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International Science and Technology Institute, Inc

FINAL EVALUATION

OF

SRI LANKA - WATER MANAGEMENT

(Project No. 383-0057)

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GAL OYA LEFT BANK SYSTEM

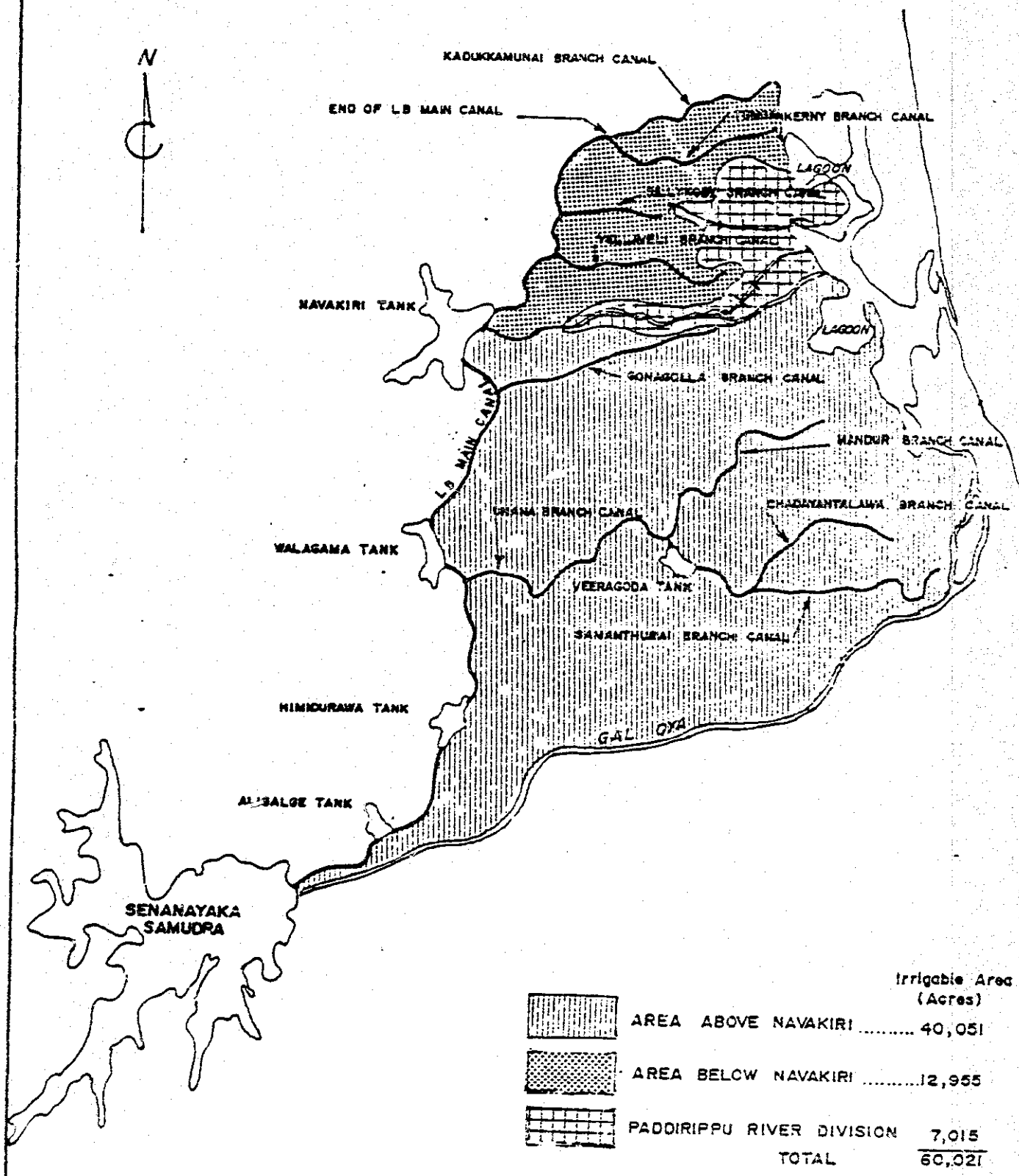

FIG. 1

BASIC PROJECT IDENTIFICATION DATA

1. Country : Sri Lanka

2. Project Title : Water Management I

3. Project Number : 383-0056 (Loan and Grant)

4. Project Dates :

   a) First Project Agreement : June 25, 1979

   b) Project Amendment : April 28, 1983

   c) Final Obligation : FY 1984

   d) Potential Obligation : FY 1985

   e) Project Activity Completion Date (PACD): December 31, 1985

5. Project Funding:

   a) AID Bilateral Funding (Loan): $ 8,800 million
      (Grant): $ 4,800

   b) Other Major Donors: None

   c) Host Country Counterpart Funds: $ 6,900 million
      $20,500 million

6. Mode of Implementation: Grant and Loan Agreements with the Government of Sri Lanka

7. Project Design: The Government of Sri Lanka
   USAID/Colombo
   Contract Project Design Team

8. Responsible Mission Officials:

   a) Mission Director: Sara Jane Littlefield, 1979-1984
      Frank D. Correl, 1984 - Present

   b) Project Officers: Ken Lyver 1979 - 1982
      Herbert G Black 1982 - Present

9. Previous Evaluations: Mid Term Evaluation 1982

10. Cost of Present Evaluation: a) Direct Hire: None
    b) Contract: $ 99,925

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

This report presents the results of the final evaluation of the Water Management Project in Sri Lanka - a six and a half year project with a total projected cost of $19.1 million and a U.S. grant and loan contribution of $12.2 million. The evaluation was carried out in Nov.- Dec. 1985 by a 6-person contract team.

The project's purpose was to develop an institutional capability, which can be replicated, to manage large irrigation schemes in Sri Lanka more efficiently and effectively with active farmer assistance. This purpose has been substantially achieved.

The Concept

The purpose was to be achieved by rehabilitating the Left Bank of the Gal Oya Irrigation System, which was completed in 1955 with the capacity to irrigate 42,000 acres. Since that time the system has experienced a reduction in the area which could be irrigated as poorly designed and maintained canals and structures deteriorated and silted up. It has been estimated that by 1980 the system was only able to irrigate approximately 30,000 acres.

Major AID inputs were equipment and other commodities, $4.0 million; direct rehabilitation costs $4.5 million; technical assistance, $5.1 million; and training $1 million. The Sri Lankan Government's contribution of $6.9 million was in cash, primarily for rehabilitation work.

The Project's Outcome

The evaluation team concluded that :

- Mistakes have been made and there are lessons to be learned from the project, but by any reasonable standard, the Project as a whole has definitely been a success.
  - A badly deteriorated major irrigation scheme has been rehabilitated, in a cost effective manner and it is operational.
  - Three hundred and seventy farmer organizations have been formed and are functioning, despite a fragmented social structure. They have made an important contribution to both the construction and the operation of the system.
  - Changes in agronomic practices, increased yields and increased cropping intensity - all due at least partly to improved water delivery and reliability - have combined with an increase of 11,000 irrigated acres to produce an Internal Rate of Return of 47.4 percent.

- One of the most significant outcomes of this project were the changes in attitude, communication and behaviour among farmers and government personnel that has occured. This is is a very important project achievement. The factors, each of which contributed to it were:

  - the improved reliability of water delivery as a result of rehabilitation;

  - an Institutional Organizer program and the farmer organizations it created;

  - the leadership of the Project Director, and

  - the training program.

- Ethnic disturbances have adversely affected the project.

- The Project's strategy, as it evolved, was appropriate, but

  - Too much equipment was bought too soon. It has been underutilized and poorly maintained.

  - At first there was an overemphasis on detailed planning and master plan preparation. It was replaced by a pragmatic approach to design and construction which has worked well, and has been a key element in the physical rehabilitation effort. And, construction quality is good.

  - The Project included too much research and testing, in both its farmer organization and water management aspects.

- Both the original and final strategy paid inadequate attention to maintenance - physical maintenance and the maintenance of farmer organizations.

- AID's Fixed Amount Reimbursement Method has worked well, but it would have provided a greater incentive if reimbursements had gone to a revolving fund in the Irrigation Department, rather than to the General Treasury.

- A computer model is being used for operation of the completed part of the system. Abundant water and efficient systems operation helped produce cropping intensities in the 1985 dry Yala (summer) season of 97 percent in the upper part of the system and 57 percent in the lower part.

- The plan for field channel rehabilitation was based on free farmer labor and this has not been forthcoming. The Government must find an alternative way to complete this work if the system is to achieve full efficiency.

- The training program was important and well executed.

- No special effort was made to involve women, and it would not have been justified. However, approximately 25 percent of the Institutional Organizers have been women and they have been as effective as the male IOs.

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ACRONYMS AND GLOSSARY

ADA	-	Assistant Director Agriculture
ANDE	-	a form of sharecropping
ARTI	-	Agrarian Research and Training Institute
D-CHANNEL	-	Distributary Channel
FAR	-	Fixed Amount Reimbursement
FO	-	Field Channel Farmer Organization
IMD	-	Irrigation Management Division
IO	-	Institutional Organizer
IRR	-	Internal Rate of Return
IRRI	-	International Rice Research Institute
O & M	-	Operation and Maintenance
PACD	-	Project Activity Completion Date
PIL	-	Project Implementation Letter
SHRAMADANA	-	a traditional form of voluntary collective work

THE EVALUATION REPORT

INTRODUCTION

This evaluation of the Sri Lanka Water Management Project (Project No. 383-0057) was conducted by the International Institute for Science and Technology, Inc. (ISTI) under contract No. PDC-0000-I-00-3083-00, Work Order No. 40. It was carried out in Sri Lanka during the period November 3 to December 13, 1985 by a six person team. The team members were:

Mr. William R. Thomas 3d, Team Leader and Training Analyst
Dr. Gladys A. Nott, Social Scientist
Dr. C. R. Panabokke, Agricultural Specialist
Dr. G.V.V. Rao, Irrigation Engineer
Mr. K. Satgunasingam, Irrigation Engineer
Mr. John W. Smith, Economist

All of the team members are regular or temporary employees of ISTI, except for Dr. Panebokke, who was on deputation from the International Irrigation Management Institute. Mr. Piyasena Ganewatte also served as a consultant to the team in the farmer organization aspects of the project.

The team's evaluation methodology included a review of available documents and interviews with Mission and Government Officials in Colombo, a week long field visit to Ampara where on-site records were reviewed and interviews were held with Irrigation Department personnel at all levels from the Deputy Director, Ampara to maintenance workers; Institutional Organizers; the project's engineering consultants (PRC Engineering Consultants, Intl.); other government officials; and individual farmers. Special analyses of available data were also prepared for this evaluation by the Agrarian Research and Training Institute (ARTI) with assistance from Cornell staff members.

We have received full cooperation and support from the Mission and the Government in the conduct of this evaluation. However, there are three limiting factors which the reader should bear in mind :

- the first is the fact that an enormous amount of written material has been produced on the Gal Oya project. The inventory of AID bulk files lists 325 separate documents or files; and a Gal Oya bibliography prepared by ARTI lists 159 separate studies and reports. We could barely scratch this mountain of material and there are undoubtedly studies and reports that would have enhanced our evaluation if we had had the time to review them. (A profitable activity for the successor Irrigation Systems Management Project might be the preparation of an annotated bibliography of the Gal Oya materials).

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- the second factor is the fact that a number of key personnel with long associations with the project were not available at the time of the evaluation, mostly because they were abroad for training. Our evaluation would have benefitted if we had been able to draw on the experience and knowledge of these key people - especially Mr. S. Senthinathan, who was the on site Project Manager for three years and who clearly was a driving force in the outcome of the Gal Oya project.

- the third factor is the current inaccessibility of the system below Navakiri tank, due to the security situation. This has had a major effect on the actual outcome of the project and has severely limited our ability to judge the project's impact on the critical tail end of the system.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

1. Overall Assessment of the Project

Mistakes have been made in the design and execution of the Water Management Project and there are lessons to be learned from it. But, by any reasonable standard, the project as a whole has definitely been a success.

- A badly deteriorated major irrigation scheme has been rehabilitated in a cost effective manner, and it is operational.

- Farmer organizations have been formed and are functioning despite a fragmented social structure.

- Changes in agronomic practices, increased yields and increased cropping intensity, all due at least partly to improved water delivery and reliability, have combined with an increase in irrigated acres to produce an Internal Rate of Return of 47.4 percent.

2. The Project Strategy and Components

The project's strategy, as it has evolved, is appropriate for the project's goals and purpose. But this end of project strategy differs significantly from the strategy set forth in the original project paper. The most important way in which the final strategy differs, or should have differed, from the original one are:

- An overemphasis in the original strategy on heavy equipment. The equipment was provided, but utilization has been very low and maintenance is a continuing problem.

- An overemphasis originally on detailed planning and the preparation of master plans. The master plans have proved to have little practical value, and the basic conclusion of the mid term evaluation was that it was time to stop planning and get on with the work. The adoption of the pragmatic approach to design and construction in the PP amendment has been a key element in the physical rehabilitation effort.

- An overemphasis in the original design on research and testing both in the farmer organization and water management aspects of the project. In a five year project there is a limit to the amount of research that should be done, particularly when it is intended to determine how elements of the project are to be carried out.

- The absence in the original PP of a specific plan and specific funding for rehabilitation of distributary and field channels. Distributory channels and structures in field channels were provided for under the Fixed Amount Reimbursement section in the PP amendment. Who will do the field channel earthwork remains unresolved.

Both the original and the final strategy have paid inadequate attention to maintenance - physical maintenance and the maintenance of farmer organizations. This is not critical now, but it will become so, and the successor ISM project quite properly addresses these needs.

The Overall Result

The project has substantially achieved its purpose of "developing an institutional capability, which can be replicated, to manage large irrigation schemes in Sri Lanka more efficiently and effectively with active farmer assistance". We say substantially, because the capability and methodology that have been created at Gal Oya cannot be replicated as is. They can be, and should be extended to other irrigation schemes, but this will require adaptation to different physical and social environments.

One of the most important outcomes of this project is the change in attitude, communication and behavior among farmers and government personnel that have occurred at Gal Oya. All the available evidence points to a major change in this regard. Violence over water disputes (including murder) is gone; oral and written complaints to MPs and the Government Agent about water have been reduced to a minimum; and our interviews disclose ample examples of improved attitudes and increased dialogue and their positive effect on the project outcome. This is a very important project achievement. It should not be underestimated. But we also want to stress the fact that it is the result of a combination of the project components, and not any one of them. The factors which each contributed to this project outcome were:

- the improved reliability of water delivery as a result of rehabilitation;
- the Institutional Organizer program and the farmer organizations it created;
- the leadership of the Project Director, who actively promoted communication by direction and by example; and
- the training program.

2. Ethnic Disturbances

Ethnic disturbances have adversely affected the project. They have retarded rehabilitation of the tail end of the system and prevented the formation of Tamil farmer organizations.

3. The Physical System

Overall Performance of the System

Better hydraulic performance has been achieved. Water is reaching areas previously unreachable and the system is conveying water more efficiently.

As a result of rehabilitation the main canal can supply water to irrigate 60,021 acres. It will now service all the area currently under the Left Bank main canal, namely 53,006 acres and will provide supplemental water through the Navakiri dam for the Paddirappu river area - which covers 7,015 acres. The Paddiruppu system was not in the project and remains to be rehabilitated.

In the main left bank canal system only 80 percent of the distributary channels and none of the field channels are complete below Navakiri. Above Navakiri 35 percent of the field channel structures and 25 percent of the field channel earthworks are complete. Thus the system is fully rehabilitated and capable of functioning up to full design capacity in only 15 percent of the total area. The Irrigation Department must complete this work if the full benefits of rehabilitation are to be achieved. However, it must be emphasized that the system is functioning effectively now. This is demonstrated by the fact that double cropping in the 1985 Yala season was 97 percent above Navakiri and 57 percent below it.

The PP assumed that field channel earthwork would be done free by farmers. This was an unrealistic expectation and an alternative must be found. Three possibilities are :

- Contract with farmers for complete field channel rehabilitation
- Contract with farmers for the earthwork only
- Have the Irrigation Department do the whole job

The last alternative is the least desirable and the first two will require the Department to provide technical assistance to farmers.

Rehabilitation of the physical infrastructure at Gal Oya, cost Rs 2.990/acre of currently servicable land (53,006 acres were considered for this purpose). Given the special conditions in Gal Oya, this compares favorably with experience on other similar projects in the country.

Technical Performance

The project began with a virtually non-existent data base. The first phase of the rehabilitation project attempted to correct this lacuna. But the time and effort needed to prepare this data base was under- estimated and the resultant master plan, while filling the gaps in data to some extent, did not play its

intended role as the point of departure for the rehabilitation. As a result, a pragmatic approach stressing safety and functional performance, was adopted. This approach appears to have worked well and should be applied to future projects.

Most structures were rebuilt and measuring devices were introduced at all off-takes. The overall quality of construction work appears satisfactory.

A computer model is being used for operation of the completed part of the system. With proper calibration this can be adpated for operation of the full system when it is complete.

According to the project design criteria, farm outlets should have been only from a field channel, except in rare cases. However, exceptions have become more the rule and direct outlets are prevalent. They make the system functionally difficult to operate to maintain.

Maintenance is practically non-existent, even in canals that were rehabilitated over two years ago. If this state of affairs continues, the system will be ready for another massive rehabilitation very soon. It is imperative that the Government establish a maintenance policy, lay down procedures for regular as well as preventive maintenance and provide adequate maintenance funding.

The equipment procured for the project was underutilized and some was never used. Equipment needs were overestimated and the equipment was ordered too soon. The availability of private sector contractors with necessary equipment now should obviate the need for a large equipment procurement component in future projects.

Fixed Amount Reimbursements

The Fixed Amount Reimbursement (FAR) system seems to have worked well in the main system, but has been less successful on the field channels where free labor of the farmers was expected.

The method of returning FAR amounts to the General Treasury rather to a special project account as was proposed in Project Implementation Letter 13, subjected the project to budget constraints. This has led to a situation where substantial parts of the project are incomplete, even though AID rehabilitation funds will not be utilized. In future projects, a special project account into which FAR amounts are ploughed back, should be established if possible.

Technical Assistance

Even though a master plan for domestic water supply was prepared, as was required under the consultant's contract, very little follow up action appears to have been taken.

The early emphasis on data collection vs. the need for visible progress of work appears to have caused wasted effort and caused some misunderstandings between the consultant (PRC/ECI) and the

Irrigation Department. Once these misunderstandings were corrected, co-operation between the consultant and the Department improved considerably, and the consultant's services appear to have been responsive and supportive. However, if the Department had made counterparts, at the appropriate level, available on time, the consultant's experts could have been more effectively utilized.

4. Farmer Organizations and the IO Program

The Farmer Organizations

The IO program has covered all of the 25,000 acres of the Sinhala areas in the head and middle of the Gal Oya system. Ninety four percent of the targeted 370 field channel organizations have been formed. Direct and indirect participation in these organizations is estimated at between 60 and 80 percent of the water users, with the least co-operation found among sharecroppers, leasers and mortgagers.

The establishment of the farmer organization structure (from Field Channel Organizations to the Project Level Committee) has been generally acknowledged by officers and Farmer Representatives as creating an important and useful new avenue for improved communication between farmers and officials.

Numerous examples of the contribution of farmer organizations in irrigation operation and maintenance can be cited, but these still only represent a beginning. And, the effectiveness of most organizations in times of water shortage is still untested. However the experience so far does reflect a potential far more effective farmer participation which should continue to be tapped.

The Role of Women

No special effort was made to involve omen in Farmer organizations and their direct participation was negligible. Because women have a limited role in water management, a special effort to increase participation by women would not have been justified. Approximately 25 percent of the Institutional Organizers have been women and they have been as effective as the male IOs.

The IO Program

The Institutional Organizer Program has been critical in the establishment of Farmer Organizations in Gal Oya, as have the good leadership and training in the Irrigation Department and the physical rehabilitation of the irrigation system.

The intensive special effort to promote farmer organizations through Institutional Organizers which was adopted in Gal Oya by ARTI and Cornell was justified. The results of an early attempt to train Irrigation Department Irrigators as IOs indicates that a more complex experiment involving the testing of a range of types of catalysts (government officers, volunteers, teachers, etc) would have been beyond ARTI's administrative capability and there

was no reasonable alternative capacity available. However, the same intensity of effort is no longer needed in Gal Oya and it is probably not needed in schemes where the extent of deterioration of the physical system and the social divisions are not as great. In other schemes the use of alternative personnel as catalysts needs to be tested.

The efficiency of the IO Program has been undermined by the high turnover of IOs. Over 60 percent if the Farmer Organizations have been in existence for less than 2 years and they have been formed at a time when there was very little continuity in the service of IOs. The continuing need for outside support for the Farmer Organizations is indicated by the belief among officers and farmers that, if there is a major reduction in the number of IOs, only about half of the field channel organizations would continue to function, and most of those not so well. The Irrigation Department is committed to continuing IO activity for the next three years. It should do so.

A continuation of IO type activity on the basis solely of recruitment of temporary staff will yield unsatisfactory results. A core cadre of Assistant Project Managers/Institutional Organizers as outlined in the Irrigation Systems Management Project Paper, should be established within the Irrigation Management Division. This cadre should be responsible for determining the correct type and level of intensity of catalysts needed in each project area. The Assistant Project Manager would identify suitable catalysts (offices, teachers, volunteers, IOs - if necessary) and work closely with them.

ARTI Research

The performance of ARTI's research, monitoring and evaluation effort for the project has been uneven. While some reports have provided useful information about the project area, the presentation of the results should have been more concise and project oriented. Data collection has been over-ambitious and the follow-up has been inconsistent. Monitoring should have concentrated on regular collection of a small number of core indicators complemented by a regular analysis of the IO process documentation.

Training

The activity to reopen Galgamuwa Irrigation Training Institute pre-service and in-service training institution for technical personnel of the Irrigation Department has been a success. The training is effective, the project support that was given to Galgamuwa was appropriate, and the effect of Galgamuwa training extends far beyond Gal Oya. Steps must be taken to preserve this when the present staff transfers.

The long term participant training program was well designed and executed, except that more consideration should have been given to masters degree programs for at least some of these participants. The one PhD program will have little direct benefit to this project.

The short term participant training program was generally well designed and executed. However, the benefits, while important are somewhat intangible. They have more to do with an awareness of the importance of water management, motivation and morale, than with specifically acquired skills.

The in-country training activities are almost impossible to evaluate now, and they appear to have diminished in emphasis over the life of the project.

Other Project Components

The Diagnostic Analysis data collection effort at Polonnaruwa will provide data that will be of value to the successor ISM project, but it will not achieve its primary purpose of establishing a continuing data collection and analysis capability in in the Government. And, in the future a more pragmatic approach may be required.

Agriculture Production and Economic Analysis

The benefits of increased acreage and increased yields have been larger and have come sooner in the project than anticipated. This is important in an investment project as it will have a significant effect on the discounted stream of benefits. The anticipated increase was 5,000 acres in the seventh year. The actual increase was 11,000 acres in the sixth year.

There are four major variables which have affected yields; physical rehabilitation, organization of farmer groups, weather and extension activities. It is not possible to know how much of the increase in yields is attributable to any one of them.

The most important agricultural changes to occur during the first six years of project life are the following :

- An increase of 11,000 irrigated acres
- A cropping intensity increase from 129% to 179% in the past two years. This will drop to about 165% in the short term, but it is expected to average 175% in the future.
- Yields per acre have increased from an estimated 65 bushels per acre in 1980 to 79 in 1985.

As a result, the present base case internal rate of return to project investment is an estimated 47.4 percent. This is substantially higher than the rate anticipated in the Project Paper (23.3%) and the PP amendment (34.7%).

Four important changes have taken place in agronomic practices that can be attributed in part to the increased reliability of water delivery as a result of rehabilitation. They are :

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- timeliness of land prepration;
- shortening the time between land preparation and sowing;
- enhanced use of fertilizers;
- improved weed and pest control

Last year's planting was almost all in the scheduled four week period designated for it. Agriculturalists consider this a major benefit as it reduces disease and pest problems. Irrigation engineers also see this as a major element in water management.

There does not appear to be a systematic program linking the activities of the Irrigation Department with the Extension Service and Agrarian Services. There was some tie-in with the farm management practices by the Extension Service, but they appeared to be a result of an individual initiative rather than policy directed activities. Overlapping administrative and irrigation boundaries have probably contributed to this problem.

B. Recommendations

The following recommendations are drawn from the conclusions above and from the discussion and analysis in the Report chapters and their supporting appendices. They are presented in approximate order of importance.

In summary, we recommend :

- That ISM and any successor projects include the following

  -- Less detailed planning and a pragmatic approach to rehabilitation

  -- Limited equipment procurement, and this only after requirements are firmly established

  -- Strict adherence to the requirement that counterparts be available before Technical Assistance is called forward

  -- More focussed research and testing as an integral part of the project

  -- A careful definition of data collection to limit it to what is essential and can be realistically collected and analyzed.

  -- Specific provisions for system maintenance.

  -- A requirement that maps of the project area at an appropriate scale be developed at the beginning of the project.

