SUPPORTING REPORT

PART-H

ECONOMIC EVALUATION AND FINANCING

THE STUDY ON FLOOD CONTROL FOR AMBON AND PASAHARI AREA IN THE REPUBLIC OF INDONESIA SUPPORTING REPORT PART-II

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1.1.1   Basis for Economic Evaluation

(1) General Concept

The economic evaluation for this project was performed by comparing the present value (at the beginning of the year 1998) of costs and benefits that occur in different time periods. The benefits, which will start to materialize immediately after the completion of the construction of each flood control facility, are comprised of several types of damage alleviation to be achieved by the flood control facilities - damage to general assets (houses/buildings, household goods and industry inventories), damage to infrastructure and damage from disruption of businesses. In order to estimate the benefits of the project, yearly averages of damage alleviation were computed for each river by using the data presented in Part-D.

Table-II.1.1 shows the yearly averages of damage alleviation of the five rivers at a 30-year return period, estimated by the study team.

Table-II.1.1   Yearly Averages of Damage Alleviation of the Five Rivers at a 30 Year Return Period (Rp million)

Name of River	Yearly Average of Damage Alleviation
Ruhu	2,879
Batu Merah	8,157
Tomu	3,534
Batu Gajah	5,801
Batu Gantung	2,865

Source: Study Team

The amount of money described above will be saved every year due to the construction of flood control facilities. After effects of real GDP growth to the property value in the study area were added, the present value of the project was obtained by discounting these numbers to the beginning of the year 1998.

(2) Assumptions for Economic Analysis for Master Plan Study

Economic analysis at the Master Plan level was conducted under the following assumptions:

Price level	End of December 1996
Design Scale	30 years return period
Project life	50 years
Maintenance costs	0.5% of the total construction costs
Shadow price	Standard conversion rate - 85%
Growth rate of property value	5.0 % per annum
Construction period	From 1999 to 2003 for separate cases From 1999 to 2007 for the entire project
Costs and benefits for water supply	Rp 890 /m³ for distribution pipes and OM costs Rp 2,500 /m³ for water supply benefits

<Price Level>

The price level for the estimation of costs and benefits was set at the end of December 1996. The exchange rate for the Master Plan was fixed at Rp 2,500 to US$ 1.00 for calculation purposes.

<Design Scale>

The design scale was set at 30-year return period at the Master Plan level, taking into account the standard return period for flood control facilities used in Indonesia.

<Project Life>

The economic life of the project was set at 50 years; the residual value of the facilities is considered to be zero after 50 years when they will need to be replaced.

<Maintenance Costs>

The maintenance work is assumed to require 0.5% of the total construction costs every year. The maintenance activities will be necessary from the year following completion of construction through the last year of the project life.

<Shadow Pricing>

Taxes and duties must be deducted from financial costs in order to obtain economic costs. A 85% standard conversion rate was applied at the Master Plan level.

<Growth Rate of Property Value>

The same rate as the product of per capita GDP and population increase in the Central City estimated by the study team - 5.0% per year - was applied for the growth rate of the property value.

<Construction Period>

Five year construction period - from 1999 to 2004 - was applied for the economic analysis of each of the five rivers, while nine year period - from 1999 to 2007 - was applied for the implementation of the entire project. Construction of the dam in Ruhu River was assumed to be started in 2004 in the latter case.

<Costs and Benefits for Water Supply>
In addition to the costs for purification facilities and pipelines mentioned in Section 3.3, Rp 890 /m³ was added in multi-purpose dam options as water distribution costs including distribution pipes, administration and operation, estimated from the PDAM financial report. Water loss was assumed to be 40%. On the benefit side of water supply, willingness to pay by Ambon City residents was estimated at Rp 2,500 /m³ through field investigations. This is an actual buying price of water that people are paying to water tank lorries.

1.1.2 Economic Analysis

(1) Economic Analysis on the Flood Control Facilities in Each of the Five Rivers

Table-II.1.2 shows the results of economic analysis on the construction of the flood control facilities for each of the five rivers, based on the assumption that all the facilities are constructed in five years:

Table-II.1.2 Economic Cost, NPV, B/C and IRR of Flood Control Facilities in Each of the Five Rivers

Case		Economic Cost	NPV at 10%	B/C at 10%	IRR
Ruhu	River improvement (5 year return period) <A-1>	Rp 12,066 million	Rp 22,456 million	3.4	20.8%
	River improvement and flood control dam <A-2>	Rp 56,948 million	- Rp 813 million	0.98	9.9%
Batu Merah	River improvement and diversion channel <B>	Rp 43,550 million	Rp 90,614 million	3.6	21.8%
Tomu	River improvement <C>	Rp 22,347 million	Rp 36,514 million	3.1	19.7%
Batu Gajah	River improvement and flood control dam <D-1>	Rp 50,093 million	Rp 49,359 million	2.3	16.4%
Batu Gantung	River improvement and flood control dam <E-1>	Rp 38,418 million	Rp 13,588 million	1.5	12.6%

A 10% discount rate, which is standard for public work projects in Indonesia, was applied for this study. Construction of flood control facilities in each river is overall assessed to be feasible, showing IRR of between 10 % to 22%. The high IRR which can be attained in river improvement option for Ruhu River (A-1) is severely affected if a flood control dam is constructed (A-2) in order to achieve a 30 year return period, reducing the IRR to the marginal level.

Flood control dams can be upgraded, with additional investment, into multi-purpose dams which can supply water to downtown Ambon. The following table shows economic returns of flood control facilities when flood control dams are upgraded into multi-purpose dams.

Table-II.1.3 Economic Cost, NPV, B/C and IRR of Options with Multi-purpose Dams

Case		Economic Cost	NPV at 10%	B/C at 10%	IRR
Ruhu	River improvement and multi-purpose dam <A-3>	Rp 77,094 million	Rp 18,965 million	1.2	12.1%
Batu Gajah	River improvement and multi-purpose dam <D-2>	Rp 76,594 million	Rp 45,628 million	1.7	14.4%
Batu Gantung	River improvement and multi-purpose dam <E-2>	Rp 53,634 million	Rp 6,256 million	1.1	10.9%

Construction of multi-purpose dams in Batu Gajah and Batu Gantung rivers imposes a burden on economic returns of the project. The IRR goes down when the flood control dams in Batu Gajah and Batu Gantung rivers are upgraded into multi-purpose dams since the IRR for incremental costs and benefits of these rivers are 8.3% and 3.2%, respectively. These additional investments are not economically efficient. On the other hand, upgrading the flood control dam in Ruhu River into a multi-purpose dam will give a positive impact on the IRR; the IRR for its incremental costs and benefits is 19.4%.

(2) Economic Analysis on the Project as a Whole

In order to assess the feasibility of the entire project, economic returns of the following six combinations were examined.

Option 1:   A-1, B, C, D-1, E-1
Option 2:   A-2, B, C, D-1, E-1
Option 3:   A-3, B, C, D-1, E-1
Option 4:   A-3, B, C, D-2, E-1
Option 5:   A-1, B, C, D-2, E-2
Option 6:   A-3, B, C, D-2, E-2

Table-II.1.4 Economic Cost, NPV, B/C and IRR of the Project as a Whole

Option	Economic Cost	NPV at 10%	B/C at 10%	IRR
Option 1	Rp 166,473 million	Rp 175,923 million	2.7	17.5%
Option 2	Rp 211,356 million	Rp 166,366 million	2.4	16.7%
Option 3	Rp 231,501 million	Rp 181,077 million	2.4	16.9%
Option 4	Rp 258,003 million	Rp 183,149 million	2.3	16.4%
Option 5	Rp 208,191 million	Rp 174,421 million	2.4	16.4%
Option 6	Rp 273,219 million	Rp 179,576 million	2.2	16.0%

The entire project is assessed to be feasible in each of the cases. The option without a multi-purpose dam (Option 1) shows the highest IRR of all the options. Construction of multi-purpose dams in Batu Gajah and Batu Gantung rivers - Option 4, 5 and 6 -decreases the IRR of the Project.

1.2 Feasibility Study

1.2.1 Basis for Economic Evaluation

(1)   Assumptions for Economic Analysis for Feasibility Study

Economic analysis at the feasibility study level was conducted under the following assumptions:

Price level	End of December 1996
Design Scale	30 years
Project life	50 years
Maintenance costs	0.5% of the total construction costs
Residual value of dams	30 year equivalent value
Shadow price	Equipment (85% of the market price), Material: (90%), Labor (90%)

Growth rate of property value	5.0 % per annum
Value added from sediment excavation	Rp 7,000 /m³
Construction period	From 1999 to 2003 for separate cases
	From 1999 to 2007 for the entire project
Incremental costs and benefits for water supply	Rp 890 /m3 for distribution pipes and OM costs
	Rp 2,500 /m3 for water supply benefits
Value of Reclaimed Land	Rp 0.4 million /m²

<Price Level>
The price level for the estimation of costs and benefits was set at the end of December 1996. The exchange rate for the Master Plan was fixed at Rp 2,500 to US$ 1.00 for calculation purposes.

<Design Scale>
The design scale was set at 30-year return period at the Master Plan level, taking into account the standard return period for flood control facilities used in Indonesia.

<Project Life>
The economic life of the project was set at 50 years; the residual value of the facilities except for that of dams is considered to be zero after 50 years when they will need to be replaced.

<Maintenance Costs>
The maintenance work is assumed to require 0.5% of the total construction costs every year. The maintenance activities will be necessary from the year following completion of construction through the duration of the project.

<Residual Value of Dams>
Since dams are supposed to last for 80 years, 30 years equivalent value will be left after 50 years project life. The value was added back to the benefit side in the end of Year 50.

<Shadow Pricing>
Taxes and duties must be deducted from financial costs in order to obtain economic costs. Taxes and import duties for construction equipment are 15% and for materials 10%. Labor costs are reduced by 10% considering the Project will employ a number of jobless people in Ambon City.

<Growth Rate of Property Value>
The same rate as the product of per capita GDP and population increase in the Central City estimated by the study team - 5.0% per year - was applied for the growth rate of the property value.

<Value Added from Sediment Excavation>
Sediment from check dams will be sold as construction material at Rp 7,000 /m³ every year after the completion of the construction of check dams. The amount of sediment will be 4,000 m³/year from Ruhu River, 3,700 m³/year from Tomu River, 1,000 m³/year from Batu Gaja River and 3,600 m³/year from Batu Gantung River.

<Construction Period>
Five year construction period - from 1999 to 2004 - was applied for the economic analysis of each of the five rivers, while six year period - from 1999 to 2004 - was applied for the implementation of the entire project.

<Costs and Benefits for Water Supply>
In addition to the costs for purification facilities and pipelines, Rp 890 /m³ was added in multi-purpose dam options as water distribution costs including distribution pipes, administration and operation, estimated from the PDAM financial report. Water loss was assumed to be 40%. On the benefit side of water supply, willingness to pay by Ambon City residents was estimated at Rp 2,500 /m3 through field investigations. This is an actual buying price of water that people are paying to water tank lorries.

<Value of Reclaimed Land>
New land will be created at the river mouth of Nitu River through disposal of excavated material from Batu Gajah and Batu Gantung rivers. Total size of the land to be created is 6.56 ha and the price of the land is estimated at Rp 0.4 million /m². The economic cost for the land reclamation is Rp 8,260 million while the value to be generated in five years after completion of the flood control facilities will be Rp 26,240 million, both of which were included in the economic evaluation.

1.2.2 Economic Analysis

(1) Economic Analysis on Each of the Five Rivers

Table-H.1.5 shows the results of economic analysis on the construction of the flood control facilities for each of the five rivers, based on the assumption that all the facilities are constructed in five years:

Table-H.1.5 Economic Cost, NPV, B/C and IRR of Each of the Five Rivers

Case		Economic Cost	NPV at 10%	B/C at 10%	IRR
Ruhu	River improvement (5 year return period)	Rp 7,768 million	Rp 26,154 million	5.3	28.1%
Batu Merah	River improvement (5 year return period)	Rp 13,480 million	Rp 88,955 million	9.6	39.1%
	River improvement and diversion channel	Rp 34,635 million	Rp 98,256 million	4.7	25.8%
Tomu	River improvement	Rp 23,115 million	Rp 36,474 million	3.0	19.9%
Batu Gajah	River improvement (10 year return period)	Rp 15,761 million	Rp 52,938 million	5.4	28.0%
	River improvement and multi-purpose dam	Rp 92,980 million	Rp 37,262 million	1.4	13.1%
Batu Gantung	River improvement (10 year return period)	Rp 11,211 million	Rp 29,932 million	4.4	25.1%
	River improvement and multi-purpose dam	Rp 63,104 million	Rp 3,619 million	1.1	10.5%

Construction of river improvement facilities in each of the five rivers is highly feasible, showing IRR of between 20 % to 40%. Incremental benefits from the diversion tunnel construction in Batu Merah River exceeds incremental costs at the 10% discount rate, which results in an increase in the Net Present Value. On the other hand, construction of multi-purpose dams in Batu Gaja and Batu Gantung Rivers significantly decreases the NPV and IRR. (IRR obtained from incremental benefits and costs for dam construction are 7.9% for Batu Gaja River and 3.4% for Batu Gantung River.)

(2) Economic Analysis on the Project as a Whole

The following is the results of the economic analysis, on the assumption that all the priority projects are implemented in six years. The project is assessed to be feasible.

Economic Cost:	Rp 221,602 million
IRR:	16.4%
NPV at 10%:	Rp 168,757 million
B/C at 10%:	2.2

(3). Economic Analysis on Alternative Combinations

The following four options were compared to examine the impacts of the construction of the diversion channel in Ruhu River and multi-purpose dams in Batu Gajah and Batu Gantung rivers on the economic returns of the project.

(×- with, ○- without)

	Diversion Channel in Ruhu River	Multi-purpose Dam in Batu Gajah River	Multi-purpose Dam in Batu Gantung River
Option 1	×	×	×
Option 2	○	×	×
Option 3	○	○	×
Option 4	○	×	○

Table-H.1.6 shows the results of economic analysis on each of the above options:

Table-H.1.6 Economic Cost, NPV and IRR of the Alternative Combinations

Option	Economic Cost	NPV at 10%	IRR
Option 1	Rp 71,335 million	Rp 191,114 million	25.9%
Option 2	Rp 98,202 million	Rp 250,195 million	25.4%
Option 3	Rp 175,421 million	Rp 239,032 million	20.0%
Option 4	Rp 144,383 million	Rp 181,229 million	19.4%

The Project is assessed to be feasible in each case. Option 1 has the highest IRR, while Option 2 has the highest NPV.

