Report # R-42

PILOT PROJECT FOR FARMER-MANAGED IRRIGATED AGRICULTURE UNDER THE LEFT BANK OUTFALL DRAIN STAGE-1 PROJECT, PAKISTAN

PROSPECTS FOR FARMER-MANAGED IRRIGATED AGRICULTURE IN THE SINDH PROVINCE OF PAKISTAN

FINAL REPORT

D. J. Bandaragoda
Gaylord V. Skogerboe
Yameen Memon

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PAKISTAN NATIONAL PROGRAM
INTERNATIONAL IRRIGATION MANAGEMENT INSTITUTE,
LAHORE

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Acknowledgements

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Summary

An action research program conducted in three pilot distributaries in the Sindh Province found that organizing water users at the secondary level was socially viable. The popular notions related to constraints of illiterate farmers, social pressure from big landowners and obstacles caused by the hierarchical society were proved invalid under conditions of a participatory process of social organization. The methodology used was characterized by a step-wise process, which was catalyzed by a locally recruited small field team with the assistance of community-based social organization volunteers. Training and other forms of capacity building were the major motivating influences. A field implementation coordination committee consisting of representatives of all service delivery agencies working in the area, along with selected water users, highlighted the needed farmer-agency coordination and greatly facilitated an incentive mechanism through collaborative activities. This combined effort successfully achieved the formation of eighty water users associations (WUAs) at the watercourse level, and three water users federations (WUFs) at the distributary level.

The three WUFs negotiated with government irrigation authorities and entered into three joint management agreements (JMAs) for managing water resources at the distributary level. The JMAs could not be given effect as the government had to suddenly decide to lay them in abeyance due to a procedural difficulty imposed by the present legal framework. However, the WUFs proceeded to test their capacity in undertaking a planned maintenance program during the canal closure period, and also initiating a maintenance-related infrastructure improvement program. Testing the economic viability of WUFs was not completed as the JMAs were not operational.

Replicability of this social organization program lies in the methodology adopted, deployment of small field teams and the use of local volunteers. Sustanability is enhanced by the phased step-wise organizational development process, which has proved to be a success in consolidating the organized behavior. One drawback has been the lack of full commitment from the related government agencies, which have to take the initiative for empowering the water users for effective joint management of water resources. However, both the enthusiasm and the capacity demonstrated by the water users in social organization for collective action show that the potential for further progress is encouraging. It is very likely that the demand generated at the local level could facilitate a process of bureaucratic reorientation, which in turn would provide the necessary institutional support for the new WUOs.

The Final Report presents eight specific recommendations arising from its conclusions. They are all aimed at encouraging the Government of Sindh to proceed with the intended institutional reforms, including the formation of water users federation at the secondary canal level.

Chapter 1

INTRODUCTION

1.1 The Report

This Report sums up the results of an action research program on social organization for irrigated agriculture in Pakistan conducted by the International Irrigation Management Institute (IIMI). While summarizing the program outcomes, an analysis of action research empirical data is presented in the light of existing theoretical knowledge on collective action for natural resource management. The report also highlights the constraints associated with a wider application of some of these findings and outlines the prospects of related institutional reforms in Pakistan.

The action research program covered three pilot sites in the Left Bank Outfall Drain (LBOD) area of the Sindh Province (see map of LBOD area in Figure 1.1). As the main focus of the action research was to test the viability of establishing effective users organizations to manage water resources at the secondary canal level, three distributaries were selected as pilot sites, one from each of the three LBOD districts: Bareji Distributary in Mirpurkhas District; Dhoro Naro Minor in Nawabshah District; and Heran Distributary in Sanghar District[1].

Each of the three pilot distributary sites was of intermediate size, having between 20 to 30 watercourses and a command area of about 5,000 to 6,000 hectares, with a manageable number of people, the total population in each pilot command area ranging from 10,000 to 25,000. The Heran Distributary in Sanghar, which has one minor (Khadwari), offtakes from the Nara Canal at RD[2] 129, whereas, the Baraeji Distributary in Mirpurkhas offtakes from Nara's Branch, Jamrao East, at RD 408. The Dhoro Naro Minor in Nawabshah offtakes from a different canal system, the Gajrah Branch of the Rohri Canal, at RD 91. See Figure 1.1 for a location map of the three pilot distributaries.

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1 In the Sindh Province, the term "minor" is often used to mean a small distributary (Dhoro Naro Minor is actually a distributary). In this report, while retaining the popular usage in referring to specific canal sites, the generic term "distributary" is used to mean a distributary or a minor offtaking from a main or branch canal. Any secondary canal offtaking from a distributary will be referred to as a minor (e.g. Khadwari Minor, which offtakes from Heran Distributary).

2 Reduced distance is the distance in measures of 1000 feet of any point on the center line of a canal from the head of the canal (RD 24 = 24,000 ft from the head of the canal).

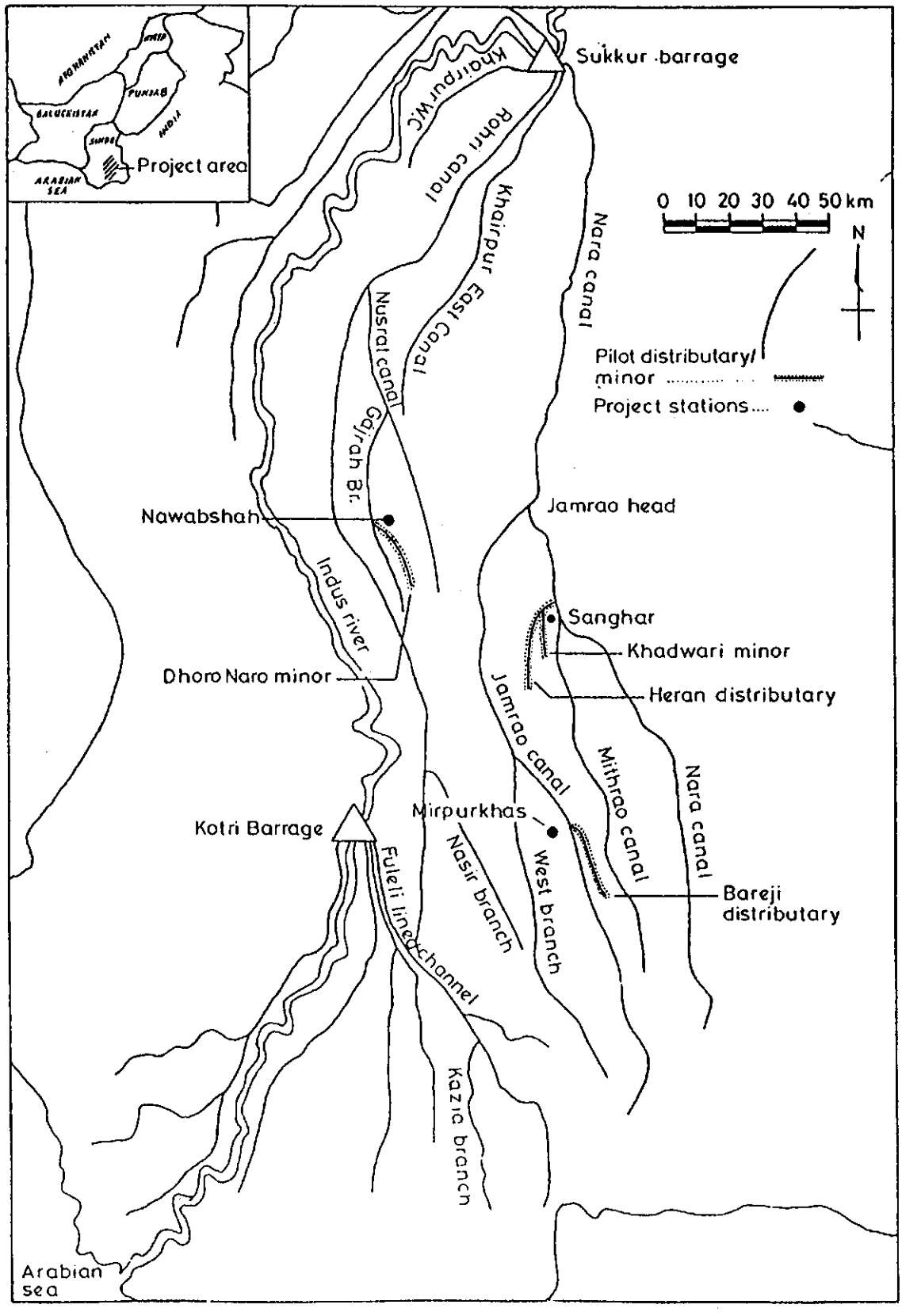

Figure 1.1 - Map of LBOD Areas.

The action research program was financially supported by the World Bank and the Swiss Development Cooperation, and was sponsored by the Government of Sindh through its Directorate of Agriculture Engineering and Water Management. The study itself was part of a larger infrastructure development effort installing extensive drainage facilities in LBOD area, supported by a number of donors coordinated by the World Bank. The initiative for exploring greater users' involvement was based on the likely realization that the completion of LBOD Project facilities would drastically increase the budget requirements for proper maintenance of the irrigation and drainage systems in Sindh.

During the 30-month study period, the donors and the government authorities were consistently kept informed of the progress of study activities through regular monthly progress reports (MPRs). The project's Terms of Reference required that, in addition to MPRs, there should be summary reports at the end of each phase of the project[3].

The Phase I Report was issued in October 1995, along with a detailed Inception Report, which described the project objectives, concepts and methodologies, and the plan of operations. The Phase II Report was issued in January 1997 to cover the period from 1 October 1995 to 31 December 1996. Extending the Phase II period beyond the originally planned end date of September 1996 helped to include some important organizational activities leading to the formation of three water users federations for the three pilot distributaries.

This final report summarizes all of these MPRs, along with Phase I and Phase II reports, and includes a summary of Phase III activities. It also supplements them with a broader commentary on the prospects of collective action for water resources management in the Sindh Province based on field experiences from the three pilot sites. As a departure from the Phase II Report, this final report will devote a substantial portion of its text to present a rationale for collective action on irrigated agriculture, using a theoretical view point based on property rights related to water resources in large irrigation canal systems.

This introductory chapter will be followed by Chapter 2 dealing with the key concepts underlying the action research program, Chapter 3 giving the identified technical context for social organization part of action research, and Chapter 4 on action research results. In Chapter 5 and Chapter 6, there will then be a discussion on the institutional support and business planning information that would be required to nurture the fledgling water users organizations. In Chapter 7, the report will present some concluding remarks and also set out some guidelines for future action.

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[3] The project was designed for three phases to be implemented during a period of 30 months from July 1995 to December 1997. According to the project profile, Phase I of the project covered the inception period of three months starting from 1 July 1995, whereas, Phase II covered the period from October 1995 to September 1996, and Phase III was to cover the period up to 31 December 1997.

1.2 Project Background

Pakistan's heavy investment in irrigation infrastructure has given the country the world's largest contiguous canal irrigation system. The massive resource base of the Indus Basin Irrigation System is the cumulative effect of more than a hundred years of consistent investment in irrigation development. The high water mark of this investment was the Indus Basin Project (IBP) of the 1960s, which saw an increase in the total water supply for irrigation from about 79 billion cubic meters at the time of independence to almost 135 billion cubic meters by the end of the IBP effort (**Bandaragoda, 1993:10**). For the pre-independence projects during the First Five-Year Plan period (1955-60), the share of public investment on agriculture and irrigation was around 30%. This share increased to about 46% during the Second and Third Plan periods (1960-70) when the Indus Treaty projects were implemented, but since then declined rapidly to a level of about 17% in the Sixth Plan period in the 1980's (**Hamid and Tims, 1990**).

Although the share of the government budget for development work gradually declined since the completion of the IBP, the government continued to allocate resources for upgrading and enhancing the system to meet an increasing demand for irrigation. The operation and maintenance of this extensive irrigation system and its related drainage and flood protection measures have largely been a responsibility of the government. While the Provincial Irrigation Departments (PIDs) have been responsible for the major part of the task, the operation and maintenance (O & M) of the main and secondary canal sub-systems, farmers have attended to the maintenance of the tertiary sub-systems at the watercourse level.

The annual O & M allocations for the PIDs gradually became insufficient due to inflation and heavy inter-sector competition for resources, and the management of O & M became increasingly ineffective due to changing socio-economic conditions. Despite the increases in water charges (e.g. an average of 5% per annum from 1983 to 1987), the revenues as a percentage of O & M costs declined (e.g. from 53% to 38% during the period). Increases in O & M costs, low assessment of water charges and low recovery rates, all combined to form this imbalance (**WSIP, 1990**).

The canal system started to deteriorate. The resultant decline in performance deprived the country of its expected return on investment in irrigation development. Pakistan's crop yields remained generally low, or progressed only very slowly when compared to many other countries. Similarly, poverty has stubbornly persisted in rural areas despite their proximity to irrigation. A daunting aspect of this unsatisfactory irrigation performance, despite the favorable resource base and related technological advances, could well be a substantial food deficit in the future, particularly in view of the country's fast growing population.

Donors and external evaluators started to draw attention on the need to identify correct solutions to improve this state of unsatisfactory performance. Pakistan's major irrigation problem in the present context might not necessarily be one of water shortage due to difficulties of further enhancing the physical system. Considerable performance improvement could be achieved by introducing and sustaining appropriate institutional and management innovations.

Illustrating this concern, the World Bank funded four projects: On-Farm Water Management Projects I and II (1981-1992), Irrigation System Rehabilitation Project (1982-1987) and Command Water Management Project (1984-1992) to address the major system management and institutional issues. All of these four projects, at an investment level of $175 millions, were to concentrate on reducing drainage and saving water using existing infrastructure, rather than building new dams, and had a specifically designed institutional component. The importance of this shift of emphasis was further accentuated by continued donor pressure for institutional reforms, which resulted in a slow movement towards change. This situation is summarized below.

1) Provincial legislation was passed in the early 1980s, allowing the formation of Water Users Associations (WUAs) on individual watercourses. Since that time, thousands of WUAs have been organized with government subsidy and support given under the **On-Farm Water Management (OFWM)** development program.

2) In some selected area commands, a certain degree of institutional coordination was attempted under the **Command Water Management Program (CWMP)**, in which farmer participation was made an essential requirement for project implementation.

3) Various evaluations of this work (**Byrnes, 1992; Asrar-ul-Haq, Shahid and Akram, 1996**) created the common impression that these attempts at farmer involvement in the management of the irrigation system so far have not led to sustained farmers participation or to lasting benefits. The World Bank's post-project evaluations later confirmed that the projects achieved their physical components (watercourse water losses reduced from about 40% to 25-30%; and annual water savings from the four projects amounting to about 2.3 billion cubic meters), but failed in most of their institutional objectives. The evaluations further commented that the newly formed WUAs, to meet project conditions, were merely token associations or the old watercourse committees renamed, making the whole exercise an "empty ritual" (**World Bank, 1996**).

4) Government policy levels started to participate in discussions with the donors on possible institutional reforms. Several seminars were held among local opinion leaders to discuss the implications of suggested reforms, and these ideas were later expressed in published form (e.g **Asrar-ul-Haq et al, 1996**).

5) Meanwhile, the World Bank in their report on **"Pakistan, Irrigation and Drainage: Issues and Options" (World Bank, 1994)** proposed a reorganization of the whole irrigation sector, including the establishment of autonomous public utilities for the management (including operation and maintenance) of the irrigation water.

6) Many government officials found this approach too radical, but recognized the need for some institutional change.

7) An initial government agreement on the need to change was arrived at a seminar on "Participatory Irrigation Management", co-sponsored by Pakistan's Ministry of Water and Power and the World Bank's Economic Development Institute, which was held in Islamabad during 2-6 October 1994. This initiative was followed by another EDI sponsored workshop held in Burban in October 1995, during which the representatives from four provinces worked out tentative action plans for institutional change.

8) In the midst of considerable pessimism about participatory irrigation management and its validity in Pakistan's large canal systems, a consensus started to be developed on the need to undertake some pilot projects in selected locations.

9) IIMI's preliminary study results in irrigation system management, policy and institutional analysis in Pakistan coincided with, and probably helped to catalyze, these newly emerging concerns and interests (**Bhutta and Vander Velde, 1992; Vander Velde and Murray-Rust 1992; Bandaragoda and Firdousi, 1992; Bandaragoda, 1993; Restreppo, Bandaragoda and Strosser, 1994; Bandaragoda and Saeed ur Rehman, 1995**).

10) Currently, there is a growing awareness regarding the necessity for farmers' involvement in operation and maintenance, mostly prompted by donor concerns, and also based on the realization that declining budgetary capacities would soon have adverse effects. Yet, there is considerable pessimism among many government officials about being able to form effective farmers organizations and their impact on the productivity and sustainability of irrigated agriculture.

Although it has been a slow process of change, Pakistan's plan for institutional change in this vitally important water sector is a very practical and contextually appropriate strategy. Sensing the initial objections to concepts, such as "privatization of irrigation" and "irrigation management turnover", the planners consciously shifted to a strategy of organizational reform as an initial step. While many other countries floundered on this essential requirement, Pakistan put forward the ideas of "decentralization" and "participatory irrigation management" to neutralize initial objections. The reforms started with the enactment of new laws in the form of Provincial Irrigation and Drainage Authority (PIDA) Acts of 1997, and the appointment of PIDA Boards.

1.3 Project Inception

As budgetary pressure was increasing, the government authorities and donors explored measures to involve the farmers in managing irrigation and drainage systems for improved irrigated agriculture performance. Following this new trend, the Government of Sindh (GoS) decided to try some interventions through a few pilot projects on farmers organizations at the distributary level in areas where infrastructure development was already under way through the World Bank-sponsored Left Bank Outfall Drain (LBOD) Project in the Sindh. This initiative was basically motivated by the fact that the completion of the LBOD Project facilities would drastically increase the budget requirements for proper operation and maintenance of the irrigation and drainage systems in the Sindh, and that the involvement of farmers in a participatory management approach could reduce the burden of budgetary constraints.

Consequent to preliminary discussions between GoS authorities and the two donors, the World Bank and Swiss Development Cooperation, the Department of Agriculture prepared a Supplementary PC-I which was approved by the GoS in September 1994. Based on this project document, IIMI prepared a study proposal focusing on the social organization aspects of the PC I project content. The proposal included the field research approach and the implementation strategy for action research to implement a pilot project in which three Farmer Organizations[4] (FOs) would be established, one in each of three LBOD districts. Finally, the consultancy contract between IIMI and the GoS Department of Agriculture Engineering and Water Management for the pilot project[5], titled, "Farmer-Managed Irrigated Agriculture Under the Left Bank Outfall Drain, Stage I Project", was signed on 26 July 1995, but made retroactive to 1 July 1995.

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[4] Although the initial project document used the term, Farmers Organization (FO), the term, Water Users Organization (WUO) was thought to be more appropriate for the action research which focused on actual users of water resources in the field.

[5] Currently, in addition to IIMI's present efforts in the Sindh, there are at least five distributary level pilot projects in Pakistan, which are underway for enhanced water users' involvement in the management of operation and maintenance. With financial support from the Royal Netherlands Government, IIMI is conducting one such pilot project in the Fordwah Eastern Sadiqia command area, as part of its study project, "Managing Irrigation for Environmentally Sustainable Agriculture in Pakistan". As part of the World Bank-supported Fordwah and Eastern Sadiqia (South) Irrigation and Drainage project, the On-Farm Water Management Directorate of Punjab is engaged in two pilot projects in the same area. The Federal Coordination Unit (Water Management Wing) of the Ministry of Agriculture, Food and Cooperatives is working on two pilot projects, one in the NWFP and the other in the Punjab.

Immediately after this arrangement, essential project staff were recruited, an office was opened in Hyderabad, and the field teams were trained (see Section 4.3.1) and deployed in the three LBOD district centers. A reconnaissance survey was carried out to obtain preliminary information for the purpose of selecting appropriate pilot sites.

A one-day workshop was held on 26 November 1995, specifically for the purpose of discussing inception activities and selecting three pilot sites. The workshop was attended by a number of senior officials representing various collaborating agencies (Irrigation, On-Farm Water Management, Agriculture Extension, WAPDA's LBOD Project), and the representatives from the Research and Development Engineers (RADE) Consultants and IIMI. They had the opportunity to discuss the relevant issues on the basis of field information provided to them and their own experience, and assist in deciding three sites, one from each of the three LBOD districts, Mirpurkhas, Nawabshah and Sanghar.

The three pilot distributaries were selected in the workshop considering a set of short-listed distributaries in the LBOD area prepared by IIMI's field teams in collaboration with the staff of operating agencies (**Table 1.1** gives some details). The criteria adopted in this decision were:

* Number of land holders and their distribution according to size of landholding;
* Extent of political influence;
* Availability of drainage system;
* Number of lined watercourses indicating previous organized behavior;
* Law and order situation; and
* Distance of head and tail of distributary from a suitable field station location.

Table 1.1. Information on three selected distributaries.

Name of Distributary/Minor	No. of Outlets	CCA Hectares	No. of Land Owners			No. of Villages	No. of House holds	Population
			Total	Owning >40 ha	Owning <10 ha			
Bareji Distributary (Mirpurkhas)	24	5,728	197	20	109	79	1,703	10,580
Dhoro Naro Minor (Nawabshah)	25	5,353	421	17	336	147	2,468	19,822
Heran Disty Main Stream (Sanghar)	24	4,935	435		100	30	2,053	15,687
Khadwari Minor (Sanghar)	7	1,230	104	1	33	14	1,097	11,130
Heran Disty Total (Sanghar)	31	6,164	539	1	133	44	3,150	26,817

(Data collected by IIMI Field Teams during project inception stage)

Chapter 2

KEY CONCEPTS

The action research program had two broad objectives, which were to be achieved through four main sets of activities. The chosen approach was on the premise that "farmers can manage", which was a marked deviation from the popular local notion that the farmers were illiterate and incapable of undertaking management responsibilities. Yet, the effort was based on a number of assumptions, while it was firmly grounded on several theoretical concepts concerning collective action for natural resource management. As a major deviation from the current emphasis on devising institutional strategies for reducing government budgetary pressure on operation and maintenance of irrigation systems, the action research program aimed at broader resource management goals. The following sections of this chapter give some details of this conceptual framework, including objectives, approaches, assumptions and theoretical bases of the action research program.

2.1 Objectives, Approaches and Assumptions

Project Objectives: IIMI's proposal for this action research had two main objectives:

(A) to test the viability of farmers organizations managing parts of the irrigation systems so that more efficient and equitable allocation of water can be achieved; and

(B) to make recommendations on future extension from the results of the pilot projects.

In order to achieve these two main objectives, the pilot project aimed to conduct the following four main activities:

(1) help establish water users organizations (WUOs) in three selected distributary canal command areas;

(2) train the WUO members in the pilot sites for taking collective choice decisions and actions related to water resources management;

(3) assist these WUOs to undertake distributary canal level water resources management on the basis of joint management agreements between WUOs and irrigation authorities; and

(4) identify the necessary legal and institutional support services for effectively implementing a water users organization program on a wider scale.

Project Approach: The broad conceptual approach underlying the pilot project had more specific expectations for the future progress of participatory management:

* that the WUOs would eventually be accountable for the water received at the head of distributary canals;

* that the WUOs would be responsible for distribution of water among the member water users associations (WUAs) at the watercourse level according to their own agreed allocation rules;

* that the WUOs and their member WUAs would be responsible for managing groundwater levels in their respective command areas;

* that the WUOs would reach an agreement with their members, as well as with the agencies, for assessment and collection of appropriate water charges and/or operation and maintenance (O&M) costs of irrigation and drainage facilities in their distributary command areas; and

* that they will undertake the collection of water/drainage charges, improve water management practices, and other activities related to the use and disposal of irrigation water, including the maintenance of irrigation and drainage facilities.

To realize these expectations, the project design further conceptualized that the WUOs would be able to develop and enforce appropriate internal by-laws, which will be binding on their members, and resolve any water-related disputes that may arise among them. It was envisaged that some "social engineering" by the social organizers would be able to catalyze this process so that the WUOs and their members would agree upon a set of rules, rights and responsibilities.

Assumptions: Several assumptions underlie these conceptual project approaches, of which the main items are:

* that the operating agencies will be ready to empower the new pilot WUOs and cooperate with them to ensure uninterrupted water supplies and operation and maintenance of the physical systems (the requirement for government agencies' commitment in this regard was not reflected in any of the project documents);

* that the government will assist the new WUOs to enforce their internal rules by providing them with an adequate enabling legal environment;

* that the individual water users will derive some economic gain out of being organized for taking over additional responsibility (for lack of clear empirical evidence from any of the trial efforts conducted so far regarding the extent of profitability or individual economic gain from collective action, farmers often question the potential of such gain); and

* that the organized farmers could cope with the existing social pressure that is fashioned by political and feudalistic forces, and proceed with their intended collective actions to improve equity in water distribution.

2.2 Water Resources Management vs Irrigation System Management

Many donor-related projects and government interventions on investment in irrigation development tend to focus on two main post-project management responsibilities: system operation and system maintenance. Accordingly, irrigation agencies in developing countries are primarily concerned with the O&M of "irrigation schemes", rather than managing water as a resource. Rare occasions of performance studies and using performance indicators usually try to evaluate more about the behavior of the physical systems, rather than how the human beings behave in managing water as a resource. Recently introduced concepts and strategies of "participatory irrigation management", which refer to the needed involvement of users in irrigation management, also retain this preferred focus on system management.

Popular participation is believed to be a strategy primarily to increase the probability of establishing infrastructure people want, in ways people can and will manage them (**Mienzen-Dick, Reindinger and Manzardo, 1995**). The major benefits from users participation through collective action have frequently been presented as increasing the potential for better maintenance of physical facilities, contributing to community cohesion and empowerment, and reducing the financial and management burdens of the governments. The developing country governments usually tend to be content in satisfying donor pressure on these preferred emphases, whereas the donors also perceive the countries' fiscal and management constraints as their major motivating factors for change. A common perception is that "governments are finding that by involving strong water users associations in project management and fee collection at the local level, they can use the capacity of community members to exert social pressure on their neighbors to pay" (**World Bank, 1993:57**).

Increasingly, many developing countries are looking for strategies in fostering users' participation primarily for this limited purpose of irrigation system management. Irrigation management turnover (IMT), which is the popular term for "the shift in responsibility and authority for the management of irrigated agriculture from the government to non-government entities" (**Vermillion, 1996**), has become a prominent national policy in more than 20 countries, including those with major irrigated farming systems (**Turral, 1995:7**). These, apparently extractive, objectives do not encourage water users towards social

organization for participatory management. The need to improve fee collection among them, or the need to reduce government expenditure, would not readily motivate the (usually self-interested) individual water users to undertake collective actions.

The term "water resources management" has a wider connotation encompassing a number of essential management features, which transcend beyond the boundaries of "irrigation system management". First, it forces the thinking about water as a resource, which is distributed among, or appropriated by, a competing group of users within integrated water resource systems[6]. Second, it compels the individuals to be concerned about the sustainability of water resource use in the long term. Third, it alludes to a socio-economic impact associated with the use of water as an important input for a production process. Similarly, there are other aspects of technical, environmental, economic, social and institutional considerations of water resources management that are not necessarily brought out by too sharp a focus on irrigation system management.

From an engineering perspective, a water resource system may be represented only by its **physical capital**, consisting of the natural resource base (rivers, lakes, aquifers) and man-made infrastructure (dams, reservoirs, canals, headworks, gates). This physical system cannot be fully operated to produce goods and services unless it is "humanized" by appropriate human operators, for which the necessary skills and knowledge, or **human capital** would be needed. When individuals and groups follow productive patterns of behavior in producing goods and services, the improvements in the structure of relationships, or **social capital** would be needed between individuals that enable them to create new values (**Coleman, 1988**). A combination of all of these three concerns is meant in a broader perspective of water resources management.

In contrast to a focus on system management, the "water resources management" approach would be more closely linked with a set of objectives with a socio-economic impact. For this, an interaction of a variety of disciplines would be needed. "Unfortunately, in most cases, water management and the many disciplines required to produce efficient management are relegated to the postanalysis of engineering works, which aggravates not only the implementation of technology, but really constrains or makes extremely difficult the implementation of a host of services requiring strong institutional measures" (**Skogerboe, 1991**).

With output-oriented objectives, it becomes necessary to consider the social impact of water resources management. For instance, what irrigation does to the rural poor is a major issue of water resources management in developing countries. Does improved system management widen the gap between the rich and the poor?

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[6] For details of the concept of integrated water resource systems (IWS), see **Keller, Keller and Seckler (1996)**.

The National Commission on Agriculture (**Ministry of Agriculture, 1988**)commented: "Input subsidies and price supports for cash crops worked more to the advantage of the large farmers, ... The overall institutional support has not adequately benefited all crops, nor all categories of farmers". Similarly, present institutional arrangements for O & M management in the canal system seem to favor the rich and the larger farmers. In Pakistan, the average per capita income in rural areas (where about 70% of the population live) is less than half that in urban areas, and value added per worker in agriculture (which employs about 50% of the work force) is less than one-third of the rest of the economy (**Hamid and Tims, 1990**). Absolute rural poverty dropped by only one-third in twenty years, a much lower rate compared to achievements in some States of India (**John Mellor Associates and Asianics Agro-Dev, 1994**).

A more recent evaluation pointed out that poverty considerations were not a priority in Pakistan's irrigation development projects (**World Bank, 1996**). "While the projects helped alleviate poverty through their effects on farm production, they also provided large and unnecessary transfers of public resources to some of the rural elite". In effect, On-Farm Water Management Projects, the Irrigation System Rehabilitation Project and the Command Water Management Project have all tended to favor the more affluent farmer groups.

Thus, a key concept underlying this social organization action research is that water users organizations at the distributary canal level would be concerned with these broader aspects of overall water resources management within the distributary command area (see Section 2.4).

Value of Water as a Resource: In a broader concept of water resources management, another important consideration is how the economic value of water, as a resource, should be considered.

Pure public goods, such as national defence, clean air, or street lamp's light, are characterized by the jointness of supply and impossibility of excluding others efficiently from its consumption (**Scheumann, 1997**). These two characteristics of non-subtractability and non-excludability are not present in water resource systems. Water, when extracted by consumers as discrete resource units, is subtractable, in the sense that what one extracts would not be available to another. Also, for a given quantity of water, a group of consumers can be identified, excluding the others. Obviously then, in irrigation and drainage systems, water is not a pure public good.

Some prefer to see water as a social good or a free good. Yet others see it in economic terms. There has been a debate between those who like to treat water as a public good, a basic human need that any person should have access to at a reasonable or subsidized price (**Chambers, 1988**), and others who want to treat water as any other private good governed purely by market mechanisms (**Briscoe, 1996**).

Positioning itself between these two perceptions, the International Conference on Water and Environment of 1992 led to the proclamation that water should be treated as "an economic good". This proclamation, however, does not fully clarify whether water can be treated in the same way as other private goods, which can be efficiently allocated through competitive market pricing. A recent publication commented on this proclamation and argued that, as the distribution of water provides wide scope for externalities, market failure and high transaction costs, the application of price-based instruments are particularly difficult in the case of water resources (**Perry, Rock and Seckler, 1997**). While there is no question about water being essentially an economic good, the issue is whether water is a purely private good governed by market forces, or a public good that requires some sort of extra-market management. A reasonable conclusion can be that water can be both a private good and a public good, depending on the specific situational conditions, and the values attached to the use and usability of water (e.g. in a poor social context, water for drinking or irrigation needs can be made available on a subsidized rate, whereas, for industrial purposes in an urban area, it can be provided on the basis of free market prices).

2.3 Common Pool Resources and Property-Rights Regimes

Definitions: A concise definition of the term "common pool resources" (CPRs), given by **Ostrom (1992)** helps us to understand the dynamics of a property-rights regime. CPRs are "natural and man-made resources sufficiently large that it is costly to exclude users from obtaining subtractable resource units". A distinction is also made between the flow of resource units and the resource system producing the flow. While subtractability is a characteristic of the resource unit appropriated from a CPR, the jointness of use is a characteristic of the resource system.

The fact that the resource is jointly owned gives it the name, common pool resource, out of which an individual consumer or appropriator obtains resource units in such a way that each bundle of resource units consumed is subtracted from the pool of resources, and is not available to other consumers. CPRs and purely public (collective) goods both have a high cost for achieving exclusion, whereas, they differ in the jointness of consumption. Resource units of purely public goods can be extracted without subtracting from what is available to others, but, in the case of CPRs, they are consumed subtractively. The overexploitation problem of CPRs does not occur when collective or purely public goods, such as national defence and clean air, are consumed.

If a large number of consumers (appropriators) make heavy demands on a CPR, without communicating with one another and acting independently on self interest, then the overexploitation and the destruction of the CPR, or the "tragedy of the commons" (**Hardin, 1968**), are possible. However, this can be avoided through coordinated actions by the individual appropriators of the CPR.

Clarifying the confusion that may arise from a reference to common property resources in the literature[7], a distinction has been made between the resource itself and the property-rights governing it (**Scheumann, 1997; Ostrom, 1990**). "There is no such thing as a common property *resource*; there are only resources controlled and managed as common property, or as state property, or as private property, ... and there are resources over which *no property rights* have been recognized" (**Bromley, 1992:4**).

The last category is "no one's property", and are the resources having "open-access". When nobody has any property rights to benefits from a resource, then the resource is most likely to be overexploited, particularly if the benefits are greater than the costs of extracting them. Usually, the confusion arises when these resources with open access are referred to as common property, and the possibility of over-exploitation and deterioration are associated with all "common property resources". Thus, the "Tragedy of the Commons" popularized by Garret Hardin is erroneously made applicable to all resources not held by individual private property rights, making privatization the only solution to avoid the Tragedy.

Property-Rights: However, when resources are linked with property rights, irrespective of whether they are private, state or common property, overexploitation would depend on how effectively the property-rights regimes operate in allocating the costs and benefits of managing the resources, particularly in handling excludability and subtractability. The nature of the property, the definition of rights for it and their application are determined by the people and the institutions created by them, and not by the resource itself. Thus, the so-called "Tragedy of the Commons" is not inevitable in such instances with defined and enforced property rights.

Scheumann (1997:34) illustrates how common pool resource systems can be held under all of the four property-rights regimes mentioned earlier, and the circumstances under which overuse can occur, and when it can be avoided. On this basis, water resource systems can also be held by the following four categories of property rights:

Private Property (e.g., private tubewell, warabandi turn in a watercourse)
* Exclusion of consumers can be easily applied
* Resource allocation can be efficiently effected

State Property (e.g., main, branch and distributary canal water)
* High cost of exclusion leads to free-riding
* Non-cooperation of consumers is common
* Susceptible to overuse

[7] The popular use of the same acronym, CPR, to mean common pool resources, common property resources, and some times, common property regimes, adds to this confusion.

