DRAFT

COMMISSION OF THE EUROPEAN COMMUNITIES
DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
MINISTRY OF IRRIGATION, POWER AND ENERGY
IRRIGATION DEPARTMENT

NATIONAL IRRIGATION REHABILITATION PROJECT
ALA/91/07
ESTABLISHMENT OF IRRIGATION RESEARCH MANAGEMENT UNIT
CONTRACT NO. 669/91/73000/102/141-01

FINAL REPORT

IRRIGATION RESEARCH MANAGEMENT UNIT
INTERNATIONAL IRRIGATION MANAGEMENT INSTITUTE
SRI LANKA NATIONAL PROGRAM
JULY 1996

INTERNATIONAL IRRIGATION MANAGEMENT INSTITUTE
Sri Lanka Field Operations, 107, Havelock Road, Colombo 5, Sri Lanka.

Tel: 508000

Fax: 94 1 508008

Office of the Technical Advisor,
IRMU, NIRP, Irrigation Department, 230, Bullers Road, Colombo 7.

10 July, 1996

Mr. J.H. Green
Charge d'Affaires a.i.
European Union
81 Barnes Place
Colombo 7.

Subject: Final Report of the Project TA to IRMU: ALA 92/07

Dear Mr. Green,

Enclosed is the draft of the above report. The report has been prepared in the light of the suggestions made by you through your memo of 28 May, 1996 and addressed to Dr. Barker.

If you have any comments please forward them to Dr. Barker as soon as possible.

Let me take this opportunity to thank you for your support to the project.

Yours sincerely,

K. Azharul Haq
Technical Advisor, IRMU

Distribution :

Mr. K. Thurairajaratnam, Add. Secretary of Irrigation
Mr. L.T. Wijesooriya, Director General/Irrigation Department
Mr. K.S.R. de Silva, Project Director/NIRP
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Mr. B.M.S. Samarasekera, DD, IRMU
Mr. W.P. Jinadasa, Snr. DD (RW)
Mr. V. Ragunathan, Snr. DD (P.I., W.G. & Tr.)
World Bank
Dr. R. Barker, Director, National & Special Programs, IIMI

Headquarters: 127, Sunil Mawatha, Pelawatte, Via Colombo, Sri Lanka.
P.O. Box 2075, Colombo

Telephone: 94 1 567404
Telex. 22318/22907 IIMIHQ CE

Fax: 94 1 566854
EMail: IIMI 157, CGI 129

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PREFACE

This final report is the outcome of the technical assistance provided by the International Irrigation Management Institute, from August, 1992 through July, 1996 to the Irrigation Department, Government of Socialist Republic of Sri Lanka for the establishment of a Irrigation Research Management Unit (IRMU).

Presently Sri Lankan irrigated agriculture stands at a cross road and is characterized by stagnant or declining productivity, low cropping intensity and lower income to the farmers. Both quantitative and qualitative improvements in the irrigated agricultural sector can be achieved through improving management of the existing irrigation schemes. It should recognized that the country achieved near self sufficiency in food production primarily through construction of irrigation project and thus bringing more area under irrigation. As most of the water resources have already been developed any further increase in irrigated area will be difficult to achieve. The only alternative for sustainable increase in production shall have to come from improvement of the "Soft ware" of the irrigation schemes and research input will, no doubt, play the most significant role.

Establishment of IRMU is probably the most significant step in achieving the above objective. Though IRMU has been established within the Irrigation Department yet it has not yet developed into an effective research management unit. Efforts should, therefore, be continued to further strengthen the IRMU to enable it to play its due role for which it has been established.

A set of recommendations have made to enable IRMU to be more effective and result oriented. If the recommendations are implemented, even in a phased way, I am convinced that IRMU will be able to achieve the desired objectives for which it has been established.

K. Azharul Haq.
Technical Advisor, IRMU.

ACKNOWLEDGEMENT

The successful completion of the technical assistance project was possible due to effective support provided by the management and professional staff of the Irrigation Department (ID), National Irrigation Rehabilitation Project(NIRP), Irrigation Research Management Unit (IRMU) and the International Irrigation Management Institute (IIMI).

I am thankful to M/S. K. Yoganathan and W.N.M. Boteju former Directors and Mr. L.T. Wijaysooriya, Director General, Irrigation Department for their constant assistance and guidance.

The professional and technical staff of IRMU, NIRP and Irrigation Training Institute deserves special citation. I will be failing in my duties if I do not recognize individual contributions made by Mr. K.S.R. de Silva, Project Director, NIRP, Mr. B.M.S. Samarasekera, Deputy Director, IRMU and Mr. H.M. Jayathilake, Deputy Director, ITI towards the fulfillment of the objectives of the technical assistance project.

I am specially grateful to Dr. C.M. Wijayratne, former Head, Sri Lanka National Program for his unqualified support.

I would also like to thank all the research and support staff of IRMU and TA project for helping with the implementation of the IRMU work plans.

Mrs. D. K. Jayasinghe deserves special thanks for meticulously typing the whole manuscript.

The European union deserves special commendation for their generous funding for the project.

K. Azharul Haq,
Technical Advisor, IRMU.

EXECUTIVE SUMMARY

INTRODUCTION

The Irrigation Research Management Unit has been established in the Irrigation Department as a research based service unit with main objective to strengthen the institutional capacity of Irrigation Department (ID) in carrying out research to increase productivity, profitability, sustainability and social equity. The other objectives are to:

* Identify research needs, carry out or contract for research, evaluate research and adapt them for implementation,

* Initiate and implement a research program which yields results of immediate interest to the irrigated agriculture sector and,

* Contribute to the quality of planning and implementation of NIRP.

The objective of the TA project, implemented by the International Irrigation Management Institute, was to provide necessary assistance for the establishment and operation of IRMU during the initial stage through a four-year Technical Assistance Project funded by the European Union (EU). This objective was achieved through a series of well defined activities which included development of an appropriate organigram with staffing policy, development and implementation of multidisciplinary research, training and technology transfer program.

ESTABLISHMENT AND STRENGTHENING OF IRMU

The mandate, strategic plan and medium term research agenda for IRMU was developed through extensive discussions with the relevant experts of different disciplines and institutes/organizations. The mandate entrusted the IRMU with the responsibility to promote improved and more productive irrigated agriculture through research in irrigation management and irrigation institutions.

The draft of the strategic plan was prepared in June, 1993. A workshop was organized during the latter part of the year to discuss and finalize the Strategic plan. The plan was finalized in December, 1993.

As a follow up on the recommendation of the March-April review mission a medium term research agenda was prepared. The first draft of which was circulated for comments in July, 1993. The research agenda was discussed in a workshop held on October 28, 1993 and based on the written comments received earlier and the deliberations of the workshop the document was finalized.

The organizational structure and staffing policy of the IRMU was developed in the light of the recommendations of a consultation workshop held in August, 1992. The document was finalized in December, 1992. The organigram and staffing policy was approved by the competent authority of the government in late 1995 and subsequently the government has also approved the creation of non-engineering cadres within IRMU.

Staff recruitment for IRMU began in April, 1993 with two engineers employed on contract. But after about a year both of them left for better and permanent jobs. In April, 1994 two more engineers were recruited, again on contract. But unfortunately they also left, after 6 months, for higher studies abroad. In July 1994, an irrigation engineer from permanent ID cadre was seconded to IRMU. But he was transferred out in February, 1995. This particular engineer was the recipient of an IRMU "Fellowship" and was contract bound to serve IRMU for at least two years after completion of higher studies. But over the objection of the IRMU the ID authorities decided to transfer him.

In 1995, three more research personnel were added to the IRMU. These are Irrigation Department's permanent staff. One of them is a senior irrigation engineer of the department and his joining has added considerable strength to the IRMU. The other two were deputed from the newly recruited batch of 1995.

IRMU was also unfortunate from the point of view that it never had a full time Head, the Deputy Director. The Deputy Director, IRMU was assigned on a part time basis. Repeated requests from the TA team as well as the review missions urging placement of a full time Deputy director was not entertained by the ID.

Physical improvement of the library is almost complete. This includes the procurement and installation of air conditioners, photocopier, computer systems and book shelves. For installing the software, including computerized cataloging and literature search system, an agreement has been signed with the Sri Lankan Library Association (SLLA) which has already initiated the work.

IIMI Technical Assistance staff assisted IRMU locate, collect and summarize past and present research conducted within the country in the field of irrigated agriculture. The exercise is expected to lead to better understanding of the problems and help design follow-up research. Over 750 such studies/reports have been identified and 140 have so far been summarized including 21 in 1996.

The staff of the technical assistance team consisted of a technical advisor, one research associate and two research officers. In addition 4 (four) specialists representing disciplines of agricultural economics, civil engineering, social science and agronomy have together provided short term inputs.

Recognizing the staffing constraints of IRMU, IIMI has provided, beginning October, 1994, from its own resources, additional Research staff. This became necessary to help in the development and implementation of IRMU annual work plans.

RESEARCH AND DEVELOPMENT

Over the last decades, Sri Lanka has supported her agricultural production principally through the expansion of irrigated area by constructing new schemes. Any further expansion will be difficult as the best sites have already been developed and the cost of new projects are increasingly becoming prohibitive. IRMU's declared policy is to develop an effective research program to improve management of the existing systems to make irrigated agriculture cost effective, sustainable and eco-friendly. Another important policy is , especially during the initial years, to provide research input to help in the improvement of planning and implementation of NIRP.

In actual conduct of research the IRMU has adopted 4 (four) procedures which included direct implementation of research program by IRMU staff, contracting out research, collaborative research and student research. In the initial years most of the research studies were implemented by the IRMU. But over the years more and more studies were either contracted out or implemented in collaboration with other ID units. In 1996, 70% of the studies have been contracted out. Over all about 50% of the 18 studies have been implemented by IRMU staff. Of the 18 studies initiated during the project period 8 (eight) have already been completed and the rest are in different stages of implementation. Two studies were carried over from MIRP.

TRAINING AND TECHNOLOGY TRANSFER

Training IRMU and ID staff on different aspects of research and research management including those on rapid appraisal techniques, research methodology, monitoring and evaluation procedures, performance and impact evaluation of systems before and after rehabilitation etc. were considered important throughout the life of the technical assistance project. This included on the job training on relevant topics, workshops, seminars, fellowships for post graduate studies and publication of newsletters.

The criteria for selection of irrigation projects for rehabilitation and modernization is an important aspect of the NIRP. Use of RRA techniques can help screening of large number of schemes in relatively shorter time span. As NIRP had to rehabilitate a large number of schemes it was necessary to train field offices on RRA techniques for quick appraisal of the systems. To train staff on RRA techniques, 3 (three) training programs were conducted.

The training course was very well received by the participants. The course was evaluated with 22.2 percent rated as excellent, 53.6 percent as good, 18.6 percent as alright, and 5.6 percent as mediocre. None of the participants rated the course as "not good." The participants, however,

made some recommendations for further improvement of the course. The completion report and the participants' report have already been completed. A training module on the RRA training has been developed and copies have been submitted to IRMU and NIRP to help with holding of the course after the expiry of the TA program.

Seminars are very effective tools to disseminate research findings. Though not included in the original TOR, considering its importance in technology transfer, the IRMU initiated a once a month seminar program titled "IRMU Seminar Series". The inaugural seminar was held on 17 December, 1992. A total of 42 seminars were held upto end of June, 1996. A wide ranging topics were covered and the speakers included professionals and researchers from national and international agencies dealing with irrigation and irrigation management research. Though these seminars form a strong component of the technology transfer program these also provided essential input to strengthen IRMU's over all program.

The information dissemination program was strengthened by initiating the publication of the IRMU Newsletter early in 1994. Three issues of the Newsletter have been published in 1995 bringing the total to 5 since its initiation. The Newsletter is distributed to over 300 professionals, researchers, administrators and planners within the country. This is also a new activity which was not included in the original proposal but included in the Inception Report.

A strong component of the staff development program is the award of fellowships to the IRMU/ID officials to pursue higher studies leading to postgraduate degrees/diplomas in national universities. There is provision for awarding 8 such fellowships upto the end of June, 1996 only 4 have been awarded. In spite of intensive effort all the fellowship could not be awarded due to lack of interest among the IRMU/ID staff. The principal reasons for lack of interest are; (i) staff prefer foreign scholarships to local ones, (ii) non-availability of an adequate number of appropriate courses, (iii) staff availing of these lose priority for eligibility for foreign fellowships, and (iv) most of the advanced degrees offered by the national universities are not recognized abroad. To offer more flexibility it was decided that in addition to technical fields these fellowships will also be offered to staff interested in pursuing higher studies in management.

A total of 10 workshops were held which covered all the important program areas of IRMU. The workshops were very well attended and the out comes are expected to substantially strengthen IRMU's programs.

PROJECT CONSTRAINTS

The performance of the TA project was adversely affected by a number of constraints which are: i) lack of total commitment from ID that was required for the quick establishment of a unit like IRMU; ii) inability of ID to provide adequate staff; iii) lack of interest of ID staff to pursue higher studies in national universities under IRMU fellowship program; iv) inadequate financial authority of IRMU in disbursing funds etc.

CONCLUSIONS AND RECOMMENDATIONS

In spite of some short comings, the IRMU has been firmly established within the ID. To further strengthen IRMU a number of recommendations have been made. If the recommendations are implemented within a reasonable time frame it is expected that IRMU will be able to contribute positively to improve the performance of irrigated agriculture for which it has been primarily established.

TECHNICAL ASSISTANCE TO IRRIGATION RESEARCH MANAGEMENT UNIT

ALA/91/07

FINAL REPORT

1.0 Introduction

It is widely recognized that the benefits derived from irrigation schemes have not been proportional to the investments made. It is also recognized that the benefits could be increased through minimizing the various constraints impeding the productivity of irrigated agriculture. One of the major constraints to achieving higher productivity has been identified as the lack of research input in improving irrigation management and slow adoption of innovations. It is, therefore, essential to establish a strong research program to improve performance of irrigated agriculture.

A comprehensive research program requires identification and continuation of research, supporting institutions, reporting and dissemination of research findings and incorporating research findings in the implementation of irrigation activities to achieve improvements in planning, design, operation and management of irrigation schemes.

1.1 Irrigation Research Management Unit (IRMU)

The Irrigation Research Management Unit is being established in the ID as a research based service unit to address the above mentioned weaknesses. The main objective of the IRMU is to strengthen the institutional capacity of Irrigation Department (ID) in carrying out research to increase productivity, profitability, sustainability and social equity. The other objectives are to:

1. Identify research needs, carry out or contract for research, evaluate research and adapt them for implementation,

2. Initiate and implement a research program which yields results of immediate interest to the irrigated agriculture sector and,

3. Contribute to the quality of planning and implementation of NIRP.

For the establishment and operation of IRMU during the initial stage, necessary assistance is being provided by the IIMI, through a four-year Technical Assistance Programme.

1.2 Objectives of Technical Assistance

The main objective of the Technical Assistance Programme is to establish and support IRMU in its initial stage. This objective is expected to be achieved through a series of well defined activities.

1.3 Activities Under Technical Assistance

During the project life of four years the following activities are assigned under the Technical Assistance.

a. Develop the mandate, strategic plan, organizational structure and staffing policy together with ID staff within the first year of assignment;

b. Assist the IRMU with the preparation of research procedures, policies, annual work plans and related budgets;

c. Develop methodology and assist training of IRMU staff;

   i) undertake rapid assessments, particularly to obtain preliminary data for research selection and to train IRMU staff;
   ii) carry out adaptive research to test technical and institutional innovations;
   iii) monitor and evaluate a number of schemes being rehabilitated under NIRP, to ascertain how improvements are being implemented and their acceptance, benefits and costs and long term sustainability;
   iv) measure the cost effectiveness of innovations identified in the research programs as required; and
   v) record and analyze lessons learned in establishing IRMU and its early operations.

d. Provide support to IRMU to develop their conceptual, administrative and research activities.

e. Assist IRMU in conducting a series of workshops to disseminate research findings and solicit inputs to the program;

f. Provide inputs to NIRP from IIMI's in-country and international research findings and IIMI's international programs.

2.0 Inputs Planned and Provided During the Reporting Period

2.1 Personnel Provided by Counterpart (ID) and EC (Technical Assistance through IIMI)

2.1.1 Personnel Provided by Counter Part (Irrigation Department)

The staffing schedule of the IRMU is presented in Appendix 2.1. Mr. P.W.C. Dayaratne was appointed as the first Deputy Director of IRMU. He resigned from the Irrigation Department in July, 1993. He was promptly replaced by Mr. B.M.S. Samarasekera who continues to be the Deputy Director, IRMU. It should be noted that both M/S Dayaratne and Samarasekera discharged the duty of DD, IRMU in addition to their responsibilities as the Deputy Directors, Training and Contracts and Procurement respectively. Repeated requests by donors, review missions and the TA team to assign a full time DD for IRMU was not entertained by the ID.

As per staffing schedule 16 (sixteen) research staff were to be recruited by the end of 1995. Though the staffing situation considerably improved during 1995 as compared to the previous years, IRMU continued to remain seriously under staffed during the reporting period. Presently, the staff strength is only 25% of the planned target.

The most significant development, however, was the government approval for the creation of the cadres for non-engineering research staff for IRMU. Based on that approval which came late in 1995, IRMU is now in the process of recruiting 10 non-engineering research staff. It is expected that the recruitment will be completed towards the latter part of 1996. When completed the staff strength of the IRMU will rise to 14 i.e. 90% of the target.

2.1.2 Personnel Provided by EEC (Technical Assistance through IIMI)

The staffing schedule of the technical assistance is provided in Appendix 2.2. The Technical Advisor has provided 34.8 MM of service during the project period against planned 36 MM. The Research Associates and the Research Officers have provided 41 MM and 96 MM of services respectively. 4 (four) short term specialists representing disciplines of agricultural economics, civil engineering, social science and agronomy have together provided 22.25 MM of services against planned 30 MM. Summary of TA staff mobilization is provided in Appendix 2.3.

Recognizing the staffing constraints of IRMU, IIMI has provided, beginning October, 1994, from its own resources, additional Research staff time equivalent to 19 MM. This became necessary to help implement the 1995 IRMU Workplan as well as to assist with the development and implementation of 1996 Workplan. IIMI has also provided a graduate student from the Wageningen University, Netherlands to assist IRMU in the implementation of the study titled "Strengthening Farmer Organization Through Increased Participation of Female Farmers". Her costs are being borne by the Gender Program of IIMI.

3.0 PRESENTATION AND ASSESSMENT OF OUTPUTS ACHIEVED

3.1 Analysis of outputs and activities planned and carried out

The logical framework of IRMU is given in Appendix 3.1. The progress is reported in relation to the targets indicated in the "Life of the project work plan" as provided in the Inception Report (Appendix 3.2). The status of activities is reported under four main output categories namely (a) Establishment and strengthening of IRMU, (b) Research and Development, (c) Training and Technology Transfer, and (d) Reports and Publication.

3.1.1 Establishment and Strengthening of IRMU

3.1.1.1 Inception Report: As per project document the inception report was to be submitted at the end of December, 1992. The first draft was submitted in January, 1992. The final version of the Inception Report (after three revisions) was submitted to the CEC through PD, NIRP in July, 1993. Three revisions were made to satisfy the EC requirements (as desired by the EC Consultant, Colombo). The need arose because format of the inception report was interpreted differently by the EC consultant and the technical assistance team. Approval of the Inception Report from the EC was received in late November, 1993.

3.1.1.2 Development of IRMU Mandate: The mandate of IRMU was developed in the in-house workshop held on 28 August, 1992. The mandate entrusts IRMU with the responsibility

> **"To promote improved and more productive irrigated agriculture through research to improve irrigation management and irrigation institutions to raise productivity, profitability, sustainability and social equity".**

3.1.1.3 Strategic Plan: The contract document stipulated that a Strategic Plan for IRMU was to be prepared during the first three months of project initiation. But during the inception phase it was recognized that the strategy document should be prepared in consultation with all the parties involved in research and management of irrigated agriculture and as such it was proposed in the inception report that the exercise be completed in a years time. The first draft of the report was circulated for comment on June, 1993. A workshop was organized on October 28, 1993, to discuss and finalize the Strategic plan. Participants from ID, IMD, DAS, AR & TI, Agriculture Department, NIRP, IRMU and IIMI. A revised draft was prepared incorporating the comments made by the workshop participants. The document was discussed during the WB/EC review mission in November 1993. The EC consultant suggested that in addition to the strategic plan which covers the period upto the turn of the century, a strategic framework should be prepared to address the immediate NIRP needs. He also gave a written outline for the preparation of the same. The strategic framework was developed in consultation with the PD and CO-PD of NIRP and was submitted to PD, NIRP in December 1993. At the same time the original strategic plan was also finalized.

