GOVERNMENT OF MALAYSIA

NATIONAL WATER RESOURCES STUDY, MALAYSIA
PERLIS-KEDAH-PULAU PINANG
REGIONAL WATER RESOURCES STUDY
PART 1

VOL. [illegible]

ANNEX

[illegible] DAM PROJECTS

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NATIONAL WATER RESOURCES STUDY MALAYSIA PERLIS-KEDAH-PULAU PINANG REGIONAL WATER RESOURCES STUDY PART 1 Vol.10 ANNEX

GOVERNMENT OF MALAYSIA

NATIONAL WATER RESOURCES STUDY, MALAYSIA
PERLIS-KEDAH-PULAU PINANG REGIONAL WATER RESOURCES STUDY
PART 1

VOL. 10
ANNEX

M. COST ESTIMATE OF PROPOSED DAM PROJECTS

N. ECONOMIC ANALYSIS OF PROPOSED SOURCE FACILITIES

FEBRUARY 1984

JAPAN INTERNATIONAL COOPERATION AGENCY

NATIONAL WATER RESOURCES STUDY, MALAYSIA
PERLIS-KEDAH-PULAU PINANG
REGIONAL WATER RESOURCES STUDY
PART 1

LIST OF VOLUMES

ABBREVIATIONS

(1) Organization/Plan

4MP	:	Fourth Malaysia Plan
DID (JPT)	:	Drainage and Irrigation Department
EPU	:	Economic Planning Unit
FELCRA	:	Federal Land Consolidation and Rehabilitation Authority
FELDA	:	Federal Land Development Authority
GSD	:	Geological Survey Department
JICA	:	Japan International Cooperation Agency
MADA	:	Muda Agricultural Development Authority
NEB (LIN)	:	National Electricity Board
NWRS	:	National Water Resources Study
PWD (JKR)	:	Public Works Department
RISDA	:	Rubber Industry Small-Holders Development Authority
WHO	:	World Health Organization

(2) Others

B	:	Benefit
BOD	:	Biochemical Oxygen Demand
C	:	Cost
COD	:	Chemical Oxygen Demand
D&I	:	Domestic and Industrial
dia.	:	Diameter
EIRR	:	Economic Internal Rate of Return
El.	:	Elevation Above Mean Sea Level
Eq.	:	Equation
Fig.	:	Figure
GDP	:	Gross Domestic Product
GNP	:	Gross National Product
H	:	Height, or Water Head
NHWL	:	Normal High Water Level
O&M	:	Operation and Maintenance
Q	:	Discharge
Ref.	:	Reference
SS	:	Suspended Solid

ABBREVIATIONS OF MEASUREMENT

Length

mm = millimeter
cm = centimeter
m = meter
km = kilometer
ft = foot
yd = yard

Area

cm^2 = square centimeter
m^2 = square meter
ha = hectare
km^2 = square kilometer

Volume

cm^3 = cubic centimeter
l = lit = liter
kl = kiloliter
m^3 = cubic meter
gal. = gallon

Weight

mg = milligram
g = gram
kg = kilogram
ton = metric ton
lb = pound

Time

s = second
min = minute
h = hour
d = day
y = year

Electrical Measures

V = Volt
A = Ampere
Hz = Hertz (cycle)
W = Watt
kW = Kilowatt
MW = Megawatt
GW = Gigawatt

Other Measures

% = percent
PS = horsepower
° = degree
' = minute
" = second
°C = degree in centigrade
10^3 = thousand
10^6 = million
10^9 = billion (milliard)

Derived Measures

m^3/s = cubic meter per second
cusec = cubic feet per second
mgd = million gallon per day
kWh = kilowatt hour
MWh = Megawatt hour
GWh = Gigawatt hour
kWh/y = kilowatt hour per year
kVA = kilovolt ampere
BTU = British thermal unit
psi = pound per square inch

Money

M$ = Malaysian ringgit
US$ = US dollar
¥ = Japanese Yen

CONVERSION FACTORS

	From Metric System	To Metric System
Length	1 cm = 0.394 inch 1 m = 3.28 ft = 1.094 yd 1 km = 0.621 mile	1 inch = 2.54 cm 1 ft = 30.48 cm 1 yd = 91.44 cm 1 mile = 1.609 km
Area	1 cm^2 = 0.155 sq.in 1 m^2 = 10.76 sq.ft 1 ha = 2.471 acres k km^2 = 0.386 sq.mile	1 sq.ft = 0.0929 m^2 1 sq.yd = 0.835 m^2 1 acre = 0.4047 ha 1 sq.mile = 2.59 km^2
Volume	1 cm^3 = 0.0610 cu.in 1 lit = 0.220 gal.(imp.) 1 kl = 6.29 barrels 1 m^3 = 35.3 cu.ft 10^6 m^3 = 811 acre-ft	1 cu.ft = 28.32 lit 1 cu.yd = 0.765 m^3 1 gal.(imp.) = 4.55 lit 1 gal.(US) = 3.79 lit 1 acre-ft = 1,233.5 m^3
Weight	1 g = 0.0353 ounce 1 kg = 2.20 lb 1 ton = 0.984 long ton = 1.102 short ton	1 ounce = 28.35 g 1 lb = 0.4536 kg 1 long ton = 1.016 ton 1 short ton = 0.907 ton
Energy	1 kWh = 3,413 BTU	1 BTU = 0.293 Wh
Temperature	°C = (°F - 32)·5/9	°F = 1.8°C + 32
Derived Measures	1 m^3/s = 35.3 cusec 1 kg/cm^2 = 14.2 psi 1 ton/ha = 891 lb/acre 10^6 m^3 = 810.7 acre-ft 1 m^3/s = 19.0 mgd	1 cusec = 0.0283 m^3/s 1 psi = 0.703 kg/cm^2 1 lb/acre = 1.12 kg/ha 1 acre-ft = 1,233.5 m^3 1 mgd = 0.0526 m^3/s
Local Measures	1 lit = 0.220 gantang 1 kg = 1.65 kati 1 ton = 16.5 pikul	1 gantang = 4.55 lit 1 kati = 0.606 kg 1 pikul = 60.6 kg

ANNEX M

COST ESTIMATE OF PROPOSED DAM PROJECTS

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1. INTRODUCTION

In the Perlis-Kedah-Pulau Pinang regional water resources study, six dams were recommended as source facilities to the demand areas in these three states. They are the Badak-Temin, Sari, Durian, Tawar-Muda and Beris dams in the State of Kedah and the Rui dam in the State of Perak.

For the purpose of optimization of dam scale some cases of alternative dam height (normal H.W.L.) were studied for each dam site as stated in the Volume 5, Annex O "Proposed Dam Project".

This report presents a summary of the assumed construction schedule and cost estimate of the six proposed dams. The contents herein are as follows:

(1) assumed basic work conditions and construction time schedule,

(2) criteria of cost estimate,

(3) unit construction costs and priced Bill of Quantities of construction work items, and

(4) construction cost of the six proposed dams and disbursement schedule.

2. WORK CONDITIONS

2.1 General

The principal features of the representative alternatives on the six proposed dams are summarized in Tables 1 and 2.

The rockfill type was primarily selected for all the dam site, but the concrete gravity type was also studied for the Sari and Beris dam sites taking into account physical conditions. On the otherhand, three alternative dam sites were studied for the Rui dam.

Location of the proposed six dams is shown in Fig. 1.

2.2 Construction Time Schedule

It is assumed that the construction works of any of the proposed dams will be commenced in the middle of 1986 after 2 years of the feasibility study and detailed design period.

The construction works will include the tendering, preparatory works and main works. The construction period was estimated to be 4 years for both rockfill and concrete gravity dams except the Rui dam.

The construction period for the Rui dam was planned to be 5 years due to the works of power house and transfar tunnel.

The procedure is summarized as follows:

1983	Prefeasibility study
1984	Feasibility study
1985 - 1986	Detailed design
1986 - 1987	Tendering and preparatory works
1987 - 1989	Main construction works for the Durian, Sari, Badak-Temin, Beris and Tawar-Muda dams
1987 - 1990	Main construction works for the Rui dam

Figures 2 to 6 show the work sequence of rockfill type dams and concrete gravity dams, respectively.

2.3 Basic Conditions for Construction Works

The yearly workable day for each work item in the project area is estimated to be 190 days for earth works, 260 days for rock and concrete works and 290 days for tunnel works on the basis of meteorological data and actual work conditions of on-going dam projects in Malaysia.

Working hour is estimated to be 8 hours a day and 1 shift system is assumed for main construction works except for tunnel works which require a 2-shift system.

3. COST ESTIMATE

3.1 Procedure of Cost Estimate

Figures 7 and 8 show the flow chart of construction cost estimate and constitution of construction cost of a dam project in this study.

The construction cost is composed of the main construction cost, compensation cost, engineering and administration cost and contingency.

The main construction cost consists of costs of preparatory works, main construction works, miscellaneous works and transportation.

The compensation costs include land acquisition cost of flooded area, construction yard and land for access roads, and relocation cost of houses, buildings, public facilities, mines and roads. For further discussions on the compensation cost, refer to Volume 6, Annex O "LAND USE IN PROPOSED RESERVOIR AREAS".

The engineering and administration cost covers the costs for detailed design and supervision works.

The contingency includes the physical contingency.

Costs of the main construction works were estimated on the unit price basis, while the other costs were estimated on the lump sum basis.

3.2 Criteria and Assumptions

(1) Construction cost is estimated at 1982 constant price level.

(2) The exchange rate of currency is US$1.0 = M$2.35 = ¥255.

(3) All items of construction cost were expressed in terms of the Malaysian Ringgit including both foreign and local currency components.

3.3 Unit Construction Cost

The cost of main construction works is estimated on the unit cost basis, principally.

The unit cost of main construction works is divided into the direct and the indirect costs. The direct cost includes labour, material, equipment, miscellaneous and supervision costs while the indirect cost consists of contractor's profit and overhead costs.

(1) Labour cost

All kinds of labours required for the dam construction are available in Malaysia. The daily wage rates of major workers are estimated as shown in Table 3 on the basis of the market investigation.

(2) Material cost

It is assumed that all kinds of construction materials are also available in Malaysia. Table 4 shows unit prices of major construction materials required for the dam facilities.

(3) Equipment expenses

The costs of construction equipment and spare parts delivered at the port of Butterworth is estimated on the basis of market price in Japan plus inland transportation charge, ocean freight charge, insurance and landing cost at the port of Butterworth.

The equipment expense per unit a hour comprises of depreciation cost, reparing cost and management cost of equipment.

Table 5 shows the hourly equipment expenses of major construction equipment in which the foreign currency portion includes equipment and spare parts costs, transportation cost to the port of Butterworth and the premium of insurance and the local currency portion includes labour and material cost of repairing and landing cost at the port of Butterworth.

(4) Miscellaneous cost

The miscellaneous cost is assumed at 3% of the sum of labour and material costs.

(5) Contractor's supervision cost

The supervision cost is required for contractor's supervision of the construction works. It is assumed at 3% of the sum of labour, material, equipment and miscellaneous costs.

(6) Profit and overhead cost

Profit and overhead cost of contractor is assumed to be 15% of the direct cost referring to the on-going dam projects in Malaysia.

The costs of the main construction works on each proposed dam are shown with priced BQ in Tables 6 to 27.

3.4 Lump Sum Cost

(1) Preparatory works

The cost of preparatory works is assumed at 10% of the main construction works for the dam projects.

(2) Miscellaneous works

The cost of miscellaneous works covers those for unallocated minor works and it is assumed at 10% of the sum of costs of preparatory and main construction works. The cost will, however, not be necessary to be counted in the detailed design stage when the estimate is supported by detailed survey and investigation.

(3) Transportation cost

Transportation cost is assumed at 2% of the sum of the costs of preparatory, the main construction and miscellaneous works. It covers the inland transportation cost of the construction equipment and plant from Butterworth to the proposed dam sites.

(4) Engineering and administration

The cost of engineering and administration covers the detailed design and construction supervision costs. Its rate to the cost of main construction works is assumed at 40% in the Beris and Sari dam, 20% in the Rui dam and 25% in the other dams, respectively.

(5) Contingency

The project contingency consists of the physical contingency.

The physical contingency is assumed at 30% of the sum of the main construction, compensation and engineering and administration costs for the study of pre-feasibility stage.

4. CONSTRUCTION COST OF PROPOSED DAMS

The construction costs of the proposed dams were calculated by applying the unit costs and the lump sum costs, above mentioned.

Tables 28 to 48 give the total construction costs by major cost items and the disbursement schedule for each alternative of the dams.

TABLES

Table 1 PRINCIPAL FEATURE OF PROPOSED DAMS (1/2)

Name of Dam		Badak Temin	Sari	Durian
1. Main Dam				
Type		Rockfill & Concrete	Concrete	Rockfill
Crest length	m	1,013	150	697
Crest elevation	EL.m	50	89	79
Maximum height	m	29	41	39
Dam volume	10^3m^3	(R) 927 (C) 67	50	1,056
2. Subordinate Dam				
Number		4	1	1
Total crest length	m	2,106	190	152
Embankment volume	10^3m^3	462	24	28

Table 2 PRINCIPAL FEATURE OF PROPOSED DAMS (1/2)

Name of Dam		Tawar Muda	Beris	Rui 2	Rui 3
1. Main Dam					
Type		Rockfill	Concrete	Rockfill	Rockfill
Crest length	m	337	145	436	283
Crest elevation	El.m	82	89	246	244
Maximum height	m	34	42	73	73
Dam volume	10^3m^3	281	51	2,387	1,634
2. Subordinate Dam					
Number		3	1	-	-
Total crest length	m	1,520	115	-	-
Embankment volume	10^3m^3	913	70	-	-

Table 3 LABOUR WAGE

Unit: M$/d

No.	Category	Wage
1.	Foreman	55
2.	Operator	40
3.	Assistant Operator	30
4.	Driver	35
5.	Mechanic	40
6.	Electrician	40
7.	Concrete Worker	35
8.	Reinforcement Worker	35
9.	Carpenter	40
10.	Powder Operator	43
11.	Driller	35
12.	Boring Worker	35
13.	Grout Worker	30
14.	Common Labour	25

Table 4 UNIT PRICE OF CONSTRUCTION MATERIALS

No.	Material	Unit	Price (M$)
1.	Diesel oil	lit	0.423
2.	Lubricant	lit	2.320
3.	Gasoline	lit	1.027
4.	Grease	kg	4.922
5.	Dynamite	kg	9.15
6.	Cement	kg	0.184
7.	Reterder	kg	1.860
8.	Reinforcement Bar	ton	1,016.00
9.	Timber (Plank Square Log)	m^3	423.73
10.	H-shaped Steel, H125 x 125	kg	1.22
11.	Boring Rod	Nos.	105.00

Table 5 HOURLY EXPENSES OF MAJOR EQUIPMENTS

No.	Equipment	Capacity	F/C (M$)	L/C (M$)	Total (M$)
1.	Bulldozer	15 t	35.96	19.86	55.82
2.	Bulldozer w/ripper	21 t	62.28	34.36	96.64
3.	Bulldozer	32 t	77.23	42.61	119.84
4.	Tractor Shovel	1.4 m^3	27.71	15.37	43.08
5.	Wheel Loader	2.1 m^3	36.96	20.32	57.28
6.	Dump Truck	15 t	30.52	15.20	45.72
7.	Dump Truck	11 t	20.58	10.84	31.42
8.	Hydraulic Crane	10 t	31.95	16.61	48.56
9.	Tamping Roller	13.5 t	23.99	11.69	35.68
10.	Vibratory Roller	0.6 t	4.45	1.84	6.29
11.	Vibratory Roller	3 t	11.89	6.38	18.27
12.	Crawler Drill	10 m^3/min	23.47	9.97	33.44
13.	Leg Hammer	40 kg	8.93	1.93	10.86*
14.	Boring Machine	5.5 kW	31.25	17.07	48.32*
15.	Grout Pump	7.5 kW	25.97	14.03	40.00*
16.	Grout Mixer	600 l x 2	43.39	23.44	66.83*
17.	Rocker Shovel, S-Dump	0.4 m^3	47.54	21.96	69.50
18.	Battery Locomotive	6 t	28.98	17.13	46.11
19.	Aggregate Plant	50 t/h	113.80	57.75	171.55
20.	Concrete Plant	1.0 m^3 x 1	106.36	56.68	163.04
21.	Cable Crane	6 t	221.20	139.09	360.29

Remark; *; Equipment expense per day

Table 6 PRICED B.Q. OF MAIN CONSTRUCTION WORKS OF BADAK TEMIN DAM (1/2)

Unit: 10^3 M$

Work Item	Unit	Unit Price	Alternative 1 (N.H.W.L.: 45 m) Quantity	Alternative 1 (N.H.W.L.: 45 m) Amount	Alternative 2 (N.H.W.L: 40 m) Quantity	Alternative 2 (N.H.W.L: 40 m) Amount
1. Access Road						
Rolling	M	223.37	13,000	2,904	13,000	2,904
2. River Div. Works						
Exca. of Inlet & Outlet						
Common	CU.M	4.97	98,700	491	102,530	510
Gate	L.S			905		905
Initial Cofferdam						
Common	CU.M	6.60	26,300	174	26,300	174
Gabion	CU.M	49.33	6,120	302	6,120	302
Sub-total				1,872		1,891
3. Main Dam & Cofferdam						
Excavation, Dam						
Common	CU.M	4.97	175,500	872	161,330	802
Weathered Rock	CU.M	10.82	32,900	340	30,250	312
Rock	CU.M	26.25	36,180	950	34,380	902
Consolidation Grout						
Drilling	M	14.66	13,820	203	10,749	158
Grouting	TON	514.92	1,106	570	860	443
Curtain Grout						
Drilling	M	52.74	19,267	1,016	17,943	946
Grouting	TON	514.92	1,541	793	1,435	739
Gallery Concrete	CU.M	247.18	21,110	5,218	20,340	5,028
Embankment, Dam						
Core	CU.M	6.60	201,200	1,328	143,240	945
Filter	CU.M	37.50	130,100	4,879	96,640	3,624
Rock	CU.M	21.47	595,300	12,781	366,760	7,874
Riprap	CU.M	20.09	2,000	40	2,000	40
Sub-total				28,990		21,813
4. Spillway						
Excavation						
Common	CU.M	4.97	69,700	346	59,990	298
Weathered Rock	CU.M	10.32	17,500	181	15,790	163
Rock	CU.M	26.25	3,200	84	3,160	83
Concrete						
Mass Concrete	CU.M	142.86	63,900	9,129	42,400	6,057
Reinforced Concrete	CU.M	247.18	2,700	667	2,390	591
Back Fill	CU.M	7.52	4,770	36	4,320	32
Curtain Grout						
Drilling	M	52.74	2,377	125	2,377	125
Grouting	TON	514.92	190	98	190	98
Sub-total				10,666		7,447

Table 7 PRICED B.Q. OF MAIN CONSTRUCTION WORKS OF BADAK TEMIN DAM (2/2)

Unit: 10^3 M$

Work Item	Unit	Unit Price	Alternative 1 (N.H.W.L.: 45 m) Quantity	Alternative 1 (N.H.W.L.: 45 m) Amount	Alternative 2 (N.H.W.L.: 40 m) Quantity	Alternative 2 (N.H.W.L.: 40 m) Amount
5. Intake & Outlet Structure						
Shaft				-		-
Valve	L.S			423		423
Gate or Valve	L.S			126		126
Trash Rack	L.S			58		58
Penstock	L.S			70		70
Sub-total				677		677
6. Saddle Dam						
Excavation						
Common	CU.M	4.97	377,600	1,877	244,500	1,215
Weathered Rock	CU.M	10.32	70,800	731	45,840	473
Rock	CU.M	26.25	23,600	620	15,290	401
Embankment						
Core	CU.M	6.60	126,200	833	66,700	440
Filter	CU.M	37.50	80,300	3,011	21,590	810
Rock	CU.M	21.47	255,100	5,477	96,560	2,073
Curtain Grout						
Drilling	M	52.74	39,300	2,073	34,100	1,798
Grouting	TON	514.92	3,144	1,619	2,728	1,405
Sub-total				16,241		8,615
Total 1 to 6				61,350		43,347
Miscellaneous				6,749		4,768
Transportation				1,485		1,049
Grand Total				69,584		49,164

Table 8 PRICED B.Q. OF MAIN CONSTRUCTION WORKS OF SARI DAM (1/2)

Unit: 10^3 M$

Work Item	Unit	Unit Price	Alternative 1 Rockfill (N.H.W.L.: 85 m)		Alternative 2 Gravity (N.H.W.L.: 85 m)		Alternative 3 Gravity (N.H.W.L.: 80 m)	
			Quantity	Amount	Quantity	Amount	Quantity	Amount
1. Access Road								
Rolling	M	223.37	22,000	4,914	22,000	4,914	22,000	4,914
2. River Div. Works								
Exca. of Inlet & Outlet								
Common	CU.M	4.97	16,300	81	4,400	22	4,400	22
Weathered Rock	CU.M	10.32	4,500	46	500	5	500	5
Rock	CU.M	26.25	18,800	493	4,100	108	4,100	108
Conc. of Inlet & Outlet								
Mass Concrete	CU.M	142.86	900	129	1,000	143	1,000	143
Reinforced concrete	CU.M	247.18	1,400	346	700	173	700	173
Tunnel Excavation	CU.M	95.62	17,500	1,673	7,100	679	7,100	679
Tunnel Concrete	CU.M	263.67	6,500	1,714	2,600	686	2,600	686
Plug Concrete	CU.M	138.51	670	93	770	107	770	107
Backfill Grout	CU.M	175.29	613	107	187	33	187	33
Consolidation Grout								
Drilling	M	52.74	4,634	244	1,160	61	1,160	61
Grouting	TON	774.13	371	287	93	72	93	72
Curtain Grout								
Drilling	M	52.74	420	22	210	11	210	11
Grouting	TON	774.13	25	19	13	10	13	10
Gate	L.S		-	1,316	-	740	-	740
Initial Cofferdam								
Common	CU.M	6.60	8,050	53	8,050	53	8,050	53
Gabion	CU.M	49.33	540	27	540	27	540	27
Sub-total				6,650		2,930		2,930
3. Main Dam & Cofferdam								
Excavation, Dam								
Common	CU.M	4.97	11,800	59	3,300	16	3,700	18
Weathered Rock	CU.M	10.32	29,300	302	13,200	136	11,900	123
Rock	CU.M	26.25	21,600	567	14,400	378	14,300	375
Consolidation Grout								
Drilling	M	14.66	1,900	28	2,650	39	2,280	33
Grouting	TON	514.92	152	78	212	109	182	94
Curtain Grout								
Drilling	M	52.74	2,000	105	7,788	411	7,130	376
Grouting	TON	514.92	160	82	623	321	570	294
Gallery Concrete	CU.M	247.18	2,500	618	-	-	-	-
Embankment, Dam								
Core	CU.M	7.87	36,800	290	-	-	-	-
Filter	CU.M	11.22	20,100	226	-	-	-	-
Rock	CU.M	21.47	191,000	4,101	-	-	-	-
Concrete Gravity Dam	CU.M	141.59	-	-	52.500	7,433	45,000	6,372
Sub-total				6,456		8,845		7,685

Table 9 PRICED B.Q. OF MAIN CONSTRUCTION WORKS OF SARI DAM (2/2)

Unit: 10^3 M$

Work Item	Unit	Unit Price	Alternative 1 Rockfill (N.H.W.L.: 85 m)		Alternative 2 Gravity (N.H.W.L.: 85 m)		Alternative 3 Gravity (N.H.W.L.: 80 m)	
			Quantity	Amount	Quantity	Amount	Quantity	Amount
4. Spillway								
Excavation								
Common	CU.M	4.97	9,000	45	1,020	5	1,400	7
Weathered Rock	CU.M	10.32	10,000	103	914	9	1,300	13
Rock	CU.M	26.25	45,000	1,181	1,890	50	1,400	37
Concrete								
Mass Concrete	CU.M	142.86	14.400	2,057	2,590	370	2,340	334
Reinforced Concrete	CU.M	247.18	800	198	2,600	643	2,250	556
Back Fill	CU.M	7.52	2,200	17	1,770	13	1,500	11
Curtain Grout								
Drillling	M	52.74	1,000	53	280	15	280	15
Grouting	TON	514.92	80	41	22	11	22	11
Sub-total				3,695		1,116		984
5. Intake & Outlet Structure								
Valve	L.S			353		353		353
Gate or Valve	L.S			96		96		96
Trash Rack	L.S			29		29		29
Penstock	L.S			58		58		58
Sub-total				536		536		536
6, Saddle Dam								
Excavation								
Common	CU.M	4.97	12,200	61	12,200	61	-	-
Weathered Rock	CU.M	10.32	12,200	126	12,200	126	-	-
Embankment								
Core	CU.M	7.87	8,850	70	8,850	70	-	-
Filter	CU.M	11.22	5,390	60	5,390	60	-	-
Rock	CU.M	21.47	9,910	213	9,910	213	-	-
Curtain Grout								
Drilling	M	52.74	6,380	336	6,380	336	-	-
Grouting	TON	514.92	510	263	510	263	-	-
Sub-total				1,129		1,129	-	-
Total 1 to 6				23,380		19,468		17,049
Miscellaneous				2,572		2,141		1,875
Transportation				566		471		413
Grand Total				26,518		22,080		19,337

Table 10 PRICED B.Q. OF MAIN CONSTRUCTION WORKS OF DURIAN DAM (1/2)

Unit: 10^3 M$

Work Item	Unit	Unit Price	Alternative 1 (N.H.W.L.: 74 m) Quantity	Alternative 1 (N.H.W.L.: 74 m) Amount	Alternative 2 (N.H.W.L.: 69 m) Quantity	Alternative 2 (N.H.W.L.: 69 m) Amount
1. Access Road						
Rolling	M	223.37	16,000	3,574	16,000	3,574
2. River Div. Works						
Exca. of Inlet & Outlet						
Common	CU.M	4.97	52,720	262	52,720	262
Weathered Rock	CU.M	10.32	24,570	254	24,570	254
Rock	CU.M	26.25	30,210	793	30,210	793
Conc. of Inlet & Outlet						
Mass Concrete	CU.M	142.86	2,190	313	2,190	313
Tunnel Excavation	CU.M	95.62	12,270	1,173	12,270	1,173
Tunnel Concrete	CU.M	263.67	4,740	1,250	4,740	1,250
Plug Concrete	CU.M	138.51	590	82	590	82
Backfill Grout	CM.M	175.29	518	91	518	91
Consolidation Grout						
Drilling	M	52.74	3,787	200	3,787	200
Grouting	TON	774.13	303	235	303	235
Curtain Grout						
Drilling	M	52.74	420	22	420	22
Grouting	TON	774.13	25	19	25	19
Gate	L.S			1,316		1,316
Initial Cofferdam						
Common	CU.M	6.60	2,270	15	2,270	15
Gabion	CU.M	49.33	540	27	540	27
Sub-total				6,052		6,052
3. Main Dam & Cofferdam						
Excavation, Dam						
Common	CU.M	4.97	248,000	1,233	213,300	1,060
Weathered Rock	CU.M	10.32	66,100	682	60,940	629
Rock	CU.M	26.25	33,300	874	45,670	1,199
Consolidation Grout						
Drilling	M	14.66	13,500	198	8,380	123
Grouting	TON	514.92	1,080	556	670	345
Curtain Grout						
Drilling	M	52.74	16,800	886	15,440	814
Grouting	TON	514.92	1,344	692	1,235	636
Gallery Concrete	CU.M	247.18	14,100	3,485	12,710	3,142
Embankment, Dam						
Core	CU.M	7.27	189,400	1,377	159,730	1,161
Filter	CU.M	41.96	112,090	4,703	86,110	3,613
Rock	CU.M	25.93	754,600	19,567	571,960	14,831
Sub-total				34,253		27,553

Table 11 PRICED B.Q. OF MAIN CONSTRUCTION WORKS OF DURIAN DAM (2/2)

Unit: 10^3 M$

Work Item	Unit	Unit Price	Alternative 1 (N.H.W.L.: 74 m) Quantity	Alternative 1 (N.H.W.L.: 74 m) Amount	Alternative 2 (N.H.W.L.: 69 m) Quantity	Alternative 2 (N.H.W.L.: 69 m) Amount
4. Spillway						
Excavation						
Common	CU.M	4.97	123,000	611	140,500	698
Weathered Rock	CU.M	10.32	67,500	697	65,500	676
Rock	CU.M	26.25	71,700	1,882	63,400	1,664
Concrete						
Mass Concrete	CU.M	142.86	35,300	5,043	22,500	3,214
Reinforced Concrete	CU.M	247.18	1,860	460	1,180	292
Back Fill	CU.M	7.52	5,316	40	4,141	31
Curtain Grout						
Drilling	M	52.74	1,373	72	1,373	72
Grouting	TON	514.92	110	57	110	57
Sab-total				8,862		6,704
5. Intake & Outlet Structure						
Excavation, Open						
Rock	CU.M	26.25	300	8	300	8
Concrete, Open						
Mass Concrete	CU.M	142.86	1,100	157	1,100	157
Reinforced Concrete	CU.M	247.18	150	37	150	37
Shaft						
Excavation	CU.M	90.46	1,700	154	1,700	154
Reinforced Concrete	CU.M	263.67	420	111	420	111
Valve	L.S			353		353
Gate or Valve	L.S			788		788
Trash Rack	L.S			77		77
Penstock	L.S			186		186
Sub-total				1,871		1,871
6. Saddle Dam						
Excavation						
Common	CU.M	4.97	17,300	86	15,290	76
Weathered Rock	CU.M	10.32	7,800	80	4,370	45
Rock	CU.M	26.25	3,350	88	2,180	57
Embankment						
Core	CU.M	7.27	13,440	98	6,160	45
Filter	CU.M	41.96	2,170	91	1,150	48
Rock	CU.m	25.93	11,940	310	3,930	102
Curtain Grout						
Drilling	M	52.74	2,820	149	2,580	136
Grouting	TON	514.92	226	116	206	106
Sub-total				1,018		615
Total 1 to 6				55,630		46,369
Miscellaneous				6,118		5,101
Transportation				1,346		1,122
Grand Total				63,094		54,592

Table 12 PRICED B.Q. OF MAIN CONSTRUCTION WORKS OF TAWAR MUDA DAM (1/3)

Unit: 10^3 M$

Work Item	Unit	Unit Price	Alternative 1 (N.H.W.L: 77 m) Quantity	Alternative 1 (N.H.W.L: 77 m) Amount	Alternative 2 (N.H.W.L: 75 m) Quantity	Alternative 2 (N.H.W.L: 75 m) Amount	Alternative 3 (N.H.W.L.: 72 m) Quantity	Alternative 3 (N.H.W.L.: 72 m) Amount
1. Access Road								
Rolling	M	223.37	13.000	2,904	13,000	2,904	13,000	2,904
2. River Div. Works								
Exca. of Inlet & Outlet								
Common	CU.M	4.97	63,000	313	63,000	313	63,000	313
Weathered Rock	CU.M	10.32	22,700	234	22,700	234	22,700	234
Rock	CU.M	26.25	20,100	528	20,100	528	20,100	528
Conc. of Inlet & Outlet								
Mass Concrete	CU.M	142.86	700	100	700	100	700	100
Reinforced Concrete	CU.M	247.18	1,095	271	1,095	271	1,095	271
Tunnel Excavation	CU.M	95.62	18,330	1,753	18,330	1,753	18,330	1,753
Tunnel Concrete	CU.M	263.67	6,770	1,785	6,770	1,785	6,770	1,785
Plug Concrete	CU.M	138.51	595	82	595	82	595	82
Backfill Grout	CU.M	175.29	547	96	547	96	547	96
Consolidation Grout								
Drilling	M	52.74	3,535	186	3,535	186	3,535	186
Grouting	TON	774.13	283	219	283	219	283	219
Curtain Grout								
Drilling	M	52.74	420	22	420	22	420	22
Grouting	TON	774.13	25	19	25	19	25	19
Gate	L.S			905		905		905
Initial Cofferdam								
Common	CU.M	6.60	1,000	7	1,000	7	1,000	7
Cabion	CU.M	49.33	660	33	660	33	660	33
Sub-total				6,553		6,553		6,553
3. Main Dam & Cofferdam								
Excavation, Dam								
Common	CU.M	4,97	98,400	489	86,200	428	87,100	433
Weathered Rock	CU.M	10,32	48,000	495	45,500	470	43,500	449
Rock	CU.M	26,25	14,300	375	14,190	372	14,100	370
Consolidation Grout								
Drilling	M	14.66	3,000	44	2,770	41	2,450	36
Grouting	TON	514.92	240	124	222	114	196	101
Curtain Grout								
Drilling	M	52.74	2,400	127	2,350	124	2,260	119
Grouting	TON	514.92	192	99	188	97	181	93
Gallery Concrete	CU.M	247.18	4,500	1,112	4,430	1,095	4,300	1,063
Embankment, Dam								
Core	CU.M	7.27	53,500	389	44,700	325	38,000	276
Filter	CU.M	6.85	25,100	172	21,400	147	19,000	130
Rock	CU.M	21.47	202,000	4,337	175,400	3,766	138,000	2,963
Sub-total				7,763		6,979		6,033

Table 13 PRICED B.Q. OF MAIN CONSTRUCTION WORKS OF TAWAR MUDA DAM (2/3)

Unit: 10^3 MS

Work Item	Unit	Unit Price	Alternative 1 (N.H.W.L.: 77 m)		Alternative 2 (N.H.W.L.: 75 m)		Alternative 3 (N.H.W.L.: 72 m)	
			Quantity	Amount	Quantity	Amount	Quantity	Amount
4. Spillway								
Excavation								
Common	CU.M	4.97	133,000	661	128,300	638	118,800	590
Weathered Rock	CU.M	10.32	46,600	481	45,900	474	45,700	472
Rock	CU.M	26.25	23,900	627	28,700	753	27,400	719
Concrete								
Mass Concrete	CU.M	142.86	58,600	8,372	54,300	7,757	49,600	7,086
Reinforced Concrete	CU.M	247.18	3,100	766	2,900	717	2,600	643
Back Fill	CU.M	7.52	16,600	125	16,500	124	16,300	123
Curtain Grout								
Drilling	M	52.74	840	44	840	44	840	44
Grouting	TON	514.92	67	34	67	34	67	34
Sub-total				11,110		10,541		9,711
5. Intake & Outlet Structure								
Excavation, Open								
Rock	CU.M	26.25	400	11	400	11	400	11
Concrete, Open								
Mass Concrete	CU.M	142.86	1,100	157	1,100	157	1,100	157
Reinforced Concrete	CU.M	247.18	200	49	200	49	200	49
Shaft								
Excavation	CU.M	90.46	1,400	127	1,400	127	1,400	127
Reinforced Concrete	CU.M	263.67	350	92	350	92	350	92
Valve	L.S			529		529		529
Gate or Valve	L.S			645		645		645
Trash Rack	L.S			77		77		77
Penstock	L.S			698		698		698
Sub-total				2,385		2,385		2,385
6. Saddle Dam								
Excavation								
Common	CU.M	4.97	263,000	1,307	238,500	1,185	205,400	1,021
Weathered Rock	CU.M	10.32	117,500	1,213	103,800	1,071	84,800	875
Rock	CU.M	26.25	13,010	342	2,760	72	1,540	40
Embankment								
Core	CU.M	7.27	188,620	1,371	166,050	1,207	129,400	941
Filter	CU.M	6.85	113,400	777	98,700	676	83,600	573
Rock	CU.M	21.47	611,300	13,125	503,000	10,799	356,000	7,643
Curtain Grout								
Drilling	M	52.74	15,200	802	13,150	694	12,200	643
Grouting	TON	514.92	1,216	626	1,052	542	976	503
Tunnel								
Excavation	CU.M	95.62	2,060	197	2,060	197	2,060	197
Concrete	CU.M	263.67	957	252	957	252	957	252
Plug Concrete	CU.M	138.51	106	15	106	15	106	15
Gate	L.S			658		658		658

