PD-ABL-209
94925 CPL

F I N A L D R A F T

BICOL INTEGRATED AREA DEVELOPMENT I

(Libmanan/Cabusao)

PROJECT NO. 492-0275

(AID LOAN NO. 492-T-037)

ASSESSMENT REPORT

April-May 1981

JUNE 1981

INTRODUCTION

Construction is essentially completed on the major physical facilities of the Libmanan-Cabusao Integrated Area Development Project (LCIADP). Preparations are being made to initiate the irrigation operational phase.

This progress evaluation (project monitoring event) was scheduled during the transition of project activities from construction to system operations in order to assess the completeness of the physical system including pumping plant, canals, laterals, control structures, interceptor channels, drains, roads and all appurtenant work as detailed in the 1979 evaluation and, more specifically to evaluate:

1. The quality of initial irrigation service including overall system operation and on-farm water management.

2. The status of interim system management arrangements including operation budget, water fee collection and the pump power cost subsidy;

3. The status of farmers organizations against that planned and its potential for assuming increased system management, operation and maintenance activities; and

4. Status of related institutional and agricultural support activities especially land tenure improvement, paddy production, credit, and marketing required to meet the project purpose.

The evaluation team leader was Dr. A. Alvin Bishop. Dr. Rodolfo C. Undan took the lead in assessing the organizational and institutional aspects of the project. Other joint team members included Francis Vargas and Fernando Alsisto, Jr. of the BRBDPO as well as Adrian K. Long, Thomas Hobgood and Cesar Umali. The latter three constituted USAID's input. Considerable help and assistance were provided by officials and staff of the Bicol River Basin Development Program Office (BRBDPO); the officers and staff of the National Irrigation Administration (NIA) located in Libmanan, Naga and Manila; USAID Project Officer David A. Heesen and USAID Engineers Ralph Bird and Oscar Bermillo. The report is based on data collected and evaluated from numerous meetings and conversations with farmers, LCISC* officers and members, and personnel of NIA-LCIADP, BRBDPO, Ministry of Agriculture (MA), Ministry of Agrarian Reform (MAR), Rural Bank of Libmanan, and USAID; a number of field inspections; and the review of project-related papers, documents and reports.

The team wishes to thank all those who contributed in assembling the many sources of information and assisted with the "pulling together" and typing of the evaluation report. Without such unselfish help the job would have been difficult instead of a pleasant assignment.

* Libmanan Cabusao Irrigators Service Cooperative, Inc.

INTRODUCTION

TABLE OF CONTENTS

LIST OF ACRONYMS

RECOMMENDATIONS

I	EVALUATION OF PHYSICAL FACILITIES	1
	Project Physical Status	1
	General Cleaning	1
	Problem of Silt	1
	High Lands	3
	Drainage and Flood Protection	3
II	QUALITY OF INITIAL IRRIGATION SERVICE	5
	System Operations Plan	5
	Immediate Operations Arrangements (May 1981)	
	On-Farm Water Management	
	Operational Losses and Waste	
III	ASSESSMENT OF THE IRRIGATORS ORGANIZATION DEVELOPMENT	9
	Rationale for Organization	9
	History of Organizational Efforts	10
	Findings, Conclusions and Recommendations	13
IV	STATUS OF AGRICULTURAL SUPPORT SERVICES	19
	Land Reform for Organization	19
	Agricultural Credit	21
	Marketing	22
	IRRI-NIA-BRBDP Water Management Applied Research and Training Program	24
	Extension and On-Farm Training Activities	25

LIST OF ACRONYMS

ACA	Agricultural Credit Administration
ADC	Area Development Council
ADCC	Agricultural Development Coordinating Council
ADT	Area Development Team
AMC	Area Marketing Cooperative
ARBA	Agrarian Reform Beneficiaries Association
BAEx	Bureau of Agricultural Extension
BC&GS	Bureau of Coast & Geodetic Survey
BCOD	Bureau of Cooperative Development
BPI	Bureau of Plant Industry
BRBDP	Bicol River Basin Development Program
BRBDPO	Bicol River Basin Development Program Office
BS	Bureau of Soils
CB	Central Bank
CLSU	Central Luzon State University
CLT	Certificate of Land Transfer
CO	Community Organizer
EDF	Economic Development Foundation
ET	Evapotranspiration
GOP	Government of the Republic of the Philippines
GPM	Gallons per Minute
HDSIA	Handong System Irrigation Association
HP	Horsepower
IADD	Institutional and Agricultural Development Division
IAD	Integrated Area Development
IAP	Inter-Agency Personnel

ID	Irrigation District
IRD	Integrated Rural Development
IRRI	International Rice Research Institute
KWH	Kilowatt-Hour
LCIADP	Libmanan-Cabusao Integrated Area Development Project
LCISC	Libmanan-Cabusao Irrigators Service Cooperative, Inc.
MA	Ministry of Agriculture
MAR	Ministry of Agrarian Reform
MLGCD	Ministry of Local Government and Community Development
MRBL	Municipal Rural Bank of Libmanan
M99	Masagana 99
NFA	National Food Authority (formerly National Grains Authority)
NIA	National Irrigation Administration
NPC	National Power Corporation
O&M	Operation and Maintenance
OSP	Office of Special Projects
PBSIA	Puro-Batia System Irrigation Association
PMO	Project Management Office
PNB	Philippine National Bank
PP	Project Paper
RA	Rotational Area
SEC	Securities and Exchange Commission
SN	Samahang Nayon
TDH	Total Dynamic Head
USAID	United States Agency for International Development

RECOMMENDATIONS

1. The general cleaning of all canals, laterals and farm ditches should be carried forward to completion along the lines as suggested in the March 23, 1981 Memo of Long and Bishop. (Attachment 1 to this report)

2. The problem of silt in the tunnels, cut and cover sections and canals should be removed, and the conveyance structures restored to their design dimensions.

3. The recently identified high lands should receive design attention to include them in the service area utilizing relift pumps or re-alignment of laterals to serve them with irrigation water from the project system.

4. The main canal service road should be compacted, graded to slope away from the canal and regraveled to finish grade. Where necessary, interceptor ditches and cross drainage should be provided to minimize future erosion of the service road, consequently minimizing silting up of canals.

5. A study should be made and plans formulated to stabilize high slopes and all erodable areas along the main canal. Sprigging, sodding, reforesting or any other "greening" processes required should be done to minimize future bank erosion and silting up of canal beds.

6. Additional drainage outlets and appurtenant structures should be provided where necessary on protection dike No. 1 to minimize waterlogging along the northeast peripherial areas of the project area abutting the dike.

7. Borrow areas or areas adjacent to any of the project facilities which are a source of erodable material that could be transported into the project irrigation and drainage system, should be modified through levelling, diking, seeding or construction of controlled inlet channels to prevent blockage of the project facilities due to the deposition of sediments or fluvial materials.

8. All drainage structures discharging from the project area through the dikes or river banks should be equipped with flap or manually controlled gates to prevent flood waters from backflowing into the project area. It may be desirable to equip the existing flap gates with a means of manually opening and closing them according to the wishes of the local people, but dictated by the operational criteria or intended function of these facilities.

9. The service road through Libmanan to San Juan should be brought up to grade and finished. The elevation of the road between the northerly end of the new bridge and the interceptor drain located just upstream from the Puro-Batia pump should be checked. If it is determined to be lower than the service road from the bridge to Libmanan, it should be built up to at least the same elevation.

10. The road from San Jose past the NIA PMO office and Concepcion to the point where it intersects the river dike should also be built up to the same elevation as the other service road along the river.

11. In view of on-going work pertaining to flood protection in the proposed Naga/Calabanga Integrated Area Development situated across the Bicol River and the Baliwag/San Vicente IAD located up the Bicol River from the Libmanan/Cabusao IAD Project, first priority should be given to stages of construction with irrigation service to begin shortly (April, 1981). The GOP has a sizeable investment in this project and the protection of an existing system should take precedence over proposed projects.

12. Excavated material disposal areas, such as those adjacent to the main canal downstream from the cut and cover section, and borrow areas, such as the one located in the vicinity of Sta. 1+500 or 2+000 along the interceptor drain, should be improved. These areas should be smoothened, diked and provided with drainage ditches seeding and drainage inlets to prevent material eroded by heavy rains from being deposited into the main canal or interceptor drain. These inlets should be paved or installed with closed conduits to prevent erosion of the canal or drain banks.

13. The main interceptor channel appears to have numerous reaches that are not in compliance with the designed capacity. Farmers have constructed dikes and restrictive foot bridges and have disposed extraneous materials in the channel. These deficiencies should be removed or corrected to permit the channel to carry accumulated flood runoff without being retarded.

14. The service roads should all be graded to slope away from the canal as designed to minimize the down-bank erosive flow of water that originates from precipitation that falls on the road surfaces.

15. NIA operation of the pump and main canal facilities should continue as long as major problems exist or until operation and maintenance have been reduced to routine activities.

16. Close cooperation should be developed between the project and the IRRI personnel to obtain the most from the Applied Water Management Research and Training Project especially with regard to:

a. Water measurement
b. Rotation delivery
c. Water management criteria
d. Cultural practices
e. Drainage
f. Water losses
g. Salinity intrusion up the Libmaman River

17. Water measurement and recording of water delivery should be given high priority in project management and operation. Automatic water stage recorders should be installed on all Parshall flumes of the main canal and laterals.

18. Any future LCISC operations and maintenance personnel should be identified and employed on a contractual basis as soon as possible so they can be trained during the period NIA is operating the system.

19. Water management criteria specific to the system's design capability and farm requirements should be developed as soon as operating history will allow.

20. Operating history should be used to develop a manual of operations for the system which would be completed by the time LCISC takes over system operation.

21. The NIA Project Management Office should exert all efforts to make the system operate before this year's season in order to reduce the frustrations/disillusions of the farmer-beneficiaries about the project's delay and inability to provide water.

22. The agencies involved in the institutional and agricultural development component should immediately resolve differences and if necessary reorganize to help improve the image of this government project in the eyes of the beneficiaries. The revised implementation plan for the project's institutional and agricultural development component should be finalized with all due haste.

23. Phased turnover of the system to the farmer organization should be done gradually such that a shift from one phase to another will not be constrained by time, but will be a matter of judgment between the Project Management Office and the LCISC. The test run should not be restricted to one year but should provide ample time for correcting deficiencies in the system and training operational personnel of the LCISC. In line with the test run of the physical facilities there should also be a "test run" of the capability of the LCISC organization to manage the system at the rotation area level with guidance from project and interagency personnel. Companion training or refresher courses should be conducted during this period.

24. Membership in the organized LCISC should be compulsory for those actually using water as soon as water delivery is fully assured and the LCISC becomes the full operating entity. Peer group pressure and non-delivery of water to non-members may be employed to solicit membership.

25. Irrigation fees should be charged even during the systems' test run for those farmers who are, in the judgment of NIA and LCISC, receiving adequate water to support crop production. It is not advisable to charge additional irrigation fees to non-members because this action will not provide correct incentives for improved water management. Non-members should be given the chance to affiliate with LCISC as soon as the system becomes operational. Otherwise, if they persist in being uncooperative they should be cut off from receiving system service.

26. Immediate attention should be given to the resolution of the right-of-way problem involving a landowner who allegedly cut a newly constructed lateral canal. Resolution of the problem will prevent any unfortunate incident between the landowner and a good number of project beneficiaries when the system begins operation.

27. The responsibilities of each existing farmer organization or sub-grouping with respect to the farming needs of the beneficiaries should be clearly spelled out by concerned agencies and farmer-leaders to avoid confusion and duplication. The LCISC should be a single-purpose organization which will deal mainly with the efficient and equitable distribution of water while the other organizations should deal with the needed complementary support services such as farm management, input supplies, credit and marketing. Participating agencies, the LCISC, and other existing organizations should clarify their roles in the Project area with the aim of combining their efforts to ensure the availability of services to the farmers in a truly cooperative and integrated manner.

28. The Libmanan-Cabusao Irrigators Service Cooperative (LCISC) should be given adequate time to develop its capability to govern the system. It may take time for the organization to mature and fully manage and operate the system. The genuine and sustained support of involved agencies in the institutional and agricultural development will help enhance this process.

29. The LCISC in cooperation with the NIA should be actively involved not only in campaigning for membership, but also in the test run and de-bugging processes. Further, it has a role to play in identifying or engaging local people who will be trained in systems operation to fill future manpower needs.

30. The community organizers are playing a major role in eliciting the participation of the project beneficiaries. In addition, they should coordinate their activities with system operation personnel and inter-agency personnel working in the service area to help improve the flow of information and coordination among project actors.

