

Table 241 BENEFICIAL AND ADVERSE EFFECTS OF  
RECOMMENDED HYDROPOWER DEVELOPMENT  
PLAN FOR PENINSULAR MALAYASIA

Item	Amount
1. National Economic Development	
1.1 Economic Benefit	
Power generation (M\$10 <sup>6</sup> )	344
1.2 Economic Cost	
Dam & power facilities (M\$10 <sup>6</sup> )	107
1.3 EIRR (%)	22
2. Environmental Quality	
2.1 Beneficial Effect	
Surface area of reservoir created (km <sup>2</sup> )	1,170
2.2 Adverse Effect	
Number of sites where kind of fish might be reduced being located immediately downstream of dam (nos. of site)	13
3. Social Well-being	
3.1 Adverse Effect	
Number of people to be removed for construction of facilities (10 <sup>3</sup> )	23

Remarks; (1): Figures in this table cover 3 States, i.e. Pahang, Trengganu and Kelantan.

(2): Economic benefit other than power generation benefit is not shown here, but included in the water demand and supply account.

Table 242 BENEFICIAL AND ADVERSE EFFECTS OF RECOMMENDED  
WATER DEMAND AND SUPPLY BALANCE PLAN IN  
PERLIS/KEDAH/P. PINANG UNDER THE CONDITION  
OF LOWER ECONOMIC GROWTH

Item	Amount
1. National Economic Development	
1.1 Economic Benefit	
Irrigation	(M\$10 <sup>6</sup> ) 62
D&I water supply	(M\$10 <sup>6</sup> ) 83
Fish culture	(M\$10 <sup>6</sup> ) 6
Reservoir recreation	(M\$10 <sup>6</sup> ) 4
Total	(M\$10 <sup>6</sup> ) 155
1.2 Economic Cost	
Irrigation	(M\$10 <sup>6</sup> ) 30
D&I water supply	(M\$10 <sup>6</sup> ) 73
Fish culture	(M\$10 <sup>6</sup> ) 6
Dams, barrages & diversion facilities	(M\$10 <sup>6</sup> ) 27
Total	(M\$10 <sup>6</sup> ) 136
1.3 EIRR	(%) 11
2. Environmental Quality	
2.1 Beneficial Effect	
Safe maintenance flow period (2000)	See Table
Surface area of lake created	(km <sup>2</sup> ) 49
2.2 Adverse Effect	
Possible reduction in kind of fish immediately downstream of dams and barrages	(nos. of site) 7
3. Social Well-being	
3.1 Beneficial Effect	
Number of farm households benefited by proposed irrigation in 2000	(10 <sup>3</sup> ) 75
Number of people served by proposed public water supply in 2000	(10 <sup>3</sup> ) 2,747
Safe supply period (2000)	See Table
3.2 Adverse Effect	
Number of people to be removed for construction of facilities	(10 <sup>2</sup> ) 4

Remarks; All effects by proposed hydropower project are not shown except irrigation, D&I water supply and reservoir recreation benefit.

Table 243 BENEFICIAL AND ADVERSE EFFECTS OF RECOMMENDED WATER POLLUTION ABATEMENT PLAN IN PERLIS/KEDAH/P, PINANG UNDER THE CONDITION OF LOWER ECONOMIC GROWTH

Item	Amount
<b>1. National Economic Development</b>	
1.1 Economic Benefit	
Sewerage	(M\$10 <sup>6</sup> ) 9
Saving in pre-treatment for D&I water supply	(M\$10 <sup>6</sup> ) 15
Total	(M\$10 <sup>6</sup> ) 24
1.2 Economic Cost	
Sewerage	(M\$10 <sup>6</sup> ) 20
Private purification facilities /2	(M\$10 <sup>6</sup> ) 1
Pre-treatment for D&I water supply	(M\$10 <sup>6</sup> ) 1
Total	(M\$10 <sup>6</sup> ) 22
<b>2. Environmental Quality</b>	
2.1 Beneficial Effects	
Length of river stretch where BOD concentration is not more than 10 mg/lit in 2000 compared with without project condition (Study length = 314 km)	(km) 314/272 <sup>/1</sup>
Length of river stretch where BOD concentration is not more than 5 mg/lit in 2000 compared with without project condition (Study length = 314 km)	(km) 293/242 <sup>/1</sup>
2.2 Adverse Effect	
-	
<b>3. Social Well-Being</b>	
3.1 Beneficial Effects	
Number of people served by proposed sewerage system in 2000	(10 <sup>3</sup> ) 404
3.2 Adverse Effect	
-	
Remarks; /1: (Length of river stretch with Project)/ (Length of river stretch without Project) and including the river stretch in the State of Perak	
/2: Including the rubber factories and palm oil mills in such part of the State of Perak as located in Basin 8 and 9.	

Table 244

BENEFICIAL AND ADVERSE EFFECTS OF RECOMMENDED  
FLOOD MITIGATION PLAN IN PERLIS/KEDAH/  
P. PINANG UNDER THE CONDITION OF LOWER  
ECONOMIC GROWTH

Item	Amount
1. National Economic Development	
1.1 Economic Benefit	
Damage reduction	(M\$10 <sup>6</sup> ) 3.9
1.2 Economic Cost	
Flood mitigation work	(M\$10 <sup>6</sup> ) 4.0
1.3 EIRR	(%) 8
2. Environmental Quality	
2.1 Beneficial Effect	
Length of improved stretch	(km) 116
2.2 Adverse Effect	-
3. Social Well-Being	
3.1 Beneficial Effect	
Number of protected people by proposed facilities in 2000	(10 <sup>3</sup> ) 92
Population served by proposed flood warning system in 2000	(10 <sup>3</sup> ) 24
Area relieved from flood hazards	(km <sup>2</sup> ) 16
3.2 Adverse Effect	
Number of people to be removed for construction of facilities	(10 <sup>3</sup> ) 6

Table 245 BENEFICIAL AND ADVERSE EFFECTS OF RECOMMENDED  
WATER DEMAND AND SUPPLY BALANCE PLAN IN  
PERAK UNDER THE CONDITION OF LOWER  
ECONOMIC GROWTH

Item	Amount
1. National Economic Development	
1.1 Economic Benefit	
Irrigation	(M\$10 <sup>6</sup> ) 16
D&I water supply	(M\$10 <sup>6</sup> ) 62
Fish culture	(M\$10 <sup>6</sup> ) 2
Reservoir recreation	(M\$10 <sup>6</sup> ) 2
Total	(M\$10 <sup>6</sup> ) 82
1.2 Economic Cost	
Irrigation	(M\$10 <sup>6</sup> ) 5
D&I water supply	(M\$10 <sup>6</sup> ) 57
Fish culture	(M\$10 <sup>6</sup> ) 2
Dams, barrages & diversion facilities	(M\$10 <sup>6</sup> ) 5
Total	(M\$10 <sup>6</sup> ) 69
1.3 EIRR	(%) 12
2. Environmental Quality	
2.1 Beneficial Effect	
Safe maintenance flow period (2000)	See Table
Surface area of lake created	(km <sup>2</sup> ) 7
2.2 Adverse Effect	
Possible reduction in kind of fish immediately downstream of dams and barrages	(nos. of site) 3
3. Social Well-being	
3.1 Beneficial Effect	
Number of farm households benefited by proposed irrigation in 2000	(10 <sup>3</sup> ) 29
Number of people served by proposed public water supply in 2000	(10 <sup>3</sup> ) 2,089
Safe supply period (2000)	See Table
3.2 Adverse Effect	
Number of people to be removed for construction of facilities	(10 <sup>2</sup> ) 1
Remarks; All effects by proposed hydropower project are not shown except irrigation, D&I water supply and reservoir recreation benefit.	