  -- Adaptation of the Gal Oya methodology to the physical and sociological conditions of the new project site(s)

-- Provisions for testing alternatives to the IO concept, using others as catalysts supervised by a permanent group of IOs.

-- The use of the Fixed Amount Reimbursement Method.

- That the Irrigation Department finish the Gal Oya system and that this be a condition to any successor project activity at Gal Oya.

- That efforts be made to insure continued support for a limited number of IOs (at least one IO per 3,000 acres) at Gal Oya by the Irrigation Department. This too should be a condition for successor project activity.

- That a solution be found to the problem of the field channel earthwork at Gal Oya, including testing of contracting with farmers or farmer organizations. (Some free labor should be preserved, if possible, to foster a farmer feeling of responsibility for the channels).

- That any future Diagnostic Analysis activity be based on a very pragamtic definition of the data to be collected.

- That the present Diagnostic Analysis activity be carried to completion.

- That AID continue to search for ways to insure active participation by the Department of Agriculture in future rehabilitation project areas.

- That AID continue to urge the Government to reconcile the conflicting administrative boundaries of farmer oriented field workers.

- That AID press for the establishment of a limited permanent cadre of IOs in the Irrigation Management Division, even though the majority of IOs will continue to be contract employees.

- That future long term participant training seek to marry an advanced degree with a job related training program.

- That the Irrigation Department working in conjunction with other agencies, develop and implement plans for the supply of domestic water in the Gal Oya project area, so that the irrigation system can be relieved of this burden.

- That changes in the Galgamuwa faculty be carefully planned to prevent disruption of the training program.

- That water user charges already collected in the Gal Oya area be used, in consultation with the farmers to encourage payment of these charges this year.

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- That AID insist, insofar as possible, that Fixed Amount Reimbursements in future projects go into a revolving fund under the control of the counterpart Ministry or Department, rather than to the Treasury.

CHAPTER I

GENERAL

A. Background

1. The Present Project

The Water Management Project (the Project) is a $24 million six and a half year project. It was authorized in June 1979 as a $18.3 million dollar project with a Project Assistance Completion Date (PACD) of April 30, 1984. The Loan Agreement was signed on August 31, 1979. In April 1983, a major project paper (PP) amendment was issued. The amendment made significant substantive changes in the project, increased the AID contribution by $6.1 million, and extended the PACD to December 31, 1985. Table 1 summarizes the funding history of the project.

TABLE 1

Summary Funding History
($000)

Item	Original PP	PP Amendment	August 85 Revision	Current Estimate
AID Grant	3,000	5,100	4,800	4,235
AID Loan	6,800	10,800	8,800	8,000
Sub Total AID	9,800	15,900	13,600	12,235
Host country	8,940	8,578	8,978	6,900
Grand Total	18,340	24,478	22,178	19,135

Source: Project Papers and Consultant Estimates

The actual Government contribution may be somewhat lower if more subprojects qualify for reimbursement than we now forecast. However, the contribution is all in cash and it represents 36 percent of the total project costs. The current estimate of the actual contribution is less than the PP forecast. It will nearly equal the forecast if the Irrigation Department completes the remaining work.

2. The Original Design

The project grew out of a series of consultant studies under the auspices of AID, the World Bank and others, which all emphasized the problem of poor water management in Sri Lanka and the need to rehabilitate the older major irrigation systems. The most relevant of these was a report prepared by CH2M Hill which proposed an eight year effort to rehabilitate the two largest irrigation systems in the country, (Gal Oya and Uda Walawe), at a

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cost of $80 million. Due to funding and other constraints, this was scaled back in the PP to the preparation of master plans for both systems, major rehabilitation of left Bank of Gal Oya and research and training which had country-wide implications.

The original PP contained some important ambiguities. It provided for a substantial amount of construction equipment, but it left open the question of how the various levels of the system were to be rehabilitated. No provision was made for the repair and construction of structures - a major requirement - or for the rehabilitation of the distributary channels, where major equipment cannot be used. Field channel rehabilitation which includes structural work requiring skilled craftsmen was to be done somehow by the farmers. The relative roles of force account and contractors were not discussed. In short, there simply was no rehabilitation plan and the loan funding pattern reflected this fact. Out of the $68 million loan, $1.7 million (25%) was for contingencies and inflation. One is led to the conclusion that the project was authorized before the planning was complete. This was probably compounded by the fact that the actual extent of the Gal Oya left bank system was not known accurately and this was still true when the project was amended in 1982. The relevant data are shown in the following Table.

TABLE 2

The Gal Oya Left Bank Irrigation System
(in Kilometers)

Element	Original PP	PP Amendment	Actual
Main Canal	51.2	41.2	41.6
Branch Canal	80.5	100.2	103.0
Distribution Channels)	109.4	437.0	449.0
Field channels)		1080.0	576.0
Drainage channels	not stated	487.0	487.0

Source: Project Papers and Irrigation Department Data.

The original project paper also envisaged that the principal implementing agency would be the Irrigation Department, and it called for significant organizational changes and increased staffing in the Department to achieve this. All technical assistance was to be provided by a single contractor.

3. The Project Amendment

By early 1982 some significant changes had taken place in the project, and it was apparent that the project was behind schedule

and would not meet its scheduled completion date. A mid term evaluation, which was essentially a two week reconnaisance, was conducted in early June 1982. It called for major revision in the project, including :

- Quick completion of the master planning to be replaced by a rehabilitation program based on a pragmatic approach to rehabilitation;

- Cancellation and re-bidding of the PRC Engineering Consultants, Intl. technical assistance contract;

- The development of a water balance model;

- Extension of the project to April 31, 1986; and

- An increase in AID funding.

The mid term evaluation expressed considerable concern that farmers who relied on re-use water would suffer as a result of the project. This has not happened, and they may in fact have benefitted. The evaluation led to a major Project Paper amendment which took the form of a completely new PP. It increased the funding and extended the PACD and it introduced a new rehabilitation element which provided for reimbursement to the Government for rehabilitation work based on the Fixed Amount Reimbursement method. (This component had already been added to the project in PIL-13). The changes in component funding are shown in Table 3.

TABLE 3

Project Funding By Element
($000)

Component	Project Paper	Amendment
Loan :		
Commodities	4,170	4,041
Training	700	1,007
Rehabilitation	0	4,520
Construction	0	200
Other Costs	230	335
Contingencies & Inflation	1,700	897
Loan Total	6,800	10,800
Grant:		
Technical Assistance	2,450	4,908
Other Costs	280	-
Contingencies	270	192
Grant Total	3,000	5,100

Source: Project Papers

The amendment made a number of other important changes in the project, many of which had already been codified in Implementation Letters. The most significant of these other changes are:

- Recognition of the pre-eminent role of the Agrarian Research and Training Institute (ARTI) in the development of farmer organizations, and adoption of the Institutional Organizer concept for creating the farmer organizations;

- Provision for Cornell University to serve as the primary technical assistance contractor to ARTI;

- The introduction of the concept of a Water Management Cell to conduct pre-feasibility studies of other major irrigation schemes scheduled for rehabilitation in preparation for a successor AID water management project. (In this report this component is referred to as Diagnostic Analysis);

- A reduction in research, including elimination of the testing of alternative farmer organization models and the on-farm research activities at Gal Oya and Uda Walawe;

- A revised scope of work for PRC's primary technical assistance contract to reflect the new project phases and directions;

- Quick completion of the master plans and an end to activity at Uda Walawe. (Rehabilitation at Uda Walawe has since been taken up by the Asian Development Bank).

4. Ethnic Disturbances

The project area is divided into distinct ethnic areas. It is roughly 40% Tamil and 60% Sinhala. Ethnic disturbances in the Tamil area have had an increasingly negative impact on certain elements of the project. They have precluded the creation of Tamil farmer organizations and they have delayed rehabilitation work. The work is continuing under difficult conditions but will not be completed by the PACD. Except for construction personnel, travel of project officers to the Tamil areas has virtually ceased.

5. The Successor Project

The Mission has completed the design of a successor Irrigation Systems Management project, and is in the final stages of negotiations with the Government. Our review of the draft PP for this new project indicates that it has drawn heavily on the lessons learned in the present project.

B. The Absence of Pre-project Data

At the time this project was designed there was virtually no data available on the Left Bank system above or below Navakiri, either as it was designed or as it actually existed. The length of the main canal was not known, much less the branch canals, or the distributary and field channels. There were no maps of the system

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(there still are none). The design drawings had been lost or destroyed. Farmer encroachments into the system and the extent the system had deteriorated were also unknown. This inhibited the ability to do a complete project design. It led to a large effort to re-create the missing data, which ultimately proved to be wasteful and unnecessary. It also affected the accuracy of projected outputs which were, in some cases, really guesses.

C. Interdisciplinary Relations

At the time of this evaluation we encountered evidence of tension between the engineering and non-engineering personnel associated with the project. This situation has certainly improved over the life of the project but it has been a continuing problem that, to some degree, has adversely affected the project's progress. Any successor project should recognize this and should include planned actions, such as regularly scheduled inter-disciplinary meetings, to help minimize it.

D. Project Outputs

The Table 4 compares actual project outputs with those contained in the logical framework of the PP amendment. (These differ slightly from those shown in the original PP but the differences are not significant). The table shows that actual outputs have fallen short of the expected ones in some cases; most notably number of farmers organized and field channels rehabilitated. Both of these outputs were affected by the ethnic disturbances in the Tamil area, although that does not explain all of the shortfall.

TABLE 4

MAGNITUDE OF PROJECTED AND ACTUAL PROJECT OUTPUTS

ESTIMATED	ACTUAL TO DATE
1. 19,000 farmers organised into irrigation organizations.	1. Between 5,200 and 6,960 Sinhala farmers organized.
2. a. Rehabilitation of one physical facility and training program established.	2. a. Galgamuwa re-organized and new facilities under construction
b. In-service training courses on water management presented to 90 T.A.'s per year from Irrigation Department and other field level personnel from other departments.	b. Courses given to 477 persons from '82 through '85.

ESTIMATED	ACTUAL TO DATE
c. Curriculum upgraded for basic T.A. training course to include water management training for 60 TA's per year.	c. Curriculum upgraded to a two year course. 204 TA's trained with 75 enrolled for 1986.
d. Seven training staff posted at GITI.	d. Seven training staff posted.
e. Twenty participants per year from I.D. and other departments provided short-term water management training in the U.S. and third countries.	e. 133 participants sent abroad for short term training.
f. Eight long term participants trained in disciplines related to water management to upgrade research, training and operations and maintenance.	f. Nine long term participants trained.
g. A minimum of 140 Institutional Organizers trained and fielded to fully cover project area.	g. 169 IO's trained, of which twenty are still working.
3. On-farm field research completed on unit 21 in Gal Oya (572 acres) and tract 3 in Walawe (500 acres).	3. On-farm research dropped.
4. Master plans and other reports prepared, approved and distributed to include recommendations on : a. Return flow re-use. b. Operation of main canal and reservoir system. c. Domestic water. d. Operation maintenance procedures.	4. Master plans prepared for Gal Oya and Uda Walawe. Domestic water report prepared and submitted. Operation and maintenance plans prepared but not adopted.
5. a. Training provided to extension staff and agricultural officers (see 2e).	5. a. Only a few persons trained.
b. Demonstration plots of subsidiary crops established at locations throughout Project area.	b. A contribution of Rs 60,000 made to the Department of Agriculture for this purpose.

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ESTIMATED	ACTUAL TO DATE
c. Meetings held with an estimated 200 farmer leaders per year to provide orientation on improved water management practices.	c. Meetings held with 300 farm leaders and the Agriculture Department posted a water management extension adviser to the area for two years.
6. a. Rehabilitation of	6. a. Rehabilitation completed on
(1) 41.2 kms main canal	(1) 41.6 kms of main canal (100%)
(2) 100.2 kms branch canal	(2) 103 kms of branch canal (100%)
(3) 437.0 kms distribution canal	(3) 436 kms of distributary channels (97%)
(4) 1080 kms field channels	(4) Field channels 145 kms of structures (25%)* 86 kms of earthwork (15%)*
(5) 487 kms drains	(5) 47 kms of main drains (10%)**
b. Specifications developed, orders placed and two excavation and two maintenance units arrive and are in full operation.	b. Equipment not provided.
c. Develop and begin water delivery schedule and measurement program. Develop irrigation operations model.	c. Computer based water balance model developed and in use.
d. Prepare and implement operating and training program for equipment.	d. Program implemented but maintenance poor.

* The total actual length of field channels is only 576 km.
** Based on a visual inspection, only 150 kms of drains required rehabilitation.

7. Re-organization takes place with appointment of key and other supporting personnel. Better operations and maintenance procedures established.	7. Overtaken by creation of Irrigation Management Division in Ministry of Lands and Land Development.

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ESTIMATED	ACTUAL TO DATE
8. Prefeasibility studies prepared for 6 major irrigation systems. One full feasibility study conducted of representative system.	8. Prefeasibility studies underway for two systems. No full feasibility study being conducted.
9. One centre established and staffed by 8 professional researchers. Training provided to selected staff (see 2e and 2f). Annual research report prepared; Water Management Newsletter established.	9. Research center established but not fully staffed.

Source: Other sections of this report.

CHAPTER II

THE PHYSICAL SYSTEM

A. Historical Perspective

At the time this project was designed there was virtually no data available on the Left Bank system above or below Navakiri, either as it was designed or as it actually existed. The length of the main canal was not known, much less the branch canals and distributary and field channels. There were no maps of the system (there still are none). The design drawings had been lost or destroyed. Farmer encroachments into the system and the extent the system had deteriorated were also inknown. This led to a large effort to re-create the missing data, which ultimately proved to be largely unnecessary. It also affected the accuracy of projected outputs which were, in some cases, really guesses.

The Left Bank system was originally designed to serve 42,000 acres, but by 1979 a total of 53,000 acres were attempting to draw water from the system, principally because of encroachments into the canal reservations. Since 1983 these encroachments have been regularized and they were taken into account in the rehabilitation design.

In 1983 area covered by the Left Bank system was determined by planimetry, based on 1981 aerial photography. It shows the total extent of irrigable area under the Left Bank canal system is :

TABLE 5

Area Served By The Project

Above Navakiri Reservoir	40,051 acres
Below Navakiri Reservoir	12,955 acres
Paddirippu River Division	7,015 acres
	60,021 acres

Source : Irrigation Department

Though the main canal is designed to command the entire 60,021 acres on the left bank, except for increases in main canal capacity, the Paddirippu River Division did not form part of the rehabilitation project.

B. Progress to Date

The rehabilitation progress achieved to date and the estimated cost is summarized in table 6.

TABLE 6

SUMMARY OF ESTIMATED CONSTRUCTION COSTS AND ACCOMPLLISHMENTS

ITEM	LENGTH KM	ESTIMATED COST MILLION RUPEES	ACCOMPLISHMENTS (% COMPLETION)
Main Canal	41.6	23.8	100%
Branch Canals	103.4	38.8	100%
D Channels:			
- above Navakiri	372	46.8	100%
- below Navakiri	77	9.7	80%
Field Channels:			
- above Navakiri	451	22.5	Structures 35% Earthwork 25%
- below Navakiri	125	6.3	Structures 0% Earthwork 0%
Total		147.9	
Main Drainage Channels and Navakiri Reservoir			
Uhana Drains	52.8	3.2	100%
Mandur Drains	31.9	1.9	No work done
Gonagolla Drains	45.4	2.7	
Navakiri Tank		2.7	100%
Total		10.6	

Total Estimated Cost Of Irrigation And Drainage

	(Million Rupees)
Irrigation Phase	147.9
Drainage Phase	10.6
	158.5

C. Cost Per Acre Of Rehabilitation

Costs per acre had to be calculated based on the design estimates of costs. An examination of some of the completed sections of work done on contract indicate that the actual costs are very close to the estimates.

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Based on the cost estimates, the cost per acre for Gal Oya is Rs 2,990. The cost of rehabilitation of seven other irrigation rehabilitation projects in Sri Lanka shows an average cost per acre of Rs 1,876, with a range from Rs 1,408 to 2,570. Thus, the cost of rehabilitation of the Gal Oya canal system is about 60 percent higher than in the other projects.

Several factors have contributed to this higher cost per acre including the cost incurred in rehabilitating the main canal to carry water for Paddiruppu and the cost of augmenting Navakiri Reservoir. In view of these factors, the cost/acre of Rupees 2,990 for rehabilitation of the canal and drainage system is reasonable.

D. Overall Benefits Of The Physical Rehabilitation

1. Increase in Area Irrigated

The Left Bank Canal System was designed to serve 42,000 acres of legally allotted land. However long years of neglect of maintenance of the canal system has reduced its capacity and thousands of acres at the tail ends, particularly downstream of the Navakiri tank, did not receive water for almost a decade. We estimate that, prior to rehabilitation, the system might have been capable of carrying water sufficient to serve, efficiently, an area of 30,000 acres in the Yala season.

The system can now serve 53,006 acres directly, and an additional 7,015 re-use acres indirectly. Thus the rehabilitation has increased the area served by a minimum of 11,000 acres and probably actually indirectly benefits up to 30,000 acres more than at the start of the project.

2. Hydraulic Performance

The hydraulic performance of the system has improved considerably due to rehabilitation.

For example, the area commanded by the Mandur Branch has increased from 1200 acres in 1980 to 4,650 acres in 1985 even though gauge heights have remained relatively equal.

E. Technical Performances

1. Master Planning

The original PP envisaged preparation of Master Plans for Gal Oya and Uda Walawe to make an inventory of the existing water resources, their use patterns and to develop alternative scenarios for optimal use of available resources. These master plans were expected to form the basis for further design and implementation of the proposed rehabilitation program.

The work on the master plans started in 1980. Some of the data deficiencies that existed right from the beginning of the original project concept were overcome and a considerable data base was established.

However the level of effort required to collect the data was underestimated and there were inevitable delays. This led to the recommendation by the 1982 mid- term evaluation to terminate further work on the Uda Walawe master plan immediately, and to wind up the master plan effort for Gal Oya soon thereafter. It was felt that rehabilitation would proceed without such plans, using a pragmatic approach to design and construction. Thus the full extent of benefits expected from the master planning effort were not achieved and the plans themselves are useful largely as reference documents.

There is one major data gap, however, that has never been overcome. That is the preparation of accurate maps of the system area at a suitable scale. Such maps would have been very useful during design and construction and they are necessary if the system is to be operated and maintained as efficiently as possible. The preparation of such maps should be a requirement in any future project and a condition for further project activity at Gal Oya.

2. The Original Design Approach

Although the design capacity of the Left Bank main canal at the head reach was 1,477 cusecs (42.2 cumecs) siltation and deviation from designs during construction had reduced inflows to the system to 1,364 cusecs (36.83 cumecs) by the start of the project. Lack of control structures on the canals had necessitated a rotational irrigation where canals were operated two to eight days at large discharges and then shut off for three to nine days.

The main consideration in formulating the rehabilitation design criteria was to develop a physical system with operational controls capable of delivering pre-scheduled flows of water to the various parts of the system. The canal system was designed for continuous flow in the main and branch canals and the channel distributary channels, with rotational irrigation to be practiced at the field canal level.

3. The Pragmatic Approach

The basic concept of the pragmatic approach was to conduct a physical inspection of the system and to determine what was needed to be done to ensure hydraulic efficiency and to stabilize the canal banks. The pragmatic approach had to rely heavily on judgement of the design engineers and this required considerable on-the-job training by PRC. However, it was successful in practice. It resulted in a hydraulically efficient, maintainable system that can supply the area under its command.

4. Overall Construction Procedures and Progress

Rehabilitation of the main canal and major branches was to be done with heavy equipment, while labor intensive techniques were

to be used for work on smaller distributaries and field channels. The progress on the labor intensive component of work has fallen very much behind schedule.

Fixed Amount Reimbursements

The Fixed Amount Reimbursement (FAR) System is a good system as far as reimbursable items are concerned, but for non-reimbursable items there is no financial incentive to complete the work. This has contributed to the slow progress on these items.

Project Implementation Letter 13, stipulated the FAR reimbursements would be paid into a revolving fund under the control of the Irrigation Department and AID advanced $100,000 into this account. However, when the first reimbursement requests were officially submitted to AID the Irrigation Department requested that the reimbursements be paid to the Treasury. Apparently, AID did not object to this important deviation from the provisions of PIL-13. Reimbursement to the Treasury, rather than to a revolving account, has slowed the pace of rehabilitation work.

Farmer Participation in Construction

In the project design farmers were expected to contribute labor to the rehabilitation of field channels. In practice this has happened in only a limited part of the area, and it was probably not a realistic expectation. In any case, the completion rate of field channels above Navakiri is only 35% for structures and 25% for earthwork. Nothing has been done below Navakiri. The system will not achieve full design efficiency until this work is done. AID should insist that the Irrigation Department complete the work, and it should be a condition of any successor project activity in Gal Oya.

There are three alternative approaches to the problem of farmer participation that might be tried. They are :

- Contract with farmer organizations for farmers to rehabilitate the field channels entirely, including earthwork and structures.

- Have the Irrigation Department, or its contractors, build the structures and contract with the farmers to do the earthwork.

- Rehabilitate the field channels completely by force account or contractors.

The last alternative would be the least desirable alternative since it would foster the belief among the farmers that the field channels are the government's responsibility. On the first two alternatives, it would be highly desirable, if not essential, to secure a partial contribution of free labor by the farmers to help foster their share of ownership of the channel.

5. System Operation

The Computer Model

A computer model has been developed to calculate the flows required at critical points in the system to meet the system demands computed on the basis of data inputs and/or assumptions on irrigated area at each off-take, soil type, evaportranspiration, rainfall, state of farming activities and canal efficiencies. The Irrigation Engineer (IE) for Ampara has developed a system of reporting and instruction on a daily basis.

This system, which started only a few months ago, appears to function reasonably well. With time the data inputs can be refined and the model made much more responsive to the actual field conditions, and a fair degree of agreement can be established between the calculated flows and actual field needs. While the IE (Ampara) issues the amounts of water requested by the IE (Kalmunai) and the Deputy Director (Batticaloa) the computer model is not being used for detailed operational decisions at the individual off-takes of those parts of the system. Eventually the computer model should be used for detailed operational decisions at all off-takes in the entire system.

One major deviation observed during field inspection of the canal system was that direct outlets to farms from distributary canals have become more a rule than an exception. This results in overuse of water by farmers with direct outlets while the farmers at the tail-end undergo hardship in getting their share of water. This was one of the inherent defects in the Gal Oya distribution system from the early days. It will have to be rectified if the system is to operate efficiently and equitably.

6. Maintenance

While the project has been primarily under rehabilitation, each division in charge of construction has been expected to maintain completed reaches. So far maintenance is done on an as needed (or as felt needed) rather than on a routine and systematic basis. No maintenance routine has been established involving regular patrolling of the canal reaches; no standard forms have been developed to note abnormal conditions needing attention; no maintenance manual has been adopted and there is no specific maintenance plan.

It must be particularly noted that in spite of the rehabilitation, the system is 35 years old and it must be nurtured carefully if its useful life is to be extended to justify the capital investment in the rehabilitation program.

Financing Maintenance

The Irrigation Department's estimated O&M costs is Rs 200 per acre. Under the terms of a World Bank agreement, it was decided that farmers benefitted by an irrigation project should contribute Rs 100 per acre towards O&M charges and that the Government would contribute the remainder. The plan is to

increase the farmers' contribution gradually until the entire Rs 200 charge is borne fully by the farmers. While we were unable to establish the exact amount allocated by the Department for the purpose of maintenance, it was clear that they have been below what was needed and were less than Rs 100 per acre.

Farmer contributions are deposited in a separate bank account in the District where they are collected, where they are held to be used in consultation with the farmers. In 1984 collections in Ampara District were 78 percent of assessments, by the highest collection rate in the country. This probably is due in part to the Gal Oya rehabilitation and the improved water reliability that ~~has~~ resulted from it. However, collections to date in 1985 have been minimal (2.7%). This may result from the fact that most of the 1984 funds have not been used, so farmers have not seen any results from their previous contributions.

7. Equipment

The reported heavy equipment depreciation for the project is estimated at less than 20 percent, although this may be somewhat understated. In any case, it is clear that too much equipment was ordered, too soon, without establishing the real needs. Cost control and management of the available equipment also leaves a lot to be desired. For example, no records are kept of the value of work done on force account using heavy equipment. This was partly due to lack of counterpart personnel, of an appropriate level, during the tour of duty of the PRC/ECI consultant.

Thus the project is now left with a large surplus of equipment with about 80 percent useful life left in it. After retaining the minimum equipment necessary for the O&M functions of Gal Oya, the remaining equipment should be transferred to other projects.

While by and large the type of equipment ordered appeared to be appropriate, there were instances of inappropriate and expensive equipment ordered and unutilized on the project. One example was the arrival of a $326,000 rock crusher that was so totally inappropriate in size and type that it was never used on the project.

F. Domestic Water Supply

Domestic water supply is a problem in the project area. Some system of domestic water supply should be found that is independent of the irrigation system. The quantity of water needed for domestic water supply is not large, but use of irrigation canals for domestic water supply requires running the canals during non-irrigation season. One estimate puts the wastage at 99.6 percent of such off-season releases, reducing valuable storage essential in the Yala irrigation season. Also such use of canals during off-season disrupts essential maintenance activities on the canals.

