CHAPTER 3 IRRIGATION DEVELOPMENT PLAN

3.1 General

The results of the field investigation and the studies in the previous chapter indicate the following constraints in the UPRIIS from the standpoints of irrigation and drainage:

1) Limited water resources especially the shortage of irrigation water during the dry season.

2) Inundation during the wet season

3) Low irrigation efficiency especially in the wet season

The irrigation development plan aims to solve the above constraints. The optimum irrigation plan is formulated through the sufficient studies on following aspects:

1) Improvement of the existing diversion dams for creation of new water resources

2) Prevention of inundation

3) Effective use of existing water resources by the construction of farm pond, re-use of water and improvement of water management of the system

The irrigation service area is determined at 111,200 ha comprising 108,000 in the dry season and 106,800 ha in the wet season for the optimum irrigation development plan. The plan consists of the rehabilitation and improvement plan of existing irrigation facilities and improved water management plan.

Overall irrigation efficiency will be improved from the present low efficiency of about 30% to about 54% in wet season and from 51% to 57% in the dry season by applying the improved operation rule.

3.2 Water Resources and Their Effective Use

In Chapter 2, the availability of the present water resources was studied and the results indicated that the potential area of 116,900 ha could not be irrigated without the improvement of the water resources or water management.

In this chapter, the water resources are reviewed and their effective use is studied for the formulation of the optimum irrigation development plan.

3.2.1 Water Resources

(1) Present Water Resources

As mentioned in Section 2.2, the major water resources in the UPRIIS are the Pampanga river with reservoir function by the Pantabangan dam, the Talavera river, the Peñaranda river and major creeks in the project area. The river discharges at five (5) diversion dams and the Pantabangan dam were estimated for the period from 1951 to 1982 based on the longterm runoff analysis by means of tank model simulation method described in Appendix I. The mean annual runoffs at the each flow point are estimated as below.

River Flow Point	Pampanga			Talavera		Peñaranda
	Pantabangan Dam	PRIS Dam	PBRIS Dam	TRIS Dam	LTRIS Dam	PEÑRIS Dam
Drainage Area (km^2)	954	52/*	1,043/*	313	88/*	513
Mean Annual Runoff (MCM)	1,248	75	1,645	360	95	422

/*: Drainage area after the upstream dam

The mean monthly discharge at each flow point is shown in Table 2.11. The wet season flow and the drought flow appear in the months of June through November and January through April, respectively. The annual runoffs of these rivers have much potential for irrigation. However the runoff in dry season is limited to irrigate whole the potential irrigation area.

The discharge of the creeks is explained in Section 3.2.2 (1).

(2) Possibility for Creation of New Water Resources

The following two plans are considered to create the new water resources:

1) Construction of new large scaled dam

2) Improvement of the existing diversion dams

The plan of item (1) is out of the scope of work agreed between NIA and JICA. In this study, the improvement plan of the existing diversion dams is studied.

There exist eight (8) diversion dams in UPRIIS. Among them 5-Bay and LTRIS dam have no possibility of reservoir function topographically.

The present effective storage capacities is estimated at zero (0) for PRIS, PBRIS, TRIS AND PEÑRIS dams, 0.3 MCM for Vaca dam and 1.0 MCM for Murcon dam. On the other hand, the potential effective storage capacities of these existing diversion dams are estimated based on the results of river cross section survey and the topographic maps on a scale of 1/4,000. The potential effective capacities and major dimensions on these dams are summarized below.

Reservoir	Effective Storage Capacity (MCM)	High Water Elevation (m)	Riverbed Elevation (m)	Existing Crest Elevation (m)	Crest Length (m)
PRIB Dam	0.5	95.0	85.0	89.45	500
PBRIS Dam	5.9	48.0	38.0	44.62	790
TRIS Dam	11.9	160.0	132.9	134.5	260
PEÑRIS Dam	8.0	35.0	27.1	29.0	370
VACA Dam	0.3	91.0	89.0	91.21	43
MURCON Dam	1.0	41.0	32.0	42.26	42

In case of PRIS and PBRIS dams, the reservoir water level will be limited at EL. 95.0 m and EL. 48.0 m, respectively because the village and cultivated land are located above those elevations at upstream. Under such circumstances, the effective storage capacity for PRIS and PBRIS will be estimated zero (0) and only 2.3 MCM at maximum respectively in case that these dams are improved taking into consideration no function of sediment release. On the other hand the effective storage capacities are expected to be only 0.5 MCM for PRIS and 5.9 MCM for PBRIS in case that the improvement of the dams are executed by installation of gates. However the construction of long crest of dam and long length of gates are required in these cases and much fund is required. Construction of reservoirs at TRIS and PEÑRIS dams is not so economically attractive. However, considering the following conditions, the reservoir functions at TRIS and PEÑRIS dam are studied:

1) The TRIS upper and SAE commanded by TRIS dam cannot receive supplemental irrigation water from the Pantabangan dam. The irrigable area in dry season is limited. It is very difficult for TRIS upper and SAE area to have new water resources except the reservoir at TRIS dam.

2) The PEÑRIS is located at the tail portion of the UPRIIS system and the conveyance distance is about 80 km from the Pantabangan dam. It is considered necessary to clarify the effect of reservoir function to the total water balance.

Since it is difficult to raise the water level of the Vaca and Murcon dams topographically, the existing storage capacities of them become potential effective storage capacities.

3.2.2 Effective Use of Present Water Resources

In order to use the present water resources effectively, the following improvement plans were studied:

1) Rehabilitation of the existing re-use structures

2) Construction of the farm pond

3) Improvement of the present operation rule

(1) Effective Use of Return Flow through Rehabilitation of Re-use Structures

There are many check gate structures on the drainage creeks to intake the local flow including return-flow from paddy field. Through the field survey, about forty (40) check gate structures were investigated.

The most of such structures did not function properly due to the deterioration of the control gates. These structures cause flood in upstream because of insufficient flood sluice capacity. By the rehabilitation of these structures, effective use of return flow and internal local flow will be realized.

Out of forty check gate structures investigated, twenty-two structures should be rehabilitated for the effective use of water, taking into consideration the following points:

1) The scale of the drainage area

2) The scale of the irrigation area commanded by the check gate structure

3) Availability of existing leading canal

General features of these check gate structures are shown in Table 2.12. The irrigation diagram including these re-use points are shown in Fig. 2.15. Total irrigation areas commanded by these re-use structures are estimated at 34,925 ha.

The available discharge at the re-use structure is estimated on the basis of the following formula which was explained in Section 2.5.2 (2):

$$Q = [K \cdot R + a] \cdot A + RF$$

where, Q: creek discharge (m^3/sec/10 days)

K: coefficient (0.00485)

R: 10 days rainfall (mm)

a: constant (0.1)

A: drainage area at re-use structure (km^2)

RF: return flow (30% of total irrigation water to the relevant paddy field) (m^3/sec/10 days)

Assuming that the return flow is zero, the mean annual runoff per unit drainage area is estimated at about 1.1 MCM for the mean annual rainfall of 1,882 mm in the UPRIIS area.

(2) Increasing Irrigation Efficiency through Construction of Farm Pond

One of the constraints in the water control is low irrigation efficiency due to time-lag of the irrigation water delivery on the long conveyance distance. To solve such constraints, farm ponds were considered to introduce functions of regulating time-lag and storage of excess water.

Using the topographic maps on a scale of 1/4,000, about 18 sites of farm pond were selected and evaluated by the possibility of construction of farm pond.

As a result of field survey, it was found that construction of the farm ponds will be difficult because of large scaled land acquisition. The submerged area by constructions of farm ponds are mostly cultivated paddy land and it will be very difficult to acquire such land in view of socio-economic point.

(3) Improvement of the Present Operation Rule

The establishment of the operation rule for water management aims at the higher irrigation efficiency, equitable distribution of irrigation water and same quality of control at each districts. The higher efficiency will be obtained through the effective utilization of rainfall and shortening the time-lag of conveyance.

Regarding this point, the standard for operation interval and rainfall amount was analyzed by a simulation study. Operation interval means the unit operation period during which control structure will not be changed except in case that certain rainfall occurs. The control of structure will be set at the start of the operation period.

The results of daily operation simulation study for 10 wet seasons period indicate that the unit operation period is one week and the certain amount of rainfall is 30 mm/day. The simulation shows that the irrigation operation efficiency will be gained at least 90%

during the wet season. The overall irrigation efficiency in the present operation for the wet season is found at about 30%. Assuming farming efficiency in the wet season at 75% and average conveyance efficiency at about 80%, the operation efficiency will be obtained at 50% as follows:

Irrigation Efficiency in Wet Season

(Unit: %)

Item	Present	Improved
Farming Efficiency	75	75
Conveyance Efficiency	80	80
Operation Efficiency	50	90
Overall Efficiency	30	54

The operation efficiency of 50% in the wet season at present will be improved at 90% by applying the above method of operation interval and rainfall standard of 30 mm/day. The overall irrigation efficiency will be gained at 54% in wet season.

As for the dry season, assuming farming efficiency of 80%, average conveyance efficiency of 80% and operation efficiency of 90%, the overall irrigation efficiency will become 57% as follows:

Irrigation Efficiency in Dry Season

(Unit: %)

Item	Present	Improved
Farming Efficiency	80	80
Conveyance Efficiency	80	80
Operation Efficiency	80	90
Overall Efficiency	51	57

The basic operation rule will be expressed as follows:

1) Unit operation period is one week.

   The control structures in a system will be set according to the irrigation schedule on the first day of the week and there will be no change of control within the week unless rainfall exceeds 30 mm/day.

2) The condition of flow and water distribution will be monitored by CMS/1. If the distribution is found skew from the schedule, necessary re-adjustment will be ordered from the base stations to the field personnel.

3) If it is monitored that amount of rainfall exceeds 30 mm/day, the irrigation water supply will be stopped from next day until the end of the week.

To realize this rule, it is necessary to fulfill the several conditions. The daily irrigation water balance is to be calculated to decide the amount of irrigation supply for the next week in accordance with the preceding week's operation. The computer of each district office is to be utilized for this purpose.

In order to control or change irrigation water, the control structures is to be quick and simple. The telecommunication system is to be utilized for this.

It is necessary to make farmers understand that there will be a period of absence of irrigation water supply.

As for the time-lag, the fundamental and complete solution will be given by having storage functions within the canal system. However, the above operation rule will contribute through the following aspects:

1) The operation is based on one week interval which can absorb the time-lag effect.

2) As the control is practiced with the whole irrigation system at certain fixed day, the check gates will be so operated as to store the water in the canals. This stored water will function to shorten the time-lag.

3.3 Delineation of Optimum Scale of Irrigation Service Area

The optimum scale of the irrigation service area is delineated by water balance study taking into consideration of the water resources, effective use of water and inundation area in the wet season. The inundation area is explained in detail in Appendix III and IV.

3.3.1 Calculation Method of Irrigation Water Requirement

As mentioned in Appendix V, Agriculture-Agro economy, double cropping of paddy per annum will be proposed to be practiced under proper irrigation farming in agricultural development. The irrigation water

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/1: CMS - Centralized monitoring system is described in Appendix VI.

requirement is calculated based on the proposed cropping pattern. The calculation method on the crop water requirement is applied to the criteria used in the UPRIIS office for the operation. The criteria is presented in Reference 1. Rainfall data at Cabanatuan City is only available for long periods from 1951 to 1982. Using these rainfall data, effective rainfall is calculated based on daily water balance calculation assuming 50 mm height of paddy dike. And same rainfall data are used for the estimation of creek run-off.

The irrigation water requirement is estimated by deducting effective rainfall from the crop water requirement on daily basis and summarized for each 10 days.

In estimation of diversion water requirement, losses for farming and conveyance are applied the same values mentioned in Section 2.5.2 and operation loss is applied to 10% based on the proposed water control method presented in Section 3.2 (3). Based on the these losses, overall irrigation efficiency is estimated. The diversion water requirement is estimated by dividing the irrigation water requirement by the overall irrigation efficiency.

As for the available water, minimum water release from the Pantabangan dam for power generation is set at 864,000 m^3/day. Release for power generation does not exceed the irrigation requirement.

3.3.2 Formulation of Alternative Irrigation Plans

In order to delineate the optimum irrigation development plan, the alternative plans are prepared based on the combination of following four parameters:

1) Irrigation service area

2) Number of re-use points

3) Reservoir function at existing diversion dams

4) Cropping pattern

(1) Irrigation Service Area

Irrigation service area is further examined for six cases from the standpoint of i) maximum use of potential irrigation area of 116,900 ha, ii) inundation area in the wet season and iii) availability of irrigation water resources. With respect to inundation area, irrigation service area of 107,695 ha in the wet season can be delineated at maximum based on the results of the drainage improvement as shown in the following Table. Details are explained in Appendix III and IV.

(Unit: ha)

Item	Potential Area	Submerged Area	Irrigable Area
District I	28,030	405	27,625
(SDA)	(12,657)	(405)	(12,252)
District II	26,183	0	26,183
District III	32,902	1,750	31,152
(PBRIS Ext'n)	(14,919)	(1,750)	(13,169)
District IV	29,765	7,030	22,735
(PEÑRIS Proper)	(22,083)	(4,900)	17,183
(PEÑRIS Ext'n)	(7,682)	(2,130)	5,552
Total	116,880	9,185	107,695

As far as availability of the irrigation water resources is concerned, it is expected from the water balance study in Section 2.5.3 that the water resources is insufficient for providing the irrigation water with whole the potential irrigation service area. The area to be excluded from irrigable area is considered such area located at the terminal of the UPRIIS systems. In these alternative plans, SDA, PBRIS ext'n, PEÑRIS and Muñoz area were considered as the terminal system. Consequently, the following six alternative plans for irrigation area were selected:

Alternative Plan	Irrigation Area (ha)	
	Dry Season	Wet Season
A	116,880	116,880
B	116,880	107,695
C	110,967	107,695
D	108,890	107,695
E	109,000	107,695
F	108,000	106,782

The breakdown of the irrigation area for each alternative plan is shown in Table 2.13.

(2) Re-use Point

Alternative study for the re-use points are carried out for following three cases:

1) 22 points (all)

2) 18 points excluding Kawayan No. 2, Kinamatayan, Sumolong and Linao check gates

3) 8 points shown in below table

Re-use points of twenty-two (22) selected in previous section are classified into two types of their present functions. One is the re-use point having independent irrigation system. The supplemental water from the Pantabangan dam is being supplied to the creek at upstream of the re-use check gate structures. The irrigation area totally depends on the intaked water through the check structure. This type of re-use points is considered equivalent to the diversion dam system and cannot be excluded from the water balance study. There are the following eight (8) re-use points of this type:

Re-use Point	Irrigation Area (ha)
De Babuyan Check Gate	1,236
5-Bay	12,657
Vaca Dam	2,375
Murcon Dam	5,028
Murcon Baby Dam	101
Carol Creek	-
PBRIS Proper Baby Dam	138
Tambo Check Gate	1,740

The other is the re-use point supplying the intaked water to a part of other irrigation system through a leading canal. The supplemental water from the Pantabangan dam is supplied to the system but not through the check gate structures at re-use point. There are fourteen (14) re-use points of this type.

Among above fourteen re-use points, four re-use points of Kawayan No. 2, Kinamatayan, Sumolong and Linao check gates are considered minor in scale from the following standpoints:

1) The area commanded by them is comparatively small.

2) Another re-use point of large scale is located at downstream.

3) The scale of rehabilitation works is large in spite of small command area.

(3) Reservoir Function at the Existing Diversion Dams

As mentioned in previous section, the reservoir functions at the Vaca, Murcon, TRIS and PEÑRIS dams are considered in the water balance study. The following four alternative plans are studied to evaluate the effects by the reservoir functions especially at TRIS and PEÑRIS dams:

1) Without reservoir function at all diversion dams

2) With reservoir function at Vaca and Murcon dams

3) With reservoir function at Vaca, Murcon and PEÑRIS dams

4) With reservoir function at four diversion dams

(4) Cropping Pattern

The proposed cropping pattern is firstly determined from the suitabilities of meteorological conditions and farming activities. In order to study the effective use of the water resources, the following four alternative patterns are studied:

1) Proposed cropping pattern

2) 10 days ahead from proposed pattern for whole districts

3) 10 days delay from proposed pattern for whole districts

4) 15 days ahead from proposed pattern for District IV only

Based on the combinations of above parameters, the following twelve (12) alternative plans have been formulated to evaluate the effect by each parameter appropriately:

Alternative Plan	A-1
"	A-2
"	A-3
"	A-4
"	B-1
"	B-2
"	C
"	D-1
"	D-2
"	D-3
"	E
"	F

The group of alternative plan A for the potential irrigation area of 116,900 ha is the plans formulated by the combination of the parameters: re-use points and cropping pattern.

The group of alternative plan B for 116,900 ha in the dry season and 107,695 ha in the wet season is the plans formulated from the parameter of reservoir function at existing diversion dams.

The alternative plan C is formulated to evaluate the irrigation service area in dry season as compared with the alternative plan B-2.

The group of alternative plan D for 108,890 ha in the dry season and 107,695 ha in the wet season is the plans formulated by the combination of the parameters: cropping pattern and reservoir function at the existing diversion dam.

The alternative plan E is formulated to evaluate the effect by the improvement of re-use points as compared with the alternative plan D-2.

The alternative plan F for 108,000 ha in the dry season and 106,782 ha in the wet season is the plan formulated to clarify the irrigation service area as compared with the other alternative plans.

The alternative plans are outlined in Table 2.14.

3.3.3 Determination of the Optimum Scale of Irrigation Service Area

The results of the water balance studies for each alternative plan were evaluated based on the criteria of irrigation water shortage.

(1) Criteria of Irrigation Water Shortage

The shortage criteria applied in the feasibility study on Pampanga Delta Development Project in 1981 was adopted in this study.

The average ratio of annual water deficit against the water requirement is to be less than seven (7) percent for the irrigation systems which depend on the Pantabangan dam.

As for TRIS upper and SAE, the ratio of fifteen (15) percent is applied as shortage criteria considering these systems are irrigated by run-of-river type.

(2) Results of Water Balance Study

The average ratio of annual water deficit for each alternative plan is shown in Table 2.14, and summarized as below.

Alternative Plan	Water Deficit for		
	Pantabangan Dam	TRIS Dam	
		Wet	Dry
	(%)	(%)	(%)
A-1	20.1	12.9	36.1
A-2	11.6	12.9	36.1
A-3	11.2	12.9	36.1
A-4	13.7	12.9	36.1
B-1	11.0	12.9	36.1
B-2	9.6	1.2	16.2
C	7.0	1.2	16.2
D-1	7.8	12.9	8.4
D-2	7.0	12.9	8.4
D-3	6.1	12.9	8.4
E	7.3	12.9	16.8
F	7.0	12.9	13.9

The ratio of water deficit in the dry season without and with the reservoir at TRIS dam are 36.1% for alternative B-2 and 16.2% for alternative B-1, respectively. The whole area of 4,676 ha commanded by TRIS dam cannot be irrigated within the shortage criteria.

With the function of PEÑRIS reservoir, the average ratio of annual water deficit will be decreased by only about 1.0%, as compared with the alternative plan D-2 and D-3.

In conclusions the implementation of TRIS and PEÑRIS reservoir are excluded from the irrigation plan.

As for the cropping pattern, it is generally effective to shift ahead the proposed pattern from the point of water resource. The fourth alternative pattern which shifts 15 days ahead of proposed one for District IV only is considered to be the most effective based on the comparison of the alternative study.

(3) Optimum Scale of Irrigation Service Area

As a result, only following three alternatives are accepted within the irrigation shortage criteria:

Item		Alternative Plan		
		D-2	D-3	F
1) Irrigation area				
Dry (ha)		108,890	108,890	108,000
Wet (ha)		107,695	107,695	106,782
2) Required points of rehabilitation of re-use point		22	22	18
3) Reservoir at PEÑRIS dam		No	Necessary	No
4) Water deficit for				
- Pantabangan dam (%)		7.0	6.1	7.0
- TRIS dam	Wet (%)	12.9	12.9	12.9
	Dry (%)	8.4	8.4	13.9

As shown in the above table, there is no significant difference of irrigation area both dry and wet seasons among alternatives. It is concluded that the alternative plan F is most optimum irrigation development plan, because the lowest rehabilitation cost is expected within the three alternative plans.

The results of water balance for alternative F are summarized in Table 2.15 for the Pantabangan dam and in Table 2.16 for the TRIS dam.

