

*The Feasibility Study of the Flood Control Project for
the Lower Cagayan River in the Republic of the Philippines
Final Report
Supporting Report*

ANNEX IX : COST ESTIMATE

THE FEASIBILITY STUDY OF
THE FLOOD CONTROL PROJECT FOR THE LOWER CAGAYAN RIVER IN
THE REPUBLIC OF THE PHILIPPINES

FINAL REPORT

Volume III-2 SUPPORTING REPORT

ANNEX IX COST ESTIMATE

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CHAPTER 1 GENERAL

ANNEX IX deals with the proposed construction plan and cost estimate for the priority projects. Objective projects for construction plan and cost estimate are the Lower Cagayan River Flood Control Project and Alcala-Amulung West Pump Irrigation Project.

1.1 Flood Control Projects

(1) Structural Measures

The Lower Cagayan River from the river mouth to Cabagan for about 170 km length is subject to the Feasibility Study of the flood control project. The measures taken are 1) urgent bank protection works, 2) river bank tree zones, 3) dike system with maintenance road, 4) cut-off channels, and 5) bank protection under the design flood of 25 years.

(2) Non-structural Measures

Evacuation system among the 1) flood forecasting and warning system (FFWS), 2) evacuation center, and 3) resettlement area development are the proposed non-structural measures subject to the feasibility study on the flood control project.

(3) Supporting Measures

Institutional establishment among the water code for the rules and regulations, operation and maintenance system, and implementation structure will have to be conducted.

1.2 Irrigation Project

Alcala Amulung West Pump Irrigation Project (AAWPIP) was selected as the priority irrigation project subject to the pre-feasibility study.

Rice mill plant system and drying yard will have to be introduced as supporting measures for the irrigation project.

CHAPTER 2 CONSTRUCTION PLAN AND SCHEDULE

2.1 Basic Conditions for Construction Execution

There are various factors and conditions for establishing the construction planning of the project works which will be carried out in the existing river channel and be much affected by the natural factors in particular the climate at the work site and availability of construction resources in and around the project area. The following are basic conditions to formulate a construction plan and schedule.

- (1) Construction of river improvement works will not be executed under rainy weather because the work will include earthworks having huge amount of excavation and embankment, which are much affected by rain fall as well as flood. Annual workable days were assumed at 210 days for earthworks and 260 days for concrete and other works based on past rainfall records and official holidays.

	Earthworks	Concrete & other works
Holidays	68 days	68 days
Suspended days due to rainfall	87 days	37 days

- (2) Standard working days and working hours are set at 25 days per month and 8 hours per day in this study. A two-shift operation system will be studied in the tender design stage.
- (3) Locally available construction resources should to be used as practicable as possible. The site survey in June 2001 provided the following information.
 - Skilled and unskilled labors are available in Philippines and in region 2.
 - Excavated soil from the cut-off channels and borrow pits in the surrounding area of the construction site will have to be used for embankment materials.
 - There are big boulders which will be able to be used for masonry and other works along Sanbavro, Isabela and Tuguegarao rivers and other areas as shown in Figure 3.12 of ANNEX III in the supporting report.
 - Ready mixed concrete factories with a 40 m³/hr production capacity are available at Gataran and Tuguegarao. Reliability of these plants will be re-checked in the tender design stage.
 - Construction equipment is available in Philippines on rental basis or by outright purchasing. However, reliability of rental basis equipment should be checked carefully.

- Other construction materials, such as cement, reinforcement steel bar, concrete aggregates, are available at Tuguegarao and other major cities in the Cagayan river basin.
- (4) Existing transportation conditions are as follows in the Lower Cagayan River area:
- The Irene seaport (Batulinao port) will be used for loading and unloading of project cargoes in sea transportation.
 - Existing paved or non-paved roads are available at left and right bank side as access and construction roads for the project.
- (5) Public electrical power is available at the almost all construction sites. Extension of power lines will be required in the left bank of lowermost the Cagayan River.
- (6) Water for construction use will be pumped-up from surrounding rivers.
- (7) It is assumed that the construction works will to be implemented by a contract system.
- (8) Preparatory works such as site camp, temporary access roads, etc. also will be included into the contract system.

2.2 Flood Control Projects

2.2.1 Priority Projects

The following 17 candidate sub-projects are identified as the priority within the projects in the Lower Cagayan River Flood Control Project reaches of 150 km with in the total length from the rivermouth to Cabagan.

No	Candidate sub-projects	Scope
1	Urgent bank protection works	21 sites
2	River bank tree zones	70 km
	Left dike systems in the lowermost from river mouth to Nassiping	25.3 km
3	(1) Mabanguc dike, length 11.3 km	
4	(2) Catugan dike, length 6.0 km	
5	(3) Lasam dike, length 8.0 km	
	Right dike systems in the lowermost from river mouth to Nassiping	42.0 km
6	(1) Camalaniugan dike, length 13.1 km	
7	(2) Lal-lo dike, length 12.9 km	
8	(3) Gattaran dike, length 6.1 km	
9	(4) Nassiping dike, length 9.7 km	
	Left dike systems in the reach from Alcala to Tuguegarao	46.2 km
10	(1) Alcala – Buntun dike, length 34.0 km	
11	(2) Enrile dike, length 12.2 km	
	Right dike systems in the reach from Alcala to Tuguegarao	37.0 km
12	(1) Tuguegarao dike, length 21.3 km	
13	(2) Amulung dike, length 11.6 km	
14	(3) Iguig dike along national highway, length 4.1 km	
	Cut-off channels in the reach from Alcala to Tuguegarao	8.1 km
15	(1) Gabut Cut-Off Channel (COC), length 0.7 km	
16	(2) San Isidoro COC, length 1.6 km	
17	(3) Tuguegarao COC, length 5.8 km	

An alternative study of a different phased implementation, 3 phases and 4 phases, was made. The 4 phased implementation is proposed, which will proceed construction from the river mouth towards upstream as presented in Figure 2.2.1 with a target completion year of 2020 allowing 6 to 10 year implementation period per phase. The following table shows sub-projects to be implemented under each phase.

Phase	Sub-project to be implemented
1 st (2002-2007)	1) Urgent bank protection works, 21 sites
	2) River bank tree zones
	3) Left and Right dike systems reaches from Rivermouth to Magapit
2 nd (2004-2011)	1) Left and Right dike systems reaches from Magapit to Nassiping
	2) Amulung dike system reaches from Alcala to Amulung
	3) Gabut cut-off channel
3 rd (2007-2015)	1) Alcala-Buntun dike system reaches from Alcala to Solana
	2) Iguig dike system reaches in Iguig
	3) San Isidoro cut-off channel
4 th (2011-2020)	1) Tuguegarao dike system reaches from Tuguegarao to Cabagan
	2) Enrile dike system reaches from Tuguegarao to Cabagan
	3) Tuguegarao cut-off channel

The basic design of the river cross section consists of low water channel and high water channel newly confined by dikes. The width of the cut-off channel is designed at 500 m which is an estimated average width of the existing low water channel. Earth dike system was designed to confine flood flow. Maintenance road is provided in landside along the dike in case there is no available road nearby. The dike section is designed as a trapezoidal one as follows:

- Dike crown elevation: 2 m free board plus design high water level.
- Dike crown width (inspection road): 7 m
- Embankment slope: 1 to 3
- Maintenance road width: 7 m with 4 m wide carriage way

The tree zone of 70 km long is constructed on the riverside along the proposed dike out of the total dike length of 150 km in the Lower Cagayan River Flood Control Project.

Main construction works required in the Lower Cagayan River Flood Control Project are summarized as follows:

- 1) Urgent bank protection works,
- 2) Construction and planting for riverbank tree zones
- 3) Dikes construction in terms of earth embankment works including maintenance and inspection roads
- 4) Cut-off channels construction in terms of excavation works
- 5) Construction of spur dikes
- 6) River bank protection
- 7) Construction of culverts and sluices
- 8) Construction of overflow type bridges

Major works in the 1st phase are urgent bank protection works, riverbank tree zones, dike embankment, and excavation of cut-off channels. A proposed implementation schedule of the flood control projects in the 1st phase is given in Figure 2.2.3. A proposed construction time schedule is shown in Figure 2.2.4.

2.2.2 Urgent Bank Protection Works

Accelerated implementation in order of priority will have to be taken for the proposed urgent bank protection works in the Flood Control Project upon early completion of detailed design in the year 2002. The proposed construction period is 2 years which will start in the year 2003.

The protection length is approximately 19.1 km at 21 construction sites at the lower Cagayan (16 sites and 18,050 m) and the Tuguegarao (5 sites and 1,050 m) rivers as shown in Table 4.2.11. The construction priority will be given to in order of 1) urbanized and densely populated area, 2) sparsely populated area, and 3) agriculture land.

The following 8 types of protection methods which can be construct with locally available materials are designed to protect important places against erosion:

Type	Method
A	Step by gabion (t=10 cm) with riprap as foot protection
B	Dry masonry (cobble stone pavement) with riprap as foot protection
C	Gabion (t=0.5-0.3 m) with riprap as foot protection
D	Spur dike by gabion
E	Gabion mattress on loose foundation
F	Gabion cages with gabion mattress foundation
G	Combination of gabion mattress and dry boulder revetment on loose boulder foundation
H	Combination of type F and gabion mattress revetment

The construction works will be carried out by manpower and mechanical power with bulldozers, backhoes, truck cranes, portable concrete mixers and other light type of equipment.

2.2.3 River Bank Tree Zones

It is assumed that construction and planting of the river tree zones about 70 km long in the lower most from river mouth to Nassiping will be implemented by LGUs. The implementation will have to be commenced from the beginning of 2003 after the establishment of the execution crews in 2002 in due consideration of growing speed of planted trees.

The planting period of 70 km long river bank trees is scheduled for 5 years from the year 2003 until the year 2007 at the end of implementation period of 1st phase for the Lower Cagayan River Flood Control Project.

A tree planting will be carried out by manpower mainly supported with hauling vehicles of trees and small type pumps for sprinkling water to planted trees.

2.2.4 Construction of Dike Systems

(Phase 1)

The proposed dike systems in the 1st phase implementation are 43.3 km long in total and locates at 4 sites in the lowermost from river mouth to Magapit. Major construction works are 1) dike embankment, 2) maintenance road, 3) bank protection and 4) culvert and spur dike.

The construction period for the left and right dike systems is scheduled for 4 years started in the year 2004. The dike length and its estimated embankment volume of each dike are summarized below.

System	Dike name	Length (km)	Embank. Volume (m ³)
Left dike systems	Mabanguc dike	11.3	1,196,000
	Catugan Sur dike	6.0	812,000
	Sub total	25.3	2,008,000
Right dike systems	Camalaniugan dike	13.1	1,150,000
	Lal-lo dike	12.9	1,039,000
	Sub total	41.8	2,189,000
	Total, left and right	67.1	4,197,000

The dike embankment is major construction work with its total volume of 4.2 million m³. No plan will be made to bring the embankment material from the proposed cut-off channels at 3 sites due to long hauling distance and saving the cost.

Material source is conceived at borrow pits nearby the construction site and abundant fine sand distributed along the river. It is advised in geo-technical and material investigation report that river fine sand is recommended to be used inside of the dike embankment to save the amount of the expensive clay material due to long transportation distance. Thus, the embankment material will be taken from soil borrows in surrounding area and river fine sand along the lowermost of Cagayan river as planned in table below.

Dike	Volume (m ³ mil.)	Material Resource
Mabanguc & Catugan	2.0	Borrows in left bank and river fine sand
Camalaniugan & Lal-lo	2.2	Borrows in right bank and river fine sand

Borrow area on each phase should be identified in the tender design stage.

It is planned that the embankment work be conducted in 4 years work period started in the year 2004 assuming approximately 1.1 million m³ of (4,200,000 m³/4 years) embankment speed per year. An hourly standard progress assumed at 650 m³/hr (1,100,000 m³/210 days / 8 hours/day). For the embankment operation, it will be required to haul the material a long distance.

Thus, the required major fleet is assumed as follows to assure the proposed standard progress of the embankment operation. However, it should be reviewed in the tender design stage upon identification of borrow areas with its respective transportation distance.

No	Equipment	Capacity (class)	No. of unit, required
1	Motor scraper	16m ³	4
2	Bulldozer	21 t	2
3	Swamp bulldozer	21 t	2
4	Tractor shovel	2 m ³	2
5	Dump truck	12 – 20 t	10
6	Vibration roller	10 t	2
7	Tamping roller, self propelled	20 – 30 t	2
8	Tamping roller, towed w/ballast	12 – 17 t	2
9	Backhoe	0.6 – 1.2 m ³	2

The other works such as construction of maintenance roads, culverts, and spur dike will be carried out concurrently or in parallel with the dike embankment operation.

(Phase 2)

The proposed dike systems in 2nd phase implementation are 35.4 km in total length at 3 sites in the lowermost from Magapit to Amulung. Major construction works are same as to the phase 1 works. The dike length and its estimated embankment volume are summarized below.

System	Dike name	Length (km)	Embank. Volume (m ³)
Left dike systems	Lasam dike	8.0	909,000
Right dike systems	Gattaran dike	6.1	560,000
	Nassiping dike	9.7	467,000
	Amulung dike	11.6	1,257,000
	Sub total, right	27.4	2,284,000
	Total, left and right	35.4	3,193,000

Major construction work is dike embankment. The embankment volume is 3.2 million m³ in total. Material source is conceived from borrow pits nearby the construction site, abundant fine sand distributed along the river. To save the construction cost, a part of excavated soil at the Gabut cut-off channel, which is planned to conduct in the 2nd phase works, will be used as for the embankment materials for the Amulung dike with approximately 5 to 6 km of hauling distance. Excavation volume at Gabut cut-off channel is estimated at approximately 4.6 million m³.

Thus, the embankment material will be taken from soil borrows in surrounding area and river fine sand along Cagayan river and the Gabut cut-off channel as planned in table below.

Dike	Volume (m ³ mil.)	Material Resource
Lasam	0.9	Borrows in left bank and river fine sand
Gattaran & Nassiping	1.0	Borrows in right bank and river fine sand
Amulung	1.3	Gabut cut-of channel

The embankment work is planned for a 4 years work period started in the year 2008 assuming approx. 0.8 million m³ of embankment speed per year. An hourly standard progress is estimated at 480 m³/hr. For the embankment operation, it will be required to haul long distance the embankment materials. The same type of earthmoving equipment will be used for the embankment operation.

(Phase 3)

The proposed dike systems in 3rd phase implementation are 38.1 km in total length at 2 sites in the reach from Amulung to Tuguegarao. The dike length and its estimated embankment volume are summarized below.

System	Dike name	Length (km)	Embank. Volume (m ³)
Left dike systems	Alcala-Buntun dike	34.0	6,574,000
Right dike systems	Iguig dike	4.1	196,000
	Total, left and right	35.4	6,770,000

The embankment volume is estimated at 6.8 million m³ in total. Material source is conceived from borrow pits nearby the construction site, abundant fine sand distributing along the river. To save the construction cost, a part of excavated soil at the San Isidoro cut-off channel, which is planned to conduct in the 3rd phase works, will be used as for the embankment materials for the Iguig dike with assumed hauling distance of 2 to 3 km and Alcala-Buntun dike with hauling distance of 20 to 30 km through the Buntun bridge. Excavation volume of San Isidoro cut-off channel is approx. 9.5 million m³. Thus, the embankment material will be taken from soil borrows in surrounding areas and river fine sand along Cagayan river and the San Isidoro cut-off channel as planned in table below.

Dike	Volume (m ³ mil.)	Material Resource
Alcala-Buntun	6.6	Borrows in left bank and river fine sand and San Isidoro cut-off channel
Iguig	0.2	San Isidoro cut off channel

The embankment work is planned for a 5 year work period starting in the year 2011 assuming approximately 1.4 million m³ of embankment speed per year. An hourly standard progress will be 830 m³/hour. Motor scraper will be used for the excavation of San Isidoro cut-off channel and embankment operation of Iguig dike. The embankment operation for the Alcala-Buntun dike will be planned by applying dump trucks, assuming for long distance hauling of embankment material from borrows pits or riverbeds.

(Phase 4)

The proposed dike systems in 4th phase implementation are 33.5 km in total length at 2 sites in the reach from Tuguegarao to Cabagan. The dike length and its estimated embankment volume are summarized below.

System	Dike name	Length (km)	Embank. Volume (m ³)
Left dike systems	Enrile dike	12.2	927,000
Right dike systems	Tuguegarao dike	21.3	3,134,000
	Total, left and right	35.4	4,061,000

The embankment volume is estimated at 4.1 million m³ in total. Material source is conceived from excavated soil at the Tuguegarao cut-off channel, which is planned to be done in the 4th phase works, with an excavation volume of approx. 19.1 million m³. Thus, whole of the embankment material will be taken from Tuguegarao cut-off channel as planned in table below.

Dike	Volume (m ³ mil.)	Material Resource
Enrile	1.0	Tuguegarao cut-off channel
Tuguegarao	3.2	Tuguegarao cut off channel

The embankment work is planned for 6 years work period started in the year 2015 assuming approximately 0.7 million m³ of embankment speed per year or 420 m³/hr. From economical point of view, the embankment operation will be planned for motor scrapers to haul from the Tuguegarao cut-off channel where situates in short distance from the Enrile and Tuguegarao dikes.

2.2.5 Construction of Cut-off Channels

(Phase 1)

No cut-off channel is planned in the 1st phase.

(Phase 2)

Gabut cut-off channel is planned to be constructed in the 2nd phase implementation of the Lower Cagayan Flood Control Project. The channel length is 700 m with its excavated material of approximately 4.6 million m³ that is planned to be used as follows.

Purpose to use	Volume (m ³ million)
Amulung dike embankment	1.3
Fill up of old Cagayan river	3.3

The channel is scheduled to be constructed in 4 years construction period in parallel with the left and right dike systems started in the year 2008. A construction sequence is planned as follows.

Step	Works
1	Excavation of center area of channel under dry condition and temporary stock of excavated material nearby existing Cagayan river
2	Excavation of end point of channel
3	Excavation of beginning point of channel
4	River diversion
5	Reclamation of old Cagayan river

The major work is huge amount of common soil excavation. No rock excavation will be required in the channel route. The excavated soil should be effectively used. It is proposed firstly that the excavated soil will be utilized for the

reclamation material for the existing Cagayan river which becomes an old river channel after the completion of the new cut-off channel. Secondly, the excavated soil will be utilized as the embankment material for the dike and reclamation of low land of the proposed resettlement area.

The channel excavation is scheduled to be conducted in a 4 year work period. A standard progress for the excavation requires 1.2 million m³ per year and or 800 m³ per hour. For the excavation operation, hauling distance is relatively short. Thus, the required major fleet will be as follows to assure the proposed standard progress of the excavation operation for the Gabut cut-off channel.

No	Equipment	Capacity (class)	No. of unit, required
1	Motor scraper	16m ³	5
2	Bulldozer	28 –32 t	2
3	Swamp bulldozer	21 t	2
4	Tractor shovel	2 m ³	2
5	Dump truck	12 – 20 t	10
6	Backhoe	0.6 – 1.2 m ³	2

(Phase 3)

San Isidoro cut-off channel is planned to be constructed in the 3rd phase implementation. The channel length is 1,600 m with its excavation volume of approximately 9.6 million m³. The channel is scheduled to be constructed in 5 years construction period in parallel with Alcala-Buntun and Iguig dikes embankment operation started in the year 2011. The same construction sequence applied in 2nd phase will be applied.

No rock excavation will be required in the channel route. The excavated soil should also be effectively used. It is proposed firstly that the excavated soil will be utilized as the reclamation material for the existing Cagayan river which becomes an old river channel after the completion of the new cut-off channel. Secondly, the excavated soil will be utilized as the embankment material for the Alcala-Buntun and Iguig dikes, and reclamation of low land of the proposed resettlement area.

The excavated material of approximately 9.6 million m³ is planned to be utilized as follows.

Purpose to use	Volume (m ³ million)
Alcala-Buntun dike embankment	3.3
Iguig dike embankment	0.2
Fill up of old Cagayan river	6.1

The channel excavation is scheduled to be conducted in 5 years work period. A standard progress for the excavation requires 1.9 million m³ per year. For the excavation operation, hauling distance is relatively short. Thus, same type of

earthmoving equipment as for the 2nd phase implementation will be applied to assure the proposed standard progress of the excavation operation for the San Isidoro cut-off channel.

(Phase 4)

Tuguegarao cut-off channel is planned to be constructed in the 4th phase implementation. The channel length is 5,800 m with its excavation volume of approx. 19.1 million m³. The channel is scheduled to be constructed in 6 years construction period in parallel with Tuguegarao and Enrile dikes embankment operation which starts in the year 2015. The same construction sequence applied in 2nd and 3rd phases will be applied from the downstream toward upstream.

The excavated soil should also be effectively used. It is proposed firstly that the excavated soil will be utilized as reclamation material for the existing Cagayan river of which becomes an old river channel after the completion of the new cut-off channel. Secondly, the excavated soil will be utilized as the embankment material for the Enrile and Tuguegarao dikes and reclamation of low land of the proposed resettlement area or such other purposes. Excess soil will be 10 million m³ after using on the dike embankment and reclamation of old Cagayan river.

The excavated material of approx. 19.1 million m³ is planned to be utilized as follows.

Purpose to use	Volume (m ³ million)
Enrile dike embankment	1.0
Tuguegarao dike embankment	3.2
Fill up of old Cagayan river	5.0
Low land reclamation material	9.9

The channel excavation is scheduled to be conducted in 6 years work period. A standard progress for the excavation requires 3.2 million m³ per year. For the excavation operation, hauling distance is relatively short. Thus, same type of earthmoving equipment as the 3rd phase implementation will be applied to assure the proposed standard progress of the excavation operation for the Tuguegarao cut-off channel.

2.2.6 Non-structural Measures

Evacuation system and resettlement area developments are proposed as the non-structural measures in the Lower Cagayan River Flood Control Project. The evacuation system comprises 1) Flood Forecasting and Warning System (FFWS)

and 2) construction of evacuation centers. The FFWS comprises the following works which is to conduct by PAGASA:

- Improvement of the existing local FFWS facilities in the Cagayan river basin, but excluding a communication system between local and central system.
- Introduction of Tuguegarao River water level station and local communication network among sub-center, disaster coordinating councils and evacuation centers.
- Strengthening of Tuguegarao sub-center and community disaster management capacity building in Tuguegarao.

The construction of evacuation center comprises the following work items which will be conducted by LGUs:

- Procurement and construction of tents, deep wells, evacuation centers, cooking tools and other requirements related to the evacuation system.
- Improvement for the evacuation centers and strengthening of disaster coordinating councils and peoples` capability in the evacuation-related activities such as preparation of disaster preparedness plan.

The FFWS and construction of evacuation center are scheduled implementation incorporated into the 1st phase.

The following works are required on the proposed resettlement area development:

- Land acquisition and compensation, which will be conducted by LGUs.
- Development of resettlement area, which will conducted by the National Government.
- Construction of public facilities, such as schools, barangay halls, which will be conducted by the National Government.
- Construction of infrastructures such as roads, electric power lines, water supply, which will be conducted by the National Government.

The resettlement area development is scheduled to be implemented to meet the phased implementation of the Lower Cagayan River Flood Control Project.

2.2.7 Supporting Measures

As the supporting measures of the flood control projects, institutional establishment among the water code for the rules and regulations, operation and maintenance system, and implementation structure will have to be conducted to meet the phased implementation of the Lower Cagayan River Flood Control Project.

2.3 Irrigation Projects

2.3.1 Priority Project

For irrigation projects, phased implementation is also applied to meet to the implementation schedule of the flood control projects. The proposed irrigation project is Alcala Amulung West Pump Irrigation Project (AAWPIP) and arranged as follows in terms of phasing.

Phase	Project	Development area (ha)
1 st (2002-2007)	Alcala Amulung West PIP, stage 1	4,090
3 rd (2007-2015)	Alcala Amulung West PIP, stage 2	2,970

The priority project, AAWPIP, is planned to develop in 1st and 2nd phases for 7,060 ha in total area. Stage wise development is proposed divided into stage 1 of 4,090 ha of which is located in higher plain and stage 2 of 2,970 ha located in lower plain based on the existing topographic conditions. Namely, the objective area for stage 1 is possible to develop at an early stage even without implementation of the flood control project. On the other hand, stage 2 area is to be developed after the implementation of the flood control project to prevent possible inundation. So, it is scheduled to be implement in stage 1 of 1st phase and the stage 2 of 3rd phase.

Figure 2.2.3 shows a proposed implementation schedule of AAWPIP. The project site is located in the left bank of Lower Cagayan River and opposite site of Amulung town. The project is pump irrigation system by using surface water of Cagayan River. Drainage system is required to drain excess rainfall, runoff and other reasons. The proposed pump capacity is 7.2 m³/s for stage 1, and 6.7 m³/s for stage 2 in total. A booster pump station is provided due to topographic conditions. The construction period of the AAWPIP in stage 1 is scheduled at 4 years started in 2004 as shown in Figure 2.3.1. The construction plan of the AAWPIP is presented briefly as follows.

2.3.2 Construction of Intake and Booster Pump Stations

The intake and pump station site is selected on stable bank on the opposite site of Alcala town. The foundation will be the rock with N value more than 30 at 2 to 7 m below ground surface according to the investigation by NIA. Thickness of overburden materials is assumed at 3 to 16 m.

An intake will be constructed by open canal system equipped with mechanical screens. The pump head is 20.0 m. The pump type is vertical mixed flow with volute casing of 900 mm diameter. The number of pump unit and electric motor is

planned at 8 sets each in total for stage 1 and 2, 4 sets each for stage 1 and stage 2 respectively. The capacity of electric motor is planned at 500 kW for each unit. A pump house constructs having 500 m² of floor space in total as for stage 1 and 2.

Major construction items and its work quantities for the intake and booster pump stations are tabulated as follows for stages 1 and 2 works.

No	Major construction items	Unit	Q`ty, stage 1	Q`ty, stage 2
1	Intake pump station			
	Transmission line expansion	km	5	0
	2) Pump and motor	set	4	4
	3) Excavation	m ³	20,000	20,000
	4) Building	m ²	500	0
2	Booster pump station			
	1) Pump and motor	set	4	4
	2) Excavation	m ³	500	0
	3) Building	m ²	200	0

The construction works of the intake and booster pump stations categorizes 1) civil works, 2) Electro-mechanical works, and 3) building works. The intake civil works will be carried out by partial coffer damming of the Cagayan river and applying earthmoving equipment.

To procure pump, motor and other electro-mechanical equipment from abroad, 1 year will be necessary including the design, manufacturing and transportation. For installation, an other 1-year will be required. Required power for the pump operation will be supplied from the existing national grid of 69 kV passing through the right bank the Cagayan river by extension. Accordingly, transmission facilities crossing the Cagayan river are required to construct. Pump house building will have to be completed before arrival the electro-mechanical equipment to the site.

The following equipment will be introduced for construction of intake and booster pump stations in stage 1.

No.	Equipment	Capacity (class)	Number of unit, required
1	Bulldozer	21 t	2
2	Backhoe	0.6 m ³	2
3	Dump truck	12 t	5
4	Concrete mixer	0.3 –0.5 m ³	3
5	Truck crane	20 t	2

2.3.3 Construction of Main Irrigation and Drainage Canal Systems

Concrete lined main and lateral irrigation canals are constructed. Farm ditches are constructed by earth. Total canal length to be constructed is approx. 140 km. Basically, existing natural drains are planned to be used for the drainage system. However, about 20 km long new drainage canals have to be constructed.

Major construction items and its work quantities for the irrigation and drainage canal system with related structures are tabulated as follows.

No	Major construction items	Unit	Q`ty, stage 1	Q`ty, stage 2
1	Main canal	km	27.5	0
2	Related structures to main canal	nos.	90	70
3	Lateral canal	km	29.5	32.3
4	Related structures to lateral canal	nos.	74	70
5	On-farm system	ha	0	150
6	Main drainage system	km	28	10
7	Related structure, main drainage system	nos.	30	25
8	Pangul river training	LS	1	0

Excavation and embankment volume is estimated approx. 1.1 million m³ and 1.0 million m³ respectively in stage 1. Excavated soil will be used as the embankment material in principle. A lot of earthmoving equipment to secure the construction time schedule will carry out on the construction works. Related structures will be constructed in parallel with the canal construction. The following equipment will be introduced for construction of irrigation and drainage canals with the related structures in stage 1.

No.	Equipment	Capacity (class)	Number of unit, required
1	Bulldozer	21 t	2
2	Backhoe	0.6 m ³	3
3	Dump truck	12 t	6
4	Vibration roller	5 t – 10 t	3
5	Concrete mixer	0.3 – 0.5 m ³	3
6	Track crane	20 t	2

2.3.4 Supporting Measures

The following supporting measures are planned in stage 1 of phase 1 to meet the development scale of paddy field of 4,090 ha.

- Rice mill plant: 4 sets x 5 t/hr capacity
- Drying yard by lean concrete: 97,000 m²

CHAPTER 3 MODE OF CONSTRUCTION EXECUTION

3.1 Implementation Mode

The proposed structure measures both for the flood control and irrigation projects in 1st phase will be implemented under the following formation.

- Urgent bank protection works by selected contractor under the international competitive bid.
- River tree zones: by LGUs
- Flood control works and irrigation development: by selected contractor under the international competitive bid.

3.2 Implementation Schedule

3.2.1 Overall Implementation Schedule

Flood control projects

Overall implementation schedule is shown in Figure 2.2.1 for the Lower Cagayan River Flood Control Project. Phased implementation for the priority sub-projects was proposed aiming at the target year of 2020. The proposed implementation schedule on flood control is presented to be implemented in order from the river mouth to upstream so as not to cause negative impacts against upstream and downstream reaches.

Irrigation projects

The proposed irrigation sub-projects are also implemented by phasing following the implementation schedule of the flood control projects.

3.2.2 Implementation Schedule, 1st Phase

(1) Flood control projects

The followings are the basic concepts to implement the proposed flood control projects.

- To implement from the river mouth toward upstream for main construction works
- To conduct divided into several construction packages for main construction works
- To commence the proposed bank protection works in an early stage
- To commence the construction of river tree zones at an early stage

The following 4 priority sub projects are planned to be implement in the 1st phase of the Lower Cagayan River Flood Control Project.

- 1) Urgent bank protection works at 21 sites
- 2) River tree zones
- 3) Left dike system reaches from Rivermouth to Magapit, Mabanguc and Catugan dikes
- 4) Right dike system reaches from Rivermouth to Magapit, Camalaniugan and Lal-lo dikes.

Total implementation period for the 1st phase is scheduled at 6 years among the lead time and the construction execution. Figure 2.2.3 and 2.2.4 show a proposed implementation schedule and construction time schedule in the 1st phase. The lead time for the main works in the 1st phase is assumed under the following activities and its duration requirements.

Activities	Duration (month)
Financial arrangement	6
Selection of consultant	6
Tender design	12
Tendering and contract	12

Urgent bank protection works should be arranged in the initial stage of its tender design and tendering. Land acquisition and compensation on the right of way for dikes and tree zones start first ahead of the above respective construction works. Similarly, resettlements except the right of way in the river area, which is defined as an open space confined by both the left and right dikes, are carried out concurrently with the above respective works.

(2) Irrigation project

The followings are the basic concepts to implement the proposed irrigation project.

- To implement following the flood control projects
- To conduct by contract basis
- To commence from the higher plain to protect probable inundation

The priority project, Alcala Amulung West Pump Irrigation Project (AAWPIP) of 4,000 ha out of 7,700 ha, is planned to be implement in the 1st phase as the stage 1. Total implementation period also scheduled at 6 years for 1st phase with lead time and the construction execution. Activities required in the lead time for irrigation project are same as for the flood control project. Land acquisition and compensation, development of resettlement and evacuation are carried out prior to

or in initial stage of construction execution. A proposed construction time schedule for the irrigation project in the 1st phase is shown in Figure 2.3.1.

3.3 Funding / Finance

- National Government and LGUs should share project cost.
- The following cost sharing is assumed in principle according to the practice in the Philippines for flood control projects:
 - Main construction works will be undertaken by the National Government with its finance.
 - LGUs will undertake resettlement, and tree zone construction.

The cost required for the structural measures will be funded by both Philippines Government for local currency portion and from possible foreign funding sources for foreign currency portion.

3.4 Contract Package and Bidding Mode

The contract package and bidding mode are proposed as shown in Table below for the main construction works in the 1st phase taking into consideration the type and scale of construction works required and expected finance source.

Package Number	Scope of construction works	Mode of bid*
Flood control		
Package A	Urgent bank protection works, 21 sites	ICB
Package B	Left and right dike systems, 43.3 km	ICB
Irrigation		
Package C	Alcala Amulung West Pump Irrigation Project, stage 1	ICB

* LCB: Local Competitive Bid, ICB: International Competitive Bid

3.5 Accredited Contractor in Region 2

The Philippine Contractors Accreditation Board published the “Rules and Regulations on Governing Licensing and Accreditation of Constructors in the Philippines”. Contractors in Philippines are classified and categorized under this rules and regulations.

The classification means that the area of operation wherein a constructor can engage is based on the technical experience of his sustaining technical employee. It is classifying 1) General Engineering, 2) General Building, and 3) Specialty.

The category indicates the graded level of aggregate capability of a constructor based on pre-determined criteria which include financial capacity, equipment

capacity, experience of firm, and experience of technical employees. The category is AAA, AA, A, B, C, and D. The number of contractors accredited in DPWH region 2 is 15 in total, among which are 2 in category AAA and 13 on category A. Stock holders' equity of Pesos 10 million and 1 million respectively are for minimum requirement of financial capability for category AAA and A respectively.

3.6 Implementation Organization

Figure 2.3.2 shows a proposed implementation organization for the contract basis construction execution of flood control and irrigation projects in the 1st phase.

CHAPTER 4 COST ESTIMATE

4.1 Conditions and Assumptions for Cost Estimate

(1) Constitution of Project Cost

The project cost estimates under the following cost composition and approaches:

Structural measures

No.	Project cost items	Notes
1	Direct construction cost	Estimate
2	VAT (Value Added Tax)	10 % of 1
3	Sub total	
4	Land acquisition, compensation cost	Estimate
5	Administration expenses	3 % of 1
6	Engineering services expenses	12 % of 1
7	Sub total	
8	Price contingency	5 % p.a. for LC, 2 % p.a. for FC
9	Sub total	
10	Physical contingency	8 % of 9
11	Total	

Non-structural measures and supporting measures

No.	Cost items	Notes
A	Non-structural measures	
1	Evacuation system	
	1) FFWS	Estimate
	2) Evacuation center	Estimate
2	Resettlement area development	
	1) Land acquisition and compensation	Estimate
	2) Development of resettlement area	Estimate
	3) Construction of public facilities	Estimate
	4) Construction of infrastructures	Estimate
B	Supporting measures	Estimate

(2) Direct Construction Cost

The direct construction cost is estimated by multiplying work quantity and unit construction cost in principle, except for lump sum items such as preparatory works. The work quantity is estimated based on project layout, outline dimensions of structures, and proposed capacities of the facilities.

(3) Unit Construction Cost for Structural Measures

The unit construction cost of each work item is determined by the following manner as tabulated in Table 4.2.16.

- Providing the breakdown for major items such as huge volume of embankment and excavation.

- Using unit construction costs in 1987 Master Plan using price deflator of 3.0, of which decided consumer price index (CPI) and wholesale price index (WPI) in 1985 to 2000, and upon review of it appropriateness.
- Referring the unit construction costs obtained from DPWH and the recent bidding data of similar projects in the Philippines.

(4) Unit Cost of Land Acquisition and Compensation for Non-structural Measures

Unit cost for land acquisition and compensation estimate from data supplied by the Provincial Assessor's Office, DPWH, LGUs and other agencies concerned in Region 2.

(5) Price level is June 2001

(6) Exchange rates used in the cost estimate are US\$ 1.0 = Pesos 50.0 = JY 120.0

(7) Classification of Local and Foreign Currency Portions

The cost estimate is made in local currency (LC) and foreign currency (FC) portions. The classification criteria of LC and FC is as follows:

(Local Currency Portion)

- Labor costs
- Locally available materials
- Inland transportation cost for materials to be imported
- Value Added Tax (VAT)
- Government administration expenses
- Land acquisition and compensation
- Evacuation system cost excluding foreign currency portion of FFWS
- Resettlement area development cost
- Local portion of engineering services expenses
- Contingencies for local portion

(Foreign Currency portion)

- Cost of materials and facilities to be imported
- Depreciation cost of construction equipment
- Foreign currency portion of FFWS as a component of evacuation system
- Foreign portion of engineering services expenses
- Contingencies for foreign portion

(8) Rate of FC and LC portion

Following the classification criteria for FC and LC and a proposed construction plan, the rate of foreign and local currency portions is as follows for the direct construction cost of the 1st phase implementation:

Sector / Projects	FC Portion (%)	LC Portion (%)
1. Flood control projects		
1) Urgent bank protection works	50	50
2) Left dike system	66	34
3) Right dike system	66	34
2. Irrigation projects		
AAWPIP, stage 1	50	50

4.2 Project Cost for Flood Control Projects

4.2.1 Project Cost in 4 Phases

(1) Cost for Structural , Non-structural and Supporting Measures (2002-2020)

The project cost for the Lower Cagayan River Flood Control Project has been worked out for 1) structural measures, 2) non-structural measures, and 3) supporting measures divided into 4 phases aiming at the target year of 2020. The estimated project costs for each phase and its summary for the flood control projects are shown in Table 4.2.1 to 4.2.5 and summarized in table below.

Unit: million Pesos

Phase / Implementation Period	Total	FC	LC
Phase 1 (2002-2007)	2,786	1,448	1,339
Phase 2 (2004-2011)	2,828	1,445	1,383
Phase 3 (2007-2015)	4,420	2,337	2,083
Phase 4 (2011-2020)	5,347	3,156	2,190
Total	15,381	8,385	6,996
Total, equivalent US\$ (million)	308	168	140

This phasing is for recommendable implementation compared with 3 phases implementation based on the financial and management aspects.

(2) Cost for Non-structural and Supporting Measures

The cost for non-structural and supporting measures in 4 phases for the Lower Cagayan River Flood Control Project was estimated as shown in Table 4.2.13, 4.2.14 and 4.2.15 and as summarized in table below, which indicates Pesos 349.5 million or US\$ 7.0 million in total in Phase 1 implementation.

Unit: million Pesos

Phase / Implementation Period	Total	Structural Measures	Supporting measures
Phase 1 (2002-2007)	349	319	30
Phase 2 (2004-2011)	469	409	60
Phase 3 (2007-2015)	547	517	30
Phase 4 (2011-2020)	126	96	30
Total	1,491	1,341	150
Total, equivalent US\$ (million)	30	27	3

(3) Sharing of Project Cost in Phase 1 (2002-2007)

The project cost in phase 1 to 4 will be shared as tabulated in Table 4.2.18 to 4.2.22.

The project cost for the implementation of phase 1 was estimated at Pesos 2,786 million or equivalent US\$ 55.7 million, which will be shared by respective agencies concerned as presented in table below:

Unit: million Pesos

Measures	Agency	Cost sharing	Cost
Structural Measures	National Government	Main works including all indirect cost <1	2,336.4
	LGUs	1) Land acquisition and compensation	55.0
		2) Tree zone construction and planting	19.2
Non-structural Measures	National Government	1) Cost for evacuation system	39.9
		2) Construction of public facilities for resettlement area	0
	LGUs	1) Land acquisition and compensation of resettlement area	23.9
		2) Evacuation center	138.3
		PAGASA	1) FFWS <2	143.3
Supporting Measures	National Government	Institutional establishment and implementation structure	30.0

Note <1: including VAT, administration expenses, E/S, contingencies for structural, non-structural and supporting measures.

Note <2: including 1) improvement of FFWS and EEWSDO facilities, 2) Special FFWS and disaster management in Tuguegarao, and 3) contingency of 1)+2) only.

(4) Direct Construction Cost in phase 1 (2002-2007)

The direct construction cost for the main works, urgent bank protection works and left and right dike systems reaches from the river mouth to Magapit, in the 1st phase (2002-2007) was worked out at Pesos 1,585 million or equivalent US\$ 31.7 million excluding VAT. Table 4.2.6 to 4.2.11 for each phase and its summary) and 4.2.11 for urgent bank protection works show the estimated direct construction cost.

To estimate the direct construction cost, unit construction cost, unit price of labor, materials and equipment has been surveyed at site in June 2001, and was tabulated in Table 4.2.16 and 4.2.17 as the supporting data.

(5) Disbursement Schedule in Phase 1 (2002-2007)

Disbursement schedule for 1st phase (2002-2007) in 4 phases implementation is shown in Table 4.2.12.

4.2.2 Project Cost in 3 Phases

(1) Cost for Structural , Non-structural and Supporting Measures (2002-2020)

The project cost for the Lower Cagayan River Flood Control Project has been worked out for 1) structural measures, 2) non-structural measures, and 3) supporting measures divided into 4 phases aiming at the target year of 2020. The estimated project costs in 3 phases are shown in Table 4.2.18 and summarized in table below:

Unit: million Pesos			
Phase / Implementation Period	Total	FC	LC
Phase 1 (2002-2007)	4,603	2,547	2,055
Phase 2 (2006-2013)	5,527	2,456	3,071
Phase 3 (2011-2015)	5,205	3,255	1,950
Total	15,335	8,258	7,076
Total, equivalent US\$ (million)	307	165	142

This phasing is not recommendable due to financial aspect that seems to be too large an investment cost in phase 1.

(2) Sharing of Project Cost in Phase 1 (2002-2007)

The project cost for the implementation of phase 1 was estimated at Pesos 4,603 million or equivalent US\$ 92.1 million of which will be shared by respective agencies concerned as presented in table below:

Unit: million Pesos			
Measures	Agency	Cost sharing	Cost
Structural Measures	National Government	1) Main works including all indirect cost <1	3,847.5
		2) Land acquisition and compensation	26.0
Non-structural Measures	LGUs	1) Tree zone construction and planting	2.0
		2) Construction of public facilities for resettlement area	41.0
	National Government	1) Resettlement area development	148.8
		2) Evacuation center	152.3
	LGUs	1) Land acquisition and compensation of resettlement area	148.1
		2) Evacuation center	152.3
Supporting Measures	National Government	1) FFWS <2	143.3
		1) Institutional establishment and implementation structure	90.0

Note <1: including VAT, administration expenses, E/S, contingencies for structural, non-structural and supporting measures.

Note <2: including 1) improvement of FFWS and EEWSDO facilities, 2) Special FFWS and disaster management in Tuguegarao, and 3) contingency of 1)+2) only.

(3) Direct Construction Cost in phase 1 (2002-2007)

The direct construction cost for the main works, urgent bank protection works and left and right dike systems reaches from the river mouth to Nasiping in the 1st phase (2002-2007) was worked out at Pesos 2,815 million or equivalent US\$ 56 million excluding VAT.

(4) Disbursement Schedule in Phase 1 (2002-2007)

Disbursement schedule for 1st phase (2002-2007) in 3 phases implementation is shown in Table 4.2.19.

4.3 Project Cost for Irrigation Projects in 4 Phases

The estimated project costs for the stage 1 in phase 1 and stage 2 in phase 3 of the AAWPIP are shown in Table 4.2.1 and 4.2.3 and summarized in the table below.

Phase / Implementation Period	Total	FC	LC
Phase 1 (2002-2007) for stage 1 <1	1,626	763	863
Phase 3 (2007-2015) for stage 2 <1	982	479	503
Total	2,608	1,242	1,366
Total, equivalent US\$ (million)	52	25	27

Note <1: including rice mill plant and drying yard as supporting measures

The direct construction cost for AAWPIP stage 1 was estimated at Pesos 1,112 million or equivalent US\$ 22 million including rice mill plant and construction of drying yard excluding VAT as shown in Table 4.3.1.

Disbursement schedule for the stage 1 project in phase 1 is shown in Table 4.2.12.

4.4 Operation and Maintenance Costs

Flood Control Projects

Annual operation and maintenance costs (O&M) was estimated at Pesos 14.3 million in total for phase 1 in 4 phases implementation as shown in Table 4.5.1 and as summarized in the table below.

O& M cost items	Annual O&M cost (Pesos million)
Structural measures	7.93
Non-structural measures	6.39
Total	14.32
Total, equivalent US\$	US\$ 286,400

Irrigation projects

Annual operation and maintenance cost for the AAWPIP was estimated at Pesos 30.0 million or US\$ 600,000 for stage 1 for 4,090 ha in phase 1 covering the 1) intake and booster pump stations, 2) irrigation and drainage canal systems, and 3) other related facilities as tabulated in Table 4.5.2.

*The Feasibility Study of the Flood Control Project for
the Lower Cagayan River in the Republic of the Philippines
Final Report
Supporting Report
Annex IX: Cost Estimate*

Tables

Table 4.2.1 Project Cost for the Lower Cagayan Flood Control Project, Phase 1 (2002-2007 in 4 Phases including AAWPIP stage 1

US\$ 1.0=Pesos 50.0=JY 120.0

Cost Items	Cost (Pesos million)		
	Total	FC	LC
A Flood control project			
1 Direct construction cost	1,585	960	625
1) Urgent Bank Protection Work:	540	270	270
2) Left and Right Dike System reach from river mouth to Magapit w/tree zone	1,045	690	355
2 VAT, 10 % of 1	158	0	158
Sub total, 1+2	1,743	960	784
3 Land Acquisition and Compensation Cos	26	0	26
4 Cost for non-structural measure:	319	129	191
5 Cost for supporting measures	30	24	6
6 Government Administration Expenses, 3 % of	48	0	48
7 Engineering Services Expenses, 12 % of	190	152	38
Sub total, 1+2+3+4+5+6+7+8	2,356	1,265	1,092
8 Price Contingency, 5 % p.a. for LC and 2 % p.a. for FC	224	76	148
Sub total, 1+2+3+4+5+6+7+8+9	2,580	1,340	1,240
9 Physical Contingency, 8 %	206	107	99
Total, Flood Control	2,786	1,448	1,339
B Irrigation project			
1 Direct construction cost			
1) Alucala Amulung West pump irrigation project , stage	902	450	452
2 VAT, 10 % of 1		0	90
Sub total, 1+2	992	450	542
3 Land Acquisition, Compensation	20	0	20
4 Supporting measures	210	126	84
5 Government Administration Expenses, 3 % of	27	0	27
6 Engineering Services Expenses, 12 % of	108	87	22
Sub total, 1+2+3+4+5	1,358	663	695
7 Price Contingency, 5 % p.a. for LC and 2 % p.a. for FC	148	44	104
Sub total, 1+2+3+4+5+6	1,505	706	799
8 Physical Contingency, 8 %	120	56	64
Total, Irrigation	1,626	763	863
Grand total, Flood Control and Irrigation	4,412	2,210	2,202

Table 4.2.2 Project Cost for the Lower Cagayan Flood Control Project, Phase 2 (2004-2011) in 4 Phases

US\$ 1.0=Pesos 50.0=JY 120.0

	Cost Items	Cost (Pesos million)		
		Total	FC	LC
A	Flood control project			
1	Direct construction cost	1,635	1,079	556
	1) Left and Right Dike System w/tree zone, reach from Magap to Nassiping, Amulung dike system w/tree zone , and Gabi cut-off channel reach from Nassiping to Amulur	1,635	1,079	556
2	VAT, 10 % of 1	164	0	164
	Sub total, 1+2	1,799	1,079	719
3	Land Acquisition and Compensation Cost	4	0	4
4	Cost for non-structural measure	409	0	409
5	Cost for supporting measure	60	48	12
6	Government Administration Expenses, 3 % of	49	0	49
7	Engineering Services Expenses, 12 % of	196	157	39
	Sub total, 1+2+3+4+5+6+7	2,517	1,284	1,233
8	Physical and Price Contingency, 12 % of 1 to 7	311	161	150
	Total, Flood Control	2,828	1,445	1,383

Table 4.2.3 Project Cost for the Lower Cagayan Flood Control Project, Phase 3 (2007-2015 in 4 Phases

US\$ 1.0=Pesos 50.0=JY 120.0

	Cost Items	Cost (Pesos million)		
		Total	FC	LC
A	Flood control project			
1	Direct construction cost	2,857	1,886	971
	1) Alcala-Buntun and Iguig Dike System w/tree zone, reach from Amulung to Tuguegarao and San Isidoro cut-off channel	2,857	1,886	971
2	VAT, 10 % of 1	255	0	255
	Sub total, 1+2	3,112	1,886	1,227
3	Land Acquisition and Compensation Cost	43	0	43
4	Cost for non-structural measures	517	0	517
5	Cost for supporting measures	30	24	6
6	Government Administration Expenses, 3 % of 1	86	0	86
7	Engineering Services Expenses, 12 % of 1	343	274	69
	Sub total, 1+2+3+4+5+6+7	4,131	2,184	1,947
8	Physical and Price Contingency	289	153	136
	Total, Flood Control	4,420	2,337	2,083
B	Irrigation project			
1	Direct construction cost			
	1) Alucala Amulung West pump irrigation project , stage 1	560	280	280
2	VAT, 10 % of 1		0	56
	Sub total, 1+2	616	280	336
3	Land Acquisition, Compensation	12	0	12
4	Supporting measures	157	94	63
5	Government Administration Expenses, 3 % of 1	17	0	17
6	Engineering Services Expenses, 12 % of 1	67	54	13
	Sub total, 1+2+3+4+5	869	428	441
7	Price and physical contingencies, 12 % of 1-6	91	43	49
	Total irrigation 1+2+3+4+5+6+7	961	471	490
	Total, Flood Control and Irrigation	5,380	2,808	2,573

Table 4.2.4 Project Cost for the Lower Cagayan Flood Control Project, Phase 4 (2011-2020 in 4 Phases

US\$ 1.0=Pesos 50.0=JY 120.0

	Cost Items	Cost (Pesos million)		
		Total	FC	LC
A	Flood control project			
1	Direct construction cost	3,696	2,439	1,257
	1) Tuguegarao and Enrile Dike System w/tree zone, reach from Tuguegarao to Cabagan and Tuguegarao cut-off channel	3,696	2,439	1,257
2	VAT, 10 % of 1	370	0	370
	Sub total, 1+2	4,066	2,439	1,626
3	Land Acquisition and Compensation Cos	28	0	28
4	Cost for non-structural measures	96	0	96
5	Cost for supporting measure:	30	24	6
6	Government Administration Expenses, 3 % of 1	111	0	111
7	Engineering Services Expenses, 12 % of 1	444	355	89
	Sub total, 1+2+3+4+5+6+7	4,774	2,818	1,956
8	Price and Physical Contingency, 12 % of 1 to 7	573	338	235
	Total, Flood Control	5,347	3,156	2,190

Table 4.2.5 Summary of Project Cost for the Lower Cagayan River Flood Control Project, Phase 1, 2, 3, and (Flood Control only)

US\$ 1.0=Pesos 50.0=JY120.0

unit:Peso million

Phase	Flood Control system / Work Item:	Total	FC	LC
1	Urgent Bank Protection Works and Left and Right Dike System with Tree Zone reach from River Mouth to Magapi	2,786	1,448	1,339
2	Left and Right Right Dike System, reach from River Magapit to Nassiping Amulung Dike System w/Tree Zone and Gabut Cut Off Channel, reach from Nassiping to Amulung	2,828	1,445	1,383
3	Alcala-Buntun Dike System w/Tree Zone and San Isidoro Cut Off Channel Reach from Amulung to Tuguegarao	4,420	2,337	2,083
4	Tuguegarao and Enrile Dike Systems w/Tree Zone, and Tuguegarao Cut-Off Channel Reach from Tuguegarao to Cabagar	5,347	3,156	2,190
	Total	15,381	8,385	6,996
	Total, equivalent US\$ (million)	308	168	140

Table 4. 2.6 Direct Construction Cost for the Left and Right Dike System Reach from River Mouth to Magapit in the Lower Cagayan River Flood Control Project Phase 1 in 4 Phases

				US\$ 1.0=Pesos 50.0=JY120.0		unit: Pesos million		
Flood Control system / Work Item:				Unit	Quantity	Unit Cost (Pesos)	Amount (Pesos, mil.)	notes
I Left Dike System in the reach from River Mouth to Magapit								
1	Main Works						464	
2	Preparatory work			LS	1		22	5 % of main works
		Embankment					351	
			Mabanguc dike	cu.m	1,196,000	174	209	
			Catugan Sur dike	cu.m	812,000	174	142	
		Maintenance road					23	
			Mabanguc dike	sq.m	43,500	300	14	
			Catugan Sur dike	sq.m	29,500	300	9	
		Tree zone	Gatugan Sur dike	sq.m	132,000	10	2	
		Culvert					66	
			Mabanguc dike	unit	17	2,475,000	43	
			Catugan Sur dike	unit	9	2,475,000	23	
II Right Dike System in the reach from River Mouth to Magapit								
1	Main Works						581	
2	Preparatory work			LS	1		28	5 % of main works
		Embankment					382	
			Camalaniugan dike	cu.m	1,150,000	174	201	
			Lal-lo dike	cu.m	1,039,000	174	181	
		Bank protection (wet masonry)					61	
			Camalaniugan dike	sq.m	26,200	1,800	48	
			Lal-lo dike	sq.m	6,900	1,800	13	
		Spur dike	Aparri	cu.m	19,000	720	14	
		Culvert					96	
			Camalaniugan dike	unit	19	2,475,000	48	
			Lal-lo dike	unit	19	2,475,000	48	
Total							1,045	

**Table 4.2.7 Direct Construction Cost for the Left and Right Dike System Reach from Magapit to Amulung
in the Lower Cagayan River Flood Control Project, Phase 2 in 4 Phases**

US\$ 1.0=Pesos 50.0=JY120.0 unit: Pesos millior

Flood Control system / Work Item:		Unit	Quantity	Unit Cost (Pesos)	Amount (Pesos, mil.)	notes
I Left Dike System in the reach from Magapit to Nassipin						
1	Main Works				246	
2	Preparatory work	LS	1		18	5 % of main works
	Embankment				159	
	Lasam dike	cu.m	909,000	174	159	
	Maintenance road				9	
	Lasam dike	sq.m	28,100	300	9	
	Culvert				60	
	Lasam dike	unit	12	5,000,000	60	
II Right Dike System in the reach from Magapit to Nassipin						
1	Main Works				319	
2	Preparatory work	LS	1		24	5 % of main works
	Embankment				180	
	Gattaran dike	cu.m	560,000	174	98	
	Nassiping dike	cu.m	467,000	174	82	
	Culvert				115	
	Gattaran dike	unit	9	5,000,000	45	
	Nassiping dike	unit	14	5,000,000	70	
III Amulung Dike System in the reach from Nassiping to Amulur						
1	Main Works				237	
2	Preparatory work	LS	1		18	5 % of main works
	Embankment (Amulung)	cu.m	1,257,000	174	219	
	Pavement (Alcala)	sq.m	0	1,350	0	
	Tree zone	sq.m	0	10	0	
IV Gabut Cut-off Channel in the reach from Nassiping to Amulur						
1	Main Works				834	
2	Preparatory work	LS	1		62	5 % of main works
	Excavation	cu.m	4,623,000	135	625	
	Bank protection (gabion)	sq.m	40,000	900	36	
	(riprap)	cu.m	50,000	720	36	
	Spur dike	cu.m	19,000	1,200	23	
	Bridge (overflow type)	sq.m	1,300	40,000	52	
	Total				1,635	

**Table 4.2.8 Direct Construction Cost for Alcala -Buntun, Iguig Dike System and San Isidoro Cut Off Channel
Reach from Amulung to Tuguegarao in the Lower Cagayan River Flood Control Project, Phase 3 in 4 Phases**

US\$ 1.0=Pesos 50.0=JY120.0 unit: Pesos millior

Flood Control system / Work Item:		Unit	Quantity	Unit Cost (Pesos)	Amount (Pesos, mil.)	notes
I Alcala- Buntun and Iguig Dike System in the reach from Amulung to Tuguegar:						
1	Main Works				1,422	
2	Preparatory work	LS	1		68	5 % of main works
	Embankment (Alcala-Buntun)	cu.m	6,574,000	174	1,144	
	Embankment (Iguig)	cu.m	196,000	174	35	
	Inspection road	sq.m	134,200	300	41	
	Tree zone	sq.m	929,000	10	0	
	Culvert	unit	49	2,475,000	122	
	Sluice	unit	2	5,634,000	12	
II San Isidro Cut-off Channel in the reach from Amulung to Tuguegar:						
1	Main Works				1,435	
2	Preparatory work	LS	1		68	5 % of main works
	Excavation	cu.m	9,563,000	135	1,292	
	Bank protection (gabion)	sq.m	26,000	900	24	
	(riprap)	cu.m	35,000	720	26	
	Bridge (overflow type)	sq.m	1,290	18,000	24	
	Relocation of irrigation canal	m	1,000	200	1	
Total					2,857	

**Table 4.2.9 Direct Construction Cost for Tuguegarao and Enrile Dike System, and Tuguegarao Cut-Off Channel
Reach from Tuguegarao to Cabagan in the Lower Cagayan River Flood Control Project, Phase 4 in 4 Phases**

US\$ 1.0=Pesos 50.0=JY120.0 unit: Pesos millior

Flood Control system / Work Items:		Unit	Quantity	Unit Cost (Pesos)	Amount (Pesos, mil.)	notes
I Tuguegarao Dike System system in the reach from Tuguegarao to Cabaga						
1	Main Works				660	
2	Preparatory work	LS	1		31	5 % of main works
	Embankment	cu.m	3,134,000	174	546	
	Maintenance road	sq.m	0	300	0	
	Tree zone	sq.m	593,000	10	6	
	Culvert	unit	31	2,475,000	77	
II Enrile Dike System system in the reach from Tuguegarao to Cabaga						
1	Main Works				219	
2	Preparatory work	LS	1		10	5 % of main works
	Embankment	cu.m	927,000	174	162	
	Maintenance road	sq.m	0	300	0	
	Tree zone	sq.m	194,000	10	2	
	Culvert	unit	18	2,475,000	45	
III Tuguegarao Cut-off Channel in the reach from Tuguegarao to Cabaga						
1	Main Works				2,816	
2	Preparatory work	LS	1		134	5 % of main works
	Excavation	cu.m	19,134,000	135	2,584	
	Bank protection (gabion)	sq.m	32,000	900	29	
	(riprap)	cu.m	66,000	720	48	
	Spur dike	cu.m	29,000	720	21	
Total					3,696	

Table 4.2.10 Summary of Direct Construction Cost for the Lower Cagayan River Flood Control Project (4-phase)

US\$ 1.0=Pesos 50.0=JY120.0

unit:Pesos millior

Flood Control system / Work Items	Total	FC	LC
1 Urgent Bank Protection Work:	540	270	270
2 Left and Right Dike System w/Tree Zone, reach from River Mouth to Magap	1,045	690	355
3 Left and Right Right Dike System, reach from River Magapit to Nassiping; Amulung Dike System w/Tree Zone and Gabut Cut Off Channel, reach fro Nassiping to Amulung	1635	1,079	556
4 Alcala-Buntun Dike System w/Tree Zone and San Isidoro Cut Off Channel Reach from Amulung to Tuguegarao	2,857	1,886	971
5 Tuguegarao and Enrile Dike Systems w/Tree Zone, and Tuguegarao Cut-Off Chann Reach from Tuguegarao to Cabaga	3,696	2,439.4	1,256.6
Total	9,773	6,364	3,409

Table 4.2.11 Scope and Cost for Urgent Bank Protection Works in the Lower Cagayan River, 21 Sites

US\$ 1.0 = P 50.0

Serial No.	River	City/Town Location	Protection length (m)	Protection method <1	Construction cost (P mil.) <2	Construction priority <3	Object to be protected
1	Cagayan	Agusi	1,000	C	35.6	2	houses & road
2	Cagayan	Camalaniugan	500	C	22.9	2	houses & road
3	Cagayan	Tucalana	1,000	C	46.1	2	houses & road
4	Cagayan	Sta. Maria	1,000	C	34.0	2	houses & road
5	Cagayan	Magapit	1,000	B	24.0	3	agriculture
6	Cagayan	Gattaran	1,000	B	22.8	3	agriculture
7	Cagayan	Tupang	1,000	C	8.2	2	houses & road
8	Cagayan	Dugayong	300	C	7.1	2	houses & road
9	Cagayan	Babayuan	200	B	5.0	3	agriculture
10	Cagayan	San Vicente	800	A	55.0	1	urban
11	Cagayan	Nattapian	500	C	24.0	3	agriculture
12	Cagayan	Cataggaman	800	A	70.3	1	urban
13	Cagayan	Jet. Enrile	500	B	10.2	3	agriculture
14	Cagayan	Alibago	350	B	8.2	3	agriculture
15	Cagayan	Namabbalan	1,800	C	48.0	2	houses & road
16	Cagayan	Sta. Maria	2,000	B	37.5	3	agriculture
17	Cagayan	Cabagan	4,000	B	61.0	3	agriculture
18	Tuguegarao	Bagumbayan	100	A	7.7	1	urban
19	Tuguegarao	Larion	250	B	2.0	3	agriculture
20	Tuguegarao	Caggay	500	D	8.3	3	houses & road
21	Tuguegarao	Tanza	200	D	2.1	3	houses & road
Total			18,800		540.0		
Total, equiv. US\$ mil.					10.8		

- Notes <1
- Type A Slope protection with step by gabion (t=1.0 m) in combination with riprap as foot protection
 - Type B Slope protection by dry masonry (cobble pavement) in combination with riprap as foot protection
 - Type C Slope protection by gabion (t=0.5 to 0.3 m) in combination with riprap as foot protection
 - Type D Spur dike (in the case of water depth at foot of the slope is shallow and applied at 2 sites in lower Tuguegarao river)
 - Type E Gabion mattress revetment on loose boulder foundation
 - Type F Gabion cages with gabion mattress foundation
 - Type G Combination of gabion mattress and dry boulder revetment on loose boulder apron
 - Type H Combination of Type F and gabion mattress revetment
- <2 without VAT
- <3 Given priority in order of 1) urbanized area, 2) houses and road, 3) agriculture land and others

Table 4.2.13 Cost Summary for Non-Structural Measures and Supporting Measures (2002-2020) in 4 Phases (1/2)

Cost Items	US\$ 1.0=Pesos 50.0=JY120.0		Unit:millio Pesos
	Total	FC	LC
A Non-Structural Measures			
1 Cost for evacuation system			
1) Phase 1 FFWS	143.3	129.0	14.3
2) Phase 1 Evacuation center	152.3	0.0	152.3
sub total	295.6	129.0	166.6
2 Resettlement Cost for ROW and River araea (see table 4.2.8 (2/2))			
Phase 1	23.9	0.0	23.9
Phase 2	652.3	0.0	652.3
Phase 3	289.3	0.0	289.3
Phase 4	95.9	0.0	95.9
sub total Phase 1	319.5	129.0	190.5
sub total Phase 2	652.3	0.0	652.3
sub total Phase 3	289.3	0.0	289.3
sub total Phase 4	95.9	0.0	95.9
Total, non-structural measures	1,357.0	129.0	1,228.0
B Supporting Measures			
Phase 1	30.0	24.0	6.0
Phase 2	60.0	48.0	12.0
Phase 3	30.0	24.0	6.0
Phase 4	30.0	24.0	6.0
Total, supporting measures	150.0	120.0	30.0
Total, non-structural and supporting measure:	1,507.0	249.0	1,258.0

Table 4.2.13 Cost Summary for Non-Structural Measures and Supporting Measures (2002-2020) in 4 Phases (2/2)
Resettlement Cost Estimate for ROW for Flood Control Project

Municipality/ City	No. of resettlement households	Public Facility 1)	Total Cost Estimate (in Million Pesos)					OM Cost 6)	
			Land acquisition 2)		Compensation 3)	Relocation Area Dep't 4)	Public facility 5)		Total
			Area (ha)	Cost					
Appari	46	-	67	6.8	2.8	0.0	0.0	9.6	0.000
Camalaniugan	0	-	25	2.5	0.0	0.0	0.0	2.5	0.000
Allacapan	0	-	0	0.0	0.0	0.0	0.0	0.0	0.000
Lal-lo	22	-	76	7.7	1.3	0.0	0.0	9.0	0.000
Gattaran	28	-	45	4.5	1.7	0.0	0.0	6.2	0.000
Lasam	0	-	40	4.1	0.0	0.0	0.0	4.1	0.000
Sto. Niño	0	-	0	0.0	0.0	0.0	0.0	0.0	0.000
Alcala	0	-	43	4.4	0.0	0.0	0.0	4.4	0.000
Amulung	0	-	107	10.8	0.0	0.0	0.0	10.8	0.000
Iguig	247	EISc(1), Ch(2), BH(1)	92	9.3	14.8	19.8	4.5	48.4	0.121
Solana	0	-	173	17.5	0.0	0.0	0.0	17.5	0.000
Tuguegarao	0	-	308	31.2	0.0	0.0	0.0	31.2	0.000
Enrile	0	-	219	22.3	0.0	0.0	0.0	22.3	0.000
Total	343	EISc(1), Ch(2), BH(1)	1,193	121.1	20.6	27.4	4.5	166.0	0.160

Resettlement Cost Estimate for ROW and River Area (Total)

Municipality/ City	No. of resettlement households	Public Facility 1)	Total Cost Estimate (in Million Pesos)					OM Cost 6)	
			Land acquisition 2)		Compensation 3)	Relocation Area Dep't 4)	Public facility 5)		Total
			Area (ha)	Cost					
Appari	46	-	104	7.8	2.8	0.0	0.0	10.6	0.00
Camalaniugan	30	-	25	2.5	1.8	0.0	0.0	4.3	0.00
Allacapan	0	-	0	0.0	0.0	0.0	0.0	0.0	0.00
Lal-lo	22	-	76	7.7	1.3	0.0	0.0	9.0	0.00
Gattaran	28	-	263	13.2	1.7	0.0	0.0	14.8	0.00
Lasam	872	SeSh(1), EISc(2), PrSc(2), Ch(4)	438	57.1	52.3	69.8	15.0	194.1	0.42
Sto. Niño	0	-	169	32.1	0.0	0.0	0.0	32.1	0.00
Alcala	250	EISc(1), Ch(1), BH(1)	1,361	128.3	15.0	20.0	4.5	167.8	0.12
Amulung	738	EISc(4), Ch(5), BH(2), DCC(4)	1,467	103.8	44.3	59.0	21.5	228.6	0.40
Iguig	784	EISc(2), Ch(4), BH(4), DCC(4)	764	113.5	47.0	62.7	18.0	241.2	0.40
Solana	6	-	884	47.2	0.4	0.5	0.0	48.0	0.00
Tuguegarao	0	-	1,179	59.0	0.0	0.0	0.0	59.0	0.00
Enrile	0	-	739	37.0	0.0	0.0	0.0	37.0	0.00
Total	2,776	SeSh(1), EISc(9), PrSc(2), Ch(14), BH(7), DCC(8)	7,468	609.0	166.6	212.0	59.0	1,047	1.34

1) SeSc: Secondary School, EISc: Elementary School, PrSc: Primary School, Ch: Church including Chapel BH: Barangay Hall, DCC: Daycare Center

2) Land Acquisition for ROW and River Area. Unit costs used for estimation are 150 Pesos/m² for residential area, 15 Pesos/m² for paddy field and 5 Pesos/m² for corn field. In the case that candidate houses for relocation are already existing in the sa

3) Estimated based on Compensation Unit Cost = 60,000 Pesos/household (based on case study)

4) Estimated based on Unit cost of Relocation Area Development = 400 Pesos/m², Area Unit = 100m² for residential are and 100m² for infrastructure and facility.

5) Unit Cost of Secondary School and Elementary School = 2.0 Mil. Pesos, Primary School = 1.5 Mil. Pesos, Church = 1.5 Mil. Pesos, Barangay Hall, Day Care Cent = 1.0 Mil. Pesos.

6) Estimated as 0.5% of Summation of Relocation Site Development Cost and Public Facility Installation Cost.

