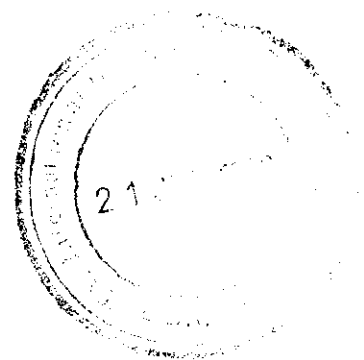


**PILOT PROJECT FOR FARMER-MANAGED IRRIGATED AGRICULTURE
UNDER THE LEFT BANK OUTFALL DRAIN STAGE-1 PROJECT, PAKISTAN**

**PRELIMINARY BUSINESS PLAN
for
DHORO NARO MINOR**

by

**Parvez Ahmad Pirzada
Mohsin Khatri
Syed Daniyal Haider**



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FOREWORD

The Water Users Federation (WUF) for each pilot distributary was established in mid-December, 1996. Unfortunately, Mr. Amin Sohani, who was entrusted with the task of developing the Business Plans for these three Pilot Distributaries resigned in July 1997 to pursue a Ph.D, degree in the U.S.A.

After some search, I and Mr. Don J. Bandaragoda, Project Leader decided to request Syed Daniyal Haider, Finance Controller, IIMI-Pakistan to take up this task. He was joined by Mr. Mohsin Khatri a recent MBA and Mr. Pervaiz Ahmed Pirzada, Social Organizer, Nawabshah Field Station.

They started their work by conducting a comprehensive field survey to record the inventory of crops on 1 October 1997. This was not an easy task so the services of persons having the necessary skills and experience to undertake this survey were hired. This task took more than 75 days, but in the end, even the field staff felt good as this survey gave them in depth knowledge of the pilot distributaries.

This Preliminary Business Plan focuses on the irrigation network only, not the drainage system which is why I have preferred to call it as preliminary. After a comprehensive study of the drainage network, we shall come out with the Proposed Business Plan, which once tested in the field by the WUF will form the basis for the Final Business Plan.

I am very pleased about the outcome of this endeavor and find this report to be a good solid piece of work. Considering the enactment of the SIDA Act, I personally feel this report may provide a very valuable financial information on the affairs of both the Irrigation department and the viability of the WUF. Certainly, this combination of a professional accountant, a business administration graduate, and a field person has proved very effective.

Gaylord V. Skogerboe, Director
Pakistan National Program
International Irrigation Management Institute

ACKNOWLEDGEMENTS

The hypothesis for this report was that the farmers are paying more than what is required to maintain the present irrigation infrastructure at the minimum level. In the end, this hypothesis proves to be somewhat correct. The authors express their profound thanks to Dr. Muhammad S. Shafique, Senior Irrigation Specialist, IIMI-Pakistan, for this hypothesis and for providing guidance to them from time to time.

Thanks are due to Dr. Yameen Memon, who kept everyone in line and on the right track. Dr. Bakhshal Khan Lashari, Abdul Hakeem Khan, Robina Siddique, Dr. Shafquat Ejaz and Mehmood ul Hassan for sharing their knowledge with us. Zaigham Habib we thank for changing our whole data collection methodology by informing us that farmers seldom provide accurate information.

For the authors, this is a first report, and we are thankful to Prof. Gaylord V. Skogerboe, Director, IIMI-Pakistan, and Mr. Don J. Bandaragoda for their confidence in us.

The authors express their good fortune having Mr. David A. Governey, Director Finance and Administration, IIMI, for his valuable comments. We acknowledge most of our errors in judgment pointed out by him.

Tabrez Ahmad we thank for his secretarial support, which was indeed one of the most valuable inputs, while Verenia Duke did the most difficult task of editing this report. Special thanks to these two gentlepersons.

In the end, our gratitude has to be extended to two persons: (1) Dr. Muhammad Aslam for showing all the patience in the world listening to our ideas about Waterlogging, Salinity and Sodicity (which were non-existent most times) and for correcting our ideas; and (2) Ineke M. Kalwij, from whom we learned the way irrigation systems work, the basics of writing a research report and how to present and interpret the research results.

1 DESCRIPTION OF THE DHORO NARO SECONDARY CANAL

1.1 LOCATION

The Dhoro Naro Minor, Nawabshah, was selected as the pilot secondary canal (minor) under the "Pilot Project for Farmer-managed Irrigated Agriculture under LBOD Stage 1 Project, Pakistan", in November 1995.

The Dhoro Naro Minor off-takes from the Gajrah Branch Canal. The head regulator of this minor is situated just outside, and towards the east of Nawabshah City, only a distance of 5 kilometers from the IIMI-Nawabshah Field Station, and its tail reach, almost 20 kilometers away. The Dhoro Naro Minor is located about 120 kilometers from the main city of Hyderabad, and approximately 270 km from the Sindh provincial capital of Karachi.

1.1.1 Historical Background

The present irrigation infrastructure of the Indus Basin in the Sindh province was established in 1932, coinciding with the construction of the Dhoro Naro Minor. "Dhoro Naro" is derived from the Sindhi language, where *dhoro* means "low-lying", and *naro* means "flow", roughly translating into "low-lying flow", or "secondary canal", but flowing with good water conveyance. At present, however, this situation no longer prevails. The gate of this secondary canal was replaced with a new, smaller gate at Chann Baboo Secondary Canal (near the head regulator of the Dhoro Naro Minor) a few years ago, and since, the flow of the Dhoro Naro Minor has slowed down. According to farmers in the area, this slow flow causes quick siltation in this minor, and has affected the once- good water conveyance velocity even further. This is the core reason for water shortages in the tail reaches of this minor, especially during the summer season. Farmers compare erstwhile years, before the change in the head regulator, when it was very difficult to swim in this minor due to a good quantity and velocity of water, with the present-day scenario of small children being able to swim in this minor with ease.

1.1.2 Geographical Features

The Dhoro Naro Minor command area is a nondescript stretch of land, about 17 kilometers long and roughly 7 kilometers wide. As this area is situated at the intersection of Nawabshah and Sanghar Districts, therefore, from an administrative point of view, it is divided into two districts; but, from an irrigation point of view, however, it falls in the Nawabshah Division.

1.2 ADMINISTRATIVE CONTROL

From an irrigation administrative point of view, the Dhoro Naro Minor is in the Nasrat Division, Nawabshah, where almost 70 branch / secondary canals are situated.

The total length of the Gajrah Branch Canal is 91.4000 RD, where the Dhoro Minor off-takes at the tail. The design discharge of the Gajrah Branch Canal is 390 cusecs, but irrigation department staff measures its actual discharge to be about 700 cusecs. The Culturable Command Area (CCA) of the Gajrah Branch command area is 93,983 acres, and its Gross Command Area (GCA), 102,400 acres.

The Gajrah Branch Canal off-takes from the Nasrat Branch Canal almost at its tail, at RD 218.500. The total length of the Nasrat Branch Canal is 316.100 RDs. The design discharge of the Nasrat Branch Canal is 1,950 cusecs, but according to the irrigation department staff, however, its discharge is normally about 3400 cusecs. The CCA and GCA of the Nasrat Branch Canal is 5,07,256 and 5,25,773, respectively.

The Nasrat Branch Canal off-takes from the Main Rohri Canal at RD 328.000. The design discharge of the Rohri Canal is 11,200 cusecs, but information obtained by the IIMI-DSS team ascertains that its actual discharge varies between 18,000 and 20,000 cusecs. The CCA and GCA of the Rohri Canal is 2.561 million and 2.664 million acres, respectively.

The Rohri Canal off-takes from the Sukkur Barrage. The design discharge of the Sukkur Barrage is 65,000 cusecs, with a flushing discharge of 50,000 cusecs. Sukkur Barrage comprises an area of 7.63 million acres. The detail of secondary canals under the Gajrah Branch Canal is given in Table 1.

Table 1. Names of Secondary Canals under Gajrah Branch Canal.

S #	Name of Secondary Canal	RD #
01	Daro Minor	15.5
02	Kandi Minor	15.5
03	Kiranjhro Minor	53.500
04	Dago Minor	53.500
05	Chodiko Minor	53.500
06	Dhoro Naro Minor	91.4
07	Khiaryoon Minor	91.4
08	Chann Baboo Distributary	91.4

Source: Nasrat Irrigation Division, Nawabshah.

1.2.1 Location of Irrigation Offices

The office of the Nasrat Division, of which Dhoro Naro forms part, is situated in the center of Nawabshah City.

An Executive Engineer heads the division level, with other staff consisting of a Divisional Accountant, one Head Clerk, one Draftsman, one Tracer; 5 Senior Clerks, 8 Junior Clerks and other subordinate staff. The Nasrat Division, Nawabshah, has 4 Sub-divisions.

The Dhoro Naro Minor also forms part of the Nawabshah Sub-division, the office of which is situated almost in the center of Nawabshah City. With two Assistant Executive Engineers at the Sub-division level, other staff includes Sub-engineers, *Daroghas*, *Beldars*, *Abdars*, *Tandels*, Canal Assistants, Clerks, Telephone Operators and other subordinate staff.

At the secondary canal level, staff consist of one Sub-engineer, one *Darogha*, one *Abdar* and two *Beldars*, and one *Tandel*, who operates the gate of the secondary canal.

1.3 PHYSICAL CHARACTERISTICS

The CCA and GCA of the Dhoro Naro minor is 13,161 and 15,067 acres, respectively. The length of the Dhoro Naro Minor is 32.275

This minor is at the tail of the Gajrah Branch Canal. The design discharge of this distributary is 51.62 cusecs, but the actual discharge of this minor, however, is about 57 cusecs. As this is a gravity flow minor, therefore, farmers have no need to install lift machines. The details of variances in the bed widths and individual CCAs of this minor's watercourses are presented in Tables 2 & 3, respectively.

Table 2. Design and Actual Bed Widths of the Dhoro Naro Minor.

Location (RD #)	Design Width	Actual Width (Average)
00+000 to 05+700	16.0 ft	20.15 ft
05+700 to 08+987	15.0 ft	18.75 ft
08+987 to 11+000	15.0 ft	13.00 ft
11+000 to 14+946	13.0 ft	12.00 ft
14+946 to 22+076	10.5 ft	11.0 ft
22+076 to 29+500	09.0 ft	09.0 ft
29+500 to 32+275	07.0 ft	06.0 ft

Source: Design (Nasrat Irrigation Division, Nawabshah)
Actual (Measured by IIMI Field Staff, Nawabshah)

Table 3. Culturable Area of the Different Watercourses of the Dhoro Naro Minor.

S #	W/C #	CCA (acres)	S #	W/C #	CCA (acres)	S #	W/C #	CCA (acres)
1	10L	776	10	2L	635	19	5R	403
2	11L	279	11	2R	400	20	6AR	175
3	1AL	552	12	3L	599	21	6L	804
4	1BL	866	13	3R	388	22	6R	206
5	1CL	978	14	4AL	76	23	7L	928
6	1DL	358	15	4BL	437	24	7R	320
7	1L	491	16	4L	360	25	9L	652
8	1R	328	17	4-R	1114			
9	2AL	441	18	5L	595		Total:	13,161

Source: Physical Assessment Survey by IIMI Field Staff, Nawabshah.

1.3.1 Technical Problems

This minor has not been remodeled, and is in a dilapidated condition, as are the inspection and non-inspection paths. However, the Water Users Federation (WUF) of the Dhoro Naro Minor has initiated the construction of an inspection path, and repair of the non-inspection path. Due to the siltation problem in this minor, excavation is necessary. The WUF of this minor has actively excavated the Dhoro Naro Minor, at their own expense, in January and June, 1997. This minor has 25 outlets, of which 16 are lined, and 9 are unlined.

Another problem faced by the farmers of the Dhoro Naro Minor is water shortage, especially during the *kharif* season. The main reasons are: (1) that this minor is situated at the tail of the branch canal; and (2) siltation in the minor, which the farmers attribute to the design fault in the head regulator. Therefore, farmers also use irrigation tubewells to irrigate their lands, besides the canal water of 51 irrigation tubewells in the Dhoro Naro command area.

Water supply reliability at the head of the Dhoro Naro secondary canal is 24.86%, and the mean water duty is 4.28 acres / 1000 acres. The average equitable water distribution at the outlets of the Dhoro Naro Minor is 78 %. The comparison of the average actual, and the designed water duties, are presented in Table 4.

Table 4. Reach-wise Design and Actual Water Duties at Dhoro Naro Minor.

Reach	Design Water Duty (cfs / 1000 acres)	Actual Water Duty (cfs / 1000 acres)
Head	3.5	5.99
Middle	2.8	6.03
Tail	3.1	2.47

Source: Measured by IIMI Field Staff, Nawabshah.

1.4 SOCIO-ECONOMIC CONDITIONS

The Dhoro Naro command area has a population of about 20,000. With few registered villages in the command area, landowners have erected their homes in the fields, called *dehs*, or hamlets. Of the 9 *dehs* in this command area, most are in the Khiaryoon and Gojro *Dehs*, with few in Kalri and Gupchani *Dehs*.

1.4.1 Dehs in Dhoro Naro Minor Command Area

1. Deh Khiaryoon

This *deh* is one of the two biggest in the Dhoro Naro command area, and at the head and right sides, are within the jurisdiction of Taluka and District Nawabshah. Watercourse numbers 1-R, 2-R, 3-R, 4-R, 5-R, 4-AL, and small sections of 6-R, are located there.

2. Deh 87-A

Also located in Taluka and District Nawabshah. This *deh* is at the head and left sides of the Dhoro Naro command area, and encompasses watercourse numbers 1-DL, 1-L and 1-AL.

3. Deh 87-Nasrat

Another *deh* in Taluka and District Nawabshah, and encompassing watercourse numbers 1-BL, 1-CL and 2-L, this *deh* is also at the head and left sides of the command area.

4. Deh 104-Nasrat

At the head, middle and left sides of the Dhoro Naro command area, and taking in watercourse numbers 1-BL, 1-CL, 2-L and 3-L, this *deh* is also in Taluka and District Nawabshah.

5. Deh Gojro

This command area is situated at the head, middle and tail, and at the left sides, of the Dhoro Naro command area, and is the second of the two biggest *dehs*. The command area includes watercourse numbers 2-L, 2-AL, 3-L, 4-L, 4-BL, 5-L, 6-L, 7-L and 9-L, in Taluka Shahdadpur, District Sanghar.

6. Deh Panjo Chann

Encompassing the middle and tail, and the right sides, this *deh* is another in Taluka Shahdadpur, District Sanghar. Watercourse numbers 5-R and 6-R are in this command area.

7. Deh Jheemal

Watercourse command areas 7-R, 10-L and 11-L are located in this *deh*, at the tail and right sides of the Dhoro Naro Minor; also in Taluka Shahdadpur, District Sanghar.

8. Deh Kalri

The Dhoro Naro command area in the middle and on the right encompasses very small sections of watercourse numbers 4-R and 5-R, and also falls within the jurisdiction of Taluka Shahdadpur, District Sanghar.

9. Deh Gupchani

This *deh* is situated at the tail, and forms part of Taluka Shahdadpur, District Sanghar. A very small area of watercourse number 10-L is located there.

The Culturable Command Area (CCA) of *dehs* situated in the Dhoro Naro Minor is presented in Table 5.

Table 5. Culturable Command Area (CCA) of *Dehs* in Dhoro Naro Command Area.

S #	Name of Deh	CCA
01	Khiaryoon	4418 acres
02	104 Nasrat	2203 acres
03	87 Nasrat	1809 acres
04	87 "A"	2457 acres
05	Gojro	5049 acres
06	Panjo Chann	3319 acres
07	Jheemal	4341 acres
08	Kalri	2188 acres
09	Gupchani	-----

Source: Mukhtirkar, Taluka, Nawabshah and Shahdadpur.

1.4.2 Major Castes Residing in Dhoro Naro Command Area

a. Zardari

This is one of the most prominent castes residing in the Dhoro Naro command area. The water users of this caste own land on watercourses 4-R, 2-L, 2-AL, 3-L and 4-L. The President of Water Users Federation (WUF) of the Dhoro Naro belongs to this community.

b. Khaskheli

Another of the major castes in the Dhoro Naro command area, these water users own land on watercourses 1-R, 2-R, 1-DL, 7-L and 11-L. The General Secretary of WUF of the Dhoro Naro Minor belongs to this community.

c. Jamali

This is the biggest caste of in this command area, and water users here own land on watercourses 3-R, 4-R, 1-L, 1-AL, 2-L and 11-L.

d. Syed

Water users of this community own land in watercourses 4-BL, 5-L, 6-L and 6-AR. The Vice President of the WUF belongs to this community.

e. Brohi

This is also one of the biggest castes in the Dhoro Naro command area. The water users of this community own land on watercourses 4-R, 6-R, 1-BL, 1-CL and 4-L.

f. Gupchani

The water users of this community have land on watercourses 6-R, 9-L and 10-L of the Dhoro Naro command area.

g. Shar

The water users of this community have land on watercourses 5-L and 6-L of the Dhoro Naro command area.

h. Keerio

Another of the major communities residing in Dhoru Naro command area, these water users own land on watercourses 2-R, 4-L, 5-L and 9-L.

i. Bhangwar

Some water users of this community possess land on watercourses 1-BL, 4-AL, 5-R and 6-R of the Dhoru Naro command area.

j. Girwah Jat

Some water users of this community own land on watercourses 4-BL and 5-R of the Dhoru Naro command area.

k. Arain

Also one of the major castes of the Dhoru Naro command area, water users here own land on watercourses 1-R, 2-R, 4-R and 1-AL. The Finance Secretary of the WUF belongs to this community.

l. Rind

The water users of this community own land on watercourses 5-L and 6-L of the Dhoru Naro command area.

1.4.3 Land Holding

There are about 500 potential water users (landowners, owner-operators, lessees) in the Dhoru Naro Minor command area. The majority of the cultivators are illiterate, and the literacy rate among them is about 15%. The maximum land holding of this command area is about 700 acres (middle and tail). There are 3 cultivators who own more than 500 acres of land (2 in the head, and 1 in the middle and tail), and about 20 cultivators who own more than 100 acres of land (head, middle and tail) in the Dhoru Naro Minor command area.

The minimum land holding in the Dhoru Naro command area is 2 acres each in the head, middle and tail. Eventhough the average landholding in this command area is 30 acres, the maximum land holdings for the head, middle and tail are 605, 400 and 300 acres, respectively.

1.4.4 Communication

The main Nawabshah-Sanghar road runs along side the Dhoru Naro Minor, which, from a marketing point of view, presents ease for the growers to transport their agricultural inputs to the main market in Nawabshah City. The 7 main bus stops along this road are Sui Gas, 3 Watercourses bus stop, Kandi Goth, Gulan Watercourse, Cheezal Abad, Ali Abad and Gupchani. Most times these bus stops are congested with the Dhoru Naro command area's inhabitants, as the bulk of the population live in the surrounds, and farmers do not experience transport problems. The main villages in this area have access to electricity and schools, but health facilities are very modest, and people have to

commute to Nawabshah City for medical treatment. Some villages, closer to Nawabshah City, have access to telephone facilities.

1.4.5 Major Crops Grown in Dhoro Naro Command Area

This area is primarily considered to be a cotton zone, however, wheat cultivation is also very popular among the farmers. The details of crops grown in the area are given below:

<i>Kharif 1997</i>		<i>Rabi 1996-97</i>	
Cotton	82 %	Wheat	66 %
Sugarcane	6 %	Oil Seed	9 %
Orchard	7 %	Orchard	7 %
Vegetable	4 %	Vegetable	3 %
Fodder	9 %	Fodder	10 %

Source: *Kharif 1997* (Survey by IIMI Field Staff, Nawabshah)

Rabi 1996-97 (Farmers of Dhoro Naro command area)

1.4.6 Physical Conditions

The Dhoro Naro Minor command area falls within the Sindh Agro-chemical Region 3, which comprises areas in the northern part of this province. This region stretches from Nawabshah to Jacobabad, with Nawabshah situated in the south. The cultivation of the rice crop is prohibited in this area. The land in this area is considered to be very fertile, and farmers firmly believe that a reliable water supply can transform the area into lush vegetative growth.

The average water table depth from the surface, and the water elevation of the Dhoro Naro Minor, for a period of 5 months, are presented in Table 7 and 8, respectively. The minimum, and maximum, ground water quality, in parts per million (PPM), is presented in Tables 6 and 7, respectively.

Table 6. Reach-wise Average Water Table Depth and Average Water Table Elevation of Dhoro Naro Minor Command Area during Different Months.

Months	Head	Middle	Tail	Water Table Elevation (Average)
May-97	7 ft	6 ft	7 ft	84.103 ft
Jun-97	7 ft	8 ft	8 ft	83.277 ft
Jul-97	8 ft	9 ft	9 ft	82.649 ft
Aug-97	9 ft	9 ft	9 ft	82.362 ft
Sep-97	9 ft	9 ft	9 ft	-----
Oct-97	8 ft	9 ft	9 ft	-----

Table 7. Reach-wise Average Water Quality and Minimum & Maximum Water Quality in PPM at Dhoro Naro Command Area.

Month	Head (ppm)	Middle (ppm)	Tail (ppm)	Minimum Water Quality (ppm)	Maximum Water Quality (ppm)
May 1997	951	653	1,509	294.4	5,004.8
June 1997	1,020	1,007	1,006	249.6	5,158.0
July 1997	1,033	1,034	1,040	224.0	7,993.6
August 1997	2,780	2,858	2,873	243.2	23,424.0
September 1997	2,534	2,605	2,594	262.4	21,440.0
October 1997	2,860	2,889	2,868	300.8	22,656.0

Source: Measured by IIMI Field Staff through 71 Piezometers installed in Dhoro Naro Command Area by IIMI-Nawabshah field staff.

1.4.7 Climate

The area's climate is arid and sub-tropical, and the weather is extremely hot in summer, and quite cold in winter. The mean daily, and monthly, maximum temperatures range between 43 and 47 degrees centigrade, and the mean daily, and monthly, minimum temperatures between 8 and 12, and 3 and 7 degrees centigrade, respectively. The mean monthly rainfall during summer is between 45 and 55 millimeters, which is slightly more than in the northern part of the Sindh Province, while the winter season is particularly dry. The rainfall data of this command area for the last 7 years is presented in Table 8.

Table 8. Rainfall in Dhoro Naro Command Area.

Year	Rainfall in <i>Kharif</i>	Rainfall in <i>Rabi</i>	Total
1986-87	11 mm	-----	11 mm
1987-88	-----	-----	-----
1988-89	411 mm	-----	411 mm
1989-90	430 mm	105 mm	535 mm
1990-91	162 mm	4 mm	166 mm
1991-92	14 mm	75 mm	89 mm
1992-93	80 mm	-----	80 mm

Source: Nasrat Irrigation Division, Nawabshah.

1.4.8 Warabandi

Cultivators mostly use *pacca warabandis* (fixed water turns) in this command area. This *warabandi* has been sanctioned by the irrigation department, and the *Abdar* is responsible for providing a *warabandi* schedule. However, there are a few watercourses on the Dhoro Naro Minor that use *katcha warabandis*.

The annual closure of this canal takes place during January for a period of approximately 30 days. During the periods of acute shortages of water, an unscheduled *warabandi* also takes place for about one week.

1.4.9 Loans and Credits

Loans and credits in this area are provided by the Agriculture Development Bank. However, owing to a majority of small landowners, who find it very difficult to meet the required criteria to obtain these loans, there are very few landowners who take advantage of this facility.

1.4.10 Water Users Organizations (WUOs)

IIMI-Pakistan has organized the farmers, both, at the watercourse level, and at the minor level, by forming resonant organizations. A continuous engagement in productive activities by the water users as a group is more likely considered to provide greater incentives to keep the organizations alive. This is the only reason why the WUAs formed by IIMI are considered to be more practical than the WUAs formed by the LBOD (Water Management Component) in executing the activity of lining watercourses, as the latter became defunct soon after the lining work was completed.

At present, the Dhoro Naro Minor consists of 25 WUAs, most of which have 8 office bearers, including a President, Vice President, General Secretary, Joint Secretary, Finance Secretary and 3 members of the Executive committee. There is one Water Users Federation (WUF) at the secondary canal level.

List of office bearers of WUF Executive Body.

President	: Anwar Khan Zardai	(Middle Reach)
Vice President	: Pir Mehdi Shah Rashidi	(Tail Reach)
General Secretary	: Muhammad Bux Khaskheli	(Tail Reach)
Joint Secretary	: Rasheed Ahmed Shaikh	(Head Reach)
Finance Secretary	: Muhammad Ahsan Hamid	(Head Reach)

Member's of the Executive Committee.

1. Muhammad Rafiq	(Head Reach)
2. Muhammad Hussain	(Head Reach)
3. Khushhal Khan Zardari	(Middle Reach)
4. Hazar Khan Bhangwar	(Middle Reach)
5. Rab Nawaz Khaskheli	(Tail Reach)
6. Muhammad Mureed Gupchani	(Tail Reach)

Presently, the WUF is conducting regular meetings, and reach decisions by mutual consent. They are also involved in development work, i.e., the construction of a WUF office and an inspection path, strengthening the non-inspection path, construction of culverts over the secondary canal and watercourse branches, rectification of outlets for equitable water distribution, etc. All these activities are carried out on a cost-sharing basis, with IIMI-Pakistan. The desilting of the Dhoro Naro Minor, however, was undertaken at the WUF's expense.

The WUF has also constructed its office, culverts over watercourse branches at different locations along the minor, and a buffalo wallow near RD 11+000, on a cost-sharing basis with IIMI. Respectively, its contributions amounted to Rs. 25,400 (of Rs. 50,403), Rs. 73,340 and Rs. 26,100, respectively for these undertakings.

1.5 DRAINAGE FACILITIES

The Left Bank Outfall Drain (LBOD) Project provides surface drainage and priority sub-surface drainage to about 1.3 million acres of land in the Sukkur Barrage left bank command, together with additional irrigation supplies to halt the present deterioration, and to allow a progressive and permanent increase in cropping intensities from 86 %, to a target of 147 %. This scheme covers areas of Sanghar, Mirpurkhas and Nawabshah. The details of this project are presented in Table 9.

Table 9. LBOD Project at a Glance.

Description	Nawabshah	Sanghar	Mirpurkhas	Total
Area Served	0.550 million acres	0.362 million acres	0.358 million acres	1.270 million acres
Surface Drains	628 km	554 km	441 km	1,623 km
Interceptor Drain	154 km	141 km	0	295 km
Tile Drains	0	0	1,733 km	1,733 km
Standard Tubewells	303	597	769	1,669
Scavenger Tubewells	189	175	0	364

Source: Brochure of LBOD Stage 1 Project by WAPDA.

1.5.1 Sub / Branch Drains

The only branch drain is the Gajrah Branch Drain, located on the extreme left of the Dhoru Naro command area. The total length of this branch drain is 46.6 kilometers, but the length passing through the command area, is 8.53 kilometers.

WN 1-AR is the only sub-drain in this command area, located on the right side of the Dhoru Naro Minor. The total length of this sub-drain is 5.7 kilometers, with 5.18 kilometers passing through the Dhoru Naro command area.

1.5.2 Saline Tubewells

There are 7 saline tubewells installed in the Dhoru Naro Minor command area, while the disposal channel of one saline tubewell is installed outside the command area, and passes through the command area of this minor. These saline tubewells cover about 2,000 acres of land. This secondary canal has 3 and 4 tubewells installed on the left and right sides, respectively. All these tubewells are installed in the head and middle reaches, but the tail reach of the Dhoru Naro Minor command area has no tubewell installed. The lengths of disposal channels, design discharges and operational dates of these tubewells, are presented in Table 10.

Table 10. Basic Data of Saline Tubewells Installed in Dhoro Naro Minor.

Tubewell #	Length (kms)	Design Discharge	Operational Date
GAJ - 16	3.750	1.5 cusec	02-12-1994
EN - 134	1.055	2.0 cusec	09-12-1995
EN - 142	0.048	2.0 cusec	06-12-1994
EN - 143	4.840	2.0 cusec	28-12-1994
EN - 144	0.184	2.0 cusec	13-12-1995
EN - 154	0.102	2.0 cusec	29-12-1994
EN - 155	0.824	2.0 cusec	30-11-1995

Source: LBOD (O&M), Nawabshah.

These disposal / sub-disposal channels are unlined. The drainage system in the Dhoro Naro Minor command area is in good working condition, and is considered to be a major reason for lower water table depths in this area. Farmers believe that the drainage has had a good impact, and that more area has been reclaimed with its use. At present, however, they are not ready to take the responsibility of operation and maintenance for the drainage system. The operational efficiency observed by IIMI-Nawabshah Field Staff is presented in Table 11.

Table 11. Operational Efficiency (%) of Saline Tubewells at Dhoro Naro Command Area.

Tubewell #	Feb 97	Mar 97	Apr 97	May 97	Jun 97	Jul 97	Aug 97	Sept 97
GAJ- 16	38.0	20.0	30.0	67.0	14.32	20.4	14.0	1.5
EN-134	0.0	0.0	17.0	19.9	3.50	34.4	30.2	0.8
EN-142	11.4	12.1	11.8	95.	0.0	105.6	0.0	67.2
EN-143	4.0	39.6	6.4	7.6	60.63	80.0	9.4	73.9
EN-144	0.0	1.0	0.0	37.9	0.0	29.0	0.0	0.0
EN-154	0.0	0.0	34.6	36.9	41.5	57.0	20.	29.4
EN-155	33.0	19.2	27.4	5.5	57.5	59.7	10.6	24.6

1.5.3 Operation and Maintenance of Drainage System

In March 1996, the LBOD (O&M) Division was established in order to operate and maintain this drainage system and this system, which was handed over to the division in April 1996. The LBOD (O&M) Divisional office is near the office of the Nasrat Irrigation Division, Nawabshah. There are two sub-divisions in Nawabshah, hence, two Sub-divisional Officers (SDOs) are working under an Executive Engineer at the divisional level. Two Sub-engineers are subordinate to each SDO. Since these tubewells are automatic, therefore, there is no need to allocate operators to these tubewells, but a *chowkidar* guards each saline tubewell. The operation and maintenance of these tubewells have been handed over to contractors to ensure good working order. The ground water quality, in PPM, currently being pumped by these tubewells, is presented in Table 12.

Table 12. Water Quality of Saline Tubewells in Dhoru Naro Command Area.

Name of Tubewell	Water Quality (ppm)
GAJ - 16	3,008.0
EN - 134	15,936.0
EN - 142	11,193.6
EN - 143	12,102.4
EN - 144	16,896.0
EN - 154	14,912.0
EN - 155	13,504.0

Source : Measured by IIMI Field Staff in Dhoru Naro Command Area.

2 CURRENT FINANCIAL SITUATION

2.1 SOURCES OF INCOME

According to the renowned economist, Plehn, taxes are general compulsory contributions of wealth levied on individuals, natural or corporate, to defray the expenses incurred for conferring common benefit upon the residents of the state.

Taxes are for the general purpose of the state. Taxpayers cannot expect the state to render a specific service in return for the tax paid by him. The various classifications of tax can be defined as under:

1) Proportional Taxes

Proportional tax specifies that whatever the size of the income, the same rate, and percentage, are charged.

2) Progressive Taxes

With progressive tax, the rate increases as the taxable income increases. This type of tax is directly proportionate to the income. One can simply describe it as, "the higher the income, the higher the rate".

The farmers pay both types of taxes, i.e., proportional taxes in the shape of *abiana*, land tax, local cess, and water-managed charges and progressive taxes in the shape of Agriculture Tax. *Usher* is an Islamic religious levy for all Muslims who derive an agricultural income. In Urdu, the national language, *abiana*, local cess and water-managed charges are called *jamabandi* (assessment items), while *usher* is known as *ghair jamabandi* (non-assess items). Local cess is also called Local Board Fund, which is utilized by the local board (District Council) for development schemes.

2.1.1 *Abiana*

Abiana (water charges) is a type of tax that is imposed on the use of irrigation facilities (sometimes *abiana* is also referred to as water delivery service charges). There are different rates of *abiana* charged for different crops claimed by the Irrigation Department, is derived according to the requirement of water for each crop. These rates vary slightly in each command area. Rates of *abiana*, per acre of cultivation for different crops in the Dhoru Naro Minor command area for the last 5 years, are presented in Table 13.

Table 13. Rates of *Abiana* on Different Crops for 5 Years.

Crop	1992-93	1993-94	1994-95	1995-96	1996-97
Cotton	36.02	45.03	51.78	64.75	80.95
Sugarcane	70.40	88.00	101.20	126.50	158.15
Wheat	20.62	25.78	29.64	37.50	46.35
Orchard / Vegetable	55.00	68.75	79.06	98.95	123.60
Oil Seed	20.62	25.78	29.64	37.05	46.35
Fodder	15.40	19.25	22.14	27.70	34.65

Source: Mukhtiarkar Taluka Nawabshah.

2.1.2 Land Revenue

Land revenue is a type of tax that is only imposed on non-Muslims, and on those Muslims who belong to the Shia sect. The rates for land tax on different crops, per acre of cultivation, are presented in Table 14.

Table 14. Rates of Land Revenue for Various Crops.

Crop	Land Tax
Cotton	10.35
Wheat	6.35
Sugarcane	3.75
Orchard / Vegetable	3.75
Oil Seed	3.75
Fodder	1.50

These rates are applicable to landowners who possess less than 2.5 acres of land. A grower owning land between 2.5 and 12.5 acres has to pay 50 % more than the above-stated rates. Similarly, landowners possessing between 12.5 and 25 acres of land, or between 25 and 50 acres, have to pay 100 %, or 200%, more than the above-stated rates. Farmers who own more than 50 acres of land are taxed 400 % more than the above fixed rates.

2.1.3 Usher

Usher is imposed on Muslims by religion. However, Muslims who belong to the Shia sect are exempted from this type of tax. There are different types of soils, and each *deh* has a particular category (i.e., A, B, C) according to the condition of the soil. If the soil is more fertile, it would be in the "A" category, and if the soil is not so fertile, it would be in a lower category. *Usher* is imposed according to these categories. There are nine *dehs* in the Dhoro Naro command area; land which is classified in all three categories, i.e., A, B and C.

There is a certain limit of production for each crop fixed by the government. If the production of a certain crop is less than its fixed limit, the rates of *Usher* can be relaxed. Similarly, landowners using groundwater for irrigation can also be facilitated for relaxed *Usher* rates.

A farmer categorized as an owner-operator is required to pay full *Usher* charges, while, if he has tenants, he pays only fifty percent of the fixed *Usher*.

Usher rates are fixed, in view of the average yield of a particular area, by the district administration of that area. Rates of *Usher* for different crops, per acre, for different categories of soils, are presented in Table 15.

Table 15. Rates of *Usher* for Different Crops Per Acre for Different Categories in the Dhoru Naro Command Area for the Year 1996-97.

Crop	Category "A"	Category "B"	Category "C"
Cotton	342.00	285.00	249.38
Sugarcane	787.50	618.75	562.50
Wheat	65.00	58.39	123.60
Mango	187.50	187.50	187.50
Vegetable	112.50	112.50	75.0
Oil Seed	48.00	48.00	48.00
Lemon	150.00	150.00	150.00
Juwar	58.50	54.00	49.50
Banana	1,125.00	1,125.00	1,125.00
Fodder	18.75	18.75	18.75

Source: Mukhtiarkar Taluka Nawabshah.