31. Some problems associated with land tenure improvement should be reviewed to determine their extent and resolution, if necessary. Further training is recommended for agrarian reform beneficiaries regarding their rights and responsibilities. Increased production and income made possible by the project may be expected to enhance the capability of the farmers to repay obligations and reduce default. The Land Bank is encouraged to improve their collection procedures.

32. With respect to credit provisions, there should be close coordination among lending institutions to avoid double financing of individual farmers. A coordination mechanism should be established between the Project Management Office and the lending institutions to provide the latter with information on who will be initially served by the irrigation system and who should receive priority in credit. The Ministry of Agriculture and its Bureau of Cooperative Development should intensity their education of farmers with regards to credit policies of

lending institutions and proper use of credit. Policy guidance is needed from the national level regarding alternatives for farmers now needing production loans but "disqualified" from current institutional loan programs because of past due loans.

33. The Project Management Office should follow up and encourage plans of NFA to establish more buying stations/warehouses in the project area. Simplified procurement and payment procedures for farmers produce should be sought. The feasibility of putting up a Farmers' Marketing Cooperative to deal with post production and marketing problems should be studied.

34. A more concrete strategy for delivering institutional and agricultural support services is needed. The personnel needed to train farmers in the technical know-how of improved irrigated rice farming and on-farm water management practices must be in place, and well supervised. Attention should be focused on farmers who will receive and use irrigation water for the first time. Intense and effective extension work require provision of transportation facilities, like motorcycles, to government field personnel.

I. EVALUATION OF PHYSICAL FACILITIES

Although construction work is more than two years behind the Project Paper's implementation schedule and the GOP implementation plan, the physical facilities are now essentially complete. At the time of the August 1979 evaluation, the system was estimated to be 77% complete. The work listed for completion by the 1979 evaluation team has been accomplished with some modifications. In addition, extensive renovation or rebuilding of parts of the system damaged by storms and floods during the rainy seasons of 1979 and 1980 are also complete. Structures completed after the August 1979 project evaluation, both programmed and additional, are shown in Attachments 4 and 5. Additional structures that were recommended by the 1979 evaluation team were completed, while some of those programmed were deleted as actual field conditions dictated. Completed structures include the pumping station, a cut-and-cover section from Station 2+000 to Station 2+250 in the Main Canal and its 200-meter extension downstream, various canal structures, terminal facilities,1/ rehabilitation of storm-damaged canals, service roads, and canal structures. A new tunnel section from Station 1+005 to Station 1+660 in the Main Canal was constructed to replace a concrete-lined section which collapsed after a storm in 1980. This 655-meter tunnel was recommended by NIA Central Office after soils investigation by NIA showed that the collapse was caused by unstable soil conditions. The current construction status is summarized in Table 1.

Project Physical Status. At the initiation of the 1981 evaluation, an inspection was carried out jointly by Project Manager and members of the joint team over a part of the project on March 19 and 20. This inspection revealed a number of problems and deficiencies in the system. The inadequacy of the system to receive water prompted a memo by two members of the team suggesting procedures for Pre-Operational Inspection and Priming of the System (see Attachment 1).2/ The Project Manager was also concerned and submitted a list of problems for possible solution or assistance (see Attachment 2).

General Cleaning. Although the system has not been used since it was built, to the casual observer it has the appearance of an "old" and neglected system. Rains and floods over the period since different sections were constructed have eroded the canal banks of some parts of the system to the point that the design operational cross-sections and freeboards do not exist. Vegetation has overgrown the channels to the extent that water conveyance will be seriously impaired. It is expected that this situation will change quickly, especially at the farm level, as soon as water delivery is apparent to the farmers. The main canal and laterals will also be cleaned and renovated during system priming of each lateral, sub-lateral and main farm ditch.

Problem of Silt. As indicated in Attachment 2, a major unsolved problem is the removal of the deep silt deposits in the cut and cover sections of the main canal. All silt removal plans proposed are expensive except removal by the erosive forces of the flowing water during operation. This method cannot be tested until water is placed in the system. A number of alternative plans

1/ Approximately 11% are yet to be built. Locations will be firmed up and construction completed once the system is primed. This is normal practice.

2/ Recommendations of the evaluation team appear throughout the text and attachments. In Sections III and IV of the report, they are clearly indicated by special headings.

Table 1

STATUS REPORT
as of March 1981
LCIADP Physical Facilities

PROJECT TITLE / COMPONENTS	ESTIMATED QUANTITIES	STATUS			TOTAL % ACCOMPLISHMENT
		ON-GOING	COMPLETED	NOT YET STARTED	
I. PHYSICAL CONTRUCTION WORK					
A. Main Canal					
1. Cut and cover	0.523 kms	-	0.523	-	100.00
2. Deep cut sect.	0.500 kms	-	0.500	-	100.00
3. Cut & Cover Ext. (Add'l. work)	675 cu.m. Class"A" concrete	-	440.19	*234.81	100.00
4. Concrete lining (Add'l. work)	310 cu.m.	-	-	*310.00	
5. Tunnel	0.037 kms	-	0.0395	-	100.00
6. Open Canals	11.536 kms	-	11.536	-	100.00
7. Structures	27 units	-	40**	-	100.00
8. Service roads	12.596 kms	-	12.596	-	100.00
9. Add'l. covered canal	715.000 kms	-	715.000	-	100.00
B. Interceptor Channel					
1. Canals	6.855 kms	-	6.855	-	100.00
2. Structures	22 units	-	14	* 8	100.00
C. Lateral drains and natural drains					
1. Canals	48.800 kms	-	48.800	-	100.00
2. Structures	160 units	-	163 **	-	100.00
D. Laterals and Sub-laterals					
1. Canals	40.152 kms	-	38.612	* 1.540	100.00
2. Service roads	35.512 kms	-	30.902**	* 5.408	100.00
3. Structures	92 units	-	130 **	-	100.00
E. Protection Dikes					
1. Protection dike No. 1	6.561 kms	-	6.561	-	100.00
2. Protection Dike No. 2	10.080 kms	-	8.700	1.380	94.51
3. Structures	14 units	-	20 **	-	100.00
F. Terminal Facilities					
1. Ditches	332.979 kms	-	305.48	27.499	97.00
2. Structures	739 units	-	433	306	58.59
G. Trash Rock & Other Safety Features (Add'l. Work)	1,500 kgs RSB	-	1,500 kgs RSB	-	100.00
H. Project Facilities	15 units	-	15	-	100.00
I. Pumping Station	Lump Sum (₱)	-	-	-	100.00
J. Pre-Const. Work & ROW Damages	Lump Sum (₱)	-	-	-	99.87
K. Contractual Supervision	Lump Sum (₱)	-	-	-	100.00
L. Procurement by Government	Lump Sum (₱)	-	-	-	100.00

* Deleted
** Including additional/extension

have been suggested that may be less costly than dewatering the sections and literally mining out the silt deposits. Nevertheless, desilting the cut-and-cover sections will ultimately be required in order to deliver the project water requirements.

High Lands. A major deficiency has recently come to light regarding the ability of the system to deliver water to all lands within the project boundaries. Apparently there are approximately 500 hectares of land that have recently been indicated as too high to receive water from the canals as now constructed. Since this represents 1/8 of the identified service area, or 1/2 the discharge of one pump at the pump station, it raises some undesirable operation alternatives, including intermittent running of one or more pumps to reduce the total water pumped and also the power consumed. Because of this, it is recommended that all such major areas should be positively identified as soon as possible and plans made to irrigate them with project water utilizing low head relift pumps, if feasible. The 500 hectares of land are reflected in the fact that 15 of the planned 129 rotational blocks are yet to be identified.

Failure to serve the 500 hectares would increase unit costs to all other areas under the project. The servicing of these lands was originally planned and the capacity of the pumping station and canals was designed accordingly. If it is feasible to include these lands with low head relift pumps, it seems logical that they should be designed and operated by the project. The capital and operating costs of these relift pumps should be part of the project cost, and farmers on these higher lands should also pay the prevailing LCIADP project water charges. Additional NIA/USAID analysis is provided (see Attachment 3) to assist GOP decision makers.

Drainage and Flood Protection. Preproject conditions in the Libmanan-Cabusao area during the wet season included frequent flooding by runoff from the watershed situated northwesterly toward Sipocot. Additionally, during typhoon flood stages, water from the Libmanan and Bicol Rivers and from San Miguel Bay would flow into the project area through the numerous creeks and natural drainage channels which normally discharged into these rivers and the bay. These conditions resulted in aggravated drainage conditions in a substantial area of the project, especially where elevation is less than 2.0 meters above mean sea level.

To help alleviate these flooding and drainage problems, a low level dike, having a maximum top elevation of about 2.5 meters above mean sea level, was constructed along with improved internal drainage channels and new outlets to the river or bay. These drainage channels were to be equipped with flap gates which would close when the water level in the river or bay rose higher than the water level in the drainage channels as a result of tidal action or low to medium flood levels.

The dike was to have been constructed along the northern and eastern sides of the project, adjacent to the San Miguel Bay and the Bicol River, respectively. It was to tie into an improved road from San Jose to the western end of the dike located southwest of Barrio Concepcion. This tie-in and the improved road network have not been completed. It is recommended that the road be built and residents in the Concepcion-Umalo-Cuyapi area be encouraged to use the road and dike as a means of access into that area.

Two interceptor channels were constructed along the toe of the watershed area situated northwest of the project. These discharge into the Libmanan River near Puro-Batia and into San Miguel Bay at Barceloneta. The discharge ends of these two interceptor channels were to have been controlled by flap-gated structures.

The project drainage system was designed to handle water that falls within the area during typhoons but not the added water that can enter the project area through uncontrolled creeks, channels and over-bank flow from the Bicol and Libmanan Rivers.

Since the construction of the interceptor channels, drainage system, improved natural drainage channels and creeks, together with flap gate control structures, some adverse developments have occurred. Some flap gates have become silted in a closed position, preventing drainage water from discharging into San Miguel Bay. Possibly these structures were installed at too low an elevation. The outlet ends of most of the drainage channels discharging into San Miguel have also been partially blocked by the build-up of sand bars across the mouths of these channels due to the littoral drift and tidal action on the beach sands at these points.

In most other instances involving flap gates, they have been propped open using bamboo poles to hold the gate open at all times. This action defeats the purpose for which the gates were installed. The gates very likely remain in this position as floodwaters in the Bicol and Libmanan Rivers rise and then are allowed to flow up the rivers and into the project area.

It is impossible to recognize all of the areas that may have drainage deficiencies during the planning and construction phases of the project. These deficiencies will appear as the project is fully completed and enters the operational stage. Close observation should be made of all project areas, and it may prove necessary to modify or construct additional drainage facilities. Finally, some structures may be found to have insufficient capacity to discharge the generated outflow under project conditions. Farmers must be encouraged to cooperate in maintaining a viable irrigation system by adopting operating procedures pertaining to both the irrigation and drainage system and preventing unauthorized diversions and checking of the water in both systems. They must also be motivated to assist in the removal and prevention of the deposition of trash and debris.

As pointed out originally, the diking system was only designed to provide project protection for low to medium level floods. Plans are currently being made to provide higher level flood protection for the proposed Naga/Calabanga IAD located across the Bicol River, and the Baliwag/San Vicente IAD located up the Bicol River from the Libmanan Project.

In view of these developments, the Libmanan Project should receive first priority consideration for the same level of flood protection because project construction is nearing completion and irrigation service to the project lands is being initiated. The GOP has invested millions of pesos in this project, and this investment should be protected and not be jeopardized by "high level flood" protection for other proposed development areas which will aggravate "high level flood" effects on the Libmanan Project. The project

must be provided with comparable "high level flood" protection before or concurrently with these other areas. The flood situation for the entire lower Bicol River area should be evaluated and not just for site specific areas such as Naga/Calabanga, Baliwag/San Vicente or the Libmanan project areas. This evaluation should be completed before any work is done to control or alleviate flooding. Priorities should then be established, addressing those areas which have existing improvement on them first, and subsequently incorporating similar flood protection for the other areas as they are developed.

II. QUALITY OF INITIAL IRRIGATION SERVICE

Detailed evaluation of this item will require more project history. The facilities are in the initial testing state, and water deliveries, except incidental or inadvertent, have not been initiated. Based on operating histories of other projects in the Bicol area, it is expected that high quality service will develop with the maturing of the project. In this regard, it should be noted that the Project Paper targeted "maximum yields and maximum income" by 1981 or after the first year following the test run. This target was probably optimistic when the PP was developed, and it overlooked the fact that irrigation projects take time to mature,[3] 5 to 10 years or more depending upon the complexity of the system. Difficulty in bringing all land under cultivation, unforeseen operational problems and other factors all take time to resolve. Although this is a relatively small project, it will experience some growing pains. It would be optimistic to think that it might reach maturity five years after completion of the test run, and ten years would probably be more realistic. Because of the reliability of the water supply and the recognized need for good physical facilities, it is expected that a quality irrigation system will evolve with the mature project.