CHAPTER III

FARMER ORGANIZATIONS

A. Current Status of Farmer Organizations in the Project Area

The farmer organization program has substantially achieved its objective of promoting the formation of farmer organizations in the Sinhala portion of the Left Bank of Gal Oya. Security problems in the Tamil pirtions of the project area have meant that these areas have not been covered. On September, 1985 348 out of the targeted 370 field channel farmer organizations, 94%, were reported to be formed in all of the approximately 25,000 acres in the Sinhala colonization areas. Between 60 percent and 80 percent of the approximately 11,200 farmer water users in the area participate in these organizations. Mortgagees and leasees make up the major portion of non-participants.

The program has also led to the progressive establishment of a farmer organization structure composed of 27 D-Channel Organizations, 6 Area Councils, and a Project Level Committee. It is notable that the Area Councils were established, at the farmers' own initiative, after the number of field channel organizations began to increase. In establishing Area Councils farmers temporarily by-passed the formation of the D-Channel organizations which program planners had assumed would be the next logical step. The formation of the Councils at this stage indicated that farmers were able to take action according to their own view of their needs and that they were not simply being pushed into activities in which they were not actively interested or involved. In response to the farmers' Area Council initiative, Farmer Representatives have been invited by the District Government Agent to take part in the District Agricultural Committee.

Both farmers and officers have felt that the newly-created farmer organization structure has provided an important and useful avenue for improved communication between and among the two groups. The principal topics for discussion so far have been the timing and rotation of water issues and the progress and problems with system rehabilitation.

While the creation of the field channel organizations and the farmer organization structure has been a significant accomplishment, most of these organizations are still relatively new and not firmly established. The majority of the field channel organizations have been in existence for less than two years and during that period the farmer organization program has been handicapped by an inability to retain experienced Institutional Organizers. It was the general impression of the officers and farmers interviewed in the course of this evaluation that only about half of the field channel organizations will continue to function after the number of Institutional Organizers is reduced at the end of 1985. This view was also reflected in the results of the survey of farmers in Gal Oya which was recently administered by the Agrarian Research and Training Institute

(ARTI). Thus, while the organizations seem to have been accepted by farmers and government officers alike, it does not appear that they have "taken root" in Gal Oya.

Many of the 421 Farmer Representatives elected by the field channel organizations appear to be more responsive to the interests of all the farmers in their organization being less politicized and being better trained as regards water management. However, there is no quantitative evidence to demonstrate the extent to which this is true. It does appear that selection of leadership from within relatively small and homogeneous groupings is giving a voice to those who may previously have been over-shadowed by a small number of politically influential individuals. The spread of political allegiances among representatives who appear to be working together to solve water problems, and the District Minister's commitment to political neutrality, indicate that progress has been made in preventing politics from interfering in the activities of the farmer organizations. Training programs for Farmer Representatives also appear to be contributing to improved leadership and greater understanding of measures which farmers can take to improve water management.

No particular effort was made to involve women in field channel organizations, and women appear generally not to have attended business meetings of these organizations. However, two women have been selected as Field Channel Representatives (one is also Chairwomen of the D-Channel organization). The evidence available indicates that women in the project area do not play an active part in water management, and therefore a special effort to try to draw women into the organizations would not have been justified.

B. Functions Served by Farmer Organizations

Since the formation of farmer organizations, there has been a discernable increase in the level of participation of farmers in the design, operation and maintenance of the irrigation system, a reduction in the level of conflict over water, and an improvement in the quality of communication between farmers and officers. While these improvements have been associated with the formation of farmer organizations, it is impossible to isolate the contribution of the organizations from the effects of the concurrent physical rehabilitation of the system and the improved receptivity and cooperation of the Irrigation Department officers in the project area. It can only be said that the combined result has been positive.

It must also be recognized that farmer organizations have still only just begun to show their effectiveness in irrigation operation and maintenance. In most cases their ability to respond positively to situations of water shortage and possible conflict is still untested. Rotations initiated by farmer organizations during the first years of the program have been less widespread and less necessary during the last two years. During these latter years there has been an ample water supply and the Irrigation Department has administered D-Channel rotations. Farmers appear

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to have worked to improve the cleaning of the field channels, but after an initial increase in communal cleaning efforts, there has been a reversion to individual cleaning. Experience has shown that it was unrealistic to expect field channel organizations to undertake the free field channel construction work which was expected of them. Some form of contractual agreement with compensation should have been instituted. The lack of realism in expecting farmers to undertake to do this work for free was recognized early on by the Cornell consultants.

Thus, while the creation of the farmer organizations in Gal Oya has been a definite step forward, more than anything the still relatively limited achievements reflect a potential for more effective farmer participation. This potential needs to continue to be supported so that it can be fully realized.

C. Assessment of the Contribution of Institutional Organizers to the Formation of Farmer Organizations

Institutional Organizers have clearly played a critical role in the establishment of farmer organizations in Gal Oya. They have provided guidance to farmers and encouraged them to take an active role in the design, operation and maintenance of the irrigation system. They have also promoted improved communication between officers and farmers by facilitating farmer meetings which officers have been invited to attend. They have also brought officers together at informal reunions and thus helped to improve coordination in the provision of services to farmers.

Women Institutional Organizers have performed as well as male IOs. In fact, it appears that farmers may have been inclined to be more receptive and cooperative towards the women IOs. The relatively minor role that women play in water management probably explains the failure of the presence of women IOs to generate a greater participation of women in the farmer organizations.

Despite the positive contributions made by the Institutional Organizers, the overall efficiency and effectiveness of the IO program has been seriously undermined by the increasingly rapid turnover of recruits. By the end of the project, only approximately 20 out of the 169 IOs trained, still remain. The average length of service of the IOs has been just under 12 months.

However, despite the turnover in IOs, an assessment of the prevailing institutional and social environment in Gal Oya at the start of the Water Management Project confirms that the strategy adopted for the IO program was justified. When the program started there was a need for a "catalyst" with the time, energy and commitment to working with farmers and with the confidence and status to influence government officials. Although it would now be useful to be able to compare the results achieved by alternative sorts of catalysts it would have probably been beyond the capacity of ARTI to manage such an experiment. An early effort to train irrigators as Institutional Organizers proved to be unsuccessful.

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While the IO training provided by ARTI appears to have been effective, the IO program has been under ARTI administration for too long. The protracted retention of the program under the wing of ARTI has led to a decline in standards of supervision and monitoring. The turnover in ARTI staff and a waning interest in administering the experiment have contributed to this decline.

The technical assistance provided by Cornell provided needed continuity and useful guidance for the program. However, the less experienced ARTI staff would have benefitted from more assistance in setting realistic targets for data gathering and analysis. The program would have seriously suffered in the absence of the locally recruited Cornell Consultants, particularly in the last two years, when the ARTI staff who had worked most closely with the program at its inception, left the Institute.

The former Deputy Director of Irrigation in Gal Oya contributed to the positive achievements of the IO Program through his active support and assistance to its administration and implementation in the field. The importance of his help to the program confirms the need for the active involvement of the Irrigation Department in the implementation of efforts with similar objectives.

D. Alternative Strategies for the Promotion of Water User Associations

While the IO program in Gal Oya has demonstrated the benefits which can be derived from the use of outside catalysts, there is no single formula for the promotion of water user associations which can be recommended for all irrigation systems in Sri Lanka. Even if one only considers major irrigation schemes, there are important differences from one scheme to the next in the skills and attitudes of officers and in the cohesiveness and leadership within the water using community. This indicates the need to assess the institutional and social environment of each system before selecting the strategy which will be used to promote water user associations.

Table III-13 in Appendix B presents a summary of the three principal types of strategies which can be used to obtain the participation of water users in irrigation system operation and maintenance.

The alternative strategies are ranked in order of the level of government resources required. It indicates that where there is a strongly cohesive community with strong and generally accepted leadership it may only be necessary to ensure that there is a receptive institutional environment and a reasonably functioning physical system. The farmers can be expected to naturally develop their own user organizations from within the existing social structure. Where community cohesion is less strong but still evident, some positive encouragement from government officers will be required. But where there is little community cohesion and/or government officers still lack the necessary orientation, the introduction of an catalyst will be required.

However, regardless of the particular strategy which is adopted for each scheme, a common element which will be essential is the appointment by the Irrigation Management Division of individuals experienced in the promotion of water user associations. These individuals will be charged with determining and implementing the correct strategy in each particular location. The Irrigation Systems Management Project Paper provides for a group of Assistant Project Manager/IOs who could fulfil this function.

It is essential that the Assistant Project Managers should be incorporated into the permanent career structure within the Irrigation Management Division (IMD). If they are not, the effectiveness of their work will continue to be undermined by the level of turnover which has dogged the IO program in Gal Oya. Given that the IMD may still be hesitant about making a long term commitment to an Assistant Project Manager cadre, the Division should explore the possibility of recruiting former IOs on three year secondment from the Ministry of Education to fill these posts.

E. ARTI Monitoring and Research Program

The monitoring of the IO Program by ARTI has been over-ambitious in its objectives and inconsistent in its performance. Too much data have been generated and the lack of continuity in ARTI staff has reduced the effectiveness of the monitoring effort as a source of feedback to the project. There should have been less reliance on anecdotal reports and more emphasis on a regular and careful analysis of the process documentation. They should have tabulated a few, accurately collected, indicators of FO progress, such as numbers and types of activities being undertaken by FOs and number of actual physical achievements from FO activities.

ARTI's final evaluation should include a discussion of farmers' actual motivation for joining or failing to join field channel organizations. It should also include a distillation of the principal results and policy implications of the project- related research which the Institute has undertaken.

The project has increased ARTI's institutional experience in investigating irrigation issues. This has led ARTI to be drawn into research for other irrigation projects such as the Mahaweli Program and the World Bank Minor Irrigation Rehabilitation Project. Having said this, it would appear that ARTI's research capacity on irrigation matters has been over- extended, given the problem with retaining experienced staff. This is one reason why the special studies funds included in the project budget have been under-utilized.

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CHAPTER IV

TRAINING

A. General

1. The Original Project Paper

The original project design provided for five separate types of training activities. They were :

- Reopening and upgrading of the Irrigation Department's Training Institute at Galgamuwa;
- Strengthening the National Diploma in Technology courses in civil engineering at Katubedde and Hardy Institute;
- A series of in-country training courses at the Hardy Institute, the Agricultural Training School and Agrarian Service Centers;
- Long and short term participant training in the Philippines and in the United States; and special observation tours for 20 policy makers.

Training for Institutional Organizers was not included in the original PP, because the IO concept had not been formulated. This important training element was recognized in the PP amendment. Based on IO performance and interviews, it appears to have been well designed and executed.

2. The Project Paper Amendment and Cost Changes

By the time the PP amendment was approved in 1983, the proposed content of the training element had been revised. The most important changes were :

- An extension of the role of, and support for the Galgamuwa Institute;
- A substantial expansion of participant training;
- Elimination of the proposed programs to upgrade training at Katubedde and the Hardy Institute; and
- Some decrease in the emphasis on other in-country training.

The line item amount for training in the original Project Paper was $700,000 in loan funds, and this was increased to $1,007,000 in the PP amendment, of which $ 75,000 was budgeted for IO training. Although there was no breakdown of training costs in the original PP, the increase appears to have been primarily for an expanded program of long term participant training. Both training estimates understate the planned and actual costs of the training program, because of the standard categories of AID funds. The details are shown in Table 7.

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TABLE 7

Total Training Costs, By Element
($000)

Item	Original PP	Amended PP	Estimated Actual End Project
Participant Training	700	932	946
(Long Term)	na	(342)	(279)
(Short Term)	na	(590)	(667)
IO Training	0	75	31
TRAINING TOTAL	700	1,007	977
OTHER TRAINING COSTS			
Galgamuwa Facilities & Equipment	na	360	351
Training Advisors	313	510	460
GRAND TOTAL	1,013	1,877	1,788

Note: Excludes Water Synthesis training workshops

Sources: PP as amended, Mission Training Reports, Consultants' Estimates

The separate elements of the training program are discussed in the following sections. The evaluations in these sections draw on interviews with 20 long and short term participants. The composition of this group was determined primarily by the availability of interviewees.

B. Galgamuwa

The Irrigation Department's Irrigation Training Institute at Galgamuwa was established in 1956 and closed in 1970. The Project Paper proposed reopening the Institute to meet a pent-up demand for trained Technical Assistants in the Department and to establish a program of in-service training for departmental and other personnel. The PP amendment carried this concept forward and included a $200,000 line item for construction of new facilities which had been determined to be needed, and $160,000 for training equipment. In addition, the project has provided long term academic training for four faculty members; a one year resident faculty advisor to assist in the revision of the basic

curriculum; and advice and assistance from the Project's long term training advisor in training methodology and the design of in-service training courses.

The Institute was reopened in 1982. It currently has a full time teaching staff of five engineers and two technical assistants, who are augmented by part time personnel. Its annual budget, excluding salaries, is Rs 1.95 million. By the end of this year it will have provided two-year entrance training for 204 Technical Assistants, with a class of 75 enrolled for a next year. Class sizes are expected to be reduced by about 50% in future years, since the pent-up demand for Technical Assistants will have been met and new trainees will be required primarily to cover attrition. In addition, since mid 1982, the Institute has held 21 in-service training courses for 402 personnel from the Irrigation Department, the Mahaweli Authority and other government agencies. Courses have been held for technical personnel at all levels from engineers to draftsmen. The Institute also participated actively in the training of the first group of IOs, and it has trained 150 farm leaders on site at Gal Oya. Part of the new facilities are still under construction and they may not be completed in time to qualify for AID reimbursement.

All available evidence indicates that this component of the Project has been a success that has reached well beyond the Gal Oya project area. The long term trainees are selected by open examination and sign a five-year bond when they enroll. Their training is not available anywhere else in Sri Lanka. It provides a solid grounding, and the graduates have filled a critical personnel need in the Irrigation Department. The short term in-service courses are meeting an important training need and appear to be equally effective. Indeed, several of our interviewees said that their in-service training at the Institute was superior to the training they received abroad.

C. Participant Training

1. Long Term Training

The most important difference between the original PP and the Amendment appears to be a substantial increase in the number and cost of long term participants. The PP makes no reference to long term participants in the project description, but the technical annex states that two professionals (presumably from the Galgamuwa Institute) would receive one year's training abroad in irrigation and educational techniques. The Amendment provides for long term training for a total of nine persons. It is a somewhat heterogeneous mixture. The three ARTI trainees were to include one PhD program, one masters program and one non degree program. Only two persons have been sent, both are still abroad, and the masters program will not be completed. The PhD program appears to have been of limited direct benefit to the Project, although the participant, who was active in the early stages of the project is doing his thesis work on the Gal Oya experience.

All of the other long term participants were sent abroad on non-degree programs, which were specifically designed for them. The programs were apparently non-degree ones because of PRC's perception that the Mission wanted them that way, and not as a result of an overt Policy decision. Our interviews indicate that these programs were all successful and that the returnees are applying their training in their work. However, all were critical of the fact that they were not able to obtain degrees both for personal reasons and because the added prestige would have made them more effective, especially in the presentation of new ideas. It is a subjective judgement, but we support this view. In most cases the degrees would have required only a little more time and money. We believe that future long term training should consider the possibility of masters degree programs which are carefully designed to insure that the course work is relevant to the trainee's job.

2. Short Term Training

Short term participant training dominates the training component in the PP, in the amendment, and in practice. A total of 115 persons have been sent abroad for short term training and an additional 18 (including eight members of Parliament) were sent on observational tours. The original PP concept was that most of the short term training would be conducted at IRRI in the Philippines. In practice, most was done through a special course designed by the National Irrigation Authority (NIA) in the Philippines and at Colorado State and Utah University, often in combined programs. The shift to the NIA was a conscious choice based on the quality and relevance of their training program. One program was held in Pakistan, but it was not repeated because differentials in climate and system magnitude and design limited its effectiveness.

These short term participant training courses appear to have been carefully selected in terms of their relevance to the project and particularly the concepts of water management. However, the benefits of the training, while important ones, are largely intangible. Our sample of interviewees is very small, but none of them could point to specific skills that they learned abroad and that they were applying to their jobs. But almost every one of them cited a general increased knowledge of water management and a heightened awareness of its importance as the most important benefit of their training. And most could cite specific examples of how that affected their performance on the job. This group includes construction technical assistants who would normally be less concerned with water management, which is more the purview of operation and maintenance TAs. Thus, while we cannot support it with hard data, we are convinced the short term participant training program was effective and worth the cost. We believe it has improved the long term performance and capabilities of the trainees; and that it was one factor in the success of the project in changing the climate of communication among government officials and between them and farmers. And it undoubtedly had important morale benefits as well.

D. In-country Training

In-country training was given important emphasis in both the PP and the amendment, but we have very little basis for making any judgements about it. Records indicate that some 300 farmers and farmer representatives were trained in one and two day workshops, and that well over 100 government personnel from more than five different agencies received training in special courses ranging in length from two days to two weeks. From the pattern in the progress reports and from interviews it seems clear that the in-country training element gradually declined over the life of the project. This apparently was due to a combination of the following factors :

- The press of the rehabilitation work in the later years;
- The creation of the IO program, which informally took over some of the farmer training;
- The reportedly limited interest of farmers;
- The sheer logistics of mounting this type of training most especially for farmers; and
- Departure of the long term training advisor and other consultants.

E. Training of Women

It appears that none, or almost none, of the persons trained under the project were women, because women do not occupy the positions from which the trainees were drawn.

F. The Program Balance

Subject to our inability to judge the in-country training, we believe the training program was well balanced. Upgrading the Galgamuwa Institute was necessary for the project, future projects and the Irrigation Department as a whole. With the exception of the PhD program, the long term training prepared individuals for specific important positions within the project. The short term participant training helped create the attitudes in a critical mass of technical personnel who were directly involved in the execution of the project and it was one key factor in the communication change that we have cited as a major accomplishment.

CHAPTER V

OTHER PROJECT COMPONENTS

A. The Problem of Conflicting Administrative Boundaries

A variety of government agencies serve the farmer. A few of these are

(a) The KVS extension agent in the Department of Agriculture, who assists the farmer with on-farm management of inputs, including water, fertilizer, seeds, etc. in order to increase his productivity and income.

(b) A Yaya Palaka is an agent of the Agrarian Services Department who is expected to coordinate the supply of inputs to the farmer.

(c) The village based banks and a variety of private lenders supply the credit to the farmers.

(d) The Cultivation Officer coordinates the decisions regarding cropping patterns and the cultivation questions at the farm level.

(e) The Jala Palaka or Irrigation Overseer controls the supply of water.

One major problem in providing comprehensive, coordinated services to the farmer is the varying jurisdictional boundaries of the different departments and agencies. The above Government employees work within their departmental administrative boundaries (not all jurisdictions of the different departmental representatives coincide), whereas the irrigation official's boundaries tend to follow hydraulogic boundaries. These jurisdictional boundaries need to be rationalized if the services are to be delivered in an efficient manner and the government employees with overlapping and inter-dependent responsibilities are to act as a team.

Despite this limitation, the general cooperation among the employees serving the Gal Oya service area appears to have been good. The Department of Agriculture in particular intensified its extension services and the Agrarian Services Department seems to have increased the availability and accessibility of the necessary imputs to coincide with the increased availability of water due to the rehabilitation project.

B. Diagnostic Analysis

The Diagnostic Analysis component of the project is being implemented at Polonnaruwa by the Consortium for International Development through a direct contract with AID. The basic purpose of this component was to work with a Government water management

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team, or Cell to prepare prefeasibility reports or proposals which would identify rehabilitation work on selected systems. This was to involve the collection of vital, basic data on the performance of the systems and then to identify areas which needed physical, operational or management improvements. Such an approach would, indeed, provide valuable insights and data that could significantly improve the design and construction of irrigation projects, including rehabilitation projects.

Our exposure to the work under this component was limited by time, and the data collection and analysis is still underway. With this caveat, our observations are as follows :

- While it is extremely desirable to collect and analyse diagnostic data such as water flow parameters, infiltration and percolation, soil characteristics, crop water needs and timing of application, water travel times and methods of application on-farm, etc, the cost and ability to do such detailed studies in all projects is greater than the resources available. This makes the replicability of the program doubtful.

- It is precisely the considerations of cost and expediency that prompted adoption of a pragmatic approach to design and construction of rehabilitation work in Gal Oya, in place of field surveys and data collection which could have improved the precision of the design. In fact, the Master Plan component of the project, which was attempting to develop a detailed data base, was abridged and terminated due to lack of time. The detailed data collection and research involved in Diagnostic Analysis should be viewed in this perspective and any future effort in this area should be subjected to a stringent test of, is the data necessary?

- The original intention of the Diagnostic Analysis component was to involve Sri Lankan counterparts and develop a team that would carry on similar work in other parts of the country. The Irrigation Management Division never established the requisite Water Management Cell and Sri Lankan professionals attached to the project have been drawn from a variety of organizations and have worked on a part time basis. The continuity of their association with similar work is unlikely. It is clear that this component of the project will not achieve its intended institutional purpose. However, given the sunk costs, the present data collection effort should be carried to completion.

C. On-Farm Water Management Research

On-farm water management research at Gal Oya was programmed to evaluate revised and improved field canal layouts with on-farm land levelling and water management features, and as a demonstration to farmers.

A similar research program is being carried out in Kalankutiya in the Mahaweli System H area funded by US AID. The Gal Oya on-

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farm research was dropped after the mid-term evaluation largely because of the press of time, but it is possible that the intention was to draw lessons from ongoing research projects such as Kalankutiya for replicability on this project. The on-farm research is an example of the over emphasis on research in original project design. We doubt that it could ever have been done in this project, and it should have been dropped.

D. PRC/ECI Contract Performance

PRC/ECI was the consultant that provided technical assistance to the Irrigation Department from the beginning of the project. The contract for consultancy called for advice and assistance on all phases of the project, including planning, design, construction, operation and maintenance.

As a result of this consultancy several reports were prepared including Master Plans for the Gal Oya and Uda Walawe Projects. Specific studies were also prepared on Domestic Water Supply, Water Re-use, Reservoir Operation etc. Also the consultant was required to compile quarterly progress reports to keep all concerned informed of the developments on the project. The consultant also certified completed construction elements before AID released funds under the FAR (Fixed Amount Reimbursement) Program. This work was carefully done and provided adequate protection for AID in its disbursement of FAR funds. The early relative emphasis on the data collection and planning vs. progress on physical construction work was a source of misunderstandings between the consultant and the Irrigation Department in the early stages of the project. Since the adoption of the pragmatic approach and the change in team leadership the cooperation between the consultant and the Irrigation Department has improved considerably and the consultants' services have been responsive and supportive of the Department's needs and the project.

In our conversation with the responsible officials of the Irrigation Department, there has been a general appreciation of the Consultant's valuable contribution to the project.

One weak point was the non-availability in the early years of properly qualified counterparts to the consultant's experts. If this problem could have been corrected by the Department in a timely manner, the benefits accruing to the project and overall capabilities of the Department could have been greater.

E. Central Support

The Irrigation Department is the principal implementation agency for this project. The Project Paper envisaged creation of a cell within the Irrigation Department to support and coordinate at the national level all project activities. The cell to be created within the department was to include other disciplines in order to coordinate all activities on an irrigation project. However, a Water Management Section in the Irrigation Department headed by a Senior Deputy Director is responsible for this project. The normal function of this division in the department is essentially

technical. The structure and composition of this division has not changed except that for the purpose of this project it has contracted the services of outside consultants. The expectation of having a permanent inter-disciplinary cell within the Irrigation Department with experience on this project for future project design and implementation has not been achieved.

Meanwhile in 1984 an Irrigation Management Division was established under the Ministry of Lands and Land Development. This Division is expected to perform the functions of the much needed inter-disciplinary team intended to be built into the water Management Division of the Irrigation Department.

Note: ARTI research and the performance of the other TA contractor, Cornell University, are discussed in Chapter III and its supporting Appendix B.

CHAPTER VI

ECONOMIC ANALYSIS

This project introduced physical and institutional improvements into a mature paddy production system. Experienced paddy farmers responded quickly to the increased availability of water and the extension service programs were linked to the greater assurance of a consistant water supply. The credit, marketing and distribution components were well established in the project and were able to cope with the increased production. These factors all combined to produce an unusually high rate of return.

A. Extent of Paddy Land Under Irrigation

The large increased acreage and early date that additional land was brought under irrigation were major factors in increasing the benefits of the project. The original design capacity of the project was to irrigate 42,000 acres under the Senanayake Samudra dam before the project and there are now approximately 53,000 acres being irrigated after rehabilitation. This 11,000 acre increase in area is more than double the 5,000 acres anticipated in the project paper and the increase was accomplished in six years rather than seven.

B. Cropping Intensity

It is anticipated that cropping intensity in the project area will average 175% in the tenth year of the project, rather than 189% in the seventh year as was expected in the Project Paper. Cropping Intensity was originally expected to increase by an average of 10 to 12 percent a year until it reached 189% in the seventh year. However,a Reservoir Operations Study, prepared by PRC Engineering Consultants, developed data on precipitation and water usage for the Senanayake Samudra and Navakiri dams which indicates that a cropping intensity of 175% is about the maximum level that can be expected in the future. To achieve this, physical rehabilitation of the canal system will bring the cropping intensity to about 164%, while changes in farm level practices which affect water consumption will be needed to bring cropping intensity up to 175%. Other factors which may affect cropping intensity on the Left Bank are water usage rates and cropping patterns on the Right Bank, particularly sugar cane production, and changes in the use of water from the Senanayake Samudra dam for domestic purposes.