3.1.1.4 Medium Term Research Agenda: The joint EC-WB review mission in the Aid memoir of March-April 1993, recommended that in addition to the strategic plan the IRMU should develop a medium term research agenda. Based on the recommendation a medium term research agenda was prepared, the first draft of which was circulated for comments in July, 1993. The research agenda was discussed in the same workshop held on October 28, 1993 and based on the written comments received earlier and the deliberations of the workshop the document was finalized.

3.1.1.5 Organizational Structure and Staffing Policy: The organizational structure and staffing policy of the IRMU was developed in the light of the recommendations of a consultation workshop held in August 28, 1992 which was participated by senior officers from Irrigation Department (ID), Irrigation Management Division and IIMI/SLFO. The document was widely circulated for comments and thoroughly discussed in different forums including RCC and RAC. The EC consultant, however, recommended certain changes in the proposed structure and staffing policy which was accommodated. The document which was finalized in December, 1992 is presented in (Appendix 3.3). The organigram and staffing policy was approved by the competent authority in late 1995 and subsequently the government has also approved the creation of non-engineering cadres within IRMU.

3.1.1.6 Staff Recruitment and Training: As per organizational structure and staffing schedule, IRMU was to be fully staffed by recruiting all 17 research staff by mid-1996 i,e at the end of the TA project. Though a total of 9 staff were recruited for or seconded to IRMU, presently only 4 are on board.

Staff recruitment for IRMU began in April, 1993 with two engineers employed on contract. But after about a year both of them left for better and permanent jobs. In April, 1994 two more engineers were recruited, again on contract. But unfortunately they also left, after 6 months, for higher studies abroad. In July 1994, an irrigation engineer from permanent ID cadre was seconded to IRMU. But he was transferred out in February, 1995. This particular engineer was the recipient of an IRMU "Fellowship" and was contract bound to serve IRMU for at least two years after completion of higher studies. But over the objection of the IRMU the ID authorities decided to transfer him.

It may be pointed out here that the terms and conditions for award of the "Fellowships" mandate awardees to serve the IRMU for atleast two years after completion of higher studies. But unfortunately only one out of 3 awardees who have completed their higher studies were assigned to IRMU. The one assigned, as has been mentioned earlier, was transferred after only 6 months.

In 1995, three more research personnel were added to the IRMU. These are Irrigation Department's permanent staff. One of them is a senior irrigation engineer of the department and his joining has added considerable strength to the IRMU. The other two were deputed from the newly recruited batch of 1995. The most significant development of the year was the government approval for the creation of non-engineering cadres for IRMU. Based on that approval which

came late in the year, IRMU is now in the process of recruiting 10 non-engineering research staff.

IRMU was also unfortunate from the point of view that it never had a full time Head, the Deputy Director. Both the Deputy Directors assigned to IRMU, one from July, 1992 - August, 1993 and the second from September, 1993 to date were assigned on a part time basis. Repeated requests from the TA team as well as the review missions urging placement of a full time Deputy director was not entertained by the ID. This arrangement seriously affected functioning of IRMU.

3.1.1.7 Establishment of the Research Library and Review of Past and Present Research: Physical improvement of the library is almost complete. This includes the procurement and installation of air conditioners, photocopier, computer systems and book shelves. For installing the software, including computerized cataloging and literature search system, an agreement has been signed with the Sri Lankan Library Association (SLLA) which has already initiated the work. A list consisting of 250 titles related to all aspects of irrigation and irrigated agriculture has been prepared and the procurement process has already been initiated.

IIMI Technical Assistance staff assisted IRMU locate, collect and summarize past and present research conducted within the country in the field of irrigated agriculture. The exercise is expected to lead to better understanding of the problems and help design follow-up research. Over 750 such studies/reports have been identified and 140 have so far been summarized including 21 in 1995.

3.2 RESEARCH AND DEVELOPMENT

3.2.1 Preparation of Research Policy, Procedures, Needs and priorities

Over the last decades, Sri Lanka has supported her agricultural production principally through the expansion of irrigated area by constructing new schemes. Any further expansion will be difficult as the best sites have already been developed and the cost of new projects are increasingly becoming prohibitive. IRMU's declared policy is to develop an effective research program to improve management of the existing systems to make irrigated agriculture cost effective, sustainable and eco-friendly. Another important policy is , especially during the initial years, to provide research input to help in the improvement of planning and implementation of NIRP.

In actual conduct of research the IRMU has adopted the following procedures. In the initial years most of the research studies were implemented by the IRMU. But over the years more and more studies were either contracted out or implemented in collaboration with other ID units:

Conduct Research : IRMU staff is involved in conducting field research directly in areas where it will had the required physical facilities and adequate staff input. Initially most of the studies were implemented by IRMU as contracting out of studies were taking much longer than expected. By 1994-95 IRMU was able to start contracting out studies. By 1990, over 50% of the studies

were contracted out. Over all about 50% of the 18 studies have been implemented by IRMU staff.

Contract for Research : IRMU has also contracted out studies to universities and other national research organizations having demonstrated capability to undertake research in mutually identified areas. Six such studies, one each related to farmer organization and crop diversification and 4 related to environmental aspects have been contracted to the university of Peradeniya and Agrarian research and Training Institute.

Contracting out studies, however, have its own share of problems. First, research capability exists only with the national research institutes and universities. As they are already over loaded with their own programs they were unable to accommodate requests from IRMU. It often took more than two years to award a research project to such organizations. Second, contracted out research, on the average, 5 to 6 times more expensive as compared to direct implementation by IRMU and when the GOSL starts funding IRMU (after the expiry of the present donor assistance) IRMU will find it extremely hard to support such contracted studies.

Collaborative Research : IRMU is also implementing certain studies in collaborative research mode. Three such studies are being implemented by the Irrigation Training Institute, Hydrology division and Range Deputy directors of ID. Studies directly implemented by IRMU also seeks assistance from both HQ and field offices of ID.

Implementation of collaborative studies were adversely affected by the inability of IRMU to secure government approval on paying honorarium to the staff of the collaborating units to compensate for the extra work they had to perform.

Student Research : Provisions were made in the technical assistance project to award fellowships to IRMU and ID staff to pursue post graduate studies at the local universities. As partial fulfillment of the degrees/diplomas the awardees are conducting research on topics related to their area of specialization. Two such research are being done by the students who have completed their course work.

3.2.2 Research Needs and Priorities : Research needs and priorities for IRMU was first developed through the consultative workshop and documented in the form of the medium term research agenda. From this agenda studies were prioritized and annual plans and budgets were developed through different means. For 1992 (from August - December) and 1993 needs and priorities were determined based on the recommendation of the consultation workshop held on August 28, 1992. In addition inputs to the program was solicited from different organizations including senior staff of the ID both through verbal and written communication. For 1994 needs and priorities were determined through the program planning workshop held on October 29, 1993. For 1995 and 1996 these were finalized in consultation with the RCC, RAC, PD and COPD of NIRP.

3.2.3 Implementation of Research Program: Eighteen studies were initiated during the project period. Of these eight have already been completed and the rest are in different stages of implementation. Two studies "Performance Monitoring of Automatic flow and Water Level Downstream Control Structures" and "Macro Catchment Modelling and Management Studies" were carried over from MIRP. Following sections provide summaries of the completed studies and brief progress reports on the ongoing studies. Summary of research program for 1996 is provided in Appendix 3.4.

3.2.3.1 Monitoring farmers' involvement in NIRP rehabilitation: Phase I.

Farmer participation in rehabilitation is a key issue under the NIRP. This study analyzes different aspects of farmer participation in rehabilitation such as farmer organization (FO) formation and preparation, farmer participation in planning and design, farmers contributing of the mandatory 10% of the rehabilitation costs, construction contracting and construction supervision by farmers or FO. In addition some other issues like effects on successful rehabilitation and development of FO management abilities have been addressed. In the phase I of the study three medium schemes; Wennoru Wewa (WW) -tank, Kurunegala, Gampola Wela Raja Ela (GWRE) and Udagoda Bandara Ela (UBE) - anicuts, Kandy, and two minor schemes; Kobeigana Maha Wewa (KMW) tank, Kurunegala and Udawela Maha Ela (UME) - anicut Kandy were selected as the field sites. In WW, GWRE and KMW rehabilitation works were under implementation while UBE and UME had been prepared to undertake rehabilitation. Strengths and weaknesses of FOs participation in the rehabilitation process and the agency involvement have been identified and documented. Political issues, weaknesses of FOs participation in the rehabilitation process and the agency involvement have been identified and documented. Political issues, weaknesses in farmer agency inter-action, some FOs losing from contracts due to inexperience and low rates of estimates, conflicts of interest between full time and part time farmers, disputes among farmers, economic and political disparity (poor vs rich) seasonal tenancy, weak leadership, lack of material benefits to the farmers from FOs are some of the factors that have to be addressed to make the FOs into effective institutions. Some of the issues are common to all schemes while others are site specific. It is too early to make any definite conclusions based on the data so far collected. A clearer picture is expected to emerge at the end of the second phase of the study.

3.2.3.2 Monitoring Farmers' Involvement in Schemes under NIRP: Phase II.

Phase II of the study on farmer participation in rehabilitation was conducted as a follow up of the outcome of the Phase I study which identified the need for further investigation in some aspects to have a more comprehensive understanding of farmer participation in rehabilitation. The study was completed in 1995.

The overall objective of the study was to review NIRP practices with respect to the development of sustainable farmer organizations (FOs) and recommend suitable alternative options, wherever applicable, for their effective participation in the rehabilitation program and subsequent takeover of the responsibility for O&M of the systems after rehabilitation.

The study was conducted in 20 schemes, 15 minor and 5 major/medium spread across 10 districts. Twenty three Institutional Organizers (IOs), 20 Technical Assistants, 19 Divisional Officers of the Agrarian Services, 49 FO office-bearers and 448 farmers from the sample schemes were interviewed separately using five structured questionnaires.

FOs have been formed in all the schemes, most of them even before the initiation of NIRP implementation. They are functioning at different levels of efficiency, which is to be expected. It was, however, observed that though over 75 percent of them became members of the FOs, active participation in FO activities including attendance in general meetings was as low as 35 percent.

It was observed that a large majority of office-bearers and farmers are full-time farmers though a part of their income is derived from non-farm sources. For farmers, the next most important was the self-employed group followed by groups on salaried employment and traders. In case of the office-bearers salaried employment was the second most important group followed by the self-employed group and traders. An attempt was made to categorize the office-bearers according to their total income as well as according to political affiliations. But they were reluctant to divulge such information. It was, however, apparent that the office-bearers came from the upper echelons of the rural society.

The study found that without assistance from the government, FOs are not able to generate adequate funds for the proper upkeep of their systems after rehabilitation. Available funds with the FOs varied from as low as Rs. 100 in some minor schemes to as high as Rs. 80,000 in major/medium schemes. FOs having very little accumulated funds did not have any sources of income other than membership fee. FOs that implemented construction contracts were able to generate upto Rs. 20,000. Those receiving O&M allocation from the government, however, were able to mobilize funds as high as Rs. 80,000.

NIRP encourages FOs to undertake construction contracts in the rehabilitation of their schemes. It was observed that in minor schemes, 80 percent of the FOs obtained and executed construction contracts. The number of contracts taken by them ranged from 4 to 17. Except for one scheme where the FO implemented the entire rehabilitation work through a construction contract, the total value of the contracts ranged from 4 to 54 percent of the total estimated cost of rehabilitation.

Farmer participation in rehabilitation planning and design involved, primarily, meetings with agency officials, participation in walk-throughs, attendance in FO meetings, etc., and finally participation in ratification meetings where the plan for rehabilitation was finalized. It was observed that over 70 percent and 80 percent farmers and office-bearers, respectively, have participated in the planning and design process.

It is mandatory on the part of the FOs to contribute 10 percent of the total cost of rehabilitation. It was found that most of the FOs have managed to accomplish this both through individual assignments and through shramadana. The form of contribution was mainly labor for earthwork or labor for other related work. Over 70 percent of farmers participated in this activity. There

were, however, some delays and 57 percent and 21 percent of office-bearers, respectively, from minor and medium schemes, reported that site-specific problems such as inclement weather, defaulting farmers, etc., were the principal reasons for the delay. In some schemes the 10 percent work was separated from the construction contracts taken by the FOs whereas in certain schemes this was built into the contracts taken by the FOs. Where it was built-in, FOs were able to accomplish the tasks with 90 percent of the allocation but could not make any profit which deprived the FOs of an important source of income.

FO involvement in construction supervision with the help of agencies helped improve the quality of work. Farmers expressed their willingness to take over the O&M of the schemes and agency officers confirmed it. There was, however, considerable disagreement between DOs and FOs as to whether the O&M plans were discussed in the meetings held at the planning stage. Farmers and office-bearers indicated that the O&M plans were discussed while the DOs disagreed with this account. About 90 percent of the farmers expressed that they are willing and able to take over the O&M responsibility which was supported by a majority of the office-bearers. More than 80 percent of the DOs indicated that the FOs will be able to manage the minor schemes after turnover but for medium/major schemes only 40 percent was of the same view. They were, however, of the opinion that the FOs will, at least in the short run, need support in training, both technical and financial, as well as funds from the agencies.

3.2.3.3 Study on the NIRP Turnover Process. The study contracted to ARTI, was initiated in August, 1995. The principal objective of the study was to evaluate the NIRP turnover process and provide information and guidance to NIRP implementing agencies to make this process more effective and sustainable.

The study entails two components, a process documentation during the first season (maha 1995/96) and a large-scale survey during the second season (yala 1996). One of the primary tasks for the research team was to recruit field assistants as process documenters. The task of recruiting 6 process documenters was completed in early August and the they were stationed in the field late in August after a week's training at ARTI.

During the first month in the field, the process documenters conducted a socioeconomic survey of a selected sample. Besides conducting this survey they were involved in understanding the system and identifying problems inherent in the irrigation schemes, particularly in the NIRP schemes. Since the in-house brainstorming session late in September, they have been documenting the process of farmer organization/agency management of the NIRP schemes during the current 1995/1996 maha season.

The study is being implemented in 6 FOs of 4 schemes: 2 minor and 2 medium, located in Hambantota (minor scheme; turned over), Anuradhapura (minor scheme; not turned over), Moneragala (medium scheme; turned over) and Kandy (medium scheme; not turned over) districts.

The preliminary findings of the study based on the observations made during process documentation are described below:

i. *Status of rehabilitation*

Physical rehabilitations in most schemes under study are either nearing completion or have already been completed. However, the most common observation is that the physical works are not upto FO satisfaction. In some cases as in Mahagalgamuwewa (Anuradhapura) it does not even meet the required standard. Hence, the issue of physical works should be treated seriously, because what matters in the ultimate turning over is the satisfaction of the FOs, the ultimate owners of the systems.

ii. *Land tenure pattern*

Land tenure is increasingly becoming a major threat to system operation and maintenance. In the two medium schemes (Buttala and Gampolawela Raja Ela) most farmers are tenants or in places like Gampolawela head end, most lands are not being cultivated due to landownership patterns. These latter lands are being owned by rich Muslim traders who are not interested in cultivation nor do they want to give tenancy to the same person for fear of losing the ownership of land to the tenant. In minor schemes (Mahagalgamawewa and Kattadiwewa) most are owner cultivators, but either they have land under neighboring small tanks (e.g., Mahagalgamwewa) or cultivate chena as their primary source of income (e.g., Kattadiwewa). In both cases, the interest, efforts and responsibility of FOs toward the NIRP rehabilitation appear to be minimal.

iii. *Cost of rice production and FO strength*

High cost of rice production under most schemes is making farmers think of other alternatives, i.e., vegetables in Gampolawela, chena in Mahalgamawewa, etc. Due to this shift, the FOs established primarily for rice farming are gradually becoming ineffective. For example, members of the FO in Kattadiwewa hardly meet for meetings. In Gampolawela, some farmers do not want to cultivate as the lands are overgrown with weeds due to non cultivation during the past three years. Hence, cultivation in the current season would mean high cost for land preparation which increases the overall cost of rice production. As the Gampolawela scheme is located in a more urbanized area, farmers there are generally more inclined toward other types of occupations than toward rice farming. The deviations from rice cultivation again affects the strength of FOs established for rice cultivation.

iv. *Commitment of agency officials*

It appears that there is a distinctive difference between the commitment shown by the central irrigation officials and provincial engineering (irrigation) officials. Though the claim cannot be fully substantiated at this moment due to inadequate information, preliminary process documentation observations indicate a high level of commitment by ID officials as against provincial engineering officials. This can be justified, for the time being, by comparing the

inputs given by the ID with respect to Buttala and Gampolawela and by the provincial engineering department with respect to Mahagalgamuwewa and Kattidiwewa. This, however, should not be interpreted as a comprehensive commitment by the ID officials.

The ID commitment will improve further if the FOs are to be sustainable. Some of the constraints identified for further improvement by ID officials are lack of adequate transport facilities to attend all FO meetings, lack of incentives for additional work performed, nonpayment or delayed payment for traveling for field officers (i.e., IOs) when they have to cover additional area, etc.

3.2.3.4 Evaluation of Maintenance Performance by FOs in Handed-Over Distributory Channels (DC):

This study was undertaken by the Irrigation Research Management Unit (IRMU) in collaboration with the Sri Lanka National Program (SLNP), IIMI, on the request of the Central Coordinating Committee of the Irrigation Ministry (CCCIM) to ascertain the consequences of maintenance activities undertaken by DC FOs and the sustainability of canals that have been handed over to the FOs for maintenance.

The specific objectives of this study were to: (1) ascertain whether government resources in some manner (funds/staff) still need to be provided to FOs after handover to enable to maintain a high level of performance and sustainability of their systems, (2) assess whether deterioration of systems (neglect) and their operation is lowered to such a degree as to affect productivity (reliability of water supply), (3) determine whether the cost savings by way of lower costs to the government by handover would be negated by having to invest in rehabilitation at intervals shorter than would have occurred under ID control, (4) determine whether or not it is a capability or resource issue rather than the need for a better definition of ID/FO responsibilities and processes, (5) assess whether the institutional arrangements and linkages available at present are adequate, and (6) ascertain whether the technical standards as set by the ID for ID performance in systems are required in reality where systems are handed over, i.e., cost-efficiency trade-off.

Four schemes namely, Kaudulla, Parakrama Samudraya, Ridi Bendi Ela and Gal Oya Left Bank were selected for the study. Twenty two DCs were purposively selected to represent head, middle and tail of the respective schemes. Among the DCs selected, eleven were handed over while the balance eleven were not handed over to the FOs.

Both primary and secondary methods were used for data collection. The direct method included the rapid appraisal techniques, interviews with DC representatives using question guidelines followed by direct observations by the research team. In addition to these, interviews were also held with field-level irrigation officials to solicit their views on relevant issues.

Results indicated that the DC FOs, on average, generate from their own resources, almost exclusively through shramadana 38 percent of the resources required to maintain the DCs in good

operating conditions. The study also found that the DC FOs were receiving, from the ID, on average, 18 percent of the resources required for the above job.

Clearly, the analysis indicates that the DC FOs are not yet in a position to mobilize adequate resources to carry out the maintenance requirements of their DCs and that they will continue to require financial assistance from the government. They, however, emphasized the need for timely disbursement of funds and also a shift from the present contractual system of payment to a more liberalized mode of payment.

