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

THE FEASIBILITY STUDY
ON

JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO, JAPAN

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THE FEASIBILITY STUDY
ON
CIDANAU-CIBANTEN
WATER RESOURCES DEVELOPMENT PROJECT

FINAL REPORT

VOLUME IV

SUPPORTING REPORT (2)

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This Report consists of

Volume I	*Summary Report*
Volume II	*Main Report*
Volume III	*Supporting Report (1)*
Volume IV	*Supporting Report (2)*
Volume V	*Data Book*

APPENDIX - F
PLAN FORMULATION

APPENDIX - F
PLAN FORMULATION

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. General

Plans for the schemes were formulated in four (4) steps,incorporating information available at each Field and Home Work throughout First stage and Second stage. Various alternative plans were examined during the course of the Study. Fig. F-5 illustrates the logic and flow of plan formulation studies.

Data and information used at each study step may be summarized as below;

Stage of Study	Phase I		Phase II	
Step of plan formulation	1st Step	2nd Step	3rd Step	4th Step
Report output	Progress Report No.1 (March 1991)	Progress Report No.2 (Aug.1991)	Interim Report (Nov.1991)	Progress Report No.3(Jan.1992) and Draft Final Report (May 1992)
Topographic information	1:50,000(Anyer& Krenceng, Rawa Danau) 1:5,000 (Cibanten) 1:2,000 (Cidanau)	1:50,000 (Beroeng) 1:5,000 (Cidanau & Rawa Danau)	1:2,000 (Krenceng) 1:400 (Cross section of Krenceng)	Revised 1:2000 (Krenceng) 1:400 (Profile of Beroeng diversion site)
Geological information	Reconnaissance & core drilling	Reconnaissance & core drilling	Core drilling Seismic Exploration	Core drilling
Construction material	Reconnaissance & test results	Reconnaissance	Test results	Test results
Hydrological information	Records at Kubang Baros & Serut stations		Modified rating curve of both Serut station	Anyer&Krenceng: estimated by Serut station
	Anyer&Krenceng: estimated by Kubang Baros station	Anyer&Krenceng: estimated by Kubang Baros station		
Discharge Measurement	Kubang Baros & Serut	Kubang Baros&Serut		Kubang Baros, Serut & Beroeng
Downstream information considered	Cibanten irrigable area		Added Anyer irrigable area	Revised Anyer irrigable area and added Beroeng irrigable area and river maintenance flow during dry season
Alternative schemes considered	5	4	15	3

2 Identification of Dam Sites

2.1 Selection of Proposed Dam Sites

1) First selection of proposed dam sites

Various possible damsites are identified in the study area through the site reconnaissance by the JICA Study Team. The following nine (9) damsites and two (2) intake weir sites are identified.

Scheme	Identified dam site & intake site	Name of river	Basin area (km^2)	Location (upstream of estuary)
A-1	Cibanten	Cibanten	73.15	22 km
A-4 & A-5	Up-Cidanau	Cidanau	199.5	7.5 km
A-2	Mid-Cidanau	Cidanau	204.1	4.7 km
A-3	Down-Cidanau	Cidanau	208.25	3.5 km
A-6	Upstream of Krakatau intake	Cidanau	214.95	1.2 km
A-4-4	Up-Anyer	Anyer	31.2	3.5 km
A-4-3	Mid-Anyer	Anyer	38.6	3.0 km
A-4-1&A-4-2	Down-Anyer	Anyer	41.3	2.0 km
K-1, K-2 & K-3	Heightening of Krenceng dam	Krenceng	13.3	4.0 km
	Beroeng intake *	Beroeng	12.1	15.0 km
	Anyer intake *	Anyer	17.5	12.5 km

Note: * means proposed intake weir site.

2) Final selection of proposed dam sites

Among nine (9) damsites identified, five (5) damsites were discarded based on the following reasons;

Anyer dam site (A-4-1, A-4-2, A-4-3 and A-4-4)

There is a lot of irrigated areas and houses in the downstream anyer river basin. Thus the Anyer storaged dam plan will bring the social problem due to the resettlement of inhabitants in the inundation area. Thus the Anyer dam site is not taken up.

Middle Cidanau damsite (A-2)

Both abutments above El.50.00 m is covered by thick residual soil of more 10 m depth and the underlying unconsolidated pumice tuff is highly weathered to more than 15 m in thickness. Besides, unconsolidated pumice tuff also develops below the river bed up to more 15 m depth. Serious geotechnical difficulties are envisaged for the stability of dam foundation.

The possible storage volume is very small comparing to the downstream Cidanau dam site even though the sediment is removed by maintenance dredging. Therefore the development cost would be quite high. Thus this damsite is not taken up.

Upstream Cidanau damsite (A-4 and A-5)

Based on a rough study, technically, a very large water storage of around 100 million m^3 could be developed by provision of a small dam, 10 m height at the outlet of Rawa Danau and by raising the lake water level up to about El.91.0 m, and the available water supply would be about 8 m^3/sec. Thus the Rawa Danau storaged dam plan will be the most beneficial with very low water cost comparing to other damsites. However, this scheme is not taken up as it is beyond the Scope of Work in this Study. It is a prerequisite in the TOR that, the full supply water level of the Cidanau damsite should be settled so as not to submerge the Rawa Danau which is a nature reserve area.

In view of the potential of development of Rawa Danau storage scheme as mentioned above, it is suggested by DGWRD that the development of Rawa Danau should be reconsidered after the environmental problem would be settled.

Also, the free intake located in the upstream of the river which will not submerge Rawa Danau is planned to convey directly through the pipeline and store the water of Cidanau river in the Anyer river or the Krenceng reservoir. From the results of simultaneous discharge measurement carried out in first and second field works, it was not emerged the possibility of decrease in discharge toward the downstream due to infiltration of the flow into the tuffaceous bed rock. Therefore, the free intake is not practical because the downstream Krakatau intake is rather suitable due to that the pipeline will be shorter.

2.2 Proposed Dam Sites

1) Cibanten dam site

The Cibanten dam site is selected at 150 m downstream of confluence point between Cibanten river about 21.75 km upstream of the river mouth, at 10 km south of Serang. The site is accessible from Serang by the all-weather motorable road.

The dam and reservoir area are characterized by wide open valley and flat topography. The hills with ridges at the dam axis is formed around El.120 m. On the dam axis, the river, about 10 m wide shows a large meander with the riverbed at El.75.0 m. The slopes on both banks rise at around 1/2.0 of gradient almost immediately from the river brinks.

Both abutments are covered by residual soil of only 1 m in thickness. The weathered welded tuff under thin residual soil is about 20 m in depth. The difficulties in foundation treatment are not envisaged.

Annual inflow from the catchment area of 73.15 km^2 is estimated to be 63 x 10^6 m^3. An area-storage curve of the reservoir is as shown in Fig. F-1.

2) Downstream Cidanau dam site

The dam site is selected at about 3.5 km upstream of the Cidanau river mouth, at 15 km south of Anyer. The site is accessible from Anyer by a jeep.

The dam and reservoir area are characterized by narrow valley and steep topography. The hills with ridges at the dam axis is formed around El.80 m. On the dam axis, the river, about 10 m wide shows a small meander with the riverbed at El.20.0 m. The slopes on both banks rise at around 1/1.5 of gradient almost immediately from the river brinks.

Both abutments around El.50 m to El.60 m are covered by residual soil of 5-10 m in thickness. The weakly welded pumice tuff under residual soil is about 10-15 m in depth and the top of CL class is located around El.50.0 m. The welded tuff under weakly welded pumice tuff widely develops around 30-45 m depth. The mudstone develops 2-3 m depth with the dipping downstream, 1/20 around El.0 m. The artesian ground water is observed beneath mudstone.

Permeability is generally high. Treatment including the artesian ground water will be made by ordinal procedure of grouting.

Annual inflow from the catchment area of 208.25 km^2 is estimated to be 429 x 10^6 m^3. An area-storage curve of the reservoir is as shown in Fig. F-2.

3) Cidanau gated weir site

The Cidanau gated weir site is selected at 200 m upstream of existing Cidanau intake weir about 1.2 km upstream of the river mouth, at 13 km south of Anyer. The site is accessible from Anyer by a jeep.

The dam and reservoir area are characterized by wide open valley and flat topography with scattered low hills. The hills with ridges at the dam axis are formed around El.35.0 m. On the dam axis, the river, about 60 m wide flows northeast at the riverbed of El.0 m. The slopes on both banks rise at around 1/3.5 of gradient almost immediately from the river brinks.

Both abutments are covered by residual soil of only 1-2 m in thickness. The unconsolidated pumice tuff under thin residual soil is about 5-7 m in depth. The welded pumice tuff under unconsolidated pumice tuff widely develops and the permeability is low. However, the riverbed is covered by deposited silt, sand and gravel of 15 m in maximum depth. The thick deposited material will be removed and backfilled by the leveling concrete for dam foundation.

Annual inflow from the catchment area of 214.95 km^2 is estimated to be 452 x 10^6 m^3. An area-storage curve of the reservoir is as shown in Fig. F-3.

4) Heightening of Krenceng dam

The Krenceng dam will be heightened at the downstream slope of the existing Krenceng dam. The dam is located about 4 km upstream of the river mouth, at 2.5 km west of Cilegon. The site is accessible from Cilegon by the all-weather motorable road.

The dam and reservoir area are characterized by wide open valley and flat topography with scattered low hills. The hills with ridges at the dam axis are formed around El.30 m.

The downstream foundation along the existing Krenceng dam is covered by residual soil of only 0.5 m in thickness. The weathered pumice tuff under thin residual soil is about 4 m in depth. The weakly welded pumice tuff under weathered pumice tuff is about 4 m in depth. The permeability is low.

Annual inflow from the catchment area of 13.3 km^2 is estimated to be 13.5 x 10^6 m^3. An area-storage curve of the reservoir is as shown in Fig. F-4.

(5) Beroeng intake weir and diverted tunnel

The Beroeng intake weir is selected at 15 km upstream of mouth, 6 km upstream of the existing Krenceng dam. The site is accessible from Cilegon by a jeep along around on the ridge between Beroeng and Krenceng rivers.

The intake area is characterized by wide open valley and flat topography with scattered low hills. The inlet portal of diverted tunnel is located just upstream of intake weir. The tunnel passes through the gentle hill, the ground covering of which is 20-30 m. The residual deposit is thin around the weir and tunnel site. The weathered pumice tuff is exposed.

Annual inflow from the catchment area of 12.1 km^2 is estimated to be 12.3 x 10^6 m^3.

(6) Anyer intake weir and diversion tunnel

The Anyer intake weir is selected at 12.5 km upstream of the river mouth, 10 km upstream of the existing Krenceng dam. The site is accessible from Cilegon by the all-weather motorable road along the ridge between Anyer and Krenceng basins.

The intake area is characterized by wide open valley and flat topography with scattered low hills. The inlet portal of diverted tunnel is located just upstream of intake weir. The tunnel passes through the gentle hill, the ground covering of which is 10-15 m. The residual deposit is thin around the weir and tunnel site. The weathered pumice tuff is exposed.

Annual inflow from the catchment area of 17.5 km^2 is estimated to be 18.6 x 10^6 m^3.

3. Comparative Study for Alternative Development Schemes

3.1 Comparative Study of Alternative Single Development Schemes

3.1.1 Formulation of Alternative Single Development Schemes

The following alternative schemes were selected through the site reconnaissance as shown in Fig. F-6. The six alternative development schemes are summarized as below;

1) A-1: Cibanten dam development scheme

Construction of a storaged type dam in the Cibanten river, together with a 28 km pipe line to convey water from the dam site to the existing Krenceng receiving reservoir at Cilegon, and an additional water treatment plant.

2) A-3: Downstream Cidanau dam development scheme

Construction of a storaged type dam in the Cidanau river, together with an additional water treatment plant. Water is conveyed from the existing Krakatau intake weir to the existing Krenceng receiving reservoir at Cilegon through the existing 27.2 km pipe line.

3) A-6: Cidanau gated weir development scheme

Construction of a weir with high gates located at just upstream of existing Krakatau intake weir, together with an additional water treatment plant. Water is conveyed from the existing Krakatau intake weir to the existing Krenceng reservoir at Cilegon through the existing 27.2 km pipeline.

4) K-1: Krenceng dam heightening scheme without diversion tunnel

Heightening of Krenceng dam, replacement of the pumping station and construction of an additional water treatment plant. Water is conveyed from the existing Krakatau intake weir to the heightened Krenceng reservoir through the existing 27.2 km pipe line.

5) K-2: Krenceng dam heightening scheme with one diversion tunnel

Heightening of Krenceng dam and construction of a diversion tunnel from Beroeng river to the Krenceng basin, replacement of the pumping station at Krakatau intake

and construction of an additional water treatment plant near Krenceng. Water is conveyed from the existing Krakatau intake weir to the heightened Krenceng reservoir

6) K-3: Krenceng dam heightening scheme with two diversion tunnels

Heightening of Krenceng dam along its downstream slope of and construction of two diversion tunnels from Beroeng river to Krenceng basin and Anyer river to Krenceng basin, replacement of the pumping station near Krakatau intake and construction of additional water treatment plant. Water is conveyed from the existing Krakatau intake weir to the heightened Krenceng reservoir through the existing 27.2 km pipe line.

3.1.2 Design Criteria

1) Design criteria of dam and appurtenant facilities

The following design criteria is adopted and applied to the Formulation study.

(1) Design flood discharge

a) The spillway is designed by 120% peak discharge of 200-year flood without reservoir retardation effect.

b) The energy dissipator is designed by the peak discharge of 100-year flood adopted as the design flood discharge without reservoir retardation effect.

c) The diameter of diversion tunnel is designed in order to discharge the 25-year inflow flood hydrograph without overtopping the cofferdam under construction.

The same design flood discharge is applied to both concrete and fill types at this stage.

Probable Flood Peak

(unit: m^3/s)

Return period (year)	Cibanten dam site	Downstream Cidanau dam site	Cidanau gated weir site	Heightening Krenceng dam site
25	814	346[1)]	346[1)]	128
100	1033	444[1)]	444[1)]	171
1.2 x 200	1324	535[1)]	535[1)]	225

Note: 1) means regulated peak outflow at the outlet of Rawa Danau.

(2) Normal high water level and low water level

In the spillway with a non-gated overflow weir being adopted, the normal high water level (NHWL.El.) corresponds to the crest elevation of a spillway overflow weir.

The low water level (LWL.El.) corresponds to the horizontal sedimentation in 100 years

(3) Freeboard and dam crest elevation

The freeboard which provides the highest crest elevation of non-overflow section of a main dam is adopted from the following alternative combination of freeboard and the maximum design water surface.

Maximum design water surface	Freeboard requirement
Normal high water level	Hf (1) = hw +he+ha+hi or 3 m for fill type and 2 m for concrete type
Design flood discharge water	Hf(2)=hw+ha+hi or 2 m for fill type and 1m for concrete type

where, hw : Wave height due to wind
he : Wave height due to earthquake
ha : Rise of water level due to unexpected accident in operating spillway gates(0.5 m for a gated type and 0 for a non-gated type)

hi : Addition of allowance for safety according to type and importance of dams (1 m for fill dams and 0 m for concrete dams)

The crest elevation of the non-overflow section of a main dam which corresponds to the crest elevation of the impervious core of a fill dam, is the sum of the maximum design water level and the freeboard.

(4) Dam foundation

The depth of the cutoff trench for fill dam is excavated down to the top of CM class. The rock and random zones for fill dam is excavated down to the top of CL class.

The foundation of concrete dam is laid on the top of CM class.

(5) River diversion

The river diversion during the construction is divided into two types, tunnel type and multi-stage diversion type.

(6) Dam

The dam type is divided into three types, rockfill type, earthfill type and concrete gravity type.

Both upstream and downstream slopes for the rockfill dam and earthfill dam are conservatively designed with 1: 3.0, respectively.

In the concrete gravity dam, the upstream is vertical and downstream is 1:0.6.

(7) Spillway

The spillway is divided into two types, gated type and non-gated type.

2) Design criteria of water supply facilities

(1) Outlet works

Intake

The intake tower which is of reinforced concrete is provided in the reservoir and its foundation is laid on the top of CM class.

Shaft and tunnel

The bottom of intake tower is connected to the diversion tunnel through the vertical shaft and horizontal tunnel. The diversion tunnel between the upstream plug portion and downstream plug portion beneath the dam axis is utilized as the permanent waterway after the operation of reservoir.

Steel conduit and outlet facility

The steel conduit is installed in the tunnel between the downstream plug portion and outlet portal. The outlet facility which consist of guard gate valve and hollow jet valve is provided at the downstream of tunnel portal.

In the proposed Cibanten dam, the irrigation water requirement to the downstream is regulated by the hollow jet valve and the water supply pipe line to the existing Krenceng reservoir is branched between the guard gate valve and hollow jet valve.

In the proposed Cidanau dam, the storaged water in the reservoir is released to the downstream Cidanau river by the hollow jet valve.

In the proposed Cidanau gated weir, the storaged water in the reservoir is directly transmitted to the existing sand trap basin by the steel conduit, about 200 m length between the upstream surface of non-overflow section at the gated weir and the entrance of existing sand trap basin. The regulation is made by hollow jet valve to be installed at the entrance.

(2) Water supply pipe line and pump station

Water transmission system from cibanten river

The water transmission system from the Cibanten dam to the existing Krenceng reservoir is of an embedded pipe line type because it is difficult to construct the open channel in view of topographic condition. The open channel will cause serious transportation loss and water pollution.

If the foundation condition is normal, pipes are placed on a sand bed of 30 cm in thickness in the excavated trench with a bottom width of 1.70 m. Side slopes of the trench will vary 1:0.3 to 1:0.5 depending on the soil condition. Soil cover of the pipe should be about 1.2 m.

Water conveyance and treatment facility from Cidanau river

(1) In principle the incremental development due to the Project above the design capacity of existing Krakatau water conveyance and treatment facilities is additionally provided for the intake sand trap basin and Cidanau pump station and the water treatment plant.

(2) The existing water conveyance facility which consists of Cidanau pump station and 27.2 km long pipe line having the conveyance capacity of 2 m^3/sec at the maximum pumping head of 67.1 m is operated so as to exceed the design capacity of the existing.

(3) The additional pumps to be provided at Cidanau pump station should be designed at the total head of 67.1 m.

(4) In case that the development yield exceeds the existing, full water can not conveyed upto the Krenceng reservoir by using the design head of Cidanau pumps.

Therefore, the booster pump station should be provided at the intermediate point, about 14.25 km from the Cidanau pump station so as to convey the water up to the Krenceng reservoir after receiving of water conveyed from the Cidanau pump station.

(5) According to the booster pump station, the surge tank is additionally provided at the place between the booster pump station and Krenceng receiving well.

(6) The existing Krenceng pump station is replaced by the proposed heightening of Krenceng dam.

(7) Distribution line

The distribution line is not included at this stage.

3.1.3 Water Balance Study

(1) General condition

The basic equation for the water balance study is;

$$ds/dt = O - I$$

where, ds : differential of reservoir capacity between time interval dt,
O : Safe yield
I : inflow

The general condition for water balance study is summarized as below;

1) The inflow at each gauging station is calculated based on five (5)-day mean inflow based on the revised discharge rating curve. The simulation of water balance is carried out for 10 years as below.

Data of five(5)-day mean inflow at Serut : 1980 to 1989
Data of five(5)-day mean inflow at Kubang Baros : 1980 to 1989

2) The inflow into the proposed dam site and intake site for diverted tunnel is calculated as below.

$$Q_{site} = Q_{key} \cdot (R_{site}/R_{key}) \cdot (A_{site}/A_{key})$$

where;

Q_{site}, R_{site}, A_{site} : daily mean discharge, annual rainfall and catchment area at the project site, respectively.

Q_{key}, R_{key}, A_{key} : daily mean discharge, annual rainfall and catchment area at the key gauge site, respectively.

Annual rainfall and catchment area of the key gauges and project sites are as follows:

Proposed sites			Key gauge		
Name of site	Catchment area (km^2)	Annual rainfall (mm)	Name of gauge	Catchment area (km^2)	Annual rainfall (mm)
Cibanten dam	73.15	2000	Serut	73.15	2000
Cidanau downstream dam	208.25	3000	Kubang Baros	199.5	3000
Krakatau intake	214.95	3000	Kubang Baros	199.5	3000
Beroeng intake	12.10	2250	Serut	73.15	2000
Anyer intake	17.50	2500	Serut	73.15	2000
Krenceng dam	13.30	2250	Serut	73.15	2000
Cidanau gated weir	214.95	3000	Kubang Baros	199.5	3000

3) The basin area of alternative plan is obtained by the topographic map of 1/50,000.

4) The evaporation loss on the reservoir and transportation loss of water transmission facilities to the water treatment plant are neglected at this stage.

5) The sedimentation volume of reservoir is estimated based on the analysis results of sediment sampling conducted during first field work at the Cidanau and Cibanten rivers.

Cibanten river basin : 900 m^3/year/km^2
Cidanau river basin : 500 m^3/year/km^2
Krenceng river basin : 900 m^3/year/km^2

6) The river maintenance flow to the downstream reach is considered only the period of dry season for proposed Beroeng and Anyer intake sites because the wet season is satisfied by the return flow due to the irrigation water to be released from the proposed intake weir.

The river maintenance flow is converted by the annual rainfall, catchment area and 2-yrs probable drought at Serut gauging station.

River maintenance flow during dry season

Downstream Anyer : 0.12 m^3/sec
Downstream Beroeng : 0.07 m^3/sec

7) The area and storage capacity curves of proposed dam sites were obtained by the following topographic maps;

Cibanten dam site : existing 1/5,000

Cidanau dam site : 1/5,000 by topographic mapping during first field work

Krenceng dam site : 1/2,000 by topographic and hydrographic survey during second field work

8) The required effective storage volume for corresponding safe yield was obtained by maximum drought during the period of 10 years.

(2) Specific condition

The specific condition of water balance study for each alternative is summarized as below.

1) Downstream conditions of proposed intake

The downstream water requirement at the proposed intake site for the diversion tunnel is obtained as below.

$$Qr = \frac{IDR}{1000} \times Ha \times 1000$$

where, Qr : downstream water requirement (m^3/day)
IDR : irrigation diversion requirement (mm/ha/day)
Ha : Total irrigable area in the Anyer basin (ha)
Downstream Anyer : 320 ha during wet season
Beroeng : 120 ha during wet season

There is no data of irrigation water requirement for the paddy area in wet season. IDR is tentatively obtained by using the basic design report for rehabilitation of Ciujung irrigation canal system (June 1990) and the effective rainfall is obtained by the data of daily rainfall at Serang gauging station.

2) Operation of diversion tunnel

The basic conditions for the water balance study against the downstream is as follows:

During wet season	$Qb \geq IDR$	:	$Q = Qb - IDR$ $Qmax = Qt$
	$Qb < IDR$	:	$Q = 0$
During dry season	$Qb \geq DRM$	:	$Q = Qb - DRM$ $Qmax = Qt$
	$Qb < DRM$	:	$Q = 0$

Where, Qb : inflow at diversion site
IDR : irrigation diversion requirement
Qt : Maximum discharge capacity of tunnel (4.0 m^3/sec)
DRM : downstream river maintenance flow

3) Downstream condition of Cibanten dam site

The present downstream paddy area of Cibanten dam site through the intake weir is estimated by 1961 ha in wet season and 566 ha in dry season. The IDR is also obtained by the report of Ciujung irrigation canal system mentioned above and the effective rainfall is obtained by the data of daily rainfall at Serang gauging station.

(3) Flow chart of computation procedure

The flow chart of computation procedure is shown in Figs. F-7 to F-9 and its schematic diagram is shown in Figs. F-10 to F-15.

3.1.4 Safe Yield for Existing Krakatau Water Supply System

The principal features of the existing Krakatau water supply system which consist of intake weir at the Cidanau river, pump station, 27.2 km long pipe line, Krenceng

reservoir, suction pump and water treatment plant are presented but there are no design data for safe yield of the existing Krakatau water supply system.

1) Basic conditions

- Water conveyance capacity of a 27.2 km long pipe line : 2.0 m^3/sec
- Capacity of suction pump and water treatment plant : 2.0 m^3/sec
- Inflow at the Krenceng dam site from Krenceng own catchment area
- Inflow at the Krakatau intake weir site

2) Revised storage volume

Based on the hydrographic survey results in the Krenceng reservoir carried out during the 2nd Field Work and 4th Field Work, the reservoir storage should be revised as below.

(unit: 10^6m^3)

Storage	Original (Krakatau's data)	Revision (Measurement)	Balance
Effective[1)]	1.45	3.155	+1.705
Gross[2)]	2.50	4.90	+2.400

Notes ; 1) between LWL.18.50 and NHWL.22.50
2) between LWL.18.50 and Max.WL.24.00

3) Simulation study results of safe yield

According to the water balance study by Scheme K-1, the simulation study for the existing Krakatau water supply system is carried out by two cases so as to justify the safe yield.

Case -1 : with pump station and 27.2 km long pipe line
(Krenceng own catchment and natural flow at Krakatau intake weir site)

Case -2 : without pump station and 27.2 km long pipe line
(Only Krenceng own catchment)

3) Safe yield

Case -1 : 1.97 m^3/sec

Case -2 : 0.235 m^3/sec

Considering the above simulation results, it is justified that the facility capacity of existing Krakatau water supply system, 2.0 m^3/sec is well coincided with the safe yield, 1.97 m^3/sec.

The safe yield of existing Krakatau water supply system is evaluated by 1.97 m^3/sec.

3.1.5 Safe Yield vs. Required Effective Storage and Safe Yield vs. NHWL for Alternative Scheme

The safe yield vs. required effective storage and safe yield vs.normal high water level (NHWL) for alternative development schemes are summarized in Figs. F-16 to F-21.

3.1.6 Maximum Exploitable Dam Scale and Development Yield

1) Cibanten dam

From the topographical constraint where the ridge of both abutments is located at El.120.00 m, upper limit (NHWL) of the Cibanten dam site is set at El.115.00 m considering the freeboard of 5 m including the overflow depth. Besides, the geological condition is favourable and with thin top soil. Thus, the maximum exploitable dam scale is limited at NHWL.El.115.00 m. The development yield is 0.45 m^3/sec under the condition that the design sedimentation has 6.58×10^6 m^3 and the downstream irrigation water requirement be satisfied with an 80% probability of exceedance the drought.

2) Downstream Cidanau dam

From the topographical constraint where the ridge of left abutment is located at El.75.0 m, upper limit (NHWL) of the Cidanau dam site is set at El.70.0 m considering the freeboard of 5 m including the overflow depth. However, the residual soil and unconsolidated pumice tuff (D class) are covered up to El.50.0 m and the underlying weakly welded pumice tuff, CL class develops. The foundation of fill dam should be laid on the top of CL class.

Thus, the maximum exploitable dam scale is limited at NHWL.El.50.00 m and the gross storage is 7.11×10^6 m^3 above the river bed of El.20.0 m.

Adding the design sedimentation, no effective storage is remained. In order to secure possible effective storage, the sediment basin is provided just upstream of outlet of Rawa danau.

Sediment basin : 1 nos x300 wide x300 m length (Wet season)

Excavation depth	2.5 m
Total water depth	2.0 m
Effective water depth	1.0 m

1 nos x100 wide x50 m length(dry season)

Excavation depth	2.0 m
Total water depth	1.5 m
Effective water depth	0.5 m

Smallest particles to be settled 0.035 mm

Critical velocity	10 cm/sec=Vc=a(d)^(1/2) =51(0.035)^(1/2)
Design velocity	0.1 m/sec=Q/A=30/(1x300)
Settled particles	60% (above 0.035 mm based on the sediment sample in 1st field work)

Considering the above, the practical sedimentation become 4.165 x 10^6 m^3 and the effective storage become 2.945 x 10^6 m^3. The development yield is 1.825 m^3/sec.

3) Cidanau gated weir

From the topographical constraint where the ridge of both abutments is located at El.35.00 m, upper limit (NHWL) of the Cidanau gated dam site is set at El.32.00 m considering the freeboard of 3 m with flood regulation by the gate. Besides, the geological condition is favourable but the removal of deposited material below the river bed is needed.

However, the maximum exploitable gate height is limited to around 20 m. Considering the above, the normal high water level is set at El.20.0 m and the development yield is 1.97 m^3/sec.

4) Heightening of Krenceng dam

From the topographical constraint where the ridge of both abutments is located at El.32.00 m, upper limit (NHWL) of the heightened Krenceng dam is set at 29.00 m considering the freeboard of 3 m with flood regulation by the gate. Besides, the geological condition is favourable for foundation of fill dam.

Thus, the maximum exploitable dam scale is limited at NHWL.El.29.00 m. The gross storage is 12.60 x 10^6 m^3 above the lowest elevation of El.13.00 m. The effective storage is 11.40 x10^6 m^3 considering the design sedimentation of 1.20 x 10^6 m^3.

Scheme	Development yield (m^3/sec)
K-1	3.10
K-2	3.15
K-3	3.20

3.1.7 Incremental Yield for Alternatives

From the above results, the incremental yield for the alternatives is summarized as below.

Scheme	Maximum exploitable dam height (m)	Effective storage volume (10^6m^3)	Development yield (cms)	Existing yield (cms)	Incremental yield (cms)	Total system yield (cms)	Water demand of forecast in 2005 (cms)	Surplus /deficit (cms)
A-1	45 1)	14.9	0.45	1.97	0.45	2.42	3.67	-1.25
A-3	35 2)	2.95	1.825	1.97	0.09	2.06	3.67	-1.61
A-6	24.2 3)	3.44	1.970	1.97	0.235	2.205	3.67	-1.465
K-1	24 1)	12.87	3.10	1.97	1.03	3.00	3.67	-0.57
K-2	24 1)	12.87	3.15	1.97	1.15	3.12	3.67	-0.52
K-3	24 1)	12.87	3.20	1.97	1.28	3.25	3.67	-0.47

Notes : 1) due to topographic constraint
2) due to geological constraint
3) due to hydro-mechanical constraint

3.1.8 Preliminary Design and Principal Features for Alternative Single Development Schemes

The general plan of proposed dam and its reservoir are shown in Figs. F-22 to F-25. The plan, the maximum section and the upstream view of the main structures for the proposed dam are shown in Figs. F-26 to F-29. The plan and profile of conveyance from the proposed Cibanten dam to Krenceng receiving reservoir is shown in Fig. F-30. The principal features for alternative single development scheme are summarized in Table F-2.

3.2 Comparative Study on Alternative Combined Development Schemes

3.2.1 Necessity of Comparative Study on Combined Development

As seen in the results of Chapter 3.1.7, any single development scheme cannot satisfy the urgent water demand in the year 2005. Therefore, the comparative study on alternative combined development scheme is required so as to increase the total system yield in the Study Area.

3.2.2 Formulation of Alternative Combined Development Schemes

The following three alternative combined development schemes are divided into three groups in terms of the type of development for the heightening of Krenceng dam and formulated by nine (9) alternatives as below.

Scheme	Single scheme to be combined
B-1	K-1 plus A-1
B-2	K-1 plus A-3
B-3	K-1 plus A-6
C-1	K-2 plus A-1
C-2	K-2 plus A-3
C-3	K-2 plus A-6
D-1	K-3 plus A-1
D-2	K-3 plus A-3
D-3	K-3 plus A-6

3.2.3 Design Criteria

1) Dam and appurtenant facilities

The design conditions concerned are same as the alternative single development one.

2) Water transmission facilities

(1) Krakatau pump station

The Krakatau pump station should be added by the incremental yield except Scheme B-1, C-1 and D-1.

(2) Booster pump station

The booster pump station should be added by the development yield except Scheme B-1, C-1 and D-1.

(3) Krenceng pump station

The Krenceng pump station should be replaced by the development yield.

(4) Water treatment plant

The water treatment plant should be added by the incremental yield.

3.2.4 Water Balance Study and Incremental Yield

1) Water balance study

The water balance study for the combined development scheme is carried out by the same procedures described in Chapter 3.1.3.

The flow chart of computation procedure and the schematic diagram is shown in Figs. F-31 (1) to F-34.

2) Safe yield

The safe yield, required effective storage volume and normal high water level for each scheme are summarized in Figs. F-35 to F-40.

3) Incremental yield

From the above results, the incremental yield for the alternatives is summarized as below.

(unit: cms)

Scheme	Development yield	Existing yield	Incremental yield	Total system yield	Water demand forecast in 2005	Surplus or deficit
B-1	3.55	1.97	1.58	3.55	3.67	-0.12
B-2	3.40	1.97	1.43	3.4	3.67	-0.27
B-3	3.435	1.97	1.465	3.435	3.67	-0.235
C-1	3.60	1.97	1.63	3.60	3.67	-0.07
C-2	3.445	1.97	1.475	3.445	3.67	-0.225
C-3	3.49	1.97	1.52	3.49	3.67	-0.18
D-1	3.65	1.97	1.68	3.65	3.67	-0.02
D-2	3.49	1.97	1.52	3.49	3.67	-0.18
D-3	3.54	1.97	1.57	3.54	3.67	-0.13

3.2.5 Principal Features of Alternative Combined Development Schemes

The principal features of alternative combined development schemes are summarized in Table F-2.

3.3 Selection of the Scheme

3.3.1 General

Based on the Single and combined Comparative Studies mentioned in Chapter 3.1 and 3.2, the schemes to be selected as the feasibility study are determined by the economic and socio-environmental view-points.

3.3.2 Cost Estimate

The construction cost is estimated based on the drawings for basic design and its principal features for the alternatives. The construction period including the tender design is 7 years. The breakdown of construction costs is summarized in Table F-3 to F-26.

3.3.3 Economic Cost

Disbursement

The construction cost is uniformly disbursed owing to the construction period.

O&M costs

The annual O&M costs for the dam and appurtenant structures are 0.5% of the direct cost. Annual O&M costs for water transmission and treatment facilities are taken at 1% of direct cost.

Pumping costs

The pumping costs due to difference between "with Project" and "without Project" are estimated by the principal features.

Replacement cost

The water conveyance facilities is assumed to be incurred for replacement after the life of 25 years.

Conversion factor

The conversion factor is 0.9

Economic cost

The cost above is converted by the conversion factor.

3.3.4 Economic Benefit

Combined water tariff

The combined water tariff which consists of domestic and industrial water is estimated by 1625 Rp/m^3.

Economic benefit

The economic benefit is obtained by multiplying the combined water tariff and incremental yield as shown in Figs. F-41 to F-55.

3.3.5 Economic Evaluation

Results

The results of economic evaluation are summarized in Table F-27 and F-28.

Selection of the Schemes as Feasibility Study

The comparative study on the above fifteen (15) alternative schemes was made through comprehensive evaluation from the economic, technical and social aspects. Among alternative above, K-3 is the highest EIRR. Second highest is with the Scheme K-2 third is with the Scheme K-1 and fourth is the Scheme C-3. However, K-3 is discarded because there is more 330 ha of paddy field in the downstream of Anyer main only except the tributary and the diversion to Krenceng reservoir might cause various social effect to the downstream.

Finally, the following three (3) schemes are selected as the feasibility study.

(i) Scheme K-1: Heightening of Krenceng dam without diversion tunnel

(ii) Scheme K-2: Heightening of Krenceng dam with Beroeng diversion tunnel

(iii) Scheme C-3: Heightening of Krenceng dam with Beroeng diversion tunnel and Cidanau gated weir

They were agreed in the Minute of Meeting on the Interim Report between the JICA Study Team, the Advisory Committee and the DGWRD on November 8, 1991.

4. Plan Optimization

The scales of heightening of Krenceng dam, Beroeng diversion tunnel and Cidanau gated weir have been decided by the maximum exploitable scale due to the topographic constraint and hydro-mechanical constraint.

Herein, the optimal development scale of each project components above was studied by comparing the capitalized net benefit of various alternative scales based on the net benefit maximization criteria.

4.1 Optimal Heightening Scale of Krenceng Dam

A comparative study of heightening scale of Krenceng dam was worked out on the 3 alternatives (Fig. F-56).

	Description	Alternative		
		H-1	H-2	H-3
1)	Dam crest elevation	El.32.00	El.29.00	El.26.00
2)	Normal high water level	NHWL.29.00	NHWL.26.00	NHWL.23.00
3)	Low water level level	LWL.18.50	LWL.18.50	LWL.18.50
4)	Effective storage (10^6 m^3)	12.81	7.90	4.05
5)	Design sediment (10^6 m^3)	1.20	1.20	1.20
6)	Gross storage (10^6 m^3)	14.01	9.1	5.25
7)	Safe yield (m^3/sec)	3.10	2.65	2.105
8)	Incremental yield (m^3/sec)	1.13	0.68	0.135
8)	Annual average conveyance from Krakatau intake (10^6 m^3/yr)	83.72	70.34	53.53
8)	Added pump capacity at Cidanau intake (m3/sec)	1.10	0.65	0.105
9)	Replaced pump capacity at Krenceng reservoir (m3/sec)	3.10	2.65	2.105
10)	Added water treatment plant(m3/hr)	3960	2340	378

The design for heightened dam and its spillway is carried out by fixing the following conditions;

i) The dam axis for the heightening of Krenceng dam is located at the downstream toe of the existing dam so as to keep the slope stability of existing one and secure the operation of ordinary grouting work after cut-off excavation. The heightened dam is planned by the homogeneous earthfill type with the slope of 1:3.0 in both upstream and downstream sides.

ii) Spillway is located at 60 m leftwards from the centre of existing spillway. The spillway is designed as a gated overflow type having a 15.5 m of net width. Spillway gate consists of two roller gates having an overall dimension of 7.75 m wide and 4.30 m high.

The stilling basin is designed as the hydraulic jump type.

The work quantities for alternatives are summarized as below.

Item		Alternative		
		H-1	H-2	H-3
1)	Dam			
	Excavation (m^3)	25590	215032	173998
	Embankment (m^3)	1356001	886564	550458
	Grouting (m)	39953	31812	28074
2)	Spillway			
	Excavation (m^3)	49769	49398	48225
	Concrete (m^3)	17866	12268	7383
3)	Gate			
	Nos.	2	2	2
	Dimension (BxH)	7.75 x 4.3	7.75 x 4.3	7.75 x 4.3

The results of the economic comparison are summarized as below.

(unit: 10^6Rp)

Description		Alternative		
		H-1	H-2	H-3
1)	Economic cost 1]	112532	78034	40195
2)	Capitalized cost (C) 2]	91575	63293	32410
3)	Capitalized benefit (B) 3]	243637	146614	29107
4)	Net benefit (B-C)	152062	83320	-3303
5)	Benefit cost ratio (B/C)	2.66	2.32	0.90

Note: 1] Conversion factor: 0.9
2] Included O&M cost and pumping cost
Capitalized by the discount rate of 12%
3] Water tariff after treatment: 1625 Rp/m^3

As shown in the table above, the alternative H-1, the maximum heightening scale yields the highest net benefit among the 3 alternatives.

4.2 Optimal Scale of Beroeng Diversion Tunnel

(1) Basic approach

The economic diameter was obtained with the least cost criteria,taking into consideration the construction cost of alternative diversion tunnel and the

differential pumping cost of Krakatau intake due to the water conveyance from the Krakatau intake.

(2) Design condition

The diversion tunnel is designed under the hydraulic condition of pressure flow. The downstream water depth at the outlet portal is assumed to set the crown of tunnel because the discharge capacity of downstream hydraulic cross section in the Krenceng river is bigger than that due to prospective tunnel diameter. The upstream water level at the inlet portal is designed to set the water depth of one (1) diameter of the tunnel above the tunnel crown at the inlet portal so as to keep the pressure flow condition. No slope of tunnel is provided.

$$H = \left(\frac{124.5\ n^2 L}{D^{4/3}} + fe + fo\right)\frac{v^2}{2g} = D$$

where, H : loss head between inlet and outlet (m)
g : acceleration of gravity (= 9.8 m/s^2)
n : roughness coefficient for concrete (= 0.014)
L : tunnel length (= 280 m)
fe : coefficient of entrance loss
fo : coefficient of exit loss (= 1.0)
v : flow velocity
D : tunnel diameter

(3) Alternatives

Four (4) alternatives are selected as below.