Common Property (e.g., village pond, farmer-managed irrigation system)

* Exclusion is possible
* Cooperation by consumers can be achieved
* Resource allocation can be made efficient

Open Access (e.g., deep ocean for fish, unsupervised lake or large canal)

* Non-exclusion is the norm
* Cooperation by consumers is not needed, or difficult to achieve
* Overuse is most likely to occur

Water Resource System as a CPR: A canal irrigation system, in which a time-based water turn rotation (warabandi) among the individual water users is in operation at the tertiary level, can be analyzed in terms of the above categorization.

(1) The tertiary level watercourse is a combination of common and private property rights. The physical system is common property as it belongs to the whole group of water users, whereas, the water flowing at a given time in the watercourse is private property as it belongs to one water user who is having the warabandi turn at the time.

(2) The secondary level distributary canal and the primary level main canal, including both water flowing in them, as well as their physical facilities, are state property.

(3) In effect, however, state owned canal systems, particularly the distributary canals, are often used as resource systems with open access. As they are large, under-supervised, and generally neglected in terms of regular operation and maintenance, exclusion is very difficult and costly. Consequently, more than officially allocated resource units are appropriated by some consumers (free-riding), and due to collusion by state agents (rent-seeking), this practice becomes more prevalent, resulting in overuse by some water users, leaving very little for others, and also causing the deterioration of the physical system.

Thus, in this action research, the distributary level water resource system is treated as a common pool resource, which is owned and managed as common property (commonly owned private property by a group of water users). Figure 2.1 gives the present and proposed property rights regimes for a canal water resource system. In a combination of property rights regimes (state, common and private), the interfaces between different regimes become important loci of research interests. Interactions between different regimes are determined by sets of external and internal rules. Converting the distributary level water resource system from its present "state property" status to a "common property" regime, the farmer-bureaucracy interface is shifted to the head regulator of the distributary canal (see Figure 2.2). While the external rules would largely determine the interactions at this interface, the distributary water resource system becomes a common pool resource for which appropriate internal rules need to be developed.

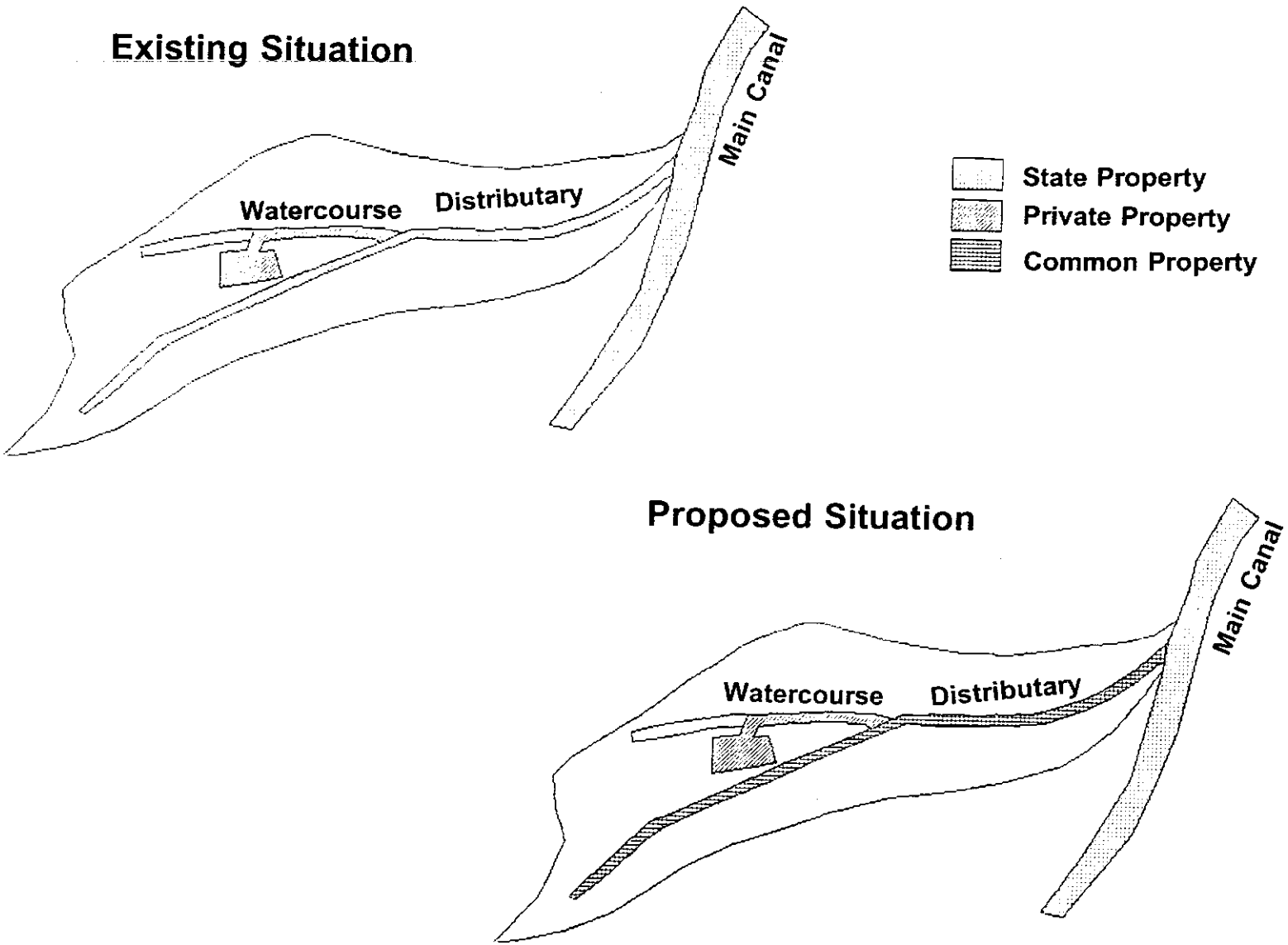
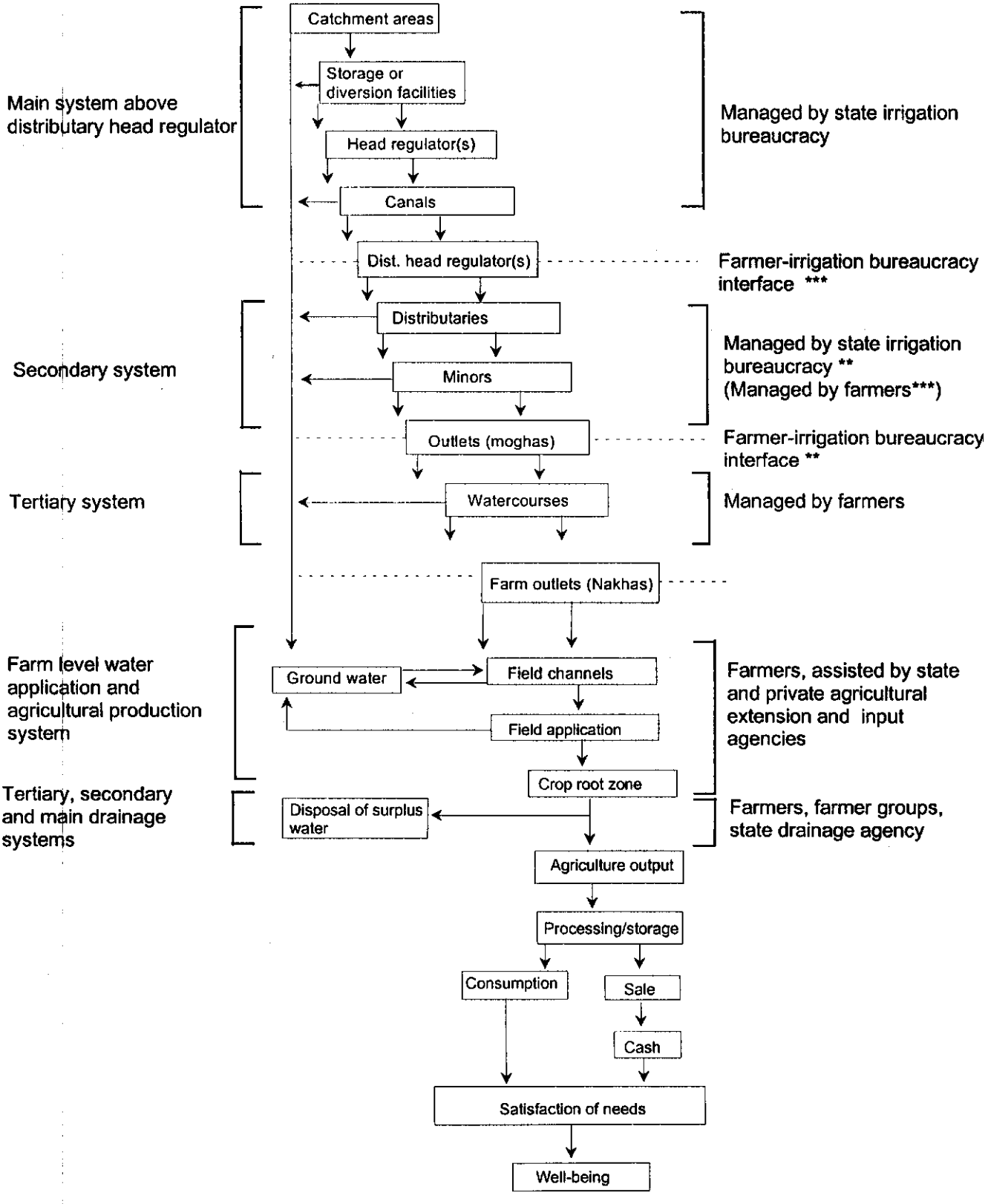


Figure 2.1. Property Rights of the Water Resources System.

Figure 2.2. Water Resources Management (WRM)*



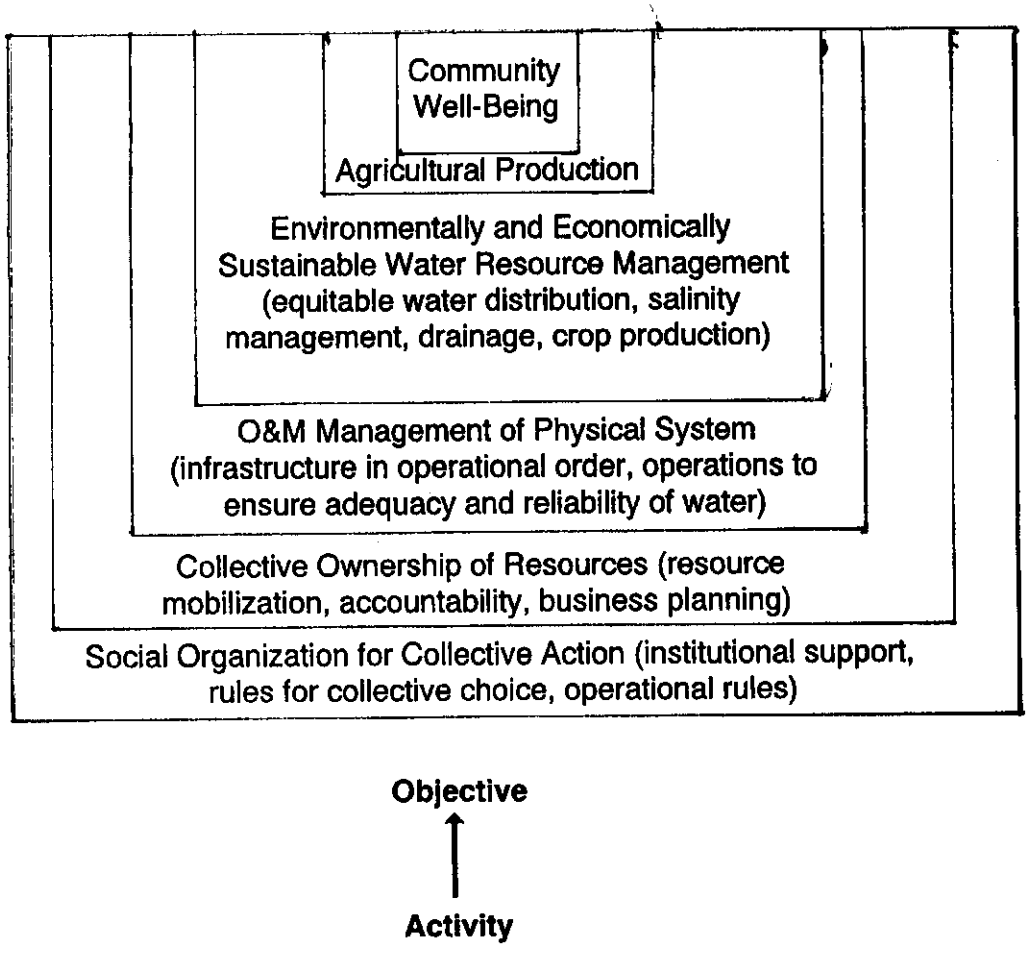
* WRM covers O&M of physical systems, water use and disposal, and related environmental aspects.
** At present *** Proposed

Adapted from: Robert Chambers, Managing Canal irrigation: Practical Analysis from South Asia (Cambridge: Cambridge University Press, 1988), p. 36.

2.4 Collective Action for Water Resources Management

Nested Objectives: Seeing the economic value of water as a resource in agricultural production, and the management of system operation and maintenance only as a means of realizing that value, helps in appreciating the importance of designing strategies for sustainable water resources management. Viewed this way, the significance of collective action becomes broader than satisfying the "engineering requirement" of keeping the physical system in proper order, or the "sociological needs", such as the sense of ownership, or group cohesion. Most of these components become parts of a nested system of activities and objectives (see Figure 2.3).

Figure 2.3. Nested Objectives and Activities of Collective Action for Irrigated Agriculture.



The nested system shown in Figure 2.3 has five items of activities or objectives: social organization, gaining collective ownership, O & M management, water resources management, and reaching enhanced community well-being. Each activity, starting with forming an organization for collective action, has its immediate objective as shown in Figure 2.3, and finally all of the activities together try to achieve an improved well-being of the community. Arguably, the water users community looks for such an integrated management system aimed at some social impact, as against the narrower objective of just forming a users organization, improving O & M of the physical system, or reducing the government budget.

The first activity of this nested system, namely, the institutionalizing of an organization for collective action is itself based on a nested set of rules. External rules associated with institutional support for its legal recognition would lead to the organization's rules of conduct (or rules for making collective choices), which in turn would determine the operational rules as to how resource management is implemented. These decision-making arrangements (**Oakerson, 1992:46**) largely determine the organization's capacity to proceed with management tasks.

Viability of an organization depends on its strength to make internal rules (i.e., rules of conduct and operational rules mentioned above), and to apply those rules effectively. Primarily, collective action is to enhance the effect of individual actions. However, considering that some persons' enhanced actions are likely to adversely affect the welfare of the others, the organization also has to collectively restrain individual action whenever necessary. Thus, the use of agreed rules becomes important, and an apt definition that is related to users groups is that "an institution is collective action in restraint, liberation and expansion of individual action" (**Parsons 1984:28**).

The view of water users organization as an "institution" in terms of this definition is of special relevance to the context of water resources systems. For example, while individual action has to be expanded for undertaking management responsibility, and liberated for realizing individual rights and effectively interacting with local officials, it also has to be restrained for reducing anti-social and "free-rider" behavior among themselves.

However, for a water users organization (WUO) to be an institution, it has to persist and develop to the point where it is commonly perceived as valuable and useful (**Merrey 1993**). A WUO formed for short-term objectives is merely a structure of identified roles accomplished by a few selected individuals, such as the president, secretary and treasurer. At best, it can be referred to as an "organization", but often it is limited to an ad-hoc group of a few people working together to achieve a temporary task. Once the short-term objectives are achieved, such WUOs can, and usually do, disappear.

An organization can eventually grow into an institution when it establishes persistent patterns of norms and behavior commonly accepted as valuable and useful to the membership. By then, it will have established accepted sets of rules and procedures for

various functions of collective action. Such a system of rules cannot just happen, or spring up on administrative fiat, but it has to evolve over time. Only at this mature stage can a water users organization exercise successful collective action to both liberate and restraint individual water user's actions for the benefit of the group as a whole. The acceptability of the organization by a substantial majority of its membership is an essential characteristic that determines its effectiveness in undertaking continuing tasks of water resources management, such as canal maintenance, water distribution, fee collection, conflict resolution and imposition of sanctions.

Some theorists would assert that common property arrangements in developing countries have failed due to overuse or misuse, and eventual degradation. As a remedy, private property regimes were imposed to replace common property arrangements. However, these changes failed to stop the overuse of resources and even resulted in "increased inequity in already unequal distribution of wealth" **(Runge, 1992)**. In Pakistan, both state as well as uncontrolled private property regimes over water resources have clearly failed in efficient and equitable water resources management. The former case can be seen in the way distributary canal sub-systems are currently managed, whereas, the latter is well illustrated by the overuse of groundwater resources through private tubewells. The hypothesis is that a well coordinated effort through a common property regime in either of these cases would arrest this overexploitation trend.

Chapter 3

TECHNICAL CONTEXT FOR SOCIAL ORGANIZATION

This action research program has been carefully designed so that the technical activities support the strengthening of the farmers' organizations. At the same time, once farmers are organized, then they are anxious to immediately undertake tasks that will improve the operation of their irrigation and drainage system so that they can increase agricultural productivity.

3.1 Irrigation and Drainage Systems

The location of the three pilot distributaries (Dhoro Naro Minor is really a distributary, but in Sindh Province, a small distributary is often called a minor) is shown in Figure 1.2 in Chapter 1. Each pilot site is provided irrigation water from a different canal, but all of them offtake from the left side of the Indus River just upstream from Sukkur Barrage, which became operational in the early 1930s. Nara Canal is a combination of excavated channel from the Indus River to intercept the old Nara River that feeds Heran Distributary; Jamrao Canal offtakes from this river channel at RD 129 (meaning 129,000 feet downstream from the head regulator for Nara Canal) and supplies water to Bareji Distributary. Dhoro Naro Minor receives water from Gajrah Branch of Nusrat Canal, which is turn, offtakes from Rohri Canal.

The climate in these three pilot distributary command areas is relatively similar. The climate is extremely hot in the summer season (May-September), sometimes exceeding 50 degrees Centigrade, but usually 38 - 43 degrees Centigrade. During the nights, strong winds come from the South, which results in pleasant summer evenings in the open air. However, winters (November – February) can be cold, particularly at night, when the temperatures can fall below 10 degrees Centigrade.

The mean monthly summer rainfall varies from 32 mm in the North to 46 mm in the South. There is very little rainfall during the winter. The mean annual precipitation ranges from 200-250 mm.

Cropping intensities, as can be expected, have substantially increased since the design of the system. They are still on the increase indicating that the farmers simply respond to availability of irrigation water.

During the action research program, field teams adopted different methods, and tried to isolate the reasons for variation in cropping intensity values. For Kharif 1997, a sample of farmers was interviewed for their responses, which usually were given on a recall basis, and a physical inspection was also conducted in their crop areas. The two sets of values differed only by about 5 percent. **Table 3.1** gives the actual cropping intensities

for three years assessed by IIMI's field teams and another research institute, along with the design stage values for the same area.

Table 3.1 Cropping intensities.

Particulars	Mirpurkhas	Sanghar	Nawabshah
Actual Intensities			
Annual (Total)*	93	95	109
Kharif 1988*	46	51	56
Rabi 1987-88*	47	45	53
Annual (Total)	66	111	114
Kharif 1996	31	55	55
Rabi 1996-97	35	56	59
Annual (Total)	110	130	121
Kharif 1997	49	65	54
Rabi 1997-98	61	65	67
Designed Intensities**			
Annual Total**	81	81	81
Kharif**	28	28	27
Rabi**	53	53	54

*Sindh Development Studies Center, University of Sindh, Jamshoro, Socio-Economic Impact Study Baseline Report Volume-2, June 1992.
**The cropping intensities were designed during 1930 by the Irrigation Department.

Some of the salient features of the three pilot distributaries are listed in **Table 3.2**. First of all, the culturable command areas are similar, ranging from 13,328 acres at Dhoro Naro Minor to 14,318 acres at Bareji Distributary and 15,410 acres for Heran Distributary; in the same order, there are 25 watercourses with 16 lined, 24 watercourses with 6 lined, and 31 watercourses with 26 lined, respectively. For each of these pilot distributaries, the actual discharge measured at the head regulators are generally 30 - 75 percent greater than the old 1930s design discharge and sometimes more.

3.1.1 Dhoro Naro Minor

A map of the Dhoro Naro Minor command area is shown in Figure 3.2. The main source of irrigation water is canal water. Some private tubewells are available, which are being used during periods of water shortage; however, this tubewell water is being mixed with canal water because of relatively high salt concentrations in the tubewell discharges.

Table 3.2. Salient features of the three pilot distributaries in Sindh Province

Description	Detail		
Name of the Pilot Distributary	Dhoro Naro	Heran	Bareji
Total number of outlets	25	31	24
Lined watercourses	16	27	7
Unlined watercourses	9	4	17
Length of channel, km	104 km	10.6+5.12	12.5 km
Old design discharge	51.62 cfs	58 cfs	14.318 acres
Off take RD	91+400 (Gajrah Branch Canal)	129 Nara Canal	408 Jamrao Canal
No. of private tubewells	52	-	-
No. of saline tubewells	8	35	-
Surface drains	2	4	5
Subsurface drainage	-	-	Tile drainage unit
No. of water users	504	718	354
Tenants (share croppers)	694	433	787
No. of villages/hamlets	147	44	55
No. of households	2,468	3150	1150
Population	19,822	26817	6800
Major communities	Jamili, Khaskheli, Syed, Zardari, Brohi, Arain, Gupchani, Shar, Mughari, Keerio, etc.	Punjabi, Lashari, Jamali, Mirani, Pathan	Lashari, Makrani, Shar, Meghwar, Punjabi, Rajar, Mangrio, Panhwar
Languages of the area	Sindhi, Siraji, Punjabi, Balochi & Brahvi, Urdu	Sindhi, Punjabi, Urdu, Seraki	Sindhi, Seraki, Punjabi, Balochi, Urdu

* Heran Distributary has Khadwari Minor, so Heran distributary has 10.6 km length and length of Khadwari is 5.12 km and thus total length should be 15.72 km.

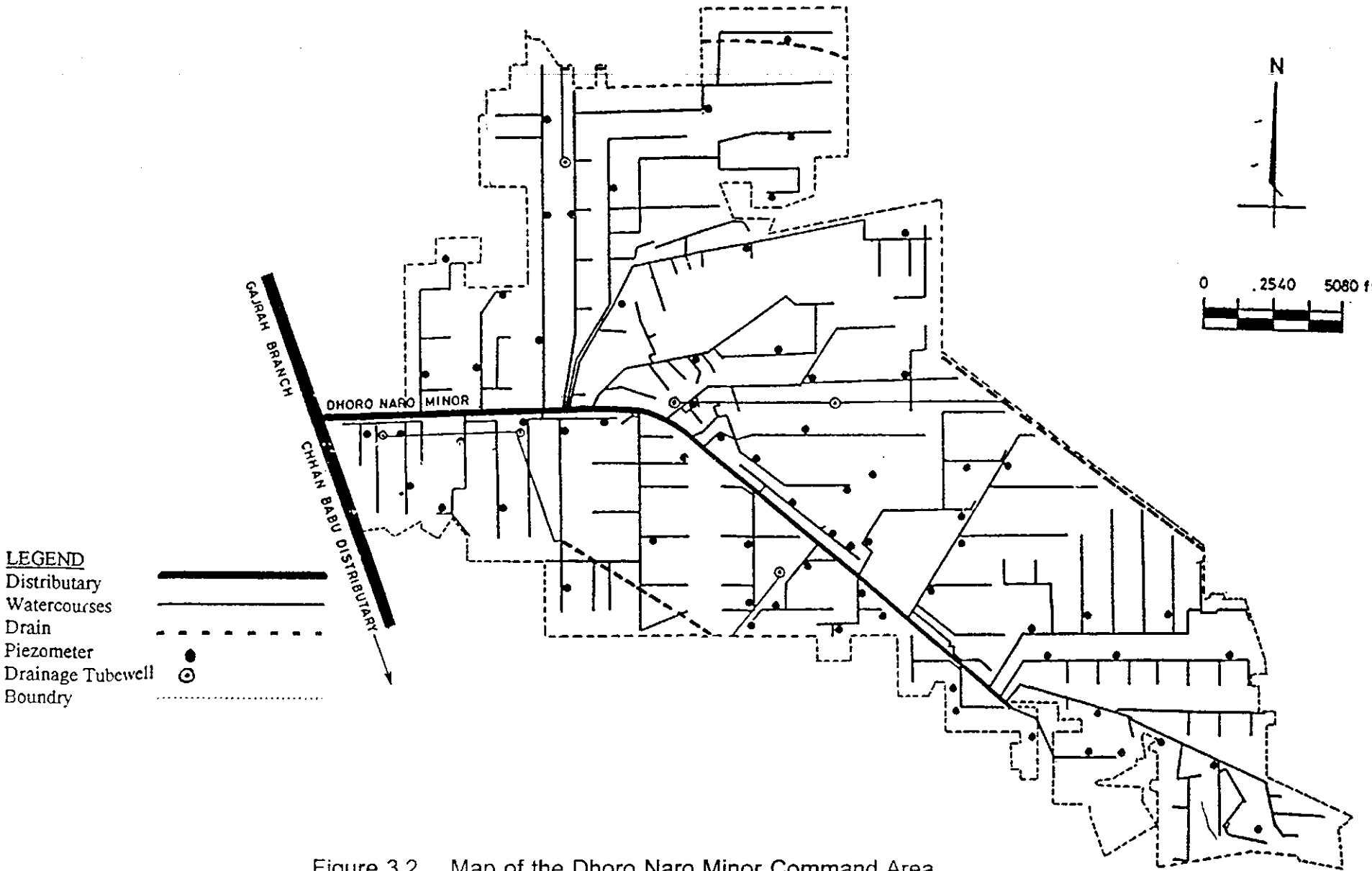


Figure 3.2. Map of the Dhoro Naro Minor Command Area.

Vertical tubewell drainage systems are being installed to lower groundwater levels. There are eight tubewells discharging saline water. This saline water enters disposal channels that discharge into Subdrain WN1 AR. This subdrain discharges the total drainage effluent into Gajrah Branch Drain. The details at the drainage system in the Dhoro Naro Minor command area are listed in **Table 3.3 and Table 3.4.**

Table 3.3. Drainage tubewells in the Dhoro Naro Minor command area, Nawabshah.

S. No	Name of Tubewell	Type of Tubewell	Design Discharge (cfs)	Area to be Drained (Acres)	Motor Hp	Running Hours (hrs/day)	Name of Disposal Channel	Length of Disposal Channel (km)
1	GAJ-16	Saline	1.5	320	10	16	DC GAJ-16	3.75
2	EN-142	Saline	1.5	320	10	16	SDC EN-142	0.048
3	EN-153	Saline	2.0	320	15	16	SDC EN-153	1.66
4	EN-154	Saline	1.5	320	10	16	DC EN-154	0.102
5	EN-155	Saline	2.0	320	15	16	DC EN-155	0.824
6	EN-134	Saline	2.0	320	15	16	DC EN-134	1.055
7	EN-143	Saline	2.0	320	15	16	DC EN-143	4.84
8	EN-144	Saline	2.0	320	15	16	DC EN-144	0.184

Source: WAPDA, LBOD, Nawabshah Where: DC = Disposal Channel; SDC = Sub Disposal Channel

The details about the surface drains located in the pilot command area are shown in **Table 3.4.**

Table 3.4. Surface drains in the Dhoro Naro Minor command area, Nawabshah, District.

Name of Drain	Total Length of Drain (km)	Total Length of Drain in Command Area (km)	Designed Discharge (cfs)
Subdrain WN-1AR	5.70	5.18	7.90
Gajrah Branch Drain	46.6	8.53	132.0

Source: WAPDA, LBOD, Nawabshah

3.1.2. Heran Distributary

A map of the Heran Distributary command area is shown in Figure 3.3. At RD 10 along the distributary channel, there is a cross-regulator to control inflow into Khadwari Minor. The watercourse command areas range from 200-700 acres in size.

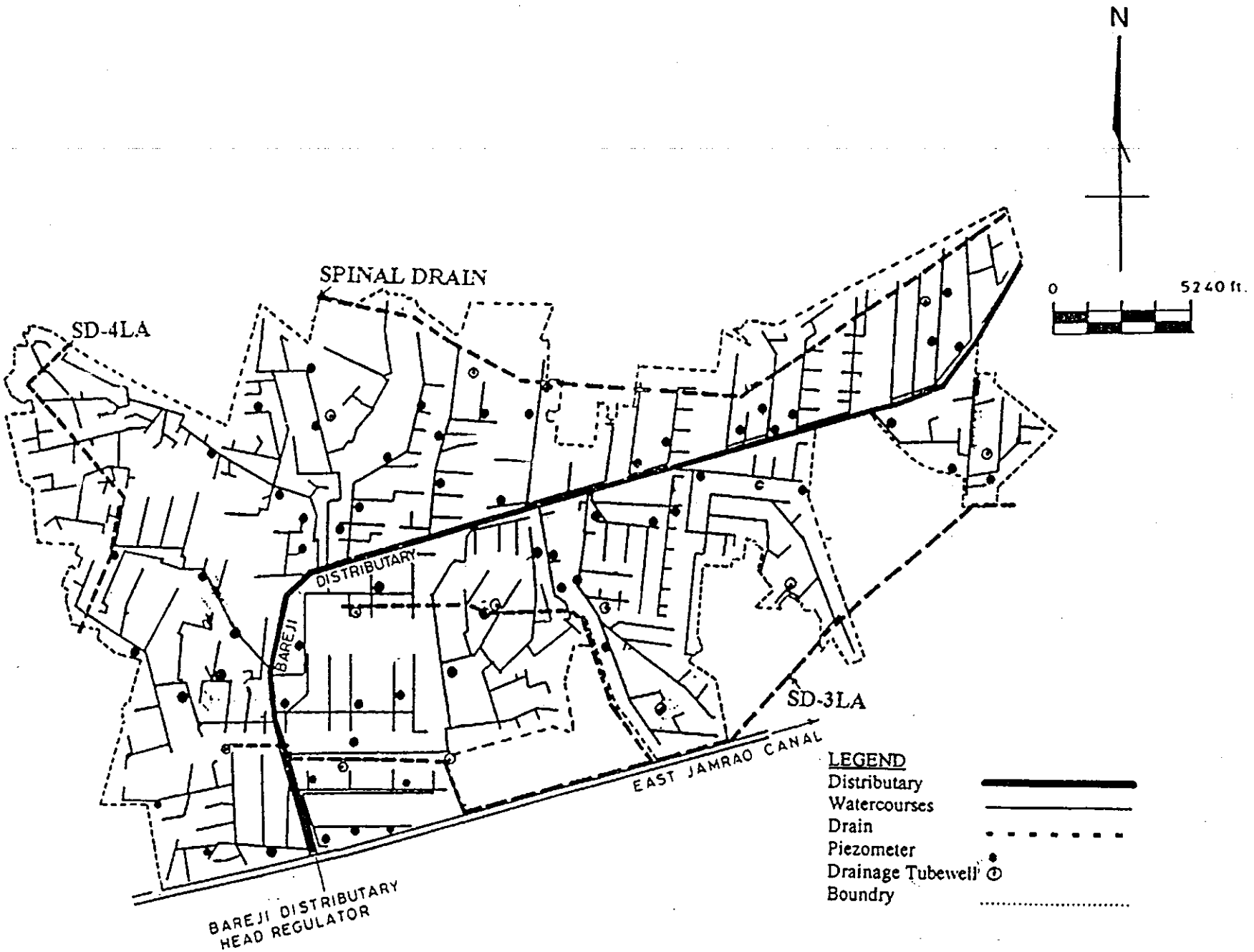


Figure 3.3. Map of the Heran Distributary Command Area.

The LBOD drainage facilities in the Heran Distributary command area consists of vertical drainage tubewells discharging saline water, along with scavenger tubewells which have two separate discharge pipes, one for deeper saline water and the other for skimming shallow fresh water that can be used for irrigation. The saline tubewell discharges are disposed into a surface drain network listed in **Table 3.5**. The number of drainage and scavenger tubewells are listed in **Table 3.6**.

Table 3.5. Surface drains in the Heran Distributary command area, Sanghar.

Name of drain	Design discharge (cfs)	Total length (km)	Length in command area (km)
MBD	96.6	20.73	9.75
M-1RA	17.60	7.10	3.76
M-1R	79.50	23.29	3.66
S-1R	43.90	11.30	11.21

Source: WAPDA, LBOD, Sanghar

Table 3.6. Vertical drainage and scavenger tubewells in the Heran Distributary command area.

Name of drain	Type of tubewell	Number	Capacity (cfs)
MBD	Drainage	07	2.0
M-1R	Drainage	01	2.0
M-1RA	Scavenger	02	2.0
S-1R	Scavenger	17	2.0
S-1R	Drainage	08	2.0

3.1.3. Bareji Distributary

A map of the Bareji Distributary command area is shown in Figure 3.4. A unique characteristic of this command area is the use of lift pumps to irrigate higher croplands, with fifteen farmers having a lift pump covering a total of 834 acres over eight watercourse command areas located in the lower middle reach of the distributary.

There are two types of LBOD drainage facilities in the Bareji Distributary command area – surface drains and subsurface tile drainage. There are a total of 13 sumps houses for collecting subsurface water through pipe collectors and lateral lines laid in the command area, then pumps lift this water, which is discharged into the surface drains. The details of the subsurface tile drainage system is listed in **Table 3.7**, which shows that a total of 9,873 acres in the command area have subsurface drainage.

There are three subsurface drains (3L, 4L and 4LA) located in the command area-sub-drain 3L is used for collecting the saline water that is being pumped from the sump houses, while sub-drains 4L and 4LA are being used to collect surface runoff. The spiral drain is also passing through the command areas of Watercourses 6L-13L. The details regarding the surface drains are listed in **Table 3.8**.