The farmers also identified the following two areas where significant state assistance is required:

i. *Technical assistance.* Continued technical support is needed to maintain the canal profile for satisfactory canal operation, in quantification of desilting needs (volume of earth to be excavated), maintenance of hydraulic structures and scheduling of water delivery.

ii. *Training.* They indicated that training should be a continuous process because trained Farmer Representatives relinquish their responsibility when a new batch of office-bearers is elected. It is, therefore, essential to train these new FO officials when they assume office. They also indicated that the training programs are conducted mostly in an unstructured manner and, more or less, on an ad hoc basis. They emphasized the importance of more structured and organized training programs with the right type of resource persons.

To assess the rate of deterioration of the turned-over systems, the status of the hydraulic structures and canal proper were ascertained. It was observed that, on average, the level of maintenance of the structures and canals was around 79 percent (assuming 100% as most satisfactory). It was also observed that the condition of structures and canals deteriorates faster during the initial years and then stabilize at around 70-75 percent. It should, however, be noted that the Gal Oya systems were handed over after full rehabilitation whereas the other 3 schemes were handed over after partial rehabilitation.

Based on the above analysis it is evident that, at this point, the systems have not deteriorated to a point to significantly affect productivity (reliability of water supply).

The study found that not a single DC has been completely handed over to the DC FOs as per agreement. In some cases, though maintenance of the channels has been handed over to the DC FOs, there is disagreement about the maintenance responsibilities as spelled out in the agreement.

As the DCs have not yet been fully handed over it was not possible to compute cost savings. In the absence of this it is not possible to predict what reduction in manpower and other logistics will occur as a result of turnover.

During the study it was also observed that the DC FOs were not very clear about their exact responsibilities and were of the opinion that some of the activities assigned to them should really be carried out by the ID. Responses suggest that a redefinition/better interpretation of ID/FO responsibilities is essential.

The institutional arrangements laid down in the agreement for participatory management is either not clearly understood or followed by either party (ID and DC FO). In the case of the ID, the government has control and hence has the responsibility to redefine the role of ID staff, in the absence of which it is quite difficult for them to integrate their changed responsibilities in the day-to-day execution of their tasks.

For the ID, maintenance is governed by the twin objectives of a) improving performance, and b) bringing the system back to design specifications. If maintenance resources are adequate this approach leads to sustainable functioning of the system. However, if maintenance resources are inadequate, the standards force the ID to devote resources to bring items to design specifications rather than to use all resources to improve performance. Therefore, the present ID standards are, given current resource constraints, less effective in sustaining performance than would be a set of standards that places primary importance on system performance. Farmers tend to be concerned only with performance. Therefore, their use of limited maintenance resources may be more effective in sustaining performance than is the ID use of maintenance resources under present standards.

3.2.3.5 Strengthening FOs through Increased Participation of Female Farmers:

The research on female involvement in FOs was initiated because it was felt that:

* The percentage of female membership in FOs is low compared to male membership, considering female participation in irrigated agriculture

* The percentage of female office-bearers compared to male office-bearers is low considering female membership in FOs

* Female members are said to be less active in meetings and other FO activities

Female participation in FOs is being studied in cooperation with NIRP and IIMI. The study aims at documenting and understanding the differential participation of men and women in FOs, as well as its impact on participatory management. In addition, it aims at providing some practical recommendations for the improved participation in the Aftercare Project of the NIRP. The reasoning is that active involvement of farmers in FOs can only be expected if the FO turns out to be an effective means in solving the problems of farmers. As men and women have different responsibilities in irrigated agriculture it is assumed/expected that both needs, and costs and benefits of participation differ for men and women. An assessment of male and female participation will, therefore, be made in view of their responsibilities in irrigated agriculture. Consequently, those findings will be related to the objectives and activities of the FO.

The study was initiated by IRMU staff in April, 1995, when it was decided to recruit a gender researcher through IIMI's program on gender issues in irrigation. When the researcher arrived in September, 1995, a small literature survey was undertaken to further develop the research proposal.

The study is divided into two components. The first component consists of short surveys in ten schemes and will concentrate on the extent of the problem. The second component consists of an in-depth study to investigate in detail the processes behind participation in FOs. Data collection focuses at inter- and intra-household differences that affect participation in irrigation management.

The research team now consists of one researcher and two counterparts, one from IRMU and the other from NIRP. For data collection of the first component two field research assistants were recruited. As they are fresh graduates a training on gender and irrigation as well as on research methods has been given to them during the first half of October. A reconnaissance survey was conducted in two minor schemes and in one medium scheme to improve guidelines prepared for data collection. A database program has been selected to process data of the first component.

Ten sites, four medium and six minor schemes, have been selected for the study. All of them are undergoing rehabilitation under the NIRP. Selection criteria were:

* size of command area--minimum of 20 ha for minor schemes and a maximum of 300 hectares for medium schemes

* commencement of the NIRP project before February, 1995

* good performance of the FO (according to the implementing agency)

In addition to these criteria, both tank and anicut schemes under the different implementing agencies, were included.

Data collection of the first component has been completed in three minor schemes. In January, 1996, the in-depth research will commence. Data collection is expected to be completed by May, 1996.

3.2.3.6 Participatory Action Research for Improved System Management and Increased Production in Minor Irrigation Schemes Rehabilitated under NIRP:

A study for identifying and implementing a strategy for the aftercare program is essential as it was not clear how to implement this program in the handed-over NIRP minor irrigation schemes to achieve the full benefits of the rehabilitation project. The Participatory Action Research methodology used in the study has been found to be an efficient mechanism for developing coordination among various agencies and the farming community for research-based problem-solving; also it results in cost-effective and sustainable internalization of research innovations.

The study is being carried out in close collaboration with the Department of Agrarian Services, the Irrigation Department, the Department of Agriculture, and farmers. Field data collection is scheduled to commence in January, 1995.

The overall objective of this study is to develop an implementation strategy for the aftercare program to achieve the maximum benefits from the rehabilitated projects. It is expected that a better farmer manageable system for improved M&E and increased production will be developed through this study. The specific objectives of the study are to strengthen FOs to manage irrigation schemes in a sustainable manner, and to develop a seasonal plan, a better O&M plan and a better cropping system based on the available resources (land and water) which will increase agricultural production and farmers' income. The expected output of the study is: a better O&M plan for sustainability of the scheme, an agriculture plan to maximize agricultural production with optimal use of land and water, a better seasonal planning procedure to reduce cultivation risk and for smoother operation, and increased farmer participation in system management.

The study is being conducted in two phases. Activities in the first phase included selecting the sites and identifying the farmers' O&M and agricultural production practices. The O&M plans, seasonal plans and cropping plans will be developed in consultation with farmers and implemented in the second phase. For the study two schemes, the Dunupotha Wewa Scheme in the Kurunegala District and the Maha Kiri Ibban Wewa in the Anuradhapura District, in which the rehabilitation work was completed and is ready for handing over to the FOs were selected. Collecting of basic data on scheme features, farmer O&M and cultivation practices, socioeconomic and institutional aspects was completed as per the work plan.

3.2.3.7 Performance monitoring of automatic water level down stream control structures

This study initiated under MIRP in yala season of 1992 in the Rajangana scheme was transferred to IRMU in July, 1993 after MIRP was completed. The primary objective of the study was to test the adaptability of Neyrtec downstream control technology for improving irrigation management under local conditions. The ITI, Galgamuwa was the implementing agency. The command area of LB Tract 2 -D1 of Rajangana served as pilot area for the study. Methodology consisted of installation of Neyrtec Baffle distributors together with head control Neyrtec orifice type automatic gates at D-channel offtake from the main canal and installation of Neyrtec Baffle Distributors with Duckbill weirs or inclined weirs for head control at field canal offtakes from D-channel. Conventional device was installed in the control area, namely LB Tract 2 - D2. Study was continued for four seasons upto the end of 1994 starting from Yala 92. Data collected included daily water levels in the LB main canal upstream of Tr2 -D1 offtake and in the downstream of automatic gate , seasonal water issues in pilot area and control area over yala and maha seasons, seasonal irrigation duty in the pilot area and control area and recorded instances of tampering.

It was found that the automatic control gate adapts easily to water level changes in the main canal compared to conventional system within practical limits. Also under similar management conditions the degree of equity attained in water distribution in the pilot area was remarkably high while the disparity in water distribution was high in the control area. The operation of orifice type automatic gate was generally interfered with by farmers attempting to obtain increased discharge. It was understood that double deflector type baffle distributor is more than single deflector type in such situations. During installation of automatic devices it is preferable to have a higher level of supervision as precision is essential. It is recommended that all second stage concrete should be of a higher grade with smaller aggregate size. Local fabrication of baffle distributors was found to be promising at a cost considerably less than imported ones. The adaptability of these baffle distributors by farmer organizations, at the system level is yet to be tested.

The study attempts to test the adaptability of Neyrtec Down Stream Control Systems under local conditions. Study locations in Rajangana and Huruluwewa schemes were established in 1987 and data collection was initiated from 1992 yala season. The Irrigation Training Institute, Galgamuwa has been responsible for implementing the study. The study at Huruluwewa could not be started due to shortage of water. The measurement network in Rajangana covered two distributaries, a control and a pilot area. Irrigation schedules were introduced and their implementation was monitored since 1992/93 Maha season. The water flow was monitored three times a day.

Data on cropping activities and yields were also collected. Under similar management conditions the degree of equity attained in water distribution in the pilot area was found to be significantly higher than that of the control area. Water use efficiency was also higher in the pilot area. The new technology was found to be relatively less sensitive to the fluctuations in the water level in the parent canal and the farmers who operated the system was quite satisfied with its performance.

Another objective of the study, local fabrication of Baffle Distributors was found to be feasible at a cost considerably less than the imported ones. Though the results of 1992 Yala and 1992/93 Maha season demonstrated that the technology is promising, it was agreed to continue the study

until 1993/94 Maha season due to substantial seasonal variations and wide diversity in the water status in irrigation systems between two consecutive years.

3.2.3.8 Adaptability of the Chinese water turbine pump for lift irrigation of other field crops: Technical and Socio-economic Evaluation.

A chinese water turbine was installed in the tract 6 of the Rajangana irrigation scheme in the early 80's to promote cultivation of OFS's in the high lands which could not be irrigated by gravity. This study initiated in 1992-93 maha season attempts to identify management constraints especially those related to technical and socio-economic factors of this lift irrigation system. A reconnaissance survey indicated that in the whole command only one farmer was irrigating less

than 0.2 ha of chilli. A combination of factors was responsible for such low usage which included farmers preference to grow OFCS in the yala season and rehabilitation of the channel network. To assess the potential command area discharge of the pump was measured. The pump on the average, delivers 14 lps at an operating head of 1.15 m. At this discharge the potential command was estimated at around 12 ha. But at present only 6 ha within the potential command is available for growing OFCs. The transformation of a part of the command area to perineal crops like coconut is the principal reason for such low serviceable area. In 1993 yala season, 14 farmers cultivated a total area of 2.93 ha of which 2.63 ha were planted to chilli. Unreliable water supply (1992-93 maha season experienced drought) resulted in low level of input use and yields. Average yield of chilli was 1,284 kg/ha which produced the gross and net returns to family labour were Rs. 120,937.00 and Rs. 82,120.00 per ha respectively. Where topography is favourable and water supply is reliable and adequate, such lift irrigation systems, which require no fuel and nearly maintenance free provide good potential for increasing farmers income.

3.2.3.9 Agro-wells: Potential for conjunctive use with surface water.

Agro-wells (open dug wells) have been introduced in the dry zone of Sri Lanka to ensure availability, adequacy and equity of irrigation water throughout the year. By 1992 nearly 5,000 agro-wells were constructed and the program is continuing.

For this study a stratified sample of 15 wells was selected from two topographies - in highlands (upstream of storage tanks) and in lowlands (down stream of storage tank in Palukadawela irrigation scheme) in Galgamuwa. The agro-wells, unlike the ordinary domestic well, has a much higher capacity by virtue of their larger size. Excluding the family labor used by the farmer families, the cost of construction of a well varied from Rs. 15,000.00 - 75,000.00. The average cost of a pump and accessories was Rs. 15,000.00. Government provides a subsidy of Rs. 20,000 per well.

The average command are of a well was 0.21 ha. Not only did the farmers cultivate rather small area but also used less inputs. Costs and returns from the wells indicated that average net income was Rs. 74,558.00 per ha per season to family labor. It appears that most of the farmers who own agro wells are not in a position to use the full potential due to lack of money and knowledge on economically attractive crops and on farm water management. It is important to indicate that these farmers have made substantial investments for the construction of wells and purchasing of pumps.

Water table data indicated that the wells located downstream of the reservoirs are hydraulically connected to the irrigation canals and the water table in the wells responds directly to the changes in the water table of the canals. It was also observed that the water table in the wells downstream of the reservoir showed relatively lower range of fluctuation as compared to those located in the highlands and away from the influence of the tanks. The static water table data indicated that the wells located in well drained paddy lands changed from 3.2 m from the ground level in early June to 4.65 m by the end of September, the driest period. In the wells located in poorly drained paddy lands, maximum distance to the static water table from ground level was

3.0m in the period. The maximum distance to the static water table from ground level in highlands (upstream of tanks) varied from 3.3m to 6.2m between early June and late September. Between June and September the maximum amount of water pumped from wells located in highlands, well drained soils, and poorly drained soils were 1,017m^3, 1,089m^3, and 753m^3 respectively. These figures implies that water removal from the wells located in poorly drained paddy soils is well below the potential. The average recharge rate ranges from 0.05 - 0.1 1ps. Even in peak dry period nearly 70% and 60% recharge occurred in wells located in poorly drained and well drained paddy soils within 30 hours of pumping. Water delivery potential of an agro well located in highlands is such that it can maintain a long duration crop with supplementary irrigation during Maha (wet season) and a short duration crop during Yala (dry season). The wells located in lowlands are capable of providing water for long duration crops even in yala season. Wells located downstream of the reservoirs were used for supplementing surface water for irrigating paddy in the latter part of the 1992/93 maha season. Upland wells were used exclusively to grow other field crops, mainly chilli by supplementing rainfall. Data obtained from pumping tests indicated that good potential exists for conjunctively using water from the wells with surface water.

3.2.3.10 Estimation of Tank Yields and Review of Spill Formulae for Minor Tanks:
This study was initiated with the objectives of estimating specific water yield from small catchments, and determining adequacy of spill capacity parameters for spillway design and inflow hydrographs.

Monitoring of the tank water levels and other related variables for the selected tanks under the above study, commenced on 1 April, 1995. At the time of installation of staff gauges and rain gauges, rehabilitation work had not been completed in some of the tanks. Even though the installation of all equipment required for monitoring was done in April, most of the tanks did not receive any appreciable amount of water during the southwest monsoon and, therefore, remained dry until October. In Senasuma Wewa at Wellawaya and Paragahalanda Wewa at Bibile, the little water that remained from the northeast monsoon had to be drained out to commence rehabilitation works after the commencement of the monitoring program. As a result and due to climatic factors and the commencement of the rehabilitation work, the monitoring program was interrupted.

During the monitoring of tank data several problems cropped up in almost every tank ; they are summarized below under five districts:

Hambantota District:

Kattadiya Wewa, Kirinda: The rehabilitation work was completed before monitoring of water levels commenced with the exception of the fixing of the sluice gate and raising of the spill crest. During November, 1995 filling of the tank was commenced and at the end of December the water level in the tank was 6.24 ft. above the sluice sill level. No water was issued from the tank at the time of writing of this report.

Even though the rehabilitation work was completed, due to dry weather conditions in the area, the tank was dry up to November, 1995. Hence, no useful data have been collected for analysis during that time. Effective monitoring of the tank water level was done only from November, 1995.

The depth-area-capacity curve for the tank was available only above the FSL. Arrangements were made to carry out the tank bed survey by the Hambantota IE and this curve was received at the end of October, 1995.

Kurunegala District.

Lihinigiriya Tank, Wedakada: During the time of gauge installation, the sluice gate and downstream structures were not completed. The rehabilitation was completed in September, 1995. At the end of the year, the water level in the tank was 0.37 ft. above the sill level of the sluice and it was going down due to the prevailing dry weather condition in the area.

There is a leak through the spill-cum-sluice. The sluice obstruction had been forced open at the beginning of August, 1995 before the installation of the gate. Monitoring of the tank water levels was interrupted during the period.

Tittawela Tank, Tittawella: The rehabilitation work was completed before the installation of the gauges. The water level in the tank was 4.4 ft. above the sill level of the sluice in mid-January, 1996 and it is going down due to the prevailing dry weather conditions in the area. The full extent of 104 acres of rice is being cultivated during maha and water for these lands is being issued on a rotational basis. Effective monitoring began in April, 1995.

Matale District:

Bulana Wewa, Galewala: The rehabilitation work was completed before the installation of the gauges. The water level in the tank was 3.5 ft. above the sluice sill level at the end of December, 1995. Water is being issued on a rotational basis. There is a leak through the spill and the sluice and cracks are appearing along the tank bund. Since there is no well-defined spill channel, the leak through the spillway cannot be measured. Due to the dry weather conditions in the area the tank was dry at the end of September, 1995 and the tank water levels could not be monitored smoothly.

Henwalayagama Wewa, Sigiriya: The rehabilitation work was completed before the installation of the gauges. The water level in the tank was 2.2 ft. above the sill level of the sluice in mid-January, 1996. Due to the dry weather conditions in the area, the tank was dry during September, 1995 and October, 1995. Hence, the duration of useful monitoring was from May, 1995 to September, 1995 and from November, 1995 onwards. There is a leak through the sluice gate and cracks have appeared along the tank bund. There is a high-level sluice which is located to the right of the original sluice. This seems to be an illegal tapping. The leak through the sluice and water issues through the high level sluice were measured.

Moneragala District:

Senasuma Wewa, Wellawaya: The installation of tank gauges was completed in March, 1995. The rehabilitation work of the tank commenced in June, 1995, which included structural improvements to the tank bund and the spill. To carry out these improvements steps were taken to empty the tank. Hence, the observation of the tank water levels was discontinued until the rehabilitation work was over. There was no water in the tank from August, 1995 to mid-November, 1995. The rehabilitation work was completed during November, 1995 and monitoring of the tank water levels commenced. The water level in the tank was 10.87 ft. above sill level of the sluice at the end of December, 1995. The duration of useful monitoring has been from November, 1995 to date.

Paragahalanda Wewa, Bibile: Tank gauges were installed in April, 1995. The rehabilitation work of the tank commenced in June, 1995 and was completed in December, 1995. Hence, the observation of tank water levels was discontinued, but rainfall observations were continued. Even though the rehabilitation work was completed in December, 1995, gauge posts had already been refixed in November, 1995.

Nuwara Eliya District:

Kande Ela Reservoir: Monitoring of the tank water level started before the rehabilitation work was initiated. Action was taken to paint the tank gauge which was installed on the Morning Glory Spillway Barrel, thereby increasing the accuracy of data. Since there are no water issues from the inception of the study, discharge measurements could not be made. The water level in the tank was 22.5 ft. above the sill in mid-December, 1995.

Another objective of the study is to model these catchments by correlating the hydrological variables such as rainfall, stream flow and evapotranspiration to physical characteristics of the catchments. Therefore, arrangements have been made with the Land Use Division of the Irrigation Department to obtain their services to identify the soil characteristics and soil properties in each catchment.

3.2.3.11 Evaluation and Use of Computer Models in Improved O&M of Irrigation Schemes:

The study is being implemented in four schemes with the main objective of applying computerized decision support tools for improved O&M of irrigation systems. A brief progress report of each scheme is provided below:

The Buttala Anicut Scheme. The above study has been carried out in the Buttala Anicut Scheme since 1994 yala season. During 1994 yala, 1994/95 maha, 1995 yala and 1995/96 maha, the daily gauge readings in selected monitoring points were observed and recorded in standard formats and the IMIS database. The research work in the Buttala Scheme mainly deals with the operation and distribution aspects of irrigation water as agreed at the inception of the study. Due to the water abundant environment of the system no efforts have been made to reduce or issue water

on a targeted schedule. However, many aspects related to main canal operation have been studied with the present system of water distribution.

