3. POTENTIAL IRRIGABLE AREA

3.1 General

In order to select potential irrigable areas including the existing irrigation areas in the Panay river basin of 2,182 km^2, various data on complex natural resources and interrelated land data have been collected and analyzed. Systematic appraisal for lands, soils, topography and so on has been conducted as a basic study in determination of relative degree of land suitability. Lands selected as potential irrigable area should be suitable for crop production under irrigation and drainage improvements.

3.2 Factors Considered in Selection

(1) Land, Soils and Topography

Land suitability classification related to soils, topography and drainage characteristics has been carried out referring to the soil map, topographic maps (1/10,000 and 1/50,000) and aerial photos (1/20,000), and has revealed the grade of irrigation suitability.

Typical soil characteristics are classified on texture, structure, depth, stoniness, horizon arrangement and layering, EC, pH, infiltration rate, moisture characteristics and so on.

Macro and micro topographic conditions are evaluated with respect to degree and direction of slope based on the available topographic maps. Irrigability relating to location and topography is a main point in this context.

Land suitability classification is firstly made into two orders, namely, suitable land and not suitable land. The suitable land is sub-classified into Very Good Land, Good Land and Moderately Good Land, according to suitable degree. The land suitability classification in the river basin is summarized as follows:

Land Suitability	Area (ha)
A: Very Good Land	29,400
B: Good Land	6,900
C: Moderately Good Land	15,100
D: Fairly Good Land	81,200
M: Steep Land, very severely eroded	56,700
X: Marshy and Swampy Land	23,100
Y: Very Hilly of Mountainous Land	5,800
Total	218,200

(2) Present Land Use

The present land use is categorized based on the available topographic map (1/10,000 and 1/50,000) and aerial photos (1/20,000).

The present land use is the major factor for selection of potential irrigable area in order to minimize the investment cost for irrigation development. To quickly reap the economic return after implementation of irrigation project, the cultivated land, especially existing paddy field, should be selected within the suitable range of land suitability classification with provision of irrigation and drainage improvements.

The present land use in the river basin is summarized in the following table:

Land Use	Area (ha)
Paddy field	40,960
Upland field	48,530
Orchard	7,740
Grass land	8,410
Shrub	86,730
Forest	11,880
Swamp	1,850
Fishpond	10,560
Others (build-up area, etc.)	1,540
Total	218,200

(3) Water Resources

In the Panay river basin, besides the Panay river, there are three main tributaries such as the Badbaran, Mambusao and Maayon, which have a considerable discharge throughout the year.

Irrigation development depends on the available water resources endowed nearby development area. In this context, potential irrigable areas should be selected along the Panay river and other three main tributaries. Monthly mean discharges of the Panay river and other tributaries are shown in Table VII.3-1.

3.3 Potential Irrigable Area

Following the results of the land suitability classification, present land use and other factors, potential irrigable areas are delineated in the river basin as shown in Fig. VII.3-1 In selection of the potential irrigable area, however, the areas dissected by small streams into small patches are abandoned in this Study.

The potential irrigable areas delineated and existing irrigation areas within the potential areas are summarized in the following table:

	Location	Potential Area (ha)	Existing Irrigation Area (ha)	(%)
(1)	Tapaz	500	190	38
(2)	Dumalag	500	250	50
(3)	Dao-Panitan	1,500	790	53
(4)	Panitan-Panay	3,400	1,590	47
(5)	Lemery	700	250	36
(6)	Dumarao	550	90	16
(7)	Cuartero	650	30	5
(8)	Jagnaya (Jamindan)	400	90	23
(9)	Mambusao	2,500	1,640	66
(10)	Ilas (Dao)	1,000	720	72
	Total	11,700	5,640	48

4. FORMULATION OF DEVELOPMENT PLAN

4.1 Development Concept

4.1.1 Basic Concept for Development

The basic concept for agricultural and irrigation development in the Panay river basin is set forth to increase rice production by increasing unit yield of paddy, productive and efficient use of land and expansion of irrigated land based on the following consideration:

(a) Government development plan: Following the Five-Year Philippine Development Plan (the Five-Year Plan) for 1978 - 1982, the Five-Year Plan for 1983 - 1987 was issued by the National Economic and Development Authority (NEDA). In order to achieve the national goals of sustainable economic growth, equitable distribution of the fruits of development and total human development, the following overall targets were established with respect to agricultural sector:

- To attain the target of about 5% increase in the Gross Domestic Product (GDP) from 1983 to 1987, increase in agricultural sector will form about 3.5 billion pesos or 70% of increase of the GDP. Annual increase in agricultural sector is expected to be 3.4%.

- In Region VI, in order to increase the Gross Regional Domestic Product (GRDP) by about 10% from 1983 to 1987, increase in agricultural sector is expected to account for 77% of total increase of the GRDP and about 660 million pesos. Annual increase rate is to be about 5%.

- To promote self-sufficiency in rice and other food production.

(b) Rice marketing to outer islands: Region VI, especially the Panay island, is one of the rice supply bases to the Luzon and other islands such as the Negros, Mindoro and Cebu, in which industrial crops of sugar cane, etc. are mainly produced. The Panay island

is endowed with natural and physical conditions suitable for rice cultivation. While, the Negros and Mindoro islands will further developed for industrial crop production in the future. In addition, the population of Metro Manila will also increase with high growth rate year by year. These facts will result in increase of demand of rice in outer islands and the Panay island will be further expected to keep the role of rice supply center.

(c) Increase of farmer's income: The farmers in the Panay river basin get their incomes from farming activities, mainly from rice cultivation. Farmer's income is, however, low due to low productivity. Net reserves of the farmers are negligibly small. The results of farmer's interview survey indicate that they are eager to produce paddy whenever provision of available irrigation water will be permitted.

(d) Profitability of rice: The ceiling price and floor price of rice are set by the Government and the price of rice is stabilized by the National Food Authority (NFA). It is expected that stabilization of price will continue in the future. On the contrary, price of common crops other than rice is not stable. Farmers also intend to cultivate rice if irrigation water is available, since rice is one of the highest crops in profitability.

(e) Increase of employment opportunity: About 45% of the total gainful workers of more than 15 years old in the river basin seems not to have gainful jobs. Introduction of intensive irrigation farming will be expected to reduce unemployment of the said people.

4.1.2 Strategy for Development

Taking into consideration the basic concept for development, strategy for agricultural and irrigation development are formulated for the purpose of increase of rice production as follows:

(a) To introduce improved irrigation farming practices.

(b) To provide appropriate agricultural extension and supporting services.

(c) To develop the existing irrigator's group in the national irrigation system into functional and viable organization.

(d) To provide irrigation facilities to supply stable perennial irrigation water to the potential irrigable areas selected.

(e) To improve and rehabilitate the existing irrigation systems to raise productivity and cropping intensity.

(f) To integrate the existing PIS dispersing along the Panay river and other tributaries to avoid complicated water supply system and to save high operation and maintenance cost.

(g) To provide adequate drainage facilities to mitigate a considerable damage due to maldrainage and flood in lowland area.

(h) To introduce proper operation and maintenance system as well as water management system after completion of irrigation schemes.

4.2 Irrigation Development Area

The potential irrigable areas delineated in Chapter 3 will be developed as irrigation scheme. Taking into consideration their areal extents, present irrigation conditions, availability of water and possible intake site in the areas, each potential area is classified into NIS, CIS, or PIS as summarized below.

	Location	Potential Area (ha)	Scheme Area (ha)	Classification of Development
(1)	Tapaz	500	300	CIS
(2)	Dumalag	500	300	CIS
(3)	Dao-Panitan	1,500	-	PIS
(4)	Panitan-Panay	3,400	3,250	NIS
(5)	Lemery	700	300	CIS
(6)	Dumarao	550	550	CIS
(7)	Cuartero	650	650	CIS
(8)	Jagnaya (Jamindan)	400	150	CIS
(9)	Mambusao	2,500	2,145	NIS
(10)	Ilas (Dao)	1,000	1,000	CIS

(1) NIS Development Area

There are two potential areas for development of NIS: the Panitan-Panay area and the Mambusao area. Their general features are described hereunder.

(a) Panitan-Panay area: About 3,400 ha of potential irrigable area is located in the flood plain extending along the Panay river mainly in the Panitan and Panay Municipalities. About 150 ha of paddy field to be occupied by flood control works will be elminated and the proposed irrigation area will be about 3,250 ha in total. This area includes the existing irrigation area of about 1,600 ha covered by PIS dispersing in the area. The existing PIS areas suffer from high operation and maintenance costs, improper distribution of irrigation water and salinity problem due to irrigation of brakish water especially in the paddy field located near the seashore. In order to solve these problems, PIS will be integrated into one irrigation system. Increase of irrigation area will be also aimed at with provision of irrigation water for rainfed paddy field. Intake facility for this proposed area will be constructed near the bridge over the Panay river near Panitan Municipality. Taking into consideration the topographic condition of the intake site, alternative study will be made between gravity system and pump system for selection of

intake system. Irrigation and drainage system including inspection road will be newly provided. Irrigation system includes main canal, lateral, main farm ditch and supplementary farm ditch covering up to 15 to 10 ha.

(b) Mambusao area: The existing Mambusao RIS area of 1,440 ha has potentiality for extension of irrigation area up to about 2,500 ha. The present irrigation area in the Mambusao RIS is 1,440 ha and 780 ha during the wet and dry seasons respectively. During the wet season, paddy fields extending over the lowland area suffer from flood and sometimes incur crop damages. While, during the dry season, due to improper maintenance of main and lateral canals and shortage of terminal facilities such as farm ditch, some paddy fields suffer from drought damages expecially in downstream area. Aside from the existing irrigation area, there exist about 500 to 700 ha of potential irrigation area in high elevated land located in the southern part of the existing irrigation area. In order to irrigate whole potential area, a small pump will be required to pump up irrigation water from the existing Lateral A. While, in case of gravity system, the extension area will be limited to about 500 ha. In comparison with these conditions, the gravity system will be preferably selected. The proposed extension system will also integrate the downstream area of about 200 ha of the Balucuan CIS. In addition to this extension area, the existing canal system can extend its commanding area with provision of improvement and rehabilitation. The total proposed irrigation area will be about 2,145 ha. The main development works are improvement and rehabilitation of the existing intake facility, main and lateral canals and new construction of high elevated canal and on-farm facilities as well as drainage facilities.

(2) CIS Development Area

There are several potential areas for development of CIS having an irrigation area of less than 1,000 ha. Their general features are mentioned overleaf.

(a) Tapaz area: The potential area of about 500 ha extending around the Tapaz town is dissected by small stream into small patches. Paddy field of about 300 ha will be developed as CIS using water from the Marino river, a tributary of the Panay river.

(b) Dumalag area: The potential area of about 500 ha extends over both banks of the Panay river immediately upstream from the junction with the Badbaran river. Extention and rehabilitation of the existing CIS will be made with about 300 ha in the left bank area. While, in the right bank area, PIS will be developed using water from the Panay river.

(c) Lemery area: Most of the high potential areas have been developed as CIS. Rehabilitation of the existing CIS of about 300 ha is a preferential work in this area. Since other potential areas are rather undulated and dissected by small streams, CIS development is not recommendable.

(d) Dumarao area: There is no favorable intake site of gravity system for the potential areas of about 550 ha extending over both banks of the Badbaran river. By means of pumps, the area can be irrigated.

(e) Cuartero area: For providing irrigation water to the potential area of about 650 ha, diversion dam will be constructed on the Badbaran river at 1 km upstream from the junction with the Panay river. The crest length of weir is, however, to be 70 m and the construction of weir is very costly.

(f) Jagnaya area: Potential areas disperse into small patches. Rehabilitation and extention works of the existing Cala Agus CIS will be made with a scale of about 150 ha in this area.

(g) Ilas area: The existing Ilas CIS has 650 ha of irrigation area and also has a potential to expand its area up to about 800 ha as far as water of the Maindang river is available. While, the existing Sinabsaban CIS locating on the right bank of Ilas river has only 40 ha of irrigation area at present. This system will be also rehabilitated and expanded up to about 200 ha of irrigation area.

(3) PIS Development Area

The potential areas in the Dao - Panitan area extending over the flood plain along the Panay river are dissected by small streams and disperse into small patches. These areas will be developed as PIS considering the future flood control plan.

4.3 Irrigation Water Requirement

4.3.1 General

This Section describes the method for determining the unit irrigation diversion requirement for each irrigation scheme, especially for NIS, proposed in the Panay river basin. The unit irrigation diversion requirements are calculated on a monthly basis for 7-year period from 1976 to 1982 for the Mambusao area and for 34-year period from 1950 to 1983 for the Panitan - Panay area, in accordance with availability of monthly rainfall data.

Calculation is made based on the proposed cropping calendar of each crop as shown in Fig. VII.4-1. For the Mambusao area, the unit irrigation diversion requirements for the alternative cropping calendar, especially for the wet season paddy, are calculated in order to examine the development scale considering availability of water of the Mambusao river. Cropping calendar of Case-1 is worked out based on the present cropping calendar. The start of paddy cropping in Case-2 is delayed by a half month from that of Case-1.

4.3.2 Crop Water Requirement

Crop water requirement is defined as amount of water needed to meet consumptive demands of crop for optimum growth from seeding until havesting. This requirement includes water necessary for nursery, land soaking, puddling and crop growth after transplanting. This can be expressed in the following equation:

$$CWR = LP + FC \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4.1)$$

where, CWR: crop water requirement (mm)

LP: for paddy; land soaking and puddling requirement including nursery water requirement (mm)
for upland crop; land preparation requirement (mm)

FC: field crop requirement (mm)

Terms of the above equation (4.1) are derived through the procedure mentioned below. The calculated results of crop water requirements are shown in Table VII.4-1.

(1) Field Crop Requirement

Field crop requirement consists of water consumed by crops during the period from seeding or transplanting until harvesting and percolation loss in the paddy field. It is expressed in the following equation:

$$FC = (ETo \cdot kc + P) \cdot Kf \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4.2)$$

where, FC: field crop requirement (mm)

ETo: reference crop evapotranspiration (mm)

kc: crop coefficient

P: percolation loss (mm)

Kf: crop area factor in main field determined by cropping calendar

(a) Reference crop evapotranspiration

Reference crop evapotranspiration may be correlated with recorded evaporation data or derived by empirical methods. However, since sufficient evaporation data are not available in the river basin, empirical method based on the meteorological data is used for calculating the reference crop evapotranspiration. Out of several empirical and theoretical methods, the modified Penman method, which is introduced in the "Crop Water Requirement" published by FAO in 1977, is selected for this study.

The meteorological data recorded at PAGASA Station in Roxas City are used in calculation of reference crop evapotranspiration for the scheme areas proposed in the river basin. The meteorological data and the calculation are shown in Table VII.4-2. The summary is shown in the following table.

(Unit: mm)

Month	Monthly	Daily
Jan.	112	3.6
Feb.	132	4.7
Mar.	183	5.9
Apr.	192	6.4
May	177	5.7
Jun.	156	5.2
Jul.	146	4.7
Aug.	130	4.2
Sep.	129	4.3
Oct.	112	3.6
Nov.	126	4.2
Dec.	112	3.6
Total or Average	1,707	4.7

(b) Crop coefficient

Relation between reference crop evapotranspiration and water consumed by crops is expressed in terms of crop coefficient. Crop coefficient of each crop varies with their growing stages. In this study, it is determined based on the FAO standard. Crop coefficient curves for each crop are shown in Fig. VII.4-2.

(c) Percolation

Percolation is affected by soil textures as well as groundwater table in paddy fields. The rate of percolation is considered to be constant throughout the year, though the slight change in groundwater condition may occur in a long range. The soil texture in the scheme area is generally clayey. The percolation rate is determined to be 1.0 mm/day referring to the percolation rate applied in the Mambusao RIS.

(2) Land Preparation Requirement

Water required for land preparation is considered for puddling works and nursery in paddy cropping and for pre-irrigation in upland cropping.

(a) Land preparation requirement for paddy

Amount of water required for land soaking and puddling in paddy field is:

$$LP = [SS + tp \cdot (EP+P+D] \cdot (tm/tp) \cdot Kl \quad \ldots\ldots\ldots\ldots \quad (4.3)$$

where,
- LP: land preparation requirement (mm)
- SS: water required for land soaking (mm), 140 mm for wet and dry seasons
- tp: number of days for land preparation (day), 25 days
- EP: evaporation from muddy or shallow basin of water (mm), 4.0 mm/day
- P: percolation rate (mm/day), 1.0 mm/day
- D: depth of ponding for transplanting (mm), 50 mm
- Kl: area factor of land preparation
- tm: number of day of month (day), 30 days

From the above equation (4.3), land preparation requirement per unit area is calculated at 315 mm.

(b) Land preparation requirement for upland crop

Amount of water required for pre-irrigation in upland cropping is assumed to be 60 mm on an average.

4.3.3 Crop Irrigation Requirement

Crop irrigation requirement is defined as amount of water required for crop growth exclusive of effective rainfall. This requirement is expressed in the following equation:

$$CIR = CWR - ER \cdot Kt \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4.4)$$

where, CIR: crop irrigation requirement (mm)
CWR: crop water requirement (mm)
ER: effective rainfall (mm)
Kt: total crop area factor

Daily and monthly rainfall data have been collected from the various meteorological stations in and around the scheme areas as presented in Sectoral Report II. Among them, the average monthly rainfall recorded from 1976 to 1982 in three stations of NIA Mambusao Office are used for estimation of effective rainfall for the Mambusao area. For the Panitan-Panay area, the monthly rainfall recorded from 1950 to 1983 at PAGASA Station in Roxas City are adopted.

Effective rainfall depends on several factors such as amount and intensity of rainfall, permeability and water holding capacity of soils, form of field plot, slope of land, irrigation method and vegetative characteristics. In this study, however, relation between monthly rainfall and monthly effective rainfall is adopted for estimating effective rainfall. According to the data on percentage of effective rainfall to monthly rainfall used in the national irrigation systems in the Philippines, their percentages range from 40 to 80% for the wet season paddy and from 50 to 90% for the dry season paddy. In order to establish the relation, the actual data observed in the other Southeast Asia countries are also referred to. The relation assumed is shown in Fig. VII.4-3. The estimated results of effective rainfall are shown in Tables VII.4-5 to VII.4-7.

4.3.4 Farm Irrigation Requirement

Farm irrigation requirement is defined as the sum of crop irrigation requirement and allowance for farm distribution losses within a farm unit or rotation irrigation unit. The farm irrigation requirement can be expressed as:

$$FIR = CIR/Ef \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4.5)$$

where, FIR: farm irrigation requirement (mm)
CIR: crop irrigation requirement (mm)
Ef: farm irrigation efficiency

The farm distribution losses consist of mainly percolation loss for upland crop and seepage losses through dike of paddy field on the farm level. Very little experiment data are available for estimation of farm efficiency in the Philippines. The average farm efficiency for paddy cultivation is assumed to be 85% and that for upland crop cultivation is assumed to be 70%.

4.3.5 Irrigation Diversion Requirement

The irrigation diversion requirement is estimated as unit water requirement based on the cropping patterns for the scheme areas.

Losses and wastes inherent in the operation of water distribution systems must be added to the farm irrigation requirement to determine the diversion requirements. These losses and wastes consist of canal conveyance losses due to evaporation and seepage and canal operation losses due to improper gate operation.

The irrigation diversion requirement is estimated by the following equation:

$$IDR = \sum_{i=1}^{n} (FIRi \cdot Ci)/Et \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4.6)$$

where, IDR: irrigation diversion requirement (lit/s/ha)

FIR: farm irrigation requirement (lit/s/ha)

Ci: cropping intensity of each crop based on the cropping pattern given in Table VII.4-8.