(4) Sensitivity Analysis

Sensitivity analysis was performed by changing the project's costs and benefits in the following fashion:

Case 1: Property value increases at a rate of 2.5% per year, which is half the product of the estimated population and GDP growth rates in the study area

Case 2: Construction costs increase by 10%

Table-H.1.7 and Table-H.1.8 show the results of sensitivity analysis performed under the above variations.

Table-II.1.7 Sensitivity Analysis on Each of the Five Rivers

Case		NPV at 10% (Rp million)		IRR	
		2.5% Growth	Costs + 10%	2.5% Growth	Costs + 10%
Ruhu	River improvement (5 year return period)	13,863	25,555	23.5%	26.5%
Batu Merah	River improvement (5 year return period)	50,764	87,916	33.9%	37.0%
	River improvement and diversion channel	50,219	95,585	21.4%	24.4%
Tomu	River improvement	15,662	34,692	15.9%	18.8%
Batu Gajah	River improvement (10 year return period)	27,933	51,723	23.4%	26.4%
	River improvement and multi-purpose dam	3,099	30,104	10.3%	12.4%
Batu Gantung	River improvement (10 year return period)	15,162	29,068	20.8%	23.7%
	River improvement and multi-purpose dam	- 13,253	- 1,383	7.6%	9.8%

Table-II.1.8. Sensitivity Analysis on the Entire Project

Case	NPV at 10% (Rp million)		IRR	
	2.5% Growth	Costs + 10%	2.5% Growth	Costs + 10%
Entire Project	48,819	156,419	12.6%	15.6%

The construction of a multi-purpose dam in Batu Gantung River becomes unfeasible when the growth rate of property value dropped to 2.5% per year or the project cost increases by 10%. However, the entire project is still feasible in these cases due to the high economic returns of Ruhu, Batu Merah and Tomu rivers.

CHAPTER 2   FINANCIAL CONSIDERATION

2.1 Budgetary Procedures

The budget formation procedures in Indonesia are a mixture of bottom-up and top-down systems. First, a budgetary committee is formed at the district level (municipalities or provinces) which discusses, coordinates and consolidates requests from sub-districts (Kecamatan), Bappeda and other departments. The requests are forwarded to the budgetary committee for discussion at the provincial level, and then finalized at the national level. After approval of the budgetary framework by the Presidency, the provincial government mainly takes charge of the allocation and execution of the budget. Although the final budgetary allocation often differs from original requests, it should be noted that each implementing agency does not always respect the changes when executing the budget. As a result, public works projects are not always carried out in a consistent manner, but rather implemented in an ad hoc fashion.

For each public works project, the provincial government determines whether the implementing agency will be at the provincial or municipal level. The source of the budget, national, provincial or municipal, is also determined for each project at the provincial level. Although most of the new and/or large projects are still implemented by the provincial level because of insufficient technical capability at the municipal level, operational and maintenance activities are gradually being transferred to the municipality, under the PU's decentralization policy.

2.2 Public Works Budget of Maluku Province

Maluku Province PU executed an operational budget of around Rp 125 billion for the fiscal year 1995/96, of which 19% was used for the projects of DGWRD. Table-II.2.1 shows the budget plan in 1996/97 of the provincial PU.

Table-II.2.1   Maluku Province PU Budget (Plan), 1996/97 (million Rp)

Source of Budget / Implementing Agency	National Budget	Loans	Provincial Budget	Total
DGWRD	25,285	5,667	1,663	32,615
DGHW	38,169	10,298	41,373	89,840
DGHS	23,923	525	2,555	27,003
Total	87,377	16,490	45,591	149,458

Source: Bina Program, Maluku Province

Although there are three budget sources for the province, there is no substantial distinction between project types under the national budget and the provincial budget.

Although Ambon City represents 11% of the total provincial population, only 5% of the provincial budget is allocated to the city. Table-II.2.2 shows the allocation of the PU provincial budget to Ambon City.

The budget of DGWRD includes allocations for the strengthening of the check dam of Batu Merah (Rp 50 million), the realignment of Batu Gantung (Rp 100 million), the excavation of sediment (Rp 150 million), and the repair of the parapet (Rp 80 million).

Table-II.2.2   PU Budget (Plan) Allocated to Ambon City in 1996/97 (million Rp)

Source of Budget / Implementing Agency	National Budget	Loans	Provincial Budget	Total
DGWRD	-	-	593	593
DGHW	666	-	727	1,393
DGHS	4,182	525	301	5,008
Total	4,842	525	1,621	6,994

Source: Bina Program, Maluku Province

2.3 Public Works Budget of Ambon City

The budget executed by the Ambon City PU itself is quite small, corresponding to only 3% of the provincial PU budget. Rehabilitation, maintenance and upgrading are the main activities. The following table shows the constitution of the budget executed by the Ambon City PU. (Ambon City does not yet have a water resource department.)

Table-II.2.3   Ambon City PU Budget (Realization), 1995/96 (million Rp)

Source of Budget / Implementing Agency	National Budget	Loans	Provincial Budget	Municipal Budget	Total
DGHW (municipality)	2,275	470	-	15	2,760
DGHS (municipality)	952	25	250	276	1,503
Total	3,227	495	250	291	4,263

Source: Financial Department, Ambon City

2.4 Financing Capacity of Maluku Province and Ambon City

Considering that most of the provincial budget has been used for the development of the wide under-developed area of Maluku Province, it would not be appropriate to drastically change the focus of the allocation of the limited provincial budget from irrigation and road construction in rural areas to flood control in urban areas. It also goes without saying that Ambon City does not have its own financial capacity to invest in a new infrastructure project. If the provincial budget is the only available fund for this project, the project will have to focus solely on minor rehabilitation or upgrading; the scale of the project will have to be limited to less than Rp 1 billion. A fully-fledged flood control project can only be financed by additional budget from the central Government and/or through a loan.

2.5 Financing Plan by the Central Government

The total budget in DGWRD for the fiscal year 1996/97 is Rp 3,098 billion, of which Rp 958 billion is financed through foreign loans. Rp 430 billion is allocated for flood control projects, of which more than 50% is currently financed through foreign loans.

The DGWRD at the central level has sent questionnaires to provincial governments for the purpose of identifying future flood control projects which could be financed by OECF loans. The DGWRD envisages that most likely two new projects could be financed by OECF every year. The flood control project in Ambon City is a strong candidate for such financing, since Ambon City is the administrative and commercial center of Maluku Province. Consistent with the Government's development policy in the eastern regions, this project is also expected to be given high priority, although the decision to invest is contingent on the cost-effectiveness
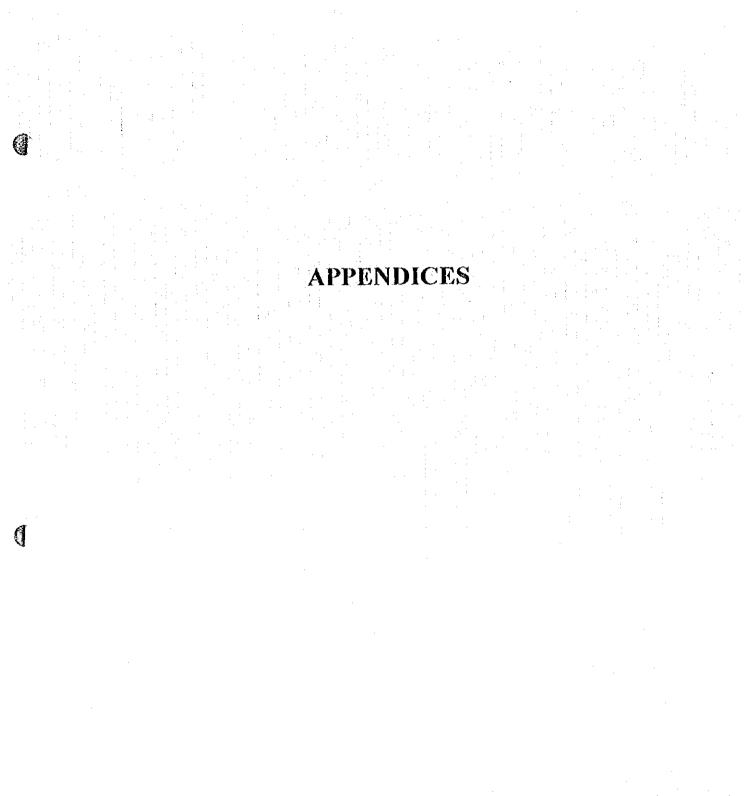
and impact of the project itself. If this project is adopted, operational and maintenance costs will also be financed through the central Government.

If an OECF loan is not available for this project, the project will have to be scaled down due to the central Government's budgetary constraints. Although it would be ideal to take long-term flood control measures, the investment would be obliged to focus only on the most critical project components.

APPENDICES

APPENDIX III   LAND ACQUISITION AND RESETTLEMENT PLAN

1   Land Acquisition Procedures

The Presidential Decree No. 55 enacted in 1993 (Land Acquisition for the Realization of Development for the Public Interest) and its supplemental regulations prescribe land acquisition procedures to be taken by governmental agencies. The following is a summary of the land acquisition procedures:

a. The Government agency which needs the land (the Agency) requests approval on the Project site to the National Land Agency (BPN) and the Mayor.
b. BPN requests the Regional Planning Agency (BAPPEDA) and other ministries to do a research on the consistency between the proposed usage of the land and the existing regional or municipal land use plan.
c. BAPPEDA and other ministries report to BPN and the Mayor.
d. BPN and the Mayor approves the Project site.
e. The Agency sends a request for land acquisition to the Land Acquisition Committee (*LAC), if the size of land is more than one hectare.
f. LAC together with the Agency hold a consultation with the inhabitants and their leaders to explains about the aims and purposes of the Project.
g. LAC undertakes a research on the boundary of the Project and an inventory analysis, with the participation of the staff from BPN, PU, Ministry of Agriculture, Municipality, etc.
h. LAC announces the results of the inventory to the inhabitants.
i. Inhabitants send objections, if any, to the LAC within a month after the announcement.
j. LAC modifies the inventory in accordance with the objection, if necessary.
k. LAC, the Agency and the inhabitants hold a consultation on the indemnity.
   (1) LAC explains about the factors which determine the amount of indemnity. (The methodology of determining indemnity is indicated in this regulation. Ownership on land is more or less admitted even if the resident does not have a certificate.)
   (2) The inhabitants express their wishes on the form and amount of indemnity.
   (3) The Agency gives comments on the above.
   (4) The indemnification is conducted in such a form that does not cause a change to the peoples' way of living by considering the possibility of transferring to the appropriate location of living.
l. If the inhabitants agree to the Agency's intention, LAC issues a decision letter on the form and amount of indemnity based on the agreement. If the inhabitants do not agree, another series of discussion is held to reach an agreement. If the both parties still cannot reach an agreement, the LAC issues a decision letter on the form and amount of indemnity based on the real value of the properties.
m. The inhabitants send an objection to the LAC, if any.
n. LAC reports the Governor on the objection of the inhabitants.
o. The Governor requests opinions from the Provincial LAC.
p. The Provincial LAC asks for an explanation from the LAC and implements a research, if necessary.
q. The Provincial LAC sends a suggestion to the Governor.
r. The Governor tries to persuade the inhabitants.
s. If there are still objections from inhabitants, the Governor issues a letter which reinforces or changes the LAC's decision.

t.   The inhabitants send their opinions to the Governor.
u.   If there are still objections, the Agency asks its superior agency for a guidance.
v.   The superior agency gives comments to the Agency and the Governor.
w.   The Governor issues a decision letter and send it to the inhabitants and the Agency.
x.   If the superior agency does not approve the claims of the inhabitants, and if 75% of the land needed or 75% of the inhabitants have been paid, the Governor proposes the revocation of the right on the land.

*Composition of LAC:
(1) Head of District / Mayor, as both chairman and member
(2) Head of District / Municipal Agrarian Office, as both vice chairman and member
(3) Head of land and building tax office, as member
(4) Head of Government regional agency responsible for the construction sector, as member
(5) Head of Government regional agency responsible for the agriculture sector, as member
(6) Head of sub-district whose area covers the piece of land in which the development will take place, as member
(7) Head of village whose area covers the piece of land in which the development will take place, as member
(8) Regional Assistance Secretary of the administrative department or Head of administrative section in the office of the district / municipality, as I Secretary non member
(9) Head of section in District / Municipal Agrarian Office, as II Secretary non member

< Small Scale Land Acquisition >
The application of the development for the public interest needing the land no more than 1 (one) hectare can be conducted directly by the Government agency needing the land and the right holders of the land by trading or exchanging or other methods accepted by both parties.

The consultation to residents is normally held three to six months before the actual acquisition, in order to avoid land speculations.

2   Resettlement Plan

In resettling people, the following conditions should be taken into consideration:
a.   relocate the whole community to the same place.
b.   rebuild income sources.
c.   avoid social conflicts (religion, race, life style, etc.) with host people.
d.   secure/provide at least the same standard of living environment (public services and infrastructure), especially secure accessibility to water supply.
e.   secure accessibility to schools and religious/cultural facilities.
f.   secure/provide public transportation to downtown with a reasonable price.

Since most of the residents to be displaced work in downtown, relocation is not expected to cause a significant change in their way of living except for those people who are raising pigs/chickens at Ruhu River (This matter will be discussed in the end of this section). According to BAPPEDA, a candidate for the resettlement location for the proposed project is Desa Nania, located approximately 15km away from downtown, in which the government owns land and has once resettled 500 households from downtown. However, it was learned from a field investigation that 1) there was a land ownership dispute between original villagers in Nania and the government and a court decision was already made in favor of the villagers; and 2) apart from the land already distributed, the government claims that it owns additional 20 ha of land, but the land was found too steep to be used for housing.

Under the proposed project, new land will be produced close to the mouth of Batu Gantung River through reclamation at Wai Nitu. However, it will take several years until the land stops subsiding and is ready to be used. Moreover, it is advisable that the land be used for certain city facilities such as a commercial or distribution center, a sewage treatment plant, or a semi-industrial park, rather than for low cost housing, since the area is located quite close to the Ambon City commercial center facing the Ambon Bay. It is envisaged that even if people are resettled to this area, the Government will have to relocate people again from this area in the future, having no other areas to construct urban facilities.

Since downtown Ambon is already saturated with population, it is quite difficult to find, close to downtown, an area suitable for resettlement and large enough to accommodate a whole community. However, since the population has been spilling over to outer areas of downtown Ambon, it has become rather common to live in the suburb and commute to downtown. In accordance with this tendency, several housing complexes are being built by developers, outside downtown along the coast line of Ambon Bay. In this proposed project, it is recommended, for the following reasons, that the government purchase houses in a newly developed housing complex from a developer and distribute them to resettlers:

(1) Developers are in the same position as the government in terms of preparing a certain size of land for resettlement, since the government does not own suitable land. Moreover, it is not difficult to obtain several hectares of land if outside downtown Ambon;

(2) Houses constructed by developers fulfill a certain quality standard, and infrastructure and public services are basically prepared before the new residents start living;

(3) Houses to be constructed will not be uniform between resettlers depending on their income level, and developers can respond to this request better than the government; and

(4) Houses provided by the government in former resettlement cases such as those in Waiheru are overall in low quality and the residents were initially distressed by the lack of infrastructure and public services.

