4.1.4 Objectives of the Project

The main objectives of the Project are:

(a) to increase agricultural productivity, especially yields of paddy through the development of irrigated agriculture, and thereby improve the poor financial position of farmers,
(b) to enhance irrigation efficiency through the rehabilitation and improvement of existing irrigation facilities, and strengthening of the skills by the NIA staff and IAs on water management and O&M practices,
(c) to sustain the water management and O&M practices through institutional development of the NIA and IAs, and
(d) to stabilize river flow, reduce sediment and sustain the Project operations as a long-term objective through watershed management.

The final goal of the Project is to improve the rural economy. This is expected to be achieved through increase of agricultural productivity, revitalization of existing RISs, sustainability of water management and O&M practices, and improvement of poor financial position of farmers. Thus, the Project is expected to support the key agricultural development policies defined in the MTPDP.

4.1.5 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:

(1) 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 introducing 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. The approaches to be adopted by the plan are:

(a) to establish the cropping pattern in conformity with effective and maximum use of available water,
(b) to increase the paddy yields through improvement of farming technology such as fertilizer application, agro-chemical application, pest control, seeding method, and low use of certified seed, and
(c) to introduce high value-added diversified crops in the Aganan and Sta. Barbara RIS areas.

(2) 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. The approaches of the plan are:

(a) to rehabilitate and improve the existing diversion dams,
(b) to renew the turnouts and provide feeder canal and measuring devices,
(c) to improve canal systems through canal lining and embankment upgrading,
(d) to provide settling basin and farm pond, and
(e) to improve the on-farm canal systems.

(3) 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. The approaches of the plan are:

(a) to provide proper and sufficient budget for water management and O&M practices through better ISF collection,
(b) to improve and strengthen water management and O&M practices' skills of the NIA staff and IAs through sufficient training by using the practical O&M manual, establishment of computerized system and communication system, and Type I and Type II contract implementation by IAs, and
(c) to establish monitoring system on the basis of computerized system and communication system to be installed.

(4) 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 Type III contract within 10-year period. The approaches of the plan are:

IA

(a) to reorganize and federate IAs, and build up institutional and financial capability of IAs,
(b) to develop and/or strengthen farmer's cooperatives,
(c) to establish integrated production and post-harvest processing system,
(d) to train and provide technical assistance in improvement of water management and O&M practices, and
(e) to train and provide technical assistance in the production of diversified crops.

NIA

(a) to strengthen inter-organization collaboration mechanism and capability of NIA for agricultural extension and other services,
(b) to improve planning and monitoring system through upgrading of the data management system at NIA RIS offices, and
(c) to train NIA field staff for proper water management and O&M practices.

(5) 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. The approaches of the plan are:

Agricultural extension

(a) farmer's participation to extension program through group meeting and field evaluation of new technologies,
(b) systematic extension services in accordance with annual performance plan, and
(c) training of extension staff of the municipal agricultural office.

Agricultural credit

(a) loan restructuring of the agricultural cooperatives,
(b) institutional strengthening of the agricultural cooperatives,
(c) development of expanded financial intermediation, and
(d) introduction of irrigators development fund (IDF).

Marketing and post-harvest facilities

(a) provision of adequate post-harvest facilities and trucking fleet,
(b) provision working capital, and
(c) intensive capacity building on agricultural marketing.

Farm-to-market road network

(a) linkage of the existing NIA's service roads with the rural road after improvement,
(b) minor repair of the existing rural roads, and
(c) provision of additional rural roads, bridge and crossing structures.

(6) Watershed management plan

The goal of the watershed management is to achieve "sustainable use of natural resources" and "stability of rural people life". Thus, the watershed management 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. The approaches of the plan are:

(a) strengthening coordination with agencies,
(b) community organization,
(c) training and extension,
(d) soil conservation measures,
(e) agro-forestry system,
(f) development of alternative energy source, and
(g) social development.

4.2 Delineation of Project Area

(1) Urbanization of irrigation service area of existing R/S

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. Barbara	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.

(2) 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

These extension areas except for Bartac Nuevo were originally identified in the Jalaur River Multipurpose Project (JRMP). In the feasibility study report on JRMP, it was planned that these extension areas would be irrigated using water to be supplied through a proposed transbasin diversion channel (so called low line canal). Although the implementation of the Stage II of JRMP was stopped due to a low EIRR of 6.7%, these extension areas still proposed by NIA in the Study. As examined in Section 3.7.2, these extension areas was excluded from the project area due to topographical objection and social object.

The extension area located at Barotac Nuevo is faced with the slow progress of land reform program and the unstable land use due to the large scale of sugarcane cultivation in the area as examined in Section 3.7.2. Therefore, this area was also excluded from the project area.

(3) Project area

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

4.3 Water Resources Development Plan

4.3.1 Possibility of Small Impounding Reservoirs

(1) General

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 (Ref. Figure A.4.1) are evaluated in the following.

(2) 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.

(3) 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, and the minimum operation level will be high for a low dam with a height of 15 m. 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.

(4) 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.

(5) 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 located on the downstream of the dam accounts for only 367 ha and is far from the Sta. Barbara RIS, 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.

(6) 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.

4.3.2 Water Availability

(1) General

Based on the monthly discharge data (1951-1971) at the three stations on the Jalaur River, namely Alibunan (JR1, CA=120 km^2), Passi (JR3, CA=534 km^2) and Dingle (diversion headworks, JR4, CA=1,065 km^2), runoff along the river was simulated assuming the following conditions:

- Runoff increases (decreases) proportionally to the catchment area
- Return flow rate, i.e., the percentage of the water which returns to the river against the total amount of extracted water, is 25 %.

(a) STEP 1

Runoff at three locations along the Jalaur River, namely Alibunan (JR1), Calinog (JR2, CA=169 km2) and Passi (JR3) was estimated proportionally (by the catchment area) from the discharge at Dingle (JR4). No upstream water use was assumed.

(b) STEP 2

Estimated discharge was compared with the actual records at JR1 and JR2. The discharge was calibrated by an "adjustment coefficient" of 1.12 to meet the

actual discharge during the dry season. This adjustment coefficient was also used for the other rivers, i.e., the Suague River, Tigum River, and the Aganan River taking the proximity of the river and/or watershed condition into account. Estimated discharge at the uppermost point of each river (JR1, SG1, TG0, AG-1) is given in Table A.4.1.

(c) STEP 3

Based on the calibrated discharge at Alibunan (JR1), discharge at Calinog (JR2), Passi (JR3) and Dingle (JR4, the intake for the Jalaur RIS) as estimated downward according to the catchment area ratio and return flow rate of 25 %. Upstream water use was estimated by the hectarage investigated during the study period (ref. Figure A.3.10) and unit irrigation requirements. These estimated discharges are to be used for the irrigation planning for each RIS as "available water at the intake". Calculated discharge for each check point is given in Table A.4.2 to Table A.4.5 by river.

(d) STEP 4

As mentioned in the subsection 3.4.4 "Water Resources", baseflow at the diversion headworks were estimated based on the field observation during the study period. They are 10 m^3/sec for the Jalaur River, 0.6 m^3/sec for the Suague River, 1.0 m^3/sec for the Tigum River and 0.5 m^3/sec (February to April) and 0.8 m^3/sec (other months) for the Aganan River. Estimated runoff smaller than these discharges were replaced with them. These discharges with the baseflow given in Table A.4.6 are to be used for the irrigation planning for each RIS as "available water at the intake".

Conceptual figures of water budget are given by river in Figure A.4.2.

4.3.3 Recommended Development Approach by RIS

(1) Jalaur RIS

The Jalaur river, having a vast catchment area of 1,065 km^2 at the intake, gives a big amount of water with comparatively stable distribution in the year. Surface water potential (rainfall) in the catchment exceeds two (2) billion cubic meters in the year. Assuming a long-term runoff coefficient of 40 % in the year, annual available water amounts to 800 million cubic meters. The proposed Jalaur multipurpose dam has a storage capacity of 400 million cubic meter, i.e., half of the available water at the intake, which influences water distribution in any year.

