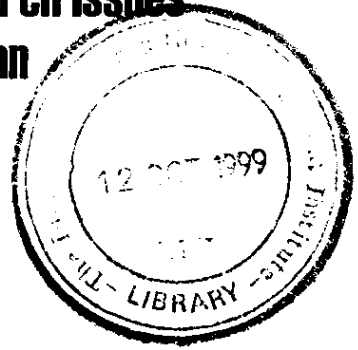


**Report No. R-82**

**Water Resources Management Research Issues  
in the Highlands of Baluchistan**



**WORKSHOP PROCEEDINGS**

**Ineke Margôt Kalwij  
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PAKISTAN NATIONAL PROGRAM  
INTERNATIONAL WATER MANAGEMENT INSTITUTE  
LAHORE**

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## FOREWORD

Baluchistan, by the largest of the four provinces of Pakistan (approximately 350,000 km<sup>2</sup>), also has the least (7 million) inhabitants. The area of the province extends between latitudes 24 to 32 N, and thus, is situated completely north of the tropics. Geologically, the province is divided into four main regions, i.e. the Central Mountain Ranges, the Chagai Hills and Ras Koh Range, Makran Mountain Ranges and the Chagai-Kharan Basin. Approximately 51.7 percent of Baluchistan's land area are classified as having high and low mountains, whereas 21 percent are gravelly fans and terraces, 11.6 percent are piedmont plains, 7.5 percent are sand plains, 2.8 percent are river plains and 2 percent are saline basins or playas. The province experienced an excessive annual population growth rate of 7 percent between 1972 and 1981, which is 70 percent above the national average. The high growth rate is a result of the combination of declining mortality and a near stable birth rate, and thus, it can be observed that the demographic transition of developing countries has not yet materialized in Baluchistan. A productive agriculture, for which the natural water resources are of crucial importance, is required to feed the increasing population.

Baluchistan is divided into three hydrological regions/units, i.e. the Nari Basin, the Kharan Closed Basin and the Makran Coast, which constitute approximately 73 small or large rivers and streams. Baluchistan's perennial water resources are limited. The Nasirabad and Jaffarabad Districts are exceptions, which are fed by the Pat Feeder and the Desert and Kithir Canals emanating from the Guddu and Sukkur Barrages on the Indus River. The irrigation in the remainder of the province depends on rainfall, tubewells, *kareze* flows, flood flows, hill torrents and diversions from non-perennial streams, which bring substantial runoff during the rainy season. Due to the scarcity of water resources, the estimation is that only 18.60 million hectares (8%) is under cultivation.

The main environmental problem in Baluchistan is desertification, in which several aspects of desertification, i.e. devegetation, groundwater depletion, salinization, erosion and biodiversity decline, play a role and are interrelated. Desertification, although conditioned by the hyper-arid to dry climate of Baluchistan, is caused by over-exploitation. The extraction of groundwater, undoubtedly the essential renewable natural resource in most of Baluchistan, has increased tremendously due to the quick development of tubewells during the recent past decades. The Hydrometric Network Project monitored and documented the groundwater level fluctuation tendency over a period of 20 years (1969 – 1989) for different valleys of Baluchistan (Quetta North Sub-basin, Quetta South, Mastung, Mangochar and Pishin). WAPDA calculated an average decline of groundwater levels for all their monitoring points of 0.75 feet / year to estimate the long-term trend for the period of 1969 to 1989; whereas, a decline of 2 feet / year was calculated for the period 1987 to August 1989.

The accelerating decline of groundwater levels had made many traditionally used *karez*s obsolete, since most of the valley floor aquifers are not being re-charged. In different valleys, the extraction of groundwater exceeds the natural recharge of the groundwater reservoir. A main concern is that if measures to manage the water resources better are not taken, the natural water resources will deplete. Hence, the agricultural development will become stagnant, while the agricultural productivity will increase considering the increasing tendency of the population and considering the importance of poverty elimination.

The International Irrigation Management Institute (IIMI) has an interest in expanding its research program to the province of Baluchistan. This conforms with the existent water-related environmental concerns in Baluchistan, and in line with IIMI's mission: *to contribute to food security and poverty eradication by fostering sustainable increases in the productivity of water through better management of irrigation and other water uses in river basins*. For this purpose, a

workshop was realized on February 11, 1999 at the Serena Hotel, Quetta. The main objectives were to introduce IIMI to a wider audience in Baluchistan, to identify key issues that need to be addressed in water resources management research, and to define collaborative activities.

To organize the workshop, *Water Resources Management research Issues in the Highlands of Baluchistan*, has been a very encouraging effort mainly because so many people representing a diverse range of institutions were present on the day of the workshop. Participants showed a great deal of enthusiasm and good spirit and unselfishly shared their knowledge. IIMI is very grateful to all the participants. Without their presence, the workshop could never have turned into such a tremendous success.

Ineke Margôt Kalwij

## **1 WORKSHOP BACKGROUND**

IMMI has had a modest interest in Baluchistan since mid-1997, and has undertaken small studies related to improved irrigation practices in Baluchistan, an inventory on the use of pressurized irrigation systems, and is involved in documenting issues pertaining to groundwater management in this province, and other irrigation-related issues.

IIMI, however, has an interest in expanding its research in the Baluchistan Province, and has a keen interest in developing a research proposal in collaboration with national partners. For this purpose, the workshop in Quetta was realized in order to synthesize the viewpoints of various institutions and individuals regarding groundwater resources management issues, and to which research can be related.

The workshop was divided into five sessions, and the program is presented in Appendix 1. The Inaugural Session includes a presentation by Dr. S.A. Prathapar, Director, IIMI-Pakistan Program, and the opening address by Haji Behram Khan Achakzai, Minister of Irrigation and Power. Session 1 of the workshop covers two presentations, the Opening Remarks by Dr. Zafar Altaf, Chairman, IIMI Board of Governors and Chairman of Session 1. The first speaker of Session 1, Mr. Abdus Salam Khan, Secretary, Irrigation and Power Department, discussed government actions to tackle the water resources problems in Baluchistan: past experiences and future strategies. The second speaker, Mr. Abdul Salam Baloch, Director General, Agriculture Department, presented issues regarding farmers' participation in water management: a historic perception and options for improvements. Session 2 of the workshop encompassed group discussions and the formulation for future research topics, followed by the Plenary Session, in which the outcome of each group discussion was presented. In the Closing Session, Major Nadir Khan, Additional Chief Secretary, provides the address, and the workshop concludes with some final remarks by Dr. Zafar Altaf.

The workshop attendance was excellent, and up to 60 participants represented various governmental organizations (GOs) and departments, development projects, and non-governmental organizations (NGOs). The list of participants is presented in Appendix 2.

## 2 INAUGURAL SESSION

### 2.1 INTRODUCTION TO IIMI AND ITS RESEARCH PROGRAM BY DR. S.A. PRATHAPAR, DIRECTOR IIMI.

The International Irrigation Management Institute (IIMI) is a non-profit international research organization with its head office in Colombo, Sri Lanka, and one of the sixteen members of the Consultative Group for International Agricultural Research (CGIAR). The CGIAR, an association of public and private sector members that supports the network of research centers, aims to contribute towards sustainable agriculture for food security in developing countries.

IIMI's mission is to contribute to food security and poverty eradication by fostering sustainable increases in the productivity of water through better management of irrigation and other water uses in river basins. IIMI conducts a worldwide research program to generate knowledge to improve water resources and irrigation management through improved technology, policies, and management. Currently, IIMI has activities in Côte-d' Ivoire, India, Iran, Kenya, Mexico, Nepal, Pakistan, South Africa, Sri Lanka and Turkey.

IIMI Pakistan receives funding support from the Governments of The Royal Netherlands, France, Australia and the United Kingdom, from the World Bank and Asian Development Bank and from allocations from the unrestricted support provided to IIMI by the Governments of Australia, Brazil, Canada, China, Denmark, France, Germany, Mexico, The Netherlands, Norway, Sweden, Switzerland, the United States of America, and the World Bank.

