2.6 UPRIIS Farmers

2.6.1 General

A survey on UPRIIS farmers, recipients of services from UPRIIS, was conducted by the questionnaire method using the participant observation technique. Two hundred and seventy six (276) farmers were selected at random from farmers who had been identified in the Input and Output Monitoring Program (IOMP).

This questionnaire survey aims to: i) grasp the general profile of UPRIIS farmers and their farming status, ii) identify farmers' perception on water management, communication, irrigation service fee, farmers' associations, etc. and iii) clarify constraints against the proper management of the system.

2.6.2 General Profile of UPRIIS Farmers

With regard to the civil status of UPRIIS farmers, more than 90% of them are "married". 46.9% of the heads of family are over 50 years old and 29.3% are between 40 and 49. Average family size is estimated at 6.

The educational standard of UPRIIS farmers is: primary school 45.6%, intermediate 30.7%, high school 15.7%, no school 4.7% and college 3.3%.

As to the ancestral origin of farmers, the percentages in order of size are the following: Nueva Ecija 77.4%, Bulacan 8.8%, Ilocos 4.4%, Pampanga 3.6%, Pangasinan 2.9%, Tarlac 2.6% and other 0.3%. About 75% of farmers speak Tagalog in daily life, while the rest (20.3%) speak Ilocano.

The distribution pattern by land tenure and farm size of the UPRIIS farmers are summarized below:

(Unit: %)

Land Tenure	Farm Size				Total
	Below 1.0 ha	1.0 - 2.0 ha	2.0 - 3.0 ha	Above 3.0 ha	
Owner Operator	2	3	3	2	10
Amortizing Owner Operator	1	11	11	3	26
Lessee	3	24	24	13	64
Whole Area	6	38	38	18	100

It is noticeable that the lessees represent about 64% of the total number of farmers. The average farm size is estimated at about 2 ha. 82% of the total UPRIIS farmers have farms of less than 3 ha in area.

Most of the income of UPRIIS farmers is derived from crop production. In addition, more than 50% of the farmers are earning off-farm incomes from subsidiary businesses such as: i) working for other farms (41.8%), ii) driver (12.0%), iii) sari-sari store (10.8%) and iv) others (35.4%).

2.6.3 Farm Economy

Farm economy of the UPRIIS farmers is analyzed using the farm budget method to examine farmer's capacity-to-pay for the irrigation service fee. The result of farm budget analysis by farm size and land tenure status is presented in Table 10 and summarized below:

(Unit: ₱10^3)

Item	Farm Size			
	Below 1.0 ha	1.0 - 2.0 ha	2.0 - 3.0 ha	Above 3.0 ha
Owner Operator				
(Average farm size (ha))	(0.63)	(1.14)	(2.77)	(3.42)
- Gross income	14.1	21.1	43.8	56.0
- Gross outgo	11.6	16.4	29.8	37.1
- Net reserve	2.5	4.7	14.0	18.9
(Irrigation service fee)/1	(0.3)	(0.6)	(1.4)	(1.7)
Amortizing Owner Operator				
(Average farm size (ha))	(0.58)	(1.40)	(2.45)	(3.10)
- Gross income	13.2	22.4	35.2	41.8
- Gross outgo	12.7	19.4	28.4	31.1
- Net reserve	0.5	3.0	6.8	10.7
(Irrigation service fee)/1	(0.3)	(0.7)	(1.2)	(1.6)
Lessee				
(Average farm size (ha))	(0.59)	(1.34)	(2.29)	(3.32)
- Gross income	15.0	22.4	35.9	49.6
- Gross outgo	14.7	21.2	30.8	40.1
- Net reserve	0.3	1.2	5.1	9.5
(Irrigation service fee)/1	(0.3)	(0.7)	(1.2)	(1.7)

/1: Irrigation service fee 1981 = Area planted x 6 cavans/year x ₱72.5/cavan

Through the analysis of farm budget, the characteristics of the farmer in the UPRIIS area are summarized below:

1) Farm budget of all farmers categorized as owner operator seems well balanced in general. On the other hand, that of the amortizing owner operator and lessee is badly balanced.

2) About 50 to 80% of gross income is derived from farm income and remaining 20 to 50% consists of off/non-farm income and loans from Masagana-99, relatives and friends.

3) Most of farm income is derived from paddy production. Source of livestock raising is very limited.

4) Production cost of paddy occupies about 39% of total farm paddy income. Half of production cost is comprise of hired labor and machine costs.

5) A considerable amount of net reserve has been produced from the farmer's off/non-farm incomes.

It can be concluded from the survey that living conditions of amortizing owner operators with less than 1.0 ha and lessees with less than 2.0 ha are still at the subsistence level. This fact indicates that these farmers or 28% of all farmers have insufficient capacity-to-pay of irrigation service fee, although its charge occupies only a low ratio of their gross outgoings.

2.6.4 Farmers' Perception on UPRIIS Services

(1) Perception on Water Management

With regard to the present water management, it must be noticed that 35% of farmer-respondents express their dissatisfaction. This is mainly due to: i) inadequate supply of irrigation water (49.5%), ii) defective irrigation facilities (33%), iii) lack of responsibilities and duties of the UPRIIS staff (5.5%) and others.

As regards the present performance of duties and responsibilities of the UPRIIS staff, farmers give bad marks compared with those in the 1970s. It is noticed that 37.4% of 273 farmers indicate "not improved" in the questionnaire survey. Further survey results show that there exists a correlation between farmers' discontent on water management and non payment of the irrigation service fee.

Synthetically, farmers are used to understand water management as UPRIIS staff's services, whereas these, as a whole, seem to be not yet creditable among them.

(2) Perception on Communication

Out of 272 farmer-respondents, only 23.1% keep close communication with the UPRIIS staff, whereas the rest (76.9%) gave as answers "not so much" (42.5%) and "seldom" (34.4%) and still have little contact. The reasons behind this regrettable situation are mainly due to: i) poor comprehension of UPRIIS staff (51.6%) and ii) no time because of busy daily work (41.8%). The farmers' opinion on this matter forms a remarkable contrast to that of AWMTs and DTs. 81% of AWMTs and DTs answered to the same question that they keep close communication with farmers.

The results of the questionnaire survey can be summarized as showing that a wider gap in communication is observed between UPRIIS staff and farmers in several aspects. This gap constitutes one of the causes of farmers' discontents over UPRIIS services and lessening cooperation between the farmers and the UPRIIS. Detailes are explained in Appendix IX.

(3) Perception on Irrigation Fee

In this survey, special attention was paid to the following items: i) concept, ii) payment status, iii) effects of payment, iv) pricing basis, v) price of irrigation fee, vi) fee exemption and vii) payment pattern.

For the question related to irrigation fee, it is noticeable that 87.9% of 273 farmer-respondents knew that the irrigation service fee is charged for the operation and maintenance of the systems and nobody answered "no concept on irrigation fee, because water is a sort of blessing".

As a result of this survey, 55% of farmers indicate "full payment", followed by 34% for "partial payment" and 11% for "no payment". The reasons for non-payment were mostly concentrated on the following two points: i) inadequate supply of irrigation water (42.5%) and ii) insufficient net income (41.8%).

In connection with the payment of irrigation fee, 78% of farmers think that their payment affects the upgrading of UPRIIS's services. On the other hand, 38.5% indicate that the attitude of withholding payment was also effective in bringing about better management. Regarding the relationship between payment of irrigation fee and participation in the maintenance works at farm level facilities, 88% of farmers answer that they are willing to participate in these works, if the rate of irrigation service fee is reduced.

As to the base of charging irrigation service fee, 66.8% of farmers approve of the present basis on size of farm irrigated, while the rate (33.2%) think that the UPRIIS should adopt other bases such as volume of water used (19.5%), average cost of irrigation services (7.4%) and quantity of produce (6.3%).

On the matter of the actual amount of irrigation service fee, 60.8% indicate "fairly high" (54.2%) or "very high" (6.6%) whereas the rest (39.2%) consider the prevailing amount "appropriate" (20%) or "not so much high" (19.2%).

As the last resort, the UPRIIS grants the farmers/water users exemption from payment of irrigation service fees, when the average actual harvest is only 40 cavans or less per hectare due to water shortage, typhoon, flood, widespread pest and rat infestation and the like. 9.6% of farmers have so far applied for exemption from payment of

the irrigation service fee, but 6.2% don't know even the existence of this regulation. It must be noticed that out of the farmers who applied for exemption, 27.4% answer that their application has not yet been assessed, and they have not yet received any reply.

Relating to the payment pattern of irrigation service fees, 58% of farmer-respondents indicate "in cash", followed by 30.1% for "both (case by case)" and 11.9% for "in kind". In most cases (97.2%), farmers go to the UPRIIS field office to pay it and 97.1% of these approve of this pattern of payment.

(4) Farmer's Viewpoint on their Organization Set-up

The results of questionnaire survey on farmers' organizations are summarized as follows.

The farmers' organizations to which UPRIIS farmers are (or have been) affiliated in the order of ratio are the following: i) Farmer-Irrigators' Group (FIG) (58.3%), ii) Samahang Nayon (37.5%), iii) ARBA (1.5%), iv) KKK (9.8%) and v) others (1.9%).

Among them, Samahang Nayon is most appreciated by farmers with 57.7% of 196 respondents, followed by FIG (39.3%). The reasons why UPRIIS farmers appreciate Samahang Nayon are mainly attributable to: i) loan services through its organization which plays a role as guarantor, ii) unity and cooperation in community such as mutual aid capability to settle problems, and various assistance functions for procurement of farm inputs, marketing of produce, acquisition of certification of land transfer, etc.

On the other hand, the appreciation of FIG (39.3%) is principally focused on: i) good communication & consensus on farming activities and ii) good understanding in water management. 98.5% of farmer-respondents feel keenly the necessity for proper implementation of water management in spite of the fact that FIG is still inactive.

To remove the causes of inactivity, farmers consider that it is necessary to take the following measures: i) reorganization (or reshifting) of FIGs (41%), ii) adequate supervision and cooperation of NIA (31%), iii) rehabilitation of improvement of irrigation facilities (19%), iv) intensive seminar and campaign (3%) and v) others (6%).

About the optimum number of farmers in one FIG and the optimum scale of one irrigation service unit, it is noticeable that UPRIIS farmers indicate "the smaller, the better", giving answers as follows:

Optimum number of FIG members		Optimum scale of FIG (ha)	
- less than 25	95.6%	- less than 50	96.6%
- 26 to 100	4.4%	- 51 to 200	3.4%

2.7 Farmers' Organizations

2.7.1 General

In twenty four (24) cities/municipalities covering the project area, there exist the following farmers' organizations:

Designation	No. of Units	No. of Members	Characteristics (Promotor)
1) FIG	3,082	45,913	Irrigation unit of 50 ha (NIA-UPRIIS)
FIA	98	27,279	Federation of FIGs, unit area of 500 ha (NIA-UPRIIS)
2) ARBA	488	22,124	Group of agrarian reform beneficiaries (MAR)
3) ISA	30	2,586	Small-scale (1,000 ha and below) pump irrigation system (FSDC)
KAISA	3	2,586	Federation of ISAs
4) CIA	14	2,568	Community systems
5) Compact Farm	46	3,568	Small individually cultivated farms
6) Corporate Farm	1	158	Private corporation farm
7) KKK	5	835	National livelihood program (MHS)
8) Kilusang Bayan (AMC)	4	-	Market and supply organization
9) Samahang Nayon	407	37,628	Barrio-based organization (MA)
10) FBC	22	2,377	Barrio cooperative
11) FACOMA	2	12,390	Cooperative at municipality level

As a rule, farmers' organizations are vertically set up with a view to meet the various needs of farmers at all levels. (See Fig. 9)

These organizations seem not to compete nor contend with each other, even though they have similar legitimate objectives.

However, many inconveniences and problems experienced by farmers are pointed out. At first, most programs lack an integrated approach in transferring modern technology as well as extending financial assistance to the farmers. Traditional banking system and credit sources are easily available from banks, while technology transfers are separately carried out by the government and private research institutions. Secondly, farmers are periodically faced with extreme natural calamities. Thirdly, farmers complain of the weak farmers' organization and as a result thereof they have serious operational and financial troubles. At all events, farmers want irrigation water, farm inputs, etc. to be delivered on schedule.

2.7.2 Farmer-Irrigator's Groups (FIGs) and Farmer-Irrigators' Associations (FIAs)

(1) General

With the view of instigating farmers' participation in operation and maintenance of the irrigation systems, FIGs and FIAs have been instituted in the Project area under the assistance of the UPRIIS Office.

There exist at present 3,082 FIGs and 98 FIAs in the UPRIIS as shown in Table 11.

45,900 farmers are affiliated with the FIGs and 27,300 farmers with the FIAs. Out of 98 FIAs, twenty four (24) are now registered with the Securities and Exchange Commission (SEC) and have entered into a contract with NIA on matter of irrigation fee collection and irrigation water management.

However, according to the results of the evaluation survey of Irrigation Associations (IAs), a good deal of IAs are considered either least active or inactive. Further, it was confirmed by this survey that 27 FIAs among 98 (or 28% of the total) are already inactive and have regressed into FIGs. Details are explained in Appendix IX.

(2) Organizational Structure

The organizational structure of Irrigation Association (IA) is shown in Fig. 10.

Institutionally, each of UPRIIS farmers becomes a member of one Rotation Unit Group (RUG) with about 10 ha. Five (5) RUGs are affiliated with one FIG covering 50 ha. Then, 8 to 10 FIGs are federated to one FIA covering 500 to 750 ha. A further, bigger organization called the Federation of FIAs (FFIA) at division level (3,000 ha) is planned. In the structure of IA, the FIAs are core organizations which make a contract with NIA on water management and irrigation service fee collection as previously mentioned.

The FIAs are managed in accordance with the Articles of Incorporation and related By-Laws. The final decision of the policy and affairs on the FIA is made in the Board of Directors comprising the following seven (7) officials headed by the President. Under this Board, six (6) standing committees are created.

In order to clarify the characteristics of FIAs representatives and members, the investigations on their general profile were conducted in the questionnaire survey.

The age distribution of FIA representatives (Board members) is as follows: i) 29% from 51 to 60, ii) 28% from 41 to 50, iii) 23% from 31 to 40, iv) 14% from 61 to 70 and v) 6% for others. The educational level of the members is: i) intermediate school 44%, ii) high school 30%, iii) college 16%, iv) primary school 9% and zero schooling 1%.

The land tenure of FIA representatives is as follows: i) owner operator 13%, ii) amortizing owner 54% and iii) lessee 33%. It can be noted that most of representatives concurrently hold posts in other organizations as shown hereafter: i) 60% of 253 FIA leader-respondents hold posts as representative of Samahang Nayon, ii) 20% Samahang Nayon leader, iii) 12% Barangay representative, iv) 6% Barangay captain and 2% representative of other farmers' organization.

On the other hand, one FIA is generally composed of farmer-members belonging to several Barangays. As for the Barangay distribution of FIA representatives, 34% of 71 FIAs consists of member-representatives belonging to 3 - 4 Barangays, 31% for 2 Barangays, 24% for 1 Barangay and 11% for more than 5 Barangays.

(3) Activities

The FIAs in the project area are non-stock, non-sectarian and non-profit making association. It is defined in the Articles of Incorporation of the FIA that its major activities are: i) to serve as a foundation in strengthening agrarian reform, ii) to help and cooperate in operating and maintaining the irrigation facilities, iii) to serve as the channel between government and private agencies in the provision of technical assistance, etc., iv) to act as the catalyzer for payment of loans, land amortizations, irrigation fees as well as in the distribution of supplies for farmers and v) others.