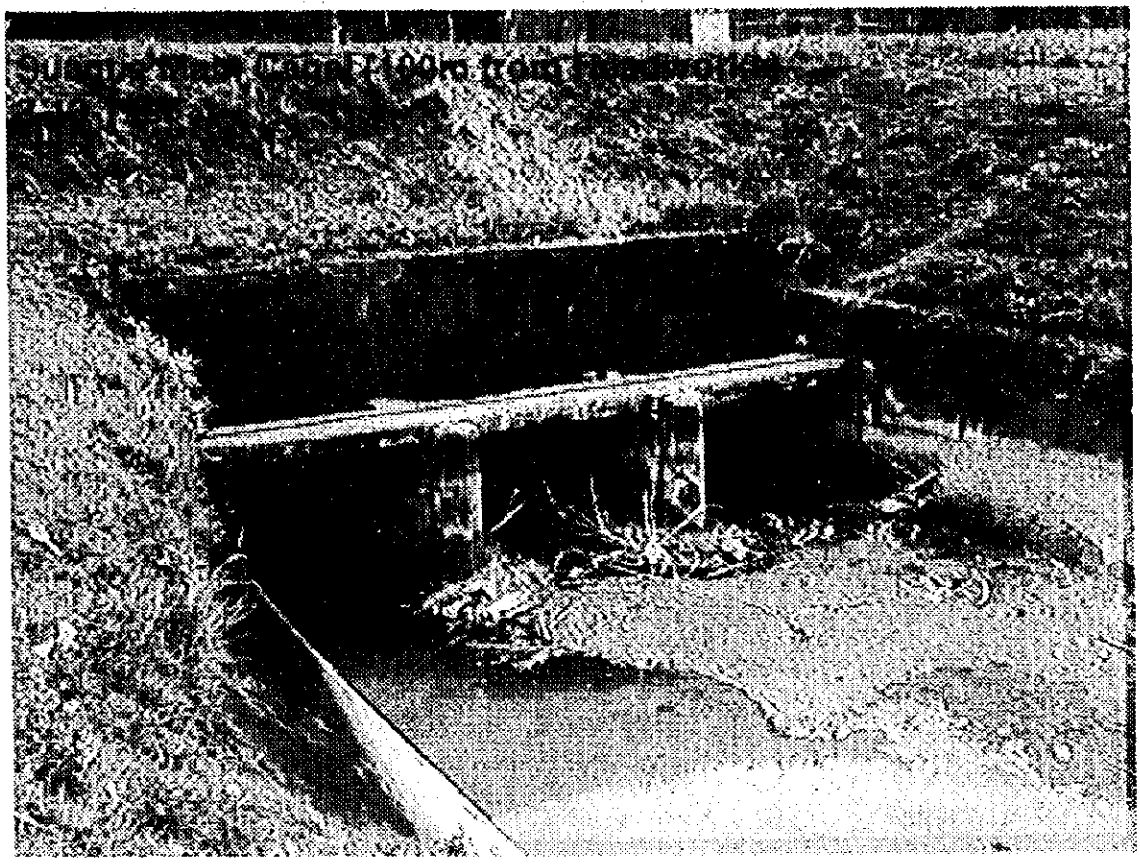
In other words, large benefits for the Jalaur RIS cannot be expected with small impounding reservoirs upstream the Jalaur River because of their low influence to the large water duty. It is more recommendable for the system: i) to reduce losses of available water upstream of the Jalaur headworks by means of management or re-allocation of water use/right, ii) to enhance irrigation efficiency by rehabilitation or improvement works of irrigation and drainage facilities, improvement or strengthening of O&M practice and water management. According to the results of field survey, the present capacity of the Jalaur proper main canal is 90 % or less of the designed capacity (13.5 m^3/sec). Rehabilitation and/or improvement works on the main canal will increase the available water by 10 % with comparatively low investment.

(2) Suague RIS

It is obvious from the results of field observations that one of main reasons of water shortage problems in the Suague RIS is upstream water use which is not officially

permitted. The proposed small impounding dam, with a capacity which could be much less than that mentioned in the original proposal (8.0 MCM), seems to accommodate a certain extent of the upstream paddy fields. It is recommended to install a discharge monitoring station at Quiput, the uppermost Barangay of the water use areas, not only for evaluating water resources but also for giving an index to control the upstream water use.

According to the discharge measurements at the Suague main canal, the intake capacity of the system is only 30 % of the designed capacity (4.5 m^3/sec) because of sedimentation at a box culvert located 100 m downstream from the headworks. Minor rehabilitation works will improve the present condition of the system to a large extent.



(3) Tigum RIS (Santa Barbara IS)

Needs for water resource development in the Santa Barbara irrigation system, with a service area much reduced by urbanization, are not considered very high. Dam construction for a single purpose (irrigation) is not recommended considering that the Tigum River is a main source of potable/industrial water for Iloilo city.

In order to solve the water shortage and realize well-balanced development in light of the urbanization in the service area, it is recommended to reduce water duty on the downstream service area and to apply intensive agriculture in the upstream. Crop diversification to high value crops with lower irrigation requirements in the downstream, and intensive paddy rice cultivation with higher cropping intensity are considered to be two alternatives.

(4) Aganan RIS

Aganan basin has difficulties in its watershed, as mentioned above, which hinder water resource development in the basin. Floods and sedimentation are more serious considering its catchment area, and "small impounding reservoir" is thus not a suitable development option. Few short-term development works would remove these difficulties . Reforestation and introduction of erosion control cultivation methods and crops are recommended. Improvement of the main irrigation system had been completed by a JICA grant-aid project and no more major hardware development is recommended on irrigation system. Software development such as water management, institutional strengthening, etc. along with watershed management is considered to be a suitable development strategy for this system.

4.4 Improvement Plan of Irrigation and Drainage Facilities

4.4.1 Development Strategy

The following development strategies are applied to the improvement plan on irrigation and drainage facilities.

(a) Taking into consideration the current irrigation water use in the upper reach from the existing diversion dams, water allocation is made for the irrigation use with the new irrigation development program in order to reduce the wasteful use of the river water and to sustain the proper basin-wide water management. The new irrigation development is recommended to implement as the communal irrigation system projects with the legal registration of the water right under the NIA's technical guidance in near future. Therefore, the water allocation for irrigation use in the upper reach is accounted as one (1) component of the water balance calculation in the study area.

(b) Overall irrigation efficiency shall be increased to a certain high level through installation of additional feeder canal and turnout, renewal of the control structures, canal lining, rehabilitation of canal and related structures , and improvement of existing on-farm canal system. For establishment of the proper water distribution and sustaining the proper irrigation efficiency, measuring devices with gates is constructed at all the head gate and turnout.

(c) For reducing the siltation in canal and sustaining the canal flow capacity, the settling basin is provided at the head section of all the main canal of the 5 RISs.

(d) Farm pond will be provided to accelerate water run and to improve the irrigation water management for crop diversification.

(e) For strengthening the function of the farm - to - market road in the RIS areas and the acceleration of agricultural mechanization, the following approach is made, and the link road system is established.

  (i) The improvement of the existing services road with gravel pavement,
  (ii) The minor repairing of the existing rural road concerned with the services road, and
  (iii) Provision of additional rural road

4.4.2 Water Allocation for Irrigation Use

Private irrigation system of about 3,000 ha is extended in the upper reach from the existing diversion dams of the 5 RISs as described in the Section 3.7.1 (3), and the

water absorption for the irrigation use is carried out during all season, using the temporary brush dams, small and permanent diversion dams, free intakes and pumps. Their water right for irrigation use are not authorized at present, and the uncontrolled water absorption make the irrigation of the 5 RISs disturb.