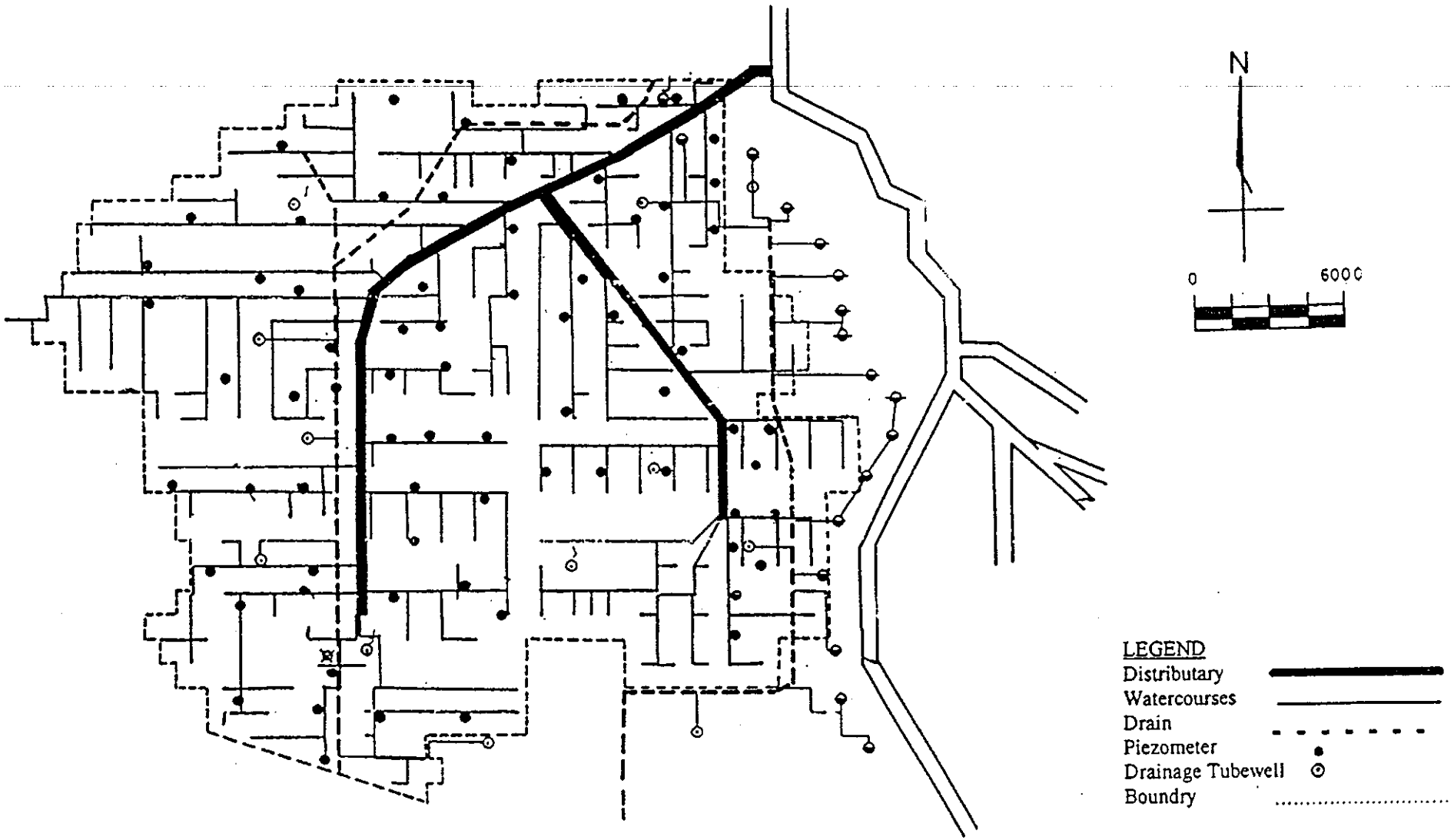


Figure 3.4. Map of the Bareji Distributary Command Area.

Table 3.7. Subsurface tile drainage facilities in the Bareji Distributary command area.

Sr. No.	Pump Station	CCA of sump house, acres	Design discharge, cusecs	Length of collector lines, Feet	Length of lateral lines, Feet	Deh* covered
1	3L-26	733	2.5	23520	76340	229
2	SD-19	750	2.5	22484	57080	224
3	SD-24	701	2.5	22324	60740	227
4	3L 25 A	587	2.5	15810	56000	240
5	SD-22	747	2.5	22690	50160	226
6	3L 22 B	533	1.5	15390	39100	239
7	SD 21 A	491	1.5	17080	49490	225
8	3L 22 A	758	2.5	21070	63530	238
9	3L 20	1078	1.5+1.5	35220	104180	238
10	3L 17	1023	1.5+1.5	33350	103490	236
11	31 21 B	1045	1.5+1.5	27406	73070	240
12	3L 23	877	2.5	23256	56459	239
13	3L 24	550	1.5	12660	59430	240

*Deh = Small village.

Table 3.8. Surface drains located in the Bareji Distributary command area.

Sr. No	Name of drain	Design discharge (cfc)	Total Length (km)	Length in command area	Dispose off into
1	4L Sub drain	25.6	7	4 7	Spinal drain
2	4LA sub drain	16.5	5	1	4l Sub drain
3	3L Sub drain	NA	30.97	12.98	Spinal drain
4	DC-1R	NA	4	4	3L Sub drain
5	Spinal drain	NA	NA	10	Arabian Sea

3.1.4 Comparisons

3.1.4.1 Irrigation facilities. There are significant differences between the three pilot distributaries. First of all, the outlets along Dhoro Naro Minor are all open flume outlets, which would be expected to create major difficulties in delivering water to the tail reach. Even if the discharge at the head regulator were doubled, there would only be a modest increase in the discharge rate reaching the tail reach, with most of the additional water passing through the outlets in the head reach followed by moderate increases in the middle reach. These problems are further aggravated by an extreme amount of tampering of the outlet structures.

Khadwari Minor, offtaking from Heran Distributary, has all seven of the outlets as open flumes; thus, there would be an expectation that there would be difficulties with limited discharges reaching the tail watercourses. However, the main channel of Heran Distributary has appropriate outlet structures, but with tampering. The major problem in getting water to the tail reach is the lack of maintenance.

There are significant operational difficulties along Bareji Distributary, which can be primarily attributed to the fifteen lift pumps. Many of these pumps are capable of taking much more than their appropriate share of water from the distributary channel, thereby reducing the discharge rates in the tail reach.

3.1.4.2 Drainage facilities. Seventy percent of the Bareji Distributary command area is underlain by subsurface tile drainage. This is a tremendous asset. However, the pumps at the thirteen sump houses are only partially operated. But, in the future, these facilities have the capability of providing very good drainage for the croplands.

The Heran Distributary command area has sixteen vertical drainage tubewells for pumping saline groundwater that can be discharged into surface drains that convey this saline water to the Arabian Sea. In addition, there are nineteen scavenger wells that pump saline groundwater for discharge into the surface drain network, but also skims better quality shallow groundwater that can be used for irrigation and possibly domestic uses. Not all of these facilities are presently operational, but when they are, there should be a good capability for controlling groundwater levels that will allow higher crop yields to be achieved.

The Dhoro Naro Minor has the most limited drainage facilities, with only eight vertical drainage tubewells for pumping saline groundwater that can be discharged into the surface drains. However, this drainage system may very well prove sufficient for controlling groundwater levels. Again, not all of the eight drainage tubewells are presently operational.

3.2 Distributary Maintenance

The Water Users Federation (WUF) for each pilot distributary was established in mid-December 1996. Three weeks later, a walk-thru survey was conducted along each distributary channel, wherein farmers leaders and IIMI staff walked together discussing the many maintenance and operational problems along the way. While walking, numerous farmers were encountered and discussions were held with them. There was a great deal of enthusiasm among the participants, even though it was Ramadan. In January 1998, two days were spent with each WUF. The first day was spent conducting another walk-thru survey very similar to the survey conducted a year earlier. The second day was a large meeting to discuss the maintenance program, operational situation with particular emphasis on achieving equitable water distribution among the watercourses, and the combined management of the irrigation and drainage facilities. The following subsections present the results achieved in the maintenance program during 1997.

3.2.1 Dhoro Naro Minor

The biggest problem confronting the water users is sediment deposition in their minor. The sediment load passing through the head regulator of this minor is quite large. There is considerable sediment deposition in the head reach, which raises the water level and increases the discharge into each watercourse. Sediment deposition is aggravated by livestock, particularly water buffaloes, bathing in the channel, which increases the velocity near the banks that results in scoring and widening of the channel, thereby reducing the flow velocities and increasing the sediment deposition. Desilting of the minor is required at least twice a year.

The WUF managed the desilting campaign during June and July of 1997 at a cost of Rs. 63,500 (approximate exchange rate was U.S. $ 1.00 equals Rs. 40). Much effort went into stabilizing the embankments, which cost another Rs. 142,500. Thus, the total cost for deferred maintenance was Rs. 206,000. In addition, Rs. 163,000 was spent on improvements including the construction of a WUF office (Rs. 66,400), a buffalo wallow (Rs. 46,300), a bridge and five watercourse culverts. Project funds were used to pay half of these costs, while the WUF also paid half. About forty percent of available project funds were utilized.

3.2.2 Heran Distributary

The greatest problem confronting the water users of Heran Distributary was the almost complete lack of any maintenance for nine years. As a result, very little water was available in the tail reach. In addition, there was considerable leakage through the embankments in some portions of the middle reach. Also, there was considerable sediment deposition in the upper reach, largely attributable to livestock bathing in the distributary channel.

One of the WUF office bearers has an unusual practical capability for correcting deficiencies that result in sediment deposition; in fact, he supervised the reconstruction of the distributary and minor channels at a total cost of Rs. 175,000. In the lower portion of the middle reach, over a length of only four RDs (4,000 feet), which was like thick jungle, the WUF requested a quote from the Irrigation Department that amounted to Rs. 300,000 which was not unreasonable, but the farmers completed this work at a total cost of Rs. 85,000. In this short distance, water is no longer ponded along the left embankment and twenty acres of land are being reclaimed. The total cost of desilting was Rs. 61,800 (Rs. 47,300 for Heran Distributary and Rs. 14,500 for Khadwari Minor). The WUF advertised in Sanghar City that free soil was available in the lower reach of Heran Distributary; many tractors with trolleys came to remove these finer sediment deposits. In addition, various improvements were undertaken with the total cost being Rs. 138,200 for a bridge and twelve culverts. Thus, the total cost of desilting, deferred maintenance, and improvements was Rs. 375,000, with the WUF paying 56 percent and

project funds were used for the balance. About thirty percent of available project funds committed to Heran Distributary were utilized.

3.2.3 Bareji Distributary

As part of LBOD, Jamrao Canal was remodeled, which resulted in a new gate head regulator for Bareji Distributary and many new outlet structures. Thus, there was not a lot of deferred maintenance that required attention. However, there is some scouring of embankments and sediment deposition in the upper portion of the head reach. The water users have undertaken to stabilize the upper embankments by narrowing the cross-section using wooden poles embedded in the distributary bed, along with placing shrubs along the embankments.

3.2.4 Comparisons

Bareji Distributary did not have a major maintenance problem, while the other two pilot distributaries had to undertake major efforts to correct all of the maintenance deficiencies. Both Dhoro Naro Minor and Heran Distributary experienced a major achievement by rectifying all deferred maintenance needs during 1997. That such major efforts could be completed in one year is a major tribute to these WUFs.

A highly important observation is that the costs of correcting deferred maintenance needs were quite modest. In addition, the quality of the work was very good.

3.3 Monitoring and Evaluation Program

The detailed planning for the Monitoring and Evaluation (M&E) activities in the pilot distributaries was initiated in December 1996. The main objective was to document the on-going situation before the management turnover of each pilot site to a WUF. As a first step, the stakeholders were identified and the objectives, approach and methodology were developed for data collection to monitor the combined irrigation and drainage facilities in the pilot distributaries. Following this period, the actual field data collection was begun in April 1997, which had been preceded during February and March of 1997 by field installation of necessary instruments.

The M&E field data collection program is broadly outlined in **Table 3.9**. For example, the data to be utilized in Section 3.4 utilizes the discharge measurements for irrigation facilities. For Section 3.5, all of the discharge measurements are used, plus groundwater levels.

Table 3.9. Outline of monitoring and evaluation data collection.

Discharge Measurements
Irrigation Facilities
Flow at Head Regulators
Seepage in Head, Middle and Tail Reaches
Flow in Outlets (Moghas)
Periodic Round-the-clock Discharges
Drainage Facilities
Surface Drainage
Sub-surface Drainage
Vertical Drainage
Scavenger Tubewells
Saline Drainage Tubewells
Ground Water Level
Vegetative Quality
Vegetative Growth Surveys in Surface Drains
Surface Drainage Embankment Conditions
Irrigation Water Disposal into Surface Drains

3.4 Water Distribution

The most important operational objective of an irrigation delivery system is to provide reliable and equitable water supplies to the secondary canals (distributaries and minors) and tertiary (watercourses) units in the canal command area. To evaluate reliability and equity, discharges were measured twice a week during the same time period at both the head regulator and the outlets. In addition, hourly discharge measurements were collected during a 7-day period round-the-clock.

3.4.1 Dhoro Naro Minor

Average monthly discharge values at the head regulator for Dhoro Naro Minor during the 1997 Kharif season are presented in Figure 3.5. The temporal coefficient of variability is quite satisfactory. The round-the-clock discharge measurements produced similar results; however, there were times when the variability was much greater, but there were no round-the-clock discharge measurements corresponding with these time periods. In general, the water supply is fairly reliable.

The discharge at each outlet from the Dhoro Naro Minor was measured at least eight times each month. An example of the normalized data for the month of July, 1997 is shown in Figure 3.6. The results show that two outlets located in the head reach (1R and 1DL) and three outlets located in the middle reach (4L, 4BL and 6AR) were drawing exceptionally high discharges. Most of the outlets in the tail reach were drawing

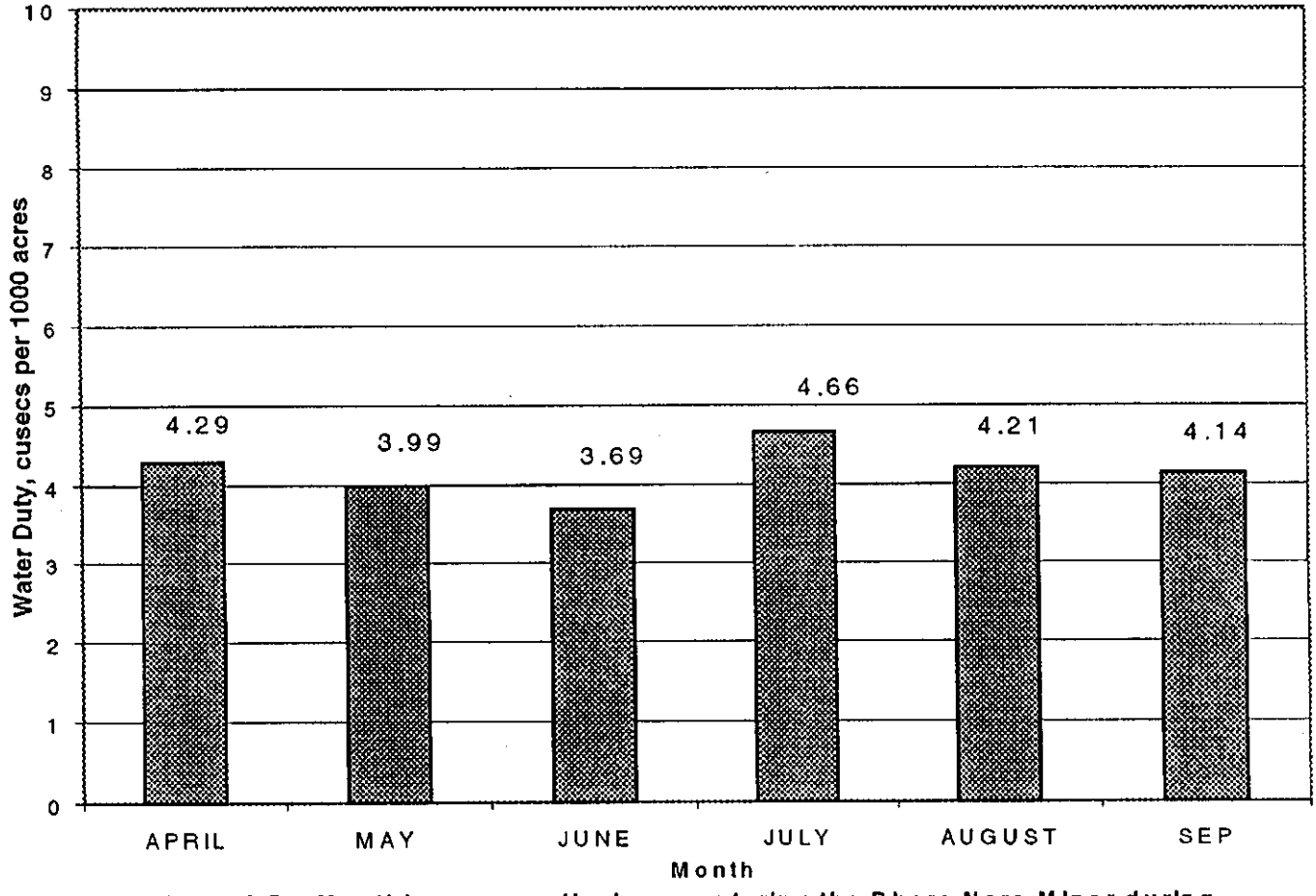


Figure 3.5 Monthly average discharge entering the Dhoro Naro Minor during Kharif 1997.

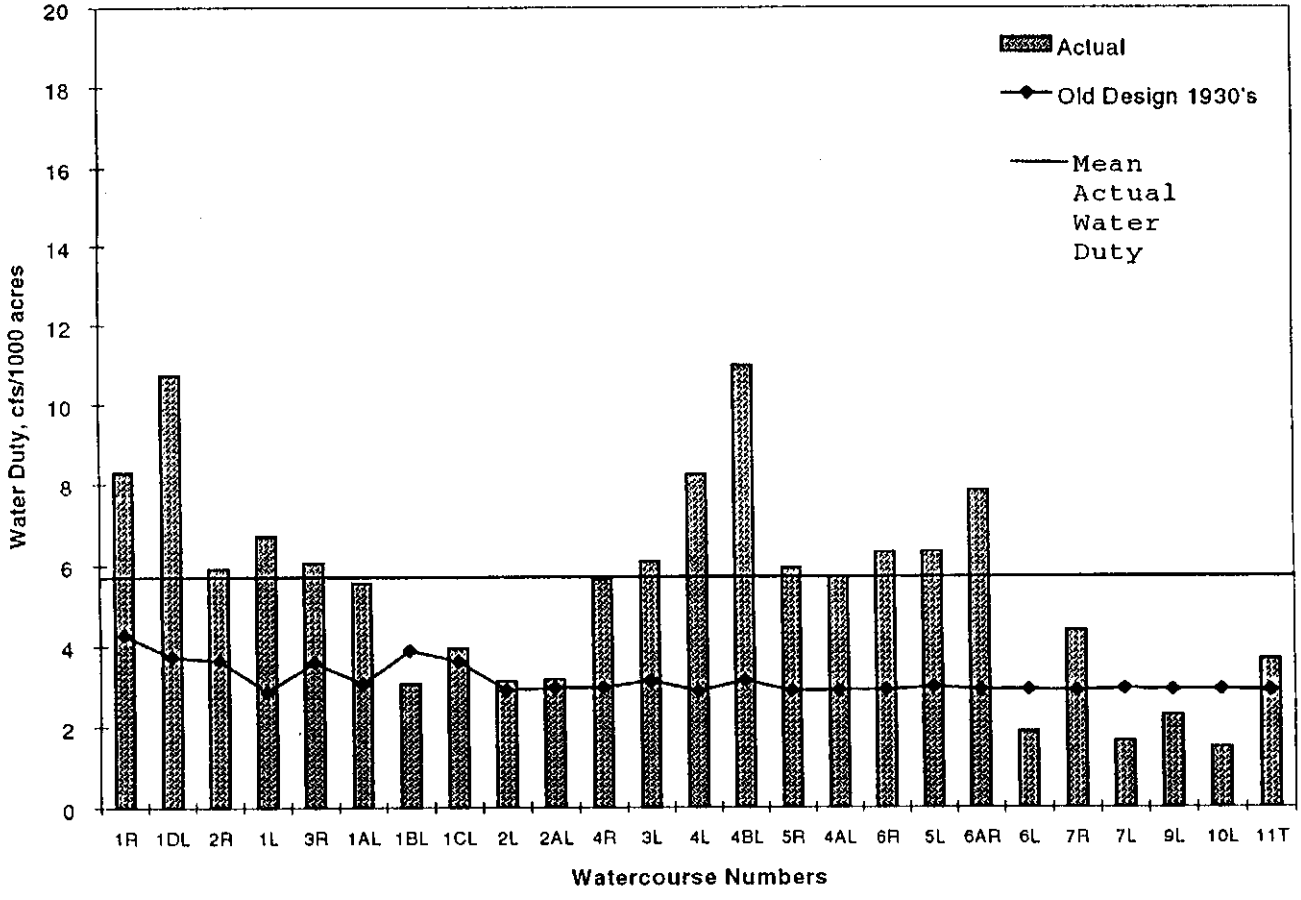


Figure 3.6 Normalized monthly water discharges of outlets from Dhoro Naro Minor for July 1997.

discharges lower than the old design discharges. This trend throughout the Kharif 1997 season, though some other outlets also drew more water later in the season.

The variability of the mean monthly water duty among outlets is presented in Figure 3.7. The spatial coefficient of variability ranged from 0.48 (48%) for April to 1.13 (113%) during June. The temporal coefficient of variability ranged from 0.24 (24%) during August to 0.81 (81%) for June. Based on these results, water distribution among outlets is highly inequitable. A major cause of this problem is tampering of outlets, which is quite common and even excessive. In addition, all of the outlets are open flumes, which aggravates the problem of water being delivered to the tail reach.

3.4.2 Heran Distributary

The normalized monthly water duty for each outlet along Heran Distributary is illustrated for the month of July 1997 in Figure 3.8. the mean actual water duty is quite high, being 8.4 cusecs per 1000 acres. Six watercourses in the upper half of the distributary have discharges above the mean water duty, with two watercourses (7-L and 10-R) being excessive at more than 15 cusecs per 1000 acres. However, in the lower half of the distributary, the distribution among the outlets is reasonably uniform.

The hydraulic performance of the Heran Distributary during Kharif 1997 is summarized in **Table 3.10**. The water duty for April is lower than later months as a result of less water demand because of the transition from the rabi to Kharif seasons. The temporal coefficient of variability at the head regulator averages 0.10 (10%), which is quite good. The temporal variability at the outlets is much more at 0.20 (20%). However, the spatial coefficient of variability at the outlets is quite high, averaging 0.45 (45%), which indicates highly inequitable water distribution among outlet structures that are.

Table 3.10. Summary of hydraulic performance for Heran Distributary during Kharif 1997.

Months 1997	Average Discharge at head regulator (cfs/1000 acres)	Temporal coefficient of variability at head regulator	Spatial coefficient of variability at outlets	Temporal coefficient of variability at outlets
April	4.85	0.12	0.47	0.24
May	6.31	0.09	0.48	0.21
June	6.61	0.11	0.46	0.18
July	7.04	0.10	0.48	0.20
August	6.44	0.10	0.39	0.20
September	6.77	0.08	0.40	0.18

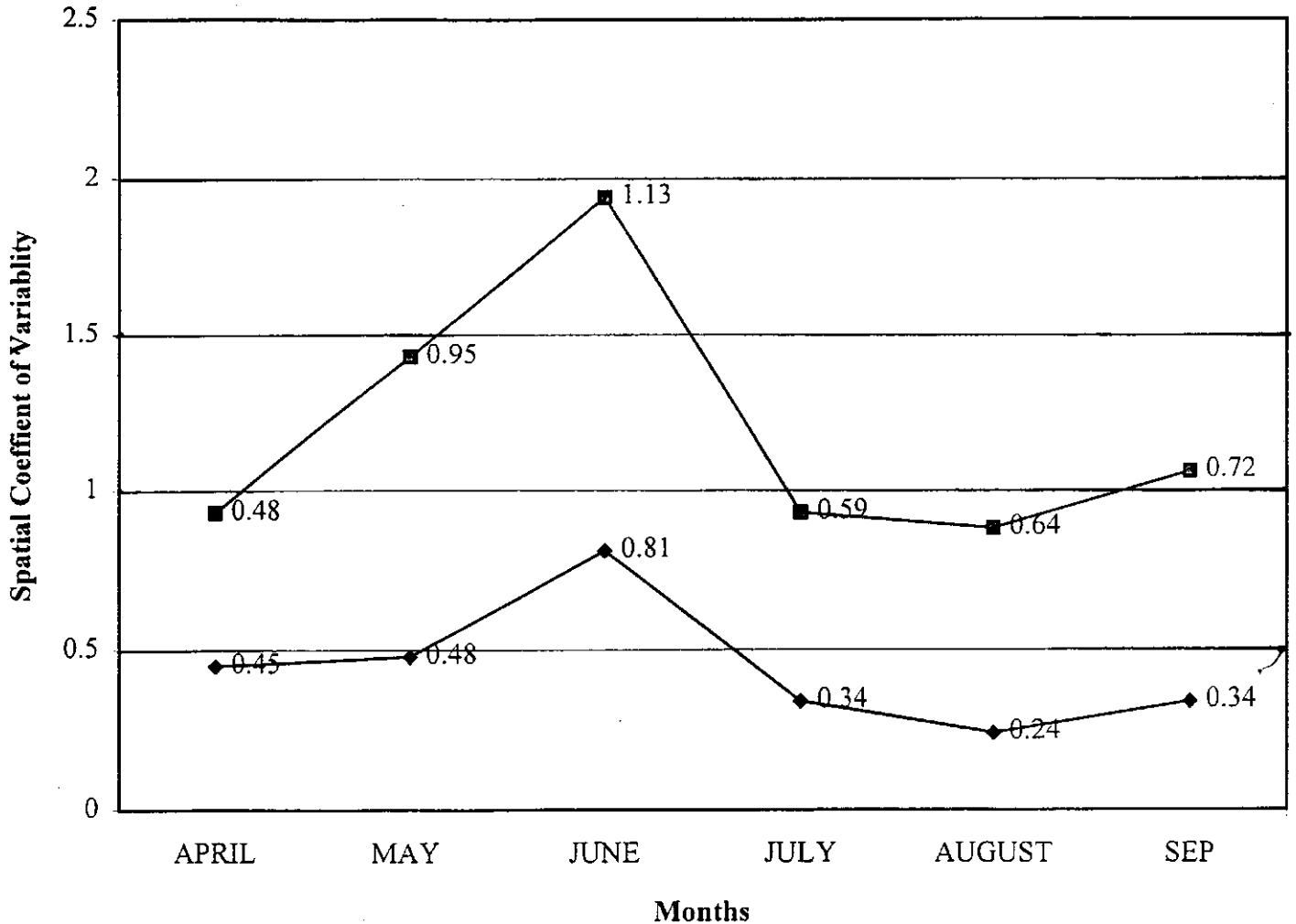


Figure 3.7. Spatial and temporal coefficients of variability among the outlets from Dhoro Naro Minor during Kharif 1997.

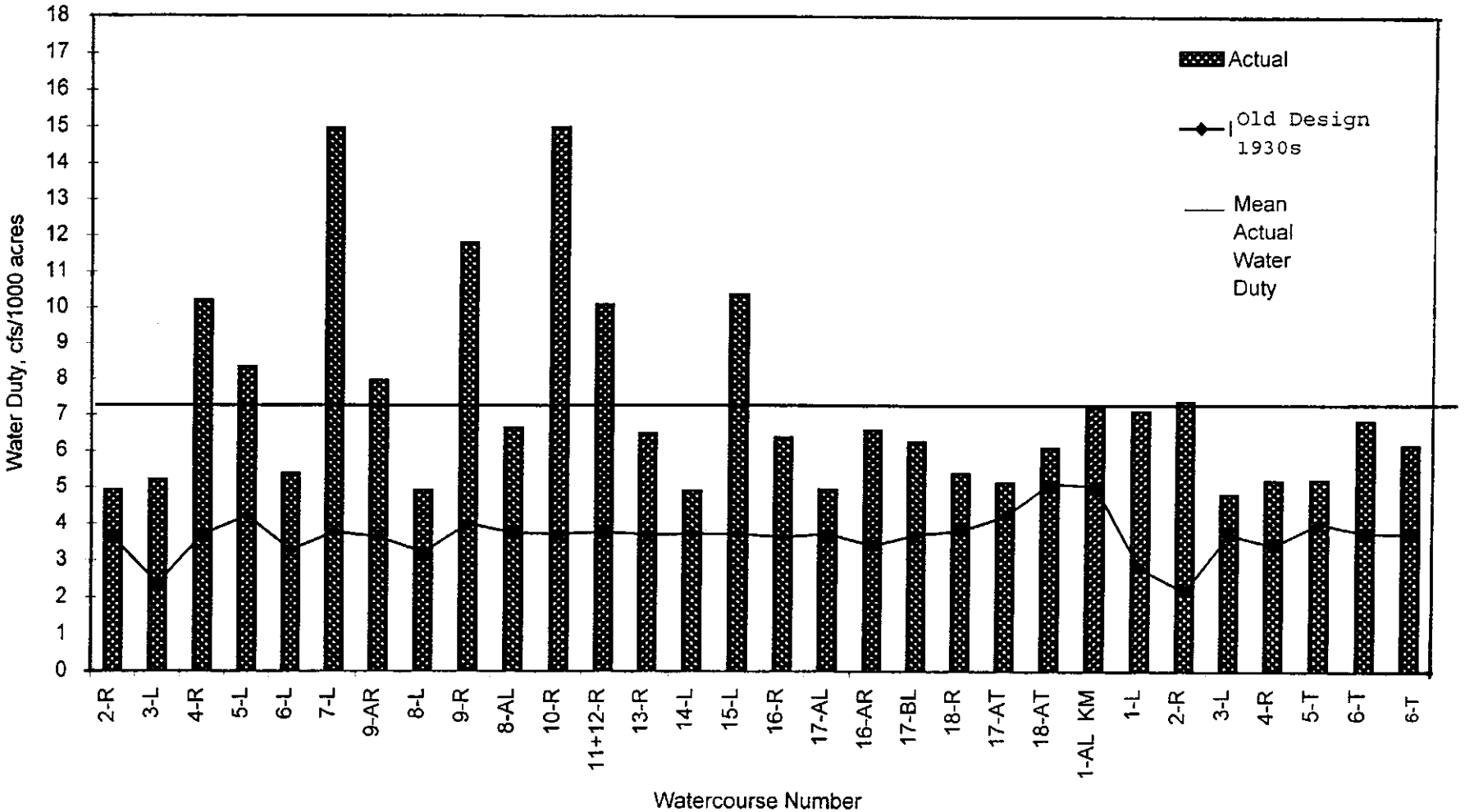


Figure 3.8. Normalized water discharges of outlets along Heran Distributary during July 1997.

3.4.3 Bareji Distributary

The average water duty for the month of July 1997 is shown in Figure 3.9 for each of the outlets along Bareji Distributary. The mean monthly water duty of roughly 5 cusecs per 1000 acres is more than doubled in WC 6-R, while being 50 percent more for another four watercourses. The higher than average water duty for WCs 7L, 9L, 10L and 11l is the result of lift pumps that are capable of taking more than their due share.

A summary of the mean monthly hydraulic performance, as measured at the head regulator and the outlets, is listed in **Table 3.11**. The temporal coefficient of variability is extremely good at 0.05 (5%), except for the month of May, when it was 0.13 (13%), which corresponds with the average value for the parameter (0.13) evaluated for the outlets. The spatial coefficient variability at the outlets is 0.5 (50%), which is very high and reflects a high degree of inequity in water distribution among outlets.

Table 3.11. Summary of the hydraulic performance for Bareji Distributary during Kharif 1997.

Months 1997	Average Discharge at head regulator (cfc/1000 acres)	Temporal coefficient of Variability at head regulator	Spatial coefficient of variability at head regulator	Temporal coefficient of variability at outlets
May	4.61	0.13	0.58	0.13
June	4.53	0.05	0.51	0.14
July	4.80	0.05	0.46	0.11
August	5.46	0.04	0.49	0.18
September	5.24	0.05	0.44	0.09

3.4.4 Comparisons

From May through September the actual mean monthly water duty in cusecs per 1000 acres ranging from an average of 4.14 for Dhoro Naro Minor to 4.93 for Bareji Distributary and 6.63 for Heran Distributary. Certainly, for Dhoro Naro Minor with open flume outlets, a high degree of inequitable water distribution would have to be expected, which could partially be overcome by doubling the water duty, but still the outlets need to be converted into orifices in order for adequate quantities of water to reach the tail watercourses. The contrast, Heran Distributary has the highest water duty and more equitable water distribution among watercourses as compared with the other distributaires, but still there is a need for considerable improvement.

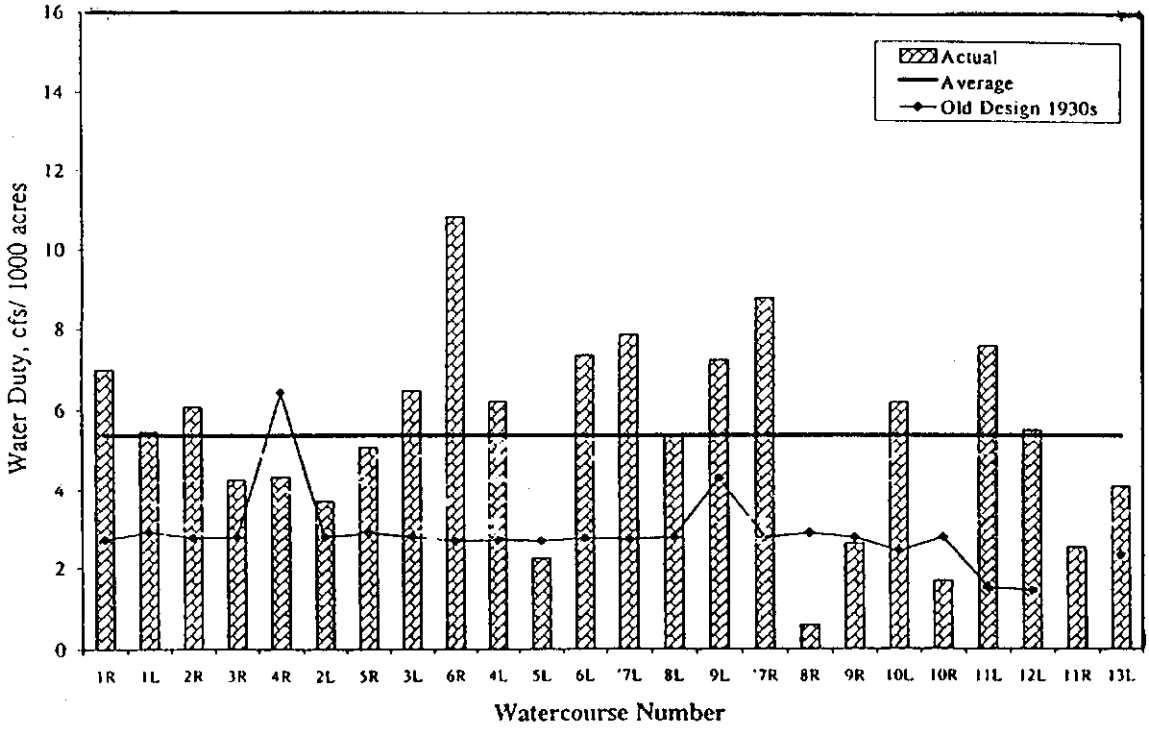


Figure 3.9. Normalized water duty for outlets from Bareji Distributary during July 1997.