From the viewpoint that the integration of different activities into farmers' association is rational and more advantageous for its future development, investigations into service activities of FIAs were conducted. In this survey, it was found that FIAs in UPRIIS are not actually engaged in activities other than some involvements in UPRIIS training programs.

(4) Financial Status

The source of revenue of the FIA derives from any or all of the following: i) membership fees, ii) annual dues, iii) voluntary contributions, iv) penalties of fines and charges and v) incentives given by UPRIIS Office in accordance with the fixed criteria in the agreement "Kasunduan".

As for the amounts of fees, dues and others mentioned above, FIAs are given a free hand in their management and then these vary in each FIA. Funds accumulated as working capital are, in principle, used for the payment of: i) charges and obligations of the IA, ii) cost of maintenance and repair of terminal facilities, farm ditches and

other irrigation structures within the area of the IA, and iii) other expenses that may be incurred in the conduct and operation of its activities.

According to the results of the questionnaire survey, the amounts of membership fees and annual dues required are only ₱1 - 20 and ₱1 - 10, respectively. In spite of the low amounts imposed by the FIA, collection ratios is extremely low: 4% for membership fees and 7% for annual dues. These percentages clearly demonstrate the inefficiency of the irrigation service fee collection.

As regards the incentives to be given by UPRIIS Office for the collection of irrigation fees and back accounts, only 4 FIAs merited them. Likewise, collection of contributions and other incomes are negligible.

Consequently, the number of FIAs which accumulated the working capital fund is no more than 13 out of 98 and the total amount of each is less than ₱1,000 except in 2 cases.

Judging from the above-mentioned findings, it is well-founded to conclude that almost FIAs in UPRIIS, to say nothing of FIGs, are defective in all respects. Especially, lack of funds as well as leadership, which are vitally essential for their activities, deals the IAs a fatal blow.

(5) Perception of FIA Leaders on its Management

The results of the questionnaire survey on perception of FIA leaders on its management are summarized hereunder.

The major constraints encountered by FIAs are: i) lack of discipline and non cooperation between NIA personnel & farmers and among farmers (45%), ii) defective and incomplete facilities (18%), iii) insufficient supply of irrigation water during the dry season (17%), iv) lack of capital (10%), v) deficient O&M (/%) and vi) difficulties in transportation and marketing of paddy (2%).

As for the existing regulations such as the Articles of Incorporation, related By-Laws, Kasunduan, etc., FIA leaders give the following answers: i) strict application is necessary (32%), ii) useful in FIA management (19%), iii) revisions should be made (17%), iv) close coordination with UPRIIS and assistance from other government agencies is required (16%) and v) a clear explanation and information drive is requested (16%).

From the above, it is noticeable that about 80% of FIA leaders' opinions concentrates on the inconveniences of existing regulations and indicates the necessity of improvements in their implementation.

For the question of possible turn-over of UPRIIS O&M responsibilities to Irrigation Associations, opinions stated by 71 farmers' leaders (with multiple answers) are: i) too early to manage it (38%), ii) training & seminars should be conducted before the turn-over (25%), iii) trouble will arise (17%), iv) ready to take over it and it will help farmers (15%) and v) lack of capital for the management (5%). It should be noted that only 15% of their opinions are "ready" for the immediate turn-over, while the rest (85%) suggests the importance of preparation work to set-up the consolidated FIAs before taking over the O&M responsibilities.

As one of the principal means to consolidate FIAs financial status, the question on accumulation of their capital funds was posed to 71 interviewed FIA leaders. Most of the leaders recognize its importance and suggest to accumulate it by allocating: i) penalties imposed on delinquent farmers, ii) contributions of farmer-members, iii) incentives from NIA and iv) borrowing capital from lending institutions.

For the service activities other than water management, their opinions on promoting activities in agricultural extension, purchasing, marketing and credit facilities are: i) training & seminars needed (38%), ii) not yet ready (30%), iii) not interested (17%), iv) assistance from other government agencies is necessary (12%) and v) useful for accumulating the capital fund (3%).

To keep the lasting viability of FIAs, most of FIA leaders feel keenly the need to establish a closer relationship and good communication with UPRIIS and local authorities.

2.8 Crop Insurance in the Philippines

The Philippine Crop Insurance Corporation (PCIC), one of the governmental institutions, was created in June 1978 for the purpose of providing insurance protection to farmers against crop losses arising from natural disasters as well as plant diseases and pest infestations.

The program was launched in May 1981. The crops covered by the insurance are standing paddy and corn. The maximum amount of coverage for crop insurance is ₱1,700/ha for Nueva Ecija province, ₱1,350/ha for Pampanga province and ₱1,600/ha for Bulacan province. The total premium for paddy is set at 11% of the insured amount, of which 2% is borne by the farmers themselves and remaining 9% is granted by the government and/or lending institutions. The assessment of crop loss is done by the team composed of: i) PCIC representatives as head, ii) district agricultural officer of Ministry of Agriculture and iii) team leader of Ministry of Agrarian Reform.

In twenty four (24) municipalities related to the project area, 10,256 farmers covering 24,600 ha in the 1982 wet season and 3,621 farmers covering 9,250 ha in the 1983 dry season respectively are insured.

Presently, the Crop Insurance is limited only to standing paddy and corn crops, and to the extent of the cost of production, or production inputs which include all costs of labor, fertilizers, pesticides, farmers' share of the insurance premium, and other cost items qualified for financing under the government's supervised credit program. The Crop Insurance in the Philippines is really one of the effective instruments to stabilize farmers' incomes, but it does not yet come to insure the "crop" itself.

2.9 Socio-Economic Conditions

The project area extends over three (3) provinces, i.e. Nueva Ecija, Bulacan and Pampanga in Central Luzon. In this area, there exist 24 cities/municipalities (20 in Nueva Ecija, 2 in Bulacan and 2 in Pampanga) consisting of 638 Barangays.

The population in the project area in 1980, was estimated at 847,100 with 144,300 households. The graphic age distribution forms a typical pyramid reflecting the high population growth rate of 2.8%. 55% of the total population is under 20 years of age and only 6% is about 60 years old. The population density is estimated at about 540 persons per km^2. An average family size is 5.9.

43% of total households is engaged in farming. Their land tenure status is the following: i) land owner 10%, ii) amortizing owner 26% and iii) lessee 64%. Most of farmers are engaged in rice culture. Landless laborer-households which earn their living by undertaking mainly transplanting and harvest of paddy, occupy about 33% of total households. They have played an important role in supplying the farm labor force in the project area. The remainder (24%) are supposed to be employees working in government and private offices.

Labor force available in the project area is estimated at 37.2 million man-days per year. On the other hand, the actual labor requirement for farming in the area is estimated at 13.5 million man-days per year on the basis of present conditions of cropping pattern and land use. Out of the total available labor force, 36% is engaged in farming of paddy.

Accordingly, the excess of labor force reaches 23.7 million man-days per year in the project area.

CHAPTER 3 THE PROJECT

3.1 General

Through various kind of surveys and studies, constraints for development in the project area were identified from the technical, socio-economic and institutional standpoints.

Based on the results of the surveys and the studies, the development plans of the project area such as agriculture, irrigation, drainage, river improvement, management of operation and maintenance, UPRIIS organization/ farmer's organization set-up are formulated.

These development plans aim to improve system efficiency through good system-wide irrigation management with principle emphasis on i) efficient and optimum use of water resources, ii) sufficient supply of irrigation water and its equitable distribution, iii) realization of higher efficiency of irrigation service fee collection, iv) rationalization of management with balanced finance and v) improvement of living conditions of the UPRIIS farmers through increasing agricultural production.

3.2 Proposed Farming Development

3.2.1 Land Use and Proposed Cropping Pattern

The basic concept for agricultural development for the project area is to increase rice production by increasing unit yield of paddy and expansion of irrigated land for the following reasons: i) The project area has played an important role as rice supply basis to Metro Manila and will be expected to become a more important rice supply basis as the demand for rice in Metro Manila will rapidly increase with high population growth rate in the future. ii) The price of rice is controlled and stabilized by the Government. It is expected that stabilization of price of rice will be continued in the future. Further, rice is one of the highest profitable crops. iii) The UPRIIS farmers are very familiar with rice cultivation and have superior ability for irrigation farming. The farmer's interview survey indicates that they have strong intention to continue producing paddy whenever provision of available water were permitted and iv) Soils in the project area are suitable for rice cultivation.

The project including irrigation, drainage, partial improvement of the Talavera river and operation and management of the system will provide bases to increase the unit yield of rice and expansion of the irrigated area.

The irrigation service area is determined as 111,200 ha from 157,000 ha of the project area mainly based on the results of water balance and inundation studies. After implementation of the project, 108,000 ha will be irrigated during dry season and 106,800 ha in the wet season. Land use in both the existing and proposed project conditions is shown in the following table:

(Unit: ha)

Item	Proposed Project Condition	Existing Condition	Difference
a. Total irrigation service area	111,200	111,200	-
b. Area irrigated in wet season	106,800	91,800	15,000
c. Area irrigated in dry season	108,000	84,900	23,100
d. Area under rainfed in wet season	4,400	19,400	-15,000
e. Multi-cropping index	1.97	1.76	0.21

Based on the concept for agricultural development, double cropping of paddy per annum under proper irrigation and drainage facilities is formulated. A cropping calendar is framed as illustrated on Fig. 11, taking into consideration the following conditions: i) Since critical growth periods in terms of sunlight requirement are about 15 days just before heading and about 25 days just after heading, the cropping calendar is designed so that as much as possible these critical growth periods are not in the period of August, the lowest in sunshine hour duration. ii) Interval period between seeding and last harvest should be designed to be more than 30 days at least from the standpoint of farming practices and maintenance & repair of irrigation facilities. iii) The calendar is designed so as to expand the irrigable area as much as possible taking into consideration the balance of consumptive use of rice plant, and effective rainfall and river discharge available for irrigation water and

iv) Capacity of main canal of PBRIS is restricted and seeding in the PEÑRIS Proper area will be started 15 days before commencement of seeding in other areas so as to reduce peak water requirement.

3.2.2 Proposed Farming Practice

Proper farming practices are the most essential factor for realizing full exploitation of the agricultural potential in the area. As mentioned in 2.1.5, increase of numbers of panicles per ha is essential to increase the yield of rice in the project area. For this purpose special attantion should be paid on such countermeasures as i) provision of drainage facilities and ii) supply of nitrogen at the initial tillering stage on time and iii) increase of the application amount of nitrogenous fertilizers.

The design criteria of proposed irrigation farming is shown in Table 12.

3.2.3 Anticipated Yield and Crop Production

Unit yield of paddy in future with project condition is estimated on the basis of the results of the yield survey on well irrigated paddy field, the experimental data of the Maligaya Rice Research and Training Center and the International Rice Research Institute and the past data of Masagana-99 program.

The anticipated unit yield of paddy is estimated at 4.5 ton/ha in the wet season and 5.2 ton/ha in the dry season.

To achieve the anticipated yield, application of farm inputs proposed in the design criteria will be required together with effective water management.

The yield will increase gradually from the present level and reach the target yield in the 3rd year after the completion of the irrigation and drainage facilities.

Total production of paddy is estimated by multiplying the anticipated unit yield with the future cultivation area for with project conditions. Production of paddy is estimated at about one million ton.

3.3 Irrigation Plan

3.3.1 General

Through the investigation and the analysis of the present status in the UPRIIS, it is clarified that the UPRIIS encounters the following constraints in the irrigation and drainage aspects.

1) Shortage of irrigation water during the dry season
2) Inundation in the wet season
3) Low irrigation efficiency especially in the wet season

The optimum irrigation development plan is formulated through the following detailed studies to solve these constraints.

1) Possibility of creation of new water resources
2) Prevention of inundation
3) Effective use of present water resources through construction of farm pond, re-use of water, rehabilitation & improvement of the existing irrigation facilities and improvement of the water management rule.

In the optimum irrigation development plan, the irrigation service area is determined at 111,200 ha, comprising 108,000 ha in the dry season and 106,800 ha in the wet season.

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

3.3.2 Water Resources and Their Effective Use

Prior to formulation of the optimum irrigation development plan, the water resources in the UPRIIS were reviewed and their effective use was studied.

(1) Water Resources

The runoffs at five diversion dams and the Pantabangan dam were estimated for the period from 1951 to 1982 based on the long-term runoff analysis by means of tank model simulation method.

The mean monthly runoff at each flow point is shown in Table 13. The wet season flow and the drought flow appear in the months of June through November and January through April, respectively. The annual runoffs of these rivers have much potential for irrigation. However the runoff during the drought flow period is estimated at only about 10% of annual runoff and hinders expansion of irrigated land in the dry season.

To identify possibility on creation of new water resources, the regulating function at the existing eight diversion dams was studied.

Among them 5-Bay and LTRIS dam have no possibility of regulating function topographically. The construction of reservoirs at the PRIS and PBRIS dams is not economically feasible. The construction of reservoirs at the TRIS and PEÑRIS dams is not economically attractive, however the reservoir functions at the TRIS and PEÑRIS dam were studied in consideration of the following conditions:

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

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

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

The potential effective capacities and major dimensions of the four dams are summarized below.

Reservoir	Effective Storage Capacity (MCM)	High Water Elevation (m)	River Bed Elevation (m)	Existing Crest Elevation (m)	Crest Length (m)
TRIS Dam	11.9	160.0	132.9	134.5	260
PEÑRIS Dam	8.0	35.0	27.1	29.0	370
VACA Dam	0.3	91.0	89.0	91.21	43
MURCON Dam	1.0	41.0	32.0	42.26	42

(2) Effective Use of Present Water Resources

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

1) Rehabilitation of the existing re-use structures
2) Construction of the farm pond
3) Improvement of the present operation rule

There are many check gate structures on the drainage creeks to intake the local flow including return-flow from the paddy field. Most of these re-use structures do not function sufficiently due to the deterioration of the control gates. Through the field investigation and the study for their functions, it became clear that twenty-two structures among them should be rehabilitated for the effective use of water. The irrigation diagram including these re-use points are shown in Fig. 12. General features of these re-use points are shown in Table 14.

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

The farm pond of 18 sites was selected for the studies of regulating function. The studies made it clear that the lands submerged by the construction of such farm ponds are very large in spite of their small effective storage function. Further most of the submerged area is intensively used by paddy at present. It was concluded that construction of the farm ponds would be difficult due to such large scaled land acquisition.

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

Regarding this point, the basic operation rule is formulated through the daily operation simulation study as follows:

a) Unit operation period is one week

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

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

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

/1: CMS: Centralized Monitoring System (refer to Section 3.7)

The results of daily operation simulation study indicate that the irrigation operation efficiency increased to at least 90% during the wet season. By applying the operation efficiency of 90%, the low overall irrigation efficiency at present will be improved as follows:

(Unit: %)

Item	Wet Season		Dry Season	
	Present	Improved	Present	Improved
Farming Efficiency	75	75	80	80
Conveyance Efficiency	80	80	80	80
Operation Efficiency	50	90	80	90
Overall Efficiency	30	54	51	58

3.3.3 Optimum Scale of Irrigation Service Area

The optimum scale of the irrigation service area is formulated by water balance study taking into consideration of the water resources, effective use of water and the inundation area in the wet season.

In the water balance study, the irrigation water requirement is calculated based on the proposed cropping pattern and the operation efficiency of 90% is applied. The detailed calculation method is explained in Appendix II "Irrigation".

(1) Formulation of Alternative Irrigation Plans

In order to formulate the optimum irrigation development plan, the alternative plans were prepared based on the combination of four parameters; i) Irrigation service area, ii) Number of re-use points, iii) Reservoir function at existing diversion dams and iv) Cropping pattern.

