INDIA

FEASIBILITY STUDY ON
IRRIGATION AND DRAINAGE DEVELOPMENT OF
SHARDA CANAL CAD PROJECT

VOLUME II - 2

ANNEXES

NOVEMBER

INDIA

MINISTRY OF WATER RESOURCES
GOVERNMENT OF INDIA

DEPARTMENT OF AREA DEVELOPMENT
STATE GOVERNMENT OF UTTAR PRADESH

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Japan International Cooperation Agency

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LIST OF REPORTS

ABBREVIATIONS

BOR	Board of Revenue, UP
CAD	Command Area Development
CADA	Command Area Development Authority
CCA	Culturable Command Area
CGWB	Central Ground Water Board
FAO	Food and Agriculture Organization, United Nations
GDP	Gross Domestic Product
GNP	Gross National Product
GOI	Government of India
GOJ	Government of Japan
GSI	Geological Survey of India (Central)
GWB	Ground Water Board
GWD	Ground Water Department
ID	Irrigation Department, UP
IMD	India Meteorological Department (Central)
IWC	Irrigation Work Circle
JICA	Japan International Cooperation Agency
OFD	On-Farm Development
RSAC	Remote Sensing Application Center, UP
SI	Survey of India
UNDP	United Nation Development Programme
UP	Uttar Pradesh
USDA	United States, Department of Agriculture

ABBREVIATIONS OF MEASUREMENT

Length

cm	=	Centimeter
m	=	Meter
km	=	Kilometer
ft	=	Foot
yd	=	Yard

Area

cm^2	=	sq.cm	= Square centimeter
m^2	=	sq.m	= Square meter
ha	=	Hectare	
km^2	=	sq.km	= Square kilometer

Volume

cm^3	=	cu.cm	= Cubic centimeter
l	=	lit = liter	
kl	=	Kiloliter	
m^3	=	cu.m	= Cubic meter
gal.	=	Gallon	
MCM	=	Million Cubic Meters	

Weight

mg	=	Milligram
g	=	Gram
kg	=	Kilogram
ton	=	Metric ton
lb	=	Pound

Time

sec	=	s = Second
min	=	Minute
hr	=	Hour
d	=	Day
yr	=	Year

Electrical Measures

V	=	Volt
A	=	Ampere
Hz	=	Hertz (cycle)
W	=	Watt
kW	=	Kilowatt
MW	=	Megawatt
GW	=	Gigawatt

Other Measures

%	=	Percent
PS	=	Horsepower
o	=	Degree
'	=	Minute
"	=	Second
°C	=	Degree centigrade
10^3	=	Thousand
10^5	=	Lakh
10^6	=	Million
10^7	=	Crore
10^9	=	Billion (milliard)

Derived Measures

m^3/s	=	m^3/sec = Cubic meter per second
cusec	=	Cubic feet per second
mgd	=	Million gallon per day
kWh	=	Kilowatt hour
MWh	=	Megawatt hour
GWh	=	Gigawatt hour
kWh/yr	=	Kilowatt hour per year
kVA	=	Kilovolt ampere
BTU	=	British thermal unit

Money

Rs.	=	Indian Rupees
US$	=	US dollar
Yen	=	Japanese Yen

CONVERSION FACTORS

	From Metric System			To Metric System		
Length	1 cm	=	0.394 inch	1 inch	=	2.54 cm
	1 m	=	3.28 ft = 1.094 yd	1 ft	=	30.48 cm
	1 km	=	0.621 mile	1 yd	=	91.44 cm
				1 mile	=	8 furlongs
					=	5,280 feet
					=	1.609 km
				1 furlong	=	201.17 m
Area	1 cm^2	=	0.155 sq.in	1 sq.ft	=	0.0929 m^2
	1 m^2	=	10.76 sq.ft.	1 sq.yd	=	0.835 m^2
	1 ha	=	2.471 acres	1 acre	=	0.4047 ha
	1 km^2	=	0.386 sq.mile	1 sq.mile	=	2.59 km^2
Volume	1 cm^3	=	0.0610 cu.in	1 cu.ft	=	28.32 lit
	1 lit	=	0.220 gal. (imp.)	1 cu.yd	=	0.765 m^3
	1 kl	=	6.29 barrels	1 gal. (imp.)	=	4.55 lit
	1 m^3	=	35.3 cu.ft	1 gal. (US)	=	3.79 lit
	10^6 m^3	=	811 acre-ft	1 acre-ft	=	1,233.5 m^3
Energy	1 kWh	=	3,413 BTU	1 BTU	=	0.293 Wh
Temperature	°C	=	(°F-32) 5/9	°F	=	1.8°C + 32
Derived Measures						
	1 m^3/s	=	35.3 cusec	1 cusec	=	0.0283 m^3/s
	1 kg/cm^2	=	14.2 psi	1 psi	=	0.703 kg/cm^2
	1 ton/ha	=	891 lb/acre	1 lb/acre	=	1.12 kg/ha
	10^6 m^3	=	810.7 acre-ft	1 acre-ft	=	1,233.5 m^3
	1 m^3/s	=	19.0 mgd	1 mgd	=	0.0526 m^3/s

ANNEX-F

IRRIGATION

FEASIBILITY STUDY ON
IRRIGATION AND DRAINAGE IMPROVEMENT OF
SHARDA CANAL CAD PROJECT

ANNEX F
IRRIGATION

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ANNEX F IRRIGATION

1. Sharda Canal System

1.1 General Features of Sharda Canal System

(1) Sharda Canal System

The Sharda Main Canal takes off from the Sharda river through an intake structure at Banbassa in the District Nainital. The Sharda Main Canal was commissioned in the year of 1928 with a head discharge of 9,500 cusec or 268.9 cumec. After construction of regulating reservoirs, i.e., Sharda Sagar reservoir, and remodeling of the main canal, the capacity of the main canal was increased up to 11,500 cusec or 325.5 cumec. The general features of the intake structure, Sharda Sagar Reservoir and main canal are shown in Table F.1. The Sharda Canal System covers the culturable command area (CCA) of 1.612 million ha in 11 districts of Nainital, Pilibhit, Bareilly, Shahjahanpur, Kheri, Sitapur, Hardoi, Unnao, Lucknow, Barabanki and Rae Bareli. However, the present capacity of the Sharda Canal System, in principle, can serve only 24% and 25% of C.C.A. in Kharif cropping and Rabi cropping, respectively. The irrigation Sharda Canal System consists of a main canal, 14 branch canals, numbers of distributary canals and minor canals with the total length of 9,973 km as shown in Table F.2. The design discharge and CCA of each branch canal of the Sharda Canal System are as shown in Table F.3. The general layout of Sharda Canal System is as shown in Fig. F.1.

The irrigation potential area is 804 thousand ha, and annual actual irrigation areas average to 631 thousand ha for the recent five years, consisting of Kharif cropping of 301 thousand ha and Rabi cropping of 330 thousand ha as shown in Table F.4.

(2) Hardoi Branch System

The Sharda Main Canal bifurcates into Hardoi Branch Canal and Kheri Branch Canal through a bifurcation structure at the tail end, after running down for about 45 km from the intake site. Sharda Sagar reservoir, which is located in the downstream of the main canal, augments discharges of Hardoi Branch Canal especially in the Rabi crop season.

Hardoi Branch Canal flows down and joins an outlet channel diverted from the Sharda Sagar reservoir at about 13 miles or 26 km downstream from the head. The Hardoi Branch

Canal diverts four (4) major branch canals such as Lucknow Branch Canal , Asiwan Branch Canal, Purwa and Unnao Branch Canals at the 55 miles, 142 miles and the tail end, respectively. The Lucknow Branch Canal again takes off the Sandila Branch Canal at 55 miles. Each branch canal is equipped with such related structures as bridge, fall, culvert, siphon and so on.

Each branch canal takes off numbers of distributary canals and minor canals, as summarized below.

Unit: Nos.

Canal Name	Distributary	Minor	Total
Hardoi Branch	15	152	167
Lucknow Branch	23	153	176
Sandila Branch	7	47	54
Asiwan Branch	14	63	77
Unnao Branch	8	66	74
Purwa Branch	7	89	96
Total	74	570	644

Source : Irrigation Department, U.P.

Some numbers of distributary and minor irrigation canals are presently less functioning due to silting, weeds, much seepage and so on, Irrigation Department U.P.as shown in Table F.5 in canal-wise and Table F.6 in block-wise.

1.2 Irrigation Area

Sharda Canal Command extends over 11 districts. In such areas, irrigation is practiced not only by Sharda Canal System, but also by tubewells or other water sources. The total net irrigated area in the related 11 districts is approximately 1,800 thousand ha, or 52% of the total geographical area as shown in Table F.7. The table indicates that the district with the lowest percentage of irrigated area to the geographical area is generally located downstream such as Sitapur, Hardoi, Barabanki and Unnao Districts.

In the Hardoi Command, the rates of an actual irrigated area to the proposed irrigation area, in addition to the irrigation performance by the Government canals, widely vary with high irrigation rate in upstream areas as shown in Table F.8.

The average irrigation area by Sharda Canal System is 631 thousand ha, as mentioned in the preceding section. Thus irrigated areas by tubewells and other measures in the 11 districts is estimated to be approximately 1,170 thousand ha or 65% of the total irrigated area.

The irrigated areas commanded by the Hardoi Branch System for the recent five years from 1985 to 1990 are estimated 292 thousand ha out of CCA of 757 thousand ha at the head of Hardoi Branch Canal, consisting of 127 thousand ha of the Kharif cropping and 163 thousand ha of the Rabi cropping as summarized below. The details are as shown in Table F.9.

Location	CCA (ha)	Proposed Irrigation Area (ha)	Irrigated Area (ha)	Rate to P.I.A. (%)
1. Hardoi Branch				
1) at head	757,772	356,359	291,988	81.9
2) at 23 miles	723,599	337,564	284,249	84.2
3) at 53 miles	668,895	310,760	257,590	82.9
4) at 99 miles	308,771	151,299	115,009	76.0
5) at tail	152,379	74,647	59,828	80.1
2. Lucknow Branch				
1) at head	209,771	102,788	82,076	79.8
2) at 72 miles	112,201	47,810	6,478	76.3
3. Sandila Branch	71,672	35,119	26,549	75.6
4. Asiwan Branch				
1) at head	85,511	41,920	28,345	67.6
5. Purwa Branch				
1) at head	74,565	36,539	33,893	92.8
2) at 30 miles	32,638	5,993	3,953	87.6
6. Unnao Branch				
1) at head	77,814	38,110	25,935	68.1
2) at 33 miles	31,465	15,399	8,129	52.8

Source : Irrigation Department, UP

1.3 Water Supply

The irrigation water supply schedule so-called roster is prepared on a weekly basis for six months in advance of both Kharif and Rabi croppings by the operation and maintenance offices concerned of the Irrigation Department. The water supply is made intermittent even for the branch canals, especially in the Rabi cropping due to the limited water source and easy water management.