Systems Operations Plan. The team studied the "Manuals of Organization and Management Systems" for the Libmanan-Cabusao Irrigators Service Cooperative (LCISC). It was generally felt that a good start has been made. The various levels of operation and the needed personnel are identified and the jobs and responsibilities are outlined. However, only a general operational plan for the irrigation system was spelled out. Therefore, the initial operation of the canal system by the National Irrigation Administration (NIA) will have to follow the original design criteria and assumptions for the project with modifications as dictated by the actual performance of the system. This is logical for during the initial years the design assumptions and criteria will be tested, and this will provide information for future projects as well as for the betterment of this one. In addition, the performance of the system, as related to the design, will certainly show some deficiencies that should be corrected over time to improve its operations. An annual report of operations is undoubtedly planned. Such reports will be helpful in eventually formulating an operations manual for the Libmanan-Cabusao

3/ Maturity of an irrigation system in this context connotates a system in which the physical works are in place and all operational problems reduced to routine with a betterment program in operation for routine replacement of structures; a functional institution or organization for the management, operation and maintenance of the physical works exists, developed farming area with all lands fully farmed and cropped to potential has been established; and input services including fertilizer, seeds, credit extension, etc., are available to farmers.

Integrated Area Development Project (LCIADP). The annual reports should be as complete as possible and provide details of the following which are each described in more detail below:

a. Records of water delivery
b. Area farmed/Crop Yield Report
c. Pump operations
d. Maintenance and Betterment
e. Drainage and Flood Protection
f. Income and Expenditure
g. Participation of LCISC
h. Recommendations for improving operations

a. Records of Water Delivery. Parshall flumes have been provided at the pump house and all major laterals with double orifice gates at the rotation block delivery points. If these measurement devices are used appropriately, they will constitute a very strong tool in ensuring high quality water management.

It is recommended that the Parshall flumes be equipped with automatic water stage recorders to obtain water measurement on a continuous basis at these points. Such records will be extremely valuable in making canal and lateral hydrographs for determining water losses and delivery efficiency. They will also provide operating information regarding travel time of the water and other operation characteristics of the system. Records of delivery from the double orifice gates will provide delivery records to the rotation blocks which can be used in determining on-farm efficiencies. To do this, records should be kept of the amount and time of delivery of water to each farm.

Ideally, on a pumped system such as this, water charges should be based on the cubic meters used and this is only possible if the water deliveries are carefully measured and the delivery to each farm is recorded. Good, reliable data on the timing and amount of water delivered at various points throughout the system will make it possible to improve the management of the system and provide equitable distribution of water to all users. Without firm data, losses cannot be identified and the designing of betterment programs for water use will be difficult if not impossible.

b. Area Farmed and Crop Yield Report. Area cropped and yields should be measured and reported on a farm basis by rotational blocks for both wet and dry seasons. The area served will be essential for determining water requirements, and yield information will be an important element in determining the success of the project. Crop area and yield data along with water records will be needed to determine crop water requirements and where efficiencies and on-farm water management can be improved. The adequacy and timing of water deliveries in the field have important impact on farming operations such as land preparation and transplanting.

c. Pump Operations. The pump superintendent or maintenance and equipment chief should keep a record of the operating time of each pump along with operating head, the KWH consumed and water delivered. Similar records should be obtained for any other possible relift pumps that might be operated by NIA or LCISC. River water levels should be recorded several times each day to determine tidal effects, if any. If the "zero points" of the river staff gage and

the staff gage in the main canal are tied to the BC&GS level network, and both gages are read simultaneously several times during each operational period, the operational head can be determined directly. These records can be used to determine best pump operation times for maximum yield per KWH. These records will provide the data needed to determine pump efficiencies and in predicting any possible problems or needed repairs. Since the pump operations will be one of the major costs, such records will be essential.

Relatedly, NIA has had discussions with the National Power Corporation (NPC) and has sent a written request to the President's Office, asking that major pump irrigation projects like ICIADP be allowed to connect directly to the National Power Corporation grid. This may allow the system to draw power at a subsidized rate, reducing farm irrigation fees.

d. Maintenance and Betterment. Records of maintenance work performed throughout the system should be kept. Both general maintenance such as canal cleaning and minor repairs, and emergency work such as structure or canal bank failure should be recorded along with associated costs. In this way, the deficiencies and potential weaknesses of the system can be determined and a betterment program designed. The betterment work designed and built each year should also be reported along with work programmed for future construction. All these activities can be identified on color-coded project maps.

e. Drainage and Flood Protection. A section of the annual report should be devoted to the performance of the drains and protective structures. The condition of the protective dikes and needed repairs should be noted. The operation of the tidal control gates and any problems related thereto should be reported. The times and duration of flooding and the problems of excessive water in the project area need to be recorded so that protective devices and structures can be improved or augmented and damage minimized.

f. Income and Expenditures. The need for good cost accounting is self-evident. Careful fiscal records are an integral part of any operating system and are essential for both operations and planning.

g. Participation of ICISC and Farmer Groups. A general report should be made of all farmers' meetings held regarding the project. All ICISC directors' meetings, the general assembly and special meetings as may be called for training of farmers should be reported. The recommendations, farmer reactions and other important information stemming from these meetings should be reported in detail and incorporated into future planning and operations. Good relationships with the water users is imperative in obtaining their cooperation in the care and protection of all facilities.

h. Recommendations for improving operations. Perhaps the most important part of every annual report is the summary of the problems encountered in the operation for the year and the discussion of how problems were resolved and recommendations for alleviating unresolved problems and improving the operations for the years ahead. The recommendations should include those items pertinent to the physical operations as well as changes and improvements in scheduling deliveries of water, maintenance, renovations or assessments that will better meet the needs and requirements of the farmers using the water.

Immediate Operations Arrangements (May 1981). Without any operating history up to this time, those involved in the design and construction of the project are the best informed about the physical system. They are probably the best qualified to initiate water deliveries and operate the project in the next few years, working side by side with those being trained to take over the specific jobs involved. Specifically, the Project Manager and a number of his staff should be charged with the management, operation, and maintenance of the system for the immediate future. As operating history is accumulated, it will be possible to develop a manual of "Operation and Management" specifically oriented to the Libmanan Project. Detailed job descriptions applicable to this specific project can be developed for all project personnel to aid in orienting the replacement staff and generally upgrading the efficiency of operations.

On-Farm Water Management. The general water level requirements for different growth stages have been presented in the LCISC Manual. However, the detailed On-Farm Water Management Guide will require some operating history before it can be developed for the project. Obviously, it must cover details such as the timing and water quantities to be provided at the farm turnouts for various stages of the farming operations, i.e., land soaking, land preparation, seeding or transplanting, growing and maturing the crop. The method of delivery should also be established. That is, whether rotation will be up the lateral beginning with the farmer at the distal end, or down the lateral beginning with the farmer nearest the turnout, or if continuous flow will be allowed. Other factors should also be established. For example, the freeboard allowance to be maintained in each paddy in order to effectively harness the rainfall during the rainy season without wasting either pumped water or rainfall; the water delivery or rotation schedule necessary to maintain standing water in the paddy without developing "stress days;" definitions of water waste, operational losses, paddy percolation, canal seepage and other terms; specific quantification of all water use factors for the project including evapotranspiration, percolation, seepage, runoff, drainage coefficient, etc.

Water Management

The NIA-IRRI-BRBDP "Applied/Research and Training Project at LCIADP" now being negotiated should be of considerable value in developing and improving the on-farm water management of the project. The technical competence and prestige of IRRI, together with the strengths of NIA, will help in establishing good water measurement practices and developing criteria for water management and optimum production. If all components of the IRRI/NIA research plan are implemented, the LCISC and the farmers of LCIADP will have first-hand information specific to their area to use in improving water management and rice production. For example, in the water supply component, it is planned to obtain information regarding the hydrology of the river, the water pumped, water delivered, water distribution efficiency, seepage, percolation, soil water quality, water shortages, water excesses, climatological factors, yield-water factors and conduct production trials. It can be seen that this component will complement and amplify the project operating data collected and reported annually.

Operational Losses and Wastes. On a project such as the LCIADP where the land surface is low and water table is high and both are at or near sea level, the paddy percolation and seepage from canals will be near zero. If the water table is at the ground surface, as it will be over most of the project area, theoretically there can be no percolation from the paddy for there is no

hydraulic gradient and no place for the water to go. The paddy lands around the boundary of the project may have some percolation loss where a difference in water surface exists between the paddy and the water surface in the rivers or drains forming the boundary. Under these conditions, the small difference in water surface elevation results in a very small or near zero hydraulic gradient indicating only a limited possibility for percolation losses. A similar situation exists for the canal seepage. The small difference in elevation between the canal water surface and the water elevation of the adjacent paddies indicates that canal and lateral seepage will necessarily be low because there is only a small hydraulic gradient causing seepage. The unique and site specific conditions of ICIADP indicate that any water pumped in excess of the evapotranspiration (ET) of the project area should be considered as operation waste. This will show as surface runoff and can be noted if the area is carefully patrolled. In effect, surface runoff or ET is the only way water can escape from this project. Determining the source and amount of surface runoff is a phase of water management which can be important in reducing the pumping demands and total pumping costs. It is possible that the crop requirement of the entire project can be supplied by the operation of three pumps, leaving the fourth as standby equipment. A well maintained water distribution system operated in an efficient manner could make such conditions possible.

III. ASSESSMENT OF THE IRRIGATORS ORGANIZATION DEVELOPMENT

Rationale for Organization. It is envisioned that to fully attain the objectives of the project, the physical infrastructure development was to be complemented with four institutional and agricultural development component programs, namely: compact farm and extension service development; organization of an irrigators association; acceleration of governmental land tenure improvement program; and applied agricultural research and demonstration. All these were designed to help efficiently utilize and manage the project's physical facilities. Obviously, the activities were geared towards the development and upliftment of the primary target beneficiaries - the farmers - in a fashion that required good orchestration of effort, and participation of government line agencies, local leaders and the farmers themselves.

Like the other components, the organization of the irrigators association, as indicated in the Project Paper, was to be started one year after the initiation of the construction of irrigation and drainage facilities. The members and staff of the association were to be trained and prepared to take over the system after the construction and test run had been conducted satisfactorily by the NIA. Compact farm units were to be grouped to form rotational areas and these, in turn, were to be combined to form irrigation districts. Each district was to be represented on a Board of Directors whose composition eventually will become officers of the area-wide irrigation association. The association was to have its own charter and was to register with the Securities and Exchange Commission (SEC).

History of Organizational Efforts

a. Organization of the Institutional and Agricultural Development Division. From the beginning, NIA has been the recognized lead implementing and executing agency assigned the primary responsibility in the management of LCIADP. Early in the implementation stage of the project, the direct supervision of LCIADP was transferred from the NIA Region V Office in Bicol to the NIA Central Office in Manila. Prior to this event, initial steps were taken by the regional agencies to set up an institutional and agricultural development core staff comprised of interagency personnel (IAP), to integrate the activities of involved agencies dealing with the farmers.

The NIA Central Office in Manila then contracted Economic Development Foundation (EDF) to do some of the institutional work. This happened prior to consulting the involved agencies in the region. Not surprisingly, this appeared to project interagency participants to be inconsistent with the creation of an interagency task force at the project level. Then the delay in the release of incentive allowances for the IAP members, occasioned by some personality conflicts dampened full participation of other agency technicians in project institutional and agricultural development activities. Perhaps most significantly, the costly delay and slippage in project infrastructure construction had much to do with the slow progress and the low priority given to the development of the institutional and agricultural component. Matters were further confused with the introduction of an Agricultural Development Coordinating Council (ADCC), NIA's project level body concerned with interagency coordination, which duplicated the functions of the Area Development Team/Area Development Council (ADT/ADC) of the BRBDP. These and other factors resulted in weakening interagency participation and the erosion of relationships among the IAP of the institutional and agricultural development staff.

b. Contracting the Services of the EDF. In September 1977, the services of the Economic Development Foundation (EDF) were contracted by NIA for two years to help in the organization of irrigators' association in the LCIADP service area. Specifically, the activities of EDF during the contract period revolved around the following:

1) Organization of farmers

   a) consultation surveys/meetings

   b) information and promotional meetings

   c) pre-membership meetings

   d) organization of Rotation Areas

   e) organization of Irrigation Districts

2) Installation of systems and procedures

   a) consultation surveys/meetings

   b) de-bugging

3) Implementation of training program

a) consultation surveys/meetings

b) membership training program

Module 1 - Training on Cooperatives

Module 2 - Farm Management

Module 3 - Water Management

c) Management training

The employment of EDF to carry out the above work was apparently based on the premise that the project level interagency team could not be mobilized and the required task could not be completed on schedule (Evaluation Report, 1979). At the project level, EDF's duties were viewed as overlapping with the role and responsibility of the interagency personnel.

