the applied method and data as shown in Figure 2, and concluded that the projected water demands are applicable for water demand/supply balance analysis in the Study with slight modification. Table 1 indicates the projected M&I water demands during the time horizon till 2025 in Jabotabek and its surrounding Kabupatens.

The JWRMS recommended that the M&I water demands in Serang, Tangerang, and DKI Jakarta as well as the irrigation water requirement in the existing areas be supplied from the envisaged Karian, Pasir Kopo, Cilawang, and Tanjung dams and the Karian-Serpong conveyance system in the Ciujung and Cidurian river basins.

The total M&I water demands in these areas are summarized as follows:

Year	(unit:m ³ /s)								
	Serang			Tangerang			DKI Jakarta		
	Surface water	Ground-water	Total	Surface water	Ground-water	Total	Surface water	Ground-water	Total
Scenario A									
1990	2.2	2.6	4.8	2.3	4.4	6.7	9.0	15.1	24.1
2000	4.3	4.0	8.3	4.4	6.4	10.8	12.2	16.8	29.0
2010	7.1	6.0	13.1	7.3	8.5	15.8	18.2	17.6	35.8
2025	11.8	8.2	20.0	12.5	10.9	23.4	26.0	17.7	43.7
Scenario C									
1990	2.2	2.6	4.8	2.3	4.4	6.7	9.0	15.1	24.1
2000	4.4	4.0	8.4	4.8	6.7	11.5	18.9	14.8	33.7
2010	9.1	5.0	14.1	11.1	7.9	19.0	36.0	11.1	47.1
2025	17.3	5.3	22.6	22.2	8.4	30.6	42.1	10.1	52.2

The M&I water demands for the surface water in Serang, those in Tangerang excluding water amount of 2 m³/s to be taken in from the Cisadane river, and 6 m³/s in DKI Jakarta were planned to be supplied by the envisaged dam schemes and water conveyance system in the JWRMS. The water supply to DKI Jakarta is also planned to start in 2015 in order to replace the intake water at the on-going Serpong water treatment plant due to predicted significant

water pollution in the Cisadane river, and also to meet additional M&I water demands in DKI Jakarta.

The irrigation water requirement in the existing Ciujung and Rancasumur areas was reviewed using the meteo-hydrological data from 1970 to 1993 and the typical cropping patterns in these areas, assuming the following conditions:

- (1) The irrigation area will be gradually decreased due to expansion of the residential area to support the increasing population.
- (2) Agricultural diversification from paddy to vegetable is expected in order to meet the requirement of vegetables in the urban areas and to effectively use the available water in the Jabotabek and north Banten areas.

The estimated irrigation water requirement in 1990 and 2025 is given as follows:

	Unit	Ciujung		Rancasumur	
		1990	2025	1990	2025
Scenario A					
Irrigation area	(ha)	22,988	18,862	10,805	9,312
Cropping intensity	(%)	168	197	142	171
Annual mean water requirement	(m ³ /s)	12.6	10.4	4.7	4.2
Scenario C					
Irrigation area	(ha)	22,988	18,862	10,805	8,873
Cropping intensity	(%)	168	223	142	197
Annual mean water requirement	(m ³ /s)	12.6	10.1	4.7	3.8

Note : The above water requirement is the average from 1970 to 1993.

3.2 Review of the Four Dam Schemes

A review of the Karian, Pasir Kopo, Cilawang, and Tanjung dam schemes was carried out by adopting the following procedure, mainly focusing on the supply capacity of these dam schemes and updating runoff data in the respective river basins in such manner as incorporating the severe drought years in 1980's:

- (1) Single purpose for M&I water supply

Supply failure once for 24 years is allowed assuming that the second drought corresponds to the drought with the probability of 10 % (Cilawang dam).

- (2) Multi-purpose for M&I and Irrigation water supply

Supply failure once for 24 years for M&I water supply and 4 times for irrigation water supply is allowed (Karian, Tanjung and Pasir Kopo dams).

Applying the above criteria, the supply capacity of the proposed dam schemes in the scenarios A and C was reviewed through the water demand and supply balance analysis for the surface water resources in the Ciujung and Cidurian river basins. As a result, the water supply plan for 2025 in Figure 3 is proposed in order to meet the M&I water demands under the drought with the excess probability of once in 10 years.

The scenario A5 recommended by the JWRMS consists of two dam schemes; the Karian and Cilawang dams. However, the current analysis with a runoff series including those in the drought years after 1980 proved the need of the Pasir Kopo dam scheme with a small scale.

As indicated in Figure 3, the Karian and Pasir Kopo dam schemes in the Ciujung river and the Cilawang dam scheme in the Cidurian river are necessary to be developed to supply water to meet the M&I water demands for 2025 even in severe drought with an excess probability of once in 10 years in the scenario A.

The M&I water demands for 2025 in the scenario C were estimated as 1.5 times greater than the scenario A in Serang and 1.8 times greater than the scenario A in Tangerang and will require the implementation of the four (4) dam schemes.

Through the water demand and supply balance analysis for the scenarios A and C, the irrigation water requirement for dry season crops was identified to be restricted to 30 % in the scenario A and 50 % in the scenario C against the total water requirement in the severe drought with a return period of 10 years. As a result of this restriction, the water supply amount for the existing Ciujung irrigation area was assumed to be reduced to 6.4 m³/s in the scenario A and 7.1 m³/s in the scenario C, and that for the existing Rancasumur area was to be 3.3 m³/s in the scenario C.

3.3 Water Resources Development Plan

Priorities of the proposed four (4) dam schemes in the water resources development plan were examined by comparing the present situation of water availability and demand. The drought runoff with a return period of 10 years in the Ciujung and Cidurian rivers was estimated at 3.6 m³/s for the existing Pamarayan weir and 1.1 m³/s for the Rancasumur weir by means of a statistical analysis using the annual minimum daily discharges from 1970 to 1993. Under this situation, the M&I water demand in Serang and Tangerang will be satisfied only till 1995 to 2000 by these runoffs. Furthermore, taking into account the possibility of water pollution in the Rancasumur canal, the available water at the Rancasumur weir will not be a permanent measure for M&I water supply as suggested by the JWRMS.

In consideration of the above-mentioned present water demand and supply balance situation, the first priority is given to the Karian dam scheme and water conveyance system, which are able to supply M&I water for both Serang and Tangerang. The commencement time of the water supply from the Karian dam is proposed to be 2002 taking into account the necessary period for the detailed design (2 years), financial arrangement and land acquisition (1 year)

and construction period (4 years), after the completion of the study as shown in the proposed action program in Figure 4. Obtaining the consent of all the local residents subject to relocation for land acquisition and compensation and making resettlement operations only for structure sites requiring complete relocation are planned to be made before the commencement of the construction works. While the resettlement operation for reservoir area will be required to be carried out and completed by the time of the impoundment of the reservoir.

The Pasir Kopo, Cilawang and Tanjung dam schemes are proposed to be implemented based on the following consideration and examination:

Scenario A

The Karian reservoir is able to solely satisfy the M&I water demand in Tangerang till 2015. However, the water supply of 6 m³/s to DKI Jakarta scheduled to start in 2015 will induce supply failure even in a drought year with a return period of 5 years. Therefore, it needs an additional water supply of 3.3 m³/s from the Karian reservoir achieved by reducing the irrigation water supply to Serang and providing the Cilawang dam to meet the M&I water demand in Tangerang and DKI Jakarta.

The Pasir Kopo dam is proposed to be introduced in 2015 in order to cope with the increasing M&I water demand in Serang and to compensate for the reduced irrigation water supply from the Karian reservoir as shown in Figure 4.

Scenario C

The Karian reservoir is able to solely meet the water demand of 9.1 m³/s both in Serang and Tangerang including the irrigation water supply to the Ciujung area by 2010. Afterwards, the rapidly increasing water demands in Tangerang and Serang will require a water supply from the Pasir Kopo reservoir to Serang and an increase of the supply capacity of the Karian to Tangerang from 9.1 m³/s to 12.4 m³/s thereby meeting the water demand till 2014. Furthermore, growing water demands in the aforesaid areas after 2014 and the water supply of 6 m³/s to DKI Jakarta in 2015 will need the start of services of the Tanjung reservoir with its large supply capacity of 9.7 m³/s in 2014 and the Cilawang reservoir with a supply capacity of 4.1 m³/s in 2018.

Shifting of the M&I water demand from the scenario A to C

The future water demands are expected to shift from the growth curve of water demand in the scenario A to that in the scenario C taking into account the rapid industrialization and urbanization, the full highway connection between Merak and Jakarta within a few years, the provision of a new harbour near Serang city, and the diversification of the water source for M&I water supply from groundwater to surface water.

This situation of the M&I water demands will require the introduction of the Tanjung dam scheme by 2020 as shown in Figure 4, in addition to the dam schemes proposed for the scenario A. The Tanjung dam scheme is predicted to have significant problems with resettlement in its implementation since the planned reservoir area is situated on well-developed agricultural land and is densely populated. Therefore, it is considered that the development series of the Karian, Pasir Kopo, Cilawang and Tanjung dam schemes in the mentioned case (scenario C) may be preferable in order to create sufficient time to solve the resettlement problem.

3.4 Phasing Development Plan for Karian-Serpong Conveyance System

The M&I water demands in Serang and Tangerang, and DKI Jakarta will increase between those estimated for the scenarios A and C. Therefore, the construction of a water conveyance system is necessary to be incorporated into the water resources development plan by applying a phased development.

A phasing development plan during the time horizon till 2025 was examined by dividing it into two (2) phases:

- Phase I : until 2015 in the scenario A and 2014 in the scenario C, when the M&I water supply from the western water resources is scheduled to start, and
- Phase II : until 2025 after the start of water supply to DKI Jakarta both in the scenarios A and C.

These two phases were set up considering the following assumptions which are significant for the projection of M&I water demands to be supplied from the Ciujung and Cidurian river basins:

- (1) the possibility of the abandonment of intake water of 3.0 m³/s from the Cisadane river at 2015 and its replacement with water resources from the Ciujung and Cidurian rivers,
- (2) the success of diversification of the main M&I water source from groundwater to surface water,
- (3) the reduction of the existing irrigation areas and a change in the agricultural cropping pattern in the Ciujung and Rancasumur areas in future, and
- (4) the possibility of changes of the above assumptions from those assumed in the Study.

Taking the above into account, the phasing development plan for KSCS was established as illustrated in Figure 5 to flexibly cope with the changes in the M&I water demands and to avoid over-investment.

As shown in Figure 5, the first phase of KSCS (KSCS I) with a length of 36.5 km between the Karian reservoir and Parungpanjang and a maximum capacity of 12.4 m³/s aims at conveying the stored water in the Karian reservoir for M&I water use in Tangerang till 2014 in the scenario C and 2015 in the scenario A.

The second phase consists of the Cilawang canal, KSCS II and KSCS III in the scenario A, or the Tanjung canal, Cilawang canal, KSCS II and KSCS III in the scenario C.

4. PRELIMINARY DESIGN OF THE KARIAN-SERPONG CONVEYANCE SYSTEM

4.1 Selection of the Optimum Route of the Karian-Serpong Conveyance System (KSCS)

Taking into account the topography in the area, four (4) alternatives routes from the Ciuyah tunnel to the Serpong water treatment plant were set out as illustrated in Figure 6 and the topographic characteristics of the alternative routes are described as follows:

Alternative Routes	Topographic Condition	Total Length (km)
N-1	Northern edge of a contour line with EL. 50 m till Tenjo and EL. 40 m till IP.2 near Parungpanjang	47.1
N-2	Northern edge of a contour line with EL. 50 m till IP.2 near Parungpanjang	47.2
	Similar to N-2 but shortened by running in the slightly southern area	46.2
S-1	Along an existing railway line with an elevation of 40 m to 60 m, and the shortest among the alternatives.	45.7

In delineating the alternative routes, it was further considered not to cause, as much as possible, significant land acquisition problems for the existing towns and villages, the land acquisition areas along the Cisadane river near Serpong, and the areas planned to be developed for industrial and housing uses such as Bumi Serpong Damai and Tigaraksa New Towns.

Through a comparative study on the construction cost of the main waterway to the Serpong water treatment plant under construction, the N-2 route was selected as the optimum, costing the least for a gravity conveyance method to the right bank of the Cisadane river, and adopting a concrete rectangular type waterway in consideration of water pollution, operation and maintenance, water conveyance loss, and so on. The waterway along the N-2 route between Parungpanjang and Serpong was aligned through a hilly area with an altitude of about 60 m in order to avoid the developing area of Bumi Serpong Damai. Therefore, comparing the construction cost per unit conveyed water in this section along the N-2 route with that upstream of Parungpanjang, it was judged to be significantly expensive due to the vast amount of excavation work required to form a gravity conveyance waterway. Also, it was identified that the application of a pumping-up method with pipeline conveyance for this section along the route of N-2 will significantly reduce the construction cost, which was estimated at around 50 % of the cost of the gravity conveyance method.

The Serpong WTP is planned to convey treated water to two (2) distribution centers in DKI Jakarta; the R.4 center and the Lebakbulus center. Therefore, an optimum route between the

Parungpanjang and Serpong water treatment plant is examined taking into account the routes to the aforesaid distribution centers in DKI Jakarta. In the optimization study, five (5) alternative routes to the R.4 distribution center through and not through the Serpong water treatment plant, and two (2) routes to Lebakbulus distribution center were studied, as shown in Figure 9. As a result, the route to both the distribution centers through the pipeline route under construction through the Serpong water treatment plant was selected as the optimum among the alternatives because of the lowest cost in terms of the present value including construction cost, operation and maintenance cost, and land acquisition cost.

Through the above optimization study, the route of "N-2" to Serpong with a pipeline conveyance system from Parungpanjang was proved to be the optimum route of KSCS. The alignment of the optimum route, the longitudinal profile and cross section of the KSCS are shown in Figures 8 to 10.

4.2 Preliminary Design of the Karian-Serpong Conveyance System

A preliminary design was made at the feasibility study level for the major structures; 1) intake structures at the Karian, Cilawang and Tanjung reservoirs; 2) the main waterways and Tanjung and Cilawang canals; 3) river crossing structures, syphon or aqueduct; 4) pumping facilities at Parungpanjang; and 5) other related structures as shown in Figures 11 to 23. The main features and required number of the proposed structures are given in Table 2.

5. ENVIRONMENTAL IMPACT ANALYSIS

The environmental impact analysis (ANDAL) for the Karian, Cilawang and Tanjung dam schemes and the Karian-Serpong conveyance system (KSCS) has been carried out based on the Terms of Reference approved by the Central Committee in November 1993. While, for the Pasir Kopo dam scheme, the study team carried out a preliminary investigation and analysis using field reconnaissance and data collection.

Among the environmental impacts, the resettlement of the inhabitants in the reservoir areas, along the Karian-Serpong conveyance system (KSCS) and the river improvement stretch was identified to be one of the significant issues dominating the feasibility of the schemes. While, the several kinds of birds to be endangered were identified in the reservoir areas and harmful heavy metal within the standard in Indonesia for drinking water were detected in the river water in Cijung and Cidurian river basins. These are required to be monitored for identification of necessary measures.

According to the ANDAL, the following population in the envisaged areas are identified:

Project	Scenario A				Scenario C			
	Area (ha)	Kam-pong	House-hold	Popu-lation	Area (ha)	Kam-pong	House-hold	Popu-lation
Karian	1,740	26	2,055	12,124	1,740	26	2,055	12,124
Cilawang	1,056	16	639	3,706	1,056	16	639	3,706
Tanjung	-	-	-	-	2,487	28	2,469	15,060
Pasir Kopo	640	11	846	3,810	920	18	1,781	8,020
KSCS	260	16	117	632	260	16	117	632
River Improvt.	71	16	98	578	71	16	98	578
Total	3,767	85	3,755	20,850	6,534	120	7,159	40,120

Relocation of the households and population required for the implementation of the proposed schemes was estimated at 3,755 and 20,850 in the scenario A and 7,159 and 40,120 in the scenario C, respectively.

It was identified through an interview survey made by the Study that most of the local residents living in the affected area could agree to the resettlement on the assumption they move to an adjacent area. From this view point, several potential resettlement areas were found out in Lebak and Bogor as shown in Table 3 and Figures 24 to 26 and summarized as follows:

(unit : ha)

Project Components	Settlement Area to be Affected	Agricultural Land to be Affected	Total	Available Area in Adjacent Area	of Potential Area
Karian	229	1,190	1,419	1,550	Estate
Cilawang	23	735	758	570	ditto but in the hilly area
Tanjung	518	1,969	2,487	6,639	ditto but in the hilly area
Pasir Kopo	83	644	727	4,100	ditto
KSCS	4	133	137	-	-
River Improvt.	3	104	107	-	-

As indicated in the above table, the potential resettlement area compatible for well-developed agricultural land, mainly paddy, in the Tanjung reservoir areas is considered not to be available in the neighbouring kecamatans and kabupatens. The Cilawang dam scheme also does not have sufficient space for resettlement of local residents living in the reservoir area.

However, the Tangerang area near the Tanjung and Cilawang reservoirs has been rapidly urbanized and industrialized. Taking into account the introduction of the dam schemes after 2014 or 2015, there is a high possibility that life style, living standards, and income levels of the local residents at the implementation stage will have changed drastically from the present situation and that this socio-economic change may require other resettlement concepts in the future.

In order to successfully implement the proposed projects and carry out resettlement during time horizon till 2025 under this prospected situation, the establishment of an organization under the executing body is required to; 1) continuously monitor socio-economic changes and resettlers' requirement in the planned reservoir areas; 2) establish a realistic resettlement concept which should satisfy resettlers' requirements and socio-economic situation; and 3) effectively carry out the resettlement of the local residents well in advance of the commencement of the respective stage of the development works.

6. PROJECT ORGANIZATION

6.1 Environmental Monitoring and Management Unit (EMMU)

The required works and organizations concerned with the water resources development plan in the Ciujung and Cidurian river basins are studied, as shown in Figure 27. As shown in the mentioned figure, the DGWRD has responsibility for planning, implementation, and operation and maintenance of the proposed projects, and will coordinate with other agencies concerned. While, the environmental monitoring and management, especially for the resettlement and compensation of local residents is one of the significant issues dominating the feasibility of the proposed projects.

In consideration of the long-term period needed for implementing all the proposed schemes and the problems on resettlement for the Cilawang and Tanjung dam schemes, the Environmental Monitoring and Management Unit (EMMU) is proposed to be provided in order to successfully undertake the resettlement. The proposed EMMU will consist of the Environmental Unit (EU) for dealing with wider environmental problems and the Environmental Monitoring and Management Committee (EMMC) for making important decision to be required for the necessary works. The EU is proposed to be provided at the project office in Pandeglang by the well trained staff of the DGWRD and the EMMC to be organized by the related agencies of the DGWRD, the West Java Provincial Government, the Ministry of Forestry, the National Land Affair, the Ministry of Environment and Population, the Ministry of Agriculture, and other authorities.

The EMMU will cover the following works:

- (1) monitoring and management of all the environmental aspects related to the proposed schemes,
- (2) coordination of institutional matters related to environmental monitoring and management,
- (3) supervision of the actual resettlement and land compensation,
- (4) evaluation of the actual performance of resettlement and land compensation,
- (5) monitoring any changes in the requirements of the resettlers, and
- (6) establishment of an appropriate concept and manner for resettlement.

6.2 Coordination Committee for Drought Management

The proposed dam schemes and Karian-Serpong conveyance system are planned to provide raw water for M&I water supply in Serang, Tangerang, and DKI Jakarta even during the severe droughts with a return period of 10 years. The irrigation water requirement under these severe drought conditions, will be restricted. Therefore, a coordination committee for water allocation is strongly required in order not to induce conflict on water allocation between water users.

Figure 28 shows the general procedure for drought management. As shown in the figure, the project office will collect the data on hydrology and water requirement and analyze them to establish the draft water allocation plan. A coordination committee will decide the final water allocation plan for coming dry and wet seasons. Based on the final water allocation plan, the proposed schemes will be operated and when it is necessary to adjust or revise the water allocation plan, the project office will organize a coordination committee and prepare a revised water allocation plan.

7. PROJECT COST

7.1 Major Works of the Proposed Schemes

The main features of the proposed schemes are shown in Table 4 and the work quantities are estimated as follows:

Projects		Earth Work		(unit : million m ³)
		Excavation	Embankment	Concrete Work
Phase I	Karian dam	0.26	1.23	0.05
	KSCS I	3.42	1.34	0.16
	River improvement works	2.07	0.60	-
	Total	5.75	3.17	0.21
Phase IIA	Pasir Kopo dam	0.48	0.50	0.09
	Cilawang dam	0.18	0.40	0.04
	KSCS II&III and Cilawang canal	0.94	0.15	0.12
	Total	1.60	1.05	0.25
Phase IIC	Pasir Kopo dam	0.55	0.80	0.09
	Tanjung dam	0.58	8.00	0.04
	KSCS II & III and Tanjung canal	1.01	0.25	0.11
	Cilawang dam	0.18	0.40	0.04
	Cilawang canal	0.44	0.11	0.05
	Total	2.76	9.56	0.33

Note : "-" means minor work of the project.

The work quantities for the Karian, Tanjung and Cilawang dam and the river improvement works are based on those estimated by the preliminary design of the previous studies as shown in Figures 29 to 36. While, those for Pasir Kopo dam were estimated by the preliminary design of the Study at the master plan level illustrated in Figures 37 and 40 and for KSCS at the feasibility study level.

The four (4) dam schemes, the Karian-Serpong conveyance system, and the river improvement works are proposed to be implemented by applying phased development taking into account the urgency of the schemes, and the trend of increasing municipal and industrial water demands. The proposed implementation schedule was prepared as follows in consideration of two (2) years for the detailed design, one (1) year for the financial arrangement and land acquisition, and construction period in parenthesis in the following table:

Projects		Implementation Period	Duration (years)
Phase I	: Karian dam, KSCS I and River improvement works	1995 to 2002	7 (4)
Phase IIA	: Pasir Kopo dam	2008 to 2015	7 (4)
	: Cilawang dam	2008 to 2015	7 (4)
	: KSCS II&III and Cilawang canal	2009 to 2015	6 (3)
Phase IIC	: Pasir Kopo dam	2004 to 2011	7 (4)
	: Tanjung dam, KSCS II & III and Tanjung canal	2005 to 2014	9 (6)
	: Cilawang dam and Cilawang canal	2011 to 2018	7 (4)

7.2 Project Cost

The construction cost was estimated under the following assumptions and conditions:

- (1) The unit prices of material, labor and equipment which constitute the unit costs of the civil works are based on price levels in August, 1994.
- (2) The exchange rates of foreign currencies are Yen 1.00 to Rp. 21.77 and US dollar \$ 1.00 to Rp. 2,177 as of August, 1994.
- (3) The estimated unit costs are composed of foreign and local currency portions and both portions are expressed in Rupiah currency.
- (4) Land acquisition and compensation cost were based on monetary compensation and preparation of the resettlement area.
- (5) Engineering services will cover the detailed design and the whole construction period. The rates of engineering services to the total construction cost was assumed at 14 % for the foreign currency portion and 9 % for the local currency portion.
- (6) The Government administration cost was set at 5.0 % of the total construction cost.
- (7) The Governmental value added tax (PPN) was estimated at 10 % of the total construction cost and engineering service cost.
- (8) Physical contingency was provided to cope with unforeseen physical conditions and was assumed to be 10 % of the sum of the total construction cost and costs in items 4 to 7 for each foreign and local currency portion.
- (9) The price escalation rate was assumed to be 3 % per annum for the foreign currency portion and 8 % per annum for the local currency portion till the completion of the first phase development in 2002 and afterwards, a rate of zero was applied for both portions taking into account the uncertainty of the escalation rate in the future.

- (10) The interest during construction was estimated on the sum of the total construction cost and costs in items 4 to 7 for the foreign currency portion, assuming the interest rate of 2.6 % per annum, which corresponds to the latest rate of the Overseas Economic Cooperation Fund (OECF) .
- (11) Operation and maintenance cost was estimated at 1 % of the total cost for civil works and 0.5 % of the total cost for metal works for the respective project.

