ANNEX-VI

IRRIGATION AND DRAINAGE

ANNEX- VI

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1. PRESENT CONDITIONS

1.1 Irrigation and Drainage Works

1.1.1 Existing irrigation systems

In the Study Area, fifteen (15) communal irrigation systems (CIS) have been constructed by use of river or creek flows. The locations of the respective CIS are as shown in Fig.VI.1.1. The general features of the CIS are as shown below.

EXISTING COMMUNAL IRRIGATION SYSTEMS
IN THE STUDY AREA

Name of CIS	Location (Barangay)	Construction Year/Agency	Service Area	Irrigation Area Wet s.	Dry s.
1. Sipsipin	Sipsipin	1957/NIA	86 ha	73 ha	10 ha
2. Puang Linis	-do-	1939/DPWH	34	24	15
3. Butsinge	-do-	1977/NIA	60	54	8
4. Manggahan	-do-	1978/ADCR	26	23	4
5. L.Mapakla	District I	1986/NIA	38	29	3
6. U.Mapakla	-do-	1968/DPWH	48	48	15
7. Ilog Tangge	District II	1977/NIA/FSDC	16	(not functioning)	
8. Bayugo	Bayugo	1980/NIA/FSDC	18	(not functioning)	
9. Bagumbong	Bagumbong	1985/PRV'I GT	44	39	10
10. Pulong Matsing	-do-	1981/NIA	8	8	0
11. Ilog Munti	-do-	1988/NIA	10	8	0
12. Ilog Na Malaki	-do-	-	28	8	0
13. Lumang Nayon	-do-	1985/NIA	27	22	5
14. Lubo	Lubo	1985/NIA	22	14	0
15. Ik-Ik	-do-	1977/NIA	18	(not functioning)	
Total			483	350	70

Rainfalls and river discharges in the Study Area fluctuates in magnitude ant time of occurrence. Irrigation area in the wet season counts for 350 ha or 72 % of the service area. Further, the river discharges in the dry season are scarce or dried up, then the irrigation service in the dry season is limited to 70 ha in total or 14 % of the service area.

The irrigation facilities of CIS are as shown in Table VI.1.1. The general features of the irrigation facilities are described below.

All existing CIS are provided with diversion dams which are mostly constructed on the middle reaches of steep rivers or creeks. There exist fifteen diversion dams, inclusive of non-functioning CIS. Various kinds of diversion dam are constructed, i.e., diversion weir, barrage with wooden stoplogs, simple check structure, depending on sizes of rivers and topography. No provision or less functioning of scouring sluices occurs heavy sedimentation in the upstream river sections and serious scouring in the downstream river sections. Further, absence of the intake gates accelerates siltation in their canal systems.

A total of 25.5 km of main and lateral irrigation canals serves for operational CIS. Feeder canals are not developed yet. About 74 % of the canals are lined with concrete blocks or wet stone masonry of u-shape flume type, to save losses of the limited water sources. In general, canal slopes are steep ,running on the surfaces of steep slope land. Most of canal linings are superannuated.

No diversion structure such as turnout, division box is provided in the CIS. Some conveyance structures to cross roads and streams are constructed. Diversion of water to lateral canals or to fields is controlled only by means of stones or turfs through breakage of canal embankments or canal linings.

There is no inspection road of both main and lateral canals. Field borders provide access to the canal systems.

Water supply to fields is carried out by plot to plot supply. The downstream fields confront excess water in flood seasons and water shortage in the dry seasons. Equitable water supply is not assured.

The inventory of irrigation facilities of the existing CIS are summarized below.

Intake structure	
Diversion weir	5 nos.
Barrage type	4 nos.
Check structure type	6 nos.
Irrigation canal	
Number	43 nos.
Length,Total	25,460 m
Concrete lining	18,730 m
Earth canal	6,730 m
Canal structure	
Siphon	1 no.
Culvert	11 nos.
Aqueduct	2 nos.

In addition to the above-mentioned CIS, pumping irrigation is practiced in individual farms of 15 ha by use of pumping equipment loaned by NIA. During the survey period, it was confirmed that 8 pumping units were operated, and those were sparsely located in rainfed areas in Bagumbong area. Water sources of pumping irrigation are groundwater for 5 units and lake water for 3 units.

1.1.2 Existing drainage conditions

There are no distinct drainage canals to evacuate excess rainfall or to convey excess irrigation water to the natural streams or creeks.Some irrigation canals are functioning a dual purpose of irrigation and drainage, which results in damage of irrigation canals and inundation of the downstream areas when heavy rainfalls occur.

The major streams or creeks running in steep areas have sufficient capacities to flow down surface runoffs from mountain areas. However, after entering mild slope areas, they get smaller in their capacities toward Lake Laguna, and at crossing points of lake coastal roads, the flow capacities are remarkably decreased due to less capacities of crossing structures or the lack of structures.

Runoffs collected to the small streams are presently used for irrigation and the stream courses disappear in paddy fields.
During the heavy rainfall seasons,it occurs inundation in the low-lying areas.

1.2 Operation and Maintenance

Operation and maintenance of CIS are carried out by irrigator association which are organized and registered. The existing organizations of the operation and maintenance of the existing CIS are as shown in Table VI.1.2.

The association decides cropping calender and water supply schedule prior to the commencement of the cropping year. Before the commencement of water delivery, canal cleaning is undertaken generally by members of the association. The water tender of the association monitors farming operation and water distribution according to the authorized schedule.

Irrigation fees are collected by irrigation association and they are paid by paddy or cash on the basis of the prevailing market price. Irrigation fees are collected by irrigation fee collector hired or designated by the association with a monetary incentive of 5 % of his collected irrigation fees. Irrigation fees in the Study Area range from 125 kg to 175 kg of paddy per ha per cropping. Collection rates of irrigation fees fluctuate year by year, depending upon irrigation services.

The existing CIS are classified as participatory and non-participatory of water users in construction of irrigation systems,according to which the irrigation fees of CIS are

determined. The existing CIS are categorized as follows according to amortization of the construction cost:

Amortising CIS

Lower Mapakla CIS	:	Participatory
Bagumbong CIS	:	Participatory
Pulong Matsing CIS	:	Participatory
Lumang Nayon CIS	:	Participatory
Ilog Munti CIS	:	Participatory
Butsinge CIS	:	Non-Participatory

Non-amortising CIS

Sipsipin CIS	Puang Linis CIS
Upper Mapakla CIS	Manggahan CIS
Bayugo CIS	Lubo CIS
Ik-Ik CIS	Ilog Na Malaki CIS
Ilog Tangge CIS	

2. IRRIGATION AND DRAINAGE DEVELOPMENT PLAN

2.1 Irrigation Plan

2.1.1 General

The main objective of irrigation development is :

(1) to increase paddy crop production for attaining self sufficiency of food in the Study area and

(2) to introduce intensified agriculture in upland fields for raising farm income.

The paddy fields of 770 ha extend over major part of lowlying area. About 64 % of the paddy fields is commanded with the communal irrigation systems, but irrigation service in the dry season is limited due to small dependable river flows. The remaining paddy fields stand on a rainfed condition.

Upland fields and orchards locating in the lowlying area count for 360 ha. In the dry season, the upland fields remain uncultivated ,and fruit trees confront water shortage, resulting in low production.

Irrigation is indispensable to expand the cultivation area and to stabilize production. To attain the above mentioned objectives effectively, the following development concept is established:

(a) to establish year-round irrigation systems by means of improvement and upgrading of the existing communal irrigation systems and provision of irrigation facilities in the rainfed paddy fields

(b) to introduce upland irrigation in the existing upland fields and orchards located in the gently sloped area

2.1.2 Delineation of Irrigation Area

The irrigation areas of paddy fields and upland fields of the Project is delineated on the basis of the proposed land use plan.

In principle, independent irrigation systems are formulated for paddy fields taking into account the following :

1) Twelve (12) communal irrigation systems (CISs) presently serve forpaddy fields of 350 ha in the Study area. With the Project, those systems are improved to stabilize water supply in the rainy season and to expand the irrigation area in the dry season. Those systems are presently operated and maintained by farmers' water users associations. After improvement,the systems will also be operated and maintained by the same associations. In principle, no modification of the present boundaries of the existing CISs is made.

2) Paddy fields to be irrigated lie in the alluvial plains of small streams with different elevations at debouchments and varied shapes. Unification of the existing CISs is made only where the CISs are located in the same Barangay and efficientcanal system and diversion plan can be formulated.

3) Major irrigation areas will be irrigated by means of pumping-up of Laguna lake water, to supplement dry season irrigation water. In consideration of operation and maintenance of pumping equipment, small scale pump equipment is appropriate.

On the other hand, upland fields to be irrigated disperse in slightly high elevated areas contiguous to paddy fields. The extent of each area is limited to less than 30 ha.

Further, Geo-hydrological investigation conducted by the study team revealed that the ground water potential in the Study area is not adequate for irrigation purpose as mentioned in ANNEX-II. Then, a main water source of upland areas will be Laguna lake water by pumping. Irrigation plans of upland fields are formulated with incorporation in paddy field irrigation system. However, the upland fields and orchards in Bagumbong area are collectively located . Then, irrigation systems for such areas are independently formulated in consideration of the efficient operation and maintenance.

Thus, thirteen (13) irrigation systems commanding an area of 1,160 ha are formulated as shown in Fig.VI.2.1.

2.1.3 Irrigation Methods

1) Selection of Irrigation Method

Upland crops to be irrigated are corn, soybeans, vegetables and citrus. In making the best choice of the irrigation method, a comparison of three methods, i.e., surface, sprinller and drip irrigation methods was conducted.

Irrigation efficiency varies with the irrigation method affected by many factors among which major factors are soil characteristics, land slopes, crops to be irrigated.

The basic intake rates of the irrigation upland fields were measured in the representative sites. The basic intake rate lies in the range of 10 mm/hr to 20 mm/hr as shown in Fig.VI.2.2. From the view point of the basic intake rate, any irrigation method will be applied in upland fields of the Project area.

The upland irrigation areas of the Project are located in rather sleep sloped areas. The surface irrigation method requires mild and smooth field surface to attain the adequate irrigation efficiency. Whereas,the sprinkler and drip irrigation method can be adopted to any land slope without land levelling.

In consideration of the above, the alteranative study was conducted in the representative area in Bagumbong .The general features of the alternative plans and the result of comparison are as shown in Table VI.2.1. The result shows that the surface irrigation method is more economical than the other methods, because of that sprinkler and drip irrigationn methods can save much water but the high head are required, resulting in expensive pumping operation costs and equipment are expensive.

3) Water supply operation method

Water supply operation method greatly influences irrigation application efficiency and irrigation system capacity.

It is clear that continuous 24-hour supply operation makes minimum system capacity and efficient water diversion from the river. This method can be applied to paddy field irrigation because no special water management at a field level is required during water supply.

Whereas, upland irrigation requires precise water management of water supply to attain the appropriate irrigation efficiency. According to the soil condition and ground surface slope of the Project, irrigation supply operation will be finished within a comparatively short period and frequent water management practice is required. Thus, continuous water supply

for upland irrigation is not practical. Night storage pond is required at the outlet of discharge pipeline of pumps.

Therefore, at the peak demend period, 24-hour continuous water supply to irrigation blocks is adopted for paddy field irrigation and 16-hour operation is selected for upland irrigation with night storage ponds.

2.1.4 Irrigation Water Requirement

(1) General

The crops proposed for the Project are paddy rice, upland crops such as soybeans,corn,beans,eggplant ,etc. and citrus.The irrigation water requirements for them are separately estimated according to the proposed cropping patterns for respective irrigation systems.

The irrigation water requirement for the Project are estimated, using the climatic data for consumptive use of water and effective rainfall and the survey result of percolation in the paddy fields.

The irrigation water requirements are estimated by the following procedures:

Paddy rice

- Estimate of paddy rice water consumption by product of potential evapotranspiration by crop coefficient relating to the crop growth stages,CU
- Estimate of percolation rate,P
- Estimate of effective rainfall,ER
- Estimate of nursery water,NU and puddling water requirement,PU
- Estimate of net water requirement,NR

  $NR = CU + P - ER + NU + PU$
- Estimate of gross water requirement,GR by dividing the net water requirement by irrigation efficiency

Upland crops and citrus

- Estimate of crop water consumption, CU
- Estimate of pre-irrigation requirement,PI
- Estimate of effective rainfall, ER
- Estimate of net water requirement,NR

  $NR = CU + PI - ER$

  For citrus, pre-irrigation is not included.
- Estimate of gross water requirement,GR divided net water requirement by irrigation efficiency

(2) Consumptive use

Consumptive use of water by crops is estimated as a product of potential evapotranspiration by crop coefficients relating to crop growth stages. The climatic data including calculated potential evapotranspiration by means of modified Penman method were made available at IRRI climatic station in Los Banos, covering a measurement period of 5 years from 1984 to 1988 as shown in Table VI.2.2.

The average potential evapotranspiration of the above station is as summarized below.

Unit : mm/month

Jan	Feb	Mar	Apr	May	un	Jul	Aug	Sep	Oct	Nov	Dec
89.6	98.2	132.0	135.2	145.6	119.8	120.2	120.4	109.1	97.7	91.8	88.1

The crop coefficients of respective crops are estimated with reference to FAO Irrigation and Drainage Paper, Crop Water Requirements,as shown in Fig.VI.2.3. In calculating the water requirement, crop coefficients are estimated on monthly basis for proposed cropping schedule.

(3) Percolation

The percolation rate in the Project area was measured at four representative paddy fields during the wet season paddy cropping. The locations of the measurement sites and the result are as shown in Fig. VI.2.4.

The soil in the Project area is classified as clay to clay loam. Based on the result of the investigation and soil classification ,the percolation rate of 2 mm/day is adopted in estimating irrigation water requirements for wet and dry season paddy cropping.

(4) Puddling water requirement

Puddling water requirements consist of water equivalent to the difference in the soil moisture before and after puddling, standing water required above the soil surface, evaporation and percolation losses from paddy fields. The puddling water requirement is assessed as follows:

(i)	Depth of soil and porosity		
	soil depth	:	300 mm
	porosity	:	55 %
(ii)	Soil vapor phase after puddling	:	5 %
(iii)	Soil moisture before water supply	:	15 %
(iv)	Water to be supplied		
	Water to be supplied to soil profile	:	105 mm
	Evaporation	:	15 mm
	Percolation	:	10 mm
	Standing water depth after puddling	:	50 mm
	Total		180 mm

(5) Nursery water requirement

Nursery water requirements consist of water needed for preparation of nursery beds,and evapotranspiration and percolation during nursery period. The water requirement is estimated with the following conditions:

(i)	Area required for nursery bed	:	5 % of paddy field
(ii)	Nursery period	:	25 days
(iii)	Required water for 25 days		
	Preparation of nursery bed	:	180 mm
	Evapotranspiration	:	Kc x PET
	Percolation	:	2 mm/day

(6) Effective rainfall

The effective rainfall for paddy fields and upland fields are separately estimated based on the rainfall data and crop growing conditions.

Paddy field

- Based on the daily rainfall data in the Project area, effective rainfall was estimated by means of the daily water balance rainfall and requirement. Based on the above result, correlation between monthly rainfall and effective rainfall was established for the purpose of calculation of the long term water assessment as shown in Fig.VI.2.5. The relation can be expressed as follows:

  In case of R less than 250 mm :

  $$ER = 0.76 \times R - 19.0$$

  In case of R larger than 250 mm:

  $$ER = 0.083 \times R + 150.2$$

Upland field

- Based on the evapotranspiration/precipitation ratio method prepared by USDA, the relationship between average monthly effective rainfall and mean monthly rainfall is drawn for the different values of the average monthly crop water requirement. The relationship is as shown below.

$$ER = 0.2 \times R^{0.95} \times Cu^{0.31}$$

where, ER : Effective rainfall (mm)
R : Monthly effective rainfall (mm)
Cu : Crop water requirment (mm)

In the above calculation, the effective rainfall should not exceed crop water requirement.

(7) Irrigation efficiency

Irrigation efficiencies of paddy field irrigation and upland field irrigation are determined, taking into account the following conditions:

(i) Upland cropping irrigation is conducted by surface irrigation methods, as described in the succeeding section. Furrow or border irrigation methods are applied in consideration of the above mentioned crops.
(ii) Lining canals up to rotation blocks are adopted.
(iii) Irrigation blocks are of small size of 10 to 15 ha, and canal lengths from intakes or pump outlets to fields are short because of small irrigation system area.

The overall irrigation efficiencies for respective paddy and upland irrigation are estimated as follows:

Irrigation efficiency	Paddy field	Upland field
Application efficiency	75 %	65 %
Conveyance efficiency	85 %	85 %
Overall efficiency	64 %	55 %

(8) Diversion water requirement

Diversion water requirements of each crop are estimated on the basis of the above mentioned calculation conditions as shown in Table VI.2.3. Diversion water requirements for respective irrigation systems are calculated for a series of 20 years as shown in Table VI.2.4.

2.1.5 Intake and Canal System Plan

(1) Selection of intake systems

The existing CISs have been dependent only on the river flows, then irrigation services are largely affected by the fluctuation of rainfall in the rainy season cropping and fall in only 14 % of the service area in the dry season cropping due to scarce or dried up river flows. In order to stabilize cropping in the rainy season and expand the irrigation area in the dry season. the following intake measures are taken to the respective irrigation systems.

1) Irrigation system by use of river flow supplemented with pumping-up of lake water

Through the water balance study between irrigation water requirements and river discharges as mentioned in the succeeding section, available river flows of the major rivers were assessed. Based on the result,improvement of the existing intakes located on major rivers are contemplated. However,the dry season river flows do not meet irrigation water demands for dry season cropping. Thus, pumping systems are additionally required.

Construction and/or improvement of intakes on the following rivers are proposed in combination with pumping stations:

River name	Proposed irrigation system	Existing irrigation system
Puang	Sipsipin	Puang, Sipsipin Butsinge
Mapakla	Mapakla	Upper Mapakla Lower Mapakla
Manggahan	Manggahan	Manggahan
Ik-Ik	Ik-Ik	Ik-Ik
Lubo	Lubo	Lubo
Lumang Nayon	Lumang Nayon	Lumang Nayon Ilog Munti, Ilog Na Malaki
Bagumbong	Pulong Ligaya	Pulong Matsing
Bagumbong	Bagumbong (paddy field area)	Bagumbong

2) Irrigation system by pumping-up of lake water

In the irrigation systems within which no rivers to provide stable runoffs are existed, a pump irrigation system is adopted. The rainfed paddy field area and deteriorated CIS area generally belong to this system. All irrigation water will be taken from pumping-up of lake water.

The following irrigation systems are formulated with this intake system:

Proposed irrigation system	Existing irrigation system
Bayugo	Bayugo
Llano	(rainfed area)
Punta	(rainfed area)
Pagkalinawan	(rainfed area)
Bagumbong (upland area)	(rainfed area)

3) Irrigation system with an impound

All the rivers in the Study area are generally steep. The suitable impounding site is limited on the Palay-Palay river. With economic comparison with a pumping system as mentioned in the succeeding section, the impounding plan for Palay-Palay irrigation system of 140 ha was selected and appropriate scale and site of impounding was selected.

(2) Water balance

The annual runoff of the rivers are estimated to be approximately 1,560 mm on an average as mentioned in ANNEX-I. However, most of the river flows discharge within the short period due to small catchment areas and steep river slopes, thus dependable river flows are limited. In order to estimate the available river flow for irrigation, the water balance study was carried out. The summary of the results are as shown in Fig.VI.2.6, and summarized below.

Irrigation system	Total diversion requirement (TCM)	(%)	Diversion from river (TCM)	(%)	Water to be pumped-up (TCM)	(%)
Sipsipin						
Average year	2,346	(100)	1,122	(48)	1,225	(52)
Critical year	2,611	(100)	1,052	(40)	1,559	(60)
Mapakla						
Average year	1,508	(100)	799	(53)	709	(47)
Critical year	1,709	(100)	861	(50)	847	(50)
Lubo						
Average year	476	(100)	279	(59)	196	(41)
Critical year	543	(100)	306	(56)	237	(44)
Bagumbong and Pulong Ligaya						
Average year	1,521	(100)	916	(60)	604	(40)
Critical year	1,694	(100)	977	(58)	716	(42)

Note: TCM : 10^3 m^3
Average year : represented by 1982
Critical year : represented by 1988

Judging from the result, the following can be said:

(a) About 50 % of the total diversion requirements can be supplied from the rivers in the average year. This means that operation hours of pumps will be much reduced.

(b) The Turnina river flow can be diverted to Pulong Ligaya irrigation system through the natural stream in addition to its own commanding area in Bagumbong.

(3) Palay-Palay impound plan

The Palay-Palay river remains unutilized for irrigation upto the present due mainly to its deep valley, even it is one of the major rivers in the Project area. In formulating the irrigation plan of Palay-Palay irrigation system of 140 ha, an impounding plan of the Palay-Palay river was studied, compared with a pumping up plan from Lake Laguna. The general features of the alternative plans are as follows:

Dam Plan : The dam site is selected at about 1.5 km upstream of the river mouth in consideration of the large storage capacity, and the comparatively narrow river cross section. The low water level is set at El 20 m ,whereas the irrigation area extends from El.30 m immediately downstream of the dam. Then, a high elevated area can not be served directly by a canal system from the dam. An additional pumping station to use storage water is contemplated for such area.

Pumping System Plan : The pumping station is selected at the east of Palay-Palay village. The irrigation water is pumped up from Lake Laguna.The pump equipment is provided with high head and low head pumps according to the result of the study of pumping system.

The general features of both plans are described in Table VI.2.5 The economic comparison shows that an impounding plan is economical than the pumping plan in terms of the annual cost as shown in Tbable VI.2.6. Therefore, Palay-Palay irrigation system is formulated with an imounding plan.

(4) Selection of pumping system

The irrigation areas of the Project have gradually dipping slopes toward Lake Laguna with different required pumping heads and irrigation areas. The Project area is broadly classified into the following two categories in terms of a pumping system :

i) High pumping head and large irrigation area

Irrigation System	Irrigation area (ha)	Required pumping head (m)
i) High pumping head and large irrigation area		
Sipsipin	170	47
Mapakla	130	44
Lumang Nayon	95	44
Bagumbong	230	62
ii) Low pumping head and small irrigation area		
Mangahan	55	31
Bayugo	50	26
Llano	65	28
Punta	35	16
Pagkalinawan	55	32
Ik-Ik	45	27
Lubo	45	24
Pulong Ligaya	45	17

The irrigation area of the categories ii) is in general located along the skirts of the fill. In consideration of the low pumping heads and a small extent of the area, a direct pumping system is adopted to those areas.

On the other hand, the category i), the following alternatives are conceived in view of the initial cost and pump operation cost:

i) The pumps lift up the whole amount of water needed in the scheme area directly to an outlet. Each pump is provided with the same capacity. In this case, the system will reduce the number of pump equipment contributing to decreasing pump equipment cost, but will fall in expensive electric cost since the whole amount of water is pumped up to the high elevated outlet.

ii) In case that the pumps with different capacities and heads are provided and separate discharge pipes with different outlets are constructed, the system will save electric cost, however the pump equipment cost will increase.

In order to determine the most economical pumping system, the following alternative pumping plans are compared.

Plan-1 : One outlet system
Plan-2 : Two outlets system with different discharge pipelines
Plan-3 : Three outlets system with different discharge pipelines

An economic comparison was made in terms of the annual cost of initial investment of pumping system, electric charge. The result is as shown in Table VI.2.7. The result shows that Plan-2 is the most economical plan among three plans due mainly to saving electric cost and a comparatively low pump equipment cost.

Consequently, one outlet system is adopted for the low head pumping area and two outlet system is applied to the high head pumping area.

(5) Canal system

(a) Terminal canal system

The irrigation canal system consists of main canal, main farm ditch and farm ditch. The main canal will run generally along the skirts of the hills. Main farm ditches run perpendicular to contour lines. Farm ditches will be constructed along the longer sides of field borders which have been laid along contour lines. The irrigation system area is divided into several irrigation blocks. A main farm ditches command one irrigation block of about 10 ha. The irrigation block consists of some rotation blocks of about 1 ha which is commanded by a farm ditch. The typical layouts of terminal canal systems for paddy fields and upland fields are as shown in Fig. VI.2.7.

(b) Selection of canal lining

The land slopes of irrigation areas are mild to steep. Main farm ditches, in particular, will fall in steep slopes, resulting in high velocity.