Table 3.12 Mean monthly water duties for the three pilot distributaries.

Month during 1997	Mean Monthly Water Duty at Head Regulators (cfs/1000 acres)		
	Dhoro Naro Minor	Heran Distributary	Bareji Distributary
April	4.29	4.85	
May	3.99	6.31	4.61
June	3.69	6.61	4.53
July	4.66	7.04	4.80
August	4.21	6.44	5.46
September	4.14	6.77	5.24
Mean for May - September	4.14	6.63	4.93

Table 3.13 lists the mean monthly spatial coefficient of variability for the three pilot distributaries. The mean values for Kharif 1997 are 0.75, 0.45 and 0.50 for Dhoro Naro Minor, Heran Distributary and Bareji Distributary, respectively. All three of these values indicate a very high degree of inequity in water distribution. Clearly, Dhoro Naro Minor experiences the greatest degree of inequity, which is attributable to two major factors: (1) extremely high degree of tampering, including busted outlet floors and holes through the outlet walls; and (2) all of the outlets are open flumes rather than orifices, so that increased water levels in the minor result in much higher discharge rates entering the outlet. The variability among the outlets at Bareji Distributary is higher than for Heran Distributary, largely because of the many (13) pumps lifting water at a number of outlets where more than their due share can be pumped.

Table 3.13. Mean monthly spatial coefficient of variability at the outlets for three pilot distributaries.

Month during 1997	Spatial coefficient of variability at outlets		
	Dhoro Naro Minor	Heran Distributary	Bareji Distributary
April	0.48	0.47	
May	0.95	0.48	0.58
June	1.13	0.46	0.51
July	0.59	0.48	0.46
August	0.64	0.39	0.49
September	0.72	0.40	0.44

3.5 Groundwater and Drainage

3.5.1 Groundwater Levels

There are seventy piezometers installed in the Dhoro Naro Minor command area to monitor the water table depth. All of the piezometers have been referenced to mean sea level. The mean monthly water table depth was 6.4 feet in April, but was more than eight feet in July and later. The average water table depth for Kharif 1997 is shown in Figure

3.10 for each piezometer. Since the desired water table depth is 5-7 feet, or more, so as not to interfere with crop production, the command area is experiencing a healthy drainage situation.

There were 86 piezometers installed in the Heran Distributary command area. During May 1997, the mean monthly water table depth was 3.0 feet, with groundwater levels rising thereafter so that the mean water table depth was only 2.7 feet during July 1997. This certainly had detrimental effects on crop production. Thus, there is an urgent need to commission the drainage tubewells so that the water table can be lowered.

A total of 65 piezometers were installed in the Bareji Distributary command area. The mean monthly water table depth varied only form 4.0-4.3 feet during the Kharif 1997 season. The maximum water table depth in the command area was 9.1 feet, whereas the minimum water table depth was 0.63 foot. Only 19 of 65 piezometers (30%) had an average water table depth of more than five feet. This situation demonstrates the importance of commissioning the subsurface tile drainage system,

3.5.2 Water Balance for Dhoro Naro Minor

Two Swiss M. Sc. students (Beatirce Keller and Gabor Jaimes) undertook surface water hydrology and groundwater hydrology studies during August-December 1997, with the dependent parameters for both analyses being monthly groundwater recharge. The monthly analysis of crop water requirements compared with the canal water supply plus rainfall is shown in Figure 3.11. The largest water deficits occur in the months of May, June, July and August. There are modest surpluses in the months of March, October, November and December.

These studies included an analysis of long-term groundwater level trends for some of the piezometers used by the SCARPs Monitoring Organization (SMO). Figure 3.12 illustrates the positive impact of LBOD in lowering water table depths after 1992, as well as the groundwater fluctuations from the trend lines.

3.6 Agricultural Development

Based upon the technical context described above, as well as experiences to date with the three WUF's, a reasonable picture of the potential for agricultural development in the three pilot sites has become clearer. An assessment of the situation as of December 1997 is stated below.

3.6.1 Reliable Water Supply

Farmers often comment that their biggest problem is obtaining a reliable water supply, rather than obtaining more water. However, the monitoring data does not capture the high degree of variability in water discharges passing through the distributary head

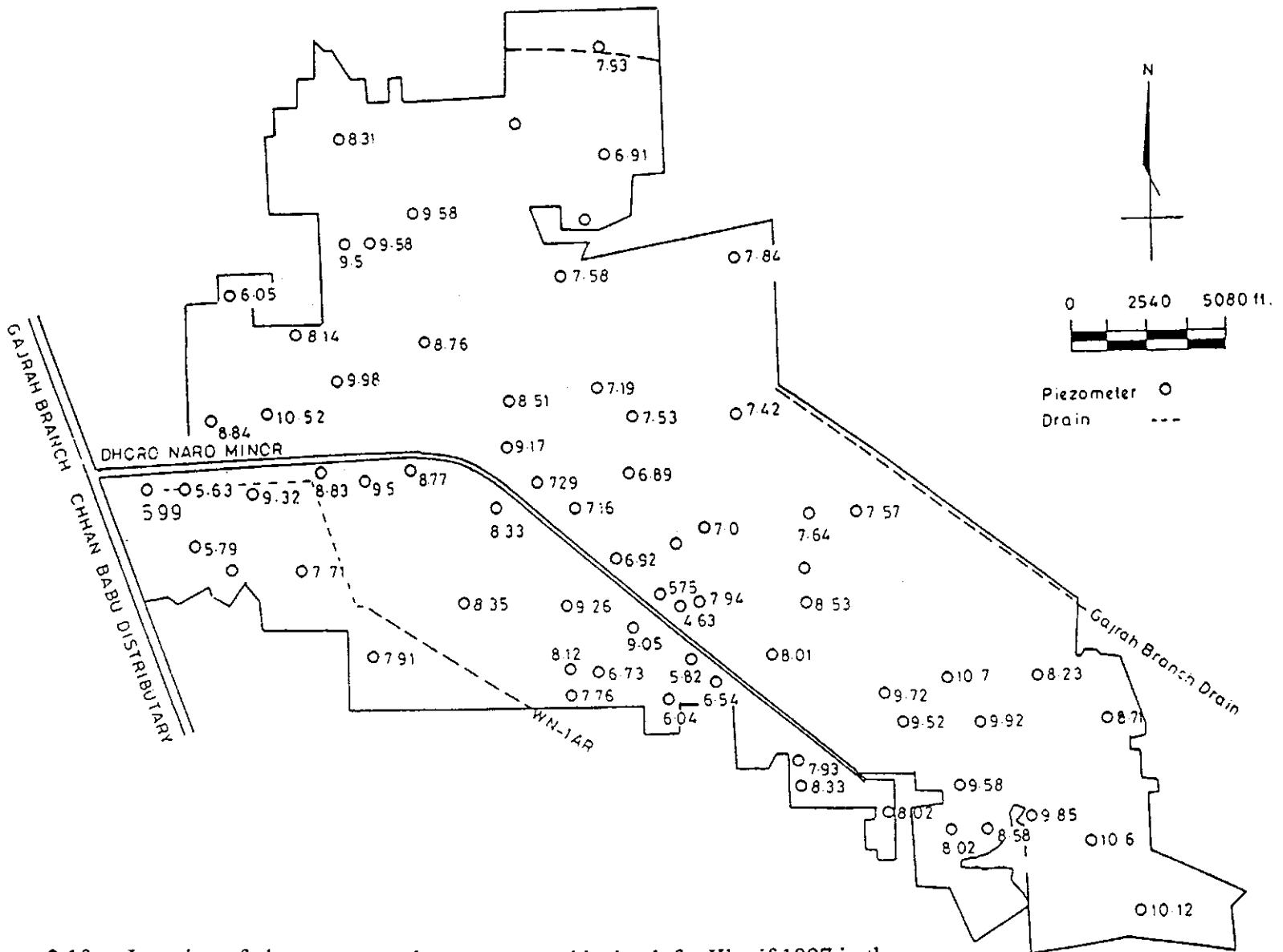


Figure 3.10 Location of piezometers and mean water table depth for Kharif 1997 in the Dhoro Nao Minor command area.

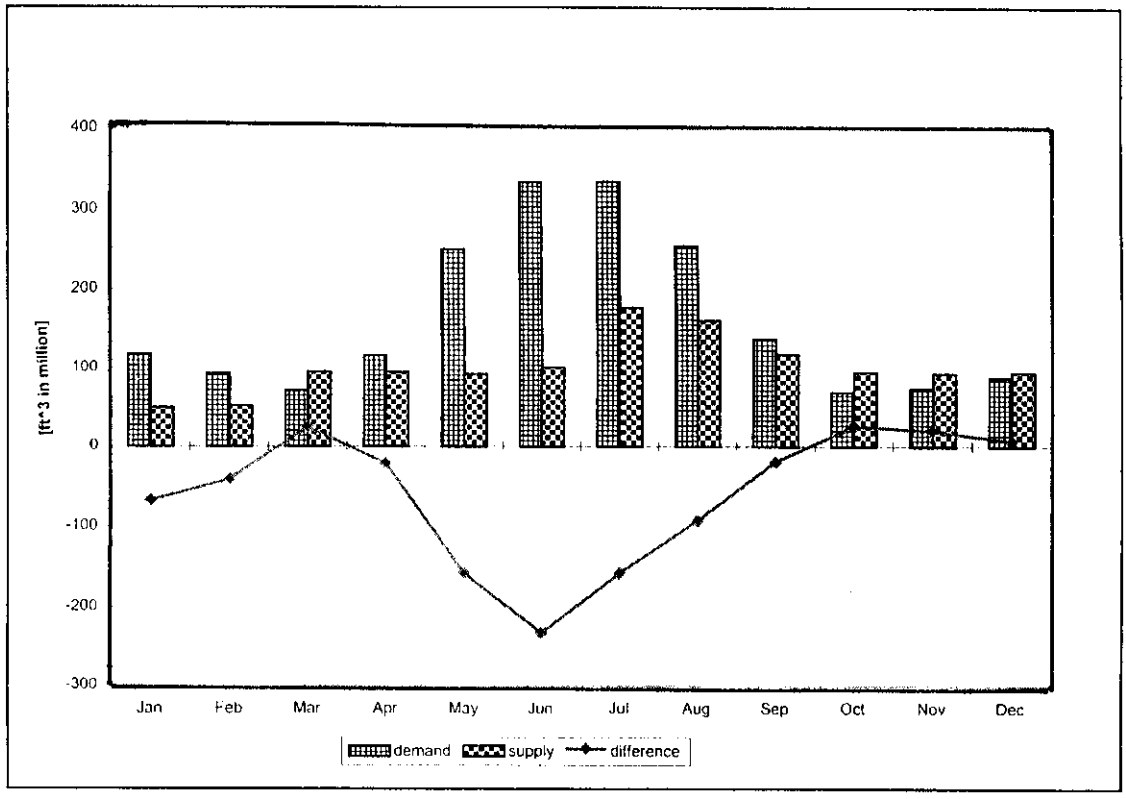


Figure 3.11. Mean monthly crop water requirements and water supply for Dhoro Naro Minor command area.

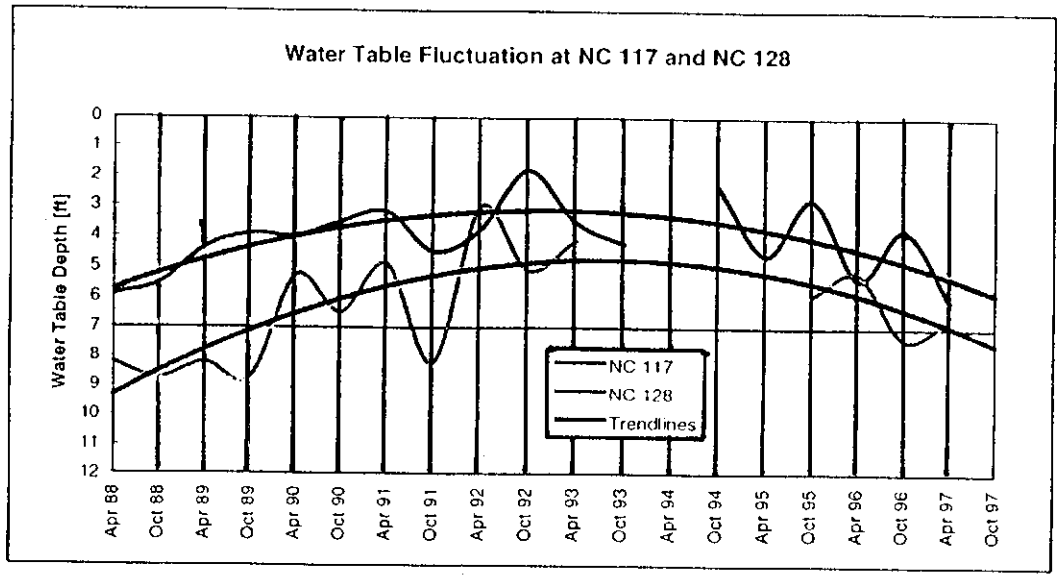


Figure 3.12. Water table fluctuations and long-term water table depth trend lines at SMO Piezometers NC 117 and NC 128 within Dhoro Naro Minor command area.

regulators because these desicharges are measured only twice a week. When the discharges were being monitored every hour or two round-the-clock for seven days, the Irrigation Department gate operators knew about the monitoring program, so they were careful not to introduce discharge fluctuations into the system. Yet, it is known that Dhoro Naro Minor periodically suffers with large discharge fluctuations of at least 30 percent.

The irrigation system is operated to maximize the rent extorted from farmers, rather than maximizing agricultural productivity. The only likelihood for achieving reliable water delivery will be when all of the distributaries on a canal command have been organized into WUFs.

3.6.2 Equitable Water Distribution

For all three pilot sites, there is a very high degree of inequity in water distribution among the outlets serving testing watercourse command areas. This is not a static situation, but a situation that is changing even during a single cropping season.

The field data collected by IIMI has been shared with each of the WUFs. In general, the farmer leaders have expressed a strong interest in achieving equitable water distribution. They recognize that their WUF is not sustainable without equity.

The Dhoro Naro Minor WUF began implementing changes in their outlets during Kharif 1997 in order to move water to the tail reach, but Irrigation Department field staff interfered with this work. Now, the three WUFs recognize that equitable water distribution cannot be implemented until they have legal authority to operate and maintain their system.

Normally, to remodel an outlet structure costs about Rs. 30,000 – 50,000. However, in these pilot sites, only Rs. 5,000 – 7,000 will be expended. These structures will not be beautiful, but they will be functional. Afterwards, IIMI field staff will check the discharge rating of each outlet, share this information with the WUF, then the WUF will make any structural adjustments, such as resetting of the crest elevation for an outlet.

3.6.3 Controlling the Groundwater Level

The Dhoro Naro Minor command area has already significantly benefited from LBOD drainage facilities. The depth to water table is 8-10 feet throughout the command area, which is quite sufficient.

In many locations, the groundwater levels are too high in the Heran Distributary command area. This problem would largely be rectified if the installed drainage tubewells were made operational.

The Bareji Distributary command area suffers much from high water tables, which are only 2-3 feet below the ground surface, and sometimes shallower. Yet, this command area has been endowed with subsurface drainage pipe over more than seventy percent of the command area. If the 13 sump houses in the command area were operated, then certainly most all of the drainage problems would be alleviated and there would be a highly significant increase in agricultural productivity.

3.6.4 Combined Management of Irrigation and Drainage Facilities

Although there is still much work to be done regarding the management of the drainage facilities, the hydrological studies conducted during August – December 1997 for the Dhoro Naro Minor command area provides some clear guidelines. For example, many of the saline drainage tubewells will have to be heavily operated during a few months, but they will also be dormant during some months, thereby reducing operating costs.

Similar hydrologic studies need to be undertaken for the other pilot sites. But, as indicated in Section 3.6.3, the management of groundwater levels is looking very feasible. But, nearly another year of field studies will be required to document for the farmers all of the benefits associated with the LBOD drainage facilities. However, this topic is often discussed with the WUF leaders.

3.6.5 Improved Surface Irrigation Methods and Practices

IIMI has been conducting research in southeastern Punjab since 1994 on improved surface irrigation methods. Better irrigation methods are being field tested for crops that are sensitive to flooding and consequent soil saturation, such as cotton, maize and groundnuts. Also, methods are being tested for more rapid advance across a field so that a farmer can irrigate more bunded fields during his allocated warabandi.

Some of these methods, such as bed-and-furrow were enthusiastically received by 100 farmers in South Punjab during Kharif 97 on a program implemented by Punjab On-Farm Water Management (OFWM) with technical support from IIMI. During Kharif 98, a Joint Research Dissemination Program will be undertaken in the Fordwah Eastern Sidiqia (South) Irrigation and Drainage Project that includes the Mona Reclamation Experimental Project of WAPDA, Punjab Agricultural Extension Technology Division, OFWM and IIMI.

With this background experience, a similar program could be undertaken in the three pilot sites during Kharif 1998, which would be focused on cotton production. Experience to date would indicate a thirty percent water savings that would result in reduced groundwater recharge. Also, yield increases of more than thirty percent can be expected.

3.6.6 Cropping Potential

The most immediate benefits to increased crop production will come from operationalizing the saline drainage tubewells in the Heran Distributary command area and the 13 sump houses that collect water from the subsurface drainage network in the Bareji Distributary command area. The next important step would be achieving equitable water distribution among the watercourses in each pilot site. This would then provide the basis for a highly effective program for combined management of the irrigation and drainage facilities. This can be followed by a program of improved surface irrigation methods and practices that would include efforts with developing relationships between the WUFs and multinational fertilizer and chemical suppliers to insure that farmers are receiving good quality products that are not adulterated. The combined management of all resources will support highly significant increases in agricultural production, where fifty percent crop yield increases would be very conservative estimates.

Chapter 4

SOCIAL ORGANIZATION ACTION RESEARCH

4.1 Basis of Action Research

The action research design took into account both the historical development of irrigation in the area, as well as the present socio-economic status of the community. A brief reference to both of these aspects is given below.

The context of action research had origins in the following main characteristics of the country's century old canal irrigation:

* run-of-river water supplies;
* protective irrigation;
* low water allocations of 0.21-0.28 l/s/ha (3-4 cusecs per 1000 acres);
* low cropping intensity (annual average 75%);
* infrastructure design for equity and reliability of supply;
* few gated structures and minimal operational adjustments required; and
* all distributary and minor outlets to draw their design discharge.

With the passage of time, many changes occurred and most of the traditional design features became outdated in the context of new environmental conditions. The often used "design discharge" parameter lost its meaning as the system parameters were not properly updated, although many modifications were effected in an ad-hoc manner, and the water users themselves constantly tampered with the system. The present situation is characterized by:

* increased water allocations (0.35-0.49 l/s/ha, or 5-7 cusecs/1000 acres)
* increased cropping intensities (over 100% in many systems);
* diversification in cropping patterns;
* increased indiscipline in the operation of the system;
* cumulative effect of poor maintenance;
* advent of groundwater development;
* fragmentation of irrigable land;
* increased seasonal water shortages and fluctuations in water supply; and
* stagnant crop yields.

The physical changes are closely related to a set of social changes. For instance, general deterioration of the physical infrastructure can be linked with operational irregularities and neglected system maintenance, which in turn are a result of the declining law and order situation. The overall effect is a lack of reliability in irrigation water supplies and an increasing inequity in water distribution within the system.

While the causality between these two sets of changes in physical and social conditions is not clearly discernible, the constant interactions between them seem to have led to the present situation of unsatisfactory performance. Under-investment, poor maintenance, supply deficiencies, political influence, improper operations, and management inefficiencies are some of the features that can be seen as both the causes, as well as the effects, of a process of change.

Thus, the poor performance of a water resource system can be seen as primarily a problem of social behavior. The physical sub-system is what the social sub-system makes it to be. In this sense, it is important to consider the present social setting of Pakistan's irrigation, which can be outlined by the following main features:

* skewed land ownership pattern; in LBOD areas, 20 percent of landowners have 80 percent of the land (LBOD Project Reports);

* increasing number of small landholders due to fragmentation of land; in Dhoro Naro command area, 80 percent of the water users had less than 10 hectares of land (project Inception Report);

* the majority of water users are illiterate and poor (this was evident in the baseline survey of the three pilot sites);

* lack of information sharing as a majority of farmers have no access to good information as extension staff usually meet only the few big landowners;

* centralized irrigation administration; although irrigation is a subject devolved on the Provinces, its administration is still highly centralized;

* lack of accountability; operating agencies are not accountable to water users for equity, adequacy and reliability of water distribution;

* rent-seeking behavior is rampant; widespread corruption is a known feature in farmer agency interactions related to water distribution, abiyana assessment and collection, and maintenance contracts;

* neglect in operation and maintenance; established operational rules are relaxed with little or no consequences, and maintenance is deferred for long periods;

* political interference -- a frequent complaint by agency staff is related to interference in staff transfers, promotions, and disciplinary actions; and

* inequity in water distribution -- tailend deprivation is a common feature.

The physical location of this action research program was the lower part of Pakistan's large contiguous canal irrigation system having the above-mentioned physical and social characteristics. The basis of this action research program was that the effectiveness of water resources management would be location-specific, and largely determined by a number of contextual factors. Thus, it was necessary to adapt available theories, concepts and models related to social organization, collective action and irrigated agriculture to suit the local conditions.

The main advantage in conducting action research on social organization through a pilot project was to test the viability of establishing water users organizations at the secondary level and also the viability of their collective actions in this socio-economic context. Another advantage was the opportunity it offered to test the existing theories on rational choice, which valued the coordinating role of an external central authority, such as a government irrigation agency. An interesting aberration in the present context confronting the conventional rational choice theory is the intervening variable of collusion between some influential water users and state functionaries who are expected to control free-riding on water use. This seemed to make a change in the existing state property arrangement for water resources very essential at this stage. The adopted conceptual basis of this needed change was outlined in Section 2.3 above.

4.2 Overview of Action Research Activities

An indicative action research plan was developed, leaving the details to be worked out as field work and interactions with the community progressed. Simultaneously with the implementation of various steps in this plan (see Section 4.3 for details of these steps), related field processes and outcomes were observed and documented. The research group employed methodologies which were helpful in implementing an agreed plan of action in collaboration with other partners directly involved with the action program. Participatory techniques, such as PRA and PLA, and participant observation and process documentation were used.

The action research was richly contributed to by its main actor, the water users community. They participated in the initial data collection, social organization interactions, planning processes and self-evaluations. One actor, who could have contributed more, was the OFWM Directorate, the executing agency of this donor-assisted and government sponsored program. Their assistance in facilitating the project proposal through government channels was excellent, but they lacked resources to physically participate in the action research activities along with IIMI and the water users.

Lessons were drawn from past efforts on social organization made by government and non-government organizations. International experience, including the major "irrigation management turnover" efforts sponsored by the World Bank and other donors elsewhere was critically examined and useful elements were adopted. In the final analysis, this action research program focused on identifying local capacity and interest for taking over water resources management responsibility, rather than on the often highlighted failure of state agencies to mobilize financial resources and manage the canal irrigation system.

4.2.1 Documentation of Action Research

Process documentation was one key element of the action research program. The three field teams located in the pilot area prepared initial sets of field notes, containing interview results, observations, and measurements wherever relevant. These notes were converted to semi-processed reports, which in turn were used in preparing MPRs and other research reports. A number of published reports provide details of concepts, activities, and some evaluations related to the action research program, and another set of reports covers the technical and financial planning aspects for the functioning of new WUOs (see **Annex 1** for the list of project related publications).

A synopsis of the material given in these reports is given below, with specific references to the theoretical relevance of some of the actions taken.

4.2.2. Main Features of the Program

Strategically, the action research program conducted to date can be characterized by six main special features:

(1) action research was conducted essentially in a **participatory** mode;
(2) **replicability** was a foremost consideration in pilot project implementation;
(3) **equality of opportunity** was provided to all water users to participate;
(4) selection of organizational leaders was effected in a truly **democratic** way;
(5) selection was through **consensus**, and not open competition; and
(6) emphasis was to form an **economic organization**, and not a welfare group.

The special emphasis on these features was prompted by the country's past experience in forming water users associations (WUAs) through the OFWM and CWM programs (Section 1.2). The largely non-democratic methods of selecting organizational leaders and the lack of long-term objective-orientation resulted in those WUAs becoming defunct shortly after the immediate objective of watercourse improvement was accomplished. The choice of watercourses for improvement through the programs had also been a subject of criticism as the decisions tended to be dominated by larger landowners.

4.2.3 Site Selection

A contentious issue in many project discussions was on the representativeness of the three selected pilot distributary sites in the Sindh Province. However debatable the issue is, the fact remains that the effort in site selection was designed during the project inception stage to ensure a fair representative selection, given that the number of sites was to be limited to three. The sites were selected in a highly participatory manner, involving both field level, as well as higher officials of the operating agencies, and the water users (see Section 1.3).

At this initial stage of data collection, the land distribution pattern in the pilot areas was found to be fairly skewed, more than 50% of the water users owning less than 10

hectares each. In retrospect, the three selected distributaries provided an interesting variety of field situations (also, see Sections 3.1.4, 3.2.4 and 3.4.4).

- The pilot distributary in Sanghar District has more owner-operators than any other site, and this is confirmed by its large proportion of small land holdings.

- The proportion of lessees is also highest in the pilot distributary located in Sanghar District.

- The pilot distributary in Mirpurkhas District has the most number of tenants.

- Most of the tenants in the Mirpurkhas District pilot distributary are scheduled caste Hindus.

- Mostly managers are responsible for the management of land on behalf of the absentee landlords of Dhoro Naro Minor in Nawabshah District.

From the perspective of community characteristics, the Bareji Distributary in Mirpurkhas District was seen to be markedly different from the other two sites. It was conspicuous in its social structure; it had a high percentage of non-muslims, and a high proportion of tenants to landowners (Mirpurkhas - 787/354; Nawabshah - 190/504; Sanghar- 409/667). This peculiarity was also supported by a relatively high proportion of large landowners. The Bareji command area had 10% of its landowners owning more than 40 hectares, whereas this ratio in the Dhoro Naro was 4% and the Heran command area had only one person in this category. In the overall, the selection of pilot sites turned out to be appropriate for the planned action research program. The three sites together provided an adequate representativeness that is required for a pilot project, and also sufficient variability for research purposes.

4.2.4 Socio-Economic Baseline Survey

The action research work plan for the pilot projects included a baseline survey as one of the preliminary actions to be taken. A number of watercourses were randomly selected from the three pilot distributaries for this survey. For each selected watercourse, warabandi lists were prepared to determine the total number of water users, out of which a sample of respondents was selected. The baseline survey generated more focused information related to the action research locations. Some of the main characteristics identified in the baseline survey report **(Memon, Hassan and Bandaragoda, 1997)** are mentioned below:

* The average age of a water user was around 40 years, and a maximum of the water users were between 31 to 60 years of age;

* The average water user's experience in irrigated agriculture ranged between 20 to 30 years;

* A majority of the water users (64%) were illiterate and the average number of school going children in a family was also very low (indicating that future illiteracy levels will not decline significantly);

* The average family size in the three pilot sites ranged between 8 to 13;

* A majority of the respondents at Bareji Distributary were non-muslims (mostly tenants), while at other pilot sites, the majority were muslims;

* The mean number of full-time workers in the family engaged in farming ranged between 2 to 4;

* A majority of the water user respondents were tenants at Bareji, Dhoro Naro and Heran sites, whereas a majority of the respondents at Khadwari Minor were owner operators.

* Average operated area of a respondent varied between 7 to 20 acres at different sites, out of which, 5 to 15 acres were owned by them and the rest of the land had been leased in. Both the average area operated and owned were higher at Khadwari Minor, comparatively because of a higher tendency of self cultivation by the owner operators.

4.2.5 Technical Baseline Information

Initial "walk-thru" surveys conducted in groups involving both the water users, as well as agency staff, provided useful information on the physical condition of the distributary canal system, its water flow and its immediate maintenance requirements. The initial water measurement program provided a tentative set of data regarding the various hydraulic structures and actual discharges in the canal system. The two activities provided a very useful training to all of the participants. Although not very accurate, this preliminary physical data helped the water users to engage in water related and production related discussions, which usually converged on the need for organized behavior and collective action.

4.2.6 Organizational Development Activities

A four-phase organizational development process[8] was used as a guide during action research implementation (see **Annex 2**). The four phases of this process are:

1. Support mobilization;
2. Initial organization;
3. Organization consolidation; and
4. Organizational action.

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[8] This four-phase process for water users organization activities in Pakistan was adapted from the M & O guidelines provided by **Skogerboe, Poudyal and Shrestha (1993).**

The support mobilization phase was a "get set" stage during which the field teams were mobilized and trained, initial collaborative arrangements were discussed with the staff of OFWM, PID and other irrigation-related agencies, selection of the pilot sites was finalized, members for a Field Implementation Coordination Committee (FICC) were identified, and initial baseline information was collected.

In the second phase (initial organization phase), some progressively advancing steps in interacting with the community were taken (see Section 4.3.5). The core social organization field activity was implemented during this phase. Starting from a familiarization program, the field teams and the social organization volunteers proceeded through three other series of interactions, and finally reached the culminating step of forming the water users federations.

The organizational consolidation phase included a series of capacity-building programs to provide WUO leaders and their members with the necessary knowledge and skills to engage in actual water resources management tasks. Registration of WUOs with the OFWM Directorate under the Water Users Ordinance, and the preparation of joint management agreements (JMAs) between the distributary level water users federations and the PID were two important tasks undertaken during this phase. The last phase was meant to give effect to the provisions of the JMAs. This task could not be completed as the PID withdrew the three signed JMAs on the basis that the then Secretary PID had not properly executed them with due authority from the Government of Sindh.

The decision to place the collectively concluded joint management agreements "in abeyance" until the government considered the legal basis for such a transfer of state owned assets to water users groups was a tremendous setback on the growing enthusiasm of water users in the three pilot areas. Notwithstanding this discouraging event, the WUOs decided to proceed with some physical development work in the distributaries on a cost-sharing basis.

In this organizational development process, many actors contributed. A design team coordinated the planning effort, and collaborated with the social organization field team located in the three pilot sites. The selected SOVs and the Field Implementation Coordination Committee (FICC) were the other partners in the field. The FICC consisted of representatives from various agencies providing irrigated agriculture services to the farmers, including the civil administration, and selected farmer representatives. Social organization activities were supported by some collaborative activities by various agencies. The idea of conducting collaborative activities was to maintain the water users' interest on the action research program. IIMI played a catalyst role in bringing various line agencies and other service delivery groups to the water users on their request. These agencies included agricultural extension, livestock and forest departments, as well as LBOD the Water Management Component of the OFWM Directorate of the Government of Sindh. Private sector groups included Fauji Fertilizer Corporation, National Rural Support Program (NRSP) and some agricultural educational and research

institutes and NGOs. The developing water users organizations facilitated the effective delivery of services at the field level. Some details about these activities are listed in **Annex 3.**

The overall process described above is depicted in the diagram given below.

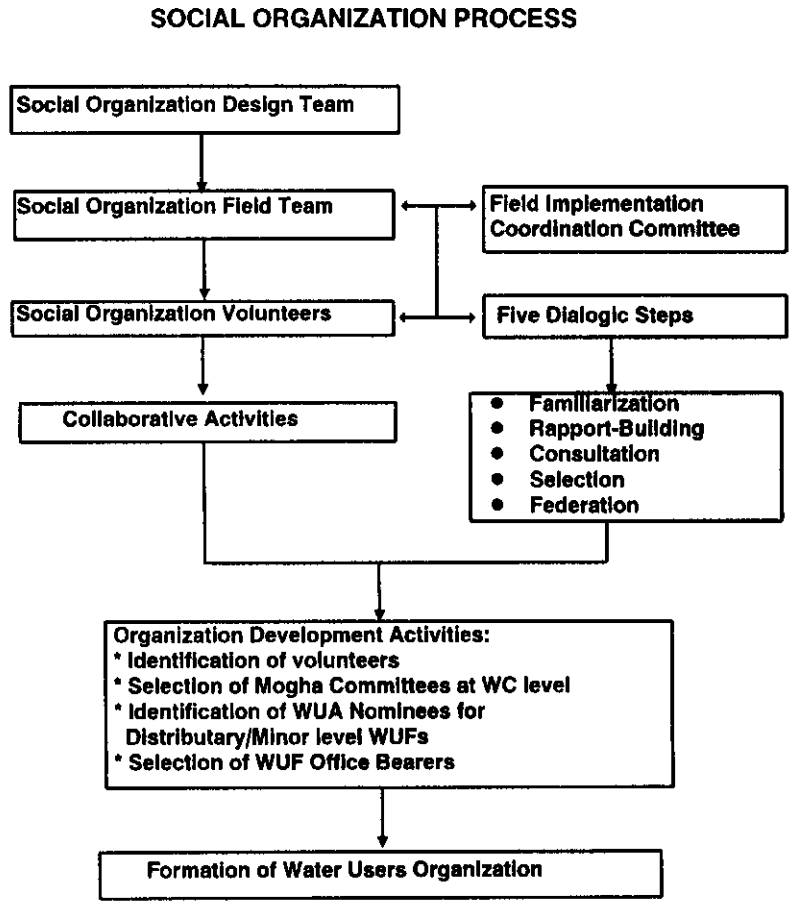

Figure 4.1. Social Organization Process.

4.3 Success of Contextually Appropriate Methodologies

A question is often raised: what is special about this action research effort? One response is related to the methodologies used in organizing water users. Four special features can be highlighted: deployment of small social organization field teams consisting of persons with a strong local background; use of community-based volunteers; non-dependence on outside funds for physical improvements; and a step-wise social organization process.