The financial cost for the proposed schemes was estimated as given in Table 5 based on the assumptions in section 7.4.1 and summarized as follows:

(unit : million Rp.)			
Projects	Foreign Currency	Local Currency	Amount
Phase I : Karian dam and Ciuyah tunnel, KSCS I, River improvement works			
a) Construction cost including preparatory works	253,074	131,034	384,108
b) Engineering service	35,430	11,793	47,223
c) Government administration	0	19,205	19,205
d) Land acquisition and compensation cost	0	66,906	66,906
e) Tax	0	43,133	43,133
Sub-total	288,504	272,072	560,576
f) Physical contingency	30,014	28,342	58,356
g) Price escalation	51,173	126,982	178,156
Sub-total	81,187	155,324	236,511
h) Interest during construction	33,162	0	33,162
Total	402,853	427,396	830,249
Phase IIA : Pasir Kopo dam, Cilawang dam, KSCS II&III and Cilawang canal			
a) Construction cost including preparatory works	257,820	112,546	370,366
b) Engineering service	36,095	10,129	46,224
c) Government administration	0	18,518	18,518
d) Land acquisition and compensation cost	0	46,634	46,634
e) Tax	0	41,659	41,659
Sub-total	293,915	229,486	523,401
f) Physical contingency	29,391	22,949	52,340
g) Price escalation	78,408	195,277	273,685
Sub-total	107,799	218,226	326,025
h) Interest during construction	32,804	0	32,804
Total	434,518	447,712	882,230

(unit : million Rp.)			
Projects	Foreign Currency	Local Currency	Amount
Phase IIC : Pasir Kopo dam, Tanjung dam, KSCS II & III and Tanjung canal, Cilawang dam and Cilawang canal			
a) Construction cost including preparatory works	587,654	248,544	836,198
b) Engineering service	82,272	28,484	110,755
c) Government administration	0	41,810	41,810
d) Land acquisition and compensation cost	0	149,734	149,734
e) Tax	0	94,695	94,695
Sub-total	669,926	563,267	1,233,192
f) Physical contingency	66,993	56,327	123,319
g) Price escalation	175,903	472,540	648,443
Sub-total	242,896	528,867	771,763
h) Interest during construction	91,481	0	91,481
Total	1,004,302	1,092,134	2,096,436

As indicated in the above table, the total amount of required funds reaches Rp. 1,712 billion in the scenario A or Rp. 2,927 billion in the scenario C to implement all the proposed schemes during the time horizon of 30 years till the year 2025. The disbursement schedules of the proposed schemes are given in Tables 6 to 12.

8. ECONOMIC EVALUATION

The economic benefit and construction cost necessary for the economic evaluation were estimated under the following conditions;

- (1) The economic benefit of raw water supply for municipal and industrial (M&I) water use was assumed to be a return obtained by the current water tariff. The raw water price in the current water tariff was evaluated at 60 % of the tariff referring to the result of analysis on raw and treated water prices made by the JWRMS.
- (2) The economic benefit for the river improvement project is given as the effect of a reduction in the annual mean flood damage to assets in and around the flood protection area under present socio-economic conditions. Since the design flood is 10-year probable flood, the benefit corresponds to a reducible amount of annual mean flood damage after the construction work against a 10-year probable flood is completed.
- (3) The JWRMS and also the Study expected the increase of cropping intensity by planting palawija and/or vegetables in order to meet the increase of vegetable requirement in the urban areas in Jabotabek and north Banten areas and to save water especially during dry and/or wet seasons. Therefore, the water requirement for the existing irrigation areas was allocated in the Study, incorporating increased cropping intensity under the supply criteria in which the irrigation water requirement is satisfied in droughts with return periods of less than 5 years, but restricted in severer droughts.

The incremental benefit due to increase of cropping intensity was not included in the benefit of the schemes in the current economic evaluation, since the agricultural diversification from paddy to palawija and/or vegetables is requiring further detailed study and needs to establish the definitive agricultural development plan in the areas.

- (4) The economic cost differs from the financial cost as it is valued at a real resource cost and the financial cost is valued at market prices. Thus, to estimate the economic costs of the proposed project, the financial costs estimated were converted in consideration of shadow prices of labour wage, material and equipment cost.

The economic viability of the project was evaluated by means of an Economic Internal Rate of Return (EIRR) under the following conditions;

- (1) The economic life of the project is taken as 50 years from the commencement of the project works.
- (2) The basic price level for cost and benefit estimates is set at the end of August 1994.

- (3) The exchange rates of foreign currencies are Yen 1.00 to Rp. 21.77 and US dollar \$ 1.00 to Rp. 2,177 as of August, 1994.
- (4) Operation and maintenance cost is assumed to be 1.0 % of the total cost for the civil works and 0.5% for the metal work. The replacement of pumps and gates are assumed to be made 25 years after completion of the construction works.

Based on the above mentioned conditions and assumptions, the EIRR was worked out for the first phase development consisting of the Karian dam scheme, a part of Karian-Serpong conveyance system (KSCS) and the river improvement works in the Ciujung river, and the full development including the first phase and the second phase comprising of the Pasir Kopo, Cilawang and/or Tanjung dam schemes and other portions of KSCS connecting dams with Serpong water treatment plant. The result is summarized as follows:

Works	First Phase Development		Full development	
	Scenario A	Scenario C	Scenario A	Scenario C
Water Supply	16.1	20.2	21.7	24.2
River Improvement		13.4		
Water supply + River Improvement	16.0	19.8	21.3	23.7

The EIRR for the full development of the proposed schemes indicates a high economic viability of 21.7 % for the scenario A, and 24.2 % in the scenario C. The first phase development planned to meet the M&I water demands till 2010 in the scenario C and 2015 in the scenario A worked out at 16.1 % in the scenario A and 20.2 % in the scenario C. The EIRR for the river improvement works was derived at 13.4 %.

Unit raw water prices were also estimated for the proposed dam schemes and the Karian-Serpong conveyance system based on the financial cost and the M&I water demands, assuming a discount rate of 9 %. The result is given as follows:

Works	(Rp. per m ³)	
	Scenario A	Scenario C
First Phase Development	360	267
Full Development	265	283

Comparing the above unit raw water price with the estimated raw water price of about Rp. 600 per m³, the proposed dam schemes and Karian-Serpong conveyance system are considered to economically viable.

In addition to the above-mentioned economic analysis, the sensitivity analysis was made under the following conditions:

- (1) The first phase development is proposed to be completed by applying an accelerated implementation schedule from the fiscal year 1995/1996 to 2001/2002 taking into

account the urgency of the project works. However, there is a possibility to delay the completion of the construction works including the tendering. Therefore, a sensitivity analysis assumed that completion of the construction works will be delayed one year from the schedule.

- (2) The Study estimated the cost for interest during construction, applying a interest rate of 2.6 %, the same as the Overseas Economic Cooperation Fund (OECF). The interest rates of other international funds such as the World Bank and the Asian Development Bank are around 6 % to 8 % for Indonesia. The higher rate of 8 % was applied for this sensitivity analysis.

The estimated EIRR and unit raw water prices are as follows:

Works	EIRR (%)		Unit Raw Water Price (RP./m ³)	
	Scenario A	Scenario C	Scenario A	Scenario C
First Phase Development				
• Water Supply	16.0	20.1	379	284
• Water Supply + River Improvement	15.9	19.6	-	-
Full Development				
• Water Supply	20.9	23.2	286	311
• Water Supply + River Improvement	20.5	22.7	-	-

As indicated in the above table, the proposed schemes indicate a high EIRR even in the case of a lower benefit induced by the delay in the construction works. Also, the estimated unit raw water prices are lower than the mentioned raw water price even in the case of the higher construction costs due to a longer construction period, and higher interest rates during construction and the lower benefit.

9. PROPOSED ACTION PROGRAM

The proposed action program for the Ciujung-Cidurian integrated water resources development project is illustrated in Figure 41.

First step development

First step development consists of:

- a) The Karian dam scheme for water supply and flood control purposes,
- b) The Ciuyah tunnel with a length of 1.2 km, connecting the Karian reservoir and the KSCS I waterway,
- c) KSCS I with the maximum capacity of 12.4 m³/s and a total length of 35.3 km, and
- d) River improvement work along the middle reaches of the Ciujung river between the existing Pamarayan weir and Rangkasbitung.

It is urgent for all the components of the first step development to start implementation, considering the water shortage predicted to occur within in Tangerang and Serang before 2000, and the actual severe flood damage caused by the flood in 1993, as shown in Figure 42, and the increase of flood damage potential in the middle reaches of the Ciujung river.

Second and Third Step Developments

The projected M&I and irrigation water demands are based on many assumptions. In order to review those and to decide the next step development, an updating study for water resources development in the study area is recommended to be carried on the basis of the performance of the first step development and population census at the year of 2000, and accumulated data related to M&I and irrigation water demands.

This study will propose the configuration of the third step development including the necessary scale of the Pasir Kopo dam scheme and the implementation scenario of the Tanjung and Cilawang dam schemes and other portions of the KSCS.

10. RECOMMENDATIONS

10.1 Recommendations

- (1) Through the investigations and analyses made by the current study, it is identified that the first step development works consisting of the Karian dam schemes, the Karian-Serpong conveyance system (KSCS I) with a length of 36.5 km from the Ciuyah tunnel to the planned Parungpanjang water treatment plant, and the river improvement works along the Ciujung river have an urgency in terms of water demand and supply balance, and flooding, and will support the current economic development in the study area. It is also revealed that the first step development works have a high economic viability. Therefore, it is strongly recommended to proceed with the necessary procedures for executing these works urgently.
- (2) The Karian dam scheme and KSCS I in the first step development are planned to provide raw water for the M&I water supply in Serang and Tangerang. In order to supply the treated water to water users in these areas, it is necessary for proceeding the first step development to coordinate with the water supply agencies such as Chipta Karya, and PDAMs in Tangerang and Serang. Therefore, it is recommended to make necessary coordination with the related agencies to the M&I water supply.
- (3) In order to successfully execute the resettlement of local residents in the affected area by the first step development and the following projects in the third step development, it is recommended that the Environmental Monitoring and Management Unit (EMMU) consisting of the Environmental Unit (EU) at the project office in Pandeglang and Environmental Monitoring and Management Committee (EMMC) be established under the initiation of the DGWRD.

10.2 Main Points of the Required Engineering Works in the Detailed Design for the First Phase Development

- (1) Basic and detailed design
 - a) Review of water resources in the Ciujung river basin

In the Ciujung river basin, the severe drought occurred in 1994. The runoff data was not reflected in the Study since the data was under compilation. The water resources in the Ciujung river needed to be reviewed by adding the runoff data in the river basin.

b) Review of the proposed route of Karian-Serpong conveyance system

Currently, the area along the Karian-Serpong conveyance system is being rapidly developed for housing and industrialization. After updating the data and information of the on-going development plans, the proposed route from the outlet of the Ciuyah tunnel to the Parungpanjang water treatment plant by the current study is necessary to be reviewed.

c) Updating the flood control master plan and establishing definitive plan for the detailed design

The flood control master plan in the Ciujung river basin and the river improvement plan between the existing Pamarayan weir and Rangkasbitung was established in 1983 and 1985, respectively. While, in the Ciujung river basin, especially in the middle and lower reaches of the river, the current industrialization and housing development is heightening the flood damage potential there. Furthermore, the largest flood for the past 24 years occurred and caused severe flood damage along the middle and lower reaches of the Ciujung river in 1993.

Therefore, the above mentioned plans have to be reviewed by updating the flood runoff data and the socio-economic situation and investigating the existing flood control facilities provided along the lower reaches. A definitive flood control plan has to be established through the review studies.

d) Detailed geological investigation for dam foundation

The feasibility study on the Karian multi-purpose dam construction project reported the existence of a layer with high permeability on the left bank of the dam site. In order to design the foundation treatment of the dam body, detailed geological investigation works are required to review the result of the feasibility study.

e) Construction material survey for the dam embankment

The rock material for the dam embankment of the Karian dam is planned to be conveyed from the quarry site with a hauling distance of about 30 km. In order to reduce the construction cost for the embankment, a construction material survey is necessary in the detailed design.

(2) Environmental impact analysis and resettlement study

The environmental impact assessment (AMDAL) needs to be carried out focusing on the social impacts to be induced by the resettlement of the local residents. Also, a

detailed resettlement study is required to establish a detailed and acceptable resettlement plan. The following investigation and studies will be covered by the aforesaid AMDAL and resettlement study:

- a) interview survey for all the local residents subject to relocation,
- b) public consultation in order to identify requirements of local residents for resettlement under their sufficient recognition for necessity of the Project and agreement with the implementation of the Project to be discussed,
- c) examination of the appropriate manner for resettlement and compensation,
- d) survey on the suitability of the potential resettlement area for the Karian dam scheme and prepare frame work plan of resettlement area,
- e) identification of problems after resettlement and necessary countermeasures required,
- f) preparation of a resettlement and compensation plan, and
- g) institutional study on Environmental Monitoring and Management Unit (EMMU).

TABLES

Table 1 FUTURE MUNICIPAL AND INDUSTRIAL WATER DEMAND PROJECTED BY JWRMS

(unit : cu.m/s)

Areas			Scenario	Surface Water Source								Groundwater Source							
				Year								Year							
				1990	1995	2000	2005	2010	2015	2020	2025	1990	1995	2000	2005	2010	2015	2020	2025
Jakarta	North	A	6.6	7.6	8.4	10.8	12.3	13.9	15.3	18.1	7.2	7.5	7.8	7.8	7.7	7.5	7.2	6.6	
		B	6.6	7.6	8.4	10.4	11.5	12.8	14.1	16.2	7.2	7.7	8.1	8.3	8.4	8.3	8.1	7.9	
		C	6.6	9.1	11.9	18.5	23.9	24.3	24.6	26.2	7.2	7.1	6.7	5.2	3.3	3.0	2.7	2.5	
	South	A	2.4	3.0	3.8	5.0	5.9	6.5	7.2	7.9	7.9	8.4	9.0	9.5	9.9	10.3	10.6	11.1	
		B	2.4	3.1	4.0	4.8	5.6	6.2	6.7	7.4	7.9	8.5	9.1	9.7	10.1	10.5	10.8	11.2	
		C	2.4	4.6	7.0	9.4	12.1	13.2	13.9	15.9	7.9	8.1	8.1	8.2	7.8	7.7	7.7	7.6	
	Total	A	9.0	10.6	12.2	15.8	18.2	20.4	22.5	26.0	15.1	15.9	16.8	17.3	17.6	17.8	17.8	17.7	
		B	9.0	10.7	12.4	15.2	17.1	19.0	20.8	23.6	15.1	16.2	17.2	18.0	18.5	18.8	18.9	19.1	
		C	9.0	13.7	18.9	27.9	36.0	37.5	38.5	42.1	15.1	15.2	14.8	13.4	11.1	10.7	10.4	10.1	
Tangerang		A	2.3	3.2	4.4	5.7	7.3	9.0	11.0	12.5	4.4	5.4	6.4	7.4	8.5	9.3	10.1	10.9	
		B	2.3	3.0	3.9	4.9	6.0	7.0	8.1	9.0	4.4	5.2	5.9	6.7	7.4	8.0	8.6	9.2	
		C	2.3	3.4	4.8	7.3	11.1	15.1	19.1	22.3	4.4	5.6	6.7	7.6	7.9	8.1	8.2	8.4	
Bekasi		A	1.6	2.1	2.8	3.7	4.8	5.9	7.4	8.6	3.4	4.3	5.2	6.1	7.0	7.8	8.6	9.2	
		B	1.6	2.0	2.5	3.1	3.9	4.6	5.4	6.0	3.4	4.1	4.7	5.4	6.0	6.6	7.2	7.7	
		C	1.6	2.2	3.1	4.2	7.4	10.2	13.6	16.2	3.4	4.5	5.5	6.5	6.8	7.1	7.2	7.3	
Bogor	North	A	0.4	0.6	1.2	1.7	2.4	3.1	3.7	4.6	1.6	2.1	2.6	3.2	3.7	4.2	4.7	5.0	
		B	0.4	0.5	1.0	1.5	1.9	2.4	2.8	3.2	1.6	2.0	2.4	2.8	3.1	3.5	3.8	4.1	
		C	0.4	0.7	1.2	1.9	2.7	3.7	4.4	5.3	1.6	1.8	2.1	2.3	2.4	2.4	2.4	2.4	
	South	A	0.7	1.2	1.9	2.6	3.5	4.4	5.5	6.5	2.0	2.7	3.5	4.4	5.2	5.9	6.6	7.2	
		B	0.7	1.1	1.6	2.3	3.1	3.8	4.7	5.3	2.0	2.6	3.2	3.8	4.4	4.8	5.3	5.6	
		C	0.7	1.2	2.0	3.2	5.5	7.5	9.5	10.9	2.0	2.6	3.3	3.7	3.8	3.9	4.0	4.0	
	South-west	A	0.3	0.5	0.7	1.0	1.2	1.7	2.0	2.4	1.3	1.6	1.9	2.2	2.5	2.7	3.1	3.3	
		B	0.3	0.4	0.6	0.8	1.0	1.2	1.5	1.7	1.3	1.5	1.7	1.9	2.1	2.3	2.5	2.7	
		C	0.3	0.5	0.6	0.8	1.4	2.0	2.6	3.3	1.3	1.5	1.8	2.1	2.1	2.2	2.2	2.2	
	West	A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.7	0.8	0.9	1.0	1.2	1.3	1.5	
		B	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6	0.7	0.8	0.9	1.0	1.1	1.2	
		C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.4	
	East	A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.7	0.8	1.0	1.1	1.3	1.5	1.7	
		B	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.4	
		C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.7	0.8	0.9	1.0	1.2	1.4	1.5	
	Total	A	1.4	2.3	3.8	5.3	7.1	9.2	11.2	13.5	6.1	7.8	9.6	11.7	13.5	15.3	17.2	18.7	
		B	1.4	2.0	3.2	4.6	6.0	7.4	9.0	10.2	6.1	7.4	8.8	10.2	11.5	12.7	13.9	15.0	
		C	1.4	2.4	3.8	5.9	9.6	13.2	16.5	19.5	6.1	7.3	8.8	9.9	10.3	10.8	11.2	11.5	
Outside Jabotabek	Serang	A	2.2	3.2	4.3	5.8	7.1	8.7	10.2	11.8	2.6	3.2	4.0	5.1	6.0	6.8	7.5	8.2	
		B	2.2	2.9	3.6	4.6	5.4	6.4	7.0	7.7	2.6	3.0	3.5	4.2	4.8	5.3	5.7	6.2	
		C	2.2	3.3	4.4	6.9	9.1	12.2	14.3	17.3	2.6	3.2	4.0	4.6	5.0	5.1	5.2	5.3	
	Purwakarta/ Karawang	A	1.0	1.5	2.8	4.1	5.5	7.2	8.9	11.0	3.5	4.0	4.7	5.7	6.8	7.7	8.5	9.2	
		B	1.0	1.3	2.4	3.3	4.3	5.4	6.3	7.3	3.5	3.8	4.3	4.9	5.5	6.1	6.6	7.1	
		C	1.0	1.5	2.9	4.9	7.7	11.4	14.6	18.1	3.5	4.0	4.7	5.4	5.7	5.7	5.6	5.6	
Grand Total		A	17.5	22.9	30.3	40.4	50.0	60.4	71.2	83.4	35.1	40.6	46.7	53.3	59.4	64.7	69.7	73.9	
		B	17.5	21.9	28.0	35.7	42.7	49.8	56.6	63.8	35.1	39.7	44.4	49.4	53.7	57.5	60.9	64.3	
		C	17.5	26.5	37.9	57.1	80.9	99.6	116.6	135.5	35.1	39.8	44.5	47.4	46.8	47.5	47.8	48.2	

Table 2 MAIN FEATURES OF THE PROPOSED STRUCTURES

Main Features	KSCS I	KSCS II	KSCS III	Tanjung Canal	Cilawang Canal
1) Length					
2) Bed slope	1/5,000	1/5,000	-	1/600	1/500
3) Type of waterway	RC rectangular channel	RC rectangular channel	PC pipe (10.2 km) and steel pipe (1.7 km)	RC rectangular channel	RC rectangular channel
4) Maximum dimension of cross section	(w) 4.85 m (h) 3.05 m	(w) 5.30 m (h) 3.05 m	Ø 2.2 m	(w) 3.00 m (h) 1.95 m	(w) 2.10 m (h) 1.30 m
5) Maximum flow capacity	12.4 m ³ /s	13.8 m ³ /s	6.0 m ³ /s	9.7 m ³ /s	4.1 m ³ /s
6) Conveyance method	gravity	gravity	pressure flow	gravity	gravity
7) River crossing structures (numbers and total length)					
- Syphon	7 (775.2m)	4 (265.2m)	-	-	2 (350.7m)
- Acqueduct	-	-	1 (140m)	-	-
8) Road crossing structures (numbers)					
- Road	36	17	16	4	16
- Foot path	22	14	8	3	12
Total	58	31	24	7	28
9) Cross drain (numbers)	63	0	15	8	7
10) Railway crossing (numbers)	1	2	1	0	0

Table 3 LIST OF POTENTIAL AND AVAILABLE RESETTLEMENT AREA

a. Estate						
Owner of the Area	Name of Location	Kabupaten	Kecamatan	Existing Area (ha)	Available Area (ha)	Remarks
PT.P11*	Cisalak Baru	Lebak	Rangkasbitung Maja, Cimarga	2,980	1,550	1,430 ha is in the Protection Area
PT.Candi Putra	Pasir Ayunan	Lebak	Sajira	600	570	30 ha is in the Protection Area.
PT.Silalangu	Silalangu	Lebak	Maja	464	379	85 ha to be submerged.
PT.Pasir Roko	Pasir Kopo	Lebak	Cimarga	91	-	Whole area is in the Protection Area
PT.Jaura Atmaja Utama	Jaura	Lebak	Maja	59	59	
Sub-total				4,194	2,558	
PT.P11*	Cikasungka	Bogor	P/panjang, Jasinga	3,094	3,094	Suitable for settlement but not for agriculture
Kab. Bogor	Cikopo Mayak	Bogor	Jasinga	600	600	ditto
PBS Cikopo Mayak	Cikopo Mayak	Bogor	Jasinga	2,427	2,427	ditto
PBS Jasinga	Jasinga	Bogor	Jasinga	518	518	ditto
Sub-total				6,639	6,639	
Total Existing Area				10,834		
Total Available Area for Relocation					9,198	

Note: " * " - Estate company owned by the Department of Agriculture

b. Forest						
Owner of the Area	Name of Location	Kabupaten	Kecamatan	Existing Area (ha)	Available Area (ha)	
Perum Perhutani**	1) Gn.Cabe (Cipanas)	Lebak	Cimarga	2,210	-	
	2) Gn.Cabe (Muncang)	Lebak	Muncang	1,269	-	
	3) Ciberang I, II, III	Lebak	Cipanas	928	-	
Perum Perhutani **		Bogor	Tenjo, Jasinga	4,235	-	
Total Existing Area				8,641		
Total Available Area for Relocation					-	

Note: ** - General Forestry Company owned by the Department of Forestry

Table 4 MAIN FEATURES OF THE PROJECT COMPONENTS

Main Features	Karian Dam	Pasir Kopo Dam		Cilawang Dam	Tanjung Dam
		A	C		
I. Dam scheme					
1) Catchment area (km ²)	288	172	172	93	280
2) Dam type	Rockfill	Rockfill	Rockfill	Rockfill	Rockfill
3) Dam crest level (EL. m)	72.5	97.0	106.5	81.0	60.5
4) Flood high water level (EL.m)	69.9	94.2	103.7	78.5	59.5
5) Normal high water level	67.5	90.5	100.5	75.6	56.5
6) Low water level	46.0	80.0	80.0	66.5	50.0
7) Dam height (m)	60.5	52.0	61.5	36.0	35.5
8) Reservoir area (ha)	1,740	640	920	1,056	2,487
9) Effective storage volume (mil. m ³)	219.0	44.5	112.6	62.0	120.0
10) Embankment volume of main dam (mil. m ³)	1.23	0.42	0.70	0.42	8.39
11) Design flood discharge (PMF)					
a) Inflow	3,400	3,300	3,300	1,700	3,098
b) Outflow	2,670	1,760	1,430	1,230	727
12) Spillway gate					
a) Type	Radial gate	overflow type	overflow type	Radial gate	overflow type
b) Nos.	2			2	
c) Height	12.5			9.5	
d) Width	12.5			9.0	
13) Side overflow spillway weir (m)	50.0	125.0	125.0	20.0	-
14) Flood control volume against 10-year probable flood (mil. m ³)	33.5	-	-	-	-
Main Features	Description				
II. Karian-Serpong conveyance system					
1) Length (km)					
a) KSCS I	36.5				
b) KSCS II	19.3				
c) KSCS III	11.9				
d) Cilawang canal	17.1				
e) Tanjung canal	4.3				
2) Type of conveyance					
a) KSCS I&II and Cilawang & Tanjung Canal	gravity conveyance				
b) KSCS III	pumping-up and pipeline				
3) Maximum flow capacities (m ³ /s)					
a) KSCS I	12.4				
b) KSCS II	13.8				
c) KSCS III	6.0				
d) Cilawang canal	4.1				
e) Tanjung canal	9.7				
III. River improvement works					
1) River length to be improved (km)	18.20				
2) Improvement method	Provision of river dredging, short-cut channel (4 km) and flood dyke				
3) Design discharge					
a) Design scale	10-year probable flood discharge				
b) Design discharge	1,100 m ³ /s with retardation of flood peak discharge in the Karian reservoir				
4) Earth work volume					
a) Embankment volume (mil. m ³)	0.60				
b) Excavation volume (mil. m ³)	1.40				
c) Dredging volume (mil. m ³)	0.67				

Table 5 FINANCIAL COST FOR CIUJUNG-CIDURIAN INTEGRATED WATER RESOURCES DEVELOPMENT

First Phase Development

(Unit : million Rp)