Reports indicate that EDF managed to organize 128 rotation areas and 7 irrigation districts. The apex organization called the Libmanan/Cabusao Irrigators Service Cooperative, Inc. (LCISC) was formed and was later registered in accordance with basic legal requirements. Training was also conducted with the support and participation of the IAP. The Manual of Organization and Management Systems was developed to serve as the basic framework from which the operational and administrative system of the LCISC would evolve. The LCISC has remained dormant up to this time because the system has not yet been put into operation.

c. The LCISC Formation. In January 1980, the Libmanan/Cabusao Irrigators Service Cooperative, Inc. was reportedly incorporated and registered with the Bureau of Cooperative Development with an initial membership of 150. The latest count on paid members was 704 out of the 2300 farmer-beneficiaries expected to join the association. Efforts are being made to increase membership in preparation for the operation of the system. Irrigation District Directors have been elected and the area-wide officers have been selected. However, its rank and file have remained passive in the past months because of the long delay in the completion of project construction.

The LCISC is an area-wide organization of farmer-beneficiaries in the Libmanan/Cabusao area and was established primarily for the purpose of operating and managing the system in a cooperative manner. Farmer members of LCISC are said to be constituted into 128 Rotation Area (RA) and 7 Irrigation Districts (ID).

The RA is the first level in the organization structure. It is composed of farmer members within a well defined area of about 25-50 has. which is served by one turnout. It is constituted as a vehicle for effective and efficient water use and management at its level, as a means of ensuring farmer participation and representation in the affairs of the cooperative, and as a channel of information and communication. The RA may also serve as compact farm units dealing with other common needs such as securing credit, agricultural supplies, marketing and extension. However, this is a secondary

function that may be executed with difficulty or without the help of concerned agencies and technicians. Each RA has an elected leader, who will be responsible for the distribution of water released by the ditch tender from the turnout to the individual farm lots in the area. He will be assisted by a secretary-treasurer and an appointed farmer-leader if necessary.

The ID is the second level in the LCISC organization. It is composed of a number of RAs within a geographical subdivision of the irrigation service area. It is constituted mainly to serve as the coordinating mechanism within its area coverage.

At the district level, the ID officials will consist of an irrigation district director assisted by an ID secretary-treasurer and elected RA leaders within the district coverage. In water distribution, the district director will coordinate within the water management technician in the allocation of irrigation water to the different turnouts in his district.

d. Role of Community Organizers. As the EDF terminated their services with the LCIADP, the PMO's Institutional and Agricultural Development Division (IADD) fielded trained community organizers (CO's) to pursue and assist further the development of an irrigators organization. To the extent possible, they have adopted the "participatory approach," quite different from that of the EDF, in eliciting the cooperation of the target clientele. In this approach, the participation of the client community is sought in developing their own capabilities. This calls for joint responsibilities of the beneficiaries and the proponent agency in the design, decision-making, implementation, and evaluation process of the project. The farmer-irrigators were baffled at first by this approach, but the CO's felt that the farmers have started to realize the importance of their participation especially in those existing communal irrigation systems (Handong and Puro-Batia) which were being used as pilot projects of LCIADP.

Through the CO's, the information campaign for gradual turnover and increased membership in LCISC has been carried out. The farmers were encouraged to involve themselves in group decisions and actions like making resolutions for fuel and oil for their pump and contracting "takay" work in their RAs. Problems and issues are threshed out together and consultations have been more close than before. While delay in the completion of physical facilities of the system remains a major problem, the CO's are playing a major role in enhancing the credibility between the project and its intended beneficiaries. Recently, the move of streamlining the IADD organization setup and implementing guidelines further bolstered the significant role of the CO's in the next five years of project development. It only remains for them to work more closely with the water management technicians and field level interagency personnel when the project operates in order to maintain their effectiveness.

e. LCIADP Five-Year Agricultural Development Program. Following the standard operating policies of the NIA, the LCIADP was required to prepare a five-year institutional and agricultural development plan which will be implemented as soon as the operation of the system has begun. The first attempt to prepare this plan was in July-August of 1979 when a series of workshops

with participating agencies and farmer organization leaders were held in anticipation of the start of system operation in mid-1980. This initiative did not result in a concrete implementation plan. The implied reasons for setting aside the tentative plan were the inability of the physical facilities to operate in 1980 and emerging conflicts among participating agencies at various levels. Accordingly, the PMO's IADD began finalizing the plan and soliciting inputs from the other line agencies. To date all the needed inputs have not yet been received, and the plan has not been finalized and ratified by the agencies concerned. There may be some valid reasons for the other agencies' attitude of not responding. These are implied in a recent position paper prepared by the Region V Ministry of Agriculture Office.[4] Perhaps the problem can best be solved at a higher level where interested parties could sit together, define differences and move towards resolutions with the attainment of a common project objective given preferential weight. This problem seems to be given attention now at the regional level through the BRBDP office. Resolution of outstanding problems is important if the government is to attain an improved image in the eyes of the beneficiaries and if these farmers are to start reaping long awaited project benefits.

Findings, Conclusions and Recommendations

a. Project Turnover to Farmer Organization. As indicated in the project implementation plan and schedule, the operation and maintenance of the system--including provision for repayment of construction costs--will be turned over to a fully organized and properly chartered irrigators association. The LCISC was the irrigators association to be charged with these responsibilities.

In late 1979 the association, through its representatives, proposed basic conditions which it felt must be met prior to any turnover. Most important among these conditions were the following:

1) all necessary irrigation components be installed and constructed for effective and functional water management;

2) scheduled test run, de-bugging of the irrigation components and necessary rehabilitation of the physical structures;

3) parcellary maps of entire service area be completed, confirmed and verified correct by farmer-members before initial water is delivered;

4) farmer representatives be allowed to look into the financial records of expenditures incurred in the installation and construction of the project;

5) farmer-beneficiaries be consulted/informed on areas which can and cannot be irrigated by the system during wet and dry season;

6) that an agreed task/function for both parties (NIA and the LCISC) be drawn.

4/ A proposal of Ministry of Agriculture Regional Director for the transfer of responsibility for implementation of the Institutional and Agricultural Development Component of the project from NIA to MA.

It was contemplated that NIA's proposed turnover scheme would be gradually accomplished over a period of three years beginning immediately after the test run was completed. The proposed schedule follows:

Irrigation Components	Assignment of Responsibilities		
	1st yr	2nd yr	3rd yr
Pumping plant	NIA	NIA	LCISC
Main canal/lateral & sub-lateral canals/drainage facilities	NIA	LCISC	LCISC
Rotation area level (turnouts and internal farm ditches)	LCISC	LCISC	LCISC

During the third year, maybe earlier or later depending upon the capability of the LCISC to manage, full responsibility of managing and operating the system may be given the LCISC.

The LCISC conditions and NIA's proposed phased turnover evidently did not come to terms. Negotiations are still attempting to strike an agreement acceptable to both parties concerned. In 1980, it was expected that the test run could start immediately at the beginning of the year's wet season cropping. Due to construction difficulties and the major collapse which occurred in the main canal in July 1980, work had to be extended (the open canal had to be changed into a cut-and-cover section) and water delivery had to be postponed for another year. This failure of the physical facilities to deliver water was sufficient to cause the farmers to be doubly doubtful of the operation of the system. There is now clear reluctance on the part of the irrigators organization to accept the system without being sure that the system will work and will, in fact, be fully operational.

Recommendations: The phased turnover appears to be the best solution but NIA should reconsider the time frame for its test run and turnover of the system. It would be beneficial for the test run not be limited to a one-year period in order to have ample time for correcting deficiencies in the system, training of operational personnel of the LCISC, and turning over a system that is fully operational, especially at the rotation area level. During the test run it is highly desirable to solicit the cooperation of the LCISC, without strings attached, except for payment of the regular irrigation fee. There should be a "test run" of the capability of the organization to manage the system at the rotation area level with guidance from the project interagency personnel. During this test period, the farmers' capability could also be enhanced by companion training or refresher courses on systems operation and responsibilities, as well as on water management and related farming activities.

b. Viability of LCISC. The viability of the organized irrigators service cooperative cannot be easily gaged because its capability has not really been tested. However, there are indications that there is much more to be desired in this organization especially in terms of membership and participation. While EDF reportedly organized a total of 128 rotational areas, it was noted that initial membership was only 107 when registered with the Bureau of

Cooperative Development (BCOD). To date, only 41 percent of the expected members have paid their dues.[5/] In the most recent three months (January to March 1981), a CO project coordinator reported only an increase of 5 among paid members. Most of the unregistered members were keeping a "wait and see" attitude. This complacency is a result of the long delay in the initiation of the operation of the irrigation system, exacerbated by the July 1980 collapse in the main canal and the numerous fee collection being made by different farmer organizations. Lately, however, there are indications of active participation on the part of the district officers including soliciting loans for fuel and oil in the functional pilot pump system, formulating proposal for water charges and increase in membership fee, and following the flow of water in the new canal during the recent priming operations.

As long as the irrigation system is not operational and the farmers have not seen any benefits for being a member of LCISC, the farmers will continue to resist paying membership fees and active involvement in the organization. The question of whether to make the membership of farmers in the cooperative voluntary or compulsory will come after the reliability and adequacy of water in the farm are ascertained.

Recommendation: The NIA should strive hard to put the system in operation this year in order to be able to observe the response of the organization with respect to its expected role. If water is adequate and reliable and benefits are realized, peer groups in the LCISC can pressure the other members to join in shouldering the responsibility of running the system. The viability of the LCISC can also be enhanced through (a) constant and sustained guidance from the CO's of NIA, (b) sustained agricultural support services from line agencies especially the MA, and (c) training of farmers and farmer-leaders not only on water management but also in organizational/financial management.

c. Irrigation Fee. In discussing this issue, several questions emerged. Is it appropriate to charge an irrigation fee when water is delivered during the test run period? If so, how much? Who will determine this amount? How about during the period of gradual turnover and thereafter? Is it appropriate to charge higher irrigation fees to non-members?

For a pump irrigation system under NIA's operation and maintenance, the policy is to collect an irrigation fee of 8 cav/ha/yr (3 cav for wet season and 5 cav for dry season). During the test run period, NIA seemed not certain whether it will charge any irrigation fee and whether or not it should use this standard NIA rate. Meantime the LCISC Board is proposing (based on initial deliberations) that members will pay 9½ cavans per hectare per year for irrigation fee (as initially proposed by NIA) and an additional 25 percent for non-members during the first 5 years of operation after the test run. In this arrangement, (LCISC should have been participating already in the operation as suggested on the cartoon-type campaign pamphlet used by the PMO's IADD) six cavans will be turned over to NIA and the rest will be retained by the Association for capital build up, i.e., replacement of pumps and accessories, and maintenance.

Recommendation: If the test run proceeds smoothly and results in a good crop harvest, NIA should charge the irrigation fee right at the beginning to those farmers benefiting from the system. Hence, it is important that the project field

5/ Based on the information provided by the community organizers of LCIADP.

personnel be able to identify those areas which were to a great extent served by the system so that fees can be collected. To help increase yield and, hence, fee collection in newly irrigated areas, agricultural extension workers should be more active in extending technical help to farmers in adopting new and improved cultural practices in rice production. Also, NIA should carefully study the irrigation fee rate and adjust it based on the latest costs of operating the project and the area actually served by the system.[6] It was already certain that some 466 hectares of the project (14 rotational areas) area cannot be irrigated until proposed relift pumps are installed. There may be other areas which can be identified during the test run as receiving inadequate or poor service from existing facilities. To cover these areas will entail additional costs and consequently require adjustments in the irrigation fee rates. The idea of putting additional levy to those who have not paid their fee may be beneficial to LCISC to some extent but this will not guarantee attraction of membership to the association. Rather, it may work against the basic objective of water management. The non-members who have paid greater dues will think that they should be privileged to use water without regards to efficiency. In this regard, it is suggested that non-members should be encouraged to join. If they persist in remaining non-members of LCISC, the organization should recommend that they be cut off from the system and not provided with water.

d. Right-of-way problem. The problem of right of way involving a landowner who cut the newly constructed lateral C canal and road thereby precluding possible irrigation activities in the downstream part of the system was raised as an issue by the 1979 Evaluation Team. It was reported that the case was brought to the court and was receiving attention from NIA legal staff. To date, the problem has remained unresolved. With construction nearing completion, there is talk of farmers resorting to group action by confronting the landowner and possibly taking the law into their own hands if only to assure the delivery of water to their lands.

