XVI ECONOMIC EVALUATION

SECTOR XVI
ECONOMIC EVALUATION

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CHAPTER 1 OVERALL DEVELOPMENT PLAN

1.1 Basic Conditions for Evaluation

1.1.1 Projects to be Evaluated

Five overall development projects are proposed in this study and economic evaluation is carried out. The development projects to be evaluated are as follows:

(1) Kampar Kanan Water Supply Project
(2) Kampar Kanan River Improvement Project
(3) Kampar and Kampar Kiri River Development Project
(4) Indragiri River Development Project
(5) Upper Indragiri River Improvement Project

1.1.2 Flood Control Plan

The Flood Control Plan is formulated to protect flood-prone areas from a 50-year return period flood and its economic viability is assessed, based on annual average benefit and economic project cost. The basic conditions for the economic evaluation of the Flood Control Plan are as follows:

(1) Annual average benefit or potential flood damage is calculated by the unit based on Landsat analysis data;

(2) Target year is fixed at the year 2019, and project life is assumed at 50 years, considering the durable life of facilities to be installed and other similar projects in Indonesia;

(3) Project benefit is estimated on the projected development stage in 2019; and

(4) Currency conversion rates are assumed at US$1.00 = Rp. 2,175 and 1.00 Yen = Rp. 21.90 as of July 1994.

1.1.3 Water Resources Development Plan

The Water Resource Development Plan aims to match the demand in 2019 for public, irrigation and hydropower uses. Public water supply corresponds to water demand consisting of (1) domestic, (2) industry, (3) tourism and (4) urban area flushing water. The benefit of both public and irrigation water and hydropower generation were estimated. The remaining four categories were not included in the estimation of benefit because these categories are not expected to bring any monetary benefit.

Basic conditions for economic evaluation of the Water Resource Development Plan are the same as those of the Flood Control Plan except item (1) above.

1.1.4 Hydropower Development Plan

The economic evaluation on the Hydropower Development Plan is conducted for Kampar Kiri No. 1 Dam, Kampar Kiri No. 2 Dam and Kuantan Dam which are proposed as multipurpose dams and have the function of hydropower generation.

Basic conditions for economic evaluation of the Hydropower Development Plan are the same as the Water Resources Development Plan, as mentioned above.

1.2 Economic Benefit

1.2.1 Flood Control Plan

Flood control benefit is defined as the reduction of inundation damage attributed to the proposed works. The reduction is obtained as the difference between the estimated inundation damage under the with- and the without-the-project situations.

Methodology and Calculation Conditions

(1) Mesh Data

From the economic viewpoint, inundation areas and assets were examined in project areas, which were divided into meshes. Present land use on each mesh of the project was based on LANDSAT analysis data. For future land use, increase of settlement area by the growth of population and increase of paddy field and plantation are taken into consideration according to the development plan of REPELITA VI and PJP II.

(2) Direct Damage

Damageable value is the maximum amount of asset value that will suffer from the inundation. Generally, direct damage in the area can be calculated as follows:

[Direct Damage in the Area (Rp.)] = [Area Size (ha)]
× [Damageable Value (Rp./ha)] × [Damage Rate]

Damageable value for each asset classification is as presented below.

(a) Agricultural and Aquacultural Products

In this study, paddy, vegetables, fruits, upland crops and plantation are taken into account for agricultural products, and fish is considered as and aquacultural product. The value of each product was estimated for the average net value of products, which was derived by the deduction of production cost from farmer's gate price (refer to Table XVI.1.1).

(b) Residential, Industrial and Business House and Buildings

These assets are divided into building and their household effects or indoor movables. The value of each building category is estimated on

the basis of average value per ha, referring to the data from the interview survey carried out by the study team. The quality and distribution of residences have been taken into consideration on the basis of the survey. This value of each building category is employed as the basic value of buildings in the project area (refer to Table XVI.1.2).

The value of indoor movables or household effects are assumed in proportion to the house/building value. Proportion applied for this estimation are as follows:

Residence	0.600
Industrial Building	2.000
Business Building	2.364
Public Building	0.769

(c) Public Facilities

Damage to public facilities is estimated in proportion to the damage to general assets (houses/buildings and their indoor movables) calculated above excluding the damage to agricultural crops, aquacultural crops and damages caused by business suspension. Proportions applied for this estimation are as follows:

Roads and Bridges	28.2%
Farmland	5.6%
Railways	13.2%
Telecommunications	3.1%
Electric Power Facilities	2.4%

These rates are employed in accordance with the field survey and other reports on flood control projects similar to this study, as well as the "Main Principles on Investigation of River Economy, Ministry of Construction, Japan".

(3) Indirect Damage

Damage caused by business suspension due to floods is estimated using the rate (6%) to the damage to general assets (houses/building and their indoor movables). The rate is applied in accordance with the field survey and other reports on flood control projects similar to this Study, as well as the "Main Principles on Investigation of River Economy, Ministry of Construction, Japan".

(4) Damage Rate by Inundation Depth

The damage rates for each item vulnerable to flood damage are determined in accordance with the inundation depth, the field survey and other reports on flood control projects similar to this study, as well as the "Main Principles on

Investigation of River Economy, Ministry of Construction, Japan" (refer to Table XVI.1.3). Inundation duration is taken into consideration for agricultural crops. Inundation depth is calculated by mesh unit for floods of 2-, 5-, 10-, 25-, and 50-year return periods (refer to SECTOR I, METEOROLOGY AND HYDROLOGY).

(5) Calculated Flood Damage

Direct flood damage as well as the indirect one is calculated for each mesh in the five cases of flooding condition mentioned above.

Estimation of Annual Average Benefit

Flood control benefit is defined as the expected amount of average annual reduction of damages by the proposed works, and it can be calculated in the following procedure:

- Assume several levels of flood discharge: 2-, 5-, 10-, 25-, and 50-year return periods in this study;
- Obtain the average annual probability of the discharges between one discharge level and the next (this can be derived from calculation of the excess probability for each discharge level and then, attaining the difference between these probabilities);
- Obtain the average annual amount of damage due to floods at this discharge level, multiplying the average annual probability by the amount of estimated damage at this discharge level; and
- Obtain a cumulative total of these amounts from the minimum discharge to the maximum discharge.

Estimated under the development conditions, the annual average benefits were calculated, as shown in Table XVI.1.4 and summarized in the following table.

Flood Control Project	Average Annual Benefit (Rp. 10^6)
(1) Kampar Kanan River Improvement Project	
- Bangkinang Area River Improvement Works	38,342
- Lower Kampar Kanan River Improvement Works	51,846
(2) Kampar and Kampar Kiri River Improvement Project	
- Kampar Kiri River Improvement Works	7,250
- Kampar Kiri No. 1 Dam	3,259
- Kampar Kiri No. 2 Dam	480
- Kampar River Improvement Works	35,298
(3) Indragiri River Development Project / Kuantan-Indragiri River Improvement Project	
- Lubukjambi-Peranap Area River Improvement Works	69,763
- Peranap-Japura Area River Improvement Works	58,833
- Rengat Area Flood Protection Works	36,536

(4) Upper Indragiri River Improvement Project	
- Payakumbuh Area River Improvement Works	43,556
- Solok Area River Improvement Works	34,453
- Sijunjung Area River Improvement Works	12,420

1.2.2 Water Resources Development Plan

Public Water

Since public water supply plan does not contain construction of water transmission line, treatment plants and distribution system, the benefit is considered as water supply at water sources. According to similar water supply projects in Indonesia in recent years, economic price of raw water ranges from Rp. 25/m^3 to Rp. 45/m^3. In this study the economic price of raw water is assumed to be Rp. 46.3/m^3 by taking account of growth rate of GRDP of Riau Province in recent years.

Kuok Intake Weir will supply public water for domestic water, urban area flushing, industry and tourism water, as well as irrigation water, for the Pekanbaru City. Lubukjambi Intake Weir will be constructed only to supply irrigation water and is not estimated for benefit with regard to domestic water.

It is assumed that the economic price of raw water is different from the quality of water and willingness to pay by customers. Especially, the quality of water for urban area flushing is assumed to be lower than other kinds of water, and then willingness to pay by its customers is cheaper than other kinds of water. Therefore, the price of raw water for urban area flushing is considered to be 60% of Rp. 46.3/m^3.

Kuok Intake Weir will start to supply public water at 4.78 m^3/s in 2004 and gradually increase the supply amount as the demand increases until 10.90 m^3/s in 2019. It will generate the average annual benefit of Rp. $5,075\times10^6$ at 4.78 m3/s and Rp. $12,230\times10^6$ at 10.90 m^3/s as shown in the table below.

Purpose	Unit Benefit (Rp./m^3)	2004		2019	
		Water Demand (m^3/s)	Annual Benefit (Rp. 10^6)	Water Demand (m^3/s)	Annual Benefit Rp. 10^6)
Domestic	46.3	1.06	1,547.7	3.80	5,548.4
Industry	46.3	0.45	657.1	0.78	1,138.9
Tourism	46.3	0.01	14.6	0.01	14.6
Urban Area Flushing	27.8	3.26	2,856.0	6.31	5,528.0
Total		4.78	5,075.4	10.90	12,229.9

Irrigation Water

The benefit by irrigation water is generated on (1) existing; (2) existing, rainfed; (3) existing, undeveloped; and (4) incremental paddy fields. Unit economic value of benefit is estimated at Rp. 1,020,300/ha. This value is the net value of rice derived

from deducing market price of production cost from farmer's gate price. In this study, it is assumed that unit economic value of benefit is different from the additional harvesting ratio by kind of paddy field. Then the unit economic values of benefit are estimated as follows:

Kinds of Paddy Field	Additional Harvesting Ratio (%)	Unit Economic Value of Benefit (Rp. 1,000/ha)
Existing	30	306.1
Existing (Rainfed)	60	612.2
Existing (Undeveloped)	100	1,020.3
Incremental	100	1,020.3

The area of paddy field and average annual benefit by kind of field and by starting year for the Rantauberangin Irrigation Area are estimated as follows:

Kind of Paddy Field	Unit Benefit (Rp. 1,000/ha)	Initial Phase (Start from 2005)		Final Phase (Start from 2010)	
		Area (ha)	Average Annual Benefit (Rp. 10^6)	Area (ha)	Average Annual Benefit (Rp. 10^6)
Existing	306.1 (30%)	3,659	1,120.0	0	0
Existing (Rainfed)	612.2 (60%)	928	568.1	0	0
Existing (Undeveloped)	1,020.3 (100%)	4,922	5,021.9	0	0
Incremental	1,020.3 (100%)	4,706	4,801.5	6,088	6,211.6
Total		14,215	11,511.5	6,088	6,211.6

Total benefit generated in the year 2010 is estimated at Rp. $17,723 \times 10^6$ which is accumulated for the benefit newly generated in the year 2005 and 2010 in the table shown above.

The area of paddy field and average annual benefit by kind of field and by starting year for Lubukjambi Irrigation Area are estimated as follows:

Kind of Paddy Field	Unit Benefit (Rp. 1,000/ha)	Initial Phase (Start from 2005)		Final Phase (Start from 2015)	
		Area (ha)	Average Annual Benefit (Rp. 10^6)	Area (ha)	Average Annual Benefit (Rp. 10^6)
Existing	306.1 (30%)	1,670	511.2	1,515	463.7
Existing (Rainfed)	612.2 (60%)	376	230.2	65	39.8
Existing (Undeveloped)	1,020.3 (100%)	2,096	2,138.5	650	663.2
Incremental	1,020.3 (100%)	5,234	5,340.3	18,543	18,919.4
Total		9,376	8,220.2	20,773	20,086.1

Total benefit generated in the year 2015 is estimated at Rp. $28,306 \times 10^6$ which is accumulated for the benefit newly generated in the year 2005 and 2015 in the table shown above.

1.2.3 Hydropower Development Plan

It is considered to be difficult to directly estimate economic benefit of a hydropower development plan. Therefore, economic benefit is estimated by means of the "alternative facilities' cost method" which is a method to evaluate the cost of alternative facilities as the benefit of the project, because the cost of alternative facilities will be saved when the project is implemented. In this method, the alternative facilities are the second best with the same characteristics as the hydropower generation project with regard to power supply.

Practically, the sum of kWh value (energy value) and kW value (power value) as the economic benefit of the hydropower generation plant is equivalent to the sum of kWh cost and kW cost of an alternative power generation plant. In this project, a hypothetical thermal power plant is assumed to be the alternative power generation plant. kWh cost and kW cost are estimated as shown in the table below. The unit kWh and kW values are assumed as follows:

kWh value	US$0.0178/kWh
kW value	US$318.14/kW (> 50,000 kW)
	US$391.66/kW (< 50,000 kW)

Energy in GWh, power in MW and unit values are summarized as follows:

Project	Starting Year	GWh	MW	Unit Value (Rp.)	
				kWh	kW
Kampar Kiri No. 1 Dam	2010	398.5	121.2	38.715	691,955
Kampar Kiri No. 2 Dam	2016	128.3	38.2	38.715	851,861
Kuantan Dam	2005	583.4	94.4	38.715	691,955
	2015	657.0	103.6	38.715	691,955

Then kWh cost and kW cost were estimated, as follows:

Project	Starting Year	kWh Value (Rp. 10^6)	kW Value (Rp. 10^6)	Annual Benefit (Rp. 10^6)
Kampar Kiri No. 1 Dam	2010	15,428	83,865	99,293
Kampar Kiri No. 2 Dam	2016	4,967	32,541	37,508
Kuantan Dam	2005	22,586	65,321	87,907
	2015	25,436	71,687	97,123

1.3 Economic Cost

1.3.1 Basic Conditions

Economic costs of the projects are nominal figures that duly reflect the economic value of goods and services involved. These costs are used only for the economic evaluation of the project.

The economic costs are converted from financial costs of the projects under the following conditions and assumptions:

(1) Transfer items such as value added tax (10% of market price of construction cost) and contractor's profit (10% of market price of construction materials procured locally) are exempted.

(2) Standard conversion factor (SCF) for local commodities and services is assumed to be 96.8% of the local prices, based on export and import statistics in recent years.

(3) Economic wage of unskilled laborers employed for construction works of the project is assumed to be 75% of the actual market wage, taking account of the employment opportunity of laborers in Indonesia.

(4) Economic cost of land compensation is assumed to be 90% of the actual payment, taking account of the opportunity cost of land.

(5) Price contingency is excluded from the financial cost, while physical contingency is included in the economic cost.

1.3.2 Economic Cost of Proposed Projects

Based on the basic conditions mentioned above, economic costs of the Overall Development Projects are estimated as follows (refer to Tables XV.1.25 to XV.1.29):

Project	Economic Cost (Rp. 10^6)
(1) Kampar Kanan Water Supply Project	234,606
(2) Kampar Kanan River Improvement Project	719,397
(3) Kampar and Kampar Kiri River Improvement Project	1,501,603
(4) Indragiri River Development Project	2,073,459
(5) Upper Indragiri River Improvement Project	553,387

1.4 Economic Evaluation on Overall Development Plan

1.4.1 Cash Flow of Annual Cost and Benefit

The Overall Development Plan is evaluated from the economic viewpoint by the calculation of indicators for the economic validity in terms of Economic Internal Rate

of Return (EIRR), Benefit-Cost Ratio (B/C) and Net Present Value (NPV), with comparison between cash flow of annual economic project cost and benefit that may accrue in the project life (refer to Tables XVI.1.5 to XVI.1.9).

The opportunity cost of capital is a criterion for judgment of economic feasibility of projects. Observing recent applications of opportunity cost of capital to similar projects in Indonesia, 10% has been applied. Furthermore, international financial institutions like the World Bank (IBRD), the Asian Development Bank (ADB), the Overseas Development Ministry of Britain (ODM) and the United States Agency of International Development (USAID) recommend application of 8% to 12% as the opportunity cost of capital to projects.

Hence, the opportunity cost of capital is assumed to be 10% which is applied to judge economic feasibility and used as a discount rate for cash flow of annual economic cost and benefit in this study.

To calculate the indicators of EIRR, B/C and NPV of the projects, the annual cost-benefit flow is estimated based on the disbursement schedule.

The benefit by irrigation is generated by irrigation system construction, intake weir construction and dam construction. Basically, the benefit by irrigation is produced after the completion of intake weir construction or dam construction. The benefit by irrigation accrues from the second year after the commencement of the irrigation system construction, or after completion of intake weir construction or dam construction, and generate full benefit after completion of the system.

The benefit is estimated according to the ratio of total implemented construction cost to total construction cost of each stage. With regard to the benefit accrued before the completion year of the final stage, total construction cost includes not only that of the final stage but also that of the initial stage.

The estimated operation, maintenance and replacement (OMR) cost is needed annually after the commencement of system operation.