Description		Alternative			
		J-1	J-2	J-3	J-4
1)	Tunnel diameter(m)	1.50	2.00	2.50	3.00
2)	Maximum discharge(cms)	4	11	20.5	35

The water balance study was carried out by fixing the following conditions;

i) The water conveyance capacity of Krakatau pump station has 3.15 m^3/sec which corresponds to the safe yield of heightening of Krenceng reservoir.

ii) The basic conditions for the water balance study against the downstream Beroeng is as follow.

During wet season	Qb ≥ IDR	:	Q = Qb - IDR Qmax = Qt
	Qb < IDR	:	Q = 0
During dry season	Qb ≥ DRM	:	Q = Qb - DRM Qmax = Qt
	Qb < DRM	:	Q = 0

where, Qb : inflow at Beroeng diversion site
IDR : irrigation diversion requirement
Qt : Maximum discharge capacity of tunnel
DRM : downstream river maintenance flow

(4) Results of water balance study

	Description	Alternative			
		J-1	J-2	J-3	J-4
1)	Development yield(cms)	3.15	3.15	3.15	3.15
2)	Required effective storage (10^6m^3)	12.83	12.83	12.83	12.83
3)	Design sediment(10^6m^3)	1.20	1.20	1.20	1.20
4)	Gross storage(10^6m^3)	14.03	14.03	14.03	14.03
5)	Normal high water level (El-m)	29.00	29.00	29.00	29.00
6)	Water conveyance from Krakatau intake(10^6m^3/yr)	77.238	77.057	77.057	77.057
7)	Water conveyance thru Beroeng diversion tunnel (10^6m^3/yr)	10.062	10.243	10.243	10.243
8)	Total water conveyance to Krenceng reservoir (10^6m^3/yr)	87.300	87.300	87.300	87.300

The annual equivalent of tunnel construction cost and differential pumping cost are summarized as below.

(unit: 10^6Rp)

	Description	Alternative			
		J-1	J-2	J-3	J-4
1)	Tunnel diameter(m)	1.5	2.0	2.5	3.0
2)	Direct cost for tunnel	422.73	599.91	803.65	1033.94
3)	Annual equivalent cost 1]	50.90	72.24	96.77	124.50
4)	Annual pumping cost	2980.9	2974.5	2974.5	2974.5
5)	Total annual cost	3031.8	3046.7	3071.3	3099.0

Note: 1] Capital recovery factor, CRF:0.120416
Discount rate: 12%

As shown in the table above, the alternative J-1,the minimum tunnel diameter in the practical construction yields the lowest cost among the 4 alternatives.

4.3 Optimal Scale of Cidanau Gated Weir

A comparative study of gate height of Cidanau gated weir was worked out on the 2 alternatives (Fig. F-56).

	Description	Alternative	
		M-1	M-2
1)	Dam crest elevation	El.24.20	El.21.20
2)	Normal high water level	NHWL.21.20	NHWL.18.20
3)	Low water level	LWL.1.50	LWL.1.50
4)	Effective storage (10^6m^3)	3.44	2.37
5)	Design sediment (10^6m^3)	-	-
6)	Gross storage (10^6m^3)	3.44	2.37
7)	Safe yield (cms)	1.97	1.75
8)	Total yield (cms)	2.205	1.985
9)	Incremental yield (cms)	0.235	0.015
10)	Spillway gate	3 nos. x 17 m wide x 20 m high	3 nos. x 17 m wide x 17 m high
11)	Added pump capacity at Cidanau intake (m^3/sec)	-	-
12)	Added water treatment plant (m^3/hr)	738	54

The design for gated weir and its spillway is carried out by fixing the following conditions;

i) The dam type for both abutments is of concrete gravity one. The upstream is vertical and downstream is 1:0.6.

ii) The crest elevation and net width for gated weir are set at El.1.50 m and 51 m, respectively.

The work quantities for alternatives are summarized as below.

Item		Alternative	
		M-1	M-2
1)	Dam		
	Excavation(m^3)	21324	20067
	Concrete(m^3)	23519	18984
	Grouting(m)	3806	3140
2)	Spillway		
	Excavation(m^3)	24059	24059
	Concrete(m^3)	22011	19884
3)	Gate		
	Nos.	2	2
	Dimension(BxH)	17 x 20	17 x 17

The results of the economic comparison are summarized as below.

(unit:10^6Rp)

	Description	Alternative	
		M-1	M-2
1)	Economic cost [1]	67484	57927
2)	Capitalized cost (C) [2]	46012	39182
3)	Capitalized benefit (B) [3]	50668	3234
4)	Net benefit value (B-C)	4656	-35948
5)	Benefit cost ratio (B/C)	1.10	0.08

Note: 1] Conversion factor: 0.9
2] Included O&M cost and pumping cost
Capitalized by the discount rate of 12%
3] Water tariff after treatment: 1625 Rp/m^3

As shown in the table above,the alternative M-1, the maximum gate height is more economical than M-2.

4.4 Final Reservoir Operation and Net Safe Yield

The final reservoir operation was carried out by fixing the development scale of each component determined in the preceding chapter so as to obtain the net safe yield for each scheme which means the supply yield after the evaporation loss from the reservoir.

1) Basic conditions

(i) Reservoir operation study

The reservoir operation study was carried out by the following four (4) cases;

Case 1 : Existing Krenceng dam

Case 2 : Scheme K-1 (Heightening of Krenceng dam without Beroeng diversion tunnel)

Case 3 : Scheme K-2 (Heightening of Krenceng dam with Beroeng diversion tunnel)

Case 4 : Scheme C-3 (Heightening of Krenceng dam with Beroeng diversion tunnel and Cidanau gated weir)

	Description	Case 1	Case 2	Case 3	Case 4	
1)	Reservoir	Krenceng	Krenceng	Krenceng	Krenceng	Cidanau
2)	NHWL	22.50	29.00	29.00	29.00	21.20
3)	LWL	18.50	18.00	18.00	18.00	1.50
4)	Capacity of diversion tunnel (m^3)	-	-	4.0	4.0	-

(ii) Evaporation loss

The evaporation loss from the reservoir surface is estimated to be 70% of the mean pan-evaporation observed at Padarincang.

(unit:mm/day)

	Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1)	Observed pan record	4.5	3.7	3.3	3.4	3.4	3.1	3.4	4.4	4.0	4.1	4.5	4.1
2)	Evaporation loss	3.15	2.59	2.31	2.38	2.38	2.17	2.38	3.08	2.80	2.87	3.15	2.87

2) Results of reservoir operation study

(i) Net supply yield

The net supply yield for each case is summarized as below.

	Case	Net supply yield (m^3/sec)	Net incremental supply yield (m^3/sec)
i)	Existing Krenceng dam	1.94	-
ii)	Heightening of Krenceng dam without diversion	3.05	1.11
iii)	Heightening of Krenceng dam with Beroeng diversion tunnel	3.11	1.17
iv)	Heightening of Krenceng dam with Beroeng diversion tunnel and Cidanau gated weir	3.435	1.495

(ii) Reservoir operation study

The results of reservoir operation study were shown in Figs. F-58 to F-65 and Table F-34 (1) to F-37 (12).

TABLES

Table F-1 Principal Features for Alternative Single Development Schemes

		A-1 Cibanten Dam		A-3 Down-stream Cidanau Dam	A-6 Cidanau Gated Weir	K-1 Heightening of Krenceng Dam without Diversion	K-2 Heightening of Krenceng Dam with One Diversion	K-3 Heightening of Krenceng Dam with Two Diversions	
Reservoir									
Name of river		Cibanten		Cidanau	Cidanau	Krenceng	Krenceng	Krenceng	
Catchment area	km^2	73.15		208.25	214.95	13.3	13.3	13.3	
Reservoir surface area	km^2	2.1		0.6	0.41	1.8	1.8	1.8	
Gross capacity	10^6m^3	21.5		7.11	3.44	14.1	14.1	14.1	
Effective capacity	10^6m^3	14.9		2.95	3.44	12.9	12.9	12.9	
Development yield	m^3/s	0.45		1.825	1.97	3.10	3.15	3.20	
High water level	EL-m	115.0		50.0	21.2	29.0	29.0	29.0	
Low water level	EL-m	104.5		44.0	0	18.0	18.0	18.0	
Annual rainfall	mm/yr	2,250		3,000	3,000	2,250	2,250	2,250	
Mean runoff	m^3/sec	2.0		13.63	14.36	0.43	0.43	0.43	
Design peak flood	m^3/sec								
25 yrs		814		346	346	128	128	128	
100 yrs		1,033		444	44	171	171	171	
1.2 x 200 yrs		1,324		535	535	225	225	225	
Dam and Rated Facility									
Diversion Work									
River diversion		Tunnel scheme		Tunnel scheme	Multi-stage diversion	Multi-stage diversion	Multi-stage diversion	Multi-stage diversion	
Diversion tunnel, L	m	410		400	-	-	-	-	
D	m	5		5	-	-	-	-	
Diversion gate	Nos.	1		1	-	-	-	-	
Dam		Main dam	Saddle dam						
Type		Rock-fill	Rando m-fill	Rockfill	Gravity	Impervious random-fill	Impervious random-fill	Impervious random-fill	
Crest elevation	EL-m	120	120	55	24.2	32	32	32	
Height (from river bed)	m	45	34	35	24.2	16	16	16	
Crest length	m	340	275	255	299	2,800	2,800	2,800	
Embankment/Conc.volume	10^3m^3	947	168	474	43	1,281	1,281	1,281	
Spillway									
Type		Side overflow		Side overflow	Roller gate	Roller gate	Roller gate	Roller gate	
Crest elevation of weir	EL-m	115		50	1.5	24	24	24	
Width of weir	m	150		120	61	20	20	20	
Gate (wide x height x Nos.)		-		-	17x20x3	8.75x5.5x2	8.75x5.5x2	8.75x5.5x2	
Outlet Works									
Intake type		Vertical		Vertical	Horizontal	-	-	-	
Steel conduit, L	m	230		285	200	-	-	-	
Guard valve	Nos.	1		1	1	-	-	-	
Hollow jet valve	Nos.	1		1	1	-	-	-	
Diversion Tunnel									
Name of river		-		-	-	-	Beroeng	Beroeng	Anyer
Catchment area at weir	km^2	-		-	-	-	12.1	12.1	17.5
Mean runoff	m^3/sec	-		-	-	-	0.39	0.39	0.59
Maximum discharge capacity	m^3/sec	-		-	-	-	4.0	4.0	4.0
Diverted tunnel, L	m	-		-	-	-	300	300	700
D	m	-		-	-	-	1.5	1.5	1.5
Water Transmission Facility									
Transmission pipeline, L	km	28.0		Existing	Existing	Existing	Existing	Existing	
D	m	0.7		Existing	Existing	Existing	Existing	Existing	
Krakatau pump station 2/									
Pump discharge	m^3/s	-		Existing	Existing	1.1	1.19	1.2	
Pump head	m	-		Existing	Existing	67.1	67.1	67.1	
Additional pump	kW	-		Existing	Existing	1150	1200	1250	
Booster pump station3/									
Pump discharge	m^3/s	-		-	-	3.1	3.15	3.20	
Pump head	m	-		-	-	75	76	77	
Pump capacity	kW	-		-	-	3550	3650	3750	
Krenceng pump station 3/									
Pump discharge	m^3/s	0.45 3/		0.06 3/	0.205 3/	3.1	3.15	3.20	
Pump head	m	12.0		12.0	12	20	20	20	
Pump capacity	kW								
Connection pipeline 2/, L	m	160		160	160	160	160	160	
Water treatment plant 3/	m^3/hr	1,620		220	740	3960	4140	4320	

Notes: 1/ means regulated peak outflow at the outlet of Rawa Danau.
2/ Facility replaced due to development scheme
3/ Facility added due to development scheme

Table F-2 Principal Features for Alternative Combined Development Schemes

Item	Unit	B-1	B-2	B-3	C-1	C-2	C-3	D-1	D-2	D-3
Scheme combined		K-1 & A-1	K-1 & A-3	K-1 & A-6	K-2 & A-1	K-2 & A-3	K-2 & A-6	K-3 & A-1	K-3 & A-3	K-3 & A-6
Development yield	m^3/sec	3.55	3.40	3.435	3.60	3.445	3.49	3.65	3.49	3.54
Reservoir and Dam Facility		Same as corresponding single development scheme								
Transmission Facility										
Transmission pipeline, L	km	28.0			28.0			28.0		
D	m	0.7 & Existing	Existing	Existing	0.7	Existing	Existing	0.7 & Existing	Existing	Existing
Krakatau pump station 1/										
pump discharge	m^3/sec	1.55	1.40	1.435	1.60	1.445	1.49	1.65	1.49	1.54
pump head	m	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1
Additional pumps	kW	1,130	1,430	1,480	1,180	1,480	1,530	1,230	1,530	1,580
Booster pump station 1/										
Pump discharge	m^3/sec	3.55	3.40	3.435	3.60	3.445	3.49	3.65	3.49	3.54
Pump head	m	65	82	84	66	83.5	85	67.5	85	86
Pump capacity	kW	3,510	4,240	4,380	3,630	4,380	4,520	3,750	4,520	4,650
Krenceng pump station 2/										
pump discharge	m^3/sec	3.55	3.40	3.435	3.60	3.445	3.49	3.65	3.49	3.54
pump head	m	20	20	20	20	20	20	20	20	20
Connection pipeline, L	m	160	160	160	160	160	160	160	160	160
Water treatment plant 1/	m^3/hr	5,580	5,040	5,170	5,760	5,200	5,370	5,950	5,370	5,500

Notes: 1/ Facility added due to development scheme
2/ Facility replaced due to heightening of Krenceng dam

Table F-3 Cost Estimate for Cibanten Dam: Scheme A-1

DESCRIPTION		Unit	Qty	UNIT PRICE Fc (Yen)	UNIT PRICE Lc (Rp)	AMOUNT Fc (Yen)	AMOUNT Lc (Rp)
1. PREPARATORY WORK (20% of 2+3+4+5+6)						463,304,644	2,942,315,506
2. DIVERSION WORK							
2.1 Inlet & outlet							
Excavation	Common	m3	1,053	276	1,651	290,628	1,738,503
	Wea.rock	m3	2,106	339	1,398	713,934	2,944,188
	Rock	m3	7,371	962	3,475	7,090,902	25,614,225
Concrete		m3	2,640	13,442	132,187	35,486,880	348,973,680
Rein bar		t	100	5,292	1,460,955	529,200	146,095,500
(Sub-total)						44,111,544	525,366,096
2.2 Tunnel(l=410m,D=5m)							
Excavation		m3	10,462	8,744	105,122	91,479,728	1,099,786,364
Lining conc.		m3	2,401	13,488	155,546	32,425,152	373,932,584
Plug conc.		m3	686	13,488	155,546	9,252,768	106,704,556
Grouting		t	246	6,500	90,000	1,599,000	22,140,000
Rein bar		t	123	5,292	1,460,955	650,916	179,697,465
(Sub-total)						135,407,564	1,782,260,969
SUB-TOTAL OF 2.						179,519,108	2,307,627,065
3. DAM							
3.1 Cofferdam							
Excavation		m3	2,500	276	1,651	690,000	4,127,500
Embankment		m3	200,000	1,514	5,964	302,800,000	1,192,800,000
(Sub-total)						303,490,000	1,196,927,500
3.2 Main dam							
Excavation	Common	m3	11,075	276	1,651	3,056,700	18,284,825
	Wea.rock	m3	22,150	339	1,398	7,508,850	30,965,700
	Rock	m3	77,520	962	3,475	74,574,240	269,382,000
Embankment	Core	m3	101,416	605	2,359	61,356,680	239,240,344
	Filter	m3	62,644	2,285	5,756	143,141,540	360,578,864
	Random	m3	174,900	441	1,144	77,130,900	200,085,600
	Rock	m3	408,105	1,514	5,964	617,870,970	2,433,938,220
Grouting	Blanket	t	474	6,500	90,000	3,081,000	42,660,000
	Consoli.	t	114	6,500	90,000	741,000	10,260,000
	Curtain	t	1,287	6,500	90,000	8,365,500	115,830,000
(Sub-total)						996,827,380	3,721,225,553
3.3 Saddle dam							
Excavation	Common	m3	3,595	276	2,176	992,220	7,822,720
	Wea.rock	m3	7,190	339	2,585	2,437,410	18,586,150
	Rock	m3	25,160	962	4,433	24,203,920	111,534,280
Embankment		m3	167,975	244	1,717	40,985,900	288,413,075
Grouting		t	597	6,500	90,000	3,880,500	53,730,000
(Sub-total)						72,499,950	480,086,225
SUB-TOTAL OF 3.						1,372,817,330	5,398,239,278
4. SPILLWAY							
4.1 Side channel							
Excavation	Common	m3	8,100	276	1,651	2,235,600	13,373,100
	Wea.rock	m3	16,200	339	1,398	5,491,800	22,647,600
	Rock	m3	56,700	962	3,475	54,545,400	197,032,500
Concrete		m3	21,176	13,442	132,187	284,567,140	2,798,398,790
Rein bar		t	400	5,292	1,460,955	2,116,800	584,382,000
(Sub-total)						348,956,740	3,615,833,990
4.2 Chuteway							
Excavation	Common	m3	14,245	276	1,651	3,931,620	23,518,495
	Wea.rock	m3	28,490	339	1,398	9,658,110	39,829,020
	Rock	m3	99,715	962	3,475	95,925,830	346,509,625
Concrete		m3	11,395	13,442	132,187	153,171,590	1,506,270,865
Rein bar		t	220	5,292	1,450,955	1,164,240	319,210,100
(Sub-total)						263,851,390	2,235,338,105
4.3 Plunge pool							
Excavation	Common	m3	4,032	276	1,651	1,112,832	6,656,832
	Wea.rock	m3	8,061	339	1,398	2,733,696	11,273,472
	Rock	m3	28,224	962	3,475	27,151,488	98,078,400
(Sub-total)						30,998,016	116,008,704
SUB-TOTAL OF 4.						643,806,146	5,967,180,799
5. OUTLET WORKS							
5.1 Intake tower							
Excavation	Common	m3	515	276	1,651	142,140	850,265
	Wea.rock	m3	1,030	339	1,398	349,170	1,439,940
	Rock	m3	3,606	962	3,475	3,468,972	12,530,850
Concrete		m3	760	13,442	132,187	10,215,920	100,462,120
Rein bar		t	29	5,292	1,460,955	153,468	42,367,695
(Sub-total)						14,329,670	157,650,870
5.2 Intake shaft							
Excavation		m3	332	8,744	107,122	2,903,008	33,904,504
Concrete		m3	191	13,488	155,546	2,576,208	29,709,286
Rein bar		t	6	5,292	1,460,955	31,752	8,765,730
(Sub-total)						5,510,968	72,379,520
SUB-TOTAL OF 5.						19,840,638	230,030,390
6. METAL WORK							
6.1 Diversion gate		Ls	1	33,040,000		33,040,000	
6.2 Steel conduit		Ls	1		808,500,000		808,500,000
6.3 Hollow jet valve		Ls	1	45,000,000		45,000,000	
6.4 Guard valve		Ls	1	22,500,000		22,500,000	
SUB-TOTAL OF 6.						100,540,000	808,500,000
7. WATER SUPPLY PIPE LINE							
7.1 Excavation		m3	134,400	276	1,651	37,094,400	221,894,400
7.2 Backfill		m3	123,200	244	1,717	30,060,800	211,534,400
7.3 Add. pump station		Ls	1	57,000,000	385,000,000	57,000,000	385,000,000
7.4 Add. purification plant		Ls	1	569,000,000	3,805,000,000	569,000,000	3,805,000,000
7.5 Add. pipe line		Ls	1		40,040,000,000		40,040,000,000
7.6 Add. intake & surge tank		Ls					
SUB-TOTAL OF 7.						693,155,200	44,663,428,800
TOTAL OF DIRECT CONSTRUCTION COST						3,472,983,066	62,317,321,838

Table F-4 Cost Estimate for Downstream Cidanau Dam: Scheme A-3

DESCRIPTION		Unit	Q'ty	UNIT PRICE Fc (Yen)	UNIT PRICE Lc (Rp)	AMOUNT Fc (Yen)	AMOUNT Lc (Rp)
1. PREPARATORY WORK (20% of 2+3+4+5+6)						375,176,927	2,810,769,979
2. DIVERSION WORK							
2.1 Inlet & outlet							
Excavation	Common	m3	997	276	1,651	275,172	1,646,047
	Wea.rock	m3	11,970	339	1,398	4,057,830	16,734,060
	Rock	m3	6,982	962	3,475	6,716,684	24,262,450
Concrete		m3	2,640	13,442	132,187	35,486,880	348,973,680
Rein bar		t	100	5,292	1,460,955	529,200	146,095,500
(Sub-total)						47,065,766	537,711,737
2.2 Tunnel(l=400m,D=5m)							
Excavation		m3	10,710	8,744	105,122	93,648,240	1,125,856,620
Lining conc.		m3	2,464	13,488	155,546	33,234,432	383,265,344
Plug conc.		m3	686	13,488	155,546	9,252,768	106,704,556
Grouting		t	504	6,500	90,000	3,276,000	45,360,000
Rein bar		t	126	5,292	1,460,955	666,792	184,080,330
(Sub-total)						140,078,232	1,845,266,850
SUB-TOTAL OF 2.						187,143,998	2,382,978,587
3. DAM							
3.1 Cofferdam							
Excavation		m3	2,500	276	1,651	690,000	4,127,500
Embankment		m3	200,000	1,514	5,964	302,800,000	1,192,800,000
(Sub-total)						303,490,000	1,196,927,500
3.2 Main dam							
Excavation	Common	m3	24,986	276	1,651	6,896,136	41,251,886
	Wea.rock	m3	54,136	339	1,398	18,352,104	75,682,128
	Rock	m3	4,164	962	3,475	4,005,768	14,469,900
Embankment	Core	m3	49,100	605	2,359	29,705,500	115,826,900
	Filter	m3	31,308	2,285	5,756	71,538,780	180,208,848
	Random	m3	72,975	441	1,144	32,181,975	83,483,400
	Rock	m3	170,275	1,514	5,964	257,796,350	1,015,520,100
Grouting	Blanket	t	56	6,500	90,000	364,000	5,040,000
	Consoli.	t	182	6,500	90,000	1,183,000	16,380,000
	Curtain	t	2,556	6,500	90,000	16,614,000	230,040,000
(Sub-total)						438,637,613	1,777,903,162
3.3 Sand trap basin							
Excavation	Common	m3	306,750	276	2,176	84,663,000	667,488,000
	Wea.rock	m3		339	2,585		
	Rock	m3		962	4,433		
Maintenance road(2km)		m3	55,000	244	1,717	13,420,000	94,435,000
Concrete		m3	1,200	13,442	132,187	16,130,400	158,624,400
(Sub-total)						114,213,400	920,547,400
SUB-TOTAL OF 3.						856,341,013	3,895,378,062
4. SPILLWAY							
4.1 Side channel							
Excavation	Common	m3	103,760	276	1,651	28,632,240	171,274,760
	Wea.rock	m3	116,707	339	1,398	39,563,673	163,156,386
	Rock	m3	38,902	962	3,475	37,423,724	135,184,450
Concrete		m3	27,724	13,442	132,187	372,666,008	3,664,752,388
Rein bar		t	520	5,292	1,460,955	2,751,840	759,696,600
(Sub-total)						481,037,485	4,894,064,564
4.2 Chuteway							
Excavation	Common	m3	53,093	276	1,651	14,657,668	87,656,543
	Wea.rock	m3	127,425	339	1,398	43,197,075	178,140,150
	Rock	m3	31,856	962	3,475	30,645,472	110,699,600
Concrete		m3	8,775	13,442	132,187	117,953,550	1,159,940,925
Rein bar		t	175	5,292	1,450,955	926,100	253,917,125
(Sub-total)						207,375,865	1,790,354,343
4.3 Plunge pool							
Excavation	Common	m3	2,030	276	1,651	560,280	3,351,530
	Wea.rock	m3	14,210	339	1,398	4,817,190	19,865,580
	Rock	m3	24,360	962	3,475	23,434,320	84,651,000
(Sub-total)						28,811,790	107,868,110
SUB-TOTAL OF 4.						717,225,140	6,792,287,017
5. OUTLET WORK							
5.1 Intake tower							
Excavation	Common	m3	3,758	276	1,651	1,037,208	6,204,458
	Wea.rock	m3	4,176	339	1,398	1,415,664	5,838,048
	Rock	m3	418	962	3,475	402,116	1,452,550
Concrete		m3	500	13,442	132,187	6,721,000	66,093,500
Rein bar		t	20	5,292	1,460,955	105,840	29,219,100
(Sub-total)						9,681,828	108,807,656
5.2 Intake shaft							
Excavation		m3	299	8,744	102,122	2,614,456	30,534,478
Concrete		m3	171	13,488	155,546	2,306,448	26,598,365
Rein bar		t	6	5,292	1,460,955	31,752	8,765,730
(Sub-total)						4,952,656	65,898,574
SUB-TOTAL OF 5.						14,634,484	174,706,230
6. METAL WORK							
6.1 Diversion gate		Ls	1	33,040,000		33,040,000	
6.2 Steel conduit		Ls	1		808,500,000		808,500,000
6.3 Hollow jet valve		Ls	1	45,000,000		45,000,000	
6.4 Guard valve		Ls	1	22,500,000		22,500,000	
SUB-TOTAL OF 6.						100,540,000	808,500,000
7. WATER SUPPLY PIPE LINE							
7.1 Excavation		m3		276	1,651		
7.2 Backfill		m3		244	1,717		
7.3 Add. pump station		Ls	1	15,000,000	101,000,000	15,000,000	101,000,000
7.4 Add. purification plant		Ls	1	79,000,000	530,000,000	79,000,000	530,000,000
7.5 Add. pipe line		Ls	1		504,000,000		504,000,000
7.6 Add. Intake & surge tank		Ls	1	11,000,000	411,000,000	11,000,000	411,000,000
SUB-TOTAL OF 7.						94,000,000	1,135,000,000
TOTAL OF DIRECT CONSTRUCTION COST						2,345,061,562	17,999,619,875

Table F-5 Cost Estimate for Cidanau Gated Weir: Scheme A-6

DESCRIPTION		Unit	Q'ty	UNIT PRICE Fc (Yen)	UNIT PRICE Lc (Rp)	AMOUNT Fc (Yen)	AMOUNT Lc (Rp)
1. PREPARATORY WORK (20% of 2+3+4+5)						414,455,432	1,755,702,092
2. DIVERSION WORK							
2.1 Coffering work							
Sheet pile & bracing		t	159	131,583	36,915	20,921,697	5,869,485
SUB-TOTAL OF 2.						20,921,697	5,869,485
3. DAM							
3.1 Main dam							
Excavation	Common	m3	10,662	276	1,651	2,942,712	17,602,962
	Wea.rock	m3	8,462	339	1,398	2,868,618	11,829,876
	Rock	m3	2,200	962	3,475	2,116,400	7,645,000
Concrete		m3	21,325	5,052	118,708	107,733,900	2,531,448,100
Grouting	Consoli.	t	219	6,500	90,000	1,423,500	19,710,000
	Curtain	t	352	6,500	90,000	2,288,000	31,680,000
SUB-TOTAL OF 3.						119,373,130	2,619,915,938
4. SPILLWAY							
4.1 Dental work							
Excavation	Common	m3	22,389	276	1,651	6,179,364	36,964,239
	Wea.rock	m3		339	1,398		
	Rock	m3		962	3,475		
Concrete		m3	8,379	5,052	118,708	42,330,708	994,654,332
(Sub-total)						48,510,072	1,031,618,571
4.2 Weir & pier							
Excavation	Common	m3		276	1,651		
	Wea.rock	m3	1,170	339	1,398	396,630	1,635,660
	Rock	m3	500	962	3,475	481,000	1,737,500
Concrete		m3	10,761	13,442	132,187	144,649,362	1,422,464,307
Rein bar		t	1,290	5,292	1,460,955	6,826,680	1,884,631,950
Grouting	Consoli.	t	126	6,500	90,000	819,000	11,340,000
	Curtain	t	180	6,500	90,000	1,170,000	16,200,000
(Sub-total)						154,342,672	3,338,009,417
4.3 Hoist & bridge							
Concrete		m3	2,871	13,442	132,187	38,591,982	379,508,877
Rein bar		t	574	5,292	1,460,955	3,037,608	838,588,170
(Sub-total)						41,629,590	1,218,097,047
SUB-TOTAL OF 4.						244,482,334	5,587,725,035
5. METAL WORK							
5.1 Roller gate		Ls	1	1,620,000,000		1,620,000,000	
5.2 Steel conduit		Ls	1		565,000,000		565,000,000
5.3 Hollow jet valve		Ls	1	45,000,000		45,000,000	
5.4 Guard valve		Ls	1	22,500,000		22,500,000	
SUB-TOTAL OF 5.						1,687,500,000	565,000,000
6. WATER SUPPLY PIPE LINE							
6.1 Excavation		m3		276	1,651		
6.2 Backfill		m3		244	1,717		
6.3 Add. pump station		Ls	1	30,000,000	207,000,000	30,000,000	207,000,000
6.4 Add. purification plant		Ls	1	261,000,000	1,747,000,000	261,000,000	1,747,000,000
6.5 Add. pipe line		Ls	1		504,000,000		504,000,000
6.6 Add. intake & surge tank		Ls	1	14,000,000	537,000,000	14,000,000	537,000,000
SUB-TOTAL OF 6.						305,000,000	2,995,000,000
TOTAL OF DIRECT CONSTRUCTION COST						2,791,732,593	13,529,212,550

Table F-6 Cost Estimate for Heightening of Krenceng Dam without Diversion Tunnel: Scheme K-1

DESCRIPTION		Unit	Q'ty	UNIT PRICE Fc (Yen)	UNIT PRICE Lc (Rp)	AMOUNT Fc (Yen)	AMOUNT Lc (Rp)
1. PREPARATORY WORK (20% of 2+3)						257,537,340	1,466,768,687
2. DIVERTED TUNNEL							
2.1 Coffering work							
Coffering	Exca.	m3		276	1,651		
	Embank	m3		441	1,144		
(Sub-total)							
2.2 Weir							
Excavation	Common	m3		276	1,651		
	Wea.rock	m3		339	1,398		
	Rock	m3		962	3,475		
Concrete		m3		5,052	118,708		
Rein bar		t		5,292	1,460,955		
Gate		Ls		2,000,000			
(Sub-total)							
2.3 Inlet & outlet							
Excavation	Common	m3		276	1,651		
	Wea.rock	m3		339	1,398		
	Rock	m3		962	3,475		
Concrete		m3		13,442	132,187		
Rein bar		t		5,292	1,460,955		
Trash rack		Ls		1,000,000			
(Sub-total)							
2.4 Diverted tunnel							
Excavation		m3		8,744	105,122		
Lining conc.		m3		13,488	155,546		
Plug conc.		m3		13,488	155,546		
Grouting		t		6,500	90,000		
Rein bar		t		5,292	1,460,955		
(Sub-total)							
SUB-TOTAL OF 2.							
3. HEIGHTENING OF KRENCENG DAM							
3.1 Main dam							
Excavation	Common	m3	146,652	276	1,651	40,475,952	242,122,452
	Wea.rock	m3	97,768	339	1,398	33,143,352	136,679,664
	Rock	m3		962	3,475		
Embankment	Core	m3	1,281,085	605	2,359	775,056,425	3,022,079,515
	Filter	m3		2,285	5,756		
	Random	m3		441	1,144		
	Rock	m3		1,514	5,964		
Grouting	Blanket	t	1,868	6,500	90,000	12,142,000	168,120,000
	Curtain	t	3,676	6,500	90,000	23,894,000	330,840,000
(Sub-total)						884,711,729	3,899,841,631
3.2 Spillway							
(1) Approach wall & weir							
Excavation	Common	m3	3,097	276	1,651	854,772	5,113,147
	Wea.rock	m3	4,645	339	1,398	1,574,655	6,493,710
	Rock	m3		962	3,475		
Concrete		m3	6,628	13,442	132,187	89,093,576	876,135,436
Rein bar		t	135	5,292	1,460,955	714,420	197,228,925
(2) Chuteway & basin							
Excavation	Common	m3	11,879	276	1,651	3,278,604	19,612,229
	Wea.rock	m3	17,818	339	1,398	6,040,302	24,909,564
	Rock	m3		962	3,475		
Concrete		m3	14,260	13,442	132,187	191,682,920	1,884,986,620
Rein bar		t	285	5,292	1,460,955	1,508,220	416,372,175
Grouting	Consoli.	t	35	6,500	90,000	227,500	3,150,000
(3) Metal work							
Spillway gate		Ls	1	108,000,000		108,000,000	
(Sub-total)						402,974,969	3,434,001,806
SUB-TOTAL OF 3.						1,287,686,698	7,333,843,437
4. WATER SUPPLY PIPE LINE							
4.1 Excavation		m3		276	1,651		
4.2 Backfill		m3		244	1,717		
4.3 Add. pump station		Ls	1	1,022,000,000	6,833,000,000	1,022,000,000	6,833,000,000
4.4 Add. purification plant		Ls	1	1,385,000,000	9,263,000,000	1,385,000,000	9,263,000,000
4.5 Add. pipe line		Ls			1,428,000,000		
4.6 Add. intake & surge tank		Ls	1	63,000,000	2,305,000,000	63,000,000	2,305,000,000
4.7 Receiving well		Ls	1	6,000,000	218,400,000	6,000,000	218,400,000
SUB-TOTAL OF 4.						2,476,000,000	18,619,400,000
TOTAL OF DIRECT CONSTRUCTION COST						4,021,224,038	27,420,012,124

Table F-7 Cost Estimate for Heightening of Krenceng Dam with One Diversion Tunnel: Scheme K-2

DESCRIPTION		Unit	Q'ty	UNIT PRICE Fc (Yen)	UNIT PRICE Lc (Rp)	AMOUNT Fc (Yen)	AMOUNT Lc (Rp)
1. PREPARATORY WORK (20% of 2+3)						264,175,476	1,556,022,425
2. DIVERTED TUNNEL							
2.1 Coffering work							
Coffering	Exca.	m3	500	276	1,651	138,000	825,500
	Embank	m3	500	441	1,144	220,500	572,000
(Sub-total)						358,500	1,397,500
2.2 Weir							
Excavation	Common	m3	400	276	1,651	110,400	660,400
	Wea.rock	m3	400	339	1,398	135,600	559,200
	Rock	m3	200	962	3,475	192,400	695,000
Concrete		m3	150	5,052	118,708	757,800	17,806,200
Rein bar		t	15	5,292	1,460,955	79,380	21,914,325
Gate		Ls	1	2,000,000		2,000,000	
(Sub-total)						3,275,580	41,635,125
2.3 Inlet & outlet							
Excavation	Common	m3	1,664	276	1,651	459,264	2,747,264
	Wea.rock	m3	1,664	339	1,398	564,096	2,326,272
	Rock	m3	832	962	3,475	800,384	2,891,200
Concrete		m3	100	13,442	132,187	1,344,200	13,218,700
Rein bar		t	20	5,292	1,460,955	105,840	29,219,100
Trash rack		Ls	1	1,000,000		1,000,000	
(Sub-total)						4,273,784	50,402,536
2.4 Diverted tunnel							
Excavation		m3	1,600	8,744	105,122	13,990,400	168,195,200
Lining conc.		m3	650	13,488	155,546	8,767,200	101,104,900
Plug conc.		m3		13,488	155,546		
Grouting		t	360	6,500	90,000	2,340,000	32,400,000
Rein bar		t	35	5,292	1,460,955	185,220	51,133,425
(Sub-total)						25,282,820	352,833,525
SUB-TOTAL OF 2.						33,190,684	446,268,686
3. HEIGHTENING OF KRENCENG DAM							
3.1 Main dam							
Excavation	Common	m3	146,652	276	1,651	40,475,952	242,122,452
	Wea.rock	m3	97,768	339	1,398	33,143,352	136,679,664
	Rock	m3		962	3,475		
Embankment	Core	m3	1,281,085	605	2,359	775,056,425	3,022,079,515
	Filter	m3		2,285	5,756		
	Random	m3		441	1,144		
	Rock	m3		1,514	5,964		
Grouting	Blanket	t	1,868	6,500	90,000	12,142,000	168,120,000
	Curtain	t	3,676	6,500	90,000	23,894,000	330,840,000
(Sub-total)						884,711,729	3,899,841,631
3.2 Spillway							
(1) Approach wall & weir							
Excavation	Common	m3	3,097	276	1,651	854,772	5,113,147
	Wea.rock	m3	4,645	339	1,398	1,574,655	6,493,710
	Rock	m3		962	3,475		
Concrete		m3	6,628	13,442	132,187	89,093,576	876,135,436
Rein bar		t	135	5,292	1,460,955	714,420	197,228,925
(2) Chuteway & basin							
Excavation	Common	m3	11,879	276	1,651	3,278,604	19,612,229
	Wea.rock	m3	17,818	339	1,398	6,040,302	24,909,564
	Rock	m3		962	3,475		
Concrete		m3	14,260	13,442	132,187	191,682,920	1,884,986,620
Rein bar		t	285	5,292	1,460,955	1,508,220	416,372,175
Grouting	Consoli.	t	35	6,500	90,000	227,500	3,150,000
(3) Metal work							
Spillway gate		Ls	1	108,000,000		108,000,000	
(Sub-total)						402,974,969	3,434,001,806
SUB-TOTAL OF 3.						1,287,686,698	7,333,843,437
4. WATER SUPPLY PIPE LINE							
4.1 Excavation		m3		276	1,651		
4.2 Backfill		m3		244	1,717		
4.3 Add. pump station		Ls	1	1,043,000,000	6,977,000,000	1,043,000,000	6,977,000,000
4.4 Add. purification plant		Ls	1	1,448,000,000	9,683,000,000	1,448,000,000	9,683,000,000
4.5 Add. pipe line		Ls			1,428,000,000		
4.6 Add. intake & surge tank		Ls	1	65,000,000	2,394,000,000	65,000,000	2,394,000,000
4.7 Receiving well		Ls	1	6,000,000	218,400,000	6,000,000	218,400,000
SUB-TOTAL OF 4.						2,562,000,000	19,272,400,000
TOTAL OF DIRECT CONSTRUCTION COST						4,147,052,858	28,608,534,548

Table F-8 Cost Estimate for Heightening of Krenceng Dam with Two Diversion Tunnels: Scheme K-3