Cash compensation is also an alternative; it would be applicable to the small pieces of land to be acquired in Batu Merah River, Batu Gajah River and Batu Gantung River.

The following are the major housing complexes visited by the Study Team where low cost houses will be available. Since most of the current residents moved from downtown and their origin is rather mixed, significant social conflicts due to different life styles or religions are not expected to occur when the resettlement to these areas takes place.

a. Desa Lateri
    The housing complex in Desa Lateri, located approximately 7km away from downtown Ambon, is constructed by excavating a hillside area. Currently around 100 houses are under construction in one ha of land, all of which have already been sold out. However, the developer is ready to build another 100 houses on part of the neighboring 4 ha of land if the demand is confirmed. It will take only four to five months to develop a new complex. Most of the houses to be constructed will be relatively cheap - Rp 14 million per house (a living room, a bedroom and a kitchen). For each house, the land and infrastructure cost Rp 7 million and the house itself Rp 7 million. Water (Rp 7500 / month) and electricity will be connected to each house by the time when the settlement starts.

b. Desa Waiheru
    The biggest housing complex in Ambon is found in Waiheru, located at approximately 15 km away from downtown. 538 out of the total 600 units in Waiheru complex I (30ha) have already been sold and 24 units of low cost houses - Rp 19 million (a living room, two bedrooms and a kitchen) - are still available. PDAM and PLN are requested to connect water and electricity, and wells will also be prepared. Another 4 ha of land is currently planned to be developed as Waiheru complex II, although the land has not yet been acquired. Residents take taxies to go to downtown (Rp 600 for one way).

c. Desa Wayame
    Another housing complex is found in Desa Wayame, approximately 22 km away from downtown. 70 units of low cost houses - Rp 18 million (a living room, two bedrooms and a kitchen) - are expected to be constructed by the end of 1997, of which 30 houses were not yet sold at the time of the interview. Water and electricity will be provided by PDAM and PLN. Residents use speedboats to go to downtown at Rp 1,000.

The Government should find a substitute land for those people who will lose their land to raise pigs and chickens. The location of the new land is a sensitive issue since pig farms cannot be located close to Muslims' residence. Although it would not be difficult to find land in Ambon Island for pig farming, the farmers would be obliged to change their life style if the location is far from downtown. The Government should have close consultation with these people to know what they want in exchange for giving up their land and life style.

Ruhu River (x10^ Rp)

Return Period	Discharge (m3/sec)	Probability (N)	Part Prob. A=N$_1$-N$_2$	Damage	Part Damage (B)	Average Damage=A*B	Cum.Ave.Ann Dasmage
0.3	50	3.333		0			
0.4	70	2.500	0.833	384	192	160	160
3	123	0.333	2.167	1,175	780	1,689	1,849
5	168	0.200	0.133	2,395	1,785	238	2,087
10	223	0.100	0.100	3,885	3,140	314	2,401
20	280	0.050	0.050	8,510	6,198	310	2,711
30	314	0.033	0.017	11,269	9,890	168	2,879
50	358	0.020	0.013	12,019	11,644	151	3,030
100	418	0.010	0.010	13,042	12,531	125	3,155

Batu Merah River (x10^ Rp)

Return Period	Discharge (m3/sec)	Probability (N)	Part Prob. A=N$_1$-N$_2$	Damage	Part Damage (B)	Average Damage=A*B	Cum.Ave.Ann Dasmage
0.3	20	3.333		0			
0.4	35	2.500	0.833	2,036	1,018	848	848
3	64	0.333	2.167	2,748	2,392	5,183	6,031
5	84	0.200	0.133	4,081	3,415	454	6,485
10	108	0.100	0.100	5,681	4,881	488	6,973
20	132	0.050	0.050	22,938	14,310	715	7,688
30	145	0.033	0.017	32,285	27,612	469	8,157
50	163	0.020	0.013	35,821	34,053	443	8,600
100	188	0.010	0.010	40,732	38,277	383	8,983

Tomu River (x10^ Rp)

Return Period	Discharge (m3/sec)	Probability (N)	Part Prob. A=N$_1$-N$_2$	Damage	Part Damage (B)	Average Damage=A*B	Cum.Ave.Ann Dasmage
0.3	30	3.333		0			
0.4	35	2.500	0.833	671	336	280	280
3	54	0.333	2.167	815	743	1,610	1,890
5	69	0.200	0.133	2,826	1,821	242	2,132
10	87	0.100	0.100	5,240	4,033	403	2,535
20	106	0.050	0.050	19,042	12,141	607	3,142
30	117	0.033	0.017	27,033	23,038	392	3,534
50	131	0.020	0.013	29,764	28,399	369	3,903
100	151	0.010	0.010	33,666	31,715	317	4,220

Batu Gajah River (x10^ Rp)

Return Period	Discharge (m3/sec)	Probability (N)	Part Prob. A=N$_1$-N$_2$	Damage	Part Damage (B)	Average Damage=A*B	Cum.Ave.Ann Dasmage
0.3	30	3.333		0			
0.4	40	2.500	0.833	1,079	540	450	450
3	62	0.333	2.167	1,364	1,222	2,647	3,097
5	80	0.200	0.133	5,017	3,191	424	3,521
10	102	0.100	0.100	9,481	7,249	725	4,246
20	124	0.050	0.050	29,145	19,313	966	5,212
30	137	0.033	0.017	40,164	34,655	589	5,801
50	158	0.020	0.013	45,300	42,732	556	6,357
100	177	0.010	0.010	49,403	47,352	474	6,831

Batu Gantung River (x10^ Rp)

Return Period	Discharge (m3/sec)	Probability (N)	Part Prob. A=N$_1$-N$_2$	Damage	Part Damage (B)	Average Damage=A*B	Cum.Ave.Ann Dasmage
0.3	30	3.333		0			
0.4	45	2.500	0.833	596	298	248	248
3	81	0.333	2.167	1,125	861	1,864	2,112
5	102	0.200	0.133	1,705	1,415	188	2,300
10	129	0.100	0.100	2,450	2,078	208	2,508
20	156	0.050	0.050	6,548	4,499	225	2,733
30	172	0.033	0.017	8,977	7,763	132	2,865
50	193	0.020	0.013	9,774	9,376	122	2,987
100	221	0.010	0.010	10,836	10,305	103	3,090

Master Plan – Ruhu River Improvement
Base Case: Property Value Growth Rate 5.0%

Ruhu
Growth   1.05000
Total Fin-Cost 14,195
Total Eco-Cost 12,066
Ave Benefit/y (1 2,087

Year	Cost	Benefit	Net Value
0			0
1	2,413	0	(2,413)
2	2,413	0	(2,413)
3	2,413	0	(2,413)
4	2,413	0	(2,413)
5	2,413	0	(2,413)
6	60	2,937	2,876
7	60	3,083	3,023
8	60	3,239	3,177
9	60	3,400	3,339
10	60	3,569	3,509
11	60	3,748	3,688
12	60	3,935	3,875
13	60	4,132	4,072
14	60	4,339	4,278
15	60	4,556	4,495
16	60	4,783	4,723
17	60	5,023	4,962
18	60	5,274	5,213
19	60	5,537	5,477
20	60	5,814	5,754
21	60	6,105	6,045
22	60	6,410	6,350
23	60	6,731	6,670
24	60	7,067	7,007
25	60	7,421	7,360
26	60	7,792	7,731
27	60	8,181	8,121
28	60	8,590	8,530
29	60	9,020	8,960
30	60	9,471	9,411
31	60	9,944	9,884
32	60	10,442	10,381
33	60	10,964	10,903
34	60	11,512	11,452
35	60	12,088	12,027
36	60	12,692	12,632
37	60	13,326	13,266
38	60	13,993	13,932
39	60	14,692	14,632
40	60	15,427	15,367
41	60	16,198	16,138
42	60	17,008	16,949
43	60	17,859	17,798
44	60	18,752	18,691
45	60	19,689	19,629
46	60	20,674	20,613
47	60	21,707	21,647
48	60	22,793	22,732
49	60	23,932	23,872
50	60	25,129	25,069

IRR   20.8%
NPV (10%)   22,456
PV-Cost (10%)   9,517
PV-Benefit (10%)   31,973
B/C (10%)   3.36

Ruhu (incl. Flood Control Dam)

Dam(1) Fin–Cost	66,998
Dam(1) Eco–Cost	56,948
Ave.Benefit/y (2)	2879

Year	Dam (1) Cost	Dam (1) Benefit	Net Value
0			
1	11,390	0	(11,390)
2	11,390	0	(11,390)
3	11,390	0	(11,390)
4	11,390	0	(11,390)
5	11,390	0	(11,390)
6	285	4,051	3,766
7	285	4,254	3,969
8	285	4,466	4,182
9	285	4,690	4,405
10	285	4,924	4,639
11	285	5,170	4,886
12	285	5,429	5,144
13	285	5,700	5,415
14	285	5,985	5,700
15	285	6,284	6,000
16	285	6,599	6,314
17	285	6,929	6,644
18	285	7,275	6,990
19	285	7,639	7,354
20	285	8,021	7,736
21	285	8,422	8,137
22	285	8,843	8,558
23	285	9,285	9,000
24	285	9,749	9,465
25	285	10,237	9,952
26	285	10,749	10,464
27	285	11,286	11,001
28	285	11,850	11,566
29	285	12,443	12,158
30	285	13,065	12,780
31	285	13,718	13,434
32	285	14,404	14,119
33	285	15,124	14,840
34	285	15,881	15,596
35	285	16,675	16,390
36	285	17,508	17,224
37	285	18,384	18,099
38	285	19,303	19,018
39	285	20,268	19,983
40	285	21,282	20,997
41	285	22,346	22,061
42	285	23,463	23,178
43	285	24,636	24,351
44	285	25,868	25,583
45	285	27,161	26,876
46	285	28,519	28,235
47	285	29,945	29,661
48	285	31,443	31,158
49	285	33,015	32,730
50	285	34,665	34,381

IRR	9.9%
NPV (10%)	(813)
PV–Cost (10%)	44,920
PV–Benefit (10%)	44,106
B/C (10%)	0.98

Ruhu (Inc Multi-dam)

Dam(2) Fin-Cost	90,699
Dam(2) Eco-Cost	77,094
Willingness to pay	0.0025
Water Supply Vol	3,504,000

Year	Dam (2) Incremental Cost	Dam (2) Inc	Inc Net Value (2)	Inc Net Value	Total Cost	Total Benefit	Net Value
0							
1	4,029	0	(4,029)	(13,006)	15,419	0	(15,419)
2	4,029	0	(4,029)	(13,006)	15,419	0	(15,419)
3	4,029	0	(4,029)	(13,006)	15,419	0	(15,419)
4	4,029	0	(4,029)	(13,006)	15,419	0	(15,419)
5	4,029	0	(4,029)	(13,006)	15,419	0	(15,419)
6	3,036	8,760	5,724	6,614	3,321	12,811	9,490
7	3,036	8,760	5,724	6,669	3,321	13,014	9,693
8	3,036	8,760	5,724	6,728	3,321	13,226	9,905
9	3,036	8,760	5,724	6,789	3,321	13,450	10,129
10	3,036	8,760	5,724	6,854	3,321	13,684	10,353
11	3,036	8,760	5,724	6,922	3,321	13,930	10,609
12	3,036	8,760	5,724	6,993	3,321	14,189	10,868
13	3,036	8,760	5,724	7,067	3,321	14,460	11,139
14	3,036	8,760	5,724	7,146	3,321	14,745	11,424
15	3,036	8,760	5,724	7,228	3,321	15,044	11,724
16	3,036	8,760	5,724	7,315	3,321	15,359	12,038
17	3,036	8,760	5,724	7,405	3,321	15,689	12,368
18	3,036	8,760	5,724	7,501	3,321	16,035	12,714
19	3,036	8,760	5,724	7,601	3,321	16,399	13,078
20	3,036	8,760	5,724	7,706	3,321	16,781	13,460
21	3,036	8,760	5,724	7,816	3,321	17,182	13,861
22	3,036	8,760	5,724	7,932	3,321	17,603	14,282
23	3,036	8,760	5,724	8,054	3,321	18,045	14,724
24	3,036	8,760	5,724	8,181	3,321	18,509	15,188
25	3,036	8,760	5,724	8,315	3,321	18,997	15,676
26	3,036	8,760	5,724	8,456	3,321	19,509	16,188
27	3,036	8,760	5,724	8,604	3,321	20,046	16,725
28	3,036	8,760	5,724	8,759	3,321	20,610	17,289
29	3,036	8,760	5,724	8,922	3,321	21,203	17,882
30	3,036	8,760	5,724	9,093	3,321	21,825	18,504
31	3,036	8,760	5,724	9,273	3,321	22,478	19,157
32	3,036	8,760	5,724	9,462	3,321	23,164	19,843
33	3,036	8,760	5,724	9,660	3,321	23,884	20,563
34	3,036	8,760	5,724	9,868	3,321	24,641	21,320
35	3,036	8,760	5,724	10,086	3,321	25,435	22,114
36	3,036	8,760	5,724	10,316	3,321	26,268	22,947
37	3,036	8,760	5,724	10,557	3,321	27,144	23,823
38	3,036	8,760	5,724	10,810	3,321	28,063	24,742
39	3,036	8,760	5,724	11,075	3,321	29,028	25,707
40	3,036	8,760	5,724	11,354	3,321	30,042	26,721
41	3,036	8,760	5,724	11,647	3,321	31,106	27,785
42	3,036	8,760	5,724	11,954	3,321	32,223	28,902
43	3,036	8,760	5,724	12,277	3,321	33,396	30,075
44	3,036	8,760	5,724	12,615	3,321	34,628	31,307
45	3,036	8,760	5,724	12,971	3,321	35,921	32,600
46	3,036	8,760	5,724	13,345	3,321	37,279	33,958
47	3,036	8,760	5,724	13,737	3,321	38,705	35,384
48	3,036	8,760	5,724	14,149	3,321	40,203	36,882
49	3,036	8,760	5,724	14,582	3,321	41,775	38,454
50	3,036	8,760	5,724	15,036	3,321	43,425	40,104

IRR			19.3%	9.4%		12.1%
NPV (10%)			19,779	(3,490)		18,965
PV-Cost (10%)			33,868			78,787
PV-Benefit (10%)			53,646			97,753
B/C (10%)			1.58			1.24