Table 14 PRICED B.Q. OF MAIN CONSTRUCTION WORKS OF TAWAR MUDA DAM (3/3)

Unit: 10^3 M$

Work Item	Unit	Unit Price	Alternative 1 (N.H.W.L.: 77 m) Quantity	Alternative 1 (N.H.W.L.: 77 m) Amount	Alternative 2 (N.H.W.L.: 75 m) Quantity	Alternative 2 (N.H.W.L.: 75 m) Amount	Alternative 3 (N.H.W.L.: 72 m) Quantity	Alternative 3 (N.H.W.L.: 72 m) Amount
Backfill Grout	CU.M	175.29	103	18	103	18	103	18
Consolidation Grout								
Drilling	M	52.74	1,092	58	1,092	58	1,092	58
Grouting	TON	774.13	87	67	87	67	87	67
Curtain Grout								
Drilling	M	52.74	210	11	210	11	210	11
Grouting	TON	774.13	13	10	13	10	13	10
Excavation, App. Channel								
Common	CU.M	4.97	2,620	13	2,620	13	2,620	13
Weathered Rock	CU.M	10.32	7,860	81	7,860	81	7,860	81
Rock	CU.M	26.25	2,620	69	2,620	69	2,620	69
Cofferdam								
Common	CU.M	6.60	6,300	42	6,300	42	6,300	42
Sub-total				21,054		17,737		13,730
Total 1 to 6				51,769		47,099		41,316
Miscellaneous				5,695		5,181		4,545
Transportation				1,253		1,140		1,000
Grand Total				58,717		53,420		46,861

Table 15 PRICED B.Q. OF MAIN CONSTRUCTION WORKS OF BERIS NO.2 DAM (GRAVITY) (1/2)

Unit: 10^3 M$

Work Item	Unit	Unit Price	Alternative 1 (N.H.W.L.: 85 m)		Alternative 2 (N.H.W.L.: 82 m)		Alternative 3 (N.H.W.L.: 77 m)	
			Quantity	Amount	Quantity	Amount	Quantity	Amount
1. Access Road								
Rolling	M	223.37	11,000	2,457	11,000	2,457	11,000	2,457
2. River Div. Works								
Exca. of Inlet & Outlet								
Common	CU.M	4.97	5,000	25	5,000	25	5,000	25
Weathered Rock	CU.M	10.32	3,400	35	3,400	35	3,400	35
Rock	CU.M	26.25	7,000	184	7,000	184	7,000	184
Conc. of Inlet & Outlet								
Reinforced Concrete	CU.M	247.18	900	222	900	222	900	222
Tunnel Excavation	CU.M	95.62	7,700	736	7,580	725	7,400	708
Tunnel Concrete	CU.M	263.67	2,900	765	2,860	754	2,800	738
Plug Concrete	CU.M	138.51	520	72	490	68	440	61
Backfill Grout	CU.M	175.29	210	37	210	37	210	37
Consolidation Grout								
Drilling	M	52.74	1,358	72	1,358	72	1,358	72
Grouting	TON	774.13	109	84	109	84	109	84
Curtain Grout								
Drilling	M	52.74	210	11	210	11	210	11
Grouting	TON	774.13	13	10	13	10	13	10
Gate	L.S		740			740		740
Initial Cofferdam								
Common	CU.M	6.60	1,600	11	1,600	11	1,600	11
Gabion	CU.M	49.33	720	36	720	36	720	36
Sub-total				3,040		3,014		2,974
3. Main Dam & Cofferdam								
Excavation, Dam								
Common	CU.M	4.97	9,310	46	8,740	43	7,870	39
Weathered Rock	CU.M	10.32	4,160	43	4,150	43	4,160	43
Rock	CU.M	26.25	15,300	402	15,240	400	15,280	401
Consolidation Grout								
Drilling	M	14.66	1,900	28	1,600	23	1,200	18
Grouting	TON	514.92	152	78	128	66	96	49
Curtain Grout								
Drilling	M	52.74	2,800	148	2,500	132	2,300	121
Grouting	TON	514.92	224	115	200	103	184	95
Concrete Gravity Dam	CU.M	141.59	57,560	8,150	49,900	7,065	38,860	5,502
Sub-total				9,010		7,875		6,268

Table 16 PRICED B.Q. OF MAIN CONSTRUCTION WORKS OF BERIS NO.2 DAM (GRAVITY) (2/2)

Unit: 10^3 M$

Work Item	Unit	Unit Price	Alternative 1 (N.H.W.L.: 85 m) Quantity	Alternative 1 (N.H.W.L.: 85 m) Amount	Alternative 2 (N.H.W.L.: 82 m) Quantity	Alternative 2 (N.H.W.L.: 82 m) Amount	Alternative 3 (N.H.W.L.: 77 m) Quantity	Alternative 3 (N.H.W.L.: 77 m) Amount
4. Spillway								
Excavation								
Common	CU.M	4.97	8,430	42	8,000	40	7,450	37
Weathered Rock	CU.M	10.32	2,730	28	2,540	26	2,300	24
Rock	CU.M	26.25	10,920	287	10,180	267	9,180	241
Concrete								
Mass Concrete	CU.M	142.86	4,900	700	4,480	640	3,920	560
Reingorced Concrete	CU.M	247.18	3,120	771	2,720	672	2,140	529
Back Fill	CU.M	7.52	700	5	640	5	560	4
Sub-total				1,833		1,650		1,395
5. Intake & Outlet Structure								
Valve	L.S			529		529		529
Gate or Valve	L.S			170		170		170
Trash Rack	L.S			87		87		87
Penstock	L.S			101		101		101
Sub-total				887		887		887
6. Saddle Dam								
Excavation								
Common	CU.M	4.97	12,500	62	10,300	51	6,300	31
Weathered Rock	CU.M	10.32	25,000	258	20,400	211	12,670	131
Embankment								
Core	CU.M	7.87	22,800	179	16,800	132	8,360	66
Filter	CU.M	37.50	16,500	619	12,000	450	6,290	236
Rock	CU.M	21.47	65,000	1,396	41,300	887	16,100	346
Curtain Grout								
Drilling	M	52.74	3,990	210	3,500	185	2,620	138
Grouting	TON	514.92	319	164	280	144	210	108
Sub-total				2,888		2,060		1,056
Total 1 to 6				20,115		17,943		15,037
Miscellaneous				2,212		1,974		1,653
Transportation				487		434		364
Grand Total				22,814		20,351		17,054

Table 17 PRICED B.Q. OF MAIN CONSTRUCTION WORKS OF BERIS NO.2 DAM (ROCKFILL) (1/2)

Unit: 10^3 M$

Work Item	Unit	Unit Price	Alternative 4 (N.H.W.L.: 82 m) Quantity	Amount
1. Access Road				
Rolling	M	223.37	11,000	2,457
2. River Div. Works				
Exca. of Inlet & Outlet				
Common	CU.M	4.97	600	3
Weathered Rock	CU.M	10.32	1,200	12
Rock	CU.M	26.25	4,200	110
Conc. of Inlet & Outlet				
Reinforced Concrete	CU.M	247.18	2,200	544
Tunnel Excavation	CU.M	95.62	12,700	1,214
Tunnel Concrete	CU.M	263.67	4,900	1,292
Plug Concrete	CU.M	138.51	960	133
Backfill Grout	CU.M	175.29	470	82
Consolidation Grout				
Drilling	M	52.74	3,700	195
Grouting	TON	774.13	300	232
Curtain Grout				
Drilling	M	52.74	420	22
Grouting	TON	774.13	25	19
Gate	L.S			1,316
Initial Cofferdam				
Common	CU.M	6.60	1,800	12
Gabion	CU.M	49.33	720	36
Sub-total				5,222
3. Main Dam & Cofferdam				
Excavation, Dam				
Common	CU.M	4.97	19,700	98
Weathered Rock	CU.M	10.32	4,900	51
Rock	CU.M	26.25	12,200	320
Consolidation Grout				
Curtain Grout				
Drilling	M	52.74	6,300	332
Grouting	TON	514.92	504	260
Gallery Concrete	CU.M	247.18	3,200	791
Embankment, Dam				
Core	CU.M	7.87	35,800	282
Filter	CU.M	37.50	15,200	570
Rock	CU.M	21.47	161,100	3,459
Sub-total				6,163

Table 18 PRICED B.Q. OF MAIN CONSTRUCTION WORKS OF BERIS NO.2 DAM (ROCKFILL) (2/2)

Unit: 10^3 M$

Work Item	Unit	Unit Price	Alternative 4 (N.H.W.L.: 82 m) Quantity	Amount
4. Spillway				
Excavation				
Common	CU.M	4.97	12,500	62
Weathered Rock	CU.M	10.32	25,100	259
Rock	CU.M	26.25	87,700	2,302
Concrete				
Mass Concrete	CU.M	142.86	32,100	4,586
Reinforced Concrete	CU.M	247.18	3,600	890
Back Fill	CU.M	7.52	5,400	41
Curtain Grout				
Drilling	M	52.74	1,400	74
Grouting	TON	514.92	112	58
Sub-total				8,272
5. Intake & Outlet Structure				
Shaft	L.S			-
Valve	L.S			529
Gate or Valve	L.S			170
Trash Rack	L.S			87
Penstock	L.S			101
Sub-total				887
6. Saddle Dam				
Excavation				
Common	CU.M	4.97	70,300	349
Weathered Rock	CU.M	10.32	20,400	211
Embankment				
Core	CU.M	7.87	16,900	132
Filter	CU.M	37.50	12,000	450
Rock	CU.M	21.47	41,300	887
Curtain Grout				
Drilling	M	52.74	3,500	185
Grouting	TON	514.92	280	144
Sub-total				2,358
Total 1 to 6				25,359
Miscellaneous				2,789
Transportation				614
Grand Total				28,762

Table 19 PRICED B.Q. OF MAIN CONSTRUCTION WORKS OF RUI NO.2 DAM (1/6)

Unit: 10^3 M$

Work Item	Unit	Unit Price	Alternative 1 (N.H.W.L.: 241 m)		Alternative 2 (N.H.W.L.: 236 m)		Alternative 3 (N.H.W.L.: 231 m)	
			Quantity	Amount	Quantity	Amount	Quantity	Amount
1. Access Road								
Rolling	M	223.37	24,000	5,361	24,000	5,361	24,000	5,361
2. River Div. Works								
Exca. of Inlet & Outlet								
Common	CU.M	4.97	168,000	835	168,000	835	168,000	835
Weathered Rock	CU.M	10.32	36,000	372	36,000	372	36,000	372
Rock	CU.M	26.25	23,000	604	23,000	604	23,000	604
Conc. of Inlet & Outlet								
Mass Concrete	CU.M	142.86	1,900	271	1,900	271	1,900	271
Reinforced Concrete	CU.M	247.18	1,300	321	1,300	321	1,300	321
Tunnel Excavation	CU.M	95.62	56,000	5,355	56,000	5,355	56,000	5,355
Tunnel Concrete	CU.M	263,67	20,000	5,273	20,000	5,273	20,000	5,273
Plug Concrete	CU.M	138.51	2,400	332	2,400	332	2,400	332
Backfill Grout	CU.M	175.29	1,362	239	1,362	239	1,362	239
Consolidation Grout								
Drilling	M	52.74	7,320	386	7,320	386	7,320	386
Grouting	TON	774.13	586	454	586	454	586	454
Curtain Grout								
Drilling	M	52.74	420	22	420	22	420	22
Grouting	TON	774.13	25	19	25	19	25	19
Gate	L.S			2,303		2,303		2,303
Initial Cofferdam								
Common	CU.M	6.60	3,000	20	3,000	20	3,000	20
Gabion	CU.M	49.33	1,350	67	1,350	67	1,350	67
Sub-total				16,873		16,873		16,873
3. Main Dam & Cofferdam								
Excavation, Dam								
Common	CU.M	4.97	276,000	1,372	250,000	1,243	224,000	1,113
Weathered Rock	CU.M	10.32	220,000	2,270	201,000	2,074	179,000	1,847
Rock	CU.M	26.25	68,200	1,790	62,000	1,628	45,000	1,181
Consolidation Grout								
Drilling	M	14.66	16,800	246	15,200	223	13,700	201
Grouting	TON	514.92	1,344	692	1,216	626	1,096	564
Curtain Grout								
Drilling	M	52.74	27,600	1,456	25,100	1,324	22,600	1,192
Grouting	TON	514.92	2,208	1,137	2,008	1,034	1,808	931
Gallery Concrete	CU.M	247.18	11,000	2,719	9,700	2,398	8,700	2,150
Embankment, Dam								
Core	CU.M	6.60	444,800	2,936	395,500	2,610	366,500	2,419
Filter	CU.M	14.25	138,100	1,968	122,000	1,739	104,400	1,488
Rock	CU.M	23.50	1,804,100	42,396	1,490,000	35,015	1,219,400	28,656
Sub-total				58,982		49,914		41,742

Table 20 PRICED B.Q. OF MAIN CONSTRUCTION WORKS OF RUI NO.2 DAM (2/6)

Unit: 10^3 M$

Work Item	Unit	Unit Price	Alternative 1 (N.H.W.L.: 241 m)		Alternative 2 (N.H.W.L.: 236 m)		Alternative 3 (N.H.W.L.: 231 m)	
			Quantity	Amount	Quantity	Amount	Quantity	Amount
4. Spillway								
Excavation								
Common	CU.M	4.97	103,700	515	108,600	540	113,400	564
Weathered Rock	CU.M	10.32	155,600	1,606	162,900	1,681	170,100	1,755
Rock	CU.M	26.25	122,700	3,221	134,100	3,520	145,500	3,819
Concrete								
Mass Concrete	CU.M	142.86	64,700	9,243	62,200	8,886	59,700	8,529
Reinforced Concrete	CU.M	247.18	3,400	840	3,300	816	3,200	791
Back Fill	CU.M	7.52	38,200	287	38,200	287	38,200	287
Curtain Grout								
Drilling	M	52.74	9,100	480	9,100	480	9,100	480
Grouting	TON	514.92	428	220	428	220	428	220
Sub-total				16,412		16,430		16,445
5. Intake & Outlet Structure								
Exavation, Open								
Rock	CU.M	26.25	300	8	300	8	300	8
Concrete, Open								
Mass Concrete	CU.M	142.86	2,800	400	2,800	400	2,800	400
Reinforced Concrete	CU.M	247.18	150	37	150	37	150	37
Shaft								
Excavation	CU.M	90.46	4,500	407	4,500	407	4,500	407
Reinforced Concrete	CU.M	263.67	1,050	277	1,050	277	1,050	277
Valve	L.S			423		423		423
Gate or Valve	L.S			2,294		2,924		2,294
Trash Rack	L.S			135		135		135
Penstock	L.S			1,070		1,070		1,070
Sub-total				5,051		5,051		5,051
6. Transfar Tunnel (L=9KM)								
Excavation, Adit	CU.M	132.07	31,500	4,160	31,500	4,160	31,500	4,160
Concrete, Adit	CU.M	198.62	10,400	2,066	10,400	2,066	10,400	2,066
Tunnel Excavation	CU.M	137.02	163,300	22,375	163,300	22,375	163,300	22,375
Tunnel Concrete	CU.M	261.06	68,200	17,804	68,200	17,804	68,200	17,804
Backfill Grout	CU.M	175.29	7,065	1,238	7,065	1,238	7,065	1,238
Consolidation Grout								
Drilling	M	52.74	63,000	3,323	63,000	3,323	63,000	3,323
Grouting	TON	774.13	5,040	3,902	5,040	3,902	5,040	3,902
Curtain Grout								
Drilling	M	52.74	420	22	420	22	420	22
Grouting	TON	774.13	25	19	25	19	25	19
Sub-total				54,909		54,909		54,909

Table 21 PRICED B.Q. OF MAIN CONSTRUCTION WORKS OF RUI NO.2 DAM (3/6)

Unit: 10^3 M$

Work Item	Unit	Unit Price	Alternative 1 (N.H.W.L.: 241 m)		Alternative 2 (N.H.W.L.: 236 m)		Alternative 3 (N.H.W.L.: 231 m)	
			Quantity	Amount	Quantity	Amount	Quantity	Amount
7. Power Station								
Excavation	L.S			306		306		306
Concrete								
Sub-structure	L.S			1,964		1,964		1,964
Super-structure	L.S			4,090		4,090		4,090
Metal Works	L.S			5,109		4,406		3,626
Sub-total				11,469		10,766		9,986
8. Generating Equipment	L.S			16,246		14,210		12,347
9. Micro Hydropower	L.S			1,200		1,200		1,200
10. Transmission Line	L.S			4,465		4,465		4,465
Total 1 to 10				190,968		179,179		168,379
Miscellaneous				21,005		19,709		18,520
Transportation				4,621		4,336		4,075
Grand Total				216,594		203,224		190,974

Table 22 PRICED B.Q. OF MAIN CONSTRUCTION WORKS OF RUI NO.2 DAM (4/6)

Unit: 10^3 M$

Work Item	Unit	Unit Price	Alternative 4 (Up-stream) Quantity	Amount
1. Access Road				
Rolling	M	223.37	24,000	5,361
2. River Div. Works				
Exca. of Inlet & Outlet				
Common	CU.M	4.97	100,000	497
Weathered Rock	CU.M	10.32	54,000	557
Rock	CU.M	26.25	46,000	1,208
Conc. of Inlet & Outlet				
Mass Concrete	CU.M	142.86	1,900	271
Reinforced Concrete	CU.M	247.18	1,300	321
Tunnel Excavation	CU.M	95.62	43,000	4,112
Tunnel Concrete	CU.M	263.67	15,100	3,981
Plug Concrete	CU.M	138.51	2,400	332
Backfill Grout	CU.M	175.29	1,056	185
Consolidation Grout				
Drilling	M	52.74	5,670	299
Grouting	TON	774.13	454	351
Curtain Grout				
Drilling	M	52.74	420	22
Grouting	TON	774.13	25	19
Gate	L.S			2,303
Initial Cofferdam				
Common	CU.M	6.60	3,000	20
Gabion	CU.M	49.33	1,350	67
Sub-total				14,545
3. Main Dam Cofferdam				
Excavation, Dam				
Common	CU.M	4.97	209,500	1,041
Weathered Rock	CU.M	10.32	168,000	1,734
Rock	CU.M	26.25	42,000	1,103
Consolidation Grout				
Drilling	M	14.66	9,890	145
Grouting	TON	514.92	791	407
Curtain Grout				
Drilling	M	52.74	14,800	781
Grouting	TON	514.92	1,184	610
Gallery Concrete	CU.M	247.18	5,800	1,434
Embankment, Dam				
Core	CU.M	6.60	224,200	1,480
Filter	CU.M	14.25	87,100	1,241
Rock	CU.M	23.50	1,007,300	23,672
Sub-total				33,648

Table 23 PRICED B.Q. OF MAIN CONSTRUCTION WORKS OF RUI NO.2 DAM (5/6)

Unit: 10^3 M$

Work Item	Unit	Unit Price	Alternative 4 (Up-stream) Quantity	Amount
4. Spillway				
Excavation				
Common	CU.M	4.97	111,600	555
Weathered Rock	CU.M	10.32	167,500	1,729
Rock	CU.M	26.25	142,700	3,746
Concrete				
Mass Concrete	CU.M	142.86	65,600	9,372
Reingorced Concrete	CU.M	247.18	3,500	865
Back Fill	CU.M	7.52	23,900	180
Curtain Grout				
Drilling	M	52.74	8,500	448
Grouting	TON	514.92	680	350
Sub-total				17,245
5. Intake & Outlet Structure				
Excavation, Open				
Rock	CU.M	26.25	300	8
Concrete, Open				
Mass Concrete	CU.M	142.86	2,800	400
Reinforced Concrete	CU.M	247.18	150	37
Shaft				
Excavation	CU.M	90.46	4,500	407
Reinforced Concrete	CU.M	263.67	1,050	277
Valve	L.S			423
Gate or Valve	L.S			2,294
Trash Rack	L.S			135
Penstock	L.S			1,070
Sub-total				5,051
6. Transfar Tunnel (L=9KM)				
Excavation, Adit	CU.M	132.07	31,500	4,160
Concrete, Adit	CU.M	198.62	10,400	2,066
Tunnel Excavation	CU.M	137.02	163,300	23,375
Tunnel Concrete	CU.M	261.06	68,200	17,804
Backfill Grout	CU.M	175.29	7,065	1,238
Consolidation Grout				
Drilling	M	52.74	63,000	3,323
Grouting	TON	774.13	5,040	3,902
Curtain Grout				
Drilling	M	52.74	420	22
Grouting	TON	774.13	25	19
Sub-total				54,909

Table 24 PRICED B.Q. OF MAIN CONSTRUCTION WORKS OF RUI NO.2 DAM (6/6)

Unit: 10^3M$

Work Item	Unit	Unit Price	Alternative 4 (Up-stream) Quantity	Amount
7. Power Station				
Excavation	L.S			306
Concrete				
Sub-structure	L.S			1,964
Super-structure	L.S			4,090
Metal Works	L.S			5,109
Sub-total				11,469
8. Generating Equipment	L.S			16,246
9. Micro Hydropower	L.S			1,200
10. Transmission Line	L.S			4,465
Total 1 to 10				164,139
Miscellaneous				18,055
Transportation				3,972
Grand Total				186,166

Table 25 PRICED B.Q. OF MAIN CONSTRUCTION WORKS OF RUI NO.3 DAM (1/3)

Unit: 10^3 M$

Work Item	Unit	Unit Price	Alternative 1 (N.H.W.L.: 238 m) Quantity	Alternative 1 (N.H.W.L.: 238 m) Amount	Alternative 2 (N.H.W.L.: 233 m) Quantity	Alternative 2 (N.H.W.L.: 233 m) Amount	Alternative 3 (N.H.W.L.: 228 m) Quantity	Alternative 3 (N.H.W.L.: 228 m) Amount
1. Access Road								
Rolling	M	223.37	24,000	5,361	24,000	5,361	24,000	5,361
2. River Div. Works								
Exca. of Inlet & Outlet								
Common	CU.M	4.97	36,600	182	36,600	182	36,600	182
Weathered Rock	CU.M	10.32	24,400	252	24,400	252	24,400	252
Rock	CU.M	26.25	42,600	1,118	42,600	1,118	42,600	1,118
Conc. of Inlet & Outlet								
Mass Concrete	CU.M	142.86	4,970	710	4,970	710	5,000	714
Reinforced Concrete	CU.M	247.18	104	26	104	26	100	25
Tunnel Excavation	CU.M	95.62	43,700	4,179	43,700	4,179	43,700	4,179
Tunnel Concrete	CU.M	263.67	15,600	4,113	15,600	4,113	15,600	4,113
Plug Concrete	CU.M	138.51	2,580	357	2,580	357	2,580	357
Backfill Grout	CU.M	175.29	1,010	177	1,010	177	1,010	177
Consolidation Grout								
Drilling	M	52.74	5,362	283	5,362	283	5,362	283
Grouting	TON	774.13	429	332	429	332	429	332
Curtain Grout								
Drilling	M	52.74	420	22	420	22	420	22
Grouting	TON	774.13	25	19	25	19	25	19
Gate	L.S			2,303		2,303		2,303
Initial Cofferdam								
Common	CU.M	6.60	26,200	173	26,200	173	26,200	173
Gabion	CU.M	49.33	1,350	67	1,350	67	1,350	67
Sub-total				14,313		14,313		14,316
3. Main Dam & Cofferdam								
Excavation, Dam								
Common	CU.M	4.97	204,680	1,017	273,700	1,360	231,000	1,148
Weathered Rock	CU.M	10.32	78,480	810	78,200	807	66,000	681
Rock	CU.M	26.25	39,240	1,030	39,100	1,026	33,000	866
Consolidation Grout								
Drilling	M	14.66	15,900	233	13,200	194	11,900	174
Grouting	TON	514.92	1,272	655	1,056	544	952	490
Curtain Grout								
Drilling	M	52.74	14,900	786	12,400	654	14,800	781
Grouting	TON	514.92	1,192	614	992	511	1,184	610
Gallery Concrete	CU.M	247.18	6,700	1,656	6,100	1,508	5,500	1,359
Embankment, Dam								
Core	CU.M	6.60	234,780	1,550	195,400	1,290	173,600	1,146
Filter	CU.M	14.25	99,530	1,418	87,000	1,240	74,000	1,055
Rock	CU.M	23.50	1,300,080	30,552	1,091,000	25,639	921,500	21,655
Sub-total				40,321		34,773		29,965

Table 26 PRICED B.Q. OF MAIN CONSTRUCTION WORKS OF RUI NO.3 DAM (2/3)

Unit: 10^3 M$

Work Item	Unit	Unit Price	Alternative 1 (N.H.W.L.: 238 m) Quantity	Alternative 1 (N.H.W.L.: 238 m) Amount	Alternative 2 (N.H.W.L.: 233 m) Quantity	Alternative 2 (N.H.W.L.: 233 m) Amount	Alternative 3 (N.H.W.L.: 228 m) Quantity	Alternative 3 (N.H.W.L.: 228 m) Amount
4. Spillway								
Excavation								
Common	CU.M	4.97	269,300	1,338	268,200	1,333	267,000	1,327
Weathered Rock	CU.M	10.32	115,400	1,191	115,000	1,187	114,500	1,182
Rock	CU.M	26.25	156,900	4,119	167,200	4,389	177,400	4,657
Concrete								
Mass Concrete	CU.M	142.86	96,200	13,743	93,300	13,329	90,400	12,915
Reinforced Concrete	CU.M	247.18	5,000	1,236	4,900	1,211	4,800	1,186
Back Fill	CU.M	7.52	46,300	348	42,200	317	38,000	286
Curtain Grout								
Drilling	M	52.74	4,000	211	4,000	211	4,000	211
Grouting	TON	514.92	320	165	320	165	320	165
Sub-total				22,351		22,142		21,929
5. Intake & Outlet Structure								
Excavation, Open								
Rock	CU.M	26.25	300	8	300	8	300	8
Concrete, Open								
Mass Concrete	CU.M	142.86	2,800	400	2,800	400	2,800	400
Reinforced Concrete	CU.M	247.18	150	37	150	37	150	37
Shaft								
Excavation	CU.M	90.46	4,500	407	4,500	407	4,500	407
Reinforced Concrete	CU.M	263.67	1,050	277	1,050	277	1,050	277
Valve	L.S			423		423		423
Gate or Valve	L.S			2,294		2,294		2,294
Trash Rack	L.S			135		135		135
Penstock	L.S			1,070		1,070		1,070
Sub-total				5,051		5,051		5,051
6. Transfar Tunnel (L=9KM)								
Excavation, Adit	CU.M	132.07	31,500	4,160	31,500	4,160	31,500	4,160
Concrete, Adit	CU.M	198.62	10,400	2,066	10,400	2,066	10,400	2,066
Tunnel Excavation	CU.M	137.02	163,300	22,375	163,300	22,375	163,300	22,375
Tunnel Concrete	CU.M	261,06	68,200	17,804	68,200	17,804	68,200	17,804
Backfill Grout	CU.M	175,29	7,065	1,238	7,065	1,238	7,056	1,238
Consolidation Grout								
Drilling	M	52.74	63,000	3,323	63,000	3,323	63,000	3,323
Grouting	TON	774.13	5,040	3,902	5,040	3,902	5,040	3,902
Curtain Grout								
Drilling	M	52.74	420	22	420	22	420	22
Grouting	TON	774.13	25	19	25	19	25	19
Sub-total				54,909		54,909		54,909

Table 27 PRICED B.Q. OF MAIN CONSTRUCTION WORKS OF RUI NO.3 DAM (3/3)

Unit: 10^3 M$

Work Item	Unit	Unit Price	Alternative 1 (N.H.W.L.: 238 m)		Alternative 2 (N.H.W.L.: 233 m)		Alternative 3 (N.H.W.L.: 228 m)	
			Quantity	Amount	Quantity	Amount	Quantity	Amount
7. Power Station								
Excavation	L.S			306		306		306
Concrete								
Sub-structure	L.S			1,964		1,964		1,964
Super-structure	L.S			4,090		4,090		4,090
Metal Works	L.S			5,109		4,406		3,626
Sub-total				11,469		10,766		9,986
8. Generating Equipment	L.S			16,246		14,210		12,347
9. Micro Hydropower	L.S			1,200		1,200		1,200
10. Transmission Line	L.S			4,465		4,465		4,465
Total to 1 to 10				175,686		167,190		159,529
Miscellaneous				19,325		18,388		17,548
Transportation				4,252		4,046		3,861
Grand Total				199,263		189,624		180,938

Table 28 ANNUAL DISBURSEMENT SCHEDULE (1/21)

Name of Dam: Badak-Temin Dam Type: Rockfill Scheme: Max. N.H.W.L.: 45 m

Unit: $M\$10^6$

Item	Amount	1985	1986	1987	1988	1989	1990
1. Preparatory Works	6.13	-	-	6.13	-	-	-
2. Main Construction Works	69.58	-	2.09	7.04	32.86	25.50	2.09
3. Engineering & Administration	18.93	6.63	3.79	1.89	2.84	2.84	0.94
4. Compensation	20.10	-	8.04	6.03	6.03	-	-
5. Physical Contingency	34.42	1.99	4.18	6.33	12.51	8.50	0.91
Total	149.16	8.62	18.10	27.42	54.24	36.84	3.94

Table 29 ANNUAL DISBURSEMENT SCHEDULE (2/21)

Name of Dam: Badak-Temin Dam Type: Rockfill Scheme: Min. N.H.W.L.: 40 m

Unit: $M\$10^6$

Item	Amount	1985	1986	1987	1988	1989	1990
1. Preparatory Works	4.34	-	-	4.34	-	-	-
2. Main Construction Works	49.16	-	1.47	6.26	24.60	15.36	1.47
3. Engineering & Administration	13.37	4.69	2.67	1.34	2.00	2.00	0.67
4. Compensation	14.50	-	5.80	4.35	4.35	-	-
5. Physical Contingency	24.41	1.40	2.99	4.88	9.28	5.22	0.64
Total	105.78	6.09	12.93	21.17	40.23	22.58	2.78

Table 30 ANNUAL DISBURSEMENT SCHEDULE (3/21)

Name of Dam: Sari Dam Type: Rockfill Scheme: --- N.H.W.L.: 85 m

Unit: M10^6

Item	Amount	1985	1986	1987	1988	1989	1990
1. Preparatory Works	2.34	-	-	2.34	-	-	-
2. Main Construction Works	26.52	-	0.80	10.90	8.77	5.25	0.80
3. Engineering & Administration	11.54	4.04	2.31	1.16	1.73	1.73	0.57
4. Compensation	15.20	-	6.08	4.56	4.56	-	-
5. Physical Contingency	16.68	1.21	2.75	5.69	4.52	2.10	0.41
Total	72.28	5.25	11.94	24.65	19.58	9.08	1.78

Table 31 ANNUAL DISBURSEMENT SCHEDULE (4/21)

Name of Dam: Sari Dam Type: Gravity Scheme: Max. N.H.W.L.: 85 m

Unit: M10^6

Item	Amount	1985	1986	1987	1988	1989	1990
1. Preparatory Works	1.94	-	-	1.94	-	-	-
2. Main Construction Works	22.08	-	0.67	7.78	6.96	6.00	0.67
3. Engineering & Administration	9.61	3.36	1.93	0.96	1.44	1.44	0.48
4. Compensation	15.20	-	6.08	4.56	4.56	-	-
5. Physical Contingency	14.65	1.01	2.59	4.59	3.89	2.23	0.34
Total	63.48	4.37	11.27	19.83	16.85	9.67	1.49

Table 32 ANNUAL DISBURSEMENT SCHEDULE (5/21)

Name of Dam: Sari Dam Type: Gravity Scheme: Min. N.H.W.L.: 80 m

Unit: M10^6$

Item	Amount	1985	1986	1987	1988	1989	1990
1. Preparatory Works	1.70	-	-	1.70	-	-	-
2. Main Construction Works	19.34	-	0.58	7.67	5.49	5.02	0.58
3. Engineering & Administration	8.41	2.95	1.68	0.84	1.26	1.26	0.42
4. Compensation	14.80	-	5.92	4.44	4.44	-	-
5. Physical Contingency	13.28	0.89	2.45	4.40	3.36	1.88	0.30
Total	57.53	3.84	10.63	19.05	14.55	8.16	1.30

Table 33 ANNUAL DISBURSEMENT SCHEDULE (6/21)

Name of Dam: Durian Dam Type: Rockfill Scheme: Max. N.H.W.L.: 74 m

Unit: M10^6$

Item	Amount	1985	1986	1987	1988	1989	1990
1. Preparatory Works	5.56	-	-	5.56	-	-	-
2. Main Construction Works	63.09	-	1.90	11.50	26.39	21.40	1.90
3. Engineering & Administration	17.16	6.02	3.43	1.71	2.57	2.57	0.86
4. Compensation	1.35	-	0.53	0.41	0.41	-	-
5. Physical Contingency	26.15	1.80	1.76	5.76	8.81	7.19	0.83
Total	113.31	7.82	7.62	24.94	38.18	31.16	3.59

Table 34 ANNUAL DISBURSEMENT SCHEDULE (7/21)

Name of Dam: Durian Dam Type: Rockfill Scheme: Min. N.H.W.L.: 69 m

Unit: M10^6

Item	Amount	1985	1986	1987	1988	1989	1990
1. Preparatory Works	4.64	-	-	4.64	-	-	-
2. Main Construction Works	52.59	-	1.58	11.26	22.19	15.98	1.58
3. Engineering & Administration	14.30	5.02	2.86	1.43	2.14	2.14	0.71
4. Compensation	1.16	-	0.46	0.35	0.35	-	-
5. Physical Contingency	21.81	1.50	1.47	5.30	7.41	5.44	0.69
Total	94.50	6.52	6.37	22.98	32.09	23.56	2.98

Table 35 ANNUAL DISBURSEMENT SCHEDULE (8/21)