Many people, both within and outside the country, asserted that organizing water users for distributary level management in Pakistan was a very difficult task; some believed that it was impossible. Most of the contextual factors described in the earlier sections of this report contributed to this perception. Preliminary field investigations also indicated that organizing water users for a federation at the distributary level was going to be an enormously difficult task. Only some of the watercourses in the pilot area had experienced the formation of WUAs sponsored by the OFWM, and these WUAs were already defunct. The water users in these watercourses were particularly hostile to the idea of yet another attempt to "organize" them. People in the area appeared to be overwhelmed by problems of salinity and unproductive farming, and showed little patience to consider possible long-term solutions. Specially designed social organization methodologies were needed in this context.

4.3.1 Locally Recruited Small Field Teams as Catalysts

Among the project concepts was the understanding that, for social organization to be effective in any given area, it would need to be conducted by the people with a strong local background. Giving effect to this understanding, the project staff who were expected to be directly involved in field activities were all recruited from the Sindh Province. All of the necessary staff positions were filled on time according to the project plan. The field team at each pilot site was kept at a minimum size of five, with a combination of three social science and two agriculture engineering graduates. The small size of the team meant easy replicability of the catalytic effort on a wider scale.

To reflect the special features of the project design in actual field work, the Social Organization Field Teams[9], and all of the supportive staff employed at pilot sites and the office in Hyderabad, were given a training on project objectives and methodologies. An orientation program was conducted in early September 1995. The field teams visited the Aga Khan Rural Support Program (AKRSP) in Gilgit for a ten-day training program on social organization, followed by a two-day training program in the Water Resources Research Institute (WRRI) of the National Agriculture Research Center (NARC) in Islamabad. A fair understanding of the institutional implications of irrigated agriculture was considered important in motivating people to see the value of social organization. This training to the staff also attempted to provide them with the necessary basic tools and skills required for undertaking self-assessment of their field operations and collective action. The staff were further trained in the principles of water measurement. As a follow up of the initial training on hydraulics and measurement devices, a further course on field calibration of moghas was conducted for the field teams during December 1995.

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[9] The term **"SOFTware"** was coined by the IIMI's staff in the Hakra 4-R Distributary pilot project in Punjab to distinguish these Social Organization Field Teams from IIMI's other teams engaged in more technical work.

4.3.2 Local Volunteers

To supplement the small field team, a strategy was developed to use community-based volunteers in social organization work. Initially, the project decided to call these volunteers "contact farmers" because they had to play a pivotal role as a ***contact*** between the field teams and the community. Selecting some suitable persons from the local community to be deployed as "contact farmers" was an important strategy in the social organization process. The term "contact farmers" was found to be associated with the "influentials", big land owners and farmer leaders of the T & V system adopted by the Agricultural Extension Directorate. Since the use of these contact farmers had not resulted in the proper functioning of the T&V system, the term had an unfavorable connotation. The project staff agreed that, in order to avoid farmers' mistrust from the start, the term "contact farmers" should be replaced by the term **"Social Organization Volunteers" (SOVs)**.

Organizing people is a socially sensitive and politically vulnerable activity. This is not a task to be solely undertaken by an international institute like IIMI; rather, it should be the responsibility of local people (i.e. local agencies and the water users) themselves. An internally generated demand for social organization has a greater chance of making these organizations productive and sustainable. IIMI, primarily as a provider of objective information useful for change, or a catalyst in action research, could only provide a facilitating role in this process, based on its international experience, by helping the people to become organized.

The decision to look for assistance from the community itself for reaching the community at large was compatible with this thinking. Members of the community, who were adequately informed about the community and its needs, and prepared to assist the action research process, were selected. The members of this extended field team were based in the community, knew the people fairly intimately, and shared their language, beliefs, traditions, rituals, needs and problems.

The methodology of using local volunteers had the following advantages:

* Interventions could be routed through local people, causing little room for mistrust;

* The SOVs could reach the community in the large pilot distributary command area fairly quickly, partially meeting the projects time constraint; and

* As SOVs were deployed on a voluntary basis, the method was cost-effective and could easily be applied on a wider scale.

The biggest advantage in having the SOVs was felt when they took upon themselves to explain the objectives of the project and the background of IIMI, at a very critical stage of the project. A few months after the field work was started, IIMI's initial social organization activities related to farmers' participation in management were seen by some people, particularly those who had some vested interest in retaining the status

quo, as part of a hidden agenda sponsored globally by aid agencies and countries more closely associated with them. IIMI was projected by these people as an alien agency working for achieving conspiratory objectives detrimental to Pakistan. At this stage, no amount of discourses by IIMI staff could save the situation, and only the SOVs' voluntary actions managed to dispel such doubts and misconceptions. The community preferred to rely on assurances and explanations of their own opinion leaders than on the professional discourses by outsiders.

4.3.3 Training as a Motivating Influence

The project did not have access to funds allocated for any physical improvements to be effected in the pilot sites. This was a major deviation from the usual social organization project designs adopted earlier in Pakistan. Both OFWM and CWM programs had physical improvements as the main task, and the associated institutional development component was to enable this primary task. Consequently, both programs could not achieve any meaningful results from the second objective. Instead of physical incentives, this action research program planned to use training as an incentive for organizational interactions. The participatory approach adopted throughout the project period typically suited this strategy, and a series of training programs and similar interaction programs were helpful in maintaining a steady level of enthusiasm among the water users. A list of capacity building activities is given in **Annex 3**.

The motivational effort, through training and information sharing, was also to engage the water users in building awareness, confidence and mutual trust. There was no monetary incentives and no promises of physical assets. The training inputs were incorporated into other social organization activities, the interventions being in a slow process, monitoring the effect of each step and building on it. The strategy was also to share project-related information with the water users in frequent meetings with small and large groups, in places which were considered as "neutral", such as schools, mosques, playgrounds and other community meeting places.

Water users showed a greater interest in learning about the physical aspects of the irrigation and drainage systems than about proposed organizations. This was quite natural as the physical sub-system of an irrigation system would be foremost in the minds of the people. They would like to hear about quantity and quality of water they receive, sedimentation in their canal system, and the conditions of the structures, etc.

The members of WUFs and WUAs were trained to undertake several important maintenance activities during 1996-97. They were assisted in building their capacity for identifying and implementing maintenance works in the future. Most of the capacity-building activities were undertaken in two steps. The first step was the identification of maintenance needs and the second step was the actual implementation of work to meet the identified maintenance needs. Identification of maintenance needs was done by gathering information through field observations, surveys, farmers interviews, etc. The following two key surveys were particularly important.

The intent of a maintenance program to fix all flow control structures required for the improved hydraulic operation of the system is to ensure that they can function both as flow control and flow measurement structures. This activity is the crucial linkage between maintenance and operations. The information may cover the water supply situation, water distribution pattern, irrigation structures, channel reaches, channel physical conditions, existing maintenance strategies, involvement of beneficiaries, responsible agency role and possible constraints. After acquiring a good knowledge of maintenance needs, all maintenance requirements are categorized into two different maintenance programs: (1) essential structural maintenance; and (2) deferred maintenance.

In addition to the maintenance training, the WUO groups were also provided with some basic ideas about operating the physical system to distribute water equitably. Improved irrigation and agricultural practices formed the focus of a number of field visits to Sakrand Experimental Station and the demonstration plots established within the pilot areas. The water distribution pattern was also studied during walk-thru surveys.

Diagnostic walk-thru maintenance surveys were conducted to list in detail all deferred maintenance needs along the distributary and minors, including the inlet structure to each tertiary sub-system. The main objectives for undertaking this survey in conjunction with the water users were:

(1) to gain an understanding about maintenance problems;
(2) to gain farmers views about maintenance problems; and
(3) to obtain historical and social aspects about specific water management difficulties.

The surveys were undertaken in January 1997 jointly with the three WUFs for a detailed assessment of all the maintenance needs along the selected distributaries and minor. The joint teams walked along the channels from the head regulators to the tail watercourses. All of the major and minor deferred maintenance needs of the channels were comprehensively discussed with water users. Special attention was given to existing cross sections, condition of banks, vegetative growth, silt deposition, and animal crossing paths. Possible causes and effects of maintenance needs were identified.

The deferred maintenance needs were discussed with the water users. The water users on their own came to the conclusion that ignoring the deferred maintenance needs could create major problems for the future. Therefore, these deficiencies should be handled quickly so that related problems like water distribution, breaches, etc. could be overcome. Similarly, for Essential Structural Maintenance, they were of the view that the outlets should be redesigned and a cast iron frame should be fixed for a small amount of money at this stage instead of spending huge amounts afterwards.

4.3.4 Phased Social Organization Process

Experiences in other countries suggested that **"getting the process right" (Uphoff, 1986)** was a valuable initial investment in social organization work. An attempt was

made, therefore, to develop an appropriate process before embarking on the actual field work in the pilot project (see Section 4.2.6).

Another idea drawn from international experience was the value in **"putting people first" (Cernea, 1985)**. During the reconnaissance surveys in the pilot project area, many water users inquired about the package of physical incentives planned for the project. They were accustomed to the government subsidies on watercourse lining and tubewell development, etc. A considerable effort was spent to convince the water users of the need to get organized first so that a form of collective action could benefit more from whatever the government could deliver, or from their own resource mobilization initiatives. The encouraging result is that they were eventually convinced of this approach towards self-relianc.

4.3.5 Five Dialogic Steps

An important feature of the iterative process was the progressively enhanced interactions in a series of meetings with the water users, which culminated in forming water users federations in the pilot areas. Adopting a step-wise approach, and building on the steps already taken, the process advances towards the group behaving on mutual trust, sharing information, consulting for consensus, developing options and implementing an appropriate organization design. Since the interactions were between the catalysts and the water users, the stages of this iterative process of social organization was named "Five Dialogic Steps" as indicated below.

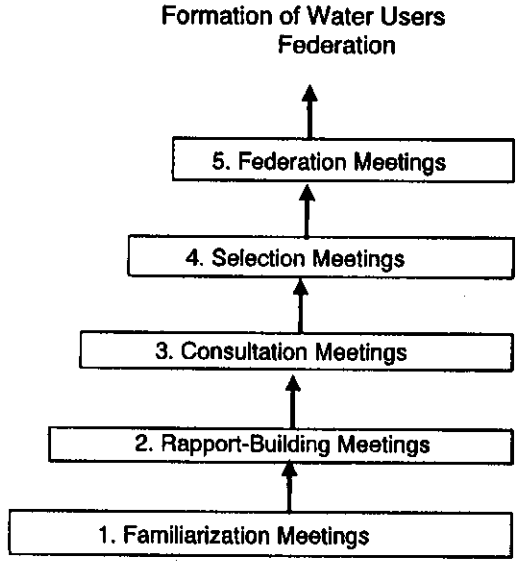

Figure 4.2. Five Dialogic Steps. Leading to the Formation of a Water Users Federation.

First Dialogue: A series of **"familiarization meetings"** to get to know the area and the people in general, and to introduce the purpose of the field team's visit to whomsoever were met in the command areas, the idea of the pilot project, and its proposed activities.

Second Dialogue: A series of **"rapport-building meetings"** to meet with the identified SOVs and other water users in small groups. The main purpose was to explain the objectives, status and programs of IIMI and build up fellowship with the SOVs and their colleagues.

Third Dialogue: A series of **"consultation meetings"** to consult the water users for developing tentative plans for establishing water users organizations. The meetings were to be in groups larger than those used for "rapport-building" meetings. These consultation or planning meetings formed a crucial step in the social organization process to ensure that the water users knew the project objectives clearly, and to follow up on earlier rapport building meetings for clarifying any misunderstandings among the people regarding the program.

Fourth Dialogue: A series of **"selection meetings"** for the purpose of discussing the process for selecting or electing organizational leaders at the primary (watercourse) level. After clarifying the elements of a democratic method for this purpose, meetings were held for each watercourse to select the organizational leaders.

Fifth Dialogue: **"Federation meetings"** to initiate the identification of office bearers for the pilot Water Users Federations. During these interactions, the water users were encouraged to select the watercourse nominees, who would form the general body of the federation in each pilot area, and then proceed towards selecting the WUF leaders.

This slow step-wise approach made the field team's task much more difficult than the traditional approach of "handed down" instructions. The real challenge was that each step taken collectively with the people had to be based on the popular agreement on the previous step's results. Gradually, the majority of the water users were convinced that the pilot projects were for their own benefit, but something they had to work hard to be built by themselves. This effort was not without misunderstandings and objections. The challenge itself provided a motivation to the field staff and the participating water users. It was a valuable experience for the field team members to see how some of the water users played the role of promoters of WUOs to argue with and convince their own fellow water users who were showing dissent. Sometimes, the efforts of the field team in trying to forge some agreement and some confidence among the people were followed by extremely frustrating negative results. New strategies had to be developed while the work was in progress so that the project staff could meet new field situations.

The organizational leaders chosen in this process appear to represent a wide range of community characteristics. In terms of age, education, land-ownership, and location, the group has a reasonable distribution. The profile of watercourse nomiinees and selected WUO office bearers is given in **Annex 4.**

4.4 Social Viability of WUOs

The viability of organizing water users in the Sindh Province is adequately proved by the three pilot projects. Evidence to this effect can be seen in processes that have been completed so far (described in the foregoing sections). One constraint has been the reluctant participation by the bureaucracy in this institutional development effort. This is not surprising. In many countries where social experiments have been attempted, the main resistance to change has come from the bureaucracy. Out of the four main actors in social change, three have shown positive support. Important criteria for assessing this situation are mainly threefold, involving these three actors: community, opinion leaders, and political leaders.

(1) The members of the community in all of the three pilot project areas were initially very reluctant to participate in any form of interactions with the field teams. This initial diffidence was transformed to a gradual appreciation of self-management and the need for getting organized, and today, they are keen to take over the distributaries from the government as fully farmer-managed systems.

(2) Socially differentiated groups, such as headend and tailend water users, large and small landowners, landowners and tenants, and influentials and vulnerable groups, have cooperated to form WUOs. A democratic process for selecting the WUO leaders was successfully completed.

(3) Political leaders have provided a non-partisan sponsorship without interfering in this social organization process. The acceptance of the new WUOs by the community is almost 100 percent.

4.5 Demonstrated Ability for Collective Action

4.5.1 Organized Campaigns for Distributary Maintenance

During the canal closure periods (January-February 1997 and 1998) and also during the months of May and June 1997, the WUOs were productively engaged in desilting (Khati) of their respective distributaries at the three pilot sites. This activity was undertaken by the water users on their own cost as the Irrigation Department had financial constraints and could not offer any assistance. During this desilting operation, WUOs reflected a great deal of enthusiasm and cooperation among themselves. The office bearers of WUFs monitored and coordinated the entire desilting process. They efficiently allocated

the financial as well as human resources and organized the work equitably among the various watercourses to the satisfaction of all participants. A significant feature of this activity during the canal closure period was that it was an unprecedented organized behavior in mobilizing resources and attending to a well prepared maintenance plan.

The WUOs through discussions in their various meetings identified some critical infrastructure development work items that would improve the physical system in their respective distributaries. The Irrigation Department gave official approval before the WUOS undertook the physical work. The WUOs implemented these activities mostly on their own, with 50 percent support coming from project funds allocated by IIMI. **Table 4.1** shows the assessed value of the items of work accomplished through collective action.

With these activities successfully completed, the WUOs expressed the view that they could undertake fully the management of the distributaries provided the government was willing to trust them.

4.5.2 An Attempt to Improve Equity

The WUF of Dhoro Naro Minor made an attempt to try the idea of modifying outlet structures to ensure the delivery of water according to the agreed water rights and the related allocation pattern. Unfortunately, this work had to be suspended when the PID authorities disallowed the modification plan when the Joint Management Agreement was not made effective. However, the fact that the WUF was ready to undertake a change reflects the potential for effective M&O through collective action.

Table 4.1. An assessment of expenditure for different activities by the water users of the pilot distributaries (in Rupees).

Activities	Water Users Federations of Pilot Distributaries		
	Dhoro Naro Minor, Nawabshah	Heran Distributary, Sanghar	Bareji Distributary, Mirpurkhas
Desilting 1997	27,500 (Jan 1997) 40,000 (June 1997)	47,250 (Heran) 61,750 (Khadwari)	6,800
Desilting 1998	25,700	71,500 (Heran) 20,500 (Khadwari)	56,000
Development work	164,600	148,900	95,500
Repair of head regulator	-	5,000	-
Construction of WUF office	25,000	-	-
Repair of WUF office	-	6,000	1,500
Total assessed value	282,800	360,900	159,800

4.5.3 Establishing Offices and Bank Accounts

All three WUFs initiated action to establish their offices. The WUF meetings are now being convened in these offices. The WUFs have also opened their own bank accounts.

The signatories of the bank accounts are the President, General Secretary and Finance Secretary of each WUF.

4.5.4 Raising of Funds for WUO Expenses

The WUFs have been making consistent efforts to raise funds from the water user members. They formed sub-committees to collect contributions from water users by visiting them at their houses. Part of these funds have been deposited in the bank, and the WUFs are meeting their incidental expenses from these funds.

4.5.5 Holding of Regular Meetings

The WUOs have been holding their regular meetings and engaging in broad consultation processes. This strategy has so far paid dividends as the WUF members have shown some motivation to discuss various field issues and follow up on decisions taken at different meetings. The WUOs are keeping their minutes of meetings and a record of their correspondence.

4.5.6 Participation in Field Research

To assess the on-farm application of irrigation water and the effectiveness of the drainage system, a piezometer was installed at the head, middle and tail reaches of each watercourse in the command areas of pilot distributaries. The purpose of collecting this information is for the WUOs to inform their water user members regarding improved water management practices. A total of 230 piezometers were installed in the three distributary command areas. Every month, the watertable depth is monitored. To sustain this effort, selected WUO members were given a training to undertake the task of monitoring the watertable depth. Since August 1997, with WUOs' involvement, the trained WUO members have started this monitoring activity.

4.5.7 WUO Membership Drive

The water users associations (WUAs) at the watercourse level made efforts to register the water user members of their association and obligated them to fill the membership forms. The forms are designed to provide some background information of their landholdings, tenancy status and educational level. The members include landowners, owner-operators, and lessees (in case of absentee landowners, with their approval, their managers and temporary tenants are included as WUA members). The Executive Committee of the water users associations have decided that no person shall be excluded from the membership on the grounds of caste, creed, social group or gender.

4.5.8 Short-Term Impacts

After the formation of WUFs, the frequency of breaches in the distributaries (particularly Dhoro Naro Minor) has declined substantially. One reason could be that some of the breaches that occurred in the past were probably man-made. WUOs' efforts in stabilizing and strengthening the weak points of the canal banks of the pilot distributaries also could have contributed to this reduction in incidents of breaches.

The water users generally refer to some improvement in the water flow in the tail reaches in the distributaries, and attribute it to the organized desilting campaigns. However, this observation is clouded by a feeling of frustration among them that the discharges into the distributaries have tended to be less than what they used to get prior to the formation of WUOs, as a result of PID staff's recent actions to adhere to the old design discharge levels.

The sharing of information among the water users has been initiated by the WUOs. The field teams promoted this idea of networking among the WUOs with the purpose of encouraging them to disseminate the decisions taken at different fora and exchange new ideas among the organizations from time to time. The Executive Committee members of WUFs have started to attend the regular meetings of WUAs. Cluster meetings of different WUAs are being held to facilitate the understanding of each other's activities.

4.6 Evaluations of the Action Research Program

The Donors' Joint Review Mission on LBOD (13 November to 5 December 1996) had expressed the need for a mid-term evaluation of the pilot projects. Accordingly, the Swiss Development Cooperation (SDC) initiated a mid-term evaluation of the project, which was carried out from 27 October to 3 November 1997. The main purposes of this evaluation were to assess the project progress as compared to the objectives it had originally set out to achieve, identify the important lessons learned from this process, and the future strategy of the project; also, address the question of replicability of the pilot project's results. The SDC evaluation team had discussions with the project staff and the members of WUOs in the field. They visited the WUF offices in all of the three pilot project sites.

Some of the observations of the SDC Evaluation Report are given below.

> *Given the mandates of the WUAs and WUFs, a systematic effort is needed to develop the necessary skills and capacities, so that these organizations can become more self reliant and sustainable into the foreseeable future.*
>
> *The project has done excellent documentation of its work.*
>
> *The signing of the Joint Management Agreement between the WUFs and the SIDA has thrilled the water users and this happiness was evident at all the project sites.*

To build strong linkages with the Government and other institutions, IIMI needs to concentrate on this vital area in the next phase.

Some work will be needed to help organize women such that they can either become members of the WUOs and/or participate in activities that emerge from the rehabilitation of land from appropriate irrigation and drainage inputs.

IIMI has distributed drainage related educational and information material prepared by LBOD's Drainage Advisory Service (DAS), and there appears to be the message that irrigation and drainage are inexorably linked and that the taking over of irrigation and drainage infrastructure must go hand in hand.

The importance of involving all the stakeholders in such projects has been clearly brought out in this project. The Government is an important stakeholder in this process. Unless the Government owns the entire process, this project would remain nothing more than an experiment."

In addition, another mission sponsored by the Royal Netherlands Embassy in Islamabad visited the project during September 1997. The main purpose of this mission was to review the Sindh component of IIMI's Dutch-funded project, "Managing Irrigation for Environmentally Sustainable Agriculture". However, the Mission also reviewed the WB/SDC-funded pilot project on water users organizations in LBOD areas as a similar activity was being conducted by IIMI in the Punjab under the Dutch-funded project.

Some of the observations given in the Mission Report are as follows:

"*The basic premise is that organized behavior exists at the village level, and requires reactivation by suitable means. IIMI's approach is that motivation from social organizers and community based social organization volunteers (SOVs) is the key to this reactivation;*

Rather than too much concern at the micro watercourse level, IIMI's approach has moved one tier higher to the minor or distributary taking off from a branch or main canal; IIMI has piloted the formation of Water Users Federations (WUFs), on the premise that the crucial interface between farmers and the Provincial Irrigation Department (PID) can be more effectively achieved at the head of the distributary;

IIMI's interaction with farmers is certainly not low profile; wherever IIMI operates, farmers are familiar with the helmeted motorcyclists visiting and interacting with them frequently; farmers welcome them, but some officials resent them; undaunted, IIMI's motorcyclists carry on with the day's work with clock work regularity;

IIMI has cordial linkages with the National Rural Support Program (NRSP) at all possible levels; at the local level in Sindh, informal linkages with the Oxford Committee for Famine Relief (OXFAM) exists;

WUF formation has proceeded apace in the selected distributaries/minors in the LBOD area of Sindh and at the Fordwah Eastern Sadiqia in the Punjab; IIMI initiatives are attempting to create replicable models by working on selected pilot areas in Sindh.

The human resource development is perhaps IIMI's strongest side in Pakistan today; the four cardinal points of IIMI's charter-research, education, training and information are probably best exemplified in IIMI's programs that work towards creating an indigenous base of trained human resources for the enhancement of agricultural productivity; and

IIMI's social acceptability has been strengthened by the work ethic of the field staff: farmers interviewed expressed admiration for the regularity and the hard work put in by the IIMI staff. "

Chapter 5

INSTITUTIONAL SUPPORT FOR WATER USERS ORGANIZATIONS

5.1 Legal Framework for Joint-Management

One of the major activities in the organizational consolidation phase is to obtain the necessary support for the fledgling water users organizations to be institutionalized within the broader socio-economic environment. This support has to be solicited from the government, which is the appropriate authority to provide an enabling environment for social organization as one of its prime responsibilities in institutional development. Since the inception of this current action research effort, the project has been consistently focusing government's attention on the urgent need for an administrative and legal base for the WUO program. The Government's demonstrated willingness to accept these new organizations on the basis of a legal framework, including a mechanism for their registration, would greatly facilitate the process of WUOs' gaining wide recognition as an institution, or as a useful formal group.

Part of the action research program was to initiate a discussion on the needed legal basis for these new water users organizations at the distributary level. The pilot project benefited from the consultations with a prominent legal professional, who was invited to undertake a study of the existing legal framework for irrigation in Pakistan and his report will be published soon[10]. Meanwhile, action was taken by other authorities to draft new laws to incorporate some of the planned institutional reforms in the irrigated agriculture sector. The legal framework for the development of WUOs should include at least three main components: an enabling law to establish the necessary institutions; legal agreements to determine the state agency - water users organization interface; and the internal rules (bylaws) of the WUOs. A brief description of some of the actions taken in Pakistan is given below.

5.1.1 Enabling Law

Recognizing the importance of the need for change, the donors identified some important steps to be taken by the Government, including the introduction of legal reforms, as priority requirements for the launching of the new National Drainage Program. Consequently, the government initiated the enactment of Provincial Irrigation and Drainage Authority (PIDA) acts in 1997, which among other things, also provided for "encouraging the formation of farmer organizations at the distributary level" (see Section 1.2). The four PIDA acts from the four provinces are basically similar in its core substance, particularly regarding the objectives, but differ in their treatment of the framework for PIDA governance and farmers organizations. Only two PIDA Acts (Sindh

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10 Professor Dr. Dil Mohammad Malik, the Dean of the Faculty of Law, Punjab University, agreed to undertake this study.

and NWFP) contain specific provisions regarding the present pilot projects on farmers organizations.

An important feature of developing this new legal framework through PIDA acts is the apparently dominant role played by the donors. Interestingly, the significance of external influence in bringing about this legal reform for irrigated agriculture in 1997 is very similar to the dominant role played by the "outsiders", donors and consultants in introducing the earlier legal provisions.

For obvious reasons, the colonial administration's influence created the original Canal and Drainage Act of 1873, which, despite a number of subsequent revisions, remains to date as the most important legal framework for the irrigation and drainage administration in Pakistan. Even after independence, external assistance seems indispensable for Pakistan. When the Water Users Associations Ordinances were promulgated in 1980, the initiative in developing the laws was prominently taken by the donor-sponsored consultancy inputs. A series of seminars on Water Users Associations for Irrigated Agriculture was organized at Islamabad, Peshawar, Faisalabad, Hyderabad, and Quetta to elicit the opinions of government agencies, private institutions and farmers regarding the formalization of traditional institutions. A draft was then circulated to the Provinces for adoption in accordance with their needs. As a result, each Province promulgated an Ordinance to this effect **(Federal Water Management Cell, 1987)**. The passive role played by the country's relevant local authorities in accepting the idea of users' involvement in water resources management can be seen in the rather weak legal provisions in these Ordinances for the growth of democratic local management mechanisms. True to its spirit, if not intent, no meaningful institutional development gained root as the nominal WUAs served a short-term purpose and ceased to exist soon after the watercourses were improved. Almost after two decades of unsatisfactory results from the first attempt at establishing water users associations, no change seems to have occurred in this passive attitude when the PIDA laws were introduced in 1997.

The four main objectives for the PIDA acts mentioned in the preamble of the first draft were related to: the government's new strategy for decentralizing the management of the irrigation and drainage system; the need to establish more responsive, efficient and transparent management; the need to ensure equity of water distribution and effective drainage management; and the need to introduce participatory and financially self-supporting management. Of these, the last objective on participatory management, which is closely linked to the first objective on decentralization, did not receive adequate attention in the text of the draft Bill.

The package of institutional reforms proposed by the Government included three components: transformation of PIDs to autonomous PIDAs; creation of AWBs; and encouraging WUFs at the distributary or minor level through a pilot approach. The proposed Act was basically for PIDAs, but included a section on the proposed Area Water Boards. The sections on WUFs (or FOs as they were referred to in the Act) were

relatively weak in that they lacked even references to enabling clauses for the functioning of pilot WUF pilots at the distributary or minor level, and for appropriate amendments of the existing WUA Ordinances of 1981 and 1982. A stronger section for this component could have provided for adequate preparatory work in establishing real participatory management.

At best, the Acts seemed only to provide for PIDAs as semi-autonomous parastatals and the creation of AWBs as their subsidiaries (like WAPDA and its component organizational units). One major issue that has remained unresolved, even after some modification to the earlier draft, is the possibility of PIDAs taking unilateral decisions regarding matters such as increased water charges, representation in AWBs, etc.

5.1.2 Sindh Irrigation and Drainage Authority (SIDA) Act

The Sindh Irrigation and Drainage Authority (SIDA) Act, when formally enacted, had tried to address some of the drawbacks in the first common PIDA draft. However, the lack of focus on the most essential element dealing with the formation of farmers organizations remained relatively weak. The SIDA law is still not operational for establishing distributary level water users organizations. An attempt by the pilot project's three new water users federations to gain an opportunity to test their organizational capacity failed because the irrigation authorities could not legally hand over to them the pilot distributaries. The reason given was that appropriate rules and regulations under the SIDA law were not established yet, while the existing legal framework did not have adequate provisions for such a transfer.

SIDA is generally known among most of the water users in the area. However, comparing with the democratic consensus process that led to the formation of the three pilot WUFs, the water users are apprehensive about the top-down approach to be adopted in forming the SIDA according to the new law. People seem to think that the influential and big landowners, having good links with the political system, as well as, with the bureaucracy, may capture decision making positions in the SIDA structure and create hurdles in the process of introducing the desired institutional reforms. Their logic is that the reforms would not serve the economic and social power which the status quo offers to the few people with vested interests. The water users fear that some politicians and influential landlords would try to dominate the new institutions and divert their benefits to themselves and away from the majority of deserving people. Similarly, a frustrated bureaucracy could create obstacles against the success of the program. Should that be the outcome of the reforms, the changes would only be nominal, and again the water users would continue to be at the mercy of the officials, as well as the big landlords who could be entrenched in powerful official positions.

The water users interviewed were of the opinion that more than fifty percent of the Directors in the canal system based Area Water Boards and the provincial level SIDA should be the farmer representatives selected by the distributary level WUOs. This

strategy alone could avert any undue influence of the existing political and bureaucratic systems on the smooth functioning of the new organizations. The water users perceive that the establishment of the SIDA in this more transparent and more democratic manner will have a greater chance of improving the reliability and equitability of water distribution in the canal system. The reliable and equitable supply of the irrigation water, rather than more water, will be the essential requirement for improving agriculture production.

There is a wide-spread belief among the water users that a more democratically constituted SIDA-AWB-FO system with adequate people's participation will improve the maintenance and operation of the canal system, which has deteriorated due to prolonged maintenance deficiencies. Consequently, the supply of water will be improved and shortages, particularly at the tail end of the system, can be overcome. Further, they think that the performance of lower level irrigation staff will significantly be improved when they are made accountable to the FOs. With the SIDA, its AWBs and their WUOs being set up under a more democratic scheme, other benefits, such as group credit, cooperative marketing and collective purchases of agricultural inputs, could be derived through their organizational mechanisms. The people are hopeful.

Learning a lesson from this pilot project experience, most of the water users interviewed wished that political influence would be avoided in the formation of proposed FOs and AWBs. As the PIDA institutional reforms have a potential of bringing a significant change in the socio-economic status of the majority of the people in the area, there should be adequate safeguards against the possible obstacles that can be caused by a few who might get affected in the short term. Some argue that the sustainability of the proposed changes cannot be envisaged without a clear government commitment to devise such safeguards, including effective land reforms.

5.1.3 Joint Management Agreements (JMAs)

The signing of three Joint Management Agreements by the Presidents of the three pilot WUFs of Heran, Bareji and Dhoro Naro distributaries and the representatives of irrigation authorities of the Government of Sindh on 20 October 1997, can be considered the single most significant event in the recent history of Pakistan's efforts to introduce institutional reforms in the country's irrigated agriculture sector. The significance of this event is further accentuated by the political and administrative interest it evoked and the subsequent developments. Despite the fact that these signed JMAs were later suspended by the Government, causing an equally significant setback on the social organization development process, the consultation process that led to the signing of the Agreements remains as an indelible mark on the farmer-bureaucracy relationships.

In August 1997, the Secretary, Irrigation and Power Department, Government of Sindh, constituted a committee to discuss a draft Joint Management Agreement (JMA) between the Irrigation Department and the WUFs. The committee consisted of the Executive Engineers/Irrigation of Jamrao, Thar and Nasrat Canal Divisions, Presidents and General

Secretaries of all the three WUFs, and IIMI project's Team Leader, O&M Specialist and Supervisory Social Organizers (Mirpurkhas, Sanghar, Nawabshah). On 13 September 1997, the committee held a meeting to discuss the draft JMA in detail. The committee recommended that the WUFs can take over the O&M responsibility of their respective distributary or minor initially for one year (two crop seasons) with effect from 15 October 1997. Almost all the points of the draft agreement were studied by the committee. The only item in the draft JMA that could not be finalized was related to the assessment and collection of abiyana (water charges) by the WUF, and the portion of abiyana to be retained by the federation for operation and maintenance during the joint management agreement period. The committee findings were recommended for a final decision by the Project Implementation Coordination Committee (PICC).

On 4 October 1997, the PICC met under the chairmanship of the Secretary, Irrigation and Power Department (also the designated Managing Director of SIDA). In addition to the nominated PICC members, the Secretary, Land Commission, Sindh Board of Revenue, Hyderabad, and the World Bank Monitor, Hyderabad, also participated in the meeting on special invitation. The recommendations on the Joint Management Agreement (JMA) between the Water Users Federation and the SIDA given by the JMA Committee were discussed item by item, and finally approved with consensus by the PICC. Regarding the suggestion that the three pilot WUFs should be allowed to levy and collect water charges in the three pilot distributaries or minor canal command areas, it was decided in the PICC meeting that the Managing Director of SIDA would arrange for a notification to be issued by an appropriate competent authority. Finally, the Secretary and the Managing Director of SIDA, who chaired the PICC, authorized the three Executive Engineers, Irrigation associated with the pilot sites to sign the JMA on behalf of SIDA.

After the confirmation and circulation of the minutes of the PICC meeting, the three JMAs were signed by the respective Executive Engineers and the Presidents of WUFs on 20 October 1997. On this gracious occasion, the Superintending Engineer, Nara Canal, the Director General, Agricultural Engineering & Water Management, Sindh, and Director LBOD (WMC) were also present to witness the signing of the Agreement documents. A copy of a Joint Management Agreement is given in **Annex 5.**

After signing the JMAs, the water users in their respective areas celebrated their pioneering step towards participatory irrigation management. However, this jubilation did not last long as the signed JMAs between the WUFs and the respective authorized Executive Engineers of SIDA were kept in abeyance as the Sindh Government's higher authorities needed some clarification on the propriety of these Agreements. Consequently, the Agreements could not be implemented at the field level.