Et: combined irrigation efficiency

n: number of crop in cropping pattern

Combined irrigation efficiency consists of canal conveyance efficiency and canal operation efficiency. These efficiencies are assumed to be 80% for canal conveyance and also 80% for canal operation. Therefore, the combined irrigation efficiency of 64% is adopted in this study.

The calculated results of the unit irrigation diversion requirements for the scheme areas are shown in Tables VII.4-9 to VII.4-11.

4.4 Irrigation Water Demand and Water Availability

4.4.1 Irrigation Water Demand

Irrigation water demands required for the Panitan - Panay area of 3,250 ha and the Mambusao area of 2,145 ha are estimated as the probable irrigation diversion requirement based on the effective rainfall with 5-year return period of non-excess probability. Based on the calculated results of unit irrigation diversion requirements in Section 4.3, the basic year with 5-year return period are selected for both areas.

For the Panitan - Panay area, the year 1968 is selected for making irrigation plan. While, for the Mambusao area, since the rainfall data are available only for 7 years, the basic year is selected separately for the dry and wet seasons. The year 1978 is selected for the dry season paddy and the year 1976 is selected for the wet season paddy respectively. The selected diversion requirements of both years are the maximum out of 7-year diversion requirements.

For estimation of the irrigation water demand for the CIS development areas, the unit irrigation diversion requirements for the cropping calendar of Case-1 for the Mambusao area are adopted.

The estimated irrigation water demands for the NIS and CIS development areas are shown in Table VII.4-12.

4.4.2 Water Availability of the River

According to the present cropping calendar and the records of diverted irrigation water in the existing Mambusao RIS, the peak use of irrigation water occurs within the following five months: February, March, April, May and June. On the contrary, the river discharges of the Panay and Mambusao rivers during these months fall less than the annual mean discharges as shown in Table VII.4-13 which presents the monthly mean discharges at the proposed intake sites for the Panitan - Panay and Mambusao areas.

The recording period of rainfall used for calculation of irrigation water demand is not the same period as the available river discharge data. Therefore, in order to examine availability of river discharge for irrigation water use on run-of-the-river condition, the comparison is made by every month between the monthly drought discharge with 80% dependability at the proposed intake sites and the irrigation water demand estimated in the previous Subsection 4.4.1, as follows:

(Unit: m^3/s)

Month	Panitan - Panay		Mambusao		
	Drought Discharge	Irrigation Demand	Drought Discharge	Irrigation Demand Case-1	Irrigation Demand Case-2
Feb.	26.3	1.14	3.0	2.51	2.51
Mar.	20.1	2.21	1.8	0.66	0.66
Apr.	12.8	2.57	0.6	0	0
May	16.4	4.75	0.8	2.10	0.64
Jun.	40.1	3.22	3.6	1.97	2.60

As shown in the above table, the Panitan - Panay area can keep the stable irrigation water even in the drought year, whereas the river discharge of the Mambusao river can not fulfill the irrigation water demand especially in May of Case-1. This means that the additional water resources must be newly exploited in the upstream reaches. However, the river discharges can cover the irrigation water demands of Case-2 without any exploitation of additional water. Taking into consideration these facts, the cropping pattern of Case-2 is preferably adopted for the Mambusao area.

4.5 Drainage Requirement

4.5.1 General

The proposed irrigation scheme areas such as the Panitan - Panay and Mambusao areas mainly extend over the alluvial plains developing along the Panay river and its tributaries. If the lands are not drained well within a feasible range, the productivity will not rise even after provision of well-designed irrigation facilities.

From the past experiments and observation in Japan on the yield reduction rate of paddy by submergence, the following could be confirmed:

(1) Submergence at the growing stage of young panicle formation gives a serious damage to the yield of paddy, while damage due to submergence at the maturity stage is insignificant.

(2) Submergence within 1 to 3 days is not so harmful, but damage of paddy remarkably increases due to submergence beyond 3 days.

The midest wet season in the Panay river basin occurs during the period from July to September. On the growing stage of the wet season paddy, the middle stage of tillering and the beginning stage of panicle formation will correspond to the midest wet season. Taking into account these considerations, the drainage requirement is estimated for making a future drainage plan in the scheme area.

4.5.2 Drainage Requirement

In general, a criteria for calculation of drainage requirement defines a storm rainfall with certain probability and a drainage period necessary for removal of excess water to an allowable extent.

In this study, unit drainage water requirement is estimated on the basis of the following assumptions and procedure:

(1) The daily rainfall data observed at Roxas City (1948 - 1982) are used for estimation.

(2) Design storm rainfall is taken to be 440 mm of 3-day rainfall with 5-year return period of excess probability, based on the result of the following probable analysis:

Return Period (year)	3-day Rainfall (mm)
100	955
50	811
10	538
5	440
2	321

(3) Allowable retention of rainfall in paddy field is assumed to be 100 mm.

(4) Drainage period for removal of excess water is to be 3 days.

(5) Unit drainage water requirement is derived from the following equation:

$$R = \frac{I - D}{8.64 \cdot T} \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \quad (4.7)$$

where, R: unit drainage water requirement (lit/s/ha)
I: design storm rainfall (mm)
D: retention of rainfall in paddy field (mm)
T: drainage period (day)

Based on the above procedure, the unit drainage requirement in the area is computed at 13.1 lit/s/ha or 113 mm/day.

4.6 Alternative Study on Intake System for the Panitan - Panay Area

4.6.1 General

The potential irrigable areas of 3,400 ha in the Panitan - Panay area located on the alluvial plains extending over both banks of the lower reaches of the Panay river. The land has very flat topography and its ground elevation is in the range of about El. 7 m and 2 m. On the other hand, the water stage of the Panay river is comparatively low with a fluctuation between about El. 5 m and 1 m at the Panitan bridge.

In general, a gravity intake system is preferentially selected for irrigation scheme in view of operation and maintenance cost to be spent after implementation of the system. However, adoption of gravity intake system will depend on topographic condition to check up water level of the river by means of weirs. Since there is no suitable intake site for the gravity system, pump system may be an alternative as the intake system, even though the annual operation and maintenance works for pump system will be costly.

4.6.2 Economic Comparison

Table 4.14 shows the comparison on general project features for both alternative intake systems. As for the pump system, two pump stations will be constructed on both banks of the Panay river about 1.0 km upstream from the Panitan bridge and can provide irrigation water to the whole irrigable area of 3,250 ha. Whereas, the construction site of gravity intake system is limited at about 2.5 km upstream from the Panitan bridge due to topographic condition. The checked water level is also limited at El. 5 m so as not to make the paddy fields, extending along the upstream reaches, submerge under the checked water. Then, the irrigation area served by the gravity system is reduced to 1,250 ha. Their general layout plans are comparatively shown in Fig. VII.4-4 and both general features of facilities are illustrated in Figs. VII.4-5 and VII.4-6 respectively.

In order to select the proposed intake system, the economic comparison between both alternatives is made based on the following assumptions:

(1) The economic comparison is made by comparing the annual equivalent cost per ha, which are estimated from construction cost of intake facility and headreach, including the annual operation and maintenance cost.

(2) The pump system requires a headreach of about 2 km in total for both pump stations to convey water from pumping sites to the service areas. While, the gravity system needs a long headreach of about 7 km. These construction costs are counted in the comparison.

(3) The operation and maintenance costs are estimated only for the intake facilities and headreaches.

(4) The construction costs per ha of canal systems from main canal down to farm ditches and drainage canals are assumed to be same in both systems, though both development scales are different.

(5) The incremental benefits to be reaped in both areas are also assumed to be same.

(6) The electric charges for operating the pumps are estimated based on the CAPELCO's unit rate of 2.495 ₱/kWh.

(7) The annual equivalent cost of the construction cost is calculated by using the discount rate of 8% and applying the useful life of 50 years for civil works and 25 years for pump and other equipment.

Based on the above assumptions, the economic comparison is made as shown in Table VII.4-15. From this result, the pump system is more economical and attractive than the gravity system in view of annual equivalent cost per ha. Other than this economic advantage, the pump system can cover the whole irrigable areas in this area and achieve equitable distribution of the Government investment to the farmers in the region.
Therefore, the pump system is proposed as the intake system for the Panitan - Panay area.

4.7 Comparative Study on Operation Cost for Pump

Detailed records of actual operation cost of the Present PIS in the Panitan-Panay area are not made available. So the operation cost of it is estimated to assume a typical area of 1,673 ha by using Table of page 2-3. The comparative study between the present PIS and the proposed project is made based on the assumption which perennial irrigation water supply is assured. Table VII.4-16 shows the result of the comparative study. From the result, the proposed project is cheaper than the present PIS in view of the operation cost per ha.

4.8 Integration of the Existing PIS into the Panitan-Panay Area

The existing PIS into the project area is planned to be integrated into the proposed irrigation project taking into consideration the reason as mentioned in Section 4.2. There remains the problem with respect to amortization of the cost required for installation of pump equipment. The farmers cannot pay two loans. If there remains the salvage value of the pump and the incidental structure. The pump will be shift to the other area after integration and the salvage value of the pump shall be amotized by a new user. The salvage value of the incidental structure shall be amotized by the executive agency. If there doesn't remain the salvage value of the pump and the incidental structure, they shall be disused.

5. PLANNING AND PRELIMINARY DESIGN OF PROJECT FACILITIES

5.1 General

Major objective of the irrigation scheme is to increase agricultural productions with provision of appropriate irrigation and drainage systems. In order to supply optimum irrigation water to the service area and to introduce an effective irrigation farming practice, the facilities required are composed of intake facilities, irrigation canals, drainage canals, inspection roads and their related structures.

The basis for determining the facility requirements is that enough facilities be provided in the most effective and economical manner so that each function can be combined with and fully compatible with other farming operations. Based on these requirements, the following planning and preliminary design of facilities are prepared. The salient features of facilities required for each scheme are summarized in Tables VII.5-1.and VII.5-2 for the Panitan - Panay and Mambusao areas respectively. Their general layouts are also shown in Figs. VII.5-1 and VII.5-2 for the respective areas.

5.2 Design Water Requirement

Design capacity of irrigation facility is determined based on design unit irrigation diversion requirement which is calculated by using effective rainfall with 5-year return period of non-excess probability.

According to the calculated results of irrigation water requirement and the study results of water availability in Chapter 4, the design unit irrigation diversion requirement is determined to be 1.46 lit/s/ha for the Panitan - Panay area and 1.21 lit/s/ha for the Mambusao area.

The design diversion requirement at headgate is defined as the peak diversion discharge which is obtained by multiplying the design unit irrigation diversion requirement by the irrigation area. The design diversion requirements thus calculated for the respective scheme areas are shown below.

Scheme	Irrigation Area (ha)	Design Irrigation Diversion Requirement (lit/s/ha)	Design Diversion Requirement (m^3/s)
Panitan - Panay	3,250	1.46	4.75
Mambusao	2,145	1.21	2.60

5.3 Intake Facilities

5.3.1 General

According to the results of the alternative study on the intake system for the Panitan - Panay area mentioned in Section 4.6, the irrigation water for this area will be diverted from the Panay river through the pump stations which will be constructed on both right and left banks of the river. The pumped-up water is conveyed from the pump station to the main canals through the headreach and bifurcation structure.

For the Mambusao area, the irrigation water is taken from the Mambusao river through the existing intake gate at the diversion dam site. The intaked water is transported to the main canal passing the closed conduit of about 200 m. The existing intake facilities including the diversion dam and the intake gate will be rehabilitated and improved due to the deteriorated degree of each portion of the facility. The rehabilitation works for water intake will be repair of apron and bank protection of the dam and repair and replacement of the intake gates.

In this Section, the preliminary planning of the intake facility for the Panitan - Panay area is only discussed hereunder, since the existing intake facility for the Mambusao area is used for the proposed irrigation planning with rehabilitation works.

5.3.2 Pump Station

(1) Location

The locations of pump stations are selected on both right and left banks of the Panay river about 0.8 km upstream from the Panitan bridge for the right bank area (P-1 Area) and about 1.2 km upstream for the left bank area (P-2 Area), where the river bed and water course are expected to be stable.

The foundation of each pump station is relatively deep at the proposed locations. According to the geological investigation, a dense silty sand layer is found at about 10 m below the ground surface and is assumed to be favorable for the foundation of the proposed pump stations.

(2) Preliminary Design

The design pumping discharges for both P-1 and P-2 pump stations are determined based on the design water requirement presented in Section 5.2. The required pump head is determined between the average river water level and the required irrigation water level.

Based on the design pump discharge and the required head, the vertical mixed flow type is selected for both pump stations. The determination of the size of unit pump bore is made based on the following table:

Total Head (m)	Discharge (m^3/min)	15	20	26	32	39	47	65	85	110
7 or 8	Bore (mm)	350	400	450	500	550	600	700	800	900

(a) For P-1 Pump Station

Item	Alternative - 1	Alternative - 2
1. Type of Pump	- Vertical Mixed Flow Pump -	
2. Pump Bore	ø400 mm	ø450 mm
3. Number of Pump	4 nos.	3 nos.
4. Design Discharge	20.6 m^3/min/no	27.4 m^3/min/no
5. Total Head	7 m	7 m

(b) For P-2 Pump Station

Item	Alternative-1	Alternative-2
1. Type of Pump	- Vertical Mixed Flow Pump -	
2. Pump Bore	ϕ700 mm	ϕ800 mm
3. Number of Pump	3 nos.	2 nos.
4. Design Discharge	67.4 m^3/min/no	101.1 m^3/min/no
5. Total Head	8 m	8 m

Tables VII.5-3 and VII.5-4 show the results of the above economic comparison. From the results, the combination of 3 nos. of 450 mm pump bore is selected for the P-1 pump station and 2 nos. of 800 mm pump bore for the P-2 pump station. Their preliminary features are shown in Fig. VII.4-5.

The electric motor drive method is adopted for the pump facility taking into consideration the availability of electricity in the NPC PANITAN SUBSTATION and the economical aspects of cheaper initial investment cost. When the electric power runs short, the diesel engine drive method shall be adopted to have priority the present users.

5.3.3 Headreach

Between the outlet of pump station and the head of main canal, the headreach is constructed. The channel is lined with a 10-cm thick plain concrete in its all reaches. The length of headreach for the P-1 pump station is 0.6 km and that for the P-2 pump station is 1.2 km. At the end of the P-2 headreach, the bifurcation structure is facilitated to distribute water into both main canals; M-2 and M-3 main canals, as shown in Fig. VII.5-3.

5.4 Irrigation Canal System

5.4.1 Function and Requirement of Canal

The irrigation canal system consists of main canals, lateral canals and on-farm facilities such as farm ditch and supplementary farm ditch. Irrigation canals are aligned along the existing road and village boundary as long as possible, so that land acquisition due to construction of irrigation facilities and number of crossing structures is minimized.

The functions and requirements of canals are mentioned below.

(1) Main Canals

The function of main canal is to convey irrigation water from intake site to development area in the most economical way.

(2) Lateral Canals

Lateral canal is branched off the main canal with approximate intervals of 1 km supplying water to several main farm ditches. The commanded area of one lateral canal is in the range of 100 ha to 150 ha on an average.

(3) Main Farm Ditches

Main farm ditch is branched off the lateral canal with an average interval of 500 m supplying water to one rotation block of about 50 ha. Length of one main farm ditch is 800 m on an average.

(4) Supplementary Farm Ditch

Distribution of water within the rotation block will be made by supplementary farm ditches to be branched off the main farm ditch with an interval of 200 m and cover 10 to 15 ha. There are several number of supplementary farm ditches in one location block in principle. Length of one supplementary farm ditch is 400 m on an average.

5.4.2 Preliminary Design of Irrigation Canal

All irrigation canals proposed for the Panitan - Panay and Mambusao areas are designed as unlined earth canals with trapezoidal section, since suitable earth material is available in and around the area. The preliminary design of irrigation canals is made based on the basic design criteria described below. The irrigation diagrams showing the design capacities of canals are illustrated in Figs. VII.5-4, VII.5-5 and VII.5-6 for the respective areas. The profiles of main canals are shown in Figs. VII.5-7 and VII.5-8. The typical cross section of each canal is shown in Fig. VII.5-9.

(1) Design Discharge

Based on the design unit irrigation water requirement determined in Section 5.2 and the commanding area, the design discharges for each irrigation canal are estimated. The unit design discharge for farm ditch is determined at 1.9 lit/s/ha so as to supply the irrigation water required during the land preparation period.

(2) Velocity

The maximum permissible velocity in unlined canals is determined so as not to cause scouring of canal base and slope, the minimum permissible velocity determined so as not to allow the growth of aquatic plant and moss and not to cause the sedimentation in canal. The permissible velocity of each canal is determined as follows:

Canals	Maximum (m/s)	Minimum (m/s)
Main & Lateral Canals	0.8	0.3
Farm Ditches	0.65	0.25

(3) Roughness Coefficient

Based on the design criteria of NIA, roughness coefficient is determined as follows:

Canals	Manning's "n"
Main & Lateral Canals	0.025
Farm Ditches	0.03

(4) Freeboard and Top Berm Width

The freeboard of canals is also designed based on the design criteria of NIA.

- For main canal and lateral canal;

$$Fd = 0.4 \cdot d \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (5.1)$$

- For main farm ditch and supplementary farm ditch;

$$Fd = 0.1 \cdot d + 0.15 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (5.2)$$

where, Fd: freeboard (m)
d: water depth (m)

Top berm width of major irrigation canals such as main and lateral canals are designed to be 1 meter.

(5) Side Slope

The side slope of 1 : 1.5 is adopted for the design of major canals such as main and lateral canals. As for minor canals such as main and supplementary farm ditches, the side slope of 1 : 1 is adopted.

(6) Canal Base Width and Water Depth

The relationship between canal base width and maximum water depth is decided as follows:

Canal Base Width (m)	Maximum Water Depth (m)
I. Main and Lateral Canals	
3.0	1.50
2.5	1.50
2.0	1.20
1.5	1.00
1.0	0.80
0.8	0.50
0.6	0.40
II. Main and Supplementary Farm Ditch	
0.5	0.45
0.4	0.30

5.4.3 Preliminary Design of Related Structure

A number of related structures are required in conjunction with irrigation canals for conveyance, regulation and measurement of irrigation water and protection of canal system.

Their features of the major canal related structures are shown in Figs. VII.5-10 to VII.5-18. The general characteristics and design criteria of those structures are briefed as follows:

(1) Culvert

Culverts are constructed to convey water under roads. The culverts in the proposed canal system are classified into 4 types depending on their discharges. One type for main canal has box barrels and the others have pipe barrels. Design water depth in the barrel is taken to be about 80% of barrel height, and design velocity is to be 110% to 130% of canal water velocity.

(2) Syphon

Syphons are constructed to convey irrigation water under river and drainage channels. These structures are classified into four types depending on canal discharge. One type has a design capacity of more than 2.0 m^3/s and is provided with box barrel and the other types have a design capacity of less than 2.0 m^3/s and provided with pipe barrel. The maximum velocity is taken to be 1.5 to 2.0 m/s.

(3) Drop Structure

The function of drop structure is to dissipate excess energy. The structures are classified into two types depending on drop height. Their drop heights are 0.5 m and 1.0 m.

(4) Check Structure

In order to maintain the required water level at the site of off-taking even during periods of off-peaking discharge, a check structure is provided where a number of turnouts are densely provided or where fairly large discharge is diverted. The check structure consists of upstream transition, throat section and downstream transition and is equipped with slide gates and operation deck in the throat.

(5) Head Gate and Turnout

Head gate is constructed to divert the required water from main canal to lateral canal and turnout is constructed to divert the required water from parent canal; main and lateral canals, to main farm ditch. The pressure flow type of both head gate and turnout is introduced. Parshall flume is provided in all head gates for the purpose of measuring the discharge.