The density of the proposed main canals and main farm ditches are about 4 m/ha and 60 m/ha, respectively. Irrigation water of the Project is diverted partly or whole by pumps. Thus,the water loss during conveyance should be minimized. And canals should be sufficiently strong against erosion of canals to be occurred by high velocities. To cope with these conditions, canal lining is considered effective.

The most influencing canal to the above matters is a main farm ditch according to its length. Thus, to judge the economic aspect of the canal lining of the main farm ditch, a comparison of concrete lining and earth canal is carried out. The comparison is conducted in terms of annual cost of initial investment of canal lining, saving loss water and saving occupied land by selecting the sample area. The result is as shown in Table VI.2.8. The result indicates that the lining of the whole reaches of main farm ditches is much advantageous than earth canals due mainly to saving the loss water and land to be occupied by canals.

Therefore, the irrigation canals of the Project are lined up to the end of main farm ditch.

(6) Selection of power supply system

Irrigation pumps require the power of about 1,000 kW. The existing power supply system is of low voltage 3.6 kV with a single phase current. The present power system is not sufficient to supply the power to the pumping equipment. Under these situations, two types of power supply system are conceivable; electric motor driven and diesel engine driven. In order to determine the most suitable power supply system, an economic comparison was carried out for the above-mentioned to cases. The comparison was made in terms of annual cost of initial investment of pumping equipment, operation and maintenance cost of electric charge and fuel cost. The result is as shown in Table VI.2.9.

According to the result, electric power supply system is more economical than the diesel engine system. In addition to the above condition, electric motor driven system is more advantageous in operation and maintenance . Thus, the pump systems are proposed to be driven by electric motors.

2.1.6 Preliminary Design of Irrigation Facilities

(1) Irrigation System Capacity

The irrigation system consists of head works such as intake, pump station, and main canal, main farm ditch and farm ditch.

The design capacities of intake ,pump station and main canal are determined on the basis of 24 hour continuous water supply at the peak demand period at 80 % dependability level (4 out of 5 years).

The capacity of the main farm ditch and farm ditch are determined on the basis of rotational irrigation within the rotation block. The paddy field water supply is practiced with 10 days rotation, 24 hour operation within 10 ha.

Upland irrigation is practiced with 16 hour water supply operation at the field level, to ensure the equitable water supply. Therefore, a night storage pond is required to store the discharge difference between 24 hour diversion from pump or intake and field operation of 16 hour.

The system capacities of the irrigation facilities thus determined are as shown in Table VI 2.10.

(2) Pump Station

Fourteen (14) pump stations are proposed for the Project. The general design considerations are described hereunder.

(a) Station layout

The pump station consists of an inlet channel, suction pond, pump house, discharge pipeline,and outlet structure.The locations of pump stations are selected at the center of the respective irrigation areas near to Lake Laguna.

The pump house is located at the end of the inlet channel with suction pond. A gradually varied transition connects with a suction pits. The discharge pipeline extends from the pump house toward the outlet mainly along the existing roads.

(b) Design discharge and pumping heads

Based on the unit design water requirements, design discharges of respective pump irrigation systems are calculated.

The water levels in the suction ponds are determined based on Laguna Lake water level record as shown in Table VI.2.11. After conversion to RI bench mark system based on which topographic maps of the Project have been prepared, the recorded minimum and maximum water levels were taken to be the design low and high water levels

Design high water level : El.+2.84 m
Design low water level : El.- 0.40 m

The water levels at outlets are determined so as to effectively command the irrigation areas for each irrigation system.

The design discharge, design head and discharge pipeline are as shown in Table VI.2.12.

(c) Pump set

The pumping equipment is designed on the basis of continuous 24-hour operation at peak demand period. According to the estimate of he diversion requirements of each systems, the peak requirement occurs in one month and in the other periods the requirements are less than 50 %. In consideration of these patterns of seasonal water requirements, two sets of pump without a spare set are proposed.

(d) Type of pump

The design discharges per set are 1 to 5 m^3/min and total heads range from 10 to 60 m. In addition to the above hydraulic conditions, taking into account the convenience of the repair and maintenance of pump,and low price of pump equipment, horizontal shaft volute pump is selected for the pump stations.

(3) Intake

1) General

Eleven (11) existing intakes are improved according to the result of the water balance study. The existing eight intakes located in the upstream rivers on steep slope reaches are confronted with sediment with boulders in the upstream sections and erosion in the downstream sections. Based on the present diversion condition and structure conditions revealed by the field investigation, improvement plan of intakes are determined.

The type of intake is determined in consideration of the following:

i) To ensure stable diversion even under the quickly varied river discharges,

ii) To secure sufficient diversion against drift cobbles boulders and others, and to be strong enough to drift cobbles and boulders,

iii) To be simple in structure and convenient in operation and maintenance

To suit the above conditions, a bar-screen backstream intake type out of a torrent intake type (mountain stream diversion works) is selected. The preliminary design is described hereunder.

Bar screen	;	steel pipe of dia. 90 mm
Bar angle	:	45 degree
Bar length	:	0.85 m
Opening of bar screen	:	14 %

Based on Mostkov formula, diversion discharges of respective widths are calculated.

$$Q = L \times u \times c \times B \times (2g\,E)^{0.5}$$

where, Q : diversion discharge (cu.m/sec)
L : Length of bar-screen (m)
u : coefficient of inflow, 0.55
c ; opening of bar-screen, 14 %
B : Width of bar-screen portion (m)
g : acceleration due to gravity 9.8
E : specific energy on the weir (m)

The remaining 3 intakes are improved with provision of intake gates and protection of upstream and downstream river side slopes.

(3) Palay-Palay Dam

1) General

The main function of Palay-Palay dam is to store the water of the Palay-Palay river and to supply irrigation water to Palay-Palay irrigation system. The details are as shown in the attached Drawings.

The proposed dam site is selected at a narrow neck of the Palay-Palay river about 1.5 km upstream of the river mouth, in consideration of the following:

i) Topography and geology

- Narrow portion of the river course,
- The site with large catchment area and enough storage capacity
- Sufficient foundation condition to construct required embankment

ii) Construction : The site to economize on construction

iii) Operation and maintenance : The site to provide good access for operation and maintenance

2) Geological condition of dam site

According to the geological investigation , the following conditions were disclosed as detailed in ANNEX-II:

i) he dam site is underlain by a interbedded sequence of tuff and tuffaceuos sandstone,
ii) Those are moderately consolidated and slightly undulated making the rock friable and permeable.
iii) Fresh tuff is generally hard but friable,

Based on the above finding, the following conditions should be taking into account the dam design

- seepage in sandstone beds on the right abutment
- Sliding along bedding planes on the left abutment
- Bearing capacity and shear of the foundation materials

3) Selection of dam type

In consideration of topographical condition, geological and foundation condition, available material, the fill type dam is selected.

4) Preliminary design of Palay-Palay dam

(a) Design flood

The peak flood discharges are analyzed, as presented in ANNEX - I " Meteorology and Hydrology". The spillway and river diversion are designed for the following conditions:

Structure	Peak flood discharge	Remarks
Spillway	64 m^3/sec	100-year flood
	78 m^3/sec	200-year flood
River diversion	38 m^3/sec	5-year flood

(b) Storage capacity

The storage consists of the following:

- Irrigation water for Palay-Palay irrigation system
- Evaporation and seepage loss
- Sedimentation

The irrigation requirement is first calculated by means of water balance of the river flow and irrigation diversion requirement as shown in Table VI.2.13. The design storage required for irrigation with dependable level of 80 % (4 out of 5 years) is 570,000 m^3 as shown in Fig VI.2.8.

The other storage requirements are estimated on the following basis:

Sedimentation :

The annual sediment volume in the reservoir is determined to be 600 m^3/km^2/year.
The design year for sediment volume is taken to be 100 years. Thus, the design sediment volume is 229,000 m^3.

Evaporation and seepage losses :

This is estimated on the basis of the measurement data of pan evaporation at IRRI in Los Banos, by converting to equivalent rate from free water surfaces.
(1,312 mm/year x 11.8 ha x 50 %)

The required storage of Palay-Palay dam is determined as follows:

Unit : 10^3 m^3

Total storage	1,060
Effective storage	722
Irrigation requirement	570
Evaporation and seepage losses	152
Dead storage	338
Sediment volume	229
Dead storage	109

(c) Normal high water level and low water level

Low water level is determined to be 20 m on the basis of required water level for irrigation. Thus, the normal high water level is determined to be 26.5 m as shown in Fig.VI.2.8.

(d) Crest elevation

The crest elevation of a dam is determined to be the maximum design water surface plus a required freeboard.The maximum design water

surface is calculated to be 27.50 as mentioned in the succeeding section A freeboard is calculated by the following formula:

$$Hf \geq hw + 1.0$$

where,

Hf : Height of freeboard (m)

hw : Wind wave height on reservoir surface (m)

$$hw = 0.032 \times F \times V + 0.763 - 0.271 \times F^{1/4}$$

where,

F : Fetch of reservoir (km)

V : Maximum observed wind velocity (km/hr)

Then, the crest elevation is determined to be EL.29.50.

(e) Type of Dam

Judging from topography, geology and available construction materials around the dam site, an earthfill dam with central earth core is selected.

(f) Spillway

The spill way is constructed on the left bank of a dam. The type of the spillway is of non-gated overflow type with shuteway and settling basin. The design discharge of the spillway is 68 m^3/sec. The crest length of the spillway is determined to be 30 m on the basis of comparison on the spillway length and dam height.

Thus,the maximum water surface elevation is determined to be 27.5 m. The 200-year flood of 78 m^3/sec is released safely within the freeboard.

(g) River diversion

The concrete pipe of diversion with a diameter of 2.4 m is installed with the base elevation of the same level as the existing river bed. The pipe is laid under the dam. After completion of the dam, the pipe will be closed by concrete.

(h) Intake

An intake structure is provided on the right bank, capable to release the irrigation requirement of 0.253 m^3/sec. The irrigation water is released through the discharge pipeline of 0.50 m in diameter. The regulation

gate is installed at the end of the discharge pipeline with an energy dissipator.

(4) Irrigation canal

1) Permissible velocity

The main canal and main farm ditch are lined with U-shaped concrete flume. Farm ditch is of earth canal. The maximum velocity of the lining canal is determined for avoiding the upliftment of the lining. For earth canals, erosion control is considered. The maximum and minimum velocities of canals thus are,

Maximum velocity	
Lined canal	: 1.5 m/sec
Earth canal	: 0.3 m/sec
Minimum velocity	: 0.3 m/sec

2) Roughness coefficient

Roughness coefficients of canals for determination of the hydraulic properties for application of Manning's formula are as follows:

Concrete canal	: 0.015
Earth canal	: 0.030

3) Freeboard

The design discharges of the Project canals are comparatively small. In consideration of the scale of canals,the following minimum freeboard heights are taken in the design and the typical canal sections are adopted in consideration of the efficient construction.

- Minimum freeboard height to the top of lining	: 0.20 m
- Embankment height from the top of lining	: 0.20 m
- Minimum freeboard for earth canal	: 0.20 m

4) Lining

The lining is constructed with U-shape flume precast unit of 13 cm thick.

5) Embankment

The width of embankment on the both sides are 0.50 m for main canal and 0.40 m for main farm ditch. The main canals running along the skirts hills are provided with catch drains. Then, by using excavated soils, canal inspection will be provided.

(6) Canal Related Structures

A number of canal related structures such as turnouts, farm ponds, culverts, aqueducts, siphons, drops are provided. The irrigation diagrams of respective irrigation systems are as shown in Fig. VII.2.9.

2.1.7 General Features of Irrigation Facilities

Thirteen (13) irrigation systems are formulated to serve farm land of 1,160 ha which consists of paddy fields of 950 ha, upland fields of 130 ha and orchards of 80 ha.

The general features of the irrigation systems are described hereunder and are summarized in Table VI.2.14. The salient features of respective irrigation systems are as shown in Table VI.2.15.

1) Sipsipin Irrigation System

The Sipsipin irrigation system is located in Barangay Sipsip. It serves for paddy fields of 160 ha. The irrigation area consists of the existing Puan-Linis CIS and Butingge CIS. Since the Butingge river flows are not sufficient to irrigate Butingge CIS, it is unified with Puan-Linis CIS. To supplement irrigation water in the dry season, a pumping station is provided. According to water balance calculation between irrigation water requirements and river flows, about 50 % of the water requirement is required to be pumped up, but most of the rainy season cropping will be served from the Puan river flows. The works consit of improvement of the existing Puang intake, a pump station, and irrigation canals and related structures

2) Mapakla Irrigation System

The Mapakla irrigation system is located in the Special District. It commands paddy fields of 100 ha and upland fields of 30 ha. The irrigation area consists of the existing Lower Mapakla CIS, Upper Mapakla CIS,Ilog Tangge CIS and reinfed upland fields lying north of Jala-Jala poblacion. The irrigation water is supplied from the Mapakla river, supplemented by pumping from Laguna lake. The works consist of improvement of the existing Upper Mapakla and Lower Mapakla intakes, construction of a pumping station, and irrigation canals and related structures.

3) Manggahan Irrigation System

The Mnaggahan irrigation system is located in Special District. The irrigation service area is 55 ha consisting of paddy fields of 45 ha and upland fields of 10 ha. This system includes the existing Manggahan CIS and reinfed upland fields.

The irrigation water is supplied from the Manggahan river and supplemented by pumping-up of lake Laguna. The works consist of improvement of the existing Manggahan intake, and construction of a pumping station ,and irrigation canals and related structures.

4) Bayugo Irrigation System

The Bayugo Irrigation system is located in Barangay Bayugo. The irrigation service area is 50 ha of paddy fields. The Bayugo CIS was constructed but it is presently not functioning due to lack of Bayugo river flows and deterioration of irrigation facilities. Its service area remains under reinfed conditions or grass land. All of irrigation water is supplied by a pumping station to be constructed. The works consist of construction of a pumpstation and irrigation canals and related strucrures.

5) Llano Irrigation System

The Llano irrigation system is situated in the southwestern part of Barangay Bayugo. commanding the rainfed paddy fields of 65 ha. The irrigation area currently stands on reinfed conditions because of no reliable riverflows in this area. Irrigation water is supplied by a pump station. The works consist of construvctionof a pumping station, and irrigation canals and related structures.

6) Punta Irrigation System

This system is located in Barangay Punta in a pointed head of the Peninsular. The irrigation area is 35 ha of paddy fields. Formerly in this area, pump irrigation was practiced by a land owner, but presently irrigation facilities are deteriorated and not functioning. Pump irrigation is introduced because of no reliable river flows. Yhe works consist of construction of a pumping station, and irrigation canals and related structures.

7) Palay Palay Irrigation System

The Palay-Palay irrigation system is located in Barangay Palay-Palay, commanding an area of 140 ha with an impounding in the Palay Palay river. The rainfed paddy fields extend in the service area. A dam embankment will be of center-cored earthfill type with its height of 24 m with total storage volume of 1,060 x 10^3 cu.m. The general features of Palay-Palay damare as shown in Table VI.2.16. The works consist of construction of Palay-Palay dam, additional pump station to divert dam storage water to a high elevated area, irrigation canals and related structures.

8) Pagkalinawan Irrigation system

The irrigation system is situated in Barangay Pagkalinawan with a commanding area of 55 ha of paddy fields (45 ha) and citrus orchards (15 ha). The area is a narrow strip extending on comparatively steep slopes. Due to lack of stable irrigation water,paddy fields are not effectively utilized. With the Project, a pumping irrigation system is introduced. The works consist of construction of a pump station,irrigation canals and related structures.

9) Ik Ik Irrigation System

This system is located in Barangay Lubo in the center of the eastern side of the Study area. The irrigation area is paddy fields of 45 ha presently put under rainfed conditions. The Ik Ik CIS is not functioning due to deterioration of intake and irrigation canals. With the Project,the area is served by Ik Ik river flows supplemented by pumping-up from lake Laguna. The owrks consist of construction of an intake in the Ik-Ik river,a pump station, irrigation canals and relatde structures.

10) Lubo Irrigation System

The Lubo irrigation system is located in Barangy Lubo, serving an area of 45 ha of paddy fields of 30 ha and upland fields of 15 ha. The existing Lubo CIS is serving to a limited extent of the paddy fields. Upland fields extending on lower terraces contiguously to paddy fields are included in the irrigation area. Water supply will be carried out from the Lubo river supplemented by pumping-up from lake Laguna. The works consist of improvement of the existing Lubo inake, construction of pumping station, irrigation canals and related structures.

11) Lumang Nayon Irrigation System

The Lumang Nayon irrigation system is located in Barangay Bagumbong. With unification of the existing Lumang Nayon CIS, Ilog Munti CIS and Ilog Na Malaki CIS, paddy fields of 95 ha are irrigated by use of river flows of the Lumang Nayon and the Munti, supplemented by pumping-up from Lake Laguna. To effectively utilize the dry season flow of the above rivers which originate from the springs, the existing three intakes are improved. The works consist of improvemen of the existing ithree intakes ,construction of a pumping station ,irrigation canals and related structres.

12) Pulong Ligaya Irrigation System

The Pulong Ligaya irrigation system is located in Barangay Bagumbong. The srvice area covers the existing Pulong Matsing CIS and raifed paddy fields. The Pulong Matsing CIS is presently diverting drain water to its commanding area in the rainy season. The water balance study shows that the Turnina riverflows can be diverted to this irrigation system. The irrigation area is 45 ha of Pulong Matsing CIS area and reinfed areas. The works consist of

improvement of the existing Pulong Matsing intake, construction of a pump station, irrigation canals and related structures.

13) Bagumbong Irrigation System

The Bagumbong irrigation system is located in Barangay Bagumbong. The irrigation area is 230 ha consisting of paddy fields of 85 ha and upland fields of 145 ha. Irrigation system is separated into the right and left bank areas in consideration of canal layout. The Turnina riverflows are diverted to paddy field areas, including adjacent Pulong Ligaya irrigation system. The works consist of improvement of the existing Bagumbong iantke,construction of two pumpstations, irrigation canals and related structures.

The general features of the irrigation systems are summarized as follows:

	IRRIGATION SYSTEM	IRRIGATION AREA PADDY	UPLAND	HEADWORK
1.	SIPSIPIN	170	-	1-intake, 1-pump station
2.	MAPAKLA	100	30	2-intake, 1-pump station
3.	MANGGAHAN	45	10	1-intake, 1-pump station
4.	BAYUGO	50	-	- 1-pump station
5.	LLANO	65	-	- 1-pump station
6.	PUNTA	35	-	- 1-pump station
7.	PALAY-PALAY	140	-	1-impound 1-pump station
8.	PAGKALINAWAN	45	10	- 1-pump station
9.	IK-IK	45	-	1-intake 1-pump station
10.	LUBO	30	15	1-intake 1-pump station
11.	LUMANG NAYON	95	-	3-intake 1-pump station
12.	PULONG LIGAYA	45	-	1-intake 1-pump station
13.	BAGUMBONG	85	145	1-intake 2-pump station
	TOTAL	950	210	12-intakes 14-pump stations 1-impound

2.2 Drainage Plan

2.2.1 General

The drainage systems consist of main, and farm drains. Natural drains running across irrigation areas are used as main drains with enlargement of stream sections, where flow capacities are not sufficient. The main drains function to convey run-off from hilly areas to lake Laguna. Farm drains are connected with main or lateral drains to evacuate excess water in the irrigation area.

2.2.2 Drainage Water Requirement

(1) General

The drainage areas of the Project consist of paddy fields, upland fields and hilly areas. The drainage characteristics differ in respective areas. Drainage water requirements of the paddy fields, upland fields and hilly areas are separately estimated hereunder.

Drainage systems for paddy fields are provided on the assumption that 5-year, 24-hour rainfall storm is drained from paddy fields within 24 hours.

Drainage water requirements for upland and hilly areas are estimated to respective areas on the basis of drainage characteristics of vegetation, soil and ground surface slope
The drainage system of upland irrigation areas is provided on the basis that 5-year, 4 hour continuous rainfall storm is drained in the period of 4 hours.

(2) Drainage water requirement of paddy field

Drainage water requirement of paddy field areas is estimated by the following formula:

$$Q = C \times I \times A$$

where,
- Q: Drainage water requirement (l/sec/ha)
- C: Peak runoff coefficient of paddy field, 0.4
- I: Design rainfall
  5-year, 24-hour rainfall storm, 182 mm/day
- A: Drainage area (ha)

$$Q = \frac{0.4 \times 182 \times 10^{-3}}{(24 \times 3{,}600) \times 10^{7}} \quad \text{(l/sec/ha)}$$

$$= 8.4$$

(3) Drainage water requirement of upland field and hilly area

Drainage water requirements for upland fields and hilly areas are estimated by using McMath formula as shown below.

$$Q = 2.3 \times C \times i \times S^{1/5} \times A^{4/5}$$

where,
- Q: Drainage discharge (l/sec)
- C: Coefficient representing the drainage area characteristics
  - for upland : 0.40
  - for hilly area : 0.42

i : Rainfall intensity for the time of concentration and frequency (mm/hr)
S : Fall of drainage channel between the farthest contribution point and the point of concentration
A : drainage area (ha)

Rainfall intensity,i,is estimated by converting from the daily rainfall intensity using the following formula:

$Rt = R24 \times (t/24)^k$

where, Rt : Rainfall depth within t hour (mm)
t : ime of concentration (hr)
k : factor,1/2, which is determined on the basis of the rainfall characteristics at IRRI climatic station in Los Banos

The design rainfall intensity is estimated as follows:

5 year 4 hour continuous rainfall:
$R4 = 182 \times (4/24)^{0.5} = 74.3$ mm
I = 74.4/4 =18.6 mm/hr

Based on the results of the drainage requirements of the representative areas, the relation between the drainage area and unit drainage water requirements are obtained as shown in Fig.VI.2.10.

2.2.3 Drainage Facilities

The drainage diagram for respective irrigation systems are prepared on the basis of the unit drainage water requirements, as shown in Table VI.2.11.

The inspection roads are provided along the main drains to provide the function of feeder roads in the irrigation areas.

The general features of the drainage system in each irrigation system are as summarized below.

Main drain	Length	11.2 km
	Nos.	9 nos
	Type	Trapezoidal earth canal
Farm drain	Length	9.3 km
	Nos.	92 nos
	Type	Trapezoidal earth canal
Related structures	Road crossing	70 nos

The farm road length of each irrigation system is as shown below.

Irrigation Area	Canal Length (m)
Sipsipin	6,990
Mapakla	2,620
Manggahan	3,230
Bayugo	3,290
Llano	4,950
Punta	2,950
Palay-Palay	7,320
Pagkalinawan	3,320
Ik-Ik	3,900
Lubo	2,820
Lumang Nayong	1,890
Pulong Ligaya	2,690
Bagumbong-1	3,720
Bagumbong-2	730
Total	50,420

2.3 Farm Road Plan

To make smooth the transportation between fields and feeder roads, the existing village roads are improved with gravel metalling. The width of gravel metalling is 3 m. The layout of the farm road improvement is as shown in the attached Drawings. The General features of farm road improvement are as follows:

Width	4 m
Width of gravel metalling	3 m
Length	9.6 km
Nos	16 nos.