Table 4.2.14 Cost for FFWS for the Lower Cagayan River Flood Control Project, Phase 1 in 4 Phases

US\$ 1.0=Pesos 50.0=JY120.0

unit: Pesos million

Cost Items		Total	FC	LC
1	Improvement of FFWS and EEWSDO Facilities			
1.1	Rehabilitation of telenmetering system			
	1) FFWS	90.0		
	2) FFWSDO	0.0		
1.2	Restoration of computer system			
	1) FFWS	1.2		
	2) FFWSDO	0.4		
1.3	Provision of Telefax communication facility (RDCC/PDCCV/MDCC)	2.4		
1.4	Spare parts and others	9.2		
2	Special FFWS and Disaster Management in Tuguegarao			
2.1	Establishment of local hydrological observation stations	6.2		
2.2	Local communication network			
	1) Among sub-center, RDCC and members	7.2		
	2) Among MDCC, evacuation center and Barangays	8.0		
	sub total	124.6		
3	Contingency, 15 % of sub total	18.7		
	Total	143.3	129.0	14.3

Table 4.2.15 Cost for Evacuation Center for the Lower Cagayan River Flood Control Project. Phase 1 in 4 Phases

US\$ 1.0=Pesos 50.0=JY120.0

unit: Pesos million

Cost Items		Total	FC	LC
A	Procurement and installation, constructor			
1	Tent, 12 persons/set, 1,204 set x P40,000	48.2	0	48.2
2	Deep well	22.0	0	22.0
3	Construction of evacuation center	45.4	0	45.4
4	Cooking tools	5.1	0	5.1
	sub total	120.7	0	120.7
	contingency, 15 % of sub total	18.1	0	18.1
B	DCC strengthening and training of habitants	13.5	0	13.5
	3 M/M x P 15,000 x 300 days			
	Total	152.3	0.0	152.3

Table 4.2.16 List of Unit Construction Cost Applied in the Feasibility Study

US\$ 1.0 = Pesos 50.0

Sector / Work Items		Unit	Unit Cost (Pesos)	Unit Cost (equivalent US\$)
A	Flood control			
1	Dike embankment	m ³	174	3.5
2	Excavation, cut-off channel	m ³	135	2.7
3	Maintenance road	m ²	300	6.0
4	Tree zone	m ²	10	0.2
5	Culvert	unit	2,475,000	49,500.0
6	Culvert, Lasam, Gataran, Nassiping	unit	5,000,000	100,000.0
7	Wet masonry for bank protection	m ²	1,800	36.0
8	Spur dike	m ³	720	14.4
9	Pavement (Alcala)	m ²	1,350	27.0
10	Gabion for bank protection	m ²	900	18.0
11	Riprap bank protection	m ³	720	14.4
12	Bridge, overflow type	m ²	18,000	360.0
13	Bridge, Gabut cut-off channel	m ²	40,000	800.0
14	Inspection road	m ²	300	6.0
15	Sluice	unit	5,634,000	112,680.0
16	Relocation of irrigation canal	m	200	4.0
17	Reinforcement steel bar	ton	1,013	20.3
18	Metal works	ton	8,613	172.3
B	Irrigation			
1	Excavation, rock	m ³	429	8.6
2	Excavation, common, canal	m ³	47	0.9
3	Embankment, main canal	m ³	44	0.9
4	Embankment, lateral canal	m ³	122	2.4
5	Backfill, pump station	m ³	110	2.2
6	Concrete A, pump house w/form, re-bar	m ³	7,586	151.7
7	Concrete B, canal lining w/form, re-bar	m ³	3,025	60.5
8	Concrete for drying yard, t=5 cm	m ²	100	2.0
9	Gravel pavement	m ³	346	6.9
10	Farm ditch & drain w/related structures	ha	6,200	124.0
11	Land levelling	ha	47,500	950.0
12	Rice mill plant, 5 t/hr	set	50,000,000	1,000,000.0

Table 4.2.17 Unit Prices for Labor, Materials, Equipment and Other Data Surveyed at Site in June 2001 (1/5)

US\$1.0=P 50.0

Plan and Cost estimate on the F/S of Flood Control Project for the Lower Cagayan Riv

Survey Items / Propose Plans	Suevey Results			
A on construction plan				
1 Cagayan basin				
1) catchment area	27,281 km ²			
2) topography	mostly hilly to mountainous, River bed EL 10 m at Tuguegarac			
3) geology	thick sequence of pre-Tertiary metamorphic and plutonic rocks			
4) river length	520 km main Cagayan			
5) riverbed slope	1/13,000 Magapit - 1/7000 Cabagan			
6) channel width	Magapit to Alcala 300 to 1,000 m, Alcala to Tuguegarao 500 m, US of Tuguegarao 600 m			
7) rainfall	2,600 mm			
8) climate	Dry : November to April. Wet : May to October (Type III)			
9) temperature	Mean : 26.4 C January 23.1 C, May 29.0 C			
2 Reconnaissance survey on flood control priority project site:	general/topography	soil	access road	public power
1) Tupang for widening of bottleneck and narrows, L=6 km, W=500 m	small hills at left bank in Carallangan village	clayey soil rocks exist partly	left bank: available rural non-paved road w/3 to 4 m width via Magat bridge right bank: national highway no.5	available at both right and left bank sides
2) Alcala-Buntun diking system, L=38.6 km	right bank: flat left bank : gentle slope		left bank: available rural non-paved road w/3 to 4 m width right bank: national highway no.5	available at both right and left bank sides
3) Tuguegarao diking system, L=14.3 km	right bank: flat left bank: flat	clayey soil / fine sanc	left bank: available rural non-paved road w/3 to 4 m width right bank: national highway no.5	available at both right and left bank sides
4) Enrile diking system, L=4.6 km	right bank: flat left bank: flat	clayey soil / fine sanc	left bank: available rural non-paved road w/3 to 4 m width right bank: national highway no.5	available at both right and left bank sides
5) Gabut cut-off channel, L=0.9 km	flat entirely at El 10 m paddy and corn fields NIA's pump irr. System close to planned route	clayey soil / fine sanc	available rural road of W=2 to 3 m and national highway no.5	available
6) San Isidro cut-off channel, L=2.1 km	flat entirely at El 5 to 10 m paddy and corn fields NIA's pump irr. System close to planned route	clayey soil / fine sanc	available rural road of W=2 to 3 m and national highway no.5	available
7) Tuguegarao cut-off channel, L=6.7 km	flat entirely at El 10 to 20 m corn and peanut fields NIA's Solana pump irr. system close to planned route. corn fields	silt and sand, ML	left bank: available non-paved rural road (W2 to 3 m) and paved national highway no. 6 (W5m) right bank: available paved national highway no.5 (W5m) and paved or non-paved rural roads (W2 to 3 m)	available at both banks
3 Reconnaissance survey on irrigation project priority site:	topography	soil	access road	public power
1) Alcala Amulung West Irrigation Project (AAWIP), 7,700 ha, New, left bank	El 5-15 m for planned area. El 15 m for pump station. corn & pasture land mostly		available gravel paved rural roads with W=2 to 3 m	available

Table 4.2.17 Unit Prices for Labor, Materials, Equipment and Other Data Surveyed at Site in June 2001 (2/5)

US\$1.0=P 50.0

Plan and Cost estimate on the F/S of Flood Control Project for the Lower Cagayan Riv

Survey Items / Propose Plans	Suevey Results		
2) Solana Pump Irrigation System-Rehabilitatin & Extention Project (SPIS-REP), 7,880 ha at left bank	El 5-15 m for planned area. corn and pasture land mostly for extension area. existing pump station: vertical axial flow type 4-unit x 1.01 cmc/unit		available gravel paved rural roads with W=2 to 3 m available
3) Enrile Pump Irrigation Project (EPIP), 3,100 ha, New at left bank	El 10-20 m for planned area. corn fields mostly.		available gravel paved rural roads with W=3 to 4 m, and national highway no.6 available
4) Iguig-Alcala-Amulung Pump Irrigation System (IAAPIS), 2,306 ha, Rehabilitation	El 10-15 m for planned area. reinfed paddy.		available national highway no.5 and non-paved rural roads with W=3-4 m available
4 Landfill sites (major 2 sites)			
1) Gaput low land area (1) 340 ha	locate along national highway no.5 at El 10 m and villege Pagban caraon. mostly corn fields		national highway no.5 available possible H=1.5 m, and 5 mil. M3
2) Gaput low land area (2) 170 ha	locate and close to right bank side of planned cut off channel route and villege Jurisdiccioin. paddy and corn fields		national highway no.5 available possible H=1.0 m, and 2 mil. M3
5 Quarry sites, borrow pits	No mountainous quarry. Available river sand and gravel at Tuguegarao, Pared and other tributaries Big boulders, > 30 cm, taking from Sanbavro, Isabela with 40 km hauling distance		
6 Seaports			
1) St. Visente, Santa Ana	Fishery and transportation purposes. No commercial port. Small scale		
2) Irene (Batuliniao port)	* 1-birth (L100m xW15 m) w/draft depth of 4-5 m at low tide, 1-loading conveyor, no warehouse and other port facilitie		
7 Crushing plant	Tuguegarao 100 t/hr with washing KAWASAKI by R.C Interior JR Construction		
7 Ready mixed concrete factory	Tuguegarao 40 m3/hr x 1 set, Gataran 40 m3/hr x 1 set by R.C Interior JR Construction, operation efficiency 30-50 %		
8 Supplier for fine and coarse aggregates	General contractors		
9 General contractors			
1) Contract administration in terms of budget	>P100 million by Central Gov., P100<50 million by Regional, <P50 million by Distric		
2) Registration of Contractors/DPWH's R-2 classification	amount of project (Bid)	classification	size-range
	P 0.5 - 1.5 millin	E	small -A
	P <1.5 - 3.0 millin	D	small -B
	P <3.0 - 15.0 million	C	medium - A
	P <3.0 - 30.0 million	B	medium - B
	P <3.0 - 50.0 million	A	large - A
	above 50.0 million	AAA	large - B
10 DPWH's Bureau of Equipment (Regional Equipment Services)	RES Centarl in Region 2 at Tuguegarao: 230 employee (see breakdown) , 517 units of equipment (see list)		

Table 4.2.17 Unit Prices for Labor, Materials, Equipment and Other Data Surveyed at Site in June 2001 (3/5)

US\$1.0=P 50.0

Plan and Cost estimate on the F/S of Flood Control Project for the Lower Cagayan Riv

Survey Items / Propose Plans		Suevey Results						
B on cost estimate								
B1	Direct construction cost							
B1-1	unit construction cost	unit	unit cost by DPWH R-2	equivalent	unit cost by AAA Contractor	equivalent	applied	equiv.
(flood control works)			(P)	(US\$)	(P)	(US\$)	(P)	(US\$)
1)	excavation, loading, and hauling of 1 km for river channel, commor	m3	50 (excavation only)		250			
2)	excavation, loading, and hauling of 1 km for river channel, rock	m3			850			
3)	excavation, loading, and hauling of 1 km for cut-off channel, common	m3	50 (excavation only)		250			
4)	excavation, loading, and hauling of 1 km for cut-off channel, rock	m3			850			
5)	dredging of river channel w/500 m discharge	m3			300			
6)	dredging of cut-off channel w/500 m dischatge	m3			300			
7)	dike embankment by excavated material, Hauling distance= 0 kr	m3	80		250			
8)	dike embankment by borrowed material, Hauling distance=10 kr	m3	110		450			
9)	embankment for closing dike by excavated material, Hauling distance=0 kr	m3	80		200			
10)	embankment for closing dike by borrowed material, Hauling distance=10 kr	m3	110		400			
11)	landfill by excavated material, Hauling distance=0 kr	m3			150			
12)	revetment by gabion for closing dike and spur dike	m3	2100		3,500			
13)	RC drainage culvert, 1.5 x 1.5 m	lin.m			8,000			
(irrigation works)								
1)	excavation, loading, and hauling of 1 km for headworks, common	m3	140 (excavation only)		250			
2)	excavation, loading, and hauling of 1 km for large canals, commor	m3			250			
3)	excavation, loading, and hauling of 1 km for small canals, commor	m3			250			
4)	excavation, loading, and hauling of 1 km for rocks	m3	210 (excavation only)		850			
5)	embankment by excavated material, Hauling distance= 0 kr	m3	80		250			
6)	embankment by borrowed material, Hauling distance=10 kr	m3	110		350			
(common)								
1)	reinforcement concrete, 25 Mpa	m3	4,800		5,250			
2)	lining concrete	m3			5,000			
3)	plain concrete	m3	2,200		3,071			
4)	reinforcement bar	ton	20,000		35,000			
5)	stone masonry	m3	1,500		2,500			
6)	backfill	m3	110		250			
7)	metal form	m2			650			
8)	wooden form	m2	220		400			
9)	gravel metalling	m2	40		250			
10)	concrete pipe, D500 mm	lin.m	1,080 (D610 mm)		2,500			
11)	concrete pipe, D700 mm	lin.m	1,580 (D910 mm)		2,800			
12)	concrete pipe, D1,000 mm	lin.m	2,080 (D1,220 mm)		3,500			
13)	gate and other metal works	ton			50,000			
14)	RC bridge	m2			50,000			
15)	1,200 mm bored pile	lin.m			42,500			
B1-2 Land acquisition and compensation								
1)	paddy field	sq.m	30		850			
2)	corn field	sq.m	15		850			
3)	pasture land	sq.m			850			
4)	residential, RC made	sq.m	3,000		15,000			
5)	residential, brick made	sq.m	1,500		15,000			
6)	residential, wooden made	sq.m	1,000		15,000			
(The followings are present values of assets applied the IP for urgent works)								
1	Assets	ISABELA	NUEVA VIZCAYA					
a	Land	(Pesos)	(Pesos)					
a1	residential lands	150 /m2	360/m2					

Table 4.2.17 Unit Prices for Labor, Materials, Equipment and Other Data Surveyed at Site in June 2001 (4/5)

US\$1.0=P 50.0

Plan and Cost estimate on the F/S of Flood Control Project for the Lower Cagayan Riv

Survey Items / Propose Plans			Suevey Results							
a2	paddy field	20 /m2	18.5/m2							
a3	corn field	10 /m2	9.4/m2							
b	Buildings									
b1	residential	175,000/m2	175,000/m2							
b2	school buildings	305,000/unit	305,000/unit							
c	Other structures									
c1	NIA canal	205/m2	205/m2							
d	Roads									
d1	national	6,000,000/km	6,000,000/km							
d2	provincial	5,000,000/km	5,000,000/km							
d3	barangay	4,000,000/km	4,000,000/km							
II	Production									
a	paddy	80/m2	80/m2							
b	corn	20/m2	20/m2							
B2	Basic price									
B2-1	Unit price of construction materials	unit	unit price (P) by DPWH	equivalent US\$	unit cost by AAA Contractor	availability				
1)	portland cement	bag	155	3.1	165	Local, 40 kg/bag				
2)	coarse aggregates	ton	350		450 / 203	Local, river gravel				
3)	fine aggregate	ton	240		300 / 192	Local, river sand				
4)	cobble stone for masonry and gabion works	m3			850	Local at Cagayan				
5)	gravel for road pavement	m3	100							
6)	reinforcement steel bar, round	ton	20,000		35,000	Local at Cagayan				
7)	reinforcement steel bar, deformed	ton			35,000	Local at Cagayan				
8)	structural steel	ton	50,000		75,000	Import				
9)	steel sheetpile	type II lin.m			75,000	Import				
10)	steel sheetpile	type I-A lin.m	2,043			import	at Ilagan District office			
11)	reinforced concrete sheet pile	lin.m			3,500	Local at Cagayan				
12)	light oil	lit.	16	0.32	15	Local at Cagayan				
13)	gasoline	lit.	20	0.40	20	Local at Cagayan				
14)	lubricants	lit.	105		85	Local at Cagayan				
15)	wooden materials	m3			15,000	Local at Cagayan				
16)	bitumen	ton	2,000		20,000	Local at Cagayan				
17)	ready mixed concrete, 25 Mpa	m3	4,800		3,500	Local at Cagayan				
18)	ready mixed concrete, 15 Mpa	m3			3,000	Local at Cagayan				
19)	ready made RC pile, 400 x 400 mm	lin.m	1,800		3,500	Local at Cagayan				
20)	gabion cilinder, 90 cm	lin.m			3,000					
21)	gabion, rectangular, H=60 cm	lin.m			3,000					
22)	tree for river forest, Balete, Acacia, Tamarind	pc.			300					
B2-2	Labor charge	unit	unit rate (P) by DPWH	equiv. US\$	unit charge by AAA Contractor	origin				
1)	foreman, local	m.day	377		400					
2)	operator for heavy equipment, local	m.day	261.4		350					
3)	driver for vehicles, local	m.day	261.4		250					
4)	skilled labor, local	m.day	261.4		300					
5)	unskilled labor, local	m.day	220		150					
6)	foreman, foreign	m.day	20,000	400	20,000					
7)	technician, foreign	m.day	15,000	300	15,000					
8)	operator for heavy equipment, foreign	m.day	12,500	250	12,500					

Table 4.2.17 Unit Prices for Labor, Materials, Equipment and Other Data Surveyed at Site in June 2001 (5/5)

US\$1.0=P 50.0

Plan and Cost estimate on the F/S of Flood Control Project for the Lower Cagayan Riv

Survey Items / Propose Plans		Suevey Results				
		unit	unit rate (P) by DPWH	equiv. US\$	unit cost by AAA Contractor	origin
B2-3	Equipment cost					
1)	bulldozer, 12 tons class	hour	3,115		3,854	
2)	swamp bulldozer, 21 tons class	hour			3,854	
3)	backhoe, 0.6 m ³ class	hour	1,459		2,755	
4)	backhoe, 1.2 m ³ class	hour	2,959		3,250	
5)	tractor shovel, 2.0 m ³ class	hour			3,000	
6)	wheel loader, 2.0 m ³ class	hour	777		1,278	
7)	dump truck, 8 tons class	hour	807		950	
8)	dump truck, 11 tons class	hour	1,004		1,180	
9)	cargo truck, 6 tons class	hour	870		1,500	
10)	road roller, 8-10 tons class	hour	1,273		1,362	
11)	sheeps foot roller, 22 tons class	hour	2,750		1,200	
12)	motor grader, 3.7 m class	hour	817		1,500	
13)	sprinkler truck, 6 kl	hour			1,265	
14)	portable concrete mixer, 0.5 m ³ class	hour	173		500	
15)	agitator truck, 4.5 m ³ class	hour			550	
16)	concrete pump car, 50 m ³ /hr class	hour	1,377		850	
17)	truck crane, 10 tons class	hour	521		990	
18)	truck crane, 20 tons class	hour	938		1,709	
19)	submersible pump, 4" class	day	248		1,200	
20)	submersible pump, 6" class	day	357		1,800	
21)	diesel generator, 30 kVA class	day	22,842		11,500	
22)	diesel generator, 100 kVA class	day	30,340		15,500	
23)	diesel pile hammer, 2.5 tons class	day			18,000	
24)	diesel pile hammer, 4 tons class	day	5,856			
25)	vibration hammer, 40 kW class	day	9,584		12,500	
26)	air compressor, 6 m ³ /min. class	day	4,472		6,800	
27)	truck trailer, 40 tons class	day	10,000 (5,000 DPWH's)		18,000	
B2-4	Charge of public services	unit	unit rate (P)	equiv. US\$	notes	origin
1)	power tariff	kwh	3.5		10	
2)	water charge	m ³			25	
B3	Rates for indirect cost	unit				
1)	Contractor's overhead and profit (make-up)	%	10-12		23.0 of direct cost	
	(indirect cost □□□□□□□□22% for material, 32% for labor and equipment against direct cost)					
2)	VAT	%	10		9.5 of direct cost	
3)	Contractor's all risk insurance	%			1.0 of direct cost	
4)	physical contingency	%	10 for FC & LC (4% DPWH R2)			
5)	price contingency	%	2 for FC & LC (5% DPWH R2)			
6)	engineering services expenses	%	15.0			
7)	administartion expenses for executing agency	%	5.0			
8)	interest during construction	%	2.0			

Table 4.2.18 Cost Sharing of Phase 1 (Implementation Period : 2002-2007

Measures / Project Cost Items		Unit	Q'ty	Cost total Pesos million	Expected Cost Sharing for Phase 1 (Pesos millior															Implement- ation Timing		
					National Gov't		Local Government Units (Municipality/City) by Local Currency Portio										PAGASA					
					FC	LC	Apari	Camalagan	Allapan	Lallo	Gattaran	Lasam	S.Nino	Alcala	Amulung	Iguig	Solana	Tuguegarao	Enrile		FC	LC
A Flood Control (River mouth to Magapit)																						
A1	Structural Measures																					
A1-1	Urgent bank protection works																					
	1) Construction execution, bank protection	site	21	540.0	270	270	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2002-2005
A1-2	Left & Right Dike Systems																					
	1) Construction execution, main works	km	43.3	1,043.0	690	353	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2002-2007
	2) Construction execution, tree zone, river mouth to Cabagan, W30 m (along Dikes)	km	61.7	19.2	0	0	0	0	0	2	0	0	0	0.9	4.2	4.2	0.0	5.9	2.0	0	0	2002-2007
	sub total, A1-1+A1-2 including VAT			1,762.4	960	783	0	0	0	2	0	0	0	0	(3 km)	(14 km)	(14 km)	(19.8 km)	(6.5 km)	0	0	0
A1-3	Government administration expenses	LS	1	48.0	0	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A1-4	Engineering services expenses	LS	1	190.0	152	38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A1-5	Price and physical contingencies	LS	1	422.0	183	239	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A1-6	Land acquisition and compensation, river main works	LS	1	24.0	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2002-2004
A1-7	Land acquisition & compensation, tree zones, river mouth to Cabagan, W30 m	LS	1	31.0	0	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total, A1-1 to A1-7			2,477.4	1,295	1,163	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
A2	Non-structural Measures																					
A2-1	Cost for evacuation system																					
	1) FFWS	LS	1	143.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	129.0	14.3	2002-2007
	2) Evacuation center, tents, deepwell, confort room & cookin facilities	LS	1	138.3	0	0	5.5	5.6	1.6	22.9	3.8	1.2	5.7	1.2	15.3	5.4	55.1	9.8	5.2	0	0	2002-2007
	3) Evacuation center, preparation & updating of disaster preparedness plan	LS	1	13.5	0	13.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2002-2007
	4) Evacuation center, education & training of DOC staff & local people	LS	1	26.4	0	26.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2002-2007
	sub total, A2-1			321.5	0	39.9	5.5	5.6	1.6	22.9	3.8	1.2	5.7	1.2	15.3	5.4	55.1	9.8	5.2	129.0	14.3	
A2-2	Cost for resettlement																					
	1) Land acq. & compensation of resettlement area	LS	1	23.9	0	0	10.6	4.3	0.0	9.0	0	0	0	0	0	0	0	0	0	0	0	2002-2004
	2) Resettlement area development	LS	1	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2002-2004
	3) Public facilities construction	LS	1	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2002-2004
	sub total, A2-2			23.9	0	0	10.6	4.3	0.0	9.0	0	0	0	0	0	0	0	0	0	0	0	0
	Total, A2-1+A2-2			345.4	0	39.9	16.1	9.9	1.6	31.9	3.8	1.2	5.7	1.2	15.3	5.4	55.1	9.8	5.2	129.0	14.3	
A3	Supporting Measures																					
	1) Institutional establishment and implementation structures	LS	1	30.0	24.0	6.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2002-2007
	Total, A1+A2+A3, Phase 1			2,852.8	1,319.0	1,209.1	16.1	9.9	1.6	33.9	3.8	1.2	5.7	1.2	15.3	5.4	55.1	9.8	5.2	129.0	14.3	
B Irrigation																						
B1	Structural Measures																					
B1-1	AAWPIP, stage 1	ha	4,090	902.0	450	452	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2004-2007
	VAT			90.2	0	90.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	sub total			992.2	450	542.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B1-2	Land acquisition and compensation	ha	204	19.0	0	19.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2003-2005
B1-3	Government administration expenses	LS	1	27.0	0	27.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B1-4	Engineering services expenses	LS	1	108.0	87.0	21.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B1-5	Price and physical contingencies	LS	1	268.0	100.0	168.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total, B1			1,414.2	637.0	777.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B2	Non-structural Measures																					
B3	Supporting Measures																					
B3-1	Rice mill and drying yard	LS	1	210.0	126.0	84.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2002-2007
B3-2	Land acquisition and compensation	ha	4	0.6	0.0	0.0	0	0	0	0	0	0	0	0.3	0.3	0	0	0	0	0	0	2003-2005
	sub total, B3			210.6	126.0	84.0	0	0	0	0	0	0	0	0.3	0.3	0	0	0	0	0	0	0
	Total, B1+B2+B3, Phase 1			1,624.8	763.0	861.2	0	0	0	0	0	0	0	0.3	0.3	0	0	0	0	0	0	0
Grand Total, A + B				4,477.6	2,082.0	2,070.3	16.1	9.9	1.6	33.9	3.8	1.2	5.7	1.5	15.6	5.4	55.1	9.8	5.2	129.0	14.3	

Table 4.2.20 Cost Sharing of Phase 3 (Implementation Period : 2007-2015)

Measures / Project Cost Items		Unit	Q'ty	Cost total Pesos million	Expected Cost Sharing for Phase 1 (Pesos million)														Implementation Timing		
					National Gov't		Local Government Units (Municipality/City) by Local Currency Portion														
					FC	LC	Apari	Camalagan	Allapan	Lallo	Gattaran	Lasam	S.Nino	Alcala	Amulung	Iguig	Solana	Tuguegarao		Enrile	
A Flood Control (Reach from Amulung to Tuguegarao)																					
A1	Structural Measures																				
A1-1	Left & Right Dike Systems, Alcala-Buntun & Iguig Dike, and Sansidorto COC																				
	1) Construction execution, main works	km	39.7	2,857.0	1,886	971	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2011-2015
	2) Construction execution, tree zone, W=30 m (along Alcala-Buntun Dike)	km	31.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2002-2007
	sub total, A1-1 including VAT			3,142.7	1,886	1,257	0	0	0	0	0	0	0	0	3 km	14 km	14 km	0	0	0	0
A1-2	Government administration expenses	LS	1	86.0	0	86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A1-3	Engineering services expenses	LS	1	343.0	274	69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A1-4	Price and physical contingencies	LS	1	497.0	262	235	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A1-5	Land acquisition and compensation	LS	1	27.0	0	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total, A1-1 to A1-5			4,095.7	2,422	1,674	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A2	Non-structural Measures																				
A2-1	Cost for evacuation system																				
	1) FFWS	LS	1	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2) Evacuation center, tents, deepwell, confort room & cookin facilities	LS	1	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3) Evacuation center, preparation & updating of disaster preparedness plan	LS	1	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4) Evacuation center, ecucation & training of DOC staff & local people	LS	1	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	sub total, A2-1			0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A2-2	Cost for resettlement																				
	1) Land acq. & compensation of resettlement area	LS	1	356.2	0	0	0	0	0	0	0	0	0	148.1	160.5	47.6	0	0	0	0	2007-2010
	2) Resettlement area development	LS	1	122.2	0	0	0	0	0	0	0	0	0	59.0	62.7	0.5	0	0	0	0	2007-2010
	3) Public facilities construction	LS	1	39.5	0	0	0	0	0	0	0	0	0	21.5	18.0	0.0	0	0	0	0	2007-2010
	sub total, A2-2			517.9	0	0	0	0	0	0	0	0	0	228.6	241.2	48.1	0	0	0	0	
	Total, A2-1+A2-2			517.9	0	0.0	0	0	0	0	0	0	0	228.6	241.2	48.1	0	0	0	0	
A3	Supporting Measures																				
	1) Institutional establishment and implementation structures	LS	1	30.0	24.0	6.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2007-2015
	Total, A1+A2+A3, Phase 3			4,643.6	2,446.0	1,679.7	0	0	0	0	0	0	0	0	228.6	241.2	48.1	0	0	0	
B Irrigation, Stage 2																					
B1	Structural Measures																				
B1-1	AAWPPI, stage 2	ha	2,970	560.0	280.0	280.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2011-2015
	VAT			56.0	0.0	56.0															
	sub total			616.0	280.0	336.0															
B1-2	Land acquisition and compensation	ha	125	12.2	0.0	12.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2009-2012
B1-3	Government administration expenses	LS	1	17.0	0.0	17.0															
B1-4	Engineering services expenses	LS	1	67.0	54.0	13.0															
B1-5	Price and physical contingencies	LS	1	105.0	51.0	54.0															
	Total, B1			817.2	385.0	432.2															
B2	Non-structural Measures																				
B3	Supporting Measures																				
B3-1	Rice mill and drying yard	LS	1	157.0	94.0	63.0															
B3-2	Land acquisition and compensation	ha	3	0.5	0.0	0.0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	2009-2012
	sub total, B3			157.5	94.0	63.0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	
	Total, B1+B2+B3			974.7	479.0	495.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	
	Grand Total, A + B			5,618.3	2,925.0	2,174.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	229.1	241.2	48.1	0.0	0.0	0.0	0.0	

Table 4.2.22 Evacuation Center, Cost Sharing by Each City/Municipality and Timing of Implementation by Local Currency Portion

No.	City/ Municipality	Phase and Timing of Implementation	(1) Tents			(2) Deepwells			(3) Confort rooms			(4) Cooking Facility			Total Cost (P mil.)
			Unit	Q'ty	Cost (P mil.)	Unit	Q'ty	Cost (P mil.)	Unit	Q'ty	Cost (P mil.)	Unit	Q'ty	Cost (P mil.)	
1	Aparri	1 (2002-2004)	set	0	0	no.	15	1.4	no.	115	4.0	no.	320	0.2	5.5
2	Camalaniugan	1 (2002-2004)	set	28	1.3	no.	18	1.7	no.	67	2.3	no.	541	0.3	5.6
3	Allacapan	1 (2002-2004)	set	0	0	no.	4	0.4	no.	30	1.0	no.	270	0.2	1.6
4	Lallo	1 (2002-2004)	set	269	12.4	no.	46	4.2	no.	161	5.6	no.	1,239	0.7	22.9
5	Gattaran	1 (2002-2004)	set	0	0	no.	16	1.5	no.	60	2.1	no.	398	0.2	3.8
6	Lasam	1 (2002-2004)	set	0	0	no.	0	0.0	no.	32	1.1	no.	210	0.1	1.2
7	Sto. Nino	1 (2002-2004)	set	0	0	no.	32	2.9	no.	79	2.7	no.	122	0.1	5.7
8	Alcala	1 (2002-2004)	set	0	0	no.	4	0.4	no.	20	0.7	no.	211	0.1	1.2
9	Amulung	1 (2002-2004)	set	137	6.3	no.	30	2.8	no.	162	5.6	no.	1,149	0.7	15.3
10	Iguig	1 (2002-2004)	set	39	1.8	no.	11	1.0	no.	67	2.3	no.	572	0.3	5.4
11	Solana	1 (2002-2004)	set	731	33.6	no.	68	6.2	no.	402	13.9	no.	2,370	1.4	55.1
12	Tuguegarao	1 (2002-2004)	set	0	0	no.	13	1.2	no.	217	7.5	no.	1,904	1.1	9.8
13	Enrile	1 (2002-2004)	set	0	0	no.	14	1.3	no.	100	3.5	no.	874	0.5	5.2
	total			1,204	55.4		271	24.9		1,512	52.2		10,180	5.9	138.4

Cost items of evacuation center and its estimate method

- 1 Purchase of tents : unit cost basis as above
- 2 Construction of deep wells : unit cost basis as above
- 3 Construction of confort room: : unit cost basis as above
- 4 Purchase of cookin facilities: : unit cost basis as above
- 5 Preparation and updating of disaster preparedness plan : M/M basis
- 6 Education and training of DOC staff and local people : yearly and M/M basis

Table 4.3.1 Direct Construction Cost for Alcala Amulung West Pump Irrigation Project, Stage 1 (4,090 ha)

Work item	Unit	Quantity		Total	Cost (US\$)		Cost (Phil. Peso)		Remarks	Stage 1	Stage 2
		Phase I	Phase II		Unit	Amount	Unit	Amount			
stage 1 4,090 ha (2002-2007) USS 1 = PHP 50 stage 2 2,970 ha (2007-2015)											
1. General Item											
(1) Mobilization/demobilization	L.S.										
(2) Temporary works	L.S.										
(3) Preparatory works	L.S.										
(4)	L.S.										
2. AAWPPP Pump Station											
2.1 Civil works											
(1) Excavation (rock)	m3	20000		20,000			429	8,580,000		8,580	
(2) Backfill	m3	14000		14,000			110	1,540,000		1,540	
2.2 Electro-Mechanical works											
(1) Transmission line with tower	L.S.		1	1			18,500,000	18,500,000	5km, 2 towers	18,500	
(2) Sub-station	L.S.										
(3) Pump & Motor with appurtenant	L.S.						10,000,000	500,000,000		270,000	180,000
(4) Screen	L.S.										
(5) Desilting facilities	L.S.										
2.3 Building and concrete works											
(1) Pump house	L.S.										
(2) Pump sump: concrete "A"	m3	1200		1,200			7,586	9,103,200		9,103	
3. Booster Pump Station											
3.1 Civil works											
(1) Excavation (rock)	m3	300		300				429	128,700	129	
(2) Backfill	m3	50		50				110	5,500	6	
3.2 Electro-Mechanical works											
(1) Transmission line	km		15	15				2,500,000	37,500,000	37,500	
(2) Sub-station	L.S.										
(3) Pump & Motor with appurtenant	L.S.						2,500,000	125,000,000		67,500	45,000
(4) Screen	L.S.										
2.3 Building and concrete works											
(1) Pump house	L.S.										
(2) Pump sump: concrete "A"	m3	120		120			7,586	910,320		910	
4. Main Irrigation System											
4.1 Main Canal (MC) I: 27.50km, II: 0.00km											
(1) Excavation (indurated)	m3	825,000		825,000			81	66,825,000		66,825	
(2) Embankment	m3	824,000		824,000			44	36,256,000	side borrow	36,256	
(3) Concrete lining (Class "B")	m3	28,300		28,300			3,025	85,607,500		85,608	
(4) Concrete pavement	m3	-		-			3,025	-		-	
(5) Gravel pavement	m3	24,800		24,800			346	8,580,800		8,581	
4.2 Related structure for MC											
(1) Head gate	no.			10							
(2) Turnout	no.			40							
(3) Syphon	L.S.			1				20,384,000	2nos	20,384	
(4) Culvert	L.S.			1				8,666,000		8,666	
(5) Bridge	m2		2,000	2,000	400	800,000	20,000	40,000,000		36,000	
(6) Cross drain	no.			39							
(7) Others	L.S.			1				20,715,000	20% of total	13,010	
4.3 Lateral & Sub Lateral Canals (LC/SLC) I: 29.45km, II: 32.30km											
(1) Excavation (common)	m3	120,400	144,400	264,800			47	12,445,600		5,659	6,787
(2) Embankment	m3	614,200	624,700	1,238,900			122	151,145,800	I/2: 6km	74,932	76,213
(3) Concrete lining (Class "B")	m3	11,900	10,700	22,600			3,025	68,365,000		35,998	32,368
(4) Concrete pavement	m3	-	-	-			3,025	-		-	
(5) Gravel pavement	m3	18,300	18,800	37,100			346	12,836,600		6,332	6,505
4.4 Related structure for LC											
(1) Head gate	no.			9							
(2) Turnout	no.			100							
(3) Syphon	L.S.			1				10,548,400		5,125	5,423
(4) Culvert	L.S.			1				2,610,000		2,152	458
(5) Cross drain	no.			25							
(6) Others	L.S.							77,385,420	20% of total	26,040	25,551
(7)											
5. On-farm System											
(1) Farm Ditch & Drain with related structure	ha			7,060			6,200	43,772,000		25,358	18,414
(2)											
(3) Land levelling	ha			150			47,500	7,125,000			7,125
6. Main Drainage System											
6.1 Main & Lateral Drains (MD-I: 7.60km, II: 0.70km, LD-I: 19.70km, II: 7.50km)											
(1) Excavation (common)	m3			492,000			47	23,124,000		20,000	3,124
(2) Masonry	m3										
(3) Gabion	m3			100	40	4,000	2,000	200,000			180
6.2 Related structure											
(1) Culvert	no.			50			433,000	21,650,000		11,650	10,000
(2)											
7. Pangul River Training											
7.1 Cut-off channel											
(1) Excavation (common)	m3		1,620,000	1,620,000			47	76,140,000			76,140
(2) Gabion	m3		200	200	40	8,000	2,000	400,000			360
(3) Bridge	m2		400	400	400	160,000	20,000	8,000,000			7,200
7.2 Flood dike											
(1) Embankment	m3		378,000	378,000			122	46,116,000	I/2: 6km		46,116
(2) Sluice	no.		1	1							
Total 1 to 7										902,343	546,963
8. Supprting Measures											
(1) Rice Mill, 5 t/hr	no.	4	3	7			50,000,000	350,000,000		200,000	150,000
(2) Drying yard, lean concrete t= 5 cm	m2	97,000	73,000	170,000			100	17,000,000		9,700	7,300
										1,112,043	704,263

Table 4.5.1 Annual Operation and Maintenance Costs for Flood Control Projects, Phase 1 in 4 Phases

unit: million

		Direct construction cost (Pesos)	O&M Costs Pesos	equivalent US\$	notes
A	Structural measures				
	Phase 1	1,585	7.93	0.16	0.5 % of direct construction cost
	Phase 2	1,460	7.30	0.15	0.5 % of direct construction cost
	Phase 3	2,868	14.34	0.29	0.5 % of direct construction cost
	Phase 4	3,696	18.48	0.37	0.5 % of direct construction cost
	sub total		48.05	0.96	
B	Non-structural measures				see Table 4.2.8 (2/2)
	Phase 1	320	6.39	0.13	2 % of construction cost (combined figure of 3 %
	Phase 2	652	13.04	0.26	for FFWS, 2 % of evacuaion center and 1 %
	Phase 3	289	5.78	0.12	of resettlement)
	Phase 4	96	1.92	0.04	
	sub total		27.13	0.54	
	total		75.17	1.50	

Table 4.5.2 Annual Operation and Maintenance Cost for AAWPIP

Unit: Pesos million

	Stage 1 in Phase 1	Stage 2 in Phase 3	Stage 1 and 2	Notes
1 Power cost				
1) Main Pump Station	18.4	13.4	31.8	see breakdown
2) Booster Pump Station	1.9	2.2	4.1	
2 OM cost for pump,				
3 irrigation & drainage systems,	10	5	15	
4 rice mill and others (around 1 %)				
Total	30.3	20.6	50.9	

Breakdown for power cost

(irrigation demand = 2,400 mm/year)

	Intake Pump stage 1		Booster Pump		2.4
		stage 1 and 2	stage 1	stage 1 & 2	
Area (ha)	4,090	7,060	1,700	3,660	
Volume (mcm)	98.16	169.44	40.8	87.84	
Q (m3/s)	6.96	12.29	2.88	6.41	
Q (m3/min)	418	737	173	385	
time (1,000 min.)	235	230	236	228	
time (hour)	3,918	3,830	3,935	3,807	
Head (m)	20	20	5	5	
Power (kW)	1,957	3,456	202	451	0.163 1.15 0.8
Pxhr(MWH)	7,667	13,234	797	1,715	
Unit Cost (Peso/kWH)	2.4	2.4	2.4	2.4	
Operation cost (Pesos million)	18.4	31.8	1.9	4.1	

*The Feasibility Study of the Flood Control Project for
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Figures

Descriptions	Unit	Q'ty	Year (2002 - 2020)																	
			02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
Flood control projects																				
1 Feasibility Study	LS	1	■		■			■				■								
2 Financial Arrangement	LS	1	■		■			■				■								
3 Selection of Consultant	LS	1	■		■			■				■								
4 Tender Design	LS	1	■	■	■		■	■		■		■		■						
5 Tendering Procedures	LS	1	■	■	■		■	■		■		■		■						
6 Development of Resettlement Area and Evacuation	LS	1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
7 Land Acquisition and Compensation	LS	1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
8 Construction Supervision	LS	1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
9 Construction, Structure Measures																				
Phase 1 (2002-2007)																				
1) Urgent bank protection works	site	21		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
2) Left & right dike systems w/tree zone, from R. Mouth to Magapit (Mabanguc 11.3 km, Catugan 6 km, Camalaniugan 13.1 km, Lal-lo 12.9 km)	km	43.3		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Phase 2 (2004-2011)																				
1) Left & right dike systems w/tree zone, from Magapit to Nassiping (Lasam 8 km, Gataran 6.1 km, Nassiping 9.7 km)	km	23.8						■	■	■	■	■	■	■	■	■	■	■	■	■
2) Amulung dike system w/tree zone, from Nassiping to Amulung (Amulung 11.6 km)	km	11.6						■	■	■	■	■	■	■	■	■	■	■	■	■
3) Gabut cut-off channel, 4,620,000 m3	km	0.7						■	■	■	■	■	■	■	■	■	■	■	■	■
Phase 3 (2007-2015)																				
1) Alcala-Buntun dike system w/tree zone, from Amulung to Tuguegarao (Alcala-buntun 34 km, Iguig 4.1 km)	km	38.1																		
2) San Isidoro cut-off channel, 9,560,000 m3	km	1.6																		
Phase 4 (2011-2020)																				
1) Tuguegarao and Enrile dike systems w/tree zone, from Tuguegarao to Cabagan (Tuguegarao 21.3 km, Enrile 12.2 km)	km	33.5																		
2) Tuguegarao cut-off channel, 19,130,000 m3	km	5.8																		
10 Related Non-structural & Supporting Measures	LS	1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

Descriptions	Unit	Q'ty	Year (2002 - 2020)																	
			02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
Flood control projects																				
1 Feasibility Study	LS	1	■				■					■								
2 Financial Arrangement	LS	1	■				■					■								
3 Selection of Consultant	LS	1	■	■			■					■								
4 Tender design	LS	1		■	■			■				■								
5 Tendering procedures	LS	1		■	■			■				■								
6 Development of Resettlement Area and Evacuation	LS	1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
7 Land Acquisition and Compensation	LS	1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
8 Construction supervision	LS	1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
9 Construction, Structure Measures			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Phase 1 (2002-2007)																				
1) Urgent bank protection works	site	21		■	■	■	■	■	■											
2) Left & right dike systems w/tree zone, from R. Mouth to Magapit (Mabangue 11.3 km, Catugan 6 km, Camalaniugan 13.1 km, Lal-lo 12.9 km)	km	43.3		■	■	■	■	■	■											
3) Left & right dike systems w/tree zone, from Magapit to Nassiping (Lasam 8 km, Gataran 6.1 km, Nassiping 9.7 km)	km	23.8		■	■	■	■	■	■											
4) Gabut cut-off channel, 4,620,000 m3	km	0.7		■	■	■	■	■	■											
Phase 2 (2006-2013)																				
1) Amulung dike system w/tree zone, from Nassiping to Amulung (Amulung 11.6 km)	km	11.6									■	■	■	■	■	■	■	■	■	■
2) Alcala-Buntun dike system w/tree zone, from Amulung to Tuguegarao (Alcala-buntun 34 km, Iguig 4.1 km)	km	38.1									■	■	■	■	■	■	■	■	■	■
3) San Isidoro cut-off channel, 9,560,000 m3	km	1.6									■	■	■	■	■	■	■	■	■	■
Phase 3 (2011-2020)																				
1) Tuguegarao and Enrile dike systems w/tree zone, from Tuguegarao to Cabagan (Tuguegarao 21.3 km, Enrile 12.2 km)	km	33.5																	■	■
2) Tuguegarao cut-off channel, 19,130,000 m3	km	5.8																	■	■
10 Related Non-structural & Supporting Measures	LS	1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

	Descriptions	Unit	Q'ty	1 2002	2 2003	3 2004	4 2005	5 2006	6 2007
A	Flood Control Projects								
	1 Feasibility Study	LS	1	■					
	2 Financial Arrangement	LS	1	■					
	3 Selection of Consultant	LS	1	■					
	4 Tender Design	LS	1		■				
	5 Tendering Procedures	LS	1		■				
	6 Land Acquisition and Compensation	LS	1	■	■				
	7 Construction Supervision	LS	1			.....	.....	.....	.....
	8 Construction, Structure Measures	LS	1						
	1) Urgent bank protection works	site	21		■	■			
	2) River bank tree zones	km	70		■	■	■	■	■
	3) Left dike systems, river mouth to Magapit	km	25.3			■	■	■	■
	4) Right dike systems, river mouth to Magapit	km	41.8			■	■	■	■
	9 Related Non-structural & Supporting Measures	LS	1	.....	.....	.....	.....	.....	.....
B	Irrigation project (AAWPIP stage 1)								
	1 Review of Feasibility Study	LS	1	■					
	3 Financial Arrangement	LS	1	■					
	4 Selection of Consultant	LS	1	■					
	5 Tender Design	LS	1		■				
	6 Tendering Procedures	LS	1		■				
	7 Development of Resettlement Area and Evacuation	LS	1	■	■				
	8 Land Acquisition and Compensation	LS	1	■	■				
	9 Construction Supervision	LS	1			.....	.....	.....	.....
	10 Construction, Structure Measures								
	1) AAWPIP, stage 1	ha	4,000			■	■	■	■
	11 Related Non-structural Measures	LS	1	.....	.....	.....	.....	.....	.....

The Feasibility Study of the Flood Control Project
 for the Lower Cagayan River
 in the Republic of the Philippines
 JAPAN INTERNATIONAL COOPERATION AGENCY

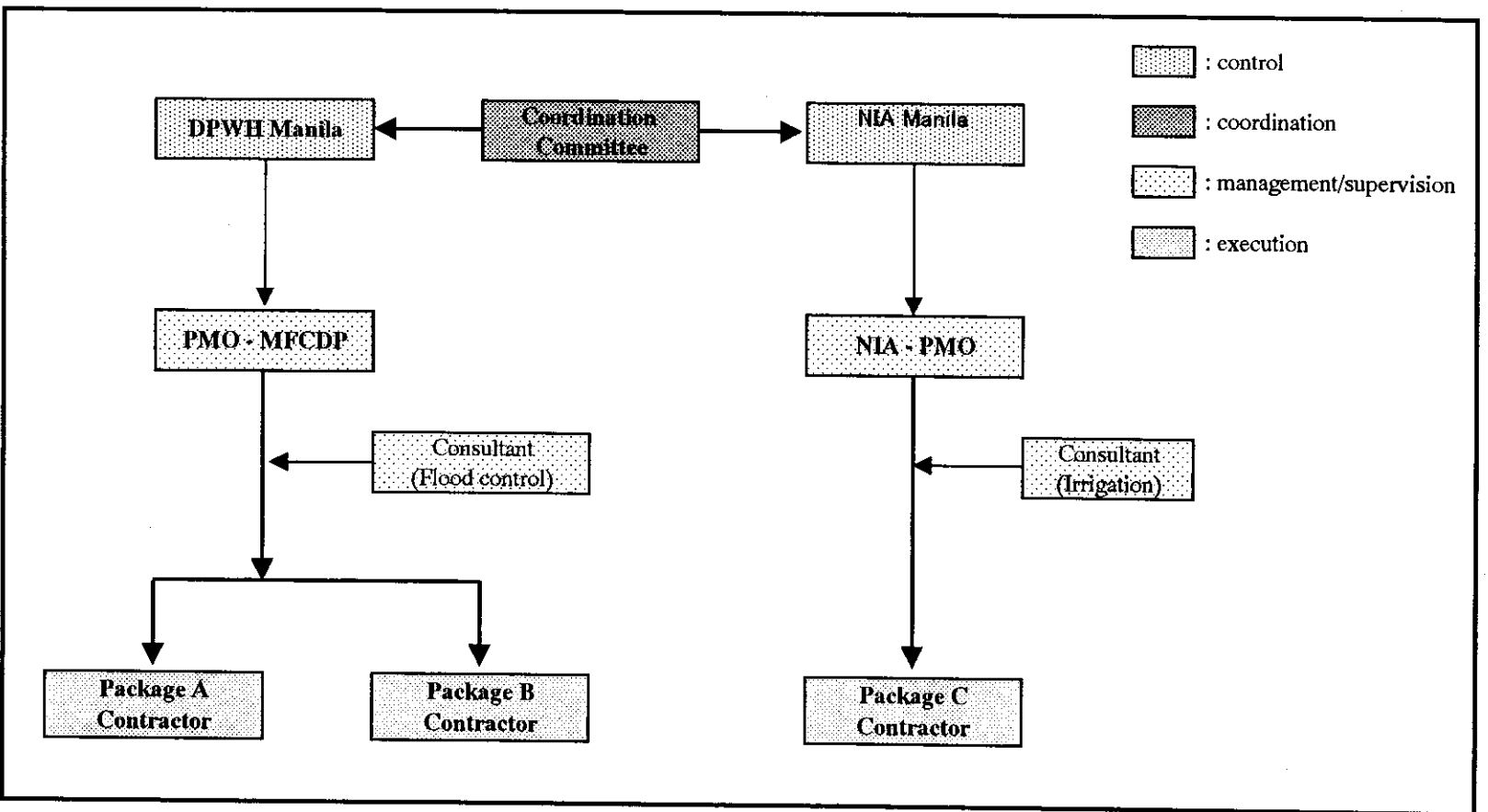
Figure 2.2.3 Implementation Schedule for the
 Lower Cagayan Flood Control Project, Phase 1
 (2002-2007) in 4 Phases including AAWPIP Stage 1

No.	Sub Projects /Construction Items	Unit	Q'ty	1 2002	2 2003	3 2004	4 2005	5 2006	6 2007
1	Urgent bank protection works	site	21		■	■	■		
2	River bank tree zones	km	70		■	■	■	■	■
3	Left dike systems in the lowermost from Rivermouth to Magapit	km	25.3						
	1) Preparatory works					■			
	2) Dike embankment, Mabanguc, l = 11.3 km	m3	1,196,000			■	■	■	■
	3) Dike embankment, Catugan Sur, l = 6.0 km	m3	812,000			■	■	■	■
	4) Maintenance road, Mabanguc	m2	43,500				■	■	■
	5) Maintenance road, Catugan Sur	m2	29,500				■	■	■
	6) Tree zone	m2	132,000			■	■	■	■
	7) Culvert, Mabanguc	set	17				■	■	■
	8) Culvert, Catugan Sur	set	9				■	■	■
4	Right dike systems in the lower most from river mouth to Nassiping	km	42						
	1) Preparatory works					■			
	2) Dike embankment, Camalaniugan, l = 13.1 km	m3	1,150,000			■	■	■	■
	3) Dike embankment, Lal-lo, l = 12.9km	m3	1,039,000			■	■	■	■
	6) Bank protection (wet masonry), Camalaniugan	m2	26,200				■	■	■
	7) Bank protection (wet masonry), Lal-lo	m2	6,900				■	■	■
	8) Spur dike, Aparri	m3	19,000				■	■	■
	9) Culvert, Camalaniugan	set	19				■	■	■
	10) Culvert, Lal-lo	set	19				■	■	■
6	Related non-structural measures	LS	1	■	■	■	■	■	■

No.	Construction Items	Unit	Q'ty	1 2002	2 2003	3 2004	4 2005	5 2006	6 2007
1	Preparatory works	LS	1			■			
2	AAWPIP Intake pump station								
	1) Civil works	LS	1			■	■		
	2) Electro-mechanical works	LS	1			design, manufacture, procurement		■	■
	3) Building and concrete works	LS	1			■	■		
3	AAWPIP booster pump station								
	1) Civil works	LS	1			■	■		
	2) Electro-mechanical works	LS	1			design, manufacture, procurement		■	■
	3) Building and concrete works	LS	1			■	■		
4	Main irrigation system								
	1) Main canal	km	27.5			■	■	■	■
	2) Related structure for main canal	LS	1			■	■	■	■
	3) Lateral canal	km	30			■	■	■	■
	4) Related structures for lateral canal	LS	1			■	■	■	■
5	On-farm system								
	1) Farm ditch	LS	1			■	■	■	■
6	Main drainage system								
	1) Main drain	km	7.6			■	■	■	■
	2) Related structures	LS	1			■	■	■	■
7	Pungul river ytraining								
	1) Short cut as floodway	LS	1			■	■	■	■
	2) Flood dike	LS	1			■	■	■	■
8	Related non-structural measures	LS	1	■	■	■	■	■	■

The Feasibility Study of the Flood Control Project
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Figure 2.3.1 Construction Time Schedule for
Alcala Armilung West Pump Irrigation Project, Stage
1 (4,090 ha) in Phase 1 (2002 - 2007) in 4 Phases



**Figure 2.3.2 Contract Basis Implementation
Organization for the Lower Cagayan River
Flood Control Project, Phase 1 (2002-2007)**

*The Feasibility Study of the Flood Control Project for
the Lower Cagayan River in the Republic of the Philippines
Final Report
Supporting Report*

ANNEX X : PROJECT EVALUATION

THE FEASIBILITY STUDY OF
THE FLOOD CONTROL PROJECT FOR THE LOWER CAGAYAN RIVER IN
THE REPUBLIC OF THE PHILIPPINES

FINAL REPORT

Volume III-2 SUPPORTING REPORT

ANNEX X PROJECT EVALUATION

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PART-A ENVIRONMENT

PART-1 GENERAL

CHAPTER 1 NATURAL ENVIRONMENT

Based on the existing data, 298 species of terrestrial flora and 182 species of terrestrial fauna were recorded in the whole Cagayan River basin. Most of which are common ones including more than 40 of those registered in CITES List and/or Red List of IUCN. The results of on-site survey conducted in the lower and middle portion of the basin showed that there were six endangered or rare species. There are around 40 nekton species recorded in the Cagayan River system. Out of them, the Ludong (*Cestraeus plicatilis*) is the most vulnerable one. It is reported that the habitat and the population of it have been decreasing to excessive fishing. It is not registered in the Red List of IUCN but is being threatened with extinction. There are 18 protected areas in the Cagayan River basin, most of which are apart enough from the river channel in the lower Cagayan area.

The results of water sampling and quality test showed that river water quality of the river is, as a whole, at good condition with low concentration of BOD (mostly, less than 2 mg/l) and high DO (mostly, more than 7 mg/l) and so on. It was revealed, however, that the river water is contaminated by coliform bacteria. The groundwater along the river has the same tendency as that of river water. Regarding ambient air and noise, there is no serious issue on their quality in terms of pollution.

CHAPTER 2 SOCIAL ENVIRONMENT

The Cagayan is providing good fishing grounds for local people. Most of fisher folks work as farmers at the same time. At least 18 routes for navigation currently exist in the lower Cagayan River, including 3 routes of car ferry boat. The draft depth of them is less than 1 m according to the interview survey. There are 1,584 of water permit grantees registered in the Cagayan Valley as of 1999. Sources of water intake are surface water and groundwater, and the registration is managed by NWRB. There are many historical and cultural heritage in the Cagayan Valley, most of which are churches constructed during the era of Spanish colony. Rice Terraces located in Ifugao Province is another one registered in the World Heritage List of UNESCO.

Public health and sanitation has been remarkably improved in recent years, but there are still such problems as high morbidity and mortality of water related disease. Insufficient access rate to safety water and insufficient rate of sanitary toilet installation are other ones. The situation of education in terms of the performance indicators of elementary and secondary schools have been improved lately. The biggest problem on education is the lack of educational equipments at present. The problem related to flooding is that classes are disrupted during floods since schools are used as evacuation centers.

Lots of minority tribes, or indigenous people, exist in the Cagayan Valley. Most of them, however, have been assimilated into Ilocano, the majority tribe. Hence their life style and culture are not distinguished currently. There are many informal settlers, or squatters, dwelling in the Cagayan Valley. The detailed situation is not clarified due to the lack of available data. The Region 2 has high poverty incidence. Farmers are suffering from poverty problem mostly because of the low productivity of agriculture.

PART-2 REVIEW OF 1987 MASTER PLAN

CHAPTER 3 NATURAL ENVIRONMENTAL EVALUATION

In the 1987 Master Plan survey, three project components, i.e. 1) dam construction, 2) river improvement and 3) agricultural development, were proposed and examined for environmental impact assessment. In this study, the components of watershed management including reforestation and sabo dams, and resettlement under non-structural measure are added considering with their environmental effects.

Dam construction may cause the submergence of upper part of dam site, which will make all the plants growing over the area to be extinct. Dam construction would disturb the migration of some aquatic organisms including the Ludong due to the disconnection of the special connectivity of the river system. It is necessary, therefore, to conduct EIA study at the stage of Feasibility Study of the planned dam construction. Because the dam construction project incorporated in the Master Plan is not located in or around any protected area, there is no adverse effect on natural environment in it.

Construction works of flood control structures and agricultural development may cause turbid water flow, air pollution and noise in and around the construction sites or along the transportation routes. These effects, however, will not last but confined within construction phase.

CHAPTER 4 SOCIAL ENVIRONMENTAL EVALUATION

The projects in the reviewed Master Plan are aiming at social development in view of alleviation of flood risks and agricultural development. In this respect, the projects are expected to contribute to improve the social environment in Region 2. Even these projects might cause significant adverse effect unless enough considerations for minimizing the possible social impacts are given.

The navigation existing in the lower Cagayan River is so important that detailed hydrological analysis and design should be done in order to prevent or minimize the lowering of water level of the river. Regarding the existing cultural and historical heritage, there will be no impacts on them because of enough distance between the planned projects and the heritage. There would be no significant impacts on minority tribes along the Cagayan River because they have been already assimilated with Ilocano, the majority tribe. However, at the Feasibility Study stage of the dam construction, the study on minority tribes should be done for social consideration. The dam construction will create a water body, which might act as a source of water related diseases such as malaria, dengue fever. The thorough vector control and education on environmental health to local people, therefore, should be carried out following the construction.

PART-3 FEASIBILITY STUDY OF THE PRIORITY PROJECTS

Environmental Impact Assessment for the priority projects, the Lower Cagayan Flood Control Project and Alcala-Amulung Pump Irrigation Project, was conducted and the environmental evaluation was done.

CHAPTER 5 NATURAL ENVIRONMENTAL EVALUATION

The vegetation clearance accompanied by the implementation of the projects would disturb the habitat of terrestrial flora and fauna, which may cause the decrease of their population. With respect to the endangered or rare species identified during on-site survey, there would be no impacts because their habitat is not directly disturbed by the projects. The Ludong is a vulnerable species of the Cagayan River system, going downstream during October to December and going upstream during February to March. Therefore, the turbid water flow and siltation, which may be caused by excavation work, should be minimized during their migration period in particular.

The impacts on air pollution and noise will occur during construction phase in and around the construction site and along the transportation routes. These impacts will be confined within construction phase and should be mitigated by consideration of implementation plan of the construction.

As a conclusion, the proposed projects will not generate serious negative impacts. Therefore, it is considered that they have an environmental validity.

CHAPTER 6 SOCIAL ENVIRONMENTAL EVALUATION

The biggest problem caused by the implementation of the flood control project is the land acquisition for the alignment of dikes and cut-off channels as well as resettlement of households living on the acquired land. The number of households to be relocated will be 2,766 in total, composed of 343 households for the alignment of the flood control structures and 2,433 ones for being incorporated in the river area between right and left banks. The irrigation projects will also cause a small scale resettlement with nine households. The necessary actions including resettlement area development are to be undertaken by the concerned LGUs in cooperation with DPWH, NIA and the relevant government agencies such as NHA. The concerned LGUs agreed with the implementation and the necessity of the proposed projects and the resettlement of affected households. However, they are expressing some worries on the resettlement in respect of persuading the local people of relocation. Therefore, further consultation meetings for understanding of benefits and impacts of the projects are required.

As for other impacts on navigation, fisheries, water rights and public health, the magnitudes of effects are considered to be minimal.

On the contrary, the proposed projects will bring about lots of positive impacts such as the boost of local economy accompanied by the contracts on construction works and the employment of local laborers.

As a conclusion, the proposed projects have an environmental validity, but further consultation meetings with LGUs and local communities should be held.

PART B ECONOMIC EVALUATION

PART-1 GENERAL

CHAPTER 1 INTRODUCTION

In project evaluation, two quantitative analyses, i.e., (1) financial evaluation, and (2) economic evaluation, are discussed in general, in addition to evaluations through technical, social and environmental aspects. The financial evaluation is to examine a proposed project from the financial point of view, involving tests of earning capacity and financial efficiency. The economic evaluation is to examine the proposed project from the economic point of view, testing the viability of social investment in the national economy.

In order to examine earning capacity of project, the financial evaluation is examined on the basis of market values of project costs and incomes from a proposed project. The revenue accrues from beneficiaries as a compensation of services that the proposed project offers to them. Based on these cost and revenue, the projects are examined in terms of financial efficiency and evaluated taking into account of financial circumstances. However, in the case that the proposed project does not accrue any revenue directly from beneficiaries, the financial evaluation cannot be conducted generally. Flood control scheme exactly corresponds to this case. Thus, the financial evaluation is not conducted in this section.

This study consists of three parts. The respective parts include the following contents. Part 1 contains general information and data common to the review study and to the Feasibility Study. Part 2 mentions economic evaluation in the review study of the 1987 Master Plan. Part 3 presents economic evaluation in the feasibility study, particularly for flood control projects.

CHAPTER 2 BASIC CONDITIONS OF ECONOMIC EVALUATION

2.1 Basic Conditions for Economic Evaluation

Economic evaluation of the proposed projects based on economic benefit and cost is a guideline of assessing their economic viability. In terms of flood control project, economic benefit is given as the effect of reduction in annual mean flood damage to assets in and around the flood protection area. Since design flood for rivers is determined to be 25 year probable flood at the stage of the master plan, benefit corresponds to reducible amount of annual mean flood damage against 25 year probable flood. In addition, some agricultural lands will be recovered and rehabilitated for crop cultivation, which used to suffer from flood and sedimentation disasters under the condition of no effective flood control measures. The damage on irrigation facilities such as dams and canals by the habitual floods will be mitigated by the proposed projects. These effects are accounted as the project benefits.

Economic cost differs from financial cost in the sense of value judgment since the former is valued at real resource cost and the latter is resource cost valued at market prices. Thus, to estimate the economic costs of the proposed project, the financial costs which were estimated in ANNEX IX have to be converted by using conceivable adjustment.

Economic evaluation is carried out to ascertain the economic viability by comparing economic benefit and cost. As a method of project evaluation, economic internal rate of return (EIRR) is utilized as a tool of assessing economic viability to judge whether the proposed projects are to be worth being invested. Besides EIRR, net present value (NPV) and benefit-cost ratio (B/C) are presented as supplementary indices, for which costs and benefits are discounted at 15% per annum, a social discount rate in the Philippines.

2.2 Structure of Project Benefits

In a flood control project, its economic benefit is given as the effect of reduction in annual mean flood damage to public and private assets and production activities in and around the flood area. For estimation of the benefit, thus, it is the first step to identify and quantify potential flood damages in the flood prone area under without-project condition. The structure of these flood control benefits is tabulated in Table 2.2.1. In particular, the feasibility study adopts the following damage components for project benefits taking account of data availability.

They are (1) direct damages, (2) infrastructure damages and (3) indirect damages. In the Feasibility Study, the project benefits are estimated through bottom-up estimation method. The flood damages were estimated on the basis of actual distribution of damageable assets in the flood prone areas and hydrologic analysis in the Cagayan River Basin.

2.2.1 Direct Damage

The components of direct damage are selected taking existing number of facilities and data availability into consideration. They are as follows.

- 1) Residential building
- 2) Manufacturing establishment
- 3) Wholesale and retail trading establishment
- 4) Educational facility
- 5) Medical facility
- 6) Agriculture production

In terms of building property such as residence and industrial facilities, flood damage is calculated with the following formula in general: [unit property value] x [damage rate]. In a more palpable form, the direct damages to buildings, their assets and agricultural production are estimated in mesh-by-mesh through mesh analysis. They are calculated by mesh-by-mesh as follows.

$$FD = \sum_{i=1}^n \{Nh \bullet (Vh_i \bullet R_b + Vm_i \bullet R_m) + \sum_j (Vb_{ij} \bullet R_b + Va_{ij} \bullet R_a + Vs_{ij} \bullet R_s) + \sum_k (A_k \bullet V_k \bullet R_c)\}$$

Where, FD : Flood damage

Nh : Number of housing units in a mesh block (1km by 1km)

Vh : Value of housing unit

Vm : Value of household effects

Vb : Value of industrial buildings such as factories, stores & restaurants, schools and hospitals

Va : Value of depreciable assets such as equipment and machinery in the respective buildings listed above

Vs : Value of inventory stocks such as raw materials, products and semi-products in the respective buildings listed above

R_b : Damage rate of buildings

R_m : Damage rate of residential indoor movables

R_a : Damage rate of depreciable assets

R_s : Damage rate of inventory stocks

R_c : Damage rate of crop production

A_k : Cultivated area for crop production

- V_k : Value of crop
- i : Number of mesh in flood prone areas
- j : Number of industrial buildings in mesh
- k : Agricultural land status such as irrigated or rainfed
- n : Total number of meshes in flood prone areas

Although average values of the respective facilities will be discussed in the following Section 9.1, their values in economic terms were shown in Table 9.1.7. The rates of flood damage to the respective facilities are proportionate with inundation depth. These rates are also tabulated in Table 9.1.8.

2.2.2 Infrastructure Damage

Infrastructure damage has rarely been recorded sufficiently, although it is usually larger than the damage to building properties and agricultural production. The ratio of infrastructure damage to that of private property is estimated at the range of 0.37 for Tacloban project to 19.47 for Batangas Project, referring to the past flood control projects in the Philippines. In the new manual of Japan, the damage rate of infrastructures was proposed as 169% of the direct damage. The rate seems to be too large taking into account of the flood control studies in the past in the Philippines. Taking consideration of the regional condition in the basin, the ratio for this study is set at 20%. The 20% may look conservative as compared with the rates of the information above.

2.2.3 Indirect Damage

The following components of indirect damage are selected taking account of data availability.

- (a) Residence, cleaning away materials damaged after inundation
- (b) Business losses of private business establishments
- (c) Other indirect damages

After flood, a family has to clean rooms and furniture damaged by flood and to repair things damaged. These activities are done by members of the household in general. Thus, these activities are considered as loss of housekeeping, so their labor cost is estimated as a part of flood damages. Its amount is estimated as a product of daily household income multiplying the number of days spent. The number of days is enumerated in Table 9.1.8.

After flood, a damaged business establishment is closed to clean, fix and repair its workspace, furniture and equipment damaged by flood, and to clean away inventory stocks damaged. Even after these activities, its business stagnates for a few days until returning to its former state. These losses are considered as

business losses. The loss days are proportionate to inundation depth. Its amount is estimated as a product of daily value added of the business establishment multiplying the number of days closed and stagnated. The number of these days is enumerated in Table 9.1.8.

Indirect losses included the following activities in general.

- (a) Emergency activities: Emergency activities such as evacuation and relief of flood victims are brought about during flooding period and just after the disaster. These activities are usually executed by the public sector or by social welfare bodies.
- (b) Medical care and cure for victims suffering from waterborne diseases because of flood inundation: Even after flood disaster, some victims could suffer from waterborne diseases, since the circumstance of flood prone areas is vulnerable against public hygiene. Then, medical activities are indispensable for these victims.
- (c) Prevention activities against crimes: Crimes such as stealing and pilfering in the confusion at the scene of the flood should be prevented in addition to evacuation and relief activities.

In large cities, particularly, the other indirect damages could be sufficient to require inclusion in the flood damage computation. Although the actual computation of the other indirect damages above was not undertaken, it is presumed to be 10% of the direct damage.

These damage categories were recognized even in the master plan stage. The benefits were estimated taking account of these categories in the 1987 Master Plan. In the review study, the benefits are fundamentally re-evaluated from the figures of benefits in the 1987 Master Plan. In the Feasibility Study, the benefits are estimated on the basis of the benefit structure. The details are discussed in Part III.

2.3 Future Damageable Assets

Socio-economic conditions in the basin will be improved in accordance with the growth of regional economy. Then, the damageable assets could increase along with the growth of socio-economic conditions. Thus, the flood mitigation benefit would increase, and it could be estimated on the basis of socio-economic projection. They are based on population increase, improvement of people's living standard, growth of economic activity in various industries, and expansion and rehabilitation of irrigation systems in the basin areas.

PART-2 REVIEW OF 1987 MASTER PLAN

CHAPTER 3 Conditions for Economic Evaluation

3.1 Projects in Review Study of 1987 Master Plan

The projects proposed in the 1987 Master Plan were summarized in the following categories. In this review study, these projects are examined from economic point of view.

- (1) Flood control projects, including some multi-purpose dam projects which have flood control function.
- (2) Watershed conservation projects, which were newly identified as important measures for water resources development.
- (3) Irrigation projects, including not only schemes proposed in the 1987 Master Plan but also schemes proposed or implemented as on-going projects by agencies concerned.

3.2 Criteria and Assumptions for Re-evaluation in Review Study

Economic evaluation is carried out to ascertain the economic viability. In this review study, Economic Internal Rate of Return (EIRR) is utilized as a tool of assessing economic viability to judge whether the proposed projects are to be worth being invested. Besides EIRR, Net Present Value (NPV) and Benefit-Cost ratio (B/C) are presented as supplementary indices, for which costs and benefits are discounted at 15% per annum in the Philippines.

In economic evaluation study, economic cost and benefit are used for basic figures for evaluation. Economic cost differs from financial cost in the sense of value judgment since the former is valued at real resource cost and the latter is resource cost valued at market prices. Thus, to estimate the economic costs of the proposed project, the financial costs that were estimated by cost estimators have to be converted by using conceivable adjustment. In estimating the economic cost and benefit, the economic values are estimated applying the following criteria and assumptions.

For economic evaluation, the following criteria and assumptions are applied to calculate the evaluation indices.

No.	Item	Set-up Conditions and Assumptions
(1)	Base Year	Beginning of the year 2002
(2)	Construction Period	In 2001, the preparatory works such as engineering services and land acquisition are conducted. The construction works are completed in five years.
(3)	Disbursement Schedule	Disbursed in accordance with construction schedule
(4)	Economic Life	50 years after the completion of the projects
(5)	Evaluation Period	56 years of 6 year for the construction period and 50 years after the completion of the construction works
(6)	Timing of Accruing Benefits	The matured benefits will appear after the completion of the respective projects. During construction period, the partial benefits will appear in proportion to the progress of the construction works for flood control scheme. In irrigation projects, the matured benefit will appear after five years from inauguration of the projects.
(7)	Price Level	Costs and benefits of the projects were set down at the year 2000.
(8)	Prevailing Exchange Rate	45.00 Pesos per US\$1.00 and ¥125 per US\$1.00 in 2000
(9)	Social Discount Rate	15 % per annum
(10)	Conversion Factor	85% of Standard Conversion Factor is used to convert financial value to economic value. In the 1987 Master Plan, most of costs and benefits were already estimated in economic terms, so they will be used through re-evaluation method applying price deflators.
(11)	Growth till Target Year 2020	Based on the projection in Chapter 8, ANNEX I

The master plan study was reported in 1987, 14 years ago. Socio-economic conditions in the study area have considerably been changed since the time of the master plan formulation. Thus, the economic evaluation of the proposed schemes was reviewed applying price deflators. The deflators for cost components were derived from consumer price index (CPI) and wholesale price index (WPI). The deflator for benefit components was calculated on the basis of CPI, population increase and economic growth in the study area. Although the master plan was reported in 1987, the prices of the 1985 level were used for estimation of costs and benefits. These factors are summarized below.

Factor	1985	2000	Ratio
1. CPI	46.1	152.1	3.30
2. WPI	95.5	253.5	2.65
3. Population in Region 2 (1000)	2,188	2,844	1.30
4. GRDP per Capita at 1985 Constant Price (Pesos)	7,225	6,387	0.88

Finally, the price deflators between 1985 and 2000 were set as 3.0 for cost components taking account of CPI and WPI, and 3.4 for benefit components taking account of growth of both population and GRDP per capita on CPI and WPI, for all schemes except agricultural projects.

In terms of benefits of agricultural projects only, however, the price deflator was set as around 3.0 reflecting economic prices of rice and corn in the world market. In the 1987 Master Plan, the economic prices of rice and corn were 3,800 Pesos/ton and 2,700 Pesos/ton, respectively. On the other hand, these prices in 2000 were estimated at 10,300 Pesos/ton and 8,100 Pesos/ton in economic terms respectively, referring to the world market values in the World Bank Report. Based on these data and the local market prices of vegetables, the price deflators were calculated as 2.7 for rice, 3.0 for corn and 3.4 for vegetables for the 2000 value against the 1987 value in the Master Plan.

CHAPTER 4 FLOOD CONTROL PLAN

4.1 Review of 1987 Flood Control Plan

In the Master Plan study, eleven schemes were proposed for flood control structural measures in addition to four multipurpose schemes with a dam component. Among the 4 multipurpose schemes, 3 flood control schemes were included as a component of the multipurpose. The costs and benefits of the projects were re-estimated applying the deflators. On the basis of these costs and benefits, the projects were reevaluated through evaluation indices. In this review study, the procedure of calculation was based on the same as done in the 1987 Master Plan study. The results of evaluation indices were enumerated in Table 4.1.1 and summarized in the table below. The detailed cost and benefit streams in economic terms for the respective projects are tabulated in Table 4.1.2 to 4.1.21.

No.	Name of Project	Flood Control Purpose		Multipurpose Scheme		Priority Order
		EIRR (%) Under Present Conditions	EIRR (%) Under Future Conditions	EIRR (%) Under Present Conditions	EIRR (%) Under Future Conditions	
1.	Tuguegarao Dike	16.8	28.5	-	-	2
2.	Narrow Improvement (Site: NLL)	12.5	22.6	-	-	4
3.	Siffu No.1 Dam	6.9	14.6	21.4	28.5	3
4.	Bank Protection Work	6.9	15.1	-	-	8
5.	Cabagan Dike	7.6	15.5	-	-	7
6.	Narrow Improvement (Site: NLR)	6.4	13.9	-	-	9
7.	Magat/Alimit Dam	6.9	13.2	11.7	19.3	5
8.	Mallig No.2 Dam	3.7	9.0	14.4	18.5	6
9.	Matuno Dam	-	-	19.9	29.7	1
10.	Cagayan No.1 Dam	5.2	11.3	-	-	10
11.	Ilagan No1. Dam	-	4.1	-	-	11
12.	Narrow Improvement (Site: NUP)	-	-	-	-	12

As shown in the table above, the projects where the EIRR is more than 15% under future conditions are 8 schemes among 12 listed. They are (i) Matuno Dam Multipurpose Project, (ii) Tuguegarao Dike Project, (iii) Siffu No.1 Dam Multipurpose Project, (iv) Narrow Improvement (site: Nassiping Lower Left: NLL), (v) Magat/Alimit Dam Multipurpose Project, (vi) Mallig No.2 Dam Multipurpose Project, (vii) Cabagan Dike Project and (viii) Bank Protection Work.

