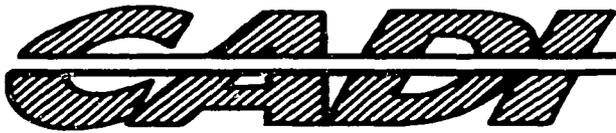


PD-ABL-706



Computer Assisted Development, Inc.

96147

## CONTRACT COMPLETION REPORT

August 1995



Computer Assisted Development, Inc.  
1635 Blue Spruce Drive, Suite 101  
Fort Collins, Colorado 80524  
USA

His Majesty's Government  
Ministry of Water Resources  
Department of Irrigation  
Irrigation Management Division

## **Irrigation Management Project**

Contract No. 367-0153-C-00-1235-00  
Project No. 367-0153

## **CADI Contract Completion Report**

for

Office of Agriculture and Rural Development  
U.S. Agency for International Development  
Kathmandu, Nepal

by

Computer Assisted Development, Inc.  
1635 Blue Spruce Drive, Suite 101  
Fort Collins, Colorado 80524  
USA

August 1995

## PREFACE

The overall objective of this contract was to provide the technical assistance needed to help implement the re-structured Irrigation Management Project designed to improve the capacity of His Majesty's Government of Nepal; through its Department of Irrigation, to respond national need for improving the effectiveness of irrigation systems.

The following technical assistance team, consisting of two private consulting firms, provided technical and managerial expertise to the Department of Irrigation through the Irrigation Management Project (IMP) from 1991 to 1995.

**Computer Assisted Development, Inc. (CADI)**, Fort Collins, Colorado, USA is responsible for providing extensive international expertise in irrigation and agricultural engineering, social and institutional development, training and human resource development, research, and management to the IMD of the Department of Irrigation.

**GEOCE Consultants (P.) Ltd.**, Kathmandu, Nepal provides extensive domestic expertise in irrigation and agricultural engineering, social and institutional development, training and human resource development, research, and management to the IMD of the Department of Irrigation.

USAID support for irrigation management activities over the last 10 years has been very appropriate and effective. CADI is encouraged the Department of Irrigation's joint management and turnover programs will continue with full force under the new project. Irrigation Management Transfer Project funded by the Asian Development Bank and USAID.

This contract completion report covers major changes of the irrigation institutional environment during the four-year period, accomplishments, lessons learned, recommendations for program continuation, reports produced, and level of effort provided.

## EXECUTIVE SUMMARY

The Irrigation Management Project, initiated in 1985, had the purpose of increasing the institutional capability of the Department of Irrigation, other Government line agencies, and farmers to develop and sustain efficient irrigation management practices. The objective of CADI's contract with USAID was to provide technical assistance needed to help implement IMP to improve the capacity of HMG/N, through DOI, to respond to the increased national need for improving the effectiveness of irrigation systems. The duration of CADI's contract was from July 8, 1991 to June 15, 1995.

During its four year term with IMP, there has been significant progress in improving irrigation management in Nepal. CADI, working as a team with DOI, GEOCE, and farmers has been able to realize the following achievements:

- ▶ *The establishment and strengthening of IMD.* This marked the institutionalization of irrigation management functions within the Department of Irrigation.
- ▶ *Capability Buildup of Irrigation Professionals.* Professionals from a variety of disciplines and institutions including DOI, local and expatriate TA have been trained from the practical experience gained during IMP implementation.
- ▶ *The promotion local level democracy, through the establishment and strengthening of WUAs.* CADI has helped to develop processes and procedures for WUA formation and strengthening, and has assisted in effectively implementing these procedures. Several successful WUAs have been formed on agency managed systems through IMP.
- ▶ *The promotion of privatization through DOI's joint management and turnover programs.* CADI has provided key assistance in process development and implementation of DOI's program to transfer management of irrigation systems from HMG to WUAs. The programs will continue through the HMG-USAID-ADB Irrigation Management Transfer Project.
- ▶ *Improvements in local management, production and income for farmers in irrigated agriculture.* Through support of WUAs, DOI, and programs of joint management and turnover, measured increase in production and income have been achieved. A major reason for these increases has been local management of water resources.
- ▶ *Support of irrigation management functions of maintenance, operations, resource mobilization, farmer organizations, monitoring and evaluation, training, and research.* CADI has been directly involved with DOI and farmers to improve the capacity of DOI and farmers in irrigation management functions.

- ▶ *Input to Policy and Regulations.* Through its field experience, the IMP team have been able to provide key input to policy regarding irrigation and water resources.
- ▶ *Support of Ministry of Water Resources in its hydropower development activities.* CADI has provided key support by providing advise on legislature and contracting procedures that promote private sector investment in hydropower.

To obtain these achievements CADI provided a total of 47.5 months of long term TA and 40 person months of short term TA. The TA were involved in developing processes, developing and implementing training, and working as a team with DOI to perform research and system management activities.

CADI TA was involved developing and presenting a total of 27 training, talk programs and seminar activities where 648 participants were involved. This capability buildup has led to an increased number of manpower capable of to carry out irrigation management activities, an increased awareness of the importance of irrigation management, and WUAs that are more capable or running their irrigation systems.

CADI supported DOI in several applied research activities focusing on irrigation management. Working as a team with DOI, CADI has assisted with evaluation studies, rapid appraisals, diagnostic studies and special studies. These research activities have helped to shed light on actual field situation faced by farmers and DOI implementors.

System management activities of O&M, WUA formation and strengthening, resource mobilization, monitoring and evaluation, joint management and turnover all received considerable attention from CADI. CADI worked closely with the Irrigation Management Division in developing procedures and implementing the joint management and turnover program.

The joint management and turnover programs are expanding rapidly in Nepal. CADI worked with DOI and farmers to form and strengthen WUAs at eight irrigation systems. Additionally, CADI has worked with DOI and farmers on O&M and monitoring. The results of this program has been very encouraging with measured increases in production and income. The DOI will continue the program on the base that has been developed.

With the Irrigation Management Division in the DOI firmly in place and a cadre of professionals involved in irrigation management, CADI feels that the impact of IMP will sustain. Continued and expanding emphasis should be placed on the research and training programs. CADI is also pleased that the joint management and turnover programs are continuing with full enthusiasm.

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## **1. INTRODUCTION**

### **1.1 Objective of this Contract**

The Irrigation Management Project (IMP) was initiated in 1985 with the purpose of increasing the institutional capability of the Department of Irrigation (DOI), other Government of Nepal agencies, and farmers to develop and sustain efficient irrigation management practices. The project established a Systems Management Division, responsible for operation and maintenance (O&M), monitoring and evaluation, water users associations, and an Irrigation Management Center responsible for training and applied research activities. The IMP supported the two institutions in a project mode, outside of the DOI.

The IMP was redesigned in 1989 to respond to new opportunities provided by changes in the DOI institutional environment. In essence, the redesign changed the IMP from a project, peripheral to mainstream DOI activities, to a program in support of the institutional development process. The functions and activities of the original IMP were taken up by two DOI agencies, the Research and Training Branch (RTB) and the Systems Management Branch (SMB). Now the irrigation management functions are firmly institutionalized in the Irrigation Management Division (IMD) and its three branches, the Human Resources Development and Training Branch (HRDTB), the Research and Technology Development Branch (RTDB), and the Systems Management Branch (SMB).

A USAID contract was awarded to Computer Assisted Development, Inc. (CADI) on July 8, 1991 under the IMP. The purpose of CADI's contract was to provide technical assistance and administrative support to strengthen DOI's capacity to implement participatory approaches in irrigation management and farmer assistance programs by institutionalizing and strengthening IMD (formerly the RTB and SMB). The IMD is responsible for field directed activities, developing, and refining procedures for improved irrigation system O&M and water user participation in irrigation system management. CADI's objective was to provide the technical assistance needed to help implement the restructured IMP designed to improve the capacity, through DOI, to respond to the increased national need for improving the effectiveness of irrigation systems.

### **1.2 Purpose of the Contract Completion Report**

This report is submitted to the Irrigation Management Division (IMD), DOI and the Office of Agriculture and Rural Development, United States Agency for International Development (USAID), Kathmandu, Nepal by CADI in compliance with the contract number 367-0153-C-00-1235-00 for the IMP.

The contract between USAID and CADI requires the submission of a final report that reviews accomplishments, discusses lessons learned, sets recommendations for program continuation, and summarizes the managerial and administrative activities. This report covers the eighth reporting period of the contract from January 9, 1995 through June 15, 1995, as

well as summarizing project activities and accomplishments since contract inception. The purpose of this report is to present an overview of CADI's technical, managerial and administrative activities under this project.

## **2. IRRIGATION INSTITUTIONAL ENVIRONMENT DURING THE FOUR YEAR PERIOD**

During CADI's term in Nepal, several change within the Department of Irrigation were observed. The DOI, traditionally a construction agency, has been evolving into a service providing agency. An increasing emphasis is placed on improving water delivery service and agricultural production. IMP was well placed to make some positive contributions during this transition.

At the start of the CADI contract, the DOI and the Ministry of Water Resources felt a need to re-orient the DOI from a construction agency to a service providing agency, placing greater emphasis on irrigation management. An officiating Director General (DG) was acting to administer the DOI until a new DG was selected in late November 1991. The new DG acted quickly to transform the department by assigning task forces on irrigation policy and a new departmental organization.

As of July, 1991, functions of RTB and SMB were under the Planning Design and Research Division. However, RTB and SMB were not officially recognized units within the DOI. Realizing the importance of management functions such as operation and maintenance (O&M), institutional development, improving the participatory approach through joint management and turnover, a new division was formed in November, 1991, the Irrigation Management and Water Utilization Division (IMWUD). Functions supported by the IMP were moved into this division.

The irrigation environment during this period placed a much greater emphasis on irrigation management. To improve irrigation, there existed a need for improved operation and maintenance achieved by increased water user association involvement. The SMB and RTB were to be instrumental in bringing about these changes. There was a clear and growing mandate for the IMP to support the functions of these two branches.

During the second reporting period continued work was being done on the new irrigation policy, new irrigation regulations, and revised structure of the DOI. It was expected that the reforms would soon be completed. In line with the restructuring, several exercises were held to define the roles and functions of IMWUD. However, formal recognition of RTB and SMB had not yet taken place, leading to lack of recognition by other DOI offices and difficulties in implementation of the IMP activities. It remained clear that the roles of RTB and SMB were critical for developing and implementing procedures for O&M, joint management, and turnover, and reorienting the DOI to management.

The third reporting period saw continued transformation and changes within the Department of Irrigation. The Irrigation Policy, 2049 (1992), was completed and circulated. This policy recognized the vital role of irrigation management, and among other things, called for: an increased role of water users in management; training for improved management; job descriptions; and monitoring and evaluation. The IMP was a key player in supporting DOI in these activities.

During this same period, IMWUD's mandate was clear. IMWUD had requested a mandate from DOI to carry out its work in systems management, training, and research. A letter from the Director General (DG) to the Deputy Director General (DDG) of IMWUD stated that IMWUD was to allocate O&M budget to 25 agency-managed systems and monitor its expenditure. The same letter stated that IMWUD was to be the lead DOI organization for the Rajapur, East Rapti, Irrigation Management Transfer, and Institutional Development Support projects, all dealing with management issues. Another letter stated that IMWUD was to have a lead role for participatory management in large projects (Narayani, Sunsari Morang, Mahakali, etc.). IMWUD's role had greatly expanded.