DESCRIPTION		Unit	Q'ty	UNIT PRICE Fc (Yen)	UNIT PRICE Lc (Rp)	AMOUNT Fc (Yen)	AMOUNT Lc (Rp)
1. PREPARATORY WORK (20% of 2+3)						277,982,360	1,734,709,347
2. DIVERTED TUNNEL							
2.1 Coffering work							
Coffering	Exca.	m3	1,000	276	1,651	276,000	1,651,000
	Embank	m3	1,000	441	1,144	441,000	1,144,000
(Sub-total)						717,000	2,795,000
2.2 Weir							
Excavation	Common	m3	1,200	276	1,651	331,200	1,981,200
	Wea.rock	m3	1,200	339	1,398	406,800	1,677,600
	Rock	m3	600	962	3,475	577,200	2,085,000
Concrete		m3	410	5,052	118,708	2,071,320	48,670,280
Rein bar		t	41	5,292	1,460,955	216,972	59,899,155
Gate		Ls	2	2,000,000		4,000,000	
(Sub-total)						7,603,492	114,313,235
2.3 Inlet & outlet							
Excavation	Common	m3	4,576	276	1,651	1,262,976	7,554,976
	Wea.rock	m3	4,576	339	1,398	1,551,264	6,397,248
	Rock	m3	2,288	962	3,475	2,201,056	7,950,800
Concrete		m3	200	13,442	132,187	2,688,400	26,437,400
Rein bar		t	40	5,292	1,460,955	211,680	58,438,200
Trash rack		Ls	2	1,000,000		2,000,000	
(Sub-total)						9,915,376	106,778,624
2.4 Diverted tunnel							
Excavation		m3	5,320	8,744	105,122	46,518,080	559,249,040
Lining conc.		m3	2,170	13,488	155,546	29,268,960	337,534,820
Plug conc.		m3		13,488	155,546		
Grouting		t	1,200	6,500	90,000	7,800,000	108,000,000
Rein bar		t	76	5,292	1,460,955	402,192	111,032,580
(Sub-total)						83,989,232	1,115,816,440
SUB-TOTAL OF 2.						102,225,100	1,339,703,299
3. HEIGHTENING OF KRENCENG DAM							
3.1 Main dam							
Excavation	Common	m3	146,652	276	1,651	40,475,952	242,122,452
	Wea.rock	m3	97,768	339	1,398	33,143,352	136,679,664
	Rock	m3		962	3,475		
Embankment	Core	m3	1,281,085	605	2,359	775,056,425	3,022,079,515
	Filter	m3		2,285	5,756		
	Random	m3		441	1,144		
	Rock	m3		1,514	5,964		
Grouting	Blanket	t	1,868	6,500	90,000	12,142,000	168,120,000
	Curtain	t	3,676	6,500	90,000	23,894,000	330,840,000
(Sub-total)						884,711,729	3,899,841,631
3.2 Spillway							
(1) Approach wall & weir							
Excavation	Common	m3	3,097	276	1,651	854,772	5,113,147
	Wea.rock	m3	4,645	339	1,398	1,574,655	6,493,710
	Rock	m3		962	3,475		
Concrete		m3	6,628	13,442	132,187	89,093,576	876,135,436
Rein bar		t	135	5,292	1,460,955	714,420	197,228,925
(2) Chuteway & basin							
Excavation	Common	m3	11,879	276	1,651	3,278,604	19,612,229
	Wea.rock	m3	17,818	339	1,398	6,040,302	24,909,564
	Rock	m3		962	3,475		
Concrete		m3	14,260	13,442	132,187	191,682,920	1,884,986,620
Rein bar		t	285	5,292	1,460,955	1,508,220	416,372,175
Grouting	Consoli.	t	35	6,500	90,000	227,500	3,150,000
(3) Metal work							
Spillway gate		Ls	1	108,000,000		108,000,000	
(Sub-total)						402,974,969	3,434,001,806
SUB-TOTAL OF 3.						1,287,686,698	7,333,843,437
4. WATER SUPPLY PIPE LINE							
4.1 Excavation		m3		276	1,651		
4.2 Backfill		m3		244	1,717		
4.3 Add. pump station		Ls	1	1,065,000,000	7,120,000,000	1,065,000,000	7,120,000,000
4.4 Add. purification plant		Ls	1	1,511,000,000	10,103,000,000	1,511,000,000	10,103,000,000
4.5 Add. pipe line		Ls			1,540,000,000		
4.6 Add. intake & surge tank		Ls	1	68,000,000	2,484,000,000	68,000,000	2,484,000,000
4.7 Receiving well		Ls	1	6,000,000	218,400,000	6,000,000	218,400,000
SUB-TOTAL OF 4.						2,650,000,000	19,925,400,000
TOTAL OF DIRECT CONSTRUCTION COST						4,317,894,158	30,333,656,083

Table F-9 Cost Estimate for Cibanten Dam: Scheme B-1

DESCRIPTION		Unit	Qty	UNIT PRICE Fc (Yen)	UNIT PRICE Lc (Rp)	AMOUNT Fc (Yen)	AMOUNT Lc (Rp)
1. PREPARATORY WORK							
(20% of 2+3+4+5+6)						464,133,519	2,947,352,634
2. DIVERSION WORK							
2.1 Inlet & outlet							
Excavation	Common	m3	1,053	276	1,651	290,628	1,738,503
	Wea.rock	m3	2,106	339	1,398	713,934	2,944,188
	Rock	m3	7,371	962	3,475	7,090,902	25,614,225
Concrete		m3	2,640	13,442	132,187	35,486,880	348,973,680
Rein bar		t	100	5,292	1,460,955	529,200	146,095,500
(Sub-total)						44,111,544	525,366,096
2.2 Tunnel(i=410cm,D=5m)							
Excavation		m3	10,462	8,744	105,122	91,479,728	1,099,786,364
Lining conc.		m3	2,404	13,488	155,546	32,425,152	373,932,584
Plug conc.		m3	686	13,488	155,546	9,252,768	106,704,556
Grouting		t	246	6,500	90,000	1,599,000	22,140,000
Rein bar		t	123	5,292	1,460,955	650,916	179,697,465
(Sub-total)						135,407,564	1,782,260,969
SUB-TOTAL OF 2.						179,519,108	2,307,627,065
3. DAM							
3.1 Cofferdam							
Excavation		m3	2,500	276	1,651	690,000	4,127,500
Embankment		m3	200,000	1,514	5,964	302,800,000	1,192,800,000
(Sub-total)						303,490,000	1,196,927,500
3.2 Main dam							
Excavation	Common	m3	11,075	276	1,651	3,056,700	18,284,825
	Wea.rock	m3	22,150	339	1,398	7,508,850	30,965,700
	Rock	m3	77,520	962	3,475	74,574,240	269,382,000
Embankment	Core	m3	101,416	605	2,359	61,356,680	239,240,344
	Filter	m3	62,644	2,285	5,756	143,141,540	360,578,864
	Random	m3	174,900	441	1,144	77,130,900	200,085,600
	Rock	m3	408,105	1,514	5,964	617,870,970	2,435,935,220
Grouting	Blanket	t	474	6,500	90,000	3,081,000	42,660,000
	Consol.	t	114	6,500	90,000	741,000	10,260,000
	Curtain	t	1,287	6,500	90,000	8,365,500	115,830,000
(Sub-total)						996,827,380	3,721,225,553
3.3 Saddle dam							
Excavation	Common	m3	3,595	276	2,176	992,220	7,822,720
	Wea.rock	m3	7,190	339	2,585	2,437,410	18,586,150
	Rock	m3	25,160	962	4,433	24,203,920	111,531,280
Embankment		m3	167,975	244	1,717	40,985,900	288,413,075
Grouting		t	597	13,442	132,187	8,024,874	78,915,639
(Sub-total)						76,644,324	505,271,864
SUB-TOTAL OF 3.						1,376,961,704	5,423,424,917
4. SPILLWAY							
4.1 Side channel							
Excavation	Common	m3	8,100	276	1,651	2,235,600	13,373,100
	Wea.rock	m3	16,200	339	1,398	5,491,800	22,647,600
	Rock	m3	56,700	962	3,475	54,545,400	197,032,500
Concrete		m3	21,170	13,442	132,187	284,567,140	2,798,398,790
Rein bar		t	400	5,292	1,460,955	2,116,800	584,382,000
(Sub-total)						348,956,740	3,615,833,990
4.2 Chuteway							
Excavation	Common	m3	14,245	276	1,651	3,931,620	23,518,495
	Wea.rock	m3	28,490	339	1,398	9,658,110	39,829,020
	Rock	m3	99,715	962	3,475	95,925,830	346,509,625
Concrete		m3	11,395	13,442	132,187	153,171,590	1,506,270,865
Rein bar		t	220	5,292	1,450,955	1,164,240	319,210,100
(Sub-total)						263,851,390	2,235,338,105
4.3 Plunge pool							
Excavation	Common	m3	4,032	276	1,651	1,112,832	6,656,832
	Wea.rock	m3	8,064	339	1,398	2,733,696	11,273,472
	Rock	m3	28,224	962	3,475	27,151,488	98,078,400
(Sub-total)						30,998,016	116,008,704
SUB-TOTAL OF 4.						643,806,146	5,967,180,799
5. OUTLET WORK							
5.1 Intake tower							
Excavation	Common	m3	515	276	1,651	142,140	850,265
	Wea.rock	m3	1,030	339	1,398	349,170	1,439,940
	Rock	m3	3,606	962	3,475	3,468,972	12,530,850
Concrete		m3	760	13,442	132,187	10,215,920	100,462,120
Rein bar		t	29	5,292	1,460,955	153,468	42,367,695
(Sub-total)						14,329,670	157,650,870
5.2 Intake shaft							
Excavation		m3	332	8,744	102,122	2,903,008	33,904,504
Concrete		m3	191	13,488	155,546	2,576,208	29,709,286
Rein bar		t	6	5,292	1,460,955	31,752	8,765,730
(Sub-total)						5,510,968	72,379,520
SUB-TOTAL OF 5.						19,840,638	230,030,390
6. METAL WORK							
6.1 Diversion gate		Ls	1	33,040,000		33,040,000	
6.2 Steel conduit		Ls	1		808,500,000		808,500,000
6.3 Hollow jet valve		Ls	1	45,000,000		45,000,000	
6.4 Guard valve		Ls	1	22,500,000		22,500,000	
SUB-TOTAL OF 6.						100,540,000	808,500,000
7. WATER SUPPLY PIPE LINE							
7.1 Excavation		m3	134,400	276	1,651	37,094,400	221,894,400
7.2 Backfill		m3	123,200	244	1,717	30,060,800	211,534,400
7.3 Add. pump station		Ls					
7.4 Add. purification plant		Ls					
7.5 Add. pipe line		Ls	1		39,200,000,000		39,200,000,000
7.6 Add. intake & surge tank		Ls					
SUB-TOTAL OF 7.						67,155,200	39,633,428,800
TOTAL OF DIRECT CONSTRUCTION COST						2,851,956,315	57,317,544,605

Table F-10 Cost Estimate for Heightening of Krenceng Dam without Diversion Tunnel: Scheme B-1

DESCRIPTION		Unit	Q'ty	UNIT PRICE Fc (Yen)	UNIT PRICE Lc (Rp)	AMOUNT Fc (Yen)	AMOUNT Lc (Rp)
1. PREPARATORY WORK (20% of 2+3)						257,537,340	1,466,768,687
2. DIVERTED TUNNEL							
2.1 Coffering work							
Coffering	Exca.	m3		276	1,651		
	Embank	m3		441	1,144		
(Sub-total)							
2.2 Weir							
Excavation	Common	m3		276	1,651		
	Wea.rock	m3		339	1,398		
	Rock	m3		962	3,475		
Concrete		m3		5,052	118,708		
Rein bar		t		5,292	1,460,955		
Gate		Ls		2,000,000			
(Sub-total)							
2.3 Inlet & outlet							
Excavation	Common	m3		276	1,651		
	Wea.rock	m3		339	1,398		
	Rock	m3		962	3,475		
Concrete		m3		13,442	132,187		
Rein bar		t		5,292	1,460,955		
Trash rack		Ls		1,000,000			
(Sub-total)							
2.4 Diverted tunnel							
Excavation		m3		8,744	105,122		
Lining conc.		m3		13,488	155,546		
Plug conc.		m3		13,488	155,546		
Grouting		t		6,500	90,000		
Rein bar		t		5,292	1,460,955		
(Sub-total)							
SUB-TOTAL OF 2.							
3. HEIGHTENING OF KRENCENG DAM							
3.1 Main dam							
Excavation	Common	m3	146,652	276	1,651	40,475,952	242,122,452
	Wea.rock	m3	97,768	339	1,398	33,143,352	136,679,664
	Rock	m3		962	3,475		
Embankment	Core	m3	1,281,085	605	2,359	775,056,425	3,022,079,515
	Filter	m3		2,285	5,756		
	Random	m3		441	1,144		
	Rock	m3		1,514	5,964		
Grouting	Blanket	t	1,868	6,500	90,000	12,142,000	168,120,000
	Curtain	t	3,676	6,500	90,000	23,894,000	330,840,000
(Sub-total)						884,711,729	3,899,841,631
3.2 Spillway							
(1) Approach wall & weir							
Excavation	Common	m3	3,097	276	1,651	854,772	5,113,147
	Wea.rock	m3	4,645	339	1,398	1,574,655	6,493,710
	Rock	m3		962	3,475		
Concrete		m3	6,628	13,442	132,187	89,093,576	876,135,436
Rein bar		t	135	5,292	1,460,955	714,420	197,228,925
(2) Chuteway & basin							
Excavation	Common	m3	11,879	276	1,651	3,278,604	19,612,229
	Wea.rock	m3	17,818	339	1,398	6,040,302	24,909,564
	Rock	m3		962	3,475		
Concrete		m3	14,260	13,442	132,187	191,682,920	1,884,986,620
Rein bar		t	285	5,292	1,460,955	1,508,220	416,372,175
Grouting	Consoli.	t	35	6,500	90,000	227,500	3,150,000
(3) Metal work							
Spillway gate		Ls	1	108,000,000		108,000,000	
(Sub-total)						402,974,969	3,434,001,806
SUB-TOTAL OF 3.						1,287,686,698	7,333,843,437
4. WATER SUPPLY PIPE LINE							
4.1 Excavation		m3		276	1,651		
4.2 Backfill		m3		244	1,717		
4.3 Add. pump station		Ls	1	1,145,000,000	7,657,000,000	1,145,000,000	7,657,000,000
4.4 Add. purification plant		Ls	1	1,385,000,000	9,263,000,000	1,385,000,000	9,263,000,000
4.5 Add. pipe line		Ls			1,540,000,000		
4.6 Add. intake & surge tank		Ls	1	74,000,000	2,720,000,000	74,000,000	2,720,000,000
4.7 Receiving well		Ls	1	6,000,000	218,400,000	6,000,000	218,400,000
SUB-TOTAL OF 4.						2,610,000,000	19,858,400,000
TOTAL OF DIRECT CONSTRUCTION COST						4,155,224,038	28,659,012,124

Table F-11 Cost Estimate for Downstream Cidanau Dam: Scheme B-2

DESCRIPTION		Unit	Qty	UNIT PRICE Fc (Yen)	UNIT PRICE Lc (Rp)	AMOUNT Fc (Yen)	AMOUNT Lc (Rp)
1. PREPARATORY WORK (20% of 2+3+4+5+6)						375,176,927	2,810,769,979
2. DIVERSION WORK							
2.1 Inlet & outlet							
Excavation	Common	m3	997	276	1,651	275,172	1,646,047
	Wea.rock	m3	11,970	339	1,398	4,057,830	16,734,060
	Rock	m3	6,982	962	3,475	6,716,684	24,262,450
Concrete		m3	2,640	13,442	132,187	35,486,880	348,973,680
Rein bar		t	100	5,292	1,460,955	529,200	146,095,500
(Sub-total)						47,065,786	537,711,737
2.2 Tunnel(l=400m,D=5m)							
Excavation		m3	10,710	8,744	105,122	93,648,240	1,125,856,620
Lining conc.		m3	2,464	13,488	155,546	33,234,432	383,265,344
Plug conc.		m3	686	13,488	155,546	9,252,768	106,704,556
Grouting		t	504	6,500	90,000	3,276,000	45,360,000
Rein ber		t	126	5,292	1,460,955	666,792	184,080,330
(Sub-total)						140,078,232	1,845,266,850
SUB-TOTAL OF 2.						187,143,998	2,382,978,587
3. DAM							
3.1 Cofferdam							
Excavation		m3	2,500	276	1,651	690,000	4,127,500
Embankment		m3	200,000	1,514	5,964	302,800,000	1,192,800,000
(Sub-total)						303,490,000	1,196,927,500
3.2 Main dam							
Excavation	Common	m3	24,986	276	1,651	6,896,136	41,251,886
	Wea.rock	m3	54,136	339	1,398	18,352,104	75,682,128
	Rock	m3	4,164	962	3,475	4,005,768	14,469,900
Embankment	Core	m3	49,100	605	2,359	29,705,500	115,826,900
	Filter	m3	31,308	2,285	5,756	71,538,780	180,208,848
	Random	m3	72,975	441	1,144	32,181,975	83,483,400
	Rock	m3	170,275	1,514	5,964	257,796,350	1,015,520,100
Grouting	Blanket	t	56	6,500	90,000	364,000	5,040,000
	Consoli.	t	182	6,500	90,000	1,183,000	16,380,000
	Curtain	t	2,556	6,500	90,000	16,614,000	230,040,000
(Sub-total)						438,637,613	1,777,903,162
3.3 Sand trap basin							
Excavation	Common	m3	306,750	276	2,176	84,663,000	667,488,000
	Wea.rock	m3		339	2,585		
	Rock	m3		962	4,433		
Maintenance road(2km)		m3	55,000	244	1,717	13,420,000	94,435,000
Concrete		m3	1,200	13,442	132,187	16,130,400	158,624,400
(Sub-total)						114,213,400	920,547,400
SUB-TOTAL OF 3.						856,341,013	3,895,378,062
4. SPILLWAY							
4.1 Side channel							
Excavation	Common	m3	103,740	276	1,651	28,632,240	171,274,740
	Wea.rock	m3	116,707	339	1,398	39,563,673	163,156,386
	Rock	m3	38,902	962	3,475	37,423,724	135,184,450
Concrete		m3	27,724	13,442	132,187	372,666,008	3,664,752,388
Rein bar		t	520	5,292	1,460,955	2,751,840	759,696,600
(Sub-total)						481,037,485	4,894,064,564
4.2 Chuteway							
Excavation	Common	m3	53,093	276	1,651	14,653,668	87,656,543
	Wea.rock	m3	127,425	339	1,398	43,197,075	178,140,150
	Rock	m3	31,856	962	3,475	30,645,472	110,689,600
Concrete		m3	8,775	13,442	132,187	117,953,550	1,159,940,925
Rein bar		t	175	5,292	1,450,955	926,100	253,917,125
(Sub-total)						207,375,865	1,790,354,343
4.3 Plunge pool							
Excavation	Common	m3	2,030	276	1,651	560,280	3,351,530
	Wea.rock	m3	14,210	339	1,398	4,817,190	19,865,580
	Rock	m3	24,360	962	3,475	23,434,320	84,651,000
(Sub-total)						28,811,790	107,868,110
SUB-TOTAL OF 4.						717,225,140	6,792,287,017
5. OUTLET WORK							
5.1 Intake tower							
Excavation	Common	m3	3,758	276	1,651	1,037,208	6,204,458
	Wea.rock	m3	4,176	339	1,398	1,415,664	5,838,048
	Rock	m3	418	962	3,475	402,116	1,452,550
Concrete		m3	500	13,442	132,187	6,721,000	66,093,500
Rein bar		t	20	5,292	1,460,955	105,840	29,219,100
(Sub-total)						9,681,828	108,807,656
5.2 Intake shaft							
Excavation		m3	299	8,744	102,122	2,614,456	30,534,478
Concrete		m3	171	13,488	155,546	2,306,448	26,598,366
Rein bar		t	6	5,292	1,460,955	31,752	8,765,730
(Sub-total)						4,952,656	65,898,574
SUB-TOTAL OF 5.						14,634,484	174,706,230
6. METAL WORK							
6.1 Diversion gate		Ls	1	33,040,000		33,040,000	
6.2 Steel conduit		Ls	1		808,500,000		808,500,000
6.3 Hollow jet valve		Ls	1	45,000,000		45,000,000	
6.4 Guard valve		Ls	1	22,500,000		22,500,000	
SUB-TOTAL OF 6.						100,540,000	808,500,000
7. WATER SUPPLY PIPE LINE							
7.1 Excavation		m3		276	1,651		
7.2 Backfill		m3		244	1,717		
7.3 Add. pump station		Ls					
7.4 Add. purification plant		Ls					
7.5 Add. pipe line		Ls	1		504,000,000		504,000,000
7.6 Add. intake & surge tank		Ls					
SUB-TOTAL OF 7.							504,000,000
TOTAL OF DIRECT CONSTRUCTION COST						2,251,061,562	17,368,619,875

Table F-12 Cost Estimate for Heightening of Krenceng Dam without Diversion Tunnel: Scheme B-2

DESCRIPTION		Unit	Q'ty	UNIT PRICE Fc (Yen)	UNIT PRICE Lc (Rp)	AMOUNT Fc (Yen)	AMOUNT Lc (Rp)
1. PREPARATORY WORK (20% of 2+3)						257,537,340	1,466,768,687
2. DIVERTED TUNNEL							
2.1 Coffering work							
Coffering	Exca.	m3		276	1,651		
	Embank	m3		441	1,144		
(Sub-total)							
2.2 Weir							
Excavation	Common	m3		276	1,651		
	Wea.rock	m3		339	1,398		
	Rock	m3		962	3,475		
Concrete		m3		5,052	118,708		
Rein bar		t		5,292	1,460,955		
Gate		Ls		2,000,000			
(Sub-total)							
2.3 Inlet & outlet							
Excavation	Common	m3		276	1,651		
	Wea.rock	m3		339	1,398		
	Rock	m3		962	3,475		
Concrete		m3		13,442	132,187		
Rein bar		t		5,292	1,460,955		
Trash rack		Ls		1,000,000			
(Sub-total)							
2.4 Diverted tunnel							
Excavation		m3		8,744	105,122		
Lining conc.		m3		13,488	155,546		
Plug conc.		m3		13,488	155,546		
Grouting		t		6,500	90,000		
Rein bar		t		5,292	1,460,955		
(Sub-total)							
SUB-TOTAL OF 2.							
3. HEI HEIGHTENING OF KRENCENG DAM							
3.1 Main dam							
Excavation	Common	m3	146,652	276	1,651	40,475,952	242,122,452
	Wea.rock	m3	97,768	339	1,398	33,143,352	136,679,664
	Rock	m3		962	3,475		
Embankment	Core	m3	1,281,085	605	2,359	775,056,425	3,022,079,515
	Filter	m3		2,285	5,756		
	Random	m3		441	1,144		
	Rock	m3		1,514	5,964		
Grouting	Blanket	t	1,868	6,500	90,000	12,142,000	168,120,000
	Curtain	t	3,676	6,500	90,000	23,894,000	330,840,000
(Sub-total)						884,711,729	3,899,841,631
3.2 Spillway							
(1) Approach wall & weir							
Excavation	Common	m3	3,097	276	1,651	854,772	5,113,147
	Wea.rock	m3	4,645	339	1,398	1,574,655	6,493,710
	Rock	m3		962	3,475		
Concrete		m3	6,628	13,442	132,187	89,093,576	876,135,436
Rein bar		t	135	5,292	1,460,955	714,420	197,228,925
(2) Chuteway & basin							
Excavation	Common	m3	11,879	276	1,651	3,278,604	19,612,229
	Wea.rock	m3	17,818	339	1,398	6,040,302	24,909,564
	Rock	m3		962	3,475		
Concrete		m3	14,260	13,442	132,187	191,682,920	1,884,986,620
Rein bar		t	285	5,292	1,460,955	1,508,220	416,372,175
Grouting	Consoli.	t	35	6,500	90,000	227,500	3,150,000
(3) Metal work							
Spillway gate		Ls	1	108,000,000		108,000,000	
(Sub-total)						402,974,969	3,434,001,806
SUB-TOTAL OF 3.						1,287,686,698	7,333,843,437
4. WATER SUPPLY PIPE LINE							
4.1 Excavation		m3		276	1,651		
4.2 Backfill		m3		244	1,717		
4.3 Add. pump station		Ls	1	1,146,000,000	7,665,000,000	1,146,000,000	7,665,000,000
4.4 Add. purification plant		Ls	1	1,749,000,000	11,699,000,000	1,749,000,000	11,699,000,000
4.5 Add. pipe line		Ls			1,540,000,000		
4.6 Add. intake & surge tank		Ls	1	77,000,000	2,824,000,000	77,000,000	2,824,000,000
4.7 Receiving well		Ls	1	6,000,000	218,400,000	6,000,000	218,400,000
SUB-TOTAL OF 4.						2,978,000,000	22,406,400,000
TOTAL OF DIRECT CONSTRUCTION COST						4,523,224,038	31,207,012,124

Table F-13 Cost Estimate for Cidanau Gated Weir: Scheme B-3

DESCRIPTION		Unit	Q'ty	UNIT PRICE Fc (Yen)	UNIT PRICE Lc (Rp)	AMOUNT Fc (Yen)	AMOUNT Lc (Rp)
1. PREPARATORY WORK (20% of 2+3+4+5)						414,455,432	1,755,702,092
2. DIVERSION WORK							
2.1 Coffering work							
Sheet pile & bracing		t	159	131,583	36,915	20,921,697	5,869,485
SUB-TOTAL OF 2.						20,921,697	5,869,485
3. DAM							
3.1 Main dam							
Excavation	Common	m3	10,662	276	1,651	2,942,712	17,602,962
	Wea.rock	m3	8,462	339	1,398	2,868,618	11,829,876
	Rock	m3	2,200	962	3,475	2,116,400	7,645,000
Concrete		m3	21,325	5,052	118,708	107,733,900	2,531,448,100
Grouting	Consoli.	t	219	6,500	90,000	1,423,500	19,710,000
	Curtain	t	352	6,500	90,000	2,288,000	31,680,000
SUB-TOTAL OF 3.						119,373,130	2,619,915,938
4. SPILLWAY							
4.1 Dental work							
Excavation	Common	m3	22,389	276	1,651	6,179,364	36,964,239
	Wea.rock	m3		339	1,398		
	Rock	m3		962	3,475		
Concrete		m3	8,379	5,052	118,708	42,330,708	994,654,332
(Sub-total)						48,510,072	1,031,618,571
4.2 Weir & pier							
Excavation	Common	m3		276	1,651		
	Wea.rock	m3	1,170	339	1,398	396,630	1,635,660
	Rock	m3	500	962	3,475	481,000	1,737,500
Concrete		m3	10,761	13,442	132,187	144,649,362	1,422,464,307
Rein bar		t	1,290	5,292	1,460,955	6,826,680	1,884,631,950
Grouting	Consoli.	t	126	6,500	90,000	819,000	11,340,000
	Curtain	t	180	6,500	90,000	1,170,000	16,200,000
(Sub-total)						154,342,672	3,338,009,417
4.3 Hoist & bridge							
Concrete		m3	2,871	13,442	132,187	38,591,982	379,508,877
Rein bar		t	574	5,292	1,460,955	3,037,608	838,588,170
(Sub-total)						41,629,590	1,218,097,047
SUB-TOTAL OF 4.						244,482,334	5,587,725,035
5. METAL WORK							
5.1 Roller gate		Ls	1	1,620,000,000		1,620,000,000	
5.2 Steel conduit		Ls	1		565,000,000		565,000,000
5.3 Hollow jet valve		Ls	1	45,000,000		45,000,000	
5.4 Guard valve		Ls	1	22,500,000		22,500,000	
SUB-TOTAL OF 5.						1,687,500,000	565,000,000
6. WATER SUPPLY PIPE LINE							
6.1 Excavation		m3		276	1,651		
6.2 Backfill		m3		244	1,717		
6.3 Add. pump station		Ls					
6.4 Add. purification plant		Ls					
6.5 Add. pipe line		Ls					
6.6 Add. intake & surge tank		Ls					
SUB-TOTAL OF 6.							
TOTAL OF DIRECT CONSTRUCTION COST						2,486,732,593	10,534,212,550

Table F-14 Cost Estimate for Heightening of Krenceng Dam without Diversion Tunnel: Scheme B-3

DESCRIPTION		Unit	Q'ty	UNIT PRICE Fc (Yen)	UNIT PRICE Lc (Rp)	AMOUNT Fc (Yen)	AMOUNT Lc (Rp)
1. PREPARATORY WORK (20% of 2+3)						257,537,340	1,466,768,687
2. DIVERTED TUNNEL							
2.1 Coffering work							
Coffering	Exca.	m3		276	1,651		
	Embank	m3		441	1,144		
(Sub-total)							
2.2 Weir							
Excavation	Common	m3		276	1,651		
	Wea.rock	m3		339	1,398		
	Rock	m3		962	3,475		
Concrete		m3		5,052	118,708		
Rein bar		t		5,292	1,460,955		
Gate		Ls		2,000,000			
(Sub-total)							
2.3 Inlet & outlet							
Excavation	Common	m3		276	1,651		
	Wea.rock	m3		339	1,398		
	Rock	m3		962	3,475		
Concrete		m3		13,442	132,187		
Rein bar		t		5,292	1,460,955		
Trash rack		Ls		1,000,000			
(Sub-total)							
2.4 Diverted tunnel							
Excavation		m3		8,744	105,122		
Lining conc.		m3		13,488	155,546		
Plug conc.		m3		13,488	155,546		
Grouting		t		6,500	90,000		
Rein bar		t		5,292	1,460,955		
(Sub-total)							
SUB-TOTAL OF 2.							
3. HEIGHTENING OF KRENCENG DAM							
3.1 Main dam							
Excavation	Common	m3	146,652	276	1,651	40,475,952	242,122,452
	Wea.rock	m3	97,768	339	1,398	33,143,352	136,679,664
	Rock	m3		962	3,475		
Embankment	Core	m3	1,281,085	605	2,359	775,056,425	3,022,079,515
	Filter	m3		2,285	5,756		
	Random	m3		441	1,144		
	Rock	m3		1,514	5,964		
Grouting	Blanket	t	1,868	6,500	90,000	12,142,000	168,120,000
	Curtain	t	3,676	6,500	90,000	23,894,000	330,840,000
(Sub-total)						884,711,729	3,899,841,631
3.2 Spillway							
(1) Approach wall & weir							
Excavation	Common	m3	3,097	276	1,651	854,772	5,113,147
	Wea.rock	m3	4,645	339	1,398	1,574,655	6,493,710
	Rock	m3		962	3,475		
Concrete		m3	6,628	13,442	132,187	89,093,576	876,135,436
Rein bar		t	135	5,292	1,460,955	714,420	197,228,925
(2) Chuteway & basin							
Excavation	Common	m3	11,879	276	1,651	3,278,604	19,612,229
	Wea.rock	m3	17,818	339	1,398	6,040,302	24,909,564
	Rock	m3		962	3,475		
Concrete		m3	14,260	13,442	132,187	191,682,920	1,884,986,620
Rein bar		t	285	5,292	1,460,955	1,508,220	416,372,175
Grouting	Consoli.	t	35	6,500	90,000	227,500	3,150,000
(3) Metal work							
Spillway gate		Ls	1	108,000,000		108,000,000	
(Sub-total)						402,974,969	3,434,001,806
SUB-TOTAL OF 3.						1,287,686,698	7,333,843,437
4. WATER SUPPLY PIPE LINE							
4.1 Excavation		m3		276	1,651		
4.2 Backfill		m3		244	1,717		
4.3 Add. pump station		Ls	1	1,167,000,000	7,808,000,000	1,167,000,000	7,808,000,000
4.4 Add. purification plant		Ls	1	1,812,000,000	12,118,000,000	1,812,000,000	12,118,000,000
4.5 Add. pipe line		Ls			1,540,000,000		
4.6 Add. intake & surge tank		Ls	1	80,000,000	2,914,000,000	80,000,000	2,914,000,000
4.7 Receiving well		Ls	1	6,000,000	218,400,000	6,000,000	218,400,000
SUB-TOTAL OF 4.						3,065,000,000	23,058,400,000
TOTAL OF DIRECT CONSTRUCTION COST						4,610,224,038	31,859,012,124

Table F-15 Cost Estimate for Cidanau Dam: Scheme C-1

DESCRIPTION		Unit	Qty	UNIT PRICE Fc (Yen)	UNIT PRICE Lc (Rp)	AMOUNT Fc (Yen)	AMOUNT Lc (Rp)
1. PREPARATORY WORK (20% of 2+3+4+5+6)						464,133,519	2,947,352,634
2. DIVERSION WORK							
2.1 Inlet & outlet							
Excavation	Common	m3	1,053	276	1,651	290,628	1,738,503
	Weathered rock	m3	2,106	339	1,398	713,934	2,944,188
	Rock	m3	7,371	962	3,475	7,090,902	25,614,225
Concrete		m3	2,640	13,442	132,187	35,486,880	348,973,680
Reinforcing bar		t	100	5,292	1,460,955	529,200	146,095,500
(Sub-total)						44,111,544	525,366,096
2.2 Tunnel(l=410m,D=5m)							
Excavation		m3	10,462	8,744	105,122	91,479,728	1,099,786,364
Lining conc.		m3	2,904	13,488	155,546	32,425,152	373,932,584
Plug conc.		m3	686	13,488	155,546	9,252,768	106,704,556
Grouting		t	246	6,500	90,000	1,599,000	22,140,000
Reinforcing bar		t	123	5,292	1,460,955	650,916	179,697,465
(Sub-total)						135,407,564	1,782,260,969
SUB-TOTAL OF 2.						179,519,108	2,307,627,065
3. DAM							
3.1 Cofferdam							
Excavation		m3	2,500	276	1,651	690,000	4,127,500
Embankment		m3	200,000	1,514	5,964	302,800,000	1,192,800,000
(Sub-total)						303,490,000	1,196,927,500
3.2 Main dam							
Excavation	Common	m3	11,075	276	1,651	3,056,700	18,284,825
	Weathered rock	m3	22,150	339	1,398	7,508,850	30,965,700
	Rock	m3	77,520	962	3,475	74,574,240	269,382,000
Embankment	Core	m3	101,416	605	2,359	61,356,680	239,240,344
	Filter	m3	62,644	2,285	5,756	143,141,540	360,578,864
	Random	m3	174,900	441	1,144	77,130,900	200,085,600
	Rock	m3	408,105	1,514	5,964	617,870,970	2,433,938,220
Grouting	Blanket	t	474	6,500	90,000	3,081,000	42,660,000
	Consoli.	t	114	6,500	90,000	741,000	10,260,000
	Curtain	t	1,287	6,500	90,000	8,365,500	115,830,000
(Sub-total)						996,827,380	3,721,225,553
3.3 Saddle dam							
Excavation	Common	m3	3,595	276	2,176	992,220	7,822,720
	Weathered rock	m3	7,190	339	2,585	2,437,410	18,586,150
	Rock	m3	25,160	962	4,433	24,203,920	111,534,280
Embankment		m3	167,975	244	1,717	40,985,900	288,413,075
Grouting		t	597	13,442	132,187	8,024,874	78,915,639
(Sub-total)						76,644,324	505,271,864
SUB-TOTAL OF 3.						1,376,961,704	5,423,424,917
4. SPILLWAY							
4.1 Side channel							
Excavation	Common	m3	8,100	276	1,651	2,235,600	13,373,100
	Weathered rock	m3	16,200	339	1,398	5,491,800	22,647,600
	Rock	m3	56,700	962	3,475	54,545,400	197,032,500
Concrete		m3	21,170	13,442	132,187	284,567,140	2,798,398,790
Reinforcing bar		t	400	5,292	1,460,955	2,116,800	584,382,000
(Sub-total)						348,956,740	3,615,833,990
4.2 Chuteway							
Excavation	Common	m3	14,245	276	1,651	3,931,620	23,518,495
	Weathered rock	m3	28,490	339	1,398	9,658,110	39,829,020
	Rock	m3	99,715	962	3,475	95,925,830	346,509,625
Concrete		m3	11,395	13,442	132,187	153,171,590	1,506,270,865
Reinforcing bar		t	220	5,292	1,450,955	1,164,240	319,210,100
(Sub-total)						263,851,390	2,235,338,105
4.3 Plunge pool							
Excavation	Common	m3	4,032	276	1,651	1,112,832	6,656,832
	Weathered rock	m3	8,064	339	1,398	2,733,696	11,273,472
	Rock	m3	28,224	962	3,475	27,151,488	98,078,400
(Sub-total)						30,998,016	116,008,704
SUB-TOTAL OF 4.						643,806,146	5,967,180,799
5. OUTLET WORK							
5.1 Intake tower							
Excavation	Common	m3	515	276	1,651	142,140	850,265
	Weathered rock	m3	1,030	339	1,398	349,170	1,439,940
	Rock	m3	3,606	962	3,475	3,468,972	12,530,850
Concrete		m3	760	13,442	132,187	10,215,920	100,462,120
Reinforcing bar		t	29	5,292	1,460,955	153,488	42,367,695
(Sub-total)						14,329,670	157,650,870
5.2 Intake shaft							
Excavation		m3	332	8,744	102,122	2,903,008	33,904,504
Concrete		m3	191	13,488	155,546	2,576,208	29,709,286
Reinforcing bar		t	6	5,292	1,460,955	31,752	8,765,730
(Sub-total)						5,510,968	72,379,520
SUB-TOTAL OF 5.						19,840,638	230,030,390
6. METAL WORK							
6.1 Diversion gate		Ls	1	33,040,000		33,040,000	
6.2 Steel conduit		Ls	1		808,500,000		808,500,000
6.3 Hollow jet valve		Ls	1	45,000,000		45,000,000	
6.4 Guard valve		Ls	1	22,500,000		22,500,000	
SUB-TOTAL OF 6.						100,540,000	808,500,000
7. WATER SUPPLY PIPE LINE							
7.1 Excavation		m3	134,400	276	1,651	37,094,400	221,894,400
7.2 Backfill		m3	123,200	244	1,717	30,060,800	211,534,400
7.3 Add. pump station		Ls					
7.4 Add. purification plant		Ls					
7.5 Add. pipe line		Ls	1		39,200,000,000		39,200,000,000
7.6 Add. intake & surge tank		Ls					
SUB-TOTAL OF 7.						67,155,200	39,633,428,800
TOTAL OF DIRECT CONSTRUCTION COST						2,851,956,315	57,317,544,605

Table F-16 Cost Estimate for Heightening of Krenceng Dam with One Diversion Tunnel: Scheme C-1

DESCRIPTION		Unit	Q'ty	UNIT PRICE Fc (Yen)	UNIT PRICE Lc (Rp)	AMOUNT Fc (Yen)	AMOUNT Lc (Rp)
1. PREPARATORY WORK (20% of 2+3)						264,175,476	1,556,022,425
2. DIVERTED TUNNEL							
2.1 Coffering work							
Coffering	Exca.	m3	500	276	1,651	138,000	825,500
	Embank	m3	500	441	1,144	220,500	572,000
(Sub-total)						358,500	1,397,500
2.2 Weir							
Excavation	Common	m3	400	276	1,651	110,400	660,400
	Wea.rock	m3	400	339	1,398	135,600	559,200
	Rock	m3	200	962	3,475	192,400	695,000
Concrete		m3	150	5,052	118,708	757,800	17,806,200
Rein bar		t	15	5,292	1,460,955	79,380	21,914,325
Gate		Ls	1	2,000,000		2,000,000	
(Sub-total)						3,275,580	41,635,125
2.3 Inlet & outlet							
Excavation	Common	m3	1,664	276	1,651	459,264	2,747,264
	Wea.rock	m3	1,664	339	1,398	564,096	2,326,272
	Rock	m3	832	962	3,475	800,384	2,891,200
Concrete		m3	100	13,442	132,187	1,344,200	13,218,700
Rein bar		t	20	5,292	1,460,955	105,840	29,219,100
Trash rack		Ls	1	1,000,000		1,000,000	
(Sub-total)						4,273,784	50,402,536
2.4 Diverted tunnel							
Excavation		m3	1,600	8,744	105,122	13,990,400	168,195,200
Lining conc.		m3	650	13,488	155,546	8,767,200	101,104,900
Plug conc.		m3		13,488	155,546		
Grouting		t	360	6,500	90,000	2,340,000	32,400,000
Rein bar		t	35	5,292	1,460,955	185,220	51,133,425
(Sub-total)						25,282,820	352,833,525
SUB-TOTAL OF 2.						33,190,684	446,268,686
3. HEIGHTENING OF KRENCENG DAM							
3.1 Main dam							
Excavation	Common	m3	146,652	276	1,651	40,475,952	242,122,452
	Wea.rock	m3	97,768	339	1,398	33,143,352	136,679,664
	Rock	m3		962	3,475		
Embankment	Core	m3	1,281,085	605	2,359	775,056,425	3,022,079,515
	Filter	m3		2,285	5,756		
	Random	m3		441	1,144		
	Rock	m3		1,514	5,964		
Grouting	Blanket	t	1,868	6,500	90,000	12,142,000	168,120,000
	Curtain	t	3,676	6,500	90,000	23,894,000	330,840,000
(Sub-total)						884,711,729	3,899,841,631
3.2 Spillway							
(1) Approach wall & weir							
Excavation	Common	m3	3,097	276	1,651	854,772	5,113,147
	Wea.rock	m3	4,645	339	1,398	1,574,655	6,493,710
	Rock	m3		962	3,475		
Concrete		m3	6,628	13,442	132,187	89,093,576	876,135,436
Rein bar		t	135	5,292	1,460,955	714,420	197,228,925
(2) Chuteway & basin							
Excavation	Common	m3	11,879	276	1,651	3,278,604	19,612,229
	Wea.rock	m3	17,818	339	1,398	6,040,302	24,909,564
	Rock	m3		962	3,475		
Concrete		m3	14,260	13,442	132,187	191,682,920	1,884,986,620
Rein bar		t	285	5,292	1,460,955	1,508,220	416,372,175
Grouting	Consoli.	t	35	6,500	90,000	227,500	3,150,000
(3) Metal work							
Spillway gate		Ls	1	108,000,000		108,000,000	
(Sub-total)						402,974,969	3,434,001,806
SUB-TOTAL OF 3.						1,287,686,698	7,333,843,437
4. WATER SUPPLY PIPE LINE							
4.1 Excavation		m3		276	1,651		
4.2 Backfill		m3		244	1,717		
4.3 Add. pump station		Ls	1	1,166,000,000	7,800,000,000	1,166,000,000	7,800,000,000
4.4 Add. purification plant		Ls	1	1,448,000,000	9,683,000,000	1,448,000,000	9,683,000,000
4.5 Add. pipe line		Ls			1,540,000,000		
4.6 Add. intake & surge tank		Ls	1	77,000,000	2,810,000,000	77,000,000	2,810,000,000
4.7 Receiving well		Ls	1	6,000,000	218,400,000	6,000,000	218,400,000
SUB-TOTAL OF 4.						2,697,000,000	20,511,400,000
TOTAL OF DIRECT CONSTRUCTION COST						4,282,052,858	29,847,534,548