Description	Karian Dam		Ciuyah Tunnel		KSCS I		River Improvement		Total	
	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC
I. Basic Cost										
1) Preparatory Works	11,032	7,266	469	205	10,703	8,799	2,659	2,541	24,863	18,811
2) Civil Works	87,765	34,892	10,277	4,383	97,002	59,854	17,862	11,392	212,906	110,521
3) Metal Works	11,390	1,266	2,021	225	1,894	211	0	0	15,305	1,702
4) Engineering Service	15,426	3,908	1,787	433	15,344	6,198	2,873	1,254	35,430	11,793
5) Administration	0	7,681	0	879	0	8,923	0	1,723	0	19,205
6) Compensation Cost	0	58,714	0	0	0	6,266	0	1,926	0	66,906
7) Tax (PPN)	0	17,295	0	1,980	0	20,001	0	3,858	0	43,133
Sub-total	125,613	131,021	14,554	8,105	124,943	110,251	23,394	22,694	288,504	272,072
II. Contingency										
1) Physical Contingency	12,561	13,102	1,455	811	12,494	11,025	3,503	3,404	30,014	28,342
2) Price Escalation	21,647	53,483	2,738	4,506	22,728	57,850	4,061	11,144	51,173	126,982
Sub-total	34,208	66,585	4,193	5,316	35,222	68,875	7,563	14,548	81,187	155,324
III. Interest During Construction	14,946	0	1,534	0	13,813	0	2,869	0	33,162	0
Total	174,767	197,606	20,281	13,422	173,978	179,127	33,826	37,242	402,853	427,396
Grand Total (FC+LC)		372,373		33,703		353,105		71,068		830,249

Second Phase Development (IIA) in Scenario A

(Unit : million Rp)

Description	Posir Kopo Dam		Cilawang Dam		KSCS II&III Cilawang Canal		Total	
	FC	LC	FC	LC	FC	LC	FC	LC
I. Basic Cost								
1) Preparatory Works	5,936	3,255	10,217	5,154	8,763	7,602	24,916	16,011
2) Civil Works	43,704	19,573	33,116	13,926	89,475	55,635	166,295	89,134
3) Metal Works	9,185	1,021	7,483	831	49,941	5,549	66,609	7,401
4) Engineering Service	8,236	2,146	7,114	1,792	20,745	6,191	36,095	10,129
5) Administration	0	4,134	0	3,536	0	10,848	0	18,518
6) Compensation Cost	0	20,138	0	25,226	0	1,270	0	46,634
7) Tax (PPN)	0	9,306	0	7,963	0	24,390	0	41,659
Sub-total	67,061	59,573	57,930	58,429	168,924	111,485	293,915	229,486
II. Contingency								
1) Physical Contingency	6,706	5,957	5,793	5,843	16,892	11,149	29,391	22,949
2) Price Escalation	17,890	50,692	15,454	49,719	45,064	94,866	78,408	195,277
Sub-total	24,596	56,649	21,247	55,562	61,956	106,015	107,799	218,226
III. Interest During Construction	8,228	0	7,578	0	16,998	0	32,804	0
Total	99,884	116,222	86,756	113,990	247,879	217,500	434,518	447,712
Grand Total (FC+LC)		216,106		200,746		465,378		882,230

Second Phase Development (IIC) in Scenario C

(Unit : million Rp)

Description	Posir Kopo Dam		Tanjung Dam		Cilawang Dam		KSCS II&III Tanjung Canal		Cilawang Canal		Total	
	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC
I. Basic Cost												
1) Preparatory Works	5,936	3,255	27,531	14,590	10,217	5,154	7,741	7,371	6,708	4,977	58,133	35,347
2) Civil Works	55,063	19,573	265,468	107,442	33,116	13,926	78,946	46,846	25,136	17,730	457,729	205,517
3) Metal Works	11,860	1,021	2,352	261	7,483	831	49,828	5,537	269	30	71,792	7,680
4) Engineering Service	10,200	2,146	41,349	17,121	7,114	1,792	19,112	5,378	4,496	2,046	82,272	28,484
5) Administration	0	4,835	0	20,882	0	3,536	0	9,813	0	2,743	0	41,810
6) Compensation Cost	0	33,579	0	89,246	0	25,226	0	1,512	0	171	0	149,734
7) Tax (PPN)	0	10,905	0	47,611	0	7,963	0	22,076	0	6,139	0	94,695
Sub-total	83,059	75,315	336,700	297,154	57,930	58,429	155,627	98,533	36,609	33,836	669,926	563,267
II. Contingency												
1) Physical Contingency	8,306	7,532	33,670	29,715	5,793	5,843	15,563	9,853	3,661	3,384	66,993	56,327
2) Price Escalation	22,158	64,088	87,009	246,096	15,454	49,719	41,517	83,845	9,766	28,792	175,903	472,540
Sub-total	30,464	71,620	120,679	275,812	21,247	55,562	57,079	93,698	13,427	32,176	242,896	528,867
III. Interest During Construction	10,159	0	54,960	0	7,578	0	15,639	0	3,145	0	91,481	0
Total	123,682	146,935	512,339	572,965	86,756	113,990	228,345	192,231	53,180	66,012	1,004,302	1,092,134
Grand Total (FC+LC)		270,617		1,085,304		200,746		420,577		119,192		2,096,436

Table 6 DISBURSEMENT SCHEDULE IN FIRST PHASE (1/2)

Karian Dam

Description	Disbursement (F.C. in million Rp)										Disbursement (L.C. in million Rp)									
	Total	1995	1996	1997	1998	1999	2000	2001	2002	Total	1995	1996	1997	1998	1999	2000	2001	2002		
I. Basic Cost																				
1) Preparatory Works	11,032				8,274	2,758				7,266				5,450	1,817					
2) Civil Works																				
River diversion	13,930				4,040	7,940	1,950			6,451				1,871	3,677	903				
Coffer dam	4,237						4,237			1,605						1,605				
Main dam	51,844				7,777	15,553	15,553	12,961		19,309				2,896	5,793	5,793	4,827			
Saddle dam	6,414				2,117	4,297				2,429				802	1,627					
Spillway	10,491					2,623	3,882	3,987		4,616					1,154	1,708	1,754			
Intake	849					340	509			482					193	289				
Subtotal	87,765				13,933	30,753	26,131	16,948		34,892				5,569	12,444	10,298	6,581			
3) Metal Works	11,390					3,417	3,417	3,417	1,139	1,266					380	380	380	127		
Total of 1 to 3	110,187				22,207	36,928	29,548	20,365	1,139	43,424				11,018	14,640	10,678	6,961	127		
4) Engineering Service	15,426	1,620	2,314	694	2,052	2,700	2,700	2,700	648	3,908	410	586	176	520	684	684	684	164		
5) Administration										7,681	768	768	768	1,152	1,152	1,152	1,152	768		
6) Compensation Cost										58,714			39,338	19,376						
7) Tax (PPN)										17,295	203	290	87	3,580	5,495	4,361	3,071	208		
Total of 1 to 7	125,613	1,620	2,314	694	24,259	39,628	32,248	23,064	1,787	131,021	1,381	1,644	40,369	35,645	21,971	16,875	11,868	1,267		
II. Contingency																				
1) Physical	12,561	162	231		2,426	3,963	3,225	2,306	179	13,102	138	164	4,037	3,565	2,197	1,687	1,187	127		
2) Price Escalation	21,647	49	141	64	3,045	6,312	6,258	5,302	477	53,483	111	274	10,484	12,850	10,312	9,903	8,472	1,078		
Total of 1 & 2	34,208	211	372		5,471	10,274	9,483	7,608	655	66,585	249	438	14,521	16,414	12,509	11,591	9,659	1,204		
III. Interest during Construction	14,946	48	117	135	908	2,206	3,291	4,088	4,152											
Financial Cost	174,767	1,878	2,804	830	30,638	52,108	45,022	34,761	6,594	197,606	1,630	2,082	54,891	52,060	34,480	28,466	21,527	2,471		
IV. O & M	935									355										

Ciuyah Tunnel

Description	Disbursement (F.C. in million Rp)										Disbursement (L.C. in million Rp)									
	Total	1995	1996	1997	1998	1999	2000	2001	2002	Total	1995	1996	1997	1998	1999	2000	2001	2002		
I. Basic Cost																				
1) Preparatory Works	469				469					205				205						
2) Civil Works																				
Inlet and Outlet	465				465					260				260						
Tunnel	7,263				436	2,542	1,307	2,542	436	3,076				185	1,077	554	1,077	185		
Intake Shaft	2,216						1,418	798		823						527	296			
Approach Channel	333							266	67	224						179	45			
Subtotal	10,277				901	2,542	2,726	3,606	502	4,383				445	1,077	1,260	1,418	185		
3) Metal Works	2,021					606	606	606	202	225					68	68	68	23		
Total of 1 to 3	12,767				1,370	3,148	3,332	4,213	704	4,813				650	1,144	1,327	1,485	207		
4) Engineering Service	1,787	188	268	80	238	313	313	313	75	433	45	65	19	58	76	76	76	18		
5) Administration										879	88	88	88	132	132	132	132	88		
6) Compensation Cost										1,980	23	33	10	231	468	505	609	100		
7) Tax (PPN)																				
Total of 1 to 7	14,554	188	268	80	1,608	3,461	3,645	4,525	780	8,105	157	186	117	1,070	1,820	2,040	2,301	414		
II. Contingency																				
1) Physical	1,455	19	27	8	161	346	364	453	78	811	16	19		107	182	204	230	41		
2) Price Escalation	2,738	6	16	7	202	551	707	1,040	208	4,506	13	31	30	386	854	1,197	1,643	352		
Total of 1 & 2	4,193	24	43	16	363	897	1,072	1,493	286	5,316	28	50	30	493	1,036	1,401	1,873	393		
III. Interest during Construction	1,534	6	14	16	67	181	303	460	487											
Financial Cost	20,281	218	325	112	2,037	4,539	5,020	6,478	1,553	13,422	185	236	148	1,563	2,856	3,440	4,174	807		
IV. O & M	113									45										

Note: Engineering service FC : 14 % and LC : 9 % for total of items 1.1 to 1.3.
Administration FC : 5 % and LC : 5 % for total of items 1.1 to 1.3.
Tax FC : 10 % and LC : 10 % for total of items 1.1 to 1.4.
O&M 1 % for Item 1.2 and 0.5 % for Item 1.3 in both FC and LC

Physical Contingency FC : 10 % and LC : 10 % for total of items 1.
Price escalation FC : 3 % and LC : 8 % for total of items 1.
Interest rate 2.6 % for FC

Table 7 DISBURSEMENT SCHEDULE IN FIRST PHASE (2/2)

Karia-Serpong Conveyance System (KSCS)

Description	Disbursement (F.C. in million Rp)										Disbursement (L.C. in million Rp)									
	Total	1995	1996	1997	1998	1999	2000	2001	2002		Total	1995	1996	1997	1998	1999	2000	2001	2002	
I. Basic Cost																				
1) Preparatory Works	10,703				10,703					8,799					8,799					
2) Civil Works																				
Waterway	72,652				9,445	19,616	19,616	19,616	4,359	45,794					5,953	12,364	12,364	12,364	2,748	
Syphon	4,455				579	1,292	1,292	1,292		2,769					360	803	803	803		
Railway Crossing	6,537							6,014	523	1,863								1,714	149	
Road Crossing	3,589				251	1,113	1,113	1,113		2,272					159	704	704	704		
Spillway at Cicinta	191							191		123								123		
Division Structure at Tenjo	856						856			543							543			
Division Structure at Parunpanjang	194					194				124						124				
Inspection Road	5,164						2,582	2,582		3,988							1,994	1,994		
Foot path	132				25	36	36	36		61					12	16	16	16		
Cross Drain	3,232				420	937	937	937		2,317					301	672	672	672		
Subtotal	97,002				10,720	23,188	26,432	31,781	4,882	59,854					6,785	14,684	17,097	18,391	2,897	
3) Metal Works																				
Syphon	59				8	17	17	17		7					1	2	2	2		
Spillway at Cicinta	372							372		41								41		
Division Structure at	945						945			105							105			
Division Structure at	518					518				58						58				
Subtotal	1,894				8	535	962	389		211					1	60	107	43		
Total of 1 to 3	109,599				21,431	23,723	27,394	32,170	4,882	68,864					15,585	14,744	17,204	18,434	2,897	
4) Engineering Service	15,344	1,611	2,302	690	2,041	2,685	2,685	2,685	644	6,198	651	930	279	824	1,085	1,085	1,085	260		
5) Administration										8,923	892	892	892	1,338	1,338	1,338	1,338	892		
6) Compensation Cost										6,266				4,198	2,068					
7) Tax (PPN)										20,001	226	323	97	3,988	4,224	4,837	5,437	868		
Total of 1 to 7	124,943	1,611	2,302	690	23,472	26,408	30,079	34,855	5,527	110,251	1,769	2,145	5,466	23,804	21,391	24,464	26,295	4,918		
II. Contingency																				
1) Physical	12,494	161	230		2,347	2,641	3,008	3,485	553	11,025	177	215		2,380	2,139	2,446	2,629	492		
2) Price Escalation	22,728	48	140	64	2,946	4,206	5,837	8,012	1,474	57,850	142	357	1,420	8,581	10,039	14,357	18,770	4,185		
Total of 1 & 2	35,222	209	370		5,293	6,847	8,845	11,498	2,027	68,875	318	571	1,420	10,961	12,178	16,804	21,399	4,676		
III. Interest during Construction	13,813	47	117	135	883	1,747	2,759	3,964	4,161											
Financial Cost	173,978	1,868	2,789	825	29,648	35,002	41,683	50,317	11,714	179,127	2,088	2,717	6,886	34,765	33,569	41,268	47,694	9,594		
IV. O & M	979									600									1,579	

First Phase : River Improvement Works

Description	Disbursement (F.C. in million Rp)										Disbursement (L.C. in million Rp)								
	Total	1995	1996	1997	1998	1999	2000	2001	2002	Total	1995	1996	1997	1998	1999	2000	2001	2002	
I. Basic Cost																			
1) Preparatory Works	2,659				2,659					2,541				2,541					
2) Civil Works																			
Earth Works	14,158				2,690	3,823	3,823	3,823		9,016				1,713	2,434	2,434	2,434		
Structural Works	1,490				283	402	402	402		1,371				260	370	370	370		
Road Works	2,214						1,107	1,107		1,005						503	503		
Subtotal	17,862				2,973	4,225	5,332	5,332		11,392				1,974	2,804	3,307	3,307		
Total of 1 & 2	20,521				5,632	4,225	5,332	5,332		13,933				4,515	2,804	3,307	3,307		
3) Engineering Service	2,873	302	431	129	382	503	503	503	121	1,254	132	188	56	167	219	219	219	53	
4) Administration										1,723	172	172	172	258	258	258	258	172	
5) Compensation Cost										1,926			1,290	636					
6) Tax (PPN)										3,858	43	62	19	1,070	775	936	936	17	
Total of 1 to 6	23,394	302	431	129	6,014	4,728	5,835	5,835	121	22,694	347	422	1,538	6,645	4,058	4,721	4,721	242	
II. Contingency																			
1) Physical	3,503	45	65	13	902	709	875	875	18	3,404	52	63	231	997	609	708	708	36	
2) Price Escalation	4,061	9	26	12	755	753	1,132	1,341	32	11,144	28	70	399	2,395	1,904	2,771	3,370	206	
Total of 1 & 2	7,563	54	91	25	1,657	1,462	2,007	2,216	50	14,548	80	134	630	3,392	2,513	3,479	4,078	242	
III. Interest during Construction	2,869	9	23	27	226	387	591	800	805										
Financial Cost	33,826	365	545	181	7,897	6,577	8,433	8,852	976	37,242	427	556	2,168	10,037	6,570	8,200	8,799	485	
IV. O & M	205									139								345	

Note: Engineering service FC : 14 % and LC : 9 % for total of items I.1 to I.3.
Administration FC : 5 % and LC : 5 % for total of items I.1 to I.3.
Tax FC : 10 % and LC : 10 % for total of items I.1 to I.4.
O&M 0.5 % for civil work and metal work in both FC and LC
Physical Copntingenc FC : 10 % and LC : 10 % for total of items I. (KSCS)
FC : 15 % and LC : 15 % for total of items I. (River improvement)

Price escalation
Interest rate

FC : 3 % and LC : 8 % for total of items I.
2.6 % for FC

Table 8 DISBURSEMENT SCHEDULE OF PHASE IIA (1/2)

Pasir Kopo Dam

Description	Disbursement (F.C. in million Rp)									Disbursement (L.C. in million Rp)								
	Total	2008	2009	2010	2011	2012	2013	2014	2015	Total	2008	2009	2010	2011	2012	2013	2014	2015
I. Basic Cost																		
1) Preparatory Works	5,936				4,452	1,484				3,255				2,441	814			
2) Civil Works																		
River diversion	5,991				1,737	3,415	839			2,689				780	1,533	376		
Coffer dam	1,764						1,764			653						653		
Main dam	14,872				2,231	4,462	4,462	3,718		5,507				826	1,652	1,652	1,377	
Spillway	20,002					5,001	7,401	7,601		10,194					2,549	3,772	3,874	
Intake and	1,075					430	645			530					212	318		
Emergency Outlet																		
Subtotal	43,704				3,968	13,307	15,110	11,319		19,573				1,606	5,945	6,771	5,250	
3) Metal Works	9,185					2,756	2,756	2,756	919	1,021					306	306	306	102
Total of 1 to 3	58,825				8,420	17,546	17,866	14,074	919	23,849				4,047	7,065	7,078	5,557	102
4) Engineering Service	8,236	865	1,235	371	1,095	1,441	1,441	1,441	346	2,146	225	322	97	285	376	376	376	90
5) Administration										4,134	413	413	413	620	620	620	620	413
6) Compensation Cost										20,138			13,492	6,646				
7) Tax (PPN)										9,306	109	156	47	1,385	2,643	2,676	2,145	146
Total of 1 to 7	67,061	865	1,235	371	9,516	18,988	19,307	15,515	1,264	59,573	748	891	14,049	12,983	10,704	10,749	8,697	751
II. Contingency																		
1) Physical	6,706	86	124	37	952	1,899	1,931	1,552	126	5,957	75	89	1,405	1,298	1,070	1,075	870	75
2) Price Escalation	17,890	231	330	99	2,538	5,065	5,150	4,139	337	50,692	636	758	11,954	11,048	9,108	9,147	7,401	639
Total of 1 & 2	24,596	317	453	136	3,490	6,964	7,081	5,691	464	56,649	711	847	13,359	12,346	10,179	10,222	8,270	714
III. Interest during Construction	8,228	31	75	88	426	1,101	1,787	2,338	2,383									
Financial Cost	99,884	1,213	1,763	594	13,431	27,052	28,175	23,544	4,111	116,222	1,459	1,738	27,408	25,330	20,883	20,971	16,968	1,466
IV. O & M	483									201								684

Note: Engineering service FC: 14 % and LC: 9 % for total of items I.1 to I.3. Physical Contingency FC: 10 % and LC: 10 % for total of items I.
Administration FC: 5 % and LC: 5 % for total of items I.1 to I.3. Price escalation FC: 3 % and LC: 8 % for total of items I till 2002.
Tax FC: 10 % and LC: 10 % for total of items I.1 to I.4. 0 % after 2002
O&M 1 % for Item I.2 and 0.5 % for Item I.3 in both FC and LC Interest rate 2.6 % for FC

Table 9 DISBURSEMENT SCHEDULE OF PHASE IIA (2/2)

Cilawang Dam

Description	Disbursement (P.C. in million Rp)									Disbursement (L.C. in million Rp)								
	Total	2008	2009	2010	2011	2012	2013	2014	2015	Total	2008	2009	2010	2011	2012	2013	2014	2015
I. Basic Cost																		
1) Preparatory Works	10,217				7,663	2,554				5,154				3,866	1,289			
2) Civil Works																		
River diversion	5,514				1,599	3,143	772			2,582				749	1,472	361		
Coffer dam	2,147						2,147			802						802		
Main dam	15,174				2,276	4,552	4,552	3,794		5,495				824	1,649	1,649	1,374	
Saddle dam	1,563				516	1,047				586				193	393			
Spillway	8,280					2,070	3,064	3,146		4,239					1,060	1,568	1,611	
Intake	438					175	263			222					89	133		
Subtotal	33,116				4,391	10,988	10,798	6,940		13,926				1,766	4,661	4,514	2,985	
3) Metal Works	7,483					2,245	2,245	2,245	748	831					249	249	249	83
Total of 1 to 3	50,816				12,054	15,787	13,042	9,185	748	19,911				5,632	6,199	4,763	3,234	83
4) Engineering Service	7,114	747	1,067	320	946	1,245	1,245	1,245	299	1,792	188	269	81	238	314	314	314	75
5) Administration										3,536	354	354	354	530	530	530	530	354
6) Compensation Cost										25,226			16,901	8,325				
7) Tax (PPN)										7,963	94	134	40	1,887	2,354	1,936	1,398	121
Total of 1 to 7	57,930	747	1,067	320	13,000	17,032	14,287	10,430	1,047	58,429	635	756	17,376	16,612	9,398	7,543	5,476	633
II. Contingency																		
1) Physical	5,793	75	107	32	1,300	1,703	1,429	1,043	105	5,843	64	76	1,738	1,661	940	754	548	63
2) Price Escalation	15,454	199	285	85	3,468	4,544	3,811	2,782	279	49,719	541	643	14,786	14,136	7,997	6,419	4,659	538
Total of 1 & 2	21,247	274	391	117	4,768	6,247	5,240	3,825	384	55,562	604	719	16,523	15,797	8,937	7,173	5,207	602
III. Interest during Construction	7,578	27	64	76	538	1,143	1,651	2,021	2,059									
Financial Cost	86,756	1,048	1,523	513	18,306	24,422	21,178	16,277	3,490	113,990	1,239	1,475	33,899	32,409	18,334	14,717	10,683	1,234
IV. O & M	369										143							512

KSCS II & III and Cilawang Canal

Description	Disbursement (F.C. in million Rp)										Disbursement (L.C. in million Rp)									
	Total	2008	2009	2010	2011	2012	2013	2014	2015	Total	2008	2009	2010	2011	2012	2013	2014	2015		
I. Basic Cost																				
1) Preparatory Works	8,763					8,763				7,602					7,602					
2) Civil Works																				
Waterway	41,404					7,453	14,905	14,905	4,140	29,535					5,316	10,633	10,633	2,954		
Aqueduct	2,549					510	1,020	1,020		499					100	200	200			
Syphon	2,826						1,413	1,413		1,445						723	723			
Railway Crossing	5,989						5,510		479	1,502							1,382	120		
Road Crossing	3,738					897	1,420	1,420		2,348					564	892	892			
Spillway at Cicinta	202						202			130							130			
Inspection Road	3,971						1,986	1,986		2,632						1,316	1,316			
Foot Path	137					36	51	51		56					15	21	21			
Cross Drain	490					108	191	191		352					77	137	137			
Parunpanjang P.S.	2,908					291	1,163	1,163	291	1,175					118	470	470	118		
Pipeline	25,261					4,547	9,094	9,094	2,526	15,961					2,873	5,746	5,746	1,596		
Subtotal	89,475					13,841	31,243	36,955	7,436	55,635					9,062	20,137	21,649	4,787		
3) Metal Works																				
Aqueduct	2,294						1,147	1,147		255						128	128			
Syphon	61						31	31		7						4	4			
Spillway at Cicinta	178							178		20							20			
Division Structure at Tenjo	388							388		43							43			
Division Structure at Parunpanjang	210							210		23							23			
P.S. at Parunpanjang	34,067					10,220	10,220	10,220	3,407	3,785					1,136	1,136	1,136	379		
Pipeline	12,743					2,294	4,587	4,587	1,274	1,416					255	510	510	142		
Subtotal	49,941					12,514	15,985	16,761	4,681	5,549					1,390	1,776	1,862	520		
Total of 1 to 3	148,179					35,118	47,228	53,716	12,117	68,786					18,054	21,913	23,511	5,307		
4) Engineering Service	20,745		2,178	3,112	934	2,614	5,228	5,228	1,452	6,191		650	929	279	780	1,560	1,560	433		
5) Administration										10,848		1,085	1,085	1,085	2,170	2,170	2,170	1,085		
6) Compensation Cost										1,270				851	419					
7) Tax (PPN)										24,390		283	404	121	5,657	7,593	8,401	1,931		
Total of 1 to 7	168,924		2,178	3,112	934	37,732	52,456	58,944	13,570	111,485		2,018	2,417	2,336	27,080	33,236	35,642	8,757		
II. Contingency																				
1) Physical	16,892		218	311	93	3,773	5,246	5,894	1,357	11,149		202	242	234	2,708	3,324	3,564	876		
2) Price Escalation	45,064		581	830	249	10,066	13,994	15,724	3,620	94,866		1,717	2,057	1,987	23,043	28,281	30,329	7,451		
Total of 1 & 2	61,956		799	1,141	342	13,839	19,239	21,619	4,977	106,015		1,919	2,299	2,221	25,751	31,605	33,893	8,327		
III. Interest during Construction	16,998		77	188	221	1,562	3,426	5,521	6,003											
Financial Cost	247,879		3,055	4,441	1,497	53,132	75,121	86,083	24,549	217,500		3,936	4,716	4,556	52,831	64,841	69,535	17,083		
IV. O&M	1,636										900									