From above results, the irrigation service area in UPRIIS is determined at 108,000 ha in the dry season and 106,782 ha in the wet season. The irrigation service area by system is shown in Table 2.17, and total irrigation service area in UPRIIS is estimated at 111,200 ha.

As for the proposed irrigation area of 111,200 ha, the water balance was studied with applying the present operation efficiency of 50% in the wet season, and of 80% in the dry season. The average ratio of annual water deficit for this case study is 22.8%. This result indicates that the improvement of the operation efficiency is very effective for the water utilization in the UPRIIS.

The irrigation service area for each system is presented in Fig. 2.16 as the form of irrigation diagram.

3.4 Irrigation Development Plan

The optimum irrigation development plan aims to use the present water resources effectively by the establishment of the centralized monitoring system (CMS) and by the improvement of the irrigation facilities.

The water management in the UPRIIS would be improved by the CMS. The functions of the CMS are as mentioned below:

1) to monitor rainfall, river discharge, canal discharge and meteorological and hydrological data at the Pantabangan dam,

2) to estimate the irrigation water requirement, the diversion water requirement, and the water requirement released from the Pantabangan dam,

3) and to inform the estimated value to each field station.

The above process which need for the water management is automatically and speedily carried out by using micro computer. The irrigation water requirement can be calculated through the daily water balance, taking into full account of the daily rainfall and river flow. As a result, rainfall and river flow would be used effectively.

Furthermore, by applying the proposed operation rule to the water management with the CMS, overall irrigation efficiency will be improved from present low efficiency of about 30% to about 54% in the wet season and from 51% to 57% in the dry season.

In order to practice the water management according to the proposed operation rule, the irrigation facilities must function sufficiently. The deteriorated and unoperable existing irrigation facilities are proposed to be rehabilitated, and the checkgate structures are additionally constructed to control irrigation water more effectively. The proposed works for the irrigation development plan are described in Section 3.6.

3.5 Design Discharge for Irrigation Facilities

As mentioned in previous section, the irrigation water requirement is calculated with the same method applied in the UPRIIS office. The design irrigation water requirement is estimated based on the result of water balance calculation of alternative F and on the basic year for the design.

3.5.1 Basic Year for Design

The water balance calculation was conducted for the period of 32 years from 1951 to 1982. Witnin 32 years, the basic year for the design is determined based on the drought year in five return period with regard to following four items:

1) Annual rainfall

2) Dry season rainfall (November to April)

3) Annual river discharge at the Pantabangan dam

4) River discharge at the Pantabangan dam in dry season (November to April)

The year of 1969 is selected as a basic year for the design because the values in 1969 for the above four items are close to the values in five years return period as shown in Table 2.18.

3.5.2 Irrigation Water Requirement

The irrigation water requirement of basic year was calculated by 10 day in the water balance calculation of alternative F as shown in Table 2.19. The annual irrigation water requirements for each District are summarized as below.

(Unit: mm)

District	Annual Irrigation Water Requirement
I	1,309
II	1,267
III	1,305
IV	1,358
Average	1,310

3.5.3 Diversion Water Requirement

Diversion water requirement for irrigation is estimated by dividing the irrigation water requirement by the overall irrigation efficiency.

Ten day diversion water requirements for each system and re-use point are shown in Table 2.20 (1) and (2).

The annual diversion water requirements are estimated with range from 1,973 mm to 2,401 mm by systems.

3.5.4 Design Discharge for Irrigation Facilities

The design discharge for the irrigation facilities such as intake, main canal, lateral canal and related structures is set at the maximum value of the 10 day diversion water requirements.

The unit design discharges for each system are shown in Table 2.21.

The design discharges for each canal are shown in Fig. 2.16. The design discharges of the canals conveying supplemental water to re-use system are estimated by deducting the creek discharge from the diversion water requirement. The discharges of each creek for basic year are shown in Table 2.22.

3.6 Proposed Works

In order to obtain the proper water distribution and better management for the irrigation area determined in previous section, the rehabilitation and improvement works for the irrigation facilities are required.

The following major rehabilitation and improvement works are proposed:

1) Improvement of re-use points

2) Installation of control gates

3) Construction of spillway and wasteway

4) Rehabilitation of damaged and deteriorated structures and canals

5) Rehabilitation and construction of discharge measuring devices

The work quantities are summarized as follows:

Item	Quantity
1) Diversion dam	8 Nos.
2) Re-use structure	18 Nos.
3) Irrigation canals	
- Diversion canal	46.6 km
- Main canal	236 km
- Lateral	1,281 km
4) Related structures	
- Head gate & turnout	1,556 Nos.
- Check gate	1,520 Nos.
- Spillway and wasteway	35 Nos.
- Syphon	12 Nos.

3.6.1 Improvement and Rehabilitations of Existing Facilities

According to the design discharges for irrigation facilities, the flow capacity of major canals is studied whether the present capacity is enough to flow the design discharge or not. As a result of this study, all major canals except PBRIS proper main canal and lateral G-2 extension are enough to flow the design discharge.

The present flow capacity of PBRIS proper main canal is about 34 m^3/s at maximum. The design discharge of that canal is about 60 m^3/s. In order to flow the design discharge, the main canal and lateral G-2 extension are proposed to rehabilitate as concrete lining canal.

The other rehabilitation works and their volume are shown in Table 2.23.

The numbers of structures rehabilitated or constructed newly are summarized in Table 2.24.

3.6.2 Improvement of Re-use Points

As mentioned in Section 3.4.4, the following eighteen re-use structures are improved to intake the creek discharge effectively:

District	System	Re-use Point
I	TRIS Lower	Lubut, De Leon, De Babuyan
	SDA	5-Bay, Buasao, Santa Rita
II	PRIS	Dibulo, Guliat
	VCIS	Vaca dam
	MCIS	Murcon dam, Baby dam
III	PBRIS Proper	Baby dam, Tambo
	—	Carol & DC No. 2
	PBRIS Ext'n	Viola
IV	PEÑRIS	Campana, Bulo, Salupurgan

In the water balance study, the creek discharge is estimated by 10 days during the period of 32 years. The design flood discharge for each re-use point are set at the maximum value of that creek discharge. The design flood discharges are shown in Table 2.25.

The improvement works of re-use structures are designed to spillout the above flood discharge safely, and to intake the design irrigation water requirement.

Major improvement works are as follows:

1) Installation or replacement of check gates and intake gates

2) Construction of spillway

3) Excavation of leading channel

4) Embankment of dike

The work volume for improvement of re-use points is summarized in Table 2.26.

3.6.3 Construction of Spillway and Wasteway

As described in Section 2.4.3, the structures to control excess water and the safety of canal system for emergency are most neglected in the present system. Spillway and wasteway are constructed at the upstream of major structures such as syphon, major head gate and supply head gate to creek.

The location of spillway and wasteway is listed in Table 2.27.

CHAPTER 4 COST ESTIMATE

The direct construction cost for irrigation facilities is estimated on the basis of quantity of rehabilitation and improvement works and the respective unit prices. The unit prices are described in Appendix X. The direct construction cost is summarized as below.

(Unit: ₱10³)

District	Foreign Currency	Local Currency	Total
I	29,560	27,390	56,950
II	38,560	38,050	76,610
III	76,610	81,250	157,860
IV	45,790	46,970	92,760
Total	190,520	193,660	384,180

The breakdown of the direct construction cost for each system are shown in Table 2.28 to Table 2.43.

The other costs such as replacement cost and O&M cost are explained in Appendix X.

Table 2.1 LIST OF DATA COLLECTED

No.	Title	Issued	Date
1.	Discharge records of canal at the major points (26 stations)	WCCC	1979 - 1982
2.	Weekly farming activity reports	WCCC	1979 - 1982
3.	Pantabangan dam operation record	WCCC	1979 - 1982
4.	UPRIIS irrigation operation evaluation report	WCCC	1975 wet 1976 dry 1977 wet 1978 wet/dry 1979 " 1980 "
5.	Data for water requirement calculation	WCCC	1982
6.	Irrigation networks map (Scale: 1/4,000)	NIA	1970 - 1973
7.	Topographic map (Scale: 1/4,000)	NIA	1977
8.	UPRIIS & APIP canal network	UPRIIS	1977
9.	District layout map (Scale: 1/20,000 - 1/50,000)	UPRIIS	1977
10.	Design and construction drawings	NIA	1970 - 1973
11.	Inventory report on rehabilitation	UPRIIS	1982
12.	Monthly operation and maintenance reports	WCCC	1979 - 1982
13.	Lists of hydrological measurement stations	WCCC	1982

Table 2.2 MONTHLY MEAN DISCHARGE

(Unit: m^3/s)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Pantabangan Dam Inflow (A = 954 km^2)/1												
1976	10.6	7.8	6.4	10.4	346.4	127.0	59.9	77.9	95.0	35.8	13.1	8.1
1977	7.8	5.9	6.3	5.3	17.5	9.1	62.3	59.4	110.9	27.7	47.4	8.7
1978	8.9	6.8	6.0	2.5	4.9	33.6	40.4	289.3	169.1	208.6	64.4	19.2
1979	9.7	6.9	3.3	4.9	12.7	19.0	57.5	70.5	48.9	72.8	20.9	7.7
1980	16.3	15.9	21.0	7.5	20.6	38.2	89.0	44.2	94.0	43.9	233.6	17.5
1981	18.6	15.5	15.7	10.2	6.2	58.3	139.2	104.0	60.5	32.3	21.8	24.6
1982	9.5	9.4	11.0	7.9	7.3	10.9	52.7	72.4	56.5	28.8	-	-
Mean	11.6	9.7	10.0	7.0	59.4	42.3	71.6	102.5	90.7	64.3	66.9	14.3
Max.	18.6	15.9	21.0	10.4	346.4	127.0	139.2	289.3	169.1	208.6	233.6	24.6
Min.	7.8	5.9	3.3	2.5	4.9	9.1	40.4	59.4	48.9	27.7	13.1	7.7
Talavera Dam Inflow (A = 313 km^2)												
1972	8.7	10.5	11.8	6.2	14.8	14.5	-	-	-	-	-	-
1973	5.1	6.9	5.8	4.9	8.9	10.3	12.9	16.0	18.0	23.4	14.1	10.2
1974	3.2	6.3	5.9	6.4	6.5	14.8	10.4	23.6	16.8	22.8	23.5	11.0
1975	6.8	4.8	6.8	6.4	4.6	-	6.5	11.6	15.7	16.3	-	5.3
1976	2.8	2.6	-	-	-	-	-	-	-	-	-	-
Mean	5.3	6.2	7.6	6.0	8.7	13.2	9.9	17.1	16.8	20.8	18.8	8.8
Max.	8.7	10.5	11.8	6.4	14.8	14.8	12.9	23.6	18.0	23.4	23.5	11.0
Min.	2.8	2.6	5.8	4.9	4.6	10.3	6.5	11.6	15.7	16.3	14.1	5.3
Peñaranda Diversion Dam Inflow (A = 513 km^2)												
1977	9.5	6.7	-	-	-	-	15.9	12.2	4.9	17.8	32.9	14.7
1978	8.3	8.5	13.6	10.3	6.8	7.1	12.6	15.7	24.4	27.9	145.4	16.9
1979	9.8	9.4	9.3	-	-	14.9	14.4	15.3	13.6	17.1	21.3	15.8
1980	10.3	8.0	6.5	10.3	8.1	-	25.8	19.9	28.2	20.6	28.1	15.0
1981	10.8	8.4	6.3	7.9	17.9	13.4	29.6	25.5	22.7	23.6	23.6	17.8
Mean	9.7	8.2	8.9	9.5	10.9	11.8	19.7	17.7	18.8	21.4	50.3	16.0
Max.	10.8	9.4	13.6	10.3	17.9	14.9	29.6	25.5	28.2	27.9	145.4	17.8
Min.	8.3	6.7	6.3	7.9	6.8	7.1	12.6	12.2	4.9	17.1	21.3	14.7
Coronel River Flow at Bangkerohan (A = 709 km^2)												
1979	19.9	10.1	8.2	9.5	11.8	22.7	19.1	35.5	18.1	45.7	30.3	18.2
1980	15.2	13.1	13.5	8.2	17.4	20.1	23.7	22.6	49.5	34.9	76.3	25.0
1981	10.1	9.3	8.3	5.5	9.5	17.1	39.0	28.5	17.7	21.5	35.4	22.1
1982	14.2	12.8	11.0	11.1	10.7	10.9	24.4	32.9	23.0	14.8	-	14.0
1983	14.0	15.8	9.6	6.4	4.4	-	-	-	-	-	-	-
Mean	14.7	12.2	10.1	8.1	10.8	17.7	26.6	29.9	27.1	29.2	47.3	19.8
Max.	19.9	15.8	13.5	11.1	17.4	22.7	39.0	35.5	45.9	45.7	76.3	25.0
Min.	10.1	9.3	8.2	5.5	4.4	10.9	19.1	22.6	17.7	14.8	30.3	14.0

Remarks: /1: Catchment Area included Aurora River Basin (64 km^2)

Table 2.3 POTENTIAL IRRIGATION SERVICE AREA

SYSTEM	SERVICE AREA /1	POTENTIAL AREA /2
DISTRICT I		
(1) San Agustin Extension	881.22	769
(2) Talavera River Irrigation System (Upper)	4,591.17	3,908
(3) Talavera River Irrigation System (Lower)	8,500.00	10,696
(4) Sto. Domingo Area	10,500.00	12,657
(Sub-total)	(24,472.39)	(28,030)
DISTRICT II		
(5) Pampanga River Irrigation System	13,517.13	13,542
(6) Rizal Munic Area	2,509.00	2,579
(7) Lower Talavera River Irrigation System	2,581.52	2,659
(8) Vaca Creek Irrigation System	1,711.51	2,375
(9) Murcon Creek Irrigation System	5,038.66	5,028
(Sub-total)	(25,357.82)	(26,183)
DISTRICT III		
(10) Pampanga Bongabon River Irrigation System (Proper)	9,772.65	10,420
(11) Pampanga Bongabon River Irrigation System (Extension)	12,964.51	14,919
(12) Aliaga Area	3,965.11	5,266
(13) Pamaldan Cinco Cinco Area	1,154.25	1,327
(14) Platero Area	574.16	970 /3
(Sub-total)	(28,430.68)	(32,902)
DISTRICT IV		
(15) Penaranda River Irrigation System (Proper)	19,691.00	22,083
(16) Penaranda River Irrigation System (Extension)	5,609.00	7,682
(Sub-total)	(25,300.00)	(29,765)
GRAND TOTAL	103,560.89	116,880

/1 : Source: Five-Year Integrated Agricultural Development Program (Updated) Upper Pampanga River Integrated Irrigation System (UPRIIS)

/2 : Area estimated based on map of Irrigation Network scaled by 1/4,000.

/3 : Area estimated by list of rotation area prepared by WCCC.

Table 2.4(1) INVENTORY OF IRRIGATION FACILITIES

(I) IRRIGATION CANAL LENGTH

System	Canal Length (km)		
	Main Canal	Lateral	Total
TRIS	23.8	139.5	163.3
S D A	25.2	130.4	155.6
S A E	4.3	5.7	10.0
Sub-total	(53.3)	(275.6)	(328.9)
PRIS	6.5	170.1	176.6
LTRIS	13.3	26.1	39.4
RMA	-	20.2	20.2
VACA	11.5	16.6	28.1
MURCON	19.4	63.6	83.0
Sub-total	(50.7)	(296.6)	(347.3)
PBRIS PROPER	34.7	129.4	164.1
PBRIS EXT'N	16.6	178.1	194.7
ALIAGA	20.0	40.4	60.4
PLATERO /2	-	-	-
PCCA	-	12.7	12.7
Sub-total	(71.3)	(360.6)	(431.9)
PENRIS PROPER	43.0	258.5	301.5
PENRIS EXT'N	17.7 /1	85.6	103.3
Sub-total	(60.7)	(344.1)	(404.8)
DC NO. 1	19.2	-	19.2
DC NO. 2	27.4	-	27.4
LAT G-2 EXT'N	-	4.1	4.1
Sub-total	(40.6)	(4.1)	(50.7)
	282.6	1,281.0	1,563.6

/1 Length of Lateral C - Extention

/2 No data available

Table 2.4(2) INVENTORY OF IRRIGATION FACILITIES

(II) NUMBER OF STRUCTURES

	H. G. & T. O /2	Check	Crossing Structure	Syphon	Drainage Culvert	Bridge	Others
DISTRICT I	668 (60)	52	348	19	31	1	36
S.A.E	31 (5)	3	9	0	3	0	0
TRIS	301 (26)	34	97	10	5	0	10
S.D.A	336 (29)	15	242	9	23	1	26
DISTRICT II	685 (85)	140	596	14	17	7	100
R.M.A	82 (12)	8	47	3	6	5	12
PRIS	319 (35)	90	301	2	2	1	38
LTRIS	63 (9)	7	59	3	1	0	16
VACA	72 (9)	7	61	0	3	0	11
MURCON	149 (20)	28	128	6	5	1	23
DISTRICT III	942 (107)	58	517	51	35	0	82
PBRIS Pr.	345 (40)	30	150	25	2	0	33
PBRIS Ex.	399 (53)	19	234	16	20	0	27
ALIAGA	142 (14)	9	105	9	7	0	15
PLATERO /1	-	-	-	-	-	-	-
PCCA	56 (7)	0	28	1	6	0	7
DISTRICT IV	935 (98)	103	734	47	130	2	94
PENRIS Pr.	640 (71)	100	559	42	69	1	58
PENRIS Ex.	295 (27)	3	175	5	61	1	36
TOTAL	3230 (350)	353	2195	131	213	10	312

/1 : No Available Data

/2 : ( ) Number of H.G.

Table 2.5 ACTUAL FARMING AREA IN EACH SYSTEM

(Unit: ha)

System	Potential Area	1979		1980		1981		1982	
		Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
District I									
SAE	769	100	750	150	715	100	715	120	730
TRIS Upper	3,908	350	3,760	600	3,767	400	3,730	501	3,731
TRIS Lower	10,696	8,730	8,330	8,178	9,224	8,530	8,946	8,546	10,042
S.D.A	12,657	9,102	9,180	8,888	9,851	9,074	9,396	9,349	9,362
District II									
PRIS	13,542	12,476	13,525	12,959	13,471	12,109	13,148	12,738	12,850
R.M.A	2,579	2,313	2,276	2,317	2,294	2,170	2,204	2,789	2,213
LTRIS	2,659	2,219	2,544	2,257	2,582	2,047	2,443	2,190	2,326
VACA	2,375	1,389	1,708	1,430	1,622	1,510	1,825	2,209	1,793
MURCON	5,028	4,337	4,731	4,473	3,328	4,290	4,628	4,283	4,607
District III									
PBRIS Proper & PLATERO Area	10,420 970	10,280	10,400	10,323	10,327	10,086	10,220	10,006	10,220
PBRIS Extension	14,919	11,442	11,350	10,274	10,974	10,724	11,014	10,838	11,014
ALIAG & PCCA	5,266 1,327	4,710	4,860	4,695	4,629	4,681	4,667	4,820	4,667
District IV									
PENRIS	29,765	17,850	17,434	17,547	16,297	17,669	19,387	18,483	21,549
Total	116,880	85,297	90,848	84,091	89,081	83,390	92,323	86,872	95,104

Table 2.6 CONVEYANCE LOSS FOR EACH SYSTEM

Systems	Diversion Dam	Conveyance Loss (%)	Conveyance Efficiency (%)
SAE	TRIS Dam	6.30	94
TRIS UPPER	-do-	13.13	88
TRIS LOWER	PRIS Dam	19.10	84
SDA	5-Bay	18.67	84
- SDA SUPPLY HDGT	PRIS Dam	19.10	84
RMA	PRIS Dam	13.44	88
PRIS	-do-	17.28	85
VACA	VACA Dam	13.13	88
- VACA SUPPLY HDGT	PRIS Dam	14.49	87
LTRIS	LTRIS Dam	18.08	85
- LTRIS SUPPLY HDGT	PRIS Dam	16.97	85
MURCON	MURCON Dam	22.35	82
- MURCON SUPPLY SPILLWAY	PRIS Dam	11.42	90
PBRIS PROPER	PBRIS Dam	21.59	82
PLATERO	-do-	14.45	87
ALIAGA	-do-	23.33	81
PCCIS	-do-	23.33	81
PBRIS EXT'N	-do-	27.75	78
PEÑRIS PROPER	PEÑRIS Dam	25.00	80
PEÑRIS EXT'N	-do-	25.00	80

Remarks: $FC = \frac{1}{1 + CL}$, where, FC: conveyance efficiency
CL: conveyance loss

Table 2.7 WATER BALANCE WITH MAXIMUM POTENTIAL IRRIGATION AREA

(IRRIGATED AREA = 116,880 ha)

(Unit: MCM)

Year	Crop Season	Reservoir Volume	Inflow	Water Release		Evapo-ration
				Irrigation	Power	
1978 (Dec. 1)		2,180				
	1979 DRY		157	1,524	19	3
1979 (June 1)		791				
	1979 WET		778	329	48	2
1979 (Dec. 1)		1,190				
	1980 DRY		234	931 (443)	17 (2)	2
1980 (June 1)		474				
	1980 WET		1,477	164 (1)	66	2
1980 (Dec. 1)		1,719				
	1981 DRY		215	1,481 (58)	15 (1)	3
1981 (June 1)		435				
	1981 WET		1,157	276	67	2
1981 (Dec. 1)		1,247				
	1982 DRY		196	991 (458)	14 (15)	2
1982 (June 1)		436				
	1982 WET		587	144 (11)	63 (5)	2
1982 (Nov. 1)		814				

The volume in the parentheses is a value of water deficit.