IIMI's activities are carried out in four research programs, namely:

- Performance and Impact Assessment;
- Design and Operation;
- Policy, Institutions and Management;
- Health and Environment.

The central aim of the Pakistan program is to implement IIMI's mission in the local context. IIMI-Pakistan, of which has approximately 100 staff members, has its main office in Lahore. In addition, IIMI has provincial offices in Hyderabad and Quetta. Field stations are operated at project sites for the duration of specific projects. Currently, IIMI operates field stations at Haroonabad and Bahawalnagar in the Punjab Province, and Nawabshah, Mirpurkhas and Sanghar in the Sindh Province.

The following research activities are undertaken in Pakistan, presented according to the four research programs.

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#### I. Performance and Impact Assessment Program

Identifies the determinants and assesses the impacts of sustainable, high irrigation performance.

- Project 1: Assess agricultural and environmental performance of the Indus Basin Irrigation System.
- Activities: - Establish a comprehensive database of physical and non-physical features of the Indus Basin.

- Evaluate the overall performance of canal commands with reference to water and land.
- Project 2: Apply advanced tools to determine spatial and temporal variation in equity, adequacy and reliability of water use and crop yields within the Indus Basin Irrigation System.
- Activity: - Spatial and temporal variation in crop yields and water use are being determined by analysis of remotely sensed satellite images of the Indus Basin.

## II. Design and Operation Program

Identifies, field tests and disseminates methodologies and tools to increase the productivity and sustainability of water for irrigation in the context of water basins

- Project 1: Develop tools to improve the management of irrigation canals.
- Activity: - Research and analytical support for Pehur High Level Canal and Chasma Right Bank Canal.
- Project 2: Develop techniques to minimize land and water quality degradation due to salinization.
- Activities: - Conjunctive water management in the Rechna Doab.
- Root-zone salinity management with skimming wells and pressurized irrigation systems.
- Waterlogging and salinity management in the Hakra Canal Command.
- Applying and evaluating inexpensive salinity control measures.
- Project 3: Develop a framework for improved water allocation in the Indus Basin Irrigation System.
- Activities: - Assess water availability and current demand of canal commands, and analyze current water allocation and regulation practices.
- Classify irrigation canal commands.
- Determine coherent water allocation rules and recommendations to rehabilitate the Indus Basin Irrigation System.

## III. Policy, Institutions and Management Program

Identifies the tasks, policy tools, organizational designs and institutional frameworks required to achieve and sustain high productivity.

- Project 1: Assist the development of a feasible and sustainable institutional framework for reforms of the irrigation and drainage sector in Pakistan.
- Activities: - Assist the establishment of a joint water allocation committee for the Hakra Branch Canal.
- Develop guidelines for Institutional reforms adaptable to site-specific conditions in the four provinces of Pakistan's irrigation sector.
- Project 2: Understand people's gender-specific roles, especially of women and socially disadvantaged men, in water management.
- Activities: - Understanding the specific responsibilities of people in water management.
- Communicate the research results to policy makers, water service providers, research institutions, NGOs, etc.
- Develop methodologies for inclusion of women and economically disadvantaged men in formal and informal management decision making.

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#### **IV. Health and Environment Program**

Enhances the positive and reduces the negative effects of irrigation to human health and environment.

**Project:** Domestic water supply and sanitation in irrigated areas to determine the impacts of irrigation water and health.

**Activities:** - Epidemiological and water quality studies in the Hakra 6-R Distributary, which is a brackish water zone where people are completely dependent on irrigation water for all their domestic requirements.

- Evaluate the possibility for low-cost water treatment facilities.
- Assess the impact of waterlogging on on-site sanitation.

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IIMI's Pakistan Program has invested its resources to improve the water management skills of Pakistani farmers, students, NARS personnel and IIMI national staff. IIMI facilitates this through formal short courses, on-the-job training for students and NARS personnel at IIMI, joint research and development activities with NARS and NGOs, and the organization and participation of IIMI staff at international, national and regional workshops.

IIMI-Pakistan has various national and international collaborators:

##### **National Collaborators:**

- Water and Power Development Authority (WAPDA);
- Provincial Irrigation and Drainage Authority (PIDA), Punjab;
- Provincial Irrigation and Drainage Authority (PIDA), NWFP;
- MONA Reclamation and Experimental Project (MREP), Bhalwal;
- International Waterlogging and Salinity Research Institute (IWASRI), Lahore;
- On-Farm Water Management (OFWM), Punjab;
- Agricultural Extension, Agricultural Department, Punjab;
- Water Resources Research Institute (WRRI), Islamabad;
- Space and Upper Atmospheric Research Commission (SUPARCO), Karachi;
- Health-net International;
- University of Peshawar;
- National Institute of Malaria Research and Training, Lahore; and
- Institute of Public Health.

##### **International Collaborators:**

- International Institute for Aerospace Survey and Earth Sciences (ITC), The Netherlands;
- CEMAGREF, France; and
- Commonwealth Scientific and Industrial Research Organization (CSIRO), Australia.

## 2.2 OPENING ADDRESS

BY THE MINISTER OF IRRIGATION AND POWER, HAJI BEHRAM KHAN ACHAKZAI

Dr. Zafar Altaf, Chairman, Board of Governors, IIMI; Mr. Abdus Salam Khan, Secretary, Irrigation and Power Department; Dr. Prathapar, Director, IIMI; distinguished guests:

Ladies and gentlemen, it is my pleasure and honor to be invited to inaugurate this one-day workshop on water resources. I am extremely thankful to the Director of IIMI, who has felt the need to highlight the vital problem of water resources for the economic development of my province.

As we all know, water is scarce in Baluchistan, and with each passing day the situation becomes increasingly serious. Human pressure, maybe for domestic use or for agricultural purposes, is to be met with proper planning. The water resources are not infinite. The whole scenario demands a careful evaluation and planning of these resources. The first step in this direction is the evaluation of need, project planning and scheme preparation before executing projects. For this purpose, my department is fully geared to face the challenge to meet the future demands of the province.

We all know that rainfall in Baluchistan is not much, and that the province passes through periods of low rainfall most of the times. We have limited irrigated agriculture in Nasirabad and Bela Districts, whereas, vast areas of the province are without dependable sources of water. Due to the electrification program and improved communication over the past two decades, groundwater exploitation has been on the increase. We have achieved a momentum in the agriculture sector in some areas, but at the heavy cost of lowering the water table. My department is aware of these problems, but the province has financial limitations. Land resources are abundant but the main constraint remains water. If we have water, we can grow sufficient food to meet the shortfall faced by the country.

Coming back to the subject of groundwater mining, I would strongly say that we should conserve water from flash floods for groundwater replenishment and also create enough storage to irrigate vast tracts of land otherwise unutilized due to the lack of water.

On behalf of the Government of Baluchistan and my Department, I welcome IIMI for establishing a unit in Quetta and for organizing this workshop on an issue to which our government is committed. Once again, I thank you for giving me this opportunity to inaugurate this workshop. May God bless you all.



### **3 PRESENTATIONS RELATED TO WATER RESOURCES MANAGEMENT ISSUES IN THE HIGHLANDS OF BALUCHISTAN (SESSION 1)**

#### **3.1 ADDRESS BY DR. ZAFAR ALTAF, CHAIRMAN, IIMI'S BOARD OF GOVERNORS**

We all know that the reason we are gathered here is to look at Baluchistan's potential. Scientists from IIMI-Pakistan did visit a few areas in Baluchistan. The future lies here. What kind of transformation are we talking about? We are not just talking about transformation in natural resources, but transformation generated by your imagination.