Merah
Growth	1.05000		
Total Fin-Cost	51,235		
Total Eco-Cost	43,550		
Ave Benefit/y (1)	8,157		

Year	Cost	Benefit	Net Value
0			0
1	8,710	0	(8,710)
2	8,710	0	(8,710)
3	8,710	0	(8,710)
4	8,710	0	(8,710)
5	8,710	0	(8,710)
6	218	11,478	11,260
7	218	12,052	11,834
8	218	12,654	12,436
9	218	13,287	13,069
10	218	13,951	13,733
11	218	14,649	14,431
12	218	15,381	15,163
13	218	16,150	15,933
14	218	16,958	16,740
15	218	17,806	17,588
16	218	18,696	18,478
17	218	19,631	19,413
18	218	20,612	20,395
19	218	21,643	21,425
20	218	22,725	22,507
21	218	23,861	23,644
22	218	25,054	24,837
23	218	26,307	26,089
24	218	27,622	27,405
25	218	29,004	28,786
26	218	30,454	30,236
27	218	31,976	31,759
28	218	33,575	33,358
29	218	35,254	35,036
30	218	37,017	36,799
31	218	38,868	38,650
32	218	40,811	40,593
33	218	42,852	42,634
34	218	44,994	44,776
35	218	47,244	47,026
36	218	49,606	49,388
37	218	52,086	51,869
38	218	54,691	54,473
39	218	57,425	57,207
40	218	60,296	60,079
41	218	63,311	63,094
42	218	66,477	66,259
43	218	69,801	69,583
44	218	73,291	73,073
45	218	76,955	76,737
46	218	80,803	80,585
47	218	84,843	84,625
48	218	89,085	88,868
49	218	93,540	93,322
50	218	98,217	97,999

IRR	21.8%
NPV (10%)	90,614
PV-Cost (10%)	34,351
PV-Benefit (10%)	124,965
B/C (10%)	3.64

4

Tomu
Growth   1.05000
Total Fin-Cost   26,290
Total Eco-Cost   22,347
Ave Benefit/y (1)   3,534

Year	Cost	Benefit	Net Value
0			0
1	4,469	0	(4,469)
2	4,469	0	(4,469)
3	4,469	0	(4,469)
4	4,469	0	(4,469)
5	4,469	0	(4,469)
6	112	4,973	4,861
7	112	5,221	5,110
8	112	5,482	5,371
9	112	5,757	5,645
10	112	6,044	5,933
11	112	6,347	6,235
12	112	6,664	6,552
13	112	6,997	6,885
14	112	7,347	7,235
15	112	7,714	7,603
16	112	8,100	7,988
17	112	8,505	8,393
18	112	8,930	8,819
19	112	9,377	9,265
20	112	9,846	9,734
21	112	10,338	10,226
22	112	10,855	10,743
23	112	11,398	11,286
24	112	11,967	11,856
25	112	12,566	12,454
26	112	13,194	13,082
27	112	13,854	13,742
28	112	14,546	14,435
29	112	15,274	15,162
30	112	16,037	15,926
31	112	16,839	16,728
32	112	17,681	17,570
33	112	18,565	18,454
34	112	19,494	19,382
35	112	20,468	20,357
36	112	21,492	21,380
37	112	22,566	22,455
38	112	23,695	23,583
39	112	24,879	24,768
40	112	26,123	26,012
41	112	27,429	27,318
42	112	28,801	28,689
43	112	30,241	30,129
44	112	31,753	31,641
45	112	33,341	33,229
46	112	35,008	34,896
47	112	36,758	36,646
48	112	38,596	38,484
49	112	40,526	40,414
50	112	42,552	42,440

IRR   19.7%
NPV (10%)   36,514
PV-Cost (10%)   17,626
PV-Benefit (10%)   54,141
B/C (10%)   3.07

Gajah
Growth   1.05000
Total Fin-Cost 58,933
Total Eco-Cost 50,093
Ave Benefit/y (t) 5,801

Year	Cost	Benefit	Net Value
0			0
1	10,019	0	(10,019)
2	10,019	0	(10,019)
3	10,019	0	(10,019)
4	10,019	0	(10,019)
5	10,019	0	(10,019)
6	250	8,163	7,912
7	250	8,571	8,320
8	250	8,999	8,749
9	250	9,449	9,199
10	250	9,922	9,671
11	250	10,418	10,167
12	250	10,939	10,688
13	250	11,486	11,235
14	250	12,060	11,809
15	250	12,663	12,412
16	250	13,296	13,046
17	250	13,961	13,710
18	250	14,659	14,408
19	250	15,392	15,141
20	250	16,161	15,911
21	250	16,969	16,719
22	250	17,818	17,567
23	250	18,709	18,458
24	250	19,644	19,394
25	250	20,626	20,376
26	250	21,658	21,407
27	250	22,741	22,490
28	250	23,878	23,627
29	250	25,072	24,821
30	250	26,325	26,075
31	250	27,641	27,391
32	250	29,023	28,773
33	250	30,475	30,224
34	250	31,998	31,748
35	250	33,598	33,348
36	250	35,278	35,028
37	250	37,042	36,792
38	250	38,894	38,644
39	250	40,839	40,589
40	250	42,881	42,630
41	250	45,025	44,775
42	250	47,276	47,026
43	250	49,640	49,390
44	250	52,122	51,872
45	250	54,728	54,478
46	250	57,465	57,214
47	250	60,338	60,087
48	250	63,355	63,104
49	250	66,522	66,272
50	250	69,849	69,598

IRR	16.4%
NPV (10%)	49,359
PV-Cost (10%)	39,512
PV-Benefit (10%)	88,871
B/C (10%)	2.25

Gajah (incl. Multi-dam)

Dam Fin-Cost	90,111	
Dam Eco-Cost	76,594	
Willingness to pay	0.0025	
Water Supply Vol	1,752,000	

Year	Dam Inc Cost	Dam Inc Benefit	Inc. Net Value	Total Cost	Total Benefit	Net Value
0						
1	5,300	0	(5,300)	15,319	0	(15,319)
2	5,300	0	(5,300)	15,319	0	(15,319)
3	5,300	0	(5,300)	15,319	0	(15,319)
4	5,300	0	(5,300)	15,319	0	(15,319)
5	5,300	0	(5,300)	15,319	0	(15,319)
6	1,708	4,380	2,672	1,959	12,543	10,584
7	1,708	4,380	2,672	1,959	12,951	10,992
8	1,708	4,380	2,672	1,959	13,379	11,420
9	1,708	4,380	2,672	1,959	13,829	11,870
10	1,708	4,380	2,672	1,959	14,302	12,343
11	1,708	4,380	2,672	1,959	14,798	12,839
12	1,708	4,380	2,672	1,959	15,319	13,360
13	1,708	4,380	2,672	1,959	15,866	13,907
14	1,708	4,380	2,672	1,959	16,440	14,481
15	1,708	4,380	2,672	1,959	17,043	15,084
16	1,708	4,380	2,672	1,959	17,676	15,717
17	1,708	4,380	2,672	1,959	18,341	16,382
18	1,708	4,380	2,672	1,959	19,039	17,080
19	1,708	4,380	2,672	1,959	19,772	17,813
20	1,708	4,380	2,672	1,959	20,541	18,583
21	1,708	4,380	2,672	1,959	21,349	19,391
22	1,708	4,380	2,672	1,959	22,198	20,239
23	1,708	4,380	2,672	1,959	23,089	21,130
24	1,708	4,380	2,672	1,959	24,024	22,065
25	1,708	4,380	2,672	1,959	25,006	23,048
26	1,708	4,380	2,672	1,959	26,038	24,079
27	1,708	4,380	2,672	1,959	27,121	25,162
28	1,708	4,380	2,672	1,959	28,258	26,299
29	1,708	4,380	2,672	1,959	29,452	27,493
30	1,708	4,380	2,672	1,959	30,705	28,746
31	1,708	4,380	2,672	1,959	32,021	30,063
32	1,708	4,380	2,672	1,959	33,403	31,445
33	1,708	4,380	2,672	1,959	34,855	32,896
34	1,708	4,380	2,672	1,959	36,378	34,420
35	1,708	4,380	2,672	1,959	37,978	36,020
36	1,708	4,380	2,672	1,959	39,658	37,699
37	1,708	4,380	2,672	1,959	41,422	39,463
38	1,708	4,380	2,672	1,959	43,274	41,315
39	1,708	4,380	2,672	1,959	45,219	43,260
40	1,708	4,380	2,672	1,959	47,261	45,302
41	1,708	4,380	2,672	1,959	49,405	47,446
42	1,708	4,380	2,672	1,959	51,656	49,697
43	1,708	4,380	2,672	1,959	54,020	52,061
44	1,708	4,380	2,672	1,959	56,502	54,543
45	1,708	4,380	2,672	1,959	59,108	57,149
46	1,708	4,380	2,672	1,959	61,845	59,886
47	1,708	4,380	2,672	1,959	64,718	62,759
48	1,708	4,380	2,672	1,959	67,735	65,776
49	1,708	4,380	2,672	1,959	70,902	68,944
50	1,708	4,380	2,672	1,959	74,229	72,270

IRR	8.3%	14.4%
NPV (10%)	(3,731)	45,628
PV-Cost (10%)	30,554	70,066
PV-Benefit (10%)	26,823	115,695
B/C (10%)	0.88	1.65

Gantung
Growth   1.06000
Total Fin-Cost   45,193
Total Eco-Cost   38,418
Ave Benefit/y (1) 2,865

Year	Cost	Benefit	Net Value
0			0
1	7,684	0	(7,684)
2	7,684	0	(7,684)
3	7,684	0	(7,684)
4	7,684	0	(7,684)
5	7,684	0	(7,684)
6	192	4,031	3,839
7	192	4,233	4,041
8	192	4,445	4,252
9	192	4,667	4,475
10	192	4,900	4,708
11	192	5,145	4,953
12	192	5,402	5,210
13	192	5,673	5,480
14	192	5,956	5,764
15	192	6,254	6,062
16	192	6,567	6,375
17	192	6,895	6,703
18	192	7,240	7,048
19	192	7,602	7,410
20	192	7,982	7,790
21	192	8,381	8,189
22	192	8,800	8,608
23	192	9,240	9,048
24	192	9,702	9,510
25	192	10,187	9,995
26	192	10,696	10,504
27	192	11,231	11,039
28	192	11,793	11,601
29	192	12,382	12,190
30	192	13,001	12,809
31	192	13,652	13,459
32	192	14,334	14,142
33	192	15,051	14,859
34	192	15,803	15,611
35	192	16,594	16,401
36	192	17,423	17,231
37	192	18,294	18,102
38	192	19,209	19,017
39	192	20,170	19,977
40	192	21,178	20,986
41	192	22,237	22,045
42	192	23,349	23,157
43	192	24,516	24,324
44	192	25,742	25,550
45	192	27,029	26,837
46	192	28,381	28,189
47	192	29,800	29,608
48	192	31,290	31,098
49	192	32,854	32,662
50	192	34,497	34,305

IRR	12.6%
NPV (10%)	13,588
PV-Cost (10%)	30,303
PV-Benefit (10%)	43,892
B/C (10%)	1.45

Gantung (incl. Multi-dam)

Dam Fin-Cost 63,099
Dam Eco-Cost 53,634
Willingness to pay 0.0025
Water Supply Vol. 547,500

Year	Dam Inc Cost	Dam Inc Benefit	Inc Net Value	Total Cost	Total Benefit	Net Value
0						
1	3,043	0	(3,043)	10,727	0	(10,727)
2	3,043	0	(3,043)	10,727	0	(10,727)
3	3,043	0	(3,043)	10,727	0	(10,727)
4	3,043	0	(3,043)	10,727	0	(10,727)
5	3,043	0	(3,043)	10,727	0	(10,727)
6	682	1,369	686	874	5,400	4,526
7	682	1,369	686	874	5,602	4,727
8	682	1,369	686	874	5,813	4,939
9	682	1,369	686	874	6,036	5,161
10	682	1,369	686	874	6,269	5,394
11	682	1,369	686	874	6,514	5,639
12	682	1,369	686	874	6,771	5,897
13	682	1,369	686	874	7,041	6,167
14	682	1,369	686	874	7,325	6,450
15	682	1,369	686	874	7,623	6,748
16	682	1,369	686	874	7,935	7,061
17	682	1,369	686	874	8,264	7,389
18	682	1,369	686	874	8,608	7,734
19	682	1,369	686	874	8,970	8,096
20	682	1,369	686	874	9,351	8,476
21	682	1,369	686	874	9,750	8,875
22	682	1,369	686	874	10,169	9,294
23	682	1,369	686	874	10,609	9,734
24	682	1,369	686	874	11,071	10,196
25	682	1,369	686	874	11,556	10,681
26	682	1,369	686	874	12,065	11,191
27	682	1,369	686	874	12,600	11,725
28	682	1,369	686	874	13,161	12,287
29	682	1,369	686	874	13,751	12,877
30	682	1,369	686	874	14,370	13,496
31	682	1,369	686	874	15,020	14,146
32	682	1,369	686	874	15,703	14,828
33	682	1,369	686	874	16,420	15,545
34	682	1,369	686	874	17,172	16,298
35	682	1,369	686	874	17,962	17,088
36	682	1,369	686	874	18,792	17,918
37	682	1,369	686	874	19,663	18,789
38	682	1,369	686	874	20,578	19,703
39	682	1,369	686	874	21,538	20,664
40	682	1,369	686	874	22,547	21,672
41	682	1,369	686	874	23,606	22,731
42	682	1,369	686	874	24,718	23,843
43	682	1,369	686	874	25,885	25,011
44	682	1,369	686	874	27,111	26,236
45	682	1,369	686	874	28,398	27,523
46	682	1,369	686	874	29,749	28,875
47	682	1,369	686	874	31,168	30,294
48	682	1,369	686	874	32,658	31,784
49	682	1,369	686	874	34,223	33,348
50	682	1,369	686	874	35,866	34,991

IRR	3.2%	10.9%
NPV (10%)	(7,333)	6,256
PV-Cost (10%)	15,715	46,018
PV-Benefit (10%)	8,382	52,274
B/C (10%)	0.53	1.14

Option 1   Flood Control (phase 1)
Growth: 1.05000
Total Fin-Cost 195,851
Total Eco-Cos   166,473
Benefit   22,444