Thus, they are considered as feasible from the economic point of view. Other 6 schemes recorded less than 15% of EIRR even under future conditions.

4.2 Alternative Projects of Flood Control in Lower Cagayan River

The alternatives in the Lower Cagayan River are discussed in ANNEX VI. For evaluation purposes of the flood control projects, irrigation projects are indispensable to examine viability of flood control projects especially in the rural sites. Thus, irrigation projects in the respective reaches are combined in the flood control schemes. They are summarized as follows:

i) Alternatives in Reach from Alcala to the Buntun Bridge

- Case1: Construction of 2 cut-off channels (Gabut and San Isidro) and 1 dike system (Alcala to Buntun)
- Case2: Construction of 1 cut-off channel (Gabut) and 2 dike systems (Amulung and Solana)
- Case3: Construction of 1 cut-off channel (Gabut) and 2 dike systems (Amulung and Solana)
- Case4: Construction of 2 dike systems (West Amulung and Solana)

In the reach, the following irrigation projects are proposed: Alcala-Amulung West Irrigation Project and Solana Pump Irrigation Project.

ii) Alternatives in Reach from the Buntun Bridge to Upstream of Tuguegarao

- Case1: Improvement of the present Cagayan River channel and construction of 2 dike systems (Tuguegarao and Enrile)
- Case2: Construction of Tuguegarao diversion channel and 1 dike system (Tuguegarao)
- Case3: Construction of 1 cut-off channel (Tuguegarao) and 2 dike systems (Tuguegarao and Enrile)

Enrile Pump Irrigation Project is proposed in the reach.

In this economic evaluation study, the most effective alternative is selected from the economic point of view. Finally, the most appropriate flood control project is proposed as the comprehensive scheme consisting of several components.

4.3 Economic Costs

The financial construction costs of the projects are estimated in the respective sections on the basis of financial market prices. The initial investment cost consists of the following items:

- i) Main construction cost;
- ii) Compensation cost;
- iii) Government administration cost;
- iv) Engineering service cost; and
- v) Physical contingency cost.

The economic costs of the respective projects are obtained after going through the conversion procedure of the financial costs. Their results are summarized as follows:

(Unit: Million Pesos)

Alternatives	Financial Cost		Economic Cost		
	Flood Control	Irrigation	Flood Control	Irrigation	Total
i) Alternatives in Reach from Alcala to Buntun Bridge					
Case 1	5,143	2,458	4,573	2,090	6,663
Case 2	3,127	1,759	2,673	1,495	4,168
Case 3	2,608	1,638	2,230	1,393	3,623
Case 4	1,416	1,311	1,206	1,114	2,320
ii) Alternatives in Reach from Buntun Bridge to Upstream of Tuguegarao					
Case 1	1,969	560	1,740	476	2,216
Case 2	15,968	560	13,133	476	13,609
Case 3	4,974	560	4,032	476	4,508

Operation and maintenance (O&M) cost is annually required during the economic life of the respective projects in conformity with management of the schemes. The O&M cost is also given by making adjustment to economic prices. In flood control projects, the O&M cost is assumed at 0.5% of the total direct construction cost of flood control schemes. In irrigation projects, the O&M cost is estimated on consumption of electricity for pumps and other costs individually.

In order to compare economic efficiency, construction schedule is standardized as follows:

- i) The first year: engineering services and land acquisition, in addition to administration works.
- ii) The succeeding five years: construction works for flood control schemes and irrigation schemes.

4.4 Economic Benefits

Flood control benefit is defined as flood damage reduction by the proposed works as mentioned in Section 2.2. However, the benefits of the alternatives above, some of which their project formation was modified from the master plan, are estimated referring to the benefits in the 1987 Master Plan. In particular, the benefits of the irrigation projects in the alternatives in i) above are estimated individually, on the basis of the revised schemes. These schemes were

reorganized taking account of situation changes from the master plan stage under discussion between the agricultural expert and NIA.

In the reach from the Buntun Bridge to Upstream of Tuguegarao, particularly Case 2 and 3, the benefits from the flood control projects were considered to accrue from the potential value of urban central zone in Tuguegarao City, in addition of the benefits estimated in the 1987 Master Plan. Because, the central area of the city could be extended to south-eastern parts where the new lands are created by the alternative projects. The potential values of new central zones are estimated referring to the market value of land, which are considered to be justified on the balance of supply and demand in the market. The values applied for the studies were as follows: 4,000 Pesos/m² for the core central zone (within a 500m radius from the center); 2,000 Pesos/m² for the second central zone; and 1,000 Pesos/m² for the third central zone.

These benefit amounts were converted from financial market value to economic value by means of the conversion factor, 0.85, which is mentioned in Section 8.1 in the feasibility study.

The annual average benefits derived from the respective schemes were calculated in the following table. The table summarized the annual benefits after the completion of the respective schemes under the present conditions. The annual benefits under future conditions were also estimated in the table below, as well. The annual benefits under the future conditions were summarized in the year 2010 and the target year 2020 as follows:

(Unit: Million Pesos at Economic Terms)

Alternative	Under Present Conditions After Completion of Construction	Under Future Conditions		
		In 2010	In Target Year 2020	
i) Alternatives in Reach from Alcala to Buntun Bridge				
Case 1	974	1,960	3,853	
Case 2	663	1,204	2,365	
Case 3	573	1,043	2,047	
Case 4	409	689	1,352	

ii) Alternatives in Reach from Buntun Bridge to Upstream of Tuguegarao				
Case 1	226	457	877	
Case 2	588	1,135	2,013	
Case 3	837	1,616	2,866	

The flood mitigation benefits were assumed to accrue in proportion to the completion of the construction works, even if the construction was a part of them. The matured benefits would accrue just after the completion of the entire construction works. Although the annual benefits were constant during the economic life under present conditions, the benefits under the future conditions

were expected to increase until the target year in proportion to the GRDP growth in the region annually.

After the completion of the proposed schemes, the farmers in the areas free from flood disasters would be motivated to develop the agricultural lands on their own initiative, which used to be damaged by flood inundation. The agricultural activities could be expected in these fields, at the same time as the proposed projects were implemented in the basin. Thus, these agricultural products were considered as land use enhancement benefits. The irrigation projects were assumed to reach the matured benefit in five years after the completion of the projects.

For the sake of installation of flood control facilities, the undertaker of the projects has to expropriate some areas for cut-off channels, dykes and irrigation canals. These sites include some agricultural lands for cropping partially. Therefore, crop production cannot be carried on after the construction works begin. This production activity has to be considered as negative benefit of the projects. These negative benefits were estimated on the assumption that all expropriated croplands were used for paddy harvest.

4.5 Economic Evaluation

Economic efficiency of all alternatives is examined by means of evaluation indices. Based on the economic costs and benefits, EIRRs were calculated as shown in the table below. The table includes EIRRs under both present and future conditions mentioned before. The detailed cost and benefit streams of these alternatives are tabulated in Table 4.5.1 to 4.5.14.

Alternative	EIRR (Present Conditions) (%)	EIRR (Future Conditions) (%)
i) Alternatives in Reach from Alcalá to Buntun Bridge		
Case 1	10.0	19.6
Case 2	9.4	19.2
Case 3	9.4	19.1
Case 4	9.1	19.0
ii) Alternatives in Reach from Buntun Bridge to Upstream of Tuguegarao		
Case 1	15.3	26.0
Case 2	4.1	10.5
Case 3	16.4	27.6

Among the alternative schemes under future conditions, the most effective ones in the respective reaches were Case 1 for the reach from Alcalá to the Buntun Bridge and Case 3 for the reach from the Buntun Bridge to Upstream of Tuguegarao. For the alternative i) and ii), Case 1 and Case 3 were selected without further consideration among the alternatives, because they recorded the highest EIRRs among the alternatives.

4.6 Economic Viability of Master Plan Schemes

The alternatives of Master Plan schemes are formulated on the basis of the preliminary design results. The respective schemes were formulated as follows, as discussed in ANNEX VI.

Case 1

- Without widening of the Magapit narrows
- 2 cut-off channels and 1 dike system in the reach from Alcala to the Buntun Bridge
- 1 cut-off channel and 2 dike systems in the reach from the Buntun Bridge to upstream of Tuguegarao

Case 2

- Widening of one site of Tupang (low water channel: widening to 500 m)
- 2 cut-off channels and 1 dike system in the reach from Alcala to the Buntun Bridge
- 1 cut-off channel and 2 dike systems in the reach from the Buntun Bridge to upstream of Tuguegarao

Case 3

- Widening of two sites of Tupang and Nassiping (low water channel: widening to 500 m)
- 2 cut-off channels and 1 dike system in the reach from Alcala to the Buntun Bridge
- 1 cut-off channel and 2 dike systems in the reach from the Buntun Bridge to upstream of Tuguegarao

Case 4

- Widening of three sites of Tupang, Nassiping and Magapit (low water channel: widening to 500 m)
- 2 cut-off channels and 1 dike system in the reach from Alcala to the Buntun Bridge
- 1 cut-off channel and 2 dike systems in the reach from the Buntun Bridge to upstream of Tuguegarao

Case 5

- Widening of three sites of Tupang, Nassiping and Magapit (low water channel: widening to 700 m)
- 2 cut-off channels and 1 dike system in the reach from Alcala to the Buntun Bridge

- 1 cut-off channel and 2 dike systems in the reach from the Buntun Bridge to upstream of Tuguegarao

In the same manner, economic efficiency of the five cases above, is examined by means of evaluation indices. Based on the costs and benefits, EIRRs were calculated as follows. The detailed cost and benefit streams of these alternatives are tabulated in Table 4.6.1 to 4.6.10.

Alternative	EIRR (Present Conditions) (%)	EIRR (Future Conditions) (%)
Case 1	12.5	22.5
Case 2	10.5	19.4
Case 3	9.6	18.2
Case 4	9.0	16.9
Case 5	2.9	8.4

All cases under future condition except Case 5 seem to be viable from the economic point of view because their EIRRs are higher than 15%, the opportunity cost of capital in the Philippines. Among them, Case 1 is the highest EIRR of 19.1% under the expectation of future economic development in the basin.

In the review of the 1987 Master Plan, the entire combined project of all the flood control schemes has to be examined from the economic point of view. The projects are composed of the following 4 categories.

- Widening of the bottlenecks in the narrows
- Embankment (dike) to protect residential areas and agricultural lands
- Bank protection works to stabilize the low water channels
- Multipurpose dam schemes to supply irrigation water, to reduce flood peaks and to generate hydropower electricity.

The economic efficiency of the former 3 types was examined in the previous section. The multipurpose dam schemes were already examined in Table 4.1.1. Then, the economic efficiency of all these flood control projects was calculated at 15.6% under present conditions and 23.4% under future conditions. Consequently, the overall flood control projects is said to be quite viable taking into account the future economic development conditions in the basin, and even under present conditions.

4.7 Other Flood Control Schemes

4.7.1 Bank Protection Works

Bank protection schemes are proposed along the Cagayan River and its tributaries, after the review of bank protection works in the 1987 Mater Plan. They are counted to 73 sites in total. In this section, their economic efficiency was examined as one inclusive scheme. The economic efficiency (EIRR) was

calculated at 6.9% under present conditions and 15.1% under future conditions. The rate under future conditions was slightly higher than the social discount rate in the Philippines. Many farmers live along the river, most of who suffer from poverty because of frequent flood disaster. Then, the local governments having these areas are intent on these bank protection works. Since their EIRRs slightly exceed 15%, these schemes could be recommended to be implemented in general. Among 73 schemes, however, the recommendable schemes could be selected after individual economic screening. In the Lower Cagayan River Basin, 21 bank protection works were identified through the Reviewed Master Plan study. These works were also verified through evaluation indices. Their overall EIRR was calculated at 10.2% under present conditions and 17.0% under future conditions. Among 21 bank protection works, EIRRs of two works were lower than 15%, as shown in Table 4.7.1. The detailed economic cost and benefit stream were tabulated in Table 4.7.2 under present conditions and 4.7.3 under future conditions. Accordingly, other 19 bank protection works are recommendable for implementation from the economic viewpoint.

4.7.2 Evacuation System

In the non-structural measures, an evacuation system including a flood forecasting and warning system (FFWS) is a project accompanying some amount of capital investment. According to the estimate of the evacuation system, its cost amounted to 398 million pesos in financial terms. It was converted to 338 million pesos in economic terms. On the other hand, its benefit is said to be 5% of annual flood damage or 112 million pesos in its target area, according to the reference of "Potential Economic Benefits from Improvements in Weather Information" by J.C. Thompson, World Weather Watch Planning Report No. 27, WMO, 1968". However, this project is a rehabilitation work, so the existing system is still functioning insufficiently. Then, the net benefit of the proposed project, i.e., difference of the evacuation system's effects between with-project and without-project conditions, is assumed to be 3% of the total benefit in this study. Incidentally, in the SAPS study on the flood forecasting and warning system, the net benefit of this project was assumed at 3% of annual flood damage, as well. Thus, its annual benefit was estimated in 67 million pesos. Accordingly, its economic efficiency was calculated at 9.7% of EIRR under present conditions, as shown in Table 4.7.4. It was also calculated at 20.6% under future conditions, as shown in Table 4.7.5. Thus, the evacuation system project is evaluated as economically viable.

CHAPTER 5 WATERSHED CONSERVATION PLAN

5.1 Reforestation Schemes

Reforestation is expected to provide lots of public benefits in natural and human environment. Among these benefits, the following functions are identified in reforestation schemes in general.

- (1) Storage function of rainfall water into underground, functioning as peak-cut effect for flood discharge, alleviation of drought damage and purification of water contamination
- (2) Function of erosion control
- (3) Function of soil collapse control
- (4) Function of hygiene and refreshment for people
- (5) Function of wildlife preservation
- (6) Function of air preservation by means of carbon dioxide (CO₂) absorption and oxygen (O₂) emission
- (7) Conservation function of gene resources in forest
- (8) Mitigation function of weather change
- (9) Preservation function of storm damage, falls of rocks, etc.
- (10) Function of sound suppression
- (11) Preservation function of environment for aquatic lives

Project evaluation of reforestation project has not been conducted so far, because of the difficulty in quantifying its benefits. In this study, therefore, a tentative economic evaluation was tried in the following manner. Among the effects above, the following tangible benefits were enumerated for the reforestation project. The respective benefits were quantified as follows.

- (1) Storage function of rainfall water: effect of water volume reserved under ground was quantified by means of equivalent irrigation dam cost.
- (2) Function of flood control: peak-cut effect through rainfall water storage was quantified by means of equivalent flood control dam cost.
- (3) Function of erosion control: this effect was quantified by means of equivalent sabo dam cost.
- (4) Function of soil collapse control: this effect was quantified by means of equivalent hillside retaining wall cost.

As a result, these benefits were estimated in economic terms for the proposed reforestation schemes. These annual benefits were worked out as follows: 0.30 billion pesos for rainfall water storage effect, 0.50 billion pesos for peak-cut effect for flood, 0.55 billion pesos for erosion control and 0.63 billion pesos for soil collapse control. However, these matured benefits are assumed to arrive at 20 years later since the commencement of reforestation.

On the other hand, the economic cost of the reforestation schemes was estimated at 4.72 billion pesos in total, which was converted from 5.55 billion pesos in market prices. The O/M cost of the project was estimated at 0.41 billion pesos in economic terms.

On the basis of these cost and benefit estimates, its economic efficiency was calculated at 5.2% of EIRR under present conditions, as shown in Table 5.1.1. It was also calculated at 16.7% under future conditions, as shown in Table 5.1.2. Thus, the reforestation project seems to be economically viable from the economic point of view. Thus, the project is economically viable, although its EIRR was not so high. However, it should be promoted from the point of global environmental conservation in the world no matter what its economic efficiency may be.

5.2 Sabo Schemes

Sabo dam schemes are expected to prevent sedimentation of earth and sand into the Magat Dam. The sedimentation of solid materials affects to decrease the effective water volume of Magat Dam. Thus, benefit of these sabo dams is quantified by means of irrigation water from the reservoirs concerned. The irrigation water was estimated to be 10 Pesos/m³, which was estimated on the basis of initial investment cost and O/M cost of the dam. The sedimentation volume was estimated at 11.4 million m³/year on average for 20 years. However, since around one-third of this volume is considered to go into dead water space in the reservoir, the total volume that decreases effective water is estimated at two-thirds of the total sedimentation volume. Accordingly, the project benefit was estimated at 65 million pesos/year. The benefit will be accumulative every year, because the irrigation dam volume decreases every year.

On the other hand, the total investment cost was estimated at 5.47 billion pesos in market prices. It was converted to 4.65 billion pesos in economic terms. O/M cost of the sabo dams was assumed at 0.1 of the direct main work cost. Then, the O/M cost was calculated at 3.5 million Pesos per annum in economically terms.

On the basis of these cost and benefit estimates, its economic efficiency was calculated at 8.7% of EIRR under present conditions, as shown in Table 5.1.3. It was also calculated at 16.8% under future conditions, as shown in Table 5.1.4. Thus, the sabo projects seem to be economic viable from the economic point of view.

CHAPTER 6 IRRIGATION DEVELOPMENT PLAN

6.1 Review of 1987 Irrigation Schemes

The 1987 Master Plan proposed 9 irrigation schemes and 5 rehabilitation and/or improvement schemes. Since then, National Irrigation Administration (NIA) and other agencies concerned have been developing numerous irrigation projects in the basin. Reviewing these backgrounds, the 20 irrigation schemes were identified through the review study, including the schemes in the 1987 Master Plan. Needless to say, other on-going and planning projects will be implemented by the agencies concerned in their generally appropriated budgets for agricultural development schemes. In this part, thus, these 20 schemes are evaluated from the economic point of view.

6.2 Economic Cost

The project costs of the irrigation schemes were estimated by the expert. The capital investment costs of the schemes proposed in the 1987 Master Plan were recalculated referring to the original estimates and the price deflator mentioned in ANNEX VIII. The newly identified schemes were estimated referring to their development plan reports and the recent cost information from the agencies concerned.

Annual O&M costs of the irrigation schemes consist of salaries of personnel, materials and labor costs for repair and maintenance, and running costs of irrigation facilities. Besides, some of irrigation facilities such as pumps and other durable materials must be replaced at certain interval within their project life. These costs are estimated as replacement costs. These estimates of the irrigation schemes were based on the market prices. Afterwards, the economic costs are calculated by multiplying the conversion factor to the financial costs.

In order to examine economic efficiency for the respective schemes, construction schedule is standardized as follows:

- i) The first year: engineering services and land acquisition, in addition to administration works.
- ii) The succeeding five years: construction works for irrigation schemes and flood control schemes

6.3 Economic Benefits

In the flood control project, these agriculture benefits were combined as comprehensive scheme of area development. In the evaluation of irrigation schemes, thus, the evaluation was separated into two ways: (i) irrigation scheme without flood control and (ii) irrigation scheme with flood control. In the former case, the irrigation scheme is evaluated in the normal way. In the latter case, the scheme is evaluated under ignoring the effects of flood control for irrigation activities in order to verify its viability for independent irrigation project.

In addition, some agricultural lands are laid down to another purposes such as irrigation facilities and canals. These lands are considered as negative benefit, because crops cannot be cultivated after laid down. This negative benefit is enumerated through an annual production foregone. The foregone is defined as an annual net return under the present condition in the cropland.

6.4 Economic Evaluation

Based on the annual economic costs and benefits, EIRRs and other evaluation indices for each scheme were calculated in the same manner, as done in the evaluation of the flood control schemes. They are summarized in the table below. The table shows EIRRs under both present and future conditions. The details are enumerated in Table 6.3.1. As references, economic cost and benefit stream of Alcala Amulung West Irrigation Project was shown in Table 6.3.2 under present conditions and Table 6.3.3 under future conditions.

Project	Without Flood Control		Combined to Flood Control	
	Under Present Condition (%)	Under Future Condition (%)	Under Present Condition (%)	Under Future Condition (%)
I. Affected by Flood (Need Flood Control)				
1. Alcala Amulung West Irrigation Project	-	-	18.1	22.8
2. Solana Pump Irrigation System Rehabilitation & Extension Project	-	-	20.1	25.0
3. Enrile Pump Irrigation Project	13.0	17.8	18.2	23.1
4. Zinundungan Irrigation Extension Project	12.7	16.3	15.0	18.8
5. Lal-lo West Pump Irrigation Project	12.0	16.5	14.9	19.5
6. Nassiping Pump Irrigation Project	13.9	18.5	17.0	21.8
7. Rehabilitation of CIADP (Magapit & Iguig-Alcala-Amulung PISs)	15.7	21.8	22.7	28.7
8. Pinacanan River Irrigation System	23.7	28.2	27.1	31.9
9. San Pablo-Cabagan Irrigation System	16.9	22.8	21.1	27.0
10. Santa Maria Communal Pump Irrigation System	17.1	23.1	21.4	27.3
11. Delfin Albano Pump Irrigation Project	13.9	18.5	17.0	21.8
12. Tumauini Reservoir Project	14.0	17.8	16.4	20.4

Project	Without Flood Control		Combined to Flood Control	
	Under Present Condition (%)	Under Future Condition (%)	Under Present Condition (%)	Under Future Condition (%)
13. Mallig River Irrigation System	26.7	31.5	30.5	35.5
14. Nueva Vizcaya Bagabag Irrigation System	28.1	33.0	32.0	37.1
15. Ilagan Pump Irrigation Project	11.5	15.9	12.6	17.2
16. Sto. Nino Pump Irrigation Project	12.2	16.8	12.8	17.6
II. No Need of Flood Control				
1. Upper Ilagan Western Barangay. Pump Irrigation Project	12.3	16.8	-	-
2. Dabubu Irrigation Project	14.8	18.6	-	-
3. Lower Chico River Irrigation System	24.3	29.0	-	-
4. San Mariano Pump Irrigation Project	13.1	17.8	-	-

Among the 20 proposed schemes above under future condition, EIRRs of all schemes exceeded 15% of the opportunity costs of capital. In particular, rehabilitation and/or improvement schemes have quite high values as shown in the table. Thus, they are considered as viable from the economic point of view.

CHAPTER 7 INTEGRATED PACKAGE PLAN

7.1 Integration of Sectoral Schemes

In order to formulate the Reviewed Master Plan, package plans were organized to select recommendable schemes in the basin in consideration of the results derived from the sectoral analysis. This integration procedure was already discussed in ANNEX VI and VII. The package plans were summed up into seven packages as follows.

Package Alternative	Component of Sectoral Schemes							
	Dam	AB	TE	FS	FA	IL	IS	IA
Package 1	Siffu	○	○	○	-	○	○	-
Package 2	-	○	○	○	-	○	○	-
Package 3	Siffu	○	○	-	-	○	-	-
Package 4	-	○	○	-	-	○	-	-
Package 5	Alimit	○	○	-	○	○	-	○
Package 6	-	○	○	-	○	○	-	○
Package 7	Alimit	○	○	-	-	○	-	-

Note: Dame: Siffu No.1 dam or Alimit No.1/Magat dams
 AB: Alcala-Buntun dike and Gabut cut-off channel
 TE: Tuguegarao dike and cut-off channel, and Enrile dike
 FS: Flood control projects relating to Siffu No.1 dam except AB and TE
 FA: Flood control projects relating to Alimit No.1/Magat dams AB and TE
 IL: Four irrigation projects between Alcala and Tuguegarao, i.e., Alcala-Amulung West pump irrigation project (PIP), Solana pump irrigation system (PIS), Enrile PIP, and Iguig-Alcala-Amulung PIS
 IS: Eleven irrigation projects relating to Siffu No.1 dam except IL above, i.e., Mamil PIP, Santa Isabel PIP, Zinundungan irrigation extension project, Lal-lo West PIP, Nassiping PIP, Magapit PIS, Pinacanauan River irrigation system, San Pablo-Cabagan irrigation system, Santa Maria Communal PIS, Delfin Albano PIP, Tumauni multipurpose project
 IA: 15 irrigation project relating to Alimit No.1/Magat dams except IL above, i.e., Damao PIP, Lapogan PIP, Lulutan PIP, Gamu PIP in addition to IS above

7.2 Economic Costs

As mentioned in the previous sections, the economic costs of the respective packages are obtained after going through the conversion procedure of the financial costs. Their results are summarized as follows:

(Unit: Million Pesos)

Package Alternative	Dam	Flood Control	Irrigation	Total
Package 1	2,696	25,304	7,605	35,605
Package 2	-	25,304	7,605	32,909
Package 3	2,696	16,014	2,727	21,437
Package 4	-	16,014	2,727	18,741
Package 5	4,989	28,654	8,595	42,238
Package 6	-	28,654	8,595	37,249
Package 7	4,989	16,014	2,727	23,730

O&M costs for the respective schemes are annually required during the economic life of the respective projects in conformity with management of the schemes. The O&M costs are also given by making adjustment to economic prices. In flood control and dam schemes, the O&M cost is assumed at 0.5% of the total direct construction cost. In irrigation projects, the O&M cost is estimated on consumption of electricity for pumps and other costs individually.

In order to compare economic efficiency, construction schedule is standardized as follows:

- i) The first year: engineering services and land acquisition, in addition to administration works.
- ii) The succeeding five years: construction works for both flood control schemes and irrigation schemes.

7.3 Economic Benefits

The annual average benefits were calculated as the sum of the benefits estimated in the respective schemes. They were calculated as shown in the table below. The table summarized the annual benefits after the completion of the respective schemes under the present conditions. The annual benefits under future conditions were also estimated in the table below, as well. The annual benefits under the future conditions were summarized in the year 2010 and the target year 2020:

(Unit: Million Pesos at Economic Terms)

Package Alternative	Under Present Conditions After Completion of Construction	Under Future Conditions	
		In 2010	In Target Year 2020
Package 1	5,676	8,664	16,400
Package 2	4,785	7,419	12,261
Package 3	2,804	4,324	7,130
Package 4	1,929	3,093	5,191
Package 5	6,217	9,823	16,400
Package 6	5,475	8,597	14,279
Package 7	2665	4,345	7,335

As mentioned in Section 7.3, the flood mitigation benefits were assumed to accrue in proportion to the completion of the construction works, even if the construction was a part of them. The matured benefits would accrue just after the completion of the entire construction works. The annual benefits were constant during the economic life under present conditions. On the other hand, the benefits under the future conditions were expected to increase until the target year in proportion to the GRDP growth in the region annually. In terms of irrigation schemes, the

project benefits were assumed to reach the matured benefit in five years after the completion of the projects.

7.4 Economic Evaluation

Economic efficiency of the respective packages is examined by means of evaluation indices. Based on the economic costs and benefits, EIRRs were calculated as shown in the table below. The detailed economic cost and benefit streams were enumerated in Table 7.4.1 to 7.4.14. The table includes EIRRs under both present and future conditions as mentioned before.

Package Alternative	EIRR (Present Conditions) (%)	EIRR (Future Conditions) (%)
Package 1	12.6	19.7
Package 2	11.7	18.9
Package 3	10.6	17.3
Package 4	8.7	15.3
Package 5	12.0	19.5
Package 6	11.9	19.3
Package 7	9.5	16.6

All of the packages are viable from the economic point of view, because their EIRRs are more than 15%, the opportunity cost of capital. Among the packages under future conditions, the most effective one was Package 1, as shown in the table above. As mentioned before, Package 1 includes the following schemes: (i) Alcala-Buntun dike and Gabut cut-off channel, (ii) Tuguegarao dike and cut-off channel, and Enrile dike, (iii) flood control projects relating to Siffu No.1 dam, (iv) 4 irrigation projects between Alcala and Tuguegarao, i.e., Alcala-Amulung West PIP, Solana PIS, Enrile PIP, and Iguig-Alcala-Amulung PIS, and (v) 11 irrigation projects relating to Siffu No.1 dam except IL above, i.e., Mamil PIP, Santa Isabel PIP, Zinundungan irrigation extension project, Lal-lo West PIP, Nassiping PIP, Magapit PIS, Pinacanauan River irrigation system, San Pablo-Cabagan irrigation system, Santa Maria Communal PIS, Delfin Albano PIP, Tumauni multipurpose project.

PART-3 FEASIBILITY STUDY OF PRIORITY PROJECTS

CHAPTER 8 CONDITIONS FOR ECONOMIC EVALUATION

8.1 Conversion Factors and Elements for Real Economic Values

8.1.1 Conversion Factors and Elements for Real Economic Values

(1) Transfer Payments

Market values are usually distorted by transfer payments such as taxes and subsidies. These transfer payments are transferred to the government which acts on behalf of the society. Then, they should not be treated as cost. These have to be eliminated from the market values of cost and benefit as a whole. In the Philippines, the taxes concerning to the construction works are enumerated as follows: the value added tax (VAT), excise tax, income tax, customs duties, tax on sand, gravel and quarry resources, various local taxes, etc. The overall tax rates on major materials and services are shown in Table 8.1.1.

(2) Shadow Wage

Wages of skilled workers are considered to reflect an opportunity cost of labor, because the workers are usually shortage in the markets. Therefore, the shadow wage rate of skilled workers is set up as 1.0. On the other hand, unskilled workers are in excess in general, since NCR including the project basin has excess workers in condition of unemployment and underemployment. Thus, the shadow wage rate of unskilled workers is assumed at 0.6 of legislated wage rate.

(3) Shadow Foreign Exchange

It is said that the foreign exchange rate has some distortions in the prevailing exchange rate due to balance of payments disequilibrium and protection structures in the country. In this study, the shadow exchange rate is assumed at 1.2 of the prevailing exchange rate, as recommended to use in "ICC Project Evaluation Procedures and Guidelines" by NEDA. This rate is applied to the imported materials and services. Incidentally, the import portions of major construction materials are enumerated in Table 8.1.2.

(4) Conversion Factors

The material costs were nominally segregated into the following proportion of foreign and local portions, referring to NEDA information.

Item		Local Portion	Foreign Portion
1.	Materials		
	Cement	0.3	0.7
	Aggregate (Coarse and Fine)	0.6	0.4
	Steel	0.2	0.8
	Fuel and Lubricant	0.3	0.7
	Lumber	0.6	0.4
2.	Machinery and Equipment Rental	0.3	0.7
3.	Labor	1.0	0.0
4.	Administration Cost	1.0	0.0
5.	Engineering Cost	0.1	0.9

In simplifying conversion from financial market value to real economic value, conversion factors are set up in consideration of the elements discussed above, i.e., transfer payments, shadow wage rate and shadow foreign exchange. Taking into account of the foreign and local compositions, the conversion factors corresponding to cost estimation above were summarized as follows. The details of the factors were broken down in Table 8.1.1 to 8.1.3.

Item	Local/Foreign Separate Estimate		Local/Foreign Combined Estimate
	Local Portion *1	Foreign Portion	
1. Materials			
Cement	0.51	1.06	0.89
Aggregate (Coarse and Fine)	0.68	1.04	0.83
Steel	0.23	1.06	0.90
Fuel and Lubricant	0.38	1.06	0.85
Lumber	0.79	1.01	0.88
Others	0.72	1.05	0.88
2. Machinery and Equipment Rental	0.27	1.13	0.87
3. Labor			
Skilled	0.93	-	0.93
Unskilled	0.60	-	0.60
4. Indirect Costs			
Overhead, contingencies and miscellaneous (OCM)	0.86	-	0.86
Profit	0.65	-	0.65
Value Added Tax *2	0.00	-	0.00
5. Government Expenditure *3	0.95	-	0.95
6. Engineering Service *4	-	1.22	1.10
7. Standard Conversion Factor	-	-	0.85

Note: *1 Including all taxes national and local in the Philippines
*2 Imposed on item numbers of (2) and (3) only in this form.
*3. For engineering and administrative overhead
*4 Detailed design and supervising services by foreign consultants

All the market values not to be involved in the table above are converted to economic costs applying a standard conversion factor (SCF). It is clearly impracticable to trace procurement sources for all the detailed components. Thus, taking this situation into consideration and referring to Table 8.1.4, the economic costs are assumed to be 85% of the financial values. In the 1987 Master Plan Study, this SCR was applied to re-evaluate to convert market values to economic values.

8.1.2 Land Value

Land value should be evaluated on the basis of productivity of the land for productive plots such as crop cultivation, and balance of supply and demand for non-productive land such as residential plots. In this study, most lands which would be expropriated for dikes and cut-off channel are located in rural areas. Then, the economic value of land expropriated was evaluated foregone crop cultivation, as negative benefit.

Yet, new urban central zones will be created in the reach from the Buntun Bridge to Upstream of Tuguegarao. In this case, the potential values of the new zones are estimated referring to the market value of land, which are considered to be justified on the balance of supply and demand in the market. This is the same as discussed in the review study of the 1987 Master Plan.

8.2 Schedule and Other Criteria

(1) Base Year	Beginning of 2002
(2) Construction Period	Three phases: 1 st phase from 2002 to 2007, 2 nd phase from 2008 to 2011, 3 rd phase from 2011 to 2015 and 4 th phase from 2015 to 2020
(3) Disbursement Schedule	Disbursed in accordance with actual construction schedule during the construction period above
(4) Economic Life	50 years after the completion of the project
(5) Evaluation Period	56 to 68 years including preparatory works such as detailed design and construction period, and economic life of the project scheme
(6) Timing of Benefits Accruing	The benefit accrues in proportion to the progress of the construction works for flood control scheme. Regarding cut-off channels, after the completion. In terms of irrigation scheme, the benefit starts just after the completion and the matured benefit accrues five years after the completion.
(7) Prevailing Exchange Rate	50.00 Pesos per US\$1.00 and ¥120 per US\$1.00 as of June 2001
(8) Social Discount Rate	15% per annum

CHAPTER 9 FLOOD CONTROL PLAN

9.1 Economic Benefit

9.1.1 Distribution of Damageable Assets

Distribution of damageable assets is worked out on the basis municipal information. The inventory of damageable assets in every municipality is given or estimated on the basis of results of the population and housing census, results of establishments' survey of the respective economic sub-sectors, land use maps, topographic maps, administrative municipal map, and socio-economic data.

As regard housing units, the distribution was figured out through the following procedure. The distribution of housing units by mesh was counted through the topographic map. The total number of dwelling units is verified in the 2000 population census. Through this estimation procedure, the number of residential buildings in the potential flood area of the Lower Cagayan River Basin was counted at 85,500 units in total.

In the potential flood area, there were 720 manufacturing establishments in the year 2000. The number of existing establishments was provided by NSO as municipal information that was compiled through the "survey of establishment, 1999/2000". In the same manner, the number of major facilities in the potential flood area was enumerated as follows: trading establishments of 1,740 units, education facilities of 290 units and medical facilities of 130 units.

The distribution of crop cultivation lands was figured out on the basis of site inspection and analysis of land use map. The crop cultivation areas in flood prone areas were estimated as follows: 20,200 ha of irrigated fields and only 31,100 ha of rainfed fields.

The table below shows the distribution of aforesaid facilities and croplands in the potential flood area for 2-year, for 25-year and for 100-year return periods.

Item	2-Year Return Period	25-Year Return Period	100-Year Return Period
Population (1000)	105	390	422
Housing Units (1000)	22	78	84
Manufacturing	152	651	716
Trading	308	1,517	1,738
Educational Facility	67	269	288
Medical Facility	26	110	129
Agricultural Lands (1000ha)	23	49	51
Irrigated Fields	6	19	20
Rainfed Fields	17	30	31

9.1.2 Unit Value of Damageable Assets

(1) Housing Units

Housing unit is classified into four types. An unit construction cost (Pesos/m²) of new house is estimated in city assessor's office as follows: 5,370 pesos for Type I, 3,450 pesos for Type II, 2,130 pesos for Type III and 900 pesos for Type IV. The unit costs were selected as an average value of B-class in the respective types. That of type IV was derived from the rural information. The average floor area was 29 m², referring to Table 3.3.3 in ANNEX I. Then, the new dwelling unit costs 155,730 pesos for Type I, 100,050 pesos for Type II and 61,770 pesos for Type III and 26,100 pesos for Type IV. According to the 1990 census, the average age of dwelling units was 12 years as seen in Table 3.3.2 in ANNEX I. Then, its depreciated value might be 22% for Type I, 30% for Type II, 43% for Type III and 52% for Type IV, referring to schedule of depreciation in municipalities. Accordingly, the average market value was estimated at 121,469 pesos for Type I, 70,035 pesos for Type II, 35,209 pesos for Type III and 12,528 pesos for Type IV.

According to Table 3.3.1 in ANNEX I, there were 15,400 units or 10% of the total units of Type I/II, 39,900 units or 27% of Type III and 93,900 units or 63% of Type IV in 1990. Applying this distribution ratio to the value information above, the weighted average market value was estimated at 27,000 pesos per unit, as shown in the table below.

Building Type	Type I/II	Type III	Type IV
Unit Value (pesos)	95,750	35,200	12,500
Distribution	10%	27%	63%
Weighted Average (pesos)	27,000		

It is said that an assessed value for taxation purposes is smaller than an actual market value. The distortion between these assessed value and actual market value is not clear. Although it is shrinking gradually, the difference of between the two is still 200% to 300%, according to an authority. In this current study, thus, the actual market value of dwelling unit was assumed to be 81,000 pesos, which is 200% higher than the above estimated average value of 27,000 pesos.

It is said that an assessed value for taxation purposes is smaller than an actual market value. The distortion between these assessed value and actual market value is not clear. Although it is shrinking gradually, the difference of between the two is still 200% to 300%, according to an authority. In this current study,

thus, the actual market value of dwelling unit was assumed to be 67,000 pesos, which is 250% higher than the above estimated average value of 27,000 pesos.

Indoor movable or household effects in an average family were estimated at 75% of the value of housing unit on average, according to the JICA study on “Flood Control Project in Laoag River Basin”. Once this ratio was applied, the value of indoor movable was estimated at around 50,000 pesos.

(2) Manufacturing Industry

Asset holdings of manufacturing establishment were already discussed in the socio-economic study, ANNEX I. The values of these assets were reported in the survey of establishment as shown in the summary table below. The detail figures are enumerated in Table 5.2.2 in ANNEX I. Based on these figures in the table, damageable assets of manufacturing establishments as of the 1995 census year were estimated as weighted averages: 19,000 pesos of building, 251,000 pesos of durable assets and 33,000 pesos of stock on average of entire establishment.

				(Unit: 1000 pesos)
Item	Large & Medium	Small & Cottage	Entire Est.*1	
1. Number of Establishment	97	3,817	3,914	
2. Fixed Assets	17,964	132	277	
3. Land	309	-	8	
4. Buildings	773	-	19	
5. Inventory Stock	1,082	6	33	
Value Added	7,180	86	262	
Damageable Assets				
1995 Prices				
6. Building	773	-	19	
7. Durable Assets	4,911	132	251	
8. Stock	1,082	6	33	
Value Added	7,180	86	262	
2001 Prices				
9. Building	1,080	-	27	
10. Durable Assets	6,880	185	350	
11. Stock	1,520	8	46	
Value Added	10,050	120	370	

Note: *1 Amounts show weighted averages

In 2001, these damageable assets were reevaluated at 27,000 pesos of building, 350,000 pesos of durable assets and 46,000 pesos of inventory stocks. Hence, 2001 values were calculated applying a price index of 1.40 between 1995 and 2001. The consumer price index (CPI) was 1.47 during the same period, according to the official CPI data. On the other hand, the wholesale price index (WPI) was 1.34 for the same period. The index applied 1.40 was set referring these indices. In this study, then, the damageable values of manufacturing establishments are set as the figures shown in the table.

(3) Services Industry

Asset holdings of wholesale and retail trade establishment were reported in the socio-economic study in ANNEX I. A summary is shown in the table below. The detail figures are enumerated in Table 5.3.1 for trading firms and Table 5.3.2 for service firms in ANNEX I. In this study, the figures of trading firms represent the services industry because of the number of establishments. As a result, damageable assets of wholesale and retail trade establishments as of the 1993 census year were summarized: 82,000 pesos of building, 200,000 pesos of durable assets and 85,000 pesos of stock on average of entire establishment.

In 2001, these damageable assets were reevaluated at 130,000 pesos of building, 320,000 pesos of durable assets and 140,000 pesos of inventory stocks. Incidentally, 2001 values were calculated applying a price index of 1.60 between 1993 and 2001. The consumer price index (CPI) was 1.72 during the same period, according to the official CPI data. On the other hand, the wholesale price index (WPI) was 1.54 for the same period. The index applied 1.60 was set referring these indices. In this study, then, the damageable values of trading establishments are set as the figures shown in the table below.

(Unit: 1000 pesos)

Item	Large & Medium	Small & Cottage	Entire Est.*1
1. Number of Establishment	128	5,858	5,986
2. Fixed Assets	2,463	246	294
3. Land	550	-	12
4. Building	865	65	82
5. Inventory Stock	3,957	-	85
Value Added	3,038	174	235
Damageable Assets 1993 Prices			
6. Building	865	65	82
7. Durable Assets	1,049	181	200
8. Stock	3,957	-	85
Value Added	3,038	174	235
2001 Prices			
9. Building	1,380	104	130
10. Durable Assets	1,680	290	320
11. Stock	6,330	-	140
Value Added	4,860	300	380

Note: *1 Amounts show weighted averages

b) Educational Facilities

The average number of classrooms per elementary school was estimated at 10.2 rooms in Cagayan and 9.9 rooms in Isabela, respectively. The average number of classrooms per elementary school was considered as 10 classrooms per school.

According to the Bureau of Construction in DPWH, a standard one-story academic classroom school building with conventional toilet is estimated at

689,000 pesos in 2001. Then, a construction cost of a new school costs is estimated at 6.89 million pesos. Besides the classrooms, it has to install a multi-purpose workshop and faculty rooms, so the total cost is assumed to cost at 50% more than that of the classroom costs. Then, the total building cost was aggregated to around 10 million pesos in total. Accordingly, the actual damageable value of the school is considered to be a half of the value above taking account of depreciation, the present value of the school was estimated at 5 million pesos.

In addition, it requires furniture, equipment and inventory stocks. According to the survey of establishment in Region 4 by NSO, a school had the following assets on average in 1991. The composition of these assets was calculated as 28% of depreciable assets and 4% of inventory assets to the building' value. Applying these compositions to the building value above, the average school is estimated to have the following assets in 2001: 1.4 million of depreciable assets and 0.2 million of inventory assets.

c) Medical Facilities

There were 666 medical facilities in Cagayan and Isabela Provinces. They are composed of 71 hospitals and 526 barangay health stations and 69 rural health units in these provinces.

According to budgetary requirement for construction of hospitals and other health facilities in DOH, a hospital with 25-beds and a main health center (rural model) are reported in 2001 as follows:

		(Unit: Million Pesos)	
Item		Hospital (25 Beds)	Health Center
1. Building		37.5	1.4
	Total Floor Area (m ²)	1,873	90
	Unit Cost (Pesos/m ²)	20,000	16,000
2. Site Preparation		3.8	0.2
3. Equipment and Furniture		11.2	0.4
Total		52.5	2.0

Accordingly, the actual damageable value of the medical facilities is considered to be a half of the value above taking account of depreciation, the present value of the hospital and health center was estimated as follows.

		(Unit: 1000 Pesos)		
Item		Hospital	Health Center	Two Provinces
No. of Facility		71	595	666
Buildings		20.7	0.8	2.9
Depreciable Assets		5.6	0.2	0.8
Inventory Assets		7.0	0.3	1.0
Total		65.2	2.5	4.7

According to the survey of establishment in Region 4 by NSO in 1991, a hospital had the following assets on average. The hospital had 0.89 million pesos of inventory assets, against 2.59 million pesos of buildings. The rate of the inventory assets was calculated as 34% of the building's value. Applying this composition to the building value above, the average medical facility is estimated to have 7.0 million of inventory assets in hospital and 0.3 million pesos in health center, as shown in the table.

(4) Agricultural Production

The degree of crop damage varies from month to month, depending on the cropping stage and timing of flood occurrence. Therefore, the annual average damageable value of crop per hectare is estimated as an aggregate of expected net income and accumulated expenditure for production until the time when flood occurs. In that case, flood frequency and planted area cultivated in each month have to be taken into account as well. It is expressed by the following formula:

$$DV = \sum_{i=Jan.}^{Dec.} CA_i \cdot FF_i \cdot (AC_i \cdot PC_i + NI)$$

where;

DV : damageable value (Pesos/ha)

CA : cultivated area (%)

FF : flood frequency (%)

AC : accumulated cost (%)

PC : production cost (Pesos/ha)

NI : net income (Pesos/ha)

In terms of paddy production, paddy yields were set as 2.7 ton/ha (wet season) and 2.8 ton/ha (dry season) for irrigation system and 2.0 ton/ha for rainfed system under the present cultivation conditions. Applying the formula above, the damageable value was estimated at 17,500 Pesos/ha for irrigated fields (Table 9.1.1) and 12,300 Pesos/ha for rainfed fields (Table 9.1.2) in economic terms. After implementing rehabilitation or new irrigation system, paddy yields were set as 4.5 ton/ha and 5.0 ton/ha for two-crop cultivation. In the same manner, the damageable value was estimated at 32,200 Pesos/ha in economic terms (Table 9.1.3).

9.1.3 Economic Values

These financial values are converted into real economic values applying the conversion factors, as discussed in the previous section. The conversion factors for respective damageable facilities were calculated in Tables 9.1.4 to 9.1.6. The

conversion factors ranged from 0.83 to 0.84 as shown in the following table, and 0.83 is used for the conversion factors in economic benefit calculation. The conversion factor of household effects and inventory stocks are assumed to be the same as those of the corresponding facilities, i.e., 0.83.

Facility	Conversion Factor (CF)	Detailed Calculation	Comprehensive Conversion Factor
Housing Unit	0.83	Table 8-6	0.83
Educational Facility	0.83	Table 8-7	
Medical Facility	0.84	Table 8-8	

Applying the comprehensive conversion factor, finally, the economic values of damageable assets are calculated for the respective facilities. The economic damageable values are tabulated in Table 9.1.7. The values including building, household effects or inventory stock and equipment are summarized as shown in the following page.

Damageable Property	Unit	Total Economic Value
Housing Unit	1000 Pesos/Unit	98
Manufacturing	1000 Pesos/Unit	351
Trading	1000 Pesos/Unit	490
Education Facility	1000 Pesos/Unit	5,478
Medical Facility	1000 Pesos/Unit	3,901
Irrigated New Fields	Pesos/ha	32,200
Irrigated Rehabilitated Fields	Pesos/ha	32,200
Existing Irrigated Fields	Pesos/ha	17,500
Rainfed Paddy Fields	Pesos/ha	12,300

These financial values are converted into real economic values applying the conversion factors in general. The conversion factors for cost items were already discussed in Chapter 8.

9.1.4 Estimation of Flood Damages

The JICA study team made 2 alternatives for implementation, i.e., 4 phases and 3 phases. Through a comparison analysis of these alternatives, the 4 phase plan was proposed to be recommendable for the proposed flood control projects. In this section, the 4 phase plan is discussed hereinafter. The 3 phase plan, however, is presented in the Section 9.4.

The direct damages are estimated as a product of the number of facilities inundated by flood in affected areas, a damageable value of inundated property and a damage rate in accordance with inundation depth. The number of facilities inundated was counted by the respective return period in Section 9.1.1. The inundation depth in the area was identified by the hydrologic analysis. The financial values of the respective facilities were also discussed in Section 9.1.2. The economic damageable values of the assets are tabulated in Table 9.1.7.

The rates of flood damage to the respective facilities are proportionate with inundation depth. These rates are also tabulated in Table 9.1.8. The rates are based on the new manual named “Manual for Economic Study on Flood Control” published by Ministry of Land, Infrastructure and Transport of the Japanese Government in June 1999.

The infrastructure damage was calculated as 20% of the total value of the direct damage. In addition, the indirect damages were estimated in the procedure discussed in Section 2.2.3. Finally, the entire damages are calculated for the respective return period of flood. The damages of the respective phases are tabulated in Table 9.1.9 to 9.1.16 including under present conditions and under future conditions. The flood damages of 25-year probable rainfall under without-project and with-project conditions were summarized in the table below. These damages are estimated under present conditions and under future conditions in the target year 2020.

Flood Damages of 25-year flood under Present Conditions:

Item	Implementation Phasing (Million Pesos)			
	Phase 1	Phase 2	Phase 3	Phase 4
Direct Damage	1,219	2,819	4,709	7,154
Facility	966	2,216	3,668	5,655
Agriculture	50	133	257	306
Infrastructure	203	470	785	1,192
Indirect Damage	219	500	831	1,261
Total	1,438	3,319	5,540	8,415

Flood Damages of 25-year flood in 2020 under Future Conditions:

Item	Implementation Phasing (Million Pesos)			
	Phase 1	Phase 2	Phase 3	Phase 4
Direct Damage	4,050	9,059	15,108	23,666
Facility	3,294	7,340	12,183	19,248
Agriculture *	81	209	407	474
Infrastructure	675	1,510	2,518	3,944
Indirect Damage	730	1,608	2,667	4,204
Total	4,780	10,666	17,785	27,870

Note: *1 Benefits from flood damages to new and rehabilitation irrigation systems were included only a half of the total damages, because they increased owing to a multiplier effect of flood control and irrigation projects.

9.1.5 Estimation of Annual Benefit

The annual damage is calculated applying the following formula, on the basis of the flood damages for the respective probable rainfalls.

$$B = \sum_{i=1}^n \frac{1}{2} [D(Q_{i-1}) + D(Q_i)] \cdot [P(Q_{i-1}) - P(Q_i)]$$

Where, B : Annual average benefit

$D(Q_{i-1}), D(Q_i)$: Flood damage caused by the floods with Q_{i-1} and Q_i discharges, respectively

$P(Q_{i-1}), P(Q_i)$: Probabilities of occurrence of Q_{i-1} and Q_i discharges, respectively

n : Number of flood applied

The annual average benefit is defined as the reduction of probable damage under with- and without-project conditions. The project was proposed as flood control scheme for 25-year probable rainfall. The annual benefit of the first phase schemes of flood control plan in Lower Cagayan River Basin was estimated at 325 million Pesos under present conditions.

Through the same procedure using the estimates of flood damages, the annual benefits of the respective phasing schemes are calculated as shown below.

(Unit: Million Pesos per Year)

Socio-Economic Condition	Phase 1	Phase 2	Phase 3	Phase 4
1. Under Present Condition	325	639	1,212	2,389
2. Under Future Condition (in 2020)	1,144	2,026	3,476	4,791

In addition to flood mitigation benefit, bank protection works and evaluation benefits are added as flood control benefit, since these works are proposed together with the river improvement flood control schemes. These benefits are derived from the review study of the 1987 Master Plan Study. They were estimated at 64.9 million Pesos for bank protection works and 55.9 million Pesos for evacuation system in economic terms under present conditions. They were also estimated at 222.2 million Pesos for bank protection works and 191.4 million Pesos for evacuation system under future conditions.

On the other hand, the negative benefits for foregone crop production lands were estimated at 0.6 million Pesos per annum for Phase 1 area, 0.3 million Pesos for Phase 2, 0.8 million Pesos for Phase 3 and 1.3 million Pesos for Phase 4 area.

9.2 Economic Cost

The construction cost consists of the following major items. The construction costs are segregated into the respective projects of each phase.

- a) Direct construction cost
- b) Compensation cost
- c) Engineering service cost
- d) Administration cost
- e) Physical contingency cost
- f) Price contingency cost

To simplify the procedure of conversion from financial cost to economic cost, the direct construction costs are segregated into (i) materials, (ii) machinery and

equipment rental, (iii) labor and (iv) contingency costs. The conversion factors of these cost items from financial cost to economic cost were discussed in Section 9.1.1. Conversion factors of major civil works such as excavation work and filling works are calculated applying these conversion factors. These factors were enumerated in Table 9.2.1.

The economic cost of the respective phases was calculated from the corresponding financial cost through the procedure mentioned above. The conversion tables were enumerated in Table 9.2.2 and 9.2.3. They are summarized as follows. The costs of the respective phases are estimated as accumulation from the beginning.

(Unit: Million Pesos)

Item	Phase 1	Phase 2	Phase 3	Phase 4
Financial Cost				12,061
Direct Main Works*1	2,094	4,396	7,870	101
Compensation	26	30	73	289
Administration	48	92	178	1,153
Engineering Services	190	365	709	668
Price Contingency	218	319	477	1,107
Physical Contingency	207	409	725	15,378
Total	2,786	5,611	10,031	
Economic Cost				
Direct Main Works	1,605	3,474	6,243	9,569
Compensation*2	0	0	0	0
Administration	46	87	169	274
Engineering Services	222	426	827	1,344
Price Contingency	0	0	0	0
Physical Contingency	175	347	615	940
Total	2,047	4,334	7,854	12,127

Note: *1 Including non-structural measures and supporting measures in addition to value added tax (VAT).

*2 Counted in benefit stream as negative benefit.

In terms of the compensation items, the land acquisition cost is converted as crop production foregone as mentioned in Section 9.1. The house acquisition cost is converted using the conversion factor of housing unit (0.83). The price contingency cost is excluded from economic cost. As a result, the entire economic cost is calculated as 2.05 billion pesos in Phase 1. Since the financial total cost is 2.79 billion pesos, the economic construction cost corresponds to 73% of the financial costs.

The construction cost is disbursed in compliance with the construction schedule. The operation and maintenance (O&M) cost is annually required during the economic life of the objective project. The O&M cost is assumed to be 0.5% of the total direct construction cost of flood control schemes. In terms of FFWS, the O/M cost was estimated at 6.0 million pesos per annum. Then, the total O/M cost of the Phase 1 schemes was estimated at 12.9 million pesos in economic terms. In terms of FFWS, some of equipment will be replaced every ten-years.

Then, the expenditure for replacement of the equipment has to be added as replacement cost in the cost stream.

9.3 Economic Evaluation

9.3.1 Economic Viability

In this section, the proposed project is examined from the economic point of view. The projects are evaluated for the respective phases on the basis of accumulated costs and benefits.

The economic evaluation indices are calculated applying the benefits and costs estimated above. The evaluation indices are listed in the table below. The economic internal rate of return (EIRR) of the respective phases is estimated to be 14.8%, 12.3%, 13.0% and 14.1% under present conditions, respectively. However, it jumped up to 27.1%, 25.4%, 26.8% and 27.4% under future conditions. Thus, the EIRRs under future conditions are much higher than the social discount rate of 15%. In particular, the flood control projects in Phase 1 seem to be quite viable because their EIRR was 27.1% under future conditions. Incidentally, their cost-benefit ratio (B/C) is 2.15 and net present value (NPV) is estimated at 1,255 million pesos. Table 9.3.1 to 9.3.8 shows the cost and benefit stream of flood control projects for all phases under present conditions and under future conditions.

Item		Phase 1	Phase 2	Phase 3	Phase 4
Under Present Conditions	EIRR (%)	14.8	12.3	13.0	14.1
	B/C ^{*1}	0.99	0.83	0.87	0.93
	NPV ^{*1} (Bil. Pesos)	-15	-319	-327	-186
Under Future Conditions	EIRR (%)	27.1	25.4	26.8	27.3
	B/C ^{*1}	2.15	1.88	2.06	2.14
	NPV ^{*1} (Bil. Pesos)	1,255	1,673	2,565	3,193

Note: *1 Discounted at 15%

9.3.2 Sensitivity Test

The cost and benefits are estimated with discretion by respective experts in this study. In spite of that, some uncertainty still exists in the estimation. In particular, the cases with long implementation period and/or expectation of future growth have high risks in terms of judgment on project viability. In this context, the sensitivity test is introduced in the following aspects, in consideration of sensitive factors for project feasibility.

- a) 5% or 10% higher than the cost estimated
- b) 5% or 10% lower than the benefit expected
- c) Combined the both aspects at the same time

The influence of the above phenomena was examined as follows. The results were presented for the Phase 1 schemes under future conditions. As shown in the table below, EIRRs of the all cases exceeded 16%. Thus, the proposed project is sufficiently feasible from the economic point of view. Incidentally, in case that the benefit only decreases to 50% of the original estimate, EIRR would still keep the economically feasible level, i.e., 15% of the social discount rate. On the other hand, in the case of that the cost only increase to around 100% or twice of the original estimate, EIRR would still keep the economically feasible level, i.e., 15% of the social discount rate.

		Benefit		
		0%	5% Down	10% Down
Cost	0%	27.1%	26.0%	25.0%
	5% Up	26.1%	25.1%	24.1%
	10% Up	25.2%	24.2%	23.2%

9.4 Economic Evaluation of Implementation Alternative Plan 2

The proposed projects are proposed to be implemented in three phases. Flood damages of 25-year flood for the 4 phases of phase-in implementation.

(Unit: Billion Pesos)

Socio-Economic Condition	Phase 1	Phase 2	Phase 3
Under Present Conditions	3.1	5.5	8.4
Under Future Conditions	9.8	17.8	27.9

Based on the estimates of flood damages, the annual benefits of the respective phase schemes are calculated as shown in the table below.

(Unit: Billion Pesos)

Socio-Economic Condition	Phase 1	Phase 2	Phase 3
Under Present Conditions	0.5	0.7	1.2
Under Future Conditions	1.7	3.3	4.6

The economic cost of the respective phases was calculated from the corresponding financial cost applying conversion factors for the respective cost items, as recommended in “ICC Project Evaluation Procedures and Guidelines”. They are summarized as follows. The costs of the respective phases are estimated as accumulation from the beginning.

(Unit: Billion Pesos)

Initial Cost	Phase 1	Phase 2	Phase 3
Financial Cost	4.6	10.1	15.5
Economic Cost	3.4	7.9	12.1

The EIRRs of the respective phases were estimated at 13.3%, 12.8% and 13.6% under present conditions. Under future conditions, they were 25.5%, 25.5% and 25.8%. Thus, they are quite viable because EIRRs were much higher than the social discount rate of 15%.

CHAPTER 10 IRRIGATION DEVELOPMENT PLAN

10.1 Proposed Irrigation Project

Among irrigation development projects, Alcala-Amulung-West Irrigation Project is selected for the first priority projects. Referring to the effects of flood control projects, the project is implemented in two phases, i.e., Phase 1 and Phase 3. The project is examined in the respective phases in accordance with the construction schedule.

10.2 Economic Benefit

Economic benefit is estimated as a difference of net crop production values between with-project conditions and without-project conditions. The crop production value is calculated on the basis of crop yield, farm-gate price, production cost for the crops cultivated in the project sites. Table 10.2.1 shows economic values of rice and corn at farm gate of farmers. Table 10.2.2 shows farmgate prices of commodities cultivated in the sites in market prices. Table 10.2.3 shows them in economic terms. Table 10.2.4 shows production cost of commodities cultivated in the sites.

The economic benefit of the proposed project for the phase-1 was estimated at 266 million Pesos per annum, as shown in Table 10.2.5. It composed of crop production increment benefit and rice milling services (25 million Pesos per annum) in the project site. In the same manner, the economic benefit of Phase 3 was estimated at 167 million Pesos as shown in Table 10.2.6 from crop production and 19 million Pesos from rice milling services. Then, the total benefit of Alcala-Amulung West project was calculated at 435 million Pesos under present conditions.

By the target year, values of crops produced in the project sites would rise in accordance with value in the international market as well as in the domestic markets. The value index for this appreciation was derived from the rice value projected by the World Bank. The total benefits for the respective phases are shown in the table below.

(Unit: Million Pesos per Year)

Item	Phase 1	Phase 3
Under Present Conditions	266	435
Under Future Conditions (in 2020)	291	476

Some areas are expropriated for pump station and canals. In these areas, no more crops could be cultivated after implementation of the project. These areas

are evaluated as negative benefit. They were estimated at 9.0 million Pesos per annum for Phase 1 and 6.4 million Pesos for Phase 3.

10.3 Economic Cost

The construction costs estimated in Section 9.2 were based on market prices. Then, these costs have to be converted to economic costs. The conversion factors of these cost items from financial cost to economic cost were discussed in Section 9.1.3. The costs of the respective phases are estimated as accumulation from the beginning.

(Unit: Million Pesos)

Item	Financial Cost		Economic Cost	
	Phase 1	Phase 3	Phase 1	Phase 3
Direct Main Works*1	1,202	1,894	864	1,415
Compensation	20	40	0	0
Administration	27	54	25	51
Engineering Services	109	218	127	254
Price Contingency	147	235	0	0
Physical Contingency	120	195	102	166
Total	1,625	2,636	1,118	1,886

Note: *1 Including supporting measures such as rice millers and drying yards.

The financial cost of direct main works includes value added tax (VAT).

The O&M cost is annually required during the economic life of the objective project. The total O/M costs of the respective phases were estimated at 26 million Pesos and 18 million Pesos in economic terms. In addition, equipment such as pumps and gates will be replaced every 15-years. Then, the expenditure for replacement has to be added as replacement cost in the cost stream.

10.4 Economic Evaluation

The EIRRs of the respective phases are estimated to be 15.6%, and 15.2% under present conditions. However, it went up to 16.4%, and 16.1% under future conditions. Tables 10.4.1 to 10.4.4 show economic cost and benefit stream of this project for Phase 1 and accumulation form of Phase 3. Thus, the EIRRs under future conditions are higher than the social discount rate of 15%. The irrigation development project seems to be viable from the economic view point.

Item		Phase 1	Phase 3
Under Present Conditions	EIRR (%)	15.6	15.2
	B/C*1	1.04	1.01
	NPV*1 (Million Pesos)	27	11
Under Future Conditions (in 2020)	EIRR (%)	16.4	16.1
	B/C*1	1.10	1.08
	NPV*1 (Million Pesos)	66	60

Note: *1 Discounted at 15%

*The Feasibility Study of the Flood Control Project for
the Lower Cagayan River in the Republic of the Philippines
Final Report
Supporting Report
Annex X: Project Evaluation*

Tables

Table 2.2.1 Benefits of Flood Control Project

Category of Damageable Assets and Activities				Damages Mitigated by FC Project	
Benefits of Flood Mitigation	Direct Damages	Effects of Mitigating Damages to General Assets	Damages to General Assets	Building Unit	Damage to residential and business's buildings due to inundation
				Household Effects	Furniture and movables such as automobile, electric appliances
				Depreciable Assets of Business Establishments	Damage to depreciable assets of business establishments except their sites and buildings
				Inventory Stocks of Business Establishments	Damage to inventory stocks of business establishments due to inundation
				Depreciable Assets for Farming and Fishery	Damage to depreciable assets of farming or fishery in farmers or business establishments except their sites and buildings
				Inventory Stocks for Farming and Fishery	Damage to inventory stocks of farming or fishery in farmers or business establishments except their sites and buildings
			Damages to Agricultural Production		Damage to crop production due to inundation
			Damages to Infrastructures	Road, Bridge, Railway, River Facility, Sewerage, Water Supply, Electric Power, Gas, Telephone, Park, Irrigation, etc.	Damage to infrastructures supporting livelihood, business activities and farming production
	Effects of Mitigating Damage to Human Lives			Damage to living space, causing casualties	
	Indirect Damages	Effects of Mitigating Damages to Daily Activities	Damage to Daily Maintenance and Business Activities	Household Economy	Damage to daily housekeeping tasks and community activities due to inundation
				Industrial Production	Stoppage or decrease of business and production activities due to inundation
				Public Services	Stoppage or decrease of public services
		Effects of Mitigating Damages after Flood	Expenses for State of Emergency	Household Economy	After inundation, cleaning and repairing houses damaged by flood, and extra expenses for state of emergency
				Industrial Production	After inundation, cleaning and repairing buildings damaged by flood, and extra expenses for state of emergency
				Government's Activities	Expenses for emergency activities to casualties in addition to the works above
			Damage due to Traffic Disruption	Road, Railway, Port, Airport, etc.	Disruption of traffic systems such as road network, railway, etc., spreading to surrounding areas
			Damage due to Disruption of Lifeline Services	Water Supply, Electric Power, Gas, Telephone, etc.	Disruption of public utility services such as water supply, electricity, gas, etc., spreading to surrounding areas
Damage due to Stoppage and Decrease of Daily Activities		Decrease of production due to lack of raw and semi finished materials, Stoppage of public services such as medical and utilities, spreading to surrounding areas			
Effects of Mitigating Mental Influence		Influence due to Damages Above		Mental influence due to damages to general assets, business losses, casualties, aftereffects, and influence over surrounding areas	
Benefit from Sophisticated Environment				Land appreciation owing to improvement of flood control	

Table 4.1.1 Review of Projects Proposed in 1987 Master Plan at 2000 Prices

Flood Control Schemes							
Project Name	Cost *1		Benefit Under Present Condition				
	Initial Investment (Mil. Pesos)	O/M (Million Pesos per Year)	Benefit (Million Pesos per Year)	EIRR (%)	B/C*3	NPV*3 (Million Pesos)	
1. Tuguegarao Dike	1,501	6	216	16.8	1.12	89	
2. Narrow Improvement (Site: NLL)	2,700	10	294	12.5	0.84	-217	
3. Siffu No.1 Dam	1,469	5	110	6.9	0.48	-455	
4. Bank Protection Work	3,502	13	264	6.9	0.49	-1,076	
5. Cabagan Dike	761	3	62	7.6	0.53	-217	
6. Narrow Improvement (Site: NLR)	8,152	31	573	6.4	0.45	-2,669	
7. Magat/Alimit Dam	5,559	20	416	6.9	0.48	-1,720	
8. Cagayan No.1 Dam	4,461	15	273	5.2	0.39	-1,631	
9. Mallig No.2 Dam	1,207	4	57	3.7	0.30	-504	
10. Ilagan No.1 Dam	5,894	21	133	-	0.15	-3,020	
11. Narrow Improvement (Site: NUP)	9,218	35	17	-	0.01	-5,470	

Project Name	Benefit Counting on Future Economic Growth					Priority Order Based on Economic Efficiency
	Benefit		EIRR (%)	B/C*3	NPV*3 (Million Pesos)	
	in 2010 (Million Pesos per Year)	in 2020 (Million Pesos per Year)				
1. Tuguegarao Dike	216	703	28.5	2.23	922	1
2. Narrow Improvement (Site: NLL)	294	955	22.6	1.67	915	2
3. Siffu No.1 Dam	110	357	14.6	0.96	-32	6
4. Bank Protection Work	510	905	15.1	1.01	20	4
5. Cabagan Dike	62	200	15.5	1.05	21	3
6. Narrow Improvement (Site: NLR)	573	1,862	13.9	0.91	-462	6
7. Magat/Alimit Dam	416	1,352	13.2	0.86	-539	5
8. Cagayan No.1 Dam	273	888	11.3	0.70	-889	8
9. Mallig No.2 Dam	57	184	9.0	0.88	-115	9
10. Ilagan No.1 Dam	133	433	4.1	0.26	-2,949	10
11. Narrow Improvement (Site: NUP)	17	57	-	0.02	-5,401	11

Multipurpose Schemes							
Project Name	Cost *1		Benefit Under Present Condition				
	Initial Investment (Mil. Pesos)	O/M (Million Pesos per Year)	Benefit (Million Pesos per Year)	EIRR (%)	B/C*3	NPV*3 (Million Pesos)	
1. Multipurpose Siffu No.1 Dam	2,696	52.1	942.3	21.4	1.56	974	
2. Multipurpose Magat/Alimit Dam	4,989	68.7	810.9	11.7	0.75	-790	
3. Multipurpose Mallig No.2 Dam	9,474	71.9	1,897.7	14.4	0.95	-308	
4. Multipurpose Matuno Dam	14,794	19.2	4,428.1	19.9	1.46	4,022	

Project Name	Benefit Counting on Future Economic Growth					Priority Order Based on Economic Efficiency
	Benefit		EIRR (%)	B/C*3	NPV*3 (Million Pesos)	
	in 2000 (Million Pesos per Year)	in 2020 (Million Pesos per Year)				
1. Multipurpose Siffu No.1 Dam	1,388	1,999	28.5	2.55	2,696	2
2. Multipurpose Magat/Alimit Dam	1,359	2,188	19.3	1.44	1,384	3
3. Multipurpose Mallig No.2 Dam	2,512	3,219	18.5	1.34	1,962	4
4. Multipurpose Matuno Dam	7,818	13,084	29.7	3.01	17,569	1

Note: *1 Costs at 2000 constant prices was estimated from the M/P estimates applying a price deflator of 3.0, derived from CPI and WPI.

*2 Benefit at 2000 constant prices was estimated from the M/P estimates applying a price deflator of 3.4, derived from CPI, and growth of population and GRDP per capita.

*3 Discounted at 15%.