Table 2.8 WATER BALANCE EXCLUDING PEÑARANDA RIVER IRRIGATION SYSTEM

(IRRIGATED AREA = 87,115 ha)

(Unit: MCM)

Year	Crop Season	Reservoir Volume	Inflow	Water Release		Evapo-ration
				Irrigation	Power	
1978 (Dec. 1)		2,180				
	1979 DRY		157	1,113	25	3
1979 (June 1)		1,196				
	1979 WET		778	235	56	2
1979 (Dec. 1)		1,681				
	1980 DRY		234	1,007	25	3
1980 (June 1)		880				
	1980 WET		1,477	157	66	2
1980 (Dec. 1)		2,132				
	1981 DRY		215	985	15	4
1981 (June 1)		1,343				
	1981 WET		1,157	277	67	2
1981 (Dec. 1)		2,154				
	1982 DRY		196	1,064	19	4
1982 (June 1)		1,263				
	1982 WET		587	152	68	2
1982 (Nov. 1)		1,628				

Table 2.9 WATER BALANCE EXCLUDING PEÑARANDA RIVER IRRIGATION SYSTEM EXTENSION

(IRRIGATED AREA = 109,198 ha)

(Unit: MCM)

Year	Crop Season	Reservoir Volume	Inflow	Water Release		Evapo-ration
				Irrigation	Power	
1978 (Dec. 1)		2,180				
	1979 DRY		157	1,372	25	3
1979 (June 1)		937				
	1979 WET		778	275	56	2
1979 (Dec. 1)		1,382				
	1980 DRY		234	1,117 (113)	23 (2)	2
1980 (June 1)		474				
	1980 WET		1,477	157	66	2
1980 (Dec. 1)		1,726				
	1981 DRY		215	1,358	15	3
1981 (June 1)		565				
	1981 WET		1,157	276	68	2
1981 (Dec. 1)		1,376				
	1982 DRY		196	1,120 (199)	14 (5)	2
1982 (June 1)		436				
	1982 WET		587	144 (7)	63 (5)	2
1982 (Nov. 1)		814				

The volume in the parenthese is a value of water deficit.

Table 2.10 ACTUAL IRRIGATION EFFICIENCY

OVERALL SYSTEM EFFICIENCY AT MAJOR DIVERSION DAM

(Unit: %)

System	Dry Season					Wet Season				
	1979	1980	1981	1982	Ave.	1979	1980	1981	1982	Ave.
TRIS Dam	-	-	-	-	-	29	19	33	33	29
PRIS Dam	49	51	52	52	51	30	28	29	27	29
PBRIS Dam	47	54	55	49	51	36	30	23	29	30
PENRIS Dam	86	79	97	87	87	29	34	32	33	32

OVERALL SYSTEM EFFICIENCY FOR EACH IRRIGATION SYSTEM

(Unit: %)

System	Dry Season					Wet Season				
	1979	1980	1981	1982	Ave.	1979	1980	1981	1982	Ave.
TRIS Lower	53	56	57	59	56	35	30	25	39	32
SDA	63	64	75	55	64	40	33	26	20	30
PRIS	45	43	45	47	45	25	24	28	29	27
PRIS (LAT.C-1)	60	48	51	59	55	27	31	53	41	38
PRIS (LAT.F)	84	78	78	80	80	40	55	54	38	47
LTRIS	43	46	43	46	45	31	25	24	19	25
VACA	40	60	65	69	59	26	30	44	43	36
MURCON	50	49	55	67	55	34	34	39	42	37
PBRIS Proper	40	45	45	41	43	24	28	12	20	21
PBRIS Ext'n	57	74	83	81	74	62	46	45	40	48

Table 2.11 ESTIMATED MEAN MONTHLY DISCHARGE

Average from 1951 to 1982 (32 years) (Unit: MCM)

FLOW POINT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Pampanga River													
Pantabangan Dam (954 Km^2) /1	39.6	32.5	33.3	32.8	75.5	127.7	179.4	240.4	222.0	146.0	99.2	55.4	1,283.8
Pampanga Diversion Dam (52 Km^2)	2.3	1.9	1.9	1.9	4.4	7.5	10.5	14.1	13.0	8.6	5.8	3.3	75.2
Pampanga Bongabon Diversion Dam (1,043 Km^2)	52.3	43.0	44.5	44.2	98.2	164.0	228.5	303.8	280.5	186.0	127.6	72.6	1,645.2
Talavera River													
Talavera Diversion Dam (313 Km^2)	9.7	7.7	7.7	7.5	20.1	35.7	51.6	70.8	65.4	41.9	27.5	14.3	359.9
Lower Talavera Diversion Dam (88 Km^2)	2.4	1.9	1.9	1.8	5.2	9.4	13.7	18.9	17.4	11.1	7.2	3.7	94.6
Peñaranda River													
Peñaranda Diversion Dam (513 Km^2)	20.0	14.5	13.7	11.4	13.6	25.9	42.6	62.5	73.0	66.8	46.4	31.2	421.6

/1 : Catchment area included Aurora River Basin (64 Km^2)

Table 2.12 WATER RE-USE POINTS IN UPRIIS

(Unit: ha)

No.	System	Re-use Point	Creek	Max. Irrigation Area	Connected Canal	Drainage Area			Remarks
						Irrigated Area	Non-Irrigated Area	Total	
District I									
I-1	TRIS Lower	Lubut Check Gate	Natan	2,386	TRIS Lower Lat. F	1,723	427	2,150	
I-2	TRIS Lower	De Leon Check Gate	Natan	271	TRIS Lower Lat. F-5	719	181	900	/1
I-3	TRIS Lower	Kawayan No.2 Check Gate	Kawayan	341	TRIS Lower MC	1,200	300	1,500	
I-4	TRIS Lower	De Babuyan Check Gate	De Babuyan	1,236	TRIS Lower Lat. G-3	504	126	630	
I-5	SDA	5-Bay	De Babuyan	12,657	SDA MC	1,053	267	1,320	/2
I-6	TRIS Lower	Kinamatayan Check Gate	Sibak	488	TRIS Lower Lat. F	1,337	333	1,670	
I-7	SDA	Buasao Check Gate	De Babuyan	895	SDA Lat. A EXTRA	2,515	625	3,140	/3
I-8	SDA	Santa Rita Check Gate	Santa Rita	1,588	SDA Lat. F	2,821	709	3,530	
District II									
II-1	PRIS	Debulo Check Gate	Debulo	530	PRIS Lat. B	686	3,804	4,490	
II-2	PRIS	Guliat Check Gate	Guliat	1,033	PRIS Lat. C-1 & C-4	1,705	425	2,130	
II-3	VCIS	Vaca Dam	Vaca	2,375	VCIS MC	3,100	1,680	4,780	
II-4	MCIS	Murcon Dam	Murcon	5,028	MCIS MC	5,590	2,300	7,890	
II-5	MCIS	Baby Dam	Cabasta	101	MCIS Lat. MC	641	159	800	
District III									
III-1		Carol & DC No.2	Carol	-	DC No.2	2,653	667	3,320	
III-2	PBRIS Proper	Baby Dam	Bangad	138	PBRIS Proper Lat. B Extra	477	643	1,120	
III-3	PBRIS Proper	Tambo Check Gate	Tambo	1,740	PBRIS Proper T. MC	-	1,000	1,000	
III-4	ARIAGA	Sumolong Check Gate	Cinco-Cinco	383	ALIAGA Lat. AM-3	1,259	311	1,570	
III-5	PBRIS Ext'n	Viola Check Gate	Manaol	1,495	PBRIS Ext'n Lat. A	1,918	482	2,400	
District IV									
IV-1	PENRIS Proper	Campana Check Gate	Cababao	1,782	PENRIS Proper Lat. D	4,529	2,131	6,660	
IV-2	PENRIS Proper	Linao Check Gate	Malimba	187	PENRIS Proper Lat. C-9a & C-9b	4,725	6,985	11,710	
IV-3	PENRIS	Bulo Check Gate	Bulo	1,556	PENRIS Lat. C-9b & CX-2	-	15,000	15,000	
IV-4	PENRIS Ext'n	Salupurgan Check Gate	San Miguel	2,058	PENRIS Ext'n Lat. CX	-	20,000	20,000	

Remarks: /1: After Lubut Check Gate
/2: After Kawayan No.2 and De Babuyan Check Gates
/3: After 5-Bay and Kinamatayan Check Gate

Table 2.13 IRRIGATION AREA BY SYSTEM FOR ALTERNATIVE PLANS

System	Potential Area /1	Alternative B		Alternative C		Alternative D		Alternative E		Alternative F	
		Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
District I											
(1) SAE	769	*/2	*	*	*	400	*	500	*	400	*
(2) TRIS UPPER	3,908	*	*	*	*	2,200	*	2,700	*	2,600	*
(3) TRIS LOWER	10,696	*	*	9,783	*	9,783	*	*	*	9,783	9,783
(4) SDA	12,657	*	12,252	10,657	12,252	10,657	12,252	10,500	12,252	10,700	12,252
(Sub-total)	(28,030)	(28,030)	(27,625)	(25,117)	(27,625)	(23,040)	(27,625)	(24,396)	(27,625)	(23,483)	(26,712)
District II											
(5) PRIS	13,542	*	*	*	*	*	*	*	*	*	*
(6) RMA	2,579	*	*	*	*	*	*	*	*	*	*
(7) LTRIS	2,659	*	*	*	*	*	*	*	*	*	*
(8) VCIS	2,375	*	*	*	*	*	*	*	*	*	*
(9) MCIS	5,028	*	*	*	*	*	*	*	*	*	*
(Sub-total)	(26,183)	(26,183)	(26,183)	(26,183)	(26,183)	(26,183)	(26,183)	(26,183)	(26,183)	(26,183)	(26,183)
District III											
(10) PBRIS PROPOER	10,420	*	*	*	*	*	*	*	*	*	*
(11) PBRIS EXT'N	14,919	*	13,169	13,919	13,169	13,919	13,169	13,169	13,169	13,169	13,169
(12) ALIAGA	5,266	*	*	*	*	*	*	*	*	*	*
(13) PCCA	1,327	*	*	*	*	*	*	*	*	*	*
(14) PLATERO	970	*	*	*	*	*	*	*	*	*	*
(Sub-total)	(32,902)	(32,902)	(31,152)	(31,902)	(31,152)	(31,902)	(31,152)	(31,152)	(31,152)	(31,152)	(31,152)
District IV											
(15) PENRIS PROPER	22,083	*	17,183	*	17,183	*	17,183	21,717	17,183	21,630	17,183
(16) PENRIS EXT'N	7,682	*	5,552	5,682	5,552	5,682	5,552	5,552	5,552	5,552	5,552
(Sub-total)	(29,765)	(29,765)	(22,735)	(27,765)	(22,735)	(27,765)	(22,735)	(27,269)	(22,735)	(27,182)	(22,735)
Total	116,880	116,880	107,695	110,967	107,695	108,890	107,695	109,000	107,695	108,000	106,782

/1 : Alternative A ia same area as the potential area.

/2 : Blank is same area as the potential area.

Table 2.14 ALTERNATIVE PLANS FOR WATER BALANCE STUDY

Alternative Plan	Irrigation Area[/1] (ha)		Re-use Point[/2]	Reservoir Function	Cropping Pattern	Water Deficit (%)	TRIS Upper & SAE			
							Irrigation Area (ha)		Water Deficit (%)	
	Dry	Wet					Dry	Wet	Dry	Wet
A-1	116,800	116,880	8 points (I-4,I-5,II-3,II-4, II-5,III-1,IV-2,IV-3)	-	Proposed pattern	20.1	4,676	4,676	36.1	12.9
A-2	116,800	116,880	22 points (All)	-	Proposed pattern	11.6	4,676	4,676	36.1	12.9
A-3	116,800	116,880	22 points (All)	-	10 days ahead from proposed	11.2	4,676	4,676	36.1	12.9
A-4	116,800	116,880	22 points (All)	-	10 days delay from proposed	13.7	4,676	4,676	36.1	12.9
B-1	116,880	107,695	22 points (All)	-	Proposed pattern	11.0	4,676	4,676	36.1	12.9
B-2	116,880	107,695	22 points (All)	TRIS dam, PENRIS dam, VACA dam, MURCON dam	Proposed patter	9.6	4,676	4,676	16.2	1.2
C	110,967	107,695	22 points (All)	TRIS dam, PENRIS dam, VACA dam, MURCON dam	Proposed pattern	7.0	4,676	4,676	16.2	1.2
D-1	108,890	107,695	22 points (All)	VACA dam, MURCON dam	Proposed pattern	7.8	2,600	4,676	8.4	12.9
D-2	108,890	107,695	22 points (All)	VACA dam, MURCON dam	District I-III: Proposed District IV: 15 days ahead from proposed	7.0	2,600	4,676	8.4	12.9
D-3	108,890	107,695	22 points (All)	PENRIS dam, VACA dam, MURCON dam	District I-III: Proposed District IV: 15 days ahead from proposed	6.1	2,600	4,676	8.4	12.9
E	109,000	107,695	18 points[/3]	VACA dam, MURCON dam	District I-III: Proposed District IV: 15 days ahead from proposed	7.3	3,200	4,676	16.8	12.9
F	108,000	106,782	18 points[/3]	VACA dam, MURCON dam	District I-III: Proposed District IV: 15 days ahead from proposed	7.0	3,000	4,676	13.9	12.9

Remarks: /1: Refer to Table 3.15.
/2: Refer to Table 2.13.
/3: I-1, II-2, I-4, I-5, I-7, I-8, II-1, II-2, II-3, II-4, II-5, III-1, III-2, III-3, III-5, IV-1, IV-3, IV-4.

Table 2.15 RESULT OF WATER BALANCE AT PANTABANGAN DAM

(Unit: $10^6 m^3$)

Year	Reservoir Capacity	Inflow	Required Outflow	Evapo-ration	Spillout	Water Deficit	Percent*
1951	2,300.00	1,094.86	1,348.19	6.77	469.28	0	0
52	1,570.58	1,148.72	1,307.30	6.17	0	0	0
53	1,405.80	1,167.76	1,151.30	5.93	0	0	0
54	1,416.30	870.94	1,740.00	4.59	0	0	0
55	542.62	968.84	1,508.71	2.94	0	412.57	27.3
56	412.38	1,117,02	1,504.79	2.98	0	319.68	21.2
57	341.31	1,038.38	1,530.09	2.77	0	493.18	32.2
58	340.00	884.10	1,479.46	2.55	0	597.92	40.4
59	340.00	760.60	1,745.12	2.41	0	986.92	56.6
1960	340.00	1,439.20	1,486.75	3.43	0	92.04	6.2
61	381.05	1,553.81	1,385.12	4.03	0	0	0
62	545.70	1,240.26	1,396.54	3.79	0	0	0
63	385.63	1,250.58	1,363.22	3.33	0	70.33	5.2
64	340.00	1,546.32	979.52	4.11	0	1.10	0.1
65	903.79	1,439.03	1,322.02	5.18	0	0	0
66	1,015.60	1,596.18	1,046.09	5.86	0	0	0
67	1,559.81	1,722.03	1,302.18	6.30	491.20	0	0
68	1,482.14	1,198.85	1,553.80	5.58	0	0	0
69	1,121.58	1,090.06	1,625.71	4.54	0	0	0
1970	581.36	869.81	1,545.94	2.87	0	437.65	28.3
71	340.00	1,279.96	988.99	3.70	0	0	0
72	627.27	1,676.36	1,436.36	4.75	0	0	0
73	862.51	1,544.96	1,271.67	5.07	0	0	0
74	1,130.71	1,508.85	1,194.08	5.62	0	0	0
75	1,439.83	1,128.26	1,119.87	6.04	0	0	0
76	1,442.15	2,152.01	1,325.00	6.37	922.72	0	0
77	1,340.05	965.45	1,437.32	5.23	0	0	0
78	862.92	2,272.86	1,368.30	5.64	280.20	0	0
79	1,481.62	987.51	1,784.03	4.83	0	0	0
1980	680.24	1,604.28	1,378.22	4.42	0	0	0
81	901.38	1,346.27	1,375.44	4.84	0	0	0
82	867.35	-	-	-	-	-	-
Average							7.0%

Note: (1) Reservoir capacity is a value at the beginning of May.
(2) Others are the total value from May to April of next year.

*: (Water Deficit) ÷ (Required Outflow) x 100

Table 2.16 RESULTS OF WATER BALANCE AT TALAVERA DIVERSION DAM

(Irrigation Area, Wet: 4,677 ha, Dry: 3,000 ha)

(Unit: $10^6 m^3$)

Year	Wet (MCM)			Dry (MCM)		
	D.W.R	Deficit	Percent	D.W.R	Deficit	Percent
1951	22.458	3.266	14.5	37.689	3.928	10.4
52	15.184	0	0	40.812	2.938	7.2
53	14.638	0.166	1.1	36.595	1.241	3.4
54	25.670	9.641	37.6	43.994	7.417	16.9
55	21.700	2.378	11.0	41.939	9.087	21.7
56	27.771	14.042	50.6	35.985	4.270	11.9
57	17.278	1.719	9.9	43.896	9.042	20.6
58	20.384	2.055	10.1	37.984	17.103	45.0
59	23.037	13.271	57.6	40.863	22.165	54.2
1960	14.556	3.480	23.9	43.429	16.113	37.1
61	7.269	0	0	43.337	8.623	19.9
62	11.588	0	0	44.228	8.440	19.1
63	10.820	0	0	41.580	11.138	26.8
64	5.360	0	0	35.531	2.010	5.7
65	9.793	0	0	44.387	2.279	5.1
66	21.498	0	0	36.673	0.101	0.3
67	13.236	0	0	45.931	0.136	0.3
68	19.513	4.501	23.1	45.745	1.699	3.7
69	28.264	2.977	10.5	44.404	6.560	14.8
1970	23.497	4.550	19.4	41.798	10.041	24.0
71	15.842	0	0	33.324	2.382	7.1
72	16.029	2.311	14.4	44.927	2.733	6.1
73	14.564	0	0	43.790	1.309	3.0
74	27.573	1.239	4.5	35.896	0.631	1.8
75	11.175	0	0	38.663	1.300	3.4
76	16.379	0	0	43.174	1.239	2.9
77	13.861	0	0	44.968	3.496	7.8
78	14.662	3.712	25.3	45.129	1.275	2.8
79	33.251	14.046	42.2	41.432	9.760	23.6
1980	19.157	4.092	21.4	40.277	6.247	15.5
81	15.505	2.174	14.0	41.307	2.983	7.2
82	28.683	5.921	20.6	-	-	-
Average			12.9%			13.9%

Table 2.17 PROPOSED IRRIGATION SERVICE AREA

(Unit: ha)

System	Service Area		
	Dry	Wet	System
DISTRICT I			
(1) SAE	400	769	769
(2) TRIS upper	2,600	3,908	3,908
(3) TRIS lower	9,783	9,783	9,783
(4) SDA	10,700	12,252	12,252
(Sub-total)	(23,483)	(26,712)	(26,712)
DISTRICT II			
(5) PRIS	13,542	13,542	13,542
(6) RMA	2,579	2,579	2,579
(7) LTRIS	2,659	2,659	2,659
(8) VCIS	2,375	2,375	2,375
(9) MCIS	5,028	5,028	5,028
(Sub-total)	(26,183)	(26,183)	(26,183)
DISTRICT III			
(10) PBRIS proper	10,420	10,420	10,420
(11) PBRIS ext'n	13,169	13,169	13,169
(12) ALIAGA	5,266	5,266	5,266
(13) PCCA	1,327	1,327	1,327
(14) PLATERO	970	970	970
(Sub-total)	(31,152)	(31,152)	(31,152)
DISTRICT IV			
(15) PEÑRIS proper	21,630	17,183	21,630
(16) PEÑRIS ext'n	5,552	5,552	5,552
(Sub-total)	(27,182)	(22,735)	(27,182)
Total	108,000	106,782	111,229