(6) Spillway

A spillway is constructed in the canal system for the purpose of spilling out excess water or flushing out all water in the canals in case of emergency and clearing and repairing canals. This structure is provided at upstream of syphon and the end of main canals. All the spillways are connected to the nearby drainage canals.

(7) Crossdrain

Crossdrain is constructed across the irrigation canals at the place where the canals run across depressed lands or natural streams. These structures are classified into five types depending on the design discharge. Two types have a design capacity of more than 2.0 m^3/s and are provided with box barrels. Other three types have a design capacity of less than 2.0 m^3/s and provided with pipe barrel.

(8) Aqueduct

In order to convey irrigation water crossing over the river or creek, aqueducts are provided in case that the base elevation of canal is enough to cross over the river.

(9) Diversion Work

In order to distribute the irrigation water from main farm ditch to supplementary farm ditch a prefabricated concrete cut-off with groove for stop log is installed on main farm ditch.

5.5 Drainage Canal System

5.5.1 Preliminary Design of Drainage Canal

(1) Design Discharge

According to the drainage water requirement calculated in Section 4.5, the unit design discharge is determined at 13.1 lit/s/ha. The design discharges of the respective drainage canals are calculated on the basis of the unit design discharge and their commanding areas.

(2) Canal Section

The drainage canal section is designed as follows:

- Type of canal : Trapezoidal earth canal
- Side slope of canal

	Inside	Outside
Main drain :	1:1.5	1:1.5
Collector drain :	1:1.5	1:1.5
Farm drain :	1:1.0	1:1.0
Drainage ditch :	1:1.0	1:1.0

- Coefficient of roughness : 0.03

The typical cross section of each drainage canal is shown in Fig. VII.5-8.

5.5.2 Preliminary Design of Related Structure

The related structures of drainage canals are drainage culvert and drainage inlet. Culvert is planned and designed with same principles as mentioned in Subsection 5.4.3. The drainage inlet is provided at the head of collector and farm drains, which will flow directly into the main and collector drains, so as to prevent the canal bed erosion and retrogressive erosion in the drainage canal.

5.6 Inspection Road

For proper operation and maintenance of project facilities, well-designed inspection roads are of vital importance. Since these roads will be used as village roads and farm roads after the project implementation, the arrangement of the inspection roads should be made considering the existing networks. Typical cross section of road is shown in Fig. VII.5-8.

(1) Main Inspection Road

Main inspection road is required for inspection, operation and maintenance of canal. Considering the future increase of vehicles for inspection and operation, all the main inspection roads are so designed as to have an effective width of 4 meters and to be gravel-metalled. These roads are also used for movement of agricultural products and equipment and for the day-to-day services between villages and from them to the highway.

(2) Lateral Inspection Road

Lateral inspection road is mainly provided along the lateral canal. This road has an effective width of 4 meters for the canal of which capacity is more than 0.3 m^3/s. For the canal of less than 0.3 m^3/s, the roads have an effective width of 2.5 meters. These roads are also used for the purpose of farm operation.

6. IMPLEMENTATION SCHEDULE

6.1 Basic Considerations

In order to prepare the implementation schedules of the proposed irrigation schemes, i.e. the Panitan - Panay and the Mambusao areas, the following basic conditions are considered:

(1) Implementation arrangements of both irrigation projects will be smoothly promoted by the Government.

(2) The preparatory works such as study and detailed design will be commenced in 1986.[1/] Therefore, the project mobilization which includes financing, legalization, establishment of project executive organization will be completed by the end of 1985.

(3) Annual workable days for construction equipment are estimated to be about 160 days based on the rainfall data recorded in Roxas City. However, it has no pronounced difference between rainy and dry seasons.

(4) All construction works will be conducted on a contract basis. The mechanized construction will be principally introduced in the main construction works. However, in order to maximize the employment opportunity in and arund the development area, man-power construction will be adopted as much as possible.

6.2 Implementation Schedule

The implementation schedules for both Panitan - Panay and Mambusao irrigation schemes are prepared in Figs. VII.6-1 and VII.6-2. Their schedules are described hereunder.

(1) Panitan - Panay Area

The preparatory works comprises mapping, survey, study, detailed design, tendering, land acquisition and so on.

Note: 1/; This scheduling was prepared on an assumption that the implementation of the project would be commenced in 1986. However, this should be modified depending on the recommendation of the overall basin development schedule.

The implementation will be commenced by review of the project formulation and planning of the previous study and preparation of the detailed design. In order to smoothly perform these works, maps of the proposed pump station sites will be prepared on a scale of 1/500 with a contour interval of 0.5 m.

The detailed design works will be commenced from 1986 including the additional geological and soil mechanical investigations and the detailed topographic survey for canal alignment. The tender documents will be also prepared for international and/or local bidding.

After completion of tendering and contract administration, the construction works will be started in the middle of 1988.

The construction of the pump station will be commenced in the middle of 1988 and last for two (2) years including installation of pumps and construction of headreach of about 2.0 km. The irrigation canal systems will be constructed from the middle of 1988 to the middle of 1991. The construction of the drainage facilities will be commenced in April 1989 and completed in September 1991. The on-farm facilities will be also constructed in this scheme from the middle of 1989 to September 1991. The total construction period will be about 3 years.

(2) Mambusao Area

The major construction works of the Mambusao area are rehabilitation and improvement of the existing irrigation and drainage facilities.

The detailed design works will be commenced in April 1986. Before start of the detailed design works, the following survey works will be required to be completed:

(a) Longitudinal and cross sectional survey of the existing main and lateral canals.

(b) Detailed inventory survey of structures including the diversion dam and the related structures of the main and lateral canals in order to examine the deteriorated condition.

The detailed design works will be completed within one (1) year including the preparation of tender documents for competitive bidding. After completion of the design works, the construction of office and quarter, the tendering works and the land acquisition will be started. These works will be mostly completed by the middle of 1988.

The main construction works such as rehabilitation and improvement of the main and lateral canals will be commenced in the middle of 1988 and takes two (2) years for completion. The new lateral canals which cover the new extension irrigation areas will be also constructed during the same period. The drainage canals and on-farm facilities will be newly constructed in this scheme from the beginning of 1989 to the end of 1990. The total construction period for rehabilitation and canal extension will be about 2.5 years.

7. COST ESTIMATE

7.1 Conditions

The project cost required for construction of irrigation scheme is estimated based on the following conditions and assumption:

(1) The conversion rate among Philippine Peso, US Dollar and Japanese Yen is assumed to be ₱18.0 = US$1.0 = ¥234.0 referring to the current exchange rate in July 1984.

(2) All of the construction works would be executed by contract basis. Machinery and equipment required for construction works would be provided by contractors themselves. Therefore, depreciation cost of construction machinery and equipment would be counted in the direct construction cost. Contractor's profits and expenses are also included.

(3) The construction costs are divided into foreign and local currency components. To estimate the construction cost, the following ratios of foreign and local currency components of major unit prices are assumed:

Item	Foreign (%)	Local (%)
Fuel and oil	60	40
Cement	65	35
Reinforcement bar	75	25
Aggregate and sand	0	100
Concrete product	0	100
Steel material	80	20
Metal form	85	15
Gate	90	10
Labor	0	100

(4) As regards the physical contingency related to the construction quantities, commissions and changes in estimation, around 15% equivalence of the construction cost is incorporated in the estimate.

(5) The price contingency is not taken into consideration in the estimate.

(6) Associated costs to be financed by the Government, such as costs for strengthening the extension services, facilities of water users' association and improvement of social infrastructures, are not included in the estimate.

7.2 Construction Cost Estimate

The construction cost comprises direct construction cost, cost for O& M facilities, land acquisition cost, administration cost of executive agency and physical contingency. These costs are estimated based on 1984 price level. The summary of the construction cost for each irrigation scheme is shown in Tables VII.7-1 and VII.7-2. The annual disbursement schedule of the construction cost is worked out based on the construction time schedule. The details of disbursement schedule are shown in Tables VII.7-3 to VII.7-6.

(1) Direct Construction Cost

The direct construction cost is estimated on the basis of work quantity of the construction and the respective unit prices are summarized as follows:

(Unit: 10^3US$)

Scheme	Total	Foreign	Local
Panitan - Panay (Overall)	6,560	3,825	2,735
Panitan-Panay (P-1 Pump)	1,771	2,699	2,090
Panitan-Panay (P-2 Pump)	4,789	2,699	2,090
Mambusao	2,701	1,342	1,359

The breakdowns of the direct construction cost for the respective schemes are shown in Tables VII.7-7 and VII.7-8. The prices of the major local materials and labor wages used in the estimate and the unit prices for major construction works are presented in Tables VII.7-9 and VII.7-10.

(2) Cost for O& M Facilities

The cost for the O& M facilities includes the construction cost of office and quarters and the purchase cost of machinery and equipment required for the operation and maintenance works. The costs for the respective schemes are shown in Tables VII.7-11 to VII.7-14.

(3) Land Acquisition Cost

The private land acquired for the project implementation is compensated in the rate of fair market value of the land based on the current tax declaration. The land acquisition costs thus estimated are shown in Tables VII.7-15and VII.7-16 for the Panitan - Panay and Mambusao areas respectively

(4) Engineering Cost

The engineering cost is required for engineering services by foreign consultants for study and detailed design works and construction supervision. The engineering cost is assumed to be about 20% of the direct construction cost of each scheme.

(5) Administration Cost of Executive Agency

The administration cost includes the staff salaries and the general expenses to be consumed during the project implementation by the executive agency. This amount is assumed to be 5% of the direct construction cost.

(6) Total Construction Cost

Based on the above estimation, the total construction costs including the physical contingency are estimated and summarized as follows:

(a) Panitan - Panay (Overall)

(Unit: 10^3US$)

Item	Total	Foreign	Local
Direct Construction Cost	6,560	3,825	2,735
Indirect Cost	2,270	1,375	895
Sub-total	8,830	5,200	3,630
Physical Contingency	1,325	780	545
Total	10,155	5,980	4,175

(b) Panitan - Panay (P-1 Pump)

(Unit: 10^3US$)

Item	Total	Foreign	Local
Direct Construction Cost	1,771	1,126	645
Indirect Cost	823	494	329
Sub-total	2,594	1,620	974
Physical Contingency	389	243	146
Total	2,983	1,863	1,120

(c) Panitan-Panay (P-2 Pump)

(Unit: 10^3US$)

Item	Total	Foreign	Local
Direct Construction Cost	4,789	2,699	2,090
Indirect Cost	1,683	1,109	604
Sub-total	6,472	3,778	2,694
Physical Contingency	971	567	404
Total	7,443	4,345	3,098

(d) Mambusao

(Unit: 10^3US$)

Item	Total	Foreign	Local
Direct Construction Cost	2,701	1,342	1,359
Indirect Cost	1,135	745	390
Sub-total	3,836	2,087	1,749
Physical Contingency	575	313	252
Total	4,411	2,400	2,001

7.3 Operation and Maintenance Cost

The annual operation and maintenance costs are composed of the salaries for project administration and water control staffs, the material and labor costs for repair and maintenance of facilities and equipment, and the running cost of project facilities including the electric charges for pump operation in the Panitan - Panay area. The O & M costs for the Panitan - Panay and Mambusao areas are shown in Tables VII.7-17 to VII.7-20 respectively and summarized as follows:

Operation and Maintenance Costs

Area	Annual O & M Cost (US$)	(US$/ha)
Panitan-Panay (Overall)	334,500	102.9
Panitan-Panay (P-1 Pump)	103,800	110.6
Panitan-Panay (P-2 Pump)	234,400	101.8
Mambusao	77,800	36.2

7.4 Replacement Cost

Some of the project facilities, especially mechanical and electrical works, have shorter useful life than civil works and require replacement at a certain interval within 50 years of the project life. The replacement cost and useful life are shown below, and details are shown in Table VII.7-21 and VII.7-22.

Useful Life and Replacement Cost

Item	Useful life (year)	Cost (US$ x 10^3)		
Panitan-Panay Area		Overall	P-1 Pump	P-2 Pump
Pump and other works	25	1,108	530	586
Gates for canals	25	58	17	41
O & M equipment	10	361	306	348
Mambusao Area				
Gates for canals	25		46	
O & M equipment	10		348	

8 EVALUATION

8.1 Project Economic Cost

Economic viability is preliminarily evaluated in terms of economic internal rate of return (EIRR). Economic costs are estimated by deducting the land acquisition cost from the construction cost estimated in Section 7 and by multiplying the standard conversion factor of 0.82 by the financial cost of local currency portion. The estimated economic costs are summarized as follows:

Estimated Economic Cost of Irrigation Schemes

Item	Cost (US$ x 10^3)		
Panitan-Panay Area	Overall	P-1 Pump	P-2 Pump
1. Direct Construction Cost	6,068	1,655	4,413
2. O & M Facilities	514	334	410
3. Engineering Services	1,265	341	923
4. Administration Cost	269	73	196
5. Physical Contingency	1,227	363	898
Total	9,343	2,766	6,840
Mambusao Area			
1. Direct Construction Cost		2,456	
2. O & M Facilities		410	
3. Engineering Services		520	
4. Administration		111	
5. Physical Contingency		528	
Total		4,025	

8.2 Project Benefit

Economic benefits to be reaped in both areas are estimated based on import substitution price of paddy. The economic farm gate prices of farm products and farm inputs are calculated based on the projected international market prices forecasted by IBRD in the long-term range for the

period of 1983 to 1995. In this study, the 1994 prices forecasted are used in the estimation of the economic benefits.

The project benefit is defined as the incremental net production values with and without the project. The net production values of typical farmers with and without the project are estimated at the full development stage as shown in Tables VII.8-1 and VII.8-2. The residual flood damage that would be inflicted by the floods exceeding the protection level of flood control plans are counted as the residual negative benefit. The total incremental benefits of the project under different protection levels are summarized as follows:

Incremental Benefit Accrued from Irrigation Development

Item		Panitan-Panay Area			Mambusao Area
		Overall	P-1 Pump	P-2 Pump	
Typical Form Size	(ha)	1.5	1.5	1.5	2.2
Net Irrigation Area	(ha)	3,250	940	2,310	2,145
Without project					
Typical farm	(US$)	1,331	1,331	1,331	1,923
Total	(US$ x 10^3)	3,090	894	2,196	1,964
Without project					
Typical farm	(US$)	2,361	2,361	2,361	3,265
Total	(US$ x 10^3)	5,481	1,585	3,896	3,335
Residual damage by risk level	(US$ x 10^3)				
No protection		768	222	546	396
2-year flood		600	174	426	301
10-year flood		197	57	140	91
25-year flood		80	23	57	35
100-year flood					
Incremental benefit by risk level	(US$ x 10^3)				
No protection		1,623	469	1,154	974
2-year flood		1,791	517	1,274	1,069
10-year flood		2,194	634	1,560	1,279
25-year flood		2,311	668	1,643	1,335
100-year flood		2,391	691	1,700	1,370

8.3 Economic Evaluation

The economic internal rate of return (EIRR) is calculated as shown in Table VII.8-3 to VII.8-6 for the respective schemes. The EIRR for the Panitan-Panay area under the flood control plan of 10-year protection level is expected to be 11.7%, 11.4% and 11.8% for overall, P-1 Pump and P-2 Pump respectively and that for the Mambusao area is to be 15.7%. The EIRR of the both projects under several flood protection levels are summarized below.

Comparison of EIRR by Risk Level

Risk Level	Panitan-Panay Area			Mambusao Area
	Overall	P-1 Pump	P-2 Pump	
No protection	7.9	7.4	8.0	12.3
2-year flood	9.1	8.6	9.1	13.7
10-year flood	11.7	11.4	11.8	16.6
25-year flood	12.4	12.2	12.6	17.4
100-year flood	12.8	12.7	13.1	17.8

Based on the above results, both development plans are economically feasible and also expected to be promoted for realization, provided that or flood protection work is provided for the Panitan-Panay area.

TABLES

FOR

APPENDIX VII

TABLE VII. 2-1 CULTIVATION RECORD IN MAMBUSAO IRRIGATION SERVICE AREA

Year	Planted Area (ha)		Diverted Water (m^3)
	Wet Season	Dry Season	
1975	601	601	5,081,792
1976	749	706	12,088,648
1977	786	731	4,961,038
1978	786	731	6,226,740
1979	1,262	751	11,785,381
1980	1,440	730	5,885,818
1981	1,440	751	0
1982	1,440	750	7,466,839
1983	803	607	10,251,657

Data source : Mambusao NIA Office

TABLE VII.2-2 OPERATION RECORD OF IRRIGATION DIVERSION WATER FOR MAMBUSAO NATIONAL IRRIGATION SYSTEM

Month	1975		1976		1977		1978		1979		1980		1981		1982		1983	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Jan	367,580	0.14	0	0	0	0	-	-	10,247	0	0	0	0	0	0	0	2,302,560	0.86
Feb	498,380	0.21	1,822,210	0.73	0	0	-	-	2,655,504	1.10	1,492,992	0.60	0	0	0	0	2,326,233	0.96
Mar	780,044	0.29	626,400	0.23	0	0	-	-	3,182,198	1.19	0	0	0	0	0	0	1,830,600	0.68
Apr	0	0	1,184,936	0.46	1,877,867	0.72	1,651,960	0.64	6,333,152	0.51	227,050	0.09	0	0	2,231	0	0	0
May	0	0	2,026,510	0.76	1,632,096	0.61	2,420,064	0.90	2,675,920	1.00	4,165,776	1.56	0	0	1,257,504	0.47	0	0
Jun	1,563,344	0.64	2,183,328	0.84	0	0	572,400	0.22	946,944	0.37	0	0	0	0	1,527,504	0.59	2,657,400	1.03
Jul	0	0	2,168,208	0.81	501.120	0.19	279,936	0.10	359,424	0.13	0	0	0	0	1,527,552	0.57	1,134,864	0.42
Aug	996,544	0.37	1,835,136	0.69	627,955	0.23	851,804	0.32	621,992	0.23	0	0	0	0	0	0	0	0
Sep	482,800	0.19	0	0	322,000	0.12	450,576	0.17	0	0	0	0	0	0	0	0	0	0
Oct	51,840	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov	0	0	241,920	0.09	0	0	0	0	0	0	0	0	0	0	1,669,248	0.64	0	0
Dec	341,260	0.13	0	0	0	0	0	0	0	0	0	0	0	0	1,482,800	0.55	0	0
Total	5,081,792		12,088,648		4,961,038		6,226,740		11,785,381		5,885,818		0		7,466,839		10,251,657	

Note ; A : Total diverted water (m^3)
B : Average unit diversion water (m^3/s)

TABLE VII.2-3 LIST OF COMMUNAL IRRIGATION SYSTEM IN THE PANAY RIVER BASIN

No.	Name of CIS	Location	Construction Started	Construction Completed	Source of Irrigation Water	Type of Diversion	Diversion Requirement (l/s)	Irrigated Area (ha) Wet	Irrigated Area (ha) Dry
1.	SALCED	Dumarao, Capiz	1979/1	1980	Mali-aw creek	Gravity	405	250	130
2.	ALIPASYAWAN	Dumarao, Capiz	1983/1	1983	Alipasyawan creek	Gravity	90	60	50
3.	SAN ROQUE	Dumalag, Capiz	1981/1	1982	Tiniklan creek	Gravity	90	55	45
4.	NAGBA	Cuartero, Capiz	1983/1	1983	Pangawitaw creek	Gravity	315	170/2	170
5.	CONSOLACION	Dumalag, Capiz	1977/1	1977	Mapanag creek	Gravity	150	-/2	-
6.	MALONOY	Dumarao, Capiz	1980/1	1980	Aslum creek	Gravity	300	-/2	-
7.	STA. RITA	Dumalag, Capiz	1981/1	1982	Mapanag creek	Gravity	165	90	65
8.	CODINGLE	Dumarao, Capiz	1982/1	1982	C dingle creek	Gravity	67.5	40	35
9.	TASLAN-TRACIANO	Dumarao, Capiz	1980/1	1980	Luplopan creek	Gravity	112.5	26/2	20
10.	BATING	Mambusao, Capiz	1981/1	1978	Bating creek	Gravity	90	-/2	-
11.	CALA-AGUS	Mambusao, Capiz	1978	1979	Cal-agus creek	Gravity	213	70	60
12.	SAN JOSE HUMAGEKHEK	Roxas City	1979/1	1979	Cabanatuan creek	Gravity	300	68	45
13.	MIANAY	Sigma, Capiz	1980/1	1980	Mianay creek	Gravity	150	85	55
14.	ILAS	Dao, Capiz	1981	1982	Maindang river	Gravity	1,050	650	550
15.	BALUCUAN	Sigma, Capiz	1981	1982	Balucuan creek	Gravity	472.5	280	250
16.	SINABSABAN	Maayon, Capiz	1980	1980	Sinabsaban creek	Gravity	420	40	25
17.	NASUNOGAN-ABUAC	Lemery, Iloilo	1977	1977	Nasunogan-abuac creek	Gravity	225	50	20
18.	MAPARAL	Lemery, Iloilo	1976	1976	Maparal creek	Gravity	210	65	40
19.	LEMERY	Lemery, Iloilo	1974	1975	Badbaran river	Gravity	270	15	5
20.	PONTOC	Lemery, Iloilo	1975	1975	Badbaran river	Gravity	270	170	130
21.	DAYOC	Dao, Capiz	} Systems are not operated						
22.	MALONOY	Dao, Capiz							
23.	MANHOY	Cuartero, Capiz							
	TOTAL						5,365.5	2,184	1,695

Note : /1 : Rehabilitated

/2 : Not operated due to improper maintenance of facility, as of December 1983.