For sustaining the basin - wide water management in the 4 rivers concerned with the RISs, the water allocation for irrigation use in the upper reach will be planned to adopt as one (1) component in the water balance of the 5 RIS areas, and the communal irrigation system development is scheduled to implement under the NIA's technical guidance in near future.

The necessary water amount in the each upper reach is estimated based on the current cropping pattern in the upper reach as described in the Section 4.4.3 (2). 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

4.4.3 Estimation of Irrigation Requirement

(1) 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 mm 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

(2) Irrigation requirement in the existing irrigation areas of the upper reach

The irrigation water use in the existing irrigation areas of the upper reaches 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. The estimated seasonal irrigation requirement in each basin is converted into the basin wide - water balance calculation. Tables A.4.7 to A.4.8 show the seasonal requirements in the respective upper reaches.

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

(a) 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 services areas as explained in Section 3.7.6. 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.

(b) 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 as shown in Tables A.4.9 to A.4.13 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 the 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

(4) Irrigation requirement in the plan and development potential

(a) 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 efficiency will be upgraded by the improvement of the

irrigation canal layout, provision of canal lining, improvement of water management, etc. The irrigation efficiency of the paddy field is assumed at 50 %, consisting of conveyance efficiency of 72 % and operation and application efficiency of 70 %. The irrigation efficiencies of the vegetable and fruit are assumed respectively at 50 % and 61%, taking into consideration the irrigation method for each crop. The irrigation method adopted is furrow irrigation method for vegetable cultivation and drip or sprinkler irrigation method for fruit cultivation. The 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
Vegetable	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 Sprinkler irrigation method

(b) Seasonal irrigation requirement

Seasonal irrigation requirement is estimated as shown in Tables A.4.14 to A.4.18 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

(c) 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 he 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

4.4.4 Preliminary Plan on Rehabilitation of Canals and Drains

(1) 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	-

(2) Canal and drain

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

- Improvement of head gate and turnout including provision of measuring devices to sustain proper water management,
- Additional feeder canals and turnouts to sustain the optimum command area for suitable water distribution,
- Canal lining in main canal canals, and
- Strengthening of drainage canals in the Suague, Jalaur proper and Jalaur extension RIS areas.

Figures A.4.3 to A.4.4 show the improvement works for irrigation canal. 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. The possibility of changing in the canal layout is identified in 2 sites, such as the lateral - A of the Sta. Barbara RIS and the lateral - E of the Jalaur proper RIS. However, technical background of the change in canal layout will be verified in the future. The canal lining is planned to provide

approximately 72 km in main canal network of the 4 RISs , excluding the Aganan RIS which main canal has been already lined by the concrete, as shown below.

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

(3) Related structure

The improvement of existing structures and the addition of necessary structures. The improvement of existing structures is the repairing and / or replacement of gates at head gates and turnouts, the repairing 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, 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 A.4.5. 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.

(4) 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.

(5) 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 2.4.6.

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.

4.5 Irrigated Agricultural Development Plan

4.5.1 General

Agricultural development aims to increase agricultural production as well as farmers' income through effective irrigation by proper water management and application of appropriate farming practices together with improvement of irrigation facilities and O&M.

As mentioned in Chapter 3, paddy rice is a significantly dominant and priority crop in the study area. Under the present condition, paddy production is stagnant and the yield is still low due to limited water resources, inadequate farming practices, malfunctioning irrigation facilities, and inadequate O&M. The main objective of agricultural development is to increase paddy rice production by improvement of irrigation facilities and water management as well as application of adequate farming technology.

The Jalaur proper, Jalaur extension and Suague RISs are located in rural areas, while both the Aganan and Sta. Barbara RIS are located adjacent to Iloilo city. The former RISs are typical NIS for paddy irrigation in the rural zone, aimed at increasing paddy rice production. The latter RISs are being affected by urbanization due to the expansion of built-up. Aganan RIS are have recently introduced crop diversification with small area as initial stage of suburb type agriculture for intensive land use and raising land profitability, considering marketability of diversified crops and utilization of agro-processing facilities in the urban area.

The strategy and approach of agricultural development are summarized below:

i) To increase the production of paddy rice which is the most suitable crop in the study area, aiming at self-sufficiency in staple food in Philippines;
ii) To maximize the utilization of irrigated area and achieve higher cropping intensity by effective and impartial water distribution;
iii) To increase the productive efficiency and net return with minimum production cost and appropriate farming practices;
iv) To introduce valuable diversified crops in both Aganan and Sta. Barbara RIS, as the first stage of suburb type agriculture development, aiming at increasing; a) farmers' income, especially for small-scale and tenant farmers, and b) employment opportunities for landless farm labors;
v) To strengthen extension activities for adequate irrigated farming of both paddy rice and diversified crops, and to introduce intensive and integrated

crop management technology: plant protection, ecological farming, and sustainable agriculture; and

vi) To improve post-harvest system and facilities as well as those for marketing.

4.5.2 Proposed Cropping Pattern

Following crops are selected for the future cropping pattern to be affected by the project considering existing crops in the study area and suitability on climate and soil conditions.

Paddy rice: Paddy rice is an important, traditional and major food crop suitable for the climate and soil conditions in the study area. The Philippines has imported 1.2 million tons of rice between July 1995 and Jun. 1996 to meet the shortfall in domestic production. Increase of rice production is important to the national food security.

Vegetables: Eggplant, okra, squash, tomato, sweet pepper, chili, ampalaya, stringbean, cabbage, and cucumber are candidate crops. These vegetables are planted in the study area, mostly as backyard crops or 3rd crops after harvest of second paddy in the dry season.
Onion, sweet corn, baby corn, cauliflower have not been grown in the study area, however, it is supposed that they are suitable for the climate and soil conditions in the study area.
Watermelon including muskmelon are major diversified crops which are currently cultivated in the study area, especially in Aganan RIS area.

Other annual crops:
Aside from the above-mentioned crops, garlic and cutflower are also planted in the study area. The cutflower is one of the ten priority crops of the MTADP in Iloilo province.

Perennial/Biennial fruits crops:
Mango, mangosteen, juckfruit, banana, papaya, durian, citrus and rambutan are candidate crops. Among them, mango and banana are also priority crops of Iloilo province in the MTADP. Durian, mangosteen, jackfruit and rambutan have been produced with irrigation facilities at orchard in Negros island which has similar climate and soil condition.

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 A.4.6, 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 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. Barbara
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
Service Area (ha)	8,820	2,620	2,960	4,360	3,000
Cropping Intensity (%)	200	200	141	137	147

4.5.3 Proposed Farming Practices

Low crop production is caused by the shortage of irrigation water and inadequate farming system. The farming method should be improved with advanced technology in order to attain the project objective. Proposed farming practices and management are summarized below.

(1) 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 one of the causes of low yield of paddy presently. Transplanting method can reduce seeding rate from 150 - 200 kg/ha at present to less than 100 kg/ha, also herbicide will be reduced. On the other hand, transplanting method requires larger labor force than of the direct seeding. According to the comparison of production cost, the cost of transplanting is pesos 1,100 higher than of direct-seeding. The difference of the costs is nearly equal with value of paddy rice 140 kg. That is, if transplanting method could produce more than 140 kg/ha of paddy rice than of the direct seeding, the transplanting would be profitable comparing with direct-seeding.

Comparison of Cost between Direct-Seeding and Transplanting (Unit: peso/ha)

Cost	Direct seeding (D)	Transplanting (T)	Balance (D-T)
Seed	2,240	960	1,280
Herbicide	700	525	175
Labor	880	3,440	-2,560
Total	3,820	4,925	-1,105

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 be also controlled by adequate management and agro-chemicals following instructions and recommend 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.

vi) Harvesting must be done properly at maturing stage in order to minimize field loss and quality problem. Harvested paddy grain should be dried below 14 % moisture contents by sundry or mechanical dryer. Mechanical dryer would be used for drying of paddy harvested in the wet season, if available.