1.4.2 Economic Viability of Projects

The economic viability of the five overall development projects has been assessed by means of EIRR, B/C and NPV as mentioned above, which were calculated based on the annual cost-benefit flow. A discount rate of 10% was applied. The economic viabilities of the five overall development plans were figured out as follows:

Project	EIRR (%)	B/C	NPV (Rp. 10^6)
(1) Kampar Kanan Water Supply Project	9.82	0.98	- 2,300
(2) Kampar Kanan River Improvement Project	10.30	1.03	7,592
(3) Kampar and Kampar Kiri River Development Project	12.46	1.23	71,146
(4) Indragiri River Development Project	13.19	1.33	222,775
(5) Upper Indragiri River Improvement Project	10.55	1.07	15,851
(6) All Overall Development Projects	11.90	1.20	315,451

Judging from the results of calculation for indicators, the Indragiri River Development Project has the highest economic viability. Its indicators show 13.19% of EIRR, 1.33 of B/C and Rp. $222,775 \times 10^6$ of NPV (refer to Tables XVI.1.5 to XVI.1.9).

As for the economic evaluation of all five projects integrated, the results show 11.90% of EIRR, 1.20 of B/C and Rp. $315,451 \times 10^6$ of NPV (refer to Table XVI.1.10).

CHAPTER 2 FEASIBILITY STUDY

2.1 Kampar Kanan Water Supply Project

2.1.1 Basic Conditions for Economic Evaluation

The basic conditions for economic evaluation of the Kampar Kanan Water Supply Project are the same as those of the Water Resources Development Plan of the Overall Development Plan.

2.1.2 Economic Benefit

Public Water

Basic conditions are the same as the Overall Development Plan. Kuok Intake Weir will start to supply water of 4.78 m^3/s in 2004 and gradually increase the supply amount as the demand increases until 10.90 m^3/s in 2019. It will generate the average annual benefit of Rp. $5,075 \times 10^6$ at 4.78 m^3/s and Rp. $12,230 \times 10^6$ at 10.90 m^3/s.

Irrigation Water

The area of paddy field and average annual benefit for Kuok Intake Weir calculated based on the same unit economic values as the Overall Development Plan at the starting year 2004 are as follows:

Kind of Paddy Field	Initial Phase (Start from 2004)	
	ha	Annual Average Benefit (Rp. 10^6)
Existing	3,659	1,120.0
Existing (Rainfed)	928	568.1
Existing (Undeveloped)	4,922	5,021.9
Incremental	4,706	4,801.5
Total	14,215	11,511.5

2.1.3 Economic Cost

Basic conditions are the same as the Overall Development Plan. The economic project cost is thus estimated at Rp. $162,695 \times 10^6$ (refer to Table XV.2.10).

2.1.4 Economic Evaluation

(1) Annual Cost-Benefit Flow

The priority project is evaluated from the economic viewpoint by the calculation of indicators for the economic validity in terms of Economic Internal Rate of Return (EIRR), Benefit-Cost Ratio (B/C) and Net Present

Value (NPV), with comparison between cash flow of annual economic project cost and benefit that may accrue in the project life (refer to Table XVI.2.1).

The opportunity cost of capital is assumed to be 10% which is applied to a discount rate for cash flow of annual economic cost and benefit.

The benefit is assumed to accrue at the same level until the end of project life. The estimated operation, maintenance and replacement (OMR) cost is needed annually after project completion to keep duly the designed function.

(2) Evaluation of Kampar Kanan Water Supply Project

The EIRR as well as B/C and NPV for the project is calculated on the annual cost-benefit flow. The discount rate of 10% is applied for the calculation of B/C and NPV. The economic viability is as follows:

EIRR	10.14%
B/C	1.02
NPV	Rp. $1,524 \times 10^6$

(3) Sensitivity Analysis

Sensitivity analysis is carried out for the project on several cases of changes in the benefit or cost, as summarized below.

CASE	EIRR (%)	B/C	NPV (Rp. 10^6)
Benefit, 5% down	9.91	0.99	- 920
Benefit, 10% down	9.45	0.94	- 5,561
Cost, 5% up	9.93	0.99	- 734
Cost, 10% up	9.54	0.95	- 5,189

2.1.5 Project Justification

The EIRR of the project shows 10.14%, and in any case of sensitivity analysis on case changes in the benefit or cost, it is more than 9.4% as presented above. The Kampar Kanan Water Supply Project is therefore evaluated to be economically viable.

Furthermore, consideration is given to the exclusion of intangible benefits generated by the project such as preservation or improvement of environment that may be lost without the project in this calculation. If these intangible benefits are quantified, the EIRR can be a higher figure and viability of the project will increase.

2.2 Bangkinang Area River Improvement Works

2.2.1 Basic Conditions for Economic Evaluation

The flood control project of the Bangkinang Area River Improvement Works was recommended as a priority project selected on the basis of the same criteria as Kampar Kanan Water Supply Project in the Overall Development Plan. The economic evaluation for the project is conducted for Bangkinang Area in Kampar Kanan River on the design scale of 5-year return period.

The basic conditions for the economic evaluation of Bangkinang Area River Improvement Works are the same as those of the Flood Control Plan of the Overall Development Plan.

2.2.2 Economic Benefit

Methodology and Calculation Conditions

The economic benefit of the Bangkinang Area River Improvement Works is calculated with the same methodology and conditions as the Flood Control Plan in the Overall Development Plan.

Estimation of Annual Average Benefit

Flood control benefit is calculated in the same procedure as the Flood Control Plan in the Overall Development Plan. Estimated under the development conditions, the annual average benefit of river improvement of Bangkinang area is Rp. $28{,}111\times10^6$ (refer to Table XVI.2.2).

2.2.3 Economic Cost

The same conditions and assumptions as the Kampar Kanan Water Supply Project are applied to the Bangkinang Area River Improvement Project. The economic cost for river improvement of Bangkinang area is Rp. $204{,}867\times10^6$ (refer to Table XV.2.11).

2.2.4 Economic Evaluation

(1) Annual Cost-Benefit Flow

To calculate the indicators of EIRR, B/C and NPV of the projects, the annual cost-benefit flow is estimated based on the disbursement schedule (refer to Table XVI.2.3).

The benefit is assumed to accrue during the construction period because some of the completed works may bring project effect to a certain degree, and to increase gradually until the target year 2004 and keep the same level until the end of project life. The estimated operation, maintenance and replacement

(OMR) cost is needed annually after project completion to keep duly the designed function.

(2) Evaluation of Bangkinang Area River Improvement Works

The EIRR as well as B/C and NPV for the project is calculated on the annual cost-benefit flow. The discount rate of 10% is applied for the calculation of B/C and NPV. The economic viability is as follows:

EIRR	10.19%
B/C	1.02
NPV	Rp. $2,216 \times 10^6$

(3) Sensitivity Analysis

Sensitivity analysis is carried out from for the project on several cases of changes in the benefit or cost as summarized below.

CASE	EIRR (%)	B/C	NPV (Rp. 10^6)
Benefit, 5% down	9.73	0.97	- 3,120
Benefit, 10% down	9.25	0.92	- 8,456
Cost, 5% up	9.75	0.99	- 3,009
Cost, 10% up	9.34	0.93	- 8,234

2.2.5 Project Justification

The EIRR of the Bangkinang Area River Improvement Works shows 10.19%, and in any case of sensitivity analysis on case changes in the benefit or cost, it is more than 9.2% as presented above. The Works are therefore evaluated to be economically viable.

Furthermore, consideration is given to the exclusion of intangible benefits generated by the project such as saving of invaluable human lives that may possibly be lost by flooding, protection from possible injuries, and prevention of disease occurrence. If these intangible benefits are quantified, the EIRR can be a higher figure and viability of the project will increase.

2.3 Kuantan River Multipurpose Development Project

2.3.1 Basic Conditions for Economic Evaluation

The economic evaluation for the Kuantan River Multipurpose Development Project is conducted for the Kuantan Dam Construction Works, the Lubukjambi Intake Weir Construction Works and the Lubukjambi Irrigation System Construction Works, which were recommended as priority project based on the same criteria as the Kampar Kanan Water Supply Project in the Overall Development Plan. Kuantan Dam Construction Works has functions of irrigation water supply, flood control with

the scale of 5-year return period for the Kuantan Dam - Peranap Area, and hydropower generation.

The basic conditions for the economic evaluation of Kuantan River Multipurpose Development Plan are basically the same as those of Kampar Kanan Water Supply Project.

2.3.2 Economic Benefit

(1) Lubukjambi Irrigation System Construction Works

The benefit by irrigation water is calculated with the same unit economic values as the Overall Development Plan. The average annual benefit is estimated as follows:

Kinds of Paddy Field	Initial Phase (Start from 2005)	
	ha	Average Annual Benefit (Rp. 10^6)
Existing	1,670	511.2
Existing (Rainfed)	376	230.2
Existing (Undeveloped)	2,096	2,138.5
Incremental	5,234	5,340.3
Total	9,376	8,220.2

(2) Flood Control

Methodology, calculation conditions and estimation of average annual benefit of flood control of Lubukjambi-Peranap Area of the Indragiri River are the same as those of the Bangkinang Area River Improvement Works. The average annual benefit of flood control was calculated at Rp. $51{,}337 \times 10^6$ (refer to Table XVI.2.2).

(3) Hydropower Development Plan

It is considered to be difficult to estimate directly the economic benefit of the hydropower development plan. Therefore, economic benefit is estimated by means of the "alternative facilities' cost method" which is a method to evaluate the cost of alternative facilities as the benefit of the project, because the cost of alternative facilities will be saved when the project is implemented. In this method, the alternative facilities are the second best with the same characteristics as the hydropower development project with regard to power supply.

Practically, kWh value (capacity value or energy value) and kW value (power value) as the economic benefit of the hydropower generation plant is equivalent to kWh cost and kW cost of alternative power generation plant. In this project, a hypothetical thermal power plant is assumed to be the

alternative power generation plant. The annual benefit by hydropower has been estimated, as shown in the table below.

Particulars	Value	Unit Benefit	Annual Benefit (Rp. 10^6)
Output (90% Dependable)	94.4 MW	US$318.14/kW	65,321
Annual Generated Energy	583.4 Gwh	US$0.0178/kWh	22,586
Total			87,907

Note: Conversion rate is US$1.00 = Rp. 2,175.

2.3.3 Economic Cost

The same conditions and assumptions as the Kampar Kanan Water Supply Project are applied to the Kuantan River Multipurpose Development Project. The economic cost of the project is estimated at Rp. 613,636×10^6 (refer to Table XV.2.12).

2.3.4 Economic Evaluation

(1) Annual Cost-Benefit Flow

To calculate the indicators of EIRR, B/C and NPV of the Kuantan River Multipurpose Development Project, the annual cost-benefit flow is estimated based on the disbursement schedule..

The benefit of the river improvement plan is assumed to accrue during the construction period because some of the completed works may bring project effect to a certain degree, and to increase gradually until the target year, and the benefits of all plans will keep the same level until the end of project life. The estimated operation, maintenance and replacement (OMR) cost is needed annually after project completion to keep duly the designed function (refer to Table XVI.2.4).

(2) Evaluation of the Project

The EIRR as well as B/C and NPV for the project is calculated on the annual cost-benefit flow. The opportunity cost of capital is considered to be 10% in the project. Then, the discount rate of 10% is applied for the calculation of B/C and NPV. The economic viability is as follows:

EIRR	15.27%
B/C	1.74
NPV	Rp. 256,670×10^6

(3) Sensitivity Analysis

Sensitivity analysis is carried out for the project on several cases of changes in the benefit or cost as summarized below.

CASE	EIRR (%)	B/C	NPV (Rp. 10^6)
Benefit, 5% down	14.79	1.66	228,947
Benefit,10% down	14.23	1.58	198,742
Cost, 5% up	14.82	1.67	241,904
Cost, 10% up	14.33	1.59	224,657

2.3.5 Basic Conditions for Financial Evaluation

The financial evaluation on the Hydropower Development Plan is conducted for Kuantan Dam. Basic conditions for financial evaluation are basically the same as those of Kampar Kanan Water Supply Project.

2.3.6 Financial Benefit (Revenue)

Financial benefit is considered to be revenue from consumers of electric power. Annual revenue is calculated on the basis of the following assumptions.

(1) Unit Price of Revenue

In this study, it is assumed that average power rate is a unit price of revenue at Rp. 170/kWh which is estimated on the basis of historical total energy sold, total revenue and average power rate from 1984 to 1993 for the Pekanbaru Branch Office of PLN Region III.

(2) Annual Revenue

By using the produced energy of 583.4 GWh/year calculated in SECTOR IX, HYDROPOWER GENERATION PLAN, the annual revenue of the project is estimated at Rp. $99{,}178 \times 10^6$.

(3) Increase of Average Power Rate

Usually, power rate increases by revision because of inflation, but the increase of power rate is not taken into account in the financial evaluation.

2.3.7 Financial Cost

Financial cost of the project is estimated as real expenses of the project owner. In other works, financial cost is evaluated by market price including contractor's profit, price contingencies and value added tax.

Detailed conditions for financial cost estimate are mentioned in SECTOR XV, PROJECT COST ESTIMATE. The estimated financial cost is Rp. $406{,}872 \times 10^6$ excluding price contingency (refer to Table XV.2.14).

2.3.8 Financial Evaluation

(1) Annual Cost-Benefit Flow

To calculate the indicators of Financial Internal Rate of Return (FIRR), B/C and NPV of the project, the annual cost-benefit flow is estimated based on the disbursement schedule.

The financial benefit (revenue) for the Hydropower Generation Plan is assumed to generate after the completion year 2004 keep the same level until the end of project life. The estimated operation, maintenance and replacement (OMR) cost is needed annually after project completion to keep duly the designed function (refer to Table XVI.2.5).

(2) Evaluation of the Project

The FIRR as well as B/C and NPV for the project is calculated on the annual cost-benefit flow. The weighted average interest rate for long term loan is considered to be 8.3% per annum by referring to interest rates of international financial institutions like the Overseas Economic Cooperation Fund (OECF) of Japan at 2.6% per annum and interest rates of domestic banks at 14% per annum. Then, the discount rate of 8.3% is applied for the calculation of B/C and NPV. The financial viability is as follows:

FIRR	15.54%
B/C	2.22
NPV	Rp. $314{,}097 \times 10^6$

(3) Sensitivity Analysis

Sensitivity analysis is carried out for the project on several cases of changes in the benefit or cost as summarized below.

CASE	EIRR (%)	B/C	NPV (Rp. 10^6)
Benefit, 5% down	14.32	1.98	268,425
Benefit,10% down	13.76	1.87	239,815
Cost, 5% up	14.35	1.98	283,276
Cost, 10% up	13.87	1.89	269,518

2.3.9 Project Justification

The EIRR of the Kuantan River Multipurpose Development Project shows 15.27%, and in any case of sensitivity analysis on case changes in the benefit or cost, it is more than 14.2% as presented above. The Kuantan River Multipurpose Development Project is therefore evaluated to be economically viable.

Furthermore, consideration is given to the exclusion of intangible benefits generated by the project such as saving of invaluable human lives that may possibly be lost by flooding, protection from possible injuries, and prevention of disease occurrence. If these intangible benefits are quantified, the EIRR can be a higher figure and viability of the project will increase.

The FIRR of the Hydropower Development Project shows 15.54%, and in any case of sensitivity analysis on case changes in the benefit or cost, it is over 13.7% as presented above. The Hydropower Development Project is therefore evaluated to be financially viable.

2.4 Rengat Area Flood Protection Works

2.4.1 Basic Conditions for Evaluation

The Rengat Area Flood Protection Works is formulated to protect the flood prone area from less than 10-year return period flood, and its economic viability is assessed on the basis of annual average benefit and economic project cost. The basic conditions for the economic evaluation of Rengat Area Flood Protection Works are basically the same as those of the Bangkinang Area River Improvement Works.

2.4.2 Economic Benefit

Methodology, calculation conditions and estimation of annual average benefit are the same as those of the Bangkinang Area River Improvement Works. The average annual benefit was estimated at Rp. $5{,}002 \times 10^6$, as shown in Table XVI.2.2.

2.4.3 Economic Cost

The same conditions and assumptions as the Kampar Kanan Water Supply Project are applied to the project. The economic cost for the project is estimated at Rp. $33{,}400 \times 10^6$ (refer to Table XV.2.13).

2.4.4 Economic Evaluation

(1) Annual Cost-Benefit Flow

To calculate the indicators of EIRR, B/C and NPV of the project, the annual cost-benefit flow is estimated based on the disbursement schedule.

The benefit is assumed to accrue during the construction period because some of the completed works may bring project effect to a certain degree, and to increase gradually until the target year 2000 and keep the same level until the end of project life. The estimated operation, maintenance and replacement (OMR) cost is needed annually after project completion to keep duly the designed function (refer to Table XVI.2.6).

(2) Evaluation of Rengat Area Flood Protection Works

The EIRR as well as B/C and NPV for the Rengat Area Flood Protection Works is calculated on the annual cost-benefit flow. The opportunity cost of capital is considered to be 10% in the project. Then, the discount rate 10% is applied for the calculation of B/C and NPV. The economic viability is as follows:

EIRR	11.00%
B/C	1.11
NPV	Rp. $2,815 \times 10^6$

(3) Sensitivity Analysis

Sensitivity analysis is carried out for the project on several cases of changes in the benefit or cost as summarized below.