Table 2.18 STATISTICAL ANALYSIS OF EXTREME DRY YEAR

Year	Annual Rainfall (mm)	Dry Season Rainfall (mm)	Annual Discharge (MCM)	Dry Season Discharge (MCM)
1951	1,707.7	331.8	1,094.86	297.21
52	1,763.9	166.2	1,148.72	240.43
53	1,817.6	339.7	1,167.76	316.27
54	1,264.4	202.0	870.94	271.67
55	1,653.8	395.3	968.84	278.79
56	1,692.5	424.9	1,117.02	358.82
57	1,557.3	198.0	1,038.38	248.81
58	1,727.7	265.0	884.10	136.05
59	1,434.9	266.5	760.60	150.01
1960	2,218.3	102.5	1,439.20	188.44
61	2,254.1	128.0	1,553.81	221.11
62	1,766.0	86.6	1,240.26	195.21
63	1,815.3	165.1	1,250.58	208.04
64	2,417.4	620.2	1,546.32	488.53
65	1,922.3	169.6	1,439.03	278.29
66	2,246.6	517.3	1,596.18	509.41
67	2,248.5	114.6	1,722.03	339.85
68	1,572.1	64.6	1,198.85	252.01
69	1,517.3	101.0	1,090.06	216.71
1970	1,310.9	126.9	869.81	211.81
71	2,144.2	460.3	1,279.96	346.93
72	2,225.3	68.2	1,676.36	235.82
73	2,238.7	275.1	1,544.96	358.83
74	2,106.3	337.0	1,508.85	424.89
75	1,727.7	202.3	1,128.26	322.05
76	2,350.6	99.6	2,152.01	265.52
77	1,543.2	196.3	965.45	301.48
78	2,458.8	50.8	2,272.86	352.15
79	1,144.1	194.2	987.51	207.84
1980	2,079.0	583.6	1,604.28	502.17
81	2,372.2	484.3	1,346.27	249.95
Value in 5 Year Return Period	1,590.0	111.0	1,020.00	204.00

Table 2.19 IRRIGATION WATER REQUIREMENT

(Unit: mm)

	Date		District I	II	III	IV
1969	May	1	0	0	0	3
		2	0	0	0	0
		3	52	52	52	74
	June	1	0	0	0	0
		2	49	48	49	68
		3	79	77	79	64
	July	1	56	54	56	46
		2	0	0	0	0
		3	8	8	8	10
	Aug.	1	8	7	8	8
		2	41	39	41	44
		3	48	46	48	51
	Sept.	1	0	0	0	0
		2	16	15	16	2
		3	0	0	0	0
	Oct.	1	0	0	0	0
		2	5	5	5	11
		3	16	16	16	57
	Nov.	1	50	49	50	68
		2	15	14	15	34
		3	68	66	68	84
	Dec.	1	89	87	88	72
		2	64	62	64	63
		3	75	72	74	83
1970	Jan.	1	71	68	71	78
		2	71	68	71	77
		3	80	77	80	85
	Feb.	1	84	81	83	88
		2	83	81	83	75
		3	57	55	57	44
	Mar.	1	60	58	59	43
		2	42	41	42	24
		3	42	21	22	2
	Apr.	1	0	0	0	0
		2	0	0	0	0
		3	0	0	0	0
	Total		1,309	1,267	1,305	1,358

Wet Season

Dry Season

Table 2.20(1) DIVERSION WATER REQUIREMENT

		SAE	TRIS UPPER	TRIS LOWER	SDA	RMA	PRIS	VACA	LTRIS	MURCON	PBRIS PR.	PLA TERO	ALI AGA	PCCIS	PBRIS EX.	PENRIS PR.	PENRIS EX.
MAY	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	6
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	82	88	92	92	88	91	88	91	94	94	89	95	95	99	137	137
JUN	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	77	82	86	86	81	84	81	84	87	89	83	90	90	93	126	126
	3	125	133	139	139	130	134	130	134	139	143	135	144	144	150	119	119
JUL	1	88	94	99	99	91	94	91	94	98	101	95	102	102	106	85	85
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	13	13	14	14	13	14	13	14	14	14	14	15	15	15	19	19
AUG	1	13	13	14	14	12	12	12	12	13	14	14	15	15	15	15	15
	2	65	69	72	72	66	68	66	68	70	74	70	75	75	78	81	81
	3	76	81	85	85	77	80	77	80	83	87	82	88	88	91	94	94
SEP	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	25	27	28	28	25	26	25	26	27	29	27	29	29	30	4	4
	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OCT	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	8	8	9	9	8	9	8	9	9	9	9	9	9	9	19	19
	3	24	25	26	26	25	26	25	26	27	27	26	27	27	28	99	99
NOV	1	74	79	83	83	77	80	77	80	83	85	80	86	86	89	118	118
	2	22	24	25	25	22	23	22	23	24	25	24	26	26	27	59	59
	3	100	107	112	112	104	108	104	108	112	115	109	117	117	121	146	146
DEC	1	132	140	147	147	137	142	137	142	147	149	140	151	151	157	125	125
	2	95	101	106	106	98	101	98	101	105	108	102	110	110	114	109	109
	3	111	118	124	124	114	118	114	118	122	125	118	127	127	132	144	144
JAN	1	105	112	117	117	107	111	107	111	115	120	113	122	122	126	135	135
	2	105	112	117	117	107	111	107	111	115	120	113	122	122	126	134	134
	3	118	126	132	132	122	126	122	126	130	136	128	137	137	142	148	148
FEB	1	124	133	139	139	128	132	128	132	137	141	133	142	142	148	153	153
	2	123	131	137	137	128	132	128	132	137	141	133	142	142	148	130	130
	3	84	90	94	94	87	90	87	90	93	97	91	98	98	101	76	76
MAR	1	89	95	99	99	92	95	92	95	98	100	94	101	101	105	75	75
	2	62	66	69	69	65	67	65	67	69	71	67	72	72	75	42	42
	3	33	35	36	36	33	34	33	34	36	37	35	38	38	39	3	3
APR	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL		1973	2102	2201	2201	2037	2108	2037	2108	2184	2251	2124	2280	2280	2364	2401	2401

Table 2.20(2) DIVERSION WATER REQUIREMENT

		LUBUT	DE LEON	DE BUYAN	BA	BUASAO	SANTA RITA	DIBLOG	ULIAT	BABY (MUR)	BABY (PBRI)	TAMBO	VIOLA	CAM PANA	BULO	SALUP RUGAN
MAY	1	0	0	0	0	0	0	0	0	0	0	0	0	5	5	5
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	86	80	84	81	81	81	81	81	79	86	86	118	115	118	
JUN	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	81	76	79	76	76	75	75	75	74	81	81	108	106	108	
	3	130	122	127	123	123	120	120	120	119	130	130	102	100	102	
JUL	1	92	86	90	87	87	84	84	84	85	92	92	73	72	73	
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	3	13	12	13	12	12	12	12	12	12	13	13	16	16	16	
AUG	1	13	12	13	12	12	11	11	11	12	13	13	13	12	13	
	2	67	63	66	64	64	61	61	61	62	67	67	70	69	70	
	3	79	74	77	75	75	72	72	72	73	79	79	81	80	81	
SEP	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	2	26	25	26	25	25	23	23	23	24	26	26	3	3	3	
	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
OCT	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	2	8	8	8	8	8	8	8	8	8	8	8	16	17	16	
	3	25	23	24	23	23	23	23	23	23	25	25	85	89	85	
NOV	1	77	72	75	73	73	72	72	72	71	77	77	102	106	102	
	2	23	22	23	22	22	20	20	20	21	23	23	51	53	51	
	3	105	98	103	99	99	96	96	96	96	105	105	125	131	125	
DEC	1	137	129	134	130	130	127	127	127	125	136	136	108	112	108	
	2	99	93	97	94	94	91	91	91	91	99	99	94	98	94	
	3	116	109	113	110	110	105	105	105	105	114	114	124	129	124	
JAN	1	110	103	107	104	104	99	99	99	101	110	110	116	122	116	
	2	110	103	107	104	104	99	99	99	101	110	110	115	120	115	
	3	123	116	121	117	117	113	113	113	113	123	123	127	133	127	
FEB	1	130	122	127	123	123	118	118	118	118	128	128	131	137	131	
	2	128	120	125	121	121	118	118	118	118	128	128	112	117	112	
	3	88	82	86	83	83	80	80	80	81	88	88	66	69	66	
MAR	1	93	87	91	88	88	85	85	85	84	91	91	64	67	64	
	2	65	61	63	61	61	60	60	60	60	65	65	36	37	36	
	3	34	32	33	32	32	31	31	31	31	34	34	3	3	3	
APR	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TOTAL		2058	1930	2012	1947	1947	1884	1884	1884	1887	2051	2051	2064	2118	2064	

Table 2.21 UNIT DESIGN WATER REQUIREMENT

System	Irrigation Area (ha)		Design Requirement (ℓ/s/ha)	
	Wet	Dry	Wet	Dry
(1) TRIS UPPER	3,908	2,600	1.54	1.62
(2) SAE	769	400	1.44	1.52
(3) TRIS LOWER	(9,783)	(9,783)		
(Direct)	6,161	6,161	1.61	1.70
- Lubut	2,115	2,115	1.51	1.59
- De Leon	271	271	1.41	1.49
- Le Babuyan	1,236	1,236	1.47	1.56
(4) SDA	(12,252)	(10,700)		
(Driect)	9,859	8,307	1.61	1.70
- Buasao	805	805	1.43	1.51
- Santa Rita	1,588	1,588	1.43	1.51
(5) RMA	2,579	2,579	1.50	1.59
(6) PRIS	(13,542)	(13,542)		
(Direct)	11,979	11,979	1.55	1.65
- Debulu	530	530	1.39	1.47
- Guliat	1,033	1,033	1.39	1.47
(7) LTRIS	2,659	2,659	1.55	1.65
(8) VACA	2,375	2,375	1.50	1.59
(9) MURCON	(5,028)	(5,028)		
(Direct)	4,927	4,927	1.61	1.71
- Baby	101	101	1.39	1.47
(10) PBRIS PROPER	(10,420)	(10,420)		
(Direct)	8,542	8,542	1.65	1.73
- Baby	138	138	1.38	1.44
- Tombo	1,740	1,740	1.51	1.57
(11) PBRIS EXT'N	(13,169)	(13,169)		
(Direct)	12,064	12,064	1.74	1.81
- Viola	1,105	1,105	1.51	1.57
(12) ALIAGA	5,266	5,266	1.67	1.75
(13) PCCA	1,327	1,327	1.67	1.75
(14) PLATERO	970	970	1.56	1.63
(15) PEÑRIS PROPER	(17,183)	(21,630)		
(Direct)	16,302	18,873	1.44	1.77
- Campana	625	1,782	1.24	1.52
- Bulo	256	975	1.21	1.49
(16) PEÑRIS EXT'N	(5,552)	(5,552)		
(Direct)	4,201	4,201	1.44	1.77
- Bulo	309	309	1.21	1.49
- Salupurgan	1,042	1,042	1.24	1.52

Table 2.22 DISCHARGES OF EACH RE-USE POINTS FOR BASIC YEAR

(Unit: m^3/sec)

	DISTRICT I						DISTRICT II					DISTRIT III				DITRICT V		
	LUBUT	DE LEON	DE BABUYAN	SDA-5	BUASAO BAY	SANTA RITA	AGULIA	TDIBULO	VACA	MURCON	BABY MURCON	BABY PIBRIS	TAMBO	VIOLA	CAROL	CAMPAN	BULO	SALU PURGA
MAY 1	0.22	0.31	0.06	0.35	0.83	0.35	0.21	0.45	0.48	0.79	0.08	0.11	0.10	0.24	0.33	0.67	1.50	2.00
2	1.03	1.46	0.30	1.65	3.96	1.69	1.02	2.15	2.29	3.78	0.38	0.54	0.48	1.15	1.59	4.07	7.19	9.59
3	0.28	0.12	0.08	0.37	0.63	0.46	0.28	0.59	0.62	1.03	0.10	0.15	0.13	0.31	0.43	0.87	1.96	2.61
JUN 1	2.86	4.11	0.87	4.72	11.38	4.89	2.94	5.27	6.35	10.63	1.11	1.42	1.13	3.35	4.57	9.66	16.92	22.55
2	0.77	0.55	0.22	1.07	2.04	1.26	0.76	1.60	1.71	2.82	0.29	0.40	0.36	0.86	1.19	2.38	5.36	7.14
3	0.90	0.65	0.27	1.28	2.44	1.51	0.89	1.04	1.78	3.08	0.34	0.36	0.19	1.06	1.39	3.23	2.82	3.76
JUL 1	1.11	0.87	0.38	1.73	3.43	2.13	1.26	1.28	2.46	4.29	0.49	0.48	0.22	1.50	1.95	3.29	3.25	4.33
2	1.72	2.49	0.54	2.90	7.02	3.02	1.79	2.83	3.78	6.39	0.69	0.82	0.58	2.09	2.79	5.22	8.71	11.61
3	2.45	3.18	0.72	3.76	7.79	4.02	2.43	5.11	5.44	8.98	0.91	1.28	1.14	2.73	3.78	7.58	17.08	22.77
AUG 1	2.25	2.88	0.66	3.43	6.95	3.69	2.22	4.55	4.96	8.20	0.84	1.15	1.01	2.51	3.47	7.00	15.10	20.14
2	0.59	0.42	0.17	0.82	1.56	0.97	0.58	1.09	1.27	2.11	0.22	0.29	0.24	0.66	0.90	1.82	3.55	4.74
3	0.83	0.60	0.25	1.17	2.24	1.39	0.81	1.09	1.66	2.84	0.31	0.35	0.21	0.97	1.26	2.57	3.16	4.22
SEP 1	2.24	3.19	0.66	3.62	8.67	3.71	2.21	3.84	4.74	7.96	0.84	1.06	0.81	2.55	3.44	6.91	12.22	16.29
2	0.72	0.51	0.21	1.00	1.90	1.17	0.71	1.49	1.59	2.63	0.27	0.37	0.33	0.80	1.10	2.22	4.99	5.85
3	1.63	2.31	0.48	2.62	6.27	2.68	1.60	3.11	3.53	5.87	0.61	0.81	0.68	1.83	2.50	4.58	10.19	13.59
OCT 1	1.38	1.96	0.40	2.21	5.30	2.27	1.37	2.88	3.07	5.06	0.51	0.72	0.64	1.54	2.13	4.27	9.63	12.83
2	0.37	0.32	0.11	0.51	0.97	0.60	0.36	0.76	0.81	1.34	0.14	0.19	0.17	0.41	0.56	1.13	2.55	3.40
3	0.26	0.19	0.08	0.37	0.70	0.43	0.26	0.47	0.55	0.93	0.10	0.13	0.10	0.30	0.40	0.95	1.50	2.00
NOV 1	0.37	0.27	0.11	0.52	0.99	0.61	0.36	0.51	0.75	1.28	0.14	0.16	0.10	0.42	0.57	2.22	1.50	2.00
2	1.19	1.12	0.35	1.68	3.21	1.99	1.19	1.69	2.45	4.19	0.45	0.51	0.33	1.38	1.85	4.08	5.02	6.69
3	0.46	0.33	0.14	0.64	1.22	0.76	0.44	0.70	0.94	1.58	0.17	0.20	0.14	0.52	0.69	1.89	2.16	2.88
DEC 1	0.86	0.38	0.27	1.17	2.04	1.49	0.88	0.75	1.68	2.96	0.34	0.31	0.11	1.05	1.37	3.04	1.67	2.22
2	1.00	0.50	0.35	1.48	2.69	1.97	1.16	1.01	2.23	3.92	0.45	0.42	0.15	1.39	1.81	2.96	2.28	3.04
3	0.75	0.32	0.23	1.00	1.72	1.26	0.73	0.62	1.41	2.48	0.29	0.26	0.09	0.89	1.14	2.16	1.36	1.82
JAN 1	0.91	0.40	0.28	1.23	2.14	1.56	0.91	0.72	1.73	3.06	0.36	0.32	0.10	1.10	1.42	2.93	1.50	2.00
2	0.85	0.39	0.27	1.18	2.08	1.52	0.89	0.74	1.70	3.00	0.35	0.32	0.11	1.08	1.39	2.83	1.61	2.15
3	0.74	0.34	0.24	1.05	1.86	1.36	0.80	0.64	1.51	2.67	0.31	0.28	0.09	0.96	1.24	2.51	1.36	1.82
FEB 1	0.78	0.41	0.29	1.21	2.25	1.65	0.96	0.74	1.82	3.23	0.38	0.34	0.10	1.17	1.50	3.00	1.50	2.00
2	0.79	0.43	0.30	1.25	2.33	1.71	1.00	0.76	1.89	3.34	0.39	0.35	0.10	1.21	1.55	3.06	1.50	2.00
3	0.98	0.54	0.38	1.56	2.93	2.15	1.26	0.98	2.38	4.22	0.49	0.44	0.13	1.52	1.96	3.45	1.99	2.66
MAR 1	0.64	0.32	0.23	0.95	1.74	1.28	0.75	0.66	1.44	2.53	0.29	0.27	0.10	0.90	1.17	1.88	1.50	2.00
2	0.71	0.33	0.24	1.01	1.80	1.32	0.77	0.67	1.49	2.61	0.30	0.28	0.10	0.93	1.21	1.83	1.50	2.00
3	0.60	0.26	0.18	0.80	1.38	1.01	0.60	0.65	1.18	2.05	0.23	0.23	0.11	0.71	0.93	1.35	1.69	2.25
APR 1	0.52	0.73	0.15	0.84	2.01	0.86	0.51	0.73	1.05	1.80	0.20	0.22	0.14	0.60	0.79	1.02	2.16	2.88
2	0.33	0.47	0.10	0.54	1.28	0.55	0.33	0.70	0.74	1.23	0.12	0.17	0.16	0.37	0.52	1.03	2.33	3.11
3	0.24	0.34	0.07	0.38	0.92	0.39	0.24	0.50	0.53	0.88	0.09	0.12	0.11	0.27	0.37	0.74	1.67	2.22
AVERAGE	0.95	0.94	0.30	1.45	3.02	1.66	0.99	1.48	2.06	3.49	0.38	0.44	0.30	1.15	1.54	3.07	4.50	5.98

Table 2.23(1) WORK VOLUME FOR RIHABILITATION

	Item	Unit	UPRIIS Total	District I	II	III	IV
1. Canal	1) Removal of Silt	m^3	760,270	153,820	234,050	209,400	163,000
	2) Reshaping of Canal Section						
	a) Excavation	m^3	55,100	5,400	6,600	37,900	5,200
	b) Embankment	m^3	168,500	32,700	39,300	62,500	34,000
	c) Face Smoothing	m^2	1,894,600	245,000	398,000	856,600	395,000
	3) Concrete Lining (+ = 7cm)	m^2	604,600	-	52,000	552,600	-
	4) Riprap (Stone masonry)		3,440	1,054	494	1,266	626
2. Structure	1) New Check and Headgate Structure						
	a) Concrete demolition	m^3	2,232	352	513	767	600
	b) Concrete	m^3	5,010	793	1,145	1,549	1,523
	c) Reinforcing steel bars	t	259.7	31.5	43.93	92.93	91.34
	d) Form		42,905	7,125	10,216	12,945	12,619
	2) Rehabilitation of Check and Head Structure						
	a) Concrete	m^3	49.3	13	19.1	7.4	9.8
	b) Reinforcing steel bars	t	2.94	0.76	1.15	0.45	0.58
	c) Form	m^2	408.7	103.7	153.5	63.4	88.1
	3) New Farm Turn Out Structure						
	a) Excavation	m^3	5,396	947	939	1,940	1,570
	b) Embankment	m^3	5,126	862	855	1,762	1,647
	c) Concrete	m^3	182.5	34.4	33.9	52.9	61.3
	d) Reinforcing steel bars	t	17.96	2.02	1.99	10.27	3.68
	e) Form	m^2	7,012	1,206	1,196	2,467	2,143
	f) R.C. pipe (ø18 inches)	m	5,012	862	855	1,762	1,533
	4) Bridge Structure						
	a) Concrete demolition	m^3	2,832	26	312	2,089	405
	b) Excavation	m^3	9,926	148	1,776	6,026	1,976
	c) Embankment	m^3	7,792	126	1,512	4,495	1,659
	d) Concrete	m^3	3,154	42	504	1,985	623
	e) Reinforcing steel bars	t	189.25	2.52	30.24	119.1	37.39
	f) Form	m^2	11,576	156	1,872	7,346	2,152
	g) Riprap (Stone masonry)	m^3	1,252	32	385	378	457