TABLES

Table VI.1.1 Existing Irrigation Facilities of Communal Irrigation Systems

NAME OF SYSTEM	INTAKE	CANAL NOS.	CANAL LENGTH (m) LINING	EARTH	TOTAL	STRUCTURE
Sipsipin	Diversion weir	4	570	1,470	2,040	no
Puan Linis	Diversion weir	1	1,300	0	1,300	sp-1,cv-1
Butsingge	Diversion weir	1	1,378	360	1,738	cv-1
Lower Mapakla	Barrage	5	1,100	1,000	2,100	cv-3
Upper Mapakla	Barrage	8	3,060	0	3,060	aq-1,cv-3
Ilog Tangge	Diversion weir	0	0	0	0	no
Manggahan	Diversion weir	3	1,240	400	1,640	aq-1,cv-3
Bayugo	Diversion weir	0	0	0	0	no
Bagumbong	Diversion weir	6	4,380	0	4,380	no
Pulong Matsing	Barrage	2	0	700	700	no
Ilog Munti	Diversion weir	1	400	400	800	no
Ilog Na Malaki	Barrage	1	0	480	480	no
Lumang Nayon	Diversion weir	5	2,340	1,140	3,480	no
Lubo	Diversion weir	6	2,960	780	3,740	no
IK-IK	Diversion weir	0	0	0	0	no
Total	Diver. weir-11 Barrage-4	43	18,728	6,730	25,458	sp-1,cv-11 aq-2

Remarks:
sp ; Siphon
cv ; Culvert
aq ; Aqueduct

Table VI.1.2 Irrigation Association of Existing Communal Irrigation System

NAME OF SYSTEM	NO. OF FARMERS	NAME OF IRRIGATION ASSOCIATION	AMORTIZATION AMGTZ.	NON.
1.Sipsipin	70	Sipsipin Farmers Association Inc.	-	NP
2.Puang Linis	37	Linis Farmers Association Inc.	-	-
3.Butsinge	40	Butsinge Farmers Assciation Inc.	NP	-
4.Lower Mapakla	39	Lower Mapakla Farmers Assciation Inc.	P	-
5.Upper Mapakla	50	Poblacion-Mapakla Farmers Assciation Inc.	-	NP
6.Ilog Tangge	15	Tangge Irrigation System Association Inc.	NP	-
7.Manggahan	17	Dalig-Poblacion Farmers Association Inc.	-	NP
8.Bayugo	25	Bayugo Farmers Irrigation System Association Inc.	NP	-
9.Bagumbong	35	Bagumbong Farmers Association Inc.	P	-
10.Pulong Matsing	6	---	P	-
11.Ilog Munti	20	Ilog Munti Farmers Association Inc.	-------	
12 Ilog Na Malaki	12	---	-	NP
13.Lumang Nayon	29	Lumang Nayon Farmers Association Inc.	P	-
14.Lubo	20	Lubo Farmers Association Inc.	NP	-
15.Ik-Ik	20	Ik-Ik Farmers Association Inc.	NP	-
TOTAL	435			

Note :

/1 : NUMBER OF FARMER ; based on Rizal Provincial Irrigation Profile,
/2 : NP ; Non-participatory
P ; Participatory
/3 : not functioning ; Ilog Tangge, Bayugo, Ik-Ik farmers association inc.

Table VI.2.1 Selection of Irrigation Method

1. General Features

Description	Unit	Surface method	Sprinkler method	Drip method
1) Irrigation area	ha	55	55	55
2) Irrigation efficiency				
Application eff.	%	65	85	95
Conveyance eff.	%	85	95	95
Overall eff.	%	55	81	90
3) Water requirement				
Unit diversion req.	l/sec/ha	1.00	0.68	0.61
Peak demend	l/sec	55	37	34
Annual water demand	m3	280,000	189,000	173,000
4) Pump and motor				
Pump type		-- horizontal shaft volute --		
Set	set	2	2	2
Discharge per set	m3/min	1.65	1.11	1.02
Discharge pipe				
Diameter	mm	250	250	250
Length	m	1,270	1,320	1,300
Pump head				
Actual	m	38	68	48
Loss	m	20	12	10
Total	m	58	80	58
Motor output	kw	30	37	22
5) Storage pond				
Pump oper.hr/day	hr	24	24	24
Irrigation oper.h/day	hr	16	16	16
Pond capacity	m3	1,580	1,070	980
6) Pump operation hr				
Operation hr per set	hr	2,840	2,840	2,840
Power consumption	kWh	85,200	105,080	62,480

Note :
1. Case study of Bagumbong upland irrigation area

2. Cost Comparison of Irrigation Method

Description	Surface Method	Sprinkler Method	Drip Method
1. Construction cost (1,000 peso)			
1) Civil works			
- Pump house	1,000	900	900
- Pond	1,400	1,150	1,100
2) Pump and motor	2,400	2,460	2,340
3) Discharge pipe	2,150	2,240	2,210
4) Canal system			
- Concrete canal	760	0	0
- Sprinkler system	0	4,900	0
- Drip system	0	0	3,950
2. Annual cost			
1) Capital recovery			
- Pump and motor	283	289	275
- Civil works (Pump house,pond dis. pipe, irr. canal)	536	433	425
- Sprinkler and drip system	0	798	643
2) Electric charge	153	189	112
Total (1)+2))	972	1,709	1,455

Note
1) Capital recovery cost is estimated on the basis of the following :
- Pump and motor : 20 year c.r.f. = 0.1175
- Sprinkler and drip systems : 10 year c.r.f. = 0.1628
- Concrete canal : 50 year c.r.f. = 0.1008

2) Electric charge
- Unit electric charge : 1.80 peso/kWh

Table VI.2.2 Potential Evapotranspiration
Station: IRRI(Dry land area)

Month /Year	1984	1985	1986	1987	1988	AVERAGE mm/month	mm/day
JAN	77.8	96.5	80	92.7	100.9	89.58	2.89
FEB	89.4	108	86	96.9	110.7	98.2	3.51
MAR	119.1	137.9	127.4	135.7	140.1	132.04	4.26
APR	122.8	131.2	133.9	153.9	134	135.16	4.51
MAY	123.1	152.4	129.5	160.7	162.2	145.58	4.70
JUN	95.4	120.6	127.4	131.1	124.7	119.84	3.99
JUL	116.5	120.7	115.7	127.3	120.6	120.16	3.88
AUG	93.7	133.6	117.1	131.7	126	120.42	3.88
SEP	105.3	108.9	101.6	110.2	119.7	109.14	3.64
OCT	82.2	99.5	106.2	117.2	83.6	97.74	3.15
NOV	85.6	93.5	96.2	101.9	81.6	91.76	3.06
DEC	77.8	85.1	100.2	86	91.5	88.12	2.84
TOTAL	1,188.7	1,387.9	1,321.2	1,445.3	1,395.6	1,347.7	

Table VI 2.3 (1) Diversion Water Requirements of Each Crop

Calculation Condition of Irrigation Water Requirement

Summary of Crop and Basic Assumption

No.	Crop	Application Efficiency	Percolation Lose Code	Land prepartion Code	Pre-irrigation Code	Growing Stages
1	1 Paddy-nursery	0.75	1	1	0	2
2	2 Wet season paddy	0.75	1	1	0	6
3	3 Dry season paddy	0.75	1	1	0	6
4	4 Beans	0.65	0	0	1	4
5	5 Dry season beans	0.65	0	0	1	7
6	6 Dry season corn	0.65	0	0	2	8
7	7 Wet season corn	0.65	0	0	2	8
8	8 Eggplant	0.65	0	0	1	5
9	9 String bean	0.65	0	0	1	4
10	10 Tomato	0.65	0	0	2	5
11	11 Bitter gourd	0.65	0	0	2	6
12	12 Late wet season corn	0.65	0	0	2	8
13	13 Wet season soybeans	0.65	0	0	1	7
14	14 Citrus	0.65	0	0	0	24
15	15 Mungbeans	0.65	0	0	1	7
16	16 Water melon	0.65	0	0	2	6

No.	Crop	Crop Coefficient (by growing stage)											
1	1 Paddy-nursery	1.00	1.00										
2	2 Wet season paddy	1.10	1.13	1.17	1.20	1.18	1.13						
3	3 Dry season paddy	1.10	1.13	1.17	1.20	1.18	1.13						
4	4 Beans	0.38	0.70	1.00	0.93								
5	5 Dry season beans	0.32	0.68	0.96	1.03	1.02	0.77	0.44					
6	6 Dry season corn	0.30	0.43	0.80	1.05	1.13	1.12	0.93	0.58				
7	7 Wet season corn	0.30	0.43	0.80	1.05	1.13	1.12	0.93	0.58				
8	8 Eggplant	0.30	0.48	0.86	1.00	0.87							
9	9 String bean	0.38	0.83	1.00	0.87								
10	10 Tomato	0.30	0.78	1.05	0.93	0.33							
11	11 Bitter gourd	0.32	0.55	0.87	0.95	0.93	0.75						
12	12 Late wet season corn	0.30	0.43	0.80	1.05	1.13	1.12	0.93	0.58				
13	13 Wet season soybeans	0.32	0.68	0.96	1.03	1.02	0.77	0.44					
14	14 Citrus	0.80	0.80	0.80	0.80	0.75	0.75	0.75	0.75	0.75	0.75	0.70	0.70
		0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.75	0.75	0.75	0.75
15	15 Mungbeans	0.32	0.45	0.68	0.90	1.00	0.98	0.90					
16	16 Water melon	0.32	0.48	0.76	0.95	0.93	0.72						

Remark: 1 growing stage = 15 days

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Potential ET (mm)	89.6	98.2	132.0	135.2	145.6	119.8	120.2	120.4	109.1	97.7	91.8	88.1
Conveyance Efficiency	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Return Flow Factor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Unit:mm

Code	1	2	3	4	5	6	7	8	9	10
Land Preparation	180.	0.	0.	0.	0.	0.	0.	0.	0.	0.
Prcoration Losses	60.	0.	0.	0.	0.	0.	0.	0.	0.	0.
Pre-irrigation	40.	60.	0.	0.	0.	0.	0.	0.	0.	0.

Table VI 2.3 (2) Diversion Water Requirements of Each Crop

Monthly Rainfall in Jala-Jala Area

Unit:mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1969	30	13	25	23	87	134	406	166	165	147	154	264	1614
1970	45	31	35	54	133	235	290	158	402	568	638	206	2795
1971	26	40	102	32	261	438	357	192	238	466	382	554	3088
1972	83	16	83	54	170	370	829	310	150	259	222	132	2678
1973	50	19	20	23	105	239	213	159	292	360	399	324	2203
1974	16	36	25	22	146	223	170	478	176	366	431	305	2394
1975	133	21	110	231	80	174	105	279	269	304	212	397	2315
1976	40	22	27	55	597	259	232	290	260	150	227	243	2402
1977	168	36	42	24	105	307	207	262	290	157	219	35	1852
1978	36	20	13	43	127	118	150	558	337	824	174	129	2529
1979	23	24	16	217	260	315	159	323	264	263	236	39	2139
1980	18	0	112	28	117	265	278	246	159	358	405	219	2205
1981	32	16	18	38	130	247	395	201	295	343	356	97	2168
1982	14	28	41	37	83	155	515	176	351	134	186	77	1797
1983	66	16	28	13	32	122	254	218	149	338	128	0	1364
1984	22	14	24	74	206	236	89	363	189	682	145	42	2086
1985	22	26	36	72	137	517	241	114	184	404	138	100	1991
1986	24	22	13	17	131	45	258	382	167	381	337	99	1876
1987	28	14	13	13	49	142	107	196	277	106	249	128	1322
1988	119	63	14	148	103	334	172	214	171	644	416	20	2418
Ave.	49	23	39	60	152	243	271	264	239	362	282	170	2161

Table VI 2.3 (3) Diversion Water Requirements of Each Crop

Sample Intermediate Output in 1987

Crop : 1 Paddy-nursery
Land Preparation Requirement : 180. mm
Percolation Losses : 60. mm
Pre-irrigation : 0. mm
Growing Stages : 2 stages
Date of Water Issue : 5/ 1

Unit:mm

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crop Coefficient	0.00	0.00	0.00	0.00	0.75	0.25	0.00	0.00	0.00	0.00	0.00	0.00
Potential ET	89.6	98.2	132.0	135.2	145.6	119.8	120.2	120.4	109.1	97.7	91.8	88.1
Crop ET	0.0	0.0	0.0	0.0	109.2	30.0	0.0	0.0	0.0	0.0	0.0	0.0
Rinfall	28.0	14.0	13.0	13.0	49.0	142.0	107.0	196.0	277.0	106.0	249.0	128.0
Effective Rainfall	0.0	0.0	0.0	0.0	13.7	22.2	0.0	0.0	0.0	0.0	0.0	0.0
Land Preparation	0.0	0.0	0.0	0.0	180.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percoration Loss	0.0	0.0	0.0	0.0	45.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0
Farm Water Req.	0.0	0.0	0.0	0.0	320.5	22.7	0.0	0.0	0.0	0.0	0.0	0.0
Overall Efficiency	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64
Diversion Water Req.	0.0	0.0	0.0	0.0	502.8	35.6	0.0	0.0	0.0	0.0	0.0	0.0

Sample Intermediate Output in 1987

Crop : 2 Wet season paddy
Land Preparation Requirement : 180. mm
Percolation Losses : 60. mm
Pre-irrigation : 0. mm
Growing Stages : 6 stages
Date of Water Issue : 6/ 1

Unit:mm

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crop Coefficient	0.00	0.00	0.00	0.00	0.00	0.83	1.17	1.17	0.28	0.00	0.00	0.00
Potential ET	89.6	98.2	132.0	135.2	145.6	119.8	120.2	120.4	109.1	97.7	91.8	88.1
Crop ET	0.0	0.0	0.0	0.0	0.0	99.7	140.3	141.2	30.8	0.0	0.0	0.0
Rainfall	28.0	14.0	13.0	13.0	49.0	142.0	107.0	196.0	277.0	106.0	249.0	128.0
Effective Rainfall	0.0	0.0	0.0	0.0	0.0	66.7	62.3	130.0	43.3	0.0	0.0	0.0
Land Preparation	0.0	0.0	0.0	0.0	0.0	180.0	0.0	0.0	0.0	0.0	0.0	0.0
Percoration Loss	0.0	0.0	0.0	0.0	0.0	45.0	60.0	60.0	15.0	0.0	0.0	0.0
Farm Water Req.	0.0	0.0	0.0	0.0	0.0	258.0	138.0	71.2	2.5	0.0	0.0	0.0
Overall Efficiency	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64
Diversion Water Req.	0.0	0.0	0.0	0.0	0.0	404.8	216.5	111.7	4.0	0.0	0.0	0.0

Sample Intermediate Output in 1987

Crop : 1 Paddy-nursery
Land Preparation Requirement : 180. mm
Percolation Losses : 60. mm
Pre-irrigation : 0. mm
Growing Stages : 2 stages
Date of Water Issue : 10/ 1

Unit:mm

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crop Coefficient	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.75	0.25	0.00
Potential ET	89.6	98.2	132.0	135.2	145.6	119.8	120.2	120.4	109.1	97.7	91.8	88.1
Crop ET	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	73.3	23.0	0.0
Rainfall	28.0	14.0	13.0	13.0	49.0	142.0	107.0	196.0	277.0	106.0	249.0	128.0
Efective Rainfall	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.2	42.6	0.0
Land Preparation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	180.0	0.0	0.0
Percoration Loss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45.0	15.0	0.0
Farm Water Req.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	252.1	0.0	0.0
Oarall Efficiency	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64
Diversion Water Req.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	395.5	0.0	0.0

Table VI 2.3 (4) Diversion Water Requirements of Each Crop

Sample Intermediate Output in 1987

Crop : 3 Dry season paddy
Land Preparation Requirement : 180. mm
Percolation Losses : 60. mm
Pre-irrigation : 0. mm
Growing Stages : 6 stages
Date of Water Issue : 11/ 1

Unit:mm

I t e m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crop Coefficient	1.17	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83	1.17
Potential ET	89.6	98.2	132.0	135.2	145.6	119.8	120.2	120.4	109.1	97.7	91.8	88.1
Crop ET	105.1	27.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	76.4	102.9
Rainfall	28.0	14.0	13.0	13.0	49.0	142.0	107.0	196.0	277.0	106.0	249.0	128.0
Effective Rainfall	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	127.7	78.3
Land Preparation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	180.0	0.0
Percoration Loss	60.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45.0	60.0
Farm Water Req.	162.8	42.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	173.7	84.6
Overall Efficiency	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64
Diversion Water Req.	255.3	67.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	272.5	132.7

Sample Intermediate Output in 1987

Crop : 4 Beans
Land Preparation Requirement : 0. mm
Percolation Losses : 0. mm
Pre-irrigation : 40. mm
Growing Stages : 4 stages
Date of Water Issue : 2/16

Unit:mm

I t e m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crop Coefficient	0.00	0.06	0.53	0.76	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potential ET	89.6	98.2	132.0	135.2	145.6	119.8	120.2	120.4	109.1	97.7	91.8	88.1
Crop ET	0.0	6.2	69.5	102.8	22.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rainfall	28.0	14.0	13.0	13.0	49.0	142.0	107.0	196.0	277.0	106.0	249.0	128.0
Effective Rainfall	0.0	1.0	7.9	8.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pre-irrigation	0.0	10.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percoration Loss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farm Water Req.	0.0	15.2	91.6	94.7	19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Overall Efficiency	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Diversion Water Req.	0.0	27.6	165.8	171.5	34.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Sample Intermediate Output in 1987

Crop : 5 Dry season beans
Land Preparation Requirement : 0. mm
Percolation Losses : 0. mm
Pre-irrigation : 40. mm
Growing Stages : 7 stages
Date of Water Issue : 12/16

Unit:mm

I t e m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crop Coefficient	0.49	0.95	0.84	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
Potential ET	89.6	98.2	132.0	135.2	145.6	119.8	120.2	120.4	109.1	97.7	91.8	88.1
Crop ET	44.2	93.0	111.1	37.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7
Rainfall	28.0	14.0	13.0	13.0	49.0	142.0	107.0	196.0	277.0	106.0	249.0	128.0
Effective Rainfall	15.0	10.0	9.9	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.7
Pre-irrigation	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0
Percoration Loss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farm Water Req.	59.2	83.0	101.2	33.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0
Overall Efficiency	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Diversion Water Req.	107.1	150.2	183.3	60.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.7

Table VI 2.3 (5) Diversion Water Requirements of Each Crop

Sample Intermediate Output in 1987

Crop : 6 Dry season corn
Land Preparation Requirement : 0. mm
Percolation Losses : 0. mm
Pre-irrigation : 60. mm
Growing Stages : 8 stages
Date of Water Issue : 12/16

Unit:mm

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crop Coefficient	0.38	0.88	1.08	0.69	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.05
Potential ET	89.6	98.2	132.0	135.2	145.6	119.8	120.2	120.4	109.1	97.7	91.8	88.1
Crop ET	33.7	86.1	142.6	93.3	14.1	0.0	0.0	0.0	0.0	0.0	0.0	4.4
Rainfall	28.0	14.0	13.0	13.0	49.0	142.0	107.0	196.0	277.0	106.0	249.0	128.0
Effective Rainfall	15.3	9.8	10.6	7.8	3.1	0.0	0.0	0.0	0.0	0.0	0.0	8.4
Pre-irrigation	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.0
Percoration Loss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farm Water Req.	63.5	76.3	131.9	85.5	11.0	0.0	0.0	0.0	0.0	0.0	0.0	11.0
Overall Efficiency	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Diversion Water Req.	114.9	138.1	238.8	154.8	20.0	0.0	0.0	0.0	0.0	0.0	0.0	19.9

Sample Intermediate Output in 1987

Crop : 7 Wet season corn
Land Preparation Requirement : 0. mm
Percolation Losses : 0. mm
Pre-irrigation : 60. mm
Growing Stages : 8 stages
Date of Water Issue : 5/ 1

Unit:mm

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crop Coefficient	0.00	0.00	0.00	0.00	0.17	0.63	1.05	0.97	0.35	0.00	0.00	0.00
Potential ET	89.6	98.2	132.0	135.2	145.6	119.8	120.2	120.4	109.1	97.7	91.8	88.1
Crop ET	0.0	0.0	0.0	0.0	25.0	76.1	125.8	116.6	38.0	0.0	0.0	0.0
Rainfall	28.0	14.0	13.0	13.0	49.0	142.0	107.0	196.0	277.0	106.0	249.0	128.0
Effective Rainfall	0.0	0.0	0.0	0.0	15.1	89.8	75.8	131.6	64.6	0.0	0.0	0.0
Pre-irrigation	0.0	0.0	0.0	0.0	45.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0
Percoration Loss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farm Water Req.	0.0	0.0	0.0	0.0	54.9	1.3	50.0	0.0	0.0	0.0	0.0	0.0
Overall Efficiency	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Diversion Water Req.	0.0	0.0	0.0	0.0	99.4	2.4	90.5	0.0	0.0	0.0	0.0	0.0

Sample Intermediate Output in 1987

Crop : 8 Eggplant
Land Preparation Requirement : 0. mm
Percolation Losses : 0. mm
Pre-irrigation : 40. mm
Growing Stages : 5 stages
Date of Water Issue : 4/16

Unit:mm

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crop Coefficient	0.00	0.00	0.00	0.05	0.40	0.84	0.46	0.00	0.00	0.00	0.00	0.00
Potential ET	89.6	98.2	132.0	135.2	145.6	119.8	120.2	120.4	109.1	97.7	91.8	88.1
Crop ET	0.0	0.0	0.0	6.8	58.7	101.2	54.9	0.0	0.0	0.0	0.0	0.0
Rainfall	28.0	14.0	13.0	13.0	49.0	142.0	107.0	196.0	277.0	106.0	249.0	128.0
Effective Rainfall	0.0	0.0	0.0	0.9	27.0	92.8	29.3	0.0	0.0	0.0	0.0	0.0
Pre-irrigation	0.0	0.0	0.0	10.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percoration Loss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farm Water Req.	0.0	0.0	0.0	15.8	61.7	8.5	25.6	0.0	0.0	0.0	0.0	0.0
Overall Efficiency	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Diversion Water Req.	0.0	0.0	0.0	28.7	111.7	15.3	46.3	0.0	0.0	0.0	0.0	0.0

Table VI 2.3 (6) Diversion Water Requirements of Each Crop

Sample Intermediate Output in 1987

Crop : 9 String bean
Land Preparation Requirement : 0. mm
Percolation Losses : 0. mm
Pre-irrigation : 40. mm
Growing Stages : 4 stages
Date of Water Issue : 5/ 1

Unit:mm

I t e m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crop Coefficient	0.00	0.00	0.00	0.00	0.27	0.82	0.46	0.00	0.00	0.00	0.00	0.00
Potential ET	89.6	98.2	132.0	135.2	145.6	119.8	120.2	120.4	109.1	97.7	91.8	88.1
Crop ET	0.0	0.0	0.0	0.0	38.6	98.0	54.9	0.0	0.0	0.0	0.0	0.0
Rainfall	28.0	14.0	13.0	13.0	49.0	142.0	107.0	196.0	277.0	106.0	249.0	128.0
Effective Rainfall	0.0	0.0	0.0	0.0	15.0	94.6	29.3	0.0	0.0	0.0	0.0	0.0
Pre-irrigation	0.0	0.0	0.0	0.0	30.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0
Percoration Loss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farm Water Req.	0.0	0.0	0.0	0.0	53.6	13.4	25.6	0.0	0.0	0.0	0.0	0.0
Overall Efficiency	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Diversion Water Req.	0.0	0.0	0.0	0.0	97.1	24.2	46.3	0.0	0.0	0.0	0.0	0.0

Sample Intermediate Output in 1987

Crop : 10 Tomato
Land Preparation Requirement : 0. mm
Percolation Losses : 0. mm
Pre-irrigation : 60. mm
Growing Stages : 5 stages
Date of Water Issue : 9/16

Unit:mm

I t e m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crop Coefficient	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.53	0.84	0.26
Potential ET	89.6	98.2	132.0	135.2	145.6	119.8	120.2	120.4	109.1	97.7	91.8	88.1
Crop ET	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5	52.3	77.6	23.3
Rainfall	28.0	14.0	13.0	13.0	49.0	142.0	107.0	196.0	277.0	106.0	249.0	128.0
Effective Rainfall	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.8	57.8	145.6	26.7
Pre-irrigation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.0	45.0	0.0	0.0
Percoration Loss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farm Water Req.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	39.4	0.0	0.0
Overall Efficiency	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Diversion Water Req.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	71.4	0.0	0.0

Sample Intermediate Output in 1987

Crop : 11 Bitter gourd
Land Preparation Requirement : 0. mm
Percolation Losses : 0. mm
Pre-irrigation : 60. mm
Growing Stages : 6 stages
Date of Water Issue : 10/ 1

Unit:mm

I t e m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crop Coefficient	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.69	0.90
Potential ET	89.6	98.2	132.0	135.2	145.6	119.8	120.2	120.4	109.1	97.7	91.8	88.1
Crop ET	36.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.4	62.9	79.0
Rainfall	28.0	14.0	13.0	13.0	49.0	142.0	107.0	196.0	277.0	106.0	249.0	128.0
Effective Rainfall	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.5	145.8	77.8
Pre-irrigation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45.0	15.0	0.0
Percoration Loss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farm Water Req.	29.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.8	0.0	1.2
Overall Efficiency	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Diversion Water Req.	52.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	61.3	0.0	2.1

Table VI 2.3 (7) Diversion Water Requirements of Each Crop

Sample Intermediate Output in 1987

Crop : 12 Late wet season corn
Land Preparation Requirement : 0. mm
Percolation Losses : 0. mm
Pre-irrigation : 60. mm
Growing Stages : 8 stages
Date of Water Issue : 8/ 1