There was a major shift in personnel within the DOI. A new Director General was placed in November, 1992. The Chief of the Systems Management and Training Program (SMTP), Mr. B. K. Aryal, was promoted to DDG of Surface Water and Groundwater. The Chief of RTB, Mr. R. R. S. Neupane, was promoted to system manager of Sunsari-Morang Irrigation Project, the largest irrigation system in Nepal. The Chief of SMB, Mr. R. P. Styal, was promoted to SMTP Chief. These promotions presented a positive opportunity for irrigation management, as we saw important posts given to those with background and expertise in irrigation management.

The fourth reporting period was a time of increasing credibility and responsibility for RTB and SMB, further establishing them as viable units with DOI. RTB and SMB continued their field related system management activities, and continued their research and training activities.

New chiefs of SMB and RTB took up their responsibility. Mr. Shyam Rajbhandari, SMB Chief, brought much field related experience to his post. Dr. Khem Raj Sharma, RTB Chief, through his experience would contribute greatly in applied research and training. The new chiefs, plus the Officiating Chief of SMTP adapted well to the expanding work load of RTB and SMB.

The fifth and sixth reporting periods were a time of further institution building, applied field activities, and expansion of programs. The Irrigation Management Division (IMD) was in the process of changing its organizational structure as part of an overall DOI reorganization. The functions of system management, research, and training were placed under three separate branches: the System Management Branch (SMB), Research and Technology Development Branch (RTDB), and the Human Resource Development and Training Branch (HRDTB). These replaced the existing SMB and RTB. The reorganization

would place system management, training, and research functions firmly within the DOI organizational structure.

The scope of irrigation management activities continued to expand rapidly. There was growing interest from small to large completed irrigation systems to initiate or enhance their system management activities. During this time, IMD was deeply involved in management transfer programs of joint management and turnover. Additionally, IMD was to play a major role in the management of completed large irrigation systems like Narayani. To meet the growing demand for its services, it would be necessary for IMD to manage activities of their core staff, recruit and monitor outside resources, and enhance the capability of staff working at the field level and on other projects.

Further institution building, applied field activities, and expansion of programs continued during the sixth reporting period. SMB and RTB branches were operational during the reporting period.

During the seventh reporting period the three branches under IMD, the System Management Branch (SMB), Research and Technology Development Branch (RTDB), and the Human Resource Development and Training Branch (HRDTB) became operational. Combining Human Resource Development with Training and Technology Development with Research actually further increased the scope for IMD past irrigation management. Each of the three branches prepared separate workplans, but under one umbrella of the System Management and Training Program (SMTP). TA support was given to each branch.

The scope of field-related irrigation management activities continued to expand rapidly. There was a growing interest from small to large completed irrigation systems to initiate or enhance their system management activities. IMD was deeply involved in management transfer programs of joint management and turnover. Additionally, IMD was preparing to play a major role in the management of completed large irrigation systems like Narayani.

During the final reporting period, the pace of field activities increased from the previous period. Progress continued at joint management and turnover sites. The IMD continued to support O&M projects and work at Irrigation Management Transfer sites. Meanwhile, during the final months of IMP, TA focused on consolidating gains during implementation of IMP.

IMD, its branches, and irrigation management concepts and applications have certainly progressed through the years of IMP. Looking toward the future, there are capable individuals within the Department of Irrigation and farming community that will continue to improve irrigation management. Farmers through their WUAs are well poised to sustain the management of irrigation systems. With commitment from high levels, irrigation management functions supported by IMP will sustain.

### 3. ACHIEVEMENTS

#### 3.1 Overview

During CADI's four years with IMP, there has been significant progress in improving irrigation management functions in Nepal. CADI, working as a team with DOI, GEOCE, and farmers has been able to realize the following achievements:

- ▶ *The establishment and strengthening of IMD.* This marked the institutionalization of irrigation management functions within the Department of Irrigation.
- ▶ *Capability Buildup of Irrigation Professionals.* Professionals from a variety of disciplines and institutions including DOI, local and expatriate TA have been trained from the practical experience gained during IMP implementation.
- ▶ *The promotion local level democracy, through the establishment and strengthening of WUAs.* CADI has helped to develop process and procedures for WUA formation and strengthening, and has assisted in effectively implementing these procedures. Several successful WUAs have been formed on agency managed systems.
- ▶ *The promotion of privatization through DOI's joint management and turnover programs.* CADI has provided key assistance in process development and implementation of DOI's program to transfer management of irrigation systems from HMG to WUAs. The programs will continue through the HMG-USAID-ADB Irrigation Management Transfer Project.
- ▶ *Improvements in local management, production and income for farmers in irrigated agriculture.* Through support of WUAs, DOI, and programs of joint management and turnover, measured increase in production and income have been achieved. A major reason for these increases has been local management of water resources.
- ▶ *Support of irrigation management functions of maintenance, operations, resource mobilization, farmer organizations, monitoring and evaluation, training, and research.* CADI has been directly involved with DOI and farmers to improve the capacity of DOI and farmers in irrigation management functions.
- ▶ *Input to Policy and Regulations.* Through its field experience, the IMP team have been able to provide key input to policy regarding irrigation and water resources.
- ▶ *Support of Ministry of Water Resources in its hydropower development activities.* CADI has provided key support by providing advise on legislature and contracting procedures that promote private sector investment in hydropower.

## **3.2 Institutional Development and Strengthening**

### **Team Building**

Much of the progress made by IMP was due to the team approach developed amongst the DOI, TA teams, and USAID. One of the challenging aspects of implementing IMP was to keep clear understanding of roles and responsibilities of the different parties. The team building was accomplished by open lines of communication, and ability of all parties to respond to the other's needs.

### **Assistance with DOI/IMD Organization**

In its transition, the DOI's organizational structure has been somewhat fluid during CADI's time with IMP. There have been several changes summarized in Figures 1 and 2 regarding irrigation management functions within DOI's organization. These changes have been inspired by the need to best fit new irrigation management functions within the Department of Irrigation. CADI has provided input into the organizational structure and often provided advise on appropriate roles of branches and divisions responsible for irrigation management.

A challenge for IMD has been to retain experienced, well trained personnel. The vision for IMD has been to retain a core staff at the center of professionals to carry out research, training, and system management needs. This core staff would work closely with field staff providing backstopping and consultative support. Transfers would occur, but enough core group would be maintained so that information can be transferred to the new professionals. During the past four years, transfers have been a problem. But, during the last three years, a very well trained and effective core group is emerging at IMD.

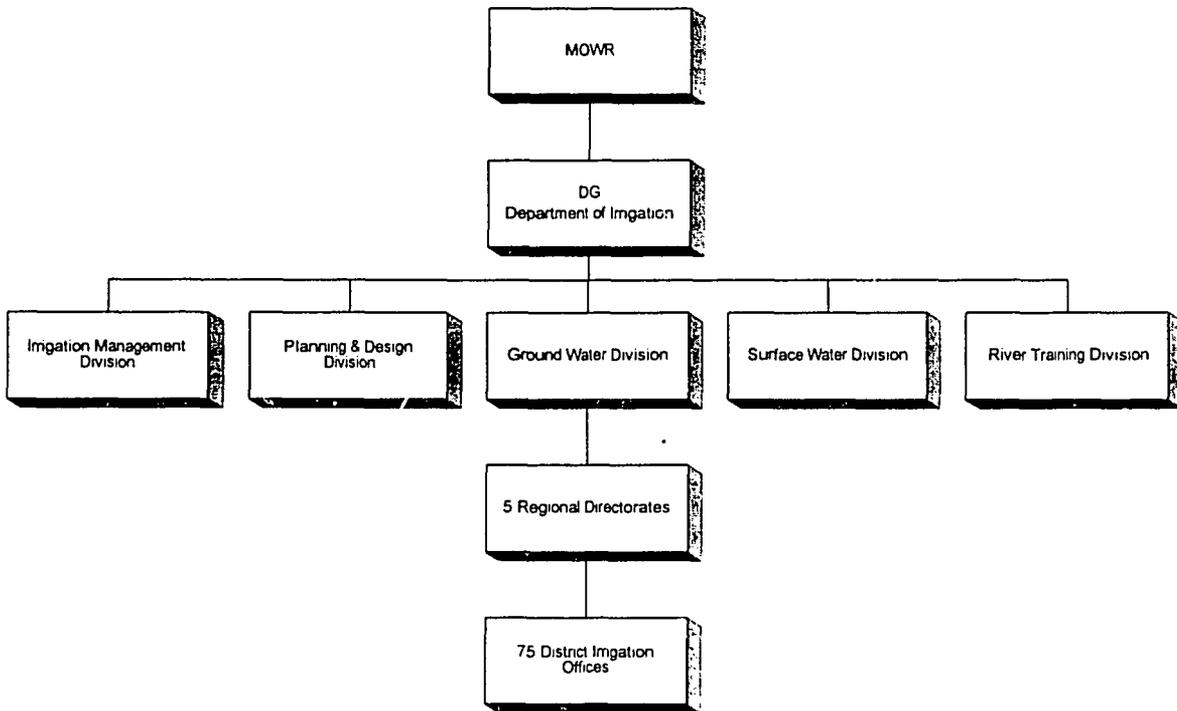
A new, permanent office building for IMD was established in Jawalakhel. IMP funds and the World Bank supported Institutional Development Project (IDS) were used in the renovation of this building. The building is now a permanent home for IMD and further marked IMD as a permanent institution within DOI.

While IMD has developed into quite a strong institution within DOI, there remain certain challenges. The link between IMD and DOI field offices and Regional Directorates needs better definition and implementation.

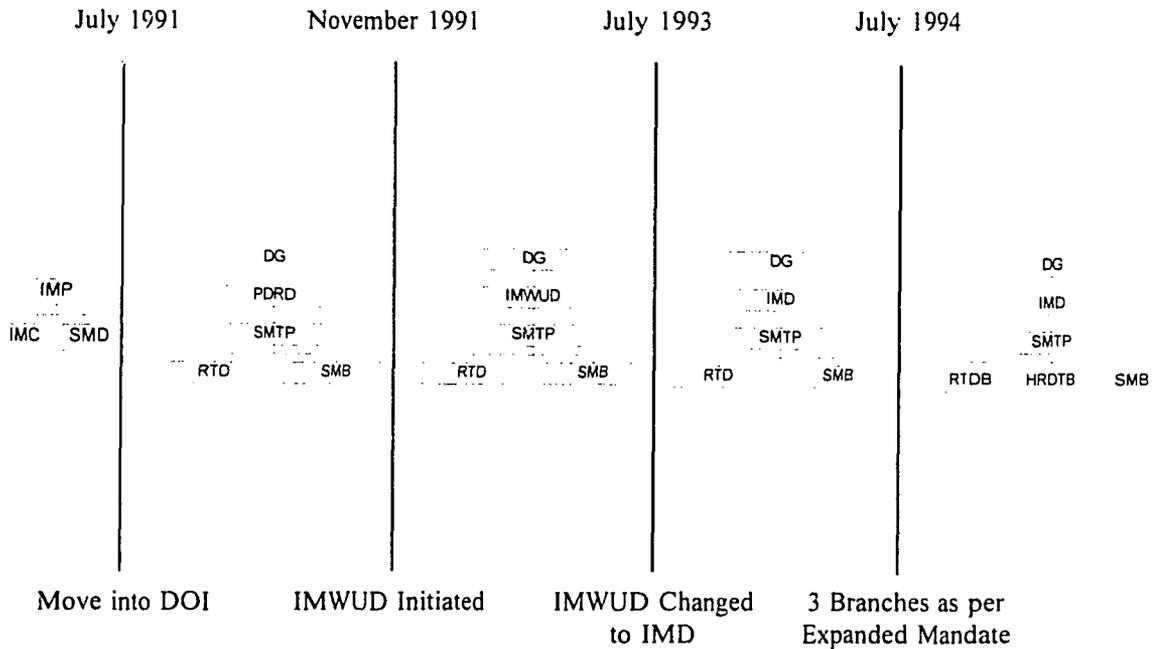
### **Strengthening IMD Library**

The IMD library, located at the new IMD headquarters, is proving to be a useful asset to many irrigation professionals. CADI through IMP has provided 17 books, six journals, and four video tapes to the library. Through SMTP funding CADI has supplied 69 books to the library. A list of these books and videotapes is attached in the Appendix.