Table 2.23(2) WORK VOLUME FOR RIHABILITATION

Item	Unit	UPRIIS Total	District I	II	III	IV
5) Spillway Structure						
a) Excavation	m3	2,700	360	540	1,080	720
b) Embankment	m3	1,800	240	360	720	480
c) Concrete	m3	1,350	180	270	540	360
d) Reinforcing steel bars	t	81	10.8	16.2	32.4	21.6
e) Form	m2	4,650	620	930	1,860	1,240
6) Wasteway Structure						
a) Excavation	m3	2,470	290	590	910	680
b) Embankment	m3	1,170	90	270	450	360
c) Concrete	m3	480	40	120	180	140
d) Reinforcing steel bars	t	28.8	2.4	7.2	10.8	8.4
e) Form	m2	1,800	150	450	700	500
7) Siphon Structure						
a) Concrete demolition	m3	120	-	-	120	-
b) Excavation	m3	54,200	-	-	54,200	-
c) Embankment	m3	33,000	-	-	33,000	-
d) Concrete	m3	5,500	-	-	5,500	-
e) Reinforcing steel bars	t	330.0	-	-	330.0	-
f) Form	m2	18,300	-	-	18,300	-
8) Flume Structure						
a) Concrete demolition	m3	175	-	-	175	-
b) Concrete	m3	260	-	-	260	-
c) Reinforcing steel bars	t	15.6	-	-	15.6	-
d) Form	m2	670	-	-	670	-

Table 2.23(3) WORK VOLUME FOR RIHABILITATION

	Item	Unit	UPRIIS Total	District I	District II	District III	District IV
3. Gate	1) Gate of Diversion Dam		-	3.0 x2.5m 1	3.5 x2.7m 2	5.5 x4.4m 2	4.0 x3.5m 2
			-	1.8 x2.0 6	5.0 x3.0 1	2.0 x1.5 5	2.0 x1.25 20
			-	1.6 x3.3 5	1.7 x2.0 12	-	-
			-	1.8 x1.8 4	2.0 x2.0 20	-	-
	2) Check Gate, Head Gate, Farm Gate						
	a) - 1.0x1.0m	no.	716	271	230	169	46
	1.0x1.0 - 1.3x1.3	no.	474	67	73	83	251
	1.3x1.3 - 1.5x1.5	no.	207	15	47	35	115
	1.5x1.5 - 1.8x1.8	no.	299	33	61	89	116
	1.8x1.8 -	no.	105	36	13	22	34
	0.6 x 0.35	no.	58	7	7	8	36
	ø18 inches	no.	1,407	331	341	426	309
	ø24 inches	no.	-	2	12	-	-
	ø30 inches	no.	-	3	1	-	1
	ø36 inches	no.	-	-	1	-	-
	b) Others	no.	-	-	-	28	-
	3) Screen	m^2	855	-	120	550	185
4. F rm Ditch	1) Excavation	m^3	189,900	44,240	43,360	71,010	31,290
	2) Embankment	m^3	267,680	62,390	61,180	100,140	43,970
5. Road	1) Face Smoothing	m^3	31,420	6,800	3,180	20,320	1,120
	2) Gravel Pavement	m^3	47,160	-	-	-	47,160
	3) Embankment	m^3	7,300	-	-	-	7,300

Table 2.24(1) NUMBERS OF STRUCTURES TO BE REHABILITATED AND CONSTRUCTED

	H.G. & T.O.			Check & Crossing Structures			
	No. of Existing Structures	No. of Rehabilitation	No. of New T.O.	No. of Existing Structures	No. of New Check Gate Structures	No. of Rehabili. of Check Gate Structures	No. of New Crossing Structures
District I	668 (60)	281 (36)	86	400	298	12	2
S.A.E.	31 (5)	12 (1)	3	12	12	0	0
TRIS	301 (26)	133 (17)	44	131	117	2	2
S.O.A.	336 (29)	136 (18)	39	257	169	10	0
District II	685 (85)	299 (41)	83	736	403	14	24
R.M.A.	82 (12)	30 (5)	9	55	32	0	0
PRIS	319 (35)	149 (18)	43	391	208	9	4
LTRIS	63 (9)	29 (6)	11	66	47	0	12
VACA	72 (9)	23 (6)	6	68	36	0	6
MURCON	149 (20)	68 (6)	14	156	80	5	2
District III	942 (107)	307 (35)	175	575	377	28	42
PBRIS Pr.	345 (40)	122 (27)	49	180	101	9	22
PBRIS Ex.	399 (53)	106 (4)	91	253	192	17	1
ALIAGA	142 (14)	46 (3)	26	114	62	2	19
PLATERO	-	12 (0)	-	-	-	-	-
PCCA	56 (7)	12 (1)	9	28	22	0	0
District IV	935 (98)	161 (16)	164	837	293	1	26
PENRIS Pr.	640 (71)	147 (11)	133	659	248	1	14
PENRIS Ex.	295 (27)	14 (5)	31	178	45	0	12
Total	3,230 (350)	1,048 (128)	508	2,548	1,371	55	94

Table 2.24(2) NUMBERS OF STRUCTURES TO BE REHABILITATED AND CONSTRUCTED

	Siphon		Spillway			Wasteway		
	No. of Existing Structures	No. of Improve-ment St.	No. of Existing Spillway	No. of Rehabili-tation	No. of New Con-struction	No. of Existing Wasteway	No. of Rehabili-tation	No. of New Con-struction
District I	19	0						
S.A.E.	0	0	0	0	0	0	0	0
TRIS	10	0	1	1	1	1	1	0
S.D.A.	9	0	0	0	1	0	0	1
District II	14	0						
R.M.A.	3	0	1	1	1	0	0	1
PRIS	2	0	2	2	0	0	0	1
LTRIS	3	0	0	0	0	0	0	0
VACA	0	0	0	0	0	0	0	0
MURCON	6	0	0	0	1	0	0	1
District III	51	12						
PBRIS Pr.	25	12	1	1	2	0	0	1
PBRIS Ex.	16	0	0	0	2	0	0	1
ALIAGA	9	0	0	0	1	0	0	1
PLATERO	-	-	2	2	1	0	0	1
PCCA	1	0	1	0	0	0	0	0
District IV	47	0						
PENRIS Pr.	42	0	1	1	3	0	0	3
PENRIS Ex.	5	0	0	0	1	0	0	1
Total	131	12	9	8	14	1	1	12

Table 2.25 DESIGN FLOOD DISCHARGE FOR RE-USE POINTS

Re-use Point	Creek	Drainage Area (ha)	Design Flood Discharge (m^3/sec)
District I			
Lubut	Natan	2,150	9.43
De Leon	Natan	900	13.38
De Babuyan	De Babuyan	630	2.76
5 Bay	De Babuyan	1,320	15.13
Buasao	De Babuyan	3,140	36.23
Santa Rita	Santa Rita	3,530	15.48
District II			
Guliat	Guliat	2,130	9.34
Dibulo	Dibulo	4,490	19.64
Vaca	Vaca	4,780	20.94
Murcon	Murcon	7,890	34.59
Murcon Baby	Cabasta	800	3.51
District III			
PBRIS Baby	Bangad	1,120	4.91
Tambo	Tambo	1,000	4.37
Viola	Manaol	2,400	10.53
Carol	Carol	3,320	14.56
District IV			
Cambana	Cababao	6,660	29.34
Bulo	Bulo	15,000	65.58
Saluparugan	San Miguel	20,000	87.44

Table 2.26 WORK VOLUME FOR IMPROVEMENT OF RE-USE POINTS

Work Item	Unit	District I	II	III	IV	Total
1) Number of Re-use Points	no.	6	3/1	4	3	15
2) Concrete Demolition	m^3	-	-	9	23	32
3) Concrete	m^3	601	37	88	420	1,146
4) Reenforcement Steel Bars	t	39.8	2.2	6.1	29.5	77.6
5) Concrete Form	m^2	350	70	165	398	983
6) Foundation Concrete	m^3	109	7	20	50.4	186.4
7) Wet Masonry	m^3	-	-	35	10	45
8) Dry Masonry	m^3	230	40	34	140	444
9) Excavation	m^3	810	-	220	-	1,030
10) Embankment	m^3	850	-	-	-	850
11) Backfill	m^3	100	-	-	-	100
12) Check Gate						
1.0 x 1.0 - 1.3 x 1.3m	no.	-	2	-	-	2
1.3 x 1.3 - 1.5 x 1.5	no.	-	-	4	-	4
1.5 x 1.5 - 1.8 x 1.8	no.	7	4	-	-	11
1.8 x 1.8 - 2.0 x 2.0	no.	-	4	1	-	5
2.0 x 2.0 -	no.	5	-	5	4	14
13) Intake Gate						
1.0 x 1.0 - 1.3 x 1.3m	no.	3	-	3	2	8
1.3 x 1.3 - 1.5 x 1.5	no.	5	3	-	1	9
1.5 x 1.5 - 1.8 x 1.8	no.	-	-	1	-	1
14) Concrete Pipe ø1,000	m	-	-	4	-	4

/1: Vaca and Murcon dams are excluded in this Table. Work volume of these dams are explained in Table 2.23 "Work Volume for Rehabilitation".

Table 2.27 LOCATION OF SPILLWAY AND WASTEWAY

Item		Location			Connected Drainage
	District	System	Canal	Station	
1. Spillway					
1.1 New Construction					
1	I	TRIS Upper	MC	3+959	Manicla
2		SDA	MC	1+051	De Babuyan
3	II	RMA	DC No.1	12+200	Talavera River
4		MURCON	MC	6+107	Cinco-Cinco
5	III	PBRIS Pr.	MC	0+800	Pampanga River
6			MC	3+704	Cabu
7		PBRIS Ex.	MC	5+625	Sanggalang
8			Lat. A	3+073	Cinco-Cinco
9		ALIAGA	MC	1+465	Tarian
10		PLATERO	DC No.2	7+839	Kawayan
11	IV	PEÑRIS Pr.	MC	6+814	Carabao
12			Lat. C	3+117	Malimba
13			Lat. D	1+180	Carabao
14		PEÑRIS Ex.	Lat. CX	2+000	Bulo River
1.2 Rehabilitation					
1	I	TRIS Upper	DC No.1	SDA Supply	De Babuyan
2	II	PRIS	MC	3+190	Guliat
3			MC	7+573	Murcon Supply
4		RMA	DC No.1	11+400	TRIS Supply
5	III	PBRIS Pr.	MC	20+498	Lat. F
6		PLATERO	DC No.2	5+870	Guliat
7			DC No.2	6+670	Carol
8	IV	PEÑRIS Pr.	MC	2+084	Lat. B
2. Wasteway					
2.1 New Construction					
1	I	SDA	MC	1+051	De Babuyan
2	II	PRIS	MC	3+190	Guliat
3		RMA	DC No.1	12+200	Talavera River
4		MURCON	MC	6+107	Cinco-Cinco
5	III	PBRIS Pr.	MC	0+800	Pampanga River
6		PBRIS Ex.	Lat. A	3+073	Cinco-Cinco
7		ALIAGA	MC	1+465	Tarian
8		PLATERO	DC No.2	7+839	Kawayan
9	IV	PEÑRIS Ex.	MC	6+814	Carabao
10			Lat. C	3+117	Malimba
11			Lat. D	1+180	Carabao
12		PEÑRIS Pr.	Lat. CX	2+000	Bulo River
2.2 Rihabilitation					
1	I	TRIS Upper	MC	3+959	Manicla

Table 2.28 BREAKDOWN OF DIRECT CONSTRUCTION COST FOR SAN AUGUSTIN EXTENSION AREA

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
1. Preparation Works	-	-	10.7	35.8
2. Major Canals (Removal of Soil)				
- Excavation by 0.7 BHS	m^3	3,420	27.7	9.2
- Hauling by D.T	m^3	3,420	91.0	36.9
Total			118.7	46.1
3. Farm Ditch				
- Excavation by M/P	m^3	1,270	-	20.6
- Embankment	m^3	1,800	-	20.3
- Excavation in borrow area	m^3	530	5.1	1.8
- Hauling to site	m^3	530	21.8	10.3
Total			26.9	53.0
4. Related Structure				
4.1 New Gate Structure				
- Concrete demolition	m^3	14	1.1	0.9
- Hauling to spoil area	m^3	14	0.4	0.2
- Concrete	m^2	30	6.4	9.5
- R.S.B.	t	0.9	5.6	1.1
- Form	m^2	280	0.2	45.3
Sub-total			13.7	57.0
4.2 New T.O Structure				
- Excavation by M/P	m^3	31	-	0.5
- Embankment	m^3	29	-	0.3
- Hauling to spoil area	m^3	2	0.1	0.1
- Concrete	m^3	1	0.2	0.3
- R.S.B.	t	0.1	0.6	0.1
- Form	m^2	40	0.1	6.5
- R.C. pipe	m	29	1.4	5.7
Sub-total			2.4	13.5
Total			16.1	70.5
5. Gate				
5.1 Check Gate, Head G. and Farm G.				
- - 1.0x1.0m	no.	12	72.0	348.0
- 1.0x1.0 - 1.3x1.3	no.	2	15.8	77.4
- ø18 inch.	no.	14	9.8	39.2
Sub-total			97.6	464.6
5.2 Overhaul & Others			50.0	150.0
Total			147.6	614.6
Grand Total			320.0	820.0

Table 2.29(1) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR TALAVERA RIVER IRRIGATION SYSTEM (UPPER AREA)

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
1. Preparation Works			476.4	292.5
2. Major Canals				
2.1 Removal of Soil				
- Excavation by 0.7 BHS	m^3	46,300	375.0	125.0
- Hauling by D.T.	m^3	46,300	1,231.6	500.0
Sub-total			1,606.6	625.0
2.2 Reshaping of Canal				
- Excavation by BHS	m^3	3,900	31.6	10.5
- Spreading by bulldozer	m^3	23,600	85.0	30.7
- Compacting	m^3	23,600	110.9	47.2
- Excavation in borrow area	m^3	19,700	159.6	53.2
- Hauling to site	m^3	19,700	360.5	169.4
- Face smoothing	m^2	92,000	-	1,122.4
Sub-total			747.6	1,433.4
2.3 Riprap	m^3	188	25.5	85.9
Total			2,379.7	2,144.3
3. Farm Ditch				
- Excavation by M/P	m^3	6,470	-	104.8
- Embankment	m^3	9,130	-	103.2
- Excavation in borrow area	m^3	2,660	25.5	9.0
- Hauling to site	m^3	2,660	109.6	51.6
Total			135.1	268.6
4. Structure				
4.1 New Gate Structure				
- Concrete demolition	m^3	98	8.0	6.0
- Hauling to spoil area	m^3	98	2.7	1.3
- Concrete	m^3	232	49.2	73.5
- R.S.B.	t	11.2	70.2	13.7
- Form	m^2	2,065	1.2	333.9
Sub-total			131.3	428.4

(to be continued)

Table 2.29(2) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR TALAVERA RIVER IRRIGATION SYSTEM (UPPER AREA)

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
4.2 Rehabilitation of Gate				
- Concrete	m^3	1	0.2	0.3
- R.S.B.	t	0.1	0.6	0.1
- Form	m^2	7	0.1	1.1
Sub-total			0.9	1.5
4.3 New T.O. Structure				
- Excavation by M/P	m^3	89	-	1.4
- Embankment	m^3	81	-	0.9
- Hauling to spoil area	m^3	8	0.1	0.1
- Concrete	m^3	3	0.6	1.0
- R.S.B.	t	0.2	1.3	0.2
- Form	m^2	113	0.1	18.3
- P.C. pipe	m	81	4.0	16.0
Sub-total			6.1	37.9
4.4 Bridge				
- Concrete demolition	m^3	26	2.1	1.6
- Excavation by M/P	m^3	148	-	2.4
- Embankment	m^3	126	-	1.4
- Hauling to spoil area	m^3	48	0.8	0.4
- Concrete	m^3	42	8.9	13.3
- R.S.B.	t	2.5	15.7	3.1
- Form	m^2	156	0.1	25.2
- Riprap	m^3	32	4.3	14.6
Sub-total			31.9	62.0
4.5 Spillway				
- Excavation by M/P	m^3	180	-	2.9
- Embankment	m^3	120	-	1.4
- Hauling to spoil area	m^3	60	1.0	0.5
- Concrete	m^3	90	19.1	28.5
- R.S.B.	t	5.4	33.9	6.6
- Form	m^2	310	0.2	50.1
Sub-total			54.2	90.0
Total			224.4	619.8

(to be continued)

Tab.e 2.29(3) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR TALAVERA RIVER IRRIGATION SYSTEM (UPPER AREA)

Work Item	Unit	Quantity	Amount (₱103) Foreign Currency	Local Currency
5. Gate				
5.1 Gate of Div. Pam				
- 3.0 x 2.5m	no.	1	375.0	60.0
- 1.8 x 2.0	no.	6	1,080.0	172.8
Sub-total			1,455.0	232.8
5.2 Check Gate, Head Gate and Farm Gate				
- - 1.0x1.0m	no.	28	168.0	812.0
- 1.0x1.0 - 1.3x1.3	no.	8	63.2	309.6
- 1.3x1.3 - 1.5x1.5	no.	7	82.6	399.0
- 1.8x1.8 -	no.	31	5,022.0	806.0
- ø18 inch.	no.	32	22.4	89.6
- Other gates ø30 inch.	no.	1	1.2	5.8
Sub-total			5,359.4	2,422.0
5.3 Overhaul & Others	L.S.	1	50.0	150.0
Total			6,864.4	2,804.8
Grand Total			10,080.0	6,130.0

Table 2.30(1) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR TALAVERA RIVER IRRIGATION SYSTEM (LOWER AREA)

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
1. Preparation Works			298.2	380.0
2. Major Canals				
2.1 Removal of Soil				
- Excavation by 0.7 BHS	m^3	43,500	352.4	117.5
- Hauling by D.T.	m^3	43,500	1,157.1	469.8
Sub-total			1,509.5	587.3
2.2 Riprap	m^3	206	27.9	94.1
Total			1,537.4	681.4
3. Farm Ditch				
- Excavation by M/P	m^3	16,200	-	262.5
- Embankment	m^3	22,860	-	258.3
- Excavation in borrow area	m^3	6,660	63.9	22.6
- Hauling to site	m^3	6,660	274.4	129.2
Total			338.3	672.6
4. Structure				
4.1 New Gate Structure				
- Concrete demolition	m^3	181	14.7	11.0
- Hauling to spoil area	m^3	181	4.9	2.3
- Concrete	m^3	387	82.1	122.7
- R.S.B.	t	10.9	68.4	13.4
- Form	m^2	3,567	2.1	576.8
Sub-total			172.2	726.2
4.2 Rehabilitation of Gate				
- Concrete	m^3	7	1.5	2.2
- R.S.B.	t	0.4	2.5	0.5
- Form	m^2	55	0.1	8.9
Sub-total			4.1	11.6

(to be continued)

Table 2.30(2) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR TALAVERA RIVER IRRIGATION SYSTEM (LOWER AREA)

Work Item	Unit	Quantity	Amount (₱103) Foreign Currency	Local Currency
4.3 New T. O. Structure				
- Excavation by M/P	m^3	399	-	6.5
- Embankment	m^3	363	-	4.1
- Hauling to spoil area	m^3	36	0.6	0.3
- Concrete	m^3	15	3.2	4.7
- R.S.B.	t	0.9	5.6	1.1
- Form	m^2	508	0.3	82.1
- R.C. pipe	m	363	18.0	71.9
Sub-total			27.7	170.7
Total			204.0	908.5
5. Gate				
5.1 Check Gate, Head Gate and Farm Gate				
- - 1.0x1.0m	no.	110	660.0	3,190.0
- 1.0x1.0 - 1.3x1.3	no.	24	189.6	928.8
- 1.5x1.5 - 1.8x1.8	no.	3	408.0	66.0
- 1.8x1.8 -	no.	2	324.0	52.0
- ø18 inch.	no.	128	89.6	358.4
- ø24 inch.	no.	2	1.8	8.2
Sub-total			1,673.0	4,603.4
5.2 Overhaul & Others	L.S.	1	50.0	150.0
Total			1,723.0	4,753.4
6. Re-use Structure				
6.1 Lubut Check Gate				
- Concrete	m^3	170	36.1	53.9
- R.S.B.	t	10	62.7	12.3
- Form	m^2	70	0.1	11.3
- Concrete (Foundation)	m^3	14	2.6	4.1
- Dry masonry	m^3	50	1.5	7.7
- Check gate 2.5x2.0m	no.	2	500.0	80.0
- Intake gate	no.	2	225.0	36.0
Sub-total			828.0	205.3