Unit:mm

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crop Coefficient	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.63	1.05	0.97	0.35
Ptential ET	89.6	98.2	132.0	135.2	145.6	119.8	120.2	120.4	109.1	97.7	91.8	88.1
Crop ET	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.7	69.3	102.3	88.9	30.7
Rainfall	28.0	14.0	13.0	13.0	49.0	142.0	107.0	196.0	277.0	106.0	249.0	128.0
Effective Rainfall	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55.1	165.3	70.5	151.9	29.0
Pre-irrigation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45.0	15.0	0.0	0.0	0.0
Percoration Loss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.6	0.0	31.8	0.0	1.7
Farm Water Req.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Overall Efficiency	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Diversion Water Req.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.2	0.0	57.5	0.0	3.0

Sample Intermediate Output in 1987

Crop : 13 Wet season soybeans
Land Preparation Requirement : 0. mm
Percolation Losses : 0. mm
Pre-irrigation : 40. mm
Growing Stages : 7 stages
Date of Water Issue : 8/16

Unit:mm

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crop Coefficient	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.49	0.95	0.84	0.28
Potential ET	89.6	98.2	132.0	135.2	145.6	119.8	120.2	120.4	109.1	97.7	91.8	88.1
Crop ET	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.4	53.8	92.5	77.3	24.2
Rainfall	28.0	14.0	13.0	13.0	49.0	142.0	107.0	196.0	277.0	106.0	249.0	128.0
Effective Rainfall	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.9	137.5	68.3	145.4	27.0
Pre-irrigation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	30.0	0.0	0.0	0.0
Percoration Loss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farm Water Req.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	0.0	24.2	0.0	0.0
Overall Efficiency	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Diversion Water Req.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.1	0.0	43.7	0.0	0.0

Sample Intermediate Output in 1987

Crop : 14 Citrus
Land Preparation Requirement : 0. mm
Percolation Losses : 0. mm
Pre-irrigation : 0. mm
Growing Stages : 24 stages
Date of Water Issue : 1/ 1

Unit:m

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	D
Crop Coefficient	0.79	0.80	0.76	0.75	0.75	0.71	0.70	0.70	0.70	0.70	0.74	0
Potential ET	89.6	98.2	132.0	135.2	145.6	119.8	120.2	120.4	109.1	97.7	91.8	8
Crop ET	70.6	78.6	100.7	101.4	109.2	85.4	84.1	84.3	76.4	68.4	67.7	6
Rainfall	28.0	14.0	13.0	13.0	49.0	142.0	107.0	196.0	277.0	106.0	249.0	12
Effective Rainfall	17.7	9.5	9.6	9.6	34.6	88.0	66.9	119.0	160.4	62.2	139.6	7
Pre-irrigation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Percoration Loss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Farm Water Req.	52.8	69.1	91.1	91.8	74.6	0.0	17.2	0.0	0.0	6.2	0.0	
Overall Efficiency	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0
Diversion Water Req.	95.6	125.0	164.9	166.2	135.1	0.0	31.1	0.0	0.0	11.2	0.0	

Table VI 2.3 (8) Diversion Water Requirements of Each Crop

Sample Intermediate Output in 1987

Crop : 15 Mungbeans
Land Preparation Requirement : 0. mm
Percolation Losses : 0. mm
Pre-irrigation : 40. mm
Growing Stages : 7 stages
Date of Water Issue : 12/16

Unit:m

I t e m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	D
Crop Coefficient	0.37	0.77	0.96	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Potential ET	89.6	98.2	132.0	135.2	145.6	119.8	120.2	120.4	109.1	97.7	91.8	8
Crop ET	33.2	75.5	126.7	62.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Rainfall	28.0	14.0	13.0	13.0	49.0	142.0	107.0	196.0	277.0	106.0	249.0	12
Effective Rainfall	14.3	9.4	10.3	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Pre-irrigation	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1
Percoration Loss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Farm Water Req.	48.9	66.1	116.5	58.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Overall Efficiency	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0
Diversion Water Req.	88.5	119.6	210.8	105.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1

Sample Intermediate Output in 1987

Crop : 16 Water melon
Land Preparation Requirement : 0. mm
Percolation Losses : 0. mm
Pre-irrigation : 60. mm
Growing Stages : 6 stages
Date of Water Issue : 12/16

Unit:m

I t e m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	D
Crop Coefficient	0.39	0.81	0.71	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Potential ET	89.6	98.2	132.0	135.2	145.6	119.8	120.2	120.4	109.1	97.7	91.8	8
Crop ET	35.2	79.1	93.5	16.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Rainfall	28.0	14.0	13.0	13.0	49.0	142.0	107.0	196.0	277.0	106.0	249.0	12
Effective Rainfall	15.4	9.5	7.8	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Pre-irrigation	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1
Percoration Loss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Frm Water Req.	64.9	69.5	85.7	15.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1
Overall Efficiency	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0
Diversion Water Req.	117.4	125.9	155.1	27.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2

Table VI 2.4 (1) Diversion Water Requirements of Each Irrigation System

Summary of crop and basic assumption
in Sipsipin Irrigation System (170 ha)

No.	Crop	Cultiva. Area(ha)	Date of Water Issue	Land Preparation Period (stages)
1	1 Paddy-nursery	8.	5/ 1	1
2	2 Wet season paddy	170.	6/ 1	1
1	1 Paddy-nursery	8.	10/ 1	1
3	3 Dry season paddy	170.	11/ 1	1
4	4 Beans	51.	2/16	2
	Total Project Area	170.		

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Unit Diversion Water Requirement

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
1 Paddy-nursery	0.	0.	0.	0.	503.	36.	0.	0.	0.	0
2 Wet season paddy	0.	0.	0.	0.	0.	405.	216.	112.	4.	0
1 Paddy-nursery	0.	0.	0.	0.	0.	0.	0.	0.	0.	395
3 Dry season paddy	255.	67.	0.	0.	0.	0.	0.	0.	0.	0
4 Beans	0.	28.	166.	171.	34.	0.	0.	0.	0.	0

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Diversion Water Requirement

Unit:x1000 m3

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Paddy-nursery	0.	0.	0.	0.	43.	3.	0.	0.	0.	0.	0.	0.
2 Wet season paddy	0.	0.	0.	0.	0.	688.	368.	190.	7.	0.	0.	0.
1 Paddy-nursery	0.	0.	0.	0.	0.	0.	0.	0.	0.	34.	0.	0.
3 Dry season paddy	434.	114.	0.	0.	0.	0.	0.	0.	0.	0.	463.	226.
4 Beans	0.	14.	85.	87.	18.	0.	0.	0.	0.	0.	0.	0.
Total	434.	128.	85.	87.	60.	691.	368.	190.	7.	34.	463.	226.

Diversion Water Requirement for Sipsipin Irrigation System (170 ha)
(Total Area : 170. ha)

Unit:x1000 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1969	430.	128.	78.	82.	55.	704.	44.	251.	51.	30.	610.	0.	2463.
1970	400.	124.	73.	66.	49.	547.	70.	267.	0.	20.	397.	67.	2081.
1971	438.	119.	40.	77.	32.	493.	55.	198.	14.	21.	440.	0.	1927.
1972	323.	128.	49.	66.	44.	504.	0.	67.	59.	23.	504.	217.	1985.
1973	389.	128.	81.	82.	53.	541.	153.	265.	6.	22.	437.	0.	2157.
1974	440.	121.	78.	83.	47.	566.	240.	30.	46.	22.	432.	0.	2105.
1975	221.	128.	36.	0.	56.	642.	372.	74.	7.	22.	520.	0.	2078.
1976	410.	128.	77.	66.	25.	523.	115.	72.	8.	30.	497.	0.	1949.
1977	150.	121.	70.	82.	53.	515.	165.	78.	6.	30.	509.	414.	2192.
1978	418.	128.	85.	72.	50.	728.	281.	12.	3.	18.	579.	224.	2596.
1979	440.	127.	83.	0.	32.	513.	263.	64.	7.	23.	483.	406.	2442.
1980	440.	129.	35.	80.	51.	522.	72.	89.	54.	22.	436.	41.	1971.
1981	426.	128.	82.	74.	49.	529.	46.	180.	6.	22.	444.	288.	2275.
1982	440.	126.	70.	75.	56.	671.	20.	230.	3.	31.	560.	329.	2611.
1983	357.	128.	77.	87.	63.	722.	77.	145.	59.	22.	650.	434.	2822.
1984	440.	128.	79.	56.	39.	546.	405.	56.	39.	19.	623.	400.	2829.
1985	440.	127.	73.	57.	48.	480.	96.	356.	42.	21.	634.	282.	2657.
1986	440.	128.	85.	85.	49.	841.	77.	51.	50.	22.	447.	284.	2559.
1987	434.	128.	85.	87.	60.	691.	368.	190.	7.	34.	463.	226.	2773.
1988	250.	106.	84.	20.	53.	510.	236.	153.	48.	19.	434.	434.	2349.
Ave.	386.	125.	71.	65.	48.	589.	158.	141.	26.	24.	505.	202.	2341.

Table VI 2.4 (2) Diversion Water Requirements of Each Irrigation System

Summary of crop and basic assumption
in Bayugo Irrigation System (50 ha)

No.	Crop	Cultiva. Area(ha)	Date of Water Issue	Land Preparation Period (stages)
1	1 Paddy-nursery	2.	5/ 1	1
2	2 Wet season paddy	50.	6/ 1	1
1	1 Paddy-nursery	2.	10/ 1	1
3	3 Dry season paddy	50.	11/ 1	1
4	4 Beans	15.	2/16	2
	Total Project Area	50.		

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Unit Diversion Water Requirement

Unit:mm

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Paddy-nursery	0.	0.	0.	0.	503.	36.	0.	0.	0.	0.	0.	0.
2 Wet season paddy	0.	0.	0.	0.	0.	405.	216.	112.	4.	0.	0.	0.
1 Paddy-nursery	0.	0.	0.	0.	0.	0.	0.	0.	0.	395.	0.	0.
3 Dry season paddy	255.	67.	0.	0.	0.	0.	0.	0.	0.	0.	273.	133.
4 Beans	0.	28.	166.	171.	34.	0.	0.	0.	0.	0.	0.	0.

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Diversion Water Requirement

Unit:x1000 m3

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Paddy-nursery	0.	0.	0.	0.	13.	1.	0.	0.	0.	0.	0.	0.
2 Wet season paddy	0.	0.	0.	0.	0.	202.	108.	56.	2.	0.	0.	0.
1 Paddy-nursery	0.	0.	0.	0.	0.	0.	0.	0.	0.	10.	0.	0.
3 Dry season paddy	128.	34.	0.	0.	0.	0.	0.	0.	0.	0.	136.	66.
4 Beans	0.	4.	25.	26.	5.	0.	0.	0.	0.	0.	0.	0.
Total	128.	38.	25.	26.	18.	203.	108.	56.	2.	10.	136.	66.

Diversion Water Requirement for Bayugo Irrigation System (50 ha)
(Total Area : 50. ha)

Unit:x1000 m3

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1969	126.	38.	23.	24.	16.	207.	13.	74.	15.	9.	179.	0.	724.
1970	118.	36.	22.	19.	14.	161.	20.	79.	0.	6.	117.	20.	612.
1971	129.	35.	12.	23.	9.	145.	16.	58.	4.	6.	129.	0.	567.
1972	95.	38.	14.	19.	13.	148.	0.	20.	17.	7.	148.	64.	584.
1973	115.	38.	24.	24.	15.	159.	45.	78.	2.	6.	129.	0.	634.
1974	129.	36.	23.	24.	14.	166.	71.	9.	13.	6.	127.	0.	619.
1975	65.	38.	11.	0.	16.	189.	109.	22.	2.	7.	153.	0.	611.
1976	121.	38.	23.	19.	7.	154.	34.	21.	2.	9.	146.	0.	573.
1977	44.	36.	20.	24.	15.	151.	49.	23.	2.	9.	150.	122.	645.
1978	123.	38.	25.	21.	15.	214.	83.	4.	1.	5.	170.	66.	764.
1979	129.	37.	24.	0.	9.	151.	77.	19.	2.	7.	142.	119.	718.
1980	129.	38.	10.	23.	15.	153.	21.	26.	16.	6.	128.	12.	580.
1981	125.	38.	24.	22.	14.	156.	14.	53.	2.	6.	131.	85.	669.
1982	129.	37.	21.	22.	16.	197.	6.	68.	1.	9.	165.	97.	768.
1983	105.	38.	23.	26.	18.	212.	23.	43.	17.	6.	191.	128.	830.
1984	129.	38.	23.	17.	11.	161.	119.	16.	11.	6.	183.	118.	832.
1985	129.	37.	21.	17.	14.	141.	28.	105.	12.	6.	187.	83.	781.
1986	129.	38.	25.	25.	14.	247.	23.	15.	15.	6.	132.	84.	753.
1987	128.	38.	25.	26.	18.	203.	108.	56.	2.	10.	136.	66.	815.
1988	73.	31.	25.	6.	16.	150.	70.	45.	14.	6.	128.	128.	691.
Ave.	114.	37.	21.	19.	14.	173.	46.	42.	8.	7.	149.	60.	689.

Table VI 2.4 (3) Diversion Water Requirements of Each Irrigation System

Summary of crop and basic assumption
in Manggahan Irrigation System (55 ha)

No.		Crop	Cultiva. Area(ha)	Date of Water Issue	Land Preparation Period (stages)
1	1	Paddy-nursery	2.	5/ 1	1
2	2	Wet season paddy	45.	6/ 1	1
1	1	Paddy-nursery	2.	10/ 1	1
3	3	Dry season paddy	45.	11/ 1	1
4	4	Beans	13.	2/16	2
5	5	Dry season beans	5.	12/16	2
6	6	Dry season corn	2.	12/16	2
7	7	Wet season corn	5.	5/ 1	2
8	8	Eggplant	2.	4/16	2
9	9	String bean	2.	5/ 1	2
10	10	Tomato	2.	9/16	2
11	11	Bitter gourd	2.	10/ 1	2
12	12	Late wet season corn	2.	8/ 1	2
13	13	Wet season soybeans	2.	8/16	2
		Total Project Area	55.		

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Unit Diversion Water Requirement

Unit:mm

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Paddy-nursery	0.	0.	0.	0.	503.	36.	0.	0.	0.	0.	0.	0.
2 Wet season paddy	0.	0.	0.	0.	0.	405.	216.	112.	4.	0.	0.	0.
1 Paddy-nursery	0.	0.	0.	0.	0.	0.	0.	0.	0.	395.	0.	0.
3 Dry season paddy	255.	67.	0.	0.	0.	0.	0.	0.	0.	0.	273.	133.
4 Beans	0.	28.	166.	171.	34.	0.	0.	0.	0.	0.	0.	0.
5 Dry season beans	107.	150.	183.	61.	0.	0.	0.	0.	0.	0.	0.	13.
6 Dry season corn	115.	138.	239.	155.	20.	0.	0.	0.	0.	0.	0.	20.
7 Wet season corn	0.	0.	0.	0.	99.	2.	90.	0.	0.	0.	0.	0.
8 Eggplant	0.	0.	0.	29.	112.	15.	46.	0.	0.	0.	0.	0.
9 String bean	0.	0.	0.	0.	97.	24.	46.	0.	0.	0.	0.	0.
10 Tomato	0.	0.	0.	0.	0.	0.	0.	0.	5.	71.	0.	0.
11 Bitter gourd	53.	0.	0.	0.	0.	0.	0.	0.	0.	61.	0.	2.
12 Late wet season corn	0.	0.	0.	0.	0.	0.	0.	19.	0.	58.	0.	3.
13 Wet season soybeans	0.	0.	0.	0.	0.	0.	0.	8.	0.	44.	0.	0.

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Diversion Water Requirement

Unit:x1000 m3

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Paddy-nursery	0.	0.	0.	0.	13.	1.	0.	0.	0.	0.	0.	0.
2 Wet season paddy	0.	0.	0.	0.	0.	182.	97.	50.	2.	0.	0.	0.
1 Paddy-nursery	0.	0.	0.	0.	0.	0.	0.	0.	0.	10.	0.	0.
3 Dry season paddy	115.	30.	0.	0.	0.	0.	0.	0.	0.	0.	123.	60.
4 Beans	0.	4.	22.	23.	5.	0.	0.	0.	0.	0.	0.	0.
5 Dry season beans	5.	8.	9.	3.	0.	0.	0.	0.	0.	0.	0.	1.
6 Dry season corn	3.	3.	6.	4.	0.	0.	0.	0.	0.	0.	0.	0.
7 Wet season corn	0.	0.	0.	0.	5.	0.	5.	0.	0.	0.	0.	0.
8 Eggplant	0.	0.	0.	1.	3.	0.	1.	0.	0.	0.	0.	0.
9 String bean	0.	0.	0.	0.	2.	1.	1.	0.	0.	0.	0.	0.
10 Tomato	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.	0.	0.
11 Bitter gourd	1.	0.	0.	0.	0.	0.	0.	0.	0.	2.	0.	0.
12 Late wet season corn	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.
13 Wet season soybeans	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.
Total	124.	45.	38.	31.	28.	184.	104.	51.	2.	16.	123.	61.

Diversion Water Requirement for Manggahan Irrigation System (55 ha)
(Total Area : 55. ha)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1969	123.	45.	35.	29.	24.	188.	12.	68.	14.	11.	161.	0.	710.
1970	114.	42.	32.	23.	19.	145.	18.	73.	0.	6.	105.	18.	597.
1971	126.	40.	17.	27.	9.	130.	14.	53.	4.	6.	116.	0.	544.
1972	91.	45.	22.	23.	16.	133.	0.	18.	17.	7.	134.	59.	562.
1973	111.	44.	36.	29.	22.	143.	41.	72.	2.	6.	116.	0.	622.
1974	127.	41.	35.	29.	18.	150.	65.	8.	12.	6.	114.	0.	606.
1975	60.	44.	16.	0.	25.	170.	106.	20.	2.	7.	138.	0.	586.
1976	117.	44.	34.	23.	7.	138.	30.	19.	2.	11.	131.	0.	558.
1977	40.	41.	31.	29.	22.	136.	44.	21.	2.	10.	135.	116.	626.
1978	120.	44.	38.	25.	20.	197.	78.	3.	1.	5.	153.	60.	744.
1979	126.	44.	37.	0.	9.	136.	72.	17.	2.	7.	128.	114.	692.
1980	127.	46.	15.	28.	21.	138.	19.	24.	15.	6.	115.	11.	566.
1981	122.	45.	36.	26.	20.	140.	12.	48.	2.	6.	118.	79.	654.
1982	127.	43.	31.	26.	24.	178.	5.	62.	1.	13.	148.	91.	750.
1983	101.	45.	34.	31.	30.	195.	21.	39.	17.	6.	172.	124.	814.
1984	127.	45.	35.	20.	13.	145.	115.	15.	11.	6.	165.	112.	807.
1985	127.	43.	32.	20.	19.	127.	26.	100.	11.	6.	168.	77.	756.
1986	126.	44.	38.	30.	19.	235.	20.	14.	14.	6.	118.	78.	743.
1987	124.	45.	38.	31.	28.	184.	104.	51.	2.	16.	123.	61.	806.
1988	69.	35.	37.	7.	22.	135.	64.	41.	13.	6.	115.	123.	666.
Ave.	110.	43.	31.	23.	19.	157.	43.	38.	7.	8.	134.	56.	670.

Table VI 2.4 (4) Diversion Water Requirements of Each Irrigation System

Summary of crop and basic assumption
in Lubo Irrigation System (45 ha)

No.		Crop	Cultiva. Area(ha)	Date of Water Issue	Land Preparation Period (stages)
1	1	Paddy-nursery	1.	5/ 1	1
2	2	Wet season paddy	30.	6/ 1	1
1	1	Paddy-nursery	1.	10/ 1	1
3	3	Dry season paddy	30.	11/ 1	1
4	4	Beans	9.	2/16	2
5	5	Dry season beans	7.	12/16	2
6	6	Dry season corn	4.	12/16	2
7	7	Wet season corn	4.	5/ 1	2
8	8	Eggplant	4.	4/16	2
9	9	String bean	4.	5/ 1	2
10	10	Tomato	4.	9/16	2
11	11	Bitter gourd	4.	10/ 1	2
12	12	Late wet season corn	4.	8/ 1	2
13	13	Wet season soybeans	4.	8/16	2
		Total Project Area	45.		

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Unit Diversion Water Requirement

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Paddy-nursery	0.	0.	0.	0.	503.	36.	0.	0.	0.	0.	0.	0.
2 Wet season paddy	0.	0.	0.	0.	0.	405.	216.	112.	4.	0.	0.	0.
1 Paddy-nursery	0.	0.	0.	0.	0.	0.	0.	0.	0.	395.	0.	0.
3 Dry season paddy	255.	67.	0.	0.	0.	0.	0.	0.	0.	0.	273.	133.
4 Beans	0.	28.	166.	171.	34.	0.	0.	0.	0.	0.	0.	0.
5 Dry season beans	107.	150.	183.	61.	0.	0.	0.	0.	0.	0.	0.	13.
6 Dry season corn	115.	138.	239.	155.	20.	0.	0.	0.	0.	0.	0.	20.
7 Wet season corn	0.	0.	0.	0.	99.	2.	90.	0.	0.	0.	0.	0.
8 Eggplant	0.	0.	0.	29.	112.	15.	46.	0.	0.	0.	0.	0.
9 String bean	0.	0.	0.	0.	97.	24.	46.	0.	0.	0.	0.	0.
10 Tomato	0.	0.	0.	0.	0.	0.	0.	0.	5.	71.	0.	0.
11 Bitter gourd	53.	0.	0.	0.	0.	0.	0.	0.	0.	61.	0.	2.
12 Late wet season corn	0.	0.	0.	0.	0.	0.	0.	19.	0.	58.	0.	3.
13 Wet season soybeans	0.	0.	0.	0.	0.	0.	0.	8.	0.	44.	0.	0.

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Diversion Water Requirement

Unit:x1000 m3

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Paddy-nursery	0.	0.	0.	0.	8.	1.	0.	0.	0.	0.	0.	0.
2 Wet season paddy	0.	0.	0.	0.	0.	121.	65.	34.	1.	0.	0.	0.
1 Paddy-nursery	0.	0.	0.	0.	0.	0.	0.	0.	0.	6.	0.	0.
3 Dry season paddy	77.	20.	0.	0.	0.	0.	0.	0.	0.	0.	82.	40.
4 Beans	0.	2.	15.	15.	3.	0.	0.	0.	0.	0.	0.	0.
5 Dry season beans	8.	11.	14.	5.	0.	0.	0.	0.	0.	0.	0.	1.
6 Dry season corn	4.	5.	9.	6.	1.	0.	0.	0.	0.	0.	0.	1.
7 Wet season corn	0.	0.	0.	0.	4.	0.	3.	0.	0.	0.	0.	0.
8 Eggplant	0.	0.	0.	1.	4.	1.	2.	0.	0.	0.	0.	0.
9 String bean	0.	0.	0.	0.	4.	1.	2.	0.	0.	0.	0.	0.
10 Tomato	0.	0.	0.	0.	0.	0.	0.	0.	0.	3.	0.	0.
11 Bitter gourd	2.	0.	0.	0.	0.	0.	0.	0.	0.	2.	0.	0.
12 Late wet season corn	0.	0.	0.	0.	0.	0.	0.	1.	0.	2.	0.	0.
13 Wet season soybeans	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.	0.	0.
Total	91.	39.	38.	27.	23.	124.	72.	35.	1.	15.	82.	42.

Diversion Water Requirement for Lubo Irrigation System (45 ha)
(Total Area : 45. ha)

Unit:x1000 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1969	90.	39.	35.	25.	19.	127.	8.	46.	10.	9.	108.	0.	515.
1970	83.	36.	32.	20.	15.	97.	12.	50.	0.	4.	70.	13.	431.
1971	92.	34.	17.	24.	6.	87.	10.	36.	3.	4.	78.	0.	390.
1972	65.	39.	22.	20.	11.	89.	0.	12.	12.	4.	89.	40.	402.
1973	80.	38.	36.	25.	17.	96.	27.	49.	1.	4.	77.	0.	451.
1974	94.	35.	35.	25.	13.	100.	44.	5.	9.	4.	76.	0.	440.
1975	41.	38.	16.	0.	20.	113.	73.	13.	1.	4.	92.	0.	411.
1976	85.	38.	34.	20.	4.	92.	20.	13.	2.	8.	88.	0.	405.
1977	27.	35.	31.	25.	17.	91.	29.	14.	1.	8.	90.	84.	451.
1978	87.	38.	38.	22.	15.	133.	53.	2.	1.	3.	102.	41.	536.
1979	93.	38.	37.	0.	6.	91.	49.	11.	2.	4.	85.	82.	497.
1980	93.	41.	15.	24.	16.	92.	13.	16.	10.	4.	77.	8.	410.
1981	89.	39.	37.	23.	15.	93.	8.	33.	1.	4.	78.	55.	475.
1982	94.	37.	31.	23.	20.	119.	3.	42.	0.	11.	99.	64.	543.
1983	73.	39.	34.	27.	25.	132.	14.	26.	12.	4.	115.	91.	591.
1984	93.	39.	35.	17.	8.	96.	80.	10.	7.	3.	110.	80.	580.
1985	93.	37.	32.	17.	14.	85.	17.	68.	8.	4.	112.	54.	541.
1986	93.	38.	38.	26.	15.	163.	14.	9.	10.	4.	79.	54.	541.
1987	91.	39.	38.	27.	23.	124.	72.	35.	1.	15.	82.	42.	588.
1988	48.	29.	37.	5.	18.	90.	43.	28.	9.	3.	77.	89.	476.
Ave.	80.	37.	31.	20.	15.	105.	29.	26.	5.	5.	89.	40.	484.