**Figure 1. Present DOI Organization Structure**



**Figure 2. Evolution of IMD**



### 3.3 Applied Research Activities

CADI has provided research support to DOI by either participating in research programs, or by providing technical advise on research activities. CADI worked with the RTDB to develop research proposals, write scopes of work, and select contractors for performing research work. A list of activities where CADI provided assistance is listed below:

- ▶ A study on Kathmandu Valley O&M costs
- ▶ A study of Women Vegetable Producer Sellers in the Kathmandu Valley
- ▶ Developed methods of preparing terms of reference and evaluating proposals
- ▶ Evaluation of Sinkalama Irrigation Project
- ▶ Rapid appraisal techniques
- ▶ Rapid appraisal for Developing a Baseline Study at Kankai Irrigation System performed by the National Administrative Staff College (NASC) under the supervision of RTB
- ▶ Developed procedures for rapid appraisal to be used for turnover
- ▶ A draft rating form for irrigation systems identified for turnover to prioritize systems for turnover
- ▶ A rapid appraisal of Manusmara Irrigation System
- ▶ Provided advise and limited assistance to graduate students Bryan Thoreson and Shanti Nath Shrestha on their studies being conducted through RTB.
- ▶ Performed a sediment study at West Gandak Irrigation System
- ▶ Advise on equipment procurement to RTDB and SMB Chiefs for research, training, and system management activities
- ▶ Research on hydraulic operations and seepage loss at Khageri irrigation system
- ▶ Advise on ME&F and water cess studies
- ▶ Advise on the process of WUA formation and process documentation for formation
- ▶ Water augmentation study at Khageri

- ▶ Evaluation of Irrigation Line of Credit Project
- ▶ Evaluation of Irrigation Sector Project
- ▶ Research on tertiary development needs at Khageri and Panchkanya

The Research and Training Branch, independently or in collaboration with other agencies, has completed several research activities. The RTDB is in a good position to expand its research scope in Nepal without further IMP assistance.

### **3.4 Human Resource Development**

#### **Individual Study Programs**

The IMP has provision for several short term, out-of-country training activities and for long term, out-of-country master degree studies. To date, participants have been sent to study tours, special training courses, and conferences held in China, Mexico, Thailand, Indonesia, Philippines, Netherlands, and the U.S.A. Four engineers successfully completed their masters degrees at Asian Institute of Technology in Bangkok, and one completed his master's degree in Sociology at Colorado State University.

## Training Activities

Part of CADI's role was the responsibility for providing training leaders to carry out workshops and courses through the short and long term TA:

Training Course	CADI Resource Person	Date	Number of Attendees
Irrigation Water Control and Measurement	Dr. Ramchand Oad	December 31, 1991	22
Organization Assessment of Irrigation	Dr. David M. Freeman	January 16, 1992	14
Microcomputer Applications in Irrigation Data Management	Mr. Robert E. Barrett	January 5, 1992 to January 24, 1992	14
Applied Research Methodologies	Dr. Larry J. Nelson	February 3, 1992 to February 21, 1992	15
Organizational Aspects of Irrigation Management	Dr. John Wilkins-Wells	March 8, 1992 to March 29, 1992	20
Turnover Strategy Development--Talk Program	Dr. W. Robert Laitos	March 11, 1992	40
Joint Management Strategy Development--Talk Program	Dr. W. Robert Laitos	March 31, 1992	30
Production of O&M Guidelines--Talk Program	Mr. Gaylord V. Skogerboe	May 26, 1992 and June 1, 1992	17 35
Procuring and Managing Services	Dr. David J. Molden	October 13, 1992 to October 15, 1992	17
Training Methodologies	Dr. James L. Layton	November 30, 1992 to December 4, 1992	23
Action Training on Maintenance, Operation and Share System	Mr. John Wilkins-Wells and Mr. Gaylord V. Skogerboe	February 15, 1993 to March 12, 1993 and February 28, 1993 to March 24, 1993	76
Value Engineering Workshop	Mr. William L. Kelly and Mr. Gary W. Long	May 17, 1993 to May 21, 1993	36
Leadership Training	Ms. Arlene D. Blum and Ms. Nancy E. Tesell	August 8, 1993 to August 10, 1993	31
Hydraulic Operations Training: Flow Control Structure Calibration and Seepage Loss	Dr. David J. Molden	August 30, 1993 to September 10, 1993	36
Hydraulic Operation Training to Operators	Dr. David J. Molden	2-day Follow Up	36

Training Course	CADI Resource Person	Date	Number of Attendees
Share System Administration-Khageri	Dr. John Wilkins-Wells	November 28, 1993 to December 2, 1993	25
Share System Development-West Gandak	Dr. John Wilkins-Wells	December 4, 1993 to December 10, 1993	37
Management Transfer	Joint IMP-IMD Team	June 1 & 2, 1994	18
Computer Training for IMD Staff	Dr. David J. Molden	September 5, 1994 to September 11, 1994	6
Irrigation Data Management--Talk Program	Dr. Tom S. Sheng	October 3, 1994	15
Orientation to Share System Training	Dr. John Wilkins-Wells	November 30, 1994 to December 10, 1994	24
Training on Flow Measurement	Dr. David J. Molden	December 11 & 12, 1994	7
WUA Assessment and Recommendations--Talk Program	Dr. John Wilkins-Wells	December 21, 1994	15
Operation and Maintenance at West Gandak	Dr. Bryan P. Thoreson	May 9 to 17, 1995	19
Management Transfer, Monitoring and Evaluation System--Talk Program	Mr. Robert E. Barrett	June 13, 1995	20
Total			648

### 3.5 System Management Activities

The program of CADI technical assistance for SMB focused on joint management, turnover, O&M, and monitoring, evaluation & feedback (ME&F). The IMP was a pioneer in its attempts at turnover and joint management, O&M, and in Handetar and Sirsia-Dudhaura where much knowledge and experience was gained on these issues. During CADI's tenure at IMP, more progress has been made on these issues. A summary of CADI's assistance to SMB is recorded below.

- ▶ Developed processes and procedures for joint management and turnover.
- ▶ Provision of policy recommendations for joint management and turnover.
- ▶ Provided technical assistance on the DOI joint management and turnover program described in more detail in section 3.6.
- ▶ Provided advise and guidance on developing procedures and implementating WUA development and strengthening.
- ▶ Assisted in developing sustainable share systems for WUAs.
- ▶ Developed procedures for making O&M manuals.
- ▶ Assistance in developing a benefit monitoring system and monitoring and evaluation system for joint management and turnover.
- ▶ Assistance to SMB to implement and improve its monitoring system for budget allocation and O&M performance on 25 O&M systems under its jurisdiction.
- ▶ Development of a computerized information system for O&M sites, joint management, and turnover.
- ▶ Assisted field offices in their flow monitoring programs
- ▶ Gave input to the development of roles and responsibilities for DOI and WUAs.
- ▶ Assessment of canal sedimentation at West Gandak Irrigation Project.
- ▶ Prepared an O&M manual for West Gandak Irrigation System.

### 3.6 Management Transfer Activities

#### Joint Management and Turnover

Throughout its time with IMP, CADI has actively supported the DOI's efforts to transfer management of agency irrigation systems to farmers. The first major activity in this regard were the recommendations given by Dr. David M. Freeman on policies required to create an environment favorable for turnover and joint management.

IMD through its SMB, RTDB, and HRDTB are initiated and are continuing joint management and turnover activities on the following systems:

- ▶ Banganga (6,200 ha) in Kapilavastu District;
- ▶ West Gandak (10,300 ha) in Nawalparasi District;
- ▶ Khageri (3,900 ha) in Chitwan District;
- ▶ Manusmara (5,200 ha) in Sarlahi District;
- ▶ Kankai (8,000 ha) in Jhapa District;
- ▶ Pathraiya (2,200 ha) in Kailali district.
- ▶ Chaurjahari (800 ha) in Rukum District
- ▶ Panchkanya (600 ha) in Chitwan District, and
- ▶ Kamala (25,000 ha) in Danusha and Siraha Districts.

The IMP, through CADI and GEOCE, has provided extensive technical assistance to plan, develop, implement, and evaluate procedures used in introducing joint management. IMD staff are the catalysts in this work while system managers are key players in establishing joint management. CADI considers this joint management activity to be the most important activity in its TA program as IMD activities have the potential to significantly increase agricultural performance of irrigation systems. Additionally, the program provides an area of focus for research, training, and system management activities.

The expected output of the joint management program will be sustainable irrigation management practices and productive irrigation systems. Farmers, through their WUAs, will be managing system operation and maintenance. They will be able to mobilize resources to cover O&M costs, make and enforce rules for canal operation, keep records, and perform maintenance activities. The DOI will provide technical assistance to farmers, and in some cases, may give technical and financial assistance in operating and maintaining the system.

It is CADI's belief the management transfer programs of joint management and turnover are ideal for the country and will lead to important benefits including:

- ▶ strengthening grass-roots democracy by working with democratically formed water users organizations establishing local control of water resources;

- ▶ through more farmer participation and better agency service, improved operation and maintenance of irrigation systems;
- ▶ increases in production and income to farmers from irrigated agriculture in areas where assistance has been provided; and
- ▶ an institution (DOI through its IMD) capable of facilitating and executing productive and sustainable irrigation system management activities for the country.

Establishment of joint management had three phases:

- Phase I:     **Initial Organization.** Water users are organized into multi-level organizations; constitutions are drafted; elections are held; and the association is registered. This phase is started with an introductory workshop where discussions are held with farmers to explain the joint management activity. IMD sociologists have been catalysts in this activity, working side-by-side with project management staff. Sociologists train farmer organizers who are then used to communicate with farmers. This phase establishes farmer leaders with whom the agency can communicate and make agreements. Approximate duration of this phase is three months.
- Phase II:     **Joint Agreement.** An action training on O&M and share systems takes place at the irrigation system with participants drawn from farmer leaders and agency staff. Maintenance needs and operation options are identified, and the cost of operation and maintenance estimated. The share system establishes a basis for water allocation and resource mobilization to cover costs of maintenance. The options are discussed between the agency and farmers. An agreement is drawn that delineates responsibilities of farmers and of DOI in managing the system. The approximate duration of this phase is one month.
- Phase III:    **Implementation of Program.** The result of phase II are agreed upon programs for: deferred maintenance; regular maintenance; operations; and payment for O&M and other management activities. Phase III implements the programs for O&M. During phase III extensive training for water users will take place to strengthen their abilities in areas such as communication, leadership, account keeping, agricultural production, improved on-farm practices, and procedures for operation and maintenance. The duration for phase III is one to five years. The end product is a sustaining, productive irrigation system that should not require large amounts of outside funding for its management.