C. Paddy Production

A review of statistical data, field observations and interviews with farmers indicate that yields are higher and have increased faster during the first six years of the project than expected. Although the Project Paper estimated that yields at the start of the project were 52.5 bu/ac, the evaluation team believe they were about 60 bu/ac and they are expected to reach 88 bu/ac by the fourteenth year of the project. In fact some farmers are already achieving yields of 80 - 100 bushels in the project area.

Thus, even after adjusting the without project yield upward, the incremental increase is greater and came earlier than expected. This was a major factor in increasing the discounted flow of benefits in the internal rate of return.

It is difficult to estimate how much of the increase in yields can be attributed to the project. Unusually heavy precipitation occurred during the 83/84 Maha season reducing yields of that crop because of flooding. But the increased water available for the next Yala season and improved water distribution brought more land under cultivation and increased yields. The extension service has also played a role in increasing crop yields by promoting the use of fertilizer and chemical herbicides and pesticides.

Based on the assumptions above on acreage, cropping intensity and yields, production increased from 3.1 million bushels of paddy in 1980 to 7 million bushels in 1985. At a farmgate price of Rs 65/bu this production level represents an increase in gross yearly income in the project area of Rs 253.5 million ($9.3 million).

D. Cost of Production

In the six years of the project the cost of paddy production has risen from about Rs 1,500/ac to 3,500/ac. Much of this increase is a result of inflationary price increases. However, there has also been an increase in the proportion of farmers using different types of fertilizers and chemicals, and an increase in the amounts used. There is also evidence of greater care in land preparation. These changes add to the cost of production over and above changes resulting from price inflation.

E. Net Returns to Production

The following are net returns to various levels of paddy produced per acre. The calculations are based on the assumption that the cost of production is Rs 3,500/ac and the farmgate price of paddy is Rs 65/bu.

TABLE 8

Net Returns to Production

Production (Bu/ac)	Net Return (Rs/acre)
54	(Break Even Point)
70	1,000
75	1,375
80	1,700
85	2,025

Source : Consultants' Estimates

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Although yields have been increasing, the cost of production appears to have been increasing at about the same rate. Farmers in the field responded that they are not making more money even with higher yields because of rising costs. This is consistent with the findings in other studies. Farmers with holdings of 2 1/2 acres and a cropping intensity of 164% would net Rs 4,100 a year from paddy cultivation at current yields.

F. Internal Rate of Return

The internal rate of return for this project over a twenty year period is estimated at 47.4%. The data for this are based on records and observations of acreage, cropping intensity and yields for the first six years and assumptions about the future fourteen years. The main reasons for this unusually high IRR are that yearly net benefits were large and came early in the project. Capital costs were larger than originally anticipated, but they were spread over ten years, rather than being lumped into the first two or three years of the project.

The net benefits for the IRR were based on the estimates of increased production of paddy. Although no attempt was made to factor indirect benefits into the IRR calculations, there were undoubtedly benefits to employment and business. The impact on employment is particularly important on second and third generation farmers who are attempting to derive a living from the limited land available.

G. Production Components

The evaluation team did not observe any major bottlenecks in the production components to production. As paddy production has been the major agricultural activity in the project area for the past thirty years, the credit, marketing, input distribution and extension information components are well established. The farmers are familiar with the formal and informal sources of credit. Institutional credit sources operate in the area, but many farmers are ineligible because of past due debts or lack of collateral. Informal sources of credit are accessable, but costly. Private traders are active in marketing and there is a Paddy Marketing Board facility in Ampara. There are input distribution outlets in Ampara and traders, cooperatives, and Agrarian Services Offices are involved in input distribution. The Extension Service appears to be active and there were no major extension problems observed by the team.

CHAPTER VII

AGRONOMIC CHANGES

A. Production Potential

The production potentials of the rice lands within the project area are closely related to the soil textures and soil hydrology of the various soil groupings that occur in this region. With the use of modern rice varieties and the adoption of improved management practices, rice yields of around 60 bu/acre are attainable on the shallower coarse textured soils, while rice yields around 120 bu/acre are attainable on the deeper fine textured soils. The average yields for the whole project area will thus be a weighted mean of a range of yield figures which represent the different area extents of the respective soil groupings.

There are no significant physical and biological constraints to rice production in this environment. Scope for crop diversification is limited to the well drained soils during the dry yala season, and future expansion will need state intervention with respect to pricing and marketing.

B. Changes in Agronomic Practices

Significant changes have taken place in agronomic practices which can be attributed in part to the enhanced reliability of water delivery as a result of rehabilitation. They are :

- timeliness of land preparation;
- shortening the time between land preparation and sowing;
- enhanced and balanced use of fertilizer components and increased fertilizer use; and
- improved weed and pest control.

A reduction in the time period from land preparation to sowing has been one of the more important strategies in water management pursued by the Extension Service of the Department of Agriculture. The stipulated period from land preparation to sowing has been targetted for four weeks. Data supplied by the office of the Assistant Director Agriculture (ADA) for the Uhana Administrative Division show a reduction in the percentage of land sown after the stipulated period from 16 percent in Yala '82 to 2.8 percent in Yala '85. A significant reduction in the staggering of cultivation seasons is also reported.

The levels of fertilizer used by farmers has shown a marked increase over a four year period. Equally important has been a positive shift towards a more balanced use in the proportion of the nutrient elements N, P and K, with the result that the ratio of basal dressing to top dressing is now closer to the Department of Agriculture recommendation. These trends in fertilizer use are attributed to improved reliability of water deliveries, improved

transport .facilities down to the tertiary level, and a vigorous extension effort:

In the earlier situation of unstable water deliveries farmers were accustomed to using seeding rates in excess of 5 to 6 bu/acre to compensate for hasty land preparation and consequent weed competition. Proper timing of herbicidal applications was also constrained by the unpredictability of irrigation water. The ADA reports that the seeding rate is now stabilized at 4 bu/acre for the Yala. Qualitative improvements in the degree of weed infestation are now clearly visible throughout the areas that have benefitted from the rehabilitation.

A major spin-off that has resulted from the reduction in the degree of staggering in the cultivation seasons within the project area has been the near elimination of the disasterous epidemics of the brown plant hopper which required very expensive control measures.

PHYSICAL INFRASTRUCTURE

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THE PHYSICAL SYSTEM

A. Historial Perspective

The Gal Oya Project was initiated in 1947 and the Senanayake Samudra reservoir and part of the canal system were completed in 1955. The Project covers a gross area of 281,000 acres. Within the Gal Oya project area is the Gal Oya service area, which covers a total area of 225,250 acres of land. The system is divided into four separate divisions; Left Bank, Right Bank, River Division and Navakiri. The first two lie in the Ampara Irrigation Range, while the latter two lie in the Batticaloa Range.

At the time this rehabilitation project began, there was virtually no data available on the Left Bank system above or below Navakiri, either as it was designed or as it actually existed. The length of the main canal was not known, much less the branch canals, and the distributary and field channels. There were no maps of the system (there still are none). The design drawings had been lost or destroyed. Farmer encroachments into the system and the extent the system had deteriorated were also unknown. This inhibited the ability to do a complete project design. It led to a large effort to re-create the missing data, which ultimately proved to be not necessary for the project. It also affected the accuracy of projected outputs which were, in some cases, really guesses.

The Left Bank system was originally designed to serve 42,000 acres, but by 1979 a total of 53,000 acres were attempting to draw water from the system. Many factors have contributed to this increase in service area, but the principal ones are probably the following:

- Established farmers have encroached into the canal reservations as far as they could go and still get water either through existing inlets or by building new inlets.

- New farmers have moved into the reservations and started farming.

- New anicut schemes have been constructed in the re-use systems.

Since 1983 these encroachments have been regularized and they were taken into count in the rehabilitation design.

In 1983 the Left Bank system was determined by planimetry, based on 1981 aerial photography. It shows that the total extent of irrigable area under the left bank canal system is :

TABLE II-1

Area Served By The Project

Above Navakiri Reservoir	40,051 acres
Below Navakiri Reservoir	12,955 acres
Paddirippu River Division	7,015 acres
TOTAL	60,021 acres

The Paddirippu River Division comprises several anicut schemes along Navakiri Aru and Kandakadumadu Aru as a re-use system. Though the main canal is designed to command the entire 60,021 acres on the left bank, except for increase in main canal capacity, the Paddirippu River Division does not form part of the work carried out under rehabilitation. The Paddiruppu River Division serves private lands which were settled prior to development of the original Gal Oya scheme.

B. Progress to Date

The overall progress of the rehabilitation effort is reported at 72.5 percent as of September 30, 1985. It is expected to reach about 80 percent by PACD. The rehabilitation progress achieved to date and the estimated cost is summarized in Table II-2. The number of structures repaired or improved is summarized in Table II-3.

Table II-2

Summary Of Estimated Cost And Accomplishments In Construction

ITEM	LENGTH km	ESTIMATED COST (MILLION RUPEES)	ACCOMPLISHMENT % COMPLETION
Main Canal	41.6	23.8	100%
Branch Canals			
Uhana	15.2	10.4)	
Mandur	15.4	6.9)	
Malwatte	4.8	1.7)	
Chadiyantalawa	8.8	2.6)	
Sammanturai	10.5	3.1)	100%
Gonagolla	13.5	6.0)	
Vellaveli	10.5	3.2)	
Sillikody	5.3	1.1)	
Thumbankerni	11.7	2.3)	
Kadukamunai	7.7	1.5)	

D-Channels and Field Channels above Navakiri

Uhana Area

Distributary Channels	39	4.9	D-Channels 100%
Field Channels	70	3.5	
Mandur Area			Field channels:
			structure 35%
Distributary Channels	144	18.1	
Field Channels	175	8.7	Earthwork 25%
Malwatte, Chadayantalawa and Samanturai Area			
Distributary Channels	47	5.9	
Field Channels	70	3.5	
Gonagolla Area			
Distributary Channels	53	6.7	
Field Channels	60	3	

Channels Branching Directly From the Left Bank Canal

Distributary Channels	89	11.2	
Field Channels	76	3.8	

D-Channels and Field Channels Below Navakiri

Sillikody Area

Distributary Channels	7	0.9	
Field Channels	15	0.8	
Vellaveli Area			
Distributary Channels	29	3.7	D-Channels 80%
Field Channels	40	2	
			Field Channels:
Thumbankerni Area			Structures 0%
Distributary Channels	30	3.8	Earthwork 0%
Field Channels	50	2.5	
Kadukamunai Area			
Distributary Channnels	11	1.3	
Field Channels	20	1.0	
Total		147.9	

Main Drainage Channels and Navakiri Reservoir

Uhana Drains	52.8	3.2	100%
Mandur Drains	31.9	1.9	No work done
Gonagoila Drains	45.4	2.7	
Navakiri Tank		2.7	100%
Total		10.6	

Total Estimated Cost Of Irrigation And Drainage

	(Million Rupees)
Irrigation Phase	147.9
Drainage Phase	10.6
	158.5

Source: Irrigation Department and PRC Quarterly Progress Report of September, 1985.

Table II-3

Number of Structures Constructed, or Repaired and/or Improved

	New	Repair/Improvement	Total
Main Canals	51	8	59
Branch Canals	268	107	375
D Channels	1753	910	2663
Field Channels	751	--	751

Source: PRC Quarterly Progress Report of September 1985

C. Cost Per Acre Of Rehabilitation

The actual cost of rehabilitation for the whole project was not available at the time of this evaluation, because cost records of force account work were not up to date and the work on distributaries and field channels was not complete. As a result, costs per acre had to be calculated based on the design estimates of costs. Based on the Quarterly Reports, actual costs are very close to the estimates.

Based on the cost estimates, the cost per acre for Gal Oya is Rs 2,990. Figures obtained from the Irrigation Department for the cost of rehabilitation of seven other irrigation rehabilitation projects in Sri Lanka show an average cost per acre of Rs. 1,876, with a range from Rs. 1,408 to 2,570. Thus the cost of rehabilitation of the Gal Oya canal system is about 60 percent higher than in other projects.

Higher costs at Gal Oya are partly due to some sandy reaches in the canal trace, the extreme deterioration due to lack of maintenance over a long period of time, structural defects in the irrigation infrastructure and the need to build essential structures that were not included in the original design. Further the main canal is designed to issue supplemental water to 7,015 acres in the Padiruppu River Division . The cost incurred in rehabilitating the main canal to carry this additional capacity and the cost of augmenting Navakiri Reservoir have both increased the average cost per acre. In view of all these factors, the cost per acre of Rupees 2,990 for rehabilitation of the Gal Oya canal and drainage system is reasonable.

D. Overall Benefits Of The Physical Rehabilitation

1. Increase in Extent Irrigated

The Left Bank Canal System was designed to serve 42,000 acres of legally allotted land. However over the years, there has been illegal encroachment into the canal reservation (the canal right of way).

Long years of neglect of maintenance of the canal system has reduced its capacity and hence all areas intended to be served by the original design were not receiving water. Thousands of acres at the tail ends, particularly downstream of the Navakiri tank, did not receive water for almost a decade. While no quantification of the reduction in the canal capacity is available, we estimate that, prior to rehabilitation, the system might have been capable of carrying water sufficient to serve, efficiently, an area of 30,000 acres in the Yala season.

The system can now serve 53,006 acres directly, and an additional 7,015 re-use acres indirectly. Thus, the rehabilitation has increased the area served by a minimum of 11,000 acres and probably actually indirectly benefits up to 30,000 acres more than at the start of the project.

2. Hydraulic Performance

The hydraulic performance of the system has improved considerably due to rehabilitation. This is best illustrated by a comparison of the flows achieved, and the command area served at the MPM-18 gauge in the lower reaches of the Mandur Branch.

Although the guage hieghts on this branch are about the same in 1980 and 1985,the amount of water carried increased considerably

due to the improved hydraulic carrying capacity of the channel now. As a result the area commanded has increased from 1,200 acres in 1980 to 4,650 acres in 1985.

E. Technical Performance

While it is evident that the physical rehabilitation has been done well overall, there are several technical issues arising out of this experience that can be useful in improved design of future projects, as well as better management of the system covered by the current project. These issues are evaluated and summarized below.

1. Master Planning

The original PP envisaged preparation of Master Plans for Gal Oya and Uda Walawe to make an inventory of the existing water resources, their use patterns and to develop alternative scenarios for optimal use of available resources. The master plans were also expected to focus on drainage and water re-use, as well as provision of domestic water supply for farmer settlements. These master plans were expected to form the basis for further design and implementation of the proposed rehabilitation program.

The work on the master plans started with the arrival of the PRC/ECI consultants in 1980. Some of the data deficiencies that existed right from the beginning of the original project concept were overcome and a considerable data base was established, containing information such as :

- The status of existing canals, their design capacity and their discharge capacity;
- Sites where control structures were needed;
- Hydrological features,such as inflows into the reservoirs;
- The rotation patterns in use in the system; and
- Indications of water use practices by cultivators.

However the level of effort required to collect the data was underestimated at the time the work started and there were inevitable delays in the compilation of the data bases. This resulted in a review of the relative effort to be expended for master planning and led to the recommendation by the 1982 mid-term evaluation to terminate further work on the Uda Walawe master plan immediately and to wind up the master plan effort for Gal Oya soon thereafter. Rather than carry the planning effort forward to the preparation of detailed rehabilitation plans, it was decided that rehabilitation would proceed without such plans, using a pragmatic approach to design and construction. The ultimate result was that, while the master plans resulted in fairly strong data bases, where none existed before, their analytical strength and usefulness as guides for further design and construction of specific rehabilitation work was severely limited. Thus the full extent of benefits expected from the master planning effort were not achieved and the plans themselves are useful largely as reference documents.

There is one major data gap, however, that has never been overcome. That is the preparation of accurate maps of the system area at a suitable scale. Such maps would have been very useful during design and construction and they are necessary if the system is to be operated and maintained as efficiently as possible. The preparation of such maps should be a requirement in any future project and a condition for further project activity at Gal Oya.

2. The Original Design Approach

Although the design capacity of left bank main canal at the head reach was 1,477 cusecs (42.2 cumecs) siltation and deviation from designs during construction had reduced inflows to the system to 1,364 cusecs (36.83 cumecs) by the start of the project. Lack of control structures on the canals had necessitated a rotational irrigation where canals were operated two to eight days at large discharges and then shut off for three to nine days. This system of irrigation over a long period without proper maintenance resulted in siltation and the deterioration of the canal banks due to frequent draw down effects. These reduced flows and the encroachments coupled with deteriorated irrigation infrastructure, contributed to acutely unreliable and inequitable distribution of water.

The main consideration in formulating the rehabilitation design criteria was to develop a physical system with operational controls capable of delivering pre-scheduled flows of water to the various parts of the system. The canal system was designed for continuous flow in the main and branch canals and the distributary channels, with rotational irrigation to be practiced at the field channel level. It was based on the creation of farmer organizations to manage water rotation to the individual farm lots. This requires construction of new field channels to replace direct pipe outlets from distributary channels to adjacent farms and the incorporation of suitable measuring structures, checks and pipe outlets in all field channels to facilitate timely and equitable distribution of water to individual farm lots on a rotational basis.

The main canal is now designed to convey 50 cumecs at the head reach, enough to command 60,021 acres. Delivery schedules for each field channel are determined from the cropping calendar and area cultivated. The releases of water to each field and distributary channel and to each branch and main canal regulatory structure are computed from these schedules.

To meet this requirement, the original project design envisaged detailed canal trace surveys and sizing of canal profiles and control structures that would meet the delivery schedules. The system incorporates water measurement devices to monitor performance, to provide the basis for gate adjustments and to prepare daily, monthly and annual water delivery records.

3. The Pragmatic Approach

Drawing on the data that had been collected, the basic concept of the pragmatic approach was to conduct a physical inspection of the system to determine what needed to be done to ensure hydaulic efficiency of the system at the required capacities and to stabilize the canal banks, which had been subject to severe erosion. The governing principal was 'it it ain't broke, don't fix it'. The pragmatic approach stressed the following activities, among others :

- Repair weak sections as needed to assure safety and full operability.
- Repair major structures to full design standards and to recalibrate the discharge relationships of gates.
- Bring the entire canal system to practical design standards to facilitate ease of operation and maintenance.
- Carry out minimal work necessary to reduce sluffing bank areas, and erosion at the outside of bends.
- Reduce silt intake and remove major silt deposits.
- Replace direct outlets from distributary channels with field channels where their economic and operational practicality could be demonstrated. Where such field channels would serve widely spaced outlets, individual small diameter outlets in the distributary channels were to be installed as the farm turnouts, as exceptions to the basic rule.

Since the design and construction carried out under this approach did not have the benefit of a full and thorough planning phase, it had to rely heavily on the experience and judgement of the design engineers and this required considerable on-the-job training by PRC. However, it was successful in practice. It resulted in a hydraulically efficient, maintainable system that can supply the area under its command.

4. Overall Construction Procedure and Progress

Construction procedures were drawn up for rehabilitation of the main canal and major branches by use of heavy equipment, while labor intensive techniques were to be used for work on smaller distributaries and field channels. The progress on the labor intensive component of the work has falled very much behind schedule.

Fixed Amount Reimbursements

Under the Fixed Amount Reimbursement (FAR) System, the executing agency is obliged to complete the various items of work with its own resources before seeking reimbursement. This is a good system. In the case of non-reimbursable items, such as the construction of field channel earthwork by farmers, and drainage

canals by use of heavy equipment on force account, there was less financial incentive to complete the work. This has contributed to the slow progress on these items.

When the FAR system was established by Project Implementation Letter (PIL) 13, the letter stipulated that the FAR reimbursements would be paid into a revolving fund under the control of the Irrigation Department. In the fall of 1982 AID advanced $ 100,000 into such an account, and this amount was maintained separately in the projects account until it was finally liquidated in the first quarter of 1984. However, when the first reimbursement requests were officially submitted to AID the Irrigation Department requested that the reimbursements to be paid to the Treasury. Apparantly, AID did not object to this important deviation from the provisions of PIL-13.

The fact that reimbursements have been made to the Treasury rather than to an Irrigation Department revolving account has slowed the pace of rehabilitation work. It has probably diluted the Department's incentive to complete the rehabilitation work and it has certainly subjected the work to budgetary constraints that otherwise would not have been imposed. One result will be the de-obligation of funds that might have accrued to Sri Lanka. If possible, the situation should be avoided in future projects.

Farmer Participation in Construction

In the project design farmers were expected to do the earthwork on field channels on a self-help basis, and to co-operate with the Irrigation Department technicians in placing and constructing the structures on field channels.

In practice this has happened in only a limited part of the area, and it was probably an unrealistic expectation. (This is discussed further in Appendix B). In any case, the completion rate for field channels above Navakiri is only 35 percent for structures and 25 percent for earthwork. Nothing has been done below Navakiri. As a result, the percentages for the system overall are 25 and 15 percent, respectively. The system will not achieve full design efficiency until this work is done, and it will be especially important in the years to come, when water availability in the Yala season will be restricted. AID should insist that the Irrigation Department complete the work, and it should be a condition of any successor project activity in Gal Oya.

The problem of farmer participation in field channel earthwork might have been resolved, if there had been better cooperation between the engineers and non engineers in trying to find a solution. There are three alternative approaches to the problem that might be tried now. They are :

- Contract with farmer organizations or farmers to rehabilitate the field channel entirely, including earthwork and structure. The Irrigation Department would provide technical assistance, conduct the necessary surveys, field stake out the channels and the layout and placement of structures, supply materials such as cement, and pay for the labor involved.

- Have the Irrigation Department, or its constructors, build the structures and contract with the farmers to do do the earthwork, with technical assistance from the Department.

- Rehabilitate the field channels completely by force account or contractors.

The last alternative would be the least desirable alternative since it would foster the belief among the farmers that the field channels are the government's responsibility. On the first two alternatives it would be highly desirable, if not essential, to require a partial contribution of free labor by the farmers. This would help foster their sense of ownership of the channel and thus stipilate them to maintain it after rehabilitation.

5. System Operation

Rotation vs Continuous Flow

The original Gal Oya project design and subsequent operation was on a rotation basis at the branch canal level, as was then customary with the majority of irrigation projects in the country. The disadvantages of this were discussed above, and the rehabilitation design for this project adopted the principle of continuous flow in the entire system providing for rotation only among the farmers along a field channel. This change in the operational pattern was made to effect economy by using existing canals with minimal change in cross-sections and for ease and simplicity of operation. This is highly desirable and preferred by the farmers, since continuous flow in the system inspires their confidence in the availability of water and hence the reliability of the system.

The Computer Model

Under the PRC/ECI contract for technical assistance, a computer model was developed to calculate the flows required at critical points in the system to meet the system demands computed on the basis of data inputs and/or assumptions on irrigated area at each off-take, soil type, evaportranspiration, rainfall, state of farming activities and canal efficiencies. The Irrigation Engineer (IE) for Ampara, who is in charge of operation of the head works of the left bank main canal and all of the left bank system above Navakiri except the areas below Weeragoda tank (Unit 26 and Block J) has developed a system of reporting and instruction, on a daily basis, with the TAs, Works Supervisors and Irrigators in his area. Through this network he obtains the gauge readings at all offtakes early in the day (about 8 AM), consults the model and passes instructions back to the field

within an hour or so. A similar communication in the afternoon ensures that the system is operating as expected and provides the opportunity to make any further adjustments if necessary, based on feed back from farmers and field staff observations).

This system, which started in 1984, appears to function reasonably well. With time the data inputs can be refined and the model made much more responsive to the actual field conditions, and a fair degree of agreement can be established between the calculated flows and actual field needs. While the IE (Ampara) issues the amounts of water requested by the IE (Kalmanai), who controls the operation of the canals in Unit 26 and Block J; and the Deputy Director (Batticaloa), who controls the system below Navakiri, the computer model is not being used for detailed operational decisions at the individual off-takes of those parts of the system. This is because large parts of the system under those jurisdictions are still under construction. Eventually when the construction work is completed and the entire system is operational, the computer model should be used for detailed operational decisions at all off-takes in the entire system. Considering the number of measuring devices introduced as part of the rehabilitation project, such detailed fine-tuning of the operation is feasible and desirable.

Some Operational Issues

It is quite clear that the hydraulic operation of the system has improved considerably because of rehabilitation. But the rehabilitation is not complete and considerable areas in the lower reaches have yet to come under full operation. Due to the apparent abundance of water available and better hydraulic efficiency, combined with good rainfall patterns in the past two years, there is a feeling of surplus water in the head reaches. This may have led to some wasteful water use practices. However with the completion of the entire system, water use has to be more efficient throughout, if the benefits of the rehabilitation are to be enjoyed more equitably in all sections of the command area.