Table VI 2.4 (5) Diversion Water Requirements of Each Irrigation System

Summary of crop and basic assumption
in Llano Irrigation System (65 ha)

No.	Crop	Cultiva. Area(ha)	Date of Water Issue	Land Preparation Period (stages)
1	1 Paddy-nursery	3.	5/ 1	1
2	2 Wet season paddy	65.	6/ 1	1
1	1 Paddy-nursery	3.	10/ 1	1
3	3 Dry season paddy	65.	11/ 1	1
4	4 Beans	19.	2/16	2
	Total Project Area	65.		

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Unit Diversion Water Requirement

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Paddy-nursery	0.	0.	0.	0.	503.	36.	0.	0.	0.	0.	0.	0.
2 Wet season paddy	0.	0.	0.	0.	0.	405.	216.	112.	4.	0.	0.	0.
1 Paddy-nursery	0.	0.	0.	0.	0.	0.	0.	0.	0.	395.	0.	0.
3 Dry season paddy	255.	67.	0.	0.	0.	0.	0.	0.	0.	0.	273.	133.
4 Beans	0.	28.	166.	171.	34.	0.	0.	0.	0.	0.	0.	0.

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Diversion Water Requirement

Unit:x1000 m3

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Paddy-nursery	0.	0.	0.	0.	17.	1.	0.	0.	0.	0.	0.	0.
2 Wet season paddy	0.	0.	0.	0.	0.	263.	141.	73.	3.	0.	0.	0.
1 Paddy-nursery	0.	0.	0.	0.	0.	0.	0.	0.	0.	13.	0.	0.
3 Dry season paddy	166.	44.	0.	0.	0.	0.	0.	0.	0.	0.	177.	86.
4 Beans	0.	5.	32.	33.	7.	0.	0.	0.	0.	0.	0.	0.
Total	166.	49.	32.	33.	23.	264.	141.	73.	3.	13.	177.	86.

Diversion Water Requirement for Llano Irrigation System (65 ha)
(Total Area : 65. ha)

Unit:x1000 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1969	164.	49.	30.	31.	21.	269.	17.	96.	20.	12.	233.	0.	942.
1970	153.	47.	28.	25.	19.	209.	27.	102.	0.	8.	152.	26.	796.
1971	168.	45.	15.	30.	12.	188.	21.	76.	5.	8.	168.	0.	737.
1972	123.	49.	19.	25.	17.	193.	0.	26.	23.	9.	193.	83.	759.
1973	149.	49.	31.	31.	20.	207.	59.	101.	2.	8.	167.	0.	825.
1974	168.	46.	30.	32.	18.	216.	92.	12.	17.	8.	165.	0.	805.
1975	85.	49.	14.	0.	22.	245.	142.	28.	3.	9.	199.	0.	795.
1976	157.	49.	30.	25.	10.	200.	44.	27.	3.	12.	190.	0.	745.
1977	57.	46.	27.	31.	20.	197.	63.	30.	2.	12.	195.	158.	839.
1978	160.	49.	32.	27.	19.	278.	107.	5.	1.	7.	221.	85.	993.
1979	168.	49.	32.	0.	13.	196.	100.	25.	3.	9.	185.	155.	934.
1980	168.	49.	13.	30.	20.	200.	28.	34.	21.	8.	167.	16.	754.
1981	163.	49.	31.	28.	19.	202.	18.	69.	2.	9.	170.	110.	870.
1982	168.	48.	27.	29.	21.	257.	8.	88.	1.	12.	214.	126.	999.
1983	137.	49.	29.	33.	24.	276.	30.	56.	23.	9.	248.	166.	1079.
1984	168.	49.	30.	22.	15.	209.	155.	21.	15.	7.	238.	153.	1082.
1985	168.	48.	28.	22.	19.	183.	37.	136.	16.	8.	243.	108.	1016.
1986	168.	49.	32.	33.	19.	322.	29.	20.	19.	8.	171.	109.	979.
1987	166.	49.	32.	33.	23.	264.	141.	73.	3.	13.	177.	86.	1061.
1988	95.	41.	32.	8.	20.	195.	90.	59.	18.	8.	166.	166.	898.
Ave.	148.	48.	27.	25.	19.	225.	60.	54.	10.	9.	193.	77.	895.

Table VI 2.4 (6) Diversion Water Requirements of Each Irrigation System

Summary of crop and basic assumption
in Punta Irrigation System (35 ha)

No.	Crop	Cultiva. Area(ha)	Date of Water Issue	Land Preparation Period (stages)
1	1 Paddy-nursery	2.	5/ 1	1
2	2 Wet season paddy	35.	6/ 1	1
1	1 Paddy-nursery	2.	10/ 1	1
3	3 Dry season paddy	35.	11/ 1	1
4	4 Beans	10.	2/16	2
	Total Project Area	35.		

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Unit Diversion Water Requirement

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Paddy-nursery	0.	0.	0.	0.	503.	36.	0.	0.	0.	0.	0.	0.
2 Wet season paddy	0.	0.	0.	0.	0.	405.	216.	112.	4.	0.	0.	0.
1 Paddy-nursery	0.	0.	0.	0.	0.	0.	0.	0.	0.	395.	0.	0.
3 Dry season paddy	255.	67.	0.	0.	0.	0.	0.	0.	0.	0.	273.	133.
4 Beans	0.	28.	166.	171.	34.	0.	0.	0.	0.	0.	0.	0.

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Diversion Water Requirement

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Paddy-nursery	0.	0.	0.	0.	9.	1.	0.	0.	0.	0.	0.	0.
2 Wet season paddy	0.	0.	0.	0.	0.	142.	76.	39.	1.	0.	0.	0.
1 Paddy-nursery	0.	0.	0.	0.	0.	0.	0.	0.	0.	7.	0.	0.
3 Dry season paddy	89.	23.	0.	0.	0.	0.	0.	0.	0.	0.	95.	46.
4 Beans	0.	3.	17.	18.	4.	0.	0.	0.	0.	0.	0.	0.
Total	89.	26.	17.	18.	13.	142.	76.	39.	1.	7.	95.	46.

Diversion Water Requirement for Punta Irrigation System (35 ha)
(Total Area : 35. ha)

Unit:x1000 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1969	89.	26.	16.	17.	12.	145.	9.	52.	11.	6.	125.	0.	507.
1970	82.	26.	15.	14.	10.	113.	14.	55.	0.	4.	82.	14.	429.
1971	90.	24.	8.	16.	7.	101.	11.	41.	3.	4.	91.	0.	397.
1972	66.	26.	10.	14.	9.	104.	0.	14.	12.	5.	104.	45.	409.
1973	80.	26.	17.	17.	11.	111.	32.	55.	1.	5.	90.	0.	444.
1974	91.	25.	16.	17.	10.	117.	49.	6.	9.	5.	89.	0.	434.
1975	46.	26.	7.	0.	12.	132.	77.	15.	1.	5.	107.	0.	428.
1976	84.	26.	16.	14.	5.	108.	24.	15.	2.	6.	102.	0.	402.
1977	31.	25.	14.	17.	11.	106.	34.	16.	1.	6.	105.	85.	452.
1978	86.	26.	17.	15.	10.	150.	58.	3.	1.	4.	119.	46.	535.
1979	91.	26.	17.	0.	7.	106.	54.	13.	2.	5.	99.	84.	503.
1980	91.	27.	7.	16.	11.	107.	15.	18.	11.	5.	90.	8.	406.
1981	88.	26.	17.	15.	10.	109.	10.	37.	1.	5.	91.	59.	469.
1982	91.	26.	14.	15.	12.	138.	4.	47.	1.	7.	115.	68.	538.
1983	74.	26.	16.	18.	13.	149.	16.	30.	12.	5.	134.	89.	581.
1984	91.	26.	16.	12.	8.	112.	83.	11.	8.	4.	128.	82.	583.
1985	91.	26.	15.	12.	10.	99.	20.	73.	9.	5.	131.	58.	547.
1986	91.	26.	17.	18.	10.	173.	16.	11.	10.	5.	92.	59.	527.
1987	89.	26.	17.	18.	13.	142.	76.	39.	1.	7.	95.	46.	571.
1988	51.	22.	17.	4.	11.	105.	49.	32.	10.	4.	89.	89.	484.
Ave.	80.	26.	15.	13.	10.	121.	32.	29.	5.	5.	104.	42.	482.

Table VI 2.4 (7) Diversion Water Requirements of Each Irrigation System

Summary of crop and basic assumption
in IK-IK Irrigation System (45 ha) Pulong Ligaya Irrigation System (45 ha)

No.	Crop	Cultiva. Area(ha)	Date of Water Issue	Land Preparation Period (stages)
1	1 Paddy-nursery	2.	5/ 1	1
2	2 Wet season paddy	45.	6/ 1	1
1	1 Paddy-nursery	2.	10/ 1	1
3	3 Dry season paddy	45.	11/ 1	1
4	4 Beans	13.	2/16	2
	Total Project Area	45.		

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Unit Diversion Water Requirement

Unit:mm

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Paddy-nursery	0.	0.	0.	0.	503.	36.	0.	0.	0.	0.	0.	0.
2 Wet season paddy	0.	0.	0.	0.	0.	405.	216.	112.	4.	0.	0.	0.
1 Paddy-nursery	0.	0.	0.	0.	0.	0.	0.	0.	0.	395.	0.	0.
3 Dry season paddy	255.	67.	0.	0.	0.	0.	0.	0.	0.	0.	273.	133.
4 Beans	0.	28.	166.	171.	34.	0.	0.	0.	0.	0.	0.	0.

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Diversion Water Requirement

Unit:x1000 m3

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Paddy-nursery	0.	0.	0.	0.	12.	1.	0.	0.	0.	0.	0.	0.
2 Wet season paddy	0.	0.	0.	0.	0.	182.	97.	50.	2.	0.	0.	0.
1 Paddy-nursery	0.	0.	0.	0.	0.	0.	0.	0.	0.	9.	0.	0.
3 Dry season paddy	115.	30.	0.	0.	0.	0.	0.	0.	0.	0.	123.	60.
4 Beans	0.	4.	22.	23.	5.	0.	0.	0.	0.	0.	0.	0.
Total	115.	34.	22.	23.	16.	183.	97.	50.	2.	9.	123.	60.

Diversion Water Requirement for IK-IK Irrigation System (45 ha) Pulong Ligaya
(Total Area : 45. ha)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1969	114.	34.	21.	22.	15.	186.	12.	66.	14.	8.	161.	0.	652.
1970	106.	33.	19.	18.	13.	145.	18.	71.	0.	5.	105.	18.	551.
1971	116.	31.	11.	21.	9.	130.	14.	52.	4.	6.	116.	0.	510.
1972	85.	34.	13.	18.	12.	133.	0.	18.	16.	6.	134.	58.	526.
1973	103.	34.	21.	22.	14.	143.	41.	70.	2.	6.	116.	0.	571.
1974	117.	32.	21.	22.	13.	150.	64.	8.	12.	6.	114.	0.	558.
1975	59.	34.	10.	0.	15.	170.	98.	20.	2.	6.	138.	0.	551.
1976	108.	34.	20.	17.	7.	138.	30.	19.	2.	8.	131.	0.	516.
1977	40.	32.	18.	22.	14.	136.	44.	21.	2.	8.	135.	110.	581.
1978	111.	34.	22.	19.	13.	193.	74.	3.	1.	5.	153.	59.	688.
1979	117.	34.	22.	0.	9.	136.	70.	17.	2.	6.	128.	107.	647.
1980	117.	34.	9.	21.	14.	138.	19.	23.	14.	6.	115.	11.	522.
1981	113.	34.	22.	20.	13.	140.	12.	48.	2.	6.	118.	76.	602.
1982	117.	33.	19.	20.	15.	178.	5.	61.	1.	9.	148.	87.	691.
1983	95.	34.	20.	23.	17.	191.	21.	38.	16.	6.	172.	115.	747.
1984	117.	34.	21.	15.	10.	145.	107.	15.	10.	5.	165.	106.	749.
1985	117.	34.	19.	15.	13.	127.	26.	94.	11.	6.	168.	75.	704.
1986	117.	34.	22.	23.	13.	223.	20.	14.	13.	6.	118.	75.	678.
1987	115.	34.	22.	23.	16.	183.	97.	50.	2.	9.	123.	60.	734.
1988	66.	28.	22.	5.	14.	135.	63.	41.	13.	5.	115.	115.	622.
Ave.	102.	33.	19.	17.	13.	156.	42.	37.	7.	6.	134.	54.	620.

Table VI 2.4 (8) Diversion Water Requirements of Each Irrigation System

Summary of crop and basic assumption
in Lumang Nayon Irrigation System (95 ha)

No.	Crop	Cultiva. Area(ha)	Date of Water Issue	Land Preparation Period (stages)
1	1 Paddy-nursery	5.	5/ 1	1
2	2 Wet season paddy	95.	6/ 1	1
1	1 Paddy-nursery	5.	10/ 1	1
3	3 Dry season paddy	95.	11/ 1	1
4	4 Beans	28.	2/16	2
	Total Project Area	95.		

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Unit Diversion Water Requirement

Unit:mm

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Paddy-nursery	0.	0.	0.	0.	503.	36.	0.	0.	0.	0.	0.	0.
2 Wet season paddy	0.	0.	0.	0.	0.	405.	216.	112.	4.	0.	0.	0.
1 Paddy-nursery	0.	0.	0.	0.	0.	0.	0.	0.	0.	395.	0.	0.
3 Dry season paddy	255.	67.	0.	0.	0.	0.	0.	0.	0.	0.	273.	133.
4 Beans	0.	28.	166.	171.	34.	0.	0.	0.	0.	0.	0.	0.

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Diversion Water Requirement

Unit:x1000 m3

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Paddy-nursery	0.	0.	0.	0.	24.	2.	0.	0.	0.	0.	0.	0.
2 Wet season paddy	0.	0.	0.	0.	0.	385.	206.	106.	4.	0.	0.	0.
1 Paddy-nursery	0.	0.	0.	0.	0.	0.	0.	0.	0.	19.	0.	0.
3 Dry season paddy	243.	64.	0.	0.	0.	0.	0.	0.	0.	0.	259.	126.
4 Beans	0.	8.	47.	49.	10.	0.	0.	0.	0.	0.	0.	0.
Total	243.	72.	47.	49.	34.	386.	206.	106.	4.	19.	259.	126.

Diversion Water Requirement for Lumang Nayon Irrigation System (95 ha)
(Total Area : 95. ha)

Unit:x1000 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1969	240.	72.	44.	46.	31.	393.	24.	140.	29.	17.	341.	0.	1377.
1970	223.	69.	41.	37.	27.	306.	39.	149.	0.	11.	222.	38.	1163.
1971	245.	66.	22.	43.	18.	275.	31.	111.	8.	12.	246.	0.	1077.
1972	180.	71.	28.	37.	25.	282.	0.	38.	33.	13.	282.	122.	1109.
1973	218.	71.	45.	46.	30.	302.	86.	148.	3.	12.	244.	0.	1206.
1974	246.	68.	44.	46.	26.	316.	134.	17.	26.	12.	241.	0.	1177.
1975	124.	71.	20.	0.	32.	359.	208.	41.	4.	13.	291.	0.	1162.
1976	229.	71.	43.	37.	14.	292.	64.	40.	4.	17.	278.	0.	1089.
1977	84.	68.	39.	46.	30.	288.	92.	44.	3.	17.	284.	231.	1225.
1978	234.	71.	47.	40.	28.	407.	157.	7.	2.	10.	323.	125.	1451.
1979	246.	71.	46.	0.	18.	287.	147.	36.	4.	13.	270.	227.	1365.
1980	246.	72.	20.	44.	29.	292.	40.	49.	30.	12.	244.	23.	1102.
1981	238.	71.	46.	42.	28.	296.	26.	100.	3.	12.	248.	161.	1271.
1982	246.	70.	39.	42.	31.	375.	11.	129.	1.	18.	313.	184.	1459.
1983	200.	71.	43.	49.	35.	404.	43.	81.	33.	12.	363.	243.	1577.
1984	246.	72.	44.	31.	22.	305.	226.	31.	22.	11.	348.	223.	1581.
1985	246.	71.	41.	32.	27.	268.	54.	199.	23.	12.	354.	158.	1485.
1986	246.	71.	47.	48.	28.	470.	43.	29.	28.	12.	250.	159.	1431.
1987	243.	72.	47.	49.	34.	386.	206.	106.	4.	19.	259.	126.	1550.
1988	140.	59.	47.	11.	30.	285.	132.	86.	27.	11.	243.	243.	1313.
Ave.	216.	70.	40.	36.	27.	329.	88.	79.	14.	13.	282.	113.	1309.

Table VI 2.4 (9) Diversion Water Requirements of Each Irrigation System

Summary of crop and basic assumption
in Bagumbong Irrigation System p-1-1 (65 ha)

No.	Crop	Cultiva. Area(ha)	Date of Water Issue	Land Preparation Period (stages)
1	1 Paddy-nursery	3.	5/ 1	1
2	2 Wet season paddy	65.	6/ 1	1
1	1 Paddy-nursery	3.	10/ 1	1
3	3 Dry season paddy	65.	11/ 1	1
4	4 Beans	19.	2/16	2
	Total Project Area	65.		

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Unit Diversion Water Requirement

Unit:mm

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Paddy-nursery	0.	0.	0.	0.	503.	36.	0.	0.	0.	0.	0.	0.
2 Wet season paddy	0.	0.	0.	0.	0.	405.	216.	112.	4.	0.	0.	0.
1 Paddy-nursery	0.	0.	0.	0.	0.	0.	0.	0.	0.	395.	0.	0.
3 Dry season paddy	255.	67.	0.	0.	0.	0.	0.	0.	0.	0.	273.	133.
4 Beans	0.	28.	166.	171.	34.	0.	0.	0.	0.	0.	0.	0.

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Diversion Water Requirement

Unit:x1000 m3

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Paddy-nursery	0.	0.	0.	0.	17.	1.	0.	0.	0.	0.	0.	0.
2 Wet season paddy	0.	0.	0.	0.	0.	263.	141.	73.	3.	0.	0.	0.
1 Paddy-nursery	0.	0.	0.	0.	0.	0.	0.	0.	0.	13.	0.	0.
3 Dry season paddy	166.	44.	0.	0.	0.	0.	0.	0.	0.	0.	177.	86.
4 Beans	0.	5.	32.	33.	7.	0.	0.	0.	0.	0.	0.	0.
Total	166.	49.	32.	33.	24.	264.	141.	73.	3.	13.	177.	86.

Diversion Water Requirement for Bagumbong Irrigation System p-1-1 (65 ha)
(Total Area : 65. ha)

Unit:x1000 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1969	164.	49.	30.	31.	22.	269.	17.	96.	20.	12.	233.	0.	943.
1970	153.	47.	28.	25.	19.	209.	27.	102.	0.	8.	152.	26.	797.
1971	168.	45.	15.	30.	13.	188.	21.	76.	5.	8.	168.	0.	738.
1972	123.	49.	19.	25.	17.	193.	0.	26.	23.	9.	193.	83.	760.
1973	149.	49.	31.	31.	21.	207.	59.	101.	2.	9.	167.	0.	826.
1974	168.	46.	30.	32.	19.	216.	92.	12.	17.	9.	165.	0.	806.
1975	85.	49.	14.	0.	22.	245.	142.	28.	3.	9.	199.	0.	796.
1976	157.	49.	30.	25.	10.	200.	44.	27.	3.	12.	190.	0.	746.
1977	57.	46.	27.	31.	21.	197.	63.	30.	2.	12.	195.	158.	839.
1978	160.	49.	32.	27.	20.	279.	107.	5.	1.	7.	221.	85.	994.
1979	168.	49.	32.	0.	13.	196.	100.	25.	3.	9.	185.	155.	935.
1980	168.	49.	13.	30.	20.	200.	28.	34.	21.	9.	167.	16.	755.
1981	163.	49.	31.	28.	19.	202.	18.	69.	2.	9.	170.	110.	871.
1982	168.	48.	27.	29.	22.	257.	8.	88.	1.	13.	214.	126.	1000.
1983	137.	49.	29.	33.	25.	276.	30.	56.	23.	9.	248.	166.	1080.
1984	168.	49.	30.	22.	15.	209.	155.	21.	15.	8.	238.	153.	1083.
1985	168.	48.	28.	22.	19.	183.	37.	136.	16.	9.	243.	108.	1017.
1986	168.	49.	32.	33.	19.	322.	29.	20.	19.	9.	171.	109.	980.
1987	166.	49.	32.	33.	24.	264.	141.	73.	3.	13.	177.	86.	1062.
1988	95.	41.	32.	8.	21.	195.	90.	59.	18.	8.	166.	166.	899.
Ave.	148.	48.	27.	25.	19.	225.	60.	54.	10.	9.	193.	77.	896.

Table VI 2.4 (10) Diversion Water Requirements of Each Irrigation System

Summary of crop and basic assumption
in Bgumbong Irrigation System pump-2-1 (20 ha)

No.	Crop	Cultiva. Area(ha)	Date of Water Issue	Land Preparation Period (stages)
1	1 Paddy-nursery	1.	5/ 1	1
2	2 Wet season paddy	20.	6/ 1	1
1	1 Paddy-nursery	1.	10/ 1	1
3	3 Dry season paddy	20.	11/ 1	1
4	4 Beans	6.	2/16	2
	Total Project Area	20.		

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Unit Diversion Water Requirement

Unit:mm

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Paddy-nursery	0.	0.	0.	0.	503.	36.	0.	0.	0.	0.	0.	0.
2 Wet season paddy	0.	0.	0.	0.	0.	405.	216.	112.	4.	0.	0.	0.
1 Paddy-nursery	0.	0.	0.	0.	0.	0.	0.	0.	0.	395.	0.	0.
3 Dry season paddy	255.	67.	0.	0.	0.	0.	0.	0.	0.	0.	273.	133.
4 Beans	0.	28.	166.	171.	34.	0.	0.	0.	0.	0.	0.	0.

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Diversion Water Requirement

Unit:x1000 m3

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Paddy-nursery	0.	0.	0.	0.	5.	0.	0.	0.	0.	0.	0.	0.
2 Wet season paddy	0.	0.	0.	0.	0.	81.	43.	22.	1.	0.	0.	0.
1 Paddy-nursery	0.	0.	0.	0.	0.	0.	0.	0.	0.	4.	0.	0.
3 Dry season paddy	51.	13.	0.	0.	0.	0.	0.	0.	0.	0.	55.	27.
4 Beans	0.	2.	10.	10.	2.	0.	0.	0.	0.	0.	0.	0.
Total	51.	15.	10.	10.	7.	81.	43.	22.	1.	4.	55.	27.