Table 246 BENEFICIAL AND ADVERSE EFFECTS OF  
RECOMMENDED WATER POLLUTION ABATEMENT  
PLAN IN PERAK UNDER THE CONDITION  
OF LOWER ECONOMIC GROWTH

Item	Amount
1. National Economic Development	
1.1 Economic Benefit	
Sewerage	(M\$10 <sup>6</sup> ) 5
Saving in pre-treatment for D&I water supply	(M\$10 <sup>6</sup> ) 1
Total	(M\$10 <sup>6</sup> ) 6
1.2 Economic Cost	
Sewerage	(M\$10 <sup>6</sup> ) 22
Private purification facilities <sup>/2</sup>	(M\$10 <sup>6</sup> ) 1
Pre-treatment for D&I water supply	(M\$10 <sup>6</sup> ) 0
Total	(M\$10 <sup>6</sup> ) 23
2. Environmental Quality	
2.1 Beneficial Effects	
Length of river stretch where BOD concentration is not more than 10 mg/lit in 2000 compared with without project condition (Study length = 510 km)	(km) 510/472 <sup>/1</sup>
Length of river stretch where BOD concentration is not more than 5 mg/lit in 2000 compared with without project condition (Study length = 510 km)	(km) 510/385 <sup>/1</sup>
2.2 Adverse Effect	
3. Social Well-Being	
3.1 Beneficial Effects	
Number of people served by proposed sewerage system in 2000	(10 <sup>3</sup> ) 446
3.2 Adverse Effect	

Remarks; /1: (Length of river stretch with Project)/  
(Length of river stretch without Project)  
and including the river stretch in the State  
of P.Pinang and Selangor.

/2: Including the rubber factories and palm oil mills  
in such part of the State of P.Pinang and Selangor as  
located in Basin 8, 9 and 11.

Table 247

BENEFICIAL AND ADVERSE EFFECTS OF RECOMMENDED  
FLOOD MITIGATION PLAN IN PERAK UNDER THE  
CONDITION OF LOWER ECONOMIC GROWTH

Item	Amount
1. National Economic Development	
1.1 Economic Benefit	
Damage reduction	(M\$10 <sup>6</sup> ) 7.6
1.2 Economic Cost	
Flood mitigation work	(M\$10 <sup>6</sup> ) 8.9
1.3 EIRR	(%) 6.6
2. Environmental Quality	
2.1 Beneficial Effect	
Length of improved stretch	(km) 13
2.2 Adverse Effect	-
3. Social Well-Being	
3.1 Beneficial Effect	
Number of protected people by proposed facilities in 2000	(10 <sup>3</sup> ) 268
Population served by proposed flood warning system in 2000	(10 <sup>3</sup> ) 168
Area relieved from flood hazards	(km <sup>2</sup> ) 95
3.2 Adverse Effect	
Number of people to be removed for construction of facilities	(10 <sup>3</sup> ) 4

Table 248 BENEFICIAL AND ADVERSE EFFECTS OF RECOMMENDED  
WATER DEMAND AND SUPPLY BALANCE PLAN IN  
SELANGOR UNDER THE CONDITION OF LOWER  
ECONOMIC GROWTH

Item	Amount
1. National Economic Development	
1.1 Economic Benefit	
Irrigation	(M\$10 <sup>6</sup> ) 0
D&I water supply	(M\$10 <sup>6</sup> ) 257
Fish culture	(M\$10 <sup>6</sup> ) 4
Reservoir recreation	(M\$10 <sup>6</sup> ) 6
Total	(M\$10 <sup>6</sup> ) 269
1.2 Economic Cost	
Irrigation	(M\$10 <sup>6</sup> ) 0
D&I water supply	(M\$10 <sup>6</sup> ) 223
Fish culture	(M\$10 <sup>6</sup> ) 4
Dams, barrages & diversion facilities	(M\$10 <sup>6</sup> ) 31
Total	(M\$10 <sup>6</sup> ) 258
1.3 EIRR	(%) 11
2. Environmental Quality	
2.1 Beneficial Effect	
Safe maintenance flow period (2000)	See Table
Surface area of lake created	(km <sup>2</sup> ) 10
2.2 Adverse Effect	
Possible reduction in kind of fish immediately downstream of dams and barrages	(nos. of site) 3
3. Social Well-being	
3.1 Beneficial Effect	
Number of farm households benefited by proposed irrigation in 2000	(10 <sup>3</sup> ) 12
Number of people served by proposed public water supply in 2000	(10 <sup>3</sup> ) 4,775
Safe supply period (2000)	See Table
3.2 Adverse Effect	
Number of people to be removed for construction of facilities	(10 <sup>2</sup> ) 4
Remarks; All effects by proposed hydropower project are not shown except irrigation, D&I water supply and reservoir recreation benefit.	



Table 249 BENEFICIAL AND ADVERSE EFFECTS OF  
RECOMMENDED WATER POLLUTION ABATEMENT  
PLAN IN SELANGOR UNDER THE CONDITION  
OF LOWER ECONOMIC GROWTH

Item	Amount
1. National Economic Development	
1.1 Economic Benefit	
Sewerage	(M\$10 <sup>6</sup> ) 43
Saving in pre-treatment for D&I water supply	(M\$10 <sup>6</sup> ) 0
Total	(M\$10 <sup>6</sup> ) 43
1.2 Economic Cost	
Sewerage	(M\$10 <sup>6</sup> ) 105
Private purification facilities <sup>/2</sup>	(M\$10 <sup>6</sup> ) 2
Pre-treatment for D&I water supply	(M\$10 <sup>6</sup> ) 0
Total	(M\$10 <sup>6</sup> ) 107
2. Environmental Quality	
2.1 Beneficial Effects	
Length of river stretch where BOD concentration is not more than 10 mg/lit in 2000 compared with without project condition (Study length = 497 km)	(km) 448/372 <sup>/1</sup>
Length of river stretch where BOD concentration is not more than 5 mg/lit in 2000 compared with without project condition (Study length = 497 km)	(km) 378/232 <sup>/1</sup>
2.2 Adverse Effect	
-	
3. Social Well-Being	
3.1 Beneficial Effects	
Number of people served by proposed sewerage system in 2000	(10 <sup>3</sup> ) 2,873
3.2 Adverse Effect	
-	
Remarks; <u>/1</u> : (Length of river stretch with Project)/ (Length of river stretch without Project) and including the river stretch in the State of Perak and N.Sembilan	
<u>/2</u> : Including the rubber factories and palm oil mills in such part of the State of Perak and N.Sembilan as located in Basin 11, 16 and 17	