Note: Engineering service FC: 14 % and LC: 9 % for total of items I.1 to I.3.
Administration FC: 5 % and LC: 5 % for total of items I.1 to I.3.
Tax FC: 10 % and LC: 10 % for total of items I.1 to I.4.
O&M 1 % for Item I.2 and 0.5 % for Item I.3 in both FC and LC

Physical Contingency FC: 10 % and LC: 10 % for total of items I.
Price escalation FC: 3 % and LC: 8 % for total of items I till 2002.
0 % after 2002
Interest rate 2.6 % for FC

Table 10 DISBURSEMENT SCHEDULE OF PHASE IIC (1/3)

Pasir Kopo Dam

Description	Disbursement (F.C. in million Rp)									Disbursement (L.C. in million Rp)								
	Total	2004	2005	2006	2007	2008	2009	2010	2011	Total	2004	2005	2006	2007	2008	2009	2010	2011
I. Basic Cost																		
1) Preparatory Works	5,936				4,452	1,484				3,255				2,441	814			
2) Civil Works																		
River diversion	6,766				1,962	3,857	947			2,689				780	1,533	376		
Coffer dam	3,497						3,497			653						653		
Main dam	23,547				3,532	7,064	7,064	5,887		5,507				826	1,652	1,652	1,377	
Spillway	19,892					4,973	7,360	7,559		10,194					2,549	3,772	3,874	
Intake and	1,361					544	817			530					212	318		
Emergency Outlet																		
Subtotal	55,063				5,494	16,438	19,685	13,446		19,573				1,606	5,945	6,771	5,250	
3) Metal Works	11,860					3,558	3,558	3,558	1,186	1,021					306	306	306	102
Total of 1 to 3	72,859				9,946	21,480	23,243	17,004	1,186	23,849				4,047	7,065	7,078	5,557	102
4) Engineering Service	10,200	1,071	1,530	459	1,357	1,785	1,785	1,785	428	2,146	225	322	97	285	376	376	376	90
5) Administration										4,835	484	484	484	725	725	725	725	484
6) Compensation Cost										33,579			22,498	11,081				
7) Tax (PPN)										10,905	130	185	56	1,564	3,071	3,248	2,472	181
Total of 1 to 7	83,059	1,071	1,530	459	11,303	23,265	25,028	18,789	1,614	75,315	839	991	23,134	17,702	11,237	11,427	9,130	856
II. Contingency																		
1) Physical	8,306	107	153	46	1,130	2,327	2,503	1,879	161	7,532	84	99	2,313	1,770	1,124	1,143	913	86
2) Price Escalation	22,158	286	408	122	3,015	6,206	6,677	5,012	431	64,088	714	843	19,685	15,064	9,562	9,723	7,769	729
Total of 1 & 2	30,464	393	561	168	4,146	8,533	9,180	6,891	592	71,620	797	942	21,999	16,834	10,686	10,866	8,682	814
III. Interest during Construction	10,159	38	92	109	510	1,337	2,227	2,894	2,952									
Financial Cost	123,682	1,502	2,184	736	15,959	33,135	36,434	28,574	5,158	146,935	1,636	1,933	45,132	34,536	21,922	22,293	17,812	1,671
IV. O & M	610									201								811

Note: Engineering service FC: 14 % and LC: 9 % for total of items I.1 to I.3.
Administration FC: 5 % and LC: 5 % for total of items I.1 to I.3.
Tax FC: 10 % and LC: 10 % for total of items I.1 to I.4.
O&M 1 % for Item I.2 and 0.5 % for Item I.3 in both FC and LC

Physical Copntingency FC: 10 % and LC: 10 % for total of items I.
Price escalation FC: 3 % and LC: 8 % for total of items I till 2002.
0 % after 2002
Interest rate 2.6 % for FC

Table 11 DISBURSEMENT SCHEDULE IN SECOND PHASE IIC (2/3)

Tanjung Dam

Description	Disbursement (P.C. in million Rp)												Disbursement (L.C. in million Rp)											
	Total	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014		
I. Basic Cost																								
1) Preparatory Works	27,531				20,648	6,883						14,590				10,943	3,648							
2) Civil Works																								
River diversion	7,707				2,235	4,393	1,079					3,303				958	1,883	462						
Coffer dam	11,161					3,683	7,478					4,414					1,457	2,957						
Main dam	227,316				18,185	43,190	43,190	43,190	43,190	36,371		90,279				7,222	17,153	17,153	17,153	17,153	14,445			
Saddle dam	1,289				425	864						630				208	422							
Spillway	9,648						1,833	2,798	2,798	2,219		5,108						971	1,481	1,481	1,175			
Low level outlet	6,973								3,068	3,905		2,830								1,245	1,585			
Intake	1,374							605	769			878							386	492				
Subtotal	265,468				20,846	52,130	53,580	46,593	49,826	42,494		107,442				8,388	20,914	21,543	19,021	20,371	17,204			
3) Metal Works	2,352							706	706	706	235	261							78	78	78	26		
Total of 1 to 3	295,351				41,494	59,013	53,580	47,298	50,531	43,200	235	122,293				19,331	24,562	21,543	19,099	20,450	17,283	26		
4) Engineering Service	41,349	4,342	6,202	1,861	2,026	5,210	5,210	5,210	5,210	5,210	868	17,121	1,798	2,568	770	839	2,157	2,157	2,157	2,157	2,157	360		
5) Administration												20,882	1,044	1,044		1,253	2,506	3,132	3,132	3,132	3,132	1,253		
6) Compensation Cost												89,246				59,795	29,451							
7) Tax (PPN)												47,611				263	6,369	9,094	8,249	7,376	7,835	6,785	149	
Total of 1 to 7	336,700	4,342	6,202	1,861	43,520	64,223	58,790	52,508	55,741	48,410	1,104	297,154	2,842	3,612	62,081	57,242	38,319	35,082	31,765	33,574	29,357	1,787		
II. Contingency																								
1) Physical	33,670	434	620	186	4,352	6,422	5,879	5,251	5,574	4,841	110	29,715	284	361	6,208	5,724	3,832	3,508	3,176	3,357	2,936	179		
2) Price Escalation	87,009	1,158	1,655	496	11,610	17,133	15,683	14,008	14,870	12,914	294	246,096	2,418	3,074	52,827	48,709	32,607	29,852	27,030	28,569	24,981	1,521		
Total of 1 & 2	120,679				682	15,962	23,555	21,562	19,258	20,444	405	275,812	2,702	3,435	59,035	54,434	36,439	33,361	30,206	31,926	27,917	1,700		
III. Interest during Construction	54,960	113	274	340	1,887	4,169	6,258	8,124	10,105	11,825	11,864													
Financial Cost	512,339	4,455	6,477	2,883	61,369	91,946	86,611	79,891	86,290	77,991	13,373	572,965	5,544	7,047	121,117	111,676	74,758	68,442	61,971	65,500	57,274	3,487		
IV. O & M	2,666											1,076										3,742		

KSCS II & III and Tanjung Canal

Description	Disbursement (P.C. in million Rp)												Disbursement (L.C. in million Rp)											
	Total	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014		
I. Basic Cost																								
1) Preparatory Works	7,741							7,741				7,371							7,371					
2) Civil Works																								
Waterway	34,001							6,120	12,240	12,240	3,400	22,687							4,084	8,167	8,167	2,269		
Aqueduct	2,549							510	1,020	1,020		499							100	200	200			
Syphon	1,904								952	952		1,064								532	532			
Railway Crossing	6,532									6,009	523	1,853										148		
Road Crossing	2,313							555	879	879		1,306							313	496	496			
Inspection Road	2,763								1,382	1,382		1,827								914	914			
Foot Path	158							41	58	58		73							19	27	27			
Cross Drain	557							123	217	217		401							88	156	156			
Parupanjang P.S.	2,908							291	1,163	1,163	291	1,175							118	470	470	118		
Pipeline	25,261							4,547	9,094	9,094	2,526	15,961							2,873	5,746	5,746	1,596		
Subtotal	78,946							12,187	27,005	33,015	6,740	46,846							7,595	16,708	18,413	4,131		
3) Metal Works																								
Aqueduct	2,294								1,147	1,147		255								128	128			
Syphon	61								31	31		7								4	4			
Division Structure at Tenjo	388									388		43									43			
Division Structure at P.panjang	275									275		31									31			
P.S. at P.panjang	34,067							10,220	10,220	10,220	3,407	3,785							1,136	1,136	1,136	379		
Pipeline	12,743							2,294	4,587	4,587	1,274	1,416							255	510	510	142		
Subtotal	49,828							12,514	15,985	16,648	4,681	5,537							1,390	1,776	1,850	520		
Total of 1 to 3	136,515							32,441	42,990	49,663	11,421	59,754							16,356	18,484	20,263	4,651		
4) Engineering Service	19,112				2,007	2,867	860	2,408	4,816	4,816	1,338	5,378				565	807	242	678	1,355	1,355	376		
5) Administration												9,813				981	981	981	1,963	1,963	1,963	981		
6) Compensation Cost												1,512						1,013	499					
7) Tax (PPN)												22,076				257	367	110	5,188	6,765	7,610	1,779		
Total of 1 to 7	155,627				2,007	2,867	860	34,849	47,807	54,479	12,758	98,533				1,803	2,155	2,347	24,684	28,567	31,191	7,787		
II. Contingency																								
1) Physical	15,563				201	287	86	3,485	4,781	5,448	1,276	9,853				180	216	235	2,468	2,857	3,119	779		
2) Price Escalation	41,517				535	765	229	9,297	12,753	14,533	3,404	83,845				1,534	1,834	1,997	21,004	24,308	26,541	6,626		
Total of 1 & 2	57,079				736	1,051	315	12,782	17,534	19,981	4,679	93,698				1,715	2,050	2,231	23,472	27,165	29,660	7,405		
III. Interest during Construction	15,639				71	173	204	1,442	3,141	5,077	5,530													
Financial Cost	228,345				2,814	4,091	1,379	49,073	68,482	79,537	22,968	192,231				3,518	4,205	4,578	48,156	55,732	60,851	15,192		
IV. O&M	1,077											533										1,610		

Note:

Engineering service
Administration
Tax
O&M

FC : 14 % and LC : 9 % for total of items 1.1 to 1.3.
FC : 5 % and LC : 5 % for total of items 1.1 to 1.3.
FC : 10 % and LC : 10 % for total of items 1.1 to 1.4.
1 % for Item 1.2 and 0.5 % for Item 1.3 in both FC and LC (Ciawang dam)
0.5 % for Items 1.2 and 1.3 in both FC and LC (KSCS)

Physical Contingency
Price escalation
Interest rate

FC : 10 % and LC : 10 % for total of items 1.
FC : 3 % and LC : 8 % for total of items 1 till 2002.
0 % after 2002
2.6 % for FC

Table 12 DISBURSEMENT SCHEDULE OF PHASE IIC (3/3)

Cilawang Dam

Description		Disbursement (F.C. in million Rp)										Disbursement (L.C. in million Rp)									
		Total	2011	2012	2013	2014	2015	2016	2017	2018	Total	2011	2012	2013	2014	2015	2016	2017	2018		
I. Basic Cost																					
1) Preparatory Works		10,217				7,663	2,554				5,154				3,866	1,289					
2) Civil Works																					
River diversion		5,514				1,599	3,143	772			2,582				749	1,472	361				
Coffer dam		2,147						2,147			802						802				
Main dam		15,174				2,276	4,552	4,552	3,794		5,495			824	1,649	1,649	1,374				
Saddle dam		1,563				516	1,047				586			193	393						
Spillway		8,280					2,070	3,064	3,146		4,239				1,060	1,568	1,611				
Intake		438					175	263			222				89	133					
Subtotal		33,116				4,391	10,988	10,798	6,940		13,926			1,766	4,661	4,514	2,985				
3) Metal Works		7,483					2,245	2,245	2,245	748	831				249	249	249		83		
Total of 1 to 3		50,816				12,054	15,787	13,042	9,185	748	19,911			5,632	6,199	4,763	3,234		83		
4) Engineering Service		7,114	747	1,067	320	946	1,245	1,245	1,245	299	1,792	188	269	81	238	314	314	314	75		
5) Administration											3,536	354	354	354	530	530	530		354		
6) Compensation Cost											25,226			16,901	8,325						
7) Tax (PPN)											7,963	94	134	40	1,887	2,354	1,936	1,398	121		
Total of 1 to 7		57,930	747	1,067	320	13,000	17,032	14,287	10,430	1,047	58,429	635	756	17,376	16,612	9,398	7,543	5,476	633		
II. Contingency																					
1) Physical		5,793	75	107	32	1,300	1,703	1,429	1,043	105	5,843	64	76	1,738	1,661	940	754	548	63		
2) Price Escalation		15,454	199	285	85	3,468	4,544	3,811	2,782	279	49,719	541	643	14,786	14,136	7,997	6,419	4,659	538		
Total of 1 & 2		21,247	274	391	117	4,768	6,247	5,240	3,825	384	55,562	604	719	16,523	15,797	8,937	7,173	5,207	602		
III. Interest during Construction		7,578	27	64	76	538	1,143	1,651	2,021	2,059											
Financial Cost		86,756	1,048	1,523	513	18,306	24,422	21,178	16,277	3,490	113,990	1,239	1,475	33,899	32,409	18,334	14,717	10,683	1,234		
IV. O & M		369									143								512		

Cilawang Canal

Ciwang Canal		Disbursement (F.C. in million Rp)										Disbursement (L.C. in million Rp)									
Description		Total	2011	2012	2013	2014	2015	2016	2017	2018	Total	2011	2012	2013	2014	2015	2016	2017	2018		
I. Basic Cost																					
1) Preparatory Works		6,708						6,708			4,977						4,977				
2) Civil Works																					
Waterway		19,446						5,639	11,084	2,722	14,037						4,071	8,001	1,965		
Syphon		1,099							1,099		694							694			
Spillway at Cicinta		202							202		130							130			
Division structure at		287							287		207							207			
Road Crossing		1,833						697	1,136		1,133						431	702			
Inspection Road		1,819							1,819		1,226							1,226			
Foot Path		39						13	26		13						4	9			
Cross Drain		411						148	263		290						104	186			
Subtotal		25,136						6,497	15,917	2,722	17,730						4,610	11,155	1,965		
3) Metal Works																					
Syphon		49							49		5							5			
Spillway at Cicinta		178							178		20							20			
Division Structure at		42							42		5							5			
Tenjo																					
Subtotal		269							269		30							30			
Total of 1 to 3		32,113						13,205	16,186	2,722	22,737						9,587	11,185	1,965		
4) Engineering Service		4,496			472	674	202	913	1,794	441	2,046			215	307	92	415	816	201		
5) Administration											2,743			274	274	527	724	724	219		
6) Compensation Cost											171					115	56				
7) Tax (PPN)											6,139			69	98	29	2,412	2,998	533		
Total of 1 to 7		36,609			472	674	202	14,117	17,980	3,163	33,836			558	679	763	13,194	15,723	2,918		
II. Contingency																					
1) Physical		3,661			47	67	20	1,412	1,798	316	3,384			56	68	76	1,319	1,572	292		
2) Price Escalation		9,766			126	180	54	3,766	4,796	844	28,792			475	578	649	11,227	13,380	2,483		
Total of 1 & 2		13,427			173	247	74	5,178	6,594	1,160	32,176			530	646	726	12,547	14,952	2,775		
III. Interest during Construction		3,145			17	41	48	550	1,189	1,301											
Financial Cost		53,180			662	962	324	19,845	25,763	5,624	66,012			1,088	1,325	1,489	25,741	30,675	5,693		
IV. O&M		286									202										

Note: Engineering service FC: 14 % and LC: 9 % for total of items 1.1 to 1.3.
Administration FC: 5 % and LC: 5 % for total of items 1.1 to 1.3.
Tax FC: 10 % and LC: 10 % for total of items 1.1 to 1.4.
O&M 1 % for Item 1.2 and 0.5 % for Item 1.3 in both FC and LC
0.5 % for Items 1.2 and 1.3 in both FC and LC (KSCS)

Physical Contingency FC: 10 % and LC: 10 % for total of items 1.
Price escalation FC: 3 % and LC: 8 % for total of items 1 till 2002.
0 % after 2002
Interest rate 2.6 % for FC

FIGURES

Figure 1 THE STUDY AREA

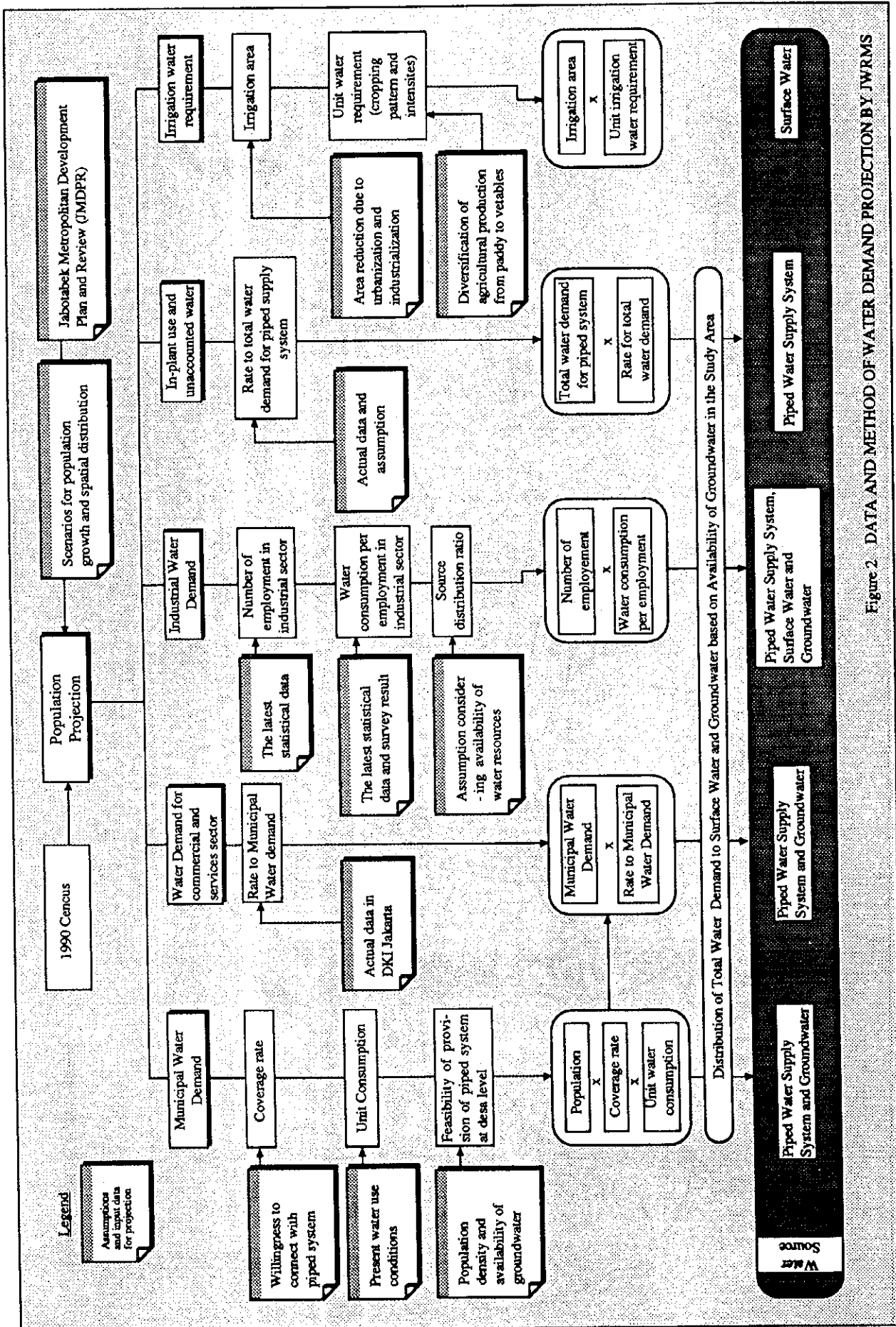
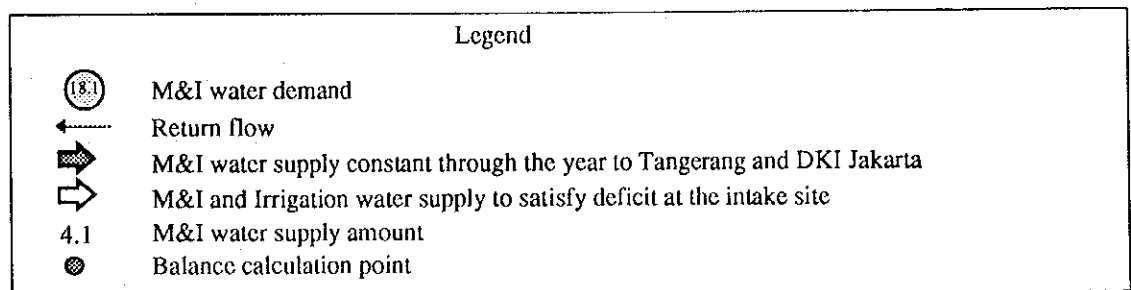
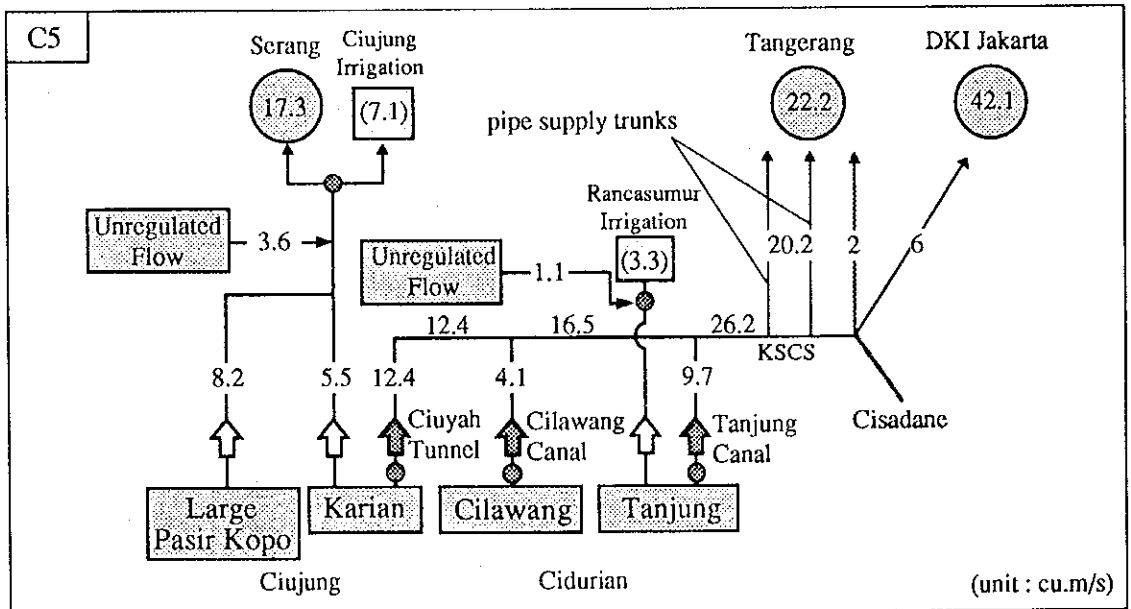
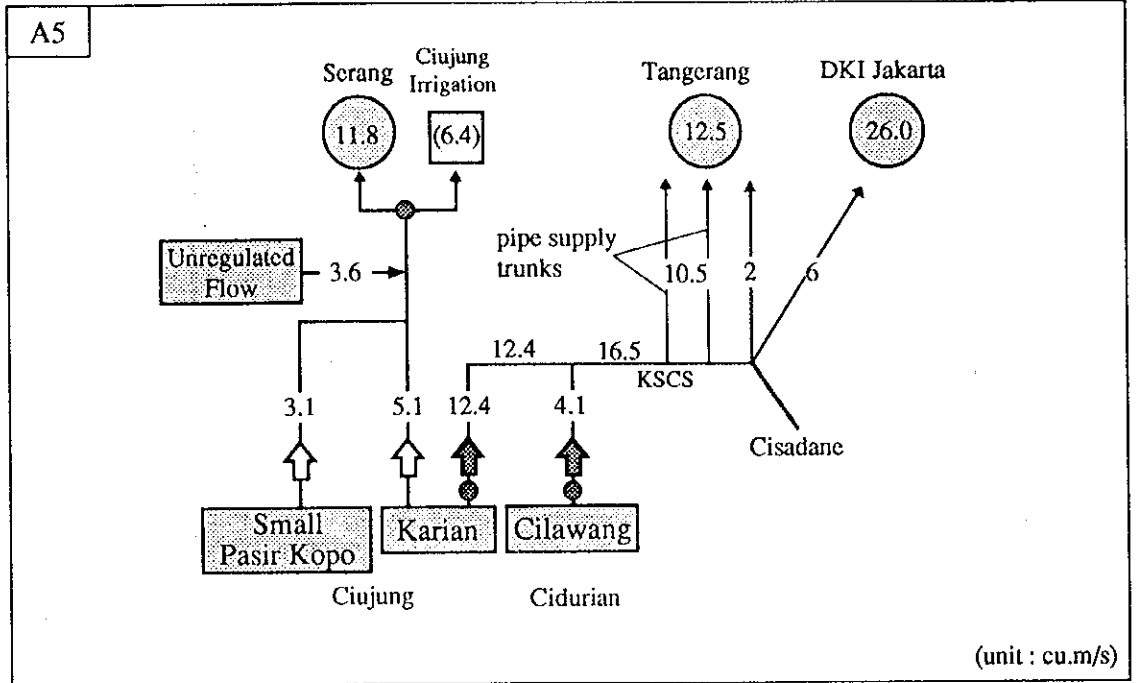
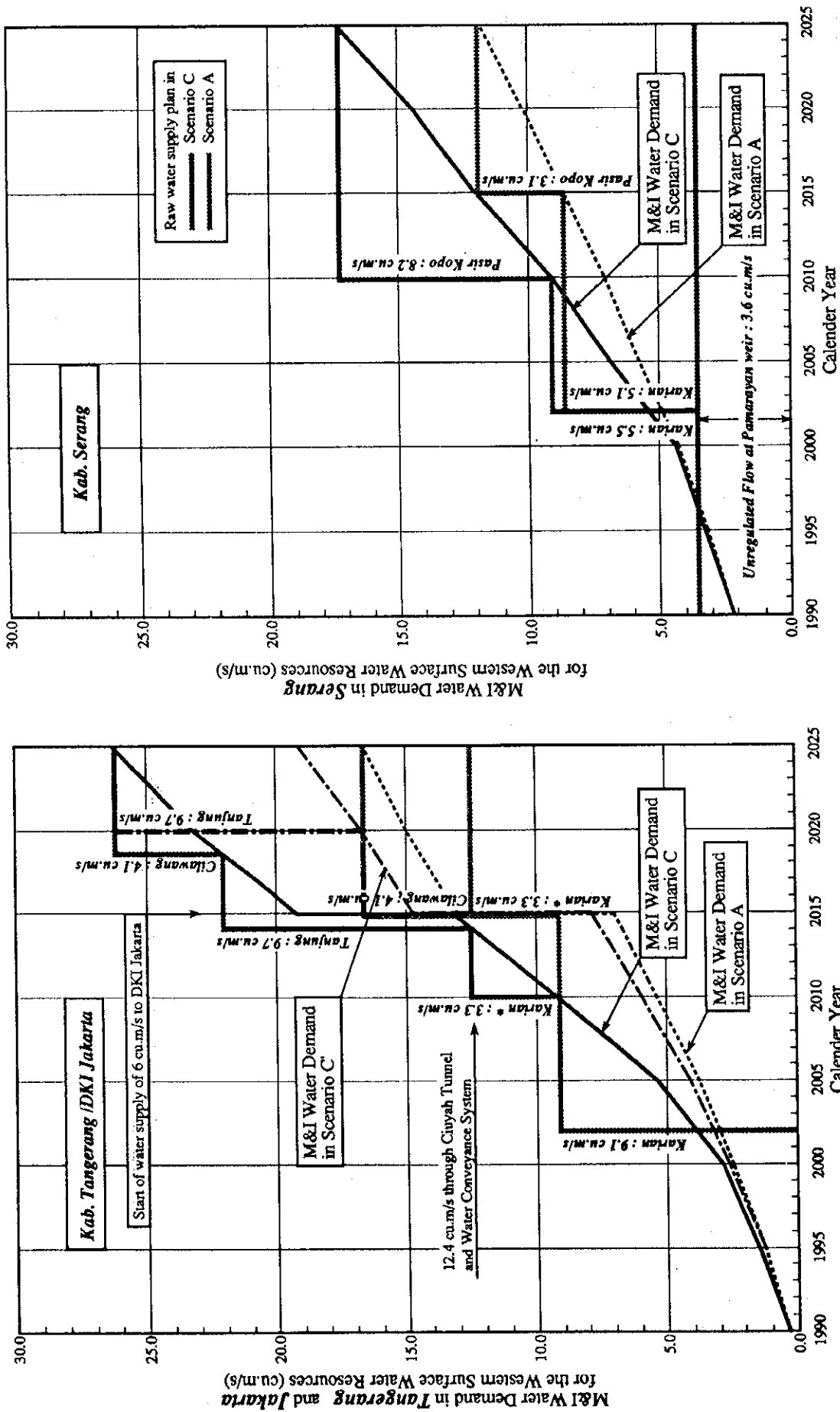