(2) 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 at 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

(3) 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

4.5.4 Requirements for Labor and Farming Machinery

Farm labor requirements for proposed farming practices in the future plan are shown in Table A.4.20, 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 so change 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.

As mentioned in Section 3.6.3, at present the available labor force and number of hand-tractors are enough for the requirement of farming activities.

It can roughly estimated that the labor force and working capacity of farm machinery are enough to requirement of future plan.

4.5.5 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.- Do, 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

To achieve the expected yields, optimum application of farm inputs, appropriate farming practices as well as proper water management shall be required.

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

As stated in (3) of Section 3.6.6, the low yields of paddy in the study area are caused by improper application of fertilizer, especially basal nitrogenous fertilizer, and shortage of irrigation water supply. Generally, there is a close relationship between nitrogen fertilizer application level (N) and paddy yield (Y) as shown in the following empirical formula :

$$Y = 3.0 + 25 \times N/1,000$$

where, Y = paddy yield (ton/ha)
N = Nitrogen application (kg/ha)

If the nitrogen fertilizer is applied properly, especially as a basal fertilizer, under proper irrigation and drainage condition, the future production will follow the above formula. Consequently, the expected paddy yield under the with-project condition amounts to 5.5 ton/ha by the application of 100 kg N/ha in total. But taking consideration of dissemination of new farming practices into the large area, predominance of direct seeding and difficulty in snail and rat control measures, anticipated unit yield apply 5.0 ton/ha conservatively.

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. Table A.4.19 shows future total production of crops in each RIS compared with the present condition, as summarized below:

(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

4.5.6 Crop Budget and Project Benefit

Project benefit to be expected is defined as the difference of profit from crops between future "with project" and "without project" conditions. In this master plan study, the project benefit is given by the difference of the profit under "without project" condition of low irrigation efficiency and the profit under "with project" condition of improved irrigation efficiency. Due to the shortage of canal system water, the study area is supplementary irrigated by various kinds of water resources such as creek, river, dug-well and shallow tube-well. The irrigated area by canal system under "without project" condition is estimated on the basis of the irrigation efficiency in the present condition. The estimated overall irrigation efficiency at present condition is very low as mentioned in Section 4.4. 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 shown in Table A.4.20 to A.4.22, and 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 Table A.4.23.

4.6 Improvement Plan of Rural Infrastructures

4.6.1 Development Strategy

Rural road and potable water supply are ones of the 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, the improvement plan of the rural road is only made in the study.

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

4.6.2 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 as shown in Figures A.4.7 to A.4.8. 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 as shown below.

RIS	Road Length (km)			Structures (nos.)	
	Existing Road	Additional Farm Road	Link Road	Bridge	Culvert
Jalaur proper	84	51	5	2	112
Jalaur extension	38	18	3	1	41
Suague	33	8	1	0	17
Sta. Barbara	38	5	5	1	20
Aganan	44	9	1	3	21
Total	237	91	15	7	211

4.7 Improvement Plan of Water Management and O&M Practices

4.7.1 General

The plan of water management and O&M practices will be formulated to solve most of the physical, technical and financial constraints on the water management and O&M practices in the systems through rehabilitation and improvement of the irrigation & drainage facilities, and through institutional and organizational improvement of the RIS offices and farmers' organizations.

These approaches will result in proper and effective water management and O&M practices to achieve higher irrigation efficiency and ISF collection efficiency.

4.7.2 Organization

The organization of each system will be formed according to the type of system management. It depends on the degrees of responsibilities for operation and maintenance of the systems to IAs. At present, as mentioned in Section 3.10, NIA has two different kinds of contracts with IAs in the systems of the study area, i.e. Types I and II contracts.

At the field level of the systems, in case that Type I contract does not exist, the WRF Tenders are tasked for the maintenance (grass cutting and clearing, etc.) of canals in addition to their usual routine works and then in case that Type II contract does not exist, the WRF Technicians are tasked to act as collectors of Irrigation Service Fee (ISF) in their respective areas or division in addition to their usual routine works. Accordingly, if such works are undertaken by the contract with IA in the concerned areas, the work load of the WRF Technicians and the WRF Tenders will be lessened. As a result, they will be able to concentrate on their usual routine works in a more effective manner.

Type I & II contracts should be set in all of areas as a first step of the improvement plan for the O&M performance of the existing NIS in the study area. However, the activities of IA under the contract are not sufficient for the necessary O&M works, because there are incentives only for the maintenance (grass cutting and clearing, etc.) of canals in Type I contract and the ISF collection in Type II contract at present (refer to Section 3.10). Therefore, the improvement of incentives and obligations on the conditions of the contract between NIA and IAs will be needed to effectively motivate the IAs in O&M works.

Normally each WRF Technician and WRF Tender will be assigned to 750 ha-irrigation service area and 3.5 km-canal length or 250-300 ha-irrigation service area, respectively, as mentioned in Section 3.8. The present condition on the assignment of them is shown in Table A.4.24. As shown in this table, in some divisions, the number of these personnel are not sufficient for the effective O&M works, making the work of existing personnel to be overloaded at present.

Accordingly, the number of the WRF Technicians and the WRF Tenders will be increased to perform more effective O&M works with higher irrigation efficiency. However, they will be hired as contractual employees up to the end of Type I & II contract implementation, and such number is within the approved number of positions by Department of Budget and Maintenance. Based on this, the proposed number of additional field staff is shown in Table A.4.24 in the present condition, i.e., up to the end of Type I & II contract implementation. However, the final target of the O&M performance of the existing NIS in the study area will conform to NIA's Type III Contract (full turn over of system management to IAs) after development. After full system management turn over to the IAs, the WRF Tenders will be terminated, but the

WRF Technicians will be retained to provide continued technical assistance to IAs. As a result, the expenses of the RIS office will be reduced.

The basic organization and staffing pattern at the NIA's office level will be retained in the Phase I study. It will be further clarified in the Phase II study.

4.7.3 Water Management Practices

(1) Water delivery schedule

The water delivery schedules are prepared by each RIS office based on the cropping calendar which is, in turn, prepared on the basis of the meteorological and hydrological data and the condition of farmers' farming activities. However, at present, the basic data such as river discharge and intake discharge are not properly recorded and the farming activities are not considered well in the preparation of the cropping calendar. Under such situation, the cropping calendars are not being followed by the farmers. Accordingly, the meteorological and hydrological data should be recorded properly and regularly, and the farming activities should be clarified under the monitoring system as mentioned later.

As for the recording of the river discharge and intake discharge data, there are no proper measuring devices in the systems. Aganan RIS has the automatic water level recorders at the diversion dam and the intake channel, however, the method of recording and converting the discharge data is not being done properly by the persons in charge of the recording. The proper installation of measuring devices and training to the persons in charge of the recording should be done under the proposed monitoring system as mentioned later and practical operation manuals should be prepared. Specific farming activities and conditions should also be clarified properly before the preparation of the cropping calendar by the Agriculturist of each RIS office in coordination with the IAs every year under the proposed monitoring system.

As mentioned in Section 3.8.2, in some systems, the water delivery and distribution schedules, except for the whole water delivery period, are presently not officially informed to the farmers and beneficiaries. All of RIS offices should inform broadly and officially to them the detailed irrigation water rotation program as well as the whole water delivery period to be comprehended easily and followed for the cropping calendar. In Jalaur proper and Jalaur extension RIS, there is no systematic and regular irrigation water rotation program and continuous irrigation is being adopted. In fact, in such systems, all of the irrigation service areas are not irrigated even on the wet cropping. The systematic and regular irrigation water rotation program should be also prepared in such systems to increase the irrigation efficiency.