Much field experience has been gained by IMD. The DOI sociologists did an excellent job in initial organizing of farmers. The concept of using members of the local farming community to facilitate the organizing process was a tremendous success. Where the system manager had good communication with water users, there was great progress in mobilizing local resources.

A summary of completed joint management activities are shown on the table below.

Activity	Khageri	Banganga	West Gandak	Kankai	Manusmara	Panchkanya	Pathraiya	Chaurjahari	Kamala
Introductory Workshop	x	x	x	x	x	x	x	x	x
FO Training	x	x	x	x	x	x	x	**	
WUA Formation	x	x	x	x	x	x	**	**	
Baseline Study	x	x	x	x		x			
Share System Development	x	x	x	x	x	x			
Share System Administration	x	**	**	**	**				
Maintenance Walk-through	x	x	**			**			
Hydraulic Operation	x								
Action Plan Development									
Memorandum of Agreement									

x - completed before this reporting period

\*\* - completed during this reporting period

### Status Report of Joint Management Systems

#### Khageri

Initially an introductory workshop was completed, and training of FOs completed. The WUA organization completed, constitution drafted, and WUA registered. O&M and share system training was completed. An RTB augmentation study was carried out for this system. The WUA now possess the knowledge to administer a successful share system. Follow up and leverage using DOI funded maintenance and improvement work is required to ensure that WUA implemented its programs on resource mobilization, record keeping, hiring a water delivery workforce, and executing its operation plan.

The WUA received contracts from DOI to perform maintenance work on main and branch canals. There was significant work done for the amount of money and the quality of work was very good. The desilting and cross-section improvement could lead to better water delivery performance. While the WUA work has been good, there is a danger that the WUA

may divert its attention from the management of O&M to management of contracts. We began seeing evidence that they would rather generate resources from these contracts rather than mobilizing their own resources.

The WUA had been existence for two years and completed an election as per their constitution in February 1995. Completion of Action Plan and Memorandum of Agreement was scheduled for this reporting period. CADI helped the System Manager get the process underway, but it was not complete by the end of the eighth reporting period.

The WUA has become quite capable and active, and with some skillful technical work and negotiation, the system could be turned over to farmers soon. Farmers through their self-management have an opportunity to become much more productive. The 1994 monsoon season was quite good for Khageri farmers. They benefitted from additional water from the repaired Narayani Lift irrigation and were able to serve more area than in several previous years. The yield of late paddy increased from the baseline value of 2.5 tons per hectare in 1992 to the an average value of 3.1 tons per hectare (based on the crop cutting survey) for this year.

The Khageri WUA is developing into a strong organization. They hired an office administration staff for the main WUA office to assist with record keeping. Some branch committees also hired staff for O&M. The WUA was quite active in controlling its limited supply of water and yields were reported to have slightly improved. Water during the 1994 monsoon was more readily reaching the tail end of the system. The WUA is now beginning to mobilize resources for deferred maintenance, and are collecting a great deal of membership fees and water cess.

### **West Gandak**

The West Gandak Irrigation system has been the most promising success story in the joint management program to date. Initially, the canal was silted up to a state where only 30% of the design discharge could be delivered. Before joint management, farmers were very disenchanted with the management of O&M of the system.

The first step was to get the farmers organized for joint management. The sociologist and system manager were an excellent team in mobilizing farmers. The organization process lasted 6 months and ended up with a four level organization of the WUA, branch committees, tolis and uptolis.

While the WUA was being organized the important task of desilting and performing critical maintenance work was required to get the system into functional condition. Desilting works were carried out on the main canal supervised by selected farmers, engineers, and overseers. Desilting on branches was carried out jointly by DOI and farmers. In tertiary level canals and below, desilting was done by farmers. An estimated 5 lakhs of resources were mobilized by farmers for the work.

To date approximately 6,200 ha of the 10,300 ha have been turned over to farmers organizations. The System Manager is targeting to turn over the remaining area to branch committees, tolis, and upa-tolis (sub branch and tertiary organizations). After this, the main canal will be turned over to the Water Users Association. One of the striking differences between Khageri and West Gandak is the activity of the Main Committee and General Assembly at both places. At Khageri, the Main Committee and General Assembly are strong, with branch committees subordinate to them. At West Gandak, certain branch committees are exhibiting positive institutional development with good record keeping and resource mobilization. But the main committee is weak compared to Khageri.

Agricultural performance of West Gandak for the 1993/94 season has shown a remarkable improvement over the baseline situation of 1992/93. Average yields of rice increased from 2 to 4 tons per hectare, while average yields for wheat increased from 1.7 to 3.4 tons per hectare (1993/94 yield data are based on crop cutting while the 1992/93 was done by household survey during the baseline study). 1994/95 yields sustained this increase. After subtracting production costs, the increment in net benefit to farmers at West Gandak was estimated at 66 million rupees for the year for the two crops. The data for sugar cane has not yet been analyzed. In other words, on a per hectare basis, the net benefit from the two crops was Rs 6,600 more in 1993/94 than in 1992/93. Maintaining this advantage should be of great interest to the farmers. The change has been due to improved management of the system, and the involvement of the farmers through the joint management program.

### **Banganga**

The Banganga case has been more difficult than Khageri and West Gandak. We feel that the scope for improvement of production is similar to West Gandak and greater than Khageri, but this has yet to be achieved. The start of the joint management program at Banganga was marred by difficulties. The organizational design and formation process did not yield leaders who were representative of farmers wishes and could inspire the confidence of farmers. Fortunately, enough checks and balances were built into the organizational design so that appropriate changes could be made. During last year, new chairholders were selected and the modifications made to the organization structure. Additionally, the DOI Field Level System Management has been more receptive to the farmers and program than the previous System Management. With these changes, the program is beginning to progress in a positive direction.

Two indicators of positive progress are the area turned over to farmers and the amount of resource mobilization from the farmers themselves. Up to present, about 1100 ha have been turned over to farmers. It has been observed that farmers are becoming more active in the cleanup of the canals, and the amount of labor mobilized as part of the cost share program has been estimated at Rs 118,000. This is in comparison to almost zero the previous year.

Two issues need to be addressed to get the program moving at a greater pace. The first is to improve the operation of the main system. At both Khageri and West Gandak it

has been demonstrated that improved main system operation allowing a more adequate and reliable supply of farmers leads to results in terms of area effectively served and yields. With these improvements farmers get more interested in the program. At Banganga, the System Management has to find a way to get more water in the main canal and to better operate the reservoir. The maximum observed discharge at Banganga at the reservoir outlet was 3.26 cumecs compared to a design capacity of 5.66 cumecs at that point.

The second issue is regarding institutional development. While turnover has taken place, the branch organizations running the turnover areas do not represent the strength of the West Gandak organizations nor the Khageri main committee. The Main Committee is definitely improving, but there remains a lack of vision and a lack of understanding their role. Training activities are highly recommended there to improve the situation. In addition, funds for O&M need to be effectively used to leverage improved WUA activities including membership, record keeping, resource mobilization, and water cess collection.

During the last reporting period, discussions were held with the System Manager to set up institutional development benchmarks for the WUA. The concept was that when the benchmarks are met, then the office would assist with certain maintenance and improvements works. This system of benchmarks will be well communicated to farmers and will commence next Nepali fiscal year.

### **Panchkanya**

Panchkanya was identified to be in Phase I of the Irrigation Management Transfer Projects. That is, it is expected that activities will be concentrated there and that management transfer will result in a period of about three years. Panchkanya has the advantages of being a smaller system and even though it is technically an agency managed system, and receives maintenance assistance from the DOI, a significant amount of operation and maintenance activities are done by the farmers. Panchkanya has the advantage of an existing informal WUA that ran the system before the turnover program. In the first half of 1994, the WUA was made formal with a constitution and by registration. The existing WUA, the system has the potential to be a success.

Besides the initial organizing efforts and share system training held during this reporting period, very little institutional development efforts have taken place. However, the WUA has a strong base and with some strengthening will be in excellent condition to take over the entire system. The development of the Action Plan was started during the last reporting period. Informally, the WUA has indicated that after some limited repair, they are quite willing to take over the system.

### **Manusmara**

Manusmara organizational efforts led to two WUAs representing two separate command areas within the system. The area was severely affected by flood during the 1993 monsoons. Institutional development of the WUA is very slow, mostly due to recovery from

the flood, but also in part due to the lack of follow up efforts with the WUA. The WUA still exists but is not very active. Irrigation management and institutional development programs at Manusmara were very few during the last two years. The DOI and farmers have been working very hard to repair the flood damaged system. Unfortunately, they did not use this flood repair opportunity to build up the strength of the WUAs. Before it is too late, some further efforts need to be done with institutional development at Manusmara. During this reporting period a Share System Development training was given at Manusmara by the HRDTB.

### **Kankai**

Major joint management inputs into the Kankai Irrigation system have been WUA formation and share system training. Kankai received little budget for O&M this year, and most of the budget was required for repair of a damaged culvert. Kankai was not selected to be included in the Irrigation Management Transfer Project. We feel that this should not deter the management transfer activity at Kankai, and the DOI should proceed using its own resources.

In spite of the limited budget, the system has shown remarkable signs of improvement through excellent initiatives of the WUA and DOI. Farmers through their organizations are mobilizing their own resources to clean and repair canals. In one branch, S14, the branch committee had mobilized Rs 150,000 to clean the canal and repair the embankment. This branch received water for early paddy during 1994 for the first time ever. The Main Committee of the WUA is quite active and is involved in water distribution, and system wide policy.

The DOI is now involved in the turnover of three branch canals, and it has been stated that the demand for turnover of branches has been high. Institutional issues that must be carefully watched are: (1) the branches should not feel separate from the system-wide WUA even though they are turned over, and (2) the WUA has to begin efforts to install the share system.

### **Kamala**

Kamala is the largest system of the joint management program. During the last 12 months organizing efforts have started there with the creation of an organizational design. The design envisages two WUAs, one corresponding to each headwork tapping Kamala river water. The organizing efforts were postponed due to lack of funding which was supposed to come from IMTP funds which are not yet available. The organizing job, and other work will require a massive effort. Yet, we feel that over the long run, there are vast improvements that could be made here. We must be careful not to make a false start by getting activities going, then dropping them later.

## Pathraiya

Pathraiya Irrigation System is one system that shows excellent potential for turnover. The farmers already have some good management practices and are showing enthusiasm for the program. During the last reporting period, the WUA formation process was complete, and the WUA was registered.

## Chaurjahari

During the last reporting period, the WUA was formed at Chaurjahari Irrigation System. The newly recruited IMD sociologists were instrumental in the process.

## Irrigation Management Transfer Project

Over the past two years, the Asian Development Bank (ADB) has designed the project and negotiated a Memorandum of Understanding between ADB and HMG/N for the Project. IMD and IMP TA staff interacted frequently with ADB to provide input into these documents. The loan agreement between ADB and the HMG has now been signed.