Based on information on the actual supply and irrigation area at the respective sections of the Hardoi Branch System for the recent five year, the unit supplied water depth and irrigation rate are worked out by cropping season from 1986 to 1989. Irrigation rates in the downstream of the Lucknow, Sandila, Asiwan, and Unnao Branch Canals are generally low, whereas, both unit water supplied depth and irrigation rate of Purwa Branch Canal are comparatively higher than those of the other branch canals. The results are as shown in Table F.10 and Fig. F.2.

Comparison of diversion volumes of water between roster and actual supply at the representative sections of the Main Canal, Hardoi Branch and other all branch canals is made for Rabi and Kharif seasons in 1989 and 1990. The result shows that the actual supply is generally agreed with the scheduled in the roster in terms of volume as shown in Fig. F.3.

However, the reliability of supply is very low, especially in the downstream sections. The comparison of the weekly discharge between the roster and the actual supply in the upstream and downstream sections of Sharda Main Canal, Hardoi Branch and its other branch canals is made in 1989/90 Rabi cropping as shown in Fig. F.4. Low reliability causes less effective water utilization in canal operation and farmers' water use.

Based on the data on the actual irrigation areas and supplies the conveyance efficiency of Hardoi Branch Canal was estimated as shown in Table F.11, and as summarized below. The conveyance efficiency thus estimated average to the high values of 30% and 26% is Kharif and Rabi.

Description	Unit	1986	1987	1988	1989	Average
Kharif Season						
(1) Actual Supply	MCM	2,242	2,366	2,444	2,168	2,305
(2) Estimated Loss	MCM	696	645	859	601	495
(3) Conveyance Efficiency	%	31	27	35	28	30
Rabi Season						
(1) Actual Supply	MCM	1,673	1,488	1,582	1,580	1,581
(2) Estimated Loss	MCM	358	551	387	331	407
(3) Conveyance Efficiency	%	21	37	24	21	26

1.4 Operation and Maintenance

(1) O & M Organization

The operation and maintenance of Sharda Canal System is executed by the Department of Irrigation, UP with three Irrigation Work Circles (I.W.C.) under the administration of the Chief Engineer for Sharda Canal System. The organization chart of O&M of the Sharda Canal System is shown in Fig. F.5. The canals and C.C.A covered by each I.W.C. are as follows:

I.W.C.	Place	Commanding Canal	CCA (ha)
I.W.C.-V	Bareily	Bisalpur Branch	42,072
		Hardoi Branch (M.0 -23)	2,173
		D.B.Feeder	169,781
		Nigohi Branch (M.0 - 23)	12,139
		Khatima	2,374
		Madoho Tanda Distributary	32,000
		Total	260,539
I.W.C. Sitapur	Sitapur	Nigohi Branch (M.23 - tail)	66,509
		Hardoi Branch (M 23 to 53)	55,148
		Shahjahanpur Branch	139,232
		Kheri Branch	323,114
		Aliganji	85,800
		Total	669,803
I.W.C.-VI	Lucknow	Hardoi Branch	388,049
		Lucknow Branch	280,402
		Total	668,451
		Khatima Channel (I.W.C. Nainital)	13,840
Grand Total			1,612,633

The I.W.C. is headed by a superintending engineer, who is assisted by three to four executive engineers. The executive engineer is assisted by some assistant engineers and one deputy revenue officer. Each assistant engineer is supported by three to four junior engineers who supervise tendals. Tendals control the gate opening of their covering areas. A deputy revenue officer is supported by ziledars, who are assisted by 2 to 4 amins with 3 to 5 patrols.

The communication system used for conveying the information of O&M consists of telephone and telegraph lines of canal telegraph offices. The existing telephone and telegraph system is outdated and are liable to occur break downs frequently. O&M equipment are

provided only with minimum requirement. Maintenance works are commonly executed on the contract basis.

(2) Water Supply Operation

The roster is prepared on a weekly basis for every six months before commencement of the cropping. First, the schedule of diversion water from Banbassa intake, discharge at the head of the Main Canal, Hardoi Branch, Kheri Branch at bifurcation structure and other all branch canals, are prepared in view of the provable discharges of the Sharda river. Then, the roster is distributed to offices of respective I.W.C., which further prepares the rosters of its concerned canals directly diverted from the branch canal. However, the roster for the second offtaking canals from those diverted canals are not prepared and water is not intensively controlled. The roster prepared are finally informed to farmers through deputy revenue officers and chiefs of villages.

During the irrigation practices, the diversion water from turnouts/diversion structures are adjusted according to rainfall, available water to be supplied from a parent canal. The present constraints in the operation of water supply are as follows:

(a) Insufficient canal water against crop water requirements
(b) Irregular water requirements due to mixed cropping pattern
(c) Irregular water supply because of poor water management
(d) High canal water loss, especially seepage
(e) No regulation of diversion to outlets
(f) Insufficient communication system

In the water shortage period, it is a common case that farmers in the head reaches strengthen the outlet and damage the gates of the distributary/minor canal, or construct cross bands and breach channel banks in order to maximize their supplies. The farmers at the tail end are obliged to respond to the uncertain supplies, by irrigating at night and cultivating other crops requiring less water.

2. Irrigation Systems in Four Representative Areas

2.1 Existing Irrigation Systems

Low reliability and insufficient supply of irrigation water from the Sharda Canal System for respective four representative areas call for development of numbers of irrigation

sources to extend irrigation area, by a private sector and/or the government institutions. The other major source of irrigation water is ground water utilized by means of tubewells. To disclose the present irrigation conditions in the four Study Areas, those existing irrigation facilities are examined, as described hereunder.

(1) Irrigation Canal System

The parent canals commanding four study areas are the Hardoi Branch for Sursa area and Lucknow Branch for the Sarojini Nagar, Asiwan Branch for the Sataon and Purwa Branch for the Purwa Study Areas as shown in Fig. F.6.

The Hardoi Branch is bifurcated from the tail end of the Sharda Main Canal with a flow capacity of 5,400 cusec, a total length of 249.63 km, and the C.C.A. of 756,000 ha. The Hardoi Branch diverts four(4) branch canals, three(3) of which are aforesaid, as shown below.

Branch Canal	Diverting on H.B.C.	Discharge (cusec)	Length (km)	C.C.A. (ha)
Lucknow Branch	55 miles	2,200	188.6	281,443
Asiwan Branch	142 miles	600	41.8	85,511
Unnao Branch	tail end	400	63.5	77,814
Purwa Branch	tail end	800	93.8	74,565

The branch canals divert directly into numbers of the distributary canals and minor canals through the head structures, and them the distributary canals divert into some numbers of minor canals. Besides, many outlets diverts directly from branch canals and distributary canals. Most of the head regulators are not provided with any gates, and the control and supply of the water is being made by use of the plank woods.

Outlets, so-called Kulaba, are provided on the minor, distributary canals even on the branch canals to supply the water to the fields. The structure of the Kulaba is just steel pipe of 3 to 6 inches in diameter and no gate is provided. Operation of the Kulaba is being made by use of muddy soil around the Kulaba. After the Kulaba, earthen field channels are constructed to lead the irrigation water to the field by the farmers.

The existing irrigation canal system in each area is described below:

(a) Sarojini Nagar Study Area

The Sarojini Nagar Study Area is served by the Amausi distributary canal system, which is diverted on the right bank of the Lucknow Branch canal at 106-6-0. The Amausi distributary canal takes off 1 distributary and 11 minors canals with a head discharge of 125 cusec, a total canal length of 109.53 km and a total C.C.A. of 14,862 ha. Number of Kulaba totals 434 with the average command area of 34 ha. The general features and plan of the canal system are shown in Table F.12 and Fig. F.7.

(b) Sataon Study Area

The Sataon Study Area is served by the Maurawan distributary canal system, diverted from the Ashiwan Branch Canal at the tail end, from downstream of 28-0-600 miles with a head capacity of 34 cusec and 1 distributary canal and 8 minor canals. The Sataon Study Area has the C.C.A. of 12,874 ha and has a total canal length of 67.5 km. Number of Kulaba totals 212 having average command area of 61 ha. The general features and plan of the canal system are as shown in Table F.13 and Fig. F.8.

(c) Sursa Study Area

The Sursa Study Area is served by two canal systems, namely the Badaicha distributary canal system with a canal capacity of 124 cusec and Marsa minor canal system of 12.4 cusec, both of which one directly branched from the Hardoi Branch Canal. The Sursa Study Area has a C.C.A. of 17,313 ha. Both systems consist of nine (9) minor canals and two (2) minor canals, respectively. The total canal length is 99.66 km. Number of Kulaba in total is 323 with the average command area of 54 ha. The general features and plan of the canal system are as shown in Table F.14 and Fig. F.9.

(d) Purwa Study Area

The Purwa Study Area is supplied by four (4) canal systems, namely Purwa distributary, Chimyani minor, Pakra minor and Tikar distributary canals, which are directly diverted from the Purwa Branch Canal. The Purwa Study Area has the C.C.A. of 12,252 ha. These canals have ten (10) off-taking canals and total canal length is 81.38 km. Number of Kulaba in total is 290 having the average command

area of 42 ha. The general features and the plan of the canal system are as shown in Table F.15 and Fig. F.10.

(2) Tubewell

The tubewells are classified into two main types i.e. the government tubewells and the private tubewells according to operating organization. The former is usually an electrified deep tubewell by use of casing pipes and strainer with a depth from 100 to 200 meters, which was constructed and is operated/maintained by the Tubewell Division of the Irrigation Department, U.P.

The latter is commonly a shallow tubewell with a depth from 10 to 50 meters, owned by the individual farmers making the best of subsidy by the U.P. Government through Minor Irrigation Department. The shallow well is classified into two types; a strainer type and a cavity type mainly depending on the soil strata prevailing. Both diesel engines and electricity are used for the power source.

