3.2 Study on Development Plan

3.2.1 Basic Concepts for Project Formulation

(1) Main issues in the study area

The poor performance of irrigation services is generally common to most national irrigation systems (NIS) in the Philippines. As clarified in Section 3.1, existing five (5) NIS such as the Aganan, Sta. Barbara, Suague, Jalaur proper, and Jalaur extension RISs in the study area also are not properly maintained to ensure adequate, equitable and timely supply of water. This causes low agricultural productivity in the said RIS areas. The major issues related to the performance of these RISs are summarized as follows:

(a) Low agricultural productivity

Agricultural productivity is generally low as reflected by the low paddy yields of about 3.3 tons/ha to 3.9 tons/ha obtained in the study area The low yields of paddy can be attributed largely to insufficient supply of irrigation water, improper farming technology brought about by inadequate provision of agricultural extension services, and lack and improper use of certified seeds.

(b) Low irrigation efficiency

As clarified in Section 3.1.8, the present overall irrigation efficiencies of existing RISs in the study area are estimated at approximately 20 % to 30 %. The low irrigation efficiencies can be attributed to inadequate supply of water due to siltation in canal systems caused by the absence of silt excluders, low embankment, difficulty of operation by the absence of measuring devices and insufficient control structures due to deterioration, and poor water management and operation of facilities by NIA staff and IA members due to lack of proper skills.

(c) Poor water management and O&M practice and low collection of ISF

Water management and O&M practice in the systems of existing RISs in the study area are not being properly and effectively performed by NIA staff and IA members. The average ISF collection efficiencies of existing RISs for the past five (5) years from 1992 to 1996 are estimated at 28 % to 41 %. These rates are lower than the national average of 48 %.

The poor water management and O&M practice can be attributed mainly to insufficient O&M budget due to low collection of ISF, inadequate O&M competence on the part of NIA staff and the IAs, and insufficient water control structures and lack of measuring devices.

The low collection of ISF can be attributed mainly to low farm incomes received by farmers, low consciousness of farmers for ISF payment, improper

evaluation of benefited areas and production by the NIA field staff. The latter has been tolerated by the NIA staff who have been assigned to the site for long years. Inaccurate collection of ISF is also due to poor database management particularly on ISF billing and collection records.

(d) Institutional and technical weakness of Irrigators' Association and NIA

After almost a decade of existence, most of the IAs are still dependent on NIA's field staff in the formulation and implementation of organizational policies and activities for effective and sustainable O&M of facilities, water delivery and distribution, cropping schedule, fund generation, and skills development of the general membership. This can be attributed mainly to unclear organizational activities and benefits, inadequate organizing strategy, financial weakness, non-participation of farm workers, no functional IA/TSAG service committee for water management and O&M work, and absence of practical, easy-to-understand manual on water management, O&M practice and cropping calendar preparation.

NIA's capacity to support the IA development is also presently constrained by institutional and technical weakness. This can be attributed to lack of training and experience of IDOs on community organizing, cooperative development and inter-agency coordination, absence of systematic management information system for quick and accurate generation of operational map and updated database for each IA, and unclear delineation of functions of IDO and WRF technician/WRF ditch tender.

(e) Financial weakness of farmers

Most farmers in the study area have cash flow problem. This poor financial position of farmers can be attributed mainly to low agricultural productivity and small size of farm land. Compounding this is the limited access to government institutional credit program. They borrow money from the private traders for land preparation and purchase of farm inputs whose interest rates are normally above market rate. The farmers sell their paddy immediately after harvest without drying to repay their loans. Thus, the farmers are deprived of better farmgate price.

(f) Watershed degradation

Due to fuelwood gathering for sugarcane factory, the forest areas in the watershed areas of the water source rivers for existing RISs have been destroyed. This has resulted in severe flood during wet season, lowering the baseflow of river in dry season and increased sedimentation of river due to soil erosion.

The relationship among the said issues and their main causes are shown in Figure 3.2.1. The vicious circle of the main issues and their causes in the study area are also shown in Figure 3.2.2.

In addition to the above issues, the following are also identified which are specific to the study area:

(g) Illegal water use in the upper river basin

There are 2,988 ha of total irrigation areas which utilize water by brush dams or pumps in the upper river basins of existing RISs without obtaining water right. This issue would greatly affect the sustainability of the Project if the river water would be disorderly used in the said irrigation areas.

(h) Conversion of agricultural land

Part of agricultural lands of both the Aganan RIS and Sta. Barbara RIS located near the Iloilo city has been converted into mainly residential or commercial lands due to urbanization, covering 500 ha and 400 ha, respectively. This has developed mainly due to abandonment of agricultural lands by farmers because of insufficient supply of irrigation water and its convenient location along the national road.

(2) Development policies for basic issues on project sustainability

Of the eight (8) main issues identified in the study area, the issues on land conversion, illegal water use and watershed degradation are considered to affect the sustainability of the Project. To address these basic issues on the project sustainability, certain development policies are taken into consideration as briefly discussed below.

(a) Land conversion

To protect the agricultural lands of both the Aganan and Sta. Barbara RIS areas from further reduction and sprawl due to disordered land conversion, the following development policies will be adoped:

(i) to ensure adequate, equitable and timely supply of irrigation water to all irrigation service areas of both the Aganan RIS and Sta. Barbara RIS through rehabilitation and improvement of existing irrigation facilities and strengthening of the skills of the NIA staff and IAs on water management and O&M practices, thereby revitalizing the irrigation system, and

(ii) to introduce high value - added diversified crops in both the Aganan and Sta. Barbara RIS areas through the development of irrigated agriculture in order to improve the poor financial position of farmers and increase farmers' access to markets.

(b) Illegal water use in the upper river basin

Water users in the upper river basins utilize river water for irrigation without restraint by taking advantage of the location of their paddy fields.

However, their irrigation facilities are inappropriate with low efficiencies, resulting in wasteful use of river water. Taking into consideration the importance of the basin - wide water management approach, the development policies to be adoped are as follows:

(i) to enhance the irrigation efficiencies through improvement of water users' facilities and thereby reduce the wasteful use of river water, and
(ii) to give water rights to their irrigation areas for legal authorization.

It is recommended that the said improvement of facilities be done by developing new communal irrigation system projects under the guidance of the NIA and LGU in the future. Only the required amount of irrigation water under the communal irrigation system projects would be allocated and accounted in the water balance calculation for the study area.

(c) Watershed management

Generally, proper management and rehabilitation of watershed require a high investment and considerably long time to recover the stable river water flow, reduce sediment and sustain the project life and get significant effect. Taking this into account, the development policies for issues on the watershed degradation are as follows:

(i) as a short term plan, to provide a settling basin at each head of the main canal to protect canal systems from siltation by sediment intrusion to the systems, and
(ii) as a long term plan, to disseminate the sustainable upland farming system on sloping land, promote the social forestry program (reforestration program) such as community forestry management agreement (CFMA) and to develop the alternative energy sources such as introduction of biogas, improved stove, and establishment of community forest.

The short term plan would be implemented as the first step under the Project, while the long term plan would be in the form of recommendations to NIA and DENR under the Project.

(3) Prospective plan

To address the above common issues to NIS, the following projects financed by the World Bank have been, or are being implemented for the Aganan, Sta. Barbara, Suague, Jalaur proper, Jalaur extension RISs.

- The First Irrigation Operation Support Project (IOSP I)
- The Second Irrigation Operation Support Project (IOSP II)
- The Water Resources Development Project (WRDP)

These projects have aimed to improve and sustain the operational efficiency of the NIS to increase agricultural production (mainly rice), expand small farmer incomes and rural employment opportunities, and contribute to rural poverty alleviation. But, since the operations of these projects have been nationwide in scope and covered all the existing NIS, the project fund for each RIS has been limited. In fact, only minor repair and desilting works were executed under IOSP I & IOSP II. Most of the funds were used for desilting works of the irrigation canals. The system improvement and repair works under WRDP would be implemented from 1998 for the Jalaur proper RIS, but the planned budget would be limited to about 29,500 thousand pesos (US$ 1,032 thousand). Due to this condition, the projects are not effective to solve the fundamental issues on the low agricultural productivity and low irrigation efficiency in the project areas.

As stated in the subsequent Sections 3.2.1 and 3.2.2, the construction plan for the proposed small impounding dams and irrigation plan for the proposed extension areas would be excluded from the development plan mainly on technical consideration. Thus, the development of irrigated agriculture within the limited irrigation service areas of the existing RISs would be a main subject to increase agricultural productivity at the highest level, especially the yields of paddy. This would be achieved by enhancing irrigation efficiency for effective and maximum use of available water. To address the major issues in the areas and attain the above goal, the following plans are envisaged:

- Irrigated agriculture development plan anchored on increasing productivity, especially yield of paddy,
- Rehabilitation and improvement plan of existing irrigation facilities to enhance irrigation efficiency for maximum use of available water,
- Improvement and strengthening plan of present water management and O&M practice including improvement plan of ISF collection by NIA and IA to enhance irrigation efficiency for maximum use of available water and to protect the facilities to be rehabilitated and improved from deterioration,
- Institutional development plan of IA and NIA for sustainability of water management and O&M practice and implementation of parcial system management,
- Strengthening and improvement plan of agricultural support services such as extension, research, credit, post-harvest facilities and marketing, and rural infrastructures including farm-to-market road network for effective implementation of the irrigated agriculture development plan to improve the financial weakness of farmers, and
- Watershed management plan to stabilize river water flow, reduce sediment and sustain the Project operations.

The integration of those prospective plans is necessary to reactivate the existing RISs, maximize the agricultural productivity, improve the financial position of farmers, and thereby improve the regional economy.

(4) Approach to the prospective plan

The prospective plans stated above will be formulated to solve the major issues in the study area. The approaches to the prospective plans are:

(a) Irrigated agriculture development plan

In the formulation of the irrigated agriculture development plan, emphasis shall be placed on increasing productivity, especially the yields of paddy and introducting high value-added diversified crops in the Aganan and Sta. Barbara RIS areas to improve the poor financial position of farmers in the study area.

(b) Rehabilitation and improvement plan of existing irrigation facilities

The rehabilitation and improvement plan of existing irrigation facilities shall be a revitalization model plan of irrigation systems emphasizing on immediate measures for the problems on siltation of canals and difficulty of operation by the absence of measuring devices and insufficient water control structures to enhance irrigation efficiency for maximum use of available water.

(c) Improvement and strengthening plan of water management and O&M practices

In the formulation of the improvement and strengthening plan of water management and O&M practices, emphasis shall be placed on improvement of institutional and technical weakness of NIA and IA, improvement of inadequate funding through better ISF collection, and establishment of monitoring system for proper water management.

(d) Institutional development plan of IA and NIA

The institutional development plan of IA and NIA shall be formulated mainly to ensure the sustainability of water management and O&M practices and implementation of partial system management.

(e) Strengthening and improvement plan of agricultural support services

The strengthening and improvement plan shall be formulated to emphasize the effective implementation of the irrigated agriculture development plan for improving the financial weakness of farmers.