We have been reconstituting our steering committee and welcome two new members, Mr. Bashir Ahmad Mian and Mr. Salam Abdus. We appreciate their support. We hope to do some more work on these water resource issues. IIMI is here to fill in the gaps. Sometimes, when we are locked in a system we only see the obvious. We should also identify the not-so-obvious. Whatever our requirement is also the requirement of every Pakistani, not just of Punjabis or Sindhis. We have to move towards creating a national psyche; one that is positive and in which we can work fast, as time is very short.

I am greatly impressed by people's interest in this workshop. Now that we have created a better opportunity, it is up to us to put up a show. We want centrifugal forces so that we are all at the same center. It is important to understand that there are no universal answers. There are a few generic options, but most important, is that you believe in yourselves because you are capable of much more.

In conclusion, I would like to stress that IIMI's presence would be serious in the backdrop.

### 3.2 GOVERNMENT ACTIONS TO TACKLE THE WATER RESOURCES PROBLEMS IN BALUCHISTAN: PAST EXPERIENCES AND FUTURE STRATEGIES

**Mr. Abdus Salam Khan**  
Secretary, Irrigation and Power Department

As we all know, the majority of people in rural areas are engaged in subsistence farming. In Quetta, we have a serious problem of groundwater mining. Nuclear blasts during May 1998 have prevented our efforts to continue work according to schedule. We also had the Makran flashfloods during March 1998. The cost of the damage as assessed by WAPDA is Rs. 800 million. A later assessment amounted to Rs 4000 million. It has not been possible to implement our construction plans because of the lack of finance. Then, we also have fourteen delay action dams divided into three sections. The remaining construction requirement has been submitted.

Now, with the flood-affected Makran Division, the concentration of our irrigation staff remained there. We have submitted proposals, but these have not been financed. NESPAK has expressed an interest. We have also presented proposals to the World Bank to fund four OFWM projects. We need help to secure funding.

*The speaker continued the presentation through discussing different issues, summarized in tables. The following issues were discussed:*

- Physiographic units of Baluchistan (Table 1);
- Land resources (Table 2);
- Surface water resources (Table 3);
- Groundwater – Basin-wise potential and the level of groundwater utilization (Table 4);
- The activities of the Irrigation Department in the field of water resources (Table 5);
- Status of completed, present and proposed water resources development projects at a glance (Table 6);
- The status of completed projects, elaborated (Tables 7a and 7b);
- The status of present projects, elaborated (Tables 8a, 8b and 8c);
- The status of proposed water resources development projects, elaborated (Table 9);
- Miscellaneous water resources development projects available with the Department (Table 10); and
- Water resources development constraints (Table 11).

*Tables 1 to 11 were then presented respectively:*

Table 1. Physiographic Units.

DESCRIPTION	AREA		%AGE OF TOTAL
	M. HA	M. ACRES	
Piedmont Plains	4.16	10.29	12
Playas	0.69	1.71	2
Sand Plains	2.78	6.86	8
Valley Bottoms	1.04	2.57	3
Tidal Plains	0.35	0.86	1
Mountain Ranges	18.04	44.57	52
Alluvial Fans	7.63	18.86	22
Total	34.70	85.71	100

Table 2. Land Resources.

DESCRIPTION	AREA		%AGE OF TOTAL
	M. HA	M. ACRES	
Area not reported	16.31	40.28	47
Not available for cultivation	11.10	27.43	32
Forest	1.04	2.57	3
Culturable waste	4.51	11.14	13
Current fallow	0.69	1.71	2
Net area shown	1.04	2.57	3
Total	34.70	85.71	100

Table 3. Surface Water Resources.

S.No.	Source	Available Runoff (MAF)	Existing Uses (MAF)	Balance Runoff (MAF)
1	Indus Basin Component	4.100	1.026	3.074
2	Makran Coast	3.700	0.502	3.198
3	Kharan C. Desert	2.600	0.872	1.728
Total	10.400	2.400	8.000	

Table 4. Groundwater – Basin - Wise Potential and the Level of Groundwater Utilization.

Name of Basin	Potential Available (Cusecs)	Exploited (Cusecs)	Available Future (Cusecs)
Zhob River	125	114	11
Nari River	120	110	10
Kachi Plain	95	53	42
Pishin Lora	145	145	00
Mula River	26	15	11
Gaj River	38	25	13
Porali River	155	65	90
Hingol River	168	25	143
Hamun-I-Lora	28	10	18
Dasht River	51	20	31
Rakhshan River	27	10	17
Humn-e-Mashkhel	168	60	8
Other Areas	70	35	35
	116	687	429

Source: Hydrogeology Directorate, WAPDA, Quetta.

Table 5. Activities of Irrigation Department in the Field of Water Resources.

**Types of Irrigation Schemes Constructed**

- Major canal works on Indus Basin canals
- Flood irrigation schemes such as weirs
- Perennial irrigation schemes based on:
  - ♦ Weirs
  - ♦ Infiltration galleries
  - ♦ River intakes
  - ♦ Karezes and spring improvement
  - ♦ Channel lining
  - ♦ Groundwater development through tubewell construction
  - ♦ Artificial groundwater recharge
  - ♦ Flood protection works

Table 6. Status of Completed, Present and Proposed Water Resources Development Projects at a Glance.

S. No.	Resource	No. of Schemes	Cost (Rs. In Billion)	Area Benefited
<b>A</b>	<b>Completed</b>			
	• Foreign-funded schemes	467	13.60	0.35 M Acres
	• PSDP	503	1.30	1.27 M. Acres
	Total	970	14.90	1.52 M Acres
<b>B</b>	<b>On going</b>			
	• Foreign-funded schemes	59	5.00	0.462 M Acres
	• PSDP	14	0.559	0.100 M Acres
	• Federally-funded	73	0.652	0.070 M Acres
	Total	146	6.211	0.632 M Acres
<b>C</b>	<b>Proposed</b>			
	• Foreign-submitted	13	31.150	0.650M Acres
	• Ready for submission	8	7.306	0.250 M Acres
	Total	21	38.456	0.900 M Acres

Table 7a. The Status of Completed Projects: Internationally-Funded Schemes.

S. No.	Name of Project	No. of Sub Projects	Completion Cost (M. Rs.)	Area Benefited (Acres)
1	Baluchistan Minor Irrigation and Agriculture Development Project (BMIDP) 1982-95	42	1200	32000
2	Small Irrigation Schemes under Kuwait's Fund Phase I (1980-1985)	34	456.66	126884
3	Irrigation System Rehabilitation Project ISRP- Phases I and II (1987-1996)	125	3.30	147900
4	Command Water Management Project at Hub (1987-1992)	1	147	18000
5	Income Generating Project for Afghan Refugees – Phases I-II-II (1987-1996)	24	151.71	14820
6	1988 Flood Damages Restoration Project (1989-1992)	117	73.06	-
7	1992/94 Flood Damages Restoration Project (1993-1997)	82	156.28	-
8	Flood Protection Sector Project- Phase I	42	343.3	10307
	Total	467	1365.801	349911

Table 7b. The Status of Completed Projects: Public Sector Development Program.

S. No.	Name of Project	No. of Sub-Projects	Completion Cost (M. Rs.)	Area Benefited (Acres)
1	Flood Irrigation Schemes	83	218	519590
2	Perennial Irrigation Schemes	2.4	618	718927
3	Flood Protection Schemes	83	208	6240
4	Delay Action Dams	133	266.768	25000
	Total	5.3	1310.768	1269757

Table 8a. The Status of Present Projects: Internationally-Funded Schemes.

S. No.	Name of Project	No. of Sub-Projects	Completion Cost (M. Rs.)	Area Benefited (Acres)
1	Baluchistan Community Irrigation and Agriculture Project - 1996 - 2001	42	1355.2	12000
2	National Drainage Program (1997-2003) • Drainage schemes • Check/D.A. Dams	17	2446.78 937.46 1509.32	450000
3	Second Flood Protection Sector Project	103	480	14000
	Total	162	4281.98	476000

Table 8b. The Status of Present Projects: Public Sector Development Program - 1998-99.