Groundwater exploitation in Sataon Study Area has been accelerated as compared with the other Study Areas, since Sataon Study Area lying in the most downstream of the Sharda Canal System is served with less irrigation canal water. Many tubewells in Sarojini Nagar Study Area have been also constructed due to insufficient canal water supply.

(3) Pump Lifting

Pumping irrigation is practiced not only by use of tubewells but also lifting from the rivers or lakes. There exist 16 pumping sites along the Sai river, one of which is located in Sarojini Nagar Study area, shown in Table F.16. These facilities are operated and maintained by the Minor Lift Canal Division under Irrigation Department. Average design discharge is 5 cusec, ranging from 3 cusec. to 15 cusec. Water of lake is also being utilized in order to supplement the irrigation water in all of four(4) study areas to some extent.

(4) Others

In addition to the above irrigation methods, the groundwater is being utilized by use of the wind mill, although only a few are observed in Sarojini Nagar Study Area. A storage pond is provided in this system because of thoroughly relying on the natural wind energy. The subsidy for construction cost of the boring, well etc. is available by the Non-

Conventional Energy Development Agency under the Department of Additional Sources of Energy.

2.2 Irrigation Area

Three kinds of data on the irrigation area are available in the Study Area, i.e., (a) Canal-wise irrigation area for last five years (the Irrigation Department, U.P.), (b) Outlet(Kulaba)-wise irrigation area of each canal for last five years (the Irrigation Department, U.P.) and (c) Village-wise irrigation area by Milan Khasra obtained (the Tehsil Head Quarters concerned). Actual irrigation areas are registered for respective irrigation seasons in the field by the staff of the Irrigation Department for the purpose of the collection of irrigation fees. The amount of water supplied on number of watering is not observed and accordingly irrigation sufficiency is not considered for every available data.

(1) Canal-wise Irrigation Area

Canal-wise irrigation area rates are tabulated in Tables F.17 to F.20 for the respective Study Area, as summarized below.

Unit: ha

Study Area	C.C.A.	P.I.A.		Actual Irrigated Area			
		Kharif	Rabi	Kharif	% of CCA	Rabi	% of CCA
1) Sarojini Nagar	14,862	3,567	3,716	1,342	9.0%	1,821	12.3%
2) Sataon	12,874	3,090	3,219	259	2.0%	404	3.1%
3) Sursa	17,313	4,155	4,328	2,595	15.0%	4,827	27.9%
4) Purwa	12,252	2,941	3,063	2,908	23.7%	3,103	25.7%
Total	57,301	13,753	14,326	7,104	12.4%	10,155	17.7%

Source : Circle VI, Irrigation Department, U.P.
Remarks : PIA means Proposed Irrigation Area

Irrigation area rate in Sataon Study Area is extremely low compared with the other Study Areas in both Kharif and Rabi cropping due to its tail and location. Equitable distribution of the irrigation water is not being made and tail end area is always suffering from scarce irrigation water.

The canal wise irrigation conditions are summarized below.

- The irrigation areas decrease toward downstream of canal. Every study areas are suffered from the tail end problem.

- A large amount of irrigation water is taken by the canals directly diverted from the branch canals. It is judged that less control of water delivery from offtake canals is made.

(2) Outlet-wise Irrigation Area

Many outlets are provided on the parent canals of the Study Area. The irrigated area by outlets for those canals in both Kharif and Rabi are as shown in Figs. F.11 to F.14.

- Sarojini Nagar Study Area — Amausi Distributary
- Sataon Study Area — Maurawan Distributary from 28-0-600 to tail
- Sursa Study Area — Badaicha Distributary
- Purwa Study Area — Purwa Distributary

Irrigation rate by each Kulaba is quite irregular, but the tendency of rate of both Kharif and Rabi cropping is quite similar. Irrigation rate of the downstream is low in general, which is likely attributed to topographic and structure conditions.

(3) Village-wise Irrigation Area

Village-wise irrigation information for the Study Area is made available from, so called Milan Khasra, from the Tehsil Head Quarters concerned, which indicates the present irrigation conditions by source as well as the land classification etc. The irrigation areas by sources are as shown in Tables F.21 to F.24 and its summary is described below.

Unit: ha

Study Area	Geograph-ical Area	Cultivated Area		Irrigated Area*1	Source-wise Irrigated Area							
		Total Area	w/o D.C.		By Canal Area*1		By Tube-Well		By Dug Well		By Others	
Sarojini Nagar	33,488	27,765	18,807	13,117	4,200	32%	8,230	63%	118	1%	569	4%
Sataon	25,763	19,655	14,713	10,028	1,624	16%	7,637	76%	10	0%	757	8%
Sursa	32,269	26,949	26,116	16,976	8,300	49%	6,701	39%	1,696	10%	279	2%
Purwa	20,0828	18,153	13,492	11,035	8,710	82%	1,702	15%	16	0%	559	5%

Source : Milan Khasra obtained from tehsil concerned
Remarks : *1 .Double cropped areas are excluded.

As seen from the above, the Purwa Study Area is largely dependent on the canal water, because the canals for Purwa areas are located near its parent canal, i.e. Purwa Branch canals, then water is easily taken. On the other hand, the irrigation area by Canal for both

Sarojini Nagar and Sataon Study Areas are small, whereas the tubewell irrigation areas are large. Both Study areas are characterized by the high dependency on the groundwater.

Figs. F.15 to F.18 represent the rate of the irrigation area to the cultivated area excluding the double cropped area and Figs. F.19 to F.22 represent the dependency on the canals.

2.3 Water Supply

The irrigation water supply schedule for respective Study area, so-called roster, is prepared by Executive Engineer Office on the weekly basis for every six months. However, the roster is prepared only for the canals directly diverted from the Branch canals, but not for the offtaking canals diverted from those canals.

Comparison of diversion volumes of water between roster and actual supply at the major canal system of each Area is made on a crop season basis in 1989 and 1990.

Unit: MCM

Study Area	Canal System	89/90 Rabi			90 Kharif		
		Schedule	Actual		Schedule	Actual	
1) Sarojini Nagar	Amausi Dy.	12.3	16.4	133%	18.5	15.8	85%
2) Sataon	Maurawan Dy.	45.2	26.6	59%	65.7	37.5	57%
3) Sursa	Badaicha Dy.	7.5	24.4	324%	16.6	28.0	169%
4) Purwa	Purwa Dy.	7.8	5.3	68%	10.7	8.3	77%

Source: Circle VI, Irrigation Department, U.P.

Similarly to the extent of the irrigation area, the water delivery much differs in the Study areas. Water delivery to Sataon area located in the most downstream is lowest and that to Sursa is highest.

The timing of supply is also much different from the schedule. The weekly discharges between roster and actual supply in 1989/90 Rabi and 1990 Kharif is compared as shown in Fig. F.23. The timing of supply is so different from the schedule.

In order to activate the conveyance losses of a distributary canal, the discharge measurement was conducted during the survey period. The result showing the conveyance losses of about 20% corresponds to the design value used in the design drawings.

2.4 Operation and Maintenance

(1) O&M Organization

The operation and maintenance of Sharda canal system is executed by the State Irrigation Department with three Irrigation Work Circles (I.W.C.), i.e., I.C.W-V, I.C.W.Sitapur and I.C.W.-VI under the administration of the Chief Engineer for Sharda Canal System. The operation and maintenance of Sharda canal irrigation systems in the four Study Areas are executed under the administration of I.C.W.-VI.

The jurisdiction of I.W.C.-VI consists of four divisions of Sharda Canal Hardoi, Division-II (Lucknow), Sharda Canal Unnao Division, Irrigation Division Unnao which are headed by the Executive Engineers. The irrigation canals and drains and their duties of the respective divisions are as shown below.

O&M Division	Location of Divisional Office	Command/ Function
Sharda Canal Hardoi Division Division-II	Hardoi Lucknow	- Hardoi Branch and its offtaking canals - Lucknow Branch and its Office offtaking canals - O&M of Gomti river barrage - O&M of Gomti river embankment
Sharda Canal Unnao Division	Unnao	- Hardoi Branch and its offtaking canals - Unnao Branch and its offtaking canals - Purwa Branch and its offtaking canals - miscellaneous drainage works
Irrigation Division Unnao	Unnao	- Asiwan Branch and its offtaking canals - Unnao Branch and its offtaking canals - Purwa Branch and its offtaking canals mile

The O&M of the existing irrigation canal and drainage systems related to the four Study Areas are executed by the following Divisional Offices and their Sub-divisional Offices:

Sarojini Nagar Study Area	:	Divisional Office-II - III-Sub-division
Sataon Study Area	:	Irrigation Division Unnao - V-Sub-division
Sursa Study Area	:	Sharda Canal Hardoi Division - II-Sub-division
Purwa Study Area	:	Sharda Canal Unnao Division - III-Sub-division

The organization chart of O&M for the respective Divisional Offices are also shown in Fig. F.24. The present numbers of the staff are as shown in Table F.25.

The Executive Engineers, the heads of the Divisional Offices, are assisted by 3 to 4 assistant engineers and one deputy revenue officer. The assistant engineers ,the heads of Sub-Divisional Offices, are supported by three to four junior engineers who supervise tendals. This group is executing such operation and maintenance works of irrigation systems as gate opening or closing, recording of diversion discharges, repair and maintenance works. The deputy revenue officers are supported by ziledar, who is assisted by amins who control patrols. This group is carried out the recording and reporting of actual irrigation areas by the canal system, which are submitted to the revenue office for collecting irrigation fees.

(2) Operation and Maintenance

The control of diversion discharges from the parent canal to the distributaries is basically executed by means of on-off of head regulators. Most of offtaking regulators for the minor canal and some of the distributaries are not provided with control gates. Whenever the parent canal runs, the water is easily taken from offtakes located in the upstream. Outlets are also not provided with diversion control facilities.

The farmers in the tail end of the canal have been getting irrigation water from ground water by construction of shallow tube wells in the canal command under the guidance of the Minor Irrigation Department. Conjunctive use of canal water and ground water has been executed.

The maintenance works consist of routine maintenance and repair. The desilting works of minor canals are regularly executed in the off-season after Kharif irrigation operation, but those for distributaries are not provided in every season. Desilting works of most distributaries are conducted once in five year or more, depending on the available fund. The desilting works or minor repairs are conducted on the contact basis.