Table F-17 Cost Estimate for Downstream Cidanau Dam: Scheme C-2

DESCRIPTION		Unit	Q'ty	UNIT PRICE Fc (Yen)	UNIT PRICE Lc (Rp)	AMOUNT Fc (Yen)	AMOUNT Lc (Rp)
1. PREPARATORY WORK (20% of 2+3+4+5+6)						375,176,927	2,810,769,979
2. DIVERSION WORKS							
2.1 Inlet & outlet							
Excavation	Common	m3	997	276	1,651	275,172	1,646,047
	Wea.rock	m3	11,970	339	1,398	4,057,830	16,734,060
	Rock	m3	6,982	962	3,475	6,716,684	24,262,450
Concrete		m3	2,640	13,442	132,187	35,486,880	348,973,680
Rein bar		t	100	5,292	1,460,955	529,200	146,095,500
(Sub-total)						47,065,766	537,711,737
2.2 Tunnel(l=400m,D=5m)							
Excavation		m3	10,710	8,744	105,122	93,618,240	1,125,956,620
Lining conc.		m3	2,464	13,488	155,546	33,234,432	383,265,344
Plug conc.		m3	686	13,488	155,546	9,252,768	106,704,556
Grouting		t	504	6,500	90,000	3,276,000	45,360,000
Rein bar		t	126	5,292	1,460,955	666,792	184,080,330
(Sub-total)						140,078,232	1,845,266,850
SUB-TOTAL OF 2.						187,143,998	2,382,978,587
3. DAM							
3.1 Cofferdam							
Excavation		m3	2,500	276	1,651	690,000	4,127,500
Embankment		m3	200,000	1,514	5,964	302,800,000	1,192,800,000
(Sub-total)						303,490,000	1,196,927,500
3.2 Main dam							
Excavation	Common	m3	24,986	276	1,651	6,896,136	41,251,886
	Wea.rock	m3	54,136	339	1,398	18,352,104	75,682,128
	Rock	m3	4,164	962	3,475	4,005,768	14,469,900
Embankment	Core	m3	49,100	605	2,359	29,705,500	115,826,900
	Filter	m3	31,308	2,285	5,756	71,538,780	180,208,848
	Random	m3	72,975	441	1,144	32,181,975	83,483,400
	Rock	m3	170,275	1,514	5,964	257,796,350	1,015,520,100
Grouting	Blanket	t	56	6,500	90,000	364,000	5,040,000
	Consoli.	t	182	6,500	90,000	1,183,000	16,380,000
	Curtain	t	2,556	6,500	90,000	16,614,000	230,040,000
(Sub-total)						438,637,613	1,777,903,162
3.3 Sand trap basin							
Excavation	Common	m3	306,750	276	2,176	84,663,000	667,488,000
	Wea.rock	m3		339	2,585		
	Rock	m3		962	4,433		
Maintenance road(2km)		m3	55,000	244	1,717	13,420,000	94,435,000
Concrete		m3	1,200	13,442	132,187	16,130,400	158,624,400
(Sub-total)						114,213,400	920,547,400
SUB-TOTAL OF 3.						856,341,013	3,895,378,062
4. SPILLWAY							
4.1 Side channel							
Excavation	Common	m3	103,740	276	1,651	28,632,240	171,274,740
	Wea.rock	m3	116,707	339	1,398	39,563,673	163,156,386
	Rock	m3	38,902	962	3,475	37,423,724	135,184,450
Concrete		m3	27,724	13,442	132,187	372,666,008	3,664,752,388
Rein bar		t	520	5,292	1,460,955	2,751,840	759,696,600
(Sub-total)						481,037,485	4,894,064,564
4.2 Chuteway							
Excavation	Common	m3	53,093	276	1,651	14,653,668	87,656,543
	Wea.rock	m3	127,425	339	1,398	43,197,075	178,140,150
	Rock	m3	31,856	962	3,475	30,645,472	110,699,600
Concrete		m3	8,775	13,442	132,187	117,953,550	1,159,940,925
Rein bar		t	175	5,292	1,450,955	926,100	253,917,125
(Sub-total)						207,375,865	1,790,354,343
4.3 Plunge pool							
Excavation	Common	m3	2,030	276	1,651	560,280	3,351,530
	Wea.rock	m3	14,210	339	1,398	4,817,190	19,865,580
	Rock	m3	24,360	962	3,475	23,434,320	84,651,000
(Sub-total)						28,811,790	107,868,110
SUB-TOTAL OF 4.						717,225,140	6,792,287,017
5. OUTLET WORK							
5.1 Intake tower							
Excavation	Common	m3	3,758	276	1,651	1,037,208	6,204,458
	Wea.rock	m3	4,176	339	1,398	1,415,664	5,838,048
	Rock	m3	418	962	3,475	402,116	1,452,550
Concrete		m3	500	13,442	132,187	6,721,000	66,093,500
Rein bar		t	20	5,292	1,460,955	105,840	29,219,100
(Sub-total)						9,681,828	108,807,656
5.2 Intake shaft							
Excavation		m3	299	8,744	102,122	2,614,456	30,534,478
Concrete		m3	171	13,488	155,546	2,306,448	26,598,366
Rein bar		t	6	5,292	1,460,955	31,752	8,765,730
(Sub-total)						4,952,656	65,898,574
SUB-TOTAL OF 5.						14,634,484	174,706,230
6. METAL WORK							
6.1 Diversion gate		Ls	1	33,040,000		33,040,000	
6.2 Steel conduit		Ls	1		808,500,000		808,500,000
6.3 Hollow jet valve		Ls	1	45,000,000		45,000,000	
6.4 Guard valve		Ls	1	22,500,000		22,500,000	
SUB-TOTAL OF 6.						100,540,000	808,500,000
7. WATER SUPPLY PIPE LINE							
7.1 Excavation		m3		276	1,651		
7.2 Backfill		m3		244	1,717		
7.3 Add. pump station		Ls					
7.4 Add. purification plant		Ls					
7.5 Add. pipe line		Ls	1		504,000,000		504,000,000
7.6 Add. intake & surge tank		Ls					
SUB-TOTAL OF 7.							504,000,000
TOTAL OF DIRECT CONSTRUCTION COST						2,251,061,562	17,368,619,875

Table F-18 Cost Estimate for Heightening of Krenceng Dam with One Diversion Tunnel: Scheme C-2

DESCRIPTION		Unit	Q'ty	UNIT PRICE Fc (Yen)	UNIT PRICE Lc (Rp)	AMOUNT Fc (Yen)	AMOUNT Lc (Rp)
1. PREPARATORY WORK (20% of 2+3)						264,175,476	1,556,022,425
2. DIVERTED TUNNEL							
2.1 Coffering work							
Coffering	Exca.	m3	500	276	1,651	138,000	825,500
	Embank	m3	500	441	1,144	220,500	572,000
(Sub-total)						358,500	1,397,500
2.2 Weir							
Excavation	Common	m3	400	276	1,651	110,400	660,400
	Wea.rock	m3	400	339	1,398	135,600	559,200
	Rock	m3	200	962	3,475	192,400	695,000
Concrete		m3	150	5,052	118,708	757,800	17,806,200
Rein bar		t	15	5,292	1,460,955	79,380	21,914,325
Gate		Ls	1	2,000,000		2,000,000	
(Sub-total)						3,275,580	41,635,125
2.3 Inlet & outlet							
Excavation	Common	m3	1,664	276	1,651	459,264	2,747,264
	Wea.rock	m3	1,664	339	1,398	564,096	2,326,272
	Rock	m3	832	962	3,475	800,384	2,891,200
Concrete		m3	100	13,442	132,187	1,344,200	13,218,700
Rein bar		t	20	5,292	1,460,955	105,840	29,219,100
Trash rack		Ls	1	1,000,000		1,000,000	
(Sub-total)						4,273,784	50,402,536
2.4 Diverted tunnel							
Excavation		m3	1,600	8,744	105,122	13,990,400	168,195,200
Lining conc.		m3	650	13,488	155,546	8,767,200	101,104,900
Plug conc.		m3		13,488	155,546		
Grouting		t	360	6,500	90,000	2,340,000	32,400,000
Rein bar		t	35	5,292	1,460,955	185,220	51,133,425
(Sub-total)						25,282,820	352,833,525
SUB-TOTAL OF 2.						33,190,684	446,268,686
3. HEIGHTENING OF KRENCENG DAM							
3.1 Main dam							
Excavation	Common	m3	146,652	276	1,651	40,475,952	242,122,452
	Wea.rock	m3	97,768	339	1,398	33,143,352	136,679,664
	Rock	m3		962	3,475		
Embankment	Core	m3	1,281,085	605	2,359	775,056,425	3,022,079,515
	Filter	m3		2,285	5,756		
	Random	m3		441	1,144		
	Rock	m3		1,514	5,964		
Grouting	Blanket	t	1,868	6,500	90,000	12,142,000	168,120,000
	Curtain	t	3,676	6,500	90,000	23,894,000	330,840,000
(Sub-total)						884,711,729	3,899,841,631
3.2 Spillway							
(1) Approach wall & weir							
Excavation	Common	m3	3,097	276	1,651	854,772	5,113,147
	Wea.rock	m3	4,645	339	1,398	1,574,655	6,493,710
	Rock	m3		962	3,475		
Concrete		m3	6,628	13,442	132,187	89,093,576	876,135,436
Rein bar		t	135	5,292	1,460,955	714,420	197,228,925
(2) Chuteway & basin							
Excavation	Common	m3	11,879	276	1,651	3,278,604	19,612,229
	Wea.rock	m3	17,818	339	1,398	6,040,302	24,909,564
	Rock	m3		962	3,475		
Concrete		m3	14,260	13,442	132,187	191,682,920	1,884,986,620
Rein bar		t	285	5,292	1,460,955	1,508,220	416,372,175
Grouting	Consoli.	t	35	6,500	90,000	227,500	3,150,000
(3) Metal work							
Spillway gate		Ls	1	108,000,000		108,000,000	
(Sub-total)						402,974,969	3,434,001,806
SUB-TOTAL OF 3.						1,287,686,698	7,333,843,437
4. WATER SUPPLY PIPE LINE							
4.1 Excavation		m3		276	1,651		
4.2 Backfill		m3		244	1,717		
4.3 Add. pump station		Ls	1	1,167,000,000	7,808,000,000	1,167,000,000	7,808,000,000
4.4 Add. purification plant		Ls	1	1,812,000,000	12,118,000,000	1,812,000,000	12,118,000,000
4.5 Add. pipe line		Ls			1,540,000,000		
4.6 Add. intake & surge tank		Ls	1	80,000,000	2,914,000,000	80,000,000	2,914,000,000
4.7 Receiving well		Ls	1	6,000,000	218,400,000	6,000,000	218,400,000
SUB-TOTAL OF 4.						3,065,000,000	23,058,400,000
TOTAL OF DIRECT CONSTRUCTION COST						4,650,052,858	32,394,534,548

Table F-19 Cost Estimate for Cidanau Gated Weir: Scheme C-3

DESCRIPTION		Unit	Q'ty	UNIT PRICE Fc (Yen)	UNIT PRICE Lc (Rp)	AMOUNT Fc (Yen)	AMOUNT Lc (Rp)
1. PREPARATORY WORK (20% of 2+3+4+5)						414,455,432	1,755,702,092
2. DIVERSION WORK							
2.1 Coffering work							
Sheet pile & bracing		t	159	131,583	36,915	20,921,697	5,869,485
SUB-TOTAL OF 2.						20,921,697	5,869,485
3. DAM							
3.1 Main dam							
Excavation	Common	m3	10,662	276	1,651	2,942,712	17,602,962
	Wea.rock	m3	8,462	339	1,398	2,868,618	11,829,876
	Rock	m3	2,200	962	3,475	2,116,400	7,645,000
Concrete		m3	21,325	5,052	118,708	107,733,900	2,531,448,100
Grouting	Consoli.	t	219	6,500	90,000	1,423,500	19,710,000
	Curtain	t	352	6,500	90,000	2,288,000	31,680,000
SUB-TOTAL OF 3.						119,373,130	2,619,915,938
4. SPILLWAY							
4.1 Dental work							
Excavation	Common	m3	22,389	276	1,651	6,179,364	36,964,239
	Wea.rock	m3		339	1,398		
	Rock	m3		962	3,475		
Concrete		m3	8,379	5,052	118,708	42,330,708	994,654,332
(Sub-total)						48,510,072	1,031,618,571
4.2 Weir & pier							
Excavation	Common	m3		276	1,651		
	Wea.rock	m3	1,170	339	1,398	396,630	1,635,660
	Rock	m3	500	962	3,475	481,000	1,737,500
Concrete		m3	10,761	13,442	132,187	144,649,362	1,422,464,307
Rein bar		t	1,290	5,292	1,460,955	6,826,680	1,884,631,950
Grouting	Consoli.	t	126	6,500	90,000	819,000	11,340,000
	Curtain	t	180	6,500	90,000	1,170,000	16,200,000
(Sub-total)						154,342,672	3,338,009,417
4.3 Hoist & bridge							
Concrete		m3	2,871	13,442	132,187	38,591,982	379,508,877
Rein bar		t	574	5,292	1,460,955	3,037,608	838,588,170
(Sub-total)						41,629,590	1,218,097,047
SUB-TOTAL OF 4.						244,482,334	5,587,725,035
5. METAL WORK							
5.1 Roller gate		Ls	1	1,620,000,000		1,620,000,000	
5.2 Steel conduit		Ls	1		565,000,000		565,000,000
5.3 Hollow jet valve		Ls	1	45,000,000		45,000,000	
5.4 Guard valve		Ls	1	22,500,000		22,500,000	
SUB-TOTAL OF 5.						1,687,500,000	565,000,000
6. WATER SUPPLY PIPE LINE							
6.1 Excavation		m3		276	1,651		
6.2 Backfill		m3		244	1,717		
6.3 Add. pump station		Ls					
6.4 Add. purification plant		Ls					
6.5 Add. pipe line		Ls					
6.6 Add. intake & surge tank		Ls					
SUB-TOTAL OF 6.							
TOTAL OF DIRECT CONSTRUCTION COST						2,486,732,593	10,534,212,550

Table F-20 Cost Estimate for Heightening of Krenceng Dam with One Diversion Tunnel: Scheme C-3

DESCRIPTION		Unit	Q'ty	UNIT PRICE Fc (Yen)	UNIT PRICE Lc (Rp)	AMOUNT Fc (Yen)	AMOUNT Lc (Rp)
1. PREPARATORY WORK (20% of 2+3)						264,175,476	1,556,022,425
2. DIVERTED TUNNEL							
2.1 Coffering work							
Coffering	Excs.	m3	500	276	1,651	138,000	825,500
	Embank	m3	500	441	1,144	220,500	572,000
(Sub-total)						358,500	1,397,500
2.2 Weir							
Excavation	Common	m3	400	276	1,651	110,400	660,400
	Wea.rock	m3	400	339	1,398	135,600	559,200
	Rock	m3	200	962	3,475	192,400	695,000
Concrete		m3	150	5,052	118,708	757,800	17,806,200
Rein bar		t	15	5,292	1,460,955	79,380	21,914,325
Gate		Ls	1	2,000,000		2,000,000	
(Sub-total)						3,275,580	41,635,125
2.3 Inlet & outlet							
Excavation	Common	m3	1,664	276	1,651	459,264	2,747,264
	Wea.rock	m3	1,664	339	1,398	564,096	2,326,272
	Rock	m3	832	962	3,475	800,384	2,891,200
Concrete		m3	100	13,442	132,187	1,344,200	13,218,700
Rein bar		t	20	5,292	1,460,955	105,840	29,219,100
Trash rack		Ls	1	1,000,000		1,000,000	
(Sub-total)						4,273,784	50,402,536
2.4 Diverted tunnel							
Excavation		m3	1,600	8,744	105,122	13,990,400	168,195,200
Lining conc.		m3	650	13,488	155,546	8,767,200	101,104,900
Plug conc.		m3		13,488	155,546		
Grouting		t	360	6,500	90,000	2,340,000	32,400,000
Rein bar		t	35	5,292	1,460,955	185,220	51,133,425
(Sub-total)						25,282,820	352,833,525
SUB-TOTAL OF 2.						33,190,684	446,268,686
3. HEIGHTENING OF KRENCENG DAM							
3.1 Main dam							
Excavation	Common	m3	146,652	276	1,651	40,475,952	242,122,452
	Wea.rock	m3	97,768	339	1,398	33,143,352	136,679,664
	Rock	m3		962	3,475		
Embankment	Core	m3	1,281,085	605	2,359	775,056,425	3,022,079,515
	Filter	m3		2,285	5,756		
	Random	m3		441	1,144		
	Rock	m3		1,514	5,964		
Grouting	Blanket	t	1,868	6,500	90,000	12,142,000	168,120,000
	Curtain	t	3,676	6,500	90,000	23,894,000	330,840,000
(Sub-total)						884,711,729	3,899,841,631
3.2 SPILLWAY							
(1) Approach wall & weir							
Excavation	Common	m3	3,097	276	1,651	854,772	5,113,147
	Wea.rock	m3	4,645	339	1,398	1,574,655	6,493,710
	Rock	m3		962	3,475		
Concrete		m3	6,628	13,442	132,187	89,093,576	876,135,436
Rein bar		t	135	5,292	1,460,955	714,420	197,228,925
(2) Chuteway & basin							
Excavation	Common	m3	11,879	276	1,651	3,278,604	19,612,229
	Wea.rock	m3	17,818	339	1,398	6,040,302	24,909,564
	Rock	m3		962	3,475		
Concrete		m3	14,260	13,442	132,187	191,682,920	1,884,986,620
Rein bar		t	285	5,292	1,460,955	1,508,220	416,372,175
Grouting	Consoli.	t	35	6,500	90,000	227,500	3,150,000
(3) Metal work							
Spillway gate		Ls	1	108,000,000		108,000,000	
(Sub-total)						402,974,969	3,434,001,806
SUB-TOTAL OF 3.						1,287,686,698	7,333,843,437
4. WATER SUPPLY PIPE LINE							
4.1 Excavation		m3		276	1,651		
4.2 Backfill		m3		244	1,717		
4.3 Add. pump station		Ls	1	1,189,000,000	7,951,000,000	1,189,000,000	7,951,000,000
4.4 Add. purification plant		Ls	1	1,875,000,000	12,538,000,000	1,875,000,000	12,538,000,000
4.5 Add. pipe line		Ls			1,540,000,000		
4.6 Add. intake & surge tank		Ls	1	82,000,000	3,003,000,000	82,000,000	3,003,000,000
4.7 Receiving well		Ls	1	6,000,000	218,400,000	6,000,000	218,400,000
SUB-TOTAL OF 4.						3,152,000,000	23,710,400,000
TOTAL OF DIRECT CONSTRUCTION COST						1,585,052,858	9,336,134,548

Table F-21 Cost Estimate for Cibanten Dam: Scheme D-1

DESCRIPTION		Unit	Qty	UNIT PRICE Fc (Yen)	UNIT PRICE Lc (Rp)	AMOUNT Fc (Yen)	AMOUNT Lc (Rp)
1. PREPARATORY WORK (20% of 2+3+4+5+6)						464,133,519	2,947,352,634
2. DIVERSION WORK							
2.1 Inlet & outlet							
Excavation	Common	m3	1,053	276	1,651	290,628	1,738,503
	Wea rock	m3	2,106	339	1,398	713,934	2,944,188
	Rock	m3	7,371	962	3,475	7,090,902	25,614,225
Concrete		m3	2,640	13,442	132,187	35,486,880	348,973,680
Rein bar		t	100	5,292	1,460,955	529,200	146,095,500
(Sub-total)						44,111,544	525,366,096
2.2 Tunnel(i=410m,D=5m)							
Excavation		m3	10,462	8,744	105,122	91,479,728	1,099,786,364
Lining conc.		m3	2,404	13,488	155,546	32,425,152	373,932,584
Plug conc.		m3	686	13,488	155,546	9,252,768	106,704,556
Grouting		t	246	6,500	90,000	1,599,000	22,140,000
Rein bar		t	123	5,292	1,460,955	650,916	179,697,465
(Sub-total)						135,407,564	1,782,260,969
SUB-TOTAL OF 2.						179,519,108	2,307,627,065
3. DAM							
3.1 Cofferdam							
Excavation		m3	2,500	276	1,651	690,000	4,127,500
Embankment		m3	200,000	1,514	5,964	302,800,000	1,192,800,000
(Sub-total)						303,490,000	1,196,927,500
3.2 Main dam							
Excavation	Common	m3	11,075	276	1,651	3,056,700	18,284,825
	Wea rock	m3	22,150	339	1,398	7,508,850	30,965,700
	Rock	m3	77,520	962	3,475	74,574,240	269,382,000
Embankment	Core	m3	101,416	605	2,359	61,356,680	239,240,344
	Filter	m3	62,644	2,285	5,756	143,141,540	360,578,864
	Random	m3	174,900	441	1,144	77,130,900	200,085,600
	Rock	m3	408,105	1,514	5,964	617,870,970	2,433,938,220
Grouting	Blanket	t	474	6,500	90,000	3,081,000	42,660,000
	Consoli.	t	114	6,500	90,000	741,000	10,260,000
	Curtain	t	1,287	6,500	90,000	8,365,500	115,830,000
(Sub-total)						996,827,380	3,721,225,553
3.3 Saddle dam							
Excavation	Common	m3	3,595	276	2,176	992,220	7,822,720
	Wea rock	m3	7,190	339	2,585	2,437,410	18,586,150
	Rock	m3	25,160	962	4,433	24,203,920	111,534,280
Embankment		m3	167,975	244	1,717	40,985,500	288,413,075
Grouting		t	597	13,442	132,187	8,024,874	78,935,639
(Sub-total)						76,644,324	505,271,864
SUB-TOTAL OF 3.						1,376,961,704	5,423,424,917
4. SPILLWAY							
4.1 Side channel							
Excavation	Common	m3	8,100	276	1,651	2,235,600	13,373,100
	Wea rock	m3	16,200	339	1,398	5,491,800	22,647,600
	Rock	m3	56,700	962	3,475	54,545,400	197,032,500
Concrete		m3	21,170	13,442	132,187	284,567,140	2,798,398,790
Rein bar		t	400	5,292	1,460,955	2,116,800	584,382,000
(Sub-total)						348,956,740	3,615,833,990
4.2 Gateway							
Excavation	Common	m3	14,245	276	1,651	3,931,620	23,518,495
	Wea rock	m3	28,490	339	1,398	9,658,110	39,829,020
	Rock	m3	99,715	962	3,475	95,925,830	346,509,625
Concrete		m3	11,395	13,442	132,187	153,171,590	1,506,270,865
Rein bar		t	220	5,292	1,450,955	1,164,240	319,210,100
(Sub-total)						263,851,390	2,235,338,105
4.3 Plunge pool							
Excavation	Common	m3	4,032	276	1,651	1,112,832	6,655,632
	Wea rock	m3	8,064	339	1,398	2,733,696	11,273,472
	Rock	m3	28,224	962	3,475	27,151,488	98,078,400
(Sub-total)						30,998,016	116,008,704
SUB-TOTAL OF 4.						643,806,146	5,967,180,799
5. OUTLET WORK							
5.1 Intake tower							
Excavation	Common	m3	515	276	1,651	142,140	850,265
	Wea rock	m3	1,030	339	1,398	349,170	1,439,940
	Rock	m3	3,606	962	3,475	3,468,972	12,530,850
Concrete		m3	780	13,442	132,187	10,215,920	100,462,120
Rein bar		t	29	5,292	1,460,955	153,468	42,367,695
(Sub-total)						14,329,670	157,650,870
5.2 Intake shaft							
Excavation		m3	332	8,744	102,122	2,903,008	33,904,504
Concrete		m3	191	13,488	155,546	2,576,208	29,709,286
Rein bar		t	6	5,292	1,460,955	31,752	8,765,730
(Sub-total)						5,510,968	72,379,520
SUB-TOTAL OF 5.						19,840,638	230,030,390
6. METAL WORK							
6.1 Diversion gate		Ls	1	33,040,000		33,040,000	
6.2 Steel conduit		Ls	1		808,500,000		808,500,000
6.3 Hollow jet valve		Ls	1	45,000,000		45,000,000	
6.4 Guard valve		Ls	1	22,500,000		22,500,000	
SUB-TOTAL OF 6.						100,540,000	808,500,000
7. WATER SUPPLY PIPE LINE							
7.1 Excavation		m3	134,400	276	1,651	37,094,400	221,894,400
7.2 Backfill		m3	123,200	244	1,717	30,060,800	211,534,400
7.3 Add. pump station		Ls					
7.4 Add. purification plant		Ls					
7.5 Add. pipe line		Ls	1		39,200,000,000		39,200,000,000
7.6 Add. intake & surge tank		Ls					
SUB-TOTAL OF 7.						67,155,200	39,633,428,800
TOTAL OF DIRECT CONSTRUCTION COST						2,851,956,315	57,317,544,605

Table F-22 Cost Estimate for Heightening of Krenceng Dam with Two Diversion Tunnels: Scheme D-1

DESCRIPTION		Unit	Q'ty	UNIT PRICE Fc (Yen)	UNIT PRICE Lc (Rp)	AMOUNT Fc (Yen)	AMOUNT Lc (Rp)
1. PREPARATORY WORK (20% of 2+3)						277,982,360	1,734,709,347
2. DIVERTED TUNNEL							
2.1 Coffering work							
Coffering	Exca.	m3	1,000	276	1,651	276,000	1,651,000
	Embank	m3	1,000	441	1,144	441,000	1,144,000
(Sub-total)						717,000	2,795,000
2.2 Weir							
Excavation	Common	m3	1,200	276	1,651	331,200	1,981,200
	Wea.rock	m3	1,200	339	1,398	406,800	1,677,600
	Rock	m3	600	962	3,475	577,200	2,085,000
Concrete		m3	410	5,052	118,708	2,071,320	48,670,280
Rein bar		t	41	5,292	1,460,955	216,972	59,899,155
Gate		Ls	2	2,000,000		4,000,000	
(Sub-total)						7,603,492	114,313,235
2.3 Inlet & outlet							
Excavation	Common	m3	4,576	276	1,651	1,262,976	7,554,976
	Wea.rock	m3	4,576	339	1,398	1,551,264	6,397,248
	Rock	m3	2,288	962	3,475	2,201,056	7,950,800
Concrete		m3	200	13,442	132,187	2,688,400	26,437,400
Rein bar		t	40	5,292	1,460,955	211,680	58,438,200
Trash rack		Ls	2	1,000,000		2,000,000	
(Sub-total)						9,915,376	106,778,624
2.4 Diverted tunnel							
Excavation		m3	5,320	8,744	105,122	46,518,080	559,249,040
Lining conc.		m3	2,170	13,488	155,546	29,268,960	337,534,820
Plug conc.		m3		13,488	155,546		
Grouting		t	1,200	6,500	90,000	7,800,000	108,000,000
Rein bar		t	76	5,292	1,460,955	402,192	111,032,580
(Sub-total)						83,989,232	1,115,816,440
SUB-TOTAL OF 2.						102,225,100	1,339,703,299
3. HEIGHTENING OF KRENCENG DAM							
3.1 Main dam							
Excavation	Common	m3	146,652	276	1,651	40,475,952	242,122,452
	Wea.rock	m3	97,768	339	1,398	33,143,352	136,679,664
	Rock	m3		962	3,475		
Embankment	Core	m3	1,281,085	605	2,359	775,056,425	3,022,079,515
	Filter	m3		2,285	5,756		
	Random	m3		441	1,144		
	Rock	m3		1,514	5,964		
Grouting	Blanket	t	1,868	6,500	90,000	12,142,000	168,120,000
	Curtain	t	3,676	6,500	90,000	23,894,000	330,840,000
(Sub-total)						884,711,729	3,899,841,631
3.2 SPILLWAY							
(1) Approach wall & weir							
Excavation	Common	m3	3,097	276	1,651	854,772	5,113,147
	Wea.rock	m3	4,645	339	1,398	1,574,655	6,493,710
	Rock	m3		962	3,475		
Concrete		m3	6,628	13,442	132,187	89,093,576	876,135,436
Rein bar		t	135	5,292	1,460,955	714,420	197,228,925
(2) Chuteway & basin							
Excavation	Common	m3	11,879	276	1,651	3,278,604	19,612,229
	Wea.rock	m3	17,818	339	1,398	6,040,302	24,909,564
	Rock	m3		962	3,475		
Concrete		m3	14,260	13,442	132,187	191,682,920	1,884,986,620
Rein bar		t	285	5,292	1,460,955	1,508,220	416,372,175
Grouting	Consoli.	t	35	6,500	90,000	227,500	3,150,000
(3) Metal work							
Spillway gate		Ls	1	108,000,000		108,000,000	
(Sub-total)						402,974,969	3,434,001,806
SUB-TOTAL OF 3.						1,287,686,698	7,333,843,437
4. WATER SUPPLY PIPE LINE							
4.1 Excavation		m3		276	1,651		
4.2 Backfill		m3		244	1,717		
4.3 Add. pump station		Ls	1	1,188,000,000	7,943,000,000	1,188,000,000	7,943,000,000
4.4 Add. purification plant		Ls	1	1,511,000,000	10,103,000,000	1,511,000,000	10,103,000,000
4.5 Add. pipe line		Ls			1,540,000,000		
4.6 Add. intake & surge tank		Ls	1	79,000,000	2,899,000,000	79,000,000	2,899,000,000
4.7 Receiving well		Ls	1	6,000,000	218,400,000	6,000,000	218,400,000
SUB-TOTAL OF 4.						2,784,000,000	21,163,400,000
TOTAL OF DIRECT CONSTRUCTION COST						4,451,894,158	31,571,656,083

Table F-23 Cost Estimate for Downstream Cidanau Dam: Scheme D-2

DESCRIPTION		Unit	Qty	UNIT PRICE Fc (Yen)	UNIT PRICE Lc (Rp)	AMOUNT Fc (Yen)	AMOUNT Lc (Rp)
1. PREPARATORY WORK (20% of 2+3+4+5+6)						375,176,927	2,810,769,979
2. DIVERSION WORK							
2.1 Inlet & outlet							
Excavation	Common	m3	997	276	1,651	275,172	1,646,047
	Wea.rock	m3	11,970	339	1,398	4,057,830	16,734,060
	Rock	m3	6,982	962	3,475	6,716,684	24,262,450
Concrete		m3	2,640	13,442	132,187	35,486,880	348,973,680
Rein bar		t	100	5,292	1,460,955	529,200	146,095,500
(Sub-total)						47,065,766	537,711,737
2.2 Tunnel(l=400m,D=5m)							
Excavation		m3	10,710	8,744	105,122	93,648,240	1,125,856,620
Lining conc.		m3	2,464	13,488	155,546	33,234,432	383,265,344
Plug conc.		m3	686	13,488	155,546	9,252,768	106,701,556
Grouting		t	504	6,500	90,000	3,276,000	45,360,000
Rein bar		t	126	5,292	1,460,955	666,792	184,080,330
(Sub-total)						140,078,232	1,845,266,850
SUB-TOTAL OF 2.						187,143,998	2,382,978,587
3. DAM							
2.1 Cofferdam							
Excavation		m3	2,500	276	1,651	690,000	4,127,500
Embankment		m3	200,000	1,514	5,964	302,800,000	1,192,800,000
(Sub-total)						303,490,000	1,196,927,500
2.2 Main dam							
Excavation	Common	m3	24,986	276	1,651	6,896,136	41,251,886
	Wea.rock	m3	54,136	339	1,398	18,352,104	75,682,128
	Rock	m3	4,164	962	3,475	4,005,768	14,469,900
Embankment	Core	m3	49,100	605	2,359	29,705,500	115,826,900
	Filter	m3	31,308	2,285	5,756	71,538,780	180,208,848
	Random	m3	72,975	441	1,144	32,181,975	83,483,400
	Rock	m3	170,275	1,514	5,964	257,796,350	1,015,520,100
Grouting	Blanket	t	56	6,500	90,000	364,000	5,040,000
	Consoli.	t	182	6,500	90,000	1,183,000	16,380,000
	Curtain	t	2,556	6,500	90,000	16,614,000	230,040,000
(Sub-total)						438,637,613	1,777,903,162
3.3 Sand trap basin							
Excavation	Common	m3	306,750	276	2,176	84,663,000	667,488,000
	Wea.rock	m3		339	2,585		
	Rock	m3		962	4,433		
Maintenance road(2km)		m3	55,000	244	1,717	13,420,000	94,435,000
Concrete		m3	1,200	13,442	132,187	16,130,400	158,624,400
(Sub-total)						114,213,400	920,547,400
SUB-TOTAL OF 3.						856,341,013	3,895,378,062
4. SPILLWAY							
4.1 Side channel							
Excavation	Common	m3	103,740	276	1,651	28,632,240	171,274,740
	Wea.rock	m3	116,707	339	1,398	39,563,673	163,156,386
	Rock	m3	38,902	962	3,475	37,423,724	135,184,450
Concrete		m3	27,724	13,442	132,187	372,666,008	3,664,752,388
Rein bar		t	520	5,292	1,460,955	2,751,840	759,696,600
(Sub-total)						481,037,485	4,894,064,564
4.2 Chuteway							
Excavation	Common	m3	53,093	276	1,651	14,653,668	87,656,543
	Wea.rock	m3	127,425	339	1,398	43,197,075	178,140,150
	Rock	m3	31,856	962	3,475	30,645,472	110,699,600
Concrete		m3	8,775	13,442	132,187	117,953,550	1,159,940,925
Rein bar		t	175	5,292	1,460,955	926,100	253,917,125
(Sub-total)						207,375,865	1,790,354,343
4.3 Plunge pool							
Excavation	Common	m3	2,030	276	1,651	560,280	3,351,530
	Wea.rock	m3	14,210	339	1,398	4,817,190	19,865,580
	Rock	m3	24,360	962	3,475	23,434,320	84,651,000
(Sub-total)						28,811,790	107,868,110
SUB-TOTAL OF 4.						717,225,140	6,792,287,017
5. OUTLET WORK							
5.1 Intake tower							
Excavation	Common	m3	3,758	276	1,651	1,037,208	6,204,458
	Wea.rock	m3	4,176	339	1,398	1,415,664	5,838,048
	Rock	m3	418	962	3,475	402,116	1,452,550
Concrete		m3	500	13,442	132,187	6,721,000	66,093,500
Rein bar		t	20	5,292	1,460,955	105,840	29,219,100
(Sub-total)						9,681,828	108,807,656
5.2 Intake shaft							
Excavation		m3	299	8,744	102,122	2,614,456	30,534,478
Concrete		m3	171	13,488	155,546	2,306,448	26,598,366
Rein bar		t	6	5,292	1,460,955	31,752	8,765,730
(Sub-total)						4,952,656	65,898,574
SUB-TOTAL OF 5.						14,634,484	174,706,230
6. METAL WORK							
6.1 Diversion gate		La	1	33,040,000		33,040,000	
6.2 Steel conduit		La	1		808,500,000		808,500,000
6.3 Hollow jet valve		La	1	45,000,000		45,000,000	
6.4 Guard valve		La	1	22,500,000		22,500,000	
SUB-TOTAL OF 6.						100,540,000	808,500,000
7. WATER SUPPLY PIPE LINE							
7.1 Excavation		m3		276	1,651		
7.2 Backfill		m3		244	1,717		
7.3 Add. pump station		La					
7.4 Add. purification plant		La					
7.5 Add. pipe line		La	1		504,000,000		504,000,000
7.6 Add. intake & surge tank		La					
SUB-TOTAL OF 7.							504,000,000
TOTAL OF DIRECT CONSTRUCTION COST						2,251,061,562	17,368,619,875

Table F-24 Cost Estimate for Heightening of Krenceng Dam with Two Diversion Tunnels: Scheme D-2

DESCRIPTION		Unit	Q'ty	UNIT PRICE Fc (Yen)	UNIT PRICE Lc (Rp)	AMOUNT Fc (Yen)	AMOUNT Lc (Rp)
1. PREPARATORY WORK (20% of 2+3)						277,982,360	1,734,709,347
2. DIVERTED TUNNEL							
2.1 Coffering work							
Coffering	Exca.	m3	1,000	276	1,651	276,000	1,651,000
	Embank	m3	1,000	441	1,144	441,000	1,144,000
(Sub-total)						717,000	2,795,000
2.2 Weir							
Excavation	Common	m3	1,200	276	1,651	331,200	1,981,200
	Wea.rock	m3	1,200	339	1,398	406,800	1,677,600
	Rock	m3	600	962	3,475	577,200	2,085,000
Concrete		m3	410	5,052	118,708	2,071,320	48,670,280
Rein bar		t	41	5,292	1,460,955	216,972	59,899,155
Gate		Ls	2	2,000,000		4,000,000	
(Sub-total)						7,603,492	114,313,235
2.3 Inlet & outlet							
Excavation	Common	m3	4,576	276	1,651	1,262,976	7,554,976
	Wea.rock	m3	4,576	339	1,398	1,551,264	6,397,248
	Rock	m3	2,288	962	3,475	2,201,056	7,950,800
Concrete		m3	200	13,442	132,187	2,688,400	26,437,400
Rein bar		t	40	5,292	1,460,955	211,680	58,438,200
Trash rack		Ls	2	1,000,000		2,000,000	
(Sub-total)						9,915,376	106,778,624
2.4 Diverted tunnel							
Excavation		m3	5,320	8,744	105,122	46,518,080	559,249,040
Lining conc.		m3	2,170	13,488	155,546	29,268,960	337,534,820
Plug conc.		m3		13,488	155,546		
Grouting		t	1,200	6,500	90,000	7,800,000	108,000,000
Rein bar		t	76	5,292	1,460,955	402,192	111,032,580
(Sub-total)						83,989,232	1,115,816,440
SUB-TOTAL OF 2.						102,225,100	1,339,703,299
3. HEIGHTENING OF KRENCENG DAM							
3.1 Main dam							
Excavation	Common	m3	146,652	276	1,651	40,475,952	242,122,452
	Wea.rock	m3	97,768	339	1,398	33,143,352	136,679,664
	Rock	m3		962	3,475		
Embankment	Core	m3	1,281,085	605	2,359	775,056,425	3,022,079,515
	Filter	m3		2,285	5,756		
	Random	m3		441	1,144		
	Rock	m3		1,514	5,964		
Grouting	Blanket	t	1,868	6,500	90,000	12,142,000	168,120,000
	Curtain	t	3,676	6,500	90,000	23,894,000	330,840,000
(Sub-total)						884,711,729	3,899,841,631
3.2 Spillway							
(1) Approach wall & weir							
Excavation	Common	m3	3,097	276	1,651	854,772	5,113,147
	Wea.rock	m3	4,645	339	1,398	1,574,655	6,493,710
	Rock	m3		962	3,475		
Concrete		m3	6,628	13,442	132,187	89,093,576	876,135,436
Rein bar		t	135	5,292	1,460,955	714,420	197,228,925
(2) Chuteway & basin							
Excavation	Common	m3	11,879	276	1,651	3,278,604	19,612,229
	Wea.rock	m3	17,818	339	1,398	6,040,302	24,909,564
	Rock	m3		962	3,475		
Concrete		m3	14,260	13,442	132,187	191,682,920	1,884,986,620
Rein bar		t	285	5,292	1,460,955	1,508,220	416,372,175
Grouting	Consoli.	t	35	6,500	90,000	227,500	3,150,000
(3) Metal work							
Spillway gate		Ls	1	108,000,000		108,000,000	
(Sub-total)						402,974,969	3,434,001,806
SUB-TOTAL OF 3.						1,287,686,698	7,333,843,437
4. WATER SUPPLY PIPE LINE							
4.1 Excavation		m3		276	1,651		
4.2 Backfill		m3		244	1,717		
4.3 Add. pump station		Ls	1	1,167,000,000	7,808,000,000	1,167,000,000	7,808,000,000
4.4 Add. purification plant		Ls	1	1,812,000,000	12,118,000,000	1,812,000,000	12,118,000,000
4.5 Add. pipe line		Ls			1,540,000,000		
4.6 Add. intake & surge tank		Ls	1	80,000,000	2,914,000,000	80,000,000	2,914,000,000
4.7 Receiving well		Ls	1	6,000,000	218,400,000	6,000,000	218,400,000
SUB-TOTAL OF 4.						3,065,000,000	23,058,400,000
TOTAL OF DIRECT CONSTRUCTION COST						4,732,894,158	33,466,656,083