Application of SIC hydraulic simulation model to the Buttala main canal has been completed. Two field calibrations have been carried out in 1994/95 maha and 1995 yala. On both occasions data were analyzed and studied for determining the hydraulic behavior of the canal. The important parameters of the different reaches of the canal and the structures have been established. The calibrated hydraulic model will be tested for different operational scenarios to establish rules of operation. This could be used as a training tool to understand the hydraulic behavior of the canal in relation to operation and distribution aspect of water management by system managers.

During this season (1995/96 maha) the number of monitoring points required for daily operation are being observed by patrol laborers with the actual time of adjustments. This will enable to prepare norms for operation of gates by patrol laborers in addition to their normal routine work on maintenance.

The Rajangana Scheme. Progress of the study in the Rajangana Scheme has been slower as compared to the other schemes. Installation of the gauges have nearly been completed but calibration has not yet been completed. Data collection is progressing and collected data are being transferred to the IE's office regularly. After transferring all data, processing will begin. Data are being updated and entered using Lotus spreadsheet. The outputs are daily discharges, volumes issued and the cumulative volumes. No decision has yet been made on the type of computer model to be used.

The Badagiriya Tank Scheme. The measurement network has been fully established. Data collection for the year 1995 has been completed and entered into the computerized IMIS. These data are now being processed. The duty for each outlet canal is being computed and calibrations are being rechecked. A programmable calculator is being used with a simple program to compute the delivery discharge with the collected gauge readings and sluice opening.

The Kekanadura Scheme. In the Kekanadura Scheme, 8 water measuring devices were constructed at control points in the canal network and the water delivery system, and cultivation data (extent) were calculated. During the study, existing methods of water issues were not disturbed and the water issues were done according to the farmers' demand.

A computer program is being developed for water scheduling and seasonal planning. The scheduling program has already been developed (scheduling program developed for KOISP has been modified to suit the Kekanadura Scheme); the program for seasonal planning is nearing completion. Analysis of the preliminary data indicates that water delivery closely matches demand and, as such, a computer software may not be needed for this scheme. This, however, needs to be confirmed in the final analysis of data.

3.2.3.12 Semiautomatic Flow Control System for Improved O&M of Irrigation Schemes:

This is a follow-up study on performance monitoring of automatic water levels of the downstream control structures conducted by the Deputy Director, ITI in the Rajangana Major Irrigation Scheme. The objectives of the study are to develop a semiautomatic flow control system consisting of baffle distributors and long-crested weirs and to test its adaptability in a medium irrigation scheme at system level. The Panugala Scheme in the Gampaha District has been selected for the study and is being implemented on the right bank canal of the scheme in collaboration with the Deputy Director, Colombo and IE, Gampaha.

The advantage of baffle distributors for flow regulation over conventional flow regulators is that these free surface offtake equipments are designed to supply controllable constant flows whereas in the conventional flow regulators flow can be controlled easily but it is not easy for farmers to measure it. The flow is controlled at the downstream by opening or closing the requisite combination of different-sized shutters. Once the distributor is locked at a given setting the flow remains constant. Integration of the design of offtakes with long-crested weirs also results in head control at offtakes which results in a more stable flow.
The study is being implemented in the following phases: Design of the semiautomatic flow control system, manufacture of baffle distributors, construction and installation of the semiautomatic flow control system and testing its adaptability by the farmers.

The design phase which included the determination of the location and dimensions of duckbill weirs, the selection of a combination of baffle distributors and the determination of sill height of these baffle distributors has been completed. Other related activities were:

* Cross-sectional data (station, side slope L, side slope R, bed level, bed width, etc.) of the right bank main canal were entered for 78 sections and a backwater profile was computed.

* Existing turnout structures were grouped according to the location of the proposed turnout structures and the maximum head required (including losses) at each turnout was calculated in relation to the highest rice-field level with the standing water level of 0.15 m.

* Location and dimensions of the duckbill weirs were determined for the minimum flow of 140 l/s. After computing the maximum head required at each proposed turnout location, with the provision of an end regulator, the backwater profile was simulated using the basic program *'Profile'* for the flow of 140 l/s. Using the program, the backwater profile was simulated at every 30 m of the canal. At the turnout location where the water surface elevation is not sufficient to meet the head required, another duckbill weir was introduced. Thus, in addition to the end regulator two more regulators (duckbill weirs) are required to maintain the necessary head.

* For a flux (h) of 0.1 m for 140 l/s, using the equation $Q=cLh^{3/2}$ (c=1.60), length of the duckbill weir was determined (2.8m). Allowing for a flux of 0.1 m, based on the water depth required, the height of the duckbill weir was also determined for each location.

* For the length of 2.8 m, flux at the duckbill weir is 0.14 m for the maximum flow of 240 l/s.

* With the new water depth (height of duckbill weir at each location + 0.14 m) at the regulator position, the backwater profile was determined for 240 l/s.

* Depending on the water-level variation at the proposed turnout location (for 140 l/s and 240 l/s) sill of the baffle distributors was determined.

* Based on the demand at each turnout, the combinations of baffle distributors and shutter widths were also determined.

The State Engineering Corporation which was contacted for the manufacture of baffle distributors is in the process of preparing quotations for such manufacture. As this system is to be operated by the farmers they were consulted at the feasibility stage to determine flow rates and location of turnouts. Further consultations with farmers have been planned to train them on the operation of the system.

3.2.3.13 Irrigation Management for crop diversification: Evaluation of paddy-chilli inter-cropping in water deficit irrigation systems in the dry zone.

Approximately one half of the command areas in Irrigation Systems of Sri Lanka is not used for any cultivation in Yala (dry) seasons due to scarcity of water. Over the last decade cropping intensity in Sri Lanka showed a declining trend. In major and minor irrigation systems, between 1982 and 1992, cropping intensities declined from 134 to 109 and 100 to 96 respectively. Due to shortage of water some systems are unable to provide sufficient water even for Maha (wet) season cultivation. Consequently, farmers in these irrigation systems undergo serious economic difficulties as they draw their main income from irrigated agriculture, especially from rice cultivation. In spite of support given to farmers to grow non-rice crops in rice based irrigation systems, farmers prefer to grow paddy considering the food and market security, technical know etc. It is becoming increasingly important to test alternative methods for the efficient use of water in order to increase cropping intensity, productivity, and farmer income. In dry zone, specially in the minor irrigation system yala season cropping intensity is extremely low as no cultivation is done in many systems. The study attempts to evaluate potential for paddy chilli inter cropping in water deficit irrigation systems of the dry zone as a method for saving water with a view to increase irrigated command. The method included planting of rice in 'borders' and chillies in raised beds. Water was applied to meet requirements of paddy and it was expected that requirements of chilli will be met from seepage as well as capillary rise. Though the water application to the rice paddies could not be quantified it is estimated that due to the reduction

in wetted area by up to 50 percent a significant amount of water was saved. Economic returns from the experimental plots indicate the crop combination can be grown profitably. The technology, however, needs to be tested in the farmer fields for their acceptability. This study has been completed.

3.2.3.14 Irrigation Water Management for Crop Diversification under Minor Irrigation Schemes Rehabilitated by the NIRP:

Contracted to the Crop Science Department of the University of Peradeniya, the study was initiated from July, 1995. The principal objective of the study is to develop an appropriate package of diversified cropping systems to maximize the utilization of land and water and optimize farmers' income.

Two research sites, the Elapathwewa Scheme in the Anuradhapura District and the Ambalegoda Scheme in the at Kurunegala District were selected for the study. A comprehensive literature survey on the above subject was carried out during the preparatory phase. A questionnaire was developed based on the literature survey as well as the information obtained from the kanna meetings. Field layouts were made and water measuring gauges (i.e., gauge posts, flumes) were installed at the respective research sites during the preparatory phase. Three research assistants were employed for implementing the study.

Information on daily rainfall and water issues was collected from the beginning of 1995/96 maha. The questionnaire survey is currently being carried out and is nearing completion. The farm activities will be monitored continuously during the first year of the study (diagnostic phase). A computerized bibliographic survey (including abstracts, where available), on irrigation water management for crop diversification, is currently being prepared.

3.2.3.15 Macro-catchment modelling and management studies

The erratic and uncertain rainfall conditions and the variable distribution of it both in space and in time had been the main reason for the inability to develop settled rainfall agriculture in the dry zone, without resorting to water conservation systems. Community based water harvesting systems commonly referred to as "village tanks" were developed to provide supplementary irrigation for crop production in the dry zone of Sri Lanka. Nearly all these village tanks are located within catchments of major tanks. With population increases in the region, a conscious effort had been made to improve both major and village irrigation systems so that they would be able to irrigate more land in order to support the increasing population.

The water supply to many major tanks as well as to village tanks depend on their own catchments. The catchment runoff depends on many factors, namely the catchment characteristics, rainfall intensity and durations, water detention structures in the catchments, antecedent soil moisture content etc. Out of these characteristics, land use is one factor that is subjected to change from season to season and can be controlled and properly managed. The number of village tanks in a major catchment also control the water supply to major tanks. This

study was undertaken to recommend methods to improve management of the catchments of the tank systems. The data from 35 village tanks collected over four maha seasons were analyzed. Further, the runoff plot experiments showed the extent of runoff under four important land uses. The study shows that cleared land or chena lands produce high runoff (30-50% of the rainfall), whereas, forest and abandoned chena with a good weed and scrub produce negligible quantities of runoff, unless the rainfall is high and continuous to produce temporary saturation of the surface soil layers. The other land uses, such as village settlements, or landform units such as rock knob plains produce intermediate quantities of runoff.

Runoff from micro-catchments increased with increasing cumulative rainfall and for most micro-catchments it shows an exponential relationship catchment run-off starts only when the rainfall is equal to or greater than about 90 mm.

Minor tanks with a catchment to capacity at full supply level ratio of 9 ha per ha.m, or less have a very low frequency of filling. Catchment of a minor tank, if the catchment area to full supply capacity of the minor tank is 9 or less such a catchment is not effective as a source area for major tanks, where the minor tank catchment is part of a major catchment. The density of minor tanks in the major catchments investigated is high enough to reduce the effective catchment area of the major tanks.

Catchment runoff yields could be enhanced by suitable treatments of selected parts of micro-catchments. Soil compaction increased the runoff by about 60-70% compared to non compacted.

An increase in the drainage density in a catchment showed several fold increase in the catchment runoff, but with slight increases in soil erosion rate.

A relationship of runoff or a runoff model in terms of rainfall and catchment land uses provides a suitable basis to predict runoff from a catchment; therefore such a model wood form a basis to select management practices. Efforts were made to develop such a relationship. Regression analysis to develop a relationship of runoff in terms of rainfall and different land uses has not yielded a viable method.

Attempts were made to develop a simulation model. For this, each catchment was divided in to small elements or cells. The runoff from an element for each rainfall event was computed based on the runoff curves developed from runoff plot data.

To predict runoff, experiments were conducted to determine the in-situ water balance. The rainfall, runoff, soil moisture storage, evapo-transpiration from vegetation and crops were estimated by monitoring the soil moisture at regular intervals. Data show that forest and scrub consume nearly all the rainfall. Total water consumption by the natural vegetation has been about 1160 mm per annum. The water consumption in the chena land has been about 900 mm per annum.

The average rate of evapo-transpiration from forest and scrub was 3.2 mm/day. The moisture loss in chena was less and was about 2.5 mm/day. Monthly soil moisture depletion is different for the three land use types. The influence of solar radiation, soil moisture availability and the differences in the vegetation is very clear.

Natural forest and the scrub jungle have similar hydrologic properties. Both vegetation types produce low runoff compared to cleared lands or chena.

Soil erosion from chena lands attain critical levels. However, the soil loss from forest, scrub and abandoned chena are very small and it is not a serious problem.

Water management in the command areas of Nachchaduwa and Huruluwewa, was an additional component of this research effort. This is to establish the current status of the on farm water use and to develop improved methods of irrigation. In the first phase of the study, the technical problems, particularly on the on-farm distribution, waste, etc. were examined and also the socio-economic conditions of the water users were assessed.

In the second phase of the water management program attempts were made to develop alternative methods of on farm water management, particularly to develop on farm irrigation for other field crops. Two systems of water application were tested, namely top-down and bottom-up. Further, possibilities of providing on-farm supply ditches to achieve higher water use efficiency compared to the current practices are investigated.

3.2.3.16 Study on the Assessment of Tank-Bed Siltation:

This study is being implemented by the Environmental Studies Center of the University of Peradeniya. The study was begun in April, 1995 with the objective of monitoring siltation in small irrigation tanks and characterizing the spatial and temporal variability of the process. The study will also develop a model to quantify sediment yields from small catchments as well as formulate ways to minimize negative environmental impacts due to siltation that could be applied in future rehabilitation programs.

For this study, 6 sites have been selected in the dry zone of the country. A pilot sediment trap has been constructed at the Wewala Wewa Tank. But due to delay in the initiation of the study, detailed measurements could not be made before the end of the rains in April, 1995. It was, however, observed that the trap did collect sediment during the only rainfall event to occur after the construction was completed.

Apart from the trap constructed during the pilot study, five sediment traps have also been constructed in Wewala, Bulana, Heenwalayagama, Ittikattiya and Bulankulame schemes. These traps are equipped with overflow weirs with which discharge can be measured and they are provided with bypass channels to facilitate the removal of sediment from the traps after storm events.

Rain gauges have been installed, two at Wewala and one each at the other sites. Data collectors have been employed at all five sites. Their duties include care and maintenance of the traps, measuring the sediments collected in the trap after each storm event, collection of sediment samples for size analysis and measurement of rainfall.

Three traps at Wewala, Heenwalyagama and Bulana were ready at the time of the inter-monsoonal rains late in October and early in November. Two severe storms were experienced at these sites. The traps at Wewala and Bulana were damaged by these storms. Data, however, were collected at Bulana and Heenwalayagama. The sediment traps and rain gauges functioned as expected. After the above mentioned inter-monsoonal rains there has been no significant rainfall in the study areas. Therefore, no further data could be obtained. Maps of the sites on the scale of 1:50,000 have been obtained and the details of the catchments are being collected.

3.2.3.17 Study on Micro-Catchment Degradation:

Catchment degradation is the loss of the productive value of land due to human activity. This involves depletion of soil fertility, increase of storm runoff and sediment load, and drying up of streams. Catchment responses to the clearing of natural forests may take the form of soil erosion and the associated loss of productivity and alteration of hydrological processes within the catchments. Reduced infiltration capacity and acceleration of the rate of surface runoff can cause soil erosion, flooding and siltation of reservoirs, channels and low lying croplands.

The main objective of the study is to diagnose the causes and consequences of catchment degradation and preparation of a management plan. The secondary objectives are to quantify and model the effects of land use practices on surface runoff from micro-catchments and the creation of a GIS database for selected micro-catchments.

A proposal to implement the study has been submitted by the Environmental Studies Center of the University of Peradeniya. After incorporating the comments from the reviewers the proposal has been sent to the Project Director, NIRP for approval.

3.2.3.18 Archaeological Study on Ancient Irrigation Systems:

Both historical and archaeological evidence indicates the central significance of irrigation to the florescence of ancient Sri Lankan civilization. In 1975, the Irrigation Department estimated over 15,000 major and minor working schemes. Most of these schemes, like most of the 1,000 plus schemes scheduled for rehabilitation under NIRP, have pre-modern origins and form an important part of Sri Lanka's cultural and scientific heritage. The Archaeological Study on Ancient Irrigation Systems, undertaken by the Ancient Science and Technology Program of the Institute of Fundamental Studies, is designed to advance knowledge and stimulate research concerning the origins and development of ancient Sri Lankan irrigation-related technologies. The study also contains an environmental impact assessment component for recording the archaeological remains related to each NIRP project. This information is used to appraise NIRP contractors of the presence of archaeological materials to prevent the inadvertent loss of items related to the

national cultural heritage through the obliteration of archaeological remains during NIRP construction activities.

Just over fifty days of field work were completed during 1995, following the release of NIRP funds in early July. The field team completed 22 NIRP projects (9 medium/major schemes and 13 small schemes) and visited 12 non-NIRP irrigation localities in 8 districts encompassing all three rainfall zones. During this work the team recorded traces of 40 ancient irrigation-related structures, including 9 *bisokotuwas* or sluice valve cisterns (4 on NIRP schemes). In addition to the irrigation structures themselves, investigations in the near vicinity of the 34 projects have revealed 32 ancient settlements, 38 stone-pillared buildings, 14 stupas, 5 cave monasteries, 15 localities with ancient rock-cut steps, 2 stone bridges, 12 inscriptions, and 4 relief sculptures. Five of these sites have already been seriously damaged by recent irrigation construction activities, while another 9 are very likely to be impacted by currently planned irrigation construction activities. Although all NIRP irrigation projects have been renovated at least once in the past, over 50 percent of the NIRP projects visited still retains some traces of their ancient irrigation structures. The majority of these, however, have been disarticulated by earlier Irrigation Department construction activities. Much of what still remains will be further destroyed with each succeeding rehabilitation, especially now that blasting and mechanized earthmoving equipment are increasingly employed in the work.

Although no new lands are being officially brought under cultivation during NIRP activities, in some projects small remnants of higher land within the current fields are being lowered to maximize the areas of productive fields. Such remnants sometimes contain archaeological remains from the higher area, and these are being disarticulated at best, or totally removed at worst, by the field improvement process.

As might be expected, of the 12 NIRP projects that still retain traces of their ancient irrigation structures, the structures are more evident at the medium/major schemes (found at 77% of the larger schemes but at only 38% of the small schemes) where the ancient constructions were more substantial and the irrigated areas and populations were larger. Although irrigation-related structures are more commonly found on the larger projects, significant remains--even including an ancient bisokotuwa--have been discovered on small projects. Furthermore, fairly intensive surveys in the vicinity of small schemes have revealed significant frequencies of other categories of important archaeological remains such as stupas, inscriptions, stone-pillared buildings (generally religious structures), and settlement sites, although these are not as frequent as in the larger schemes. Despite the samples being fairly small, clearly, these results indicate that small schemes possess evidence that should not be ignored or discounted in the study of ancient irrigation. Even more importantly, since the remains at small schemes appear as liable to being impacted by construction activities as are those at the larger schemes, archaeological impact assessment surveys are as necessary around small schemes as around large ones.

The much lower proportion of nonirrigation remains at the non-NIRP localities that were visited results from a less-intensive survey methodology as these localities were not subjected to the archaeological impact assessment aspect of the field investigations. The identifiable remains of

the 9 bisokotuwas as well as parts of 5 other sluice structures and the disarticulated blocks of possibly 6 more sluices clearly show that substantial amounts of archaeological material are still potentially available for research on ancient irrigation. These structures require further investigation during Phase II of the study for detailed information on construction techniques, chronological changes, and other developments in irrigation technology.

3.2.4 Record and Analyze Lessons Learned in Establishing IRMU and Its Early Operations:

A short term local consultant was engaged to document and analyze lesson learnt during the establishment of IRMU and its operations.

For the purpose a survey was conducted to obtain a cross section of opinions of IRMU staff, other Irrigation Department staff and key officials from outside the Irrigation Department. The main areas dealt were:

* the need for research within the Irrigation Department and the role of IRMU in filling those needs
* the appropriateness of the structure and organization of IRMU to fulfill its role
* the performance of IRMU in fulfilling its role
* the effectiveness of the technical assistance to IRMU
* the future of IRMU.

Based on preliminary interviews and review of documents, a formal open ended questionnaire was prepared for this survey. Forty two persons were interviewed. Interviewees were selected purposively with a heavy bias towards policy level decision makers, those directly concerned with research and IRMU. Persons from the key areas of the Irrigation department in the headquarters and the ranges were included so that their ideas could be encapsulated into the exercise.

Results of this study is summarized below. The detailed report is being published separately.

3.2.4.1 The Role of the IRMU in the Irrigation Department

Many respondents said that research was important for the Irrigation Department. Although some felt that research should be confined to technical areas, there was a wider interest that included management and irrigated agriculture but did not extend much into socio economics.

In the past research had not been encouraged in the Department, although research had been carried out by interested individuals.