Diversion Water Requirement for Bgumbong Irrigation System pump-2-1 (20 ha)
(Total Area : 20. ha)

Unit:x1000 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1969	51.	15.	9.	10.	6.	83.	5.	29.	6.	4.	72.	0.	290.
1970	47.	15.	9.	8.	6.	64.	8.	31.	0.	2.	47.	8.	245.
1971	52.	14.	5.	9.	4.	58.	6.	23.	2.	2.	52.	0.	227.
1972	38.	15.	6.	8.	5.	59.	0.	8.	7.	3.	59.	26.	233.
1973	46.	15.	10.	10.	6.	64.	18.	31.	1.	3.	51.	0.	254.
1974	52.	14.	9.	10.	6.	67.	28.	4.	5.	3.	51.	0.	248.
1975	26.	15.	4.	0.	7.	75.	44.	9.	1.	3.	61.	0.	245.
1976	48.	15.	9.	8.	3.	62.	13.	8.	1.	4.	58.	0.	229.
1977	18.	14.	8.	10.	6.	61.	19.	9.	1.	3.	60.	49.	258.
1978	49.	15.	10.	8.	6.	86.	33.	1.	0.	2.	68.	26.	305.
1979	52.	15.	10.	0.	4.	60.	31.	8.	1.	3.	57.	48.	287.
1980	52.	15.	4.	9.	6.	61.	8.	10.	6.	3.	51.	5.	232.
1981	50.	15.	10.	9.	6.	62.	5.	21.	1.	3.	52.	34.	268.
1982	52.	15.	8.	9.	7.	79.	2.	27.	0.	4.	66.	39.	307.
1983	42.	15.	9.	10.	7.	85.	9.	17.	7.	3.	76.	51.	332.
1984	52.	15.	9.	7.	5.	64.	48.	7.	5.	2.	73.	47.	333.
1985	52.	15.	9.	7.	6.	56.	11.	42.	5.	3.	75.	33.	313.
1986	52.	15.	10.	10.	6.	99.	9.	6.	6.	3.	53.	33.	301.
1987	51.	15.	10.	10.	7.	81.	43.	22.	1.	4.	55.	27.	326.
1988	29.	12.	10.	2.	6.	60.	28.	18.	6.	2.	51.	51.	276.
Ave.	45.	15.	8.	8.	6.	69.	19.	17.	3.	3.	59.	24.	275.

Table VI 2.4 (11) Diversion Water Requirements of Each Irrigation System

Summary of crop and basic assumption
in Palay-Palay Irrigation System (140 ha)

No.	Crop	Cultiva. Area(ha)	Date of Water Issue	Land Preparation Period (stages)
1	1 Paddy-nursery	7.	5/ 1	1
2	2 Wet season paddy	140.	6/ 1	1
1	1 Paddy-nursery	3.	10/ 1	1
3	3 Dry season paddy	70.	11/ 1	1
15	15 Mungbeans	35.	10/ 1	2
16	16 Water melon	35.	10/ 1	2
	Total Project Area	140.		

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Unit Diversion Water Requirement

Unit:mm

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Paddy-nursery	0.	0.	0.	0.	503.	36.	0.	0.	0.	0.	0.	0.
2 Wet season paddy	0.	0.	0.	0.	0.	405.	216.	112.	4.	0.	0.	0.
1 Paddy-nursery	0.	0.	0.	0.	0.	0.	0.	0.	0.	395.	0.	0.
3 Dry season paddy	255.	67.	0.	0.	0.	0.	0.	0.	0.	0.	273.	133.
15 Mungbeans	102.	25.	0.	0.	0.	0.	0.	0.	0.	36.	0.	4.
16 Water melon	51.	0.	0.	0.	0.	0.	0.	0.	0.	60.	0.	0.

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Diversion Water Requirement

Unit:x1000 m3

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Paddy-nursery	0.	0.	0.	0.	35.	2.	0.	0.	0.	0.	0.	0.
2 Wet season paddy	0.	0.	0.	0.	0.	567.	303.	156.	6.	0.	0.	0.
1 Paddy-nursery	0.	0.	0.	0.	0.	0.	0.	0.	0.	14.	0.	0.
3 Dry season paddy	179.	47.	0.	0.	0.	0.	0.	0.	0.	0.	191.	93.
15 Mungbeans	36.	9.	0.	0.	0.	0.	0.	0.	0.	13.	0.	1.
16 Water melon	18.	0.	0.	0.	0.	0.	0.	0.	0.	21.	0.	0.
Total	232.	56.	0.	0.	35.	569.	303.	156.	6.	47.	191.	94.

Diversion Water Requirement for Palay-Palay Irrigation System (140 ha)
(Total Area : 140. ha)

Unit:x1000 m3

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1969	230.	56.	0.	0.	33.	579.	36.	206.	42.	33.	251.	0.	1466.
1970	210.	54.	0.	0.	30.	451.	57.	220.	0.	8.	164.	28.	1221.
1971	235.	52.	0.	0.	23.	406.	45.	163.	12.	9.	181.	0.	1124.
1972	161.	56.	0.	0.	28.	415.	0.	55.	48.	9.	208.	90.	1070.
1973	204.	55.	0.	0.	32.	446.	126.	218.	5.	9.	180.	0.	1275.
1974	241.	53.	0.	0.	29.	466.	198.	25.	38.	9.	178.	0.	1235.
1975	97.	55.	0.	0.	33.	528.	306.	61.	6.	9.	214.	0.	1311.
1976	217.	55.	0.	0.	20.	431.	94.	59.	6.	32.	205.	0.	1119.
1977	62.	53.	0.	0.	32.	424.	136.	64.	5.	29.	210.	241.	1255.
1978	222.	55.	0.	0.	30.	600.	231.	10.	3.	7.	238.	93.	1490.
1979	237.	55.	0.	0.	23.	423.	216.	53.	6.	9.	199.	235.	1456.
1980	240.	56.	0.	0.	31.	430.	59.	73.	45.	9.	180.	17.	1139.
1981	227.	56.	0.	0.	30.	436.	38.	148.	5.	9.	183.	143.	1274.
1982	241.	54.	0.	0.	33.	553.	16.	190.	2.	37.	231.	174.	1532.
1983	183.	56.	0.	0.	36.	595.	64.	120.	49.	9.	268.	278.	1657.
1984	238.	56.	0.	0.	25.	450.	333.	46.	32.	8.	257.	230.	1674.
1985	238.	55.	0.	0.	30.	395.	79.	293.	34.	9.	261.	138.	1532.
1986	237.	55.	0.	0.	30.	693.	63.	42.	41.	9.	184.	139.	1494.
1987	232.	56.	0.	0.	35.	569.	303.	156.	6.	47.	191.	94.	1690.
1988	115.	46.	0.	0.	32.	420.	195.	126.	40.	8.	179.	261.	1422.
Ave.	203.	54.	0.	0.	30.	485.	130.	116.	21.	15.	208.	108.	1372.

Table VI 2.4 (12) Diversion Water Requirements of Each Irrigation System

Summary of crop and basic assumption
in Mapakla Irrigation System (130 ha)

No.	Crop	Cultiva. Area(ha)	Date of Water Issue	Land Preparation Period (stages)
1	1 Paddy-nursery	5.	5/ 1	1
2	2 Wet season paddy	100.	6/ 1	1
1	1 Paddy-nursery	5.	10/ 1	1
3	3 Dry season paddy	100.	11/ 1	1
4	4 Beans	30.	2/16	2
5	5 Dry season beans	12.	12/16	2
6	6 Dry season corn	6.	12/16	2
7	7 Wet season corn	12.	5/ 1	2
8	8 Eggplant	6.	4/16	2
9	9 String bean	6.	5/ 1	2
10	10 Tomato	6.	9/16	2
11	11 Bitter gourd	6.	10/ 1	2
12	12 Late wet season corn	6.	8/ 1	2
13	13 Wet season soybeans	6.	8/16	2
14	14 Citrus	5.	1/ 1	1
	Total Project Area	130.		

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Unit Diversion Water Requirement

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Paddy-nursery	0.	0.	0.	0.	503.	36.	0.	0.	0.	0.	0.	0.
2 Wet season paddy	0.	0.	0.	0.	0.	405.	216.	112.	4.	0.	0.	0.
1 Paddy-nursery	0.	0.	0.	0.	0.	0.	0.	0.	0.	395.	0.	0.
3 Dry season paddy	255.	67.	0.	0.	0.	0.	0.	0.	0.	0.	273.	133.
4 Beans	0.	28.	166.	171.	34.	0.	0.	0.	0.	0.	0.	0.
5 Dry season beans	107.	150.	183.	61.	0.	0.	0.	0.	0.	0.	0.	13.
6 Dry season corn	115.	138.	239.	155.	20.	0.	0.	0.	0.	0.	0.	20.
7 Wet season corn	0.	0.	0.	0.	99.	2.	90.	0.	0.	0.	0.	0.
8 Eggplant	0.	0.	0.	29.	112.	15.	46.	0.	0.	0.	0.	0.
9 String bean	0.	0.	0.	0.	97.	24.	46.	0.	0.	0.	0.	0.
10 Tomato	0.	0.	0.	0.	0.	0.	0.	0.	5.	71.	0.	0.
11 Bitter gourd	53.	0.	0.	0.	0.	0.	0.	0.	0.	61.	0.	2.
12 Late wet season corn	0.	0.	0.	0.	0.	0.	0.	19.	0.	58.	0.	3.
13 Wet season soybeans	0.	0.	0.	0.	0.	0.	0.	8.	0.	44.	0.	0.
14 Citrus	96.	125.	165.	166.	135.	0.	31.	0.	0.	11.	0.	0.

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Diversion Water Requirement

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Paddy-nursery	0.	0.	0.	0.	25.	2.	0.	0.	0.	0.	0.	0.
2 Wet season paddy	0.	0.	0.	0.	0.	405.	216.	112.	4.	0.	0.	0.
1 Paddy-nursery	0.	0.	0.	0.	0.	0.	0.	0.	0.	20.	0.	0.
3 Dry season paddy	255.	67.	0.	0.	0.	0.	0.	0.	0.	0.	273.	133.
4 Beans	0.	8.	50.	51.	10.	0.	0.	0.	0.	0.	0.	0.
5 Dry season beans	13.	19.	23.	8.	0.	0.	0.	0.	0.	0.	0.	2.
6 Dry season corn	7.	9.	15.	10.	1.	0.	0.	0.	0.	0.	0.	1.
7 Wet season corn	0.	0.	0.	0.	12.	0.	11.	0.	0.	0.	0.	0.
8 Eggplant	0.	0.	0.	2.	7.	1.	3.	0.	0.	0.	0.	0.
9 String bean	0.	0.	0.	0.	6.	2.	3.	0.	0.	0.	0.	0.
10 Tomato	0.	0.	0.	0.	0.	0.	0.	0.	0.	4.	0.	0.
11 Bitter gourd	3.	0.	0.	0.	0.	0.	0.	0.	0.	4.	0.	0.
12 Late wet season corn	0.	0.	0.	0.	0.	0.	0.	1.	0.	4.	0.	0.
13 Wet season soybeans	0.	0.	0.	0.	0.	0.	0.	1.	0.	3.	0.	0.
14 Citrus	5.	6.	8.	8.	7.	0.	2.	0.	0.	1.	0.	0.
Total	284.	109.	96.	79.	69.	409.	235.	113.	4.	35.	273.	136.

Diversion Water Requirement for Mapakla Irrigation System (130 ha)
(Total Area : 130. ha)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1969	281.	109.	89.	74.	58.	419.	26.	151.	31.	23.	359.	0.	1620.
1970	259.	102.	82.	59.	44.	322.	41.	162.	0.	12.	234.	41.	1358.
1971	287.	96.	44.	69.	19.	290.	32.	118.	9.	12.	259.	0.	1236.
1972	205.	108.	54.	59.	33.	297.	0.	40.	37.	13.	297.	131.	1274.
1973	252.	107.	92.	74.	52.	318.	90.	161.	4.	13.	257.	0.	1420.
1974	291.	99.	89.	74.	40.	333.	145.	18.	28.	13.	254.	0.	1383.
1975	134.	107.	39.	0.	60.	377.	238.	44.	5.	13.	306.	0.	1322.
1976	267.	106.	87.	58.	14.	308.	67.	42.	5.	23.	292.	1.	1271.
1977	88.	99.	78.	73.	52.	303.	97.	46.	4.	21.	299.	265.	1426.
1978	272.	107.	96.	64.	46.	439.	173.	7.	2.	11.	340.	135.	1692.
1979	289.	106.	94.	0.	19.	302.	161.	38.	5.	13.	284.	259.	1570.
1980	290.	114.	38.	71.	49.	307.	42.	52.	33.	13.	257.	25.	1292.
1981	278.	108.	93.	67.	45.	311.	27.	107.	4.	13.	261.	178.	1492.
1982	291.	104.	79.	67.	59.	395.	12.	138.	2.	27.	329.	206.	1708.
1983	229.	108.	87.	79.	74.	434.	46.	86.	37.	13.	383.	285.	1862.
1984	289.	109.	89.	49.	27.	321.	261.	33.	24.	11.	367.	255.	1836.
1985	289.	105.	82.	50.	43.	282.	57.	224.	25.	13.	373.	174.	1717.
1986	289.	106.	96.	77.	44.	530.	45.	30.	31.	13.	263.	175.	1699.
1987	284.	109.	96.	79.	69.	409.	235.	113.	4.	35.	273.	136.	1843.
1988	153.	83.	95.	15.	53.	300.	143.	91.	29.	11.	255.	280.	1510.
Ave.	251.	105.	80.	58.	45.	350.	97.	85.	16.	16.	297.	127.	1527.

Table VI 2.4 (13) Diversion Water Requirements of Each Irrigation System

Summary of crop and basic assumption
in Pagkalinawan Irrigation System (55 ha)

No.	Crop	Cultiva. Area(ha)	Date of Water Issue	Land Preparation Period (stages)
1	1 Paddy-nursery	2.	5/ 1	1
2	2 Wet season paddy	45.	6/ 1	1
1	1 Paddy-nursery	2.	10/ 1	1
3	3 Dry season paddy	45.	11/ 1	1
4	4 Beans	13.	2/16	2
5	5 Dry season beans	2.	12/16	2
6	6 Dry season corn	1.	12/16	2
7	7 Wet season corn	2.	5/ 1	2
8	8 Eggplant	1.	4/16	2
9	9 String bean	1.	5/ 1	2
10	10 Tomato	1.	9/16	2
11	11 Bitter gourd	1.	10/ 1	2
12	12 Late wet season corn	1.	8/ 1	2
13	13 Wet season soybeans	1.	8/16	2
14	14 Citrus	5.	1/ 1	1
	Total Project Area	55.		

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Unit Diversion Water Requirement

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Paddy-nursery	0.	0.	0.	0.	503.	36.	0.	0.	0.	0.	0.	0.
2 Wet season paddy	0.	0.	0.	0.	0.	405.	216.	112.	4.	0.	0.	0.
1 Paddy-nursery	0.	0.	0.	0.	0.	0.	0.	0.	0.	395.	0.	0.
3 Dry season paddy	255.	67.	0.	0.	0.	0.	0.	0.	0.	0.	273.	133.
4 Beans	0.	28.	166.	171.	34.	0.	0.	0.	0.	0.	0.	0.
5 Dry season beans	107.	150.	183.	61.	0.	0.	0.	0.	0.	0.	0.	13.
6 Dry season corn	115.	138.	239.	155.	20.	0.	0.	0.	0.	0.	0.	20.
7 Wet season corn	0.	0.	0.	0.	99.	2.	90.	0.	0.	0.	0.	0.
8 Eggplant	0.	0.	0.	29.	112.	15.	46.	0.	0.	0.	0.	0.
9 String bean	0.	0.	0.	0.	97.	24.	46.	0.	0.	0.	0.	0.
10 Tomato	0.	0.	0.	0.	0.	0.	0.	0.	5.	71.	0.	0.
11 Bitter gourd	53.	0.	0.	0.	0.	0.	0.	0.	0.	61.	0.	2.
12 Late wet season corn	0.	0.	0.	0.	0.	0.	0.	19.	0.	58.	0.	3.
13 Wet season soybeans	0.	0.	0.	0.	0.	0.	0.	8.	0.	44.	0.	0.
14 Citrus	96.	125.	165.	166.	135.	0.	31.	0.	0.	11.	0.	0.

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Diversion Water Requirement

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Paddy-nursery	0.	0.	0.	0.	12.	1.	0.	0.	0.	0.	0.	0.
2 Wet season paddy	0.	0.	0.	0.	0.	182.	97.	50.	2.	0.	0.	0.
1 Paddy-nursery	0.	0.	0.	0.	0.	0.	0.	0.	0.	9.	0.	0.
3 Dry season paddy	115.	30.	0.	0.	0.	0.	0.	0.	0.	0.	123.	60.
4 Beans	0.	4.	22.	23.	5.	0.	0.	0.	0.	0.	0.	0.
5 Dry season beans	3.	4.	5.	2.	0.	0.	0.	0.	0.	0.	0.	0.
6 Dry season corn	1.	2.	3.	2.	0.	0.	0.	0.	0.	0.	0.	0.
7 Wet season corn	0.	0.	0.	0.	2.	0.	2.	0.	0.	0.	0.	0.
8 Eggplant	0.	0.	0.	0.	1.	0.	1.	0.	0.	0.	0.	0.
9 String bean	0.	0.	0.	0.	1.	0.	1.	0.	0.	0.	0.	0.
10 Tomato	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.
11 Bitter gourd	1.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.
12 Late wet season corn	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.
13 Wet season soybeans	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.
14 Citrus	5.	6.	8.	8.	7.	0.	2.	0.	0.	1.	0.	0.
Total	125.	46.	38.	35.	28.	184.	102.	51.	2.	13.	123.	60.

Diversion Water Requirement for Pagkalinawan Irrigation System (55 ha)
(Total Area : 55. ha)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1969	123.	46.	35.	33.	23.	187.	12.	67.	14.	9.	161.	0.	712.
1970	114.	43.	33.	26.	18.	145.	18.	72.	0.	5.	105.	18.	597.
1971	126.	41.	17.	31.	9.	130.	14.	53.	4.	6.	116.	0.	547.
1972	90.	45.	21.	26.	13.	133.	0.	18.	16.	6.	134.	58.	561.
1973	111.	45.	37.	33.	21.	143.	41.	71.	2.	6.	116.	0.	625.
1974	127.	42.	35.	33.	16.	150.	64.	8.	12.	6.	114.	0.	608.
1975	59.	45.	15.	0.	24.	170.	104.	20.	2.	6.	138.	0.	583.
1976	117.	45.	35.	26.	7.	138.	30.	19.	2.	9.	131.	0.	560.
1977	40.	42.	31.	33.	21.	136.	44.	21.	2.	9.	135.	117.	630.
1978	119.	45.	38.	29.	18.	196.	76.	3.	1.	5.	153.	60.	744.
1979	127.	45.	38.	0.	9.	136.	71.	17.	2.	6.	128.	115.	692.
1980	127.	47.	15.	32.	20.	138.	19.	23.	15.	6.	115.	11.	569.
1981	122.	45.	37.	30.	18.	140.	12.	48.	2.	6.	118.	79.	656.
1982	128.	44.	31.	30.	24.	178.	5.	62.	1.	10.	148.	91.	751.
1983	101.	45.	35.	35.	31.	194.	21.	39.	16.	6.	172.	126.	820.
1984	127.	46.	36.	22.	11.	145.	114.	15.	11.	5.	165.	113.	808.
1985	127.	44.	33.	22.	17.	127.	26.	98.	11.	6.	168.	77.	755.
1986	127.	45.	38.	34.	18.	234.	20.	14.	14.	6.	118.	77.	745.
1987	125.	46.	38.	35.	28.	184.	102.	51.	2.	13.	123.	60.	806.
1988	67.	35.	38.	6.	21.	135.	63.	41.	13.	5.	115.	124.	665.
Ave.	110.	44.	32.	26.	18.	157.	43.	38.	7.	7.	134.	56.	672.

Table VI 2.4 (14) Diversion Water Requirements of Each Irrigation System

Summary of crop and basic assumption
in Bagumbong Irrigation System p-1-2 (55 ha)

No.	Crop	Cultiva. Area(ha)	Date of Water Issue	Land Preparation Period (stages)
5	5 Dry season beans	20.	12/16	2
6	6 Dry season corn	10.	12/16	2
7	7 Wet season corn	20.	5/ 1	2
8	8 Eggplant	10.	4/16	2
9	9 String bean	10.	5/ 1	2
10	10 Tomato	10.	9/16	2
11	11 Bitter gourd	10.	10/ 1	2
12	12 Late wet season corn	10.	8/ 1	2
13	13 Wet season soybeans	10.	8/16	2
14	14 Citrus	15.	1/ 1	1
	Total Project Area	55.		

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Unit Diversion Water Requirement

Unit:mm

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5 Dry season beans	107.	150.	183.	61.	0.	0.	0.	0.	0.	0.	0.	13.
6 Dry season corn	115.	138.	239.	155.	20.	0.	0.	0.	0.	0.	0.	20.
7 Wet season corn	0.	0.	0.	0.	99.	2.	90.	0.	0.	0.	0.	0.
8 Eggplant	0.	0.	0.	29.	112.	15.	46.	0.	0.	0.	0.	0.
9 String bean	0.	0.	0.	0.	97.	24.	46.	0.	0.	0.	0.	0.
10 Tomato	0.	0.	0.	0.	0.	0.	0.	0.	5.	71.	0.	0.
11 Bitter gourd	53.	0.	0.	0.	0.	0.	0.	0.	0.	61.	0.	2.
12 Late wet season corn	0.	0.	0.	0.	0.	0.	0.	19.	0.	58.	0.	3.
13 Wet season soybeans	0.	0.	0.	0.	0.	0.	0.	8.	0.	44.	0.	0.
14 Citrus	96.	125.	165.	166.	135.	0.	31.	0.	0.	11.	0.	0.

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Diversion Water Requirement

Unit:x1000 m3

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5 Dry season beans	21.	30.	37.	12.	0.	0.	0.	0.	0.	0.	0.	3.
6 Dry season corn	11.	14.	24.	15.	2.	0.	0.	0.	0.	0.	0.	2.
7 Wet season corn	0.	0.	0.	0.	20.	0.	18.	0.	0.	0.	0.	0.
8 Eggplant	0.	0.	0.	3.	11.	2.	5.	0.	0.	0.	0.	0.
9 String bean	0.	0.	0.	0.	10.	2.	5.	0.	0.	0.	0.	0.
10 Tomato	0.	0.	0.	0.	0.	0.	0.	0.	0.	7.	0.	0.
11 Bitter gourd	5.	0.	0.	0.	0.	0.	0.	0.	0.	6.	0.	0.
12 Late wet season corn	0.	0.	0.	0.	0.	0.	0.	2.	0.	6.	0.	0.
13 Wet season soybeans	0.	0.	0.	0.	0.	0.	0.	1.	0.	4.	0.	0.
14 Citrus	14.	19.	25.	25.	20.	0.	5.	0.	0.	2.	0.	0.
Total	53.	63.	85.	55.	63.	4.	32.	3.	0.	25.	0.	5.

Diversion Water Requirement for Bagumbong Irrigation System p-1-2 (55 ha)
(Total Area : 55. ha)

Unit:x1000 m3

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1969	52.	63.	78.	52.	46.	9.	0.	6.	2.	9.	0.	0.	316.
1970	44.	54.	73.	40.	27.	0.	0.	8.	0.	0.	0.	2.	248.
1971	53.	49.	36.	48.	0.	0.	0.	3.	1.	0.	0.	0.	191.
1972	27.	62.	46.	40.	12.	0.	0.	0.	4.	0.	0.	5.	195.
1973	42.	60.	81.	52.	39.	0.	0.	8.	0.	0.	0.	0.	282.
1974	58.	51.	78.	52.	21.	0.	6.	0.	2.	0.	0.	0.	269.
1975	6.	59.	32.	0.	49.	0.	33.	0.	1.	0.	0.	0.	180.
1976	47.	58.	77.	39.	0.	0.	0.	0.	1.	8.	0.	1.	231.
1977	0.	51.	69.	51.	39.	0.	0.	0.	0.	6.	0.	40.	256.
1978	49.	59.	85.	44.	29.	18.	13.	0.	0.	0.	0.	5.	303.
1979	55.	57.	83.	1.	0.	0.	10.	0.	1.	0.	0.	38.	245.
1980	57.	71.	31.	50.	33.	0.	0.	0.	2.	0.	0.	2.	246.
1981	51.	62.	82.	46.	28.	0.	0.	2.	0.	0.	0.	14.	285.
1982	59.	55.	69.	46.	48.	1.	0.	4.	0.	13.	0.	22.	319.
1983	34.	62.	77.	55.	71.	16.	0.	1.	4.	0.	2.	55.	377.
1984	55.	63.	79.	33.	6.	0.	41.	0.	1.	0.	0.	37.	315.
1985	55.	56.	72.	33.	25.	0.	0.	25.	2.	0.	0.	13.	282.
1986	54.	58.	85.	54.	28.	64.	0.	0.	2.	0.	0.	13.	358.
1987	53.	63.	85.	55.	63.	4.	32.	3.	0.	25.	0.	5.	389.
1988	10.	37.	85.	6.	39.	0.	6.	2.	2.	0.	0.	46.	233.
Ave.	43.	57.	70.	40.	30.	6.	7.	3.	1.	3.	0.	15.	276.