(f) Watershed management plan

The watershed management plan shall be formulated to achieve "sustainable use of natural resources" and "stability of rural people life". This plan shall include not only the bio-physical aspect (forest development) but also the social and cultural aspect (rural development), and financial and economic milieu of the rural people and communities.

(5) Delineation of project area

(a) Urbanization of irrigation service area of existing RIS

It was found through the field survey that urbanization of the irrigation service areas of existing RIS, especially Aganan RIS and Sta. Barbara RIS, was much in progress. The present irrigation service area of each RIS is shown below compared with the original irrigation service area by NIA:

(Unit : ha)

RIS	Original	Present
Jalaur proper	9,000	8,820
Jalaur extension	2,700	2,620
Suague	2,900	2,960
Sta. Babara	4,600	3,000
Aganan	5,500	4,360
Total	24,700	21,760

The figures of present irrigation service area surveyed by the study team shall be used for formulation of development/improvement plan in the Master Plan.

(b) Extension areas in the study area

The extension areas originally proposed by NIA and survey by the study team in the Phase I study are comparatively shown below.

Name of Extension Area	Original	Surveyed
Pototan	600	500
New Lucena	420	410
Sta. Barbara	980	1,030
San Miguel	2,000	2,510
Oton	1,800	1,430
Borotac Nuevo	5,500	2,830
Total	11,300	8,710

As examined in Section 3.1.8, these extension areas was excluded from the project area due to topographical objection and slow progress of land reform program.

(c) Project area

As stated above, the project area to be examined in the Study is limited to the existing irrigation service area of 5 RISs, 21,760 ha in total.

3.2.2 Water Resources Development Plan

Advantages of "small impounding reservoir" are i) low construction cost, ii) quick yielding, iii) technical soundness, and iv) easier water management as an independent system. On the other hand, small dam project is difficult to justify because

of low scale-merit and high unit cost per irrigation area. The following conditions are considered necessary for justifying the small dam project:

1) Dam efficiency (storage-embankment volume ratio) is high enough (at least 20, e.g. 96.2 for the Jalaur multipurpose dam),
2) Dam should be located close to the irrigation area,
3) Catchment area should be less than 100 km^2, preferably between 10 to 50 km^2 considering design floods and spillway cost,
4) Sediment load of the river should be low, and
5) Sufficient effective storage volume to accommodate proposed irrigation area (about 10 MCM per 1,500 to 2,000 ha)

Proposed small impounding dams are evaluated below.

(1) Jalaur small impounding dam

Possibility of a small impounding dam at the location of the proposed Jalaur multipurpose dam is considered very low. According to the study report on the Jalaur multipurpose dam, sedimentation rate is estimated at 1.5 mm/km^2/year which amounts to 8.0 million cubic meter (MCM) in 50 years. Dead storage volume will occupy a large part of the total storage volume of the reservoir. The dam site cross-section shows a "V" shape which requires a higher dam to store a large volume of water. Furthermore, the dam itself is very far from the Jalaur RIS area, which will make water management very difficult. Taking into account the catchment area at the dam site (CA=109 km^2) and the intake (CA=1,065 km^2), it is considered more practical to save water by controlling or managing upstream water use than to construct small impounding reservoirs.

(2) Ulian small impounding dam

Dimensions and basic features of the proposed dam are shown below:

Location	:	BRGY. Tampucan, Lambunao
Catchment area	:	96 km^2
Dam height	:	15 m
Dam length	:	137 m
Reservoir area	:	108 ha
Storage volume	:	8.10 MCM

Although the above figures are derived based on 1:50,000 topographic map, the proposed capacity of 8.10 MCM is considered feasible according to the site reconnaissance made during the study period. However, design flood (PMF) is estimated to be more than 2,000 m^3/sec from its catchment area and rainfall. Construction cost of the spillway will be very high compared to that of the dam itself. Sedimentation rate is estimated to be similar to that of the Jalaur dam. Sedimentation for 50 years is estimated at 7.2 MCM which is almost 90 % of the total storage volume. Hence, the small impounding dam is not recommended.

(3) Suague small impounding dam

Dimensions and basic features of the proposed dam in the NIA proposal are shown below:

Location	:	BRGY. Quiput, Janiuay
Catchment area	:	39 km^2
Dam height	:	45 m
Dam length	:	120 m
Reservoir area	:	37 ha
Storage volume	:	8.32 MCM

A dam of 45 m high is hardly classified into "small impounding dam". It was observed during the site reconnaissance that the estimated storage volume of 8.32 MCM which was estimated on the 1:50,000 scale topographic map will not be realized at the proposed dam site. Longitudinal gradient of the river is 1/100 or less and the possible storage is estimated about half of the proposed volume. Sedimentation in the reservoir is estimated to be nearly 3.0 MCM in 50 years. The sediment will occupy a large part of the reservoir volume. Taking these conditions into consideration, the small reservoir is not recommended.

(4) Tigum small impounding dams

Several locations have been proposed by NIA for small impounding dams. The original proposed dam site is located at the Salog River, one of the tributaries of the Tigum River. The details are given below:

Location	:	BRGY. Kabankalan, Maasin
Catchment area	:	14.1 km^2
Dam height	:	33.0 m
Dam length	:	176.0 m
Reservoir area	:	30.0 ha
Storage volume	:	4.95 MCM

The command area of extension area located on the downstream of the dam accounts for only 410 ha and is far from the Sta Barbara RIS, thus the proposed dam is not considered feasible not only for the Sta. Barbara RIS but also for the upstream area.

The dam site with the highest development potential identified in this study is situated at 4.0 km upstream (CA=58 km^2) of the Metro Iloilo Water District diversion weir at Daja, Maasin. Details of the proposed dam are given below:

Location	:	BRGY. Daja, Maasin	
Catchment area	:	58.3 km^2	
		Alternative-I	Alternative-II
Dam height	:	40.0 m	18.0 m
Dam length	:	750.0 m	700.0 m
Reservoir area	:	100.0 ha	60.0 ha
Storage volume	:	22.80 MCM	3.42 MCM

The proposed dam is located 200 m on the upstream side of the confluence of the Tigum River and its tributary, and the length of the dam which is proposed to be constructed across the two rivers is quite very long. The dam efficiency will be less than ten (10). Hence, the proposed small reservoir is considered neither feasible nor recommendable.

(5) Aganan small impounding dams

Three dam sites have been identified along the Aganan river, and one on the Piandaan river, a tributary of the Aganan River. Dimensions and basic features of the proposed dams in the NIA proposal are shown below:

Dam #1

Location	:	BRGY. Cabacanan, Alimodian
Catchment area	:	8.0 km^2
Dam height	:	30.0 m
Dam length	:	126.0 m
Reservoir area	:	3.0 ha
Storage volume	:	0.45 MCM

Dam #2

Location	:	BRGY. Ugbo, Alimodian
Catchment area	:	41.0 km^2
Dam height	:	20.0 m
Dam length	:	208.0 m
Reservoir area	:	20.0 ha
Storage volume	:	3.0 MCM

Dam #3

Location	:	BRGY. Pajo, Alimodian
Catchment area	:	61.0 km^2
Dam height	:	22.0 m
Dam length	:	163.0 m
Reservoir area	:	53.0 ha
Storage volume	:	5.8 MCM

Piandaan Dam

Location	:	BRGY. Piandaan Norte, Alimodian
Catchment area	:	6.6 km^2
Dam height	:	20.0 m
Dam length	:	203.0 m
Reservoir area	:	46.0 ha
Storage volume	:	4.6 MCM

Dam site #1 is not technically feasible because of extensive land slides at the dam site. Dam site #2 and #3 are situated on the main stream of the Aganan river. Taking into account the present watershed conditions, the sedimentation rate is estimated to be more than that of the Jalaur dam site. Even assuming the same sedimentation rate of 1.5 mm/km^2/year, the proposed reservoirs will be filled up in less than 50 years. Thus, construction of small impounding dams on the main stream of the Aganan River is not recommended until a sound watershed management project has been implemented.

Piandaan dam has a comparatively large storage capacity among the proposed reservoirs in the Aganan basin. However, its catchment area is very small and the water source river dries up during the dry season.

Small impounding dams on the Aganan river and its tributaries are hardly recommendable mainly because of high sedimentation rate and big floods.

3.2.3 Irrigated Agricultural Development Plan

(1) Proposed cropping pattern

Paddy, vegetables, and perennial/biennial fruit crops are selected for the future cropping pattern to be affected by the Project considering existing crops in the study area and suitability to climate and soil conditions.

Generally, diversified crops can be planted only in the dry season because the crops are sensitive to water-logging and high humidity in the wet season. Soil condition in the study area has limitation on drainability for most diversified crops. Land selection or proper measures to poor drainage are required for cultivation.

Proposed cropping pattern is determined as shown in Figure 3.2.3, according to the following conditions:

i) To stop water distribution for 1.5 - 2 months in the dry season for maintenance works on irrigation facilities,
ii) To introduce valuable diversified crops including vegetables and perennial fruits using furrow irrigation in the service area of Aganan and Sta. Barbara RIS to a small extent: vegetables and tree fruits in about 10 % of the service areas,
iii) To plant paddy rice to a full extent in the wet season except for perennial crops area,

iv) To assume that the cropped area of watermelon is irrigated by groundwater from dug-wells same as present condition,

v) To irrigate paddy by optimizing water resources,

vi) To plant rainfed paddy in second crop by supplemental irrigation using surface or groundwater from creeks and shallow tube-well in same area under the present condition if irrigated paddy cannot be fully planted, and

vii) To exclude rainfed diversified crops and 3rd paddy under the present condition because these crops cannot be given a guarantee for water distribution in the future plan.

The cropping patterns in the future plan are summarized as below:

	Cropped Area (ha)				
	Jalaur prop.	Jalaur extn.	Suague	Aganan	Sta. Barnara
1st Paddy Irrigated	8,820	2,620	2,960	4,290	2,960
2nd Paddy Irrigated	8,820	2,620	600	500	800
2nd Paddy Rainfed	0	0	610	900	300
Vegetables	0	0	0	200	300
Perennial fruits crops	0	0	0	70	40
Total (ha)	17,640	5,240	4,170	5,960	4,400
Sercice Area (ha)	8,820	2,620	2,960	4,360	3,000
Cropping Intensity (%)	200	200	141	137	147

(2) Proposed farming practices

Proposed farming practices and management are summarized below.