S. No.	Name of Project	No. of Sub-Projects	Completion Cost (M. Rs.)	Area Benefited (Acres)
1	Public Sector Development Program 1998-99	14	559.94	98800
	Total	14	559.94	98800

Table 8c. The Status of Present Projects: Federally-Funded Projects.

S. No.	Name of Project	No. of Sub-Projects	Completion Cost (M. Rs.)	Area Benefited (Acres)
1	Groundwater Recharge of Quetta, Pishin, Mastung and Mangochar Valleys	53	436.54	15000
2	Accelerated Water Management Project	5	15	2500
3	Flood Management of Marri Bugti Hill Torrents	5	125	50000
4	Flood Protection Schemes under Normal Federal ADP	10	75.48	2250
	Total	73	652.02	69750

Table 9. Status of Major Water Resources Development Projects Submitted to Federal Government.

S. No.	Name of Project	Estimated Cost (M. Rs.)	Status
1	<ul style="list-style-type: none"> <li>Utilization of additional perennial water from Indus Water (as a result of Indus Water Accord 1991)</li> <li>Feasibility Study</li> <li>Construction Cost</li> </ul>	6.80 1403	The concept paper has been cleared by CDWP. NESPAK has prepared the prefeasibility study.
2	<ul style="list-style-type: none"> <li>Utilization of additional flood water from Indus Water (as a result of Indus Water Accord 1991) through extension/remodelling of D.G. Khan, Dajal Canal from Taunsa Barrage to Kashmore and new Kachhi Canals in Baluchistan</li> <li>Feasibility Study</li> <li>Construction Cost</li> </ul>	13.50 7000	The concept paper has been cleared by CDWP. NESPAK has prepared the prefeasibility study.
3	Rehabilitation of K.K. Bund in Pishin area	659.06	The project has been approved by ECNEC in April 1986 at a cost of Rs. 203.625 million. The revised cost based on the estimation by Halcrow consultant is Rs. 659.06 million.
4	Groundwater Recharge of Quetta, Pishin, Mastung and Mangochar	436.54	The project has been approved by ECNEC in May 1994. The scheme is reflected in the federal ADP 1998-99 with an allocation of Rs. 100.00 million for the year. Funds are awaited.
5	Hingol Dam	6888.99	Feasibility study carried out by WAPDA during 1987-92. Submitted to Federal Government for approval and funding.
6	Mirani Dam	7624.50	The project has been approved by CDWP. On September 18, 1994 ECNEC decided that fresh international bids be invited for the project, both with and without financing arrangement aspects of the Project and the interest of lower riparian. The revised PC-I is under preparation by WAPDA due to changed condition at site after March 2-3, 1998 floods.
7	Naulong Storage Dam on Mula River	4073.24	The feasibility study and PC-I prepared by WAPDA P&I. The project stands submitted to federal Government for approval and funding.
8	Agriculture Package announced by the Prime Minister of Pakistan	7287	A PC-I was prepared by the Department and submitted to the federal Government in 1997 for approval.
9	Flood Management of Upper Kaha Hill Torrents	44.12	Feasibility study carried out by VBB Viak and NESPAK consultants. The project is under consideration by the Federal Government under Swedish Loan/Grant.
10	Water Resources Development with Delay Action Dams in Baluchistan – JICA Grant	811.442	Approved by ECNEC. The project has been passed on to the Japanese Government for funding.
11	Flood Protection Works for Flood Affected Areas of Makran Division (Crash Program)	270.085	The PC-I has been prepared and submitted to Federal Government for approval and funding.
12	Small Irrigation Schemes under Kuwait Fund Project – Phase II	2462.5	PC-I stands submitted to Federal Government for approval/funding in 1995.
13	Fourth On-farm Water Management Project		The project is being co-financed by the World Bank and GOP. The Department has identified/proposed portfolio of projects estimated as Rs. – million. For inclusion in the project.
	Total	38963.477	

Table 10. Miscellaneous Water resources Development Projects available with the Department.

S. No.	Name of Project	Estimated Cost (M Rs.)
1	Re-Construction of Bolan Dam	100.00
2	Small Dams in Baluchistan	731.24
3	Winder Storage Dam	279.15
4	Flood Management of Hill Torrents of Baluchistan – Potential Water Conservation Schemes	5385.45
5	Command Water Management Project – Phase II	448.80
6	Construction of Delay Action Dams in Quetta Valley for Groundwater Recharge	219.30
7	Agriculture Package for Chagai announced by the Prime Minister	95.00
8	Schemes proposed under saving accruing from Kuwait Fund Phase I project	46.00
	Total	7304.94

Table 11. Water resources Development Constraints.

S. No.	Constraints	Suggestions
1	Lack of adequate capacity to undertake planning, design, implementation and impact evaluation of irrigation and drainage projects	Strengthening of design cell with multidisciplinary staff, vehicles and computer hardware and software.
2	Lack of proper human resource development program	Formulation of comprehensive local and foreign training program.
3	Lack of library and laboratory facilities	Creation/Construction of these facilities.
4	Problems associated with collection of Abiana/Water charges and drainage cess	Magisterial powers be given to the canal irrigated area staff.
5	Shortfall of O&M and development funds	<ul style="list-style-type: none"> <li>• Bridge shortfall to avoid system deterioration.</li> <li>• Funds release/authorization procedure be streamlined.</li> </ul>
6	Undue interference of Director (Dev) of Divisional Administrative Headquarters	Being non-technical, should not be allowed to interfere in development works of departments.

### 3.3 FARMERS' PARTICIPATION IN WATER MANAGEMENT: A HISTORIC PERSPECTIVE AND OPTIONS FOR IMPROVEMENTS

**Mr. Abdul Salam Baloch**  
**Director General, Agricultural Department**

Nature has endowed Baluchistan with an abundance of land for agriculture. Crops are being grown from the coastal belt to the highlands. If you explore Baluchistan, you will find that the world has exported Pakistan.

1.8 Million acres of land have been brought under cultivation. Four months ago we visited various areas and witnessed the potential for groundwater development. The requirement can easily be met if appropriate suggestions are forthcoming. As part of the solution, the Prime Minister of Pakistan has sanctioned the installation of 100 tubewells in Baluchistan.

From historic perspective we have land, but a severe lack of water. The allocation is in favor of *barani*, or flood-affected lands, etc. (Table 3.1). The remaining land is irrigated by the *salaiba* system, as this is the only source in remote and far-flung areas.

Previously, there were no diversions for flood-irrigated systems. People had no tractors, with the only source being donkeys. This meant that each person had to contribute towards constructing dykes to divert the floodwater to the command area. Those who did not participate had to pay a penalty: they were not allowed to cultivate for two years.

In *dana* or *pata*, people left the land unplowed so that run-off water could irrigate the land. The crop was enough for their survival.

Table 3.1. Historic Perspective.

<b>Barani</b>
<ul style="list-style-type: none"> <li>• Sailaba</li> <li>• Flood water</li> <li>• Rod Kohi</li> <li>• Water harvesting techniques</li> </ul>
<b>Perennial</b>
<ul style="list-style-type: none"> <li>• Karezes</li> <li>• Streams</li> <li>• Weirs</li> <li>• Korjos</li> <li>• Persian wheels</li> <li>• Open surface wells</li> <li>• Tubewells</li> </ul>
<b>Role of Community</b>
<ul style="list-style-type: none"> <li>• Water right</li> <li>• Allocation</li> <li>• Rehabilitation and maintenance</li> <li>• Fines/penalties</li> <li>• Handing over full management control of completed project to communities</li> </ul>



Thus, in the past, everyone contributed their share, including towards maintenance; or otherwise, they made cash payments. With the passage of time, employment was created, and the *karez* vanished. Every family or tribe had their own share, and they had to allocate water themselves. The responsible person had to get the water where he wanted to irrigate. Today, the problem is that our survival is at stake because with the use of tubewells, there is no recharge. After 5 to 10 years, there will be no water in Baluchistan. If farmers' associations are strong then benefits will become clear.