2.1.4 Agriculture Tax

Agriculture tax is a recent levy imposed by the government of Sindh. This tax is payable only by those landowners who possess more than 12 acres of canal-irrigated land, and/or 24 acres of barrage-irrigated land. The rates of agriculture tax for different crops, per acre, are presented in Table 16.

Table 16. Rates of Agriculture Tax for Different Crops Per Acre.

Name of Crop	Agriculture Tax Per Acre
Cotton	75.0
Sugarcane	75.0
Fodder	40.0
Orchard / Vegetable	300.0
Wheat	40.0
Oil Seed	40.0

Source: Mukhtiarkar Taluka Nawabshah.

2.1.5 Drainage Cess

Drainage cess is collected from each grower at the rate of Rs. 2 for each acre of land holding.

2.2 TAX ASSESSMENT PROCEDURES

Both, the Irrigation and Revenue Departments, are responsible for the assessment of taxes. The Revenue Department assesses all taxes, like that of land revenue, *Usher*, agriculture tax, and local cess; whereas, the Irrigation Department assesses *abiana* only. *Tapedar* from the Revenue Department and *Abdar* from the Irrigation Department prepare the assessments. The procedure of assessment for both is similar; first they conduct a crop survey in the fields, which they enter in their field books. Summary sheets from these field books are then compiled. Later, the Revenue Department compares its *abiana* merit with that of the Irrigation Department, before finalizing the *abiana*. However, supervisors in the revenue department verify the assessments of *Tapedars* for presentation to the *Mukhtiarkar*, who finally presents his report to the Assistant Commissioner of that particular area.

2.3 TAX COLLECTION PROCEDURES

For the collection of taxes, only the Revenue Department is responsible. The Revenue Department dispatches invoices to the farmers. Some farmers pay these invoices while in the field, and others pay at the Revenue Department's office. Nearly all farmers make payments in cash, which they are issued receipts for. *Tapedars* and supervisors are involved in tax collection procedures, also issuing invoices and receipts to the farmers.

2.4 EXPENDITURES

The Assistant Executive Engineer of a concerned sub-division compiles an estimate of the expenditures for operation and maintenance of canals, and sends it to the Executive Engineer of the concerned irrigation division. The accountant of that division checks this estimate and reports it to the Executive Engineer. For an estimate amounting to less than Rs. 25,000, the Executive Engineer is himself an approving authority, and he is allowed to allocate money to the Assistant Executive Engineer to commence the work. Estimates between Rs. 25,000 and Rs. 0.25 million require approval from the Superintending Engineer, on the recommendation of the Executive Engineer. Any estimate in excess of Rs. 0.25 million needs to be routed to the Chief Engineer, who, after consulting the Secretary of Irrigation through the Ministry of Finance, is authorized to release the money.

2.5 MAINTENANCE, IMPROVEMENT AND ESTABLISHMENT COSTS

There are various types of expenses at the irrigation divisional level, which are normally categorized under three headings, namely: (1) Establishment cost; (2) Maintenance cost; and (3) Improvements and Extension costs.

- (1) Establishment cost is based on the salaries of staff and their related expenses.
- (2) Maintenance cost includes expenses like excavation, earth-work, clearing vegetation, repair of canal gates, or outlets. Repair to culverts and bridges over the secondary canal are also grouped under maintenance cost.
- (3) Improvement, or extension, costs includes the extension of distributaries, new head regulators (if the old one is completely damaged, or design discharge has been increased), and construction of new outlets, etc. The construction of new culverts and bridges over a secondary canal is also classified under improvements and extension costs.

3 FARM INCOME ANALYSIS

3.1 BACKGROUND

A farmer derives his/her source of income by selling agricultural produce. Being conservative by nature, when a farmer considers any additional expense like that of an investment, which, in return, will contribute towards the farm income, (s)he would consider it as a favorable investment.

With this preference of the farmers in mind, a methodology, which will be explained later in this chapter, was devised in order to calculate the nett farm income, and to understand, in more detail, the different factors affecting farm income.

Generally, three techniques are employed: (a) farm income analysis; (b) fund flow analysis; and (c) farm investment analysis, which are used to measure the performance of an agriculture project. While the latter two techniques are used to determine liquidity and the attraction of a proposed investment, farm income analysis is normally used to evaluate the performance of a farm during a particular year (Gittinger 1992).

The farm income analysis technique has been favored in this report, as, at present, our primary objective is to test the financial viability of the FO's for a possible take-over of Operation and Maintenance of the Dhoru Naro Minor.

3.1.1 Cropping Intensity and Cropping Pattern - Importance

Cropping intensity is normally expressed in percentage, and is referred to as the cropped land within a given Culturable Command Area (CCA), while the cropping pattern means identification of different crops in a particular cropped area.

The values for these two are needed to calculate the following:

- a) Forming the basis to calculate crop yields.
- b) Forming the basis to calculate farm inputs.
- c) Forming the basis to calculate *abiana* (water tax).

The foregoing were considered as a core requirement to arrive at the farm income figure. Furthermore, the calculation of the *abiana* payable by a farmer also depends entirely on this information.

3.1.2 Information Collected on Cropping Intensity at Different Intervals

IIMI-Pakistan's field office in Mirpurkhas has been collecting information on cropping intensities since 1996. Information has also been obtained from the Revenue Department. Mr. Amin Sohani, Financial Analyst, conducted a special survey with the help

of field staff to collect this information. The information thus collected through different sources, is summarized in Table 17.

Table 17. Cropping Intensities for Dhoro Naro Minor.

Crop Season	Total/Sample CCA (in acres)	Cropped Area (in acres)	Cropping Intensity (in %)	Remarks
<i>Kharif</i>			28.00	Designed Intensity
<i>Rabi</i>			53.00	Designed Intensity
<i>Rabi 95/96</i>	59.03	27.46	46.00	Mean figures by A. Sohani
<i>Rabi 95/96</i>			58.88	Survey by field team
<i>Rabi 96/97</i>			59.98	Survey by field team
<i>Kharif 95</i>			55.40	Survey by field team
<i>Kharif 96</i>	59.03	22.53	38.00	Mean figures by A. Sohani
<i>Kharif 96</i>			55.00	Survey by field team
<i>Kharif 97</i>			53.69	Survey by field team

3.1.3 Farm Revenue and Farm Expenses Calculated by Amin Sohani

Mr. Amin Sohani (1997), in his interim report based on field surveys, has calculated farm revenue and farm expenses for this minor. These findings are presented in Table 18.

Table 18. Farm Revenue, Expenses and Income (Sohani, 1997).

Season	Mean Farm Revenue (CCA Acre)	Mean Farm Expense (CCA Acre)	Mean Farm Income (CCA Acre)
<i>Rabi 95-96</i>	952	932	20
<i>Kharif 96</i>	1,378	1,014	364

3.2 JUSTIFICATION FOR REVIEW OF THE EXISTING DATA

One important objective in organizing the farmers is to promote their maximum involvement in the operation and maintenance of distributary/minor canals (Phase II Report, 1997). This preliminary Business Plan (financial framework) is intended to facilitate the Farmer Organization of this secondary canal in order to manage the financial affairs of this minor in an amicable manner.

The variance in the existing data is somewhat substantial. Although the data collected by the IIMI field team sounds more reasonable, since this data is largely based on samples, therefore, the chances of inherent limitations are possible. Considering the sensitive nature of the final product involved, i.e., a preliminary framework (financial)

which is also acceptable to the farmers, the authors of this report supported the need to conduct a more comprehensive survey of this secondary canal.

Furthermore, a need to obtain more confidence by having in-depth knowledge about this minor was felt, which may prove helpful in extending maximum assistance to the FO's during negotiations in the Joint Management Agreement on the one hand; whereas, to come up with the best possible financial solutions on the other.

3.3 DATA COLLECTION AND DATA ENTRY METHODOLOGY

In the first step, familiarity between the IIMI-Nawabshah field staff and the farmers of the Dhoro Naro Minor command area was developed. A field visit of this minor canal was undertaken in August 1997. Mr. Nizamuddin Bharchoond, the Supervisory Social Organizer and head of the IIMI field station, assisted by other members of his team, gave a detailed presentation about this secondary canal. Later, he accompanied staff on a field visit of the Dhoro Naro command area. The decision for a full day's meeting at the Hyderabad office to discuss the business plan was reached at the end of this meeting.

The purpose of the full day meeting in Hyderabad was to devise a preliminary strategy for the collection of necessary data. Since information about cropping intensities and cropping patterns was considered essential, therefore, it was resolved to conduct a thorough detailed survey of this pilot minor canal, by hiring the part-time services of *Abdars*, with 50% assistance from the IIMI-Nawabshah field staff members.

This strategy was discussed in detail with Dr. Yameen Memon, the IIMI-team leader for the Sindh Province, Mr. Don J. Bandaragoda, Project Leader, and Prof. Gaylord V. Skogerboe, Director, IIMI-Pakistan, whereby it was decided to organize a one-day workshop in Hyderabad for participation by all the Sindh-based project staff.

The workshop started with a simple introduction to a Business Plan; Dr. Yameen Memon described the purpose of the proposed survey, and expectations from the field staff during this period. Later, an open discussion session was held with participants in order to gather different ideas to improve the quality of this survey, bottlenecks that may arise, and corrective measures to be adopted in the event of such situations. Participants agreed to the suggestion of conducting this survey at individual watercourse levels, and to prepare maps. Accordingly, an initial proforma was developed. The recommendations of this workshop are as follows:

- Technical staff, particularly those who are familiar with the command area, and have about five years experience in the field, are to be hired.
- One field staff is to accompany the new technical person to the fields for data collection, and to fill out the proforma.
- Two proforma were suggested; one to be used for mapping purposes, and the other for crop identification.
- Each member will be responsible for the accuracy and correctness of data by comparing these two proforma.

- A Supervisory Social Organiser (SSO) from the Nawabshah Field station will be responsible for the final verification of data, before forwarding it to the IIMI-Hyderabad Office.

The proforma developed at the end of the workshop were pre-tested on the following day. Once relevant modifications were made, a concluded format was approved.

The salient features of this questionnaire are as follows:

- A one page questionnaire in landscape format.
- Data is easy to record.
- One page can easily record information for 9 blocks.
- The basic information relating to the cultivator includes: (1) watercourse number; (2) surveys, or block number; (3) *deh* name; (4) holding, in acres; (5) owner's name; (6) managed by; (7) status; (8) number of tenants; (9) water allocation (hrs); and (10) day and time of water allocation.
- Information for each crop cultivated, including that of orchards and vegetables.
- Information about un-cropped land, i.e., fallow.
- Information about waterlogged and salinized lands.
- Information about abandoned land.
- Information relating to the drainage infrastructure.
- Information about lift pumps and a piezometer situated in the area.
- The last column to be used to record any special information.

IIMI-Nawabshah staff contacted a variety of individuals before identifying three suitable persons who were willing to conduct this survey. A timetable was then drawn up for the field survey, to compile an inventory of the crops at Dhoro Naro Minor Canal. The names and current designations of these three individuals are presented in Table 19.

Table 19. Names of Individuals who Assisted IIMI field staff in the Crop Assessment Survey.

S#	Name of Hired Person involved in Survey	Designation	No. of W/Cs Surveyed
1	Muhammad Is'haque Samo	<i>Abdar</i> , Irrigation Sub-division, Nawabshah	13
2	Ghulam Hussain Solangi	Crop Reporter, Agriculture Extension, Nawabshah	11
3	Jurial Khan Ansari	<i>Abdar</i> , Irrigation Sub-division, Nawabshah	01

According to each day's timetable, field staff took the concerned technical person into the field by motorbike, which were parked in a safe place near the watercourse before the survey was conducted on foot. Where block numbers existed, the survey became much easier. At some locations, however, where irregular block sizes existed, the pacing technique was used to confirm the area. The survey numbers of the field blocks

were very difficult to indicate on the maps, therefore, on watercourses where survey numbers existed, field staff enlarged the maps a day earlier so that data in the maps could be entered easily. The list of staff members associated with these hired individuals is presented in Table 20.

Table 20. List of IIMI staff and Hired Individuals who Participated in Crop Assessment Survey.

S #	W/C #	Name of IIMI Staff	Name of Hired Individual
01	5-L	Nizamuddin Bharchoond	Muhammad Is'haque Samo
02	6-L	-- do --	-- do --
03	6-AR	-- do --	-- do --
04	1-R	Abdul Rehman Soomro	Ghulam Hussain Solangi
05	2-R	-- do --	-- do --
06	3-R	-- do --	-- do --
07	1-AL	-- do --	-- do --
08	3-L	-- do --	Muhammad Is'haque Samo
09	4-R	Parvez Ahmed Pirzado	Ghulam Hussain Solangi
10	5-R	-- do --	-- do --
11	6-R	-- do --	Muhammad Is'haque Samo
12	1-BL	-- do --	Ghulam Hussain Solangi
13	1-CL	-- do --	-- do --
14	2-L	-- do --	Muhammad Is'haque Samo
15	7-R	Munir Ahmed Mangrio	-- do --
16	7-L	-- do --	Ghulam Hussain Solangi
17	9-L	-- do --	-- do --
18	10-L	-- do --	Muhammad Is'haque Samo
19	11-L	-- do --	-- do --
20	1-DL	Fateh Muhammad Mari	Ghulam Hussain Solangi
21	1-L	-- do --	Jurial Khan Ansari
22	2-AL	-- do --	Muhammad Is'haque Samo
23	4-L	-- do --	-- do --
24	4-BL	-- do --	-- do --
25	4-AL	-- do --	-- do --

Data in the field was collected per the mapping proforma. This proforma contained 4 blocks on one page. The number of that block was written in the center of each proforma block; each block was divided into four equal parts (i.e. 1,2,3,4); and finally, each part of each block was further sub-divided into four more parts, and classified as A, B, C and D. Entries in these proforma were made using certain codes. The list of codes used is presented in Table 21.

Table 21. Different Codes for Crops Used during Crop Survey.

Land Classification	Code
Cotton	Ct
Sugarcane	Sc
Juwar	Ju
Home	H
Waterlogging	Wl
Salinity	Sl
Abandoned	Ad

In the evenings, at the field stations, the second proforma (questionnaire) was filled out with the help of the mapping proforma. Certain parts of this data, e.g., owner's name, block number, etc., were compared with field books and a *Karria* Register (Watercourse-wise Irrigation Department Record Register Book) obtained from the Irrigation Department.

As the survey started at the end of the *kharif* season, a few of these crops were no longer present in the fields, and *rabi* crops were sown, which made it difficult to estimate which crop had been sown on that particular piece of land during the *kharif* season. In cases like these, information about the farmers, and experiences of the hired individuals, were most reliable.

Government records contained data pertaining to land allocated to people who had either died, or had become too old to manage the land, in which case another person, whose name was not registered, would be cultivating the land. This problem was solved after consulting with related people in the field, and the concerned Irrigation Department staff.

At many locations, part of the gross command area (GCA) was also being cultivated, which also created problems, because the cultivated land increased the total land holding of a person. To overcome this problem, the cultivation, in GCA, was indicated in separate parentheses in the questionnaire.

Drains / disposal channels were difficult to identify on maps, as no knowledge about the locations, and the areas in which these were covered, existed, because these drains are not recorded in Irrigation, or Revenue Department records. To solve this issue, field staff met with LBOD officials to obtain the relevant information.

The field survey was difficult and tiring work, as participants needed to walk continuously for 5 to 8 hours. As meals were impossible to accommodate, it was more difficult to walk. Upon completion, staff had to return to the starting point by foot to where the motorbike was parked.

3.4 FARM REVENUE ANALYSIS

Farm Revenue is calculated by multiplying the physical productivity with the per unit price of the commodity. The formula used to calculate the farm revenue is:

$$FR = (TYP * Pr) + (TYB * Pr)$$

Where;

FR	=	Farm Revenue
TYP	=	Total Yield of Principle Crop
TYB	=	Total Yield of By-product
Pr	=	Per Unit Price

Farm revenue analysis was considered very important in order to formulate a business plan for the Farmer Organization, as, based on these analyses about financial

efficiency, incentives, credit worthiness and liquidity could be formed. The following information is important to calculate farm revenue.

- Total land holding of a farmer.
- Cropping pattern.
- Cropping intensity.
- Total production.
- Farm-gate prices.

3.4.1 Farm-gate Prices

The price at the point of first sale can be accepted as the farm-gate price, even if this point is in a nearby village market. The farmer sells his output there, thus earning any fee that might include transporting the commodity from the farm to the point of sale.

The farm-gate price is generally considered to be the best for the value of production for domestic consumption. Sometimes it may be extremely difficult to determine a realistic farm-gate price for a crop produced primarily for domestic consumption, because so little of the crop appears on the open market. On one hand, some argue that the true value of the crop is overstated if the market price is used as a basis for valuation, as normally, a small proportion of the product is actually sold at the market price.

For the purposes of the farm revenue analysis in this report, farm-gate prices have been calculated by deducting the cost of transportation and local taxes on the agricultural produce, from the market price at the time of first produce arriving in the market. These prices were obtained from the contact farmers along each watercourse (who have proof of sale receipts). The detailed calculations pertaining to the farm-gate prices for this command area are given in Annex A to this report.

3.4.2 Land Considered as Affected Due to Waterlogging, Salinity and Other Reasons

During this survey, parts of the uncultivated agricultural land were categorized as waterlogged, salinized and abandoned. The reasons for these categorizations are based on farmers' perceptions, which are as follows:

- (a) According to the farmers, a substantial amount of irrigation water seeps underground from the canals, watercourses and fields. This seeping water, having no natural means of escape, continues to accumulate underground, and the level of underground water continues to rise until it reaches the ground surface. This creates waterlogged conditions. Therefore, in this report, such areas have been categorized as waterlogged.
- (b) According to the farmers, sometimes, when water moves up, water salts also rise and deposit at the root zone, rendering the soil unproductive, or forming a white layer on the surface. Irrigation water (canal or groundwater) containing

large amounts of salts causes salinization. Therefore, uncropped areas of land, where white layers of salts were visible, have been categorized as salinized fields in this report.

- (c) According to the farmers, other reasons for uncultivated land are either sand dunes, and/or non-availability of canal irrigation water, especially in areas where there is a very low ground water quality. Therefore, in this report, such areas have been categorized as abandoned lands.

3.5 FARM LAND REVENUE OF DHORO NARO MINOR

The information deemed necessary, as explained in Section 3.4, was available at the end of this survey for the *kharif* 97 cropping season. However, the same information for the *rabi* 96-97 season was not possible through this survey. In order to ascertain the economic strength of the farmers, farm land revenue should be calculated for a period of one year. Therefore, field data collected by the IIMI-Nawabshah team, using the sampling method, has been relied upon to tabulate the figures for the *rabi* 96-97 cropping season.

The other important factor to calculate the farm revenue, is crop yield per acre. Again, contact farmers from each watercourse, owning land considered to be fairly representative of the whole watercourse, were contacted. The information provided by these farmers was further cross-checked with the information available for the other two pilot-distributaries, and may be considered fairly reliable. The yield, per acre, for major crops in this command area, when compared with the national and international information, is presented in Table 22.

Table 22. Various Yields for Crops in different Countries.

	Seed Cotton	Wheat	Maize	Sugarcane	Rice (Paddy)
Country	(kg/ha)	(kg/ha)	(kg/ha)	(kg/ha)	(kg/ha)
USA	1,902.25	2,566.25	7,450	76,846.25	6,377.50
China	2,302.25	3,229.75	4,375.25	-	5,664.75
Turkey	2,445.75	2,027.5	4,082	-	-
Mexico	2,351.25	4,102.5	1,944.75	-	-
Iran	1,883.00	1,473.25	-	-	-
India	742.50	2,298.00	1,558.25	63,680.75	2,617.50
Pakistan	1,865.25	1,900.50	1,386.00	42,176.75	2,323.75
Dhoro Naro	1,335.77	2,454.19	-	44,460.00	-

Source: Agricultural Statistics of Pakistan 1992-1993.

For the purposes of calculating farm land revenue expenditure and income, it was assumed that a farmer conceals the actual cropped area; whereas, s(h)e would normally provide the correct crop yields, crop prices and crop expenditures, as other sources to

confirm, or negate, this information. Therefore, the main emphasis was to collect accurate information (maximum possible) regarding cropped area and patterns.

Important information gathered during data collection regarding crops, and its cropped area, divided into maximum and minimum area, average water-table depths, average water quality in parts per million, and average water duty, is presented in Table 23. This information can be used to explain the farmers' preference to certain crops in respective watercourses.

Table 23. Farmers Preferences for Selected Crops in different Watercourses.

Particulars	Cotton		Sugarcane		Wheat		Fodder		Oil Seeds	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
W/Course number	4R	1R	1R	1CL	1CL	4AL	1L	4AL	2AL	6AR
Land Cultivated in acres	393	42	95	1	338	65	68	5	97	3
Total Cropped area in acres	487	248	247	367	589	76	327	74	419	77
CCA in acres	1,144	328	328	978	978	75	491	978	441	175
W/Quality in PPM (avg.)	929	605	605	528	528	1,118	2,602	1,118	908	633
W/Table depth (avg.)	8.25	5.80	5.80	8.71	8.71	6.00	9.39	6.00	8.42	6.17
W/Duty (Avg.)	2.55	11.58	11.58	2.72	2.72	7.89	5.77	7.89	5.76	6.63

Source: For cultivated area and crop identification surveys, by IIMI-Nawabshah.

For water quality, water table depth, and water average duties of time-series data for the last 5 months, by IIMI-Nawabshah field staff.

In the case of cotton, the only reason for a high-cropped area in watercourse number 4R, is that the CCA of this watercourse is very large, i.e., 1,144.33 acres. This is the largest watercourse in this command area. Low cotton cropped area in watercourse number 1R can be attributed to farmers' interest to cultivate sugarcane, as water duty in this watercourse is 11.58.

From the above table it is interesting to note that in watercourse number 1R, the cropped area for sugarcane is the highest, which can be attributed to a very high water duty, i.e., 11.58; a lower water table depth from the surface, i.e., only 5.80 feet; and a reasonable quality of groundwater, i.e., 605 ppm. Sugarcane is a very high water-consuming crop, and 24% of the total sugarcane cultivated in this command area is cultivated in this watercourse, which has a CCA of only 332.13 acres out of the minor canal's total CCA of 13,161.65 acres. Sugarcane cultivation is very low in Watercourse 1-CL, where water duty is 2.72, and a higher water table depth from the surface, i.e., 8.71 feet, is measured.

The high cropped area in Watercourse 1-CL is due to good ground water quality, i.e., 528 ppm, and a higher water table depth from the surface, i.e., 8.71 feet, which is considered quite good for this crop although its water duty is quite normal, i.e., 2.72. Whereas, a low cropped wheat in watercourse number 4-AL is due to its CCA, i.e., only 75.73 acres. Another interesting point to note in this watercourse, is its comparatively lower groundwater quality, i.e., 1,118 ppm. However, since its water duty is high, i.e., 7.89, therefore it can be assumed that leaching of root-zone salts takes place.

A study to; (1) identify groundwater contribution to the water requirements of major crops; (2) develop irrigation management strategies for major crops under different watertable conditions; and (3) evaluate the effect of groundwater quality on soil salinization and crop yields under different watertable depths, has been conducted by the Mona Reclamation and Experimental Project (MREP) and the Lower Indus (LIM), over a period of three years. The conclusions of this paper are as follows:

- (a) Low water table depth from the surface is generally not conducive for good crop yields. Water supplied to a crop by capillary rise from shallow groundwater can be an important resource. However, it reduces the depth of root zone and increases the threat of soil salinization, especially when ground water quality is inferior, which ultimately affects the crop yields.
- (b) The general practice of applying 5-6 irrigations to wheat and cotton crops is wasteful and unproductive on soils having a water table less than 9 feet from the ground surface. For good yields, 1-2 irrigations at water table depth of 3 to 6 feet, and 2-3 irrigations at water table depth of 6 to 9 feet, are required.
- (c) At shallow watertables, bed planting of crops not only provides better soil conditions during the rainy season, but also saves more water when compared to conventional flat/basin methods.

The results of LIM, based in the Sindh Province, identifying groundwater contribution to the water requirement of major crops, is presented in Table 24.

Table 24. Groundwater Contribution to Crop Water Requirements for Selected Crops.

	W/table depth Less than 3 ft.	W/table depth 3 to 6 feet.	W/table depth 6 to 9 feet.	W/table depth 9 to 12 feet.	Surface water Application.
Total ET losses (cm)	77.9	53.8	50.7	55.5	
G/water cont. (% of total ET)	82.8	24.2	7.6	3.8	
Sub-irrigation (cm)	64.5	13.1	3.9	2.1	
Cotton	196.4	279.4	620.2	736.0	30 cm or 4 irrig.
Sugarcane (kg/acre)	31,500.0	31,780.0	26,520.0	26,480.0	91 cm
Wheat yield (kg/acre)	446.2	579.8	1,323.9	1,545.7	30 cm or 4 irrig.

Source: Benefits of Shallow Drainage, paper by MREP & LIM

The data of watercourses of the Dhoro Naro Minor, indicating maximum and minimum crop yields, watertable depths from the surface, ground water quality and water duty, is presented in Table 25.

Table 25. Crop Yields, Water Quality, Water Table Depth and Water Duty for Selected Crops.

Particulars	Cotton		Sugarcane		Wheat		Fodder		Oil Seeds	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
W/Course number	6R	10L	6AR	1R	6R	7L	6AR	1CL	6L	4L
Yield in kg. per acre	1,200	80	24,000	16,000	1,400	400	12,000	1,200	600	100
W/Quality in PPM (avg.)	492	1,751	633	605	492	1,225	633	528	1,479	506
W/Table depth (avg.)	7.87	9.99	6.17	5.80	7.87	9.41	6.17	8.71	8.07	8.19
W/Duty (Avg.)	6.09	0.90	6.63	11.58	6.09	1.142	6.63	2.72	1.52	5.547

The high yields of sugarcane and wheat in this command area are nearly equal to those obtained by LIM under the relevant water table depths. However, the results for cotton are different. Low yields of cotton and wheat are due to the shortage of water in these watercourses; in these watercourses water duty is only 0.9 and 1.142, respectively. Furthermore, the groundwater quality in these watercourses is also very low, i.e., 1,751 and 1,225 ppm, thus rendering it inappropriate for irrigational use. However, low yields of sugarcane remain unexplained.

The farmers of this distributary normally sell their agriculture produce in the nearby grain market. However, sugarcane and cotton are usually sold to the sugar mills and cotton ginning factories, which are also situated nearby, while wheat is sold to the food department, which purchases at the rates established by the Government of Pakistan. Important information regarding maximum and minimum farm-gate prices for major crops, is presented in Table 26.

Table 26. Farm Gate Prices, Water Quality, Water Table Depth and Water Duty for Selected Crops.

Particulars	Cotton		Sugarcane		Wheat		Fodder		Oil Seeds	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
W/Course number	11L	10L	1AL	1R	1R	10L	9L	10L	6AR	1CL
Price per kgs. In Rupees	20.19	19.07	0.79	0.64	6.274	4.274	0.90	0.28	11.67	6.04
W/Quality in PPM (avg.)	614	1,751	1,372	605	605	1,751	1,271	1,751	633	528
W/Table depth (avg.)	8.67	9.99	9.34	5.80	5.80	9.99	9.41	9.99	6.17	8.71
W/Duty (Avg.)	2.62	0.90	4.60	11.60	11.60	0.90	1.22	0.90	6.63	2.72

The mean farm-gate prices for these major crops are calculated at Rs. 19.22 per kg. for cotton, Rs. 0.75 per kg. for sugarcane, Rs. 5.71 per kg. for wheat, Rs. 0.60 per kg. for fodder and Rs. 8.04 per kg. for oil-seed, although the purchase price for wheat is fixed by the Government of Pakistan. The reasons for price fluctuations are; (1) initially, the price was fixed at Rs. 240 per 40 kgs, which was later reduced to Rs. 200 per 40 kgs; and (2) the quality of wheat in watercourse number 10-L was not up to the mark, hence, it was sold at the low price of Rs. 170 per 40 kgs.

The prices a crop can fetch depends on its quality, which, in turn, depends on various factors, e.g., availability of water, soil conditions, quality of seed, quantity and quality of fertilizer, pesticides, and the farming practices. Therefore, the above analysis becomes more meaningful when seen with the farm-input costs, which is explained later in this chapter. Here, the purpose is to identify the range of prices the farmers of this distributary fetch for major crops.

Although by-products of crops like wheat and cotton are either sold by the farmers, or consumed domestically, the value of these by-products has not been considered in this report. Thus, farm revenue, calculated by multiplying the physical productivity with the per unit farm-gate price of the commodity, for the *rabi* 96/97, and *kharif* 97 cropping seasons, for the Dhoru Naro Minor command area, amounts to Rs. 6,346 and Rs. 9,769, respectively, per cropped acre, which comes totals Rs. 16,115 per cropped acre. Important information derived from farm revenue analysis for this distributary, is presented in Table 27.

Table 27. Gross Agriculture Revenue Analysis.

Particulars	Rabi - 96-97	Kharif - 97	Total (one year)
Cropped Area in acres	7,894	6,869	14,763
Fallow Area in acres	2,224	3,249	--
Waterlogged Area in acres	185	185	--
Salinized Area in acres	1,680	1,680	--
Abandoned Area in acres	1,178	1,178	--
CCA in acres	13,161	13,161	--
Cropping Intensity (in %age)	59.98	53.69	113.67
Gross Revenue (Rupees)	50,093,203	67,104,926	117,198,129
Gross Revenue per cropped acre (Rupees)	6,346	9,769	16,115
Gross Revenue per CCA acre (Rupees)	3,806	5,099	8,905
Gross Revenue (US\$)	1,138,482	1,525,112	2,663,594
Gross Revenue per cropped acre (US\$)	144	222	366
Gross Revenue per CCA acre (US\$)	87	116	203
Avg. price of land per acre (Rupees)	65,000	65,000	65,000
G/revenue to land (Crop) price in %age.	9.76	15.03	24.79
G/revenue to land (CCA) price in %age.	5.86	7.84	13.70

Rate applied: 1 US\$ = Pakistan Rupees 44.00.

The total uncultivated land in this command area categorized as waterlogged, salinized or abandoned, is 3,043 acres. The mean gross revenue per cultivated acre is Rs. 16,115, hence, the farmers of this command area, in one cropping season, have lost a gross revenue of about Rs. 49.038 million (US\$1.114 million), which is equivalent to Rs. 3,726.00 per CCA acres, and a decrease in the cropping intensity by 23.12%.

The revenue of this command area, when compared with other available information for Pakistan, is presented in Table 28.

Table 28. Comparison of Gross Agriculture Revenue.

	All-Pakistan	LBOD Baseline	IIMI-Various	Dhoro Naro Minor
Gross Revenue (Rs/Acre)	3,644	5,263	3,240 - 10,120	8,905
Gross Revenue (US\$/Acre)	83	120	74 - 230	203

Source: Consultancy Report by Dr. Christopher Perry.

The gross revenue for each watercourse of this distributary has been analyzed; important findings of this analysis, summarizing the two watercourses with the highest gross revenue when compared to the watercourse earning minimum gross revenue, and the mean gross revenue, is presented in Table 29.

Table 29. Maximum, Minimum and Mean Gross Agriculture Revenue within Dhoro Naro Minor.

	Revenue Max.		Revenue Max.		Revenue Min.		Revenue Mean	
	K-97	R-96	K-97	R-96	K-97	R-96	K-97	R-96
Watercourse no.	6R	1R	1DL	1BL	10L	10L	Avg.	Avg.
Per Cult. Acres	21,512	13,741	18,257	9,150	1,326	2,538	10,083	6,477
Per CCA Acres	20,413	9,024	15,605	6,194	106	422	7,002	4,451
Cropping Intensity	95.40	81.98	91.20	67.74	8.00	16.62	62.22	67.18
W/Quality in PPM (avg.)	492	605	966	8,015	1,751	1,751	1,484	1,484
W/Table Depth (avg.)	8.25	5.80	7.48	8.62	9.99	9.99	8.17	8.17
W/Duty (Avg.)	6.09	11.60	14.11	3.22	0.903	0.903	4.97	4.97

During both cropping seasons, watercourse 10-L has reaped the lowest gross farm revenue. The main reason is very low water duty; only 0.903. This watercourse is located in the tail reach area, implying a problem of equity in water distribution in this command area.

The other point observed is the effect of non-availability of adequate water on the gross revenue. The gross revenue of watercourse no. 10-L, compared to the mean gross revenue of this minor command area, is less by an amount of Rs. 10,925 per CCA acre. This figure, of Rs. 10,925 per CCA acre, can be considered for the calculation of opportunity cost for water.

3.6 FARM EXPENDITURE ANALYSIS

Generally, farm expenditure is calculated by multiplying the quantity of inputs with the rates of these inputs. Farm expenditure is the sum total of all costs, from sowing, to harvesting and marketing. These farm expenses can be classified into fixed costs and variable costs. The former encompasses fixed taxes and sometimes the rent of land on opportunity cost basis. The variable inputs include labor inputs, capital inputs and marketing costs.

The cost of inputs calculated in this report are explained in the following sub-sections:

3.6.1 Seed

Seed is a basic input for any crop. There are different types of seeds for each crop, and prices for these depend on the quality of seed. The average cost per acre of the seeds used by the farmers in the Dhoro Naro Command area is presented in Table 22.

3.6.2 Fertilizer

Farmers of the Dhoro Naro Minor consider fertilizers as one of the most important inputs used in almost every crop. There are different types of fertilizers, and varying quantities are used for each crop. Normally, farmers use 1 bag of DAP and 3 bags of Urea in one acre of land for major crops, i.e., cotton, wheat and sugarcane. Some farmers also use natural fertilizer, especially for vegetables. The quantity of fertilizer depends on the economic condition of the farmer and the availability of water. Some big landowners use 5 bags of fertilizer, besides natural fertilizer, while small growers use only two bags of fertilizer. The availability of water is considered important for the application of fertilizer, because farmers apply fertilizer with each water turn. If there is a shortage of water, then farmers tend to avoid the use of fertilizer. The average cost of fertilizer, per acre, in the Dhoro Naro command area, is Rs. 1,580.

3.6.3 Pesticides

Pesticides are used to protect crops from different diseases. Farmers mostly use pesticides for the cotton crop, however, big landowners use pesticides for other crops also. The average cost of pesticide per acre, for cotton crop in the Dhoro Naro command area, is Rs. 1500.

3.6.4 Farm Machinery Rentals

Farmers use machinery for ploughing, land leveling and thrashing. There are very few farmers in the Dhoro Naro command area who own this machinery; mostly, farmers hire machinery on rent. Farmers of this command area level their land only once during a season, however, they plough their land twice a season. The per acre average cost for land preparation in the Dhoro Naro command area is Rs. 450/=. Thrashing is for only wheat crop; the cost of thrashing is Rs. 18.00 per 40 kgs. Some farmers also use bull carts for land leveling and ploughing.

3.6.5 Labor for Agriculture

A farmer who is an owner-operator would normally provide labor in the shape of himself and his whole family. Whereas, if a farmer is a landowner and he has tenant(s), then all agricultural work is executed by these tenant(s), who engage their entire families in agricultural activities. Occasionally, farmers hire labor for agricultural work, especially for cotton picking, because this is a very time-consuming activity, and the farmer has to prepare his land for the next crop. Hence, time available for this activity is short. The rate for cotton picking in the Dhoro Naro command area is Rs. 80 per 40 kgs.