TABLE VII.2-4 LIST OF PUMP IRRIGATION SYSTEM (FSDC)

Name	Location	Irrigation Area (ha)	Water Right (l/s)
1. Panay River			
Reach - I			
(1) FSDC	Lagdungan, Tapaz	44	44
(2) Poblacion Ilaya ISA	Garcia, Tapaz	40	40
(3) Poblacion Ilaya ISA	Poblacion, Dumalag	165	165
(4) Poblacion Ilaya ISA	San Jose, Dumalag	40	50
(5) FSDC	Sta. Teresa, Dumalag	27	27
Sub-total		316	316
Reach - II			
(6) Poblacion Ilaya ISA	Poblacion Ilaya, Quartero	23	23
(7) FSDC	Poblacion, Dao	35	35
(8) FSDC	Bita, Dao	50	50
(9) Manhoy ISA	Manhoy, Dao	45	45
(10) Daplos II ISA	Poblacion, Dao	72	72
(11) Malagabi ISA	Malagabi, Dao	38	38
(12) Agtanguay II ISA	Agtambi, Dao	22	22
Sub-total		285	285
Reach - III			
(13) Vicente de la Cruz ISA	Agtanguay, Dao	18	18
(14) FSDC	Dayoc, Dao	56	56
(15) Agtangauy I ISA	Agtanguay, Dao	142	142
(16) Mapulangbato ISA	Mapulangbata, Dao	23	23
(17) Daplos I ISA	Daplos, Dao	30	30
(18) FSDC	Ambilay, Panitan	55	55
Sub-total		324	324
Reach - IV			
(19) FSDC	Intampilan, Panitan	73	73
(20) Cadio ISA	Cadio, Panitan	57	57
(21) FSDC	Duna, Panitan	26	26
Sub-total		156	156
Reach - V			
(22) Salocon I,II ISA	Salocon, Panitan	233	233
(23) Bagochiquita ISA	Bagochiquita, Panay	80	80
(24) FSDC	Bago Grande, Panay	126	126
(25) FSDC	Agbanban, Panay	75	75
(26) FSDC	Daga, Panay	45	45
(27) Calitan-Anhawan ISA	Calitan-Anhawan, Panay	100	100
(28) Tanza Sur ISA	Tanza sur, Panay	75	75
(29) Cabugao Oeste ISA	Cabugao, Panay	90	90
(30) Tabuc-Calitan ISA	Tabuc-Calitan, Panay	90	90
(31) FSDC	Daga, Oeste, Roxas	21	21
(32) FSDC	Tanza Sur, Roxas	45	45
(33) FSDC	Bago-Luctogan, Roxas	65	65
(34) FSDC	Adlawan, Roxas	170	170
(35) FSDC	Bato I, Roxas	25	25
(36) FSDC	Lanot, Roxas	30	30
(37) FSDC	Bato, Roxas	15	15
(38) FSDC	Bolo, Roxas	75	75
Sub-total		1,360	1,360
Total		2,441	2,451
2. Mambusao River			
(1) FSDC	Agbalico, Jamindan	50	50
(2) FSDC	Nangka, Jamindan	150	150
(3) FSDC	Masgarod, Jamindan	20	20
(4) FSDC	Pangabat, Jamindan	90	90
(5) Guibardo Navarro ISA	Fe, Jamindan	30	30
(6) Digno Protacio ISA	Sigma	16	16
(7) Ramon Arcenas ISA	Poblacion Sur, Sigma	17	17
(8) Cayetano Calmo ISA	Poblacion Sur, Sigma	12	12
(9) FSDC	Matangcong, Sigma	80	80
(10) FSDC	Poblacion Norte, Sigma	41	41
(11) FSDC	Poblacion Sur, Sigma	150	150
(12) FSDC	Bangonbangon, Dao	72	72
Total		738	728
3. Maayon River			
(1) Batabat ISA	Poblacion, Maayon	57	57
(2) FSDC	Camagon, Maayon	41	41
(3) FSDC	Tuburan, Maayon	35	35
(4) Lacaron ISA	Lacaron, Dao	148	148
Total		281	281
Grand Total		3,460	3,460

TABLE VII. 3-1 MONTHLY MEAN DISCHARGE OF THE PANAY RIVER

(Unit: m^3/s)

Month	Aglinab-Tapaz /1	Cuartero /2	Tumalalud /3	Rallano /4
Jan	24.6	54.6	23.2	11.0
Feb	19.5	38.1	10.6	6.4
Mar	13.3	23.5	8.2	4.4
Apr	9.1	18.7	5.2	3.3
May	16.1	23.2	7.4	4.4
Jun	27.3	45.3	17.4	8.7
Jul	31.8	69.3	18.8	14.1
Aug	29.2	53.1	13.2	13.4
Sep	35.7	68.2	16.7	13.7
Oct	31.5	68.6	23.3	15.3
Nov	38.8	112.0	29.2	16.5
Dec	37.0	98.4	28.7	12.7
Average	26.2	56.1	16.8	10.3

Note ; /1 : Panay river, Catchment area; 240 km^2
Recorded period; 1959 - 1965

/2 : Panay river, Catchment area; 930 km^2
Recorded period; 1956 - 1978

/3 : Mambusao river, Catchment area; 305 km^2
Recorded period; 1950 - 1977

/4 : Maayon river, Catchment area; 265 km^2
Recorded period; 1957 - 1978

TABLE VII.4-1 CROP WATER REQUIREMENT

(Unit: mm)

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1. Mambusao Area												
(1) Wet Season Paddy (Case-1)												
- LP	0	0	0	0	182	133	0	0	0	0	0	0
- FC	0	0	0	0	4	130	192	157	36	0	0	0
- CWR	0	0	0	0	186	263	192	157	36	0	0	0
(2) Wet Season Paddy (Case-2)												
- LP	0	0	0	0	49	243	23	0	0	0	0	0
- FC	0	0	0	0	0	42	179	174	165	3	0	0
- CWR	0	0	0	0	49	285	202	174	165	3	0	0
(3) Dry Season Paddy												
- LP	0	0	0	0	0	0	0	0	0	0	182	133
- FC	156	173	52	0	0	0	0	0	0	0	3	100
- CWR	156	173	52	0	0	0	0	0	0	0	185	233
2. Panitan-Panay Area												
(1) Wet Season Paddy												
- LP	0	0	0	0	182	133	0	0	0	0	0	0
- FC	0	0	0	0	4	130	190	118	3	0	0	0
- CWR	0	0	0	0	186	263	190	118	3	0	0	0
(2) Dry Season Paddy												
- LP	0	0	0	0	0	0	0	0	49	243	23	0
- FC	35	0	0	0	0	0	0	0	0	33	163	153
- CWR	35	0	0	0	0	0	0	0	49	276	186	153
(3) Beans												
- LP	0	60	0	0	0	0	0	0	0	0	0	0
- FC	0	24	170	186	75	0	0	0	0	0	0	0
- CWR	0	84	170	186	75	0	0	0	0	0	0	0

TABLE VII.4-2 CALCULATION OF REFERENCE CROP EVAPOTRANSPIRATION

Station: PAGASA in Roxas
Period: 1971 - 1983

Item		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Temperature (°C)		25.9	26.0	26.7	27.9	28.5	27.9	27.6	27.7	27.1	27.0	27.2	26.5
Mean Relative Humidity (%)		80	81	79	77	78	82	83	82	83	83	81	83
Solar Radiation* (Cal/cm^2/day)		347	419	490	516	475	436	410	362	383	349	360	346
Wind Velocity (km/day)		297	280	320	284	235	231	209	218	204	253	324	351
Form of Equation													
ETo = c[W.Rn + (1-w).f(u).(ea-ed)]													
(1) (ea-ed)	(mbar)	6.68	6.68	7.36	8.65	8.57	6.77	6.28	6.69	6.10	6.07	6.86	5.89
(2) f(u) = 0.27 (1+u/100)		1.08	1.03	1.13	1.04	0.90	0.89	0.83	0.86	0.82	0.95	1.14	1.22
(3) 1 - W		0.25	0.25	0.24	0.23	0.23	0.23	0.23	0.23	0.24	0.24	0.24	0.25
(4) W		0.75	0.75	0.76	0.77	0.77	0.77	0.77	0.77	0.76	0.76	0.76	0.75
(5) Rn	(mm/day)	2.9	4.1	5.2	5.6	5.1	5.0	4.5	3.7	4.1	3.5	3.7	2.9
(6) C		0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9
(7) ETo	(mm/day)	3.6	4.7	5.9	6.4	5.7	5.2	4.7	4.2	4.3	3.6	4.2	3.6
	(mm/month)	112	132	183	192	177	156	146	130	129	112	126	112

Note; * : Recorded in Quezon City (1971-1980)

TABLE VII.4-3 CROP AREA FACTOR

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1. Mambusao Area												
(1) Wet Seasson Paddy (Case-1)												
- LP (kl)	0	0	0	0	0.48	0.35	0	0	0	0	0	0
- FC (kf)	0	0	0	0	0.02	0.65	1.00	0.94	0.22	0	0	0
- Total (kt)	0	0	0	0	0.50	1.00	1.00	0.94	0.22	0	0	0
(2) Wet Season Paddy (Case-2)												
- LP (kl)	0	0	0	0	0.13	0.64	0.06	0	0	0	0	0
- FC (kf)	0	0	0	0	0	0.22	0.94	1.00	0.70	0.02	0	0
- Total (kt)	0	0	0	0	0.13	0.86	1.00	1.00	0.70	0.02	0	0
(3) Dry Season Paddy												
- LP (kl)	0	0	0	0	0	0	0	0	0	0	0.48	0.35
- FC (kf)	1.00	0.94	0.22	0	0	0	0	0	0	0	0.02	0.65
- Total (kt)	1.00	0.94	0.22	0	0	0	0	0	0	0	0.50	1.00
2. Panitan-Panay Area												
(1) Wet Season Paddy												
- LP (kl)	0	0	0	0	0.48	0.35	0	0	0	0	0	0
- FC (kf)	0	0	0	0	0.02	0.65	1.00	0.70	0.02	0	0	0
- Total (kt)	0	0	0	0	0.50	1.00	1.00	0.70	0.02	0	0	0
(2) Dry Season Paddy												
- LP (kl)	0	0	0	0	0	0	0	0	0.13	0.64	0.06	0
- FC (kf)	0.22	0	0	0	0	0	0	0	0	0.22	0.94	0.94
- Total (kt)	0.22	0	0	0	0	0	0	0	0.13	0.86	1.00	0.94
(3) Beans (kt)	0	0.25	1.00	1.00	0.50	0	0	0	0	0	0	0

TABLE VII. 4-4 AVERAGE CROP COEFFICIENT

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1. Mambusao Area												
(1) Wet Season Paddy (Case-1)	0	0	0	0	1.02	1.09	1.10	1.05	1.02	0	0	0
(2) Wet Season Paddy (Case-2)	0	0	0	0	0	1.02	1.09	1.10	1.05	0.99	0	0
(3) Dry Season Paddy	1.12	1.18	1.12	0	0	0	0	0	0	0	1.02	1.09
2. Panitan-Panay Area												
(1) Wet Season Paddy	0	0	0	0	1.02	1.09	1.09	1.06	0.99	0	0	0
(2) Dry Season Paddy	1.15	0	0	0	0	0	0	0	0	1.07	1.14	1.18
(3) Beans	0	0.72	0.93	0.97	0.85	0	0	0	0	0	0	0

TABLE VII. 4-5 EFFECTIVE RAINFALL IN ROXAS (PADDY)

(Unit: mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1950	140	48	95	83	131	186	85	146	215	189	124	80	1,522
1951	55	30	26	34	180	57	151	78	192	142	164	157	1,266
1952	58	58	50	1	116	151	150	211	156	303	163	120	1,537
1953	85	52	38	36	26	246	171	162	142	240	159	248	1,595
1954	41	54	127	26	138	220	158	146	99	138	119	156	1,420
1955	166	30	19	5	102	168	138	156	145	215	230	60	1,434
1956	84	49	31	168	207	112	224	177	152	216	102	268	1,790
1957	144	29	39	59	18	154	159	145	110	184	102	34	1,177
1958	57	23	72	45	42	139	150	220	40	276	190	52	1,306
1959	38	4	57	3	45	142	220	123	167	133	160	202	1,294
1960	31	85	87	60	135	130	135	171	216	212	152	60	1,474
1961	15	38	45	7	118	152	81	114	148	118	103	41	980
1962	75	50	50	40	124	129	184	235	229	163	165	28	1,472
1963	27	17	24	40	50	105	204	178	105	160	67	63	1,100
1964	13	62	14	7	167	163	198	148	210	240	232	82	1,536
1965	114	14	55	52	84	145	112	152	163	113	90	127	1,221
1966	67	5	0	12	278	150	238	165	166	231	-	126	1,221
1967	186	92	17	19	81	123	141	124	50	167	184	36	1,220
1968	76	25	13	2	25	123	167	143	109	203	153	105	1,144
1969	34	26	17	9	118	136	213	170	102	112	65	123	1,125
1970	38	94	78	0	0	182	174	109	178	341	222	105	1,521
1971	109	58	91	99	182	294	231	123	160	208	206	63	1,824
1972	226	16	49	18	23	171	37	102	152	121	160	120	1,195
1973	3	21	31	10	0	93	176	206	278	175	422	208	1,623
1974	82	59	17	18	59	112	170	109	89	237	150	155	1,257
1975	96	58	7	168	76	145	116	146	210	332	140	212	1,706
1976	26	21	24	10	119	105	106	180	103	155	202	167	1,218
1977	94	101	24	38	63	186	151	144	138	130	60	62	1,191
1978	40	26	10	54	86	164	117	101	160	-	144	145	-
1979	51	21	6	122	83	209	102	157	125	152	64	126	1,218
1980	66	48	80	31	69	322	162	129	93	162	146	92	1,400
1981	14	14	10	25	46	145	94	108	149	154	136	91	986
1982	48	29	74	9	84	139	70	205	106	105	76	44	989
1983	16	3	5	2	5	177	203	146	158	224	149	-	-

TABLE VII. 4-6 EFFECTIVE RAINFALL IN ROXAS (UPLAND CROP)

(Unit: mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1950	120	42	83	73	113	154	75	124	175	157	107	70	1,293
1951	48	26	22	30	150	50	128	124	159	122	138	133	1,130
1952	51	50	44	1	100	128	128	68	132	238	137	103	1,180
1953	75	46	34	22	23	197	143	172	122	193	134	199	1,360
1954	36	47	109	23	119	178	134	137	84	119	103	132	1,221
1955	140	26	17	4	89	141	118	125	124	175	186	53	1,198
1956	74	43	27	141	169	97	182	132	129	176	89	213	1,492
1957	123	25	34	52	15	131	134	148	95	153	88	30	1,028
1958	50	20	63	39	37	119	128	124	35	219	157	46	1,037
1959	34	4	50	3	39	121	179	129	140	115	135	166	1,115
1960	27	74	76	53	116	112	116	95	176	173	129	53	1,200
1961	13	33	39	6	102	129	71	35	126	102	89	36	781
1962	66	43	43	35	107	111	153	140	185	137	139	25	1,184
1963	24	15	21	35	43	91	167	176	139	135	59	55	960
1964	11	55	12	6	140	137	163	126	172	193	187	72	1,274
1965	99	13	48	46	74	124	97	185	137	98	79	109	1,109
1966	59	4	0	11	220	128	192	139	140	187	-	108	-
1967	154	80	15	17	71	106	121	172	43	140	153	32	1,104
1968	67	22	11	2	22	106	140	137	94	167	130	91	989
1969	30	22	15	8	102	117	174	140	89	97	57	106	957
1970	33	82	68	0	0	152	146	43	148	265	180	91	1,208
1971	95	50	79	86	152	232	187	94	135	170	168	55	1,503
1972	176	14	43	15	20	143	32	89	129	104	135	103	1,003
1973	3	18	27	9	0	81	147	168	220	146	209	170	1,198
1974	72	52	15	16	52	97	142	95	78	191	127	131	1,068
1975	83	51	6	141	67	124	100	125	172	174	123	173	1,339
1976	23	18	21	9	103	91	92	150	89	131	166	140	1,033
1977	82	88	21	33	55	154	128	123	119	112	53	55	1,023
1978	35	22	9	48	75	68	101	88	135	-	123	124	-
1979	45	18	6	105	73	171	88	133	108	129	56	109	1,041
1980	57	42	70	27	60	252	137	111	81	137	124	80	1,178
1981	12	12	9	22	40	124	82	93	127	131	117	80	849
1982	42	25	65	8	73	120	62	168	92	91	67	39	852
1983	14	3	4	1	4	148	167	124	134	182	127	-	-

TABLE VII.4-7 EFFECTIVE RAINFALL IN MAMBUSAO (PADDY)

(Unit: mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1976	161	44	71	23	87	133	148	144	146	156	183	347	1,643
1977	133	152	102	26	81	213	144	141	133	137	195	107	1,564
1978	94	49	10	90	127	212	150	135	148	145	136	198	1,494
1979	56	20	28	142	101	209	172	158	82	167	235	149	1,519
1980	127	64	140	22	12	280	215	195	248	199	261	195	1,958
1981	154	86	18	105	191	147	159	135	215	254	211	209	1,884
1982	162	126	93	13	85	204	117	190	145	121	109	92	1,457

TABLE VII.4-8 CROPPING INTENSITY

Crop	Wet Season	Dry Season	Total
1. Mambusao Area			
(1) Wet Season Paddy	1.0	-	1.0
(2) Dry Season Paddy	-	1.0	1.0
Total	1.0	1.0	2.0
2. Panitan-Panay Area			
(1) Wet Season Paddy	1.0	-	1.0
(2) Dry Season Paddy	-	1.0	1.0
(3) Beans	-	0.5	0.5
Total	1.0	1.5	2.5