The canal inspection roads are provided alongside the canal. Due to unauthorized outlets constructed across the roads, and depositing of desilting materials, transportation by use of inspection roads is presently difficult.

3. Irrigation Development Plan of Four Representative Areas

3.1 Irrigation Water Requirement

3.1.1 General

The crops proposed for the Project are paddy rice and groundnut for Kharif season and wheat, vegetables for Rabi season and sugarcane. The irrigation water requirements for them are separately estimated according to the proposed cropping patterns for respective irrigation systems.

The irrigation water requirement for the Project are estimated, using the climatic data for consumptive use of water and effective rainfall on the basis of the modified Penman method.

The irrigation water requirements are estimated by the following procedures:

Paddy rice

- Estimate of paddy rice water consumption by product of reference evapotranspiration by crop coefficient relating to the crop growth stages, CU
- Estimate of percolation rate, P
- Estimate of effective rainfall, ER
- Estimate of nursery water, NU and puddling water requirement, PU
- Estimate of net water requirement, NR

  NR = CU + P - ER +NU + PU
- Estimate of gross water requirement,GR by dividing the net water requirement by irrigation efficiency

Upland crops and sugarcane

- Estimate of crop water consumption, CU
- Estimate of pre-irrigation requirement, PI
- Estimate of effective rainfall, ER
- Estimate of net water requirement, NR

  NR = CU + PI - ER
- Estimate of gross water requirement,GR divided net water requirement by irrigation efficiency

3.1.2 Consumptive Use of Water

(1) Consumptive Use by Crops

Consumptive use of water by crops is estimated as a product of potential evapotranspiration by crop coefficients relating to crop growth stages. The climatic data at Lucknow station is used for calculation of reference evapotranspiration by the modified Penman method.

The reference evapotranspiration thus calculated is as summarized below.

Unit: mm/month

Jan.	Feb.	Mar.	Apr.	May.	Jun	Jul.	Aug.	Sep.	Oct	Nov	Dec
77	108	172	235	267	231	149	162	138	131	89	63

The crop coefficients of respective crops are estimated with reference to "Methodology of Evaluation Studies for Irrigation and CAD Projects",Central Board of Irrigation and Power,India and "Irrigation and Drainage Paper, Crop Water Requirements" FAO, as shown in Fig. F.25. In calculating the water requirement, crop coefficients are estimated on a half-monthly bases according to the proposed cropping schedule.

(2) Percolation

The intake rate measurements in the Project area were conducted in the field investigation period at the respective four representative areas. The locations of the measurement sites and the result are as shown in Figs. F.26 to 29.

Most of the soils in the Project area is classified as clay to clay loam. Based on the result of the investigation and soil classification, the percolation rate of 2 mm/day is adopted in estimating irrigation water requirements for paddy cropping.

(3) Puddling Water and Pre-Irrigation Requirements

Puddling water requirements consist of water equivalent to the difference in the soil moisture before and after puddling, standing water required above the soil surface, evaporation and percolation losses from paddy fields. The puddling water requirement is assessed as follows:

(i)	Depth of soil and porosity		
	soil depth	:	300 mm
	porosity	:	55 %
(ii)	Soil vapor phase after puddling	:	5 %
(iii)	Soil moisture before water supply	:	15 %
(iv)	Water to be supplied		
	Water to be supplied to soil profile	:	105 mm
	Evaporation	:	15 mm
	Percolation	:	10 mm
	Standing water depth after puddling	:	50 mm
	Total	:	180 mm

Pre-irrigation is supplied for the upland crops cultivation. The depth of pre-irrigation is 50 mm for the proposed crops.

(4) Nursery Water Requirement

Nursery water requirements consist of water needed for preparation of nursery beds,and evapotranspiration and percolation during nursery period. The water requirement is estimated with the following conditions:

(i)	Area required for nursery bed	:	5 % of paddy field
(ii)	Nursery period	:	25 days
(iii)	Required water for 25 days		
	Preparation of nursery bed	:	180 mm
	Evapotranspiration	:	Kc x PET
	Percolation	:	2 mm/day

3.1.3 Effective Rainfall

The effective rainfall for paddy fields and upland fields are separately estimated based on the rainfall data and crop growing conditions.

Rainfall data used in the calculation are as follows:

Sarojini Nagar area	:	Lucknow station
Sataon area	:	Rae Bareli station
Sursa area	:	Hardoi station
Purwa area	:	Purwa station

Paddy field

- Based on the daily rainfall data in the Project area, effective rainfall was estimated by means of the daily water balance between rainfall and requirement.

Based on the above result, correlation between monthly rainfall and effective rainfall was estimated for the purpose of calculation of the long term water assessment as shown in Fig. F.30. The relation can be expressed as follows:

In case of R less than 200 mm :

$$ER = 0.79 * R$$

In case of R larger than 200 mm:

$$ER = 0.22 * R + 114.0$$

Upland field

- Based on the evapotranspiration/precipitation ratio method prepared by USDA, the relationship between average monthly effective rainfall and mean monthly rainfall is drawn for the different values of the average monthly crop water requirement. The relationship is as shown below.

$$ER = 0.2 \times R^{0.95} \times Cu^{0.31}$$

where, ER : Effective rainfall (mm)
R : Monthly effective rainfall (mm)
Cu : Crop water requirement (mm)

In the above calculation, the effective rainfall should not exceed crop water requirement.

3.1.4 Irrigation Efficiency

Irrigation efficiencies of paddy field irrigation and upland field irrigation are determined, taking into account the following conditions:

(i) Most of the soils are medium soils in the Project area and the applied surface irrigation methods are border or basin method. According to the standards of

US Soil Conservation Services, field application efficiency of 75% is applied for Rabi cropping.

(ii) Application efficiency of paddy cropping is estimated to be 90% in consideration of limited irrigation service areas; 24% of CCA and plot to plot irrigation condition.

(iii) Field irrigation canal will be lined for about 60 % of its length. Seepage from the field irrigation canals is much reduced. Conveyance efficiency of 85% is applied.

(iv) Conveyance efficiency of minor and distributary canal system is estimated to be 85% on the basis of the actual field measurements of conveyance loss of 20% and the proposed lining of permeable soil and high embankment portions.

The overall irrigation efficiencies at the head for respective Kharif and Rabi cropping are summarized as follows:

Irrigation Efficiency	Kharif Cropping	Rabi Cropping
Application efficiency	90%	75%
Conveyance efficiency	72%	72%
Field irrigation channel	(85%)	(85%)
Distributary and minor	(85%)	(85%)
Overall efficiency	65%	54%

3.1.5 Diversion Water Requirement

Crop water requirements for the respective representative areas are estimated on the basis of the above mentioned calculation conditions as shown in Tables F.26 to F.29. Diversion water requirements of composite cropped areas for the respective representative areas for Kharif and Rabi cropping are calculated in terms of 1,000 m^3/100 ha (corresponding to unit depth, mm/unit area) for a series of 10 years as shown in the same tables.

3.2 Available Water and Irrigation Areas

3.2.1 Available Water

The irrigation water has been taken at Banbassa intake and distributed to Hardoi Branch Canal through Main Canal and a bifurcation structure with augmentation of water from Sharda Sagar reservoir.

The irrigation water supply of the Sharda Canal System is practiced in accordance with the roster. The seasonal scheduled deliveries set up in the roster and actual deliveries at the respective canal sections of the Sharda Canal System are compared as shown in Table F.30.

The seasonal deliveries of the Hardoi Branch Canal system is generally agreed with the scheduled ones at the respective sections. The water deliveries from distributaries and minor canals for sub-project areas, however, much differ from the scheduled deliveries in terms of the volumes and timing. According to the probability analysis of the seasonal diversion volume at Banbassa intake as well as Hardoi branch Canal at a head section, the minimum seasonal diversion in 80 % of occurrence was occurred in 1989-1990.

The seasonal deliveries of the Main Canal and Hardoi Branch System are supplied according to the schedule. Then ,with implementation of the Project, the reliable water deliveries to the distribution systems will be ensured. Thus, the irrigation planning is based on the following scheduled discharges in 1989-90 as summarized below.

Seasonal Water Deliveries in Design Year

Description		Kharif			Rabi		
		Roster MCM	Actual MCM	Rate %	Roster MCM	Actual MCM	Rate %
Banbassa intake		4,535	4,102	(90)	2,44	3,021	(109)
Hardoi Branch at head		2,211	2,172	(98)	1,490	1,580	(106)
Lucknow Branch at head		723	717	(99)	468	522	(112)
Asiwan Branch at Head		154	158	(103)	103	136	(132)
Purwa Branch at head		187	194	(104)	104	152	(146)
Unnao Branch at head		102	96	(94)	68	98	(144)
Sarojini Nagar Area	Amausi Dy.	27.4	16.1	(59)	15.1	15.4	(102)
Sataon Area	Maurawan Dy.	11.9	0.2	(2)	6.1	0.9	(15)
Sursa Area	Badaicha Dy.	18.6	23.9	(128)	12.1	19.0	(156)
	Marsa Mr.	6.5	4.4	(68)	2.7	2.6	(59)
Purwa Area	Purwa Dy.	10.7	8.0	(75)	7.8	5.3	(68)
	Tikar Dy.	5.6	4.3	(77)	3.4	3.8	(112)
	Chimyani and Pakra Mr. at head	3.7	5.3	(142)	2.5	4.3	(172)

The diversion requirements at the head of the representative areas thus estimated are as summarized below.

Diversion Water Requirement

Kharif 1990 Unit: mm

Description	Apr.	May	Jun	Jul	Aug	Sep	Oct	Total
Sarojini Nagar	0	6	174	149	186	66	36	617
Sataon	0	6	130	108	166	117	35	562
Sursa	23	39	212	196	59	144	59	732
Purwa	0	6	179	162	90	190	37	664

Rabi 1989-90 Unit: mm

Description	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total
Sarojini Nagar	20	110	125	157	120	38	570
Sataon	21	115	123	157	108	38	562
Sursa	48	117	116	140	116	44	581
Purwa	21	106	125	157	97	38	544

Note :October in Rabi; starting from the middle of October

3.2.2 Water Balance

In order to estimate the irrigation service areas, the water balance study was carried out between the supply and the demand under the following conditions:

(1) The design year is set to be 1990 and 1989-90 for Kharif and Rabi seasons,respectively in accordance with the occurrence probability of supply at the Banbassa intake and Hardoi Branch head.