Name of Dam: Tawar-Muda Dam Type: Rockfill Scheme: Max. N.H.W.L.: 77 m

Unit: M10^6

Item	Amount	1985	1986	1987	1988	1989	1990
1. Preparatory Works	5.18	-	-	5.18	-	-	-
2. Main Construction Works	58.72	-	1.76	12.05	22.70	20.45	1.76
3. Engineering & Administration	15.97	5.57	3.20	1.60	2.40	2.40	0.80
4. Compensation	8.30	-	3.32	2.49	2.49	-	-
5. Physical Contingency	26.45	1.67	2.48	6.39	8.29	6.85	0.77
Total	114.62	7.24	10.76	27.71	35.88	29.70	3.33

Table 36 ANNUAL DISBURSEMENT SCHEDULE (9/21)

Name of Dam: Tawar-Muda Dam Type: Rockfill Scheme: Med. N.H.W.L.: 75 m

Unit: M10^6$

Item	Amount	1985	1986	1987	1988	1989	1990
1. Preparatory Works	4.71	-	-	4.71	-	-	-
2. Main Construction Works	53.42	-	1.61	11.80	20.47	17.93	1.61
3. Engineering & Administration	14.53	5.08	2.90	1.46	2.18	2.18	0.73
4. Compensation	7.60	-	3.04	2.28	2.28	-	-
5. Physical Contingency	24.08	1.53	2.27	6.08	7.46	6.04	0.70
Total	104.34	6.61	9.82	26.33	32.39	26.15	3.04

Table 37 ANNUAL DISBURSEMENT SCHEDULE (10/21)

Name of Dam: Tawar-Muda Dam Type: Rockfill Scheme: Min. N.H.W.L.: 72 m

Unit: M10^6$

Item	Amount	1985	1986	1987	1988	1989	1990
1. Preparatory Works	4.14	-	-	4.14	-	-	-
2. Main Construction Works	46.86	-	1.40	11.52	17.89	14.65	1.40
3. Engineering & Administration	12.74	4.47	2.54	1.27	1.91	1.91	0.64
4. Compensation	6.30	-	2.52	1.89	1.89	-	-
5. Physical Contingency	21.01	1.34	1.94	5.65	6.50	4.97	0.61
Total	91.05	5.81	8.40	24.47	28.19	21.53	2.65

Table 38 ANNUAL DISBURSEMENT SCHEDULE (11/21)

Name of Dam: Beris No.2 Dam Type: Gravity Scheme: Max. N.H.W.L.: 85 m

Unit: M10^6$

Item	Amount	1985	1986	1987	1988	1989	1990
1. Preparatory Works	2.01	-	-	2.01	-	-	-
2. Main Construction Works	22.81	-	0.69	5.64	7.91	7.88	0.69
3. Engineering & Administration	9.93	3.46	1.99	1.00	1.49	1.49	0.50
4. Compensation	22.30	-	8.92	6.69	6.69	-	-
5. Physical Contingency	17.12	1.04	3.48	4.60	4.82	2.82	0.36
Total	74.17	4.50	15.08	19.94	20.91	12.19	1.55

Table 39 ANNUAL DISBURSEMENT SCHEDULE (12/21)

Name of Dam: Beris No.2 Dam Type: Gravity Scheme: Med. N.H.W.L.: 82 m

Unit: M10^6$

Item	Amount	1985	1986	1987	1988	1989	1990
1. Preparatory Works	1.79	-	-	1.79	-	-	-
2. Main Construction Works	20.35	-	0.61	5.56	6.93	6.64	0.61
3. Engineering & Administration	8.86	3.10	1.77	0.89	1.33	1.33	0.44
4. Compensation	18.70	-	7.48	5.61	5.61	-	-
5. Physical Contingency	14.91	0.93	2.95	4.16	4.16	2.39	0.32
Total	64.61	4.03	12.81	18.01	18.03	10.36	1.37

Table 40 ANNUAL DISBURSEMENT SCHEDULE (13/21)

Name of Dam: Beris No. 2 Dam Type: Gravity Scheme: Min.N.H.W.L.: 77 m

Unit: M10^6$

Item	Amount	1985	1986	1987	1988	1989	1990
1. Preparatory Works	1.51	-	-	1.51	-	-	-
2. Main Construction Works	17.05	-	0.52	5.43	5.60	4.98	0.52
3. Engineering & Administration	7.43	2.61	1.49	0.74	1.11	1.11	0.37
4. Compensation	12.60	-	5.04	3.78	3.78	-	-
5. Physical Contingency	11.58	0.78	2.11	3.44	3.15	1.83	0.27
Total	50.17	3.39	9.16	14.90	13.64	7.92	1.16

Table 41 ANNUAL DISBURSEMENT SCHEDULE (14/21)

Name of Dam: Beris No. 2 Dam Type: Rockfill Scheme: --- N.H.W.L.: 77 m

Unit: M10^6$

Item	Amount	1985	1986	1987	1988	1989	1990
1. Preparatory Works	2.54	-	-	2.54	-	-	-
2. Main Civil Works	28.76	-	0.86	7.92	10.95	8.17	0.86
3. Engineering & Administration	12.52	4.39	2.50	1.26	1.87	1.87	0.63
4. Compensation	12.60	-	5.04	3.78	3.78	-	-
5. Physical Contingency	16.93	1.31	2.53	4.64	4.99	3.01	0.45
Total	73.35	5.70	10.93	20.14	21.59	13.05	1.94

Table 42 ANNUAL DISBURSEMENT SCHEDULE (15/21)

Name of Dam: Rui No. 2 Dam Type: Rockfill Scheme: Max. N.H.W.L.: 241 m

Unit: $M\$10^6$

Item	Amount	1985	1986	1987	1988	1989	1990
1. Preparatory Works	19.09	-	-	19.09	-	-	-
2. Main Civil Works	216.59	-	6.51	54.36	79.59	49.49	26.64
3. Engineering & Administration	47.14	16.50	9.43	4.71	7.07	7.07	2.36
4. Compensation	0.30	-	0.12	0.09	0.09	-	-
5. Physical Contingency	84.94	4.94	4.81	23.48	26.04	16.97	8.70
Total	368.06	21.44	20.87	101.73	112.79	73.53	37.70

Table 43 ANNUAL DISBURSEMENT SCHEDULE (16/21)

Name of Dam: Rui No. 2 Dam Type: Rockfill Scheme: Med. N.H.W.L.: 236 m

Unit: $M\$10^6$

Item	Amount	1985	1986	1987	1988	1989	1990
1. Preparatory Works	17.92	-	-	17.92	-	-	-
2. Main Civil Works	203.22	-	6.11	53.40	73.91	45.28	24.52
3. Engineering & Administration	44.23	15.49	8.84	4.43	6.63	6.63	2.21
4. Compensation	0.20	-	0.08	0.06	0.06	-	-
5. Physical Contingency	79.67	4.64	4.51	22.74	24.19	15.57	8.02
Total	345.24	20.13	19.54	98.55	104.79	67.48	34.75

Table 44 ANNUAL DISBURSEMENT SCHEDULE (17/21)

Name of Dam: Rui No. 2 Dam Type: Rockfill Scheme: Min. N.H.W.L.: 231 m

Unit: M10^6$

Item	Amount	1985	1986	1987	1988	1989	1990
1. Preparatory Works	16.84	-	-	16.84	-	-	-
2. Main Civil Works	190.97	-	5.74	52.38	68.32	41.87	22.66
3. Engineering & Administration	41.56	14.56	8.31	4.16	6.23	6.23	2.07
4. Compensation	0.20	-	0.08	0.06	0.06	-	-
5. Physical Contingency	74.87	4.36	4.24	22.03	22.39	14.43	7.42
Total	324.44	18.92	18.37	95.47	97.00	62.53	32.15

Table 45 ANNUAL DISBURSEMENT SCHEDULE (18/21)

Name of Dam: Upstream Rui No. 2 Dam Type: Rockfill Scheme:-- N.H.W.L.: 241 m

Unit: M10^6$

Item	Amount	1985	1986	1987	1988	1989	1990
1. Preparatory Works	16.41	-	-	16.41	-	-	-
2. Main Civil Works	186.17	-	5.60	52.34	66.49	40.30	21.44
3. Engineering & Administration	40.51	14.18	8.10	4.06	6.07	6.07	2.03
4. Compensation	0.20	-	0.08	0.06	0.06	-	-
5. Physical Contingency	72.99	4.26	4.14	21.86	21.78	13.91	7.04
Total	316.28	18.44	17.92	94.73	94.40	60.28	30.51

Table 46 ANNUAL DISBURSEMENT SCHEDULE (19/21)

Name of Dam: Rui No. 3 Dam Type: Rockfill Scheme: Max. N.H.W.L.: 238 m

Unit: $M\$10^6$

Item	Amount	1985	1986	1987	1988	1989	1990
1. Preparatory Works	17.57	-	-	17.57	-	-	-
2. Main Civil Works	199.26	-	5.99	52.01	71.00	46.80	23.46
3. Engineering and Administration	43.37	15.19	8.67	4.34	6.50	6.50	2.17
4. Compensation	5.20	-	2.08	1.56	1.56	-	-
5. Physical Contingency	79.62	4.56	5.03	22.63	23.71	16.00	7.69
Total	345.02	19.75	21.77	98.11	102.77	69.30	33.32

Table 47 ANNUAL DISBURSEMENT SCHEDULE (20/21)

Name of Dam: Rui No. 3 Dam Type: Rockfill Scheme: Med. N.H.W.L.: 233 m

Unit: $M\$10^6$

Item	Amount	1985	1986	1987	1988	1989	1990
1. Preparatory Works	16.71	-	-	16.71	-	-	-
2. Main Civil Works	189.62	-	5.70	5.31	66.79	43.90	21.92
3. Engineering and Administration	41.27	14.44	8.26	4.13	6.19	6.19	2.06
4. Compensation	5.20	-	2.08	1.56	1.56	-	-
5. Physical Contingency	75.85	4.33	4.81	22.13	22.36	15.02	7.20
Total	328.65	18.77	20.85	95.84	96.90	65.11	31.18

Table 48 ANNUAL DISBURSEMENT SCHEDULE (21/21)

Name of Dam: Rui No. 3 Dam Type: Rockfill Scheme: Min. N.H.W.L.: 228 m

Unit: $M\$10^6$

Item	Amount	1985	1986	1987	1988	1989	1990
1. Preparatory Works	15.95	-	-	15.95	-	-	-
2. Main Civil Works	180.94	-	5.44	50.42	63.21	41.24	20.63
3. Engineering and Administration	39.37	13.79	7.87	3.94	5.90	5.90	1.97
4. Compensation	5.20	-	2.08	1.56	1.56	-	-
5. Physical Contingency	72.44	4.13	4.62	21.56	21.20	14.15	6.78
Total	313.90	17.92	20.01	93.43	91.87	61.29	29.38

FIGURES

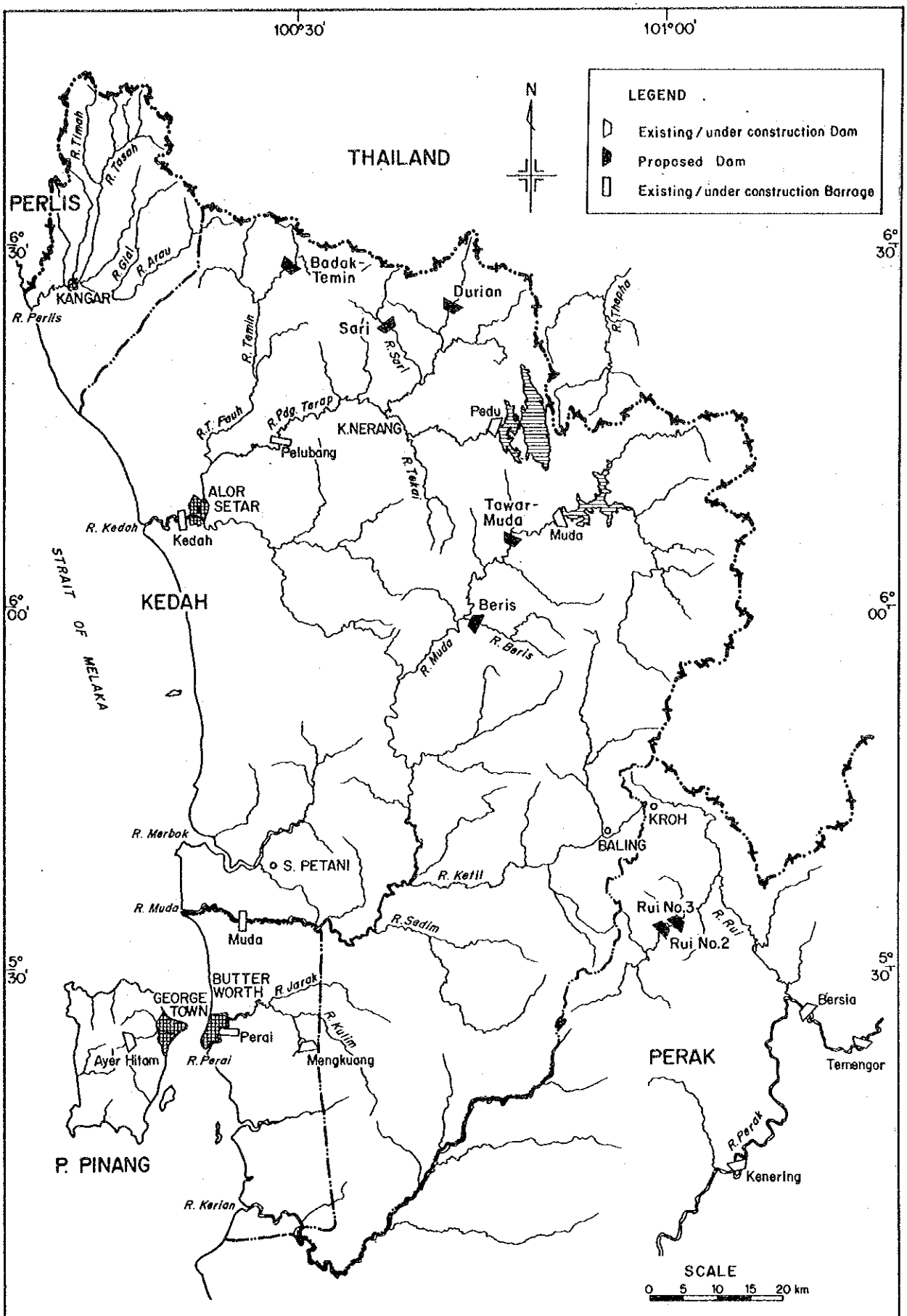

Fig.1 Location Map

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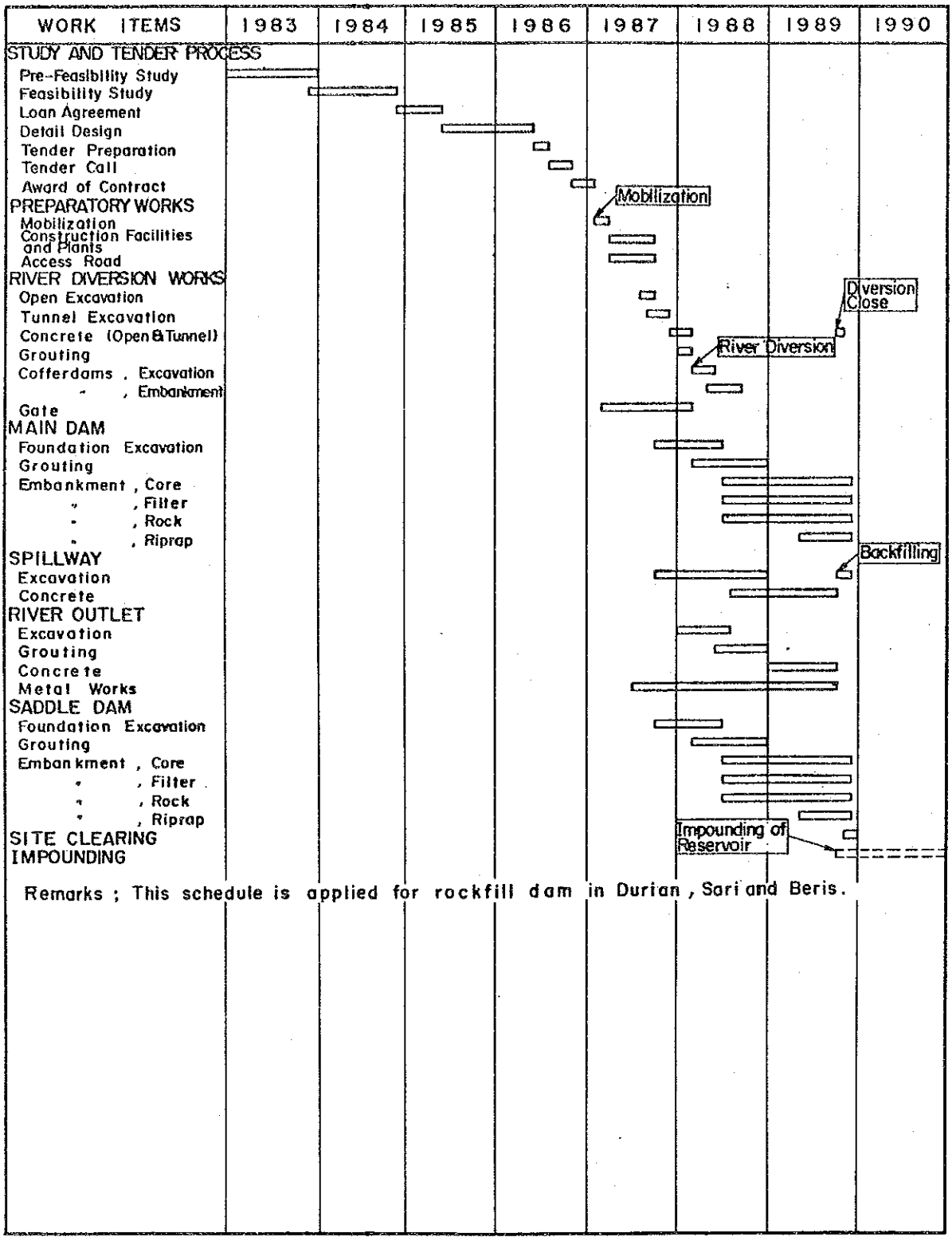

Remarks ; This schedule is applied for rockfill dam in Durian , Sari and Beris.

Fig.2 Construction Time Schedule of Rockfill Dam (1/4)

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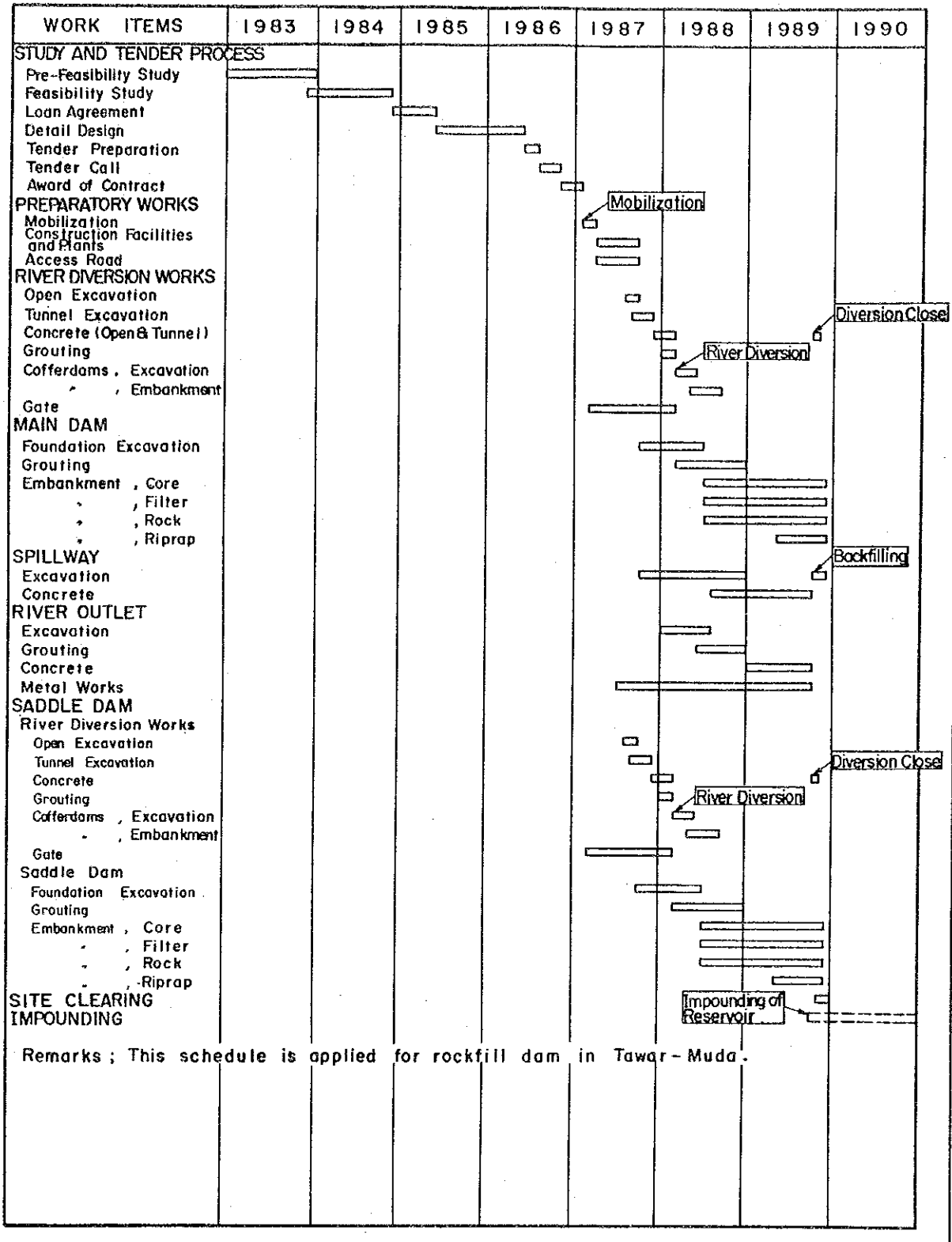

Fig.3 Construction Time Schedule of Rockfill Dam (2/4)

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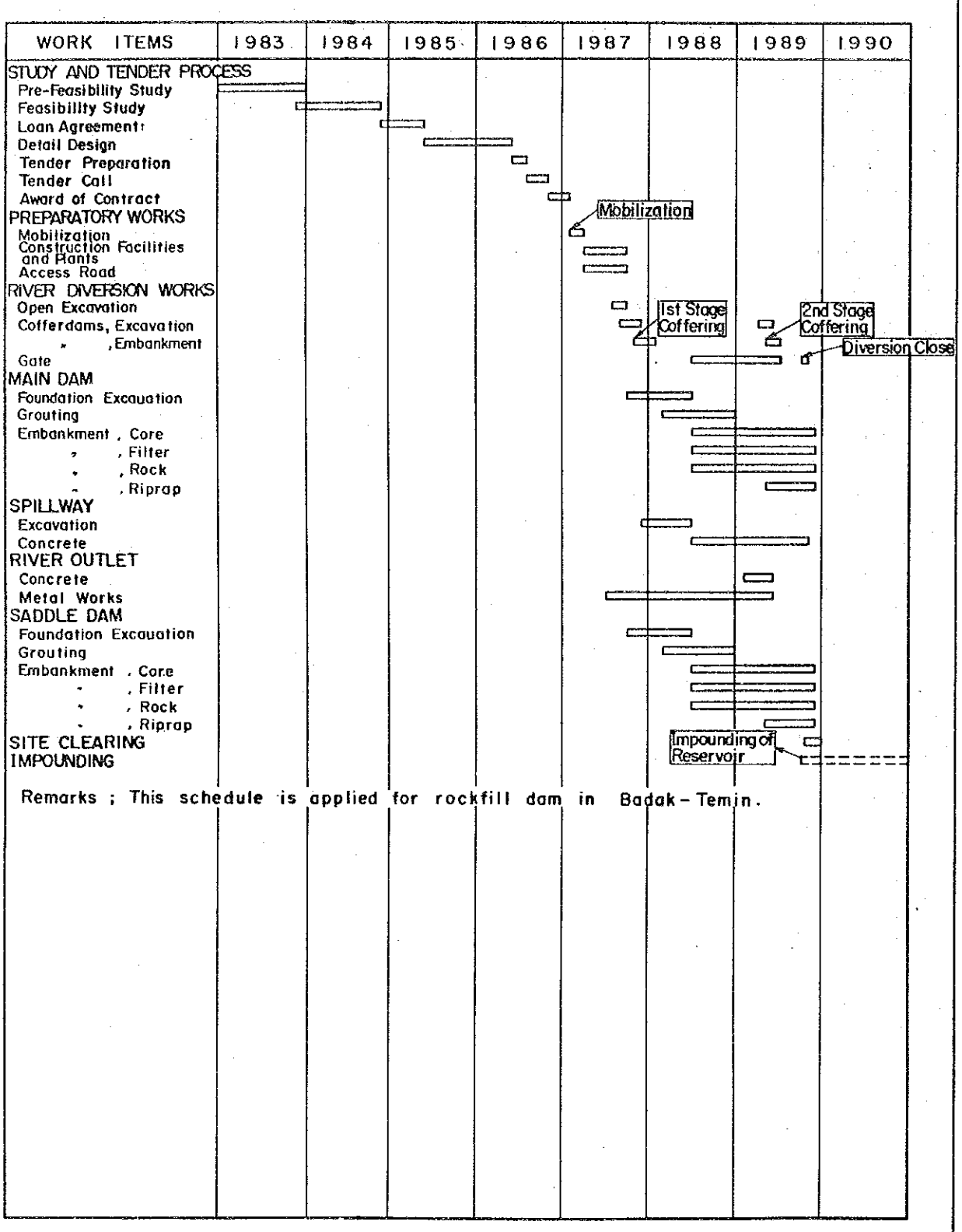

Fig.4 Construction Time Schedule of Rockfill Dam (3/4)

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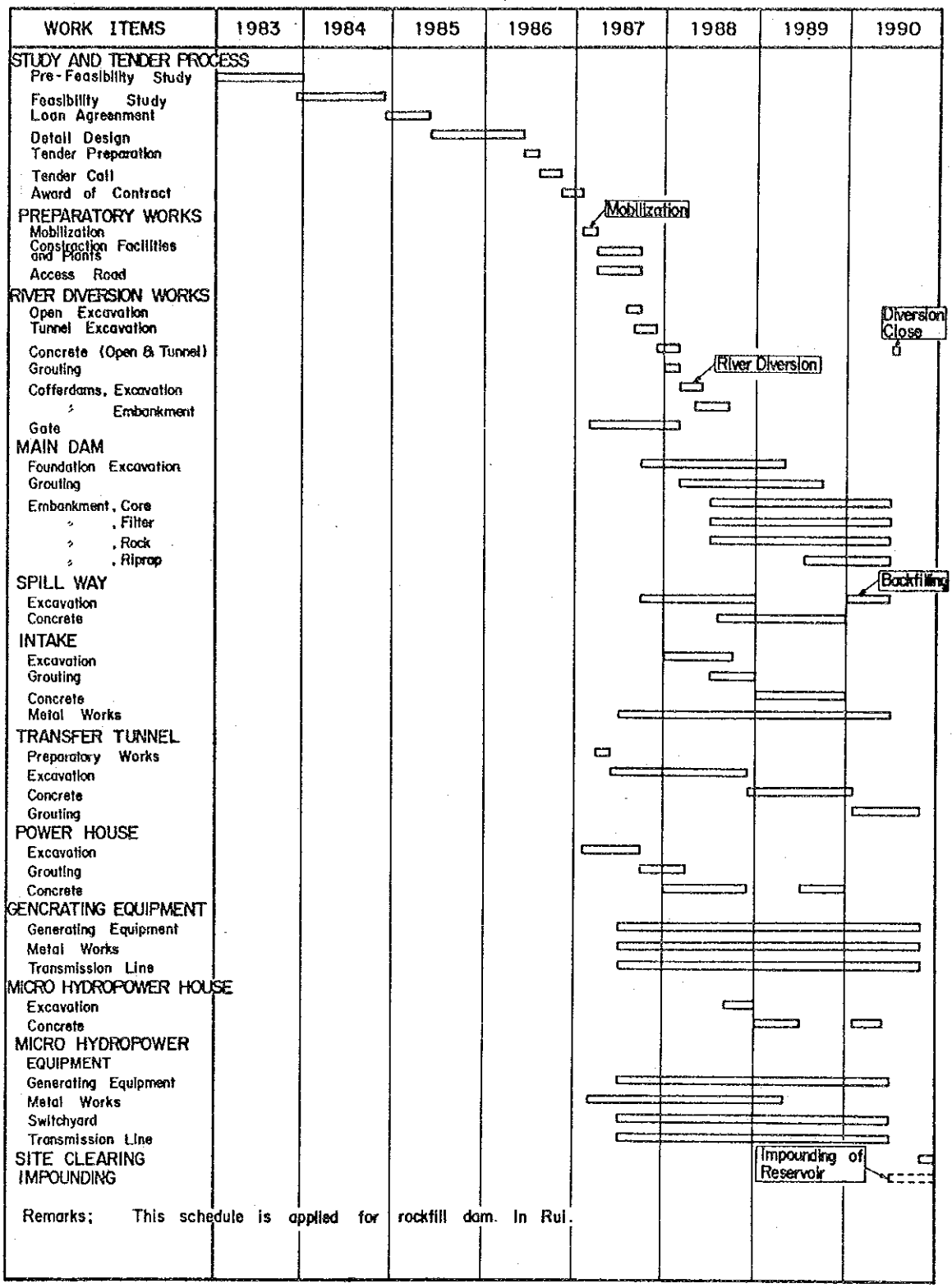

Fig.5 Construction Time Schedule of Rockfill Dam (4/4)

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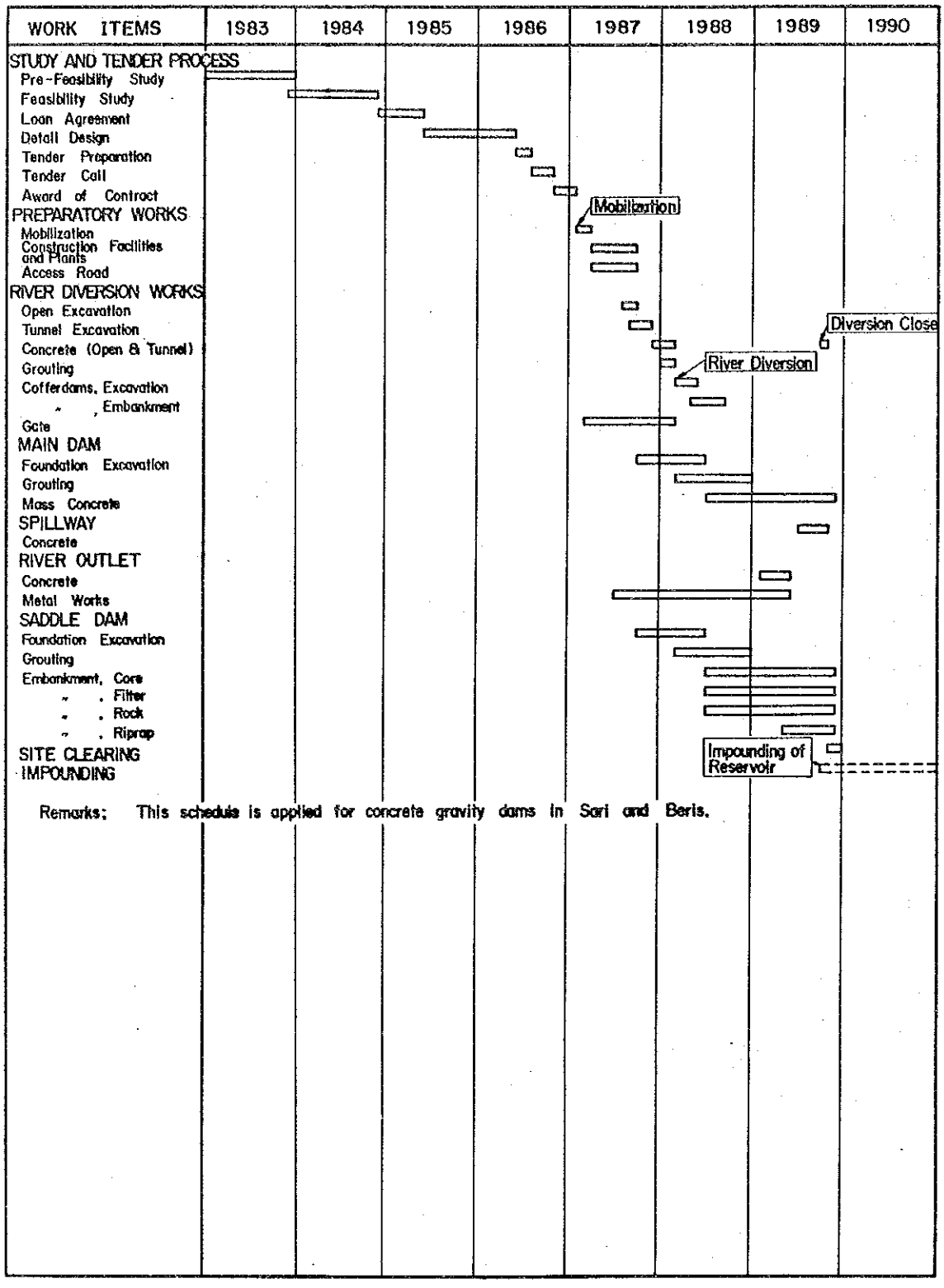