Table 250 BENEFICIAL AND ADVERSE EFFECTS OF  
RECOMMENDED FLOOD MITIGATION PLAN IN  
SELANGOR UNDER THE CONDITION OF  
LOWER ECONOMIC GROWTH

Item	Amount
1. National Economic Development	
1.1 Economic Benefit	
Damage reduction	(M\$10 <sup>6</sup> ) 2.2
1.2 Economic Cost	
Flood mitigation work	(M\$10 <sup>6</sup> ) 5.3
1.3 EIRR	(%) 2.6
2. Environmental Quality	
2.1 Beneficial Effect	
Length of improved stretch	(km) 36
2.2 Adverse Effect	-
3. Social Well-Being	
3.1 Beneficial Effect	
Number of protected people by proposed facilities in 2000	(10 <sup>3</sup> ) 204
Population served by proposed flood warning system in 2000	(10 <sup>3</sup> ) 131
Area relieved from flood hazards	(km <sup>2</sup> ) 3
3.2 Adverse Effect	
Number of people to be removed for construction of facilities	(10 <sup>3</sup> ) 1

Table 251 BENEFICIAL AND ADVERSE EFFECTS OF RECOMMENDED WATER DEMAND AND SUPPLY BALANCE PLAN IN N. SEMBILAN/MELAKA/NORTHWEST JOHOR UNDER THE CONDITION OF LOWER ECONOMIC GROWTH

Item	Amount
1. National Economic Development	
1.1 Economic Benefit	
Irrigation	(M\$10 <sup>6</sup> ) 5
D&I water supply	(M\$10 <sup>6</sup> ) 67
Fish culture	(M\$10 <sup>6</sup> ) 3
Reservoir recreation	(M\$10 <sup>6</sup> ) 1
Total	(M\$10 <sup>6</sup> ) 76
1.2 Economic Cost	
Irrigation	(M\$10 <sup>6</sup> ) 2
D&I water supply	(M\$10 <sup>6</sup> ) 38
Fish culture	(M\$10 <sup>6</sup> ) 3
Dams, barrages & diversion facilities	(M\$10 <sup>6</sup> ) 29
Total	(M\$10 <sup>6</sup> ) 72
1.3 EIRR	(%) 9
2. Environmental Quality	
2.1 Beneficial Effect	
Safe maintenance flow period (2000)	See Table
Surface area of lake created	(km <sup>2</sup> ) 13
2.2 Adverse Effect	
Possible reduction in kind of fish immediately downstream of dams and barrages	(nos. of site) 3
3. Social Well-being	
3.1 Beneficial Effect	
Number of farm households benefited by proposed irrigation in 2000	(10 <sup>3</sup> ) 9
Number of people served by proposed public water supply in 2000	(10 <sup>3</sup> ) 1,734
Safe supply period (2000)	See Table
3.2 Adverse Effect	
Number of people to be removed for construction of facilities	(10 <sup>2</sup> ) 2
Remarks;	All effects by proposed hydropower project are not shown except irrigation, D&I water supply and reservoir recreation benefit,

Table 252 BENEFICIAL AND ADVERSE EFFECTS OF  
RECOMMENDED WATER POLLUTION ABATEMENT PLAN  
IN N. SEMBILAN/MELAKA/NORTHWEST JOHOR  
UNDER THE CONDITION OF LOWER ECONOMIC GROWTH

Item	Amount
1. National Economic Development	
1.1 Economic Benefit	
Sewerage	(M\$10 <sup>6</sup> ) 5
Saving in pre-treatment for D&I water supply	(M\$10 <sup>6</sup> ) 28
Total	(M\$10 <sup>6</sup> ) 33
1.2 Economic Cost	
Sewerage	(M\$10 <sup>6</sup> ) 18
Private purification facilities <sup>/2</sup>	(M\$10 <sup>6</sup> ) 2
Pre-treatment for D&I water supply	(M\$10 <sup>6</sup> ) 15
Total	(M\$10 <sup>6</sup> ) 35
2. Environmental Quality	
2.1 Beneficial Effects	
Length of river stretch where BOD concentration is not more than 10 mg/lit in 2000 compared with without project condition (Study length = 853 km)	(km) 795/573 <sup>/1</sup>
Length of river stretch where BOD concentration is not more than 5 mg/lit in 2000 compared with without project condition (Study length = 853 km)	(km) 736/444 <sup>/1</sup>
2.2 Adverse Effect	
-	
3. Social Well-Being	
3.1 Beneficial Effects	
Number of people served by proposed sewerage system in 2000	(10 <sup>3</sup> ) 423
3.2 Adverse Effect	
-	
Remarks; <u>/1</u> : (Length of river stretch with Project) / (Length of river stretch without Project) and including the river stretch in the State of Selangor and Pahang	
<u>/2</u> : Including the rubber factories and palm oil mills in such part of the State of Selangor, Johor and Pahang as located in Basin 16, 17, 20, 21 and 30	

Table 253 BENEFICIAL AND ADVERSE EFFECTS OF RECOMMENDED  
FLOOD MITIGATION PLAN IN N. SEMBILAN/MELAKA/  
NORTHWEST JOHOR UNDER THE CONDITION OF LOWER  
ECONOMIC GROWTH

Item	Amount
1. National Economic Development	
1.1 Economic Benefit	
Damage reduction	(M\$10 <sup>6</sup> )      2.6
1.2 Economic Cost	
Flood mitigation work	(M\$10 <sup>6</sup> )      2.0
1.3 EIRR	(%)              10
2. Environmental Quality	
2.1 Beneficial Effect	
Length of improved stretch	(km)             113
2.2 Adverse Effect	
3. Social Well-Being	
3.1 Beneficial Effect	
Number of protected people by proposed facilities in 2000	(10 <sup>3</sup> )            161
Population served by proposed flood warning system in 2000	(10 <sup>3</sup> )            42
Area relieved from flood hazards	(km <sup>2</sup> )            19
3.2 Adverse Effect	
Number of people to be removed for construction of facilities	(10 <sup>3</sup> )            2

Table 254 BENEFICIAL AND ADVERSE EFFECTS OF RECOMMENDED  
WATER DEMAND AND SUPPLY BALANCE PLAN IN  
JOHOR UNDER THE CONDITION OF LOWER  
ECONOMIC GROWTH