Year	Cost	Benefit	Net Value
0			0
1	8,324	0	(8,324)
2	8,324	0	(8,324)
3	8,324	0	(8,324)
4	23,584	0	(23,584)
5	23,584	0	(23,584)
6	23,584	0	(23,584)
7	23,584	0	(23,584)
8	23,584	0	(23,584)
9	23,584	0	(23,584)
10	832	38,387	37,554
11	832	40,306	39,474
12	832	42,322	41,489
13	832	44,438	43,605
14	832	46,659	45,827
15	832	48,992	48,160
16	832	51,442	50,610
17	832	54,014	53,182
18	832	56,715	55,883
19	832	59,551	58,718
20	832	62,528	61,696
21	832	65,655	64,822
22	832	68,937	68,105
23	832	72,384	71,552
24	832	76,003	75,171
25	832	79,804	78,971
26	832	83,794	82,961
27	832	87,983	87,151
28	832	92,383	91,550
29	832	97,002	96,169
30	832	101,852	101,019
31	832	106,944	106,112
32	832	112,292	111,459
33	832	117,906	117,074
34	832	123,801	122,969
35	832	129,992	129,159
36	832	136,491	135,659
37	832	143,316	142,483
38	832	150,481	149,649
39	832	158,006	157,173
40	832	165,906	165,073
41	832	174,201	173,369
42	832	182,911	182,079
43	832	192,057	191,224
44	832	201,660	200,827
45	832	211,742	210,910
46	832	222,330	221,497
47	832	233,446	232,614
48	832	245,118	244,286
49	832	257,374	256,542
50	832	270,243	269,411

IRR	17.5%
NPV (10%)	175,923
PV-Cost (10%)	101,329
PV-Benefit (10%)	277,252
B/C (10%)	2.74

II-A-15

Option 2   Flood Control (total)
Growth: 1.05000 (2nd stage)
Total Fin-Cost   195,851   52,803
Total Eco-Cos   166,473   44,883
Benefit   22,444   792

Year	Cost	Benefit	Net Value
0			0
1	8,324	0	(8,324)
2	8,324	0	(8,324)
3	8,324	0	(8,324)
4	23,584	0	(23,584)
5	23,584	0	(23,584)
6	25,828	0	(25,828)
7	25,828	0	(25,828)
8	25,828	0	(25,828)
9	29,942	0	(29,942)
10	7,191	38,387	31,196
11	7,191	40,306	33,115
12	7,191	42,322	35,131
13	7,191	44,438	37,247
14	7,191	46,659	39,469
15	1,057	50,721	49,664
16	1,057	53,257	52,201
17	1,057	55,920	54,863
18	1,057	58,716	57,659
19	1,057	61,652	60,595
20	1,057	64,735	63,678
21	1,057	67,971	66,915
22	1,057	71,370	70,313
23	1,057	74,938	73,882
24	1,057	78,685	77,629
25	1,057	82,620	81,563
26	1,057	86,751	85,694
27	1,057	91,088	90,031
28	1,057	95,643	94,586
29	1,057	100,425	99,368
30	1,057	105,446	104,389
31	1,057	110,718	109,661
32	1,057	116,254	115,197
33	1,057	122,067	121,010
34	1,057	128,170	127,113
35	1,057	134,579	133,522
36	1,057	141,308	140,251
37	1,057	148,373	147,316
38	1,057	155,792	154,735
39	1,057	163,581	162,524
40	1,057	171,760	170,703
41	1,057	180,348	179,291
42	1,057	189,366	188,309
43	1,057	198,834	197,777
44	1,057	208,776	207,719
45	1,057	219,214	218,158
46	1,057	230,175	229,118
47	1,057	241,684	240,627
48	1,057	253,768	252,711
49	1,057	266,457	265,400
50	1,057	279,779	278,723

IRR	16.7%
NPV (10%)	166,366
PV-Cost (10%)	118,285
PV-Benefit (10%)	284,651
B/C (10%)	2.41

Option 3   Multi-purpose (Ruhu)
Growth   1.05000 (2nd stage)
Total Fin-Cos   195,851   76,504
Total Eco-Cos   166,473   65,028
Water Benefit   0   8,760

Year	Cost	Benefit	Net Value
0			0
1	8,324	0	(8,324)
2	8,324	0	(8,324)
3	8,324	0	(8,324)
4	23,584	0	(23,584)
5	23,584	0	(23,584)
6	26,835	0	(26,835)
7	26,835	0	(26,835)
8	26,835	0	(26,835)
9	32,796	0	(32,796)
10	10,045	38,387	28,342
11	10,045	40,306	30,261
12	10,045	42,322	32,277
13	10,045	44,438	34,393
14	10,045	46,659	36,615
15	1,158	59,481	58,324
16	1,158	62,017	60,860
17	1,158	64,680	63,523
18	1,158	67,476	66,319
19	1,158	70,412	69,255
20	1,158	73,495	72,337
21	1,158	76,731	75,574
22	1,158	80,130	78,972
23	1,158	83,698	82,541
24	1,158	87,445	86,288
25	1,158	91,380	90,222
26	1,158	95,511	94,353
27	1,158	99,848	98,691
28	1,158	104,403	103,245
29	1,158	109,185	108,027
30	1,158	114,206	113,048
31	1,158	119,478	118,321
32	1,158	125,014	123,857
33	1,158	130,827	129,669
34	1,158	136,930	135,773
35	1,158	143,339	142,181
36	1,158	150,068	148,910
37	1,158	157,133	155,975
38	1,158	164,552	163,394
39	1,158	172,341	171,184
40	1,158	180,520	179,363
41	1,158	189,108	187,951
42	1,158	198,126	196,968
43	1,158	207,594	206,436
44	1,158	217,536	216,378
45	1,158	227,974	226,817
46	1,158	238,935	237,778
47	1,158	250,444	249,286
48	1,158	262,528	261,371
49	1,158	275,217	274,059
50	1,158	288,539	287,382

IRR   16.9%
NPV (10%)   181,077
PV-Cost (10%)   125,895
PV-Benefit (10%)   306,973
B/C (10%)   2.44

Option 4   Multi-purpose (Ruhu & Gajah)
Growth: 1.05000 (2nd stage)
Total Fin-Cos 227,029   76,504
Total Eco-Co 192,975   65,028
Water Benefit   4,380   8,760

Year	Cost	Benefit	Net Value
0			0
1	9,649	0	(9,649)
2	9,649	0	(9,649)
3	9,649	0	(9,649)
4	27,338	0	(27,338)
5	27,338	0	(27,338)
6	30,589	0	(30,589)
7	30,589	0	(30,589)
8	30,589	0	(30,589)
9	36,550	0	(36,550)
10	10,177	42,767	32,590
11	10,177	44,686	34,509
12	10,177	46,702	36,524
13	10,177	48,818	38,640
14	10,177	51,039	40,862
15	1,290	63,861	62,571
16	1,290	66,397	65,107
17	1,290	69,060	67,770
18	1,290	71,856	70,566
19	1,290	74,792	73,502
20	1,290	77,875	76,585
21	1,290	81,111	79,821
22	1,290	84,510	83,220
23	1,290	88,078	86,788
24	1,290	91,825	90,535
25	1,290	95,760	94,470
26	1,290	99,891	98,601
27	1,290	104,228	102,938
28	1,290	108,783	107,493
29	1,290	113,565	112,275
30	1,290	118,586	117,296
31	1,290	123,858	122,568
32	1,290	129,394	128,104
33	1,290	135,207	133,917
34	1,290	141,310	140,020
35	1,290	147,719	146,429
36	1,290	154,448	153,158
37	1,290	161,513	160,223
38	1,290	168,932	167,642
39	1,290	176,721	175,431
40	1,290	184,900	183,610
41	1,290	193,488	192,198
42	1,290	202,506	201,216
43	1,290	211,974	210,684
44	1,290	221,916	220,626
45	1,290	232,354	231,064
46	1,290	243,315	242,025
47	1,290	254,824	253,534
48	1,290	266,908	265,618
49	1,290	279,597	278,306
50	1,290	292,919	291,629

IRR	16.4%
NPV (10%)	183,149
PV-Cost (10%)	142,026
PV-Benefit (10%)	325,175
B/C (10%)	2.29

Option 5   Multi-purpose (Gajah & Gantun.
Growth: 1.05000
Total Fin-Cos   244,930
Total Eco-Cos   208,191
Water Benefit   5,749

Year	Cost	Benefit	Net Value
0			0
1	10,410	0	(10,410)
2	10,410	0	(10,410)
3	10,410	0	(10,410)
4	29,494	0	(29,494)
5	29,494	0	(29,494)
6	29,494	0	(29,494)
7	29,494	0	(29,494)
8	29,494	0	(29,494)
9	29,494	0	(29,494)
10	1,041	44,136	43,095
11	1,041	46,055	45,014
12	1,041	48,070	47,029
13	1,041	50,186	49,145
14	1,041	52,408	51,367
15	1,041	54,741	53,700
16	1,041	57,191	56,150
17	1,041	59,763	58,722
18	1,041	62,464	61,423
19	1,041	65,299	64,258
20	1,041	68,277	67,236
21	1,041	71,403	70,362
22	1,041	74,686	73,645
23	1,041	78,133	77,092
24	1,041	81,752	80,711
25	1,041	85,552	84,511
26	1,041	89,542	88,501
27	1,041	93,732	92,691
28	1,041	98,131	97,090
29	1,041	102,750	101,709
30	1,041	107,601	106,560
31	1,041	112,693	111,652
32	1,041	118,040	116,999
33	1,041	123,655	122,614
34	1,041	129,550	128,509
35	1,041	135,740	134,699
36	1,041	142,240	141,199
37	1,041	149,064	148,023
38	1,041	156,230	155,189
39	1,041	163,754	162,713
40	1,041	171,655	170,614
41	1,041	179,950	178,909
42	1,041	188,660	187,619
43	1,041	197,805	196,764
44	1,041	207,408	206,367
45	1,041	217,491	216,450
46	1,041	228,078	227,037
47	1,041	239,195	238,154
48	1,041	250,867	249,826
49	1,041	263,123	262,082
50	1,041	275,992	274,951

IRR	16.4%
NPV (10%)	174,421
PV-Cost (10%)	126,721
PV-Benefit (10%)	301,142
B/C (10%)	2.38

Option 6	Multi-purpose (Total)	
Growth:	1.05000	(2nd stage)
Total Fin-Cos	244,930	76,504
Total Eco-Co	208,191	65,028
Water Benefit	5,749	8,760

Year	Cost	Benefit	Net Value
0			0
1	10,410	0	(10,410)
2	10,410	0	(10,410)
3	10,410	0	(10,410)
4	29,494	0	(29,494)
5	29,494	0	(29,494)
6	32,745	0	(32,745)
7	32,745	0	(32,745)
8	32,745	0	(32,745)
9	38,706	0	(38,706)
10	10,253	44,136	33,882
11	10,253	46,055	35,802
12	10,253	48,070	37,817
13	10,253	50,186	39,933
14	10,253	52,408	42,155
15	1,366	65,230	63,864
16	1,366	67,766	66,400
17	1,366	70,429	69,063
18	1,366	73,225	71,859
19	1,366	76,161	74,795
20	1,366	79,243	77,877
21	1,366	82,480	81,114
22	1,366	85,879	84,513
23	1,366	89,447	88,081
24	1,366	93,194	91,828
25	1,366	97,128	95,762
26	1,366	101,259	99,893
27	1,366	105,597	104,231
28	1,366	110,151	108,785
29	1,366	114,933	113,567
30	1,366	119,955	118,589
31	1,366	125,227	123,861
32	1,366	130,763	129,397
33	1,366	136,576	135,209
34	1,366	142,679	141,313
35	1,366	149,087	147,721
36	1,366	155,816	154,450
37	1,366	162,882	161,516
38	1,366	170,300	168,934
39	1,366	178,090	176,724
40	1,366	186,269	184,903
41	1,366	194,857	193,491
42	1,366	203,874	202,508
43	1,366	213,343	211,977
44	1,366	223,284	221,918
45	1,366	233,723	232,357
46	1,366	244,684	243,318
47	1,366	256,193	254,827
48	1,366	268,277	266,911
49	1,366	280,965	279,599
50	1,366	294,288	292,922

IRR	16.0%
NPV (10%)	179,576
PV-Cost (10%)	151,288
PV-Benefit (10%)	330,863
B/C (10%)	2.19

Ruhu
Growth: 1.05000
Total Eco-Cost 7,768
Ave Benefit/y (1) 2,087
Benefit from Exca 28

Year	Cost	Benefit	Benefit from Excavat	Net Value
0				0
1	1,036	0		(1,036)
2	1,407	0		(1,407)
3	1,775	0		(1,775)
4	1,775	0		(1,775)
5	1,775	0		(1,775)
6	39	2,937	28	2,926
7	39	3,083	28	3,073
8	39	3,238	28	3,227
9	39	3,400	28	3,389
10	39	3,569	28	3,559
11	39	3,748	28	3,737
12	39	3,935	28	3,925
13	39	4,132	28	4,121
14	39	4,339	28	4,328
15	39	4,556	28	4,545
16	39	4,783	28	4,773
17	39	5,023	28	5,012
18	39	5,274	28	5,263
19	39	5,537	28	5,527
20	39	5,814	28	5,803
21	39	6,105	28	6,094
22	39	6,410	28	6,399
23	39	6,731	28	6,720
24	39	7,067	28	7,056
25	39	7,421	28	7,410
26	39	7,792	28	7,781
27	39	8,181	28	8,170
28	39	8,590	28	8,580
29	39	9,020	28	9,009
30	39	9,471	28	9,460
31	39	9,944	28	9,934
32	39	10,442	28	10,431
33	39	10,964	28	10,953
34	39	11,512	28	11,501
35	39	12,088	28	12,077
36	39	12,692	28	12,681
37	39	13,326	28	13,316
38	39	13,993	28	13,982
39	39	14,692	28	14,682
40	39	15,427	28	15,416
41	39	16,198	28	16,188
42	39	17,008	28	16,998
43	39	17,859	28	17,848
44	39	18,752	28	18,741
45	39	19,689	28	19,678
46	39	20,674	28	20,663
47	39	21,707	28	21,697
48	39	22,793	28	22,782
49	39	23,932	28	23,922
50	39	25,129	28	25,118

IRR 28.1%
NPV (10%) 26,154
B/C (10%) 5.34

Ruhu
Growth   1.05000
Total Eco-Cost   7,768
Ave Benefit/y (1)   2,087
Benefit from Exca   28