1) Irrigation Service Area

The irrigation service area was further examined for the following six cases from the standpoint of i) maximum use of potential irrigation area of 116,900 ha, ii) inundation area in the wet season and iii) availability of irrigation water resources.

Alternative Plan	Irrigation Area (ha)	
	Dry Season	Wet Season
A	116,900	116,900
B	116,900	107,700
C	111,000	107,700
D	108,900	107,700
E	109,000	107,700
F	108,000	106,800

Details are explained in Appendix II.

2) Re-use Point

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

i) 22 points selected in previous section (shown in Table 14)

ii) 18 points excluding Kawayan No.2, Kinamatayan, Sumolong and Linao check gates from 22 points. These re-use points are considered minor in scale such as commanded area, drainage area and so on.

iii) 8 points comprising De Babuyan check gate, 5-Bay, Vaca dam, Murcon dam, Murcon Baby dam, Carol creek, PBRIS proper Baby dam and Tambo check gate. These re-use points are considered equivalent to the diversion dam system.

3) Regulating Function at the Existing Diversion Dam

The reservoir functions at the Vaca, Murcon, TRIS and PEÑRIS dams were considered in the water balance study. The following four alternative plans were studied to evaluate the effects of the regulating functions especially at the TRIS and PEÑRIS dams:

i) Without regulating function at all diversion dams
ii) With regulating function at Vaca and Murcon dams
iii) With regulating function at Vaca, Murcon and PEÑRIS dams
iv) With regulating function at four diversion dams

4) Cropping Pattern

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

i) Proposed cropping pattern
ii) 10 days ahead from proposed pattern for whole districts
iii) 10 days delay from proposed pattern for whole districts
iv) 15 days ahead from proposed pattern for District IV only

Based on the combinations of above parameters, the following twelve (12) alternative plans have been prepared to formulate the optimum irrigation development plan:

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

The alternative plans are outlined in Table 15.

(2) Determination of the Optimum Scale of Irrigation Service Area

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

1) Criteria of Irrigation Water Shortage

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

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

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

2) Results of Water Balance Study

The average ratio of annual water deficit for each alternative plan is shown in Table 15 and summarized as below.

As a result plans of D-2, D-3 and F are accepted within the irrigation shortage criteria.

(Unit: %)

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

3) Optimum Scale of Irrigation Development Plan

Features of three alternatives with the irrigation shortage criteria are as follows:

Item	Alternative Plan		
	D-2	D-3	F
1) Irrigation area			
Dry (ha)	108,900	108,900	108,000
Wet (ha)	107,700	107,700	106,800
2) Required points of rehabilitation of re-use point	22	22	18
3) Reservoir at PEÑRIS dam	Non	Necessary	Non
4) Water deficit for			
- Pantabangan dam (%)	7.0	6.1	7.0
- TRIS dam Wet (%)	12.9	12.9	12.9
Dry (%)	8.4	8.4	13.9

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

From the above results, the irrigation service area in UPRIIS is determined at 108,000 ha in the dry season and 106,800 ha in wet season. The irrigation service area by system is shown in Table 16, and total irrigation service area in UPRIIS is estimated at 111,200 ha.

3.3.4 Irrigation Development Plan

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

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

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

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

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

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

Furthermore, by applying the proposed operation rule to the water management with the CMS, overall irrigation efficiency will be improved as explained in Section 3.3.2 (2).

In order to make the CMC function sufficiently, the irrigation facilities have to be maintained well. Most of the existing facilities for the water management are deteriorated and do not function. These irrigation facilities are planned to be rehabilitated and the proposed works are described in Section 3.3.6.

3.3.5 Design Discharge for Irrigation Facilities

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

(1) Basic Year for Design

The water balance calculation was conducted for the period of 32 years from 1951 to 1982. Within 32 years, the basic year for the design is determined based on the drought year in five return period with regard to i) Annual rainfall, ii) Dry season rainfall (November to April), iii) Annual river discharge at the Pantabangan dam and iv) River discharge at the Pantabangan dam in dry season (November to April).

As a result of statistical analysis for above data, the year of 1969 is selected as a basic year for the design.

(2) Irrigation Water Requirement

The irrigation water requirement of basic year was calculated by 10 day-basis in the water balance calculation of alternative F. The annual irrigation water requirements for each District are summarized as follows:

(Unit: mm)

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

(3) Diversion Water Requirement

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

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

(4) Design Discharge for Irrigation Facilities

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

The unit design discharges for each system are shown in Table 17.

3.3.6 Proposed Works

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

The following major rehabilitation and improvement works are proposed.

1) Improvement of re-use points
2) Installation of control gates
3) Construction of spillway and wasteway
4) Rehabilitation of damaged and deteriorated structures and canals
5) Rehabilitation and construction of discharge measuring devices

The work quantities are summarized in the following table.

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

3.4 Drainage Plan

3.4.1 General

The drainage problems to be urgently improved are the habitual and large scaled inundation along the area of the San Antonio swamp, the North Candaba swamp and the lower Talavera river. The drainage plan for the area along the swamps is formulated by the studies of improvement of drainage creeks in the area. The improvement of the lower Talavera river basin will be discussed in Section 3.5.

3.4.2 Drainage Requirement

According to the NIA design criteria for irrigation and drainage channels, the drainage requirement for drainage ditches is defined to be 5 ℓ/sec/ha for flat area and 9 ℓ/sec/ha for moderately sloping area. The drainage simulations show that the peak discharge from paddy field with probable rainfall scale of 5-year, is about 4.1 ℓ/sec/ha at present condition. After the improvement of creek alignment, the peak discharge becomes 5.5 ℓ/sec/ha for flat area and about 10 ℓ/sec/ha for moderately sloping area.

The proposed improvement works were, then, formulated based on the 5-year probable rainfall scale which shows almost the same drainage requirement with the NIA design criteria.

3.4.3 Improvement Plan

The purpose of improvement is to stop overflow from the creek to the adjacent paddy field and to minimize the inundation area and duration by means of widening, deepening and shortening the creeks. An improvement plan was prepared to solve the problems for probable rainfall scale of 5-year.

(1) San Antonio Swamp

After several simulations, longitudinal profile and cross sections at each improvement points were set and flow condition against 5-year probable rainfall scale was obtained by simulation model. No overflow occurs in the improved condition at upstream. Backwater or

reversed flow from the swamp reaches the extent of ground elevation EL. 11.0 m and 11.5 m for Manaol creek system and Along-Along creek system respectively.

Below these elevations, the area is submerged by the flood water not from upstream drain water but from the swamp reversed flow. The area of inundation after improvement for 5-year probability scale is estimated to be reduced at about 17.5 km^2 from the present inundation of 43 km^2. This area of 17.5 km^2 (1,750 ha) will be eliminated from the potential irrigation service area of about 14,900 ha for PBRIS Extension area during wet season. The inundation area is compared with the present condition and shown in Fig. 13.

(2) North Candaba Swamp

With the improvement profile of creek, the overflow at upstream does not occur and inundation area is reduced to the area lower than the ground elevation of about EL. 7.0 m to 7.5 m. This inundation area is about the same as the area of no farming activity during wet season at present. Fig. 14 shows the estimated inundation area with present and improved condition of creeks.

Applying the simulation results to the PEÑRIS Proper and Extension areas, the total inundation area expected for 5-year rainfall probability is reduced from 100 km^2 at present condition to 70 km^2 (7,000 ha) after the improvement works. This area of 7,000 ha (4,900 ha in PEÑRIS Proper, 2,100 ha in PEÑRIS Extension) will be deleted from the potential irrigation area of about 29,800 ha.

Inundation and benefit areas within the potential irrigation area by proposed improvement works for 5-year probable rainfall are summarized as follows:

(Unit: ha)

Item	San Antonio Area (PBRIS Extension)	North Candaba Area (PEÑRIS)
Inundation area at present (A)	4,300	10,000
Inundation area after improvement (B)	1,750	7,000
Benefit area by improvement (A)-(B)	2,550	3,000

3.4.4 Proposed Works

The proposed works are the improvement of creek systems around the San Antonio and the North Candaba swamps through re-alignment of creek cross section and longitudinal profile. Estimated work quantities are summarized as follows:

Proposed Work	San Antonio Area	North Candaba Area
Total improvement length (km)	53	46
Surface stripping (m^2)	710,000	710,000
Excavation (m^3)	1,270,000	710,000
Embankment (m^3)	470,000	850,000
Land acquisition (ha)	18	77
Structure		
Drainage inlet (nos.)	20	24
Bridge (nos.) (Width 4 m, Length 10 m	8	2

3.5 Partial Improvement Plan for the Talavera River

3.5.1 General

The Pampanga river basin is frequently hit by tropical typhoons and has repeatedly experienced big floods which inflicted heavy damages to agriculture, property and social activities. After historical big floods, the construction of the flood control structures started in 1939.

The existing flood control scheme consists of a comprehensive system of earth dikes, cutoff channels and relief floodways, supplemented by utilization of the San Antonio and the Candaba swamps as retarding basins. A magnitude of 50-year design discharge is applied to the basic plan in the Upper Pampanga basin and 10 to 20-year is stepwise selected to the first phase plan.

The improvement plan on a part of the lower Talavera reaches (partial river improvement) was studied in line with the existing scheme mentioned above. Furthermore, alternative project scales were studied to select the most appropriate project scale for the improvement plan.

3.5.2 Partial River Improvement Plan

(1) Improvement Plans and Alternative Scales

The following improvement plans were compared in consideration with the existing dike conditions and flood control scheme of the basin:

Plan 1	Widening of river width (construction of new dikes) and excavation of the low water channel
Plan 2	Raising and strengthening of the existing dikes and minor excavation of the low water channel

As for Plan 1, there will be difficult problems such as right of way and extremely large amount of excavation volume of the low water channel to lower the flood water levels during the flood time. Whereas, Plan 2 has an advantage of effective utilization of existing dikes, although it is difficult to obtain lower flood water levels than as present.

Considering such existing conditions and possibility of realization of the works, Plan 2 was accepted as the improvement plan for the lower Talavera river. Furthermore, alternative scales of 20-year, 10-year and 5-year design flood discharges were studied to select the optimum project scale as the first phase plan.

(2) Design Flood Discharge Allocation

Design flood discharges for each scale were estimated based on the probable flood discharges in the Talavera river. Allocation of design flood discharges is shown below:

Design Flood Discharge

(Unit: m^3/sec)

River	Alternative Scale 1/20	1/10	1/5
Talavera River	1,250	900	600
Tributary A (Santo Domingo Creek)	315	225	160
Tributary B	195	150	100

(3) Design River Profile

Design high water levels were determined on the basis of the condition that both the Talavera and Rio Chico rivers are confined by diking systems. High water levels were calculated by non uniform flow method. Coefficients of roughness were adopted at 0.03 for low water channel and 0.05 for the high water channel. The low water channel was excavated with average channel width and depth of the lower reaches. The two major right tributaries (creeks) will be raised and strengthened as backwater levee.

Design river profiles thus prepared are shown in Fig. 15. Typical cross sections are illustrated in Fig. 16.

(4) Design Profile of Tributaries

There are two tributaries (drainage creeks) joining from the right side to the Talavera river within the overflow reaches. The tributary A (Santo Domingo Creek) has 5 to 15 m riverbed width and gradient of 1/1,000. Tributary B creek is supposed to join to the Talavera river but previous construction of the Talavera river dike has no outlet for these creeks. The creek course at present diverges into several small streams and disappears near the Talavera river dike. This is one of the major cause of habitual inundation of these area.

After the implementation of the flood control scheme for the Talavera river by raising the bank height, it will be evident that the flood water level in the Talavera river will affect backwater to the creeks. The present bank height of the creeks is not enough to confine the backwater. To solve this problem, it is proposed to raise the creek banks.

In the case of this improvement, it is expected that the drainage discharges from upstream area can be drained through the creeks but the adjacent downstream area will not be drained by gravity. However, the undrained water during flood time is only such runoff from the adjacent downstream area itself after confining flood water into the Talavera and upstream drainage runoff into the creeks. This inundation area is expected to be the smallest of the alternatives.

The standard design section of the dike for the improvement of creeks is shown in Fig. 17. Design high water level in the creek was calculated by non uniform flow applying the design high water level of the improved Talavera river profile.

Proposed creek profile and high water level are presented in Fig. 18.

(5) Inundation Area

As a result of confining the flood water into the river channel by raising the dike, the low-lying area along the right side of the Talavera river has difficulties to drain by gravity during flood period. Downstream of such area will still be inundated although the area will no longer receive the overbanked flood water from the rivers. Drainage by gravity can be possible through the gate after the flood water level is lowered.

Area and duration of inundation were estimated from the balance of drainage inflow and outflow from the gate. Inundation area for present and improved conditions are summarized as follows:

(Unit: ha)

Item	Alternative Scales		
	1/20	1/10	1/5
Inundation Area			
Present Condition			
Right bank area*	960	830	640
Left bank area**	6,100	5,500	1,500
Improved Condition			
Right bank area	585	440	305
Left bank area**	0	0	0
Benefit Area			
Right bank area*	375	390	335
Left bank area**	6,100	5,500	1,500

*: Area affected by inundation of more than 2 days

**: Area under overbanked flood flow

(6) Determination of the Optimum Scale of the Improvement Plan

Based on the area benefited and cost of damage, decreases in flood damages with the river improvement plan of 5-year, 10-year and 20-year design flood discharge are estimated. The annual equivalent damages are ₱2.96 million for 5-year design flood, ₱7.08 million for 10-year and ₱10.36 million for 20-year. On the other hand economic

construction costs are estimated at ₱42.9 million for 5-year, ₱60.6 million for 10-year and ₱103.2 million for 20-year. Benefits and costs are explained in detail in Appendix IV.

Based on the economic cost and river improvement benefit, alternative plans are assessed economically by internal rate of return (IRR). The internal rate of return for each alternative plan is calculated as follows:

Alternative Plan	IRR (%)
5-year	5.2
10-year	9.7
20-year	8.3

As a result, the alternative plan with 10-year design flood discharge is determined as the optimum scale for the project.

3.5.3 Proposed Works

The proposed works for the optimum scale of river improvement plan are outlined as follows:

Work Item	Talavera River	Tributary A	Tributary B	Total
Length to be improved (km)	26.5	9	8	43.5
Direct works				
Excavation (10^3 m^3)	720	250	170	1,140
Embankment (10^3 m^3)	1,020	90	290	1,400
Bridge (nos.)	-	1	-	1
Gate (nos.)	-	2	2	4
Land compensation (ha)	137	21	19	177

3.6 UPRIIS Organization

3.6.1 General

The organization of the UPRIIS will be shaped according to the type of system management which the UPRIIS Office will adopt. Concretely, it depends on the degrees of transferring the ownership and responsibilities for management & maintenance of the systems to Farmer-Irrigation Associations (FIAs).

The following four (4) types of system-management can be viewed in perspective as shown hereunder:

Type of System-Management	Ownership of Irrigation Facilities & Structures				Responsibilities for Management & Maintenance			
	NIA-UPRIIS		Irrigation Association		NIA-UPRIIS		Irrigation Association	
Rotational Area (RA) Basis (50 ha)/1	<	≧	<	≧	<	≧	<	≧
I	o	o	x	x	o	x	x	o
II	o	x	x	o	o	x	x	o
Sub-lateral (SL)/2 Canal Basis	<	≧	<	≧	<	≧	<	≧
III	o	o	x	x	o	x	x	o
IV	o	x	x	o	o	x	x	o

Remrarks: /1: This is merely a standard figure.
The area varies actually from 40 to 80 ha.

/2: The area served by a sub-lateral canal varies from 50 to over 800 ha.