Item	Amount
1. National Economic Development	
1.1 Economic Benefit	
Irrigation	(M\$10 <sup>6</sup> ) 10
D&I water supply	(M\$10 <sup>6</sup> ) 82
Fish culture	(M\$10 <sup>6</sup> ) 4
Reservoir recreation	(M\$10 <sup>6</sup> ) 7
Total	(M\$10 <sup>6</sup> ) 103
1.2 Economic Cost	
Irrigation	(M\$10 <sup>6</sup> ) 4
D&I water supply	(M\$10 <sup>6</sup> ) 70
Fish culture	(M\$10 <sup>6</sup> ) 4
Dams, barrages & diversion facilities	(M\$10 <sup>6</sup> ) 9
Total	(M\$10 <sup>6</sup> ) 87
1.3 EIRR	(%) 11
2. Environmental Quality	
2.1 Beneficial Effect	
Safe maintenance flow period (2000)	See Table
Surface area of lake created	(km <sup>2</sup> ) 85
2.2 Adverse Effect	
Possible reduction in kind of fish immediately downstream of dams and barrages	(nos. of site) 6
3. Social Well-being	
3.1 Beneficial Effect	
Number of farm households benefited by proposed irrigation in 2000	(10 <sup>3</sup> ) 4
Number of people served by proposed public water supply in 2000	(10 <sup>3</sup> ) 2,423
Safe supply period (2000)	See Table
3.2 Adverse Effect	
Number of people to be removed for construction of facilities	(10 <sup>2</sup> ) 3
Remarks; All effects by proposed hydropower project are not shown except irrigation, D&I water supply and reservoir recreation benefit.	

Table 255 BENEFICIAL AND ADVERSE EFFECTS OF  
RECOMMENDED WATER POLLUTION ABATEMENT  
PLAN IN JOHOR UNDER THE CONDITION  
OF LOWER ECONOMIC GROWTH

Item	Amount
<b>1. National Economic Development</b>	
1.1 Economic Benefit	
Sewerage	(M\$10 <sup>6</sup> ) 7
Saving in pre-treatment for D&I water supply	(M\$10 <sup>6</sup> ) 21
Total	(M\$10 <sup>6</sup> ) 28
1.2 Economic Cost	
Sewerage	(M\$10 <sup>6</sup> ) 21
Private purification facilities/2	(M\$10 <sup>6</sup> ) 3
Pre-treatment for D&I water supply	(M\$10 <sup>6</sup> ) 8
Total	(M\$10 <sup>6</sup> ) 32
<b>2. Environmental Quality</b>	
2.1 Beneficial Effects	
Length of river stretch where BOD concentration is not more than 10 mg/lit in 2000 compared with without project condition (Study length = 846 km)	(km) 832/446 <sup>/1</sup>
Length of river stretch where BOD concentration is not more than 5 mg/lit in 2000 compared with without project condition (Study length = 846 km)	(km) 753/232 <sup>/1</sup>
2.2 Adverse Effect	
-	
<b>3. Social Well-Being</b>	
3.1 Beneficial Effects	
Number of people served by proposed sewerage system in 2000	(10 <sup>3</sup> ) 570
3.2 Adverse Effect	
-	
Remarks; <u>/1</u> : (Length of river stretch with Project)/ (length of river stretch without Project) and including the river stretch in the State of N.Sembilan, Malaka and Pahang	
<u>/2</u> : Including the rubber factories and palm oil mills in such part of the State of N.Sembilan, Malaka and Pahang as located in Basin 20, 21, 27 and 28.	

Table 256

BENEFICIAL AND ADVERSE EFFECTS OF RECOMMENDED  
FLOOD MITIGATION PLAN IN JOHOR UNDER THE  
CONDITION OF LOWER ECONOMIC GROWTH

Item	Amount
1. National Economic Development	
1.1 Economic Benefit	
Damage reduction	(M\$10 <sup>6</sup> )      3.6
1.2 Economic Cost	
Flood mitigation work	(M\$10 <sup>6</sup> )      7.6
1.3 EIRR	(%)      3.5
2. Environmental Quality	
2.1 Beneficial Effect	
Length of improved stretch	(km)      154
2.2 Adverse Effect	-
3. Social Well-Being	
3.1 Beneficial Effect	
Number of protected people by proposed facilities in 2000	(10 <sup>3</sup> )      102
Population served by proposed flood warning system in 2000	(10 <sup>3</sup> )      31
Area relieved from flood hazards	(km <sup>2</sup> )      31
3.2 Adverse Effect	
Number of people to be removed for construction of facilities	(10 <sup>3</sup> )      3



Table 257 BENEFICIAL AND ADVERSE EFFECTS OF RECOMMENDED WATER DEMAND AND SUPPLY BALANCE PLAN IN PAHANG UNDER THE CONDITION OF LOWER ECONOMIC GROWTH

Item		Amount
1. National Economic Development		
1.1 Economic Benefit		
Irrigation	(M\$10 <sup>6</sup> )	38
D&I water supply	(M\$10 <sup>6</sup> )	69
Fish culture	(M\$10 <sup>6</sup> )	7
Reservoir recreation	(M\$10 <sup>6</sup> )	5
Total	(M\$10 <sup>6</sup> )	119
1.2 Economic Cost		
Irrigation	(M\$10 <sup>6</sup> )	18
D&I water supply	(M\$10 <sup>6</sup> )	68
Fish culture	(M\$10 <sup>6</sup> )	7
Dams, barrages & diversion facilities	(M\$10 <sup>6</sup> )	3
Total	(M\$10 <sup>6</sup> )	96
1.3 EIRR	(%)	11
2. Environmental Quality		
2.1 Beneficial Effect		
Safe maintenance flow period (2000)		See Table
Surface area of lake created	(km <sup>2</sup> )	7
2.2 Adverse Effect		
Possible reduction in kind of fish immediately downstream of dams and barrages	(nos. of site)	2
3. Social Well-being		
3.1 Beneficial Effect		
Number of farm households benefited by proposed irrigation in 2000	(10 <sup>3</sup> )	15
Number of people served by proposed public water supply in 2000	(10 <sup>3</sup> )	1,589
Safe supply period (2000)		See Table
3.2 Adverse Effect		
Number of people to be removed for construction of facilities	(10 <sup>2</sup> )	1

Remarks; All effects by proposed hydropower project are not shown except irrigation, D&I water supply and reservoir recreation benefit.