Fig.6 Construction Time Schedule of Concrete Gravity Dam

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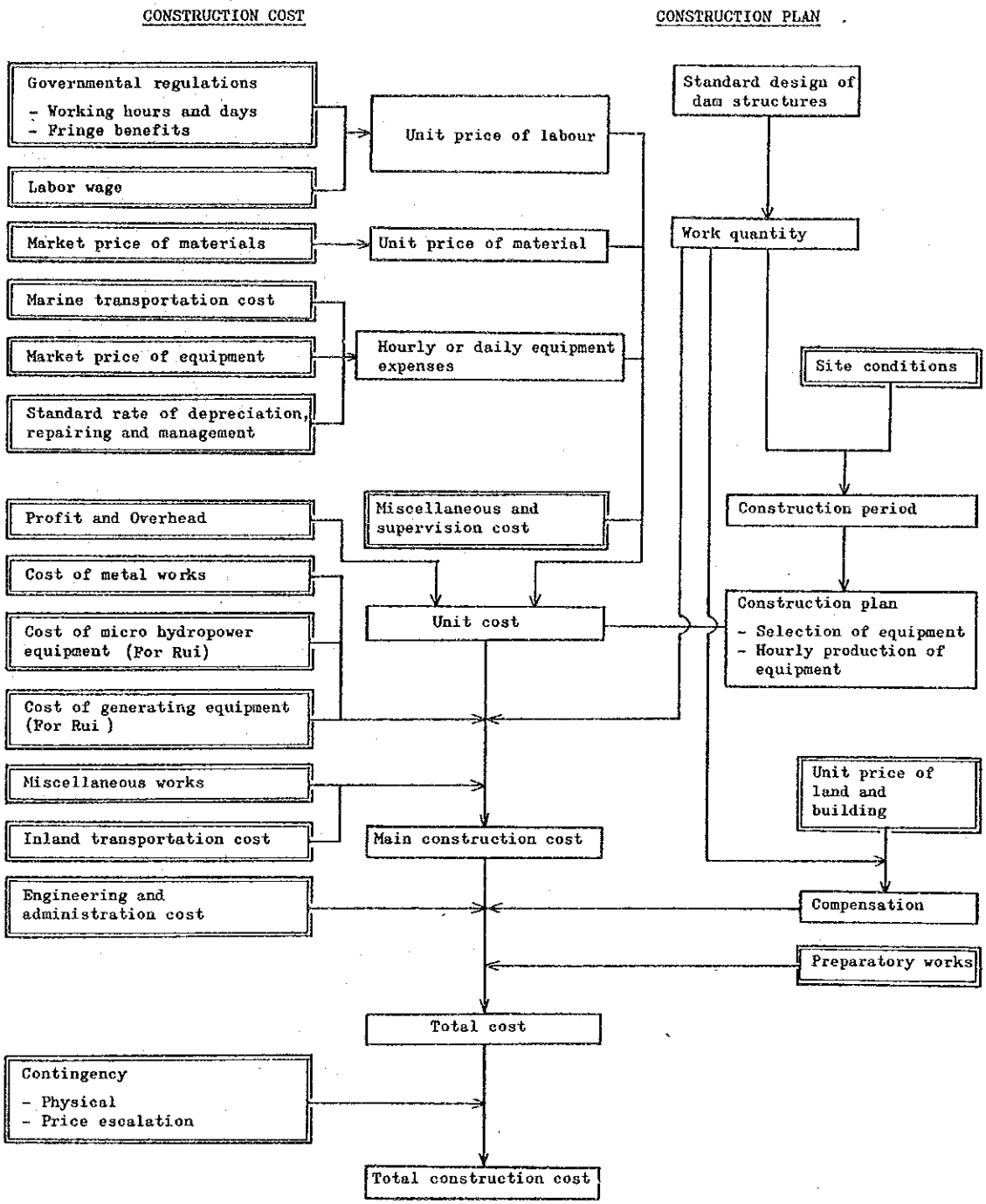

Fig.7 Flow Chart of Construction Cost Estimate

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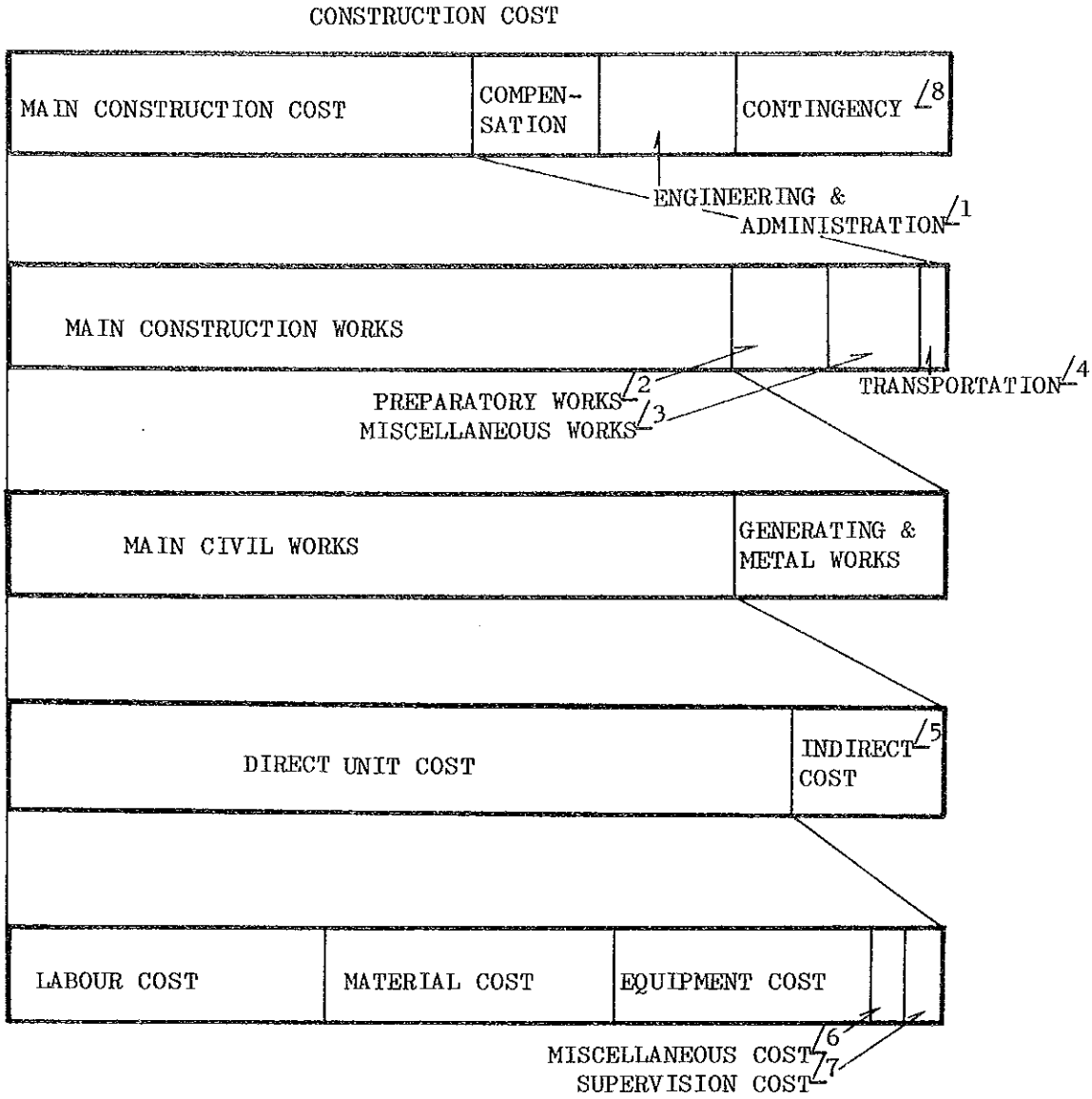

Remarks ; /1: 25% to 40% of MAIN CONSTRUCTION COST

/2: 10% of MAIN CONSTRUCTION WORKS

/3: 10% of MAIN CONSTRUCTION &PREPARATORY WORKS

/4: 2% of MAIN CONSTRUCTION,PREPARATORY & MISCELLANEOUS WORKS

/5: 15% of DIRECT COST (PROFIT & OVERHEAD)

/6: 3% of LABOUR & MATERIAL COST

/7: 3% of LABOUR,MATERIAL,EQUIPMENT & MISCELLANEOUS COST

/8: 30% of MAIN CONSTRUCTION COST,COMPENSATION & ENGINEERING

Fig.8 Constitution of Construction Cost

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ANNEX N

ECONOMIC ANALYSIS OF PROPOSED SOURCE FACILITIES

TABLE OF CONTENTS

LIST OF TABLES

1. INTRODUCTION

This ANNEX N presents the details of assumptions and calculations which are made in relation to the economic and financial analysis of water demand and supply balance Plan.

2. WATER DEMAND AND WATER DEFICIT

Water demand and water deficit are summarized herein, to the extent relevant to the economic analysis in the subsequent Chapters. The details of water demand are described in ANNEXes B and D and those of water deficit are compiled in ANNEX I.

Herein the following definitions are introduced:

(1) MADA or MADA main; the major irrigation scheme in the MADA area,

(2) MADA minor; minor irrigation schemes depending on off-take of the MADA canal or main stream of the Kedah river. MADA minor is main minor,

(3) Main minor; minor irrigation schemes in the main stream,

(4) Tributary minor or tributary; minor irrigation scheme depending on a tributary,

(5) D&I; domestic and industrial water supply,

(6) Main stream; a river stretch upstream of which a source project is assumed, and

(7) Tributary; a river stretch upstream of which no source project is assumed.

The annual water demand in the main stream of the Kedah and Muda rivers is summarized for 1982, 1990 and 2000 as shown in Table 1, based on Tables 10, 12, 15, 28 and 29 of ANNEX I. The Pinang Tungal irrigation scheme and public water supply system in the State of Pinang conjunctively utilize water in the Muda and Perai rivers. Their water demand is counted for only the portion which is supplied from the Muda river in estimating water demand in the main stream of the Muda-Perai river system.

The rate of river maintenance flow in Table 2 is a reproduction of Table 21 of ANNEX I.

Average annual water deficit by cause by affected area in Tables 3 and 4 are reproducted from Tables 60 and 62 of ANNEX I. The water deficit shown are that occuring in the main stream of the Kedah and Muda rivers on an average between 1961 and 1980.

Tables 5 to 7 are the reproduction of Tables 63 to 65 of ANNEX I, showing the net water output of the Jeniang system, Beris dam and Tawar-Muda dam broken down into the causes of water deficit. The net water output shown are an average annual volume between 1961 and 1980. The distribution of water output to causes is estimated for 3 different operation rules of the Jeniang system: In Alternative 1, the Jeniang system can take water from the Muda river only if it does not cause

water deficit in the Muda-Perai river system, in Alternative 2, the Jeniang system takes water so that the proportion of water deficit to water demand is even between the Kedah river system and Muda-Perai river system, and in Alternative 3, the Jeniang system can take water unless it does not interfere 1982 water demand in the Muda-Perai river system.

For all the Alternatives, the following roles of the source facilities are assumed:

The Jeniang system is constructed to supply water deficit within its net water output in MADA, minor irrigation projects in the main stream and domestic and industrial water supply which are existing and to be developed in the Kedah river system up to 2000. The Beris dam is constructed to supply most water deficit caused by increase in domestic and industrial water supply demand in the Muda-Perai river system, all water deficit caused by minor irrigation development in tributaries in both the Kedah and Muda-Perai river system, and a part of remaining water deficit in MADA, minor irrigation projects and domestic and industrial water supply in the Kedah river system. The Tawar-Muda dam is constructed to supply all remaining water deficit caused by increase in domestic and industrial water demand in the Muda-Perai river system and a part of water deficit in the MADA area, minor irrigation projects in the Kedah river system.

3. ECONOMIC BENEFITS AND COSTS

3.1 Economic Benefit

(1) Irrigation benefit

(a) Crop yield

According to the paddy statistics, the paddy yield in 1981/82 was 4.0 ton/ha for the main season cropping and 4.2 ton/ha for the dry season cropping in the MADA area, 2.1 ton/ha for the rainfed cropping, 3.4 ton/ha for the main season cropping and 3.5 ton/ha for the dry season cropping in other paddy cultivation areas in the Region. Under with-project condition, crop yield is assumed to be increased as the tertiary canal system and farm road network are improved and a reasonable cropping pattern is adopted which enables the optimum application of water and fertilizer, together with the adoption of suitable rice varieties to the regional climate. It is also assumed that 4 years will be required to achieve the full crop yield.

It is assumed that the paddy yield in the MADA area will be 4.2 ton/ha for the main season cropping, 5.0 ton/ha for the off season cropping on the transplanting fields and 4.8 ton/ha for the off season cropping on the direct-seeding fields under the condition that sufficient water is available and tertiary development is provided. For the minor irrigation projects which would be developed after 1982, paddy yield is assumed to be 4.2 ton/ha for the main season cropping and 4.8 ton/ha for the off season cropping under the condition that sufficient water is available and tertiary canal density is 45 m/ha.

Where the tertiary development is not provided yet in the MADA area, the crop yield is assumed to be identical with that under without-project condition but increased cropping intensity is assumed. The existing minor irrigation projects, whose canal density is generally low, is assumed that no structural improvement will be conducted and water demand will not be increased beyond the present level. Consequently, crop yield will remain at the present level.

(b) Cropping intensity

The schedule of double cropping a year in the MADA area is always staggered and the period of every two crops exceeds one year. This has resulted the cancel of one off season cropping every 6 years. The off season cropping area is limited within 94% of total area. These facts are caused by insufficient water availability. The average cropping intensity of 178% at present is assumed for the MADA area under without-project condition. The cropping intensity in

the existing minor irrigation projects has a wide range of 100% to 200% depending on water availability in each project. It is 108% in the Kedah river basin and 176% in the Muda river basin on an average. It is assumed that the present cropping intensity will remain the same to the future, water being used within the present water right.

Under with-project condition, cropping intensity in the whole MADA area is assumed to be 197%. For the minor irrigation projects to be developed after 1982, cropping intensity is assumed to be 150% if the projects get water from a tributary upstream of which there is neither existing nor assumed source project, and 200% if there were an existing or assumed source project upstream.

(c) Net incremental production value

The economic farm gate price of paddy is estimated to be M$459/ton in 1982 and M$609/ton in 1995 at 1982 constant price level, based on the actual price in 1982 and projected price for 1995 by IBRD for the standard 15% broken Thai grade, assuming an average milling ratio of 65%. It is assumed that the farm gate price of paddy will linearly increase between the above-mentioned prices from 1982 to 1995 and it will be constant thereafter (See Table 29 of ANNEX C).

The net production value of paddy is estimated from the economic point of view, as the balance between the gross production value and production cost including family labor cost and fertilizer cost, which was estimated based on international market price (See Table 32 of ANNEX C). The net production value in 1995 onward at 1982 price level with insufficient water at present is estimated as shown in Table 8. In the same table, the paddy yield and net production value with sufficient water are also shown.

In estimating rice yield in case that water deficit is not fully avoided, it is normally assumed that the crop area is reduced in proportion to water available, as the relationship between water applied and rice yield has not been quantified. In this Study, therefore, it is assumed that the net production value in an area will be reduced in proportion to the water deficit/water demand.

The net incremental production value which is the balance between the net production values with- and without-project conditions in 2003 onward is shown in Table 9. Net production value streams with- and without-project condition were prepared for the Kedah river basin as shown in Table 10 and for the Muda-Perai river basin as shown in Table 11, based on data in ANNEX C.

(2) Domestic and industrial water supply benefit

The benefit which accrues from supplying the deficit in domestic and industrial water use is estimated based on the least-costly alternative method.

It is assumed that the water stored in the proposed dam and its alternative is released into the river course and abstracted at the same water supply intake located downstream. It is also assumed that the associated water supply systems comprising water mains, treatment plants and distribution systems are identical for the proposed dam and its alternative. Accordingly, the benefit attributable to the water at the outlet of the proposed dam is measured as that of the least-costly alternative dam.

The least-costly alternative dam is assumed to be such a proposed dam that it is ranked next to the proposed dam.

The unit domestic and industrial water supply benefit is measured in this Study as the unit value of water to be developed by its least-costly alternative dam to supply water deficit in domestic and industrial supply, assuming a discount rate of 8% as shown in Table 12.

(3) Hydropower benefit

The benefit of hydropower generation of the Rui dam project is counted as a sum of capacity benefit and energy benefit. The capacity value and energy value are estimated to be M$208/kW and M$0.145/kWh as discussed in ANNEX O.

(4) Adverse effect of tributary irrigation

Water use for minor irrigation schemes in a tributary causes some water deficit in irrigation and water supply in the main stream. The loss in irrigation benefit and water supply benefit due to this water deficit are the adverse effect of tributary irrigation.

The adverse effect of tributary irrigation is calculated as shown in Tables 13 and 14. The calculation procedure is herein explained according to column number in Table 13.

(a) Net production value in MADA with-project in Table 10,

(b) Net production value in main minor with-project in Table 10,

(c) Percentage of water deficit caused by tributary minor and affecting on MADA and main minor in Table 3 to water demand of MADA and main minor in the Kedah river system in Table 1,

(d) (c) x ((a) + (b))/100,

(e) Water deficit caused by tributary minor and affecting on D&I in the Kedah river system in Table 3 multiplied by unit D&I water supply benefit for the Kedah river system based on the cost of the Beris dam in Table 12,

(f) Net production value in main minor with-project in Table 11,

(g) Percentage of water deficit caused by tributary minor and affecting on main minor in the Muda-Perai river system in Table 3 to water demand of main minor in the Muda-Perai river system in Table 1,

(h) (f) x (g)/100,

(i) Water deficit caused by tributary minor and affecting on D&I in the Muda-Perai river system in Table 3 multiplied by unit D&I water supply benefit for the Muda-Perai river system based on the cost of the Beris dam in Table 12,

(j) (d) + (e) + (h) + (i).

(5) River maintenance flow

No economic benefit is assumed for the river maintenance flow.

(6) Recreation benefit

The concept of willingness-to-pay is used for estimating the economic benefit accrued from reservoir recreation. The out-of-pocket expenses on travelling to the reservoirs is used for measuring the willingness-to-pay of each visitor to the reservoir, where only the domestic visitors living within one hour drive distance is considered as potential visitors.

The reservoir recreation benefit is estimated for the Jeniang system, Beris dam and Tawar-Muda dam, assuming the fuel cost of M$0.11/km. The estimated net present value of benefit in 1982 at the discount rate of 8% is M$9.3 x 10^6 for the Jeniang system, M$13.9 x 10^6 for the Beris dam and M$13.2 x 10^6 for the Tawar-Muda dam.

The reservoir recreation benefit may be included in the benefit of the recommended source projects. It is, however, treated as supplementary benefit and not counted in this Study.

3.2 Economic Cost

Economic investment cost of the irrigation projects, domestic and industrial water supply projects and the source development projects is assumed to be 80% of the corresponding financial investment cost, assuming that the remaining 20% was the transfer payment including tax, local contractors' profit, land rent, etc., referring to the national economic conversion factors prepared by EPU as shown in Table 15.

The economic investment cost of the irrigation direct facilities is estimated at M$7,200/ha for the tertiary development for the MADA area, M$9,200/ha for pump/gravity schemes and M$7,200/ha for control head offtake schemes. A cost stream of irrigation direct facilities is shown in Table 16 (for more detail, see ANNEX C).

Economic investment cost, annual cost and production foregone of the Jeniang system and the proposed and potential dams are shown in Table 17 (for more detail, see ANNEXes L, M and O). Assuming the year of commission to be 1990 for the Jeniang system, 1991 for the proposed and potential dams, cost streams of these source facilities are prepared as shown in Tables 18 and 19.

4. ECONOMIC ANALYSIS OF OVERALL SOURCE DEVELOPMENT PLAN

It is assumed that water demand will grow as projected and direct facilities for irrigation and domestic and industrial water supply will be, accordingly, constructed.

If a source project is implemented the overall cost will increase by the cost of the source project and the overall benefit will also increase by the benefit corresponding to the water deficit which is reduced by the source project. The implementation of the source project is economically justified, if the incremental benefit is greater than the incremental cost, or incremental net benefit is positive. Additional source project is also justified if its incremental net benefit is positive. In this way, the overall source development plan is economically optimized by including all the source projects which show positive incremental net benefit.

In the optimization process, the priority of the proposed dams is assumed in the reverse order of investment cost/net water output as shown in Table 20.

A detailed breakdown of present values of benefit and cost assuming variable discount rate in High and Low Growth Case with the operation of Jeniang system of Alternatives 1, 2 and 3 is shown in Tables 21 to 26 for the plans involving the following source projects;

Jeniang,
Jeniang + Beris,
Jeniang + Beris + Tawar-Muda, and
Jeniang + Beris + Tawar-Muda + Sari.

The backgrounds of the above-mentioned tables are compiled in Tables 27 to 44. The calculation procedure is described for Tables 27 to 29:

(a) Total supply with Jeniang is total demand in Table 1 deducted by caused deficit in Table 3 and added by net water output of Jeniang in Table 5. Regarding MADA and main minor in the Kedah river system, percentage of total supply with Jeniang to water demand in Table 1 is calculated.

(b) Percentage of Beris net water output for MADA + Main Minor + Tributary minor in the Kedah river system in Table 5 less D&I deficit caused by tributary minor in the Kedah river system in Table 3 to MADA + main minor water demand in the Kedah river system in Table 1.

(c) Percentage of Tawar-Muda output for MADA + main minor in the Kedah river system in Table 5 to MADA + main minor water demand in the Kedah river system in Table 1.

(d) Percentage of Sari output for MADA + minor to MADA + main minor water demand in the Kedah river system in Table 1.

(e) Increase in incremental net production value by Jeniang; Net production value in MADA with-project in Table 10 multiplied by (a) less the same value for 1983.

(f) - (l) Similar to (e)

(m) Percentage of Beris output for main minor and tributary minor in the Muda-Perai river system in Table 5 less D&I deficit caused by Tributary minor in the Muda-Perai river system in Table 3 to main minor water demand in the Muda-Perai river system in Table 1.

(n) Percentage of Tawar-Muda output for main minor in the Muda-Perai river system in Table 5 to main minor water demand in the Muda-Perai river system in Table 1.

(o) Net production value in main minor in Table 11 multiplied by (m).

(p) Net production value in main minor in Table 11 multiplied by (n).

(q) Jeniang output for D&I in the Kedah river system in Table 5 multiplied by unit water cost of Beris water for Kedah system in Table 12.

(r) Beris output for D&I in the Kedah system in Table 5 multiplied by unit water cost of Tawar-Muda for Kedah system in Table 12 plus D&I deficit caused by tributary minor in the Kedah river system multiplied by unit water value of Beris for Kedah system in Table 12.

(s) Tawar-Muda output for D&I in Table 5 multiplied by unit water cost of Sari for the Kedah system in Table 12.

(t) Sari output for D&I multiplied by unit water cost of Badak-Temin for the Kedah system.

(u) Beris output for D&I in the Muda-Perai river system in Table 5 multiplied by unit water cost of Tawar-Muda for the Muda-Perai system in Table 12 plus D&I water deficit caused by tributary minor in the Muda-Perai river system in Table 3 multiplied by unit water cost of Beris for the Muda-Perai river system.

(v) Tawar-Muda output for D&I in the Muda-Perai system in Table 5 multiplied by unit water cost of Sari for the Muda-Perai system in Table 12.

The same calculation assuming that the Reman dam and Merbok storage can be implemented among the potential dams is shown in Tables 45 to 52.

5. ECONOMIC ANALYSIS OF INDIVIDUAL SOURCE PROJECTS

Estimated values of EIRR of the Jeniang system, proposed source projects and potential ones are summarized in Table 53. The supporting figures are compiled in Table 54 to 76.

Table 54, compiled from Tables 10, 11 and 16, shows the net irrigation benefit as the net production value less irrigation direct facilities cost.

The calculation procedure for Table 55 is described hereunder:

(a), (b) from Table 5

(c) Percentage of (a) to total Kedah river deficit caused by MADA in Table 3.

(d) Percentage of (b) to total Kedah river deficit caused by main minor.

(e) MADA main net irrigation benefit in Table 54 multiplied by (c).

(f) MADA minor net irrigation benefit multiplied by (d).

(g) D&I deficit in the Kedah system in Table 5 multiplied by unit water cost of the Beris dam for the Kedah system in Table 12.

(h) (e) + (f) + (g)

(i) from Table 18.

The calculation procedure for Table 57 is as follows:

(a), (b) from Table 5

(c) Percentage of (a) to total Kedah river deficit caused by MADA in Table 3.

(d) Percentage of (b) to total Kedah river deficit caused by main minor.

(e) MADA main net irrigation benefit in Table 54 multiplied by (c).

(f) MADA minor net irrigation benefit multiplied by (d)

(g) Tributary minor net irrigation benefit in the Kedah system in Table 54.

(h) D&I deficit in the Kedah system in Table 5 multiplied by unit water cost of the Tawar-Muda dam for the Kedah system in Table 12.

(i) Water deficit in main minor in the Muda-Perai system in Table 5 plus main minor deficit caused by tributary minor in the Muda-Perai system in Table 3.

(j) Percentage of (i) to water demand for main minor in the Muda-Perai system in Table 1.

(k) Net production value of main minor with project in Table 11 multiplied by (j).

(l) D&I deficit in the Muda-Perai system in Table 5 multiplied by unit water cost of the Tawar-Muda dam for the Muda-Perai system in Table 12 plus D&I deficit caused by tributary minor in the Muda-Perai system in Table 3.

(m) (e) + (f) + (g) + (h) + (k) + (l)

(n) from Table 18.

Source development in the main stream for the purpose of tributary irrigation is to eliminate water deficit caused by the tributary irrigation and adversely affects on the water uses in the main stream. The benefit of above-mentioned source development may be either the net irrigation benefit in tributary minor in Table 54 or the adverse effect in Tables 13 and 14. Herein the small between the 2 is regarded as the benefit; the net irrigation benefit in Table 54 for the Kedah river system and adverse effect in Table 13 or 14 for the Muda river system.

6. FINANCIAL ANALYSIS

6.1 Fund Requirement and Cost Allocation

Financial investment cost disbursements are estimated for the recommended demand and supply balance plans in High Growth Case and Low Growth Case as shown in Table 77. The Financial analysis of development plans is carried out for the recommended plan including the Jeniang, Beris and Tawar-Muda dams as new source facilities. It is assumed that the distribution of remaining deficit follows Alternative 1, the Muda priority case. A schedule of O&M cost is shown in Table 78. The direct facilities costs including the public investment costs for the above-mentioned source facilities, on-going tertiary development in the MADA area, minor irrigation schemes development, rehabilitation of existing minor irrigation schemes, PWD/PWA and RESP public water supply system development, and private investment costs for water supply system by private enterprises and the recommended source projects costs are the cost components. It is noted that the costs of the committed projects except the Jeniang system are not incorporated in Tables 77 and 78. The estimated investment cost for the plan totals M$6.1 x 10^9 in High Growth Case and M$3.4 x 10^9 in Low Growth Case in terms of 1982 constant price. The investment cost of the recommended source development projects is estimated at M$73.9 x 10^6 for the Jeniang system, M$72.6 x 10^6 for the Beris dam and M$111.3 x 10^6 for the Tawar-Muda dam.

The costs of the source projects are allocated to the water users based on the deficit to be met by the net water outputs of the projects caused by the water users. The separable costs-remaining benefits method based on the present value of the investment and O&M costs in 1982 at the discount rate of 8% is adopted as a cost allocation rule in order to indicate the share of each purpose in the total cost. The allocations of the joint cost of the Beris and Tawar-Muda dams are shown in Tables 79 and 80 for High Growth Case and Tables 81 and 82 for Low Growth Case. For the Jeniang system, unit of use method which allocates the cost according to the use of net water output is used because separable cost of the Jeniang system is not realistic. The allocation of the joint cost of the Jeniang system is shown in Table 83 for High Growth Case and Table 84 for Low Growth Case. The estimated cost allocation of the investment and O&M costs of the source projects by State/MADA by purpose by MP is shown in Tables 85 and 86 for High Growth Case and Tables 87 and 88 for Low Growth Case. The total fund requirement of public and private investment and O&M costs for the water demand and supply balance plan by State/MADA by purpose by MP including the allocated source development costs is shown in Tables 89 to 92 for High Growth Case and Tables 93 to 96 for Low Growth Case, in which the construction costs of on-going projects are also included.

The separable costs-remaining benefits method is adopted as allocation rule in this Study because it complies with the following principles which should be met whichever allocation method be adopted:

(1) The allocated cost should not exceed the total net benefit of the purpose.

(2) The allocated cost should at least cover the sum of the exclusive cost and separable cost of the purpose, where separable cost is defined as the expenditure that could be avoided if the purpose was excluded from the project.

It is noted, however, the adopted method is by no means a perfect resolution for cost allocation and used only as a tentative allocation vehicle. The cost allocation rule should finally be set up so that all the conflicting interests among the parties concerned should successfully be resolved.

For the States of Perlis and Kedah, the total public development expenditure is estimated at M$1,313 x 10^6 comprising M$223 x 10^6 for irrigation, M$1,084 x 10^6 for public water supply and M$6 x 10^6 for river maintenance flow in High Growth Case. The allocated investment cost of the Jeniang system, Beris dam and Tawar-Muda dam is M$90 x 10^6, or 7% of the total public development expenditure. The private expenditure for water supply system is estimated at M$1,316 x 10^6. For Low Growth Case, the public development expenditure is estimated at M$713 x 10^6 including M$226 x 10^6 for irrigation and M$551 x 10^6 for public water supply. The allocated cost of the 3 source projects is M$66 x 10^6 or 5% of total expenditure. Private investment cost is estimated at M$264 x 10^6.

For the State of Pulau Pinang, the public development expenditure in High Growth Case is estimated at M$1,571 x 10^6 including M$1 x 10^6 for irrigation and M$1,570 x 10^6 for public water supply. The allocated cost of the Beris and Tawar-Muda dams is M$58 x 10^6 or 4% of the total expenditure. The private expenditure is estimated at M$1,182 x 10^6. For Low Growth Case, the total public development expenditure is estimated at M$934 x 10^6 consisting of M$1 x 10^6 for irrigation and M$933 x 10^6 for public water supply. The allocalted cost of the two dams is M$12 x 10^6 or 7% of the total expenditure. The private expenditure is estimated at M$642 x 10^6.

The public development expenditure for MADA is estimated at M$952 x 10^6, consisting of M$838 x 10^6 of tertiary development cost and M$115 x 10^6, or 12% of allocated cost of the Jeniang system, Beris dam and Tawar-Muda dam in High Growth Case and it is M$1,022 x 10^6 in Low Growth Case. The tertiary development cost is equal to that in the High Growth Case but the allocated cost of the 3 source projects was M$185 x 10^6, or 15% of the total expenditure.

The percentage distribution of allocated cost of the Beris dam is 22.7% for MADA, 39.7% for minor irrigation, 2.1% for domestic and industrial water supply in the Kedah river system, 15.8% for minor irrigation and 19.0% for domestic and industrial water supply in the Muda-Perai river system and 0.7% for the river maintenance flow in the Kedah river system in High Growth Case. It is 41.1% for MADA, 43.5% for minor irrigation, 0.0% for domestic and industrial water supply in the Kedah river system and 11.3% for minor irrigation and 4.1% for domestic and industrial water supply in the Muda-Perai river system in Low Growth Case.

The same ratio of the Tawar-Muda dam is 38.7% for MADA, 4.6% for minor irrigation, 4.8% for domestic and industrial water supply in the Kedah river system, 1.8% for minor irrigation and 48.9% for domestic and industrial water supply in the Muda-Perai river system and 1.2% for the river maintenance flow in the Kedah river system in High Growth Case, and 80.4% for MADA, 8.3% for minor irrigation, 0.4% for domestic and industrial water supply in the Kedah river system and 1.4% for minor irrigation, 9.5% for domestic and industrial water supply in the Muda-Perai river system.

Major portion of the cost of the Jeniang system is allocated to MADA, accounting for 72.6% in High Growth Case and 83.8% in Low Growth Case. The rest are allocated to the water users in the States of Perlis and Kedah in both cases. None is allocated to the State of Pulau Pinang.

6.2 Unit Water Cost

Assuming that the appropriate portion of the source development projects should be borne by the private sector as described in the previous section, the unit cost of water including the costs of direct facilities and source facilities to be borne by the consumers is estimated at M$0.58/$m^3$ or 0.70% of household expenditure (0.35% of per capita GRP) for domestic use and M$1.16/$m^3$ or 0.9% of gross output value of manufacturing industries for industrial use on the condition that commercial water rate is set twice as high as household water rate. It seems within the limit of the capacity to pay of the consumers.

The water rate applied by PWA was revised in 1981 and 1983 in recent years. It is M$0.30/$m^3$ for domestic use and M$0.40/$m^3$ for commercial use, according to the tariff applicable in 1983. These rates may be considered as indicative of the present cost of water, because the account of PWA usually shows a reasonable surplus. With new facilities increasingly coming in, the cost of water will increase and will reach the above-mentioned cost in the future. It seems possible for PWA to continue its sound account toward future.

The rate of public water supply of M$0.22/$m^3$ for domestic use and M$0.44/$m^3$ for commercial use has remained unchanged for years in the States of Perlis and Kedah. The water supply account is in deficit in these States. The management and development of water supply system to meet increasing demand cannot be undertaken, unless a sound account is established. It is recommended to include provisions for accounting and auditing procedure in the Water Supply Fund Enactment of these States.

The cost of source facilities for domestic and industrial water supply owned by private enterprise was estimated to be M$0.05 - 0.08/$m^3$. The rate of raw water supply for private water supply system which should be borne by private sector should be established to cover this cost.

The investment cost of irrigation development is at present totally made up by federal grant with little exceptions. O&M cost of the proposed irrigation facilities is estimated to be M$218/ha for the MADA area and M$170/ha for minor irrigation projects but the present irrigation rate remains in the range of M$20 - 25/ha in the MADA area and M$7 - 15/ha in minor irrigation projects.

Although it may not be realistic to make farmers bear the investment cost, it is considered practicable and recommended that the irrigation water rate should gradually be raised so that it should meet the O&M cost of irrigation facilities, taking into account the increase in farmers' income owing to the implementation of the projects.

TABLES

Table 1 ANNUAL WATER DEMAND IN THE MAIN STREAM

Unit: 10^6 m^3

	Low Growth Case	High Growth Case
1982		
Kedah System		
MADA	1,621.1	1,621.1
Main minor	6.1	6.1
D&I	28.8	28.8
Total	1,656.0	1,656.0
Muda-Perai System		
Main minor	265.4	265.4
D&I	38.1	38.1
Total	303.5	303.5
1990		
Kedah System		
MADA	1,543.0	1,543.0
Main minor	61.4	61.4
D&I	47.4	62.1
Total	1,651.8	1,666.5
Muda-Perai System		
Main minor	280.9	280.9
D&I	53.7	90.5
Total	334.6	371.4
2000		
Kedah System		
MADA	1,484.7	1,484.7
Main minor	84.9	84.9
D&I	69.3	158.1
Total	1,638.9	1,627.7
Muda-Perai System		
Main minor	282.9	282.9
D&I	142.2	297.5
Total	425.1	580.4

Source; Tables 10, 12, 15, 28 and 29 of ANNEX I

Table 2 RIVER MAINTENANCE FLOW

Unit: m^3/s

River System	1990		2000	
	High Growth	Low Growth	High Growth	Low Growth
Perlis	0.5	-	1.5	-
Kedah	2.2	2.0	6.1	2.3
Muda	0	0	0	0
Merbok	0	0	0	0
Perai	0	0	0	0
Juru	0	0	0	0

Table 3 AVERAGE ANNUAL WATER DEFICIT BY CAUSE BY AFFECTED AREA IN HIGH GROWTH CASE

Unit: 10^6 m^3

Cause of Water Deficit	Affected Area by Water Deficit: Kedah River System				Muda-Perai River System		
	MADA	Main Minor	D&I	Total	Main Minor	D&I	Total
1982							
Kedah System							
MADA	271			271			
Main minor		1		1			
Tributary minor	5.9		0.1	6			
D&I			5	5			
Total	276.9	1	5.1	283			
Muda-Perai System							
Main minor					3		3
Tributary minor					0.8	0.2	1
D&I						1	1
Total					3.8	1.2	5
1990							
Kedah System							
MADA	280.0	11.0	11.0	302			
Main minor	31.5	1.2	1.3	34			
Tributary minor	10.2	0.4	0.4	11			
D&I				0			
Total	321.7	12.6	12.7	347			
Muda-Perai System							
Main minor					2.3	0.7	3
Tributary minor					4.5	0.5	5
D&I						0	0
Total					6.8	1.2	8
2000							
Kedah System							
MADA	231.8	13.3	24.9	270			
Main minor	43.8	2.5	4.7	51			
Tributary minor	30.0	1.8	3.2	35			
D&I	26.6	1.5	2.9	31			
Total	332.2	19.1	35.7	387			
Muda-Perai System							
Main minor					1.5	1.5	3
Tributary minor					5.0	5.0	10
D&I					13.0	0	13
Total					19.5	6.5	26

Remarks; Supply by Ahning and Mengkuang dams is counted in D&I deficit in 1990 and 2000.