As for the present 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.

(2) Facilities management

As mentioned in Section 3.8.2, at present, water discharge in the main canal and laterals is being recorded through the staff gauges in some canals. However, the calibration of canal discharges through the staff gauges are not being done regularly and such recorded data are not reliable and sufficient for the proper water management due to the absence of workable control structures and lack of measuring devices even at major stream points. 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, and the maintenance of accuracy of measurement, i.e., physical maintenance such as desilting near measuring devices should be done for accurate and effective water management. Type of the measuring devices is mentioned in Section 4.4.

Accordingly, effective water management practices will be realized after the implementation of rehabilitation and improvement works of the facilities.

(3) Monitoring system

At present, there is no proper monitoring system for the effective water management in the RIS offices in the study area. A proposed monitoring system is composed of the collection of field data such as farming activities and rainfall, river water level, canal water level and gate opening on time through communication system, processing the data, monitoring the field operation, and improvement of recording and filing system (refer to Section 4.9).

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 data processing consists of the conversion of collected data into the necessary dimensions required for the operation, preparation of operation plan, and management of operation data.

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. The plan will be composed of the following:

(a) Seasonal management plan

In accordance with the yearly water delivery and distribution schedule, each RIS office will prepare the seasonal management plan for each irrigation system. This plan will clarify the actual cropped area and cropping calendar.

(b) Monthly management plan

After the irrigation has started, the seasonal plan will be always checked and corrected by the weekly water balance study, and monthly water delivery and distribution plan will be prepared for each month.

(c) Weekly operation plan

This plan is to be prepared for the subsequent week's operation from the result of water balance study for the previous week based on the operation monitoring records. The weekly operation plan will indicate the volume of irrigation water delivery at each point up to the turnout level of the field.

According to the weekly operation plan, the field staff will be set at the irrigation facilities to control the irrigation water delivery and distribution. The irrigation water delivery and distribution, and hydrological features will be monitored by the field staff through the communication system.

4.7.4 Operation and Maintenance Practices

(1) O&M method

As mentioned in Section 3.8, operation and maintenance works are being done by NIA staff and/or IAs on a contract basis. The present O&M method will be basically followed with the proposed monitoring system.

However, the present work load of NIA staff such as the WRF Technicians and the WRF Tenders are overloaded. The number of them 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 as mentioned in Section 4.7.2. At the final step, Type III Contract (full management turn over to IAs) will be applied and the full O&M management 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, and as the prerequisite conditions for the effective O&M works, the following physical aspects should be done properly.

(i) Rehabilitation and improvement (installation of measuring device) works for the water control structures to perform accurate, proper and effective water delivery and distribution, and
(ii) Installation of settling basin to reduce siltation in the canals to supply water effectively.

(2) 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. The NIA prepared "General Operation and Maintenance Manual" as guidelines for the operation and maintenance in 1991 under IOSP I. However, this manual is not being utilized by the O&M staff in the concerned systems because this is not practical and easily comprehensible and also it is not widely known 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.

As mentioned in Section 3.10, the present training program to the O&M staff is not so sufficient. 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 (refer to Section 4.9).

(3) O&M cost

As mentioned in Section 3.8.3, in the budget preparation, the estimated expenses and income for the year are included. The estimated income for the year includes collection of Irrigation Service Fee (ISF), rental of equipment from NIA projects and/or from private lessees and other government agencies, and other minor income. At present, such income is being used for the personal services such as personnel salaries and wages, etc., and the routine needs of the office operation such as power supply, office supplies and fuel, etc. In some cases, the actual expenses have exceeded the actual income.

Under such situation, the existing budget is not sufficient to cover O&M costs for the system facilities and the institutional strengthening cost, and such works as the desilting works and the rehabilitation and improvement works of existing facilities are being done under several projects such as Irrigation Operations Support Project (IOSP), Water Resources Development Project (WRDP), and through the General Appropriation Act (GAA), etc. However, actual budget is not constant and stable, and it causes deterioration of irrigation and drainage facilities and improper water management due to insufficient O&M budget.

In short, 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.

4.7.5 Irrigation Service Fee (ISF) Collection

Present ISF collection is lower than the actually required O&M cost, causing difficulty for the RIS offices to allocate enough funds for the operation and maintenance cost of the water control facilities. The proposed improvement plan on ISF collection is formulated focusing on the following main points in order to increase ISF collection.

(1) Method of collection

At present, ISFs are collected from individual water users by NIA collectors designated by each RIS office and/or collected by IAs themselves with Type II contract. As shown in Table A.4.25 in Jalaur proper RIS, Jalaur extension RIS and Suague RIS, Type II contract is being applied at only one (1) irrigation division out of nineteen (19) divisions. In Aganan RIS and Sta. Barbara RIS, Type II contract is being applied at five (5) irrigation divisions out of ten (10) divisions. In most of cases, ISF collection is being done by the WRF Technicians, Tenders and Operators deputized as the NIA collectors. And also ISF collection efficiency is too low compared to the national average regardless of the method of collection. In some cases, ISF collection efficiency of the IA with Type II contract is lower than that of NIA's hired collectors. However, Type II contract will be recommended to be applied for the ISF collection based on the following merit of Type II contract.

(a) Reduction of administration cost of the NIA and proper work load of the NIA field staff

Type II contract contributes to the reduction of administration cost of the NIA for decreasing the need for maintenance personnel and ISF collectors, and to the usual routine O&M works of the WRF Technicians, Tenders and Operators. The lower ISF collection efficiency of the IA with Type II contract in the study

area compared to that of NIA's hired collectors could not be totally attributed to the low technical capability of the IA but also to the following:

(i) the manner by which this task is introduced to the IA , i.e., treating the IA as contractor rather than partner in irrigation management,
(ii) the low and less attractive incentives given to the IA in ISF collection,
(iii) the lack of practical, easy-to-use manual on O&M practice, and
(iv) the ineffectiveness of organizational development process.

Proper measures to correct and upgrade these present conditions will motivate the IA to exert more efforts to increase ISF collection efficiency and improve system operation.

(b) Real meaning to the concept of farmers' participation

Type II contract gives real meaning to the concept of farmers' participation in the operation and management of the NIS (or RIS) which would enable the farmers' group (IA) to build up capabilities and develop a process to sustain and control the O&M of irrigation canals/facilities. Further, it will serve as an on-the-job training for the IA to undertake Type III contract at the appropriate time as specified in implementation schedule for strengthening of farmers' organizations.

(c) Confidence among IA farmer-members

Type II contract builds confidence among IA farmer-members that the government is entrusting them to carry out more responsible tasks such as system operation normally done by technical people.

(d) Strategy to build up working capital for the IA

Type II contract offers an strategy to build up working capital for the IA if the IA shares from ISF collection would be granted at the time when there is a need for working capital.

(2) 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. Under such situation, such billing and collection documents are also not promptly prepared by the billing clerks by means of computer, and distribution of such documents to the water users are not done on time after evaluation of billing and some ISF collectors start ISF collection without official billing and collection documents. It causes non-payment of ISF by water users.

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.

In order to issue the billing documents (ISF bills) required for ISF collection to the water users on time after evaluation of billing by each RIS office, such documents will be efficiently prepared by the computer in each RIS office and distributed to the water users through NIA collectors and IAs promptly after preparation of billing and collection documents.

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

At present, the ISF collectors have no clear demarcation for their water users to visit for the ISF collections each other and no effective check list to clarify the progress and status in the collections . Under such situation, their activities are not so proper and systematic due to lack of knowledge for ISF collection caused by insufficient training and seminar program for the ISF collectors.

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.

(4) 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.