Table VI 2.4 (15) Diversion Water Requirements of Each Irrigation System

Summary of crop and basic assumption
in Bagumbong p-2-1 Irrigation System (90 ha)

No.	Crop	Cultiva. Area(ha)	Date of Water Issue	Land Preparation Period (stages)
5	5 Dry season beans	15.	12/16	2
6	6 Dry season corn	7.	12/16	2
7	7 Wet season corn	15.	5/ 1	2
8	8 Eggplant	7.	4/16	2
9	9 String bean	7.	5/ 1	2
10	10 Tomato	7.	9/16	2
11	11 Bitter gourd	7.	10/ 1	2
12	12 Late wet season corn	7.	8/ 1	2
13	13 Wet season soybeans	7.	8/16	2
14	14 Citrus	60.	1/ 1	1
	Total Project Area	90.		

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Unit Diversion Water Requirement

Unit:mm

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5 Dry season beans	107.	150.	183.	61.	0.	0.	0.	0.	0.	0.	0.	13.
6 Dry season corn	115.	138.	239.	155.	20.	0.	0.	0.	0.	0.	0.	20.
7 Wet season corn	0.	0.	0.	0.	99.	2.	90.	0.	0.	0.	0.	0.
8 Eggplant	0.	0.	0.	29.	112.	15.	46.	0.	0.	0.	0.	0.
9 String bean	0.	0.	0.	0.	97.	24.	46.	0.	0.	0.	0.	0.
10 Tomato	0.	0.	0.	0.	0.	0.	0.	0.	5.	71.	0.	0.
11 Bitter gourd	53.	0.	0.	0.	0.	0.	0.	0.	0.	61.	0.	2.
12 Late wet season corn	0.	0.	0.	0.	0.	0.	0.	19.	0.	58.	0.	3.
13 Wet season soybeans	0.	0.	0.	0.	0.	0.	0.	8.	0.	44.	0.	0.
14 Citrus	96.	125.	165.	166.	135.	0.	31.	0.	0.	11.	0.	0.

Sample Intermediate Output in 1987
Summary of Water Demand for Each Crop
Diversion Water Requirement

Unit:x1000 m3

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5 Dry season beans	16.	23.	27.	9.	0.	0.	0.	0.	0.	0.	0.	2.
6 Dry season corn	9.	10.	18.	12.	1.	0.	0.	0.	0.	0.	0.	1.
7 Wet season corn	0.	0.	0.	0.	15.	0.	14.	0.	0.	0.	0.	0.
8 Eggplant	0.	0.	0.	2.	8.	1.	3.	0.	0.	0.	0.	0.
9 String bean	0.	0.	0.	0.	7.	2.	3.	0.	0.	0.	0.	0.
10 Tomato	0.	0.	0.	0.	0.	0.	0.	0.	0.	5.	0.	0.
11 Bitter gourd	4.	0.	0.	0.	0.	0.	0.	0.	0.	5.	0.	0.
12 Late wet season corn	0.	0.	0.	0.	0.	0.	0.	1.	0.	4.	0.	0.
13 Wet season soybeans	0.	0.	0.	0.	0.	0.	0.	1.	0.	3.	0.	0.
14 Citrus	57.	75.	99.	100.	81.	0.	19.	0.	0.	7.	0.	0.
Total	86.	108.	144.	123.	113.	3.	39.	2.	0.	24.	0.	4.

Diversion Water Requirement for Bagumbong p-2-1 Irrigation System (90 ha)
(Total Area : 90. ha)

Unit:x1000 m3

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1969	84.	109.	132.	114.	79.	8.	0.	5.	1.	6.	0.	0.	538.
1970	71.	92.	122.	87.	38.	0.	0.	6.	0.	0.	0.	2.	416.
1971	88.	83.	56.	106.	0.	0.	0.	2.	1.	0.	0.	0.	336.
1972	38.	106.	74.	87.	9.	0.	0.	0.	3.	0.	0.	3.	321.
1973	67.	103.	137.	114.	62.	0.	0.	6.	0.	0.	0.	0.	489.
1974	97.	87.	132.	114.	26.	0.	5.	0.	1.	0.	0.	0.	462.
1975	4.	101.	49.	0.	85.	0.	41.	0.	0.	0.	0.	0.	281.
1976	75.	100.	130.	86.	0.	0.	0.	0.	1.	6.	0.	1.	398.
1977	0.	87.	115.	113.	62.	0.	0.	0.	0.	5.	0.	69.	451.
1978	79.	102.	144.	96.	43.	24.	10.	0.	0.	0.	0.	4.	502.
1979	90.	98.	141.	0.	0.	0.	7.	0.	0.	0.	0.	66.	404.
1980	95.	122.	47.	109.	52.	0.	0.	0.	2.	0.	0.	1.	428.
1981	82.	106.	139.	100.	40.	0.	0.	2.	0.	0.	0.	19.	489.
1982	99.	95.	116.	101.	82.	1.	0.	3.	0.	10.	0.	35.	541.
1983	53.	106.	129.	123.	129.	20.	0.	1.	3.	0.	1.	100.	664.
1984	91.	108.	133.	70.	5.	0.	55.	0.	1.	0.	0.	63.	526.
1985	91.	96.	121.	71.	34.	0.	0.	30.	1.	0.	0.	17.	462.
1986	90.	100.	144.	119.	39.	97.	0.	0.	1.	0.	0.	17.	608.
1987	86.	108.	144.	123.	113.	3.	39.	2.	0.	24.	0.	4.	647.
1988	8.	62.	143.	9.	64.	0.	4.	1.	1.	0.	0.	82.	375.
Ave.	69.	99.	117.	87.	48.	8.	8.	3.	1.	3.	0.	24.	467.

Table VI.2.5 General Features of Alternatives of Palay-Palay Irrigation System

General features of dam plan		
I. Palay-Palay dam		
1.Storage capacity		
Total storage capacituy	1,060,000	cu.m
Effective storage capacity	722,000	cu.m
Dead storage capacity	338,000	cu.m
2.Water elevation		
Maximum water surface elevation	27.5	m
Normal water surface elevation	26.5	m
Dead water surface elevation	20.0	m
3.Dam type		
Type	Earthfill dam with central impervious earth core	
Crest elevation	29.5	m
Crest lenght	130	m
4.Spillway		
Type	Non-gated overflow weir	
Design elevation	64	cu.m
Crest elevation	26.5	m
Crest length	30	m
5.River diversion		
Type	concrete pipe dia.2,400 mm	
Design discharge	38	cu.m
6.Work volume		
Earthfill, Main dam	65,000	cu.m
Sub-dam	13,200	cu.m
Excavation	29,000	cu.m
Spillway ,concrete	3,000	cu.m
Diversion work ,concrete pipe	200	m
Intake steel pipe	90	m
II.Additional pump station		
1.Command area	30	ha
2.Pump equipment		
head	13	m
net	10	m
friction etc	3	m
3.Pump		
Discharge/set	2.07	cu.m/min
kW/set	11	kW/set

General features of pumping system		1st pump (high head)	2nd pump (low head)
1.Command area	ha	30	110
2.Pumping equipment			
Head	m	40	34
Net	m	31	21
Friction,etc	m	9	13
Pump			
Type		-- Volute pump --	
Set	sec	2	2
Discharge/sec	cu.m/sec	2.07	7.59
Motor output/sec	kW	22	75
Power consumption			
Operation	hr	2,360	2,360
Power consumption	kWh	51,920	177,000
3.Discharge pipe			
Length	m	1,550	850
Diameter	mm	250	400

Table VI.2.6 Comparison of Palay-Palay Irrigation System

I. CONSTRUCTION COST

Description	Amount (1,000 peso)
1.Construction cost of dam plan	
1) Dam	18,000
2) Additional pump station	
Pump and motor	1,562
Pump house and others	672
Total (1)+2))	20,234
2.Construction cost of pump system	
1) Pumping equipment	4,350
2) Discharge pipe	9,130
3) Pump house and outlet	1,050
Total	14,530

II. COMPARISON OF ANNUAL COST AND ADDITONAL BENEFIT

Description	Annual cost (1,000 peso) Dam plan	Pumping system
1.ANNUAL COST		
1) Capital recovery		
Dam embankment	1,802	0
Pump station	262	635
Discharge pipe	0	920
2) Maintenace cost	202	436
3) Electric charge	32	363
Total	2,298	2,354
2.INCREMENTAL BENEFIT		
1) Island fishery by use of reservior 11 ha	280	0
NET ANNUAL COST (1-2)	2018	2354

Note

1. Economic life
   - Dam : 80 years
   - Pumping equipment : 20 years
   - Discharge pipe and others : 50 years
2. Maintenance
   - Dam plan : 1 % of initial cost
   - Pumping plan : 3 % of initial cost
3. Electric charge
   - Unit charge : 1.8 peso/kWh

Table VI.2.7 Selection of Pumping System

Description	Unit	DIRECT PUMPING SYSTEM	2 SHIFT PUMPING SYSTEM		3 SHIFT PUMPING SYSTEM		
			1st pump	2nd pump	1st pump	2nd pump	3rd pump
		(high head)	(high head)	(low head)	(high head)	(mid head)	(low head)
I. General Features							
1. Command area	ha	170	75	95	56	56	58
2. Pumping Equipment							
Head	m	45	47	19	48	26	14
net	m	41	41	14	41	20	10
friction ,etc.	m	4	6	5	7	6	4
Pump							
Type	-		---------- Horizontal Shaft Volute Pump ----------				
Set	set	2	2	2	2	2	2
Discharge/set	m3/min	11.7	5	7	4	4	4
KW/set	kW	132	55	30	45	30	15
Power consumtion							
Operation hr		1,740	1,740	1,740	1,740	1,740	1,740
Power consumtion	kWh	278,400	95,700	52,200	78,300	52,200	26,100
3. Discharge Pipe							
Length	m	1,580	1,580	640	1,580	1,000	500
Diameter	mm	700	450	500	400	400	400
II. Construction Cost (1,000 peso)							
1) Pumping equipment							
Pump and motor		1,370	800	770	730	630	440
Others		2,200	3,300	0	3,570	0	0
2) Discharge pipe		15,800	10,270	4,480	9,480	6,000	3,000
3) Pump house		1,000	1,000	0	1,100		0
Sub-total (2 to 3)		16,800	11,270	4,480	10,580	6,000	3,000
Total		20,370	15,370	5,250	14,880	6,630	3,440
III.Annual cost (1,000 peso)							
1) Capital recovery							
Pumping equipment		420	482	91	506	74	52
Civil works		1,694	1,137	452	1,067	605	303
2) Maintenance		1,019	769	263	744	332	172
3) Electric charge		501	172	94	141	94	47
Total		3,634	2,561	900	2,458	1,105	573
Grand Total		3,634		3,460			4,136

Note :
1. Case study of Sipsipin Irrigation system
2. Annual cost estimate
   - Pump and motor economic life 20 yrs, c.r.f. 0.1175
   - Civil works economic life 50 yrs, c.r.f. 0.1009
   - Electric charge 1.8 peso/ kWh
3. Pump operation hr : based on 52 % of requirement by pump

Table VI.2.8 Comparison of Canal Lining

1. General Features of Canal

	Unit	Earth canal	Lining canal
1) Canal			
- Total length	m	2,710	2,710
- Number of canal	nos	6	6
- Discharge	l/sec	36	32
2) Canal design			
- Canal type		Trapezoidal earth	U-shape concrete flume
- Canal base width	m	0.30	0.30
- Canal height	m	0.40	0.30
- Gradient (Aver.)	-	1/500	1/40
- Roughness coefficient	-	0.030	0.015
- Water depth	m	0.20	0.08
- Velocity	m/sec	0.35	1.47
- Berm width	m	0.40	0.40
- Canal right of way	sq.m	13,400	7,060
3) Irrigation efficiency			
- Conveyance efficiency	%	76	85
- main canal	%	95	95
- main f.ditch	%	80	90
- Application efficiency	%	75	75
- Overall efficiency	%	57	64
4) Water consumption			
- Annual consumption	cu.m	1,010,500	900,000
5) Pump and motor			
- Pump set	set	2	2
- Discharge per set	cu.m/m	5.1	4.5
- Motor output	kW	37	30
- Pump operation hr/set	hr	3,300	3,300

Note: Care study of Llano irrigation system for lining of main farm ditch.

2. Cost Comparison of Lining

Description	Unit	Unit price	Earth canal Q'tv	Earth canal Amount	lining canal Q'tv	lining canal Amount
1.Construction cost (peso)						
1) Canal earthworks		(ps)		(ps)		(ps)
Excavation	m3	31	10,050	311,550	1,000	31,000
Earthfill	m3	26	1,620	42,120	1,700	44,200
1) Lining	m	360	0	0	2,710	975,600
Total				353,670		1,050,800
2.Annual cost (peso)						
1) Capital recovery				46,508		105,921
1) Annual maintenance cost				17,684		10,508
2) Pump operation cost				219,780		178,200
3) Reduction of farm product				46,920		24,480
Total				330,892		319,109

Note

1) Capital recovery :
   Based on interest rate 10 % and economic life 50 yrs
   Capital recovery factor ; 0.1008
2) Annual maintenance cost :
   For earth canal 3 % of initial cost
   For lining canal 1 % of initial cost
3) pump operation cost :
   Based on electric charge ; 1.8 peso/kWhr
4) Reduction of farm product :
   Based on net production value of cropping pattern
   Type-I ; 34,000 peso/ha

Table VI.2.9 Comparison of Power Supply System

Works	Motor driven System	Diesel engine System
1. Capital cost		
1) Increasing civil work by fuel tank ,etc	0	1,000
2) Pump equipment	41,419	33,315
- Pump	3,697	3,697
- Motor	3,446	0
- Generator	0	12,337
- Accessories	34,276	17,280
2. Maintenance cost		
1) Overhole of engine		
- After 4 years	0	4,452
- After 8 years	0	6,679
Present worth		6,156
3. Annual cost		
1) Capital recovery cost		
i) Increasing civil works	0	117
ii) Pump equipment		
- Pump and motor	839	434
- Diesel generator	0	1,811
- Accessories	4,026	2,030
2) Maintenance cost		
i) Routine maintenance	0	247
ii) Overhole of engine	0	903
3) Operation cost		
i) Power cost	1,676	0
ii) Fuel	0	1,280
Total	6,541	6,822
	(100 %)	(104 %)

Note
1. Comparison for the care of all irrigation pumps of 13 irrigation systems
2. Overhaul of engine : once in 4,000 hr operation
3. Economic life of pump equipment :

	Economic life	Capital recovery factor
Diesel engine	12 years	0.14676
Pump and others	20 years	0.11746

4. Energy cost
Total operation of pumps : 930,000 kWhr
Unit electric cost : 1.8 peso/kWhr
Diesel engine : 0.25 l/kWhr, 5.5 peso/l

Table VI.2.10 Irrigation System Capacity

I. *Main system*

1. Cropping pattern Type-I and Type-II

Period of maximum requirement : June
Puddling water suply period : 20 days
Design year with 80 % dependability : 1978
Crop : Wet season paddy

Water requirement		Wet season paddy
Kc	-	1.10
PET	mm/month	120
ET	mm/day	4.4
PE	mm/day	2
PU	mm/day	9
ER	mm/day	3
FWR	mm/day	12.4
DWR	mm/day	19.4
	l/sec/ha	2.24

2. Cropping pattern-III

Cropping area		Manggahan	Lubo
Paddy	ha	45	30
Upland	ha	10	15
Total	ha	55	45

Water requirement	U.W.R		
Paddy	2.24	100.8	67.2
Upland	0.04	0.4	0.6
Diversion w.r.	(l/sec)	101.2	67.8
	(l/sec/ha)	1.84	1.51

3. Cropping pattern-IV

(1) Paddy field, upland field and orchard area ,June 1987

Cropping area		Mapakla	Pagkalinawan
Paddy	ha	100	45
upland	ha	25	5
Citrus	ha	5	5
Total	ha	130	55

Water requirement	U.W.R		
Paddy	2.24	224	101
Upland	0.04	1	0
Citrus	0.00	0	0
Diversion w.r.	(l/sec)	225	101
	(l/sec/ha)	1.73	1.84

(2) Upland field and orchard area, March 1987

Cropping area		Bagumbong p-1-2	Bagumbong p-2-1
Upland	ha	40	30
Citrus	ha	35	40
Total	ha	55	90
Water requirement	l/sec/ha		
Upland,bear	0.71	14	11
,corn	0.92	9	7
Citrus	0.64	10	38
Diversion w (l/sec)		33	56
	(l/sec/ha)	0.60	0.62

Unit diversion water requirement of upland fields ,June 1987

Upland	Crop	Rate	U.W.R mm/mont	l/sec/ha	Weighted l/sec/ha
	Wet s. corn	50 %	2.4	0.01	0.005
	Eggplant	25 %	15.3	0.06	0.015
	String beans	25 %	24.2	0.09	0.023
Unit diversion req.					0.04

II. On-farm system

Paddy field canals

Main farm ditch commanding an irrigation block

Puddling water 180 mm for 2 rotation blocks for 2 days
= 180 mm x 2 ha x 10 ^4/(2 x 86,400) / 0.64
= 32 l/sec

Farm ditch commanding a rotation block

Puddling water 180 mm for 1 rotation block for 2 days
= 180 mm x 1 ha x 10^4/(2 x 86,400)/0.64
= 16 l/sec

Upland field canals

Main farm ditch commanding an irrigation block

Water depth 90 mm for 2 ha for 2 days
Furror stream size : 1 l/sec
Number of furrows : 15
Supply duration : 2.00 hr
Irrigated area/opera : 0.12 ha
(furrow length : 100 m)
(furrow width : 0.8 m)
Irrigation operation/day : 16 hr at peak demand
= 15 l/sec x 2 irrigation blocks
= 30 l/sec

SUMMARY OF SYSTEM CAPACITY

Irrigation system	Unit diversion requirement Main system (l/sec/ha)	On-farm system M.F.D. (l/sec)	F.D. (l/sec)
Sipsipin	2.30	32	16
Bayugo	2.30	32	16
Llano	2.30	32	16
Punta	2.30	32	16
Ik-Ik	2.30	32	16
Lumang Nayon	2.30	32	16
Pulong Ligaya	2.30	32	16
Bagumbong p-1-1	2.30	32	16
Bagumbong p-2-2	2.30	32	16
Palay-Palay	2.30	32	16
Manggahan	1.85	32	16
Lubo	1.85	32	16
Mapakla	1.85	32	16
Pakalinawan	1.85	32	16
Bagumbong p-1-2	1.00	30	15
Bagumbong p-2-1	1.00	30	15

Note:
Applied the maximum unit requirement in respective cr
is for future possible change in cropping.

Table VI.2.11 Laguna Lake Water Level

YEAR	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	MAX	MIN
JAN	11.69	10.74	11.24	11.40	11.07	10.96	11.18	11.06	11.96	11.40	11.70	11.96	10.74
FEB	11.13	10.53	10.84	11.05	11.00	10.69	10.79	10.78	11.39	11.15	11.23	11.39	10.53
MAR	10.71	10.46	10.59	10.72	10.81	10.50	10.57	10.56	10.84	10.82	11.03	11.03	10.46
APR	10.57	10.52	10.41	10.46	10.63	10.36	10.46	10.45	10.49	10.68	10.88	10.88	10.36
MAY	10.67	10.47	10.36	10.48	10.43	10.42	10.39	10.47	10.31	10.61	10.90	10.90	10.31
JUN	10.90	10.62	10.72	10.68	10.36	10.55	10.60	10.62	10.34	11.12	11.24	11.24	10.34
JUL	11.09	11.05	11.38	11.02	10.64	10.94	12.04	11.30	10.56	11.23	11.34	12.04	10.56
AUG	11.60	11.34	11.53	11.53	11.12	11.31	11.81	11.90	10.74	11.37	11.89	11.90	10.74
SEPT	11.55	11.54	11.32	11.86	11.32	11.74	11.70	12.49	11.32	11.19	12.06	12.49	11.19
OCT	11.66	11.72	11.51	11.62	11.75	12.00	11.82	13.08	11.24	11.92	12.04	13.08	11.24
NOV	11.33	12.21	11.77	11.24	11.76	12.33	11.88	13.08	11.11	13.25	11.67	13.25	11.11
DEC	11.02	11.77	11.71	11.06	11.35	12.75	11.50	12.67	11.46	12.39	11.21	12.75	11.02
MAX	11.69	12.21	11.77	11.86	11.76	12.75	12.04	13.08	11.96	13.25	12.06	13.25	11.69
MIN	10.57	10.46	10.36	10.46	10.36	10.36	10.39	10.45	10.31	10.61	10.88	10.88	10.31

NOTE : The above measurement of water levels is referred to the datumn 10.71 m below the mean lower low water (M.L.L.W.).

Design Low Water Level occurred in May 16, 1981; 10.31 m meams EL.-0.40 m (M.L.L.W basis)
Design High Water Level occurred in November 9, 1988; 13.55 m means EL.+2.84 m (M.L.L.W basis)

Table VI.2.12 General Features of Pump Equipment

Pump satation	Irrigation area (ha)	Pump set	Design discharge (cu.m/min)	Design head Actual (m)	Design head Total (m)	Motor out put/set (kW)	Discharge pipe Diameter (mm)	Discharge pipe Length (m)
Sipsipin								
High head pump	75	2	5.19		47	55	450	1,580
Low head pump	95	2	6.57		19	30	500	640
Mapakla								
High head pump	80	2	4.44		44	45	400	1,800
Low head pump	50	2	2.79		16	11	350	900
Manggahan	55	2	3.06		31	22	350	650
Bayugo	50	2	3.45		26	22	350	210
Llano	65	2	4.50		28	30	400	70
Punta	35	2	2.43		16	11	300	180
Pala-Palay	30	2	2.07		22	11	300	10
Pagkalinawan	55	2	3.06		33	30	350	120
Ik-Ik	45	2	3.12		27	18.5	350	590
Lubo	45	2	2.49		24	15	300	510
Lumang Nayon								
High head pump	45	2	3.12		44	37	350	1,010
Low head pump	50	2	3.45		20	18.5	350	480
Pulong Ligaya	45	2	3.12		17	15	350	690
Bagumbong								
Pump-1								
High head pump	65	2	4.49		62	75	400	2,110
Low head pump	55	2	1.65		34	15	250	1,300
Pump-2								
High head pump	90	2	2.70		44	30	350	1,950
Low head pump	20	2	1.38		13	5.5	250	450

Table VI.2.13 Required Storage Volume of Palay-Palay Dam

Unit : 1,000 m3/month

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1969												
RDIS	0	0	0	0	61	199	1,170	394	531	333	276	732
DWR	230	56	0	0	33	579	36	206	42	33	251	0
DEF	-230	-56	0	0	28	-380	1,134	188	489	300	25	732
ACDF	-230	-286	-286	-286	-258	-639	0	0	0	0	0	0
1970												
RDIS	134	0	0	91	218	541	782	209	1,239	1,473	1,773	919
DWR	210	54	0	0	30	451	57	220	0	8	164	28
DEF	-76	-54	0	91	188	90	725	-11	1,239	1,465	1,609	891
ACDF	-76	-130	-130	-40	0	0	0	-11	0	0	0	0
1971												
RDIS	121	0	238	0	518	1,333	1,045	346	610	1,248	763	1,858
DWR	235	52	0	0	23	406	45	163	12	9	181	0
DEF	-114	-52	238	0	495	927	1,000	183	598	1,239	582	1,858
ACDF	-114	-166	0	0	0	0	0	0	0	0	0	0
1972												
RDIS	432	36	81	21	273	984	2,247	918	729	389	714	475
DWR	161	56	0	0	28	415	0	55	48	9	208	90
DEF	271	-20	81	21	245	569	2,247	863	681	380	506	385
ACDF	0	-20	0	0	0	0	0	0	0	0	0	0
1973												
RDIS	0	21	0	0	164	626	534	391	680	977	1,117	1,072
DWR	204	55	0	0	32	446	126	218	5	9	180	0
DEF	-204	-34	0	0	132	180	408	173	675	968	937	1,072
ACDF	-204	-238	-238	-238	-106	0	0	0	0	0	0	0
1974												
RDIS	38	0	35	0	241	580	427	1,333	336	998	1,123	997
DWR	241	53	0	0	29	466	198	25	38	9	178	0
DEF	-203	-53	35	0	212	114	229	1,308	298	989	945	997
ACDF	-203	-256	-221	-221	-9	0	0	0	0	0	0	0
1975												
RDIS	276	142	53	169	23	474	140	719	712	891	502	556
DWR	97	55	0	0	33	528	306	61	6	9	214	0
DEF	179	87	53	169	-10	-54	-166	658	706	882	288	556
ACDF	0	0	0	0	-10	-64	-230	0	0	0	0	0
1976												
RDIS	655	1	0	26	1,685	705	504	946	536	283	543	824
DWR	217	55	0	0	20	431	94	59	6	32	205	0
DEF	438	-54	0	26	1,665	274	410	887	530	251	338	824
ACDF	0	-54	-54	-29	0	0	0	0	0	0	0	0
1977												
RDIS	261	177	1	21	118	703	685	668	820	291	666	12
DWR	62	53	0	0	32	424	136	64	5	29	210	241
DEF	199	124	1	21	86	279	549	604	815	262	456	-229
ACDF	0	0	0	0	0	0	0	0	0	0	0	-229
1978												
RDIS	0	0	0	0	150	283	390	1,562	693	2,301	941	170
DWR	222	55	0	0	30	600	231	10	3	7	238	93
DEF	-222	-55	0	0	120	-317	159	1,552	690	2,294	703	77
ACDF	-451	-506	-506	-506	-386	-702	-543	0	0	0	0	0