Table 258 BENEFICIAL AND ADVERSE EFFECTS OF  
RECOMMENDED WATER POLLUTION ABATEMENT  
PLAN IN PAHANG UNDER THE CONDITION  
OF LOWER ECONOMIC GROWTH

Item	Amount
1. National Economic Development	
1.1 Economic Benefit	
Sewerage	(M\$10 <sup>6</sup> ) 3
Saving in pre-treatment for D&I water supply	(M\$10 <sup>6</sup> ) 17
Total	(M\$10 <sup>6</sup> ) 20
1.2 Economic Cost	
Sewerage	(M\$10 <sup>6</sup> ) 7
Private purification facilities /2	(M\$10 <sup>6</sup> ) 2
Pre-treatment for D&I water supply	(M\$10 <sup>6</sup> ) 20
Total	(M\$10 <sup>6</sup> ) 29
2. Environmental Quality	
2.1 Beneficial Effects	
Length of river stretch where BOD concentration is not more than 10 mg/lit in 2000 compared with without project condition (Study length = 974 km)	(km) 974/759 <sup>/1</sup>
Length of river stretch where BOD concentration is not more than 5 mg/lit in 2000 compared with without project condition (Study length = 974 km)	(km) 971/585 <sup>/1</sup>
2.2 Adverse Effect	
-	
3. Social Well-Being	
3.1 Beneficial Effects	
Number of people served by proposed sewerage system in 2000	(10 <sup>3</sup> ) 352
3.2 Adverse Effect	
-	
Remarks; <u>/1</u> : (Length of river stretch with Project)/ (Length of river stretch without Project) and including the river stretch in the State of N. Sembilan and Johor	
<u>/2</u> : Including the rubber factories and palm oil mills in such part of the State of N.Sembilan and Johor as located in Basin 21, 27 and 28	

Table 259 BENEFICIAL AND ADVERSE EFFECTS OF  
RECOMMENDED FLOOD MITIGATION PLAN IN  
PAHANG UNDER THE CONDITION OF  
LOWER ECONOMIC GROWTH

Item	Amount
1. National Economic Development	
1.1 Economic Benefit	
Damage reduction	(M\$10 <sup>6</sup> ) 3.6
1.2 Economic Cost	
Flood mitigation work	(M\$10 <sup>6</sup> ) 13.3
1.3 EIRR	(%) 0.6
2. Environmental Quality	
2.1 Beneficial Effect	
Length of improved stretch	(km) 6
2.2 Adverse Effect	-
3. Social Well-Being	
3.1 Beneficial Effect	
Number of protected people by proposed facilities in 2000	(10 <sup>3</sup> ) 89
Population served by proposed flood warning system in 2000	(10 <sup>3</sup> ) 107
Area relieved from flood hazards	(km <sup>2</sup> ) 5
3.2 Adverse Effect	
Number of people to be removed for construction of facilities	(10 <sup>3</sup> ) 3

Table 260 BENEFICIAL AND ADVERSE EFFECTS OF RECOMMENDED WATER DEMAND AND SUPPLY BALANCE PLAN IN TRENGGANU UNDER THE CONDITION OF LOWER ECONOMIC GROWTH

Item	Amount
<b>1. National Economic Development</b>	
<b>1.1 Economic Benefit</b>	
Irrigation	(M\$10 <sup>6</sup> ) 6
D&I water supply	(M\$10 <sup>6</sup> ) 27
Fish culture	(M\$10 <sup>6</sup> ) 1
Reservoir recreation	(M\$10 <sup>6</sup> ) 0
Total	(M\$10 <sup>6</sup> ) 34
<b>1.2 Economic Cost</b>	
Irrigation	(M\$10 <sup>6</sup> ) 4
D&I water supply	(M\$10 <sup>6</sup> ) 27
Fish culture	(M\$10 <sup>6</sup> ) 1
Dams, barrages & diversion facilities	(M\$10 <sup>6</sup> ) 0
Total	(M\$10 <sup>6</sup> ) 32
1.3 EIRR	(%) 10
<b>2. Environmental Quality</b>	
<b>2.1 Beneficial Effect</b>	
Safe maintenance flow period (2000)	See Table
Surface area of lake created	(km <sup>2</sup> ) -
<b>2.2 Adverse Effect</b>	
Possible reduction in kind of fish immediately downstream of dams and barrages	(nos. of site) -
<b>3. Social Well-being</b>	
<b>3.1 Beneficial Effect</b>	
Number of farm households benefited by proposed irrigation in 2000	(10 <sup>3</sup> ) 9
Number of people served by proposed public water supply in 2000	(10 <sup>3</sup> ) 938
Safe supply period (2000)	See Table
<b>3.2 Adverse Effect</b>	
Number of people to be removed for construction of facilities	(10 <sup>2</sup> ) -
Remarks; All effects by proposed hydropower project are not shown except irrigation, D&I water supply and reservoir recreation benefit.	

Table 261 BENEFICIAL AND ADVERSE EFFECTS OF  
RECOMMENDED WATER POLLUTION ABATEMENT  
PLAN IN TRENGGANU UNDER THE CONDITION  
OF LOWER ECONOMIC GROWTH

Item	Amount
1. National Economic Development	
1.1 Economic Benefit	
Sewerage	(M\$10 <sup>6</sup> ) 2
Saving in pre-treatment for D&I water supply	(M\$10 <sup>6</sup> ) 0
Total	(M\$10 <sup>6</sup> ) 2
1.2 Economic Cost	
Sewerage	(M\$10 <sup>6</sup> ) 7
Private purification facilities	(M\$10 <sup>6</sup> ) 0
Pre-treatment for D&I water supply	(M\$10 <sup>6</sup> ) 0
Total	(M\$10 <sup>6</sup> ) 7
2. Environmental Quality	
2.1 Beneficial Effects	
Length of river stretch where BOD concentration is not more than 10 mg/lit in 2000 compared with without project condition (Study length = 267 km)	(km) 267/267 <u>/1</u>
Length of river stretch where BOD concentration is not more than 5 mg/lit in 2000 compared with without project condition (Study length = 267 km)	(km) 267/250 <u>/1</u>
2.2 Adverse Effect	-
3. Social Well-Being	
3.1 Beneficial Effects	
Number of people served by proposed sewerage system in 2000	(10 <sup>3</sup> ) 329
3.2 Adverse Effect	-
Remarks; <u>/1</u> : (Length of river stretch with Project)/ (Length of river stretch without Project)	

Table 262

BENEFICIAL AND ADVERSE EFFECTS OF RECOMMENDED  
FLOOD MITIGATION PLAN IN TRENGGANU UNDER  
THE CONDITION OF LOWER ECONOMIC GROWTH

Item		Amount
1. National Economic Development		
1.1 Economic Benefit		
Damage reduction	(M\$10 <sup>6</sup> )	3.6
1.2 Economic Cost		
Flood mitigation work	(M\$10 <sup>6</sup> )	4.5
1.3 EIRR	(%)	6.1
2. Environmental Quality		
2.1 Beneficial Effect		
Length of improved stretch	(km)	71
2.2 Adverse Effect		-
3. Social Well-Being		
3.1 Beneficial Effect		
Number of protected people by proposed facilities in 2000	(10 <sup>3</sup> )	144
Population served by proposed flood warning system in 2000	(10 <sup>3</sup> )	44
Area relieved from flood hazards	(km <sup>2</sup> )	31
3.2 Adverse Effect		
Number of people to be removed for construction of facilities	(10 <sup>3</sup> )	6

Table 263

BENEFICIAL AND ADVERSE EFFECTS OF RECOMMENDED  
WATER DEMAND AND SUPPLY BALANCE PLAN IN  
KELANTAN UNDER THE CONDITION OF LOWER  
ECONOMIC GROWTH