### 3.7 Short Term Technical Assistance

Over the time of CADI's involvement, short term TAs have been employed for a variety of topics from policy recommendations to implementation of training. A total of 40 person months were used on assignments. A list of TAs, their activities and duration is presented below.

Name	Title	Activity	Duration (weeks)
Dr. Ramchand Oad	Irrigation Engineer	Workshop on Irrigation Water Control and Management	6.00
Mr. Robert E. Barrett	Computer Specialist	- Workshop on Microcomputer Applications in Irrigation - Initiation of ME&F Information System - Develop a database on Human Resource Development	4.00 1.50 1.50
Dr. W. Robert Laitos	Sr. Social Scientist	- TA on turnover strategy development document - TA on joint management strategy--development document	6.00 6.00
Dr. Larry J. Nelson	Water Management Specialist	Workshop on Applied Research Methodologies	7.00
Dr. David M. Freeman	Irrigation Organization Specialist	TA on irrigation organization assessment	4.00

Name	Title	Activity	Duration (weeks)
Dr. John Wilkins-Wells	Sociologist	Workshop in the Organizational Aspects of Irrigation	7.00
Mr. Gaylord V. Skogerboe	Irrigation Engineer	TA to develop guidelines for operations and maintenance for joint managed systems	4.00
Dr. James L. Layton	Training Methodology Specialist	<ul style="list-style-type: none"> <li>- Prepared manual on training methodologies</li> <li>- Conducted workshop on Training Trainers</li> </ul>	6.50
Mr. Steven W. Thompson	Hydropower Policy Advisor	Report summarizing recommendations and proposed by-laws, rules and regulations	8.83
Dr. John Wilkins-Wells	Share System Specialist	Action training and manual on O&M and share system	9.33
Mr. Gaylord V. Skogerboe	Operation & Maintenance Engineer	Action training and manual on O&M and share system	9.00
Mr. Steven W. Thompson	Hydropower Policy Advisor	<ul style="list-style-type: none"> <li>- Report recommending essential functions to be addressed</li> <li>- A concise "Statement of Vision for Power Sector Development"</li> </ul>	13.00
Mr. William L. Kelly	Value Engineer	Conducted Value Engineering Workshop	3.17
Mr. Gary W. Long	Value Engineer	Conducted Value Engineering Workshop	2.17
Mr. Steven W. Thompson	Hydropower Advisor	<ul style="list-style-type: none"> <li>- Recommend power sector development strategy</li> <li>- Assisted USAID/USIS in the promotional activity in US</li> <li>- Assisted MOWR in contract negotiations between HMG/Nepal and Himal Power Ltd.</li> </ul>	19.81
Ms. Arlene D. Blum and Ms. Nancy E. Teselle	Workshop Leader Trainer	Prepared and conducted Leadership Training Workshop	2.17
Dr. John Wilkins-Wells	Share System Specialist	<ul style="list-style-type: none"> <li>- Developed a training course on Share System Development and Administration</li> <li>- Conduct training</li> <li>- Prepare manuals for future training</li> </ul>	6.17

Name	Title	Activity	Duration (weeks)
Mr. Steven W. Thompson	Hydropower Advisor	Assisted MOWR in contract negotiations on the Khimte Khola Hydropower Plant	5.55
Dr. W.W. Shaner	Benefit & Monitoring Specialist	Prepared a procedure for monitoring benefits of joint management and turnover sites	6.20
Dr. John Wilkins-Wells	Share System Specialist	<ul style="list-style-type: none"> <li>- Conducted a Share System Orientation Training to DOI</li> <li>- Developed an annual status report to be used by WUAs</li> <li>- Assessed the progress of the WUA development at the management transfer site</li> </ul>	7.20
Dr. Bryan P. Thoreson	O&M Engineer	<ul style="list-style-type: none"> <li>- Developed a O&amp;M Manual</li> <li>- Conducted a O&amp;M training course</li> <li>- Prepared procedures for O&amp;M manual development</li> </ul>	10.40
Mr. Robert E. Barrett	Data Management Advisor	<ul style="list-style-type: none"> <li>- Designed and developed a computerized data management system</li> <li>- Trained the SMB and RTDB staff to manage the system</li> </ul>	9.00
Dr. John Wilkins-Wells	WUA Specialist	<ul style="list-style-type: none"> <li>- Reviewed and made suggestions for the Memorandum of Agreement and the plan of action for irrigation system</li> <li>- Prepared a proposal to integrate Narayani Lift and Khageri with a share system</li> <li>- Provided a vision of legal and policy requirements for the WUA to operate as a business house</li> </ul>	6.20
Total			171.70

## **4. LESSONS LEARNED**

### **4.1 Institutional Development of WUA**

**On Farmers Skills.** In general, CADI TA have been pleasantly surprised by the extent of the capability possessed by farmers to manage their own affairs. Farmers of irrigation communities possess excellent technical and managerial skills that can and should be tapped to obtain success. The lesson learned, is that a well implemented, farmer focused program has great potential for impact.

**Let the Farmers Manage O&M.** This is basically the theme of management transfer, and CADI believes this lessons keeps repeating itself through IMP. Farmers through their organization have done a marvelous job in making regulations, performing maintenance and operation, keeping records, and managing their own affairs. Originally, the common thought for management transfer was to let farmers run the tertiary system. Later it was felt OK for farmers to take over branch canals and let the DOI run the main canal. Now, even on large systems such as West Gandak, CADI feels that it is appropriate to let the farmers run the entire system themselves.

### **4.2 Contracting to WUAs**

IMP has now had much experience in contracting to WUAs - both positive and negative. On the positive side, contracts have provided experience in planning, costing, conducting and supervising maintenance. They have contributed to a sense of pride and ownership in completed works. Additionally, they give the WUA an opportunity to earn income to be reinvested into their system.

On the negative side, contracts may contribute to more WUA dependency on the government by requesting contracts every year to do maintenance instead of generating funds from their system management fee. This may lead to certain interest groups benefitting exclusively from the contract. Also, farmers may view the purpose of the organization as being contracting instead of managing and financing O&M in the future.

Benefits and drawbacks are not so much a part of the contract, but the way they are administered and supervised. The System Manager and WUA must work together to achieve the benefits, and to check those instances and practices leading to the more negative aspects of contracting.

The recommendation is to assure that sufficient checks and balances are present in the WUA, including an active General Assembly, accounting procedures practiced, and a posting of the contract amount in public places. Second, all WUA members should mobilize resources according to their share program. Third, the WUA should present a plan on how the money should be reinvested into their system to improve water service.

### 4.3 Training WUAs and Farmers

We have advocated an "Action Training" approach. That is, WUA members do constructive exercises while they are learning. For example, general information is given on rules, regulations, then record keeping. Afterward, the WUA is asked to break into groups and develop rules and record keeping formats. This method of training has been highly successful. The evidence of success is the record keeping procedures at Khageri and West Gandak. Even though this approach has been a success, it has not been practiced enough.

CADI strongly recommends that field-oriented, action training be continued to develop WUAs. Even though this type of training may be more time consuming than classroom training focusing on theory, it is worth the additional effort.

### 4.4 WUA Development Program

Through IMP, CADI believes we have made excellent progress in how to get a WUA started. One of the achievements of the last years of IMP was in organizational design and WUA formation. The idea was to start purely from the grass roots level, making lower tiered organizations strong (ie tolis, upatolis), then move up to the branch level. This process was long and tedious and seldom completed. Now, the process is to get the organizational structure for the entire command area in place at one time. Initial success has been demonstrated at Khageri, West Gandak, Panchkanya, and Kankai. One of our important lessons learned, and achievements, is this holistic WUA development process.

### 4.5 Institutional Development of DOI

On fiscal budget expenditures, the procedure for annual budget operations is to allocate the budget to a program near the beginning of a fiscal year, then expend the budget as per the program. Progress is monitored by several important agencies including the National Planning Commission (NPC) and Ministry of Water Resources (MOWR) on budget expenditures. If the money has been spent, well done; if not, performance is not up to the mark. For institutional development of WUAs there are several problems with this approach, listed below.

- ▶ Our philosophy for institutional development is to wait until the institution (ie the WUA) is strong, then spend the money. This is in conflict with the present practice of expenditure as described above. If an implementor must wait to achieve institutional development, progress as measured by budget expenditure may not be achieved. Because of this budgeting and performance monitoring practice, it is often difficult for implementors to craft sustaining WUAs.

Recommendation: Monitor progress on institutional development and other factors, and put less emphasis on whether the target budget was spent.

- ▶ There is very limited flexibility with this system because budgets cannot easily be switched between items. As an example, a rather large budget was allotted to Banganga, while small budgets were allotted to Khageri and West Gandak waiting for other budgets from IMTP. The Banganga institutional development program was proceeding very slow, with many difficulties, while the Khageri and West Gandak WUAs were moving fast. The money for IMTP did not come, and we ended up supporting Banganga, but not Khageri and West Gandak.

Recommendation: Leave some flexibility to switch between programs if we get good performance at one place and not the other.

- ▶ One effect of this is that money is sometimes wasted, and/or programs are not effectively fulfilled because of the drive to fulfill targets. Money is spent to fulfill targets without regard to the effectiveness of its utilization. Another effect is that some activities are done half-heartedly, often with poor quality to achieve targets. CADI does want to state that this is only sometimes true as there are many activities where much excellent work has been done.

Recommendation: Reward people for performance based on set objectives like better water delivery, better yield, strong WUA, good training, rather than on budget expenditures. If there has been good performance against the objectives, and money has been saved, give a big reward. If an activity becomes irrelevant, just drop it with proper justification.

#### **4.6 Monitoring**

Setting up a program of monitoring and data collection has proven to be extremely difficult. It is easy for a project to come in and collect data on a one-time basis, but difficult to achieve a continuous flow of data. It will continue to be difficult until somebody is truly interested in the data. This situation will be resolved only when decision makers start asking the right questions - how much water was delivered, what was the impact on production, how is the WUA performing, etc.

#### **4.7 Obtaining Results from Nepal's Skilled Human Resource Bank**

It is widely recognized, that there is sufficient talent in Nepal to perform development works, yet much of the potential remains untapped. Even though PhDs and Masters Degrees are obtained, and there remains a tremendous scope for work, many are not working up to their potential. CADI is proud to have worked with many very bright and energetic professionals within the DOI. There has been a lot of devotion and hard work from these individuals, even though the remuneration to them has been very low. The lesson is that given a good environment, professionals will perform well. (CADI definitely supports the idea that DOI staff should receive more monetary compensation for the work they do). The

environment includes some very simple, non-monetary incentives, including: recognition of good work, listening to ideas, and encouragement.

#### **4.8 Research**

We have just touched the surface in irrigation management research. While there have been good studies during the time of IMP, there is still much more to be done. Additionally, more emphasis must be put on applied research in the field. We need to be able to respond quickly to field based needs. For example, reservoir and canal operation can definitely be improved at Banganga, but needs some technical engineering support on how to do it. For example, at Khageri, we still don't know the water requirements for the system taking into consideration deep percolation and seepage losses. Policy makers need to place more emphasis on applied research.

#### **4.9 Future Visions**

**The Role of DOI.** Throughout the time of CADI in IMP, the theme of DOI as service provider has been prevalent. We are doing much of the work that farmers should be doing (like routine O&M) and less of the work that engineers should do (like special studies and calibrating structures). There is so much work to do in Nepal that there should be no fear in opening up new roles. Jobs that DOI should start to place more emphasis on are:

- ▶ help determine and administer water rights within river basins;
- ▶ improve the discharge measurement program on rivers and within irrigation systems;
- ▶ give advise to farmers on technical problems; and
- ▶ provide more training and applied research that will help resolve field level problems.