TABLE VII.4-9 UNIT IRRIGATION DIVERSION REQUIREMENT
PANITAN - PANAY AREA

(Unit: lit/s/ha)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1950	0.03	0.34	0.38	0.49	0.90	0.55	0.72	0.11	0.15	0.78	0.49	0.53
1951	0.16	0.36	0.64	0.67	0.66	1.46	0.27	0.44	0.17	1.06	0.23	0.04
1952	0.15	0.32	0.55	0.80	0.98	0.79	0.27	0	0.20	0.11	0.23	0.28
1953	0.11	0.33	0.59	0.71	1.45	0.12	0.13	0.03	0.22	0.48	0.26	0
1954	0.18	0.33	0.28	0.70	0.87	0.30	0.22	0.11	0.27	1.08	0.53	0.04
1955	0	0.36	0.66	0.78	1.05	0.67	0.36	0.06	0.21	0.63	0	0.66
1956	0.11	0.33	0.62	0.19	0.57	1.07	0	0	0.21	0.62	0.64	0
1957	0.02	0.36	0.59	0.58	1.50	0.77	0.21	0.11	0.25	0.81	0.64	0.83
1958	0.15	0.36	0.47	0.63	1.37	0.88	0.27	0	0.33	0.27	0.05	0.71
1959	0.18	0.38	0.52	0.79	1.35	0.86	0	0.22	0.19	1.11	0.25	0
1960	0.19	0.29	0.41	0.57	0.88	0.94	0.38	0	0.15	0.64	0.31	0.66
1961	0.22	0.35	0.57	0.78	0.97	0.79	0.75	0.26	0.21	1.20	0.63	0.79
1962	0.13	0.34	0.55	0.65	0.94	0.95	0.04	0	0.14	0.93	0.22	0.87
1963	0.20	0.37	0.64	0.65	1.33	1.12	0	0	0.20	0.95	0.87	0.64
1964	0.22	0.31	0.68	0.78	0.72	0.71	0	0.10	0.15	0.48	0	0.52
1965	0.07	0.37	0.53	0.60	1.15	0.84	0.54	0.08	0.20	1.23	0.72	0.23
1966	0.14	0.38	0.73	0.75	0.32	0.80	0	0.02	0.19	0.53	0.31	0.24
1967	0	0.30	0.67	0.73	1.16	0.99	0.34	0.21	0.32	0.91	0.09	0.82
1968	0.13	0.35	0.68	0.79	1.46	0.99	0.16	0.12	0.25	0.70	0.30	0.37
1969	0.19	0.36	0.67	0.77	0.97	0.90	0	0	0.26	1.23	0.89	0.26
1970	0.18	0.29	0.45	0.80	1.59	0.57	0.11	0.29	0.18	0	0	0.37
1971	0.08	0.33	0.40	0.43	0.65	0	0	0.22	0.20	0.67	0	0.64
1972	0	0.36	0.55	0.74	1.47	0.65	1.05	0.32	0.21	1.18	0.25	0.28
1973	0.24	0.37	0.62	0.76	1.59	1.21	0.10	0	0.09	0.86	0	0
1974	0.12	0.33	0.67	0.73	1.28	1.07	0.14	0.29	0.27	0.50	0.32	0.05
1975	0.10	0.33	0.70	0.19	1.19	0.84	0.51	0.11	0.15	0	0.39	0
1976	0.20	0.35	0.64	0.76	0.97	1.12	0.58	0	0.26	0.98	0	0
1977	0.10	0.29	0.64	0.66	1.26	0.55	0.27	0.12	0.22	1.13	0.92	0.65
1978	0.18	0.36	0.69	0.59	1.14	0.70	0.50	0.32	0.20	0.78	0.36	0.11
1979	0.16	0.37	0.70	0.35	1.15	0.38	0.60	0.06	0.24	1.00	0.89	0.24
1980	0.14	0.33	0.44	0.68	1.23	0	0.19	0.19	0.27	0.94	0.35	0.46
1981	0.22	0.37	0.69	0.71	1.35	0.84	0.66	0.29	0.21	0.99	0.41	0.46
1982	0.17	0.36	0.46	0.77	1.15	0.88	0.82	0	0.26	1.27	0.81	0.77
1983	0.22	0.38	0.71	0.80	1.56	0.61	0	0.11	0.20	0.57	0.33	0.31

TABLE VII.4-10 UNIT IRRIGATION DIVERSION REQUIREMENT
MAMBUSAO AREA, CASE-1

(Unit: lit/s/ha)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	0	0.97	0.25	0	0.98	0.92	0.30	0.15	0.03	0	0.66	0
1977	0.16	0.23	0.20	0	1.00	0.35	0.33	0.17	0.05	0	0.62	0.86
1978	0.43	0.96	0.34	0	0.84	0.36	0.29	0.21	0.02	0	0.83	0.24
1979	0.69	1.17	0.31	0	0.93	0.38	0.14	0.06	0.13	0	0.48	0.58
1980	0.20	0.83	0.15	0	1.24	0	0	0	0	0	0.39	0.26
1981	0.01	0.70	0.33	0	0.62	0.82	0.23	0.21	0	0	0.56	0.16
1982	0	0.41	0.22	0	0.98	0.42	0.51	0	0.03	0	0.93	0.97

TABLE VII.4-11 UNIT IRRIGATION DIVERSION REQUIREMENT
MAMBUSAO AREA, CASE-2

(Unit: lit/s/ha)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	0	0.97	0.25	0	0.26	1.21	0.37	0.21	0.45	0	0.66	0
1977	0.16	0.23	0.20	0	0.26	0.72	0.40	0.23	0.51	0	0.62	0.86
1978	0.43	0.96	0.34	0	0.22	0.73	0.36	0.27	0.44	0	0.83	0.24
1979	0.69	1.17	0.31	0	0.25	0.75	0.21	0.11	0.76	0	0.48	0.58
1980	0.20	0.83	0.15	0	0.33	0.31	0	0	0	0	0.39	0.26
1981	0.01	0.70	0.33	0	0.17	1.12	0.30	0.27	0.10	0	0.56	0.16
1982	0	0.41	0.22	0	0.26	0.78	0.58	0	0.45	0	0.93	0.97

TABLE VII. 4-12 IRRIGATION WATER DEMAND

(Unit: m^3/s)

Name of Scheme		Area (ha)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NIS														
(1)	Panitan-Panay	3,250	0.42	1.14	2.21	2.57	4.75	3.22	0.52	0.39	0.81	2.26	0.98	1.20
(2)	Mambusao	1,720												
	- Case - 1		1.19	2.01	0.53	0	1.69	1.38	0.32	0.26	0.05	0	1.43	0.41
	- Case - 2		1.19	2.01	0.53	0	0.45	2.08	0.64	0.36	0.77	0	1.43	0.41
CIS														
(1)	Tapaz	300	0.21	0.35	0.09	0	0.29	0.28	0.09	0.05	0.01	0	0.25	0.07
(2)	Dumalag	300	0.21	0.35	0.09	0	0.29	0.28	0.09	0.05	0.01	0	0.25	0.07
(3)	Lemery	300	0.21	0.35	0.09	0	0.29	0.28	0.09	0.05	0.01	0	0.25	0.07
(4)	Dumarao	550	0.40	0.64	0.17	0	0.54	0.51	0.17	0.08	0.02	0	0.46	0.13
(5)	Cuartero	650	0.45	0.76	0.20	0	0.64	0.60	0.20	0.10	0.02	0	0.54	0.16
(6)	Jagnaya	150	0.10	0.18	0.05	0	0.15	0.14	0.05	0.02	0.01	0	0.12	0.04
(7)	Ilas	1,000	0.69	1.17	0.31	0	0.98	0.92	0.30	0.15	0.03	0	0.83	0.24

TABLE VII.4-13 MONTHLY MEAN RIVER DISCHARGES AT PROPOSED INTAKE SITES

(Unit: m^3/s)

Month	Panitan-Panay /1 C.A. = 1,955 km^2	Mambusao /2 C.A. = 305 km^2
Jan	114.7	23.2
Feb	80.0	10.6
Mar	49.4	8.2
Apr	39.3	5.2
May	48.7	7.4
Jun	95.1	17.4
Jul	145.5	18.8
Aug	111.5	13.2
Sep	143.2	16.7
Oct	144.1	23.3
Nov	235.2	29.2
Dec	206.6	28.7

Note; /1 : Discharges are derived from the monthly mean discharges gauged at Cuartero using a conversion factor of 2.1 as explained in the Sectoral Report of Hydrology.

/2 : Discharges are regarded as the same monthly mean discharges gauged at Tumalalud.

TABLE VII.4-14 COMPARISON ON GENERAL FEATURE FOR ALTERNATIVE INTAKE SYSTEMS

Item	Pump System	Gravity System
(1) Intake Facility	Pump Station and Headreach of about 2 km (See Fig.4.5)	Headworks and Headreach of about 7 km (See Fig.4.6)
(2) Location of Intake Facility	On the both right and left banks of the Panay river about 1.0 km upstream of the Panitan bridge (See Fig.4.4)	On the Panay river about 2.5 km upstream of the Panitan bridge (See Fig.4.4)
(3) Potential Area	3,250 ha	3,250 ha
(4) Irrigable Area	3,250 ha	1,150 ha
(5) Intake Water Level	No limitation, providing whole potential area with irrigation water	Maximum is El. 5 m, so as not to make paddy field in the upstream reaches submerge under the checked water
(6) Initial Investment	Cheap	Costly
(7) Construction	No coffering works	Need coffering works and longer costruction period
(8) Operation & Maintenance	Complicated, costly, but accurate diversion of water	Easy, cheap, but rough diversion of water

TABLE VII.4-15 ECONOMIC COMPARISON ON ALTERNATIVE INTAKE SYSTEMS

	Item	Pump System	Gravity System
(1)	Irrigation Area (ha)	3,250	1,300
(2)	Initial Investment (10^3US$)	2,250	7,235
	(a) Preparatory works	51	386
	(b) Civil works	642	4,831
	(c) Pump	424	-
	(d) Mechanical works	275	924
	(e) Electrical works	409	150
	(f) Miscellaneous	156	-
	(g) Contingency	293	944
(3)	Annual O & M Cost (10^3US$)	225	40
	(a) Personnel charge	5	4
	(b) Maintenance charge	15	36
	(c) Electric power charge/1	205	-
(4)	Annual Equivalent Cost of Initial Investment (10^3US$)	201	606
	(a) Civil works/2	65	490
	(b) Other works/3	136	116
(5)	Total Annual Equivalent Cost ((3) + (4)) (10^3US$)	426	646
(6)	Total Annual Equivalent Cost per ha ((5)/(1)) (US$/ha)	131	497

Note: /1: CAPELCO's electric charge of 2.495 ₱/kWh is applied.
/2: Useful life; 50 years, discount rate; 8%
/3: Useful life; 25 years, discount rate; 8%

TABLE VII.4-16 COMPARATIVE STUDY ON OPERATION COST FOR PUMP

	Item	Present P/S	Proposed Project
(1)	Irrigation Area	1,637 ha (1,360 + 277)	3,250 ha
(2)	Discharge	1,765 lit./S (1,360 + 405)	4,745 lit./S
(3)	Number of Pump	41 nos (17 + 24)	5 nos
(4)	Discharge/no.	2.58 m^3/min/no.	56.94 m^3/min/no.
(5)	Driving Method	Diesel Engine	Electric Mortor
(6)	Peak Power	7.5 PS	400 kW
(7)	Power Charge/no.	1.56 ₱/PSH/no. /1	2.495 ₱/KWH/no. /2
(8)	Annual Power Requirement/no.	65,700 PSH/no.	296,810 KWH/no.
(9)	Annual Power Charge/no. ((7) x (8))	102,500 ₱/no.	740,500 ₱/no.
(10)	Annual Power Charge ((9) x (3))	4,202,500 ₱	3,702,500 ₱
(11)	Annual Power Charge/ha ((10) / (11))	2,567 ₱/ha	1,139 ₱/ha

Note: /1: 0.25 lit./PSH is applied

/2: CAPELCO's electric charge of 2.495 ₱/KWH is applied

TABLE VII. 5-1 (1) GENERAL FEATURE OF PROJECT FACILITIES FOR PANITAN-PANAY AREA

1.	Source of Irrigation Water	:	the Panay river
2.	Net Irrigation Area	:	3,400 ha
3.	Design Diversion Requirement	:	P-1 Area: 1.37 m^3/s ; P-2 Area: 3.37 m^3/s
4.	Intake Facility	:	
	(1) Pump station		
	– Location	:	right bank / left bank
	– Commanding area	:	940 ha / 2,310 ha
	– Pump bore	:	ϕ 450 mm / ϕ 800 mm
	– Number of pump	:	2 nos. / 3 nos.
	– Type of pump	:	vertical mixed flow
	– Design discharge	:	82.2 m^3/min / 202.2 m^3/min
	– Total head	:	7 m / 8 m
	– Design water level		
	Flood water level	:	EL 10.2 m / EL 10.2 m
	Normal water level	:	EL 1.5 m / EL 1.5 m
	Low water level	:	EL 0 m / EL 0 m
	(2) Headreach		
	– Type of canal	:	trapezoidal concrete lined
	– Side slope of canal	:	1 : 1.5
	– Width of inspection road	:	4.0 m
	– Length	:	0.6 km / 1.2 km
	(3) Related structure		
	– Culvert	:	2 nos. / 4 nos.
	– Crossdrain	:	– / 1 no.
	– Bifurcation structure	:	– / 1 no.
5.	Irrigation Facilities		
	(1) Main canal		
	– Type of canal	:	trapezoidal earth canal
	– Side slope of canal	:	1 : 1.5
	– Width of inspection road	:	4.0 m
	– Length	:	2.3 km / 15.5 km

(to be continued)

TABLE VII.5-1 (2) GENERAL FEATURE OF PROJECT FACILITIES FOR PANITAN-PANAY AREA

		P-1 Area	P-2 Area
(2)	Lateral canal		
	– Type of canal :	trapezoidal earth canal	
	– Side slope of canal :	1 : 1.5	
	– Width of inspection road:	4.0 to 2.5 m	
	– Length :	16.0 km	23.6 km
(3)	Related structures		
	– Culvert :	6 nos.	37 nos.
	– Check structure :	12 nos.	25 nos.
	– Drop structure :	–	4 nos.
	– Headgate :	3 nos.	8 nos.
	– Turnout :	38 nos.	62 nos.
	– Spillway :	2 no.	4 nos.
	– Aqueduct :	5 nos.	5 nos.
	– Crossdrain :	2 no.	2 nos.
	– Terminal structure :	5 nos.	6 nos.
	– Parshall flume :	5 nos.	6 nos.
6.	Drainage Facilities		
(1)	Main drain		
	– Type of canal :	trapezoidal earth canal	
	– Side slope of canal :	1 : 1.5	
	– Length :	0.7 km	12.3 km
(2)	Collector drain		
	– Type of canal :	trapezoidal earth canal	
	– Side slope of canal :	1 : 1.5	
	– Length :	6.3 km	11.4 km
(3)	Related structures		
	– Drainage culvert :	2 no.	2 nos.
	– Drainage inlet :	18 nos.	59 nos.

(to be continued)

TABLE VII.5-1 (3) GENERAL FEATURE OF PROJECT FACILITIES FOR PANITAN-PANAY AREA

		P-1 Area	P-2 Area
7. On-Farm Development			
(1) Farm ditch			
– Type of canal	:	trapezoidal earth canal	
– Side slope of canal	:	1 : 1.0	
– Length	:	48.9 km	191.1 km
(2) Farm drain			
– Type of canal	:	trapezoidal earth canal	
– Side slope of canal	:	1 : 1.0	
– Length	:	14.9 km	147.6 km
(3) Related structures			
– Culvert	:	41 nos.	102 nos.
– Division work	:	85 nos.	208 nos.
– Overchute	:	–	1 no.
– Crossdrain	:	5 nos.	11 nos.
– Drainage culvert	:	3 no.	1 nos.

TABLE VII.5-2 (1) GENERAL FEATURES OF PROJECT FACILITIES FOR MAMBUSAO AREA

1.	Source of Irrigation Water	:	the Mambusao river		
2.	Net Irrigation Area	:	2,145 ha		
	– Existing area	:	1,640 ha		
	– Extension area	:	505 ha		
3.	Design Diversion Requirement	:	2.60 m^3/s		
4.	Intake Facility				
	– Design intake capacity	:	2.60 m^3/s		
	– Design intake water level	:	EL 18.4 m		
	– Rehabilitation	:	repair of appron		
		:	bank protection		
		:	repair of intake gate		
5.	Irrigation Facilities & Road				
	(1) Main canal				
	– Type of canal	:	trapezoidal earth canal		
	– Side slope of canal	:	1 : 1.5		
	– Width of inspection road	:	4 m (effective width 3 m)		
	– Length	:	14.6 km (rehabilitation)		
	(2) Lateral canals				
	– Type of canal	:	trapezoidal earth canal		
	– Side slope of canal	:	1 : 1.5		
	– Width of inspection road	:	4 to 2.5 m (effective width		
		:	3-1.7 m)		
	– Length	:	33.2 km (rehabilitation)		
		:	5.5 km (new construction)		
	(3) No. of related structure		Rehab.	Const.	Total
	– Culvert	:	13	10	23
	– Syphon	:	31	3	34
	– Check structure	:	1	12	13
	– Drop structure	:	0	5	5
	– Head gate	:	9	1	10
	– Turnout	:	0	63	63

(to be continued)

TABLE VII.5-2 (2) GENERAL FEATURES OF PROJECT FACILITIES FOR MAMBUSAO AREA

		Rehab.	Const.	Total
- Cross drain	:	6	28	34
- Parshall flume	:	0	9	9
6. Drainage Facilities				
- Construction of drain	:	25 km		
- Rehabilitation of creek	:	11 km		
- No. of drainage culvert	:	5 nos.		
- No. of drainage culvert	:	48 nos.		
7. On-farm Development				
- Construction of farm ditch	:	150 km		
- Construction of farm drain	:	105 km		
- No. of division box	:	190 nos.		
- No. of culvert	:	90 nos.		

TABLE VII.5-3 ALTERNATIVE STUDY ON PUMP SYSTEM

(Unit: US$)

Item	P - 1 (Right Bank)		P - 2 (Left Bank)	
	Alt - 1 (ϕ400 x 4 nos.)	Alt - 2 (ϕ450 x 3 nos.)	Alt - 1 (ϕ700 x 3 nos.)	Alt - 2 (ϕ800 x 2 nos.)
1. Initial Investment Cost				
(1) Civil works /1	87,500	84,800	77,900	76,300
(2) Pump	183,700	170,700	270,500	253,600
(3) Mechanical works	139,000	126,300	150,200	149,000
(4) Electrical works	247,700	230,400	188,700	178,900
(5) Valve and others	88,500	76,400	84,600	75,700
Total	746,400	688,600	771,900	733,500
2. Annual O & M Cost				
(1) Personnel charge	2,100	2,100	2,900	2,900
(2) Maintenance charge	7,400	6,900	8,500	7,600
(3) Electric power charge /2	53,200	57,500	143,000	147,300
Total	62,700	66,500	154,400	157,800
3. Annual Equivalent Cost				
(1) Initial investment /3	68,900	63,600	71,400	67,800
(2) O & M Cost	62,700	66,500	154,400	157,800
Total	131,600	130,100	225,800	225,600

Note: /1: Construction cost only for pump house.

/2: CAPELCO's electric charge of 2.495 ₱/kWh is applied.