Table F-25 Cost Estimate for Cidanau Gated Weir: Scheme D-3

DESCRIPTION		Unit	Q'ty	UNIT PRICE Fc (Yen)	UNIT PRICE Lc (Rp)	AMOUNT Fc (Yen)	AMOUNT Lc (Rp)
1. PREPARATORY WORK (20% of 2+3+4+5)						414,455,432	1,755,702,092
2. DIVERSION WORK							
2.1 Coffering work							
Sheet pile & bracing		t	159	131,583	36,915	20,921,697	5,869,485
SUB-TOTAL OF 2.						20,921,697	5,869,485
3. DAM							
3.1 Main dam							
Excavation	Common	m3	10,662	276	1,651	2,942,712	17,602,962
	Wea.rock	m3	8,462	339	1,398	2,868,618	11,829,876
	Rock	m3	2,200	962	3,475	2,116,400	7,645,000
Concrete		m3	21,325	5,052	118,708	107,733,900	2,531,448,100
Grouting	Consoli.	t	219	6,500	90,000	1,423,500	19,710,000
	Curtain	t	352	6,500	90,000	2,288,000	31,680,000
SUB-TOTAL OF 3.						119,373,130	2,619,915,938
4. SPILLWAY							
4.1 Dental work							
Excavation	Common	m3	22,389	276	1,651	6,179,364	36,964,239
	Wea.rock	m3		339	1,398		
	Rock	m3		962	3,475		
Concrete		m3	8,379	5,052	118,708	42,330,708	994,654,332
(Sub-total)						48,510,072	1,031,618,571
4.2 Weir & pier							
Excavation	Common	m3		276	1,651		
	Wea.rock	m3	1,170	339	1,398	396,630	1,635,660
	Rock	m3	500	962	3,475	481,000	1,737,500
Concrete		m3	10,761	13,442	132,187	144,649,362	1,422,464,307
Rein bar		t	1,290	5,292	1,460,955	6,826,680	1,884,631,950
Grouting	Consoli.	t	126	6,500	90,000	819,000	11,340,000
	Curtain	t	180	6,500	90,000	1,170,000	16,200,000
(Sub-total)						154,342,672	3,338,009,417
4.3 Hoist & bridge							
Concrete		m3	2,871	13,442	132,187	38,591,982	379,508,877
Rein bar		t	574	5,292	1,460,955	3,037,608	838,588,170
(Sub-total)						41,629,590	1,218,097,047
SUB-TOTAL OF 4.						244,482,334	5,587,725,035
5. METAL WORK							
5.1 Roller gate		Ls	1	1,620,000,000		1,620,000,000	
5.2 Steel conduit		Ls	1		565,000,000		565,000,000
5.3 Hollow jet valve		Ls	1	45,000,000		45,000,000	
5.4 Guard valve		Ls	1	22,500,000		22,500,000	
SUB-TOTAL OF 5.						1,687,500,000	565,000,000
6. WATER SUPPLY PIPE LINE							
6.1 Excavation		m3		276	1,651		
6.2 Backfill		m3		244	1,717		
6.3 Add. pump station		Ls					
6.4 Add. purification plant		Ls					
6.5 Add. pipe line		Ls					
6.6 Add. intake & surge tank		Ls					
SUB-TOTAL OF 6.							
TOTAL OF DIRECT CONSTRUCTION COST						2,486,732,593	10,534,212,550

Table F-26 Cost Estimate for Heightening of Krenceng Dam with Two Diversion Tunnels: Scheme D-3

DESCRIPTION		Unit	Q'ty	UNIT PRICE Fc (Yen)	UNIT PRICE Lc (Rp)	AMOUNT Fc (Yen)	AMOUNT Lc (Rp)
1. PREPARATORY WORK							
(20% of 2+3)						277,982,360	1,734,709,347
2. DIVERTED TUNNEL							
2.1 Coffering work							
Coffering	Exca.	m3	1,000	276	1,651	276,000	1,651,000
	Embank	m3	1,000	441	1,144	441,000	1,144,000
(Sub-total)						717,000	2,795,000
2.2 Weir							
Excavation	Common	m3	1,200	276	1,651	331,200	1,981,200
	Wea.rock	m3	1,200	339	1,398	406,800	1,677,600
	Rock	m3	600	962	3,475	577,200	2,085,000
Concrete		m3	410	5,052	118,708	2,071,320	48,670,280
Rein bar		t	41	5,292	1,460,955	216,972	59,899,155
Gate		Ls	2	2,000,000		4,000,000	
(Sub-total)						7,603,492	114,313,235
2.3 Inlet & outlet							
Excavation	Common	m3	4,576	276	1,651	1,262,976	7,554,976
	Wea.rock	m3	4,576	339	1,398	1,551,264	6,397,248
	Rock	m3	2,288	962	3,475	2,201,056	7,950,800
Concrete		m3	200	13,442	132,187	2,688,400	26,437,400
Rein bar		t	40	5,292	1,460,955	211,680	58,438,200
Trash rack		Ls	2	1,000,000		2,000,000	
(Sub-total)						9,915,376	106,778,624
2.4 Diverted tunnel							
Excavation		m3	5,320	8,744	105,122	46,518,080	559,249,040
Lining conc.		m3	2,170	13,488	155,546	29,268,960	337,534,820
Plug conc.		m3		13,488	155,546		
Grouting		t	1,200	6,500	90,000	7,800,000	108,000,000
Rein bar		t	76	5,292	1,460,955	402,192	111,032,580
(Sub-total)						83,989,232	1,115,816,440
SUB-TOTAL OF 2.						102,225,100	1,339,703,299
3. HEIGHTENING OF KRENCENG DAM							
3.1 Main dam							
Excavation	Common	m3	146,652	276	1,651	40,475,952	242,122,452
	Wea.rock	m3	97,768	339	1,398	33,143,352	136,679,664
	Rock	m3		962	3,475		
Embankment	Core	m3	1,281,085	605	2,359	775,056,425	3,022,079,515
	Filter	m3		2,285	5,756		
	Random	m3		441	1,144		
	Rock	m3		1,514	5,964		
Grouting	Blanket	t	1,868	6,500	90,000	12,142,000	168,120,000
	Curtain	t	3,676	6,500	90,000	23,894,000	330,840,000
(Sub-total)						884,711,729	3,899,841,631
3.2 Spillway							
(1) Approach wall & weir							
Excavation	Common	m3	3,097	276	1,651	854,772	5,113,147
	Wea.rock	m3	4,645	339	1,398	1,574,655	6,493,710
	Rock	m3		962	3,475		
Concrete		m3	6,628	13,442	132,187	89,093,576	876,135,436
Rein bar		t	135	5,292	1,460,955	714,420	197,228,925
(2) Chuteway & basin							
Excavation	Common	m3	11,879	276	1,651	3,278,604	19,612,229
	Wea.rock	m3	17,818	339	1,398	6,040,302	24,909,564
	Rock	m3		962	3,475		
Concrete		m3	14,260	13,442	132,187	191,682,920	1,884,986,620
Rein bar		t	285	5,292	1,460,955	1,508,220	416,372,175
Grouting	Consoli.	t	35	6,500	90,000	227,500	3,150,000
(3) Metal work							
Spillway gate		Ls	1	108,000,000		108,000,000	
(Sub-total)						402,974,969	3,434,001,806
SUB-TOTAL OF 3.						1,287,686,698	7,333,843,437
4. WATER SUPPLY PIPE LINE							
4.1 Excavation		m3		276	1,651		
4.2 Backfill		m3		244	1,717		
4.3 Add. pump station		Ls	1	1,208,000,000	8,080,000,000	1,208,000,000	8,080,000,000
4.4 Add. purification plant		Ls	1	1,931,000,000	12,916,000,000	1,931,000,000	12,916,000,000
4.5 Add. pipe line		Ls			1,540,000,000		
4.6 Add. intake & surge tank		Ls	1	84,000,000	3,084,000,000	84,000,000	3,084,000,000
4.7 Receiving well		Ls	1	6,000,000	218,400,000	6,000,000	218,400,000
SUB-TOTAL OF 4.						3,229,000,000	24,298,400,000
TOTAL OF DIRECT CONSTRUCTION COST						4,896,894,158	34,706,656,083

Table F-27 Economic Cost and Economic Evaluation for Alternative Single Development Schemes

(Unit : Million)

Description	Scheme											
	A-1		A-3		A-6		K-1		K-2		K-3	
	F/C *5	L/C *6	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C
1) Direct Const. cost	3,473	62,317	2,345	18,000	2,792	13,529	4,021	27,420	4,147	28,609	4,318	30,334
Dam and related facility	2,780	17,654	2,251	16,865	2,487	10,534	1,545	8,801	1,585	9,336	1,668	10,408
Water transmission facility	693	44,663	94	1,135	305	2,995	2,476	18,619	2,562	19,272	2,650	19,925
2) Land acquisition cost	0	210	0	12	0	28	0	3,722	0	3,722	0	3,722
3) Administration *1	0	6,253	0	1,801	0	1,356	0	3,114	0	3,233	0	3,406
4) Engineering Services *2	521	3,116	352	900	419	676	603	1,371	622	1,430	648	1,517
5) Physical contingency *3	599	10,753	405	3,105	482	2,334	694	4,786	715	4,991	745	5,288
6) Grand Total	4,593	82,649	3,101	23,818	3,692	17,924	5,318	40,413	5,484	41,985	5,710	44,266
(Rp) *4	154,300		72,199		75,520		123,375		127,542		133,348	
7) Economic cost *7	138,681		64,968		67,943		107,688		111,439		116,664	
8) Capitalized cost *8	106,165		48,612		51,116		96,189		98,398		101,167	
9) Capitalized benefit *8	97,024		19,405		50,668		243,637		254,418		265,198	
10) Net benefit	-9,141		-29,208		-448		147,449		156,019		164,031	
11) Benefit cost ratio	0.91		0.40		0.99		2.53		2.59		2.62	
12) Economic internal rate of return (EIRR)	11.16		5.22		11.92		24.02		24.22		24.26	

Note : *1 F/C 0%, LC 10% of 1) + 2)
*2 F/C 15%, L/C 5% of 1)
*3 F/C 15%, L/C 15% of 1) + 3) + 4)
*4 Yi = Rp.15.6
*5 F/C: Japanese Yen
*6 L/C: Rupiah
*7 Conversion factor : 0.9 / Excluded land acquisition cost
*8 Capitalized by discount rate of 12%
Excluded Land acquistion cost

Table F-28 Economic Cost and Economic Evaluation for Alternative Combined Development Schemes

(Unit : Million)

Description	Scheme																	
	B-1		B-2		B-3		C-1		C-2		C-3		D-1		D-2		D-3	
	F/C *5	L/C *6	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C
1) Direct Const. cost	7,007	85,977	6,774	48,576	7,097	42,393	7,134	87,165	6,901	49,763	7,224	43,581	7,304	88,889	6,984	50,855	7,384	45,241
Dam and related facility	4,330	26,485	3,796	25,665	4,032	19,335	4,270	27,020	3,836	26,201	4,072	19,870	4,453	28,092	3,919	27,273	4,155	20,942
Water transmission facility	2,677	59,492	2,978	22,910	3,065	23,058	2,764	60,145	3,065	23,562	3,152	23,710	2,851	60,797	3,065	23,562	3,229	24,298
2) Land acquisition cost	0	5,372	0	5,174	0	5,190	0	5,362	0	5,174	0	5,190	0	5,372	0	5,174	0	5,190
3) Administration *1	0	9,135	0	5,375	0	4,758	0	9,253	0	5,494	0	4,877	0	9,426	0	5,601	0	5,043
4) Engineering Services *2	1,051	4,299	1,016	2,429	1,065	2,120	1,070	4,358	1,035	2,488	1,084	2,179	1,096	4,444	1,048	2,542	1,108	2,262
5) Physical contingency *3	1,209	14,912	1,169	8,457	1,224	7,391	1,231	15,116	1,190	8,662	1,246	7,596	1,260	15,414	1,205	8,847	1,274	7,882
6) Grand Total	9,267	119,693	8,959	70,010	9,386	61,852	9,435	121,254	9,127	71,581	9,553	63,422	9,659	123,545	9,236	72,998	9,765	65,618
(Rp) *4	264,259		209,770		208,269		268,436		213,957		212,456		274,231		217,084		217,949	
7) Economic cost *7	232,998		184,137		182,771		236,767		187,905		186,540		241,974		190,720		191,484	
8) Capitalized cost *8	192,065		156,747		153,174		194,290		156,491		155,149		197,046		157,051		157,279	
9) Capitalized benefit *8	330,235		305,286		313,873		336,925		313,873		321,535		343,026		321,535		328,184	
10) Net benefit	138,170		148,539		160,699		142,635		157,382		166,386		145,980		164,484		170,905	
11) Benefit cost ratio	1.72		1.95		2.05		1.73		2.01		2.07		1.74		2.05		2.09	
12) Economic internal rate of return (EIRR)	18.00		19.91		20.60		18.04		20.22		20.64		18.00		20.36		20.58	

Note : *1 F/C 0%, L/C 10% of 1) + 2)
*2 F/C 15%, L/C 5% of 1)
*3 F/C 15%, L/C 15% of 1) + 3) + 4)
*4 ¥1 = Rp.15.6
*5 F/C: Japanese Yen
*6 L/C: Rupiah
*7 Conversion factor : 0.9 / Excluded land acquisition cost
*8 Capitalized by discount rate of 12%

Table F-29 Water Conveyance and Treatment Facilities for Alternative Development Scale of Heightening of Krenceng Dam

	Alternative		
	H-1	H-2	H-3
Required Additional Pump Capacity*	1.10 m^3/s	0.65 m^3/s	0.105 m^3/s
Intake Facilities (Cidanau)			
Intake*	L = 40 m B = 2.0 m H = 2.2 m	L = 40 m B = 1.0 m H = 2.2 m	-
Sand trap basin*	L = 80 m B = 6.5 m H = 3.0 m	L - 80 m B = 4 m H = 3.0 m	-
Water Conveyance Facilities			
Cidanau Pump station*	0.55 m^3/s x 2 units	0.33 m^3/s x 2 units	0.105 m^3/s x 1 unit
Booster pump station*	1.03 m^3/s x 4[1]	0.88 x m^3/s x 4[1]	0.70 m^3/s x 4[1]
Surge tank	2 units	2 units	1 unit
Purification Facilities			
Pump station**	1.03 m^3/s x 4[1]	0.88 m^3/s x 4[1]	0.105 m^3/s x 1
Receiving well**	Replaced	Replaced	Replaced
Water purification plant**	1.10 m^3/s	0.65 m^3/s	0.105 m^3/s

Note: 1] included one standby.
* additional facilities
** replaced facilities

Table F-30 Water Conveyance and Treatment Facilities for Alternative Development Scale of Cidanau Gated Weir

	Alternative	
	M-1	M-2
Required Additional Pump Capacity*	0.205 m^3/s	0
Intake Facilities (Cidanau)		
Intake*	-	-
Sand trap basin*	-	-
Pump station*	-	-
Conveyance Facilities		
Booster pump station*	-	-
Surge tank	-	-
Purification Facilities		
Pump station*	0.205 m^3/s x 1 unit	0.015 m^3/s x 1 unit
Receiving well	-	-
Water purification plant	0.205 m^3/s	0.015 m^3/s

Note: * additional facilities

Table F-31 Five (5)-day Mean Inflow Discharge at Existing Cidanau Weir Site

(Unit: m3/sec)

Year	Period (day)	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Mean
1980	1st - 5th	9.02	7.63	10.49	5.16	1.9	8.89	3.78	5.07	6.12	1.98	21.75	64.63	12.20
	6th - 10th	9.22	11.72	7.95	4.09	0.42	10.17	6.52	10.38	62.58	1.47	25.6	73.43	18.63
	11th - 15th	9.38	11.6	32.45	15.05	2.04	4.36	6.51	15.84	66.5	5.88	31.05	75.87	23.04
	16th - 20th	9.07	11.72	22.15	11.21	4.42	7.34	10.99	29.73	28.67	14.2	35.87	97.76	23.59
	21st - 25th	9.02	11.78	5.29	7.57	12.4	8.74	6.11	12.25	5.73	15.9	42.38	68.39	17.13
	26th - 31st	6.86	14.65	3.35	4.61	9.63	5.49	5.29	4.09	3.78	19.05	49.61	91.21	18.14
1981	1st - 5th	143.78	42.67	28.32	28.78	14.89	6.52	9.97	18.6	5.04	96.83	10.68	29.59	36.31
	6th - 10th	167.61	49.8	4.05	28.48	10.24	8.54	2.94	7.15	15.09	33.15	9.34	26.9	30.27
	11th - 15th	66.59	32.67	5.24	26.98	6.84	11.8	6.44	5.13	16.4	11.46	56.21	19.97	22.14
	16th - 20th	70.21	24.47	8.51	23.48	10.07	22	12.86	3.65	3.8	8.17	157.94	7.96	29.43
	21st - 25th	32.2	4.33	5.41	20.12	7.49	9.99	17.02	8.72	2.63	4.25	60.02	13.4	15.46
	26th - 31st	33.02	43.04	22.74	18.03	2.12	9.78	22.06	10.29	22.8	20.99	21.64	72.94	24.95
1982	1st - 5th	49.48	6.42	21.14	24.15	12.58	5.62	3.25	3.88	1.95	2.92	1.13	3.15	11.31
	6th - 10th	26.97	2.63	73.45	24.62	8.29	8.78	2.95	2.95	1.33	1.29	12.36	0.98	13.88
	11th - 15th	10.12	4	29.24	16.71	7.78	5.92	2.88	1.89	1.23	0.84	3.98	5.15	7.48
	16th - 20th	41.99	3.63	39.29	40.02	4.48	5.88	4.14	1.61	1.05	2.22	1.8	6.45	12.71
	21st - 25th	36.65	7.71	56.8	12.54	3.94	4.37	5.11	1.31	2.22	2.17	6.13	6.78	12.14
	26th - 31st	7.07	10.93	15.69	17.23	4.46	3	9.21	1.03	2.48	1.22	5.88	16.55	7.90
1983	1st - 5th	15.68	18.28	12.53	11.42	4.78	9.32	18.42	3.31	1.14	0.87	16.39	44.79	13.08
	6th - 10th	16.16	21.76	6.29	10.11	4.7	7.94	11.4	1.57	1.76	0.67	13.21	23.81	9.95
	11th - 15th	14.29	6	5.37	8.8	14.13	6.23	5.87	2.78	1.96	0.75	17.05	10.13	7.78
	16th - 20th	25.58	6.53	4.6	10.47	7.12	9.07	7.77	3.44	1.63	0.85	90.38	10.25	14.81
	21st - 25th	46.39	7.22	4.57	8.87	9.33	11.23	5.69	9.1	1.63	5.81	1.49	8.64	10.00
	26th - 31st	26.34	9.6	6.81	10.93	6	11.91	6.5	2.04	1.25	12.64	50.62	13.61	13.19
1984	1st - 5th	13.13	17.21	13.6	27.51	13.54	14.43	5.3	5.79	3.86	24.07	3.73	46.23	15.70
	6th - 10th	3.19	28.98	24.73	6.62	24.73	8.04	11.33	4.46	11.56	10.2	6.39	44.47	15.39
	11th - 15th	14.45	13.05	29.99	8.87	36.17	7.25	7.62	3.43	14.49	4.69	11.28	18.37	14.14
	16th - 20th	16.08	9.61	24.88	7.79	13.42	6.04	4.98	3.5	11.67	5.54	11.43	16.23	10.93
	21st - 25th	16.33	6.64	44.2	10.14	9.18	7.22	6.4	3.24	10.14	5.35	8.25	7.7	11.23
	26th - 31st	18.98	17.45	50.95	15.02	24.37	3.22	7.21	4.19	8.05	6.53	8.69	33.45	16.51
1985	1st - 5th	21.96	11.95	13.08	4.25	15.15	5.23	4.75	12.42	2.74	4.04	9.46	33.72	11.56
	6th - 10th	19.4	11.84	42.17	5.48	11.79	4.76	4.82	12.07	2.78	6.16	8.98	28.56	13.23
	11th - 15th	37.45	14.6	32.83	10.57	9.33	5.76	5.32	7.34	10.2	13.03	9.98	9.68	13.84
	16th - 20th	12.81	7.56	11.11	21.81	7.82	7.11	5.69	6.28	7.87	16.73	6.94	4.41	9.68
	21st - 25th	8.72	13.14	6.93	15.98	8.38	7.34	13.79	4.77	5.53	21.81	8.6	4.08	9.92
	26th - 31st	13.47	14.16	5.11	17.61	6.73	6.71	15.19	3.51	5.15	10.44	15.24	4.25	9.80
1986	1st - 5th	15.11	28.46	11.96	24.45	12.69	5.92	2.81	6.07	1.89	7.88	21.24	11.94	12.54
	6th - 10th	48.59	18.48	10.04	24.03	9.79	5.53	3.19	7.26	3.09	5.27	32.92	4.67	14.41
	11th - 15th	51.29	24.43	8.07	18.98	9.8	5.06	4.65	8.59	5.97	8.81	53.45	14.23	17.78
	16th - 20th	26.19	20.85	6.83	17.98	9.4	5.17	3.21	5.66	6.65	9.6	23.06	22.26	13.07
	21st - 25th	53.9	17.23	29.23	11.07	5.97	5.94	2.49	2.89	6.82	6.08	9.45	11.96	13.59
	26th - 31st	51.05	13.74	53.76	8.67	5.28	3.66	4.93	2.31	9.29	15.9	12.24	7.32	15.68
1987	1st - 5th	11.51	17.83	36.37	11.65	22.55	6.91	5.4	2.92	1.22	1.16	1.54	1.95	10.08
	6th - 10th	44.13	28.18	36.32	15.09	17.38	7.01	4.13	2.14	1.13	1.13	2.66	3.34	13.55
	11th - 15th	61.24	25.46	19.54	16.16	19.87	7.63	3.32	2.36	1.13	2.81	5.79	7.32	14.39
	16th - 20th	34.2	20.36	8.49	15.64	16.83	7.59	2.46	1.82	1.13	2.15	5.31	9.12	10.43
	21st - 25th	21.03	42.99	10.47	6.91	8.75	6.91	2.56	1.53	1.13	2.53	3.29	13.2	10.11
	26th - 31st	20.56	44.32	10.85	11.22	7.99	6.1	3.17	1.28	1.13	1.55	2	7.33	9.79
1988	1st - 5th	3.34	38.29	15.24	47.82	17.99	7.23	4.65	2.39	2.01	3.32	8.32	33.61	15.35
	6th - 10th	1.79	48.05	24.94	23.5	19.95	13.23	3.18	4.39	2.65	2.67	10.41	21.84	14.72
	11th - 15th	1.96	34.22	15.25	16.91	15.6	14.51	2.11	3.48	3.47	2.61	13.72	31.22	12.92
	16th - 20th	4.87	50.13	14.61	16.79	21.4	12.64	2.49	3.21	3.06	4.65	12.61	58.7	17.10
	21st - 25th	7.52	25.29	16.7	19.45	17.94	10.34	2.14	3.43	3	5.25	18.37	28.63	13.17
	26th - 31st	15.99	7.87	22.49	14.13	8.59	7.25	2.22	2.23	2.89	4.98	31.08	14.3	11.17
1989	1st - 5th	10.35	9.84	57.46	7.82	7.82	7.63	3.17	2.67	3.89	3.17	3.88	5.28	10.25
	6th - 10th	7.94	36.72	39.68	7.82	7.82	9.29	6.28	1.79	2.39	2.67	3.33	6.51	11.02
	11th - 15th	6.52	24.09	21.83	7.82	7.82	9.3	10.52	2.26	4.34	2.19	5.15	9.45	9.27
	16th - 20th	8.52	74.81	18.76	7.82	7.82	6.35	12.33	1.44	5.45	1.89	4.85	10.6	13.39
	21st - 25th	9.03	30.83	10.8	7.82	7.82	3.75	8.72	1.63	3.54	2.01	5.35	9.9	8.43
	26th - 31st	7.36	82.69	7.54	7.82	7.82	3.24	4.44	2.46	1.93	4.69	4.05	10.03	12.01
Mean		26.71	21.70	20.64	15.14	10.76	7.74	6.51	5.22	7.20	8.32	19.09	23.30	14.36

Table F-32 Five (5)-day Mean Inflow Discharge at Krenceng Dam Site

(Unit: m3/sec)

Year	Period (day)	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Main
1980	1st - 5th	0.27	0.43	0.34	0.14	0.25	0.26	0.09	0.27	0.53	0.25	0.41	0.11	0.28
	6th - 10th	0.46	1.11	0.53	0.15	0.22	0.13	0.09	0.43	0.46	0.28	0.23	0.15	0.35
	11th - 15th	0.68	1.14	0.36	0.66	0.25	0.17	0.1	0.66	0.74	0.28	0.29	0.12	0.45
	16th - 20th	0.67	1.8	0.38	0.23	0.24	0.11	0.12	0.87	0.26	0.19	0.73	0.41	0.50
	21st - 25th	0.67	1.07	0.16	0.39	0.17	0.14	0.11	0.12	0.18	0.28	0.17	1.23	0.39
	26th - 31st	0.76	0.54	0.21	0.25	0.12	0.12	0.12	0.1	0.33	0.22	0.15	1.23	0.35
1981	1st - 5th	3.96	0.92	1.52	0.32	0.49	0.15	0.14	0.38	0.42	0.77	0.32	0.71	0.84
	6th - 10th	2.72	0.81	0.77	0.37	0.38	0.13	0.13	0.4	0.39	0.77	0.64	0.46	0.66
	11th - 15th	1.65	1.19	1.18	0.22	0.48	0.28	0.49	0.24	1.09	0.59	0.97	0.39	0.73
	16th - 20th	0.96	1.19	0.74	0.31	0.67	0.47	0.74	0.34	0.26	0.25	2.28	0.39	0.72
	21st - 25th	0.68	1.07	0.39	0.32	0.25	0.21	0.82	0.34	0.23	0.28	0.4	0.78	0.48
	26th - 31st	0.95	2.88	0.6	0.24	0.19	0.27	1.29	0.23	0.36	0.42	1.07	1.49	0.83
1982	1st - 5th	0.9	1.1	0.68	0.64	0.55	0.57	0.19	0.25	0.11	0.15	0.09	0.1	0.44
	6th - 10th	2.07	0.52	0.86	0.52	0.49	0.43	0.15	0.19	0.11	0.1	0.15	0.09	0.47
	11th - 15th	3.25	0.67	1.4	0.49	0.38	0.31	0.15	0.09	0.1	0.1	0.14	0.1	0.60
	16th - 20th	2.09	0.51	1.36	0.8	0.26	0.26	0.38	0.07	0.1	0.23	0.14	0.1	0.53
	21st - 25th	1.49	0.41	1.02	0.53	0.26	0.17	0.4	0.05	0.09	0.11	0.14	0.11	0.40
	26th - 31st	1.06	0.5	0.8	0.76	0.32	0.26	0.39	0.04	0.12	0.1	0.13	0.24	0.39
1983	1st - 5th	0.43	0.5	1	0.43	0.58	0.34	0.36	0.05	0.01	0.01	0.09	0.86	0.39
	6th - 10th	0.25	0.51	0.45	0.68	1.07	2.24	0.05	0.04	0.02	0	0.18	0.83	0.53
	11th - 15th	0.18	0.13	0.36	0.14	0.66	0.84	0.04	0.03	0.02	0	0.02	0.27	0.22
	16th - 20th	0.28	0.32	0.15	0.31	0.65	0.5	0.11	0.03	0.03	0.01	1.08	0.18	0.30
	21st - 25th	0.75	0.19	0.16	1.37	0.41	0.28	0.1	0.06	0.02	0.09	3.17	0.13	0.56
	26th - 31st	0.11	1.02	0.6	1.04	0.53	0.62	0.12	0.02	0.01	0.09	9.05	0.15	1.11
1984	1st - 5th	0.28	1.06	0.87	0.41	1.16	0.46	0.56	0.2	0.26	1.1	0.34	0.24	0.58
	6th - 10th	0.54	0.79	2.34	0.56	0.98	0.38	0.39	0.16	0.9	0.31	0.19	0.2	0.65
	11th - 15th	0.19	0.92	3.27	0.37	0.52	0.5	0.21	0.36	0.93	0.52	0.19	0.34	0.69
	16th - 20th	0.3	1.84	2.14	0.56	0.35	0.48	0.19	0.22	0.63	0.42	0.43	0.27	0.65
	21st - 25th	2.07	1.67	4.11	0.42	0.55	0.32	0.38	0.2	0.42	0.5	0.33	0.23	0.93
	26th - 31st	3.25	1.33	3.9	1.06	0.43	0.23	0.34	0.36	0.97	0.26	0.18	0.75	1.09
1985	1st - 5th	0.26	0.23	0.39	0.25	0.24	0.14	0.16	0.58	0.09	0.27	0.19	0.7	0.29
	6th - 10th	0.94	0.2	0.88	0.35	0.18	0.19	0.32	0.22	0.19	0.24	0.34	0.28	0.36
	11th - 15th	0.27	0.17	0.33	0.57	0.2	0.12	0.39	0.14	0.13	0.16	0.14	0.11	0.23
	16th - 20th	0.2	0.11	0.35	1.33	0.14	0.13	0.4	0.14	0.11	0.78	0.1	0.18	0.33
	21st - 25th	0.28	0.42	0.18	0.41	0.12	0.49	0.62	0.11	0.1	0.16	0.14	0.28	0.28
	26th - 31st	0.45	0.11	0.29	0.42	0.18	0.13	0.21	0.13	0.22	0.15	0.24	0.22	0.23
1986	1st - 5th	0.18	0.78	0.61	0.68	0.24	0.14	0.22	0.11	0.14	0.41	0.24	0.14	0.32
	6th - 10th	1.94	0.64	0.37	0.49	0.36	0.25	0.21	0.12	0.33	0.29	0.46	0.11	0.46
	11th - 15th	0.68	1.11	0.55	0.64	0.39	0.51	0.7	0.36	0.32	0.16	0.39	0.51	0.53
	16th - 20th	0.99	0.39	0.44	0.38	0.19	0.21	0.34	0.16	0.17	0.15	0.57	0.65	0.39
	21st - 25th	2.78	0.53	0.41	0.3	0.25	0.12	0.19	0.11	0.12	0.1	0.24	0.15	0.44
	26th - 31st	1.76	0.58	0.29	0.49	0.2	0.14	0.27	0.15	0.14	0.58	0.43	0.22	0.44
1987	1st - 5th	0.37	0.32	0.58	0.29	0.46	0.2	0.14	0.1	0.09	0.09	0.1	0.1	0.24
	6th - 10th	1.42	0.87	0.33	0.23	0.61	0.23	0.12	0.09	0.09	0.09	0.24	0.11	0.37
	11th - 15th	1.13	0.35	0.25	0.24	0.43	0.31	0.1	0.09	0.09	0.09	0.13	0.16	0.28
	16th - 20th	0.41	0.46	0.22	0.23	0.34	0.18	0.1	0.09	0.11	0.09	0.09	0.66	0.25
	21st - 25th	0.53	0.3	0.29	0.21	0.17	0.18	0.1	0.09	0.09	0.09	0.09	0.14	0.19
	26th - 31st	0.57	1.78	0.31	0.72	0.17	0.15	0.1	0.09	0.09	0.09	0.09	0.09	0.35
1988	1st - 5th	0.09	2.92	0.19	0.37	0.13	0.18	0.19	0.11	0.09	0.09	0.64	0.12	0.43
	6th - 10th	0.17	2.02	0.16	0.22	0.11	0.12	0.13	0.12	0.09	0.09	0.21	0.12	0.30
	11th - 15th	0.17	0.37	0.15	0.17	0.13	0.11	0.08	0.14	0.09	0.51	0.16	0.88	0.25
	16th - 20th	0.27	0.18	0.15	0.16	0.16	0.09	0.1	0.12	0.09	0.32	0.11	0.21	0.16
	21st - 25th	0.19	0.16	0.19	0.19	0.13	0.09	0.08	0.11	0.09	0.15	0.12	0.09	0.13
	26th - 31st	0.77	0.16	0.17	0.14	0.1	0.09	0.09	0.1	0.09	0.36	0.11	0.09	0.19
1989	1st - 5th	0.09	0.5	0.8	0.08	0.05	0.04	0.13	0.14	0.12	0.09	0.09	0.09	0.19
	6th - 10th	0.1	0.5	0.69	0.1	0.04	0.16	0.13	0.18	0.16	0.09	0.09	0.17	0.20
	11th - 15th	0.13	0.21	0.51	0.1	0.02	0.21	0.14	0.14	0.12	0.09	0.09	1.14	0.24
	16th - 20th	0.14	0.62	0.24	0.04	0.03	0.18	0.13	0.14	0.09	0.09	0.1	0.38	0.18
	21st - 25th	0.27	1.75	0.08	0.03	0.04	0.18	0.12	0.13	0.09	0.09	0.09	0.17	0.25
	26th - 31st	0.16	1.49	0.1	0.03	0.04	0.18	0.15	0.29	0.09	0.09	0.09	0.47	0.27
Mean		0.86	0.81	0.72	0.41	0.33	0.28	0.25	0.19	0.23	0.25	0.50	0.36	0.43

Table F-33 Five (5)-day Mean Inflow Discharge at Beroeng Intake Weir Site

(Unit: m3/sec)