Table 4.1.2 Economic Cost and Benefit Stream of Tuguegarao Dike Project under Present Conditions

(Unit: Million Pesos)

No.	Year	Cost				Benefit	Balance	
		Const.	Other	O/M	Total			
0	2001			3.3		3.3	0.0	-3.3
1	2002	224.7	25.2			249.9	0.0	-249.9
2	2003	224.7	25.2	1.1		251.0	43.3	-207.7
3	2004	224.7	25.2	2.2		252.1	86.6	-165.6
4	2005	224.7	25.2	3.4		253.3	129.8	-123.4
5	2006	224.7	21.9	4.5		251.1	173.1	-77.9
6	2007			5.6		5.6	216.4	210.8
7	2008			5.6		5.6	216.4	210.8
8	2009			5.6		5.6	216.4	210.8
9	2010			5.6		5.6	216.4	210.8
10	2011			5.6		5.6	216.4	210.8
11	2012			5.6		5.6	216.4	210.8
12	2013			5.6		5.6	216.4	210.8
13	2014			5.6		5.6	216.4	210.8
14	2015			5.6		5.6	216.4	210.8
15	2016			5.6		5.6	216.4	210.8
16	2017			5.6		5.6	216.4	210.8
17	2018			5.6		5.6	216.4	210.8
18	2019			5.6		5.6	216.4	210.8
19	2020			5.6		5.6	216.4	210.8
20	2021			5.6		5.6	216.4	210.8
21	2022			5.6		5.6	216.4	210.8
22	2023			5.6		5.6	216.4	210.8
23	2024			5.6		5.6	216.4	210.8
24	2025			5.6		5.6	216.4	210.8
25	2026			5.6		5.6	216.4	210.8
26	2027			5.6		5.6	216.4	210.8
27	2028			5.6		5.6	216.4	210.8
28	2029			5.6		5.6	216.4	210.8
29	2030			5.6		5.6	216.4	210.8
30	2031			5.6		5.6	216.4	210.8
31	2032			5.6		5.6	216.4	210.8
32	2033			5.6		5.6	216.4	210.8
33	2034			5.6		5.6	216.4	210.8
34	2035			5.6		5.6	216.4	210.8
35	2036			5.6		5.6	216.4	210.8
36	2037			5.6		5.6	216.4	210.8
37	2038			5.6		5.6	216.4	210.8
38	2039			5.6		5.6	216.4	210.8
39	2040			5.6		5.6	216.4	210.8
40	2041			5.6		5.6	216.4	210.8
41	2042			5.6		5.6	216.4	210.8
42	2043			5.6		5.6	216.4	210.8
43	2044			5.6		5.6	216.4	210.8
44	2045			5.6		5.6	216.4	210.8
45	2046			5.6		5.6	216.4	210.8
46	2047			5.6		5.6	216.4	210.8
47	2048			5.6		5.6	216.4	210.8
48	2049			5.6		5.6	216.4	210.8
49	2050			5.6		5.6	216.4	210.8
50	2051			5.6		5.6	216.4	210.8
51	2052			5.6		5.6	216.4	210.8
52	2053			5.6		5.6	216.4	210.8
53	2054			5.6		5.6	216.4	210.8
54	2055			5.6		5.6	216.4	210.8
55	2056			5.6		5.6	216.4	210.8
B/C:		1.12		NPV:	88.8 Mil. Pesos		EIRR:	16.8%

Table 4.1.3 Economic Cost and Benefit Stream of Narrow Improvement (NLL) Project under Present Conditions

(Unit: Million Pesos)

No.	Year	Cost				Benefit	Balance	
		Const.	Other	O/M	Total			
0	2001			5.8		5.8	0.0	-5.8
1	2002	407.8	44.1			451.9	0.0	-451.9
2	2003	407.8	44.1		2.0	453.9	58.8	-395.1
3	2004	407.8	44.1		4.1	456.0	117.6	-338.3
4	2005	407.8	44.1		6.1	458.0	176.5	-281.6
5	2006	407.8	38.3		8.2	454.2	235.3	-219.0
6	2007				10.2	10.2	294.1	283.9
7	2008				10.2	10.2	294.1	283.9
8	2009				10.2	10.2	294.1	283.9
9	2010				10.2	10.2	294.1	283.9
10	2011				10.2	10.2	294.1	283.9
11	2012				10.2	10.2	294.1	283.9
12	2013				10.2	10.2	294.1	283.9
13	2014				10.2	10.2	294.1	283.9
14	2015				10.2	10.2	294.1	283.9
15	2016				10.2	10.2	294.1	283.9
16	2017				10.2	10.2	294.1	283.9
17	2018				10.2	10.2	294.1	283.9
18	2019				10.2	10.2	294.1	283.9
19	2020				10.2	10.2	294.1	283.9
20	2021				10.2	10.2	294.1	283.9
21	2022				10.2	10.2	294.1	283.9
22	2023				10.2	10.2	294.1	283.9
23	2024				10.2	10.2	294.1	283.9
24	2025				10.2	10.2	294.1	283.9
25	2026				10.2	10.2	294.1	283.9
26	2027				10.2	10.2	294.1	283.9
27	2028				10.2	10.2	294.1	283.9
28	2029				10.2	10.2	294.1	283.9
29	2030				10.2	10.2	294.1	283.9
30	2031				10.2	10.2	294.1	283.9
31	2032				10.2	10.2	294.1	283.9
32	2033				10.2	10.2	294.1	283.9
33	2034				10.2	10.2	294.1	283.9
34	2035				10.2	10.2	294.1	283.9
35	2036				10.2	10.2	294.1	283.9
36	2037				10.2	10.2	294.1	283.9
37	2038				10.2	10.2	294.1	283.9
38	2039				10.2	10.2	294.1	283.9
39	2040				10.2	10.2	294.1	283.9
40	2041				10.2	10.2	294.1	283.9
41	2042				10.2	10.2	294.1	283.9
42	2043				10.2	10.2	294.1	283.9
43	2044				10.2	10.2	294.1	283.9
44	2045				10.2	10.2	294.1	283.9
45	2046				10.2	10.2	294.1	283.9
46	2047				10.2	10.2	294.1	283.9
47	2048				10.2	10.2	294.1	283.9
48	2049				10.2	10.2	294.1	283.9
49	2050				10.2	10.2	294.1	283.9
50	2051				10.2	10.2	294.1	283.9
51	2052				10.2	10.2	294.1	283.9
52	2053				10.2	10.2	294.1	283.9
53	2054				10.2	10.2	294.1	283.9
54	2055				10.2	10.2	294.1	283.9
55	2056				10.2	10.2	294.1	283.9
B/C:		0.84		NPV:	-217.1	Mil. Pesos	EIRR:	12.5%

Table 4.1.4 Economic Cost and Benefit Stream of Multipurpose Siffu No.1 Dam Project under Present Conditions

		(Unit: Million Pesos)						
No.	Year	Cost				Benefit	Balance	
		Const.	Other	Replacemen	O/M(Other) Total			
0	2001		18.7			18.7	0.0	-18.7
1	2002	397.3	141.9			539.2	0.0	-539.2
2	2003	397.3	141.9			539.2	0.0	-539.2
3	2004	397.3	141.9			539.2	0.0	-539.2
4	2005	397.3	141.9			539.2	0.0	-539.2
5	2006	397.3	123.1			520.5	0.0	-520.5
6	2007				52.1	52.1	942.3	890.2
7	2008				52.1	52.1	942.3	890.2
8	2009				52.1	52.1	942.3	890.2
9	2010				52.1	52.1	942.3	890.2
10	2011				52.1	52.1	942.3	890.2
11	2012				52.1	52.1	942.3	890.2
12	2013				52.1	52.1	942.3	890.2
13	2014				52.1	52.1	942.3	890.2
14	2015				52.1	52.1	942.3	890.2
15	2016			42.0	52.1	94.2	942.3	848.2
16	2017				52.1	52.1	942.3	890.2
17	2018				52.1	52.1	942.3	890.2
18	2019				52.1	52.1	942.3	890.2
19	2020				52.1	52.1	942.3	890.2
20	2021				52.1	52.1	942.3	890.2
21	2022				52.1	52.1	942.3	890.2
22	2023				52.1	52.1	942.3	890.2
23	2024				52.1	52.1	942.3	890.2
24	2025				52.1	52.1	942.3	890.2
25	2026			42.0	52.1	94.2	942.3	848.2
26	2027				52.1	52.1	942.3	890.2
27	2028				52.1	52.1	942.3	890.2
28	2029				52.1	52.1	942.3	890.2
29	2030				52.1	52.1	942.3	890.2
30	2031			54.0	52.1	106.1	942.3	836.3
31	2032				52.1	52.1	942.3	890.2
32	2033				52.1	52.1	942.3	890.2
33	2034				52.1	52.1	942.3	890.2
34	2035				52.1	52.1	942.3	890.2
35	2036			42.0	52.1	94.2	942.3	848.2
36	2037				52.1	52.1	942.3	890.2
37	2038				52.1	52.1	942.3	890.2
38	2039				52.1	52.1	942.3	890.2
39	2040				52.1	52.1	942.3	890.2
40	2041				52.1	52.1	942.3	890.2
41	2042				52.1	52.1	942.3	890.2
42	2043				52.1	52.1	942.3	890.2
43	2044				52.1	52.1	942.3	890.2
44	2045				52.1	52.1	942.3	890.2
45	2046			42.0	52.1	94.2	942.3	848.2
46	2047				52.1	52.1	942.3	890.2
47	2048				52.1	52.1	942.3	890.2
48	2049				52.1	52.1	942.3	890.2
49	2050				52.1	52.1	942.3	890.2
50	2051				52.1	52.1	942.3	890.2
51	2052				52.1	52.1	942.3	890.2
52	2053				52.1	52.1	942.3	890.2
53	2054				52.1	52.1	942.3	890.2
54	2055				52.1	52.1	942.3	890.2
55	2056			96.0	52.1	148.1	942.3	794.2
		B/C:	1.56	NPV:	974.5	Mil. Pesos	EIRR:	21.4%

Table 4.1.5 Economic Cost and Benefit Stream of Bank Protection Project under Present Conditions

(Unit: Million Pesos)

No.	Year	Cost				Benefit	Balance	
		Const.	Other	O/M	Total			
0	2001			23.7		23.7	0.0	-23.7
1	2002	520.9	179.6			700.4	0.0	-700.4
2	2003	520.9	179.6		2.6	703.0	52.9	-650.2
3	2004	520.9	179.6		5.2	705.6	105.7	-599.9
4	2005	520.9	179.6		7.8	708.2	158.6	-549.7
5	2006	520.9	155.8		10.4	687.1	211.4	-475.7
6	2007				13.0	13.0	264.3	251.3
7	2008				13.0	13.0	264.3	251.3
8	2009				13.0	13.0	264.3	251.3
9	2010				13.0	13.0	264.3	251.3
10	2011				13.0	13.0	264.3	251.3
11	2012				13.0	13.0	264.3	251.3
12	2013				13.0	13.0	264.3	251.3
13	2014				13.0	13.0	264.3	251.3
14	2015				13.0	13.0	264.3	251.3
15	2016				13.0	13.0	264.3	251.3
16	2017				13.0	13.0	264.3	251.3
17	2018				13.0	13.0	264.3	251.3
18	2019				13.0	13.0	264.3	251.3
19	2020				13.0	13.0	264.3	251.3
20	2021				13.0	13.0	264.3	251.3
21	2022				13.0	13.0	264.3	251.3
22	2023				13.0	13.0	264.3	251.3
23	2024				13.0	13.0	264.3	251.3
24	2025				13.0	13.0	264.3	251.3
25	2026				13.0	13.0	264.3	251.3
26	2027				13.0	13.0	264.3	251.3
27	2028				13.0	13.0	264.3	251.3
28	2029				13.0	13.0	264.3	251.3
29	2030				13.0	13.0	264.3	251.3
30	2031				13.0	13.0	264.3	251.3
31	2032				13.0	13.0	264.3	251.3
32	2033				13.0	13.0	264.3	251.3
33	2034				13.0	13.0	264.3	251.3
34	2035				13.0	13.0	264.3	251.3
35	2036				13.0	13.0	264.3	251.3
36	2037				13.0	13.0	264.3	251.3
37	2038				13.0	13.0	264.3	251.3
38	2039				13.0	13.0	264.3	251.3
39	2040				13.0	13.0	264.3	251.3
40	2041				13.0	13.0	264.3	251.3
41	2042				13.0	13.0	264.3	251.3
42	2043				13.0	13.0	264.3	251.3
43	2044				13.0	13.0	264.3	251.3
44	2045				13.0	13.0	264.3	251.3
45	2046				13.0	13.0	264.3	251.3
46	2047				13.0	13.0	264.3	251.3
47	2048				13.0	13.0	264.3	251.3
48	2049				13.0	13.0	264.3	251.3
49	2050				13.0	13.0	264.3	251.3
50	2051				13.0	13.0	264.3	251.3
51	2052				13.0	13.0	264.3	251.3
52	2053				13.0	13.0	264.3	251.3
53	2054				13.0	13.0	264.3	251.3
54	2055				13.0	13.0	264.3	251.3
55	2056				13.0	13.0	264.3	251.3
B/C:		0.49	NPV:		-1,076.1 Mil. Pesos	EIRR:		6.9%

Table 4.1.6 Economic Cost and Benefit Stream of Cabagan Dike Project under Present Conditions

(Unit: Million Pesos)

No.	Year	Cost				Benefit	Balance	
		Const.	Other	O/M	Total			
0	2001			5.3		5.3	0.0	-5.3
1	2002	112.1	40.0			152.1	0.0	-152.1
2	2003	112.1	40.0	0.6		152.7	12.3	-140.3
3	2004	112.1	40.0	1.1		153.2	24.7	-128.5
4	2005	112.1	40.0	1.7		153.8	37.0	-116.7
5	2006	112.1	34.7	2.2		149.1	49.4	-99.7
6	2007			2.8		2.8	61.7	58.9
7	2008			2.8		2.8	61.7	58.9
8	2009			2.8		2.8	61.7	58.9
9	2010			2.8		2.8	61.7	58.9
10	2011			2.8		2.8	61.7	58.9
11	2012			2.8		2.8	61.7	58.9
12	2013			2.8		2.8	61.7	58.9
13	2014			2.8		2.8	61.7	58.9
14	2015			2.8		2.8	61.7	58.9
15	2016			2.8		2.8	61.7	58.9
16	2017			2.8		2.8	61.7	58.9
17	2018			2.8		2.8	61.7	58.9
18	2019			2.8		2.8	61.7	58.9
19	2020			2.8		2.8	61.7	58.9
20	2021			2.8		2.8	61.7	58.9
21	2022			2.8		2.8	61.7	58.9
22	2023			2.8		2.8	61.7	58.9
23	2024			2.8		2.8	61.7	58.9
24	2025			2.8		2.8	61.7	58.9
25	2026			2.8		2.8	61.7	58.9
26	2027			2.8		2.8	61.7	58.9
27	2028			2.8		2.8	61.7	58.9
28	2029			2.8		2.8	61.7	58.9
29	2030			2.8		2.8	61.7	58.9
30	2031			2.8		2.8	61.7	58.9
31	2032			2.8		2.8	61.7	58.9
32	2033			2.8		2.8	61.7	58.9
33	2034			2.8		2.8	61.7	58.9
34	2035			2.8		2.8	61.7	58.9
35	2036			2.8		2.8	61.7	58.9
36	2037			2.8		2.8	61.7	58.9
37	2038			2.8		2.8	61.7	58.9
38	2039			2.8		2.8	61.7	58.9
39	2040			2.8		2.8	61.7	58.9
40	2041			2.8		2.8	61.7	58.9
41	2042			2.8		2.8	61.7	58.9
42	2043			2.8		2.8	61.7	58.9
43	2044			2.8		2.8	61.7	58.9
44	2045			2.8		2.8	61.7	58.9
45	2046			2.8		2.8	61.7	58.9
46	2047			2.8		2.8	61.7	58.9
47	2048			2.8		2.8	61.7	58.9
48	2049			2.8		2.8	61.7	58.9
49	2050			2.8		2.8	61.7	58.9
50	2051			2.8		2.8	61.7	58.9
51	2052			2.8		2.8	61.7	58.9
52	2053			2.8		2.8	61.7	58.9
53	2054			2.8		2.8	61.7	58.9
54	2055			2.8		2.8	61.7	58.9
55	2056			2.8		2.8	61.7	58.9
B/C:		0.53	NPV:		-216.8 Mil. Pesos	EIRR:		7.6%

Table 4.1.7 Economic Cost and Benefit Stream of Narrow Improvement (NLR) Project under Present Conditions

		(Unit: Million Pesos)						
No.	Year	Cost			Total	Benefit	Balance	
		Const.	Other	O/M				
0	2001			52.9		52.9	0.0	-52.9
1	2002	1,229.9	400.5			1,630.4	0.0	-1,630.4
2	2003	1,229.9	400.5	6.1		1,636.6	114.6	-1,521.9
3	2004	1,229.9	400.5	12.3		1,642.7	229.3	-1,413.4
4	2005	1,229.9	400.5	18.4		1,648.9	343.9	-1,304.9
5	2006	1,229.9	347.6	24.6		1,602.2	458.6	-1,143.6
6	2007			30.7		30.7	573.2	542.5
7	2008			30.7		30.7	573.2	542.5
8	2009			30.7		30.7	573.2	542.5
9	2010			30.7		30.7	573.2	542.5
10	2011			30.7		30.7	573.2	542.5
11	2012			30.7		30.7	573.2	542.5
12	2013			30.7		30.7	573.2	542.5
13	2014			30.7		30.7	573.2	542.5
14	2015			30.7		30.7	573.2	542.5
15	2016			30.7		30.7	573.2	542.5
16	2017			30.7		30.7	573.2	542.5
17	2018			30.7		30.7	573.2	542.5
18	2019			30.7		30.7	573.2	542.5
19	2020			30.7		30.7	573.2	542.5
20	2021			30.7		30.7	573.2	542.5
21	2022			30.7		30.7	573.2	542.5
22	2023			30.7		30.7	573.2	542.5
23	2024			30.7		30.7	573.2	542.5
24	2025			30.7		30.7	573.2	542.5
25	2026			30.7		30.7	573.2	542.5
26	2027			30.7		30.7	573.2	542.5
27	2028			30.7		30.7	573.2	542.5
28	2029			30.7		30.7	573.2	542.5
29	2030			30.7		30.7	573.2	542.5
30	2031			30.7		30.7	573.2	542.5
31	2032			30.7		30.7	573.2	542.5
32	2033			30.7		30.7	573.2	542.5
33	2034			30.7		30.7	573.2	542.5
34	2035			30.7		30.7	573.2	542.5
35	2036			30.7		30.7	573.2	542.5
36	2037			30.7		30.7	573.2	542.5
37	2038			30.7		30.7	573.2	542.5
38	2039			30.7		30.7	573.2	542.5
39	2040			30.7		30.7	573.2	542.5
40	2041			30.7		30.7	573.2	542.5
41	2042			30.7		30.7	573.2	542.5
42	2043			30.7		30.7	573.2	542.5
43	2044			30.7		30.7	573.2	542.5
44	2045			30.7		30.7	573.2	542.5
45	2046			30.7		30.7	573.2	542.5
46	2047			30.7		30.7	573.2	542.5
47	2048			30.7		30.7	573.2	542.5
48	2049			30.7		30.7	573.2	542.5
49	2050			30.7		30.7	573.2	542.5
50	2051			30.7		30.7	573.2	542.5
51	2052			30.7		30.7	573.2	542.5
52	2053			30.7		30.7	573.2	542.5
53	2054			30.7		30.7	573.2	542.5
54	2055			30.7		30.7	573.2	542.5
55	2056			30.7		30.7	573.2	542.5
B/C:		0.45		NPV:	-2,668.7	Mil. Pesos	EIRR:	6.4%

Table 4.1.8 Economic Cost and Benefit Stream of Multipurpose Magat/Alimit Dam Project under Present Conditions

(Unit: Million Pesos)

No.	Year	Cost			Benefit	Balance	
		Const.	Other	Replacemen			
0	2001		34.7		34.7	0.0	-34.7
1	2002	735.3	262.6		997.9	0.0	-997.9
2	2003	735.3	262.6		997.9	0.0	-997.9
3	2004	735.3	262.6		997.9	0.0	-997.9
4	2005	735.3	262.6		997.9	0.0	-997.9
5	2006	735.3	227.9		963.2	0.0	-963.2
6	2007				68.7	810.9	742.2
7	2008				68.7	810.9	742.2
8	2009				68.7	810.9	742.2
9	2010				68.7	810.9	742.2
10	2011				68.7	810.9	742.2
11	2012				68.7	810.9	742.2
12	2013				68.7	810.9	742.2
13	2014				68.7	810.9	742.2
14	2015				68.7	810.9	742.2
15	2016			20.1	68.7	810.9	722.1
16	2017				68.7	810.9	742.2
17	2018				68.7	810.9	742.2
18	2019				68.7	810.9	742.2
19	2020				68.7	810.9	742.2
20	2021				68.7	810.9	742.2
21	2022				68.7	810.9	742.2
22	2023				68.7	810.9	742.2
23	2024				68.7	810.9	742.2
24	2025				68.7	810.9	742.2
25	2026			20.1	68.7	810.9	722.1
26	2027				68.7	810.9	742.2
27	2028				68.7	810.9	742.2
28	2029				68.7	810.9	742.2
29	2030				68.7	810.9	742.2
30	2031			25.9	68.7	810.9	716.3
31	2032				68.7	810.9	742.2
32	2033				68.7	810.9	742.2
33	2034				68.7	810.9	742.2
34	2035				68.7	810.9	742.2
35	2036			20.1	68.7	810.9	722.1
36	2037				68.7	810.9	742.2
37	2038				68.7	810.9	742.2
38	2039				68.7	810.9	742.2
39	2040				68.7	810.9	742.2
40	2041				68.7	810.9	742.2
41	2042				68.7	810.9	742.2
42	2043				68.7	810.9	742.2
43	2044				68.7	810.9	742.2
44	2045				68.7	810.9	742.2
45	2046			20.1	68.7	810.9	722.1
46	2047				68.7	810.9	742.2
47	2048				68.7	810.9	742.2
48	2049				68.7	810.9	742.2
49	2050				68.7	810.9	742.2
50	2051				68.7	810.9	742.2
51	2052				68.7	810.9	742.2
52	2053				68.7	810.9	742.2
53	2054				68.7	810.9	742.2
54	2055				68.7	810.9	742.2
55	2056			46.0	68.7	810.9	696.2

B/C: 0.75 NPV: -789.9 Mil. Pesos EIRR: 11.7%

Table 4.1.9 Economic Cost and Benefit Stream of Multipurpose Mallig No.2 Dam Project under Present Conditions

		(Unit: Million Pesos)						
No.	Year	Cost				Benefit	Balance	
		Const.	Other	Replacemen	O/M Total			
0	2001			65.8		65.8	0.0	-65.8
1	2002	1,396.2	498.6			1,894.8	0.0	-1,894.8
2	2003	1,396.2	498.6			1,894.8	0.0	-1,894.8
3	2004	1,396.2	498.6			1,894.8	0.0	-1,894.8
4	2005	1,396.2	498.6			1,894.8	0.0	-1,894.8
5	2006	1,396.2	432.8			1,829.0	0.0	-1,829.0
6	2007				71.9	71.9	1,897.7	1,825.8
7	2008				71.9	71.9	1,897.7	1,825.8
8	2009				71.9	71.9	1,897.7	1,825.8
9	2010				71.9	71.9	1,897.7	1,825.8
10	2011				71.9	71.9	1,897.7	1,825.8
11	2012				71.9	71.9	1,897.7	1,825.8
12	2013				71.9	71.9	1,897.7	1,825.8
13	2014				71.9	71.9	1,897.7	1,825.8
14	2015				71.9	71.9	1,897.7	1,825.8
15	2016			86.6	71.9	158.5	1,897.7	1,739.2
16	2017				71.9	71.9	1,897.7	1,825.8
17	2018				71.9	71.9	1,897.7	1,825.8
18	2019				71.9	71.9	1,897.7	1,825.8
19	2020				71.9	71.9	1,897.7	1,825.8
20	2021				71.9	71.9	1,897.7	1,825.8
21	2022				71.9	71.9	1,897.7	1,825.8
22	2023				71.9	71.9	1,897.7	1,825.8
23	2024				71.9	71.9	1,897.7	1,825.8
24	2025				71.9	71.9	1,897.7	1,825.8
25	2026			86.6	71.9	158.5	1,897.7	1,739.2
26	2027				71.9	71.9	1,897.7	1,825.8
27	2028				71.9	71.9	1,897.7	1,825.8
28	2029				71.9	71.9	1,897.7	1,825.8
29	2030				71.9	71.9	1,897.7	1,825.8
30	2031			60.3	71.9	132.1	1,897.7	1,765.6
31	2032				71.9	71.9	1,897.7	1,825.8
32	2033				71.9	71.9	1,897.7	1,825.8
33	2034				71.9	71.9	1,897.7	1,825.8
34	2035				71.9	71.9	1,897.7	1,825.8
35	2036			86.6	71.9	158.5	1,897.7	1,739.2
36	2037				71.9	71.9	1,897.7	1,825.8
37	2038				71.9	71.9	1,897.7	1,825.8
38	2039				71.9	71.9	1,897.7	1,825.8
39	2040				71.9	71.9	1,897.7	1,825.8
40	2041				71.9	71.9	1,897.7	1,825.8
41	2042				71.9	71.9	1,897.7	1,825.8
42	2043				71.9	71.9	1,897.7	1,825.8
43	2044				71.9	71.9	1,897.7	1,825.8
44	2045				71.9	71.9	1,897.7	1,825.8
45	2046			86.6	71.9	158.5	1,897.7	1,739.2
46	2047				71.9	71.9	1,897.7	1,825.8
47	2048				71.9	71.9	1,897.7	1,825.8
48	2049				71.9	71.9	1,897.7	1,825.8
49	2050				71.9	71.9	1,897.7	1,825.8
50	2051				71.9	71.9	1,897.7	1,825.8
51	2052				71.9	71.9	1,897.7	1,825.8
52	2053				71.9	71.9	1,897.7	1,825.8
53	2054				71.9	71.9	1,897.7	1,825.8
54	2055				71.9	71.9	1,897.7	1,825.8
55	2056			146.9	71.9	218.8	1,897.7	1,678.9
		B/C:	0.95	NPV:	-307.5	Mil. Pesos	EIRR:	14.4%

Table 4.1.10 Economic Cost and Benefit Stream of Multipurpose Matuno Dam Project under Present Conditions

		(Unit: Million Pesos)						
No.	Year	Cost				Benefit	Balance	
		Const.	Other	Replacemen	O/M Total			
0	2001			102.8		102.8	0.0	-102.8
1	2002	2,180.2	778.5			2,958.7	0.0	-2,958.7
2	2003	2,180.2	778.5			2,958.7	0.0	-2,958.7
3	2004	2,180.2	778.5			2,958.7	0.0	-2,958.7
4	2005	2,180.2	778.5			2,958.7	0.0	-2,958.7
5	2006	2,180.2	675.8			2,855.9	0.0	-2,855.9
6	2007				19.2	19.2	4,428.1	4,409.0
7	2008				19.2	19.2	4,428.1	4,409.0
8	2009				19.2	19.2	4,428.1	4,409.0
9	2010				19.2	19.2	4,428.1	4,409.0
10	2011				19.2	19.2	4,428.1	4,409.0
11	2012				19.2	19.2	4,428.1	4,409.0
12	2013				19.2	19.2	4,428.1	4,409.0
13	2014				19.2	19.2	4,428.1	4,409.0
14	2015				19.2	19.2	4,428.1	4,409.0
15	2016			30.0	19.2	49.2	4,428.1	4,379.0
16	2017				19.2	19.2	4,428.1	4,409.0
17	2018				19.2	19.2	4,428.1	4,409.0
18	2019				19.2	19.2	4,428.1	4,409.0
19	2020				19.2	19.2	4,428.1	4,409.0
20	2021				19.2	19.2	4,428.1	4,409.0
21	2022				19.2	19.2	4,428.1	4,409.0
22	2023				19.2	19.2	4,428.1	4,409.0
23	2024				19.2	19.2	4,428.1	4,409.0
24	2025				19.2	19.2	4,428.1	4,409.0
25	2026			30.0	19.2	49.2	4,428.1	4,379.0
26	2027				19.2	19.2	4,428.1	4,409.0
27	2028				19.2	19.2	4,428.1	4,409.0
28	2029				19.2	19.2	4,428.1	4,409.0
29	2030				19.2	19.2	4,428.1	4,409.0
30	2031			38.5	19.2	57.7	4,428.1	4,370.5
31	2032				19.2	19.2	4,428.1	4,409.0
32	2033				19.2	19.2	4,428.1	4,409.0
33	2034				19.2	19.2	4,428.1	4,409.0
34	2035				19.2	19.2	4,428.1	4,409.0
35	2036			30.0	19.2	49.2	4,428.1	4,379.0
36	2037				19.2	19.2	4,428.1	4,409.0
37	2038				19.2	19.2	4,428.1	4,409.0
38	2039				19.2	19.2	4,428.1	4,409.0
39	2040				19.2	19.2	4,428.1	4,409.0
40	2041				19.2	19.2	4,428.1	4,409.0
41	2042				19.2	19.2	4,428.1	4,409.0
42	2043				19.2	19.2	4,428.1	4,409.0
43	2044				19.2	19.2	4,428.1	4,409.0
44	2045				19.2	19.2	4,428.1	4,409.0
45	2046			30.0	19.2	49.2	4,428.1	4,379.0
46	2047				19.2	19.2	4,428.1	4,409.0
47	2048				19.2	19.2	4,428.1	4,409.0
48	2049				19.2	19.2	4,428.1	4,409.0
49	2050				19.2	19.2	4,428.1	4,409.0
50	2051				19.2	19.2	4,428.1	4,409.0
51	2052				19.2	19.2	4,428.1	4,409.0
52	2053				19.2	19.2	4,428.1	4,409.0
53	2054				19.2	19.2	4,428.1	4,409.0
54	2055				19.2	19.2	4,428.1	4,409.0
55	2056			68.4	19.2	87.6	4,428.1	4,340.5
		B/C:	1.46	NPV:	4,021.6 Mil. Pesos	EIRR:	19.9%	

Table 4.1.11 Economic Cost and Benefit Stream of Narrow Improvement (NUP) Project under Present Conditions

(Unit: Million Pesos)

No.	Year	Cost			Benefit	Balance	
		Const.	Other	O/M			Total
0	2001			59.7	59.7	0.0	-59.7
1	2002	1,391.5	452.0		1,843.5	0.0	-1,843.5
2	2003	1,391.5	452.0	7.0	1,850.5	3.3	-1,847.1
3	2004	1,391.5	452.0	13.9	1,857.4	6.7	-1,850.8
4	2005	1,391.5	452.0	20.9	1,864.4	10.0	-1,854.4
5	2006	1,391.5	392.4	27.8	1,811.7	13.3	-1,798.3
6	2007			34.8	34.8	16.7	-18.1
7	2008			34.8	34.8	16.7	-18.1
8	2009			34.8	34.8	16.7	-18.1
9	2010			34.8	34.8	16.7	-18.1
10	2011			34.8	34.8	16.7	-18.1
11	2012			34.8	34.8	16.7	-18.1
12	2013			34.8	34.8	16.7	-18.1
13	2014			34.8	34.8	16.7	-18.1
14	2015			34.8	34.8	16.7	-18.1
15	2016			34.8	34.8	16.7	-18.1
16	2017			34.8	34.8	16.7	-18.1
17	2018			34.8	34.8	16.7	-18.1
18	2019			34.8	34.8	16.7	-18.1
19	2020			34.8	34.8	16.7	-18.1
20	2021			34.8	34.8	16.7	-18.1
21	2022			34.8	34.8	16.7	-18.1
22	2023			34.8	34.8	16.7	-18.1
23	2024			34.8	34.8	16.7	-18.1
24	2025			34.8	34.8	16.7	-18.1
25	2026			34.8	34.8	16.7	-18.1
26	2027			34.8	34.8	16.7	-18.1
27	2028			34.8	34.8	16.7	-18.1
28	2029			34.8	34.8	16.7	-18.1
29	2030			34.8	34.8	16.7	-18.1
30	2031			34.8	34.8	16.7	-18.1
31	2032			34.8	34.8	16.7	-18.1
32	2033			34.8	34.8	16.7	-18.1
33	2034			34.8	34.8	16.7	-18.1
34	2035			34.8	34.8	16.7	-18.1
35	2036			34.8	34.8	16.7	-18.1
36	2037			34.8	34.8	16.7	-18.1
37	2038			34.8	34.8	16.7	-18.1
38	2039			34.8	34.8	16.7	-18.1
39	2040			34.8	34.8	16.7	-18.1
40	2041			34.8	34.8	16.7	-18.1
41	2042			34.8	34.8	16.7	-18.1
42	2043			34.8	34.8	16.7	-18.1
43	2044			34.8	34.8	16.7	-18.1
44	2045			34.8	34.8	16.7	-18.1
45	2046			34.8	34.8	16.7	-18.1
46	2047			34.8	34.8	16.7	-18.1
47	2048			34.8	34.8	16.7	-18.1
48	2049			34.8	34.8	16.7	-18.1
49	2050			34.8	34.8	16.7	-18.1
50	2051			34.8	34.8	16.7	-18.1
51	2052			34.8	34.8	16.7	-18.1
52	2053			34.8	34.8	16.7	-18.1
53	2054			34.8	34.8	16.7	-18.1
54	2055			34.8	34.8	16.7	-18.1
55	2056			34.8	34.8	16.7	-18.1
B/C:		0.01	NPV:	-5,470.1	Mil. Pesos	EIRR:	

Table 4.1.12 Economic Cost and Benefit Stream of Tuguegarao Dike Project under Future Conditions

(Unit: Million Pesos)

No.	Year	Cost				Benefit	Balance	
		Const.	Other	O/M	Total			
0	2001			3.3		3.3	0.0	-3.3
1	2002	224.7	25.2			249.9	0.0	-249.9
2	2003	224.7	25.2		1.1	251.0	52.1	-198.9
3	2004	224.7	25.2		2.2	252.1	111.0	-141.1
4	2005	224.7	25.2		3.4	253.3	177.2	-76.0
5	2006	224.7	21.9		4.5	251.1	251.6	0.5
6	2007				5.6	5.6	334.8	329.2
7	2008				5.6	5.6	356.5	350.9
8	2009				5.6	5.6	379.6	374.0
9	2010				5.6	5.6	404.3	398.7
10	2011				5.6	5.6	427.2	421.6
11	2012				5.6	5.6	451.4	445.7
12	2013				5.6	5.6	476.9	471.3
13	2014				5.6	5.6	504.0	498.4
14	2015				5.6	5.6	532.6	527.0
15	2016				5.6	5.6	562.9	557.3
16	2017				5.6	5.6	595.0	589.4
17	2018				5.6	5.6	628.9	623.3
18	2019				5.6	5.6	664.8	659.2
19	2020				5.6	5.6	702.8	697.2
20	2021				5.6	5.6	702.8	697.2
21	2022				5.6	5.6	702.8	697.2
22	2023				5.6	5.6	702.8	697.2
23	2024				5.6	5.6	702.8	697.2
24	2025				5.6	5.6	702.8	697.2
25	2026				5.6	5.6	702.8	697.2
26	2027				5.6	5.6	702.8	697.2
27	2028				5.6	5.6	702.8	697.2
28	2029				5.6	5.6	702.8	697.2
29	2030				5.6	5.6	702.8	697.2
30	2031				5.6	5.6	702.8	697.2
31	2032				5.6	5.6	702.8	697.2
32	2033				5.6	5.6	702.8	697.2
33	2034				5.6	5.6	702.8	697.2
34	2035				5.6	5.6	702.8	697.2
35	2036				5.6	5.6	702.8	697.2
36	2037				5.6	5.6	702.8	697.2
37	2038				5.6	5.6	702.8	697.2
38	2039				5.6	5.6	702.8	697.2
39	2040				5.6	5.6	702.8	697.2
40	2041				5.6	5.6	702.8	697.2
41	2042				5.6	5.6	702.8	697.2
42	2043				5.6	5.6	702.8	697.2
43	2044				5.6	5.6	702.8	697.2
44	2045				5.6	5.6	702.8	697.2
45	2046				5.6	5.6	702.8	697.2
46	2047				5.6	5.6	702.8	697.2
47	2048				5.6	5.6	702.8	697.2
48	2049				5.6	5.6	702.8	697.2
48	2050				5.6	5.6	702.8	697.2
48	2051				5.6	5.6	702.8	697.2
48	2052				5.6	5.6	702.8	697.2
48	2053				5.6	5.6	702.8	697.2
48	2054				5.6	5.6	702.8	697.2
48	2055				5.6	5.6	702.8	697.2
48	2056				5.6	5.6	702.8	697.2
B/C:		2.23		NPV:	923.9 Mil. Pesos		EIRR:	28.5%

Table 4.1.13 Economic Cost and Benefit Stream of Narrow Improvement (NLL) Project under Future Conditions

(Unit: Million Pesos)

No.	Year	Cost				Benefit	Balance	
		Const.	Other	O/M	Total			
0	2001			5.8		5.8	0.0	-5.8
1	2002	407.8	44.1			451.9	0.0	-451.9
2	2003	407.8	44.1		2.0	453.9	70.9	-383.1
3	2004	407.8	44.1		4.1	456.0	150.8	-305.1
4	2005	407.8	44.1		6.1	458.0	240.9	-217.2
5	2006	407.8	38.3		8.2	454.2	341.9	-112.4
6	2007				10.2	10.2	455.0	444.8
7	2008				10.2	10.2	484.5	474.3
8	2009				10.2	10.2	515.9	505.7
9	2010				10.2	10.2	549.5	539.3
10	2011				10.2	10.2	580.6	570.4
11	2012				10.2	10.2	613.4	603.2
12	2013				10.2	10.2	648.2	638.0
13	2014				10.2	10.2	685.0	674.8
14	2015				10.2	10.2	723.9	713.7
15	2016				10.2	10.2	765.1	754.9
16	2017				10.2	10.2	808.6	798.4
17	2018				10.2	10.2	854.7	844.5
18	2019				10.2	10.2	903.5	893.3
19	2020				10.2	10.2	955.2	945.0
20	2021				10.2	10.2	955.2	945.0
21	2022				10.2	10.2	955.2	945.0
22	2023				10.2	10.2	955.2	945.0
23	2024				10.2	10.2	955.2	945.0
24	2025				10.2	10.2	955.2	945.0
25	2026				10.2	10.2	955.2	945.0
26	2027				10.2	10.2	955.2	945.0
27	2028				10.2	10.2	955.2	945.0
28	2029				10.2	10.2	955.2	945.0
29	2030				10.2	10.2	955.2	945.0
30	2031				10.2	10.2	955.2	945.0
31	2032				10.2	10.2	955.2	945.0
32	2033				10.2	10.2	955.2	945.0
33	2034				10.2	10.2	955.2	945.0
34	2035				10.2	10.2	955.2	945.0
35	2036				10.2	10.2	955.2	945.0
36	2037				10.2	10.2	955.2	945.0
37	2038				10.2	10.2	955.2	945.0
38	2039				10.2	10.2	955.2	945.0
39	2040				10.2	10.2	955.2	945.0
40	2041				10.2	10.2	955.2	945.0
41	2042				10.2	10.2	955.2	945.0
42	2043				10.2	10.2	955.2	945.0
43	2044				10.2	10.2	955.2	945.0
44	2045				10.2	10.2	955.2	945.0
45	2046				10.2	10.2	955.2	945.0
46	2047				10.2	10.2	955.2	945.0
47	2048				10.2	10.2	955.2	945.0
48	2049				10.2	10.2	955.2	945.0
49	2050				10.2	10.2	955.2	945.0
48	2051				10.2	10.2	955.2	945.0
48	2052				10.2	10.2	955.2	945.0
48	2053				10.2	10.2	955.2	945.0
48	2054				10.2	10.2	955.2	945.0
48	2055				10.2	10.2	955.2	945.0
48	2056				10.2	10.2	955.2	945.0
B/C:		1.68		NPV:	917.8	Mil. Pesos	EIRR:	22.6%

Table 4.1.14 Economic Cost and Benefit Stream of Multipurpose Siffu No1. Dam Project under Future Conditions

(Unit: Million Pesos)

No.	Year	Cost				Benefit	Balance	
		Const.	Other	Replacemen	O/M(Other) Total			
0	2001		18.7			18.7	0.0	-18.7
1	2002	397.3	141.9			539.2	0.0	-539.2
2	2003	397.3	141.9			539.2	0.0	-539.2
3	2004	397.3	141.9			539.2	0.0	-539.2
4	2005	397.3	141.9			539.2	0.0	-539.2
5	2006	397.3	123.1			520.5	0.0	-520.5
6	2007				52.1	52.1	1,231.4	1,179.3
7	2008				52.1	52.1	1,281.0	1,228.9
8	2009				52.1	52.1	1,333.1	1,281.0
9	2010				52.1	52.1	1,387.7	1,335.6
10	2011				52.1	52.1	1,437.5	1,385.4
11	2012				52.1	52.1	1,489.5	1,437.4
12	2013				52.1	52.1	1,543.8	1,491.7
13	2014				52.1	52.1	1,600.5	1,548.4
14	2015				52.1	52.1	1,659.7	1,607.6
15	2016			42.0	52.1	94.2	1,721.6	1,627.4
16	2017				52.1	52.1	1,786.2	1,734.1
17	2018				52.1	52.1	1,853.8	1,801.7
18	2019				52.1	52.1	1,924.6	1,872.5
19	2020				52.1	52.1	1,998.5	1,946.4
20	2021				52.1	52.1	1,998.5	1,946.4
21	2022				52.1	52.1	1,998.5	1,946.4
22	2023				52.1	52.1	1,998.5	1,946.4
23	2024				52.1	52.1	1,998.5	1,946.4
24	2025				52.1	52.1	1,998.5	1,946.4
25	2026			42.0	52.1	94.2	1,998.5	1,904.4
26	2027				52.1	52.1	1,998.5	1,946.4
27	2028				52.1	52.1	1,998.5	1,946.4
28	2029				52.1	52.1	1,998.5	1,946.4
29	2030				52.1	52.1	1,998.5	1,946.4
30	2031			54.0	52.1	106.1	1,998.5	1,892.5
31	2032				52.1	52.1	1,998.5	1,946.4
32	2033				52.1	52.1	1,998.5	1,946.4
33	2034				52.1	52.1	1,998.5	1,946.4
34	2035				52.1	52.1	1,998.5	1,946.4
35	2036			42.0	52.1	94.2	1,998.5	1,904.4
36	2037				52.1	52.1	1,998.5	1,946.4
37	2038				52.1	52.1	1,998.5	1,946.4
38	2039				52.1	52.1	1,998.5	1,946.4
39	2040				52.1	52.1	1,998.5	1,946.4
40	2041				52.1	52.1	1,998.5	1,946.4
41	2042				52.1	52.1	1,998.5	1,946.4
42	2043				52.1	52.1	1,998.5	1,946.4
43	2044				52.1	52.1	1,998.5	1,946.4
44	2045				52.1	52.1	1,998.5	1,946.4
45	2046			42.0	52.1	94.2	1,998.5	1,904.4
46	2047				52.1	52.1	1,998.5	1,946.4
47	2048				52.1	52.1	1,998.5	1,946.4
48	2049				52.1	52.1	1,998.5	1,946.4
49	2050				52.1	52.1	1,998.5	1,946.4
48	2051				52.1	52.1	1,998.5	1,946.4
48	2052				52.1	52.1	1,998.5	1,946.4
48	2053				52.1	52.1	1,998.5	1,946.4
48	2054				52.1	52.1	1,998.5	1,946.4
48	2055				52.1	52.1	1,998.5	1,946.4
48	2056				52.1	52.1	1,998.5	1,946.4
		B/C:	2.56	NPV:	2,701.4	Mil. Pesos	EIRR:	28.5%

**Table 4.1.15 Economic Cost and Benefit Stream of Bank Protection Project
under Future Conditions**

(Unit: Million Pesos)

No.	Year	Cost				Benefit	Balance	
		Const.	Other	O/M	Total			
0	2001			23.7		23.7	0.0	-23.7
1	2002	520.9	179.6			700.4	0.0	-700.4
2	2003	520.9	179.6		2.6	703.0	64.4	-638.6
3	2004	520.9	179.6		5.2	705.6	137.5	-568.1
4	2005	520.9	179.6		7.8	708.2	220.4	-487.9
5	2006	520.9	155.8		10.4	687.1	313.8	-373.4
6	2007				13.0	13.0	418.9	405.9
7	2008				13.0	13.0	447.4	434.4
8	2009				13.0	13.0	477.8	464.8
9	2010				13.0	13.0	510.3	497.3
10	2011				13.0	13.0	540.4	527.4
11	2012				13.0	13.0	572.3	559.3
12	2013				13.0	13.0	606.0	593.0
13	2014				13.0	13.0	641.8	628.8
14	2015				13.0	13.0	679.7	666.7
15	2016				13.0	13.0	719.8	706.8
16	2017				13.0	13.0	762.2	749.2
17	2018				13.0	13.0	807.2	794.2
18	2019				13.0	13.0	854.8	841.8
19	2020				13.0	13.0	905.3	892.3
20	2021				13.0	13.0	905.3	892.3
21	2022				13.0	13.0	905.3	892.3
22	2023				13.0	13.0	905.3	892.3
23	2024				13.0	13.0	905.3	892.3
24	2025				13.0	13.0	905.3	892.3
25	2026				13.0	13.0	905.3	892.3
26	2027				13.0	13.0	905.3	892.3
27	2028				13.0	13.0	905.3	892.3
28	2029				13.0	13.0	905.3	892.3
29	2030				13.0	13.0	905.3	892.3
30	2031				13.0	13.0	905.3	892.3
31	2032				13.0	13.0	905.3	892.3
32	2033				13.0	13.0	905.3	892.3
33	2034				13.0	13.0	905.3	892.3
34	2035				13.0	13.0	905.3	892.3
35	2036				13.0	13.0	905.3	892.3
36	2037				13.0	13.0	905.3	892.3
37	2038				13.0	13.0	905.3	892.3
38	2039				13.0	13.0	905.3	892.3
39	2040				13.0	13.0	905.3	892.3
40	2041				13.0	13.0	905.3	892.3
41	2042				13.0	13.0	905.3	892.3
42	2043				13.0	13.0	905.3	892.3
43	2044				13.0	13.0	905.3	892.3
44	2045				13.0	13.0	905.3	892.3
45	2046				13.0	13.0	905.3	892.3
46	2047				13.0	13.0	905.3	892.3
47	2048				13.0	13.0	905.3	892.3
48	2049				13.0	13.0	905.3	892.3
49	2050				13.0	13.0	905.3	892.3
48	2051				13.0	13.0	905.3	892.3
48	2052				13.0	13.0	905.3	892.3
48	2053				13.0	13.0	905.3	892.3
48	2054				13.0	13.0	905.3	892.3
48	2055				13.0	13.0	905.3	892.3
48	2056				13.0	13.0	905.3	892.3
B/C:		1.01	NPV:		17.4 Mil. Pesos	EIRR:		15.1%

Table 4.1.16 Economic Cost and Benefit Stream of Cabagan Dike Project under Future Conditions

(Unit: Million Pesos)

No.	Year	Cost				Benefit	Balance	
		Const.	Other	O/M	Total			
0	2001			5.3		5.3	0.0	-5.3
1	2002	112.1	40.0			152.1	0.0	-152.1
2	2003	112.1	40.0	0.6		152.7	14.9	-137.8
3	2004	112.1	40.0	1.1		153.2	31.7	-121.6
4	2005	112.1	40.0	1.7		153.8	50.6	-103.2
5	2006	112.1	34.7	2.2		149.1	71.8	-77.3
6	2007			2.8		2.8	95.5	92.7
7	2008			2.8		2.8	101.7	98.9
8	2009			2.8		2.8	108.3	105.5
9	2010			2.8		2.8	115.3	112.5
10	2011			2.8		2.8	121.9	119.0
11	2012			2.8		2.8	128.7	125.9
12	2013			2.8		2.8	136.0	133.2
13	2014			2.8		2.8	143.8	141.0
14	2015			2.8		2.8	151.9	149.1
15	2016			2.8		2.8	160.6	157.8
16	2017			2.8		2.8	169.7	166.9
17	2018			2.8		2.8	179.4	176.6
18	2019			2.8		2.8	189.6	186.8
19	2020			2.8		2.8	200.5	197.7
20	2021			2.8		2.8	200.5	197.7
21	2022			2.8		2.8	200.5	197.7
22	2023			2.8		2.8	200.5	197.7
23	2024			2.8		2.8	200.5	197.7
24	2025			2.8		2.8	200.5	197.7
25	2026			2.8		2.8	200.5	197.7
26	2027			2.8		2.8	200.5	197.7
27	2028			2.8		2.8	200.5	197.7
28	2029			2.8		2.8	200.5	197.7
29	2030			2.8		2.8	200.5	197.7
30	2031			2.8		2.8	200.5	197.7
31	2032			2.8		2.8	200.5	197.7
32	2033			2.8		2.8	200.5	197.7
33	2034			2.8		2.8	200.5	197.7
34	2035			2.8		2.8	200.5	197.7
35	2036			2.8		2.8	200.5	197.7
36	2037			2.8		2.8	200.5	197.7
37	2038			2.8		2.8	200.5	197.7
38	2039			2.8		2.8	200.5	197.7
39	2040			2.8		2.8	200.5	197.7
40	2041			2.8		2.8	200.5	197.7
41	2042			2.8		2.8	200.5	197.7
42	2043			2.8		2.8	200.5	197.7
43	2044			2.8		2.8	200.5	197.7
44	2045			2.8		2.8	200.5	197.7
45	2046			2.8		2.8	200.5	197.7
46	2047			2.8		2.8	200.5	197.7
47	2048			2.8		2.8	200.5	197.7
48	2049			2.8		2.8	200.5	197.7
49	2050			2.8		2.8	200.5	197.7
48	2051			2.8		2.8	200.5	197.7
48	2052			2.8		2.8	200.5	197.7
48	2053			2.8		2.8	200.5	197.7
48	2054			2.8		2.8	200.5	197.7
48	2055			2.8		2.8	200.5	197.7
48	2056			2.8		2.8	200.5	197.7
B/C:		1.05		NPV:	21.4 Mil. Pesos		EIRR:	15.6%

Table 4.1.17 Economic Cost and Benefit Stream of Narrow Improvement (NLR) Project under Future Conditions

(Unit: Million Pesos)

No.	Year	Cost				Benefit	Balance	
		Const.	Other	O/M	Total			
0	2001			52.9		52.9	0.0	-52.9
1	2002	1,229.9	400.5			1,630.4	0.0	-1,630.4
2	2003	1,229.9	400.5		6.1	1,636.6	138.1	-1,498.5
3	2004	1,229.9	400.5		12.3	1,642.7	294.0	-1,348.7
4	2005	1,229.9	400.5		18.4	1,648.9	469.5	-1,179.4
5	2006	1,229.9	347.6		24.6	1,602.2	666.4	-935.8
6	2007				30.7	30.7	886.8	856.1
7	2008				30.7	30.7	944.3	913.6
8	2009				30.7	30.7	1,005.6	974.9
9	2010				30.7	30.7	1,071.0	1,040.3
10	2011				30.7	30.7	1,131.6	1,100.8
11	2012				30.7	30.7	1,195.6	1,164.9
12	2013				30.7	30.7	1,263.4	1,232.6
13	2014				30.7	30.7	1,335.1	1,304.3
14	2015				30.7	30.7	1,410.9	1,380.2
15	2016				30.7	30.7	1,491.2	1,460.5
16	2017				30.7	30.7	1,576.1	1,545.4
17	2018				30.7	30.7	1,666.0	1,635.2
18	2019				30.7	30.7	1,761.1	1,730.3
19	2020				30.7	30.7	1,861.7	1,831.0
20	2021				30.7	30.7	1,861.7	1,831.0
21	2022				30.7	30.7	1,861.7	1,831.0
22	2023				30.7	30.7	1,861.7	1,831.0
23	2024				30.7	30.7	1,861.7	1,831.0
24	2025				30.7	30.7	1,861.7	1,831.0
25	2026				30.7	30.7	1,861.7	1,831.0
26	2027				30.7	30.7	1,861.7	1,831.0
27	2028				30.7	30.7	1,861.7	1,831.0
28	2029				30.7	30.7	1,861.7	1,831.0
29	2030				30.7	30.7	1,861.7	1,831.0
30	2031				30.7	30.7	1,861.7	1,831.0
31	2032				30.7	30.7	1,861.7	1,831.0
32	2033				30.7	30.7	1,861.7	1,831.0
33	2034				30.7	30.7	1,861.7	1,831.0
34	2035				30.7	30.7	1,861.7	1,831.0
35	2036				30.7	30.7	1,861.7	1,831.0
36	2037				30.7	30.7	1,861.7	1,831.0
37	2038				30.7	30.7	1,861.7	1,831.0
38	2039				30.7	30.7	1,861.7	1,831.0
39	2040				30.7	30.7	1,861.7	1,831.0
40	2041				30.7	30.7	1,861.7	1,831.0
41	2042				30.7	30.7	1,861.7	1,831.0
42	2043				30.7	30.7	1,861.7	1,831.0
43	2044				30.7	30.7	1,861.7	1,831.0
44	2045				30.7	30.7	1,861.7	1,831.0
45	2046				30.7	30.7	1,861.7	1,831.0
46	2047				30.7	30.7	1,861.7	1,831.0
47	2048				30.7	30.7	1,861.7	1,831.0
48	2049				30.7	30.7	1,861.7	1,831.0
49	2050				30.7	30.7	1,861.7	1,831.0
48	2051				30.7	30.7	1,861.7	1,831.0
48	2052				30.7	30.7	1,861.7	1,831.0
48	2053				30.7	30.7	1,861.7	1,831.0
48	2054				30.7	30.7	1,861.7	1,831.0
48	2055				30.7	30.7	1,861.7	1,831.0
48	2056				30.7	30.7	1,861.7	1,831.0
B/C:		0.91		NPV:	-456.6 Mil. Pesos		EIRR:	13.9%

Table 4.1.18 Economic Cost and Benefit Stream of Multipurpose Magat/Alimit Dam Project under Future Conditions

		(Unit: Million Pesos)						
No.	Year	Cost				Benefit	Balance	
		Const.	Other	Replacemen	O/M(Other) Total			
0	2001		34.7			34.7	0.0	-34.7
1	2002	735.3	262.6			997.9	0.0	-997.9
2	2003	735.3	262.6			997.9	0.0	-997.9
3	2004	735.3	262.6			997.9	0.0	-997.9
4	2005	735.3	262.6			997.9	0.0	-997.9
5	2006	735.3	227.9			963.2	0.0	-963.2
6	2007				68.7	68.7	1,159.6	1,090.9
7	2008				68.7	68.7	1,222.1	1,153.4
8	2009				68.7	68.7	1,288.4	1,219.7
9	2010				68.7	68.7	1,358.8	1,290.1
10	2011				68.7	68.7	1,423.6	1,354.9
11	2012				68.7	68.7	1,491.8	1,423.1
12	2013				68.7	68.7	1,563.7	1,495.0
13	2014				68.7	68.7	1,639.5	1,570.8
14	2015				68.7	68.7	1,719.4	1,650.7
15	2016			20.1	68.7	88.8	1,803.5	1,714.7
16	2017				68.7	68.7	1,892.3	1,823.6
17	2018				68.7	68.7	1,985.8	1,917.1
18	2019				68.7	68.7	2,084.4	2,015.8
19	2020				68.7	68.7	2,188.5	2,119.8
20	2021				68.7	68.7	2,188.5	2,119.8
21	2022				68.7	68.7	2,188.5	2,119.8
22	2023				68.7	68.7	2,188.5	2,119.8
23	2024				68.7	68.7	2,188.5	2,119.8
24	2025				68.7	68.7	2,188.5	2,119.8
25	2026			20.1	68.7	88.8	2,188.5	2,099.6
26	2027				68.7	68.7	2,188.5	2,119.8
27	2028				68.7	68.7	2,188.5	2,119.8
28	2029				68.7	68.7	2,188.5	2,119.8
29	2030				68.7	68.7	2,188.5	2,119.8
30	2031			25.9	68.7	94.5	2,188.5	2,093.9
31	2032				68.7	68.7	2,188.5	2,119.8
32	2033				68.7	68.7	2,188.5	2,119.8
33	2034				68.7	68.7	2,188.5	2,119.8
34	2035				68.7	68.7	2,188.5	2,119.8
35	2036			20.1	68.7	88.8	2,188.5	2,099.6
36	2037				68.7	68.7	2,188.5	2,119.8
37	2038				68.7	68.7	2,188.5	2,119.8
38	2039				68.7	68.7	2,188.5	2,119.8
39	2040				68.7	68.7	2,188.5	2,119.8
40	2041				68.7	68.7	2,188.5	2,119.8
41	2042				68.7	68.7	2,188.5	2,119.8
42	2043				68.7	68.7	2,188.5	2,119.8
43	2044				68.7	68.7	2,188.5	2,119.8
44	2045				68.7	68.7	2,188.5	2,119.8
45	2046			20.1	68.7	88.8	2,188.5	2,099.6
46	2047				68.7	68.7	2,188.5	2,119.8
47	2048				68.7	68.7	2,188.5	2,119.8
48	2049				68.7	68.7	2,188.5	2,119.8
49	2050				68.7	68.7	2,188.5	2,119.8
48	2051				68.7	68.7	2,188.5	2,119.8
48	2052				68.7	68.7	2,188.5	2,119.8
48	2053				68.7	68.7	2,188.5	2,119.8
48	2054				68.7	68.7	2,188.5	2,119.8
48	2055				68.7	68.7	2,188.5	2,119.8
48	2056				68.7	68.7	2,188.5	2,119.8
		B/C:	1.44	NPV:	1,389.5 Mil. Pesos	EIRR:	19.3%	

Table 4.1.19 Economic Cost and Benefit Stream of Multipurpose Mallig No.2 Dam Project under Future Conditions

		(Unit: Million Pesos)						
No.	Year	Cost				Benefit	Balance	
		Const.	Other	Replacemen	O/M(Other) Total			
0	2001		65.8			65.8	0.0	-65.8
1	2002	1,396.2	498.6			1,894.8	0.0	-1,894.8
2	2003	1,396.2	498.6			1,894.8	0.0	-1,894.8
3	2004	1,396.2	498.6			1,894.8	0.0	-1,894.8
4	2005	1,396.2	498.6			1,894.8	0.0	-1,894.8
5	2006	1,396.2	432.8			1,829.0	0.0	-1,829.0
6	2007				71.9	71.9	2,308.0	2,236.1
7	2008				71.9	71.9	2,373.9	2,302.0
8	2009				71.9	71.9	2,441.8	2,369.9
9	2010				71.9	71.9	2,511.7	2,439.9
10	2011				71.9	71.9	2,574.3	2,502.4
11	2012				71.9	71.9	2,638.5	2,566.7
12	2013				71.9	71.9	2,704.5	2,632.6
13	2014				71.9	71.9	2,772.2	2,700.3
14	2015				71.9	71.9	2,841.7	2,769.9
15	2016			86.6	71.9	158.5	2,913.2	2,754.7
16	2017				71.9	71.9	2,986.6	2,914.7
17	2018				71.9	71.9	3,061.9	2,990.1
18	2019				71.9	71.9	3,139.4	3,067.5
19	2020				71.9	71.9	3,219.0	3,147.1
20	2021				71.9	71.9	3,219.0	3,147.1
21	2022				71.9	71.9	3,219.0	3,147.1
22	2023				71.9	71.9	3,219.0	3,147.1
23	2024				71.9	71.9	3,219.0	3,147.1
24	2025				71.9	71.9	3,219.0	3,147.1
25	2026			86.6	71.9	158.5	3,219.0	3,060.5
26	2027				71.9	71.9	3,219.0	3,147.1
27	2028				71.9	71.9	3,219.0	3,147.1
28	2029				71.9	71.9	3,219.0	3,147.1
29	2030				71.9	71.9	3,219.0	3,147.1
30	2031			60.3	71.9	132.1	3,219.0	3,086.8
31	2032				71.9	71.9	3,219.0	3,147.1
32	2033				71.9	71.9	3,219.0	3,147.1
33	2034				71.9	71.9	3,219.0	3,147.1
34	2035				71.9	71.9	3,219.0	3,147.1
35	2036			86.6	71.9	158.5	3,219.0	3,060.5
36	2037				71.9	71.9	3,219.0	3,147.1
37	2038				71.9	71.9	3,219.0	3,147.1
38	2039				71.9	71.9	3,219.0	3,147.1
39	2040				71.9	71.9	3,219.0	3,147.1
40	2041				71.9	71.9	3,219.0	3,147.1
41	2042				71.9	71.9	3,219.0	3,147.1
42	2043				71.9	71.9	3,219.0	3,147.1
43	2044				71.9	71.9	3,219.0	3,147.1
44	2045				71.9	71.9	3,219.0	3,147.1
45	2046			86.6	71.9	158.5	3,219.0	3,060.5
46	2047				71.9	71.9	3,219.0	3,147.1
47	2048				71.9	71.9	3,219.0	3,147.1
48	2049				71.9	71.9	3,219.0	3,147.1
49	2050				71.9	71.9	3,219.0	3,147.1
48	2051				71.9	71.9	3,219.0	3,147.1
48	2052				71.9	71.9	3,219.0	3,147.1
48	2053				71.9	71.9	3,219.0	3,147.1
48	2054				71.9	71.9	3,219.0	3,147.1
48	2055				71.9	71.9	3,219.0	3,147.1
48	2056				71.9	71.9	3,219.0	3,147.1
		B/C:	1.34	NPV:	1,970.0	Mil. Pesos	EIRR:	18.5%

Table 4.1.20 Economic Cost and Benefit Stream of Multipurpose Matuno Dam Project under Future Conditions

(Unit: Million Pesos)

No.	Year	Cost				Benefit	Balance	
		Const.	Other	Replacemen	O/M(Other) Total			
0	2001		102.8			102.8	0.0	-102.8
1	2002	2,180.2	778.5			2,958.7	0.0	-2,958.7
2	2003	2,180.2	778.5			2,958.7	0.0	-2,958.7
3	2004	2,180.2	778.5			2,958.7	0.0	-2,958.7
4	2005	2,180.2	778.5			2,958.7	0.0	-2,958.7
5	2006	2,180.2	675.8			2,855.9	0.0	-2,855.9
6	2007				19.2	19.2	6,574.0	6,554.8
7	2008				19.2	19.2	6,963.3	6,944.1
8	2009				19.2	19.2	7,377.4	7,358.2
9	2010				19.2	19.2	7,818.1	7,798.9
10	2011				19.2	19.2	8,225.0	8,205.8
11	2012				19.2	19.2	8,654.6	8,635.4
12	2013				19.2	19.2	9,108.3	9,089.1
13	2014				19.2	19.2	9,587.3	9,568.2
14	2015				19.2	19.2	10,093.3	10,074.1
15	2016			30.0	19.2	49.2	10,627.7	10,578.6
16	2017				19.2	19.2	11,192.3	11,173.1
17	2018				19.2	19.2	11,788.6	11,769.4
18	2019				19.2	19.2	12,418.6	12,399.4
19	2020				19.2	19.2	13,084.3	13,065.1
20	2021				19.2	19.2	13,084.3	13,065.1
21	2022				19.2	19.2	13,084.3	13,065.1
22	2023				19.2	19.2	13,084.3	13,065.1
23	2024				19.2	19.2	13,084.3	13,065.1
24	2025				19.2	19.2	13,084.3	13,065.1
25	2026			30.0	19.2	49.2	13,084.3	13,035.1
26	2027				19.2	19.2	13,084.3	13,065.1
27	2028				19.2	19.2	13,084.3	13,065.1
28	2029				19.2	19.2	13,084.3	13,065.1
29	2030				19.2	19.2	13,084.3	13,065.1
30	2031			38.5	19.2	57.7	13,084.3	13,026.6
31	2032				19.2	19.2	13,084.3	13,065.1
32	2033				19.2	19.2	13,084.3	13,065.1
33	2034				19.2	19.2	13,084.3	13,065.1
34	2035				19.2	19.2	13,084.3	13,065.1
35	2036			30.0	19.2	49.2	13,084.3	13,035.1
36	2037				19.2	19.2	13,084.3	13,065.1
37	2038				19.2	19.2	13,084.3	13,065.1
38	2039				19.2	19.2	13,084.3	13,065.1
39	2040				19.2	19.2	13,084.3	13,065.1
40	2041				19.2	19.2	13,084.3	13,065.1
41	2042				19.2	19.2	13,084.3	13,065.1
42	2043				19.2	19.2	13,084.3	13,065.1
43	2044				19.2	19.2	13,084.3	13,065.1
44	2045				19.2	19.2	13,084.3	13,065.1
45	2046			30.0	19.2	49.2	13,084.3	13,035.1
46	2047				19.2	19.2	13,084.3	13,065.1
47	2048				19.2	19.2	13,084.3	13,065.1
48	2049				19.2	19.2	13,084.3	13,065.1
49	2050				19.2	19.2	13,084.3	13,065.1
48	2051				19.2	19.2	13,084.3	13,065.1
48	2052				19.2	19.2	13,084.3	13,065.1
48	2053				19.2	19.2	13,084.3	13,065.1
48	2054				19.2	19.2	13,084.3	13,065.1
48	2055				19.2	19.2	13,084.3	13,065.1
48	2056				19.2	19.2	13,084.3	13,065.1
		B/C:	3.02	NPV:	17,604.6	Mil. Pesos	EIRR:	29.7%

Table 4.1.21 Economic Cost and Benefit Stream of Narrow Improvement (NUP) Project under Future Conditions

(Unit: Million Pesos)

No.	Year	Cost			Benefit	Balance
		Const.	Other	O/M		
0	2001			59.7	59.7	0.0
1	2002	1,391.5	452.0		1,843.5	0.0
2	2003	1,391.5	452.0	7.0	1,850.5	4.1
3	2004	1,391.5	452.0	13.9	1,857.4	8.7
4	2005	1,391.5	452.0	20.9	1,864.4	13.9
5	2006	1,391.5	392.4	27.8	1,811.7	19.8
6	2007			34.8	34.8	26.4
7	2008			34.8	34.8	28.2
8	2009			34.8	34.8	30.1
9	2010			34.8	34.8	32.2
10	2011			34.8	34.8	34.1
11	2012			34.8	34.8	36.1
12	2013			34.8	34.8	38.2
13	2014			34.8	34.8	40.5
14	2015			34.8	34.8	42.8
15	2016			34.8	34.8	45.4
16	2017			34.8	34.8	48.0
17	2018			34.8	34.8	50.9
18	2019			34.8	34.8	53.9
19	2020			34.8	34.8	57.1
20	2021			34.8	34.8	57.1
21	2022			34.8	34.8	57.1
22	2023			34.8	34.8	57.1
23	2024			34.8	34.8	57.1
24	2025			34.8	34.8	57.1
25	2026			34.8	34.8	57.1
26	2027			34.8	34.8	57.1
27	2028			34.8	34.8	57.1
28	2029			34.8	34.8	57.1
29	2030			34.8	34.8	57.1
30	2031			34.8	34.8	57.1
31	2032			34.8	34.8	57.1
32	2033			34.8	34.8	57.1
33	2034			34.8	34.8	57.1
34	2035			34.8	34.8	57.1
35	2036			34.8	34.8	57.1
36	2037			34.8	34.8	57.1
37	2038			34.8	34.8	57.1
38	2039			34.8	34.8	57.1
39	2040			34.8	34.8	57.1
40	2041			34.8	34.8	57.1
41	2042			34.8	34.8	57.1
42	2043			34.8	34.8	57.1
43	2044			34.8	34.8	57.1
44	2045			34.8	34.8	57.1
45	2046			34.8	34.8	57.1
46	2047			34.8	34.8	57.1
47	2048			34.8	34.8	57.1
48	2049			34.8	34.8	57.1
49	2050			34.8	34.8	57.1
48	2051			34.8	34.8	57.1
48	2052			34.8	34.8	57.1
48	2053			34.8	34.8	57.1
48	2054			34.8	34.8	57.1
48	2055			34.8	34.8	57.1
48	2056			34.8	34.8	57.1
B/C:		0.02	NPV:	-5,401.1 Mil. Pesos		EIRR:

Table 4.5.1 Economic Cost and Benefit Stream of Alternatives in Reach from Alcalá to Buntun Bridge under Present Conditions: Case 1

(Unit: Million Pesos)

No.	Year	Cost			Benefit			Balance		
		Const.	Supporting	Replacemer O/M	Total	Benefit	Negative		Total	
0	2001		48.2		48.2			0.0	-48.2	
1	2002	967.4	365.1		1,332.5		-1.1	-1.1	-1,333.6	
2	2003	967.4	365.1	30.7	1,363.2	5.7	-2.2	3.5	-1,359.8	
3	2004	967.4	365.1	61.5	1,394.0	11.4	-3.3	8.0	-1,385.9	
4	2005	967.4	365.1	92.2	1,424.7	17.1	-4.4	12.6	-1,412.1	
5	2006	967.4	316.9		1,284.3	22.7	-4.4	18.3	-1,389.0	
6	2007				153.7	153.7	576.2	-4.4	571.7	418.1
7	2008				153.7	153.7	795.3	-4.4	790.8	637.2
8	2009				153.7	153.7	904.8	-4.4	900.4	746.7
9	2010				153.7	153.7	1,014.4	-4.4	1,009.9	856.3
10	2011				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
11	2012				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
12	2013				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
13	2014				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
14	2015				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
15	2016			35.7	153.7	189.4	1,123.9	-4.4	1,119.5	930.1
16	2017				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
17	2018				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
18	2019				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
19	2020				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
20	2021				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
21	2022				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
22	2023				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
23	2024				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
24	2025				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
25	2026			35.7	153.7	189.4	1,123.9	-4.4	1,119.5	930.1
26	2027				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
27	2028				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
28	2029				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
29	2030				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
30	2031			329.7	153.7	483.3	1,123.9	-4.4	1,119.5	636.2
31	2032				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
32	2033				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
33	2034				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
34	2035				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
35	2036			35.7	153.7	189.4	1,123.9	-4.4	1,119.5	930.1
36	2037				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
37	2038				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
38	2039				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
39	2040				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
40	2041				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
41	2042				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
42	2043				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
43	2044				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
44	2045				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
45	2046			35.7	153.7	189.4	1,123.9	-4.4	1,119.5	930.1
46	2047				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
47	2048				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
48	2049				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
49	2050				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
50	2051				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
51	2052				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
52	2053				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
53	2054				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
54	2055				153.7	153.7	1,123.9	-4.4	1,119.5	965.8
55	2056			365.3	153.7	519.0	1,123.9	-4.4	1,119.5	600.5
		B/C:	0.63		NPV:	-1,670.5	MillionPesos	EIRR:	10.0%	

Table 4.5.2 Economic Cost and Benefit Stream of Alternatives in Reach from Alcalá to Buntun Bridge under Present Conditions: Case 2

(Unit: Million Pesos)

No.	Year	Cost			Benefit			Balance		
		Const.	Supporting	Replacemer O/M	Total	Benefit	Negative		Total	
0	2001		27.9		27.9			0.0	-27.9	
1	2002	622.2	211.3		833.6		-0.7	-0.7	-834.3	
2	2003	622.2	211.3	23.8	857.4	4.6	-1.4	3.2	-854.2	
3	2004	622.2	211.3	47.6	881.1	9.1	-2.1	7.0	-874.1	
4	2005	622.2	211.3	71.3	904.9	13.7	-2.8	10.9	-894.0	
5	2006	622.2	183.4		900.8	18.3	-2.8	15.5	-885.3	
6	2007				118.9	118.9	355.9	-2.8	353.1	234.3
7	2008				118.9	118.9	489.2	-2.8	486.4	367.5
8	2009				118.9	118.9	555.8	-2.8	553.0	434.1
9	2010				118.9	118.9	622.4	-2.8	619.6	500.7
10	2011				118.9	118.9	689.0	-2.8	686.2	567.3
11	2012				118.9	118.9	689.0	-2.8	686.2	567.3
12	2013				118.9	118.9	689.0	-2.8	686.2	567.3
13	2014				118.9	118.9	689.0	-2.8	686.2	567.3
14	2015				118.9	118.9	689.0	-2.8	686.2	567.3
15	2016			26.0	118.9	144.9	689.0	-2.8	686.2	541.3
16	2017				118.9	118.9	689.0	-2.8	686.2	567.3
17	2018				118.9	118.9	689.0	-2.8	686.2	567.3
18	2019				118.9	118.9	689.0	-2.8	686.2	567.3
19	2020				118.9	118.9	689.0	-2.8	686.2	567.3
20	2021				118.9	118.9	689.0	-2.8	686.2	567.3
21	2022				118.9	118.9	689.0	-2.8	686.2	567.3
22	2023				118.9	118.9	689.0	-2.8	686.2	567.3
23	2024				118.9	118.9	689.0	-2.8	686.2	567.3
24	2025				118.9	118.9	689.0	-2.8	686.2	567.3
25	2026			26.0	118.9	144.9	689.0	-2.8	686.2	541.3
26	2027				118.9	118.9	689.0	-2.8	686.2	567.3
27	2028				118.9	118.9	689.0	-2.8	686.2	567.3
28	2029				118.9	118.9	689.0	-2.8	686.2	567.3
29	2030				118.9	118.9	689.0	-2.8	686.2	567.3
30	2031			265.4	118.9	384.2	689.0	-2.8	686.2	302.0
31	2032				118.9	118.9	689.0	-2.8	686.2	567.3
32	2033				118.9	118.9	689.0	-2.8	686.2	567.3
33	2034				118.9	118.9	689.0	-2.8	686.2	567.3
34	2035				118.9	118.9	689.0	-2.8	686.2	567.3
35	2036			26.0	118.9	144.9	689.0	-2.8	686.2	541.3
36	2037				118.9	118.9	689.0	-2.8	686.2	567.3
37	2038				118.9	118.9	689.0	-2.8	686.2	567.3
38	2039				118.9	118.9	689.0	-2.8	686.2	567.3
39	2040				118.9	118.9	689.0	-2.8	686.2	567.3
40	2041				118.9	118.9	689.0	-2.8	686.2	567.3
41	2042				118.9	118.9	689.0	-2.8	686.2	567.3
42	2043				118.9	118.9	689.0	-2.8	686.2	567.3
43	2044				118.9	118.9	689.0	-2.8	686.2	567.3
44	2045				118.9	118.9	689.0	-2.8	686.2	567.3
45	2046			26.0	118.9	144.9	689.0	-2.8	686.2	541.3
46	2047				118.9	118.9	689.0	-2.8	686.2	567.3
47	2048				118.9	118.9	689.0	-2.8	686.2	567.3
48	2049				118.9	118.9	689.0	-2.8	686.2	567.3
49	2050				118.9	118.9	689.0	-2.8	686.2	567.3
50	2051				118.9	118.9	689.0	-2.8	686.2	567.3
51	2052				118.9	118.9	689.0	-2.8	686.2	567.3
52	2053				118.9	118.9	689.0	-2.8	686.2	567.3
53	2054				118.9	118.9	689.0	-2.8	686.2	567.3
54	2055				118.9	118.9	689.0	-2.8	686.2	567.3
55	2056			291.3	118.9	410.2	689.0	-2.8	686.2	276.0
		B/C:	0.60		NPV:	-1,162.2	MillionPesos	EIRR:	9.4%	