CASE	EIRR (%)	B/C	NPV (Rp. 10^6)
Benefit, 5% down	10.52	1.06	1,444
Benefit, 10% down	10.03	1.00	72
Cost, 5% up	10.54	1.06	1,584
Cost, 10% up	10.12	1.01	354

2.4.5 Project Justification

The EIRR of the Rengat Area Flood Protection Works shows 11.00%, and in any case of sensitivity analysis on case changes in the benefit or cost, it is more than 10.0% as presented above. The Rengat Area Flood Protection Works is therefore evaluated to be economically viable.

Furthermore, consideration is given to the exclusion of intangible benefits generated by the project such as saving of invaluable human lives that may possibly be lost by flooding, protection from possible injuries, and prevention of disease occurrence. If these intangible benefits are quantified, the EIRR can be a higher figure and viability of the project will increase.

2.5 All Projects

An integrated economic evaluation is conducted for all priority projects in the Feasibility Study. By this evaluation, the final judgment of feasibility is made possible for all projects.

2.5.1 Economic Evaluation

(1) Annual Cost-Benefit Flow

To calculate the indicators of EIRR, B/C and NPV of all projects, the annual cost-benefit flow is calculated by accumulation of the annual costs and benefits of all projects in the Feasibility Study consisting of the Flood Control, Water Resources Development and Hydropower Development projects (refer to Table XVI.2.7).

The benefit of river improvement project is assumed to accrue during the construction period because some of the completed works may bring project effect to a certain degree, and to increase gradually until the target year and keep the same level until the end of project life. The estimated operation, maintenance and replacement (OMR) cost is needed annually after project completion to keep duly the designed function.

(2) Integrated Evaluation

The EIRR as well as B/C and NPV for project is calculated on the annual cost-benefit flow. The opportunity cost of capital is considered to be 10% in the project. Then, the discount rate 10% is applied for the calculation of B/C and NPV. The economic viability is as follows:

EIRR	13.59%
B/C	1.46
NPV	Rp. $263,292 \times 10^6$

(3) Sensitivity Analysis

Sensitivity analysis is carried out for the project on several cases of changes in the benefit or cost as summarized below.

CASE	EIRR (%)	B/C	NPV (Rp. 10^6)
Benefit, 5% down	13.15	1.40	226,349
Benefit, 10% down	12.60	1.33	184,796
Cost, 5% up	13.17	1.41	239,744
Cost, 10% up	12.70	1.34	211,586

2.5.2 Project Justification

The EIRR of the projects as a whole shows 13.59%, and in any case of sensitivity analysis on case changes in the benefit or cost, it is more than 12.6% as presented above. The project for the Feasibility Study as a whole is therefore evaluated to be economically viable.

TABLES

XVI ECONOMIC EVALUATION

Table XVI.1.1 ESTIMATES OF ECONOMIC PRICE OF AGRICULTURAL AND AQUACULTURAL PRODUCTS

(at 1994 Price)

Name of Products	Area	Productions	Yield	Market Price					Economic Price *1)				
				Farm Gate Price		Production Cost		Net Value	Farm Gate Price		Production Cost		Net Value
	(ha.)	(tons)	(tons/ha.)	(Rp./ton)	(Rp./ha.)	(Rp./ton)	(Rp./ha.)	(Rp./ha.)	(Rp./ton)	(Rp./ha.)	(Rp./ton)	(Rp./ha.)	(Rp./ha.)
Paddy	520,425	2,139,397	4.11	429,688	1,766,388	173,277	712,320	1,054,068	415,938	1,709,864	167,733	689,526	1,020,338
Wet Paddy	473,738	2,038,500	4.30	644,532	2,773,427	259,916	1,118,422	1,655,004	623,907	2,684,677	251,599	1,082,633	1,602,044
Dry Paddy	46,687	100,897	2.16	322,266	696,460	129,958	280,857	415,603	311,953	674,174	125,799	271,870	402,304
Upland Crops	94,412	437,592	4.63	312,140	1,446,744	197,589	915,810	530,934	302,152	1,400,448	191,266	886,504	513,944
Maize	25,952	58,103	2.24	377,158	844,405	231,533	518,371	326,034	365,089	817,384	224,124	501,783	315,601
Cassava	18,144	270,098	14.89	188,579	2,807,253	115,766	1,723,341	1,083,912	182,544	2,717,421	112,062	1,668,194	1,049,227
Sweet Potato	5,655	54,488	9.64	226,295	2,180,433	138,920	1,338,543	841,890	219,053	2,110,659	134,474	1,295,709	814,949
Peanuts	13,791	18,076	1.31	1,000,000	1,310,710	481,429	631,013	679,697	968,000	1,268,767	466,023	610,821	657,946
Soybean	30,870	36,827	1.19	905,174	1,079,846	691,630	825,094	254,752	876,208	1,045,290	669,497	798,691	246,600
Vegetables	41,675	106,524	2.56	452,589	1,156,848	277,840	710,176	446,672	438,107	1,119,829	268,949	687,450	432,379
Fruits	13,112	90,685	6.92	678,884	4,695,287	416,759	2,882,384	1,812,904	657,160	4,545,038	403,423	2,790,147	1,754,891
Estate	1,100,143	821,951	0.75	320,071	239,135	156,999	117,299	121,836	309,829	231,483	151,975	113,546	117,937
Rubber	393,758	156,013	0.40	671,000	265,861	407,000	161,260	104,601	649,528	257,353	393,976	156,099	101,254
Oil Palm	270,088	351,540	1.30	100,000	130,158	38,000	49,460	80,698	96,800	125,993	36,784	47,877	78,115
Coconut	436,297	314,398	0.72	392,000	282,477	166,000	119,621	162,857	379,456	273,438	160,688	115,793	157,645
Fish	124,878	31,078	0.25	995,691	247,795	285,908	71,153	176,642	963,829	239,865	276,759	68,876	170,989

Source: 1. Riau in Figures,1992,Statistical Office of Riau Province

2. West Sumatra in Figures ,1992,Statistical Office of West Sumatra Province

3. Provincial Office of Agriculture in Riau

4. Provincial Office of Agriculture in West Sumatra

Note: *1) Standard conversion rate (SCF) of 0.968 is applied to change market price to economic price.

TableXVI.1.2 VALUE OF ASSETS OF HOUSES AND BUILDINGS

Classification of Assets	Average Area of Ground Floor*1) (m^2)	Average Value of Assets per House / Building *1) (Rp.)	Average Value of Assets (Rp./m^2)	Density Indicator *2)			Average Value of Assets by Density		
				Low Density	Middle Density	High Density	Low Density (10^6Rp./ha)	Middle Density (10^6Rp./ha)	High Density (10^6Rp./ha)
Residential House									
House									
Permanent	55	14,164,123	257,530	5	3	1.5	515	858	1,717
Semi Permanent	62	7,815,510	126,875	5	3	1.5	254	423	846
Temporary	67	3,782,259	56,452	5	3	1.5	113	188	376
Household Effects									
Permanent		8,498,474	386,294				773	1,288	2,575
Semi Permanent		4,689,306	190,313				381	634	1,269
Temporary		2,269,355	84,677				169	282	565
Shops		24,998,218	534,721				1,069	1,782	3,565
Buildings	47	10,415,924	222,801	5	3	1.5	446	743	1,485
Stocks and Equipments		14,582,294	311,921				624	1,040	2,079
Offices		4,975,546	85,816				172	286	572
Buildings	63	2,261,612	35,757	5	3	1.5	72	119	238
Household Effects		2,713,934	50,059				100	167	334
Factories		90,569,445	1,317,374				2,635	4,391	8,782
Buildings	138	30,189,815	219,562	5	3	1.5	439	732	1,464
Stocks and Equipments		60,379,630	1,097,811				2,196	3,659	7,319
Public Buildings		123,843,580	1,143,548				2,287	3,812	7,624
Governmental Bld.		47,245,128	312,364				625	1,041	2,082
Buildings	165	21,475,058	130,152	5	3	1.5	260	434	868
Stocks and Equipments		25,770,070	182,213				364	607	1,215
School		30,062,576	21,864				44	73	146
Buildings	2,200	20,041,717	9,110	5	3	1.5	18	30	61
Stocks and Equipments		10,020,859	12,754	5			26	43	85
Hospital		46,535,877	809,320				1,619	2,698	5,395
Buildings	275	20,232,990	73,575	5	3	1.5	147	245	490
Stocks and Equipments		26,302,887	735,745				1,471	2,452	4,905

Note: *1) Results of Interview Survey carried out by JICA study team

*2) "Density Indicator" stands for ratio of settlement area to ground floor area.

Table XVI.1.3 Damage Rates of Assets by Inundation Depth

Inundation Depth(m)	Vegetables	Fruits	Plantation	Paddy	Upland Crops	Fish Pond	House & Building	Household Effects
0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.01 - 0.50	0.590	0.590	0.062	0.500	0.620	0.300	0.048	0.095
0.50 - 1.00	0.750	0.750	0.100	0.710	1.000	0.800	0.065	0.210
1.00 - 1.50	0.840	0.840	0.100	0.710	1.000	1.000	0.098	0.364
1.50 - 2.00	0.840	0.840	0.100	0.740	1.000	1.000	0.098	0.549
2.00 -2.50	0.840	0.840	0.100	0.740	1.000	1.000	0.137	0.549
2.50 <	0.840	0.840	0.100	0.740	1.000	1.000	0.137	0.549

Table XVI.1.4(1/4) CALCULATION OF AVERAGE ANNUAL BENEFIT OF FLOOD CONTROL PROJECT
(KAMPAR RIVER:BANKINANG AREA)

Return Period (Year)	Flood Damage Reduction (10^6Rp.)	Average Damage Reduction (10^6Rp.)	Expectation	Probable Benefit (10^6Rp.)	Average Annual Benefit (10^6Rp.)
1	0				
		24,551.6	0.5	12,275.8	12,275.8
2	49,103.2				
		52,784.4	0.3	15,835.3	28,111.1
5	56,465.7				
		56,624.5	0.1	5,662.5	33,773.6
10	56,783.4				
		56,945.4	0.06	3,416.7	37,190.3
25	57,107.4				
		57,601.1	0.02	1,152.0	38,342.3
50	58,094.9				

(KAMPAR RIVER:LOWER REACHES)

Return Period (Year)	Flood Damage Reduction (10^6Rp.)	Average Damage Reduction (10^6Rp.)	Expectation	Probable Benefit (10^6Rp.)	Average Annual Benefit (10^6Rp.)
1	0				
		32,532.5	0.5	16,266.2	16,266.2
2	65,065.0				
		70,127.4	0.3	21,038.2	37,304.5
5	75,189.7				
		77,988.6	0.1	7,798.9	45,103.3
10	80,787.5				
		83,093.0	0.06	4,985.6	50,088.9
25	85,398.6				
		87,838.8	0.02	1,756.8	51,845.7
50	90,279.0				

(KAMPAR KIRI RIVER:KAMPAR KIRI NO.1 DAM)

Return Period (Year)	Flood Damage Reduction (10^6Rp.)	Average Damage Reduction (10^6Rp.)	Expectation	Probable Benefit (10^6Rp.)	Average Annual Benefit (10^6Rp.)
1	0				
		1,784.0	0.5	892.0	892.0
2	3,568.1				
		4,254.0	0.3	1,276.2	2,168.2
5	4,939.9				
		5,508.3	0.1	550.8	2,719.0
10	6,076.7				
		6,581.8	0.06	394.9	3,114.0
25	7,086.9				
		7,264.1	0.02	145.3	3,259.2
50	7,441.3				

Table XVI.1.4(2/4) CALCULATION OF AVERAGE ANNUAL BENEFIT OF FLOOD CONTROL PROJECT
(KAMPAR KIRI RIVER:KAMPAR KIRI NO.2 DAM)

Return Period (Year)	Flood Damage Reduction (10^6Rp.)	Average Damage Reduction (10^6Rp.)	Expectation	Probable Benefit (10^6Rp.)	Average Annual Benefit (10^6Rp.)
1	0				
		285.2	0.5	142.6	142.6
2	570.5				
		627.3	0.3	188.2	330.8
5	684.1				
		754.4	0.1	75.4	406.2
10	824.8				
		898.4	0.06	53.9	460.1
25	972.1				
		975.5	0.02	19.5	479.7
50	978.9				

(KAMPAR KIRI RIVER IMPROVEMENT)

Return Period (Year)	Flood Damage Reduction (10^6Rp.)	Average Damage Reduction (10^6Rp.)	Expectation	Probable Benefit (10^6Rp.)	Average Annual Benefit (10^6Rp.)
1	0				
		4,587.8	0.5	2,293.9	2,293.9
2	9,175.5				
		9,767.0	0.3	2,930.1	5,224.0
5	10,358.5				
		9,581.3	0.1	958.1	6,182.1
10	8,804.0				
		10,395.9	0.06	623.8	6,805.9
25	11,987.8				
		11,995.9	0.02	239.9	7,045.8
50	12,004.1				

(KAMPAR RIVER IMPROVEMENT)

Return Period (Year)	Flood Damage Reduction (10^6Rp.)	Average Damage Reduction (10^6Rp.)	Expectation	Probable Benefit (10^6Rp.)	Average Annual Benefit (10^6Rp.)
1	0				
		23,119.1	0.5	11,559.6	11,559.6
2	46,238.3				
		47,463.0	0.3	14,238.9	25,798.5
5	48,687.8				
		49,536.9	0.1	4,953.7	30,752.2
10	50,386.0				
		52,983.8	0.06	3,179.0	33,931.2
25	55,581.6				
		59,721.7	0.02	1,194.4	35,125.6
50	63,861.7				

Table XVI.1.4(3/4) CALCULATION OF AVERAGE ANNUAL BENEFIT OF FLOOD CONTROL PROJECT
(INDRAGIRI RIVER:LUBUKJAMBI-PERANAP)

Return Period (Year)	Flood Damage Reduction (10^6Rp.)	Average Damage Reduction (10^6Rp.)	Expectation	Probable Benefit (10^6Rp.)	Average Annual Benefit (10^6Rp.)
1	0				
		45,028.1	0.5	22,514.1	22,514.1
2	90,056.3				
		96,075.0	0.3	28,822.5	51,336.6
5	102,093.7				
		94,418.9	0.1	9,441.9	60,778.4
10	86,744.0				
		95,266.3	0.06	5,716.0	66,494.4
25	103,788.5				
		106,290.9	0.02	2,125.8	68,620.2
50	108,793.4				

(INDRAGIRI RIVER:PERANAP-JAPURA)

Return Period (Year)	Flood Damage Reduction (10^6Rp.)	Average Damage Reduction (10^6Rp.)	Expectation	Probable Benefit (10^6Rp.)	Average Annual Benefit (10^6Rp.)
1	0				
		37,677.6	0.5	18,838.8	18,838.8
2	75,355.3				
		79,678.2	0.3	23,903.5	42,742.3
5	84,001.1				
		65,614.1	0.1	6,561.4	49,303.7
10	47,227.2				
		70,898.6	0.06	4,253.9	53,557.6
25	94,570.0				
		96,833.4	0.02	1,936.7	55,494.3
50	99,096.8				

(INDRAGIRI RIVER:RENGAT AREA)

Return Period (Year)	Flood Damage Reduction (10^6Rp.)	Average Damage Reduction (10^6Rp.)	Expectation	Probable Benefit (10^6Rp.)	Average Annual Benefit (10^6Rp.)
1	0				
		20,990.9	0.5	10,495.4	10,495.4
2	41,981.8				
		49,422.3	0.3	14,826.7	25,322.1
5	56,862.8				
		55,312.4	0.1	5,531.2	30,853.4
10	53,761.9				
		62,564.5	0.06	3,753.9	34,607.2
25	71,367.1				
		75,318.9	0.02	1,506.4	36,113.6
50	79,270.8				

Table XVI.1.4(4/4) CALCULATION OF AVERAGE ANNUAL BENEFIT OF FLOOD CONTROL PROJECT
(INDRAGIRI RIVER:PAYAKUNBUH AREA)

Return Period (Year)	Flood Damage Reduction (10^6Rp.)	Average Damage Reduction (10^6Rp.)	Expectation	Probable Benefit (10^6Rp.)	Average Annual Benefit (10^6Rp.)
1	0				
		3,472.6	0.5	1,736.3	1,736.3
2	6,945.2				
		57,265.0	0.3	17,179.5	18,915.8
5	107,584.7				
		117,617.4	0.1	11,761.7	30,677.5
10	127,650.1				
		148,007.4	0.06	8,880.4	39,558.0
25	168,364.6				
		174,734.5	0.02	3,494.7	43,052.7
50	181,104.4				

(INDRAGIRI RIVER:SOLOK AREA)

Return Period (Year)	Flood Damage Reduction (10^6Rp.)	Average Damage Reduction (10^6Rp.)	Expectation	Probable Benefit (10^6Rp.)	Average Annual Benefit (10^6Rp.)
1	0				
		14,953.3	0.5	7,476.6	7,476.6
2	29,906.5				
		44,520.7	0.3	13,356.2	20,832.8
5	59,134.9				
		66,297.3	0.1	6,629.7	27,462.6
10	73,459.7				
		83,297.6	0.06	4,997.9	32,460.4
25	93,135.5				
		99,609.2	0.02	1,992.2	34,452.6
50	106,082.9				

(INDRAGIRI RIVER:SIJUNJUNG AREA)

Return Period (Year)	Flood Damage Reduction (10^6Rp.)	Average Damage Reduction (10^6Rp.)	Expectation	Probable Benefit (10^6Rp.)	Average Annual Benefit (10^6Rp.)
1	0				
		7,131.4	0.5	3,565.7	3,565.7
2	14,262.8				
		16,590.7	0.3	4,977.2	8,542.9
5	18,918.5				
		20,212.9	0.1	2,021.3	10,564.2
10	21,507.3				
		22,625.7	0.06	1,357.5	11,921.7
25	23,744.2				
		24,931.4	0.02	498.6	12,420.4
50	26,118.6				

Table XVI.1.5 CASH FLOW OF ECONOMIC COST AND BENEFIT FOR KAMPAR KANAN WATER SUPPLY PROJECT

Unit: Million Rp.