Year	Period (day)	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Mean
1980	1st - 5th	0.25	0.39	0.31	0.13	0.23	0.23	0.08	0.25	0.48	0.23	0.38	0.1	0.26
	6th - 10th	0.42	1.01	0.48	0.14	0.2	0.12	0.08	0.39	0.41	0.26	0.21	0.14	0.32
	11th - 15th	0.62	1.03	0.33	0.6	0.23	0.16	0.09	0.6	0.67	0.26	0.27	0.11	0.41
	16th - 20th	0.61	1.64	0.34	0.21	0.22	0.1	0.11	0.79	0.23	0.17	0.66	0.37	0.45
	21st - 25th	0.61	0.97	0.15	0.36	0.15	0.12	0.1	0.11	0.17	0.25	0.16	1.12	0.36
	26th - 31st	0.69	0.49	0.19	0.23	0.11	0.11	0.11	0.09	0.3	0.2	0.13	1.12	0.31
1981	1st - 5th	3.61	0.84	1.38	0.29	0.45	0.14	0.13	0.35	0.38	0.7	0.29	0.65	0.77
	6th - 10th	2.48	0.73	0.7	0.34	0.34	0.12	0.12	0.36	0.36	0.7	0.58	0.41	0.60
	11th - 15th	1.5	1.09	1.07	0.2	0.44	0.26	0.45	0.22	0.99	0.54	0.88	0.35	0.67
	16th - 20th	0.88	1.08	0.68	0.28	0.61	0.43	0.67	0.31	0.24	0.22	2.07	0.35	0.65
	21st - 25th	0.62	0.98	0.35	0.29	0.22	0.19	0.75	0.31	0.21	0.26	0.36	0.71	0.44
	26th - 31st	0.86	2.62	0.54	0.22	0.17	0.25	1.18	0.21	0.33	0.38	0.97	1.35	0.76
1982	1st - 5th	0.82	1	0.61	0.58	0.5	0.52	0.17	0.23	0.1	0.13	0.08	0.09	0.40
	6th - 10th	1.88	0.47	0.78	0.48	0.45	0.39	0.14	0.17	0.1	0.09	0.13	0.08	0.43
	11th - 15th	2.96	0.61	1.28	0.45	0.34	0.28	0.14	0.08	0.09	0.09	0.13	0.09	0.55
	16th - 20th	1.9	0.47	1.24	0.73	0.24	0.24	0.35	0.06	0.09	0.21	0.13	0.09	0.48
	21st - 25th	1.35	0.37	0.93	0.48	0.24	0.16	0.36	0.05	0.08	0.1	0.12	0.1	0.36
	26th - 31st	0.97	0.45	0.73	0.69	0.29	0.24	0.35	0.03	0.11	0.09	0.12	0.22	0.36
1983	1st - 5th	0.39	0.46	0.91	0.39	0.53	0.31	0.32	0.04	0.01	0.01	0.09	0.78	0.35
	6th - 10th	0.23	0.46	0.41	0.62	0.97	2.04	0.05	0.03	0.02	0	0.17	0.75	0.48
	11th - 15th	0.17	0.12	0.33	0.13	0.6	0.76	0.04	0.03	0.02	0	0.02	0.25	0.21
	16th - 20th	0.25	0.29	0.13	0.29	0.59	0.45	0.1	0.03	0.02	0.01	0.98	0.17	0.28
	21st - 25th	0.68	0.17	0.14	1.24	0.37	0.26	0.09	0.06	0.02	0.08	2.89	0.12	0.51
	26th - 31st	0.1	0.93	0.55	0.94	0.48	0.56	0.11	0.02	0.01	0.08	8.23	0.13	1.01
1984	1st - 5th	0.26	0.96	0.79	0.37	1.06	0.42	0.51	0.18	0.24	1	0.31	0.22	0.53
	6th - 10th	0.49	0.72	2.13	0.51	0.89	0.35	0.35	0.15	0.82	0.28	0.17	0.18	0.59
	11th - 15th	0.18	0.84	2.98	0.34	0.47	0.45	0.19	0.32	0.85	0.47	0.18	0.31	0.63
	16th - 20th	0.27	1.68	1.94	0.51	0.32	0.44	0.18	0.2	0.57	0.38	0.4	0.25	0.60
	21st - 25th	1.89	1.52	3.74	0.39	0.5	0.29	0.34	0.18	0.39	0.45	0.3	0.21	0.85
	26th - 31st	2.96	1.21	3.55	0.96	0.39	0.21	0.31	0.33	0.88	0.24	0.16	0.68	0.99
1985	1st - 5th	0.24	0.21	0.36	0.23	0.22	0.13	0.15	0.53	0.09	0.24	0.17	0.63	0.27
	6th - 10th	0.86	0.18	0.8	0.32	0.16	0.17	0.29	0.2	0.18	0.22	0.31	0.26	0.33
	11th - 15th	0.24	0.16	0.3	0.52	0.18	0.11	0.36	0.13	0.12	0.15	0.13	0.1	0.21
	16th - 20th	0.18	0.1	0.32	1.21	0.13	0.12	0.36	0.13	0.1	0.71	0.09	0.16	0.30
	21st - 25th	0.26	0.38	0.17	0.37	0.11	0.44	0.56	0.1	0.09	0.15	0.13	0.25	0.25
	26th - 31st	0.41	0.1	0.26	0.38	0.16	0.12	0.19	0.11	0.2	0.14	0.21	0.2	0.21
1986	1st - 5th	0.16	0.71	0.55	0.62	0.21	0.13	0.2	0.1	0.13	0.38	0.22	0.12	0.29
	6th - 10th	1.77	0.58	0.34	0.44	0.33	0.23	0.19	0.11	0.3	0.27	0.42	0.1	0.42
	11th - 15th	0.62	1.01	0.5	0.58	0.35	0.46	0.64	0.32	0.29	0.14	0.35	0.47	0.48
	16th - 20th	0.9	0.35	0.4	0.35	0.17	0.19	0.31	0.14	0.15	0.13	0.52	0.6	0.35
	21st - 25th	2.53	0.48	0.37	0.27	0.23	0.11	0.17	0.1	0.11	0.09	0.22	0.13	0.40
	26th - 31st	1.6	0.53	0.27	0.44	0.18	0.12	0.25	0.14	0.13	0.53	0.39	0.2	0.40
1987	1st - 5th	0.34	0.29	0.53	0.26	0.41	0.18	0.13	0.09	0.08	0.08	0.09	0.09	0.21
	6th - 10th	1.29	0.79	0.3	0.21	0.55	0.21	0.1	0.08	0.08	0.08	0.22	0.1	0.33
	11th - 15th	1.03	0.32	0.23	0.22	0.39	0.28	0.09	0.08	0.08	0.08	0.12	0.14	0.26
	16th - 20th	0.37	0.42	0.2	0.21	0.31	0.16	0.09	0.08	0.1	0.08	0.08	0.6	0.23
	21st - 25th	0.48	0.27	0.27	0.19	0.16	0.17	0.09	0.08	0.08	0.08	0.08	0.13	0.17
	26th - 31st	0.51	1.62	0.28	0.66	0.16	0.14	0.09	0.08	0.08	0.08	0.08	0.08	0.32
1988	1st - 5th	0.08	2.66	0.17	0.34	0.12	0.16	0.17	0.1	0.09	0.08	0.58	0.11	0.39
	6th - 10th	0.15	1.84	0.15	0.2	0.1	0.11	0.12	0.11	0.08	0.08	0.19	0.11	0.27
	11th - 15th	0.15	0.33	0.14	0.15	0.12	0.1	0.07	0.13	0.08	0.46	0.14	0.8	0.22
	16th - 20th	0.24	0.16	0.13	0.15	0.14	0.08	0.09	0.11	0.08	0.29	0.1	0.19	0.15
	21st - 25th	0.17	0.15	0.17	0.18	0.12	0.08	0.07	0.1	0.08	0.14	0.11	0.08	0.12
	26th - 31st	0.7	0.14	0.16	0.13	0.1	0.08	0.08	0.09	0.08	0.32	0.1	0.08	0.17
1989	1st - 5th	0.08	0.46	0.73	0.08	0.04	0.04	0.12	0.13	0.11	0.08	0.08	0.08	0.17
	6th - 10th	0.09	0.46	0.63	0.1	0.03	0.15	0.12	0.17	0.15	0.08	0.08	0.08	0.18
	11th - 15th	0.12	0.19	0.47	0.09	0.02	0.19	0.13	0.13	0.11	0.08	0.08	0.08	0.14
	16th - 20th	0.13	0.56	0.21	0.03	0.03	0.16	0.12	0.13	0.08	0.08	0.09	0.09	0.14
	21st - 25th	0.25	1.59	0.08	0.03	0.04	0.17	0.11	0.11	0.08	0.08	0.08	0.08	0.23
	26th - 31st	0.14	1.35	0.09	0.02	0.04	0.16	0.14	0.26	0.08	0.08	0.08	0.08	0.21
Mean		0.78	0.73	0.65	0.37	0.30	0.26	0.23	0.17	0.21	0.22	0.45	0.30	0.39

Table F-34 (1) Reservoir Operation Study for Existing Krenceng Dam (1/12)

Net supply yield: 1.94m3/sec
Water conveyance capacity: 2.00 m3/sec
of 27.2 km pipe line

(Unit : 10^6 m3)

Year	Month	Serial No. of 5 day period	Inflow discharge		Supply yeild	Evapo	Water conveyance from Cida	Krenceng Reservoir		Spillout
			Krenceng	Cidanau intake				Storage volume	Water level (El-m)	
1980	1	1	0.12	3.9	0.84	0.02	0.74	4.66	22.5	0
1980	1	2	0.2	3.98	0.84	0.02	0.66	4.66	22.5	0
1980	1	3	0.29	4.05	0.84	0.02	0.56	4.66	22.5	0
1980	1	4	0.29	3.92	0.84	0.02	0.56	4.66	22.5	0
1980	1	5	0.29	3.9	0.84	0.02	0.57	4.66	22.5	0
1980	1	6	0.39	3.56	1.01	0.02	0.63	4.66	22.5	0
1980	2	1	0.19	3.3	0.84	0.01	0.66	4.66	22.5	0
1980	2	2	0.48	5.06	0.84	0.01	0.37	4.66	22.5	0
1980	2	3	0.49	5.01	0.84	0.01	0.36	4.66	22.5	0
1980	2	4	0.78	5.06	0.84	0.01	0.07	4.66	22.5	0
1980	2	5	0.46	5.09	0.84	0.01	0.39	4.66	22.5	0
1980	2	6	0.19	5.06	0.67	0.01	0.5	4.66	22.5	0
1980	3	1	0.15	4.53	0.84	0.01	0.7	4.66	22.5	0
1980	3	2	0.23	3.44	0.84	0.01	0.62	4.66	22.5	0
1980	3	3	0.15	14.02	0.84	0.01	0.7	4.66	22.5	0
1980	3	4	0.16	9.57	0.84	0.01	0.69	4.66	22.5	0
1980	3	5	0.07	2.29	0.84	0.01	0.78	4.66	22.5	0
1980	3	6	0.11	1.74	1.01	0.01	0.91	4.66	22.5	0
1980	4	1	0.06	2.23	0.84	0.01	0.79	4.66	22.5	0
1980	4	2	0.07	1.77	0.84	0.01	0.78	4.66	22.5	0
1980	4	3	0.28	6.5	0.84	0.01	0.57	4.66	22.5	0
1980	4	4	0.1	4.84	0.84	0.01	0.75	4.66	22.5	0
1980	4	5	0.17	3.27	0.84	0.01	0.68	4.66	22.5	0
1980	4	6	0.11	1.99	0.84	0.01	0.74	4.66	22.5	0
1980	5	1	0.11	0.82	0.84	0.01	0.74	4.66	22.5	0
1980	5	2	0.09	0.18	0.84	0.01	0.18	4.08	21.87	0
1980	5	3	0.11	0.88	0.84	0.01	0.86	4.2	22.01	0
1980	5	4	0.11	1.91	0.84	0.01	0.86	4.32	22.14	0
1980	5	5	0.07	5.36	0.84	0.01	0.86	4.41	22.23	0
1980	5	6	0.06	4.99	1.01	0.01	1.04	4.49	22.32	0
1980	6	1	0.11	3.84	0.84	0.01	0.86	4.61	22.45	0
1980	6	2	0.06	4.39	0.84	0.01	0.84	4.66	22.5	0
1980	6	3	0.08	1.89	0.84	0.01	0.77	4.66	22.5	0
1980	6	4	0.05	3.17	0.84	0.01	0.8	4.66	22.5	0
1980	6	5	0.06	3.77	0.84	0.01	0.79	4.66	22.5	0
1980	6	6	0.05	2.37	0.84	0.01	0.8	4.66	22.5	0
1980	7	1	0.04	1.63	0.84	0.01	0.81	4.66	22.5	0
1980	7	2	0.04	2.82	0.84	0.01	0.81	4.66	22.5	0
1980	7	3	0.04	2.81	0.84	0.01	0.81	4.66	22.5	0
1980	7	4	0.05	4.75	0.84	0.01	0.8	4.66	22.5	0
1980	7	5	0.05	2.64	0.84	0.01	0.8	4.66	22.5	0
1980	7	6	0.06	2.74	1.01	0.01	0.96	4.66	22.5	0
1980	8	1	0.12	2.19	0.84	0.02	0.74	4.66	22.5	0
1980	8	2	0.19	4.48	0.84	0.02	0.67	4.66	22.5	0
1980	8	3	0.28	6.84	0.84	0.02	0.57	4.66	22.5	0
1980	8	4	0.38	12.84	0.84	0.02	0.48	4.66	22.5	0
1980	8	5	0.05	5.29	0.84	0.02	0.8	4.66	22.5	0
1980	8	6	0.05	2.12	1.01	0.02	0.98	4.66	22.5	0
1980	9	1	0.23	2.64	0.84	0.01	0.62	4.66	22.5	0
1980	9	2	0.2	27.03	0.84	0.01	0.66	4.66	22.5	0
1980	9	3	0.32	28.73	0.84	0.01	0.53	4.66	22.5	0
1980	9	4	0.11	12.39	0.84	0.01	0.74	4.66	22.5	0
1980	9	5	0.08	2.48	0.84	0.01	0.77	4.66	22.5	0
1980	9	6	0.14	1.63	0.84	0.01	0.71	4.66	22.5	0
1980	10	1	0.11	0.86	0.84	0.01	0.74	4.66	22.5	0
1980	10	2	0.12	0.63	0.84	0.01	0.63	4.56	22.39	0
1980	10	3	0.12	2.54	0.84	0.01	0.83	4.66	22.5	0
1980	10	4	0.08	6.13	0.84	0.01	0.77	4.66	22.5	0
1980	10	5	0.12	6.87	0.84	0.01	0.73	4.66	22.5	0
1980	10	6	0.11	9.88	1.01	0.02	0.91	4.66	22.5	0

Table F-34 (2) Reservoir Operation Study for Existing Krenceng Dam (2/12)

Net supply yield: 1.94m3/sec
Water conveyance capacity: 2.00 m3/sec of 27.2 km pipe line

(Unit : 10^6 m3)

Year	Month	Serial No. of 5 day period	Inflow discharge		Supply yeild	Evapo	Water conveyance from Cida	Krenceng Reservoir		Spillout
			Krenceng	Cidanau intake				Storage volume	Water level (El-m)	
1980	11	1	0.18	9.4	0.84	0.02	0.68	4.66	22.5	0
1980	11	2	0.1	11.06	0.84	0.02	0.75	4.66	22.5	0
1980	11	3	0.13	13.41	0.84	0.02	0.73	4.66	22.5	0
1980	11	4	0.31	15.5	0.84	0.02	0.54	4.66	22.5	0
1980	11	5	0.08	18.31	0.84	0.02	0.78	4.66	22.5	0
1980	11	6	0.06	21.43	0.84	0.02	0.79	4.66	22.5	0
1980	12	1	0.05	27.92	0.84	0.01	0.81	4.66	22.5	0
1980	12	2	0.07	31.72	0.84	0.01	0.79	4.66	22.5	0
1980	12	3	0.05	32.78	0.84	0.01	0.8	4.66	22.5	0
1980	12	4	0.18	42.23	0.84	0.01	0.68	4.66	22.5	0
1980	12	5	0.53	29.54	0.84	0.01	0.32	4.66	22.5	0
1980	12	6	0.64	47.28	1.01	0.02	0.39	4.66	22.5	0
1981	1	1	1.71	62.12	0.84	0.02	0	4.66	22.5	0.86
1981	1	2	1.18	72.41	0.84	0.02	0	4.66	22.5	0.32
1981	1	3	0.71	28.77	0.84	0.02	0.14	4.66	22.5	0
1981	1	4	0.42	30.33	0.84	0.02	0.44	4.66	22.5	0
1981	1	5	0.29	13.91	0.84	0.02	0.56	4.66	22.5	0
1981	1	6	0.49	17.12	1.01	0.02	0.53	4.66	22.5	0
1981	2	1	0.4	18.43	0.84	0.01	0.45	4.66	22.5	0
1981	2	2	0.35	21.51	0.84	0.01	0.5	4.66	22.5	0
1981	2	3	0.52	14.11	0.84	0.01	0.34	4.66	22.5	0
1981	2	4	0.51	10.57	0.84	0.01	0.34	4.66	22.5	0
1981	2	5	0.46	1.87	0.84	0.01	0.39	4.66	22.5	0
1981	2	6	0.75	11.16	0.5	0.01	0	4.66	22.5	0.24
1981	3	1	0.66	12.23	0.84	0.01	0.19	4.66	22.5	0
1981	3	2	0.33	1.75	0.84	0.01	0.52	4.66	22.5	0
1981	3	3	0.51	2.26	0.84	0.01	0.34	4.66	22.5	0
1981	3	4	0.32	3.68	0.84	0.01	0.53	4.66	22.5	0
1981	3	5	0.17	2.34	0.84	0.01	0.68	4.66	22.5	0
1981	3	6	0.31	11.79	1.01	0.01	0.71	4.66	22.5	0
1981	4	1	0.14	12.43	0.84	0.01	0.71	4.66	22.5	0
1981	4	2	0.16	12.3	0.84	0.01	0.69	4.66	22.5	0
1981	4	3	0.1	11.66	0.84	0.01	0.75	4.66	22.5	0
1981	4	4	0.13	10.14	0.84	0.01	0.72	4.66	22.5	0
1981	4	5	0.14	8.69	0.84	0.01	0.71	4.66	22.5	0
1981	4	6	0.11	7.79	0.84	0.01	0.74	4.66	22.5	0
1981	5	1	0.21	6.43	0.84	0.01	0.64	4.66	22.5	0
1981	5	2	0.16	4.42	0.84	0.01	0.69	4.66	22.5	0
1981	5	3	0.21	2.96	0.84	0.01	0.64	4.66	22.5	0
1981	5	4	0.29	4.35	0.84	0.01	0.56	4.66	22.5	0
1981	5	5	0.11	3.23	0.84	0.01	0.74	4.66	22.5	0
1981	5	6	0.1	1.1	1.01	0.01	0.92	4.66	22.5	0
1981	6	1	0.06	2.82	0.84	0.01	0.78	4.66	22.5	0
1981	6	2	0.06	3.69	0.84	0.01	0.79	4.66	22.5	0
1981	6	3	0.12	5.1	0.84	0.01	0.73	4.66	22.5	0
1981	6	4	0.2	9.5	0.84	0.01	0.65	4.66	22.5	0
1981	6	5	0.09	4.31	0.84	0.01	0.76	4.66	22.5	0
1981	6	6	0.12	4.23	0.84	0.01	0.73	4.66	22.5	0
1981	7	1	0.06	4.31	0.84	0.01	0.79	4.66	22.5	0
1981	7	2	0.06	1.27	0.84	0.01	0.79	4.66	22.5	0
1981	7	3	0.21	2.78	0.84	0.01	0.64	4.66	22.5	0
1981	7	4	0.32	5.56	0.84	0.01	0.53	4.66	22.5	0
1981	7	5	0.36	7.35	0.84	0.01	0.49	4.66	22.5	0
1981	7	6	0.67	11.43	1.01	0.01	0.35	4.66	22.5	0
1981	8	1	0.16	8.03	0.84	0.02	0.69	4.66	22.5	0
1981	8	2	0.17	3.09	0.84	0.02	0.68	4.66	22.5	0
1981	8	3	0.11	2.22	0.84	0.02	0.75	4.66	22.5	0
1981	8	4	0.15	1.58	0.84	0.02	0.71	4.66	22.5	0
1981	8	5	0.15	3.77	0.84	0.02	0.71	4.66	22.5	0
1981	8	6	0.12	5.33	1.01	0.02	0.91	4.66	22.5	0

Table F-34 (3) Reservoir Operation Study for Existing Krenceng Dam (3/12)

Net supply yield: 1.94m3/sec
Water conveyance capacity: 2.00 m3/sec
of 27.2 km pipe line

(Unit : 10^6 m3)

Year	Month	Serial No. of 5 day period	Inflow discharge		Supply yeild	Evapo	Water conveyance from Cida	Krenceng	Reservoir	Spillout
			Krenceng	Cidanau intake				Storage volume	Water level (El-m)	
1981	9	1	0.18	2.18	0.84	0.01	0.67	4.66	22.5	0
1981	9	2	0.17	6.52	0.84	0.01	0.68	4.66	22.5	0
1981	9	3	0.47	7.08	0.84	0.01	0.38	4.66	22.5	0
1981	9	4	0.11	1.64	0.84	0.01	0.74	4.66	22.5	0
1981	9	5	0.1	1.14	0.84	0.01	0.75	4.66	22.5	0
1981	9	6	0.16	9.85	0.84	0.01	0.7	4.66	22.5	0
1981	10	1	0.33	41.85	0.84	0.01	0.52	4.66	22.5	0
1981	10	2	0.33	14.32	0.84	0.01	0.52	4.66	22.5	0
1981	10	3	0.25	4.95	0.84	0.01	0.6	4.66	22.5	0
1981	10	4	0.11	3.53	0.84	0.01	0.75	4.66	22.5	0
1981	10	5	0.12	1.83	0.84	0.01	0.73	4.66	22.5	0
1981	10	6	0.22	10.88	1.01	0.02	0.8	4.66	22.5	0
1981	11	1	0.14	4.61	0.84	0.02	0.72	4.66	22.5	0
1981	11	2	0.28	4.04	0.84	0.02	0.58	4.66	22.5	0
1981	11	3	0.42	24.28	0.84	0.02	0.44	4.66	22.5	0
1981	11	4	0.98	68.23	0.84	0.02	0	4.66	22.5	0.13
1981	11	5	0.17	25.93	0.84	0.02	0.68	4.66	22.5	0
1981	11	6	0.46	9.35	0.84	0.02	0.39	4.66	22.5	0
1981	12	1	0.31	12.78	0.84	0.01	0.55	4.66	22.5	0
1981	12	2	0.2	11.62	0.84	0.01	0.66	4.66	22.5	0
1981	12	3	0.17	8.62	0.84	0.01	0.69	4.66	22.5	0
1981	12	4	0.17	8.44	0.84	0.01	0.69	4.66	22.5	0
1981	12	5	0.34	5.79	0.84	0.01	0.52	4.66	22.5	0
1981	12	6	0.77	37.81	1.01	0.02	0.25	4.66	22.5	0
1982	1	1	0.39	21.37	0.84	0.02	0.47	4.66	22.5	0
1982	1	2	0.89	11.65	0.84	0.02	0	4.66	22.5	0.04
1982	1	3	1.4	4.37	0.84	0.02	0	4.66	22.5	0.55
1982	1	4	0.9	18.14	0.84	0.02	0	4.66	22.5	0.05
1982	1	5	0.64	15.83	0.84	0.02	0.21	4.66	22.5	0
1982	1	6	0.55	3.66	1.01	0.02	0.47	4.66	22.5	0
1982	2	1	0.48	2.77	0.84	0.01	0.37	4.66	22.5	0
1982	2	2	0.22	1.14	0.84	0.01	0.63	4.66	22.5	0
1982	2	3	0.29	1.73	0.84	0.01	0.56	4.66	22.5	0
1982	2	4	0.22	1.57	0.84	0.01	0.63	4.66	22.5	0
1982	2	5	0.18	3.33	0.84	0.01	0.67	4.66	22.5	0
1982	2	6	0.13	2.83	0.5	0.01	0.38	4.66	22.5	0
1982	3	1	0.29	9.13	0.84	0.01	0.56	4.66	22.5	0
1982	3	2	0.37	31.73	0.84	0.01	0.48	4.66	22.5	0
1982	3	3	0.61	12.63	0.84	0.01	0.24	4.66	22.5	0
1982	3	4	0.59	16.98	0.84	0.01	0.26	4.66	22.5	0
1982	3	5	0.44	24.54	0.84	0.01	0.41	4.66	22.5	0
1982	3	6	0.42	8.13	1.01	0.01	0.6	4.66	22.5	0
1982	4	1	0.27	10.43	0.84	0.01	0.58	4.66	22.5	0
1982	4	2	0.23	10.64	0.84	0.01	0.62	4.66	22.5	0
1982	4	3	0.21	7.22	0.84	0.01	0.64	4.66	22.5	0
1982	4	4	0.34	17.29	0.84	0.01	0.51	4.66	22.5	0
1982	4	5	0.23	5.42	0.84	0.01	0.62	4.66	22.5	0
1982	4	6	0.33	7.44	0.84	0.01	0.52	4.66	22.5	0
1982	5	1	0.24	5.44	0.84	0.01	0.61	4.66	22.5	0
1982	5	2	0.21	3.58	0.84	0.01	0.64	4.66	22.5	0
1982	5	3	0.16	3.36	0.84	0.01	0.69	4.66	22.5	0
1982	5	4	0.11	1.94	0.84	0.01	0.74	4.66	22.5	0
1982	5	5	0.11	1.7	0.84	0.01	0.74	4.66	22.5	0
1982	5	6	0.17	2.31	1.01	0.01	0.86	4.66	22.5	0
1982	6	1	0.25	2.43	0.84	0.01	0.6	4.66	22.5	0
1982	6	2	0.18	3.79	0.84	0.01	0.67	4.66	22.5	0
1982	6	3	0.13	2.56	0.84	0.01	0.72	4.66	22.5	0
1982	6	4	0.11	2.54	0.84	0.01	0.74	4.66	22.5	0
1982	6	5	0.07	1.89	0.84	0.01	0.78	4.66	22.5	0
1982	6	6	0.11	1.29	0.84	0.01	0.74	4.66	22.5	0

Table F-34 (4) Reservoir Operation Study for Existing Krenceng Dam (4/12)

Net supply yield: 1.94m3/sec
Water conveyance capacity: 2.00 m3/sec of 27.2 km pipe line

(Unit : 10^6 m3)

Year	Month	Serial No. of 5 day period	Inflow discharge		Supply yeild	Evapo	Water conveyance from Cida	Krenceng	Reservoir	Spillout
			Krenceng	Cidanau intake				Storage volume	Water level (El-m)	
1982	7	1	0.08	1.41	0.84	0.01	0.77	4.66	22.5	0
1982	7	2	0.07	1.28	0.84	0.01	0.79	4.66	22.5	0
1982	7	3	0.07	1.24	0.84	0.01	0.79	4.66	22.5	0
1982	7	4	0.17	1.79	0.84	0.01	0.68	4.66	22.5	0
1982	7	5	0.17	2.21	0.84	0.01	0.68	4.66	22.5	0
1982	7	6	0.2	4.78	1.01	0.01	0.82	4.66	22.5	0
1982	8	1	0.11	1.68	0.84	0.02	0.75	4.66	22.5	0
1982	8	2	0.08	1.28	0.84	0.02	0.77	4.66	22.5	0
1982	8	3	0.04	0.81	0.84	0.02	0.81	4.65	22.5	0
1982	8	4	0.03	0.69	0.84	0.02	0.69	4.52	22.35	0
1982	8	5	0.02	0.57	0.84	0.02	0.57	4.26	22.06	0
1982	8	6	0.02	0.54	1.01	0.02	0.54	3.79	21.55	0
1982	9	1	0.05	0.84	0.84	0.01	0.84	3.83	21.59	0
1982	9	2	0.05	0.57	0.84	0.01	0.57	3.6	21.34	0
1982	9	3	0.04	0.53	0.84	0.01	0.53	3.32	21.04	0
1982	9	4	0.04	0.45	0.84	0.01	0.45	2.96	20.65	0
1982	9	5	0.04	0.96	0.84	0.01	0.86	3.02	20.71	0
1982	9	6	0.05	1.07	0.84	0.01	0.86	3.08	20.78	0
1982	10	1	0.06	1.26	0.84	0.01	0.86	3.16	20.86	0
1982	10	2	0.04	0.56	0.84	0.01	0.56	2.91	20.59	0
1982	10	3	0.04	0.36	0.84	0.01	0.36	2.47	19.98	0
1982	10	4	0.1	0.96	0.84	0.01	0.86	2.58	20.15	0
1982	10	5	0.05	0.94	0.84	0.01	0.86	2.65	20.24	0
1982	10	6	0.05	0.63	1.01	0.01	0.63	2.31	19.75	0
1982	11	1	0.04	0.49	0.84	0.01	0.49	1.99	19.29	0
1982	11	2	0.06	5.34	0.84	0.01	0.86	2.07	19.4	0
1982	11	3	0.06	1.72	0.84	0.01	0.86	2.15	19.52	0
1982	11	4	0.06	0.78	0.84	0.01	0.78	2.13	19.5	0
1982	11	5	0.06	2.65	0.84	0.01	0.86	2.21	19.61	0
1982	11	6	0.06	2.54	0.84	0.01	0.86	2.28	19.71	0
1982	12	1	0.04	1.36	0.84	0.01	0.86	2.34	19.79	0
1982	12	2	0.04	0.42	0.84	0.01	0.42	1.95	19.24	0
1982	12	3	0.04	2.22	0.84	0.01	0.86	2.01	19.32	0
1982	12	4	0.04	2.79	0.84	0.01	0.86	2.07	19.41	0
1982	12	5	0.05	2.93	0.84	0.01	0.86	2.13	19.5	0
1982	12	6	0.13	8.58	1.01	0.01	1.04	2.28	19.71	0
1983	1	1	0.19	6.77	0.84	0.01	0.86	2.48	20	0
1983	1	2	0.11	6.98	0.84	0.01	0.86	2.6	20.18	0
1983	1	3	0.08	6.17	0.84	0.01	0.86	2.7	20.31	0
1983	1	4	0.12	11.05	0.84	0.01	0.86	2.83	20.5	0
1983	1	5	0.32	20.04	0.84	0.01	0.86	3.17	20.87	0
1983	1	6	0.06	13.66	1.01	0.02	1.04	3.24	20.95	0
1983	2	1	0.22	7.9	0.84	0.01	0.86	3.47	21.2	0
1983	2	2	0.22	9.4	0.84	0.01	0.86	3.71	21.46	0
1983	2	3	0.06	2.59	0.84	0.01	0.86	3.78	21.54	0
1983	2	4	0.14	2.82	0.84	0.01	0.86	3.93	21.7	0
1983	2	5	0.08	3.12	0.84	0.01	0.86	4.02	21.81	0
1983	2	6	0.26	2.49	0.5	0.01	0.52	4.3	22.11	0
1983	3	1	0.43	5.41	0.84	0.01	0.78	4.66	22.5	0
1983	3	2	0.19	2.72	0.84	0.01	0.66	4.66	22.5	0
1983	3	3	0.16	2.32	0.84	0.01	0.69	4.66	22.5	0
1983	3	4	0.06	1.99	0.84	0.01	0.79	4.66	22.5	0
1983	3	5	0.07	1.97	0.84	0.01	0.78	4.66	22.5	0
1983	3	6	0.31	3.53	1.01	0.01	0.71	4.66	22.5	0
1983	4	1	0.19	4.93	0.84	0.01	0.67	4.66	22.5	0
1983	4	2	0.3	4.37	0.84	0.01	0.55	4.66	22.5	0
1983	4	3	0.06	3.8	0.84	0.01	0.79	4.66	22.5	0
1983	4	4	0.14	4.52	0.84	0.01	0.72	4.66	22.5	0
1983	4	5	0.59	3.83	0.84	0.01	0.26	4.66	22.5	0
1983	4	6	0.45	4.72	0.84	0.01	0.4	4.66	22.5	0

Table F-34 (5) Reservoir Operation Study for Existing Krenceng Dam (5/12)

Net supply yield: 1.94m3/sec
Water conveyance capacity: 2.00 m3/sec
of 27.2 km pipe line

(Unit : 10^6 m3)

Year	Month	Serial No. of 5 day period	Inflow discharge		Supply yeild	Evapo	Water conveyance from Cida	Krenceng	Reservoir	Spillout
			Krenceng	Cidanau intake				Storage volume	Water level (El-m)	
1983	5	1	0.25	2.07	0.84	0.01	0.6	4.66	22.5	0
1983	5	2	0.46	2.03	0.84	0.01	0.39	4.66	22.5	0
1983	5	3	0.28	6.1	0.84	0.01	0.57	4.66	22.5	0
1983	5	4	0.28	3.08	0.84	0.01	0.57	4.66	22.5	0
1983	5	5	0.18	4.03	0.84	0.01	0.67	4.66	22.5	0
1983	5	6	0.27	3.11	1.01	0.01	0.75	4.66	22.5	0
1983	6	1	0.15	4.03	0.84	0.01	0.7	4.66	22.5	0
1983	6	2	0.97	3.43	0.84	0.01	0	4.66	22.5	0.12
1983	6	3	0.36	2.69	0.84	0.01	0.49	4.66	22.5	0
1983	6	4	0.21	3.92	0.84	0.01	0.63	4.66	22.5	0
1983	6	5	0.12	4.85	0.84	0.01	0.73	4.66	22.5	0
1983	6	6	0.27	5.14	0.84	0.01	0.58	4.66	22.5	0
1983	7	1	0.15	7.96	0.84	0.01	0.7	4.66	22.5	0
1983	7	2	0.02	4.92	0.84	0.01	0.83	4.66	22.5	0
1983	7	3	0.02	2.54	0.84	0.01	0.83	4.66	22.5	0
1983	7	4	0.05	3.36	0.84	0.01	0.8	4.66	22.5	0
1983	7	5	0.05	2.46	0.84	0.01	0.81	4.66	22.5	0
1983	7	6	0.06	3.37	1.01	0.01	0.96	4.66	22.5	0
1983	8	1	0.02	1.43	0.84	0.02	0.83	4.66	22.5	0
1983	8	2	0.02	0.68	0.84	0.02	0.68	4.5	22.33	0
1983	8	3	0.01	1.2	0.84	0.02	0.86	4.52	22.35	0
1983	8	4	0.01	1.48	0.84	0.02	0.86	4.54	22.38	0
1983	8	5	0.03	3.93	0.84	0.02	0.86	4.58	22.42	0
1983	8	6	0.01	1.06	1.01	0.02	1.04	4.6	22.44	0
1983	9	1	0	0.49	0.84	0.01	0.49	4.25	22.06	0
1983	9	2	0.01	0.76	0.84	0.01	0.76	4.16	21.96	0
1983	9	3	0.01	0.85	0.84	0.01	0.85	4.17	21.97	0
1983	9	4	0.01	0.7	0.84	0.01	0.7	4.03	21.82	0
1983	9	5	0.01	0.7	0.84	0.01	0.7	3.89	21.66	0
1983	9	6	0.01	0.54	0.84	0.01	0.54	3.59	21.33	0
1983	10	1	0	0.38	0.84	0.01	0.38	3.11	20.81	0
1983	10	2	0	0.29	0.84	0.01	0.29	2.55	20.11	0
1983	10	3	0	0.33	0.84	0.01	0.33	2.03	19.35	0
1983	10	4	0	0.37	0.84	0.01	0.37	1.56	18.58	0
1983	10	5	0.04	2.51	0.84	0.01	0.86	1.61	18.68	0
1983	10	6	0.05	6.55	1.01	0.01	1.04	1.68	18.81	0
1983	11	1	0.04	7.08	0.84	0.01	0.86	1.74	18.91	0
1983	11	2	0.08	5.71	0.84	0.01	0.86	1.83	19.06	0
1983	11	3	0.01	7.36	0.84	0.01	0.86	1.86	19.1	0
1983	11	4	0.47	39.04	0.84	0.01	0.86	2.34	19.8	0
1983	11	5	1.37	0.64	0.84	0.01	0.64	3.5	21.24	0
1983	11	6	3.91	21.87	0.84	0.01	0	4.66	22.5	1.91
1983	12	1	0.37	19.35	0.84	0.01	0.48	4.66	22.5	0
1983	12	2	0.36	10.29	0.84	0.01	0.5	4.66	22.5	0
1983	12	3	0.12	4.38	0.84	0.01	0.74	4.66	22.5	0
1983	12	4	0.08	4.43	0.84	0.01	0.77	4.66	22.5	0
1983	12	5	0.06	3.73	0.84	0.01	0.8	4.66	22.5	0
1983	12	6	0.08	7.05	1.01	0.02	0.95	4.66	22.5	0
1984	1	1	0.12	5.67	0.84	0.02	0.73	4.66	22.5	0
1984	1	2	0.23	1.38	0.84	0.02	0.62	4.66	22.5	0
1984	1	3	0.08	6.24	0.84	0.02	0.77	4.66	22.5	0
1984	1	4	0.13	6.94	0.84	0.02	0.72	4.66	22.5	0
1984	1	5	0.9	7.06	0.84	0.02	0	4.66	22.5	0.04
1984	1	6	1.69	9.84	1.01	0.02	0	4.66	22.5	0.66
1984	2	1	0.46	7.43	0.84	0.01	0.39	4.66	22.5	0
1984	2	2	0.34	12.52	0.84	0.01	0.51	4.66	22.5	0
1984	2	3	0.4	5.64	0.84	0.01	0.45	4.66	22.5	0
1984	2	4	0.8	4.15	0.84	0.01	0.06	4.66	22.5	0
1984	2	5	0.72	2.87	0.84	0.01	0.13	4.66	22.5	0
1984	2	6	0.46	6.03	0.67	0.01	0.22	4.66	22.5	0

Table F-34 (6) Reservoir Operation Study for Existing Krenceng Dam (6/12)

Net supply yield: 1.94m3/sec
Water conveyance capacity: 2.00 m3/sec of 27.2 km pipe line

(Unit : 10^6 m3)

Year	Month	Serial No. of 5 day period	Inflow discharge		Supply yeild	Evapo	Water conveyance from Cida	Krenceng Reservoir		Spillout
			Krenceng	Cidanau intake				Storage volume	Water level (El-m)	
1984	3	1	0.38	5.87	0.84	0.01	0.48	4.66	22.5	0
1984	3	2	1.01	10.68	0.84	0.01	0	4.66	22.5	0.16
1984	3	3	1.41	12.95	0.84	0.01	0	4.66	22.5	0.56
1984	3	4	0.92	10.75	0.84	0.01	0	4.66	22.5	0.07
1984	3	5	1.78	19.09	0.84	0.01	0	4.66	22.5	0.93
1984	3	6	2.02	26.41	1.01	0.01	0	4.66	22.5	1
1984	4	1	0.18	11.88	0.84	0.01	0.67	4.66	22.5	0
1984	4	2	0.24	2.86	0.84	0.01	0.61	4.66	22.5	0
1984	4	3	0.16	3.83	0.84	0.01	0.69	4.66	22.5	0
1984	4	4	0.24	3.37	0.84	0.01	0.61	4.66	22.5	0
1984	4	5	0.18	4.38	0.84	0.01	0.67	4.66	22.5	0
1984	4	6	0.46	6.49	0.84	0.01	0.39	4.66	22.5	0
1984	5	1	0.5	5.85	0.84	0.01	0.35	4.66	22.5	0
1984	5	2	0.42	10.68	0.84	0.01	0.43	4.66	22.5	0
1984	5	3	0.22	15.63	0.84	0.01	0.63	4.66	22.5	0
1984	5	4	0.15	5.8	0.84	0.01	0.7	4.66	22.5	0
1984	5	5	0.24	3.97	0.84	0.01	0.61	4.66	22.5	0
1984	5	6	0.22	12.63	1.01	0.01	0.8	4.66	22.5	0
1984	6	1	0.2	6.23	0.84	0.01	0.65	4.66	22.5	0
1984	6	2	0.17	3.47	0.84	0.01	0.68	4.66	22.5	0
1984	6	3	0.21	3.13	0.84	0.01	0.64	4.66	22.5	0
1984	6	4	0.21	2.61	0.84	0.01	0.64	4.66	22.5	0
1984	6	5	0.14	3.12	0.84	0.01	0.71	4.66	22.5	0
1984	6	6	0.1	1.39	0.84	0.01	0.75	4.66	22.5	0
1984	7	1	0.24	2.29	0.84	0.01	0.61	4.66	22.5	0
1984	7	2	0.17	4.9	0.84	0.01	0.68	4.66	22.5	0
1984	7	3	0.09	3.29	0.84	0.01	0.76	4.66	22.5	0
1984	7	4	0.08	2.15	0.84	0.01	0.77	4.66	22.5	0
1984	7	5	0.16	2.76	0.84	0.01	0.69	4.66	22.5	0
1984	7	6	0.18	3.74	1.01	0.01	0.85	4.66	22.5	0
1984	8	1	0.09	2.5	0.84	0.02	0.77	4.66	22.5	0
1984	8	2	0.07	1.93	0.84	0.02	0.79	4.66	22.5	0
1984	8	3	0.15	1.48	0.84	0.02	0.7	4.66	22.5	0
1984	8	4	0.09	1.51	0.84	0.02	0.76	4.66	22.5	0
1984	8	5	0.08	1.4	0.84	0.02	0.77	4.66	22.5	0
1984	8	6	0.19	2.17	1.01	0.02	0.84	4.66	22.5	0
1984	9	1	0.11	1.67	0.84	0.01	0.74	4.66	22.5	0
1984	9	2	0.39	4.99	0.84	0.01	0.46	4.66	22.5	0
1984	9	3	0.4	6.26	0.84	0.01	0.45	4.66	22.5	0
1984	9	4	0.27	5.04	0.84	0.01	0.58	4.66	22.5	0
1984	9	5	0.18	4.38	0.84	0.01	0.67	4.66	22.5	0
1984	9	6	0.42	3.48	0.84	0.01	0.43	4.66	22.5	0
1984	10	1	0.48	10.4	0.84	0.01	0.38	4.66	22.5	0
1984	10	2	0.13	4.41	0.84	0.01	0.72	4.66	22.5	0
1984	10	3	0.22	2.02	0.84	0.01	0.63	4.66	22.5	0
1984	10	4	0.18	2.39	0.84	0.01	0.67	4.66	22.5	0
1984	10	5	0.22	2.31	0.84	0.01	0.64	4.66	22.5	0
1984	10	6	0.13	3.38	1.01	0.02	0.89	4.66	22.5	0
1984	11	1	0.15	1.61	0.84	0.02	0.71	4.66	22.5	0
1984	11	2	0.08	2.76	0.84	0.02	0.77	4.66	22.5	0
1984	11	3	0.08	4.87	0.84	0.02	0.77	4.66	22.5	0
1984	11	4	0.19	4.94	0.84	0.02	0.67	4.66	22.5	0
1984	11	5	0.14	3.57	0.84	0.02	0.71	4.66	22.5	0
1984	11	6	0.08	3.76	0.84	0.02	0.78	4.66	22.5	0
1984	12	1	0.1	19.97	0.84	0.01	0.75	4.66	22.5	0
1984	12	2	0.09	19.21	0.84	0.01	0.77	4.66	22.5	0
1984	12	3	0.15	7.94	0.84	0.01	0.71	4.66	22.5	0
1984	12	4	0.12	7.01	0.84	0.01	0.74	4.66	22.5	0
1984	12	5	0.1	3.33	0.84	0.01	0.75	4.66	22.5	0
1984	12	6	0.39	17.34	1.01	0.02	0.64	4.66	22.5	0

Table F-34 (7) Reservoir Operation Study for Existing Krenceng Dam (7/12)

Net supply yield: 1.94m3/sec
Water conveyance capacity: 2.00 m3/sec
of 27.2 km pipe line

(Unit : 10^6 m3)