Table 4.5.3 Economic Cost and Benefit Stream of Alternatives in Reach from Alcalá to Buntun Bridge under Present Conditions: Case 3

(Unit: Million Pesos)

No.	Year	Cost				Benefit			Balance	
		Const.	Supporting	Replacemer	O/M	Total	Benefit	Negative		Total
0	2001		24.2			24.2			0.0	-24.2
1	2002	540.9	183.6			724.5		-0.6	-0.6	-725.1
2	2003	540.9	183.6		21.9	746.4	4.3	-1.2	3.1	-743.3
3	2004	540.9	183.6		43.8	768.3	8.6	-1.8	6.7	-761.6
4	2005	540.9	183.6		65.7	790.2	12.8	-2.4	10.4	-779.8
5	2006	540.9	159.4		87.6	787.9	17.1	-2.4	14.7	-773.2
6	2007				109.5	109.5	308.7	-2.4	306.3	196.8
7	2008				109.5	109.5	423.7	-2.4	421.2	311.8
8	2009				109.5	109.5	481.1	-2.4	478.7	369.2
9	2010				109.5	109.5	538.6	-2.4	536.2	426.7
10	2011				109.5	109.5	596.1	-2.4	593.7	484.2
11	2012				109.5	109.5	596.1	-2.4	593.7	484.2
12	2013				109.5	109.5	596.1	-2.4	593.7	484.2
13	2014				109.5	109.5	596.1	-2.4	593.7	484.2
14	2015				109.5	109.5	596.1	-2.4	593.7	484.2
15	2016			24.2	109.5	133.7	596.1	-2.4	593.7	460.0
16	2017				109.5	109.5	596.1	-2.4	593.7	484.2
17	2018				109.5	109.5	596.1	-2.4	593.7	484.2
18	2019				109.5	109.5	596.1	-2.4	593.7	484.2
19	2020				109.5	109.5	596.1	-2.4	593.7	484.2
20	2021				109.5	109.5	596.1	-2.4	593.7	484.2
21	2022				109.5	109.5	596.1	-2.4	593.7	484.2
22	2023				109.5	109.5	596.1	-2.4	593.7	484.2
23	2024				109.5	109.5	596.1	-2.4	593.7	484.2
24	2025				109.5	109.5	596.1	-2.4	593.7	484.2
25	2026			24.2	109.5	133.7	596.1	-2.4	593.7	460.0
26	2027				109.5	109.5	596.1	-2.4	593.7	484.2
27	2028				109.5	109.5	596.1	-2.4	593.7	484.2
28	2029				109.5	109.5	596.1	-2.4	593.7	484.2
29	2030				109.5	109.5	596.1	-2.4	593.7	484.2
30	2031			248.3	109.5	357.7	596.1	-2.4	593.7	235.9
31	2032				109.5	109.5	596.1	-2.4	593.7	484.2
32	2033				109.5	109.5	596.1	-2.4	593.7	484.2
33	2034				109.5	109.5	596.1	-2.4	593.7	484.2
34	2035				109.5	109.5	596.1	-2.4	593.7	484.2
35	2036			24.2	109.5	133.7	596.1	-2.4	593.7	460.0
36	2037				109.5	109.5	596.1	-2.4	593.7	484.2
37	2038				109.5	109.5	596.1	-2.4	593.7	484.2
38	2039				109.5	109.5	596.1	-2.4	593.7	484.2
39	2040				109.5	109.5	596.1	-2.4	593.7	484.2
40	2041				109.5	109.5	596.1	-2.4	593.7	484.2
41	2042				109.5	109.5	596.1	-2.4	593.7	484.2
42	2043				109.5	109.5	596.1	-2.4	593.7	484.2
43	2044				109.5	109.5	596.1	-2.4	593.7	484.2
44	2045				109.5	109.5	596.1	-2.4	593.7	484.2
45	2046			24.2	109.5	133.7	596.1	-2.4	593.7	460.0
46	2047				109.5	109.5	596.1	-2.4	593.7	484.2
47	2048				109.5	109.5	596.1	-2.4	593.7	484.2
48	2049				109.5	109.5	596.1	-2.4	593.7	484.2
49	2050				109.5	109.5	596.1	-2.4	593.7	484.2
50	2051				109.5	109.5	596.1	-2.4	593.7	484.2
51	2052				109.5	109.5	596.1	-2.4	593.7	484.2
52	2053				109.5	109.5	596.1	-2.4	593.7	484.2
53	2054				109.5	109.5	596.1	-2.4	593.7	484.2
54	2055				109.5	109.5	596.1	-2.4	593.7	484.2
55	2056			272.4	109.5	381.9	596.1	-2.4	593.7	211.7
		B/C:	0.59		NPV:	-1,039.4	MillionPesos		EIRR:	9.3%

Table 4.5.4 Economic Cost and Benefit Stream of Alternatives in Reach from Alcalá to Buntun Bridge under Present Conditions: Case 4

(Unit: Million Pesos)

No.	Year	Cost			Benefit			Balance	
		Const.	Supporting	Replacemer O/M	Total	Benefit	Negative		Total
0	2001		15.5		15.5		0.0	-15.5	
1	2002	346.5	117.5		464.0		-0.4	-464.4	
2	2003	346.5	117.5	17.0	481.0	3.5	-0.8	-478.3	
3	2004	346.5	117.5	33.9	497.9	7.0	-1.3	-492.1	
4	2005	346.5	117.5	50.9	514.9	10.5	-1.7	-506.0	
5	2006	346.5	102.0	67.8	516.3	14.1	-1.7	-503.9	
6	2007			84.8	84.8	205.3	-1.7	203.6	
7	2008			84.8	84.8	280.3	-1.7	278.7	
8	2009			84.8	84.8	317.9	-1.7	316.2	
9	2010			84.8	84.8	355.4	-1.7	353.7	
10	2011			84.8	84.8	392.9	-1.7	391.3	
11	2012			84.8	84.8	392.9	-1.7	391.3	
12	2013			84.8	84.8	392.9	-1.7	391.3	
13	2014			84.8	84.8	392.9	-1.7	391.3	
14	2015			84.8	84.8	392.9	-1.7	391.3	
15	2016			19.3	84.8	104.1	392.9	-1.7	391.3
16	2017			84.8	84.8	392.9	-1.7	391.3	
17	2018			84.8	84.8	392.9	-1.7	391.3	
18	2019			84.8	84.8	392.9	-1.7	391.3	
19	2020			84.8	84.8	392.9	-1.7	391.3	
20	2021			84.8	84.8	392.9	-1.7	391.3	
21	2022			84.8	84.8	392.9	-1.7	391.3	
22	2023			84.8	84.8	392.9	-1.7	391.3	
23	2024			84.8	84.8	392.9	-1.7	391.3	
24	2025			84.8	84.8	392.9	-1.7	391.3	
25	2026			19.3	84.8	104.1	392.9	-1.7	391.3
26	2027			84.8	84.8	392.9	-1.7	391.3	
27	2028			84.8	84.8	392.9	-1.7	391.3	
28	2029			84.8	84.8	392.9	-1.7	391.3	
29	2030			84.8	84.8	392.9	-1.7	391.3	
30	2031			200.5	84.8	285.3	392.9	-1.7	391.3
31	2032			84.8	84.8	392.9	-1.7	391.3	
32	2033			84.8	84.8	392.9	-1.7	391.3	
33	2034			84.8	84.8	392.9	-1.7	391.3	
34	2035			84.8	84.8	392.9	-1.7	391.3	
35	2036			19.3	84.8	104.1	392.9	-1.7	391.3
36	2037			84.8	84.8	392.9	-1.7	391.3	
37	2038			84.8	84.8	392.9	-1.7	391.3	
38	2039			84.8	84.8	392.9	-1.7	391.3	
39	2040			84.8	84.8	392.9	-1.7	391.3	
40	2041			84.8	84.8	392.9	-1.7	391.3	
41	2042			84.8	84.8	392.9	-1.7	391.3	
42	2043			84.8	84.8	392.9	-1.7	391.3	
43	2044			84.8	84.8	392.9	-1.7	391.3	
44	2045			84.8	84.8	392.9	-1.7	391.3	
45	2046			19.3	84.8	104.1	392.9	-1.7	391.3
46	2047			84.8	84.8	392.9	-1.7	391.3	
47	2048			84.8	84.8	392.9	-1.7	391.3	
48	2049			84.8	84.8	392.9	-1.7	391.3	
49	2050			84.8	84.8	392.9	-1.7	391.3	
50	2051			84.8	84.8	392.9	-1.7	391.3	
51	2052			84.8	84.8	392.9	-1.7	391.3	
52	2053			84.8	84.8	392.9	-1.7	391.3	
53	2054			84.8	84.8	392.9	-1.7	391.3	
54	2055			84.8	84.8	392.9	-1.7	391.3	
55	2056			219.8	84.8	304.5	392.9	-1.7	391.3
		B/C:	0.59	NPV:	-690.9	MillionPesos	EIRR:	9.1%	

Table 4.5.5 Economic Cost and Benefit Stream of Alternatives in Reach from Alcalá to Buntun Bridge under Future Conditions: Case 1

(Unit: Million Pesos)

No.	Year	Cost			Total	Benefit		Total	Balance
		Const.	Supporting	Replacem		O/M	Benefit			Negative
0	2001		48.2		48.2			0.0	-48.2
1	2002	967.4	365.1		1,332.5		-1.3	-1.3	-1,333.8
2	2003	967.4	365.1		1,363.2	8.1	-2.7	5.4	-1,357.9
3	2004	967.4	365.1		1,394.0	17.3	-4.3	12.9	-1,381.1
4	2005	967.4	365.1		1,424.7	27.7	-6.2	21.5	-1,403.2
5	2006	967.4	316.9		1,407.3	39.5	-6.6	32.9	-1,374.3
6	2007				153.7	153.7	-7.0	914.0	760.3
7	2008				153.7	153.7	-7.5	1,347.1	1,193.4
8	2009				153.7	153.7	-8.0	1,636.9	1,483.2
9	2010				153.7	153.7	-8.6	1,959.8	1,806.1
10	2011				153.7	153.7	-9.1	2,348.4	2,194.7
11	2012				153.7	153.7	-9.6	2,435.2	2,281.5
12	2013				153.7	153.7	-10.2	2,578.9	2,425.3
13	2014				153.7	153.7	-10.8	2,731.2	2,577.5
14	2015				153.7	153.7	-11.4	2,892.4	2,738.7
15	2016			35.7	153.7	189.4	-12.1	3,063.1	2,873.7
16	2017				153.7	153.7	-12.8	3,243.9	3,090.2
17	2018				153.7	153.7	-13.5	3,435.3	3,281.7
18	2019				153.7	153.7	-14.3	3,638.1	3,484.4
19	2020				153.7	153.7	-15.2	3,852.8	3,699.2
20	2021				153.7	153.7	-15.2	3,852.8	3,699.2
21	2022				153.7	153.7	-15.2	3,852.8	3,699.2
22	2023				153.7	153.7	-15.2	3,852.8	3,699.2
23	2024				153.7	153.7	-15.2	3,852.8	3,699.2
24	2025				153.7	153.7	-15.2	3,852.8	3,699.2
25	2026			35.7	153.7	189.4	-15.2	3,852.8	3,663.5
26	2027				153.7	153.7	-15.2	3,852.8	3,699.2
27	2028				153.7	153.7	-15.2	3,852.8	3,699.2
28	2029				153.7	153.7	-15.2	3,852.8	3,699.2
29	2030				153.7	153.7	-15.2	3,852.8	3,699.2
30	2031			329.7	153.7	483.3	-15.2	3,852.8	3,369.5
31	2032				153.7	153.7	-15.2	3,852.8	3,699.2
32	2033				153.7	153.7	-15.2	3,852.8	3,699.2
33	2034				153.7	153.7	-15.2	3,852.8	3,699.2
34	2035				153.7	153.7	-15.2	3,852.8	3,699.2
35	2036			35.7	153.7	189.4	-15.2	3,852.8	3,663.5
36	2037				153.7	153.7	-15.2	3,852.8	3,699.2
37	2038				153.7	153.7	-15.2	3,852.8	3,699.2
38	2039				153.7	153.7	-15.2	3,852.8	3,699.2
39	2040				153.7	153.7	-15.2	3,852.8	3,699.2
40	2041				153.7	153.7	-15.2	3,852.8	3,699.2
41	2042				153.7	153.7	-15.2	3,852.8	3,699.2
42	2043				153.7	153.7	-15.2	3,852.8	3,699.2
43	2044				153.7	153.7	-15.2	3,852.8	3,699.2
44	2045				153.7	153.7	-15.2	3,852.8	3,699.2
45	2046			35.7	153.7	189.4	-15.2	3,852.8	3,663.5
46	2047				153.7	153.7	-15.2	3,852.8	3,699.2
47	2048				153.7	153.7	-15.2	3,852.8	3,699.2
48	2049				153.7	153.7	-15.2	3,852.8	3,699.2
49	2050				153.7	153.7	-15.2	3,852.8	3,699.2
50	2051				153.7	153.7	-15.2	3,852.8	3,699.2
51	2052				153.7	153.7	-15.2	3,852.8	3,699.2
52	2053				153.7	153.7	-15.2	3,852.8	3,699.2
53	2054				153.7	153.7	-15.2	3,852.8	3,699.2
54	2055				153.7	153.7	-15.2	3,852.8	3,699.2
55	2056			365.3	153.7	519.0	-15.2	3,852.8	3,333.8
		B/C:	1.52		NPV:	2,334.1	MillionPesos	EIRR:	19.6%

Table 4.5.6 Economic Cost and Benefit Stream of Alternatives in Reach from Alcalá to Buntun Bridge under Future Conditions: Case 2

(Unit: Million Pesos)

No.	Year	Cost				Benefit			Balance	
		Const.	Supporting	Replacemer	O/M	Total	Benefit	Negative		Total
0	2001		27.9			27.9			0.0	-27.9
1	2002	622.2	211.3			833.6		-0.8	-0.8	-834.4
2	2003	622.2	211.3		23.8	857.4	6.5	-1.7	4.8	-852.6
3	2004	622.2	211.3		47.6	881.1	13.9	-2.7	11.1	-870.0
4	2005	622.2	211.3		71.3	904.9	22.3	-3.9	18.4	-886.5
5	2006	622.2	183.4		95.1	900.8	31.8	-4.2	27.6	-873.2
6	2007				118.9	118.9	570.4	-4.4	566.0	447.1
7	2008				118.9	118.9	834.8	-4.7	830.1	711.2
8	2009				118.9	118.9	1,012.1	-5.1	1,007.0	888.2
9	2010				118.9	118.9	1,209.6	-5.4	1,204.2	1,085.4
10	2011				118.9	118.9	1,456.6	-5.7	1,450.9	1,332.0
11	2012				118.9	118.9	1,500.9	-6.1	1,494.9	1,376.0
12	2013				118.9	118.9	1,589.5	-6.4	1,583.1	1,464.2
13	2014				118.9	118.9	1,683.3	-6.8	1,676.6	1,557.7
14	2015				118.9	118.9	1,782.7	-7.2	1,775.5	1,656.6
15	2016			26.0	118.9	144.9	1,888.0	-7.6	1,880.3	1,735.5
16	2017				118.9	118.9	1,999.4	-8.1	1,991.3	1,872.5
17	2018				118.9	118.9	2,117.4	-8.5	2,108.9	1,990.0
18	2019				118.9	118.9	2,242.4	-9.0	2,233.4	2,114.5
19	2020				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
20	2021				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
21	2022				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
22	2023				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
23	2024				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
24	2025				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
25	2026			26.0	118.9	144.9	2,374.8	-9.6	2,365.2	2,220.3
26	2027				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
27	2028				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
28	2029				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
29	2030				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
30	2031			265.4	118.9	384.2	2,374.8	-9.6	2,365.2	1,981.0
31	2032				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
32	2033				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
33	2034				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
34	2035				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
35	2036			26.0	118.9	144.9	2,374.8	-9.6	2,365.2	2,220.3
36	2037				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
37	2038				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
38	2039				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
39	2040				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
40	2041				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
41	2042				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
42	2043				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
43	2044				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
44	2045				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
45	2046			26.0	118.9	144.9	2,374.8	-9.6	2,365.2	2,220.3
46	2047				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
47	2048				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
48	2049				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
49	2050				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
50	2051				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
51	2052				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
52	2053				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
53	2054				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
54	2055				118.9	118.9	2,374.8	-9.6	2,365.2	2,246.3
55	2056			291.3	118.9	410.2	2,374.8	-9.6	2,365.2	1,955.0
		B/C:	1.45		NPV:	1,305.7	MillionPesos		EIRR:	19.2%

Table 4.5.7 Economic Cost and Benefit Stream of Alternatives in Reach from Alcalá to Buntun Bridge under Future Conditions: Case 3

(Unit: Million Pesos)

No.	Year	Cost			Total	Benefit		Total	Balance	
		Const.	Supporting	Replacemer O/M		Benefit	Negative			
0	2001		24.2		24.2			0.0	-24.2	
1	2002	540.9	183.6		724.5		-0.7	-0.7	-725.2	
2	2003	540.9	183.6	21.9	746.4	6.1	-1.5	4.6	-741.8	
3	2004	540.9	183.6	43.8	768.3	13.0	-2.4	10.6	-757.7	
4	2005	540.9	183.6	65.7	790.2	20.8	-3.4	17.5	-772.7	
5	2006	540.9	159.4	87.6	787.9	29.7	-3.6	26.1	-761.7	
6	2007			109.5	109.5	495.2	-3.8	491.4	381.9	
7	2008			109.5	109.5	723.5	-4.1	719.4	609.9	
8	2009			109.5	109.5	876.7	-4.4	872.3	762.8	
9	2010			109.5	109.5	1,047.4	-4.7	1,042.7	933.2	
10	2011			109.5	109.5	1,263.5	-5.0	1,258.6	1,149.1	
11	2012			109.5	109.5	1,299.1	-5.2	1,293.9	1,184.4	
12	2013			109.5	109.5	1,375.8	-5.6	1,370.2	1,260.8	
13	2014			109.5	109.5	1,457.0	-5.9	1,451.1	1,341.7	
14	2015			109.5	109.5	1,543.0	-6.2	1,536.8	1,427.3	
15	2016			24.2	109.5	1,634.1	-6.6	1,627.5	1,493.9	
16	2017			109.5	109.5	1,730.6	-7.0	1,723.6	1,614.1	
17	2018			109.5	109.5	1,832.8	-7.4	1,825.4	1,715.9	
18	2019			109.5	109.5	1,941.0	-7.8	1,933.1	1,823.6	
19	2020			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
20	2021			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
21	2022			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
22	2023			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
23	2024			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
24	2025			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
25	2026			24.2	109.5	133.7	2,055.5	-8.3	2,047.2	1,913.6
26	2027			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
27	2028			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
28	2029			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
29	2030			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
30	2031			248.3	109.5	357.7	2,055.5	-8.3	2,047.2	1,689.5
31	2032			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
32	2033			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
33	2034			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
34	2035			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
35	2036			24.2	109.5	133.7	2,055.5	-8.3	2,047.2	1,913.6
36	2037			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
37	2038			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
38	2039			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
39	2040			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
40	2041			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
41	2042			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
42	2043			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
43	2044			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
44	2045			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
45	2046			24.2	109.5	133.7	2,055.5	-8.3	2,047.2	1,913.6
46	2047			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
47	2048			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
48	2049			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
49	2050			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
50	2051			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
51	2052			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
52	2053			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
53	2054			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
54	2055			109.5	109.5	2,055.5	-8.3	2,047.2	1,937.8	
55	2056			272.4	109.5	381.9	2,055.5	-8.3	2,047.2	1,665.3
		B/C:	1.43	NPV:	1,099.7	MillionPesos	EIRR:	19.0%		

Table 4.5.8 Economic Cost and Benefit Stream of Alternatives in Reach from Alcalá to Buntun Bridge under Future Conditions: Case 4

(Unit: Million Pesos)

No.	Year	Cost			Total	Benefit		Balance		
		Const.	Supporting	Replacemer O/M		Benefit	Negative		Total	
0	2001		15.5		15.5			0.0	-15.5	
1	2002	346.5	117.5		464.0		-0.5	-0.5	-464.5	
2	2003	346.5	117.5	17.0	481.0	5.0	-1.0	4.0	-477.0	
3	2004	346.5	117.5	33.9	497.9	10.7	-1.6	9.0	-488.9	
4	2005	346.5	117.5	50.9	514.9	17.1	-2.3	14.8	-500.1	
5	2006	346.5	102.0	67.8	516.3	24.4	-2.5	22.0	-494.3	
6	2007			84.8	84.8	330.2	-2.6	327.5	242.7	
7	2008			84.8	84.8	479.7	-2.8	476.9	392.1	
8	2009			84.8	84.8	580.3	-3.0	577.3	492.5	
9	2010			84.8	84.8	692.3	-3.2	689.1	604.3	
10	2011			84.8	84.8	840.2	-3.4	836.8	752.0	
11	2012			84.8	84.8	857.8	-3.6	854.1	769.4	
12	2013			84.8	84.8	908.4	-3.8	904.6	819.8	
13	2014			84.8	84.8	962.0	-4.1	958.0	873.2	
14	2015			84.8	84.8	1,018.8	-4.3	1,014.6	929.8	
15	2016			19.3	84.8	1,079.0	-4.5	1,074.5	970.4	
16	2017			84.8	84.8	1,142.7	-4.8	1,137.9	1,053.1	
17	2018			84.8	84.8	1,210.2	-5.1	1,205.1	1,120.3	
18	2019			84.8	84.8	1,281.6	-5.4	1,276.2	1,191.4	
19	2020			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
20	2021			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
21	2022			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
22	2023			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
23	2024			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
24	2025			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
25	2026			19.3	84.8	1,357.3	-5.7	1,351.6	1,247.5	
26	2027			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
27	2028			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
28	2029			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
29	2030			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
30	2031			200.5	84.8	285.3	1,357.3	-5.7	1,351.6	1,066.3
31	2032			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
32	2033			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
33	2034			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
34	2035			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
35	2036			19.3	84.8	1,357.3	-5.7	1,351.6	1,247.5	
36	2037			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
37	2038			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
38	2039			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
39	2040			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
40	2041			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
41	2042			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
42	2043			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
43	2044			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
44	2045			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
45	2046			19.3	84.8	1,357.3	-5.7	1,351.6	1,247.5	
46	2047			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
47	2048			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
48	2049			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
49	2050			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
50	2051			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
51	2052			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
52	2053			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
53	2054			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
54	2055			84.8	84.8	1,357.3	-5.7	1,351.6	1,266.8	
55	2056			219.8	84.8	304.5	1,357.3	-5.7	1,351.6	1,047.0
		B/C:	1.43	NPV:	727.4	MillionPesos	EIRR:	19.1%		

Table 4.5.9 Economic Cost and Benefit Stream of Alternatives in Reach from Buntun Bridge to Upstream of Tuguegarao under Present Conditions: Case 1

(Unit: Million Pesos)

No.	Year	Cost				Benefit			Balance	
		Const.	Other	Replacemer	O/M	Total	Benefit	Negative		Total
0	2001		15.8			15.8	0.0		0.0	-15.8
1	2002	323.9	119.4			443.2	0.0	-0.6	-0.6	-443.9
2	2003	323.9	119.4		1.3	444.5	43.6	-0.2	43.4	-401.1
3	2004	323.9	119.4		2.5	445.8	87.1	-0.3	86.8	-359.0
4	2005	323.9	119.4		3.8	447.0	130.7	-0.5	130.2	-316.8
5	2006	323.9	103.6		5.0	432.5	174.2	-0.6	173.6	-258.9
6	2007				43.7	43.7	357.9	-0.6	357.3	313.6
7	2008				43.7	43.7	398.7	-0.6	398.1	354.4
8	2009				43.7	43.7	419.1	-0.6	418.5	374.8
9	2010				43.7	43.7	439.5	-0.6	438.9	395.2
10	2011				43.7	43.7	459.9	-0.6	459.3	415.6
11	2012				43.7	43.7	459.9	-0.6	459.3	415.6
12	2013				43.7	43.7	459.9	-0.6	459.3	415.6
13	2014				43.7	43.7	459.9	-0.6	459.3	415.6
14	2015				43.7	43.7	459.9	-0.6	459.3	415.6
15	2016			17.0	43.7	60.7	459.9	-0.6	459.3	398.6
16	2017				43.7	43.7	459.9	-0.6	459.3	415.6
17	2018				43.7	43.7	459.9	-0.6	459.3	415.6
18	2019				43.7	43.7	459.9	-0.6	459.3	415.6
19	2020				43.7	43.7	459.9	-0.6	459.3	415.6
20	2021				43.7	43.7	459.9	-0.6	459.3	415.6
21	2022				43.7	43.7	459.9	-0.6	459.3	415.6
22	2023				43.7	43.7	459.9	-0.6	459.3	415.6
23	2024				43.7	43.7	459.9	-0.6	459.3	415.6
24	2025				43.7	43.7	459.9	-0.6	459.3	415.6
25	2026			17.0	43.7	60.7	459.9	-0.6	459.3	398.6
26	2027				43.7	43.7	459.9	-0.6	459.3	415.6
27	2028				43.7	43.7	459.9	-0.6	459.3	415.6
28	2029				43.7	43.7	459.9	-0.6	459.3	415.6
29	2030				43.7	43.7	459.9	-0.6	459.3	415.6
30	2031			161.0	43.7	204.7	459.9	-0.6	459.3	254.6
31	2032				43.7	43.7	459.9	-0.6	459.3	415.6
32	2033				43.7	43.7	459.9	-0.6	459.3	415.6
33	2034				43.7	43.7	459.9	-0.6	459.3	415.6
34	2035				43.7	43.7	459.9	-0.6	459.3	415.6
35	2036			17.0	43.7	60.7	459.9	-0.6	459.3	398.6
36	2037				43.7	43.7	459.9	-0.6	459.3	415.6
37	2038				43.7	43.7	459.9	-0.6	459.3	415.6
38	2039				43.7	43.7	459.9	-0.6	459.3	415.6
39	2040				43.7	43.7	459.9	-0.6	459.3	415.6
40	2041				43.7	43.7	459.9	-0.6	459.3	415.6
41	2042				43.7	43.7	459.9	-0.6	459.3	415.6
42	2043				43.7	43.7	459.9	-0.6	459.3	415.6
43	2044				43.7	43.7	459.9	-0.6	459.3	415.6
44	2045				43.7	43.7	459.9	-0.6	459.3	415.6
45	2046			17.0	43.7	60.7	459.9	-0.6	459.3	398.6
46	2047				43.7	43.7	459.9	-0.6	459.3	415.6
47	2048				43.7	43.7	459.9	-0.6	459.3	415.6
48	2049				43.7	43.7	459.9	-0.6	459.3	415.6
49	2050				43.7	43.7	459.9	-0.6	459.3	415.6
50	2051				43.7	43.7	459.9	-0.6	459.3	415.6
51	2052				43.7	43.7	459.9	-0.6	459.3	415.6
52	2053				43.7	43.7	459.9	-0.6	459.3	415.6
53	2054				43.7	43.7	459.9	-0.6	459.3	415.6
54	2055				43.7	43.7	459.9	-0.6	459.3	415.6
55	2056			178.0	43.7	221.7	459.9	-0.6	459.3	237.6
		B/C:	1.52		NPV:	934.1	MillionPesos		EIRR:	15.3%

Table 4.5.10 Economic Cost and Benefit Stream of Alternatives in Reach from Buntun Bridge to Upstream of Tuguegarao under Present Conditions: Case 2

(Unit: Million Pesos)

No.	Year	Cost				Benefit			Balance	
		Const.	Other Replacemer	O/M	Total	Benefit	Negative	Total		
0	2001		82.1			82.1	0.0		0.0	-82.1
1	2002	2,099.8	622.0			2,721.8	0.0	-1.4	-1.4	-2,723.2
2	2003	2,099.8	622.0		10.1	2,731.9	43.6	-1.7	41.9	-2,690.1
3	2004	2,099.8	622.0		20.3	2,742.1	87.1	-2.6	84.5	-2,657.6
4	2005	2,099.8	622.0		30.4	2,752.2	130.7	-3.5	127.2	-2,625.1
5	2006	2,099.8	539.9		40.6	2,680.3	174.2	-3.7	170.6	-2,509.7
6	2007				88.1	88.1	689.9	-3.7	686.2	598.1
7	2008				88.1	88.1	730.7	-3.7	727.0	638.9
8	2009				88.1	88.1	751.1	-3.7	747.4	659.3
9	2010				88.1	88.1	771.5	-3.7	767.8	679.7
10	2011				88.1	88.1	791.9	-3.7	788.2	700.1
11	2012				88.1	88.1	791.9	-3.7	788.2	700.1
12	2013				88.1	88.1	791.9	-3.7	788.2	700.1
13	2014				88.1	88.1	791.9	-3.7	788.2	700.1
14	2015				88.1	88.1	791.9	-3.7	788.2	700.1
15	2016			17.0	88.1	105.1	791.9	-3.7	788.2	683.1
16	2017				88.1	88.1	791.9	-3.7	788.2	700.1
17	2018				88.1	88.1	791.9	-3.7	788.2	700.1
18	2019				88.1	88.1	791.9	-3.7	788.2	700.1
19	2020				88.1	88.1	791.9	-3.7	788.2	700.1
20	2021				88.1	88.1	791.9	-3.7	788.2	700.1
21	2022				88.1	88.1	791.9	-3.7	788.2	700.1
22	2023				88.1	88.1	791.9	-3.7	788.2	700.1
23	2024				88.1	88.1	791.9	-3.7	788.2	700.1
24	2025				88.1	88.1	791.9	-3.7	788.2	700.1
25	2026			17.0	88.1	105.1	791.9	-3.7	788.2	683.1
26	2027				88.1	88.1	791.9	-3.7	788.2	700.1
27	2028				88.1	88.1	791.9	-3.7	788.2	700.1
28	2029				88.1	88.1	791.9	-3.7	788.2	700.1
29	2030				88.1	88.1	791.9	-3.7	788.2	700.1
30	2031			161.0	88.1	249.1	791.9	-3.7	788.2	539.1
31	2032				88.1	88.1	791.9	-3.7	788.2	700.1
32	2033				88.1	88.1	791.9	-3.7	788.2	700.1
33	2034				88.1	88.1	791.9	-3.7	788.2	700.1
34	2035				88.1	88.1	791.9	-3.7	788.2	700.1
35	2036			17.0	88.1	105.1	791.9	-3.7	788.2	683.1
36	2037				88.1	88.1	791.9	-3.7	788.2	700.1
37	2038				88.1	88.1	791.9	-3.7	788.2	700.1
38	2039				88.1	88.1	791.9	-3.7	788.2	700.1
39	2040				88.1	88.1	791.9	-3.7	788.2	700.1
40	2041				88.1	88.1	791.9	-3.7	788.2	700.1
41	2042				88.1	88.1	791.9	-3.7	788.2	700.1
42	2043				88.1	88.1	791.9	-3.7	788.2	700.1
43	2044				88.1	88.1	791.9	-3.7	788.2	700.1
44	2045				88.1	88.1	791.9	-3.7	788.2	700.1
45	2046			17.0	88.1	105.1	791.9	-3.7	788.2	683.1
46	2047				88.1	88.1	791.9	-3.7	788.2	700.1
47	2048				88.1	88.1	791.9	-3.7	788.2	700.1
48	2049				88.1	88.1	791.9	-3.7	788.2	700.1
49	2050				88.1	88.1	791.9	-3.7	788.2	700.1
50	2051				88.1	88.1	791.9	-3.7	788.2	700.1
51	2052				88.1	88.1	791.9	-3.7	788.2	700.1
52	2053				88.1	88.1	791.9	-3.7	788.2	700.1
53	2054				88.1	88.1	791.9	-3.7	788.2	700.1
54	2055				88.1	88.1	791.9	-3.7	788.2	700.1
55	2056			178.0	88.1	266.1	791.9	-3.7	788.2	522.1
		B/C:	0.46		NPV:	-5,411.1	MillionPesos		EIRR:	4.1%

Table 4.5.11 Economic Cost and Benefit Stream of Alternatives in Reach from Buntun Bridge to Upstream of Tuguegarao under Present Conditions: Case 3

(Unit: Million Pesos)

No.	Year	Cost				Benefit		Total	Balance
		Const.	Other	Replacemer	O/M	Benefit	Negative		
0	2001		27.1			27.1	0.0	0.0	-27.1
1	2002	696.2	205.5			901.7	0.0	-1.0	-902.6
2	2003	696.2	205.5		3.1	904.8	43.6	-0.9	-862.1
3	2004	696.2	205.5		6.2	907.9	87.1	-1.4	-822.2
4	2005	696.2	205.5		9.4	911.0	130.7	-1.9	-782.3
5	2006	696.2	178.4		12.5	887.0	174.2	-2.1	-714.9
6	2007				53.0	53.0	938.7	-2.1	936.7
7	2008				53.0	53.0	979.5	-2.1	977.5
8	2009				53.0	53.0	999.9	-2.1	997.9
9	2010				53.0	53.0	1,020.3	-2.1	1,018.3
10	2011				53.0	53.0	1,040.7	-2.1	1,038.7
11	2012				53.0	53.0	1,040.7	-2.1	1,038.7
12	2013				53.0	53.0	1,040.7	-2.1	1,038.7
13	2014				53.0	53.0	1,040.7	-2.1	1,038.7
14	2015				53.0	53.0	1,040.7	-2.1	1,038.7
15	2016			17.0	53.0	70.0	1,040.7	-2.1	1,038.7
16	2017				53.0	53.0	1,040.7	-2.1	1,038.7
17	2018				53.0	53.0	1,040.7	-2.1	1,038.7
18	2019				53.0	53.0	1,040.7	-2.1	1,038.7
19	2020				53.0	53.0	1,040.7	-2.1	1,038.7
20	2021				53.0	53.0	1,040.7	-2.1	1,038.7
21	2022				53.0	53.0	1,040.7	-2.1	1,038.7
22	2023				53.0	53.0	1,040.7	-2.1	1,038.7
23	2024				53.0	53.0	1,040.7	-2.1	1,038.7
24	2025				53.0	53.0	1,040.7	-2.1	1,038.7
25	2026			17.0	53.0	70.0	1,040.7	-2.1	1,038.7
26	2027				53.0	53.0	1,040.7	-2.1	1,038.7
27	2028				53.0	53.0	1,040.7	-2.1	1,038.7
28	2029				53.0	53.0	1,040.7	-2.1	1,038.7
29	2030				53.0	53.0	1,040.7	-2.1	1,038.7
30	2031			161.0	53.0	214.0	1,040.7	-2.1	1,038.7
31	2032				53.0	53.0	1,040.7	-2.1	1,038.7
32	2033				53.0	53.0	1,040.7	-2.1	1,038.7
33	2034				53.0	53.0	1,040.7	-2.1	1,038.7
34	2035				53.0	53.0	1,040.7	-2.1	1,038.7
35	2036			17.0	53.0	70.0	1,040.7	-2.1	1,038.7
36	2037				53.0	53.0	1,040.7	-2.1	1,038.7
37	2038				53.0	53.0	1,040.7	-2.1	1,038.7
38	2039				53.0	53.0	1,040.7	-2.1	1,038.7
39	2040				53.0	53.0	1,040.7	-2.1	1,038.7
40	2041				53.0	53.0	1,040.7	-2.1	1,038.7
41	2042				53.0	53.0	1,040.7	-2.1	1,038.7
42	2043				53.0	53.0	1,040.7	-2.1	1,038.7
43	2044				53.0	53.0	1,040.7	-2.1	1,038.7
44	2045				53.0	53.0	1,040.7	-2.1	1,038.7
45	2046			17.0	53.0	70.0	1,040.7	-2.1	1,038.7
46	2047				53.0	53.0	1,040.7	-2.1	1,038.7
47	2048				53.0	53.0	1,040.7	-2.1	1,038.7
48	2049				53.0	53.0	1,040.7	-2.1	1,038.7
49	2050				53.0	53.0	1,040.7	-2.1	1,038.7
50	2051				53.0	53.0	1,040.7	-2.1	1,038.7
51	2052				53.0	53.0	1,040.7	-2.1	1,038.7
52	2053				53.0	53.0	1,040.7	-2.1	1,038.7
53	2054				53.0	53.0	1,040.7	-2.1	1,038.7
54	2055				53.0	53.0	1,040.7	-2.1	1,038.7
55	2056			178.0	53.0	231.0	1,040.7	-2.1	1,038.7
		B/C:	1.73		NPV:	2,526.1	MillionPesos	EIRR:	16.4%

Table 4.5.12 Economic Cost and Benefit Stream of Alternatives in Reach from Buntun Bridge to Upstream of Tuguegarao under Future Conditions: Case 1

(Unit: Million Pesos)

No.	Year	Cost				Benefit			Balance	
		Const.	Other	Replacemer	O/M	Total	Benefit	Negative		Total
0	2001		15.8			15.8	0.0		0.0	-15.8
1	2002	323.9	119.4			443.2	0.0	0.0	0.0	-443.2
2	2003	323.9	119.4		1.3	444.5	106.1	0.0	106.1	-338.4
3	2004	323.9	119.4		2.5	445.8	170.0	0.0	170.0	-275.8
4	2005	323.9	119.4		3.8	447.0	242.1	0.0	242.1	-205.0
5	2006	323.9	103.6		5.0	432.5	323.2	0.0	323.2	-109.4
6	2007				43.7	43.7	489.4	0.0	489.4	445.7
7	2008				43.7	43.7	571.5	0.0	571.4	527.7
8	2009				43.7	43.7	632.5	0.0	632.5	588.8
9	2010				43.7	43.7	697.4	0.0	697.4	653.7
10	2011				43.7	43.7	761.3	0.0	761.2	717.5
11	2012				43.7	43.7	861.5	0.0	861.5	817.8
12	2013				43.7	43.7	904.6	0.0	904.6	860.9
13	2014				43.7	43.7	950.3	0.0	950.3	906.6
14	2015				43.7	43.7	998.6	0.0	998.6	954.9
15	2016			17.0	43.7	60.7	1,049.8	0.0	1,049.8	989.1
16	2017				43.7	43.7	1,104.0	0.0	1,104.0	1,060.3
17	2018				43.7	43.7	1,161.5	0.0	1,161.4	1,117.7
18	2019				43.7	43.7	1,222.3	0.0	1,222.3	1,178.6
19	2020				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
20	2021				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
21	2022				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
22	2023				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
23	2024				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
24	2025				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
25	2026			17.0	43.7	60.7	1,286.8	0.0	1,286.7	1,226.0
26	2027				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
27	2028				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
28	2029				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
29	2030				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
30	2031			161.0	43.7	204.7	1,286.8	0.0	1,286.7	1,082.0
31	2032				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
32	2033				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
33	2034				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
34	2035				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
35	2036			17.0	43.7	60.7	1,286.8	0.0	1,286.7	1,226.0
36	2037				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
37	2038				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
38	2039				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
39	2040				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
40	2041				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
41	2042				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
42	2043				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
43	2044				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
44	2045				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
45	2046			17.0	43.7	60.7	1,286.8	0.0	1,286.7	1,226.0
46	2047				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
47	2048				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
48	2049				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
49	2050				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
50	2051				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
51	2052				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
52	2053				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
53	2054				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
54	2055				43.7	43.7	1,286.8	0.0	1,286.7	1,243.0
55	2056			178.0	43.7	221.7	1,286.8	0.0	1,286.7	1,065.0
		B/C:	3.21		NPV:	3,973.1	MillionPesos		EIRR:	26.0%

Table 4.5.13 Economic Cost and Benefit Stream of Alternatives in Reach from Buntun Bridge to Upstream of Tuguegarao under Future Conditions: Case 2

(Unit: Million Pesos)

No.	Year	Cost				Benefit			Balance	
		Const.	Other	Replacemer	O/M	Total	Benefit	Negative		Total
0	2001		82.1			82.1	0.0		0.0	-82.1
1	2002	2,099.8	622.0			2,721.8	0.0	-0.8	-0.8	-2,722.6
2	2003	2,099.8	622.0		10.1	2,731.9	106.1	-1.7	104.5	-2,627.5
3	2004	2,099.8	622.0		20.3	2,742.1	170.0	-2.6	167.5	-2,574.6
4	2005	2,099.8	622.0		30.4	2,752.2	242.1	-3.5	238.6	-2,513.6
5	2006	2,099.8	539.9		40.6	2,680.3	323.2	-3.6	319.6	-2,360.7
6	2007				88.1	88.1	1,054.8	-3.7	1,051.1	963.0
7	2008				88.1	88.1	1,172.1	-3.8	1,168.3	1,080.2
8	2009				88.1	88.1	1,270.5	-3.9	1,266.6	1,178.5
9	2010				88.1	88.1	1,375.1	-4.0	1,371.1	1,283.0
10	2011				88.1	88.1	1,475.0	-4.1	1,471.0	1,382.8
11	2012				88.1	88.1	1,613.3	-4.2	1,609.1	1,521.0
12	2013				88.1	88.1	1,696.4	-4.3	1,692.1	1,604.0
13	2014				88.1	88.1	1,784.1	-4.4	1,779.8	1,691.6
14	2015				88.1	88.1	1,876.8	-4.5	1,872.3	1,784.2
15	2016			17.0	88.1	105.1	1,974.6	-4.6	1,970.0	1,864.9
16	2017				88.1	88.1	2,077.9	-4.7	2,073.2	1,985.0
17	2018				88.1	88.1	2,186.9	-4.8	2,182.1	2,094.0
18	2019				88.1	88.1	2,302.1	-4.9	2,297.2	2,209.0
19	2020				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
20	2021				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
21	2022				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
22	2023				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
23	2024				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
24	2025				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
25	2026			17.0	88.1	105.1	2,423.7	-5.0	2,418.7	2,313.6
26	2027				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
27	2028				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
28	2029				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
29	2030				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
30	2031			161.0	88.1	249.1	2,423.7	-5.0	2,418.7	2,169.6
31	2032				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
32	2033				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
33	2034				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
34	2035				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
35	2036			17.0	88.1	105.1	2,423.7	-5.0	2,418.7	2,313.6
36	2037				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
37	2038				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
38	2039				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
39	2040				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
40	2041				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
41	2042				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
42	2043				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
43	2044				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
44	2045				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
45	2046			17.0	88.1	105.1	2,423.7	-5.0	2,418.7	2,313.6
46	2047				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
47	2048				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
48	2049				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
49	2050				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
50	2051				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
51	2052				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
52	2053				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
53	2054				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
54	2055				88.1	88.1	2,423.7	-5.0	2,418.7	2,330.6
55	2056			178.0	88.1	266.1	2,423.7	-5.0	2,418.7	2,152.6
		B/C:	1.06		NPV:	572.0	MillionPesos		EIRR:	10.5%

Table 4.5.14 Economic Cost and Benefit Stream of Alternatives in Reach from Buntun Bridge to Upstream of Tuguegarao under Future Conditions: Case 3

(Unit: Million Pesos)

No.	Year	Cost				Benefit			Balance	
		Const.	Other	Replacemer	O/M	Total	Benefit	Negative		Total
0	2001		27.1			27.1	0.0		0.0	-27.1
1	2002	696.2	205.5			901.7	0.0	-0.4	-0.4	-902.1
2	2003	696.2	205.5		3.1	904.8	106.1	-0.8	105.3	-799.5
3	2004	696.2	205.5		6.2	907.9	170.0	-1.2	168.8	-739.1
4	2005	696.2	205.5		9.4	911.0	242.1	-1.7	240.4	-670.6
5	2006	696.2	178.4		12.5	887.0	323.2	-1.7	321.5	-565.5
6	2007				53.0	53.0	1,449.2	-1.7	1,447.5	1,394.5
7	2008				53.0	53.0	1,593.3	-1.8	1,591.5	1,538.5
8	2009				53.0	53.0	1,720.4	-1.8	1,718.6	1,665.6
9	2010				53.0	53.0	1,855.6	-1.9	1,853.7	1,800.7
10	2011				53.0	53.0	1,983.9	-1.9	1,982.0	1,929.0
11	2012				53.0	53.0	2,152.1	-2.0	2,150.2	2,097.1
12	2013				53.0	53.0	2,267.1	-2.0	2,265.0	2,212.0
13	2014				53.0	53.0	2,388.5	-2.1	2,386.4	2,333.4
14	2015				53.0	53.0	2,516.8	-2.1	2,514.7	2,461.6
15	2016			17.0	53.0	70.0	2,652.4	-2.2	2,650.2	2,580.2
16	2017				53.0	53.0	2,795.6	-2.2	2,793.4	2,740.4
17	2018				53.0	53.0	2,947.0	-2.3	2,944.7	2,891.7
18	2019				53.0	53.0	3,107.0	-2.3	3,104.7	3,051.7
19	2020				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
20	2021				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
21	2022				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
22	2023				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
23	2024				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
24	2025				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
25	2026			17.0	53.0	70.0	3,276.2	-2.4	3,273.8	3,203.8
26	2027				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
27	2028				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
28	2029				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
29	2030				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
30	2031			161.0	53.0	214.0	3,276.2	-2.4	3,273.8	3,059.8
31	2032				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
32	2033				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
33	2034				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
34	2035				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
35	2036			17.0	53.0	70.0	3,276.2	-2.4	3,273.8	3,203.8
36	2037				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
37	2038				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
38	2039				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
39	2040				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
40	2041				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
41	2042				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
42	2043				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
43	2044				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
44	2045				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
45	2046			17.0	53.0	70.0	3,276.2	-2.4	3,273.8	3,203.8
46	2047				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
47	2048				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
48	2049				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
49	2050				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
50	2051				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
51	2052				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
52	2053				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
53	2054				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
54	2055				53.0	53.0	3,276.2	-2.4	3,273.8	3,220.8
55	2056			178.0	53.0	231.0	3,276.2	-2.4	3,273.8	3,042.8
		B/C:	4.08		NPV:	10,634.1	MillionPesos		EIRR:	27.6%

Table 4.6.1 Economic Cost and Benefit Stream of Alternatives of Master Plan Schemes under Present Conditions: Case 1

(Unit: Million Pesos)

No.	Year	Cost				Benefit			Balance	
		Const.	Supporting	Replacemer	O/M	Total	Benefit	Negative		Total
0	2001	0.0	76.4	0.0	0.0	76.4	0.0	0.0	0.0	-76.4
1	2002	1,684.2	578.6	0.0	0.0	2,262.8	0.0	-2.1	-2.1	-2,264.9
2	2003	1,684.2	578.6	0.0	33.9	2,296.7	49.2	-3.1	46.2	-2,250.6
3	2004	1,684.2	578.6	0.0	67.9	2,330.7	98.5	-4.7	93.8	-2,236.9
4	2005	1,684.2	578.6	0.0	101.8	2,364.6	147.7	-6.3	141.4	-2,223.2
5	2006	1,684.2	502.2	0.0	135.8	2,322.2	197.0	-6.5	190.5	-2,131.7
6	2007	0.0	0.0	0.0	207.2	207.2	1,514.9	-6.5	1,508.4	1,301.2
7	2008	0.0	0.0	0.0	207.2	207.2	1,774.8	-6.5	1,768.3	1,561.1
8	2009	0.0	0.0	0.0	207.2	207.2	1,904.8	-6.5	1,898.3	1,691.1
9	2010	0.0	0.0	0.0	207.2	207.2	2,034.7	-6.5	2,028.2	1,821.0
10	2011	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
11	2012	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
12	2013	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
13	2014	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
14	2015	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
15	2016	0.0	0.0	35.7	207.2	242.9	2,164.7	-6.5	2,158.2	1,915.3
16	2017	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
17	2018	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
18	2019	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
19	2020	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
20	2021	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
21	2022	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
22	2023	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
23	2024	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
24	2025	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
25	2026	0.0	0.0	35.7	207.2	242.9	2,164.7	-6.5	2,158.2	1,915.3
26	2027	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
27	2028	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
28	2029	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
29	2030	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
30	2031	0.0	0.0	329.7	207.2	536.9	2,164.7	-6.5	2,158.2	1,621.3
31	2032	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
32	2033	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
33	2034	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
34	2035	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
35	2036	0.0	0.0	35.7	207.2	242.9	2,164.7	-6.5	2,158.2	1,915.3
36	2037	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
37	2038	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
38	2039	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
39	2040	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
40	2041	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
41	2042	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
42	2043	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
43	2044	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
44	2045	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
45	2046	0.0	0.0	35.7	207.2	242.9	2,164.7	-6.5	2,158.2	1,915.3
46	2047	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
47	2048	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
48	2049	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
49	2050	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
50	2051	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
51	2052	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
52	2053	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
53	2054	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
54	2055	0.0	0.0	0.0	207.2	207.2	2,164.7	-6.5	2,158.2	1,951.0
55	2056	0.0	0.0	365.3	207.2	572.6	2,164.7	-6.5	2,158.2	1,585.6
		B/C:	0.81	NPV:		-1,434.1	MillionPesos	EIRR:		12.5%

Table 4.6.2 Economic Cost and Benefit Stream of Alternatives of Master Plan Schemes under Present Conditions: Case 2

(Unit: Million Pesos)

No.	Year	Cost			Benefit			Balance
		Const.	Supporting	Replacemer O/M	Total	Benefit	Negative		Total
0	2001		101.8		101.8		0.0	-101.8
1	2002	2,278.6	770.8		3,049.4		-2.1	-2.1
2	2003	2,278.6	770.8	43.0	3,092.5	50.7	-3.2	47.6
3	2004	2,278.6	770.8	86.0	3,135.5	101.5	-4.8	96.6
4	2005	2,278.6	770.8	129.0	3,178.5	152.2	-6.5	145.7
5	2006	2,278.6	669.1	172.0	3,119.7	202.9	-6.5	196.5
6	2007			252.5	252.5	1,643.5	-6.5	1,637.0
7	2008			252.5	252.5	1,951.9	-6.5	1,945.4
8	2009			252.5	252.5	2,106.0	-6.5	2,099.6
9	2010			252.5	252.5	2,260.2	-6.5	2,253.7
10	2011			252.5	252.5	2,414.4	-6.5	2,407.9
11	2012			252.5	252.5	2,414.4	-6.5	2,407.9
12	2013			252.5	252.5	2,414.4	-6.5	2,407.9
13	2014			252.5	252.5	2,414.4	-6.5	2,407.9
14	2015			252.5	252.5	2,414.4	-6.5	2,407.9
15	2016			150.0	252.5	402.5	-6.5	2,407.9
16	2017			252.5	252.5	2,414.4	-6.5	2,407.9
17	2018			252.5	252.5	2,414.4	-6.5	2,407.9
18	2019			252.5	252.5	2,414.4	-6.5	2,407.9
19	2020			252.5	252.5	2,414.4	-6.5	2,407.9
20	2021			252.5	252.5	2,414.4	-6.5	2,407.9
21	2022			252.5	252.5	2,414.4	-6.5	2,407.9
22	2023			252.5	252.5	2,414.4	-6.5	2,407.9
23	2024			252.5	252.5	2,414.4	-6.5	2,407.9
24	2025			252.5	252.5	2,414.4	-6.5	2,407.9
25	2026			150.0	252.5	402.5	-6.5	2,407.9
26	2027			252.5	252.5	2,414.4	-6.5	2,407.9
27	2028			252.5	252.5	2,414.4	-6.5	2,407.9
28	2029			252.5	252.5	2,414.4	-6.5	2,407.9
29	2030			252.5	252.5	2,414.4	-6.5	2,407.9
30	2031			331.5	252.5	584.0	-6.5	2,407.9
31	2032			252.5	252.5	2,414.4	-6.5	2,407.9
32	2033			252.5	252.5	2,414.4	-6.5	2,407.9
33	2034			252.5	252.5	2,414.4	-6.5	2,407.9
34	2035			252.5	252.5	2,414.4	-6.5	2,407.9
35	2036			150.0	252.5	402.5	-6.5	2,407.9
36	2037			252.5	252.5	2,414.4	-6.5	2,407.9
37	2038			252.5	252.5	2,414.4	-6.5	2,407.9
38	2039			252.5	252.5	2,414.4	-6.5	2,407.9
39	2040			252.5	252.5	2,414.4	-6.5	2,407.9
40	2041			252.5	252.5	2,414.4	-6.5	2,407.9
41	2042			252.5	252.5	2,414.4	-6.5	2,407.9
42	2043			252.5	252.5	2,414.4	-6.5	2,407.9
43	2044			252.5	252.5	2,414.4	-6.5	2,407.9
44	2045			252.5	252.5	2,414.4	-6.5	2,407.9
45	2046			150.0	252.5	402.5	-6.5	2,407.9
46	2047			252.5	252.5	2,414.4	-6.5	2,407.9
47	2048			252.5	252.5	2,414.4	-6.5	2,407.9
48	2049			252.5	252.5	2,414.4	-6.5	2,407.9
49	2050			252.5	252.5	2,414.4	-6.5	2,407.9
50	2051			252.5	252.5	2,414.4	-6.5	2,407.9
51	2052			252.5	252.5	2,414.4	-6.5	2,407.9
52	2053			252.5	252.5	2,414.4	-6.5	2,407.9
53	2054			252.5	252.5	2,414.4	-6.5	2,407.9
54	2055			252.5	252.5	2,414.4	-6.5	2,407.9
55	2056			481.5	252.5	734.0	-6.5	2,407.9

B/C: 0.67

NPV: -3,293.1 MillionPesos

EIRR: 10.5%

Table 4.6.3 Economic Cost and Benefit Stream of Alternatives of Master Plan Schemes under Present Conditions: Case 3

(Unit: Million Pesos)

No.	Year	Cost			Benefit			Balance	
		Const.	Supporting	Replacemer O/M	Total	Benefit	Negative		Total
0	2001		113.2		113.2		0.0	-113.2	
1	2002	2,546.9	857.4		3,404.3		-2.2	-2.2	
2	2003	2,546.9	857.4	44.3	3,448.7	51.3	-3.2	48.0	
3	2004	2,546.9	857.4	88.7	3,493.0	102.6	-4.9	97.6	
4	2005	2,546.9	857.4	133.0	3,537.4	153.8	-6.6	147.2	
5	2006	2,546.9	744.2	177.4	3,468.5	205.1	-6.6	198.5	
6	2007			259.2	259.2	1,647.0	-6.6	1,640.4	
7	2008			259.2	259.2	1,955.7	-6.6	1,949.1	
8	2009			259.2	259.2	2,110.0	-6.6	2,103.4	
9	2010			259.2	259.2	2,264.4	-6.6	2,257.7	
10	2011			259.2	259.2	2,418.7	-6.6	2,412.1	
11	2012			259.2	259.2	2,418.7	-6.6	2,412.1	
12	2013			259.2	259.2	2,418.7	-6.6	2,412.1	
13	2014			259.2	259.2	2,418.7	-6.6	2,412.1	
14	2015			259.2	259.2	2,418.7	-6.6	2,412.1	
15	2016			150.0	259.2	409.2	2,418.7	-6.6	
16	2017			259.2	259.2	2,418.7	-6.6	2,412.1	
17	2018			259.2	259.2	2,418.7	-6.6	2,412.1	
18	2019			259.2	259.2	2,418.7	-6.6	2,412.1	
19	2020			259.2	259.2	2,418.7	-6.6	2,412.1	
20	2021			259.2	259.2	2,418.7	-6.6	2,412.1	
21	2022			259.2	259.2	2,418.7	-6.6	2,412.1	
22	2023			259.2	259.2	2,418.7	-6.6	2,412.1	
23	2024			259.2	259.2	2,418.7	-6.6	2,412.1	
24	2025			259.2	259.2	2,418.7	-6.6	2,412.1	
25	2026			150.0	259.2	409.2	2,418.7	-6.6	
26	2027			259.2	259.2	2,418.7	-6.6	2,412.1	
27	2028			259.2	259.2	2,418.7	-6.6	2,412.1	
28	2029			259.2	259.2	2,418.7	-6.6	2,412.1	
29	2030			259.2	259.2	2,418.7	-6.6	2,412.1	
30	2031			331.5	259.2	590.8	2,418.7	-6.6	
31	2032			259.2	259.2	2,418.7	-6.6	2,412.1	
32	2033			259.2	259.2	2,418.7	-6.6	2,412.1	
33	2034			259.2	259.2	2,418.7	-6.6	2,412.1	
34	2035			259.2	259.2	2,418.7	-6.6	2,412.1	
35	2036			150.0	259.2	409.2	2,418.7	-6.6	
36	2037			259.2	259.2	2,418.7	-6.6	2,412.1	
37	2038			259.2	259.2	2,418.7	-6.6	2,412.1	
38	2039			259.2	259.2	2,418.7	-6.6	2,412.1	
39	2040			259.2	259.2	2,418.7	-6.6	2,412.1	
40	2041			259.2	259.2	2,418.7	-6.6	2,412.1	
41	2042			259.2	259.2	2,418.7	-6.6	2,412.1	
42	2043			259.2	259.2	2,418.7	-6.6	2,412.1	
43	2044			259.2	259.2	2,418.7	-6.6	2,412.1	
44	2045			259.2	259.2	2,418.7	-6.6	2,412.1	
45	2046			150.0	259.2	409.2	2,418.7	-6.6	
46	2047			259.2	259.2	2,418.7	-6.6	2,412.1	
47	2048			259.2	259.2	2,418.7	-6.6	2,412.1	
48	2049			259.2	259.2	2,418.7	-6.6	2,412.1	
49	2050			259.2	259.2	2,418.7	-6.6	2,412.1	
50	2051			259.2	259.2	2,418.7	-6.6	2,412.1	
51	2052			259.2	259.2	2,418.7	-6.6	2,412.1	
52	2053			259.2	259.2	2,418.7	-6.6	2,412.1	
53	2054			259.2	259.2	2,418.7	-6.6	2,412.1	
54	2055			259.2	259.2	2,418.7	-6.6	2,412.1	
55	2056			481.5	259.2	740.8	2,418.7	-6.6	
		B/C:	0.60		NPV:	-4,344.7	MillionPesos	EIRR:	9.6%

Table 4.6.4 Economic Cost and Benefit Stream of Alternatives of Master Plan Schemes under Present Conditions: Case 4

(Unit: Million Pesos)

No.	Year	Cost				Benefit			Balance	
		Const.	Supporting	Replacemer	O/M	Total	Benefit	Negative		Total
0	2001		132.0			132.0			0.0	-132.0
1	2002	2,979.9	999.8			3,979.7		-2.4	-2.4	-3,982.1
2	2003	2,979.9	999.8		47.9	4,027.6	52.5	-3.8	48.7	-3,978.8
3	2004	2,979.9	999.8		95.7	4,075.4	105.0	-5.7	99.3	-3,976.2
4	2005	2,979.9	999.8		143.6	4,123.3	157.5	-7.7	149.8	-3,973.5
5	2006	2,979.9	867.8		191.5	4,039.2	210.0	-7.7	202.3	-3,836.9
6	2007				276.8	276.8	1,748.3	-7.7	1,740.6	1,463.8
7	2008				276.8	276.8	2,095.0	-7.7	2,087.3	1,810.5
8	2009				276.8	276.8	2,268.4	-7.7	2,260.7	1,983.9
9	2010				276.8	276.8	2,441.8	-7.7	2,434.1	2,157.2
10	2011				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
11	2012				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
12	2013				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
13	2014				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
14	2015				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
15	2016			190.1	276.8	466.9	2,615.1	-7.7	2,607.4	2,140.5
16	2017				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
17	2018				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
18	2019				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
19	2020				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
20	2021				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
21	2022				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
22	2023				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
23	2024				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
24	2025				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
25	2026			190.1	276.8	466.9	2,615.1	-7.7	2,607.4	2,140.5
26	2027				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
27	2028				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
28	2029				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
29	2030				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
30	2031			337.8	276.8	614.6	2,615.1	-7.7	2,607.4	1,992.8
31	2032				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
32	2033				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
33	2034				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
34	2035				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
35	2036			190.1	276.8	466.9	2,615.1	-7.7	2,607.4	2,140.5
36	2037				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
37	2038				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
38	2039				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
39	2040				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
40	2041				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
41	2042				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
42	2043				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
43	2044				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
44	2045				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
45	2046			190.1	276.8	466.9	2,615.1	-7.7	2,607.4	2,140.5
46	2047				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
47	2048				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
48	2049				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
49	2050				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
50	2051				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
51	2052				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
52	2053				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
53	2054				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
54	2055				276.8	276.8	2,615.1	-7.7	2,607.4	2,330.6
55	2056			527.8	276.8	804.7	2,615.1	-7.7	2,607.4	1,802.8
		B/C:	0.56		NPV:	-5,607.5	MillionPesos		EIRR:	9.0%

Table 4.6.5 Economic Cost and Benefit Stream of Alternatives of Master Plan Schemes under Present Conditions: Case 5

		(Unit: Million Pesos)								
No.	Year	Cost				Benefit			Balance	
		Const.	Supporting	Replacemer	O/M	Total	Benefit	Negative		Total
0	2001		347.4			347.4			0.0	-347.4
1	2002	8,034.9	2,632.2			10,667.1		-2.6	-2.6	-10,669.7
2	2003	8,034.9	2,632.2		73.1	10,740.2	56.1	-4.2	51.9	-10,688.3
3	2004	8,034.9	2,632.2		146.3	10,813.4	112.2	-6.4	105.8	-10,707.6
4	2005	8,034.9	2,632.2		219.4	10,886.5	168.3	-8.6	159.7	-10,726.8
5	2006	8,034.9	2,284.7		292.6	10,612.2	224.4	-8.6	215.8	-10,396.4
6	2007				403.2	403.2	1,788.3	-8.6	1,779.7	1,376.5
7	2008				403.2	403.2	2,143.8	-8.6	2,135.2	1,732.0
8	2009				403.2	403.2	2,321.6	-8.6	2,313.0	1,909.8
9	2010				403.2	403.2	2,499.3	-8.6	2,490.8	2,087.5
10	2011				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
11	2012				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
12	2013				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
13	2014				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
14	2015				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
15	2016			190.1	403.2	593.3	2,677.1	-8.6	2,668.5	2,075.3
16	2017				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
17	2018				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
18	2019				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
19	2020				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
20	2021				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
21	2022				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
22	2023				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
23	2024				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
24	2025				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
25	2026			190.1	403.2	593.3	2,677.1	-8.6	2,668.5	2,075.3
26	2027				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
27	2028				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
28	2029				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
29	2030				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
30	2031			337.8	403.2	741.0	2,677.1	-8.6	2,668.5	1,927.6
31	2032				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
32	2033				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
33	2034				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
34	2035				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
35	2036			190.1	403.2	593.3	2,677.1	-8.6	2,668.5	2,075.3
36	2037				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
37	2038				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
38	2039				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
39	2040				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
40	2041				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
41	2042				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
42	2043				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
43	2044				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
44	2045				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
45	2046			190.1	403.2	593.3	2,677.1	-8.6	2,668.5	2,075.3
46	2047				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
47	2048				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
48	2049				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
49	2050				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
50	2051				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
51	2052				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
52	2053				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
53	2054				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
54	2055				403.2	403.2	2,677.1	-8.6	2,668.5	2,265.3
55	2056			527.8	403.2	931.0	2,677.1	-8.6	2,668.5	1,737.5

B/C: 0.22 NPV: -25,509.6 MillionPesos EIRR: 2.9%

Table 4.6.6 Economic Cost and Benefit Stream of Alternatives of Master Plan Schemes under Future Conditions: Case 1

(Unit: Million Pesos)

No.	Year	Cost				Benefit			Balance	
		Const.	Supporting	Replacemer	O/M	Total	Benefit	Negative		Total
0	2001	0.0	76.4	0.0	0.0	76.4	0.0	0.0	0.0	-76.4
1	2002	1,684.2	578.6	0.0	0.0	2,262.8	0.0	-1.6	-1.6	-2,264.4
2	2003	1,684.2	578.6	0.0	33.9	2,296.7	114.2	-3.5	110.7	-2,186.0
3	2004	1,684.2	578.6	0.0	67.9	2,330.7	187.3	-5.5	181.7	-2,149.0
4	2005	1,684.2	578.6	0.0	101.8	2,364.6	269.8	-7.8	262.0	-2,102.7
5	2006	1,684.2	502.2	0.0	135.8	2,322.2	362.7	-8.3	354.4	-1,967.8
6	2007	0.0	0.0	0.0	207.2	207.2	2,370.2	-8.8	2,361.5	2,154.2
7	2008	0.0	0.0	0.0	207.2	207.2	2,947.9	-9.3	2,938.6	2,731.4
8	2009	0.0	0.0	0.0	207.2	207.2	3,365.3	-9.8	3,355.5	3,148.2
9	2010	0.0	0.0	0.0	207.2	207.2	3,824.0	-10.4	3,813.5	3,606.3
10	2011	0.0	0.0	0.0	207.2	207.2	4,341.4	-11.0	4,330.4	4,123.2
11	2012	0.0	0.0	0.0	207.2	207.2	4,596.9	-11.6	4,585.4	4,378.2
12	2013	0.0	0.0	0.0	207.2	207.2	4,856.2	-12.2	4,844.0	4,636.8
13	2014	0.0	0.0	0.0	207.2	207.2	5,130.4	-12.8	5,117.6	4,910.4
14	2015	0.0	0.0	0.0	207.2	207.2	5,420.5	-13.5	5,407.0	5,199.8
15	2016	0.0	0.0	35.7	207.2	242.9	5,727.5	-14.2	5,713.3	5,470.4
16	2017	0.0	0.0	0.0	207.2	207.2	6,052.3	-15.0	6,037.3	5,830.1
17	2018	0.0	0.0	0.0	207.2	207.2	6,395.9	-15.8	6,380.1	6,172.9
18	2019	0.0	0.0	0.0	207.2	207.2	6,759.5	-16.7	6,742.8	6,535.6
19	2020	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
20	2021	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
21	2022	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
22	2023	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
23	2024	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
24	2025	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
25	2026	0.0	0.0	35.7	207.2	242.9	7,144.2	-17.6	7,126.6	6,883.7
26	2027	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
27	2028	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
28	2029	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
29	2030	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
30	2031	0.0	0.0	329.7	207.2	536.9	7,144.2	-17.6	7,126.6	6,589.8
31	2032	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
32	2033	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
33	2034	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
34	2035	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
35	2036	0.0	0.0	35.7	207.2	242.9	7,144.2	-17.6	7,126.6	6,883.7
36	2037	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
37	2038	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
38	2039	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
39	2040	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
40	2041	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
41	2042	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
42	2043	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
43	2044	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
44	2045	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
45	2046	0.0	0.0	35.7	207.2	242.9	7,144.2	-17.6	7,126.6	6,883.7
46	2047	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
47	2048	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
48	2049	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
49	2050	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
50	2051	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
51	2052	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
52	2053	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
53	2054	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
54	2055	0.0	0.0	0.0	207.2	207.2	7,144.2	-17.6	7,126.6	6,919.4
55	2056	0.0	0.0	365.3	207.2	572.6	7,144.2	-17.6	7,126.6	6,554.1
		B/C:	1.84	NPV:		6,241.1	MillionPesos	EIRR:	22.5%	

Table 4.6.7 Economic Cost and Benefit Stream of Alternatives of Master Plan Schemes under Future Conditions: Case 2

(Unit: Million Pesos)

No.	Year	Cost				Benefit			Balance	
		Const.	Supporting	Replacemer	O/M	Total	Benefit	Negative		Total
0	2001	0.0	101.8	0.0	0.0	101.8			0.0	-101.8
1	2002	2,278.6	770.8	0.0	0.0	3,049.4		-1.7	-1.7	-3,051.1
2	2003	2,278.6	770.8	0.0	43.0	3,092.5	116.0	-3.6	112.5	-2,980.0
3	2004	2,278.6	770.8	0.0	86.0	3,135.5	191.2	-5.6	185.5	-2,949.9
4	2005	2,278.6	770.8	0.0	129.0	3,178.5	276.1	-8.0	268.1	-2,910.4
5	2006	2,278.6	669.1	0.0	172.0	3,119.7	371.7	-8.4	363.2	-2,756.5
6	2007	0.0	0.0	0.0	252.5	252.5	2,528.4	-8.9	2,519.4	2,266.9
7	2008				274.2	274.2	3,170.9	-9.5	3,161.5	2,887.3
8	2009				277.6	277.6	3,625.8	-10.0	3,615.8	3,338.2
9	2010				281.2	281.2	4,123.8	-10.6	4,113.2	3,832.0
10	2011				284.7	284.7	4,681.3	-11.2	4,670.1	4,385.4
11	2012				288.4	288.4	4,945.4	-11.8	4,933.6	4,645.3
12	2013				292.2	292.2	5,213.4	-12.4	5,201.1	4,908.9
13	2014				296.2	296.2	5,496.8	-13.0	5,483.7	5,187.5
14	2015				300.4	300.4	5,796.2	-13.7	5,782.5	5,482.0
15	2016			283.3	304.8	588.2	6,112.7	-14.4	6,098.3	5,510.1
16	2017				309.5	309.5	6,447.4	-15.2	6,432.1	6,122.7
17	2018				314.3	314.3	6,801.1	-16.0	6,785.1	6,470.8
18	2019				319.3	319.3	7,175.1	-16.9	7,158.2	6,838.9
19	2020				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
20	2021				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
21	2022				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
22	2023				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
23	2024				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
24	2025				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
25	2026			283.3	324.6	608.0	7,570.5	-17.8	7,552.7	6,944.7
26	2027				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
27	2028				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
28	2029				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
29	2030				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
30	2031			334.5	324.6	659.2	7,570.5	-17.8	7,552.7	6,893.5
31	2032				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
32	2033				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
33	2034				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
34	2035				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
35	2036			283.3	324.6	608.0	7,570.5	-17.8	7,552.7	6,944.7
36	2037				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
37	2038				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
38	2039				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
39	2040				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
40	2041				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
41	2042				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
42	2043				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
43	2044				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
44	2045				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
45	2046			283.3	324.6	608.0	7,570.5	-17.8	7,552.7	6,944.7
46	2047				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
47	2048				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
48	2049				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
49	2050				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
50	2051				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
51	2052				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
52	2053				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
53	2054				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
54	2055				324.6	324.6	7,570.5	-17.8	7,552.7	7,228.1
55	2056			617.8	324.6	942.5	7,570.5	-17.8	7,552.7	6,610.2
		B/C:	1.45		NPV:	4,540.9	MillionPesos		EIRR:	19.4%