(5) IA incentives for ISF collection

At present, in the 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 NIA releases the computed IA share within 90 days after the year end. 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%

According to the above incentives, no incentive is given to the IA at all in case that the collection efficiency do not exceed 50%. In order to encourage the IA to improve the present low level of ISF collection, incentives (e.g., 1% incentive for 41-50% efficiency and 0.5% incentive for 31-40% efficiency) will be considered for collection efficiency less than 51%.

As stated above, the IA normally receives the above share after 90 days of the year end in the present condition. The NIA should promptly release IA share to be utilized for the cost of farming activities whenever they need and build up working capital for the association.

4.8 Improvement Plan of Agricultural Support Services

4.8.1 Research and Extension

Extension activities and research should be strongly activated for realizing the agricultural development plan. The relevant agencies should be encouraged to support village/farmers level farming practices and generalizing appropriate technology.

Extension personnel should be trained in the specialty as well as organizing and management technique of farmers group. Farmers are starving for knowledge of increase production and attractive and profitable crop diversification. 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,
v) Priority of farmers needs in research.

Extension workers of MAO will directly provide appropriate farming technology to the irrigation beneficiaries of IA. 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 which is a organized farmers in one or two turn-out service area (TSA) . The leader of each group, who will be assigned to a progressive farmer, will work in 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	14
Jalaur proper	35	6
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, a 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.

Extension activities at the IA level will be held in the field (demonstration plots and other farms) and in multipurpose hall to be proposed in the project for rural community activities, members meeting of IA, and farming technology guidance.

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 courses 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.

4.8.2 Agricultural Credit

The agricultural credit improvement plan should address the twin problems of the indebtedness 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 agricultural cooperatives or juridical IA organizations would remain to be the institutions that can support rural financial intermediation in the study 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 agricultural 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 agricultural cooperatives that would eventually continue their access to the LBP lending window.

(b) Institutional strengthening.

In parallel to the loan restructuring program, the agricultural cooperatives would be strengthened 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 agricultural 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 micocredit activities.

4.9 Improvement Plan for Strengthening of Farmers' Organizations and NIA

The improvement plan for strengthening of farmers' organizations and NIA will seek to solve the major constraints presently facing them in order to carry out and/or promote agricultural crop diversification, intensive paddy rice production, sustainable O&M of irrigation systems, and rational water management system.

4.9.1 Farmers' Organizations

The key concepts for strengthening of farmers' organizations especially the IAs are discussed below with the end view of making them implement Type III contract within 10-year period based on implementation schedules shown in Figure A.4.9 for Jalaur-Suague RIS and Figure A.4.10 for Aganan-Sta. Barbara RIS.

(1) Jalaur-Suague RIS

(a) Reorganization, federation and capability building of the IAs

Twenty-five IAs in the Jalaur-Suague RIS (i.e., 14 IAs in Jalaur proper, 6 in Jalaur extension and 5 in Suague) are considered to have less functional IA board of directors (BOD) and working committees that constrain the NIA to give them Type II contract. Even the implementation of Type I contract by the 22 contracted IAs is experiencing low participation by members due to the low unity and cooperation within the IAs.

Reorganization of the IAs will emphasize improvement of the leadership and management style, development of mass-based structures, skills upgrading of members, and team building. The IA reorganization and development process is envisioned to undertake the following activities:

- Recruitment of local-based NGOs to assist in the reorganization and federation of the IAs;
- Intensive on-the-job training of IA officers and members on various organizational and technical aspects including site visits to successful farmers' organizations;
- Increasing the frequency of IA General Assembly meeting from once a year to once every quarter to improve decision-making process;
- Improvement of procedures in decision-making and terms of officers at the IA level;
- Development of farmer trainers and subject matter specialists for effective and efficient technology transfer and extension services; and
- Activation of a continuing education and training program in each IA.

The NIA should exert all efforts to enjoin the 37% potential farmer-members in the Jalaur proper RIS to become actual IA members to maximize and improve sustainability of the O&M of the NIS.

Federation of the IAs will be pursued by merging all the IAs in each of the three RISs after the reorganization and development process. Training and technical guidance to the IAs will be provided by the NIA and local-based NGOs to prepare them for the establishment and management of IA federation.

A needs-oriented training program will be developed by the recruited local-based NGOs in close collaboration with the IAs and the NIA's IDOs for organizational development. The existing institutional development profile of the IAs in the Jalaur-Suague RIS is an important input to the development of such training program, as shown below (with that of the IAs in the Aganan-Sta. Barbara RIS):

	Organizational Development Continuum			
	Start-Up	Development	Consolidation/ Expansion	Sustainability
IAs by RIS				
Jalaur proper (14)		G	A, B, C, D, E, F	
Jalaur extension (6)		B, G	A, C, D, E, F	
Suague (5)		B, G	A, C, D, E, F	
Sta Barbara (4)			A, B, C, E, F, G	D
Aganan (6)		B, C, F	A, D, E, G	

Organizational Characteristics/ Resources: A. Leadership/management style (BOD); B. Mission, goals and objectives; C. Structure; D. Membership skills; E. Membership commitment/cooperation; F. Planning skills; G. Public relations/networking skills

(b) Development and/or strengthening of farmers' cooperatives

The IA farmer-members are constantly faced with financial shortage during the paddy rice production and marketing period for productive and consumptive use, thereby making them prematurely dispose off their paddy rice to credit providers (i.e., traders) and millers at lower prices. In order to rectify this

situation, development and/or strengthening of farmers' credit cooperatives in the RISs concerned becomes an urgent matter, and measures to achieve this will include the following:

- Identification and development of appropriate farmer group/s (i.e., women farmers or pure tenant farmers) into credit cooperatives;
- Area assignment of local-based NGOs' staff to train and assist the identified farmer group/s to form and manage credit cooperatives;
- Development of simple credit application procedure and flexible loan repayment scheme for IA members;
- Expansion of the scope of credit assistance to cover both production and marketing of paddy rice; and
- Provision of seminar and technical guidance to the IA member-loaners on credit application and repayment procedures, and their obligations.

Proper coordination with the Lug's MAO, CDA and financial institutions such as the LBP will be made by the NIA for provision of further technical and financial assistance in the development of farmers' credit cooperatives.

(c) Establishment of integrated production and post-harvest processing system including marketing for paddy rice

In order for the IAs and farmers in the Jalaur-Suague RIS to reap high benefits from irrigated paddy rice production, they need to control and own the post-harvest processing including marketing of their produce. Very few of the IAs, however, have easy access to the limited post-harvest facilities such as dry-yard and warehouse provided by the NIA. Furthermore, practically all the IAs have no organized marketing system so that the members sell their paddy rice independently to the traders who normally set the farm gate price. Measures to integrate production and post-harvest processing/marketing of paddy rice are of high necessity, and will consider the following:

- Establishment of tie-ups with big landowners and private owners of post-harvest facilities such as warehouse, rice mill and office; and semi-mechanized drying house and/or sun-drying floor to meet the needs of the IAs concerned;
- Organization of IA marketing committee to manage the group buying and selling of paddy rice and other crop for its members;
- Coordination with the Lug's MAO and DA Region VI Office for the provision of training and extension services to the IAs on improved irrigated paddy rice production including the sourcing of quality rice seeds;
- Development of farmer trainers/subject matter specialists in irrigated paddy rice production; and
- Promotion of the production and use of organic fertilizers.

(d) Further assistance in training and guidance in the improvement of O&M practices and rational water management system

The plan for the IAs to undertake Types I and II contracts in the Jalaur-Suague RIS will be supported with further assistance in training and guidance to improve water management and system operation including the ISF collection. This assistance will be started immediately after the reorganization and development of the IAs, which will adopt the following measures:

- Development of simplified manual on water management;

- Activation of the Service Committee at the IA or TSAG level for canal maintenance and water allocation;
- Training of the IA members especially those assigned to the IA Service Committee;
- Computerization of ISF billing system;
- Activation of the IA Finance Committee to take the responsibility of ISF billing and collection for its members; and
- Establishment of IA office to ensure proper record keeping and maintenance and provide permanent venue for continuous education program for the IA.