5.1.4 Bylaws for the WUOs

An IIMI consultant prepared a model set of bylaws for the WUOs (Ganewatte, 1996). These bylaws were translated into the Sindhi and Urdu languages and distributed among the WUO Executive Committee members. Prior to this, the existing bylaws given in the Sindh Irrigation Water Users Associations Ordinance of 1982 had also been translated and distributed among the water users. The purpose was to give them an opportunity to read, discuss and be able to understand the model bylaws so that their own internal rules could be appropriately passed by the respective WUOs. This step, however, is temporarily suspended pending the publication of the SIDA Act's rules and regulations. Meanwhile, the WUOs have taken some collective decisions to adopt a minimum set of internal rules governing their conduct of business at meetings.

5.2 Coordinated Services from State Agencies

The present situation regarding the delivery of irrigated agriculture services to the farmers by various state agencies can best be described as disjointed, ad-hoc, and therefore ineffective. Particularly when the water users are organized, the service delivery mechanisms need to be coordinated. The advantage of a coordinated service by a family of agencies mandated to provide these services was seen when the FICC started functioning during the action research implementation (see Section 5.5.1).

Once the WUOs are institutionalized, a farmer-bureaucracy coordination mechanism could be effectively established to meet this requirement. This would assist in the preparation of seasonal cropping plans, developing irrigation schedules, planning for more effective input management and marketing of produce, and more importantly the extracting of benefits from extension services and a needed technology transfer to the new WUOs and their members. Particularly in the LBOD area, a crucial coordination requirement would be to consider an overall integrated water resources management approach and to integrate irrigation and drainage functions. While the new WUOs would be willing to consider the operation and maintenance of both irrigation and drainage facilities in a distributary command area, the state agencies dealing with these functions may need to coordinate more closely.

5.3 Catalysts for Organizational Development

This social organization action research program tends to conclude that there is a need for some group to undertake awareness building, capacity building, demand identification, and some degree of social engineering. The role of a catalyst in social organization becomes critical at the present level of social awareness in Pakistan's rural society.

Often, farmers organizations are planned and implemented mainly by the government organizations, and often, the government-sponsored organizations become mere

extensions of the public bureaucracy. As these efforts are rarely based on any expressed or intrinsic demand among the water users, they usually fail to create viable organizations at the local level. With an overall change in attitudes, the water users may be able to take a greater initiative and play a more significant role than they do now if the governments can gainfully play a more accommodating and supportive role. In this new approach, the NGOs can act as an intermediary between the water users and the government, while implementing a "learning process" method in social organization. Four main tasks are recommended for the NGOs' involvement: assessing the social and economic viability of a management take-over; identifying the local demand (and the capacity) for such a change; building the local capacity; and providing technical advice for a management take-over. All of these tasks are meant to facilitate organized interest articulation among the water users.

5.4 Linkages with the Private Sector

The WUOs have already started to engage in effective negotiations with private sector groups, such as, input suppliers, marketing groups, and manufacturers of implements, etc. The natural development of this process, if allowed to gain root, would be to consolidate a firm commercial relationship between the private sector groups and the WUOs. The latter would be willing to pay for the services that the private sector can offer in many functions, which are now inefficiently handled by the government agencies. A recent literature survey on changing public and private roles identified a growing philosophy for this "institutional pluraism" in agricultural service provision (**Carney, 1998**).

The traditional agricultural extension service, which was primarily a top down mode of providing instructions to the farmers, is fast becoming obsolete. Although the extension model greatly helped in the green revolution, the "after-glow" of its great success lingered on long after the necessary conditions for it have passed away (**Vermillion, 1997**). The threat of famine, dominant role of the government in agricultural research and extension, and large government budgets for this work, have all been diminished in size and importance. The economies of scale, facility of making quicker decisions and the articulation of internal demand, all of which are associated with well organized farmers groups would facilitate a greater role for a demand-driven private sector irrigated agriculture advisory service.

5.5 Agency-Farmer Interface

The needed coordination mechanisms for integrated irrigated agriculture and integrated water resources management covering irrigation, drainage, salinity management and crop water requirements are yet to be fully developed. Section 5.2 mentioned part of this urgent requirement. The pilot projects experimented with two such mechanisms for action research implementation, but the idea can be easily extrapolated for a longer term and wider application.

5.5.1 Field Implementation Coordination Committee (FICC)

While IIMI's field teams played a catalyst's role in social organization activities, the actual responsibility for organizing water users lay with the operating agencies and the water users themselves. To give effect to this "ownership" concept, the strategy was to introduce a mechanism to have the participation of a number of selected representatives from field level agency staff (Irrigation, On-Farm Water Management, Agriculture Extension, Agriculture Bank, Agriculture Development Authority, etc.,), representatives of NGOs working in the area and from the water users. This arrangement was called the Field Implementation Coordination Committee (FICC), which was meant to help both the catalyst, as well as the participating agency field staff and water users, to collaborate with one another closely on a regular basis.

The FICC served two main purposes. First, during the social organization interventions, the FICC discussed and decided, in a highly participatory mode, the implementation strategies, such as the deployment of staff in different areas and functions, scheduling of their work, solutions to constraints encountered in the field, mobilizing the necessary support from farmers and their groups, and monitoring the progress of field work related to social organization. Second, the FICC acted as an extension arm, or an intermediary between the service delivery organizations and the intended recipients of such services.

The FICC provided considerable assistance in terms of both these objectives. Initially, the idea of an FICC was conceived of as a forum to cushion the harsh effects of some field level constraints against the action research program. Soon after its introduction, the FICC, consisting of all the related government agencies and farmer representatives, became a convenient platform to discuss farmers' common problems related to irrigation services and agricultural production. The most important aspect of the FICC's success was that the discussions on problems were soon followed by some actions to bring the relevant services to the field. The FICCs, which started functioning in March 1996, held 11 meetings during the project period on the basis of about once every two months. The project benefited mainly in the following ways:

Concept clearance of farmer-agency linkages;

Information transmitted to the water users by the line agencies;

Several collaborative activities were planned and implemented;

Drainage issues were openly discussed, which helped the O&M officials; and

Drainage and irrigation issues were seen as components of integrated water resources management.

5.5.2 Project Implementation Coordination Committee (PICC)

Another important institutional support for nurturing social organization efforts is the policy sponsorship that is needed to facilitate field level officials' assistance. When the Field Implementation Coordination Committees (FICCs) started to function fairly early during the project, they confronted some issues which needed the attention of more senior officials. As a strategy to solve this problem, the idea of having a PICC at the Hyderabad level was proposed. For a long time, the project staff tried to mobilize the interest of senior officials in irrigation-related agencies for a PICC meeting at Hyderabad. Despite some efforts from the Director LBOD (WMC), this meeting did not take place until May 1997. The first meeting of the PICC was convened at the IIMI Hyderabad Office on 12 May 1997, with the Secretary of Irrigation in the Chair.

The following important decisions were taken:

* the new WUFs should be given official recognition;
* the established discharge of irrigation water at the head of the distributary should be ensured by the Irrigation Department;
* the responsibility of water distribution in the distributary be given to WUFs;
* a Joint Management Agreement should be prepared specifying the respective functions and responsibilities of the WUFs and the Irrigation Department regarding the operation and maintenance of the pilot distributaries, including the head regulators; and
* this agreement would represent an empowerment to the WUFs, enabling them to undertake the implementation of a Joint Management Action Plan.

The second meeting of the PICC was held on 4 October 1997 at Hyderabad. At this historic meeting, the first ever joint management agreement between the government and a water users organization was agreed upon. The intensity of discussions and the level of decisions taken at this single meeting could not have been achieved by any number of visits by farmer groups to different government organizations.

5.5.3 Pre-Seasonal Planning Meetings

An idea that could not be implemented yet was a meeting of WUO members and representatives of key government agencies for the purpose of planning the requirements of a crop season. In other countries, this form of agency-farmer coordination mechanisms have become very useful instruments for planning and conflict resolution (e.g. Cultivation Meeting or "Kanna Meeting" in Sri Lanka). Unless the WUOs have some recognition and authority, such a meeting is not likely to be productive, as the tendency would be for the government officials to dominate the meeting and hand down various instructions to water users.

Chapter 6

BUSINESS PLANS

Under the Monitoring and Evaluation (M&E) program, water distribution along each pilot distributary has been measured for many months. Also, better watercourse command area maps have been developed. This is important background information when undertaking a farm income analysis.

The farm income analysis is affected by the water supply and groundwater levels (depth to watertable). The irrigation facilities have been field evaluated, but not the drainage facilities. Thus, the required Irrigation O&M Fees have been determined, but this is not the case for the Drainage O&M Fees. Consequently, a Preliminary Business Plan has been prepared for each pilot distributary. Once the costs and benefits for each drainage facility has been field evaluated, then a Proposed Business Plan will be presented to each Water Users Federation for their deliberation in developing a Final Business Plan that they feel comfortable in implementing.

6.1 Farm Income Analysis

An initial farm survey was conducted during the Rabi 1996-97 season by IIMI field staff, which was reported by Sohani (1997). This was followed by another farm survey during Kharif 1997 that emphasized watercourse command areas as the basis for analysis.

To complete the Farm Income Analysis, the farm revenues had to be established, farm expenditures for agricultural inputs calculated, and various taxes investigated. All of this information is contained in the Preliminary Business Plan for each pilot distributary (see Pirzada, Khatri and Haider, 1997 for Dhoro Naro Minor; Khanzada, Khatri and Haider, 1997 for Bareji Distributary; and Sial, Khatri and Haider, 1997 for Heran Distributary.

A comparison of the three pilot distributaries regarding net annual agricultural income is listed in Table 6.1, which has been derived from the more detailed presentation in Table 6.3. The various costs are presented in terms of per acre actually cropped and per acre of culturable command area (CCA). Farm income per acre cropped represents the true productivity to the farmer, while farm income per CCA acre is valuable since O&M assessments to farmers will most likely be in terms of CCA.

Table 6.1 shows that farmers in the Heran Distributary command area have the lowest farm income (Rs. 6,705) per acre cropped, while farmers in the Bareji Distributary command area have double this amount (Rs. 13,445/ acre cropped) and Dhoro Naro farmers have farm incomes 15 percent greater (Rs. 7,723/acre cropped). In comparison with Heran Distributary in terms of acres of CCA, Dhoro Naro is only 4 percent greater and Bareji 50 percent greater.

Table 6.1. Net annual agricultural income analysis for the three pilot distributaries.

Pilot Distributary	Dhoro Naro		Heran		Bareji	
Rabi 1996-97 plus Kharif 1997	Totals		Totals		Totals	
	Per Crop Acre	Per CCA Acre	Per Crop Acre	Per CCA Acre	Per Crop Acre	Per CCA Acre
Gross Revenue, Rupees	16,115	8,905	17,202	10,396	23,397	10,805
Gross Input Costs, Rupees	7,841	4,330	9,964	5,981	9,408	4,291
Total Taxes, Rupees	552	304	533	320	543	248
Total Expenditure Rupees	8,392	9,634	10,497	6,301	9,951	4,539
Farm Income, Rupees	7,723	4,270	6,705	4,095	13,445	6,266

In the three Preliminary Business Plans mentioned above, information has been provided on the gross revenue for the watercourse command areas in each pilot distributary. Table 6.2 lists the watercourses having the maximum and minimum gross watercourse revenues from each pilot distributary. Dhoro Naro Minor represents the most extreme case where the maximum net farm income is Rs. 21,305 per crop acre, while the minimum is a loss of Rs. (3,667) per crop acre as a result of being located in the tail reach. For the Heran and Bareji distributaries, the maximum gross watercourse revenue is more than double the minimum gross watercourse revenue; however, when net farm income per crop acre is compared, the differences are not so great, where Watercourse 7R (minimum gross watercourse revenue) of Bareji Distributary has a higher net farm income per crop acre than Watercourse 5L having the maximum gross watercourse revenue.

Table 6.2. Net agricultural income analysis by watercourse command areas during the Rabi 1996-97 and Kharif 1997 seasons for the three pilot pilot distributaries.

Pilot Distributary	Dhoro Naro Minor		Heran Distributary		Bareji Distributary	
	WC Revenue Rabi 96-97 and Kharif 97		WC Revenue Rabi 96-97 and Kharif 97		WC Revenue Rabi 96-97 and Kharif 97	
	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
Watercourse (WC) Number	6R	10L	4R	K 2R*	5L	7R
Gross WC Revenue, Rupees	6,075,922	410,079	13,710,195	5,223,533	12,622,361	5,368,040
Gross WC Input Costs, Rs.	1,594,359	625,161	7,755,567	3,005,236	5,827,946	2,131,825
Gross Taxes, Rupees	112,891	44,638	335,554	160,933	307,488	123,343
Total WC Expenditures, Rs.	1,707,250	669,799	8,091,212	3,166,169	6,135,439	2,255,168
Net Farm Income, Rupees	4,368,672	(259,720)	5,619,074	2,057,364	6,486,928	3,112,872
Per Crop Acre, Rs.	21,305	(3,667)	8,328	6,705	12,368	13,445
Per CCA Acre, Rs.	21,233	(335)	6,033	4,095	4,240	6,266

*K2R means Watercourse 2R along Khadwari Minor that offtakes from heran Disty.

Table 6.3. Net agricultural income analysis by distributary command areas during the Rabi 96-97 and Kharif 1997 seasons.

Pilot Distributary	Bareji Distributary				Heran Distributary				Dhoro Naro Minor			
Seasons	Rabi – 96-97		Kharif – 97		Rabi– 96-97		Kharif– 97		Rabi–96-97		Kharif–97	
Cropped Area in acres	4,790		5,684		8,513		9,323		7,894		6,869	
Fallow Area in acres	2,085		1,371		2,215		1,405		2,224		3,249	
Waterlogged Area in acres	133		133		870		870		185		185	
Salinized Area in acres	798		798		1,673		1,673		1,680		1,680	
Abandoned Area in acres	3,938		3,938		1,802		1,802		1,178		1,178	
CCA in acres	11,924		11,924		15,073		15,073		13,161		13,161	
Cropping Intensity (in %age)	41.68		48.71		56.48		64.84		59.98		53.69	
Gross Revenue (Rupees)	**28,932,902**		**99,900,048**		**38,563,030**		**118,142,975**		**50,093,203**		**67,104,926**	
Gross input costs (Rupees)	16,098,713		35,065,075		28,791,329		61,365,760		24,124,018		32,866,131	
Total Taxes (Rupees)	892,632		2,067,596		1,496,627		3,331,355		1,655,040		2,346,203	
Total Expenditures	16,991,345		37,132,671		30,287,956		64,697,115		25,779,058		35,212,334	
Net Farm Income (Rupees)	**11,941,556**		**62,767,377**		**8,275,073**		**53,445,860**		**24,314,145**		**31,892,592**	
	Per Crop Acre	Per CCA Acre	Per Crop Acre	Per CCA acre	Per Crop Acre	Per CCA Acre	Per Crop Acre	Per CCA Acre	Per Crop Acre	Per CCA Acre	Per Crop Acre	Per CCA Acre
Gross Revenue (Rupees)	5,822	2,426	17,575	8,378	4,530	2,558	12,673	7,838	6,346	3,806	9,769	5,099
Gross input costs (Rupees)	180	75	364	173	176	99	357	221	210	126	342	178
Total Expenditures	3,419	1,425	6,533	3,114	3,558	2,009	6,939	4,292	3,266	1,958	5,126	2,676
Farm Income (Rupees)	2,403	1,001	11,043	5,267	972	549	5,733	3,546	3,080	1,847	4,643	2,423

A comparison of watercourse command areas by maximum and minimum net farm income per crop acre is even more enlightening, with the results listed in Table 6.4. The maximum net farm income for a watercourse command area varies from Rs. 19,300 - 21,900 per crop acre, with these watercourses being located in the head and middle reaches. For each pilot distributary, the minimum net farm income occurs in watercourse command areas at the very tail, but there is considerable variation, from a loss of Rs. (3,667) per crop acre at Dhoro Naro Minor, to Rs. 3,444 at the tail of Heran Distributary, and a fairly respectable net farm income of Rs. 9,012 at the tail of Bareji Distributary.

Table 6.4. Maximum and minimum net farm incomes per crop acre for watercourse command areas in the three pilot distributaries.

Pilot Distributrary	Net Farm Income in Rs per crop acre	
	Maximum	Minimum
Dhoro Naro Minor	21,336 WC 6R	(3,667)* WC 10L
Heran Distributary	19,284 WC 2R	3,444 WC 7L
Bareji Distributary	21,863 WC 4R	9,012 WC 7L

*The brackets indicate that there is a loss.

6.2 Irrigation O&M Fees

6.2.1 Irrigation Infrastructure Expenditures

The allocated funding by the Government of Sindh (GoS) to the Irrigation Department for fiscal year 1997-98 is summarized in Table 6.5. The cost in rupees per CCA acre was derived by using 13.615 million acres as the total CCA for the Province of Sindh.

Table 6.5. Summary of fiscal year 1997-98 budget for the Irrigation Department, Province of Sindh.

Description	Total Cost in Rupees	Rupees per CCA acre
Irrigation Administration	873,082,820	66.16
Irrigation Dams	33,338,100	2.53
Machinery & Equipment	7,280,580	0.56
Repairs & Maintenance	322,989,680	24.48
Total:	**1,236,691,180**	**93.73**
Irrigation Establishment	**873,082,820**	**66.16**
O&M without Establishment	**363,608,360**	**27.57**

Source: Estimates of Charged Expenditure and Demands for Current Grants.

The Irrigation Department budget amounts to Rs. 93.73 pe CCA acre, of which 71 percent is allocated for the irrigation establishment, while the remaining 29 percent (Rs. 27.57 per CCA acre) is allocated for maintenance activities. Yet, according to the 1986-87 Yard Stick for O&M costs, Rs. 25 per CCA acre was required in 1986-87, which would have a present cost of Rs. 68 per CCA acre. Thus, the total O&M costs would be Rs. 66.16 per CCA acre for operations (Table 6.5) plus Rs. 68 per CCA for maintenance, so that the total O&M costs for fiscal year should preferably be Rs. 134.16 per CCA acre, or Rs. 134 per CCA acre.

Although irrigation is the major use of water in Sindh Province, the water supplies for cities is significant. If domestic and industrial water users were to pay O&M costs at double the rate paid by irrigators, then the annual O&M costs would be Rs. 108 per CCA acre for the Province of Sindh., which would be considered as the maximum rate that could be applied, while there a number of additional arguments that can be made for further reducing this rate.

6.2.2 WUF O&M Costs

In the Preliminary Business Plans, a WUF O&M organization has been designed and the establishment costs calculated, including capital costs. In addition, based on the Maintenance Plan for each pilot distributary, an annual maintenance budget has been calculated. The establishment and maintenance costs for each pilot distributary is listed in Table 6.6 based on annual costs in rupees per CCA acre, which only varies from Rs. 56.7 to Rs. 60.4 per CCA acre per year. The average O&M costs are Rs. 59/CCA acre/year. Subtracting this amount from the total irrigation system costs Rs. 108/CCA acre/year, would mean that Rs. 49/CCA acre/year should be paid to the Area Water Board, while each WUF would retain Rs. 59/CCA acre/year.

These costs are quite similar to the monies presently being paid by farmers. The combined sum of abiana plus monies paid illegally for water varies from Rs. 88.111 per CCA acre for the three pilot distributaries, with the average being Rs. 100 per CCA acre.

Table 6.6. Estimated WUF O&M costs for each pilot distributary.

Item	Annual Rupee Costs per CCA acre		
Pilot Distributary	Dhoro Naro Minor	Heran Distributary	Bareji Distributary
Establishment	36.8	34.5	40.6
Maintenance	19.9	25.9	19.4
Total O&M Budget	56.7	60.4	60.0

6.3. Drainage O&M Fees

At this time, considerable efforts is required to assess the benefits of each drainage facility in each pilot distributary command area. The benefits need to be shared with each WUF, along with the O&M costs. Some efforts were undertaken during 1997, particularly for saline tubewells in Dhoro Naro Minor and surface drains in the Heran Distriburary command area. However, nearly one year will be required to complete this work.

The expected drainage O&M costs for each WUF are expected to range from Rs. 80-100/CCA acre/year for the distributary command area. However, there are some preliminary indications that good management practices can reduce these costs. Earlier, the LBOD consultants had reported an O&M annual cost for all drainage facilities of Rs. 570 million per year (including the Spinal Drain and Tidal Link), which would amount to Rs. 460/CCA acre/year. Thus, the abovementioned rate of Rs. 80-100 is only one-fifth of the total drainage O&M costs because of only representing the drainage facilities in the pilot distributary command areas.

6.4 Future Focus

IIMI has applied for a three-year contract extension in order to complete this "Pilot Project for Farmer-managed Irrigated Agriculture under the Left Bank Outfall Drain, Stage I Project." The major activities that need to be pursued during this three-year period are briefly described in the subsections below.

6.4.1 Drainage O&M Costs and Benefits

A major effort is required to field evaluate the various drainage facilities in the three pilot distributaries. Some work has been done on field evaluations for saline tubewell discharges in the Dhoro Naro Minor command area and surface drains in the Heran Distributary command area,. But a much larger effort is needed. The estimated time requirement for project staff is one year.

Each of the drainage facilities needs to, first of all, be evaluated for hydraulic performance. Then, an assessment needs to be made regarding the operational requirements for managing the water-table depth at various levels, which in turn, can be related to expected crop yield decrements. Finally, a financial analysis has to be undertaken to relate costs and benefits, including maintenance and equipment replacement. All of this information has to be shared with farmers so that they can make management and financial decisions.

6.4.2 Proposed Business Plans

Presently, Preliminary Business Plans exist, one for each pilot distributary, which focuses only on the irrigation facilities. Once the drainage O&M costs and benefits are known, then the business plans can be upgraded to include both irrigation and drainage facilities, which will require about six months of effort. Then, the Proposed Business Plan for each pilot distributary can be presented to the appropriate WUF. The results will need to be discussed among all of the WUF members for thorough discussions and deliberations.

6.4.3 Equitable Water Distribution

The first essential requirement for sustaining a viable WUF is that the available water supply at the head regulator is equitably distributed among all of the watercourses (WUAs). All of the pilot distributaries presently experience a considerable degree of inequity. At the same time, as experienced by the Dhoro Naro Minor WUF during Kharif 1997, without legal authority for managing the distributary command area, equitable water distribution cannot be implemented because of interference by Irrigation Department (ID) staff. Thus, each WUF must have legal authority in order to undertake a meaningful program of equitable water distribution. Therefore, the proposed Joint Management Agreement (JMA) between each WUF and ID is essential. Once the JMA becomes official, about one year of field effort will be required to achieve equitable water distribution within each pilot distributary.

6.4.4 Final Business Plans

Some months will be required for the WUF members to begin arriving at a consensus about implementing a business plan. At the same time, equitable water distribution must be achieved so that farmers have some confidence that their efforts will be rewarded. When these conditions have been met, then the WUF can be expected to have approval from their members to proceed with the implementation of a Final Business Plan; however, there should be an expectation that the WUF members will want to proceed cautiously; in other words, they will be conservative in their approach.

6.4.5 Combined Management of Drainage and Irrigation Facilities

Once a Final Business Plan has been approved by the WUF, then the combined management of the drainage and irrigation facilities can proceed. Monitoring and evaluation (M&E) of this combined management will be necessary in order to provide feedback for improving management practices. Some of the WUF members will be trained for accomplishing this continual refinement for managing both drainage and irrigation facilities. Significant improvements in management practices would be expected during the first year of combined management.

6.4.6 Improved Surface Irrigation Methods and Practices

The major emphasis of farmers is to increase net farm income. Certainly, equitable water distribution will hurt some farmers, but help many more, with significant increases in agricultural production being expected. When equitable water distribution has been achieved, certainly the combined management of drainage and irrigation facilities will further enhance the environment for increased agricultural productivity.

By introducing improved surface irrigation methods and practices, even greater levels of agricultural production can be achieved. In addition, during the warabandi at each participating farmer, more bunded fields can be irrigated with the same water supply. In turn, this will reduce deep percolation losses and groundwater recharge, thereby reducing the annual operating time for drainage pumps. As a consequence, higher levels of water management and agricultural production can be achieved.

6.4.7 Reporting Offenders and Applying Sanctions

An essential requirement for a WUF to become sustainable is that farmers feel free to report offenders and the WUF is capable of applying and enforcing sanctions. As long as the WUF can continue to satisfy this requirement, then the WUF can be considered as sustainable.

Chapter 7

CONCLUSIONS AND RECOMMENDATIONS ON THE POTENTIAL FOR FARMER-MANAGED IRRIGATED AGRICULTURE

7.1 Social Organization Process

The foregoing chapters of this report provide a summary of a fairly complex and extensive program of work implemented during a period of thirty months. The activity chart indicating the main items of work given in **Annex 6** supplements this information.

The initial phase of the action research program has come to an end, and the extension of this action research for another phase is still under consideration. An extension of this work will cover the identification and field testing of measures for the sustainability of the newly formed water users organizations (WUOs), and their ability to implement a water resources management action plan. While anticipating a decision for this extended action research program, the organized water users groups are continuing to move forward with the momentum already gained, for further testing their strength in collective action.

The action research conducted in the three pilot sites reaches the conclusion that, in the given socio-political context in the Sindh Province, a broader program of action for organizing water users at the distributary level is viable. Given that the social organization process is truly participatory, that it is designed to involve all sections of the water users community, and that they are provided with equal opportunity for participation, the task of selecting a representative group of organizational leaders is possible within a duration of time, much shorter than what the pilot project has taken.

The action research program effectively used a small group of locally recruited social organizers as catalysts, assisted by a number of social organization volunteers selected from the local community. The small field teams and the community-based volunteers are two important methodological features, which the action research has tested thoroughly. Both methodologies are cost effective and are easily adaptable in a participatory action research approach, in which the local community's strengths and weaknesses can be identified and taken into account in the action program, while concepts and experiences from other contexts can also be appropriately incorporated.

The action research program proves the value of conducting an initial investigation to explore the internal dynamics of the community before social organization interventions are planned. The physical and social characteristics of the context determine the type and scope of the organization that is needed, and the best way it can be effected in the community. This initial survey can also serve to create an awareness of the objectives of social organization and set in motion a participatory and evolutionary process for organizing the community of water users.

A demand based organizational effort and an expression of interest to take over management responsibility will be far more effective than a top-down approach in "organizing" water users for the purpose of "turning over" water resource systems to them.

7.2 Potential for Collective Action

Sections 3.2, 3.4 and 4.5 of this report described the context of distributary maintenance and operation in general, and also referred to some initial efforts by the new WUOs in undertaking maintenance work in the pilot distributaries. The level of enthusiasm shown by the water users for mobilizing resources for maintenance during canal closure, and even while the distributaries were running, showed that the collective action by WUOs has a far greater chance of solving maintenance problems than the present system of state intervention.

To build sufficient confidence among the water users themselves, and also to satisfy the agency staff who tend to doubt the capacity of WUOs to handle maintenance and operation management responsibilities, a well planned program of capacity building is a prerequisite to any arrangement for collective action. The viability of a WUO depends on its ability to resolve and enforce collective decisions, including sanctions against individual members who may try to disregard collective decisions. For this purpose, the WUOs need to be helped in building their capacity for correct decisions and proper actions by providing them with training, technical assistance and powers.

Proper maintenance is closely related to operational needs, and the usual term O&M can be inverted to M&O, to emphasize the primacy of the maintenance task in managing water resources (**Skogerboe et al, 1993**). However, for WUOs, the more difficult, and socially more cumbersome to achieve, would be the task of operating the distributary infrastructure in order to effect equitable water distribution. The experience of the pilot project shows that the water users in the Sindh Province are capable of handling both these aspects through collective action. The information collected for the tentative business plans indicates that the water users will be able to mobilize sufficient resources for this purpose on a sustainable basis.

7.3 Remaining Institutional Barriers

The failure to secure at least a temporary transfer of the three pilot distributaries to the newly formed WUFs reflects the continued presence of a bureaucratic "hard pan" underneath the smooth surface of suave official acceptance of "participatory irrigation management". Probably, the reasons for this subsurface bureaucratic apathy, which at times can get transformed into more direct dissenting statements, will have to be found in the larger social context. The main question is whether the institutional changes intended in the new PIDA enactments in Provincial Assemblies are seen by the irrigation bureaucracy as a threat to their existence. If the answer is in the affirmative, then, a

secondary issue is how one could articulate this likely threat to the bureaucracy. An earlier study on "decentralization" commented that local government institutions in Pakistan had been traditionally dominated by the ruling elites comprising feudals and bureaucrats (**Nasir, 1992**). They had developed monopolies over these institutions and made it difficult for poor and middle class people to share power with them. This tendency was seen as a major reason for the wastage, corruption and poor performance in the present resources management system.

A similar exposition of Pakistan's politics and bureaucracy was given by **Mustafa Choudhry (1988)**, in which the bureaucracy in Pakistan was seen to be exercising " a preponderant role in policy making, due mainly to the weakness of representative institutions". Unless this situation becomes corrected by the strengthening of roles and functions expected from representative institutions, it is doubtful that the bureaucracy will readily endorse substantial institutional changes that entail a reduction in the bureaucracy's current status, power and benefits.

7.4 Institutional Support

The action research indicated that there could be a few water users who might be benefiting from the status quo of neglected maintenance and operational deficiencies. Certain physical conditions of the canal and its structures might favor more water to be delivered into some specific areas. With a planned and systematic maintenance and operation program, such individuals with special privileges could be adversely affected and could cause obstacles to the implementation of a water users organization program. The WUOs' actions in sustaining a good maintenance program and in ensuring equitable water distribution within the distributary canal command area would, therefore, need adequate legal authority to safeguard the interests of the group against individual free-riding behavior.

Action research has surfaced some useful suggestions for providing institutional support to the social organization process. Initially, the experience in the pilot project regarding the participation of agency staff was that, although the nominations for membership of the FICC were effected in consultation with each agency's higher authorities, the individual members' participation in regular FICC meetings and in implementing FICC decisions was greatly hampered by a lack of higher level support. This situation was corrected later, and the results were encouraging. The FICC provided an effective forum for strengthening the collaborative relationships developed and tested in the pilot project.

Water users organizations are socially viable in the present context, which has been proved in the pilot project. However, collective actions through these organizations will be productive only if they can be fashioned to serve the majority of their members. For a meaningful participatory structure to be developed for sustainable water resources management in Pakistan, the existing social imbalances, particularly those in the form of skewed distribution of productive assets, will need to be further reduced.

7.5 Recommendations

7.5.1 Transfer of Pilot Distributaries

The relevant authorities need to consider the present impasse regarding the three Joint Management Agreements (JMAs) reached between the new WUFs and Sindh Irrigation and Drainage Authority (SIDA). The transfer of the three pilot distributaries to the new WUFs should be effected soon so that the WUFs could test the economic viability of these collective action arrangements in managing water resources at the distributary level. Further delays in this process are likely to cause considerable loss of credibility in the reform plans.

7.5.2 Expediting of Legal Reforms

The transition from the Irrigation Departments to new autonomous PIDAs is now inevitable, but an extremely cautious approach may become too slow for the institutions to gain root. The process of introducing institutional change through the already enacted PIDA laws needs to be expedited. The delay in proceeding with the remaining steps to be taken after the enactment, such as formulating the administrative rules and regulations under the new law, has caused some disappointment among the water users. They look forward to seeing a more broad-based SIDA established soon.

7.5.3 Prototype Area Water Boards

Pakistan's contextually appropriate approach in planning for institutional change (see Section 1.2, last paragraph), should be continued to introduce the proposed structural changes gradually. An initial step should be to form and test the functioning of a prototype AWB before the Province undertakes the formation of AWBs for all of its canal commands. An attempt should be made to establish a democratically constituted AWB in the Nara Canal command area, which is the chosen canal command for the purpose of a prototype. In this area, water users organizations should first be established in all of the distributary commands, and these WUOs should be given a chance to nominate the members for the AWB.

7.5.4 Implementing a Larger Water Users Organization Program

The results of the action research program outlined in Sections 7.1 to 7.4 above show that the Government of Sindh can now initiate a larger program to establish distributary level WUFs. The policy for participatory water resources management is clear, the enabling legislation is in place, and cost-effective methodologies have been identified. Through an extended program, IIMI's facilitating role can be continued in the implementation of a WUO program for the suggested prototype AWB.

7.5.5 Internalizing Field Implementation Coordination Committee (FICC)

The concept of FICC can be gainfully used in a wider application of the current action research results, if it can be institutionalized with the full support and commitment of relevant policy level officials of different agencies. Therefore, the institutionalizing of the FICC as an officially accepted coordination mechanism is highly recommended. This group can meet specially at the beginning of a crop season to prepare a pre-seasonal plan, and regularly meet to monitor the implementation of this agreed plan.

7.5.6 Establishing a Project Steering Committee

The Project Implementation Coordination Committee (PICC), which is another important element in the action research program, can also be institutionalized for greater and wider acceptance. A group representing policy and senior management levels in the government's relevant operating agencies and research institutes, NGOs and the representatives of WUOs can play a very effective role in steering a program of social organization for irrigated agriculture in the Sindh Province.

7.5.7 Promoting WUO / Private Sector Interactions

As a more efficient mechanism for coordinated irrigated agriculture services, the organized water users groups may establish commercially viable relationships with the inputs suppliers, marketing agencies, and even private sector groups willing to provide extension advice to farmers. The role of the government in this instance will be to ensure the business ethics aspects of these relationships, particularly related to the quality of services provided by the private sector groups.

7.5.8 Institutional Development Units (IDU)

One major drawback in the present circumstances is the absence of a more permanent arrangement to provide a catalytic role in implementing a larger water users program in the Province. There is no government organization, or organizational unit, which can immediately take over this responsibility. Therefore, action is urgently needed to establish new Institutional Development Units (IDUs) in the Government of Sindh administrative framework, preferably associated with the SIDA and AWBs.

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Annex-1

Documentation Generated by the Action Research Program

(1) "Inception Report and Implementation Plan: Pilot Project for Farmer-Managed Irrigated Agriculture under the Left Bank Outfall Drain Stage I Project, Pakistan". Planning Report No. P-1, Pakistan National Program, IIMI, Lahore, October 1995.

(2) "Water Users' Participation in Irrigation Management at Distributary Canal Level: Issues from IIMI's Pilot Projects", Paper presented by D. J. Bandaragoda at the National Seminar on Participatory Irrigation Management in Pakistan, held in Lahore, organized by the Federal Water Management Cell of the Ministry of Food, Agriculture and Livestock, Islamabad, and the On-Farm Water Management Programme of Punjab, Lahore, 11-13 August 1996.

(3) "Distributary Level Water Users Associations in Pilot Projects for Farmer-Managed Irrigated Agriculture, Punjab and Sindh Provinces, Pakistan", by Prachanda Pradhan, Consultancy Report No. C-5, Pakistan National Program, IIMI, Lahore, September 1996.