(a) Paddy rice

Unit yield of paddy rice will be increased by the application of proper irrigation through rehabilitation of irrigation facilities and improvement of water management, and farming practices, fertilization in particular. Present farming method should be improved on land preparation, seeding method, fertilizing, control of pest/disease/weed, etc.

i) Direct seeding had been applied widely in the wet and dry seasons, however, it seems that direct seeding is presently one of the causes of low yield of paddy . Transplanting method can reduce seeding rate from 150 - 200 kg/ha at present to less than 100 kg/ha, also herbicide will be reduced.

ii) Certified seeds from seed-grower should be used every 1 - 2 cropping, and dose of seeds should be reduced from 200 kg/ha at present to 100 kg/ha in order to save on seed cost, avoid over vegetative growth, and reduce input cost, applying molloscide and rodenticide for snail and rat control.

iii) Land preparation will be fully performed by hand-tractor or tractor with 20-30 horse-power. Organic fertilizers, such as crop residues and animal manure should be incorporated into the soil by plowing. Excrement of hog which nearly 50 % of farmers are rising, can be used for preparing farm manure. Insect, disease, weed, rat and golden snail should also be controlled by adequate management and agro-chemicals following instructions of extension worker.

iv) Crop fertilization should be applied at 100:35:35 kg/ha of N:P:K in total. All of the P and K, and 1/3 of N should be applied as basal, and the remaining N should be dosed 6 weeks after seeding, and at the panicle initiation stage by side dressing, respectively.

v) Weed control in the vegetative and reproductive stages will be done by appropriate pre-emergence herbicides as recommended, and resistant weed to herbicides should be pulled by hand. Pest and insect control also should be done timely as recommended.

(b) Eggplant (as a representative crop of vegetables)

i) The land should be plowed and harrowed 2 to 3 times. For furrow irrigation and drainage of logging water, row ridge should be made with 1.0 m wide.

ii) Seedling grown in the seedbed should be transplanted into the prepared land with a spacing of 100 cm x 50 cm.

iii) After several days of transplanting, fertilizer should be applied at the rate of 70:70:70 kg/ha of N:P:K, and side dressings should be applied at 80:0:30 kg/ha of N:P:K after three and seven weeks of transplanting.

iv) The excessive and sickly branches should be pruned. Weed control should be done using herbicide in consultation with extension workers, hill-up by plow or hoe and manual weeding

(c) Mango (Perennial/biannual fruit crop)

Mango is one of the major tree fruits crops in the adjacent area. It will be planted in gently sloping or higher land in order to avoid crop damage due to low drainability.

i) The seedlings should be planted 10 to 14 m distance of trees.
ii) During the non-bearing period, five years of the initial stage, the land can be cultivated with annual crops like mungbean.
iii) Fertilizer rate of N:P:K is recommended at 150:100:60 kg/ha per year

(3) Requirements for labor and farming machinery

Farm labor requirements for proposed farming practices in the future plan are shown in Table 3.2.1, production cost under "with project" condition. Labor requirement per hectare is given below:

Crop	Labor Requirement (man-day/ha)
Paddy*	64 - 67 (direct seeding)
	96 - 100 (transplanting)
Watermelon	82
Vegetable	95
Tree fruits	120

Note *: Labor requirement in crop budget applied direct seeding method

Labor and farm machinery balance will not change so much from present condition to future plan. Labor and farm machinery requirements in the future plan is similar with the present condition in case of applying direct seeding. Because the cropped area and cropping intensity as well as labor and farm machinery requirement per hectare are similar with present conditions, it can roughly estimated that the labor force and working capacity of farm machinery are enough for the requirement of future plan.

(4) Anticipated crop yield and production

Unit yield of crops in the future plan is estimated on the basis of the results of the socio-economic survey on progressive farmers in well irrigated land, interview with MAOs of relevant municipalities, and data from MTADP in Iloilo province.

Target yield in near future in MAOs of relevant municipalities	:	5.5 - 6.3 ton/ha
Target yield of irrigated paddy of Gintong Ani Program	:	5.0 ton/ha
Present average yield in progressive area in Philippines	:	4.9 to 5.3 ton/ha
Average yield in good year in Iloilo province (Oct.- Dov, 1993)	:	4.83 ton/ha
Potential yield of HYV	:	7.00 ton/ha
Actual yields at demonstration plots (Techno-demo-farm) supervised by MAOs	:	4.8 - 5.5 ton/ha

Crop/Condition	Anticipated Yield (ton/ha)
1st paddy irrigated	5.0
2nd paddy irrigated	5.0
Eggplant irrigated	6.0
Mango irrigated	4.0

Crop production in the study area at full development stage under "with project" condition is estimated by multiplying the expected unit yield with the cropped area. Total production is estimated at 180,780 ton of paddy, 3,000 ton of vegetables, and

440 ton of fruits. The net incremental of crop production is expected at 72,520 ton of paddy rice, 3,000 ton of vegetables and 440 ton of fresh fruits.

(unit: 1,000 ton)

RIS	Paddy	Vegetables	Tree fruits
Jalaur proper	88.20	-	
Jalaur extension	26.20	-	-
Suague	19.63	-	-
Aganan	26.65	1.20	0.28
Sta. Barbara	20.10	1.80	0.16
Total	180.78	3.00	0.44

(5) Crop budget and project benefit

On the basis of the irrigation efficiency and reliable run-off of each river, the estimated irrigated area of "without-project" and "with-project" conditions are shown below:

(Unit: ha)

	Without Project		With Project			
	1st paddy	2nd paddy	1st paddy	2nd paddy	Vegetables	Tree fruits
Jalaur proper	5,910	4,620	8,820	8,820	-	-
Jalaur extension	2,260	2,170	2,620	2,620	-	-
Suague	2,600	420	2,960	600	-	-
Aganan	3,000	550	4,290	500	200	70
Sta. Barbara	2,700	880	2,960	1,000	300	40

Profit and production cost per hectare of crops on both "with project" and "without project" conditions are estimated on the basis of the socio-economic survey and proposed farming practice. The unit yield of "without project" condition is estimated to be the same as that of present condition. Production cost and net profit of "with project" and "without project" conditions are summarized below.

(Unit: peso/ha)

	Without Project			With Project		
	Gross Income	Production Cost	Profit	Gross Income	Production Cost	Profit
1st paddy irrigated	29,170 - 33,120	14,900	14,270 - 18,220	42,900	15,720	31,470
2nd paddy irrigated	28,310 - 30,540	15,200	13,110 - 15,340	42,900	16,830	32,080
1st paddy rainfed**	19,220	11,400	7,820	19,220	11,400	7,820
2nd paddy rainfed**	19,220	11,800	7,420	19,220	11,400	7,820
Vegetables	-	-	-	54,000	17,360	36,640
Tree crops*	-	-	-	74,330	16,320	58,010

Note *: Weight average of 5 years of non-bearing period and 25 years of bearing period.
**: Assumed with-project same as without-project

As a result, the incremental project benefit at full development stage is estimated at 290.03 million pesos in Jalaur proper RIS, 64.40 million pesos in Jalaur extension RIS, 44.92 million pesos in Suague RIS, 75.79 million pesos in Aganan RIS, and 54.80 million pesos in Sta. Barbara RIS as shown in Table3.2.2.

3.2.4 Improvement Plan of Irrigation and Drainage Facilities

(1) Water allocation for irrigation use

Private irrigation system of about 3,000 ha is extended in the upper river basin from the existing diversion dams of the 5 RISs. For sustaining the basin - wide water management in the 4 rivers concerned with the RISs, the water allocation for irrigation use in the upper rriver basin will be planned to adopt as one (1) component in the water balance of the 5 RIS areas.

The necessary water amount in each upper river basin is estimated based on the current cropping pattern in the basin as explained in the proceeding sections. The amount of water allocation is estimated as shown below.

RIS concerned	Private Irrigation System in the Upper Reach (ha)	Water Amount (MCM/year)
Jalaur RIS	1,420	24
Suague RIS	1,035	17
Sta.Barbara RIS	259	4
Aganan RIS	274	4

(2) Irrigation water requirement

(a) General

Irrigation water requirement is computed based on the guidelines of the FAO on irrigation and drainage paper No. 24, and the potential evapo-transpiration (ETo) is estimated by Modified Penman method using meteorological data from Iloilo airport. The seasonal ETo ranges from 3.9 to 6.9 mm and the annual ETo is estimated at 1,809 mm. Crop coefficient is also estimated based on the guidelines of the FAO irrigation and drainage paper No. 24.

The effective rainfall for paddy field is estimated by applying the relationship curve derived from the water balance calculation in the model for paddy field, using the short term data (10 years) from Iloilo airport,. and the effective rainfall for the upland crops is estimated using the USDA SCS method. Percolation rate is estimated at 1.1 to 2.0 mm / day in the dry season and 1.1 to 1.5 mm/day in the wet season based on the local information suggested by NIA operation office.

The nursery requirement is not considered in the computation of irrigation requirement because of the existing farming practices for paddy cultivation which

apply direct seeding method. Irrigation requirement is computed by the following formula.

$$IR = \{(Kc \times ETo) + P + LP - RE\} / Ie$$

where,

IR	:	Irrigation Requirement
Kc	:	Crop coefficient
ETo	:	Potential evapo-transpiration
P	:	Percolation
LP	:	Land preparation requirement
RE	:	Effective rainfall
Ie	:	Overall irrigation efficiency

(b) Irrigation requirement in the existing irrigation areas of the upper river basin

The irrigation water use in the existing irrigation areas of the upper basins of the 4 rivers, namely Jalaur, Suague, Tigum and Aganan rivers is computed based on the current cropping patterns in the Jalaur proper - Suague RIS and the Aganan - Sta. Barbara RIS areas. Seasonal irrigation requirements for the upper reaches of the Jalaur - Suague rivers and the Aganan - Tigum rivers are estimated at approximately 1,675 mm and 1,417 mm, respectively. In the estimation, overall irrigation efficiency is assumed at 45 % by taking into account well sustained water management condition under future irrigation development, such as communal irrigation system development.

(c) Projection of present irrigated paddy field in the RIS areas

(i) Overall irrigation efficiency

The current overall irrigation efficiencies of the 5 RIS areas are estimated using the calculated run-off at diversion dam and the statistics data on the NIA's benefited service areas as explained in Section 3.1.8. The overall irrigation efficiencies are estimated at 20 % for Jalaur proper and extension RISs, 25 % for Suague RIS and 30 % for Aganan and Sta. Barbara RISs.

(ii) Projection of present irrigated area

For the estimation of the irrigated service area under the probable drought year with 80 % chance, the irrigation water requirement is computed using the overall irrigation efficiency of the each RIS mentioned above and the current cropping pattern. The irrigation water requirement is used to make water balance calculation in each RIS area, using the run-off data for 20 years, and the services area to be irrigated under the probable drought year with 80 % chance is projected as follows.

RIS	Crop	Irrigated area (ha)
Jalaur proper	1st paddy	5,910
	2nd paddy	4,620
Jalaur extension	1st paddy	2,260
	2nd paddy	2,170
Suague	1st paddy	2,600
	2nd paddy	420
Sta. Barbara	1st paddy	2,700
	2nd paddy	880
Aganan	1st paddy	3,000
	2nd paddy	550

(d) Irrigation requirement in the plan and development potential

(i) Overall irrigation efficiency

The irrigation requirement for the irrigation projects of the NIA regional office is generally estimated based on the standard figures of the irrigation requirement depending to the conditions of soil, topography, scale of irrigation area, etc. for instance, 1.19 lit/sec/ha for ordinary clayey soils, and the overall irrigation efficiency is not discussed. Therefore, the overall irrigation efficiency is assumed based on the guidelines of the FAO irrigation and drainage paper. The overall irrigation efficienciesbased on conveyance efficiency and operation cum application efficiency are respectively assumed as shown below .