One major deviation observed during the field inspection of the canal system was that direct outlets to farms from distributary channels have become more a rule than an exception. This results in over use of water by farmers with direct outlets while the farmers at the tail-end undergo hardship in getting their share of water. This was one of the inherent defects in the Gal Oya distribution system from the early days and unless it is rectified, proper and equitable distribution of water under a rotational system at the field channel level, with predetermined delivery schedules, would be a very difficult task.

An example of the problem of direct outlets is the distributary channel L23, serving approximately 160 acres. It has about 52 direct outlets serving approximately 90 acres. One lot of 5 acres has seven direct outlets. Most of the lots served by the direct outlets are also situated at the head of the 5.5 km long distributary. The three field channels serving 20 lots are at the tail end of the channels. The farmers on the field channels are

expected to maintain the field channels and practice rotation among themselves. This is patently inequitable considering the fact that majority of farmers in the upper reaches get water from direct pipe outlets, have no field channels to maintain, and are absolutely assured of water at any time from the continuously flowing distributary channel. Currently the farmers on the field channels at the tail end are being satisfied by pushing discharges far in excess of the design discharge through the distributary channel. This, is an extreme example of operational problems, but it is certainly not the only one. There are a considerable number of channels with similar problems. If the system is to operate properly, such built-in inequities will have to be corrected.

Due to good rainfall and availability of sufficient quantities of water in the upper reaches, it was possible in the past year to achieve almost 200 percent cropping intensity in 1985. However the reservoir operation studies carried out by PRC/ECI point out that the cropping intensities that can be expected in this project area in an average year will be somewhat less, and even then some of the tail end areas can expect failures once in three to four years. This fact must be brought to the attention of the current beneficiaries before they develop too much complacency and slip into wasteful water management practices both on-farm and off-farm.

6. Maintenance

General

So far the project has been primarily in the rehabilitation construction mode, although attention has been paid to operations as well. Each division in charge of construction has been expected to maintain completed reaches, while proceeding with construction in new areas. However, the IE (Ampara) was recently placed in full charge of operation and maintenance of the majority of the project area, with the exception of areas under the jurisdiction of the IE (Kalmanai) and the DD (Batticaloa) So far maintenance is done on as needed (or as felt needed) basis rather than on a routine and systematic basis. No maintenance routine has been established involving regular patrolling of the canal reaches and no standard forms have been developed to note abnormal conditions needing attention. Also, no maintenance manual has been adopted, laying down specifications and guidelines governing the type of work to be done in case of required repairs, or the work to be done as part of a preventive maintenance program. The Irrigation Department has published a general manual "Maintenance of Irrigation Works", however, under the PRC/ECI contract the consultant was expected to provide guidance and assistance in establishing a specific maintenance plan for the Gal Oya project. The consultant submitted a draft plan in 1982 and an updated plan in early 1985. The project authorities have yet to accept and adopt these plans.

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The visible lack of maintenance and apparent neglect of the main system within the O&M jurisdiction of the Irrigation Department, does not lend credibility to demands that farmers must maintain their field channels regularly.

It must be particularly noted that in spite of the rehabilitation, the system is 35 years old and must be nurtured carefully if its useful life is to be extended to justify the capital investment in the rehabilitation program.

Now that the bulk of the rehabilitation construction is completed the Irrigation Department should consider converting the Ampara range into an O&M range and reorganize it with emphasis on maintenance.

Financing Maintenance

It was estimated by the Irrigation Department that on the average, operation and maintenance (O&M) of Irrigation systems would cost approximately Rs 200 per acre. Under the terms of a World Bank agreement, it was decided that farmers benefitted by an irrigation project should contribute Rs 100 per acre towards O&M charges and that the Government would contribute the remaining Rs 100 per acre. The idea was to increase the farmers' contribution gradually until the entire Rs 200 charge was borne fully by the farmers. Considering the marginal and subsistence level returns expected to accrue to the farmers it may be unrealistic to expect them to bear the full cost of O&M. (See appendix C).

In practice the Government contributions are being made as part of the regular budget. While we were unable to establish the exact amounts allocated to the Department for the purpose of maintenance, it was clear that they were below what was needed and were less than Rs 100 per acre.

The amounts that were available seem to have been spent more on operation, namely the salaries, wages and running of the government establishment rather than on maintenance, i.e., patrolling, spotting and correcting problems as well as regular preventive maintenance.

Farmer contributions are deposited in a separate bank account in the district where they are collected, where they are held to be used in consultation with the farmers. In 1984 collections in Ampara District were 78 percent of assessments, by far the highest collection rate in the country. This probably was due in part to the Gal Oya rehabilitation and the improved water reliability that has resulted from it. However, collections to date in 1985 have been minimal (2.7%). This may result from the fact that most of the 1984 funds have not been used, so farmers have not seen any results from their previous contributions.

For the country as a whole, the collection rate was 36.8 percent and is only 5.4 percent so far in 1985. Even if the farmer assessment rate ultimately reaches its targets, this will take

time to accomplish, and a levy of Rs 200 acre may never be possible. In the meantime the Irrigation Maintenance Division and the Department should prepare a plan which takes this shortfall into consideration and does not neglect the vital maintenance work which is necessary to prolong the life of the system.

7. Equipment

A list of heavy equipment procured and utilized on this project is given in Table II-2. The reported equipment depreciation is less than 20 percent, although this may be somewhat understated. In any case, it is clear that too much equipment was ordered, too soon, without establishing the real needs. However, considering the weak data base that existed prior to start of the rehabilitation project, it would not have been possible to determine the quantities of work to be done and equipment necessary without careful analysis.

Cost control and management of the available equipment also leaves a lot to be desired. For example, no records are kept of the value of work done on force account using heavy equipment. This was partly due to lack of counterpart personnel, of an appropriate level, during the tour of duty of the PRC/ECI consultant.

Thus the project is now left with a large surplus of equipment which originally cost $3.5 million, with about 80 percent useful life left in it. After retaining the minimum equipment necessary for the O&M functions of Gal Oya, the remaining equipment should be transferred to other projects.

While by and large the type of equipment ordered appeared to be appropriate, there were instances of inappropriate and expensive equipment ordered and unutilized on the project. One example was the arrival of a $362,000 rock crusher that was so totally inappropriate in size and type that it was never used on the project. Another example was a set of radio equipment that could have been extremely useful in maintaining necessary communications between strategic locations of the far flung parts of the project. However, we were told that the radio equipment became inoperable in a short period of four months and was never fixed or re-used for the life of the project. This could have been avoided by ordering appropriate equipment and then providing the necessary training in its installation and operation.

TABLE II - 2

HEAVY EQUIPMENT

IDENTITY	DESCRIPTION	HOURS	DEPRECIATION
ID/MG/9	Motor Grader	2196	22%
ID/MG/10	Motor Grader	2038	20%
ID/MS/16	Elevating Scraper	345	3%
ID/MS/17	Elevating Scraper	2922	29%
ID/FL/24	Loader	3685	36%
ID/CT/36	Crawler Tractor	2405	24%
ID/CT/37	Crawler Tractor	3138	31%
ID/CE/39	Backhoe	1371	14%
ID/CE/40	Backhoe	1006	10%
ID/CE/10	Backhoe	1187	12%
ID/CE/11	Backhoe	3155	32%
ID/CE/8	Dragline	1967	20%
ID/CE/9	Dragline	2016	20%
ID/CT/34	Crawler Tractor	1150	11%
ID/CT/35	Crawler Tractor	758	8%
	Average:		20%

Note: The useful life of heavy earth moving equipment is assumed to be about 10,000 hours.

Source: IE (Gal Oya).

F. Domestic Water Supply

The PRC/ECI contract for Technical Assistance calls for a study of the situation with regard to domestic water supply and preparation of a master plan. They completed such a study and submitted it to the government in 1984. While it meets the contractual obligations, there is no evidence of government intention to act on it, even though some minor tanks (about 12) were built in local depressions through the initiative of local farmers, TAs and the IE (Gal Oya).

Domestic water supply is a problem in the project area. Many people use the canal water for bathing, cattle washing and for drinking water. In some cases shallow wells are situated on canal banks very close to the water surface in the canal. This is dangerous from a public health point of view. Some system of domestic water supply should be found that is independent of the irrigation system. The quantity of water needed for domestic water supply is not large, but use of irrigation canals for domestic water supply requires running the canals during non-irrigation season. This wastes considerable water. One estimate puts such wastage at 99.6 percent of such off-season releases, thus reducing valuable storage essential in the Yala irrigation season. Also such use of canals during off-season disrupts essential maintenance activities on the canals.

G. Summary

In summary, the physical rehabilitation work will be about 80 percent complete by the PACD. The work has been of a good quality and the pragmatic approach to rehabilitation has proven to be effective. It has produced a system which is hydraulically efficient with measuring devices at all outlets which support a computerized operational model which is in use and can be extended to manage the whole system. The Fixed Amount Reimbursement method has worked well, but would have been better if reimbursement had gone into an Irrigation Department revolving account.

The majority of the field channels remain to be rehabilitated and this must be done if full system efficiency is to be achieved. Maintenance is virtually non-existent, and a maintenance system is not yet in place. Equipment utilization and maintenance have been poor and excess equipment should be disposed of.

FARMER ORGANIZATIONS

AND

INSTITUTIONAL DEVELOPMENT

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FARMER ORGANIZATIONS AND INSTITUTIONAL DEVELOPMENT

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III - 2 Structure of Farmer Organizations in Gal Oya Left Bank

A. BACKGROUND TO THE EVALUATION

1. Evaluation Approach

This evaluation assesses the effectiveness of the Farmer Organization component in achieving the two purposes ascribed to it :

- its effectiveness in generating farmer involvement in system rehabilitation, operation and maintenance in Gal Oya Left Bank;

- its contribution to knowledge about how to effectively promote farmer involvement in irrigation systems in Sri Lanka.

The evaluation starts from two basic premises about the involvement of farmers in irrigation system operation and maintenance. These premises, which are supported by experiences with irrigation systems in Sri Lanka and elsewhere are :

- That farmer participation in the design, operation and maintenance of irrigation systems is desirable.

- That in order for the participation of farmers in these activities to be effective three environmental pre-requisites must be satisfied. These are :

  -- There must be a <u>receptive bureaucratic and institutional environment</u>. This means that the officers involved in the administration of the system and in providing supporting services to farmers (irrigation officers and staff, agricultural officers, Agrarian Services Officers, Land Commission Officers, etc) must be willing to encourage and accept the active participation of farmers in decision-making regarding how, when and where these services will be provided. The legal and institutional environment must also be conducive to the encouragement and enforcement of collective decisions and actions by farmers in areas such as the distribution of water, the maintenance of the physical channels, and undertaking construction contracts.

  -- There must be <u>a well functioning and well managed irrigation environment</u>. This means that the physical irrigation system must be capable of providing farmers with a predictable and reliable supply of water. Since no system can be entirely predictable and reliable, farmers must be actively involved in deciding on the appropriate response to constraints in the system.

  -- There must be a <u>social environment within the farming community which is conducive to active co-operation and</u>

involvement in the operation and maintenance of the irrigation system. This means that farmers must see the benefits of such co-operation and involvement; must be willing to collaborate to achieve those benefits; and must have the practical, technical and material resources necessary to effectively participate in the operation and maintenance of the system.

Based on the Project Paper, the Baseline Study, and various consultants' reports, it can be said that at the commencement of the Water Management Project, none of the three prerequisites for effective farmer involvement in the operation and maintenance of the Gal Oya system were present, although some were beginning to be in evidence. Officers were not accustomed to encouraging and impartially responding to farmer initiatives. The physical system was in a state of disrepair and water delivery was highly unreliable. Farmers in the Sinhala portions of the Left Bank System at the head end, where rehabilitation was to be undertaken first, were in socially heterogeneous and uncohesive communities with a history of political and ineffective government-initiated farmer organizations and committees. Farmers in the Tamil portions, where water was most unreliable, were in more cohesive communities, but they lacked the experience and some technical knowledge for more efficient water use once an improvement in water delivery could be achieved.

The principal issues with regard to the Farmer Organization component in Gal Oya relate to the extent to which the environmental pre-requisites referred to above have been met through the project, and to the associated level of activity and likely sustainability of the farmer organizations which have been created. The principal issues with regard to the knowledge gained from the Gal Oya experience relate to the strengths and weaknesses of the Institutional Organizer Program (described below) and the implications for how farmer organizations should be supported in Gal Oya and elsewhere in Sri Lanka in the future.

2. Background and Objectives of the Farmer Organization Component.

The promotion of farmer participation in the rehabilitation and subsequent operation and maintenance of the Left Bank of the Gal Oya Irrigation System was identified as a key element in the Water Management Project. The project paper accepted the importance of farmer participation in reducing the cost of rehabilitation and in improving the performance of the system after rehabilitation. However, it was felt that more socio-economic research and experimentation was needed in order to determine how this participation could be achieved. The project design therefore combined the establishment and monitoring of farmer irrigation organizations with a program of socio-economic research and experimentation. The responsibility for this combined function was allocated to the Agrarian Research and Training Institute (ARTI). ARTI was to receive technical assistance in its efforts from consultants from the staff of

Cornell University and was to work with the Irrigation Department and other government agencies to facilitate the organization of water users into viable irrigation organizations.

In practice the formation of farmer organizations has been promoted through the ARTI-administered Institutional Organizer (IO) Program, which has been the focal point for the farmer organization component of the Water Management Project. The program has been based on the recruitment of 6 groups of 21 to 33 (a total of 169) university arts and social science graduates who have been trained for 4 to 6 weeks and then sent to live and work as catalysts among the rural residents of the Gal Oya Left Bank system. As catalysts the IOs have been expected to encourage and facilitate the formation of informal, self-help-oriented, groups of water users at the field channel level. Subsequently these field channel organizations have been encouraged to send representatives to Area Councils, the District Agricultural Committee, D-Channel Organizations, and a Project Level Committee. (Farmer participation in these organizations has progressed more-or-less in that chronoligical order. The order of formation is discussed in Section B.1 below).

The approach of the IOs has been in sharp contrast with the familiar top-down, officer-instigated, formal, frequently politicized, administratively rather than hydraulogically-based, government-promoted farmer organizations. The IO strategy was adopted by ARTI on the grounds that previous government-initiated farmer organizations had proven to be ineffective in mobilizing farmers for the maintenance and operation of water distribution in the Gal Oya Left Bank System. Poor farmer-officer communication and an atmosphere of mutual distrust and recrimination led to the conclusion that the government officers already operating in the field could not be expected to initiate the changes in modes of thinking and working together which were necessary among and between both officers and farmers. At the same time the social heterogenity, internal community division and an absence of broadly accepted local leadership was seen to militate against the formation of cohesive and effective farmer water management groups in the absence of outside encouragement and assistance.

The AID-funded project budget authorized $217,000 in loan funds for ARTI, primarily for training, and $496,000 in grant funds to cover technical assistance from Cornell ($403,000) and special studies ($93,000). By September, 1985, 53% of the loan funds, 90% of the technical assistance funds, and 48% of the special studies funds had been expended. With the exception of AID contribution to training costs and commodities for IOs (bicycles, motorcycles for supervisory staff, etc.) and the cost of Cornell Technical Assistance, the entire budget of the IO Program has been provided by the Irrigation Department. This has helped to keep the IO program from becoming an ARTI- owned activity completely divorced from the Department. The average estimated annual cost of the IO Program, including the cost of training 169 IOs, has been Rs 1,976,361 (see Tables III-1 and III-2).In 1984 Widanapathirana estimated that the cost of the Institutional Organizer Program had been equivalent to approximately Rs 222 per acre served.

Table III-1

Estimated Cost of IO Program - 1981 to 1985

	Rupees
Training	
169 IOs @ Rs 5,000	845,000
Maintenance in the Field	
2005.95 manmonths @ Rs 4,505	9,036,805
	Rs. 9,881,805
Average Annual Cost (for 5 years)	Rs. 1,976,361

Source : Table III.2 and Cornell data.

Table III-2

Approximate Cost Of One Institutional Organizer, Per Month	Rupees
I. (a) Salary 1 @ Rs. 1500/-	1500.00
(b) Travelling & Subsistence 1 @ Rs. 400/-	400.00
(c) Stationery Rs. 100/-	100.00
(d) Bicycle, mosquito net, torch, other capital costs	175.00
(e) Administration & Supervision *	2000.00
(f) In-service training	330.00
Total monthly cost	Rs. 4505.00
II. Cost of Initial Recruitment and Training, per IO	Rs. 5000.00

* Includes salaries of R&TO, Travel costs, Supervisor honorarium, office support. Does not include the cost of consultants.

Source: Water Management Project Quarterly Report No. 21 (30 Sept. 1985).

In the Gal Oya Farmer Organization Program, the average tenure of an IO been just under 12 months. If the cost of initial training is divided by 12 to get the monthly rate, and added to the other monthly costs of an IO, the total monthly cost is Rs.4922 per IO. With a reduced turnover rate, this monthly apportionment of initial training cost could be reduced considerably, almost to zero, so that the monthly cost of an IO would approximate Rs. 4505.

3. Evaluation Method

The conclusions drawn in this evaluation are based on discussions with Irrigation Department officers in Colombo and in the field, meetings in the field with IOs and officers from other government departments serving farmers in the project area, informal interviews in the field with around 20 farmers (singly and in groups) operating in the Uhana, Gonagolla, Weeragoda and Paragahakale areas, and a close collaboration with three Cornell consultants (2 local and 1 from the United States) who have been working with the ARTI IO Program over a period of 2 to 4 years. Unfortunately, the ARTI people who were most closely involved in the formulation and implementation of the IO program were not available for interview.

In addition to discussions, reference has been made to what is hopefully a representative portion of the mass of documentation which is available in English on the program. The limited time available made it impossible to make a thorough review of all that has been written in English on the Gal Oya IO program, and there is also a large quantity of material (files, minutes of meetings, the process documentation prepared throughout the project by the Institutional Organizers) which has remained untranslated and/or unanalysed and could possibly fill in some of the gaps in information which will be refered to in the following discussion.

ARTI is currently working on an end-of-project evaluation of the IO program and some use has been made of the analysis and observations which have been made so far. However, quite a bit of work still remains to be done on collation and analysis of material. Therefore only a limited amount of ARTI's data could be used here.

Among the elements in the ARTI evaluation has been a survey of 250 farmers in both the Sinhala and Tamil areas of the Left Bank to assess the level of participation and impact of the Farmer Organizations. This will be subsequently referred to as the ARTI Impact Survey. The survey of the 156 farmers in the Sinhala portion of the sample was completed while the present evaluation was being undertaken, and a rapid tabulation of a selection of the questions has been used to provide additional evidence in the following discussion. In using the survey for the present evaluation, it was only possible to do a partial and very tentative analysis. Problems with the wording and length of the questionnaire, with incomplete responses and with possible biases introduced by the administration of the survey to the record-keeping sample mean that ARTI must be very careful in its

use and interpretation of the results. One problem is the small size of the "without Farmer Organization" sample and the possibility of a spillover effect from the areas which have had a Farmer Organization. The tables which present the results of responses to specific questions in the ARTI Impact Survey are presented as an attachment to this appendix. They are marked in the text with an asterix, e.g. Table III-3*. The conclusions presented here must be treated as only indicative and requiring further examination once all the survey results are in.

B. EVOLUTION AND CURRENT STATUS OF FARMER ORGANIZATIONS IN GAL OYA

1. Progress of Formation of Farmer Organizations

Areas covered, Number of Farmer Organizations and Membership

While all of the Sinhala area has been included in the IO Program, the majority of the Farmer Organizations have been in existence for less than two years, and during that period the program has been handicapped by an inability to retain experienced Institutional Organizers.

It was originally intended that the Insitutional Organizer Program should ultimately cover all of the colonization area in the Left Bank (it was not expected to cover private land). However, an initial attempt in mid 1984 to extend program activities into the Tamil areas at the tail end of the system had to be adandoned because of the unsettled security situation. Consequently the program has only had an impact in the Sinhala areas located almost entirely at the head and middle of the system. According to the Water Management Quarterly Report for September 1985, the IO program has covered all of the approximately 25,000 acres (Irrigation Department figures) in the Sinhala colonization areas.

A major objective of the program has been to bring about the formation of Field Channel Farmer Organizations (FOs), each composed of 15 to 20 water users operating along the same field channel. Roughly speaking, there is one FO per field channel, although water users on short field channels may amalgamate and water users on long field channels may split to attain the desirable number of members. As at September 1985 348 out of the target 370 field channel farmer organizations (95%) were reported to be formed. The target number of farmer organizations was set in relation not only to the number of field channels but on the basis of the number of allotments along the field channel. Had allotments remained intact, the total number of water users expected to participate in farmer organizations should have been between 5550 and 7400 in Sinhala areas.

However, because of land fragmentation and allocation of land to family members, leasees and mortgagees, the IOs estimate that more than 11,200 water users are farming in the Sinhala areas. Yet, based on the expected number of members in each farmer organization (no consistent figures available on the actual

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number of water users the 348 FOs represent) only between 5,220 and 6,960 water users are actually involved in the organizations. This means that only up to 60% of the farmers in the colonization areas are members of the FOs. Given the pattern of land fragmentation, many of those who are not counted may participate indirectly as members of participants' families, and the apparent shortfall in membership is not particularly important. This may bring the direct and indirect level of participation in FOs up to 80%. However, a significant proportion of the non-participants are mortgagees and leasees who, though eligible for membership simply have no interest in cooperating with the organizations. (Perera reported that in 1980 on the Left Bank 22% of farmers were ande farmers, mortgagees or leasees. On Distributary Channel U.B.9 the proportion was 39% (p.54). The failure of this group to cooperate with the organizations has been cited as a source of weakness in the establishment of Farmer Organizations.

Three factors related to the organization of the IO Program which may influence the current and future strength of the Organizations formed so far are: the length of time which the areas have been served by an IO, the turnover in IOs, and the length of time the organizations have been in existence.

For the first 1 1/2 years of the program, activity was concentrated in 6000 acres (in the Uhana and Gonagolla areas). In the following year,the area covered was doubled (to include parts of Weeragoda/ Mandur, Malwatte and Galapitigala). After a drop in coverage associated with a sharp reduction in the number of IOs, coverage more than doubled in 1984 to incorporate all of the Sinhala areas and a portion of the Tamil areas. After 6 months there was a decline in the area covered when the Tamil portions were dropped from the program.

While 24% of the Sinhala area has been served by the IO program for over 4 years, 32% of the area has been served for 2 years and 44% has been served for only 1 1/2 years. Over 60% of the Farmer Organizations have been in existence for less than 2 years. Furthermore, during the last two year period there has been a sharp fluctuation in numbers of IOs and an associated instability in the contact of Farmer Organizations with IOs. In some areas the IO changed three times within the period of a year. Consequently the majority of farmer organizations which have been formed will not have benefitted from strong and continuous support from IOs and may consequently still be weak.

Development of the Farmer Organization Structure

In the course of the project the institutional structure for Farmer Organizations has progressed from the formation of informal Field Channel Organizations, to the establishment, on the farmers initiative, of Area Councils composed of between 23 and 109 Farmer Representatives from the associated Field Channel Organizations, and to the subsequent creation of D-Channel Organizations composed of 10 to 20 Farmer Representatives from within a common D-Channel. In addition, in response to the farmers' Area Council initiative, Farmer Representatives have been invited by the District Government Agent to take part in the

District Agricultural Committee. In June 1985 a Project Level Committee, made up of Farmer Representatives, Irrigation Department Officers, and other relevant government officers, was established to directly address project level issues in a way that has not been possible in the more broadly focussed District Agricultural Committee. Figure III-1 indicates the present structure of the Farmer Organizations from Field Channel to Project level. It is notable that farmers initially by-passed the formation of D Channel Organizations. This development surprised the FO Program planners who had anticipated a sequential formation of Field, D, Area, and Project Level organizations. It indicates that farmers saw a more immediate need for a level of organization which could address more senior officials and deal with area level problems.

The establishment of this structure has been generally acknowledged by officers and Farmer Representatives interviewed in this evaluation as creating an important and useful new avenue for improved communication between farmers and officials. Officers from the field level upward felt that the existence of these groupings facilitated and rationalized their interaction with farmers. Farmer Representatives appreciated the greater accessibility and receptivity of officers, particularly Irrigation Officers, to their suggestions and problems. They felt that this improvement has been associated with the creation of Farmer Organizations as a forum for discussion. The principal topics for discussions have been the timing and rotation of water issues and the progress and problems with system rehabilitation.

Figure III-1

Structure of Farmer Organizations in Gal Oya Left Bank

(Number of each type of organization as at 30 September 1985 in brackets)

Project Level Committee

(1)

Area Councils

(6)

D-Channel Organizations

(27)

Field Channel Organizations

(348)

Source: Water Management Project Quarterly Report, Sept. 1985

The establishment of the Farmer Organization structure is definitely a step forward. The ARTI Impact Survey results indicate that the proportion of farmers reporting that they participate in their local Field Channel Organization is quite high (77% of farmers living in areas where a Field Channel Organization exists). However, only 54% reported that they knew of the existence of a D-Channel Organization (57% thought a D-Channel Organization was necessary), 35% had received reports of Area Council meetings from the Farmer Representatives, 26% knew of the existence of a Project-Level Committee and 47% knew of the presence of Farmer Representatives on the District Agricultural Committee.