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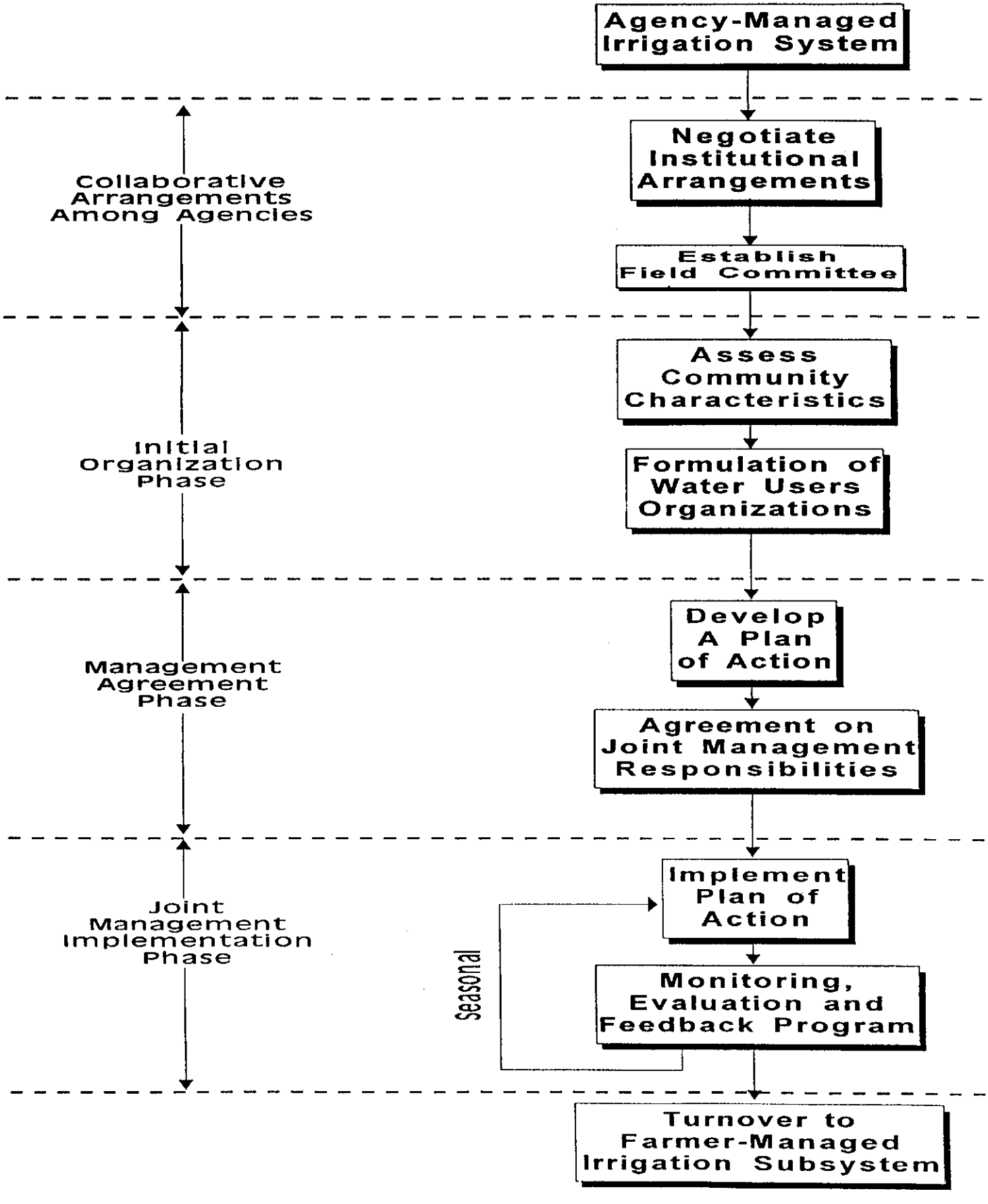
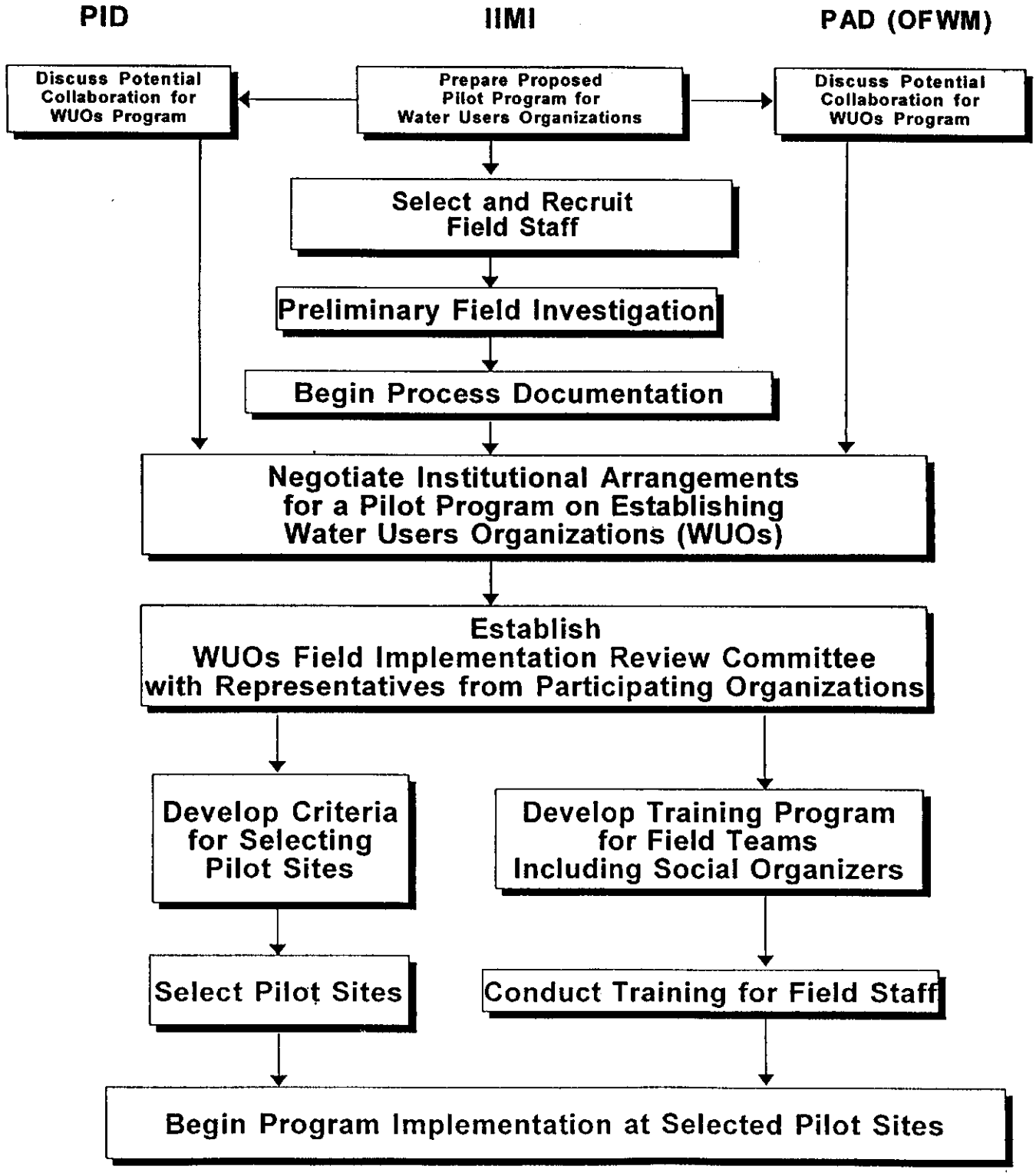
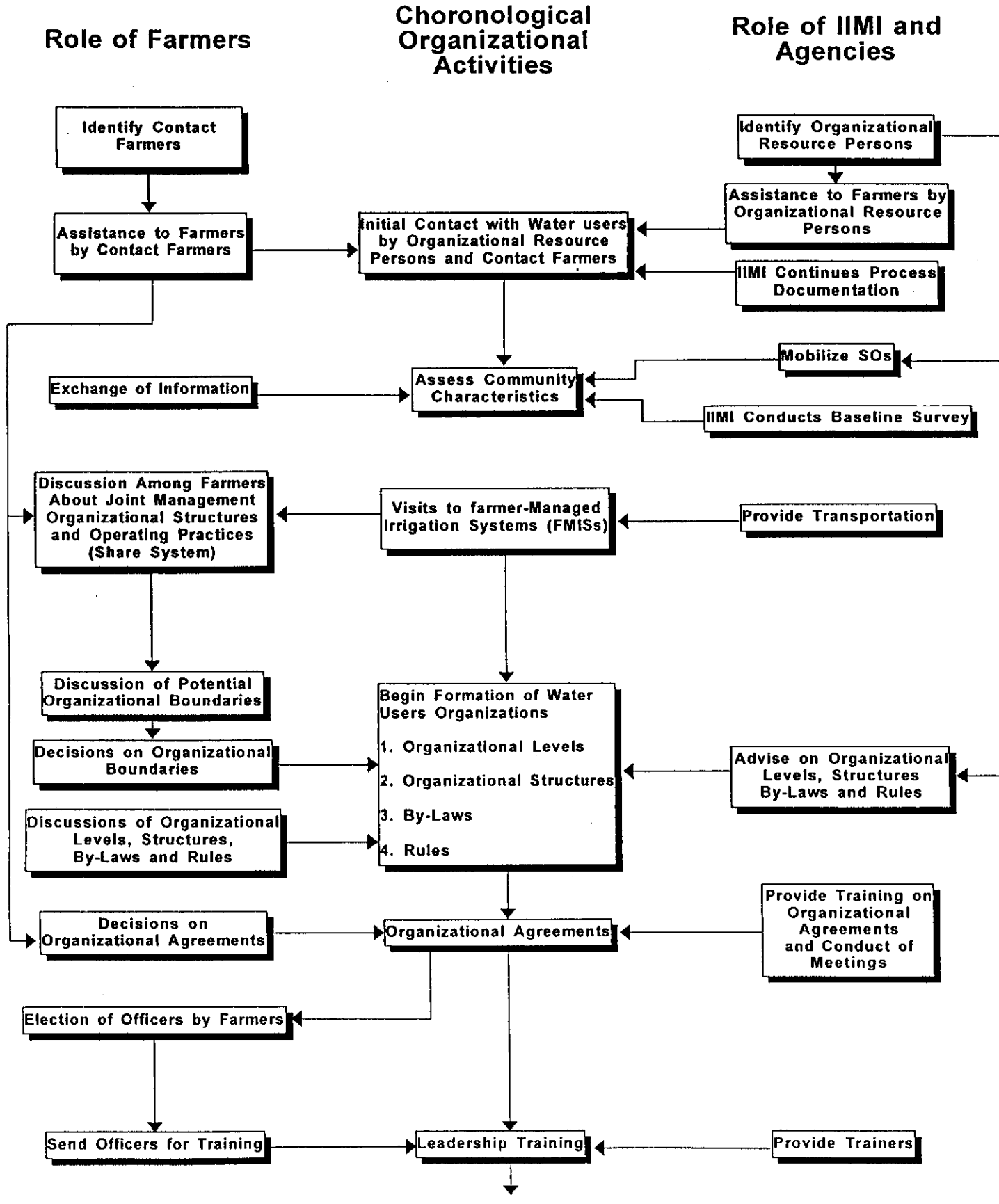
PROPOSED PROCESS FOR CREATING SUSTAINABLE WATER USERS ORGANIZATIONS IN PAKISTAN



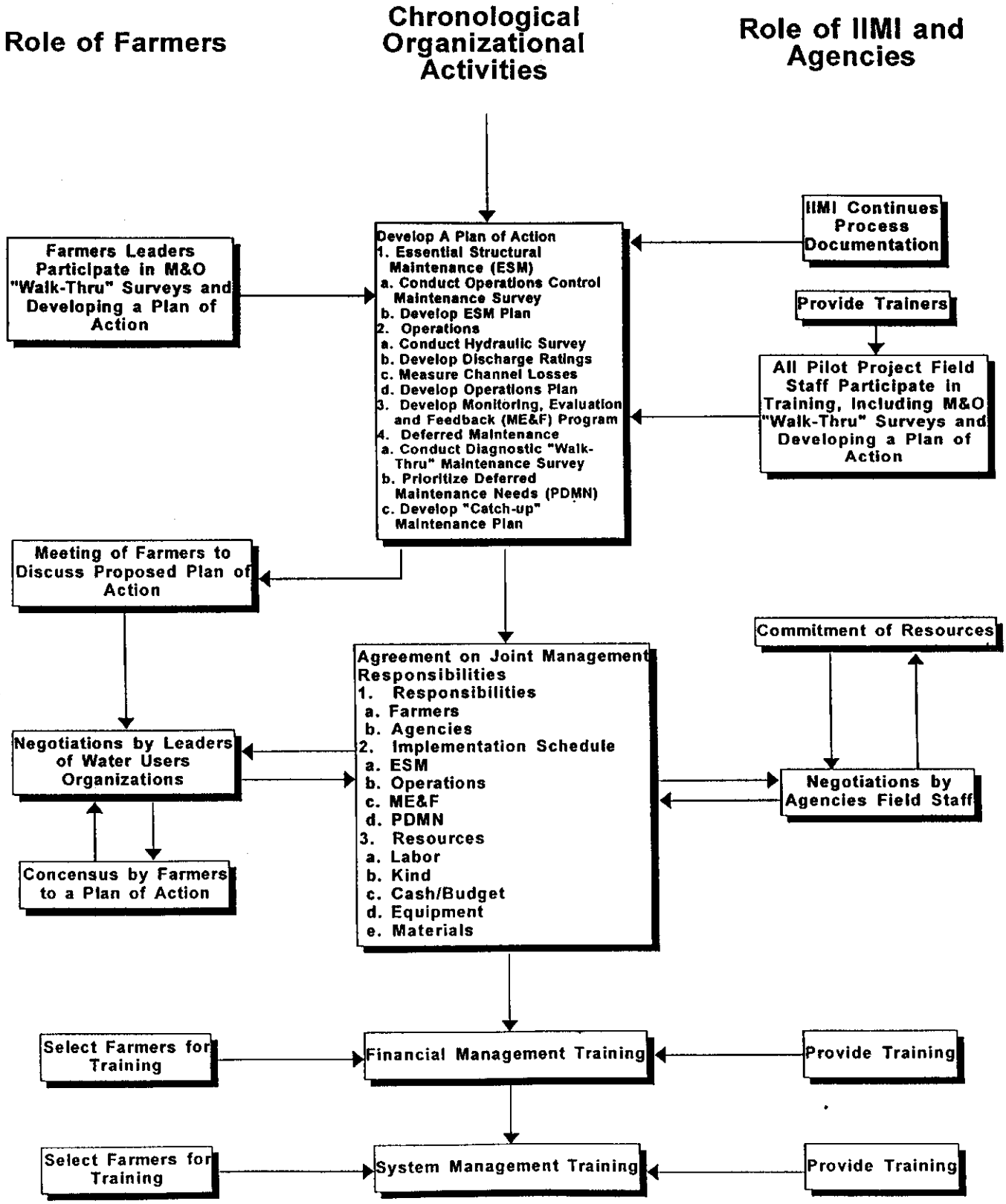
Phase I: COLLABORATIVE ARRANGEMENTS AMONG AGENCIES



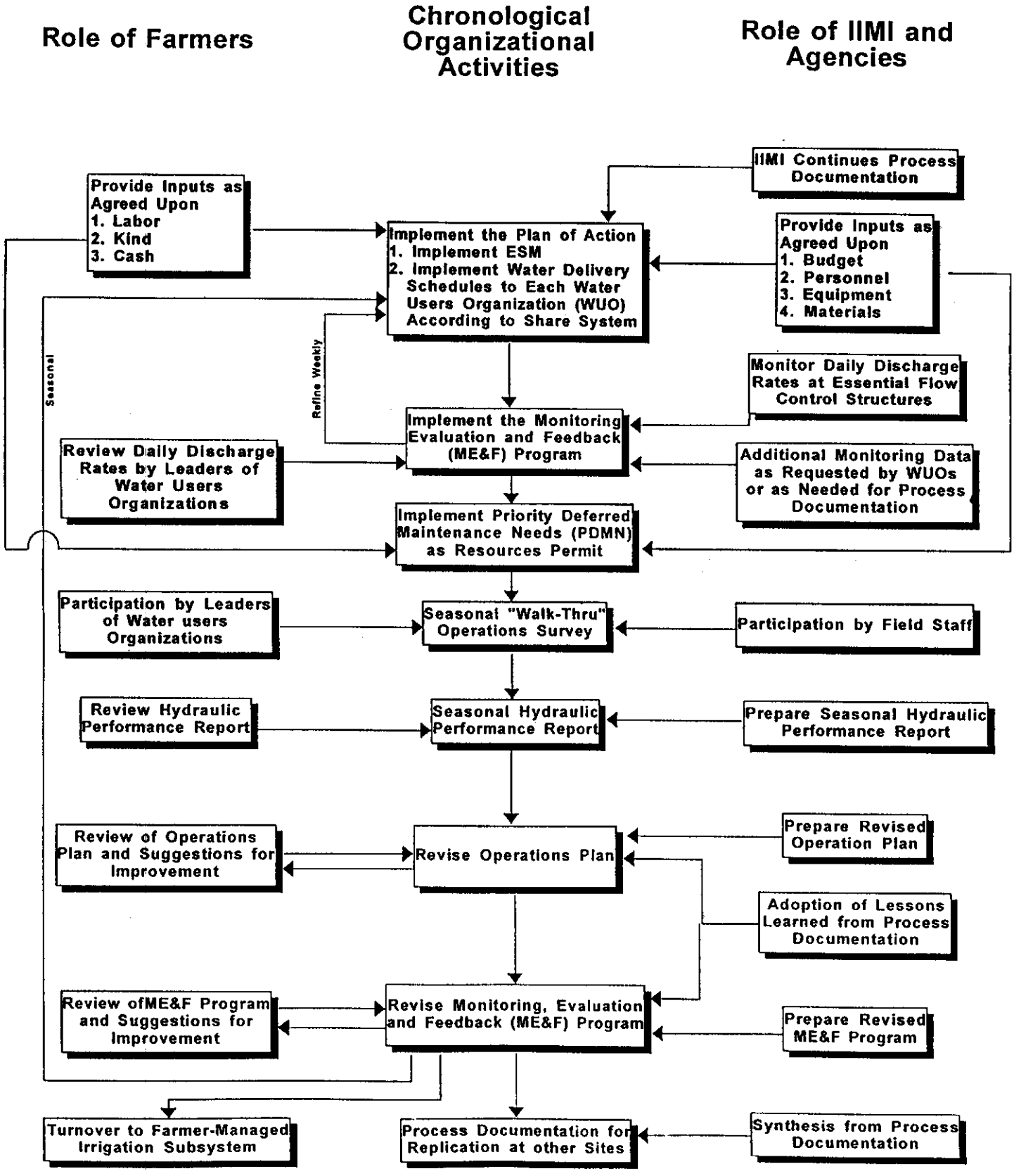
Phase II: INITIAL ORGANIZATION



Phase III: JOINT MANAGEMENT AGREEMENT



Phase IV: JOINT MANAGEMENT IMPLEMENTATION



Annex 3

Collaborative Capacity Building Activities

Activity	Beneficiaries/ Benefits	Sponsoring Organization
Lectures and Trainings		
• Wheat Cultivation	115	Sindh Agri. University, Tando Jam
• Cotton Production	230	Sindh Agri. University, Tando Jam
• Role of WUOs in Improved Irrigation Practices	62	IIMI
• Tile Drainage Technology	12	DRIP
• Optimum Use of Irrigation Water Scheduling	60	Sindh Agri. University, Tando Jam and IIMI
• Operation and Maintenance of Distributaries	125	IIMI
• Organizational Management	33	IIMI
• Piezometer and its Importance in Monitoring	65	IIMI
• Training of Finance Secretaries	75	SAFWCO and IIMI
• Organizational Management, Motivation and Communication	55	NRSP and IIMI
• Walk-thru Survey of Pilot Distributaries	125	IIMI
Demonstration Visits and Study Tours		
• On-Farm Water Management Training Institute, Sakrand	63	IIMI
• Sindh Agriculture & Forestry Workers Cooperative Organization (SAFWCO), Shahdadpur	25	IIMI
• Pakistan Institute for Environment Development Action Research (PIEDAR), Punjab	22	IIMI, SWISS NGO
• The Community Organizations of National Rural Support Program (NRSP)	24	IIMI
• Participatory Irrigation Management Systems in Nepal	19	SDC
Video Movie on Wheat Cultivation	119	Agricultural Extension
Health Camp	380	SAFWCO, RWWO, Health Dept, Local Administration
Vaccination of Animals	6,821	Animal Husbandry & Livestock Department
Tree Plantation (Provision of Saplings)	7,850	Forest Department
Formation of Community Organizations	10	National Rural Support Program (NRSP)

SOME PRELIMINARY RESULTS OF NOMINEE PROFILES FOR WUFs

Particulars		Bareji Distributary (Mirpurkhas) N=48		Dhoro Naro Minor (Nawabshah) N=50		Heran Distributary (Sanghar) N=62		Overall N=160	
		No.	%	No.	%	No.	%	No.	%
Location of Nominees at Watercourse Level	Head	19	43	12	24	16	26	47	30
	Middle	11	24	23	46	30	48	64	41
	Tail	15	33	15	30	16	28	46	29
Three nominees did not have land									
Age of Nominees	< 30 years	12	25	19	38	11	18	42	26
	31-60 years	35	73	31	62	48	77	114	71
	> 60 years	1	2	-	-	3	5	4	3
	Mean (STD)	38 (10.8)		36 (8.8)		42 (11.0)		39(10.5)	
Years of Experience in Irrigation Agriculture	< 20 years	39	81	39	78	43	69	121	76
	21-40 years	8	17	11	22	16	26	35	22
	> 41 years	1	2	-	-	3	5	4	3
	Mean (STD)	14 (9.7)		14 (9.7)		18 (10.6)		16(10.1)	
Educational Level of Nominees	Illiterate	3	6	3	6	2	3	8	5
	Primary	17	36	20	40	7	11	44	28
	Matric	14	29	12	24	22	36	48	30
	College	14	29	15	30	31	50	60	37
Annual Income	8000-25000	1	2	8	16	22	36	31	19
	25001-50000	5	10	17	34	13	21	35	22
	50001-75000	5	10	7	14	8	13	20	13
	75001-100000	6	13	8	16	12	19	26	16
	100001-3500,000	31	65	10	20	7	11	48	30
Position of Nominees at Watercourse	President	21	44	17	34	22	36	60	38
	Vice President	8	17	6	12	7	11	21	13
	General Secretary	9	19	11	22	15	24	35	22
	Joint Secretary	-	-	2	4	3	5	5	3
	Finance Secretary	5	10	6	12	4	7	15	9
	Executive Committee Member	5	10	2	4	3	5	10	6
	No Position	-	-	6	12	8	13	14	9
Tenancy Status	Landowner	37	77	34	68	41	66	112	69
	Owner-Operator	5	11	12	24	19	30	36	22
	Lessee	3	6	-	-	1	2	4	3
	Tenant	1	2	3	6	-	-	4	3
	Manager	2	4	1	2	1	2	4	3

Annex 4 (2 of 20)

Particulars		Bareji Distributary (Mirpurkhas) N=48		Dhoro Naro Minor (Nawabshah) N=50		Heran Distributary (Sanghar) N=62		Overall N=160	
		No.	%	No.	%	No.	%	No.	%
Worked as Contact Farmer	Yes	22	46	28	56	32	52	87	51
	No	26	54	22	44	30	48	78	49
Family Member	1-10 Member	33	69	22	44	41	66	96	60
	11-20 Member	13	27	13	26	16	26	42	26
	21-30 Members	2	4	8	16	5	8	15	9
	31+ Members	-	-	7	14	-	-	7	5
	Mean (S+D)	9.3(4.9)		16.7 (12.2)		10.4 (5.9)		12 (8.8)	
Land Holding	0-25 Acres	22	46	25	50	30	48	77	48
	26-50 Acres	7	15	7	14	26	42	40	25
	51-75 Acres	8	17	2	4	3	5	13	8
	76-100 Acres	1	2	4	8	2	3	7	4
	101-250 Acres	8	17	10	20	1	2	19	12
	251-600 Acres	2	4	2	4	-	-	4	3
	Mean (std)	60 (69)		73.8 (103)		30.8 (33.6)		53 (74)	

PROFILE OF OFFICE BEARERS-OVERALL RESULTS

Indicators	POSITION						
	President N=80	Vice President N=79	General Secretary N=80	Joint Secretary N=53	Finance Secretary N=80	Committee Member N=178	Total N=550
Land Distribution (Acres)							
0-25	34	42	52	37	57	131	353(64.2)
26-50	20	25	20	14	14	38	131(23.8)
51-75	11	5	2	1	5	3	27(4.9)
76-100	4	2	2	1	0	1	10(1.8)
101+	11	5	4	0	4	5	29(5.3)
Total	80	79	80	53	80	178	550(100)
Mean Land=34.03, Std.Dev.=52.0, Min.=1.0, Max. 560, Mode=32.0							
Location of Land Holdings							
Head	27	28	22	13	26	41	157(28.5)
Middle	28	20	29	20	35	72	204(37.1)
Tail	25	31	29	20	19	65	189(34.4)
Total	80	79	80	53	80	178	550(100)
Tenancy Status							
Landowners	58	43	43	20	44	61	269(48.9)
Owner-Operators	16	32	26	27	25	72	198(36.0)
Lessees	1	1	4	0	2	6	14(2.6)
Tenants	1	1	3	3	2	31	41(7.5)
Kamdars	4	2	4	3	7	8	28(5.0)
Total	80	79	80	53	80	178	550(100)
Educational Status							
Illitrate	6	16	0	13	8	52	95(17.3)
Primary	28	26	18	13	26	63	174(31.6)
Matric	17	17	35	14	22	45	150(27.3)
Intermediate & Above	29	20	27	13	24	18	131(23.8)
Total	8	29	80	53	80	178	550(100)
Age Distribution(Years)							
16-29	8	10	18	10	20	28	94(17.1)
30-45	42	40	43	29	43	100	297(54.0)
46-59	24	18	12	12	11	36	113(20.5)
60+	6	11	7	2	6	14	46(8.4)
Total	80	79	80	53	80	178	550(100)
Mean Age=40.2, Std.Dev.=11.6, Min.=16.0, Max.=75.0, Mode=40.0							
Family Members(Numbers)							
1-5	13	10	20	8	16	24	91(16.6)
6-10	35	39	27	21	38	86	246(45.0)
11-15	16	14	17	13	13	43	116(21.2)
16-20	4	6	5	2	7	13	37(6.8)
21-100	11	9	11	9	5	12	57(10.4)
Total	79	78	80	53	79	178	547(100)
Mean Family Members=11.4, Std.Dev.8.1, Min.=1.0, Max.=70.0, Mode=8.0, Missing=3							
Income Distribution(Rupees)							
5,000-25,000	14	18	20	17	24	71	164(29.9)
26,000-50,000	13	23	31	25	23	70	185(33.8)

Indicators	POSITION						
	President N=80	Vice President N=79	General Secretary N=80	Joint Secretary N=53	Finance Secretary N=80	Committee Member N=178	Total N=550
Land Distribution (Acres)							
51,000-75,000	14	6	10	5	8	16	59(10.8)
76,000-100,000	12	13	6	2	8	11	52(9.5)
101,000-500,000	20	18	11	4	16	10	79(14.4)
501000-3500,000	6	1	2	0	0	0	9(1.6)
Total	79	79	80	53	79	178	548(100)
Mean Income=89,917.00, Std.Dev.=217,667.00, Min.=5,000.0, Max.=3500,000.00, Mode=50,000.00, Missing=2							
Contact Farmers Selected as Office Bearers				Yes 142 26%		No 408 74%	
Note: Percentages are given in parantheses							

PROFILE OF OFFICE BEARERS OF WUAs BAREJI DISTRIBUTARY - MIRPURKHAS (NUMBERS)

Indicators	POSITION						
	President N=24	Vice President N=24	General Secretary N=24	Finance Secretary N=24	Joint Secretary N=0	Committee Member N=20	Total No=116
Land Distribution (Acres)							
0-25	9	12	17	17	0	17	72
26-50	1	6	4	2	0	2	15
51-75	5	4	1	3	0	0	13
76-100	2	1	0	0	0	0	3
101+	7	1	2	2	0	1	13
Total	24	24	24	24	0	20	116
Mean Land=45.9, Std.Dev=57.7, Min=2.0, Max=312.0, Mode=16.0							
Location of Land Holdings							
Head	10	10	10	13	0	6	49
Middle	5	5	8	6	0	3	27
Tail	9	9	6	5	0	11	27
Total	24	24	24	24	0	20	116
Tenancy Status							
Landown-ers	22	17	13	14	0	78	73
Owner-Operators	0	6	5	3	0	10	24
Lessees	1	0	3	1	0	0	5
Tenants	0	0	1	1	0	1	3
Kamdars	1	1	2	5	0	2	11
Total	24	24	24	24	0	20	116
Educational Status							
Illiterate	1	6	0	5	0	5	17
Primary	12	11	8	12	0	10	53
Matric	4	3	10	2	0	3	22
Inter & Above	7	4	6	5	0	2	24
Total	24	24	24	24	0	20	116
Age Distribution(Years)							
16-29	3	3	9	8	0	2	25
30-45	12	13	11	12	0	14	62
46-59	7	5	4	1	0	3	20
60 +	2	3	0	3	0	1	9
Total	24	24	24	24	0	20	116
Mean Age=39.5, Std.Dev.=11.9, Min=16.0, Max=75.0, Mode=35.0							

Indicators	POSITION						
	President N=24	Vice President N=24	General Secretary N=24	Finance Secretary N=24	Joint Secretary N=0	Committee Member N=20	Total No=116
Land Distribution (Acres)							
Family Members (Numbers)							
1-5	6	3	10	5	0	0	24
6-10	10	14	11	14	0	15	64
11-15	5	4	3	3	0	5	20
16-20	1	1	0	1	0	0	3
21+	2	1	0	0	0	0	3
Total	24	23	24	23	0	20	114
Mean Family Members=8.7, Std.Dev.=4.1, Min=2.0, Max=25.0, Mode=8.0, Missing=2							
Income Distribution (Rupees)							
5,000-25,000	0	0	6	5	0	5	16
26,000-50,000	1	4	5	4	0	0	14
51,000-75000	2	2	3	2	0	3	12
76,000-100000	2	8	1	1	0	5	17
101,000-500,000	13	9	7	11	0	7	47
500,000-3,500,000	6	1	2	0	0	0	9
Total	24	24	24	23	0	20	115
Mean Income=237,652.0, Std.Dev.=434,009.0, Min=10,000, Max=3,500,000.00, Mode=100,00.00,Missing=1							

PROFILE OF OFFICE BEARERS OF WUAs DHORONARO MINOR - NAWABSHAH (NUMBERS)

Indicators	POSITION						
	President N=25	Vice President N=25	General Secretary N=25	Finance Secretary N=25	Joint Secretary N=24	Committee Members N=71	Total N=195
Land Distribution (Acres)							
0-25	12	14	21	19	18	52	136
26-50	5	6	1	4	5	13	34
51-75	4	1	1	1	0	2	9
76-100	1	0	0	0	1	0	2
101+	3	4	2	1	0	4	14
Total	25	25	25	25	24	71	195
Mean Land=39.9, Std.Dev.=71.5, Min=1.0, Max=560.0, Mode=8.0							
Location of Land of Holdings							
Head	9	8	4	6	5	16	48
Middle	7	6	10	13	8	32	76
Tail	9	11	11	6	11	23	71
Total	25	25	25	25	24	71	195
Tenancy Status							
Landowners	17	13	14	14	10	26	94
Owner-Operators	5	9	7	8	10	29	68
Lessees	0	1	1	0	0	2	4
Tenants	1	1	1	1	1	8	13
Kamdars	2	1	2	2	3	6	16
Total	25	25	25	25	24	71	195
Educational Status							
Illiterate	4	6	0	1	9	23	43
Primary	10	10	7	10	11	31	79
Matric	3	4	12	7	3	14	43
Inter and Above	8	5	6	7	1	3	30
Total	25	25	25	25	24	71	195
Age Distribution (Years)							
16-29	2	3	5	9	3	13	35

30-45	14	17	14	13	15	37	110
46-59	6	3	3	2	4	16	34
60+	3	2	3	1	2	5	16
Total	25	25	25	25	24	71	195
Mean Age=38.9, Std.Dev.=11.84, Min.=17.0, Max=70.0, Mode=40.0							
Family Members (Numbers)							
1-5	3	2	4	4	1	8	22
6-10	9	12	5	9	7	28	70
11-15	3	3	7	5	10	18	46
16-20	2	3	2	3	2	6	18
21-100	8	5	7	4	4	11	39
Total	25	25	25	25	24	71	195
Mean=14.4, Std.Dev.=10.6, Min=1.0, Max=70.0, Mode=10.0							
Income Distribution (Rupees)							
5,000-25,000	4	7	5	7	8	31	62
26,000-50,000	7	8	15	11	13	32	86
51,000-75,000	7	1	2	2	0	5	17
76,000-100,000	3	2	2	3	0	1	11
101,000-500,000	4	7	1	2	3	2	19
Total	25	25	25	25	24	71	195
Mean Income=54,466.00, Std.Dev.=64.244, Min=6,000.00, Max=500,000.00, Mode=5000.00							

PROFILE OF OFFICE BEARERS OF WUAs HERAN DISTRIBUTARY - SANGHAR (NUMBERS)

Indicators	POSITION						
	President N=24	Vice President N=24	General Secretary N=24	Finance Secretary N=24	Joint Secretary N=24	Committee Member N=69	Total N=189
Land Distribution (Acres)							
0-25	9	11	11	16	15	47	109
26-50	13	12	12	7	9	20	73
51-75	2	0	0	1	0	1	4
76-100	0	1	1	0	0	1	3
101+	0	0	0	0	0	0	0
Total	24	24	24	24	24	69	189
Mean=23.4, Std.Dev.15.9, Min.2.0, Max.96.0, Mode=32.0							
Location of Land Holdings							
Head	7	6	7	6	6	16	48
Middle	11	8	9	12	10	30	80
Tail	6	10	8	6	8	23	61
Total	24	24	24	24	24	69	189
Tenancy Status							
Landowners	17	11	14	14	10	23	89
Owner-Operators	7	13	10	9	12	24	75
Lessees	0	0	0	1	0	4	5
Tenants	0	0	0	0	2	18	20
Karndars	0	0	0	0	0	0	0
Total	24	24	24	24	24	69	189
Educational Status							
Illiterate	0	2	0	1	4	21	28
Primary	3	3	1	2	1	14	24
Matric	9	10	10	9	8	22	68
Inter and Above	12	9	13	12	11	12	69
Total	24	24	24	24	24	69	189
Age Distribution (Years)							