Item	Amount
1. National Economic Development	
1.1 Economic Benefit	
Irrigation	(M\$10 <sup>6</sup> ) 55
D&I water supply	(M\$10 <sup>6</sup> ) 34
Fish culture	(M\$10 <sup>6</sup> ) 3
Reservoir recreation	(M\$10 <sup>6</sup> ) 2
Total	(M\$10 <sup>6</sup> ) 94
1.2 Economic Cost	
Irrigation	(M\$10 <sup>6</sup> ) 31
D&I water supply	(M\$10 <sup>6</sup> ) 34
Fish culture	(M\$10 <sup>6</sup> ) 3
Dams, barrages & diversion facilities	(M\$10 <sup>6</sup> ) 2
Total	(M\$10 <sup>6</sup> ) 70
1.3 EIRR	(%) 12
2. Environmental Quality	
2.1 Beneficial Effect	
Safe maintenance flow period (2000)	See Table
Surface area of lake created	(km <sup>2</sup> ) 200
2.2 Adverse Effect	
Possible reduction in kind of fish immediately downstream of dams and barrages	(nos. of site) 2
3. Social Well-being	
3.1 Beneficial Effect	
Number of farm households benefited by proposed irrigation in 2000	(10 <sup>3</sup> ) 73
Number of people served by proposed public water supply in 2000	(10 <sup>3</sup> ) 1,339
Safe supply period (2000)	See Table
3.2 Adverse Effect	
Number of people to be removed for construction of facilities	(10 <sup>2</sup> ) 1
Remarks; All effects by proposed hydropower project are not shown except irrigation, D&I water supply and reservoir recreation benefit.	

Table 264

BENEFICIAL AND ADVERSE EFFECTS OF  
RECOMMENDED WATER POLLUTION ABATEMENT  
PLAN IN KELANTAN UNDER THE CONDITION  
OF LOWER ECONOMIC GROWTH

Item	Amount
<b>1. National Economic Development</b>	
1.1 Economic Benefit	
Sewerage	(M\$10 <sup>6</sup> ) 2
Saving in pre-treatment for D&I water supply	(M\$10 <sup>6</sup> ) 0
Total	(M\$10 <sup>6</sup> ) 2
1.2 Economic Cost	
Sewerage	(M\$10 <sup>6</sup> ) 8
Private purification facilities	(M\$10 <sup>6</sup> ) 0
Pre-treatment for D&I water supply	(M\$10 <sup>6</sup> ) 0
Total	(M\$10 <sup>6</sup> ) 8
<b>2. Environmental Quality</b>	
2.1 Beneficial Effects	
Length of river stretch where BOD concentration is not more than 10 mg/lit in 2000 compared with without project condition (Study length = 205 km)	(km) 205/204 <sup>/1</sup>
Length of river stretch where BOD concentration is not more than 5 mg/lit in 2000 compared with without project condition (Study length = 205 km)	(km) 205/182 <sup>/1</sup>
2.2 Adverse Effect	
-	
<b>3. Social Well-Being</b>	
3.1 Beneficial Effects	
Number of people served by proposed sewerage system in 2000	(10 <sup>3</sup> ) 352
3.2 Adverse Effect	
-	
Remarks; <u>/1</u> : (Length of river stretch with Project) / (Length of river stretch without Project)	



Table 265 BENEFICIAL AND ADVERSE EFFECTS OF RECOMMENDED  
FLOOD MITIGATION PLAN IN KELANTAN UNDER THE  
CONDITION OF LOWER ECONOMIC GROWTH

Item	Amount
1. National Economic Development	
1.1 Economic Benefit	
Damage reduction	(M\$10 <sup>6</sup> ) 14.0
1.2 Economic Cost	
Flood mitigation work	(M\$10 <sup>6</sup> ) 9.3
1.3 EIRR	(%) 11.5
2. Environmental Quality	
2.1 Beneficial Effect	
Length of improved stretch	(km) 65
2.2 Adverse Effect	-
3. Social Well-Being	
3.1 Beneficial Effect	
Number of protected people by proposed facilities in 2000	(10 <sup>3</sup> ) 517
Population served by proposed flood warning system in 2000	(10 <sup>3</sup> ) 231
Area relieved from flood hazards	(km <sup>2</sup> ) 92
3.2 Adverse Effect	
Number of people to be removed for construction of facilities	(10 <sup>3</sup> ) 25

Table 266 BENEFICIAL AND ADVERSE EFFECTS OF RECOMMENDED HYDROPOWER DEVELOPMENT PLAN FOR PENINSULAR MALAYSIA UNDER THE CONDITION OF LOWER ECONOMIC GROWTH

Item	Amount
1. National Economic Development	
1.1 Economic Benefit	
Power generation (M\$10 <sup>6</sup> )	270
1.2 Economic Cost	
Dam & power facilities (M\$10 <sup>6</sup> )	81
1.3 EIRR (%)	23
2. Environmental Quality	
2.1 Beneficial Effect	
Surface area of reservoir created (km <sup>2</sup> )	1,064
2.2 Adverse Effect	
Number of sites where kind of fish might be reduced being located immediately downstream of dam (nos. of site)	11
3. Social Well-being	
3.1 Adverse Effect	
Number of people to be removed for construction of facilities (10 <sup>3</sup> )	23

Remarks; (1): Figures in this table cover 3 States, i.e. Pahang, Trengganu and Kelantan.

(2): Economic benefit other than power generation benefit is not shown here, but included in the water demand and supply account.

*PART 2*  
*SABAH AND*  
*SARAWAK*



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#### SPECIAL ABBREVIATIONS

O&M : Operation and maintenance  
EIRR : Economic internal rate of return



## 1. INTRODUCTION

The Water Resources Development and Use Plan has been prepared to give a general direction of water resources development in Malaysia, identifying future problems and needs and availability of water and other resources, based on analysis and interpretation of readily available data and information, rather than dealing with specific projects.

The main objective of this Report, Public Expenditure and Beneficial and Adverse Effects, is to describe the frameworks for estimating effects, both beneficial and adverse, to be derived from the proposed projects and estimating public expenditure comprising development (investment) and recurrent (O&M), and manpower requirement and to illustrate the estimated effects and requirements with fuller details. The estimates were given not only for the recommended plans but for the alternative plans in order to give the decision makers the idea of relative magnitude of effects and requirements, resulting from various choices. The methodologies for deriving effects and requirements are explained in more detail in the respective Sectoral Reports.

The effects and requirements are also given for the Water Resources Development and Use Plan under the condition of lower economic growth; another possibility for the future water resources development.

The estimated figures in this Report were given only to show the order of magnitude. The effects and requirements should be estimated in more detail with additional data and information before judging the viability of specific projects.

In this Report, private development costs were also given for reference.

## 2. INVESTMENT AND O&M COSTS

### 2.1 Basic Assumptions

The investment costs comprise i) direct investment cost, ii) engineering and administration cost, iii) land acquisition cost, and iv) physical contingency. It is noted that the costs at this stage are only notional just to indicate the order of magnitude.