No.	Year	Economic Cost						Benefit			
		Construction	Compensation	Administration	Engineering Service	Physical Contingency	OMR	Total	Water Supply	Irrigation	Total	Net Benefit
-13	1996			708	2,467	246		3,421			0	-3,421
-12	1997			708	2,056	206		2,970			0	-2,970
-11	1998		455	708	2,056	251		3,470			0	-3,470
-10	1999		2,049	1,063	1,645	369		5,126			0	-5,126
-9	2000	12,138	2,049	1,063	822	1,501		17,573			0	-17,573
-8	2001	28,939		708	1,371	3,031		34,049			0	-34,049
-7	2002	33,601		708	1,371	3,497		39,177			0	-39,177
-6	2003	31,422		708	1,371	3,279		36,780			0	-36,780
-5	2004	17,104		708	549	1,765	497	20,623	5,075	10,057	15,132	-5,491
-4	2005						569	569	5,552	11,512	17,064	16,495
-3	2006		2,458	626	3,609	607	569	7,869	6,029	11,512	17,541	9,672
-2	2007	19,656		626	722	2,037	569	23,610	6,506	11,512	18,018	-5,592
-1	2008	24,570		1,566	1,203	2,577	658	30,574	6,983	13,771	20,754	-9,820
0	2009	9,828		313	481	1,031	769	12,422	7,460	16,594	24,054	11,632
1	2010						813	813	7,937	17,723	25,660	24,847
2	2011						813	813	8,414	17,723	26,137	25,324
3	2012						813	813	8,891	17,723	26,614	25,801
4	2013						813	813	9,368	17,723	27,091	26,278
5	2014						813	813	9,845	17,723	27,568	26,755
6	2015						813	813	10,322	17,723	28,045	27,232
7	2016						813	813	10,799	17,723	28,522	27,709
8	2017						813	813	11,276	17,723	28,999	28,186
9	2018						813	813	11,753	17,723	29,476	28,663
10	2019						813	813	12,230	17,723	29,953	29,140
11	2020						813	813	12,230	17,723	29,953	29,140
12	2021						813	813	12,230	17,723	29,953	29,140
13	2022						813	813	12,230	17,723	29,953	29,140
14	2023						813	813	12,230	17,723	29,953	29,140
15	2024						813	813	12,230	17,723	29,953	29,140
16	2025						813	813	12,230	17,723	29,953	29,140
17	2026						813	813	12,230	17,723	29,953	29,140
18	2027						813	813	12,230	17,723	29,953	29,140
19	2028	21,436		1,072	857	2,230	813	26,408	12,230	17,723	29,953	3,545
20	2029						813	813	12,230	17,723	29,953	29,140
21	2030						813	813	12,230	17,723	29,953	29,140
22	2031						813	813	12,230	17,723	29,953	29,140
23	2032						813	813	12,230	17,723	29,953	29,140
24	2033						813	813	12,230	17,723	29,953	29,140
25	2034						813	813	12,230	17,723	29,953	29,140
26	2035						813	813	12,230	17,723	29,953	29,140
27	2036						813	813	12,230	17,723	29,953	29,140
28	2037						813	813	12,230	17,723	29,953	29,140
29	2038						813	813	12,230	17,723	29,953	29,140
30	2039						813	813	12,230	17,723	29,953	29,140
31	2040						813	813	12,230	17,723	29,953	29,140
32	2041						813	813	12,230	17,723	29,953	29,140
33	2042						813	813	12,230	17,723	29,953	29,140
34	2043						813	813	12,230	17,723	29,953	29,140
35	2044						813	813	12,230	17,723	29,953	29,140
36	2045						813	813	12,230	17,723	29,953	29,140
37	2046						813	813	12,230	17,723	29,953	29,140
38	2047						813	813	12,230	17,723	29,953	29,140
39	2048						813	813	12,230	17,723	29,953	29,140
40	2049						813	813	12,230	17,723	29,953	29,140
41	2050						813	813	12,230	17,723	29,953	29,140
42	2051						813	813	12,230	17,723	29,953	29,140
43	2052						813	813	12,230	17,723	29,953	29,140
44	2053						813	813	12,230	17,723	29,953	29,140
45	2054						813	813	12,230	17,723	29,953	29,140
46	2055						813	813	12,230	17,723	29,953	29,140
47	2056						813	813	12,230	17,723	29,953	29,140
48	2057						813	813	12,230	17,723	29,953	29,140
49	2058						813	813	12,230	17,723	29,953	29,140
50	2059						813	813	12,230	17,723	29,953	29,140
	TOTAL	198,694	7,011	11,285	20,580	22,627	44,280				EIRR =	9.82%

(Discount Rate 10%)

B/C = 0.98

NPV = -2,300

Table XVI.1.6 CASH FLOW OF ECONOMIC COST AND BENEFIT FOR KAMPAR KANAN RIVER IMPROVEMENT PROJECT

Unit: Million Rp.

No.	Year	Economic Cost						Benefit				
		Construction	Compensation	Administration	Engineering Service	Physical Contingency	OMR	Total	Bangkinang Area	Kampar Kan. Lower Reaches	Total	Net Benefit
-23	1996							0			0	0
-22	1997							0			0	0
-21	1998							0			0	0
-20	1999			1,340	7,395	740		9,475			0	-9,475
-19	2000		1,266	2,233	3,169	444		7,112			0	-7,112
-18	2001		1,266	2,680		127		4,073			0	-4,073
-17	2002	57,448		893	2,113	5,956		66,410			0	-66,410
-16	2003	71,811		893	3,522	7,534	287	84,047	6,517		6,517	-77,530
-15	2004	28,724		893	1,408	3,013	646	34,684	14,766		14,766	-19,919
-14	2005			2,157	11,943	1,194	790	16,084	18,169		18,169	2,085
-13	2006		3,080	3,595	5,119	819	790	13,403	18,832		18,832	5,429
-12	2007	69,662		4,313	2,275	7,193	790	84,233	19,495		19,495	-64,738
-11	2008	92,882		2,876	4,550	9,743	1,138	111,189	20,158	9,091	29,249	-81,940
-10	2009	92,882		1,438	4,550	9,743	1,603	110,216	20,821	21,092	41,913	-68,303
-9	2010						2,067	2,067	21,483	32,988	54,471	52,404
-8	2011						2,067	2,067	22,146	33,420	55,566	53,499
-7	2012			943	4,404	441	2,067	7,855	22,809	33,852	56,661	48,806
-6	2013		1,952	943		195	2,067	5,157	23,472	34,284	57,756	52,599
-5	2014	35,822		943	1,468	3,729	2,067	44,029	24,135	34,717	58,851	14,822
-4	2015	29,852		943	1,468	3,132	2,246	37,641	27,658	35,149	62,807	25,165
-3	2016			1,073	5,108	510	2,395	9,086	30,670	35,581	66,251	57,164
-2	2017		677	1,073		68	2,395	4,213	32,588	36,013	68,601	64,388
-1	2018	41,595		1,073	1,703	4,330	2,395	51,096	34,506	36,445	70,951	19,855
0	2019	34,662		1,073	1,703	3,637	2,603	43,678	36,424	44,748	81,172	37,494
1	2020						2,777	2,777	38,342	51,846	90,188	87,411
2	2021						2,777	2,777	38,342	51,846	90,188	87,411
3	2022						2,777	2,777	38,342	51,846	90,188	87,411
4	2023						2,777	2,777	38,342	51,846	90,188	87,411
5	2024						2,777	2,777	38,342	51,846	90,188	87,411
6	2025						2,777	2,777	38,342	51,846	90,188	87,411
7	2026						2,777	2,777	38,342	51,846	90,188	87,411
8	2027						2,777	2,777	38,342	51,846	90,188	87,411
9	2028						2,777	2,777	38,342	51,846	90,188	87,411
10	2029						2,777	2,777	38,342	51,846	90,188	87,411
11	2030						2,777	2,777	38,342	51,846	90,188	87,411
12	2031						2,777	2,777	38,342	51,846	90,188	87,411
13	2032						2,777	2,777	38,342	51,846	90,188	87,411
14	2033						2,777	2,777	38,342	51,846	90,188	87,411
15	2034						2,777	2,777	38,342	51,846	90,188	87,411
16	2035						2,777	2,777	38,342	51,846	90,188	87,411
17	2036						2,777	2,777	38,342	51,846	90,188	87,411
18	2037						2,777	2,777	38,342	51,846	90,188	87,411
19	2038						2,777	2,777	38,342	51,846	90,188	87,411
20	2039						2,777	2,777	38,342	51,846	90,188	87,411
21	2040						2,777	2,777	38,342	51,846	90,188	87,411
22	2041						2,777	2,777	38,342	51,846	90,188	87,411
23	2042						2,777	2,777	38,342	51,846	90,188	87,411
24	2043						2,777	2,777	38,342	51,846	90,188	87,411
25	2044						2,777	2,777	38,342	51,846	90,188	87,411
26	2045						2,777	2,777	38,342	51,846	90,188	87,411
27	2046						2,777	2,777	38,342	51,846	90,188	87,411
28	2047						2,777	2,777	38,342	51,846	90,188	87,411
29	2048						2,777	2,777	38,342	51,846	90,188	87,411
30	2049						2,777	2,777	38,342	51,846	90,188	87,411
31	2050						2,777	2,777	38,342	51,846	90,188	87,411
32	2051						2,777	2,777	38,342	51,846	90,188	87,411
33	2052						2,777	2,777	38,342	51,846	90,188	87,411
34	2053						2,777	2,777	38,342	51,846	90,188	87,411
35	2054						2,777	2,777	38,342	51,846	90,188	87,411
36	2055						2,777	2,777	38,342	51,846	90,188	87,411
37	2056						2,777	2,777	38,342	51,846	90,188	87,411
38	2057						2,777	2,777	38,342	51,846	90,188	87,411
39	2058						2,777	2,777	38,342	51,846	90,188	87,411
40	2059						2,777	2,777	38,342	51,846	90,188	87,411
41	2060						2,777	2,777	38,342	51,846	90,188	87,411
42	2061						2,777	2,777	38,342	51,846	90,188	87,411
43	2062						2,777	2,777	38,342	51,846	90,188	87,411
44	2063						2,777	2,777	38,342	51,846	90,188	87,411
45	2064						2,777	2,777	38,342	51,846	90,188	87,411
46	2065						2,777	2,777	38,342	51,846	90,188	87,411
47	2066						2,777	2,777	38,342	51,846	90,188	87,411
48	2067						2,777	2,777	38,342	51,846	90,188	87,411
49	2068						2,777	2,777	38,342	51,846	90,188	87,411
50	2069						2,777	2,777	38,342	51,846	90,188	87,411
	TOTAL	555,340	8,241	31,375	61,898	62,548	167,265				EIRR =	10.30%

(Discount Rate 10%)
B/C = 1.03
NPV = 7,592

Table XVI.1.7 CASH FLOW OF ECONOMIC COST AND BENEFIT FOR KAMPAR AND KAMPAR KIRI RIVER DEVELOPMENT PROJECT

Unit: Million Rp.

No.	Year	Economic Cost							Benefit								
		Construction	Compensation	Administration	Engineering Service	Physical Contingency	OMR	Total	Hydropower Generation		Flood Control					Total	Net Benefit
											Kampar Kiri River			Kampar River			
									(No.1 Dam)	(No.2 Dam)	(No.1 Dam)	(No.2 Dam)	(Improvement		Improvement		
-23	1996							0								0	0
-22	1997							0								0	0
-21	1998							0								0	0
-20	1999							0								0	0
-19	2000							0								0	0
-18	2001							0								0	0
-17	2002							0								0	0
-16	2003							0								0	0
-15	2004			3,543	19,588	1,959		25,090								0	-25,090
-14	2005		5,400	5,905	8,395	1,380		21,080								0	-21,080
-13	2006	17,627		7,086	1,866	1,949		28,528								0	-28,528
-12	2007	87,932		2,362	7,462	9,539		107,295								0	-107,295
-11	2008	148,340		2,362	5,597	15,394		171,693								0	-171,693
-10	2009	165,618		2,362	3,731	16,935		188,646								0	-188,646
-9	2010			2,089	11,922	1,192	2,098	17,301	99,293		2,921					102,214	84,913
-8	2011		2,935	3,481	4,593	753	2,098	13,860	99,293		2,955					102,248	88,388
-7	2012	25,895		4,177	1,583	2,748	2,098	36,501	99,293		2,988					102,281	65,781
-6	2013	66,761		1,695	4,404	7,116	2,561	82,537	99,293		3,022		1,611			103,927	21,390
-5	2014	87,473		5,573	29,902	11,737	2,998	137,683	99,293		3,056		3,566			105,915	-31,768
-4	2015	67,076	3,067	8,058	8,369	7,851	3,334	97,755	99,293		3,090		6,823			109,206	11,452
-3	2016	113,165		8,362	2,216	11,538	3,899	139,180	99,293	37,508	3,124	462	6,909			147,296	8,115
-2	2017	203,698		2,787	8,866	21,256	4,918	241,525	99,293	37,508	3,158	467	6,994		4,553	151,973	-89,552
-1	2018	135,799		2,787	6,650	14,244	5,597	165,077	99,293	37,508	3,192	471	7,079		20,356	167,899	2,822
0	2019	45,266		2,787	4,433	4,970	5,823	63,279	99,293	37,508	3,225	476	7,164		31,158	178,824	115,545
1	2020						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
2	2021						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
3	2022						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
4	2023						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
5	2024						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
6	2025						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
7	2026						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
8	2027						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
9	2028						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
10	2029						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
11	2030						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
12	2031						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
13	2032						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
14	2033						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
15	2034						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
16	2035						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
17	2036						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
18	2037						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
19	2038						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
20	2039						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
21	2040						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
22	2041						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
23	2042						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
24	2043						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
25	2044						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
26	2045						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
27	2046						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
28	2047						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
29	2048						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
30	2049						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
31	2050						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
32	2051						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
33	2052						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
34	2053						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
35	2054						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
36	2055						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
37	2056						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
38	2057						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
39	2058						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
40	2059						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
41	2060						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
42	2061						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
43	2062						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
44	2063						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
45	2064						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
46	2065						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
47	2066						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
48	2067						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
49	2068						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
50	2069						5,823	5,823	99,293	37,508	3,259	480	7,250		35,298	183,088	177,265
	TOTAL	1,164,650	11,402	65,416	129,577	130,561	326,585									EIRR =	12.46%

(Discount Rate 10%)
B/C = 1.23
NPV = 71,146

Table XVI.1.8 CASH FLOW OF ECONOMIC COST AND BENEFIT FOR INDRAGIRI RIVER DEVELOPMENT PROJECT

Unit: Million Rp.