16-29	2	4	3	1	5	9	24
30-45	11	6	13	15	13	39	97
46-59	10	10	5	6	6	14	51
60+	1	4	3	2	0	7	17
Total	24	24	24	24	24	69	189
Mean Age=41.9, Std.Dev=11.4, Min=17.0, Max=70.0, Mode=30.0							
Family Members (Numbers)							
1-5	4	5	6	6	7	15	43
6-10	14	11	8	12	13	37	95
11-15	5	6	6	5	3	15	40
16-20	1	0	2	1	0	2	6
21-100	0	2	2	0	1	0	5
Total	24	24	24	24	24	69	189
Mean Family Members=8.9, Std.Dev.=4.8, Min=1.0, Max=30.0, Mode=8.0							
Income Distribution (Rupees)							
5,000-25,000	7	9	5	9	9	29	68
26,000-50,000	5	9	11	7	10	29	71
51,000-75000	4	2	2	3	3	7	21
76,000-100000	5	3	3	3	2	3	19
101000+	3	1	3	2	0	1	10
Total	24	24	24	24	24	69	189
Mean Income=46,343.00, Std.Dev.=41,006.00, Min=6000.00, Max.=350,000.00, Mode=30,000.00							

PROFILE OF OFFICE BEARERS OF WUAs KHADWARI MINOR - SANGHAR (NUMBERS)

Indicators	POSITION						
	President N=7	Vice President N=6	General Secretary N=7	Finance Secretary N=7	Joint Secretary N=5	Committee Member N=18	Total N=50
Land Distribution (Acres)							
0-25	4	5	3	5	4	15	36
26-50	1	1	3	1	0	3	9
51-75	0	0	0	0	1	0	1
76-100	1	0	1	0	0	0	2
101+	1	0	0	1	0	0	2
Total	7	6	7	7	5	18	50
Mean Land=23.4, Std.Dev.=15.9, Min=2.0, Max=96.0, Mode=32.0							
Location of Land Holdings							
Head	1	4	1	1	2	3	12
Middle	5	1	2	4	2	7	21
Tail	1	1	4	2	1	8	17
Total	7	6	7	7	5	18	50
Tenancy Status							
Landowners	2	2	2	2	0	5	13
Owner-Operators	4	4	4	5	5	9	31
Lessees	0	0	0	0	0	0	0
Tenants	0	0	1	0	0	4	5
Kamdars	1	0	0	0	0	0	1
Total	7	6	7	7	5	18	50
Educational Status							
Illiterate	1	2	0	1	0	3	7
Primary	3	2	2	2	1	8	18
Matric	1	0	3	4	3	6	17
Inter and Above	2	2	2	0	1	1	8
Total	7	6	7	7	5	18	50

Age Distribution (Years)							
16-29	1	0	1	2	2	4	10
30-45	5	4	5	3	1	10	28
46-59	1	0	0	2	2	3	8
60+	0	2	1	0	0	1	4
Total	7	6	7	7	5	18	50
Mean Age=40.0, Std.Dev.=12.2, Min.=22.0, Max=70.0, Mode=45.0							
Family Members (Numbers)							
1-5	0	0	0	1	0	1	2
6-10	2	2	3	3	1	6	17
11-15	3	1	1	0	0	5	10
16-20	0	2	1	2	0	5	10
21-100	1	1	2	1	4	1	10
Total	6	6	7	7	5	18	49
Mean Family Members=15.06, Std.Dev.=8.6, Min=5.0, Max=45.0, Mode=10.0							
Income Distribution (Rupees)							
5,000-25,000	3	2	4	3	0	6	18
26,000-50,000	0	2	0	1	2	9	14
51,000-75000	1	1	3	1	2	1	9
76,000-100000	2	0	0	1	0	2	5
101000+	0	1	0	1	1	0	3
Total	6	6	7	7	5	18	49
Mean Income=52,346.00, Std.Dev.=54,602.00, Min=5000.00, Max=300,000.00, Mode=30,000.00							

INCOME DISTRIBUTION BY POSITION AND TENANCY STATUS OF OFFICE BEARERS(RUPEES)

S#	POSITION	TENANCY	MEAN	STD.DEV.	CASES
1	President	Overall	219,683	474,572	79
		Landowners	261,614	474,572	57
		Owner- Operators	42,375	27,290	16
		Lessees	1500,000	-	1
		Tenants	20,000	-	1
		Kamadars	61,250	22,500	4
2	Vice President	Overall	92,822	110,935	79
		Landowners	136,860	133,911	43
		Owner- Operators	39,062	25,238	32
		Lessees	100,000	-	1
		Tenants	20,000	-	1
		Kamdars	39,000	1414	2
3	General Secretary	Overall	95075	232,123	80
		Landowners	80,883	65509	43
		Owner-Operator	48,576	58,878	26
		Lessees	666,250	928,559	4
		Tenants	40,666	25,716	3
		Kamdars	19,500	7141	4
4	Joint Secretary	Overall	49,018	49.134	53
		Landowners	59,350	49,043	20
		Lessees	-	-	-
		Tenants	17,666	11239	3
		Kamdars	26,333	3214	3
5	Finance Secretary	Overall	81,556	97,715	79
		Landowners	112,255	114,742	43
		Owner-Operators	40,720	46,897	25
		Lessees	175,000	106,066	2
		Tenants	20,000	14,142	2
		Kamdars	29,714	15,808	7

S#	POSITION	TENANCY	MEAN	STD.DEV.	CASES
6	Committee Members	Overall	44,606	51,520	61
		Landowners	54,000	52,909	61
		Owner-Operators	39,500	28,636	72
		Lessees	50,000	30,983	6
		Tenants	42,451	86,987	31
		Kamdars	23,250	9,361	8
Entire Population			89,917	217667	548

INCOME BY POSITION AND TENANCY STATUS (NUMBERS)

S #	Position	Tenancy Status	Income Groups (Rupees)					
			5000-25000	26000-50,000	51,000-75000	76,000 - 100,000	101,000 - 500,000	501,000-3,500,000
1	President	Landowner	7	7	9	9	20	5
		Owner-Operators	6	5	3	2	0	0
		Lessees	0	0	0	0	0	1
		Tenants	1	0	0	0	0	0
		Kamadars	0	1	2	1	0	0
2	Vice Presient	Landowner	5	10	0	9	18	1
		Owner-Operators	12	11	6	3	0	0
		Lessees	0	0	0	1	0	0
		Tenants	1	0	0	0	0	0
		Kamdars	0	2	0	0	0	0
3	General Secretary	Landowner	4	18	6	6	9	0
		Owner-Operators	10	11	3	0	2	0
		Lessees	1	1	0	0	0	2
		Tenants	1	1	1	0	0	0
		Kamdars	4	0	0	0	0	0
4	Joint Secretary	Landowner	5	9	1	2	3	0
		Owner-Operators	8	14	4	0	1	0
		Lessees	0	0	0	0	0	0
		Tenants	2	1	0	0	0	0
		Kamdars	2	1	0	0	0	0
5	Finance Secretary	Landowner	7	10	5	7	14	0
		Owner-Operators	12	10	2	0	1	0
		Lessees	0	0	0	1	1	0
		Tenants	1	1	0	0	0	0
		Kamadars	4	2	1	0	0	0

S #	Position	Tenancy Status	Income Groups (Rupees)					
			5000-25000	26000-50,000	51,000-75000	76,000 - 100,000	101,000 - 500,000	501,000-3,500,000
6	Committee Members	Landowners	16	30	4	5	6	0
		Owner-Operators	30	26	9	4	3	0
		Lessees	1	2	2	1	0	0
		Tenants	20	8	1	1	1	0
		Kamdars	4	4	0	0	0	0

LAND HOLDINGS BY POSITION AND TENANCY STATUS (ACRES)

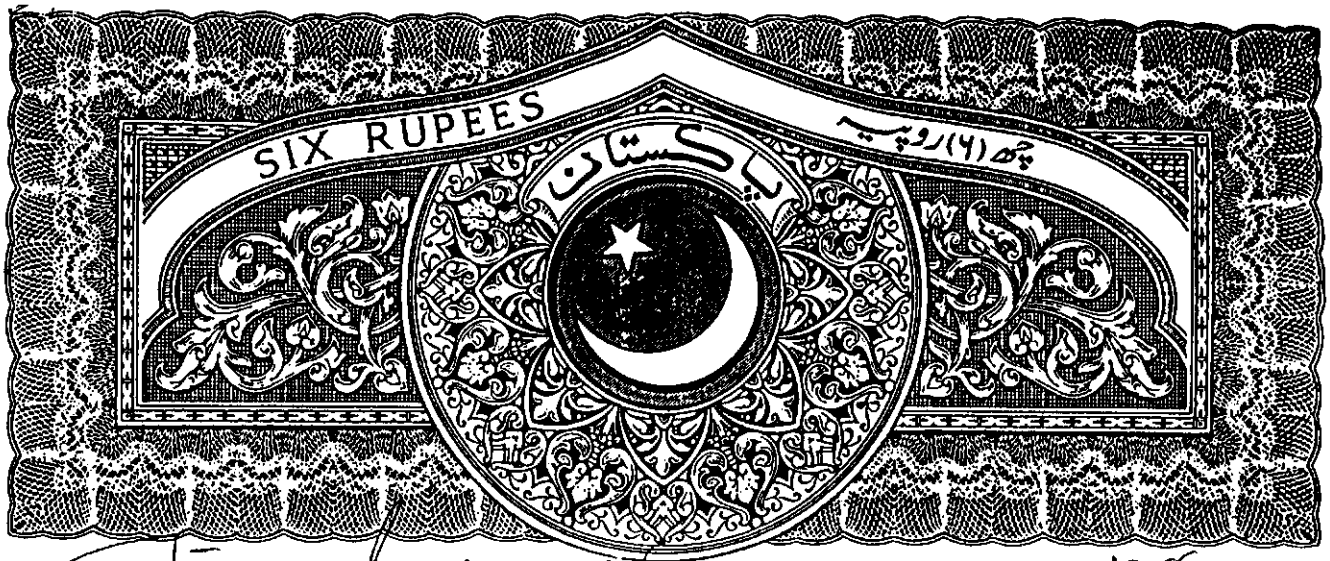
S#	POSITION	TENANCY	MEAN	STD.DEV.	CASES
1	President	Overall	53	64	80
		Landowners	62	62	58
		Owner-Operators	19	15	16
		Lessees	312	-	1
		Tenants	-	-	1
		Kamadars	19	38	4
2	Vice President	Overall	37	60	79
		Landowners	46	55	43
		Owner-Operator	18	16	1
		Lessees	400	-	1
		Tenants	-	-	1
		Kamdars	-	-	2
3	General Secretary	Overall	29	40	80
		Landowners	34	43	43
		Owner-Operators	15	12	26
		Lessees	84	90	4
		Tenants	27	46	3
		Kamdars	-	-	4
4	Joint Secretary	Overall	2	18	53
		Landowners	27	21	20
		Owner-Operators	20	15	27
		Tenants	7	12	3
		Kamdars	-	-	3
5	Finance Secretary	Overall	31	69	80
		Landowners	47	90	44
		Owner-Operators	13	8	25
		Lessees	36	28	2
		Tenants	-	-	2
		Kamdars	-	-	7

S#	POSITION	TENANCY	MEAN	STD.DEV.	CASES
6	Committee Members	Overall	21	33	178
		Landowners	36	49	61
		Owner-Operators	15	10	72
		Lessees	24	13	6
		Tenants	13	26	31
		Kamdars	-	-	8

AGE BY POSITION AND TENANCY STATUS (YEARS)

S#	POSITION	TENANCY	MEAN	STD.DEV.	CASES
1	President	Overall	43	11	80
		Landowners	43	12	58
		Owner-Operators	44	10	16
		Lessees	45	-	1
		Tenants	40	-	1
		Kamadars	44	9	4
2	Vice President	Overall	43	12	79
		Landowners	41	12	43
		Owner-Operators	45	14	32
		Lessees	40	-	1
		Tenants	35	-	1
		Kamdars	41	12	2
3	General Secretary	Overall	38	12	80
		Landowners	37	10	43
		Owner-Operators	38	15	26
		Lessees	46	10	4
		Tenants	39	10	3
		Kamdars	42	11	4
4	Joint Secretary	Overall	39	10	53
		Landowners	38	11	20
		Owner-Operators	39	10	27
		Tenants	35	10	3
		Kamdars	48	8	3
5	Finance Secretary	Overall	39	11	80
		Landowners	37	12	44
		Owner-Operators	41	10	25
		Lessees	31	1	2
		Tenants	30	7	2
		Kamdars	44	11	

S#	POSITION	TENANCY	MEAN	STD.DEV.	CASES
6	Committee Members	Overall	40	11	178
		Landowners	39	11	61
		Owner-Operators	39	12	72
		Lessees	38	7	6
		Tenants	42	11	31
		Kamdars	47	9	8



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JOINT MANAGEMENT AGREEMENT BETWEEN THE HERAN DISTRIBUTARY WATER USERS' FEDERATION (WUF) AND THE SINDH IRRIGATION AND DRAINAGE AUTHORITY (SIDA)

On behalf of the Sindh Irrigation and Drainage Authority , the Executive Engineer Thar Canal Division, and on behalf of the Water Users' Federation (WUF) of Registration No.50, the President of the Heran Distributary Federation hereby execute the following agreement at Hyderabad on Monday, 20 October, 1997.

As per this agreement, the area of 15444 Acres, under the command of the Distributary of Nara Canal will be managed jointly by the Heran Distributary WUF and Sindh Irrigation and Drainage Authority for the period of this agreement for the purpose of operation and maintenance related to irrigation management. (A copy of the map showing the said command area is attached herewith).

The right of use on such distributary inclusive of all structures will be handed over to the Water Users Federation for irrigation management, the land acquired by the Government for it and also all other works executed in the said area at Government cost shall remain vested with the Government. This agreement shall remain valid for an initial period of one year (two crop seasons), with effect from 15 October 1997, and shall be extendible at the option of both the parties for a further period as deemed necessary. For the above purpose, the conditions laid down as under in this agreement are accepted by both the parties.

OBJECTIVES

The primary objective in executing this agreement is to test the effective participation of the beneficiaries in irrigation management so as to achieve optimum crop production by proper utilization of available water.

(A) RESPONSIBILITIES AND RIGHTS OF THE WATER USERS' FEDERATION (WUF)

1. The WUF will collect water charges from the water users as per the rate, prescribed by the Government to cover the operation and maintenance cost of the distributary and an agreed share as service fees that will be paid to the Sindh Irrigation and Drainage Authority.

2. The WUF will assume full responsibility for the operation and maintenance of the distributary and all its structures given under the agreement. It will also ensure construction, maintenance, redesign and repair of all the watercourses, field channels, field drains within the jurisdiction of the WUF and will ensure that the system is made fully operational.

3. The WUF will equitably distribute water among its water users associations (WUAs) according to their due share with reference to land holdings/cultivated crops. The federation will have the right to impose fines on any WUA if it contravenes agreed bylaws or any other agreement between WUF and WUAs. The Sindh Irrigation Act and the Sindh Irrigation and Drainage Authority Act may be used until the By-laws of the Federation are approved.

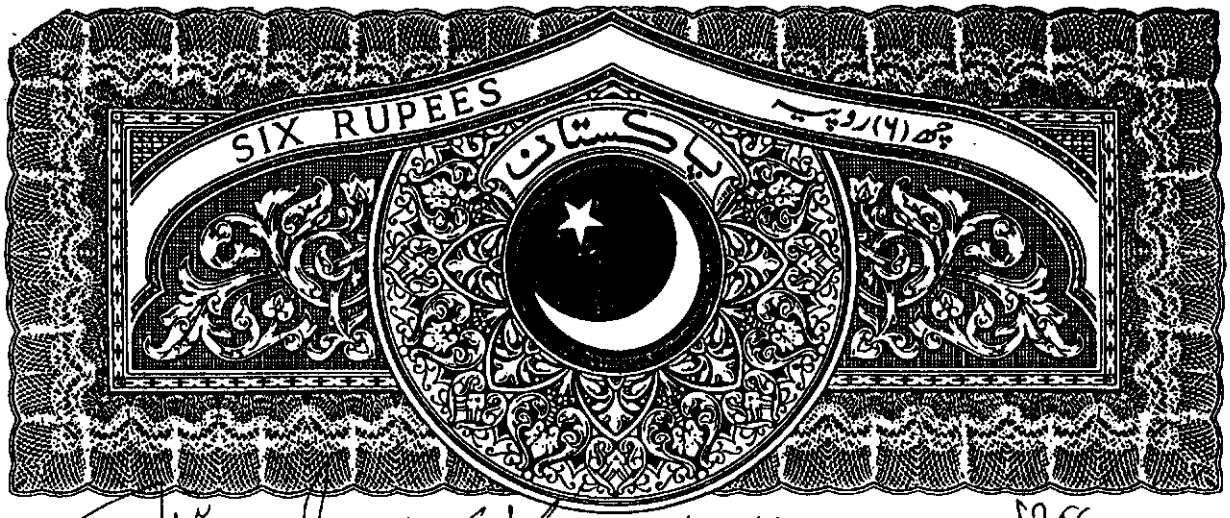
4. The WUF will establish its own operation and maintenance fund (O&M fund) to meet the operation and maintenance expenditure. The operation of this fund will be audited by an auditor appointed by the Government in consultation with the WUF.

5. To carry out its responsibilities, the WUF will employ the necessary field staff.

6. The WUF will identify shortages of water, if any, at the head of the distributary and communicate such shortages to the Sindh Irrigation and Drainage Authority officials for follow up action. The water shortage problems will be collectively solved.

7. The WUF will collect all relevant data from line departments, prepare and implement O&M plans in consultation with the Sindh Irrigation and Drainage Authority.

8. The WUF will also be responsible to conduct the affairs of the WUF in an organized and satisfactory manner and to maintain the cash books, bank accounts, and other records properly.



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JOINT MANAGEMENT AGREEMENT BETWEEN THE HERAN DISTRIBUTARY WATER USERS' FEDERATION (WUF) AND THE SINDH IRRIGATION AND DRAINAGE AUTHORITY (SIDA) Continued .....

9. The following items of work are included in maintenance work:

   a) Removal of silt from distributary and proper upkeep of the same.

   b) Maintenance of inspection path and non-inspection path of the distributary in good condition and carry out proper earth work to restore banks of the distributary.

   c) Removal of grass, weed and bushes, any other obstruction from the distributary canal embankments, and bed etc.

   d) Maintenance/repair of the structures within the distributary.

   e) Protection of all the trees on the distributary.

10. The WUF will reasonably protect the entire system within its jurisdiction from any damage.

11. The WUF will undertake measures for improved water management at the level of distributary.

12. The WUF shall have the right to obtain from the Sindh Irrigation and Drainage Authority information on operation and maintenance activities in the entire system including the concerned distributary.

13. The WUF may, with the permission of the Sindh Irrigation and Drainage Authority, utilize any Government land, taking due care to protect the environment and the system.

14. The WUF will inform the Sindh Irrigation and Drainage Authority promptly if there is any damage due to natural calamities like earthquake, heavy rains, floods or any other unforeseen event.

(B) RESPONSIBILITIES AND RIGHTS OF THE SINDH IRRIGATION AND DRAINAGE AUTHORITY.

1. The Sindh Irrigation and Drainage Authority will supply water to the WUF up to an agreed quantity according to the seasonal needs of the WUF command area, which will be calculated on the basis of the average deliveries for the past two to three years. Information regarding irrigation schedule, rotation program. etc. will also be intimated to the WUF well before commencement of Kharif and Rabi seasons. The WUF will be taken into confidence for the finalization and implementation of the distributary rotation program.

   The following are recognized as the three main technical reasons of water shortage:

   - Shortfall in the river
   - Heavy silt in the canal
   - Breach in the canal

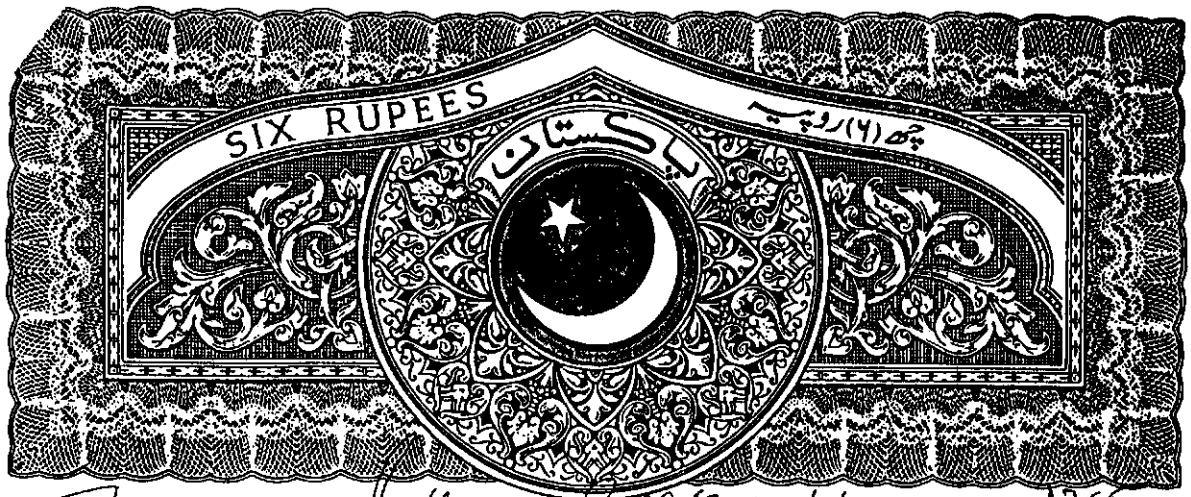
2. The Sindh Irrigation and Drainage Authority will operate and maintain the head regulator of the distributary subject to clause B(1) above.

3. The Sindh Irrigation and Drainage Authority may suggest improvement, if any, for O&M within the distributary.

4. The Sindh Irrigation and Drainage Authority Officials and the WUF office bearers will jointly prepare an inventory of the works being handed over to the WUF showing lengths of lined and unlined sections, structures, crossings, outlets and lands acquired for the above, etc.

5. The Sindh Irrigation and Drainage Authority, or, the Board of Revenue of Government of Sindh, depending on their respective responsibilities, may after reasonable notice to the WUF, inspect the position of water supplied, irrigation works and crops cultivated in the command of the distributary and field level structures under the jurisdiction of the WUF to verify whether or not the agreement is implemented satisfactorily.

6. The agreed service fees payable to the Sindh Irrigation and Drainage Authority for the water supplied at the head of the distributary will depend on the actual crop area cultivated, adopting the present procedure in case of using tubewell water.



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7. Water will be supplied to the WUF only for irrigation purposes, and if it is required by the WUF for any other purpose, it may be obtained through special approval from the Sindh Irrigation and Drainage Authority.

8. If the WUF fails to maintain the distributary system satisfactorily, the Sindh Irrigation and Drainage Authority shall have the right to carry out, after 15 days notice to the WUF, the necessary repairs, and to recover its reasonable cost from the WUF.

9. If the WUF continues to fail in maintaining the distributary up to a satisfactory level, the Sindh Irrigation and Drainage Authority may, after three notices each of 15 days due notice, withdraw the management and maintenance responsibilities from the WUF.

10. With a view to achieving the optimum utilization available water, the Sindh Irrigation and Drainage Authority may also make provision for allowing the following concessions to the WUF;

i) Benefits of special schemes, if any, floated by the Government; and

ii) Financial assistance as outright grants for special development and major rehabilitation work in the distributary.

11. The current field staff of the Sindh Irrigation and Drainage Authority deployed in the distributary will be shifted except the Beldars from the distributary. The Beldards who will stay at the distributary will be paid their salaries initially by the Sindh Irrigation and Drainage Authority on the certification of WUF. When the WUF is able to generate adequate funds, these salaries will be payable by the WUF.

12. The Sindh Irrigation and Drainage Authority will share with the WUF the relevant data such as canal design and actual discharges, water levels, discharge at each outlet, water allocation design details of outlets, seepage and operation losses. The Sindh Irrigation and Drainage Authority will also maintain the main canal and branches to ensure the agreed discharge at the head regulator of the pilot distributary.

13. The Sindh Irrigation and Drainage Authority and WUF will jointly undertake repairs of the distributary channel and its structures arising due to natural calamities such as earthquakes, floods, heavy rains or other unforeseen events.

14. All disputes in respect of various provisions made under this agreement will be resolved at the level of Executive Engineer and WUF, and in case the issue is not resolved, then a Committee comprising the Superintending Engineer and the Executive Engineer concerned, and one nominee each from the concerned WUF and IIMI. The decision of the Committee will be binding on both the parties to this Agreement.

15. In case of extreme emergency when water excesses occur in the main canal, the Sindh Irrigation and Drainage Authority will in consultation with the WUF, release canal water proportionally to off-taking distributary to save the main canal.

The role of IIMI would be to facilitate both the parties in the implementation of this agreement. Any amendments to this agreement may be made only with the explicit consent of both the parties to this Agreement.

Executive Engineer Irrigation
Thar Canal Division
Sindh Irrigation and Drainage
Authority Mirpurkhas

Date: 20-10-97

President Water Users' Federation
Heran Distributary, Sanghar

Date: 20-10-97

Page.....6

Witness

Dr. yameen Khan

20/10/97
SE Naag Canal Circle
Mirpurkhas.

Time Plan IIMI's Action Research Program On Farmer Managed Irrigated Agriculture Under LBOD Stage I Project

S.No	Major Items of Work Accomplished	1995						1996												1997											
		7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
1	Project Proposal Approved																														
2	Procurement of Equipment and Recruitment of Staff																														
3	Orientation Workshop at IIMI Hyderabad																														
	TECHNICAL																														
4	Reconnaissance Survey of Nine Distributaries in LBOD																														
5	Distributaries Selection Workshop																														
6	Walk thru Survey of Distributaries																														
7	Hydraulic Survey of Distributaries																														
8	Discharge Rating of Outlets & Distry(s) head regulator																														
9	Water Logging and Salinity Survey																														
10	Discharge Measurement of Distry & its Watercourses																														
11	Discharge Measurement at Section wise of Distributary																														
12	Seepage Loss Rate Measurments in the Distributaries																														
13	Partial & No Supply of Water Days																														
14	Disposal of Irrigation Water into the Drainage																														
15	Functional and Dysfunctional of Irrigation Structures																														
16	Vegetative Growth Survey of Distributaries & Drains																														
17	Drainage Flow Measurement of the Surface Drains																														
18	Operational Hours of Drainage Pumps																														
19	Weak-Portion Survey of Distributaries and Drains																														
20	Installation of Piezometers (Three at each W-course)																														
21	Desilting of Distributaries by WUOs																														
22	Development Work on Pilot Distributaries by WUOs																														
23	Monitoring of W-Table and W-Quality thru Piezometers																														
24	Round-the-Clock Discharge Measurement																														
25	Pumping Test in Nawabshah																														
	SOCIAL																														
26	Pretesting of Questionnaires																														
27	Socio-Econmic Baseline Survey																														
28	Identification of Contact Farmers																														
29	Meetings with Contact Farmers																														
30	Rapport Building, Consultation & Planning Meetings																														
31	Formation of Water Users' Associations (WUAs)																														
32	Meetings of WUAs																														

S.No	Major Items of Work Accomplished	1995						1996												1997											
		7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
33	Distribution of Brochure (Sindhi & Urdu) regarding Pilot Project to the Water Users											■	■																		
34	Formation and Meetings of Field Implementation Coordination Committees (FICC)												■	■	■		■		■		■		■		■		■		■		■
35	Nomination of Members for Water Users Federation																	■													
36	Formation of Water Users Federations (WUFs)																	■	■												
37	Meetings of Project Implementation Coordination Committee (PICC)																							■					■		
38	Signing of Joint Management Agreement (JMA)																														
39	Collaborative Activities with Line Agencies															■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
40	Meetings of Water Users Federation (WUF)																			■	■	■	■	■	■	■	■	■	■	■	■
41	Preliminary Results of Data Analysis of Socio-Economic Base Line Survey														■																
42	Registration of WUOs (WUAs & WUFs)																				■										
43	Certificate of Registration, Distribution																					■									
44	Publication and Distribution of Leaflet on Waterlogging and Salinity and Piezometer																			■			■								
45	Distribution of By-Laws for WUOs																							■							
46	Distribution of "Sindh Irrigation Water Users Association Ordinance 1982" (Sindhi & Urdu)																	■													
47	Evaluation by Swiss Development Cooperation (SDC)																												■		
48	Project Evaluation by Staff																							■							
49	Recognition of WUOs by the Irrigation Department																							■							
	FINANCIAL																														
50	O&M Data Collection																			■	■										
51	Financial Data Collection of Desilting																			■	■										
52	Initial Financial Investigation																			■	■										
53	Farm Income Analysis																									■					
54	Physical Assessment of CCA																													■	■
55	Questionnaire for Business Plan																														■
56	Survey of Cropping Intensity and Cropping Pattern																		■		■	■									■
	TRAINING																														
57	IIMI Field Staff at AKRSP Gilgit & PARC, Islamabad			■																											
58	Measurement of Discharge, Calibration of Moghas						■	■																							
59	WUOs Office Bearers on Walk-Thru Survey																			■	■										
60	WUOs Office Bearers on Improved Water Management																							■							
61	Monitoring of Piezometer to Members of WUOs																								■	■					

S.No	Major Items of Work Accomplished	1995						1996												1997											
		7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
62	Workshop on Base Line Survey																														
63	Microcomputer Training to the Field Staff																														
64	Workshop for Contact Farmers																														
65	Organizational Management for WUOs																														
66	Financial Aspects to the Finance Secretaries of WUOs																														
	VISITS																														
67	Donor Review Mission																														
68	Ruedi Hager and Suhail Malik of SDC																														
69	Michael Percy of World Bank Monitor																														
70	SAFWCO Officials																														
71	Piyasena Ganewattee, Consultant																														
72	Dr. Prachanda Pradhan, Consultant																														
73	Jeevan Das and Abid Shah of OXFAM																														
74	Dutch Mission																														
75	Office Bearers of WUFs to PIEDAR, Punjab																														
76	Office Bearers of WUFs to Nepal on Study Tour																														
77	Orientation Visit of WUOs Office Bearers OFWM Training Institute, Sakrand																														
78	Orientation Visit of WUOs Office Bearers to OFWM																														
	REPORTS																														
79	Project Phase-I Report																														
80	Distributary Level Water Users Associations In Pilot Projects for Farmer Managed Irrigated Agriculture																														
81	Water Users Organization Program in IIMI's Pilot Projects																														
82	Inception Report																														
83	Cutthroat Flume as a Measuring Device																														
84	Moving Towards Participatory Irrigation Management Phase II																														
85	Hydraulic Characteristics of Pilot Distributaries																														
86	Financial Feasibility Analysis of Operation and Maintainnce Costs for Water Users Federations																														
87	Socio-Economics Baseline Survey for Three Pilot Distributaries in Sindh Province, Pakistan																														
88	Study Tour of Pakistani Pilot Project Farmer-Leader to Nepal																														
89	An Outline of the Legal Framework for the Water Users and Their Organizations																														

S.No	Major Items of Work Accomplished	1995						1996												1997											
		7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
90	Distributary Level Water Users Associations in Pilot Projects																														
91	Maintenance Plans for Irrigation Facilities of Pilot Distributaries in Sindh, Pakistan - Vol. I: Bareji Distributary, Mirpurkhas District - Vol. II: Heran Distributary, Sanghar District - Vol. III: Dhoro Naro Minor, Nawabshah District																														
92	Methodology for Monitoring and Evaluation (M&E) of Combined Irrigation and Drainage System Vol. I																														
93	Monitoring and Evaluation of Irrigation and Drainage Facilities for Pilot Distributary in Sindh, Pakistan (Interim Report) - Vol. II: Dhoro Naro Minor, Nawabshah District - Vol. III: Heran Distributary, Sanghar District - Vol. IV: Bareji Distributary, Mirpurkhas District																														
94	Monthly Progress Reports																														

IIMI's ACTION RESEARCH PILOT PROJECT ON FARMER MANAGED IRRIGATED AGRICULTURE UNDER LBOD STAGE I PROJECT

KEY PERSONNEL
PROJECT STAFF DURING PHASE-III

D.J. Bandaragoda	Irrigation Institutional Specialist (Project Leader)
Prof. Gaylord V. Skogerboe	Water Management Specialist
Dr. M.S. Shafique	M&E Specialist
Dr. Prachanda Pradhan	Irrigation Institutional Expert (Short Term Consultant)
Piyasena Ganewatte	Irrigation Institutional Expert (Short Term Consultant)
Laurence E. Smith	Financial Specialist (Short Term Consultant)
Dr. M. Akhtar Bhatti	Agronomist (Short Term Consultant)
Dr. M. Yameen Memon	Sociologist (Team Leader), Hyderabad
Dr. Bakhshal Khan Lashari	O&M Specialist, Hyderabad
Syed Daniyal Haider	Financial Analyst (Part Time)
Mohsin Khatir	Assistant Financial Analyst, Hyderabad
Ahsan Ali Kazi	Secretary, Hyderabad
Ayaz Anwar Solangi	Data Entry Specialist, Hyderabad
M. Naveed Khayal	Supervisory Social Organizer, Sanghar
Niaz Hussain Sial	Field Research Assistant, Sanghar
Abdul Majeed	Field Research Assistant, Sanghar
Abdul Jalil Ursani	Field Research Assistant, Sanghar
Shabir Soomro	Social Organizer, Sanghar
Ghous Laghari	Social Organizer, Sanghar
Nizamuddin Bharchoond	Supervisory Social Organizer, Nawabshah
Rehman Soomro	Field Research Assistant, Nawabshah
Muneer Mangrio	Field Research Assistant, Nawabshah
Pervaiz Pirzado	Social Organizer, Nawabshah
Fateh Marri	Social Organizer, Nawabshah
Waryam Baloch	Supervisory Social Organizer, Mirpurkhas
Asghar Ali Memon	Field Research Assistant, Mirpurkhas
Badrul Hassan	Field Research Assistant, Mirpurkhas
Mohammad Nadeem	Social Organizer
Ghulam Mustafa Talpur	Social Organizer

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Report No.	Title	Author	Year
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