(2) The discharges from the canals is those set out in the rosters of the concerned canals in the above-mentioned design year, except Sataon area for which is estimated due to no available data. The discharge used in the water balance of the Maurawan Distributary is as shown in Table F.31, which is estimated on the basis of the even distribution of the Maurawan command.

(3) Irrigation deliveries are made in accordance with the full irrigation requirements as estimated as above.

The water balance simulation is made for Kharif and Rabi in the design year to estimate the water sufficiency to serve the areas with the proposed crop intensity ,i.e., 24%

and 25% of the CCA. The results of the canal commands of the respective representative areas are as shown in Tables F.32 to F.38, and summarized below.

Result of Water Balance

Description	Area (ha)	Water Supply Roster (MCM)	Water Supply Actual (MCM)	D.R. (MCM)	Water Deficit Roster (MCM)	Water Deficit Actual (MCM)
Sarojini Nagar						
CCA		14,862				
PIA,Kharif	3,567	27.38	16.14	22.01	5.37	-5.87
PIA,Rabi	3,716	15.06	15.42	21.18	-6.12	-5.76
Sataon						
CCA		12,874				
PIA,Kharif	3,090	12.32	0.19	17.37	-5.04	-17.18
PIA,Rabi	3,219	6.16	0.94	18.09	-11.93	-17.15
Sursa						
CCA		17,313				
PIA,Kharif	4,065	25.12	28.28	30.41	-5.28	-2.14
PIA,Rabi	4,328	14.86	21.56	25.15	-10.29	-3.58
Purwa						
CCA		12,252				
PIA,Kharif	2,941	20.02	17.65	20.96	-0.94	-3.31
PIA,Rabi	3,062	13.68	13.38	16.90	-3.22	-3.52

The canal water deliveries are not sufficient in volume to serve the whole areas with the proposed crop intensities.

3.2.3 Water Supply Plan

To ensure the reliable water deliveries as well as to supplement the canal water deliveries, the following water supply plans are proposed:

(a) utilization of the Sai river discharge as pump lift irrigation
(b) groundwater development as conjunctive use of canal water
(c) adjustment of rostering with respect of equitable distribution

The water supply plan for the respective representative areas is described hereunder.

(1) Sarojini Nagar Area

The groundwater use is vast and the groundwater table drawdown in the recent year is remarkable. With a view to maintaining groundwater regime, the groundwater development

for this area is not promoted by the Project. This area requires the surface water supply from the outside area to supplement the canal water as well as to augment the recharge of groundwater source.

The Sai river, which runs along the southern boundary of the area, provides sufficient irrigation water as shown in Table F.39. The pump lift irrigation by use of the Sai river water is proposed for this area. According to the sloping topography of the area adjacent to the Sai river, and the calculated deficit of water, the pump station is selected to be located downstream of the Amausi distributary to which the pumping water will be delivered.

(2) Sataon Area

The irrigation of this area has been largely dependent upon the groundwater due to scarce canal water supply for a long period, then the remarkable drawdown of groundwater table has occurred. With a view to avoiding an adverse environmental effect, the groundwater development is not promoted with the Project similarly to Sarojini Nagar area. To secure the irrigation requirements as well as to augment the groundwater recharge, two measures are required in this area,i.e., re-arrangement of canal delivery from the Asiwan Branch being a parent canal of this area and the Sai river water use for making up the further deficit.

The Asiwan Branch receives the canal deliveries lager than the schedule, whereas less water reaches to the Maurawan Distributary, which is mainly attributed to insufficient water management of the offtaking especially direct outlet from the Asiwan Branch as shown in Table F.40. Further the schedule discharge to the Sataon area is about half of the average supply in the Maurawan Distributary command.

	Command Area		Water Delivery		Unit Water Depth	
	CCA (ha)	PIA (ha)	Actual (MCM)	Schedule (MCM)	Actual (MCM)	Schedule (MCM)
Rabi						
Asiwan Branch	85,511	21,378	131.8	113.0	0.62	0.53
Maurawan Dy. (at head)	32,530	8,133	26.6	45.2	0.33	0.56
Maurawan Dy. (at head of Sataon Area)	12,874	3,219	1.07	7.40	0.03	0.23
Kharif						
Asiwan Branch	85,511	20,523	165.3	157.5	0.81	0.77
Maurawan Dy. (at head)	32,530	7,807	37.5	65.7	0.48	0.84
Maurawan Dy. (at head of Sataon Area)	12,874	3,090	0.26	13.71	0.01	0.44

Major reason of small deliveries to Maurawan distributary command especially in the Sataon Area is considered to be the over diversion from direct outlets from Asiwan Branch. Thus, firstly the parallel minor canals along Asiwan Branch should be constructed to avoid the inefficient deliveries from the direct outlets. Secondly, the water delivery in the Maurawan Distributary should be adjusted so as to ensure the equitable delivery over the command as shown in Table F.41.

(3) Sursa Area

The water balance study shows that a large amount of water shortage occurs. The scheduled deliveries in the roster are small. Thus, first, re-arrangement to increase the roster delivery of Badaicha Distributary is required from the authorized discharge of 88 cusec to 125 cusec. To improve the water-logging area along Hardoi Branch, a pipe drainage scheme is proposed as a drainage work and it will provide the additional irrigation water by pumping up drainage water. Further, in order to make up the further deficit as well as to alleviate water-logging and alkalinity/salinity affected areas, the groundwater development will be executed.

(4) Purwa Area

The groundwater development is promoted to supplement the canal water deliveries in addition to the re-arrangement of the scheduled discharges within Purwa area. The tubewells is constructed in the water logging and alkalinity/salinity affected areas for alleviation of such problems through conjunctive use of canal water with regulated rostering.

The water balance and water supply plan is as shown in Table F.42.

3.3 Irrigation Method and Schedule

3.3.1 Structured System Plan

The water supply method with variable discharges requires adjustment of deliveries at control points every time when any significant change in demand occurs. The management under this method largely depend on the human activities, sometimes falling in miss management, illegal gate operation, etc.

The structured system delivers the irrigation requirements at a rate equal to the peak crop requirement at the pre-determined interval. The advantage of this system is the minimum

amount of intervention for day to day operation. The system requires only division control and will be run in full "ON" or "OFF" turn, and the variation in water requirements will be met by timing the intermittent supply.

During the peak demand, constant and pre-determined irrigation streams are delivered continuously to the chak rotation units. During off-peak periods of the demand, the flow to these units are intermittent. The intervals are kept in any 7 day multiple so as to maintain weekly osrabandi turns.

When irrigation block is "on", the constant irrigation stream is rostered amongst farmers according to the osrabandi schedule. The chak area is sub-divided into 7 sub-chak of about 6 ha of CCA. Each sub-chak will receive the irrigation once a week during "ON" week in proportion to the size of the sub-chak. In sub-chak, the water delivery to the farmers' fields will be adjusted with a period proportional to the size of the holding.

The distributaries and minors branched therefrom run either in full or closed. The outlet needs not be gated as they will run to their design capacities whenever the distributary or minor is running. Operation of sub-chak outlet is required only for opening or closing with on/off gate.

The design discharge of system is determined by the peak flow rate to be delivered to the chak area. Based on the authorized discharge at the offtake structures of the respective Representative areas, the peak flow rates for the representative areas are calculated as follows:

Qd : Design unit discharge for distributary canal (cusec/ha)
Qc : Peak rate of flow to be delivered to the chak areas (cusec/ha)
A : CCA (ha)
Ec : Conveyance efficiency of distributary and minor canal (from head regulator to outlet)
Qm : Authorized discharge of offtake of the parent canal of the representative area

Canal	A (ha)	Qm (cusec)	Qd (cusec/ha)	Qc*1 (cusec/ha)
Amausi Distributary	12,532	125	0.0100	0.0085
Maurawan Distributary	10,052	75	0.0075	0.0063
Badaicha Distributary	15,671	116	0.0074	0.0063
Purwa Distributary	5,300	57	0.0108	0.0092

Note : ha in CCA,
*1 conveyance efficiency of distributary and minor 0.85

The unit diversion water requirements for the system design are estimated on the basis of the results of water requirement calculation as shown in Tables F.43 to F.46. The comparison between the diversion requirements calculated from the proposed cropping patterns and the authorized discharges to respective distributary canals is as shown below.

Canal	Unit diversion requirement (l/sec/ha)	
	Qdn	Qpc
Amausi distributary	1.13	1.17
Maurawan distributary	0.85	1.24
Badaicha distributary	0.85	1.00
Purwa distributary	1.22	1.36

Note : ha in net irrigation area
Qdn: unit diversion requirement calculated from authorized discharge
Qpc: unit diversion requirement calculated from proposed cropping pattern

There is no much difference between the two values except those of Maurawan distributary. Further, in consideration of the conjunctive use of groundwater in the command, the diversion requirements calculated from the authorized discharges are adopted as the canal system design values of the Project.

According to the peak flow rate to the chak as mentioned above, the irrigation stream size and irrigation schedule for upland crops are calculated as follows:

Description	Unit	Amausi Dy.	Maurawan Dy.	Sursa Dy.	Purwa Dy.
Peak flow rate	(cusec/ha)	0.0085	0.0063	0.0063	0.0092
Pre-irrigation depth at field	(m)	50	50	50	50
at the head of *1	(mm)	78	78	78	78
field channel	(m^3/ha)	780	780	780	780
Available water in a day					
Pre-irrigation area	(ha of CCA)	42	42	42	42
Field channel dis.	(cusec)	0.357	0.265	0.265	0.386
Available water	(m3)	873	647	647	945
Pre-irrigation area in a day					
Net area	(ha)	1.12	0.83	0.83	1.21
CCA (25% intensity)	(ha)	4.5	3.3	3.3	4.8
Pre-irrigation period	(day)	9	13	13	9

Note: *1 Irrigation efficiency: 64%
application efficiency : 75%
conveyance efficiency : 85%
(field channel)

3.4 Groundwater Development

3.4.1 Conjunctive Use of Water

From the agricultural and ecological point of view, it has been noted that the maximum crop production is obtained in those area where groundwater development lies between 35% and 50% and groundwater table is always below the critical level in safe zone varying from 5.0 m to 10.0 m below the ground. Under such conditions, ecology is balanced, and water-logging and soil salinity, or declining of groundwater tables are reduced. If the groundwater development is less than 35%, water-logging and salinity may occur. On the other hand, if the groundwater development is more than 50%, groundwater table tends to decline ,which causes degradation of ecology causing drought damage in the groundwater irrigation areas.