**The Role of TA.** The stated role of the TA team during CADI's tenure at IMP has been mostly advisory. This is often times not an easy role for several reasons. In many cases, the desire is not for an advisor, rather an executor. At times, many of the highly experienced and educated staff at DOI rightly feel that they themselves could have given the same consultation. CADI does feel that the advisory role is appropriate as opposed to an execution role for this type of activity. We agree that if we ourselves implement work, it does not build the capacity of the local bureaucracy. The lesson learned for technical assistance is to build up team work as much as possible. Work with counterparts as a team, listen to ideas, and jointly produce output. It is not very effective to write reports or give a long list of recommendations in isolation. Working as a team, many people have ownership on the tasks that TA have assisted on.

## 5. RECOMMENDATIONS FOR PROGRAM CONTINUATION

CADI feels that the USAID support for irrigation management activities over the last 10 years has been very appropriate and effective. Changes may not have occurred as quickly as envisioned, but by this time, great progress has been made. IMD through its branches possess all the tools to be effective and are now performing quite well. If IMD is a sustaining institution, it should be able to continue its work without outside support. An important question is whether after IMP, IMD will sustain.

IMD will sustain given proper emphasis placed by policy level decisionmakers. CADI strongly recommends that emphasis at the policy making level be given to IMD. CADI recommends that IMD continue its monitoring system and make the decisionmakers aware of the positive impacts from irrigation management.

CADI is encouraged that DOI's joint management and turnover programs will continue and that the Asian Development Bank and USAID will support the effort. The IMP has made significant progress at these sites, yet there is work remaining. Successful management transfer is a continuous effort that cannot be dropped and picked up later. It is recommended that these programs be continued in full force without delay, and that USAID does not leave a large gap between technical assistance activities.

## 6. REPORTS

For the past four years, CADI with DOI and GEOCE prepared 45 technical reports and papers as listed below.

Applied Research Methodologies Workshop Team. March, 1992. *Rapid Appraisal: Dunge Dara Irrigation System.*

Applied Research Methodologies Workshop Team. March 1992. *Rapid Appraisal: Nadi Irrigation System.*

Applied Research Methodologies Workshop Team. March 1992. *Rapid Appraisal: Indrayani Irrigation System.*

Barrett, R.E. March 1992. *Microcomputer Applications in Irrigation Data Management - Notebook for Participants and Microcomputer Application in Irrigation Data Management - Instructor's Guide.*

Barrett, R.E. March 1992. *A Database for Irrigation System O&M Monitoring for SMB.*

Barrett, R.E. March 1992. *A Database for Monitoring Training Activities at RTB.*

Freeman, D.M. January 1992. *Creating a Supportive Policy Environment for Irrigation System Turnover and Joint Management.*

Laitos, W.R. and C.B. Shakya. February 1992. *An Evolving Turnover Strategy for Agency-Managed Irrigation Systems.*

Laitos, W.R. and J.D. Rana. March 1992. *A joint Management Strategy for Nepal's Department of Irrigation.*

Laitos, W.R. March 1992. *Turnover and the Handetar Irrigation System: Present Status and Lessons Learned.*

Nelson, L.J. March 1992. *Trainer's Guide: Applied Research Methodologies.*

Oad, R.C. January 1992. *Irrigation Water Control and Measurement: Instructor's Guide.*

Verma, S.C., U.R. Timilsina, J.D. Rana, and D.J. Molden. March 1992. *Assessment of Silt Status at West Gandak Irrigation Project: a Report on Short and Long Term Solutions.*

- Wilkins-Wells, J. April 1992. *Reflections on the Workshop Activities and Case Studies Reviewed during the Workshop Titled Organizational Aspects of Irrigation Management.*
- Research and Training Branch. July 1992. *Evaluation of the SINKALAMA Irrigation Program.*
- Layton, J.J. November 1992. *Training Methodologies Field Manual.*
- Layton, J.J. November 1992. *Training Methodologies Field Manual - Workbook.*
- Molden, D.J. July 1993. *Guidelines for Procuring and Managing Irrigation Services.*
- Research and Training Branch. July 1993. *Evaluation of the Irrigation Line of Credit Irrigation Program.*
- Research and Training Branch. March 1993. *Khageri Irrigation System, Organization, Maintenance, and Operation.*
- Research and Training Branch. April 1993. *Banganga Irrigation System, Organization, Maintenance, and Operation.*
- Skogerboe, G.V., L.P. Poudel and K.B. Shrestha. May 1993. *Guidelines for Joint Management of Irrigation System.*
- Thompson, S.W. March 1993. *Rules, Regulations, and Recommendations for Private Sector Financing of Electric Generation Facilities.*
- Wilkins-Wells, J. and G.V. Skogerboe and edited by D.J. Molden. May 1993. *Training Manual for Joint Management of Irrigation Systems.*
- Hemchuri, H.P., S. Upadhyaya, S. Sijapati, and D.J. Molden. December 1993. *Water Augmentation Study for Khageri Irrigation System.*
- Kalu, I.L. September 1993. *Khageri Irrigation System, Chitwan, Flow Measurement Manual.* Research and Training Branch.
- Kalu, I.L., P. Manandhar, S. Regmi, and D.J. Molden. November 1993. *Hydraulic Operations Report, Khageri Irrigation System.*
- Kalu, I.L. November 1993. *Suggested Plan for Hydraulic Operation of Khageri Irrigation System,* Research and Training Branch and System Management Branch.

Molden, D.J. and I.L. Kalu. December 1993. *Hydraulic Operations Training Manual: Flow Control Structure Calibration and Seepage Loss Measurements*, Research and Training Branch.

Research and Training Branch. December 1993. *Share System Report for Khageri Irrigation System*.

Research and Training Branch. December 1993. *Share System Report for West Gandak Irrigation System*.

Wilkins-Wells, J. December 1993 (draft). *Share System Development and Administration for Water Users Association*, Research and Training Branch.

Rajbhandari, S.P., V.S. Mishra, D.J. Molden, and J.D. Rana. March 1994. *Some Initial Impacts of Joint Management at the West Gandak Irrigation System*, Irrigation Management Division.

Shaner, W.W. and M. Banskota. April 1994. *Benefit Monitoring and Evaluation for Nepal's Joint Management and Turnover Program*, Irrigation Management Division.

Uprety, D.P. April 1994. *Water Users Association Formation Manual*, Irrigation Management Division.

Wilkins-Wells, J., S. Upadhyaya, P. Manandhar, and N.C. Shrestha. February 1994. *Share System Development and Administration*, Irrigation Management Division.

Sheng, T.S. and M. Banskota. October 1994. *Recommendations for the Development of SMB's Data Management System*. System Management Branch.

Wilkins-Wells, J. December 1994. *Share System Orientation Workshop Training and Evaluation of WUA Institutional Development Program*. System Management Branch.

Reports completed this reporting period where a significant amount of input has been provided by CADI.

Barrett, R.E. June 1995. *MTME: Management Transfer Monitoring and Evaluation System*. Version 1.0 User's Manual. System Management Branch, Irrigation Management Division, Department of Irrigation.

Molden, D.J. and J. Wilkins-Wells. June 1995. *Guidebook for Developing the Plan of Action*. Irrigation Management Division.

Wilkins-Wells, J. June 1995. *Some Legal and Policy Considerations in the Promotion of Water Users Association Development*. Irrigation Management Division, DOI.

Wilkins-Wells, J. June 1995. *Feasibility Study: A Water Users Association Cooperative Share System for the Narayani Lift Irrigation System, Chitwan District, Nepal*. RTDB, IMD, DOI.

Thoreson, B.P. June 1995. *West Gandak Irrigation System Operation and Maintenance Manual*. In English and Nepali. RTDB and SMB

Thoreson, B.P. June 1995. *Guidelines for Operation and Maintenance Training and preparation of Operation and Maintenance Training Manuals*. IMD, RTDB and SMB.

Research and Technology Development Branch. June 1995. *Evaluation of the Irrigation Sector Project*.

### **Presentations**

Listed below are presentations where CADI served a major role.

Freeman, D.M., CSU. January 16, 1992. *Creating a Supportive Policy Environment for Joint Management and Turnover*, attended by 40 participants. Kathmandu.

Laitos, W.R., CADI. March 11, 1992. *Irrigation System Turnover*, attended by approximately 40 participants. Kathmandu.

Laitos, W.R., CADI. March 31, 1992. *Joint Management*, attended by 30 participants. Kathmandu.

Wilkins-Wells, J., CSU. April 9, 1992. *Reflections on Organizational Aspects of Irrigation Water Management Workshop*, attended by 25 participants. Kathmandu.

Skogerboe, G.V., USU. May 26, 1992. *Introducing Effective Maintenance and Operation in Joint Managed Irrigation Systems*, attended by 17 participants. Pokhara.

Skogerboe, G.V., USU. June 1, 1992. *Introducing Effective Maintenance and Operation in Joint Managed Irrigation Systems*, attended by 17 participants. Kathmandu.

### **Professional Papers**

Wilkins-Wells J., D.J. Molden, P. Pradhan, and S.P. Rajbhandari, *Discussion Paper for Developing Share Systems for Sustainable Water Users Associations in Nepal*.

Rana J.D., R.P. Satyal, S.P. Rajbhandari, K.R. Sharma, and D.J. Molden. *Experience of Management Transfer to Users in Nepal*

Wilkins-Wells J. and K.P. Prasad. *The Role of Rural Credit Institutions in Irrigation Management Transfer.*

Mishra, V.S. and D.J. Molden. *Experience of Management Transfer at West Gandak, in progress.*

## **7. ADMINISTRATON AND MANAGEMENT**

### **7.1 General**

CADI is a Gray Amendment consulting firm (participates in the 8 (a) program of the U.S. Small Business Administration (SBA) specializing in land, water, and professional development. Its mandate is to offer specialized and interdisciplinary short term technical assistance, long term advisory services, and training in the following areas:

- ▶ Irrigation, drainage, and water resources
- ▶ Institutional and human resource development
- ▶ Computer applications in irrigation, agriculture, and natural resources management
- ▶ Watershed management, evaluation, and erosion control
- ▶ Forest planning and management
- ▶ Natural resources management

CADI was incorporated in April 1987 and the home office is located in Fort Collins, Colorado, USA with a team of 20 professional staff members.

### **7.2 Administration and Management**

The major project activities for the last period were submitting candidates for short-term TA assignments, mobilizing short-term TA, and finalizing the project extension. A summary of administrative activities by month is presented below.

#### January 1995

- ▶ Received a copy of the signed TOR for Operation and Maintenance TA.
- ▶ Submitted several candidates for the Operation and Maintenance TA for review.
- ▶ Reviewed TA schedule for the next six months.
- ▶ Ordered the books for IMD, DOI.

#### February

- ▶ Reviewed the TOR for Data Management TA.
- ▶ Assisted in preparing the TOR for WUA Institutional Development II TA.
- ▶ Assisted in preparing and finalizing CADI's Bi-annual Report 7.

- ▶ Contacted Bryan Thoreson for the Operation and Maintenance TA.
- ▶ Received and mailed the books to IMD.