Some farmers pick on an exchange basis; in the Sindhi language, this activity is called *WANGAAR*. In cases like these, a farmer invites his neighboring farmers to help him with cotton picking; neighboring farmers, along with their families, provide the help.

Similarly, the benefiting farmer reciprocates when a call is received from these neighboring farmers. In such cases no remuneration is paid, and only meals are provided.

3.6.6 Taxes to Government

Farmers pay different taxes for different crops to the relevant government authorities. The detail of these taxes has already been mentioned in Chapter 2 of this report.

3.6.7 Labor for Desilting

Normally, farmers clean their watercourses regularly. One leader at each watercourse decides when to excavate (sometimes this date is already fixed). Accordingly, he informs all farmers of that watercourse. On the agreed day, all farmers send labor, usually in accordance with their land holdings. The schedule for desilting is different for each watercourse. Some farmers clean every week, some every fortnight, some every month, while other farmers desilt their watercourses only once during a season.

Farmers decide desilting activities according to the physical condition of their watercourses; after observing the slopes of the watercourse, when good, then farmers feel no need to desilt, even for an entire season. On the other hand, if the slope of a watercourse is high when compared to the crest level of the minor canal, then farmers may feel a need to desilt as frequently as once a week

3.7 FARM LAND EXPENDITURE OF DHORO NARO MINOR

This information was collected from the farmers through interviews. The field staff was adequately briefed in order to understand the importance of accuracy when providing this information. Before the interview process they visited the local markets to familiarize themselves with the different kinds of pesticides, fertilizers, and seed qualities and prices.

Farmers of this command area keep a fairly good record of farm inputs. Most of the farmers interviewed had kept the original receipts of different inputs purchased. The information regarding maximum and minimum costs per acre incurred by farmers on different farm inputs for key crops of this minor command area, is presented in Table 30.

Table 30. Maximum, Minimum Agriculture Input Costs Within Dhoro Naro Minor.

Particulars	Cotton		Sugarcane		Wheat		Fodder		Oil Seeds	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Land prep. Cost/ acre	1,000	450	1,000	300	500	450	500	300	300	250
Seeds	500	120	2,475	1,600	2,160	300	660	240	100	40
Fertilizer	4,580	710	4,660	1,469	3,600	910	37	37	1,240	300
Pesticides	5,000	375	600	600	500	100	0	0	0	0
Labor	2,000	560	1,300	800	1140	306	0	0	0	0

From the above table, the range of costs per cropped acre for different key crops incurred by the farmers can be inferred. Furthermore, it is observed that farmers spent high amounts on the land preparation for cotton and sugarcane crops. Similarly, expenses for the purchase of seeds and fertilizers are comparatively high for the sugarcane and wheat crops. Farmers also incur high costs when purchasing pesticides for the cotton crop, while this expense is lowest for the wheat crop, and nil for fodder and oil seed.

The information pertaining to maximum and minimum farm input costs by the farmers of this minor command area, grouped by watercourse numbers for major crops, is presented in Table 31.

Table 31. Maximum and Minimum Agriculture Input Costs for Selected Crops.

Particulars	Cotton		Sugarcane		Wheat		Fodder		Oil Seeds	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Watercourse number:	1L	1AL	6AR	1AL	2R	1R	7R	7L	7R	6AR
Land prep. Cost/ acre	600	450	300	600	450	450	332	332	292	292
Seeds	275	132	2,475	2,160	400	500	1,199	20	40	31
Fertilizer	1,920	904	3,860	1,469	3,600	1,035	37	37	1,240	300
Pesticides	5,000	375	600	600	249	249	0	0	0	0
Labor	1,760	1,360	1,300	1,050	720	540	0	0	0	0
Total in Pakistan Rupees:	9,555	3,221	8,535	5,879	5,419	2,774	1,568	389	1,572	623
Total in US Dollars:	217	73	194	134	123	63	36	9	36	14

The mean costs for these major crops per cropped acre, are; (1) Cotton, Rs. 4,919 (US\$112); (2) Sugarcane, Rs. 7,330 (US\$167); (3) Wheat, Rs. 3,463 (US\$79); (4) Fodder, Rs. 787 (US\$18); and (5) Oil Seeds, Rs. 717 (US\$16).

The mean cost per cropped acre for sugarcane, which is a 12-month crop, is the highest among different crops, i.e., Rs. 7,330 (US\$167) per acre. Other crops are cultivated bi-annually. Farmers in this command area usually utilize their land by cultivating different combinations of crops in a cropped year. Accumulated mean costs per acre for these combinations during one year, is presented in Table 32.

Table 32. Mean Agriculture Input Costs for different Crop Combinations.

Crop Combinations	Mean cost of Crop no. 1 in Rupees	Mean cost of Crop no. 2 in Rupees	Total Mean cost of Crop in Rupees	Total Mean cost of Crop in US Dollars
Sugarcane only	7,330		7,330	167
Cotton + Fodder	4,919	787	5,706	130
Cotton + Oil seed	4,919	717	5,636	128
Cotton + Wheat	4,919	3,463	8,382	191
Fodder + Oil seed	787	717	1,504	34
Fodder + Wheat	787	3,463	4,250	97

Therefore, when compared to the sugarcane crop, the combination of the cotton and wheat crops is the most expensive, while that of fodder and oil seed is the least expensive combination.

The farm input costs, calculated by multiplying the crop inputs with the per unit cost of these inputs, for the *rabi* 96/97 and *kharif* 97 cropping seasons for the Dhoro Naro Minor command area, amounts to Rs. 3,056 and Rs. 4,785, respectively, per cropped acre. For one cropped year, this amounts to a total of Rs. 7,841 per cropped acre. Important information derived from farm input cost analyses for this distributary is presented in Table 33.

Table 33. Agriculture Input Costs Analysis.

Particulars	Rabi - 96-97	Kharif - 97	Total (1 year)
Cropped Area in acres	7,894	6,869	14,763
Fallow Area in acres	2,224	3,249	--
Waterlogged Area in acres	185	185	--
Salinized Area in acres	1,680	1,680	--
Abandoned Area in acres	1,178	1,178	--
CCA in acres	13,161	13,161	13,161
Cropping Intensity (in %age)	59.98	53.69	113.67
Gross input costs (Rupees)	24,124,018	32,866,131	56,990,149
Gross input costs per cropped acre (Rupees)	3,056	4,785	7,841
Gross input costs per CCA acre (Rupees)	1,833	2,497	4,330
Gross input costs (US\$)	548,273	746,958	1,295,231
Gross input costs per cropped acre (US\$)	69	107	176
Gross input costs per CCA acre (US\$)	42	57	99
Avg. price of land per acre (Rupees)	65,000	65,000	65,000
G/input cost to land (Crop) price in %age.	4.70	7.26	11.96
G/input cost to land (CCA) price in %age.	2.82	3.84	6.66

Rate applied: 1 US\$ = Pakistan Rupees 44.00.

3.8 CALCULATION OF *ABIANA*, *USHER* AND TAXES PAYABLE IN DHORO NARO MINOR

Abiana payable has been calculated by multiplying the cropping pattern of the Dhoro Naro minor with that of the rates of *abiana* for this period. Similarly, local cess and drainage cess figures have been reached by multiplying its area with its rate. However, to calculate agriculture tax and *usher*, the data was arranged according to a farmer's total holding of agriculture land. The various taxes and their rates have been discussed in detail in Chapter 2. The information about these taxes is presented in Table 34.

Table 34. Agriculture Land Taxes Analyses.

Particulars	Rabi - 96-97		Kharif - 97		Total (1 year)	
Cropped Area in acres	7,894		6,869		14,763	
CCA in acres	13,161		13,161		13,161	
Cropping Intensity (in %age)	59.98		53.69		113.67	
Abiana total in rupees	413,181		600,913		1,014,094	
Agriculture Tax total in rupees	172,316		516,169		688,485	
Drainage Cess total in rupees	27,358		27,358		54,716	
Local Cess total in rupees	75,432		69,992		145,424	
Usher total in rupees	966,753		1,131,772		2,098,525	
Total Taxes in rupees:	1,655,040		2,346,203		4,001,243	
Total Taxes in US Dollars:	37,615		53,323		90,938	
	Per Crop Acre	Per CCA Acre	Per Crop Acre	Per CCA Acre	Per Crop Acre	Per CCA Acre
Abiana in rupees	52	31	87	46	139	77
Agriculture Tax in rupees	22	13	75	39	97	52
Drainage Cess in rupees	3	2	4	2	7	4
Local Cess in rupees	10	6	10	5	20	11
Usher in rupees	122	73	165	86	287	159
Total Taxes in rupees:	209	125	341	178	550	302
Total Taxes in US Dollars:	5	3	8	4	13	7

Therefore, *abiana* (water service charges) per cropped land payable for one year in the Dhoro Naro Minor amounts to Rs. 139 (US\$3.16) per acre, or Rs. 343 (US\$7.80) per hectare, while *abiana* per CCA equals Rs. 77 (US\$1.75) per acre, or Rs. 190 (US\$4.32) per hectare. *Usher*, levied by Islam, is about 50% of the total taxes payable by the farmers in one year.

3.9 CALCULATION OF FARM INCOME IN DHORO NARO MINOR

The information considered useful during farm income analysis, which can be used to identify the range of farm inputs, and net farm income per kilogram, of major crops, is presented in Table 35.

The reasons for low profitability in watercourse 10-L have been explained earlier in this chapter; the low yield due to the shortage of water, and pest attacks on the cotton crop, are the main reasons.

The mean net farm income of the farmers of the Dhoro Naro Minor for major crops has been calculated by multiplying the mean yield for these crops with the mean net return per kilogram of each crop. The results of these calculations are presented in Table 36.

Table 35. Net Agriculture Income Analysis in per Kilogram of Yield for Selected Crops.

Particulars	Cotton		Sugarcane		Wheat		Fodder		Oil Seeds	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
W/Course number	11L	10L	1AL	1R	1R	10L	9L	10L	6AR	1CL
Revenue per kg in Rupees	20.19	19.07	0.79	0.64	6.27	4.27	0.90	0.28	12.29	6.04
Land Preparation/Kg (Rs.)	0.90	6.73	0.04	0.04	0.38	1.00	0.17	0.09	1.46	0.94
Seed/Kg in Rupees	0.42	1.88	0.14	0.10	0.42	0.94	0.12	0.22	0.16	0.09
Fertilizer/Kg in Rupees	2.68	16.25	0.09	0.29	0.86	3.46	0.02	0.01	1.50	1.09
Pesticide/Kg in Rupees	0.83	25.0	0.04	0.04	0.21	0.52	0.00	0.00	0.00	0.00
Labor/Kg in Rupees	2.09	15.66	0.07	0.07	0.45	1.21	0.00	0.00	0.00	0.00
Total Cost/Kg:	6.92	65.52	0.38	0.54	2.32	7.13	0.31	0.32	3.12	2.12
Net return/Kg in Rupees	13.27	(46.45)	0.41	0.10	3.95	(2.86)	0.59	(0.04)	9.17	3.92

Table 36. Mean Profit Analysis for Selected Crops.

Particulars	Cotton	Sugarcane	Wheat	Fodder	Oil Seeds
Mean yield per acre in kg	541.00	18,000.00	994.00	5,704.00	410.00
Mean price/kg in rupees	19.22	0.75	5.71	0.60	8.70
Mean costs/kg in rupees	9.09	0.41	3.48	0.14	1.75
Mean return/kg in rupees	10.13	0.34	2.23	0.46	6.95
Mean profit per acre	5,480.00	6,120.00	2,216.00	2,626.00	2,850.00

The main result of this table when compared to sugarcane, which is an annual crop, the combination of cotton crop with oil seed crop, both of which are seasonal crops, yields a much higher net farm income to the farmers of this command area. The main reason why farmers tend to plant sugarcane is that this is a very low-risk crop.

Information derived during farm income analysis, which can be used to identify the factors that affect yields of major crops, is presented in Table 37.

Table 37. Effects of Cost-of-Inputs, GW/Quality, WT Depth and W/Duty on Yields for Selected Crops.

Particulars	Cotton		Sugarcane		Wheat		Fodder		Oil Seeds	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
W/Course number	6R	10L	6AR	1R	6R	7L	6AR	1CL	6L	4L
Yield in kg. Per acre	1,200	80	24,000	16,000	1,400	400	12,000	1,200	600	100
Land preparation p/acre Rs.	538	538	300	600	479	479	300	300	292	292
Seed per acre in Rupees	200	150	2,475	1,600	800	600	100	500	40	50
Fertilizer per acre Rs.	1,580	1,300	3,860	4,660	1,920	1,240	37	37	680	699
Pesticide per acre Rs.	750	2,000	600	600	112	249	0	0	0	0
Labor per acre Rs.	1,253	1,253	1,300	1,050	581	581	0	0	0	0
W/Quality in PPM (avg.)	492	1,751	633	605	492	1,225	633	528	1,479	506
W/Table depth (avg.)	7.87	9.99	6.17	5.80	7.87	9.41	6.17	8.71	8.07	8.19
W/Duty (Avg.)	6.09	0.90	6.63	11.58	6.09	1.142	6.63	2.72	1.52	5.547

Low yields for cotton and wheat crops are mainly due to three reasons:

1. Less amounts spent on the purchase of seeds, i.e., less by Rs. 50 and Rs. 200 per acre, respectively, for cotton and wheat crops.
2. Less amounts spent on the purchase of fertilizer, i.e., less by Rs. 280 and Rs. 680 per acre, respectively, for cotton and wheat crops.

3. Less availability of water, i.e., less water duty by 5.19 and 4.95, respectively, for cotton and wheat crops.

Interesting to note, is that in the watercourses that have low water duties, the farmers spend less money for the purchase of fertilizer, which confirms the perception of the farmers that fertilizer should only be used with sufficient water application.

The difference in yield for sugarcane is mainly due to one factor, i.e., less money spent (Rs. 875 per acre) on the purchase of seed. Furthermore, the studies conducted by LIM indicate that the maximum cane yield is obtained with 120 cm depth of water application, where watertables are up to 6 feet from the surface. With each 10 cm over-application of water, the sugarcane crop yields drop by approximately 1.5%. The farmers of Watercourse 1-R have more water available to apply to this crop when compared with farmers of Watercourse 6-AR. Interestingly, their yield is also very low.

While the reason for the low fodder yield in Watercourse 1-CL is attributed to a low water duty, the reasons for low yield for oil-seed remain to be investigated.

The analysis of farm income for all the watercourses of this command area reveals that there is a big disparity in the earning capacity of farmers. The farmers in the head, and the majority in the middle reaches of this minor command area, earn fairly well. Farmers in the tail reach areas of this minor are badly affected. The range of farm income for this minor is presented in Table 38.

Table 38. Maximum, Minimum and Mean Agriculture Net Revenue of Dhoro Naro Minor.

	Revenue Max.			Revenue Min.			Revenue Mean
	K-97	R-96	Total	K-97	R-96	Total	Total
Watercourse no.	6R	6R	6R	10L	10L	10L	
Farm-gate revenue	4,198,544	1,877,378	6,075,922	82,634	327,445	410,079	4,687,925
Gross input costs	796,082	798,277	1,594,359	264,045	361,116	625,161	2,279,606
Gross taxes	64,013	48,878	112,891	18,042	26,596	44,638	160,050
Total expenditures	860,095	847,155	1,707,250	282,087	387,712	669,799	2,339,656
Net income	3,338,449	1,030,223	4,368,672	(199,453)	(60,267)	(259,720)	2,248,269
Per cult. Acres	17,105	4,200	21,305	(3,200)	(476)	(3,667)	7,727
Per CCA Acres	16,232	5,001	21,233	(257)	(78)	(335)	4,271

There are a total of 25 watercourses in the Dhoro Naro Minor; the farm income of 14 watercourses is less than the mean farm income by approximately 50%. The four watercourses at the tail reach of this minor experience acute shortage of water, and their net incomes are nearly negligible due to two reasons. First, availability of water; while the range of water duty in this command area is between 0.90 and 11.54, the water duty of these 14 watercourses is less than 3. By achieving equity in water distribution, certainly, the net farm incomes can be increased. Second, groundwater quality; unfit for

agriculture purposes, unless a treatment of the same takes place. In fact, in some fields, due to the use of this groundwater, secondary salinity has also been observed.

Since the water table depth from the surface is between three and six feet in the head and middle areas of this minor, the crop water requirement is also less, due to the groundwater contribution towards ET losses, i.e., around 24.2%. This may form a basis to increase the availability of water to the tail reach areas.

Farm income has been calculated by subtracting farm expenditure and farm taxes from the gross farm revenue. The total farm income for one crop year, and other important information, is presented in Table 39.

Table 39. Net Agriculture Income Analysis.

Particulars	Rabi-96-97		Kharif-97		Total (1 year)	
Cropped Area in acres	7,894		6,869		14,763	
Fallow Area in acres	2,224		3,249		--	
Waterlogged Area in acres	185		185		--	
Salinized Area in acres	1,680		1,680		--	
Abandoned Area in acres	1,178		1,178		--	
CCA in acres	13,161		13,161		13,161	
Cropping Intensity (in %age)	59.98		53.69		113.67	
Gross Revenue (Rupees)	50,093,203		67,104,926		117,198,129	
Gross input costs (Rupees)	24,124,018		32,866,131		56,990,149	
Total Taxes (Rupees)	1,655,040		2,346,203		4,001,243	
Total Expenditure	25,779,058		35,212,334		60,991,392	
Farm Income (Rupees)	24,314,145		31,892,592		56,206,737	
Farm Income (before taxes) in percentage	48.16		51.02		48.62	
Farm Income (after taxes) in percentage	48.53		47.52		47.96	
Farm taxes to Farm income (Bef./tax) in %age	6.37		6.85		6.65	
	Per Crop Acre	Per CCA Acre	Per Crop Acre	Per CCA Acre	Per Crop Acre	Per CCA Acre
Gross Revenue (Rupees)	6,346	3,806	9,769	5,099	16,115	8,905
Gross input costs (Rupees)	3,056	1,833	4,785	2,497	7,841	4,330
Total Taxes (Rupees)	210	126	342	178	552	304
Total Expenditure	3,266	1,958	5,126	2,676	8,392	4,634
Farm Income (Rupees)	3,080	1,847	4,643	2,423	7,723	4,270
Farm Income (US Dollars)	70	42	106	55	175	97
Avg. price of land per acre (Rupees)	70,000		70,000		70,000	
Farm Income to land (Crop) price in %age.	4.40		6.63		11.03	

Rate applied: 1 US\$ = Pakistan Rupees 44.00.

The analysis of farm income for the Dhoru Naro Minor reveals the following facts:

- (a) Farm income percentage during the *rabi* season is higher by 1.01%. However, considering that the two types of taxes, i.e., Local Cess and Drainage Cess, are fixed taxes, and that farm revenue is higher during

kharif by about 33.96%, the net farm income percentage remains nearly the same during both seasons.

- (b) Although the cropping intensity during the *rabi* season is higher by 6.29% when compared with that of the *kharif* season, the farm income during *kharif* is higher by 33.96%, in total. Therefore, *kharif* crops (cotton, sugarcane, etc.,) are more revenue-generating when compared with the *rabi* crops (wheat, oil seed, etc.,).
- (c) The loss of farm income for the farmers in this command area, due to non-cultivated land equivalent to about 3,043 acres, is estimated at Rs. 23.501 million (US\$0.534 million). If this land is reclaimed, the per CCA farm income can increase to Rs. 6,056 per acre (US\$137) when compared with that of the existing per CCA farm income of Rs. -4,270 per acre (US\$97).
- (d) The fixed deposit schemes of the banks generate a higher interest rate, i.e., about 17.5%, which, after tax and *Zakat*, amounts to about 15.31%. Apart from these two bank taxes, an investor has also to pay wealth tax, the rates of which vary from 2.5% to 10%. Assuming a rate of 5% for wealth tax, the effective rate of interest is equivalent to 14.44%. At first glance, this rate appears to be quite lucrative. However, when we consider the time value of money with an inflation rate of 12%, in reality, the rate of return is only 2.44%. One year ago the average land price in Dhoro Naro Minor was approximately Rs. 70,000 per acre. The net farm income before tax per cropped acre to average land price, amounts to 11.83%, and farm income after tax, to 11.03%. Since the prices for land and crops increase nearly at par with the inflation rate, the farmers of the Dhoro Naro Minor can be considered as earning fairly well.
- (e) The banks give an interest rate of 12.5% (per annum) on all Pakistan rupee saving accounts; however, by law they deduct 12.5% (W/tax is 10% plus *Zakat* 2.5%), the amount of interest earned on these accounts, thereby reducing the interest rate to 10.94%. Again, considering the time value of money by assuming an inflation rate of 12%, the effective interest rate is equivalent to 1.06% negative.
- (f) The Income Tax authorities in Pakistan, for the purpose of income tax, considers a net profit (before tax) percentage of 20-30% as reasonable in the case of sole proprietorship and partnership concerns. When compiling the profit and loss accounts of sole proprietorship and partnership concerns, the salaries for partners are not considered as an expense, therefore, for the purpose of comparison, the farming community can be considered as sole proprietorship or partnership concerns. In the Dhoro Naro Minor, net farm income, in percentage to the farm revenue, is 48.62%. This makes farming in Dhoro Naro Minor a very reasonable profession.

4 NEED FOR A BUSINESS PLAN FOR DHORO NARO MINOR

4.1 COUNTRY SETTING

Pakistan encompasses about 80 million ha. of land, of which about 26% is cultivated. Pakistan is divided into three hydrological regions; the Indus Basin, covering more than 56 million ha. (70% of the country's area), the Kharan Desert in the west of Balochistan, and the arid Makran coast along the Arabian Sea in southern Balochistan. The deserts in the south (Thar and Cholistan) have no water resources.

Pakistan's climate is arid to semi-arid. The annual rainfall over much of the Indus Plain is uneven and does not exceed 150 mm, while evaporation rates are high, varying from 1,250 to 2,800 mm. Agriculture is crucial to Pakistan's economy, but non-irrigated agriculture within the Indus Plain is impossible. The importance, therefore, of an efficient and effective irrigation network cannot be overstated.

Although Pakistan has substantial natural water resources, these are inadequate for crop production on all irrigable land. River flows are highly seasonal, with roughly 85% of annual flow occurring during the *kharif* season. Due to limitations on water availability, cropping intensities tend to be low. Furthermore, the majority of irrigation systems suffer from low delivery efficiencies, inequitable water distribution, inadequate system maintenance, insufficient cost recovery from beneficiaries and the need to improve drainage.

Despite Pakistan's growth being agriculturally based, parallel non-agricultural growth has occurred in areas with large employment bases. Wages have been increasing, in real terms, and absolute poverty has been declining.

4.2 POLICY REVIEW

Current national and provincial agricultural policies seek the same fundamental goals; raising rural incomes, reducing imports and increasing exports of raw materials and processed goods. However, the 1988 Report by the National Commission on Agriculture concludes that in order to meet the demands of Pakistan's high population growth rate (3% per annum), accelerated growth in agriculture production is essential. The present rate (estimated at 3.8% per annum in 1993) is inadequate; agricultural growth must rise by an average of 5% per annum if the GoP strategy of virtual self-sufficiency is to be achieved and sustained.

4.3 A FRAMEWORK FOR REFORMS

The institutional reforms, which are essential to safeguard future agriculture production, have been the focus of a major study sponsored by GoP and the World Bank (Institutional Reforms to Accelerated Irrigated Agriculture, 1994). The major conclusions and recommendations for policy reform arising from this study are:

➤ **Fertilizer Policy:**

Currently, fertilizer is grossly underused, and requires the implementation of policies that will bring effective competitive fertilizer supply and a distribution system that encourages private competition.

➤ **Research and Extension:**

There is gross under-investment in research, which requires the doubling of expenditure and the introduction of a large competitive grants program.

➤ **Irrigation and Agriculture:**

The deterioration of the irrigation infrastructure poses serious long term problems; the underlying causes of deterioration are effectively built into the operation procedures, and requires radical change by establishing farmers' irrigation groups, an irrigation commission to enforce efficient and equitable management, and shifting irrigation systems to semi-autonomous water authorities.

➤ **Price Policy:**

Import subsidy on wheat should be gradually removed and abolished; sugar prices should be decreased to promote a shift to higher value crops, and direct taxes on agriculture increased to support expenditures on rural infrastructure programs.

The radical change required for irrigation operation procedure was further discussed through a seminar on Participatory Irrigation Management (PIM) held in October 1994. This seminar was co-sponsored by the Economic Development Institute (EDI) of the World Bank, with the primary objective of identifying ways to increase food production through improved irrigation management. One of the products of the seminar was a series of provincial action plans prepared by WAPDA, using, as a starting point, current OFWM programs, but generally aiming for the pilot introduction of a WUA federation responsible for assessment, collection and disbursement of irrigation fees. Further, it was understood that the pilot turnover of a distributary, or minor canal, to water users will be implemented under the Left Bank Outfall Drain (LBOD) (North West Canal Remodelling Project, Interim Report, March 1995).

The LBOD project management, in consultation with the World Bank and Swiss Development Cooperation (SDC), entered into a consultancy agreement with the International Irrigation Management Institute (IIMI) to implement three pilot projects, in which Water Users Organizations (WUO's) would be established to operate and maintain (O&M) irrigation facilities in distributary/minor canal command areas (Inception Report, 1995).

4.4 CURRENT STATUS

The farmers of the Dhoru Naro Minor canal formed their federation with the assistance of IIMI-Pakistan and elected its office bearers in December 1996. The

aspiration is for this WUF to operate and maintain their minor canal in the future. Specifically, it is anticipated that the WUF can achieve a more equitable distribution of water, improved reliability and timeliness of delivery, and through collaboration with the extension department, OFWM and IIMI-Pakistan, increased adoption of improved irrigation and agricultural practices.

With this policy and research background, the WUF needs to be assisted by testing its financial viability to bear the O&M costs of the irrigation facilities. And, by developing a framework for sound financial planning and management, including mobilization of resources in the achievement of the aforesated goals.

The importance of a financial framework for the WUF is further established with the fact that in 1997, the Sindh Assembly passed a bill to provide for the establishment of the irrigation and drainage authority (SIDA). For equitable distribution of irrigation water and effective drainage and flood control sustainable on a long term basis through participation of beneficiaries in the operation and management of irrigation drainage network, and to provide for matters connected therewith, or incidental thereto.

The relevant sections and sub-sections of this bill directly affecting the finances of the Dhoro Naro Minor WUF are reproduced as follows:

Section 21(2) The rates at which the Authority shall supply water shall be so fixed as to provide for meeting the operation and maintenance cost of the system within a period of seven to ten years; provided always that before proposing any enhancement in the existing rates and/or agreeing to the same, the Authority/AWBs concerned shall use their best endeavors to reduce the quantum of the following measures:

- (i) reducing costs;
- (ii) improving assessment and collection of water rates and drainage cess;
- (iii) recovery of arrears;
- (iv) recovery of cost for providing drainage flood control to non-farming beneficiaries; and
- (v) dis-investment of fresh water tubewells in SCARP areas.

Section 21(3) The components of O&M to be recovered from the farmers in the form of *abiana* shall be the full O&M cost of Irrigation Canals and Secondary Drains.

Section 21 (4) The O&M cost of flood protection and public sector FWG tubewells will be excluded from *abiana*. A nominal proportion (say five to ten percent) of the O&M cost of SGW tubewells and/or main drains may, however, be borne by the farmers, should such a need be felt by the Authority.

Section 26 C (4) To collect the agreed water charges/other dues, if any, from its water users and pay the agreed consideration for supply of irrigation water and conveyance and/or disposal of drainage effluent to the SIDA or AWB concerned.

Section 26 C (5) To engage, hire or employ any consultants, advisors and employees as may be deemed necessary, or be otherwise reasonably required for the due

and effective performance of various powers and functions on such terms and conditions as may be prescribed, including terms and conditions relevant to the conclusion or premature termination of such engagement, etc., of any consultants, advisors or employees, as the case may be.

4.5 CURRENT EXPENDITURE ON IRRIGATION INFRASTRUCTURE BY THE GoS

The Finance Department of the GoS prepares a detailed budget for the province of Sindh each year, covering the period from July 1 to June 30 the following year. The budget for the Irrigation infrastructure appears in Volume III, containing demand numbers 25 to 50. Demand number 37 represents irrigation. For the year 1997-98, the total demand, and voted, is Rs. 1,236,691,240 or Rs. 1.237 billion, i.e., US Dollars 28.100 million.

These costs are mainly categorized under four heads of expenses, namely: (1) Irrigation Administration; (2) Irrigation Dams; (3) Machinery and Equipment; and (4) Repair and Maintenance. The breakdown of these heads of expenses in various sub-heads, and their rate per CCA acre for the province of Sindh, is presented in Tables 40, 41 and 42.

Table 40. Irrigation Administration.

Description	Salaries and Benefits	Supplies and Services	Communication	Utilities	Total	Per CCA acre
Irrigation Secretariat	13,360,810	1,210,460	446,980	450	15,018,700	1.14
Chief Engineers:						
Sukkur Barrage	6,634,230	629,060	290,010	79,480	7,632,780	0.58
Irrig. Development	2,822,030	213,700	66,000	61,000	3,162,730	0.24
Kotri Barrage	5,490,730	389,980	82,110	61,730	6,024,550	0.46
Guddu Barrage	2,932,330	334,610	150,150	30,240	3,447,330	0.26
Superin. Engineers:						
Superin. Engineers	19,559,750	839,600	346,680	144,800	20,890,830	1.58
Guddu Barrage	1,845,310	164,350	88,830	17,960	2,116,450	0.16
Executive Engineers:						
Executive Engineers	668,932,620	2,619,880	1,537,470	581,170	673,671,140	51.05
Guddu Barrage	90,283,620	498,240	211,560	63,900	91,057,320	6.90
Director Regulation	5,080,910	270,140	146,000	2,270	5,499,320	0.42
Spec. Revenue Est.:						
Spec. Revenue Est.	29,761,510	225,340	80,430	43,680	30,110,960	2.28
Guddu Barrage	5,253,650	61,950	5,990	5,250	5,326,840	0.40
Medical	589,410	56,970	2,250	2,700	651,330	0.05
Director Irr. Res.	5,283,260	190,260	57,540	2,730	5,533,790	0.42
Director Irr. Design	2,900,400	27,900	-	10,450	2,938,750	0.22
Total:	860,730,570	7,732,440	3,512,000	1,107,810	873,082,820	66.16
Per CCA acre	65.23	0.27	0.08	0.59	66.16	

The Provincial Irrigation Department spends about 70.60% of its total allocated budget (i.e., Rs. 1,236.691 million) on irrigation establishment. Other percentages within the establishment costs are Salaries and Benefits, 69.60%, office supplies (rent, rates,

stationery, newspapers, maintenance etc.), 0.63%, Communications, 0.28% and Utility bills, 0.09%.

The irrigation secretariat is situated in Karachi. The percentage share within the total establishment cost is about 2%, while the costs for Special Revenue Establishment is 4.06%.

The Provincial Irrigation Department spends about 3.00% of its total allocated budget (i.e., Rs. 1,236.691 million) on irrigation dams. Other percentages within the Irrigation Dams cost are Maintenance and Repairs; 2.56%. Stone Pitching and Repairs and Carriage make up the balance of 0.46%.

Table 41. Irrigation Dams.

Description	Maint. And Repairs	Recouping of Stone Pitching and apron of Ruk Loop Bund	Repairs and Carriage	Total	Per CCA acre
Sukkur Barrage	14,584,920	1,523,970		16,108,890	1.22
Kotri Barrage	5,784,870			5,784,870	0.44
Guddu Barrage	7,196,050			7,196,050	0.55
Machinery & Equipment:					
Research Division			52,390	52,390	0.00
Disch. Observation Cell			42,530	42,530	0.00
Embark. & Drainage Works:					
S.M.H.L	307,330			307,330	0.02
Kinjhar Lake	724,520			724,520	0.05
Machinery & Equipment			25,410	25,410	0.00
Other Charges:					
Ghar Inspect. Bungalow	291,060			291,060	0.02
Research Division	2,138,200			2,138,200	0.16
Disch. Observation Cell	94,920			94,920	0.01
Rest House at Lahore	65,830			65,830	0.00
Soil Mechanic & Hydraulic Lab.	506,100			506,100	0.04
Total:	31,693,800	1,523,970	120,330	33,338,100	2.53
Per CCA acre	2.40	0.12	0.01	2.53	

Table 42. Machinery & Equipment.

Description	Machinery & Equipment	Sukkur Barrage	Chief Engineer Irrigation Develop.	Kotri Barrage	Guddu Barrage	Total	Per CCA acres
Durable Goods	4,971,000					4,971,000	0.38
Repairs & Carriage		1,020,810	99,220	796,850	392,700	2,309,580	0.18
Total:	4,971,000	1,020,810	99,220	796,850	392,700	7,280,580	0.56
Per CCA acre	0.38	0.08	0.01	0.06	0.03	0.56	

Table 43. Repair and Maintenance.

Description	Sukkur Barrage	Guddu Barrage	Kotri Barrage	Silt Clearance	Makhi Dhand	Thatta Sajawal Road	Dadu Moro Road	Malir River	Total	Per CCA acres
Irrig. Head Works	5,754,520	5,635,980	2,675,930						14,066,430	1.11
Main Canal Feeders	91,470,220	27,603,660	34,921,420						153,995,300	12.21
Silt Clearance				116,644,500					116,644,500	9.25
Lift Irrigation Schemes:										
Maintenance & Repairs	9,332,000		701,510						10,033,510	0.80
Electricity Charges	10,120,640		2,252,250						12,372,890	0.98
Drainage Schemes										
Bridges			10,383,130		3,152,520	1,045,590	950,570		13,535,650	1.07
Operat. & Maintenance								345,520	345,240	0.16
										0.03
Total:	116,677,380	33,239,640	50,934,240	116,644,500	3,152,520	1,045,590	950,570	345,520	322,989,680	24.48
Per CCA acre	8.84	2.52	3.86	8.84	0.24	0.08	0.07	0.03	24.48	

The Provincial Irrigation Department spends about 26.00% of its total allocated budget (i.e., Rs. 1,236.691 million) on the Repair and Maintenance of Irrigation Canals. Other significant percentages within the Repair and Maintenance of Irrigation Canals are Sukkur Barrage, 9.00%, Guddu Barrage, 3.00%, Kotri Barrage, 4.00% and Silt Clearance, 9.00%.

The summary of costs for the four main budget line items for the Irrigation Department Government of Sindh, is presented in Table 44.

Table 44. Summary of Costs.

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 GoS spends a total of Rs. 1,236.691 million (Rs. 93.73 per CCA acre) on the Provincial Irrigation Department, out of which 71% (Rs. 66.16 per CCA acre) is spent on the irrigation establishment, while the rest, i.e., 29% (Rs. 27.57 per CCA acre), is spent on maintenance activities.

In 1986/87, a detailed Yard Stick for O&M costs was prepared by the Irrigation Department and submitted to the Government of Sindh. According to this Yard Stick in 1986/87, Rs. 25.16 per CCA acre was required for Irrigation O&M Costs to attain a reasonable efficiency level in the system.

Table 45. Reasonable Requirements for O&M of Irrigation Infrastructure.