Recommendations: The right-of-way problem should be resolved before any untoward incident concerning a good number of farmer-beneficiaries occurs. This is especially important because the system is expected to provide water within the next month or so. Appropriate authorities should be requested to intercede and facilitate an amicable settlement of the problem and pacify or guide the farmers to a better course of action. More importantly, the continuity of Lateral C has to be restored to make the water available in due time to a significant number of intended farmer-beneficiaries.

e. Preferred Farmers Organization. There are a number of farmers organizations in the area at present, and there are good reasons for farmers to be confused on what organization they will have to affiliate with and which group has the novel intention of alleviating their plights in farming. There are, for example, the Agrarian Reform Beneficiaries Association (ARBA) organized by the MAR, the Samahang Nayon (SN) of the MLGCD and MA, the LCISC of NIA-LCIADP, and many more. Farmers have observed that most organizations became inactive after fees have been collected, officers installed, and a few meetings have taken place. It was also noted that some farmers are members or leaders of two or more organizations. These organizations, differing in

[6] Attachment 3 provides an illustrative irrigation fee based upon the project's present cost structure.

personality and launched by different government agencies, have complementing objectives as well as overlapping concerns for the farmers. It is therefore not surprising that farmers are cold and indecisive in officially joining an organization like the LCISC. There is also the question of which organization should prevail, and if it is the LCISC, should it be installed as a single or multiple purpose organization. In this regard, NIA is committed to proceed in institutionalizing the system through the LCISC as a single purpose organization to be responsible for the operation and maintenance of the irrigation network.

The Samahang Nayon (SN) is the barangay level organization upon which the agricultural cooperative development program of the government is built, while the LCISC is a group of beneficiaries mainly formed to possibly operate and maintain the irrigation system. The latter has the very specific mandate to provide irrigation which does not duplicate or conflict with SN functions. The latter will be able to supplement the SN's basic function without interfering in its structure and objectives. With basic objectives and responsibilities clearly delineated, the two organizations should be able to exist and operate with harmony and mutual benefit.

Recommendation: Instead of competing individually with the farmers, the participating agencies should develop a practical and mutually accepted strategy which will benefit not only the implementors but their clientele as well. Interagency and personal conflicts should be minimized and immediately resolved through regular consultations. Leaders should be able to work well with others, accommodate suggestions, and most importantly give due regard and credit to partners, even if supportive, who are contributing through their integrated roles. Authority and responsibility should be clearly delineated and success or failures should be mutually shared. All steps should be taken to make the farmer less confused concerning organizations, eliminating those which serve no useful purpose. The LCISC should, at this stage, be charged only with the responsibility of partially or fully, depending on their capability, operating and maintaining the system and should not be burdened yet with other roles which will disperse its energies.

Clearly defined goals, functions and responsibilities should be redrawn by the agencies concerned to help accelerate the delivery of needed services to the target clientele.

f. Problems in Pilot Project. Two separate existing pump irrigation systems in the LCIADP area were adopted as pilot projects to serve as laboratories for testing the institutional and interagency approach in small existing pump systems. The two associations, now covered by two separate districts of the LCISC, are the Handong System Irrigators Association (HDSIA) and the Puro-Batia System Irrigators Association (PBSIA). The Handong pump system covers approximately 300 hectares while the Puro-Batia is around 200 hectares. For both systems the association was given the responsibility to operate the pump. The members of the Association pay 3 cav/ha. for wet season and 5 cav/ha. for dry season aside from the cost of fuel and oil in running the system. Latest reports indicate that irrigation fee repayment was very low at PBSIA but was encouraging at the HDSIA.

The systems, especially Puro-Batia, are reportedly plagued by problems of engine breakdown and inefficiency and, most recently, difficulties in

obtaining loans for fuel and oil. Other aggravating circumstances are the observed tendency of some farmers in the organization to go their own way. Examples include well-to-do farmers running the pump with their own oil and fuel to irrigate their own farms, other farmers using their own small pumps, and the lack of any definite cropping calendar (farms were observed to have crops at different stages) especially in the Puro-Batia area.

Another recent development was the confirmed information that only about one-fourth of the Puro-Batia's four rotational areas will be irrigated by the new system under the present facilities because of the difference in elevations. The present director of Irrigation District 7 covering Puro-Batia happened to be the reigning PBSIA president. Hence, the above information along with the inability of PBSIA to further obtain fuel and oil loan from NIA have prompted him to resign as District 7 director. Incidentally, he is also the elected president of the ARBA in Libmanan. Also, according to NIA, the PBSIA has not settled the past fuel-and-oil loan with them. Two factions of farmers in the district appear to be emerging and there was reported clamor in some sectors for reorganization in the district leadership.

Recommendation: NIA should be committed to cover the whole area of Puro-Batia under the new system. The scheme suggested earlier, i.e., using low lift pumps and reworking the elevation of the lateral canal serving the area, should be seriously considered. Rehabilitation of the old pump may be an alternative, but may not be cost effective. Whatever the case, any development or plan to irrigate Puro-Batia should be immediately transmitted to the farmers and farmer-leaders in this district to prevent further disorganization. A practical cropping calendar which will utilize available water resources should be developed and presented to this group of farmers for possible adoption once water is available.

IV. STATUS OF AGRICULTURAL SUPPORT SERVICES

Land Reform Activities. The implementation of the Agrarian Reform Program is being carried out by the personnel of the Ministry of Agrarian Reform (MAR) detailed in the Project area. The targeted activities were completed approximately two years ago. Table 2 indicates that to date, 1346 Certificates of Land Transfer (CLT) have been issued to 1,045 farmer-beneficiaries covering 2,080 hectares. This land formerly belonged to 117 land owners, 7 of which have been paid by the Land Bank. In addition, 632 farmers have been covered through written leasehold arrangements involving 739 hectares. Land disputes in the Project area appear to be minimal with only 3 cases presently being contested in the courts.

While the targets have been reached and the land reform program in the project area essentially completed, some problems should be reviewed to determine their extent and resolution, if necessary.

a. It is said that some CLT holders (estimates range from 2% to 10%)[7/] have in effect "mortgaged" their CLT rights to other farmers. This is the result of these farmers trying to meet their immediate cash needs with the low income they receive from their small and presently non-irrigated parcels.[8/] The practice may be considered illegal, but the chance for the Ministry to uncover such acts is small since both parties concerned may not admit to the act.

b. More than one-half of the CLT holders are not paying their amortization payments to the Land Bank. Theoretically, if continued this could result in a cancellation of their CLT rights. The inability to pay is attributed largely to low yield or crop failure as a result of floods and typhoons, lack of water, pests and/or inadequate input supplies. Those who are in a position to pay, and did not, complain about the inaccessibility of the Land Bank office.

c. It was reported to the evaluation team that some farmers, although CLT holders, may still operate under a tenant-landlord relationship through informal arrangements. In addition, some farmers are said to still be tenants either by choice or because they do not understand the benefits or the mechanics of the program. This is not considered a major problem and its existence could be very minimal.

d. It was also reported that some CLT holders have been ejected by landowners. Such cases, if any, are very few and may go unreported because the CLT holders are afraid to report the incident or because they are unaware of their rights. However, if reported to the local MAR office, steps are taken to ensure fairness to the parties concerned.

7/ Information coming from various sources; lower figure was provided by the MAR.

8/ Formal transfer is not allowable by regulation. However for financial and in some cases, management purposes, the land may be informally, but effectively, sold or mortgaged.

Table 2. Tenure Status of Farmer Operators
March 15, 1981

TENURE STATUS	
Leasees	632
Amortizing owners	1,045
Owner-operators	209
T O T A L	1,886
AGGREGATE LAND HOLDINGS (HAS)	
Leasees	739
Amortizing owners	2,080
Owner-operators	931
T O T A L	3,750
CLTS Issued	1,346
Area (HAS)	2,080

SOURCE: MAR Field Team Office, Libmanan.

e. As pointed out in the June 1979 evaluation, there are several large land holdings effectively controlled by a small number of farmers in the project area. These holdings apparently were not covered by current government land reform policies. Still, the evaluation team feels their existence in the project area should be noted.

Recommendation: Some of the problems identified above, such as selling or mortgaging of CLT rights and non-payment of amortizations are due in part to the low-income the farmers receive from their presently non-irrigated land. Project management should make every possible effort to get the irrigation system operating before the situation deteriorates further. All of the problems identified above should be reviewed to determine their extent and possible solutions. Finally, farmers should continue to be educated and trained regarding their rights and responsibilities under the Agrarian Reform Program.

Agricultural Credit. Presently, production credit for rice in the area is obtained primarily from the Municipal Rural Bank of Libmanan (MRBL), the Philippine National Bank (PNB) in Naga and Sipocot, the Agricultural Credit Administration (ACA) in Naga, and from various private sources. During the 1980 wet season, ACA extended ₱55,230 to 34 farmers in the pilot Handong Pump Irrigation System covering approximately 41 hectares. At the same time PNB extended ₱519,600 to 433 farmers or 520 hectares throughout the project area, and the MRBL extended ₱925,380 to 354 farmers farming 685 hectares. Loan repayments for the 1980 wet season were quite low, primarily due to numerous typhoons which passed through the area and related flooding. ACA was able to collect 56 percent of its loans, PNB only 25 percent and the MRBL collected only 41 percent of the total amount loaned to farmers during the 1980 wet season.

Despite these setbacks, both the PNB and MRBL appear willing to accelerate their loan activities to qualified farmers when the irrigation system becomes operational. In addition, the Rural Bank of Cabusao will apply to the Central Bank of the Philippines for accreditation under the Masagana 99 production credit program when the system is operational. The MRBL appears to be especially active. For example, anticipating that the irrigation system would be operational this past dry season the bank released some ₱1,745,006 to farmers in the project area representing almost a 100 percent increase in the amount extended for rice production. Due to the collapse of the main canal, however, the system did not operate and the Bank is now worried about its collections. The MRBL has a loan portfolio of ₱10.4 million and is willing to extend as many loans as necessary to qualified borrowers once the system delivers water. However, the bank no longer accepts loan application under the compact farm or selda system of group financing. It requires individual borrowers to post some form of collateral, i.e., lot, carabao, hand tractor, etc. or in some cases will accept the consignment of the expected production as collateral. In the absence of collateral, the bank will accept a co-maker for the loan. The bank has a tie-up with a chemical dealer in Manila and all releases are made in-kind. It does not charge a mark-up for handling of fertilizers and chemicals because they believe providing the service and being able to release the loan in-kind rather than in cash will improve collections.

There is the possibility of banks extending credit utilizing the Samahang Nayon (SN) structure. In discussions with the Ministry of Agriculture, they believe it is well worth testing extension of production credit to SN members with a guarantee offered by the respective SN. The MA's Bureau of Cooperatives Development has developed some expertise in group lending (with the loan specifically being in the name and responsibility of the SN), although thus far the program has concentrated on longer term infrastructure loans for light farm equipment and low-cost multi-purpose bodegas. Much of the research and pilot testing has been and is being performed in Libmanan.

A major constraint to extending production credit to farmers in the project area is that many farmers, perhaps more than 50%, have past due loans from the early stages of the M99 Program. These loans are mostly with PNB and were extended to farmers on non-irrigated lands with little supervision. The MRBL has transferred some of these loans from PNB and restructured them, but this represents only a very small percentage of those farmers with past due loans.

Recommendations: To avoid any further misunderstandings by lending institutions in what project management plans to do in the area, a mechanism for coordinating production financing should be established. Since not all areas will be irrigated when the system begins operation, coordination becomes even more important. To avoid double financing of individual farmers or new lending to farmers not willing to restructure debts to other banks, there should also be close coordination among lending institutions in the area. Farmers should be educated regarding proper use of credit and the credit policies of the various lending institutions by MA and its Bureau of Cooperatives Development. The possibility of credit lines coordinated through the SN may be pursued. Project Management in conjunction with MA should look into the coverage and cost to farmers under the new crop insurance program in case of natural calamities.[9/] Finally, there should be policy guidance from the national level regarding farmers who incurred past due loans during the early stages of the M99 Program, but now need new production loans.

Marketing. An estimated 170,000 cavans of rice are currently being produced in the Libmanan-Cabusao Project area annually. A rough estimate of annual production after the project is in operation (1983-85) is 455,000 cavans (3500 has. x 65 cavans x 2 crops = 455,000 cavans).

Table 3 indicates that there are 12 Cono mills registered in Libmanan with a capacity of 65 cavans per 12 hour period of operation. There are 11 warehouses, 3 leased by National Food Authority (NFA) and 8 owned by the private sector with a

9/ If the rice production loans are granted from a lending institution, 1.5% of the total is subtracted from the loan for the end-users premium; the lending institution pays 2% of the total, and the government pays 7.5% of the total. For all borrowers, this is mandatory. Non-borrower producers have the option of paying 3.5% of the insured amount, with the government (through the Philippine Crop Insurance Corp.) paying the remaining 7.5% of the insured amount.