The role of IRMU as initially defined was that it would do some research as a learning experience for the ID staff but majority of the studies would be done by contracting outside the organization. The information dissemination function was also given prominence.

According to the respondents, of the three functions , research, training and disseminating research findings, IRMU has been most successful with the last. Research took time to get off the ground and ID staff were hardly involved in it. The recruitment of staff mainly took place during the last year and they were given only back up work and not supported much by the department.

Staff support did not come from the department because of procedural and externally caused problems such as the high market value of good professionals. Mostly freshly recruited engineers were assigned to IRMU. Due to the prevailing perception of limited promotions engineers from mid-level management positions shyed away from the IRMU. Attitudinal problems sometimes outweighed the procedural problems.

Commissioning research although necessary for the ID at the moment had many shortcomings such as high cost and availability of only limited number of qualified researchers in the private sector. The national research institutes were not interested to contract IRMU studies as they were overloaded with their own programs. This situation is not likely to ease in the near future. From the long term perspective it would, therefore, be better to have more IRMU personnel trained.

3.2.4.2 Structure and Organization of IRMU

Most felt that the present placement of IRMU within ID was not ideal. It would be better to have a full time Deputy Director as head . Some felt there was not enough work for a full time head. Some expressed the need for a person experienced in research for this post. There is also a plan for creating a Senior Deputy Director position for Training and Research in the restructuring plan of ID. Recruitment and placement of engineers and non engineers had been a problem. It appears that adequate criteria have not yet been developed for recruitment of staff for IRMU. As a result some who were not interested in research had been placed in IRMU while some who were interested were left out.

The bigger problem was the recruitment of non- engineering research staff. Although it was agreed earlier that new cadres should be created for such staff the procedure to do so moved very slowly. In this instance it appeared that attitudinal problems were the real cause and not procedural. It was more acceptable to have Senior staff recruited to assist engineers and there were only few Senior positions. IIMI was criticized for not finding a solution.

Other obstacles pointed out a) were the relationship with NIRP, donors insistence on certain topics, the financial and other procedural delays etc; b) the ineffectiveness of the RAC and the RCC in pushing the procedures through. The RAC however was cited for contributing to developing relationships between IRMU and outside institutions.

3.2.4.3 IRMU's Performance

Less than half the sample felt that IRMU's main contribution was to generate some interest in research within the ID. Information disseminating activities were developed more widely within and outside the department and this particularly the former were much appreciated.

Not many knew about IRMU's research efforts. From among those who did, some felt it was satisfactory given the obstacles whilst others criticized the choice of topics and other factors. One of the main problems was that IRMU's research was carried out by III staff independently rather than jointly with ID staff. Another was that there was inadequate dialogue with field and other personnel within the department. The research on Farmer organizations had been identified as useful.

IRMU's training programme on Rapid Rural Appraisal was highly commended.

IRMU's relatively slow progress is to be explained by a variety of factors of which the most important were non- cooperation and lack of interest by the ID personnel in many areas; staffing delays and procedural, logistic problems from NIP.

3.2.4.4 IIMI's Performance in Providing technical assistance to IRMU

Although some respondents voiced appreciation for specific IIMI efforts and the technical advisor was considered to be good yet there was criticism of IIMI's Technical assistance efforts. Inexperienced national staff, high costs, inadequate communication with ID staff were specially signalled out as problem areas.

The large number of criticisms and their varied nature suggest that IIMI staff should have tried to find a way to spend more time working directly with ID personnel. This might also have resulted in some changes in plans and activities

3.2.4.5 The future of IRMU

Despite the various concerns and complaints, the respondents were overwhelmingly in favor of continuing IRMU. Most however wanted to see some changes. Some suggested to bring IRMU further within the Department while the others were in favour of granting greater autonomy to IRMU.

Suggestions to improve IRMU included reorganizing the Dept to give it a different place putting more emphasis on research and using IRMU to channel funds to different divisions in the department for them to do research. For non-engineering studies collaboration with out side agencies were suggested.

Some respondents continued to express doubts about the IDs commitment in continuing with IRMU as the ID do not seem to appreciate research within the department.

3.3 TRAINING AND TECHNOLOGY TRANSFER

3.3.1 Training

Training IRMU and ID staff on different aspects of research and research management including those on rapid appraisal techniques, research methodology, monitoring and evaluation procedures, performance and impact evaluation of systems before and after rehabilitation etc. were considered important throughout the life of the technical assistance project. This included on the job training on relevant topics, workshops, seminars, fellowships for post graduate studies and publication of newsletters.

3.3.1.1 Training on Rapid Appraisal of Irrigation Systems

The criteria for selection of irrigation projects for rehabilitation and modernization is an important aspect of the NIRP. Use of RRA techniques can help screening of large number of schemes in relatively shorter time span. As NIP had to rehabilitate a large number of schemes it was necessary to train field offices on RRA techniques for quick appraisal of the systems.

The general objective of the course was to sensitize irrigation officials interested in diagnostic and research activities on the advantage of using the RRA technique in collecting the required information. Other objectives were:

* To provide course participants with a thorough understanding of the purposes, principles and methods of RRA

* Help course participants plan RRA techniques in live irrigation schemes

* Guide course participants in implementing and reporting RRA results

The course was a blend of classroom lectures, group discussions and extensive field exercises. During the first week, classroom lectures including case studies and group discussions were conducted on the following topics:

* Introduction to RRA

* RRA needs for NIP schemes

* RRA: A tool for identifying research needs

* Appraisal methods for irrigation supplies and drainage

* Social and institutional aspects

* Farm management

* RRA analysis and presentation techniques

* Farmer group interview techniques

* RRA case studies

During the second week, field work was conducted at live irrigation Schemes located in the Galgamuwa Irrigation District. For the purpose of rapid appraisal, the participants were organized into 3 groups to appraise engineering, agricultural and socioeconomic aspects. Field data were collected with the active participation of farmers. The first draft of the appraisal report was presented to the farmers to verify data and solicit their comments for improvements. The final report was presented on the last day of the training program.

Four such courses were planned during the project period out of which 3 were held. All preparations for conducting the first training course in mid-1993, including preparation of the proposal, identification of the resource personnel as well as trainees, preparation of the course materials, and a comprehensive schedule were made. But the program could not be implemented as the approval of the Inception Report was pending. All the courses were held at the Sri Lanka Irrigation Training Institute, Galgamuwa.

The first training course was held from 7-17 June, 1994. Seventeen participants from ID, IRMU, NIP and provincial Councils attended the course. 12 resource persons - 3 from ID and 9 from III were involved in the training.

During the first week class room lecture were held on selected topics. During the second week, field work was conducted in Mahasiyambangamuwa Irrigation Scheme where a rehabilitation program was being implemented under the ADB financed North-Western Province Water Resources Development Project. For the field exercise, participants were divided into three groups to cover engineering, socio-economic and agricultural aspects. About 25 farmers spent two full days with the study groups. In addition, the study teams visited women farmers and agency officials involved in irrigation and agriculture. The first draft of the field reports were presented to farmers to verify data and solicit their comments for improvements. The final drafts of the field reports were presented at the concluding session of the training program.

The second RRA training course was held from 18 to 28 April, 1995.
Nineteen participants from the ID, the NIP and the IRMU attended the course. Ten resource persons, 3 from the ID and 7 from III were involved in the training program. Field work was conducted at the at the Pahala Kokwewa minor irrigation scheme. The third RRA training course was held from 18 to 28 June, 1996 with 28 participants.

The training course was very well received by the participants. The course was evaluated with 22.2 percent rated as excellent, 53.6 percent as good, 18.6 percent as alright, and 5.6 percent as mediocre. None of the participants rated the course as "not good." The participants, however,

made some recommendations for further improvement of the course. The completion report and the participants' report have already been completed.

A training module on the RRA training has been developed and copies have been submitted to IRMU and NIP to help with holding of the course after the expiry of the TA program.

3.3.1.2 Training on Research Methodology

This training program was designed to help develop research capability of IRMU staff. Course content included standard methodologies used for research in technological, socio-economic and environmental aspects of irrigated agriculture. At the end of the course the participants were expected to learn the following:

* Problem identification
* Literature review and hypothesis development
* Questionnaire development and conducting surveys
* Planning, designing and conducting experiments
* Data collection, analysis and interpretation, and
* Report writing.

But unfortunately the course could not be held due shortage of trainees (at any given time IRMU had between 2 - 3 staff on board).

3.3.2 Technology Transfer

3.3.2.1 Holding of Seminars

Seminars are very effective tools to disseminate research findings. Though not included in the original TOR, considering its importance in technology transfer, the IRMU initiated a once a month seminar program titled "IRMU Seminar Series". The inaugural seminar was held on 17 December, 1992. A total of 42 seminars were held upto end of June, 1996. A wide ranging topics were covered and the speakers included professionals and researchers from national and international agencies dealing with irrigation and irrigation management research. Though these seminars form a strong component of the technology transfer program these also provided essential input to strengthen IRMU's over all program.

The seminars covered the following program areas of IRMU and their distribution was as follows: Assessing and Improving Performance of Irrigation Systems -13, Local Management of Irrigation Systems-12, Operational Management of Water Delivery and Disposal-7, Crop Diversification - 4, and Environmental Studies -6.

Professionals and researchers from national and international agencies as well as free lance consultants dealing with irrigated agriculture and irrigation management participated as resource persons. Speakers came from the Department of Agriculture, the University of Peradeniya, the

Irrigation Department (ID), the Irrigation Research Management Unit (IRMU),the Open University of Sri Lanka, the Field Crop Research and Development Institute - Maha Illuppallama, the International Irrigation Management Institute (III), the Food and Agriculture Organization of the United Nations/Regional Office for Asia and the Pacific (FAO/ROAP), the University of Moratuwa, the National Irrigation Rehabilitation Project (NIP), Central Bank of Sri Lanka, Institute of Fundamental Studies (IFS) and Agrarian Research & Training Institute (ARTI). III was involved in 15 presentations (including collaborative studies with the ID), faculty members of University of Peradeniya gave 4 presentations, the ID gave 4 presentations, the Open University of Sri Lanka gave 2 presentations, IRMU gave 4 presentations, NIP consultants gave 2 presentations, faculty members from the University of Moratuwa gave 2 presentations, Central Bank of Sri Lanka, IFS, Department of Agriculture, Field Crop Research and Development Institute - MI, ARTI and a project manager from the Province of Alberta, Canada gave one presentation each in addition to 3 presentations from freelance consultants. In addition to serving as a strong component of the technology transfer program, these seminars also provide essential inputs in strengthening IRMU's research program. These seminars, in general were well received, which was evident from the wide participation of different institutions and agencies.

Titles of the seminar topics, name and designation of presenters and dates of presentation is provided in Appendix 3.5.

3.3.2.2 Publication of Newsletter

The information dissemination program was strengthened by initiating the publication of the IRMU Newsletter early in 1994. Three issues of the Newsletter have been published in 1995 bringing the total to 6 since its initiation. The Newsletter is distributed to over 300 professionals, researchers, administrators and planners within the country. This is also a new activity which was not included in the original proposal but included in the Inception Report.

3.3.2.3 Award of Fellowships

A strong component of the staff development program is the award of fellowships to the IRMU/ID officials to pursue higher studies leading to postgraduate degrees/diplomas in national universities. There is provision for awarding 8 such fellowships upto the end of June, 1996 only 4 have been awarded. In spite of intensive effort all the fellowship could not be awarded due to lack of interest among the IRMU/ID staff. The principal reasons for lack of interest are; (i) staff prefer foreign scholarships to local ones, (ii) nonavailability of an adequate number of appropriate courses, (iii) staff availing of these lose priority for eligibility for foreign fellowships, and (iv) most of the advanced degrees offered by the national universities are not recognized abroad. To offer more flexibility it was decided that in addition to technical fields these fellowships will also be offered to staff interested in pursuing higher studies in management. This also did not improve the situation.

Names of awardees, major areas of studies and name of the university is presented in Appendix 3.6.

The awardees were contract bound to serve IRMU for at least 2 (two) years after completion of higher studies. But unfortunately, out of 3 who have completed higher studies under the fellowship program only one was assigned to IRMU who was also transferred after about 6 months.

3.3.2.4 Review Of Past And Present Research

IIMI Technical Assistance staff is helping IRMU to locate, collect and summarize present and past research conducted within the country in the field of irrigated agriculture. This exercise is expected to lead to better understanding of the problems and help design follow-up research. Over 750 studies/reports have been identified and 125 have so far been summarized. These summaries have been published separately.

3.3.2.5 Holding of Workshops

The project document called for holding of 10 workshops during the project period. All the 10 workshops were held which covered all the important program areas of IRMU. A brief description of the workshops including main objectives and principal outcomes are given below. Proceedings/report of each workshop has been separately published.

i) Workshop on use of computer models as decision support tools in operation and management of irrigation systems: A Sri Lankan Experience

The use of computer models as decision support tools have become popular in almost all sectors of the economy. Nevertheless, the use of computer technology in irrigation is yet to reach its full potential and research is still ongoing to identify the potential areas for the possible application of computer technology in this field.

In the recent past various computer based decision support tools have been developed and introduced to help irrigation project managers in the operational management of the systems. A number of such tools are being used in different irrigation schemes in Sri Lanka to address mainly the problems of low rainfall effectiveness and consequent over reliance in stored water, high degree of inequity of water distribution within the systems and inadequate irrigation potential in the yala season. The studies generally include establishment of reliable flow monitoring networks, development of computerized decision tools for assisting water scheduling and other system operation activities and development of indicators to evaluate the effect of changes in management practices.

This workshop was held on 15-16 July, 1993 at the Irrigation Training Institute of the Irrigation Department located at Galgamuwa. 40 (Forty) participants from ID and Mahaweli Development Authority attended the workshop. The inaugural session was presided over by the State Secretary

for Irrigation and present among others were Directors International Cooperation and Research from IIMI, Snr. Deputy Directors of ID and Project Director, NIRP.

The workshop was organized with the objective of reviewing and comparing experiences in the application of computerized decision support tools to improve performance of water management in the irrigation systems of Sri Lanka. The performance of seven computer models, currently in use, was presented during the course of the workshop to a selected group irrigation engineers working in the field. The constraints and the potentials of these models were evaluated at the end of the two day workshop and recommendations were made for the future advancement of the computer usage in irrigation water management, in Sri lanka.

Based on the deliberations, the workshop recognized that introduction of computer models along with proper data collection system for implementation of irrigation schedules will improve the performance of irrigation systems, as was observed in the Galoya and Hawatuna schemes. However, for wider applicability and institulization of the system the participants recommended that (1) institutional problems associated with data collection, processing and conversion of data into information shall have to be resolved, and (2) Initiate a study to pilot test promising models in a few selected schemes. Another outcome of the workshop recommendations was the constitution of a committee to develop a proposal for pilot testing promising models in a number of new schemes. The proposal was developed and the study was initiated in late 1993 in four schemes, which is nearing completion.

ii) Workshop to Discuss and Finalize Strategic Plan and Medium Term Research Plan of IRMU

The workshop was held on October 28, 1993 at the ID. 40 (Forty) participants for ID, IRMU, DAS, AR & TI and universities participated in the deliberations. The objective of the seminar was to obtain views of the learned participants on the draft reports on strategic as well as the medium term research plan. Based on the recommendations the above two documents were finalized (also reported under output 1).

iii) Workshop on Catchment Management Studies and Performance Monitoring of Downstream Control Structures

The above studies were initiated under MIRP. After the expiry of the MIRP in June 1993, these studies were included in the IRMU workplan. The workshop was held on October 26, 1993 with the objective of ascertaining the status of the studies as well as to develop workplans and budgets to bring the studies to successful conclusion. Based on the on the deliberations of the workshop revised schedules and budgets were prepared and the studies were completed accordingly.

iv) Workshop on Seasonal Planning Procedures to Improve Irrigation Management Performance: How Kirindi Oya Experience of IIMI/ID can be Transferred to NIRP Schemes

The workshop focused on the study implemented by IIMI at the Kirindi Oya Irrigation & Settlement Project in collaboration with the agencies in charge of development and management of this project.

The objective of the Workshop was to share experiences of researchers and implementors involved in the study conducted at Kirindi Oya with professionals involved in National Irrigation Rehabilitation Project (NIRP) and exploring the possibility of incorporating Kirindi Oya experiences to NIRP schemes. 87 Participants from Irrigation Department, NIRP, Irrigation Research Management Unit (IRMU), IMD, Universities, Agrarian Services Department, Department of Agriculture, Mahaweli Authority, IIMI, Provincial Councils, and NGOs participated.

The methodology adopted for overall improvement of performance of the scheme was Participatory Action Research (PAR) in which, the system management agencies, including farmers became the implementors of the research program.

The workshop recommended that for the schemes rehabilitated under NIRP, irrespective of the limited number of farmers and small commands, a plan of operation and maintenance be prepared. The participants recognized that Kirindi Oya experience can contribute to the preparation of operation and maintenance plans for all types of schemes. Given the serious water supply constraints experienced by the Kirindi Oya System, the framework for water issues has become a useful tool to build a strong O&M organization. The workable water issue plan for Kirindi Oya can and should be replicated in other schemes including those under NIRP with some site specific alterations, if required.

v) Workshop on Farmer Participation in Planning, Design, and Rehabilitation of NIRP Schemes: Current Status and Needed Improvements

The workshop generated a very lively discussion as this is an important topic to engineers, social scientists as well as system managers. The workshop was organized to share experiences with others and disseminate the information which was gathered through the research conducted by the IRMU. 39 participants from ID, NIRP, IIMI, Mahaweli Authority, AR&TI, Department of Agrarian Services, Department of Agriculture, Universities and IRMU attended the workshop.

Main objectives of the workshop was to make the participants aware about the present status of the farmer participation in NIRP schemes and identify measures that NIRP should take to maximize effective farmer participation.

To achieve the objectives, two papers were presented, one covering plans and concepts and the other covering the actual field situation relating to farmer participation in NIRP schemes. Each

presentation was followed by an hour of discussion. A set of recommendations were developed to further strengthen farmer participation in NIRP schemes.

vi) Workshop on Farmer Participation in Planning, Design and Rehabilitation of NIRP Schemes: Farmers' Perspective

This workshop was held at the Sri Lanka Irrigation Training Institute (SLITI), Galgamuwa on 25 February 1995. Twenty farmer representatives were invited to represent 8 Deputy Director (DD) Ranges covering 12 Irrigation Engineer (IE) Divisions and 19 of them participated in the workshop. The objective of the workshop was to document their experiences and solicit recommendations to further strengthen farmer participation in the rehabilitation of NIRP schemes. Participants were divided into 4 groups. Each group presented its experiences with the guidance of a facilitator. They expressed their views and experiences under the following components of farmer participation:

* FO formation and preparation
* Farmer participation in the planning and design of rehabilitation
* Contribution by farmers of 10 percent of the resources needed for the rehabilitation
* Construction contracting by FOs
* Construction supervision by FOs

Farmer representatives expressed their satisfaction over the functioning of their respective FOs in spite of some unavoidable shortcomings. Rehabilitation was identified as an incentive for farmers to join FOs and the presence of Institutional Organizers (IOs) was considered an added benefit in continuing FO activities.

FO members were concerned about the lack of legal authority to deal with defaulters, especially in relation to the 10 percent contribution toward rehabilitation. However, FOs used different strategies in achieving the 10 percent contribution from the members. Most of the construction contracts have been carried out by individuals through subcontracts rather than by FOs. The overall quality of this work was good due to the close supervision by the FOs during the entire process. The proceedings of the workshop has already been finalized and will be published very soon.

vii) Workshop on Beneficiary-Centered Management of Irrigation Systems: Retrospection of Recent Endeavors

This important workshop was held on 25 May, 1995 at the Irrigation Department, Colombo and attended by over 25 participants invited from implementing agencies like the Irrigation Management Division (IMD), the Mahaweli Economic Agency (MEA), research institutes, the

Irrigation Department and IIMI. "One of the major drawbacks to successful implementation of beneficiary-centered management of irrigation systems in the true sense has been the lack of a multidisciplinary approach. While there is no doubt that, with training, qualified technical staff do prove to be successful institutional staff, this is essentially tied to personal qualities and in instances where conflicts of interest arise, as they often do, with respect to irrigation and, especially, construction work, it is likely that true participation will result" said Mr. Jaliya Medagama, Secretary to the Ministry of Irrigation, Power and Energy, while delivering his address as the chief guest. The workshop was organized by the IRMU and the ID in collaboration with the Sri Lanka Field Operation office of the International Irrigation Management Institute.