(c) Guidelines, training and technical assistance for Type III contract

Depending on the capability and willingness of the IAs to undertake Type III contract by the ninth year of the Project, appropriate guidelines/practical manual on full or partial system management will be prepared. The IAs will be trained on these guidelines/manual and will receive continuous technical assistance from the NIA's O&M Offices.

(2) Aganan-Sta. Barbara RIS

(a) Strengthening of the IA federation

Six of the 9 IAs in the Aganan-Sta. Barbara RIS are presently involved in Types I and II contracts (O&M work, water management and ISF collection) which have relatively more advanced organizational development. Three of these 6 IAs are in the Aganan RIS which already formed a federation that now operates the JICA-funded post-harvest facility in Oton municipality. The other 3 IAs in Sta. Barbara RIS, together with the remaining 3 less functional IAs, are in the process of setting up a federation. The main purpose of this federation is to unify the IAs for a more comprehensive approach to water management and O&M of irrigation canals/facilities.

At this early stage of the federation development, the IAs need not only knowledge on how to establish it but also skills in managing the federation to meet its main aim without adversely affecting the respective IA activities. In order to make the IA federation more functional, the following measures will be undertaken:

- Making IA federation as the central organization in each RIS in charge of (1) coordinating and reviewing the allocation and utilization of irrigation water, and the O&M work across irrigation divisions and (2) coordinating water rights and other interests between the IAs and other water users in the upstream and downstream areas at the RIS level;
- Training of the IA federation officers in managing federation, RIS-wide water management and RIS-wide O&M practices; and
- Joint NIA-LGU/MAO collaboration in the supervision of the post-harvest facility operated by the IA federation such as that in Oton municipality for maximum utilization and in provision of training and extension services to the IA members.

(b) Training and technical assistance in diversified crop production

Proper coordination with the LGUs' MAO, NIA-DCIEP and other service providers will be established to train and support the IA members who are directly involved in diversified crops production. The measures to be adopted are as follows:

- Organization of IA members who are engaged in diversified crop production to formulate the corresponding detailed operational plan;
- Training of diversified crop farmers;
- Provision of farm inputs and facilities such as seed supply, storage, demonstration farm and marketing facilities;
- Development of farmer subject matter specialists in crop production, marketing, and maintenance of farm facilities; and
- Establishment of farm inputs procurement committee in the IAs to coordinate the group purchase and distribution of farm inputs for the members including the monitoring of input use in the farm.

(c) Increasing IA members' access to extended credit assistance for irrigated paddy rice and diversified crops production

Despite the importance of credit to farmers for paddy rice cultivation in the Aganan-Sta. Barbara RIS, there are quite a few credit cooperatives (only about 6% of the total farmers' cooperatives in the same RIS) to meet the farmers' needs for credit. The introduction of diversified, high valued crops will further increase the need for financial support to enable the farmers to buy the desired crop varieties and agro-chemicals for higher crop yield. The following measures will be adopted to increase farmers' access to micro credit:

- Mobilization of local-based NGOs such as the Taytay sa Kauswagan, Inc. (TSKI) and Visayas Cooperative Development Center (VICTO) to provide micro credit to the IA members and other farmer groups;
- Linking the selected NGOs with existing credit facility of the Land Bank of the Philippines (LBP) for farmer-beneficiaries of the Project;
- Restructuring of loans of existing farmers' cooperatives with LBP;
- Promotion of farmers' group credit availment system;
- Development of group savings as precondition for credit approval; and
- Farmers' training on credit availment procedures and requirements.

(d) Intensive refresher training of the IAs in water management and O&M of irrigation canals/facilities

In support of the plan to make the 10 IAs in the Aganan-Sta. Barbara RIS to implement Types I and II contracts within the first year of the Project, the following measures will be undertaken:

- Development of simplified manual on water management;
- Training of IA officers and members especially those involved in the IA Service Committee in using the manual on water management and in proper O&M practices;
- Activation of the Service Committee at the IA or TSAG level for water allocation and canal maintenance works;
- Computerization of ISF billing system; and
- Strengthening of the IA Finance Committee to take the responsibility of ISF billing and collection for its members.

(c) Pilot testing of Type III contract implementation

Given the high level of technical functionality of the IAs in Aganan-Sta. Barbara RIS, Type III contract implementation will be pilot tested in said RIS areas on the sixth year of the Project, subject to validation of the capability and willingness of the IAs. Experience from this pilot testing will determine whether the same plan will be replicated in the Jalaur-Suague RIS.

4.9.2 National Irrigation Administration

The institutional strengthening of the NIA will focus on three broad areas of concern, as follows:

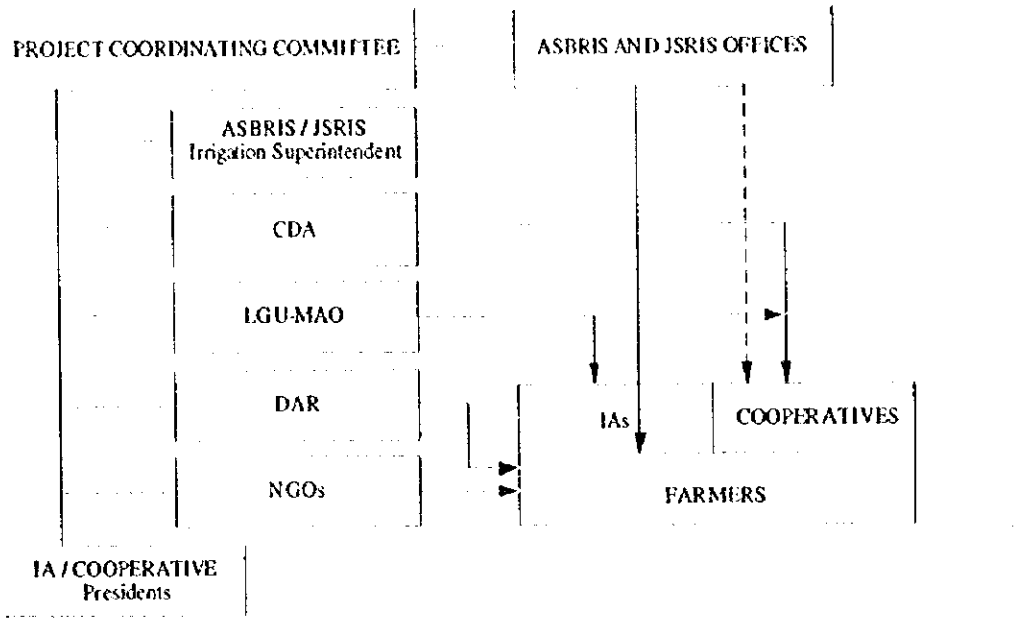
(1) Strengthening of inter-organizational collaboration mechanism for agricultural extension and other support services

The establishment of multi-sectoral committee to coordinate, oversee and monitor the delivery of integrated agricultural support services will be considered in the design for institutional strengthening. Expected to become members of this body are the NIA, CDA, NFA, LGU-MAO, DAR, NGOs and farmers' organizations such as the IAs and farmers' cooperatives. This committee will be responsible for coordinating with the LBP, NFA, Quedancor and other institutions to provide the needed inputs and services to the IAs and farmers.