(to be continued)

Table 2.30(3) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR TALAVERA RIVER IRRIGATION SYSTEM (LOWER AREA)

Work Item	Unit	Quantity	Amount (₱103) Foreign Currency	Local Currency
6.2 De Leon Check Gate				
- Concrete	m^3	100	21.2	31.7
- R.S.B.	t	7	43.9	8.6
- Form	m^2	20	0.1	3.2
- Concrete (Foundation)	m^3	20	3.7	5.8
- Dry masonry	m^3	40	1.2	6.2
- Excavation	m^3	180	1.7	0.6
- Embankment	m^3	600	2.0	4.7
- Excavation in borrow area	m^3	420	4.0	1.4
- Hauling to site	m^3	420	17.3	8.1
- Check gate 2.0x3.4m	no.	3	1,020.0	163.2
- Intake gate 1.0x1.0m	no.	1	6.0	29.0
Sub-total			1,121.1	262.5
6.3 De Babyan Check Gate				
- Concrete	m^3	40	8.5	12.7
- R.S.B.	t	3	18.8	3.7
- Form	m^2	20	0.1	3.2
- Dry masonry	m^3	30	0.9	4.6
- Excavation	m^3	250	2.4	0.9
- Hauling to spoil area	m^3	250	6.8	3.2
- Intake gate 1.5x1.5m	no.	1	112.5	18.0
Sub-total			150.0	46.3
Total			2,099.1	514.1
Grand Total			6,200.0	7,910.0

Table 2.31(1) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR SANTO DOMINGO AREA

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
1. Preparation Works			716.7	599.8
2. Major Canals				
2.1 Removal of Soil				
- Excavation by 0.7 BHS	m^3	60,600	490.8	163.6
- Hauling by D.T.	m^3	60,600	1,612.0	654.5
Sub-total			2,102.8	818.1
2.2 Reshaping of Canal				
- Excavation by BHS	m^3	1,500	12.1	4.0
- Spreading by bulldozer	m^3	9,100	32.7	11.8
- Compacting	m^3	9,100	42.8	18.2
- Hauling to spoil area	m^3	7,600	202.2	82.1
- Hauling to site	m^3	7,600	139.1	65.4
- Face smoothing	m^2	153,000	-	1,866.6
Sub-total			428.9	2,048.1
2.3 Riprap	m^3	660	89.4	301.6
Total			2,621.1	3,167.8
3. Farm Ditch				
- Excavation by M/P	m^3	20,300	-	328.9
- Embankment	m^3	28,600	-	323.2
- Excavation in borrow area	m^3	8,300	79.7	28.2
- Hauling to site	m^3	8,300	341.9	161.0
Total			421.6	841.3
4. Structure				
4.1 New Gate Structure				
- Concrete demolition	m^3	59	4.8	3.6
- Hauling to spoil area	m^3	59	1.6	0.8
- Concrete	m^3	144	30.6	45.7
- R.S.B.	t	8.6	53.9	10.5
- Form	m^2	1,213	0.7	196.1
Sub-total			91.6	256.7

(to be continued)

Table 2.31(2) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR SANTO DOMINGO AREA

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Amount (₱10³) Local Currency
4.2 Rehabilitation of Gate				
- Concrete	m^3	5	1.0	1.6
- R.S.B.	t	0.3	1.9	0.3
- Form	m^2	42	0.1	6.8
Sub-total			3.0	8.7
4.3 New T.O Structure				
- Excavation by M/P	m^3	428	-	6.9
- Embankment	m^3	389	-	4.4
- Hauling to spoil area	m^3	39	0.7	0.3
- Concrete	m^3	16	3.4	5.1
- R.S.B.	t	0.9	5.6	1.1
- Form	m^2	545	0.3	88.1
- R.C. pipe	m	389	19.3	77.1
Sub-total			29.3	183.0
4.4 Spillway				
- Excavation by M/P	m^3	180	-	2.9
- Embankment	m^3	120	-	1.4
- Hauling to spoil area	m^3	60	1.0	0.5
- Concrete	m^3	90	19.1	28.5
- R.S.B.	t	5.4	33.9	6.6
- Form	m^2	310	0.2	50.1
Sub-total			54.2	90.0
4.5 Wasteway				
- Excavation	m^3	190	-	3.1
- Embankment	m^3	90	-	1.0
- Hauling to spoil area	m^3	100	1.8	0.8
- Concrete	m^3	40	8.5	12.7
- R.S.B.	t	2.4	15.0	2.9
- Form	m^2	150	0.1	24.3
Sub-total			25.4	44.8
Total			203.5	583.2
5. Gate				
5.1 Gate of Div. Dam				
- 1.6 x 3.3m	no.	5	1,320.0	210.0
- 1.8 x 1.8	no.	4	648.0	104.0
Sub-total			1,968.0	314.0

(to be continued)

Table 2.31(3) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR SANTO DOMINGO AREA

Work Item	Unit	Quantity	Amount (₱103) Foreign Currency	Local Currency
5.2 Check Gate, Head Gate and Farm Gate				
- - 1.0x1.0m	no.	121	726.0	3,509.0
- 1.0x1.0 - 1.3x1.3	no.	33	260.7	1,277.1
- 1.3x1.3 - 1.5x1.5	no.	8	94.4	456.0
- 1.5x1.5 - 1.8x1.8	no.	30	4,080.0	660.0
- 1.8x1.8 -	no.	3	486.0	78.0
- 0.6 x 0.35m	no.	7	8.4	42.7
- ø18 inch.	no.	157	109.9	439.6
- Other gates ø30 inch.	no.	2	2.4	11.6
Sub-total			5,767.8	6,474.0
5.3 Overhaul and Others	L.S.		50.0	150.0
Total			7,785.8	6,938.0
6. Road (Face smoothing)	m^3	6,800	50.3	18.4
7. Re-use Structure				
7.1 5-Bay				
- Concrete	m^3	100	21.2	31.7
- R.S.B.	t	7	43.9	8.6
- Form	m^2	20	0.1	3.2
- Concrete (Foundation)	m^3	20	3.7	5.8
- Dry masonry	m^3	40	1.2	6.2
- Excavation	m^3	180	1.7	0.6
- Embankment	m^3	250	0.8	2.0
- Excavation in borrow area	m^3	70	0.7	0.2
- Hauling to site	m^3	70	2.9	1.4
Sub-total			76.2	59.7
7.2 Buasao Check Gate				
- Concrete	m^3	180	38.2	57.1
- R.S.B.	t	12	75.2	14.7
- Form	m^2	160	0.1	25.9
- Concrete (Foundation)	m^3	50	9.2	14.6
- Dry masonry	m^3	50	1.5	7.7
- Excavation	m^3	200	1.9	0.7
- Hauling to spoil area	m^3	200	5.4	2.6
- Check gate	no.	3	378.0	60.5
- Intake gate 10x10m	no.	1	6.0	29.0
Sub-total			515.5	212.8

(to be continued)

Table 2.31(4) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR SANTO DOMINGO AREA

Work Item	Unit	Quantity	Amount (₱103) Foreign Currency	Local Currency
7.3 Santa Rita Check Gate				
- Concrete	m^3	11	2.3	3.5
- R.S.B.	t	0.8	5.0	1.0
- Form	m^2	60	0.1	9.7
- Concrete (Foundation)	m^3	5	0.9	1.5
- Dry masonry	m^3	20	0.6	3.1
- Backfill	m^3	100	0.3	0.8
- Excavation in borrow area	m^3	100	1.0	0.3
- Hauling to site	m^3	100	4.1	1.9
- Check gate 1.6x1.0m	no.	4	320.0	51.2
- Intake gate 1.5x1.5m	no.	2	225.0	36.0
Sub-total			559.3	109.0
Total			1,151.0	381.5
Grand Total			12,950.0	12,530.0

Table 2.32(1) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR RIZAL MUNIC AREA

Work Item	Unit	Quantity	Amount (₱103) Foreign Currency	Local Currency
1. Preparation Works			90.7	169.7
2. Major Canals				
2.1 Removal of Soil				
- Excavation of 0.7 BHS	m^3	17,500	141.8	47.3
- Hauling by D.T.	m^3	17,500	463.3	189.0
Sub-total			607.3	236.3
2.2 Riprap	m^3	108	14.6	49.3
Total			621.9	285.6
3. Farm Ditch				
- Excavation by M/P	m^3		-	69.2
- Embankment	m^3		-	68.1
- Excavation in borrow area	m^3		16.9	6.0
- Hauling to site	m^3		72.5	34.1
Total			89.4	177.4
4. Structure				
4.1 New Gate Structure				
- Concrete demolition	m^3	48	3.9	2.9
- Hauling top soil area	m^3	48	1.3	0.6
- Concrete	m^3	102	21.6	32.3
- R.S.B.	t	2.9	18.2	3.6
- Form	m^2	940	0.6	152.0
Sub-total			45.6	191.4
4.2 Rehabilitation of gate				
- Concrete	m^3	4	0.8	1.3
- R.S.B.	t	0.2	1.2	0.2
- Form	m^2	3.3	0.1	5.3
Sub-total			2.1	6.8
4.3 New T.O. Structure				
- Excavation by M/P	m^3	105	-	1.7
- Embankment	m^3	96	-	1.1
- Hauling to spoil area	m^3	9	0.2	0.1
- Concrete	m^3	4	0.8	1.3
- R.S.B.	t	0.2	1.2	0.2
- Form	m^2	134	0.1	21.7
- P.C. pipe	m	96	4.8	19.0
Sub-total			7.2	45.1

(to be continued)

Table 2.32(2) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR RIZAL MUNIC AREA

Work Item	Unit	Quantity	Amount (₱103) Foreign Currency	Local Currency
4.4 Spillway				
- Excavation by M/P	m^3	180	-	2.9
- Embankment	m^3	120	-	1.4
- Hauling to spoil area	m^3	60	1.0	0.5
- Concrete	m^3	90	19.1	28.5
- R.S.B.	t	5.4	33.8	6.6
- Form	m^2	310	0.2	50.1
Sub-total			54.1	90.0
4.5 Wasteway				
- Excavation	m^3	250	-	4.1
- Embankment	m^3	90	-	1.0
- Hauling to spoil area	m^3	160	2.8	1.3
- Concrete	m^3	50	10.6	15.9
- R.S.B.	t	3.0	18.8	3.7
- Form	m^2	200	0.1	32.3
Sub-total			32.3	58.3
Total			141.3	391.6
5. Gate				
5.1 Check Gate, Head Gate and Farm Gate				
- - 1.0x1.0m	no.	2.9	174.0	841.0
- 1.0x1.0 - 1.3x1.3	no.	9	71.1	348.3
- 1.8x1.8 -	no.	3	486.0	78.0
- ø18 inch.	no.	34	23.8	95.2
- ø24 inch.	no.	2	1.8	8.2
Sub-total			756.7	1,370.7
5.2 Screen	m^2	35	210.0	1,015.0
5.3 Overhaul and Others	L.S.	1	50.0	150.0
Total			1,016.7	2,535.7
Grand Total			1,960.0	3,560.0

Table 2.33(1) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR PAMPANGA RIVER IRRIGATION SYSTEM

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
1. Preparation Works			843.5	848.0
2. Major Canals				
2.1 Removal of Soil				
- Excavation by 0.7 BHS	m^3	77,300	626.1	208.7
- Hauling by D.T.	m^3	77,300	2,056.2	834.9
Sub-total			2,682.3	1,043.6
2.2 Reshaping of Canal				
- Excavation by BHS	m^3	3,600	29.2	9.7
- Spreading by bulldozer	m^3	21,800	78.5	28.4
- Compacting	m^3	21,800	102.5	43.6
- Excavation in borrow area	m^3	18,200	147.4	49.1
- Hauling to site	m^3	18,200	333.0	156.5
- Face smoothing	m^2	213,000	-	2,598.6
- Concrete lining	m^2	52,000	780.0	1,185.6
- Riprap	m^3	196	26.5	89.6
Sub-total			1,497.2	4,161.0
Total			4,179.4	5,204.7
3. Farm Ditch				
- Excavation by M/P	m^3	22,430	-	363.4
- Embankment	m^3	31,640	-	357.5
- Excavation in borrow area	m^3	9,210	88.4	31.3
- Hauling to site	m^3	9,210	379.5	178.7
Total			467.9	930.9
4. Structure				
4.1 New Gate Structure				
- Concrete demolition	m^3	262	21.3	15.9
- Hauling to spoil area	m^3	262	7.1	3.4
- Concrete	m^3	588	124.8	186.4
- R.S.B.	t	22.9	143.6	28.1
- Form	m^2	5,267	3.1	851.7
Sub-total			299.9	1,083.5

(to be continued)

Table 2.33(2) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR PAMPANGA RIVER IRRIGATION SYSTEM

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
4.2 Rehabilitation of Gate				
- Concrete	m^3	10	2.1	3.2
- R.S.B.	t	0.6	3.7	0.7
- Form	m^2	80	0.1	12.9
Sub-total			5.9	16.8
4.3 New T.O. Structure				
- Excavation by M/P	m^3	483	-	7.8
- Embankment	m^3	439	-	5.0
- Hauling to spoil area	m^3	44	0.7	0.4
- Concrete	m^3	17	3.6	5.4
- R.S.B.	t	1.0	6.3	1.2
- Form	m^2	615	0.4	99.4
- R.C. pipe	m	439	21.8	87.0
Sub-total			32.8	206.2
4.4 Bridge				
- Concrete demolition	m^3	52	4.2	3.2
- Excavation by M/P	m^3	296	-	4.8
- Embankment	m^3	252	-	2.9
- Hauling to spoil area	m^3	96	1.7	0.8
- Concrete	m^3	84	17.8	26.6
- P.S.B.	t	50	31.3	6.1
- Form	m^2	312	0.2	50.5
- Riprap	m^3	64	8.7	29.2
Sub-total			63.9	124.1
4.5 Spillway				
- Excavation by M/P	m^3	180	-	2.9
- Embankment	m^3	120	-	1.4
- Hauling to spoil area	m^3	60	1.0	0.5
- Concrete	m^3	90	19.1	28.5
- R.S.B.	t	5.4	33.9	6.6
- Form	m^2	310	0.2	50.1
Sub-total			54.2	90.0

(to be continued)

Table 2.33(3) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR PAMPANGA RIVER IRRIGATION SYSTEM

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
4.6 Wasteway				
- Excavation	m^3	200	-	3.2
- Embankment	m^3	90	-	1.0
- Hauling to spoil area	m^3	110	1.9	0.9
- Concrete	m^3	40	8.5	12.7
- R.S.B.	t	2.4	15.1	2.9
- Form	m^2	150	0.1	24.3
Sub-total			25.6	45.0
Total			482.3	1,567.6
5. Gate				
5.1 Gate of Div. Dam				
- 3.5 x 2.7m	no.	2	945.0	151.2
- 1.7 x 2.0	no.	10	1,700.0	272.0
Sub-total			2,645.0	423.2
5.2 Check Gate, Head Gate and Farm Gate				
- - 1.0x1.0m	no.	113	678.0	3,277.0
- 1.0x1.0 - 1.3x1.3	no.	35	276.5	1,354.5
- 1.3x1.3 - 1.5x1.5	no.	26	306.8	1,482.0
- 1.5x1.5 - 1.8x1.8	no.	35	4,760.0	770.0
- 1.8x1.8 -	no.	9	1,458.0	234.0
- 0.6x0.35m	no.	2	2.4	12.2
- ø18 inch.	no.	174	121.8	487.2
- ø24 inch.	no.	3	2.7	12.3
Sub-total			7,606.2	7,629.2
5.3 Screen	m^2	30	180.0	870.0
5.4 Overhaul & Others	L.S.	1	50.0	150.0
Total			10,481.2	9,072.4
6. Road (Face smoothing)	m^3	2,620	19.4	7.1

(to be continued)

Table 2.33(4) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR PAMPANGA RIVER IRRIGATION SYSTEM

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
7. Re-use Structure				
7.1 Dibulo Check Gate				
- Concrete	m^3	20	4.2	6.3
- R.S.B.	t	1	6.3	1.2
- Form	m^2	30	0.1	4.9
- Concrete (Foundation)	m^3	7	1.3	2.0
- Dry masonry	m^3	20	0.6	3.1
- Check gate 2.0x1.5m	no.	4	600.0	9.6
- Intake gate 1.5x1.5m	no.	1	30.0	5.0
Sub-total			642.5	32.1
7.2 Guliant Check Gate				
- Concrete	m^3	17	3.6	5.4
- R.S.B.	t	1.2	7.5	1.5
- Form	m^2	40	0.1	6.5
- Dry masonry	m^3	20	0.6	3.1
- Check gate 1.6x1.6m	no.	4	512.0	81.9
- Intake gate 1.2x1.5m	no.	2	180.0	28.8
Sub-total			703.8	127.2
Total			1,346.3	159.3
Grand Total			17,830.0	17,790.0

Table 2.34(1) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR LOWER TALAVERA RIVER IRRIGATION SYSTEM

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
1. Preparation Works			318.1	239.7
2. Major Canals				
2.1 Removal of Soil				
- Excavation by 0.7 BHS	m^3	100,170	811.4	270.5
- Hauling by D.T.	m^3	100,170	2,664.5	1,081.8
Sub-total			3,475.9	1,352.3
2.2 Reshaping or Canal				
- Excavation by BHS	m^3	1,500	12.1	4.0
- Spreading by bulldozer	m^3	9,000	32.4	11.7
- Compacting	m^3	9,000	42.3	18.0
- Excavation in borrow area	m^3	7,500	60.8	20.3
- Hauling to site	m^3	7,500	137.2	64.5
- Face smoothing	m^2	72,000	-	878.4
Sub-total			284.8	996.9
Total			3,760.7	2,349.2
3. Farm Ditch				
- Excavation by BHS	m^3	4,400	-	71.3
- Embankment	m^3	6,210	-	70.2
- Excavation in borrow area	m^3	1,810	17.4	6.1
- Hauling to site	m^3	1,810	74.5	35.1
Total			91.9	182.7
4. Structure				
4.1 New Gate Structure				
- Concrete demolition	m^3	57	4.6	3.5
- Hauling to spoil area	m^3	57	1.6	0.7
- Concrete	m^3	129	27.4	40.9
- R.S.B.	t	5.4	33.8	6.6
- Form	m^2	1,088	0.6	175.9
Sub-total			68.0	227.6

(to be continued)

Table 2.34(2) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR LOWER TALAVERA RIVER IRRIGATION SYSTEM

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
4.2 New T.O. Structure				
- Excavation by M/P	m^3	130	-	2.1
- Embankment	m^3	118	-	1.3
- Hauling to spoil area	m^3	12	0.2	0.1
- Concrete	m^3	5	1.1	1.6
- R.S.B.	t	0.3	1.9	0.4
- Form	m^2	165	0.1	26.6
- P.C. pipe	m	118	5.8	23.4
Sub-total			9.1	55.5
4.3 Bridge				
- Concrete demolition	m^3	156	12.7	9.5
- Excavation by M/P	m^3	888	-	14.4
- Embankment	m^3	756	-	8.6
- Hauling to spoil area	m^3	288	5.0	2.4
- Concrete	m^3	252	53.5	79.9
- R.S.B.	t	15.1	94.7	18.5
- Form	m^2	936	0.6	151.4
- Riprap	m^3	193	26.1	88.2
Sub-total			192.6	372.8
Total			269.7	655.9
5. Gate				
5.1 Gate of Div. Dam				
- 5.0 x 3.0m	no.	1	750.0	120.0
- 1.7 x 2.0	no.	2	340.0	54.4
Sub-total			1,090.0	174.4
5.2 Check Gate, Head Gate and Farm Gate				
- ~ 1.0x1.0m	no.	23	138.0	667.0
- 1.0x1.0 ~ 1.3x1.3	no.	8	63.2	309.6
- 1.3x1.3 ~ 1.5x1.5	no.	2	23.6	114.0
- 1.5x1.5 ~ 1.8x1.8	no.	6	816.0	132.0
- 1.8x1.8 ~	no.	1	162.0	26.0
- 0.6 x 0.35m	no.	1	1.2	6.1
- ø18 inch.	no.	34	23.8	95.2
- ø24 inch.	no.	2	1.8	8.2
Sub-total			1,229.6	1,358.1
5.3 Overhaul and Others	L.S.	1	50.0	150.0
Total			2,369.6	1,682.5
Grand Total			6,810.0	5,110.0