Figure 2. DATA AND METHOD OF WATER DEMAND PROJECTION BY JWRMS



Note:
Figures in parenthesis indicate the water amount supplied to the existing irrigation areas by the proposed dams in addition to that for M&I water supply in terms of annual mean.

Figure 3 PROPOSED M&I WATER SUPPLY PLAN AT 2025



Note : Karian with a symbol of " + " means incremental discharge from the Karian dam to Karian-Serpong Conveyance System and decrease of water supply amount for Serang. The decreased discharge is planned to be replaced by the Pasir Kopo dam.

Figure 4 RAW WATER SUPPLY PLAN FOR MUNICIPAL AND INDUSTRIAL USE IN SERANG, TANGERANG AND DKI JAKARTA

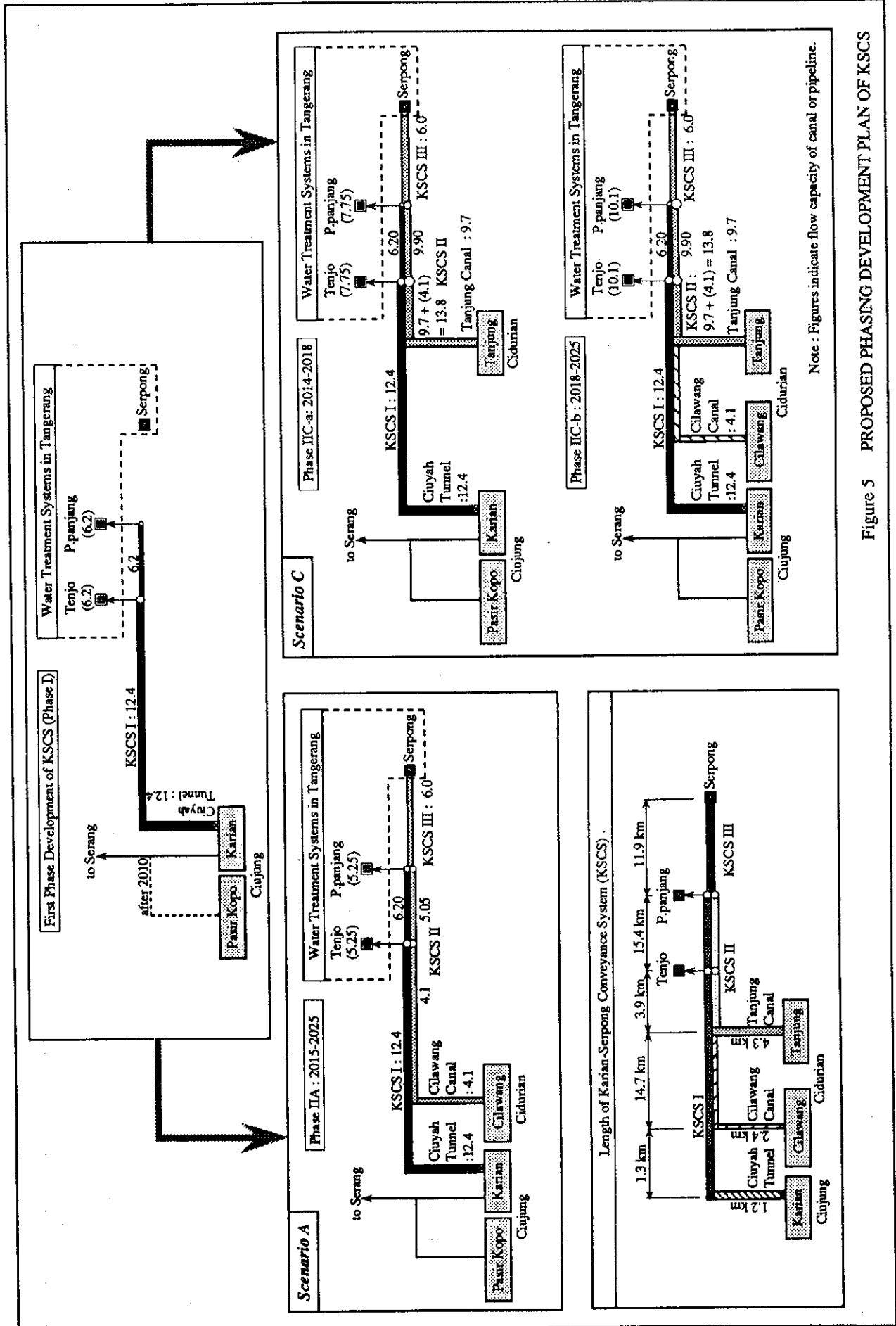


Figure 5 PROPOSED PHASING DEVELOPMENT PLAN OF KSCS

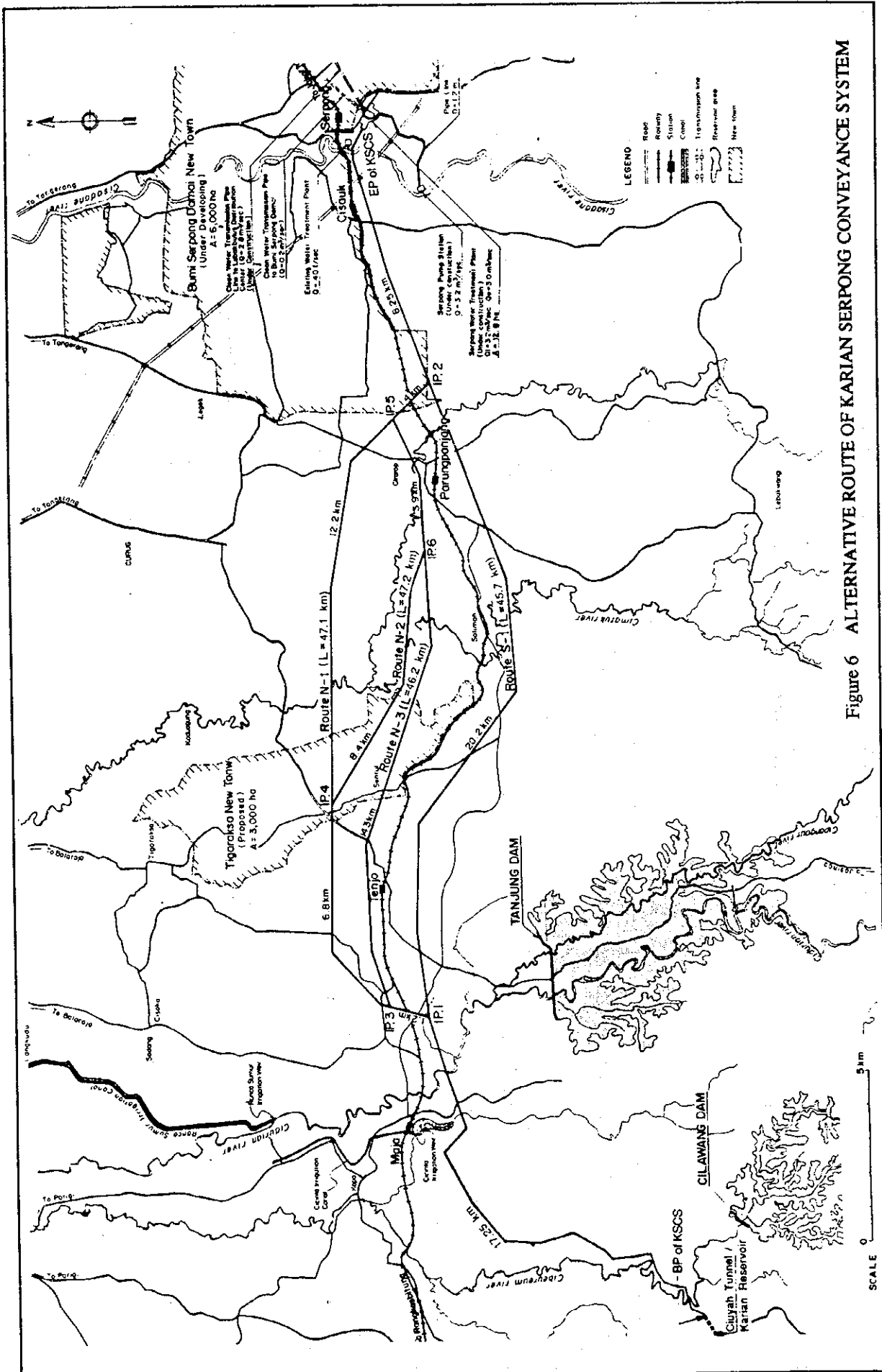
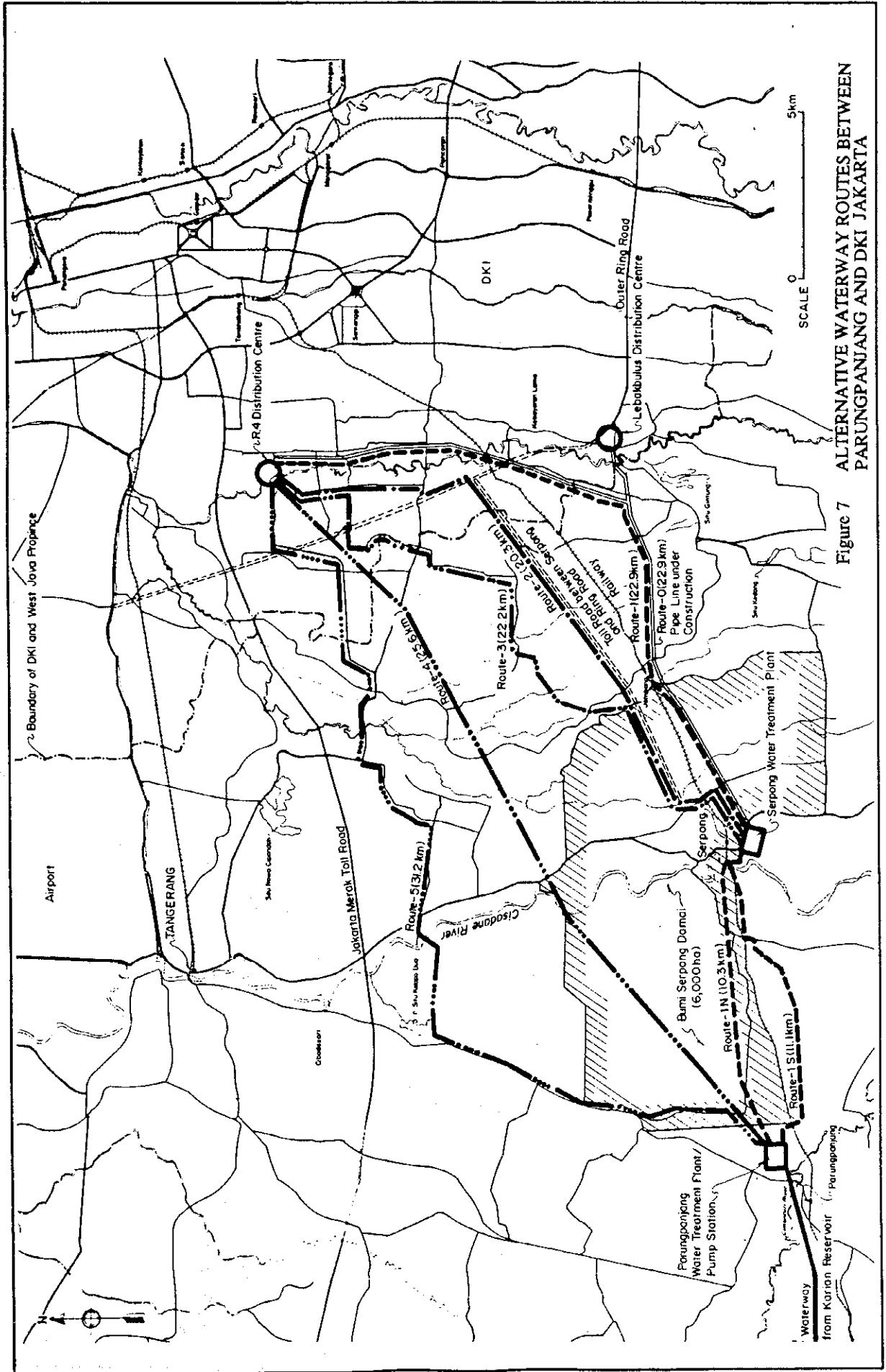
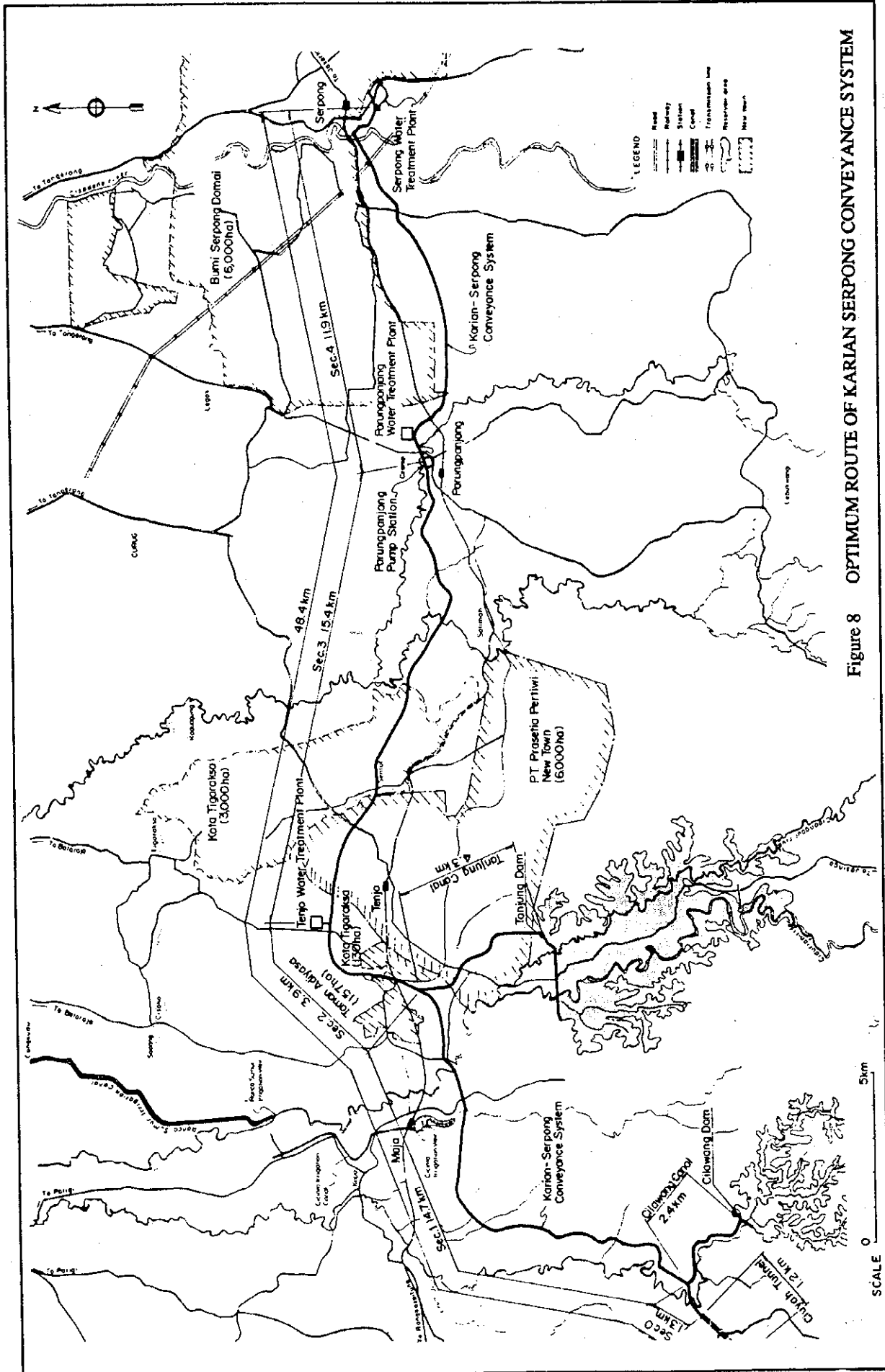