According to the water balance between crop water requirements and canal water supply in the canal command, the deficit of irrigation water occurred. To supplement the canal water, groundwater development will be executed.

The groundwater is taken by tubewells pumps from the shallow aquifers in salinity affected and water-logging areas in the canal command. The water thus taken is supplied to the minor canal systems and the rostering of the minor canal system will be regulated to such extent of the augmented water volume from the tubewells. The systematic control of groundwater draft and regulating roster will maintain lowering groundwater table within the safe zone.

3.4.2 Groundwater Development Plan

(1) Required number of tubewell

As mentioned in section 3.2.3, the groundwater development will be implemented in Sursa and Purwa Representative Areas to supplement the canal water and to alleviate the water-logging and salt affected areas. The tubewells to be constructed are of shallow tubewell type, and the construction of the tubewells are concentrated in the shallow groundwater table and salt affected areas on the basis of the results of soil investigation and groundwater table fluctuation survey.

According to the water balance study, the following water requirements are needed to be supplemented from groundwater. The calculation is as shown in Table 47.

Sursa Area

- Badaicha Distributary command

Annual water deficit	:	15.57 MCM
Expected unit annual draft	:	18,000 m^3/no.
Required no. of tubewell	:	900 nos. (15.57/0.018=865)

Purwa Area

- Chimyani and Pakra Minors command

Annual water deficit	:	2.19 MCM
Expected unit annual draft	:	15,000 m^3/no.
Required no.of tubewell	:	150 nos. (2.19/0.015=146)

- Tikar Distributary command

Annual water deficit	:	1.97 MCM
Expected unit annual draft	:	15,000 m^3/no.
Required no.of tubewell	:	130 nos. (1.97/0.015=131)

(2) Type of Tubewell

The strata in Sursa Area consists of alternating sand layers of coarse grain sand. Strainer-type wells are used for those aquifers. The expected yield will be 6 to 10 ℓ/sec from an aquifer at depths of 15 to 20 m. The spacing of the wells is estimated to be 200 m to 250 m.

The strata in Purwa Area consists of thick clay layer underlain by 3 to 7 m sand layer at depth of about 30 m. Cavity-type wells are suitable for this area according to the result of pumping test. The expected yield will be 5 ℓ/sec from the above-mentioned aquifer. The spacing of wells will be 150 m to 200 m

(3) Power Supply System

The tubewells are in general of electrically driven type. For electrification of tubewells, the construction of new power distribution lines to each of the tubewells is needed. The percentage of electrified villages in Sursa and Purwa is 44 % and 47 % as of 1987/88 as shown in Table D-15 of ANNEX-D. The power requirement of a tubwell pump is 3.7 kW, therefore the total power requirement of respective areas is about 3,000 kW and 1,000 kW in Sursa and Purwa areas, respectively. The power distribution line of 240 to 415 V, single

phase, to the group of tubewells is proposed to be branched off from the existing distribution lines in the villages.

(4) Groundwater Investigation, Development and Management

Water management is the most important part of Canal Command Area Development . Its mis-management causes water logging and soil salinity in the heavy soil rich areas. Judicious management of surface water and ground groundwater preventive measures to keep water level in the safe zone should be taken into consideration, to root out further soil salinization.

The following investigation and pilot scheme are proposed:

(a) Investigation

1) Water Resource Estimate :

Village-wise estimation of available surface water & ground water potential with respect to groundwater recharge and groundwater draft.

2) Hydrological Parameter tests :

For actual assessment of ground water recharge, some parameters, such as specific yield, permeability, infiltration and seepage rates ,etc. will be determined. Well spacing, well depth and well design will be worked out accordingly.

3) Water Level Monitoring :

One piezometer representing a command of 200 ha to 500 ha, depending on soil types and lithology has been proposed and water level monitoring will be made and accordingly preventive measures will be recommended to avoid further ecological degradation.

(b) Pilot Studies

A pilot scheme commanding about 50 ha is first constructed in the shallow groundwater table area for investigation of :

(i) Conjunctive use of ground water and surface water at selected research farms

(ii) Ground water drainage to lower down ground water table to the safe zone

The location of the pilot scheme will be selected by CADA in coordination with Ground Water Department during the detailed design stage.

(5) Implementation Plan of Tubewell

On the basis of the results of the investigation and pilot scheme, shallow tube wells construction will be executed for assured irrigation as well as improvement of water logging and salt affected areas. This work can be performed by CADA in coordination with Minor Irrigation Department/Ground Water Department,U.P.

3.5 On-Farm Development Plan

3.5.1 General

In order to successfully introduce osrabandi system in the command areas, establishment of the on-farm development is a crucial element. It will consist of field irrigation canals, field drainage canals, related structures such as outlets, road crossing, fall, etc. and farm road within the command.

The command area by an outlet, so called chak, is the irrigation unit within which the rotation irrigation will be practiced. Irrigation rotation will be made on the 7-days multiple basis. A chak is, therefore, be divided into 7 sub-chaks. In view of the manageable and efficient farm discharge by farmers, the standard size of the chak is 42 ha of CCA or its multiples. Unification of the existing chak boundaries is required for smaller chak areas.

The capacities of head regulators and their authorized discharges to the respective representative areas have been fixed, within which water supply and system design have to be designed.

The proposed irrigation system operation is as follows: The irrigation system of the Project is a structured distribution canal system under which the canal will be run either full "ON" or "OFF" and that variations in water requirements will be met by timing the intermittent supply. During the peak demand period when crop water requirements are highest, constant and predetermined irrigation streams are delivered continuously to chak rotation units. During non-peak period of demand, the flow to these units are intermittent.

Each sub-chak receives the irrigation stream once a week during an "ON" week for a prescribed period in proportion to the size of the sub-chak.

Thus, the chak outlets are not gated as they will run to their capacities whenever the parent canal is "ON". Turnouts serving sub-chaks are gated with on/off gates to enable rotational operation.

3.5.2 Design Criteria

(1) Chak Area

The existing chak size varies widely according to the topographical, administrative and social conditions. The frequency distribution of the size of CCA covered by one Kulaba is worked out. The result is as follows:

Unit: %

Area	Sarojini Nagar	Sataon	Sursa	Purwa
0 to 10	14	21	5	42
10 to 20	26	36	16	28
20 to 30	21	39	19	9
30 to 40	18	22	16	6
40 to 50	10	24	10	2
50 to 60	4	14	6	2
60 to 70	3	6	7	2
more than 70	4	50	21	9
Average (ha/no)	34	61	55	45

In consideration of the peak flow rate as mentioned in section 3.3 and manageable and efficient farm stream of more than 10 ℓ/sec, the chak size should be more than 42 ha (6 ha x 7 days). Therefore, the existing small size chak should be unified at least to the above-mentioned size.

(2) Field Irrigation Channel

The field irrigation channel is lined by bricks so as to minimize the conveyance losses to the extent of 50 to 60% of the whole reaches of the field channels, according to the result of the economic comparison shown in Fig. 31. The lining section is of rectangular type and the earth canal is of trapezoidal type. The field irrigation channel is constructed up to the outlet to the sub-chak of about 6 ha.

The principal design values used in the basic design are as follows:

(a) Permissible velocity

Maximum velocity		
brick lining canal	:	1.5 m/sec
earth canal	:	0.7 m/sec
Minimum velocity	:	0.25 m/sec

(b) Roughness coefficient

Brick lining canal	:	0.016
Earth canal	:	0.0225

(c) Minimum free board : 0.15 m

(3) Field drainage canal

The field drainage canal is constructed to collect drain water from the sub-chak. The field drainage canal system are provided with the capacity that 5-year, 3 days rainfall storm is drained within 3 days. The design capacity is fixed to be 5.00 ℓ/sec/ha. The drainage canal is of trapezoidal earth canal type.

(4) Chak road

To ensure the efficient transportation within the chak, the existing village roads in the chaks are improved with embankment with the width of 4 meter.

(5) Outlet and other related structures

The outlets serving the field irrigation channels are of proportional divisor type without control gate with precast concrete construction. The other related structures are of brick construction.

3.5.3 Proposed On-farm Works

The on-farm design of about 100 ha for each of the Representative areas,for which the detailed topographic maps were prepared during the survey period were worked out. Based on the result of the sample designs in the respective area, the required facilities such as the field irrigation channels, field drains and related structures are estimated for the CCA of the representative areas. The on-farm development works thus estimated are as shown below.include the following:

Description		Sarojini Nagar	Sataon	Sursa	Purwa
Field irrigation canal					
lining	(km)	295	256	344	244
earth	(km)	161	139	187	133
Field drainage canal	(km)	369	320	430	304
Related structures	(nos.)				
turnout		2,082	658	2,425	1,716
culvert		760	658	885	626
aqueduct		198	172	231	163
transition		496	429	577	409
drainage culvert		925	802	1,078	763
Chak road	(km)	456	395	532	376

3.6 Modernization of Existing Irrigation System

3.6.1 General Design Consideration

The irrigation water supply of Sharda Canal system is uncertain. To ensure the reliable supply of water, the following modernization of the existing irrigation canals and related structures will be proposed. The general layouts of four Representative Areas are as shown in Figs. F.32 to F.35, and irrigation diagrams are as shown in Figs. F.36 to F.39.

(1) Improvement of existing irrigation system

(a) Canal lining where the canal runs in high permeable soils and across low-depressed areas

Canal lining is provided to the selected canal sections of distributary and minor canals to achieve the following:

- reduction of seepage loses through unlined canal section
- prevention of water logging in the area adjacent to the canal by reducing seepage of canal
- improvement of operational efficiency
- reduction of maintenance cost

According to the soil investigation result, the canal reaches in high permeable portions are selected for lining of distributary and minor canals. Further where the canals cross the low-depression areas, the lining is provided for those reaches.

The lining section is determined with special attention to the existing canal sections so as to reduce additional filling/excavation as much as possible.

The principal design values are as follows:

section	:	trapezoidal section
type of lining	:	single tile lining with thickness of 10 cm
roughness coefficient	:	0.016
side slope	:	1:1.0
maximum permissible velocity	:	1.5 m/sec

General features of improvement of existing irrigation system are shown in Tables F.48 to 51.