No.	Year	Economic Cost						Benefit							Total	Net
		Construction	Compensation	Administration	Engineering Service	Physical Contingency	OMR	Total	Kuantan Riv.Mutl.Dev.Pro. Hydropower Generation	Kuantan Riv.Mutl.Dev.Pro. Lubukjambi Irrigation Dev	Kuantan-Indragiri River Improvement Project (Initial) Kuantan Daro Lubuk.Peranap Area	Kuantan-Indragiri River Improvement Project (Final) Japura Area	Kuantan-Indragiri River Improvement Project (Final) Peranap Rengat Area			Benefit
-23	1996			1,834	11,461	1,146		14,441							0	-14,441
-22	1997		268	2,264	9,760	1,003		13,295							0	-13,295
-21	1998	9,259	11,610	4,486	4,252	2,512		32,119							0	-32,119
-20	1999	11,574	1,076	2,508	2,914	1,557		19,629							0	-19,629
-19	2000	48,716	2,151	3,856	3,093	5,395		63,211							0	-63,211
-18	2001	101,970	1,076	3,039	4,686	10,773	348	121,892						4,035	4,035	-117,857
-17	2002	144,481		2,365	6,509	15,100	765	169,220						4,086	4,086	-165,134
-16	2003	80,858		2,365	3,909	8,477	1,322	96,931						4,137	4,137	-92,794
-15	2004	38,250		2,365	1,823	4,008	1,468	47,914						4,188	4,188	-43,727
-14	2005			2,323	27,590	2,759	2,114	34,786	87,907	8,220	43,696			4,239	144,062	109,276
-13	2006		4,474	10,277	5,618	1,009	2,114	23,492	87,907	8,220	44,206			4,290	144,623	121,130
-12	2007	150,104		7,955	11,136	16,124	2,865	188,184	87,907	8,220	44,715			4,340	145,183	-43,001
-11	2008	187,630	9,986	4,297	9,197	20,682	3,803	235,595	87,907	8,220	45,225		14,195	4,391	159,938	-75,657
-10	2009	75,052		3,310	3,679	7,873	4,178	94,092	87,907	8,220	45,734		31,944	4,442	178,247	84,155
-9	2010	30,602		3,031	25,013	5,561	4,331	68,538	87,907	8,220	46,243		39,138	4,493	186,002	117,464
-8	2011	45,902	4,150	9,161	2,247	5,230	4,561	71,251	87,907	12,224	46,753		39,538	4,544	190,966	119,715
-7	2012	193,007		7,118	7,849	20,086	5,526	233,586	87,907	16,297	47,262		39,939	4,595	196,000	-37,586
-6	2013	180,055		3,031	8,837	18,889	6,426	217,238	87,907	24,303		55,130	40,339	4,646	212,325	-4,913
-5	2014	81,203		3,031	3,985	8,519	6,832	103,570	87,907	26,305		62,592	40,739	4,697	222,240	118,670
-4	2015			1,180	14,050	1,405	8,033	24,668	97,123	28,306		66,547	41,140	4,748	237,864	213,196
-3	2016		1,730	4,720		173	8,033	14,656	97,123	28,306		67,191	41,540	4,798	238,958	224,302
-2	2017	76,585		3,540	2,810	7,939	8,033	98,907	97,123	28,306		67,834	41,940	4,849	240,053	141,146
-1	2018	95,731		1,180	4,684	10,042	8,033	119,670	97,123	28,306		68,477	45,006	16,373	255,285	135,615
0	2019	38,293		1,180	1,874	4,016	8,033	53,396	97,123	28,306		69,120	52,948	30,315	277,813	224,417
1	2020						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
2	2021						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
3	2022						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
4	2023						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
5	2024						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
6	2025						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
7	2026						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
8	2027						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
9	2028						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
10	2029						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
11	2030						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
12	2031						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
13	2032						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
14	2033						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
15	2034						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
16	2035						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
17	2036						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
18	2037						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
19	2038						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
20	2039						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
21	2040						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
22	2041						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
23	2042						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
24	2043						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
25	2044						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
26	2045						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
27	2046						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
28	2047						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
29	2048						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
30	2049						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
31	2050						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
32	2051						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
33	2052						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
34	2053						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
35	2054						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
36	2055						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
37	2056						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
38	2057						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
39	2058						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
40	2059						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
41	2060						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
42	2061						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
43	2062						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
44	2063						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
45	2064						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
46	2065						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
47	2066						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
48	2067						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
49	2068						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
50	2069						9,297	9,297	97,123	28,306		69,763	58,833	36,536	290,561	281,264
	Total	1,589,272	36,521	90,416	176,976	180,278	551,659								EIRR =	13.19%

(Discount Rate 10%)
B/C = 1.33
NPV = 222,775

Table XVI.1.9 CASH FLOW OF ECONOMIC COST AND BENEFIT FOR UPPER INDRAGIRI RIVER IMPROVEMENT PROJECT

Unit: Million Rp.

No.	Year	Economic Cost							Benefit				
		Consr-uction	Compen-sation	Admini-stration	Engineering Service	Physical Contingency	OMR	Total	Payakunbuh Area	Solok Area	Sijunjung Area	Total	Net Benefit
-23	1996			509	4,031	403		4,943				0	-4,943
-22	1997		602	1,695		60		2,357				0	-2,357
-21	1998	32,937		848	1,344	3,428		38,557				0	-38,557
-20	1999	27,448		339	1,344	2,879	165	32,175		3,008		3,008	-29,166
-19	2000			1,252	9,818	982	302	12,354		5,119		5,119	-7,235
-18	2001		3,133	4,172		313	302	7,920		5,573		5,573	-2,347
-17	2002	80,263		2,086	3,273	8,354	302	94,278		6,027		6,027	-88,251
-16	2003	66,886		834	3,273	7,016	703	78,712	8,821	6,481		15,302	-63,411
-15	2004			687	5,386	538	1,038	7,649	16,186	6,934		23,120	15,472
-14	2005		1,701	2,289		170	1,038	5,198	16,356	7,388		23,745	18,547
-13	2006	44,033		1,144	1,795	4,583	1,038	52,593	16,527	7,842		24,369	-28,224
-12	2007	36,695		458	1,795	3,849	1,258	44,055	16,698	8,296	1,513	26,506	-17,549
-11	2008			235	1,840	184	1,441	3,700	16,868	8,750	2,780	28,398	24,697
-10	2009		602	782		60	1,441	2,885	17,039	9,203	3,017	29,260	26,374
-9	2010	14,938		391	614	1,555	1,441	18,939	17,209	9,657	3,231	30,098	11,159
-8	2011	12,448		156	614	1,306	1,516	16,040	17,380	14,535	3,424	35,339	19,299
-7	2012			690	5,390	539	1,578	8,197	17,551	18,666	3,597	39,814	31,617
-6	2013		2,215	2,302		222	1,578	6,317	17,721	20,639	3,753	42,114	35,797
-5	2014	43,951		1,151	1,797	4,575	1,578	53,052	17,892	22,613	3,894	44,398	-8,654
-4	2015	36,626		460	1,797	3,842	1,798	44,523	29,630	24,586	4,020	58,236	13,713
-3	2016			245	1,905	191	1,981	4,322	39,480	26,559	4,134	70,173	65,851
-2	2017		894	817		89	1,981	3,781	40,499	28,533	4,236	73,268	69,487
-1	2018	15,547		408	635	1,619	1,981	20,190	41,518	30,506	4,328	76,352	56,162
0	2019	12,956		163	635	1,359	2,059	17,172	42,537	32,480	8,701	83,717	66,546
1	2020						2,124	2,124	43,556	34,453	12,420	90,429	88,305
2	2021						2,124	2,124	43,556	34,453	12,420	90,429	88,305
3	2022						2,124	2,124	43,556	34,453	12,420	90,429	88,305
4	2023						2,124	2,124	43,556	34,453	12,420	90,429	88,305
5	2024						2,124	2,124	43,556	34,453	12,420	90,429	88,305
6	2025						2,124	2,124	43,556	34,453	12,420	90,429	88,305
7	2026						2,124	2,124	43,556	34,453	12,420	90,429	88,305
8	2027						2,124	2,124	43,556	34,453	12,420	90,429	88,305
9	2028						2,124	2,124	43,556	34,453	12,420	90,429	88,305
10	2029						2,124	2,124	43,556	34,453	12,420	90,429	88,305
11	2030						2,124	2,124	43,556	34,453	12,420	90,429	88,305
12	2031						2,124	2,124	43,556	34,453	12,420	90,429	88,305
13	2032						2,124	2,124	43,556	34,453	12,420	90,429	88,305
14	2033						2,124	2,124	43,556	34,453	12,420	90,429	88,305
15	2034						2,124	2,124	43,556	34,453	12,420	90,429	88,305
16	2035						2,124	2,124	43,556	34,453	12,420	90,429	88,305
17	2036						2,124	2,124	43,556	34,453	12,420	90,429	88,305
18	2037						2,124	2,124	43,556	34,453	12,420	90,429	88,305
19	2038						2,124	2,124	43,556	34,453	12,420	90,429	88,305
20	2039						2,124	2,124	43,556	34,453	12,420	90,429	88,305
21	2040						2,124	2,124	43,556	34,453	12,420	90,429	88,305
22	2041						2,124	2,124	43,556	34,453	12,420	90,429	88,305
23	2042						2,124	2,124	43,556	34,453	12,420	90,429	88,305
24	2043						2,124	2,124	43,556	34,453	12,420	90,429	88,305
25	2044						2,124	2,124	43,556	34,453	12,420	90,429	88,305
26	2045						2,124	2,124	43,556	34,453	12,420	90,429	88,305
27	2046						2,124	2,124	43,556	34,453	12,420	90,429	88,305
28	2047						2,124	2,124	43,556	34,453	12,420	90,429	88,305
29	2048						2,124	2,124	43,556	34,453	12,420	90,429	88,305
30	2049						2,124	2,124	43,556	34,453	12,420	90,429	88,305
31	2050						2,124	2,124	43,556	34,453	12,420	90,429	88,305
32	2051						2,124	2,124	43,556	34,453	12,420	90,429	88,305
33	2052						2,124	2,124	43,556	34,453	12,420	90,429	88,305
34	2053						2,124	2,124	43,556	34,453	12,420	90,429	88,305
35	2054						2,124	2,124	43,556	34,453	12,420	90,429	88,305
36	2055						2,124	2,124	43,556	34,453	12,420	90,429	88,305
37	2056						2,124	2,124	43,556	34,453	12,420	90,429	88,305
38	2057						2,124	2,124	43,556	34,453	12,420	90,429	88,305
39	2058						2,124	2,124	43,556	34,453	12,420	90,429	88,305
40	2059						2,124	2,124	43,556	34,453	12,420	90,429	88,305
41	2060						2,124	2,124	43,556	34,453	12,420	90,429	88,305
42	2061						2,124	2,124	43,556	34,453	12,420	90,429	88,305
43	2062						2,124	2,124	43,556	34,453	12,420	90,429	88,305
44	2063						2,124	2,124	43,556	34,453	12,420	90,429	88,305
45	2064						2,124	2,124	43,556	34,453	12,420	90,429	88,305
46	2065						2,124	2,124	43,556	34,453	12,420	90,429	88,305
47	2066						2,124	2,124	43,556	34,453	12,420	90,429	88,305
48	2067						2,124	2,124	43,556	34,453	12,420	90,429	88,305
49	2068						2,124	2,124	43,556	34,453	12,420	90,429	88,305
50	2069						2,124	2,124	43,556	34,453	12,420	90,429	88,305
	Total	424,728	9,147	24,113	47,286	48,116	132,701					EIRR =	10.55%

(Discount Rate 10%)

B/C = 1.07

NPV = 15,851

Table XVI.1.10 CASH FLOW OF ECONOMIC COST AND BENEFIT FOR ALL OVERALL DEVELOPMENT PROJECTS

Unit: Million Rp.

No.	Year	Economic Cost					OMR	Total	Benefit	Net Benefit
		Construc-tion	Compen-sation	Admini-stration	Engineering Service	Physical Contingency				
-23	1996	0	0	3,051	17,959	1,795	0	22,805	0	-22,805
-22	1997	0	870	4,667	11,816	1,269	0	18,622	0	-18,622
-21	1998	42,196	12,065	6,042	7,652	6,191	0	74,146	0	-74,146
-20	1999	39,022	3,125	5,250	13,298	5,545	165	66,405	3,008	-63,397
-19	2000	60,854	5,466	8,404	16,902	8,322	302	100,250	5,119	-95,131
-18	2001	130,909	5,475	10,599	6,057	14,244	650	167,934	9,608	-158,326
-17	2002	315,793	0	6,052	13,266	32,907	1,067	369,085	10,113	-358,972
-16	2003	250,977	0	4,800	12,075	26,306	2,313	296,471	25,956	-270,515
-15	2004	84,078	0	8,196	28,754	11,283	3,649	135,960	57,172	-78,788
-14	2005	0	7,101	12,674	47,928	5,503	4,511	77,717	203,040	125,323
-13	2006	61,660	10,012	22,728	18,007	8,967	4,511	125,885	205,365	79,480
-12	2007	364,049	0	15,714	23,390	38,742	5,481	447,376	209,202	-238,174
-11	2008	453,422	9,986	11,336	22,387	48,580	7,040	552,751	238,339	-314,412
-10	2009	343,380	602	8,205	12,441	35,642	7,991	408,261	273,474	-134,787
-9	2010	45,540	0	5,511	37,549	8,308	10,750	107,658	398,445	290,787
-8	2011	58,350	7,085	12,798	7,454	7,289	11,054	104,030	410,256	306,226
-7	2012	218,902	0	12,928	19,226	23,814	12,082	286,952	421,370	134,418
-6	2013	246,816	4,167	7,971	13,241	26,422	13,445	312,062	443,213	131,151
-5	2014	248,449	0	10,698	37,152	28,560	14,289	339,148	458,972	119,824
-4	2015	133,554	3,067	10,641	25,684	16,230	16,224	205,400	496,158	290,758
-3	2016	113,165	1,730	14,400	9,229	12,412	17,122	168,058	551,200	383,142
-2	2017	280,283	1,571	8,217	11,676	29,352	18,141	349,240	562,894	213,654
-1	2018	288,672	0	5,448	13,672	30,235	18,820	356,847	599,953	243,106
0	2019	131,177	0	5,203	8,645	13,982	19,332	178,339	651,479	473,140
1	2020						20,833	20,833	684,219	663,386
2	2021						20,834	20,834	684,219	663,385
3	2022						20,834	20,834	684,219	663,385
4	2023						20,834	20,834	684,219	663,385
5	2024						20,834	20,834	684,219	663,385
6	2025						20,834	20,834	684,219	663,385
7	2026						20,834	20,834	684,219	663,385
8	2027						20,834	20,834	684,219	663,385
9	2028	21,436		1,072	857	2,230	20,834	46,429	684,219	637,790
10	2029						20,834	20,834	684,219	663,385
11	2030						20,834	20,834	684,219	663,385
12	2031						20,834	20,834	684,219	663,385
13	2032						20,834	20,834	684,219	663,385
14	2033						20,834	20,834	684,219	663,385
15	2034						20,834	20,834	684,219	663,385
16	2035						20,834	20,834	684,219	663,385
17	2036						20,834	20,834	684,219	663,385
18	2037						20,834	20,834	684,219	663,385
19	2038						20,834	20,834	684,219	663,385
20	2039						20,834	20,834	684,219	663,385
21	2040						20,834	20,834	684,219	663,385
22	2041						20,834	20,834	684,219	663,385
23	2042						20,834	20,834	684,219	663,385
24	2043						20,834	20,834	684,219	663,385
25	2044						20,834	20,834	684,219	663,385
26	2045						20,834	20,834	684,219	663,385
27	2046						20,834	20,834	684,219	663,385
28	2047						20,834	20,834	684,219	663,385
29	2048						20,834	20,834	684,219	663,385
30	2049						20,834	20,834	684,219	663,385
31	2050						20,834	20,834	684,219	663,385
32	2051						20,834	20,834	684,219	663,385
33	2052						20,834	20,834	684,219	663,385
34	2053						20,834	20,834	684,219	663,385
35	2054						20,834	20,834	684,219	663,385
36	2055						20,834	20,834	684,219	663,385
37	2056						20,834	20,834	684,219	663,385
38	2057						20,834	20,834	684,219	663,385
39	2058						20,834	20,834	684,219	663,385
40	2059						20,834	20,834	684,219	663,385
41	2060						20,834	20,834	684,219	663,385
42	2061						20,834	20,834	684,219	663,385
43	2062						20,834	20,834	684,219	663,385
44	2063						20,834	20,834	684,219	663,385
45	2064						20,834	20,834	684,219	663,385
46	2065						20,834	20,834	684,219	663,385
47	2066						20,834	20,834	684,219	663,385
48	2067						20,834	20,834	684,219	663,385
49	2068						20,834	20,834	684,219	663,385
50	2069						20,834	20,834	684,219	663,385
	TOTAL	3,932,684	72,322	222,605	436,317	444,130	1,230,621		EIRR =	11.90%

(Discount Rate 10%)

B/C = 1.20

NPV = 315,451

Table XVI.2.1 CASH FLOW OF ECONOMIC COST AND BENEFIT FOR KAMPAR KANAN WATER SUPPLY PROJECT (PRIORITY PROJECT)

Unit: Million Rp.