Figure 6 ALTERNATIVE ROUTE OF KARIAN SERPONG CONVEYANCE SYSTEM





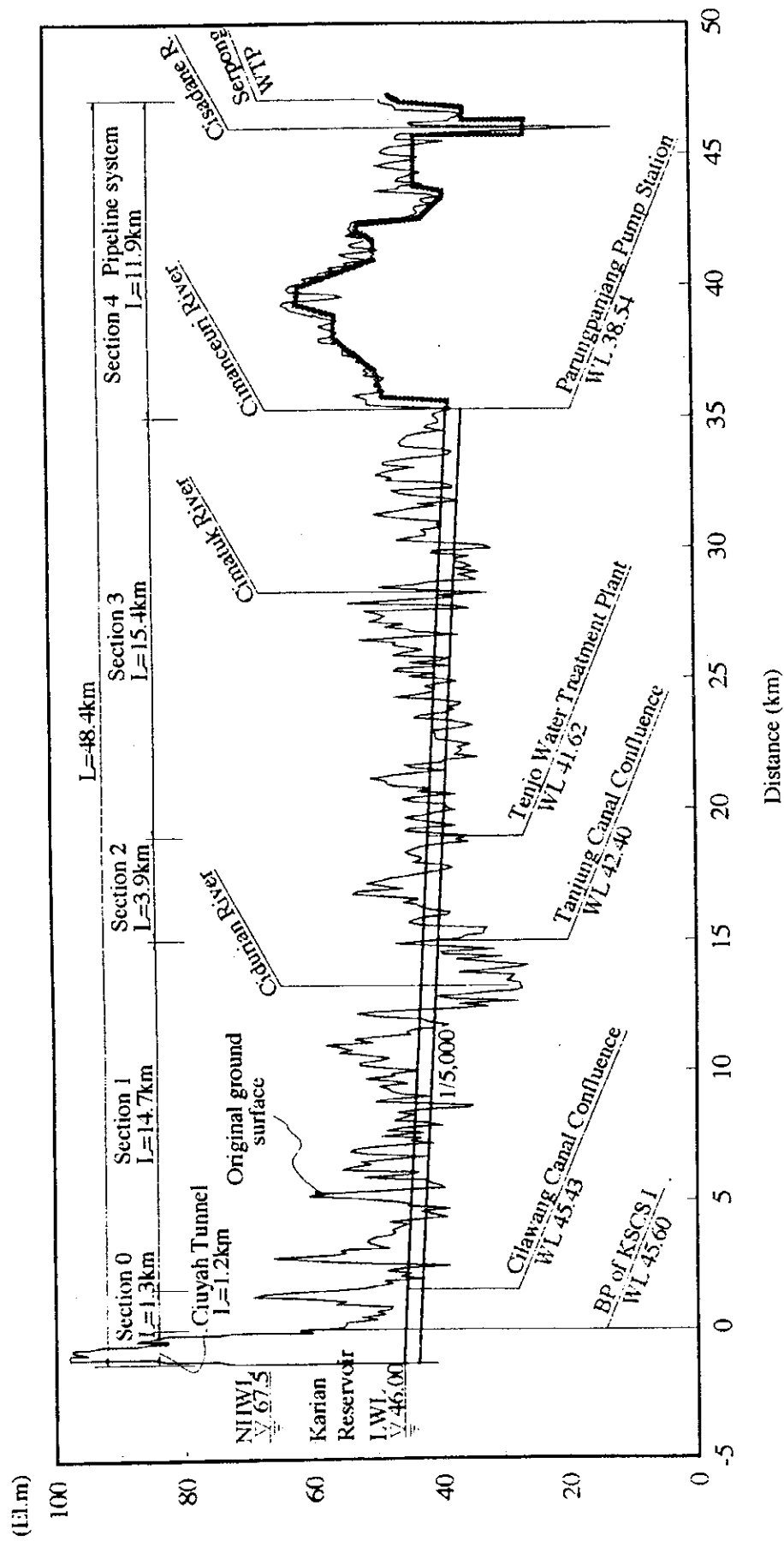


Figure 9 PROPOSED LONGITUDINAL PROFILE OF KSCS

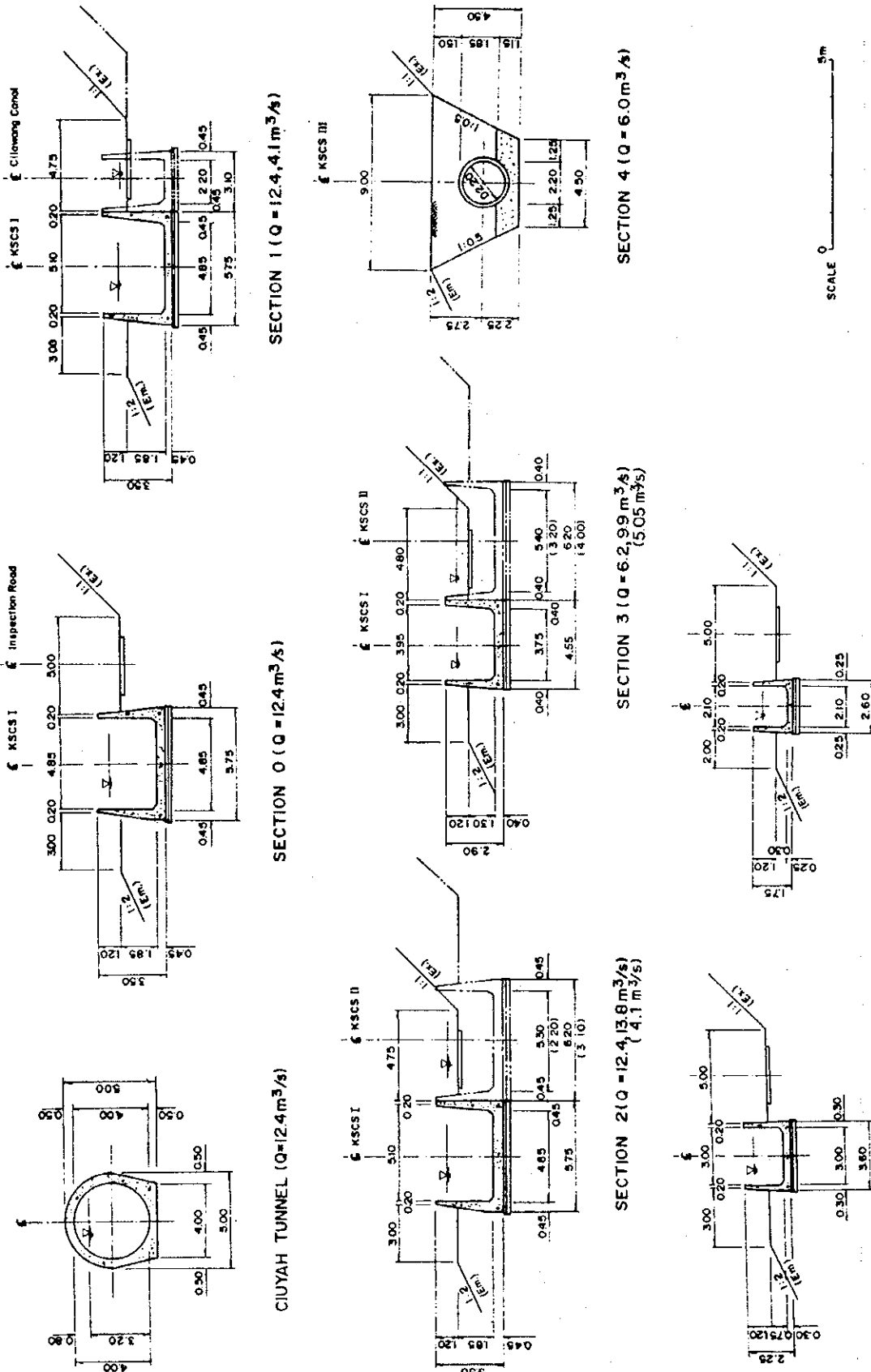
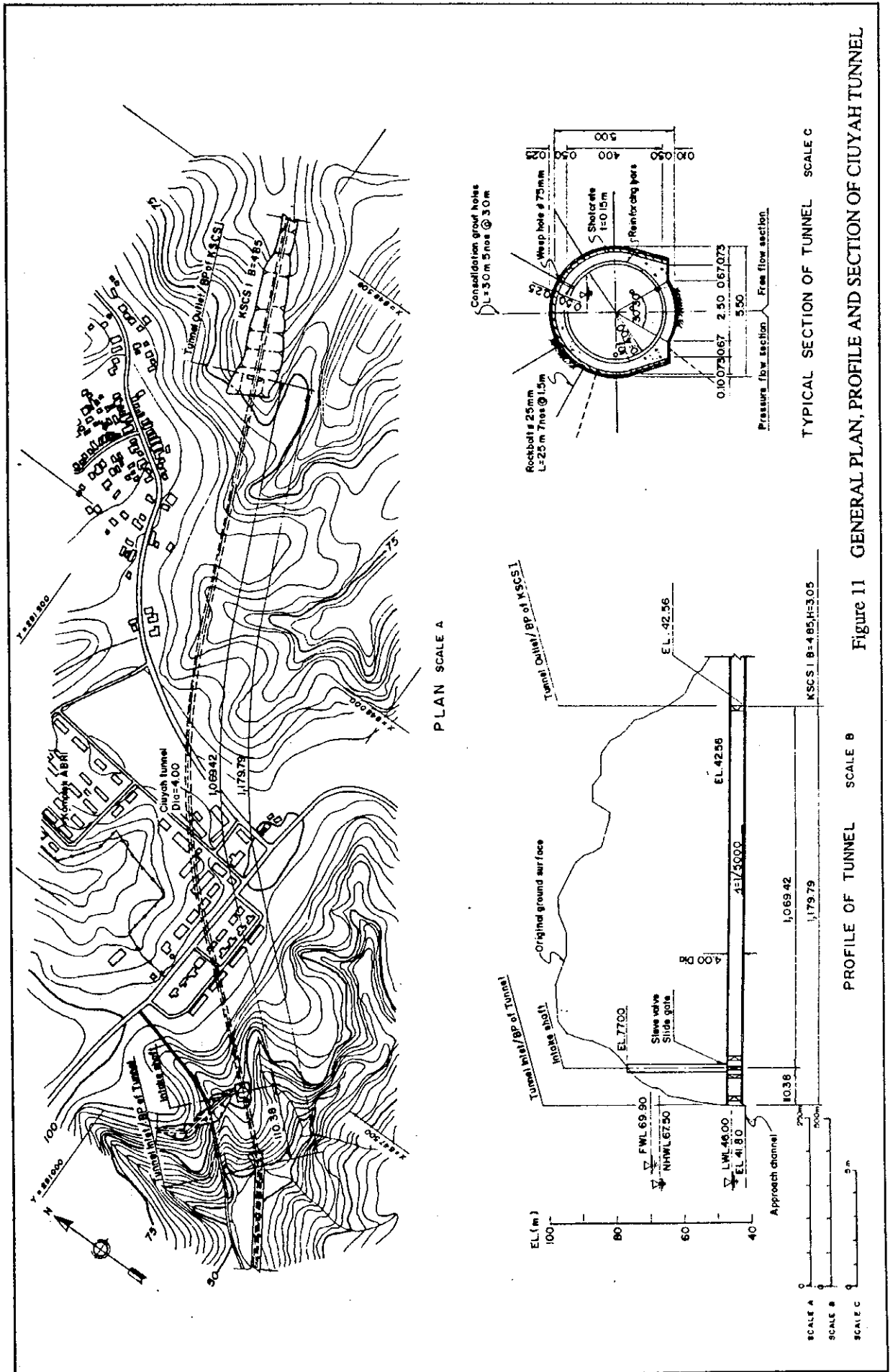
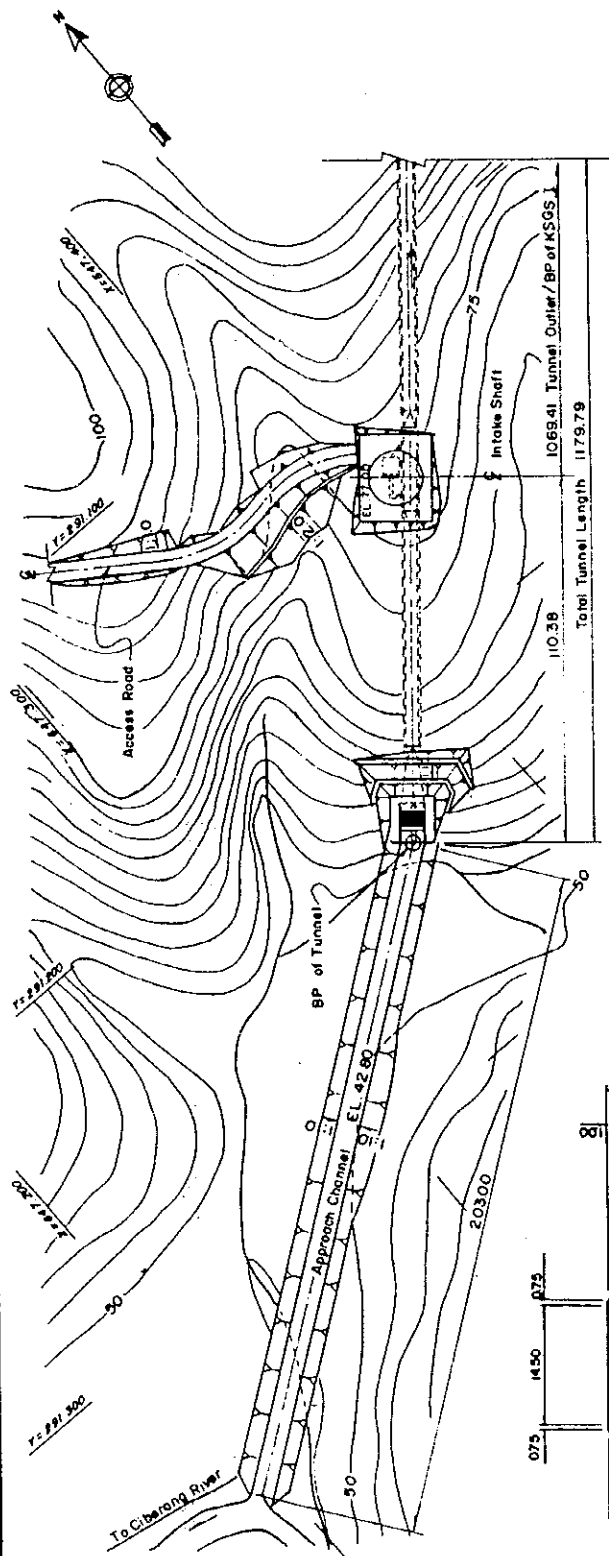


Figure 10 TYPICAL CROSS SECTION OF KSCS

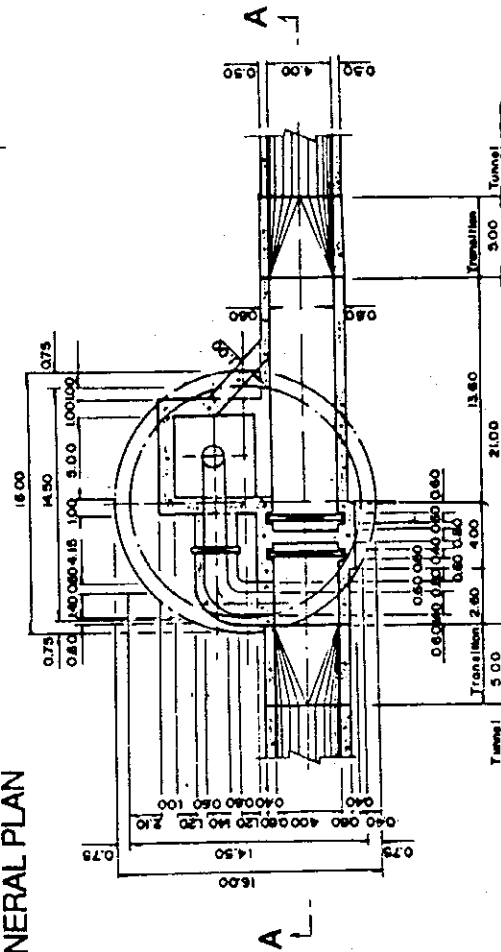
CILAWANG CANAL ($Q = 4.1 m^3/s$)

TANJUNG CANAL ($Q = 9.7 m^3/s$)

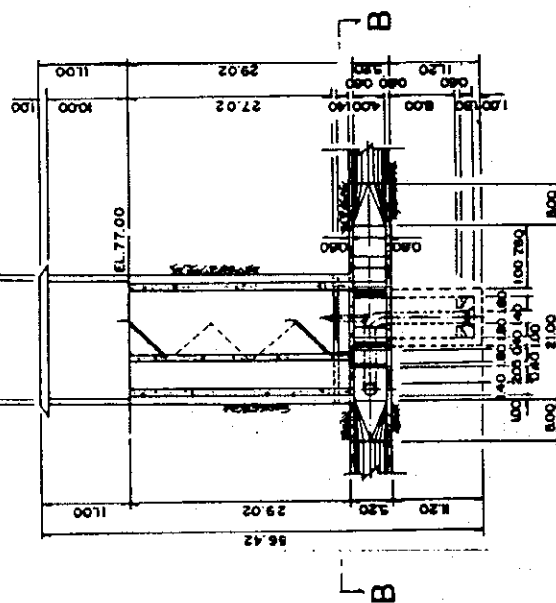




GENERAL PLAN



SECTION B-B



SECTION A-A

Figure 12 INTAKE STRUCTURE AT CIUYAH TUNNEL

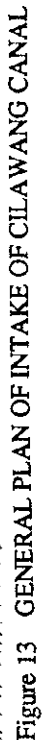


Figure 13 GENERAL PLAN OF INTAKE OF CILAWANG CANAL

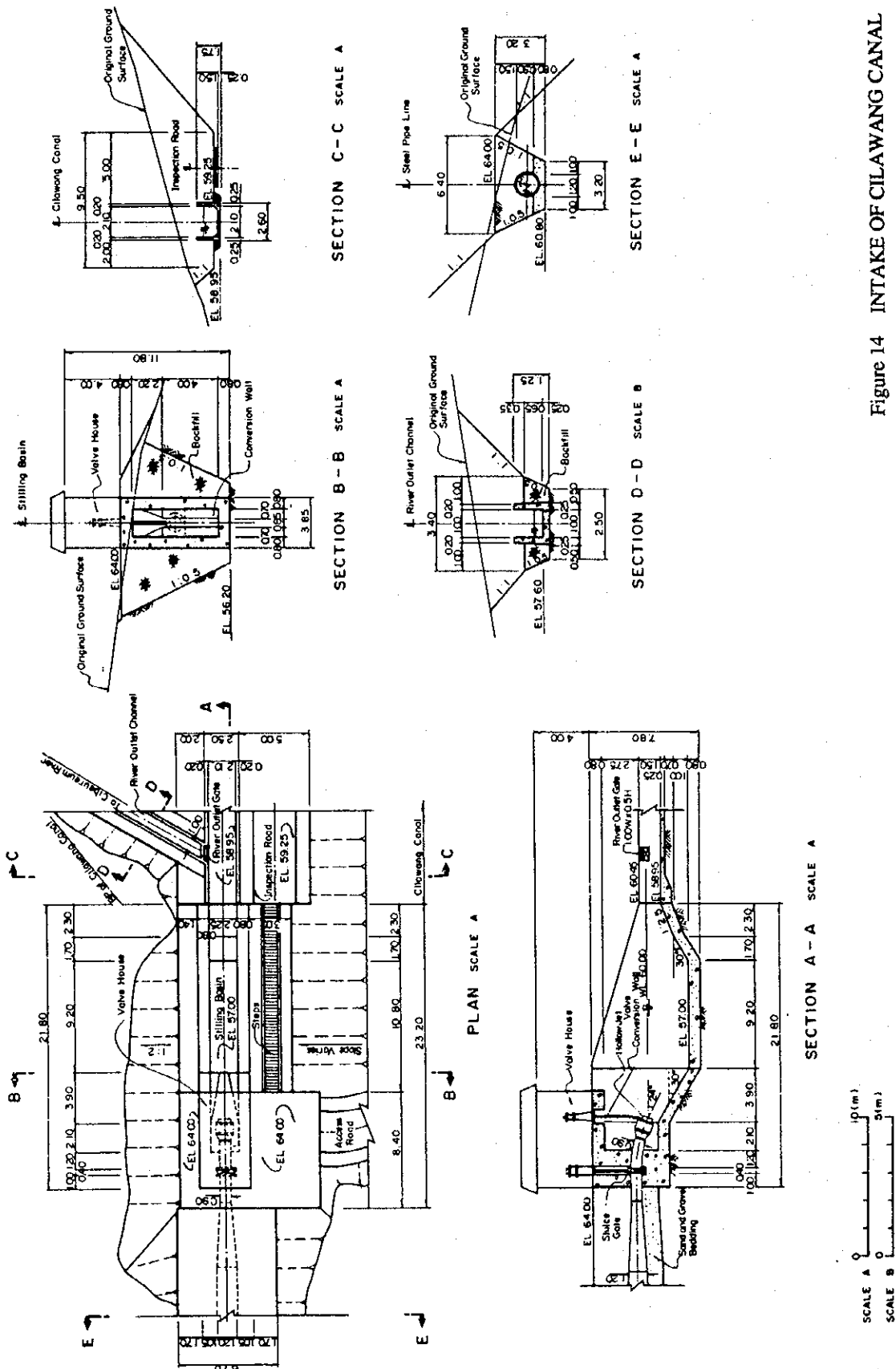
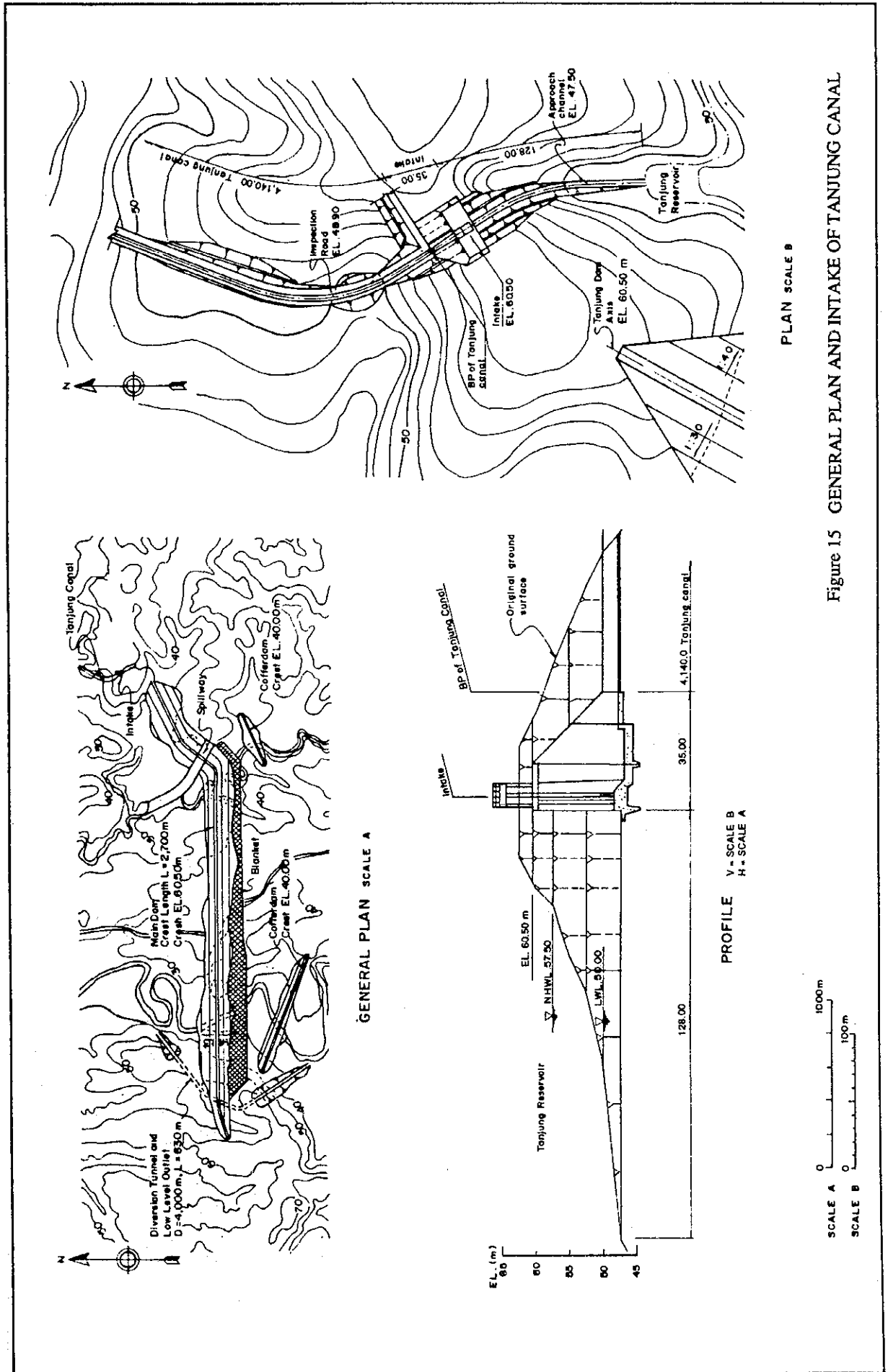
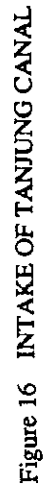