	Quantity or Units	Unit Yard-Stick Rate	Amount (Millions Rs.)	Remarks
Irrigation Works.				
Flow Irrigation (including Irrigation Colonies)	14,865 Virtual Miles.	13,333	198.195	
Repair & Maintenance of Barrage Gates & other E&I works.	50,000*1,659		82.95	
Lift Irrigation (small Irrigation schemes):				
(a) On Rivers.	1,750 H. Power	4,963	8.685	
(b) On Canals.	3,155 H. Power	4,834	15.251	
Flood Embankments:				
(a) Main Bunds (River)	935.00	27,470	25.684	
(b) Loop Bunds (River)	339.00	21,131	7.164	
(c) Hill Torrent Bunds	198.50	19,967	3.963	
(d) Kinjhar Lake (Bund)	12.50	54,940	0.687	
Total Irrigation:			342.579	Rs. in millions
CCA (acres) of three barrages including Inundation canals & Lift Irrigation Schemes			13.615	Acres in Millions
Rate per CCA acre			25.16	Rupees

Although this Yard Stick is a good measurement for required O&M costs, it does not take into account the Establishment Cost, which is a major fixed proportion of the O&M costs. In order to calculate a true maintenance cost (based on Yard Stick), the recommended cost has been adjusted for the current prices by applying a GDP deflator, which is given in Table 46.

Table 46. Maintenance Cost based on Yard Stick.

Year	GDP- Deflator	Index	Per CCA acre of Irrigation O&M without Establishment Cost
86-87	142	1	25
96-97	387	2.7	68

This data is based on a 1986 analysis by NESPAK, updated as above to 1996-97 prices. In IIMI's opinion, these figures are a minimum level. A similar study in north India, in a state with similar infrastructure (Haryana Water Resources Consolidation Project, World Bank, 1995), but where costs and wage rates are somewhat higher, indicated costs approximately double those indicated above, but no more detailed analysis on current needs in Sindh is available (Dr. Christopher Perry, Status Report on Financial Feasibility Analysis).

Hence, a minimum estimate for maintenance costs amounts to Rs. 68 per acre, whereas, the Irrigation Department intends to spend only Rs. 27.57 per acre, thus, there is a shortfall of Rs. 40.43 per acre. In other words, the Sindh Irrigation Department is going to under-spend by 59% during the year 1997/98 on the maintenance of irrigation infrastructure.

Therefore, to maintain the irrigation infrastructure in order to meet the system adequately, so that the design service can be given on a continuing basis, the total O&M cost comes to Rs. 134.16 (US\$3.04) per acre, or Rs. 331.38 (US\$7.51) per hectare. However, this does not mean that the farmers have to pay for all of these costs, as the main cities of Sindh, i.e., Karachi and Hyderabad, also consume this water for domestic use. The total capacity of the Indus Basin Irrigation System is around 110 million area feet (MAF) per annum, out of which the share for Sindh is about 46 MAF. The cities in the Sindh province use about 3.3 MAF of water for domestic use, while about 10 MAF water goes into the Arabian Sea (Indian Ocean).

Hence, out of a total of 36 MAF (46-10) of water available for the Sindh province, about 9.17% is utilized for non-agricultural purposes. Non-agricultural use of water generates high economic returns, therefore, the rate for non-agricultural use is proposed to be comparatively higher, i.e., twice the rate that farmers are to be charged. These calculations are given as follows:

Table 47. Irrigation Water Consumed in Sindh Province.

Description	Amount in millions	Water Available	Rate per MAF
Used in Sindh Province	1,236.70	36.0	34.35
Deduct: Maint. Cost	(363.61)	36.0	
Add: Y. Stick Maint. Cost	924.96	36.0	
Estimated O&M Cost	1,798.05	36.0	49.95
Non-irrig. Use at double rate	329.67	3.3	99.90
Irrig. Use cost	1,468.38	32.7	44.90

Therefore, the cost of water to the farmers amounts to around Rs. 108 per CCA acre (Rs. 1,468.38 m/13.615 ma), or Rs. 267 per hectare.

5 ORGANIZATIONAL AND OPERATIONAL COSTS OF DHORO NARO MINOR WATER USERS FEDERATION

The Dhoro Naro Minor Canal has 25 watercourses. The water users of this command area have elected 25 Water Users Organizations, i.e., one for each watercourse, and 1 Water Users Federation at the level of this minor itself. Presently, each WUO and the WUF comprises of 5 members, besides the executive body members. The Presidents are administratively incharge of these organizations and the federation.

Once this minor canal is transferred to the Dhoro Naro Minor WUF, the overall management of the minor canal command area will also become the responsibility of this federation. These responsibilities shall include, but will not be limited, to the following:

1. Levy of *abiana* mechanism on its members
2. Supervision of the staff hired
3. O&M of the minor canal
4. Collection of *abiana* from its members
5. Payment of cost for water to the Area Water Board
6. Conflict Resolution
7. Maintaining proper accounts

5.1 LEVY OF *ABIANA* MECHANISM ON ITS MEMBERS

Broadly, three mechanisms can be implemented, namely: (a) a crop-based charge, broadly relating *abiana* to water consumption; (b) a volumetric charge; and (c) a flat rate, independent of crop type or cropping intensity.

(a) Crop-based Charge

This is the present mechanism in practice. The farmers pay according to the rates as specified by the Government for different crops. The line agencies claim that these rates have been developed in view of the crop water requirements for different crops. However, this system has two main flaws; (1) assessment of the cropping pattern for each farmer is required at the end of each cropping season; and (2) involvement of judgment as precise assessment of the cropping pattern is not possible.

(b) A Volumetric Charge

This is the most preferred mechanism by the engineers; water meters are installed and, hence, water charges relate to the water consumed. This mechanism is not installed widely around the world, although certain countries, e.g., Taiwan, South Korea and certain areas of Australia and America, have this system installed. This system, if installed, will require a complete overhaul of the present system and a huge investment. Two other methods resembling this mechanism favored by some consultants and the farmers are explained as follows:

- i. The *moghas* (modules or outlets) should be of the open flume type to ensure proportional flow at varying water levels. Water level gauges should be installed, monitored and the data computer-processed on a daily basis. A simple spreadsheet would enable a reasonable assessment of water delivered to the farmers.
- ii. The *moghas* are calibrated and their designs are noted down. Water users pay *abiana* according to the allocated time for water allowed during their turns. The hourly rates for these will be calculated in view of the discharge of water agreed with the Irrigation Department at the head of the regulator.

The first method involves the use of computers. The question is whether the Irrigation Department will agree with the daily data processed by the WUF. The success of the second method will largely depend on a continuous and reliable water supply at the head regulator and the effectiveness of the warabandi lists.

(c) A Flat Rate Charge

This is a simple mechanism; a flat rate, per acre, is charged to the farmers according to their individual land holdings. The success of this method depends on the ability of the WUF to provide water to its members on an equitable basis, otherwise the farmers at the tail reaches of the distributary will not agree to this method.

(d) Another Approach

The WB staff Appraisal Report, Pakistan, for NDP, discusses levy of *abiana* from a different angle under section 1.31, as reproduced below:

Lessons from Research: The lessons from research on water rights in other countries are also of interest: (i) there are very substantial welfare and income gains from permitting trade in water, at whatever level; (ii) water rights should be separated from land; (iii) water rights should be allocated based on historical usage, and surplus amounts to usage should be auctioned off; (iv) transaction costs for trading in water is very low, and the availability of adjustable gates is helpful to facilitate such trading; (v) environmental regulations need to be enforced; (vi) the Government has a role to play in resolving the conflicts that could arise; and (vii) public subsidies for O&M of irrigation obstruct water markets development.

The historical water rights in Pakistan are based on the design of IBIS in 1932; since then the situation has changed due to the construction of new dams and storage facilities. These dams and storage facilities have increased the availability of water over the years, and auctioning of surplus water will certainly yield more economic returns, but only the wealthy will benefit; poor farmers of this country will sell off their lands. This is what has happened in Mexico.

The WUF will be responsible for the collection of *abiana* from its members, therefore, a simple mechanism to charge a flat rate is suggested. However, the WUF will have to ensure that the watercourses receive their share of water in an equitable and reliable manner, and at the watercourse levels, the WUO's will have to ensure that its members receive water according to their land holdings.

5.2 SUPERVISION OF THE STAFF HIRED

Currently, these organizations and the federation are collecting cost contributions for repairs and other expenses. However, eventually the water users will be managing their secondary canal command areas independently. Certainly, this will require a good set-up consisting of technical, secretarial and unskilled staff.

Based on the observations of the IIMI-Nawabshah field staff, the following set of employees is suggested for the Dhoro Naro WUF in the initial stages:

1. Assistant Engineer
2. Administrative Assistant
3. *Darogha*
4. *Tandel*
5. *Baildars*

The above-stated personnel, their qualifications, range of salaries and job descriptions are suggested as follows:

Assistant Engineer

Qualification: Diploma in Agricultural Engineering or Civil Engineering.

Experience in rural areas will be preferred.

Age: Under 35 years.

Salary: Rs. 5,500 to Rs. 6,000, inclusive of all benefits.

Job Description:

This person will be answerable to the members of the WUF, and will act as the federation's right hand person. However, he will not be allowed to interact with water users personally, but will inform the WUF when required. The main duties of this person shall be to:

- a. Liaise with the Irrigation Department;
- b. Supervise all O&M activities in this command area;
- c. Record the water discharge at the head regulator, and to pursue a decrease with the ID;
- d. Keep a record of the design (width and depth) of the outlets;
- e. Record the discharge at the outlets;
- f. Advise the WUF about the design and discharge of the outlets;
- g. Ensure that the banks, berms and inspection paths of the minor are in reasonably good condition;

- h. Advise the WUF about timings for desilting, and
- i. Bring to the notice of the WUF those issues reported by *Darogha*.

Logistic Requirements:

- 1. Motor Bike
- 2. Table, Chair and chairs for visitors
- 3. Book Shelves

Darogha

Qualification: Intermediate, however diploma holder will be preferred.
Rural experience will be preferred.

Age: Under 40 years.

Salary: Rs. 4,500 to Rs. 5,000, inclusive of all benefits.

Job Description:

This person will be answerable to the Assistant Engineer, and will act as his right hand person. The main duties of this person shall be to:

- a. Take water discharge readings of the outlets;
- b. Verify the designs of outlets with the design list approved by the WUF, and to report any variations to the AE, from time to time;
- c. Monitor the banks, berms and the inspection path regularly, and to report serious cases to the AE immediately, while supervising *baildars* for minor repairs;
- d. Monitor the overhead bridge and culverts;
- e. Report theft of trees along the inspection path, or tampering of outlets, or insertion of dikes, to the AE immediately;
- f. Supervise the *baildars*; and
- g. Assist the WUF in the absence of the Assistant Engineer.

Logistic Requirements:

- 1. Bicycle
- 2. Water measuring devices

Administrative Assistant

Qualification: Intermediate.

Typing skills, computer literacy will be preferred.

Age: Under 40 years.

Salary: Rs. 3,500 to Rs. 4,000, inclusive of all benefits.

Job Description:

This person will be answerable to the Assistant Engineer. The main duties of this person shall be as follows:

- a. Typing;
- b. Maintaining files and related records;
- c. Despatch of WUF meeting letters and agenda;

- d. Maintenance of mail and despatch registers;
- e. Maintain records of petty cash expenses;
- f. Assist the Assistant Engineer in the maintenance of discharge readings for both, head regulator and the outlets; and
- g. Assist the WUF in the absence of the Assistant Engineer.

Logistic Requirements:

- 1 Typewriter
- 2 Table, chair and chairs for visitors
- 3 Book shelves

Tandail (2; alternating 12-hour schedule)

Qualification: Primary or Middle.

Rural background with some mechanical work experience.

Age: Under 50 years.

Salary: Rs. 3,000, inclusive of all benefits.

Job Description:

These persons will be answerable to the Assistant Engineer. The main duties of these persons shall be as follows:

- a. Maintain gauge book of the head regulator on an hourly basis;
- b. Operate gate of the head regulator;
- c. Greasing, oiling and cleaning the head regulator; and
- d. To report fluctuations in the water discharge to the AE, or the WUF.

Logistic Requirements:

- 1. Tool kit
- 2. Torch
- 3. Lubricants
- 4. Gauge book

Baildars (3, one each for head, middle and tail reaches)

Qualification: Good physical health.

Rural background with some relevant work experience.

Age: Under 45 years.

Salary: Rs. 3,000, inclusive of all benefits.

Job Description:

These persons will be answerable to the *Darogha*. The main duties of these persons shall be as follows:

- a. Remove vegetation from the berms, banks and the inspection paths;
- b. Sprinkle water on the inspection paths;
- c. Carry out earth work repairs to the inspection paths;

- d. Prevent animals from destroying the inspection paths;
- e. Notice and report any instances of water theft.

Logistic Requirements:

- 1. Spade
- 2. Bucket
- 3. Axe
- 4. Earth work bowls

Based on the above-stated staff deployment and their logistic needs, the budget estimates for the first year are given in Table 58. The capital equipment costs will only appear in the first year. WUF establishment costs will be reduced in subsequent periods, i.e., Rs 438,400 per annum (Rs. 428,400 plus contingencies, Rs. 10,000). Hence, the requirement to establish cost below the head of this minor will be Rs. 33.31 per acre, which in the first year will increase to Rs. 40.42 per acre due to investment required for the purchase of capital items.

Table 48. WUF Establishment Budget.

Particulars	Period	Qty.	Base cost	Amount
Salaries				
Assistant Engineer	12 m.	1	6,000	72,000
Darogha	12 m.	1	5,000	60,000
Administrative Assistant	12 m.	1	4,000	48,000
Tandail	12 m.	2	3,000	72,000
Baildar	12 m	3	3,000	108,000
Subtotal:				360,000
Supplies & Services				
Utility bills for office	12 m	1	3,000	36,000
Stationery	12 m	1	500	6,000
Meeting exp. & other supplies	12 m	1	800	9,600
Subtotal:				51,600
Travel				
Maintenance of M/Bike	12 m	1	1,000	12,000
Local Travel	12 m	1	400	4,800
Subtotal:				16,800
Capital Equipment				
Motor Bike	1 st year	1	70,000	70,000
Bicycle	- do -	1	3,000	3,000
Office furniture sets	- do -	2	6,500	13,000
Repairs & Maint. Equipment	- do -	Estimated	5,600	5,600
Typewriter	- do -	1	2,000	2,000
Subtotal:				93,600
Contingencies				10,000
Total:				532,000
Per CCA acre full costs				40.42
Per CCA acre w/o Capital Cost				33.31

5.3 MAINTENANCE AND IMPROVEMENT COSTS OF DHORO NARO MINOR

A general description of the physical phenomenon occurring in the irrigation system needs to be presented in order to understand the relationship between the field maintenance inventory and the proposed solution contained in the form of maintenance needs, including activities, costs and manpower. From the diagnostic walk thru survey,

different major, and minor, maintenance problems were observed. Most of these problems are inter-related. The inventory of these main problems is given below:

- a. Essential structural, deferred, maintenance;
- b. Sedimentation;
- c. Vegetation;
- d. Weak banks;
- e. Erosion;
- f. Wider cross sections; and
- g. Lack of inspection path.

A. Essential Structural Maintenance and Deferred Maintenance

Essential Structural Maintenance (ESM) is considered to be the minimum level of investment that should be made in order to improve water deliveries. This maintenance requires correctness of all flow control structures (repair of gates), water measurement (repair of damaged outlet structures), or installing new structures. The major problems observed under ESM and Deferred Maintenance are as follows:

- i. **Head Regulator:** The head regulator of the Dhoro Naro Minor operates and is in good condition. The head regulator has a vertical type gate, moveable within an angled iron frame through a geared rod (threaded rod) with a lever type key. There is no leakage from its sides, however, a little leakage is observed when the gate is fully seated. The up-stream gauge is not clearly visible, whereas, the downstream gauge is in good condition; however, its reading is incorrect as silt deposition at this point is between 1 foot and 1.5 feet above the crest.
- ii. **Outlets:** The Dhoro Naro Minor has 25 outlets, which are of open flume-type. The percentage of outlets tampered (changing design of its throat and crest) is very high, i.e., 85%. Water users also tamper outlets by making side openings (called *Wanjhi* in Urdu).
- iii. **Culverts:** Out of 25 culvert structures, only 20% were observed to be damaged; 24% of the outlets were either without culverts, or damaged completely, while the remaining 56% were found to be partially damaged.
- iv. **Bridges:** Bridges over channels are used to cross the roads near the villages. The Dhoro Naro Minor has five bridges, all of which have RCC construction (only abutment). The abutment of these bridges are in a fairly good condition, whereas side raising walls are either missing, or need repairs.

B,C, D& E. Sedimentation, Vegetation, Weak Banks and Erosion

The most serious problem in earthen channels is sedimentation, which is often the case for lined channels also. Erosion has also been observed in a few channels.

Vegetative and aquatic growth has also created difficulties in the flow of water. The farmers of this minor canal are aware of this problem, and therefore, they decided to desilt this secondary canal on a self-help basis. For this purpose, the length of the Dhoro Naro Minor was divided into 25 equal parts, and each WUA undertook to clean 400 meters of this minor canal.

F. Wider Cross Sections

Due to non-maintenance of this minor canal, the shape of this minor has changed and its cross sections have widened over a period of time. These wider cross sections are also one cause for slow velocity of water in the minor.

G. Lack of Inspection Path

Inspection paths serve a dual purpose; that of banks and conveyance path. The physical condition of banks of the Dhoro Naro Minor is poor in many places. The estimate of these costs is given in Table 49.

Table 49. Expected Maintenance Cost Requirement of Dhoro Naro Minor.

Type of Maintenance	Amount
Essential Structural Maintenance	62,692
Excavation of Sedimentation	32,096
Removal of Vegetation	9,221
Wider Section Improvement	36,000
Weak Bank Improvement	44,866
Dressing and Repairs of Inspection Path	77,487
Total:	262,362
Per CCA acre:	19.93

Therefore, it can safely be assumed that maintenance cost per acre requirement below the head of this minor will be Rs. 19.93 per CCA acre.

5.3.1 Operations and Maintenance Cost of Dhoro Naro Minor

From Sections 5.2 and 5.3, it is estimated that the O&M costs for the Dhoro Naro Minor will be Rs. 53.24 per CCA acre, i.e., establishment cost, Rs. 33.31 per acre, and maintenance cost, Rs. 19.93 per CCA acre. In the first year this cost will be higher by Rs. 7.11 per CCA acre due to the purchase of capital nature items. The share of O&M costs by the farmers of Sindh to cover the costs of the irrigation infrastructure amounts to Rs. 108 per acre (see Chapter 4 for more details). Therefore, O&M costs above the minor amounts to Rs. 54.76 per acre. This total amount of Rs. 108 per acre to the farmers may seem to be higher. Based on the experience in Mexico, where, after introduction of farmer management, the staffing levels within the farmer-operated areas declined by as much as two thirds. The experience in Senegal, where farmers demanded the right to hire their own staff, choosing SAED (the agency providing irrigation services) operators only

if they had performed well (and even then reducing their salaries from the full civil service package). There is a reasonable chance that the same situation may also prevail in the province of Sindh. Therefore, a total O&M cost at Rs. 100 per acre will be a reasonable cost recovery from the farmers.

These figures can be compared with the findings of Dr. Christopher Perry. In his status report, the estimated requirement for O&M expenditures at the level of the Division has been calculated at Rs. 81 per CCA acre, the breakdown of which is Rs. 43 below the distributary, and Rs. 38 above the distributary.

5.3.2 Suggested Water Charges to the Dhoro Naro Minor WUF

Based on the analysis in Section 5.3.1, the Dhoro Naro Minor WUF is suggested to charge a flat rate of Rs. 100 per acre to its members as water charges. In addition, it is also suggested to the WUF to charge an annual membership fee of Rs. 10 per acre to its members. This additional amount should be treated as a reserve fund by the WUF, and may be used to pay for unusual expenditures, like capital replacements, consultants' fees for trainings, emergency repairs, etc..

5.3.3 Justification of the Water Charges Rate

The Revenue Department is responsible for the assessment and collection of *abiana*, however, the Irrigation Department assists the Revenue Department at the time of assessment. Their *modus operandi* has been explained in detail in Chapter 2 of this report.

The Revenue Department, upon request, provided figures of various taxes assessed during the previous 5 years, i.e., from the year 1991-92 to the year 1995-96. The Revenue Department makes assessments on the basis of *dehs* and not on the basis of the hydrological boundaries of the Dhoro Naro Minor. The figures for the last 5 years are given in Table 50.

The different taxes payable by the farmers of this minor canal, per CCA acre, have been analyzed in Chapter 3. These values, when compared to the assessed figures of the Revenue Department, are given in Table 51.

Table 50. Assessed Agriculture Land Taxes for Previous 5 Years.

Years	Abiana	Usher & Land Revenue	Local Cess	Drainage Cess	Mutation fee
1991-92	664,687	278,288	224,121	-	73,460
1992-93	659,139	280,748	223,524	-	100,497
1993-94	783,771	360,262	224,927	-	31,574
1994-95	998,095	253,448	131,365	81,133	20,976
1995-96	1,281,229	333,529	150,594	81,309	11,666
Average	877,384	281,255	190,906	81,221	47,635
CCA acres	24,044	24,044	24,044	24,044	24,044
Per acre	36.49	11.70	7.94	3.38	1.98

Source: Revenue Department, Nawabshah.

Table 51. Comparison of Agriculture Land Taxes Assessed and Payable.

	Abiana	Usher & Land Revenue	Local Cess	Drainage Cess	Mutation fee
Payable on the basis of survey	77.00	159.00	10.00	4.00	2.00
Revenue Deptt. assess. (avg.)	36.49	11.70	7.94	3.38	1.98
Unexplained Difference	40.51	147.30	2.06	0.62	0.02

This unexplained difference of Rs. 190.51 per CCA acre can be explained on the basis of the findings of Mr. Amin Sohani from his interim report captioned "Financial Feasibility Analysis of Operation and Maintenance Costs for Water Users Federations on three Pilot Distributaries in the Province of Sindh, Pakistan", wherein he concludes that farmers pay about Rs. 64.51 per CCA acre as water-related charges (rent-seeking) to the Irrigation and Revenue Departments and the remaining unexplained amount of Rs. 126 per CCA acre can be considered as a saving in the payment of taxes by the farmers.

5.3.3.1 Conclusion

The following points form the basis to conclude the justification of the water charges rate (Rs. 100 per acre) suggested to the Dhoro Naro Minor WUF:

- a. Presently, the *abiana* rate payable amounts to Rs. 77 per acre. The suggested rate of Rs. 100 per acre will increase *abiana* payable by Rs. 23, or by 30 %. Taking the examples from Senegal, where, after the transfer, farmers paid an irrigation service fee 2 to 4 times as high, and Mexico, where the fees increased by 400% to 600%. Comparatively, this suggested *abiana* increase of 30% is insignificant.
- b. The farmers are depositing, on average, Rs. 39.75 per acre as *abiana* with the Revenue Department (1996-97). However, considering the amount of rent-seeking paid along with this tax, the total amount is around Rs.

104.26 per acre. Therefore, by collecting the *abiana* themselves, the farmers will save Rs. 4.26 per acre (Rs. 104.26 – Rs 100).

- c. Apart from rent-seeking, the agriculture income of the farmers is presently Rs. 7,723 per cultivated acre, or Rs. 4,270 per CCA acre (see Chapter 3 for details). The suggested rate will decrease this agricultural income by only Rs. 23, i.e., by 0.30% per cultivated acre, or by 0.56% per CCA acre.
- d. The analysis for agriculture income of the Dhoro Naro Minor reveals that the income of 11 watercourses, out of 25, averages Rs. 897 per CCA acre, while the average income of the remaining 14 watercourses is Rs. 6,608 per CCA acre. The main reason is reliable availability of water; the range of water duty is from 0.903 to 14.108 per 1000 acres. Transfer of this minor canal to the farmers will result in an equitable distribution of water, and assuming the present cropping pattern, the agriculture income of the afore-stated 11 watercourses will increase by at least 300%, i.e., at Rs. 2,691 per CCA acre (current income is Rs. 897 per CCA acre), thus increasing the overall present agriculture income of this command area to Rs. 4,885 per CCA acre from Rs 4,270 per CCA acre, i.e., an increase of Rs. 615 per CCA acre, or by 14.40%. Therefore, an increase in the *abiana* rate by Rs. 23 per CCA acre will prove to be a very productive investment.
- e. The WUF will keep Rs. 54 per acre for the O&M of the Dhoro Naro Minor, while they will pay the Area Water Board Rs. 46 per acre, which is Rs. 6.25, or 15.72% more than what is currently being collected from the farmers.
- f. Presently, the Sindh Irrigation Department's cost is Rs. 94 per CCA acre. The estimated cost will be Rs. 108 per CCA acre, which is inclusive of estimated costs below the head of the distributary/minors. Suggested *abiana* rate is Rs. 100 per acre. Nearly all of the current staff employed with the Irrigation Department will fit into the suggested staffing requirement of the Dhoro Naro WUF. Therefore, the costs to maintain this minor canal can be deducted from the total amount payable to the SIDA. Since the FOs are expected to be self-sufficient within a period of seven years, therefore, in the interim period, the GoP is expected to finance the shortfall in the Irrigation Department.

5.4 COLLECTION OF *ABIANA* FROM WATER USERS

The farmers of the Dhoro Naro Minor Canal have been organized using the two-tier approach, i.e., Water Users Organizations at the level of the watercourses, and a Water Users Federation at the level of the minor canal itself. This is a very effective organizational setup, as the delegation of authority takes place from top to bottom. Keeping in view this setup, the following *modus operandi* to collect *abiana*, is suggested:

- a. The WUF to negotiate with the AWB for the supply of water, at least equal to the average of what has been received in the previous year. IIMI-Nawabshah field station has the time series record of the discharge for the year 1997.
- b. The WUF to distribute the sanctioned discharge among the different watercourses in proportion to the CCA of each watercourse. This discharge list, to the various watercourses, should be approved in the general meeting of the federation.
- c. The *moghas* of all the watercourses to be designed in accordance with the water discharge calculated in "step b" above. The *moghas* situated at the head and middle reaches of this minor canal to be Adjustable Proportional Modules (APM), so that excess water received, if any, at the head of the minor does not go into the fields. While the *moghas* in the tail reaches of the minor are preferred as open flume type, since excess water, if any, may flow into the fields, as no excess water escapes, have been provided in the existing system, and over-topping of water from the distributary may create major maintenance problems.
- d. The physical condition of the minor canal should permit flow of water to the tail reach *moghas* freely.
- e. The relevant WUOs to prepare *warabandi* lists (water share lists) of its members in proportion to the land holding of each farmer under their watercourse. These *warabandi* lists to be approved in the WUOs general meeting, and a copy be given to the WUF for their record.
- f. Once the lists of *warabandi* are approved, the farmers should be free to choose their own set of cropping patterns and/or to sell their share of water time in part, or full, to other farmers, like water markets.
- g. If lift machines are to be installed in certain fields, their capital and O&M costs will be the responsibility of the respective WUOs.
- h. Installation of the tubewells and conjunctive use of ground water and the canal water should be allowed only after obtaining permission from the WUF, which will normally grant approval, except in such cases where the ground water quality is not good for the irrigation use. All expenses relating to tubewells should be the responsibility of individual farmers, and they will be free to buy, or sell, this water.
- i. The financial year of the WUF is suggested from July 1 to June 30 of the next year following.
- j. WUOs to collect *abiana* bi-annually from its members at the start of the cropping season, i.e., in advance, while the annual membership fee should be collected once a year during the month of July.

- k. The WUO's finance secretary should prepare bank *challan* forms in triplicate of its bank account indicating the amount of *abiana*, membership fee, and/or other charges payable in different columns; after obtaining approval of the organization issue, these to the members. The members should deposit the amounts into the bank account through these *challans*, keep one copy for themselves, the bank will retain one copy, while the bank should be instructed to provide the third copy to the WUO's finance secretary.
- l. The members should be restricted to a period of 10 days to deposit these amounts into the bank account; failure to do so will result in a surcharge of Rs. 50 per day, up to a period of 10 days, on the members in default. Upon receiving complaint, from the WUO finance secretary, the WUO may consider to stop the water turn of any such member who does not deposit the amount within 20 days of receiving these bank *challans*. A WUO meeting be called to decide ways in which this amount can be recovered.
- m. The WUF finance secretary should prepare bank *challan* forms in triplicate of its bank account indicating the amount of *abiana*, membership fee, and/or other charges payable in different columns, and after obtaining approval for the federation issue, these *challans* to the relevant WUOs. The relevant WUOs should deposit the amounts into the bank account through these *challans*, keep one copy for their record, the bank will retain one copy, while the bank should be instructed to provide the third copy to the WUF's finance secretary.
- n. A period of 30 days is to be given to the WUOs for depositing these amounts into the bank account; failure to do so will result in a surcharge of Rs. 100 per day up to a period of 10 days, on the WUOs in default. Upon receiving complaint from the WUF finance secretary, the WUF may issue a warning to such WUOs, who do not deposit the amount within 40 days of the receipt of these bank *challans*. A WUF meeting be called to decide ways in which this amount can be recovered.

This system of depositing the payments into the bank accounts of the relevant WUOs and the WUF will ensure safety of *abiana* thus collected. Furthermore, surcharge on the late deposit of *abiana* will ensure timely collection of the *abiana* from the water users and the WUOs. Another suggestion is that the finance secretaries of the relevant WUOs should present an *abiana* collection status report at the end of 20 days in a special WUO meeting. Similarly, the WUF finance secretary should present an *abiana* collection status report at the end of 40 days in a special WUF meeting.

5.5 PAYMENT OF COST OF WATER TO THE AREA WATER BOARD

The major task of the WUF is to negotiate the allocation of water discharge for the Dhoro Naro Minor Canal with the AWB, and deductions in *abiana* due to the usage of lift machines, and/or short delivery of water, if any. Once the discharge is approved, the

WUF should maintain a proper record of the discharge being received at the head of the minor canal. The discharge rating tables may need revision, and similarly, gauges installed may need to be replaced. This will primarily be the duty of the assistant engineer hired by the WUF, who, with the assistance of the *tandils*, will monitor the discharge regularly at the head regulator.

The AE of this minor canal will advise the WUF, in writing, of the average discharge received from the AWB, and his comments about whether the agreed amount of *abiana* should be paid in full, or certain deductions are to be made for short delivery *in lieu* thereof. In case of short delivery of water at certain intervals, the AE will be responsible for the agreement of the AWB concerned person in writing.

The WUF finance secretary, based on the recommendation of the AE, and after obtaining the approval of the WUF at the end of each cropping season, shall deposit into the Government Treasury the agreed amount of up-stream *abiana*, and subsequently present a status report in the first next meeting of the WUF.

5.6 CONFLICT RESOLUTION

These may involve purely administrative issues. The WUF will have to act in accordance with its by-laws; however, certain issues may involve financial matters. Some of these issues and the remedial actions to be taken are suggested as follows:

5.6.1 Theft of Water

The irrigation system in Chile is considered a very good example to be cited for farmer-managed irrigation systems. In Chile, the water users groups are known as *Comunidad de Aguas* (CA), according to a report titled "Irrigation Water Management in the Irrigation System of the Diguillin River, Chile" (Ineke M. Kalwij 1994). Water theft is the major cause of conflicts at canal, as well as field, level. The role of the CA in conflict management is limited, although the president of the canal sometimes goes to the police and the judge.

There is a reasonable chance that this situation may also take place in this command area. Settling of such conflicts through police and the judiciary requires both, time and money, therefore, the WUF of the Dhoro Naro Minor is suggested to consider this act very seriously, as this will mean breach of trust, which each water user member has towards the other. *Darogha*, who is supposed to make a round of the minor canal by bicycle 3 to 4 times a day, and *baidars* working in the three reaches of this canal should be able to notice it immediately, even if the theft takes place in the middle of the night. In such instances, a WUO meeting should be called, and the farmer involved should be asked to explain his position. An estimate of the loss to the other farmer due to this act should be made up, and after levy of a surcharge equal to 100% of the loss assessed, the accused farmer should be penalized. The penalized farmer, however, should have a right to appeal to the WUF, which in such cases, should hold an open inquiry and confirm, or may rescind the decision of the WUO.

The SIDA explains the Powers and Duties of the AWB in Chapter VI of this act, while it explains Powers and Duties of FO's in Chapter VII. Interestingly, both these chapters are silent on this issue of water theft. However, clause 6 of Section 26 under Part C, captioned "Functions and Powers of FO's", states that, "*Any other power and function not being inconsistent with the functions and powers given above which may be vested in the FO's under the By-Laws and Regulations framed by the Authority*". Since the FO's are responsible for obtaining water from SIDA, or AWB, and supply the same to its members, and are also responsible for collection the agreed water charges/other dues, if any, from its members under the SIDA act. Therefore, in order to stop water theft, it is suggested to the Dhoro Naro WUF to obtain approval of its by-laws with the necessary clauses legalizing any actions that may be required to curb water theft.

5.6.2 Theft of Trees on the Inspection Paths

Certain areas around this minor canal are supposed to be the property of the GoS, in which the inspection path is also situated. Some instances of the theft of trees planted along the minor canal, and alongside the inspection path, have taken place in the past. Upon transfer of this minor canal to the farmers, the WUF will be responsible for safeguarding this property.

The WUF should make it compulsory for the *Darogha* hired for this minor canal to keep a record of these trees, and to report any unauthorized cutting of these trees to the AE immediately. The AE should inform the WUF, which should ask the WUO of that respective area to hold an inquiry and present its findings to the WUF. The farmer thus found guilty should be penalized for the market value of the trees, plus a fine equivalent to 100% of the market value of the trees.

5.6.3 Other Issues

The WUF should follow a strict policy of non-interference into the affairs of the WUOs. Any conflicts arising among the farmers of a watercourse should be the responsibility of the concerned WUO, and the WUF should encourage settlement of the disputes at the local level. However, right of appeal to the WUF should be given to the farmers.

5.6.4 Honorarium to the Office Bearers of the WUO's and the WUF

The elected office bearers of WUOs and the WUF will spend their time and efforts in maintaining this minor canal; logically, they should be compensated for their time and efforts. However, experiences in the other parts of the world are different, and normally the office bearers work on an honorary basis. The reasons may not be possible to quantify, as these are qualitative in nature. These reasons are explained as follows:

1. The farmers elect the office bearers, on the basis of their previous records, such as their involvement and ability in the settlement of disputes. They are

socially respected and have been involved in social uplift within this command area, without expecting any monetary benefits in return. Hence, recognition is an incentive for these office bearers.

2. The office bearers elected have a voice in system management, i.e., feeling of importance, which is an incentive in itself.
3. The office bearers are elected from the grassroots level; if their performance is good they can also be elected as members to the AWB of the main canal. This is another incentive for them.
4. On the basis of their performance, they can run for the parliament elections, which till now, has only been possible for people who are born with golden spoons in their mouths.

Therefore, no honorarium to the office bearers of the WUOs and the WUF is suggested. Further, if the farmers are not satisfied with the performance of any of the office bearers, they should have a right to remove such office bearer by calling a general meeting of the concerned WUOs, or the WUF, as the case may be.

5.6.5 Equitable Distribution of Water

This is an issue, which, if not addressed properly, may result in the failure of the Farmer Organizations, and in turn, the whole financial framework in the future, despite system rehabilitation, or upgrading of physical facilities. Reduced costs to the farmers; inspite of the fact that *abiana* rates tend to increase, especially if proper O&M is undertaken, system transfer will reduce the need for side payments to the agency staff, resulting in a reduction in the costs of irrigation facilities. Better irrigation facilities, services, or even "voice" in system management, and most important of all, the ownership of the irrigation system, are very powerful incentives for the farmers to participate in the irrigation system's management and upkeep.