Costs of equipment, materials and labor locally available were estimated at 1980 end price level based on the actual costs (contract amount) and previous estimates for similar projects in Malaysia. For updating the costs, the following escalation rates were assumed:

1976 through 1978	0% p.a.
1979 through 1980	27% p.a.

The prices of internationally traded goods and services were estimated based on the international market price at 1980 end or the IBRD projection up to 1990 where applicable. The exchange rates of US\$1 = M\$2.22 and US\$1 = ¥216, which were the average from January through December, 1980, were assumed for currency conversion.

The approximate foreign-local currency proportion by type of projects is given in Table 1 for reference.

Major unit investment costs assumed are listed in Tables 2 and 3. They are given with fuller detail in the relevant Sectoral Reports. The engineering and administration cost was assumed at 10% of the direct investment cost uniformly regardless the type of the works. Physical contingency was assumed at 30% of the sum of direct investment cost, engineering and administration cost and land acquisition cost. The investment cost was assumed to be disbursed in five years antecedent to the year of commission of the proposed facilities except that the investment costs for rural untreated water supply and inland fishery were assumed to be disbursed in one year.

The construction costs were estimated for all the facilities proposed by the Study and those of which construction was started after 1980, except that the existing budget for water supply and irrigation system in 4MP was assumed to be capable of constructing public water supply systems and irrigation facilities to the extent required up to 1985 and was not included in the expenditure for 4MP.

It was assumed that investment and O&M costs for irrigation, source development, hydropower development and flood mitigation works should sole be borne by the public sector.

Public water supply systems administered by State PWDs, Waterworks Departments and Water Authorities and these under RESP will be rapidly expanded to cover the entire population in 2000. It was assumed that

all the investment and O&M costs for these systems should be borne by public agencies. Under RESP, O&M should be conducted by rural communities at their own expenses.

Considering the current practice, it was assumed for public sewerage projects that the house connection expenses should be borne by private sector in the existing town area and branch sewers and house connections expenses in the new town area.

O&M costs (recurrent expenditure) were assumed as the percentage of investment cost as shown in Table 4.

## 2.2 Estimated Costs

Estimated public investment costs by MP for the recommended plans and alternatives and for those under the condition of lower economic growth are given in the following tables with fuller detail:

- |  |                              |
|--|------------------------------|
| (1) Dams, barrages and diversion facilities: | <u>Lower Economic Growth</u> |
| Tables 5 to 12                               | Tables 40 to 41              |
| (2) Public water supply in urban area:       | <u>Lower Economic Growth</u> |
| Table 13                                     | Table 42                     |
| (3) Treated water supply in rural area:      | <u>Lower Economic Growth</u> |
| Tables 14 to 15                              | Table 43                     |
| (4) Untreated water supply in rural area:    | <u>Lower Economic Growth</u> |
| Tables 16 to 17                              | Table 44                     |
| (5) Pre-treatment facilities:                | <u>Lower Economic Growth</u> |
| Tables 18 to 20                              | Tables 45 to 46              |
| (6) Irrigation:                              |                              |
| Tables 21 to 22                              |                              |
| (7) Constructed pond:                        |                              |
| Table 23                                     |                              |
| (8) Inland fishery in reservoirs:            | <u>Lower Economic Growth</u> |
| Tables 24 to 27                              | Table 47                     |

(9) Hydropower:	<u>Lower Economic Growth</u>
Table 28	Table 48
(10) Public sewerage:	<u>Lower Economic Growth</u>
Table 29	Table 49
(11) Flood mitigation:	<u>Lower Economic Growth</u>
Tables 30 to 35	Tables 50 to 51

They are summarized in Tables 36 to 38 and 52. Public recurrent expenditure (O&M cost) is summarized for the recommended plans in Tables 39 and 53.

Private investment costs for water supply, sewerage and palm and rubber plants purification facilities and for those under the condition of lower economic growth are given in the following tables with fuller detail:

(1) Water supply:	<u>Lower Economic Growth</u>
Table 54	Table 59
(2) Sewerage:	<u>Lower Economic Growth</u>
Table 55	Table 60
(3) Palm and rubber:	<u>Lower Economic Growth</u>
Tables 56 to 57	Table 61

They are summarized in Tables 58 and 62.

### 3. MANPOWER REQUIREMENT

#### 3.1 Basic Assumptions

Requirement for the government staff for construction and O&M of the relevant public facilities was estimated, assuming that consultants should be fully utilized for design and construction supervision and that construction works should be carried out by contractors. O&M was assumed to be conducted by the respective public agencies. For estimating the requirement, present level of staffing in the public sector of Malaysia and these of the advanced countries as well as the prospective automation of the facilities were taken into consideration.

Only the manpower for the management offices and construction offices required for the construction and O&M of water supply facilities proposed in this Study was considered, excluding the staffs at the headquarters.

The government staffs requirement was estimated according to the classification currently adopted in Malaysia as given hereunder:

<u>Grade</u>	<u>Category</u>
A (Engineer):	Engineer, Superscale F Engineer, Superscale G Engineer, Senior Timescale Engineer, Timescale Quantity Surveyor
B (Technical Assistant):	Technical Assistant, Special Grade Technical Assistant, Timescale
C (Technician):	Special Grade Technician Timescale Technician Draftsman Grade I Draftsman Grade II Stenographer Clerk Storekeeper
D (Others):	Typist Junior Clerk Junior Storekeeper Office Boy Drivers I.M.G.

#### 3.2 Estimated Manpower Requirement

Estimated manpower requirement by sector is given for the recommended plans and alternatives for the States of Sabah and Sarawak in Tables 63 to 68.

The figures under the condition of lower economic growth are given in Tables 69 to 72.

## 4. BENEFICIAL AND ADVERSE EFFECTS

### 4.1 General

The beneficial and adverse effects of the recommended and alternative plans were evaluated in the following three independent accounts:

- (1) National economic development (NED),
- (2) Environmental quality (EQ), and
- (3) Social well-being (SW).

NED was estimated in terms of annual equivalents of economic benefit and cost and economic internal rate of return (EIRR), attributable to the plans.

Since EQ and SW have strong impacts on the affected population though they cannot be quantified in monetary terms, an attempt was made to quantify them, choosing appropriate indices.

### 4.2 National Economic Development Account

#### 4.2.1 Basic assumptions

The beneficial and adverse effects of proposed plans in the national economic development account were calculated as the annual equivalents of economic benefit and cost, assuming an evaluation period of 50 years from 1981 through 2030 and a discount rate of 8% which is considered as the minimum acceptable rate of return on the water resources development projects in Malaysia.

The prices of internationally traded goods and services were estimated based on the World Bank projection up to 1990, or the international market prices in December, 1980. The prices of locally traded goods and services were the normalized price in December, 1980. The transfer payments such as tax and local contractors' profit were deducted from financial cost. The ratio of transfer payment to the financial cost was assumed at 20% considering the ratio of tax revenue to GDP at purchasers' price in 1980.