(b) Provision of additional minor canals along with distributary canals

To avoid direct diversion from outlets which have been provided on the distributary canals, additional minor canals will be provided along the distributary canals. And direct outlets will be replaced and shifted to the parallel minor canals. The Sataon Area, the existing deliveries are far lower than the roster deliveries, because most of offtaking water at the Asiwan Branch head regulator have been used up to the end of the Asiwan Branch. To avoid direct diversion from outlets on Asiwan Branch and to introduce the water to the Sataon Area, the parallel minors along Asiwan Branch will be constructed. Details are shown in Tables F.52 to 55.

(c) Review of the water levels of distributary canals

The relationship between the water levels of distributary canals and groundwater level is reviewed on the basis of the longitudinal section drawings supplied by the Irrigation Department UP, topographic maps and information of lift irrigation areas obtained during the survey period. The proposed divisors as offtaking structures for minor canals require some head losses for regulating deliveries by structures themselves. The gravity irrigation areas should be reduced to extend gravity irrigation areas. For the purpose of raising water levels in the distributary canals, falls in distributary canals are proposed to be cancelled.

(d) improvement of existing control structures

The following improvement works are proposed to the existing control structures:

- provision of steel gate to head regulators
- provision of measuring devices downstream of a head regulators
- replacement of existing off-taking structures for minor canals with the proportional diversion structure according to the required capacities
- replacement of existing outlets on minor canals with the proportional diversion outlet structures according to the required capacities

(e) improvement of canal inspection road with brick boling on distributary inspection roads

The inspection roads of distributary canals will be improved by means of brick boling of single brick with a thickness of 10 cm hawing width of 3 m. The inspection roads of minor canals will be improved by the additional filling/reshaping.

(2) Sai river pump lift schemes as supplemental water sources development

The Sai river water is used for supplementation to the canal water of Sarojini Nagar and Sataon Areas. The pump lift schemes for Sarojini Nagar and Sataon areas are as shown in Table 56.

(a) Sarojini Nagar area

The existing pump station located on the left bank of the Sai river in the downstream of Amausi distributary will be improved. The pumping water will be delivered to Amausi distributary through improved Manoharpur minor. The general features of the pump station are as follows:

(b) Sataon area

The pump station will be constructed on the left bank of the Sai river in Sataon village, of which the pumping water will be delivered to Maurawan distributary through improved Sataon minor. The general features of the pump station are as follows:

(3) Construction of wireless communication system

In order to achieve the efficient water supply, a reliable and fast communication system is required to collect various information on the water supply and irrigation demand such as sown areas, sowing timing, growth stages,rainfall and available canal discharges. As mentioned i section 1.3 (Water Supply), the conveyance losses are estimated to be 30% to 26% of Hardoi Branch deliveries. The higher losses are occurred in Kharif. This fact indicates that irrigation efficiency of Hardoi Branch is much improved introduction of the systematic operation. For the purpose of the above, the wireless communication system is installed with the following functions:

(a) Operational function
- controlling of water deliveries in main canal and various canals through transmitting the information about the release and the discharges to be maintained at various points and various offtakes
- collection of information about discharges running at different points of canal and offtakes
- instruction regarding correction and modification to be made in the gate operations
- collection of data on irrigation requirements such as cropped areas, time of sowing, rainfall data, etc.

(b) Administrative function
- important messages about the administrative matters having high priority

(c) Emergency case
- messages such as breaches of canals, structure broken

The wireless communication system consists of a main network and a branch network as indicated in Fig.40. The main network will be a HF radio link. It connects the Central Control Station with CAD Office, Chief Engineer Office, Superintending Engineers Offices, Executive Engineers Offices, Office in charge of OFD works. The branch network will be a VHF radio link. It connects the Executive Engineers Office with the Sub-divisional Offices, and major offtakes,cross regulators or other discharge control sites in their jurisdiction. The flow chart of wireless communication system is as shown in Fig.41.

3.6.2 Proposed Modernization Works

The general features of the proposed modernization works of the irrigation systems are as follows:

(1) Improvement of existing irrigation system

The improvement works of the existing irrigation canal systems include the following:

Description		Sub-Project			
		Sarojini Nagar	Sataon	Sursa	Purwa
- Setting of existing canal section					
Dy.	(km)	55.0	91.8	34.8	35.3
Mr.	(km)	54.7	19.1	64.9	46.1
- Canal lining					
Dy.	(km)	16.4	38.6	19.5	17.8
Mr.	(km)	16.3	51.6	36.4	20.3
- Additional parallel Mr.					
	(nos)	11	27	10	12
	(km)	41.6	104.0	45.0	53.0
- Improvement of existing control structure (nos)					
Replacement					
Head regulator		1	37	2	4
Offtaking structure		29	40	16	18
Outlet		365	768	386	291
Provision					
Measuring device		32		27	26
Steel slide gate		1	27	2	4
- Improvement of canal inspection road (km)					
Inspection road for Dy.		55.0	91.8	34.8	35.3
Inspection road for Mr.		54.7	19.1	64.9	46.1

(2) Sai river pump lift irrigation scheme

The pump is of vertical shaft mixed flow type, driven by electric motor. The power distribution lines of respective pump stations are as follows: The lift canal scheme in Sarojini Nagar area is contemplated with improvement of the existing lift canal scheme. The power line for the existing pump can be used without replacement. The power distribution line for a lift canal scheme in Sataon is proposed to be newly constructed with 11 kV, three phase, branched from the existing main line in the adjacent power line .

The general features of the Sai river pump lift irrigation schemes for Sarojini Nagar and Sataon areas are shown below:

Pump Lift Irrigation Plan

Description		Sarojini Nagar	Sataon
Pump command area			
- CCA	:	2,167 ha	2,822 ha
- Proposed irrigation area			
Kharif	:	520 ha	677 ha
Rabi	:	542 ha	706 ha
Pump equipment			
- type	:	--Vertical shaft mixed flow--	
- nos	:	2 nos.	2 nos.
- discharge	:	25 m^3/min/no.	34 m^3/min/no
- motor output	:	68 kw/no.	102 kw/no
- total head	:	11 m	14.5 m

(3) Groundwater development

The tubewells to be constructed in Sursa and Purwa areas are as follows:

General Features of Tubewells

Description		Sursa	Purwa
Tubewell			
Type	:	Shallow tubewell with screen	Shallow tubewell with cavity type
Number	:	900 nos	280 nos
Location	:	Salinity/alkalinity affected areas	

(3) Construction of wireless communication system

The general features of wireless communication system to be constructed are as follows:

Central control station		
HF radiotelephone	:	1 no.
Data processing unit	:	1 no.
Controlling station		
HF radiotelephone	:	9 nos.
Data processing unit	:	3 nos.
Sub-station		
VHF radiotelephone	:	34 nos.

4. Overall Irrigation Improvement Plan

4.1 Necessity of the Renovation of the Sharda Canal System

(1) Irrigation condition of Sharda Canal system

Sharda canal system is a integrated system served from the Sharda river, Sharda Sagar reservoir, Nanak Sagar reservoir and Baigul reservoir. Total CCA of the Project is 1.612 million ha with the design crop intensity of 49% consisting of 24% in Kharif and 25% in Rabi. The Sharda Sagar reservoir is supplied from the main canal and augments Hardoi Branch canal, and Nanak Sagar reservoir water is utilized in Shahjahanpur Branch system of Sharda canal command through the river Deva and Deva Baigul feeder. Some share of Baigul reservoir water is taken through the Apsara river for Shahjahanpur Branch system.

The Sharda river, which is a main water source, supplied the irrigation water on an average for the past five years from 1986 with 4,360 MCM and 2,990 MCM in Kharif and Rabi. It corresponds to an equivalent irrigation depth of 0.27 m and 0.19 m to the whole CCA. The capacity of the main canal is fixed at 11,500 cusec. In the beginning of the Kharif season the river flows are not sufficient and in the other period the river flow occurs more than the canal capacity with the average intake discharge of 9,500 cusec. During the Rabi season the river flows reduces and the most of the river flows are diverted to the main canal with an average diversion discharge of 7,000 cusec. The delivery from Sharda Sagar, Nanak Sagar and Baigul reservoirs augments the canal water from the intake.

Hardoi Branch is the largest Branch in the Sharda Canal System with a CCA of 757,772 or 47% of 1.61 million ha of the Sharda Command, and having a head discharge of 5,400 cusec (153 cumec) or 39% of the main canal discharge of 13,800 cusec (390 cumec).

As mentioned in the previous sections, the water deliveries of Hardoi Branch has been executed as scheduled in respect of seasonal delivery volume. Purwa and Unnao Branches, which are bifurcated at the end of Hardoi Branch, have received the annual deliveries of about 17% more than the scheduled irrigation area with the annual crop intensity of 49% to CCA.

Despite the agreed annual deliveries with the schedule, the annual irrigation area was far less than the scheduled irrigation area, averaged to about 292,000 ha or 39% of CCA for the past five years.

Hardoi Branch runs continuously for 24 weeks in Kharif and intermittently for 23 weeks in Rabi. The offtaking branches are scheduled to be supplied intermittently for 17 to 14 weeks in Kharif and 14 to 8 weeks in Rabi. Most of offtaking branches however, are served water continuously from Hardoi Branch. These conditions are occurred similarly in distributaries and minors.

As mentioned above, the annual water deliveries of the Sharda canal system and Hardoi Branch system is agreed with the roster deliveries, and the weekly discharges in the upstream part of those canal systems also generally coincide with the roster. Those in the downstream part, however, much differ from the roster. Further the deliveries to distribution canal systems are apart from the roster to the large extent in volume and timing. The reliable water supply in the command is not attainted. Irrigation service areas are much larger than the scheduled crop intensity in the upstream part and much lower in the downstream part. Those insufficient systematic control of the head regulators to distributary and minor canals and direct outlets causes low utilization of irrigation water.

The Project area, i.e., four Representative areas, is located in Hardoi Branch command area. Systematic operation of Hardoi Branch will much contribute to reliable water supply to the Project area. In this context, it is desirable that the following improvement works of control structures of Hardoi Branch are executed as early as possible.

(1) Replacement of head regulator for distributaries and minors located in Hardoi Branch with installation of head gates
(2) Provision of parallel minors along Hardoi Branch to cancel direct outlets from Hardoi Branch
(3) Replacement of direct outlet on Hardoi Branch to parallel minors to be provided

(4) Canal structures related to parallel minors to be provided such as bridges drainage crossing

The required cost for execution of the above works are estimated to be approximately Rs.150 million as shown in Table F.57.