No.	Year	Economic Cost							Benefit			
		Construction	Compensation	Administration	Engineering Service	Physical Contingency	OMR	Total	Public Water	Irrigation Water	Total	Net Benefit
-8	1996			708	2,467	246		3,421			0	-3,421
-7	1997			708	2,056	206		2,970			0	-2,970
-6	1998		455	708	2,056	251		3,470			0	-3,470
-5	1999		2,049	1,063	1,645	369		5,126			0	-5,126
-4	2000	12,138	2,049	1,063	822	1,501		17,573			0	-17,573
-3	2001	28,939		708	1,371	3,031		34,049			0	-34,049
-2	2002	33,601		708	1,371	3,497		39,177			0	-39,177
-1	2003	31,422		708	1,371	3,279		36,780			0	-36,780
0	2004	17,104		708	549	1,765	495	20,621	5,075	10,057	15,132	-5,489
1	2005						569	569	5,552	11,512	17,064	16,495
2	2006						569	569	6,029	11,512	17,541	16,972
3	2007						569	569	6,506	11,512	18,018	17,449
4	2008						569	569	6,983	11,512	18,495	17,926
5	2009						569	569	7,460	11,512	18,972	18,403
6	2010						569	569	7,937	11,512	19,449	18,880
7	2011						569	569	8,414	11,512	19,926	19,357
8	2012						569	569	8,891	11,512	20,403	19,834
9	2013						559	569	9,368	11,512	20,880	20,311
10	2014						569	569	9,845	11,512	21,357	20,788
11	2015						569	569	10,322	11,512	21,834	21,265
12	2016						569	569	10,799	11,512	22,311	21,742
13	2017						569	569	11,276	11,512	22,788	22,219
14	2018						569	569	11,753	11,512	23,265	22,696
15	2019						569	569	12,230	11,512	23,742	23,173
16	2020						569	569	12,230	11,512	23,742	23,173
17	2021						569	569	12,230	11,512	23,742	23,173
18	2022						569	569	12,230	11,512	23,742	23,173
19	2023						569	569	12,230	11,512	23,742	23,173
20	2024						569	569	12,230	11,512	23,742	23,173
21	2025						569	569	12,230	11,512	23,742	23,173
22	2026						569	569	12,230	11,512	23,742	23,173
23	2027						569	569	12,230	11,512	23,742	23,173
24	2028	21,436		1,072	857	2,230	569	26,164	12,230	11,512	23,742	-2,422
25	2029						569	569	12,230	11,512	23,742	23,173
26	2030						569	569	12,230	11,512	23,742	23,173
27	2031						569	569	12,230	11,512	23,742	23,173
28	2032						569	569	12,230	11,512	23,742	23,173
29	2033						569	569	12,230	11,512	23,742	23,173
30	2034						569	569	12,230	11,512	23,742	23,173
31	2035						569	569	12,230	11,512	23,742	23,173
32	2036						569	569	12,230	11,512	23,742	23,173
33	2037						569	569	12,230	11,512	23,742	23,173
34	2038						569	569	12,230	11,512	23,742	23,173
35	2039						569	569	12,230	11,512	23,742	23,173
36	2040						569	569	12,230	11,512	23,742	23,173
37	2041						569	569	12,230	11,512	23,742	23,173
38	2042						569	569	12,230	11,512	23,742	23,173
39	2043						569	569	12,230	11,512	23,742	23,173
40	2044						569	569	12,230	11,512	23,742	23,173
41	2045						569	569	12,230	11,512	23,742	23,173
42	2046						569	569	12,230	11,512	23,742	23,173
43	2047						569	569	12,230	11,512	23,742	23,173
44	2048						569	569	12,230	11,512	23,742	23,173
45	2049						569	569	12,230	11,512	23,742	23,173
46	2050						569	569	12,230	11,512	23,742	23,173
47	2051						569	569	12,230	11,512	23,742	23,173
48	2052						569	569	12,230	11,512	23,742	23,173
49	2053						569	569	12,230	11,512	23,742	23,173
50	2054						569	569	12,230	11,512	23,742	23,173
	TOTAI	144,640	4,553	8,154	14,565	16,375	28,945				EIRR =	10.14%

(Discount Rate 10%)

B/C = 1.02

NPV = 1,524

Table XVI.2.2 CALCULATION OF AVERAGE ANNUAL

(KAMPAR RIVER:BANKINANG AREA)

Return Period (Year)	Flood Damage Reduction (10^6Rp.)	Average Damage Reduction (10^6Rp.)	Expectation	Probable Benefit (10^6Rp.)	Average Annual Benefit (10^6Rp.)
1	0	24,551.6	0.5	12,275.8	12,275.8
2	49,103.2	52,784.4	0.3	15,835.3	28,111.1
5	56,465.5				

(INDRAGIRI RIVER:LUBUKJAMBI-PERANAP)

Return Period (Year)	Flood Damage Reduction (10^6Rp.)	Average Damage Reduction (10^6Rp.)	Expectation	Probable Benefit (10^6Rp.)	Average Annual Benefit (10^6Rp.)
1	0	45,028.1	0.5	22,514.0	22,514.0
2	90,056.3	96,075.0	0.3	28,822.5	51,336.6
5	102,093.7				

(INDRAGIRI RIVER:RENGAT AREA)

Return Period (Year)	Flood Damage Reduction (10^6Rp.)	Average Damage Reduction (10^6Rp.)	Expectation	Probable Benefit (10^6Rp.)	Average Annual Benefit (10^6Rp.)
1	0	3,374.5	0.5	1,687.3	1,687.3
2	6,749.0	7,944.8	0.3	2,383.4	4,070.7
5	9,140.6	9,314.7	0.1	931.5	5,002.2
10	9,488.7				

Table XVI.2.3 CASH FLOW OF ECONOMIC COST AND BENEFIT FOR BANGKINANG AREA RIVER IMPROVEMENT WORKS (PRIORITY PROJECT)

Unit: Million R

No.	Year	Economic Cost						Benefit		
		Construction	Compensation	Administration	Engineering Service	Physical Contingency	OMR	Total	Bangkinang Area	Net Benefit
-8	1,996							0	0	0
-7	1,997							0	0	0
-6	1,998							0	0	0
-5	1,999			1,340	7,395	740		9,475	0	-9,475
-4	2,000		1,266	2,233	3,169	444		7,112	0	-7,112
-3	2,001		1,266	2,680		127		4,073	0	-4,073
-2	2,002	57,448		893	2,113	5,956		66,410	0	-66,410
-1	2,003	71,811		893	3,522	7,534	287	84,047	6,517	-77,530
0	2,004	28,724		893	1,408	3,013	646	34,684	14,766	-19,918
1	2,005						790	790	18,169	17,379
2	2,006						790	790	18,832	18,042
3	2,007						790	790	19,495	18,705
4	2,008						790	790	20,158	19,368
5	2,009						790	790	20,820	20,030
6	2,010						790	790	21,483	20,693
7	2,011						790	790	22,146	21,356
8	2,012						790	790	22,809	22,019
9	2,013						790	790	23,471	22,681
10	2,014						790	790	24,134	23,344
11	2,015						790	790	24,797	24,007
12	2,016						790	790	25,460	24,670
13	2,017						790	790	26,122	25,332
14	2,018						790	790	26,785	25,995
15	2,019						790	790	27,448	26,658
16	2,020						790	790	28,111	27,321
17	2,021						790	790	28,111	27,321
18	2,022						790	790	28,111	27,321
19	2,023						790	790	28,111	27,321
20	2,024						790	790	28,111	27,321
21	2,025						790	790	28,111	27,321
22	2,026						790	790	28,111	27,321
23	2,027						790	790	28,111	27,321
24	2,028						790	790	28,111	27,321
25	2,029						790	790	28,111	27,321
26	2,030						790	790	28,111	27,321
27	2,031						790	790	28,111	27,321
28	2,032						790	790	28,111	27,321
29	2,033						790	790	28,111	27,321
30	2,034						790	790	28,111	27,321
31	2,035						790	790	28,111	27,321
32	2,036						790	790	28,111	27,321
33	2,037						790	790	28,111	27,321
34	2,038						790	790	28,111	27,321
35	2,039						790	790	28,111	27,321
36	2,040						790	790	28,111	27,321
37	2,041						790	790	28,111	27,321
38	2,042						790	790	28,111	27,321
39	2,043						790	790	28,111	27,321
40	2,044						790	790	28,111	27,321
41	2,045						790	790	28,111	27,321
42	2,046						790	790	28,111	27,321
43	2,047						790	790	28,111	27,321
44	2,048						790	790	28,111	27,321
45	2,049						790	790	28,111	27,321
46	2,050						790	790	28,111	27,321
47	2,051						790	790	28,111	27,321
48	2,052						790	790	28,111	27,321
49	2,053						790	790	28,111	27,321
50	2,054						790	790	28,111	27,321
	TOTA	157,983	2,532	8,932	17,607	17,814	40,433		EIRR =	10.19%

(Discount Rate 10%)

B/C = 1.02

NPV = 2,216

Table XVI.2.4 CASH FLOW OF ECONOMIC COST AND BENEFIT FOR KUANTAN RIVER MULTIPURPOSE DEVELOPMENT PROJECT (PRIORITY PROJECT)

Unit: Million Rp.

No.	Year	Economic Cost						Benefit					Net Benefit
		Construction	Compensation	Administration	Engineering Service	Physical Contingency	OMR	Total	Hydropower Generation	Lubukjambi Irrigation System	Flood Control by Kuantan Dam	Total	
-8	1996			2,006	11,309	1,131		14,446				0	-14,446
-7	1997			2,006	11,309	1,131		14,446				0	-14,446
-6	1998		21,735	4,689	3,912	2,564		32,900				0	-32,900
-5	1999		1,276	2,684	2,347	363		6,670				0	-6,670
-4	2000	49,593	2,552	4,040	3,072	5,521		64,778				0	-64,778
-3	2001	115,545	1,276	3,362	5,306	12,213		137,702				0	-137,702
-2	2002	162,582		2,684	7,336	16,991		189,593				0	-189,593
-1	2003	85,382		2,684	4,115	8,950		101,131				0	-101,131
0	2004	42,776		2,684	2,029	4,481		51,970				0	-51,970
1	2005						2,049	2,049	87,907	8,220	43,696	139,824	137,775
2	2006						2,049	2,049	87,907	8,220	44,206	140,333	138,284
3	2007						2,049	2,049	87,907	8,220	44,715	140,842	138,794
4	2008						2,049	2,049	87,907	8,220	45,225	141,352	139,303
5	2009						2,049	2,049	87,907	8,220	45,734	141,861	139,812
6	2010						2,049	2,049	87,907	8,220	46,243	142,370	140,322
7	2011						2,049	2,049	87,907	8,220	46,753	142,880	140,831
8	2012						2,049	2,049	87,907	8,220	47,262	143,389	141,340
9	2013						2,049	2,049	87,907	8,220	47,771	143,899	141,850
10	2014						2,049	2,049	87,907	8,220	48,281	144,408	142,359
11	2015						2,049	2,049	87,907	8,220	48,790	144,917	142,868
12	2016						2,049	2,049	87,907	8,220	49,299	145,427	143,378
13	2017						2,049	2,049	87,907	8,220	49,809	145,936	143,887
14	2018						2,049	2,049	87,907	8,220	50,318	146,445	144,396
15	2019						2,049	2,049	87,907	8,220	50,827	146,955	144,906
16	2020						2,049	2,049	87,907	8,220	51,337	147,464	145,415
17	2021						2,049	2,049	87,907	8,220	51,337	147,464	145,415
18	2022						2,049	2,049	87,907	8,220	51,337	147,464	145,415
19	2023						2,049	2,049	87,907	8,220	51,337	147,464	145,415
20	2024						2,049	2,049	87,907	8,220	51,337	147,464	145,415
21	2025						2,049	2,049	87,907	8,220	51,337	147,464	145,415
22	2026						2,049	2,049	87,907	8,220	51,337	147,464	145,415
23	2027						2,049	2,049	87,907	8,220	51,337	147,464	145,415
24	2028						2,049	2,049	87,907	8,220	51,337	147,464	145,415
25	2029						2,049	2,049	87,907	8,220	51,337	147,464	145,415
26	2030						2,049	2,049	87,907	8,220	51,337	147,464	145,415
27	2031						2,049	2,049	87,907	8,220	51,337	147,464	145,415
28	2032						2,049	2,049	87,907	8,220	51,337	147,464	145,415
29	2033						2,049	2,049	87,907	8,220	51,337	147,464	145,415
30	2034						2,049	2,049	87,907	8,220	51,337	147,464	145,415
31	2035						2,049	2,049	87,907	8,220	51,337	147,464	145,415
32	2036						2,049	2,049	87,907	8,220	51,337	147,464	145,415
33	2037						2,049	2,049	87,907	8,220	51,337	147,464	145,415
34	2038						2,049	2,049	87,907	8,220	51,337	147,464	145,415
35	2039						2,049	2,049	87,907	8,220	51,337	147,464	145,415
36	2040						2,049	2,049	87,907	8,220	51,337	147,464	145,415
37	2041						2,049	2,049	87,907	8,220	51,337	147,464	145,415
38	2042						2,049	2,049	87,907	8,220	51,337	147,464	145,415
39	2043						2,049	2,049	87,907	8,220	51,337	147,464	145,415
40	2044						2,049	2,049	87,907	8,220	51,337	147,464	145,415
41	2045						2,049	2,049	87,907	8,220	51,337	147,464	145,415
42	2046						2,049	2,049	87,907	8,220	51,337	147,464	145,415
43	2047						2,049	2,049	87,907	8,220	51,337	147,464	145,415
44	2048						2,049	2,049	87,907	8,220	51,337	147,464	145,415
45	2049						2,049	2,049	87,907	8,220	51,337	147,464	145,415
46	2050						2,049	2,049	87,907	8,220	51,337	147,464	145,415
47	2051						2,049	2,049	87,907	8,220	51,337	147,464	145,415
48	2052						2,049	2,049	87,907	8,220	51,337	147,464	145,415
49	2053						2,049	2,049	87,907	8,220	51,337	147,464	145,415
50	2054						2,049	2,049	87,907	8,220	51,337	147,464	145,415
	Total	455,878	26,839	26,839	50,735	53,345	102,442						

EIRR = 15.27%

(Discount Rate 10%)

B/C = 1.74

NPV = 256,670

Table XVI.2.5 CASH FLOW OF FINANCIAL COST AND BENEFIT FOR KUANTAN HYDROPOWER DEVELOPMENT PROJECT (PRIORITY PROJECT)

Unit: Million Rp.

No.	Year	Financial Cost								Benefit	
		Construction	Compensation	Administration	Engineering Service	Physical Contingency	Value Added Tax	OMR	Total	(Revenue)	Net Benefit
-8	1996			1,474	8,435	844	1,075		11,828	0	-11,828
-7	1997			1,474	8,435	844	1,075		11,828	0	-11,828
-6	1998		13,572	2,947		1,357	1,788		19,664	0	-19,664
-5	1999			1,474		0	147		1,621	0	-1,621
-4	2000	38,010		1,474	1,124	3,913	4,452		48,974	0	-48,974
-3	2001	81,054		1,474	3,374	8,443	9,434		103,779	0	-103,779
-2	2002	108,072		1,474	4,499	11,257	12,530		137,832	0	-137,832
-1	2003	27,018		1,474	1,124	2,814	3,243		35,673	0	-35,673
0	2004	27,018		1,474	1,124	2,814	3,243		35,673	0	-35,673
1	2005							1,406	1,406	99,178	97,772
2	2006							1,406	1,406	99,178	97,772
3	2007							1,406	1,406	99,178	97,772
4	2008							1,406	1,406	99,178	97,772
5	2009							1,406	1,406	99,178	97,772
6	2010							1,406	1,406	99,178	97,772
7	2011							1,406	1,406	99,178	97,772
8	2012							1,406	1,406	99,178	97,772
9	2013							1,406	1,406	99,178	97,772
10	2014							1,406	1,406	99,178	97,772
11	2015							1,406	1,406	99,178	97,772
12	2016							1,406	1,406	99,178	97,772
13	2017							1,406	1,406	99,178	97,772
14	2018							1,406	1,406	99,178	97,772
15	2019							1,406	1,406	99,178	97,772
16	2020							1,406	1,406	99,178	97,772
17	2021							1,406	1,406	99,178	97,772
18	2022							1,406	1,406	99,178	97,772
19	2023							1,406	1,406	99,178	97,772
20	2024							1,406	1,406	99,178	97,772
21	2025							1,406	1,406	99,178	97,772
22	2026							1,406	1,406	99,178	97,772
23	2027							1,406	1,406	99,178	97,772
24	2028							1,406	1,406	99,178	97,772
25	2029							1,406	1,406	99,178	97,772
26	2030							1,406	1,406	99,178	97,772
27	2031							1,406	1,406	99,178	97,772
28	2032							1,406	1,406	99,178	97,772
29	2033							1,406	1,406	99,178	97,772
30	2034							1,406	1,406	99,178	97,772
31	2035							1,406	1,406	99,178	97,772
32	2036							1,406	1,406	99,178	97,772
33	2037							1,406	1,406	99,178	97,772
34	2038							1,406	1,406	99,178	97,772
35	2039							1,406	1,406	99,178	97,772
36	2040							1,406	1,406	99,178	97,772
37	2041							1,406	1,406	99,178	97,772
38	2042							1,406	1,406	99,178	97,772
39	2043							1,406	1,406	99,178	97,772
40	2044							1,406	1,406	99,178	97,772
41	2045							1,406	1,406	99,178	97,772
42	2046							1,406	1,406	99,178	97,772
43	2047							1,406	1,406	99,178	97,772
44	2048							1,406	1,406	99,178	97,772
45	2049							1,406	1,406	99,178	97,772
46	2050							1,406	1,406	99,178	97,772
47	2051							1,406	1,406	99,178	97,772
48	2052							1,406	1,406	99,178	97,772
49	2053							1,406	1,406	99,178	97,772
50	2054							1,406	1,406	99,178	97,772
	TOTAL	281,172	13,572	14,739	28,115	32,286	36,988			FIRR =	15.54%

(Discount Rate 8.3%
B/C = 2.22
NPV = 314,097

Table XVI.2.6 CASH FLOW OF ECONOMIC COST AND BENEFIT FOR RENGAT AREA FLOOD PROTECTION WORKS (PRIORITY PROJECT)

Unit: Million Rp.