/3: Discount rate of 8% is applied.
Useful life of civil works is 50 years and others are 25 years.

TABLE VII.5-4 ELECTRIC POWER REQUIREMENT AND POWER CHARGE FOR PUMP ALTERNATIVES

Month	P-1 (Right Bank)				P-2 (Left Bank)			
	ϕ400 x 4		ϕ450 x 3		ϕ700 x 3		ϕ900 x 2	
	Power /1 Requirement	Power /2 Charge	Power Requirement	Power Charge	Power Requirement	Power Charge	Power Requirement	Power Charge
JAN.	8,700	1,200	9,400	1,300	24,600	3,400	25,400	3,500
FEB.	19,600	2,700	21,000	2,900	55,800	7,700	57,200	7,900
MAR.	39,900	5,500	42,800	5,900	106,500	14,700	109,400	15,100
APR.	44,900	6,200	48,600	6,700	117,400	16,200	121,000	16,700
MAY	78,300	10,800	84,800	11,700	205,800	28,400	212,300	29,300
JUN.	50,700	7,000	55,100	7,600	134,800	18,600	138,400	19,100
JUL.	19,600	2,700	21,700	3,000	54,300	7,500	56,500	7,800
AUG.	6,500	900	7,200	1,000	21,700	3,000	22,500	3,100
SEP.	13,000	1,800	13,800	1,900	37,700	5,200	38,400	5,300
OCT.	54,300	7,500	58,700	8,100	142,800	19,700	147,100	20,300
NOV.	23,900	3,300	25,400	3,500	65,200	9,000	67,400	9,300
DEC.	26,100	3,600	28,300	3,900	69,600	9,600	71,700	9,900
TOTAL	385,500	53,200	416,700	57,500	1,036,200	143,000	1,067,300	147,300

Note: /1: Unit: KWH
: /2: CAPELCO;S electric charge of 2,495 ₱/KWH is applied
Unit: US$

TABLE VII.7-1 SUMMARY OF CONSTRUCTION COST FOR PANITAN-PANAY AREA

(Unit: 10^3US$)

Item	Overall			P-1 Pump			P-2 Pump		
	Total	Foreign Currency	Local Currency	Total	Foreign Currency	Local Currency	Total	Foreign Currency	Local Currency
1. Direct Construction Cost									
1.1 Preparatory works	312	62	250	84	17	67	228	45	183
1.2 Pump stations	1,947	1,518	429	693	592	101	1,254	926	328
1.3 Irrigation facilities	2,745	1,328	1,417	694	342	352	2,051	986	1,065
1.4 Drainage facilities	877	520	357	169	100	69	708	420	288
1.5 On-farm development	679	397	282	131	75	56	548	322	226
Sub-total	6,560	3,825	2,735	1,771	1,126	645	4,789	2,699	2,090
2. O & M Facilities	556	325	231	361	211	150	431	313	118
3. Land Acquisition	74	0	74	19	0	19	55	0	55
4. Engineering Services	1,312	1,050	262	354	283	71	958	766	192
5. Administration Cost of Executive Agency	328	0	328	89	0	89	239	0	239
Sub-total	8,830	5,200	3,630	2,594	1,620	974	6,472	3,778	2,694
6. Physical Contingency	1,325	780	545	389	243	146	971	567	404
Grand Total	10,155	5,980	4,175	2,983	1,863	1,120	7,443	4,345	3,098

TABLE VII.7-2 SUMMARY OF CONSTRUCTION COST FOR MAMBUSAO AREA

(Unit: 10^3US$)

Item	Total	Foreign Currency	Local Currency
1. Direct Construction Cost			
1.1 Preparatory works	129	26	103
1.2 Intake facility	21	14	7
1.3 Irrigation facilities	1,528	696	832
1.4 Drainage facilities	578	345	233
1.5 On-farm development	445	261	184
Sub-total	2,701	1,342	1,359
2. O & M Facilities	431	313	118
3. Land Acquisition	29	0	29
4. Engineering Services	540	432	108
5. Administration Cost of Executive Agency	135	0	135
Sub-total	3,836	2,087	1,749
6. Physical Contingency	575	313	262
Grand Total	4,411	2,400	2,011

TABLE VII.7-3 DISBURSEMENT SCHEDULE OF CONSTRUCTION COST FOR PANITAN-PANNAY AREA (Overall)

(Unit: 10^3 US$)

Item	Total			1st year			2nd year			3rd year			4th year			5th year			6th year		
	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC
1. Direct Construction Cost																					
1.1 Preparatory works	312	62	250	0	0	0	0	0	0	218	43	175	84	19	75	0	0	0	0	0	0
1.2 Pump station	1,947	1,518	429	0	0	0	0	0	0	585	456	129	777	606	171	585	456	129	0	0	0
1.3 Irrigation facilities	2,745	1,328	1,417	0	0	0	0	0	0	549	265	284	823	399	424	823	398	425	550	266	284
1.4 Drainage facilities	877	520	357	0	0	0	0	0	0	0	0	0	263	156	107	351	208	143	263	156	107
1.5 On-farm development	679	397	282	0	0	0	0	0	0	0	0	0	135	79	56	272	159	113	272	159	113
Sub-total	6,560	3,825	2,735	0	0	0	0	0	0	1,352	764	588	2,092	1,259	833	2,031	1,221	810	1,085	581	504
2. O & M Facilities	556	325	231	0	0	0	112	65	47	111	65	46	111	65	46	111	65	46	111	65	46
3. Land Acquisition	74	0	74	0	0	0	22	0	22	30	0	30	22	0	22	0	0	0	0	0	0
4. Engineering Services	1,312	1,050	262	131	104	27	263	210	53	328	263	65	263	210	53	186	159	37	131	104	27
5. Administration Cost of Executive Agency	328	0	328	33	0	33	65	0	65	66	0	66	66	0	66	65	0	65	33	0	33
Sub-total	8,830	5,200	3,630	164	104	60	462	275	187	1,887	1,092	795	2,554	1,534	1,020	2,403	1,445	958	1,360	750	610
6. Physical Contingency	1,325	780	545	25	16	9	69	41	28	282	163	119	382	229	153	361	217	144	206	114	92
Grand Total	10,155	5,980	4,175	189	120	69	531	316	215	2,169	1,255	914	2,936	1,763	1,173	2,764	1,662	1,102	1,566	864	702

TABLE VII.7-4 DISBURSEMENT SCHEDULE OF CONSTRUCTION COST FOR PANITAN-PANAY AREA (P-1 PUMP)

Item	Total			1st year			2nd year			3rd year			4th year		
	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC
1. Direct Construction															
1.1 Preparatory works	84	17	67	0	0	0	84	17	67	0	0	0	0	0	0
1.2 Pump station	693	592	101	0	0	0	485	414	71	208	178	30	0	0	0
1.3 Irrigation facilities	694	342	352	0	0	0	278	137	141	416	205	211	0	0	0
1.4 Drainage facilities	169	100	69	0	0	0	0	0	0	0	0	0	169	100	69
1.5 On-farm development	131	75	56	0	0	0	0	0	0	26	15	11	105	60	45
Sub-total	1,771	1,126	645	0	0	0	847	568	279	650	398	252	274	160	114
2. O & M Facilities	361	211	150	0	0	0	108	63	45	145	85	60	108	63	45
3. Land Acquisition	19	0	19	0	0	0	19	0	19	0	0	0	0	0	0
4. Engineering Services	354	283	71	88	70	18	90	73	17	88	70	18	88	70	18
5. Administration Cost of Executive Agency	89	0	89	9	0	9	27	0	27	27	0	27	26	0	26
Sub-total	2,594	1,620	974	97	70	27	1,091	704	387	910	553	357	496	293	203
6. Physical Contingency	389	243	146	15	10	5	163	106	57	137	83	54	74	44	30
Grand Total	2,983	1,863	1,120	112	80	32	1,254	810	444	1,047	636	411	570	337	233

TABLE VII.7-5 DISBURSEMENT SCHEDULE OF CONSTRUCTION COST FOR PANITAN-PANAY AREA (P-2 PUMP)

(Unit: 10^3US$)

Item	Total			1st year			2nd year			3rd year			4th year			5th year		
	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC
1. Direct Construction Cost																		
1.1 Preparatory works	228	45	183	0	0	0	0	0	0	228	45	183	0	0	0	0	0	0
1.2 Pump station	1,254	926	328	0	0	0	0	0	0	690	509	181	564	417	147	0	0	0
1.3 Irrigation facilities	2,051	986	1,065	0	0	0	0	0	0	615	296	319	1,026	493	533	410	197	213
1.4 Drainage facilities	708	420	288	0	0	0	0	0	0	0	0	0	425	252	173	283	168	115
1.5 On-farm development	548	322	226	0	0	0	0	0	0	0	0	0	219	129	90	329	193	136
Sub-total	4,789	2,699	2,090	0	0	0	0	0	0	1,533	850	683	2,234	1,291	943	1,022	558	464
2. O & M Facilities	431	313	118	0	0	0	110	79	31	107	78	29	107	78	29	107	78	29
3. Land Acquisition	55	0	55	0	0	0	17	0	17	21	0	21	17	0	17	0	0	0
4. Engineering Services	958	766	192	194	154	40	191	153	38	191	153	38	191	153	38	191	153	38
5. Administration Cost of Executive Agency	239	0	239	24	0	24	48	0	48	71	0	71	48	0	48	48	0	48
Sub-total	6,472	3,778	2,694	218	154	64	366	232	134	1,923	1,081	842	2,597	1,522	1,075	1,368	789	579
6. Physical Contingency	971	567	404	33	23	10	55	35	20	288	162	126	390	228	162	205	119	86
Grand Total	7,443	4,345	3,098	251	177	74	421	267	154	2,211	1,243	968	2,987	1,750	1,237	1,573	908	665

TABLE VII.7-6 DISBURSEMENT SCHEDULE OF CONSTRUCTION COST FOR MAMBUSAO AREA

(Unit: 10^3US$)

Item	Total																	
	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC
1. Direct Construction Cost																		
1.1 Preparatory works	129	26	103	0	0	0	0	0	0	129	26	103	0	0	0	0	0	0
1.2 Intake facilities	21	14	7	0	0	0	0	0	0	11	7	4	10	7	3	0	0	0
1.3 Irrigation facilities	1,528	696	832	0	0	0	0	0	0	611	278	333	611	278	333	306	140	166
1.4 Drainage facilities	578	345	233	0	0	0	0	0	0	0	0	0	347	207	140	231	138	93
1.5 On-farm development	445	261	184	0	0	0	0	0	0	0	0	0	178	104	74	267	157	110
Sub-total	2,701	1,342	1,359	0	0	0	0	0	0	751	311	440	1,146	596	550	804	435	369
2. O & M Facilities	431	313	118	0	0	0	87	63	24	129	94	35	129	94	35	86	62	24
3. Land Acquisition	29	0	29	0	0	0	14	0	14	15	0	15	0	0	0	0	0	0
4. Engineering Services	540	432	108	108	86	22	108	86	22	108	86	22	108	87	21	108	87	21
5. Administration Cost of Executive Agency	135	0	135	14	0	14	27	0	27	40	0	40	27	0	27	27	0	27
Sub-total	3,836	2,087	1,749	122	86	36	236	149	87	1,043	491	552	1,410	777	633	1,025	584	441
6. Physical Contingency	575	313	262	18	13	5	35	22	13	156	73	83	212	117	95	154	88	66
Grand Total	4,411	2,400	2,011	140	99	41	271	171	100	1,199	564	635	1,622	894	728	1,179	672	507

TABLE VII.7-7 (1) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR PANITAN PANAY AREA

(Unit: US$)

Item	Unit	Overall			P-1 Pump			P-2 Pump		
		Quantity	Foreign Currency	Local Currency	Quantity	Foreign Currency	Local Currency	Quantity	Foreign Currency	Local Currency
1. Preparatory Works		L.S.	62,000	250,000	L.S.	17,000	67,000	L.S.	45,000	183,000
2. Pump Stations & Headreach			1,518,000	429,000		591,600	100,900		926,400	328,100
2.1 Temporary works		L.S.	8,100	31,500	L.S.	2,500	10,000	L.S.	5,600	21,500
2.2 Excavation	m^3	80,000	121,100	73,600	23,200	35,200	21,300	56,800	85,900	52,300
2.3 Embankment	m^3	7,000	201,400	182,900	200	6,100	8,400	6,800	195,300	174,500
2.4 Concrete works	m^3	1,420	29,900	22,200	450	9,600	7,100	970	20,300	15,100
2.5 Pavement	m^2	8,100	6,500	4,800	2,700	2,100	3,200	5,400	4,400	1,600
2.6 Pump	set	5	386,100	38,200	3	155,300	15,400	2	230,800	22,800
2.7 Mechanical works		L.S.	250,500	24,800	L.S.	114,900	11,400	L.S.	135,600	13,400
2.8 Electrical works		L.S.	372,500	36,800	L.S.	209,700	20,700	L.S.	162,800	16,100
2.9 Transmission	km	2	6,000	1,000	0.8	2,400	400	1.2	3,600	600
2.10 Miscellaneous		L.S.	135,900	13,200	L.S.	53,800	3,000	L.S.	82,100	10,200
3. Irrigation Facilities & Roads			1,328,000	1,417,000		341,540	352,300		986,460	1,064,700
3.1 Main canals			554,000	572,000		83,140	88,900		470,860	483,100
3.1.1 Stripping	m^2	198,000	75,200	85,100	29,700	11,200	12,700	168,300	64,000	72,400
3.1.2 Excavation	m^3	79,000	121,700	83,000	1,500	1,700	1,600	77,500	120,000	81,400
3.1.3 Embankment	m^3	121,000	139,200	98,000	36,300	41,700	29,400	84,700	97,500	68,600
3.1.4 Sod facing	m^2	48,000	-	149,300	7,600	-	23,800	40,400	-	125,500
3.1.5 Pavement	m^2	42,000	128,900	95,800	5,400	16,700	12,400	36,600	112,200	83,400
3.1.6 Related structure										
- Concrete works	m^3	1,100	54,200	36,900	100	5,400	4,800	1,000	48,800	32,100
- Gate	ton	5	20,000	2,000	0.7	3,000	300	4.3	17,000	1,700
- Concrete pipe	m	330	300	11,300	40	40	1,400	290	260	9,900
- Earthworks	m^3	5,000	10,200	7,200	700	1,500	1,000	4,300	8,700	6,200
- Miscellaneous		L.S.	4,300	3,400	L.S.	1,900	1,500	L.S.	2,400	1,900
3.2 Lateral canals			774,000	845,000		258,400	263,400		515,600	581,600
3.2.1 Stripping	m^3	282,000	107,200	121,300	9,300	35,300	40,000	189,000	71,900	81,300
3.2.2 Excavation	m^3	45,000	69,300	47,300	15,300	23,500	16,000	29,700	45,800	31,300
3.2.3 Embankment	m^3	166,000	247,300	169,300	41,500	61,800	42,300	124,500	185,500	127,000
3.2.4 Sod facing	m^2	84,000	-	261,200	21,800	-	67,900	62,200	-	193,300
3.2.5 Pavement	m^2	70,000	214,900	159,600	28,000	85,900	63,800	42,000	129,000	95,800

(to be continued)

TABLE VII.7-7 (2) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR PANITAN PANAY AREA

(Unit: US$)

Item	Unit	Overall Quantity	Overall Foreign Currency	Overall Local Currency	P-1 Pump Quantity	P-1 Pump Foreign Currency	P-1 Pump Local Currency	P-2 Pump Quantity	P-2 Pump Foreign Currency	P-2 Pump Local Currency
3.2.6 Related Structure										
- Concrete works	m^3	2,000	90,900	62,000	760	34,500	23,600	1,240	56,400	38,400
- Gate	ton	8.2	32,800	3,300	3.2	12,800	1,300	5	20,000	2,000
- Concrete pipe	m_3	760	300	14,200	310	100	5,800	450	200	8,400
- Earthworks	m^3	2,740	5,300	3,800	1,100	2,100	1,500	1,640	3,100	2,300
- Miscellaneous		L.S.	6,000	3,000	L.S.	2,400	1,200	L.S.	3,600	1,800
4. Drainage Facilities			520,000	357,000		99,920	68,600		420,080	288,400
4.1 Main drain			251,000	171,000		14,800	10,000		236,200	161,000
4.1.1 Excavation	m^3	52,000	83,200	54,600	2,600	4,200	2,700	49,400	79,000	51,900
4.1.2 Embandment	m^3	54,000	92,900	62,600	2,700	4,600	3,100	51,300	88,300	59,500
4.1.3 Related structure										
- Concrete works	m^3	520	41,900	25,100	50	3,800	2,300	470	38,100	22,800
- Wet masonry	m^3	3,100	24,100	22,200	200	1,400	1,300	2,900	22,700	20,900
- Earthworks	m^3	2,500	4,000	2,600	200	300	200	2,300	3,700	2,400
- Miscellaneous		L.S.	4,900	3,900	L.S.	500	400	L.S.	4,400	3,500
4.2 Collector drain			269,000	186,000		85,120	58,600		183,880	127,400
4.2.1 Excavation	m^3	128,000	197,100	134,400	44,800	69,000	47,000	83,200	128,100	87,400
4.2.2 Embankment	m^3	7,100	3,300	2,700	2,500	1,200	900	4,600	2,100	1,800
4.2.3 Related structure										
- Concrete works	m^3	540	41,000	24,400	120	9,000	5,400	420	32,000	19,400
- Wet masonry	m^3	2,100	16,300	15,100	400	3,400	3,200	1,700	12,900	11,900
- Concrete pipe	m_3	130	100	1,800	30	20	400	100	80	1,400
- Earthworks	m^3	4,100	8,100	5,700	900	1,800	1,300	3,200	6,300	4,400
- Miscellanous		L.S.	3,100	1,900	L.S.	700	400	L.S.	2,400	1,500
5. On-Farm Development			397,000	282,000		75,030	55,600		321,970	226,400
5.1 Farm ditch			229,000	161,000		55,260	39,100		173,740	121,900
5.1.1 Excavation	m^3	40,000	44,000	27,600	9,200	10,100	6,300	30,800	33,900	21,300
5.1.2 Embankment	m^3	99,000	134,600	93,100	22,800	31,000	21,400	76,200	103,600	71,700
5.1.3 Related structure										
- Concrete works	m^3	630	46,000	27,200	180	12,900	7,600	450	33,100	19,600
- Concrete pipe	m	790	200	10,900	230	60	3,200	560	140	7,700
- Miscellaneous		L.S.	4,200	2,200	L.S.	1,200	600	L.S.	3,000	1,600

(to be continued)

TABLE VII.7-7 (3) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR PANITAN PANAY AREA

(Unit: US$)

Item	Unit	Overall			P-1 Pump			P-2 Pump		
		Quantity	Foreign Currency	Local Currency	Quantity	Foreign Currency	Local Currency	Quantity	Foreign Currency	Local Currency
5.2 Farm drain			168,000	121,000		19,770	16,500		148,230	104,500
5.2.1 Excavation	m^3	112,000	123,200	77,300	10,100	11,100	7,000	101,900	112,100	70,300
5.2.2 Embankment	m^3	53,000	25,700	20,800	4,800	2,300	1,900	48,200	23,400	18,900
5.2.3 Related structure										
- Concrete works	m^3	190	14,100	8,300	60	4,700	2,700	130	9,400	5,600
- Wet masonry	m^3	400	3,100	2,900	130	1,000	1,000	270	2,100	1,900
- Concrete pipe	m	710	200	9,800	230	70	3,200	480	130	6,600
- Miscellaneous		L.S.	1,700	1,900	L.S.	600	700	L.S.	1,100	1,200
Total			3,825,000	2,735,000		1,125,090	644,400		2,699,910	2,090,600