Table 3: Processing and Storage Facilities LCIADP

	Number	Capacity (cav./12 hr.	Storage Capacity (Cav.)
Ricemills:			
Cono	12	760	
Kiskisan	53	3,054	
Warehousing	11		44,700
Threshers	12	3,600	
Dryers	10	400	

SOURCE: NFA Provincial Office
Pili, Camarines Sur

total storage capacity of 44,700 cavans. In addition, there are indications that the private sector is already responding as evidenced by two new rice mill/warehouses operations which have recently been constructed in the project area.

There are also some threshers and dryers available in the project area. There are 12 portable threshers registered with NFA with a capacity of 300 cavans per 12 hour operating period and 10 dryers owned by NFA. Due to the projected increase in production when the irrigation system become fully operational, the processing and storage facilities available at present will not be enough to cope with the needs of the farmers. The problem of drying palay will escalate especially during the wet season when solar drying on concrete pavements is quite impossible.

A related problem reported to the evaluation team is the "red tape" and consequent payment delays that farmers must deal with when they attempt to sell their produce to NFA When palay is taken to or held for NFA (assuming a large enough lot can be assembled), farmers must wait for moisture and purity tests to be performed which they do not understand. Moreover, they must wait up to two weeks before they are paid. Since farmers need cash immediately to take care of obligations, marketing their produce through NFA is not presently the most favorable alternative. Most farmers prefer to deal with private buyers.

Recommendations: NFA has indicated it plans to establish more warehouses in the project area. Project management should follow up on this and actively encourage NFA to pursue their plans. There should also be a discussion with NFA on how it could simplify its procurement procedures and expedite payment to farmers for their produce. Farmers should also be trained regarding the procurement procedures of NFA. Again, the SN can play a role as assembly point for NFA or other buyers. The marketing situation should be continuously monitored by Project Management. If the NFA and the private sector do not respond adequately, then a Farmers' Marketing Cooperative via the SN/AMC mechanism should be considered. A feasibility study of whether SNs should purchase dryers and threshers should also be undertaken.

IRRI-NIA-BRBDP Water Management Applied Research and Training Project. An applied water management research and training project is to be implemented in the LCIADP jointly by IRRI and NIA with grant financing support from USAID through the BRBDPO. USAID is providing the peso equivalent of $200,000 in grant fund over a period of two years and nine months running through September 1983. The counterpart funds from IRRI and NIA for the project are estimated to be $156,600 and $334,900, respectively, for over three and one-half years. IRRI and NIA started preliminary activities in July 1980 and the project is expected to last through March 1984.

The continued economic and financial viability of such system operation as the LCIADP is seen to rely heavily on efficient water management practices. The IRRI-NIA-BRBDP research project is expected to address this issue by studying the relevant agro-engineering factors related to water man-

agement and developing a model package of feasible water management practices for the system. This model will be field tested and refined to suit the practical needs of the project for long-term use and adoption. An assessment will also be made on the other factors, including farmer organizational issues, credit, and marketing that may limit the attainment of the potential of the service area to produce. The research activities will be coupled with on-the-job training of a) project staff who will take part in the early data gathering activities and water management model testing, b) farmers and farmer-leaders on water management procedures at farm and systems levels, and c) selected graduate students who will conduct research work on specific problems encountered in the project area.

The general program of work has already been outlined together with the tentative schedule and phasing of activities. A memorandum of Agreement is currently being finalized by IRRI, NIA, and the PRBDPO. This Memorandum outlines implementation responsibilities and a general program of work. The progress obtained towards the full implementation of the research project is very timely. Initial collection of field data has begun and will be vital in the development of a long-term operational plan for the system. The IRRI Water Management Department has shown genuine interest in pushing through the project and NIA is equally receptive to the joint implementation of the project. It is expected that the research/training activities will be able to jibe well with the supposed start of systems' test run operation this coming rice farming season.

Recommendation: Full support and cooperation should be developed between the Project Management Office and the IRRI personnel to obtain the most from the applied water management research and training project. This is especially important in areas such as water measurement, water delivery, water management criteria, improved cultural practices, water losses, drainage, and salinity intrusion. Budget releases should receive high priority together with staffing requirements. The presence of IRRI should be seen as complementary support to assist the development of capability in the project staff and beneficiaries rather than an independent activity that ought to be supervised, monitored and/or checked. As opportunity arises, the immediate utilization of research results to improve the operationalization of the system must be carried out.

Extension and On-farm Training Activities. Some extension and training activities are being undertaken by the community organizers assigned to the NIA Institutional and Agricultural Development Division (IADD), the NIA operations and maintenance staff, and other agency personnel assigned to the IADD or independently working in the municipalities of Libmanan and Cabusao. Table 4 shows the manpower deployment by line-agencies in the project area as of December 30, 1980. At this time only 28 of the 47 personnel required (60%) have been detailed to the project by their line agencies. This is in part due to the non-operation of the system and the home agencies not seeing a need to assign additional personnel until the irrigation system is functioning. The slow processing of personnel appointments, discontinued payment of incentive allowances, and "home" agencies requiring their personnel to perform additional duties and responsibilities has resulted in a lowering of morale of those personnel assigned to the IADD.

Table 4. MANPOWER DEPLOYMENT BY LINE-AGENCY
As of December 30, 1980

AGENCY/DESIGNATION	NUMBER TOTAL REQUIREMENT	NUMBER PRESENTLY DEPLOYED	SERVICES RENDERED
Ministry of Agriculture			
BAEx:			General Extension
Extension Specialist	1	1	
Area Supervisor	1	1	
Generalist Ext'n. Workers	12	8	
SUB-TOTAL	14	10	
BPI:			Crop Protection and Seed Certification
Crop Production Specialist	1	1	
Area Supervisor	1	1	
Generalist Ext'n. Workers	8	3	
SUB-TOTAL	10	5	
BS:			Soil Analysis, Fertilizer Recommendation and conduct of Applied Soil Fertilizer Studies
Plants Nutrition Specialist	1	1	
SUB-TOTAL	1	1	
BCOD:			Organization/Training of Samahang Nayon and Kilusang Bayan Member
Cooperative Dev't. Specialist	1	1	
Area Supervisor	1	1	
Generalist Ext'n. Workers	6	2	
SUB-TOTAL	8.	4	
Ministry of Agrarian Reform			Land Tenure Improvement and Training
Legal Officer	1	1	
Land Reform Specialist	1	1	
Area Supervisor	1	1	
Generalist Ext'n Workers	10	4	
SUB-TOTAL	13	7	
Agricultural Credit Administration			Technical Assistance Through Supervised Credit
Agricultural Credit Specialist	1	1	
SUB-TOTAL	1	1	
GRAND TOTAL	47	28	

Source: Agencies Concerned - Agricultural Progress Report, Wet Season 1980

In the past, training and extension activities have been primarily focused on NIA personnel, such as ditch tenders and water-masters, CO's, etc., and farmer leaders. There is an indication that training and extension activities are beginning to focus more on the ordinary farmers as evidenced by an increase in the number of individual and group trainings conducted. As water becomes available there will be a greater need, and hopefully a greater interest, on the part of the farmers to avail of extension services and training activities, particularly in irrigated rice production technology and on-farm water management. More personnel than presently assigned to the project will definitely be required to effectively undertake these activities (one extension agent to every 100 to 150 farmers).

As noted elsewhere in this report, the mechanics of how the institutional development and agricultural support services are to be provided when the system becomes operational were to be detailed in a five-year institutional and agricultural development plan. Due to the reorganization of the Ministry of Agriculture and a rethinking of how these services should be provided, this five year plan has not yet been finalized by the agencies involved. There are indications, however, that the differences of opinion between the agencies involved are beginning to be resolved. Now that water delivery is imminent, there is a renewed interest of all concerned to work together, resolve differences, and provide the necessary support to make the project successful. USAID and BRBDP have indicated a willingness to finance a special two-year Agricultural Support Services pilot project out of the grant Bicol IRD Project to intensify support during the initial two years of Libmanan system operation (1982-83). The project under the MA regional office would organize the BAEx, BPI, BS, BCOD, and ACA technicians in the area and assign additional staff as required.

Recommendations: The process involved in this evaluation resulted in much brainstorming and discussion among agencies as to how the institutional and agricultural support services should be provided. It appears that at least somewhat of a concensus is emerging. This process should continue so that a firm plan of action can be approved, accepted by all concerned, and implemented as soon as possible. It is extremely important to have the necessary personnel in place and ready to teach farmers the technical details of on-farm water management and irrigated rice production technology by the time water is delivered to individual farms. Extension and training activities should continue to be focused at the farmer level.

Attachment 1

March 23, 1981

MEMORANDUM

To : Ralph Bird, Project Engineer, USAID/Naga

From : Adrian K. Long and A. Alvin Bishop

Subject : Suggested Procedures for Pre operational Inspection and Priming of the Libmanan-Cabusao Integrated Area Development Project

Introduction:

The Libmanan project is nearly complete and about ready to enter the operational stage. Preliminary plans are being made to pump water into the system in preparation for the initiating irrigated agriculture in the project area. The system includes numerous kilometers of new water conveyance channels and water regulating structures, some of which have been in place for in excess of 3 years but have never been used to convey or regulate irrigation water. A visual inspection of part of the system on March 19 and 20 revealed that in the three year period since construction channel banks have subsided, been cut or damaged, with growths of vegetation prevalent in many channels. Compacted earth materials around concrete structures have subsided or partially eroded away by typhoon season rains and overland flood flows. Earth materials in the canal banks and around structures are cracked and fractured due to the evaporation of the soil moisture which occurs when no water is in the channel during the hot dry season which is currently present. All of these deficiencies must be identified and corrected before water is diverted into the system. A thorough inspection, cleaning and priming program is therefore recommended.

Inspection and Cleaning

If the ocular survey of a portion of the irrigation system carried out on March 19-20, 1981 is indicative of conditions throughout the entire system, it appears that the initial thrust prior to putting water into the system would be a massive inspection and cleaning effort. All vegetal growth within the canal should be cut as close to the soil surface of the bed and banks as practically possible. Moderate to heavy growths of vegetation within canal sections affects the coefficient of roughness factor "n" changing it from the probable design "n" of 0.030 to 0.050 thus reducing the carrying capacity as much as 40 to 50%. The vegetal growth retards the flow by reducing the velocity, causing a substantial rise in the water surface elevations. This in turn increases the wetted perimeter of the canal resulting in more seepage loss and also encroaches on the design free board of the canal. With this condition it is more susceptible to overtopping of banks and endangering structures which may not have adequate backfill around them. The main canal and the laterals, sub-laterals and farm ditches of the proposed initiatory service area, which has been designated as that area served by Lateral "B", should be the focus of the initial work and priming effort. The priming and rehabilitation of the other laterals and facilities could follow just prior to the initiation of water service to those areas.

The vegetal growth should be removed first to expose all of the other problems within the system many of which are presently apparent even with the heavy vegetal growth. For example a lot of moss, weeds, etc., were observed in the main canal above the cut and cover sections. Other deficiencies noticed include channel siltation, crudely installed foot bridges made of logs, bamboo, and earth dikes. Prior to priming the system the sediment, dikes and obstructions within the channel must be removed. All unauthorized outlet cuts, pipes, culverts, etc., that have been made through the canal or lateral banks must be removed and backfilled properly. During our inspection of Lateral "C", three cuts through the canal banks were observed within a 30 meter reach of the canal and not 50 meters further along the canal a precast concrete lining in Lateral C-2 had been broken in four places and the embankment cut under this concrete slab lining to delivery water that had accumulated in the canal, to the adjacent land.

All of these "farmer excavated" breaches along the system cannot be tolerated. Diversions from the irrigation system must be made through the constructed turnouts. If inservice operation of the system indicates a need for additional turnouts, they should be authorized and provided after careful consideration and evaluation. Project operations personnel and especially the farmers must accept this operation criteria if the integrity and benefits of the project are to be realized.

It was indicated that within the NIA organization there are 20± ditch tenders and no doubt numerous laborers that could be organized to accomplish this cleaning and rehabilitation work. It is also suggested that the farmers in the area to be served be contacted, informed and enlisted in a personal contributory effort to expedite the rehabilitation and priming activities that is the prelude to receiving full service irrigation to their lands. In addition, all farmers representatives or personnel who have been designated as the future operators of the irrigation system should participate as counterparts of the NIA personnel during this exercise.

Priming the Canal

One of the most important and critical phases of the development and operation of an irrigation project is the initial diversion of water into the canals, laterals and ditches of the system. This activity is generally referred to as priming the system. The activity occurs initially when all construction has been completed on the water conveyance channels and appurtenant diversion, control and regulatory structures. It also occurs, sometimes at less crucial times when water is diverted back into the system after short or longer periods when the canal is taken out of service to accomplish regular maintenance and repair activities or out of service during non-irrigation intervals between cropping periods.