No.	Year	Economic Cost							Benefit	
		Constr-uction	Compen-sation	Admini-stration	Engineering Service	Physical Contingency	OMR	Total	Rengat Area	Net Benefit
-4	1996			146	1,729	173		2,048	0	-2,048
-3	1997		268	582	0	27		877	0	-877
-2	1998	9,416		437	345	976		11,174	0	-11,174
-1	1999	11,769		146	576	1,235		13,726	0	-13,726
0	2000	4,707		146	231	494		5,578	0	-5,578
1	2001						129	129	4,035	3,906
2	2002						129	129	4,086	3,957
3	2003						129	129	4,137	4,007
4	2004						129	129	4,188	4,058
5	2005						129	129	4,239	4,109
6	2006						129	129	4,289	4,160
7	2007						129	129	4,340	4,211
8	2008						129	129	4,391	4,262
9	2009						129	129	4,442	4,313
10	2010						129	129	4,493	4,363
11	2011						129	129	4,544	4,414
12	2012						129	129	4,595	4,465
13	2013						129	129	4,646	4,516
14	2014						129	129	4,696	4,567
15	2015						129	129	4,747	4,618
16	2016						129	129	4,798	4,669
17	2017						129	129	4,849	4,720
18	2018						129	129	4,900	4,770
19	2019						129	129	4,951	4,821
20	2020						129	129	5,002	4,872
21	2021						129	129	5,002	4,872
22	2022						129	129	5,002	4,872
23	2023						129	129	5,002	4,872
24	2024						129	129	5,002	4,872
25	2025						129	129	5,002	4,872
26	2026						129	129	5,002	4,872
27	2027						129	129	5,002	4,872
28	2028						129	129	5,002	4,872
29	2029						129	129	5,002	4,872
30	2030						129	129	5,002	4,872
31	2031						129	129	5,002	4,872
32	2032						129	129	5,002	4,872
33	2033						129	129	5,002	4,872
34	2034						129	129	5,002	4,872
35	2035						129	129	5,002	4,872
36	2036						129	129	5,002	4,872
37	2037						129	129	5,002	4,872
38	2038						129	129	5,002	4,872
39	2039						129	129	5,002	4,872
40	2040						129	129	5,002	4,872
41	2041						129	129	5,002	4,872
42	2042						129	129	5,002	4,872
43	2043						129	129	5,002	4,872
44	2044						129	129	5,002	4,872
45	2045						129	129	5,002	4,872
46	2046						129	129	5,002	4,872
47	2047						129	129	5,002	4,872
48	2048						129	129	5,002	4,872
49	2049						129	129	5,002	4,872
50	2050						129	129	5,002	4,872
	Total	25,892	268	1,457	2,881	2,905	6,473		EIRR =	11.00%

(Discount Rate 10%)
B/C = 1.11
NPV = 2,815

Table XVI.2.7 CASH FLOW OF ECONOMIC COST AND BENEFIT FOR ALL PRIORITY PROJECTS

Unit: Million Rp.

No.	Year	Economic Cost					OMR	Total	Benefit	Net Benefit
		Construc-tion	Compen-sation	Admini-stration	Engineering Service	Physical Contingency				
-8	1996	0	0	2,860	15,505	1,550	0	19,915	0	-19,915
-7	1997	0	268	3,296	13,365	1,364	0	18,293	0	-18,293
-6	1998	9,416	22,190	5,834	6,313	3,791	0	47,544	0	-47,544
-5	1999	11,769	3,325	5,233	11,963	2,707	0	34,997	0	-34,997
-4	2000	66,438	5,867	7,482	7,294	7,960	0	95,041	0	-95,041
-3	2001	144,484	2,542	6,750	6,677	15,371	129	175,953	4,035	-171,918
-2	2002	253,631	0	4,285	10,820	26,444	129	295,309	4,086	-291,223
-1	2003	188,615	0	4,285	9,008	19,763	416	222,087	10,654	-211,433
0	2004	88,604	0	4,285	3,986	9,259	1,270	107,404	34,052	-73,352
1	2005						3,537	3,537	179,296	175,758
2	2006						3,537	3,537	180,995	177,457
3	2007						3,537	3,537	182,695	179,157
4	2008						3,537	3,537	184,396	180,858
5	2009						3,537	3,537	186,095	182,557
6	2010						3,537	3,537	187,795	184,257
7	2011						3,537	3,537	189,496	185,958
8	2012						3,537	3,537	191,196	187,658
9	2013						3,537	3,537	192,896	189,358
10	2014						3,537	3,537	194,595	191,057
11	2015						3,537	3,537	196,295	192,757
12	2016						3,537	3,537	197,996	194,458
13	2017						3,537	3,537	199,695	196,157
14	2018						3,537	3,537	201,395	197,857
15	2019						3,537	3,537	203,096	199,558
16	2020						3,537	3,537	204,319	200,781
17	2021						3,537	3,537	204,319	200,781
18	2022						3,537	3,537	204,319	200,781
19	2023						3,537	3,537	204,319	200,781
20	2024						3,537	3,537	204,319	200,781
21	2025						3,537	3,537	204,319	200,781
22	2026						3,537	3,537	204,319	200,781
23	2027						3,537	3,537	204,319	200,781
24	2028	21,436		1,072	857	2,230	3,537	29,132	204,319	175,186
25	2029						3,537	3,537	204,319	200,781
26	2030						3,537	3,537	204,319	200,781
27	2031						3,537	3,537	204,319	200,781
28	2032						3,537	3,537	204,319	200,781
29	2033						3,537	3,537	204,319	200,781
30	2034						3,537	3,537	204,319	200,781
31	2035						3,537	3,537	204,319	200,781
32	2036						3,537	3,537	204,319	200,781
33	2037						3,537	3,537	204,319	200,781
34	2038						3,537	3,537	204,319	200,781
35	2039						3,537	3,537	204,319	200,781
36	2040						3,537	3,537	204,319	200,781
37	2041						3,537	3,537	204,319	200,781
38	2042						3,537	3,537	204,319	200,781
39	2043						3,537	3,537	204,319	200,781
40	2044						3,537	3,537	204,319	200,781
41	2045						3,537	3,537	204,319	200,781
42	2046						3,537	3,537	204,319	200,781
43	2047						3,537	3,537	204,319	200,781
44	2048						3,537	3,537	204,319	200,781
45	2049						3,537	3,537	204,319	200,781
46	2050						3,537	3,537	204,319	200,781
47	2051						3,537	3,537	204,319	200,781
48	2052						3,537	3,537	204,319	200,781
49	2053						3,537	3,537	204,319	200,781
50	2054						3,537	3,537	204,319	200,781
	TOTAL	784,393	34,192	45,382	85,788	90,439	178,811		EIRR =	13.59%

(Discount Rate 10%)

B/C = 1.46

NPV = 263,292

XVII ORGANIZATION FOR OPERATION AND MAINTENANCE

SECTOR XVII
ORGANIZATION FOR OPERATION AND MAINTENANCE

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CHAPTER 1 GENERAL

1.1 Basic Concept

The Minister's law on government organization states that responsibilities on operation and maintenance of public works facilities should be decentralized and entrusted to related provincial government agencies. In accordance with Law No. 5 on Regional Government Administration, future operation and maintenance work will be transferred gradually from central government agencies to local government agencies.

In line with the decentralization policy, an institutional setup for all-inclusive water resources management work was introduced in Java Irrigation Improvement and Water Resources Management Project (JIWMP) in January 1993. Previously, operation and maintenance for public works facilities have been executed under the hierarchy classified into the central level, the provincial level and the district level. In addition to these existing organization levels, the basin-wide management level was newly proposed by the JIWMP to have an integrated approach to basin-wide water management works. The territorial jurisdiction of the basin-wide management level is placed within the watershed boundary (called "SWS" in the Indonesian term), so that it does not necessarily coincide with the existing administrative boundary.

Correspondingly, the hierarchy of the institutional setup is classified into the central level, the provincial level, the basin-wide management level, and the district level. In this hierarchy, emphasized are the roles of the basin-wide management level and the district level to promote the decentralization process.

The basic concept of the institutional setup proposed by JIWMP is considered to be suitable to formulate the operation and maintenance plan in the present study. Furthermore, the particular names or abbreviations for the organizational units introduceD in the JIWMP are commonly used by Indonesian government agencies, so that they are also adopted in this study.

1.2 Outline of Proposed Organization

The organization for operation and maintenance of flood control and water resources development facilities is proposed in this study as shown in Fig. XVII.1.1. In this organization, each of the organization hierarchy levels will undertake the following roles in general:

- The central level will set up the national regulations specifying the technical and administrative standards for operation and maintenance of objective facilities.
- The provincial level will undertake the overall supervisory and coordination tasks for the objective operation and maintenance facilities.

- The basin-wide management level will execute the operation and maintenance for major facilities such as dams, weirs, and river channels that have strategic importance in the basin and/or require highly developed technology.
- The district level will execute the operation and maintenance for minor facilities other than the objects of the above basin-wide management level.

In the priority projects for feasibility study, the proposed basin-wide management level will have an integrated approach on operation and maintenance. Thus, the basin-wide management level will have a single management body. All dam reservoirs, weirs on the main stream and river channel located in the above river basins will then be operated and maintained in the basin-wide management level.

As for the district level, two districts will be involved in the organization for operation and maintenance, namely, Kabupaten Kampar and Indragiri Hulu. All minor flood control and water resources development facilities installed in these districts will be operated and maintained by each district government office.

CHAPTER 2 ORGANIZATION IN CENTRAL LEVEL

The organization in the central level will be composed of three units, namely, the technical management unit, the coordinating unit and the administrative unit. The specific roles and government agencies involved in these units are described below.

2.1 Technical Management Unit

This unit will prepare the nationwide technical criteria and carry out the technical guidance for operation/maintenance. The ministry in charge will be the Ministry of Public Works (MPW) and the following directorates/commission will take partial charge of technical management works, as follows:

- The Directorate of Technical Guidance (Bina Tech), DGWRD will take charge of the preparation of criteria and technical guidance related to flood control and water resources development facilities; and,
- The Dam Safety Commission established as an extra-departmental body of MPW will carry out general supervision on dam safety.

2.2 Coordinating Unit

A new National Water Council (NWC) is proposed as the central government coordinating unit. The NWC will be composed of representatives from relevant ministries and will resolve potential conflicts among the ministries.

2.3 Administrative Unit

The present Ministry of Home Affairs (MHA) will undertake the integrated supervision of administration to be carried out by each provincial government in Indonesia.

CHAPTER 3 ORGANIZATION IN PROVINCIAL LEVEL

The organization in the provincial level will be composed of four units, namely, the administrative unit, the coordinating unit, the technical management unit, and the water users associations. The specific roles and government agencies to be involved in these units are described below.

3.1 Administrative Unit

The Riau and West Sumatra provincial governments will be designated as the provincial leading supervisor and coordinator for all activities related to operation/maintenance. This designation of the Provincial Government will entail approval of annual operation/maintenance plans (including the implementation plan and the budgetary allocation plan), evaluation of performance, and licensing/authorization for surface water use.

3.2 Coordinating Unit

The competent provincial authority of the Ministry of Public Works (KANWIL) will be assigned, as a substructure of the MPW, to the Riau and West Sumatra provinces and will undertake the role of coordination of technical guidance provided from the central level to the provincial level.

3.3 Technical Management Unit

The Provincial Office for Public Works (DPUP) will undertake technical supervision on the execution of operation/maintenance based on the technical guidance provided from the central level.

3.4 Water Users Association

The Water Resources Committee (WRC) will be formed out of the existing provincial irrigation committee and expanded to a larger user committee accommodating all provincial water user groups such as the State Electricity Corporation (PLN) and the Water Supply Public Corporation (PAM). The WRC will undertake coordination and supervisory work on the annual water use of each water user group at the provincial level. Thus, the role of WRC is related solely to water resources development facilities but not to the flood control and urban drainage facilities.

CHAPTER 4 ORGANIZATION IN BASIN-WIDE MANAGEMENT LEVEL

As mentioned in Section 1.2, the organization in the basin- wide management level will undertake an integrated approach to the basin-wide implementation of operation/maintenance for flood control and water resources development facilities within the subject watershed boundary. The subject watershed boundary (SWS) is herein defined to cover the two objective river basins (Kampar and Indragiri river basins).

The organization in the basin-wide management level will be composed of two units, namely, the Basin-Wide O&M Execution Unit ("UPT SWS" in the Indonesian term) and the Coordination Board (SWS Board) for the basin-wide operation/maintenance. The details of these units are described below.

4.1 Basin-Wide O&M Execution Unit

Among the objective facilities in the Overall Development Plan, flood control and water resources development facilities will be operated and maintained by the Basin-Wide O&M Execution Unit (UPT SWS). The major roles of the UPT SWS are as enumerated below.

- To carry out periodical inspection and maintenance work on the objective facilities;
- To prepare the annual water allocation plan based on the annual water use requested by the Provincial Water Users Association and to monitor conflicts associated with the annual water allocation plan;
- To operate the water resources development facilities such as dam reservoirs, water conveyance canals, and weirs on main streams in accordance with the water allocation plan;
- To operate flood control facilities such as dam reservoirs and weirs on main streams, and issue flood warning as required; and,
- To determine water service charges such as the irrigation service fee, the Water Supply Public Corporation (PAM) charge, the hydropower supply charge, and the water pollution charge for industry, all of which could contribute to the necessary financial resources for the activities of the UPT SWS as well as the SWS Board mentioned below.

4.2 Basin-Wide Coordination Board

The Basin-Wide Coordination Board (SWS Board) is proposed to resolve and coordinate potential conflicts between the annual water allocation plan prepared/monitored by the UPT SWS and the water demand required from the water

user groups. Thus, the SWS Board will coordinate matters related solely to the operation/maintenance of water resource development facilities.

The members of the SWS Board will be composed of representatives of the districts, the water user groups, and the relevant provincial government offices.

CHAPTER 5 ORGANIZATION IN DISTRICT LEVEL

The organization in the district level will be composed of the district execution unit and the district water user groups. The details of these components are described below.

5.1 District Execution Unit

The existing District Office for Public Works (DPUK) will be responsible for the operation/maintenance of the following facilities:

- Minor facilities installed within the administrative boundary of each district for flood control and water resources development such as flap gates/culverts installed along rivers and secondary/tertiary water distribution pipes; and,
- All urban drainage facilities including drainage pumps, retarding ponds, and primary, secondary and tertiary drainage channels.