Crops	Efficiency			Remarks
	Conveyance eff.	Operation & Application eff.	Overall eff.	
Paddy	72	70	50	Canal lining in main canal section
Vegerable	72	70	50	Canal lining in main canal section
				Furrow irrigation method
Fruit	72	85	61	Canal lining in main canal section
				Drip and /or Splinkler irrigation method

(ii) Seasonal irrigation requirement

Seasonal irrigation requirement is estimated based on the proposed cropping pattern and summarized below.

RIS	Crops	Seasonal Irrigation Requirement (mm)
Jalaur proper	1st paddy	308
	2nd paddy	1,260
Jalaur extension	1st paddy	606
	2nd paddy	726
Suague	1st paddy	268
	2nd paddy	1,240
Sta. Barbara	1st paddy	242
	2nd paddy	1,042
	Vegetable	340
	Fruit	1,103
Aganan	1st paddy	242
	2nd paddy	1,042
	Vegetable	340
	Fruit	1,103

(iii) Projection of irrigation service area

The irrigation area in the development plan is estimated through water balance calculation using the estimated run-off under the condition of the basin wide - water management. The irrigation area is estimated below under the condition of the probable drought year with 80 % chance.

RIS	Crop	Irrigated area (ha)
Jalaur proper	1st paddy	8,820
	2nd paddy	8,820
Jalaur extension	1st paddy	2,620
	2nd paddy	2,620
Suague	1st paddy	2,960
	2nd paddy	600
Sta. Barbara	1st paddy	2,960
	2nd paddy	1,000
	Vegetable	300
	Fruit	40
Aganan	1st paddy	4,290
	2nd paddy	500
	Vegetable	200
	Fruit	70

(3) Preliminary plan on rehabilitation of canals and drains

(a) Diversion dam

The major rehabilitation works needed on diversion dam are the repair of intake and scouring sluice gates, provision of new trashracks, improvement of discharge measuring system at head section of main canal, and installation of communication system as shown below.

Diversion Dam	unit	Jalaur	Suague	Sta. Barbara	Aganan
Repairing of intake gate	nos.	10	2	1	7
Repairing of main gate	nos.	13	-	-	-
Repairing of sluice gate	nos.	4	1	-	-
Installation of trashrack	nos.	10	2	6	7
Provision of measuring devices	nos.	2	1	1	1
Installation of communication system	set	2	1	1	1
Rehabilitation of gate master 's office	nos.	-	-	1	-

(b) Canal and drain

The improvement and rehabilitation works of existing canals and drains are carried out to increase the overall irrigation efficiency, adopting the following approach in the improvemet plan.

- Additional feeder canals and turnouts to sustain the optimum command area for suitable water distribution,
- Canal lining in main canals, and
- Strengthening of drainage canals in the Suague, Jalaur proper and Jalaur extension RIS areas.

Based on the preliminary plan, 28 feeder canals will be added to the existing canal networks in order to achieve the optimum command area which is less than 35 ha. The total length of feeder canals would be approximately 26 km. As shown below, the canal lining is planned to provide approximately 72 km in main canal network of the 4 RISs , excluding the Aganan RIS in which main canal has been already lined by the concrete under the Japanese Grant Aid Program.

RIS	Canal	Length (km)
Jalaur proper	Head race/Main canal	25
Jalaur extension	Head race/Main canal	28
Suague	Head race/Main canal	9
Sta. Barbara	Head race/Lateral C	10
Aganan	-	0
Total		72

The inundation problem in the Jalaur proper and Suague RIS areas is mainly caused by the insufficient flow capacity of the existing drainage culvert and/or the lack of drainage culvert of the highways. For solution of the inundation problem, additional drainage culverts and /or bridges and additional drainage canals are constructed.

The tail portion of the Jalaur proper RIS area also suffers from back water for 2 to 3 days during only heavy rainfall at the high tide. However, the

inundation damage is not severe. Therefore, the specified plan to deal with the inundation is not proposed in the study.

As for the flood of the Jalaur river, flood occurs only during the big typhoon . The flood water gives inundation problem in the tail portion of the Jalaur proper RIS area for 2 to 3 days , but does not result in the deterioration of agriculture land of the entire area of the Jalaur proper and extension RISs. Taking into account the flood damage mentioned above, the need for flood control is considered to be low. Therefore, the specified plan of flood control is not proposed in the study.

(c) Related structure

The improvement of existing structures includes the repair and/or replacement of gates at head gates and turnouts, the repair of riprap protection of the structures, the replacement of concrete pipes of turnout, etc. The necessary additional structures are settling basin in each main canal and turnout, measuring devices at head gates and turnouts, spillway, trashrack at syphons, farm pond, etc. The settling basin is planned to be self-flushing type of siltation. Additional turnout is approximately 150, and distributed as shown below.

RIS	Nos.
Jalaur proper	45
Jalaur extension	57
Suague	0
Sta. Barbara	30
Aganan	17
Total	149

The farm pond to be provided is about 35 in the Aganan and Sta. Barbara RIS areas to support proper water management for vegetables and fruits cultivation as shown in Figure 3.2.4. Furthermore, for improvement of water operation and more effective water use for irrigation in the dry season, small water ponds are provided in main drains by construction of check structure and/or the excavated pond.

(d) On - farm development

The canal layout in which canal and drain networks are completely separated is suitable to sustain proper water management at the on-farm. Therefore, the layout of main farm ditch and main farm drain is improved, in the line with improvement of existing turnout and addition of new turnout.

(e) Overlapping improvement works with the WRDP

Some improvement works in the Jalaur proper RIS mentioned above, specially earth works of main and lateral canals overlap with the works to be improved by the WRDP. The major works of the WRDP are the desilting and

embankment in main canal systems, farm service road, replacement of steel gates, etc. as mentioned in Section 2.3.

The WRDP is scheduled to start the construction since the year of 1997, and the implementation period is 5 years. Taking into consideration the implementation schedule of the WRDP, the works to be improved in the WRDP are deleted from the project cost estimation of the study.

3.2.5 Improvement Plan of Rural Infrastructures

(1) Development strategy

Rural road and potable water supply are the two highest development needs in the study area. However, the improvement and upgrading project of potable water supply has been undertaken by the respective LGUs concerned under the technical assistance of LWUA. Large scale rural water supply project such as the Metro Iloilo potable water supply project is being conducted by MIWD. Therefore, only the improvement plan of the rural road is made in the Study.

Development strategies on the rural road are to make smooth linkage system by improvement of the existing NIA's service road, minor repair of the existing rural road and addition of rural road, bridges and crossing structures in order to strengthen the farm - to - market road network.

(2) Service roads and link roads

The road linkage system between the service road and rural road is provided in order to improve the rural economy through transportation improvement of agricultural input and output. The improvement of existing service road will involve an additional road of approximately 90 km, which is about 38 % of all the existing service roads of the 5 RISs. The link road of approximately 15 km is proposed to connect the existing service road with rural road networks. The bridge will be constructed in 7 sites for crossing small river, and culverts of approximately 210 are to be provided in the 5 RIS areas .

3.2.6 Improvement Plan of Water Management and O&M Practices

(1) Water management practices

(a) Water delivery schedule

As for the water delivery and distribution schedule, the irrigation water rotation program adopted by system will be modified based on the actual conditions of water delivery and distribution, and farming activities by means of the proposed monitoring system to be suited for each system, because such schedule is not followed due to insufficient water supply, and is not so accurate and effective due to the absence of proper measuring devices in the canals in some cases.

In Aganan and Sta. Barbara RIS, irrigation system for the diversified crop will be proposed by using farm pond. Water delivery for the water storage in the farm pond will be considered as one of the tertiary blocks on the current rotation system, and water distribution to the diversified crop from the farm pond will be done separately from the water distribution to the paddy.

(b) Facilities management

Accurate measurement is a fundamental and indispensable factor for the proper operation of irrigation system, and such measuring devices should be practical for easy utilization by the field staff such as WRF Technicians and WRF Tenders.The accurate and practical measuring devices should be installed in all of the control structures such as intake gates, head gates and turnouts.

(c) Monitoring system

A proposed monitoring system will compose of collection of field data such as farming activities and rainfall, river water level, canal water level and gate opening through communication system, processing the data, monitoring the field operation, and improvement of recording and filing system by means of computer and wireless radio.

The measured data will be transmitted by wireless radio to each RIS office on time through the communication system. The wireless radio will be set in each RIS office as a base station and carried by the field staff such as the Field Engineers and the WRF Technicians, and installed at each diversion dam/intake gate site and each IA office to be proposed during Type III contract implementation.

The water management and operation plan will be prepared at each RIS office in accordance with the yearly water delivery and distribution schedule prepared by each RIS office in coordination with the IAs before the wet season cropping.

(2) Operation and maintenance practices

(a) O&M method

The number of NIA field personnel will be increased for the effective O&M practices and Type I&II contracts by IAs will be set as the first step of the improvement plan for the O&M performance of the existing NIS in the study area to be able to concentrate their usual routine works and to be activated effectively. At the final step, Type III Contract (parcial management turn over to IAs) will be applied and the full O&M management of sections of the existing NIS in the study area will be turned over to IAs. Regardless of type of O&M practice, useful and practical O&M manuals and training to the O&M staff with institutional development to activate NIA, IA and farmers' organization are indispensable.

(b) O&M manual and training

At present, there are no practical O&M manuals to be comprehended easily and utilized sufficiently by the field personnel in the systems of the study area. Practical O&M manuals should be prepared to be comprehended easily and utilized sufficiently by the field personnel such as the WRF Technicians, Operators and Tenders to improve their water management and O&M practice.

In order to perform the effective O&M works, thus the training program should be improved to sufficiently give the opportunity of training to all of O&M staff concerned with water management and O&M works to improve their activity.

(c) O&M cost

The present ISF collection is lower than the actually required O&M costs, causing difficulty for the RIS offices to allocate enough funds for the operation and maintenance cost of the system facilities and the institutional strengthening cost. Therefore, the improvement of ISF collection is indispensable to increase ISF collection efficiency and to obtain the sufficient and regular income for the development of sustainable systems.

(3) Irrigation service fee (ISF) collection

The proposed improvement plan on ISF collection is formulated focusing on the following main points in order to increase ISF collection.

(a) Method of collection

Type II contract will be recommended to be applied for the ISF collection based on the following merit.