There are four canals in Baluchistan. Big landlords exert tremendous power without the need to involve farmers' associations and organizations. They divert the water where they want it because they think "might is right". The result is that the lands have become waterlogged and salinized.

Strong farmer-involvement is imperative: upstream, there is flooding, and downstream, farmers wait for water, and lands are inundated.

Government efforts to ensure equity are not feasible (Table 3.2). Water-related activities started in 1977, but up to 1981, only 5 watercourses had been lined. The World Bank became involved between 1981 and 1984, and 137 watercourses were improved. Water tanks were lined, land leveling activities were initiated, and whatever water was saved was used judiciously.

Then, groundwater pumping took place from about 120 feet, but now, we are drilling up to 800 feet in some valleys. That water is the legacy of our future generations. What we received from our elders must be handed down to the future generations for their survival and prosperity.

After 1986, 600 watercourses were lined. Catchment conservation, improved irrigation schemes and the trickle irrigation scheme were introduced. The introduction of trickle irrigation spanned over two years, and was launched in 8 districts. But this, too, failed, because farmers were not provided with follow-up.

Table 3.2. Government Efforts through Schemes.

1. Increasing agricultural production by effective utilization of irrigation water saved through improved water management practices applied in irrigated, *barani* and *sailaba* area.
2. Exploitation and management of water resources in *barani* and *sailaba* areas through micro irrigation, water harvesting and other improved water management practices.
3. Strengthening farmers participating in WUAs to improve water and non-water inputs management and to ensure adequate maintenance of civil works.

	Watercourse Improvement
US-Aid Pilot Project 1976-77 to 1980-81	5
World Bank OFWM-I Project 1981-82 to 1985	128
World Bank OFWM-II Project 1986 to 1990	612
US-Aid Command Water Management Project Hub 1985-86 to 1990-91	73
BMIAD Project 1982 to 1995	100
World Bank OFWM-III Project 1991 to 1996	822
Total	1740
OECF O.F.W.M. 1992-93 to 1997-98	278
BCIAP	100
PFCAD Project	1235
National Drainage	200
Construction of Delay Action Dams, Mini Dams, Bulldozer Hours, Dikes	

The area irrigated through surface irrigation yields 420 lakhs of apples. We consume 50 percent and the remaining apples go to the Punjab and Sindh Provinces. We can easily spare 10 percent for export. We must train farmers to grow for export. Apple prices have been stagnant for the last three years; there has just been no increase. At the moment we do not have a scheme to take care of these problems. Our future is at stake.

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For improvement, our options must include (see also Table 3.3):

- The total and full involvement of Water Users Associations, which must be aware of the goings-on in the province; and
- Women participation, as they use water for household consumption, washing, kitchen gardens, etc. If we involve women, their family incomes will increase.

Table 3.3. Options for Improvement.

- 
- |    |                                                                                                                                      |
|----|--------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Water user's association given much greater role in planning , design, joint supervision, more training for sustainable development. |
| 2. | Women should be consulted as part of the development.                                                                                |
| 3. | Community irrigation schemes to be picked up.                                                                                        |
| 4. | Awareness campaign.                                                                                                                  |
| 5. | Chairman should be from middle class.                                                                                                |
| 6. | Community mobilization program should be mandatory in each project.                                                                  |
| 7. | Frequent transfers.                                                                                                                  |
| 8. | Political patronage.                                                                                                                 |
| 9. | Cost recovery should be made in advance. 10% during designing and remaining before execution.                                        |
- 

Currently, only one or two families benefit from the upland projects because they own nearly all the land. We must select poor farming families who will benefit. Big landlords do not listen to anyone. Another pitfall is that whenever we initiate new projects, unwanted people appear because of the benefits involved, i.e. vehicles, sand, gravel, etc.. Once the benefits are utilized, these people move on. We should involve those who will be around for the entire duration of the project, right through until the end.

If project people are given a free hand, the results will be better. Cost recovery at 5-10 percent has been suggested. Also important, is that funds should be collected from the farmers before projects are implemented. I hope IIMI will take care of other crops in other areas also. We have only one major institutional problem; we lack water management facilities.

*Table 3.4 presents the activities to be undertaken as proposed by the speaker.*

Table 3.4. Activities to be undertaken.

---

1	Lining of watercourses
2	Precision land leveling.
3	Water storage tanks.
4	Demonstration centers/plots.
5	Water harvesting and catchment conservation.
6	Improvement of <i>Rod Kohi</i> and <i>Sailaba</i> irrigation schemes.
7	High efficiency irrigation schemes.
8	Surface drains.
9	Farmers' training centers.
10	Demonstration orchards.

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## 4 OUTCOME OF THE GROUP DISCUSSIONS (SESSION 2)

After Session 1, the workshop continued with the group discussions. The participants divided into three groups, and each group was chaired by a moderator. Appendix 3 presents the composition of each group. The main purpose of the discussions is to discuss in detail the various issues for which the need was felt to be shared with the groups participants and which need follow up by institutions. Past experiences, constraints and future ideas were discussed. The group discussions were synthesized by the moderator and was presented point-wise to the participants in the Plenary Session. The issues discussed by each group are presented in Appendix 4. In this chapter, all the suggestions were taken into consideration and grouped accordingly.

### A. Technical:

- Optimization of the groundwater resources usage: an efficient use of the water resources;
- Reuse of the water resources, e.g. the Sibi system: untreated sewage water is being treated before disposed off as effluent. The system deals with different kinds of water usage (i.e. not only for agricultural purposes;
- Research focus on watershed management: for all these years policy makers and donors have ignored watershed management. Insight into the water flow and behavior is of crucial importance. One suggestion was that the social Forestry Approach be adopted. This approach has a participatory character integrating different disciplines;
- Use of subsurface storage dams: by a recharge technique whereby an artificial increase of the infiltration rate is achieved;
- Focus on the consumptive use / water use intensity for different crops, for irrigation scheduling;
- Integrated water management approach;
- Review of research projects: already being done to a certain extent by IIMI;
- Future strategies: O&M modality; a mechanism to take care of O&M should be established; and
- Research should not only be confined to a certain number of years, but continuous support for the beneficiaries of the project, such as for water saving techniques suitable for the local environment. So, not only trickle, but more local products.

### B. Institutional:

- Updating the current act to make it more effective (governance);
- Review of institutional work by involving key agencies and key stakeholders;
- Watershed management;
- Participatory approach, i.e. *kareze* management and groundwater management;
- Review of traditional and customary laws in Baluchistan's multi-tribal society;
- Legislation should be based on scientific evidence;
- A technical committee should assess tubewell installation;
- Improve and enforce rules, regulations and laws; and
- Establish financially sustainable Water Users Associations.

### C. Miscellaneous:

- Collaboration with other research institutes and organizations;
- Public awareness;
- Actual billing of power consumption;
- Orientation of extension services;

- High level inter-departmental committee to prioritize research;
- Capacity building of research institutes, universities, local councils and line agencies to develop instruction manuals for staff and trainees;
- Financial analysis of pressurized irrigation systems;
- Assistance to line agencies to prioritize development projects and to prepare PCIs;
- Duplication of efforts;
- Financial support, incentive, disseminating awareness about possible benefits, constraints, flat rates, overhead charges, etc.;
- Issues associated with electricity pricing; and
- Charging full cost accounting for water supply.

## 5 CLOSING SESSION

### 5.1 CLOSING ADDRESS

BY MAJOR NADIR KHAN, ADDITIONAL CHIEF SECRETARY (DEVELOPMENT)

Dr. Prathapar, Director, International Irrigation Management Institute, Dr. Zafar Altaf and distinguished guests, it gives me a real pleasure to be here for the concluding session on this Water Resources Management Workshop. We appreciate and commend the efforts of IIMI for arranging this whole-day workshop on this subject. I am sure that the issues and findings mentioned by Dr. Prathapar, particularly on the past experiences and future strategies, would provide a framework for us to understand the problems of Water Resources Management in Baluchistan. We share your perception that Baluchistan is faced with many problems, such as scarce groundwater, a lack of irrigation facilities, variable rainfall, inadequate funds, deficient data, and negligent research activities. These problems are compounded with ignorance and illiteracy among the farmers. Though IIMI's presence in Baluchistan is small, however, it is our desire that they should have a sizeable activity in this province, particularly in the area of research, which has always been neglected in the past.