However, in the long run, the farmers of the Dhoro Naro Minor would certainly like to see a return to their investment of time, material and enhanced *abiana* rates in a more rational manner, which can only be in the form of a better water supply in an equitable manner. The IBIS in Pakistan is not demand-based; rather, it is a supply-based irrigation system, therefore, equitable water distribution will take place only when water available at the head of the Dhoro Naro Minor Canal is distributed among the farmers in proportion to their individual land holdings. This distribution of water will require re-sizing and re-calibration of the *moghas*, keeping in mind the allowance of water required at the start, and end, of the *warabandi* turns. Once this water distribution issue is settled, the farmers will put their confidence into the WUOs and the WUF.

The equitable distribution of water will result in a decrease of water supply to the farmers of this command area who have formerly been receiving water in excess of their shares. Therefore, the WUF needs to engage specialists to train farmers in the efficient use of their water turns by changing their current irrigation methods and practices. IIMI's research in the Hasilpur, Punjab, area has revealed that by using bed-and-furrow method

instead of basin irrigation savings in water application can be achieved between 25% to 35%, and crop yields can be enhanced by 20% to 75%.

5.7 MAINTAINING PROPER BOOKS OF ACCOUNTS

The relevant sections of the SIDA, which will be applicable to the Dhoro Naro Minor WUF upon transfer of this minor canal system, are as follows:

Section 27(1) The FO's, AWB and the Authority shall submit to Government as soon as possible after the end of every financial year but, before the expiry of a period of seven months of such end of the financial year a report on the conduct of their affairs for that year including audited financial statement for the year in question.

This act under Section 22 Clauses 1, 3, 4 and 7, states that financial statements include (1) a balance sheet; (2) income and expenditure account; and (3) a statement of changes in financial position or statement of sources and application of funds. Further, Accounting Standards of the Institute of Chartered Accountants Pakistan (ICAP) shall be followed and the commercial auditors shall carry out audit in accordance with the professional standards of Auditing prescribed by the ICAP.

Section 27 clearly says that the FOs will be bound to submit an audited financial statement to the GoS. However, this section is silent on the type and mechanism of these financial statements, whereas, Section 22 is applicable to the Authority only, therefore, it is assumed that the FOs will be required to maintain accounts in a simple manner and their financial statements will only consist of balance sheets and the Income and Expenditure account.

On the basis of the above, the following set of procedures is suggested for the Dhoro Naro Minor WUF and the WUOs:

- 1 *Abiana* to be deposited by the water users to the bank account of the relevant WUOs, whereas the WUOs should deposit their share of *abiana* into the bank account of the WUF (see Section 5.4 for more details).
- 2 Other miscellaneous cash receipts to the WUOs or the WUF should also be deposited into the bank on the first available working day, and proper receipts be issued by the relevant finance secretaries *in lieu* thereof.
- 3 Proper receipt books and bank *challan* forms to be printed. Upon issue of receipts, the counterfoils also to be signed by the depositors.
- 4 All expenses to be paid strictly by cheque. Only the administrative assistant hired by the WUF should be allowed petty expenses, for which a cash imprest of Rs. 3,000 is suggested. The administrative assistant shall settle his account on a bi-monthly basis.

5. Three office bearers are recommended as signatories to the bank; the presidents, general secretaries and finance secretaries. Each cheque will require at least two signatures before it can be presented to the bank.
6. Any expense in excess of Rs. 3,000 will require approval from all of the members of the federation, or of the relevant organization.
7. The federation will, from the portion of *abiana* kept for the O&M of this minor canal, transfer, in proportion, any savings made, e.g., towards the cost of labor to all the WUOs in proportion at the end of each year. The WUO's will be free to spend these monies in a manner approved by their governing bodies.
8. Profit and Loss Saving accounts are recommended for the WUF and the WUOs.
9. The annual membership fee will be at the discretion of the WUF, and WUOs will have no claim to it. However, the WUF will take care of the O&M costs of the lift machines, if any.
10. The profit earned on these bank accounts will be at the discretion of the relevant WUOs and the WUF.
11. All invoices/bills for payment will require two signatures, and these should be kept in a separate file for the time being; later on, vouchers should be printed and these invoices/bills be attached to these.
12. The following books of accounts are suggested for the WUOs and the WUF:
 - a. Cash Book, single column; later cash book with bank column be introduced;
 - b. General Ledger; and
 - c. Salary Register.
13. Double entry book keeping system on cash basis is suggested for the time being, which should be gradually updated by accrual method.
14. All kinds of receipts should be recorded on the receipt side of the cash book, and deposits into the bank account to be entered on the payment side of the cash book.
15. All expenditures to be recorded on the payment side of the cash book, while cheques issued for these to be recorded on the receipt side of the cash book.
16. Cash book to be balanced on a daily basis, and cash-in-hand to be reconciled. Similarly, transactions recorded in the cash book to be posted on a daily basis into their ledger accounts.
17. A separate file containing lists of the water users and the amount of *abiana* payable to be maintained. The *challan* forms received from the bank to be reconciled with this list, and defaulters, if any, should be identified

immediately. Once the finance secretaries become familiar with the accounting system, they should be encouraged to introduce party ledgers to keep track of member contributions.

- 18 At the end of each month the relevant finance secretaries should prepare bank reconciliation statements, list of outstanding amounts and the trial balance. These documents should be discussed in the meetings and decisions made, if any, should be implemented.

The introduction of this system will require specialized training for the finance secretaries. The WUF should make adequate arrangements to arrange for these trainings, so that the finance secretaries are well equipped to serve their respective WUOs and the WUF, and can manage the audit queries at the end of each financial year.

5.8 PROJECTED CASH FLOWS

The following assumptions have been made in the preparation of the cash flow projections of the Dhoro Naro Minor Canal for the next 10 years:

- 1 The farmers will pay Rs. 10 per acre of land holding as an annual membership fee to the WUF. This rate will be revised every two years and enhanced by Rs. 5 per acre.
- 2 The *abiana* payable by the farmers for the first year is suggested at Rs. 100 per acre of land holding. The breakdown of this amount is Rs. 48 towards establishment cost, and Rs. 52 for Maintenance and Improvement (M&I) cost. Although it can be assumed that once the farmers are handed over the irrigation system, staff deployment will be reduced. However, it is expected that the salaries of the remaining staff will increase sharply. Therefore, salary cost of Rs. 48 per acre has been inflated by 12.5% each year, while the Maintenance and Improvement cost has been inflated by 10% per year.
- 3 During the first year, it is assumed that 10 farmers will be in default of depositing *abiana* for a period of 10 days. Therefore, a surcharge of Rs. 50 per day will be recovered from them. In subsequent years, 6 farmers, for 10 days each per year, have been assumed in default.
- 4 The bank profit has been assumed at the rate of 10.5% per annum, and has been calculated as follows:
 - (a) Full year's profit on the previous year's closing balance.
 - (b) Full year's profit on the one-tenth of the annual cash-inflow into the bank. Considering the fact that *abiana* to the AWB shall be paid bi-annually, at the end of each cropping season, this assumption is considered reasonable.
- 5 The WUF will pay Rs. 46 per acre to the AWB, which consists of Rs. 14 towards the establishment cost, and Rs. 32 as M&I cost. As explained in "2"

above, these amounts have been inflated by 12.5 % and 10%, respectively, per year.

- 6 Salaries to the staff hired by the WUF have been inflated by 12.5% per year.
- 7 Supplies and Services, and Travel expenses, by the WUF office bearers and/or the employed staff, Material and Machinery hired on rent for M&I of the minor canal, have been inflated by 10% each year.
- 8 The expectation is that only one-third of the labor cost will have to be paid by the WUF, as most of the farmers will assist in the maintenance activities. This cost has also been inflated by 10% per year.
- 9 The WUF is expected to hire consultants to conduct different training courses for the benefit of its members. During the first two years, the expense is estimated to be higher than this expense, thus, will drop, and is estimated at Rs. 10,000 per year. During the 6th year, it is expected that a major overhaul of this minor will take place, hence, excessive services of the consultants will be required.
- 10 Initially, the audit fee is expected to be Rs. 5,000; for subsequent years, this has been enhanced by Rs. 1,000 per year.
- 11 Miscellaneous expenses include O&M of the lift machines installed, if any, and other incidental expenses. This amount is estimated at Rs. 25,000 per year and has not been inflated, except for in the 6th year, when major M&I activities are expected.
- 12 The remaining two-thirds of the labor cost is expected to be contributed by the farmers in kind. Therefore, this amount will be refunded to the WUOs in proportion to their CCA. The governing body will decide the utilization of these amounts.
- 13 During the first year certain capital items, like motorbike, bicycle, furniture, tool-kit and water measuring devices will be purchased; these items will be replaced during the 6th year. During the 3rd year, purchase of computer, printer, and accessories, by the WUF are assumed; this equipment will be replaced in Year 8.

Based on these assumptions, the projected cash flow statement of the Dhoro Naro Minor WUF, for a period of 10 years, is given in Table 52.

Further, on the basis of these cash flow projections, projected 10 year Income and Expenditure Accounts, and the Balance Sheet, which the Farmer Organizations will be required to submit annually to the GoS, are given in Tables 53 and 54.

Table 52. Cash Flow Projections for Dhoro Naro Minor for a Period of 10 Years

Particulars	Year 1 (Rs.)	Year 2 (Rs.)	Year 3 (Rs.)	Year 4 (Rs.)	Year 5 (Rs.)	Year 6 (Rs.)	Year 7 (Rs.)	Year 8 (Rs.)	Year 9 (Rs.)	Year 10 (Rs.)
Abiana Rate per CCA acre	100	111	124	138	154	172	191	212	236	263
Receipts										
Membership fee	131,620	131,620	197,430	197,430	263,240	263,240	329,050	329,050	394,860	394,860
Abiana Collected	1,316,200	1,460,982	1,632,088	1,816,356	2,026,948	2,263,864	2,513,942	2,790,344	3,106,232	3,461,606
Penalties/Surcharge	5,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Bank Profit	15,255	16,957	29,959	40,467	64,657	98,645	65,416	108,269	141,536	200,348
Cash inflow	1,468,075	1,612,559	1,862,477	2,057,253	2,357,845	2,628,749	2,911,408	3,230,663	3,645,628	4,059,814
Expenditure										
Abiana paid to AWB	631,776	697,586	776,558	855,530	947,664	1,052,960	1,158,256	1,289,876	1,421,496	1,579,440
Salaries to staff	360,000	405,000	455,625	512,578	576,650	648,732	729,824	821,052	923,684	1,039,144
Supplies & Services	51,600	56,760	63,855	71,837	80,817	90,919	102,284	115,070	129,454	145,636
Travel	16,800	18,480	20,328	22,360	24,596	27,056	29,762	32,738	36,012	39,613
Material for O&M	46,052	50,657	55,723	61,295	67,425	74,168	81,585	89,744	98,718	108,590
Machinery rent for O&M	129,501	142,451	156,696	172,366	189,603	208,563	229,419	252,361	277,597	305,357
Labor 1/3 of estimated cost	28,936	31,830	35,013	38,514	42,366	46,603	51,263	56,389	62,028	68,230
Consultancy fees	20,000	15,000	10,000	10,000	10,000	25,000	10,000	10,000	10,000	10,000
Audit fee	5,000	6,000	7,000	8,000	9,000	10,000	11,000	12,000	13,000	14,000
Miscellaneous expenses	25,000	25,000	25,000	25,000	25,000	600,000	25,000	25,000	25,000	25,000
Transferred to WUO's	57,872	63,660	70,026	77,028	84,732	93,206	102,526	112,778	124,056	136,460
Capital Purchase	93,600	Nil	105,000	Nil	Nil	99,600	Nil	135,000	Nil	Nil
Cash outflow	1,466,137	1,512,424	1,780,824	1,854,508	2,057,853	2,976,807	2,530,919	2,952,008	3,121,045	3,471,470
Net Cash Flow	1,938	100,135	81,653	202,745	299,992	-348,058	380,489	278,655	524,583	588,344
Open. Cash&bank balance	0	1,938	102,073	183,726	386,471	686,463	338,405	718,894	997,549	1,522,132
Clos. Cash & bank balance	1,938	102,073	183,726	386,471	686,463	338,405	718,894	997,549	1,522,132	2,110,476

Table 53. Projected Income and Expenditure Accounts of Dhoro Naro Minor for a Period of 10 Years.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
	(Rs.)	(Rs.)	(Rs.)	(Rs.)	(Rs.)	(Rs.)	(Rs.)	(Rs.)	(Rs.)	(Rs.)
Income										
Abiana Collected	1,316,200	1,460,982	1,632,088	1,816,356	2,026,948	2,263,864	2,513,942	2,790,344	3,106,232	3,461,606
Penalties/Surcharge	5,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Bank Profit	15,255	16,957	29,959	40,467	64,657	98,645	65,416	108,269	141,536	200,348
Profit on disposal of Assets						23,400		25,000		
Gross Income	1,336,455	1,480,939	1,665,047	1,859,823	2,094,605	2,388,909	2,582,358	2,926,613	3,250,768	3,664,954
Expenditures										
Abiana paid to the AWB	631,776	697,586	776,558	855,530	947,664	1,052,960	1,158,256	1,289,876	1,421,496	1,579,440
Transferred to WUO's	57,872	63,660	70,026	77,028	84,732	93,206	102,526	112,778	124,056	136,460
Salaries to Staff	360,000	405,000	455,625	512,578	576,650	648,732	729,824	821,052	923,684	1,039,144
Supplies & Services	51,600	56,760	63,855	71,837	80,817	90,919	102,284	115,070	129,454	145,636
Travel	16,800	18,480	20,328	22,360	24,596	27,056	29,762	32,738	36,012	39,613
M&I expenses	204,489	224,938	247,432	272,175	299,394	329,334	362,267	398,494	438,343	482,177
Consultancy fees	20,000	15,000	10,000	10,000	10,000	25,000	10,000	10,000	10,000	10,000
Depreciation	18,720	18,720	39,720	39,720	39,720	45,600	45,600	56,600	56,600	56,600
Audit fee	5,000	6,000	7,000	8,000	9,000	10,000	11,000	12,000	13,000	14,000
Miscellaneous Expenses	25,000	25,000	25,000	25,000	25,000	600,000	25,000	25,000	25,000	25,000
Total expenses	1,391,257	1,531,144	1,715,544	1,894,228	2,097,573	2,922,807	2,576,519	2,873,608	3,177,645	3,528,070
Retained Earnings/(Loss)	(54,802)	(50,205)	(50,497)	(34,405)	(2,968)	(533,898)	5,839	53,005	73,123	136,884

Table 54. Projected Balance Sheets for Dhoro Naro Minor for a Period of 10 Years.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
	(Rs.)	(Rs.)	(Rs.)	(Rs.)	(Rs.)	(Rs.)	(Rs.)	(Rs.)	(Rs.)	(Rs.)
Fixed Capital Expenditure										
Fixed Assets										
Motorbike	70,000	70,000	70,000	70,000	70,000	91,700	91,700	91,700	91,700	91,700
Bicycle	3,000	3,000	3,000	3,000	3,000	3,950	3,950	3,950	3,950	3,950
Furniture & Fixtures	15,000	15,000	15,000	15,000	15,000	19,650	19,650	19,650	19,650	19,650
Field Equipment	5,600	5,600	5,600	5,600	5,600	7,700	7,700	7,700	7,700	7,700
Computer & Allied			105,000	105,000	105,000	105,000	105,000	160,000	160,000	160,000
Total Fixed Assets at Cost	93,600	93,600	198,600	198,600	198,600	228,000	228,000	283,000	283,000	283,000
Cash & Bank Balances										
Cash-in-hand	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Cash-at-Bank	(1,062)	99,073	180,726	383,471	683,463	335,405	715,894	994,549	1,519,132	2,107,476
Total Cash & Bank Balance	1,938	102,073	183,726	386,471	686,463	338,405	718,894	997,549	1,522,132	2,110,476
Total:	95,538	195,673	382,326	585,071	885,063	566,405	946,894	1,280,549	1,805,132	2,393,476
Funds & Liabilities										
Accumulated Depreciation										
Motorbike	14,000	28,000	42,000	56,000	70,000	18,340	36,680	55,020	73,360	91,700
Bicycle	600	1,200	1,800	2,400	3,000	790	1,580	2,370	3,160	3,950
Furniture & Fixtures	3,000	6,000	9,000	12,000	15,000	3,930	7,860	11,790	15,720	19,650
Field Equipment	1,120	2,240	3,360	4,480	5,600	1,540	3,080	4,620	6,160	7,700
Computer & Allied			21,000	42,000	63,000	84,000	105,000	32,000	64,000	96,000
Total Accum. Depreciation	18,720	37,440	77,160	116,880	156,600	108,600	154,200	105,800	162,400	219,000
Fund Balances										
Opening Balance		76,818	158,233	305,166	468,191	728,463	457,805	792,694	1,174,749	1,642,732
Add: Membership fee	131,620	131,620	197,430	197,430	263,240	263,240	329,050	329,050	394,860	394,860
Less: Ret. Earnings/(Loss)	(54,802)	(50,205)	(50,497)	(34,405)	(2,968)	(533,898)	5,839	53,005	73,123	136,884
Total Fund Balance	76,818	158,233	305,166	468,191	728,463	457,805	792,694	1,174,749	1,642,732	2,174,476
Total:	95,538	195,673	382,326	585,071	885,063	566,405	946,894	1,280,549	1,805,132	2,393,476

DHORO NARO MINOR WATER USERS FEDERATION**Accounting Policies**

A summary of the more important accounting policies is set out below:

1. **Basis of Accounting**

Accounts are prepared on the cash basis of accounting whereby the transactions are recorded on the dates when the assets were paid for, the liabilities were discharged and contributions from the members were actually received.

2. **Inventories**

The cost of consumable stores purchased is charged to the Income and Expenditure Account in the year of purchase. The value of any inventory in hand at the year-end is therefore, not recognized in the accounts.

3. **Fixed Assets**

All tangible assets of Rs. 3,000 or over in value and 3 years or over in life are capitalized as Fixed Assets.

Fixed Assets are depreciated on the straight-line basis at 20% on cost, which is considered by the management to be appropriate to write off the cost of the respective assets over their useful lives to the Federation. Full year's depreciation is charged in the year of purchase and no depreciation is charged in the year of disposal.

6 SUMMARY OF MAIN FINDINGS

6.1 SOCIO-ECONOMIC SETUP

The population of this minor canal is about 20,000. The climate of this area is arid and sub-tropical. There are a number of castes residing in this command area, out of which 11 castes are considered to affect the socio-economic relations and power balance noticeably. The potential water users are about 500, and include landowners, owner-operators and lessees. The average land-ownership in this area is 30 acres. The literacy rate is only 15% among the farmers. The farmers follow a *Pacca Warabandi* schedule (fixed water turn). This area is primarily considered to be a cotton zone, although wheat is also very commonly sown by the farmers.

The main road runs parallel to this minor canal. The distance to Nawabshah City is only 5 kilometers from the head of this minor, hence, farmers do not experience any transportation problems. The main villages in this area are provided with electricity and schools (both, for girls and boys), and telephone facilities are also available in some villages. Health facilities are very modest, and people have to go to Nawabshah City for medical treatment.

Therefore, the socio-economic conditions of this area can be considered comparable with that of the people living in the suburbs of large cities.

6.2 WATER SHORTAGE

The tail end farmers of this minor canal experience acute shortage of water; water duty ranges from 0.903 to 3.220 cusecs per 1000 acres, whereas, the mean water duty for the entire minor canal comes to 4.97 per 1000. During *rabi* 96-97 and *kharif* 97, their incomes were far below the mean income (Rs. 4,095 per CCA acre) of this distributary, and is only about Rs. 1,980 per CCA acre.

The actual discharge of the Rohri Canal, Nasrat Branch Canal and Gajrah Branch Canal, when compared to the design discharge, is 170%, 174% and 179%, respectively. The current discharge received by this minor canal is about 57 cusecs, while its design discharge is 51.62 cusecs, thus, the minor receives an increased discharge of only 10.42 %. Considering that the canals supplying water have an additional discharge of about 70%, the discharge of the Dhoru Naro Minor should also be enhanced accordingly.

6.3 CREDIT FACILITIES

Loans and credit facilities are available in this area through the Agricultural Development Bank of Pakistan. However, only a few landowners benefit from this facility, as most of the farmers who are small landowners, find it very difficult to complete the required paper work. There is a need to make the process of acquiring credit simple, quick and more attractive to the farmers.

6.4 DRAINAGE INFRASTRUCTURE

The drainage network in this command area is quite comprehensive, and is in working condition. There are 7 saline tubewells installed in this network, 1 sub-drain and a branch drain, which suffice the need. None of these 7 saline tubewells are installed in the tail reach of this minor canal; the farmers believe one tubewell is enough to fulfill the drainage requirement in the tail reach of the Dhoro Naro Minor.

6.5 TAX COLLECTION AND ASSESSMENT PROCEDURES

The *abiana* payable calculated in this report for the *rabi* 96-97 and *kharif* 97 season amounts to Rs. 77 per acre. The average *abiana* assessed during the previous 5 years, as per the records of the Revenue Department, is Rs. 37 per acre, while *abiana* assessed in 1995-96 was Rs. 53 per acre; the *abiana* recovery rate is in the range of 75% to 80% of the assessed amount. Certainly, the present procedures cannot be termed as effective.

6.6 IRRIGATION DEPARTMENT RECORDS

During the field surveys, it has been noted that names of certain landowners, who have died are still appearing in the records of the Irrigation Department. Hence, there is need to update the records of the Irrigation Department.

In many places it has been observed that part of the land not owned by any person and is the property of the GoS, is also being cultivated by certain farmers. Rent for such areas of land should be recovered from the cultivators, and amounts thus received be deposited into the GoS treasury.

After the installation of the drainage network, the maps of the Dhoro Naro Minor canal, by the Irrigation Department, have not been updated. The Irrigation Department should take steps to modify the maps.

6.7 WATERLOGGED, SALINIZED AND ABANDONED TRACTS OF LAND

The farmers consider tracts of land with groundwater on the surface as waterlogged (185 acres), tracts of land on which white layers of salts are visible as salinized (1,680 acres), and tracts of land with sand dunes as abandoned (1,178 acres). The effect of waterlogging and salinity on the soil is not known. Therefore, a comprehensive survey of these tracts of lands should be undertaken in order to determine the extent of waterlogged and salinized areas, and to propose remedial measures that can be taken to reclaim these tracts of land. With a drainage network already in place, probably the answer lies in the availability of additional water to leach the salts from the soil profile of the affected lands. The case of increase in water supply has been discussed in Section 6.1.2 above.

The installation of tubewells, surface drains and tile drains (subsurface drains) can control waterlogging, but soil salinity remains a problem and in many places, sodicity is a main concern, which needs chemical amendments and leaching for reclamation. This means that a hydrological approach alone is not sufficient for effective control of salinity, alongwith waterlogging. For this purpose, the farmers should be made well aware of employing chemical amendments, like gypsum, or treatment of irrigation water with sulfuric acid and biological (e.g., salt tolerant crops) techniques and leaching requirements for reclaiming salt-affected lands, besides lowering the watertable through training measures¹.

The assumption is that the present cropping pattern estimated loss in net agriculture revenue to this minor canal due to waterlogging, salinity and abandoned lands, is Rs. 23.14 million per annum.

6.8 CROP YIELDS

The crop yields of wheat and sugarcane for the *rabi* 96/97 and *kharif* 97 of this command area are better than the average yields for the same crops of Pakistan. The yield of cotton is on the lower side. The survey reveals that the crop yields of the five major crops among 25 watercourses of this minor canal vary between 1.5 times to 15 times, and that about 30% of the watercourses have yields less than the mean yield of this minor canal. One factor is availability of water, and certainly, efficient cultural, agronomic and irrigation practices can also bridge this difference.

6.9 GROSS AGRICULTURE REVENUE

The gross agriculture revenue of the Dhoro Naro Minor Canal is Rs. 8,905 per acre. When compared with national figures (Rs. 3,644 per acre), or LBOD baseline figures (Rs. 5,263 per care), the gross revenue seems to be on the higher side. Various IIMI-Pakistan surveys have concluded gross revenue in the range of Rs. 3,240 to Rs. 10,120 per acre, therefore, the mean gross agriculture revenue of this minor canal indicates that the incomes of farmers are very reasonable.

6.10 NET REVENUE FROM CROPS

Return on investment from the sugarcane crop is the highest (Rs. 6,120 per acre). However, this is an annual crop. A combination of cotton and oil-seed is most profitable for the farmers of this minor canal (Rs. 8,330 per acre). Farmers prefer sugarcane crop due to two reasons: (1) negligible danger of pest attack, hence, it is a low risk investment; and (2) roots of this crop can be used as seed for a period of two to three years, therefore, less average cost of plantation and seed bed preparation is needed.

¹ "Personal Communication", Dr. Muhammad Aslam.

6.11 NET AGRICULTURE INCOME

The farmers of the Dhoro Naro Minor earn a mean farm agriculture income, after taxes, of Rs. 7,723 per cropped acre, or Rs. 4,270 per CCA acre. The cost of agriculture land in this area was estimated at Rs. 70,000 per acre, thus, their return on investment is 11.03% (7,723/70,000). This percentage is far better than investing this amount in a fixed deposit scheme, which generates interest at the rate of 17.5% nonetheless; however, after considering the time value of money and taxes, this drops to 2.44%.

The net to gross income percentage is 48.62%, which is very good, and better than the small and medium scale business concerns in the cities, whose percentages are between 25-30%. Considering that the socio-economic conditions of this minor canal are comparable with the suburb areas of the big cities (see Section 6.1.1), farmers in this command area can be considered as economically comfortable.

6.12 EXPENDITURE ON THE PROVINCIAL IRRIGATION DEPARTMENT

The GoS spends a total of Rs. 1,236.691 million (Rs. 93.73 per acre) on the Provincial Irrigation Department, out of which 71% (Rs. 66.16 per acre) is spent on the irrigation establishment, while the rest, i.e., 29% (Rs. 27.57 per acre) is spent on the maintenance activities.

NESPAK, in 1986, prepared a Maintenance Yardstick for the Irrigation Department. This yardstick, updated to 1996-97 price levels, requires an amount of Rs. 924.96 million (Rs. 68 per acre) per annum for the maintenance activities; in IIMI-Pakistan's opinion, these figures are a minimum level.

In order to maintain the irrigation infrastructure to meet the system adequately so that the design service can be provided on an ongoing basis, the total O&M cost amounts to Rs. 134.16 per acre, and consists of Rs. 66.16 per acre as establishment cost, and Rs. 68 per acre as maintenance and improvement cost. Hence, the Irrigation Department will under-spend by 59% on the maintenance activities during the year 1997-98.

6.13 SIDA ACT

On 15 September 1997, the Sindh Assembly passed a bill to provide for the establishment of the Irrigation and Drainage Authority (SIDA). The authority is intended for the management of equitable distribution of irrigation water and effective drainage and flood control, sustainable on a long term basis through participation of beneficiaries in the operation and management of the irrigation drainage network, and to provide for matters connected therewith, or incidental thereto. The salient features of this act are as follows:

- SIDA will supply water to the AWB at rates that will make provision for meeting the O&M cost of the system within a period of 7 to 10 years.

- The components of O&M to be recovered from farmers in the form of *abiana* will be the full cost for Irrigation Canals and Secondary Canals.
- FOs will collect water charges from its members, and for the supply of irrigation water to the concerned AWB, or SIDA.
- FOs may hire, engage or employ any consultants, advisors and employees as may be deemed necessary, for the due and effective performance of various powers and functions.
- FOs will submit to government within a period of 7 months, at the end of each financial year, a report on the conduct of their affairs for that year, including a financial statement for the year in question.

6.14 *ABIANA* MECHANISM

Of the three mechanisms in practice, namely: (1) crop-based charge; (2) volumetric charge; and (3) flat rate charge, the simple mechanism of charging a flat rate is suggested. The success of this method will depend on equitable distribution of water among the water users.

6.15 STAFFING REQUIREMENTS OF THE MINOR

The following set of employees is suggested to the Dhoro Naro WUF in the initial stages:

Assistant Engineer	1	Administrative Assistant	1
<i>Darogha</i>	1	<i>Tandel</i>	2
<i>Baildars</i>	3		

Based on the above-stated staff and their logistic needs, the budget estimate for the first year amounts to Rs. 0.438 million (Rs. 33.31 per acre). This amount has been considered as the downstream establishment cost for the Dhoro Naro Minor Canal.

6.16 MAINTENANCE COSTS FOR THE MINOR

The maintenance costs for this minor canal are estimated at Rs. 0.262 million (Rs. 19.93 per acre) per annum. These estimates are based on the maintenance surveys conducted by the IIMI-field staff. This amount has been considered as the downstream maintenance cost for the Dhoro Naro Minor Canal.

6.17 SUGGESTED *ABIANA*

The estimated total O&M cost comes to Rs. 134.16 per acre for the Sindh Provincial Irrigation Department. The water consumed for non-agricultural purposes is about 9.17% of the water available for consumption to the province of Sindh (see Chapter 4 for details). As the non-agricultural use of water generates high economic returns, therefore, it has been assumed that this use be charged twice the rate for agricultural

purposes. Thus, the cost of water to the farmers amounts to Rs. 108 per acre. Considering the experiences in Mexico and Senegal, wherein the staff complement was decreased upon transfer of the irrigation system to the farmers, a flat rate of Rs. 100 per acre (estimated Rs. 48 and maintenance Rs. 52) is suggested as the rate for *abiana* to be charged to the farmers.

The FOs will pay Rs. 54 per acre (estimated Rs. 33 and maintenance Rs. 21) as downstream cost, while they will pay the AWB Rs. 46 per acre (estimated Rs. 15 and maintenance Rs. 31) as downstream cost.

In order to meet the O&M costs in future, an increase of 10.25% in the per annum rate of *abiana* is suggested.

In addition to the *abiana*, the farmers will pay Rs. 10 per acre as annual membership fee to the federation. This fee will be increased subsequently by Rs. 5 per acre after every two years.

6.18 COLLECTION AND PAYMENT OF *ABIANA*

The same principle as that of the two-tier system should be adopted, which has been used to organize the farmers of this canal command, and *abiana* should be collected by the relevant WUOs from its members and deposited with the WUF. The *abiana* should be collected in advance at the start of each cropping season. The WUF should deposit *abiana* to the AWB at the end of each cropping season. This is in line with the current practice, wherein the assessment and collection of *abiana* takes place at the end of each cropping season.

The farmers should deposit their share of *abiana* into the bank, for which the relevant finance secretaries should issue them bank *challan* forms, in triplicate, in advance.

Certain time limits should be given to the farmers within which to deposit this amount; a period of 10 days is suggested, and failure to meet this deadline will result in the farmers at default being penalized at Rs. 50 per day per acre.

6.19 CONFLICT RESOLUTION

The WUF should follow a strict policy of non-interference into the affairs of the WUOs, and should encourage settlement of disputes at the level of the concerned WUOs. However, the farmers should have a right to appeal to the WUF. Theft of water should be taken seriously as it means breach of trust; and based on the experiences in Chile, it is suggested that the WUF should insert necessary clauses in its by-laws so that it has the legal cover to settle these issues. Thus, the aggrieved farmers do not have to waste their time and money by seeking justice through the police and judicial system.

6.20 HONORARIUM TO OFFICE BEARERS

The recognition, and feeling of being important and their chances to run for parliament and the AWB membership for good performance, are considered very strong qualitative incentives in return for their investment of time and effort. Therefore, no honorarium to the office bearers of the farmer organizations is suggested.

6.21 EQUITY IN WATER DISTRIBUTION

In the long run, it will be difficult to satisfy the majority of farmers with incentives like system rehabilitation, reduced costs by exterminating side payments to the agency staff, or even "voice" in system management and ownership of the irrigation system, or by keeping them involved in different activities. They would certainly like to see a return to their investment of time, material and enhanced *abiana* rates in a more rational manner and tangible form. Only better water supply in an equitable manner will satisfy the majority, and can convert these FOs into sustainable organizations and guarantee the success of a business plan.

The IBIS in Pakistan is not demand-based, rather it is a supply-based irrigation system, therefore, equitable water distribution will take place only when water available at the head of the Dhoro Naro Minor Canal is distributed among the farmers in proportion to their individual land holdings. This distribution of water will require re-sizing and re-calibration of the *moghas* (modules or outlets), keeping in mind the allowance of water required at the start, and at the end, of their *warabandi* turns.

6.22 STATISTICAL ANALYSIS

In order to visualize the post-scenario of equitable distribution of water, and to see whether some kind of relationship exists between farm income to water duty, water table depth from surface and the groundwater quality. Graphs were plotted and log-linear regression analyses and multiple regression analysis were performed. The results of analyses are as follows:

- The trend of line graph is positive between water duty and net revenue; however, the relationship is not linear.
- From the multiple regression, the following equation is derived:

$$\text{Income} = 3,292.95 + 888.27 \cdot W/\text{duty} - .216 \cdot (W/\text{depth} \cdot \text{EC})$$
 The R squared is 0.4954, which is considered good for field data. The number of observations were 25.

The Standard Error of Coefficient is quite low, reflecting that both the coefficients are significant at a 5% level of error.

- From the log-linear regression, the following equation is derived:

$$\text{Log}(\text{Income}) = 11.959 + 1.368(\log(W/\text{duty})) - .636(\log(W/\text{depth} \cdot \text{EC}))$$
 R squared is 0.5894, which means field data is reliable.

The Standard Error of Coefficient is quite low, reflecting that both the coefficients are significant at a 5% level of error.

The mean water duty of this minor canal command area is 4.97 cusecs per 1,000 acres. By substituting this value in the above equations, it was discovered that the mean income of the farmers will remain unchanged. Thus, statistically, equitable distribution of water will not make any difference to the mean farm income of this minor canal, rather, agriculture revenue will be uniformly distributed among the farmers, i.e., to the benefit of the poorest of the poor.

Statistical analysis have their limitations, and after having achieved equity, the farmers, especially those whose water duty will be reduced, will look for more efficient cultural, agronomic and irrigation practices. The drop in water duty to the farmers receiving more than their share of water is estimated at 38%. IIMI-Pakistan's research in the Hasilpur, Punjab, area has revealed that by using the bed-and-furrow method instead of the basin, irrigation savings in water application can be achieved between 25% to 35%, and crop yields can be enhanced by 20% to 75%. Therefore, it is estimated that the mean agriculture income of this minor canal can increase by 19.28%, or by Rs. 790 per acre.

6.23 BOOKS OF ACCOUNTS AND INFORMATION IT CAN PROVIDE

Initially, a double entry book-keeping system, consisting of one single column cash book and a ledger, on cash basis, is suggested. All transactions should be through the bank, and in no manner should cash transactions take place except for an imprest to be kept with the administrative assistant of the WUF. Cheques should require at least two signatories, and proper supporting documents for expenditures incurred should be kept.

The relevant finance secretaries should balance their books of accounts and draw trial balances at the end of each month. In each monthly meeting, they should present the accounts report, consisting of position of cash-imprest and cash-at-bank, recoveries in default, collection of receipts and expenditure incurred during the period.