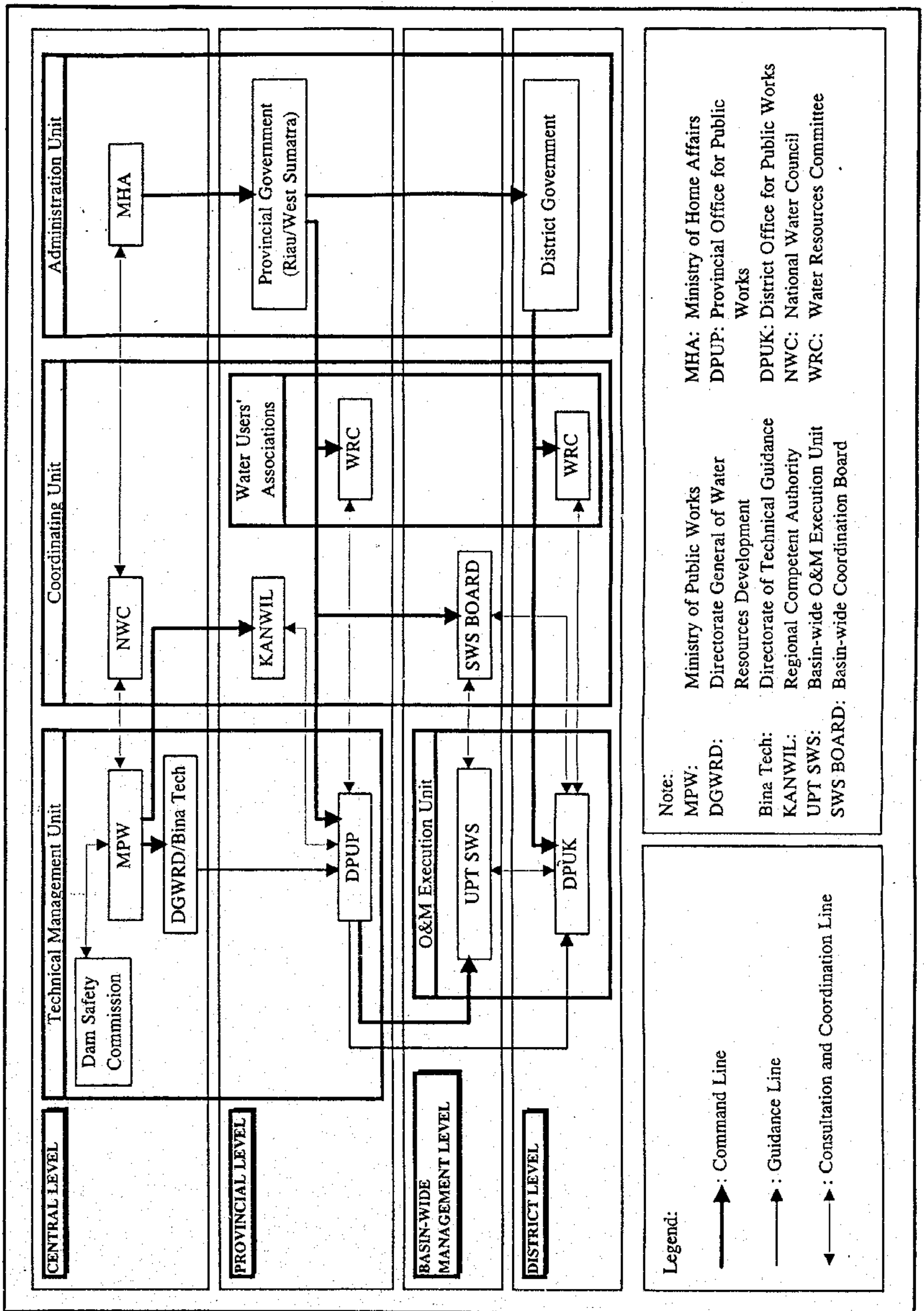
The operation/maintenance for minor facilities as mentioned above will be based on consultations with the Basin-Wide O&M Execution Unit (UPT SWS) and executed by the related district offices for public works in Kabupaten Kampar, Kabupaten Indragiri Hulu, Kabupaten Indragiri Hilir, Kabupaten Limapuluh Kota, Kabupaten Solok and Kabupaten Sawahlunto/Sijunjung, respectively.

5.2 District Water User Group

The Water Resources Committee (WRC) will be formed out of the existing district irrigation committee and expanded to a larger user committee accommodating representatives from all end water users. The WRC will prepare the annual water use plan based on coordination among the end users, and submit the annual plan to the Provincial WRC.

FIGURES

XVII ORGANIZATION FOR OPERATION AND MAINTENANCE



THE STUDY ON KAMPAR-INDRAGIRI RIVER BASIN DEVELOPMENT PROJECT IN THE REPUBLIC OF INDONESIA	Fig.XVII.1.1	ORGANIZATION FOR OPERATION AND MAINTENANCE OF FLOOD CONTROL AND WATER RESOURCES DEVELOPMENT FACILITIES
JAPAN INTERNATIONAL COOPERATION AGENCY		

XVIII TOPOGRAPHIC SURVEY

SECTOR XVIII
TOPOGRAPHIC SURVEY

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CHAPTER 1 RIVER SURVEY FOR KAMPAR AND INDRAGIRI RIVER SYSTEMS

The river survey for the Kampar and Indragiri river systems was carried out on subcontract basis by a local surveyor under the supervision of the Study Team. The work consists of longitudinal profiling and cross-sectioning survey. The survey locations are as shown in Fig. XVIII.1.1, and the work volumes are tabulated in the table below. Drawings of longitudinal profiles and cross sections are compiled as APPENDIX.

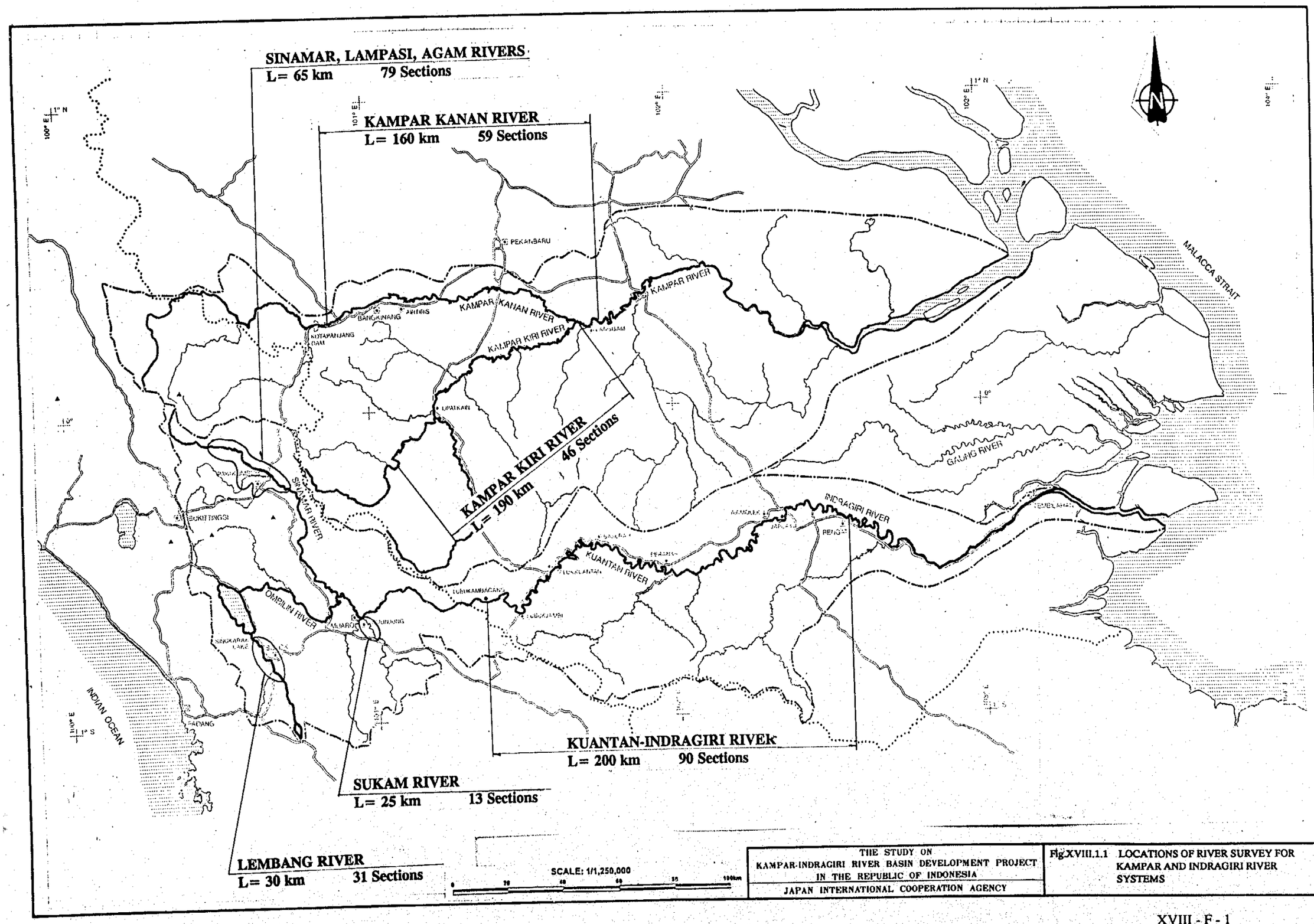
River Stretch	Longitudinal Profile (km)	Cross-Section (No. of Sections)
Kampar Kanan River	160	59
Kampar Kiri River	190	46
Sinamar, Lampasi, Agam Rivers	65	79
Lembang River	30	31
Sukam River	25	13
Kuantan-Indragiri River	200	90
Total	670	318

CHAPTER 2 TOPOGRAPHIC SURVEY FOR KUANTAN DAMSITE AND RENGAT AREA

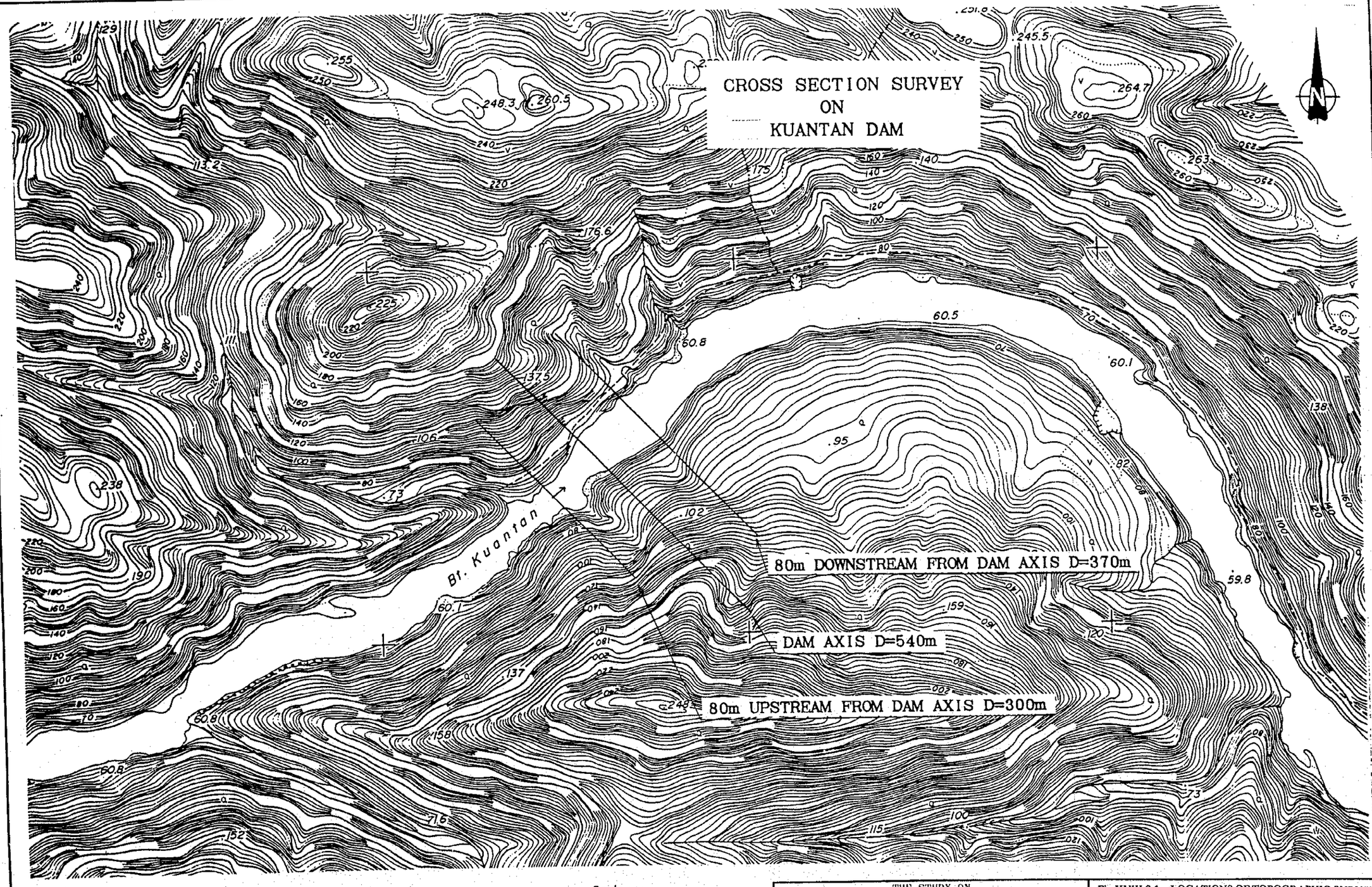
The topographic survey for the Kuantan Damsite and the Rengat Area was carried out on subcontract basis by a local surveyor under the supervision of the JICA Study Team. The work consists of longitudinal profiling and cross-sectioning survey for the Kuantan Damsite and the Rengat area. The survey locations are as shown in Figs. XVIII.2.1 and XVIII.2.2, and the work volumes are as tabulated in the table below. Drawings of longitudinal profiles and cross sections are compiled as APPENDIX.

Location	Longitudinal Profie (km)	Cross-Section (No. of Sections)
Kuantan Damsite	-	3
Rengat Area	10.2	11
Total	10.2	14

FIGURES

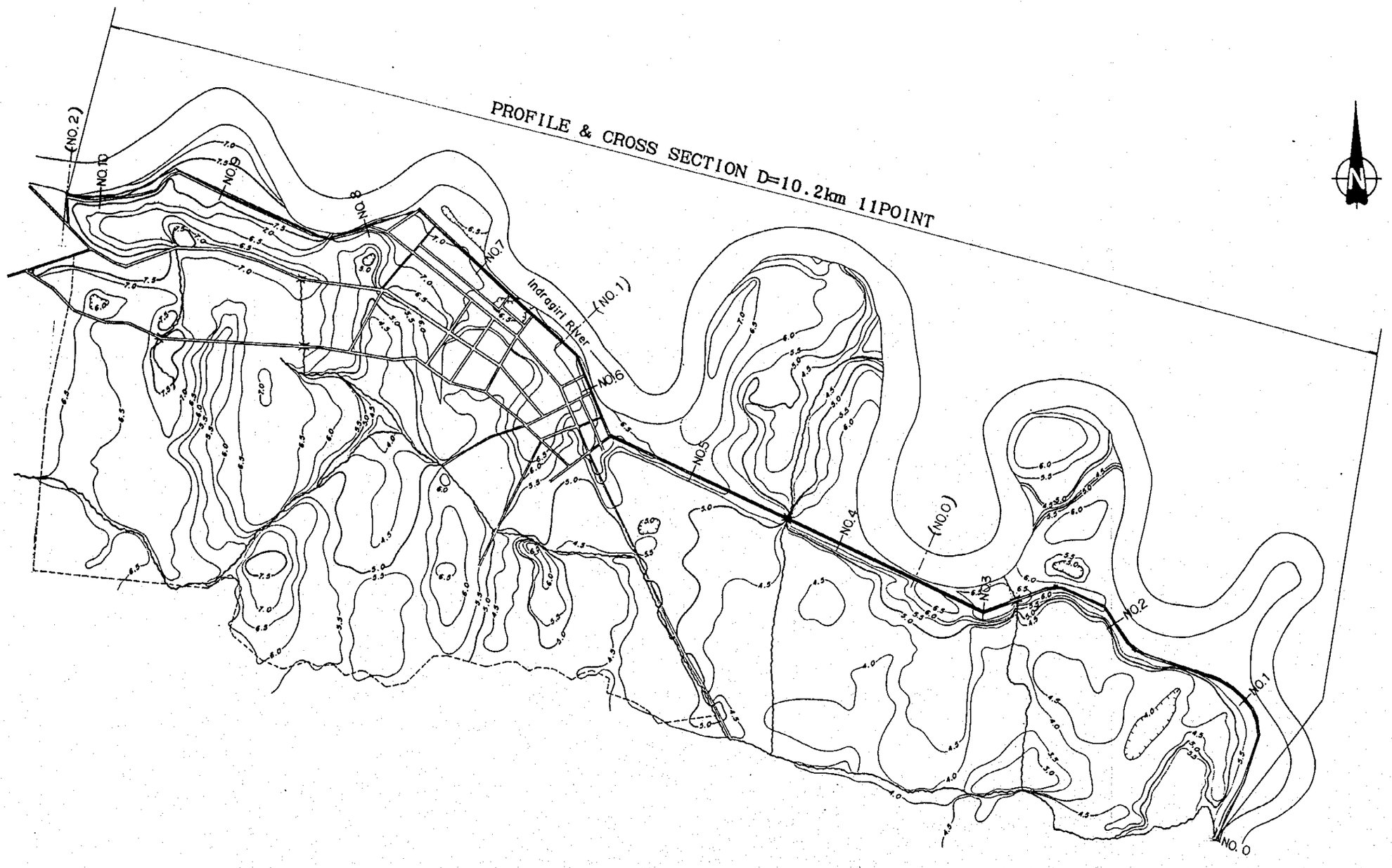


THE STUDY ON KAMPAR-INDRAGIRI RIVER BASIN DEVELOPMENT PROJECT IN THE REPUBLIC OF INDONESIA JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.XVIII.1.1 LOCATIONS OF RIVER SURVEY FOR KAMPAR AND INDRAGIRI RIVER SYSTEMS



THE STUDY ON KAMPAR-INDRAGIRI RIVER BASIN DEVELOPMENT PROJECT IN THE REPUBLIC OF INDONESIA JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.XVIII 2.1 LOCATIONS OF TOPOGRAPHIC SURVEY FOR KUANTAN DAMSITE

PROFILE & CROSS SECTION D=10.2km 11POINT



0 0.5 1 1.5 2km

THE STUDY ON KAMPAR-INDRAGIRI RIVER BASIN DEVELOPMENT PROJECT IN THE REPUBLIC OF INDONESIA JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. XVIII.2.2 LOCATIONS OF TOPOGRAPHIC SURVEY FOR RENGAT AREA