### March

- ▶ Requested for approval to carry out the two tasks- (1) review of the Memorandum of Agreement by and between the DOI and WUA and the Plan of Action for Irrigation System (2 days) and (2) preparation of a proposal for Narayani Lift (5 days) - in Colorado.
- ▶ Received USAID approval for John Wilkins-Wells, Colorado State University to carry out the above tasks in Colorado (LOE - 7 days).
- ▶ Sent comments on the Memorandum of Agreement and the Plan of Action for Irrigation System.
- ▶ Provided software information and prices for MapInfo, MapBasic and dBASE 5 Windows.
- ▶ Submitted Bryan Thoreson's resume and AID 1420 form for the Operation and Maintenance TA.
- ▶ Provide contacts in India for the USAID Out of Country Training Program.
- ▶ Requested international travel approval for Bryan Thoreson to carry out the Operation and Maintenance TA.
- ▶ Assisted in finalizing the one month, no cost IMP extension proposal.
- ▶ Provided equipment information for setting up Internet in Nepal.
- ▶ Requested and received USAID approval for Internet connection.
- ▶ Received a copy of the signed TOR for Data Management TA.
- ▶ Received USAID travel approval for Bryan Thoreson to carry out the Operation and Maintenance TA (LOE - 52 days).

### April

- ▶ Requested international travel approval for Robert E. Barrett to carry out the Data Management TA.

- ▶ Mobilized Bryan Thoreson for the Operation and Maintenance TA.
- ▶ Received USAID travel approval for Robert Barrett to carry out the Data Management TA (LOE - 45 days).
- ▶ Procured the required software packages for the Data management TA.
- ▶ Requested international travel approval for Tom S. Sheng and Velora L. Sosovec to close out the project.
- ▶ Mobilized Robert Barrett for the Data Management TA.
- ▶ Submitted more suggestions for completion of WUA Development II TA.
- ▶ Received USAID travel approval for Tom S. Sheng and Velora L. Sosovec (LOE - 14 days each).
- ▶ Received USAID approval for John Wilkins-Wells, Colorado State University to complete the WUA Development II TA in Colorado (LOE - 24 days).

#### May

- ▶ Received AIDAR and FAR on transportation and final project report requirements.
- ▶ Provided USAID more information on the software procured in April.
- ▶ Assisted in selecting a freight company to pack and move Molden's UAB and HIE from Kathmandu, Nepal to Fort Collins, Colorado.
- ▶ Submitted a copy of Guidebook for System Managers on Preparing a Plan of Action prepared by John Wilkins-Wells, Colorado State University.

#### June

- ▶ Mobilized Tom S. Sheng and Velora L. Sosovec for project close-out.
- ▶ Bryan Thoreson and Robert Barrett debriefed CADI on their TA activities.
- ▶ David J. Molden debriefed CADI on IMP final status.
- ▶ CADI closed out the project successfully on June 15, 1995.

### 7.3 Staff and Consultants

During the period of January 8 - June 15, 1995, CADI provided short term specialists to work with IMP as follows:

Name	Title	Organization	Activity	Duration (Weeks)*
Thoreson, Bryan P.	O&M Engineer	CADI	Developed a O&M Manual, conducted a O&M training course, prepared procedures for O&M manual development	10.40
Barrett, Robert .E.	Data Management Advisor	CADI	Designed and developed a computerized data management system and trained the SMB and RTDB staff to manage the system	9.00
Wilkins-Wells, John	WUA Specialist	CSU	Reviewed and made suggestions for the Memorandum of Agreement and the Plan of Action for Irrigation System, prepared a proposal to integrate Narayani Lift and Khageri with a share system, and provided a vision of legal and policy requirements for the WUA to operate as a business house.	6.20
Total				25.60

\* Six-day work week

As of June 15, 1995, CADI has provided the following Level of Effort (LOE).

Category	7/91 - 12/94 (Person Months)	1/1-6/15/95 (Person Months)	Cumulative Project to June 15, 1995 (Person Months)	Approved June 15, 1995 (Person Months)
Field Office				
- IMA	42.00	5.50	47.50	47.50
- Office Manager	41.50	5.50	47.00	47.00
Home Office				
- Project Manager	9.01	1.45	10.46	10.37
- Adm/Fin Officer	9.90	0.95	10.85	15.11
Short Term TAs	25.25	4.48	29.73	33.20
Subcontract	8.71	1.43	10.14	11.09
Total			97.72	164.27

A combined list of all CADI specialists and staff employed during the duration of the project is provided below:

Name	Title	Activity	LOE (months)	Assignment Period
<b>Field Office</b>				
Dr. David J. Molden	Chief of Party	- Long-term TA - Project Management	47.50	07/18/91 - 06/20/95
Mr. I.B. Rajbhandari	Office Manager	- Financial activities - Monthly reports	47.00	08/08/91 - 06/17/95
Total			94.50	

Name	Title	Activity	LOE (months)	Assignment Period
<b>Home Office</b>				
Dr. Tom S. Sheng	Project Manager	- Carried out a project management reviews - Prepared recommendations for the development of SMB's data management system - Contract Management	10.46	07/18/91 - 06/17/95
Ms. Karen K. Brooks Ms. Linda M. Green Ms. Lori M. Sterling Ms. Vikki L. Sosovec	Administrative & Financial Officer	- Home office financial operations - Voucher preparation - TA travel arrangements	10.85	07/30/91 - 08/25/91 09/09/91 - 06/17/94 05/23/94 - 02/20/95 03/27/95 - 06/17/95
Total			21.31	
<b>Short Term TA</b>				
Dr. Ramchand Oad	Irrigation Engineer	- Workshop on Irrigation Water Control and Management	1.39	11/14/91 - 01/16/92
Mr. Robert E. Barrett	Computer Specialist	- Workshop on Microcomputer Applications in Irrigation - Initiation of ME&F Information System - Developed a database on Human Resource Development	1.62	12/18/91 - 02/24/92
Dr. W. Robert Laitos	Senior Social Scientist	- TA on turnover strategy development document - TA on joint management strategy development document	2.77	01/06/91 - 02/02/91 02/27/91 - 04/06/91
Dr. Larry J. Nelson	Water Management Specialist	- Workshop on Applied Research Methodologies	1.62	01/09/92 - 03/09/92
Dr. James L. Layton	Training Methodology Specialist	- Prepared manual on training methodologies - Conducted workshop on Training Trainers	1.71	11/02/92 - 12/14/92

Name	Title	Activity	LOE (months)	Assignment Period
Mr. Steven W. Thompson	Hydropower Policy Advisor	- Report summarizing recommendations and proposed by-laws, rules and regulations	2.04	01/22/93 - 03/31/93
Mr. Gaylord V. Skogerboe	Operation & Maintenance Engineer	- Action training and manual on O&M and share system	2.08	02/27/93 - 03/29/93
Mr. Steven W. Thompson	Hydropower Policy Advisor	- Report recommending essential functions to be addressed - A concise "Statement of Vision for Power Sector Development" - Recommended power sector development strategy - Assisted USAID/USIS in the promotional activity in US - Assisted MOWR in contract negotiations between HMG/Nepal and Himal Power Ltd.	7.58	04/01/93 - 01/19/94
Mr. William L. Kelly	Value Engineer	- Conducted Value Engineering Workshop	0.73	05/06/93 - 05/26/93
Mr. Gary W. Long	Value Engineer	- Conducted Value Engineering Workshop	0.50	05/10/93 - 05/23/93
Ms. Arlene D. Blum and Ms. Nancy E. Teselle	Workshop Leader Trainer	- Prepared and conducted Leadership Training Workshop	0.50	07/26/93 - 08/11/93
Mr. Steven W. Thompson	Hydropower Advisor	- Assisted MOWR in contract negotiations on the Khimte Khola Hydropower Plant	1.28	01/02/94 - 02/23/94
Dr. W. W. Shaner	Benefit & Monitoring Specialist	- Prepared a procedure for monitoring benefits of joint management and turnover sites	1.43	03/19/94 - 04/25/94

Name	Title	Acitivity	LOE (months)	Assignment Period
Dr. Bryan P. Thoreson	O&M Engineer	<ul style="list-style-type: none"> <li>- Developed an O&amp;M Manual</li> <li>- Conducted an O&amp;M trianing course</li> <li>- Prepared procedures for O&amp;M Manual development</li> </ul>	2.40	04/14/95 - 06/12/95
Mr. Robert E. Barrett	Data Management Advisor	<ul style="list-style-type: none"> <li>- Designed and developed a computerized data management system</li> <li>- Trained the SMB and RTDB staff to manage the system</li> </ul>	2.08	04/07/95 - 06/15/95
Total			29.73	
<b>Subcontracts</b>				
Dr. David M. Freeman	Irrigation Organization Specialist	- TA on irrigation organization assessment	0.92	01/02/92 - 1/20/92
Dr. John Wilkins-Wells	Sociologist	- Workshop in Organization Aspects of Irrigation	1.62	02/13/92 - 04/14/92
Mr. Gaylord V. Skogerboe	Irrigation Engineer	- TA to develop guidelines for operations and maintenance for joint managed systems	0.92	04/23/92 - 05/05/92
Dr. John Wilkins-Wells	Share System Specialist	- Action training and manual on O&M and share system	2.16	01/27/93 - 03/31/93
Dr. John Wilkins-Wells	Share System Specialist	<ul style="list-style-type: none"> <li>- Developed a training course on Share System Development and Administration</li> <li>- Conduct training</li> <li>- Prepare manuals for future training</li> </ul>	1.43	11/09/93 - 12/21/93

Name	Title	Activity	LOE (months)	Assignment Period
Dr. John Wilkins-Wells	Share System Specialist	<ul style="list-style-type: none"> <li>- Conducted a Share System Orientation Training to DOI</li> <li>- Developed an annual status report to be used by WUAs</li> <li>- Assessed the progress of the WUA development at the management transfer site</li> </ul>	1.66	11/14/94 - 12/23/94
Dr. John Wilkins-Wells	WUA Specialist	<ul style="list-style-type: none"> <li>- Reviewed and made suggestions for the Memorandum of Agreement and the plan of action for irrigation system</li> <li>- Prepared a proposal to integrate Narayani Lift and Khageri with a share system</li> <li>- Provided a vision of legal and policy requirements for the WUA to operate as a business house</li> </ul>	1.43	11/14/94 - 12/23/94
Total			10.14	

## 8. APPENDICES

### 8.1 Books Supplied by IMP/CADI to the RTDB Library

- Anderson, R.D., and A. Maas. 1986. *...and the Desert Shall Rejoice - Conflict, Growth and Justice in Arid Environments.*
- Belasco, J.A. 1991. *Teaching the Elephant to Dance.*
- Bos, M.G., J.A. Replogle, and A.J. Clemmens. 1991. *Flow Measuring Flumes for Open Channel Systems.*
- Lewis, H.T. 1991. *Ilocano Irrigation, The Corporate Resolution.*
- Enge, K.I. and S. White. 1989. *The Keepers of Water and Earth: Mexican Rural Social Organization and Irrigation.*
- Freeman, D.M., V. Bhandarkar, E. Shinn, J.R. Wilkins-Wells, and P. Wilkins-Wells. 1989. *Local Organization for Social Development.*
- Freeman, D.M. 1992. *Choice Against Choice.*
- Hoffman, G.J., T.A. Howell, K.H. Soloman, eds. 1990. *Management of Farm Irrigation Systems.*
- Johnston, W.R. and J.B. Robertson, Eds. 1991. *Management, Operation and Maentenance of Irrigation Systems.*
- Simpson, A. 1988. *dBase Instant Reference.*
- Simpson, A. 1989. *dBase IV Programmer's Instant Reference.*
- Wood, G.D. and R.P. Jones. 1991. *The Water Sellers: a Cooperative Venture by the Rural Poor.*
- Skogerboe, G.V., K. Kawsard, and N. Reansuwong. 1988. *Handbook of Improved Irrigation Project Operation Practice for the Kingdom of Thailand.*
- Skogerboe, G.V. and W. Smitthimadhindra. 1988. *Handbook of Improved Irrigation Project Maintenance Practices for the Kingdom of Thailand.*

Skogerboe, G.V., G.P. Merkley, M.S. Shafique, and C.A. Gandarillas. 1992. *Field Calibration of Irrigation Flow Control Structures*.