The projected cash-flow statement, income and expenditure account, and the balance sheet for a period of 10 years have been prepared and are contained under Section 5.8 of this report.

The projected income and expenditure accounts reveal that each year the Dhoro Naro WUF, on average, will incur a loss of Rs. 70,000. Therefore, it will not be possible to levy income tax on this federation in the near future. The federation will cover this loss by collecting membership fees from its members.

The cash flow projection statements give a good liquidity position for this federation over the period of 10 years. The farmers will be able to finance the expected major overhaul of the irrigation infrastructure of their minor canal by incurring an estimated cost of Rs. 600,000 in Year 6.

6.24 COST BENEFIT ANALYSIS

The arguments below indicate that it is not possible to quantify the benefits of transfer of irrigation management to the farmers. Further, an alternative approach and likely benefits arising thereto, are discussed.

6.24.1 Review of Available Literature

The main justification for transfer of irrigation management to farmer organizations appears to be to reduce the cost of irrigation management to the government. Agency budget stringency has contributed to this movement, as well as the belief that farmers organizations can better manage irrigation systems, at least at the lower levels ("Impacts of Irrigation Management Transfer: A Review of the Evidence" by Douglas Vermillion, Research Report No. 11, IIMI, 1997).

In order to evaluate the success, or failure, of irrigation management properly, researchers need a measure of irrigation performance. Unfortunately, there is not a single agreed upon standard measure of irrigation performance. Not only does it depend on the perspective of the viewer, but also on the importance of certain variables in the context. Success to a farmer may mean reducing cost of water, while maintaining a certain level of service.

One² researcher has used adequacy of water supply, level of system maintenance and degree of rule conformance among cultivators. Another³ used cropping intensity, status of infrastructure, and water availability (Herb Blank, paper presented in National Workshop on South Africa Water Law).

As a result of management transfer, increase in fee collection is often observed. Farmer organizations become more involved in making financial decisions, farmers are given more voice when determining expenditures, and often, there is more transparency in financial matters. The available evidence shows that where there is a subsidy, turnover increases cost to farmers (Dr. Vermillion).

Therefore, in the short run, benefits for farmers organizations may not be expressed quantitatively in the farmers' favour. However, the GoS appears to gain benefit in economic terms as a result of management transfer; the *abiana* recovered from the Dhoro Naro Minor during the year 1996/97 was Rs. 39.75 per acre, while the estimated *abiana* suggested in this report amounts to Rs. 100 per acre. Hence, the expenditure by the GoS on Non-development Budget (NDB) may be reduced by about Rs. 0.793 million, thus, in return, reducing the overall budgetary deficit.

² "Institutions and Collective Action: Self-governance in Irrigation" by Shui Yan Tang. San Francisco, California, USA: Institute for Contemporary Studies Press, 1992

³ "Institutions, Incentives and Irrigation in Nepal" by Paul Benjamin, Wai Fung Lam, Elinor Ostrom, and Ganesh Shivakoti. Decentralization, Finance and Management Project, Burlington, Vermont, USA, Associates in Rural Development, 1994

6.24.2 A Possible Alternative Approach

The authors believe that the benefits to the farmers, as a result of management transfer, are more likely possible to quantify in the area of water resource management, especially when seen in the context of a worldwide concern that exists about the sustainability of the natural water resources, as well as the emphasis for a more efficient use of these resources⁴. To elaborate further a few paragraphs from the World Bank Operations Evaluation Study are reproduced as follows:

The World Bank is encouraging *Water Resource Management* because it is widely believed that farmers and irrigation-system operators will be facing increasing competition in the future for water from aquifers, streams, and lakes. Irrigators account for at least 70 percent of the water withdrawn from these sources today, but water almost invariably has a higher marginal value product for competing users, especially people who drink it and wash with it, and power companies that use it to generate electricity. Competition for water is already intense in the Middle East, in Central Asia, in North Africa, in growing parts of South, Southeast, and East Asia, and in Europe, and in western South and Meso-America.

Meanwhile, prospective sources of new irrigation water are becoming fewer. In general, the best dam and pumping sites have already been developed. Prospective sites for new dams, weirs, and pumps have become less attractive in economic terms. This means that larger dam and longer canals are needed per unit of water and per unit of land irrigated. Deeper drilling for pumping over greater vertical distances also becomes necessary. Like plant breeding and fertilizer use, irrigation faces the law of diminishing returns.

At the same time, prices of foods and fibers that agriculture helps to produce, are at historic lows.

This new environment is considerably different from that of the 1960s and early 1970s. Therefore, *future emphasis should be on upgrading existing irrigation*, a process that uses engineering and social science intensively to improve irrigation service to people, lower unit costs, and conserve water where it is scarce.

This does not mean simply rehabilitating irrigation systems to standards designed for an environment that no longer exists. This approach recognizes that irrigation serves a changing world. This growing emphasis, a challenge for engineers, agriculturists, economists, and other social scientists, is consistent with the thrust of the *Water Resources Management Policy Paper* (William I. Jones, The World Bank and Irrigation, A World Bank Operations Evaluation Study).

⁴ "Personal Communication", Ineke M. Kalwij

6.24.3 Findings of Alternative Approach

Having organized and management transfer is not the end product, rather, it is the start of a new era. The farmers should learn about the strength of being organized, and how they can use it to their benefit. Many constraints remain within the farming system, e.g., lack of proper farm machinery, lack of good and timely availability of seed, fertilizers and pesticides, lack of agricultural produce storage facilities, and most important of all, efficient management of the present threat of scarce water resources⁵.

Studies show that there tend to be a greater intensification of production after turnover (Dr. Vermillion). Based on his findings, a hypothesis was made that after having achieved equity (Section 6.22), the farmers, especially those whose water duty will be reduced, are likely to look for more efficient cultural, agronomic and irrigation management practices in order to retain their agriculture incomes at the present levels.

Research conducted by IIMI-Pakistan has revealed that by using improved methods of irrigation for the cotton crop, savings in water application can be achieved between 15% to 30%, hence, a farmer can irrigate more land during his *warabandi* turn, and crop yields may increase by 10% to 20% (some studies have shown 40% to 60%). Further, for wheat, fodder and oil-seed corrugations (furrow), methods of irrigation are expected to increase crop yields by 5% to 15%, and savings in water application is possible between 10% to 20%.

Although these are interim results, the research is continuing, and final recommendations will take some time. Considering the importance of water resource management in the post-equity period due to the reasons stated in the previous paragraphs, certain calculations based on these interim results were made. To be on a conservative side, percentage increase in yield, and more land irrigated due to savings made in the water application, are taken as the starting point of the given ranges. The results of these computations are given in Table 55.

Table 55. Expected Increase in Net Agriculture Income by Adopting Improved Water Management Techniques.

Particulars	Cotton	Wheat	Fodder	Oil-Seed	Total
Total Cropped Land (acres)	5,278.78	5,214.00	594.60	690.00	--
Mean Yield per acre (kgs.)	540.80	993.60	5,708.00	410.00	--
Net Income before Tax per kgs. (Rs)	9.88	2.25	0.26	6.33	--
Net Income of Minor (Rs)	28,205,070.53	11,656,418.40	882,433.97	1,790,757.00	42,534,679.90
Projected Cropped Land (acres)	6,070.60	5,735.40	654.06	759.00	--
Projected Mean Yield per acre (Kgs.)	594.88	1,043.28	5,993.40	430.50	--
Net Income before Tax per kgs. (Rs)	9.88	2.25	0.26	6.33	--
Projected Net Income of Minor (Rs)	35,679,431.86	13,463,163.25	1,019,211.23	2,068,324.34	52,230,130.68
Increase in Net Income (Rs.)	7,474,361.32	1,806,744.85	136,777.27	277,567.34	9,695,450.78
Increase in Income per CCA acre (Rs)	567.87	137.27	10.39	21.09	736.62

⁵ "Personal Communication", Ineke M. Kalwij

The following assumptions have been made for the above calculations:

- Cotton cropped area will increase by 15%, while cotton yield will increase by 10%; the net revenue per acre has been kept at the current level.
- For the other crops in this table area, cropped area has been increased by 10%, while their yields have been increased by 5%; net revenues remain unchanged from the current price level.
- Orchards, sugarcane crop and the vegetable crops have not been considered in these computations.

Thus, by evolving improvements in on-farm water management, the Dhoru Naro Minor WUF may increase the mean agriculture income of the farmers of this command area by Rs. 737 per acre. Similarly, arrangements for proper farm machinery, good and timely availability of seed, fertilizers and pesticides by the farmers using their strength of being organized, will result in practicing intensive agriculture⁶. This area needs more data to calculate the change in the level of the agriculture incomes of the farmers, and may be considered during the preparation of the interim business plan.

Farmers lose a considerable amount of their revenues to the grain market agents. This happens with them around the world, and seemingly, farmers cannot get out of this circle. The Dhoru Naro WUF can maximize the profits of its members by constructing storage facilities. Although agents will still remain involved, the farmers will be able to obtain higher prices for their produce by selling them in the agriculture off-season. This area also needs more data to calculate change in the level of the agriculture incomes of the farmers.

Environmental Sustainability is another area in which the impact of the Dhoru Naro Minor WUF needs to be evaluated. "Only a few studies refer to impacts of management transfer on the environment. The problems that have been mentioned, for example, are waterlogging and salinization due to poor management practices of new and inexperienced managers hired by farmer associations" (Dr. Vermillion).

In Pakistan, at the turn of the century, the groundwater was usually more than 20 meters (62 feet) below the ground surface. Today, about 40 percent of the irrigated land has a groundwater table within 1.8 meters (10 feet) of the ground surface, with half of this land having the water table within 6 feet of the ground (WAPDA 1994).

In the Dhoru Naro Minor command area, the average groundwater table depth from the surface is within 10 feet. A drainage network is installed and is in working condition. The SIDA act speaks of the recovery of full O&M costs for the irrigation and drainage network from the farmers. By using the installed drainage network, with reasonable care, certainly the farmers can enhance the life of this network, which will result in the distribution of its capital cost over a period of more years, thus, reducing the annual burden on the farmers.

⁶ "Personal Communication", Prof. Gaylord V. Skogerboe

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ANNEXURES

Farmgate Price per Mound (in Rupees)Area Cultivated for Kharif 1997 (in Acres)

Gross Agriculture Revenue for Kharif 1997 (in Rupees)

**Gross Agriculture Revenue
For Rabi 1996-97**

Gross Agriculture Revenue for Rabi 1996-97 (in Rupees)

[illegible]

Dhoro Naro Minor
Gross Agriculture Revenue
For the Year 1996-97

Gross Agriculture Revenue for the Year 1996-97 (in Rupees)

W/C #	10L	11L	1AL	1P	1CL	1DL	1L	1R	2AL	2L	2R	3L	3R	4AL	4BL	4L	4R	5L	5R	6AR	6L	6R	7L	7R	9L	Total
Wheat (Rabi)	187,199	1,218,532	903,054	2,228,504	2,228,094	894,970	1,263,351	572,186	1,748,098	1,488,749	1,764,534	714,590	1,231,594	300,245	1,298,203	2,069,402	2,824,398	1,658,293	843,004	457,301	2,085,569	1,426,755	294,474	510,999	318,725	30,342,858
Vegetables (Kharif)	9,453	359,960	19,650	4,727	-	108,732	82,530	409,280	23,634	470	249,984	1,503	249,984	-	-	86,174	326,145	75,828	11,344	-	84,535	-	108,715	14,180	23,634	2,238,042
Orchard (Rabi)	43,467	189,953	482,584	2,563,570	1,181,184	1,307,778	217,035	1,909,809	282,146	412,387	447,843	1,135,598	869,140	-	-	535,907	318,407	88,814	65,111	-	130,221	238,139	141,073	-	-	12,805,883
Oil Seeds (Rabi)	96,036	104,983	237,529	272,719	129,546	-	135,068	12,477	344,018	49,809	-	21,390	49,809	-	-	37,432	144,380	21,533	2,398	7,373	135,068	89,124	174,083	112,228	131,903	2,431,281
Fodder (Rabi)	9,350	50,898	105,188	204,141	81,375	45,800	177,075	58,275	158,400	134,400	307,950	187,200	90,060	48,200	80,325	96,150	141,890	89,300	49,500	27,800	139,320	122,760	30,160	34,155	53,490	2,495,069
Cotton (Kharif)	72,073	1,690,878	3,091,351	2,081,354	1,736,432	2,048,508	3,192,197	84,144	2,821,484	633,323	2,694,787	2,430,470	2,878,408	778,238	2,265,483	4,494,555	2,339,406	2,720,870	2,857,858	1,945,787	1,749,740	4,094,952	512,578	1,284,506	442,259	51,339,861
Sugarcane (Kharif)	-	-	595,350	27,000	6,760	739,125	578,025	972,090	289,683	223,500	287,350	288,313	51,300	69,189	-	34,198	87,311	-	113,837	-	390,285	-	5,053	-	-	5,071,358
Orchard (Kharif)	2,850	10,905	38,503	784,519	352,720	2,698,895	85,034	193,060	45,357	310,471	190,324	133,272	234,949	-	-	482,127	4,480	41,832	2,383	-	17,725	27,072	18,718	-	-	5,387,328
Vegetable (Kharif)	3,545	38,693	81,923	77,186	10,928	70,841	43,820	1,069,140	49,086	-	1,439,598	3,457	112,578	-	-	61,898	83,876	131,138	37,280	81,840	40,237	81,974	20,128	25,618	51,192	1,959,259
Fodder (Kharif)	4,188	38,693	81,923	77,186	10,928	70,841	43,820	1,069,140	49,086	-	1,439,598	3,457	112,578	-	-	61,898	83,876	131,138	37,280	81,840	40,237	81,974	20,128	25,618	51,192	1,959,259
Total	419,060	3,674,397	5,573,004	9,311,729	5,734,028	7,843,745	5,988,211	5,912,731	5,597,234	3,599,240	7,855,017	4,996,178	5,598,410	1,214,139	4,470,559	7,593,704	6,256,761	4,990,867	3,998,303	2,910,488	4,443,189	8,075,922	1,300,526	1,981,884	1,094,245	117,198,129

Annexure 3a

Dhoro Naro Minor Agriculture Input Costs For Kharif 1997

Area Cultivated for Kharif 1997 (in Acres)

	10L	11L	11AL	11BL	1CL	1DL	1L	1R	2AL	2L	2R	3L	3R	4AL	4BL	4R	4L	5L	5R	6AL	6L	6R	7L	7R	8L	9L	Total
Carbon	47.25	139.55	238.88	341.13	325.25	140.83	180.25	42.05	264.40	218.53	172.15	318.68	195.18	83.78	292.00	392.00	235.95	356.73	182.58	102.05	268.78	174.40	224.03	210.53	115.98	5,278.78	
Supercarb	-	-	47.25	2.00	0.50	54.75	45.88	95.30	19.98	17.00	21.30	18.88	3.80	5.13	-	-	9.00	29.38	3.75	1.00	20.85	0.38	-	-	-	394.90	
Orchard	1.50	2.88	8.50	137.58	34.00	98.75	14.85	33.00	7.75	10.15	25.53	56.35	33.83	5.13	10.33	15.25	-	-	-	-	9.80	4.75	4.25	-	-	480.95	
Vegetable	0.38	-	5.83	-	-	13.38	18.73	77.25	4.88	-	-	50.43	1.15	11.53	-	-	0.48	4.43	0.25	-	1.88	1.00	-	-	-	250.68	
Fodder	7.58	9.73	33.10	22.50	11.75	43.13	67.08	23.85	18.78	30.25	39.85	23.18	37.40	4.83	83.83	19.85	30.73	27.55	11.30	8.80	12.43	5.95	6.68	8.63	15.90	594.60	

Land Preparation (Rate per Acre in Rupees)

[illegible]

Seeds (Rate per Acre in Rupees)

[illegible]

Fertilizers (Rate per Acre in Rupees)

[illegible]

Pesticides (Rate per Acre in Rupees)

[illegible]

Labor (Rate per Acre in Rupees)

[illegible]

**Dhoro Naro Minor
Agriculture Input Costs
For Rabi 1996-97**

Area Cultivated for Rabi 1996-97 (in Acres)

W/C #	10L	11L	11AL	11BL	1CL	1DL	1L	1R	2AL	2L	2R	3L	3R	4AL	4BL	4L	4R	5L	5R	6AL	6L	6R	7L	7R	8L	Total
Wheat	81.50	150.50	170.00	330.00	330.00	155.00	273.50	78.00	252.00	263.50	191.00	221.00	197.50	45.00	224.50	280.00	516.50	359.00	182.50	63.00	301.00	178.50	127.50	147.50	86.00	5,214.00
Orchard	2.00	11.50	23.00	119.50	49.00	65.00	10.00	88.00	13.00	19.00	18.00	45.00	40.00	-	31.00	-	14.50	4.00	3.00	-	6.00	11.00	6.50	-	-	590.00
Vegetable	1.00	35.00	6.50	20.50	0.50	-	31.50	29.50	2.50	3.00	10.50	0.50	25.50	-	-	-	34.50	8.00	1.20	-	10.00	-	11.50	1.50	2.50	242.70
Fodder	17.00	13.50	42.50	59.50	87.50	47.50	46.50	18.50	44.00	32.00	44.50	48.00	43.50	11.00	25.50	21.00	52.00	17.50	15.00	3.00	43.00	31.00	13.00	11.50	16.50	816.50
Oil Seeds	27.50	15.00	49.50	76.50	65.50	-	34.50	3.50	88.50	14.00	-	6.00	14.00	-	10.50	40.50	22.00	40.00	11.00	3.00	23.00	25.00	49.00	27.50	37.00	690.00

Land Preparation (Rate per Acre in Rupees)

W/C #	10L	11L	11AL	11BL	1CL	1DL	1L	1R	2AL	2L	2R	3L	3R	4AL	4BL	4L	4R	5L	5R	6AL	6L	6R	7L	7R	8L	Mean
Wheat	479	-	-	450	450	450	450	450	479	479	479	450	450	479	479	479	479	500	479	450	479	479	479	479	479	479
Orchard	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vegetable	371	371	300	371	300	300	300	300	371	371	371	300	300	371	371	371	371	371	371	371	371	371	371	371	371	371
Fodder	332	332	300	332	300	300	300	300	332	332	332	300	300	332	332	332	332	332	332	332	332	332	332	332	332	332
Oil Seed	292	292	300	292	300	292	300	292	292	292	292	300	292	292	292	292	292	292	292	292	292	292	292	292	292	292

Seeds (Rate per Acre in Rupees)

W/C #	10L	11L	11AL	11BL	1CL	1DL	1L	1R	2AL	2L	2R	3L	3R	4AL	4BL	4L	4R	5L	5R	6AL	6L	6R	7L	7R	8L	Mean
Wheat	450	600	2,180	600	480	500	800	400	600	600	400	400	600	50	800	600	600	600	600	300	600	600	600	600	500	610
Orchard	1,870	1,870	1,870	1,870	1,870	1,870	1,870	2,880	1,870	1,870	3,000	1,870	1,870	1,870	1,870	1,870	1,870	1,870	1,870	1,870	1,870	1,870	1,870	1,870	1,870	1,870
Vegetable	867	200	800	867	487	300	250	500	500	867	250	500	2,000	1,200	867	867	867	867	867	867	867	867	867	867	867	867
Fodder	800	540	240	423	500	400	600	280	280	860	90	400	650	60	280	600	600	500	350	160	100	210	700	20	1,200	240
Oil Seed	50	100	24	50	30	50	50	40	50	50	50	50	50	50	50	50	50	70	50	100	31	40	30	40	50	50

Fertilizers (Rate per Acre in Rupees)

W/C #	10L	11L	11AL	11BL	1CL	1DL	1L	1R	2AL	2L	2R	3L	3R	4AL	4BL	4L	4R	5L	5R	6AL	6L	6R	7L	7R	8L	Mean
Wheat	1,660	2,050	1,489	1,812	910	1,155	1,920	1,035	1,240	1,495	3,600	2,054	1,240	1,520	1,260	1,580	1,240	1,580	1,240	900	1,240	1,240	1,240	1,240	1,240	1,549
Orchard	1,554	730	1,200	1,554	560	5,055	1,554	1,554	1,554	2,700	560	585	3,590	1,554	350	1,200	820	1,354	1,554	1,554	1,554	1,554	1,554	1,554	1,554	
Vegetable	2,212	440	1,868	2,212	2,212	350	5,420	4,060	2,212	865	4,860	442	900	2,212	2,212	2,212	2,212	2,212	2,212	2,212	2,212	2,212	2,212	2,212	2,212	
Fodder	1,300	1,170	1,017	1,138	1,138	920	2,740	1,265	880	865	1,800	1,170	3,900	3,340	350	900	900	680	900	300	60	340	540	340	680	
Oil Seed	699	1,170	452	699	350	699	699	699	699	699	699	699	699	699	699	699	699	699	699	699	699	699	699	699	699	

Pesticides (Rate per Acre in Rupees)

W/C #	10L	11L	11AL	11BL	1CL	1DL	1L	1R	2AL	2L	2R	3L	3R	4AL	4BL	4L	4R	5L	5R	6AL	6L	6R	7L	7R	8L	Mean
Wheat	250	100	400	249	249	249	249	249	249	249	200	249	249	249	249	249	249	225	249	249	249	249	112	249	249	249
Orchard	663	200	663	663	1,200	663	663	663	663	663	663	663	1,000	663	663	663	663	663	663	663	663	663	663	663	663	663
Vegetable	1,370	1,370	1,000	1,370	1,370	350	5,000	300	1,370	1,370	1,370	1,370	1,370	200	1,370	1,370	1,370	1,370	1,370	1,370	1,370	1,370	1,370	1,370	1,370	
Fodder	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oil Seed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Labor (Rate per Acre in Rupees)

W/C #	10L	11L	11AL	11BL	1CL	1DL	1L	1R	2AL	2L	2R	3L	3R	4AL	4BL	4L	4R	5L	5R	6AL	6L	6R	7L	7R	8L	Mean
Wheat	581	581	414	540	540	450	360	540	540	581	581	720	300	489	581	581	581	581	581	581	581	581	581	581	581	581
Orchard	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vegetable	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fodder	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oil Seed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Agriculture Input Costs for the Year 1996-97 (In Rupees)																																																																																																																																																																																																																																			
W/C #	10L	11L	12AL	13L	14L	15L	16L	17L	18L	19L	20L	21L	22L	23L	24L	25L	26L	27L	28L	29L	30L	31L	32L	33L	34L	35L	36L	37L	38L	39L	40L	41L	42L	43L	44L	45L	46L	47L	48L	49L	50L	51L	52L	53L	54L	55L	56L	57L	58L	59L	60L	61L	62L	63L	64L	65L	66L	67L	68L	69L	70L	71L	72L	73L	74L	75L	76L	77L	78L	79L	80L	81L	82L	83L	84L	85L	86L	87L	88L	89L	90L	91L	92L	93L	94L	95L	96L	97L	98L	99L	100L	Total																																																																																																																																							
Land Preparation	81,135	172,204	252,401	352,964	453,527	554,090	654,653	755,216	855,779	956,342	1,056,905	1,157,468	1,258,031	1,358,594	1,459,157	1,559,720	1,660,283	1,760,846	1,861,409	1,961,972	2,062,535	2,163,098	2,263,661	2,364,224	2,464,787	2,565,350	2,665,913	2,766,476	2,867,039	2,967,602	3,068,165	3,168,728	3,269,291	3,369,854	3,470,417	3,570,980	3,671,543	3,772,106	3,872,669	3,973,232	4,073,795	4,174,358	4,274,921	4,375,484	4,476,047	4,576,610	4,677,173	4,777,736	4,878,299	4,978,862	5,079,425	5,179,988	5,280,551	5,381,114	5,481,677	5,582,240	5,682,803	5,783,366	5,883,929	5,984,492	6,085,055	6,185,618	6,286,181	6,386,744	6,487,307	6,587,870	6,688,433	6,788,996	6,889,559	6,990,122	7,090,685	7,191,248	7,291,811	7,392,374	7,492,937	7,593,500	7,694,063	7,794,626	7,895,189	7,995,752	8,096,315	8,196,878	8,297,441	8,398,004	8,498,567	8,599,130	8,699,693	8,800,256	8,900,819	9,001,382	9,101,945	9,202,508	9,303,071	9,403,634	9,504,197	9,604,760	9,705,323	9,805,886	9,906,449	10,007,012	10,107,575	10,208,138	10,308,701	10,409,264	10,509,827	10,610,390	10,710,953	10,811,516	10,912,079	11,012,642	11,113,205	11,213,768	11,314,331	11,414,894	11,515,457	11,616,020	11,716,583	11,817,146	11,917,709	12,018,272	12,118,835	12,219,398	12,319,961	12,420,524	12,521,087	12,621,650	12,722,213	12,822,776	12,923,339	13,023,902	13,124,465	13,225,028	13,325,591	13,426,154	13,526,717	13,627,280	13,727,843	13,828,406	13,928,969	14,029,532	14,130,095	14,230,658	14,331,221	14,431,784	14,532,347	14,632,910	14,733,473	14,834,036	14,934,599	15,035,162	15,135,725	15,236,288	15,336,851	15,437,414	15,537,977	15,638,540	15,739,103	15,839,666	15,940,229	16,040,792	16,141,355	16,241,918	16,342,481	16,443,044	16,543,607	16,644,170	16,744,733	16,845,296	16,945,859	17,046,422	17,146,985	17,247,548	17,348,111	17,448,674	17,549,237	17,649,800	17,750,363	17,850,926	17,951,489	18,052,052	18,152,615	18,253,178	18,353,741	18,454,304	18,554,867	18,655,430	18,755,993	18,856,556	18,957,119	19,057,682	19,158,245	19,258,808	19,359,371	19,459,934	19,560,497	19,661,060	19,761,623	19,862,186	19,962,749	20,063,312	20,163,875	20,264,438	20,364,901	20,465,464	20,566,027	20,666,590	20,767,153	20,867,716	20,968,279	21,068,842	21,169,405	21,269,968	21,370,531	21,471,094	21,571,657	21,672,220	21,772,783	21,873,346	21,973,909	22,074,472	22,175,035	22,275,598	22,376,161	22,476,724	22,577,287	22,677,850	22,778,413

[illegible]

**Dhoro Naro Minor
Agriculture Land Taxes
For Kharif 1997**

Area Cultivated for Kharif 1997 (in Acres)

W/C #	10L	11L	1A	1B	1C	1D	1E	1R	2A	2L	2R	3L	3R	4A	4B	4R	4L	5L	5R	6A	6L	6R	7L	7R	9L	Total
Cotton	47.25	139.55	238.88	341.13	325.25	148.83	180.25	42.05	284.40	218.53	172.15	318.68	195.18	63.78	292.00	392.90	235.95	358.73	182.58	102.05	288.78	174.40	224.03	210.53	115.98	5,275.78
Sugarcane	-	-	47.25	2.00	0.50	54.75	45.88	95.30	19.98	17.00	21.30	19.88	3.80	5.13	-	9.00	29.38	3.75	1.00	20.65	-	0.38	-	-	-	396.90
Orchard	1.50	2.88	8.50	137.58	34.00	67.58	14.65	33.00	7.75	10.15	25.53	56.35	33.93	-	10.33	15.25	-	-	3.20	-	9.80	4.75	4.25	-	-	480.95
Vegetable	0.38	-	5.93	-	-	13.38	18.73	77.25	4.88	-	60.43	1.15	11.53	-	-	51.00	0.48	4.43	0.25	-	1.88	1.00	-	-	0.33	250.98
Fodder	7.58	9.73	33.10	22.50	11.75	43.13	67.68	23.85	16.78	30.25	38.85	23.18	37.40	4.83	63.83	19.65	30.73	27.45	11.30	8.80	12.43	15.65	8.68	8.63	15.80	594.80
Total	58.70	152.15	331.65	503.20	371.30	325.65	335.18	271.45	313.78	275.83	319.25	419.23	281.83	73.73	386.15	487.80	296.53	392.45	198.33	131.50	310.88	196.18	238.95	219.15	132.10	8,999.20

Area Liable for Agriculture Tax (in Acres)

W/C #	10L	11L	1A	1B	1C	1D	1E	1R	2A	2L	2R	3L	3R	4A	4B	4R	4L	5L	5R	6A	6L	6R	7L	7R	9L	Total
Cotton	43.80	102.73	217.88	312.13	320.25	76.63	144.08	19.75	187.35	177.80	121.83	207.43	130.28	83.78	277.23	202.35	378.15	307.18	177.15	102.05	237.48	68.50	182.58	154.10	107.48	4,307.90
Sugarcane	-	-	-	-	-	-	-	5.00	-	3.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.50
Orchard	1.00	2.88	8.50	137.58	34.00	51.73	13.65	22.50	1.53	7.15	16.15	52.00	20.55	-	4.48	-	13.75	-	3.20	-	7.90	4.75	3.00	-	-	406.28
Vegetable	0.38	-	5.93	-	-	4.13	15.48	44.58	1.28	-	41.28	1.15	6.13	-	-	0.48	47.75	4.43	0.25	-	1.88	1.00	-	-	-	176.08
Fodder	7.08	7.45	31.10	17.13	11.75	21.90	60.53	11.60	5.95	27.23	22.25	15.83	21.25	4.83	52.15	21.45	15.00	27.05	9.80	8.80	9.93	5.75	5.63	7.40	13.55	443.35
Total	52.25	113.05	263.40	486.83	366.00	154.38	233.73	103.43	176.10	215.18	201.50	278.40	178.20	68.60	333.85	224.78	452.85	338.85	190.40	110.85	237.18	80.00	202.20	161.50	121.03	5,342.10

Land Holdings (in Acres)

W/C #	10L	11L	1A	1B	1C	1D	1E	1R	2A	2L	2R	3L	3R	4A	4B	4R	4L	5L	5R	6A	6L	6R	7L	7R	9L	Total
Land Holdings	780.88	283.85	808.83	904.83	988.30	395.63	527.85	338.23	480.88	848.13	419.55	632.25	411.83	78.20	448.10	1,186.13	368.03	629.13	415.75	180.05	835.88	220.45	966.23	342.30	682.33	13,678.95

Area Cultivated for Kharif 1997 Including Intercropped (in Acres)

W/C #	10L	11L	1A	1B	1C	1D	1E	1R	2A	2L	2R	3L	3R	4A	4B	4R	4L	5L	5R	6A	6L	6R	7L	7R	9L
Cotton	47.25	115.68	238.88	341.13	325.25	148.83	190.25	40.55	283.40	218.53	172.15	318.68	194.68	63.78	292.00	334.45	392.90	334.55	182.58	102.05	284.83	174.40	218.53	210.53	115.98
Sugarcane	-	-	47.25	2.00	0.50	54.75	45.88	94.05	19.98	17.00	21.30	19.88	3.80	5.13	-	29.38	9.00	3.75	1.00	20.65	-	0.38	-	-	-
Mango	0.50	2.88	7.50	126.33	30.00	25.55	12.68	25.58	6.28	6.75	19.73	48.55	23.53	-	9.58	-	8.50	-	1.38	-	4.70	4.75	3.00	-	-
Lemon	-	-	1.00	6.88	2.00	11.00	1.98	7.43	1.53	-	2.25	9.30	9.40	-	0.75	-	6.00	-	-	-	3.70	-	0.25	-	-
Banana	-	-	-	-	-	31.03	-	-	-	3.40	-	0.50	-	-	-	-	-	-	1.33	-	-	-	-	-	-
Orchard Other	1.00	-	-	4.38	2.00	-	-	-	-	-	3.55	0.50	0.50	-	-	-	0.75	-	0.50	-	1.40	-	1.00	-	-
Vegetable	0.38	-	5.93	-	-	13.38	16.73	77.25	4.88	-	60.43	1.15	11.53	-	-	0.48	51.00	4.43	0.25	-	1.88	1.00	-	-	0.33
Fodder	7.58	8.40	33.10	22.50	11.75	43.13	67.68	22.80	16.78	30.25	39.85	23.18	37.40	4.83	63.83	30.73	19.65	27.55	11.30	8.80	12.43	15.65	8.68	8.63	15.80

Abiana (Rate per Acre in Rupees)

W/C #	10L	11L	1A	1B	1C	1D	1E	1R	2A	2L	2R	3L	3R	4A	4B	4R	4L	5L	5R	6A	6L	6R	7L	7R	9L
Cotton	80.95	80.95	80.95	80.95	80.95	80.95	80.95	80.95	80.95	80.95	80.95	80.95	80.95	80.95	80.95	80.95	80.95	80.95	80.95	80.95	80.95	80.95	80.95	80.95	80.95
Sugarcane	158.15	158.15	158.15	158.15	158.15	158.15	158.15	158.15	158.15	158.15	158.15	158.15	158.15	158.15	158.15	158.15	158.15	158.15	158.15	158.15	158.15	158.15	158.15	158.15	158.15
Wheat	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35
Orchard	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60
Vegetable	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60	123.60
Fodder (Kharif)	34.65	34.65	34.65	34.65	34.65	34.65	34.65	34.65	34.65	34.65	34.65	34.65	34.65	34.65	34.65	34.65	34.65	34.65	34.65	34.65	34.65	34.65	34.65	34.65	34.65
Fodder (Rabi)	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35
Oil seeds	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35	46.35

Agriculture Tax (Rate per Acre in Rupees)

W/C #	10L	11L	1A	1B	1C	1D	1E	1R	2A	2L	2R	3L	3R	4A	4B	4R	4L	5L	5R	6A	6L	6R	7L	7R	9L
Cotton	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00
Sugarcane	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00
Wheat	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
Orchard	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00
Vegetable	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00	300.00
Fodder (Kharif)	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
Fodder (Rabi)	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
Oil seeds	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00

Drainage Cess (Rate per Acre in Rupees)

W/C #	10L	11L	1A	1B	1C	1D	1E	1R	2A	2L	2R	3L	3R	4A	4B	4R	4L	5L	5R	6A	6L	6R	7L	7R	9L
Rate per Acre	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00

**Dhoro Naro Minor
Agriculture Land Taxes
For Kharif 1997**

Total Abiana (in Rupees)

WIC #	10L	11L	14L	16L	1CL	1DL	1L	1R	2AL	2L	2R	3L	3R	4AL	4BL	4R	4L	5L	5R	6AR	6L	6R	7L	7R	9L	Total
Cotton	3,025	11,297	19,175	27,614	26,329	11,885	15,401	3,404	21,403	13,936	25,797	15,799	5,163	23,637	31,805	19,100	20,677	14,779	8,261	23,214	14,118	18,135	17,042	9,388	427,074	
Sugarcane	-	-	-	7,473	316	79	8,659	7,255	15,072	3,159	2,669	3,143	601	811	-	1,423	4,648	593	158	3,268	-	59	-	-	-	52,770
Orchard	185	355	1,051	17,004	4,202	8,352	1,811	4,079	958	1,255	3,155	6,965	4,193	-	1,276	1,865	-	-	398	-	1,211	587	525	-	-	59,445
Vegetable	48	-	732	-	-	1,653	2,087	9,548	603	-	7,469	142	1,424	-	-	6,304	59	-	547	31	-	232	124	-	-	40,310
Fodder	262	337	1,147	780	407	1,494	2,345	828	581	1,048	1,381	803	1,296	167	2,212	681	1,065	855	392	305	431	542	301	288	547	20,602
Total	4,319	11,989	29,577	45,714	31,018	32,044	28,879	32,929	28,704	22,681	29,308	36,850	23,314	6,140	27,125	42,098	24,669	30,971	15,756	11,832	25,088	15,430	18,961	17,341	9,976	600,913