Table 4.6.8 Economic Cost and Benefit Stream of Alternatives of Master Plan Schemes under Future Conditions: Case 3

(Unit: Million Pesos)

No.	Year	Cost				Benefit			Balance
		Const.	Supporting	Replacemer	O/M	Total	Benefit	Negative		Total
0	2001	0.0	113.2		0.0	113.2		0.0	-113.2
1	2002	2,546.9	857.4		0.0	3,404.3		-0.1	-3,404.4
2	2003	2,546.9	857.4		44.3	3,448.7	116.7	-0.2	-3,332.2
3	2004	2,546.9	857.4		88.7	3,493.0	192.6	-0.2	-3,300.7
4	2005	2,546.9	857.4		133.0	3,537.4	278.3	-0.3	-3,259.3
5	2006	2,546.9	744.2		177.4	3,468.5	374.9	-0.3	-3,093.9
6	2007				259.2	259.2	2,533.7	-0.3	2,274.1
7	2008				284.1	284.1	3,177.0	-0.3	2,892.5
8	2009				288.1	288.1	3,632.4	-0.4	3,344.0
9	2010				292.2	292.2	4,131.0	-0.4	3,838.4
10	2011				296.3	296.3	4,689.1	-0.4	4,392.4
11	2012				300.5	300.5	4,953.6	-0.4	4,652.7
12	2013				304.9	304.9	5,222.1	-0.4	4,916.8
13	2014				309.5	309.5	5,505.8	-0.4	5,195.9
14	2015				314.3	314.3	5,805.7	-0.4	5,491.0
15	2016			283.3	319.4	602.7	6,122.7	-0.4	5,519.6
16	2017				324.7	324.7	6,457.8	-0.4	6,132.7
17	2018				330.2	330.2	6,812.1	-0.4	6,481.5
18	2019				336.0	336.0	7,186.7	-0.5	6,850.2
19	2020				342.1	342.1	7,582.7	-0.5	7,240.1
20	2021				342.1	342.1	7,582.7	-0.5	7,240.1
21	2022				342.1	342.1	7,582.7	-0.5	7,240.1
22	2023				342.1	342.1	7,582.7	-0.5	7,240.1
23	2024				342.1	342.1	7,582.7	-0.5	7,240.1
24	2025				342.1	342.1	7,582.7	-0.5	7,240.1
25	2026			283.3	342.1	625.4	7,582.7	-0.5	6,956.8
26	2027				342.1	342.1	7,582.7	-0.5	7,240.1
27	2028				342.1	342.1	7,582.7	-0.5	7,240.1
28	2029				342.1	342.1	7,582.7	-0.5	7,240.1
29	2030				342.1	342.1	7,582.7	-0.5	7,240.1
30	2031			334.5	342.1	676.6	7,582.7	-0.5	6,905.6
31	2032				342.1	342.1	7,582.7	-0.5	7,240.1
32	2033				342.1	342.1	7,582.7	-0.5	7,240.1
33	2034				342.1	342.1	7,582.7	-0.5	7,240.1
34	2035				342.1	342.1	7,582.7	-0.5	7,240.1
35	2036			283.3	342.1	625.4	7,582.7	-0.5	6,956.8
36	2037				342.1	342.1	7,582.7	-0.5	7,240.1
37	2038				342.1	342.1	7,582.7	-0.5	7,240.1
38	2039				342.1	342.1	7,582.7	-0.5	7,240.1
39	2040				342.1	342.1	7,582.7	-0.5	7,240.1
40	2041				342.1	342.1	7,582.7	-0.5	7,240.1
41	2042				342.1	342.1	7,582.7	-0.5	7,240.1
42	2043				342.1	342.1	7,582.7	-0.5	7,240.1
43	2044				342.1	342.1	7,582.7	-0.5	7,240.1
44	2045				342.1	342.1	7,582.7	-0.5	7,240.1
45	2046			283.3	342.1	625.4	7,582.7	-0.5	6,956.8
46	2047				342.1	342.1	7,582.7	-0.5	7,240.1
47	2048				342.1	342.1	7,582.7	-0.5	7,240.1
48	2049				342.1	342.1	7,582.7	-0.5	7,240.1
49	2050				342.1	342.1	7,582.7	-0.5	7,240.1
50	2051				342.1	342.1	7,582.7	-0.5	7,240.1
51	2052				342.1	342.1	7,582.7	-0.5	7,240.1
52	2053				342.1	342.1	7,582.7	-0.5	7,240.1
53	2054				342.1	342.1	7,582.7	-0.5	7,240.1
54	2055				342.1	342.1	7,582.7	-0.5	7,240.1
55	2056			617.8	342.1	960.0	7,582.7	-0.5	6,622.3
		B/C:	1.32		NPV:	3,535.7	MillionPesos	EIRR:	18.2%

Table 4.6.9 Economic Cost and Benefit Stream of Alternatives of Master Plan Schemes under Future Conditions: Case 4

(Unit: Million Pesos)

No.	Year	Cost				Benefit			Balance
		Const.	Supporting	Replacemer	O/M	Total	Benefit	Negative		Total
0	2001		132.0		0.0	132.0		0.0	-132.0
1	2002	2,979.9	999.8		0.0	3,979.7		-0.4	-3,980.0
2	2003	2,979.9	999.8		47.9	4,027.6	118.2	-0.7	-3,910.1
3	2004	2,979.9	999.8		95.7	4,075.4	195.8	-1.1	-3,880.8
4	2005	2,979.9	999.8		143.6	4,123.3	283.5	-1.5	-3,841.3
5	2006	2,979.9	867.8		191.5	4,039.2	382.3	-1.6	-3,658.5
6	2007				276.8	276.8	2,658.3	-1.6	2,379.9
7	2008				310.4	310.4	3,352.6	-1.7	3,040.6
8	2009				315.7	315.7	3,837.5	-1.7	3,520.1
9	2010				321.2	321.2	4,367.1	-1.8	4,044.1
10	2011				326.6	326.6	4,956.6	-1.8	4,628.2
11	2012				332.2	332.2	5,227.9	-1.8	4,893.8
12	2013				338.1	338.1	5,503.3	-1.9	5,163.3
13	2014				344.3	344.3	5,794.2	-1.9	5,448.0
14	2015				350.8	350.8	6,101.5	-2.0	5,748.7
15	2016			370.1	357.5	727.7	6,426.1	-2.0	5,696.4
16	2017				364.6	364.6	6,769.0	-2.1	6,402.3
17	2018				372.1	372.1	7,131.2	-2.1	6,757.1
18	2019				379.8	379.8	7,514.0	-2.2	7,132.0
19	2020				388.0	388.0	7,918.5	-2.2	7,528.3
20	2021				388.0	388.0	7,918.5	-2.2	7,528.3
21	2022				388.0	388.0	7,918.5	-2.2	7,528.3
22	2023				388.0	388.0	7,918.5	-2.2	7,528.3
23	2024				388.0	388.0	7,918.5	-2.2	7,528.3
24	2025				388.0	388.0	7,918.5	-2.2	7,528.3
25	2026			370.1	388.0	758.1	7,918.5	-2.2	7,158.2
26	2027				388.0	388.0	7,918.5	-2.2	7,528.3
27	2028				388.0	388.0	7,918.5	-2.2	7,528.3
28	2029				388.0	388.0	7,918.5	-2.2	7,528.3
29	2030				388.0	388.0	7,918.5	-2.2	7,528.3
30	2031			350.8	388.0	738.7	7,918.5	-2.2	7,177.5
31	2032				388.0	388.0	7,918.5	-2.2	7,528.3
32	2033				388.0	388.0	7,918.5	-2.2	7,528.3
33	2034				388.0	388.0	7,918.5	-2.2	7,528.3
34	2035				388.0	388.0	7,918.5	-2.2	7,528.3
35	2036			370.1	388.0	758.1	7,918.5	-2.2	7,158.2
36	2037				388.0	388.0	7,918.5	-2.2	7,528.3
37	2038				388.0	388.0	7,918.5	-2.2	7,528.3
38	2039				388.0	388.0	7,918.5	-2.2	7,528.3
39	2040				388.0	388.0	7,918.5	-2.2	7,528.3
40	2041				388.0	388.0	7,918.5	-2.2	7,528.3
41	2042				388.0	388.0	7,918.5	-2.2	7,528.3
42	2043				388.0	388.0	7,918.5	-2.2	7,528.3
43	2044				388.0	388.0	7,918.5	-2.2	7,528.3
44	2045				388.0	388.0	7,918.5	-2.2	7,528.3
45	2046			370.1	388.0	758.1	7,918.5	-2.2	7,158.2
46	2047				388.0	388.0	7,918.5	-2.2	7,528.3
47	2048				388.0	388.0	7,918.5	-2.2	7,528.3
48	2049				388.0	388.0	7,918.5	-2.2	7,528.3
49	2050				388.0	388.0	7,918.5	-2.2	7,528.3
50	2051				388.0	388.0	7,918.5	-2.2	7,528.3
51	2052				388.0	388.0	7,918.5	-2.2	7,528.3
52	2053				388.0	388.0	7,918.5	-2.2	7,528.3
53	2054				388.0	388.0	7,918.5	-2.2	7,528.3
54	2055				388.0	388.0	7,918.5	-2.2	7,528.3
55	2056			720.9	388.0	1,108.8	7,918.5	-2.2	6,807.4
		B/C:	1.19		NPV:	2,448.1	MillionPesos	EIRR:	16.9%

Table 4.6.10 Economic Cost and Benefit Stream of Alternatives of Master Plan Schemes under Future Conditions: Case 5

(Unit: Million Pesos)

No.	Year	Cost				Benefit			Balance	
		Const.	Supporting	Replacemer	O/M	Total	Benefit	Negative		Total
0	2001		347.4		0.0	347.4		0.0	-347.4	
1	2002	8,034.9	2,632.2		0.0	10,667.1		-0.6	-10,667.7	
2	2003	8,034.9	2,632.2		73.1	10,740.2	122.6	-1.2	121.4	-10,618.9
3	2004	8,034.9	2,632.2		146.3	10,813.4	205.2	-1.9	203.4	-10,610.0
4	2005	8,034.9	2,632.2		219.4	10,886.5	298.6	-2.6	296.1	-10,590.5
5	2006	8,034.9	2,284.7		292.6	10,612.2	403.9	-2.6	401.2	-10,211.0
6	2007				403.2	403.2	2,713.8	-2.7	2,711.1	2,307.9
7	2008				498.5	498.5	3,421.7	-2.8	3,419.0	2,920.5
8	2009				513.4	513.4	3,915.4	-2.8	3,912.6	3,399.2
9	2010				529.0	529.0	4,454.3	-2.9	4,451.4	3,922.4
10	2011				544.2	544.2	5,053.0	-3.0	5,050.0	4,505.9
11	2012				560.0	560.0	5,328.0	-3.1	5,324.9	4,764.9
12	2013				576.6	576.6	5,607.2	-3.1	5,604.1	5,027.4
13	2014				594.0	594.0	5,902.1	-3.2	5,898.9	5,304.8
14	2015				612.2	612.2	6,213.5	-3.3	6,210.2	5,598.0
15	2016			370.1	631.3	1,001.4	6,542.4	-3.4	6,539.1	5,537.7
16	2017				651.3	651.3	6,889.9	-3.4	6,886.5	6,235.2
17	2018				672.2	672.2	7,257.0	-3.5	7,253.4	6,581.3
18	2019				694.0	694.0	7,644.7	-3.6	7,641.1	6,947.1
19	2020				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
20	2021				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
21	2022				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
22	2023				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
23	2024				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
24	2025				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
25	2026			370.1	716.9	1,087.0	8,054.5	-3.7	8,050.8	6,963.7
26	2027				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
27	2028				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
28	2029				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
29	2030				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
30	2031			350.8	716.9	1,067.7	8,054.5	-3.7	8,050.8	6,983.1
31	2032				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
32	2033				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
33	2034				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
34	2035				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
35	2036			370.1	716.9	1,087.0	8,054.5	-3.7	8,050.8	6,963.7
36	2037				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
37	2038				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
38	2039				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
39	2040				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
40	2041				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
41	2042				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
42	2043				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
43	2044				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
44	2045				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
45	2046			370.1	716.9	1,087.0	8,054.5	-3.7	8,050.8	6,963.7
46	2047				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
47	2048				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
48	2049				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
49	2050				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
50	2051				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
51	2052				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
52	2053				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
53	2054				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
54	2055				716.9	716.9	8,054.5	-3.7	8,050.8	7,333.8
55	2056			720.9	716.9	1,437.8	8,054.5	-3.7	8,050.8	6,613.0
		B/C:	0.47		NPV:	-17,635.3	MillionPesos	EIRR:	8.4%	

Table 4.7.1 Results of Economic Evaluation of Bank Protection Works

No.	Location	Economic Cost		Economic Benefit after Completion (Mil. Pesos/Yr)	EIRR (%)		Priority Order on Economic Efficiency
		Initial Investment (Million Pesos)	O/M Mil. Pesos/Yr		Under Present Conditions	Under Future Conditions	
1	Agusi	40.0	0.15	3.89	9.2	17.8	10
2	Camalaniugan	25.7	0.10	4.70	17.8	29.4	1
3	Tucana	52.4	0.20	5.08	12.3	22.2	4
4	Sta. Maria	38.3	0.14	3.51	8.6	17.0	17
5	Magapit	27.0	0.10	1.15	3.1	9.2	20
6	Gattaran	25.6	0.10	2.93	8.7	17.1	13
7	Tupang	9.2	0.03	0.90	9.6	18.1	9
8	Dugayon	8.0	0.03	0.74	8.7	17.1	12
9	Babayuan	5.7	0.02	0.77	13.2	23.2	3
10	San Vicente	62.4	0.23	8.88	13.8	24.0	2
11	Nattapian	27.4	0.10	3.18	11.1	20.5	5
12	Cataggaman	83.5	0.30	9.33	10.7	19.9	7
13	Jct. Enrile	11.4	0.04	1.05	8.7	17.1	15
14	Alibago	9.2	0.03	0.85	8.7	17.1	14
15	Namabbalan	54.8	0.21	5.90	10.3	19.3	8
16	Sta. Maria	40.3	0.15	3.70	8.7	17.0	16
17	Cabagan	68.3	0.26	6.19	8.5	16.9	19
18	Bagumbayan	8.7	0.03	1.01	11.1	20.4	6
19	Larion	0.7	0.00	0.02	2.3	7.8	21
20	Caggay	9.3	0.04	0.86	8.8	17.2	11
21	Tanza	2.4	0.01	0.22	8.6	17.0	18
	Entire Schemes	607.0	2.29	64.87	10.2	19.2	-

Table 4.7.2 Economic Cost and Benefit Stream of Bank Protection Works in Lower Cagayan River Basin under Present Conditions (1/3)

1 Agusi (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.4		0.4	0.0	-0.4	
2002	10.1	3.3		13.3	0.0	-13.3	
2003	10.1	3.3	0.1	13.4	1.3	-12.1	
2004	10.1	2.8	0.1	13.0	2.6	-10.4	
2005			0.1	0.1	3.9	3.8	
2006			0.1	0.1	3.9	3.8	
:			:	:	:	:	
2053			0.1	0.1	3.9	3.8	
2054			0.1	0.1	3.9	3.8	
2055			0.1	0.1	3.9	3.8	
B/C:		0.59	NPV:	-10.6	EIRR:	8.6%	

2 Camalaniugan (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.3		0.3	0.0	-0.3	
2002	6.5	2.1		8.6	0.0	-8.6	
2003	6.5	2.1	0.0	8.6	1.6	-7.0	
2004	6.5	1.8	0.1	8.4	3.1	-5.2	
2005			0.1	0.1	4.7	4.6	
2006			0.1	0.1	4.7	4.6	
:			:	:	:	:	
2053			0.1	0.1	4.7	4.6	
2054			0.1	0.1	4.7	4.6	
2055			0.1	0.1	4.7	4.6	
B/C:		1.18	NPV:	3.2	EIRR:	17.8%	

3 Tucana (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.0		0.0	0.0	0.0	
2002	13.2	0.0		13.2	0.0	-13.2	
2003	13.2	0.0	0.1	13.3	1.7	-11.6	
2004	13.2	0.0	0.1	13.3	3.4	-9.9	
2005			0.2	0.2	5.1	4.9	
2006			0.2	0.2	5.1	4.9	
:			:	:	:	:	
2053			0.2	0.2	5.1	4.9	
2054			0.2	0.2	5.1	4.9	
2055			0.2	0.2	5.1	4.9	
B/C:		0.83	NPV:	-4.7	EIRR:	12.3%	

4 Sta. Maria (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.4		0.4	0.0	-0.4	
2002	9.6	3.1		12.8	0.0	-12.8	
2003	9.6	3.1	0.0	12.8	1.2	-11.6	
2004	9.6	2.7	0.1	12.4	2.3	-10.1	
2005			0.1	0.1	3.5	3.4	
2006			0.1	0.1	3.5	3.4	
:			:	:	:	:	
2053			0.1	0.1	3.5	3.4	
2054			0.1	0.1	3.5	3.4	
2055			0.1	0.1	3.5	3.4	
B/C:		0.59	NPV:	-10.6	EIRR:	8.6%	

5 Magapit (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.3		0.3	0.0	-0.3	
2002	6.8	2.2		9.0	0.0	-9.0	
2003	6.8	2.2	0.0	9.0	0.4	-8.6	
2004	6.8	1.9	0.1	8.8	0.8	-8.0	
2005			0.1	0.1	1.2	1.1	
2006			0.1	0.1	1.2	1.1	
:			:	:	:	:	
2053			0.1	0.1	1.2	1.1	
2054			0.1	0.1	1.2	1.1	
2055			0.1	0.1	1.2	1.1	
B/C:		0.28	NPV:	-13.3	EIRR:	3.1%	

6 Gattaran (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.3		0.3	0.0	-0.3	
2002	8.5	2.1		10.6	0.0	-10.6	
2003	8.5	2.1	0.0	10.7	1.0	-9.7	
2004	8.5	1.8	0.1	10.4	2.0	-8.5	
2005			0.1	0.1	2.9	2.8	
2006			0.1	0.1	2.9	2.8	
:			:	:	:	:	
2053			0.1	0.1	2.9	2.8	
2054			0.1	0.1	2.9	2.8	
2055			0.1	0.1	2.9	2.8	
B/C:		0.60	NPV:	-8.7	EIRR:	8.7%	

7 Tupang (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.1		0.1	0.0	-0.1	
2002	2.3	0.7		3.1	0.0	-3.1	
2003	2.3	0.7	0.0	3.1	0.3	-2.8	
2004	2.3	0.7	0.0	3.0	0.6	-2.4	
2005			0.0	0.0	0.9	0.9	
2006			0.0	0.0	0.9	0.9	
:			:	:	:	:	
2053			0.0	0.0	0.9	0.9	
2054			0.0	0.0	0.9	0.9	
2055			0.0	0.0	0.9	0.9	
B/C:		0.65	NPV:	-2.2	EIRR:	9.6%	

8 Dugayon (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.1		0.1	0.0	-0.1	
2002	2.0	0.7		2.7	0.0	-2.7	
2003	2.0	0.7	0.0	2.7	0.2	-2.4	
2004	2.0	0.6	0.0	2.6	0.5	-2.1	
2005			0.0	0.0	0.7	0.7	
2006			0.0	0.0	0.7	0.7	
:			:	:	:	:	
2053			0.0	0.0	0.7	0.7	
2054			0.0	0.0	0.7	0.7	
2055			0.0	0.0	0.7	0.7	
B/C:		4.61	NPV:	4.6	EIRR:	460.5%	

Table 4.7.2 Economic Cost and Benefit Stream of Bank Protection Works in Lower Cagayan River Basin under Present Conditions (2/3)

9 Babayuan (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.1		0.1	0.0	-0.1	
2002	1.4	0.5		1.9	0.0	-1.9	
2003	1.4	0.5	0.0	1.9	0.3	-1.6	
2004	1.4	0.4	0.0	1.8	0.5	-1.3	
2005			0.0	0.0	0.8	0.8	
2006			0.0	0.0	0.8	0.8	
:			:	:	:	:	
2053			0.0	0.0	0.8	0.8	
2054			0.0	0.0	0.8	0.8	
2055			0.0	0.0	0.8	0.8	
B/C:		0.88	NPV:	-0.5	EIRR:	13.2%	

10 San Vicente (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.7		0.7	0.0	-0.7	
2002	15.6	5.2		20.8	0.0	-20.8	
2003	15.6	5.2	0.1	20.9	3.0	-17.9	
2004	15.6	4.5	0.2	20.3	5.9	-14.4	
2005			0.2	0.2	8.9	8.6	
2006			0.2	0.2	8.9	8.6	
:			:	:	:	:	
2053			0.2	0.2	8.9	8.6	
2054			0.2	0.2	8.9	8.6	
2055			0.2	0.2	8.9	8.6	
B/C:		0.92	NPV:	-3.4	EIRR:	13.8%	

11 Nattapian (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.3		0.3	0.0	-0.3	
2002	6.9	2.2		9.1	0.0	-9.1	
2003	6.9	2.2	0.0	9.2	1.1	-8.1	
2004	6.9	1.9	0.1	8.9	2.1	-6.8	
2005			0.1	0.1	3.2	3.1	
2006			0.1	0.1	3.2	3.1	
:			:	:	:	:	
2053			0.1	0.1	3.2	3.1	
2054			0.1	0.1	3.2	3.1	
2055			0.1	0.1	3.2	3.1	
B/C:		0.75	NPV:	-4.7	EIRR:	11.1%	

12 Cataggaman (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		1.0		1.0	0.0	-1.0	
2002	20.0	7.8		27.8	0.0	-27.8	
2003	20.0	7.8	0.1	27.9	3.1	-24.8	
2004	20.0	6.8	0.2	27.0	6.2	-20.8	
2005			0.3	0.3	9.3	9.0	
2006			0.3	0.3	9.3	9.0	
:			:	:	:	:	
2053			0.3	0.3	9.3	9.0	
2054			0.3	0.3	9.3	9.0	
2055			0.3	0.3	9.3	9.0	
B/C:		0.72	NPV:	-15.7	EIRR:	10.7%	

13 Jct. Enrile (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.1		0.1	0.0	-0.1	
2002	2.9	0.9		3.8	0.0	-3.8	
2003	2.9	0.9	0.0	3.8	0.4	-3.5	
2004	2.9	0.8	0.0	3.7	0.7	-3.0	
2005			0.0	0.0	1.1	1.0	
2006			0.0	0.0	1.1	1.0	
:			:	:	:	:	
2053			0.0	0.0	1.1	1.0	
2054			0.0	0.0	1.1	1.0	
2055			0.0	0.0	1.1	1.0	
B/C:		0.60	NPV:	-3.2	EIRR:	8.7%	

14 Alibago (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.1		0.1	0.0	-0.1	
2002	2.3	0.8		3.1	0.0	-3.1	
2003	2.3	0.8	0.0	3.1	0.3	-2.8	
2004	2.3	0.7	0.0	3.0	0.6	-2.4	
2005			0.0	0.0	0.8	0.8	
2006			0.0	0.0	0.8	0.8	
:			:	:	:	:	
2053			0.0	0.0	0.8	0.8	
2054			0.0	0.0	0.8	0.8	
2055			0.0	0.0	0.8	0.8	
B/C:		0.60	NPV:	-2.5	EIRR:	8.7%	

15 Namabbalan (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.6		0.6	0.0	-0.6	
2002	13.8	4.5		18.3	0.0	-18.3	
2003	13.8	4.5	0.1	18.3	2.0	-16.4	
2004	13.8	3.9	0.1	17.8	3.9	-13.9	
2005			0.2	0.2	5.9	5.7	
2006			0.2	0.2	5.9	5.7	
:			:	:	:	:	
2053			0.2	0.2	5.9	5.7	
2054			0.2	0.2	5.9	5.7	
2055			0.2	0.2	5.9	5.7	
B/C:		0.70	NPV:	-11.4	EIRR:	10.3%	

16 Sta. Maria (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.4		0.4	0.0	-0.4	
2002	10.2	3.3		13.4	0.0	-13.4	
2003	10.2	3.3	0.1	13.5	1.2	-12.3	
2004	10.2	2.9	0.1	13.1	2.5	-10.6	
2005			0.2	0.2	3.7	3.5	
2006			0.2	0.2	3.7	3.5	
:			:	:	:	:	
2053			0.2	0.2	3.7	3.5	
2054			0.2	0.2	3.7	3.5	
2055			0.2	0.2	3.7	3.5	
B/C:		0.59	NPV:	-11.2	EIRR:	8.7%	

Table 4.7.2 Economic Cost and Benefit Stream of Bank Protection Works in Lower Cagayan River Basin under Present Conditions (3/3)

17 Cabagan							18 Bagumbayan						
(Unit: Million Pesos)							(Unit: Million Pesos)						
Year	Cost				Benefit	Balance	Year	Cost				Benefit	Balance
	Const.	Other	O/M	Total				Const.	Other	O/M	Total		
2001		0.7		0.7	0.0	-0.7	2001		0.1		0.1	0.0	-0.1
2002	17.2	5.6		22.8	0.0	-22.8	2002	2.2	0.7		2.9	0.0	-2.9
2003	17.2	5.6	0.1	22.8	2.1	-20.8	2003	2.2	0.7	0.0	2.9	0.3	-2.6
2004	17.2	4.8	0.2	22.2	4.1	-18.1	2004	2.2	0.6	0.0	2.8	0.7	-2.2
2005			0.3	0.3	6.2	5.9	2005			0.0	0.0	1.0	1.0
2006			0.3	0.3	6.2	5.9	2006			0.0	0.0	1.0	1.0
:			:	:	:	:	:			:	:	:	:
2053			0.3	0.3	6.2	5.9	2053			0.0	0.0	1.0	1.0
2054			0.3	0.3	6.2	5.9	2054			0.0	0.0	1.0	1.0
2055			0.3	0.3	6.2	5.9	2055			0.0	0.0	1.0	1.0
B/C: 0.59 NPV: -19.2 EIRR: 8.5%							B/C: 0.75 NPV: -1.5 EIRR: 11.1%						
19 Laron							20 Caggay						
(Unit: Million Pesos)							(Unit: Million Pesos)						
Year	Cost				Benefit	Balance	Year	Cost				Benefit	Balance
	Const.	Other	O/M	Total				Const.	Other	O/M	Total		
2001		0.0		0.0	0.0	0.0	2001		0.1		0.1	0.0	-0.1
2002	0.2	0.1		0.2	0.0	-0.2	2002	2.4	0.8		3.1	0.0	-3.1
2003	0.2	0.1	0.0	0.2	0.0	-0.2	2003	2.4	0.8	0.0	3.1	0.3	-2.8
2004	0.2	0.0	0.0	0.2	0.0	-0.2	2004	2.4	0.7	0.0	3.0	0.6	-2.5
2005			0.0	0.0	0.0	0.0	2005			0.0	0.0	0.9	0.8
2006			0.0	0.0	0.0	0.0	2006			0.0	0.0	0.9	0.8
:			:	:	:	:	:			:	:	:	:
2053			0.0	0.0	0.0	0.0	2053			0.0	0.0	0.9	0.8
2054			0.0	0.0	0.0	0.0	2054			0.0	0.0	0.9	0.8
2055			0.0	0.0	0.0	0.0	2055			0.0	0.0	0.9	0.8
B/C: 0.22 NPV: -0.4 EIRR: 2.3%							B/C: 0.60 NPV: -2.5 EIRR: 8.8%						
21 Tanza													
(Unit: Million Pesos)													
Year	Cost				Benefit	Balance							
	Const.	Other	O/M	Total									
2001		0.0		0.0	0.0	0.0							
2002	0.6	0.2		0.8	0.0	-0.8							
2003	0.6	0.2	0.0	0.8	0.1	-0.7							
2004	0.6	0.2	0.0	0.8	0.1	-0.6							
2005			0.0	0.0	0.2	0.2							
2006			0.0	0.0	0.2	0.2							
:			:	:	:	:							
2053			0.0	0.0	0.2	0.2							
2054			0.0	0.0	0.2	0.2							
2055			0.0	0.0	0.2	0.2							
B/C: 0.59 NPV: -0.7 EIRR: 8.6%													

Table 4.7.3 Economic Cost and Benefit Stream of Bank Protection Works in Lower Cagayan River Basin under Future Conditions (1/3)

1 Agusi (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.4		0.4	0.0	-0.4	
2002	10.1	3.3		13.3	0.0	-13.3	
2003	10.1	3.3	0.1	13.4	1.6	-11.8	
2004	10.1	2.8	0.1	13.0	3.4	-9.6	
2005			0.2	0.2	5.4	5.3	
2006			0.2	0.2	5.8	5.6	
:			:	:	:	:	
2053			0.1	0.1	13.3	13.2	
2054			0.1	0.1	13.3	13.2	
2055			0.1	0.1	13.3	13.2	
B/C:		1.25	NPV:	6.8	EIRR:	17.8%	

2 Camalaniugan (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.3		0.3	0.0	-0.3	
2002	6.5	2.1		8.6	0.0	-8.6	
2003	6.5	2.1	0.0	8.6	1.9	-6.7	
2004	6.5	1.8	0.1	8.4	4.1	-4.3	
2005			0.1	0.1	6.5	6.4	
2006			0.1	0.1	7.0	6.9	
:			:	:	:	:	
2053			0.1	0.1	16.1	16.0	
2054			0.1	0.1	16.1	16.0	
2055			0.1	0.1	16.1	16.0	
B/C:		2.34	NPV:	23.5	EIRR:	29.4%	

3 Tucana (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.0		0.0	0.0	0.0	
2002	13.2	0.0		13.2	0.0	-13.2	
2003	13.2	0.0	0.1	13.3	2.1	-11.2	
2004	13.2	0.0	0.1	13.3	4.4	-8.9	
2005			0.2	0.2	7.1	6.9	
2006			0.2	0.2	7.5	7.3	
:			:	:	:	:	
2053			0.2	0.2	17.4	17.2	
2054			0.2	0.2	17.4	17.2	
2055			0.2	0.2	17.4	17.2	
B/C:		1.64	NPV:	17.3	EIRR:	22.2%	

4 Sta. Maria (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.4		0.4	0.0	-0.4	
2002	9.6	3.1		12.8	0.0	-12.8	
2003	9.6	3.1	0.0	12.8	1.4	-11.4	
2004	9.6	2.7	0.1	12.4	3.0	-9.4	
2005			0.1	0.1	4.9	4.7	
2006			0.1	0.1	5.2	5.1	
:			:	:	:	:	
2053			0.1	0.1	12.0	11.9	
2054			0.1	0.1	12.0	11.9	
2055			0.1	0.1	12.0	11.9	
B/C:		1.17	NPV:	4.5	EIRR:	17.0%	

5 Magapit (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.3		0.3	0.0	-0.3	
2002	6.8	2.2		9.0	0.0	-9.0	
2003	6.8	2.2	0.0	9.0	0.5	-8.6	
2004	6.8	1.9	0.1	8.8	1.0	-7.8	
2005			0.1	0.1	1.6	1.5	
2006			0.1	0.1	1.7	1.6	
:			:	:	:	:	
2053			0.1	0.1	3.9	3.8	
2054			0.1	0.1	3.9	3.8	
2055			0.1	0.1	3.9	3.8	
B/C:		0.55	NPV:	-8.3	EIRR:	9.2%	

6 Gattaran (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.3		0.3	0.0	-0.3	
2002	8.5	2.1		10.6	0.0	-10.6	
2003	8.5	2.1	0.0	10.7	1.2	-9.5	
2004	8.5	1.8	0.1	10.4	2.5	-7.9	
2005			0.1	0.1	4.1	4.0	
2006			0.1	0.1	4.3	4.2	
:			:	:	:	:	
2053			0.1	0.1	10.0	9.9	
2054			0.1	0.1	10.0	9.9	
2055			0.1	0.1	10.0	9.9	
B/C:		1.18	NPV:	4.0	EIRR:	17.1%	

7 Tupang (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.1		0.1	0.0	-0.1	
2002	2.3	0.7		3.1	0.0	-3.1	
2003	2.3	0.7	0.0	3.1	0.4	-2.7	
2004	2.3	0.7	0.0	3.0	0.8	-2.2	
2005			0.0	0.0	1.2	1.2	
2006			0.0	0.0	1.3	1.3	
:			:	:	:	:	
2053			0.0	0.0	3.1	3.1	
2054			0.0	0.0	3.1	3.1	
2055			0.0	0.0	3.1	3.1	
B/C:		1.28	NPV:	1.7	EIRR:	18.1%	

8 Dugayon (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.1		0.1	0.0	-0.1	
2002	2.0	0.7		2.7	0.0	-2.7	
2003	2.0	0.7	0.0	2.7	0.3	-2.4	
2004	2.0	0.6	0.0	2.6	0.6	-2.0	
2005			0.0	0.0	1.0	1.0	
2006			0.0	0.0	1.1	1.1	
:			:	:	:	:	
2053			0.0	0.0	2.5	2.5	
2054			0.0	0.0	2.5	2.5	
2055			0.0	0.0	2.5	2.5	
B/C:		1.18	NPV:	1.0	EIRR:	17.1%	

Table 4.7.3 Economic Cost and Benefit Stream of Bank Protection Works in Lower Cagayan River Basin under Future Conditions (2/3)

9 Babayuan (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.1		0.1	0.0	-0.1	
2002	1.4	0.5		1.9	0.0	-1.9	
2003	1.4	0.5	0.0	1.9	0.3	-1.6	
2004	1.4	0.4	0.0	1.8	0.7	-1.2	
2005			0.0	0.0	1.1	1.1	
2006			0.0	0.0	1.1	1.1	
:			:	:	:	:	
2053			0.0	0.0	2.6	2.6	
2054			0.0	0.0	2.6	2.6	
2055			0.0	0.0	2.6	2.6	
B/C:		1.75	NPV:	2.9	EIRR:	23.2%	

10 San Vicente (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.7		0.7	0.0	-0.7	
2002	15.6	5.2		20.8	0.0	-20.8	
2003	15.6	5.2	0.1	20.9	3.6	-17.3	
2004	15.6	4.5	0.2	20.3	7.7	-12.6	
2005			0.2	0.2	12.3	12.1	
2006			0.2	0.2	13.2	12.9	
:			:	:	:	:	
2053			0.2	0.2	30.4	30.2	
2054			0.2	0.2	30.4	30.2	
2055			0.2	0.2	30.4	30.2	
B/C:		1.82	NPV:	35.0	EIRR:	24.0%	

11 Nattapian (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.3		0.3	0.0	-0.3	
2002	6.9	2.2		9.1	0.0	-9.1	
2003	6.9	2.2	0.0	9.2	1.3	-7.9	
2004	6.9	1.9	0.1	8.9	2.8	-6.1	
2005			0.1	0.1	4.4	4.3	
2006			0.1	0.1	4.7	4.6	
:			:	:	:	:	
2053			0.1	0.1	10.9	10.8	
2054			0.1	0.1	10.9	10.8	
2055			0.1	0.1	10.9	10.8	
B/C:		1.49	NPV:	9.1	EIRR:	20.5%	

12 Cataggaman (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		1.0		1.0	0.0	-1.0	
2002	20.0	7.8		27.8	0.0	-27.8	
2003	20.0	7.8	0.1	27.9	3.8	-24.1	
2004	20.0	6.8	0.2	27.0	8.1	-18.9	
2005			0.3	0.3	13.0	12.7	
2006			0.3	0.3	13.8	13.5	
:			:	:	:	:	
2053			0.3	0.3	32.0	31.7	
2054			0.3	0.3	32.0	31.7	
2055			0.3	0.3	32.0	31.7	
B/C:		1.43	NPV:	24.7	EIRR:	19.9%	

13 Jct. Enrile (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.1		0.1	0.0	-0.1	
2002	2.9	0.9		3.8	0.0	-3.8	
2003	2.9	0.9	0.0	3.8	0.4	-3.4	
2004	2.9	0.8	0.0	3.7	0.9	-2.8	
2005			0.0	0.0	1.5	1.4	
2006			0.0	0.0	1.6	1.5	
:			:	:	:	:	
2053			0.0	0.0	3.6	3.6	
2054			0.0	0.0	3.6	3.6	
2055			0.0	0.0	3.6	3.6	
B/C:		1.18	NPV:	1.4	EIRR:	17.1%	

14 Alibago (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.1		0.1	0.0	-0.1	
2002	2.3	0.8		3.1	0.0	-3.1	
2003	2.3	0.8	0.0	3.1	0.3	-2.7	
2004	2.3	0.7	0.0	3.0	0.7	-2.3	
2005			0.0	0.0	1.2	1.1	
2006			0.0	0.0	1.3	1.2	
:			:	:	:	:	
2053			0.0	0.0	2.9	2.9	
2054			0.0	0.0	2.9	2.9	
2055			0.0	0.0	2.9	2.9	
B/C:		1.18	NPV:	1.1	EIRR:	17.1%	

15 Namabbalan (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.6		0.6	0.0	-0.6	
2002	13.8	4.5		18.3	0.0	-18.3	
2003	13.8	4.5	0.1	18.3	2.4	-15.9	
2004	13.8	3.9	0.1	17.8	5.1	-12.7	
2005			0.2	0.2	8.2	8.0	
2006			0.2	0.2	8.7	8.5	
:			:	:	:	:	
2053			0.2	0.2	20.2	20.0	
2054			0.2	0.2	20.2	20.0	
2055			0.2	0.2	20.2	20.0	
B/C:		1.38	NPV:	14.2	EIRR:	19.3%	

16 Sta. Maria (Unit: Million Pesos)							
Year	Cost				Benefit	Balance	
	Const.	Other	O/M	Total			
2001		0.4		0.4	0.0	-0.4	
2002	10.2	3.3		13.4	0.0	-13.4	
2003	10.2	3.3	0.1	13.5	1.5	-12.0	
2004	10.2	2.9	0.1	13.1	3.2	-9.9	
2005			0.2	0.2	5.1	5.0	
2006			0.2	0.2	5.5	5.3	
:			:	:	:	:	
2053			0.2	0.2	12.7	12.5	
2054			0.2	0.2	12.7	12.5	
2055			0.2	0.2	12.7	12.5	
B/C:		1.18	NPV:	4.8	EIRR:	17.0%	

Table 4.7.3 Economic Cost and Benefit Stream of Bank Protection Works in Lower Cagayan River Basin under Future Conditions (3/3)

17 Cabagan							18 Bagumbayan						
(Unit: Million Pesos)							(Unit: Million Pesos)						
Year	Cost				Benefit	Balance	Year	Cost				Benefit	Balance
	Const.	Other	O/M	Total				Const.	Other	O/M	Total		
2001		0.7		0.7	0.0	-0.7	2001		0.1		0.1	0.0	-0.1
2002	17.2	5.6		22.8	0.0	-22.8	2002	2.2	0.7		2.9	0.0	-2.9
2003	17.2	5.6	0.1	22.8	2.5	-20.3	2003	2.2	0.7	0.0	2.9	0.4	-2.5
2004	17.2	4.8	0.2	22.2	5.4	-16.8	2004	2.2	0.6	0.0	2.8	0.9	-2.0
2005			0.3	0.3	8.6	8.3	2005			0.0	0.0	1.4	1.4
2006			0.3	0.3	9.2	8.9	2006			0.0	0.0	1.5	1.5
:			:	:	:	:	:			:	:	:	:
2053			0.3	0.3	21.2	20.9	2053			0.0	0.0	3.4	3.4
2054			0.3	0.3	21.2	20.9	2054			0.0	0.0	3.4	3.4
2055			0.3	0.3	21.2	20.9	2055			0.0	0.0	3.4	3.4
B/C: 1.16 NPV: 7.6 EIRR: 16.9%							B/C: 1.48 NPV: 2.9 EIRR: 20.4%						

19 Larion							20 Caggay						
(Unit: Million Pesos)							(Unit: Million Pesos)						
Year	Cost				Benefit	Balance	Year	Cost				Benefit	Balance
	Const.	Other	O/M	Total				Const.	Other	O/M	Total		
2001		0.0		0.0	0.0	0.0	2001		0.1		0.1	0.0	-0.1
2002	0.2	0.1		0.2	0.0	-0.2	2002	2.4	0.8		3.1	0.0	-3.1
2003	0.2	0.1	0.0	0.2	0.0	-0.2	2003	2.4	0.8	0.0	3.1	0.4	-2.8
2004	0.2	0.0	0.0	0.2	0.0	-0.2	2004	2.4	0.7	0.0	3.0	0.8	-2.3
2005			0.0	0.0	0.0	0.0	2005			0.0	0.0	1.2	1.2
2006			0.0	0.0	0.0	0.0	2006			0.0	0.0	1.3	1.2
:			:	:	:	:	:			:	:	:	:
2053			0.0	0.0	0.1	0.1	2053			0.0	0.0	1.2	1.2
2054			0.0	0.0	0.1	0.1	2054			0.0	0.0	1.2	1.2
2055			0.0	0.0	0.1	0.1	2055			0.0	0.0	1.2	1.2
B/C: 0.44 NPV: -0.3 EIRR: 7.8%							B/C: 1.19 NPV: 1.2 EIRR: 17.2%						

21 Tanza						
(Unit: Million Pesos)						
Year	Cost				Benefit	Balance
	Const.	Other	O/M	Total		
2001		0.0		0.0	0.0	0.0
2002	0.6	0.2		0.8	0.0	-0.8
2003	0.6	0.2	0.0	0.8	0.1	-0.7
2004	0.6	0.2	0.0	0.8	0.2	-0.6
2005			0.0	0.0	0.3	0.3
2006			0.0	0.0	0.3	0.3
:			:	:	:	:
2053			0.0	0.0	0.8	0.7
2054			0.0	0.0	0.8	0.7
2055			0.0	0.0	0.8	0.7
B/C: 1.17 NPV: 0.3 EIRR: 17.0%						

Table 4.7.4 Economic Cost and Benefit Stream of Evacuation System under Present Conditions

(Unit: Million Pesos)

No.	Year	Cost			Benefit	Balance
		Const.	O/M	Total		
1	2001	112.8		112.8	0.0	-112.8
2	2002	112.8		112.8	0.0	-112.8
3	2003	112.8		112.8	0.0	-112.8
4	2004		7.3	7.3	67.1	59.7
5	2005		7.3	7.3	67.1	59.7
6	2006		7.3	7.3	67.1	59.7
7	2007		7.3	7.3	67.1	59.7
8	2008		7.3	7.3	67.1	59.7
9	2009		7.3	7.3	67.1	59.7
10	2010		7.3	7.3	67.1	59.7
11	2011		7.3	7.3	67.1	59.7
12	2012		7.3	7.3	67.1	59.7
13	2013		7.3	7.3	67.1	59.7
B/C:	0.79	NPV:	-60.5 Million Pesos		EIRR:	9.7%

Table 4.7.5 Economic Cost and Benefit Stream of Evacuation System under Future Conditions

(Unit: Million Pesos)

No.	Year	Cost			Benefit	Balance
		Const.	O/M	Total		
1	2001	112.8		112.8	0.0	-112.8
2	2002	112.8		112.8	0.0	-112.8
3	2003	112.8		112.8	0.0	-112.8
4	2004		7.3	7.3	87.3	79.9
5	2005		7.3	7.3	93.2	85.8
6	2006		7.3	7.3	99.5	92.2
7	2007		7.3	7.3	106.3	99.0
8	2008		7.3	7.3	113.5	106.2
9	2009		7.3	7.3	121.2	113.9
10	2010		7.3	7.3	129.5	122.1
11	2011		7.3	7.3	137.1	129.8
12	2012		7.3	7.3	145.2	137.9
13	2013		7.3	7.3	153.8	146.4
B/C:	1.29	NPV:	82.6 Million Pesos		EIRR:	20.6%

Table 5.1.1 Economic Cost and Benefit Stream of Reforestation Projects under Present Conditions

(Unit: Million Pesos)

	Year	Cost			Balance	
		Const.	O/M	Total		
0	2001	131.1		131.1	0.0	-131.1
1	2002	196.7		196.7	2.2	-194.5
2	2003	262.2		262.2	6.6	-255.6
3	2004	262.2		284.8	13.2	-271.6
4	2005	262.2	45.1	307.3	21.9	-285.4
5	2006	262.2	67.7	329.9	32.9	-297.0
6	2007	262.2	90.2	352.5	49.3	-303.1
7	2008	262.2	112.8	375.0	71.3	-303.7
8	2009	262.2	135.4	397.6	98.7	-298.9
9	2010	262.2	157.9	420.1	131.6	-288.5
10	2011	262.2	180.5	442.7	170.0	-272.7
11	2012	262.2	203.0	465.3	213.8	-251.4
12	2013	262.2	225.6	487.8	261.5	-226.4
13	2014	262.2	248.2	510.4	314.6	-195.8
14	2015	262.2	270.7	532.9	373.1	-159.8
15	2016	262.2	293.3	555.5	437.2	-118.3
16	2017	262.2	315.8	578.1	506.7	-71.3
17	2018	262.2	338.4	600.6	581.8	-18.9
18	2019	131.1	361.0	492.1	667.8	175.7
19	2020	65.6	383.5	449.1	763.0	313.9
20	2021		383.5	383.5	763.0	379.5
21	2022		383.5	383.5	763.0	379.5
22	2023		383.5	383.5	763.0	379.5
23	2024		383.5	383.5	763.0	379.5
24	2025		383.5	383.5	763.0	379.5
25	2026		383.5	383.5	763.0	379.5
26	2027		383.5	383.5	763.0	379.5
27	2028		383.5	383.5	763.0	379.5
28	2029		383.5	383.5	763.0	379.5
29	2030		383.5	383.5	763.0	379.5
30	2031		383.5	383.5	763.0	379.5
31	2032		383.5	383.5	763.0	379.5
32	2033		383.5	383.5	763.0	379.5
33	2034		383.5	383.5	763.0	379.5
34	2035		383.5	383.5	763.0	379.5
35	2036		383.5	383.5	763.0	379.5
36	2037		383.5	383.5	763.0	379.5
37	2038		383.5	383.5	763.0	379.5
38	2039		383.5	383.5	763.0	379.5
39	2040		383.5	383.5	763.0	379.5
40	2041		383.5	383.5	763.0	379.5
41	2042		383.5	383.5	763.0	379.5
42	2043		383.5	383.5	763.0	379.5
43	2044		383.5	383.5	763.0	379.5
44	2045		383.5	383.5	763.0	379.5
45	2046		383.5	383.5	763.0	379.5
46	2047		383.5	383.5	763.0	379.5
47	2048		383.5	383.5	763.0	379.5
48	2049		383.5	383.5	763.0	379.5
49	2050		383.5	383.5	763.0	379.5
50	2051		383.5	383.5	763.0	379.5
51	2052		383.5	383.5	763.0	379.5
52	2053		383.5	383.5	763.0	379.5
53	2054		383.5	383.5	763.0	379.5
54	2055		383.5	383.5	763.0	379.5
55	2056		383.5	383.5	763.0	379.5
56	2057		383.5	383.5	763.0	379.5
57	2058		383.5	383.5	763.0	379.5
58	2059		383.5	383.5	763.0	379.5
59	2060		383.5	383.5	763.0	379.5
60	2061		383.5	383.5	763.0	379.5
61	2062		383.5	383.5	763.0	379.5
62	2063		383.5	383.5	763.0	379.5
63	2064		383.5	383.5	763.0	379.5
64	2065		383.5	383.5	763.0	379.5
65	2066		383.5	383.5	763.0	379.5
66	2067		383.5	383.5	763.0	379.5
67	2068		383.5	383.5	763.0	379.5
68	2069		383.5	383.5	763.0	379.5
69	2070		383.5	383.5	763.0	379.5
B/C:	0.42	NPV:	-1,248.8	Million Pesos	EIRR:	5.2%

Table 5.1.2 Economic Cost and Benefit Stream of Reforestation Projects under Future Conditions

(Unit: Million Pesos)

No.	Year	Cost			Benefit		Balance
		Const.	O/M	Total	Total		
0	2001	131.1		0.0	131.1	0.0	-131.1
1	2002	196.7		0.0	196.7	2.5	-194.2
2	2003	262.2		0.0	262.2	8.0	-254.2
3	2004	262.2		22.6	284.8	17.1	-267.7
4	2005	262.2		45.1	307.3	30.5	-276.9
5	2006	262.2		67.7	329.9	48.8	-281.1
6	2007	262.2		90.2	352.5	78.2	-274.2
7	2008	262.2		112.8	375.0	120.7	-254.4
8	2009	262.2		135.4	397.6	178.4	-219.2
9	2010	262.2		157.9	420.1	254.1	-166.1
10	2011	262.2		180.5	442.7	347.5	-95.2
11	2012	262.2		203.0	465.3	463.0	-2.2
12	2013	262.2		225.6	487.8	599.5	111.7
13	2014	262.2		248.2	510.4	763.8	253.4
14	2015	262.2		270.7	532.9	959.5	426.6
15	2016	262.2		293.3	555.5	1,190.6	635.1
16	2017	262.2		315.8	578.1	1,461.4	883.3
17	2018	262.2		338.4	600.6	1,776.8	1,176.1
18	2019	131.1		361.0	492.1	2,159.7	1,667.7
19	2020	65.6		383.5	449.1	2,613.3	2,164.2
20	2021			383.5	383.5	2,613.3	2,229.8
21	2022			383.5	383.5	2,613.3	2,229.8
22	2023			383.5	383.5	2,613.3	2,229.8
23	2024			383.5	383.5	2,613.3	2,229.8
24	2025			383.5	383.5	2,613.3	2,229.8
25	2026			383.5	383.5	2,613.3	2,229.8
26	2027			383.5	383.5	2,613.3	2,229.8
27	2028			383.5	383.5	2,613.3	2,229.8
28	2029			383.5	383.5	2,613.3	2,229.8
29	2030			383.5	383.5	2,613.3	2,229.8
30	2031			383.5	383.5	2,613.3	2,229.8
31	2032			383.5	383.5	2,613.3	2,229.8
32	2033			383.5	383.5	2,613.3	2,229.8
33	2034			383.5	383.5	2,613.3	2,229.8
34	2035			383.5	383.5	2,613.3	2,229.8
35	2036			383.5	383.5	2,613.3	2,229.8
36	2037			383.5	383.5	2,613.3	2,229.8
37	2038			383.5	383.5	2,613.3	2,229.8
38	2039			383.5	383.5	2,613.3	2,229.8
39	2040			383.5	383.5	2,613.3	2,229.8
40	2041			383.5	383.5	2,613.3	2,229.8
41	2042			383.5	383.5	2,613.3	2,229.8
42	2043			383.5	383.5	2,613.3	2,229.8
43	2044			383.5	383.5	2,613.3	2,229.8
44	2045			383.5	383.5	2,613.3	2,229.8
45	2046			383.5	383.5	2,613.3	2,229.8
46	2047			383.5	383.5	2,613.3	2,229.8
47	2048			383.5	383.5	2,613.3	2,229.8
48	2049			383.5	383.5	2,613.3	2,229.8
49	2050			383.5	383.5	2,613.3	2,229.8
50	2051			383.5	383.5	2,613.3	2,229.8
51	2052			383.5	383.5	2,613.3	2,229.8
52	2053			383.5	383.5	2,613.3	2,229.8
53	2054			383.5	383.5	2,613.3	2,229.8
54	2055			383.5	383.5	2,613.3	2,229.8
55	2056			383.5	383.5	2,613.3	2,229.8
56	2057			383.5	383.5	2,613.3	2,229.8
57	2058			383.5	383.5	2,613.3	2,229.8
58	2059			383.5	383.5	2,613.3	2,229.8
59	2060			383.5	383.5	2,613.3	2,229.8
60	2061			383.5	383.5	2,613.3	2,229.8
61	2062			383.5	383.5	2,613.3	2,229.8
62	2063			383.5	383.5	2,613.3	2,229.8
63	2064			383.5	383.5	2,613.3	2,229.8
64	2065			383.5	383.5	2,613.3	2,229.8
65	2066			383.5	383.5	2,613.3	2,229.8
66	2067			383.5	383.5	2,613.3	2,229.8
67	2068			383.5	383.5	2,613.3	2,229.8
68	2069			383.5	383.5	2,613.3	2,229.8
69	2070			383.5	383.5	2,613.3	2,229.8
B/C:	1.17	NPV:	357.6 Million Pesos			EIRR:	16.7%

Table 5.1.3 Economic Cost and Benefit Stream of Sabo Projects under Present Conditions

(Unit: Million Pesos)

No.	Year	Cost			Benefit	Balance
		Const.	O/M	Total		
1	2001	756.2		756.2	0.0	-756.2
2	2002	3,895.3		3,895.3	0.0	-3,895.3
3	2003		3.5	3.5	64.6	61.1
4	2004		3.5	3.5	129.3	125.8
5	2005		3.5	3.5	193.9	190.4
6	2006		3.5	3.5	258.6	255.1
7	2007		3.5	3.5	323.2	319.7
8	2008		3.5	3.5	387.9	384.4
9	2009		3.5	3.5	452.5	449.0
10	2010		3.5	3.5	517.2	513.7
11	2011		3.5	3.5	581.8	578.3
12	2012		3.5	3.5	646.5	643.0
13	2013		3.5	3.5	711.1	707.6
14	2014		3.5	3.5	775.8	772.3
15	2015		3.5	3.5	840.4	836.9
16	2016		3.5	3.5	905.1	901.6
17	2017		3.5	3.5	969.7	966.2
18	2018		3.5	3.5	1,034.4	1,030.9
19	2019		3.5	3.5	1,099.0	1,095.5
20	2020		3.5	3.5	1,163.7	1,160.1
21	2021		3.5	3.5	1,228.3	1,224.8
22	2022		3.5	3.5	1,293.0	1,289.4
B/C:	0.54	NPV:	-1,672.0	Million Pesos	EIRR:	8.7%

Table 5.1.4 Economic Cost and Benefit Stream of Sabo Projects under Future Conditions

(Unit: Million Pesos)

No.	Year	Cost			Benefit	Balance
		Const.	O/M	Total		
1	2001	756.2		756.2	0.0	-756.2
2	2002	3,895.3		3,895.3	0.0	-3,895.3
3	2003		3.5	3.5	78.8	75.2
4	2004		3.5	3.5	168.2	164.7
5	2005		3.5	3.5	269.5	266.0
6	2006		3.5	3.5	383.7	380.2
7	2007		3.5	3.5	512.3	508.8
8	2008		3.5	3.5	656.6	653.0
9	2009		3.5	3.5	818.1	814.6
10	2010		3.5	3.5	998.5	995.0
11	2011		3.5	3.5	1,189.6	1,186.1
12	2012		3.5	3.5	1,399.8	1,396.3
13	2013		3.5	3.5	1,630.6	1,627.1
14	2014		3.5	3.5	1,883.8	1,880.3
15	2015		3.5	3.5	2,161.2	2,157.7
16	2016		3.5	3.5	2,464.7	2,461.2
17	2017		3.5	3.5	2,796.6	2,793.1
18	2018		3.5	3.5	3,159.0	3,155.5
19	2019		3.5	3.5	3,554.5	3,551.0
20	2020		3.5	3.5	3,985.7	3,982.1
21	2021		3.5	3.5	3,985.7	3,982.1
22	2022		3.5	3.5	3,985.7	3,982.1
B/C:	1.19	NPV:	696.7	Million Pesos	EIRR:	16.8%

Table 6.3.1 Summary of Economic Evaluation of Alternative Irrigation Projects

Project	Initial Investment Cost	Without Flood Control			Combined to Flood Control		
		Annual Benefit	EIRR under Present Condition (%)	EIRR under Future Condition (%)	Annual Benefit	EIRR under Present Condition (%)	EIRR under Future Condition (%)
	(Mil.Pesos/Yr)		(%)	(%)	(Mil.Pesos/Yr)	(%)	(%)
I. Affected by Flood (Need Flood Control)							
1. Alcala Amulung West Irrigation Project	1,180	-	-	-	473	18.1	22.8
2. Solana Pump Irrigation System Rehabilitation & Extension Project	910	-	-	-	404	20.1	25.0
3. Enrile Pump Irrigation Project	500	143	13.0	17.8	205	18.2	23.1
4. Zinundungan Irrigation Extension Project	782	152	12.7	16.3	190	15.0	18.8
5. Lal-lo West Pump Irrigation Project	167	41	12.0	16.5	51	14.9	19.5
6. Nassiping Pump Irrigation Project	127	38	13.9	18.5	47	17.0	21.8
7. Rehabilitation of CIADP (Magapit & Iguig-Alcala-Amulung PISs)	320	148	15.7	21.8	213	22.7	28.7
8. Pinacanan River Irrigation System	77	38	23.7	28.2	48	27.1	31.9
9. San Pablo-Cabagan Irrigation System	92	44	16.9	22.8	55	21.1	27.0
10. Santa Maria Communal Pump Irrigation System	49	24	17.1	23.1	30	21.4	27.3
11. Delfin Albano Pump Irrigation Project	427	123	13.9	18.5	154	17.0	21.8
12. Tumauni Reservoir Project	1,997	445	14.0	17.8	556	16.4	20.4
13. Mallig River Irrigation System	141	87	26.7	31.5	108	30.5	35.5
14. Nueva Vizcaya Bagabag Irrigation System	106	71	28.1	33.0	89	32.0	37.1
15. Ilagan Pump Irrigation Project	1,006	235	11.5	15.9	258	12.6	17.2
16. Sto. Nino Pump Irrigation Project	204	55	12.2	16.8	59	12.8	17.6
II. No Need of Flood Control							
1. Upper Ilagan Western Barangay. Pump Irrigation Project	551	138	12.3	16.8	-	-	-
2. Dabubu Irrigation Project	265	64	14.8	18.6	-	-	-
3. Lower Chico River Irrigation System	114	60	24.3	29.0	-	-	-
4. San Mariano Pump Irrigation Project	75	21	13.1	17.8	-	-	-

Table 6.3.2 Economic Cost and Benefit Stream of Alcala Amulung West Irrigation Project under Present Conditions

(Unit: Million Pesos)

No.	Year	Cost				Benefit			Balance (Benefit-Cost)		
		Capital Cost		Replac- ment	O & M Cost	Total	Irrigation	Flood Protection			
		Dam	Irrigation					Damage		Foegone	
1	2001		58.98			58.98			0.00	-58.98	
2	2002		224.11			224.11		-1.09	-1.09	-225.20	
3	2003		224.11			224.11		-1.53	-1.53	-225.64	
4	2004		224.11			224.11		-1.75	-1.75	-225.86	
5	2005		224.11			224.11		-1.97	-1.97	-226.08	
6	2006		224.11			224.11		-2.19	-2.19	-226.29	
7	2007				81.84	81.84	235.80	0.00	-2.19	233.61	151.77
8	2008				81.84	81.84	330.12	0.00	-2.19	327.93	246.09
9	2009				81.84	81.84	377.27	0.00	-2.19	375.09	293.25
10	2010				81.84	81.84	424.43	0.00	-2.19	422.24	340.41
11	2011				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
12	2012				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
13	2013				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
14	2014				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
15	2015				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
16	2016			19.16	81.84	101.00	471.59	0.00	-2.19	469.40	368.41
17	2017				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
18	2018				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
19	2019				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
20	2020				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
21	2021				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
22	2022				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
23	2023				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
24	2024				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
25	2025				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
26	2026			19.16	81.84	101.00	471.59	0.00	-2.19	469.40	368.41
27	2027				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
28	2028				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
29	2029				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
30	2030				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
31	2031			247.86	81.84	329.69	471.59	0.00	-2.19	469.40	139.71
32	2032				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
33	2033				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
34	2034				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
35	2035				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
36	2036			19.16	81.84	101.00	471.59	0.00	-2.19	469.40	368.41
37	2037				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
38	2038				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
39	2039				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
40	2040				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
41	2041				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
42	2042				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
43	2043				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
44	2044				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
45	2045				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
46	2046			19.16	81.84	101.00	471.59	0.00	-2.19	469.40	368.41
47	2047				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
48	2048				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
49	2049				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
50	2050				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
51	2051				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
52	2052				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
53	2053				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
54	2054				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
55	2055				81.84	81.84	471.59	0.00	-2.19	469.40	387.57
56	2056				81.84	81.84	471.59	0.00	-2.19	469.40	387.57

B/C: 1.24

NPV: 227.32 Million Pesos

EIRR: 18.1%

Table 6.3.3 Economic Cost and Benefit Stream of Alcala Amulung West Irrigation Project under Future Conditions

(Unit: Million Pesos)

No.	Year	Cost				Benefit			Balance (Benefit-Cost)		
		Capital Cost		Replac- ment	O & M Cost	Total	Irrigation	Flood Protection			
		Dam	Irrigation					Damage		Foegone	
1	2001		58.98			58.98			0.00	-58.98	
2	2002		224.11			224.11		-1.15	-1.15	-225.26	
3	2003		224.11			224.11		-1.66	-1.66	-225.77	
4	2004		224.11			224.11		-1.95	-1.95	-226.05	
5	2005		224.11			224.11		-2.25	-2.25	-226.36	
6	2006		224.11			224.11		-2.57	-2.57	-226.67	
7	2007				81.84	81.84	284.14	0.00	-2.64	281.50	199.67
8	2008				81.84	81.84	397.79	0.00	-2.71	395.09	313.25
9	2009				81.84	81.84	466.90	0.00	-2.78	464.11	382.28
10	2010				81.84	81.84	539.44	0.00	-2.86	536.58	454.75
11	2011				81.84	81.84	615.56	0.00	-2.93	612.64	530.80
12	2012				81.84	81.84	645.46	0.00	-3.00	642.47	560.63
13	2013				81.84	81.84	660.95	0.00	-3.07	657.89	576.05
14	2014				81.84	81.84	676.82	0.00	-3.14	673.68	591.84
15	2015				81.84	81.84	693.06	0.00	-3.22	689.84	608.01
16	2016			19.16	81.84	101.00	709.69	0.00	-3.29	706.40	605.40
17	2017				81.84	81.84	726.73	0.00	-3.37	723.35	641.52
18	2018				81.84	81.84	744.17	0.00	-3.45	740.72	658.88
19	2019				81.84	81.84	762.03	0.00	-3.54	758.49	676.66
20	2020				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
21	2021				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
22	2022				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
23	2023				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
24	2024				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
25	2025				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
26	2026			19.16	81.84	101.00	780.32	0.00	-3.62	776.70	675.70
27	2027				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
28	2028				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
29	2029				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
30	2030				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
31	2031			247.86	81.84	329.69	780.32	0.00	-3.62	776.70	447.00
32	2032				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
33	2033				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
34	2034				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
35	2035				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
36	2036			19.16	81.84	101.00	780.32	0.00	-3.62	776.70	675.70
37	2037				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
38	2038				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
39	2039				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
40	2040				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
41	2041				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
42	2042				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
43	2043				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
44	2044				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
45	2045				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
46	2046			19.16	81.84	101.00	780.32	0.00	-3.62	776.70	675.70
47	2047				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
48	2048				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
49	2049				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
50	2050				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
51	2051				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
52	2052				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
53	2053				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
54	2054				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
55	2055				81.84	81.84	780.32	0.00	-3.62	776.70	694.86
56	2056				81.84	81.84	780.32	0.00	-3.62	776.70	694.86

B/C: 1.74 NPV: 704.20 Million Pesos EIRR: 22.8%

Table 7.4.1 Economic Cost and Benefit Stream of Package 1 under Present Conditions

(Unit: Million Pesos)

No. Year	Cost				Total	Benefit			Balance	
	Flood Control		Irrigation			Flood Control	Irrigation	Total		
	Const.	O/M	Const.	O/M emplacement						
0 2001	1,120.0		304.2		1,424.2		0.0	0.0	-1,424.2	
1 2002	5,600.0		1,521.0		7,121.0		0.0	0.0	-7,121.0	
2 2003	5,600.0	29.6	1,521.0		7,150.6	500.8	0.0	500.8	-6,649.8	
3 2004	5,600.0	59.2	1,521.0		7,180.2	1,001.6	0.0	1,001.6	-6,178.6	
4 2005	5,600.0	88.8	1,521.0		7,209.8	1,502.4	0.0	1,502.4	-5,707.4	
5 2006	4,480.0	118.4	1,216.8		5,815.2	2,003.2	0.0	2,003.2	-3,812.0	
6 2007		148.0		443.0	591.0	2,504.0	1,881.5	4,385.5	3,794.5	
7 2008		148.0		443.0	591.0	2,504.0	2,634.1	5,138.1	4,547.1	
8 2009		148.0		443.0	591.0	2,504.0	3,010.4	5,514.4	4,923.4	
9 2010		148.0		443.0	591.0	2,504.0	3,386.7	5,890.7	5,299.7	
10 2011		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
11 2012		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
12 2013		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
13 2014		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
14 2015		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
15 2016		148.0		443.0	132.0	723.0	2,504.0	3,763.0	6,267.0	5,544.0
16 2017		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
17 2018		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
18 2019		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
19 2020		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
20 2021		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
21 2022		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
22 2023		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
23 2024		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
24 2025		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
25 2026		148.0		443.0	132.0	723.0	2,504.0	3,763.0	6,267.0	5,544.0
26 2027		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
27 2028		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
28 2029		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
29 2030		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
30 2031		148.0		443.0	1,762.0	2,353.0	2,504.0	3,763.0	6,267.0	3,914.0
31 2032		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
32 2033		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
33 2034		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
34 2035		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
35 2036		148.0		443.0	132.0	723.0	2,504.0	3,763.0	6,267.0	5,544.0
36 2037		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
37 2038		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
38 2039		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
39 2040		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
40 2041		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
41 2042		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
42 2043		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
43 2044		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
44 2045		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
45 2046		148.0		443.0	132.0	723.0	2,504.0	3,763.0	6,267.0	5,544.0
46 2047		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
47 2048		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
48 2049		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
49 2050		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
50 2051		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
51 2052		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
52 2053		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
53 2054		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
54 2055		148.0		443.0	591.0	2,504.0	3,763.0	6,267.0	5,676.0	
55 2056		148.0		443.0	1,858.0	2,449.0	2,504.0	3,763.0	6,267.0	3,818.0
B/C:	0.82		NPV:	-4,095	Million Pesos		EIRR:	12.6%		

Table 7.4.2 Economic Cost and Benefit Stream of Package 1 under Future Conditions

(Unit: Million Pesos)

No.	Year	Cost				Total	Benefit			Balance	
		Flood Control		Irrigation			Flood Control	Irrigation	Total		
		Const.	O/M	Const.	O/M emplacement						
0	2001	1,120.0		304.2		1,424.2	0.0	0.0	0.0	-1,424.2	
1	2002	5,600.0		1,521.0		7,121.0	0.0	0.0	0.0	-7,121.0	
2	2003	5,600.0	29.6	1,521.0		7,150.6	610.1	0.0	610.1	-6,540.5	
3	2004	5,600.0	59.2	1,521.0		7,180.2	1,303.1	0.0	1,303.1	-5,877.1	
4	2005	5,600.0	88.8	1,521.0		7,209.8	2,087.6	0.0	2,087.6	-5,122.2	
5	2006	4,480.0	118.4	1,216.8		5,815.2	2,972.7	0.0	2,972.7	-2,842.5	
6	2007		148.0		443.0	591.0	3,968.6	2,267.2	6,235.8	5,644.8	
7	2008		148.0		443.0	591.0	4,238.4	3,259.8	7,498.3	6,907.3	
8	2009		148.0		443.0	591.0	4,526.6	3,826.1	8,352.8	7,761.8	
9	2010		148.0		443.0	591.0	4,834.4	4,420.6	9,255.0	8,664.0	
10	2011		148.0		443.0	591.0	5,119.7	5,029.7	10,149.3	9,558.3	
11	2012		148.0		443.0	591.0	5,421.7	5,150.4	10,572.1	9,981.1	
12	2013		148.0		443.0	591.0	5,741.6	5,274.0	11,015.6	10,424.6	
13	2014		148.0		443.0	591.0	6,080.4	5,400.6	11,480.9	10,889.9	
14	2015		148.0		443.0	591.0	6,439.1	5,530.2	11,969.3	11,378.3	
15	2016		148.0		443.0	132.0	723.0	6,819.0	5,662.9	12,481.9	11,758.9
16	2017		148.0		443.0	591.0	7,221.4	5,798.8	13,020.2	12,429.2	
17	2018		148.0		443.0	591.0	7,647.4	5,938.0	13,585.4	12,994.4	
18	2019		148.0		443.0	591.0	8,098.6	6,080.5	14,179.1	13,588.1	
19	2020		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
20	2021		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
21	2022		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
22	2023		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
23	2024		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
24	2025		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
25	2026		148.0		443.0	132.0	723.0	8,576.4	6,226.4	14,802.8	14,079.8
26	2027		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
27	2028		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
28	2029		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
29	2030		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
30	2031		148.0		443.0	1,762.0	2,353.0	8,576.4	6,226.4	14,802.8	12,449.8
31	2032		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
32	2033		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
33	2034		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
34	2035		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
35	2036		148.0		443.0	132.0	723.0	8,576.4	6,226.4	14,802.8	14,079.8
36	2037		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
37	2038		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
38	2039		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
39	2040		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
40	2041		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
41	2042		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
42	2043		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
43	2044		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
44	2045		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
45	2046		148.0		443.0	132.0	723.0	8,576.4	6,226.4	14,802.8	14,079.8
46	2047		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
47	2048		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
48	2049		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
49	2050		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
50	2051		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
51	2052		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
52	2053		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
53	2054		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
54	2055		148.0		443.0	591.0	8,576.4	6,226.4	14,802.8	14,211.8	
55	2056		148.0		443.0	1,858.0	2,449.0	8,576.4	6,226.4	14,802.8	12,353.8

B/C: 1.44 NPV: 10,228 Million Pesos EIRR: 19.7%

Table 7.4.3 Economic Cost and Benefit Stream of Package 2 under Present Conditions