Type I

The existing system management is based on this case. The whole ownership of the system and the responsibilities for management & maintenance of the system of more than 50 ha belong to the UPRIIS Office, while the operation and maintenance of rotational irrigation area are left to the care of Irrigation Associations (IAs)/*.

Type II

This idea consists in transforming the existing UPRIIS with areas of less than 50 ha into communal systems. The UPRIIS Office transfers the ownership of a part of the system of less than 50 ha to IAs and takes charge of the management and maintenance of the area of more than 50 ha. The cost of construction of the rotational irrigation area will be repaid by the IAs.

Type III

Type III is similar to Type I in its system management, but may be different in size. In this type, the whole ownership of the system belongs to the UPRIIS Office, whereas the responsibilities for operation and maintenance of the system at sub-lateral canal level are transferred to FIAs.

Type IV

This case is similar to Type II in its system management, but may be different in size. The UPRIIS Office transfers the ownership and responsibility for management and maintenance of a part of the system (at sub-lateral canal level) to FIAs on condition that FIAs pay its construction costs.

/*: The term of "Irrigation Association" (IA) is used herein as common name Farmer-Irrigation Groups (FIGs) and Farmer-Irrigation Associations (FIAs).

Among four (4) types of system management, Type III is most realistic and practical taking into consideration the following main points: i) Farmer's capability for management of irrigation systems, ii) Reduction of operation and maintenance cost of the UPRIIS office, iii) Counter-measures to cut irrigation water supply for farmers who do not pay the irrigation service fee, iv) Participation of farmers to owner water management and promotion of farmer's self-existence for management, v) Sphere of farmer's communication and control for FIA by UPRIIS Office.

3.6.2 Proposed Organization

The proposed organizational structure of the UPRIIS office is presented in Fig. 19.

Head Office

In principle most of the present organization of UPRIIS Head Office is assessed to be well. Some modification of the organization will be necessary as follows:

1) Establishment of the strengthened Maintenance and Equipment Division which will integrate the maintenance functions shared by the existing Equipment and Engineering and Operations Divisions;

2) Creation of the planning and Operations Division which will take over the present functions of the WCCC and the function of operation in the existing Engineering & Operation Division; and

3) Transformation of the Agriculture Division into the Farmers' Assistance Division and its consolidation.

As for the system management of the UPRIIS, the Field Services and Repair Section in the Equipment Division shares at present responsibilities with the Engineering and Operations Division (EDD). For smooth implementation of maintenance works, it seems to be more effective to transfer the maintenance functions of the EOD to a strengthened Engineering and Maintenance Section under the supervision of Maintenance and Equipment Division Manager, since the fundamental requirement for the successful

operation of the systems is proper maintenance. The existing Utilization and Control Section and Central Shop and Deport Section will be incorporated and transformed into the Equipment Section under the Maintenance and Equipment Division.

Hence, the Planning and Operations Division composed of Planning and Evaluation Section and Water Distribution and Control Section will take over the present functions of the WCCC and be responsible for operating the systems.

As mentioned in Section 3.8, about 3,008 Farmer-Irrigation Groups and 865 Farmer-Irrigation Associations will be set up for the smooth operation and maintenance of the UPRIIS. For the purpose, the existing Agriculture Division will be transformed into the Farmers' Assistance Division strengthened in institutional development functions.

District Offices

The proposed organizational structure of the District Offices is presented in Fig. 20.

In addition to the existing Repair & Maintenance, Operations and Administration Section, it seems to be convenient to establish a Billing & Collection Section in each District Office in order to intensify the tied-up activities of billing and collection.

3.6.3 Proposed Staffing Pattern

Proposed work load and staffing pattern of the main field staff are presented in Table 18.

As pointed out in the Section 2.5.1, the existing organizational structure of the District Office is characterized by the presence of the multi-posts in the monitoring channel for operation and maintenance work. It takes a long time to go through the necessary steps. Delayed transmission of information from DTs to Operations Manager and inaccuracy of data often occur. Such situations become one of the constraints for quick and accurate operational action in water management. To remove these obstacles, it is advisable to simplify that channel.

In the case of National Irrigation Systems other than UPRIIS and Angat-Massim, all systems are administrated by the channel of command consisting of four (4) steps from DT, WM, Irrigation Engineer and Irrigation Superintendent. The operation and management in the above-mentioned systems are seen to be efficient especially in the 13 National Irrigation Systems mentioned in Appendix VII.

It is proposed that the present long monitoring channel is simplified to 5 steps from Operations Manager, Irrigation Superintendent, Irrigation Engineer, WM or AWMT to DT.

It is also recommended that Irrigation Association Organizers (IAOs), the new posts in the Farmers' Assistance Division (FAD) will be produced to promote the implementation of the program of organization and development of the Farmer-Irrigation Associations (FIAs).

The work load of AWMT and DT is thick at present. It is recommended that the present work loads of AWMT and DT will be increased respectively from 620 to 750 ha at least and 120 to 200 ha at least for each staff. The work load of AWMT is as determined in the Memorandum Circular No.2. The work load of DT is taken into consideration the work load prevailing in the 13 National Irrigation Systems with an irrigation fee collection efficiency rate of more than 70% and introduction of computer system.

Based on the work load proposed for organizational modification of the UPRIIS, the number of main field staffs will be shown in Table 18.

3.7 Management Plan for Operation and Maintenance

3.7.1 General

Most of the physical constraints on the UPRIIS will be solved through rehabilitation and improvement of the irrigation & drainage facilities and through institutional modification of the UPRIIS office. Under such conditions, management plan for operation and maintenance of the UPRIIS is formulated paying special attention to the introduction of the centralized computer monitoring system, to solve the constraints on O&M identified previously in Section 2.5.2.

3.7.2 Planning of Irrigation Schedule

The planning procedure being practiced in WCCC at present is judged appropriate. In addition to this, it is requisite for proper water management that the hydrological and statistical analysis is intensified in the planning process. Planning of irrigation schedule is proposed as follows.

Planning of irrigation schedule will be prepared at the UPRIIS head office by three stages, long-term plan, yearly plan and seasonal plan.

(1) Long-term Plan

The long-term irrigation plan will be prepared once every 3 to 4 years. This plan will define the targets such as total irrigated area, irrigation efficiency, reservoir volume to attain at the end of planning year, irrigation fee collection rate, crop production and specified targets of maintenance.

Evaluating from operations and experiences in the previous years, the plan will be prepared based on the predicted water balance studies. The long-term plan will be evaluated at the end of planning period.

(2) Yearly Plan

Before the start of the wet season, usually from March to May, the yearly plan will be prepared for the coming wet and dry seasons in accordance with the long-term plan. Several alternative statistical studies will be included in this planning procedure. The alternative water balance studies are, for example, to be made for the combinations of proposed irrigated crop area and irrigation schedule against drought year, normal year and rainy year of appropriate probability. The decision on selecting the plan will be based on the estimated reservoir volume at the end of year and calculated risk against probability of occurrence.

(3) Seasonal Plan

A seasonal plan for the wet season will be included in the said yearly plan. A seasonal plan for the dry season will be prepared in line with the yearly and long-term plans.

The planning and evaluation will be the responsibility of the Planning and Evaluation Section under the Planning and Operations Divisions. A hydrologist is assigned in this section and statistical analysis for previous seasons is included in the evaluation report. The evaluation report will be issued yearly.

3.7.3 Control of Irrigation Water Delivery

The introduction of centralized monitoring system (CMS) and the establishment of operation rule are proposed to satisfy the efficient management of irrigation water delivery.

The Water Distribution and Control Section in the head office and the Operations Section in the district office are to be responsible for the delivery and control of irrigation water.

(1) Centralized Monitoring System

The purposes of this system are the collection of field data in a short time, processing the data, monitoring the field operation and to improve the recording and filing system. The CMS is composed of a central station, base stations and field stations connected with the telecommunication network.

The irrigation water management system under CMS is expressed by the following work flow:

a) Data Collection

The data required for the operation are farming activity and hydrological data such as hourly rainfall, river water level, canal water level, gate opening, reservoir water level and inflow/outflow from the Pantabangan dam.

b) Data Processing

Major activities of the data processing are composed of three items. These are the conversion of the collected data into the necessary dimensions required for the operation, preparation of operation plan by execution of the water balance simulation and management of operation and hydrological data for recording.

c) Water Management and Operation Plan

The water management and operation plan will be prepared at each District level in accordance with the seasonal irrigation plan. The plan will comprise followings:

i) Seasonal Management Plan

In accordance with the seasonal irrigation plan of the UPRIIS, each District office will prepare the seasonal management plan by each irrigation system. This plan will clarify the proposed irrigation area, irrigation schedule, cropping calendar, etc.

ii) Monthly Management Plan

After the irrigation starts, the seasonal plan is always checked and corrected by the daily water balance study and monthly water distribution plan will be prepared for the next month.

iii) Weekly Operation Plan

This plan is to be made for the operation of the next week from the result of water balance study for the previous week based on the operation monitoring records. The weekly operation plan will indicate the planned amount of irrigation water delivery at each point of the field.

d) Operation and Monitoring

According to the weekly operation plan, the field personnel will set the irrigation facilities to control the irrigation water delivery. It should be noted that the minimum operation term is not a day but week. So that the control facilities will be set at the beginning of the week and will not be changed except in case of the order from the district office. The irrigation water distribution and hydrological features will be minotored by the field personnel and field monitoring station through the telecommunication network.

(2) Monitoring System Layout

The monitoring system to be proposed in the UPRIIS is the remote monitoring system but not the remote control system. The control of irrigation facilities will be the manual control by the gatekeeper. The self control system may be introduced for such facilities as diversion dam intake gates, in case that the electricity is available. The monitoring system comprises central station, base station and field station. General concept of the monitoring system is shown in Fig. 21.

1) Central Station

The central station is located at the head office in Cabanatuan. The station will be equipped with mini-computer, disc-memory, display panel, operation console, display monitor, typewriter, telemeter, receiver/transmitter, interface unit and supplemental machines.

Major functions are: i) Collection of water management data from the base stations, processing the data, displaying on the panel and monitoring, ii) Computer processing of the water balance, and statistical and other necessary calculations, iii) Storing the water management data in the disc-memory, processing the data and filing through typewriter, iv) Transmitting the management and control order to the base stations and v) Computer processing on administrative matters including billing, irrigation fee collection and others.

2) Base Station

The base stations are located at four (4) district offices and the Pantabangan dam office. It will be equipped with mini-computer, floppy disc-memory, display board, operation console, display monitor, typewriter, telemeter, receiver/transmitter, interface unit and other supplemental machines.

The major functions are as follows except at the dam station: i) Collection of water management data from field stations, displaying on board and typewriter and monitoring, ii) Computer processing of the water balance and other necessary calculations, iii) Storing the water management data, processing the data and filing through typewriter, iv) Transmitting the management and control order to the field personnel and to the field stations and v) Computer processing of administrative matters including billing, irrigation fee collection and others. The farmers' Assistance Division can use the computer facilities in the base station at the District I office.

3) Field Station

There are two types of field stations, one is the station with operator and the other is without operator. The field stations with operator are such as diversion dam station and major head gate stations where an operator is always stationed. This type of field station will work as the field head quarter which receives the control order from the base station and transmits to the field personnel.

The other type of station is facilitated with the measuring devices such as rainfall and water level gage and telemeter unit.

The function of the station is only to collect and transmit data to the base station by non manual.

The proposed station layout is shown in Fig. 22. The list of proposed field stations by District are summarized as follows:

Number of Stations

Station	District I	II	III	IV	Pantabangan Dam	Total
1. Base Station	1	1	1	1	1	5
2. Field Station	9	13	15	11	-	48
Diversion dam	2	4	1	1	-	8
Head gate w/operator	4	6	9	7	-	26
Head gate w/o operator	3	3	5	3	-	14
Water level gage	14	20	30	24	2	90
Raingage	3	5	8	3	1	20

4) Telecommunication Network

The telecommunication system is composed of telemeter and communication network. The wireless radio system will be introduced as a communication network to cover the whole irrigation service area. The wireless radio system will be the VHF symplex wireless radio network.

3.7.4 Hydrological Measurement

Hydrological data are the key informations for operation. Re-arrangement of hydrometeorological stations is necessary together with the introduction of the telecommunication network. It will be necessary to arrange the communication rule between the UPRIIS office and other agencies such as PAGASA, CLSU and IRRI concerning the transferring of hydrometeorological data. Automatic raingages are not recommended for the hydromet stations except for those stations included in the telecommunication network.

As for the discharge measurement, rehabilitation work on instrument at the non-functional measurement points shown in Section 2.5.2 are required. Improvement work such as canal lining will be proposed for major stream gaging points.

Hydrometeorological data will be stored in the proposed computer system and be processed as mentioned before.

3.7.5 Proposed Operation Rule

The establishment of the operation rule aims at gaining the highest irrigation efficiency, equitable distribution of irrigation water and equality of control at each irrigation systems.

The proposed operation rule is as follows.

1) Unit operation period is one week. The control structures in a system will be set according to the irrigation schedule on the first day of the week and there will be no change of control within the week unless daily rainfall exceeds 30 mm/day.

2) If the rainfall amount of more than 30 mm/day is monitored, the irrigation supply will be stopped for the respective irrigation system from the next day until the end of the week.

3) Checking by Water Balance Calculation

a) At the beginning of the week, the daily water balance for the previous week will be executed based on the farming activity, daily rainfall and the amount of water supplied.

b) As for the farming activity record, investigation is required at the beginning of the season on the following points.

- actual farming area and rice variety
- start and end of transplanting

The irrigation water requirement will be calculated based on the results of the above investigations. Modification of farming activity may be made if necessary during the irrigation season.

c) At the first day of the week after concluding the water distribution, the control order will be transmitted from the district office to the field personnel through telecommunication system. The UPRIIS head office will coordinate control among the four districts.

4) The condition of flow and water distribution will be monitored by the patrol of field personnel and through CMS. If the distribution is found skew from the schedule, necessary readjustment will be ordered from the base stations to the field personnel.

5) At the time of terminating the irrigation supply during the week and readjustment at the first day of the week, the way and order of gate operation will be finalized through the experimental practice in the field.

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

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

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

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

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

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

Emergency Operation:

The emergency operation will be classified into three cases as follows: i) Typhoon, ii) Troubles at main receiver/transmitter and iii) Troubles at major control points.

It is necessary to establish the operation rules for the case of emergency.

In case of typhoon, the operation rule will be prepared corresponding to the signal number issued from PAGASA.

In case of machinery trouble, one of the base stations except dam station will take over the troubled station's tasks.

As for the third case the detailed operation rule will be prepared assuming possible occurrence of troubles at each major control points such as the Pantabangan dam, diversion dams, etc.

3.7.6 Proposed Recording System

One of the major purposes of introducing the computer system in the UPRIIS is to simplify the present monitoring and recording systems. The basic data of operation and administration will be stored and processed through the computer at any time when required. The greater part of effort used in preparing reports and in filing will be reduced and the accuracy of data will be preserved.

The major items to be integrated into the computer processing are as follows:

(1) Hydrometeorological Data

Rainfall, river discharge, evaporation, etc.

(2) Operation and Control Data

Discharge at major canal points, dam operation, etc.

(3) Fee Collection and Administrative Data

List of beneficiaries, status of payment, farm size, list of UPRIIS personnel, budget, expenditure, etc.

(4) Agricultural Data

Yield, kind of crop varieties, etc.