Total Agriculture Tax (in Rupees)

WIC #	10L	11L	11A	11B	1CL	1DL	1L	1R	2A	2L	2R	3L	3R	4A	4B	4R	4L	5L	5R	6A	6L	6R	7L	7R	9L	Total	
Cotton	3,285	7,704	16,341	23,409	24,019	5,747	10,806	1,481	12,551	13,335	9,137	15,557	9,771	4,783	20,782	15,176	20,211	23,038	13,286	7,654	17,811	5,136	14,443	11,558	-	8,061	323,093
Sugarcane	-	-	-	-	-	-	-	375	-	-	225	-	-	-	-	-	38	-	-	-	-	-	-	-	-	638	
Orchard	300	863	2,550	41,273	10,200	15,518	4,085	8,750	458	2,145	4,845	15,600	6,165	-	1,343	-	4,125	-	980	-	2,370	1,425	900	-	-	121,883	
Vegetable	113	-	1,778	-	-	1,238	4,643	13,373	383	-	12,383	345	1,838	-	-	-	143	14,325	1,328	75	553	300	-	-	-	52,823	
Fodder	283	298	1,244	685	470	878	2,421	464	238	1,089	890	633	850	193	2,086	858	600	1,082	392	352	397	230	265	236	542	17,734	
Total	3,981	8,865	21,912	65,367	34,689	23,378	21,964	22,443	13,628	16,794	27,254	32,135	18,623	4,976	24,220	16,214	47,281	28,448	14,713	8,006	21,140	7,083	15,608	11,854	8,603	516,169	

Total Drainage Cess (in Rupees)

WIC #	10L	11L	11A	11B	1CL	1DL	1L	1R	2A	2L	2R	3L	3R	4A	4B	4R	4L	5L	5R	6A	6L	6R	7L	7R	9L	Total
Cotton	1,981.75	5,67.70	1,217.25	1,895.85	1,878.89	771.25	1,884.75	872.45	821.35	1,284.35	639.10	1,284.56	873.25	159.40	882.20	2,312.35	739.05	1,248.25	831.50	390.10	1,881.75	440.80	1,522.05	884.80	1,324.88	27,871.88

Total Local Cess (in Rupees)

WIC #	10L	11L	11A	11B	1CL	1DL	1L	1R	2A	2L	2R	3L	3R	4A	4B	4R	4L	5L	5R	6A	6L	6R	7L	7R	9L	Total
Cotton	473	1,398	2,989	3,411	3,253	1,468	1,903	421	2,644	2,105	1,722	3,187	1,952	638	2,920	3,929	2,360	3,567	1,826	1,021	2,868	1,744	2,240	2,105	1,160	52,758
Sugarcane	-	-	473	20	5	548	459	563	200	170	213	199	38	51	-	90	294	39	10	207	-	4	-	-	-	3,989
Orchard	15	29	85	1,376	340	678	147	330	78	102	255	584	339	-	103	153	-	-	32	-	98	48	43	-	-	4,810
Vegetable	4	-	59	-	-	134	167	773	49	-	604	12	115	-	-	510	5	44	3	-	19	10	-	-	-	2,510
Fodder	76	97	331	225	118	431	677	239	168	303	399	232	374	48	638	197	307	276	113	88	124	157	87	86	158	5,946
Total	567	1,522	3,317	5,032	3,715	3,257	3,552	2,715	3,138	2,759	3,193	4,192	2,618	737	3,662	4,878	2,965	3,925	1,963	1,315	3,109	1,962	2,370	2,182	1,321	69,992

Total Usher (in Rupees)

WIC #	10L	11L	11A	11B	1CL	1DL	1L	1R	2A	2L	2R	3L	3R	4A	4B	4R	4L	5L	5R	6A	6L	6R	7L	7R	9L	Total
Cotton	7,225	22,886	33,755	51,182	49,946	23,616	33,185	6,348	55,101	44,281	32,494	45,411	34,207	9,089	45,059	45,846	58,033	56,437	39,285	14,542	69,707	37,260	35,529	31,888	18,486	699,257
Sugarcane	-	-	14,818	619	155	16,938	16,439	30,520	9,173	5,259	7,208	6,149	1,176	1,896	-	11,872	2,784	1,080	619	5,389	-	116	-	-	-	132,776
Marwad	94	270	703	11,843	2,813	2,385	1,329	2,386	841	914	2,072	4,384	3,401	-	1,376	-	797	-	129	-	881	891	305	-	-	37,814
Barana	-	-	75	516	150	868	158	557	125	-	179	698	797	-	72	-	450	-	-	-	353	-	24	-	-	5,019
Orchard Other	56	-	-	302	113	-	-	-	-	-	256	28	58	-	-	-	-	-	745	-	-	-	-	-	-	20,391
Vegetable	21	-	333	-	-	865	990	4,870	444	-	4,086	65	727	-	-	-	42	-	28	-	79	-	113	-	-	1,073
Fodder	218	319	894	635	317	1,225	2,281	882	711	988	1,437	628	1,116	130	2,093	1,202	636	879	531	238	628	708	278	233	539	19,537
Total	7,614	23,174	50,378	65,097	63,557	63,557	54,378	45,175	68,398	53,353	47,734	57,340	41,761	10,804	49,588	59,947	65,638	59,948	40,345	21,168	71,780	39,087	36,248	31,921	19,062	1,131,772

Total Agriculture Land Taxes for Kharif 1997 (in Rupees)

WIC #	10L	11L	11A	11B	1CL	1DL	1L	1R	2A	2L	2R	3L	3R	4A	4B	4R	4L	5L	5R	6A	6L	6R	7L	7R	9L	Total
Abiana	4,319	11,989	29,577	45,714	31,018	32,044	28,879	32,929	28,704	22,681	29,308	36,850	23,314	5,140	27,125	42,098	24,669	30,971	15,756	11,832	25,088	15,430	18,961	17,341	9,976	600,913
Agri. Tax	3,981	8,865	21,912	65,367	34,689	23,378	21,964	22,443	13,628	16,794	27,254	32,135	18,623	4,976	24,220	16,214	47,281	28,448	14,713	8,006	21,140	7,083	15,608	11,854	8,603	516,169
Drainage Cess	1,562	568	1,217	1,810	1,977	771	1,056	872	921	1,298	839	1,265	823	156	882	2,312	736	1,258	632	360	1,852	441	1,932	885	1,325	27,356
Local Cess	567	1,522	3,317	5,032	3,715	3,257	3,552	2,715	3,138	2,759	3,193	4,192	2,618	737	3,662	4,878	2,965	3,925	1,963	1,315	3,109	1,962	2,370	2,182	1,321	69,992
Usher	7,614	23,174	50,378	65,097	63,557	63,557	54,378	45,175	68,398	53,353	47,734	57,340	41,761	10,804	49,588	59,947	65,638	59,948	40,345	21,168	71,780	39,087	36,248	31,921	19,062	1,131,772
Total Taxes	18,042	46,117	106,401	183,018	124,891	122,808	109,629	103,834	110,786	96,863	106,328	131,782	87,332	22,814	104,496	124,449	141,470	120,548	73,628	42,681	122,788	64,013	75,117	63,962	40,286	2,348,203

Abiana (Rate per Acre in Rupees)

Usher (Rate per Acre in Rupees)Agriculture Tax (Rate per Acre in Rupees)

Local Cess (Rate per Acre in Rupees)

Drainage Cess (Rate per Acre in Rupees)

Land Holdings (in Acres)

Area Cultivated for Rabi 1996-97 (in Rupees)

DOY	WVC #	1A	1B	1C	2A	2B	2C	3A	3B	4A	4B	4C	5A	5B	6A	6B	7A	7B	Total
91	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
92	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
93	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
94	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
95	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
96	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
97	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
98	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
99	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
100	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
101	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
102	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
103	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
104	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
105	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
106	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
107	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
108	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
109	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
110	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
111	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
112	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
113	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
114	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
115	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
116	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
117	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
118	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
119	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
120	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
121	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
122	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
123	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
124	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
125	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
126	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
127	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
128	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
129	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
130	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
131	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
132	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
133	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
134	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
135	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
136	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
137	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
138	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
139	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
140	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
141	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
142	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
143	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
144	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
145	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
146	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
147	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
148	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
149	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
150	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
151	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
152	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
153	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
154	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
155	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
156	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
157	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
158	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
159	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
160	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
161	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
162	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
163	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
164	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
165	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
166	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
167	150	170	120	32	78	42	43	107	107	165	107	107	318	359	189	68	178	127	99
168	150	170	120	32	78	42	43	107	107	16									

**Dhoro Naro Minor
Agriculture Land Taxes
For Rabi 1996-97**

Total Abiana (in Rupees)

W/C #	10L	11L	11AL	11BL	1CL	1DL	1L	1R	2AL	2L	2R	3L	3R	4AL	4BL	4L	4R	5L	5R	6AL	6L	6R	7L	7R	8L	Total
Wheat	3,716	9,976	2,880	15,296	15,643	7,184	12,877	3,523	12,213	12,877	12,213	8,853	10,243	9,154	3,013	10,406	12,978	23,940	18,840	4,499	3,059	13,951	8,181	5,910	6,837	241,689
Orchard	247	1,421	3,090	14,770	5,933	8,034	1,238	10,877	1,607	2,348	2,225	5,562	4,944	-	-	3,832	-	1,792	494	371	742	1,380	803	-	-	71,888
Vegetable	124	4,320	803	62	-	-	2,334	3,893	3,848	308	371	1,298	62	3,152	-	865	4,264	990	148	-	-	1,236	1,421	185	-	309
Fodder	788	628	1,970	2,758	4,056	2,202	2,819	657	2,039	1,483	2,083	2,225	2,152	-	-	1,182	973	2,410	811	695	1,39	1,983	1,437	603	533	37,845
Oil Seeds	1,275	695	2,248	3,548	3,036	-	1,599	162	4,473	649	-	278	649	-	-	487	1,877	1,020	1,854	510	139	1,066	1,159	2,271	1,275	31,982
Total	6,211	14,044	15,991	36,431	28,667	19,954	22,024	19,065	20,108	17,065	14,438	18,370	20,008	3,523	15,906	16,984	33,428	20,788	10,183	3,337	18,988	12,136	11,008	8,830	5,887	413,181

Total Agriculture Tax (in Rupees)

W/C #	10L	11L	11AL	11BL	1CL	1DL	1L	1R	2AL	2L	2R	3L	3R	4AL	4BL	4L	4R	5L	5R	6AL	6L	6R	7L	7R	8L	Total
Wheat	1,752	4,109	8,715	12,485	12,810	3,065	5,763	780	6,894	7,112	4,873	8,297	5,211	2,551	11,089	8,094	13,046	12,287	7,080	4,082	9,498	2,740	7,703	6,164	4,299	172,316
Orchard	1,752	4,109	8,715	12,485	12,810	3,065	5,763	780	6,894	7,112	4,873	8,297	5,211	2,551	11,089	8,094	13,046	12,287	7,080	4,082	9,498	2,740	7,703	6,164	4,299	172,316
Total	1,752	4,109	8,715	12,485	12,810	3,065	5,763	780	6,894	7,112	4,873	8,297	5,211	2,551	11,089	8,094	13,046	12,287	7,080	4,082	9,498	2,740	7,703	6,164	4,299	172,316

Total Drainage Cess (in Rupees)

Watercourse No.	10L	11L	11AL	11BL	1CL	1DL	1L	1R	2AL	2L	2R	3L	3R	4AL	4BL	4L	4R	5L	5R	6AL	6L	6R	7L	7R	8L	Total
Total	1,582	588	1,217	1,810	1,977	771	1,056	672	921	1,296	639	1,265	623	156	892	2,312	736	1,258	832	380	1,552	441	1,932	885	1,325	27,358

Total Local Cess (in Rupees)

W/C #	10L	11L	11AL	11BL	1CL	1DL	1L	1R	2AL	2L	2R	3L	3R	4AL	4BL	4L	4R	5L	5R	6AL	6L	6R	7L	7R	8L	Total
Wheat	815	1,505	1,700	3,300	3,375	1,550	2,735	760	2,520	2,835	1,910	2,210	1,975	850	850	2,245	2,800	5,165	3,590	1,825	580	3,010	1,765	1,275	1,475	880
Orchard	20	115	250	1,195	480	550	100	880	130	180	180	450	400	-	-	310	-	145	40	30	-	60	110	85	-	580
Vegetable	10	350	85	5	-	-	205	315	295	25	30	105	5	255	-	70	345	80	12	-	-	100	115	15	-	25
Fodder	170	135	425	585	875	475	585	185	440	320	445	480	455	110	255	210	520	175	150	30	430	310	130	115	165	815
Oil Seeds	275	150	495	785	855	-	345	35	965	140	-	60	140	-	-	105	405	220	400	110	30	230	250	490	275	6,900
Total	1,290	2,255	2,925	5,860	5,385	2,880	4,060	2,155	4,060	3,315	2,640	3,205	3,225	760	2,915	3,485	6,395	4,285	2,127	720	3,630	2,435	2,075	1,800	1,250	75,432

Total Usher (in Rupees)

W/C #	10L	11L	1AL	1BL	1CL	1DL	1L	1R	2AL	2L	2R	3L	3R	4AL	4BL	4L	4R	5L	5R	6AL	6L	6R	7L	7R	8L	Total
Wheat	12,103	22,349	25,245	49,005	50,119	23,018	40,615	11,286	37,422	39,130	28,364	32,819	29,329	9,653	33,336	41,580	76,700	53,312	27,101	9,801	44,699	26,210	18,934	21,904	10,247	774,279
Orchard	225	1,264	2,813	13,444	5,400	7,313	1,125	9,800	1,463	2,138	2,025	5,083	4,500	-	-	3,486	-	1,631	450	338	-	875	1,238	731	-	65,250
Vegetable	113	3,938	731	56	-	-	2,306	3,544	3,319	281	338	1,181	58	2,869	-	788	3,681	900	135	-	-	1,125	1,204	169	281	27,304
Fodder	701	557	1,753	2,454	3,809	1,959	2,331	763	1,815	1,320	1,636	1,980	1,877	454	1,052	866	2,145	722	819	134	1,774	1,279	558	478	881	33,681
Oil Seeds	2,640	1,440	4,658	7,344	6,268	-	3,312	336	9,264	1,844	-	578	1,344	-	-	1,006	3,888	2,112	3,840	288	2,208	2,400	4,704	2,587	3,552	69,240
Total	15,782	29,577	35,198	72,303	65,416	34,596	50,928	25,604	50,245	44,269	33,405	40,493	39,919	10,108	39,886	47,122	86,470	59,223	29,249	10,213	50,480	31,127	28,199	25,187	14,760	966,753

Total Agriculture Land Taxes for Rabi 1996-97 (in Rupees)

W/C #	10L	11L	11AL	11BL	1CL	1DL	1L	1R	2AL	2L	2R	3L	3R	4AL	4BL	4L	4R	5L	5R	6AL	6L	6R	7L	7R	8L	Total
Abiana	6,211	14,044	15,991	36,431	28,667	19,954	22,024	19,065	20,108	17,065	14,438	18,370	20,008	3,523	15,906	16,984	33,426	20,788	10,183	3,337	18,988	12,136	11,008	8,830	5,887	413,181
Agriculture Tax	1,752	4,109	8,715	12,485	12,810	3,065	5,763	790	6,894	7,112	4,873	8,297	5,211	2,551	11,089	8,094	13,046	12,287	7,080	4,082	9,498	2,740	7,703	6,164	4,299	172,316
Drainage Cess	1,582	588	1,217	1,810	1,977	771	1,056	672	921	1,296	639	1,265	623	156	892	2,312	736	1,258	832	380	1,552	441	1,932	885	1,325	27,358
Local Cess	1,290	2,255	2,925	5,860	5,385	2,880	4,060	2,155	4,060	3,315	2,640	3,205	3,225	760	2,915	3,485	6,395	4,285	2,127	720	3,630	2,435	2,075	1,800	1,250	75,432
Usher	15,782	29,577	35,198	72,303	65,416	34,596	50,928	25,804	50,245	44,269	33,405	40,493	39,919	10,108	38,886	47,122	86,470	59,223	29,249	10,213	50,480	31,127	28,199	25,187	14,760	966,753
Total	28,596	50,553	64,046	128,869	114,255	61,266	83,829	48,287	62,048	73,057	56,198	71,630	69,165	17,096	69,888	77,707	142,073	97,842	49,476	18,712	84,449	49,978	42,745	27,621	1,655,049	

Source: physical assessment survey by IBM, sold along Newshawk from a Chicago-based firm.

Analysis of Sugarcane for Kharif 1997 of Dhoro Naro Minor

WIC #	10L	11L	1A1	1B1	1C1	1D1	1L	1R	2A1	2L	2R	3L	3R	4A1	4B1	4L	4R	5L	5R	6A1	6L	6R	7L	7R	8L	9L	Mean	
Yield per acre (Kg)	18000.00	18000.00	18000.00	18000.00	18000.00	18000.00	18000.00	18000.00	18000.00	18000.00	18000.00	18000.00	18000.00	18000.00	18000.00	18000.00	18000.00	18000.00	18000.00	18000.00	18000.00	18000.00	18000.00	18000.00	18000.00	18000.00	18000.00	
Farmgate price per Kg (Rs)	0.75	0.75	0.79	0.75	0.75	0.75	0.79	0.79	0.64	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	
Gross Agriculture Revenue per acre (Rs)	13500.00	13500.00	12800.00	13500.00	13500.00	13500.00	12800.00	12000.00	13500.00	13500.00	13500.00	13500.00	13500.00	13500.00	13500.00	13500.00	13500.00	13500.00	13500.00	13500.00	13500.00	13500.00	13500.00	13500.00	13500.00	13500.00	13512.00	
Land Preparation per acre (Rs)	625	625	600	625	625	625	625	1000	625	625	625	625	625	625	625	625	625	625	625	625	625	625	625	625	625	625	625	
Seed per acre (Rs)	2009	2009	2160	2009	2009	2009	2009	1800	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	
Fertilizer per acre (Rs)	2977	2977	1469	2977	2977	2977	2977	1920	2977	2977	2977	2977	2977	2977	2977	2977	2977	2977	2977	2977	2977	2977	2977	2977	2977	2977	2977	
Pesticides per acre (Rs)	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	
Labor per acre (Rs)	1050	1050	1050	1050	1050	1050	800	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	
Total Agriculture Input Costs per acre (Rs)	7261	7261	5879	7261	7261	7261	7261	8510	7261	7261	7261	7261	7261	7261	7261	7261	7261	7261	7261	7261	7261	7261	7261	7261	7261	7261	7261	
Net Agriculture Income per acre (Rs)	6239	6239	8721	6239	6239	6239	6480	1600	6239	6239	6239	6239	6239	6239	6239	6239	6239	6239	6239	6239	6239	6239	6239	6239	6239	6239	6239	
Area Cultivated per w/c (Acre)	10L	11L	1A1	1B1	1C1	1D1	1L	1R	2A1	2L	2R	3L	3R	4A1	4B1	4L	4R	5L	5R	6A1	6L	6R	7L	7R	8L	9L	Total Mean	
Gross Agriculture Revenue per w/c (Rs)	-	-	595.350	27.000	6.750	739.125	578.025	972.060	269.603	229.500	287.550	284.313	51.300	69.188	-	121.500	390.543	50.625	13.500	390.285	-	5.003	-	-	-	-	202.854	
Cost Inputs:																												
Land Preparation per w/c	-	-	28.350	1.250	313	34.219	45.875	57.180	12.484	10.625	13.313	12.422	2.375	3.203	-	5.825	18.359	2.344	625	6.195	-	234	-	-	-	-	10.200	
Seed per w/c	-	-	102.060	4.018	1.004	109.079	82.575	152.480	40.125	34.149	42.786	39.924	7.633	10.296	-	18.079	59.007	7.533	2.009	51.109	-	753	-	-	-	-	30.621	
Fertilizer per w/c	-	-	69.410	5.955	1.489	163.004	88.080	444.098	59.471	50.613	63.415	58.173	11.314	15.258	-	26.786	87.437	1.166	2.977	79.709	-	1.116	-	-	-	-	49.820	
Pesticides per w/c	-	-	28.350	1.200	300	32.950	27.525	57.180	11.965	10.200	12.780	11.925	2.280	3.075	-	5.400	17.825	2.250	600	12.300	-	225	-	-	-	-	9.526	
Labor per w/c	-	-	49.813	2.100	525	57.488	36.700	100.065	20.974	17.850	22.385	20.869	3.990	5.381	-	9.450	30.844	3.938	1.050	26.845	-	394	-	-	-	-	16.418	
Total Agriculture Cost/Inputs per w/c	-	-	277.783	14.522	3.631	397.540	280.755	811.003	145.038	123.437	154.659	144.312	27.592	37.213	-	65.349	213.292	27.229	7.261	176.248	-	2.723	-	-	-	-	128.504	
Taxes:																												
Abiana per w/c	-	-	7.473	316	79	8.659	7.255	15.072	3.159	2.689	3.369	3.143	601	811	-	1.423	4.048	503	158	3.208	-	59	-	-	-	-	2.511	
Agriculture Tax per w/c	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Drainage Cess per w/c	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Local Cess per w/c	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Usher per w/c	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total Agriculture Land Taxes per w/c	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Net Agriculture Income per w/c	-	-	284.810	11.519	2.880	315.331	273.029	113.947	112.052	97.686	122.088	114.470	21.866	29.517	-	42.710	175.488	21.598	5.450	204.135	-	2.140	-	-	-	-	79.433	
Water Duty	WIC #	10L	11L	1A1	1B1	1C1	1D1	1L	1R	2A1	2L	2R	3L	3R	4A1	4B1	4L	4R	5L	5R	6A1	6L	6R	7L	7R	8L	9L	Mean
Water Quality	0.003	2.616	4.598	3.22	2.724	14.108	5.768	11.582	5.76	3.798	5.485	4.578	5.478	7.999	8.781	5.547	2.555	5.563	5.033	6.028	1.52	6.091	1.142	2.849	1.219	5	1.479	
Water Table Depth	1751	614	1372	8015	528	966	2602	605	908	4397	700	723	678	1118	1371	508	929	2638	643	833	1479	482	1225	820	1271	1.479	8	
	9.99	8.67	9.34	8.82	8.71	7.48	9.39	5.8	8.42	8.13	7.86	7.61	9.1	6	7.57	8.19	8.25	7.16	8.69	6.17	8.07	7.87	9.41	8.22	9.41	8	8	

Source: Physical assessment survey by IIMI field staff, Nawabshah, from 10 October to 10 December 1997.

Source: Physical assessment survey by IIMI field staff, Nawabshah, from 10 October to 10 December 1997.

W/C #	11L	11A	11B	11C	11D	11E	11F	11G	11H	11I	11J	11K	11L	11M	11N	11O	11P	11Q	11R	11S	11T	11U	11V	11W	11X	11Y	11Z	11AA	11AB	11AC	11AD	11AE	11AF	11AG	11AH	11AI	11AJ	11AK	11AL	11AM	11AN	11AO	11AP	11AQ	11AR	11AS	11AT	11AU	11AV	11AW	11AX	11AY	11AZ	11BA	11BB	11BC	11BD	11BE	11BF	11BG	11BH	11BI	11BJ	11BK	11BL	11BM	11BN	11BO	11BP	11BQ	11BR	11BS	11BT	11BU	11BV	11BW	11BX	11BY	11BZ	11CA	11CB	11CC	11CD	11CE	11CF	11CG	11CH	11CI	11CJ	11CK	11CL	11CM	11CN	11CO	11CP	11CQ	11CR	11CS	11CT	11CU	11CV	11CW	11CX	11CY	11CZ	11DA	11DB	11DC	11DD	11DE	11DF	11DG	11DH	11DI	11DJ	11DK	11DL	11DM	11DN	11DO	11DP	11DQ	11DR	11DS	11DT	11DU	11DV	11DW	11DX	11DY	11DZ	11EA	11EB	11EC	11ED	11EE	11EF	11EG	11EH	11EI	11EJ	11EK	11EL	11EM	11EN	11EO	11EP	11EQ	11ER	11ES	11ET	11EU	11EV	11EW	11EX	11EY	11EZ	11FA	11FB	11FC	11FD	11FE	11FG	11FH	11FI	11FJ	11FK	11FL	11FM	11FN	11FO	11FP	11FQ	11FR	11FS	11FT	11FU	11FV	11FW	11FX	11FY	11FZ	11GA	11GB	11GC	11GD	11GE	11GF	11GG	11GH	11GI	11GJ	11GK	11GL	11GM	11GN	11GO	11GP	11GQ	11GR	11GS	11GT	11GU	11GV	11GW	11GX	11GY	11GZ	11HA	11HB	11HC	11HD	11HE	11HF	11HG	11HH	11HI	11HJ	11HK	11HL	11HM	11HN	11HO	11HP	11HQ	11HR	11HS	11HT	11HU	11HV	11HW	11HX	11HY	11HZ	11IA	11IB	11IC	11ID	11IE	11IF	11IG	11IH	11II	11IJ	11IK	11IL	11IM	11IN	11IO	11IP	11IQ	11IR	11IS	11IT	11IU	11IV	11IW	11IX	11IY	11IZ	11JA	11JB	11JC	11JD	11JE	11JF	11JG	11JH	11JI	11JJ	11JK	11JL	11JM	11JN	11JO	11JP	11JQ	11JR	11JS	11JT	11JU	11JV	11JW	11JX	11JY	11JZ	11KA	11KB	11KC	11KD	11KE	11KF	11KG	11KH	11KI	11KJ	11KL	11KM	11KN	11KO	11KP	11KQ	11KR	11KS	11KT	11KU	11KV	11KW	11KX	11KY	11KZ	11LA	11LB	11LC	11LD	11LE	11LF	11LG	11LH	11LI	11LJ	11LK	11LM	11LN	11LO	11LP	11LQ	11LR	11LS	11LT	11LU	11LV	11LW	11LX	11LY	11LZ	11MA	11MB	11MC	11MD	11ME	11MF	11MG	11MH	11MI	11MJ	11MK	11ML	11MN	11MO	11MP	11MQ	11MR	11MS	11MT	11MU	11MV	11MW	11MX	11MY	11MZ	11NA	11NB	11NC	11ND	11NE	11NF	11NG	11NH	11NI	11NJ	11NK	11NL	11NM	11NO	11NP	11NQ	11NR	11NS	11NT	11NU	11NV	11NW	11NX	11NY	11NZ	11OA	11OB	11OC	11OD	11OE	11OF	11OG	11OH	11OI	11OJ	11OK	11OL	11OM	11ON	11OO	11OP	11OQ	11OR	11OS	11OT	11OU	11OV	11OW	11OX	11OY	11OZ	11PA	11PB	11PC	11PD	11PE	11PF	11PG	11PH	11PI	11PJ	11PK	11PL	11PM	11PN	11PO	11PP	11PQ	11PR	11PS	11PT	11PU	11PV	11PW	11PX	11PY	11PZ	11QA	11QB	11QC	11QD	11QE	11QF	11QG	11QH	11QI	11QJ	11QK	11QL	11QM	11QN	11QO	11QP	11QQ	11QR	11QS	11QT	11QU	11QV	11QW	11QX	11QY	11QZ	11RA	11RB	11RC	11RD	11RE	11RF	11RG	11RH	11RI	11RJ	11RK	11RL	11RM	11RN	11RO	11RP	11RQ	11RR	11RS	11RT	11RU	11RV	11RW	11RX	11RY	11RZ	11SA	11SB	11SC	11SD	11SE	11SF	11SG	11SH	11SI	11SJ	11SK	11SL	11SM	11SN	11SO	11SP	11SQ	11SR	11SS	11ST	11SU	11SV	11SW	11SX	11SY	11SZ	11TA	11TB	11TC	11TD	11TE	11TF	11TG	11TH	11TI	11TJ	11TK	11TL	11TM	11TN	11TO	11TP	11TQ	11TR	11TS	11TT	11TU	11TV	11TW	11TX	11TY	11TZ	11UA	11UB	11UC	11UD	11UE	11UF	11UG	11UH	11UI	11UJ	11UK	11UL	11UM	11UN	11UO	11UP	11UQ	11UR	11US	11UT	11UU	11UV	11UW	11UX	11UY	11UZ	11VA	11VB	11VC	11VD	11VE	11VF	11VG	11VH	11VI	11VJ	11VK	11VL	11VM	11VN	11VO	11VP	11VQ	11VR	11VS	11VT	11VU	11VV	11VW	11VX	11VY	11VZ	11WA	11WB	11WC	11WD	11WE	11WF	11WG	11WH	11WI	11WJ	11WK	11WL	11WM	11WN	11WO	11WP	11WQ	11WR	11WS	11WT	11WU	11WV	11WW	11WX	11WY	11WZ	11XA	11XB	11XC	11XD	11XE	11XF	11XG	11XH	11XI	11XJ	11XK	11XL	11XM	11XN	11XO	11XP	11XQ	11XR	11XS	11XT	11XU	11XV	11XW	11XX	11XY	11XZ	11YA	11YB	11YC	11YD	11YE	11YF	11YG	11YH	11YI	11YJ	11YK	11YL	11YM	11YN	11YO	11YP	11YQ	11YR	11YS	11YT	11YU	11YV	11YW	11YX	11YY	11YZ	11ZA	11ZB	11ZC	11ZD	11ZE	11ZF	11ZG	11ZH	11ZI	11ZJ	11ZK	11ZL	11ZM	11ZN	11ZO	11ZP	11ZQ	11ZR	11ZS	11ZT	11ZU	11ZV	11ZW	11ZX	11ZY	11ZZ
480.00	1400.00	320.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00	1200.																																																																																																																																																																																																																																																																																																																																																																																	

Source: Farmers Interview for Rabi 1996-97

Annexure 12

Analysis of Fodder for *Kharif* 1997 of Dhoro Naro Minor

WIC #	10L	11L	11A	11B	11C	11D	11E	11F	11G	11H	11I	11J	11K	11L	11M	11N	11O	11P	11Q	11R	11S	11T	11U	11V	11W	11X	11Y	11Z	11AA	11AB	11AC	11AD	11AE	11AF	11AG	11AH	11AI	11AJ	11AK	11AL	11AM	11AN	11AO	11AP	11AQ	11AR	11AS	11AT	11AU	11AV	11AW	11AX	11AY	11AZ	11BA	11BB	11BC	11BD	11BE	11BF	11BG	11BH	11BI	11BJ	11BK	11BL	11BM	11BN	11BO	11BP	11BQ	11BR	11BS	11BT	11BU	11BV	11BW	11BX	11BY	11BZ	11CA	11CB	11CC	11CD	11CE	11CF	11CG	11CH	11CI	11CJ	11CK	11CL	11CM	11CN	11CO	11CP	11CQ	11CR	11CS	11CT	11CU	11CV	11CW	11CX	11CY	11CZ	11DA	11DB	11DC	11DD	11DE	11DF	11DG	11DH	11DI	11DJ	11DK	11DL	11DM	11DN	11DO	11DP	11DQ	11DR	11DS	11DT	11DU	11DV	11DW	11DX	11DY	11DZ	11EA	11EB	11EC	11ED	11EE	11EF	11EG	11EH	11EI	11EJ	11EK	11EL	11EM	11EN	11EO	11EP	11EQ	11ER	11ES	11ET	11EU	11EV	11EW	11EX	11EY	11EZ	11FA	11FB	11FC	11FD	11FE	11FF	11FG	11FH	11FI	11FJ	11FK	11FL	11FM	11FN	11FO	11FP	11FQ	11FR	11FS	11FT	11FU	11FV	11FW	11FX	11FY	11FZ	11GA	11GB	11GC	11GD	11GE	11GF	11GG	11GH	11GI	11GJ	11GK	11GL	11GM	11GN	11GO	11GP	11GQ	11GR	11GS	11GT	11GU	11GV	11GW	11GX	11GY	11GZ	11HA	11HB	11HC	11HD	11HE	11HF	11HG	11HH	11HI	11HJ	11HK	11HL	11HM	11HN	11HO	11HP	11HQ	11HR	11HS	11HT	11HU	11HV	11HW	11HX	11HY	11HZ	11IA	11IB	11IC	11ID	11IE	11IF	11IG	11IH	11II	11IJ	11IK	11IL	11IM	11IN	11IO	11IP	11IQ	11IR	11IS	11IT	11IU	11IV	11IW	11IX	11IY	11IZ	11JA	11JB	11JC	11JD	11JE	11JF	11JG	11JH	11JI	11JJ	11JK	11JL	11JM	11JN	11JO	11JP	11JQ	11JR	11JS	11JT	11JU	11JV	11JW	11JX	11JY	11JZ	11KA	11KB	11KC	11KD	11KE	11KF	11KG	11KH	11KI	11KJ	11KK	11KL	11KM	11KN	11KO	11KP	11KQ	11KR	11KS	11KT	11KU	11KV	11KW	11KX	11KY	11KZ	11LA	11LB	11LC	11LD	11LE	11LF	11LG	11LH	11LI	11LJ	11LK	11LM	11LN	11LO	11LP	11LQ	11LR	11LS	11LT	11LU	11LV	11LW	11LX	11LY	11LZ	11MA	11MB	11MC	11MD	11ME	11MF	11MG	11MH	11MI	11MJ	11MK	11ML	11MN	11MO	11MP	11MQ	11MR	11MS	11MT	11MU	11MV	11MW	11MX	11MY	11MZ	11NA	11NB	11NC	11ND	11NE	11NF	11NG	11NH	11NI	11NJ	11NK	11NL	11NM	11NO	11NP	11NQ	11NR	11NS	11NT	11NU	11NV	11NW	11NX	11NY	11NZ	11OA	11OB	11OC	11OD	11OE	11OF	11OG	11OH	11OI	11OJ	11OK	11OL	11OM	11ON	11OO	11OP	11OQ	11OR	11OS	11OT	11OU	11OV	11OW	11OX	11OY	11OZ	11PA	11PB	11PC	11PD	11PE	11PF	11PG	11PH	11PI	11PJ	11PK	11PL	11PM	11PN	11PO	11PP	11PQ	11PR	11PS	11PT	11PU	11PV	11PW	11PX	11PY	11PZ	11QA	11QB	11QC	11QD	11QE	11QF	11QG	11QH	11QI	11QJ	11QK	11QL	11QM	11QN	11QO	11QP	11QQ	11QR	11QS	11QT	11QU	11QV	11QW	11QX	11QY	11QZ	11RA	11RB	11RC	11RD	11RE	11RF	11RG	11RH	11RI	11RJ	11RK	11RL	11RM	11RN	11RO	11RP	11RQ	11RR	11RS	11RT	11RU	11RV	11RW	11RX	11RY	11RZ	11SA	11SB	11SC	11SD	11SE	11SF	11SG	11SH	11SI	11SJ	11SK	11SL	11SM	11SN	11SO	11SP	11SQ	11SR	11SS	11ST	11SU	11SV	11SW	11SX	11SY	11SZ	11TA	11TB	11TC	11TD	11TE	11TF	11TG	11TH	11TI	11TJ	11TK	11TL	11TM	11TN	11TO	11TP	11TQ	11TR	11TS	11TT	11TU	11TV	11TW	11TX	11TY	11TZ	11UA	11UB	11UC	11UD	11UE	11UF	11UG	11UH	11UI	11UJ	11UK	11UL	11UM	11UN	11UO	11UP	11UQ	11UR	11US	11UT	11UU	11UV	11UW	11UX	11UY	11UZ	11VA	11VB	11VC	11VD	11VE	11VF	11VG	11VH	11VI	11VJ	11VK	11VL	11VM	11VN	11VO	11VP	11VQ	11VR	11VS	11VT	11VU	11VV	11VW	11VX	11VY	11VZ	11WA	11WB	11WC	11WD	11WE	11WF	11WG	11WH	11WI	11WJ	11WK	11WL	11WM	11WN	11WO	11WP	11WQ	11WR	11WS	11WT	11WU	11WV	11WW	11WX	11WY	11WZ	11XA	11XB	11XC	11XD	11XE	11XF	11XG	11XH	11XI	11XJ	11XK	11XL	11XM	11XN	11XO	11XP	11XQ	11XR	11XS	11XT	11XU	11XV	11XW	11XX	11XY	11XZ	11YA	11YB	11YC	11YD	11YE	11YF	11YG	11YH	11YI	11YJ	11YK	11YL	11YM	11YN	11YO	11YP	11YQ	11YR	11YS	11YT	11YU	11YV	11YW	11YX	11YY	11YZ	11ZA	11ZB	11ZC	11ZD	11ZE	11ZF	11ZG	11ZH	11ZI	11ZJ	11ZK	11ZL	11ZM	11ZN	11ZO	11ZP	11ZQ	11ZR	11ZS	11ZT	11ZU	11ZV	11ZW	11ZX	11ZY	11ZZ
Yield per acre (Kg)	2000	5200	9000	5708.33	12000	24000	6000	6000	6000	6000	12000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000																																																																																																																																																																																																																																																																																																													