Year	Month	Serial No. of 5 day period	Inflow discharge		Supply yeild	Evapo	Water conveyance from Cida	Krenceng	Reservoir	Spillout
			Krenceng	Cidanau intake				Storage volume	Water level (El-m)	
1985	1	1	0.11	9.49	0.84	0.02	0.74	4.66	22.5	0
1985	1	2	0.41	8.38	0.84	0.02	0.45	4.66	22.5	0
1985	1	3	0.11	16.18	0.84	0.02	0.74	4.66	22.5	0
1985	1	4	0.09	5.53	0.84	0.02	0.77	4.66	22.5	0
1985	1	5	0.12	3.77	0.84	0.02	0.73	4.66	22.5	0
1985	1	6	0.23	6.98	1.01	0.02	0.79	4.66	22.5	0
1985	2	1	0.1	5.16	0.84	0.01	0.75	4.66	22.5	0
1985	2	2	0.09	5.12	0.84	0.01	0.77	4.66	22.5	0
1985	2	3	0.07	6.31	0.84	0.01	0.78	4.66	22.5	0
1985	2	4	0.05	3.27	0.84	0.01	0.8	4.66	22.5	0
1985	2	5	0.18	5.68	0.84	0.01	0.67	4.66	22.5	0
1985	2	6	0.03	3.67	0.5	0.01	0.48	4.66	22.5	0
1985	3	1	0.17	5.65	0.84	0.01	0.68	4.66	22.5	0
1985	3	2	0.38	18.22	0.84	0.01	0.47	4.66	22.5	0
1985	3	3	0.14	14.18	0.84	0.01	0.71	4.66	22.5	0
1985	3	4	0.15	4.8	0.84	0.01	0.7	4.66	22.5	0
1985	3	5	0.08	2.99	0.84	0.01	0.77	4.66	22.5	0
1985	3	6	0.15	2.65	1.01	0.01	0.87	4.66	22.5	0
1985	4	1	0.11	1.83	0.84	0.01	0.74	4.66	22.5	0
1985	4	2	0.15	2.37	0.84	0.01	0.7	4.66	22.5	0
1985	4	3	0.25	4.57	0.84	0.01	0.6	4.66	22.5	0
1985	4	4	0.57	9.42	0.84	0.01	0.28	4.66	22.5	0
1985	4	5	0.18	6.9	0.84	0.01	0.67	4.66	22.5	0
1985	4	6	0.18	7.61	0.84	0.01	0.67	4.66	22.5	0
1985	5	1	0.1	6.54	0.84	0.01	0.75	4.66	22.5	0
1985	5	2	0.08	5.09	0.84	0.01	0.77	4.66	22.5	0
1985	5	3	0.09	4.03	0.84	0.01	0.76	4.66	22.5	0
1985	5	4	0.06	3.38	0.84	0.01	0.79	4.66	22.5	0
1985	5	5	0.05	3.62	0.84	0.01	0.8	4.66	22.5	0
1985	5	6	0.09	3.49	1.01	0.01	0.93	4.66	22.5	0
1985	6	1	0.06	2.26	0.84	0.01	0.79	4.66	22.5	0
1985	6	2	0.08	2.06	0.84	0.01	0.77	4.66	22.5	0
1985	6	3	0.05	2.49	0.84	0.01	0.8	4.66	22.5	0
1985	6	4	0.06	3.07	0.84	0.01	0.79	4.66	22.5	0
1985	6	5	0.21	3.17	0.84	0.01	0.64	4.66	22.5	0
1985	6	6	0.06	2.9	0.84	0.01	0.79	4.66	22.5	0
1985	7	1	0.07	2.05	0.84	0.01	0.78	4.66	22.5	0
1985	7	2	0.14	2.08	0.84	0.01	0.71	4.66	22.5	0
1985	7	3	0.17	2.3	0.84	0.01	0.68	4.66	22.5	0
1985	7	4	0.17	2.46	0.84	0.01	0.68	4.66	22.5	0
1985	7	5	0.27	5.96	0.84	0.01	0.58	4.66	22.5	0
1985	7	6	0.11	7.88	1.01	0.01	0.91	4.66	22.5	0
1985	8	1	0.25	5.37	0.84	0.02	0.6	4.66	22.5	0
1985	8	2	0.09	5.21	0.84	0.02	0.76	4.66	22.5	0
1985	8	3	0.06	3.17	0.84	0.02	0.79	4.66	22.5	0
1985	8	4	0.06	2.71	0.84	0.02	0.79	4.66	22.5	0
1985	8	5	0.05	2.06	0.84	0.02	0.8	4.66	22.5	0
1985	8	6	0.07	1.82	1.01	0.02	0.96	4.66	22.5	0
1985	9	1	0.04	1.18	0.84	0.01	0.81	4.66	22.5	0
1985	9	2	0.08	1.2	0.84	0.01	0.77	4.66	22.5	0
1985	9	3	0.06	4.41	0.84	0.01	0.8	4.66	22.5	0
1985	9	4	0.05	3.4	0.84	0.01	0.81	4.66	22.5	0
1985	9	5	0.04	2.39	0.84	0.01	0.81	4.66	22.5	0
1985	9	6	0.1	2.22	0.84	0.01	0.76	4.66	22.5	0
1985	10	1	0.12	1.75	0.84	0.01	0.74	4.66	22.5	0
1985	10	2	0.1	2.66	0.84	0.01	0.75	4.66	22.5	0
1985	10	3	0.07	5.63	0.84	0.01	0.78	4.66	22.5	0
1985	10	4	0.34	7.23	0.84	0.01	0.51	4.66	22.5	0
1985	10	5	0.07	9.42	0.84	0.01	0.78	4.66	22.5	0
1985	10	6	0.08	5.41	1.01	0.02	0.94	4.66	22.5	0

Table F-34 (8) Reservoir Operation Study for Existing Krenceng Dam (8/12)

Net supply yield: 1.94m3/sec
Water conveyance capacity: 2.00 m3/sec
of 27.2 km pipe line

(Unit : 10^6 m3)

Year	Month	Serial No. of 5 day period	Inflow discharge		Supply yeild	Evapo	Water conveyance from Cida	Krenceng	Reservoir	Spillout
			Krenceng	Cidanau intake				Storage volume	Water level (El-m)	
1985	11	1	0.08	4.09	0.84	0.02	0.77	4.66	22.5	0
1985	11	2	0.15	3.88	0.84	0.02	0.71	4.66	22.5	0
1985	11	3	0.06	4.31	0.84	0.02	0.8	4.66	22.5	0
1985	11	4	0.04	3	0.84	0.02	0.81	4.66	22.5	0
1985	11	5	0.06	3.71	0.84	0.02	0.79	4.66	22.5	0
1985	11	6	0.1	6.58	0.84	0.02	0.75	4.66	22.5	0
1985	12	1	0.3	14.57	0.84	0.01	0.55	4.66	22.5	0
1985	12	2	0.12	12.34	0.84	0.01	0.73	4.66	22.5	0
1985	12	3	0.05	4.18	0.84	0.01	0.8	4.66	22.5	0
1985	12	4	0.08	1.9	0.84	0.01	0.78	4.66	22.5	0
1985	12	5	0.12	1.76	0.84	0.01	0.73	4.66	22.5	0
1985	12	6	0.11	2.2	1.01	0.02	0.91	4.66	22.5	0
1986	1	1	0.08	6.53	0.84	0.02	0.78	4.66	22.5	0
1986	1	2	0.84	20.99	0.84	0.02	0.02	4.66	22.5	0
1986	1	3	0.29	22.16	0.84	0.02	0.56	4.66	22.5	0
1986	1	4	0.43	11.32	0.84	0.02	0.43	4.66	22.5	0
1986	1	5	1.2	23.29	0.84	0.02	0	4.66	22.5	0.34
1986	1	6	0.91	26.46	1.01	0.02	0.11	4.66	22.5	0
1986	2	1	0.34	12.29	0.84	0.01	0.51	4.66	22.5	0
1986	2	2	0.27	7.98	0.84	0.01	0.58	4.66	22.5	0
1986	2	3	0.48	10.55	0.84	0.01	0.37	4.66	22.5	0
1986	2	4	0.17	9.01	0.84	0.01	0.68	4.66	22.5	0
1986	2	5	0.23	7.44	0.84	0.01	0.62	4.66	22.5	0
1986	2	6	0.15	3.56	0.5	0.01	0.36	4.66	22.5	0
1986	3	1	0.26	5.17	0.84	0.01	0.59	4.66	22.5	0
1986	3	2	0.16	4.34	0.84	0.01	0.69	4.66	22.5	0
1986	3	3	0.24	3.49	0.84	0.01	0.61	4.66	22.5	0
1986	3	4	0.19	2.95	0.84	0.01	0.66	4.66	22.5	0
1986	3	5	0.18	12.63	0.84	0.01	0.67	4.66	22.5	0
1986	3	6	0.15	27.87	1.01	0.01	0.87	4.66	22.5	0
1986	4	1	0.3	10.56	0.84	0.01	0.56	4.66	22.5	0
1986	4	2	0.21	10.38	0.84	0.01	0.64	4.66	22.5	0
1986	4	3	0.28	8.2	0.84	0.01	0.57	4.66	22.5	0
1986	4	4	0.17	7.77	0.84	0.01	0.68	4.66	22.5	0
1986	4	5	0.13	4.78	0.84	0.01	0.72	4.66	22.5	0
1986	4	6	0.21	3.75	0.84	0.01	0.64	4.66	22.5	0
1986	5	1	0.1	5.48	0.84	0.01	0.75	4.66	22.5	0
1986	5	2	0.15	4.23	0.84	0.01	0.7	4.66	22.5	0
1986	5	3	0.17	4.24	0.84	0.01	0.68	4.66	22.5	0
1986	5	4	0.08	4.06	0.84	0.01	0.77	4.66	22.5	0
1986	5	5	0.11	2.58	0.84	0.01	0.74	4.66	22.5	0
1986	5	6	0.1	2.74	1.01	0.01	0.92	4.66	22.5	0
1986	6	1	0.06	2.56	0.84	0.01	0.79	4.66	22.5	0
1986	6	2	0.11	2.39	0.84	0.01	0.74	4.66	22.5	0
1986	6	3	0.22	2.19	0.84	0.01	0.63	4.66	22.5	0
1986	6	4	0.09	2.23	0.84	0.01	0.76	4.66	22.5	0
1986	6	5	0.05	2.56	0.84	0.01	0.8	4.66	22.5	0
1986	6	6	0.06	1.58	0.84	0.01	0.79	4.66	22.5	0
1986	7	1	0.1	1.21	0.84	0.01	0.76	4.66	22.5	0
1986	7	2	0.09	1.38	0.84	0.01	0.76	4.66	22.5	0
1986	7	3	0.3	2.01	0.84	0.01	0.55	4.66	22.5	0
1986	7	4	0.15	1.39	0.84	0.01	0.7	4.66	22.5	0
1986	7	5	0.08	1.08	0.84	0.01	0.77	4.66	22.5	0
1986	7	6	0.14	2.56	1.01	0.01	0.88	4.66	22.5	0
1986	8	1	0.05	2.62	0.84	0.02	0.81	4.66	22.5	0
1986	8	2	0.05	3.14	0.84	0.02	0.8	4.66	22.5	0
1986	8	3	0.15	3.71	0.84	0.02	0.7	4.66	22.5	0
1986	8	4	0.07	2.44	0.84	0.02	0.79	4.66	22.5	0
1986	8	5	0.05	1.25	0.84	0.02	0.81	4.66	22.5	0
1986	8	6	0.08	1.2	1.01	0.02	0.94	4.66	22.5	0

Table F-34 (9) Reservoir Operation Study for Existing Krenceng Dam (9/12)

Net supply yield: 1.94m3/sec
Water conveyance capacity: 2.00 m3/sec of 27.2 km pipe line

(Unit : 10^6 m3)

Year	Month	Serial No. of 5 day period	Inflow discharge		Supply yeild	Evapo	Water conveyance from Cida	Krenceng	Reservoir	Spillout
			Krenceng	Cidanau intake				Storage volume	Water level (El-m)	
1986	9	1	0.06	0.81	0.84	0.01	0.79	4.66	22.5	0
1986	9	2	0.14	1.34	0.84	0.01	0.71	4.66	22.5	0
1986	9	3	0.14	2.58	0.84	0.01	0.71	4.66	22.5	0
1986	9	4	0.07	2.87	0.84	0.01	0.78	4.66	22.5	0
1986	9	5	0.05	2.95	0.84	0.01	0.8	4.66	22.5	0
1986	9	6	0.06	4.01	0.84	0.01	0.79	4.66	22.5	0
1986	10	1	0.18	3.4	0.84	0.01	0.67	4.66	22.5	0
1986	10	2	0.13	2.28	0.84	0.01	0.73	4.66	22.5	0
1986	10	3	0.07	3.81	0.84	0.01	0.78	4.66	22.5	0
1986	10	4	0.06	4.15	0.84	0.01	0.79	4.66	22.5	0
1986	10	5	0.04	2.63	0.84	0.01	0.81	4.66	22.5	0
1986	10	6	0.3	8.24	1.01	0.02	0.72	4.66	22.5	0
1986	11	1	0.1	9.17	0.84	0.02	0.75	4.66	22.5	0
1986	11	2	0.2	14.22	0.84	0.02	0.66	4.66	22.5	0
1986	11	3	0.17	23.09	0.84	0.02	0.69	4.66	22.5	0
1986	11	4	0.25	9.96	0.84	0.02	0.61	4.66	22.5	0
1986	11	5	0.1	4.08	0.84	0.02	0.75	4.66	22.5	0
1986	11	6	0.19	5.29	0.84	0.02	0.67	4.66	22.5	0
1986	12	1	0.06	5.16	0.84	0.01	0.79	4.66	22.5	0
1986	12	2	0.05	2.02	0.84	0.01	0.81	4.66	22.5	0
1986	12	3	0.22	6.15	0.84	0.01	0.63	4.66	22.5	0
1986	12	4	0.28	9.62	0.84	0.01	0.57	4.66	22.5	0
1986	12	5	0.06	5.17	0.84	0.01	0.79	4.66	22.5	0
1986	12	6	0.11	3.79	1.01	0.02	0.91	4.66	22.5	0
1987	1	1	0.16	4.97	0.84	0.02	0.69	4.66	22.5	0
1987	1	2	0.61	19.07	0.84	0.02	0.24	4.66	22.5	0
1987	1	3	0.49	26.46	0.84	0.02	0.36	4.66	22.5	0
1987	1	4	0.18	14.77	0.84	0.02	0.68	4.66	22.5	0
1987	1	5	0.23	9.09	0.84	0.02	0.63	4.66	22.5	0
1987	1	6	0.29	10.66	1.01	0.02	0.73	4.66	22.5	0
1987	2	1	0.14	7.7	0.84	0.01	0.71	4.66	22.5	0
1987	2	2	0.38	12.17	0.84	0.01	0.48	4.66	22.5	0
1987	2	3	0.15	11	0.84	0.01	0.7	4.66	22.5	0
1987	2	4	0.2	8.8	0.84	0.01	0.65	4.66	22.5	0
1987	2	5	0.13	18.57	0.84	0.01	0.72	4.66	22.5	0
1987	2	6	0.46	11.49	0.5	0.01	0.05	4.66	22.5	0
1987	3	1	0.25	15.71	0.84	0.01	0.6	4.66	22.5	0
1987	3	2	0.14	15.69	0.84	0.01	0.71	4.66	22.5	0
1987	3	3	0.11	8.44	0.84	0.01	0.74	4.66	22.5	0
1987	3	4	0.09	3.67	0.84	0.01	0.76	4.66	22.5	0
1987	3	5	0.13	4.52	0.84	0.01	0.72	4.66	22.5	0
1987	3	6	0.16	5.62	1.01	0.01	0.86	4.66	22.5	0
1987	4	1	0.12	5.03	0.84	0.01	0.73	4.66	22.5	0
1987	4	2	0.1	6.52	0.84	0.01	0.75	4.66	22.5	0
1987	4	3	0.1	6.98	0.84	0.01	0.75	4.66	22.5	0
1987	4	4	0.1	6.76	0.84	0.01	0.75	4.66	22.5	0
1987	4	5	0.09	2.98	0.84	0.01	0.76	4.66	22.5	0
1987	4	6	0.31	4.85	0.84	0.01	0.54	4.66	22.5	0
1987	5	1	0.2	9.74	0.84	0.01	0.65	4.66	22.5	0
1987	5	2	0.26	7.51	0.84	0.01	0.59	4.66	22.5	0
1987	5	3	0.19	8.58	0.84	0.01	0.66	4.66	22.5	0
1987	5	4	0.15	7.27	0.84	0.01	0.7	4.66	22.5	0
1987	5	5	0.07	3.78	0.84	0.01	0.78	4.66	22.5	0
1987	5	6	0.09	4.14	1.01	0.01	0.93	4.66	22.5	0
1987	6	1	0.09	2.98	0.84	0.01	0.76	4.66	22.5	0
1987	6	2	0.1	3.03	0.84	0.01	0.75	4.66	22.5	0
1987	6	3	0.13	3.3	0.84	0.01	0.72	4.66	22.5	0
1987	6	4	0.08	3.28	0.84	0.01	0.77	4.66	22.5	0
1987	6	5	0.08	2.98	0.84	0.01	0.77	4.66	22.5	0
1987	6	6	0.07	2.63	0.84	0.01	0.78	4.66	22.5	0

Table F-34 (10) Reservoir Operation Study for Existing Krenceng Dam (10/12)

Net supply yield: 1.94m3/sec
Water conveyance capacity: 2.00 m3/sec of 27.2 km pipe line

(Unit : 10^6 m3)

Year	Month	Serial No. of 5 day period	Inflow discharge		Supply yeild	Evapo	Water conveyance from Cida	Krenceng	Reservoir	Spillout
			Krenceng	Cidanau intake				Storage volume	Water level (El-m)	
1987	7	1	0.06	2.33	0.84	0.01	0.79	4.66	22.5	0
1987	7	2	0.05	1.78	0.84	0.01	0.8	4.66	22.5	0
1987	7	3	0.04	1.43	0.84	0.01	0.81	4.66	22.5	0
1987	7	4	0.04	1.06	0.84	0.01	0.81	4.66	22.5	0
1987	7	5	0.05	1.11	0.84	0.01	0.81	4.66	22.5	0
1987	7	6	0.05	1.64	1.01	0.01	0.97	4.66	22.5	0
1987	8	1	0.04	1.26	0.84	0.02	0.81	4.66	22.5	0
1987	8	2	0.04	0.93	0.84	0.02	0.82	4.66	22.5	0
1987	8	3	0.04	1.02	0.84	0.02	0.82	4.66	22.5	0
1987	8	4	0.04	0.79	0.84	0.02	0.79	4.63	22.47	0
1987	8	5	0.04	0.66	0.84	0.02	0.66	4.47	22.3	0
1987	8	6	0.05	0.66	1.01	0.02	0.66	4.16	21.95	0
1987	9	1	0.04	0.53	0.84	0.01	0.53	3.87	21.64	0
1987	9	2	0.04	0.49	0.84	0.01	0.49	3.55	21.29	0
1987	9	3	0.04	0.49	0.84	0.01	0.49	3.22	20.93	0
1987	9	4	0.05	0.49	0.84	0.01	0.49	2.91	20.59	0
1987	9	5	0.04	0.49	0.84	0.01	0.49	2.59	20.16	0
1987	9	6	0.04	0.49	0.84	0.01	0.49	2.27	19.69	0
1987	10	1	0.04	0.5	0.84	0.01	0.5	1.96	19.25	0
1987	10	2	0.04	0.49	0.84	0.01	0.49	1.64	18.74	0
1987	10	3	0.04	1.21	0.84	0.01	0.86	1.7	18.84	0
1987	10	4	0.04	0.93	0.84	0.01	0.86	1.75	18.94	0
1987	10	5	0.04	1.09	0.84	0.01	0.86	1.81	19.03	0
1987	10	6	0.05	0.8	1.01	0.01	0.8	1.64	18.74	0
1987	11	1	0.04	0.67	0.84	0.01	0.67	1.5	18.49	0
1987	11	2	0.1	1.15	0.84	0.01	0.86	1.63	18.71	0
1987	11	3	0.05	2.5	0.84	0.01	0.86	1.7	18.84	0
1987	11	4	0.04	2.29	0.84	0.01	0.86	1.75	18.94	0
1987	11	5	0.04	1.42	0.84	0.01	0.86	1.81	19.03	0
1987	11	6	0.04	0.87	0.84	0.01	0.86	1.86	19.11	0
1987	12	1	0.04	0.84	0.84	0.01	0.84	1.9	19.16	0
1987	12	2	0.05	1.44	0.84	0.01	0.86	1.97	19.26	0
1987	12	3	0.07	3.16	0.84	0.01	0.86	2.05	19.38	0
1987	12	4	0.28	3.94	0.84	0.01	0.86	2.35	19.81	0
1987	12	5	0.06	5.7	0.84	0.01	0.86	2.43	19.92	0
1987	12	6	0.05	3.8	1.01	0.01	1.04	2.49	20.02	0
1988	1	1	0.04	1.44	0.84	0.01	0.86	2.55	20.09	0
1988	1	2	0.07	0.77	0.84	0.01	0.77	2.54	20.09	0
1988	1	3	0.07	0.85	0.84	0.01	0.85	2.61	20.19	0
1988	1	4	0.12	2.1	0.84	0.01	0.86	2.74	20.38	0
1988	1	5	0.08	3.25	0.84	0.01	0.86	2.84	20.51	0
1988	1	6	0.4	8.29	1.01	0.01	1.04	3.25	20.97	0
1988	2	1	1.26	16.54	0.84	0.01	0.86	4.53	22.36	0
1988	2	2	0.87	20.76	0.84	0.01	0.1	4.66	22.5	0
1988	2	3	0.16	14.78	0.84	0.01	0.69	4.66	22.5	0
1988	2	4	0.08	21.66	0.84	0.01	0.78	4.66	22.5	0
1988	2	5	0.07	10.92	0.84	0.01	0.78	4.66	22.5	0
1988	2	6	0.05	2.72	0.67	0.01	0.63	4.66	22.5	0
1988	3	1	0.08	6.58	0.84	0.01	0.77	4.66	22.5	0
1988	3	2	0.07	10.78	0.84	0.01	0.78	4.66	22.5	0
1988	3	3	0.06	6.59	0.84	0.01	0.79	4.66	22.5	0
1988	3	4	0.06	6.31	0.84	0.01	0.79	4.66	22.5	0
1988	3	5	0.08	7.21	0.84	0.01	0.77	4.66	22.5	0
1988	3	6	0.09	11.66	1.01	0.01	0.93	4.66	22.5	0
1988	4	1	0.16	20.66	0.84	0.01	0.69	4.66	22.5	0
1988	4	2	0.1	10.15	0.84	0.01	0.75	4.66	22.5	0
1988	4	3	0.07	7.3	0.84	0.01	0.78	4.66	22.5	0
1988	4	4	0.07	7.25	0.84	0.01	0.78	4.66	22.5	0
1988	4	5	0.08	8.4	0.84	0.01	0.77	4.66	22.5	0
1988	4	6	0.06	6.1	0.84	0.01	0.79	4.66	22.5	0

Table F-34 (11) Reservoir Operation Study for Existing Krenceng Dam (11/12)

Net supply yield: 1.94m3/sec
Water conveyance capacity: 2.00 m3/sec of 27.2 km pipe line

(Unit : 10^6 m3)

Year	Month	Serial No. of 5 day period	Inflow discharge		Supply yeild	Evapo	Water conveyance from Cida	Krenceng	Reservoir	Spillout
			Krenceng	Cidanau intake				Storage volume	Water level (El-m)	
1988	5	1	0.05	7.77	0.84	0.01	0.8	4.66	22.5	0
1988	5	2	0.05	8.62	0.84	0.01	0.8	4.66	22.5	0
1988	5	3	0.06	6.74	0.84	0.01	0.79	4.66	22.5	0
1988	5	4	0.07	9.24	0.84	0.01	0.78	4.66	22.5	0
1988	5	5	0.06	7.75	0.84	0.01	0.79	4.66	22.5	0
1988	5	6	0.05	4.45	1.01	0.01	0.97	4.66	22.5	0
1988	6	1	0.08	3.12	0.84	0.01	0.77	4.66	22.5	0
1988	6	2	0.05	5.72	0.84	0.01	0.8	4.66	22.5	0
1988	6	3	0.05	6.27	0.84	0.01	0.8	4.66	22.5	0
1988	6	4	0.04	5.46	0.84	0.01	0.81	4.66	22.5	0
1988	6	5	0.04	4.47	0.84	0.01	0.81	4.66	22.5	0
1988	6	6	0.04	3.13	0.84	0.01	0.81	4.66	22.5	0
1988	7	1	0.08	2.01	0.84	0.01	0.77	4.66	22.5	0
1988	7	2	0.06	1.37	0.84	0.01	0.79	4.66	22.5	0
1988	7	3	0.03	0.91	0.84	0.01	0.82	4.66	22.5	0
1988	7	4	0.04	1.08	0.84	0.01	0.81	4.66	22.5	0
1988	7	5	0.04	0.93	0.84	0.01	0.82	4.66	22.5	0
1988	7	6	0.04	1.15	1.01	0.01	0.98	4.66	22.5	0
1988	8	1	0.05	1.03	0.84	0.02	0.81	4.66	22.5	0
1988	8	2	0.05	1.89	0.84	0.02	0.8	4.66	22.5	0
1988	8	3	0.06	1.5	0.84	0.02	0.79	4.66	22.5	0
1988	8	4	0.05	1.39	0.84	0.02	0.8	4.66	22.5	0
1988	8	5	0.05	1.48	0.84	0.02	0.81	4.66	22.5	0
1988	8	6	0.05	1.16	1.01	0.02	0.97	4.66	22.5	0
1988	9	1	0.04	0.87	0.84	0.01	0.81	4.66	22.5	0
1988	9	2	0.04	1.15	0.84	0.01	0.81	4.66	22.5	0
1988	9	3	0.04	1.5	0.84	0.01	0.82	4.66	22.5	0
1988	9	4	0.04	1.32	0.84	0.01	0.82	4.66	22.5	0
1988	9	5	0.04	1.29	0.84	0.01	0.82	4.66	22.5	0
1988	9	6	0.04	1.25	0.84	0.01	0.81	4.66	22.5	0
1988	10	1	0.04	1.43	0.84	0.01	0.81	4.66	22.5	0
1988	10	2	0.04	1.15	0.84	0.01	0.82	4.66	22.5	0
1988	10	3	0.22	1.13	0.84	0.01	0.63	4.66	22.5	0
1988	10	4	0.14	2.01	0.84	0.01	0.71	4.66	22.5	0
1988	10	5	0.07	2.27	0.84	0.01	0.79	4.66	22.5	0
1988	10	6	0.19	2.58	1.01	0.02	0.84	4.66	22.5	0
1988	11	1	0.28	3.59	0.84	0.02	0.58	4.66	22.5	0
1988	11	2	0.09	4.5	0.84	0.02	0.77	4.66	22.5	0
1988	11	3	0.07	5.93	0.84	0.02	0.79	4.66	22.5	0
1988	11	4	0.05	5.45	0.84	0.02	0.81	4.66	22.5	0
1988	11	5	0.05	7.94	0.84	0.02	0.8	4.66	22.5	0
1988	11	6	0.05	13.43	0.84	0.02	0.81	4.66	22.5	0
1988	12	1	0.05	14.52	0.84	0.01	0.8	4.66	22.5	0
1988	12	2	0.05	9.43	0.84	0.01	0.8	4.66	22.5	0
1988	12	3	0.38	13.49	0.84	0.01	0.47	4.66	22.5	0
1988	12	4	0.09	25.36	0.84	0.01	0.76	4.66	22.5	0
1988	12	5	0.04	12.37	0.84	0.01	0.81	4.66	22.5	0
1988	12	6	0.05	7.41	1.01	0.02	0.98	4.66	22.5	0
1989	1	1	0.04	4.47	0.84	0.02	0.81	4.66	22.5	0
1989	1	2	0.04	3.43	0.84	0.02	0.81	4.66	22.5	0
1989	1	3	0.05	2.82	0.84	0.02	0.8	4.66	22.5	0
1989	1	4	0.06	3.68	0.84	0.02	0.79	4.66	22.5	0
1989	1	5	0.12	3.9	0.84	0.02	0.74	4.66	22.5	0
1989	1	6	0.08	3.81	1.01	0.02	0.94	4.66	22.5	0
1989	2	1	0.22	4.25	0.84	0.01	0.63	4.66	22.5	0
1989	2	2	0.22	15.86	0.84	0.01	0.64	4.66	22.5	0
1989	2	3	0.09	10.41	0.84	0.01	0.76	4.66	22.5	0
1989	2	4	0.27	32.32	0.84	0.01	0.58	4.66	22.5	0
1989	2	5	0.75	13.32	0.84	0.01	0.1	4.66	22.5	0
1989	2	6	0.39	21.43	0.5	0.01	0.13	4.66	22.5	0

Table F-34 (12) Reservoir Operation Study for Existing Krenceng Dam (12/12)

Net supply yield: 1.94m3/sec
Water conveyance capacity: 2.00 m3/sec of 27.2 km pipe line

(Unit : 10^6 m3)

Year	Month	Serial No. of 5 day period	Inflow discharge		Supply yeild	Evapo	Water conveyance from Cida	Krenceng	Reservoir	Spillout
			Krenceng	Cidanau intake				Storage volume	Water level (El-m)	
1989	3	1	0.35	24.82	0.84	0.01	0.5	4.66	22.5	0
1989	3	2	0.3	17.14	0.84	0.01	0.55	4.66	22.5	0
1989	3	3	0.22	9.43	0.84	0.01	0.63	4.66	22.5	0
1989	3	4	0.1	8.1	0.84	0.01	0.75	4.66	22.5	0
1989	3	5	0.04	4.66	0.84	0.01	0.81	4.66	22.5	0
1989	3	6	0.05	3.91	1.01	0.01	0.97	4.66	22.5	0
1989	4	1	0.04	3.38	0.84	0.01	0.81	4.66	22.5	0
1989	4	2	0.05	3.38	0.84	0.01	0.81	4.66	22.5	0
1989	4	3	0.04	3.38	0.84	0.01	0.81	4.66	22.5	0
1989	4	4	0.02	3.38	0.84	0.01	0.83	4.66	22.5	0
1989	4	5	0.01	3.38	0.84	0.01	0.84	4.66	22.5	0
1989	4	6	0.01	3.38	0.84	0.01	0.84	4.66	22.5	0
1989	5	1	0.02	3.38	0.84	0.01	0.83	4.66	22.5	0
1989	5	2	0.02	3.38	0.84	0.01	0.83	4.66	22.5	0
1989	5	3	0.01	3.38	0.84	0.01	0.84	4.66	22.5	0
1989	5	4	0.01	3.38	0.84	0.01	0.84	4.66	22.5	0
1989	5	5	0.02	3.38	0.84	0.01	0.83	4.66	22.5	0
1989	5	6	0.02	4.06	1.01	0.01	1	4.66	22.5	0
1989	6	1	0.02	3.3	0.84	0.01	0.83	4.66	22.5	0
1989	6	2	0.07	4.01	0.84	0.01	0.78	4.66	22.5	0
1989	6	3	0.09	4.02	0.84	0.01	0.76	4.66	22.5	0
1989	6	4	0.08	2.74	0.84	0.01	0.77	4.66	22.5	0
1989	6	5	0.08	1.62	0.84	0.01	0.77	4.66	22.5	0
1989	6	6	0.08	1.4	0.84	0.01	0.77	4.66	22.5	0
1989	7	1	0.06	1.37	0.84	0.01	0.8	4.66	22.5	0
1989	7	2	0.06	2.71	0.84	0.01	0.79	4.66	22.5	0
1989	7	3	0.06	4.54	0.84	0.01	0.79	4.66	22.5	0
1989	7	4	0.06	5.32	0.84	0.01	0.79	4.66	22.5	0
1989	7	5	0.05	3.77	0.84	0.01	0.8	4.66	22.5	0
1989	7	6	0.08	2.3	1.01	0.01	0.94	4.66	22.5	0
1989	8	1	0.06	1.15	0.84	0.02	0.79	4.66	22.5	0
1989	8	2	0.08	0.77	0.84	0.02	0.77	4.65	22.5	0
1989	8	3	0.06	0.98	0.84	0.02	0.8	4.66	22.5	0
1989	8	4	0.06	0.62	0.84	0.02	0.62	4.49	22.32	0
1989	8	5	0.05	0.7	0.84	0.02	0.7	4.39	22.21	0
1989	8	6	0.15	1.27	1.01	0.02	1.04	4.55	22.39	0
1989	9	1	0.05	1.68	0.84	0.01	0.86	4.61	22.46	0
1989	9	2	0.07	1.03	0.84	0.01	0.82	4.66	22.5	0
1989	9	3	0.05	1.88	0.84	0.01	0.8	4.66	22.5	0
1989	9	4	0.04	2.36	0.84	0.01	0.81	4.66	22.5	0
1989	9	5	0.04	1.53	0.84	0.01	0.82	4.66	22.5	0
1989	9	6	0.04	0.83	0.84	0.01	0.81	4.66	22.5	0
1989	10	1	0.04	1.37	0.84	0.01	0.82	4.66	22.5	0
1989	10	2	0.04	1.15	0.84	0.01	0.82	4.66	22.5	0
1989	10	3	0.04	0.94	0.84	0.01	0.82	4.66	22.5	0
1989	10	4	0.04	0.81	0.84	0.01	0.81	4.65	22.5	0
1989	10	5	0.04	0.87	0.84	0.01	0.82	4.66	22.5	0
1989	10	6	0.05	2.43	1.01	0.02	0.98	4.66	22.5	0
1989	11	1	0.04	1.68	0.84	0.02	0.82	4.66	22.5	0
1989	11	2	0.04	1.44	0.84	0.02	0.82	4.66	22.5	0
1989	11	3	0.04	2.22	0.84	0.02	0.82	4.66	22.5	0
1989	11	4	0.04	2.09	0.84	0.02	0.81	4.66	22.5	0
1989	11	5	0.04	2.31	0.84	0.02	0.82	4.66	22.5	0
1989	11	6	0.04	1.75	0.84	0.02	0.81	4.66	22.5	0
1989	12	1	0.04	2.28	0.84	0.01	0.81	4.66	22.5	0
1989	12	2	0.08	2.81	0.84	0.01	0.78	4.66	22.5	0
1989	12	3	0.49	4.08	0.84	0.01	0.36	4.66	22.5	0
1989	12	4	0.16	4.58	0.84	0.01	0.69	4.66	22.5	0
1989	12	5	0.07	4.28	0.84	0.01	0.78	4.66	22.5	0
1989	12	6	0.24	5.2	1.01	0.02	0.78	4.66	22.5	0

Table F-35 (1) Reservoir Operation Study for Heightening of Krenceng Dam (without Diversion Tunnel) (1/12)

Net supply yield: 3.05m3/sec
Water conveyance capacity: 3.05 m3/sec of 27.2 km pipe line

(Unit : 10^6 m3)

Year	Month	Serial No. of 5 day period	Inflow discharge		Supply yeild	Evapo	Water conveyance from Cida	Krenceng	Reservoir	Spillout
			Krenceng	Cidanau intake				Storage volume	Water level (El-m)	
1980	1	1	0.12	3.9	1.32	0.03	1.23	14.07	29	0
1980	1	2	0.2	3.98	1.32	0.03	1.15	14.07	29	0
1980	1	3	0.29	4.05	1.32	0.03	1.05	14.07	29	0
1980	1	4	0.29	3.92	1.32	0.03	1.06	14.07	29	0
1980	1	5	0.29	3.9	1.32	0.03	1.06	14.07	29	0
1980	1	6	0.39	3.56	1.58	0.03	1.22	14.07	29	0
1980	2	1	0.19	3.3	1.32	0.02	1.15	14.07	29	0
1980	2	2	0.48	5.06	1.32	0.02	0.86	14.07	29	0
1980	2	3	0.49	5.01	1.32	0.02	0.85	14.07	29	0
1980	2	4	0.78	5.06	1.32	0.02	0.56	14.07	29	0
1980	2	5	0.46	5.09	1.32	0.02	0.88	14.07	29	0
1980	2	6	0.19	5.06	1.05	0.02	0.89	14.07	29	0
1980	3	1	0.15	4.53	1.32	0.02	1.19	14.07	29	0
1980	3	2	0.23	3.44	1.32	0.02	1.11	14.07	29	0
1980	3	3	0.15	14.02	1.32	0.02	1.18	14.07	29	0
1980	3	4	0.16	9.57	1.32	0.02	1.18	14.07	29	0
1980	3	5	0.07	2.29	1.32	0.02	1.27	14.07	29	0
1980	3	6	0.11	1.74	1.58	0.03	1.5	14.07	29	0
1980	4	1	0.06	2.23	1.32	0.02	1.28	14.07	29	0
1980	4	2	0.07	1.77	1.32	0.02	1.27	14.07	29	0
1980	4	3	0.28	6.5	1.32	0.02	1.06	14.07	29	0
1980	4	4	0.1	4.84	1.32	0.02	1.24	14.07	29	0
1980	4	5	0.17	3.27	1.32	0.02	1.17	14.07	29	0
1980	4	6	0.11	1.99	1.32	0.02	1.23	14.07	29	0
1980	5	1	0.11	0.82	1.32	0.02	0.82	13.66	28.74	0
1980	5	2	0.09	0.18	1.32	0.02	0.18	12.6	28.08	0
1980	5	3	0.11	0.88	1.32	0.02	0.88	12.25	27.86	0
1980	5	4	0.11	1.91	1.32	0.02	1.32	12.34	27.91	0
1980	5	5	0.07	5.36	1.32	0.02	1.32	12.39	27.95	0
1980	5	6	0.06	4.99	1.58	0.02	1.58	12.42	27.97	0
1980	6	1	0.11	3.84	1.32	0.02	1.32	12.52	28.03	0
1980	6	2	0.06	4.39	1.32	0.02	1.32	12.55	28.05	0
1980	6	3	0.08	1.89	1.32	0.02	1.32	12.61	28.09	0
1980	6	4	0.05	3.17	1.32	0.02	1.32	12.64	28.1	0
1980	6	5	0.06	3.77	1.32	0.02	1.32	12.68	28.13	0
1980	6	6	0.05	2.37	1.32	0.02	1.32	12.71	28.15	0
1980	7	1	0.04	1.63	1.32	0.02	1.32	12.73	28.16	0
1980	7	2	0.04	2.82	1.32	0.02	1.32	12.75	28.17	0
1980	7	3	0.04	2.81	1.32	0.02	1.32	12.77	28.19	0
1980	7	4	0.05	4.75	1.32	0.02	1.32	12.8	28.21	0
1980	7	5	0.05	2.64	1.32	0.02	1.32	12.83	28.22	0
1980	7	6	0.06	2.74	1.58	0.02	1.58	12.86	28.25	0
1980	8	1	0.12	2.19	1.32	0.03	1.32	12.96	28.3	0
1980	8	2	0.19	4.48	1.32	0.03	1.32	13.12	28.4	0
1980	8	3	0.28	6.84	1.32	0.03	1.32	13.37	28.56	0
1980	8	4	0.38	12.84	1.32	0.03	1.32	13.72	28.78	0
1980	8	5	0.05	5.29	1.32	0.03	1.32	13.75	28.8	0
1980	8	6	0.05	2.12	1.58	0.03	1.58	13.76	28.81	0
1980	9	1	0.23	2.64	1.32	0.03	1.32	13.96	28.93	0
1980	9	2	0.2	27.03	1.32	0.03	1.25	14.07	29	0
1980	9	3	0.32	28.73	1.32	0.03	1.02	14.07	29	0
1980	9	4	0.11	12.39	1.32	0.03	1.23	14.07	29	0
1980	9	5	0.08	2.48	1.32	0.03	1.26	14.07	29	0
1980	9	6	0.14	1.63	1.32	0.03	1.2	14.07	29	0
1980	10	1	0.11	0.86	1.32	0.03	0.86	13.7	28.76	0
1980	10	2	0.12	0.63	1.32	0.03	0.63	13.11	28.4	0
1980	10	3	0.12	2.54	1.32	0.03	1.32	13.2	28.46	0
1980	10	4	0.08	6.13	1.32	0.03	1.32	13.26	28.49	0
1980	10	5	0.12	6.87	1.32	0.03	1.32	13.36	28.55	0
1980	10	6	0.11	9.88	1.58	0.03	1.58	13.44	28.6	0