3.7.7 Irrigation Service Fee Collection

In view of the present situation of irrigation service fee (ISF) collection explained in Section 2.5.2 and 2.5.4, the plan on ISF collection is proposed as follows:

(1) Method of Collection

At present, ISFs are collected directly from individual farmers by bill collectors or deputized collectors. But, to alleviate the burden on the UPRIIS, it is recommended that Farmer-Irrigation Associations collect ISFs by themselves and remit them to the UPRIIS office.

(2) Proper Record Keeping

To systematize the record keeping, the list of beneficiaries-farmers, their address, status of payment, etc. which serve as basic data for collection of ISFs, will be properly stored and processed by the computer installed in each district office.

(3) Preparation of Billing and Collection Documents

In principle, the documents necessary for ISFs collection will be prepared by the UPRIIS and delivered to beneficiaries-farmers through the Farmer-Irrigation Associations (FIAs).

(4) Payment of ISFs in Kind

Taking into account various constraints created by collection in kind, it is estimated that an allowance of six (6) kg per cavan collected in payment of ISFs in kind is not enough to cover all expenses incurred on the collected paddy.

Accordingly, it would be advantageous to abolish the option to pay ISFs in kind or to increase the allowance to more than ten (10) kg to recoup such losses.

(5) Rate of Interest Applied for Imposition of Penalties

Considering the current interest rate on loans (around 24% per annum or 2% a month) and penalties imposed in tax payments (surcharge of 10 - 20% and interests at the rate of 14 - 20% per annum), the present penalty charge of 1% per month for non-payment of ISFs seems too low to discharge effectively the deliquency.

Consequently, to be effective, it is recommended to impose heavier penalty in case of willful neglect.

(6) Exemption from Payment of ISFs

Because of procedural, managerial and financial constraints pointed out, it seems very hard for the UPRIIS to carry out the Board Resolution approving exemption from irrigation fees on damaged crop (in case of 40 cav. or less per ha).

Virtually, this kind of problem arising from natural calamity which is mostly considered as "forece majeure" is often beyond the control and guarantee of one irrigation system. It is therefore expected that such matters related to the stabilization of livelihood of farmers will be considered with a wise field of vision including various remedial measures such as crop insurance, natural disaster relief fund, accident compensation, etc.

3.7.8 Maintenance and Repair

The maintenance activity will be reinforced through the improvement of organization and engineering. According to the proposed plan of farmers' organization, there will be 865 Farmer-Irrigation Associations (FIA) to be set-up in the UPRIIS. The area covered by one FIA will be under the sub-lateral or approximately less than 200 ha. Minor maintenance and repair works within FIA, that is under sub-lateral, are to be transferred to FIA. These works will be vegetation control, small scaled desilting, lubrication of turnout gates, etc. The engineering support will be given by the UPRIIS staff. The maintenance works by UPRIIS staff will be concentrated on the major canals.

It is proposed to intensify the daily maintenance activities through good cooperation between the maintenance section and the operation section in District office. The field operational personnels will be given responsibility to the daily maintenance works. It is always necessary to conduct repair works as quickly as possible.

3.7.9 Proposed Operation and Maintenance Facilities

The computer system and telecommunication network are proposed for the operation of the UPRIIS. The periodical maintenance, repair and necessary supply such as paper, ribbon, etc. will be included in the maintenance cost.

The existing equipments in the UPRIIS offices are listed in Table 6. Most of the equipments are suitable for the construction works but they have overcapacity for the O&M works. Furthermore they need major or minor repair.

Evaluating from the existing equipments, the rearrangement of them for each office and the new equipment to be procured are proposed. The head office will have no heavy equipments but necessary number of light vehicles such as jeeps and motorcycles for the O&M works. Required civil works for the O&M of the UPRIIS will be the responsibility of the district offices.

The list of the equipments and the cost is summarized in Table 19. Details are described in Appendix IV, Section 3.6.

3.8 Plan of Farmers' Organization Set-up

3.8.1 General

In the UPRIIS, the FIGs and FIAs have been organized through assistance of the UPRIIS and local authorities. However, most of them are at a standstill and not viable as autonomous organizations.

The major constraints which cause their inactivity are supposed to be due to:

(1) Scale of the FIA (standard size: 500 - 700 ha)

Scale of the FIA is so large considering the number of farmers to be mobilized in a short time that they hardly manage it and face various problems, especially in institutional and financial aspects. In view of this, it is proposed to determine the optimum size of FIA from the standpoint of establishment of a cohesive face-to-face association.

(2) Share of the Incentive Granted by NIA

NIA gives due incentive to FIA in accordance with the following criteria:

- If the FIA achieves the efficiency of fee collection of more than 70%, incentive is applied in the following manner:

Efficiency of Fee Collection	Incentive
70 - 79%	1% of total amount of collection
80 - 85%	2% "
86 - 90%	3% "
91 - 95%	4% "
96 - 100%	5% "

- If the FIA pays their back account, the NIA gives two percent (2%) of their total collection.

However, the existing FIA consists of so large number of farmers (around 250 members on an average) that the chance that each individual member receives an incentive is very slim.

(3) Information Drive on Organizational Set-up

In the process of setting up the FIA, the farmers have not been disciplined sufficiently with respect to its management.

Prior to and after organization of the farmers into an association, it is indispensable to conduct a series of the following training in each stage of development:

a) Training of the UPRIIS main field staffs such as AWMTs & WMs, Ditchtenders, Gatekeepers and Irrigation Association Organizers (IAOs);

b) Information campaign to farmers on the project orientation cource;

c) Project comprehensive course for orienting farmers on the benefits and organizational requirements of the project;

d) Effective training course for farmer-leaders;

e) Refresher course for the UPRIIS main field staffs;

f) Refresher training course for farmers and farmer-leaders, etc.

(4) Poor Self-reliance of Farmers

It seems very hard to work out a countermeasure to promote farmers' self-reliance in irrigation water management. This problem which relates to the farmers' attitude of mind will be also settled through the above-mentioned training programs.

In order to establish viable Irrigation Associations (IAs), it is necessary to solve these constraints encountered in the UPRIIS in conformity with the formulated policy, strategies and program for the organization and development of IAs.

3.8.2 Proposed Organization

(1) Structure

There exist several types of system management. Taking into consideration the present conditions of the UPRIIS, it is recommended to adopt the scheme of partial transfer of the responsibilities and duties of O&M to FIAs.

This type of system management conforms to the basic philosophy "farmer participatory approach" of the Corporate Plan 1981 - 1990 of the NIA and the prevailing principle proposed in various studies and is also in line with the promotion of "participatory" democracy as envisionned by the New Republic.

As a first step, Farmer-Irrigation Group (FIG) will be reorganized in each irrigation rotation area on the basis of 3,008 blocks in the UPRIIS. FIGs will later be federated into Farmer-Irrigation Association (FIA). One FIA will be established in each irrigation block controlled, in principle, by a sub-lateral canal.

In case that the irrigation service block controlled by the sub-lateral canal exceeds 200 ha, the FIA will be established at the rate of about one association per 200 ha. The number of FIAs in the UPRIIS will reach about 865 as indicated hereunder:

Size of Irrigation Block Controlled by a Sub-lateral Canal (ha)	No. of Irrigation Block Controlled by a Sub-lateral Canal	No. of FIA
0 - 50	105	105
51 - 100	169	169
101 - 200	237	237
201 - 300	116	151
301 - 400	37	68
401 - 500	17	43
501 - 600	14	42
601 - 700	4	16
701 - 800	4	16
Over 800	3	18
Total	706	865

The Farmer-Irrigation Association (FIA) will be administered by a Board of Directors, composed of five (5) members: President, Vice-President, Secretary, Treasurer, and Auditor. The Board of Directors will have entire charge of the affairs and properties of the FIA and general management of its activities and operations.

For its smooth operation, three (3) sections: O&M, Fee Collection and General Services will be created under this Board as illustrated on Fig. 23.

(2) Activities of FIA and UPRIIS Responsibility

Legally, FIA will be formed as non-stock corporations.

In concrete terms, activities of FIA are summarized below:

1) Cleaning and maintenance of irrigation and drainage canals and related structures in the irrigation service area of FIA;

2) Scheduling of water delivery within the FIA area;

3) Preparation of a report on FIA's irrigated areas;

4) Check of collection bills for all FIA members;

5) Collection of irrigation service fees and remittance of the same to UPRIIS office.

In return for the cooperative activities of FIA, the UPRIIS office will be, as a rule, responsible for: i) providing the required volume of irrigation water, ii) taking charge of major repairs to the irrigation and drainage facilities, iii) granting management and maintenance costs for the area controlled by a sub-lateral canal, iv) providing maps and other documents necessary for fee collection and v) giving incentives/bonus to the FIA which attains a high efficiency rates in irrigation fee collection.

CHAPTER 4 PROJECT IMPLEMENTATION

4.1 Organization for Project Execution

NIA will become the executive agency for the implementation of the Project. It will be responsible for design, construction of project works and supervision of the Project. The Assistant Administrator for Operations will be responsible for the overall execution of the Proposed Project, incorporation with the Assistant Administrator for Project Development and Implementation.

The new project execution office in the field will not be established. The UPRIIS office proposed in Section 3.6 will principally executed the proposed project. In addition to the existing Divisions, Design and Construction Supervision Division will be newly established to reinforce the UPRIIS office during the construction period. After completion of the project, this division will be phased out. The Operations Manager of the UPRIIS office will manage all field works assisted by six supporting divisions and four district offices. In addition to UPRIIS staff, necessary staff including foreign consultant, local consultant and other administrative staff will be employed during the construction period to ensure the smooth and efficient execution of the project.

4.2 Implementation Schedule

The implementation schedule is shown in Fig. 24. The project works will be divided into three categories such as i) the preparatory works, ii) the construction works and iii) the installation of centralized monitoring system. All construction works will be executed on the contract basis. The total construction period for the project will be required for 10 years from 1985 to 1994.

4.2.1 Irrigation, Drainage and River Improvement Works

The total period required to complete the construction of irrigation, drainage and river improvement is 9 years from 1986 to 1994.

The construction works for irrigation development plan are the rehabilitation and improvement of the existing irrigation facilities. The construction schedule for the works is formulated from the basic considerations that the period of irrigation water supply would be minimized and irrigation benefit would be realized as early as possible. The construction works will be started from the tail portion of canals. Accordingly the construction will be started from those systems in the District III and IV in the first place.

As for the improvement works of drainage creeks and the Talavera river, the construction schedule is formulated on the basis that flood control benefit should be realized as soon as possible. The construction of these works will be required about 5 years of construction period.

4.2.2 Management Systems

According to the construction schedule of the irrigation improvement works, the centralized monitoring system (CMS) is installed in the UPRIIS.

The CMS comprises the central station, five base stations and forty-eight field stations.

The installation of equipments for the CMS and the construction of field stations will be carried out by District-bases. The establishment of the central office and the Pantabangan dam station will proceed prior to the implementation of the base station and the field station.

4.2.3 Farmers' Organization Set-up

The program of the organization and development of Farmer-Irrigation Associations will be implemented by "Irrigation Association Organizaters" (IAOs), newly posted in the Farmers' Assistance Division and O&M field personnel in the District Offices.

It is scheduled that one FIA will be organized during the period of 24 months in general. The implementation program for all FIA (865) set-up will be planned to be completed within ten years taking into consideration the implementation schedule of irrigation and drainage works.

The program for FIA set-up will be carried out through the four (4) steps: i) Preparation, ii) Pre-organization, iii) Organization and iv) Development.

Prior to the step of preparation, IAOs and O&M personnel concerned will be disciplined in the mechanics of the program and the process of the organization and development of irrigation association.

4.2.4 Modification of Staffing Pattern in UPRIIS Office

In accordance with the staffing pattern proposed in Section 3.6, the superfluous personnel in the UPRIIS office consists of 4 - District Chiefs, 4 - Operation Engineer, 12 - Zone Engineer, 38 - Water Management Technologist and 203 - Ditchtender. On the other hand new posts comprise 4 - Irrigation Superintendent, 16 - Irrigation Engineer, 20 - Gatekeeper and 50 - Irrigation Association Organizer.

In implementing the reorganization, it is recommended for the UPRIIS to adopt, as their principle, the following measures:

1) Relocation of the superfluous personnel to new posts

2) Tapering trimming of the retirable personnel and not filling up new hands, especially for ditchtender

3) Arrangements for assigning personnel concerned to the marginal posts such as Common Irrigator and Association Worker in the FIAs

Considering the limited reshuffle only within the UPRIIS, it is proposed that the superfluous personnel will be relocated as follows:

1) 4 - District Chief will be transferred to Irrigation Superintendent.

2) 4 - Operation Engineer and 12 - Zone Engineer will be transferred to Irrigation Engineer.

3) All superfluous Water Management Technologists and 12 among superfluous Ditchtenders will be incorporated in the Farmers' Assistance Division (FAD) as Irrigation Association Organizers (IAOs).

4) New post of Gatekeeper will be occupied by 20 among the superfluous Ditchtenders.

The remaining superfluous 171 Ditchtenders will be discharged as their age and/or service period requirements for retirement are satisfied.

The implementation program to tapering the 171 - superfluous Ditchtenders will be carried out during the period of 9 years, because drastic change of organization will adversely affected the present O & M functions of UPRIIS.

The program on retirement of Ditchtenders is prepared under the assumption of retirement at age 55 and after 20 years of service as follows:

	1984	1985	1986	1987	1988	1989	1990	1991	1992	Total
Number of Retirable Ditchtenders	32	3	21	26	12	17	23	29	8	171

CHAPTER 5 COST ESTIMATE

5.1 General

The project cost comprises the direct construction cost, the installation cost of the centralized monitoring system, procurement cost of O&M equipments, the engineering and administration costs and the institutional cost. All of the costs are estimated based on the current prices in August 1983. A physical contingency of the cost estimate is 15% of the project cost in principle. A price contingency applied is assumed at 7.5% in 1984, 7.0% in 1985 and 6.0% per annum after 1986 for the foreign currency portion and 12% per annum for the Peso currency portion. The ratio of foreign and Peso currency portion of each unit price is estimated on the basis of the following assumption referring to NIA criteria:

(Unit: %)

Item		Foreign Currency	Peso Currency
(1)	Cement	50	50
(2)	Steel	100	0
(3)	Hardware	20	80
(4)	Lumber	0	100
(5)	Aggregate	20	80
(6)	Boulder	20	80
(7)	Labor	0	100
(8)	Fuel & Oil	50	50
(9)	Depreciation Cost of Machinery	80	20
(10)	Gate more than 1.5 m x 1.5 m	100	0
	less than 1.5 m x 1.5 m	20	80

The conversion rate among Peso, U.S. dollar and Japanese Yen is assumed at US$1.0 = ₱11.0 = ¥240.

5.2 Project Cost

The project cost is estimated based on the detail unit price analysis and quantity calculation of the project works.

The total project cost is estimated at ₱916.2 million consisting of ₱554.1 million equivalent of foreign currency and ₱362.1 million of Peso currency as shown below.

(Unit: ₱10³)

Item	Foreign Currency	Local Currency	Total
1. Direct Construction Cost	281,820	233,670	515,490
1.1 Irrigation Improvement	190,520	193,660	384,180
(1) District I	29,560	27,390	56,950
(2) District II	38,560	38,050	76,610
(3) District III	76,610	81,250	157,860
(4) District IV	45,790	46,970	92,760
1.2 Drainage Improvement	54,840	23,980	78,820
1.3 River Improvement	36,460	16,030	52,490
2. Centralized Monitoring System	96,790	6,930	103,720
3. O & M Equipments	36,150	4,600	40,750
4. Engineering and Administration Cost	67,000	41,000	108,000
5. Institutional Cost	-	32,870	32,870
Sub-total	(481,760)	(319,070)	(800,830)
6. Physical Contingency	72,340	43,030	115,370
Total	554,100	362,100	916,200

Detailed cost estimate of each item is described in relevant Appendixes.