While these figures are quite promising the evaluators recommend that great stress should be laid on consulting farmers before meetings are held above Field Channel level and on discussing the results with them afterwards. Such discussions are important if the new structure is to avoid becoming transformed into yet another formal meeting ground for officers and a small group of co-opted farmers who are divorced from the concerns and contributions of the mass of farmers.

Development of Farmer Leadership

Part of the significance attributed to the new Farmer Organization Structure is that it represents a more representative and consensual form of communication between farmers and the Irrigation Department. It has been argued that Field Channel Organization have selected a leadership which is more responsive to the interests of all the farmers at the Field Channel level, less politicized and better trained as regards water management.

Although no quantitative evidence was available to indicate the extent to which the 421 Farmer Representatives actually demonstrate these traits, it does appear that the selection of leadership from within relatively small and homogeneous groupings is giving a voice to those who may previously have been overshadowed by a small number of politically influential individuals. The spread of political allegiances among representatives who appear to be working together to solve water problems, and the District Minister's commitment to political neutrality, indicate that progress has been made in preventing politics from interfering in the activities of the Farmer Organizations. Training programs for Farmer Representatives also appear to have contributed to improved leadership and greater understanding of measures which farmers can take to improve water management.

Participation of Women in Farmer Organizations

No particular effort was made to involve women in Field Channel Organizations. Women have contributed both food and labor to group (shramadana) activities of the organizations, but they have generally not attended the business meetings of these organizations. Nevertheless, two women have been selected as Field Channel Representatives (one is also Chairwoman of her

D-Channel Organization). These women reported that they did not feel that their effectiveness was in any way undermined by the fact that they are women.

Although women clearly represent a major part of the rural labor force and their decisions and understanding have an important influence on family well-being, the evidence available from the report on "Womens' Participation in Agricultural and Non-Agricultural Activities in the Gal Oya Project Area", prepared for ARTI by Harippriya Karunaratne, indicates that a special effort to involve women in the Farmers' Organizations probably would not have been justified. She indicates that there is a very insignificant participation of Sinhala and Tamil women in cleaning field channels and in directing water to paddy fields. Also female involvement in the selection of cultivation methods and time of planting was found to be low in both ethnic groups, with only about 10% of the cases reporting joint decision making by the husband and wife and less than 5% reporting unilateral decision-making by women.

However, it should be noted that approximately 13% of females over the age of 14 in the Sinhala community and 15% of those in the Tamil community are either widowed, divorced or separated. While customarily women in this position rely on other adult males in the family (brothers, adult sons, etc.) to take decisions which would otherwise be made by the husband, a proportion of these women may be having to cope on their own. Women in the countryside who lack the necessary male family support are often assisted by their neighbours when necessary, but these women are nevertheless thrust into an unaccustomed position of decision-making which can leave them vulnerable. Officers should be alerted to the needs of these women and be careful not to overlook them when contacting farmers.

2. Functions Served by Farmer Organizations

Since the formation of Farmer Organizations there has been a discernable increase in the level of participation of farmers in the design, operation and maintenance of the irrigation system, a reduction in the level of conflict over water, and an improvement in the quality of communication between farmers and officers. However, while these improvements have been associated with the formation of farmer organizations, it is impossible to isolate the contribution of the organizations from the effects of the concurrent physical rehabilitation of the system and the improved receptivity and cooperation of the Irrigation Department officers in the project area. It can only be said that the combined result has been positive.

Design Meetings and Design Walks

The participation of farmers in design meetings and design walks has been a significant advance over a previous lack of participation by farmers in rehabilitation design. Farmers have contributed suggestions on such things as location of bunds, site and positioning of outlet pipes, and location of bridges and culverts. Both engineers and farmers seem to have been satisfied

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with the process. In the ARTI Impact Survey, 54% of the respondents who lived where a farmer organization was operating said that they had participated in meetings with Irrigation Department officials to discuss the rehabilitation; 66% felt that the Department had implemented the suggestions made by farmers.

Construction

It was anticipated that Field Channel Organisations would make a contribution to the rehabilitation effort by contributing free labor for field channel earthworks. Precise data are not available for the overall progress in the earthworks at field channel level. However, the IO program records of shramadana earthwork undertaken (the principal means by which Farmer Organizations undertake field channel construction work) suggest that farmer participation has fallen significantly short of what was anticipated. Under the most generous assumption that farmer organizations undertaking shramadana in any given year are able to complete their task, and will not be among those counted in subsequent years, only 29% of organizations have ever undertaken any earth work shramadana. Approximately, 63% of the number of shramadana and 78% of the manhours were done by organizations representing just over a quarter of the Farmer Organizations in the Sinhala area. Sixty-five out of the total of a hundred shramadana were undertaken in 1982 and 1983 when only about a third of the organizations had been formed. While the records may suffer from incomplete reporting, particularly after the rapid turnover of IOs started in 1983, this indication of poor participation in earthwork construction is corroborated by engineers' reports that farmer completion of earthworks has failed to keep pace with the construction of field channel structures. Furthermore, it is not unlikely that some portion of the earth work which has been started under shramadana has remained incomplete. In their analysis of shramadana work undertaken in the Uhana area between 1981 and 1983, Widanapathirana and Perera found that on only 4 out of 15 channels was the earthwork which was undertaken more than 75% completed.

Widanapathirana and Perera give three reasons why farmers may have failed to complete earthworks: the work may have been too heavy for farmers to undertake; non-land owning members may have been unwilling to contribute their labor because of a lack of commitment to the channel; and a development of indifference on the part of farmers when the Irrigation Department was unable to commence construction as agreed upon.

The evidence suggests that it is not realistic to expect Field Channel Organisations to contribute labor without a greater incentive. While there may have been a relatively positive response to begin with in Uhana, once the IO program began to suffer from a rapid turnover and the enthusiasm and continuity of IOs declined, so too did the farmers' contribution of free shramadana labor for earthworks. In fact, so long as water is still able to flow to their fields, even through an

unrehabilitated field channel, only a minority of farmers seem willing to make the free investment of time and energy in rehabilitation work.

Perhaps farmers would be more responsive if Farmer Organizations were given the funds to undertake the complete rehabilitation of their field channel, possibly even including the structures. The Irrigation Department would provide all the technical assistance necessary to complete the task, and in order to receive the complete payment the farmers would have to complete the task to a satisfactory standard and within an agreed period time.

Operation of the System

The two operational activities which farmers have been involved in the past have been water rotations and water saving measures such as closing poles when fields have received sufficient water. Between 1981 Yala and 1983 Yala Farmer Organizations took an unusually active part in planning and executing water rotations. According to Widanapathirana and Perera, the number of Farmer Organizations adopting water rotations increased from 28% in 1981 Yala season to 78% in 1983 Yala in the Uhana area. They reported a 70-75% farmer participation in water rotations or savings and observed that because of rotations and water saving activities, an additional area of over 295 hectares, abandoned for 7-8 seasons at the tail of three distributary channels, were taken up for Yala cultivation.

However, since 1983 the ample availability of water and the control of rotations at the D-Channel level in many areas has reduced the farmers' need to concern themselves with rotations at the field channel level. Among the Sinhala respondents to the ARTI Impact Survey, 51% of farmers with a Farmer Organization on their field channel reported that a rotation system of water distribution was followed by farmers on their field channel following land preparation for Yala 1985 (Table III-3a*). Of those with an FO and who reported the practice of a rotation, 67% reported that the rotation was among field channels (incomplete responses recorded for those without an Organization make it impossible to make a comparison) (Table III-3b*).

The existence of the field channel organizations may well have contributed to a reduction in the amount of water wasted by farmers. The initial tabulation of the ARTI Impact Survey shows that while 83% of respondents on channels with a Farmer Organization felt that less water was wasted than 5 years ago, 69% on channels without an FO felt this way (Table III-4a*). When asked how this reduction in water wastage was achieved, a greater proportion of farmers on channels with an FO attributed the reduction to increased knowledge and awareness on the part of farmers (something actively promoted by the Institutional Organizers), while most of those channels without an FO attributed it to greater control of water by an Irrigation Department official (Table III-4b*). The small number of respondents for field channels without farmer organizations (29) compared with the number with an FO (126) means that these

observations must be considered as merely indicative. But it does suggest that where FOs are in operation the reduction in waste of water might be sustained by farmers own increased awareness whereas where they do not operate it is more dependent on outside enforcement. It remains to be seen if the difference in awareness among farmers with FOs on their channels will be reflected in the effective enforcement of rotations at field channel level when the need arises in future.

Maintenance of the System

According to the Irrigation Ordinance in Sri Lanka, farmers are responsible for the maintenance of field channels. One way in which Farmer Organizations have promoted channel cleaning has been through the organization of shramadana. Table III-5 indicates that the number of shramadana for irrigation system cleaning peaked in 1984 and has now begun to come down. This reduction can probably be explained by the reduced intensity of IO activity and by the difficulty of sustaining such collective works among essentially individualistic farmers. But it does at least reflect some willingness among farmers to engage in common efforts for the maintenance of the system. One point which should be made is that in some areas all that was required to rehabilitate the field channel was a thorough cleaning. Therefore some of this cleaning activity may have actually represented a contribution to system rehabilitation.

Table III-5

Farmer Participation in Irrigation System Cleaning Through Shramadana

Year*	No of FOS	No of FOS Undertaking Shramadana	No of Shramadana	No of Manhours
1981	100	2	3	195
1982	122	2	4	405
1983	131	51	124**	10,082
1984	302	107	166	10,643**
1985	348	50	56	4,085**

* Situation at end of year
** Figures for some shramadana missing

Source: Water Management Quarterly Report and IO records.

According to the farmers interviewed under the ARTI Impact Survey the condition of field channels has improved in the last five years and there has been a slight decrease in the number of channels which failed to be cleaned prior to the Yala season (Table III-6a*). Although only a minority of respondents with an

FO reported channel cleaning done through shramadana, the proportion is still greater than five years ago and than among farmers without an FO (Table III-6b*). The survey results indicate that where there is an FO the responsibility for organizing field channel cleaning has shifted from Irrigation Department and Agrarian Services officers to the Farmer Organizations and the IOs (Table III-6c*). Thus it would appear that Farmer Organizations are taking on more of the function of ensuring that field channels are maintained and that they have made a contribution to an improvement in field channel cleaning.

When asked their opinion about changes in the incidence of damage to structures since the formation of FOs, 77% of respondents from channels with an FO felt that the incidence had decreased (Table III-7*). Naturally other factors associated with system rehabilitation will have reduced the need for farmers to damage structures in order to obtain water, but FOs may be given some of the credit for improved farmer discipline. It must be pointed out that damages to structures, particularly gates, are still being reported by the Construction Engineer for Gal Oya. But although it is disappointing, it cannot be expected that Farmer Organizations, still at an early stage of development should eliminate all need for policing.

Other Initiatives

FO involvement in non-irrigation activities has been limited. Since 1981 there have been 6 reported cases of shramadana for road construction and other non-irrigation work. In addition there have been three cases of Field Channel Organizations undertaking construction contracts for the Irrigation Department.

In fact, it should not be expected that many Field Channel Organizations will extend their activities beyond irrigation-related matters. It may be best for them to concentrate on these irrigation matters and avoid the complications and possible conflicts which could arise if other ventures are introduced. Nevertheless the legal provisions should be made to enable these organizations to undertake contracts and become involved in other activities, such as the creation of a savings and credit scheme or the purchase of inputs, should they wish to.

Development in Farmer-Officer Relations

In the earlier discussion of the development of the Farmer Organization structure it was indicated that farmers and officers felt that the organizations had created an important avenue for improved communication and understanding. This has applied not only to Irrigation Department officers, but also to other officers,particularly those from the Agricultural Extension Services and from Agrarian Services. The Agricultural Extension Field Officers (Agricultural Instructor and KVS interviewed for this evaluation) particularly appreciated the presence of ready-made groupings for their Training and Visit Programs, and in some cases the Farmer Representative has been selected as the KVS's contact farmer. Although there has been some conflict and confusion regarding the relative roles of Farmer Representatives

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and the Yaya Palakas of the Agrarian Services Department, this should be sorted out if the Yaya Palaka bounderies are redrawn along hydraulogic lines as recommended in a paper submitted by ARTI to the Agrarian Services Department.

Table III-8 indicates that a larger proportion of farmers on channels with a Farmer Organization, compared with those without, have observed an improvement in the attitude of officials toward farmers. This lends support to the view that improved farmer-officer relations are the combined result of changing officer and farmer attitudes and the improved communication made possible by the FOs.The table also indicates that amongst farmers with an FO, the largest proportion of farmers noticed an improvement in the attitude of field level irrigation officers - particularly the Technical Assistants and the Jala Palakas. The active role of the former Deputy Director, Irrigation, Gal Oya, is reflected in the proportion of farmers who reported an improvement in the attitude of an officer who would previously have had very little contact with farmers.

TABLE III-8

Farmers' Perception of Improvement in the Attitudes of Officials towards Farmers

Type of Official	% of Farmers reporting an Improvement in Officers' attitude in the last 5 years: With An FO	Without An FO
1. Technical Assistant	85 %	14 %
2. Jala Palaka	64	21
3. Maintenance Overseer	49	21
4. District Officer/ Agrarian Services	46	28
5. Co-op Personnel	45	10
6. Irrigation Engineer	44	17
7. KVS	43	31
8. Deputy Director Irrigaton	37	21
9. Cultivation Officer	36	17
10. Bank Personnel	26	14
11. Paddy Marketing Board	22	7
N =	122	29

Source: ARTI Impact Survey

3. Assessment of the Farmer Organizations in Gal Oya and Prospects for Long Term Viability

The creation of Farmer Organizations through the Institutional Organizer Program in Gal Oya has been a definite step forward. The effectiveness of the Organizations in irrigation operation

and maintenance is only just beginning and is still untested in most cases. However, it does reflect a potential for more effective farmer participation which should continue to be tapped. The improved communications between farmers and officers - a combined result of the encouragement given by the Institutional Organizers, of the leadership and enthusiasm for farmer involvement provided by the former Deputy Director for Irrigation Gal Oya, and of the training and re-orientation of officers working at all levels in the Irrigation Department in the project area - will make an important contribution to the organizations' continued viability. It can be stated that while good leadership and training in the Irrigation Department and the physical rehabilitation through the Water Management Project have made a contribution to the fulfillment of the institutional and physical environmental prerequisites for farmer participation referred to at the beginning of this chapter, the Institutional Organizer Program has contributed to overcoming the social obstacles which could have prevented the emergence of effective farmer water user organizations.

However, farmer organizations will need continued active support before it can be concluded that they have taken root in Gal Oya. It was the general impression of the officers and farmers interviewed in the course of this evaluation as well as of farmers surveyed by ARTI (Table III-9*), that less than half of the field channel organizations will continue to function after the number of Institutional Organizers is reduced at the end of 1985. Eighty two percent of farmers feel that they need outside assistance from someone who performs the function of an Institutional Organizer (Table III-10*). This brings the evaluation to an examination of the Institutional Organizer Program and to a consideration of the implications of these observations for future strategies to encourage and support farmer organizations in Gal Oya and elsewhere in Sri Lanka.

C. ROLE AND EFFECTIVENESS OF THE INSTITUTIONAL ORGANIZER PROGRAM

1. Assessment of the Contribution of Institutional Organizers to the Formation of Farmer Organizations

The previous observations indicate that Institutional Organizers have clearly played a critical role in the establishment of farmer organizations in Gal Oya. They have not only provided guidance to farmers and encouraged them to take an active role in the design, operation and maintenance of the irrigation system, they have also promoted improved communication between officers and farmers by facilitating farmer meetings to which officers have been invited to attend. They have also helped to bring about better coordination among officers who provide services to farmers by encouraging informal reunions of officers.

2. The Performance of Women Institutional Organisers

Approximately a quarter of the 169 recruits (45) were women. Women IOs did not feel that they were particularly more or less effective than their male counterparts, but some IOs observed that farmers may have been inclined to be more receptive and

cooperative toward the women IOs. Although the women IOs probably had an easier access to and rapport with the women in the farm families they visited, this appears not to have been reflected in a higher participation of women in the Farmer Organizations which women IOs have assisted. The failure to promote greater participation by women in FOs might be explained by the observation made earlier in this chapter that women have limited involvement in water management decisions. The rate of turnover among women IOs was slightly higher than that among men IOs (Table III-11).

TABLE III-11

Average Length of Service Among Batches of Recruits to the Institutional Organizer Program

Batch + Date of Training	No. of Members in Batch		Average Length of Service (Months)	
	Total	Women	Total	Women
1. Jan-Feb 1981	31	9	28.98	21.46
2. July-Aug 1982	33	9	9.72	7.14
3. Jan-March 1983	21	5	5.81	8.68
4. Oct-Dec 1983	33	9	13.92	14.82
5. March 1984	26	5	3.08	2.40
6. Jan-Feb 1985	26	8	4.81	3.07
TOTAL	169	45	11.87	10.46

Source : Water Management Project Quarterly Reports from ARTI records.

3. Rates of Attrition and the Appropriateness of Institutional Organizers' Background

Despite the positive contributions made by Institutional Organizers the overall efficiency and effectiveness of the IO program has been seriously undermined by the increasingly rapid turnover of recruits (Table III-11) who have left the program to take up permanent positions, primarily in the teaching profession. Whereas the IO program organizers have determined that one year of closely working with farmers is necessary to establish functioning field channel groups, less than half of the IOs have remained in their post for 12 months or more, and 41% have left within 6 months of starting the job (Table III-12). The lack of continuity of IOs may have made it difficult for Farmer

Organizations to become established where farmer cohesiveness was weak.

Ironically, the experimental status of the IO program has helped to undermine the experiment. Because of uncertainty about the validity of the IO approach, no permanent government positions were created, and the IOs' departure to take up permanent posts when they were offered, gave further doubts to the skeptics. Now the question about the appropriateness of creating a permanent cadre still remains open.

However, despite the turnover in IOs, an assessment of the prevailing institutional and social environment in Gal Oya at the start of the Water Management Project confirms that the strategy adopted for the IO Program was justified (see section 5 below). The need for a catalyst with the time, energy and commitment to working with farmers and with the confidence and status to influence government officials, appears to support the decision to select graduates with farm backgrounds as IOs, at least for the Sinhala portions of Gal Oya.

TABLE III-12

Proportional Distribution of Length of Service Among Institutional Organizers

Period Remaining in Service	% of IOs
3 months or less	27 %
3 + months to 6 months	14
6 + months to 12 months	16
12 + months to 24 months	20
Over 24 months	10
Still in service	13
Total	100 %

Source : Cornell, based on ARTI data

Although it would now be useful to be able to compare the results achieved by alternative sorts of catalysts , the establishment and administration of such an "experiment" would have probably been beyond the capacity of ARTI to manage. An early effort to train irrigators as Institutional Organizers proved to be unsuccessful.

4. Administration of the Institutional Organizer Program

The IO Program has been under ARTI administration for too long. ARTI training and supervision of the program started out positively under the coordination of a team of enthusiastic Research and Training Officers; but the protracted retention of the program under the wing of ARTI (a research-oriented rather than administrative institution) has led to a decline in standards of supervision and evaluation. The turnover in ARTI staff and a waning interest in administering the experiment have contributed to this decline.

The training provided by ARTI to the IOs had an appropriate balance of practical social organization skills and introduction to technical aspects of water management. The first batch of IOs trained seems to have been an enthusiastic and capable group of workers, who generated a clearly positive response from the farmers on the 6,000 acres where there was intensive activity in in the early years of the program. However, the performance of subsequent batches may have been undermined by declining morale associated with the increasing turnover of IOs, and by weaker supervision from ARTI.

The technical assistance received from Cornell has provided needed continuity and useful guidance. However, there should have been more guidance provided in keeping the data collection to more manageable proportions. The program would have seriously suffered in the absence of the locally recruited Cornell Consultants, particularly in the last two years.

The former Deputy Director of Irrigation in Gal Oya contributed to the positive achievements of the IO Program through his active support and assistance to its administration and implementation in the field. The importance of his help to the program confirms the need for the active involvement of the Irrigation Department in the implementation of efforts with similar objectives.

5. Alternative Strategies for the Promotion of Water User Associations

While the IO program in Gal Oya has demonstrated the benefits which can be derived from the use of outside catalysts, there is no single formula for the promotion of water user associations which can be recommended for all irrigation systems in Sri Lanka. Even if one only considers major irrigation schemes, there are important differences from one scheme to the next in the skills and attitudes of officers and in the cohesiveness and leadership within the water using community. This indicates the need to assess the institutional and social environment of each system before selecting the strategy which will be used to promote water user organisations.

Table III-13 lists the three principal types of strategies which can be used to obtain the participation of water users in irrigation system operation and maintenance. In column A the strategies are ranked from the one requiring the least government resources to the one requiring the most government resources.

Column B indicates the conditions under which each strategy would be appropriate, and column C presents an assessment of the ability of organizations formed under each strategy to function in a less than adequate institutional and physical environment (as defined at the beginning of this chapter).

The conditions which existed in Gal Oya at the start of the project were such that strategy 3 in the table was the correct one to choose. Within that strategy, alternative options regarding the use of A-level rather than university qualified catalysts and the possibility of working with volunteers, teachers or some other community servant are still to be tried. In other irrigation schemes the conditions may be such that one of the other strategies may be appropriate.

TABLE III-13

Alternative Strategies For Promoting Water User Organizations and Prerequisites for their Effectiveness

A Alternative Strategy	B Conditions under which strategy is Appropriate	C Ability of Organization to Function in less than Adequate Institutional and Physical Environment
1. Await natural emergence of water user organizations.	Strongly cohesive community with strong and generally accepted leadership.	May be able to partially compensate for moderate institutional resistance and ineffectiveness and for relatively minor faults in the system.
2. Actively encourage the formation and initiatives of water user organizations through the actions of existing government officers.	-Moderately cohesive community with some consensus on leadership -Active and committed government officers willing to take time to positively encourage farmer participation and willing to encourage farmers to confront government officials when necessary.	Unlikely to function effectively in the absence of strong officer and bureaucratic commitment to encouraging and responding to farmer initiatives.

3. Actively encourage the formation of water user associations through a cadre of catalysts charged specially with the task of stimulating such groupings.	-An untapped potential for community cooperation -An enthusiastic cadre of catalysts able to identify and address the obstacles to water user collaboration in irrigation operation and maintenance.	An effective cadre may help to overcome moderate deficiencies in the institutional and/or physical environment by promoting changes in attitudes and improved communication between farmers and officers.

However, regardless of the particular strategy which is adopted for each scheme, a common element which will be essential is the appointment by the Irrigation Management Division of individuals experienced in the promotion of water user associations. These individuals will be charged with determining and implementing the correct strategy in each particular location. The Irrigation Systems Management Project Paper provides for a group of Assistant Project Manager/IO who could fulfil this function.

Where the first strategy indicated in Table III-13 is adopted, the Assistant Project Managers will provide a focal point for improved communication between existing water user groupings and the Irrigation Department. Where the second strategy is adopted they will work closely with the officers selected to promote water user groupings (KVS and Cultivation Officers appear to be promising possibilities) in the implementation of their program. The officer will also coordinate the training of officers and farmers as required to advance the effectiveness of the organizations. Where the third strategy is adopted, the managers will identify, train and supervise the catalyst cadre in their project area. In places where the third strategy is found to be necessary, it is essential that there be funds available to compensate the catalysts for their efforts. If it can be convincingly demonstrated that in a particular area only an IO type field-level catalyst could be effective, the Ministry of Education should be approached to see if potential IO recruits who have been offered a teaching position could defer their entry to the service until after they have completed a 2 1/2 year contract (including a training and probation period) as IOs.

It is essential that the Assistant Project Managers should be incorporated into the permanent government career structure within the Irrigation Management Division (IMD). If they are not, the effectiveness of their work will continue to be undermined by the level of turnover which has dogged the IO program in Gal Oya. Given that the IMD may still be hesitant about making a long term commitment to an Assistant Project Manager cadre, the Division should explore the possibility of recruiting former IOs on three year secondment from the Ministry of Education to fill these posts.

D. ARTI MONITORING AND RESEARCH PROGRAM

The monitoring of the IO Program by ARTI has been over-ambitious in its objectives and inconsistent in its performance. A great quantity of data have been generated but ARTI staff have not been able to undertake the supervision or to keep up with the analysis necessary to maintain data quality. The lack of continuity in ARTI staff has reduced the effectiveness of the monitoring effort as a source of feedback to the project. The monitoring would have been more effective if throughout the project a regular and careful analysis of the process documentation had been complemented by the tabulation of a few selected indicators of FO progress (numbers and types of activities being undertaken by FOs, number of actual participants in comparison with number of members, actual physical achievements from FO activities). Although this type of monitoring was undertaken early in the project, it was suspended after the ARTI officers originally responsible for the IO program left the Institute.

A serious weakness in the on-going evaluation of the project by ARTI has been the over-reliance on anecdotal reports. Because these observations have not been compared with developments in the project as a whole, it has not been possible to determine the extent to which particular success cases have been representative of development throughout the project area. It is also unfortunate that ARTI appears to not have followed up on the recommendation in the Mid-Term Evaluation that a study be done on farmers actual motivation for joining or failing to join field channel organizations. It would be useful to have a discussion of this issue in the forthcoming ARTI end-of-project evaluation.