Table 2.35(1) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR VACA CREEK IRRIGATION SYSTEM

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
1. Preparation Works			61.5	162.0
2. Major Canals				
2.1 Removal of Soil				
- Excavation by 0.7 BHS	m^3	12,630	102.3	34.1
- Hauling by D.T.	m^3	12,630	336.0	136.4
Sub-total			438.3	170.5
2.2 Reshaping of Canal				
- Excavation by BHS	m^3	800	6.5	2.1
- Spreading by bulldozer	m^3	4,600	16.6	6.0
- Compacting	m^3	4,600	21.6	9.2
- Excavation in borrow area	m^3	3,800	30.8	10.3
- Hauling to site	m^3	3,800	69.5	32.7
- Face smoothing	m^2	55,000	-	671.0
- Riprap	m^3	18	2.4	8.2
Sub-total			147.4	739.5
Total			585.7	910.0
3. Farm Ditch				
- Excavation by M/P	m^3	3,930	-	63.7
- Embankment	m^3	5,550	-	62.7
- Excavation in borrow area	m^3	1,620	15.6	5.5
- Hauling to site	m^3	1,620	66.7	31.4
Total			82.3	163.3
4. Structure				
4.1 New Gate Structure				
- Concrete demolition	m^3	42	3.4	2.6
- Hauling to spoil area	m^3	42	1.1	0.6
- Concrete	m^3	97	20.6	30.7
- R.S.B.	t	3.9	24.5	4.8
- Form	m^2	858	0.5	138.7
Sub-total			50.1	177.4

(to be continued)

Table 2.35(2) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR VACA CREEK IRRIGATION SYSTEM

Work Item	Unit	Quantity	Amount (₱103) Foreign Currency	Local Currency
4.2 New T.O. Structure				
- Excavation by M/P	m^3	64	-	1.0
- Embankment	m^3	59	-	0.6
- Hauling to spoil area	m^3	5	0.1	0.1
- Concrete	m^3	2	0.4	0.6
- R.S.B.	t	0.1	0.6	0.1
- Form	m^2	82	0.1	13.3
- R.C. pipe	m	59	2.9	11.7
Sub-total			4.1	27.4
4.3 Bridge				
- Concrete by M/P	m^3	78	6.3	4.7
- Excavation by M/P	m^3	444	-	7.2
- Embankment	m^3	378	-	4.3
- Hauling to spoil area	m^3	144	2.5	1.2
- Concrete	m^3	126	26.7	39.9
- R.S.B.	t	7.6	47.7	9.3
- Form	m^2	468	0.3	75.7
- R.C. pipe	m^3	96	13.0	43.9
Sub-total			96.5	186.2
Total			150.7	391.0
5. Gate				
5.1 Check Gate, Head Gate and Farm Gate				
- - 1.0x1.0m	no.	20	120.0	580.0
- 1.0x1.0 - 1.3x1.3	no.	8	63.2	309.6
- 1.3x1.3 - 1.5x1.5	no.	6	70.8	342.0
- 0.6 x 0.35m	no.	1	1.2	6.1
- ø18 inch.	no.	23	16.1	64.4
- ø24 inch.	no.	3	2.7	12.3
- Other gates ø30 inch.	no.	1	1.7	7.8
Sub-total			275.7	1,322.2
5.2 Screen	m^2	10	60.0	290.0
5.3 Overhaul and Others	L.S.	1	50.0	150.0
Total			385.7	1,762.2
6. Road (Face smoothing)	m^3	560	4.1	1.5
Grand Total			1,270.0	3,390.0

Table 2.36(1) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR MURCON CREEK IRRIGATION SYSTEM

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
1. Preparation Works			505.1	393.1
2. Major Canals				
2.1 Removal of Soil				
- Excavation by 0.7 BHS	m^3	26,450	214.2	71.4
- Hauling by D.T.	m^3	26,450	703.6	285.7
Sub-total			917.8	357.1
2.2 Reshaping of Canal				
- Excavation by BHS	m^3	6,600	53.4	17.8
- Spreading by bulldozer	m^3	39,300	141.5	51.1
- Compacting	m^3	39,300	184.7	78.6
- Excavation in borrow area	m^3	32,700	264.9	88.3
- Hauling to site	m^3	32,700	598.4	281.2
- Face smoothing	m^3	58,000	-	707.6
Sub-total			1,242.9	1,224.6
2.3 Riprap	m^3	172	23.3	78.6
Total			2,184.0	1,660.3
3. Farm Ditch				
- Excavation by M/P	m^3	8,330	-	134.9
- Embankment	m^3	11,750	-	132.8
- Excavation in borrow area	m^3	3,420	32.8	11.6
- Hauling to site	m^3	3,420	140.9	66.4
Total			173.7	345.7
4. Structure				
4.1 New Gate Structure				
- Concrete demolition	m^3	104	8.5	6.3
- Hauling to spoil area	m^3	104	2.8	1.4
- Concrete	m^3	229	48.5	72.6
- P.S.B.	t	8.9	55.8	10.9
- Form	m^2	2,063	1.2	333.6
Sub-total			116.8	424.8
4.2 Rehabilitation of Gate				
- Concrete	m^3	5	1.1	1.6
- R.S.B.	t	0.3	1.8	0.4
- Form	m^2	41	0.1	6.6
Sub-total			3.0	8.6

(to be continued)

Table 2.36(2) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR MURCON CREEK IRRIGATION SYSTEM

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Amount (₱10³) Local Currency
4.3 New T.O. Structure				
- Excavation by M/P	m^3	157	-	2.6
- Embankment	m^3	143	-	1.6
- Hauling to spoil area	m^3	14	0.2	0.1
- Concrete	m^3	6	1.3	1.9
- R.S.B.	t	0.3	1.9	0.4
- Form	m^2	200	0.1	32.3
- R.C. pipe	m	143	7.1	28.3
Sub-total			10.6	67.2
4.4 Bridge				
- Concrete demolition	m^3	26	2.1	1.6
- Excavation by M/P	m^3	148	-	2.4
- Embankment	m^3	126	-	1.4
- Hauling to spoil area	m^3	48	0.8	0.4
- Concrete	m^3	42	8.9	13.3
- R.S.B.	t	2.5	15.7	3.1
- Form	m^2	156	0.1	25.2
- Riprap	m^3	32	4.4	14.6
Sub-total			32.0	62.0
4.5 Spillway				
- Excavation by M/P	m^3	180	-	2.9
- Embankment	m^3	120	-	1.4
- Hauling to spoil area	m^3	60	1.1	0.5
- Concrete	m^3	90	19.1	28.5
- R.S.B.	t	5.4	33.9	6.6
- Form	m^2	310	0.2	50.1
Sub-total			54.3	90.0
4.6 Wasteway				
- Excavation	m^3	140	-	2.3
- Embankment	m^3	90	-	1.0
- Hauling to spoil area	m^3	50	0.9	0.4
- Concrete	m^3	30	6.4	9.5
- R.S.B.	t	1.8	11.2	2.2
- Form	m^2	100	0.1	16.2
Sub-total			18.6	31.6
Total			235.3	684.2

(to be continued)

Table 2.36(3) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR MURCON CREEK IRRIGATION SYSTEM

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Amount (₱10³) Local Currency
5. Gate				
5.1 Gate of Div. Dam	no.	20	4,000.0	640.0
5.2 Check Gate, Head Gate and Farm Gate				
- - 1.0x1.0m	no.	45	270.0	1,305.0
- 1.0x1.0 - 1.3x1.3	no.	13	102.7	503.1
- 1.3x1.3 - 1.5x1.5	no.	8	94.4	456.0
- 1.5x1.5 - 1.8x1.8	no.	20	2,720.0	440.0
- 0.6 x 0.35m	no.	3	3.6	18.3
- ø18 inch.	no.	76	53.2	212.8
- ø24 inch.	no.	2	1.8	8.2
- Other gates ø30 inch.	no.	1	1.2	5.8
Sub-total			3,246.9	2,949.2
5.3 Screen	m2	45	270.0	1,305.0
5.4 Overhaul and Others	L.S.	1	50.0	150.0
Total			7,566.9	5,044.2
6. Re-use Structure (Murcon dam)				
- Intake gate 1.25x1.0m	no.	2	15.0	72.5
Grand Total			10,680.0	8,200.0

Table 2.37(1) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR PAMPANGA BONGABON RIVER IRRIGATION SYSTEM (PROPER)

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
1. Preparation Works			2,256.4	2,366.0
2. Major Canals				
2.1 Removal of Soil				
- Excavation by 0.7 BHS	m^3	75,600	612.4	204.1
- Hauling by D.T.	m^3	75,600	2,010.9	816.5
Sub-total			2,623.3	1,020.6
2.2 Reshaping of Canal				
- Excavation by BHS	m^3	33,700	273.0	91.0
- Spreading by bulldozer	m^3	37,300	134.3	48.5
- Compacting	m^3	37,300	175.3	74.6
- Excavation in borrow area	m^3	3,600	29.1	9.7
- Hauling to site	m^3	3,600	65.9	31.0
- Face smoothing	m^2	515,600	-	6,290.3
Sub-total			677.6	6,545.1
2.3 Concrete Lining	m^2	515,600	7,734.0	11,755.7
Total			11,034.9	19,321.4
3. Farm Ditch				
- Excavation by M/P	m^3	15,800	-	256.0
- Embankment	m^3	22,200	-	250.8
- Excavation in borrow area	m^3	6,400	61.4	21.8
- Hauling to site	m^3	6,400	263.7	124.1
Total			325.1	652.7
4. Structure				
4.1 New Gate Structure				
- Concrete demolition	m^3	342	27.8	20.8
- Hauling to spoil area	m^3	342	9.3	4.4
- Concrete	m^3	565	119.8	179.1
- R.S.B.	t	33.9	212.6	41.6
- Form	m^2	4,444	2.7	718.6
Sub-total			372.2	964.5

(to be continued)

Table 2.37(2) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR PAMPANGA BONGABON RIVER IRRIGATION SYSTEM (PROPER)

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
4.2 New T.O. Structure				
- Excavation by M/P	m^3	540	-	8.8
- Embankment	m^3	490	-	5.5
- Hauling to spoil area	m^3	50	0.9	0.4
- Concrete	m^3	2	0.4	0.6
- R.S.B.	t	1.2	7.5	1.5
- Form	m^2	686	0.4	110.9
- R.C. pipe	m	490	24.3	97.1
Sub-total			33.5	224.8
4.3 Bridge				
- Concrete demolition	m^3	1,755	142.5	106.7
- Excavation by M/P	m^3	4,530	-	73.4
- Embankment	m^3	3,215	-	36.3
- Hauling to spoil area	m^3	3,070	53.4	25.2
- Concrete	m^3	1,475	313.0	467.6
- R.S.B.	t	88.5	555.0	108.5
- Form	m^2	5,580	3.3	902.3
Sub-total			1,067.2	1,720.0
4.4 Spillway				
- Excavation by M/P	m^3	360	-	5.8
- Embankment	m^3	240	-	2.7
- Hauling to spoil area	m^3	120	2.1	1.0
- Concrete	m^3	180	38.2	57.1
- R.S.B.	t	10.8	67.7	13.2
- Form	m^2	620	0.4	100.3
Sub-total			108.4	180.1
4.5 Wasteway				
- Excavation	m^3	380	-	6.2
- Embankment	m^3	180	-	2.0
- Hauling to spoil area	m^3	200	3.5	1.6
- Concrete	m^3	80	17.0	25.4
- R.S.B.	t	4.8	30.0	5.9
- Form	m^2	300	0.2	48.5
Sub-total			50.7	89.6

(to be continued)

Table 2.37(3) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR PAMPANGA BONGABON RIVER IRRIGATION SYSTEM (PROPER)

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
4.6 Siphon				
- Concrete demolition	m^3	120	9.7	7.3
- Excavation	m^3	54,200	574.2	195.1
- Spreading	m^3	33,000	99.0	36.3
- Embankment	m^3	33,000	155.1	66.0
- Hauling to spoil area	m^3	21,320	187.6	89.6
- Concrete	m^3	5,500	1,167.1	1,743.5
- R.S.B.	t	330	2,069.5	404.6
- Form	m^2	18,300	11.0	2,959.0
Sub-total			4,273.5	5,501.4
4.7 Flume				
- Concrete demolition	m^3	175	14.2	10.7
- Hauling	m^3	175	4.8	2.3
- Concrete	m^3	260	55.2	82.4
- R.S.B.	t	15.6	97.8	19.1
- Form	m^2	670	0.4	108.3
Sub-total			172.4	222.8
Total			6,077.9	8,903.2
5. Gate				
5.1 Gate of Div. Dam				
- 5.5 x 4.4m	no.	2	2,420.0	387.2
- 2.0 x 1.5	no.	5	750.0	120.0
Sub-total			3,170.0	507.2
5.2 Check Gate, Head Gate and Farm Gate				
- - 1.0x1.0m	no.	44	264.0	1,276.0
- 1.0x1.0 - 1.3x1.3	no.	36	284.4	1,393.2
- 1.3x1.3 - 1.5x1.5	no.	18	212.4	1,026.0
- ø18 inch.	no.	144	100.8	403.2
- Other gates				
3.5 x 2.5m	no.	2	875.0	140.0
3.5 x 2.8	no.	2	980.0	156.8
5.0 x 2.8	no.	26	18,200.0	2,912.0
Sub-total			20,916.6	7,307.2
5.3 Screen	m^2	350	2,100.0	10,150.0

(to be continued)

Table 2.37(4) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR PAMPANGA BONGABON RIVER IRRIGATION SYSTEM (PROPER)

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
5.4 Overhaul and Others	L.S.	1	50.0	150.0
Total			26,236.6	18,114.4
6. Road (Face smoothing)	m^3	11,080	82.0	29.9
7. Re-use Structure				
7.1 Baby Dam				
- Concrete demolition	m^3	5	0.4	0.3
- Hauling to spoil area	m^3	5	-	0.1
- Concrete	m^3	50	10.6	15.9
- R.S.B.	t	3.5	21.9	4.3
- Form	m^2	70	0.1	11.3
- Concrete (Foundation)	m^3	15	2.8	4.4
- Wet masonry	m^3	5	0.7	2.3
- Dry masonry	m^3	14	0.4	2.2
- Excavation	m^3	70	0.7	0.2
- Hauling to spoil area	m^3	70	1.9	0.9
- Check gate 2.0x2.0 m	no.	1	200.0	32.0
- Intake gate 1.0x1.0 m	no.	1	6.0	29.0
- R.C. pipe	m	4	0.9	3.7
Sub-total			246.4	107.5
7.2 Tambo Check Gate				
- Concrete	m^3	20	4.2	6.3
- R.S.B.	t	1.5	9.4	1.8
- Form	m^2	60	0.1	9.7
- Check gate 1.8x2.1m	no.	5	945.0	151.2
- Intake gate 1.8x1.8m	no.	1	162.0	25.9
Sub-total			1,120.7	194.9
Total			1,367.1	302.4
Grand Total			47,380.0	49,690.0

Table 2.38(1) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR PAMPANGA BONGABON RIVER IRRIGATION SYSTEM (EXTENSION)

Work Item	Unit	Quantity	Amount (₱103) Foreign Currency	Local Currency
1. Preparation Works			845.8	864.2
2. Major Canals				
2.1 Removal of Soil				
- Excavation by 0.7 BHS	m^3	86,400	699.9	233.3
- Hauling by D.T.	m^3	86,400	2,298.2	933.1
Sub-total			2,998.1	1,166.4
2.2 Reshaping of Canal				
- Excavation by BHS	m^3	3,200	25.9	8.6
- Spreading by bulldozer	m^3	19,200	69.1	25.0
- Compacting	m^3	19,200	90.3	38.4
- Excavation in borrow area	m^3	16,000	129.6	43.2
- Hauling to site	m^3	16,000	292.8	137.6
- Face smoothing	m^2	217,000	-	2,647.4
Sub-total			607.7	2,900.2
2.3 Concrete Lining	m^2	37,000	555.0	843.6
2.4 Riprap (Stone masonry)	m^3	562	76.1	256.8
Total			4,236.9	5,167.0
3. Farm Ditch				
- Excavation by M/P	m^3	35,100	-	568.6
- Embankment	m^3	49,500	-	559.3
- Excavation in borrow area	m^3	14,400	138.2	49.0
- Hauling to site	m^3	14,400	593.3	279.4
Total			731.5	1,456.3
4. Structure				
4.1 New Gate Structure				
- Concrete demolition	m^3	280	22.7	17.0
- Hauling to spoil area	m^3	280	7.6	3.6
- Concrete	m^3	644	136.7	204.1
- R.S.B.	t	38.7	242.7	47.5
- Form	m^2	5,582	3.3	902.6
Sub-total			413.0	1,174.8
4.2 Rehabilitation of Gate				
- Concrete	m^3	4	0.8	1.3
- R.S.B.	t	0.2	1.2	0.2
- Form	m^2	32	0.1	5.2
Sub-total			2.1	6.7

(to be continued)

Table 2.38(2) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR PAMPANGA BONGABON RIVER IRRIGATION SYSTEM (EXTENSION)

Work Item	Unit	Quantity	Amount (₱103) Foreign Currency	Local Currency
4.3 New T.O. Structure				
- Excavation by M/P	m^3	1,006	-	16.3
- Embankment	m^3	914	-	10.3
- Hauling to spoil area	m^3	92	1.6	0.7
- Concrete	m^3	37	7.9	11.7
- R.S.B.	t	8.2	51.4	10.1
- Form	m^2	1,280	0.8	207.0
- R.C. pipe	m	914	45.3	181.1
Sub-total			107.0	437.2
4.4 Bridge				
- Concrete demolition	m^3	13	1.0	0.8
- Excavation by M/P	m^3	74	-	1.2
- Embankment	m^3	63	-	0.7
- Hauling to spoil area	m^3	24	0.4	0.2
- Concrete	m^3	21	4.5	6.7
- R.S.B.	t	1.3	8.1	1.6
- Form	m^2	78	0.1	12.6
- Riprap	m^3	16	2.2	7.3
Sub-total			16.3	31.1
4.5 Spillway				
- Excavation by M/P	m^3	360	-	5.8
- Embankment	m^3	240	-	2.7
- Hauling to spoil area	m^3	120	2.1	1.0
- Concrete	m^3	180	38.2	57.1
- R.S.B.	t	10.8	67.7	13.2
- Form	m^2	620	0.4	100.3
Sub-total			108.4	180.1
4.6 Wasteway				
- Excavation	m^3	-	-	2.3
- Embankment	m^3	-	-	1.0
- Hauling to spoil area	m^3	-	0.8	0.4
- Concrete	m^3	-	6.4	9.5
- R.S.B .	t	-	11.3	2.2
- Form	m^2		0.1	16.2
Sub-total			18.6	31.6
Total			665.4	1,861.5

(to be continued)

Table 2.38(3) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR PAMPANGA BONGABON RIVER IRRIGATION SYSTEM (EXTENSION)

Work Item	Unit	Quantity	Amount (₱103) Foreign Currency	Local Currency
5. Gate				
5.1 Check Gate, Head Gate and Farm Gate				
- - 1.0x1.0m	no.	89	534.0	2,581.0
- 1.0x1.0 - 1.3x1.3	no.	35	276.5	1,354.5
- 1.3x1.3 - 1.5x1.5	no.	9	106.2	513.0
- 1.5x1.5 - 1.8x1.8	no.	63	8,568.0	1,386.0
- 1.8x1.8 -	no.	5	810.0	130.0
- 0.6 x 0.35m	no.	2	2.4	12.2
- ø18 inch.	no.	193	135.1	540.4
Sub-total			10,432.2	6,517.1
5.2 Screen	m2	65	390.0	1,885.0
5.3 Overhaul and Others	L.S.	1	50.0	150.0
Total			10,872.2	8,552.1
6. Road (Face smoothing)	m^3	7,280	53.9	19.6
7. Re-use Structure (Viela check gate)				
- Concrete demolition	m^3	4	0.3	0.2
- Hauling to spoil area	m^3	4	-	0.1
- Concrete	m^3	18	3.8	5.7
- R.S.B.	t	1.1	6.9	1.3
- Form	m^2	35	0.2	5.7
- Concrete (Foundation)	m^3	5	0.9	1.5
- Wet masonry	m^3	30	4.1	13.7
- Dry masonry	m^3	20	0.6	3.1
- Excavation	m^3	150	1.4	0.5
- Hauling to spoil area	m^3	150	4.1	1.9
- Check gate 1.2x1.5m	no.	4	360.0	57.6
- Intake gate 1.0x1.0m	no.	2	12.0	58.0
Total			394.3	149.3
Grand Total			17,800.0	18,070.0