The expected roles of each member of the multi-sectoral committee and other support institutions are as follows:

Participating Agencies	Proposed Roles
1. NIA	Lead executing agency of the Project that is responsible for the technical aspects of O&M work and water management and the coordination of agricultural support services delivery to farmers' organizations
2. LBP, Quedancor	Establishment of a micro credit facility for farmers in the study area; and assistance in training of farmers in credit systems, requirements and terms of payment/collection
3. NFA	Introduction of buy-back credit system; giving the IA and farmers highest priority in the use of NFA post-harvest facilities; and setting up funds for the procurement of paddy rice
4. LGU-MAO	Assignment of extension workers per division; undertake training of farmers in improved crop diversification (Aganan-Sta. Barbara RIS) and paddy cultivation (Jalaur-Suague RIS) technologies including integrated pest management
5. NGOs	Conduct of organizational and cooperative development training for the IAs and farmers; and provision of micro credit to the farmers
6. DAR	Provision of assistance to farmers in producing documentary requirements for the immediate transfer of land ownership under CARP
7. CDA	Provision of technical assistance in the training of farmers in the development / registration of cooperatives.

The relationships between the ASBRIS and JSRIS Offices and the multi-sectoral committee in the provision of agricultural extension, training and other support services are envisaged as depicted in the diagram below:



The solid arrow line denotes direct provision of technical assistance and training to the IAs, cooperatives and the whole farmers by the two RIS Offices and the committee members with respect to their expected roles in the Project. Overall coordination of development support will be the main responsibility of the NIA through the two RIS Offices. The broken line denotes coordination function. This committee may need to be set up for each RIS due to wide geographical coverage of the five RISs.

(2) Data management system improvement at NIA RIS Offices

This will involve: (i) the purchase of computer and communication equipment, (ii) the provision of transport vehicles for field staff, and (iii) the development of data management system from data recording to data processing including the preparation of ISF bills. The cost estimates of the equipment and transport facilities for the RIS offices are shown in Table A.4.26. These estimates will be clarified in the Phase II study.

(3) Training of NIA field personnel

The training of NIA field personnel (e.g., Engineers, IDOs, Water Masters and Ditch Tenders) will assist the agency to concentrate and improve on the provision of training and support to the IAs on technical aspects of O&M work including water management and ISF collection, and to manage inter-organizational collaboration.

The training will be provided in close collaboration with local universities and colleges, and specialized consulting firms. Specific kinds of training for the following existing NIA RIS personnel will be preliminary determined in the Phase II study.

(Unit: Number)

Position classification	JSRIS Office	ASBRIS Office	Total
1. Irrigation Superintendent I / II	2	1	3
2. Office Engineer	0	1	1
3. Senior Engineer A	1	0	1
4. Engineer A / B	3	3	6
5. Agriculturist A	1	1	2
6. Institutional Development Officer	3	2	5
7. WRF Technician	10	7	17
8. WRF Operator	4	3	7
9. Water Tender B	34	24	58
Total	58	42	100

Source: Figures A.3.31and A.3.32

A total of 36 new NIA field staff consisting of WRF Technicians and WRF Ditch Tenders are recommended to provide guidance to the IA in water management and O&M work. The distribution of new field staff by RIS is shown in Table A.4.24 and summarized below.

(Unit: Number)

	Jalaur proper	Jalaur extension	Suague	Sta. Barbara	Aganan	Total
WRF Technician	3	1	3	2	1	10
WRF Ditch Tender	12	6	2	4	2	26

These new field staff will be trained in system management/water management, essential structural maintenance and ISF collection strategy. Table A.4.27 shows the preliminary list of broad training areas for NIA field staff, including those for farmers' organizations, and the corresponding cost estimates. In support of the training, the training center in the JSRIS office will be renovated and a new training center will be constructed in the ASBRIS office. These centers will be furnished with the necessary furniture and fixtures. The cost estimates for the training centers, and furniture and fixtures are also shown in Table A.4.26

These ideas, however, will be validated with the IAs, farmers' cooperatives, LGUs and other local stakeholders during the Phase II of the Study to determine the relevance and feasibility of the plan components. At that stage, a Participatory Rural Appraisal (PRA) will also be conducted to make sure that farmers' needs for capability building and development is reflected in the improvement plan.

4.10 Improvement Plan for Marketing and Post-harvest Facilities

There are two major problems faced by the farmers in the marketing of paddy. 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 agricultural 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 agricultural

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

4.11 Watershed Management Plan

4.11.1 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 Government can directly apply the rehabilitation measurements on only the area of Forest land. Therefore, the project approach shall be divided into two ways; for Forest land and for A&D land. As for Forest land, the watershed management shall be implemented under the governments initiative like as 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 main activities on the area.

(1) On Forest Land (Referring to Rehabilitation Sub-project)

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 of country. The watershed management concept in this report will also refer to the one of watershed rehabilitation sub-project. The outline of the concepts are 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)

(2) 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.

4.11.2 Outline of Technical Approaches

(1) 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 A.4.28. 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 is a common farming system in Philippines. The recommended types of agro-forestry system (ref. Figure A.4.11) 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.

(2) 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.

4.11.3 Institutional Development Concepts

(1) 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.

(2) 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.

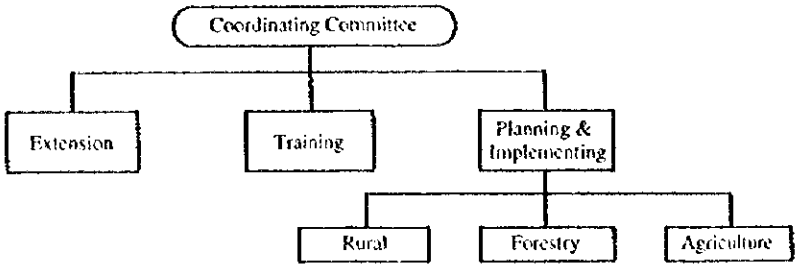
(3) Extension

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.

4.11.4 Watershed Management Plan

(1) 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.



(2) Technical Management plan

Taking into consideration 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.

(a) 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

(b) 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

(c) 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 existing irrigation system

(d) 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 existing irrigation system (on lowland area as San Enrique, Passi, etc.)

4.12 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 A.4.29).

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 sea shore. 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.

5. PROJECT WORKS

5.1 Project Works

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

Post-Harvest Facility	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 including the necessary communication and transport equipment for institutional strengthening are shown below.

Description	Unit	Jalaur pro.	Jalaur ext.	Suague	Aganan	Sta. Barbara
IA Office	nos.	14	6	5	6	4
Training Center	nos.	<	1	>	< 1	>
Communication Equipment	+	< 5 sets,	1 base	>	< 4 sets,	1 base >
NIA	sets	11	4	4	6	4
IA	sets	14	6	5	6	4
MAO	sets	3	2	3	3	3
Transport Equipment						
Pick-Up Vehicles (NIA)	nos.	<	2	>	< 2	>
Motorcycles (NIA & MAO)	nos.	14	6	7	9	7
Furniture and Fixtures	L.S.	<	1	>	< 1	>

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.

5.2 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, and physical and price contingencies.

Direct construction cost covers the cost of irrigation and drainage facilities, rural infrastructure, post-harvest facilities, 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 1,992.4 million pesos as shown below (Table A.5.1).

(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 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	74,680	35,253	13,813	15,889	17,871	157,506
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

5.3 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 Section 7.

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 reorganization and federation of the IAs will also be started at the pre-construction stage. Hence, the strengthening of the Aganan IA federation and the reorganization and federation of the IAs in the Jalaur-Suague RIS will become part of the phase I of the Project. Figure A.5.1 shows the implementation schedule of the Project.

6. PRELIMINARY ECONOMIC EVALUATION

6.1 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 $.

6.2 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.

6.3 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. The summary of the calculation is attached in the Table A.6.1. Calculation basis of economic prices of paddy and fertilizers are shown in Table A.6.2. Future economic crop budgets are given in Tables A.6.3 to A.6.5.

6.4 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 A.6.6.

7. 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

(1) 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.

(a) 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

(b) 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

(c) 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

(2) 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

(3) 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.

(a) 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

(b) 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

(c) 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

(4) 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

(5) 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.