Following the removal of the vegetal growth, dikes, bridges, closure of illegal breaches and diversion points that have been made, and the inspection, repair and replacement of compacted backfill around the system water control structures, water can then be introduced gradually into the system. This may entail the operation of only one pump on an intermittent basis. Reports indicate that there may be as much as one meter of sediment in the bottom of the channel throughout most of the cut and cover and tunnel sections of

the main canal. Reports also indicate that the invert elevation of this reach of the canal is about one meter below the bottom grade of the canal upstream and downstream from this section. This condition could aggravate the problem of "desilting" this section and some sort of agitational effort may have to be employed, mechanically or hydraulically to bring this sediment into a suspended state so that it can be eroded and flushed out of the section. Extreme care will have to be exercised in this operation to prevent untolerably high water surface conditions from developing in the event this sediment removal is difficult. Hopefully the suggested wasteway to the drainage channel that was proposed at Station 3+000 along the old main canal alignment has been incorporated into the present Lateral "A" at this same point. If so it can be a relief valve for water between the upper reach of the cut and cover section and the lower reach through the deep cut in case problems develope in the lower reach and there is a need to dewater the canal. Under such a situation Lateral "A" would have to be capable of carrying and discharging this water through such a wasteway.

Water should be introduced into the irrigation system in manageable segments using small rates of flow and volumes of water. In effect the water should be "led" gradually down the system by project personnel and participating farmers. Careful inspection should be made of all channels and each structure of the system during this operation. Water levels in each controllable section should be gradually raised and lowered, checking the channel bank and structures for any leaks or deficiencies and correcting them immediately upon identification. During this operation, there should be no rapid increases in water surface elevations nor any rapid lowering of water surface elevations. If problems develope in the system under rapid rising water surface elevation conditions disastrous damage to canal banks and or structures could occur before the water could be evacuated from the channel. Rapidly falling water surface elevations or the rapid dewatering of a canal section can result in extreme differences in water pressure on the canal bank perimeter and the hydrostatic pressure within or behind the wetted perimeter of the canal which can result in massive slippage of interior portions of the canal banks into the channel.

As the water is introduced into the main canal and advanced downstream through each section, continuous inspection and checking of embankments and structures should be maintained during this operation. Water levels in the canal should be raised slowly to the operational level and needed repairs accomplished. If major deficiencies develope or become apparent it may be necessary to discontinue the priming to accomplish the necessary repairs. After the section is proven to be operational and safe then the water is released slowly into the next reach of the canal. Slow release and subsidence of the water surface within the tested or primed section is critical because rapid drawdown can result in canal bank slippage.

This process of slow filling, build up and maintenance of water surface elevations, and observations of the canal section and structures and subsequent slow release of water into the next section of canal or lateral should be continued until that portion of the project that is to be put into irrigation service is adequately primed and tested. Such a procedure will practically eliminate potential canal and structure failures that can and do occur if irrigation systems are put into service without careful priming and testing.

Costly repairs and replacement along with considerable crop loss due to the inability to irrigate during the resultant repair period can be avoided.

During the priming operation communication between the official in charge located at the leading edge of the advancing water and the operator at the Awayan Pumpsite is extremely important. Instant communications via fixed or mobile radio units should be provided. Small hand-held two-way radio sets similar to security force or military type equipment would probably also work. Such instant communication is critical to enable the official in charge to give instructions to the pump operator to vary the amount of flow through alternate periods of pumping and pump shutdown. Also in case of problems that may develope in reaches of the canal or at structures requiring an immediate shutdown of the pump and or opening a wasteway gate to dewater the canal section, instant communication could avert major damage to the canal or structures. Future operations of the canal will also require good communication between management and operation personnel.

Proper testing and priming verifies the readiness of the irrigation system to fulfill its designed purpose of delivering adequate quantities of water to the farm ditch. The effectiveness and efficiency of the use of this water for crop production rests with the irrigation system operators and ultimately with the farmers themselves.

Attachment 2

PROBLEMS OF LCIADP TO BE SUBMITTED TO USAID
EVALUATION FOR POSSIBLE SOLUTION OR ASSISTANCE

1. Flooding of Irrigable Area from Libmanan River

During heavy rains within the watershed of the Libmanan river, outside the service area of LCIADP, flood waters instead of flowing out from Bigajo Creek, Fundado Creek and our Lateral Drain "K" reverses direction and instead flows inward and towards San Miguel Bay and the mouth of the Bicol River, flooding the irrigable area. Since the protection dike acts as a dam preventing the rapid discharge to the sea, the only outlets are the flapgates. It has been noted that these flap gates could not discharge the flood waters as fast as when the outlets were open channels. To hasten discharge of flood waters inhabitants near our protection dikes cut these dikes during flood times.

2. Silting of Flap Gates

Two flap gates, one at Lateral Drain "B" and another at Lateral Drain "D" do not function most of the time as silt deposited by wave action at the mouth of these lateral drains prevent continuous discharge of flood waters. Since the drains have been closed by this silting we have resorted to manual labor to open up the drains but the problem returns after each rainy season.

3. Desilting of Two Cut & Cover Section

The original cut and cover sections have been completed about a year ago and during rainy months have been under water, being below the water table. As the water inside have been stationary, silt, mud and other materials that have settled at the bottom may have hardened and it would be very hard to remove them by the normal water flow thus constricting the barrel and reducing discharge. To desilt the barrels manually would entail great expense while to wait until they are carried out by the water may not materialize.

4. Levees (Protection Dikes) Along the Bicol River

The top of our Protection Dike at the bank of the Bicol River is at Elev. 2.2M while at the other bank of the Bicol River we have been informed that the top of the Protection Dike is at Elev. 3.00 M. If this is constructed as such, flood waters from the Bicol River will overtop our Protection Dike being lower by 0.80 M than the dike for the Naga-Calabanga Project on the opposite side of the Bicol River.

PREPARED BY:

RAMON R. CACERES
Project Manager

AN ANALYSIS OF THE LCIADP IRRIGATION FEE

I. BACKGROUND

The following discusses the problem of determining an irrigation fee which would enable the Irrigators Association to cover operation and maintenance expenses and to recover a certain portion of project cost over a period not to exceed the 50-year life of the system.

A previous study[1/] provided a thorough analysis of the cost side of the problem; a major portion of the present report is essentially an update of that study. In addition, an inquiry is made into the question of farmer's capability and willingness to pay.

Since the time the first study was made, significant changes have occurred: 1) estimated total project cost had gone up from ₱60 M to ₱78 M; 2) potentially non-irrigable elevated areas (approx. 500 has.) had been identified; and 3) farm financial surveys had been conducted by the NIA Project Office providing useful, though preliminary, farm level data.

As a result of the second item above, a comparative financial study is made between two possible situations, a base case (hereinafter referred to as "Case 1") wherein only 3,500 has. can be served by the irrigation system, and an alternative case (hereinafter called "Case 2") wherein 4,000 has. can be irrigated with the installation of additional relift pumps.

Some of the figures and assumptions used would appear to be reasonable. However, many remain guesstimates up to this time and consequently, are presented primarily for discussion purposes.

II. SUMMARY OF ANALYSIS

Tables 1 and 2 summarize the results of detailed analysis discussed in succeeding sections.

1/Revised Financial Analysis, Irrigators Association, LCIADP (March 1, 1978)

Table 1

Summary of Estimated Annual Costs

	Case 1	Case 2
Amortization	₱ 980,000	₱1,009,102
Operation & Maintenance	2,507,920	2,645,262
Sinking Fund	1,543,180	1,574,890
Total	₱5,031,100	₱5,229,254
Annual Requirement per Hectare[2/]	1,437	1,307
Equivalent Irrigation Fee in Cavans[3/] per Hectare	22.1	20.1

Table 2

Average Net Income Per Hectare
(In Cavans)

	1978	1979	1980
Irrigated	12.4	33.5	17.5
Rainfed	2.1	35.6	23.7

Source of Basic Data: Farm Management Survey, LCIADP

2/ Assumes 100% collection from potential service area.

3/ At ₱65 cavan.

Owing to a proportionally higher increase in service area relative to costs, annual irrigation fee per hectare comes out lower under Case 2, where it is assumed that all five (5) relift pumps are integral elements of the LCIADP irrigation system and consequently, total system costs should be shared equally among all beneficiaries.

A comparative review of Tables 1 and 2 reveals a gap between costs and farmer-beneficiaries' capability to pay and implicitly an even bigger gap between a fee based on costs alone and farmers' willingness to pay. Consequently, only a portion of O & M costs might be charged to the beneficiaries during the first few years of operation of the new system.

The above situation indicates that a considerable government subsidy may be required over the entire life of the system; during the first 5 years, this subsidy may possibly be in the vicinity of ₱2.2 M annually to cover a portion of O & M and all sinking fund requirements. Additionally, a maximum repayment period is necessary to spread the cost to be amortized; this view supports the planned 50-year repayment period.

III. CASE 1: ESTIMATION OF AMORTIZATION, OPERATION & MAINTENANCE & SINKING FUND

A. PROJECT COST AMORTIZATION

With physical construction nearly completed, estimated total project cost stands at ₱78 M. Although negotiations between the farmer-beneficiaries and NIA are not yet over, it is presently estimated that approximately ₱49 M will be amortized over a 50-year period following a 5-year grace period, with no interest (Table 3). However, the question of whether or not the farmers should be asked to pay for right-of-way, construction equipment, and certain other project facilities still remains to be resolved; hence, there is some possibility that the amount to be amortized will decrease.

Table 3
Estimated Amortization of Project Cost

Estimated Project cost	₱ 78,000,000
Less: Amount to be Absorbed by NIA	-29,000,000
Portion to be Amortized	₱ 49,000,000
Interest Rate	zero
Repayment Period	50 years
Annual Amortization	₱ 980,000

B. OPERATION AND MAINTENANCE (O & M)

Annual O & M expenditures will include electricity consumption of irrigation pumps, personnel expenditure and costs to be incurred in operating and maintaining a fleet of heavy equipment and vehicles. Table 4 summarizes the resulting computations.

Table 4
Estimated Operation and Maintenance Cost

Pump Electricity Consumption	₱ 630,643
Personnel Expenditures	1,234,277
O & M for Heavy Equipment and Vehicles	643,000
Annual O & M	₱ 2,507,920

1. PUMP ELECTRICITY CONSUMPTION

To date, the best estimate of average annual water diversion requirement remains to be that used in the previous study (3,868,681 gallons/ha.). Given this figure and with the introduction of appropriate changes in the data base, i.e., potential service area is reduced from 4 thousand to 3.5 thousand hectares and cost per kilowatt-hour of electricity is raised from ₱0.45 to ₱0.75, we arrive at an annual average pump electricity consumption cost of ₱630,643. Detailed computations are shown in Annex A.

2. PERSONNEL

This study adopted the proposed LCIADP Staffing Pattern prepared by the Institutional and Agricultural Development Division of the NIA Project Office. Using that staffing pattern, an annual personnel expenditure of ₱1,234,277 was computed. See Annex B for details.

3. HEAVY EQUIPMENT AND VEHICLES

Annual expenditures of ₱643,000 include cost of fuel, lubricants, and spare parts. Computations are presented in Annex C.

C. SINKING FUND

This item originally had three components, namely heavy equipment and vehicle replacement, pump repair requirement, and major repairs requirement. In this analysis, an additional component is added, "cost escalation" to cover likely increases in operation and maintenance costs.

Table 5
Estimated Sinking Fund Requirement

Heavy Equipment and Vehicle Replacement	₱ 619,808
Pump Replacement	172,580
Major Repairs	500,000
Cost Escalation	250,792
Annual Sinking Fund	₱1,543,180

1. HEAVY EQUIPMENT AND VEHICLE REPLACEMENT

The total cost of all heavy equipment and vehicles at current prices is placed at $560,000 (Annex D). Assuming that said cost rises at an average of 10% annually compounded, replacement will require the amount of $1,450,400 at the end of an assumed ten year economic life. If funds set aside each year can earn 12% interest compounded annually, $82,641 (₱619,808) needs to be set aside yearly for heavy equipment and vehicle replacement every ten years.

2. PUMP REPLACEMENT

It is suggested that if a 20-year period is considered, pump replacement, rather than repair, should be anticipated. If current pump acquisition cost is assumed to be ₱1,840,084 and economic life is 20 years, the pumps will cost about ₱12,383,765 at the end of said period assuming that cost escalates at an average of 10% compounded annually. Consequently, ₱172,580 needs to be set aside each year assuming 12% interest compounded annually can be applied thereto.

3. MAJOR REPAIRS

In the absence of any other bases for estimate, the ₱500,000 annual requirement used in the previous study is retained.