Table 4 AVERAGE ANNUAL WATER DEFICIT BY CAUSE BY AFFECTED AREA IN LOW GROWTH CASE

Unit: 10^6 m^3

Cause of Water Deficit	Affected Area by Water Deficit: Kedah River System MADA	Kedah River System Main Minor	Kedah River System D&I	Kedah River System Total	Muda-Perai River System Main Minor	Muda-Perai River System D&I	Muda-Perai River System Total
1982							
Kedah System							
MADA	271			271			
Main minor		1		1			
Tributary minor	5.9		0.1	6			
D&I			5	5			
Total	276.9	1	5.1	283			
Muda-Perai System							
Main minor					3		3
Tributary minor					0.8	0.2	1
D&I						1	1
Total					3.8	1.2	5
1990							
Kedah System							
MADA	282.0	11.2	8.8	302			
Main minor	25.2	1.0	0.8	27			
Tributary minor	10.3	0.4	0.3	11			
D&I				0			
Total	317.5	12.6	9.9	340			
Muda-Perai System							
Main minor					3		3
Tributary minor					3.0	0	3
D&I						0	
Total					6.0	0	6
2000							
Kedah System							
MADA	244.3	14.0	11.7	270			
Main minor	46.2	2.6	2.2	51			
Tributary minor	31.7	1.8	1.5	35			
D&I	0.8	0.1	0.1	1			
Total	323.0	18.5	15.5	357			
Muda-Perai System							
Main minor					2.0	1.0	3
Tributary minor					4.6	2.4	7
D&I					2.0	0	2
Total					8.6	3.4	12

Remarks; Supply by Ahning and Mengkuang dams is counted in D&I deficit in 1990 and 2000.

Table 5 NET WATER OUTPUT OF SOURCE FACILITIES BY CAUSE OF WATER DEFICIT (ALTERNATIVE 1, MUDA PRIORITY) (1/3)

Unit: 10^6 m^3

	Low Growth Case			High Growth Case		
	Jeniang & Naok	Beris	Tawar-Muda	Jeniang & Naok	Beris	Tawar-Muda
1990						
Kedah System						
MADA	197.4	40.4	28.5	193.2	38.6	27.0
Main minor	17.6	3.6	2.5	21.8	4.4	3.0
Tributary minor	0	11.0	0	0	11.0	0
D&I	0	0	0	0	0	0
Sub-total	215.0	55.0	31.0	215.0	54.0	30.0
Muda-Perai System						
Main minor		1.0	2.0		0	3.0
Tributary minor		3.0	0		5.0	0
D&I		0	0		0	0
Sub-total		4.0	2.0		5.0	3.0
Total	215.0	59.0	33.0	215.0	59.0	33.0
2000						
Kedah System						
MADA	180.2	12.6	25.1	156.0	6.5	16.0
Main minor	34.1	2.4	4.8	29.5	1.2	3.0
Tributary minor	0	35.0	0	0	35.0	0
D&I	0.7	0.0	0.1	17.9	0.8	1.8
Maintenance flow	0	0	0	11.6	0.5	1.2
Sub-total	215.0	50.0	30.0	215.0	44.0	22.0
Muda-Perai System						
Main minor		0	3.0		0.9	2.1
Tributary minor		9.0	0		10.0	0
D&I		0	0		4.1	8.9
Sub-total		9.0	3.0		15.0	11.0
Total	215.0	59.0	33.0	215.0	59.0	33.0

Table 6 NET WATER OUTPUT OF SOURCE FACILITIES BY CAUSE OF WATER DEFICIT (ALTERNATIVE 2, EVEN DISTRIBUTION) (2/3)

Unit: 10^6 m^3

	Low Growth Case			High Growth Case		
	Jeniang & Naok	Beris	Tawar-Muda	Jeniang & Naok	Beris	Tawar-Muda
1990						
Kedah System						
MADA	197.4	40.4	29.4	193.2	38.6	28.5
Main minor	17.6	3.6	2.6	21.8	4.4	2.5
Tributary minor	0	11.0	0	0	11.0	0
D&I	0	0	0	0	0	0
Sub-total	215.0	55.0	32.0	215.0	54.0	31.0
Muda-Perai System						
Main minor		1.0	1.0		0	2.0
Tributary minor		3.0	0		5.0	0
D&I		0.0	0		0	0
Sub-total		4.0	1.0		5.0	2.0
Total	215.0	59.0	33.0	215.0	59.0	33.0
2000						
Kedah System						
MADA	180.3	14.2	26.0	156.0	9.4	17.4
Main minor	34.1	2.7	4.9	29.5	1.8	3.3
Tributary minor	0	35.0	0	0	35.0	0
D&I	0.7	0.1	0.1	17.9	1.1	2.0
Maintenance flow	0	0	0	11.6	0.7	1.3
Sub-total	215.1	52.0	31.0	215.0	48.0	24.0
Muda-Perai System						
Main minor		0	2.0		0.2	1.7
Tributary minor		7.0	0		10.0	0
D&I		0	0		0.8	7.3
Sub-total		7.0	2.0		11.0	9.0
Total	215.1	59.0	33.0	215.0	59.0	33.0

Table 7 NET WATER OUTPUT OF SOURCE FACILITIES BY CAUSE OF WATER DEFICIT (ALTERNATIVE 3, KEDAH PRIORITY) (3/3)

Unit: 10^6 m^3

	Low Growth Case			High Growth Case		
	Jeniang & Naok	Beris	Tawar-Muda	Jeniang & Naok	Beris	Tawar-Muda
1990						
Kedah System						
MADA	197.4	43.1	30.3	193.2	42.2	29.7
Main minor	17.6	3.9	2.7	21.8	4.8	3.3
Tributary minor	0	11.0	0	0	11.0	0
D&I	0	0	0	0	0	0
Sub-total	215.0	58.0	33.0	215.0	58.0	33.0
Muda-Perai System						
Main minor		0			0	
Tributary minor		1.0			1.0	
D&I		0			0	
Sub-total		1.0			1.0	
Total	215.0	59.0	33.0	215.0	59.0	33.0
2000						
Kedah System						
MADA	180.3	19.3	27.7	156.0	16.7	24.0
Main minor	34.1	3.6	5.2	29.5	3.2	4.5
Tributary minor	0	35.0	0	0	35.0	0
D&I	0.7	0.1	0.1	17.9	1.9	2.7
Maintenance flow	0	0	0	11.6	1.2	1.8
Sub-total	215.1	58.0	33.0	215.0	58.0	33.0
Muda-Perai System						
Main minor		0			0	
Tributary minor		1.0			1.0	
D&I		0			0	
Sub-total		1.0			1.0	
Total	215.1	59.0	33.0	215.0	59.0	33.0

Table 8 ESTIMATED PADDY YIELD AND NET PRODUCTION VALUE

	Main Season		Off Season	
	Yield (Ton/ha)	Net Production Value (M$/ha)	Yield (ton/ha)	Net Production Value (M$/ha)
1. With Insufficient Water				
1.1 MADA				
- Without tertiary development	4.0	1,220	4.2	1,230
1.2 Rainfed	2.1	440	-	-
1.3 Existing minor irrigation	3.4	600	3.5	610
2. With Sufficient Water				
1.1 MADA				
- Transplanting area	4.7	1,900	5.0	1,980
- Direct-seeding area	4.7	1,900	4.8	1,960
- Without tertiary development	4.0	1,220	4.2	1,230
1.2 Minor irrigation				
- New projects	4.2	1,590	4.8	1,880
- Existing since 1982	3.4	600	3.5	610

Remarks; Net production value is projected to 1995 onward in 1982 constant price.

Table 9 TOTAL NET PRODUCTION VALUE IN 2003 ONWARD UNDER WITH AND WITHOUT PROJECT CONDITIONS

Unit: M$10^6

	Without Project	With Project	Increment
Kedah River System			
MADA	209.9	359.0	149.1
Main minor	1.5	11.7	10.2
Tributary minor	5.6	10.9	5.3
Muda River System			
Main minor	19.7	26.6	6.9
Tributary minor	5.4	17.5	12.1

Remarks; In 1982 constant price.

Table 10 FLOWS OF NET PRODUCTION VALUE WITH AND WITHOUT PROJECT CONDITION FOR THE KEDAH RIVER BASIN

Unit: $M\$10^6$

Year	MADA			Main Minor			Tributary Minor		
	W/O	W/P	I/B	W/O	W/P	I/B	W/O	W/P	I/B
1983	209.9	209.9	0	1.49	1.49	0	5.56	5.56	0.00
1984	209.9	211.9	2.0	1.49	1.49	0	5.56	6.37	0.81
1985	209.9	214.6	4.7	1.49	2.05	0.56	5.56	6.58	1.02
1986	209.9	218.7	8.8	1.49	2.96	1.47	5.56	6.80	1.24
1987	209.9	221.0	11.1	1.49	4.20	2.71	5.56	6.96	1.40
1988	209.9	223.2	13.3	1.49	4.82	3.33	5.56	7.00	1.44
1989	209.9	225.5	15.6	1.49	5.26	3.77	5.56	7.05	1.49
1990	209.9	253.6	43.7	1.49	5.56	4.07	5.56	7.10	1.54
1991	209.9	264.8	54.9	1.49	10.23	8.74	5.56	7.78	2.22
1992	209.9	277.6	67.7	1.49	10.62	9.13	5.56	8.22	2.66
1993	209.9	291.5	81.6	1.49	11.09	9.60	5.56	8.72	3.16
1994	209.9	299.2	89.3	1.49	11.40	9.91	5.56	9.22	3.66
1995	209.9	306.7	96.8	1.49	11.44	9.95	5.56	9.60	4.04
1996	209.9	314.5	104.6	1.49	11.61	10.12	5.56	9.89	4.33
1997	209.9	322.7	112.8	1.49	11.65	10.16	5.56	10.24	4.68
1998	209.9	331.1	121.2	1.49	11.70	10.21	5.56	10.36	4.80
1999	209.9	340.0	130.1	1.49	11.73	10.24	5.56	10.57	5.01
2000	209.9	349.6	139.7	1.49	11.73	10.24	5.56	10.79	5.23
2001	209.9	355.3	145.4	1.49	11.73	10.24	5.56	10.87	5.31
2002	209.9	357.6	147.7	1.49	11.73	10.24	5.56	10.92	5.36
2003	209.9	359.0	149.1	1.49	11.73	10.24	5.56	10.94	5.38

Remarks; (1): W/O: Without project
W/P: With project
I/B: Incremental net production value

(2): In 1982 constant price.

Table 11 FLOWS OF NET PRODUCTION VALUE WITH AND WITHOUT PROJECT CONDITION FOR THE MUDA RIVER BASIN

Unit: M$10^6

Year	Main Minor			Tributary Minor		
	W/O	W/P	I/B	W/O	W/P	I/B
1983	20.28	20.48	0.20	5.94	6.16	0.22
1984	20.28	20.70	0.42	5.83	6.38	0.55
1985	20.28	20.88	0.60	5.68	6.99	1.31
1986	20.26	21.18	0.92	5.45	7.55	2.10
1987	20.24	21.34	1.10	5.43	8.44	3.01
1988	19.88	21.16	1.28	5.43	9.27	3.84
1989	19.68	21.58	1.90	5.43	10.05	4.62
1990	19.68	22.40	2.72	5.43	10.71	5.28
1991	19.68	24.93	5.25	5.43	11.55	6.12
1992	19.68	25.59	5.91	5.43	12.20	6.77
1993	19.68	26.21	6.53	5.43	12.72	7.29
1994	19.68	26.54	6.86	5.43	13.26	7.83
1995	19.68	26.55	6.87	5.43	13.72	8.29
1996	19.68	26.55	6.87	5.43	14.25	8.82
1997	19.68	26.55	6.87	5.43	14.76	9.33
1998	19.68	26.55	6.87	5.43	15.43	10.00
1999	19.68	26.55	6.87	5.43	16.04	10.61
2000	19.68	26.55	6.87	5.43	16.71	11.28
2001	19.68	26.55	6.87	5.43	17.07	11.64
2002	19.68	26.55	6.87	5.43	17.34	11.89
2003	19.68	26.55	6.87	5.43	17.54	12.11

Remarks; (1): W/O: Without project
W/P: With project
I/B: Incremental net production value

(2): In 1982 constant price.

Table 12 DOMESTIC AND INDUSTRIAL WATER SUPPLY BENEFIT BASED ON ALTERNATIVE FACILITIES COST

Alternative Facilities	Annual Equivalent of Cost (M10^3)	For Kedah System Net Water Output (10^6 m^3)	For Kedah System Benefit (M$/$m^3$)	For Muda-Perai System Net Water Output (10^6 m^3)	For Muda-Perai System Benefit (M$/$m^3$)
Beris	7.1	59.3	0.12	25.0	0.28
Tawar-Muda	12.4	33.4	0.37	14.0	0.89
Sari	8.6	16.7	0.51	8.0	1.08
Badak-Temin	15.5	21.5	0.72	10.1	1.54
Durian	12.4	14.6	0.85	7.8	1.59

Remarks: (1): Benefit is not unit value of raw water but unit value of water deficit met for the purpose of domestic and industrial water supply.

(2): Based on alternative facilities cost of the source projects.

(3): In 1982 constant price.

Table 13 CASH FLOW AND PRESENT WORTH OF ADVERSE EFFECT DUE TO TRIBUTARY IRRIGATION, HIGH GROWTH CASE

YEAR	KEDAH					MUDA				TOTAL LOSS
	GROSS PRODUCT OF ADVERSE EFFECT		PROPORTION	IRRIGATION LOSS	D&I LOSS	G.PRODUCT OF ADVERSE EFFECT		PROPORTION	IRRIGATION LOSS	D&I LOSS	
	MAIN ($M\$10^6$) (a)	MINOR ($M\$10^6$) (b)	(%) (c)	($M\$10^6$) (d)	($M\$10^6$) (e)	MAIN ($M\$10^6$) (f)		(%) (g)	($M\$10^6$) (h)	($M\$10^6$) (i)	($M\$10^6$) (j)
1983	209.90	1.49	0.40	0.84	0.02	20.48		0.45	0.09	0.07	1.01
1984	211.90	1.49	0.44	0.93	0.02	20.70		0.61	0.13	0.08	1.15
1985	214.60	2.05	0.47	1.02	0.03	20.88		0.78	0.16	0.09	1.30
1986	218.70	2.96	0.51	1.13	0.03	21.18		0.94	0.20	0.10	1.46
1987	221.00	4.20	0.55	1.23	0.03	21.34		1.11	0.24	0.11	1.61
1988	223.20	4.82	0.59	1.33	0.04	21.16		1.27	0.27	0.12	1.76
1989	225.50	5.26	0.62	1.44	0.04	21.58		1.44	0.31	0.13	1.92
1990	253.60	5.56	0.66	1.71	0.05	22.40		1.60	0.36	0.14	2.26
1991	264.80	10.23	0.80	2.19	0.08	24.93		1.62	0.40	0.27	2.94
1992	277.60	10.62	0.93	2.69	0.12	25.59		1.63	0.42	0.39	3.62
1993	291.50	11.09	1.07	3.24	0.15	26.21		1.65	0.43	0.52	4.34
1994	299.20	11.40	1.21	3.75	0.18	26.54		1.67	0.44	0.64	5.02
1995	306.70	11.44	1.35	4.28	0.22	26.55		1.69	0.45	0.77	5.71
1996	314.50	11.61	1.48	4.83	0.25	26.55		1.70	0.45	0.90	6.43
1997	322.70	11.65	1.62	5.41	0.28	26.55		1.72	0.46	1.02	7.17
1998	331.10	11.70	1.76	6.02	0.32	26.55		1.74	0.46	1.15	7.95
1999	340.00	11.73	1.89	6.66	0.35	26.55		1.75	0.47	1.27	8.75
2000	349.60	11.73	2.03	7.33	0.38	26.55		1.77	0.47	1.40	9.59
2001	355.30	11.73	2.03	7.45	0.38	26.55		1.77	0.47	1.40	9.70
2002	357.60	11.73	2.03	7.50	0.38	26.55		1.77	0.47	1.40	9.75
2003	359.00	11.73	2.03	7.53	0.38	26.55		1.77	0.47	1.40	9.78
2010	359.00	11.73	2.03	7.53	0.38	26.55		1.77	0.47	1.40	9.78
2011	359.00	11.73	2.03	7.53	0.38	26.55		1.77	0.47	1.40	9.78
2031	359.00	11.73	2.03	7.53	0.38	26.55		1.77	0.47	1.40	9.78
2032	359.00	11.73	2.03	7.53	0.38	26.55		1.77	0.47	1.40	9.78
NPV(6%)	4551.96	130.12		64.55	3.09	383.25			5.65	11.10	84.38
NPV(8%)	3395.42	92.67		43.71	2.04	292.23			4.11	7.31	57.17
NPV(10%)	2656.03	68.96		31.06	1.41	233.01			3.13	5.03	40.63
NPV(12%)	2157.14	53.17		23.00	1.01	192.35			2.47	3.60	30.08
NPV(14%)	1804.47	42.20		17.64	0.75	163.10			2.01	2.66	23.06
NPV(16%)	1545.09	34.30		13.94	0.57	141.23			1.67	2.02	18.21
NPV(18%)	1347.88	28.43		11.31	0.45	124.35			1.42	1.58	14.75

Table 14 CASH FLOW AND PRESENT WORTH OF ADVERSE EFFECT DUE TO TRIBUTARY IRRIGATION, LOW GROWTH CASE

YEAR	KEDAH					MUDA				TOTAL LOSS
	GROSS PRODUCT		PROPORTION OF ADVERSE EFFECT (%)	IRRIGATION LOSS	D&I LOSS	G.PRODUCT	PROPORTION OF ADVERSE EFFECT (%)	IRRIGATION LOSS	D&I LOSS	
	MAIN ($M10^6)	MINOR ($M10^6)		($M10^6)	($M10^6)	MAIN ($M10^6)		($M10^6)	($M10^6)	($M10^6)
1983	209.90	1.49	0.40	0.84	0.02	20.48	0.38	0.08	0.05	0.98
1984	211.90	1.49	0.44	0.93	0.02	20.70	0.48	0.10	0.04	1.09
1985	214.60	2.05	0.48	1.03	0.02	20.88	0.57	0.12	0.04	1.21
1986	218.70	2.96	0.52	1.14	0.02	21.18	0.67	0.14	0.03	1.34
1987	221.00	4.20	0.55	1.25	0.03	21.34	0.77	0.16	0.02	1.46
1988	223.20	4.82	0.59	1.35	0.03	21.16	0.87	0.18	0.01	1.58
1989	225.50	5.26	0.63	1.46	0.03	21.58	0.96	0.21	0.01	1.70
1990	253.60	5.56	0.67	1.74	0.04	22.40	1.06	0.24	0.00	2.01
1991	264.80	10.23	0.82	2.24	0.05	24.93	1.12	0.28	0.07	2.64
1992	277.60	10.62	0.96	2.77	0.06	25.59	1.17	0.30	0.13	3.27
1993	291.50	11.09	1.11	3.35	0.08	26.21	1.23	0.32	0.20	3.96
1994	299.20	11.40	1.25	3.89	0.09	26.54	1.29	0.34	0.27	4.60
1995	306.70	11.44	1.40	4.45	0.11	26.55	1.35	0.36	0.34	5.26
1996	314.50	11.61	1.55	5.04	0.12	26.55	1.40	0.37	0.40	5.94
1997	322.70	11.65	1.69	5.66	0.14	26.55	1.46	0.39	0.47	6.65
1998	331.10	11.70	1.84	6.30	0.15	26.55	1.52	0.40	0.54	7.39
1999	340.00	11.73	1.98	6.98	0.17	26.55	1.57	0.42	0.60	8.17
2000	349.60	11.73	2.13	7.70	0.18	26.55	1.63	0.43	0.67	8.98
2001	355.30	11.73	2.13	7.82	0.18	26.55	1.63	0.43	0.67	9.10
2002	357.60	11.73	2.13	7.87	0.18	26.55	1.63	0.43	0.67	9.15
2003	359.00	11.73	2.13	7.90	0.18	26.55	1.63	0.43	0.67	9.18
2010	359.00	11.73	2.13	7.90	0.18	26.55	1.63	0.43	0.67	9.18
2011	359.00	11.73	2.13	7.90	0.18	26.55	1.63	0.43	0.67	9.18
2031	359.00	11.73	2.13	7.90	0.18	26.55	1.63	0.43	0.67	9.18
2032	359.00	11.73	2.13	7.90	0.18	26.55	1.63	0.43	0.67	9.18
NPV(6%)	4551.96	130.12		67.29	1.54	383.25		4.68	5.04	78.55
NPV(8%)	3395.42	92.67		45.48	1.04	292.23		3.34	3.27	53.13
NPV(10%)	2656.03	68.96		32.24	0.73	233.01		2.50	2.21	37.69
NPV(12%)	2157.14	53.17		23.82	0.54	192.35		1.94	1.55	27.86
NPV(14%)	1804.47	42.20		18.23	0.41	163.10		1.56	1.13	21.33
NPV(16%)	1545.09	34.30		14.38	0.32	141.23		1.28	0.85	16.83
NPV(18%)	1347.88	28.43		11.64	0.26	124.35		1.08	0.65	13.62

Table 15 NATIONAL ECONOMIC CONVERSION FACTORS

Category	Factor
General conversion factor	0.89
Port handling	0.72
Transport services	0.66
Construction services	0.77
Construction materials	0.88
Transport equipment	0.76
Power and fuel	0.97
Public services	0.89

Source; National Parameters for Project Appraisal in Malaysia Vol. I to Vol. V; The Opportunity Cost of Labour (in Peninsular Malaysia) Vol. III; Conversion Factors for Tradeable and Non-tradeable Goods and Services, Economic Planning Unit, Prime Minister's Department.

Table 16 COST STREAM AND PRESENT WORTH OF IRRIGATION DIRECT FACILITY

	KEDAH			HUDA
YEAR	MADA MAIN	MADA MINOR	TRIBU-TARY MINOR	TRIBU-TARY MINOR
1983	35.10	1.43	1.83	1.20
1984	33.70	3.88	1.32	1.94
1985	31.50	6.67	0.37	2.64
1986	29.90	5.46	0.43	2.95
1987	30.50	2.84	0.59	2.73
1988	31.00	0.45	0.80	2.38
1989	35.10	2.31	1.51	1.94
1990	40.60	2.98	2.05	1.95
1991	45.20	2.47	2.09	2.06
1992	46.30	0.62	1.36	2.05
1993	47.30	0.41	1.00	1.93
1994	49.50	0.67	1.09	2.01
1995	52.70	0.77	1.16	2.08
1996	55.30	0.68	0.92	2.42
1997	56.40	0.42	0.56	2.79
1998	57.30	0.42	0.47	3.05
1999	44.40	0.42	0.36	2.25
2000	26.80	0.42	0.28	1.29
2001	13.00	0.42	0.23	0.54
2002	13.00	0.42	0.23	0.54
2003	13.00	0.42	0.23	0.54
2010	13.00	0.42	0.23	0.54
2011	13.00	0.42	0.23	0.54
2031	13.00	0.42	0.23	0.54
2032	13.00	0.42	0.23	0.54
NPV(6%)	494.10	26.31	12.65	26.39
NPV(8%)	403.70	23.29	10.75	22.02
NPV(10%)	338.29	20.96	9.31	18.79
NPV(12%)	289.13	19.08	8.20	16.31
NPV(14%)	251.10	17.51	7.30	14.35
NPV(16%)	220.99	16.18	6.57	12.77
NPV(18%)	196.69	15.02	5.97	11.47

Table 17 ECONOMIC INVESTMENT COST, ANNUAL COST AND PRODUCTION FORGONE OF JENIANG SYSTEM, PROPOSED DAMS AND POTENTIAL DAMS

	Investment Cost ($M\$10^6$)	Annual Cost + Production Forgone ($M\$10^3/y$)
Jeniang system	60.13	0.66
Beris dam	43.55	1.00
Tawar-Muda dam	84.31	1.05
Sari dam	51.11	1.10
Durian dam	89.25	1.11
Badak-Temin dam	98.43	1.90
Rui No. 2 dam (High)	261.12	2.60
(Low)	244.10	2.40
Ma dam	64.00	1.30
Khlong Thepha dam	72.00	1.40
Reman dam	65.10	4.75
Merbok scheme (High)	99.77	1.40
(Low)	79.82	1.12

Remarks; (1): Values at the optimum scale

(2): In 1982 constant price

Table 18 COST STREAM AND PRESENT WORTH OF SOURCE FACILITY (1/2)

Unit: M$10^6

YEAR	JENIANG SYSTEM	BERIS DAM	T-MUDA DAM	SARI DAM	DURIAN DAM	B.TEMIN DAM
1983	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00
1985	0.00	3.62	0.00	0.00	0.00	0.00
1986	1.73	5.85	5.82	3.97	6.25	6.89
1987	22.88	11.98	5.47	7.74	6.25	9.45
1988	20.42	11.98	21.14	16.92	20.53	18.66
1989	15.10	10.12	26.95	13.35	30.34	39.32
1990	0.67	1.00	24.93	9.13	25.88	30.51
1991	0.64	1.00	1.05	1.10	1.11	1.90
1992	0.64	1.00	1.05	1.10	1.11	1.90
1993	0.64	1.00	1.05	1.10	1.11	1.90
1994	0.66	1.00	1.05	1.10	1.11	1.90
1995	0.65	1.00	1.05	1.10	1.11	1.90
1996	0.65	1.00	1.05	1.10	1.11	1.90
1997	0.65	1.00	1.05	1.10	1.11	1.90
1998	0.69	1.00	1.05	1.10	1.11	1.90
1999	0.67	1.00	1.05	1.10	1.11	1.90
2000	0.66	1.00	1.05	1.10	1.11	1.90
2001	0.66	1.00	1.05	1.10	1.11	1.90
2002	0.66	1.00	1.05	1.10	1.11	1.90
2003	0.66	1.00	1.05	1.10	1.11	1.90
2010	0.66	1.84	2.46	1.64	2.51	2.50
2011	0.66	1.00	1.05	1.10	1.11	1.90
2031	0.66	1.00	1.05	1.10	1.11	1.90
2032	0.66	1.00	1.05	1.10	1.11	1.90
NPV(6%)	49.60	42.14	67.47	46.08	71.39	89.23
NPV(8%)	43.14	35.91	57.49	38.77	60.83	75.08
NPV(10%)	37.98	31.21	49.67	33.25	52.56	64.26
NPV(12%)	33.71	27.52	43.34	28.91	45.86	55.67
NPV(14%)	30.11	24.50	38.08	25.37	40.30	48.65
NPV(16%)	27.02	21.97	33.66	22.43	35.62	42.81
NPV(18%)	24.34	19.82	29.88	19.95	31.62	37.87

Table 19 COST STREAM AND PRESENT WORTH OF SOURCE FACILITY (2/2)

Unit: M$10^6

YEAR	RUI 2 DAM		MA DAM	KHLONG-THEPHA DAM	REMAN DAM	MERBOK RESERVOIR	
	(HIGH)	(LOW)				(HIGH)	(LOW)
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1985	15.66	14.64	0.00	0.00	0.00	0.00	0.00
1986	15.70	14.68	3.20	3.60	2.31	0.00	0.00
1987	73.11	68.35	6.40	7.20	1.54	14.97	11.98
1988	78.33	73.23	19.20	21.60	12.98	29.93	23.94
1989	52.22	48.80	19.20	21.60	26.68	29.93	23.94
1990	26.10	24.40	16.00	18.00	21.59	24.94	19.95
1991	2.60	2.40	1.30	1.40	4.75	1.40	1.12
1992	2.60	2.40	1.30	1.40	4.75	1.40	1.12
1993	2.60	2.40	1.30	1.40	4.75	1.40	1.12
1994	2.60	2.40	1.30	1.40	4.75	1.40	1.12
1995	2.60	2.40	1.30	1.40	4.75	1.40	1.12
1996	2.60	2.40	1.30	1.40	4.75	1.40	1.12
1997	2.60	2.40	1.30	1.40	4.75	1.40	1.12
1998	2.60	2.40	1.30	1.40	4.75	1.40	1.12
1999	2.60	2.40	1.30	1.40	4.75	1.40	1.12
2000	2.60	2.40	1.30	1.40	4.75	1.40	1.12
2001	2.60	2.40	1.30	1.40	4.75	1.40	1.12
2002	2.60	2.40	1.30	1.40	4.75	1.40	1.12
2003	2.60	2.40	1.30	1.40	4.75	1.40	1.12
2010	2.60	2.40	1.30	1.40	4.75	2.21	1.77
2011	2.60	2.40	1.30	1.40	4.75	1.40	1.12
2031	2.60	2.40	1.30	1.40	4.75	1.40	1.12
2032	2.60	2.40	1.30	1.40	4.75	1.40	1.12
NPV(6%)	211.38	197.31	56.08	62.49	88.79	81.37	65.09
NPV(8%)	184.53	172.30	47.09	52.57	68.97	69.16	55.33
NPV(10%)	162.98	152.22	40.27	45.02	55.38	59.65	47.72
NPV(12%)	145.13	135.57	34.88	39.03	45.56	51.98	41.58
NPV(14%)	130.03	121.48	30.49	34.15	38.16	45.63	36.50
NPV(16%)	117.05	109.36	26.84	30.08	32.40	40.29	32.23
NPV(18%)	105.78	98.84	23.76	26.64	27.81	35.74	28.59

Table 20 PRIORITY ORDER OF PROPOSED DAMS

Priority Order	Dam	(1) Investment Cost ($M\$10^6$)	(2) Net Water Output (10^6 m^3)	(3) (1)/(2) ($M\$/m^3$)
1	Beris	74.2	92.3	0.804
2	Tawar-Muda	114.6	40.4	2.84
3	Sari	72.5	22.8	3.18
4	Badak-Temin	149.2	30.3	4.92
5	Durian	113.3	20.5	5.53

Remarks; Net water output is estimated assuming 2,000 water demand in the Kedah river basin under the hydrological condition in 1977. Investment cost and net water output are of the optimum scale.

Table 21 PRESENT VALUE OF B-C OF OVERALL SOURCE DEVELOPMENT PLAN IN HIGH GROWTH CASE ASSUMING JENIANG OPERATION OF ALTERNATIVE 1

Unit: $M\$10^6$

	NET PRESENT VALUE WITH VARIABLE DISCOUNT RATE						
** JENIANG **	6%	8%	10%	12%	14%	16%	18%
BENEFIT							
TRIBUTARY IRRIGATION (KEDAH)	50.72	35.00	25.30	19.01	14.75	11.76	9.59
ADVERSE LOSS MADA (KEDAH)	-64.55	-43.71	-31.06	-23.00	-17.64	-13.94	-11.31
ADVERSE LOSS D & I (KEDAH)	-3.09	-2.04	-1.41	-1.01	-0.75	-0.57	-0.45
TRIBUTARY IRRIGATION (MUDA)	131.80	94.65	71.19	55.60	44.76	36.92	31.08
ADVERSE LOSS M.MINOR (MUDA)	-5.65	-4.11	-3.13	-2.47	-2.01	-1.67	-1.42
ADVERSE LOSS D & I (MUDA)	-11.10	-7.31	-5.03	-3.60	-2.66	-2.02	-1.58
MADA MAIN (KEDAH)	964.37	639.46	442.84	318.18	235.85	179.49	139.72
MADA MINOR (KEDAH)	97.17	68.03	49.66	37.51	29.12	23.11	18.69
D & I (KEDAH)	15.59	9.95	6.60	4.52	3.18	2.29	1.68
*TOTAL BENEFIT	1175.26	789.92	554.96	404.74	304.60	235.37	186.00
COST							
MADA MAIN (TERTIARY)	494.10	403.70	338.29	289.13	251.10	220.99	196.69
MADA MINOR	26.31	23.29	20.96	19.08	17.51	16.18	15.02
JENIANG SYSTEM	49.61	43.14	37.98	33.71	30.11	27.02	24.34
TRIBUTARY IRRIGATION (KEDAH)	12.65	10.75	9.31	8.20	7.30	6.57	5.97
TRIBUTARY IRRIGATION (MUDA)	26.39	22.02	18.79	16.31	14.35	12.77	11.47
*TOTAL COST	609.06	502.90	425.33	366.43	320.37	283.53	253.49
**TOTAL B-C	566.20	287.02	129.63	38.31	-15.77	-48.16	-67.49
**TOTAL COST	609.06	502.90	425.33	366.43	320.37	283.53	253.49
** JENIANG + BERIS **							
BENEFIT							
BENEFIT OF JENIANG	1175.26	789.92	554.96	404.74	304.60	235.37	186.00
BERIS MADA MAIN (KEDAH)	85.63	58.06	40.94	29.79	22.24	16.95	13.14
BERIS MADA MINOR (KEDAH)	2.97	2.04	1.45	1.06	0.80	0.61	0.48
BERIS MAIN MINOR (MUDA)	4.97	3.33	2.32	1.67	1.24	0.93	0.72
BERIS D & I (KEDAH)	5.05	3.24	2.16	1.49	1.06	0.77	0.57
BERIS D & I (MUDA)	36.95	23.63	15.70	10.78	7.61	5.50	4.05
*TOTAL BENEFIT	1310.83	880.22	617.53	449.53	337.55	260.13	204.96
COST							
COST FOR JENIANG	609.06	502.90	425.33	366.43	320.37	283.53	253.49
COST FOR BERIS DAM	42.14	35.91	31.21	27.52	24.50	21.97	19.82
*TOTAL COST	651.20	538.81	456.54	393.95	344.87	305.50	273.31
**TOTAL B-C	659.63	341.41	160.99	55.58	-7.32	-45.37	-66.35
**TOTAL COST	651.20	538.81	456.54	393.95	344.87	305.50	273.31
** JENIANG + BERIS + TAWAR-MUDA **							
BENEFIT							
BENEFIT OF JENIANG & BERIS	1310.83	880.22	617.53	449.53	337.55	260.13	204.96
T-MUDA MADA MAIN (KEDAH)	42.89	29.31	20.82	15.25	11.46	8.78	6.84
T-MUDA MADA MINOR (KEDAH)	1.50	1.03	0.74	0.55	0.41	0.32	0.25
T-MUDA MAIN MINOR (MUDA)	2.05	1.42	1.02	0.75	0.57	0.44	0.34
T-MUDA D & I (KEDAH)	6.67	4.26	2.82	1.93	1.36	0.98	0.72
T-MUDA D & I (MUDA)	89.70	44.47	29.48	20.19	14.21	10.24	7.52
*TOTAL BENEFIT	1433.65	960.71	672.41	488.20	365.56	280.89	220.63
COST							
COST FOR JENIANG & BERIS	651.20	538.81	456.54	393.95	344.87	305.50	273.31
COST FOR T-MUDA DAM	67.47	57.49	49.67	43.34	38.08	33.66	29.88
*TOTAL COST	718.67	596.30	506.21	437.29	382.95	339.16	303.19
**TOTAL B-C	714.98	364.41	166.20	50.91	-17.39	-58.27	-82.56
**TOTAL COST	718.67	596.30	506.21	437.29	382.95	339.16	303.19
** JENIANG + BERIS + TAWAR-MUDA + SARI **							
BENEFIT							
BENEFIT OF JENIANG , BERIS & TAWAR-MUDA	1433.65	960.71	672.41	488.20	365.56	280.89	220.63
SARI MADA MAIN (KEDAH)	30.70	20.66	14.46	10.45	7.75	5.88	4.53
SARI MADA MINOR (KEDAH)	1.06	0.72	0.51	0.37	0.28	0.21	0.16
SARI D & I (KEDAH)	7.33	4.67	3.10	2.12	1.49	1.08	0.79
*TOTAL BENEFIT	1472.74	986.76	690.48	501.14	375.08	288.06	226.11
COST							
COST FOR JENIANG , BERIS & TAWAR-MUDA	718.67	596.30	506.21	437.29	382.95	339.16	303.19
COST FOR SARI DAM	46.08	38.77	33.25	28.91	25.37	22.43	19.95
*TOTAL COST	764.75	635.07	539.46	466.20	408.32	361.59	323.14
**TOTAL B-C	707.99	351.69	151.02	34.94	-33.24	-73.53	-97.03
**TOTAL COST	764.75	635.07	539.46	466.20	408.32	361.59	323.14

REMARKS; IN 1982 CONSTANT PRICE.