5.3 Fund Requirement

The annual fund requirement for the project is estimated based on the price escalation factor and total project cost corresponding to the construction schedule is estimated at ₱1,446.0 million consisting of ₱752.5 million equivalent of foreign currency and ₱693.5 million of Peso currency. The annual fund requirement for the project is shown below.

(Unit: ₱10⁶)

Year	Foreign Currency	Peso Currency	Total
1985	37.3	14.8	52.1
1986	178.1	112.4	290.5
1987	161.7	116.6	278.3
1988	109.3	72.9	182.2
1989	74.1	84.6	158.7
1990	123.7	83.4	207.1
1991	18.1	59.8	77.9
1992	30.2	72.7	102.9
1993	16.0	59.0	75.0
1994	4.0	17.3	21.3
Total	752.5	693.5	1,446.0

The summary of fund requirement for the project is shown in Table 20.

5.4 Operation, Maintenance and Replacement Costs

Annual operation and maintenance costs at the full stage of the project are estimated at ₱32.68 million comprising expenses for personnel, materials, travel, water & power service, oil and gasolines, O&M equipments and repairing cost of the project facilities and others. The breakdown of O&M cost is shown in Table 21.

Gates, equipments for centralized monitoring system (CMS) and O&M equipments are to be replaced at a certain time within 50 years of the project life. The useful life is assumed to be 20 years for the gates, 5 years for the equipments of the Centralized Monitoring Systems and 10 years for the O&M equipments, respectively. The replacement costs and the useful life of these facilities are listed in Table 22.

CHAPTER 6 EVALUATION

6.1 General

An evaluation of the project was made in view of i) economic aspect, ii) financial aspect and iii) project effect. With respect to the economic aspect, the internal rate of return and benefit-cost ratio were examined and sensitivity analysis was also carried out. From the financial aspect, analysis of farm budget for typical farmers and an assessment of the financial status of the UPRIIS office through preparation of a cash flow statement were done. As for project effect, actual effects accrued from the project are examined with respect to incremental rice production, promotion of job opportunity, stabilization of people's livelihood and increase of farmer's incomes.

6.2 Economic Evaluation

6.2.1 Project Benefit

Project benefits comprise irrigation benefit, flood control benefit and reduction of personnel expenses for operation and management of the project. Irrigation benefits are expected to be the increment of paddy between future without and with project conditions. Flood control benefits are the expected reduction of flood damages for crops, private property, public facilities and indirect lossess. Reduction of personnel expenses will be expected by the introduction of the monitoring system, strengthening work load of field staff, etc. The total benefits to be expected from the project at the full stage are ₱409.94 million consisting of ₱400.37 million for irrigation, ₱7.08 million for flood control and ₱2.49 million for reduction of personnel expenses.

6.2.2 Economic Project Cost

Economic construction cost for the projects was estimated taking into consideration deducing tax and contractor's profit for project cost. Total economic project cost is estimated at ₱855.19 million comprising ₱794.59 million for irrigation and drainage project including monitoring system, and ₱60.6 million for the partial river improvement project, respectively.

6.2.3 Evaluation

Based on the benefit and economic project cost, the internal rate of return (IRR) was calculated on the assumption that the project was a life of 50 years. The project is expected to yield an internal rate of return of 19.3%, indicates that the project is economically feasible. In addition to the internal rate of return, economic evaluation by using benefit cost ratio is carried out. The results are shown below:

Discount Rate (%)	Benefit Cost Ratio
6	4.7
10	2.8
14	1.7
18	1.1

Project sensitivity is analyzed with respect to change in project benefits and costs. The results are as follows:

Project Cost	0	0	+10%	+20%	+10%	+20%
Benefit	-10%	-20%	0	0	-10%	-20%
IRR	18.3%	17.1%	18.4%	17.5%	17.3%	15.3%

The above table indicates that the project is still expected to become economically feasible even if considerably increased project costs and or decrease of benefits occur.

6.3 Financial Evaluation

Financial evaluation of the project is studied from the standpoint of i) analysis of farm budget for typical farmers and ii) assessment of financial status of the UPRIIS office.

6.3.1 Farm Budget Analysis

In order to assess the project from farmer's view point, analyses of farm budget for typical farmers were studied. After the implementation of the project, drastic increase of farm income would be expected. The farm budgets for typical farmers are shown below. Details are explained in Appendix V.

(Unit: ₱10³)

Item	Below 1.0 ha	1.0 - 2.0 ha	2.0 - 3.0 ha	Above 3.0 ha
Owner Operator				
(Average farm size (ha))	(0.63)	(1.14)	(2.77)	(3.42)
- Gross income	15.9	24.4	51.9	66.0
- Gross outgo	12.2	17.5	32.5	40.5
- Net reserve	3.7	6.9	19.4	25.5
(Irrigation fee)	(0.3)	(0.6)	(1.4)	(1.7)
Amortizing Owner Operator				
(Average farm size (ha))	(0.58)	(1.4)	(2.45)	(3.10)
- Gross income	14.9	26.5	42.3	50.8
- Gross outgo	13.3	20.8	30.8	34.1
- Net reserve	1.6	5.7	11.5	16.7
(Irrigation fee)	(0.3)	(0.7)	(1.2)	(1.6)
Lessee				
(Average farm size (ha))	(0.59)	(1.34)	(2.29)	(3.32)
- Gross income	16.7	26.3	42.6	59.4
- Gross outgo	15.2	22.5	33.1	43.4
- Net reserve	1.5	3.8	9.5	16.0
(Irrigation fee)	(0.3)	(0.7)	(1.2)	(1.7)

The table indicates that all typical farmers are able to have capacity to pay for irrigation fee.

6.3.2 Financial Status of UPRIIS Office

Financial status of the UPRIIS office with project condition was assessed by preparation of a cash flow statement.

The finances of the UPRIIS office are dependent on efficiency of irrigation service fee, and the price of rice which determines the price of irrigation service fee.

Cash flow statement for the UPRIIS office was prepared under assumption that the price of rice is ₱1.7 per kg as shown in Table 23. The table indicates that the UPRIIS office would financially manage the project under the condition which the efficiency of irrigation service fee collection exceeds 75%.

6.4 Project Effect

After the completion of the project, the following major effects will be expected.

(1) Incremental Rice Production

The project will provide a basis on increasing unit yield of paddy and expansion of irrigated land through provision of irrigation and drainage facilities and river improvement. After the implementation of the project, incremental paddy of 293 x 10^3 ton will be expected from the irrigation service area. These incremental amounts of paddy will play an important role in self-sufficiency of rice in the project area as well as supply to Metro Manila. Further these incremental amounts of paddy will activate commercial activities such as milling, processing, fertilizer & agricultural chemicals undertaking.

(2) Employment Opportunity

The project will generate job opportunity of 1.8 million man-days during an implementation period. Most of the manpower will be supplied from landless workers and farmers in and around the project area. In addition the project will create a demand for farm labor requirement accrued from increased farm activities due to insentive use of the land and high productivity. The annual incremental farm labor requirement is estimated at 4.9 million man-days at the full stage of the project.

(3) Farmer's Income

The farmer's income will be expected to improve considerably as a result of the increase of rice production. Accordingly net return or capacity to pay for farmers will increase considerably. Supposing that net reserves for typical farmers without project condition is 100, net reserve with project condition will be revealed as follows:

Tenurial Status	Farm Size			
	Below 1 ha	1-2 ha	2-3 ha	Over 3 ha
Without Project	100	100	100	100
With Project				
Owner operator	142	138	132	129
Amortizing owner operator	267	168	155	146
Lessee	300	253	170	155

The table indicates that the project has a large effect on farm economy to lessee and amortizing owner operator having smaller farm size.

(4) Stabilization of People's Livelihood

At present flood damage occurs annually. Many houses and farm lands suffer from floods. After the implementation of the project, about 6,000 ha of farm land and about 3,700 houses will be free from flood damages.

(5) Improvement of Rural Development

The project will provide bases for rural development through improvement of infrastructures such as irrigation & drainage facilities and in preventing flooding in the area.

6.5 Assessment of the Project

The project will be expected to provide greater benefits and effects to the peoples in and around the project area.

The results of the studies indicate that the project is technically sound and economically feasible. Further the project is financially justifiable from the standpoint of farmer's economy and financial status of UPRIIS Office under irrigation service fee collection efficiency rate of over 75%.

TABLES

Table 1 MEMBER LIST OF ADVISORY COMMITTEE, SURVEY TEAM AND COUNTERPART GROUP

Name	Title/Speciality
Advisory Committee	
1. Mr. Teizo Takahashi	Chairman of the Committee
2. Mr. Masaru Kimura	Advisor on Irrigation and Drainage
3. Mr. Hiromoto Aoki	Advisor on Agro-Economy
4. Mr. Shozo Kitta	Advisor on Economic Analysis
5. Mr. Yukio Yoshida	Coordinator
6. Mr. Norio Matsuda	Coordinator
JICA Survey Team	
1. Mr. Tadashi Sakamoto	Team Leader
2. Mr. Kenjiro Onaka	Co-Team Leader
3. Mr. Tadashi Ohori	Irrigation and Drainage Engineer
4. Mr. Yukihiro Kawahara	Irrigation and Drainage Design Engineer
5. Mr. Takayuki Nobe	Hydro-river Engineer
6. Mr. Tsuguo Murakami	Hydro-river Engineer
7. Mr. Hideo Tsuji	Survey/Design Engineer
8. Mr. Tadaharu Murono	Agronomist
9. Mr. Fumihiko Furuichi	Institutional Expert
10. Mr. Yoshimitsu Yukawa	Construction Planner
Counterpart Group	
1. Mr. Edilberto B. Payawal	Chief Counterpart
2. Mr. Roberto C. Suguitan	Acting Chief Counterpart
3. Mr. Aurelio D. Eugenio	Water Management & Hydrological Engineer
4. Mr. Augustito V. Bartolome	Irrigation and Drainage Engineer
5. Mr. Dominador P. Santiago, Jr.	Survey Engineer
6. Mr. Mamerto R. Garcia	Agricultural Economist
7. Mr. Virgilio O. Gomez	Agronomist
8. Mr. Felimon S. Rodriguez	Sociologist

Table 2 SUMMARY OF CLIMATIC CONDITIONS

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Mean Temperature (°C)													
Muñoz (1974-1983)	25.2	25.8	26.9	28.5	28.5	28.0	27.4	26.6	27.0	26.8	26.0	25.7	26.9
Cabanatuan (1976-1979)	25.9	23.5	27.4	29.3	28.6	28.3	28.2	27.1	27.6	27.7	27.0	26.5	27.3
San Miguel (1968-1979)	25.1	25.0	27.0	28.6	28.8	28.1	27.4	26.8	27.3	26.8	26.3	25.4	26.9
Mean Maximum Temperature (°C)													
Muñoz (1974-1983)	30.2	31.0	32.3	34.1	34.2	32.5	31.5	30.3	31.0	31.2	30.0	30.3	31.6
San Miguel (1968-1979)	31.0	31.7	33.9	35.3	34.7	33.3	32.1	30.9	31.6	31.7	30.2	30.7	33.3
Mean Minimum Temperature (°C)													
Muñoz (1974-1983)	20.2	20.8	21.5	22.9	23.7	23.5	23.2	22.9	23.0	22.6	21.9	21.0	22.3
San Miguel (1968-1979)	18.8	19.0	20.3	21.9	23.1	23.2	22.8	23.2	22.6	22.3	21.6	20.2	21.6
Mean Relative Humidity (%)													
Muñoz (1974-1983)	68.0	67.0	64.8	61.6	65.8	74.3	78.7	82.3	78.5	76.5	73.0	70.1	71.7
Cabanatuan (1976-1979)	73.1	67.8	66.1	63.1	76.8	80.4	83.8	88.0	85.6	81.9	77.9	75.6	76.7
San Miguel (1968-1979)	83.1	75.4	77.6	71.9	79.2	86.0	87.9	90.7	88.8	86.5	82.5	82.3	82.7
Sunshine Hour (hr/day)													
Muñoz (1974-1983)	7.5	8.5	8.3	8.8	7.3	6.3	5.6	4.5	5.2	6.1	7.0	7.4	6.9
San Miguel (1968-1979)	6.2	7.3	7.1	8.3	7.5	5.2	5.1	3.9	4.1	5.6	6.3	6.5	6.1
Mean Wind Speed (km/hr)													
Muñoz (1974-1983)	13.7	13.4	12.4	11.3	9.5	7.9	6.0	6.5	6.4	8.8	11.2	12.7	10.0
Evaporation (mm/month)													
Muñoz (1974-1983)	179.5	188.7	229.3	248.7	206.4	154.4	117.5	93.8	108.5	123.5	130.1	153.8	1,934.2
San Miguel (1968-1979)	145.8	152.3	194.1	204.2	170.2	138.2	127.5	112.5	126.9	130.5	131.4	134.5	1,768.1

Table 3 POTENTIAL IRRIGATION SERVICE AREA

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

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

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

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

Table 4(1) INVENTORY OF IRRIGATION FACILITIES

(I) IRRIGATION CANAL LENGTH

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

/1 Length of Lateral C - Extention

/2 No data available

Table 4(2) INVENTORY OF IRRIGATION FACILITIES

(II) NUMBER OF STRUCTURES

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

/1 : No Available Data

/2 : ( ) Number of H.G.

Table 5 WORK LOAD OF THE UPRIIS STAFF

	Basic Factors	District I	II	III	IV	Whole UPRIIS
1.	Potential area (ha)	28,000	26,200	32,900	29,800	116,900
2.	Planted area (ha)*	23,000	24,000	26,000	19,000	92,800
3.	Diversion canal (km)	7.1	12.1	27.4	-	46.6
4.	Main canal (km)	53.3	50.7	71.3	60.7	236
5.	Lateral canal (km)	275.6	296.6	360.6	348.2	1,281
6.	Total length (3+4+5)	336.0	359.4	459.3	408.9	1,563.6
7.	No. of turnout & headgate	668	685	942	935	3,230
8.	No. of headgate	60	85	107	98	350
9.	No. of farmers (as of March 1980)	10,621	11,603	13,950	9,967	46,141
10.	No. of WMT	7	9	10	12	38
11.	No. of AWMT (or WM)	38	47	47	16	148
12.	No. of ditchtender	206	215	216	122	759
13.	No. of gatekeeper	5	10	7	5	27
14.	No. of billing clerk	5	10	4	4	23
15.	No. of cashier	1	1	1	2	5
16.	2/10 (ha/person)	3,290	2,670	2,600	1,580	2,420
17.	2/11 (ha/person)	605	510	550	1,190	620
18.	2/12 (ha/person)	110	110	120	160	120
19.	6/12 (km/person)	1.6	1.7	2.1	3.3	2.1
20.	10/14 (person/person)	4,600	2,400	6,500	4,750	4,000
21.	2/15 (ha/person)	23,000	24,000	26,000	9,500	18,400
22.	2/13 (ha/person)	4,600	2,400	3,700	3,800	3,400

Remarks: * Average planted area per one crop season during the past four years from 1979 to 1982.