As you may be aware, water resources management and agriculture depend on each other; better water management increases agricultural productivity and similarly, agriculture and livelihood go hand in hand. Baluchistan, which constitutes 44 percent of the total area of the country, depends largely on agriculture and livestock. As we know, the province does not have adequate perennial water resources, except in the Nasirabad Division. In the rest of the province, irrigation depends on floodwater, tubewells and *karez*s. Therefore, the need for water resources management in Baluchistan is more important than any other area in Pakistan. The upland area excels in the production of a number of fresh and dry fruits, besides the food grain crops of Pakistan. On one hand, the province produces:

- 92 percent of cherries;
- 90 percent of grapes;
- 95 percent of almonds;
- 79 percent of apricots;
- 76 percent of peaches;
- 65 percent of pomegranates;
- 51 percent of apples; and
- 34 percent of plums in the country.

More than 80 thousand farming communities are engaged in fruit farming, which constitutes more than one-third of all agricultural households and 14 percent of the cropped area. On the other hand, water is considered the main constraint in the development of agriculture in the province. Groundwater resources are also limited in quantity. Over the years these resources have come under stress because of excessive water extraction.

At present, only 4.6 percent of the total land area of Baluchistan is cultivated. The limited rainfall and water availability drastically restricts the land area under cultivation. In the last decade (1986 – 1996), the cultivated area in the province increased by 16 percent due to the increased availability of irrigation water and the development of culturable wasteland. However, an area of 4.73 million-hectare cultivable wasteland is still available and can be developed for crop production. We hope that IIMI would have discussed the ways and means to develop this culturable wasteland.

While the government is fully cognizant of the problems, the major goal of policy and planning in the water sector will continue to be maximizing crop production, particularly of wheat and cotton. The measures would be through progressively increasing surface water supplies, harnessing rain water for recharging groundwater, improving the existing management practices by using the latest technology available, institutional reforms and by developing partnerships with communities and NGOs, like IIMI. Here, I would like to share with the participants that during the years 1997 and 1998, out of the total allocation of Rs. 804.41 million, an amount of Rs. 645.43 million (80 %) was utilized on the extension, remodeling and rehabilitation of 19,000 km of irrigation channels and remodeling 306 structures. These measures benefited 6,000 hectares of cropped land. In this financial year, an amount of Rs. 794.88 million has been allocated in the provincial ADP to carry out extension, remodeling and rehabilitation of irrigation channels. That, in turn, would benefit a cropped area of thousands of hectares of land.

I expect that by mutual consultation and an exchange of experiences among the participants of the workshop, a viable and comprehensive strategy for efficient use of water resources will be formulated. As I have already said, due to water scarcity, the need for water management in Baluchistan is of cardinal importance. Our financial constraints and weak institutional capacity limit our ability to invest more in this sector, introduce modern techniques in water management, and allocate funds for research and the education of farmers. We, therefore, wish to seek partnership in this sphere with communities, NGOs and donor agencies to increase the productivity of water through better management of irrigation, which in turn contributes to food security and poverty alleviation, the main task of the present government.

With these remarks, I thank you for giving me this opportunity to share with you my views and concerns for enhancing the water management system of our agricultural productivity on a sustainable basis. I wish you every success.

## **6 WATER RESOURCES MANAGEMENT RELATED TO RESEARCHABLE TOPICS IN THE HIGHLANDS OF BALUCHISTAN**

Natural water resources are under threat in Pakistan and proper interventions are necessary in order to combat the negative effect of irrigation agriculture on the environment. During the group discussions of the workshop many issues arose pertaining to the water resources management and institutional deficiencies, and also the on insufficient capacity to improve the current situation. Based on the outcome of the group discussions, researchable topics have been identified, which will form the core for the formulation of a research and development project in collaboration with national partners.

The following three main themes are identified:

- A. Operation and management of water resources;
- B. Institutional development; and
- C. Capacity building

### **6.1 OPERATION AND MANAGEMENT OF WATER RESOURCES**

#### **Activity A-1: Monitoring and evaluation of Delay Action Dams**

**Background:** The earliest type of delay action dam dates back to 1890, and was/is called the *Khushdil Khan Bund* in Pishin District. To date, about 141 Delay Action Dams have been constructed in various Districts of Baluchistan (i.e. Quetta, Qila Saifullah, Pishin, Kalat, Mashtung, Ziarat, Lorelai, Barkhan, Zhob, Turbat, Khuzdar, Panjgoor, Gawadar). The concept of delay action dams is to restore the reduced flow in *karez*es and recharge falling water table levels, especially in open wells; or, in other words, to improve ground water recharge. The effect of the delay action dams on the ground water recharge is debatable. Reportedly, the dams function appropriately on the one hand, and on the other hand, improperly. The appropriately main constraint faced is the sealing effect due to sedimentation, which gradually reduces the infiltration capacity and thus, diminishes the purpose for constructing the dams, resultantly considerably reducing the life span of the delay action dams. The recommendation has been the requirement for more research on the effects of the delay action dams; technically, as well as institutionally.

#### **Objectives:**

- To monitor and evaluate the extent of recharge under delay action dams, constructed at various hydrogeological settings;
- To evaluate the magnitude of vertical water movement of the infiltrated water;
- To perform a critical review of the existing delay action dams, based on monitoring and evaluation reports; and
- To assess the institutional requirements for optimum operation and management of delay action dams.



**Expected outcome:**

- Determination of the effectiveness of delay action dams in terms of recharge to the groundwater;
- Clarity to the magnitude and extent of the vertical water movement around delay action dams and to predict its impact on ground water recharge; and
- The development of community based institutions, which ensure effective functioning of Delay Action Dams after construction.

**Clients targeted:** Community (water users)

**Possible agencies as collaboration:** Baluchistan Irrigation and Drainage Authority, WAPDA, tie into the National Drainage Program (NDP)

**Activity A-2: Minimizing groundwater extraction by adopting improved irrigation practices**

Efforts have been made to reduce conveyance losses by lining watercourses. However, still more water can be saved if proper measures are taken. An increase in water use efficiency (more crop per drop) will be of benefit to the farmer (to irrigate more land during his irrigation turn) and the environment, which is threatened by the declining ground water levels. Ultimately, this may lead to the inaccessibility of ground water for human and agricultural needs. Past efforts have been undertaken to develop pressurized irrigation schemes; however, activities remained confined to the few farmers who hardly expanded the area due to the lack of incentive and follow-up. Together with the water users, feasible irrigation practices should be designed and adopted to reduce the dependence on tubewell operation. Further, for a more detailed investigation of the potential of rainwater harvesting, the collection of flood, snow and spring waters will contribute to an increase in available surface water; hence, the dependence on tubewell operation can be reduced.

**Objectives:**

- To use improved surface and pressurized irrigation methods and practices to control the over-exploitation of groundwater resources in the area; and
- To assess the potential of water harvesting methods used in conjunction with surface water use in order to reduce the extensive ground water usage.

**Expected outcome:**

- The development of feasible water conservation measures and determination of tangible impacts on the water usage; and
- The development of feasible water harvesting techniques that quantifies its impact on ground water usage.

**Clients targeted:** Community (water users)

**Possible agencies as collaborators:** Agricultural Department (OFWM), Arid Zone Research Institute, BCIAP-water management unit, Water Resources Research Institute, tie into the NDP.