(i) Reduction of administration cost of the NIA and proper work load of the NIA field staff
(ii) Real meaning to the concept of farmers' participation
(iii) Confidence among IA farmer-members
(iv) Strategy to build up working capital for the IA

(b) Proper record keeping and preparation of billing and collection documents

At present, basic data for the ISF collection such as the list of water users (farmers and beneficiaries), their addresses, status of payment, etc. are not properly stored and processed by the billing clerks by means of computer. For the effective systematization of the record keeping and the prompt preparation of the billing and collection documents, the list of water users, their addresses, status of payment, etc. which serve as basic data for the ISF collection will be properly stored and processed by the computer.

(c) Training and seminar for the billing clerks of NIA and IA finance officers, and ISF collectors (NIA & IA)

In order to perform the effective and systematic ISF collection works, training and seminar program for the ISF collectors should be regularly conducted to sufficiently give the opportunity of training and seminar to all of the ISF collectors to improve their activity .

Training of billing clerks of NIA and IA finance officers should be also considered for prompt issuance of ISF bills to the water users.

(d) Rate for imposition of penalties

The present penalty charge of 1% per month for non-payment of ISF seems too low to discipline effectively the delinquent water users. Such rate will be made higher to decrease the number of non-paying water users, and heavier penalty will be imposed in case of willful neglect.

(e) IA incentives for ISF collection

Under the present Type II contract, total current account collection from the IA during the wet and dry seasons is shared between the NIA and the IA in favor of the latter if the collection efficiency exceeds 50%. The IA incentive given under the operation and ISF collection contract is based on levels of collection which are as follows:

Collection efficiency (%)	Incentives to IA
0 - 50	0%
51 - 60	2%
61 - 70	5%
71 - 90	10%
91 - 100	15%

Accordingly, no incentive is given to the IA in case the collection efficiency does not exceed 50%. In order to encourage the IA to implement Type II contract and to improve the present low level of ISF collection by IA, additional incentives (e.g., 1% incentive for 41-50% efficiency and 0.5% incentive for 31-40% efficiency) will be considered for collection efficiency of less than 51%.

3.2.7 Improvement Plan of Agricultural Support Services

(1) Research and extension

The concepts of extension and research are as follows:

i) Farmers participation for extension program through group meeting and field evaluation of new technologies,

ii) Systematic extension service in accordance with annual performance plan prepared based on the farmers needs,
iii) Provision of appropriate training for extension staff,
iv) Improvement of linkage of extension services and research agencies, and
v) Priority of farmers needs in research.

For training and guidance on farming technology in the field, IA and extension worker shall organize farmers' groups consisting of 30-40 members per group in one or two turn-out service area (TSA). The leader of each group will work at the field level as a voluntary agricultural technician. Extension worker will regularly visit the farmers' group for training and guidance. Each farmers' group will also set up demonstration plot(s) in the field for training and field evaluation of new technologies. Number of farmers' groups in each RIS are estimated below:

	Estimated No. of farmers groups	No. of IA
Jalaur extension	90	6
Jalaur proper	35	14
Suague	30	5
Aganan	50	4
Sta. Barbara	35	6
Total	240	35

At present there are about 100 extension workers in charge of crop cultivation in the relevant municipalities. Assuming that about 50 persons of the extension workers can be active for the study area, an extension worker has about five farmers' groups on average. Extension workers will provide annual working plan according to the performance guideline by DA and PAO as well as farmers needs.

DA and PAO shall provide the guidelines on farming practices for the target crops to farmers , and extension activities in cooperation with research organization. Furthermore, DA and PAO shall hold training for extension workers and farmer leaders on new technologies and maintain close contact with MAO and farmers.

Research agencies, such as WESVIARC, state college and university should intend to support PAO and MAO staff technically. At the same time, the research agencies shall carry out examination and solution on needs and problems at the field level. Varietal trial and provision of proper farming technology for diversified crops are an important item of research on the project. Research agencies shall support the seed growers more intensively.

(2) Agricultural credit

The agricultural credit improvement plan should address the twin problems of the indedtedness of the farmer-borrowers with their cooperatives or IAs and weak capacity of the cooperatives to deliver credit. Both problems must be simultaneously addressed to be able to access to the agricultural lending window of the LBP. The LBP through the farmers' cooperatives or juridical IA organizations would remain to be the institutions

that can support rural financial intermediation in the sudy area. Along these perspectives, the following are envisaged as components of the improvement plan:

(a) Loan restructuring.

The farmer-borrowers or IA members who have past due loans are proposed to have a loan restructuring program mutually agreeable between the LBP and farmers' cooperatives. The loan restructuring would be planned to consider a modified loan amortization of past due loans while at the same time allowing the farmer-borrowers to renew their loans for new production activities. The loan restructuring is foreseen as the best route to settle the arrears of the members of the farmers' cooperatives that would eventually continue their access to the LBP lending window.

(b) Institutional strenghtening.

In parallel to the loan restructuring program, the farmers' cooperatives would be strenghtened in terms of their financial base and technical capability on credit screening, evaluation and monitoring. Expanding the financial base of the cooperatives would require mobilization of capital-build up and cleaning of bad accounts. The technical capability would involve funds management and portfolio investments.

(c) Expanded Financial Intermediation.

Given the expanded credit demand of the farmers and IA members, the farmers' cooperatives would expand their credit services by extending a variety of loans. The financial intermediation would consider the totality of the farming as a business enterprise and not simply provision of agricultural commodity loans. This would take care of microcredit activities.

(3) Improvement plan for marketing and post-harvest

There are two major problems faced by the farmers in the marketing of palay. First is related to post-harvest practices. Second is the individual selling and lack of integration between production and processing.

The marketing improvement plan envisages an integrative buying/selling and processing of paddy to be performed by the farmers' cooperatives or juridical IA organizations. The envisaged activities essentially involve procuring, hauling, milling, selling and inventory financing.

To be able to achieve this integration, the following are essential:

(a) Provision of adequate post-harvest facilities and trucking fleet.

Integrated rice mill complex is essential to be able to control production and selling. However, the issue of ownership and acquisition by the farmers'

cooperatives or IA organizations should be decided only when they are ready to operate and maintain such facilities. Leasing and renting existing facilities are financially advantageous in view of the excess capacity of rice mills and warehouses in the study area.

(b) Provision of working capital.

The provision of working capital is necessary to operate the integrated cycle of business. The release of this loan should form part of the loan restructuring program envisaged under the credit plan.

(c) Intensified capability building.

The farmers' cooperatives or IA organizations should be equipped with the necessary skills on market information matching. This is essential to be able to determine the optimun inventory and stocks to be traded at any given time.

3.2.8 Improvement Plan for Strengthening of Farmers' Organizations and NIA

The improvement plan for strengthening of farmers' organizations in the study area will improve the present institutional weakness of the IAs particularly the non-functionality of its committees, poor leadership and management skills, low participation of the members in the IA activities, and lack of access to formal credit in order to facilitate the partial or full transfer of irrigation management responsibility from NIA to the IAs. The strengthening of NIA's capability will also be carried out to realize the turnover of irrigation management function to the IAs.

(1) Farmers' organizations

(a) Jalaur-Suague RIS

In the Jalaur-Suague RIS area, the main components of the improvement plan for strengthening of farmers' organizations will be the following:

(i) Activation of the IA standing committees

The four (4) standing committees of the 25 IAs in the Jalaur-Suague RIS (i.e., 14 IAs in Jalaur proper, 6 in Jalaur extension and 5 in Suague) will be fully activated both at the IA and TSAG levels to enable them to effectively and sustainably implement the existing O&M (Types I & II) contracts with NIA and to facilitate the turnover of irrigation system management functions to the IAs in the near future. The following strategies will be adopted to carry out the activation of the IA/TSAG committees:

- Recruitment of locally-based NGOs to assist every IA in the reorganization, training and technical guidance of its 4 standing commitees,

- At the TSAG level, the members of each TSAG will be equally divided and assigned to the 4 standing committees to ensure the participation of all the members in the IA activities,
- More frequent and regular TSAG committee meetings from the present once a month to twice a month (bi-monthly) meeting to allow greater interaction and exchange of information among the 4 TSAG committees,
- Reactivation of the regular monthly meeting of the 4 standing committees at the IA level as stipulated in its by-laws for the proper monitoring of the progress of their activities and the prompt action on problems related to water management and O&M activities, etc., and
- Organization of IA working groups for O&M activities on quarterly rotational basis to reduce O&M cost and ensure the sustainability of these activities.

NIA should exert all efforts to enjoin the 37% potential farmer-members in the Jalaur proper RIS to become actual IA members to effectively consolidate the farmers' skills and resources for the sustainability of O&M activities.

(ii) Development of continuing education program

Every IA will be assisted by the proposed recruitment of locally-based NGOs to develop and implement a continuing education program that includes intensive on-the-job training and on-site technical advice to the IA officers, committees and members. In the early stage of the development of this education program, the NGOs will carry out most of the training and technical assistance works for the IAs, but the core groups (education clusters) of progressive IA members to be given intensive training by the NGOs will sustain the implementation of the education program after the NGOs leave the study area. The following activities will be undertaken to develop the continuing education program:

- Establishment of three (3) education clusters for each IA to be consist of progressive members under its committee on membership, education and training to coordinate and participate in the planning and implementation of the continuing education program for all the IA members,
- Assignment of the 3 clusters to the 3 areas of concern of the continuing education program of the IAs: (i) organizational development and participatory development, (ii) water management and O&M practices, and (iii) agricultural extension on improved farming practices,
- Preparation of the required training manuals and materials including the O&M manual to be used for the training of all IA members, and

- Publication and dissemination of simple newsletters on improved farming practices, water management and O&M practices, etc. to serve as ready guides for all the IA members, and
- On-site group education sessions to be scheduled before and after the cropping season to allow all members to benefit from the program.

(iii) Development of records management system and construction of the IA office

Every IA will be assisted by the NGOs and NIA's IDOs to develop and maintain a simple records management system to consist of the proper collection and recording of IA activities and plans on farming activities, water management and O&M practices, continuing education program, proceedings of meetings, and financial statements. The members of the relevant IA committees will be trained by the NGOs and NIA's IDOs on the operation and maintenance of the records management system.

The construction of IA office will be carried out to provide a permanent place for the safekeeping of IA records and other information, a venue for the IA meeting and training, etc. Basic office equipment such as tables, chairs, steel cabinets, etc. will also be provided for the effective operation of the IA office.

(iv) Rehabilitation of existing farmers' cooperatives

The improvement plan envisages that the lack of access to formal credit by the IA members, which has caused the dependence of farmers to traders and input suppliers for credit, will be addressed by the rehabilitation of existing farmers' cooperatives in the study area in order to re-start the agricultural loan for the IA members. The following measures will be carried out to achieve this objective:

- Loan restructuring and institutional strengthening of the existing farmers' cooperatives to supply loan to the IA members for crop production, and to directly engage in bulk buying of farm inputs, and group buying / selling and processing of paddy to increase farmers' income and capacity to pay the ISF,
- Development of women service cooperatives (WSC) in the IA areas with no existing farmers' cooperatives to supply the same loan to the IA members for crop production and group buying / selling of paddy,
- Area assignment of locally-based NGOs to train and assist the farmers' cooperatives and the WSC in coordination with the CDA, LBP and MAOs' cooperative development officers, and
- Development of simple group credit application procedure, and flexible loan repayment scheme for the IA members.