Year	Cost	Benefit	Benefit from Excavat.	Net Value
0				0
1	1,036	0		(1,036)
2	1,407	0		(1,407)
3	1,775	0		(1,775)
4	1,775	0		(1,775)
5	1,775	0		(1,775)
6	39	2,937	28	2,926
7	39	3,083	28	3,073
8	39	3,238	28	3,227
9	39	3,400	28	3,389
10	39	3,569	28	3,559
11	39	3,748	28	3,737
12	39	3,935	28	3,925
13	39	4,132	28	4,121
14	39	4,339	28	4,328
15	39	4,556	28	4,545
16	39	4,783	28	4,773
17	39	5,023	28	5,012
18	39	5,274	28	5,263
19	39	5,537	28	5,527
20	39	5,814	28	5,803
21	39	6,105	28	6,094
22	39	6,410	28	6,399
23	39	6,731	28	6,720
24	39	7,067	28	7,056
25	39	7,421	28	7,410
26	39	7,792	28	7,781
27	39	8,181	28	8,170
28	39	8,590	28	8,580
29	39	9,020	28	9,009
30	39	9,471	28	9,460
31	39	9,944	28	9,934
32	39	10,442	28	10,431
33	39	10,964	28	10,953
34	39	11,512	28	11,501
35	39	12,088	28	12,077
36	39	12,692	28	12,681
37	39	13,326	28	13,316
38	39	13,993	28	13,982
39	39	14,692	28	14,682
40	39	15,427	28	15,416
41	39	16,198	28	16,188
42	39	17,008	28	16,998
43	39	17,859	28	17,848
44	39	18,752	28	18,741
45	39	19,689	28	19,678
46	39	20,674	28	20,663
47	39	21,707	28	21,697
48	39	22,793	28	22,782
49	39	23,932	28	23,922
50	39	25,129	28	25,118

IRR   28.1%
NPV (10%)   26,154
B/C (10%)   5.34

Merah
Growth   1.05000
Total Eco-Cost   13,480
Ave Benefit/y (1)   6,495
Benefit from Exca   0

Year	Cost	Benefit	Net Value
0			0
1	1,797	0	(1,797)
2	2,440	0	(2,440)
3	3,081	0	(3,081)
4	3,081	0	(3,081)
5	3,081	0	(3,081)
6	67	9,125	9,058
7	67	9,581	9,514
8	67	10,060	9,993
9	67	10,563	10,496
10	67	11,092	11,024
11	67	11,646	11,579
12	67	12,228	12,161
13	67	12,840	12,772
14	67	13,482	13,414
15	67	14,156	14,089
16	67	14,864	14,796
17	67	15,607	15,540
18	67	16,387	16,320
19	67	17,207	17,139
20	67	18,067	18,000
21	67	18,970	18,903
22	67	19,919	19,851
23	67	20,915	20,847
24	67	21,961	21,893
25	67	23,059	22,991
26	67	24,211	24,144
27	67	25,422	25,355
28	67	26,693	26,626
29	67	28,028	27,960
30	67	29,429	29,362
31	67	30,901	30,833
32	67	32,446	32,378
33	67	34,068	34,001
34	67	35,771	35,704
35	67	37,560	37,493
36	67	39,438	39,371
37	67	41,410	41,342
38	67	43,480	43,413
39	67	45,654	45,587
40	67	47,937	47,870
41	67	50,334	50,266
42	67	52,851	52,783
43	67	55,493	55,426
44	67	58,268	58,200
45	67	61,181	61,114
46	67	64,240	64,173
47	67	67,452	67,385
48	67	70,825	70,757
49	67	74,366	74,299
50	67	78,084	78,017

IRR   39.1%
NPV (10%)   88,955
B/C (10%)   9.56

Merah (Incl. Div)
Growth: 1.05000
Total Eco-Cost   34,635
Ave Benefit/y (1) 8,157
Benefit from Exca   0

Year	Cost	Benefit	Net Value
0			0
1	4,618	0	(4,618)
2	6,269	0	(6,269)
3	7,916	0	(7,916)
4	7,916	0	(7,916)
5	7,916	0	(7,916)
6	173	11,478	11,305
7	173	12,052	11,878
8	173	12,654	12,481
9	173	13,287	13,114
10	173	13,951	13,778
11	173	14,649	14,476
12	173	15,381	15,208
13	173	16,150	15,977
14	173	16,958	16,785
15	173	17,806	17,633
16	173	18,696	18,523
17	173	19,631	19,458
18	173	20,612	20,439
19	173	21,643	21,470
20	173	22,725	22,552
21	173	23,861	23,688
22	173	25,054	24,881
23	173	26,307	26,134
24	173	27,622	27,449
25	173	29,004	28,830
26	173	30,454	30,281
27	173	31,976	31,803
28	173	33,575	33,402
29	173	35,254	35,081
30	173	37,017	36,844
31	173	38,868	38,694
32	173	40,811	40,638
33	173	42,852	42,678
34	173	44,994	44,821
35	173	47,244	47,071
36	173	49,606	49,433
37	173	52,086	51,913
38	173	54,691	54,517
39	173	57,425	57,252
40	173	60,296	60,123
41	173	63,311	63,138
42	173	66,477	66,304
43	173	69,801	69,627
44	173	73,291	73,118
45	173	76,955	76,782
46	173	80,803	80,630
47	173	84,843	84,670
48	173	89,085	88,912
49	173	93,540	93,366
50	173	98,217	98,043

IRR   25.8%
NPV (10%)   98,266
B/C (10%)   4.68

Tomu
Growth   1.05000
Total Eco-Cost   23,115
Ave Benefit/y (1)   3,534
Benefit from Exca   26

Year	Cost	Benefit	Benefit from Excavat	Net Value
0				0
1	3,082	0	0	(3,082)
2	4,184	0	0	(4,184)
3	5,283	0	0	(5,283)
4	5,283	0	0	(5,283)
5	5,283	0	0	(5,283)
6	116	4,973	26	4,883
7	116	5,221	26	5,132
8	116	5,482	26	5,393
9	116	5,757	26	5,667
10	116	6,044	26	5,955
11	116	6,347	26	6,257
12	116	6,664	26	6,574
13	116	6,997	26	6,907
14	116	7,347	26	7,257
15	116	7,714	26	7,625
16	116	8,100	26	8,010
17	116	8,505	26	8,415
18	116	8,930	26	8,841
19	116	9,377	26	9,287
20	116	9,846	26	9,756
21	116	10,338	26	10,248
22	116	10,855	26	10,765
23	116	11,398	26	11,308
24	116	11,967	26	11,878
25	116	12,566	26	12,476
26	116	13,194	26	13,104
27	116	13,854	26	13,764
28	116	14,546	26	14,457
29	116	15,274	26	15,184
30	116	16,037	26	15,948
31	116	16,839	26	16,750
32	116	17,681	26	17,592
33	116	18,565	26	18,476
34	116	19,494	26	19,404
35	116	20,468	26	20,379
36	116	21,492	26	21,402
37	116	22,566	26	22,477
38	116	23,695	26	23,605
39	116	24,879	26	24,790
40	116	26,123	26	26,034
41	116	27,429	26	27,340
42	116	28,801	26	28,711
43	116	30,241	26	30,151
44	116	31,753	26	31,663
45	116	33,341	26	33,251
46	116	35,008	26	34,918
47	116	36,758	26	36,668
48	116	38,596	26	38,506
49	116	40,526	26	40,436
50	116	42,552	26	42,462

IRR   19.9%
NPV (10%)   36,474
B/C (10%)   3.04

Gajah
Growth   1 05000
Total Eco-Cost   15,761
Ave Benefit/y (1) 4,246
Benefit from Exca   7

Year	Cost	Benefit	Benefit from Excavat	Net Value
0				0
1	2,101	0	0	(2,101)
2	2,851	0	0	(2,851)
3	3,603	0	0	(3,603)
4	3,603	0	0	(3,603)
5	3,603	0	0	(3,603)
6	79	5,975	7	5,903
7	79	6,273	7	6,201
8	79	6,587	7	6,515
9	79	6,916	7	6,844
10	79	7,262	7	7,190
11	79	7,625	7	7,553
12	79	8,006	7	7,935
13	79	8,407	7	8,335
14	79	8,827	7	8,755
15	79	9,268	7	9,197
16	79	9,732	7	9,660
17	79	10,219	7	10,147
18	79	10,729	7	10,658
19	79	11,266	7	11,194
20	79	11,829	7	11,757
21	79	12,421	7	12,349
22	79	13,042	7	12,970
23	79	13,694	7	13,622
24	79	14,378	7	14,307
25	79	15,097	7	15,026
26	79	15,852	7	15,780
27	79	16,645	7	16,573
28	79	17,477	7	17,405
29	79	18,351	7	18,279
30	79	19,269	7	19,197
31	79	20,232	7	20,160
32	79	21,244	7	21,172
33	79	22,306	7	22,234
34	79	23,421	7	23,349
35	79	24,592	7	24,520
36	79	25,822	7	25,750
37	79	27,113	7	27,041
38	79	28,468	7	28,397
39	79	29,892	7	29,820
40	79	31,386	7	31,315
41	79	32,956	7	32,884
42	79	34,603	7	34,532
43	79	36,334	7	36,262
44	79	38,150	7	38,079
45	79	40,058	7	39,986
46	79	42,061	7	41,989
47	79	44,164	7	44,092
48	79	46,372	7	46,300
49	79	48,691	7	48,619
50	79	51,125	7	51,132

IRR   28.0%
NPV (10%)   52,938
B/C (10%)   5.36

Gajah (Incl. dam)	
Growth	1.05000
Dam Eco-Cost	92,980
Ave Benefit/y (1)	5801
Benefit from Exca	7
Willingness to pay	0.0025
Water Supply Vol.	1,752,000
Treatment Plant	7,360

Year	Cost	Cost for Water Supply	Total Cost	Benefit	Benefit from Water	Benefit from Excavat	Benefit from Land Reclam	Total Benefit	Net Value
0									
1	12,397	0	12,397	0	0	0		0	(12,397)
2	16,824	0	16,824	0	0	0		0	(16,824)
3	21,253	0	21,253	0	0	0		0	(21,253)
4	21,253	0	21,253	0	0	0		0	(21,253)
5	21,253	6,256	27,509	0	0	0		0	(27,509)
6	444	1,357	1,801	8,163	4,380	7		12,550	10,749
7	444	1,357	1,801	8,571	4,380	7		12,958	11,157
8	444	1,357	1,801	8,999	4,380	7		13,386	11,585
9	444	1,357	1,801	9,449	4,380	7		13,836	12,035
10	444	1,357	1,801	9,922	4,380	7	13,120	27,429	25,628
11	444	1,357	1,801	10,418	4,380	7		14,805	13,004
12	444	1,357	1,801	10,939	4,380	7		15,326	13,525
13	444	1,357	1,801	11,486	4,380	7		15,873	14,072
14	444	1,357	1,801	12,060	4,380	7		16,447	14,646
15	444	1,357	1,801	12,663	4,380	7		17,050	15,249
16	444	1,357	1,801	13,296	4,380	7		17,683	15,882
17	444	1,357	1,801	13,961	4,380	7		18,348	16,547
18	444	1,357	1,801	14,659	4,380	7		19,046	17,245
19	444	1,357	1,801	15,392	4,380	7		19,779	17,978
20	444	1,357	1,801	16,161	4,380	7		20,548	18,747
21	444	1,357	1,801	16,969	4,380	7		21,356	19,556
22	444	1,357	1,801	17,818	4,380	7		22,205	20,404
23	444	1,357	1,801	18,709	4,380	7		23,096	21,295
24	444	1,357	1,801	19,644	4,380	7		24,031	22,230
25	444	1,357	1,801	20,626	4,380	7		25,013	23,213
26	444	1,357	1,801	21,658	4,380	7		26,045	24,244
27	444	1,357	1,801	22,741	4,380	7		27,128	25,327
28	444	1,357	1,801	23,878	4,380	7		28,265	26,464
29	444	1,357	1,801	25,072	4,380	7		29,459	27,658
30	444	1,357	1,801	26,325	4,380	7		30,712	28,911
31	444	1,357	1,801	27,641	4,380	7		32,028	30,228
32	444	1,357	1,801	29,023	4,380	7		33,410	31,610
33	444	1,357	1,801	30,475	4,380	7		34,862	33,061
34	444	1,357	1,801	31,998	4,380	7		36,385	34,584
35	444	1,357	1,801	33,598	4,380	7		37,985	36,184
36	444	1,357	1,801	35,278	4,380	7		39,665	37,864
37	444	1,357	1,801	37,042	4,380	7		41,429	39,628
38	444	1,357	1,801	38,894	4,380	7		43,281	41,480
39	444	1,357	1,801	40,839	4,380	7		45,226	43,425
40	444	1,357	1,801	42,881	4,380	7		47,268	45,467
41	444	1,357	1,801	45,025	4,380	7		49,412	47,611
42	444	1,357	1,801	47,276	4,380	7		51,663	49,862
43	444	1,357	1,801	49,640	4,380	7		54,027	52,226
44	444	1,357	1,801	52,122	4,380	7		56,509	54,708
45	444	1,357	1,801	54,728	4,380	7		59,115	57,314
46	444	1,357	1,801	57,465	4,380	7		61,852	60,051
47	444	1,357	1,801	60,338	4,380	7		64,725	62,924
48	444	1,357	1,801	63,355	4,380	7		67,742	65,941
49	444	1,357	1,801	66,522	4,380	7		70,909	69,108
50	444	1,357	1,801	97,257	4,380	7		101,644	99,843

IRR	13.1%
NPV (10%)	37,262
B/C (10%)	1.44

Gantung
Growth   1.05000
Total Eco-Cost   11,211
Ave Benefit/y (1)   2,508
Benefit from Exca   25

Year	Cost	Benefit	Benefit from Excavat	Net Value
0				0
1	1,495	0	0	(1,495)
2	2,027	0	0	(2,027)
3	2,563	0	0	(2,563)
4	2,563	0	0	(2,563)
5	2,563	0	0	(2,563)
6	56	3,529	25	3,498
7	56	3,705	25	3,675
8	56	3,891	25	3,860
9	56	4,085	25	4,054
10	56	4,290	25	4,259
11	56	4,504	25	4,473
12	56	4,729	25	4,698
13	56	4,966	25	4,935
14	56	5,214	25	5,183
15	56	5,475	25	5,444
16	56	5,748	25	5,718
17	56	6,036	25	6,005
18	56	6,338	25	6,307
19	56	6,654	25	6,624
20	56	6,987	25	6,956
21	56	7,337	25	7,306
22	56	7,703	25	7,673
23	56	8,089	25	8,058
24	56	8,493	25	8,462
25	56	8,918	25	8,887
26	56	9,364	25	9,333
27	56	9,832	25	9,801
28	55	10,323	25	10,292
29	56	10,839	25	10,809
30	56	11,381	25	11,351
31	56	11,950	25	11,920
32	56	12,548	25	12,517
33	56	13,175	25	13,145
34	56	13,834	25	13,803
35	56	14,526	25	14,495
36	56	15,252	25	15,221
37	56	16,015	25	15,984
38	56	16,816	25	16,785
39	56	17,656	25	17,625
40	56	18,539	25	18,508
41	56	19,466	25	19,435
42	56	20,439	25	20,409
43	56	21,461	25	21,430
44	56	22,534	25	22,504
45	56	23,661	25	23,630
46	56	24,844	25	24,813
47	56	26,086	25	26,056
48	56	27,391	25	27,360
49	56	28,760	25	28,729
50	56	30,198	25	30,223