Table F-35 (2) Reservoir Operation Study for Heightening of Krenceng Dam (without Diversion Tunnel) (2/12)

Net supply yield: 3.05m3/sec
Water conveyance capacity: 3.05 m3/sec of 27.2 km pipe line

(Unit : 10^6 m3)

Year	Month	Serial No. of 5 day period	Inflow discharge		Supply yeild	Evapo	Water conveyance from Cida	Krenceng	Reservoir	Spillout
			Krenceng	Cidanau intake				Storage volume	Water level (El-m)	
1980	11	1	0.18	9.4	1.32	0.03	1.32	13.59	28.7	0
1980	11	2	0.1	11.06	1.32	0.03	1.32	13.66	28.74	0
1980	11	3	0.13	13.41	1.32	0.03	1.32	13.76	28.8	0
1980	11	4	0.31	15.5	1.32	0.03	1.32	14.05	28.98	0
1980	11	5	0.08	18.31	1.32	0.03	1.3	14.07	29	0
1980	11	6	0.06	21.43	1.32	0.03	1.28	14.07	29	0
1980	12	1	0.05	27.92	1.32	0.03	1.3	14.07	29	0
1980	12	2	0.07	31.72	1.32	0.03	1.28	14.07	29	0
1980	12	3	0.05	32.78	1.32	0.03	1.29	14.07	29	0
1980	12	4	0.18	42.23	1.32	0.03	1.17	14.07	29	0
1980	12	5	0.53	29.54	1.32	0.03	0.81	14.07	29	0
1980	12	6	0.64	47.28	1.58	0.03	0.97	14.07	29	0
1981	1	1	1.71	62.12	1.32	0.03	0	14.07	29	0.37
1981	1	2	1.18	72.41	1.32	0.03	0.17	14.07	29	0
1981	1	3	0.71	28.77	1.32	0.03	0.63	14.07	29	0
1981	1	4	0.42	30.33	1.32	0.03	0.93	14.07	29	0
1981	1	5	0.29	13.91	1.32	0.03	1.05	14.07	29	0
1981	1	6	0.49	17.12	1.58	0.03	1.12	14.07	29	0
1981	2	1	0.4	18.43	1.32	0.02	0.94	14.07	29	0
1981	2	2	0.35	21.51	1.32	0.02	0.99	14.07	29	0
1981	2	3	0.52	14.11	1.32	0.02	0.83	14.07	29	0
1981	2	4	0.51	10.57	1.32	0.02	0.83	14.07	29	0
1981	2	5	0.46	1.87	1.32	0.02	0.88	14.07	29	0
1981	2	6	0.75	11.16	0.79	0.01	0.06	14.07	29	0
1981	3	1	0.66	12.23	1.32	0.02	0.68	14.07	29	0
1981	3	2	0.33	1.75	1.32	0.02	1.01	14.07	29	0
1981	3	3	0.51	2.26	1.32	0.02	0.83	14.07	29	0
1981	3	4	0.32	3.68	1.32	0.02	1.02	14.07	29	0
1981	3	5	0.17	2.34	1.32	0.02	1.17	14.07	29	0
1981	3	6	0.31	11.79	1.58	0.03	1.3	14.07	29	0
1981	4	1	0.14	12.43	1.32	0.02	1.2	14.07	29	0
1981	4	2	0.16	12.2	1.32	0.02	1.18	14.07	29	0
1981	4	3	0.1	11.66	1.32	0.02	1.24	14.07	29	0
1981	4	4	0.13	10.14	1.32	0.02	1.2	14.07	29	0
1981	4	5	0.14	8.69	1.32	0.02	1.2	14.07	29	0
1981	4	6	0.11	7.79	1.32	0.02	1.23	14.07	29	0
1981	5	1	0.21	6.43	1.32	0.02	1.13	14.07	29	0
1981	5	2	0.16	4.42	1.32	0.02	1.18	14.07	29	0
1981	5	3	0.21	2.96	1.32	0.02	1.13	14.07	29	0
1981	5	4	0.29	4.35	1.32	0.02	1.05	14.07	29	0
1981	5	5	0.11	3.23	1.32	0.02	1.23	14.07	29	0
1981	5	6	0.1	1.1	1.58	0.03	1.1	13.67	28.75	0
1981	6	1	0.06	2.82	1.32	0.02	1.32	13.71	28.77	0
1981	6	2	0.06	3.69	1.32	0.02	1.32	13.75	28.8	0
1981	6	3	0.12	5.1	1.32	0.02	1.32	13.85	28.86	0
1981	6	4	0.2	9.5	1.32	0.02	1.32	14.03	28.98	0
1981	6	5	0.09	4.31	1.32	0.02	1.29	14.07	29	0
1981	6	6	0.12	4.23	1.32	0.02	1.22	14.07	29	0
1981	7	1	0.06	4.31	1.32	0.02	1.28	14.07	29	0
1981	7	2	0.06	1.27	1.32	0.02	1.27	14.06	28.99	0
1981	7	3	0.21	2.78	1.32	0.02	1.14	14.07	29	0
1981	7	4	0.32	5.56	1.32	0.02	1.02	14.07	29	0
1981	7	5	0.36	7.35	1.32	0.02	0.98	14.07	29	0
1981	7	6	0.67	11.43	1.58	0.03	0.94	14.07	29	0
1981	8	1	0.16	8.03	1.32	0.03	1.18	14.07	29	0
1981	8	2	0.17	3.09	1.32	0.03	1.17	14.07	29	0
1981	8	3	0.11	2.22	1.32	0.03	1.24	14.07	29	0
1981	8	4	0.15	1.58	1.32	0.03	1.2	14.07	29	0
1981	8	5	0.15	3.77	1.32	0.03	1.2	14.07	29	0
1981	8	6	0.12	5.33	1.58	0.03	1.5	14.07	29	0

Table F-35 (3) Reservoir Operation Study for Heightening of Krenceng Dam (without Diversion Tunnel) (3/12)

Net supply yield: 3.05m3/sec
Water conveyance capacity: 3.05 m3/sec of 27.2 km pipe line

(Unit : 10^6 m3)

Year	Month	Serial No. of 5 day period	Inflow discharge		Supply yeild	Evapo	Water conveyance from Cida	Krenceng	Reservoir	Spillout
			Krenceng	Cidanau intake				Storage volume	Water level (El-m)	
1981	9	1	0.18	2.18	1.32	0.03	1.16	14.07	29	0
1981	9	2	0.17	6.52	1.32	0.03	1.17	14.07	29	0
1981	9	3	0.47	7.08	1.32	0.03	0.87	14.07	29	0
1981	9	4	0.11	1.64	1.32	0.03	1.23	14.07	29	0
1981	9	5	0.1	1.14	1.32	0.03	1.14	13.97	28.93	0
1981	9	6	0.16	9.85	1.32	0.03	1.29	14.07	29	0
1981	10	1	0.33	41.83	1.32	0.03	1.01	14.07	29	0
1981	10	2	0.33	14.32	1.32	0.03	1.01	14.07	29	0
1981	10	3	0.25	4.95	1.32	0.03	1.09	14.07	29	0
1981	10	4	0.11	3.53	1.32	0.03	1.24	14.07	29	0
1981	10	5	0.12	1.83	1.32	0.03	1.22	14.07	29	0
1981	10	6	0.22	10.88	1.58	0.03	1.39	14.07	29	0
1981	11	1	0.14	4.61	1.32	0.03	1.21	14.07	29	0
1981	11	2	0.28	4.04	1.32	0.03	1.07	14.07	29	0
1981	11	3	0.42	24.28	1.32	0.03	0.93	14.07	29	0
1981	11	4	0.98	68.23	1.32	0.03	0.36	14.07	29	0
1981	11	5	0.17	25.93	1.32	0.03	1.18	14.07	29	0
1981	11	6	0.46	9.35	1.32	0.03	0.88	14.07	29	0
1981	12	1	0.31	12.78	1.32	0.03	1.04	14.07	29	0
1981	12	2	0.2	11.62	1.32	0.03	1.15	14.07	29	0
1981	12	3	0.17	8.62	1.32	0.03	1.18	14.07	29	0
1981	12	4	0.17	3.44	1.32	0.03	1.18	14.07	29	0
1981	12	5	0.34	5.79	1.32	0.03	1.01	14.07	29	0
1981	12	6	0.77	37.81	1.58	0.03	0.84	14.07	29	0
1982	1	1	0.39	21.37	1.32	0.03	0.96	14.07	29	0
1982	1	2	0.89	11.65	1.32	0.03	0.45	14.07	29	0
1982	1	3	1.4	4.37	1.32	0.03	0	14.07	29	0.06
1982	1	4	0.9	18.14	1.32	0.03	0.44	14.07	29	0
1982	1	5	0.64	15.83	1.32	0.03	0.7	14.07	29	0
1982	1	6	0.55	3.66	1.58	0.03	1.06	14.07	29	0
1982	2	1	0.48	2.77	1.32	0.02	0.86	14.07	29	0
1982	2	2	0.22	1.14	1.32	0.02	1.12	14.07	29	0
1982	2	3	0.29	1.73	1.32	0.02	1.05	14.07	29	0
1982	2	4	0.22	1.57	1.32	0.02	1.12	14.07	29	0
1982	2	5	0.18	3.33	1.32	0.02	1.16	14.07	29	0
1982	2	6	0.13	2.83	0.79	0.01	0.68	14.07	29	0
1982	3	1	0.29	9.13	1.32	0.02	1.05	14.07	29	0
1982	3	2	0.37	31.73	1.32	0.02	0.97	14.07	29	0
1982	3	3	0.61	12.63	1.32	0.02	0.73	14.07	29	0
1982	3	4	0.59	16.98	1.32	0.02	0.75	14.07	29	0
1982	3	5	0.44	24.54	1.32	0.02	0.9	14.07	29	0
1982	3	6	0.42	8.13	1.58	0.03	1.19	14.07	29	0
1982	4	1	0.27	10.43	1.32	0.02	1.06	14.07	29	0
1982	4	2	0.23	10.64	1.32	0.02	1.11	14.07	29	0
1982	4	3	0.21	7.22	1.32	0.02	1.13	14.07	29	0
1982	4	4	0.34	17.29	1.32	0.02	1	14.07	29	0
1982	4	5	0.23	5.42	1.32	0.02	1.11	14.07	29	0
1982	4	6	0.33	7.44	1.32	0.02	1.01	14.07	29	0
1982	5	1	0.24	5.44	1.32	0.02	1.1	14.07	29	0
1982	5	2	0.21	3.58	1.32	0.02	1.13	14.07	29	0
1982	5	3	0.16	3.36	1.32	0.02	1.18	14.07	29	0
1982	5	4	0.11	1.94	1.32	0.02	1.23	14.07	29	0
1982	5	5	0.11	1.7	1.32	0.02	1.23	14.07	29	0
1982	5	6	0.17	2.31	1.58	0.03	1.44	14.07	29	0
1982	6	1	0.25	2.43	1.32	0.02	1.09	14.07	29	0
1982	6	2	0.18	3.79	1.32	0.02	1.15	14.07	29	0
1982	6	3	0.13	2.56	1.32	0.02	1.2	14.07	29	0
1982	6	4	0.11	2.54	1.32	0.02	1.22	14.07	29	0
1982	6	5	0.07	1.89	1.32	0.02	1.26	14.07	29	0
1982	6	6	0.11	1.29	1.32	0.02	1.22	14.07	29	0

Table F-35 (4) Reservoir Operation Study for Heightening of Krenceng Dam (without Diversion Tunnel) (4/12)

Net supply yield: 3.05m3/sec
Water conveyance capacity: 3.05 m3/sec of 27.2 km pipe line

(Unit : 10^6 m3)

Year	Month	Serial No. of 5 day period	Inflow discharge		Supply yeild	Evapo	Water conveyance from Cida	Krenceng	Reservoir	Spillout
			Krenceng	Cidanau intake				Storage volume	Water level (El-m)	
1982	7	1	0.08	1.41	1.32	0.02	1.26	14.07	29	0
1982	7	2	0.07	1.28	1.32	0.02	1.27	14.07	29	0
1982	7	3	0.07	1.24	1.32	0.02	1.24	14.04	28.98	0
1982	7	4	0.17	1.79	1.32	0.02	1.2	14.07	29	0
1982	7	5	0.17	2.21	1.32	0.02	1.17	14.07	29	0
1982	7	6	0.2	4.78	1.58	0.03	1.41	14.07	29	0
1982	8	1	0.11	1.68	1.32	0.03	1.24	14.07	29	0
1982	8	2	0.08	1.28	1.32	0.03	1.26	14.07	29	0
1982	8	3	0.04	0.81	1.32	0.03	0.81	13.58	28.69	0
1982	8	4	0.03	0.69	1.32	0.03	0.69	12.96	28.3	0
1982	8	5	0.02	0.57	1.32	0.03	0.57	12.2	27.83	0
1982	8	6	0.02	0.54	1.58	0.03	0.54	11.14	27.17	0
1982	9	1	0.05	0.84	1.32	0.02	0.84	10.69	26.89	0
1982	9	2	0.05	0.57	1.32	0.02	0.57	9.97	26.44	0
1982	9	3	0.04	0.53	1.32	0.02	0.53	9.21	25.96	0
1982	9	4	0.04	0.45	1.32	0.02	0.45	8.36	25.43	0
1982	9	5	0.04	0.96	1.32	0.02	0.96	8.02	25.22	0
1982	9	6	0.05	1.07	1.32	0.02	1.07	7.81	25.09	0
1982	10	1	0.06	1.26	1.32	0.02	1.26	7.8	25.08	0
1982	10	2	0.04	0.56	1.32	0.02	0.56	7.06	24.5	0
1982	10	3	0.04	0.36	1.32	0.02	0.36	6.13	23.72	0
1982	10	4	0.1	0.96	1.32	0.02	0.96	5.85	23.49	0
1982	10	5	0.05	0.94	1.32	0.02	0.94	5.5	23.2	0
1982	10	6	0.05	0.63	1.58	0.02	0.63	4.58	22.42	0
1982	11	1	0.04	0.49	1.32	0.02	0.49	3.78	21.54	0
1982	11	2	0.06	5.34	1.32	0.01	1.32	3.83	21.59	0
1982	11	3	0.06	1.72	1.32	0.01	1.32	3.87	21.65	0
1982	11	4	0.06	0.78	1.32	0.01	0.78	3.38	21.1	0
1982	11	5	0.06	2.65	1.32	0.01	1.32	3.42	21.15	0
1982	11	6	0.06	2.54	1.32	0.01	1.32	3.47	21.2	0
1982	12	1	0.04	1.36	1.32	0.01	1.32	3.5	21.23	0
1982	12	2	0.04	0.42	1.32	0.01	0.42	2.63	20.21	0
1982	12	3	0.04	2.22	1.32	0.01	1.32	2.66	20.26	0
1982	12	4	0.04	2.79	1.32	0.01	1.32	2.69	20.31	0
1982	12	5	0.05	2.93	1.32	0.01	1.32	2.73	20.36	0
1982	12	6	0.13	8.58	1.58	0.01	1.58	2.84	20.51	0
1983	1	1	0.19	6.77	1.32	0.01	1.32	3.02	20.7	0
1983	1	2	0.11	6.98	1.32	0.01	1.32	3.11	20.81	0
1983	1	3	0.08	6.17	1.32	0.01	1.32	3.18	20.88	0
1983	1	4	0.12	11.05	1.32	0.01	1.32	3.28	21	0
1983	1	5	0.32	20.04	1.32	0.01	1.32	3.59	21.34	0
1983	1	6	0.06	13.66	1.58	0.02	1.58	3.63	21.38	0
1983	2	1	0.22	7.9	1.32	0.01	1.32	3.84	21.61	0
1983	2	2	0.22	9.4	1.32	0.01	1.32	4.05	21.83	0
1983	2	3	0.06	2.59	1.32	0.01	1.32	4.09	21.88	0
1983	2	4	0.14	2.82	1.32	0.01	1.32	4.21	22.02	0
1983	2	5	0.08	3.12	1.32	0.01	1.32	4.28	22.09	0
1983	2	6	0.26	2.49	0.79	0.01	0.79	4.54	22.37	0
1983	3	1	0.43	5.41	1.32	0.01	1.32	4.96	22.75	0
1983	3	2	0.19	2.72	1.32	0.01	1.32	5.14	22.9	0
1983	3	3	0.16	2.32	1.32	0.01	1.32	5.29	23.02	0
1983	3	4	0.06	1.99	1.32	0.01	1.32	5.34	23.06	0
1983	3	5	0.07	1.97	1.32	0.01	1.32	5.39	23.11	0
1983	3	6	0.31	3.53	1.58	0.02	1.58	5.69	23.36	0
1983	4	1	0.19	4.93	1.32	0.01	1.32	5.86	23.5	0
1983	4	2	0.3	4.37	1.32	0.01	1.32	6.14	23.73	0
1983	4	3	0.06	3.8	1.32	0.01	1.32	6.19	23.77	0
1983	4	4	0.14	4.52	1.32	0.01	1.32	6.31	23.87	0
1983	4	5	0.59	3.83	1.32	0.01	1.32	6.88	24.35	0
1983	4	6	0.45	4.72	1.32	0.02	1.32	7.32	24.71	0

Table F-35 (5) Reservoir Operation Study for Heightening of Krenceng Dam (without Diversion Tunnel) (5/12)

Net supply yield: 3.05m3/sec
Water conveyance capacity: 3.05 m3/sec of 27.2 km pipe line

(Unit : 10^6 m3)

Year	Month	Serial No. of 5 day period	Inflow discharge		Supply yeild	Evapo	Water conveyance from Cida	Krenceng Reservoir		Spillout
			Krenceng	Cidanau intake				Storage volume	Water level (El-m)	
1983	5	1	0.25	2.07	1.32	0.02	1.32	7.55	24.9	0
1983	5	2	0.46	2.03	1.32	0.02	1.32	8	25.2	0
1983	5	3	0.28	6.1	1.32	0.02	1.32	8.26	25.37	0
1983	5	4	0.28	3.08	1.32	0.02	1.32	8.53	25.53	0
1983	5	5	0.18	4.03	1.32	0.02	1.32	8.69	25.63	0
1983	5	6	0.27	3.11	1.58	0.02	1.58	8.94	25.79	0
1983	6	1	0.15	4.03	1.32	0.02	1.32	9.07	25.87	0
1983	6	2	0.97	3.43	1.32	0.02	1.32	10.02	26.47	0
1983	6	3	0.36	2.69	1.32	0.02	1.32	10.37	26.69	0
1983	6	4	0.21	3.92	1.32	0.02	1.32	10.57	26.81	0
1983	6	5	0.12	4.85	1.32	0.02	1.32	10.67	26.88	0
1983	6	6	0.27	5.14	1.32	0.02	1.32	10.92	27.03	0
1983	7	1	0.15	7.96	1.32	0.02	1.32	11.06	27.12	0
1983	7	2	0.02	4.92	1.32	0.02	1.32	11.06	27.12	0
1983	7	3	0.02	2.54	1.32	0.02	1.32	11.06	27.12	0
1983	7	4	0.05	3.36	1.32	0.02	1.32	11.09	27.14	0
1983	7	5	0.05	2.46	1.32	0.02	1.32	11.12	27.15	0
1983	7	6	0.06	3.37	1.58	0.02	1.58	11.16	27.18	0
1983	8	1	0.02	1.43	1.32	0.02	1.32	11.15	27.17	0
1983	8	2	0.02	0.68	1.32	0.02	0.68	10.5	26.77	0
1983	8	3	0.01	1.2	1.32	0.02	1.2	10.38	26.69	0
1983	8	4	0.01	1.48	1.32	0.02	1.32	10.37	26.68	0
1983	8	5	0.03	3.93	1.32	0.02	1.32	10.37	26.68	0
1983	8	6	0.01	1.06	1.58	0.03	1.06	9.83	26.35	0
1983	9	1	0	0.49	1.32	0.02	0.49	8.98	25.82	0
1983	9	2	0.01	0.76	1.32	0.02	0.76	8.41	25.46	0
1983	9	3	0.01	0.85	1.32	0.02	0.85	7.93	25.16	0
1983	9	4	0.01	0.7	1.32	0.02	0.7	7.31	24.7	0
1983	9	5	0.01	0.7	1.32	0.02	0.7	6.68	24.18	0
1983	9	6	0.01	0.54	1.32	0.02	0.54	5.89	23.53	0
1983	10	1	0	0.38	1.32	0.02	0.38	4.94	22.74	0
1983	10	2	0	0.29	1.32	0.02	0.29	3.9	21.67	0
1983	10	3	0	0.33	1.32	0.01	0.33	2.89	20.57	0
1983	10	4	0	0.37	1.32	0.01	0.37	1.94	19.21	0
1983	10	5	0.04	2.51	1.32	0.01	1.32	1.96	19.25	0
1983	10	6	0.05	6.55	1.58	0.01	1.58	2	19.3	0
1983	11	1	0.04	7.08	1.32	0.01	1.32	2.03	19.35	0
1983	11	2	0.08	5.71	1.32	0.01	1.32	2.1	19.45	0
1983	11	3	0.01	7.36	1.32	0.01	1.32	2.1	19.44	0
1983	11	4	0.47	39.04	1.32	0.01	1.32	2.55	20.1	0
1983	11	5	1.37	0.64	1.32	0.01	0.64	3.24	20.95	0
1983	11	6	3.91	21.87	1.32	0.01	1.32	7.13	24.55	0
1983	12	1	0.37	19.35	1.32	0.02	1.32	7.48	24.84	0
1983	12	2	0.36	10.29	1.32	0.02	1.32	7.82	25.09	0
1983	12	3	0.12	4.38	1.32	0.02	1.32	7.92	25.15	0
1983	12	4	0.08	4.43	1.32	0.02	1.32	7.98	25.19	0
1983	12	5	0.06	3.73	1.32	0.02	1.32	8.02	25.21	0
1983	12	6	0.08	7.05	1.58	0.02	1.58	8.07	25.25	0
1984	1	1	0.12	5.67	1.32	0.02	1.32	8.17	25.31	0
1984	1	2	0.23	1.38	1.32	0.02	1.32	8.38	25.44	0
1984	1	3	0.08	6.24	1.32	0.02	1.32	8.44	25.48	0
1984	1	4	0.13	6.94	1.32	0.02	1.32	8.55	25.55	0
1984	1	5	0.9	7.06	1.32	0.02	1.32	9.42	26.09	0
1984	1	6	1.69	9.84	1.58	0.03	1.58	11.08	27.13	0
1984	2	1	0.46	7.43	1.32	0.02	1.32	11.52	27.4	0
1984	2	2	0.34	12.52	1.32	0.02	1.32	11.83	27.6	0
1984	2	3	0.4	5.64	1.32	0.02	1.32	12.21	27.84	0
1984	2	4	0.8	4.15	1.32	0.02	1.32	12.98	28.32	0
1984	2	5	0.72	2.87	1.32	0.02	1.32	13.68	28.76	0
1984	2	6	0.46	6.03	1.05	0.02	1.01	14.07	29	0

Table F-35 (6) Reservoir Operation Study for Heightening of Krenceng Dam (without Diversion Tunnel) (6/12)

Net supply yield: 3.05m3/sec
Water conveyance capacity: 3.05 m3/sec of 27.2 km pipe line

(Unit : 10^6 m3)

Year	Month	Serial No. of 5 day period	Inflow discharge		Supply yeild	Evapo	Water conveyance from Cida	Krenceng	Reservoir	Spillout
			Krenceng	Cidanau intake				Storage volume	Water level (El-m)	
1984	3	1	0.38	5.87	1.32	0.02	0.96	14.07	29	0
1984	3	2	1.01	10.68	1.32	0.02	0.33	14.07	29	0
1984	3	3	1.41	12.95	1.32	0.02	0	14.07	29	0.08
1984	3	4	0.92	10.75	1.32	0.02	0.42	14.07	29	0
1984	3	5	1.78	19.09	1.32	0.02	0	14.07	29	0.44
1984	3	6	2.02	26.41	1.58	0.03	0	14.07	29	0.42
1984	4	1	0.18	11.88	1.32	0.02	1.16	14.07	29	0
1984	4	2	0.24	2.86	1.32	0.02	1.1	14.07	29	0
1984	4	3	0.16	3.83	1.32	0.02	1.18	14.07	29	0
1984	4	4	0.24	3.37	1.32	0.02	1.1	14.07	29	0
1984	4	5	0.18	4.38	1.32	0.02	1.16	14.07	29	0
1984	4	6	0.46	6.49	1.32	0.02	0.88	14.07	29	0
1984	5	1	0.5	5.85	1.32	0.02	0.84	14.07	29	0
1984	5	2	0.42	10.68	1.32	0.02	0.92	14.07	29	0
1984	5	3	0.22	15.63	1.32	0.02	1.12	14.07	29	0
1984	5	4	0.15	5.8	1.32	0.02	1.19	14.07	29	0
1984	5	5	0.24	3.97	1.32	0.02	1.1	14.07	29	0
1984	5	6	0.22	12.63	1.58	0.03	1.39	14.07	29	0
1984	6	1	0.2	6.23	1.32	0.02	1.14	14.07	29	0
1984	6	2	0.17	3.47	1.32	0.02	1.17	14.07	29	0
1984	6	3	0.21	3.13	1.32	0.02	1.12	14.07	29	0
1984	6	4	0.21	2.61	1.32	0.02	1.13	14.07	29	0
1984	6	5	0.14	3.12	1.32	0.02	1.2	14.07	29	0
1984	6	6	0.1	1.39	1.32	0.02	1.24	14.07	29	0
1984	7	1	0.24	2.29	1.32	0.02	1.1	14.07	29	0
1984	7	2	0.17	4.9	1.32	0.02	1.17	14.07	29	0
1984	7	3	0.09	3.29	1.32	0.02	1.25	14.07	29	0
1984	7	4	0.08	2.15	1.32	0.02	1.26	14.07	29	0
1984	7	5	0.16	2.76	1.32	0.02	1.18	14.07	29	0
1984	7	6	0.18	3.74	1.58	0.03	1.43	14.07	29	0
1984	8	1	0.09	2.5	1.32	0.03	1.26	14.07	29	0
1984	8	2	0.07	1.93	1.32	0.03	1.28	14.07	29	0
1984	8	3	0.15	1.48	1.32	0.03	1.19	14.07	29	0
1984	8	4	0.09	1.51	1.32	0.03	1.25	14.07	29	0
1984	8	5	0.08	1.4	1.32	0.03	1.26	14.07	29	0
1984	8	6	0.19	2.17	1.58	0.03	1.43	14.07	29	0
1984	9	1	0.11	1.67	1.32	0.03	1.23	14.07	29	0
1984	9	2	0.39	4.99	1.32	0.03	0.96	14.07	29	0
1984	9	3	0.4	6.26	1.32	0.03	0.94	14.07	29	0
1984	9	4	0.27	5.04	1.32	0.03	1.07	14.07	29	0
1984	9	5	0.18	4.38	1.32	0.03	1.16	14.07	29	0
1984	9	6	0.42	3.48	1.32	0.03	0.92	14.07	29	0
1984	10	1	0.48	10.4	1.32	0.03	0.87	14.07	29	0
1984	10	2	0.13	4.41	1.32	0.03	1.21	14.07	29	0
1984	10	3	0.22	2.02	1.32	0.03	1.12	14.07	29	0
1984	10	4	0.18	2.39	1.32	0.03	1.16	14.07	29	0
1984	10	5	0.22	2.31	1.32	0.03	1.13	14.07	29	0
1984	10	6	0.13	3.38	1.58	0.03	1.48	14.07	29	0
1984	11	1	0.15	1.61	1.32	0.03	1.2	14.07	29	0
1984	11	2	0.08	2.76	1.32	0.03	1.26	14.07	29	0
1984	11	3	0.08	4.87	1.32	0.03	1.26	14.07	29	0
1984	11	4	0.19	4.94	1.32	0.03	1.16	14.07	29	0
1984	11	5	0.14	5.57	1.32	0.03	1.2	14.07	29	0
1984	11	6	0.08	3.76	1.32	0.03	1.27	14.07	29	0
1984	12	1	0.1	19.97	1.32	0.03	1.24	14.07	29	0
1984	12	2	0.09	19.21	1.32	0.03	1.26	14.07	29	0
1984	12	3	0.15	7.94	1.32	0.03	1.2	14.07	29	0
1984	12	4	0.12	7.01	1.32	0.03	1.23	14.07	29	0
1984	12	5	0.1	3.33	1.32	0.03	1.24	14.07	29	0
1984	12	6	0.39	17.34	1.58	0.03	1.23	14.07	29	0

Table F-35 (7) Reservoir Operation Study for Heightening of Krenceng Dam (without Diversion Tunnel) (7/12)

Net supply yield: 3.05m3/sec
Water conveyance capacity: 3.05 m3/sec of 27.2 km pipe line

(Unit : 10^6 m3)

Year	Month	Serial No. of 5 day period	Inflow discharge		Supply yeild	Evapo	Water conveyance from Cida	Krenceng	Reservoir	Spillout
			Krenceng	Cidanau intake				Storage volume	Water level (El-m)	
1985	1	1	0.11	9.49	1.32	0.03	1.23	14.07	29	0
1985	1	2	0.41	8.38	1.32	0.03	0.94	14.07	29	0
1985	1	3	0.11	16.18	1.32	0.03	1.23	14.07	29	0
1985	1	4	0.09	5.53	1.32	0.03	1.26	14.07	29	0
1985	1	5	0.12	3.77	1.32	0.03	1.23	14.07	29	0
1985	1	6	0.23	6.98	1.58	0.03	1.38	14.07	29	0
1985	2	1	0.1	5.16	1.32	0.02	1.24	14.07	29	0
1985	2	2	0.09	5.12	1.32	0.02	1.26	14.07	29	0
1985	2	3	0.07	6.31	1.32	0.02	1.27	14.07	29	0
1985	2	4	0.05	3.27	1.32	0.02	1.29	14.07	29	0
1985	2	5	0.18	5.68	1.32	0.02	1.16	14.07	29	0
1985	2	6	0.65	3.67	0.79	0.01	0.78	14.07	29	0
1985	3	1	0.17	5.65	1.32	0.02	1.17	14.07	29	0
1985	3	2	0.38	18.22	1.32	0.02	0.96	14.07	29	0
1985	3	3	0.14	14.18	1.32	0.02	1.19	14.07	29	0
1985	3	4	0.15	4.8	1.32	0.02	1.19	14.07	29	0
1985	3	5	0.08	2.99	1.32	0.02	1.26	14.07	29	0
1985	3	6	0.15	2.65	1.58	0.03	1.46	14.07	29	0
1985	4	1	0.11	1.83	1.32	0.02	1.23	14.07	29	0
1985	4	2	0.15	2.37	1.32	0.02	1.19	14.07	29	0
1985	4	3	0.25	4.57	1.32	0.02	1.09	14.07	29	0
1985	4	4	0.57	9.42	1.32	0.02	0.77	14.07	29	0
1985	4	5	0.18	6.9	1.32	0.02	1.16	14.07	29	0
1985	4	6	0.18	7.61	1.32	0.02	1.16	14.07	29	0
1985	5	1	0.1	6.54	1.32	0.02	1.23	14.07	29	0
1985	5	2	0.08	5.09	1.32	0.02	1.26	14.07	29	0
1985	5	3	0.09	4.03	1.32	0.02	1.25	14.07	29	0
1985	5	4	0.06	3.38	1.32	0.02	1.28	14.07	29	0
1985	5	5	0.05	3.62	1.32	0.02	1.29	14.07	29	0
1985	5	6	0.09	3.49	1.58	0.03	1.51	14.07	29	0
1985	6	1	0.06	2.26	1.32	0.02	1.28	14.07	29	0
1985	6	2	0.08	2.06	1.32	0.02	1.26	14.07	29	0
1985	6	3	0.05	2.49	1.32	0.02	1.28	14.07	29	0
1985	6	4	0.06	3.07	1.32	0.02	1.28	14.07	29	0
1985	6	5	0.21	3.17	1.32	0.02	1.13	14.07	29	0
1985	6	6	0.06	2.9	1.32	0.02	1.28	14.07	29	0
1985	7	1	0.07	2.05	1.32	0.02	1.27	14.07	29	0
1985	7	2	0.14	2.08	1.32	0.02	1.2	14.07	29	0
1985	7	3	0.17	2.3	1.32	0.02	1.17	14.07	29	0
1985	7	4	0.17	2.46	1.32	0.02	1.17	14.07	29	0
1985	7	5	0.27	5.96	1.32	0.02	1.07	14.07	29	0
1985	7	6	0.11	7.88	1.58	0.03	1.5	14.07	29	0
1985	8	1	0.25	5.37	1.32	0.03	1.1	14.07	29	0
1985	8	2	0.09	5.21	1.32	0.03	1.25	14.07	29	0
1985	8	3	0.06	3.17	1.32	0.03	1.28	14.07	29	0
1985	8	4	0.06	2.71	1.32	0.03	1.28	14.07	29	0
1985	8	5	0.05	2.06	1.32	0.03	1.3	14.07	29	0
1985	8	6	0.07	1.82	1.58	0.03	1.55	14.07	29	0
1985	9	1	0.04	1.18	1.32	0.03	1.18	13.95	28.92	0
1985	9	2	0.08	1.2	1.32	0.03	1.2	13.89	28.89	0
1985	9	3	0.06	4.41	1.32	0.03	1.32	13.92	28.91	0
1985	9	4	0.05	3.4	1.32	0.03	1.32	13.95	28.92	0
1985	9	5	0.04	2.39	1.32	0.03	1.32	13.96	28.93	0
1985	9	6	0.1	2.22	1.32	0.03	1.32	14.03	28.98	0
1985	10	1	0.12	1.75	1.32	0.03	1.27	14.07	29	0
1985	10	2	0.1	2.66	1.32	0.03	1.24	14.07	29	0
1985	10	3	0.07	5.63	1.32	0.03	1.27	14.07	29	0
1985	10	4	0.34	7.23	1.32	0.03	1.01	14.07	29	0
1985	10	5	0.07	9.42	1.32	0.03	1.27	14.07	29	0
1985	10	6	0.08	5.41	1.58	0.03	1.53	14.07	29	0

Table F-35 (8) Reservoir Operation Study for Heightening of Krenceng Dam (without Diversion Tunnel) (8/12)

Net supply yield: 3.05m3/sec
Water conveyance capacity: 3.05 m3/sec of 27.2 km pipe line

(Unit : 10^6 m3)

Year	Month	Serial No. of 5 day period	Inflow discharge		Supply yeild	Evapo	Water conveyance from Cida	Krenceng Reservoir		Spillout
			Krenceng	Cidanau intake				Storage volume	Water level (El-m)	
1985	11	1	0.08	4.09	1.32	0.03	1.26	14.07	29	0
1985	11	2	0.15	3.88	1.32	0.03	1.2	14.07	29	0
1985	11	3	0.06	4.31	1.32	0.03	1.29	14.07	29	0
1985	11	4	0.04	3	1.32	0.03	1.3	14.07	29	0
1985	11	5	0.06	3.71	1.32	0.03	1.29	14.07	29	0
1985	11	6	0.1	6.58	1.32	0.03	1.24	14.07	29	0
1985	12	1	0.3	14.57	1.32	0.03	1.04	14.07	29	0
1985	12	2	0.12	12.34	1.32	0.03	1.22	14.07	29	0
1985	12	3	0.05	4.18	1.32	0.03	1.29	14.07	29	0
1985	12	4	0.08	1.9	1.32	0.03	1.27	14.07	29	0
1985	12	5	0.12	1.76	1.32	0.03	1.22	14.07	29	0
1985	12	6	0.11	2.2	1.58	0.03	1.5	14.07	29	0
1986	1	1	0.08	6.53	1.32	0.03	1.27	14.07	29	0
1986	1	2	0.84	20.99	1.32	0.03	0.51	14.07	29	0
1986	1	3	0.29	22.16	1.32	0.03	1.05	14.07	29	0
1986	1	4	0.43	11.32	1.32	0.03	0.92	14.07	29	0
1986	1	5	1.2	23.29	1.32	0.03	0.15	14.07	29	0
1986	1	6	0.91	26.46	1.58	0.03	0.71	14.07	29	0
1986	2	1	0.34	12.29	1.32	0.02	1	14.07	29	0
1986	2	2	0.27	7.98	1.32	0.02	1.07	14.07	29	0
1986	2	3	0.48	10.55	1.32	0.02	0.86	14.07	29	0
1986	2	4	0.17	9.01	1.32	0.02	1.17	14.07	29	0
1986	2	5	0.23	7.44	1.32	0.02	1.11	14.07	29	0
1986	2	6	0.15	3.56	0.79	0.01	0.65	14.07	29	0
1986	3	1	0.26	5.17	1.32	0.02	1.08	14.07	29	0
1986	3	2	0.16	4.34	1.32	0.02	1.18	14.07	29	0
1986	3	3	0.24	3.49	1.32	0.02	1.1	14.07	29	0
1986	3	4	0.19	2.95	1.32	0.02	1.15	14.07	29	0
1986	3	5	0.18	12.63	1.32	0.02	1.16	14.07	29	0
1986	3	6	0.15	27.87	1.58	0.03	1.46	14.07	29	0
1986	4	1	0.3	10.56	1.32	0.02	1.04	14.07	29	0
1986	4	2	0.21	10.38	1.32	0.02	1.13	14.07	29	0
1986	4	3	0.28	8.2	1.32	0.02	1.06	14.07	29	0
1986	4	4	0.17	7.77	1.32	0.02	1.17	14.07	29	0
1986	4	5	0.13	4.78	1.32	0.02	1.21	14.07	29	0
1986	4	6	0.21	3.75	1.32	0.02	1.13	14.07	29	0
1986	5	1	0.1	5.48	1.32	0.02	1.24	14.07	29	0
1986	5	2	0.15	4.23	1.32	0.02	1.18	14.07	29	0
1986	5	3	0.17	4.24	1.32	0.02	1.17	14.07	29	0
1986	5	4	0.08	4.06	1.32	0.02	1.26	14.07	29	0
1986	5	5	0.11	2.58	1.32	0.02	1.23	14.07	29	0
1986	5	6	0.1	2.74	1.58	0.03	1.5	14.07	29	0
1986	6	1	0.06	2.56	1.32	0.02	1.28	14.07	29	0
1986	6	2	0.11	2.39	1.32	0.02	1.23	14.07	29	0
1986	6	3	0.22	2.19	1.32	0.02	1.12	14.07	29	0
1986	6	4	0.09	2.23	1.32	0.02	1.25	14.07	29	0
1986	6	5	0.05	2.56	1.32	0.02	1.28	14.07	29	0
1986	6	6	0.06	1.58	1.32	0.02	1.28	14.07	29	0
1986	7	1	0.1	1.21	1.32	0.02	1.21	14.04	28.98	0
1986	7	2	0.09	1.38	1.32	0.02	1.28	14.07	29	0
1986	7	3	0.3	2.01	1.32	0.02	1.04	14.07	29	0
1986	7	4	0.15	1.39	1.32	0.02	1.19	14.07	29	0
1986	7	5	0.08	1.08	1.32	0.02	1.08	13.89	28.89	0
1986	7	6	0.14	2.56	1.58	0.03	1.58	14.01	28.96	0
1986	8	1	0.05	2.62	1.32	0.03	1.32	14.03	28.97	0
1986	8	2	0.05	3.14	1.32	0.03	1.32	14.05	28.99	0
1986	8	3	0.15	3.71	1.32	0.03	1.21	14.07	29	0
1986	8	4	0.07	2.44	1.32	0.03	1.28	14.07	29	0
1986	8	5	0.05	1.25	1.32	0.03	1.25	14.02	28.97	0
1986	8	6	0.08	1.2	1.58	0.03	1.2	13.68	28.76	0