Table 6(1) O & M EQUIPMENTS

(As of May 1983)

Type of Equipment	Condition	E.D.	O&M Staff	A.D.	D.R.D.	D-I	D-II	D-III	D-IV	Total	Grand Total
(A) Light Equipment											
1. Toyota Jeep	A-1	2	5	1	6	5	2	5	5	31	
	A-2	0	0	0	1	1	0	2	4	8	39
2. Jeep Nissan Patrol	A-1	0	0	0	0	2	1	0	1	4	4
3. Kaiser Jeep	A-3	0	0	0	0	0	0	1	0	1	1
4. Toyota Station Wagon	A-1	0	1	0	0	0	1	0	0	2	2
5. Toyota Tamaraw	A-1	0	1	2	0	1	0	0	1	5	
	A-2	0	0	0	0	1	1	0	0	2	7
6. Toyota Hi-Lux	A-1	0	1	0	0	0	0	1	2	4	
	A-2	0	0	0	1	0	0	0	0	1	5
7. Volkswagen Car	A-1	0	1	0	0	0	0	0	0	1	1
8. Yamaha or Suzuki Motorcycle	A-1	0	7	11	14	45	59	70	88	294	
	A-2	0	0	2	2	2	10	1	17	34	328
9. Mitsubishi Pick-up	A-1	0	2	0	1	0	2	0	0	5	5
10. Toyota Pick-up	A-1	1	0	0	3	1	3	4	5	17	
	A-2	0	0	0	0	0	3	2	2	7	24
11. Toyota Coaster	A-1	1	0	0	0	0	0	0	0	0	1
12. Isuzu Cargo Truck	A-1	0	0	0	0	0	0	0	2	2	
	A-2	0	0	0	0	0	0	0	1	1	3
13. Stake Truck	A-1	0	0	0	0	3	3	2	0	8	
	A-2	0	0	0	2	0	1	0	0	3	11
14. Dump Truck	A-1	0	0	0	2	3	5	4	7	21	
	A-2	0	0	0	0	1	0	0	3	4	
	A-3	0	0	0	0	0	0	3	0	3	28
(B) Heavy Equipment											
1. Mobile Crane											
- PBH RI25	A-2	1	0	0	0	0	0	0	0	1	
- P&H 4357C	A-2	0	0	0	1	0	0	0	0	1	
- Sumitomo LS78	A-1	0	0	0	0	0	1	2	1	4	
	A-2	0	0	0	0	2	0	0	4	6	12
2. W & Shyo											
- G 660	A-2	1	0	0	0	0	0	0	0	1	
- G 800	A-2	0	0	0	0	1	1	2	1	5	6
3. O&K Forklift V 20	A-2	1	0	0	0	0	0	0	0	1	1

Table 6(2) O&M EQUIPMENTS

(As of May 1983)

Type of Equipment	Condition	E.D.	O&M Staff	A.D.	D.R.D.	D-I	D-II	D-III	D-IV	Total	Grand Total
4. Tractor											
- IH	A-1	2	0	0	0	0	0	0	0	2	
- Ford F5000	A-1	0	0	0	1	0	0	0	0	1	
	A-2	0	0	0	2	0	0	0	1	3	6
5. Grader	A-1	0	0	0	1	2	2	2	1	8	
	A-2	0	0	0	0	0	2	2	2	6	14
6. Dozer											
- Komatsu D65A	A-1	0	0	0	1	0	0	0	2	3	
	A-2	0	0	0	0	0	3	0	4	7	
- Komatsu D50P	A-1	0	0	0	0	0	0	1	0	1	
	A-2	0	0	0	0	1	0	2	0	3	
- " D41	A-1	0	0	0	0	0	1	1	1	3	
	A-2	0	0	0	0	0	0	1	0	1	
- Cat D6C	A-1	0	0	0	0	1	0	3	0	4	
	A-2	0	0	0	0	0	1	1	0	2	24
7. Yutani Poclain	A-1	0	0	0	0	1	0	1	1	3	3
8. Air Compressor	A-1	0	0	0	0	0	1	0	0	1	1
9. Cat Loader	A-1	0	0	0	0	2	2	0	1	5	
	A-2	0	0	0	1	1	0	2	1	5	10
10. Allis Chalmers	A-1	0	0	0	0	0	0	0	1	1	
	A-2	0	0	0	0	0	0	0	1	1	2
11. Back Hoe	A-1	0	0	0	0	1	0	1	1	3	
	A-2	0	0	0	0	0	1	0	1	2	5
12. Transit Mixer (Hiho)	A-2	0	0	0	0	0	0	0	1	1	1
13. Dynamic Compactor	A-2	0	0	0	0	0	1	0	2	3	3

Remarks: A-1: Good condition
A-2: Need minor repair
A-3: Need major repair
E.D.: Equipment Division
O&M Staff: Operation and Maintenance Staff
A.D.: Agriculture Division
D.R.D.: Dam & Reservoir Division
D-I: District I

Table 7 IRRIGATION FEE COLLECTION

District	Collectible (₱10^3)	Collected (₱10^3)	Efficiency (%)
1979			
I	6,452	3,294	51.1
II	7,800	4,997	64.1
III	8,964	4,086	45.6
IV	5,512	3,543	64.3
Whole UPRIIS	28,728	15,920	55.4
1980			
I	5,760	2,967	51.5
II	6,759	4,407	65.2
III	7,427	3,559	47.9
IV	5,330	2,534	47.5
Whole UPRIIS	25,276	13,467	53.3
1981			
I	8,394	3,842	45.8
II	9,350	4,254	45.5
III	10,571	3,509	33.2
IV	6,129	3,814	62.2
Whole UPRIIS	34,444	15,419	44.8
1982			
I	8,263	3,932	47.5
II	9,389	4,944	52.7
III	10,166	3,769	37.1
IV	7,127	4,689	65.8
Whole UPRIIS	34,945	17,334	49.6
Average Collection and Efficiency (1979-1982)		15,535	50.4

/* Including back account

Source: Annual Report, UPRIIS, NIA

Table 8 TOTAL EXPENDITURE OF UPRIIS (1978 to 1982)

(Unit: ₱10⁶)

Particulars	Amount				
	1978	1979	1980	1981	1982
A. OPERATION/MAINTENANCE	18.86	21.79	26.66	30.24	33.34
B. CONSTRUCTION WORKS					
1. Rehabilitation Works	-	0.82	-	-	0.52
2. Improvement of irrigation facilities and structures	0.95	1.43	1.36	0.27	0.24
3. Repair of typhoon damages	0.58	3.78	0.73	0.87	0.47
4. Addition and remaining work	2.59	0.30	-	-	0.17
5. Expansion of irrigation system at APIP	51.11	20.62	24.14	14.17	7.01
6. Others (specify)					
6.1 Bogting-Siclong	-	0.61	0.12	-	-
6.2 Closing the gap	-	-	1.26	0.09	-
6.3 Rehabilitation of roadway at Pantabangan	-	-	0.07	-	-
6.4 Power Phase	80.83	-	-	-	-
6.5 Resettlement and Assistance	0.04	-	-	-	-
6.6 Programmed Act for CY-1978	1.02	-	-	-	-
6.7 Repair/Maintenance of dams	12.82	-	-	-	-
6.8 Proposed warehouse	-	-	-	0.18	-
6.9 NIA-agri. institutional Dept. Project	-	-	-	0.21	-
6.10 Pinagbaryuhan Communal Irrigation Project	-	-	-	-	1.10
6.11 Agribusiness	-	-	-	-	0.21
6.12 Rehab Japanese Loan Project (Feasibility Study)	-	-	-	-	0.11
6.13 Invest and Survey Balintingon Project	-	-	-	-	0.21
6.14 Construction	-	-	-	-	1.10
6.15 Const. of Lateral D-4 and D-5	-	-	-	-	0.28
6.16 Invest and Survey Casecnan Transbasin Project	-	-	-	-	1.14
6.17 Invest and Survey Const. of Cableway Across Sumacbao River	-	-	-	-	0.03
C. EROSION CONTROL AND REFORESTATION PROJECT	8.41	5.87	-	-	-
D. PROJECT SYSTEMS DEVELOPMENT					
1. Aurora Transbasin Project	8.47	0.33	0.35	0.43	-
2. Casecnan River F/S	5.96	1.80	-	-	0.04
Total	191.64	57.35	54.69	46.46	44.87
Ratio of O & M Total Expenditure(%)	9.80	38.00	48.70	65.10	74.30

Table 9 OPERATION AND MAINTENANCE COST IN UPRIIS
(1978 to 1982)

(Unit: ₱10^3)

	1978	1979	1980	1981	1982
1. Personnel Expenses	16,302.2	19,695.4	23,472.3	27,029.1	27,581.5
a. Salaries	13,854.6	16,999.0	13,989.0	14,318.5	15,055.2
b. Gov't. Share	968.7	1,061.0	1,236.3	1,247.1	1,362.6
c. Wages	1,478.9	1,635.4	1,222.2	1,344.9	1,396.7
d. Cost of Living Allowance	-	-	5,511.5	6,153.0	5,845.4
e. Amelioration Allowance	-	-	1,492.0	1,555.8	1,619.9
f. Representation Allowance	-	-	21.3	44.5	47.2
g. Incentive Allowance	-	-	-	2,301.4	1,975.3
h. Pag-ibig Fund	-	-	-	63.9	279.2
2. Other Expenses	2,558.7	2,019.5	3,189.1	3,210.8	5,759.0
a. Traveling Expenses	282.2	135.3	322.4	262.3	266.4
b. Sundries & Other Expenses	1,010.6	499.1	465.1	533.4	720.2
c. Supplies and materials, spare parts	1,265.9	1,385.1	1,101.7	522.4	1,228.0
d. Water, illum and power services	-	-	183.0	174.4	290.6
e. Gasoline and Oils	-	-	1,116.9	1,718.3	3,095.5
f. Collection Expenses	-	-	-	-	135.5
g. Purchase of Equipment	-	-	-	-	228.8
Total (1 + 2)	18,860.9	21,714.9	26,661.4	30,239.9	33,340.5
Ratio of Personnel Expenses/Total O & M Cost (%)	86.4	90.7	88.0	89.4	82.7

Table 10 FARM BUDGET BY LAND TENURE AND FARM SIZE
(PRESENT CONDITION)
-IRRIGATED-DOUBLE CROPPING PADDY FARMER-

(Unit: ₱)

Item	Owner Operator				Amortizing Owner Operator				Lessee			
	Below 1.0 ha	1.0 - 2.0 ha	2.0 - 3.0 ha	Above 3.0 ha	Below 1.0 ha	1.0 - 2.0 ha	2.0 - 3.0 ha	Above 3.0 ha	Below 1.0 ha	1.0 - 2.0 ha	2.0 - 3.0 ha	Above 3.0 ha
Average Farm Size (ha)	(0.63)	(1.14)	(2.77)	(3.42)	(0.58)	(1.40)	(2.45)	(3.10)	(0.59)	(1.34)	(2.29)	(3.32)
I. Gross Income	14,080	21,060	43,820	55,770	13,220	22,450	35,160	41,750	15,030	22,350	35,880	49,640
1) Farm income												
- Paddy	7,080	12,810	31,130	38,440	6,520	15,740	27,540	34,840	6,630	15,060	25,740	37,320
- Others/1	670	670	440	170	670	670	440	170	210	210	110	720
2) Off and non farm income/2	5,130	5,410	6,990	10,860	4,930	3,380	2,520	850	7,070	4,530	5,680	5,290
3) Net proceeds of loan/3	1,200	2,170	5,260	6,500	1,100	2,660	4,660	5,890	1,120	2,550	4,350	6,310
II. Gross Outgo	11,600	16,350	29,720	37,090	12,640	19,400	28,330	31,040	14,650	21,140	30,750	40,060
1) Production cost	2,750	4,980	12,090	14,930	2,500	6,110	10,690	13,530	2,580	5,850	10,000	14,590
- Seed	347	628	1,527	1,885	320	772	1,350	1,708	325	738	1,262	1,830
- Fertilizer	647	1,170	2,843	3,510	595	1,437	2,514	3,181	605	1,375	2,350	3,407
- Agro-chemicals	378	684	1,662	2,052	348	840	1,470	1,860	354	804	1,374	1,992
- Hired labor/4	229	415	1,008	1,245	211	510	892	1,128	215	488	834	1,208
- Hired animal	8	14	33	41	7	17	29	37	7	16	27	40
- Hired machine/4	302	547	1,330	1,642	278	672	1,176	1,488	283	643	1,099	1,594
- Harvesting and threshing/5	708	1,281	3,113	3,844	652	1,574	2,754	3,484	663	1,506	2,574	3,732
- Miscellaneous/6	131	241	574	711	116	288	505	644	128	281	480	687
2) Amortizing fee	-	-	-	-	60	150	270	340	-	-	-	-
3) Land rent/7	-	-	-	-	-	-	-	-	1,110	2,530	4,320	6,260
4) Loan repayment	1,340	2,430	5,890	7,280	1,230	2,980	5,220	6,600	1,250	2,860	4,870	7,070
5) Living expenses	7,510	8,940	11,740	14,880	8,910	10,160	12,150	10,570	9,710	9,900	11,560	12,240
III. Net Reserve (capacity to pay)	2,480	4,710	14,100	18,880	580	3,050	6,830	10,710	380	1,210	5,130	9,580

Remarks: /1: Includes incomes from livestock raising.
/2: Includes incomes of wage earning from work at other farm, cottage industry, rent for farm machine, remittance from their family working at other place, etc.
/3: Includes loans obtained from Masagana-99, relatives and friends. /4: Excludes harvesting and threshing.
/5: Includes costs of hired labor and hired machine. (10% of farm income of paddy based on the result of socio-economic survey)
/6: Includes fuel of farm machine, minor farm tools and equipment, etc.
/7: Land rent per hectare was calculated as follows: 13 cav. x 2 crop seasons = 26 cav./ha = 1,300 kg/ha
1,300 kg/ha x (₱1.3/a + 1.6/b)/2 = 1,885 ₱/ha
/a: Farm gate price of wet season paddy
/b: Farm gate price of dry season paddy

Source: Results of farm economic survey in 1982 and data of Input and Output Monitoring Survey conducted by NIA in 1981.

Table 11 NUMBER, MEMBERSHIP AND AREA COVERED OF FIGs & FIAs BY DISTRICT
(As of July, 1983)

District	Farmer-Irrigator's Group (FIGs)			Farmer's Irrigator's Associations (FIAs)			
	No. of FIGs	Total Number of Members	Total Area Covered (ha)	No. of FIAs	No. of FIGs Federated	Total Members	Total Area Covered (ha)
I	745	10,621	27,990	28 (42)*	456 (61%)	7,056 (66%)	14,095.56
II	728	11,603	28,360	18 (47)*	296 (41%)	5,275 (45%)	9,355.06
III	916	13,950	26,650	34 (49)*	596 (65%)	10,619 (76%)	18,339.42
IV	693 (786)*	9,739 (11,266)*	18,602.91	18 (48)*	274 (40%)	4,329 (44%)	9,687.78
Total	3,082 (3,175)	45,913 (47,440)*	101,602.91	98/1 (186)*	1,622 (53%)	27,279 (59%)	51,477.82

Remarks: /1: There exist 98 FIAs set-up on the record. But it was confirmed by FIA Evaluation Survey that among them, 27 FIAs became inactive and have regressed into FIGs. 24 FIAs are registered with the SEC.

Figures in ( )* are targets.

Percentages in ( ) show the ratios of FIAs federation in set-up number and its membership.