No.	Year	Cost				Total	Benefit			Balance	
		Flood Control		Irrigation			Flood Control	Irrigation	Total		
		Const.	O/M	Const.	O/M eplacement						
0	2001	1,012.2		304.2		1,316.4		0.0	0.0	-1,316.4	
1	2002	5,061.0		1,521.0		6,582.0		0.0	0.0	-6,582.0	
2	2003	5,061.0	19.2	1,521.0		6,601.2	450.8	0.0	450.8	-6,150.4	
3	2004	5,061.0	38.4	1,521.0		6,620.4	901.6	0.0	901.6	-5,718.8	
4	2005	5,061.0	57.6	1,521.0		6,639.6	1,352.4	0.0	1,352.4	-5,287.2	
5	2006	4,048.8	76.8	1,216.8		5,342.4	1,803.2	0.0	1,803.2	-3,539.2	
6	2007		96.0		443.0	539.0	2,254.0	1,535.0	3,789.0	3,250.0	
7	2008		96.0		443.0	539.0	2,254.0	2,149.0	4,403.0	3,864.0	
8	2009		96.0		443.0	539.0	2,254.0	2,456.0	4,710.0	4,171.0	
9	2010		96.0		443.0	539.0	2,254.0	2,763.0	5,017.0	4,478.0	
10	2011		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
11	2012		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
12	2013		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
13	2014		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
14	2015		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
15	2016		96.0		443.0	629.0	2,254.0	3,070.0	5,324.0	4,695.0	
16	2017		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
17	2018		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
18	2019		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
19	2020		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
20	2021		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
21	2022		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
22	2023		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
23	2024		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
24	2025		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
25	2026		96.0		443.0	90.0	2,254.0	3,070.0	5,324.0	4,695.0	
26	2027		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
27	2028		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
28	2029		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
29	2030		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
30	2031		96.0		443.0	1,672.0	2,254.0	3,070.0	5,324.0	3,113.0	
31	2032		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
32	2033		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
33	2034		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
34	2035		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
35	2036		96.0		443.0	90.0	2,254.0	3,070.0	5,324.0	4,695.0	
36	2037		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
37	2038		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
38	2039		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
39	2040		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
40	2041		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
41	2042		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
42	2043		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
43	2044		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
44	2045		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
45	2046		96.0		443.0	90.0	2,254.0	3,070.0	5,324.0	4,695.0	
46	2047		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
47	2048		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
48	2049		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
49	2050		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
50	2051		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
51	2052		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
52	2053		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
53	2054		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
54	2055		96.0		443.0	539.0	2,254.0	3,070.0	5,324.0	4,785.0	
55	2056		96.0		443.0	1,762.0	2,301.0	2,254.0	3,070.0	5,324.0	3,023.0

B/C: 0.77 NPV: -4,980 Million Pesos EIRR: 11.7%

Table 7.4.4 Economic Cost and Benefit Stream of Package 2 under Future Conditions

No.	Year	Cost				Benefit			Balance	
		Flood Control		Irrigation		Total	Flood Control	Irrigation		
		Const.	O/M	Const.	O/M					emplacement
0	2001	1,012.2		304.2		1,316.4	0.0	0.0	0.0	-1,316.4
1	2002	5,061.0		1,521.0		6,582.0	0.0	0.0	0.0	-6,582.0
2	2003	5,061.0	19.2	1,521.0		6,601.2	549.2	0.0	549.2	-6,052.0
3	2004	5,061.0	38.4	1,521.0		6,620.4	1,173.0	0.0	1,173.0	-5,447.4
4	2005	5,061.0	57.6	1,521.0		6,639.6	1,879.1	0.0	1,879.1	-4,760.5
5	2006	4,048.8	76.8	1,216.8		5,342.4	2,675.9	0.0	2,675.9	-2,666.5
6	2007		96.0		443.0	539.0	3,572.3	1,849.7	5,422.0	4,883.0
7	2008		96.0		443.0	539.0	3,815.3	2,659.5	6,474.8	5,935.8
8	2009		96.0		443.0	539.0	4,074.7	3,121.5	7,196.2	6,657.2
9	2010		96.0		443.0	539.0	4,351.8	3,606.5	7,958.3	7,419.3
10	2011		96.0		443.0	539.0	4,608.5	4,103.4	8,711.9	8,172.9
11	2012		96.0		443.0	539.0	4,880.4	4,201.9	9,082.3	8,543.3
12	2013		96.0		443.0	539.0	5,168.4	4,302.7	9,471.1	8,932.1
13	2014		96.0		443.0	539.0	5,473.3	4,406.0	9,879.3	9,340.3
14	2015		96.0		443.0	539.0	5,796.2	4,511.7	10,308.0	9,769.0
15	2016		96.0		443.0	90.0	6,138.2	4,620.0	10,758.2	10,129.2
16	2017		96.0		443.0	539.0	6,500.4	4,730.9	11,231.3	10,692.3
17	2018		96.0		443.0	539.0	6,883.9	4,844.4	11,728.3	11,189.3
18	2019		96.0		443.0	539.0	7,290.0	4,960.7	12,250.7	11,711.7
19	2020		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
20	2021		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
21	2022		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
22	2023		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
23	2024		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
24	2025		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
25	2026		96.0		443.0	90.0	629.0	7,720.2	12,799.9	12,170.9
26	2027		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
27	2028		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
28	2029		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
29	2030		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
30	2031		96.0		443.0	1,672.0	2,211.0	7,720.2	12,799.9	10,588.9
31	2032		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
32	2033		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
33	2034		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
34	2035		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
35	2036		96.0		443.0	90.0	629.0	7,720.2	12,799.9	12,170.9
36	2037		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
37	2038		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
38	2039		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
39	2040		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
40	2041		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
41	2042		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
42	2043		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
43	2044		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
44	2045		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
45	2046		96.0		443.0	90.0	629.0	7,720.2	12,799.9	12,170.9
46	2047		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
47	2048		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
48	2049		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
49	2050		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
50	2051		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
51	2052		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
52	2053		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
53	2054		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
54	2055		96.0		443.0	539.0	7,720.2	5,079.8	12,799.9	12,260.9
55	2056		96.0		443.0	1,762.0	2,301.0	7,720.2	12,799.9	10,498.9

B/C: 1.35 NPV: 7,581 Million Pesos EIRR: 18.9%

Table 7.4.5 Economic Cost and Benefit Stream of Package 3 under Present Conditions

(Unit: Million Pesos)

No.	Year	Cost				Total	Benefit			Balance	
		Flood Control		Irrigation			Flood Control	Irrigation	Total		
		Const.	O/M	Const.	O/M						
0	2001	748.4		109.1		857.5		0.0	0.0	-857.5	
1	2002	3,742.0		545.4		4,287.4		0.0	0.0	-4,287.4	
2	2003	3,742.0	22.6	545.4		4,310.0	258.0	0.0	258.0	-4,052.0	
3	2004	3,742.0	45.2	545.4		4,332.6	516.0	0.0	516.0	-3,816.6	
4	2005	3,742.0	67.8	545.4		4,355.2	774.0	0.0	774.0	-3,581.2	
5	2006	2,993.6	90.4	436.3		3,520.3	1,032.0	0.0	1,032.0	-2,488.3	
6	2007		113.0		203.0	316.0	1,290.0	915.0	2,205.0	1,889.0	
7	2008		113.0		203.0	316.0	1,290.0	1,281.0	2,571.0	2,255.0	
8	2009		113.0		203.0	316.0	1,290.0	1,464.0	2,754.0	2,438.0	
9	2010		113.0		203.0	316.0	1,290.0	1,647.0	2,937.0	2,621.0	
10	2011		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
11	2012		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
12	2013		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
13	2014		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
14	2015		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
15	2016		113.0		203.0	89.0	405.0	1,290.0	1,830.0	3,120.0	2,715.0
16	2017		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
17	2018		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
18	2019		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
19	2020		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
20	2021		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
21	2022		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
22	2023		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
23	2024		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
24	2025		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
25	2026		113.0		203.0	89.0	405.0	1,290.0	1,830.0	3,120.0	2,715.0
26	2027		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
27	2028		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
28	2029		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
29	2030		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
30	2031		113.0		203.0	762.0	1,078.0	1,290.0	1,830.0	3,120.0	2,042.0
31	2032		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
32	2033		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
33	2034		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
34	2035		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
35	2036		113.0		203.0	89.0	405.0	1,290.0	1,830.0	3,120.0	2,715.0
36	2037		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
37	2038		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
38	2039		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
39	2040		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
40	2041		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
41	2042		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
42	2043		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
43	2044		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
44	2045		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
45	2046		113.0		203.0	89.0	405.0	1,290.0	1,830.0	3,120.0	2,715.0
46	2047		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
47	2048		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
48	2049		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
49	2050		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
50	2051		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
51	2052		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
52	2053		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
53	2054		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
54	2055		113.0		203.0	316.0	1,290.0	1,830.0	3,120.0	2,804.0	
55	2056		113.0		203.0	851.0	1,167.0	1,290.0	1,830.0	3,120.0	1,953.0

B/C: 0.69 NPV: -4,312 Million Pesos EIRR: 10.6%

Table 7.4.6 Economic Cost and Benefit Stream of Package 3 under Future Conditions

(Unit: Million Pesos)

No. Year	Cost				Total	Benefit			Balance
	Flood Control		Irrigation			Flood Control	Irrigation	Total	
	Const.	O/M	Const.	O/M						placement
0 2001	748.4		109.1		857.5	0.0	0.0	0.0	(857.5)
1 2002	3,742.0		545.4		4,287.4	0.0	0.0	0.0	(4,287.4)
2 2003	3,742.0	22.6	545.4		4,310.0	314.3	0.0	314.3	(3,995.7)
3 2004	3,742.0	45.2	545.4		4,332.6	671.3	0.0	671.3	(3,661.3)
4 2005	3,742.0	67.8	545.4		4,355.2	1,075.5	0.0	1,075.5	(3,279.7)
5 2006	2,993.6	90.4	436.3		3,520.3	1,531.5	0.0	1,531.5	(1,988.9)
6 2007		113.0		203.0	316.0	2,044.5	1,102.6	3,147.1	2,831.1
7 2008		113.0		203.0	316.0	2,183.5	1,585.3	3,768.8	3,452.8
8 2009		113.0		203.0	316.0	2,332.0	1,860.7	4,192.7	3,876.7
9 2010		113.0		203.0	316.0	2,490.6	2,149.8	4,640.4	4,324.4
10 2011		113.0		203.0	316.0	2,637.5	2,446.0	5,083.5	4,767.5
11 2012		113.0		203.0	316.0	2,793.1	2,504.7	5,297.8	4,981.8
12 2013		113.0		203.0	316.0	2,957.9	2,564.8	5,522.8	5,206.8
13 2014		113.0		203.0	316.0	3,132.5	2,626.4	5,758.8	5,442.8
14 2015		113.0		203.0	316.0	3,317.3	2,689.4	6,006.7	5,690.7
15 2016		113.0		203.0	405.0	3,513.0	2,753.9	6,266.9	5,861.9
16 2017		113.0		203.0	316.0	3,720.3	2,820.0	6,540.3	6,224.3
17 2018		113.0		203.0	316.0	3,939.8	2,887.7	6,827.5	6,511.5
18 2019		113.0		203.0	316.0	4,172.2	2,957.0	7,129.2	6,813.2
19 2020		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
20 2021		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
21 2022		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
22 2023		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
23 2024		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
24 2025		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
25 2026		113.0		203.0	89.0	405.0	4,418.4	3,028.0	7,446.4
26 2027		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
27 2028		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
28 2029		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
29 2030		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
30 2031		113.0		203.0	762.0	1,078.0	4,418.4	3,028.0	7,446.4
31 2032		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
32 2033		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
33 2034		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
34 2035		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
35 2036		113.0		203.0	89.0	405.0	4,418.4	3,028.0	7,446.4
36 2037		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
37 2038		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
38 2039		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
39 2040		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
40 2041		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
41 2042		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
42 2043		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
43 2044		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
44 2045		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
45 2046		113.0		203.0	89.0	405.0	4,418.4	3,028.0	7,446.4
46 2047		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
47 2048		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
48 2049		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
49 2050		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
50 2051		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
51 2052		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
52 2053		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
53 2054		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
54 2055		113.0		203.0	316.0	4,418.4	3,028.0	7,446.4	7,130.4
55 2056		113.0		203.0	851.0	1,167.0	4,418.4	3,028.0	7,446.4
B/C:		1.21		NPV:	2,954	Million Pesos	EIRR:	17.3%	

Table 7.4.7 Economic Cost and Benefit Stream of Package 4 under Present Conditions

(Unit: Million Pesos)

No.	Year	Cost				Total	Benefit			Balance	
		Flood Control		Irrigation			Flood Control	Irrigation	Total		
		Const.	O/M	Const.	O/M emplacement						
0	2001	640.6		109.1		749.7		0.0	0.0	-749.7	
1	2002	3,203.0		545.4		3,748.4		0.0	0.0	-3,748.4	
2	2003	3,203.0	9.2	545.4		3,757.6	207.8	0.0	207.8	-3,549.8	
3	2004	3,203.0	18.4	545.4		3,766.8	415.6	0.0	415.6	-3,351.2	
4	2005	3,203.0	27.6	545.4		3,776.0	623.4	0.0	623.4	-3,152.6	
5	2006	2,562.4	36.8	436.3		3,035.5	831.2	0.0	831.2	-2,204.3	
6	2007		46.0		203.0	249.0	1,039.0	568.5	1,607.5	1,358.5	
7	2008		46.0		203.0	249.0	1,039.0	795.9	1,834.9	1,585.9	
8	2009		46.0		203.0	249.0	1,039.0	909.6	1,948.6	1,699.6	
9	2010		46.0		203.0	249.0	1,039.0	1,023.3	2,062.3	1,813.3	
10	2011		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
11	2012		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
12	2013		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
13	2014		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
14	2015		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
15	2016		46.0		203.0	47.0	296.0	1,039.0	1,137.0	2,176.0	1,880.0
16	2017		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
17	2018		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
18	2019		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
19	2020		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
20	2021		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
21	2022		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
22	2023		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
23	2024		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
24	2025		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
25	2026		46.0		203.0	47.0	296.0	1,039.0	1,137.0	2,176.0	1,880.0
26	2027		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
27	2028		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
28	2029		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
29	2030		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
30	2031		46.0		203.0	708.0	957.0	1,039.0	1,137.0	2,176.0	1,219.0
31	2032		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
32	2033		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
33	2034		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
34	2035		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
35	2036		46.0		203.0	47.0	296.0	1,039.0	1,137.0	2,176.0	1,880.0
36	2037		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
37	2038		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
38	2039		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
39	2040		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
40	2041		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
41	2042		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
42	2043		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
43	2044		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
44	2045		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
45	2046		46.0		203.0	47.0	296.0	1,039.0	1,137.0	2,176.0	1,880.0
46	2047		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
47	2048		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
48	2049		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
49	2050		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
50	2051		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
51	2052		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
52	2053		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
53	2054		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
54	2055		46.0		203.0	249.0	1,039.0	1,137.0	2,176.0	1,927.0	
55	2056		46.0		203.0	755.0	1,004.0	1,039.0	1,137.0	2,176.0	1,172.0
B/C:		0.57		NPV:		-5,142 Million Pesos		EIRR:		8.7%	

Table 7.4.8 Economic Cost and Benefit Stream of Package 4 under Future Conditions

(Unit: Million Pesos)

No. Year	Cost				Total	Benefit			Balance
	Flood Control		Irrigation			Flood Control	Irrigation	Total	
	Const.	O/M	Const.	O/M eplacement					
0 2001	640.6		109.1		749.7	0.0	0.0	0.0	(749.7)
1 2002	3,203.0		545.4		3,748.4	0.0	0.0	0.0	(3,748.4)
2 2003	3,203.0	9.2	545.4		3,757.6	253.1	0.0	253.1	(3,504.5)
3 2004	3,203.0	18.4	545.4		3,766.8	540.7	0.0	540.7	(3,226.1)
4 2005	3,203.0	27.6	545.4		3,776.0	866.2	0.0	866.2	(2,909.8)
5 2006	2,562.4	36.8	436.3		3,035.5	1,233.5	0.0	1,233.5	(1,802.0)
6 2007		46.0		203.0	249.0	1,646.7	685.1	2,331.8	2,082.8
7 2008		46.0		203.0	249.0	1,758.7	985.0	2,743.6	2,494.6
8 2009		46.0		203.0	249.0	1,878.3	1,156.1	3,034.3	2,785.3
9 2010		46.0		203.0	249.0	2,006.0	1,335.7	3,341.7	3,092.7
10 2011		46.0		203.0	249.0	2,124.3	1,519.7	3,644.1	3,395.1
11 2012		46.0		203.0	249.0	2,249.7	1,556.2	3,805.9	3,556.9
12 2013		46.0		203.0	249.0	2,382.4	1,593.5	3,976.0	3,727.0
13 2014		46.0		203.0	249.0	2,523.0	1,631.8	4,154.8	3,905.8
14 2015		46.0		203.0	249.0	2,671.8	1,671.0	4,342.8	4,093.8
15 2016		46.0		203.0	296.0	2,829.5	1,711.1	4,540.5	4,244.5
16 2017		46.0		203.0	249.0	2,996.4	1,752.1	4,748.5	4,499.5
17 2018		46.0		203.0	249.0	3,173.2	1,794.2	4,967.4	4,718.4
18 2019		46.0		203.0	249.0	3,360.4	1,837.2	5,197.6	4,948.6
19 2020		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
20 2021		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
21 2022		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
22 2023		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
23 2024		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
24 2025		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
25 2026		46.0		203.0	296.0	3,558.7	1,881.3	5,440.0	5,144.0
26 2027		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
27 2028		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
28 2029		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
29 2030		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
30 2031		46.0		203.0	708.0	957.0	3,558.7	5,440.0	4,483.0
31 2032		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
32 2033		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
33 2034		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
34 2035		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
35 2036		46.0		203.0	296.0	3,558.7	1,881.3	5,440.0	5,144.0
36 2037		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
37 2038		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
38 2039		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
39 2040		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
40 2041		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
41 2042		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
42 2043		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
43 2044		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
44 2045		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
45 2046		46.0		203.0	296.0	3,558.7	1,881.3	5,440.0	5,144.0
46 2047		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
47 2048		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
48 2049		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
49 2050		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
50 2051		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
51 2052		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
52 2053		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
53 2054		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
54 2055		46.0		203.0	249.0	3,558.7	1,881.3	5,440.0	5,191.0
55 2056		46.0		203.0	755.0	1,004.0	3,558.7	5,440.0	4,436.0

B/C: 1.03

NPV: 357 Million Pesos

EIRR: 15.3%

Table 7.4.9 Economic Cost and Benefit Stream of Package 5 under Present Conditions

(Unit: Million Pesos)

No. Year	Cost				Total	Benefit			Balance
	Flood Control		Irrigation			Flood Control	Irrigation	Total	
	Const.	O/M	Const.	O/M eplacement					
0 2001	1,345.8		343.8		1,689.6		0.0	0.0	-1,689.6
1 2002	6,729.0		1,719.0		8,448.0		0.0	0.0	-8,448.0
2 2003	6,729.0	35.4	1,719.0		8,483.4	640.4	0.0	640.4	-7,843.0
3 2004	6,729.0	70.8	1,719.0		8,518.8	1,280.8	0.0	1,280.8	-7,238.0
4 2005	6,729.0	106.2	1,719.0		8,554.2	1,921.2	0.0	1,921.2	-6,633.0
5 2006	5,383.2	141.6	1,375.2		6,900.0	2,561.6	0.0	2,561.6	-4,338.4
6 2007		177.0		502.0	679.0	3,202.0	1,847.0	5,049.0	4,370.0
7 2008		177.0		502.0	679.0	3,202.0	2,585.8	5,787.8	5,108.8
8 2009		177.0		502.0	679.0	3,202.0	2,955.2	6,157.2	5,478.2
9 2010		177.0		502.0	679.0	3,202.0	3,324.6	6,526.6	5,847.6
10 2011		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
11 2012		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
12 2013		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
13 2014		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
14 2015		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
15 2016		177.0		502.0	804.0	3,202.0	3,694.0	6,896.0	6,092.0
16 2017		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
17 2018		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
18 2019		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
19 2020		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
20 2021		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
21 2022		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
22 2023		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
23 2024		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
24 2025		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
25 2026		177.0		502.0	804.0	3,202.0	3,694.0	6,896.0	6,092.0
26 2027		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
27 2028		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
28 2029		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
29 2030		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
30 2031		177.0		502.0	1,988.0	3,202.0	3,694.0	6,896.0	4,229.0
31 2032		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
32 2033		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
33 2034		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
34 2035		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
35 2036		177.0		502.0	804.0	3,202.0	3,694.0	6,896.0	6,092.0
36 2037		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
37 2038		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
38 2039		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
39 2040		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
40 2041		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
41 2042		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
42 2043		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
43 2044		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
44 2045		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
45 2046		177.0		502.0	804.0	3,202.0	3,694.0	6,896.0	6,092.0
46 2047		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
47 2048		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
48 2049		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
49 2050		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
50 2051		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
51 2052		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
52 2053		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
53 2054		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
54 2055		177.0		502.0	679.0	3,202.0	3,694.0	6,896.0	6,217.0
55 2056		177.0		502.0	2,113.0	3,202.0	3,694.0	6,896.0	4,104.0

B/C: 0.79

NPV: -5,826 Million Pesos

EIRR: 12.0%

Table 7.4.10 Economic Cost and Benefit Stream of Package 5 under Future Conditions

(Unit: Million Pesos)

No.	Year	Cost				Total	Benefit			Balance	
		Flood Control		Irrigation			Flood Control	Irrigation	Total		
		Const.	O/M	Const.	O/M						eplacement
0	2001	1,345.8		343.8		1,689.6	0.0	0.0	0.0	-1,689.6	
1	2002	6,729.0		1,719.0		8,448.0	0.0	0.0	0.0	-8,448.0	
2	2003	6,729.0	35.4	1,719.0		8,483.4	780.1	0.0	780.1	-7,703.3	
3	2004	6,729.0	70.8	1,719.0		8,518.8	1,666.4	0.0	1,666.4	-6,852.4	
4	2005	6,729.0	106.2	1,719.0		8,554.2	2,669.5	0.0	2,669.5	-5,884.7	
5	2006	5,383.2	141.6	1,375.2		6,900.0	3,801.4	0.0	3,801.4	-3,098.6	
6	2007		177.0		502.0	679.0	5,074.8	2,225.7	7,300.5	6,621.5	
7	2008		177.0		502.0	679.0	5,419.9	3,200.1	8,620.0	7,941.0	
8	2009		177.0		502.0	679.0	5,788.5	3,756.0	9,544.4	8,865.4	
9	2010		177.0		502.0	679.0	6,182.1	4,339.5	10,521.6	9,842.6	
10	2011		177.0		502.0	679.0	6,546.8	4,937.4	11,484.2	10,805.2	
11	2012		177.0		502.0	679.0	6,933.1	5,055.9	11,989.0	11,310.0	
12	2013		177.0		502.0	679.0	7,342.1	5,177.3	12,519.4	11,840.4	
13	2014		177.0		502.0	679.0	7,775.3	5,301.5	13,076.8	12,397.8	
14	2015		177.0		502.0	679.0	8,234.1	5,428.8	13,662.8	12,983.8	
15	2016		177.0		502.0	804.0	8,719.9	5,559.1	14,278.9	13,474.9	
16	2017		177.0		502.0	679.0	9,234.3	5,692.5	14,926.8	14,247.8	
17	2018		177.0		502.0	679.0	9,779.2	5,829.1	15,608.3	14,929.3	
18	2019		177.0		502.0	679.0	10,356.1	5,969.0	16,325.1	15,646.1	
19	2020		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
20	2021		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
21	2022		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
22	2023		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
23	2024		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
24	2025		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
25	2026		177.0		502.0	804.0	10,967.1	6,112.2	17,079.4	16,275.4	
26	2027		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
27	2028		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
28	2029		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
29	2030		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
30	2031		177.0		502.0	1,988.0	2,667.0	10,967.1	6,112.2	17,079.4	14,412.4
31	2032		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
32	2033		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
33	2034		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
34	2035		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
35	2036		177.0		502.0	804.0	10,967.1	6,112.2	17,079.4	16,275.4	
36	2037		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
37	2038		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
38	2039		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
39	2040		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
40	2041		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
41	2042		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
42	2043		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
43	2044		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
44	2045		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
45	2046		177.0		502.0	804.0	10,967.1	6,112.2	17,079.4	16,275.4	
46	2047		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
47	2048		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
48	2049		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
49	2050		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
50	2051		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
51	2052		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
52	2053		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
53	2054		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
54	2055		177.0		502.0	679.0	10,967.1	6,112.2	17,079.4	16,400.4	
55	2056		177.0		502.0	2,113.0	2,792.0	10,967.1	6,112.2	17,079.4	14,287.4

B/C: 1.41

NPV: 11,319 Million Pesos

EIRR: 19.5%

Table 7.4.11 Economic Cost and Benefit Stream of Package 6 under Present Conditions

(Unit: Million Pesos)

No. Year	Cost				Total	Benefit			Balance
	Flood Control		Irrigation			Flood Control	Irrigation	Total	
	Const.	O/M	Const.	O/M eplacement					
0 2001	1,146.2		343.8		1,490.0		0.0	0.0	-1,490.0
1 2002	5,731.0		1,719.0		7,450.0		0.0	0.0	-7,450.0
2 2003	5,731.0	21.6	1,719.0		7,471.6	544.6	0.0	544.6	-6,927.0
3 2004	5,731.0	43.2	1,719.0		7,493.2	1,089.2	0.0	1,089.2	-6,404.0
4 2005	5,731.0	64.8	1,719.0		7,514.8	1,633.8	0.0	1,633.8	-5,881.0
5 2006	4,584.8	86.4	1,375.2		6,046.4	2,178.4	0.0	2,178.4	-3,868.0
6 2007		108.0		502.0	610.0	2,723.0	1,681.0	4,404.0	3,794.0
7 2008		108.0		502.0	610.0	2,723.0	2,353.4	5,076.4	4,466.4
8 2009		108.0		502.0	610.0	2,723.0	2,689.6	5,412.6	4,802.6
9 2010		108.0		502.0	610.0	2,723.0	3,025.8	5,748.8	5,138.8
10 2011		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
11 2012		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
12 2013		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
13 2014		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
14 2015		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
15 2016		108.0		502.0	105.0	2,723.0	3,362.0	6,085.0	5,370.0
16 2017		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
17 2018		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
18 2019		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
19 2020		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
20 2021		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
21 2022		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
22 2023		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
23 2024		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
24 2025		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
25 2026		108.0		502.0	105.0	2,723.0	3,362.0	6,085.0	5,370.0
26 2027		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
27 2028		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
28 2029		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
29 2030		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
30 2031		108.0		502.0	1,962.0	2,723.0	3,362.0	6,085.0	3,513.0
31 2032		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
32 2033		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
33 2034		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
34 2035		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
35 2036		108.0		502.0	105.0	2,723.0	3,362.0	6,085.0	5,370.0
36 2037		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
37 2038		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
38 2039		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
39 2040		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
40 2041		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
41 2042		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
42 2043		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
43 2044		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
44 2045		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
45 2046		108.0		502.0	105.0	2,723.0	3,362.0	6,085.0	5,370.0
46 2047		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
47 2048		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
48 2049		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
49 2050		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
50 2051		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
51 2052		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
52 2053		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
53 2054		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
54 2055		108.0		502.0	610.0	2,723.0	3,362.0	6,085.0	5,475.0
55 2056		108.0		502.0	2,067.0	2,677.0	3,362.0	6,085.0	3,408.0
B/C:	0.78		NPV:	-5,253	Million Pesos	EIRR:	11.9%		

Table 7.4.12 Economic Cost and Benefit Stream of Package 6 under Present Conditions

(Unit: Million Pesos)

No.	Year	Cost				Total	Benefit			Balance	
		Flood Control		Irrigation			Flood Control	Irrigation	Total		
		Const.	O/M	Const.	O/M						replacement
0	2001	1,146.2		343.8		1,490.0	0.0	0.0	0.0	(1,490.0)	
1	2002	5,731.0		1,719.0		7,450.0	0.0	0.0	0.0	(7,450.0)	
2	2003	5,731.0	21.6	1,719.0		7,471.6	663.4	0.0	663.4	(6,808.2)	
3	2004	5,731.0	43.2	1,719.0		7,493.2	1,417.1	0.0	1,417.1	(6,076.1)	
4	2005	5,731.0	64.8	1,719.0		7,514.8	2,270.2	0.0	2,270.2	(5,244.6)	
5	2006	4,584.8	86.4	1,375.2		6,046.4	3,232.7	0.0	3,232.7	(2,813.7)	
6	2007		108.0		502.0	610.0	4,315.7	2,025.6	6,341.3	5,731.3	
7	2008		108.0		502.0	610.0	4,609.1	2,912.5	7,521.6	6,911.6	
8	2009		108.0		502.0	610.0	4,922.5	3,418.4	8,340.9	7,730.9	
9	2010		108.0		502.0	610.0	5,257.3	3,949.5	9,206.8	8,596.8	
10	2011		108.0		502.0	610.0	5,567.4	4,493.7	10,061.1	9,451.1	
11	2012		108.0		502.0	610.0	5,895.9	4,601.5	10,497.5	9,887.5	
12	2013		108.0		502.0	610.0	6,243.8	4,712.0	10,955.8	10,345.8	
13	2014		108.0		502.0	610.0	6,612.2	4,825.1	11,437.2	10,827.2	
14	2015		108.0		502.0	610.0	7,002.3	4,940.9	11,943.1	11,333.1	
15	2016		108.0		502.0	715.0	7,415.4	5,059.4	12,474.9	11,759.9	
16	2017		108.0		502.0	610.0	7,852.9	5,180.9	13,033.8	12,423.8	
17	2018		108.0		502.0	610.0	8,316.3	5,305.2	13,621.5	13,011.5	
18	2019		108.0		502.0	610.0	8,806.9	5,432.5	14,239.4	13,629.4	
19	2020		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
20	2021		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
21	2022		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
22	2023		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
23	2024		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
24	2025		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
25	2026		108.0		502.0	715.0	9,326.5	5,562.9	14,889.4	14,174.4	
26	2027		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
27	2028		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
28	2029		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
29	2030		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
30	2031		108.0		502.0	1,962.0	2,572.0	9,326.5	5,562.9	14,889.4	12,317.4
31	2032		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
32	2033		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
33	2034		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
34	2035		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
35	2036		108.0		502.0	715.0	9,326.5	5,562.9	14,889.4	14,174.4	
36	2037		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
37	2038		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
38	2039		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
39	2040		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
40	2041		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
41	2042		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
42	2043		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
43	2044		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
44	2045		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
45	2046		108.0		502.0	715.0	9,326.5	5,562.9	14,889.4	14,174.4	
46	2047		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
47	2048		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
48	2049		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
49	2050		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
50	2051		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
51	2052		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
52	2053		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
53	2054		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
54	2055		108.0		502.0	610.0	9,326.5	5,562.9	14,889.4	14,279.4	
55	2056		108.0		502.0	2,067.0	2,677.0	9,326.5	5,562.9	14,889.4	12,212.4

B/C: 1.39

NPV: 9,558 Million Pesos

EIRR: 19.3%

Table 7.4.13 Economic Cost and Benefit Stream of Package 7 under Present Conditions

(Unit: Million Pesos)

No. Year	Cost				Total	Benefit			Balance
	Flood Control		Irrigation			Flood Control	Irrigation	Total	
	Const.	O/M	Const.	O/M eplacement					
0 2001	840.0		109.1		949.1		0.0	0.0	-949.1
1 2002	4,200.0		545.4		4,745.4		0.0	0.0	-4,745.4
2 2003	4,200.0	26.0	545.4		4,771.4	305.8	0.0	305.8	-4,465.6
3 2004	4,200.0	52.0	545.4		4,797.4	611.6	0.0	611.6	-4,185.8
4 2005	4,200.0	78.0	545.4		4,823.4	917.4	0.0	917.4	-3,906.0
5 2006	3,360.0	104.0	436.3		3,900.3	1,223.2	0.0	1,223.2	-2,677.1
6 2007		130.0		203.0	333.0	1,529.0	734.5	2,263.5	1,930.5
7 2008		130.0		203.0	333.0	1,529.0	1,028.3	2,557.3	2,224.3
8 2009		130.0		203.0	333.0	1,529.0	1,175.2	2,704.2	2,371.2
9 2010		130.0		203.0	333.0	1,529.0	1,322.1	2,851.1	2,518.1
10 2011		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
11 2012		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
12 2013		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
13 2014		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
14 2015		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
15 2016		130.0		203.0	400.0	1,529.0	1,469.0	2,998.0	2,598.0
16 2017		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
17 2018		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
18 2019		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
19 2020		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
20 2021		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
21 2022		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
22 2023		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
23 2024		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
24 2025		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
25 2026		130.0		203.0	67.0	400.0	1,529.0	1,469.0	2,998.0
26 2027		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
27 2028		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
28 2029		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
29 2030		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
30 2031		130.0		203.0	734.0	1,067.0	1,529.0	1,469.0	2,998.0
31 2032		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
32 2033		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
33 2034		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
34 2035		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
35 2036		130.0		203.0	67.0	400.0	1,529.0	1,469.0	2,998.0
36 2037		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
37 2038		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
38 2039		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
39 2040		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
40 2041		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
41 2042		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
42 2043		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
43 2044		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
44 2045		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
45 2046		130.0		203.0	67.0	400.0	1,529.0	1,469.0	2,998.0
46 2047		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
47 2048		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
48 2049		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
49 2050		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
50 2051		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
51 2052		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
52 2053		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
53 2054		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
54 2055		130.0		203.0	333.0	1,529.0	1,469.0	2,998.0	2,665.0
55 2056		130.0		203.0	801.0	1,134.0	1,529.0	1,469.0	2,998.0
B/C:		0.63	NPV:		-5,728	Million Pesos		EIRR:	9.5%

Table 7.4.14 Economic Cost and Benefit Stream of Package 7 under Future Conditions

(Unit: Million Pesos)

No.	Year	Cost				Total	Benefit			Balance	
		Flood Control		Irrigation			Flood Control	Irrigation	Total		
		Const.	O/M	Const.	O/M						eplacement
0	2001	840.0		109.1		949.1	0.0	0.0	0.0	-949.1	
1	2002	4,200.0		545.4		4,745.4	0.0	0.0	0.0	-4,745.4	
2	2003	4,200.0	26.0	545.4		4,771.4	372.5	0.0	372.5	-4,398.9	
3	2004	4,200.0	52.0	545.4		4,797.4	795.7	0.0	795.7	-4,001.7	
4	2005	4,200.0	78.0	545.4		4,823.4	1,274.7	0.0	1,274.7	-3,548.7	
5	2006	3,360.0	104.0	436.3		3,900.3	1,815.2	0.0	1,815.2	-2,085.1	
6	2007		130.0		203.0	333.0	2,423.3	885.1	3,308.4	2,975.4	
7	2008		130.0		203.0	333.0	2,588.1	1,272.6	3,860.7	3,527.7	
8	2009		130.0		203.0	333.0	2,764.1	1,493.6	4,257.7	3,924.7	
9	2010		130.0		203.0	333.0	2,952.0	1,725.7	4,677.7	4,344.7	
10	2011		130.0		203.0	333.0	3,126.2	1,963.5	5,089.7	4,756.7	
11	2012		130.0		203.0	333.0	3,310.6	2,010.6	5,321.2	4,988.2	
12	2013		130.0		203.0	333.0	3,506.0	2,058.9	5,564.8	5,231.8	
13	2014		130.0		203.0	333.0	3,712.8	2,108.3	5,821.1	5,488.1	
14	2015		130.0		203.0	333.0	3,931.9	2,158.9	6,090.7	5,757.7	
15	2016		130.0		203.0	400.0	4,163.9	2,210.7	6,374.5	5,974.5	
16	2017		130.0		203.0	333.0	4,409.5	2,263.7	6,673.3	6,340.3	
17	2018		130.0		203.0	333.0	4,669.7	2,318.1	6,987.8	6,654.8	
18	2019		130.0		203.0	333.0	4,945.2	2,373.7	7,318.9	6,985.9	
19	2020		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
20	2021		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
21	2022		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
22	2023		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
23	2024		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
24	2025		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
25	2026		130.0		203.0	67.0	400.0	5,237.0	2,430.7	7,667.6	7,267.6
26	2027		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
27	2028		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
28	2029		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
29	2030		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
30	2031		130.0		203.0	734.0	1,067.0	5,237.0	2,430.7	7,667.6	6,600.6
31	2032		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
32	2033		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
33	2034		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
34	2035		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
35	2036		130.0		203.0	67.0	400.0	5,237.0	2,430.7	7,667.6	7,267.6
36	2037		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
37	2038		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
38	2039		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
39	2040		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
40	2041		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
41	2042		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
42	2043		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
43	2044		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
44	2045		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
45	2046		130.0		203.0	67.0	400.0	5,237.0	2,430.7	7,667.6	7,267.6
46	2047		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
47	2048		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
48	2049		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
49	2050		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
50	2051		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
51	2052		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
52	2053		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
53	2054		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
54	2055		130.0		203.0	333.0	5,237.0	2,430.7	7,667.6	7,334.6	
55	2056		130.0		203.0	801.0	1,134.0	5,237.0	2,430.7	7,667.6	6,533.6
B/C:		1.14		NPV:		2,150 Million Pesos		EIRR:		16.6%	

Table 8.1.1 Percentage of Taxation to Estimated Market Values of Local and Foreign Currency Portions

Item	Tax Rates of Construction Materials and Services on Estimated Market Values							Imposed on Total Value of Local & Foreign Portions (g)
	National Taxation				Local Taxation			
	Imposed on Both Local & Imported Goods			Imposed Only				
	Value Added Tax (a)	Excise Tax (b)	Income Tax (c)	Imported Goods Customs Duties (d)	Tax on Sand, Gravel & Quarry Resources (e)	Other Taxes*10 (f)		
1. Materials								
a. Cement	9.09% *1	1.82% *4	1.13% *8	1.87% *13	-	0.94%	14.8%	
b. Aggregate (Coarse & Fine)	9.09% *1	1.82% *4	2.86% *8	0.81% *13	3.00% *5	1.40%	19.0%	
c. Steel	9.09% *1	1.82% *6	1.57% *8	2.23% *13	-	0.60%	15.3%	
d. Fuel & Lubricant	9.09% *1	4.81% *7	1.00% *8	3.45% *14	-	0.39%	18.7%	
e. Lumber	9.09% *1	-	2.24% *8	0.12% *13	-	0.90%	12.3%	
f. Others	9.09% *1	-	2.49% *8	1.16% *13	-	1.33%	14.1%	
2. Machinery and Equipment Rental	- *16	-	1.62% *8	19.60% *15	-	0.72%	21.9%	
3. Labor								
a. Skilled Workers	- *16	-	7.00% *9	-	-	-	7.0%	
b. Unskilled Workers	- *16	-	-	-	-	-	0.0%	
4. Indirect Costs								
a. OCM*3	9.09% *1	-	1.82%	-	-	2.73% *11	13.6%	
b. Profit	-	-	35.00%	-	-	-	35.0%	
c. VAT*2	100.0% *2	-	-	-	-	-	100.0%	
5. Government Expenditure								
a. Engineering & Adm. Overhea	-	-	5.00% *11	-	-	-	5.0%	
6. Engineering Service	9.09% *1	-	0.91% *12	-	-	-	10.0%	

Source: The Fundamentals of Taxation, 1993 Edition, October 1996, REX Book Store

The National Internal Revenue Code of the Philippines Annotated, 1997 Revised Edition, National Book Store

Note: *1 Value Added Tax: 10% of sales or appropriated amount

*2 The tax is imposed on (4) machinery and equipment rental and (5) labor costs, which are eliminated from market value completely.

*3 Overhead, contingencies and miscellaneous expenses

*4 The tax was assumed to account for 2% of purchased amount excluding VAT, according to page 1046 and 1049 of the reference T44.

*5 4 pesos per 1 cu.m. of aggregate consumed including local government charge, or 3.3% of purchased value excluding VAT

*6 The tax was assumed to account for 2% of purchased amount excluding VAT, according to page 1047 of the reference T44.

*7 8.5 pesos per 1 liter of diesel fuel oil consumed, and 0.45 pesos of excise tax per liter.

*8 Compensation of workers comes from II-2 of Table 8-2 and profit (included in operating surplus) of manufacturer from II-3 of Table 8.1.2.

Income tax on workers was assumed at 10% of the compensation and income tax on manufacturer at 35% of the profit which accounts for 1/10 of operating surplus.

*9 7% of a total wage including basic salary and fringe benefits was assumed as average annual income tax.

*10 Including (1) real property tax, (2) professional tax, (3) business taxes, (4) license fee, etc.

5% of operation surplus was assumed to be paid for other local taxes, which comes from II-3 of Table 8.1.2.

*11 5% of overhead expenses, accounting for 60% of OCM, was assumed to be allocated as the taxes.

*12 10% of local personnel expenses, accounting for 10% of the total expenditure, was assumed to be paid for income tax.

*13 10% of imported CIF value, which comes from II-1 of Table 8.1.2, was assumed to be imposed as customs duties and charges.

*14 19.8% (P1.63/liter (Customs Duty) to P8.50/liter of Diesel) of imported CIF value, which comes from II-1 of Table 8.1.3, was assumed to be imposed as customs duties and charges.

*15 3% of imported CIF value of backhoe and truck-crane and 30% of dump-truck were assumed to be imposed as customs duties and charges.

*16 VAT is appropriated in the item 4-c as ultimate payment, so the VAT figure is not indicated here.

Table 8.1.2 Cost Composition of Construction Materials: 1994

(Unit: Million Pesos)

Description	Commodity							
	035 Stone & Sand Pits Aggregate	093 Misc. Wood, Cork & Cane Products Lumber	112 Lubricants & Misc. Products of Petroleum Fuel/Lubricant	121 Cement Manufacturing Cement	130 Structural Metal Products Steel Bar	142 Non-Electrical Machinery Machinery & Equipment	153 Motor Vehicles	TID Total Intermediate Demand Others
I. Composition of Material Cost								
1. Domestic Intermediate Input	1,581	789	2,519	7,623	2,525	1,165	8,996	1,171,380
2. Imports	475	17	833	3,252	1,351	932	41,696	413,960
3. Compensation of employees	1,102	236	333	828	698	692	3,869	555,784
4. Depreciation	540	25	158	874	210	142	644	153,537
5. Indirect Taxes Less Subsidie	154	21	134	312	63	45	661	95,402
6. Operating Surplus	1,643	263	365	3,258	726	910	4,854	945,565
7. Gross Value Added*1	3,439	545	990	5,273	1,697	1,789	10,027	1,750,288
8. Total Primary Inputs*2	3,914	562	1,823	8,525	3,048	2,721	51,723	2,164,248
9. Total Inputs*3	5,494	1,351	4,343	16,147	5,574	3,886	60,719	3,335,628
10. Total Inputs w/o ITS*4	5,341	1,331	4,209	15,835	5,511	3,841	60,058	3,240,226
II. Share of Component								
1. Imports to Total Inputs w/o ITS	8.9%	1.3%	19.8%	20.5%	24.5%	24.3%	69.4%	12.8%
2. Compensation to Total Inputs w/o ITS	20.6%	17.8%	7.9%	5.2%	12.7%	18.0%	6.4%	17.2%
3. Operating Surplus to Total Inputs w/o ITS	30.8%	19.7%	8.7%	20.6%	13.2%	23.7%	8.1%	29.2%
cf. Indirect Taxes Less Subsidie to Total Inputs	2.8%	1.5%	3.1%	1.9%	1.1%	1.2%	1.1%	2.9%

Source: 1994 Input-Output Table at Current Producers' Prices [229 x 229 Commodity x Commodity Use Matrix (Domestic/Non-competitive)], NSCE

Note: *1 (3)+(4)+(5)+(6)

*2 (2)+(7)

*3 (1)+(8)

*4 Total Inputs without Indirect Taxes Less Subsidies: (9)-(5)

Table 8.1.3 Conversion Factors from Financial Market Cost to Real Economic Cost

Item	Local/Foreign Currency Composition Appropriated for Project Cost Estimation*1		Tax Portion Against Total Market Cost*2	Shadow Wage Rate *3	Foreign Portion		Conversion Factors for Estimated Financial Costs of Local/Foreign Portions		Conversion Factors for Benefit Estimation
	Local	Foreign			Import Share to Total*4	Shadow Exchange Rate*3	Local	Foreign	
	1. Materials								
a. Cement	30%	70%	15%	100%	21%	120%	0.51	1.06	0.89
b. Aggregate (Coarse & Fine)	60%	40%	19%	100%	9%	120%	0.68	1.04	0.83
c. Steel	20%	80%	15%	100%	25%	120%	0.23	1.06	0.90
d. Fuel & Lubricant	30%	70%	19%	100%	20%	120%	0.38	1.06	0.85
e. Lumber	60%	40%	12%	100%	1%	120%	0.79	1.01	0.88
f. Others	50%	50%	14%	100%	13%	120%	0.72	1.05	0.88
2. Machinery and Equipment Rental	30%	70%	22%	100%	47%	120%	0.27	1.13	0.87
3. Labor									
a. Skilled Workers	100%	0%	7%	100%	-	-	0.93	-	0.93
b. Unskilled Workers	100%	0%	0%	60%	-	-	0.60	-	0.60
4. Indirect Costs									
a. OCM*3	100%	0%	14%	100%	-	-	0.86	-	0.86
b. Profit	100%	0%	35%	100%	-	-	0.65	-	0.65
c. VAT*2	100%	0%	100%	100%	-	-	0.00	-	0.00
5. Government Expenditure									
a. Engineering & Administrative Overhead	100%	0%	5%	100%	-	-	0.95	-	0.95
					*5				
6. Engineering Service	10%	90%	10%	100%	100%	120%	0.00	1.22	1.10

Source: ICC Project Evaluation Procedures and Guidelines, NEDA

Note: *1 Composition figures come from NEDA information.

*2 Refer to Column (g) of Table.8.1.1.

*3 Refer to the above source.

*4 The total figures do not include indirect taxes. Imported portion comes from II-1 of Table.8.1.2.

*5 Engineering service is supplied by a foreign consultant firm.

Table 8.1.4 Standard Conversion Factor

Item	1991	1992	1993	1994	1995	1996	1997	1998	Average
A. Import (CIF) in Million US\$	12,856	15,464	18,768	22,638	28,487	32,427	38,581	31,530	
B. Export (FOB) in Million US\$	8,755	9,726	11,210	13,302	17,447	20,660	35,934	29,496	
1. Import (CIF) in Million Pesos	359,999	421,405	499,700	583,856	748,391	961,361	1,143,810	1,290,266	
2. Export (FOB) in Million Pesos	240,911	246,173	299,664	349,454	446,735	541,711	1,049,447	1,187,995	
3. Import Tax in Million Pesos	64,391	72,871	81,971	81,610	97,601	104,566	94,800	76,005	
4. Export Tax in Million Pesos	0	0	0	0	0	0	0	0	
5. Subsidies for Foreign Trade	-	-	-	-	-	-	-	-	
6. Total of (1) & (2)	600,911	667,578	799,363	933,310	1,195,127	1,503,072	2,193,258	2,478,261	
7. (1)+(2)+(3)-(4)+(5)	665,302	740,449	881,334	1,014,920	1,292,728	1,607,638	2,288,058	2,554,266	
8. Conversion Factor*1	0.90	0.90	0.91	0.92	0.92	0.93	0.96	0.97	0.93
9. Standard Conversion Factor Considering VAT									0.85
10. Average Exchange Rate (Pesos/US\$)									
- Import	28.003	27.250	26.625	25.791	26.271	29.647	29.647	40.922	
- Export	27.516	25.310	26.732	26.271	25.605	26.220	29.205	40.276	

Source: Trade Statistics in 1991 to 1998, NSO
1999 Philippine Statistical Yearbook, NSCB

Note: *1 Conversion Factor = (6)/(7)

**Table 9.1.1 Average Damageable Value of Paddy Production
in New and Rehabilitation Irrigation Field**

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1. Crop Calendar												
2. Planted Area (%)	100	100	100	100	50	50	100	100	100	100	50	50
3. Accumulated Cost (%)	40	60	73	86	96	50	42	60	72	83	95	15
4. Flood Frequency (%)	0	0	0	0	0	4.5	13.5	13.5	21.3	24.7	22.5	0
5. Damageable Value *1 (Pesos/ha)	0	0	0	0	0	0	0	0	0	0	3,270	0
Economic Terms	0	0	0	0	0	1,369	4,541	4,802	8,017	4,893	0	0
1st Crop	0	0	0	0	0	0	0	0	0	0	4,288	0
2nd Crop	0	0	0	0	0	1,705	5,479	5,698	9,361	5,633	0	0

Economic Terms	1st Crop		2nd Crop		Total/Average	
12. Yield (ton/ha)		4.5		5.0		4.8
13. Economic Farmgate Price (Pesos/ton)		10,300		10,300		10,300
14. Gross Income (Pesos/ha)		46,350		51,500		97,850
15. Production Cost (Pesos/ha)		14,549		13,541		28,090
16. Net Income (Pesos/ha)		31,801		37,959		69,760
17. Damageable Value (Pesos/ha)		27,876		4,288		32,164 (= 32,200)

Source: (1) Quarterly Review of Commodity Market, Fourth Quarter 2000, World Bank

(2) Interview survey for selected farmers in the project areas.

(3) SCF is assumed to be 0.84.

Note: *1 (2)*(4)*{(3)*(8)+(9)}

Table 9.1.2 Average Damageable Value of Paddy Production in Existing Irrigation Field

Item	Jan.	Fev.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1. Crop Calendar												
2. Planted Area (%)	100	100	100	100	50	50	100	100	100	100	50	50
3. Accumulated Cost (%)	40	60	73	86	96	50	60	72	83	95	1	15
4. Flood Frequency (%)	0	0	0	0	0	4.5	13.5	13.5	21.3	24.7	22.5	0
5. Damageable Value *1 (Pesos/ha)	0	0	0	0	0	0	0	0	0	0	1,043	0
Economic Terms	0	0	0	0	0	640	2,354	2,615	4,566	2,892	0	0
1st Crop	0	0	0	0	0	0	0	0	0	0	1,739	0
2nd Crop	0	0	0	0	0	871	2,976	3,195	5,412	3,343	0	0
Economic Terms												
		1st Crop			2nd Crop			Total/Average				
12. Yield (ton/ha)		2.7			2.8			2.8				
13. Economic Farmgate Price (Pesos/ton)		10,300			10,300			10,300				
14. Gross Income (Pesos/ha)		27,810			28,840			56,650				
15. Production Cost (Pesos/ha)		14,549			13,541			28,090				
16. Net Income (Pesos/ha)		13,261			15,299			28,560				
17. Damageable Value (Pesos/ha)		15,797			1,739			17,536 (= 17,500)				

Source: (1) Quarterly Review of Commodity Market, Fourth Quarter 2000, World Bank

(2) Interview survey for selected farmers in the project areas.

(3) SCF is assumed to be 0.84.

Note: *1 (2)*(4)*{(3)*(8)+(9)}

Table 9.1.3 Average Damageable Value of Paddy Production in Rainfed Field

Item		Jan.	Fev.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1. Crop Calendar													
2. Planted Area (%)	1st Crop	100	100	100	100	50						50	50
	2nd Crop				50	50	100	100	100	100	50		
3. Accumulated Cost (%)	1st Crop	41	62	78	91	97	50					1	15
	2nd Crop				1	15	41	60	72	84	94	50	
4. Flood Frequency (%)		0	0	0	0	0	4.5	13.5	13.5	21.3	24.7	22.5	0
5. Damageable Value *1 (Pesos/ha)	1st Crop	0	0	0	0	0	0	0	0	0	0	1,129	0
	2nd Crop	0	0	0	0	0	493	1,689	1,817	3,072	1,889	0	0
Economic Terms	1st Crop	0	0	0	0	0	0	0	0	0	0	0	0
	2nd Crop	0	0	0	0	0	746	2,414	2,521	4,151	2,497	0	0
Economic Terms				<u>1st Crop</u>				<u>2nd Crop</u>				<u>Total/Average</u>	
12	Yield (ton/ha)			2.0				-				2.0	
13	Economic Farmgate Price (Pesos/ton)			8,100				-				8,100	
14	Gross Income (Pesos/ha)			16,200				-				16,200	
15	Production Cost (Pesos/ha)			6,829				-				6,829	
16	Net Income (Pesos/ha)			13,771				-				13,771	
17	Damageable Value (Pesos/ha)			12,329				-				12,329 (= 12,300)	

Source: (1) Quarterly Review of Commodity Market, Fourth Quarter 2000, World Bank

(2) Interview survey for selected farmers in the project areas.

(3) SCF is assumed to be 0.84.

Note: *1 (2)*(4)*{(3)*(8)+(9)}

Table 9.1.4 Financial and Economic Costs of Three-Bedroom House

Item	Total Construction Costs in Financial Market Value	Conversion Rate	Total Construction Costs in Real Economic Value
1. Materials			
a. Cement	25,053	0.89	22,297
b. Aggregate (Coarse & Fine)	2,112	0.83	1,753
c. Steel	51,262	0.90	46,136
d. Fuel & Lubricant	0	0.85	0
e. Lumber	12,000	0.88	10,560
f. Others	90,350	0.88	79,508
2. Labor			
a. Skilled Workers	23,200	0.93	21,576
b. Unskilled Workers	22,000	0.60	13,200
3. Indirect Taxes			
a. OCM	15,818	0.86	13,604
b. Profit	22,685	0.65	14,745
c. VAT	4,520	0.00	0
5. Total	269,000	-	223,379
6. Conversion Factor		0.83	

Source: City Engineer's Office, Ilocos Norte, "the Construction of Three-Bedroom House in Barangay #5, Sarrat", 1996

Note: *1 Overhead, contingency and miscellaneous

*2 Assumed as follows:

(1) 35% of contractor's income as corporation income tax

(2) 10% of personal income of engineers and managers, which was assumed as one-third of overhead expenses. The overhead was assumed as one-third of OCM.

*3 The taxes were assumed at 2% of overhead expense, which consist of Real property tax, registration Fee and license tax.

Table 9.1.5 Financial and Economic Costs of Public Elementary School*1

(Unit: 1000 Pesos)

Item	Total Construction Costs in Financial Market Value	Conversion Rate	Total Construction Costs in Real Economic Value
1. Materials	396		350
a. Cement	71	0.89	63
b. Aggregate (Coarse & Fine)	31	0.83	25
c. Steel	96	0.90	86
d. Fuel & Lubricant	0	0.85	0
e. Lumber	90	0.88	80
f. Others	108	0.88	95
2. Labor	92		69
a. Skilled Workers	41	0.93	39
b. Unskilled Workers	51	0.60	30
3. Indirect Taxes	133		92
a. Mobilization/Demobilization	5	0.86	4
b. OMC*2	54	0.86	46
c. Profit	63	0.65	41
d. VAT	11	0.00	0
4. Government Expenditure			
a. Admi. Overhead	150	0.95	143
5. Total	771	-	653
6. Comprehensive Conversion Factor		0.85	

Source: Standard Two Storey, 8 Classes School Building For Non-Volcanic Zone Based on 1994 Revised Plan, 2001, DPWH

Note: *1 Standar two storey, 8 class room's school building

*2 Overhead, contingency and miscellaneous

*3 Assumed as follows:

(1) 35% of contractor's net income as corporation income tax

(2) 10% of personal income of engineers and managers, which was assumed one-third of overhead expenses. The overhead was assumed as one-third of OCM.

*4 The taxes were assumed at 2% of overhead expense, which consist of real property tax, registration fee and license tax.

Table 9.1.6 Financial and Economic Costs of Public Hospital*1

(Unit: 1000 Pesos)

Item	Total Construction Costs in Financial Market Value	Conversion Rate	Total Construction Costs in Real Economic Value
1. Materials	11,141		9,856
a. Cement	4,493	0.89	3,999
b. Aggregate (Coarse & Fine)	467	0.83	388
c. Steel	1,536	0.90	1,382
d. Fuel & Lubricant	0	0.85	0
e. Lumber	1,314	0.88	1,157
f. Others	3,331	0.88	2,931
2. Labor	4,120		3,084
a. Skilled Workers	1,854	0.93	1,724
b. Unskilled Workers	2,266	0.60	1,360
3. Indirect Taxes	2,764		2,074
a. OMC*2	458	0.86	1,181
b. Profit	1,374	0.65	893
c. VAT	932	0.00	0
4. Government Expenditure			
a. Engineering & Admi. Overhead	382	0.95	362
5. Total	18,407	-	15,377
6. Comprehensive Conversion Factor		0.84	

Source: Construction of New Pedia Wards Building (Phase 6) in Pasig City, Health Infrastructure Service, December 1996, Department of Health

Note: *1 Total floor area is 2,800m². Then, a unit construction price is around 13,000 Pesos/m² including finishing (the same amount of building construction cost).

*2 Overhead, contingency and miscellaneous

*3 Assumed as follows:

(1) 35% of contractor's net income as corporation income tax

(2) 10% of personal income of engineers and managers, which was assumed one-third of overhead expenses. The overhead was assumed as one-third of OCM.

*4 The taxes were assumed at 2% of overhead expense, which consist of real property tax, registration fee and license tax.

Table 9.1.7 Economic Value of Damageable Assets

Asset	Damageable Value				
	Building (Pesos)	Durable Assets (Pesos)	H. Effects/ Stock (Pesos)	Value Added*1 (Pesos/day)	Crop Production (Pesos/ha)
1. Residence					
a. Residential Unit	56,000		42,000	200	*2
2. Industrial, Educational and Medical Facilities					
a. Manufacturing	22,000	291,000	38,000	840	
b. Wholesale & Retail Trade	108,000	266,000	116,000	860	
c. Education	4,150,000	1,162,000	166,000	0	
d. Health & Social Work	2,407,000	664,000	830,000	0	
3. Crop Production					
a. Irrigated New Fields (ha)					32,200
b. Irrigated Rehabilitated Fields (ha)					32,200
c. Irrigated Farm Land (ha)					17,500
d. Rainfed Paddy Field (ha)					12,300

Note: *1 VA is calculated based on not actual business days of 250 days but 365 calendar days.

*2 In residence, the daily amount for cleaning damaged house is equivalent to daily income of an average family

Table 9.1.8 Damage Rate**(1) Direct Damage**

Item	Below Floor Level	Inundation Depth				
		Over Floor Level				
		Less than 0.5 m	0.5-0.99 m	1.0-1.99 m	2.0-2.99 m	More than 3.0 m
1. Building						
a. Building*1	0	0.092	0.119	0.266	0.380	0.834
2. Residence						
a. Household Effects	0	0.145	0.326	0.508	0.928	0.991
3. Industrial, Educational and Medical Facilities						
a. Depreciable Assets	-	0.232	0.453	0.789	0.966	0.995
b. Inventory Stock	-	0.128	0.267	0.586	0.897	0.982
4. Crop Production						
	Water Depth (m)	Inundation Time (days)				
			1 to2	3 to 4	5 to 6	More Than 7
a. Lowland Crop	Less than 0.5		0.21	0.30	0.36	0.50
	0.5 to 0.99		0.24	0.44	0.50	0.71
	More than 1		0.37	0.54	0.64	0.74
b. Upland Crop	Less than 0.5		0.27	0.42	0.54	0.67
	0.5 to 0.99		0.35	0.48	0.67	0.74
	More than 1		0.51	0.67	0.81	0.91

Note: *1 In case of residence, a floor level is 15cm higher than the ground level.

However, a floor level of business establishments is the same as the ground level.

(2) Indirect Damage

Item	Below Floor Level	Inundation Depth				
		Over Floor Level				
		Less than 0.5 m	0.5-0.99 m	1.0-1.99 m	2.0-2.99 m	More than 3.0 m
1. Residence *1						
Works for Cleaning (days)		7.5	13.3	26.1	42.4	50.1
2. Industrial, Educational and Medical Facilities *2						
Stoppage of Business (days)		4.4	6.3	10.3	16.8	22.6
Stagnant Days of Business after Stoppage		2.2	3.15	5.15	8.4	11.3
Total		6.6	9.45	15.45	25.2	33.9

Source: Manual for Economic Study on Flood Control, 1999, Ministry of Land, Infrastructure and Transport in Japan

**Table 9.1.9 Damageable Property and Flood Damage of Proposed Project:
Phase-1**

Item	Return Period (Year)					
	2	5	10	25	50	100
I. Affected Population and Area						
1 Affected Population (1000)	20	46	51	72	72	72
2 Area Inundated (km2)						
II. Inundated Property						
1 Buildings (Nos)	4,117	9,619	10,551	14,966	14,982	14,999
a. Housing Units	3,985	9,266	10,168	14,378	14,394	14,411
b. Manufacturing	31	71	79	114	114	114
c. Wholesale & Retail Trade	88	239	258	400	400	400
d. Educational	11	36	38	59	59	59
e. Medical	2	7	8	15	15	15
2 Agricultural Land (ha)	2,094	4,677	5,344	5,857	6,010	6,163
a. Irrigated Field	1,647	3,693	4,172	4,579	4,653	4,771
b. Rainfed Field	447	984	1,172	1,278	1,357	1,392
III. Estimated Value of Damaged Property (Million Pesos in Economic Terms)						
1. Direct Damage	158	495	760	1,219	1,591	1,990
(1) Facilities	120	380	591	966	1,272	1,602
a. Housing Units	63	186	296	487	684	925
b. Manufacturing	5	13	19	29	35	38
c. Wholesale & Retail Trade	8	28	44	74	97	114
f. Education	32	102	155	245	290	332
g. Health	2	11	18	36	49	58
h. Other Facilities	12	39	59	96	118	135
(2) Agricultural Production	11	32	42	50	54	56
a. Irrigated Field	9	27	35	42	45	47
b. Rainfed Field	2	5	7	8	9	9
(3) Infrastructure	26	82	127	203	265	332
2. Indirect Damage	29	87	134	219	281	347
(1) Household	12	34	53	89	111	135
(2) Business Losses	1	3	5	8	11	13
(3) Other Damages	16	49	76	122	159	199
3. Total	186	582	894	1,438	1,872	2,337

**Table 9.1.10 Damageable Property and Flood Damage of Proposed Project:
Phase-2**

Item	Return Period (Year)					
	2	5	10	25	50	100
I. Affected Population and Area						
1 Affected Population (1000)	8	39	60	66	68	69
2 Area Inundated (km2)						
II. Inundated Property						
1 Buildings (Nos)	1,538	7,915	12,183	13,461	13,752	14,029
a. Housing Units	1,517	7,792	11,961	13,218	13,501	13,775
b. Manufacturing	11	65	106	116	120	121
c. Wholesale & Retail Trade	6	40	66	73	77	77
d. Educational	4	18	50	54	54	56
e. Medical	0	0	0	0	0	0
2 Agricultural Land (ha)	2,439	8,111	10,157	10,915	11,171	11,655
a. Irrigated Field	593	3,011	4,410	4,825	5,055	5,288
b. Rainfed Field	1,846	5,100	5,747	6,090	6,116	6,367
III. Estimated Value of Damaged Property (Million Pesos in Economic Terms)						
1. Direct Damage	90	458	924	1,600	1,837	1,970
(1) Facilities	62	334	702	1,251	1,444	1,550
a. Housing Units	33	224	447	832	980	1,066
b. Manufacturing	2	14	27	37	40	41
c. Wholesale & Retail Trade	1	6	13	20	22	23
f. Education	20	68	164	278	309	323
g. Health	0	0	0	0	0	0
h. Other Facilities	6	22	51	84	93	97
(2) Agricultural Production	13	47	68	83	87	92
a. Irrigated Field	4	18	32	43	46	49
b. Rainfed Field	9	29	36	40	41	43
(3) Infrastructure	15	76	154	267	306	328
2. Indirect Damage	15	85	171	281	316	336
(1) Household	6	38	75	116	127	133
(2) Business Losses	0	1	3	5	5	5
(3) Other Damages	9	46	92	160	184	197
3. Total	105	543	1,095	1,881	2,154	2,306

**Table 9.1.11 Damageable Property and Flood Damage of Proposed Project:
Phase-3**

Item	Return Period (Year)					
	2	5	10	25	50	100
I. Affected Population and Area						
1 Affected Population (1000)	26	61	69	74	76	78
2 Area Inundated (km2)						
II. Inundated Property						
1 Buildings (Nos)	5173	12433	14006	14989	15403	15894
a. Housing Units	5105	12264	13814	14785	15196	15679
b. Manufacturing	34	80	91	97	99	102
c. Wholesale & Retail Trade	21	50	55	57	58	61
d. Educational	13	39	46	50	50	52
e. Medical	0	0	0	0	0	0
2 Agricultural Land (ha)	8600	13488	14285	14648	14868	15112
a. Irrigated Field	3084	5306	5872	6165	6373	6612
b. Rainfed Field	5516	8182	8413	8483	8495	8500
III. Estimated Value of Damaged Property (Million Pesos in Economic Terms)						
1. Direct Damage	279	953	1,353	1,890	2,053	2,113
(1) Facilities	174	693	1,013	1,451	1,584	1,631
a. Housing Units	115	440	674	1,046	1,160	1,198
b. Manufacturing	6	21	27	32	33	34
c. Wholesale & Retail Trade	3	10	14	17	18	18
f. Education	38	172	230	275	288	294
g. Health	0	0	0	0	0	0
h. Other Facilities	12	51	68	81	85	87
(2) Agricultural Production	58	102	115	124	127	130
a. Irrigated Field	25	47	55	62	64	66
b. Rainfed Field	33	55	59	62	63	64
(3) Infrastructure	46	159	225	315	342	352
2. Indirect Damage	49	172	246	331	355	366
(1) Household	21	74	107	138	145	150
(2) Business Losses	1	2	3	4	4	4
(3) Other Damages	28	95	135	189	205	211
3. Total	328	1,125	1,598	2,221	2,408	2,479

**Table 9.1.12 Damageable Property and Flood Damage of Proposed Project:
Phase-4**

Item	Return Period (Year)					
	2	5	10	25	50	100
I. Affected Population and Area						
1 Affected Population (1000)	15	15	15	15	15	15
2 Area Inundated (km2)						
II. Inundated Property						
1 Buildings (Nos)	3180	3180	3180	3180	3180	3180
a. Housing Units	3007	3007	3007	3007	3007	3007
b. Manufacturing	33	33	33	33	33	33
c. Wholesale & Retail Trade	123	123	123	123	123	123
d. Educational	7	7	7	7	7	7
e. Medical	10	10	10	10	10	10
2 Agricultural Land (ha)	2991	2991	2991	2991	2991	2991
a. Irrigated Field	337	337	337	337	337	337
b. Rainfed Field	2654	2654	2654	2654	2654	2654
III. Estimated Value of Damaged Property (Million Pesos in Economic Terms)						
1. Direct Damage	220	867	1,440	2,444	2,970	3,444
(1) Facilities	166	685	1,155	1,987	2,423	2,817
a. Housing Units	69	339	575	1,103	1,379	1,629
b. Manufacturing	7	29	48	71	82	91
c. Wholesale & Retail Trade	21	73	123	199	241	276
f. Education	24	90	153	219	252	286
g. Health	26	85	141	219	261	297
h. Other Facilities	19	69	116	177	209	238
(2) Agricultural Production	17	37	44	49	52	53
a. Irrigated Field	3	7	9	10	11	11
b. Rainfed Field	14	30	36	39	41	42
(3) Infrastructure	37	145	240	407	495	574
2. Indirect Damage	38	154	259	431	515	596
(1) Household	13	59	102	163	190	220
(2) Business Losses	2	8	14	23	28	32
(3) Other Damages	22	87	144	244	297	344
3. Total	258	1,021	1,699	2,875	3,485	4,041

**Table 9.1.13 Damageable Property and Flood Damage of Proposed Project:
2020 Phase-1**

Item	Return Period (Year)					
	2	5	10	25	50	100
I. Affected Population and Area						
1 Affected Population (1000)	25	60	66	90	90	90
2 Area Inundated (km2)						
II. Inundated Property						
1 Buildings (Nos)	5,162	12,334	13,485	18,494	18,513	18,534
a. Housing Units	5,030	11,981	13,102	17,906	17,925	17,946
b. Manufacturing	31	71	79	114	114	114
c. Wholesale & Retail Trade	88	239	258	400	400	400
d. Educational	11	36	38	59	59	59
e. Medical	2	7	8	15	15	15
2 Agricultural Land (ha)	2,094	4,679	5,346	5,859	6,012	6,165
a. Irrigated Field	1,690	4,042	4,680	5,165	5,310	5,428
b. Rainfed Field	404	637	666	694	702	737
III. Estimated Value of Damaged Property (Million Pesos in Economic Terms)						
1. Direct Damage	510	1,626	2,522	4,050	5,310	6,605
(1) Facilities	411	1,305	2,035	3,294	4,339	5,415
a. Housing Units	209	629	1,004	1,624	2,286	3,053
b. Manufacturing	16	45	65	99	119	130
c. Wholesale & Retail Trade	27	99	154	258	341	398
f. Education	111	356	541	856	1,013	1,159
g. Health	8	40	64	124	170	203
h. Other Facilities	40	135	206	334	411	472
(2) Agricultural Production	15	50	67	81	86	89
a. Irrigated Field	12	47	63	76	81	84
b. Rainfed Field	2	4	4	5	5	5
(3) Infrastructure	85	271	420	675	885	1,101
2. Indirect Damage	94	290	449	730	934	1,147
(1) Household	40	116	180	296	366	440
(2) Business Losses	3	11	16	29	38	47
(3) Other Damages	51	163	252	405	531	661
3. Total	605	1,916	2,971	4,780	6,245	7,752

**Table 9.1.14 Damageable Property and Flood Damage of Proposed Project:
2020 Phase-2**

Item	Return Period (Year)					
	2	5	10	25	50	100
I. Affected Population and Area						
1 Affected Population (1000)	9	47	71	79	81	82
2 Area Inundated (km2)						
II. Inundated Property						
1 Buildings (Nos)	1,827	9,457	14,514	16,001	16,357	16,684
a. Housing Units	1,806	9,334	14,292	15,758	16,106	16,430
b. Manufacturing	11	65	106	116	120	121
c. Wholesale & Retail Trade	6	40	66	73	77	77
d. Educational	4	18	50	54	54	56
e. Medical	0	0	0	0	0	0
2 Agricultural Land (ha)	2,439	8,111	10,156	10,914	11,170	11,654
a. Irrigated Field	1,165	5,343	7,145	7,791	8,021	8,460
b. Rainfed Field	1,274	2,768	3,011	3,123	3,149	3,194
III. Estimated Value of Damaged Property (Million Pesos in Economic Terms)						
1. Direct Damage	264	1,385	2,861	5,009	5,754	6,165
(1) Facilities	203	1,081	2,278	4,046	4,661	4,996
a. Housing Units	103	697	1,391	2,587	3,046	3,311
b. Manufacturing	8	48	93	127	135	140
c. Wholesale & Retail Trade	3	21	46	70	77	81
f. Education	69	238	572	970	1,080	1,127
g. Health	0	0	0	0	0	0
h. Other Facilities	20	77	178	292	323	337
(2) Agricultural Production	17	73	106	128	135	141
a. Irrigated Field	10	57	87	107	113	119
b. Rainfed Field	7	16	19	21	22	22
(3) Infrastructure	44	231	477	835	959	1,028
2. Indirect Damage	47	261	531	878	989	1,050
(1) Household	19	117	235	361	395	414
(2) Business Losses	1	5	10	16	18	19
(3) Other Damages	26	139	286	501	575	617
3. Total	310	1,646	3,392	5,886	6,744	7,215

**Table 9.1.15 Damageable Property and Flood Damage of Proposed Project:
2020 Phase-3**

Item	Return Period (Year)					
	2	5	10	25	50	100
I. Affected Population and Area						
1 Affected Population (1000)	33	77	87	92	95	98
2 Area Inundated (km2)						
II. Inundated Property						
1 Buildings (Nos)	6,621	15,642	17,551	18,691	19,154	19,792
a. Housing Units	6,553	15,473	17,359	18,487	18,947	19,577
b. Manufacturing	34	80	91	97	99	102
c. Wholesale & Retail Trade	21	50	55	57	58	61
d. Educational	13	39	46	50	50	52
e. Medical	0	0	0	0	0	0
2 Agricultural Land (ha)	8,600	13,488	14,285	14,648	14,868	15,112
a. Irrigated Field	6,437	10,639	11,410	11,764	11,972	12,211
b. Rainfed Field	2,163	2,849	2,875	2,884	2,896	2,901
III. Estimated Value of Damaged Property (Million Pesos in Economic Terms)						
1. Direct Damage	823	3,001	4,298	6,049	6,557	6,742
(1) Facilities	594	2,340	3,399	4,844	5,263	5,412
a. Housing Units	389	1,457	2,219	3,430	3,785	3,903
b. Manufacturing	21	72	94	109	113	116
c. Wholesale & Retail Trade	9	34	47	59	62	63
f. Education	133	601	803	962	1,007	1,028
g. Health	0	0	0	0	0	0
h. Other Facilities	41	177	236	283	295	302
(2) Agricultural Production	91	162	183	197	201	206
a. Irrigated Field	79	142	162	176	180	184
b. Rainfed Field	13	20	21	21	22	22
(3) Infrastructure	137	500	716	1,008	1,093	1,124
2. Indirect Damage	155	553	793	1,070	1,143	1,178
(1) Household	70	245	352	450	472	488
(2) Business Losses	2	8	11	14	15	16
(3) Other Damages	82	300	430	605	656	674
3. Total	977	3,554	5,091	7,119	7,700	7,919

**Table 9.1.16 Damageable Property and Flood Damage of Proposed Project:
2020 Phase-4**

Item	Return Period (Year)					
	2	5	10	25	50	100
I. Affected Population and Area						
1 Affected Population (1000)	21	86	116	142	168	168
2 Area Inundated (km2)						
II. Inundated Property						
1 Buildings (Nos)	4,320	17,764	24,043	29,468	34,899	34,927
a. Housing Units	4,147	17,127	23,149	28,352	33,506	33,533
b. Manufacturing	33	133	184	228	279	279
c. Wholesale & Retail Trade	123	443	624	785	983	984
d. Educational	7	26	37	41	53	53
e. Medical	10	35	49	62	78	78
2 Agricultural Land (ha)	2,991	5,644	6,509	6,797	6,918	6,943
a. Irrigated Field	563	1,830	2,397	2,622	2,695	2,720
b. Rainfed Field	2,428	3,814	4,112	4,175	4,223	4,223
III. Estimated Value of Damaged Property (Million Pesos in Economic Terms)						
1. Direct Damage	728	2,972	4,985	8,558	10,446	12,100
(1) Facilities	587	2,428	4,095	7,064	8,635	10,011
a. Housing Units	248	1,221	2,073	3,982	4,996	5,870
b. Manufacturing	24	99	163	240	278	311
c. Wholesale & Retail Trade	72	256	429	695	843	965
f. Education	84	315	533	765	880	999
g. Health	91	296	494	766	911	1,038
h. Other Facilities	68	242	405	617	728	828
(2) Agricultural Production	20	48	59	67	70	72
a. Irrigated Field	7	23	31	37	40	41
b. Rainfed Field	13	24	28	30	31	31
(3) Infrastructure	121	495	831	1,426	1,741	2,017
2. Indirect Damage	129	539	914	1,527	1,830	2,113
(1) Household	48	213	367	591	686	791
(2) Business Losses	8	28	48	80	100	112
(3) Other Damages	73	297	499	856	1,045	1,210
3. Total	857	3,510	5,899	10,085	12,277	14,213

Table 9.2.1 Compound Conversion Factor of Civil Works

Work Item	Total Construction Conversion Cost in Financial Rate Market Value		Total Construction Cost in Real Economic Value
I. Excavation Work (Handling Distance: 500m; Unit: m3))			
1. Labor	295		274
1) Foreman	30	0.93	28
2) Operator	265	0.93	246
2. Materials	5,090		4,327
1) Light Oil	4,351	0.85	3,698
2) Lubricant	740	0.85	629
3. Equipment	49,100		42,717
1) Motorscraper	49,100	0.87	42,717
4. Overhead and Profit	13,611	0.86	11,705
Total	68,096		59,024
Average Conversion Factor		0.87	
II. Filling Work (Handling Distance: 1000m; Unit: m3)			
1. Labor	3,078		2,711
1) Foreman	351	0.93	326
2) Operator	2,267	0.93	2,108
3) Common Worker	460	0.60	276
2. Materials	10,964		9,320
1) Light Oil	9,371	0.85	7,965
2) Lubricant	1,593	0.85	1,354
3. Equipment	67,363		58,606
1) Bulldozer 21t	19,777	0.87	17,206
2) Wheel Loader	13,814	0.87	12,018
3) Dump Truck	22,035	0.87	19,170
4) Bulldozer 15t	6,362	0.87	5,535
5) Tire Roller	5,375	0.87	4,676
4. Overhead and Profit	18,464		18,464
Total	99,869		89,100
Average Conversion Factor		0.89	

Table 9.2.2 Financial Cost and Economic Cost of Phase 1

Financial Cost															
Item	Total	2002		2003		2004		2005		2006		2007			
		Cost	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	
1 Direct Construction cost w/VAT	1,585	960	625	0	0	96	63	288	188	192	125	192	125	192	125
1) Urgent Bank Protection Works	540	270	270	0	0	27	27	81	81	54	54	54	54	54	54
2) Left and Kike System	1,045	690	355	0	0	69	36	207	107	138	71	138	71	138	71
2 VAT	159		159		0		16		48		32		32		32
3 Land Acquisition and Compensation cost	26		26		10		8		8						
4 Cost for Non-structural Measures	320	129	191		76		57		57	129					
5 Cost for Supporting Measures	30	24	6		2		2		2	24					
6 Administration Expenses	48		48		5		10		10		10		10		5
7 Engineering Services Expenses	190	152	38	30	8	30	8	15	4	30	8	30	8	15	4
8 Sub Total, 1+2+3+4+5+6+7	2,358	1,265	1,107	30	102	126	162	303	315	375	174	222	174	207	165
9 Price Contingency	218	76	142	0	0	3	8	12	32	23	26	18	35	21	41
10 Physical Contingency, 8 %	207	107	100	2	8	10	14	25	28	32	16	19	17	18	17
11 Total	2,783	1,448	1,349	33	110	139	184	341	375	430	216	259	225	246	223

Economic Cost															
Item	Total	2002		2003		2004		2005		2006		2007			
		Cost	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	
1 Direct Construction cost w/VAT	1,379	835	544	0	0	84	54	251	163	167	109	167	109	167	109
1) Urgent Bank Protection Works	470	235	235	0	0	23	23	70	70	47	47	47	47	47	47
2) Left and Kike System	909	600	309	0	0	60	31	180	93	120	62	120	62	120	62
2 VAT	0		0		0		0		0		0		0		0
3 Land Acquisition and Compensation Cost*1	0		0		0		0		0						
4 Cost for Non-structural Measures	197	146	52		21		15		15	146					
5 Cost for Supporting Measures	29	27	2		1		0		0	27					
6 Administration Expenses	46		46		5		9		9		9		9		5
7 Engineering Services Expenses	222	185	36	37	7	37	7	19	4	37	7	37	7	19	4
8 Sub Total, 1+2+3+4+5+6+7	1,872	1,194	1,107	37	33	121	87	269	192	377	125	204	125	186	117
9 Price Contingency	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10 Physical Contingency, 8 %	175	91	84	2	7	9	12	21	24	27	14	16	14	15	14
11 Total	2,047	1,285	1,191	39	40	129	98	291	215	404	139	220	139	201	131

Note: *1 Counted in benefit stream as negative benefit.