A massive volume of reports has been generated through the project - much of it written by the Cornell Consultants. ARTI have also produced a number of research studies, but it would appear that the Irrigation Department found the volume of material impossible to digest. It is recommended that the forthcoming ARTI end-of-project evaluation should include a distillation of the principal results and policy implications of the project-related research which the Institute has undertaken.

Given that at the start of the project ARTI had undertaken very little work on farmer organizations and water management, the project has given ARTI some useful institutional experience in investigating irrigation issues. This has led ARTI to be drawn into research involvement with other irrigation projects such as the Mahaweli Program and the World Bank Minor Irrigation Rehabilitation Project. Having said this, it would appear that ARTI's research capacity on irrigation matters has been over-extended and this is one reason why the special study funds included in the project have not been utilized.

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SELECTED IMPACT SURVEY RESULTS

The following tables present the results of tabulations, done for this evaluation, of the responses to questions contained in the ARTI Impact Survey. The survey was conducted in November, 1985.

TABLE III-3a

Rotation of Water by Farmers on Field Channel after Land Preparation for Yala 1985
% Responding

	With an FO	Without an FO
Yes	51 %	54 %
No	49	46
Total	100 %	100 %
N =	124	35

TABLE III. 3b

If Yes, What System was Followed
% Responding

	With an FO
1. Rotation within Field Channel	27 %
2. Rotation among Field Channels (D-channel)	67
3. Other	6
Total	100 %
N =	64

Table III.4.a

Farmers Views on Whether There Has Been A Reduction in the Waste of Water Since Five Years Ago

	% Responding	
	With An FO	Without An FO
Yes	83 %	69 %
No	10	10
3an't Say	7	21
Total	100 %	100 %
N =	126	29

Table III.4b

Farmers Views on the Means by which the Improvedment was Achieved

	% Responding	
	With An FO	Without An FO
1. Greater Water Supply	7%	10 %
2. More reliable supply	23	20
3. Better Maintenance	31	10
4. Farmer more aware of other needs	40	0
5. More farmer knowledge that excess water not needed	35	10
6. ID Officials Control water more firmly	17	80
7. Other	1	
Total	153 %	135%
N =	103	20

Note: The total percent exceeds 100 because of multiple responses

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Table III-6a

Farmers Comparison of the Condition of Their Field Channel Now and Five Years Ago

% Reporting

	With an FO		Without an FO	
	Now	5 Years Ago	Now	5 Years Ago
1. Excellent	10 %	1 %	0 %	0 %
2. Good	54	7	38	31
3. Adequate	27	19	11	10
4. Poor	4	45	17	24
5. Very Poor	2	24	17	21
6. No Response	3	4	17	14
TOTAL	100 %	100 %	100 %	100 %
N =	127		29	

Table III-6b

Farmers Reporting that Field Channel Was Cleared this Yala and Yala Five Years Ago

% Reporting

	With an FO		Without an FO	
	Now	5 Years Ago	Now	5 Years Ago
1. No	4	9	10	3
2. Yes, Shramadana	22	9	3	0
3. Yes, Individual Lengths	69	72	82	51
4. Can't Say	not asked	6	not asked	21
5. No Response	5	4	5	25
TOTAL	100 %	100 %	100 %	100%
N =	127		29	

Table III-6c

Who Organized Field Channel Clearing Before and After the Formation of the Farmers' Organizations

		% Reporting		
		With An FO		
		Before FO	After FO	Without An FO
1.	Irrigation/MO	3	2	7
2.	YP/Vel Vidane	87	19	62
3.	FO/FR	1	61	0
4.	IO	0	15	0
5.	Other	3	2	24
6.	No Response	6	5	7
	TOTAL	100 %	104%*	100 %
	N =	127		29

Notes:

* Total exceeds 100 because of multiple responses

MO=Maintenance Overseers
YP=Yaya Palaka
FO=Farmer Organization
FR=Farmer Representative
IO=Institutional Organizer
ID=Irrigation Department

Table III-7

Incidence of Damage to Structures Since the Formation of Farmer Organizations

		% Reporting
		With an FO
1.	Increased	1 %
2.	Decreased	77
3.	No Change	6
4.	Can't Say	9
5.	No Response	7
	TOTAL	100 %
	N =	129

TABLE III-9

Farmers' Perception of What Will Happen to Their

Farmer Organization if the Number of Institutional Organizers is Reduced at the End of 1985

		% of Farmers with an FO responding
1.	Continue to function very well	4 %
2.	Continue to function but not so well	34
3.	It will become even more active than before	0
4.	It will decline in effectiveness	5
5.	It will collapse	45
6.	Decline and collapse	8
7.	No Response	4
	Total	100 %
	N =	127

TABLE III-10

Farmers' Opinion of the Need to Have Institutional Organizers for a Farmer Organization Program

		% of Farmers with an FO Responding
1.	Yes, necessary	82 %
2.	No, not necessary	6
3.	Can't say	4
4.	No response	8
	Total	100 %
	N =	127

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ECONOMIC ANALYSIS

ECONOMIC ANALYSIS

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B. Cropping Intensity

C. Paddy Production

D. Costs of Paddy Production

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ECONOMIC ANALYSIS

A. Extent of Paddy Land Under Irrigation

The Project Paper estimated that 52,200 acres of paddy land were irrigable on the Gal Oya Left Bank prior to rehabilitation. Of this amount, an estimated 45,000 acres of land was officially designated for agricultural production and an additional 7,000 acres were encroachments on to areas reserved for canals, tanks, road reservations, grazing grounds, etc. Cultivation of the encroached area was not provided for in the design of the irrigation scheme.

The before project estimates of the area under irrigation have been adjusted downward to reflect the irrigation potential of the Senanayake Samudra dam when it was constructed. The Project Paper notes that the Senanayake Samudra dam and reservoir which were constructed from 1949 to 1951 were designed to irrigate 42,000 acres. In the thirty year period between 1951 and 1981 it is quite likely that actual area irrigated under this design declined as the system deteriorated. At the same time we assume that there were encroachments along canals and other areas which would have compensated for the land at the tail end of the system which went out of use. After examining the data available at this time, we have adjusted the PP estimate to assume that the rehabilitation program began with a base of 42,000 acres rather than 52,000.

In response to the greater supply, more equitable distribution, and improved reliability of irrigation, the PP projected that 5,000 acres of paddy land would be developed and brought under irrigation at the rate of 1,000 acres per year beginning in the third year. By the seventh year it was expected that the full 5,000 additional acres would have been developed and that acreage would remain relatively unchanged thereafter.

The following table shows adjusted estimates and projections of irrigable paddy land for without project and with project based on the Project Paper's assumptions of annual increases of land brought under irrigation.

TABLE 1
(acres)

Project Paper Adjusted Projections Of Irrigable Paddy Acreage

Year	Adjusted Acreage Without Project	Adjusted Acreage With Project	Incremental Acreage
1	42,000	42,000	-
2	42,000	42,000	-
3	42,000	43,000	1,000
4	42,000	44,000	2,000
5	42,000	45,000	3,000
6	42,000	46,000	4,000
7 to 20	42,000	47,000	5,000

Source: Project Paper

Although project implementation started in 1980, physical rehabilitation did not begin until late 1982 and full scale work on canals and structures did not get underway until mid-1983. At the end of 1985, Irrigation Department estimates are that there are 53,006 acres under rehabilitated irrigation. An additional 7,015 acres using water from the Navakiri and Kandakadumadu rivers have benefitted from the water management in the upper reaches of the irrigation scheme, although no rehabilitation has been done because of the political disturbances in the district.

The following table shows the estimated acreage without the Project and the actual Project acreage under rehabilitation at the end of 1985.

TABLE 2

Without Project and Actual Irrigable Paddy Acreage
(acres)

Year	Estimated Acreage Without Project	Actual Acreage With Project	Incremental Increase
1	42,000	42,000	-
2	42,000	42,000	-
3	42,000	42,000	-
4	42,000	46,000	4,000
5	42,000	50,000	8,000
6 to 20	42,000	53,000	11,000

Source: Consultants' Estimates

Although physical rehabilitation did not get underway until the third year of the project, there was a rapid increase in acreage under irrigation. The actual with project acreage has increased

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far more rapidly than anticipated, peaking at 11,000 acres in the sixth year rather than than 5,000 acres in the seventh year as shown in the Project Paper. This is important to an investment project in that the stream of benefits is larger at an early stage of the project.

B. Cropping Intensity

The Project Paper assumed that the cropping intensity was 129% and anticipated increases in cropping intensity to rise by an average of 10 to 12 percent a year until it reached 189% in the seventh year.

In the Maha season, farmers in Ampara District plant nearly the entire cultivateable Left Bank to paddy, relying on a combination of rain and irrigation water. In the Yala season the amount of land under paddy depends primarily upon the amount of water issued from the reservoir and the duty at tank level. Unfortunately, reliable estimates of the area cultivated each season are unavailable and varying cropping rates are estimated by various sources. Estimates of cropping intensity prior to the project ranged from 119% by the Agrarian Research and Training Institute (ARTI) to 129% estimated in the Project Paper.

A Reservoir Operations Study submitted by PRC Engineering Consultants to the Irrigation Department in February 1983 addressed the question of cropping intensity. In this report a series of studies on Navakiri and Senanayake Samudra Reservoirs were made to determine operating criteria for each reservoir, storage criteria, and the annual area each reservoir could irrigate using various cropping patterns and project irrigation efficiencies.

The basic operating criteria for both reservoirs was to maximize wet season paddy cultivation. This was achieved, but in both cases, the service area under command of the reservoirs is considerably larger than the available flows can adequately irrigate for a 200% cropping intensity. The following disucssion is a summary of the estimates of the number of acres that can be irrigated from the two reservoirs assuming an irrigation system efficiency of 50% and at least 50% of the Maha season paddy grown under dry seeded conditions.

The Senanayake Samudra Reservoir can irrigate the entire 100,262 acres in the Maha season. This includes both left and right banks and the River Division, which is irrigated primarily by return flow and several small tanks. Studies indicated that the Maha season irrigated area would encompass all of the right and left bank areas directly. The reservoir would make up part of the Navakiri shortages, but would be of no help in the dryest years. The Yala season area served by Senanayake Samudra would be an estimated 69,160 acres. Sugarcane on 10,058 acres would have first priority for water. Based on these estimates the average year to year cropping intensity will be 169%.

Overall, the average cropping intensity that may be expected from direct irrigation of the Navakiri reservoir is 128%. Operation

studies of the Navakiri reservoir indicated that an estimated 14,079 acres can be irrigated directly from the reservoir in the Maha season and 3,952 in the Yala season. In addition, the 4,963 acres presently irrigated by return flows will continue to be irrigated by the same methods as they are today with the same degree of reliability. The Yala season return flow will support 1,235 acres on the average. This means that the full 18,772 acres in the service area will normally be irrigated in the Maha season. It is estimated that in one out of every four years the inflows to the Navakiri will not be sufficient to irrigate the entire service area in the Maha season. It may be expected in years of severe drought that no dry season area would be irrigated.

The cropping intensity for the combined areas is 164%, which is considerably short of the average of 189% which was envisaged in the project paper. However, the PRC report emphasizes that its findings are based on assumptions about various production practices. For example, production of paddy using 100% dry seeding in the area under the Navakiri reservoir would raise cropping intensity to about 186%.

In the 1981/82 Maha season the Irrigation Department authorized 62,000 acres on the left bank as the Maha season area, and the estimated area planted in the 81/82 Maha season was 61,818 acres. In the '82 Yala season 12,000 acres were planted. The Irrigation Engineer's Office in Ampara District reported that the acreage under irrigation in the 84/85 Maha season was 40,634 acres and the Yala season acreage was 39,520 acres in Ampara district. This was a cropping intensity of 197% for the Ampara District.

In the Batticaloa district, served by the Navakiri reservoir. 8,856 acres were planted in the 84/85 Maha season and 8,611 acres in the 85 Yala season. There was an estimated 14,981 acres within the irrigation system at that time, but at present discharge rates from the Navakiri reservoir, only 10,781 acres could possibly be brought under irrigation. However, because there has been no rehabilitation of structures and canals, about two thousand acres less than this potential have been under irrigation in any one season. The cropping intensity in this district was only 117%.

The figures given above show how difficult it is to determine an exact, or even reliable ball park estimate of cropping intensity for the entire irrigation scheme. With the completion of the physical rehabilitation and with lower water duties, more water will be flowing into the Navakiri reservoir from the upper areas of the system. This will bring a greater portion of this land under irrigated cultivation, particularly in the Yala season.

After completion of the rehabilitation of the area below the Navakiri reservoir at the end of 1986, the cropping intensity of the entire project area is expected to be 164% in a year of normal precipitation, with current farmer practices such as seeding methods and adherence to land preparation and planting schedules.This cropping intensity may well improve in the future. If there is a change in farmer practices which affect the use of

irrigation water, the cropping rate may reach the anticipated 189%. At the moment, much of the responsibility for increased cropping intensity rests with the ability of farmers to put into effect on-farm water saving practices.

The following table shows cropping intensity with and without the project as anticipated by the Project Paper.

TABLE VI - 3

PP Projected Cropping Intensity
(percent)

Year	Without Project	With Project
1	129	129
2	129	129
3	129	139
4	129	150
5	129	162
6	129	175
7 to 20	129	189

Source : Project Paper

Table VI-4 shows the estimated without project cropping intensity and the actual with project cropping intensity through 1985.

TABLE VI - 4

Current Projection Of Cropping Intensity
(acres)

Year	Without Project	Actual With Project (Through '85)
1 (1980)	129	129
2	129	129
3	129	129
4	129	139
5	129	179
6	129	179
		Projected
7	129	164
8	129	164
9	129	170
10 to 20	129	175

Actual cropping intensity did not change from the without project level until the fifth year because physical rehabilitation did not get underway until the third year. Heavy rains beginning in the Maha season of 83/84 made it possible to irrigate nearly all of the command area in the '84 Yala season, raising the cropping intensity to 197%. Good rains in the next seasons again led to a very high cropping intensity of 197%. Irrigation engineers feel that cropping intensity of this level is possible only with exceptionally high percipitation. As noted in this section, a cropping intensity of 164% is considered an attainable average if farm management patterns do not change. In the cropping intensity projections for 1986 onward, we assume that these changes can be achieved by farmers beginning with year nine and cropping intensity will increase to 175% in year ten.

C. Paddy Production

A crucial element in assessing the impact of the project on agricultural production is estimating paddy yields per acre prior to the project and tracking them to the present. This proved to be difficult as the two major sources gave highly divergent estimates of yields. The two major sources for these data are the Census and Statistics Department and the Agrarian Research and Training Institute. The bushels per acre estimates for the Left Bank of the Gal Oya from these two sources differ in a magnitude of nearly 30 bushels per acre with the Census and Statistics Department figures being higher.

Part of the reason for this discrepancy may be that the Census and Statistics Department data that were available to the evaluation team were for the Uhana Division only, while the ARTI data were from sample points throughout the project area. Another reason for discrepancies in estimating yields in the Ampara District is that the undulating topography and soils varying from sandy to loamy result in different yields from field to field. Time limitations precluded the evaluation team from making an in-depth examination of survey samples, data collection procedures and supervision at the field and tabulation levels. However, during the week spent on field investigation in Ampara, the team did make observations on soil types, plant density, fertilizer and chemical applications and the preparation and maintenance of fields. We also questioned farmers about yield levels.

From observations and interviews made on this field trip, we conclude that yields throughout the area would fall somewhere between the estimates of ARTI and the Census and Statistics Department. The team estimates that representative yield levels are about 10% below the crop cuts cited in the data available from the Census and Statistics Department.

These data represent estimates of bushels per acre based on crop cuts. To further refine the yield data to obtain a net acre off-take it is necessary to apply a net harvested formula for Ampara. This formula is gross harvested acreage equal to 0.99 of gross sown acreage and net harvested acreage equal to 0.95 of gross harvested acreage. Accordingly, the adjusted net yields of

paddy based on Census and Statistics Department data would be the following.

TABLE VI - 5

Adjusted Maha Season Paddy Yields
(Bu/ac)

	80/81	81/82	82/83	83/84	84/85
Bu/Ac	79.2	85.5	72.9	60.3	72.9

Source: Consultants' estimates

TABLE VI - 6

Adjusted Yala Season Paddy Yields
(Bu/Ac)

	81	82	83	84	85
Bu/Ac	67.5	82.8	79.2	76.5	86.4

Source: Consultants' estimates

These adjusted figures address only one aspect of yields per acre. The other aspect is tracking any changes in yield over the life of the project to observe any changes that may be attributed to rehabilitation and institutional improvement. As the irrigation effects of physical rehabilitation would have been felt by the majority of farmers only in the 83/84 Maha season, the team has been cautious about attributing changes in yields to the Project.

Although the immediate response to a better water supply during the Yala season which brings more land under cultivation and increases cropping intensity would be anticipated, changes in farm management practices which would increase yields significantly would not be expected to occur so rapidly. However, the ARTI yield data does show a discernable upward trend over the period. Yield data from the Department of Census and Statistics is not as conclusive.

The Baseline Study conducted by ARTI estimated an average yield of 34 bushels per acre for the 79/80 Maha season. An ARTI survey of the 82/83 crop estimated yields averaging 63 bushels per acre. Both of these estimates were for periods prior to any effect of physical rehabilitation. The 83/84 Maha season average declined to 45 bu/ac because of severe flooding.

1982 was the first year in which ARTI was able to collect Yala season yields. Estimates for that year were 53 bu/ac. In 1983 the ARTI estimates for the Yala crop average yields were 55 bu/ac. The 84 and 85 Yala season yields averaged 59 bu/ac and 58 bu/ac.

There is a definite upward trend from the 79/80 Maha season, but it is difficult to draw conclusions about how much of this is the effect of the project. The effects of physical rehabilitation would have been felt for the first time in the 83/84 Maha season. Perhaps the rehabilitation that had already taken place helped to ameliorate the flood damage and crop losses would have been higher without the rehabilitation, but this cannot be measured. There has been an increase in yields in the Yala season of about 9.5% from 1982 to 1985.

The bushels per acre reported by the Census and Statistics Department are based on crop cutting rather than field off-take which may also partially account for the discrepancy between the ARTI and Census and Statistics Department data. The yields reported by the Census and Statistics Department are substantially higher, but the year to year differences are less conclusive in terms of growth trends.

The following tables show yield data collected for 15 colonies in the Uhana A.G.A. This encompasses a major part of the project area, but may not include some of the areas in which yields are substantially lower.

TABLE VI - 7

Uhana Maha Season Average Paddy Yields (Bu/Ac)

	80/81	81/82	82/83	83/84	84/85
Bu/Ac	88	95	81	67	81

Source: Census and Statistics Department

Th Yala season yields are slightly higher but show the same lack of a decisive upward trend from 1982. However, comparing the 1982 and 1985 Yala seasons, there was a 4% increase.

TABLE VI - 8

Yala Season Average Paddy Yields (BU/Ac)

	81	82	83	84	85
Bu/Ac	75	92	88	85	96

Source: Census and Statistics Department

To estimate average yield for the project period the census and statistics yields were adjusted downwards and weighted for the Maha and Yala seasons by the cropping intensity rate which assumes that Maha season cropping is 100% and Yala is the remainder. These resulting estimates are shown in the following Table.

TABLE VI - 9

Estimated Average Bushels Per Acre - Gal Oya Left Bank

Year	Bushels/Acre
1980	60.0
1981	76.6
1982	84.9
1983	74.3
1984	67.4
1985	76.9

Source: Consultants' estimates

As yields have varied widely over the past six years it is not possible to determine a reliable trend line using this data. Future yields are projected on assumptions of soil fertility, and rates about fertilizer and chemical usage increasing as the price of paddy increases. Rice variety 94-1, which is used throughout the project area, has a research ceiling of 200 bu/ac and an extension ceiling of 160 bu/ac.

In the past six years yields have ranged from 60 to 85 bushels per acre, with an average of 76 bu/ac. Although this is a substantial increase, it is less than half of the extension ceiling and the evaluation team anticipates an increase in yields which should average 80 bu/ac in the next five years. This level and higher is already reached by many farmers, and improved water management, accompanied by continued extension efforts, should bring the average yield to this level.

For purposes of economic analysis the following table with projected paddy yields has been prepared.

TABLE VI - 10

Projected Paddy Yields (Bu/Ac)

Year	Bu/Ac
7	76
8	79
9	81
10	83
11	85
12	86
13	87
14 to 20	88

Source: Consultants' estimates

The following is an estimate of the total paddy production from the project area based on the above estimates of acreage, cropping intensity and yields.

TABLE VI - 11

Total Paddy Production - Gal Oya Project

Year	Acreage sown	Cropping intensity	Gross Acreage sown	Net Acreage harvested	Yield Bu/Ac	Total production
1	42,000	129	54,180	50,956	60.0	3,057,360
2	42,000	129	54,180	50,956	76.6	3,903,230
3	42,000	129	54,180	50,956	84.9	4,326,164
4	46,000	139	63,940	60,136	74.3	4,468,105
5	50,000	179	89,500	84,175	67.4	5,673,395
6	53,000	179	94,870	89,225	78.9	7,039,853
7	53,000	164	86,920	81,748	76.0	6,212,848
8	"	164	86,920	81,748	79.0	6,458,092
9	"	170	90,100	84,739	81.0	6,863,859
10	"	175	92,750	87,231	83.0	7,240,173
11	"	175	92,750	87,231	85.0	7,414,635
12	"	"	"	"	86.0	7,501,866
13	"	"	"	"	87.0	7,589,097
14-20	"	"	"	"	88.0	7,676,328

Source: Consultants' estimates

TABLE VI - 12

Maha Season Average Cost Of Paddy Production Per Acre

	High	Low
81/82	Rs 2,460	Rs 2,232
82/83	3,457	2,177
83/84	3,394	2,558
84/85	3,802	2,573

D. Costs Of Paddy Production

In the Mid-Term assessment Report, ARTI reported costs of paddy production per acre ranging from Rs. 1,123 to Rs. 1,456 in the 1980 Yala season. This includes an imputed value for family labor and family owned resources. The 83 yala season ranged from Rs 2,335 to Rs 3,208 and 84 yala from 2,458 to 3,673. The 81/82 maha season costs ranged from Rs 2,232/Ac to Rs 2,604/Ac. The 84/85 Maha season cost ranged from Rs 2,573 to Rs 3,802, with an average of Rs 2,985.

E. Net Returns to Production

It is difficult to determine a single figure which is representative of the net return to production for the project area. However, assuming a per acre cost of production of Rs 3,500 and farm gate price of Rs 65/bu, and calculating net returns for various per acre yields, it is possible to show a range of net returns. In the table below, a yield of 55 bu/ac will result in a net return of only Rs 75 per acre. Seventy bushels per acre would net Rs 1,000. In field interviews, farmers told the evaluation members that a "good farmer' would net about Rs 1,000 per acre. This may be a reliable statistic for the amount of paddy marketed. However, it is doubtful that the farmers took into consideration the paddy saved for seed and family consumption.

In reviewing Department of Agriculture cost estimates and in interviewing farmers in Ampara during the field visit we feel that even the higher levels they estimate are a conservative reflection of costs which include the imputed value of farm family labor, draft animals and equipment owned by the farmer. We have assumed Rs 3,500/ac as the current cost of production for net return purposes.

TABLE VI - 13

Yala Season Average Cost Of Paddy Production Per Acre

	High	Low
1980	Rs 1,456	Rs 1,123
1983	3,208	2,335
1984	3,673	2,485

Source: Department of Agriculture

TABLE VI - 14

Net Returns to Production Under Alternative Yield Assumptions

Bu/Ac yield		55	60	65	70	75	80	85
Price Bu	Rs	65	65	65	65	65	65	65
Gross Income/Ac	Rs	3,575	3,900	4,225	4,550	4,875	5,200	5,525
Cost/Ac	Rs	3,500	3,500	3,500	3,500	3,500	3,500	3,500
Net Return per acre	Rs	75	400	725	1,000	1,375	1,700	2,025
Cost/Bu	Rs	64	54	50	50	47	44	41

Source: Consultants' estimates.

F. Production Components

The following is a brief discussion of four of the major components of production. The purpose of this is to determine whether there appear to be any major constraints to increased production which should be addressed in this evaluation.

1. Credit

Credit does not appear to be a major constraint to production. The Bank of Ceylon and the People's Bank are operating in the town of Ampara. Many of the farmers have borrowed from one or the other of these institutions, but must of these have not repaid their debt and are ineligible for future loans until these are repaid. Most of the credit activity is in the informal sector with credit being extended by large farmers and traders. Although the cost of credit is high compared to the bank rates, sufficient credit does seem to be available.

2. Marketing

There is a Paddy Marketing Board in Ampara which generally operates as a market of last resort since farmers prefer to market through private traders who provide transport from the field, pay immediately and may also function as input suppliers and money lenders. The Multi-Purpose Cooperatives also assist the farmer with marketing if necessary. There does not appear to be a monopolistic situation, or any problem with transport.