Table 2.39(1) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR ALIAGA AREA

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
1. Preparation Works			299.4	338.8
2. Major Canals				
2.1 Removal of Soil				
- Excavation by 0.7 BHS	m^3	25,100	203.3	67.8
- Hauling by D.T.	m^3	25,100	667.7	271.1
Sub-total			871.0	338.9
2.2 Reshaping of Canal				
- Excavation by BHS	m^3	1,000	8.1	2.7
- Spreading by bulldozer	m^3	6,000	21.6	7.8
- Compacting	m^3	6,000	28.2	12.0
- Excavation in borrow area	m^3	5,000	40.5	13.5
- Hauling to site	m^3	5,000	91.5	43.0
- Face smoothing	m^2	124,000	-	1,512.8
Sub-total			189.9	1,591.8
2.3 Riprap (Stone masonry)	m^3	120	16.2	54.8
Total			1,077.1	1,985.5
3. Farm Ditch				
- Excavation by M/P	m^3	14,000	-	226.8
- Embankment	m^3	19,800	-	223.8
- Excavation in borrow area	m^3	5,800	55.7	19.7
- Hauling to site	m^3	5,800	238.9	112.5
Total			294.6	582.8
4. Structure				
4.1 New Gate Structure				
- Concrete demolition	m^3	98	8.0	6.0
- Hauling to spoil area	m^3	98	2.7	1.3
- Concrete	m^3	229	48.5	72.6
- R.S.B.	t	13.7	85.9	16.8
- Form	m^2	1,940	1.2	313.6
Sub-total			146.3	410.3
4.2 Rehabilitation of Gate				
- Concrete	m^3	4	0.8	1.3
- R.S.B.	t	0.2	1.3	0.2
- Form	m^2	31	0.1	5.0
Sub-total			2.1	6.5

(to be continued)

Table 2.39(2) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR ALIAGA AREA

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
4.3 New T.O. Structure				
- Excavation by M/P	m^3	286	-	4.6
- Embankment	m^3	260	-	2.9
- Hauling to spoil area	m^3	26	0.5	0.2
- Concrete	m^3	10	2.1	3.2
- R.S.B.	t	0.6	3.8	0.7
- Form	m^2	364	0.2	58.9
- R.C. pipe	m	260	12.9	51.6
Sub-total			19.5	122.1
4.4 Bridge				
- Concrete demolition	m^3	321	26.1	19.5
- Excavation by M/P	m^3	1,422	-	23.0
- Embankment	m^3	1,217	-	13.8
- Hauling to spoil area	m^3	526	9.2	4.3
- Concrete	m^3	489	103.7	155.0
- R.S.B.	t	29.3	183.8	35.9
- Form	m^2	1,738	1.0	281.1
- Riprap	m^3	362	49.0	165.4
Sub-total			372.8	698.0
4.5 Spillway				
- Excavation by M/P	m^3	180	-	2.9
- Embankment	m^3	120	-	1.4
- Hauling to spoil area	m^3	60	1.0	0.5
- Concrete	m^3	90	19.1	28.5
- R.S.B.	t	5.4	33.9	6.6
- Form	m^2	310	0.2	50.1
Sub-total			54.2	90.0
4.6 Wasteway				
- Excavation	m^3	140	-	2.3
- Embankment	m^3	90	-	1.0
- Hauling to spoil area	m^3	50	0.9	0.4
- Concrete	m^3	30	6.3	9.5
- R.S.B.	t	1.8	11.2	2.2
- Form	m^2	100	0.1	16.2
Sub-total			18.5	31.6
Total			613.4	1,358.5

(to be continued)

Table 2.39(3) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR ALIAGA AREA

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
5. Gate				
5.1 Check Gate, Head Gate and Farm Gate				
- - 1.0x1.0m	no.	26	156.0	754.0
- 1.0x1.0 - 1.3x1.3	no.	9	71.1	348.3
- 1.3x1.3 - 1.5x1.5	no.	8	94.4	456.0
- 1.5x1.5 - 1.8x1.8	no.	21	2,856.0	462.0
- 1.8x1.8 -	no.	4	648.0	104.0
- 0.6 x 3.5m	no.	6	7.2	36.6
- ø18 inch.	no.	69	48.3	193.2
Sub-total			3,881.0	2,354.1
5.2 Screen	m^2	15	90.0	435.0
5.3 Overhaul and Others	L.S.	1	50.0	150.0
Total			4,021.0	2,939.1
6. Road (Face smoothing)	m^3	1,960	14.5	5.3
Grand Total			6,320.0	7,210.0

Table 2.40(1) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR PLATERO AREA

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
1. Preparation Works			162.5	209.0
2. Major Canals				
2.1 Removal of Soils				
- Excavation by 0.7 BHS	m³	9,300	75.3	25.1
- Hauling by D.T.	m³	9,300	247.4	100.5
Sub-total			322.7	125.6
2.2 Riprap (Stone masonry)	m³	584	79.1	266.8
Total			401.8	392.4
3. Farm Ditch				
- Excavation by M/P	m³	2,580	-	41.8
- Embankment	m³	3,650	-	41.2
- Excavation in borrow area	m³	1,070	10.3	3.6
- Hauling to site	m³	1,070	44.1	20.8
Total			54.4	107.4
4. Structure				
4.1 Spillway				
- Excavation by M/P	m³	180	-	2.9
- Embankment	m³	120	-	1.4
- Hauling to spoil area	m³	60	1.0	0.5
- Concrete	m³	90	19.1	28.5
- R.S.B.	t	5.4	33.9	6.6
- Form	m²	310	0.2	50.1
Sub-total			54.2	90.0
4.2 Wasteway				
- Excavation	m³	250	-	4.1
- Embankment	m³	90	-	1.0
- Hauling to spoil area	m³	160	2.8	1.3
- Concrete	m³	40	8.5	12.7
- R.S.B.	t	2.4	15.0	3.0
- Form	m²	200	0.1	32.3
Sub-total			26.4	54.4
Total			80.6	144.4

(to be continued)

Table 2.40(2) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR PLATERO AREA

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
5. Gate				
5.1 Check Gate, Head Gate & Farm Gate				
- 1.8x1.8m	no.	13	2,106.0	338.0
- ø18 inch.	no.	21	14.7	58.8
Sub-total			2,120.7	396.8
5.2 Screen	m^2	100	600.0	2,900.0
5.3 Overhaul and Others	L.S.	1	50.0	150.0
Total			2,770.7	3,446.8
Grand Total			3,470.0	4,300.0

Table 2.41(1) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR PAMALDAN CINCO-CINCO AREA

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
1. Preparation Works			78.5	94.3
2. Major Canals (Removal of Soil)				
- Excavation by 0.7 BHS	m^3	13,000	105.3	35.1
- Hauling by D.T.	m^3	13,000	345.8	140.4
Total			451.1	175.5
3. Farm Ditch				
- Excavation by M/P	m^3	3,530	-	57.2
- Embankment	m^3	4,990	-	56.4
- Excavation in borrow area	m^3	1,460	14.0	5.0
- Hauling to site	m^3	1,460	60.2	28.3
Total			74.2	146.9
4. Structure				
4.1 New Gate Structure				
- Concrete demolition	m^3	47	3.8	2.9
- Hauling to spoil area	m^3	47	1.3	0.6
- Concrete	m^3	111	23.6	35.2
- R.S.B.	t	6.7	42.0	8.2
- Form	m^2	979	0.6	158.3
Sub-total			71.3	205.2
4.2 New T.O. Structure				
- Excavation by M/P	m^3	108	-	1.7
- Embankment	m^3	98	-	1.1
- Hauling to spoil area	m^3	10	0.2	0.1
- Concrete	m^3	4	0.8	1.3
- R.S.B.	t	0.2	1.3	0.2
- Form	m^2	137	0.1	22.2
- R.C. pipe	m	18	4.8	19.4
Sub-total			7.2	46.0
Total			78.5	251.2

(to be continued)

Table 2.41(2) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR PAMALDAN CINCO-CINCO AREA

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
5. Gate				
5.1 Check Gate, Head Gate and Farm Gate				
- - 1.0x1.0m	no.	10	60.0	290.0
- 1.0x1.0 - 1.3x1.3	no.	3	23.7	116.1
- 1.5x1.5 - 1.8x1.8	no.	5	680.0	110.0
- ø18 inch.	no.	20	14.0	56.0
Sub-total			777.7	572.1
5.2 Screen	m^2	20	120.0	580.0
5.3 Overhaul and Others	L.S.	1	50.0	150.0
Total			947.7	1,302.1
Grand Total			1,630.0	1,970.0

Table 2.42(1) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR PEÑARANDA RIVER IRRIGATION SYSTEM (PROPER)

Work Item	Unit	Quantity	Amount (₱103) Foreign Currency	Local Currency
1. Preparation Works			1,766.6	1,870.4
2. Major Canals				
2.1 Removal of Soil				
- Excavation by 0.7 BHS	m3	72,400	586.4	195.5
- Hauling by D.T.	m3	72,400	1,925.9	781.9
Sub-total			2,512.3	977.4
2.2 Reshaping of Canal				
- Excavation by BHS	m3	3,900	31.6	10.5
- Spreading by bulldozer	m3	26,300	94.7	34.2
- Compacting	m3	26,300	123.6	52.6
- Excavation in borrow area	m3	22,400	181.4	60.5
- Hauling to site	m3	22,400	409.9	192.6
- Face smoothing	m2	271,000	-	3,306.2
Sub-total			841.2	3,656.6
2.3 Riprap (Stone masonry)	m3	615	83.3	281.0
Total			3,436.8	4,915.0
3. Farm Ditch				
- Excavation by M/P	m3	28,000	-	453.6
- Embankment	m3	39,400	-	445.2
- Excavation in borrow area	m3	11,400	109.4	38.8
- Hauling to site	m3	11,900	469.7	221.2
Total			579.1	1,158.8
4. Structure				
4.1 New Gate Structure				
- Concrete demolition	m3	537	43.6	32.7
- Hauling to spoil area	m3	537	14.6	6.9
- Concrete	m3	1,372	291.1	434.9
- R.S.B.	t	82.3	516.0	100.9
- Form	m2	11,300	6.8	1,827.2
Sub-total			872.1	2,402.6
4.2 Rehabilitation of Gate				
- Concrete	m3	10	2.1	3.2
- R.S.B.	t	0.6	3.7	0.7
- Form	m2	88	0.1	14.2
Sub-total			5.9	18.1

(to be continued)

Table 2.42(2) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR PEÑARANDA RIVER IRRIGATION SYSTEM (PROPER)

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
4.3 New T.O. Structure				
- Excavation by M/P	m^3	1,227	-	19.9
- Embankment	m^3	1,334	-	15.1
- Hauling to spoil area	m^3	107	1.9	0.9
- Concrete	m^3	49	10.4	15.5
- R.S.B.	t	2.9	18.2	3.6
- Form	m^2	1,706	1.0	275.8
- R.C. pipe	m^3	1,220	60.5	241.7
Sub-total			92.0	572.5
4.4 Bridge				
- Concrete demolition	m^3	248	20.1	15.1
- Excavation by M/P	m^3	1,080	-	17.5
- Embankment	m^3	896	-	10.1
- Hauling to spoil area	m^3	432	7.5	3.5
- Concrete	m^3	369	78.3	117.0
- R.S.B.	t	22.1	138.6	27.1
- Form	m^2	1,208	0.7	195.3
- Riprap	m^3	263	35.6	120.2
Sub-total			280.9	505.8
4.5 Spillway				
- Excavation by M/P	m^3	540	-	8.7
- Embankment	m^3	360	-	4.1
- Hauling to spoil area	m^3	180	3.1	1.5
- Concrete	m^3	270	573	85.6
- R.S.B.	t	16.2	101.6	19.9
- Form	m^3	930	0.6	150.3
Sub-total			162.6	270.1
4.6 Wasteway				
- Excavation	m^3	540	-	8.7
- Embankment	m^3	270	-	3.1
- Hauling to spoil area	m^3	270	4.7	2.2
- Concrete	m^3	110	23.3	34.9
- R.S.B.	t	6.6	41.4	8.1
- Form	m^2	400	0.3	64.7
Sub-total			69.7	121.7
Total			1,483.3	3,890.8

(to be continued)

Table 2.42(3) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR PEÑARANDA RIVER IRRIGATION SYSTEM (PROPER)

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
5. Gate				
5.1 Gate of Div. Dam				
- 4.0 x 3.5m	no.	-	1,400.0	224.0
- 2.0 x 1.25	no.	-	2,500.0	400.0
Sub-total			3,900.0	624.0
5.2 Check Gate, Head Gate and Farm Gate				
- - 1.0x1.0m	no.	28	168.0	812.0
- 1.0x1.0 - 1.3x1.3	no.	237	1,872.3	9,171.9
- 1.3x1.3 - 1.5x1.5	no.	114	1,345.2	6,498.0
- 1.5x1.5 - 1.8x1.8	no.	109	14,824.0	2,398.0
- 1.8x1.8 -	no.	19	3,078.0	494.0
- 0.6 x 0.35m	no.	27	32.4	164.7
- ø18 inch.	no.	269	188.3	753.2
Sub-total			21,508.2	20,201.8
5.3 Screen	m^2	165	990.0	4,785.0
5.4 Overhaul and Others	L.S.	1	50.0	150.0
Total			26,448.2	25,850.8
6. Road				
6.1 Face Smoothing	m^3	1,120	8.3	3.0
6.2 Gravel Pavement				
- Gravel	m^3	25,480	201.3	805.2
- Spreading	m^3	25,480	76.4	28.0
Sub-total			277.7	833.2
6.3 Embankment				
- Excavation in borrow area	m^3	7,300	59.1	19.7
- Hauling to site	m^3	7,300	133.6	62.8
- Spreading	m^3	7,300	26.3	9.5
- Compaction	m^3	7,300	34.3	14.6
Sub-total			252.3	106.6
Total			538.3	942.8

(to be continued)

Table 2.42(4) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR PEÑARANDA RIVER IRRIGATION SYSTEM (PROPER)

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
7. Re-use Structure				
7.1 Campana Check Gate				
- Concrete demolition	m^3	5	0.4	0.3
- Hauling to spoil area	m3	5	-	0.1
- Concrete	m^3	7	1.5	2.2
- R.S.B.	t	0.5	3.1	0.6
- Form	m2	8	0.1	1.3
- Concrete (Foundation)	m^3	1	0.1	0.3
- Wet masonry	m^3	10	1.4	4.6
- Dry masonry	m3	20	0.6	3.0
- Intake gate 1.5x1.5m	no.	1	112.5	18.0
Sub-total			119.7	30.4
7.2 Bulo Dam				
- Concrete demolition	m3	18	1.5	1.1
- Hauling to spoil area	m3	18	-	0.2
- Concrete	m^3	370	78.5	117.3
- R.S.B.	t	26	163.0	31.9
- Form	m2	280	0.2	45.3
- Concrete (Foundation)	m^3	50	9.2	14.6
- Dry masonry	m3	120	3.6	18.6
- Check gate 4.0x4.0m	no.	3	2,400.0	384.0
- Intake gate 1.0x1.0m	no.	2	12.0	58.0
Sub-total			2,668.0	671.0
Total			2,787.7	701.4
Grand Total			37,040.0	39,330.0

Table 2.43(1) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR PEÑARANDA RIVER IRRIGATION SYSTEM (EXTENSION)

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
1. Preparation Works			412.2	367.1
2. Major Canals				
2.1 Removal of Soil				
- Excavation by 0.7 BHS	m^3	90,600	733.9	244.6
- Hauling by D.T.	m^3	90,600	2,410.0	978.5
Sub-total			3,143.9	1,223.1
2.2 Reshaping of Canal				
- Excavation by BHS	m^3	1,300	10.5	3.5
- Spreading by bulldozer	m^3	7,700	27.7	10.0
- Compacting	m^3	7,700	36.2	15.4
- Excavation in borrow area	m^3	6,400	51.8	17.3
- Hauling to site	m^3	6,400	117.1	55.0
- Face smoothing	m^2	124,000	-	1,512.8
Sub-total			243.3	1,614.0
2.3 Riprap (Stone masonry)	m^3	11	1.5	5.0
Total			3,388.7	2,842.1
3. Farm Ditch				
- Excavation by M/P	m^3	3,290	-	53.3
- Embankment	m^3	4,570	-	51.6
- Excavation in borrow area	m^3	1,280	13.3	4.4
- Hauling to site	m^3	1,280	52.7	24.8
Total			65.0	134.1
4. Structure				
4.1 New Gate Structure				
- Concrete demolition	m^3	63	5.1	3.8
- Hauling to spoil area	m^3	63	1.7	0.8
- Concrete	m^3	151	32.0	47.9
- R.S.B.	t	9.0	56.4	11.0
- Form	m^2	1,319	0.8	213.3
Sub-total			96.0	276.8

(to be continued)

Table 2.43(2) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR PEÑARANDA RIVER IRRIGATION SYSTEM (EXTENSION)

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
4.2 New T.O. Structure				
- Excavation by M/P	m^3	343	-	5.6
- Embankment	m^3	313	-	3.5
- Hauling to spoil area	m^3	30	0.5	0.3
- Concrete	m^3	13	2.8	4.1
- R.S.B.	t	0.8	5.0	1.0
- Form	m^2	437	0.3	70.6
- R.C. pipe	m	313	15.5	62.0
Sub-total			24.1	147.1
4.3 Bridge				
- Concrete demolition	m^3	157	12.7	9.6
- Excavation by M/P	m^3	896	-	14.5
- Embankment	m^3	763	-	8.6
- Hauling to spoil area	m^3	290	5.1	2.4
- Concrete	m^3	254	53.9	80.5
- R.S.B.	t	15.3	95.9	18.8
- Form	m^2	944	0.6	152.7
- Riprap	m^3	194	26.3	88.6
Sub-total			194.5	375.7
4.4 Spillway				
- Excavation by M/P	m^3	180	-	2.9
- Embankment	m^3	120	-	1.4
- Hauling to spoil area	m^3	60	1.0	0.5
- Concrete	m^3	90	19.1	28.5
- R.S.B.	t	5.4	33.9	6.6
- Form	m^2	310	0.2	50.1
Sub-total			54.2	90.0
4.5 Wasteway				
- Excavation	m^3	140	-	2.3
- Embankment	m^3	90	-	1.0
- Hauling to spoil area	m^3	50	0.9	0.4
- Concrete	m^3	30	6.4	9.5
- R.S.B.	t	1.8	11.2	2.2
- Form	m^2	100	0.1	16.2
Sub-total			18.6	31.6
Total			387.4	921.2

(to be continued)

Table 2.43(3) BREAKDOWN OF DIRECT CONSTRUCTION COST FOR PEÑARANDA RIVER IRRIGATION SYSTEM (EXTENSION)

Work Item	Unit	Quantity	Amount (₱10³) Foreign Currency	Local Currency
5. Gate				
5.1 Check Gate, Head Gate and Farm Gate				
- - 1.0x1.0m	no.	18	108.0	522.0
- 1.0x1.0 - 1.3x1.3	no.	14	110.6	541.8
- 1.3x1.3 - 1.5x1.5	no.	1	11.8	57.0
- 1.5x1.5 - 1.8x1.8	no.	7	952.0	154.0
- 1.8x1.8 -	no.	15	2,430.0	390.0
- 0.6 x 0.35m	no.	9	10.8	54.9
- ø18 inch.	no.	40	28.0	112.0
- Other gates 30 inch.	no.	1	1.2	5.8
Sub-total			3,652.4	1,837.5
5.2 Screen	m2	20	120.0	580.0
5.3 Overhaul and Others	L.S.	1	50.0	150.0
Total			3,822.4	2,567.5
6. Road (Gravel pavement)				
- Gravel	m3	21,680	171.3	685.1
- Spreading	m3	21,680	65.0	23.8
Total			236.3	708.9
7. Re-use Structure (Salupurgan check gate)				
- Concrete	m3	43	9.1	13.6
- R.S.B.	t	3	18.8	3.7
- Form	m2	110	0.1	17.8
- Check gate 2.0x4.0m	no.	1	400.0	64.0
Total			428.0	99.1
Grand Total			8,740.0	7,640.0