IRR   25.1%
NPV (10%)   29,932
B/C (10%)   4.44

Gantung (Incl. dam)
Growth   1.05000
Dam Eco-Cost   63,104
Ave Benefit/y (1) 2865
Benefit from Exca   25
Willingness to pay 0.0025
Water Supply Vol. 547,500
Treatment Plant   2,472

Year	Cost	Cost for Water Supply	Total Cost	Benefit	Benefit from Water	Benefit from Excavat	Benefit from Land Reclam.	Total Benefit	Net Value
0									
1	8,415	0	8,415	0	0	0		0	(8,415)
2	11,417	0	11,417	0	0	0		0	(11,417)
3	14,424	0	14,424	0	0	0		0	(14,424)
4	14,424	0	14,424	0	0	0		0	(14,424)
5	14,424	2,101	16,525	0	0	0		0	(16,525)
6	295	682	977	4,031	1,369	25		5,425	4,448
7	295	682	977	4,233	1,369	25		5,627	4,650
8	295	682	977	4,445	1,369	25		5,839	4,861
9	295	682	977	4,667	1,369	25		6,061	5,083
10	295	682	977	4,900	1,369	25	13,120	19,414	18,437
11	295	682	977	5,145	1,369	25		6,539	5,562
12	295	682	977	5,402	1,369	25		6,796	5,819
13	295	682	977	5,673	1,369	25		7,066	6,089
14	295	682	977	5,956	1,369	25		7,350	6,373
15	295	682	977	6,254	1,369	25		7,648	6,671
16	295	682	977	6,567	1,369	25		7,961	6,983
17	295	682	977	6,895	1,369	25		8,289	7,312
18	295	682	977	7,240	1,369	25		8,634	7,656
19	295	682	977	7,602	1,369	25		8,996	8,018
20	295	682	977	7,982	1,369	25		9,376	8,398
21	295	682	977	8,381	1,369	25		9,775	8,798
22	295	682	977	8,800	1,369	25		10,194	9,217
23	295	682	977	9,240	1,369	25		10,634	9,657
24	295	682	977	9,702	1,369	25		11,096	10,119
25	295	682	977	10,187	1,369	25		11,581	10,604
26	295	682	977	10,696	1,369	25		12,090	11,113
27	295	682	977	11,231	1,369	25		12,625	11,648
28	295	682	977	11,793	1,369	25		13,187	12,209
29	295	682	977	12,382	1,369	25		13,776	12,799
30	295	682	977	13,001	1,369	25		14,395	13,418
31	295	682	977	13,652	1,369	25		15,046	14,068
32	295	682	977	14,334	1,369	25		15,728	14,751
33	295	682	977	15,051	1,369	25		16,445	15,468
34	295	682	977	15,803	1,369	25		17,197	16,220
35	295	682	977	16,594	1,369	25		17,988	17,010
36	295	682	977	17,423	1,369	25		18,817	17,840
37	295	682	977	18,294	1,369	25		19,689	18,711
38	295	682	977	19,209	1,369	25		20,603	19,626
39	295	682	977	20,170	1,369	25		21,564	20,586
40	295	682	977	21,178	1,369	25		22,572	21,595
41	295	682	977	22,237	1,369	25		23,631	22,654
42	295	682	977	23,349	1,369	25		24,743	23,766
43	295	682	977	24,516	1,369	25		25,910	24,933
44	295	682	977	25,742	1,369	25		27,136	26,159
45	295	682	977	27,029	1,369	25		28,423	27,446
46	295	682	977	28,381	1,369	25		29,775	28,797
47	295	682	977	29,800	1,369	25		31,194	30,216
48	295	682	977	31,290	1,369	25		32,684	31,706
49	295	682	977	32,854	1,369	25		34,248	33,271
50	295	682	977	52,408	1,369	25		53,802	52,825

IRR   10.5%
NPV (10%)   3,619
B/C (10%)   1.07

Option 1   Min. (River Imp.)
Growth: 1.05000
Total Eco-Cost 71,335
Benefit   18,860
Benefit from Exca   86

Year	Cost	Benefit	Benefit from Excavat	Net Value
0				0
1	1,070	0	0	(1,070)
2	1,070	0	0	(1,070)
3	1,070	0	0	(1,070)
4	6,063	0	0	(6,063)
5	20,687	0	0	(20,687)
6	14,267	0	0	(14,267)
7	14,267	0	0	(14,267)
8	6,420	0	0	(6,420)
9	6,420	0	0	(6,420)
10	357	32,257	86	31,986
11	357	33,870	86	33,599
12	357	35,563	86	35,293
13	357	37,342	86	37,071
14	357	39,209	86	38,938
15	357	41,169	86	40,898
16	357	43,227	86	42,957
17	357	45,389	86	45,118
18	357	47,658	86	47,388
19	357	50,041	86	49,771
20	357	52,543	86	52,273
21	357	55,170	86	54,900
22	357	57,929	86	57,658
23	357	60,825	86	60,555
24	357	63,867	86	63,596
25	357	67,060	86	66,789
26	357	70,413	86	70,142
27	357	73,934	86	73,663
28	357	77,630	86	77,360
29	357	81,512	86	81,241
30	357	85,587	86	85,317
31	357	89,867	86	89,596
32	357	94,360	86	94,090
33	357	99,078	86	98,808
34	357	104,032	86	103,761
35	357	109,234	86	108,963
36	357	114,695	86	114,425
37	357	120,430	86	120,160
38	357	126,452	86	126,181
39	357	132,774	86	132,504
40	357	139,413	86	139,142
41	357	146,384	86	146,113
42	357	153,703	86	153,432
43	357	161,388	86	161,117
44	357	169,457	86	169,187
45	357	177,930	86	177,660
46	357	186,827	86	186,556
47	357	196,168	86	195,897
48	357	205,976	86	205,706
49	357	216,275	86	216,005
50	357	227,089	86	226,818

IRR   25.9%
NPV (10%)   191,114

Option 2	Min+Div(Merah)
Growth:	1.05000
Total Eco-Cos	98,202
Benefit	24,930
Benefit from E	86

Year	Cost	Benefit	Benefit from Excavat.	Net Value
0				0
1	1,473	0	0	(1,473)
2	1,473	0	0	(1,473)
3	1,473	0	0	(1,473)
4	8,347	0	0	(8,347)
5	28,479	0	0	(28,479)
6	19,640	0	0	(19,640)
7	19,640	0	0	(19,640)
8	8,838	0	0	(8,838)
9	8,838	0	0	(8,838)
10	491	42,639	86	42,234
11	491	44,771	86	44,366
12	491	47,009	86	46,604
13	491	49,360	86	48,955
14	491	51,828	86	51,423
15	491	54,419	86	54,014
16	491	57,140	86	56,735
17	491	59,997	86	59,592
18	491	62,997	86	62,592
19	491	66,147	86	65,742
20	491	69,454	86	69,049
21	491	72,927	86	72,522
22	491	76,573	86	76,168
23	491	80,402	86	79,997
24	491	84,422	86	84,017
25	491	88,643	86	88,238
26	491	93,075	86	92,670
27	491	97,729	86	97,324
28	491	102,615	86	102,210
29	491	107,746	86	107,341
30	491	113,133	86	112,728
31	491	118,790	86	118,385
32	491	124,729	86	124,325
33	491	130,966	86	130,561
34	491	137,514	86	137,109
35	491	144,390	86	143,985
36	491	151,609	86	151,205
37	491	159,190	86	158,785
38	491	167,149	86	166,745
39	491	175,507	86	175,102
40	491	184,282	86	183,877
41	491	193,496	86	193,091
42	491	203,171	86	202,766
43	491	213,330	86	212,925
44	491	223,996	86	223,591
45	491	235,196	86	234,791
46	491	246,956	86	246,551
47	491	259,304	86	258,899
48	491	272,269	86	271,864
49	491	285,882	86	285,477
50	491	300,176	86	299,771

IRR	25.4%
NPV (10%)	250,195

Option 3   Min+Div(Merah)+Dam(Gajah)
Growth: 1.05000
Total Eco-Cost   175,421
Benefit   26,485
Benefit from Exci   86
Willingness to pay   0.0025
Water Supply Vol ########
Treatment Plant   7,360

Year	Cost	Cost for Water	Total Cost	Benefit	Benefit from Water Supply	Benefit from Excavat.	Benefit from Land Reclamation	Total Benefit	Net Value
0									0
1	2,631	0	2,631	0	0	0		0	(2,631)
2	2,631	0	2,631	0	0	0		0	(2,631)
3	2,631	0	2,631	0	0	0		0	(2,631)
4	14,911	0	14,911	0	0	0		0	(14,911)
5	50,872	0	50,872	0	0	0		0	(50,872)
6	35,084	0	35,084	0	0	0		0	(35,084)
7	35,084	0	35,084	0	0	0		0	(35,084)
8	15,788	0	15,788	0	0	0		0	(15,788)
9	15,788	6,256	22,044	0	0	0		0	(22,044)
10	877	1,325	2,202	45,298	4,380	86	13,120	62,884	60,682
11	877	1,325	2,202	47,563	4,380	86		52,029	49,827
12	877	1,325	2,202	49,941	4,380	86		54,408	52,205
13	877	1,325	2,202	52,438	4,380	86		56,905	54,702
14	877	1,325	2,202	55,060	4,380	86		59,527	57,324
15	877	1,325	2,202	57,813	4,380	86		65,905	60,077
16	877	1,325	2,202	60,704	4,380	86		65,170	62,968
17	877	1,325	2,202	63,739	4,380	86		68,205	66,003
18	877	1,325	2,202	66,926	4,380	86		71,392	69,190
19	877	1,325	2,202	70,273	4,380	86		74,739	72,536
20	877	1,325	2,202	73,786	4,380	86		78,252	76,050
21	877	1,325	2,202	77,476	4,380	86		81,942	79,739
22	877	1,325	2,202	81,349	4,380	86		85,815	83,613
23	877	1,325	2,202	85,417	4,380	86		89,883	87,680
24	877	1,325	2,202	89,688	4,380	86		94,154	91,951
25	877	1,325	2,202	94,172	4,380	86		98,638	96,436
26	877	1,325	2,202	98,881	4,380	86		103,347	101,144
27	877	1,325	2,202	103,825	4,380	86		108,291	106,088
28	877	1,325	2,202	109,016	4,380	86		113,482	111,279
29	877	1,325	2,202	114,467	4,380	86		118,933	116,730
30	877	1,325	2,202	120,190	4,380	86		124,656	122,454
31	877	1,325	2,202	126,199	4,380	88		130,666	128,463
32	877	1,325	2,202	132,509	4,380	86		136,976	134,773
33	877	1,325	2,202	139,135	4,380	86		143,601	141,399
34	877	1,325	2,202	146,092	4,380	86		150,558	148,355
35	877	1,325	2,202	153,396	4,380	86		157,862	155,660
36	877	1,325	2,202	161,066	4,380	86		165,532	163,330
37	877	1,325	2,202	169,119	4,380	86		173,585	171,383
38	877	1,325	2,202	177,575	4,380	86		182,041	179,839
39	877	1,325	2,202	186,454	4,380	86		190,920	188,718
40	877	1,325	2,202	195,777	4,380	86		200,243	198,040
41	877	1,325	2,202	205,566	4,380	86		210,032	207,829
42	877	1,325	2,202	215,844	4,380	86		220,310	218,108
43	877	1,325	2,202	226,636	4,380	86		231,102	228,900
44	877	1,325	2,202	237,968	4,380	86		242,434	240,232
45	877	1,325	2,202	249,866	4,380	86		254,332	252,130
46	877	1,325	2,202	262,360	4,380	86		266,826	264,623
47	877	1,325	2,202	275,478	4,380	86		279,944	277,741
48	877	1,325	2,202	289,252	4,380	86		293,718	291,515
49	877	1,325	2,202	303,714	4,380	86		308,180	305,978
50	877	1,325	2,202	346,308	4,380	86		350,774	348,572

IRR   20.0%
NPV (10%)   239,032

Option 4   Min+Div(Merah)+Dam(Gantung)
Growth: 1.05000
Total Eco-Cost 144,383
Benefit   20,889
Benefit from Exca   86
Willingness to pay 0.0025
Water Supply Vol 547,500
Treatment Plant   2,472

Year	Cost	Cost for Water	Total Cost	Benefit	Benefit from Water Supply	Benefit from Excavat.	Benefit from Land Reclamation	Total Benefit	Net Value
0									0
1	2,166	0	2,166	0	0	0		0	(2,166)
2	2,166	0	2,166	0	0	0		0	(2,166)
3	2,166	0	2,166	0	0	0		0	(2,166)
4	12,273	0	12,273	0	0	0		0	(12,273)
5	41,871	0	41,871	0	0	0		0	(41,871)
6	28,877	0	28,877	0	0	0		0	(28,877)
7	28,877	0	28,877	0	0	0		0	(28,877)
8	12,994	0	12,994	0	0	0		0	(12,994)
9	12,994	2,101	15,096	0	0	0		0	(15,096)
10	722	414	1,136	35,727	1,369	86	13,120	50,302	49,166
11	722	414	1,136	37,514	1,369	86		38,968	37,832
12	722	414	1,136	39,389	1,369	86		40,844	39,708
13	722	414	1,136	41,359	1,369	86		42,814	41,678
14	722	414	1,136	43,427	1,369	86		44,882	43,745
15	722	414	1,136	45,598	1,369	86		47,053	45,917
16	722	414	1,136	47,878	1,369	86		49,333	48,197
17	722	414	1,136	50,272	1,369	86		51,727	50,591
18	722	414	1,136	52,785	1,369	86		54,240	53,104
19	722	414	1,136	55,425	1,369	86		56,880	55,743
20	722	414	1,136	58,196	1,369	86		59,651	58,515
21	722	414	1,136	61,106	1,369	86		62,561	61,425
22	722	414	1,136	64,161	1,369	86		65,616	64,480
23	722	414	1,136	67,369	1,369	86		68,824	67,688
24	722	414	1,136	70,738	1,369	86		72,192	71,056
25	722	414	1,136	74,274	1,369	86		75,729	74,593
26	722	414	1,136	77,988	1,369	86		79,443	78,307
27	722	414	1,136	81,888	1,369	86		83,342	82,206
28	722	414	1,136	85,982	1,369	86		87,437	86,301
29	722	414	1,136	90,281	1,369	86		91,736	90,600
30	722	414	1,136	94,795	1,369	86		96,250	95,114
31	722	414	1,136	99,535	1,369	86		100,990	99,854
32	722	414	1,136	104,512	1,369	86		105,966	104,830
33	722	414	1,136	109,737	1,369	86		111,192	110,056
34	722	414	1,136	115,224	1,369	86		116,679	115,543
35	722	414	1,136	120,985	1,369	86		122,440	121,304
36	722	414	1,136	127,035	1,369	86		128,489	127,353
37	722	414	1,136	133,386	1,369	86		134,841	133,705
38	722	414	1,136	140,056	1,369	86		141,510	140,374
39	722	414	1,136	147,058	1,369	86		148,513	147,377
40	722	414	1,136	154,411	1,369	86		155,866	154,730
41	722	414	1,136	162,132	1,369	86		163,587	162,451
42	722	414	1,136	170,238	1,369	86		171,693	170,557
43	722	414	1,136	178,750	1,369	86		180,205	179,069
44	722	414	1,136	187,688	1,369	86		189,143	188,007
45	722	414	1,136	197,072	1,369	86		198,527	197,391
46	722	414	1,136	206,926	1,369	86		208,381	207,245
47	722	414	1,136	217,272	1,369	86		218,727	217,591
48	722	414	1,136	228,136	1,369	86		229,591	228,454
49	722	414	1,136	239,543	1,369	86		240,997	239,861
50	722	414	1,136	269,431	1,369	86		270,886	269,750