4. COST ESCALATION

As a hedge against inflation, it is suggested that 10% of the previous year's O & M expenditures be set aside as sinking fund to cover likely increases in the cost of electricity, personnel outlay, fuel, lubricants, and spare parts. At current prices, this amount will be 250 thousand pesos.

IV. CASE 2: ESTIMATION OF INCREMENTAL AMORTIZATION, OPERATION, AND MAINTENANCE AND SINKING FUND

Below are presented data and discussions on the financial aspects of acquiring, installing, operating, and maintaining an additional five (5)

units of centrifugal pumps for the LCIADP irrigation system to be able to irrigate elevated farms (approx. 500 has.) within its service are. Cost estimates are summarized on Table 6.

Table 6
Summary of Estimated Annual Costs Using Relift Pumps

Type	Cost	Per Cent (%)
Amortization	₱29,102	14.7
Operation and Maintenance	137,342	69.3
Sinking Fund	31,710	16.0
Total Additional Cost per year	₱198,154	100.00

A. PROJECT COST AMORTIZATION

The three (3) items to be amortized (acquisition, installation, and civil works) amount to ₱1.455 million. Maintaining the 50-year repayment period, this translates to an additional annual amortization of ₱29 thousand or 14.7% of total additional annual costs. Detailed computations are in Annex E.

B. OPERATION AND MAINTENANCE

Under this category falls additional electricity consumption and personnel expenditures amounting to ₱137 thousand or almost 70% of total annual costs. Using the procedure in Case 1, additional electricity consumption is estimated to be ₱9 .6 thousand annually. On the other hand, ₱39.7 thousand will need to be budgeted annually for additional personnel expenses. It is suggested that one (1) operator be assigned for each of the five (5) relift pumps due to the distance between and among the pump sites. How O & M estimates were derived can be seen from Annex E.

C. Sinking Fund

Using current acquisition cost (₱338,099), the five (5) relift pumps will cost around ₱2.28 million after 20 years, assuming cost escalates at an annual rate of 10% compounded. Consequently, about ₱32 thousand (16% of total annual costs) needs to be set aside as additional annual sinking fund assuming that said fund can earn 12% interest compounded annually. Derivation of sinking fund is in Annex E.

V. FARM FINANCIAL DATA

Table 7 shows that for the past two years, rainfed farms have enjoyed higher annual net income compared to irrigated farms.

Table 7
Average Production, Cost of Production and Net Income/Hectare
(In Cavans)

	1978		1979		1980	
	Irrigated	Rainfed	Irrigated	Rainfed	Irrigated	Rainfed
Production	76.9	48.9	132.3	79.6	126.2	77.8
Variable Cost	38.1	24.0	40.6	21.7	56.5	29.2
Fixed Cost	26.4	22.8	58.2	22.3	52.2	24.9
Net Income	12.4	2.1	33.5	35.6	17.5	23.7

Source of Basic Data: Farm Management Survey, LCIADP

Throughout the period covered by the survey, the much higher production attained by irrigated farms had been offset by proportionally much higher costs, thus resulting in lower net income. Annex F shows that the biggest difference between costs incurred by irrigated and rainfed farms involves labor and land rental.

Although the picture depicted above should be viewed critically (further investigation is required) owing to survey bias resulting from the short timeframe, "unusual events" occurring during this short period of time, and other mitigating considerations, these statistics nevertheless emphasize a critical hypothesis in the determination of irrigation fee - that pertaining to farmers' willingness to pay based on their financial situation. Within the context of the LCIADP, this suggests that farmers, even if they had the capacity, initially will not be willing to pay an irrigation fee much higher than that which is paid on regular NIA pump systems (8 cavans/ha/year). This highlights the importance of 1) the dependability of the irrigation system, and 2) the need for improved access to agricultural support services.

Annex A

Case 1: DERIVATION OF THE AVERAGE ANNUAL DIVERSION REQUIREMENT AND THE AVERAGE ANNUAL PUMP ELECTRICITY CONSUMPTION COST

	1 Agronomic Water Requirement (mm)	2 Average Effective Rainfall (mm)	3 On-Farm Water Requirement (mm)	4 Turnout Requirement (Col. 3+20%) (mm)	5 Diversion Requirement (Col. 4+33%) (mm)
January	210.8	45.9	164.9	197.9	263.2
February	190.4	33.5	156.9	188.3	250.4
March (1st 22 days)	149.6	50.4	99.2	119.0	158.3
April	-	-	-	-	-
May	198.0	71.8	126.2	151.4	201.4
June	240.0	130.3	109.7	131.6	175.1
July	148.0	177.8	70.2	84.2	112.0
August	248.0	184.6	60.4	72.5	96.4
September (1st 10 days)	80.0	61.7	18.3	22.0	29.2
October	-	-	-	-	-
Nov. (last 20 days)	80.0	60.6	19.4	23.2	31.0
December	196.8	104.5	92.3	110.8	147.3
Totals	1,841.6	924.1	917.5	1,101.0	1,464.3

1. Average Annual Diversion Requirement/Hectare:
   $\frac{1,464.3 \text{ mm}}{1000 \text{ mm/meter}}$ x 10,000 square meters = 14,643 cubic meters of water/hectare or 14,643 cubic meters of water/hectare x 264.2 = 3,868,681 gallons/hectare

2. Total Average Annual Diversion Requirement:
   3,868,681 gallons/hectare x 3,500 = 13,540,383,000 gallons/year

3. Estimated Average Total Dynamic Head: 22.5 feet
   Includes statis head plus estimate of friction loss due to length of pipe and water velocity.

4. Electricity Consumption Rate in Kilowatt-Hours per 1000 Gallons Pumped: Total dynamic head x .00314/ (pump efficiency x motor efficiency x drive efficiency), or 22.5 x .00314/(.75 x 1.00 .91) = .1035.

5. Cost Per Kilowatt-Hour: ₱0.75

ANNUAL AVERAGE PUMP ELECTRICITY CONSUMPTION COST:

$$\frac{13,540,383,000}{1000} \times 0.1035 \text{ kilowatt-hours} \times ₱0.75 = ₱630,643$$

Annex B

Case 1: ESTIMATED ANNUAL PERSONNEL EXPENDITURES (IN PESOS)

1. BASIC SALARIES*

1	Irrigation Superintendent	@21,624	21,624
1	Senior Clerk	@ 9,756	9,756
2	Clerk II	@ 7,992	15,984
3	Clerk I	@ 7,236	21,708
1	Radio Operator	@ 8,832	8,832
3	Security Guards	@ 7,992	23,976
3	Janitors	@ 5,376	16,128
4	Storekeepers	@ 7,992	31,968
2	Utilitymen	@ 5,928	11,856
1	Accounting Clerk	@ 8,832	8,832
1	Disbursing Officer	@ 9,756	9,756
1	Irrigation Engineer	@16,044	16,044
7	Water Management Technologists	@13,152	92,064
2	Billing Clerks	@ 7,992	15,984
2	Bill Collectors	@ 7,992	15,984
2	Pump Operators	@ 7,236	14,472
20	Ditchtenders	@ 6,552	121,040

(Annex B Cont.)

1	Associate Mechanical Engineer	@14,532	14,532
1	Senior Mechanic	@10,776	10,776
3	Mechanic Helpers	@ 6,552	19,656
4	Heavy Equipment Operators	@ 9,756	39,024
2	Truck Drivers	@ 7,992	15,984
5	Jeep Drivers	@ 7,992	39,960
1	Head I & ADD	@19,584	19,584
1	Sr. Irrigation Engineer	@17,724	17,724
1	Hydrologist	@16,044	16,044
1	Soil Technologist	@14,532	14,532
1	Laboratory Technician	@ 8,832	8,832
3	Research Assistance	@11,904	35,712
4	Research Aides	@10,776	43,104
5	Laborers	@ 7,236	36,180
1	Agricultural Extension Specialist	@17,724	17,724
1	Agricultural Training Officer	@16,044	16,044
2	Sr. Irrigation Association Workers	@14,532	29,064
1	Agriculturist	@14,532	14,532
7	Community Organizers (CO)	@13,152	92,064
1	Agricultural Economist	@17,724	17,724
1	Info/Monitoring Officer	@13,152	13,152
3	Enumerators	@ 7,992	23,976
1	Utilityman	@ 7,236	7,236
		Sub-Total..	₱1,029,168

2. EMPLOYER'S CONSTRIBUTIONS

1.	GSIS Life and Retirement Insurance Premium (8.5% of total annual basic salaries)		87,478
2.	Medicare (No. of Personnel x ₱7.50 premium x 12 months)		9,630
		Sub-Total.....	₱ 97,109
3.	TRAVEL & PER DIEM		
2	Engineers	₱ 1,000/mo.	24,000
2	I & ADD Personnel	@1,000/mo.	24,000
10	Other Staff	@ 500/mo.	60,000
		Sub-Total	₱ 108,000
		T O T A L	₱1,234,277

*Based on the latest schedule of basic salary for class "B" government corporations.

Annex C

Case 1: ESTIMATED ANNUAL O & M COST FOR HEAVY EQUIPMENT & VEHICLES
(In Pesos)

1. Fuel

   a. Heavy Equipment

      5 units x 8 ltrs./hr. x 2 hrs./day x 260/yr. x ₱3.20/ltr. = ₱66,560

   b. Trucks

      4 units x 0.5 ltr./km. x 30 km./hr. x 3 hrs./day x 260 days/yr. x ₱3.20/ltr. = 149,760

   c. Jeeps

      5 units x 0.25 ltr./km. x 40 km./hr. x 4 hrs./day x 260 days/yr. x ₱ 5.34/ltr. = 277,680

2.	Lubricants (10% of fuel cost)	49,400
3.	Spare Parts	100,000
		₱643,400

ANNEX D

Case 1: ESTIMATED ANNUAL REQUIREMENT FOR HEAVY EQUIPMENT & VEHICLE REPLACEMENT

No. of Units	Type	Current Unit Cost	Current Total Cost
1	Truck Mounted Crane, 25 tons	$150,000	$150,000
1	Crane Crawler, 25 tons	100,000	100,000
1	Tractor Crawler, 90 HP	55,000	55,000
1	Front End Loader, Wheeled, $1^{3/4}$ yr.	40,000	40,000
1	Motor Grader, 125 HP	60,000	60,000
5	Jeeps	10,000	50,000
3	Dump Trucks	30,000	90,000
1	Stake Truck	15,000	15,000
			$560,000

Annex E

Case 2: Estimated Additional Annual Costs due to Relift Pumps

A. Amortization

1. Cost of Acquisition

6,985 GPM; 40 HP; 16' TDH	₱ 97,027
3,864 GPM; 20 HP; 12' TDH	82,838
1,813 GPM; 15 HP; 17' TDH	47,500
2,379 GPM; 15 HP; 17' TDH	47,500
2,827 GPM; 15 HP; 17' TDH	63,234
Total Acquisition Cost - - - - -	₱ 338,099
2. Cost of sumps & shed structures (including 30% labor & 20% escalation)	117,000
3. Civil works[a/]	1,000,000
TOTAL	₱ 1,455,099
Estimated Additional Annual Amortization[b/]	₱ 29,102

B. Operation & Maintenance

1. Relift Pumps Electricity Consumption

Additional Average Annual Diversion Requirement:

3,868,681 gal/ha./yr.[c/] x 500 has. = 1,934,340,500 gal/yr.

Electricity Consumption rate in KWH per 1,000 Gallons Pumped

$$\frac{\text{Average Dynamic Head x .00314}}{\text{Overall Efficiency}} = \frac{15 \times .00314}{0.70} = .0673 \text{ KWH}$$

---

a/ A very rough estimate due to inavailability of accurate topographic survey.

b/ Repayment period assumed to be 50 yrs. (without interest).

c/ From previous estimates.

Average Annual Additional Electricity Consumption Cost:

Additional Average Annual Diversion Requirement x
1000 gallons

.0673 KWH x electricity cost per KWH =

1,934,341 x .0673 x 0.75 = ₱97,636

2. Additional Personnel Expenditures (for 5 pump operators):

Basic Salaries @₱7,236	₱36,180
GSIS Life & Retirement Insurance Premium (8.5%)	3,076
Medicare (5 x ₱7.50 premium x 12 months)	450
	₱ 39,706
Estimated Additional Annual O & M -	₱1[illegible]7,342

C. Sinking Fund

Pump Replacement after 20 years:

₱338,099	- current acquisition cost
x 6.73	- compounding factor (20 yrs., 10%)
₱2,275,406	- estimated cost after 20 years
x .134	- capital recovery factor (20 yrs., 12%)
₱ 304,904	- estimated annual payments
x .104	- discount factor (20 yrs., 12%)
₱ 31,710	- estimated additional annual sinking fund, assuming annual growth rate of 12% compounded, to be able to purchase new relift pumps at the end of 20 years.

Estimated Total Additional Costs/year - ₱198,154