The objectives of the workshop were:

* To discuss the salient features of the programs implemented in the recent past that can be applied to NIRP

* To document the findings and experience in the relevant subjects for dissemination among interested persons

* To provide a forum to policy makers, technocrats and researchers to deal with a subject in close interaction so that the recommendations could be widely acceptable as well as applicable

Four papers were presented at the workshop during two session. Over 25 participants from Irrigation Management division (IMD), Mahaweli Economic Agency (MEA), national research institutes, the Irrigation Department (ID) and IIMI attended the workshop. The proceedings of the workshop have been printed separately.

viii) Workshop on Planning and Design Issues of Rehabilitation

A workshop on Planning and Design Issues of Rehabilitation was held on 5 and 6 December 1995, at the Irrigation Training Institute (ITI), in Galgamuwa. It was jointly sponsored by the IRMU and the ITI. Forty five engineers from the ID, the DAS and the MECA (Mahaweli Economic and Construction Agency) participated in the workshop deliberations.

All the members of the Senior Directorate and most of the Range Deputy Directors were among the participants from the ID.

The objectives of the workshop were:

* Identifying planning and design issues of rehabilitation and resolving them or proposing action to resolve them

* Identifying further research required to address the issues

The workshop created a forum to share the experiences of participants in the planning and design process of irrigation rehabilitation and, therefore, it created a training environment as well. There was much enthusiasm among the participants, both in small group discussions and in plenary sessions. Fifteen issues identified in the issue paper were critically evaluated during the deliberations and a positive consensus was reached in proposing solutions to most of the issues.

ix) Workshop on Crop Diversification Strategies for Minor Irrigation Schemes

This workshop was held at the Irrigation Department on 20 February, 1996 with the objective to provide a forum to the planners, researchers and implementors to share their experiences and help develop a strategy for crop diversification in minor irrigation schemes. 35 participants from national and international agencies attended the workshop.

The minor irrigation schemes play a significant role in the food production sector of Sri Lanka and provide employment to the rural sector. However, rice yields and cropping intensities are low in minor irrigation schemes when compared to major schemes. Scarcity and unreliability of water supply has been identified as the major cause for the low rate of success in these schemes. Inadequacy of water is considered the major factor for limiting cultivation in the Maha season, where as in Yala season, land in these schemes are seldom cultivated.

In the recent past partial abandonment of rice fields due to water shortages was a common incident in the minor irrigation schemes. Thus, the concept of crop diversification was adopted to devise a more efficient cropping pattern and water management system. This was to gain the maximum economic benefit from the available water. Crop diversification strategies have failed in most cases in practical implementation due to the ignorance of factors influencing the respective farming system. Thus, the present workshop was conducted to identify constraints in the implementation of sustainable crop diversification programme in minor irrigation schemes and provide the Central Government of Sri Lanka with some policy recommendations for developing viable farming systems in these schemes.

Land tenure and fragmentation were identified as major constraints in implementing crop diversification strategies. Involvement of Farmer Organizations and Agrarian Service Centers would help to overcome the limitation in land tenure. Land consolidation would possible be a temporary solution to the problems involved in land fragmentation, although implementation would be difficult.

Low expansion of irrigation investment is a major factor stagnating extents of cultivation. Achievement of the technological ceiling set by plant breeders has resulted in stagnation in crop yields. mainly rice, in the recent past. Ploughing into shallow depths, incorporation of organic manure, avoiding usage of adulterated fertilizer would help overcome this limitation to a certain extent. A major breakthrough in the production systems could be achieved by exploitation of non-traditional highlands, addition of organic manure, and development of value-added products aiming at export markets.

In terms of production, seasonal adjustment in land preparation would be necessary to implement preparation would be necessary to implement rice-based cropping systems. Detailed planning and implementation of irrigation schedules and matching them with crop requirements, physical planning of area, production analysis for correct input use, and input-output service planning for diversified cropping are necessary for the successful implementation of crop diversification strategies.. However, irrigation management may not seriously inhibit the expansion of diversified cropping in rice fields if greater flexibility exists in provision of suitable lands.

The concept of regional specialization of crops aiming at developing a better cropping pattern could be a viable technique to increase cropping intensity. It would also enhance economic returns to the farmers. Any large scale expansion of diversified cropping in rice fields or command areas under minor irrigation schemes should be focussed for special captive markets. More attention has to be paid to increase agri-business opportunities that help development of value added products, market research and promotion, quality control, and export. This would ensure that success and sustainability of crop diversification programs.

Government intervention need to focus on motivating and assisting farmers to organize and manage their own system of production and support services. Matching importation of crops with local production with the help of a favourable trade policy is vital in motivating farmers. It would also secure markets for agricultural produce. Development of a national production plan based on long term demand and supply is recommended to avoid drastic price fluctuations in the market. The development of a crop insurance scheme for OFC's to assure farmers of their income with government involvement is essential.

Improvement of water retention capacity of existing minor tanks, investigations on the conjunctive use of water and availability of other resources (eg. solar radiation) are major hydrological aspects that need greater attention in implementation of crop diversification strategies. Other hydrological aspects that determine the success and sustainability of a crop diversification program are use of agro-wells as supplement for tank-water, adoption of water conservation technologies (ie. conservation farming, mulching), and increase water use efficiency through proper application technologies.

Planning of cultivation in Yala and Maha seasons through farmer participation (decision making on crop selection and cropping pattern) is a major social aspect that should be considered in developing crop diversification programs in minor irrigation schemes. Investigations on the techniques and processes involved in harvesting, utilization and conservation of agricultural products, options available for a year-round cropping pattern to the farmers, and potential for cultivating perennial crops under water deficit conditions are key technological aspects that warrant exploration.

The success of any crop diversification program primarily depends on the profitability, availability of marketing facilities and collective approach of farmers. Therefore, the concept of crop diversification must undergo an evolutionary process which allows a reasonable time duration to be economically, socially, physically and ecologically sustainable. Participatory role

of farmers is vital in achieving the expected objectives of planning which would lead to an effective crop diversification program.

x) Workshop on Emerging Power relations in FOs and their Impact on Effectiveness and Sustainability Of FO: A workshop on "Emerging Power Relations in Farmer Organizations and Their Impact on Effectiveness and Sustainability of Farmer Organizations" was held on July 01, 1996 at the Irrigation Department Head Office in Colombo. The workshop was organized by the IRMU in collaboration with the SLNP of IIMI. Financial support for the workshop was provided by IIMI. 35 participants from various institutions such as ID, IRMU, NIRP, IMD, ARTI, Mahaweli Authority, Universities etc and freelance researchers attended the workshop.

The objective of the workshop were:

- to pool presently available experiences on power relations in FO s for formulating future research strategies, and

- to recommend future directions on how to use of power relations in enhancing the capacity of the FO s in relation to their effectiveness and sustainability.

Four papers addressing different aspects of power relations were presented during the technical session. The papers were thoroughly discussed in the technical sessions as well as in small groups. Participants were organized into 3 groups to deliberate on three important issues identified during the technical sessions. The groups discussed and analyzed these major issues and the outcome of the group discussions were presented at the end of the day. The workshop proceedings will be made available soon.

3.4 REPORTS AND PUBLICATION

3.4.1 Inception Report

The first draft of the Inception Report was submitted in January 1993. The document was revised as per comments from the local EC consultants the final version was submitted in July 1993.

3.4.2 Strategic Plan

The IRMU strategic plan covering the period upto the year 2000 was submitted in December, 1993.

3.4.3 Medium Term Research plan

Report on the medium term research plan for IRMU, for the period, 1992 - 1996 was finalized in October, 1993.

3.4.4 Quarterly Reports

Of the twelve quarterly progress reports eleven were submitted as per schedule. As the project was started from mid-August, 1992, the first quarterly report due on 30 September, 1992 was combined with the second quarterly report, i,e October - December, 1992 and a single report was prepared for the first four and a half months.

3.4.5 Annual Reports

Three annual reports were submitted. The first one covered the period from August, 1992 through December, 1993. The second and third covered, respectively, calendar year of 1994 and 1995.

3.4.6 Final Report

The final report of the project was submitted during the first week of August, 1996.

3.4.7 Workshop Proceedings

The reports/proceedings of all the following 10 workshops have been published:

* Workshop on use of computer models as decision support tools in operation and management of irrigation systems: A Sri Lankan Experience

* Workshop to discuss strategic plan and Medium Term Research Plan of IRMU

* Workshop on Catchment Management Studies and Performance Monitoring of Downstream Control Structures

* Workshop on Seasonal Planning Procedures to Improve Irrigation Management Performance: How Kirindi Oya Experience of IIMI/ID can be Transferred to NIRP Schemes

* Workshop on Farmer Participation in Planning, Design, and Rehabilitation of NIRP Schemes: Current Status and Needed Improvements

* Workshop on Farmer Participation in Planning, Design and Rehabilitation of NIRP Schemes: Farmers' Perspective:

* Workshop on Beneficiary-Centered Management of Irrigation Systems: Retrospection of Recent Endeavors:

* Workshop on Planning and Design Issues of Rehabilitation

* Workshop on Crop Diversification Strategies for Minor Irrigation Schemes:

* Workshop on Emerging Power relations in FOs and their Impact on Effectiveness and Sustainability Of FO.

3.4.8 Abstracts of Monthly Seminars

Three volumes of summaries of seminars presented between December 1992 and December, 1995 have been published.

3.4.9 IRMU Research Reports

Final report of the following 6 out of 7 completed studies have been submitted:

* Irrigation management for crop diversification: evaluation of paddy-chilli inter-cropping in water deficit irrigation systems in the dry zone.

* Macro-catchment management and modeling study

* Agro-wells: their socio-economic profile and potential for conjunctive use with surface water

* Monitoring farmers involvement in NIRP rehabilitation - Phase I

* Monitoring farmers involvement in NIRP rehabilitation - Phase II

* Evaluation of maintenance performance by farmer organizations in handed over distributory channels

Inspite of repeated efforts final report on the study "Performance monitoring of of automatic water level down stream control structures" which completed in mid-1994, could not be obtained from the principal investigator.

3.4.10 Report on Rapid Appraisal Training

The completion reports and participants reports of all the 3 Rapid Appraisal training courses has been submitted. In addition a training module of the above course has been prepared by the TA team to enable IRMU to conduct the course independently.

3.4.11 Summaries of Literature Reviews

Summaries of 119 reviews have been published in 3 volumes.

3.4.12 IRMU Newsletter

Six issues of the IRMU Newsletter have so far been published.

4.0 FINANCE AND ACCOUNTS (This sectiion will be completed after all the expenses have been reported at the end of the Project on July 31, 1996.)

4.1 Project Funding and expenditure

The total CEC support for the project was ECU 843,840 and LKR 21,684,000/-. The breakdown of itemwise allocation and expenditure is given below:

BUDGET AND EXPENDITURE: ECU COMPONENT

Ref	Items	Budget			Actual Expenditure	
		Qty	Unit	Total	Qty	Total
A	Fees					
A1	Fees for International Staff, MM	66	11,128	734,448	57.05	
C	Refundable Expenses					
C1	Long Dist. Travel(Journeys)	16	1,675	26,800		
C4	Unaccompanied Baggage, kg	6,400	1.25	8,000		
C10	Equipment	-	-	74,592		
	TOTAL					843,840

BUDGET AND EXPENDITURE: LKR COMPONENT

Ref	Items	Budget			Actual Expenditure	
		QTY	Unit	Total	QTY	Total
A.	Fees					
A2	I Fees for National staff, MM	144	24,910	3,587,040		
	II Do	96	40,185	3,857,760		
B.	Direct Expenses					
B.1	Daily Allowance, days	330	1,200	396,000		
B.2	Accommodation, MM	48	60,000	2,880,000		
B.3	Local Travel					
B.3.1	M. cycle operation, M	96	7,500	720,000		
B.3.2	Vehicle operation, M	96	23,000	2,208,000		
B.5	Office equipment					
B.5.1	Office Furniture and Admn. equipment, M	48	20,000	960,000		
B.6	Running office(s), M	48	55,000	2,640,000		
B.7	Publication Expenses, M	48	62,000	2,976,000		
B.8	Workshops, M	48	10,000	480,000		
C.	Refundable Expenses					
C.7	Fellowships	08	122,000	980,000		
	TOTAL			21,684,800		

4.2 Financial Contribution

A total of 15 invoices (claims) were submitted, by the technical assistance project, from the inception of the project. Payment of 11 invoices have been received including 3 (three) submitted in 1995.

4.3 Supply of Materials, Operations and Maintenance Costs Pertaining to Infrastructure Development

To-date no new vehicle has been procured for IRMU. To improve mobility of IRMU staff IIMI has provided, for 24 months, an extra 4-wheel drive vehicle from its vehicle pool at no extra cost to the project. This is in addition to the two vehicles procured under EC grant. IIMI has also made available two extra computer systems for use by the IRMU staff.

5.0 PROJECT CONSTRAINTS

5.1 Lack of commitment from ID

From the very inception the IRMU has suffered from lack of total commitment from ID. This was evident from its inability to provide a full time Deputy Director and adequate number of staff, inspite of repeated requests from both the TA team and donors; inability or unwillingness to process the papers related to the creation of non-engineering cadres; inability to streamline financial management by IRMU etc.

5.1 Lack of Adequate Staff

One of the most important activities of the TA Program is to help adequate staffing of IRMU and train them to carry out the responsibilities assigned. This is also the area where minimum progress has been made during the last 4 years.

At the very inception stage of the project a multidisciplinary organizational structure, including a staffing policy and a coordination mechanism was developed. The structure proposes IRMU to be organized into 4 disciplines (Irrigation and Drainage; Irrigation Agronomy; Socioeconomics and Environment). When fully staffed, the IRMU is expected to have 17 research staff including the Deputy Director (Head of IRMU). The recruitment and training of the staff were to be done in phases bringing it to full strength at the end of the 4-year TA Program at end of July, 1996.

The organizational and staffing plan has now been approved by the Treasury including the creation of new cadres for the nonengineering research staff. The next step is to obtain approval of the scheme of recruitment from the Director General of Establishments before actual recruitment can be made. As the whole process is quite lengthy it now appears extremely doubtful whether the positions can be filled before the TA Program expires at the end of July, 1996.

To date, 9 research personnel, including the Deputy Director (part-time) were recruited/seconded to IRMU, four of them on contract appointments and the other 5 on secondment from the ID. Unfortunately, all 4 recruited on contract left IRMU, 2 for more secure jobs and the other 2 for higher studies abroad. All four were trained by the TA team and they were slowly getting into the rhythm of research. Their departure has been a big loss. A fresh start shall have to be made again to recruit and train new staff.

If adequate personnel are not recruited immediately, the IRMU will not be sustainable after the Technical Assistance program terminates on 31 July, 1996.

5.2 Lack of Interest in Fellowships

Provisions have been made in the Technical Assistance Program to provide 8 fellowships for ID/IRMU staff to pursue higher studies in national universities. Four fellowships have so far been awarded. In 1995, out of the 4 planned fellowships not a single could be awarded. The demand for utilization of fellowships has become very low for the following reasons:

* These fellowships are in direct competition with fellowships offered for higher degrees in foreign universities

* Many of the advanced degrees offered by local universities are not recognized abroad

* Staff availing of these lose their priority for eligibility for foreign fellowships

* Nonavailability of adequate number of appropriate courses

To improve the situation some steps have been taken. These include the use of the fellowships for attending postgraduate courses in management and diluting its impact on eligibility for foreign scholarships. These, however, may not be enough and the fellowship program needs to be reorganized to enable participants to pursue higher studies in foreign universities.

5.3 Inadequate Financial Performance by IRMU

IRMU has been allocated LKR 50,070,400 for implementing its program. From the inception of the project to the end of 1995 only about 12 percent of the allocation has so far been expended. There has been only marginal improvement in 1996. It is evident that the IRMU expenditure has seriously lagged behind. Several reasons have been identified, which include:

* The decision of the ID not to hire local consultants for IRMU

* The very small number of professionals hired on contract; the permanent ID officers seconded to IRMU continue to receive their salary from government funds

* Practically no expenditure on support staff, traveling and supply and services as no support staff were recruited; no vehicles have yet been procured and very little expenditure has been incurred in supply and services.

The above needs have nearly entirely been covered from the TA budget.

* There have been delays in awarding contracts for research. After nearly one year of processing only one contract has been signed and another two are in advanced stages of processing.

* Provision for paying honoraria to RAC and RCC members has been approved by the government. But honoraria for ID staff from other divisions implementing IRMU research and technology transfer program have not been approved.

* There is no mechanism for IRMU to spend funds directly and to reflect them in the relevant votes. Presently all vouchers go through the Project Director, NIRP and no head office branch is authorized to disburse funds. This situation has created long delays and inconvenience in settling IRMU bills.

It is, therefore, essential that disbursement procedures of IRMU funds should be made easier.

6. CONCLUSIONS AND RECOMMENDATIONS

Though most of the activities as set out in the inception report has been completed yet one of the most important activities i,e adequately staffing and training of the newly recruited staff could not be completed. Another area where significant progress could not be made is the award of fellowships. The reasons for these have been described in details in the preceeding chapters. Inspite of these short comings, IRMU has been firmly established within the ID and a process documentation exercise clearly indicated that a overwhelming number of professionals, administrators and planners strongly recommended continuation of the IRMU within the ID. The following recommendations are, therefore, made to further strengthen IRMU.

1. From the very beginning IRMU has been headed by a part time Deputy Director. The ID should now assign a full time Deputy Director. This is more important now as the after the termination of the TA contract the work load of the DD will significantly increase. As per revised ID organigram the DD, IRMU is responsible to the Director Human Resources Development. This arrangement is not expected to help IRMU much because the major responsibility of the Director, HRD will revolve around personnel management and planning. It is, therefore, recommended that the Research and Training units should be combined to form one division and headed by a full time Director who will be responsible to the Director General.

2. Irrigation Department, without any further delay obtain approval of the "Scheme of recruitment" from the Department of Public Administration for the recruitment of newly created cadres of non-engineering research staff. With this the staffing situation of the IRMU will significantly improve. If, however, due to procedural problems these recruitments are further delayed IRMU should recruit these positions on contract utilizing the unused funds and later absorb them in the cadres when approvals are obtained.

3. From the very inception IRMU has suffered from lack of total commitment from the "Top Brass" of the Irrigation Department. At times it appeared that the ID swallowed the IRMU "Bitter pill" to obtain approval of the larger NIRP project. The newly appointed Director General has, however, reiterated IDs unequivocal commitment to IRMU and advantage must be taken of this favourable situation to establish IRMU on a much firmer footing.

4. The local university fellowship program did not create much interest among the prospective candidates for the reasons described earlier. It should be recognized that properly trained staff are pre-requisite for successful operation of the IRMU. It is, therefore, recommended that the remaining funds should be augmented by unutilized funds and IRMU staff should be sent abroad to pursue higher studies. To start with five such fellowships should be created and funded, one leading to Ph.D degree and the rest leading to Masters degree. These fellowships should be exclusively earmarked for IRMU staff. The awardees will be required to sign a bond to serve IRMU for at least 5 and 3 years respectively for Ph.D and M.S fellowships. ID must ensure that after successful completion of higher studies these staff will serve IRMU at least for the bonded period.

5. As has been mentioned earlier that 5 fellowships have so far been awarded to ID staff. 3 of them have completed their studies. As per contractual agreement these "Fellows" were required to serve IRMU atleast for 2-years after successful completion of their studies. But unfortunately not a single "Fellow" has been assigned to IRMU. ID should, therefore, immediately assign all IRMU fellowship holders to IRMU to serve the 2- year contractual obligation. Otherwise this will create a very bad precedence.