## 6.2 INSTITUTIONAL DEVELOPMENT

The transformation of Provincial Irrigation Departments to Provincial Irrigation and Drainage Authorities (called BIDA for Baluchistan Province), have created the opportunity for farmers to realize their share, and to have a role and voice in water resources management. Farmers, however, have to join hands and be “organized” in order to facilitate their new role in the operation and management of irrigation schemes. Under the BCIAP Project, farmers have been organized in various small-scale irrigation schemes. Further, this activity took place under the Patfeeder Command Area Development Project (Nasirabad District). However, the formation of farmer organizations and its effectiveness in water resources management have to be closely monitored and evaluated. Baluchistan is considered different from the other provinces because it is dominated by the tribal setup comprising various communities who have their own rules and regulations. From a research and development point of view, these tribal systems should be scrutinized and their water management practices and related rules should be understood prior to the recommendation and implementation of any institutional modifications and thus, to achieve sustainable institutional development. This activity will tie in with the activity pertaining to farmers’ participation in the operation and management of delay action dams.

- Activity B-1: Assessing and strengthening farmers’ participation in water resources management.
- Activity B-2: Assessing the effectiveness of farmer-organization in small-scale irrigation schemes.
- Activity B-3: Identifying the customary laws and official rules and regulations under the multi-tribal system and its effect on current water management practices.

### **Expected outcome:**

- Clarity to the actual role of farmers in water resources management and the identification of areas of strengths and weaknesses;
- Strengthening and/or establishment of farmers’ organizations (FO), which should have attained the ability to fulfill their role in water resources management;
- Clarity to the water management rules and regulations under the multi-tribal system and the effect of these on water management practices, as well as the extent that these practices differ from the governmental rules and regulations.

**Clients targeted:** Farmer-organizations, farming community (water users)

**Possible agencies as collaborators:** On-Farm Water Management and Agricultural Extension (Agricultural Department), BIDA, BCIAP-institutional unit, Water Resources Research Institute, local NGO(s), tie into the NDP.

## 6.3 CAPACITY BUILDING

During the workshop various participants raised the need for capacity building activities, such as curriculum improvement, manual revision, and training services and assistance. Although capacity building is not a research activity, it is a crucial component for improved water resources management, since the appropriate manpower is required for sustainable improvement to happen. Over the years IIMI has gained considerable experience in conducting various capacity building activities and shares, as indicated during the workshop, the importance of including a capacity building component in any future research program in Baluchistan.

- Activity C-1: Providing training and assistance with curriculum development and improvement for local development, extension workers and institutions (local councils, line agencies, education institutions, etc.) involved in water resources management.
- Activity C-2: Proposing improved strategies for extension services to the farmers about efficient water resources management.
- Activity C-3: Providing advice on improvements in data-based management, and improved data accessibility.

**Expected outcome:**

- Improvement of curriculum and capacity for local development, extension workers and institutions (local councils, line agencies, education institutions, etc.) involved in water resources management.
- Ability of trained extension workers to disseminate their knowledge to farmers, and to service the farming community's water resources management issues.
- Development of data-bases and improved data base management and accessibility.

**Clients targeted:** Extension workers, line agencies, etc., farming community (water users)

**Possible agencies as collaborators:** Agricultural Extension (Agricultural Department), BIDA, tie into the NDP.

## APPENDICES

### APPENDIX I      WORKSHOP PROGRAM

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9:30 - 10:00	<i>Arrival and registration of the participants at the Qila Saifullah Hall, Serena-Quetta</i>
10:00 - 10:30	<b><i>Inaugural Session</i></b>  <i>Recitation from the Holy Quran</i> <i>Introduction to IIMI-Pakistan and Workshop Briefing: Dr. S.A. Prathapar, Director, IIMI-Pakistan</i> <i>Opening Address: Mr. Haji Behram Khan Achakzai: Minister of Irrigation and Power</i>
10:30 - 10:45	<i>Tea Break</i>
10:45-11:45	<b><i>Session I: Presentations related to water resources management issues in Baluchistan</i></b>  <i>Chairman: Dr. Zafar Altaf, Chairman, IIMI-Pakistan Board of Governors</i>
10:45-11:00	<i>Speaker 1: Engineer Abdus Salam Khan, Secretary, Irrigation and Power Department: Government actions to tackle the water resources problems in Baluchistan: past experiences and future strategies.</i>
11:00-11:15	<i>Speaker 2: Mr. Abdul Salam Baloch, Director General, Agricultural Department: Farmers' participation in water management: a historic perspective and options for improvements.</i>
11:30-11:45	<i>Questions and Discussion</i>
11:45-13:15	<b><i>Session 2: Group discussions and formulation of recommendations for future research</i></b>  <i>Moderator for Group 1: Mr. Bashir Ahmad Mian, Director General, BIDA</i> <i>Moderator for Group 2: Dr. S.A. Prathapar, Director, IIMI-Pakistan</i> <i>Moderator for Group 3: Dr. M.S. Shafique, International Sub-consultant, IIMI-Pakistan</i>
13:15-14:15	<i>Prayer and Lunch Break</i>
14:15-15:00	<i>Plenary Session: Outcome of group discussions presented by the moderators</i>
15:00-15:45	<b><i>Closing Session</i></b>  <i>Dr. S.A. Prathapar, Director, IIMI-Pakistan: Summary of the major findings; Chairman, Major (Retd.) Nadir Khan, Additional Chief Secretary (Development): Closing address; and</i> <i>Dr. Zafar Altaf, Chairman, IIMI-Pakistan: Concluding remarks.</i>
15:45 – 16:00	<i>Tea</i>

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## APPENDIX 2 LIST OF PARTICIPANTS

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## **APPENDIX 4      MAIN ISSUES DISCUSSED DURING THE SESSION**

### **Group 1**

The group has identified the following issues related to water management, i.e.:

- Collaboration with research institutions;
- Groundwater management;
- Public awareness;
- Re-use of resources;
- Actual use of water saving techniques;
- Watershed management;
- Actual billing;
- Participatory approach;
- Extension services
- Integrated approach: linking disciplines;
- Review research projects;
- Review and modify training programs;
- All future research should be participatory; and
- Access to data.

### **Group 2**

The group has identified the institutional and technical issues related to water management in Baluchistan, i.e.:

#### **Institutional:**

- Management of karezes: there is no responsibility and a management group is needed;
- Lack of coordination: the capacities of line agencies must be enhanced;
- Inadequate capacities of local institutions and of local awareness;
- Customary laws: multi-tribal communities exist in Baluchistan and links should be studied further;
- University curriculum should be revised;
- A comprehensive database needs to be established;
- Prioritizing the means as to which circumstances would be conducive to recharge;
- Involving community management;
- The need to help agencies to prioritize their needs; and
- Groundwater organizations are another need towards training and capacity-building.

#### **Technical:**

- A thorough review of what has already been done is needed;
- The lack of proper data exists, for example, do we know how much water is being lost? Do we quantify run-off?;
- Dams are in inappropriate settings: a complete hydrogeological survey needs to be conducted;
- Integrated water management needs to be introduced;
- Irrigation practices are deficient, i.e. varying root zones;
- Artificial recharge is necessary: so that water is not lost due to evaporation; and
- Groundwater insulation: there is need to establish a technical committee.

### **Group 3**

The discussion has been divided into institutional, technical and financial issues, and in certain instances, constraints. We have also provided separate recommendations for each.

#### **Institutional:**

- The lack of coordination;
- The lack of political will;
- The lack of appropriate legislation;
- Duplication of efforts;
- The lack of capacity to manage water;
- The lack of community involvement; and
- One positive comment is that legislation in Baluchistan is positive.

#### **Recommendations:**

- Improved and forcible groundwater legislation;
- Mass awareness through various media;
- Strengthening or empowering water users; and
- Effective coordination among various relevant agencies.

#### **Technical:**

- Over-exploitation of groundwater.

#### **Constraints:**

- Ineffective use of groundwater;
- Problems associated with adaptation, such as irrigation scheduling; and
- Lack of awareness pertaining to the nature and extent of groundwater resource.