Table 22 PRESENT VALUE OF B-C OF OVERALL SOURCE DEVELOPMENT PLAN IN HIGH GROWTH CASE ASSUMING JENIANG OPERATION OF ALTERNATIVE 2

Unit: $M\$10^6$

		NET PRESENT VALUE WITH VARIABLE DISCOUNT RATE					
** JENIANG **	6%	8%	10%	12%	14%	16%	18%
BENEFIT							
TRIBUTARY IRRIGATION (KEDAH)	50.72	35.00	25.30	19.01	14.75	11.76	9.59
ADVERSE LOSS MADA (KEDAH)	-64.55	-43.71	-31.06	-23.00	-17.64	-13.94	-11.31
ADVERSE LOSS D & I (KEDAH)	-3.09	-2.04	-1.41	-1.01	-0.75	-0.57	-0.45
TRIBUTARY IRRIGATION (MUDA)	131.80	94.65	71.19	55.60	44.76	36.92	31.08
ADVERSE LOSS M.MINOR (MUDA)	-5.65	-4.11	-3.13	-2.47	-2.01	-1.67	-1.42
ADVERSE LOSS D & I (MUDA)	-11.10	-7.31	-5.03	-3.60	-2.66	-2.02	-1.58
MADA MAIN (KEDAH)	964.37	639.46	442.84	318.18	235.85	179.49	139.72
MADA MINOR (KEDAH)	97.17	68.03	49.66	37.51	29.12	23.11	18.69
D & I (KEDAH)	15.59	9.95	6.60	4.52	3.18	2.29	1.68
*TOTAL BENEFIT	1175.26	789.92	554.96	404.74	304.60	235.37	186.00
COST							
MADA MAIN (TERTIARY)	494.10	403.70	338.29	289.13	251.10	220.99	196.69
MADA MINOR	26.31	23.29	20.96	19.08	17.51	16.18	15.02
JENIANG SYSTEM	49.61	43.14	37.98	33.71	30.11	27.02	24.34
TRIBUTARY IRRIGATION (KEDAH)	12.65	10.75	9.31	8.20	7.30	6.57	5.97
TRIBUTARY IRRIGATION (MUDA)	26.39	22.02	18.79	16.31	14.35	12.77	11.47
*TOTAL COST	609.06	502.90	425.33	366.43	320.37	283.53	253.49
**TOTAL B-C	566.20	287.02	129.63	38.31	-15.77	-48.16	-67.49
**TOTAL COST	609.06	502.90	425.33	366.43	320.37	283.53	253.49
** JENIANG + BERIS **							
BENEFIT							
BENEFIT OF JENIANG	1175.26	789.92	554.96	404.74	304.60	235.37	186.00
BERIS MADA MAIN (KEDAH)	91.35	61.56	43.24	31.35	23.33	17.73	13.71
BERIS MADA MINOR (KEDAH)	3.16	2.16	1.53	1.12	0.84	0.64	0.50
BERIS MAIN MINOR (MUDA)	4.49	3.03	2.12	1.54	1.14	0.86	0.67
BERIS D & I (KEDAH)	5.85	3.75	2.50	1.72	1.22	0.88	0.65
BERIS D & I (MUDA)	15.63	10.02	6.69	4.61	3.26	2.36	1.75
*TOTAL BENEFIT	1295.54	870.44	611.04	445.08	334.39	257.84	203.28
COST							
COST FOR JENIANG	609.06	502.90	425.33	366.43	320.37	283.53	253.49
COST FOR BERIS DAM	42.14	35.91	31.21	27.52	26.50	21.97	19.82
*TOTAL COST	651.20	538.81	456.54	393.95	344.87	305.50	273.31
**TOTAL B-C	644.34	331.63	154.50	51.13	-10.48	-47.66	-70.03
**TOTAL COST	651.20	538.81	456.54	393.95	344.87	305.50	273.31
** JENIANG + BERIS + TAWAR-MUDA **							
BENEFIT							
BENEFIT OF JENIANG & BERIS	1295.54	870.44	611.04	445.08	334.39	257.84	203.28
T-MUDA MADA MAIN (KEDAH)	46.06	31.39	22.23	16.25	12.18	9.31	7.24
T-MUDA MADA MINOR (KEDAH)	1.60	1.10	0.79	0.58	0.44	0.34	0.26
T-MUDA MAIN MINOR (MUDA)	1.58	1.08	0.77	0.56	0.42	0.32	0.25
T-MUDA D & I (KEDAH)	7.40	4.72	3.13	2.14	1.51	1.09	0.80
T-MUDA D & I (MUDA)	57.16	36.47	24.18	16.56	11.65	8.39	6.17
*TOTAL BENEFIT	1409.34	945.20	662.14	481.17	360.59	277.29	218.00
COST							
COST FOR JENIANG & BERIS	651.20	538.81	456.54	393.95	344.87	305.50	273.31
COST FOR T-MUDA DAM	67.47	57.49	49.67	43.34	38.08	33.66	29.83
*TOTAL COST	718.67	596.30	506.21	437.29	382.95	339.16	303.19
**TOTAL B-C	690.67	348.90	155.93	43.88	-22.36	-61.87	-85.19
**TOTAL COST	718.67	596.30	506.21	437.29	382.95	339.16	303.19
** JENIANG + BERIS + TAWAR-MUDA + SARI **							
BENEFIT							
BENEFIT OF JENIANG , BERIS & TAWAR-MUDA	1409.34	945.20	662.14	481.17	360.59	277.29	218.00
SARI MADA MAIN (KEDAH)	30.70	20.66	14.46	10.45	7.75	5.88	4.53
SARI MADA MINOR (KEDAH)	1.06	0.72	0.51	0.37	0.28	0.21	0.16
SARI D & I (KEDAH)	7.33	4.67	3.10	2.12	1.49	1.08	0.79
*TOTAL BENEFIT	1448.43	971.25	680.21	494.11	370.11	284.46	223.48
COST							
COST FOR JENIANG , BERIS & TAWAR-MUDA	718.67	596.30	506.21	437.29	382.95	339.16	303.19
COST FOR SARI DAM	46.08	38.77	33.25	28.91	25.37	22.43	19.95
*TOTAL COST	764.75	635.07	539.46	466.20	408.32	361.59	323.14
**TOTAL B-C	683.68	336.18	140.75	27.91	-38.21	-77.13	-99.66
**TOTAL COST	764.75	635.07	539.46	466.20	408.32	361.59	323.14

REMARKS; IN 1982 CONSTANT PRICE.

Table 23 PRESENT VALUE OF B-C OF OVERALL SOURCE DEVELOPMENT PLAN IN HIGH GROWTH CASE ASSUMING JENIANG OPERATION OF ALTERNATIVE 3

Unit: $M\$10^6$

	NET PRESENT VALUE WITH VARIABLE DISCOUNT RATE					
** JENIANG **	6%	8%	10%	12%	14%	16%	18%
BENEFIT							
TRIBUTARY IRRIGATION (KEDAH)	50.72	35.00	25.30	19.01	14.75	11.76	9.59
ADVERSE LOSS MADA (KEDAH)	-64.55	-43.71	-31.06	-23.00	-17.64	-13.94	-11.31
ADVERSE LOSS D & I (KEDAH)	-3.09	-2.04	-1.41	-1.01	-0.75	-0.57	-0.45
TRIBUTARY IRRIGATION (MUDA)	131.80	94.65	71.19	55.60	44.76	36.92	31.08
ADVERSE LOSS M.MINOR (MUDA)	-5.65	-4.11	-3.13	-2.47	-2.01	-1.67	-1.42
ADVERSE LOSS D & I (MUDA)	-11.10	-7.31	-5.03	-3.60	-2.66	-2.02	-1.58
MADA MAIN (KEDAH)	964.37	639.46	442.84	318.18	235.85	179.49	139.72
MADA MINOR (KEDAH)	97.17	68.03	49.66	37.51	29.12	23.11	18.69
D & I (KEDAH)	15.59	9.95	6.60	4.52	3.18	2.29	1.68
*TOTAL BENEFIT	1175.26	789.92	554.96	404.74	304.60	235.37	186.00
COST							
MADA MAIN (TERTIARY)	494.10	403.70	338.29	289.13	251.10	220.99	196.69
MADA MINOR	26.31	23.29	20.96	19.08	17.51	16.18	15.02
JENIANG SYSTEM	49.61	43.14	37.98	33.71	30.11	27.02	24.34
TRIBUTARY IRRIGATION (KEDAH)	12.65	10.75	9.31	8.20	7.30	6.57	5.97
TRIBUTARY IRRIGATION (MUDA)	26.39	22.02	18.79	16.31	14.35	12.77	11.47
*TOTAL COST	609.06	502.90	425.33	366.43	320.37	283.53	253.49
**TOTAL B-C	566.20	287.02	129.63	38.31	-15.77	-48.16	-67.49
**TOTAL COST	609.06	502.90	425.33	366.43	320.37	283.53	253.49
** JENIANG + BERIS **							
BENEFIT							
BENEFIT OF JENIANG	1175.26	789.92	554.96	404.74	304.60	235.37	186.00
BERIS MADA MAIN (KEDAH)	106.64	71.65	50.08	36.15	26.78	20.28	15.63
BERIS MADA MINOR (KEDAH)	3.69	2.50	1.77	1.29	0.96	0.73	0.57
BERIS MAIN MINOR (MUDA)	0.45	0.31	0.22	0.16	0.12	0.09	0.07
BERIS D & I (KEDAH)	8.02	5.14	3.42	2.35	1.66	1.20	0.89
BERIS D & I (MUDA)	1.34	0.91	0.64	0.47	0.35	0.27	0.21
*TOTAL BENEFIT	1295.40	870.43	611.09	445.16	334.47	257.94	203.37
COST							
COST FOR JENIANG	609.06	502.90	425.33	366.43	320.37	283.53	253.49
COST FOR BERIS DAM	42.14	35.91	31.21	27.52	24.50	21.97	19.82
*TOTAL COST	651.20	538.81	456.54	393.95	344.87	305.50	273.31
**TOTAL B-C	644.20	331.62	154.55	51.21	-10.40	-47.56	-69.94
**TOTAL COST	651.20	538.81	456.54	393.95	344.87	305.50	273.31
** JENIANG + BERIS + TAWAR-MUDA **							
BENEFIT							
BENEFIT OF JENIANG & BERIS	1295.40	870.43	611.09	445.16	334.47	257.94	203.37
T-MUDA MADA MAIN (KEDAH)	59.49	40.04	28.03	20.26	15.03	11.40	8.79
T-MUDA MADA MINOR (KEDAH)	2.06	1.40	0.99	0.72	0.54	0.41	0.32
T-MUDA MAIN MINOR (MUDA)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-MUDA D & I (KEDAH)	10.01	6.39	4.23	2.90	2.04	1.47	1.08
T-MUDA D & I (MUDA)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
*TOTAL BENEFIT	1366.96	918.26	644.34	469.04	352.08	271.22	213.56
COST							
COST FOR JENIANG & BERIS	651.20	538.81	456.54	393.95	344.87	305.50	273.31
COST FOR T-MUDA DAM	67.47	57.49	49.67	43.34	38.08	33.66	29.88
*TOTAL COST	718.67	596.30	506.21	437.29	382.95	339.16	303.19
**TOTAL B-C	648.29	321.96	138.13	31.75	-30.87	-67.94	-89.63
**TOTAL COST	718.67	596.30	506.21	437.29	382.95	339.16	303.19
** JENIANG + BERIS + TAWAR-MUDA + SARI **							
BENEFIT							
BENEFIT OF JENIANG , BERIS & TAWAR-MUDA	1366.96	918.26	644.34	469.04	352.08	271.22	213.56
SARI MADA MAIN (KEDAH)	30.70	20.66	14.46	10.45	7.75	5.88	4.53
SARI MADA MINOR (KEDAH)	1.06	0.72	0.51	0.37	0.28	0.21	0.16
SARI D & I (KEDAH)	7.33	4.67	3.10	2.12	1.49	1.08	0.79
*TOTAL BENEFIT	1406.05	944.31	662.41	481.98	361.60	278.39	219.04
COST							
COST FOR JENIANG , BERIS & TAWAR-MUDA	718.67	596.30	506.21	437.29	382.95	339.16	303.19
COST FOR SARI DAM	46.08	38.77	33.25	28.91	25.37	22.43	19.95
*TOTAL COST	764.75	635.07	539.46	466.20	408.32	361.59	323.14
**TOTAL B-C	641.30	309.24	122.95	15.78	-46.72	-83.20	-104.10
**TOTAL COST	764.75	635.07	539.46	466.20	408.32	361.59	323.14

REMARKS; IN 1982 CONSTANT PRICE.

TABLE 24 PRESENT VALUE OF B-C OF OVERALL SOURCE DEVELOPMENT PLAN IN LOW GROWTH CASE ASSUMING JENIANG OPERATION OF ALTERNATIVE 1

Unit: $M\$10^6$

		NET PRESENT VALUE WITH VARIABLE DISCOUNT RATE					
** JENIANG **	6%	8%	10%	12%	14%	16%	18%
BENEFIT							
TRIBUTARY IRRIGATION (KEDAH)	50.72	35.00	25.30	19.01	14.75	11.76	9.59
ADVERSE LOSS MADA (KEDAH)	-67.29	-45.48	-32.24	-23.82	-18.23	-14.38	-11.64
ADVERSE LOSS D & I (KEDAH)	-1.54	-1.04	-0.73	-0.54	-0.41	-0.32	-0.26
TRIBUTARY IRRIGATION (MUDA)	131.80	94.65	71.19	55.60	44.76	36.92	31.08
ADVERSE LOSS M.MINOR (MUDA)	-4.68	-3.34	-2.50	-1.94	-1.56	-1.28	-1.08
ADVERSE LOSS D & I (MUDA)	-5.04	-3.27	-2.21	-1.55	-1.13	-0.85	-0.65
MADA MAIN (KEDAH)	1013.90	671.45	464.35	333.14	246.55	187.34	145.59
MADA MINOR (KEDAH)	98.85	69.12	50.40	38.02	29.49	23.39	18.89
D & I (KEDAH)	0.58	0.37	0.25	0.17	0.12	0.09	0.06
*TOTAL BENEFIT	1217.30	817.46	573.81	418.09	314.34	242.67	191.58
COST							
MADA MAIN (TERTIARY)	494.10	403.70	338.29	289.13	251.10	220.99	196.69
MADA MINOR	26.31	23.29	20.96	19.08	17.51	16.18	15.02
JENIANG SYSTEM	49.61	43.14	37.98	33.71	30.11	27.02	24.34
TRIBUTARY IRRIGATION (KEDAH)	12.65	10.75	9.31	8.20	7.30	6.57	5.97
TRIBUTARY IRRIGATION (MUDA)	26.39	22.02	18.79	16.31	14.35	12.77	11.47
*TOTAL COST	609.06	502.90	425.33	366.43	320.37	283.53	253.49
**TOTAL B-C	608.24	314.56	148.48	51.66	-6.03	-40.86	-61.91
**TOTAL COST	609.06	502.90	425.33	366.43	320.37	283.53	253.49
** JENIANG + BERIS **							
BENEFIT							
BENEFIT OF JENIANG	1217.30	817.46	573.81	418.09	314.34	242.67	191.58
BERIS MADA MAIN (KEDAH)	100.41	67.50	47.20	34.09	25.27	19.14	14.75
BERIS MADA MINOR (KEDAH)	3.47	2.36	1.67	1.21	0.91	0.69	0.54
BERIS MAIN MINOR (MUDA)	4.80	3.21	2.23	1.60	1.18	0.89	0.68
BERIS D & I (KEDAH)	1.40	0.91	0.61	0.43	0.31	0.23	0.17
BERIS D & I (MUDA)	10.01	6.39	4.23	2.90	2.04	1.47	1.08
*TOTAL BENEFIT	1337.39	897.83	629.75	458.32	344.05	265.09	208.80
COST							
COST FOR JENIANG	609.06	502.90	425.33	366.43	320.37	283.53	253.49
COST FOR BERIS DAM	42.14	35.91	31.21	27.52	24.50	21.97	19.82
*TOTAL COST	651.20	538.81	456.54	393.95	344.87	305.50	273.31
**TOTAL B-C	686.19	359.02	173.21	64.37	-0.82	-40.41	-64.51
**TOTAL COST	651.20	538.81	456.54	393.95	344.87	305.50	273.31
** JENIANG + BERIS + TAWAR-MUDA **							
BENEFIT							
BENEFIT OF JENIANG & BERIS	1337.39	897.83	629.75	458.32	344.05	265.09	208.80
T-MUDA MADA MAIN (KEDAH)	60.63	40.61	28.29	20.36	15.05	11.37	8.74
T-MUDA MADA MINOR (KEDAH)	2.09	1.42	1.00	0.72	0.54	0.41	0.32
T-MUDA MAIN MINOR (MUDA)	1.65	1.13	0.80	0.58	0.44	0.33	0.26
T-MUDA D & I (KEDAH)	0.36	0.23	0.15	0.11	0.07	0.05	0.04
T-MUDA D & I (MUDA)	9.43	6.02	3.99	2.73	1.92	1.38	1.02
*TOTAL BENEFIT	1411.55	947.24	663.98	482.82	362.07	278.63	219.18
COST							
COST FOR JENIANG & BERIS	651.20	538.81	456.54	393.95	344.87	305.50	273.31
COST FOR T-MUDA WAM	67.47	57.49	49.67	43.34	38.08	33.66	29.88
*TOTAL COST	718.67	596.30	506.21	437.29	382.95	339.16	303.19
**TOTAL B-C	692.88	350.94	157.77	45.53	-20.88	-60.53	-84.01
**TOTAL COST	718.67	596.30	506.21	437.29	382.95	339.16	303.19
** JENIANG + BERIS + TAWAR-MUDA + SARI **							
BENEFIT							
BENEFIT OF JENIANG , BERIS & TAWAR-MUDA	1411.55	947.24	663.98	482.82	362.07	278.63	219.18
SARI MADA MAIN (KEDAH)	34.21	22.88	15.92	11.44	8.45	6.37	4.89
SARI MADA MINOR (KEDAH)	1.18	0.80	0.56	0.41	0.30	0.23	0.18
SARI D & I (KEDAH)	0.51	0.32	0.21	0.15	0.10	0.07	0.05
*TOTAL BENEFIT	1447.45	971.24	680.67	494.82	370.92	285.30	224.30
COST							
COST FOR JENIANG , BERIS & TAWAR-MUDA	718.67	596.30	506.21	437.29	382.95	339.16	303.19
COST FOR SARI DAM	46.08	38.77	33.25	28.91	25.37	22.43	19.95
*TOTAL COST	764.75	635.07	539.46	466.20	408.32	361.59	323.14
**TOTAL B-C	682.70	336.17	141.21	28.62	-37.40	-76.29	-98.84
**TOTAL COST	764.75	635.07	539.46	466.20	408.32	361.59	323.14

REMARKS; IN 1982 CONSTANT PRICE.

Table 25 PRESENT VALUE OF B-C OF OVERALL SOURCE DEVELOPMENT PLAN IN LOW GROWTH CASE ASSUMING JENIANG OPERATION OF ALTERNATIVE 2

Unit: $M\$10^6$

		NET PRESENT VALUE WITH VARIABLE DISCOUNT RATE					
** JENIANG **	6%	8%	10%	12%	14%	16%	18%
BENEFIT							
TRIBUTARY IRRIGATION (KEDAH)	50.72	35.00	25.30	19.01	14.75	11.76	9.59
ADVERSE LOSS MADA (KEDAH)	-67.29	-45.48	-32.24	-23.82	-18.23	-14.38	-11.64
ADVERSE LOSS D & I (KEDAH)	-1.54	-1.04	-0.73	-0.54	-0.41	-0.32	-0.26
TRIBUTARY IRRIGATION (MUDA)	131.80	94.65	71.19	55.60	44.76	36.92	31.08
ADVERSE LOSS M.MINOR (MUDA)	-4.68	-3.34	-2.50	-1.94	-1.56	-1.28	-1.08
ADVERSE LOSS D & I (MUDA)	-5.04	-3.27	-2.21	-1.55	-1.13	-0.85	-0.65
MADA MAIN (KEDAH)	1013.90	671.45	464.35	333.14	246.55	187.34	145.59
MADA MINOR (KEDAH)	98.85	69.12	50.40	38.02	29.49	23.39	18.89
D & I (KEDAH)	0.58	0.37	0.25	0.17	0.12	0.09	0.06
*TOTAL BENEFIT	1217.30	817.46	573.81	418.09	314.34	242.67	191.58
COST							
MADA MAIN (TERTIARY)	494.10	403.70	338.29	289.13	251.10	220.99	196.69
MADA MINOR	26.31	23.29	20.96	19.09	17.51	16.18	15.02
JENIANG SYSTEM	49.61	43.14	37.98	33.71	30.11	27.02	24.34
TRIBUTARY IRRIGATION (KEDAH)	12.65	10.75	9.31	8.20	7.30	6.57	5.97
TRIBUTARY IRRIGATION (MUDA)	26.39	22.02	18.79	16.31	14.35	12.77	11.47
*TOTAL COST	609.06	502.90	425.33	366.43	320.37	283.53	253.49
**TOTAL B-C	608.24	314.56	148.48	51.66	-6.03	-40.86	-61.91
**TOTAL COST	609.06	502.90	425.33	366.43	320.37	283.53	253.49
** JENIANG + BERIS **							
BENEFIT							
BENEFIT OF JENIANG	1217.30	817.46	573.81	418.09	314.34	242.67	191.58
BERIS MADA MAIN (KEDAH)	103.43	69.41	48.65	34.94	25.86	19.56	15.06
BERIS MADA MINOR (KEDAH)	3.58	2.42	1.71	1.24	0.93	0.71	0.55
BERIS MAIN MINOR (MUDA)	4.46	2.99	2.08	1.50	1.11	0.84	0.64
BERIS D & I (KEDAH)	1.69	1.09	0.74	0.51	0.37	0.27	0.20
BERIS D & I (MUDA)	1.45	0.93	0.61	0.42	0.30	0.21	0.16
*TOTAL BENEFIT	1331.91	894.30	627.40	456.70	342.91	264.26	208.19
COST							
COST FOR JENIANG	609.06	502.90	425.33	366.43	320.37	283.53	253.49
COST FOR BERIS DAM	42.14	35.91	31.21	27.52	24.50	21.97	19.82
*TOTAL COST	651.20	538.81	456.54	393.95	344.87	305.50	273.31
**TOTAL B-C	680.71	355.49	170.86	62.75	-1.96	-41.24	-65.12
**TOTAL COST	651.20	538.81	456.54	393.95	344.87	305.50	273.31
** JENIANG + BERIS + TAWAR-MUDA **							
BENEFIT							
BENEFIT OF JENIANG & BERIS	1331.91	894.30	627.40	456.70	342.91	264.26	208.19
T-MUDA MADA MAIN (KEDAH)	62.85	42.10	29.33	21.11	15.60	11.78	9.06
T-MUDA MADA MINOR (KEDAH)	2.17	1.47	1.03	0.75	0.56	0.42	0.33
T-MUDA MAIN MINOR (MUDA)	1.58	1.04	0.72	0.51	0.37	0.28	0.21
T-MUDA D & I (KEDAH)	0.36	0.23	0.15	0.11	0.07	0.05	0.04
T-MUDA D & I (MUDA)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
*TOTAL BENEFIT	1398.87	939.14	658.63	479.18	359.51	276.79	217.83
COST							
COST FOR JENIANG & BERIS	651.20	538.81	456.54	393.95	344.87	305.50	273.31
COST FOR T-MUDA DAM	67.47	57.49	49.67	43.34	38.08	33.66	29.88
*TOTAL COST	718.67	596.30	506.21	437.29	382.95	339.16	303.19
**TOTAL B-C	680.20	342.84	152.42	41.89	-23.44	-62.37	-85.36
**TOTAL COST	718.67	596.30	506.21	437.29	382.95	339.16	303.19
** JENIANG + BERIS + TAWAR-MUDA + SARI **							
BENEFIT							
BENEFIT OF JENIANG , BERIS & TAWAR-MUDA	1398.87	939.14	658.63	479.18	359.51	276.79	217.83
SARI MADA MAIN (KEDAH)	34.21	22.88	15.92	11.44	8.65	6.37	4.89
SARI MADA MINOR (KEDAH)	1.18	0.80	0.56	0.41	0.30	0.23	0.18
SARI D & I (KEDAH)	0.51	0.32	0.21	0.15	0.10	0.07	0.05
*TOTAL BENEFIT	1434.77	963.14	675.32	491.18	368.36	283.46	222.95
COST							
COST FOR JENIANG , BERIS & TAWAR-MUDA	718.67	596.30	506.21	437.29	382.95	339.16	303.19
COST FOR SARI DAM	46.08	38.77	33.25	28.91	25.37	22.43	19.95
*TOTAL COST	764.75	635.07	539.46	466.20	408.32	361.59	323.14
**TOTAL B-C	670.02	328.07	135.85	24.98	-39.96	-78.13	-100.19
**TOTAL COST	764.75	635.07	539.46	466.20	408.32	361.59	323.14

REMARKS; IN 1982 CONSTANT PRICE.

Table 26 PRESENT VALUE OF B-C OF OVERALL SOURCE DEVELOPMENT PLAN IN LOW GROWTH CASE ASSUMING JENIANG OPERATION OF ALTERNATIVE 3

Unit: $M\$10^6$

		NET PRESENT VALUE WITH VARIABLE DISCOUNT RATE					
** JENIANG **	6%	8%	10%	12%	14%	16%	18%
BENEFIT							
TRIBUTARY IRRIGATION (KEDAH)	50.72	35.00	25.30	19.01	14.75	11.76	9.59
ADVERSE LOSS MADA (KEDAH)	-67.29	-45.48	-32.24	-23.82	-18.23	-14.38	-11.64
ADVERSE LOSS D & I (KEDAH)	-1.54	-1.04	-0.73	-0.54	-0.41	-0.32	-0.26
TRIBUTARY IRRIGATION (MUDA)	131.80	94.65	71.19	55.60	44.76	36.92	31.08
ADVERSE LOSS M.MINOR (MUDA)	-4.68	-3.34	-2.50	-1.94	-1.56	-1.28	-1.08
ADVERSE LOSS D & I (MUDA)	-5.04	-3.27	-2.21	-1.55	-1.13	-0.85	-0.65
MADA MAIN (KEDAH)	1013.90	671.45	464.35	333.14	246.55	187.34	145.59
MADA MINOR (KEDAH)	98.85	69.12	50.40	38.02	29.49	23.39	18.89
D & I (KEDAH)	0.58	0.37	0.25	0.17	0.12	0.09	0.06
*TOTAL BENEFIT	1217.30	817.46	573.81	418.09	314.34	242.67	191.58
COST							
MADA MAIN (TERTIARY)	496.10	403.70	338.29	289.13	251.10	220.99	196.69
MADA MINOR	26.31	23.29	20.96	19.08	17.51	16.18	15.02
JENIANG SYSTEM	49.61	43.14	37.98	33.71	30.11	27.02	24.34
TRIBUTARY IRRIGATION (KEDAH)	12.65	10.75	9.31	8.20	7.30	6.57	5.97
TRIBUTARY IRRIGATION (MUDA)	26.39	22.02	18.79	16.31	14.35	12.77	11.47
*TOTAL COST	609.06	502.90	425.33	366.43	320.37	283.53	253.49
**TOTAL B-C	608.24	314.56	148.48	51.66	-6.03	-40.86	-61.91
**TOTAL COST	609.06	502.90	425.33	366.43	320.37	283.53	253.49
** JENIANG + BERIS **							
BENEFIT							
BENEFIT OF JENIANG	1217.30	817.46	573.81	418.09	314.34	242.67	191.58
BERIS MADA MAIN (KEDAH)	114.24	76.47	53.26	38.31	28.30	21.36	16.42
BERIS MADA MINOR (KEDAH)	3.94	2.67	1.88	1.36	1.01	0.77	0.60
BERIS MAIN MINOR (MUDA)	0.55	0.39	0.28	0.21	0.16	0.13	0.10
BERIS D & I (KEDAH)	1.69	1.09	0.74	0.51	0.37	0.27	0.20
BERIS D & I (MUDA)	1.02	0.65	0.43	0.29	0.21	0.15	0.11
*TOTAL BENEFIT	1338.74	898.73	630.40	458.77	344.39	265.35	209.01
COST							
COST FOR JENIANG	609.06	502.90	425.33	366.43	320.37	283.53	253.49
COST FOR BERIS DAM	42.14	35.91	31.21	27.52	24.50	21.97	19.82
*TOTAL COST	651.20	538.81	456.54	393.95	344.87	305.50	273.31
**TOTAL B-C	687.54	359.92	173.86	64.82	-0.48	-40.15	-64.30
**TOTAL COST	651.20	538.81	456.54	393.95	344.87	305.50	273.31
** JENIANG + BERIS + TAWAR-MUDA **							
BENEFIT							
BENEFIT OF JENIANG & BERIS	1338.74	898.73	630.40	458.77	344.39	265.35	209.01
T-MUDA MADA MAIN (KEDAH)	66.52	44.49	30.95	22.25	16.42	12.39	9.51
T-MUDA MADA MINOR (KEDAH)	2.30	1.55	1.09	0.79	0.59	0.45	0.34
T-MUDA MAIN MINOR (MUDA)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-MUDA D & I (KEDAH)	0.36	0.23	0.15	0.11	0.07	0.05	0.04
T-MUDA D & I (MUDA)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
*TOTAL BENEFIT	1407.92	945.00	662.59	481.92	361.47	278.24	218.90
COST							
COST FOR JENIANG & BERIS	651.20	538.81	456.54	393.95	344.87	305.50	273.31
COST FOR T-MUDA DAM	67.47	57.49	49.67	43.34	38.08	33.66	29.88
*TOTAL COST	718.67	596.30	506.21	437.29	382.95	339.16	303.19
**TOTAL B-C	689.25	348.70	156.38	44.63	-21.48	-60.92	-84.29
**TOTAL COST	718.67	596.30	506.21	437.29	382.95	339.16	303.19
** JENIANG + BERIS + TAWAR-MUDA + SARI **							
BENEFIT							
BENEFIT OF JENIANG , BERIS & TAWAR-MUDA	1407.92	945.00	662.59	481.92	361.47	278.24	218.90
SARI MADA MAIN (KEDAH)	34.21	22.88	15.92	11.44	8.45	6.37	4.89
SARI MADA MINOR (KEDAH)	1.18	0.80	0.56	0.41	0.30	0.23	0.18
SARI D & I (KEDAH)	0.51	0.32	0.21	0.15	0.10	0.07	0.05
*TOTAL BENEFIT	1443.82	969.00	679.28	493.92	370.32	284.91	224.02
COST							
COST FOR JENIANG , BERIS & TAWAR-MUDA	718.67	596.30	506.21	437.29	382.95	339.16	303.19
COST FOR SARI DAM	46.08	38.77	33.25	28.91	25.37	22.43	19.95
*TOTAL COST	764.75	635.07	539.46	466.20	408.32	361.59	323.14
**TOTAL B-C	679.07	333.93	139.82	27.72	-38.00	-76.68	-99.12
**TOTAL COST	764.75	635.07	539.46	466.20	408.32	361.59	323.14

REMARKS; IN 1982 CONSTANT PRICE.