Source: Physical assessment survey by IIMI field staff, Nawabshah, from 10 October to 10 December 1997

Analysis of Cotton for Rabi 1996-97 of Dhoro Naro Minor

WIC #	10L	11L	1AL	1BL	1CL	1DL	1L	1R	2AL	2L	2R	3L	3R	4AL	4BL	4L	4R	5L	5R	6AL	6L	6R	7L	7R	8L	Mean
Yield per acre (kg)	410.00	500.00	600.00	410.00	320.00	410.00	410.00	400.00	410.00	410.00	500.00	410.00	410.00	410.00	410.00	410.00	410.00	410.00	410.00	600.00	410.00	410.00	500.00	500.00	410.00	410
Farmgate price per kg (Rs)	8.70	11.86	8.16	8.70	8.04	8.70	8.70	8.79	8.70	8.70	8.70	10.79	8.70	8.70	8.70	8.70	8.70	8.70	8.70	1.36	12.29	9.79	8.70	7.28	8.70	9
Gross Agriculture Revenue per acre (Rs)	3564.95	5997.50	4987.50	3564.95	1832.00	3564.95	3564.95	3515.00	3564.95	3564.95	4301.00	3564.95	3564.95	3564.95	3564.95	3564.95	3564.95	3564.95	3564.95	218.00	2457.50	5872.50	3564.95	4061.00	3564.95	3,635
Land Preparation per acre (Rs)	252	252	300	252	300	252	252	300	252	252	300	252	252	252	252	252	252	252	252	252	252	252	252	252	252	291
Seed per acre (Rs)	50	100	24	50	30	50	50	40	50	50	50	50	50	50	50	50	50	50	50	100	31	40	30	40	50	50
Fertilizer per acre (Rs)	699	1,170	452	699	350	699	699	1,240	699	699	699	699	699	699	699	699	699	699	699	900	300	699	340	1,240	699	699
Pesticides per acre (Rs)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Labor per acre (Rs)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Agriculture Input Costs per acre (Rs)	1,041	1,562	776	1,041	699	1,041	1,041	1,560	1,041	1,041	1,041	1,041	1,041	1,041	1,041	1,041	1,041	1,041	1,041	1,292	623	1,012	682	1,372	1,041	1,041
Net Agriculture Income per acre (Rs)	2,524	5,435	4,122	2,524	1,252	2,524	2,524	2,335	2,524	2,524	2,524	2,524	2,524	2,524	2,524	2,524	2,524	2,524	2,524	1,074	1,835	4,861	2,882	2,509	2,524	2,594
Area Cultivated per w/c (Acres)	27.50	15.00	48.50	76.50	65.50	100.00	100.00	34.50	98.50	14.00	0.00	6.00	14.00	0.00	10.50	40.50	22.00	40.00	40.00	11.00	3.00	23.00	25.00	49.00	27.50	690.00
Gross Agriculture Revenue per w/c (Rs)	98,038	104,983	237,520	272,719	128,548	-	135,068	12,477	344,018	49,908	-	21,390	49,909	-	37,432	144,380	21,533	142,598	2,398	7,373	135,068	88,124	174,883	112,228	131,903	86,051
Cost Inputs:																										
Land Preparation per w/c	6,021	4,375	14,550	22,313	19,850	-	10,350	1,021	28,148	4,083	-	1,750	4,083	-	3,083	11,813	5,500	11,807	3,208	875	6,708	7,262	14,292	8,021	10,782	8,003
Seed per w/c	1,386	1,500	1,104	3,862	1,965	-	1,380	1,177	4,871	707	-	303	707	-	530	2,044	1,540	2,019	1,100	94	920	1,202	1,470	1,100	1,968	1,279
Fertilizer per w/c	19,250	17,550	21,922	53,494	22,625	-	42,780	2,447	67,480	9,790	-	4,196	9,790	-	7,342	28,321	7,480	27,971	9,900	900	15,640	17,482	16,860	34,100	25,873	18,531
Pesticides per w/c	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Labor per w/c	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Agriculture Cost Inputs per w/c	28,638	23,425	37,536	79,668	44,540	-	54,510	3,645	100,497	14,580	-	6,249	14,580	-	10,935	42,177	14,520	41,857	14,208	1,969	23,268	26,035	32,422	43,221	38,532	27,873
Taxes:																										
Abiana per w/c	1,275	985	2,248	3,546	3,036	-	1,590	162	4,473	649	-	278	649	-	487	1,877	1,020	1,854	510	139	1,099	1,159	2,271	1,275	1,715	1,270
Drainage Cess per w/c	55	30	87	153	131	-	69	7	193	28	-	12	28	-	21	81	44	80	40	22	6	46	50	98	55	55
Local Cess per w/c	275	150	485	765	655	-	345	35	985	140	-	80	140	-	105	405	270	400	110	30	230	250	480	275	370	279
Usher per w/c	2,640	1,440	4,658	7,344	6,288	-	3,312	336	9,264	1,344	-	578	1,344	-	1,008	3,888	2,112	3,840	1,058	288	2,208	2,400	4,704	2,640	3,552	2,850
Total Agriculture Land Taxes per w/c	4,245	2,315	7,486	11,808	10,110	-	5,325	640	14,895	2,181	-	628	2,181	-	1,621	6,251	3,396	6,174	1,698	483	3,350	3,659	7,563	4,245	5,711	4,260
Net Agriculture Income per w/c	65,153	79,222	192,407	181,243	71,896	-	79,232	8,202	228,828	33,388	-	14,715	33,389	-	24,878	95,932	3,817	84,787	13,808	5,041	108,249	59,230	134,688	84,782	87,690	65,919
WIC #	10L	11L	1AL	1BL	1CL	1DL	1L	1R	2AL	2L	2R	3L	3R	4AL	4BL	4L	4R	5L	5R	6AL	6L	6R	7L	7R	8L	Mean
Water Duty	0.90	2.82	4.80	3.22	2.72	14.11	5.77	11.58	5.76	3.80	5.49	4.58	5.48	7.90	8.78	5.55	2.86	4.56	5.03	6.83	1.52	6.06	1.14	2.85	1.22	5
Water Quality	175.00	814.00	1372.00	8015.00	528.00	968.00	2802.00	605.00	908.00	4397.00	700.00	725.00	678.00	1116.00	1371.00	508.00	929.00	2838.00	643.00	933.00	1478.00	482.00	1225.00	820.00	1271.00	1,479
Water Table Depth	9.99	3.67	9.34	8.62	8.71	7.48	9.39	5.80	8.42	8.13	7.86	7.81	9.10	6.00	7.57	6.19	8.25	7.16	8.99	6.17	8.07	7.87	9.41	8.22	9.41	8

Source: Farmers Interview for Rabi 1996-97

Dhoro Naro Minor
Net Agriculture Income
For Rabi 1996-97

Gross Agriculture Revenue for Rabi 1996-97 (in Rupees)

WIC #	10L	11L	11AL	11BL	11CL	11DL	11L	1R	2AL	2L	2R	3L	3R	4AL	4BL	4L	4R	5L	5R	6AR	6L	6R	7L	7R	8L	Total
WIC#1	167,199	1,216,852	903,354	2,286,504	2,220,584	884,970	1,263,351	572,189	1,748,058	1,468,749	1,764,534	714,580	1,231,594	1,231,594	300,248	1,282,263	2,089,402	2,654,386	1,550,293	843,004	487,201	2,085,869	1,426,756	510,898	310,225	39,342,888
WIC#2	9,457	39,060	19,480	4,421	108,732	82,830	82,830	408,260	29,234	470	248,984	1,503	249,084	1,503	249,084	56,174	326,148	326,148	11,344	94,535	94,535	108,715	14,160	26,854	2,338,442	
WIC#3	45,057	104,933	1,480,231	2,853,510	1,181,184	1,307,778	217,035	1,809,809	282,146	413,367	447,843	1,133,588	868,140	1,133,588	868,140	538,907	1,443,880	21,532	142,588	2,288	7,373	138,028	89,124	174,883	112,328	
WIC#4	80,284	184,953	432,598	272,718	128,646	135,068	12,477	344,018	49,808	49,808	49,808	21,380	49,808	21,380	49,808	80,335	144,380	21,532	142,588	2,288	7,373	138,028	89,124	174,883	112,328	
WIC#5	9,359	80,423	105,189	264,741	81,372	45,850	177,075	58,273	188,400	134,400	307,050	107,200	60,080	46,200	80,335	56,150	141,860	63,200	49,800	27,800	130,320	122,760	30,180	34,155	53,480	
WIC#6	327,443	1,356,125	1,747,064	5,501,003	3,527,139	3,337,873	1,473,538	3,641,130	2,354,233	2,085,869	2,769,413	2,860,281	2,438,788	2,438,788	348,448	1,840,937	2,348,108	3,432,443	2,646,632	871,337	482,573	2,384,712	1,417,374	749,164	871,482	

Agriculture Input Costs for Rabi 1996-97 (in Rupees)

WIC #	10L	11L	11AL	11BL	11CL	11DL	11L	1R	2AL	2L	2R	3L	3R	4AL	4BL	4L	4R	5L	5R	6AR	6L	6R	7L	7R	8L	Total
WIC#1	32,085	83,889	105,750	190,741	167,775	80,150	169,273	48,821	164,424	142,076	102,450	138,500	114,258	34,786	135,847	135,847	395,464	202,013	98,079	31,475	168,920	102,181	63,970	83,071	50,248	3,132,517
WIC#2	55,870	128,283	425,514	426,848	287,875	211,200	223,945	311,547	208,188	166,737	129,510	246,253	135,282	52,680	192,630	187,311	314,900	235,537	155,310	20,194	207,237	182,532	88,753	104,400	41,884	4,740,430
WIC#3	11,809	368,053	321,273	839,215	457,585	556,535	908,976	379,700	433,007	465,287	829,880	540,836	587,480	161,840	602,987	595,103	780,036	631,000	257,015	61,200	422,800	383,992	217,314	224,428	128,183	11,118,188
WIC#4	22,075	65,000	337,278	272,718	128,646	135,068	12,477	344,018	49,808	49,808	49,808	21,380	49,808	21,380	49,808	80,335	144,380	21,532	142,588	2,288	7,373	138,028	89,124	174,883	112,328	131,803
WIC#5	9,359	80,423	105,189	264,741	81,372	45,850	177,075	58,273	188,400	134,400	307,050	107,200	60,080	46,200	80,335	56,150	141,860	63,200	49,800	27,800	130,320	122,760	30,180	34,155	53,480	2,458,889
Total	251,118	757,678	1,609,232	3,277,483	2,027,483	1,616,413	1,433,771	3,641,130	2,354,233	2,085,869	2,769,413	2,860,281	2,438,788	2,438,788	348,448	1,840,937	2,348,108	3,432,443	2,646,632	871,337	482,573	2,384,712	1,417,374	749,164	871,482	281,722

Agriculture Land Taxes for Rabi 1996-97 (in Rupees)

WIC #	10L	11L	11AL	11BL	11CL	11DL	1L	2AL	2L	2R	3L	3R	4AL	4BL	4L	4R	5L	5R	6AR	6L	6R	7L	7R	8L	Total	
Albany	6,211	14,044	15,891	20,431	20,667	19,954	22,024	19,085	20,108	17,085	14,435	16,370	20,008	3,323	15,806	16,894	33,428	20,748	10,183	3,337	16,894	12,136	11,008	8,120	5,887	113,181
Albany	1,782	4,109	9,715	12,483	12,810	3,065	5,763	7,890	6,884	7,112	4,873	8,297	8,297	2,511	11,089	9,094	10,046	12,287	7,086	4,982	9,498	7,460	7,933	5,584	172,318	
Albany	1,362	588	1,217	1,810	1,877	771	1,086	872	921	1,296	839	1,293	823	166	882	2,312	736	1,256	832	360	1,852	1,533	655	1,325	1,325	
Albany	2,250	2,253	2,253	5,980	5,385	2,880	4,060	2,155	4,060	3,315	2,840	3,205	3,225	760	2,915	3,485	4,875	2,435	2,435	2,127	720	3,810	1,880	1,260	27,358	
Albany	15,782	29,777	29,777	72,203	65,416	34,592	50,926	25,804	50,243	44,269	33,493	40,493	39,819	10,108	30,888	47,122	86,476	59,223	29,240	10,213	50,480	31,127	25,189	25,187	14,780	868,733
Total	26,396	56,323	56,323	116,283	114,233	61,268	83,229	48,287	82,648	72,657	56,186	71,830	89,185	17,896	69,888	77,707	142,073	87,842	48,476	16,712	64,449	48,278	46,818	42,748	27,631	1,618,848

Net Agriculture Income for Rabi 1996-97 (in Rupees)

WIC #	10L	11L	11AL	11BL	11CL	11DL	11L	1R	2AL	2L	2R	3L	3R	4AL	4BL	4L	4R	5L	5R	6AR	6L	6R	7L	7R	8L	Total
WIC#1	327,443	1,356,125	1,747,064	5,501,003	3,527,139	3,337,873	1,473,538	3,641,130	2,354,233	2,085,869	2,769,413	2,860,281	2,438,788	2,438,788	348,448	1,840,937	2,348,108	3,432,443	2,646,632	871,337	482,573	2,384,712	1,417,374	749,164	871,482	281,722
WIC#2	341,116	737,078	1,049,738	1,971,483	1,261,843	1,016,810	1,332,771	866,940	1,028,084	1,016,401	1,273,126	1,441,400	1,997,205	362,917	929,487	1,078,231	2,257,755	1,392,195	693,438	204,513	1,986,437	788,277	523,188	531,455	501,098	3,121,618
WIC#3	26,396	56,323	56,323	116,283	114,233	61,268	83,229	48,287	82,648	72,657	56,186	71,830	89,185	17,896	69,888	77,707	142,073	87,842	48,476	16,712	64,449	48,278	46,818	42,748	27,631	1,618,848
WIC#4	90,184	1,141,088	836,708	3,432,086	2,446,001	1,379,200	1,939,356	2,042,886	1,442,882	976,238	1,440,892	947,332	1,382,388	26,435	1,036,732	1,182,168	1,838,615	856,586	286,451	280,546	1,432,836	1,939,233	174,321	(7,597)	810,862	24,514,145

Detail Analysis (in Rupees)

WIC #	10L	11L	11AL	11BL	11CL	11DL	11L	1R	2AL	2L	2R	3L	3R	4AL	4BL	4L	4R	5L	5R	6AR	6L	6R	7L	7R	8L	Total
Total Capped Area	129	228	343	600	569	354	442	269	418	343	281	328	330	76	292	349	380	840	429	275	77	213	208	188	125	7,892
Total CCA	778	279	552	806	978	350	401	328	441	835	400	599	599	288	76	437	380	1,114	595	403	175	208	188	125	7,892	
Gross Agriculture Revenue	2,338	3,939	3,067	3,064	6,183	6,183	6,248	11,008	6,103	6,023	6,023	6,201	7,451	4,139	6,039	6,732	5,387	4,776	4,332	6,887	6,749	7,710	3,610	3,572	4,222	6,346
Net Agriculture Revenue	422	6,889	3,486	6,194	3,788	8,818	3,818	8,824	5,787	5,787	5,787	6,229	6,127	4,175	4,451	6,514	3,030	3,443	2,412	3,626	3,214	4,078	2,899	809	3,886	
Agriculture Input Costs per Capped Area	2,788	3,271	3,843	2,032	2,193	2,872	3,088	3,221	2,604	2,464	2,464	3,405	2,848	3,066	2,848	3,088	3,521	2,816	2,955	2,656	2,784	3,376	2,523	3,389	2,248	3,896
Agriculture Input Costs per CCA	465	2,448	1,892	2,077	1,953	2,843	3,324	2,643	2,537	1,809	3,163	1,953	2,586	5,088	1,888	2,088	2,013	2,173	1,647	1,171	1,326	3,081	564	1,889	451	1,233
Agriculture Land Taxes per Capped Area	206	224	186	212	186	173	189	189	186	213	208	219	210	219	219	219	222	228	220	243	220	203	226	227	231	210
Agriculture Land Taxes per CCA	34	181	118	168	117	171	171	147	186	115	148	159	178	236	159	216	216	127	165	125	107	105	134	42	128	
Net Agriculture Income per Capped Area	(487)	5,884	1,438	5,641	3,818	3,818	3,818	7,604	3,467	2,846	5,125	2,887	4,199	3,408	3,605	3,421	1,624	1,522	1,186	3,498	3,744	4,321	450	(48)	1,732	3,800
Net Agriculture Income per CCA	(73)	4,887	1,148	3,888	2,888	3,874	3,874	3,874	3,874	3,874	3,874	3,416	3,693	3,408	2,484	3,510	932	1,184	642	1,542	1,783	3,008	199	(24)	358	1,647

Dhoro Naro Minor
Net Agriculture Income
For Kharif 1997

Gross Agriculture Revenue for Kharif 1997 (in Rupees)

W/C #	10L	11L	11AL	11BL	11CL	11DL	11L	1R	2AL	2L	2R	3L	3R	4AL	4BL	4L	4R	5L	5R	6L	6R	7L	7R	8L	Total	
Cotton	73,273	1,690,976	3,001,351	2,081,354	1,739,437	2,089,506	1,192,197	641,414	2,621,484	833,333	2,894,787	2,430,470	2,878,400	776,239	2,285,426	1,494,955	336,463	2,720,497	2,857,956	1,645,787	1,749,740	4,094,982	1,122,572	1,284,506	443,259	11,518,893
Sugarcane	2,950	16,905	35,933	794,519	352,720	2,686,895	83,034	1,95,860	45,357	310,471	160,324	133,272	324,989	69,198	34,168	87,311	121,500	50,875	13,900	390,285	6,063	50,754	27,072	18,716	-	5,987,328
Orchard	3,243	-	-	-	-	-	-	1,059,140	48,088	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vegetable	4,068	36,863	81,923	77,486	-	10,928	41,400	213,176	75,128	60,390	127,050	271,985	90,363	49,365	20,295	201,049	61,895	83,879	131,138	37,290	81,840	40,257	61,974	20,126	25,616	1,919,189
Other	57,523	1,742,244	3,029,220	2,929,889	2,100,428	3,316,687	4,112,232	2,651,481	1,342,279	1,569,349	4,918,295	2,825,895	3,127,822	2,077,651	3,529,432	3,247,898	2,824,338	2,644,263	3,024,848	4,317,812	1,838,977	4,198,544	351,422	1,319,122	493,933	47,166,826
Total	82,953	1,742,244	3,029,220	2,929,889	2,100,428	3,316,687	4,112,232	2,651,481	1,342,279	1,569,349	4,918,295	2,825,895	3,127,822	2,077,651	3,529,432	3,247,898	2,824,338	2,644,263	3,024,848	4,317,812	1,838,977	4,198,544	351,422	1,319,122	493,933	47,166,826

Agriculture Input Costs for Kharif 1997 (in Rupees)

W/C #	10L	11L	11AL	11BL	11CL	11DL	11L	1R	2AL	2L	2R	3L	3R	4AL	4BL	4L	4R	5L	5R	6AL	6R	7L	7R	8L	Total
Land Preparation	28,250	76,235	146,541	92,222	159,200	117,240	190,363	104,433	161,976	136,120	120,363	183,922	103,881	39,093	175,128	242,272	192,812	184,747	102,801	110,885	156,091	99,539	122,282	116,018	67,700
Sowing	15,803	44,840	100,341	111,518	122,604	282,445	204,146	303,125	148,709	121,853	159,110	215,127	139,203	23,339	92,337	148,549	112,334	109,207	100,615	94,745	54,038	85,187	47,596	52,655	23,968
Harvesting	64,685	272,136	356,914	370,422	251,091	1,040,352	889,274	932,346	589,562	356,897	689,782	745,062	395,895	137,665	373,893	1,056,105	392,222	585,587	302,666	229,028	375,839	374,225	404,827	161,544	12,997,837
Transportation	59,225	174,803	271,713	270,450	289,718	170,352	1,074,106	225,368	428,388	344,712	264,632	399,526	130,171	130,625	152,440	438,693	490,176	543,400	94,350	114,440	285,636	135,842	141,828	631,576	116,420
Other	284,644	395,562	1,113,394	1,277,488	1,233,228	1,839,267	2,407,448	1,727,818	1,672,661	2,223,518	1,351,182	1,631,443	1,945,137	1,183,674	3,389,793	1,493,988	2,76,332	289,318	229,877	230,846	358,425	789,882	246,519	1,468,424	32,068,131
Total	1,042,557	1,642,576	2,825,895	2,767,466	2,005,823	3,316,687	4,112,232	2,651,481	1,342,279	1,569,349	4,918,295	2,825,895	3,127,822	2,077,651	3,529,432	3,247,898	2,824,338	2,644,263	3,024,848	4,317,812	1,838,977	4,198,544	351,422	1,319,122	493,933

Agriculture Land Taxes for Kharif 1997 (in Rupees)

W/C #	10L	11L	11AL	11BL	11CL	11DL	11R	2AL	2L	2R	3L	3R	4AL	4BL	4L	4R	5L	5R	6AL	6R	7L	7R	8L	Total	
Abiana	4,319	11,809	28,377	45,714	31,018	32,044	28,678	32,979	24,704	22,681	32,308	36,850	23,314	6,140	27,225	42,028	24,059	30,971	15,756	11,032	22,083	15,430	15,801	17,341	9,976
Agriculture Tax	3,981	8,865	21,912	45,267	34,058	23,778	21,864	22,443	13,629	16,294	27,254	37,131	25,448	14,713	8,006	21,140	7,093	15,608	11,640	7,093	15,608	11,640	11,640	11,640	9,603
Drainage Case	1,562	568	1,217	1,810	1,827	771	1,066	872	921	1,268	838	1,285	833	148	432	432	362	1,652	441	1,832	685	1,832	685	1,325	
Local Case	567	1,522	3,317	5,032	3,715	3,257	3,352	2,715	3,138	2,759	3,138	4,192	2,814	737	3,892	3,892	3,892	3,892	3,892	3,892	3,892	3,892	3,892	3,892	3,892
Other	7,614	23,174	50,776	65,097	53,623	43,357	54,378	45,175	66,396	53,333	47,734	57,240	41,781	10,804	48,536	59,947	62,028	38,246	40,245	21,158	71,786	39,087	38,246	31,921	19,082
Total Taxes	19,442	46,117	106,401	182,518	124,891	122,866	108,828	102,954	110,788	96,863	108,328	131,782	87,238	22,814	104,488	124,448	102,478	137,148	73,422	42,681	122,748	44,833	75,137	42,982	2,546,263

Net Agriculture Income for Kharif 1997 (in Rupees)

W/C #	10L	11L	11AL	11BL	11CL	11DL	11L	1R	2AL	2L	2R	3L	3R	4AL	4BL	4L	4R	5L	5R	6AL	6R	7L	7R	8L	Total
Gross Agriculture Revenue	82,953	1,742,244	3,029,220	2,929,889	2,100,428	3,316,687	4,112,232	2,651,481	1,342,279	1,569,349	4,918,295	2,825,895	3,127,822	2,077,651	3,529,432	3,247,898	2,824,338	2,644,263	3,024,848	4,317,812	1,838,977	4,198,544	351,422	1,319,122	493,933
Agriculture Input Costs	264,644	395,562	1,113,394	1,277,488	1,233,228	1,839,267	2,407,448	1,727,818	1,672,661	2,223,518	1,351,182	1,631,443	1,945,137	1,183,674	3,389,793	1,493,988	2,76,332	289,318	229,877	230,846	358,425	789,882	246,519	1,468,424	32,068,131
Agriculture Land Taxes	19,442	46,117	106,401	182,518	124,891	122,866	108,828	102,954	110,788	96,863	108,328	131,782	87,238	22,814	104,488	124,448	102,478	137,148	73,422	42,681	122,748	44,833	75,137	42,982	2,546,263
Net Agriculture Income	(109,433)	(1,099,535)	(2,090,575)	(1,930,117)	(1,357,691)	(2,225,448)	(2,407,448)	(1,179,291)	(448,927)	(750,832)	(2,407,448)	(1,945,137)	(1,631,443)	(1,183,674)	(3,389,793)	(1,493,988)	(2,76,332)	(289,318)	(229,877)	(230,846)	(358,425)	(789,882)	(246,519)	(1,468,424)	(32,068,131)

Detail Analysis (in Rupees)

W/C #	10L	11L	11AL	11BL	11CL	11DL	11L	1R	2AL	2L	2R	3L	3R	4AL	4BL	4L	4R	5L	5R	6AL	6R	7L	7R	8L	Total
Cropped Area	62	155	320	481	267	306	327	248	307	260	306	301	267	74	359	298	467	388	104	132	302	195	248	213	136
Total CCA	778	219	552	865	978	358	451	328	441	635	400	569	369	369	76	437	390	1,114	595	403	175	804	205	928	855
Gross Agriculture Revenue per CCA	1,326	11,242	11,380	6,133	5,749	10,243	12,278	11,314	8,882	5,363	15,977	7,477	11,089	11,769	7,816	17,884	5,784	7,423	15,289	16,387	9,888	21,512	2,219	5,876	3,632
Net Agriculture Income per CCA	4,237	3,638	3,274	3,392	3,372	6,379	7,382	7,014	5,442	4,411	3,072	4,629	3,968	5,646	3,327	11,839	2,882	4,466	4,197	5,764	4,023	4,078	2,747	6,751	3,846
Cropped area	240	2,103	2,017	1,986	1,264	5,198	4,908	5,296	2,799	1,841	3,878	3,024	2,884	4,497	2,681	9,134	1,903	2,897	2,682	4,265	1,847	3,871	1,813	4,598	813
Agriculture Land Taxes per CCA	289	297	322	381	341	401	315	420	361	348	354	337	327	388	391	418	280	313	373	397	328	302	292	286	342
Cropped area	23	188	193	211	126	242	232	317	251	152	271	229	228	381	239	348	127	263	183	244	193	311	81	200	62
Net Agriculture Income per CCA	(13,289)	7,186	7,898	2,162	2,835	11,744	4,718	4,481	4,102	688	10,931	2,511	7,461	5,514	3,488	6,122	2,321	2,856	10,720	12,339	1,388	17,105	(1,879)	(1,814)	4,843
Cropped area	(237)	3,947	4,716	1,261	761	16,072	3,247	3,363	2,808	287	8,066	1,649	5,142	5,660	3,867	5,890	1,905	1,882	5,487	9,303	611	16,232	(695)	(193)	2,432

Gross Agriculture Revenue for the Year 1996-97 (in Rupees)

	10L	11L	1AL	1BL	1CL	1DL	1L	2AL	2L	2R	3L	3R	4AL	4BL	4L	4R	5L	5R	6AR	6L	6R	7L	7R	8L	Total
Wheat (B)	187,189	1,316,852	802,034	2,226,094	884,870	1,372,188	372,351	1,748,051	1,080,749	1,764,634	714,930	331,584	1,282,420	2,080,452	2,882,388	457,201	1,851,251	843,094	2,081,889	1,429,768	2,081,889	28,474	510,999	318,728	28,422,842
Wheat (R)	9,437	168,480	18,630	4,727	22,530	401,260	23,624	479	249,844	479	249,844	1,901	33,084	80,174	75,822	11,344	11,344	11,344	80,174	108,715	108,715	10,715	14,199	23,634	2,838,842
Barley (R)	83,435	104,895	462,584	2,693,576	1,181,184	1,207,776	217,035	1,209,909	282,148	612,387	441,843	1,135,888	848,140	535,407	37,432	444,390	31,431	65,117	190,251	238,728	141,073	174,083	112,238	13,885,283	13,885,283
Oats (R)	9,340	40,983	105,158	204,141	11,375	45,600	177,975	154,000	49,909	49,909	21,390	49,909	49,909	37,432	444,390	31,431	65,117	7,273	135,094	89,724	174,083	112,238	131,003	4,951,211	
Feed (R)	72,073	1,680,678	59,335	2,681,554	1,150,432	2,088,058	319,249	1,874,887	324,804	612,387	2,878,430	2,878,430	2,878,430	2,878,430	2,878,430	2,878,430	2,878,430	2,878,430	2,878,430	2,878,430	2,878,430	2,878,430	2,878,430	2,878,430	
Grain (R)	18,605	35,923	784,818	352,720	79,641	25,024	193,665	45,357	310,471	133,272	284,313	61,500	99,188	121,500	398,863	40,676	13,500	390,241	1,429,768	1,429,768	1,429,768	1,429,768	1,429,768	1,429,768	
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610	10,928	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	1,028	2,610	2,610
Grain (R)	2,610																								

Agriculture Input Costs for the Year 1996-97 (in Rupees)

[illegible]

Agriculture Land Taxes for the Year 1996-97 (in Rupees)

WIC #	10L	11L	11AL	11BL	11CL	11DL	11R	2AL	2L	2R	3L	3R	4AL	4BL	4L	4R	5L	5R	6AR	6L	6R	7L	7R	8L	9L	Total
Abilene	10,530	45,588	82,145	58,685	27,223	23,903	46,612	39,745	45,728	55,220	8,653	43,031	59,782	59,786	40,076	25,939	51,789	25,939	15,109	15,109	27,949	27,949	68,171	15,863	1,014,083	
Adams	8,123	12,874	20,627	17,489	28,445	27,727	23,903	32,127	33,903	32,127	40,452	40,452	23,834	7,827	35,309	24,308	87,507	37,735	21,709	12,068	30,839	29,833	23,311	18,018	688,485	
Alameda East	3,124	1,135	2,435	3,953	1,843	2,111	1,445	1,943	2,862	1,613	1,244	1,847	218	1,784	4,625	1,472	2,517	1,063	720	3,304	3,855	1,588	2,649	54,718		
Alameda West	4,557	3,777	10,892	8,100	6,137	7,412	7,878	7,718	6,014	6,155	7,387	8,842	3,071	8,877	8,362	9,980	8,170	4,718	2,035	6,839	4,387	4,442	4,072	3,771	145,424	
Altamont	23,395	32,752	85,676	127,400	118,809	87,953	105,304	107,870	116,641	87,500	81,128	81,079	20,010	87,464	105,009	182,108	218,189	122,850	31,381	122,850	70,214	122,850	57,108	33,522	2,038,526	
Antelope	44,828	86,876	176,487	218,145	311,919	192,037	192,037	199,279	199,279	203,673	136,274	136,274	20,118	176,183	243,188	203,642	181,889	67,154	127,104	61,993	287,219	114,881	134,124	164,737	87,807	4,861,343

Net Agriculture Income for the Year 1996-97 (in Rupees)

WC #	11L	11A	1B1	1C1	1D1	1R	2R	3R	4R	5R	6R	7R	8R	9R	Total
Gross Agriculture Revenue	1010.080	8,573.004	5,908.211	5,912.721	5,982.724	5,982.724	5,982.724	5,982.724	5,982.724	5,982.724	5,982.724	5,982.724	5,982.724	5,982.724	5,982.724
Agriculture Input Costs	625.100	1,335.232	2,103.128	3,525.123	2,602.878	2,604.560	2,604.560	2,604.560	2,604.560	2,604.560	2,604.560	2,604.560	2,604.560	2,604.560	2,604.560
Agriculture Land Taxes	44.610	80.670	170.447	311.909	239.140	183.457	183.457	183.457	183.457	183.457	183.457	183.457	183.457	183.457	183.457
Net Agriculture Income	(248.110)	2,244.495	3,230.429	4,674.647	2,889.204	4,883.714	7,654.554	3,155.847	2,702.788	1,448.260	4,088.807	3,077.574	2,798.710	2,798.710	2,798.710

Detail Analysis (in Rupees)

WICP #	10L	11L	11A	11B	11C	11D	11L	11R	2AL	2L	2R	3L	3R	4AL	4BL	4L	4R	5L	5R	6AR	6L	6R	7L	7R	8L	Total
Grass Agriculture Revenue per cropped acre	3,644	19,882	10,659	14,930	11,812	24,222	16,825	22,922	18,000	31,280	25,832	13,760	19,146	16,328	13,293	24,240	31,595	32,451	19,812	24,724	12,759	20,232	3,839	9,890	7,875	96,115
Grass Agriculture Revenue per acre	328	13,153	10,094	9,692	5,862	23,197	12,169	18,429	12,793	5,813	19,138	9,322	14,359	16,834	10,220	21,034	5,819	8,393	9,924	16,866	3,836	20,841	1,481	9,184	1,871	8,905
Agriculture Input Costs per cropped acre	7,838	7,210	5,617	8,344	5,525	8,891	31,840	10,358	7,692	7,375	9,692	8,116	6,889	9,632	6,853	16,127	6,584	7,482	7,149	8,390	6,885	7,387	5,311	10,688	6,195	7,441
Agriculture Input Costs per CCA	886	4,772	3,919	4,873	2,589	5,038	5,214	7,938	5,331	3,841	7,668	4,939	5,280	9,497	4,939	12,122	3,338	5,971	3,769	5,460	2,874	7,232	1,378	6,379	1,384	4,338
Agriculture Land Taxes per cropped acre	486	321	308	592	331	573	325	398	357	550	554	833	528	524	298	641	512	341	982	568	817	528	238	519	817	561
Agriculture Land Taxes per CCA	55	346	369	310	245	514	394	464	438	297	411	240	483	537	398	861	264	387	384	332	319	549	116	334	160	304
Net Agriculture Income per cropped acre	19,057	12,370	9,724	7,882	5,852	15,288	8,229	12,066	7,540	3,435	15,676	8,800	11,658	6,182	7,692	8,932	4,148	4,388	11,876	16,837	5,235	21,298	1,629	1,853	1,181	7,723
Net Agriculture Income per CCA	(323)	8,925	5,468	3,699	13,648	3,973	9,818	6,134	1,894	11,866	3,838	8,768	6,099	5,371	8,490	2,035	2,937	3,889	10,446	2,964	2,964	3,641	7,003	2,641	2,641	2,641

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