IRR   19.4%
NPV (10%)   181,229

Feasibility Study – Entire Project
Base Case: Property Value Growth Rate 5.0%

Base Case	Min+Div(Mcrah)+2Dams
Growth:	1.05000
Total Eco-Cost	221,602
Benefit	22,444
Benefit from Exca	86
Willingness to pay	0.0025
Water Supply Vol.	2,299,500
Treatment Plant	9,832

Year	Cost	Cost for Water	Total Cost	Benefit from Flood Control	Benefit from Excavation	Benefit from Water	Benefit from Land Reclamation	Total Benefit	Net Value
0									0
1	3,545	0	3,545	0	0	0		0	(3,545)
2	3,544	0	3,544	0	0	0		0	(3,544)
3	3,545	0	3,545	0	0	0		0	(3,545)
4	19,048	0	19,048	0	0	0		0	(19,048)
5	65,246	0	65,246	0	0	0		0	(65,246)
6	43,999	0	43,999	0	0	0		0	(43,999)
7	44,002	0	45,742	0	0	0		0	(45,742)
8	19,336	0	19,336	0	0	0		0	(19,336)
9	19,337	8,357	27,694	0	0	0		0	(27,694)
10	1,108	1,740	2,848	38,387	86	5,749	26240	70,462	67,614
11	1,108	1,740	2,848	40,306	86	5,749		46,141	43,293
12	1,108	1,740	2,848	42,322	86	5,749		48,156	45,309
13	1,108	1,740	2,848	44,438	86	5,749		50,272	47,425
14	1,108	1,740	2,848	46,659	86	5,749		52,494	49,647
15	1,108	1,740	2,848	48,992	86	5,749		54,827	51,980
16	1,108	1,740	2,848	51,442	86	5,749		57,277	54,429
17	1,108	1,740	2,848	54,014	86	5,749		59,849	57,001
18	1,108	1,740	2,848	56,715	86	5,749		62,550	59,702
19	1,108	1,740	2,848	59,551	86	5,749		65,385	62,538
20	1,108	1,740	2,848	62,528	86	5,749		68,363	65,515
21	1,108	1,740	2,848	65,655	86	5,749		71,489	68,642
22	1,108	1,740	2,848	68,937	86	5,749		74,772	71,925
23	1,108	1,740	2,848	72,384	86	5,749		78,219	75,371
24	1,108	1,740	2,848	76,003	86	5,749		81,838	78,991
25	1,108	1,740	2,848	79,804	86	5,749		85,638	82,791
26	1,108	1,740	2,848	83,794	86	5,749		89,629	86,781
27	1,108	1,740	2,848	87,983	86	5,749		93,818	90,971
28	1,108	1,740	2,848	92,383	86	5,749		98,217	95,370
29	1,108	1,740	2,848	97,002	86	5,749		102,837	99,989
30	1,108	1,740	2,848	101,852	86	5,749		107,687	104,839
31	1,108	1,740	2,848	106,944	86	5,749		112,779	109,932
32	1,108	1,740	2,848	112,292	86	5,749		118,126	115,279
33	1,108	1,740	2,848	117,906	86	5,749		123,741	120,893
34	1,108	1,740	2,848	123,801	86	5,749		129,636	126,789
35	1,108	1,740	2,848	129,992	86	5,749		135,826	132,979
36	1,108	1,740	2,848	136,491	86	5,749		142,326	139,478
37	1,108	1,740	2,848	143,316	86	5,749		149,151	146,303
38	1,108	1,740	2,848	150,481	86	5,749		156,316	153,469
39	1,108	1,740	2,848	158,006	86	5,749		163,840	160,993
40	1,108	1,740	2,848	165,906	86	5,749		171,741	168,893
41	1,108	1,740	2,848	174,201	86	5,749		180,036	177,188
42	1,108	1,740	2,848	182,911	86	5,749		188,746	185,898
43	1,108	1,740	2,848	192,057	86	5,749		197,892	195,044
44	1,108	1,740	2,848	201,660	86	5,749		207,494	204,647
45	1,108	1,740	2,848	211,742	86	5,749		217,577	214,730
46	1,108	1,740	2,848	222,330	86	5,749		228,164	225,317
47	1,108	1,740	2,848	233,446	86	5,749		239,281	236,433
48	1,108	1,740	2,848	245,118	86	5,749		250,953	248,106
49	1,108	1,740	2,848	257,374	86	5,749		263,209	260,362
50	1,108	1,740	2,848	315,563	86	5,749		321,397	318,550

IRR 16.4%
NPV (10%) 168,757
B/C (10%) 2.18

Base Case   Min+Div(Merah)+2Dams
Growth   1.02500
Total Eco-Cost 221,602
Benefit   22,444
Benefit from Exca   86
Willingness to pay   0.0025
Water Supply Vol. 2,299,500
Treatment Plant   9,832

Year	Cost	Cost for Water	Total Cost	Benefit from Flood Control	Benefit from Excavation	Benefit from Water	Benefit from Land Reclamation	Total Benefit	Net Value
0									0
1	3,545	0	3,545	0	0	0		0	(3,545)
2	3,545	0	3,545	0	0	0		0	(3,545)
3	3,545	0	3,545	0	0	0		0	(3,545)
4	19,048	0	19,048	0	0	0		0	(19,048)
5	65,246	0	65,246	0	0	0		0	(65,246)
6	43,999	0	43,999	0	0	0		0	(43,999)
7	44,002	0	45,742	0	0	0		0	(45,742)
8	19,336	0	19,336	0	0	0		0	(19,336)
9	19,337	8,357	27,694	0	0	0		0	(27,694)
10	1,108	1,740	2,848	29,448	86	5,749	26240	61,523	58,676
11	1,108	1,740	2,848	30,185	86	5,749		36,020	33,172
12	1,108	1,740	2,848	30,939	86	5,749		36,774	33,927
13	1,108	1,740	2,848	31,713	86	5,749		37,548	34,700
14	1,108	1,740	2,848	32,506	66	5,749		38,340	35,493
15	1,108	1,740	2,848	33,318	86	5,749		39,153	36,306
16	1,108	1,740	2,848	34,151	86	5,749		39,986	37,138
17	1,108	1,740	2,848	35,005	86	5,749		40,840	37,992
18	1,108	1,740	2,848	35,880	86	5,749		41,715	38,867
19	1,108	1,740	2,848	36,777	86	5,749		42,612	39,764
20	1,108	1,740	2,848	37,697	86	5,749		43,531	40,684
21	1,108	1,740	2,848	38,639	86	5,749		44,474	41,626
22	1,108	1,740	2,848	39,605	86	5,749		45,440	42,592
23	1,108	1,740	2,848	40,595	86	5,749		46,430	43,582
24	1,108	1,740	2,848	41,610	86	5,749		47,445	44,597
25	1,108	1,740	2,848	42,650	88	5,749		48,485	45,637
26	1,108	1,740	2,848	43,716	86	5,749		49,551	46,704
27	1,108	1,740	2,848	44,809	86	5,749		50,644	47,797
28	1,108	1,740	2,848	45,930	86	5,749		51,764	48,917
29	1,108	1,740	2,848	47,078	86	5,749		52,913	50,065
30	1,108	1,740	2,848	48,255	86	5,749		54,090	51,242
31	1,108	1,740	2,848	49,461	86	5,749		55,296	52,448
32	1,108	1,740	2,848	50,698	86	5,749		56,532	53,685
33	1,108	1,740	2,848	51,965	86	5,749		57,800	54,952
34	1,108	1,740	2,848	53,264	86	5,749		59,099	56,251
35	1,108	1,740	2,848	54,596	86	5,749		60,431	57,583
36	1,108	1,740	2,848	55,961	86	5,749		61,796	58,948
37	1,108	1,740	2,848	57,360	86	5,749		63,195	60,347
38	1,108	1,740	2,848	58,794	86	5,749		64,629	61,781
39	1,108	1,740	2,848	60,264	86	5,749		66,098	63,251
40	1,108	1,740	2,848	61,770	86	5,749		67,605	64,757
41	1,108	1,740	2,848	63,314	86	5,749		69,149	66,302
42	1,108	1,740	2,848	64,897	86	5,749		70,732	67,885
43	1,108	1,740	2,848	66,520	86	5,749		72,355	69,507
44	1,108	1,740	2,848	68,183	86	5,749		74,018	71,170
45	1,108	1,740	2,848	69,887	86	5,749		75,722	72,875
46	1,108	1,740	2,848	71,634	86	5,749		77,469	74,622
47	1,108	1,740	2,848	73,425	86	5,749		79,260	76,413
48	1,108	1,740	2,848	75,261	88	5,749		81,096	78,248
49	1,108	1,740	2,848	77,142	86	5,749		82,977	80,130
50	1,108	1,740	2,848	124,391	86	5,749		130,225	127,378

IRR   12.6%
NPV (10%)   48,819
B/C (10%)   1.34

H-A-35

Case 2   Min+Div(Merah)+2Dams
Growth: 1.05000
Total Eco-Cost 243,762
Benefit 22,444
Benefit from Exca 86
Willingness to pay 0.0025
Water Supply Vol 2,299,500
Treatment Plant 9,832

Year	Cost	Cost for Water	Total Cost	Benefit from Flood Control	Benefit from Excavation	Benefit from Water	Benefit from Land Reclamation	Total Benefit	Net Value
0									0
1	3,900	0	3,900	0	0	0		0	(3,900)
2	3,898	0	3,898	0	0	0		0	(3,898)
3	3,900	0	3,900	0	0	0		0	(3,900)
4	20,953	0	20,953	0	0	0		0	(20,953)
5	71,771	0	71,771	0	0	0		0	(71,771)
6	48,399	0	48,399	0	0	0		0	(48,399)
7	48,402	0	48,402	0	0	0		0	(48,402)
8	21,270	0	21,270	0	0	0		0	(21,270)
9	21,271	8,357	29,628	0	0	0		0	(29,628)
10	1,219	1,740	2,958	38,387	86	5,749	26,240	70,462	67,503
11	1,219	1,740	2,958	40,306	86	5,749		46,141	43,183
12	1,219	1,740	2,958	42,322	86	5,749		48,156	45,198
13	1,219	1,740	2,958	44,438	86	5,749		50,272	47,314
14	1,219	1,740	2,958	46,659	86	5,749		52,494	49,536
15	1,219	1,740	2,958	48,992	86	5,749		54,827	51,869
16	1,219	1,740	2,958	51,442	86	5,749		57,277	54,319
17	1,219	1,740	2,958	54,014	86	5,749		59,849	56,891
18	1,219	1,740	2,958	56,715	86	5,749		62,550	59,591
19	1,219	1,740	2,958	59,551	86	5,749		65,385	62,427
20	1,219	1,740	2,958	62,528	86	5,749		68,363	65,405
21	1,219	1,740	2,958	65,655	86	5,749		71,489	68,531
22	1,219	1,740	2,958	68,937	86	5,749		74,772	71,814
23	1,219	1,740	2,958	72,384	86	5,749		78,219	75,261
24	1,219	1,740	2,958	76,003	86	5,749		81,838	78,880
25	1,219	1,740	2,958	79,804	86	5,749		85,638	82,680
26	1,219	1,740	2,958	83,794	86	5,749		89,629	86,670
27	1,219	1,740	2,958	87,983	86	5,749		93,818	90,860
28	1,219	1,740	2,958	92,383	86	5,749		98,217	95,259
29	1,219	1,740	2,958	97,002	86	5,749		102,837	99,878
30	1,219	1,740	2,958	101,852	86	5,749		107,687	104,728
31	1,219	1,740	2,958	106,944	86	5,749		112,779	109,821
32	1,219	1,740	2,958	112,292	86	5,749		118,126	115,168
33	1,219	1,740	2,958	117,906	86	5,749		123,741	120,783
34	1,219	1,740	2,958	123,801	86	5,749		129,636	126,678
35	1,219	1,740	2,958	129,992	86	5,749		135,826	132,868
36	1,219	1,740	2,958	136,491	86	5,749		142,326	139,368
37	1,219	1,740	2,958	143,316	86	5,749		149,151	146,192
38	1,219	1,740	2,958	150,481	86	5,749		156,316	153,358
39	1,219	1,740	2,958	158,006	86	5,749		163,840	160,882
40	1,219	1,740	2,958	165,906	86	5,749		171,741	168,782
41	1,219	1,740	2,958	174,201	86	5,749		180,036	177,078
42	1,219	1,740	2,958	182,911	86	5,749		188,746	185,788
43	1,219	1,740	2,958	192,057	86	5,749		197,892	194,933
44	1,219	1,740	2,958	201,660	86	5,749		207,494	204,536
45	1,219	1,740	2,958	211,742	86	5,749		217,577	214,619
46	1,219	1,740	2,958	222,330	86	5,749		228,164	225,206
47	1,219	1,740	2,958	233,446	86	5,749		239,281	236,323
48	1,219	1,740	2,958	245,118	86	5,749		250,953	247,995
49	1,219	1,740	2,958	257,374	86	5,749		263,209	260,251
50	1,219	1,740	2,958	315,563	86	5,749		321,397	318,439

IRR   15.6%
NPV (10%)   156,492