#### **Recommendations:**

- Research and pilot testing techniques;
- Proper watershed management; and
- Combined use of tradition and technology.

#### **Financial:**

- Support is vital;
- Incentive is necessary; and
- Awareness is crucial.

#### **Constraints:**

- Flat rate groundwater pumping charge;
- Complicated procedure for loan schemes; and
- Lack of awareness on benefits of the water system.

#### **Recommendations:**

- The flat rate should be discouraged;
- Joint resource mobilization is necessary; and
- Communities should be encouraged to raise their own funds.

# IIMI-PAKISTAN PUBLICATIONS

## RESEARCH REPORTS

Report No.	Title	Author	Year
R-1	<b>Crop-Based Irrigation Operations Study in the North West Frontier Province of Pakistan</b> Volume I: Synthesis of Findings and Recommendations	Carlos Garces-R D.J. Bandaragoda Pierre Strosser	June 1994
	Volume II: Research Approach and Interpretation	Carlos Garces-R Ms. Zaigham Habib Pierre Strosser Tissa Bandaragoda Rana M. Alaq Saeed ur Rehman Abdul Hakim Khan	June 1994
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R-2	Salinity and Sodicty Research in Pakistan - Proceedings of a one-day Workshop	J.W. Kijne Marcel Kuper Muhammad Aslam	Mar 1995
R-3	Farmers' Perceptions on Salinity and Sodicty: A case study into farmers' knowledge of salinity and sodicty, and their strategies and practices to deal with salinity and sodicty in their farming systems	Neeltje Kielen	May 1996
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R-18	<b>Proceedings of National Conference on Managing Irrigation for Environmentally Sustainable Agriculture in Pakistan</b>	M. Badruddin Gaylord V. Skogerboe M.S. Shafique (Editors for all volumes)	Nov 1996
R-18.1	Volume-I: Inauguration and Deliberations		
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R-19	Detailed Soil Survey of Eight Sample Watercourse Command Areas in Chishtian and Hasilpur Tehsils	Soil Survey of Pakistan IIMI-Pakistan	Nov 1996
R-20	Unsteady Flow Simulation of the Designed Pehur High-Level Canal and Proposed Remodeling of Machai and Miara Branch Canals, North West Frontier Province, Pakistan	Zaigham Habib Kobklat Pongput Gaylord V. Skogerboe	Dec 1996
R-21	<b>Salinity Management Alternatives for the Rechna Doab, Punjab, Pakistan</b>	Gauhar Rehman Waqar A. Jehangir Abdul Rehman Muhammad Aslam Gaylord V. Skogerboe	May 1997
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R-22	Salinisation, Alkalinisation and Sodification on Irrigated Areas in Pakistan: Characterisation of the geochemical and physical processes and the impact of irrigation water on these processes by the use of a hydro-geochemical model (M.Sc Thesis published as Research Report)	Nicolas Condom	Mar 1997
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R-27	Fluctuations in Canal Water Supplies: A Case Study	Shahid Sarwar H.M. Nafees M.S. Shafique	June 1997
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R-39	<b>Monitoring and Evaluation of Irrigation and Drainage Facilities for Pilot Distributaries In Sindh Province, Pakistan</b>		
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R-40.2	Volume Two: Heran Distributary, Sanghar District	Abdul Majeed Ansari Niaz Hussain Sial Abdul Jalil Ursani Ghulam Shabir M. Ghous Laghari M. Naveed Khayal Bakhshal Lashari M. Akhtar Bhatti Gaylord V. Skogerboe	Dec 1997

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R-41.2	Volume Two: Bareji Distributary, Mirpurkhas District	Muhammad Nadeem Mohsin Khatri Syed Daniyal Haider	Dec 1997
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R-44	Self-Help Maintenance Activities by the Water Users Federation of Hakra 4-R Distributary	Waheed uz Zaman	Feb 1998
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R-69	Preliminary Business Plan for the Water Users Federation of the Hakra 4-R Distributary	Mehmood Ul Hassan Mohsin Khatri	Nov 1998

Report No.	Title	Author	Year
R-70	<b>Waterlogging and Salinity Management in the Sindh Province</b>		
R-70.1	Volume I: Irrigated Landscape: Resource Availability across the Hydrological Divides:	Gauhar Rehman Asghar Hussain Abdul Hamid Amjad Siddique Almas Mehmooda Tabassum Muhammad Anas Nomani Kamran Yousaf	Dec 1998
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Report No.	Title	Author	Year
R-79 Final Report	Hydraulic Simulation to Evaluate and Predict Design and Operational Behavior of Chashma Right Bank Canal	Zaigham Habib Kamal Shah Alexandre Vabre Kalim Ullah Mobin ud Din Ahmed	March 1999
R-80 Final Report	Social Organization for Improved System Management and Sustainable Irrigated Agriculture in Small Dams	Ralf Starkloff Don Jayatissa Bandaragoda Muhammad Asghar Cheema Muhammad Akhtar Bhatti	Apr 1999
R-81	Root Zone Salinity and Sodcity Management in the Fordwah Eastern Sadiqia (South) Irrigated Area	Muhammad Aslam Abdul Hamid Asghar Hussain Mehmooda Tabassam	May 1999
R-82	Disseminating the Bed-and-Furrow Irrigation Method for Cotton Cultivation in Bahadarwah Minor (Joint Research Dissemination Program) Joint OFWM-IIMI Report	Jeroen Alberts Ineke M. Kalwij	May 1999
R-83	Disseminating the Bed-and-Furrow Irrigation Method for Cotton Cultivation in the Hakra-4R Distributary in Collaboration with the Water Users Federation (Joint Research Dissemination Program)	Ineke Margot Kalwij Zafar Iqbal Mirza Anjum Amin Ahdul Hameed	May 1999
R-84	Monitoring and Evaluation of Agro-Economic Benefits and Project Impact for Fordwah Eastern Sadiqia (South) Irrigation and Drainage Project  Joint WMED-IIMI Report	Muhammad Sadiq Hassan Abdul Raouf M. Akram Shahid Gaylord V. Skogerboe Muhammad Aslam Saeed ur Rehman	June 1999
R-85	Inflow-Outflow Channel Losses and Canal Lining Cost-effectiveness in the Fordwah Eastern Sadiqia (South) Irrigation and Drainage Project	Gaylord V. Skogerboe Muhammad Aslam Musthaq Ahmed Khan Khalid Mahmood Shehzad Mahmood Abdul Hakeem Khan	June 1999
R-86	Spatial and Temporal Groundwater Recharge Assessment in the Fordwah Eastern Sadiqia (South) Project Area	Muhammad Shafqat Ejaz Hafiz M. Nafees Ahmed	June 1999
R-87	Water Performance Indicators Using Satellite Imagery for the Fordwah Eastern Sadiqia (South) Irrigation and Drainage Project	Thomas Alexandridis Salman Asif Samia Ali	June 1999
R-88	Water Supply and Water Balance Studies for the Fordwah Eastern Sadiqia (South) Project Area	Bakhshal Lashari Ineke M. Kalwij Albert P. Reichert	June 1999
R-89	Institutional Measures for Improved Management of Fordwah Eastern Sadiqia (South) Irrigation and Drainage Project	Waheed uz Zaman Ralf Starkloff	June 1999
R-90 Final Report	Analysis of Water and Salinity Management Alternatives for Increasing Agricultural Production in the Fordwah Eastern Sadiqia (South) Irrigation and Drainage Project	Gaylord V. Skogerboe Saeed ur Rehman Muhammad Aslam Albert P. Reichert	June 1999
R-91	Assessment of Water Distribution at Watercourse and Minor Level of Bahadarwah Minor	Sarfraz Munir Ineke Margot Kalwij Mattijs Brouwer	July 1999
R-92	Water Resources Management Research Issues in the Highlands of Balochistan: Workshop Proceedings	Ineke Margot Kalwij Verenia Duke S.A. Prathapar	July 1999