(v) Federation of the IAs

All the IAs will be organized into IA federation for each RIS by the NGOs and NIA's IDOs for the effective system-wide coordination and management of water delivery/distribution and O&M works, etc.. Proper training and technical guidance will be given to the IA federations to carry out the system-wide water management and O&M practices and the establishment of coordinative linkages with the LGU's MAO, DA, etc. for the regular and timely delivery of appropriate agricultural support services.

(b) Aganan-Sta. Barbara RIS

The improvement plan envisages that the Aganan River Federation of Irrigators' Association (ARFIA) consisting of the 6 IAs in the Aganan RIS will be able to maximize and sustain the operation and management of the existing post-harvest facilities in the study area. At present, the attainment of this objective is contingent on the improvement of the weak financial position of the ARFIA members to enable them to actively participate in the utilization and management of the facilities. The following measures will be adopted to attain this objective:

(i) Increasing access of ARFIA members to government loan such as Quedancor's paddy inventory guarantee financing program, etc. for agricultural activities,
(ii) Diversification of capital sources through the promotion of capital build up at the IA level,
(iii) Setting up of fair quota system for the effective utilization of the post-harvest facilities,
(iv) Reduction of service charges for the utilization of the post-harvest facilities by promoting group activities,
(v) Training of the ARFIA members on relevant topics on the proper management of the post-harvest facilities, and
(vi) Promotion of rice milling and marketing to increase farmers' income from the value-added benefits of paddy drying, storing and/or milling before actual selling.

In the Sta. Barbara RIS, the improvement plan will address the weak financial position of the IA members and the institutional weakness of the existing IAs through the following measures:

(i) Recruitment of locally-based NGOs (i.e., Taytay sa Kauswagan, Inc., Katin Aran, Inc. and Visayas Cooperative Development Center) to assist the NIA's IDOs in institutional strengthening of the IAs and rehabilitation of existing farmers' cooperatives, and also to provide agricultural credit to the IA members,
(ii) Activation of the IA/TSAG standing committees through the promotion of group activities for water management and O&M practices on a quarterly basis,

(iii) Development of continuing education program through the establishment of education clusters for organizational development, water management and O&M practices, etc.,
(iv) Loan restructuring and institutional strengthening of the existing farmers' cooperatives or development of WSC in the IA areas with no such cooperatives through the proposed recruitment of the NGOs in cooperation with the LGUs' MAOs,
(v) Mobilization of internal resources through the promotion of capital build up, and
(vi) Improvement of the IA records management system.

(2) National Irrigation Administration

The improvement plan for institutional strengthening of NIA will implement the following measures:

(i) Training of NIA-RIS field staff (e.g., Engineers, IDOs, WRF Technicians and WRF Ditch Tenders) will be carried out to improve their technical skills on water management and O&M practices, monitoring system, the use of computer for ISF billing and collection system, etc. and their development facilitation skills for the strengthening of the IAs.
(ii) Renovation of the NIA Regional Training Center in Pototan will be undertaken to serve as the main venue for the training of NIA staff, IAs, farmers' cooperatives, MAOs, etc..
(iii) Procurement of required equipment for training, communication and transport will be made to facilitate the conduct of training, dissemination of information between NIA and the IAs, and regular field visits of the IDOs.
(iv) Technical assistance will be provided to NIA through the proposed recruitment of the NGOs for the institutional strengthening of the IAs and rehabilitation of farmers' cooperatives, and the required consultants for the training and technical guidance of NIA staff, MAOs, the IAs and farmers' cooperatives.

3.2.9 Watershed Management Plan

(1) Basic development approach for watershed management

The goal of the watershed management is to achieve "sustainable use of natural resources" and "stability of rural people life". The main issue on the watershed degradation is the low concern among individual rural household for the adverse impact on their welfare. This requires a development approach that considers not only the bio-physical aspect but also the social and cultural, and economical milieu of the rural people to improve their present condition and re-orient their attitudes forward proper resource use.

On the other hand, the Goverment can directly apply the rehabilitation measurements on the Forest land only. Therefore, the project approach shall be divided

into two ways; for Forest land and for Alienable and Dispasable land. As for Forest land, the watershed management shall be implemented under the governments initiative like the rehabilitation project in Maasin. Since the government will work indirectly on A&D land, the extension for dissemination of upland farming system will be the main activities on the area.

(a) On Forest land

A watershed rehabilitation sub-project will be implemented in Tigum watershed from 1998. This consists of soft (community organization) and also hard (reforestation) components. DENR has applied this watershed rehabilitation approach on the critical watersheds in the whole country. The wateshed management concept in this report will also refer to one watershed rehabilitation sub-project. The outline of the concept is as follows.

i) Community organizing by using participatory concepts
ii) Social and integrated development
iii) Rehabilitation of forest
iv) Land conservation (agro-forestry and sustainable farming)

(b) On Alienable and Dispasale land

The main work on A&D land is to disseminate the importance of soil conservation and its measures to the land users or owners. The MAO and CENRO will be a main engine for the extension works. Therefore, the strengthening of the extension is emphasized in the development concepts in order to attain the long term goal of sustainable land use in the watershed.

(2) Outline of technical approaches

(a) Upland farming system (soil conservation system and agro-forestry system)

There are three types of erosion control measures of; i) vegetative measures, ii) structural measures, and iii) cultural measures. The description of soil erosion control measures are summarized in Table 3.2.3. In the Philippines, a kind of vegetative measures, named as SALT (Sloping Agricultural Land Technology) system, have been promoted before.

Agro-forestry system is also one of the vegetative measures for land conservation and also a common farming system in the Philippines. The recommended types of agro-forestry system are as follows :

Type	Summary
Randomly-mixed agroforestry	involving different species of forest and fruit trees and also agricultural crops with no definite pattern of arrangement.
Row-inter crop agro forestry	involving the integration of the forestry species with the agricultural crops simultaneously on the same unit of land with a definite pattern, such as (i) trees along border, (ii) alternate row, (iii) alternate strips. (ref. Fig. 3.2.5)

(b) Development of alternative energy source

Firewood cutting is one of the reason for forest degradation, since the local people mainly use firewood for their energy and its demand has increased with increase of population. The improvement of cooking stove is one of the effective measures for sustainable energy development. The introduction of biogas system as an alternative energy is also useful.

(3) Institutional development concepts

(a) Strengthening coordination with agencies

The appropriate coordination among the different government line agencies will be required, especially the DENR, DA, NIA, LGUs and NGOs, etc. One approach is to establish a multi-sectoral task force which will be organized for the watershed management under the initiative of DENR.

(b) Training

It is recommended to establish a section for training in the "task force" to develop staff capability for community organizing and watershed management. Through the training, appropriate technology of sloping agriculture, agro-forestry, etc. will be inculcated to the government staff and also to beneficiaries.

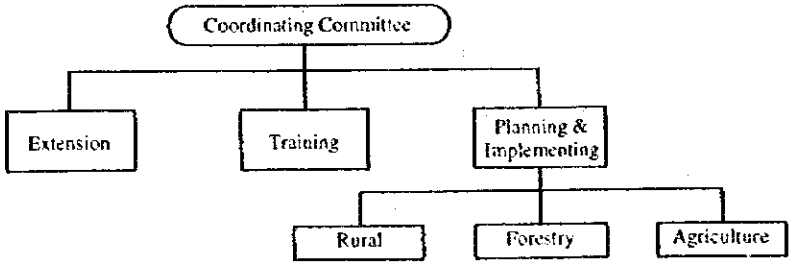
(c) Extension

For the effective extension of watershed management system, it is proposed that a model project of integrated agricultural and forestry development will be applied at sites in the watersheds. This procedure can be expected to help the government in saving money and staff and also enable the settlers to understand the effects of proper watershed management.

(4) Watershed management plan

(a) Institutional development

The institutional development plan is to establish a multi-sectoral coordinating committee at national and local level. Through WRDP, an inter-departmental steering committee will be established at national level. It is proposed that a task force committee at local level shall be established for the watershed management works as shown below.



(b) Technical management plan

Taking into consideration the particular characteristics of each watershed area, the technical preventive measures for each watershed area are considered as shown below. Each of them will include proven and effective practices being pursued by DENR such as contract reforestation, regular reforestation, ISFP, community based forest management program, etc.

(i) Aganan watershed

A significant part of the area is classified into A&D land and is presently under cultivation. Therefore, the following technical options shall be considered.

1. Community organizing
2. Extension works of sustainable upland farming system on sloping land on model area
3. Support for social and rural development on model development area
4. Reforestation on model development area
5. Development of alternative energy source

(ii) Tigum watershed area

The "watershed reservation area" is designated in the upstream area of the watershed and several forest management programs are proposed to be implemented in the reservation area. In addition to promotion of the forest management programs, the following support shall be considered to prevent further encroachment of the surrounding settlers into the reserved area.

1. Community organizing
2. Extension works of sustainable upland farming system on sloping land on model area
3. Development of alternative energy source

(iii) Suague watershed area

Similar to Aganan watershed area, population intensity and the ratio of farm land in the area are high. However, a significant area of paddy field exists in the watershed area. Therefore, the condition of water cultivation into the groundwater is better than the one in Aganan.

1. Community organizing
2. Extension works of sustainable upland farming system on sloping land on model area
3. Issuance of water right for water users
4. Support for social and rural development on model area
5. Reforestation on model area
6. Development of alternative energy source
7. Improvement of iirrigation system

(iv) Jalaur watershed area

The watershed area is large as compared to the other areas, and the vegetative condition of watershed is also complicated as evidenced by the presence of primary forest up to intensive farm areas. Therefore, a broad area-wide and sector-wide approach shall be introduced for its proper management.

1. Community Organizing
2. Extension works of sustainable upland farming system on sloping land on model area
3. Support for social and rural development on model area
4. Reforestation on model area
5. Development of alternative energy source
6. Issuance of water right for water users (on lowland area as San Enrique, Passi, etc.)
7. Improvement of exsisitng iirigation system (on lowland area as San Enrique, Passi, etc.)

3.2.10 Future Environmental Issues with the Project

Based on the present environmental condition and the development plan, the future negative environmental issues which may be caused by the implementation of the project are examined and assessed by applying screening and scoping methods. Since the construction of dam reservoir in the upstream and ground water development are not included in the development plan, the adverse environmental issues resulting from them are also eliminated from the consideration. The following five (5) issues including negative and positive impacts are identified in each RIS (Ref. Table 3.2.4).

Environmental Issues	Aganan	St. Barbara	Suague	Jalaur Prop.	Jalaur Ext.
1. Health hazard from agro-chemical use	++	++	+	+	+
2. Deterioration of downstream water quality	++	++	+	+	++
3. Loss of Farm Land	++	++	++	++	++
4. Beneficial impacts on farm and regional economy	+++	+++	+++	+++	++
5. Reduction of excessive use of ground water	+++	+++	+++	+++	+++

Remarks: The marks indicate the significance of the impacts such as, - : none, + : minor, ++ : moderate, +++ : major.