Table 27 BENEFIT CASH FLOW AND PRESENT WORTH OF IRRIGATION IN KEDAH RIVER FOR OVERALL PLAN, ALTERNATIVE 1 HIGH GROWTH CASE

YEAR	PROPORTION OF NET WATER OUTPUT TO THE TOTAL DEMAND				MADA MAIN				MADA MINOR			
	JENIANG SYSTEM (%) (a)	BERIS DAM (%) (b)	T- MUDA DAM (%) (c)	SARI DAM (%) (d)	JENIANG SYSTEM (M10^6$) (e)	BERIS DAM (M10^6$) (f)	T-MUDA DAM (M10^6$) (g)	SARI DAM (M10^6$) (h)	JENIANG SYSTEM (M10^6$) (i)	BERIS DAM (M10^6$) (j)	T-MUDA DAM (M10^6$) (k)	SARI DAM (M10^6$) (l)
1983	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	100.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1985	100.00	0.00	0.00	0.00	4.70	0.00	0.00	0.00	0.56	0.00	0.00	0.00
1986	100.00	0.00	0.00	0.00	8.80	0.00	0.00	0.00	1.47	0.00	0.00	0.00
1987	100.00	0.00	0.00	0.00	11.10	0.00	0.00	0.00	2.71	0.00	0.00	0.00
1988	100.00	0.00	0.00	0.00	13.30	0.00	0.00	0.00	3.33	0.00	0.00	0.00
1989	100.00	0.00	0.00	0.00	15.60	0.00	0.00	0.00	3.77	0.00	0.00	0.00
1990	92.46	0.00	0.00	0.00	24.58	0.00	0.00	0.00	3.65	0.00	0.00	0.00
1991	92.35	3.26	1.80	1.05	34.65	8.63	4.78	2.78	7.96	0.33	0.18	0.11
1992	92.24	3.18	1.74	1.04	46.16	8.82	4.82	2.88	8.31	0.34	0.18	0.11
1993	92.13	3.09	1.67	1.02	58.67	9.02	4.87	2.98	8.73	0.34	0.19	0.11
1994	92.02	3.01	1.61	1.01	65.44	9.01	4.81	3.03	9.00	0.34	0.18	0.12
1995	91.92	2.93	1.54	1.00	72.00	8.99	4.72	3.07	9.03	0.34	0.18	0.11
1996	91.81	2.85	1.47	0.99	78.83	8.96	4.64	3.11	9.17	0.33	0.17	0.11
1997	91.70	2.77	1.41	0.98	86.01	8.93	4.54	3.15	9.19	0.32	0.16	0.11
1998	91.59	2.68	1.34	0.96	93.35	8.89	4.44	3.19	9.23	0.31	0.16	0.11
1999	91.48	2.60	1.28	0.95	101.13	8.85	4.34	3.24	9.24	0.31	0.15	0.11
2000	91.37	2.52	1.21	0.94	109.53	8.81	4.23	3.29	9.23	0.30	0.14	0.11
2001	91.37	2.52	1.21	0.94	114.74	8.95	4.30	3.34	9.23	0.30	0.14	0.11
2002	91.37	2.52	1.21	0.94	116.84	9.01	4.33	3.36	9.23	0.30	0.14	0.11
2003	91.37	2.52	1.21	0.94	118.12	9.05	4.34	3.37	9.23	0.30	0.14	0.11
2010	91.37	2.52	1.21	0.94	118.12	9.05	4.34	3.37	9.23	0.30	0.14	0.11
2011	91.37	2.52	1.21	0.94	118.12	9.05	4.34	3.37	9.23	0.30	0.14	0.11
2031	91.37	2.52	1.21	0.94	118.12	9.05	4.34	3.37	9.23	0.30	0.14	0.11
2032	91.37	2.52	1.21	0.94	118.12	9.05	4.34	3.37	9.23	0.30	0.14	0.11
				NPV(6%)	964.37	85.63	42.89	30.70	97.17	2.97	1.50	1.06
				NPV(8%)	639.46	58.06	29.31	20.66	68.03	2.04	1.03	0.72
				NPV(10%)	442.84	40.94	20.82	14.46	49.66	1.45	0.74	0.51
				NPV(12%)	318.18	29.79	15.25	10.45	37.51	1.06	0.55	0.37
				NPV(14%)	235.85	22.24	11.46	7.75	29.12	0.80	0.41	0.28
				NPV(16%)	179.49	16.95	8.78	5.88	23.11	0.61	0.32	0.21
				NPV(18%)	139.72	13.14	6.84	4.53	18.69	0.48	0.25	0.16

Table 28 BENEFIT CASH FLOW AND PRESENT WORTH OF IRRIGATION IN MUDA RIVER FOR OVERALL PLAN, ALTERNATIVE 1 HIGH GROWTH CASE

YEAR	PROPORTION OF N.W.O. TO DEMAND		MAIN MINOR	
	BERIS DAM (%) (m)	T-MUDA DAM (%) (n)	BERIS DAM ($M\$10^6$) (o)	T-MUDA DAM ($M\$10^6$) (p)
1983	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00
1991	1.65	1.03	0.41	0.26
1992	1.70	1.00	0.43	0.25
1993	1.75	0.96	0.46	0.25
1994	1.80	0.93	0.48	0.25
1995	1.85	0.90	0.49	0.24
1996	1.89	0.87	0.50	0.23
1997	1.94	0.84	0.52	0.22
1998	1.99	0.80	0.53	0.21
1999	2.04	0.77	0.54	0.20
2000	2.09	0.74	0.55	0.20
2001	2.09	0.74	0.55	0.20
2002	2.09	0.74	0.55	0.20
2003	2.09	0.74	0.55	0.20
2010	2.09	0.74	0.55	0.20
2011	2.09	0.74	0.55	0.20
2031	2.09	0.74	0.55	0.20
2032	2.09	0.74	0.55	0.20
NPV(6%)			4.97	2.06
NPV(8%)			3.33	1.42
NPV(10%)			2.32	1.02
NPV(12%)			1.67	0.75
NPV(14%)			1.24	0.57
NPV(16%)			0.93	0.44
NPV(18%)			0.72	0.34

Table 29 BENEFIT CASH FLOW AND PRESENT WORTH OF D&I WATER SUPPLY FOR OVERALL PLAN, ALTERNATIVE 1 HIGH GROWTH CASE

Unit: $M\$10^6$

YEAR	KEDAH			MUDA		
	JENIANG SYSTEM (q)	BERIS DAM (r)	T-MUDA DAM (s)	SARI DAM (t)	BERIS DAM (u)	T-MUDA DAM (v)
1983	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00	0.00	0.00
1991	0.22	0.11	0.09	0.10	0.63	0.96
1992	0.43	0.18	0.18	0.20	1.12	1.92
1993	0.65	0.24	0.28	0.30	1.61	2.88
1994	0.86	0.30	0.37	0.40	2.10	3.84
1995	1.08	0.37	0.46	0.51	2.60	4.81
1996	1.29	0.43	0.55	0.61	3.09	5.77
1997	1.51	0.49	0.64	0.71	3.58	6.73
1998	1.72	0.55	0.74	0.81	4.07	7.69
1999	1.94	0.62	0.83	0.91	4.56	8.65
2000	2.15	0.68	0.92	1.01	5.05	9.61
2001	2.15	0.68	0.92	1.01	5.05	9.61
2002	2.15	0.68	0.92	1.01	5.05	9.61
2003	2.15	0.68	0.92	1.01	5.05	9.61
2010	2.15	0.68	0.92	1.01	5.05	9.61
2011	2.15	0.68	0.92	1.01	5.05	9.61
2031	2.15	0.68	0.92	1.01	5.05	9.61
2032	2.15	0.68	0.92	1.01	5.05	9.61
NPV(6%)	15.59	5.05	6.67	7.33	36.95	69.70
NPV(8%)	9.95	3.24	4.26	4.67	23.63	44.47
NPV(10%)	6.60	2.16	2.82	3.10	15.70	29.48
NPV(12%)	4.52	1.49	1.93	2.12	10.78	20.19
NPV(14%)	3.18	1.06	1.36	1.49	7.61	14.21
NPV(16%)	2.29	0.77	0.98	1.08	5.50	10.24
NPV(18%)	1.68	0.57	0.72	0.79	4.05	7.52

Table 30 BENEFIT CASH FLOW AND PRESENT WORTH OF IRRIGATION IN KEDAH RIVER FOR OVERALL PLAN, ALTERNATIVE 2, EVEN DISTRIBUTION, HIGH GROWTH CASE

YEAR	PROPORTION OF NET WATER OUTPUT TO THE TOTAL DEMAND				MADA MAIN				MADA MINOR			
	JENIANG SYSTEM (%)	BERIS DAM (%)	T- MUDA DAM (%)	SARI DAM (%)	JENIANG SYSTEM (M10^6$)	BERIS DAM (M10^6$)	T-MUDA DAM (M10^6$)	SARI DAM (M10^6$)	JENIANG SYSTEM (M10^6$)	BERIS DAM (M10^6$)	T-MUDA DAM (M10^6$)	SARI DAM (M10^6$)
1983	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	100.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1985	100.00	0.00	0.00	0.00	4.70	0.00	0.00	0.00	0.56	0.00	0.00	0.00
1986	100.00	0.00	0.00	0.00	8.80	0.00	0.00	0.00	1.47	0.00	0.00	0.00
1987	100.00	0.00	0.00	0.00	11.10	0.00	0.00	0.00	2.71	0.00	0.00	0.00
1988	100.00	0.00	0.00	0.00	13.30	0.00	0.00	0.00	3.33	0.00	0.00	0.00
1989	100.00	0.00	0.00	0.00	15.60	0.00	0.00	0.00	3.77	0.00	0.00	0.00
1990	92.46	0.00	0.00	0.00	24.58	0.00	0.00	0.00	3.65	0.00	0.00	0.00
1991	92.35	3.28	1.87	1.05	34.65	8.69	4.95	2.78	7.96	0.34	0.19	0.11
1992	92.24	3.22	1.81	1.04	46.16	8.94	5.02	2.88	8.31	0.34	0.19	0.11
1993	92.13	3.16	1.75	1.02	58.67	9.21	5.09	2.98	8.73	0.35	0.19	0.11
1994	92.02	3.10	1.69	1.01	65.44	9.28	5.04	3.03	9.00	0.35	0.19	0.12
1995	91.92	3.04	1.63	1.00	72.00	9.32	4.98	3.07	9.03	0.35	0.19	0.11
1996	91.81	2.98	1.56	0.99	78.83	9.37	4.92	3.11	9.17	0.35	0.18	0.11
1997	91.70	2.92	1.50	0.98	86.01	9.42	4.85	3.15	9.19	0.34	0.18	0.11
1998	91.59	2.86	1.44	0.96	93.35	9.47	4.77	3.19	9.23	0.33	0.17	0.11
1999	91.48	2.80	1.38	0.95	101.13	9.52	4.70	3.24	9.24	0.33	0.16	0.11
2000	91.37	2.74	1.32	0.94	109.53	9.58	4.61	3.29	9.23	0.32	0.15	0.11
2001	91.37	2.74	1.32	0.94	114.74	9.74	4.69	3.34	9.23	0.32	0.15	0.11
2002	91.37	2.74	1.32	0.94	116.84	9.80	4.72	3.36	9.23	0.32	0.15	0.11
2003	91.37	2.74	1.32	0.94	118.12	9.84	4.74	3.37	9.23	0.32	0.15	0.11
2010	91.37	2.74	1.32	0.94	118.12	9.84	4.74	3.37	9.23	0.32	0.15	0.11
2011	91.37	2.74	1.32	0.94	118.12	9.84	4.74	3.37	9.23	0.32	0.15	0.11
2031	91.37	2.74	1.32	0.94	118.12	9.84	4.74	3.37	9.23	0.32	0.15	0.11
2032	91.37	2.74	1.32	0.94	118.12	9.84	4.74	3.37	9.23	0.32	0.15	0.11
				NPV(6%)	964.37	91.15	46.06	30.70	97.17	3.16	1.60	1.06
				NPV(8%)	639.46	61.56	31.39	20.66	68.03	2.16	1.10	0.72
				NPV(10%)	442.84	43.24	22.23	14.46	49.66	1.53	0.79	0.51
				NPV(12%)	318.18	31.35	16.25	10.45	37.51	1.12	0.58	0.37
				NPV(14%)	235.85	23.33	12.18	7.75	29.12	0.84	0.44	0.28
				NPV(16%)	179.49	17.73	9.31	5.88	23.11	0.64	0.34	0.21
				NPV(18%)	139.72	13.71	7.24	4.53	18.69	0.50	0.26	0.16

Table 31 BENEFIT CASH FLOW AND PRESENT WORTH OF IRRIGATION IN MUDA RIVER FOR OVERALL PLAN, ALTERNATIVE 2, EVEN DISTRIBUTION, HIGH GROWTH CASE

YEAR	PROPORTION OF N.W.O. TO DEMAND		MAIN MINOR	
LOSS	BERIS DAM (%)	T-MUDA DAM (%)	BERIS DAM (M10^6$)	T-MUDA DAM (M10^6$)
1983	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00
1991	1.62	0.70	0.40	0.17
1992	1.65	0.69	0.42	0.18
1993	1.67	0.68	0.44	0.18
1994	1.70	0.67	0.45	0.18
1995	1.72	0.66	0.46	0.17
1996	1.74	0.64	0.46	0.17
1997	1.77	0.63	0.47	0.17
1998	1.79	0.62	0.48	0.17
1999	1.82	0.61	0.48	0.16
2000	1.84	0.60	0.49	0.16
2001	1.84	0.60	0.49	0.16
2002	1.84	0.60	0.49	0.16
2003	1.84	0.60	0.49	0.16
2010	1.84	0.60	0.49	0.16
2011	1.84	0.60	0.49	0.16
2031	1.84	0.60	0.49	0.16
2032	1.84	0.60	0.49	0.16
NPV(6%)	17.02		4.49	1.58
NPV(8%)	11.49		3.03	1.08
NPV(10%)	8.06		2.12	0.77
NPV(12%)	5.84		1.54	0.56
NPV(14%)	4.34		1.14	0.42
NPV(16%)	3.30		0.86	0.32
NPV(18%)	2.55		0.67	0.25

Table 32 BENEFIT CASH FLOW AND PRESENT WORTH OF D&I WATER SUPPLY FOR OVERALL PLAN ALTERNATIVE 2, EVEN DISTRIBUTION, HIGH GROWTH CASE

Unit: M$10^6

YEAR	KEDAH			MUDA		
	JENIANG SYSTEM	BERIS DAM	T-MUDA DAM	SARI DAM	BERIS DAM	T-MUDA DAM
1983	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00	0.00	0.00
1991	0.22	0.12	0.10	0.10	0.34	0.79
1992	0.43	0.20	0.20	0.20	0.53	1.58
1993	0.65	0.27	0.31	0.30	0.73	2.36
1994	0.86	0.35	0.41	0.40	0.93	3.15
1995	1.08	0.42	0.51	0.51	1.13	3.94
1996	1.29	0.49	0.61	0.61	1.32	4.73
1997	1.51	0.57	0.71	0.71	1.52	5.52
1998	1.72	0.64	0.82	0.81	1.72	6.30
1999	1.94	0.72	0.92	0.91	1.91	7.09
2000	2.15	0.79	1.02	1.01	2.11	7.88
2001	2.15	0.79	1.02	1.01	2.11	7.88
2002	2.15	0.79	1.02	1.01	2.11	7.88
2003	2.15	0.79	1.02	1.01	2.11	7.88
2010	2.15	0.79	1.02	1.01	2.11	7.88
2011	2.15	0.79	1.02	1.01	2.11	7.88
2031	2.15	0.79	1.02	1.01	2.11	7.88
2032	2.15	0.79	1.02	1.01	2.11	7.88
NPV(6%)	15.59	5.85	7.40	7.33	15.63	57.16
NPV(8%)	9.95	3.75	4.72	4.67	10.02	36.47
NPV(10%)	6.60	2.50	3.13	3.10	6.69	24.18
NPV(12%)	4.52	1.72	2.14	2.12	4.61	16.56
NPV(14%)	3.18	1.22	1.51	1.49	3.26	11.65
NPV(16%)	2.29	0.88	1.09	1.08	2.36	8.39
NPV(18%)	1.68	0.65	0.80	0.79	1.75	6.17

Table 33 BENEFIT CASH FLOW AND PRESENT WORTH OF IRRIGATION IN KEDAH RIVER FOR OVERALL PLAN, ALTERNATIVE 3, KEDAH PRIORITY, HIGH GROWTH CASE

YEAR	PROPORTION OF NET WATER OUTPUT TO THE TOTAL DEMAND				MADA MAIN				MADA MINOR			
	JENIANG SYSTEM (%)	BERIS DAM (%)	T- MUDA DAM (%)	SARI DAM (%)	JENIANG SYSTEM	BERIS DAM	T-MUDA DAM	SARI DAM	JENIANG SYSTEM	BERIS DAM	T-MUDA DAM	SARI DAM
					(M$10^6)	(M$10^6)	(M$10^6)	(M$10^6)	(M$10^6)	(M$10^6)	(M$10^6)	(M$10^6)
1983	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	100.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1985	100.00	0.00	0.00	0.00	4.70	0.00	0.00	0.00	0.56	0.00	0.00	0.00
1986	100.00	0.00	0.00	0.00	8.80	0.00	0.00	0.00	1.47	0.00	0.00	0.00
1987	100.00	0.00	0.00	0.00	11.10	0.00	0.00	0.00	2.71	0.00	0.00	0.00
1988	100.00	0.00	0.00	0.00	13.30	0.00	0.00	0.00	3.33	0.00	0.00	0.00
1989	100.00	0.00	0.00	0.00	15.60	0.00	0.00	0.00	3.77	0.00	0.00	0.00
1990	92.46	0.00	0.00	0.00	24.58	0.00	0.00	0.00	3.65	0.00	0.00	0.00
1991	92.35	3.56	2.04	1.05	34.65	9.43	5.39	2.78	7.96	0.36	0.21	0.11
1992	92.24	3.53	2.01	1.04	46.16	9.80	5.59	2.88	8.31	0.37	0.21	0.11
1993	92.13	3.50	1.99	1.02	58.67	10.20	5.80	2.98	8.73	0.39	0.22	0.11
1994	92.02	3.47	1.96	1.01	65.44	10.38	5.88	3.03	9.00	0.40	0.22	0.12
1995	91.92	3.44	1.94	1.00	72.00	10.55	5.95	3.07	9.03	0.39	0.22	0.11
1996	91.81	3.41	1.92	0.99	78.83	10.72	6.03	3.11	9.17	0.40	0.22	0.11
1997	91.70	3.38	1.89	0.98	86.01	10.91	6.11	3.15	9.19	0.39	0.22	0.11
1998	91.59	3.35	1.87	0.96	93.35	11.09	6.18	3.19	9.23	0.39	0.22	0.11
1999	91.48	3.32	1.84	0.95	101.13	11.29	6.27	3.24	9.24	0.39	0.22	0.11
2000	91.37	3.29	1.82	0.94	109.53	11.50	6.36	3.29	9.23	0.39	0.21	0.11
2001	91.37	3.29	1.82	0.94	114.74	11.69	6.47	3.34	9.23	0.39	0.21	0.11
2002	91.37	3.29	1.82	0.94	116.84	11.77	6.51	3.36	9.23	0.39	0.21	0.11
2003	91.37	3.29	1.82	0.94	118.12	11.81	6.53	3.37	9.23	0.39	0.21	0.11
2010	91.37	3.29	1.82	0.94	118.12	11.81	6.53	3.37	9.23	0.39	0.21	0.11
2011	91.37	3.29	1.82	0.94	118.12	11.81	6.53	3.37	9.23	0.39	0.21	0.11
2031	91.37	3.29	1.82	0.94	118.12	11.81	6.53	3.37	9.23	0.39	0.21	0.11
2032	91.37	3.29	1.82	0.94	118.12	11.81	6.53	3.37	9.23	0.39	0.21	0.11
				NPV(6%)	964.37	106.64	59.49	30.70	97.17	3.69	2.06	1.06
				NPV(8%)	639.46	71.65	40.04	20.66	68.03	2.50	1.40	0.72
				NPV(10%)	442.84	50.08	28.03	14.46	49.66	1.77	0.99	0.51
				NPV(12%)	318.18	36.15	20.26	10.45	37.51	1.29	0.72	0.37
				NPV(14%)	235.85	26.78	15.03	7.75	29.12	0.96	0.54	0.28
				NPV(16%)	179.49	20.28	11.40	5.88	23.11	0.73	0.41	0.21
				NPV(18%)	139.72	15.63	8.79	4.53	18.69	0.57	0.32	0.16

Table 34 BENEFIT CASH FLOW AND PRESENT WORTH OF IRRIGATION IN MUDA RIVER FOR OVERALL PLAN, ALTERNATIVE 3, KEDAH PRIORITY, HIGH GROWTH CASE

YEAR	PROPORTION OF N.W.O. TO DEMAND		MAIN MINOR	
	BERIS DAM (%)	T-MUDA DAM (%)	BERIS DAM (M10^6$)	T-MUDA DAM (M10^6$)
1983	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00
1991	0.18	0.00	0.04	0.00
1992	0.18	0.00	0.05	0.00
1993	0.18	0.00	0.05	0.00
1994	0.18	0.00	0.05	0.00
1995	0.18	0.00	0.05	0.00
1996	0.18	0.00	0.05	0.00
1997	0.18	0.00	0.05	0.00
1998	0.18	0.00	0.05	0.00
1999	0.18	0.00	0.05	0.00
2000	0.18	0.00	0.05	0.00
2001	0.18	0.00	0.05	0.00
2002	0.18	0.00	0.05	0.00
2003	0.18	0.00	0.05	0.00
2010	0.18	0.00	0.05	0.00
2011	0.18	0.00	0.05	0.00
2031	0.18	0.00	0.05	0.00
2032	0.18	0.00	0.05	0.00
NPV(6%)			0.45	0.00
NPV(8%)			0.31	0.00
NPV(10%)			0.22	0.00
NPV(12%)			0.16	0.00
NPV(14%)			0.12	0.00
NPV(16%)			0.09	0.00
NPV(18%)			0.07	0.00

Table 35 BENEFIT CASH FLOW AND PRESENT WORTH OF D&I WATER SUPPLY FOR OVERALL PLAN ALTERNATIVE 3, KEDAH PRIORITY, HIGH GROWTH CASE

Unit: $M\$10^6$

YEAR	KEDAH				MUDA	
	JENIANG SYSTEM	BERIS DAM	T-MUDA DAM	SARI DAM	BERIS DAM	T-MUDA DAM
1983	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00	0.00	0.00
1991	0.22	0.15	0.14	0.10	0.14	0.00
1992	0.43	0.26	0.28	0.20	0.14	0.00
1993	0.65	0.36	0.41	0.30	0.14	0.00
1994	0.86	0.47	0.55	0.40	0.14	0.00
1995	1.08	0.57	0.69	0.51	0.14	0.00
1996	1.29	0.67	0.83	0.61	0.14	0.00
1997	1.51	0.78	0.97	0.71	0.14	0.00
1998	1.72	0.88	1.10	0.81	0.14	0.00
1999	1.94	0.99	1.24	0.91	0.14	0.00
2000	2.15	1.09	1.38	1.01	0.14	0.00
2001	2.15	1.09	1.38	1.01	0.14	0.00
2002	2.15	1.09	1.38	1.01	0.14	0.00
2003	2.15	1.09	1.38	1.01	0.14	0.00
2010	2.15	1.09	1.38	1.01	0.14	0.00
2011	2.15	1.09	1.38	1.01	0.14	0.00
2031	2.15	1.09	1.38	1.01	0.14	0.00
2032	2.15	1.09	1.38	1.01	0.14	0.00
NPV(6%)	15.59	8.02	10.01	7.33	1.34	0.00
NPV(8%)	9.95	5.14	6.39	4.67	0.91	0.00
NPV(10%)	6.60	3.42	4.23	3.10	0.64	0.00
NPV(12%)	4.52	2.35	2.90	2.12	0.47	0.00
NPV(14%)	3.18	1.66	2.04	1.49	0.35	0.00
NPV(16%)	2.29	1.20	1.47	1.08	0.27	0.00
NPV(18%)	1.68	0.89	1.08	0.79	0.21	0.00

Table 36 BENEFIT CASH FLOW AND PRESENT WORTH OF IRRIGATION IN KEDAH RIVER FOR OVERALL PLAN, ALTERNATIVE 1, LOW GROWTH CASE

YEAR	PROPORTION OF NET WATER OUTPUT TO THE TOTAL DEMAND				MADA MAIN				MADA MINOR			
	JENIANG SYSTEM (%)	BERIS DAM (%)	T- MUDA DAM (%)	SARI DAM (%)	JENIANG SYSTEM (M$10^6)	BERIS DAM (M$10^6)	T-MUDA DAM (M$10^6)	SARI DAM (M$10^6)	JENIANG SYSTEM (M$10^6)	BERIS DAM (M$10^6)	T-MUDA DAM (M$10^6)	SARI DAM (M$10^6)
1983	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	100.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1985	100.00	0.00	0.00	0.00	4.70	0.00	0.00	0.00	0.56	0.00	0.00	0.00
1986	100.00	0.00	0.00	0.00	8.80	0.00	0.00	0.00	1.47	0.00	0.00	0.00
1987	100.00	0.00	0.00	0.00	11.10	0.00	0.00	0.00	2.71	0.00	0.00	0.00
1988	100.00	0.00	0.00	0.00	13.30	0.00	0.00	0.00	3.33	0.00	0.00	0.00
1989	100.00	0.00	0.00	0.00	15.60	0.00	0.00	0.00	3.77	0.00	0.00	0.00
1990	92.69	0.00	0.00	0.00	25.67	0.00	0.00	0.00	3.67	0.00	0.00	0.00
1991	92.92	3.38	1.93	1.06	36.15	8.94	5.10	2.81	8.02	0.35	0.20	0.11
1992	92.95	3.35	1.92	1.06	48.13	9.29	5.34	2.95	8.38	0.36	0.20	0.11
1993	92.98	3.31	1.92	1.07	61.15	9.66	5.60	3.11	8.82	0.37	0.21	0.12
1994	93.01	3.28	1.92	1.07	68.40	9.82	5.74	3.20	9.11	0.37	0.22	0.12
1995	93.05	3.25	1.92	1.07	75.47	9.97	5.87	3.28	9.15	0.37	0.22	0.12
1996	93.08	3.22	1.91	1.07	82.82	10.12	6.01	3.37	9.32	0.37	0.22	0.12
1997	93.11	3.19	1.91	1.07	90.56	10.28	6.16	3.47	9.36	0.37	0.22	0.13
1998	93.14	3.15	1.91	1.08	98.48	10.44	6.31	3.56	9.41	0.37	0.22	0.13
1999	93.17	3.12	1.90	1.08	106.87	10.61	6.47	3.67	9.44	0.37	0.22	0.13
2000	93.20	3.09	1.90	1.08	115.93	10.80	6.64	3.78	9.44	0.36	0.22	0.13
2001	93.20	3.09	1.90	1.08	121.24	10.98	6.75	3.84	9.44	0.36	0.22	0.13
2002	93.20	3.09	1.90	1.08	123.38	11.05	6.79	3.86	9.44	0.36	0.22	0.13
2003	93.20	3.09	1.90	1.08	124.69	11.09	6.82	3.88	9.44	0.36	0.22	0.13
2010	93.20	3.09	1.90	1.08	124.69	11.09	6.82	3.88	9.44	0.36	0.22	0.13
2011	93.20	3.09	1.90	1.08	124.69	11.09	6.82	3.88	9.44	0.36	0.22	0.13
2031	93.20	3.09	1.90	1.08	124.69	11.09	6.82	3.88	9.44	0.36	0.22	0.13
2032	93.20	3.09	1.90	1.08	124.69	11.09	6.82	3.88	9.44	0.36	0.22	0.13
				NPV(6%)	1013.90	100.41	60.63	34.21	98.85	3.47	2.09	1.18
				NPV(8%)	671.45	67.50	40.61	22.88	69.12	2.36	1.42	0.80
				NPV(10%)	464.35	47.20	28.29	15.92	50.40	1.67	1.00	0.56
				NPV(12%)	333.14	34.09	20.36	11.44	38.02	1.21	0.72	0.41
				NPV(14%)	246.55	25.27	15.05	8.45	29.49	0.91	0.54	0.30
				NPV(16%)	187.34	19.14	11.37	6.37	23.39	0.69	0.41	0.23
				NPV(18%)	145.59	14.75	8.74	4.89	18.89	0.54	0.32	0.18

Table 37 BENEFIT CASH FLOW AND PRESENT WORTH OF IRRIGATION IN MUDA RIVER FOR OVERALL PLAN ALTERNATIVE 1, LOW GROWTH CASE

YEAR	PROPORTION OF N.W.O. TO DEMAND		MAIN MINOR	
	BERIS DAM (%)	T-MUDA DAM (%)	BERIS DAM (M$10^6)	T-MUDA DAM (M$10^6)
1983	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00
1991	1.48	0.75	0.37	0.19
1992	1.55	0.78	0.40	0.20
1993	1.61	0.82	0.42	0.21
1994	1.68	0.85	0.44	0.23
1995	1.74	0.89	0.46	0.23
1996	1.80	0.92	0.48	0.24
1997	1.87	0.96	0.50	0.25
1998	1.93	0.99	0.51	0.26
1999	2.00	1.03	0.53	0.27
2000	2.06	1.06	0.55	0.28
2001	2.06	1.06	0.55	0.28
2002	2.06	1.06	0.55	0.28
2003	2.06	1.06	0.55	0.28
2010	2.06	1.06	0.55	0.28
2011	2.06	1.06	0.55	0.28
2031	2.06	1.06	0.55	0.28
2032	2.06	1.06	0.55	0.28
NPV(6%)			4.81	2.46
NPV(8%)			3.21	1.64
NPV(10%)			2.23	1.14
NPV(12%)			1.60	0.82
NPV(14%)			1.18	0.60
NPV(16%)			0.89	0.45
NPV(18%)			0.68	0.35

Table 38 BENEFIT CASH FLOW AND PRESENT WORTH OF D&I WATER SUPPLY FOR OVERALL PLAN, ALTERNATIVE 1, LOW GROWTH CASE

Unit: $M\$10^6$

YEAR	KEDAH			MUDA		
	JENIANG SYSTEM	BERIS DAM	T-MUDA DAM	SARI DAM	BERIS DAM	T-MUDA DAM
1983	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00	0.00	0.00
1991	0.01	0.05	0.01	0.01	0.14	0.13
1992	0.02	0.07	0.01	0.01	0.28	0.26
1993	0.02	0.08	0.02	0.02	0.41	0.39
1994	0.03	0.10	0.02	0.03	0.55	0.52
1995	0.04	0.11	0.03	0.04	0.69	0.65
1996	0.05	0.12	0.03	0.04	0.83	0.78
1997	0.06	0.14	0.04	0.05	0.97	0.91
1998	0.06	0.15	0.04	0.06	1.10	1.04
1999	0.07	0.17	0.05	0.06	1.24	1.17
2000	0.08	0.18	0.05	0.07	1.38	1.30
2001	0.08	0.18	0.05	0.07	1.38	1.30
2002	0.08	0.18	0.05	0.07	1.38	1.30
2003	0.08	0.18	0.05	0.07	1.38	1.30
2010	0.08	0.18	0.05	0.07	1.38	1.30
2011	0.08	0.18	0.05	0.07	1.38	1.30
2031	0.08	0.18	0.05	0.07	1.38	1.30
2032	0.08	0.18	0.05	0.07	1.38	1.30
NPV(6%)	0.58	1.40	0.36	0.51	10.01	9.43
NPV(8%)	0.37	0.91	0.23	0.32	6.39	6.02
NPV(10%)	0.25	0.61	0.15	0.21	4.23	3.99
NPV(12%)	0.17	0.43	0.11	0.15	2.90	2.73
NPV(14%)	0.12	0.31	0.07	0.10	2.04	1.92
NPV(16%)	0.09	0.23	0.05	0.07	1.47	1.38
NPV(18%)	0.06	0.17	0.04	0.05	1.08	1.02

Table 39 BENEFIT CASH FLOW AND PRESENT WORTH OF IRRIGATION IN KEDAH RIVER FOR OVERALL PLAN ALTERNATIVE 2, EVEN DISTRIBUTION, LOW GROWTH CASE

YEAR	PROPORTION OF NET WATER OUTPUT TO THE TOTAL DEMAND				MADA MAIN				MADA MINOR			
	JENIANG SYSTEM (%)	BERIS DAM (%)	T- MUDA DAM (%)	SARI DAM (%)	JENIANG SYSTEM ($M\$10^6$)	BERIS DAM ($M\$10^6$)	T-MUDA DAM ($M\$10^6$)	SARI DAM ($M\$10^6$)	JENIANG SYSTEM ($M\$10^6$)	BERIS DAM ($M\$10^6$)	T-MUDA DAM ($M\$10^6$)	SARI DAM ($M\$10^6$)
1983	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	100.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1985	100.00	0.00	0.00	0.00	4.70	0.00	0.00	0.00	0.56	0.00	0.00	0.00
1986	100.00	0.00	0.00	0.00	8.80	0.00	0.00	0.00	1.47	0.00	0.00	0.00
1987	100.00	0.00	0.00	0.00	11.10	0.00	0.00	0.00	2.71	0.00	0.00	0.00
1988	100.00	0.00	0.00	0.00	13.30	0.00	0.00	0.00	3.33	0.00	0.00	0.00
1989	100.00	0.00	0.00	0.00	15.60	0.00	0.00	0.00	3.77	0.00	0.00	0.00
1990	92.89	0.00	0.00	0.00	25.67	0.00	0.00	0.00	3.67	0.00	0.00	0.00
1991	92.92	3.39	2.00	1.06	36.15	8.98	5.29	2.81	8.02	0.35	0.20	0.11
1992	92.95	3.37	1.99	1.06	48.13	9.36	5.54	2.95	8.38	0.36	0.21	0.11
1993	92.98	3.35	1.99	1.07	61.15	9.77	5.80	3.11	8.82	0.37	0.22	0.12
1994	93.01	3.33	1.99	1.07	68.40	9.96	5.95	3.20	9.11	0.38	0.23	0.12
1995	93.05	3.31	1.99	1.07	75.67	10.15	6.09	3.28	9.15	0.38	0.23	0.12
1996	93.08	3.29	1.98	1.07	82.82	10.35	6.23	3.37	9.32	0.38	0.23	0.12
1997	93.11	3.27	1.98	1.07	90.56	10.55	6.39	3.47	9.36	0.38	0.23	0.13
1998	93.14	3.25	1.98	1.08	98.48	10.76	6.54	3.56	9.41	0.38	0.23	0.13
1999	93.17	3.23	1.97	1.08	106.87	10.98	6.71	3.67	9.44	0.38	0.23	0.13
2000	93.20	3.21	1.97	1.08	115.93	11.22	6.89	3.78	9.44	0.38	0.23	0.13
2001	93.20	3.21	1.97	1.08	121.24	11.41	7.00	3.84	9.44	0.38	0.23	0.13
2002	93.20	3.21	1.97	1.08	123.38	11.46	7.04	3.86	9.44	0.38	0.23	0.13
2003	93.20	3.21	1.97	1.08	124.69	11.52	7.07	3.88	9.44	0.38	0.23	0.13
2010	93.20	3.21	1.97	1.08	124.69	11.52	7.07	3.88	9.44	0.38	0.23	0.13
2011	93.20	3.21	1.97	1.08	124.69	11.52	7.07	3.88	9.44	0.38	0.23	0.13
2031	93.20	3.21	1.97	1.08	124.69	11.52	7.07	3.88	9.44	0.38	0.23	0.13
2032	93.20	3.21	1.97	1.08	124.69	11.52	7.07	3.88	9.44	0.38	0.23	0.13
				NPV(6%)	1013.90	103.43	62.85	34.21	98.85	3.58	2.17	1.18
				NPV(8%)	671.45	69.41	42.10	22.88	69.12	2.42	1.47	0.80
				NPV(10%)	464.35	48.45	29.33	15.92	50.40	1.71	1.03	0.56
				NPV(12%)	333.14	34.94	21.11	11.44	38.02	1.24	0.75	0.41
				NPV(14%)	246.55	25.86	15.60	8.45	29.49	0.93	0.56	0.30
				NPV(16%)	187.34	19.56	11.78	6.37	23.39	0.71	0.42	0.23
				NPV(18%)	143.59	15.06	9.06	4.89	18.89	0.55	0.33	0.18

Table 40 BENEFIT CASH FLOW AND PRESENT WORTH OF IRRIGATION IN MUDA RIVER FOR OVERALL PLAN, ALTERNATIVE 2, EVEN DISTRIBUTION, LOW GROWTH CASE