Figure 14 INTAKE OF CILAWANG CANAL





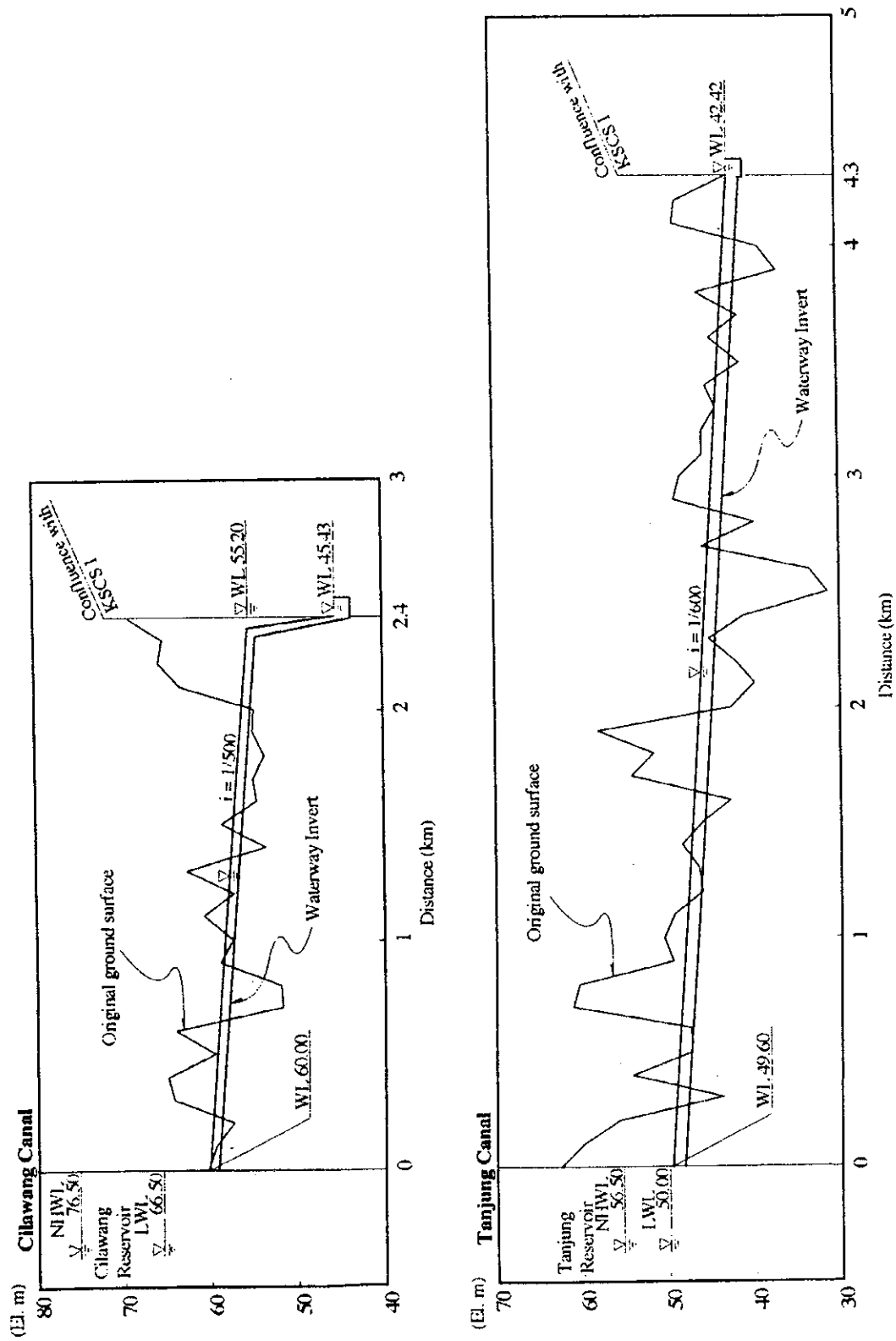


Figure 17 PROPOSED LONGITUDINAL PROFILE OF TANJUNG AND CILAWANG CANAL

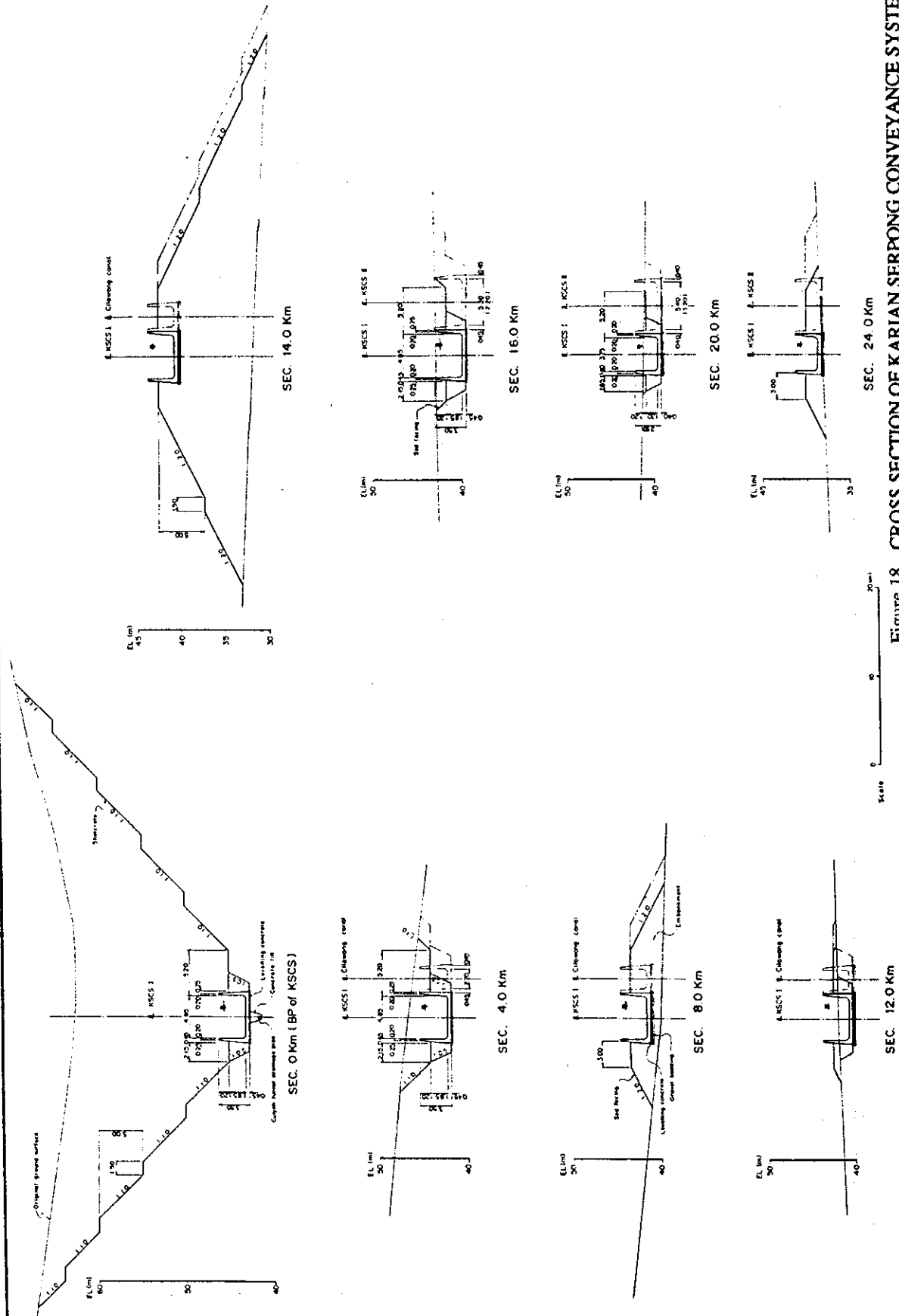


Figure 18 CROSS SECTION OF KARIAN SERPONG CONVEYANCE SYSTEM (1/2)

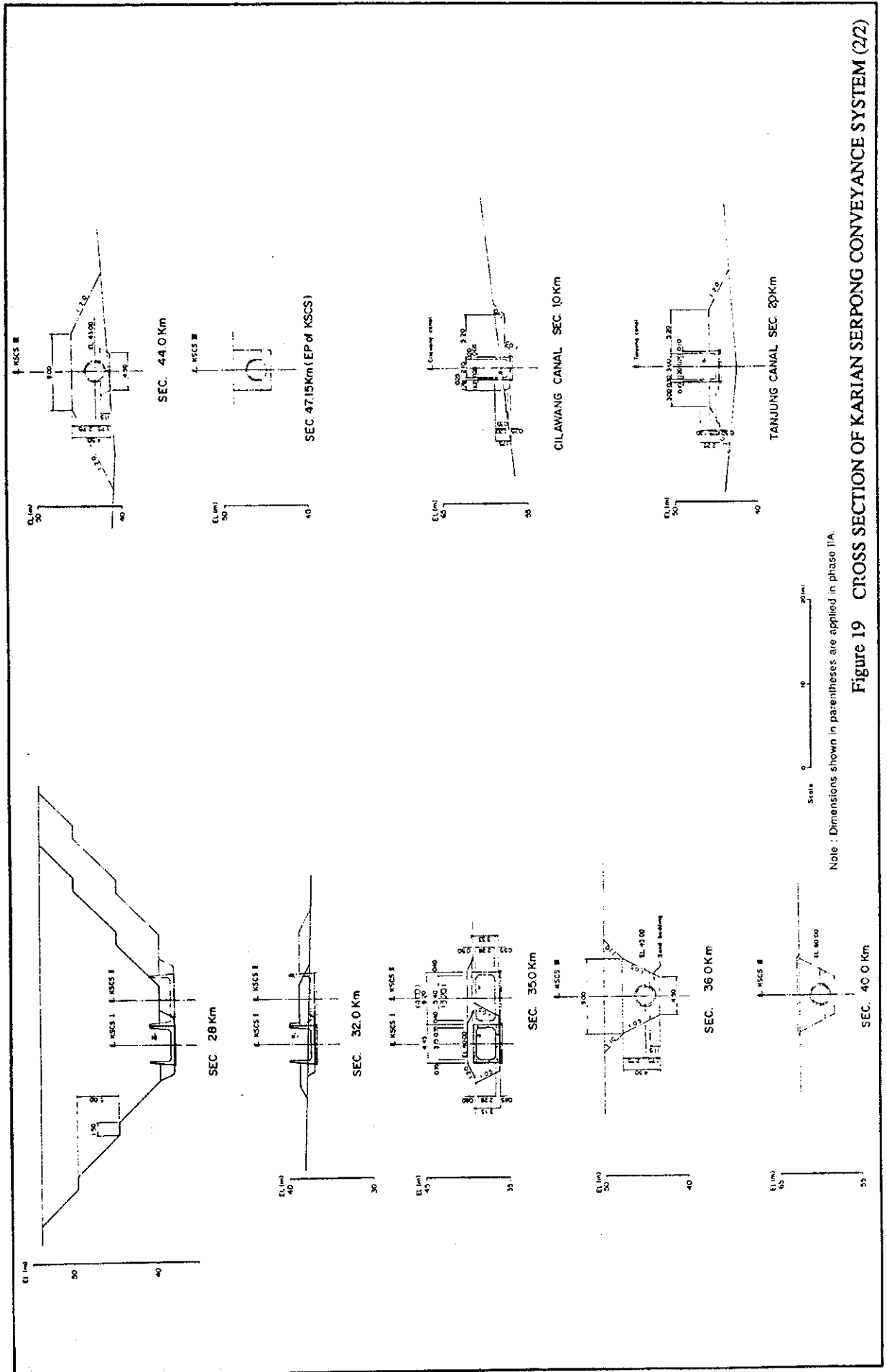


Figure 19 CROSS SECTION OF KARIAN SERPONG CONVEYANCE SYSTEM (2/2)

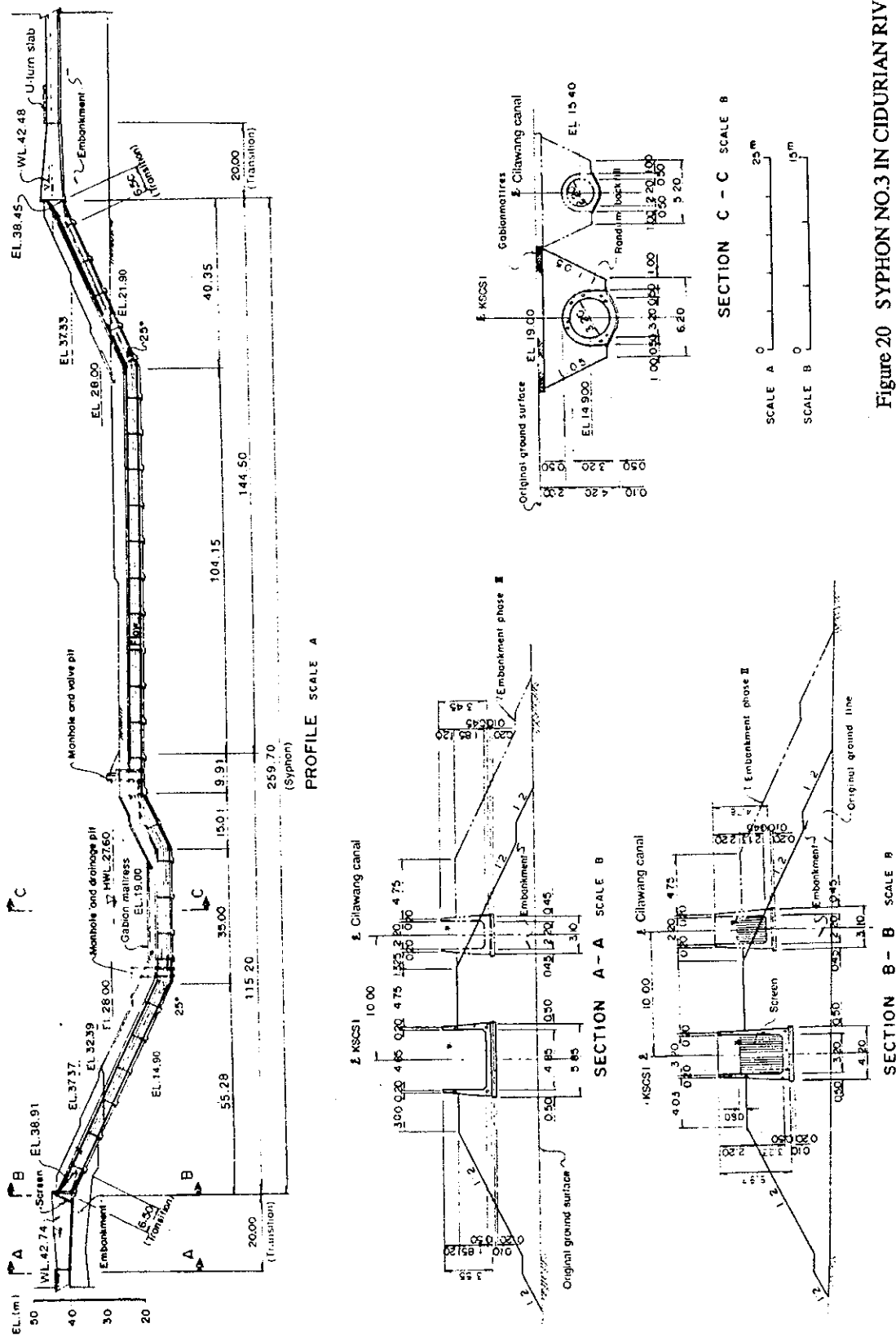


Figure 20 SYPHON NO.3 IN CIDURIAN RIVER

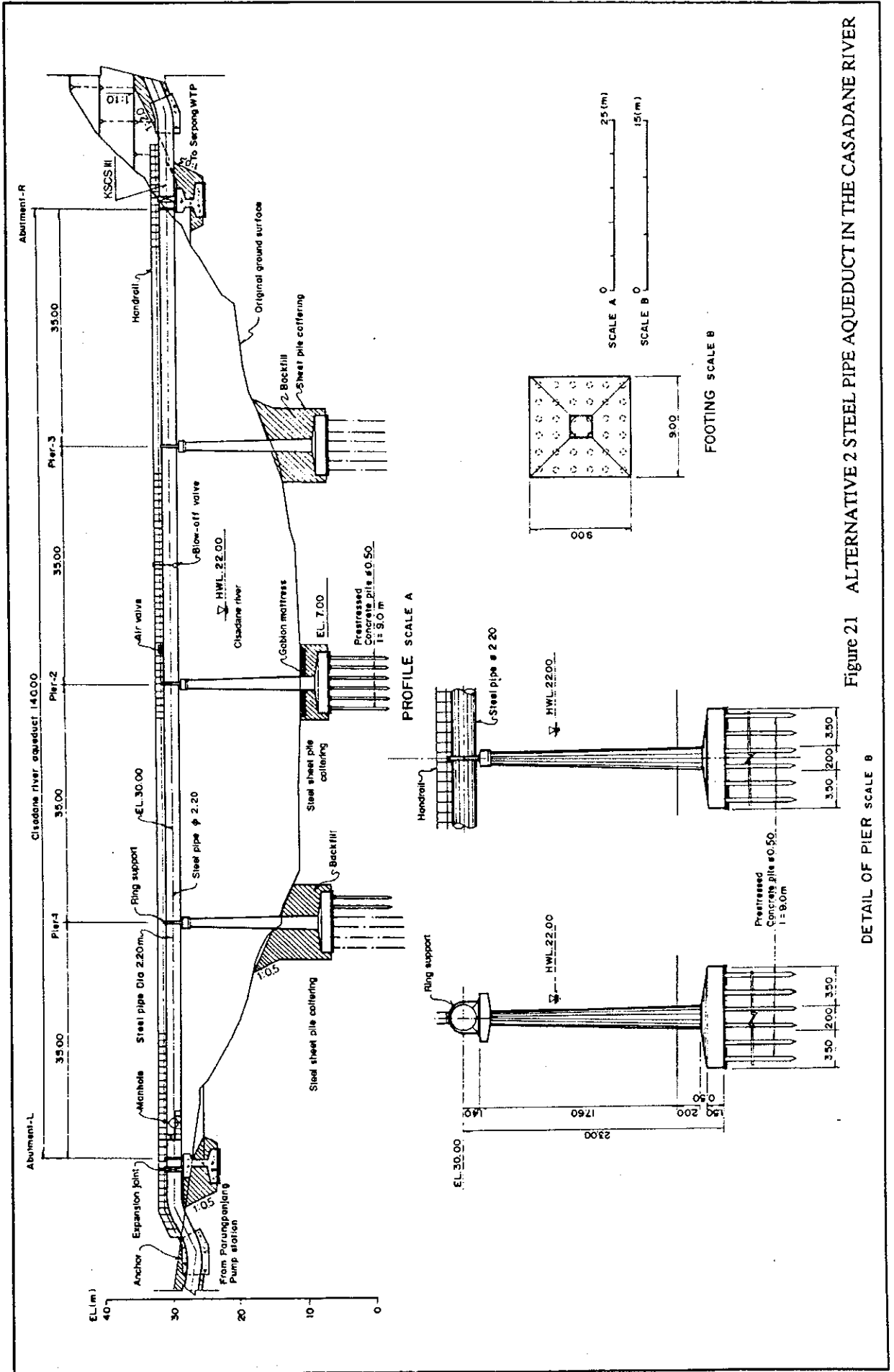
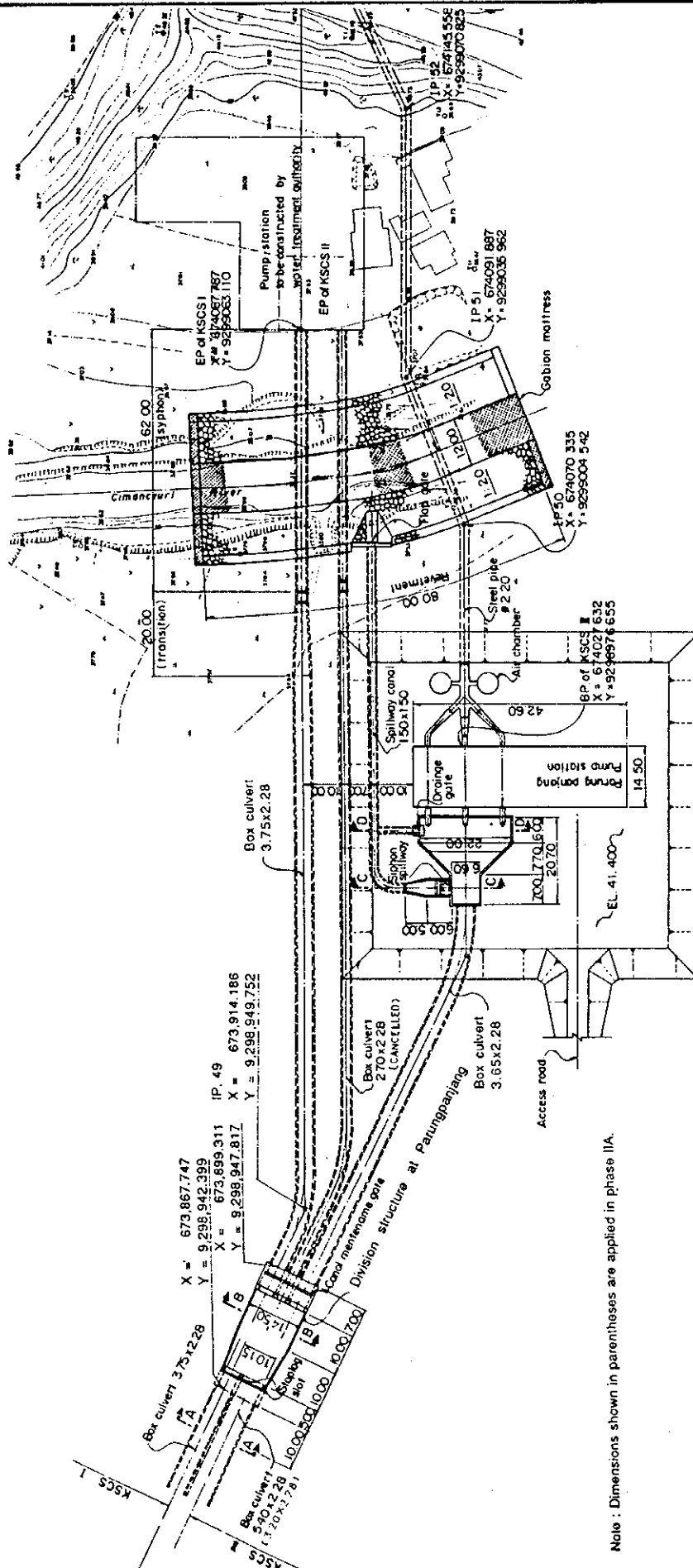


Figure 21 ALTERNATIVE 2 STEEL PIPE AQUEDUCT IN THE CASADANE RIVER

DETAIL OF PIER SCALE B



Note : Dimensions shown in parentheses are applied in phase IIA.