(1) Health hazard from agro-chemical

The use of agro-chemicals will increase in the future due to increased cropping intensity. Since direct seeding is the dominant procedure for paddy cultivation in the area, dosages of herbicide will continue in the future. Although most of farmers have experience to use agro-chemical, it is likely that mishandling of agro-chemicals and improper disposal of used containers will cause health hazards. However, its effect might be reduced if the instructions on proper handling and usage of agro-chemicals to the farmers are provided through extension services during the implementation stage. It should also be stressed that transplanting is being recommended in the agricultural plan to reduce herbicide application during the implementation of the project. In addition, the

DA has carried out extension work on the IPM system within the project area. This system is expected to be continued under the project implementation. Thus, adverse effects on the usage of agro-chemical is expected to be minimized.

(2) Deterioration of downstream water quality

Presently, the environmental issues from agro-chemical contamination was not evident in the project area, even under a high level of utilization. The dosage of agro-chemical under the project will slightly increase in the future. Therefore, it is recommended that proper chemicals should be applied through appropriate manners in order to minimize water pollution. While the level of fertilizer use will increase under the proposed cropping pattern, this might affect the nutrient load in drainage water and/or ground water. As such, the downstream aquatic ecology, especially fish culture will experience negative effects on production.

The risk to water quality pollution can be minimized by applying the proper and ecological farming practices, such as: i) proper water management, ii) proper application of farm inputs, iii) increased use of compost and green manure, iv) changing farming system from direct seeding to transplanting, and v) introduction of IPM system.

(3) Loss of farm land

The farm ponds are planned to be constructed under the project. The loss on farm land is not expected to be large. Furthermore, the construction of the pond is meant to supplement irrigation water during the dry season, and thus ensures stable crop production. There is an optimum trade-off between negative and positive impacts. It is, however, necessary to fully compensate owners and / or the tenant farmers whose lands will be converted into farm ponds.

(4) Positive impacts on farm household Income and regional economy

The significant positive impact of the project will be the increase in the farm income of the households. Such increase is feasible by way of improved farming practices. Under the agricultural development plan, the yield of paddy is projected to reach at 5 tons per ha at full development. This yield represents an increase of about 50% over the current yield of 3.3 tons per ha.

In addition, the intensive agriculture is expected to generate additional labor. The increase in labor and crop production will create spill over effects in the other sectors such as investments in post-harvest processing and farm inputs. The initial construction investment would also expand effective demand increasing regional and national incomes.

(5) Reduction of excessive use of ground water

Ground water from shallow tube wells are widely used in the project area, and excessive use of ground water is reported in some places, particularly in the dry season.

The number of shallow tube wells and pumps are still increasing at this time. If this situation continues, the ground water table will further decline, resulting in shortage of domestic water supply in the dry season and saline water intrusion near the seashore. Therefore, the excessive pumping of ground water will be prevented by the proper supply of irrigation water in each RIS on the basis of the proposed cropping pattern and water management.

3.3 Evaluation and Selection of Priority Projects

(1) Project works

(a) Project works

The Project improvement works on the 5 RISs will consist of (i) civil works such as irrigation and drainage facilities, roads, IA offices and NIA training center; (ii) procurement of equipment on agricultural extension and institutional strengthening; and (iii) the training and technical assistance on agricultural extension and institutional strengthening.

The improvement work on irrigation and drainage facilities including diversion dam will involve the upgrading of canals by canal lining of about 72 km, reshaping of earth canal sections, construction of additional feeder canals of about 26 km, repair of existing intake gates, installation of trashrack, and construction of settling basin in each head race, about 150 turnouts, measuring devices and about 35 farm ponds in the Aganan and Sta. Barbara RIS, etc. Since some improvement works on the Jalaur proper RIS, especially the earth work on canal involving reshaping canal section and excavation, are scheduled to be carried out by the WRDP, the work quantity to be covered by the WRDP is deducted from the estimation.

Improvement work on the farm service roads will involve the construction of additional farm and link roads of about 106 km with asphalt pavement. The proposed road networks will be provided with related structures such as 7 bridges and about 210 culverts.

The post-harvest will cover the construction of buildings for warehouse as shown below.

Post-harvest facilities	Unit	Jalaur pro.	Jalaur ext.	Suague	Aganan	Sta. Barbara
Warehouse	m2	7,906	1,589	1,129	1,547	1,032

Facilities for institutional strengthening will comprise the construction of IA offices and the construction of training center in the Aganan-Sta. Barbara RIS office and renovation of training center in the Jalaur-Suague RIS office. These facilities include the necessary communication and transport equipment for institutional strengthening .

The actual agricultural extension and institutional strengthening activities will cover both the (i) provision of training, guidance, information materials to the IAs and farmers including visits to demonstration fields, and (ii) training of NIA field staff and city/municipal agricultural officers, extension officers and agricultural technicians.

(b) Preliminary cost estimate

The Project cost is estimated based on March 1997 price level and the local competitive bidding (LCB) condition. The basic data in the estimation refer to the cost estimates used by similar irrigation and drainage projects in the Philippines such as the WRDP, Pampanga Delta development project, and Western Legaspi irrigation and rural area development project. The exchange rate of relevant currencies in the estimation is as follows:

US $ 1.0 = Peso 26.00 = ¥ 120.

The total Project cost for each RIS consists of the direct construction cost, engineering cost, administration cost, training cost, land acquisition cost, seed fund for microcredit, and physical and price contingencies.

Direct construction cost covers the cost of irrigation and drainage facilities, rural infrastructure, agricultural extension equipment, and the equipment and facilities for institutional strengthening. The engineering and administration costs are estimated at 10% and 2.5% of the direct cost, respectively. The training cost covers the cost of training of NIA field staff, IAs, and the MAO extension workers and technicians, and related extension services. The physical contingency is estimated at 10% of the sum of the direct construction, engineering, administration and land acquisition costs.

The total Project cost for improvement works on the 5 RISs is estimated at about 1,992 million pesos, excluding seed fund of the microcredit, as shown below.

(Unit : '000 pesos)

	Jalaur pro.	Jalaur ext.	Suague	Aganan	Sta. Barbara	Overall
<IRRIGATION AND DRAIN>						
1. Canal and Drain	335,733	167,227	46,096	33,520	51,176	633,752
2. Related Structures	37,736	31,935	11,732	17,456	34,576	133,435
3. On Farm Development	32,493	9,652	10,905	16,062	11,052	80,164
<RURAL INFRASTRUCTURE>						
4. Farm and Link Road	197,065	85,985	41,977	55,287	47,600	427,914
<POST-HARVEST, AND MARKET FACILITIES AND INSTITUTIONAL STRENGTHENING>						
5. Buildings	41,094	8,712	6,229	8,665	5,780	70,480
6. Procurement of Equipment	4,776	3,216	2,308	4,380	3,540	18,220
7. Training	4,509	2,765	1,914	2,749	1,790	13,727
	541,000	500,000	258,000	436,000	282,000	2,017,000
	3,968,000	2,265,000	1,656,000	2,313,000	1,508,000	11,710,000
Subtotal 1	653,406	309,492	121,161	138,119	155,514	1,377,692
9. Engineering Cost (10% of Subtotal)	65,341	30,949	12,116	13,812	15,551	137,769
10. Administration Cost (2.5% of Subtotal)	16,335	7,737	3,029	3,453	3,888	34,442
11. Land Acquisition	11,718	4,347	1,827	3,503	3,757	25,152
Subtotal 2	746,800	352,525	138,133	158,887	178,710	1,575,055
12. Physical contingency (10% of Subtotal 2)	74,680	35,253	13,813	15,889	17,871	157,506
Subtotal 3	821,480	387,778	151,946	174,776	196,581	1,732,561
13. Price contingency (15% of Subtotal 3)	123,222	58,167	22,792	26,216	29,487	259,884
GRAND TOTAL	944,702	445,944	174,738	200,992	226,068	1,992,445

(c) Implementation schedule

The implementation schedule of the Project is divided into three (3) phases in consideration of the very high cost of the improvement works and the wide area coverage of the Project. The priority of implementation of each RIS is decided in accordance with the selection criteria mentioned in the proceeding section.

Taking into account the development of agricultural crop diversification in the Aganan and Sta. Barbara RIS, the importance of farmers' participation to the Project, and the pre-project invested post-harvest facilities in the Aganan RIS, the strengthening of existing Aganan IA federation will be carried out during the pre-construction stage of the Project. In the Jalaur proper, Jalaur extension and Suague RIS, the institutional strengthening of the IAs will also be started at the pre-construction stage. Hence, the strengthening of the Aganan IA federation and the institutional strengthening of the IAs in the Jalaur-Suague RIS will become

part of the Phase I of the Project. Figure 3.3.1 shows the implementation schedule of the Project.

(2) Preliminary economic evaluation

(a) Conditions

In the derivation of economic costs and benefits, the following principles are applied.

i) All costs and benefits are in 1997 constant prices.
ii) The standard conversion factor of 0.83 is applied to non-traded goods and skilled labor to get border prices.
iii) A specific conversion factor of 0.6 is used for the estimation of the market wage rate of unskilled labor.
iv) For the estimation of economic farm gate prices of traded agricultural commodities, namely rice, urea, TSP and muriate of potash, import parity prices of them are derived from the World Bank's May 1997 commodity forecasts.
v) Imported goods are valued at the foreign exchange rate of 26 peso per US $.

(b) Economic costs

Economic construction costs of the project are estimated by applying the standard conversion factor of 0.83 to the financial construction costs. The land acquisition cost and price contingency cost were excluded from the economic costs. Replacing costs of rice mills and dryers were added after 10 years of construction.

Economic construction costs considered for the economic analysis were calculated at 1,705 million peso. The breakdown of cost by RIS is as follows.

Jalaur Pro.	Jalaur Ext.	Suague	Aganan	Sta. Barbara
P809 Mill.	P383Mill.	P150 Mill.	P171Mill.	P192Mill.

(c) Economic benefits

Agricultural benefits would be obtained from the increment of crop production and the improvement in crop production productivity to be caused by the improvement in irrigation systems, in the operation and maintenance of irrigation systems, and in crop husbandry improvement, basic fertilization in particular, by institutional strengthening of IAs and farmers' organizations and by the improvement of agricultural support services such as agricultural credit and agricultural extension.

With the project, cropping intensity will be increased from 157% to 172%, and cropped area will be increased by 3,320 ha. Economic incremental benefit by the project in the crop production is estimated at P319mill.

(d) Economic evaluation

Economic evaluation is made to evaluate the economic viability of the project. Economic opportunity cost of the capital expressed by an internal rate of return is used for the evaluation. The internal rates of return calculated are 18% for the Jalaur proper, 10% for Jalaur extension, 16% for Suague, 22% for Aganan and 15% for Sta. Barbara. The overall internal rate of return of the project was estimated at 16%. Thus, every sub-project is economically viable with the economic internal rate of return of more than 12%. Details of the calculation is shown in Table 3.3.1.