TABLE VII. 7-8 (1) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR MAMBUSAO AREA

(Unit: US$)

Item	Unit	Quantity	Foreign Currency	Local Currency
1. Preparatory Works		L.S.	26,000	103,000
2. Intake Facility			14,000	7,000
2.1 Backfill	m^3	1,000	1,300	1,800
2.2 Concrete works	m^3	80	6,500	3,500
2.3 Wet masonry	m^3	200	3,200	1,200
2.4 Replacement of gate		L.S.	2,000	200
2.5 Miscellaneous		L.S.	1,000	300
3. Irrigation Facilities & Road			696,000	832,000
3.1 Stripping	m^2	180,000	68,400	77,400
3.2 Excavation	m^3	60,000	92,400	63,000
3.3 Embankment	m^3	227,500	261,700	184,200
3.4 Sod facing	m^2	101,000	-	314,100
3.5 Pavement	m^2	40,000	122,800	91,200
3.6 Related structure				
- Concrete works	m^3	1,900	93,600	63,700
- Earth works	m^3	4,400	9,000	6,300
- Gate	ton	10	40,000	4,000
- Concrete pipe	m	670	500	22,500
- Miscellaneous		L.S.	7,600	5,600
4. Drainage Facilities			345,000	233,000
4.1 Excavation	m^3	142,300	227,800	149,400
4.2 Embankment	m^3	38,800	18,100	15,000
4.3 Related structure				
- Concrete works	m^3	740	59,400	35,500
- Wet masonry	m^3	3,500	27,400	25,200
- Earth works	m^3	4,160	6,700	4,300
- Miscellaneous		L.S.	5,600	3,600

(to be continued)

TABLE VII.7-8 (2) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR MAMBUSAO AREA

(Unit: US$)

Item	Unit	Quantity	Foreign Currency	Local Currency
5. On-Farm Facilities			261,000	184,000
5.1 Farm ditch			157,000	110,500
5.1.1 Excavation	m^3	32,000	35,200	22,400
5.1.2 Embankment	m^3	65,000	88,300	61,100
5.1.3 Related structure				
- Concrete works	m^3	410	30,100	17,700
- Concrete pipe	m	540	200	6,800
- Miscellaneous		L.S.	3,200	2,500
5.2 Farm drain			104,000	73,500
5.2.1 Excavation	m^3	81,900	90,100	56,500
5.2.2 Related structure				
- Concrete works	m^3	120	8,900	5,240
- Wet masonry	m^3	280	2,170	2,030
- Concrete pipe	m	530	150	7,340
- Miscellaneous		L.S.	2,680	2,390
Total			1,342,000	1,359,000

TABLE VII.7-9 LABOR WAGE AND MAJOR MATERIAL COST

Item		Unit	Cost (P)
1. Labor			
(1)	Foreman	man-day	76
(2)	Skilled labor	man-day	51
(3)	Common labor	man-day	35
(4)	Operator	man-day	63
(5)	Mechanic	man-day	63
(6)	Welder	man-day	55
(7)	Electrician	man-day	63
(8)	Driver	man-day	45
2. Material			
(1)	Fuel & lubricant		
	- Gasoline	lit	8.31
	- Diesel	lit	6.24
	- Motor oil	lit	22
(2)	Reinforcement bar	kg	8.41
(3)	Portland cement	bag	52
(4)	Aggregate & sand		
	- River run (screened)	m^3	160
	- River run (non-screened)	m^3	100
	- Sand	m^3	110
	- Boulder	m^3	160
(5)	Wood		
	- Plywood 1/4"x4'x8'	pc	75
	- Timber, square	b.t	6
	- Bamboo	pc	40
(6)	Concrete product		
	- R.C. pipe ø 1,000	m	600
	- R.C. pipe ø 600	m	400
	- R.C. pipe ø 400	m	150
	- R.C. pipe ø 200	m	100

TABLE VII.7-10 UNIT COST FOR CONSTRUCTION COST

(Unit: US$)

Item			Unit	FC	LC	Total
1.	Excavation					
	(1) Earth	1=250 m	m^3	1.10	0.69	1.79
		1=500 m	m^3	1.25	0.78	2.03
		1=1,000 m	m^3	1.51	0.95	2.46
	(2) Earth by man power		m^3	—	1.67	1.67
	(3) Rock	1=250 m	m^3	5.51	4.25	9.76
		1=500 m	m^3	5.75	4.39	10.14
		1=1,000 m	m^3	6.05	4.59	10.64
2.	Embankment					
	(1) Earth excavated		m^3	0.47	0.38	0.85
	(2) Earth borrowed		m^3	1.72	1.16	2.88
	(3) Gravel pavement		m^2	3.07	2.28	5.35
	(4) Backfill		m^3	1.31	1.73	3.04
3.	Concrete Works					
	(1) Concrete	180 kg	m^3	32.14	24.92	57.06
		210 kg	m^3	35.55	25.68	61.23
		300 kg	m^3	39.78	27.95	67.73
	(2) Form		m^2	1.48	9.09	10.57
	(3) Reinforcement bar		ton	475.42	218.87	694.29
4.	Others					
	(1) Clearing & stripping		m^2	0.38	0.43	0.81
	(2) Sod facing		m^2	—	3.11	3.11
	(3) Steel sheet pile		m	40.33	12.40	52.73
	(4) Wet rubble masonry		m^2	7.78	7.17	14.95
	(5) Gabion, mattress		m	14.05	6.25	20.30
	(6) R.C. pipe	ϕ 1,000	m	1.16	55.43	56.59
		ϕ 600	m	0.77	36.95	37.72
		ϕ 400	m	0.29	13.86	14.15
		ϕ 200	m	0.19	9.24	9.43

TABLE VII.7-11 COST ESTIMATE OF O & M FACILITIES FOR PANITAN-PANAY AREA

	Item	Q'ty	Cost (10^3 P)
1.	O & M Quarter & Motor Pool	7,000 m^2	3,500
2.	O & M Equipment		6,500
	- Radio set	1 set	290
	- Motorcycle	10 nos.	150
	- Jeep, 4 wheel drive	3 nos.	510
	- Truck, 1.5 ton pick-up	2 nos.	200
	- Dump truck (4 ton)	2 nos.	760
	- Bulldozer (11 ton)	1 no.	1,170
	- Backhoe (0.3 m^3)	1 no.	1,000
	- Tire roller (8-11 ton)	1 no.	630
	- Spare parts	L.S.	940
	- Miscellaneous	L.S.	850
	Total		10,000

TABLE VII. 7-12 COST ESTIMATE OF O & M FACILITIES FOR MAMBUSAO AREA

	Item	Q'ty	Cost (10^3 P)
1.	O & M Quarter & Motor Pool	3,000 m^2	1,500
2.	O & M Equipment		6,260
	- Radio set	1 set	290
	- Motorcycle	5 nos.	75
	- Jeep, 4 wheel drive	3 nos.	510
	- Truck, 1.5 ton pick-up	1 no.	100
	- Dump truck (4 ton)	2 nos.	760
	- Bulldozer (11 ton)	1 no.	1,170
	- Backhoe (0.3 m^3)	1 no.	1,000
	- Tire roller (8-11 ton)	1 no.	630
	- Spare parts	L.S.	910
	- Miscellaneous	L.S.	815
	Total		7,760

TABLE VII.7-13 COST ESTIMATE OF O & M FACILITIES FOR PANITAN-PANAY AREA (P-1 PUMP)

	Item	Q'ty	Cost (10^3 ₱)
1.	O & M Quarter & Motor Pool	2,000 m^2	1,000
2.	O & M Equipment		5,500
	- Radio set	1 set	290
	- Motorcycle	3 nos.	45
	- Jeep, 4 wheel drive	2 nos.	340
	- Truck, 1.5 ton pick-up	1 no.	100
	- Dump truck (4 ton)	1 no.	380
	- Bulldozer (11 ton)	1 no.	1,170
	- Backhoe (0.3 m^3)	1 no.	1,000
	- Tire roller (8-11 ton)	1 no.	630
	- Spare parts	L.S.	810
	- Miscellaneous	L.S.	735
	Total		6,500

TABLE VII.7-14 COST ESTIMATE OF O & M FACILITIES FOR PANITAN-PANAY AREA (P-2 PUMP)

	Item	Q'ty	Cost (10^3 ₱)
1.	O & M Quarter & Motor Pool	3,000 m^2	1,500
2.	O & M Equipment		6,260
	- Radio set	1 set	290
	- Motorcycle	5 nos.	75
	- Jeep, 4 wheel drive	3 nos.	510
	- Truck, 1.5 ton pick-up	1 no.	100
	- Dump truck (4 ton)	2 nos.	760
	- Bulldozer (11 ton)	1 no.	1,170
	- Backhoe (0.3 m^3)	1 no.	1,000
	- Tire roller (8-11 ton)	1 no.	630
	- Spare parts	L.S.	910
	- Miscellaneous	L.S.	815
	Total		7,760

TABLE VII.7-15 COST ESTIMATE OF LAND ACQUISITION FOR PANITAN-PANAY AREA

Description	Compensation cost (₱/ha)	Overall Compensation Area (ha)	Overall Compensation Amount (10^3 ₱)	P-1 Pump Area (ha)	P-1 Pump Amount (10^3 ₱)	P-2 Pump Area (ha)	P-2 Pump Amount (10^3 ₱)
1. Intake Facility							
(1) Paddy field	12,000	3	36	1	12	2	24
(2) Upland	8,000	3	24	1	8	2	16
(3) Houseyard	20,000	2	40	1	20	1	20
2. Canal & Road							
(1) Paddy field	12,000	72	864	17	204	55	660
(2) Upland	8,000	21	168	5	40	16	128
(3) Houseyard	20,000	10	200	3	60	7	140
Total		111		28	344	83	988

TABLE VII.7-16 COST ESTIMATE OF LAND ACQUISITION FOR MAMBUSAO AREA

Description	Overall Cost (₱/ha)	Area (ha)	Amount (10^3 ₱)
1. Canal & Road			
(1) Paddy field	10,000	42	420
(2) Upland	8,000	8	64
(3) Houseyard	17,000	2	34
Total		52	518

TABLE VII.7-17 ANNUAL OPERATION AND MAINTENANCE COST FOR PANITAN-PANAY AREA

Item	Overall		P-1 Pump		P-2 Pump	
	Amount (10^3 ₱)	Per ha (₱/ha)	Amount (10^3 ₱)	Per ha (₱/ha)	Amount (10^3 ₱)	Per ha (₱/ha)
1. Salaries and Wages						
1.1 Staff salaries (See Table VII.7-19)	900	277	338	360	630	273
1.2 Labour wages	200 (₱1,000 x 200M/M)	62	60	64	140	61
2. Office Expenses	240 (₱20,000 x 12M)	74	72 (₱6,000 x 12M)	77	168 (₱14,000 x 12M)	73
3. Operation Cost						
3.1 Electric power charge for pumps	3,685	1,134	1,035	1,101	2,650	1,147
3.2 Fuel for vehicles and equipment	96 (₱8,000 x 12M)	30	24 (₱2,000 x 12M)	26	72 (₱6,000 x 12M)	31
3.3 Others	50	15	20	22	30	13
4. Maintenance Cost						
4.1 Earthworks	70	22	20	21	50	22
4.2 Concrete works	50	15	20	21	30	13
4.3 Masonry works	70	22	20	21	50	22
4.4 Metal works	90	28	40	43	50	26
4.5 Pump	260	80	120	128	140	61
4.6 Others	100	31	40	43	60	26
5. Miscellaneous L.S.	210	65	60	64	150	65
Total	6,021	1,855	1,869	1,991	4,220	1,833
	(335 x 10^3US$)	(103 US$/ha)	(104 x 10^3US$)	(111 US$/ha)	(234 x 10^3US$)	(102 US$/ha)

TABLE VII.7-18 ANNUAL OPERATION AND MAINTENANCE COST FOR MAMBUSAO AREA

	Amount (10^3 ₱)	Per ha (₱/ha)
1. Salaries and Wages		
1.1 Staff salaries (See Table VII.7-20)	630	294
1.2 Labour wages ₱1,000 x 130M/M	130	61
2. Office Expenses ₱15,000 x 12M	180	84
3. Operation Cost		
3.1 Fuel for vehicles and equipment ₱6,000 x 12M	72	33
3.2 Others	28	13
4. Maintenance Cost		
4.1 Earth works	50	23
4.2 Concrete works	30	14
4.3 Masonry works	50	23
4.4 Metal works	60	29
4.5 Others	50	23
5. Miscellaneous L.S.	120	56
Total	1,400	653
	(77×10^3 US$)	(36.2 US$/ha)

TABLE VII.7-19 STAFF SALARY AT O & M STAGE FOR PANITAN-PANAY AREA

Staffs	Unit Annual Salary	Overall		P-1 Pump		P-2 Pump	
		Number	Total	Number	Total	Number	Total
Project Manager	48,000	1	48,000	1	48,000	1	48,000
Irrigation Superintendent	39,000	1	39,000	-		1	39,000
Administrative Section							
Cashier	9,600	1	9,600	1	9,600	1	9,600
Property Custodian	9,600	1	9,600	1	9,600	1	9,600
Accounting Clerk	9,600	1	9,600	1	9,600	1	9,600
Clerk	8,400	2	16,800	1	8,400	1	8,400
Instrumentman	10,600	1	10,600	1	10,600	1	10,600
Janitor	7,200	2	14,400	1	7,200	2	14,400
Secutiry Guard	8,800	2	17,600	-	-	2	17,600
Aide	7,400	2	14,800	-	-	1	7,400
Electrician	24,000	1	24,000	-	-	1	24,000
Radio Operation	9,600	1	9,600	1	9,600	1	9,600
Driver	11,800	3	35,400	2	23,600	3	35,400
Operation and Maintenance Section							
Division Supervision	23,000	3	69,000	1	23,000	2	46,000
Water Management Technician	21,200	4	84,800	1	21,200	2	42,400
Ditchtender	7,600	38	288,800	10	76,000	19	144,400
Mech./Electric Engineer	23,000	1	23,000	1	23,000	1	23,000
Carpenter	9,600	1	9,600	1	9,600	1	9,600
Mechanic	21,200	1	21,200	-	-	1	21,200
Aide	7,400	1	7,400	1	-	1	7,400
Collection Service Division							
Collector Officer	23,000	3	69,000	1	23,000	2	46,000
Agricultural Development Section							
Agronomist	25,600	1	25,600	1	25,600	1	25,600
Agri Liaison Officer	21,200	2	42,400	-	-	1	21,200
Total		74	899,800 (900,000)	26	337,600 (338,000)	48	630,000

TABLE VII.7-20 STAFF SALARY AT O & M STAGE FOR MAMBUSAO AREA

(Unit: P)

Staffs	No.	Unit Annual Salary	Total
Project Manager	1	48,000	48,000
Irrigation Superintendent	1	39,000	39,000
Administrative Section			
Cashier	1	9,600	9,600
Property Custodian	1	9,600	9,600
Accounting Clerk	1	9,600	9,600
Clerk	1	8,400	8,400
Instrumentman	1	10,600	10,600
Janitor	2	7,200	14,400
Security Guard	2	8,800	17,600
Aide	1	7,400	7,400
Electrician	1	24,000	24,000
Radio Operator	1	9,600	9,600
Driver	3	11,800	35,400
Operation and Maintenance Section			
Division Supervision	2	23,000	46,000
Water Management Technician	2	21,200	42,400
Ditchtender	19	7,800	144,400
Mech./Electric Engineer	1	23,000	23,000
Carpenter	1	9,600	9,600
Mechanic	1	21,200	21,200
Aide	1	7,400	7,400
Collection Service Division			
Collector officer	2	23,000	46,000
Agricultural Development Section			
Agronomist	1	25,600	25,600
Agri Liaison Officer	1	21,200	21,200
Total	48		630,000

TABLE VII.7-21 REPLACEMENT COST AND USEFUL LIFE FOR PANITAN - PANAY AREA

Item	Useful Life (year)	Overall Replacement	P-1 Pump Cost	P-2 Pump (10^3US$)
1. Project Facilities				
1.1 Pump and accessories	25	424	171	254
1.2 Mechanical works	25	275	126	149
1.3 Electrical works	25	409	233	183
1.4 Gate for canals	25	58	17	41
2. O & M Equipment	10	361	306	348

TABLE VII.7-22 REPLACEMENT COST AND USEFUL LIFE FOR MAMBUSAO AREA

Item	Useful Life (year)	Replacement Cost (10^3US$)
1. Project Facilities		
1.1 Intake gate	25	2
1.2 Gate for canals	25	44
2. O & M Equipment	10	348

TABLE VII.8-1 NET PRODUCTION VALUE WITHOUT PROJECT

Items	Panitan - Panay Area (1.5 ha)							Mambusao Area (2.2 ha)					
	Irrigated Paddy			Rainfed Paddy		Others/1	Total/2	Irrigated Paddy		Rainfed Paddy		Others/1	Total/2
	1st	2nd	3rd	1st	2nd			1st	2nd	1st	2nd		
1. Area Planted (ha)	0.65	0.65	0.3	0.75	0.75	0.1	3.2	1.6	1.6	0.5	0.5	0.1	4.3
2. Unit Yield (t/ha)	3.6	3.6	3.6	3.0	3.0	11.76		3.6	3.6	3.0	3.0	11.76	
3. Farmgate Price (₱/t)	4,390	4,390	4,390	4,390	4,390	1,050		4,390	4,390	4,390	4,390	1,050	
4. Gross Production Value (₱)	10,273	10,273	4,741	9,878	9,878	1,235	45,043	25,286	25,286	6,585	6,585	1,235	63,742
5. Production Cost													
5.1 Farm Inputs													
Seeds	429	429	198	495	495	14		1,056	1,056	330	330	14	
Fertilizers	1,196	1,196	552	1,380	1,380	195		2,944	2,944	920	920	195	
Agro-chemicals	475	475	219	548	548	122		1,168	1,168	365	365	122	
Sub-Total	2,100	2,100	969	2,423	2,423	331		5,168	5,168	1,615	1,615	331	
5.2 Bags	140	140	65	135	135	-		346	346	90	90	-	
5.3 Labour	1,762	1,573	726	2,033	1,815	174		4,336	3,872	1,355	1,210	174	
5.4 Membership Fee	258	258	119	-	-	-		636	636	-	-	-	
5.5 Miscellaneous	426	407	187	459	437	51		1,049	1,002	306	292	51	
Total Cost (₱)	4,686	4,478	2,066	5,050	4,810	556	21,090	11,535	11,024	3,366	3,207	556	29,132
6. Net Production Value (₱)	5,587	5,795	2,675	4,828	5,068	679	23,953	13,751	14,262	3,219	3,378	679	34,610

Note, /1: Calculation is made based on eggplant as representative crop of others.

/2: Not included those amount attributed to Other crops in the calculation of Total Production Value or Cost.