PLAN

Figure 22 LAYOUT OF DIVERSION STRUCTURE AND PUMP STATION AT PARUNG PANJANG

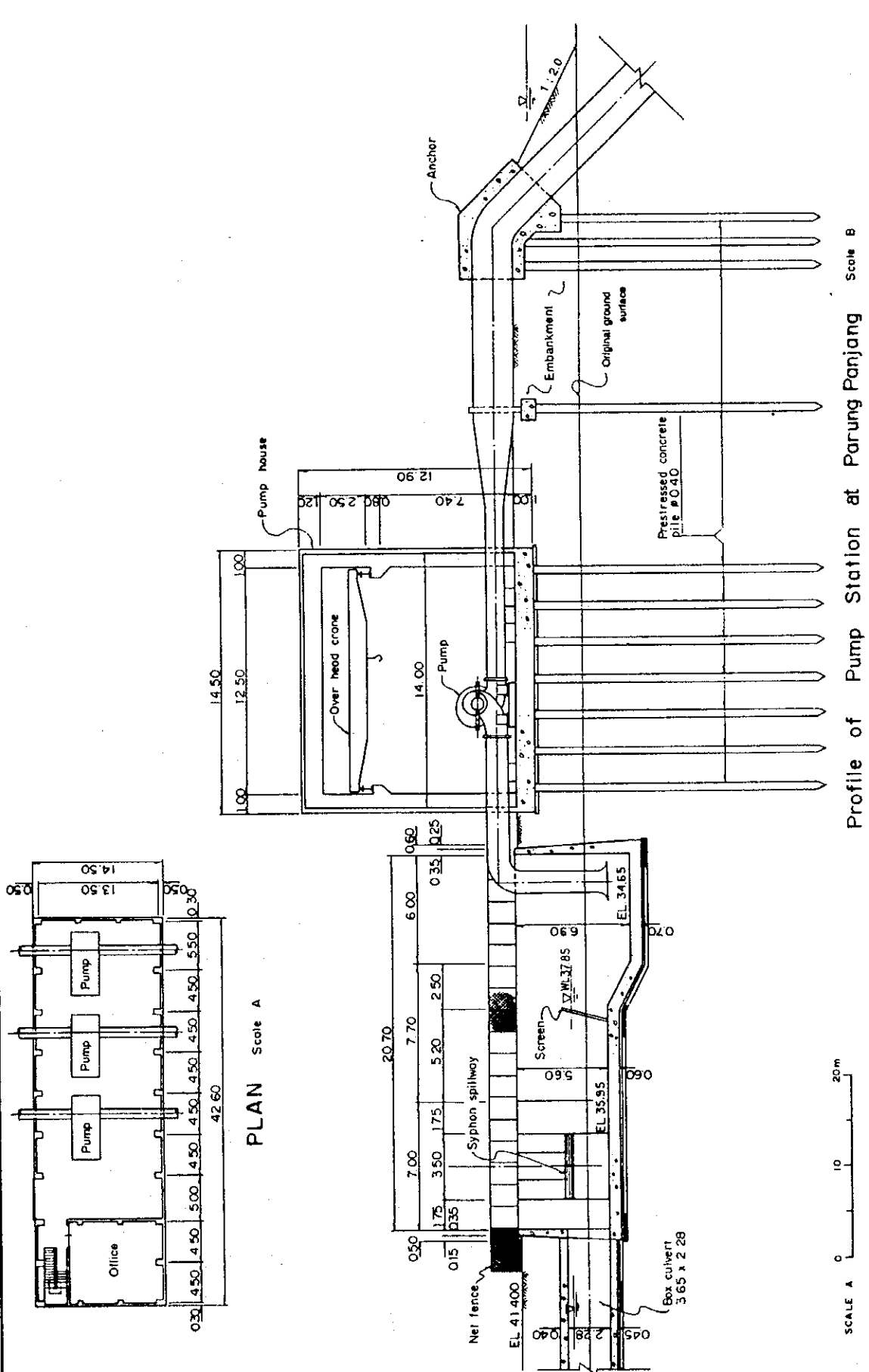


Figure 23 PLAN AND PROFILE OF PUMP STATION AT PARUNG PANJANG

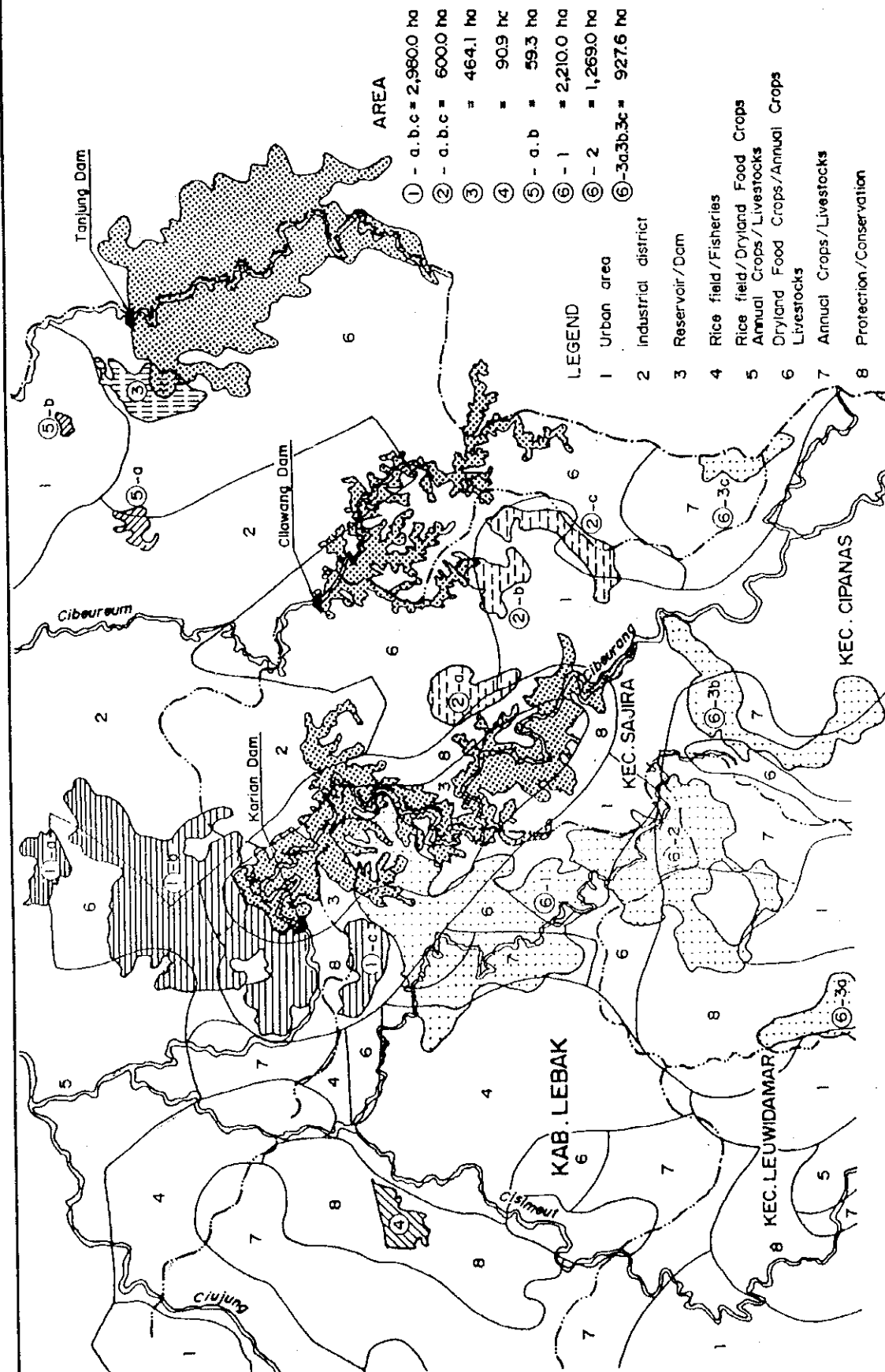
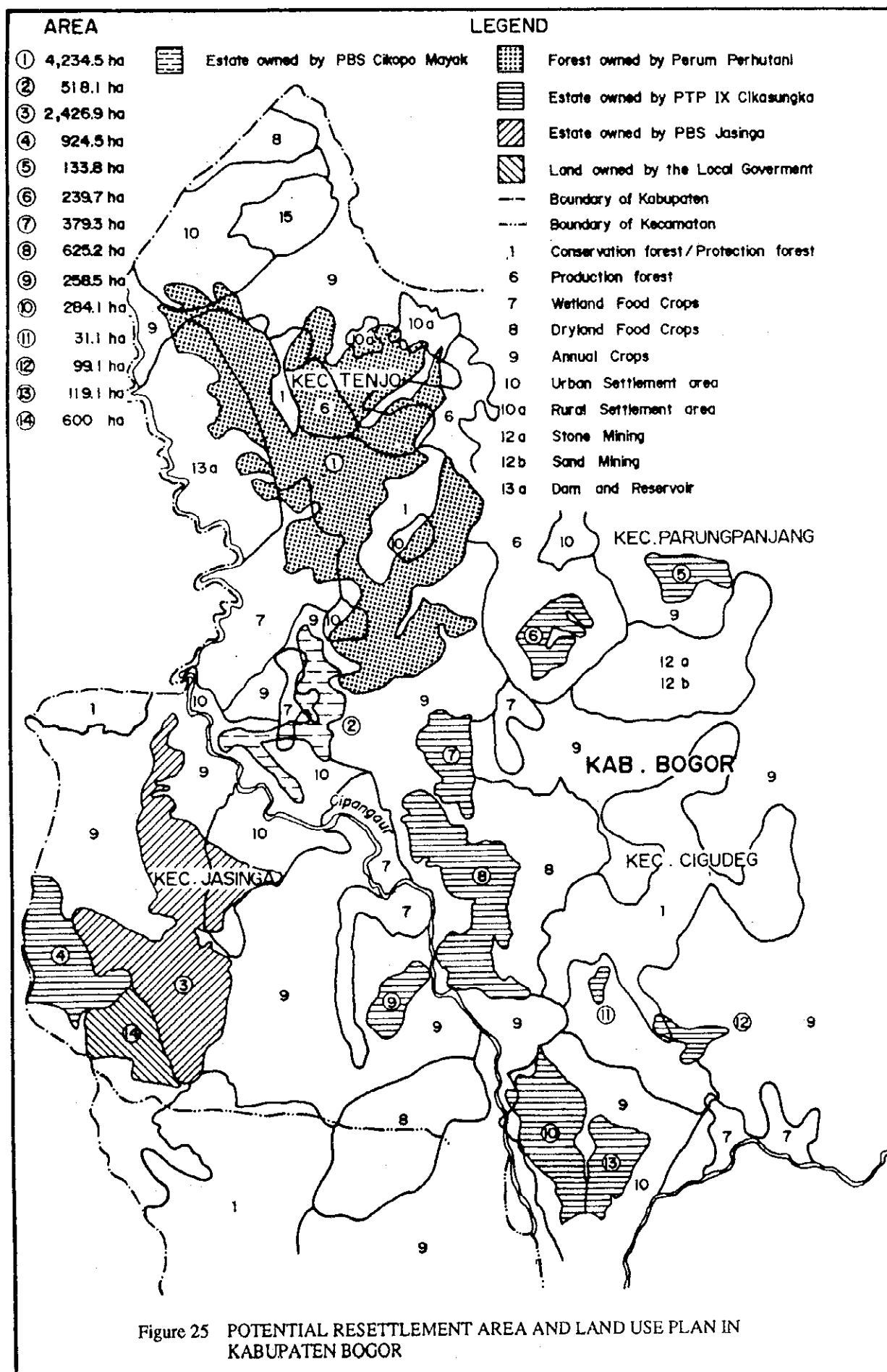
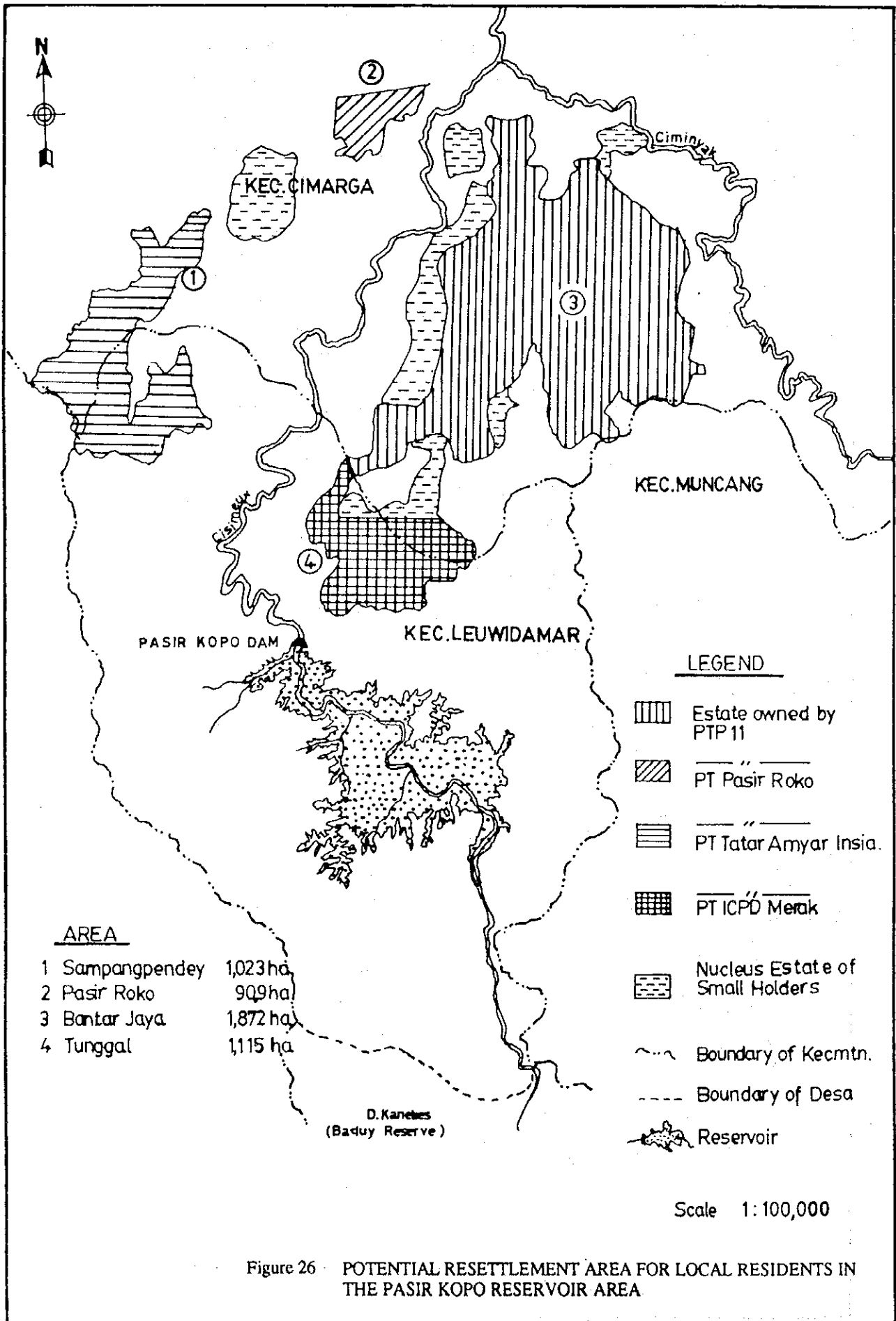


Figure 24 POTENTIAL RESETTLEMENT AREA AND LAND USE PLAN IN KABUPATEN LEBAK





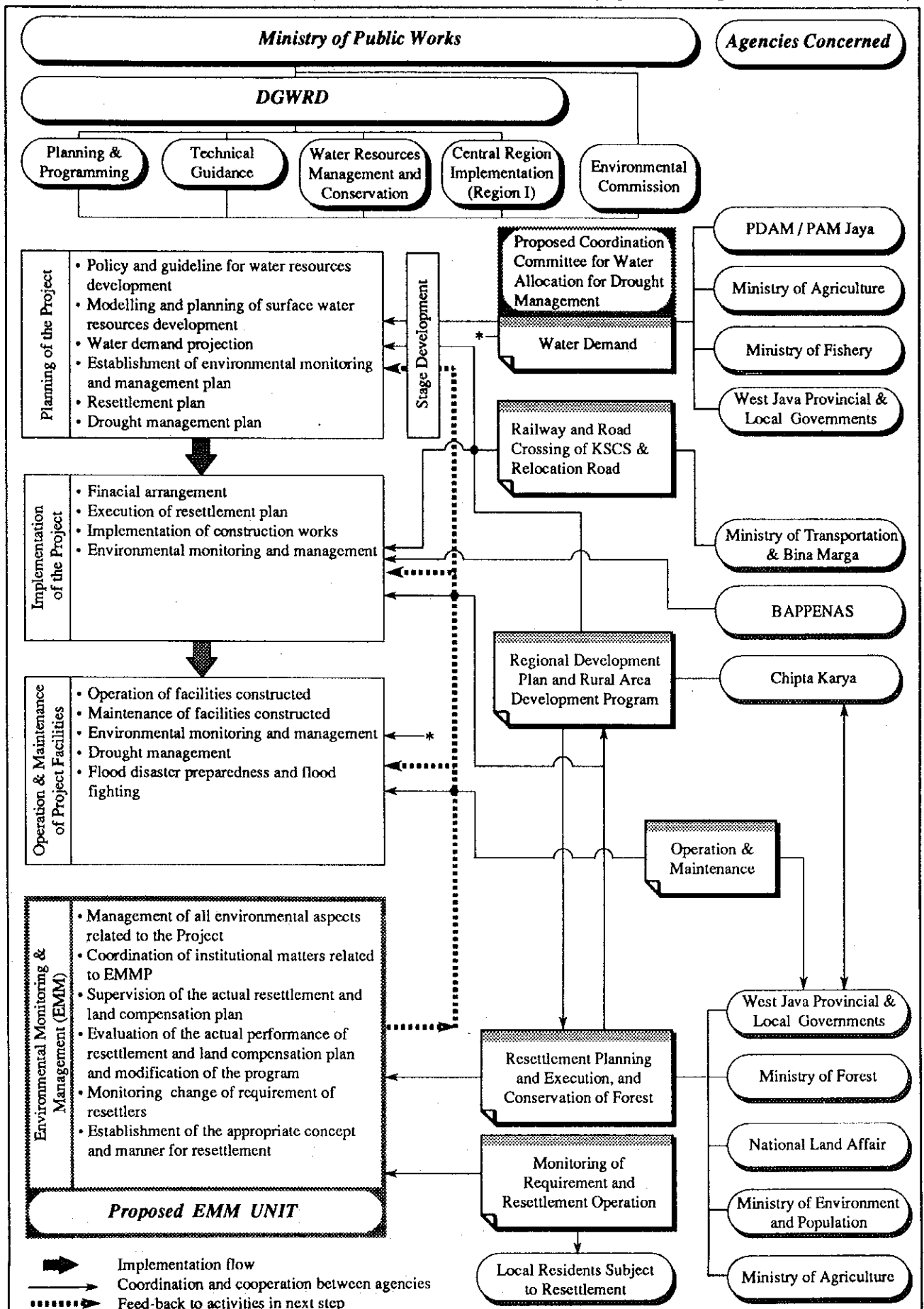
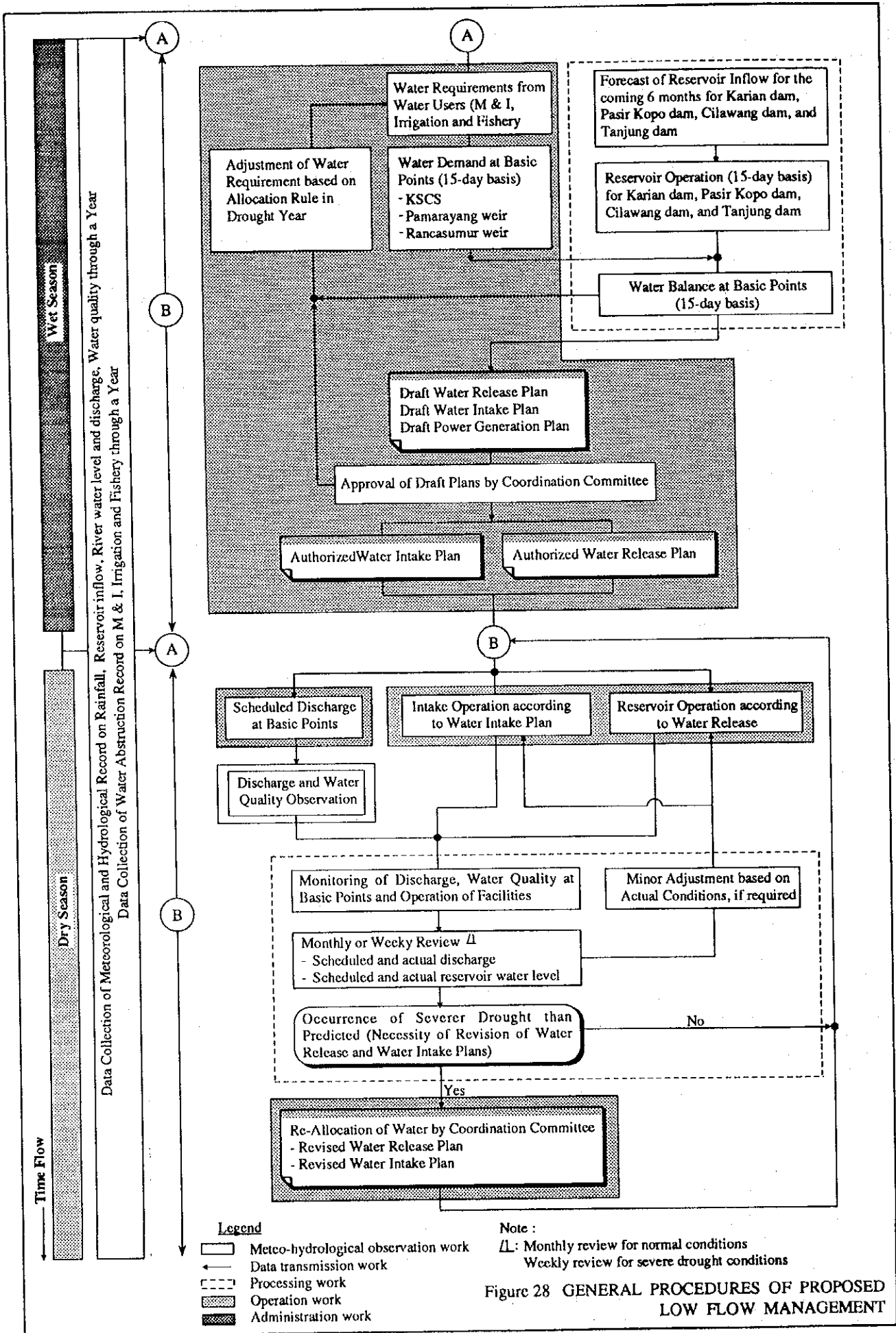


Figure 27 ORGANIZATION AND ACTIVITIES OF THE AGENCIES FOR IMPLEMENTATION OF THE PROJECT



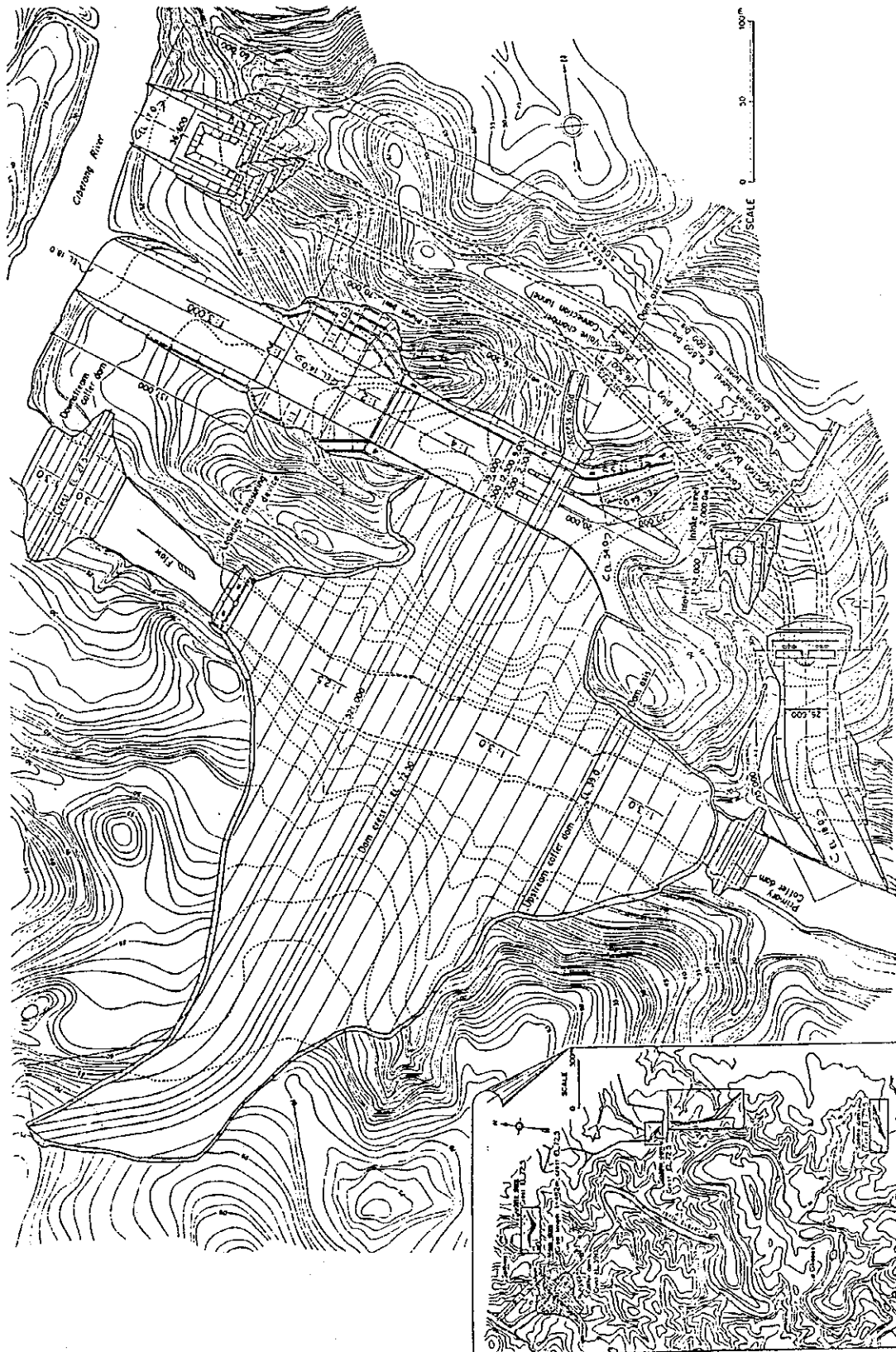


Figure 29 PLAN OF KARIAN DAM

Source : Feasibility Study on Karian Multipurpose Dam
Construction Project in 1985

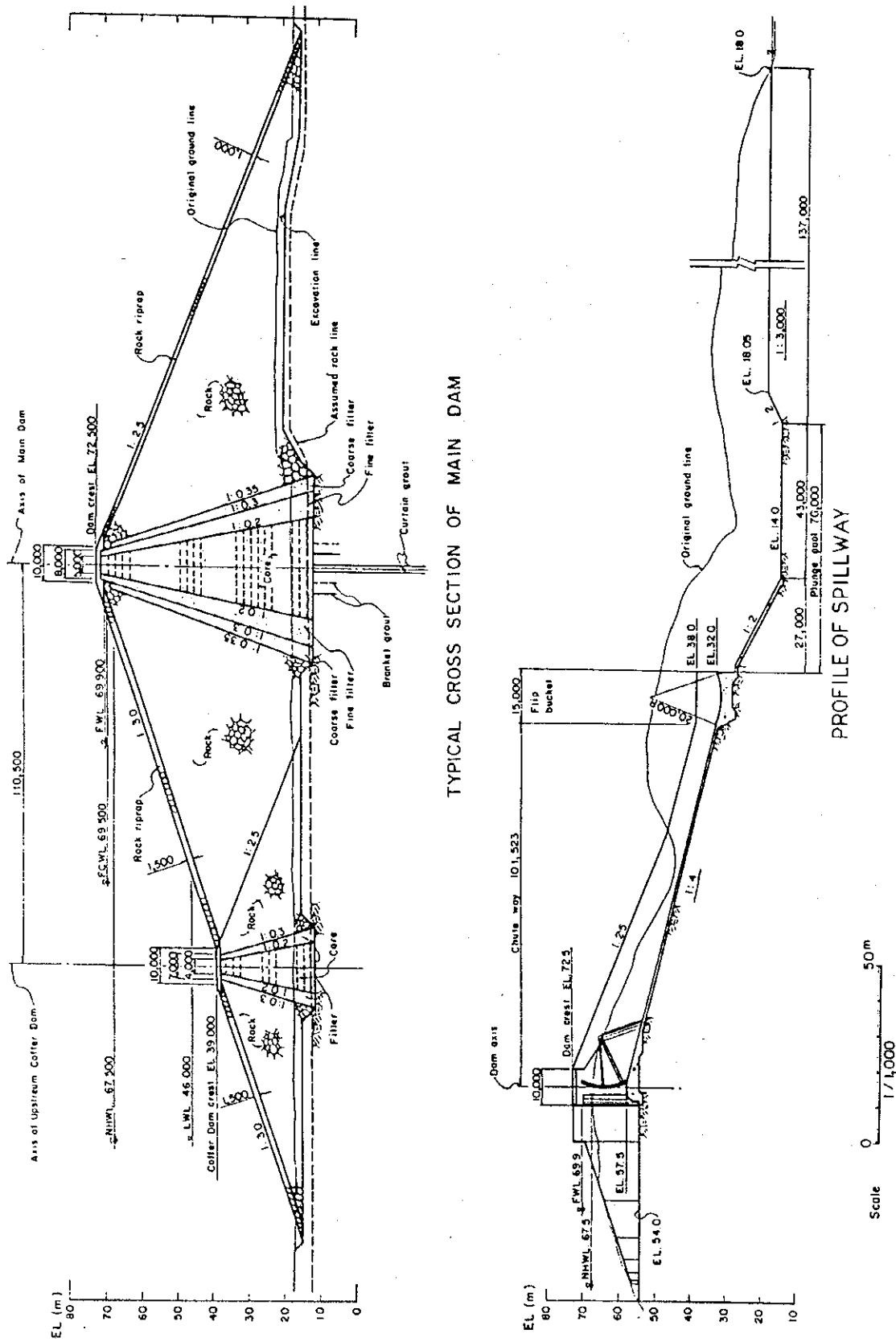


Figure 30 CROSS SECTION AND SPILLWAY OF KARIAN DAM

Source : Feasibility Study on Karian Multipurpose : Dam Construction Project in 1985