6. The coordination bodies, RCC and RAC, set up to oversee IRMU activities have not been able to play very effective roles. For IRMU to become effective and sustainable RCC and RAC shall have to take lot more interest then they have done previously.

7. For contracting out studies IRMU should also invite private sector institutions with demonstrated capabilities for conducting quality research.

8. IRMU is a new institutional set up within the irrigated agricultural sector of the country. IRMU staff can gain valuable experience by visiting similar institutes in the region. It is, therefore, recommended that provision, including allocation of funds, be made for senior IRMU staff to visit similar institutions in the region to gain on the ground experience about the functioning of such institutes (eg WALMI's in India).

9. No effective mechanisms have so far been developed for IRMU to disburse funds directly and reflect them in the relevant votes. Presently all vouchers go through the PD, NIRP and no head office branch is authorized to disburse funds. This situation has created long delays and inconvenience in fiscal management including release of funds for contract research. It is, therefore, essential that procedure for disbursement of IRMU funds be streamlined.

10. Experience indicates that it took IRMU between 1 to 3 years to award contracts for research. Such delays very often "Turn off" the prospective researchers and institutes. In case long delays the very study topic may loose its significance due to fast moving changes both in technology and management. It is, therefore, recommended that award of contract research must be processed within 6 months from the date of initiation.

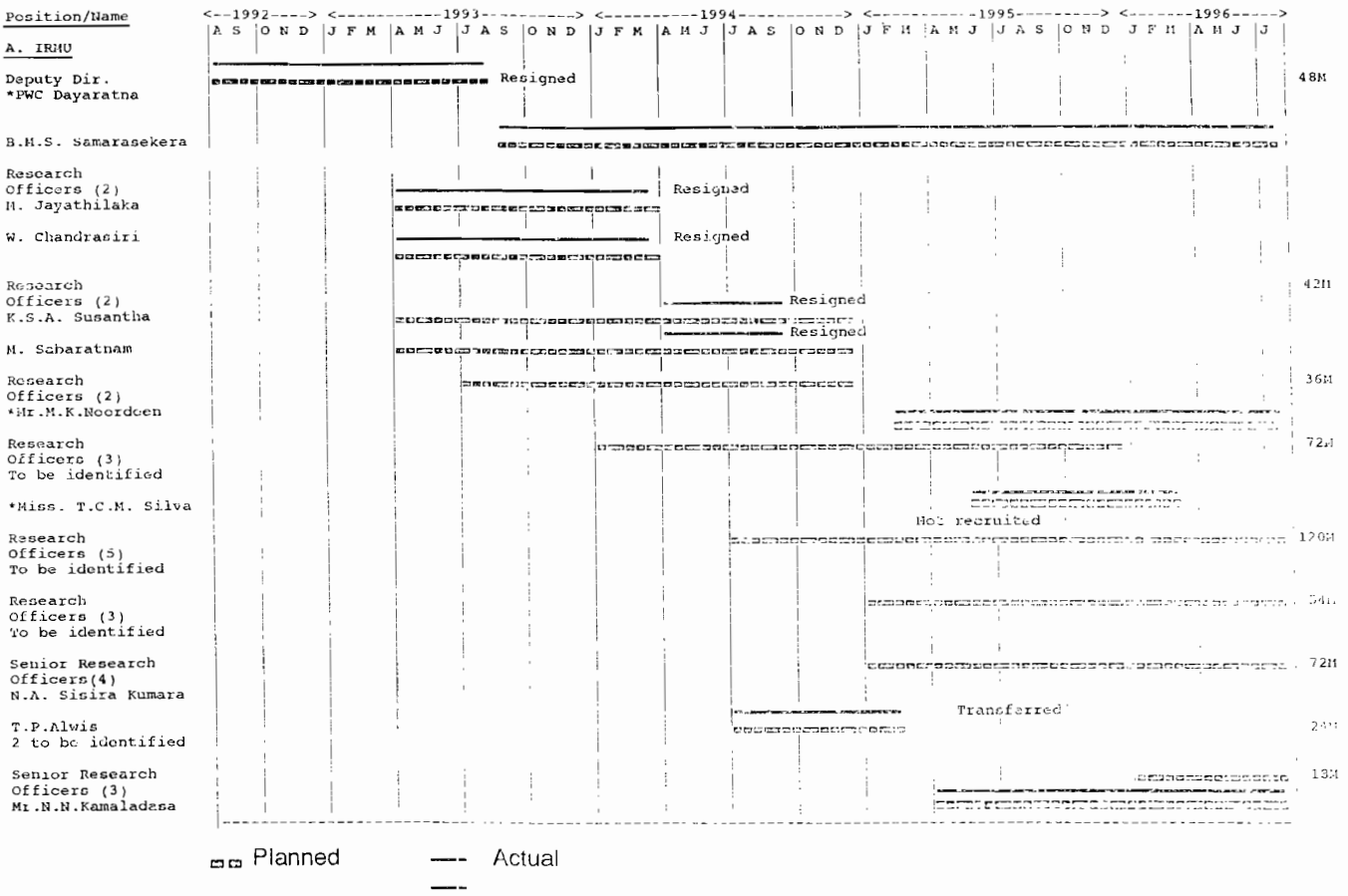
11. From the feed back received from the professionals and administrators during the process documentation analysis reinforced the view that research in irrigation management should not only be continued but also expanded. On the question of the location of the research unit views are mixed. Some think that IRMU will be more at "Home" with agricultural research system because of its built- in research culture and orientation. Others opined that as it has been established within the ID and as very little time has been given for it to organize itself, a move at this stage may be counter productive. The TA program supports the latter view. It should also be recognized that the Agriculture department will also face with the same problem of creating engineering cadres within the agricultural research system as the ID has faced in creating non-engineering cadres (after a 3- year effort ID has been able to obtain Govt. approval to create these cadres). It is, therefore, recommended that the IRMU continue to remain within the ID but develop a very strong rapport with the agricultural and other related research organizations both

in the public and private sector. It should be noted that the IRMU has already developed strong linkages with the national agricultural organization by inducting Executive Director, Council of Agricultural research, Director General, Department of Agriculture, Director, Agrarian Research and Training institute and Commissioner, Department of Agrarian Services as members of the RAC.

12. About the use of remaining program funds (unutilized amount in the TA project) IIMI still very strongly feels that a no cost extension be granted to the TA program by one year as was originally requested IIMI. It is quite evident that after the expiry of the TA program on 31 July 1996, the IRMU will not be able to be able to implement the 1996 work plan. Even the very sustainability of IRMU will be at stake. This will negate the whole purpose of the donor assistance as well as the progress made in establishing the IRMU. The best utilization of the remaining funds will, therefore, be to grant an extension of the no-cost extension of the TA by one year effective 1 August, 1996.

Appendix 2.1

STAFFING SCHEDULE - ID/IRMU

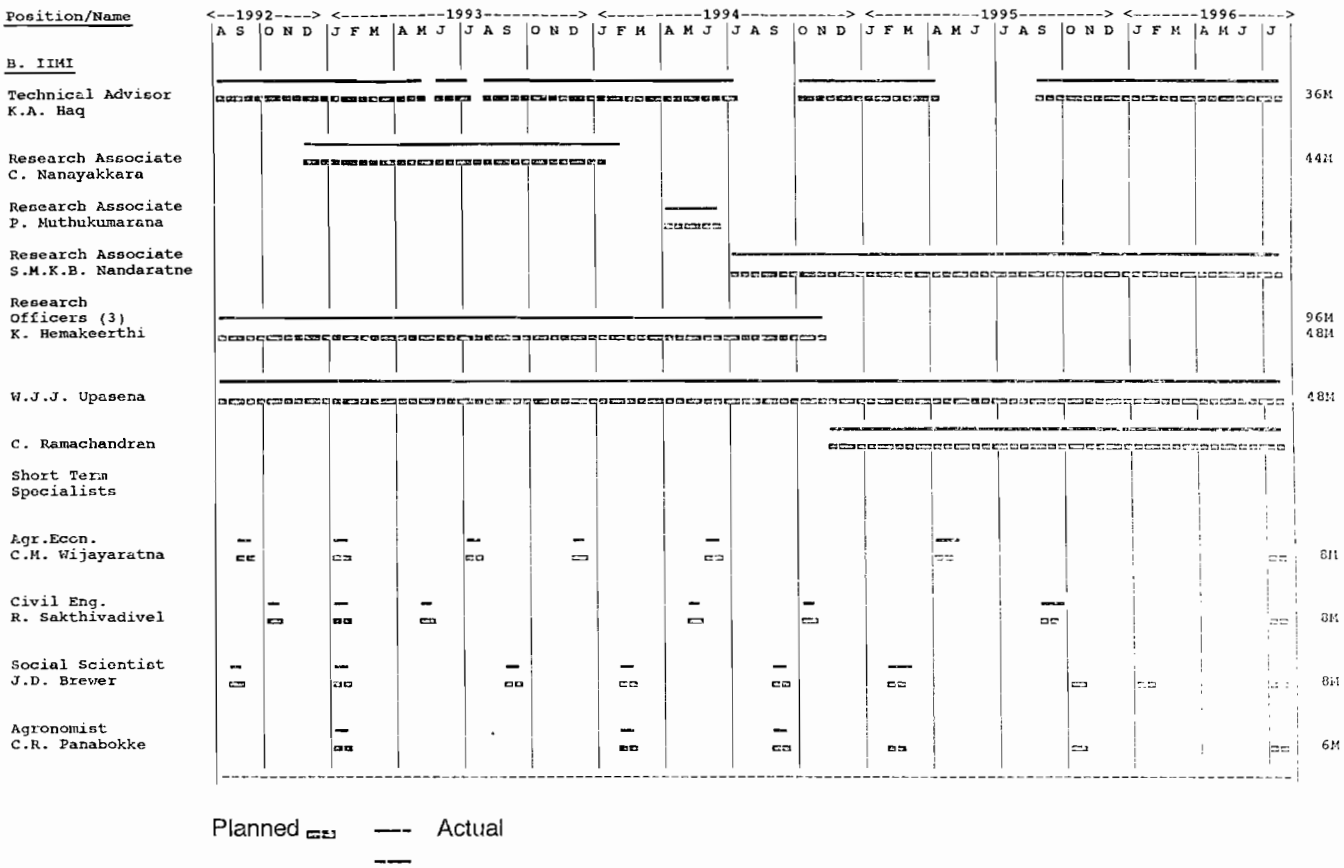


* Mr. B.M.S. Samarasekera assumed duties from September 1, 1993.

* Mr. M.K. Noordeen joined IRMU on 28 Feb. 1995

* Miss T.C.M. Silva joined IRMU on 20 June 1995

STAFFING SCHEDULE - CONSULTING SERVICES



Appendix 2.3

SUMMARY OF STAFF MOBILIZATION AND INPUTS: (AUGUST 1992 - JUNE 1996)

POST	NOMINATION	APPROVAL	DATE		MAN - MONTH			BALANCE
			START	LEAVE	ALLOCATION	UTILIZED UPTO 31.12.95	UTILIZED DURING THE QUARTER - JULY 1996	
FULL TIME STAFF								
Technical Advisor	K. Azharul Haq		17/08/92		36	31.6	3.5	0.9
Research Associates	C. Nanayakkara		01/12/92	28/02/94	48	15	0	-
	P. Muthukumarana		01/04/94	30/06/94	-	3	0	-
	S.M.K.B. Nandaratne		11/07/94	-	-	20.7	3.5	5.8
Research Officers	K. Hemakeerthi		01/08/92	15/11/94	48	27.5	-	0
	J. Upasena		01/08/92		48	44	4	0
	C. Ramachandran		01/10/94		20.5	16.5	4	0
SHORT TERM SPECIALISTS								
Agricultural Economist	C.M. Wijayaratna		01/08/92		8.0	5.75	0	2.25
Irrigation Specialist	R. Sakthivadivel		01/08/92		8.0	5.75	0	2.25
Sociologist	J. Brewer		01/08/92		8.0	6.75	01	0.25
Research Supervisors	Dr.S.Buvendralingam	-	-	-	96	48	0	48

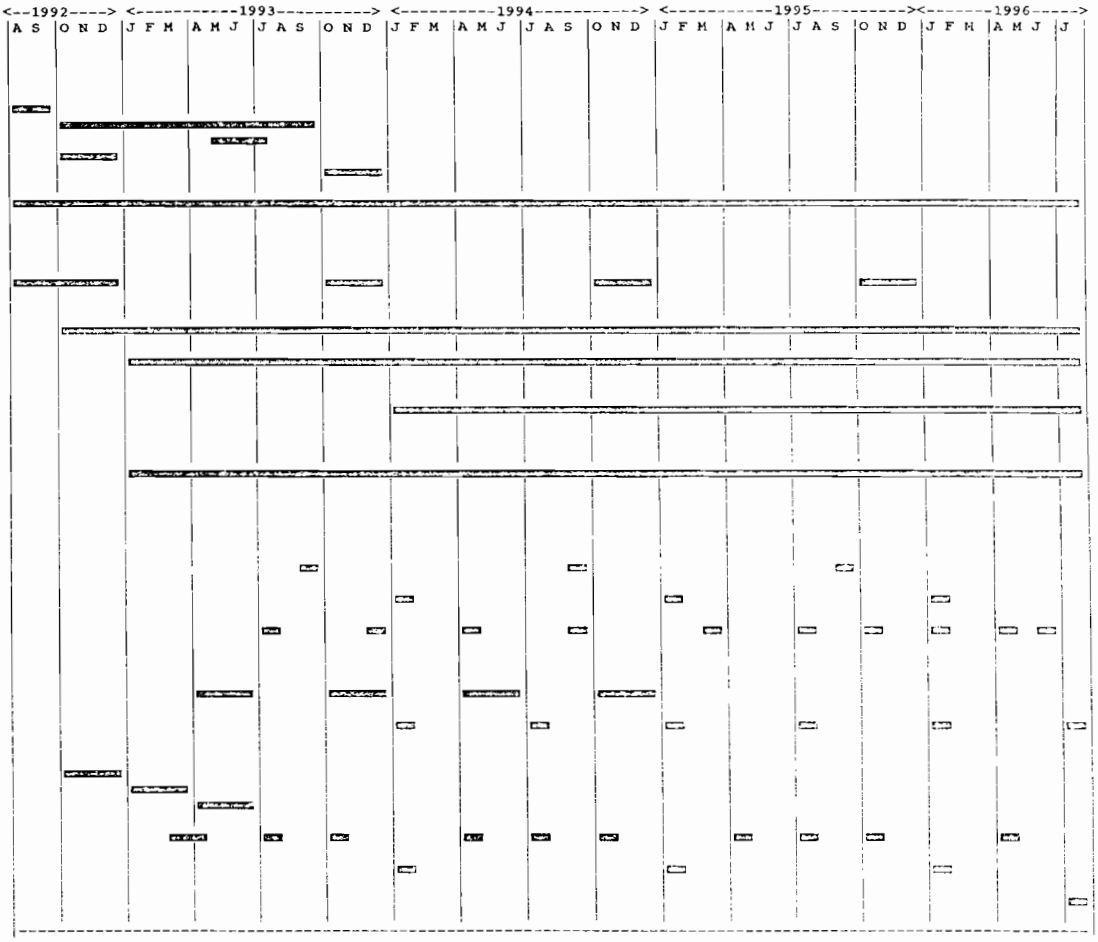
LOGICAL FRAMEWORK - IRRIGATION RESEARCH MANAGEMENT UNIT

PROJECT STRUCTURE	INDICATORS OF ACHIEVEMENT	ASSESSMENT OF INDICATORS	RISKS/ASSUMPTIONS
General objectives			
- Sustainable increase in agricultural production and income from irrigation investment by research into technical and institutional aspects	- Increased agricultural production - Increased farmer income	- Benchmark and post project evaluation - Mid term evaluation	There are no significant risks except that it will be very difficult to assess the individual contribution to increased production and income as other factors are also involved
Immediate objectives			
1. Produce adaptive research results which will be of immediate interest and applicability to NIRP	1. Adoption of innovations	1. Progress report of NIRP - External evaluation report	1. There are no significant risks
Outputs			
1. Establish a research unit	1. Sustainable IRMU	1. Progress report of NIRP - External evaluation report	1. There are no significant risks
2. A strategic research plan	2. Approved document	2. Review by RAC, NIRP, EEC WB	2. There is no risk of failure, but may be delayed due to time lag in obtaining comments from different organizations, officers etc.
3. IRMU direct research projects	3. No. of successful projects	3. Review of research reports by RAC, NIRP, EEC and WB	3. There is no specific risk except for time overrun and availability of trained personnel with IRMU
4. Contracted out research projects	4. No. of successful projects	4. Review of research reports by IRMU, NIRP, RAC, EEC, and WB	4. Availability of competent organization to undertake the work

LOGICAL FRAMEWORK (contd)

PROJECT STRUCTURE	INDICATORS OF ACHIEVEMENT	ASSESSMENT OF INDICATORS	RISKS/ASSUMPTIONS
5. Disseminated findings	5.-No. of workshops -No. of seminars -No. of newsletters -No. of technical papers -Spread of knowledge	5. Progress reports - Do - Do	5. No specific risks
6.Training	6.No. of training courses conduced and personnel trained	6. Review of the completion report of the courses	6. Unclear as to how long it might take for the staff to use acquired knowledge in actual field studies
7.Fellowships	7.No. of fellowships awarded	7. Progress report	7. There is no specific risk. There is an outside chance that some awardees may not successfully complete these studies
8.Improved methods of operation and maintenance of schemes	8.No. of cases of successful adoption	8. Annual report - review by NIRP, RAC, EEC, and WB	8. May not automatically ensure adoption because other factors may influence decision
9.Improved methods of water resources planning and utilization	9.No. of cases of successful adoption	9. Continuous monitoring	9. Conflict of interests and high cost
10.Improved cropping pattern	10.No. of cases of successful adoption	10. Progress reports continuous monitoring and evaluation by EEC, WB	10. Marketing problems may influence adoption
11.Research data for implementation	11.A research data bank of analyzed and evaluated data	11. Progress reports	11. Easy accessibility of data can occasionally be a problem
12.Improved library facilities	12.Increased nos. books, journals, modules etc. - Adequate space with matching physical facilities	12. Progress reports	12. No specific risk is involved
13.Improved awareness about environment	13.Building environment concerns in projects/studies	13. Evaluation by RAC, NIRP, EEC	13. low response from clients due to cost and other factors

WORKPLAN - LIFE OF PROJECT



ORGANIZATION, STAFFING AND COORDINATING MECHANISM

The organizational structure has been developed in the light of the recommendations of the consultation workshop of August 28, 1992. The structure, has been proposed to follow a disciplinary hierarchy basically for administrative purpose as well as to maintain uniformity with other ID units in terms of staff promotions and incentives. The activities of IRMU will, however be conducted in a programmatic mode to ensure optimal multi-disciplinary input. The organizational chart of the IRMU presented in Fig 1 also includes the technical assistance and the coordinating and regulatory mechanisms. The responsibility of successful establishment of IRMU and its development will be shared by Central Management Cell (CMC), the Project Director and Co-Project Director of NIRP and the Deputy Director, IRMU.

Organization of Irrigation Research Management Unit (IRMU)

The IRMU will be headed by a ID Deputy Director. For proper and effective functioning it is proposed that the IRMU be organized into the following four disciplines :

1. Irrigation and Drainage
2. Irrigation Agronomy
3. Socio-Economics
4. Environment.

Each discipline is to be headed by a Senior Scientist designated as Research Associate (equivalent to ID Chief Engineer). Each RA will be assisted by proposed number of senior research officers (equivalent to ID Senior Irrigation Engineer) and research officers (equivalent to ID Irrigation Engineers).

Four RAs are proposed for four program areas. In Irrigation and Drainage and Irrigation Agronomy each RA will be assisted by 2 SROs and 2 ROs. In Socio-economics and Environment program areas 2 SROs and 1 SRO respectively will assist the RA.

It is proposed that the IRMU will be fully staffed to 16 research staff at the end of the decade. The IRMU, however, shall have to initiate the process of approval of its organizational structure as well as creation of "cadre" for the non-engineering staff which is expected to take 2-3 years.