Hargreaves, G.H. and Z.A. Samani. 1986. *World Water for Agriculture*.

Chitrakar, P.L. *Planing Agriculture and Farmers Strategy for Nepal*.

## **8.2 Books Supplied by CADI through SMTP Funding**

Berkoff, D.J.W. *Irrigation Management on the Indo-Gangetic Plan*.

Freeman, David M. *Local Organizations for Social Development*.

Hillel, D. *The Efficient Use of Water in Irrigation Principles and Practices for Improving Irrigation in Arid and Semiarid Regions*.

Hoffman, G.J., T.A. Howell, and K.H. Solomon. *Management of Farm Irrigation Systems*.

Jensen, M.E., R.D. Burman, and R.G. Allen. *Evapotranspiration and Water Requirements*.

Ostrom, Elinor. *Crafting Institutions for Self-Governing Irrigation Systems*.

Safadi, Raed and Herve Plusquellec. *Research on Irrigation and Drainage Technologies, Fifteen Years of World Bank Experience*.

Sampath, R.K. and R.A. Young, eds. *Social, Economic, and Institutional Issues in third World Irrigation Management*.

Sun, Peter. *Land and Water Resources Management in Asia*.

World Bank/USAID. *Irrigation Training in the Public Sector, Guidelines for Preparing Strategies and Programs*.

World Bank. *Monitoring and Evaluating Development Projects: The South Asian Experience*.

World Bank. *Planning the Management, Operation and Maintenance of Irrigation and Drainage Systems*.

Ahmad, A. and G.P. Kutchen. 1992. *Irrigation Planning with Environmental Consideration*.

ASAE. 1984. *Erosion and Soil Productivity*.

- ASCE. 1977. *Sedimentation Engineering*.
- Ashby, Jacqueline. 1990. *Evaluating Technology with Farmers*.
- CIAT. 1988. *Effective Use of Water in Irrigated Agriculture*.
- Eaton, D.J., Ed. 1992. *Water Resources Cooperation between Nepal, India, and Bangladesh*.
- Farrington, John and Adrienne Martin. 1988. *Farmer Participation in Agricultural Research*.
- IIMI. 1990. *Role of Social Organizers in Assisting Farmer-Managed Irrigation Systems*.
- IIMI. 1990. *Resource Mobilization for Sustainable Management*.
- IIMI. 1990. *Design Issues in Farmer-Managed Irrigation Systems*.
- IIRI. 1991. *Basic Procedures for Agro-economic Resource*.
- LeMoigne, Guy, et al. 1992. *Developing and Improving Irrigation and Drainage Systems*.
- Lyndon B. Johnson School of Public Affairs. 1993. *Water Resource Cooperation in the Ganges-Brahmaputra Basin*.
- Murphy, Josette, et al. 1991. *Farmer's Estimations as a Source of Production Data*.
- Pandey, R.K. 1991. *A Primer on Organic Based Rice Farming*.
- Saito, K.A. and D.S. Purling. 1992. *Developing Agricultural Extension for Women Farmers*.
- Small, Leslie E. and Ian Carruthers. 1991. *Farmer-Financed Irrigation*.
- Small, L.E., et al. 1989. *Financing Irrigation Services*. (provided free of charge by IIMI)
- Tracey, W.R. 1992. *Designing Training and Development Systems*.
- World Bank. 1991. *Using Indigenous Knowledge in Agricultural Development*.
- Kelly, W.L. 1986. *You and Value Whatnot*.
- Dewey Decimal System Classification*. DDC Publications.

- Shrestha, K.N. and K.D. Manaandhar. 1993. *Statistics and Quantitative Techniques for Management*.
- Hansen, Gary W. 1983 *Herbicide Manual*.
- Creighton, James L. 1980. *Public Involvement Manual*.
- USBR. 1984. *Water Measurement Manual*.
- USBR. 1971. *Water Measurement Manual (Metric Supplement)*.
- USBR. 1988. *Pesticide Applicators Safety Manual for Irrigation Systems*.
- Hegdel, Paul L. and A.J. Harbour. 1991. *Prevention and Control of Animal Damage to Hydraulic Structures*.
- Avery, P. *Sediment Control at Intakes*.
- USBR. 1993. *Drainage Manual*.
- ASA. 1988. *Cropping Strategies for Efficient Use of Water and Nitrogen*.
- Umali, Dina L. *Irrigation-Induced Salinity: A Growing Problem for Development and the Environment*.
- Fredrickson, Herald D. 1992. *Water Resources Institution Some Principles and Practices*.
- World Bank. 1993. *Water Resources Management A World Bank Policy Paper*.
- World Bank. 1993. *Groundwater Irrigation and the Rural Poor. Options for Development in The Gangetic Basin*.
- World Bank. 1993. *Using Water Efficiently, Technological Options*.
- CIAT. 1991. *Gender Analysis in Agricultural Research*.
- Lynton, R.P. and U. Pareek. 1990. *Training for Development*.
- CABI. *Monitoring and Evaluation Agricultural Research*.
- Jacobson, Jodi L. *Gender Bias: Roadblock to Sustainable Development*.

Kumar, Krishna. *Rapid Appraisal Methods*.

Conway, Gordon and Edward B. Barbier. 1990. *After the Green Revolution - Sustainable Agriculture for Development*.

CIAT. *Farmer Evaluations of Technology: Preference Ranking - Instructional Unit No. 2*.

Byrnes, Kerry J. *Water Users Associations in World Bank 0 Assisted Irrigation Projects in Pakistan*.

Stroud, Ian. 1993. *Conducting On-farm Experiments*.

Cornell University. 1992. *Diversity, Farmer Knowledge and Sustainability*.

Postel, Sandra. 1992. *Last Oasis Facing Water Scarcity*.

Faye, Tom and Alphone. *Using Farmer Participatory Research to Improve Seed and Food Grain Production in Senegal*.

Hudgins, Robert E. *Selecting Technologies for Sustainable Agriculture*.

IBSRAM. 1991. *Evaluation for Sustainable Land Management (1 set of 3 parts)*.

MacMillan/CTA. 1992. *Ways of Water-Run-Off Irrigation and Drainage*.

USBR. 1990. *Earth Manual, Part 2*.

Sims, Hilary, Field Stein, and Janice Jiggins. 1994. *Tools for the Field: A Methodologies Handbook*.

Vincent, Linden. 1994. *Hill Irrigation: Water and Development on Mountain Agriculture*.

Dudley, Nigel. 1992. *Land is Life: Land Reform and Sustainable Agriculture*.

Jodha, N.S. 1992. *Sustainable Mountain Ag*

### **8.3 Journals Supplied by IMP/CADI to the RTB Library**

*Journal of Irrigation and Drainage*. ASCE

*Agricultural Water Management*. Elsevier Publications.

*Irrigation and Drainage Systems.* Kluwer Academic Publishers.

*ICID Bulletin.* International Commission on Irrigation & Drainage.

*Water International.* International Water Resources Association.

*Water Resources Development,* Carfax Publishing

#### **8.4 Videos Supplied by IMP/CADI to the RTB Library**

Crafting Institutions for Self-Governing Irrigation Systems, an International Center for Self-Governance and Studio Miramar Production.

Improving the Operation of Canal Irrigation Systems. EDI/World Bank. (provided free of charge by the World Bank)

Professional Supervision Skills, by Jack M. Everitt, Career Track Publications.

Project Management with Larry Johnson, Career Track Publications.

#### **8.5 Software Provided by IMP/CADI for the TA Team**

Lotus 123 Release 5 Spreadsheet for Windows

WordPerfect for Windows Version 5.2

dBASE for Window Version 5.0

MapInfo for Windows Version 3.0

MapBasic for Windows Version 3.0.2

Typing Tutor Version 6 for Windows

Drafix Windows CAD

## 8.6 Inventory of Major Items Purchased by CADI

S.N.	Item	Quantity	Condition	Cost (\$)	Remarks
1.	Book Shelf	1 Pc	Good	91.09	Turned over to DOI
2.	Fax Machine, Canon	1 set	Good	493.49	Turned over to DOI
3.	Birla Yamaha Generator [Engine No. E. 93.00-336 (2350 V.A) Model No. LG2800]	1 set	Good	1,303.85	Turned over to DOI
4.	Steel Filing Cabinet, 4 Drawer Podrej	1 No.	Good	164.78	Turned over to DOI
5.	Monochrome Computer Monitor (Shery VGA SER No. 4017105)	1 No.	Good	232.79	Turned over to DOI
6.	Book Rack, Wooden	1 No.	Good	55.87	Turned over to DOI
7.	Computer Keyboard	1 No.	Good	36.44	Turned over to DOI

## 9. ACRONYMS

ADB	Asian Development Bank
ARD	USAID Office of Agriculture and Rural Development
CADI	Computer Assisted Development, Inc.
CSU	Colorado State University
DBMS	Database Management System
DDG	Deputy Director General
DG	Director General
DOI	Department of Irrigation
FMIS	Farmer Managed Irrigation System
FO	Farmer Organizer
GIS	Geographic Information System
GUI	Graphical User Interface
GEOCE	GEOCE Consultants (P.) Ltd.
HMG/N	His Majesty's Government of Nepal
HRDTB	Human Resource and Technology Development Branch of IMD
IAAS	Institute of Agriculture and Animal Sciences, Rampur, Nepal
IMI	International Irrigation Management Institute
ILC	Irrigation Line of Credit Project
IMA	Irrigation Management Advisor, Irrigation Management Project
IMD	Irrigation Management Division
IMP	Irrigation Management Project, HMG/USAID/Nepal
IMS	Irrigation Management Specialist (GEOCE TA)
IMTP	Irrigation Management Transfer Project
IMWUD	Irrigation Management and Water Utilization Division
ISP	Irrigation Sector Project
LOE	Level of Effort
ME&F	Monitoring, Evaluation, and Feedback
MOWR	Ministry of Water Resources
NGO	Non-governmental Organization
NFY	Nepali Fiscal Year
O&M	Operation and Maintenance
RTB	Research and Training Branch
RTDB	Research and Technology Development Branch
RTMS	Research and Training Management Specialist (GEOCE TA)
SBA	Small Business Administration
SMB	System Management Branch
SMTTP	Systems Management and Training Program
TA	Technical Assistance
TA Team	Technical Assistance Team - CADI and GEOCE
USAID	United States Agency for International Development, Nepal
WUA	Water User Association