Table 9.2.3 Financial Cost and Economic Cost of Phase 2, 3 and 4

Item	Phase 2			Phase 3			Phase 4			
	Total	FC	LC	Total	FC	LC	Total	FC	LC	
Financial Cost										
1	Direct Construction cost w/VAT	1,460	963	496	2,868	1,893	975	3,696	2,439	1,257
2	VAT	146	0	146	287	0	287	370	0	370
3	Land Acquisition and Compensation cost	4	0	4	43	0	43	28	0	28
4	Cost for Non-structural Measures	637	0	637	289	0	289	96	0	96
5	Cost for Supporting Measures	60	48	12	30	24	6	30	24	6
6	Administration Expenses	44	0	44	86	0	86	111	0	111
7	Engineering Services Expenses	175	140	35	344	275	69	444	355	89
8	Sub Total, 1+2+3+4+5+6+7	2,525	1,151	1,374	3,947	2,192	1,755	4,774	2,818	1,956
9	Price Contingency	101	46	55	158	88	70	191	113	78
10	Physical Contingency, 8 %	202	92	110	316	175	140	382	225	156
11	Total	2,828	1,290	1,539	4,420	2,455	1,965	5,347	3,156	2,190
Economic Cost										
1	Direct Construction cost w/VAT	1,270	838	432	2,495	1,647	848	3,216	2,122	1,093
2	VAT	0	0	0	0	0	0	0	0	0
3	Land Acquisition and Compensation Cost*1	0	0	0	0	0	0	0	0	0
4	Cost for Non-structural Measures	541	0	541	246	0	246	82	0	82
5	Cost for Supporting Measures	57	54	3	29	27	2	29	27	2
6	Administration Expenses	42	0	42	82	0	82	105	0	105
7	Engineering Services Expenses	204	171	33	401	336	65	517	433	84
8	Sub Total, 1+2+3+4+5+6+7	2,115	1,063	1,051	3,252	2,010	1,243	3,948	2,582	1,366
9	Price Contingency	0	0	0	0	0	0	0	0	0
10	Physical Contingency, 8 %	172	78	93	268	149	119	325	192	133
11	Total	2,286	1,142	1,145	3,521	2,159	1,362	4,273	2,774	1,499

Note: *1 Counted in benefit stream as negative benefit.

Table 9.3.1 Economic Cost and Benefit Stream of Flood Control Project in Phase 1 under Present Conditions

(Unit: Million Pesos)

No.	Year	Cost			Benefit			Balance	
		Const.	Replacemen O/M	Total	Benefit	Negative	Total		
0	2001			0.0			0.0	0.0	
1	2002	79.1		79.1		-0.1	-0.1	-79.2	
2	2003	227.6		227.6		-0.2	-0.2	-227.9	
3	2004	505.9		506.6	26.9	-0.4	26.6	-480.1	
4	2005	542.8		545.5	107.7	-0.5	107.3	-438.3	
5	2006	359.7		363.9	217.5	-0.6	216.9	-147.0	
6	2007	332.1		337.6	271.3	-0.6	270.7	-66.8	
7	2008			12.9	325.2	-0.6	324.6	311.7	
8	2009			12.9	325.2	-0.6	324.6	311.7	
9	2010			12.9	325.2	-0.6	324.6	311.7	
10	2011			12.9	325.2	-0.6	324.6	311.7	
11	2012			12.9	325.2	-0.6	324.6	311.7	
12	2013			12.9	325.2	-0.6	324.6	311.7	
13	2014			12.9	325.2	-0.6	324.6	311.7	
14	2015			12.9	325.2	-0.6	324.6	311.7	
15	2016			12.9	325.2	-0.6	324.6	311.7	
16	2017		39.5	12.9	52.3	325.2	-0.6	324.6	272.3
17	2018			12.9	12.9	325.2	-0.6	324.6	311.7
18	2019			12.9	12.9	325.2	-0.6	324.6	311.7
19	2020			12.9	12.9	325.2	-0.6	324.6	311.7
20	2021			12.9	12.9	325.2	-0.6	324.6	311.7
21	2022			12.9	12.9	325.2	-0.6	324.6	311.7
22	2023			12.9	12.9	325.2	-0.6	324.6	311.7
23	2024			12.9	12.9	325.2	-0.6	324.6	311.7
24	2025			12.9	12.9	325.2	-0.6	324.6	311.7
25	2026			12.9	12.9	325.2	-0.6	324.6	311.7
26	2027		39.5	12.9	52.3	325.2	-0.6	324.6	272.3
27	2028			12.9	12.9	325.2	-0.6	324.6	311.7
28	2029			12.9	12.9	325.2	-0.6	324.6	311.7
29	2030			12.9	12.9	325.2	-0.6	324.6	311.7
30	2031			12.9	12.9	325.2	-0.6	324.6	311.7
31	2032			12.9	12.9	325.2	-0.6	324.6	311.7
32	2033			12.9	12.9	325.2	-0.6	324.6	311.7
33	2034			12.9	12.9	325.2	-0.6	324.6	311.7
34	2035			12.9	12.9	325.2	-0.6	324.6	311.7
35	2036			12.9	12.9	325.2	-0.6	324.6	311.7
36	2037		39.5	12.9	52.3	325.2	-0.6	324.6	272.3
37	2038			12.9	12.9	325.2	-0.6	324.6	311.7
38	2039			12.9	12.9	325.2	-0.6	324.6	311.7
39	2040			12.9	12.9	325.2	-0.6	324.6	311.7
40	2041			12.9	12.9	325.2	-0.6	324.6	311.7
41	2042			12.9	12.9	325.2	-0.6	324.6	311.7
42	2043			12.9	12.9	325.2	-0.6	324.6	311.7
43	2044			12.9	12.9	325.2	-0.6	324.6	311.7
44	2045			12.9	12.9	325.2	-0.6	324.6	311.7
45	2046			12.9	12.9	325.2	-0.6	324.6	311.7
46	2047		39.5	12.9	52.3	325.2	-0.6	324.6	272.3
47	2048			12.9	12.9	325.2	-0.6	324.6	311.7
48	2049			12.9	12.9	325.2	-0.6	324.6	311.7
49	2050			12.9	12.9	325.2	-0.6	324.6	311.7
50	2051			12.9	12.9	325.2	-0.6	324.6	311.7
51	2052			12.9	12.9	325.2	-0.6	324.6	311.7
52	2053			12.9	12.9	325.2	-0.6	324.6	311.7
53	2054			12.9	12.9	325.2	-0.6	324.6	311.7
54	2055			12.9	12.9	325.2	-0.6	324.6	311.7
55	2056			12.9	12.9	325.2	-0.6	324.6	311.7
56	2057		39.5	12.9	52.3	325.2	-0.6	324.6	272.3
		B/C:	0.99		NPV:	-15.1		EIRR:	14.8%

Table 9.3.2 Economic Cost and Benefit Stream of Flood Control Project in Phase 2 under Present Conditions

(Unit: Million Pesos)

No.	Year	Cost			Benefit			Balance	
		Const.	Replacemen O/M	Total	Benefit	Negative	Total		
0	2001			0.0			0.0	0.0	
1	2002	79.1		79.1		-0.1	-0.1	-79.2	
2	2003	227.6		227.6		-0.2	-0.2	-227.9	
3	2004	505.9		506.6	26.9	-0.4	26.6	-480.1	
4	2005	542.8		545.5	107.7	-0.5	107.3	-438.3	
5	2006	359.7		363.9	217.5	-0.6	216.9	-147.0	
6	2007	332.1		337.6	271.3	-0.6	270.7	-66.8	
7	2008	737.5		750.4	325.2	-0.7	324.5	-425.9	
8	2009	737.5		752.2	368.1	-0.7	367.3	-384.9	
9	2010	737.5		754.1	411.0	-0.8	410.2	-343.9	
10	2011	737.5		755.9	453.9	-0.9	453.0	-302.9	
11	2012			26.3	638.8	-0.9	637.9	611.5	
12	2013			26.3	638.8	-0.9	637.9	611.5	
13	2014			26.3	638.8	-0.9	637.9	611.5	
14	2015			26.3	638.8	-0.9	637.9	611.5	
15	2016			26.3	638.8	-0.9	637.9	611.5	
16	2017		39.5	26.3	65.8	638.8	-0.9	637.9	572.1
17	2018			26.3	26.3	638.8	-0.9	637.9	611.5
18	2019			26.3	26.3	638.8	-0.9	637.9	611.5
19	2020			26.3	26.3	638.8	-0.9	637.9	611.5
20	2021			26.3	26.3	638.8	-0.9	637.9	611.5
21	2022			26.3	26.3	638.8	-0.9	637.9	611.5
22	2023			26.3	26.3	638.8	-0.9	637.9	611.5
23	2024			26.3	26.3	638.8	-0.9	637.9	611.5
24	2025			26.3	26.3	638.8	-0.9	637.9	611.5
25	2026			26.3	26.3	638.8	-0.9	637.9	611.5
26	2027		39.5	26.3	65.8	638.8	-0.9	637.9	572.1
27	2028			26.3	26.3	638.8	-0.9	637.9	611.5
28	2029			26.3	26.3	638.8	-0.9	637.9	611.5
29	2030			26.3	26.3	638.8	-0.9	637.9	611.5
30	2031			26.3	26.3	638.8	-0.9	637.9	611.5
31	2032			26.3	26.3	638.8	-0.9	637.9	611.5
32	2033			26.3	26.3	638.8	-0.9	637.9	611.5
33	2034			26.3	26.3	638.8	-0.9	637.9	611.5
34	2035			26.3	26.3	638.8	-0.9	637.9	611.5
35	2036			26.3	26.3	638.8	-0.9	637.9	611.5
36	2037		39.5	26.3	65.8	638.8	-0.9	637.9	572.1
37	2038			26.3	26.3	638.8	-0.9	637.9	611.5
38	2039			26.3	26.3	638.8	-0.9	637.9	611.5
39	2040			26.3	26.3	638.8	-0.9	637.9	611.5
40	2041			26.3	26.3	638.8	-0.9	637.9	611.5
41	2042			26.3	26.3	638.8	-0.9	637.9	611.5
42	2043			26.3	26.3	638.8	-0.9	637.9	611.5
43	2044			26.3	26.3	638.8	-0.9	637.9	611.5
44	2045			26.3	26.3	638.8	-0.9	637.9	611.5
45	2046			26.3	26.3	638.8	-0.9	637.9	611.5
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52	2053			26.3	26.3	638.8	-0.9	637.9	611.5
53	2054			26.3	26.3	638.8	-0.9	637.9	611.5
54	2055			26.3	26.3	638.8	-0.9	637.9	611.5
55	2056			26.3	26.3	638.8	-0.9	637.9	611.5
56	2057		39.5	26.3	65.8	638.8	-0.9	637.9	572.1
57	2058			26.3	26.3	638.8	-0.9	637.9	611.5
58	2059			26.3	26.3	638.8	-0.9	637.9	611.5
59	2060			26.3	26.3	638.8	-0.9	637.9	611.5
60	2061			26.3	26.3	638.8	-0.9	637.9	611.5
		B/C:	0.83	NPV:		-318.7	EIRR:		12.3%

Table 9.3.3 Economic Cost and Benefit Stream of Flood Control Project in Phase 3 under Present Conditions

(Unit: Million Pesos)

No.	Year	Cost			Benefit			Balance	
		Const.	Replacemen O/M	Total	Benefit	Negative	Total		
0	2001			0.0			0.0	0.0	
1	2002	79.1		79.1		-0.1	-0.1	-79.2	
2	2003	227.6		227.6		-0.2	-0.2	-227.9	
3	2004	505.9		506.6	26.9	-0.4	26.6	-480.1	
4	2005	542.8		545.5	107.7	-0.5	107.3	-438.3	
5	2006	359.7		363.9	217.5	-0.6	216.9	-147.0	
6	2007	332.1		337.6	271.3	-0.6	270.7	-66.8	
7	2008	737.5		750.4	325.2	-0.7	324.5	-425.9	
8	2009	737.5		752.2	368.1	-0.7	367.3	-384.9	
9	2010	737.5		754.1	411.0	-0.8	410.2	-343.9	
10	2011	1,347.9		1,366.3	453.9	-0.9	453.0	-913.3	
11	2012	610.4		638.0	668.1	-0.9	667.2	29.1	
12	2013	610.4		639.3	697.3	-0.9	696.4	57.1	
13	2014	610.4		640.6	726.6	-0.9	725.7	85.1	
14	2015	610.4		641.8	755.8	-0.9	755.0	113.1	
15	2016			38.8	38.8	1,211.8	-0.9	1,210.9	1,172.0
16	2017		39.5	38.8	78.3	1,211.8	-0.9	1,210.9	1,132.6
17	2018			38.8	38.8	1,211.8	-0.9	1,210.9	1,172.0
18	2019			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
19	2020			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
20	2021			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
21	2022			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
22	2023			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
23	2024			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
24	2025			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
25	2026			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
26	2027		39.5	38.8	78.3	1,211.8	-3.0	1,208.8	1,130.5
27	2028			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
28	2029			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
29	2030			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
30	2031			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
31	2032			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
32	2033			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
33	2034			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
34	2035			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
35	2036			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
36	2037		39.5	38.8	78.3	1,211.8	-3.0	1,208.8	1,130.5
37	2038			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
38	2039			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
39	2040			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
40	2041			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
50	2051			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
51	2052			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
52	2053			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
53	2054			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
54	2055			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
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57	2058			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
58	2059			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
59	2060			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
60	2061			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
61	2062			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
62	2063			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
63	2064			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
64	2065			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
65	2066			38.8	38.8	1,211.8	-3.0	1,208.8	1,170.0
		B/C:	0.87	NPV:	-326.6	EIRR:	13.0%		

Table 9.3.4 Economic Cost and Benefit Stream of Flood Control Project in Phase 4 under Present Conditions

(Unit: Million Pesos)

No.	Year	Cost			Benefit			Balance	
		Const.	Supporting	O/M	Total	Benefit	Negative		Total
0	2001				0.0			0.0	
1	2002	79.1			79.1		-0.1	-79.2	
2	2003	227.6			227.6		-0.2	-227.9	
3	2004	505.9		0.7	506.6	26.9	-0.4	-480.1	
4	2005	542.8		2.8	545.5	107.7	-0.5	-438.3	
5	2006	359.7		4.1	363.9	217.5	-0.6	-147.0	
6	2007	332.1		5.5	337.6	271.3	-0.6	-66.8	
7	2008	737.5		12.9	750.4	325.2	-0.7	-425.9	
8	2009	737.5		14.7	752.2	368.1	-0.7	-384.9	
9	2010	737.5		16.6	754.1	411.0	-0.8	-343.9	
10	2011	1,347.9		18.4	1,366.3	453.9	-0.9	-913.3	
11	2012	610.4		27.6	638.0	668.1	-0.9	29.1	
12	2013	610.4		28.9	639.3	697.3	-0.9	57.1	
13	2014	610.4		30.2	640.6	726.6	-0.9	85.1	
14	2015	1,322.5		31.4	1,354.0	755.8	-1.1	-599.2	
15	2016	712.1		39.5	751.7	1,235.5	-1.3	482.6	
16	2017	712.1	39.5	40.2	791.8	1,259.3	-1.5	466.0	
17	2018	712.1		40.9	753.0	1,283.1	-1.7	528.3	
18	2019	712.1		41.6	753.7	1,306.9	-4.0	549.2	
19	2020	712.1		42.2	754.4	1,330.7	-4.2	572.1	
20	2021			54.9	54.9	2,389.0	-4.2	2,329.9	
21	2022			54.9	54.9	2,389.0	-4.2	2,329.9	
22	2023			54.9	54.9	2,389.0	-4.2	2,329.9	
23	2024			54.9	54.9	2,389.0	-4.2	2,329.9	
24	2025			54.9	54.9	2,389.0	-4.2	2,329.9	
25	2026			54.9	54.9	2,389.0	-4.2	2,329.9	
26	2027		39.5	54.9	94.4	2,389.0	-4.2	2,290.5	
27	2028			54.9	54.9	2,389.0	-4.2	2,329.9	
28	2029			54.9	54.9	2,389.0	-4.2	2,329.9	
29	2030			54.9	54.9	2,389.0	-4.2	2,329.9	
30	2031			54.9	54.9	2,389.0	-4.2	2,329.9	
31	2032			54.9	54.9	2,389.0	-4.2	2,329.9	
32	2033			54.9	54.9	2,389.0	-4.2	2,329.9	
33	2034			54.9	54.9	2,389.0	-4.2	2,329.9	
34	2035			54.9	54.9	2,389.0	-4.2	2,329.9	
35	2036			54.9	54.9	2,389.0	-4.2	2,329.9	
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51	2052			54.9	54.9	2,389.0	-4.2	2,329.9	
52	2053			54.9	54.9	2,389.0	-4.2	2,329.9	
53	2054			54.9	54.9	2,389.0	-4.2	2,329.9	
54	2055			54.9	54.9	2,389.0	-4.2	2,329.9	
55	2056			54.9	54.9	2,389.0	-4.2	2,329.9	
56	2057		39.5	54.9	94.4	2,389.0	-4.2	2,290.5	
57	2058			54.9	54.9	2,389.0	-4.2	2,329.9	
58	2059			54.9	54.9	2,389.0	-4.2	2,329.9	
59	2060			54.9	54.9	2,389.0	-4.2	2,329.9	
60	2061			54.9	54.9	2,389.0	-4.2	2,329.9	
61	2062			54.9	54.9	2,389.0	-4.2	2,329.9	
62	2063			54.9	54.9	2,389.0	-4.2	2,329.9	
63	2064			54.9	54.9	2,389.0	-4.2	2,329.9	
64	2065			54.9	54.9	2,389.0	-4.2	2,329.9	
65	2066			54.9	54.9	2,389.0	-4.2	2,329.9	
66	2067		39.5	54.9	94.4	2,389.0	-4.2	2,290.5	
67	2068			54.9	54.9	2,389.0	-4.2	2,329.9	
68	2069			54.9	54.9	2,389.0	-4.2	2,329.9	
69	2070			54.9	54.9	2,389.0	-4.2	2,329.9	
		B/C:	0.93	NPV:		-209.5	EIRR:		14.0%

Table 9.3.5 Economic Cost and Benefit Stream of Flood Control Project in Phase 1 under Future Conditions

		(Unit: Million Pesos)							
No.		Cost			Benefit		Balance		
		Capital Con:	Replacemen	O/M	Total	Benefit		Negative	Total
0	2001				0.0		0.0	0.0	
1	2002	79.1			79.1		-0.1	-79.2	
2	2003	227.6			227.6		-0.2	-227.9	
3	2004	505.9		0.7	506.6	36.7	-0.4	-470.3	
4	2005	542.8		2.8	545.5	155.6	-0.5	-390.4	
5	2006	359.7		4.1	363.9	247.8	-0.6	-116.7	
6	2007	332.1		5.5	337.6	394.6	-0.6	56.4	
7	2008			12.9	12.9	556.8	-0.6	543.3	
8	2009			12.9	12.9	591.2	-0.6	577.7	
9	2010			12.9	12.9	627.7	-0.6	614.3	
10	2011			12.9	12.9	666.5	-0.6	653.0	
11	2012			12.9	12.9	707.7	-0.6	694.2	
12	2013			12.9	12.9	751.5	-0.6	738.0	
13	2014			12.9	12.9	797.9	-0.6	784.4	
14	2015			12.9	12.9	847.2	-0.6	833.7	
15	2016			12.9	12.9	899.6	-0.6	886.1	
16	2017		39.5	12.9	52.3	955.2	-0.6	902.2	
17	2018			12.9	12.9	1,014.2	-0.6	1,000.7	
18	2019			12.9	12.9	1,076.9	-0.6	1,063.4	
19	2020			12.9	12.9	1,143.5	-0.6	1,130.0	
20	2021			12.9	12.9	1,143.5	-0.6	1,130.0	
21	2022			12.9	12.9	1,143.5	-0.6	1,130.0	
22	2023			12.9	12.9	1,143.5	-0.6	1,130.0	
23	2024			12.9	12.9	1,143.5	-0.6	1,130.0	
24	2025			12.9	12.9	1,143.5	-0.6	1,130.0	
25	2026			12.9	12.9	1,143.5	-0.6	1,130.0	
26	2027		39.5	12.9	52.3	1,143.5	-0.6	1,090.5	
27	2028			12.9	12.9	1,143.5	-0.6	1,130.0	
28	2029			12.9	12.9	1,143.5	-0.6	1,130.0	
29	2030			12.9	12.9	1,143.5	-0.6	1,130.0	
30	2031			12.9	12.9	1,143.5	-0.6	1,130.0	
31	2032			12.9	12.9	1,143.5	-0.6	1,130.0	
32	2033			12.9	12.9	1,143.5	-0.6	1,130.0	
33	2034			12.9	12.9	1,143.5	-0.6	1,130.0	
34	2035			12.9	12.9	1,143.5	-0.6	1,130.0	
35	2036			12.9	12.9	1,143.5	-0.6	1,130.0	
36	2037		39.5	12.9	52.3	1,143.5	-0.6	1,090.5	
37	2038			12.9	12.9	1,143.5	-0.6	1,130.0	
38	2039			12.9	12.9	1,143.5	-0.6	1,130.0	
39	2040			12.9	12.9	1,143.5	-0.6	1,130.0	
40	2041			12.9	12.9	1,143.5	-0.6	1,130.0	
41	2042			12.9	12.9	1,143.5	-0.6	1,130.0	
42	2043			12.9	12.9	1,143.5	-0.6	1,130.0	
43	2044			12.9	12.9	1,143.5	-0.6	1,130.0	
44	2045			12.9	12.9	1,143.5	-0.6	1,130.0	
45	2046			12.9	12.9	1,143.5	-0.6	1,130.0	
46	2047		39.5	12.9	52.3	1,143.5	-0.6	1,090.5	
47	2048			12.9	12.9	1,143.5	-0.6	1,130.0	
48	2049			12.9	12.9	1,143.5	-0.6	1,130.0	
49	2050			12.9	12.9	1,143.5	-0.6	1,130.0	
50	2051			12.9	12.9	1,143.5	-0.6	1,130.0	
51	2052			12.9	12.9	1,143.5	-0.6	1,130.0	
52	2053			12.9	12.9	1,143.5	-0.6	1,130.0	
53	2054			12.9	12.9	1,143.5	-0.6	1,130.0	
54	2055			12.9	12.9	1,143.5	-0.6	1,130.0	
55	2056			12.9	12.9	1,143.5	-0.6	1,130.0	
56	2057		39.5	12.9	52.3	1,143.5	-0.6	1,090.5	
		B/C:	2.15		NPV:	1,254.7		EIRR:	27.1%

Table 9.3.6 Economic Cost and Benefit Stream of Flood Control Project in Phase 2 under Future Conditions

(Unit: Million Pesos)

No.		Cost			Benefit		Balance		
		Const.	Replacemen O/M	Total	Benefit	Negative		Total	
0	2001			0.0			0.0	0.0	
1	2002	79.1		79.1		-0.1	-0.1	-79.2	
2	2003	227.6		227.6		-0.2	-0.2	-227.9	
3	2004	505.9	0.7	506.6	36.7	-0.4	36.3	-470.3	
4	2005	542.8	2.8	545.5	155.6	-0.5	155.2	-390.4	
5	2006	359.7	4.1	363.9	247.8	-0.6	247.2	-116.7	
6	2007	332.1	5.5	337.6	394.6	-0.6	393.9	56.4	
7	2008	737.5	12.9	750.4	556.8	-0.7	556.1	-194.3	
8	2009	737.5	14.7	752.2	709.5	-0.8	708.7	-43.5	
9	2010	737.5	16.6	754.1	878.1	-0.9	877.2	123.1	
10	2011	737.5	18.4	755.9	1,063.9	-0.9	1,063.0	307.0	
11	2012		26.3	26.3	1,268.4	-1.0	1,267.5	1,241.1	
12	2013		26.3	26.3	1,344.8	-1.0	1,343.8	1,317.5	
13	2014		26.3	26.3	1,425.8	-1.0	1,424.9	1,398.5	
14	2015		26.3	26.3	1,511.7	-1.0	1,510.8	1,484.4	
15	2016		26.3	26.3	1,602.8	-1.0	1,601.8	1,575.5	
16	2017		39.5	26.3	65.8	1,699.4	-1.0	1,698.4	1,632.6
17	2018		26.3	26.3	1,801.8	-1.0	1,800.8	1,774.5	
18	2019		26.3	26.3	1,910.4	-1.0	1,909.5	1,883.1	
19	2020		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
20	2021		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
21	2022		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
22	2023		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
23	2024		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
24	2025		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
25	2026		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
26	2027		39.5	26.3	65.8	2,025.6	-1.0	2,024.6	1,958.8
27	2028		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
28	2029		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
29	2030		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
30	2031		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
31	2032		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
32	2033		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
33	2034		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
34	2035		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
35	2036		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
36	2037		39.5	26.3	65.8	2,025.6	-1.0	2,024.6	1,958.8
37	2038		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
38	2039		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
39	2040		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
40	2041		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
:	:		:	:	:	:	:	:	
:	:		:	:	:	:	:	:	
47	2048		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
48	2049		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
49	2050		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
50	2051		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
51	2052		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
52	2053		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
53	2054		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
54	2055		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
55	2056		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
56	2057		39.5	26.3	65.8	2,025.6	-1.0	2,024.6	1,958.8
57	2058		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
58	2059		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
59	2060		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
60	2061		26.3	26.3	2,025.6	-1.0	2,024.6	1,998.3	
		B/C:	1.88		NPV:	1,672.8		EIRR:	25.4%

Table 9.3.7 Economic Cost and Benefit Stream of Flood Control Project in Phase 3 under Future Conditions

		(Unit: Million Pesos)					
No.		Cost			Benefit		Balance
		Const.	Replacemen O/M	Total	Benefit	Negative		Total
0	2001			0.0			0.0
1	2002	79.1		79.1		-0.1	-79.2
2	2003	227.6		227.6		-0.2	-227.9
3	2004	505.9	0.7	506.6	36.7	-0.4	-470.3
4	2005	542.8	2.8	545.5	155.6	-0.5	-390.4
5	2006	359.7	4.1	363.9	247.8	-0.6	-116.7
6	2007	332.1	5.5	337.6	394.6	-0.6	56.4
7	2008	737.5	12.9	750.4	556.8	-0.7	-194.3
8	2009	737.5	14.7	752.2	709.5	-0.8	-43.5
9	2010	737.5	16.6	754.1	878.1	-0.9	123.1
10	2011	1,347.9	18.4	1,366.3	1,063.9	-1.1	-303.5
11	2012	610.4	27.6	638.0	1,452.5	-1.3	813.2
12	2013	610.4	28.9	639.3	1,734.5	-1.5	1,093.8
13	2014	610.4	30.2	640.6	2,044.6	-1.6	1,402.4
14	2015	610.4	31.4	641.8	2,384.9	-1.8	1,741.3
15	2016		38.8	38.8	2,758.1	-1.8	2,717.4
16	2017		39.5	38.8	78.3	2,922.2	2,842.0
17	2018		38.8	38.8	3,096.1	-0.8	3,056.4
18	2019		38.8	38.8	3,280.3	-0.8	3,240.7
19	2020		38.8	38.8	3,475.5	-0.8	3,435.9
20	2021		38.8	38.8	3,475.5	-0.8	3,435.9
21	2022		38.8	38.8	3,475.5	-0.8	3,435.9
22	2023		38.8	38.8	3,475.5	-0.8	3,435.9
23	2024		38.8	38.8	3,475.5	-0.8	3,435.9
24	2025		38.8	38.8	3,475.5	-0.8	3,435.9
25	2026		38.8	38.8	3,475.5	-0.8	3,435.9
26	2027		39.5	38.8	78.3	3,475.5	3,396.4
27	2028		38.8	38.8	3,475.5	-0.8	3,435.9
28	2029		38.8	38.8	3,475.5	-0.8	3,435.9
29	2030		38.8	38.8	3,475.5	-0.8	3,435.9
30	2031		38.8	38.8	3,475.5	-0.8	3,435.9
31	2032		38.8	38.8	3,475.5	-0.8	3,435.9
32	2033		38.8	38.8	3,475.5	-0.8	3,435.9
33	2034		38.8	38.8	3,475.5	-0.8	3,435.9
34	2035		38.8	38.8	3,475.5	-0.8	3,435.9
35	2036		38.8	38.8	3,475.5	-0.8	3,435.9
36	2037		39.5	38.8	78.3	3,475.5	3,396.4
37	2038		38.8	38.8	3,475.5	-0.8	3,435.9
38	2039		38.8	38.8	3,475.5	-0.8	3,435.9
:	:		:	:	:	:	:
:	:		:	:	:	:	:
50	2051		38.8	38.8	3,475.5	-0.8	3,435.9
51	2052		38.8	38.8	3,475.5	-0.8	3,435.9
52	2053		38.8	38.8	3,475.5	-0.8	3,435.9
53	2054		38.8	38.8	3,475.5	-0.8	3,435.9
54	2055		38.8	38.8	3,475.5	-0.8	3,435.9
55	2056		38.8	38.8	3,475.5	-0.8	3,435.9
56	2057		39.5	38.8	78.3	3,475.5	3,396.4
57	2058		38.8	38.8	3,475.5	-0.8	3,435.9
58	2059		38.8	38.8	3,475.5	-0.8	3,435.9
59	2060		38.8	38.8	3,475.5	-0.8	3,435.9
60	2061		38.8	38.8	3,475.5	-0.8	3,435.9
61	2062		38.8	38.8	3,475.5	-0.8	3,435.9
62	2063		38.8	38.8	3,475.5	-0.8	3,435.9
63	2064		38.8	38.8	3,475.5	-0.8	3,435.9
64	2065		38.8	38.8	3,475.5	-0.8	3,435.9
65	2066		38.8	38.8	3,475.5	0.0	3,436.7
		B/C:	2.06	NPV:	2,564.5	EIRR:	26.8%

Table 9.3.8 Economic Cost and Benefit Stream of Flood Control Project in Phase 4 under Future Conditions

		(Unit: Million Pesos)							
No.		Cost			Benefit			Balance	
		Const.	Supporting	O/M	Total	Benefit	Negative		Total
0	2001				0.0			0.0	0.0
1	2002	79.1			79.1		-0.1	-0.1	-79.2
2	2003	227.6			227.6		-0.2	-0.2	-227.9
3	2004	505.9		0.7	506.6	36.7	-0.4	36.3	-470.3
4	2005	542.8		2.8	545.5	155.6	-0.5	155.2	-390.4
5	2006	359.7		4.1	363.9	247.8	-0.6	247.2	-116.7
6	2007	332.1		5.5	337.6	394.6	-0.6	393.9	56.4
7	2008	737.5		12.9	750.4	556.8	-0.7	556.1	-194.3
8	2009	737.5		14.7	752.2	709.5	-0.8	708.7	-43.5
9	2010	737.5		16.6	754.1	878.1	-0.9	877.2	123.1
10	2011	1,347.9		18.4	1,366.3	1,063.9	-1.1	1,062.8	-303.5
11	2012	610.4		27.6	638.0	1,452.5	-1.3	1,451.2	813.2
12	2013	610.4		28.9	639.3	1,734.5	-1.5	1,733.1	1,093.8
13	2014	610.4		30.2	640.6	2,044.6	-1.6	2,042.9	1,402.4
14	2015	1,322.5		31.4	1,354.0	2,384.9	-2.1	2,382.9	1,028.9
15	2016	712.1		39.5	751.7	2,959.0	-2.3	2,956.7	2,205.1
16	2017	712.1	39.5	40.2	791.8	3,349.3	-2.5	3,346.8	2,554.9
17	2018	712.1		40.9	753.0	3,776.9	-1.7	3,775.2	3,022.1
18	2019	712.1		41.6	753.7	4,245.0	-1.9	4,243.0	3,489.3
19	2020	712.1		42.2	754.4	4,757.0	-2.2	4,754.8	4,000.4
20	2021			54.9	54.9	4,791.1	-2.2	4,788.9	4,734.0
21	2022			54.9	54.9	5,410.1	-2.2	5,407.9	5,353.0
22	2023			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
23	2024			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
24	2025			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
25	2026			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
26	2027		39.5	54.9	94.4	5,410.1	-1.3	5,408.9	5,314.5
27	2028			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
28	2029			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
29	2030			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
30	2031			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
31	2032			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
32	2033			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
33	2034			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
34	2035			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
35	2036			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
36	2037		39.5	54.9	94.4	5,410.1	-1.3	5,408.9	5,314.5
37	2038			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
38	2039			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
:	:			:	:	:	:	:	:
:	:			:	:	:	:	:	:
54	2055			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
55	2056			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
56	2057		39.5	54.9	94.4	5,410.1	-1.3	5,408.9	5,314.5
57	2058			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
58	2059			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
59	2060			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
60	2061			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
61	2062			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
62	2063			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
63	2064			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
64	2065			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
65	2066			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
66	2067		39.5	54.9	94.4	5,410.1	-1.3	5,408.9	5,314.5
67	2068			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
68	2069			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
69	2070			54.9	54.9	5,410.1	-1.3	5,408.9	5,354.0
		B/C:	2.14		NPV:	3,193.3		EIRR:	27.3%

Table 10.2.1 Economic Price for Agricultural Outputs and Inputs at 2001 Constant Prices

I. Paddy			
	Item	Unit	Import Parity Price
1.	Export Price, Thai 5% Broken, FOB Bngkok *1	US\$/ton	#REF!
2.	Ocean Freight and Insurance	US\$/ton	40
3.	Grade Differential (25-35% broken) *2	US\$/ton	#REF!
4.	CIF Manila Price	US\$/ton	#REF!
5.	Converted to Philippines Pesos *3	Pesos/ton	#REF!
6.	Costs of Port Charge, Handing and Warehousing *4	Pesos/ton	#REF!
7.	Importer's Marging *5	Pesos/ton	#REF!
8.	Ex-warehouse Price	Pesos/ton	#REF!
9.	Transportation Cost to Selling Center *6	Pesos/ton	#REF!
10.	Trader's Margin *7	Pesos/ton	#REF!
11.	Wholesale Price of Rice in Manila	Pesos/ton	#REF!
12.	Transportation Cost (Manila - Basin) *8	Pesos/ton	287
13.	Ex-mill Rice Price	Pesos/ton	#REF!
14.	Milling Cost *9	Pesos/ton	1,120
15.	Value of By-products *10	Pesos/ton	650
16.	Value of Pre-million	Pesos/ton	#REF!
17.	Paddy Equivalent Price *11	Pesos/ton	#REF!
18.	Costs of Procurement, Transportation and Handling *12	Pesos/ton	86
19.	Farmgate Price of Paddy	Pesos/ton	#REF!
	Farmgate Price of Paddy (Round Off Figure)	Pesos/ton	#REF!

Source: 1987 Master Plan

Note: *1 Global Commodity Markets, A Comprehensive Review and Price Forecast, April 2000, World Bank

*2 15% lower than 5% broken rice of Thailand, because of rice quality.

*3 Applied a shadow exchange rate of 54 Pesos per US\$.

*4 2% of rice price imported.

*5 5% of rice price imported.

*6 1% of ex-warehouse price.

*7 2% of ex-warehouse price.

*8 $500\text{km} \times 0.70 \text{ Pesos/ton/km} \times 0.82 \text{ (SCF)} = 287 \text{ Pesos/ton}$

*9 Applied 56 Pesos/50kg of milling cost.

*10 Applied 650 Pesos/(ton of rice).

*11 Million rate is estimated at 65%.

*12 4.3 Pesos/50kg of paddy including handling charges.

II. Corn			
	Item	Unit	Import Parity Price
1.	Export Price, No.2 Yellow, FOB US Gulf Ports *1	US\$/ton	#REF!
2.	Ocean Freight and Insurance	US\$/ton	26
4.	CIF Manila Price	US\$/ton	#REF!
5.	Converted to Philippines Pesos *3	Pesos/ton	#REF!
6.	Costs of Port Charge, Handing and Warehousing *4	Pesos/ton	#REF!
7.	Importer's Marging *5	Pesos/ton	#REF!
8.	Ex-warehouse Price	Pesos/ton	#REF!
9.	Transportation Cost to Selling Center *6	Pesos/ton	#REF!
10.	Trader's Margin *7	Pesos/ton	#REF!
11.	Wholesale Price of Rice in Manila	Pesos/ton	#REF!
12.	Transportation Cost (Manila - Basin) *8	Pesos/ton	287
17.	Wholesale Price of Corn at Basin Market	Pesos/ton	#REF!
18.	Costs of Procurement, Transportation and Handling *9	Pesos/ton	86
19.	Farmgate Price of Paddy	Pesos/ton	#REF!
	Farmgate Price of Paddy (Round Off Figure)	Pesos/ton	#REF!

Source: 1987 Master Plan

Note: *1 Global Commodity Markets, A Comprehensive Review and Price Forecast, April 2000, World Bank

*2 15% lower than 5% broken rice of Thailand, because of rice quality.

*3 Applied a shadow exchange rate of 54 Pesos per US\$.

*4 2% of rice price imported.

*5 5% of rice price imported.

*6 1% of ex-warehouse price.

*7 2% of ex-warehouse price.

*8 $500\text{km} \times 0.70 \text{ Pesos/ton/km} \times 0.82 \text{ (SCF)} = 287 \text{ Pesos/ton}$

*9 4.3 Pesos/50kg of paddy including handling charges.

Table 10.2.2 Farmgate Prices of Agricultural Commodities: 1997-1999

Commodity	1997	1998	1999												Average
			Jan.	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1. Paddy	8.47	8.78	8.89	10.22	9.52	9.52	9.11	9.06	9.76	8.08	7.27	7.40	6.96	7.66	8.62
2. Corn, Yellow	6.32	5.85	5.33	5.24	5.34	5.01	5.23	-	5.10	4.57	3.96	5.25	-	-	5.00
3. Corn, White	5.94	8.16	-	6.93	-	6.73	-	-	4.74	3.96	4.15	-	-	-	5.30
4. Tobacco	23.18	30.14	-	-	-	-	-	25.17	-	-	-	-	-	-	25.17
5. Eggplant	7.48	11.37	16.40	8.08	-	12.76	5.06	6.24	6.91	7.00	6.68	18.86	15.63	-	10.36
6. Beans (Mungo)	22.68	23.45	-	-	-	-	-	-	-	-	-	-	-	-	22.89
7. Peanuts	15.58	15.81		22.10						14.74			16.54		17.79
8. Sweet Potatoes	5.04	5.04													4.79

Source: Cagayan, Farm Prices Survey, BAS, DA Region 2

**Table 10.2.3 Summary of Financial and Economic Prices of Agricultural Commodities:
2001**

Commodity	Unit	Financial Price	Economic Price
1. Paddy (Import Parity)	Pesos/ton	8,900	10,200
2. Corn (Import Parity)	Pesos/ton	5,200	8,700
3. Tobacco *1	Pesos/ton	26,000	22,100
4. Vegetable (Eggplant) *1	Pesos/ton	10,700	9,100
5. Beans (Mungo) *1	Pesos/ton	23,600	20,100
6. Peanuts *1	Pesos/ton	18,400	15,600
7. Sweet Potatoes *1	Pesos/ton	4,900	4,200

Table 10.2.4 Production Cost Per Hectare

Item	Paddy		Corn		Tobacco		Vegetable (Eggplant)		Beans (Mungo)		Peanuts		Sweet Potatoes
	W/O- Project	With- Project	W/O- Project	With- Project	W/O- Project	With- Project	W/O- Project	With- Project	W/O- Project	With- Project	W/O- Project	With- Project	W/O- Project
1. Level of Unit Yield (ton/ha)	2.50	4.50	2.50	3.75	1.00	2.00	6.00	13.00	1.00	1.50	0.70	2.00	5.00
2. Farm Input (Pesos/ha)													
(1) Cash Cost	8,397	9,766	4,561	4,602	-	-	26,369	37,670	3,684	5,263	5,395	7,707	4,933
1) Seed/Planting Materials	375	380	572	559	-	-	-	816	-	567	-	671	537
2) Fertilizer	1,224	1,310	1,301	1,271	-	-	-	6,823	-	34	-	140	580
3) Pesticides	498	523	144	141	-	-	-	11,709	-	812	-	12	49
4) Hired Labor	4,958	5,957	2,055	2,008	-	-	-	9,935	-	1,914	-	5,321	2,261
5) Irrigation Fee	200	197	-	1	-	-	-	68	-	30	-	20	-
6) Land Tax	81	84	123	120	-	-	-	68	-	184	-	163	117
7) Rentals	301	366	-	129	-	-	-	3,039	-	1,217	-	765	707
8) Fuel & Oil	161	227	118	115	-	-	-	1,117	-	96	-	85	151
9) Interest Payment	239	296	-	17	-	-	-	1,749	-	128	-	94	93
10) Food Expense	291	341	170	166	-	-	-	2,023	-	253	-	380	409
11) Transport Expense	69	84	77	75	-	-	-	322	-	29	-	55	30
(2) Non-Cash Cost	4,918	6,368	1,358	1,687	-	-	2,501	3,572	1,193	1,705	955	1,365	983
1) Seed/Planting Materials	654	785	95	93	-	-	-	354	-	468	-	861	460
2) Landlord's Share	1,213	1,542	410	400	-	-	-	2,507	-	309	-	320	352
3) Harvester's Share	1,131	1,543	735	718	-	-	-	626	-	871	-	152	133
4) Thresher's Share	801	1,120	118	115	-	-	-	-	-	-	-	-	-
5) Hired Labor	206	249	-	300	-	-	-	21	-	55	-	32	38
6) Lease Rental	674	892	-	59	-	-	-	64	-	-	-	-	-
7) Irrigation Fee	202	199	-	-	-	-	-	-	-	3	-	-	-
8) Fuel & Oil	35	39	-	2	-	-	-	-	-	-	-	-	-
(3) Imputed Cost	6,199	6,920	4,536	4,432	-	-	14,740	21,057	3,524	5,034	3,136	4,479	5,141
1) Operator/Family Labor	3,015	2,935	2,784	2,720	-	-	-	13,139	-	3,012	-	2,324	3,682
2) Exchange Labor	127	151	157	154	-	-	-	1,064	-	50	-	88	143
3) Depreciation	1,031	1,395	717	700	-	-	-	1,142	-	920	-	443	389
4) Interest	1,121	1,307	652	637	-	-	-	4,686	-	532	-	983	548
5) Rental Value of Land	905	1,132	227	222	-	-	-	1,026	-	519	-	641	379
(4) Total	19,514	23,054	10,455	10,721	12,500	21,200	43,609	62,299	8,401	12,002	9,486	13,551	11,057
	19,500	23,100	10,500	10,700	12,500	21,200	43,600	62,300	8,400	12,000	9,500	13,600	11,100

Source: Updated Production Costs and Returns for Selected Agricultural Commodities, 2000, BAS, DA
 Note: Values were converted to 2010 values from original data applying WPI.

Table 10.2.5 Irrigation Benefit in Alcala-Amulung West Project: Phase 1

Item	Harvested Area (ha)	Yield (ton/ha)	Farm Price (Pesos/ton)	Gross Income (Million Pesos)	Production Cost (Pesos/ha)	Total Cost (Million Pesos)	Net Returns (Million Pesos)
I. Without Project Condition							
1. Paddy	4,780			124.7		93.2	31.5
1) Wet Season	4,320	2.50	10,200	110.2	19,500	84.2	25.9
2) Dry Season	460	3.10	10,200	14.5	19,500	9.0	5.6
2. Corn	230	2.50	8,700	5.0	10,500	2.4	2.6
3. Tobacco	100	1.00	22,100	2.2	12,500	1.3	1.0
4. Eggplant	120	6.00	9,100	6.6	43,600	5.2	1.3
5. Beans (Mungo)	100	1.00	20,100	2.0	8,400	0.8	1.2
6. Peanuts	100	0.70	15,600	1.1	9,500	1.0	0.1
7. Sweet Potatoes	30	5.00	4,200	0.6	11,000	0.3	0.3
Total	5,460			142.2		104.2	38.0
II. With Project Condition							
1. Paddy	8,180			396.3		189.0	207.4
1) Wet Season	4,090	4.50	10,200	187.7	23,100	94.5	93.3
2) Dry Season	4,090	5.00	10,200	208.6	23,100	94.5	114.1
2. Corn	230	3.75	8,700	7.5	10,700	2.5	5.0
3. Tobacco	120	2.00	22,100	5.3	21,200	2.5	2.8
4. Eggplant	860	13.00	9,100	101.7	62,300	53.6	48.2
5. Beans (Mungo)	600	1.50	20,100	18.1	12,000	7.2	10.9
6. Peanuts	240	2.00	15,600	7.5	13,600	3.3	4.2
7. Sweet Potatoes	0	-	-	-	-	-	-
Total	10,230			536.4		258.0	278.4
III. Benefit (Million Pesos/Year)							240.5
IV. Benefit in 2020 (Milloion Pesos/Year)*1							265.9

Note: *1 It was assumed to grow at 0.53% per annum, which was calculated applying the growth of rice value between 2001 and 2020.

Table 10.2.6 Irrigation Benefit in Alcala-Amulung West Project: Phase-3

Item	Harvested Area (ha)	Yield (ton/ha)	Farm Price (Pesos/ton)	Gross Income (Million Pesos)	Production Cost (Pesos/ha)	Total Cost (Million Pesos)	Net Returns (Million Pesos)
I. Without Project Condition							
1. Paddy	190			4.9		3.7	1.2
1) Wet Season	180	2.50	10,200	4.6	19,500	3.5	1.1
2) Dry Season	10	3.10	10,200	0.3	19,500	0.2	0.1
2. Corn	4,520	2.00	8,700	78.6	10,500	47.5	31.2
3. Tobacco	0	1.00	22,100	0.0	12,500	0.0	0.0
4. Eggplant	120	6.00	9,100	6.6	43,600	5.2	1.3
5. Beans (Mungo)	100	1.00	20,100	2.0	8,400	0.8	1.2
6. Peanuts	80	0.70	15,600	0.9	9,500	0.8	0.1
7. Sweet Potatoes	0	5.00	4,200	0.0	11,000	0.0	0.0
Total	5,010			93.0		58.0	35.0
II. With Project Condition							
1. Paddy	5,940			287.8		137.2	150.6
1) Wet Season	2,970	4.50	10,200	136.3	23,100	68.6	67.7
2) Dry Season	2,970	5.00	10,200	151.5	23,100	68.6	82.9
2. Corn	920	3.75	8,700	30.0	10,700	9.8	20.2
3. Tobacco	80	2.00	22,100	3.5	21,200	1.7	1.8
4. Eggplant	120	13.00	9,100	14.2	62,300	7.5	6.7
5. Beans (Mungo)	200	1.50	20,100	6.0	12,000	2.4	3.6
6. Peanuts	160	2.00	15,600	5.0	13,600	2.2	2.8
7. Sweet Potatoes	0	-	-	-	-	-	-
Total	7,420			346.6		160.8	185.8
III. Benefit (Million Pesos/Year)							150.8
IV. Benefit in 2020 (Milloion Pesos/Year)*1							166.7

Note: *1 It was assumed to grow at 0.53% per annum, which was calculated applying the growth of rice value between 2001 and 2020.

Table 10.4.1 Economic Cost and Benefit Stream of Alcala-Amulung-West Irrigation Project under Present Conditions: Phase 1

(Unit: Million Pesos)

Year	Cost			Benefit			Balance		
	Const.	Replacemen O/M	Total	Benefit	Negative	Total			
0	2001			0.0			0.0	0.0	
1	2002	40.3		40.3		0.0	0.0	-40.3	
2	2003	39.7		39.7		-1.0	-1.0	-40.6	
3	2004	283.5		283.5		-2.9	-2.9	-286.4	
4	2005	352.5	8.3	360.7	39.1	-5.7	33.3	-327.4	
5	2006	209.3	16.3	225.6	117.7	-7.4	110.2	-115.3	
6	2007	193.6	21.1	214.7	125.2	-9.0	116.3	-98.4	
7	2008		25.5	25.5	145.3	-9.0	136.4	110.9	
8	2009		25.5	25.5	193.4	-9.0	184.4	158.9	
9	2010		25.5	25.5	217.5	-9.0	208.5	183.0	
10	2011		25.5	25.5	241.5	-9.0	232.5	207.0	
11	2012		25.5	25.5	265.6	-9.0	256.6	231.1	
12	2013		25.5	25.5	265.6	-9.0	256.6	231.1	
13	2014		25.5	25.5	265.6	-9.0	256.6	231.1	
14	2015		25.5	25.5	265.6	-9.0	256.6	231.1	
15	2016		25.5	25.5	265.6	-9.0	256.6	231.1	
16	2017		25.5	25.5	265.6	-9.0	256.6	231.1	
17	2018		25.5	25.5	265.6	-9.0	256.6	231.1	
18	2019		25.5	25.5	265.6	-9.0	256.6	231.1	
19	2020		25.5	25.5	265.6	-9.0	256.6	231.1	
20	2021		25.5	25.5	265.6	-9.0	256.6	231.1	
21	2022		70.9	25.5	96.4	265.6	-9.0	256.6	160.1
22	2023		25.5	25.5	265.6	-9.0	256.6	231.1	
23	2024		25.5	25.5	265.6	-9.0	256.6	231.1	
24	2025		25.5	25.5	265.6	-9.0	256.6	231.1	
25	2026		25.5	25.5	265.6	-9.0	256.6	231.1	
26	2027		25.5	25.5	265.6	-9.0	256.6	231.1	
27	2028		25.5	25.5	265.6	-9.0	256.6	231.1	
28	2029		25.5	25.5	265.6	-9.0	256.6	231.1	
29	2030		25.5	25.5	265.6	-9.0	256.6	231.1	
30	2031		25.5	25.5	265.6	-9.0	256.6	231.1	
31	2032		25.5	25.5	265.6	-9.0	256.6	231.1	
32	2033		25.5	25.5	265.6	-9.0	256.6	231.1	
33	2034		25.5	25.5	265.6	-9.0	256.6	231.1	
34	2035		25.5	25.5	265.6	-9.0	256.6	231.1	
35	2036		25.5	25.5	265.6	-9.0	256.6	231.1	
36	2037		70.9	25.5	96.4	265.6	-9.0	256.6	160.1
37	2038		25.5	25.5	265.6	-9.0	256.6	231.1	
38	2039		25.5	25.5	265.6	-9.0	256.6	231.1	
39	2040		25.5	25.5	265.6	-9.0	256.6	231.1	
40	2041		25.5	25.5	265.6	-9.0	256.6	231.1	
41	2042		25.5	25.5	265.6	-9.0	256.6	231.1	
42	2043		25.5	25.5	265.6	-9.0	256.6	231.1	
43	2044		25.5	25.5	265.6	-9.0	256.6	231.1	
44	2045		25.5	25.5	265.6	-9.0	256.6	231.1	
45	2046		25.5	25.5	265.6	-9.0	256.6	231.1	
46	2047		25.5	25.5	265.6	-9.0	256.6	231.1	
47	2048		25.5	25.5	265.6	-9.0	256.6	231.1	
48	2049		25.5	25.5	265.6	-9.0	256.6	231.1	
49	2050		25.5	25.5	265.6	-9.0	256.6	231.1	
50	2051		25.5	25.5	265.6	-9.0	256.6	231.1	
51	2052		70.9	25.5	96.4	265.6	-9.0	256.6	160.1
52	2053		25.5	25.5	265.6	-9.0	256.6	231.1	
53	2054		25.5	25.5	265.6	-9.0	256.6	231.1	
54	2055		25.5	25.5	265.6	-9.0	256.6	231.1	
55	2056		25.5	25.5	265.6	-9.0	256.6	231.1	
56	2057		25.5	25.5	265.6	-9.0	256.6	231.1	
	B/C:	1.04		NPV:	27.4	Million Pesos		EIRR:	15.6%

Table 10.4.2 Economic Cost and Benefit Stream of Alcala-Amulung-West Irrigation Project under Present Conditions: Phase 3 (Unit: Million Pesos)

Year	Cost			Benefit			Balance
	Const.	Replacemen O/M	Total	Benefit	Negative	Total	
0	2001	0.0	0.0	0.0	0.0	0.0	0.0
1	2002	40.3	0.0	40.3	0.0	0.0	-40.3
2	2003	39.7	0.0	39.7	0.0	-1.0	-40.6
3	2004	283.5	0.0	283.5	0.0	-2.9	-286.4
4	2005	352.5	8.3	360.7	39.1	-5.7	-327.4
5	2006	209.3	16.3	225.6	117.7	-7.4	-115.3
6	2007	193.6	21.1	214.7	125.2	-9.0	-98.4
7	2008	0.0	25.5	25.5	145.3	-9.0	110.9
8	2009	0.0	25.5	25.5	193.4	-9.0	158.9
9	2010	0.0	25.5	25.5	217.5	-9.0	183.0
10	2011	75.8	25.5	101.3	241.5	-10.6	129.6
11	2012	163.2	25.5	188.7	265.6	-14.0	62.8
12	2013	219.6	31.5	251.1	290.0	-18.9	20.0
13	2014	162.3	37.3	199.6	342.4	-21.8	121.0
14	2015	146.3	40.8	187.1	347.2	-24.5	135.5
15	2016		44.0	44.0	359.8	-24.5	291.2
16	2017		44.0	44.0	389.9	-24.5	321.4
17	2018		44.0	44.0	405.0	-24.5	336.5
18	2019		44.0	44.0	420.1	-24.5	351.5
19	2020		44.0	44.0	435.1	-24.5	366.6
20	2021		44.0	44.0	435.1	-24.5	366.6
21	2022	70.9	44.0	114.9	435.1	-24.5	295.7
22	2023		44.0	44.0	435.1	-24.5	366.6
23	2024		44.0	44.0	435.1	-24.5	366.6
24	2025		44.0	44.0	435.1	-24.5	366.6
25	2026		44.0	44.0	435.1	-24.5	366.6
26	2027		44.0	44.0	435.1	-24.5	366.6
27	2028		44.0	44.0	435.1	-24.5	366.6
28	2029		44.0	44.0	435.1	-24.5	366.6
29	2030	121.8	44.0	165.8	435.1	-24.5	244.8
30	2031		44.0	44.0	435.1	-24.5	366.6
31	2032		44.0	44.0	435.1	-24.5	366.6
32	2033		44.0	44.0	435.1	-24.5	366.6
33	2034		44.0	44.0	435.1	-24.5	366.6
34	2035		44.0	44.0	435.1	-24.5	366.6
35	2036		44.0	44.0	435.1	-24.5	366.6
36	2037	70.9	44.0	114.9	435.1	-24.5	295.7
37	2038		44.0	44.0	435.1	-24.5	366.6
38	2039		44.0	44.0	435.1	-24.5	366.6
39	2040		44.0	44.0	435.1	-24.5	366.6
40	2041		44.0	44.0	435.1	-24.5	366.6
:	:		:	:	:	:	:
:	:		:	:	:	:	:
51	2052	70.9	44.0	114.9	435.1	-24.5	295.7
52	2053		44.0	44.0	435.1	-24.5	366.6
53	2054		44.0	44.0	435.1	-24.5	366.6
54	2055		44.0	44.0	435.1	-24.5	366.6
55	2056		44.0	44.0	435.1	-24.5	366.6
56	2057		44.0	44.0	435.1	-24.5	366.6
57	2058		44.0	44.0	435.1	-24.5	366.6
58	2059		44.0	44.0	435.1	-24.5	366.6
59	2060	121.8	44.0	165.8	435.1	-24.5	244.8
60	2061		44.0	44.0	435.1	-24.5	366.6
61	2062		44.0	44.0	435.1	-24.5	366.6
62	2063		44.0	44.0	435.1	-24.5	366.6
63	2064		44.0	44.0	435.1	-24.5	366.6
64	2065		44.0	44.0	435.1	-24.5	366.6
	B/C:	1.01	NPV:	10.6	Million Pesos	EIRR:	15.2%

Table 10.4.3 Economic Cost and Benefit Stream of Alcala-Amulung-West Irrigation Project under Future Conditions: Phase 1

(Unit: Million Pesos)

Year	Cost			Benefit			Balance
	Const.	Replacemen O/M	Total	Benefit	Negative	Total	
0	2001			0.0			0.0
1	2002	40.3		40.3		0.0	-40.3
2	2003	39.7		39.7		-1.0	-40.7
3	2004	283.5		283.5		-3.1	-286.5
4	2005	352.5	8.3	360.7	39.9	-6.1	-326.9
5	2006	209.3	16.3	225.6	120.1	-7.7	-113.1
6	2007	193.6	21.1	214.7	128.5	-9.3	-95.5
7	2008		25.5	25.5	149.9	-9.3	115.0
8	2009		25.5	25.5	200.7	-9.4	165.8
9	2010		25.5	25.5	226.8	-9.4	191.9
10	2011		25.5	25.5	253.3	-9.5	218.3
11	2012		25.5	25.5	279.9	-9.5	244.9
12	2013		25.5	25.5	281.3	-9.6	246.2
13	2014		25.5	25.5	282.7	-9.6	247.6
14	2015		25.5	25.5	284.0	-9.7	248.9
15	2016		25.5	25.5	285.4	-9.7	250.2
16	2017		25.5	25.5	286.8	-9.8	251.5
17	2018		25.5	25.5	288.2	-9.8	252.8
18	2019		25.5	25.5	289.6	-9.9	254.2
19	2020		25.5	25.5	291.0	-9.9	255.5
20	2021		25.5	25.5	291.0	-9.9	255.5
21	2022		70.9	25.5	96.4	291.0	184.6
22	2023		25.5	25.5	291.0	-9.9	255.5
23	2024		25.5	25.5	291.0	-9.9	255.5
24	2025		25.5	25.5	291.0	-9.9	255.5
25	2026		25.5	25.5	291.0	-9.9	255.5
26	2027		25.5	25.5	291.0	-9.9	255.5
27	2028		25.5	25.5	291.0	-9.9	255.5
28	2029		25.5	25.5	291.0	-9.9	255.5
29	2030		25.5	25.5	291.0	-9.9	255.5
30	2031		25.5	25.5	291.0	-9.9	255.5
31	2032		25.5	25.5	291.0	-9.9	255.5
32	2033		25.5	25.5	291.0	-9.9	255.5
33	2034		25.5	25.5	291.0	-9.9	255.5
34	2035		25.5	25.5	291.0	-9.9	255.5
35	2036		25.5	25.5	291.0	-9.9	255.5
36	2037		70.9	25.5	96.4	291.0	184.6
37	2038		25.5	25.5	291.0	-9.9	255.5
38	2039		25.5	25.5	291.0	-9.9	255.5
39	2040		25.5	25.5	291.0	-9.9	255.5
40	2041		25.5	25.5	291.0	-9.9	255.5
41	2042		25.5	25.5	291.0	-9.9	255.5
42	2043		25.5	25.5	291.0	-9.9	255.5
43	2044		25.5	25.5	291.0	-9.9	255.5
44	2045		25.5	25.5	291.0	-9.9	255.5
45	2046		25.5	25.5	291.0	-9.9	255.5
46	2047		25.5	25.5	291.0	-9.9	255.5
47	2048		25.5	25.5	291.0	-9.9	255.5
48	2049		25.5	25.5	291.0	-9.9	255.5
49	2050		25.5	25.5	291.0	-9.9	255.5
50	2051		25.5	25.5	291.0	-9.9	255.5
51	2052		70.9	25.5	96.4	291.0	184.6
52	2053		25.5	25.5	291.0	-9.9	255.5
53	2054		25.5	25.5	291.0	-9.9	255.5
54	2055		25.5	25.5	291.0	-9.9	255.5
55	2056		25.5	25.5	291.0	-9.9	255.5
56	2057		25.5	25.5	291.0	-9.9	255.5
	B/C:	1.10	NPV:	65.9	Million Pesos	EIRR:	16.4%

Table 10.4.4 Economic Cost and Benefit Stream of Alcala-Amulung-West Irrigation Project under Future Conditions: Phase 3

(Unit: Million Pesos)

Year	Cost				Benefit			Balance	
	Const.	Replacemen	O/M	Total	Benefit	Negative	Total		
0	2001	0.0		0.0	0.0		0.0	0.0	
1	2002	40.3		0.0	40.3		0.0	-40.3	
2	2003	39.7		0.0	39.7		-1.0	-40.7	
3	2004	283.5		0.0	283.5		-3.1	-286.5	
4	2005	352.5		8.3	360.7	39.9	-6.1	-326.9	
5	2006	209.3		16.3	225.6	120.1	-7.7	-113.1	
6	2007	193.6		21.1	214.7	128.5	-9.3	-95.5	
7	2008	0.0		25.5	25.5	149.9	-9.3	115.0	
8	2009	0.0		25.5	25.5	200.7	-9.4	165.8	
9	2010	0.0		25.5	25.5	226.8	-9.4	191.9	
10	2011	75.8		25.5	101.3	253.3	-11.2	140.8	
11	2012	163.2		25.5	188.7	279.9	-14.9	76.4	
12	2013	219.6		31.5	251.1	307.4	-20.2	36.1	
13	2014	162.3		37.3	199.6	363.6	-23.4	140.7	
14	2015	146.3		40.8	187.1	370.4	-26.4	156.9	
15	2016			44.0	44.0	385.8	-26.5	315.3	
16	2017			44.0	44.0	420.4	-26.7	349.8	
17	2018			44.0	44.0	438.9	-26.8	368.1	
18	2019			44.0	44.0	457.6	-27.0	386.6	
19	2020			44.0	44.0	476.5	-27.1	405.4	
20	2021			44.0	44.0	476.5	-27.1	405.4	
21	2022		70.9	44.0	114.9	476.5	-27.1	334.4	
22	2023			44.0	44.0	476.5	-27.1	405.4	
23	2024			44.0	44.0	476.5	-27.1	405.4	
24	2025			44.0	44.0	476.5	-27.1	405.4	
25	2026			44.0	44.0	476.5	-27.1	405.4	
26	2027			44.0	44.0	476.5	-27.1	405.4	
27	2028			44.0	44.0	476.5	-27.1	405.4	
28	2029			44.0	44.0	476.5	-27.1	405.4	
29	2030		121.8	44.0	165.8	476.5	-27.1	283.6	
30	2031			44.0	44.0	476.5	-27.1	405.4	
31	2032			44.0	44.0	476.5	-27.1	405.4	
32	2033			44.0	44.0	476.5	-27.1	405.4	
33	2034			44.0	44.0	476.5	-27.1	405.4	
34	2035			44.0	44.0	476.5	-27.1	405.4	
35	2036			44.0	44.0	476.5	-27.1	405.4	
36	2037		70.9	44.0	114.9	476.5	-27.1	334.4	
37	2038			44.0	44.0	476.5	-27.1	405.4	
38	2039			44.0	44.0	476.5	-27.1	405.4	
39	2040			44.0	44.0	476.5	-27.1	405.4	
40	2041			44.0	44.0	476.5	-27.1	405.4	
:	:			:	:	:	:	:	
:	:			:	:	:	:	:	
51	2052		70.9	44.0	114.9	476.5	-27.1	334.4	
52	2053			44.0	44.0	476.5	-27.1	405.4	
53	2054			44.0	44.0	476.5	-27.1	405.4	
54	2055			44.0	44.0	476.5	-27.1	405.4	
55	2056			44.0	44.0	476.5	-27.1	405.4	
56	2057			44.0	44.0	476.5	-27.1	405.4	
57	2058			44.0	44.0	476.5	-27.1	405.4	
58	2059			44.0	44.0	476.5	-27.1	405.4	
59	2060		121.8	44.0	165.8	476.5	-27.1	283.6	
60	2061			44.0	44.0	476.5	-27.1	405.4	
61	2062			44.0	44.0	476.5	-27.1	405.4	
62	2063			44.0	44.0	476.5	-27.1	405.4	
63	2064			44.0	44.0	476.5	-27.1	405.4	
64	2065			44.0	44.0	476.5	-27.1	405.4	
B/C:		1.08		NPV:	59.6	Million Pesos		EIRR:	16.1%