Recruitment and promotion: There are 3 possible ways these positions can be filled up. Secondment from other institutes/agencies, as a mode to fill up these positions has not been considered as this will not help develop in-house capability of IRMU.

- Seconding existing Irrigation Department officials with requisite qualification and experience and liking for research and then absorbing them in the unit when the proposed "cadre" is created.

  This however, will be applicable to program areas of Irrigation and Drainage and probably Environment. For other 2 program areas personnel with requisite qualification and experience may not be available within ID.

- Filling all the positions with open advertisement. This, however, will limit or even eliminate chances for the personnel in the lower echelon for future promotion and naturally will not be good for moral.

- Recruiting personnel with requisite qualification at the entry level and then promoting them to higher ranks when they have satisfied all the criteria that is followed in the ID for promoting existing staff at similar levels.

As a beginning (June 1993 - Feb 1994) 2 Research Officers for each program areas may be recruited. After their promotion to Senior Research Officers position, positions (four) in the Irrigation and Drainage and Irrigation Agronomy may be filled up by fresh recruitment. In the other 2 program areas after promotion the position of Research Officer will cease to exist. Of the 2 Senior Research Officers in each program area the "better" one will be promoted to the rank of the Research Associate once all the requirement of ID for promotion to the next higher position have been met. Similar practice will continue till all the positions are filled.

As no "cadre" exist in the Irrigation Department for non-engineers and also as there is no sanctioned post from the Treasury for IRMU it is recommended that these positions (all as ROs) be filled initially on contract. At the same time process must be initiated to create a regular "cadre" to attract and retain qualified researchers in the IRMU.

For 1993 it is proposed that IRMU recruit 4 research staff representing four suggested program areas. Three of them will be assigned to the three proposed field offices and the 4th person will be based at HQ and provide back up support.

Technical Assistance : International Irrigation Management Institute

IIMI is providing technical assistance for the establishment and functioning of the IRMU. IIMI staff input includes both international and national staff.

International Staff

The contract document calls for appointment of a Technical advisor on a fulltime basis during the first two years and on part time basis in the following two years with a total input of 36 mm. In addition two short term specialists with complementary skills from SLFO will provide 30 mm of input. It is, however recommended that short term input be extended to include four specialists (economist, social scientist, civil engineer and agronomist) because it is now recognized that the very nature of the IRMU activities require a low level but continuous input from a multidisciplinary team. The short term specialist are expected to provide support to all activities related to research and training. The total allocation of 30 mm will, however remain unchanged.

National Staff: Designated national staff includes one research associate and two research officers to help IRMU staff with field work including collection, analysis, evaluation and interpretation of data.

Staffing Schedule: The revised staffing schedule is presented in Fig. 4.1.

The main changes in the revised staffing schedule have resulted from the delay in starting the project and rescheduling the short term specialists input.

Project Staff

IRMU Staff:

P W C Dayaratna - Deputy Director, IRMU
To be identified - 4-Research Associates
N A Sisirkumara - Senior Research Officer
T P De Alwis - Senior Research Officer
To be identified - 5-Senior Research Officers
M.Jayathilaka - Research Officer
W.Chandrasiri - Research Officer
To be identified - 2- Research Officers

M/S Sisirakumara and de Alwis have been awarded fellowships for pursuing masters degrees and will join IRMU on January 1, 1995. Ms. Jayathilaka and Chandrasiri have been seconded from ID.

IIMI Technical Assistance Staff:

K.Azharul Haq - Technical Advisor
C.M.Wijayratna - Short Term Specialist (Agric. Economics)
R.Shakthivadivel - Short Term Specialist (Civil Engineer)
J.Brewer - Short Term Specialist (Social Scientist)
C.Nanayakkara - Research Associate
K.A.Hemakeerthi - Research Officer
W.J.J.Upasena - Research Officer

Job descriptions

The responsibilities of IRMU and technical assistance staff are given below:

Position: Deputy Director, IRMU

Main duties and responsibilities of the Deputy Director include:

* Responsible for conduct and supervision of all IRMU activities
* Ensuring that the technical assistance services are carried out to as per TOR
* Directing and coordinating the work of all team members
* Responsibility for the final contents, conclusions and recommendations of all reports
* Taking responsibility for all project account, financial statement and reporting
* Contributing directly to the technical matters of the project
* Preparation of annual work plan and budget
* Assists holding of RAC and RCC meetings
* Liaise with other ID units and national organizations working on irrigation research

Position: Technical Adviser, IRMU

The Technical Advisor will have overall responsibility on behalf of IIMI for directing and coordinating technical assistance services. The main duties and responsibilities include:

* Ensure that all technical assistance services are carried out to the highest professional standards and in conformity with the TOR
* Help establish and development of IRMU
* Provide training and advice on a day-to-day basis to the IRMU staff and its collaborators
* Assist the IRMU to develop and implement a research program using a wide variety of methodologies

* Coordinate other IIMI inputs into the IRMU's activities and supervise IIMI's research staff
* Contribute to the planning, implementation and evaluation of other components of NIRP through participation in various coordinating and management committees
* Assist DD, IRMU in conducting all activities related to IRMU

Position: Short Term Specialists

The principal duties and responsibilities of the short term specialists will be:

* Through IIMI technical assistance program provide input to the IRMU program in their area of specialization. This will include preparation of research proposals, design of the studies, data collection, processing and evaluation and report writing. They will also assists in the implementation of training programs by being resource persons in their respective areas of specialization.

Position: Research Associates

The Research Associates will be directly responsible to the Head, IRMU and under his direction specific responsibilities will be:

* Assisting and directing field-based research staff, as well as monitoring and coordinating research activities, in all the aspects, at field level.
* Initiate, as appropriate, and develop methodologies as well as data collection techniques to facilitate research work.
* Compiling research data, analyzing and preparing progress and seasonal reports.
* Assisting in the design and conduct of research directed towards evolving innovative practices in the management of irrigation systems.
* Disseminate information pertaining to research findings to managers of the irrigation projects and other clients as desirable/appropriate.
* Liaising with ID field engineers as well as farmers.
* Planning and implementing activities, such as seminars and workshops and training of personnel including farmers.
* Other duties as enumerated from time to time, by the supervisor or as inherent/implied in the job.

Position: Senior Research Officers and Research Officers

The Senior Research Officers and Research Officers will be directly responsible to the Research Associates. His/her specific responsibilities will be:

* Collection, analysis and interpretation of field data gathered.
* Tabulation of results as well as the preparation of drafts reports pertaining to field research activities.
* Assisting in the evaluation of research based innovations and assessing the impact on irrigated agriculture of such innovative practices.
* Installation and calibration of data gathering instruments/devices, where applicable, as well as ensuring their security, care and maintenance.
* Systematically assisting fellow researchers/co-researchers by providing them with processed data for their use.
* Other duties, as enumerated by the Supervisor, from time to time, or as implied or inherent in the job.

Coordinating Mechanism

Research Advisory Committee (RAC):

To oversee the activities of the IRMU the establishment of a Research Advisory Committee with representatives from the following organizations was proposed which was approved by the PCC in its first meeting held on 5.3.1993.

Chairman: Mr. L.U. Weerakoon,
State Secretary of Irrigation

Member-Secretary: Mr. P.W.C. Dayaratna,
Deputy Director IRMU

Members: Mr. K. Yoganathan,
Director Irrigation Department

Mr. L.T. Wijesuriya
Senior Deputy Director, Rehabilitation

Director, IMD or his Representative

Mr. K.S.R. de Silva,
Project Director, NIRP

Mr. G.O. Uittenbogaard,
Co-Project Director, NIRP

Dr. S.L. Amarasiri
Deputy Director, Research
Department of Agriculture

Mr. W.M.U. Navaratna
Engineer, Water Management
Agrarian Services

Director or his Representative
Agrarian Research and Training Institute

Dr. Kapila Gunasekera
Assoc. Professor,
Department of Agric. Eng.
University of Peradeniya.

Prof. L.L. Ratnayake
Head, Department of Civil Engineering
Moratuwa University.

Mrs. Vajira Liyanage
Council of Agricultural Research Policies

Mr. G. de Silva
Mahaweli Economic Agency

Dr. C.M. Wijayaratna
Head IIMI/SLFO

Dr. K. Azharul Haq
Technical Advisor, IRMU.

Research Coordination Committee

For providing technical input to IRMU program it was recommended that a Research Coordination Committee (RCC) at the ID be set up. The RAC has accepted the recommendation in its first meeting on 23.3.1993 and a RCC has been established with the following members:

Senior Deputy Director, Rehabilitation - Chairman
Deputy Director, IRMU - Member Secretary
Members
Senior Deputy Director, Project Development and Specialized Services
Senior Deputy Director, Operation and Maintenance

Project Director, NIRP
Technical Advisor, IRMU/IIMI
Head IIMI/SLFO.

Range Research Coordination Committee (RRCC)

In order to coordinate research work at the field level it was recommended that Range Research Coordination Committees be constituted with the respective Deputy Director, Irrigation as the Chairman. Members of the Committee will be drawn from IRMU (including TA team) and other staff of the range directly involved in IRMU sponsored activities. Members from other agencies/department located in the range can also be coopted as and when there is a demonstrated need. The RAC in its first meeting held on March 23, 1993 has approved the formation of the above committees.

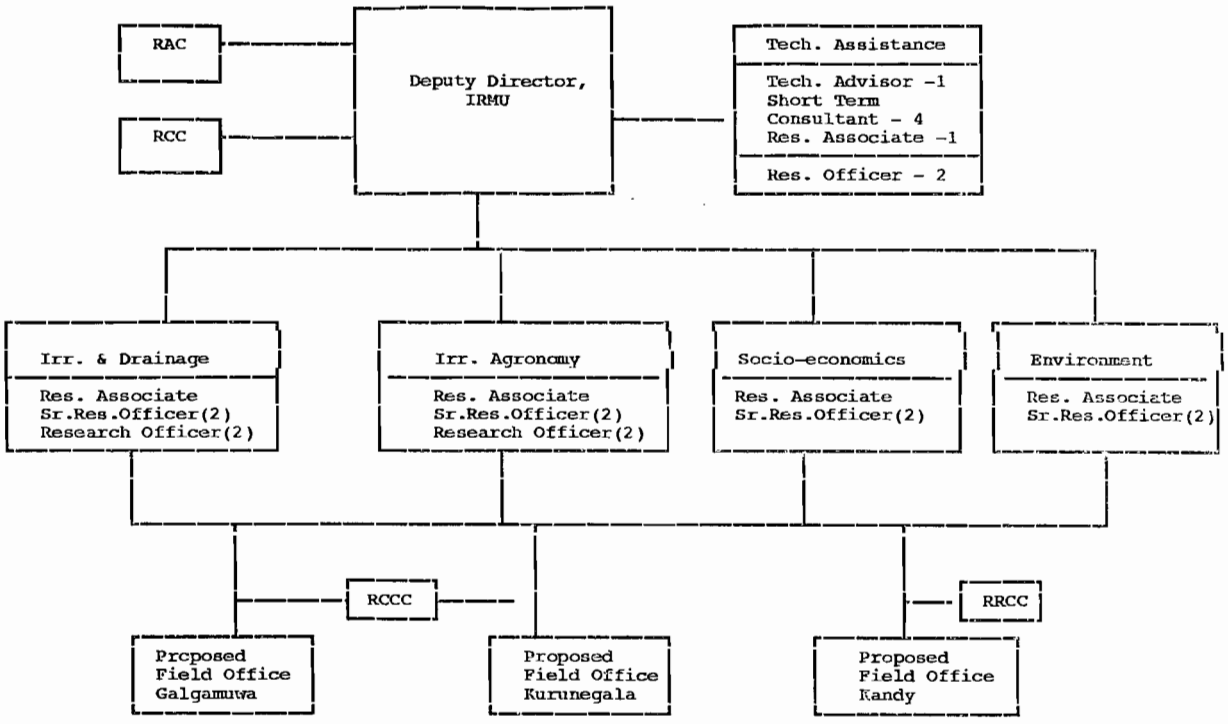
Reporting Requirements

The following reports will be submitted in accordance with the reporting requirements:

2

Report	Date of Submission
Inception Report	First Draft - January 1993 Final- April 1993
Quarterly Reports	15 March 1993 (upto December 1992) 30 April 1993, 1994, 1995, 1996, 31 July 1993, 1994, 1995, 31 October 1993, 1994, 1995
Annual Report	31 January 1994, 1995, 1996
Final Report	31 July 1996.

FIGURE 1: PROPOSED ORGANIZATIONAL STRUCTURE AND COORDINATING MECHANISM OF IRMU



PROGRESS OF RESEARCH STUDIES UPTO 31 MARCH 1995

Program : Local Management of Irrigation Systems & Turnover

1. Study on the turn over process of the NIRP schemes

Research Mode : Contracted to AR&TI.

Objective(s) : To assess effectiveness of farmer organizations in the operation and maintenance of the schemes handed over after rehabilitation including resource mobilization for O&M.

Date of commencement : June, 1995

tDate of completion : May, 1997

Duration : 2 years

Field sites : 2 completed schemes under NIRP

Estimated cost : Rs. 700,000

2. Strengthening farmer organizations through increased participation of female farmers

Research Mode : By IRMU

Objectives : To assess, a) the degree and nature of women's involvement in FOs, b) identify the main constraints for women to assume active roles in FOs, c) formulate an action plan for the promotion of increased participation of women in FOs.

Date of commencement : March 1995

Date of completion : December 1996

Duration : 10 months

Field sites : To be selected from NIRP schemes

Estimated cost : Rs. 500,000.

Program : Improving Management of Irrigation Schemes

3. **Participatory action research for improved system management and increased production in NIRP minor irrigation schemes.**

Research Mode : IRMU

Objective(s) : To develop an implementation strategy for the after care of the rehabilitated scheme

Date of commencement : February 1995

Date of completion : January 1997

Duration : 2 years

Field sites : Dunupotha Wewa in Kurunegala and Maha Kiri Ibbewa in Anuradhapura districts

Estimated cost : Rs. 400,000

4. **Estimation of tank yields and review of spill design formulae for minor tanks**

Research Mode : Collaborative with Hydrology Division, ID

Objective(s) : To improve yield estimation for small catchments by recalibrating model parameters for flood estimation formulae.

Date of commencement : January 1, 1995

Date of completion : June 30, 1997

Duration : 2.5 years

Field Site(s) : 8 schemes from Kurunegala and Matale districts.

Estimated cost : Rs. 430,000

5. **Evaluation and use of computer models for improving irrigation management**

Research Mode : Collaboration with Range Deputy Directors, ID

Objective(s) : Pilot test locally developed/modified computer assisted models for improved management of irrigation systems.

Date of commencement : July 1, 1993

Date of completion : June 30, 1995

Duration : 2.0 years

Field sites : Buttala anicut scheme (NIRP), Moneragala district, Kekandura scheme (NIRP), Matara district, Rajangana scheme, Anuradhapura district and Badagiriya scheme, Hambantota district

Estimated cost : Rs. 1,222,000

6. **Semi Automatic flow control systems in Improving O&M of irrigation systems**

Research Mode : By IRMU

Objective(s) :

a. To test the adoption of semi automatic flow control system in flow regulations by FO's in irrigation system

b. Study and compare the performance of conventional flow regulators and semi automatic flow control systemss in efficiency and economy of water use.

Date of commencement : March, 1995

Date of completion : June, 1997

Duration : 2.0 years

Field Site(s) : A medium irrigation system, preferably from Gampaha district.

Estimated cost : Rs. 163,900

Program : Irrigation Management for Crop Diversification

7. Irrigation Management for crop diversification in minor schemes

Research Mode : Contracted to University of Peradeniya.

Objective(s) : To identify appropriate water management practices for diversified cropping in NIRP schemes to increase productivity and farmers income.

Date of commencement : April, 1995

Date of completion : March, 1997

Duration : 2 years

Field sites : To be finalized with the collaborating/contracting agency

Estimated cost : Rs. 600,000

Program : Environmental Studies

8. Assessment of tank bed siltation

Research Mode : Contracted to University of Peradeniya.

Objective(s) : To quantify sediment input to the reservoir and its temporal and spatial distribution over two sediment years.

Date of commencement : March, 1995

Date of completion : February, 1997

Duration : 2.0 years

Field Site(s) : 3 sites to be identified from schemes to be rehabilitated under NIRP

Estimated cost : Rs. 1,000,000

9. Study on catchment degradation of minor tanks catchments

Research Mode : Possible contract to University of Peradeniya.

Objective(s) : Systematic identification of process and quantification of catchment degradation and prepare a total catchment management plan.

Date of commencement : June, 1995

Date of completion : May, 1997

Duration : 2.0 years

Field Site(s) : Murapola scheme in Kandy district and two other NIRP schemes (to be identified)

Estimated cost : Rs. 1,000,000

10. Archaeological study on ancient irrigation systems

Research Mode : Contracted to Institute of Fundamental Studies.

Objective(s) : To document ancient irrigation technologies and to prevent loss of national cultural heritage through the obliteration of archaeoligical material during the NIRP construction activities.

Date of commencement : April, 1995

Date of completion : March, 1997

Duration : 2.0 years

Field Site(s) : To be selected

Estimated cost : Rs. 3,750,000

Appendix 3.5

SEMINARS CONDUCTED

DATE	TITLE	RESOURCE PERSON(S)
17.02.92	Application of Performance Measurements in Irrigation Management	Mr. C. Abernethy, Senior Technical Advisor/IIMI
15.03.93	Analytic Solution for Water Profile in an Irrigation Canal	Mr. G.G.A. Godaliyadde, Deputy Director, Irrigation Department, Moneragala
01.04.93	Managing Irrigation Deliveries for Non-Rice Crops	Dr. C.R. Panabokke, Senior Associate - IIMI
28.04.93	Application of Relative Water Supply Concept for Performance Monitoring in Irrigation Systems	Mr. N. Fernando, Range Deputy Director, Polonnaruwa
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27.05.96	Preliminary Findings from the Tank Bed Siltation Study	Dr. N. Wickramanayake, Senior Lecturer, University of Peradeniya
24.06.96	Preliminary Findings from the Archaeological Study on Ancient Irrigation Systems	Dr. Prickett Fernando, Senior Scientist, Institute of Fundamental Studies

AWARD OF FELLOWSHIPS

Name of the Awardee	University	Course	Degree	Date of Award	Duration
Mr. T.P. Alwis	U.M.	Environmental Engineering	M. Eng	May 1993	18 months
Mr. N.A. Sisirakumara	U.M.	Environmental Engineering and Management	M. Eng	May 1993	18 months
Mr. C. Devendra	U.P.	Soil and Water (Field) Engineering	M.Phil	Sept. 1993	36 months
Mr. L.W. Seneviratne	U.M.	Environmental Engineering and Management	M. Eng	October 1995	12 months
Mr. N.N. Kamaladasa	PIM, Sri Jayawarda-nepura	Master of Bussiness Administration	MBA	June 1996	30 months

ACRONYMS

ARTI	-	Agrarian Research and Training Institute
CEC	-	Commission of the European Community
CMC	-	Central Management Cell
DAS	-	Department of Agrarian Services
DI	-	Director of Irrigation
DOA	-	Department of Agriculture
ID	-	Irrigation Department
IRMU	-	Irrigation Research Management Unit
IIMI	-	International Irrigation Management Institute
IMPSA	-	Irrigation Management Policy Support Activity
IRDP	-	Integrated Rural Development Project
ISMP	-	Irrigation Systems Management Project
MLI&MD	-	Ministry of Lands, Irrigation and Mahaweli Development
NIRP	-	National Irrigation Rehabilitation Project
NGO	-	Non Governmental Organization
O&M	-	Operations and Maintenance
PAR	-	Participatory Action Research
PCC	-	Project Coordinating Committee
PGIA	-	Post Graduate Institute of Agriculture
RAC	-	Research Advisory Committee
RRCC	-	Range Research Coordinating Committee
R&M	-	Rehabilitation and Modernization
SLFO	-	Sri Lanka Field Operations
SLITI	-	Sri Lanka Irrigation Training Institute
VIRP	-	Village Irrigation Rehabilitation Project