Source: FIA Evaluation Survey conducted from June to July 1983.
Agriculture Division

Table 12 DESIGN CRITERIA OF PROPOSED FARMING PRACTICES FOR PADDY WITH PROJECT

1.	Varieties	IR series
2.	Growing period	125 days
3.	Transplanting method	
	- Amount of seed	60 kg per ha
	- Nursery period	15 - 20 days
	- Area of nursery bed	1/20 - 1/25 of paddy field
4.	Direct seeding method	
	- Amount of seed	80 kg per ha
5.	Land preparation	One time of ploughing, and three times of hallowing-leveling
6.	Fertilization	
	Nursery bed	2 kg of N/ha
	Paddy field	- 81 kg of N/ha, 31 kg of P/ha and 21 kg of K/ha for wet season paddy
		- 96 kg of N/ha, 41 kg of P/ha and 21 kg of K/ha for dry season paddy
	Time in paddy field	
	All P and K	Basic dressing
	35% of N	Basic dressing at transplanting time
	25% of N	First top dressing at two weeks after transplanting time
	40% of N	2nd top dressing in the late period of of young panicle formation stage
7.	Weeding	Two times about 25th and 50th day after transplanting

Table 13 ESTIMATED MEAN MONTHLY DISCHARGE

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

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

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

Table 14 WATER RE-USE POINTS IN UPRIIS

(Unit: ha)

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

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

Table 15 ALTERNATIVE PLANS FOR WATER BALANCE STUDY

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

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

Table 16 PROPOSED IRRIGATION SERVICE AREA

(Unit: ha)

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

Table 17 UNIT DESIGN WATER REQUIREMENT

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

Table 18 PROPOSED WORK LOAD AND STAFFING PATTERN OF THE MAIN FIELD STAFF

Item	Work Load/1 (ha/person)		No. of Staff		
	Present	Proposed/2	Present/3	Proposed	Difference
Irrigation Superintendent/4	-	20,000 - 30,000	4	4	-
Irrigation Engineer/5	5,000	5,000 - 10,000	16	16	-
Water Management Technologist (WMT)	2,400	0	38	0	+38
Irrigation Association Organizer (IAO)	-	2,200	0	50	-50
Water Management Technician & Watermaster (AWMT & WM)	620	750	148	148	0
Gatekeeper	-	-	27	47	-20
Ditchtender	120	200	759	556	+203
Total	-	-	988	817	171

Remarks: /1: Work loads are estimated on the following basis; present irrigation service area = 92,000 ha/ projected irrigation service area = 111,200 ha.

/2: The proposed work load is determined on the basis of system efficiency analysis of the National Irrigation Systems and MC 2.

/3: As of July 31, 1983

/4: Present district chiefs.

/5: Present Operation Engineers and Zone Engineers.

Table 19 COST ESTIMATE OF O&M EQUIPMENTS

Item	Existing Equipment		Procured Equipment		Total	
	Nos./1	Repair Cost	Nos.	Procure-ment Cost	Nos.	Cost
		(₱10³)		(₱10³)		(₱10³)
I. Heavy Equipment						
1. Shovel	5	0	8	4,560	13	4,560
2. Dozer	12	580	12	5,040	24	5,620
3. Grader	14	300	4	2,200	18	2,500
4. Tractor	1	40	0	0	1	40
5. Loader	9	0	0	0	9	0
6. Crane	15	1,630	0	0	15	1,630
7. Compactor	3	5	12	180	15	185
8. Roller	0	0	8	2,360	8	2,360
9. Others	7	515	40	540	47	1,055
10. Spair parts	-	4,830/2	-	2,900	-	7,730
Sub-total	66	7,900	84	17,780	150	25,680
II. Light Equipment						
1. Truck	40	210	24	5,080	64	5,290
2. Jeep	44	80	28	2,520	72	2,600
3. Motor cycle	358	140	80	400	438	540
4. Others	11	40	160	560	171	600
5. Spair parts	-	2,600/2	-	1,660	-	4,260
Sub-total	453	3,070	292	10,220	745	13,290
III. Transportation Cost	-	380	-	1,400	-	1,780
Total	519	11,350	376	29,400	895	40,750/3

Remarks: /1: Exclude the equipments needed major repair.

/2: Procurement cost of spare parts.

/3: Foreign currency = ₱36,150 x 10^3
Local currency = ₱4,600 x 10^3 (80% of repair cost + Transportation cost)

Table 20 ANNUAL DISBURSEMENT SCHEDULE OF FUND REQUIREMENT

(Unit: ₱10³)

Item	Total		1985		1986		1987		1988		1989	
	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC
1. Construction Cost	281,820	233,670	-	-	70,348	58,887	72,661	52,483	38,672	26,185	37,387	29,309
1.1 Irrigation Improvement	190,520	193,660	-	-	47,861	49,034	50,175	42,631	16,652	16,566	25,234	23,966
1) District I	29,560	27,390	-	-	-	-	3,362	2,044	6,723	4,087	2,755	2,669
2) District II	38,560	38,050	-	-	-	-	-	-	-	-	16,186	13,135
3) District III	76,610	81,250	-	-	40,829	42,954	22,196	23,216	7,753	8,859	4,117	4,542
4) District IV	45,790	46,970	-	-	7,032	6,080	24,617	17,371	2,176	3,620	2,176	3,620
1.2 Drainage Improvement	54,840	23,980	-	-	22,487	9,853	22,486	9,852	9,867	4,275	-	-
1.3 River Improvement	36,460	16,030	-	-	-	-	-	-	12,153	5,344	12,153	5,343
2. Central Monitoring System	96,790	6,930	-	-	25,631	1,101	19,146	1,765	16,714	1,435	-	-
3. O&M Equipments	36,150	4,600	8,150	3,200	14,000	700	7,000	350	7,000	350	-	-
4. Engineering and Administration Cost	67,000	41,000	20,000	7,000	17,000	7,000	10,000	5,000	7,000	4,500	7,000	4,500
5. Institutional Cost	-	32,870	-	-	-	2,128	-	5,548	-	3,990	-	3,990
Sub-total	481,760	319,070	28,150	10,200	126,979	69,816	108,870	65,146	69,386	36,460	44,387	37,799
6. Physical Contingency	72,340	43,030	4,270	1,580	19,061	10,164	16,333	8,954	10,404	4,880	6,663	5,081
Total	554,100	362,100	32,420	11,780	146,040	79,980	125,140	74,100	79,790	41,340	51,050	42,880
7. Price Contingency	198,400	331,400	4,880	3,020	32,060	32,420	36,560	42,500	29,510	31,560	23,050	41,720
Grand Total	752,500	693,500	37,300	14,800	178,100	112,400	161,700	116,600	109,300	72,900	74,100	84,600

(Unit: ₱10³)

Item	1990		1991		1992		1993		1994	
	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC
1. Construction Cost	28,570	22,328	9,626	14,321	15,174	16,045	7,600	11,318	1,782	2,794
1.1 Irrigation Improvement	16,416	16,985	9,626	14,321	15,174	16,045	7,600	11,318	1,782	2,794
1) District I	4,002	4,220	4,781	5,311	4,781	5,311	3,156	3,748	-	-
2) District II	8,523	7,466	2,669	5,390	8,217	7,114	2,268	3,950	697	995
3) District III	1,715	1,679	-	-	-	-	-	-	-	-
4) District IV	2,176	3,620	2,176	3,620	2,176	3,620	2,176	3,620	1,085	1,799
1.2 Drainage Improvement	-	-	-	-	-	-	-	-	-	-
1.3 River Improvement	12,154	5,343	-	-	-	-	-	-	-	-
2. Central Monitoring System	35,299	2,629	-	-	-	-	-	-	-	-
3. O&M Equipments	-	-	-	-	-	-	-	-	-	-
4. Engineering and Administration Cost	6,000	4,000	-	3,000	-	3,000	-	2,000	-	1,000
5. Institutional Cost	-	4,408	-	4,218	-	4,294	-	3,686	-	608
Sub-total	69,869	33,365	9,626	21,539	15,174	23,339	7,600	17,004	1,782	4,402
6. Physical Contingency	10,481	4,345	1,444	2,601	2,276	2,861	1,140	1,996	268	568
Total	80,350	37,710	11,070	24,140	17,450	26,200	8,740	19,000	2,050	4,970
7. Price Contingency	43,350	45,690	7,030	35,660	12,750	46,500	7,260	40,000	1,950	12,330
Grand Total	123,700	83,400	18,100	59,800	30,200	72,700	16,000	59,000	4,000	17,300

Remarks: FC: Foreign Currency
LC: Local Currency

Table 21 ANNUAL OPERATION AND MAINTENANCE COST

(Unit: ₱10^6)

Year	Personnel Expense	Central Monitoring System	Oil & Gasoline	Maintenance Cost for Gates	Material Cost	Office Expense	Travel Expense	Other Expense	Total
1985	27.12	0.46	1.30	0.22	3.00	0.29	0.27	1.04	33.70
1986	27.08	0.46	1.30	0.59	3.00	0.29	0.27	1.04	34.03
1987	26.78	0.46	1.30	0.87	3.00	0.29	0.27	1.04	34.01
1988	26.40	0.46	1.30	0.87	3.00	0.29	0.27	1.04	33.63
1989	26.23	0.46	1.30	1.22	3.00	0.29	0.27	1.04	33.81
1990	25.99	0.46	1.30	1.23	3.00	0.29	0.27	1.04	33.58
1991	25.66	0.46	1.30	1.23	3.00	0.29	0.27	1.04	33.25
1992	25.24	0.46	1.30	1.23	3.00	0.29	0.27	1.04	32.83
1993	25.09	0.46	1.30	1.23	3.00	0.29	0.27	1.04	32.68
1994	⋮	0.46	1.30	1.23	3.00	0.29	0.27	1.04	⋮
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
2034	25.09	0.46	1.30	1.23	3.00	0.29	0.27	1.04	32.68

Table 22 REPLACEMENT COST AND USEFUL LIFE

Item	Useful Life (year)	Replacement Cost (₱10⁶)
1. Gate		
1.1 Gate installed or rehabilitated in this project.	20	(201.19)
- for irrigation improvement	20	199.62
- for river improvement	20	1.57
1.2 Gate installed in UPRP and non-rehabilitated in this project	10/1	45.46
2. Equipments of Centralized Monitoring System	5	(11.60)
- rain gage and water gage	5	2.44
- other equipments	5	9.16
3. O & M Equipments	10	37.81

/1: Useful life of 10 years is applied for the existing gate. After first replacement, useful life of 20 years is applied.

Table 23 CASH FLOW STATEMENT OF UPRIIS OFFICE

(1) Irrigation fee collection efficiency: 75%

(Unit: P10^6)

Year	Revenue from Irr. Fee	O & M Cost	Replacement Cost	Balance	Accumulated Amount
1985	33.7	26.74	0	6.96	6.96
6	30.5	27.07	0	3.43	10.39
7	29.3	27.05	0	2.25	12.64
8	31.3	26.67	0	4.63	17.27
9	32.2	26.85	0	5.35	22.62
1990	32.7	26.62	0	6.08	28.70
1	32.6	26.29	0	6.31	35.01
2	34.9	25.87	2.90	6.13	41.14
3	36.5	25.72	2.90	7.88	49.02
4	41.0	25.72	0	15.28	64.30
5	41.2	25.72	17.15	-1.67	62.63
6	41.2	25.72	58.69	-43.21	19.42
7	41.2	25.72	9.52	5.96	25.38
8	41.2	25.72	9.52	5.96	31.34
9	41.2	25.72	0	15.48	46.82
2000	41.2	25.72	5.80	9.68	56.50
1	41.2	25.72	0	15.48	71.98
2	41.2	25.72	2.90	12.58	84.56
3	41.2	25.72	2.90	12.58	97.14
4	41.2	25.72	0	15.48	112.62
5	41.2	25.72	17.15	-1.67	110.95
6	41.2	25.72	86.36	-70.88	40.07
7	41.2	25.72	65.44	-49.96	-9.89
8	41.2	25.72	9.52	5.96	-3.93
9	41.2	25.72	70.52	-55.04	-58.97
2010	41.2	25.72	7.37	8.11	-50.86
11	41.2	25.72	0	15.48	-35.38
12	41.2	25.72	2.90	12.58	-22.80
13	41.2	25.72	2.90	12.58	-10.22
14	41.2	25.72	0	15.48	5.26
15	41.2	25.72	17.15	-1.67	3.59
16	41.2	25.72	58.69	-43.21	-39.62
17	41.2	25.72	9.52	5.96	-33.66
18	41.2	25.72	9.52	5.96	-27.70
19	41.2	25.72	0	15.48	-12.22
2020	41.2	25.72	5.80	9.68	-2.54
21	41.2	25.72	0	15.48	12.94
22	41.2	25.72	2.90	12.58	25.52
23	41.2	25.72	2.90	12.58	38.10
24	41.2	25.72	0	15.48	53.58
25	41.2	25.72	17.15	-1.67	51.91
26	41.2	25.72	86.36	-70.88	-18.97
27	41.2	25.72	65.44	-49.96	-68.93
28	41.2	25.72	9.52	5.96	-62.97
29	41.2	25.72	70.52	-55.04	-118.01
2030	41.2	25.72	7.37	8.11	-109.90
31	41.2	25.72	0	15.48	-94.42
32	41.2	25.72	2.90	12.58	-81.84
33	41.2	25.72	2.90	12.58	-69.26
34	41.2	25.72	0	15.48	-53.78

(2) Irrigation fee collection efficiency: 80%

(Unit: P10^6)

Year	Revenue from Irr. Fee	O & M Cost	Replacement Cost	Balance	Accumulated Amount
1985	35.9	26.74	0	9.16	9.16
6	32.6	27.07	0	5.53	14.69
7	31.3	27.05	0	4.25	18.94
8	33.4	26.67	0	6.73	25.67
9	34.3	26.85	0	7.45	33.12
1990	34.9	26.62	0	8.28	41.40
1	34.7	26.29	0	8.41	49.81
2	37.2	25.87	2.90	8.43	58.24
3	38.9	25.72	2.90	10.28	68.52
4	43.7	25.72	0	17.98	86.50
5	43.9	25.72	17.15	1.03	87.53
6	43.9	25.72	58.69	-40.51	47.02
7	43.9	25.72	9.52	8.66	55.68
8	43.9	25.72	9.52	8.66	64.34
9	43.9	25.72	0	18.18	82.52
2000	43.9	25.72	5.80	12.38	94.90
1	43.9	25.72	0	18.18	113.08
2	43.9	25.72	2.90	15.28	128.36
3	43.9	25.72	2.90	15.28	143.64
4	43.9	25.72	0	18.18	161.82
5	43.9	25.72	17.15	1.03	162.85
6	43.9	25.72	86.36	-68.18	94.67
7	43.9	25.72	65.44	-47.26	47.41
8	43.9	25.72	9.52	8.66	56.07
9	43.9	25.72	70.52	-52.34	3.73
2010	43.9	25.72	7.37	10.81	14.54
11	43.9	25.72	0	18.18	32.72
12	43.9	25.72	2.90	15.28	48.00
13	43.9	25.72	2.90	15.28	63.28
14	43.9	25.72	0	18.18	81.46
15	43.9	25.72	17.15	1.03	82.49
16	43.9	25.72	58.69	-40.51	41.98
17	43.9	25.72	9.52	8.66	50.64
18	43.9	25.72	9.52	8.66	59.30
19	43.9	25.72	0	18.18	77.48
2020	43.9	25.72	5.80	12.38	89.86
21	43.9	25.72	0	18.18	108.04
22	43.9	25.72	2.90	15.28	123.32
23	43.9	25.72	2.90	15.28	138.60
24	43.9	25.72	0	18.18	156.78
25	43.9	25.72	17.15	1.03	157.81
26	43.9	25.72	86.36	-68.18	89.63
27	43.9	25.72	65.44	-47.26	42.37
28	43.9	25.72	9.52	8.66	51.03
29	43.9	25.72	70.52	-52.34	-1.31
2030	43.9	25.72	7.37	10.81	9.50
31	43.9	25.72	0	18.18	27.68
32	43.9	25.72	2.90	15.28	42.96
33	43.9	25.72	2.90	15.28	58.24
34	43.9	25.72	0	18.18	76.42