TABLE VII.8-2 NET PRODUCTION VALUE WITH PROJECT

Items	Panitan - Panay Area (1.5 ha)					Mambusao Area (2.2 ha)			
	Irrigated Paddy		Nung	Other	Total/1	Irrigated Paddy		Other	Total/1
	1st	2nd				1st	2nd		
1. Area Planted (ha)	1.4	1.4	0.7	0.1	3.6	2.1	2.1	0.1	4.3
2. Unit Yield (t/ha)	5.0	5.0	1.0	12.0		5.0	5.0	12.0	
3. Farmgate Price (₱/t)	4,390	4,390	7,870	1,050		4,390	4,390	1,050	
4. Gross Production Value (₱)	30,730	30,730	5,509	1,260	66,969	46,095	46,095	1,260	92,190
5. Production Cost									
5.1 Farm Inputs									
Seeds	924	924	135	14		1,386	1,386	14	
Fertilizer	3,412	3,412	478	195		5,118	5,118	195	
Agro-chemicals	1,022	1,022	259	122		1,533	1,533	122	
Sub-Total	5,358	5,358	881	331		8,037	8,037	331	
5.2 Bags	420	420	42	-		630	630	-	
5.3 Labour	3,794	3,794	1,068	174		5,691	5,691	174	
5.4 Membership Fee	557	557	-	-		835	835	-	
5.5 Miscellaneous	1,013	1,013	199	51		1,519	1,519	51	
Total Cost (₱)	11,142	11,142	2,190	556	24,474	16,712	16,712	556	33,424
6. Net Production Value (₱)	19,588	19,588	3,319	704	42,495	29,383	29,383	704	58,766

Note, /1: Not included those amount attributed to Other crops in the calculation of Total Production Value or Cost.

TABLE VII.8-3 INTERNAL RATE OF RETURN (PANITAN-PANAY, OVERALL)

ECONOMIC COST AND BENEFIT FLOW

PROJECT NAME:PANITAN

COMMANDING AREA = 3250 HA

(UNIT: 1000 US $)

NO	YEAR	CAPITAL COST	REPLACEMENT COST	O & M COST	TOTAL COST	IRRIGATION BENEFIT	(SENSITIVITY DATA)
1	1986	177	0	0	177	0	0
2	1987	474	0	0	474	0	0
3	1988	1980	0	0	1980	0	0
4	1989	2707	0	0	2707	0	0
5	1990	2566	0	0	2566	0	0
6	1991	1440	0	0	1440	0	0
7	1992	0	0	255	255	598	598
8	1993	0	0	287	287	956	956
9	1994	0	0	335	335	1435	1435
10	1995	0	0	335	335	1674	1674
11	1996	0	0	335	335	1913	1913
12	1997	0	0	335	335	2152	2152
13	1998	0	0	335	335	2391	2391
14	1999	0	0	335	335	2391	2391
15	2000	0	0	335	335	2391	2391
16	2001	0	361	335	696	2391	2391
17	2002	0	0	335	335	2391	2391
18	2003	0	0	335	335	2391	2391
19	2004	0	0	335	335	2391	2391
20	2005	0	0	335	335	2391	2391
21	2006	0	0	335	335	2391	2391
22	2007	0	0	335	335	2391	2391
23	2008	0	0	335	335	2391	2391
24	2009	0	0	335	335	2391	2391
25	2010	0	0	335	335	2391	2391
26	2011	0	361	335	696	2391	2391
27	2012	0	0	335	335	2391	2391
28	2013	0	0	335	335	2391	2391
29	2014	0	0	335	335	2391	2391
30	2015	0	0	335	335	2391	2391
31	2016	0	1166	335	1501	2391	2391
32	2017	0	0	335	335	2391	2391
33	2018	0	0	335	335	2391	2391
34	2019	0	0	335	335	2391	2391
35	2020	0	0	335	335	2391	2391
36	2021	0	361	335	696	2391	2391
37	2022	0	0	335	335	2391	2391
38	2023	0	0	335	335	2391	2391
39	2024	0	0	335	335	2391	2391
40	2025	0	0	335	335	2391	2391
41	2026	0	0	335	335	2391	2391
42	2027	0	0	335	335	2391	2391
43	2028	0	0	335	335	2391	2391
44	2029	0	0	335	335	2391	2391
45	2030	0	0	335	335	2391	2391
46	2031	0	361	335	696	2391	2391
47	2032	0	0	335	335	2391	2391
48	2033	0	0	335	335	2391	2391
49	2034	0	0	335	335	2391	2391
50	2035	0	0	335	335	2391	2391

PRESENT WORTH

PROJECT :PANITAN

SENSITIVITY DATA

COST UP = 0(%)

BENEFIT DOWN= 0(%)

(UNIT:1000 US $)

DISCOUNT RATE (%)	PRESENT WORTH COST	PRESENT WORTH BENEFIT	C/B	DISCOUNT RATE (%)	B-C	B/C
0.00	26566	99586	0.27	0	73020	3.75
2.00	18570	56994	0.33	2	38424	3.07
4.00	14090	34803	0.40	4	20713	2.47
6.00	11360	22500	0.50	6	11140	1.98
8.00	9557	15265	0.63	8	5708	1.60
10.00	8280	10778	0.77	10	2498	1.30
12.00	7321	7861	0.93	12	540	1.07
14.00	6566	5887	1.12	14	-680	0.90
16.00	5951	4505	1.32	16	-1446	0.76
18.00	5436	3510	1.55	18	-1926	0.65
20.00	4996	2776	1.80	20	-2220	0.56

DISCOUNT RATE (%)	PRESENT WORTH COST	PRESENT WORTH BENEFIT	B/C	B-C	REMARKS
12.00	7321	7861	1.07	540	
12.10	7279	7743	1.06	464	
12.20	7238	7628	1.05	391	
12.30	7197	7515	1.04	319	
12.40	7156	7405	1.03	248	
12.50	7116	7296	1.03	180	
12.60	7077	7189	1.02	113	
12.70	7038	7085	1.01	47	
12.80	6999	6982	1.00	-17	***
12.90	6961	6881	0.99	-80	
13.00	6923	6782	0.98	-141	
13.10	6886	6685	0.97	-200	
13.20	6849	6590	0.96	-259	
13.30	6812	6496	0.95	-316	
13.40	6776	6404	0.95	-371	
13.50	6740	6314	0.94	-426	
13.60	6705	6226	0.93	-479	
13.70	6669	6139	0.92	-531	
13.80	6635	6053	0.91	-582	
13.90	6600	5969	0.90	-631	

TABLE VII.8-4 INTERNAL RATE OF RETURN (PANITAN-PANAY, P-1 PUMP)

ECONOMIC COST AND BENEFIT FLOW

PROJECT NAME:PANITAN (P-1 PUMP)
COMMANDING AREA = 940 HA
(UNIT: 1000 US $)

NO	YEAR	CAPITAL COST	REPLACEMENT COST	O & M COST	TOTAL COST	IRRIGATION BENEFIT	(SENSITIVITY DATA)
1	1986	106	0	0	106	0	0
2	1987	1158	0	0	1158	0	0
3	1988	973	0	0	973	0	0
4	1989	528	0	0	528	0	0
5	1990	0	0	83	83	173	173
6	1991	0	0	94	94	276	276
7	1992	0	0	104	104	415	415
8	1993	0	0	104	104	484	484
9	1994	0	0	104	104	553	553
10	1995	0	0	104	104	622	622
11	1996	0	0	104	104	691	691
12	1997	0	0	104	104	691	691
13	1998	0	0	104	104	691	691
14	1999	0	306	104	410	691	691
15	2000	0	0	104	104	691	691
16	2001	0	0	104	104	691	691
17	2002	0	0	104	104	691	691
18	2003	0	0	104	104	691	691
19	2004	0	0	104	104	691	691
20	2005	0	0	104	104	691	691
21	2006	0	0	104	104	691	691
22	2007	0	0	104	104	691	691
23	2008	0	0	104	104	691	691
24	2009	0	306	104	410	691	691
25	2010	0	0	104	104	691	691
26	2011	0	0	104	104	691	691
27	2012	0	0	104	104	691	691
28	2013	0	0	104	104	691	691
29	2014	0	547	104	651	691	691
30	2015	0	0	104	104	691	691
31	2016	0	0	104	104	691	691
32	2017	0	0	104	104	691	691
33	2018	0	0	104	104	691	691
34	2019	0	306	104	410	691	691
35	2020	0	0	104	104	691	691
36	2021	0	0	104	104	691	691
37	2022	0	0	104	104	691	691
38	2023	0	0	104	104	691	691
39	2024	0	0	104	104	691	691
40	2025	0	0	104	104	691	691
41	2026	0	0	104	104	691	691
42	2027	0	0	104	104	691	691
43	2028	0	0	104	104	691	691
44	2029	0	306	104	410	691	691
45	2030	0	0	104	104	691	691
46	2031	0	0	104	104	691	691
47	2032	0	0	104	104	691	691
48	2033	0	0	104	104	691	691
49	2034	0	0	104	104	691	691
50	2035	0	0	104	104	691	691

PRESENT WORTH

PROJECT :PANITAN (P-1 PUMP) SENSITIVITY DATA

COST UP = 0(%)
BENEFIT DOWN= 0(%)

(UNIT:1000 US $)

DISCOUNT RATE (%)	PRESENT WORTH COST	PRESENT WORTH BENEFIT	C/B	DISCOUNT RATE (%)	B-C	B/C
0.00	9289	30163	0.31	0	20874	3.25
2.00	6480	17656	0.37	2	11176	2.72
4.00	4927	11078	0.44	4	6151	2.25
6.00	4000	7384	0.54	6	3384	1.85
8.00	3403	5177	0.66	8	1774	1.52
10.00	2991	3782	0.79	10	791	1.26
12.00	2689	2855	0.94	12	166	1.06
14.00	2456	2213	1.11	14	-242	0.90
16.00	2268	1753	1.29	16	-515	0.77
18.00	2113	1413	1.50	18	-700	0.67
20.00	1980	1156	1.71	20	-825	0.58

DISCOUNT RATE (%)	PRESENT WORTH COST	PRESENT WORTH BENEFIT	B/C	B-C	REMARKS
12.00	2689	2855	1.06	166	
12.10	2675	2817	1.05	142	
12.20	2663	2780	1.04	118	
12.30	2650	2744	1.04	94	
12.40	2637	2708	1.03	71	
12.50	2625	2673	1.02	48	
12.60	2613	2638	1.01	26	
12.70	2601	2604	1.00	4	***
12.80	2589	2571	0.99	-17	
12.90	2577	2538	0.99	-38	
13.00	2565	2506	0.98	-59	
13.10	2554	2475	0.97	-79	
13.20	2542	2444	0.96	-99	
13.30	2531	2413	0.95	-118	
13.40	2520	2383	0.95	-137	
13.50	2509	2354	0.94	-155	
13.60	2498	2325	0.93	-173	
13.70	2487	2296	0.92	-191	
13.80	2476	2268	0.92	-208	
13.90	2466	2240	0.91	-226	

TABLE VII.8-5 INTERNAL RATE OF RETURN (PANITAN-PANAY, P-2 PUMP)

ECONOMIC COST AND BENEFIT FLOW

PROJECT NAME:PANITAN (P-2 PUMP)
COMMANDING AREA = 2310 HA
(UNIT: 1000 US $)

NO	YEAR	CAPITAL COST	REPLACE-MENT COST	O & M COST	TOTAL COST	IRRIGATION BENEFIT	(SENSITIVITY DATA)
1	1986	238	0	0	238	0	0
2	1987	378	0	0	378	0	0
3	1988	2020	0	0	2020	0	0
4	1989	2750	0	0	2750	0	0
5	1990	1453	0	0	1453	0	0
6	1991	0	0	187	187	425	425
7	1992	0	0	211	211	680	680
8	1993	0	0	234	234	1020	1020
9	1994	0	0	234	234	1190	1190
10	1995	0	0	234	234	1360	1360
11	1996	0	0	234	234	1530	1530
12	1997	0	0	234	234	1700	1700
13	1998	0	0	234	234	1700	1700
14	1999	0	0	234	234	1700	1700
15	2000	0	348	234	582	1700	1700
16	2001	0	0	234	234	1700	1700
17	2002	0	0	234	234	1700	1700
18	2003	0	0	234	234	1700	1700
19	2004	0	0	234	234	1700	1700
20	2005	0	0	234	234	1700	1700
21	2006	0	0	234	234	1700	1700
22	2007	0	0	234	234	1700	1700
23	2008	0	0	234	234	1700	1700
24	2009	0	0	234	234	1700	1700
25	2010	0	348	234	582	1700	1700
26	2011	0	0	234	234	1700	1700
27	2012	0	0	234	234	1700	1700
28	2013	0	0	234	234	1700	1700
29	2014	0	0	234	234	1700	1700
30	2015	0	627	234	861	1700	1700
31	2016	0	0	234	234	1700	1700
32	2017	0	0	234	234	1700	1700
33	2018	0	0	234	234	1700	1700
34	2019	0	0	234	234	1700	1700
35	2020	0	348	234	582	1700	1700
36	2021	0	0	234	234	1700	1700
37	2022	0	0	234	234	1700	1700
38	2023	0	0	234	234	1700	1700
39	2024	0	0	234	234	1700	1700
40	2025	0	0	234	234	1700	1700
41	2026	0	0	234	234	1700	1700
42	2027	0	0	234	234	1700	1700
43	2028	0	0	234	234	1700	1700
44	2029	0	0	234	234	1700	1700
45	2030	0	348	234	582	1700	1700
46	2031	0	0	234	234	1700	1700
47	2032	0	0	234	234	1700	1700
48	2033	0	0	234	234	1700	1700
49	2034	0	0	234	234	1700	1700
50	2035	0	0	234	234	1700	1700

PRESENT WORTH

PROJECT :PANITAN (P-2 PUMP) SENSITIVITY DATA

COST UP = 0(%)
BENEFIT DOWN= 0(%)

(UNIT:1000 US $)

DISCOUNT RATE (%)	PRESENT WORTH COST	PRESENT WORTH BENEFIT	C/B	DISCOUNT RATE (%)	B-C	B/C
0.00	19318	72505	0.27	0	53187	3.75
2.00	13679	41964	0.33	2	28286	3.07
4.00	10514	25974	0.40	4	15459	2.47
6.00	8581	17049	0.50	6	8468	1.99
8.00	7301	11758	0.62	8	4457	1.61
10.00	6390	8444	0.76	10	2053	1.32
12.00	5703	6265	0.91	12	562	1.10
14.00	5160	4774	1.08	14	-386	0.93
16.00	4715	3716	1.27	16	-998	0.79
18.00	4340	2945	1.47	18	-1395	0.68
20.00	4017	2369	1.70	20	-1649	0.59

DISCOUNT RATE (%)	PRESENT WORTH COST	PRESENT WORTH BENEFIT	B/C	B-C	REMARKS
12.00	5703	6265	1.10	562	
12.10	5673	6177	1.09	504	
12.20	5643	6091	1.08	447	
12.30	5614	6006	1.07	392	
12.40	5585	5922	1.06	337	
12.50	5556	5840	1.05	284	
12.60	5527	5760	1.04	232	
12.70	5499	5681	1.03	182	
12.80	5472	5603	1.02	132	
12.90	5444	5527	1.02	83	
13.00	5417	5453	1.01	36	
13.10	5390	5379	1.00	-11	***
13.20	5363	5307	0.99	-56	
13.30	5337	5236	0.98	-101	
13.40	5311	5167	0.97	-144	
13.50	5285	5098	0.96	-187	
13.60	5259	5031	0.96	-228	
13.70	5234	4965	0.95	-269	
13.80	5209	4900	0.94	-309	
13.90	5184	4836	0.93	-348	

TABLE VII.8-6 INTERNAL RATE OF RETURN (MAMBUSAO)

ECONOMIC COST AND BENEFIT FLOW

PROJECT NAME:MAMBUSAO

COMMANDING AREA = 2145 HA

(UNIT: 1000 US $)

NO	YEAR	CAPITAL COST	REPLACEMENT COST	O & M COST	TOTAL COST	IRRIGATION BENEFIT	(SENSITIVITY DATA)
1	1986	132	0	0	132	0	0
2	1987	238	0	0	238	0	0
3	1988	1058	0	0	1058	0	0
4	1989	1477	0	0	1477	0	0
5	1990	1076	0	0	1076	0	0
6	1991	0	0	62	62	310	310
7	1992	0	0	70	70	520	520
8	1993	0	0	78	78	803	803
9	1994	0	0	78	78	940	940
10	1995	0	0	78	78	1080	1080
11	1996	0	0	78	78	1214	1214
12	1997	0	0	78	78	1370	1370
13	1998	0	0	78	78	1370	1370
14	1999	0	0	78	78	1370	1370
15	2000	0	348	78	426	1370	1370
16	2001	0	0	78	78	1370	1370
17	2002	0	0	78	78	1370	1370
18	2003	0	0	78	78	1370	1370
19	2004	0	0	78	78	1370	1370
20	2005	0	0	78	78	1370	1370
21	2006	0	0	78	78	1370	1370
22	2007	0	0	78	78	1370	1370
23	2008	0	0	78	78	1370	1370
24	2009	0	0	78	78	1370	1370
25	2010	0	348	78	426	1370	1370
26	2011	0	0	78	78	1370	1370
27	2012	0	0	78	78	1370	1370
28	2013	0	0	78	78	1370	1370
29	2014	0	0	78	78	1370	1370
30	2015	0	46	78	124	1370	1370
31	2016	0	0	78	78	1370	1370
32	2017	0	0	78	78	1370	1370
33	2018	0	0	78	78	1370	1370
34	2019	0	0	78	78	1370	1370
35	2020	0	348	78	426	1370	1370
36	2021	0	0	78	78	1370	1370
37	2022	0	0	78	78	1370	1370
38	2023	0	0	78	78	1370	1370
39	2024	0	0	78	78	1370	1370
40	2025	0	0	78	78	1370	1370
41	2026	0	0	78	78	1370	1370
42	2027	0	0	78	78	1370	1370
43	2028	0	0	78	78	1370	1370
44	2029	0	0	78	78	1370	1370
45	2030	0	348	78	426	1370	1370
46	2031	0	0	78	78	1370	1370
47	2032	0	0	78	78	1370	1370
48	2033	0	0	78	78	1370	1370
49	2034	0	0	78	78	1370	1370
50	2035	0	0	78	78	1370	1370

PRESENT WORTH

PROJECT :MAMBUSAO

SENSITIVITY DATA

COST UP = 0(%)

BENEFIT DOWN= 0(%)

(UNIT:1000 US $)

DISCOUNT RATE (%)	PRESENT WORTH COST	PRESENT WORTH BENEFIT	C/B	DISCOUNT RATE (%)	B-C	B/C
0.00	8905	58297	0.15	0	49392	6.55
2.00	6569	33705	0.19	2	27135	5.13
4.00	5230	20834	0.25	4	15604	3.98
6.00	4388	13656	0.32	6	9268	3.11
8.00	3812	9403	0.41	8	5592	2.47
10.00	3388	6742	0.50	10	3354	1.99
12.00	3059	4995	0.61	12	1936	1.63
14.00	2792	3800	0.73	14	1008	1.36
16.00	2568	2954	0.87	16	386	1.15
18.00	2376	2337	1.02	18	-39	0.98
20.00	2208	1877	1.18	20	-332	0.85

DISCOUNT RATE (%)	PRESENT WORTH COST	PRESENT WORTH BENEFIT	B/C	B-C	REMARKS
16.00	2568	2954	1.15	386	
16.10	2558	2918	1.14	360	
16.20	2547	2883	1.13	336	
16.30	2537	2849	1.12	311	
16.40	2527	2815	1.11	287	
16.50	2517	2781	1.10	264	
16.60	2507	2748	1.10	241	
16.70	2498	2716	1.09	219	
16.80	2488	2684	1.08	196	
16.90	2478	2653	1.07	175	
17.00	2468	2622	1.06	153	
17.10	2459	2591	1.05	133	
17.20	2449	2561	1.05	112	
17.30	2440	2532	1.04	92	
17.40	2431	2503	1.03	72	
17.50	2421	2474	1.02	53	
17.60	2412	2446	1.01	34	
17.70	2403	2418	1.01	15	
17.80	2394	2391	1.00	-3	***
17.90	2385	2364	0.99	-21	
18.00	2376	2337	0.98	-39	