Input Distribution

In Ampara there is a major distribution warehouse of the Ceylon Fertilizer Corporation which supplies cooperatives, Agrarian Services District Offices, and some local traders. A major part of the fertilizer is distributed by traders who purchase it in Colombo and distribute it at the field level. Pesticides and herbicides are sold through private outlets in Ampara and by private traders in the countryside. Most farmers use a portion of their own paddy production as seed. However, certified seed is available if desired. There does not appear to be a major constraint in availability, timeliness or the appropriateness of the type of input required.

Extension Information

The Department of Agriculture Extension Service appears to be active in the District. Inadequate extension does not appear to be a constraint to production.

G. Internal Rate Of Return

The present base case IRR is 47.4%, based on the following assumptions and methodology.

1. Major Assumptions

Without Project

- 42,000 acres under irrigated paddy: no change in future.
- Cropping intensity 129%: no change in future.
- Yields 60 bu/ac in first year (1980), increase 1% per year to 20th year with top yield 72.4 bu/ac.

With Project

- 42,000 acres under irrigated paddy: increase to 11,000 acres by the 6th year. Total acreage 53,000.
- Cropping intensity 129% first 3 years increasing (unevenly) to 175% in the 10th year and remaining constant thereafter.
- Average yield in first six years 74 bu/ac, increasing to

88 bu/ac in the 14th year and remaining at that level.

General

- Capital expenditure exchange rate $1.00=Rs 15.5 (1979 rate)
- O&M expenditures based on Rs 125/ac
- Cost of paddy production Rs 31.16/bu (1979 costs) with incremental increases to reflect quantity (not price inflation) changes in input use. Cost increases were correlated to yield increases.
- Price of paddy : Rs 58.43/bu. This was based on world price of rice in 1979.
- No attempt has been made to factor in indirect benefits. All benefits were based on increases in paddy production.

2. Previous IRRs

The present base care IRR of 47.4% compares with the following previous IRR calculations.

IRR : Project Paper	High	32%
	Low	13
	Base Case	23.3
IRR : Project Paper Amendment	High	44.2%
	Low	23.7
	Base Case	34.7

AGRONOMIC CHANGES

AGRONOMIC CHANGES

A. Agronomic Potential of the System

1. Nature of Soils and Environmental Conditions in the Project Area
2. Production Potential of the Respective Soil Groupings
3. Physical and Biological Constraints to Rice Production
4. Research and Extension Services Available Within the Project Area
5. Scope for Crop Diversification

B. Potential and Observed Changes in Farming Practices after Rehabilitation

1. Land Preparation and Sowing
2. Fertilizer Consumption
3. Weed Control and Seed Use
4. Herbicides
5. Crop Staggering

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VII-1 Land Preparation to Sowing Periods

VII-2 Fertilizer Use by Type - Ghana A.G.A. Division

AGRONOMIC CHANGES

A. Agronomic Potential of the System

1. Nature of Soils and Environmental Conditions in the Project Area

A notable feature of the resource base of the project area is the variation in soil and hydrological conditions that occur across the physiographic divisions within the irrigated command area. This variation is further complicated by changes in soil texture and drainage across the toposequence within the individual minor land units that make up these physiographic divisions.

Three broad physiographic divisions can be recognized as one proceeds eastwards to the coast from the main left bank canal. A highly dissected undulating residual plain with several rock outcrops occupies the western part of the project area. The central part is made up of a moderately dissected, gently undulating colluvial plain with few rock outcrops, and the eastern part is made up of a flat colluvial plain with no rock outcrops.

In the first two physiographic divisions, the upper soils are shallow and coarse textured, while the mid and lower soils are moderately deep and fine textured. The water table in the lower areas is closer to the surface than in the higher areas and percolation losses are accordingly lower.

The soils of the flat coastal plain are deep and moderately fine textured. The water table occurs close to the surface on these lands during most parts of the year.

Based on the foregoing soil-landscape relationships it is possible to distinguish the following six practical soil groupings for the project area.

Group 1 - Shallow, well drained, coarse textured soils.
Group 2 - Moderately deep, well drained, coarse textured soils
Group 3 - Moderately deep, imperfectly drained, coarse textured soils.
Group 4 - Moderately deep, imperfectly drained, fine textured soils.
Group 5 - Deep, imperfectly drained, fine textured soils.
Group 6 - Deep, poorly drained, fine textured soils.

The foregoing soil groupings do not occur in a random or haphazard manner over the project area. Rather, they occur in a definite pattern in relation to the landscape which can be easily identified by a trained and experienced field level extension worker.

2. Production Potential of the Respective Soil Groupings

Irrigated land that falls within soil groupings 1 and 2 have a high percolation rate and this necessitates a high frequency of irrigation for paddy. With proper management and judicious fertilizer use, rice yields of 50 to 60 bu/acre are recorded on these lands.

Irrigated land that falls within soil groupings 2 and 3 benefit from the seepage of the adjacent upland as well as from the water table which is usually close to the rooting depth of the rice crop. Rice yields of 65 to 80 bu/acre are recorded on these lands.

Irrigated land that falls within soil groupings 4 and 5 have a low percolation rate and also have the benefit of a shallow water table. Rice yields of 80 to 120 bu/acre are recorded on these lands; and on the fine textured soils that are not subject to flooding, yields in excess of 120 bu/acre are reported.

3. Physical and Biological Constraints to Rice Production

The atmospheric environment in this region imposes no major constraint to crop production. However, in years where low solar radiation is experienced during the later stages of crop growth in the Maha season, yields can be adversely affected. The high atmospheric humidity experienced during the wet Maha season is also conducive to a high incidence of plant disease. On the other hand, high levels of production can be achieved during the dry Yala season which is characterized by high solar radiation and low atmospheric humidity. The brown planthopper pest population is known to build up rapidly during the dry Yala season and close monitoring of the pest build up during this period is required.

Because of the low water retentive capacity of the coarse textured soils, standing water cannot be retained for more than 3 days after a single flood irrigation for rice. These coarse textured soils usually occur on the upper reaches of the field channels while the finer textured soils occur on the lower reaches. This differential water requirement down the slope of a field channel imposes problems on proper water distribution along the course of a field channel.

The leaching losses of applied nitrogen fertilizer on the coarse textured soils is also higher than on the finer textured soils, and this requires a more frequent and higher level of fertilizer application on these coarse textured soils.

4. Research and Extension Services Available within the Project Area

The national rice research program of the Department of Agriculture has been successful in evolving appropriate high yielding rice variaties for this environment. The adaptive research program under the Training and Visit system is operative in this area and it has been able to introduce meaningful

improvements in the crop management of rice. An effective plant protection service, operating out of the Assistant Director of Agriculture's office, has been able to render an efficient service to farmers in pest and disease control measures. Constant monitoring of pest and disease build up has helped to avoid the epidemics of pest and diseases that were experienced in the late seventies.

The agricultural extension service in the project area is structured along the Training and Visit system with an intensity of one field Level Extension Worker (KVS) per 450 farm families. The extension sub-divisional areas or segments are delineated along administrative boundaries of the district which are not co-terminus with irrigation boundaries. Extension workers at the district headquarters had some difficulties in relating the boundaries of the segment divisions to the irrigation system boundaries.

5. Scope for Crop Diversification

Conditions during the wet Maha season do not permit the growing of crops other than rice. Conditions during the dry Yala season however, permit the growing of diversified crops on the well drained soils in soil groupings 1 and 2. Field trials and demonstrations on the growing of diversified crops have been carried out since the Yala of 1981, when a total of 52 acres of chillies were grown. In the Yala of 1985 the extent of chillies grown has increased to 393 acres, and green gram to 605 acres. The Department of Agriculture does not envisage any further significant expansion in acreage of diversified crops until marketing and pricing policies are improved. The areas now being cultivated, however, indicate the possibilities for crop diversification in the project area.

B. Potential and Observed Changes in Farming Practices after Rehabilitation

The improvements that have taken place in the delivery and issue of irrigation water following the physical rehabilitation should have promoted changes in those farming practices that are closely related to, and dependant on, the nature of irrigation deliveries.

Following an improvement and stabilization of water deliveries, the potential is created for changes in the following farming practices:

- timeliness of land preparation
- shortening of duration between land preparation and sowing
- enhanced use of fertilizers
- improved weed control

Changes in these farming practices should eventually be reflected in improved irrigation efficiency, a reduction in the staggering of cultivation seasons, and an overall improvement in crop yields.

1. Land Preparation and Sowing

The method of land preparation adopted by farmers is closely related to water availability. In areas where there is an assured water supply the wet land preparation method is used. In areas of deficient water supply the dry land preparation method, using rain water as far as possible at the beginning of the rainy season, is practiced.

Because of wide year to year variation in the beginning of the initial Maha rains, it is difficult to adhere to a fixed date for starting land preparation for the Maha season. For the Yala season however, where the main form of land preparation is the wet method, it is feasible to fix a period for starting of land preparation and the completion of sowing. This is usually fixed for the period April 15 to May 15, or from April 1 to May 1, depending on the dates when the harvesting of the previous Maha season crop has been completed.

Data available at the Assistant Director of Agriculture's (ADA) office at Amparai for the Uhana Administrative Division, which covers 23,465 acres of paddy, shows the following changes in the percent of land sown after the stipulated land preparation to sowing period.

Table VII-1

Land Preparation to Sowing Periods

Season	Stipulated Period for Land Preparation to Sowing	Percentage of Land Sown after Stipulated Period
Yala 1982	March 15 to April 15	16
Yala 1983	March 15 to April 15	10
Yala 1984	April 15 to May 15	0
Yala 1985	April 1 to May 1	3

The ADA attributes improvement over this period of time to the improved reliability of water deliveries as a result of the physical rehabilitation. The ADA also noted that some farmers are now resorting to doing their first ploughing for the Yala season soon after the Maha harvest, thus facilitating adherence to the stipulated schedule for completion of sowing. This development is also attributed to the improved reliability of water deliveries within the system.

During the course of our field visits it was quite evident that the land preparation and sowing for this Maha season had been completed over almost all the command area within the stipulated time schedule. The ADA also reports a significant reduction in the staggering of cultivation seasons.

2. Fertilizer Consumption

With respect to fertilizer consumption, the office of the ADA has observed significant quantitative changes in the relative proportions of the nutrient elements N, P and K used by farmers since 1980. Prior to 1980, both ARTI studies and Department of Agriculture surveys showed that farmers were using excessive quantities of urea (Nitrogen) and less than the recommended quantity of the basal dressing (Phosphorus) and top dressing (Potasium). Figures quoted by the ADA indicate that farmers are now using on the average 45 lbs/ac of V1 basal fertilizer, 67 lbs/ac of the TDM top dressing mixture, and 45 lbs/ac of urea, compared to the Agriculture Department's recommendation for the Ampara district, which is 67 lbs/ac of V1, 45 lbs/ac of TDM and 36 lbs/ac of urea. The excess use of TDM is justified because of the coarse textured soils which are the more widespread soils in this region.

Further supporting evidence of more balanced use of fertilizer is seen from the figures of fertilizer consumed for the Uhana A.G.A. Division, as shown in Table D-2 below.

Table VII-2

Fertilizer Use By Type-Uhana A.G.A. Division

Season	Area Cultivated (ha)	Fertilizer Consumed (Metric Tons)		
		V1	TDM	Urea
Yala '82	7,202	297	377	172
Maha '82 - '83	11,000	688	764	NA
Yala '83 -	9,462	588	697	181
Maha '83 - '84	12,000	695	1,248	372
Yala '84	9,900	726	591	300
Maha '84 - '85	12,000	860	741	720
Yala '85	9,900	812	953	392

Source: Fertilizer Corporation

These fertilizer consumption figures do not reflect the real quantity of fertilizer used, because fertilizer distributed and sold by private traders is not included. However, using these figures as a general guide, it can be seen that the fertilizer use per acre has shown a marked increase over a four year period, and that there has been a marked improvement in the ratio of the respective plant nutrients used.

The ADA attributes this trend in fertilizer use to several things. The first is the improved reliability of water deliveries. The second is the improved transport facilities along the distributary channel and field channel network, resulting from the rehabilitation work. The third is the extension effort through the Training and Visit system. Our overall assessment is that the improved use of fertilizer over this period can be attributed to both the impact of the rehabilitation process as well as the intensive extension effort.

3. Weed Control and Seed Use

Quantitative and qualitative changes in both weed control and the use of seed paddy are reported also by the ADA. Earlier ARTI studies showed that farmers were using seed rates of more than 5 to 6 bushels per acre in the project area. The chief reason for the use of such a high seed rate for sowing was the benefits that accrued for subsequent weed control. This was necessary in a situation where unstable water deliveries resulted in poor quality land preparation, with a resultant high weed population. The ADA now reports that the seed rate has stabilized around 3 to 4 bushels per acre for the Yala season, and around 4 bushels per acre for the Maha season. Reports also show that 98 percent of the area is covered with rice variety BG 94/1 for both the Maha and Yala seasons. A further significant development resulting from the improved water supply has been the establishment of contract growing of certified seed paddy over 4,940 acres. Earlier the Department of Agriculture had considerable difficulty in meeting the seed paddy requirements of farmers every season, and this put a severe strain on the extension staff who had to handle the logistics of providing this crucial input. With the formation of farmer groups as contract growers, the problem of seed paddy supply has been substantially resolved and Ampara District now exports certified seed.

4. Herbicides

The use of chemical herbicides in weed control requires optimum timing of their application, as well as a controlled water situation in the fields. At least a short term predictability of the water status of the Field is essential to decide on when to apply the herbicide. In situations of undisciplined and poorly regulated water supply it is difficult for farmers to exploit the maximum benefits from the applied herbicide. Qualitative changes brought about in the nature of the water regime in paddy fields by the rehabilitation has helped farmers to use chemical herbicides more effectively. In contrast to the weed population that was earlier observed across the project area, the visual impression of the fields, as observed during visits to the project are during both the Maha and the Yala crops, is that farmers have now gotten on top of the weed problem. It was previously quite acute in the project area.

5. Crop Staggering

By far the most significant outcome of the rehabilitation project is that, by minimizing the degree of staggering that earlier obtained in the project area, it has been possible to drastically reduce the incidence of pest epidemics which were endemic in this area during the late seventies. In this earlier situation, where it was not uncommon to find rice in varying stages of establishment and growth within a paddy tract at any one time, conditions for the proliferation of the brown plant hopper pest were ideal. Frequent epidemics of brown plant hopper had to be combatted with expensive control measures, such as aerial spraying using army helicopters. As a result of the rehabilitation, the crop seasons are now well contained within specific time schedules, and a more uniform sequence of sowing to harvest is now practiced. This has been one of the main contributing factors to overcoming the epidemics of brown plant hopper. Other contributing factors are the early warning systems developed by the Plant Protection Unit of the Department of Agriculture, coupled with a very vigorous program of farmer training, which has taught farmers to monitor the early phases of pest build up and to take appropriate remedial measures before a high population of the pest builds up. The parallel developments of reduced staggering and an effective pest monitoring technology have enabled the near elimination of the serious pest hazards that existed before.

SCOPE OF WORK

SCOPE OF WORK

ARTICLE III - STATEMENT OF WORK

I. General

1. A major evaluation of the project was undertaken in 1982. As a result of the evaluation the project was redesigned and extended until 1985..

   This final evaluation is a) to assess the degree to which the GSL has institutionalized its capacity to manage large irrigation schemes and the effectiveness of Farmer Organizations in the institutionalization process and b) to document lessons learned from the project which will be of use to AID and GSL in future water management work.

2. In particular, the evaluation will assess the increase in irrigated acreage and production in the Gal Oya Schemes; the improvement in management including operations and maintenance in the project areas; the changes in government policies and regulations related to water management, appropriateness of the technology developed, as well as the potential for its replicability.

3. The evaluation will be conducted in November 1985, at the end of the project to determine the level of impact the project had had on the institutionalization of improved water management practices within the GSL.

4. USAID intends to incorporate pertinent and substantive findings and recommendations from the final evaluation report in the proposed development of the Irrigation Systems Management project.

II. The Evaluation Team will answer the following questions:

1. Has this been an effective and useful project?

   a. Was the project's strategy appropriate for its goals and purposes? Did they complement one another well? Should any have received greater or lesser emphasis or been added or deleted?

   b. What are the major strengths and weaknesses of the project? How could performance under the project have been improved?

   c. What are the major lessons to be drawn from the prject? Can/should the project be replicated? For a follow-on project, what elements should be retained, modified, avoided or added?

d. What are the most important implications and lessons learned, if any, resulting from the experience of this project, for the GSL, for AID and other donors and for policies and implementation strategies of other LDCS?

2. What are the positive and negative results of the work on the physical system at Gal Oya? Could they have been better? If so, how?

a. What is the extent and quality of the rehabilitation work? Were adequate resources devoted to the design effort and to the construction effort? Were appropriate designs developed? What improvements could be made to the rehabilitation process both organizationally and technically? Is the "pragmatic approach" (recommended by the mid-term evaluation) working and appropriate? Did the Irrigation Department devote adequate manpower and make good use of its equipment and other resources?

b. Has the operation of the system improved because of the Project? Is there better control over water delivery? Has the computer model developed under the Project been of value? Can it be improved?

c. Is maintenance of the system adequate? How is the newly implemented maintenance fund operating? Maintenance was not a specific component of the project. Should it have been?

d. After the mid-term evaluation the "Master Plan" component (for Gal Oya and Uda Walawe) and the on-farm water management research component were dropped, and the domestic water supply question in Gal Oya received no further attention. In retrospect was the decision to drop these and concentrate attention on other issues an appropriate one?

3. Assess the manner in which farmers have been reached and integrated into the project. Could this have been improved? Is so, how?

a. What is the status of the farmer organization element of the project? How well are the organizations accepted and what function(s) do they serve? Are there viable alternative strategies? If so what are the relative advantages or disadvantages? Has the ARTI/Cornell strategy been appropriate? How well have the Institutional Organizers performed?

b. To what extent did the project have input into extension work and farmer training? What were the results? Should the project have worked more closely with the Department of Agriculture?

c. What changes have occurred in farmer-officer relations? To what particular project intervention (if any) can these changes be attributed? What is the degree of communication, cooperation and responsiveness between irrigation officials and farmers with respect to rehabilitation and operations and maintenance?

d. Were qualified women recruited as Institutional Organizers? If yes, what percent of IOs were women? Were women effective as IOs? What were the successess/benefits/problems/failures of using women IOs?.

e. Did all (any) of the IOs involve women in farmer organizations? How many women are now members of farmer organizations? How many women are now farmer representatives?

f. Did the IOs consciously target women farmers? Were female head of households recognized as a group which may not have access to information unless a special effort was made to contact them?

g. Is the involvement of women in formal decision making appropriate in the project area?

4. Have the training programs improved irrigational officers and farmer capacity to manage irrigation systems? Could they be improved? If so, how?

a. Did the project have an appropriate balance between the various types of training (in-country, short-term overseas, long-term overseas)?

b. What is the quality and appropriateness of the curriculum and in-service training developed at GITI?

c. The team will be expected to interview a cross section of trainees to determine whether the new skills been put to use. Have the trainees learned appropriate skills and are they utilizing them?

d. How many people received training? How many were women?

5. What is the quality and usefulness of the research and special studies conducted under the project? Could this be improved? If so, how?

a. Has there been adequate monitoring of the impact of the project to provide feedback for both the project and for use in other irrigation systems?

b. Has the research program developed and strengthened Sri Lanka's capability to conduct research on irrigation systems? Have research plans been incorporated in other water management activities?

c. Is the Diagnostic Analysis being done on Puionnafume district irrigation systems providing useful information for planning interventions? Is it developing a Sri Lankan capacity to conduct similar analyses? Was this component appropriately designed and implemented?

d. The Project Paper supplement called for the establishment of a Water Management Research and Training Center. Was this activity appropriately designed and implemented?

6. Assess the performance of the entities responsible for implementing the project. What have been the strengths and weaknesses of each?

a. Given the purposes of the project and their scopes of work, how well have the contractors (PRC/ECI, Cornell, ARTI) performed? What were their strengths and weaknesses, and the quality of their assistance and performance? Was adequate Technical Assistance provided under the project? Was the mix of Sri Lankan and expatriate consultants appropriate?

b. What was the quality of performance of the GSL in implementing and USAID in monitoring the project? Were adequate resources devoted to monitoring the project?

c. Were the communications between these entities adequate? Did they improve after the mid-term evaluation?

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LIST OF PERSONS CONTACTED

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Ms. Anne Dammarell	Evaluation Officer, Program Office
Mr. Walter Abeygunawardene	Agricultural Consultant
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Gal Oya (contd.)

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Mr. V.L. Amarasekera	TA, Uhana
Mr. S.A.P. Jayawardene	TA, Uhana
Mr. S.L. Jayawardene	TA, Weeragoda
Mr. P.V.P. Pinnagoda	TA, Gonagola
Mr. Gamini Bandaranayake	TA, Gonagola
Mr. Milton de Sylva	TA, Mandur
Mr. M.S. Kaldeen	TA, Kalmunai
Mr. A.M.A. Lafir	TA, Kalmunai
Mr. W.P. Wijesena	Maintenance Overseer, Namal Oya

Technical Assistants (TA)

Work Supervisors

Mr. K.T. Thillanathan	Work Supervisor, Weeragoda
Mr. W.S. Nandasena	Work Supervisor, Gonagolla
Mr. A.G. Amaratunge	Work Supervisor, Gonagolla

Patrol Laborers

Mr. V. Gunatilake	Patrol Laborer and Farmer Representative Weeragoda
Mr. W.R.A. Piyadasa	Patrol Laborer, Weeragoda
	(5) Patrol Laborers, Gonagolla
	(5) Patrol Laborers, Uhana

Galgamuwa Irrigation Training Institute

Mr. Balasingham	Principal
Mr. Ravindran	Lecturer/Irrigation Engineer
Mr. Abeyratne	Lecturer/Irrigation Engineer
Mr. Samarasinghe	Lecturer/Irrigation Engineer
Mr. Mullengangoda	Lecturer/Irrigation Engineer

PRC/ECI Consultants

Mr. Warren Leatham	Resident Project Manager
Mr. Rodrigo	Construction Inspector
Mr. Alfred Hettiyarachchi	Administrative Officer

Agrarian Research and Training Institute

Mr. T.B. Subasinghe	Director
Mr. M.A. Goonewardena	Research & Training Officer
Mr. S.M.K. Nandaratne	Research & Training Officer
Mr. M.G.M. Razak	Research & Training Officer
Mr. R.B. Senekarachchi	Research & Training Officer
Mr. M.A. Gunawardena	Statistical Officer
Mr. Dhammika Jayawardane	Investigator
Mr. Y. Lesley Perera	Investigator, Gonagolla
Ms. Nalini Kasinadan	Consultant, Cornell University
Ms. Nancy St. Julien	Consultant, Cornell University

Institutional Organizers

Mr. D.S. Ranasinghe	IO Project Coordinator
Mr. P.B. Ratnayake	IO Coordinator, Uhana
Ms. Anula Jayalath	IO, Uhana
Mr. Priyantha Ekanayake	IO Coordinator, Weeragoda
Mr. H.M.H. Dissanayake	IO, Weeragoda
Mr. M. Jinadasa	IO Coordinator, Gonagolla
Mr. R.A. Somaratne	IO Group Coordinator, Gonagolla
Mr. P.H. Wimalasena	IO, Gonagolla
Mr. P.K. Premadasa	IO, Paragahakale
Mr. Sarath Pemsiri	IO, Paragahakale
Ms. Margaret Rupasinghe	IO, Paragahakale

Other Government Officers

Mr. Nandisena	Government Agent, Ampara
Mr. P.B. Amarasekera	Assistant Government Agent, Uhana
Mr. I.A. Jabbar	Electoral Manager, Agricultural Development Authority, Samanthurai
Mr. A.M. Emitiyagoda	Assistant Director, Agricultural Extension, Ampara District
Mr. L.B. Kumarasinghe	Agricultural Officer, A.D.A.'s Office
Mr. J. Wickramarachchi	Agricultural Instructor, Uhana
Mr. R.A. Wickramasinghe	KVS, Weeragoda
Mr. E.M. Dissanayake	Assistant Commissioner, Agrarian Services, Ampara District
Mr. Chandrapala	Divisional Officer, Paragahakale
Mr. S.H. Ukwatta	District Officer, Paragahakale
Mr. Dias Banda	Cultivation Officer, Weeragoda
Mr. M.M. Abeysekera Banda	Cultivation Officer, Paragahakale
Mr. D.M. Gunapala	Cultivation Officer, Paragahakale
Mr. H.M. Jayawardene	Cultivation Officer, Paragahakale
Mr. V.T. Wijeratne	Field Assistant, Agrarian Services, Uhana
Mr. W. Somapala	Colonization Officer, Weeragoda
Mr. H.M. Halpagoda	General Manager, People's Bank, Ampara
Mr. Basil Perera	Regional Manager, Paddy Marketing Board, Ampara
Mr. Kahawela	Regional Manager, Fertilizer Corporation, Ampara

Farmers

Mr. D.K.T. Ratnayaka	Area Council President, Weeragoda
Mr. K.B. Kurupuarachchi	Area Council Secretary, Weeragoda
Mr. Siripalla Siripaddena	Yayapalaka, Gonagolla

In addition, about 45 farmers, including a number of farmer representatives were interviewed singly and in groups by the team members.

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Other Contacts

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