YEAR	PROPORTION OF N.W.O. TO DEMAND		MAIN MINOR	
	BERIS DAM (%)	T-MUDA DAM (%)	BERIS DAM ($M\$10^6$)	T-MUDA DAM ($M\$10^6$)
1983	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00
1991	1.47	0.39	0.37	0.10
1992	1.51	0.43	0.39	0.11
1993	1.56	0.46	0.41	0.12
1994	1.60	0.50	0.43	0.13
1995	1.65	0.53	0.44	0.14
1996	1.70	0.57	0.45	0.15
1997	1.74	0.60	0.46	0.16
1998	1.79	0.64	0.47	0.17
1999	1.83	0.67	0.49	0.18
2000	1.88	0.71	0.50	0.19
2001	1.88	0.71	0.50	0.19
2002	1.88	0.71	0.50	0.19
2003	1.88	0.71	0.50	0.19
2010	1.88	0.71	0.50	0.19
2011	1.88	0.71	0.50	0.19
2031	1.88	0.71	0.50	0.19
2032	1.88	0.71	0.50	0.19
NPV(6%)			4.46	1.58
NPV(8%)			2.99	1.04
NPV(10%)			2.08	0.72
NPV(12%)			1.50	0.51
NPV(14%)			1.11	0.37
NPV(16%)			0.84	0.28
NPV(18%)			0.64	0.21

Table 41 BENEFIT CASH FLOW AND PRESENT WORTH OF D&I WATER SUPPLY FOR OVERALL PLAN, ALTERNATIVE 2, EVEN DISTRIBUTION, LOW GROWTH CASE

Unit: $M\$10^6$

YEAR	KEDAH			MUDA		
	JENIANG SYSTEM	BERIS DAM	T-MUDA DAM	SARI DAM	BERIS DAM	T-MUDA DAM
1983	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00	0.00	0.00
1991	0.01	0.06	0.01	0.01	0.05	0.00
1992	0.02	0.08	0.01	0.01	0.10	0.00
1993	0.02	0.09	0.02	0.02	0.14	0.00
1994	0.03	0.11	0.02	0.03	0.19	0.00
1995	0.04	0.13	0.03	0,04	0.24	0.00
1996	0.05	0.15	0.03	0.04	0.29	0.00
1997	0.06	0.17	0.04	0.05	0.34	0.00
1998	0.06	0.18	0.04	0.06	0.38	0.00
1999	0.07	0.20	0.05	0.06	0.43	0.00
2000	0.08	0.22	0.05	0.07	0.48	0.00
2001	0.08	0.22	0.05	0.07	0.48	0.00
2002	0.08	0.22	0.05	0.07	0.48	0.00
2003	0.08	0.22	0.05	0.07	0.48	0.00
2010	0.08	0.22	0.05	0.07	0.48	0.00
2011	0.08	0.22	0.05	0.07	0.48	0.00
2031	0.08	0.22	0.05	0.07	0.48	0.00
2032	0.08	0.22	0.05	0.07	0.48	0.00
NPV(6%)	0.58	1.69	0.36	0.51	3.48	0.00
NPV(8%)	0.37	1.09	0.23	0.32	2.22	0.00
NPV(10%)	0.25	0.74	0.15	0.21	1.47	0.00
NPV(12%)	0.17	0.51	0.11	0.15	1.01	0.00
NPV(14%)	0.12	0.37	0.07	0.10	0.71	0.00
NPV(16%)	0.09	0.27	0.05	0.07	0.51	0.00
NPV(18%)	0.06	0.20	0.04	0.05	0.38	0.00

Table 42 BENEFIT CASH FLOW AND PRESENT WORTH OF IRRIGATION IN KEDAH RIVER FOR OVERALL PLAN ALTERNATIVE 3, KEDAH PRIORITY, LOW GROWTH CASE

YEAR	PROPORTION OF NET WATER OUTPUT TO THE TOTAL DEMAND				MADA MAIN				MADA MINOR			
	JENIANG SYSTEM (%)	BERIS DAM (%)	T- MUDA DAM (%)	SARI DAM (%)	JENIANG SYSTEM (M10^6$)	BERIS DAM (M10^6$)	T-MUDA DAM (M10^6$)	SARI DAM (M10^6$)	JENIANG SYSTEM (M10^6$)	BERIS DAM (M10^6$)	T-MUDA DAM (M10^6$)	SARI DAM (M10^6$)
1983	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	100.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1985	100.00	0.00	0.00	0.00	4.70	0.00	0.00	0.00	0.56	0.00	0.00	0.00
1986	100.00	0.00	0.00	0.00	8.80	0.00	0.00	0.00	1.47	0.00	0.00	0.00
1987	100.00	0.00	0.00	0.00	11.10	0.00	0.00	0.00	2.71	0.00	0.00	0.00
1988	100.00	0.00	0.00	0.00	13.30	0.00	0.00	0.00	3.33	0.00	0.00	0.00
1989	100.00	0.00	0.00	0.00	15.60	0.00	0.00	0.00	3.77	0.00	0.00	0.00
1990	92.89	0.00	0.00	0.00	25.67	0.00	0.00	0.00	3.67	0.00	0.00	0.00
1991	92.92	3.60	2.06	1.06	36.15	9.53	5.47	2.81	8.02	0.37	0.21	0.11
1992	92.95	3.60	2.07	1.06	48.13	9.99	5.74	2.95	8.38	0.38	0.22	0.11
1993	92.98	3.60	2.07	1.07	61.15	10.49	6.04	3.11	8.82	0.40	0.23	0.12
1994	93.01	3.60	2.08	1.07	68.40	10.76	6.21	3.20	9.11	0.41	0.24	0.12
1995	93.03	3.60	2.08	1.07	75.47	11.03	6.38	3.28	9.15	0.41	0.24	0.12
1996	93.08	3.59	2.08	1.07	82.82	11.30	6.55	3.37	9.32	0.42	0.24	0.12
1997	93.11	3.59	2.09	1.07	90.56	11.59	6.74	3.47	9.36	0.42	0.24	0.13
1998	93.14	3.59	2.09	1.08	98.48	11.89	6.93	3.56	9.41	0.42	0.24	0.13
1999	93.17	3.59	2.10	1.08	106.87	12.21	7.13	3.67	9.44	0.42	0.25	0.13
2000	93.20	3.59	2.10	1.08	115.93	12.55	7.34	3.78	9.44	0.42	0.25	0.13
2001	93.20	3.59	2.10	1.08	121.24	12.76	7.46	3.84	9.44	0.42	0.25	0.13
2002	93.20	3.59	2.10	1.08	123.38	12.84	7.51	3.86	9.44	0.42	0.25	0.13
2003	93.20	3.59	2.10	1.08	124.69	12.89	7.54	3.88	9.44	0.42	0.25	0.13
2010	93.20	3.59	2.10	1.08	124.69	12.89	7.54	3.88	9.44	0.42	0.25	0.13
2011	93.20	3.59	2.10	1.08	124.69	12.89	7.54	3.88	9.44	0.42	0.25	0.13
2031	93.20	3.59	2.10	1.08	124.69	12.89	7.54	3.88	9.44	0.42	0.25	0.13
2032	93.20	3.59	2.10	1.08	124.69	12.89	7.54	3.88	9.44	0.42	0.25	0.13
				NPV(6%)	1013.90	114.24	66.52	34.21	98.85	3.94	2.30	1.18
				NPV(8%)	671.45	76.47	44.49	22.88	69.12	2.67	1.55	0.80
				NPV(10%)	464.35	53.26	30.95	15.92	50.40	1.86	1.09	0.56
				NPV(12%)	333.14	38.31	22.25	11.44	38.02	1.36	0.79	0.41
				NPV(14%)	246.55	28.30	16.42	8.45	29.49	1.01	0.59	0.30
				NPV(16%)	187.34	21.36	12.39	6.37	23.39	0.77	0.45	0.23
				NPV(18%)	145.59	16.42	9.51	4.89	18.69	0.60	0.34	0.18

Table 43 BENEFIT CASH FLOW AND PRESENT WORTH OF IRRIGATION IN MUDA RIVER FOR OVERALL PLAN, ALTERNATIVE 3, KEDAH PRIORITY, LOW GROWTH CASE

YEAR	PROPORTION OF N.W.O. TO DEMAND		MAIN MINOR	
	BERIS DAM (%)	T-MUDA DAM (%)	BERIS DAM (M10^6)	T-MUDA DAM (M10^6)
1983	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00
1991	0.33	0.00	0.08	0.00
1992	0.32	0.00	0.08	0.00
1993	0.30	0.00	0.08	0.00
1994	0.28	0.00	0.07	0.00
1995	0.27	0.00	0.07	0.00
1996	0.25	0.00	0.07	0.00
1997	0.23	0.00	0.06	0.00
1998	0.21	0.00	0.06	0.00
1999	0.20	0.00	0.05	0.00
2000	0.18	0.00	0.05	0.00
2001	0.18	0.00	0.05	0.00
2002	0.18	0.00	0.05	0.00
2003	0.18	0.00	0.05	0.00
2010	0.18	0.00	0.05	0.00
2011	0.18	0.00	0.05	0.00
2031	0.18	0.00	0.05	0.00
2032	0.18	0.00	0.05	0.00
NPV(6%)			0.55	0.00
NPV(8%)			0.39	0.00
NPV(10%)			0.28	0.00
NPV(12%)			0.21	0.00
NPV(14%)			0.16	0.00
NPV(16%)			0.13	0.00
NPV(18%)			0.10	0.00

Table 44 BENEFIT CASH FLOW AND PRESENT WORTH OF D&I WATER SUPPLY FOR OVERALL PLAN, ALTERNATIVE 3, KEDAH PRIORITY, LOW GROWTH CASE

Unit: M$10^6

YEAR	KEDAH				MUDA	
	JENIANG SYSTEM	BERIS DAM	T-MUDA DAM	SARI DAM	BERIS DAM	T-MUDA DAM
1983	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00	0.00	0.00
1991	0.01	0.06	0.01	0.01	0.01	0.00
1992	0.02	0.08	0.01	0.01	0.03	0.00
1993	0.02	0.09	0.02	0.02	0.04	0.00
1994	0.03	0.11	0.02	0.03	0.06	0.00
1995	0.04	0.13	0.03	0.04	0.07	0.00
1996	0.05	0.15	0.03	0.04	0.08	0.00
1997	0.06	0.17	0.04	0.05	0.10	0.00
1998	0.06	0.18	0.04	0.06	0.11	0.00
1999	0.07	0.20	0.05	0.06	0.13	0.00
2000	0.08	0.22	0.05	0.07	0.14	0.00
2001	0.08	0.22	0.05	0.07	0.14	0.00
2002	0.08	0.22	0.05	0.07	0.14	0.00
2003	0.08	0.22	0.05	0.07	0.14	0.00
2010	0.08	0.22	0.05	0.07	0.14	0.00
2011	0.08	0.22	0.05	0.07	0.14	0.00
2031	0.08	0.22	0.05	0.07	0.14	0.00
2032	0.08	0.22	0.05	0.07	0.14	0.00
NPV(6%)	0.58	1.69	0.36	0.51	1.02	0.00
NPV(8%)	0.37	1.09	0.23	0.32	0.65	0.00
NPV(10%)	0.25	0.74	0.15	0.21	0.43	0.00
NPV(12%)	0.17	0.51	0.11	0.15	0.29	0.00
NPV(14%)	0.12	0.37	0.07	0.10	0.21	0.00
NPV(16%)	0.09	0.27	0.05	0.07	0.15	0.00
NPV(18%)	0.06	0.20	0.04	0.05	0.11	0.00

Table 45 PRESENT VALUE OF B-C OF OVERALL PLAN FOR HIGH GROWTH CASE IF THE REMAN DAM AND MERBOK STORAGE CAN BE IMPLEMENTED

Unit: M$10^6

		NET PRESENT VALUE WITH VARIABLE DISCOUNT RATE				
** JENIANG **	6%	8%	10%	12%	14%	16%	18%
BENEFIT							
TRIBUTARY IRRIGATION (KEDAH)	50.72	35.00	25.30	19.01	14.75	11.76	9.59
ADVERSE LOSS MADA (KEDAH)	-64.55	-43.71	-31.06	-23.00	-17.64	-13.94	-11.31
ADVERSE LOSS D & I (KEDAH)	-3.09	-2.04	-1.41	-1.01	-0.75	-0.57	-0.45
TRIBUTARY IRRIGATION (MUDA)	131.80	94.65	71.19	55.60	44.76	36.92	31.08
ADVERSE LOSS M.MINOR (MUDA)	-5.65	-4.11	-3.13	-2.47	-2.01	-1.67	-1.42
ADVERSE LOSS D & I (MUDA)	-11.10	-7.31	-5.03	-3.60	-2.66	-2.02	-1.58
MADA MAIN (KEDAH)	964.37	639.46	442.84	318.18	235.85	179.49	139.72
MADA MINOR (KEDAH)	97.17	68.03	49.66	37.51	29.12	23.11	18.69
D & I (KEDAH)	15.59	9.95	6.60	4.52	3.18	2.29	1.68
*TOTAL BENEFIT	1175.26	789.92	554.96	404.74	304.60	235.37	186.00
COST							
MADA MAIN (TERTIARY)	494.10	403.70	338.29	289.13	251.10	220.99	196.69
MADA MINOR	26.31	23.29	20.96	19.08	17.51	16.18	15.02
JENIANG SYSTEM	49.61	43.14	37.98	33.71	30.11	27.02	24.34
TRIBUTARY IRRIGATION (KEDAH)	12.65	10.75	9.31	8.20	7.30	6.57	5.97
TRIBUTARY IRRIGATION (MUDA)	26.39	22.02	18.79	16.31	14.35	12.77	11.47
*TOTAL COST	609.06	502.90	425.33	366.43	320.37	283.53	253.49
**TOTAL B-C	566.20	287.02	129.63	38.31	-15.77	-48.16	-67.49
**TOTAL COST	609.06	502.90	425.33	366.43	320.37	283.53	253.49
** JENIANG + BERIS **							
BENEFIT							
BENEFIT OF JENIANG	1175.26	789.92	554.96	404.74	304.60	235.37	186.00
BERIS MADA MAIN (KEDAH)	106.64	71.65	50.08	36.15	26.78	20.28	15.63
BERIS MADA MINOR (KEDAH)	3.69	2.50	1.77	1.29	0.96	0.73	0.57
BERIS MAIN MINOR (MUDA)	0.45	0.31	0.22	0.16	0.12	0.09	0.07
BERIS D & I (KEDAH)	8.02	5.14	3.42	2.35	1.66	1.20	0.89
BERIS D & I (MUDA)	1.34	0.91	0.64	0.47	0.35	0.27	0.21
*TOTAL BENEFIT	1295.40	870.43	611.09	445.16	334.47	257.94	203.37
COST							
COST FOR JENIANG	609.06	502.90	425.33	366.43	320.37	283.53	253.49
COST FOR BERIS DAM	42.14	35.91	31.21	27.52	24.50	21.97	19.82
*TOTAL COST	651.20	538.81	456.54	393.95	344.87	305.50	273.31
**TOTAL B-C	644.20	331.62	154.55	51.21	-10.40	-47.56	-69.94
**TOTAL COST	651.20	538.81	456.54	393.95	344.87	305.50	273.31
** JENIANG + BERIS + REMAN **							
BENEFIT							
BENEFIT OF JENIANG & BERIS	1295.40	870.43	611.09	445.16	334.47	257.94	203.37
REMAN MADA MAIN (KEDAH)	215.69	141.84	97.07	68.67	49.93	37.14	28.16
REMAN MADA MINOR (KEDAH)	7.39	4.90	3.39	2.42	1.77	1.33	1.01
REMAN D & I (KEDAH)	41.42	26.42	17.52	12.00	8.44	6.08	4.47
*TOTAL BENEFIT	1559.90	1043.59	729.07	528.25	394.61	302.49	237.01
COST							
COST FOR JENIANG & BERIS	651.20	538.81	456.54	393.95	344.87	305.50	273.31
COST FOR REMAN DAM	88.79	68.97	55.38	45.56	38.16	32.40	27.81
*TOTAL COST	739.99	607.78	511.92	439.51	383.03	337.90	301.12
**TOTAL B-C	819.91	435.81	217.15	88.74	11.58	-35.41	-64.11
**TOTAL COST	739.99	607.78	511.92	439.51	383.03	337.90	301.12
** JENIANG + BERIS + REMAN + MERBOK **							
BENEFIT							
BENEFIT OF JENIANG , BERIS,& REMAN	1559.90	1043.59	729.07	528.25	394.61	302.49	237.01
MERBOK MAIN MINOR (MUDA)	8.97	6.03	4.22	3.04	2.26	1.71	1.32
MERBOK D & I (MUDA)	134.48	85.80	56.88	38.95	27.42	19.73	14.51
*TOTAL BENEFIT	1703.35	1135.42	790.17	570.24	424.29	323.95	252.84
COST							
COST FOR JENIANG , BERIS,& REMAN	739.99	607.78	511.92	439.51	383.03	337.90	301.12
COST FOR MERBOK	81.37	69.16	59.65	51.98	45.63	40.29	35.74
*TOTAL COST	821.36	676.94	571.57	491.49	428.66	378.19	336.86
**TOTAL B-C	881.99	458.48	218.60	78.75	-4.37	-54.24	-84.02
**TOTAL COST	821.36	676.94	571.57	491.49	428.66	378.19	336.86

REMARKS; IN 1982 CONSTANT PRICE.

Table 46 PRESENT VALUE OF B-C OF OVERALL PLAN FOR LOW GROWTH CASE IF THE REMAN DAM CAN BE IMPLEMENTED

Unit: M10^6$

	NET PRESENT VALUE WITH VARIABLE DISCOUNT RATE						
** JENIANG **	6%	8%	10%	12%	14%	16%	18%
BENEFIT							
TRIBUTARY IRRIGATION (KEDAH)	50.72	35.00	25.30	19.01	14.75	11.76	9.59
ADVERSE LOSS MADA (KEDAH)	-67.29	-45.48	-32.24	-23.82	-18.23	-14.38	-11.64
ADVERSE LOSS D & I (KEDAH)	-1.54	-1.04	-0.73	-0.54	-0.41	-0.32	-0.26
TRIBUTARY IRRIGATION (MUDA)	131.80	94.65	71.19	55.60	44.76	36.92	31.08
ADVERSE LOSS M.MINOR (MUDA)	-4.68	-3.34	-2.50	-1.94	-1.56	-1.28	-1.08
ADVERSE LOSS D & I (MUDA)	-5.04	-3.27	-2.21	-1.55	-1.13	-0.85	-0.65
MADA MAIN (KEDAH)	1013.90	671.45	464.35	333.14	246.55	187.34	145.59
MADA MINOR (KEDAH)	98.85	69.12	50.40	38.02	29.49	23.39	18.89
D & I (KEDAH)	0.58	0.37	0.25	0.17	0.12	0.09	0.06
*TOTAL BENEFIT	1217.30	817.46	573.81	418.09	314.34	242.67	191.58
COST							
MADA MAIN (TERTIARY)	494.10	403.70	338.29	289.13	251.10	220.99	196.69
MADA MINOR	26.31	23.29	20.96	19.08	17.51	16.18	15.02
JENIANG SYSTEM	49.61	43.14	37.98	33.71	30.11	27.02	24.34
TRIBUTARY IRRIGATION (KEDAH)	12.65	10.75	9.31	8.20	7.30	6.57	5.97
TRIBUTARY IRRIGATION (MUDA)	26.39	22.02	18.79	16.31	14.35	12.77	11.47
*TOTAL COST	609.06	502.90	425.33	366.43	320.37	283.53	253.49
**TOTAL B-C	608.24	314.56	148.48	51.66	-6.03	-40.86	-61.91
**TOTAL COST	609.06	502.90	425.33	366.43	320.37	283.53	253.49
** JENIANG + BERIS **							
BENEFIT							
BENEFIT OF JENIANG	1217.30	817.46	573.81	418.09	314.34	242.67	191.58
BERIS MADA MAIN (KEDAH)	97.16	65.32	45.67	32.98	24.45	18.52	14.28
BERIS MADA MINOR (KEDAH)	3.36	2.28	1.61	1.17	0.88	0.67	0.52
BERIS MAIN MINOR (MUDA)	7.09	4.85	3.44	2.52	1.89	1.45	1.13
BERIS D & I (KEDAH)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BERIS D & I (MUDA)	20.53	13.10	8.68	5.95	4.18	3.01	2.21
*TOTAL BENEFIT	1345.44	903.01	633.21	460.71	345.74	266.32	209.72
COST							
COST FOR JENIANG	609.06	502.90	425.33	366.43	320.37	283.53	253.49
COST FOR BERIS DAM	42.14	35.91	31.21	27.52	24.50	21.97	19.82
*TOTAL COST	651.20	538.81	456.54	393.95	344.87	305.50	273.31
**TOTAL B-C	694.24	364.20	176.67	66.76	0.87	-39.18	-63.59
**TOTAL COST	651.20	538.81	456.54	393.95	344.87	305.50	273.31
** JENIANG + BERIS + REMAN **							
BENEFIT							
BENEFIT OF JENIANG & BERIS	1345.44	903.01	633.21	460.71	345.74	266.32	209.72
REMAN MADA MAIN (KEDAH)	181.48	120.05	82.65	58.80	42.99	32.14	24.49
REMAN MADA MINOR (KEDAH)	6.23	4.16	2.89	2.08	1.53	1.15	0.88
REMAN D & I (KEDAH)	1.09	0.69	0.46	0.32	0.22	0.16	0.12
*TOTAL BENEFIT	1534.24	1027.91	719.21	521.91	390.48	299.77	235.21
COST							
COST FOR JENIANG & BERIS	651.20	538.81	456.54	393.95	344.87	305.50	273.31
COST FOR REMAN	88.79	68.97	55.38	45.56	38.16	32.40	27.81
*TOTAL COST	739.99	607.78	511.92	439.51	383.03	337.90	301.12
**TOTAL B-C	794.25	420.13	207.29	82.40	7.45	-38.13	-65.91
**TOTAL COST	739.99	607.78	511.92	439.51	383.03	337.90	301.12

REMARKS; IN 1982 CONSTANT PRICE.

Table 47 BENEFIT CASH FLOW AND PRESENT WORTH OF IRRIGATION IN KEDAH RIVER FOR HIGH GROWTH CASE IF THE REMAN DAM AND MERBOK STORAGE CAN BE IMPLEMENTED

YEAR	PROPORTION OF N.W.O. TO THE TOTAL DEMAND			MADA MAIN			MADA MINOR		
	JENIANG SYSTEM (%)	BERIS DAM (%)	REMAN DAM (%)	JENIANG SYSTEM (M10^6)	BERIS DAM (M10^6)	REMAN DAM (M10^6)	JENIANG SYSTEM (M10^6)	BERIS DAM (M10^6)	REMAN DAM (M10^6)
1983	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	100.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00
1985	100.00	0.00	0.00	4.70	0.00	0.00	0.56	0.00	0.00
1986	100.00	0.00	0.00	8.80	0.00	0.00	1.47	0.00	0.00
1987	100.00	0.00	0.00	11.10	0.00	0.00	2.71	0.00	0.00
1988	100.00	0.00	0.00	13.30	0.00	0.00	3.33	0.00	0.00
1989	100.00	0.00	0.00	15.60	0.00	0.00	3.77	0.00	0.00
1990	92.46	0.00	0.00	24.58	0.00	0.00	3.65	0.00	0.00
1991	92.35	3.56	4.89	34.65	9.43	12.94	7.96	0.36	0.50
1992	92.24	3.53	5.16	46.16	9.80	14.32	8.31	0.37	0.55
1993	92.13	3.50	5.44	58.67	10.20	15.84	8.73	0.39	0.60
1994	92.02	3.47	5.71	65.44	10.38	17.08	9.00	0.40	0.65
1995	91.92	3.44	5.99	72.00	10.55	18.36	9.03	0.39	0.68
1996	91.81	3.41	6.26	78.83	10.72	19.69	9.17	0.40	0.73
1997	91.70	3.38	6.54	86.01	10.91	21.09	9.19	0.39	0.76
1998	91.59	3.35	6.81	93.35	11.09	22.55	9.23	0.39	0.80
1999	91.48	3.32	7.09	101.13	11.29	24.09	9.24	0.39	0.83
2000	91.37	3.29	7.36	109.53	11.50	25.73	9.23	0.39	0.86
2001	91.37	3.29	7.36	114.74	11.69	26.15	9.23	0.39	0.86
2002	91.37	3.29	7.36	116.84	11.77	26.32	9.23	0.39	0.86
2003	91.37	3.29	7.36	118.12	11.81	26.42	9.23	0.39	0.86
2010	91.37	3.29	7.36	118.12	11.81	26.42	9.23	0.39	0.86
2011	91.37	3.29	7.36	118.12	11.81	26.42	9.23	0.39	0.86
2031	91.37	3.29	7.36	118.12	11.81	26.42	9.23	0.39	0.86
2032	91.37	3.29	7.36	118.12	11.81	26.42	9.23	0.39	0.86
			NPV(6%)	964.37	106.64	215.69	97.17	3.69	7.39
			NPV(8%)	639.46	71.65	141.84	68.03	2.50	4.90
			NPV(10%)	442.84	50.08	97.07	49.66	1.77	3.39
			NPV(12%)	318.18	36.15	68.67	37.51	1.29	2.42
			NPV(14%)	235.85	26.78	49.93	29.12	0.96	1.77
			NPV(16%)	179.49	20.28	37.14	23.11	0.73	1.33
			NPV(18%)	139.72	15.63	28.16	18.69	0.57	1.01

Table 48 BENEFIT CASH FLOW AND PRESENT WORTH OF IRRIGATION IN MUDA RIVER FOR HIGH GROWTH CASE IF THE REMAN DAM AND MERBOK STORAGE CAN BE IMPLEMENTED

YEAR	PROPORTION OF N.W.O. TO DEMAND		MAIN MINOR	
	BERIS DAM (%)	MERBOK DAM (%)	BERIS DAM (M$10^6)	MERBOK DAM (M$10^6)
1983	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00
1991	0.18	3.12	0.04	0.78
1992	0.18	3.18	0.05	0.81
1993	0.18	3.25	0.05	0.85
1994	0.18	3.32	0.05	0.88
1995	0.18	3.39	0.05	0.90
1996	0.18	3.45	0.05	0.92
1997	0.18	3.52	0.05	0.93
1998	0.18	3.59	0.05	0.95
1999	0.18	3.65	0.05	0.97
2000	0.18	3.72	0.05	0.99
2001	0.18	3.72	0.05	0.99
2002	0.18	3.72	0.05	0.99
2003	0.18	3.72	0.05	0.99
2010	0.18	3.72	0.05	0.99
2011	0.18	3.72	0.05	0.99
2031	0.18	3.72	0.05	0.99
2032	0.18	3.72	0.05	0.99
NPV(6%)			0.45	8.97
NPV(8%)			0.31	6.03
NPV(10%)			0.22	4.22
NPV(12%)			0.16	3.04
NPV(14%)			0.12	2.26
NPV(16%)			0.09	1.71
NPV(18%)			0.07	1.32

Table 49 BENEFIT CASH FLOW AND PRESENT WORTH OF D&I WATER SUPPLY FOR HIGH GROWTH CASE IF THE REMAN DAM AND MERBOK STORAGE CAN BE IMPLEMENTED

YEAR	KEDAH			MUDA	
	JENIANG SYSTEM (M10^6$)	BERIS DAM (M10^6$)	REMAN DAM (M10^6$)	BERIS DAM (M10^6$)	MERBOK DAM (M10^6$)
1983	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00	0.00
1991	0.22	0.15	0.57	0.14	1.85
1992	0.43	0.26	1.14	0.14	3.71
1993	0.65	0.36	1.71	0.14	5.56
1994	0.86	0.47	2.28	0.14	7.42
1995	1.08	0.57	2.86	0.14	9.27
1996	1.29	0.67	3.43	0.14	11.12
1997	1.51	0.78	4.00	0.14	12.98
1998	1.72	0.88	4.57	0.14	14.83
1999	1.94	0.99	5.14	0.14	16.69
2000	2.15	1.09	5.71	0.14	18.54
2001	2.15	1.09	5.71	0.14	18.54
2002	2.15	1.09	5.71	0.14	18.54
2003	2.15	1.09	5.71	0.14	18.54
2010	2.15	1.09	5.71	0.14	18.54
2011	2.15	1.09	5.71	0.14	18.54
2031	2.15	1.09	5.71	0.14	18.54
2032	2.15	1.09	5.71	0.14	18.54
NPV(6%)	15.59	8.02	41.42	1.34	134.48
NPV(8%)	9.95	5.14	26.42	0.91	85.80
NPV(10%)	6.60	3.42	17.52	0.64	56.88
NPV(12%)	4.52	2.35	12.00	0.47	38.95
NPV(14%)	3.18	1.66	8.44	0.35	27.42
NPV(16%)	2.29	1.20	6.08	0.27	19.75
NPV(18%)	1.68	0.89	4.47	0.21	14.51

Table 50 BENEFIT CASH FLOW AND PRESENT WORTH OF IRRIGATION IN KEDAH RIVER FOR LOW GROWTH CASE IF THE REMAN DAM CAN BE IMPLEMENTED

YEAR	PROPORTION OF N.W.O. TO THE TOTAL DEMAND			MADA MAIN			MADA MINOR		
	JENIANG SYSTEM (%)	BERIS DAM (%)	REMAN DAM (%)	JENIANG SYSTEM (M$10^6)	BERIS DAM (M$10^6)	REMAN DAM (M$10^6)	JENIANG SYSTEM (M$10^6)	BERIS DAM (M$10^6)	REMAN DAM (M$10^6)
1983	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	100.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00
1985	100.00	0.00	0.00	4.70	0.00	0.00	0.56	0.00	0.00
1986	100.00	0.00	0.00	8.80	0.00	0.00	1.47	0.00	0.00
1987	100.00	0.00	0.00	11.10	0.00	0.00	2.71	0.00	0.00
1988	100.00	0.00	0.00	13.30	0.00	0.00	3.33	0.00	0.00
1989	100.00	0.00	0.00	15.60	0.00	0.00	3.77	0.00	0.00
1990	92.89	0.00	0.00	25.67	0.00	0.00	3.67	0.00	0.00
1991	92.92	3.27	4.64	36.15	8.66	12.30	8.02	0.33	0.48
1992	92.95	3.24	4.80	48.13	8.99	13.32	8.38	0.34	0.51
1993	92.98	3.21	4.95	61.15	9.35	14.44	8.82	0.36	0.55
1994	93.01	3.18	5.11	68.40	9.50	15.28	9.11	0.36	0.58
1995	93.05	3.15	5.26	75.47	9.65	16.13	9.15	0.36	0.60
1996	93.08	3.11	5.41	82.82	9.79	17.03	9.32	0.36	0.63
1997	93.11	3.08	5.57	90.56	9.95	17.97	9.36	0.36	0.65
1998	93.14	3.05	5.72	98.48	10.11	18.95	9.41	0.36	0.67
1999	93.17	3.02	5.88	106.87	10.27	19.98	9.44	0.35	0.69
2000	93.20	2.99	6.03	115.93	10.45	21.08	9.44	0.35	0.71
2001	93.20	2.99	6.03	121.24	10.62	21.42	9.44	0.35	0.71
2002	93.20	2.99	6.03	123.38	10.69	21.56	9.44	0.35	0.71
2003	93.20	2.99	6.03	124.69	10.73	21.65	9.44	0.35	0.71
2010	93.20	2.99	6.03	124.69	10.73	21.65	9.44	0.35	0.71
2011	93.20	2.99	6.03	124.69	10.73	21.65	9.44	0.35	0.71
2031	93.20	2.99	6.03	124.69	10.73	21.65	9.44	0.35	0.71
2032	93.20	2.99	6.03	124.69	10.73	21.65	9.44	0.35	0.71
			NPV(6%)	1013.90	97.16	181.48	98.85	3.36	6.23
			NPV(8%)	671.45	65.32	120.05	69.12	2.28	4.16
			NPV(10%)	464.35	45.67	82.65	50.40	1.61	2.89
			NPV(12%)	333.14	32.98	58.80	38.02	1.17	2.08
			NPV(14%)	246.55	24.45	42.99	29.49	0.88	1.53
			NPV(16%)	187.34	18.52	32.14	23.39	0.67	1.15
			NPV(18%)	145.59	14.28	24.49	18.89	0.52	0.88

Table 51 BENEFIT CASH FLOW AND PRESENT WORTH OF IRRIGATION IN MUDA RIVER FOR LOW GROWTH CASE IF THE REMAN DAM CAN BE IMPLEMENTED

YEAR	PROPORTION OF N.W.O. TO DEMAND	MAIN MINOR
	BERIS DAM (%)	BERIS DAM (M10^6)
1983	0.00	0.00
1984	0.00	0.00
1985	0.00	0.00
1986	0.00	0.00
1987	0.00	0.00
1988	0.00	0.00
1989	0.00	0.00
1990	0.00	0.00
1991	3.14	0.78
1992	3.09	0.79
1993	3.04	0.80
1994	2.99	0.79
1995	2.95	0.78
1996	2.90	0.77
1997	2.85	0.76
1998	2.80	0.74
1999	2.75	0.73
2000	2.70	0.72
2001	2.70	0.72
2002	2.70	0.72
2003	2.70	0.72
2010	2.70	0.72
2011	2.70	0.72
2031	2.70	0.72
2032	2.70	0.72
NPV(6%)		7.09
NPV(8%)		4.85
NPV(10%)		3.44
NPV(12%)		2.52
NPV(14%)		1.89
NPV(16%)		1.45
NPV(18%)		1.13

Table 52 BENEFIT CASH FLOW AND PRESENT WORTH OF D&I WATER SUPPLY FOR LOW GROWTH CASE IF THE REMAN DAM CAN BE IMPLEMENTED

YEAR	KEDAH			MUDA
	JENIANG SYSTEM (M10^6$)	BERIS DAM (M10^6$)	REMAN DAM (M10^6$)	BERIS DAM (M10^6$)
1983	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00
1991	0.01	0.00	0.02	0.28
1992	0.02	0.00	0.03	0.57
1993	0.02	0.00	0.05	0.85
1994	0.03	0.00	0.06	1.13
1995	0.04	0.00	0.08	1.42
1996	0.05	0.00	0.09	1.70
1997	0.06	0.00	0.11	1.98
1998	0.06	0.00	0.12	2.26
1999	0.07	0.00	0.14	2.55
2000	0.08	0.00	0.15	2.83
2001	0.08	0.00	0.15	2.83
2002	0.08	0.00	0.15	2.83
2003	0.08	0.00	0.15	2.83
2010	0.08	0.00	0.15	2.83
2011	0.08	0.00	0.15	2.83
2031	0.08	0.00	0.15	2.83
2032	0.08	0.00	0.15	2.83
NPV(6%)	0.58	0.00	1.09	20.53
NPV(8%)	0.37	0.00	0.69	13.10
NPV(10%)	0.25	0.00	0.46	8.68
NPV(12%)	0.17	0.00	0.32	5.95
NPV(14%)	0.12	0.00	0.22	4.18
NPV(16%)	0.09	0.00	0.16	3.01
NPV(18%)	0.06	0.00	0.12	2.21