Note :

RDIS : River discharge
DWR : Diversion water requirement
DEF : Deficit of river discharge
ACDF : Accumulated deficit

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1979												
RDIS	127	0	0	350	618	825	298	1,035	443	954	623	27
DWR	237	55	0	0	23	423	216	53	6	9	199	235
DEF	-110	-55	0	350	595	402	82	982	437	945	424	-208
ACDF	-110	-165	-165	0	0	0	0	0	0	0	0	-208
1980												
RDIS	2	0	0	253	209	448	866	587	536	272	1,944	541
DWR	240	56	0	0	31	430	59	73	45	9	180	17
DEF	-238	-56	0	253	178	18	807	514	491	263	1,764	524
ACDF	-446	-502	-502	-249	-71	-53	0	0	0	0	0	0
1981												
RDIS	21	0	0	0	193	524	1,315	489	630	635	1,161	417
DWR	227	56	0	0	30	436	38	148	5	9	183	143
DEF	-206	-56	0	0	163	88	1,277	341	625	626	978	274
ACDF	-206	-262	-262	-262	-99	-11	0	0	0	0	0	0
1982												
RDIS	103	0	0	67	107	305	1,400	587	766	415	409	258
DWR	241	54	0	0	33	553	16	190	2	37	231	174
DEF	-138	-54	0	67	74	-248	1,384	397	764	378	178	84
ACDF	-138	-192	-192	-126	-51	-300	0	0	0	0	0	0
1983												
RDIS	60	5	10	0	0	225	567	655	131	835	584	16
DWR	183	56	0	0	36	595	64	120	49	9	268	278
DEF	-123	-51	10	0	-36	-370	503	535	82	826	316	-262
ACDF	-123	-174	-164	-164	-200	-570	-67	0	0	0	0	-262
1984												
RDIS	0	0	0	0	433	570	222	609	738	1,939	288	296
DWR	238	56	0	0	25	450	333	46	32	8	257	230
DEF	-238	-56	0	0	408	120	-111	563	706	1,931	31	66
ACDF	-500	-556	-556	-556	-149	-28	-140	0	0	0	0	0
1985												
RDIS	0	1	6	0	208	1,175	934	336	434	1,076	381	221
DWR	238	55	0	0	30	395	79	293	34	9	261	138
DEF	-238	-54	6	0	178	780	855	43	400	1,067	120	83
ACDF	-238	-292	-286	-286	-108	0	0	0	0	0	0	0
1986												
RDIS	0	0	0	0	219	6	755	1,029	435	997	847	438
DWR	237	55	0	0	30	693	63	42	41	9	184	139
DEF	-237	-55	0	0	189	-687	692	987	394	988	663	299
ACDF	-237	-292	-292	-292	-103	-790	-98	0	0	0	0	0
1987												
RDIS	0	0	0	0	14	344	66	590	687	259	241	707
DWR	232	56	0	0	35	569	303	156	6	47	191	94
DEF	-232	-56	0	0	-21	-225	-237	434	681	212	50	613
ACDF	-232	-288	-288	-288	-308	-533	-770	-336	0	0	0	0
1988												
RDIS	257	71	19	341	153	917	408	544	390	1,870	1,388	0
DWR	115	46	0	0	32	420	195	126	40	8	179	261
DEF	142	25	19	341	121	497	213	418	350	1,862	1,209	-261
ACDF	0	0	0	0	0	0	0	0	0	0	0	-261

Note:

1) 80% dependable storage requirement : 570,000 m3 (570,000 cu.m in 1983)
2) Loss Evaporation : 1,610 mm/year x 80% = 1,288mm
1,288mm x 118,300m2 = 152,000cu.m

TOTAL 722,000m3

Table VI.2.14 General Features of Irrigation Systems

NAME OF IRRIGATION SYSTEM	IRRIGATION AREA(ha) PADDY	UPLAND	EXISTING CIS	PROPOSED HEAD WORKS		CANAL SYSTEM (m) MAIN	MAIN FARM
1. SIPSIPIN	170	-	Puan-Linis CIS Butsinge CIS	Intake-1	Pump station-1	4,395	8,935
2. MAPAKLA	100	30	Lower Mapakla CIS Upper Mapakla CIS Tangge CIS	Intake-2	Pump station-1	1,975	5,930
3. MANGGAHAN	45	10	Mangahan CIS	Intake-1	Pump station-1	690	3,490
4. BAYUGO	50	-	Bayugo CIS (not functioning)		Pump station-1	1,170	2,510
5. LLANO	65	-			Pump station-1	2,000	2,710
6. PUNTA	35	-			Pump station-1	450	2,080
7. PALAY-PALAY	140	-		Impound-1	Pump station-1	3,140	6,130
8. PAGKALINAWAN	45	10			Pump station-1	1,520	2,140
9. IK-IK	45	-	Ik-Ik CIS (not functioning)	Intake-1	Pump station-1	1,120	3,020
10.LUBO	30	15	Lubo CIS	Intake-1	Pump station-1	120	2,960
11.LUMANG NAYON	95	-	Lumang Nayon CIS Ilog Munti CIS Ilog Na Malaki CIS	Intake-3	Pump station-1	1,890	4,320
12.PULONG LIGAYA	45	-	Pulong Matsing CIS	Intake-1	Pump station-1	1,010	1,910
13.BAGUMBONG	85	145	Bagumbong CIS	Intake-1	Pump station-2	2,980	10,750
TOTAL	950	210		Intake-11 Impound-1	Pump station-14	22,460	56,885

Table VI.2.15 (1) Salient Features of Irrigation System (Sipsipin)

1. Name of Irrigation System : Sipsipin irrigation system
2. System Category
   Rehabilitation : Sipsipin CIS
   Puang Linis CIS
   Butsinge CIS
3. Location
   Barangay : Sipsipin
4. Irrigation Area
   Command area : 170 ha
   Wet season paddy : 170 ha
   Dry season paddy : 170 ha
5. Project Facilities
   (1) Diversion scheme
      Diversion intake
         Improvement : Improvement of Sipsipin intake
         Water source : Puan river
         Design Q : 391 l/sec
      Pump station
         Water source : Lake Laguna
         Pump equipment : High head pump
            2 sets
            Low head pump
            2 sets
   (2) Irrigation facilities
      1) Irrigation canal
         Main canal
            Type : U-shape flume
            Nos : 4
            Length : 4,395 m
         Main farm ditch
            Type : U-shape flume
            Nos : 19
            Length : 8,935 m
      2) Related structure
         Turnout : 16 nos
         Aqueduct : 9 nos
         Others : 12 nos
   (3) Drainage facilities
      1) Drainage canal
         Type : Trapezoidal earth
         Length : 6,990 m ,4 nos
      2) Related structure: 4 nos
   (4) Farm road
      1) Farm road
         Width : 4 m with 3 m gravel metalling
         Nos : 4
         Length : 1,600 m

Table VI.2.15 (2) Salaient Features of Irrigation System (Mapakla)

1. Name of Irrigation System : Mapakla irrigation system
2. System Category
   Rehabilitation : Upper Mapakla CIS
   Lower Mapakla CIS
   Ilog Tangge CIS
3. Location
   Barangay : District I
4. Irrigation Area
   Command area : 130 ha
   Wet season paddy : 100 ha
   Dry season paddy : 100 ha
   Upland cropping : 30 ha
5. Project Facilities
   (1) Diversion scheme
      Diversion intake
         Improvement : Improvement of Upper Mapakla and Lower Mapakla intakes
         Water source : Mapakla river
         Design Q : 214 l/sec
      Pump station
         Water source : Lake Laguna
         Pump equipment : High head pump 2 sets
         Low head pump 2 sets
   (2) Irrigation facilities
      1) Irrigation canal
         Main canal
            Type : U-shape flume
            Nos : 4
            Length : 1,975 m
         Main farm ditch
            Type : U-shape flume
            Nos : 10
            Length : 5,930 m
      2) Related structure
         Turnout : 4 nos
         Aqueduct : 4 nos
         Others : 13 nos
   (3) Drainage facilities
      1) Drainage canal
         Type : Trapezoidal earth
         Length : 2,620 m, 7 nos
      2) Related structure: 3 nos
   (4) Farm road
      1) Farm road
         Width : 4 m with 3 m gravel metalling
         Nos : 1
         Length : 300 m

Table VI.2.15 (3) Salient Features of Irrigation System (Manggahan)

1. Name of Irrigation System : Manggahan irrigation system
2. System Category
   Rehabilitation : Manggahan CIS
3. Location
   Barangay : District III
4. Irrigation Area
   Command area : 55 ha
   Wet season paddy : 45 ha
   Dry season paddy : 45 ha
   Upland cropping : 10 ha
5. Project Facilities
   (1) Diversion scheme
      Diversion intake
         Improvement : Improvement of Manggahan intake
         Water source : Manggahan river
         Design Q : 102 l/sec
      Pump station
         Water source : Lake Laguna
         Pump equipment : 2 sets
   (2) Irrigation facilities
      1) Irrigation canal
         Main canal
            Type : U-shape flume
            Nos : 2
            Length : 690 m
         Main farm ditch
            Type : U-shape flume
            Nos : 7
            Length : 3,490 m
      2) Related structure
         Turnout : 5 nos
         Aqueduct : 2 nos
         Others : 4 nos
   (3) Drainage facilities
      1) Drainage canal
         Type : Trapezoidal earth
         Length : 3,230 m, 11 nos
      2) Related structure: 4 nos

Table VI.2.15 (4) Salient Features of Irrigation System (Bayugo)

1. Name of Irrigation System : Bayugo irrigation system
2. System Category
   Rehabilitation : Bayugo CIS
3. Location
   Barangay : Bayugo
4. Irrigation Area
   Command area : 50 ha
   Wet season paddy : 50 ha
   Dry season paddy : 50 ha
5. Project Facilities
   (1) Diversion scheme
      Pump station
         Water source : Lake Laguna
         Pump equipment : 2 sets
   (2) Irrigation facilities
      1) Irrigation canal
         Main canal
            Type : U-shape flume
            Nos : 1
            Length : 1,170 m
         Main farm ditch
            Type : U-shape flume
            Nos : 9
            Length : 2,510 m
      2) Related structure
         Turnout : 6 nos
         Syphon/aqueduct: 4 nos
         Others : 2 nos
   (3) Drainage facilities
      1) Drainage canal
         Type : Trapezoidal earth
         Length : 3,290 m, 11 nos
      2) Related structure: 7 nos

Table VI.2.15 (5) Salient Features of Irrigation System (Bayugo)

1. Name of Irrigation System : Llano irrigation system
2. System Category
   New development : Rainfed paddy fields
3. Location
   Barangay : Bayugo
4. Irrigation Area
   Command area : 65 ha
   Wet season paddy : 65 ha
   Dry season paddy : 65 ha
5. Project Facilities
   (1) Diversion scheme
      Pump station
         Water source : Lake Laguna
         Pump equipment : 2 sets
   (2) Irrigation facilities
      1) Irrigation canal
         Main canal
            Type : U-shape flume
            Nos : 1
            Length : 2,000 m
         Main farm ditch
            Type : U-shape flume
            Nos : 6
            Length : 2,710 m
      2) Related structure
         Turnout : 5 nos
         Syphon : 2 nos
         Others : 3 nos
   (3) Drainage facilities
      1) Drainage canal
         Type : Trapezoidal earth
         Length : 4,950 m, 14 nos
      2) Related structure: 8 nos

Table VI.2.15 (6) Salient Features of Irrigation System (Punta)

1. Name of Irrigation System : Punta irrigation system
2. System Category
   New development : Existing paddy fields
3. Location
   Barangay : Punta
4. Irrigation Area
   Command area : 35 ha
   Wet season paddy : 35 ha
   Dry season paddy : 35 ha
5. Project Facilities
   (1) Diversion scheme
      Pump station
         Water source : Lake Laguna
         Pump equipment : 2 sets
   (2) Irrigation facilities
      1) Irrigation canal
         Main canal
            Type : U-shape flume
            Nos : 1
            Length : 450 m
         Main farm ditch
            Type : U-shape flume
            Nos : 5
            Length : 2,080 m
      2) Related structure
         Turnout : 3 nos
         Others : 4 nos
   (3) Drainage facilities
      1) Drainage canal
         Type : Trapezoidal earth
         Length : 2,950 m, 6 nos
      2) Related structure: 6 nos
   (4) Farm road
      1) Farm road
         Width : 4 m with 3 m gravel metalling
         Nos : 1
         Length : 1,350 m

Table VI.2.15 (7) Salient Features of Irrigation System (Palay-Palay)

1. Name of Irrigation System : Palay-Palay irrigation system
2. System Category
   New development : Existing paddy fields
3. Location
   Barangay : Palay-Palay
4. Irrigation Area
   Command area : 140 ha
   Wet season paddy : 140 ha
   Dry season paddy : 70 ha
   Upland cropping : 70 ha
5. Project Facilities
   (1) Diversion scheme
      Impound
         Water source : Palay-Palay river
         Design Q : 253 l/sec
      Pump station
         Water source : Palay-Palay impound
         Pump equipment : 2 sets
   (2) Irrigation facilities
      1) Irrigation canal
         Main canal
            Type : U-shape flume
            Nos : 4
            Length : 3,140 m
         Main farm ditch
            Type : U-shape flume
            Nos : 13
            Length : 6,130 m
      2) Related structure
         Turnout : 11 nos
         Aqueduct : 5 nos
         Others : 11 nos
   (3) Drainage facilities
      1) Drainage canal
         Type : Trapezoidal earth
         Length : 7,320 m, 11 nos
      2) Related structure: 6 nos
   (4) Farm road
      1) Farm road
         Width : 4 m with 3 m gravel metalling
         Nos : 2
         Length : 1,100 m

Table VI.2.15 (8) Salient Features of Irrigation System (Pagkalinawan)

1. Name of Irrigation System : Pagkalinawan irrigation system
2. System Category
   New Development : Existing paddy and upland fields
3. Location
   Barangay : Pagkalinawan
4. Irrigation Area
   Command area : 55 ha
   Wet season paddy : 45 ha
   Dry season paddy : 45 ha
   Upland cropping : 10 ha
5. Project Facilities
   (1) Diversion scheme
      Pump station
         Water source : Lake Laguna
         Pump equipment : 2 sets
   (2) Irrigation facilities
      1) Irrigation canal
         Main canal
            Type : U-shape flume
            Nos : 2
            Length : 1,520 m
         Main farm ditch
            Type : U-shape flume
            Nos : 7
            Length : 2,140 m
      2) Related structure
         Turnout : 5 nos
         Syphon : 2 nos
         Others : 5 nos
   (3) Drainage facilities
      1) Drainage canal
         Type : Trapezoidal earth
         Length : 3,320 m, 11 nos
      2) Related structure: 5 nos

Table VI.2.15 (9) Salient Features of Irrigation System (Ik-Ik)

1. Name of Irrigation System : Ik-Ik irrigation system
2. System Category
   Rehabilitation : Ik-Ik CIS
3. Location
   Barangay : Lubo
4. Irrigation Area
   Command area : 45 ha
   Wet season paddy : 45 ha
   Dry season paddy : 45 ha
5. Project Facilities
   (1) Diversion scheme
      Diversion intake
         New construct. : Ik-Ik intake
         Water source : Ik-Ik river
         Design Q : 104 l/sec
      Pump station
         Water source : Lake Laguna
         Pump equipment : 2 sets
   (2) Irrigation facilities
      1) Irrigation canal
         Main canal
            Type : U-shape flume
            Nos : 2
            Length : 1.120 m
         Main farm ditch
            Type : U-shape flume
            Nos : 9
            Length : 3,020 m
      2) Related structure
         Turnout : 6 nos
         Aqueduct : 2 nos
         Others : 3 nos
   (3) Drainage facilities
      1) Drainage canal
         Type : Trapezoidal earth
         Length : 3,900 m, 15 nos
      2) Related structure: 8 nos

Table VI.2.15 (10) Salient Features of Irrigation System (Lubo)

1. Name of Irrigation System : Lubo irrigation system
2. System Category
   Rehabilitation : Lubo CIS
3. Location
   Barangay : Lubo
4. Irrigation Area
   Command area : 45 ha
   Wet season paddy : 30 ha
   Dry season paddy : 30 ha
   Upland cropping : 15 ha
5. Project Facilities
   (1) Diversion scheme
      Diversion intake
         Improvement : Lubo intake
         Water source : Lubo river
         Design Q : 89 l/sec
      Pump station
         Water source : Lake Laguna
         Pump equipment : 2 sets
   (2) Irrigation facilities
      1) Irrigation canal
         Main canal
            Type : U-shape flume
            Nos : 1
            Length : 120 m
         Main farm ditch
            Type : U-shape flume
            Nos : 6
            Length : 2,960 m
      2) Related structure
         Turnout : 3 nos
         Aqueduct : 1 no
         Others : 3 nos
   (3) Drainage facilities
      1) Drainage canal
         Type : Trapezoidal earth
         Length : 2,820 m, 8 nos
      2) Related structure: 7 nos
   (4) Farm road
      1) Farm road
         Width : 4 m with 3 m gravel metalling
         Nos : 1
         Length : 900 m

Table VI.2.15 (11) Salient Features of Irrigation System
(Lumang Nayon)

1. Name of Irrigation System : Lumang Nayon irrigation system
2. System Category
   Rehabilitation : Lumang Nayon CIS
   Ilog Munti CIS
   Ilog Na Malaki
3. Location
   Barangay : Bagumbong
4. Irrigation Area
   Command area : 95 ha
   Wet season paddy : 95 ha
   Dry season paddy : 95 ha
5. Project Facilities
   (1) Diversion scheme
      Diversion intake
         Improvement : Lumang Nayon, Ilog Munti and Ilog Na Malaki intakes
         Water source : Lumang Nayon and Munti rivers
         Design Q : 219 l/sec
      Pump station
         Water source : Lake Laguna
         Pump equipment : High head pump 2 sets
         Low head pump 2 sets
   (2) Irrigation facilities
      1) Irrigation canal
         Main canal
            Type : U-shape flume
            Nos : 5
            Length : 1,890 m
         Main farm ditch
            Type : U-shape flume
            Nos : 10
            Length : 4,320 m
      2) Related structure
         Turnout : 6 nos
         Aqueduct : 4 nos
         Others : 10 nos
   (3) Drainage facilities
      1) Drainage canal
         Type : Trapezoidal earth
         Length : 1,890 m, 6 nos
      2) Related structure: 3 nos
   (4) Farm road
      1) Farm road
         Width : 4 m with 3 m gravel metalling
         Nos : 3
         Length : 2,000 m

Table VI.2.15 (12) Salient Features of Irrigation System
(Pulong Ligaya)

1. Name of Irrigation System : Pulong Ligaya irrigation system
2. System Category
   Rehabilitation : Pulong Matsing CIS
3. Location
   Barangay : Bagumbong
4. Irrigation Area
   Command area : 45 ha
   Wet season paddy : 45 ha
   Dry season paddy : 45 ha
5. Project Facilities
   (1) Diversion scheme
      Diversion intake
         Improvement : Pulong Matsing intake
         Water source : Bagumbong and Matsing rivers
         Design Q : 104 l/sec
      Pump station
         Water source : Lake Laguna
         Pump equipment : 2 sets
   (2) Irrigation facilities
      1) Irrigation canal
         Main canal
            Type : U-shape flume
            Nos : 2
            Length : 1,010 m
         Main farm ditch
            Type : U-shape flume
            Nos : 4
            Length : 1,910 m
      2) Related structure
         Turnout : 2 nos
         Others : 5 nos
   (3) Drainage facilities
      1) Drainage canal
         Type : Trapezoidal earth
         Length : 2,690 m, 4 nos
      2) Related structure: 4 nos
   (4) Farm road
      1) Farm road
         Width : 4 m with 3 m gravel metalling
         Length : 1,200 m

Table VI.2.15 (13) Salient Features of Irrigation System (Bagumbong-1)

1. Name of Irrigation System : Bagumbong-1 irrigation system
2. System Category
   - Rehabilitation : Bagumbong CIS
   - Extension : Upland and paddy fields
3. Location
   - Barangay : Bagumbong
4. Irrigation Area
   - Command area : 120 ha
   - Wet season paddy : 65 ha
   - Dry season paddy : 65 ha
   - Upland cropping : 55 ha
5. Project Facilities
   (1) Diversion scheme
      - Diversion intake
        - Improvement : Bagumbong intake
        - Water source : Bagumbong river
        - Design Q : 253 l/sec (inclusive of Pulong Ligaya)
      - Pump station
        - Water source : Lake Laguna
        - Pump equipment : High head pump 2 sets; Low head pump 2 sets

   (2) Irrigation facilities
      1) Irrigation canal
         - Main canal
           - Type : U-shape flume
           - Nos : 10
           - Length : 1,940 m
         - Main farm ditch
           - Type : U-shape flume
           - Nos : 10
           - Length : 5,750 m
      2) Related structure
         - Turnout : 7 nos
         - Aqueduct : 2 nos
         - Farm pond : 1 no
         - Others : 12 nos

   (3) Drainage facilities
      1) Drainage canal
         - Type : Trapezoidal earth
         - Length : 3,720 m, 7 nos
      2) Related structure: 1 no

   (4) Farm road
      1) Farm road
         - Width : 4 m with 3 m gravel metalling
         - Length : 1,150 m

Table VI.2.15 (14) Salient Features of Irrigation System
(Bagumbong-2)

1. Name of Irrigation System : Bagumbong-2 irrigation system
2. System Category
   Rehabilitation : Bagumbong CIS
   Extension : Upland and paddy fields
3. Location
   Barangay : Bagumbong
4. Irrigation Area
   Command area : 110 ha
   Wet season paddy : 20 ha
   Dry season paddy : 20 ha
   Upland cropping : 90 ha
5. Project Facilities
   (1) Diversion scheme
      Pump station
         Water source : Lake Laguna
         Pump equipment : High head pump
            2 sets
            Low head pump
            2 sets
   (2) Irrigation facilities
      1) Irrigation canal
         Main canal
            Type : U-shape flume
            Nos : 2
            Length : 1,040 m
         Main farm ditch
            Type : U-shape flume
            Nos : 8
            Length : 5,000 m
      2) Related structure
         Turnout : 5 nos
         Farm pond : 1 no
         Others : 9 nos
   (3) Drainage facilities
      1) Drainage canal
         Type : Trapezoidal earth
         Length : 730 m, 7 nos
      2) Related structure: 3 nos

Table VI.2.16 General features of Palay-Palay dam

(i) General	
- Catchment area	381 ha
- Reservoir surface area at M.W.S.E.	19 ha
- Storage capacity	
Total storage capacity	1,060 x 10^3 m^3
Effective storage capacity	722 x 10^3 m^3
Dead water volume	338 x 10^3 m^3
- Water elevation	
Maximum water surface elevation	El. 27.50 m
Normal water surface elevation	El. 26.50 m
Dead water surface elevation	El. 20.00 m
(ii) Dam	
- Type	Earthfill dam with central impervious earth core
- Crest elevation	El. 29.50 m
- Dam height	24.0 m
- Crest length	123 m
(iii) Spillway	
- Type	Non-gated overflow weir
- Design discharge	68 m^3/sec
- Crest elevation	El. 26.50 m
- Crest length	30 m
(iv) River diversion	
- Type	buried concrete pipe
- Design discharge	38 m^3/sec
(v) Intake	
- Design discharge	0.253 m^3/sec
- Intake gate	Sluice gate