(3) Selection of priority projects

For evaluation and selection of priority projects, the following five (5) criteria were applied on the basis of the findings obtained through the Master Plan Study:

(i) Effectiveness of model for revitalization of irrigation system
(ii) Project scale and consistency in irrigation system
(iii) Effect on basic issues on project sustainability
(iv) Effect on environment
(v) Progress of CARP

(a) Effectiveness of model for revitalization of irrigation system

The effectiveness of model for revitalization of irrigation system is gauged by the urgency of the rehabilitation and/or improvement needs of the RISs to address the common issues to NIS in the study area.

(i) Deterioration of system/Need of rehabilitation and/or improvement

The related structures of the RISs such as head gates, checks and turnouts are considerably deteriorated except those of the Aganan RIS. The diversion dam, main canal and related structures of the Aganan RIS have been improved under the Japan's Grant Aid Program. The existing irrigation facilities shall be urgently rehabilitated and improved to enhance irrigation efficiency for maximum use of available water. The following scoring is applied for evaluation:

Very high	3
High	2
Moderate	1

(ii) Low ISF collection efficiency

The average ISF collection efficiencies of existing RISs for the past five (5) years from 1992 to 1996 are estimated at 28% in the Jalaur RIS,

29% in the Aganan RIS, 34% in the Suague RIS, 37% in the Jalaur extension RIS and 40% in the Sta. Barbara RIS. These rates are lower than the national average of 48%. The ISF collection efficiencies in the study area shall be urgently improved to provide adequate O&M funds for existing RISs. The following scoring is applied for evaluation:

Very low	3
Low	2
Moderate	1

(iii) Improper/poor water management and O&M of system

Water management and O&M practices in the existing RISs in the study area are not being properly and effectively performed by NIA staff and IA members. However, water management in both the Aganan and Sta. Barbara RISs is comparatively more advanced than that in the Jalaur proper, Suague and Jalaur extension RISs, because the water delivery and distribution schedules for both the Aganan and Sta. Barbara RISs are officially informed to IAs. Most IAs in these latter RISs have already made Type II contract with NIA. The present water management and O&M practices in the existing RISs shall be urgently improved to enhance irrigation efficiency for maximum use of available water and to protect the rehabilitated and improved facilities from deterioration. The following scoring is applied for evaluation:

Very poor	3
Poor	2
Moderate	1

(b) Project scale and consistency with national irrigation system

All RISs in the study area are typical national irrigation systems which consist of run-of-river type diversion dam, head race, main canal, laterals, related structures and on-farm facilities. The irrigation service areas of the five RISs are as follows: Jalaur proper, 8,820 ha; Aganan, 4,360 ha; Sta. Barbara, 3,000 ha; Suague, 2,960 ha; and Jalaur extension, 2,620 ha. The Jalaur proper RIS shows the highest potential for the rehabilitation and improvement of the system in comparison with the national average of 3,800 ha. The following scoring is applied for evaluation:

Good	3
Fairly good	2
Marginally good	1

(c) Effect on basic issues on project sustainability

The issues on land conversion, illegal water use in the upper river basin and watershed degradation identified in the study area are considered to affect the sustainability of the Project.

(i) Effect on land conversion due to urbanization

Social problems are anticipated in the Aganan and Sta. Barbara RISs due to the effect of urbanization of Iloilo city in the municipalities concerned, resulting in the conversion of irrigated agricultural land in these RISs into residential and commercial uses. Such problems, however, are not considered to happen in the Jalaur proper, Jalaur extension and Suague RISs which are not affected by the rapid urbanization of Iloilo city. The following scoring is applied for evaluation:

None or negligible	3
Small	2
Large	1

(ii) Effect on watershed degradation

The forest areas in the watershed areas of the water source rivers for existing RISs have been destroyed mainly due to illegal logging and fuelwood gathering for sugarcane factory. Based on the present land use condition, slope and elevation condition, land category and the present government activities, the degree of degradation of the watershed areas were evaluated in the Study. The overall evaluation result for each RIS is as follows: Aganan, poor; Suague, poor; Jalaur, moderate; and Tigum, moderate. On the basis of this result, the following scoring is applied for evaluation of the effect on watershed degradation:

None or negligible	3
Small	2
Large	1

(iii) Effect on illegal water use in the upper river basin

There are 2,988 ha of total irrigation areas which utilize water by brush dams or pump in the upper river basins of existing RISs without obtaining water right. This issue would greatly affect the sustainability of the Project if the river water would be disorderly used in the said irrigation areas. The ratio of the said irrigation areas against the RIS service areas concerned are as follows: 35.0% in the Suague RIS, 12.4% in the Jalaur proper and extension RISs, 8.6% in the Sta. Barbara RIS and 6.3% in the Aganan RIS. The following scoring is applied for evaluation:

Small	3
Large	2
Very large	1

(d) Effect on environment

In terms of the effect on environment, the main sources of identified environmental problems are seasonal inundation of the service areas of the Suague and Jalaur proper RISs, and deterioration of water quality of the Suague and Jalaur rivers due to existing sugarcane factories. The following scoring is applied for evaluation:

None or negligible	3
Small	2
Large	1

(e) Progress of CARP

Progress of CARP implementation is found to be relatively faster in the Jalaur proper and Suague RISs than in the other three RISs concerned in accordance with the data from the Department of Agrarian Reform Region VI Office. In particular, the slow transfer of sugarland to farmers in the Jalaur extension RIS under the Leasehold Operation is a potential constraint to the improvement of the system. In the Aganan and Sta. Barbara RISs, the CARP performance is almost the same at a low level of about 2-3% in the Leasehold Operation. As for the rice and corn lands, the land distribution performance is generally the same for all the RISs. The following scoring is applied for evaluation:

Good	3
Fairly good	2
Marginally good	1

All the five criteria are equally applied in the selection of priority projects in view of their equal importance to the improvement of irrigation systems and the development of irrigated agriculture. Based on the application of these criteria, the five RISs are ranked in consideration of the different improvement plans included in the Phase I study, and the results are summarized in the table below.

Selection Criteria	Aganan	Sta. Barbara	Suague	Jalaur pro.	Jalaur ext.
1. Effectiveness of model for revitalization of system					
(1) Deterioration of system	1	3	3	3	3
(2) Low ISF collection rate	3	2	2	3	2
(3) Improper/poor O&M of system	2	2	3	3	3
Sub-total	6	7	8	9	8
2. Project scale and consistency with national irrigation system	2	1	1	3	1
3. Effect on project sustainability					
(1) Effect on land conversion	1	1	3	3	3
(2) Effect on watershed degradation	1	2	1	2	2
(3) Effect on illegal water use	3	3	1	2	2
Sub-total	5	6	5	7	7
4. Effect on environment	3	3	2	2	2
5. Progress of CARP	1	1	2	3	1
Total	17	18	18	24	19
EIRR(%)	22	15	16	18	10

As reflected in the above table, the highest score (24 points) is given to the Jalaur proper RIS, followed by the Jalaur extension RIS (19 points). The EIRRs of the improvement plans of these RISs are 18% and 10%, respectively. Thus, the Jalaur proper RIS should be selected as the priority project. However, the Suague RIS is closely related to the Jalaur proper RIS due to the following factors:

- the irrigation canal system of the Suague RIS is connected with the irrigation main canal system of the Jalaur proper RIS, and
- flooding in the tail portion of the Suague RIS due to poor drainage system of the highway from Zarraga to Pototan runs along the boundary of the Suague RIS and Jalaur proper RIS.

Therefore, the irrigation and drainage canal systems of both the Suague and Jalaur proper RISs shall be integratedly rehabilitated and improved at the same time for proper O&M of the systems for both RIS areas. Hence, the Jalaur proper RIS and Suague RIS shall be finally selected as the priority project(s) for the feasibility study in the Phase II.

The maximum utilization of the pre-project post-harvest facilities constructed in the Aganan RIS area under the Japan's Grant Aid Program is another priority concern of the Project. The strengthening plan for the Aganan IA federation will be formulated in the Phase II study to comprise the following activities for effective management of the said facilities:

- establishment of clear operation and management plan/procedures, and
- upgrading plan of federation capability to manage the facilities.

3.4 Conclusion and Recommendation

3.4.1 Conclusion

(1) The Phase I study clarified the following:

(a) The construction plan for the proposed small impounding dams and irrigation plan for the proposed extension areas would be excluded from the development plan mainly on technical and social consideration.

(b) Instead, the development of irrigated agriculture to increase agricultural productivity at the highest level, especially the yields of paddy within the limited irrigation service areas of the existing RISs in the study area would be economically viable through enhancing irrigation efficiency for effective and maximum use of available water.

(c) To address the major issues in the study area, the following prospective plans are envisaged to attain the development goal:

- Irrigated agriculture development plan anchored on increasing productivity, especially yield of paddy,
- Rehabilitation and improvement plan of existing irrigation facilities to enhance irrigation efficiency for maximum use of available water,
- Improvement and strengthening plan of present water management and O&M practice including improvement plan of ISF collection by NIA and IA to enhance irrigation efficiency for maximum use of available water and to protect the rehabilitated and improved facilities from deterioration,
- Institutional development plan of IA and NIA for sustainability of water management and O&M practice ,
- Strengthening and improvement plan of agricultural support services such as extension, research, credit, post-harvest facilities and marketing, and rural infrastructures including farm-to-market road network for effective implementation of the irrigated agriculture development plan to improve the financial weakness of farmers, and
- Watershed management plan to stabilize river water flow, reduce sediment and sustain the Project operations.

(2) According to the results of the project evaluation, the irrigated agriculture development for the five (5) RISs in the study area is technically sound and economically feasible, showing the economic rate of return (EIRR) ranging from 10% to 22%. The Jalaur proper RIS and Suague RIS shall be selected to be implemented as priority projects for the feasibility study in Phase II.

(3) The maximum utilization of the post-harvest facilities constructed in the Aganan RIS area under the Japan's Grant Aid Program is another priority concern of the

Project. The strengthening plan for the Aganan River Federation of Irrigators' Association shall be formulated in the Phase II study.

3.4.2 Recommendation

(1) It is recommended that the Project shall be implemented as early as possible following the priority sequence mentioned below .

(i) Stage I: Jalaur proper RIS and Suague RIS
(ii) Stage II: Sta. Barbara RIS and Aganan RIS
(iii) Stage III Jalaur extension RIS

(2) It is recommended that the inappropriate irrigation facilities of illegal water users in the upper river basin shall be improved by developing new communal irrigation projects under the guidance of the NIA and LGU as soon as possible in consideration of the importance of the basin-wide water management approach and the water right shall be given to these areas for legal authorization

(3) It is recommended that the presently slow progress of CARP program, especially in the Jalaur extension RIS area, shall be accelerated for successful development in the study area.