The domestic and industrial water supply benefit was estimated based on the least-costly alternative facilities cost criteria. The water deficit was preliminarily allocated to domestic and industrial water supply and irrigation water supply in proportion to the demand. A construction schedule of dams to meet the deficit allocated to domestic and industrial water supply was thus prepared, choosing the least-costly dams among those which are not included in the recommended plan. The cost of the least-costly dams and the recommended intake, conveyance, treatment and distribution systems was regarded as the benefit derived from domestic and industrial water supply.



The economic farmgate price of paddy during the evaluation period was estimated at M\$640/ton based on the projected price of 5% broken rice, FOB Bangkok. Paddy yield, gross value, production cost and net value were estimated for 1990 and 2000 by type of irrigation. The hectareage of newly reclaimed land and upgraded lands from rainfed paddy to irrigated or control drained paddy, single crop to double crop and minor scheme to major scheme were estimated for the future. Then the net incremental production value was obtained for without drought condition.

It was preliminarily assumed that water withdrawal for irrigation would be allowed until the river flow reduces to the level equal to the essential minimum flow during drought periods and that no further abstraction would be permitted. With this assumption, the reduction in supply of irrigation water demand was calculated for the period for which runoff record is available. The irrigation benefit was obtained by deducting the benefit reduction due to the droughts which was assumed to be proportional to the reduction in the irrigation water supply from the net incremental production value.

The fish culture benefit was estimated based on the productivity and price of fish. It was estimated at M\$2,200/ha/y for the fish pond and M\$1.9 million/reservoir/y for the cage culture in the created dam reservoir.

The benefit of reservoir recreation in the created dam reservoir was estimated as the willingness-to-pay of the visitors to the reservoir. The willingness-to-pay was measured by the travelling cost or fuel cost of the vehicles to visit the recreation area, M\$0.1/km.

Hydropower benefit was estimated by the equivalent cost of the least-costly alternative power plant. In the States of Sabah and Sarawak, gas turbine plant of 22 MW unit capacity was selected as the least-costly alternative plant considering total power demand, type and unit capacity of the power plants planned by SEB and SESCO and other relevant matters. The unit capacity value thus estimated is M\$76/kW and unit energy value is M\$0.149/kWh.

The sewerage benefit was estimated by the willingness-to-pay of the served population and saving in the cost of purification of industrial wastes. The benefit was tentatively assumed to be 0.6% of real income of served people and gross value of manufacturing production of served industries.

Pretreatment is needed if BOD concentration in raw water is more than 2 mg/lit in the case of domestic water supply and 5 mg/lit in the case of industrial water supply. The costs could be saved, if the proposed water pollution abatement measures reduce the concentration below these limits. This saving in cost was assumed to constitute a part of water pollution abatement benefit.

Under the flood mitigation benefit, only average value of reduction in annual damage by the proposed measures was counted, while land enhancement benefit was included in the irrigation benefit. It was assumed

that the damageable value in the flood prone area will increase at a certain moderate rate, assuming lower growth rates for population and per capita GDP.

The economic cost was calculated as the annual equivalent of the construction cost and OMR cost. It was noted that the private sector cost of water supply facilities, purification facilities in palm oil mills and rubber factories and sewerage facilities are included in the economic cost.

The economic internal rate of return (EIRR) was obtained as the discount rate with which the present worth of benefit equals to that of cost.

#### 4.2.2 Estimated effects in NED account

Estimated effects in NED account for the recommended plan and alternatives and those under the condition of lower economic growth are given in the following tables:

##### Water Demand and Supply Balance:

Tables 73 to 83

##### Lower Economic Growth

Tables 92 to 95

##### Hydropower Generation:

Table 84

##### Lower Economic Growth

Table 96

##### Water Pollution Abatement:

Tables 85 to 87

##### Lower Economic Growth

Table 97

##### Flood Mitigation:

Tables 88 to 91

##### Lower Economic Growth

Table 98

#### 4.3 Environmental Quality Account

##### 4.3.1 Basic assumptions

The beneficial and adverse effects of the proposed plans in the environmental quality account are represented by the quantities of appropriate indices.

The river maintenance flow is the requisite for the conservation of river environment and adequate water use. The effect on the river maintenance flow was evaluated as the number of days when the river maintenance flow could be sustained under the condition identical with that in the driest year ever recorded.

The water surface of created reservoir provides favorable scenery, place of recreation and enhancement of wildlife. The beneficial effect of created reservoir was counted by the water surface area.

The clean water provides favorable scenery, place of recreation and enhancement of wildlife. The reduction in length of river stretches in which BOD concentration will be more than 5 mg/lit is regarded as the beneficial effect of water pollution abatement.

The channel improvement contributes to the stabilization of the river channel and provides favorable condition for navigation and other instream water uses. The length of improved river stretches was counted as an index showing the beneficial effect on environmental quality.

If a dam is constructed, some species of fish might disappear in certain length of river stretch immediately downstream of the dam, causing an adverse effect to ecological system, though such adverse effect could be compensated by possible cage culture in the created reservoir.

#### 4.3.2 Estimated effects in EQ account

Estimated effects in EQ for the recommended plan and alternatives and those under the condition of lower economic growth are given in the following tables:

Water Demand and Supply Balance:

Tables 99 to 106

Lower Economic Growth

Tables 122 to 124

Hydropower Generation:

Table 107

Lower Economic Growth

Table 125

Water Pollution Abatement:

Tables 108 to 113

Lower Economic Growth

Tables 126 to 127

Flood Mitigation:

Tables 114 to 121

Lower Economic Growth

Tables 128 to 129

#### 4.4 Social Well-being Account

##### 4.4.1 Basic assumptions

The increased and more stable income, improved public health, saving of lives and emergency preparedness, better access to safe water, increased utility and reduced risk in water supply were counted as the beneficial

effects in social well-being account. The adverse effect is the inevitable removal of people for the purpose of construction of proposed facilities.

#### 4.4.2 Estimated effects in SW account

Estimated effects in SW account are given in the following tables:

##### Water Demand and Supply Balance:

Tables 99 to 102, 130 to 134,  
137 to 138

##### Lower Economic Growth

Tables 122 to 123,  
142 to 144  
and 147

##### Hydropower Generation:

Table 139

##### Lower Economic Growth

Table 148

##### Water Pollution Abatement:

Table 135

##### Lower Economic Growth

Table 145

##### Flood Mitigation:

Tables 114 to 121, 136, 140  
and 141

##### Lower Economic Growth

Tables 128 to 129,  
146 and 149

#### 4.5 Effects Matrices

In order to illustrate the overall effects and impacts in the three independent accounts of the proposed plans, effects matrices were prepared for the recommended plans for the States of Sabah and Sarawak as shown in Tables 150 to 157. Those under the condition of lower economic growth are given in Tables 158 to 165.