To ensure reliable and equity delivery of water as well as to enable introducing systematic water management, the present system deficiencies such as outdated control structures, insufficient design discharges of distributary and minor canals, etc. have to be made proper through modernization of the canal system.

(2) On-farm Development and Water Users Association

The CAD works of the Sharda Canal Command Area Development Project will be completed by the March 1993 in so far as the on-farm works are concerned according to the present schedule. The on-farm works will be provided to the command area of about 552 thousand ha out of about 804 thousand ha irrigation potential. Lining of field irrigation canals is much effective for saving loss of the limited water sources. The present on-farm work can provide only 5 to 10% of the canal length.

Establishment of water users association and introduction of osrabandi, which are a vital element for attaining proper water management for raising water use efficiency and crop production, are not realized even in the completed areas of on-farm works.

On-farm systems have to be extended to cover the whole command area and be modernized by means of lining of field irrigation canal at least for 50% of the whole reaches, together with promotion of osrabandi system.

(3) Groundwater Development

The groundwater irrigation are extensively practiced in the related districts of the Sharda Canal Command. The potential development of groundwater in the command areas is estimated approximately to be 2,850 MCM, which corresponds to about 40 % of the annual delivery to the main canal from the Sharda river. The groundwater development in the command have to be promoted to make water delivery more reliable through ensuring conjunctive use of canal water and groundwater.

(4) Improvement of Water Logging and Salt Affected Areas

The salt affected areas lying in the related districts of the Sharda Canal Command are counted for about 10% of the geographical areas in the most downstream districts such as Lucknow, Unnao, Rae Bareli and about 5% in the districts in the middle reaches of the canal system such as Hardoi. Remote sensing imaginary data interpretation conducted in this study showed more severe salt condition in the selected representative areas. The groundwater development by shallow tubewells with regulated rostering will result in the alleviation of waterlogging and salt affected areas. On the basis of the result of the implementation of the representative areas, improvement of the water logging and salt affected areas will be successfully executed.

4.2 Implementation Plan

The diversity and complexity of the irrigation water supply problems prevailing in the Sharda Canal Command is urgently needed to be solved through the implementation of the integrated command area development programme. To ensure the early and sustainable growth of the agricultural production through the synchronized development and management of the canal water and groundwater, it is first necessary to formulate the medium and long term comprehensive development plan on the water management of Sharda Canal system and resources development in its command area.

The implementation of the representative areas will provide the suggestions on the technical and managerial solutions as to the reliable water supply, and improvement of water logging and salt affected areas.

The comprehensive study covering the Sharda Canal command of 1.612 ha has to be carried out to identify and formulate, (i) a modernization plan of Sharda canal system, consisting of the systematic water management plan and improvement measures of canal system deficiencies and (ii) renovation plan of the CAD works. The study will be commenced as early as possible to enable executing the identified plan and measures.

On the basis of the result of the comprehensive study, the modernization works of the irrigation and drainage systems, and renovation of on-farm works will be commenced with stage wise implementation. The renovation of CAD works of Hardoi Branch command and modernization of Hardoi branch system will follow immediately after completion of the development works of the representative areas.

The balanced CAD area and canal system such as Kheri branch command, Shahjahanpur branch command,etc. will be implemented in due time in consideration of managerial capacity of the CADA.

TABLES

Table F.1 General Feature of Sharda Intake, Sharda Sagar Reservoir and Main Canal

I. SHARDA INTAKE

1. Name of District	:	Nainital
2. Name of River	:	Sharda River
3. Catchment Area	:	5,788 mile^2 or 14,820 km^2
4. Maximum Design Discharge	:	600,000 cusec. or 16,900 cumec
5. Total Length of Canal System	:	7,632 mile or 12,211 km
6. Number of Bays		
(a) Under Sluice Bays	:	4 nos.
(b) Barrage Bays	:	30 nos.
7. Width of Each Bay	:	15.24 meter
8. Thickness of Piers	:	2.43 meter
9. Length of Impervious Floor		
(a) Under Sluice Bay	:	U/S 22.86 meter
		D/S 43.89 meter
(b) Barrage Bays	:	U/S 15.54 meter
		D/S 27.12 meter

II. SHARDA SAGAR RESERVOIR

1. Length of Dam	:	22.200 km
2 Top Level of Dam	:	630.00 feet
3. Full Water Level	:	625.00 feet
4 Useless Capacity Water Leval	:	603.00 feet
5 Useless Capacity at 603 feet Water Level	:	104,125 acre feet
6 Storage Capacity at Full Water Level	:	399,723 acre feet
7 Useful Capacity at Full water level	:	295,598 acre feet
8 Present Position of Feeder Sources of Dam		
(a) New S.S. feeder	:	1,000 cusec
(b) Old S.S. feeder	:	3,500 cusec
Total	:	4,500 cusec
9 Present Position of Outlet Sources of Dam		
(a) Outlet channel	:	3,500 cusec

III. SHARDA MAIN CANAL

(A) Canal Head		
1. No of Bays	:	16 (Fitted with trash screen)
2. Width of Each Bay	:	6.1 meter
3. Capacity of Head	:	13,800 cusec or 385.27 cumec
(B) Main Canal		
1. Width of Bed	:	106.7 meter
2. Capacity of Canal	:	11,500 cusec or 325.5 cumec
3. Bed Slope	:	1/6,600
4. Water Depth	:	2.76 meter
5. Average Velocity	:	1.15 meter/sec
(C) Silt Ejector		
1. Location	:	about 360 meter downstream of Head
2. Maximum Discharge	:	2,500 cusec or 70 cumec
(D) Escape Channel		
1. Discharge	:	2,300 cusec or 65 cumec
2. Bed Width	:	12.6 meter
3. Water Depth	:	1.8 meter
4. Side Slope	:	1:1
5. Velocity	:	2.25 m/sec.
6. Length of Canal	:	780 meter

Table F.2 District Wise Canal Length of Sharda Canal System

Unit: km

District	Irrigation Canal			Main	Escape
	Main & Branch	Distributary	Total		
Nainital	92.91	91.42	184.33	25.52	9.94
Barielly	80.64	1,242.08	1,322.71	251.59	81.77
Pilibhit	357.62	622.71	980.33	185.59	9.54
E/Jahanpur	155.76	747.72	903.48	522.44	23.27
Lakhimpur	233.24	507.02	740.26	442.47	11.95
Bilapur	152.05	919.39	1,071.44	849.19	14.58
Hardoi	281.67	1,378.64	1,660.31	964.00	37.47
Lucknow	54.64	703.87	758.51	336.39	6.84
Unnao	115.30	1,753.22	1,868.52	698.65	44.84
Banbareli	31.80	370.16	401.96	169.18	-
Barabanki	10.00	71.05	81.05	30.40	11.97
Total	1,565.63	8,407.28	9,972.90	4,475.42	252.17

Table F.3 Design Capacities of Canal and Benefitted Districts in Sharda Canal System

Name of Branch	Design Discharg (cusec)	Design Discharg (cumec)	C.C.A. (ha)	Benefitted Districts
1. Main Canal	11,500	325.5	1,612,633	(as shown below)
2. D.B. feeder	2,450	69.3	169,781	Bareilly
3. Shahjahanpur	970	27.5	139,232	Bareilly, Shahjahanpur, Hardoi
4. Bishalpur	330	9.3	42,072	Nainital, Pilibhit
5. Nigohi	500	14.2	78,648	Pilibhit, Shahjahanpur
6. Kheri	2,650	75.0	409,014	Pilibhit, Shahjahanpur, Kheri, Sitapur, Lucknow, Barabanki
7. Hardoi	5,400	152.8	757,771	Pilibhit, Shahjahanpur, Kheri, Hardoi, Unnao, Lucknow, Rae Bareli
a) Lucknow (including Sandila)	2,200	62.3	281,443	Kheri, Hardoi, Lucknow, Rae Bareli
b) Asiwan	600	17.0	85,511	Unnao, Rae Bareli
c) Unnao	400	11.3	77,814	Unnao, Rae Bareli
d) Purwa	800	22.6	74,565	Unnao, Rae Bareli

Table F.4 Culturable Command Area, Proposed Irrigation Area And Actual Irrigation Area in Sharda Canal System

Unit : ha

Name of Branch	C.C.A	Proposed Irrigation Area					
		Kharif				Rabi	
		Paddy	Sugar-cane	Other crops	Total	Wheat	Total
1. Bisalpur	42,072	8,414	3,366	3,786	15,566	11,780	27,346
2. Nigohi	78,648	11,799	3,933	4,718	20,450	19,665	40,115
3. Hardoi	725,772	108,866	21,773	43,546	174,185	181,443	355,628
4. Kheri	323,114	48,467	16,156	19,387	84,010	74,316	158,326
5. D.B Feeder Sysytem	169,781	33,956	8,489	8,489	50,934	42,446	93,380
6. Shahjahanpur	139,232	23,669	5,570	6,961	36,200	27,847	64,047
7. Khatima channel	16,214	3,641	414	414	4,469	4,865	9,334
8. Madohotanda Channel	32,000	4,800	2,240	2,560	9,600	8,000	17,600
9. Aliganj Channel	85,800	12,870	4,290	4,290	21,450	17,160	38,610
Total	1,612,633	256,482	66,231	94,151	416,864	387,522	804,386

CROP SEASON-WISE IRRIGATION AREA

Year	Crop Season		Total
	Kharif	Rabi	
1982-83	291,386	329,200	620,586
1983-84	291,120	349,180	640,300
1984-85	312,170	317,050	629,220
1985-86	307,520	353,150	660,670
1986-87	304,627	298,530	603,157
Average	301,365	329,422	630,787

Data Source : Irrigation Department, U.P.

Table F.5 Irrigation Canals Less Functioned(1/2)

	Name of Canal	Canal Reaches	Length(m)	Name of Block Concerned
I	Hardoi Branch Canal			
	1. Sonhar Disty.	1,650 m to tail end	9,450	Madhoganj, Mallawan
	2. Kursat Disty.	12,500 m to tail end	8,200	Aurus, Miyaganj
	3. Kabirpur Disty.	9,630 m to tail end	2,270	Ganjumuradabad
II	Lucknow Branch Canal			
	1. Pihani Disty.	whole	16,950	Pihani, Hariyawan, Tadiyawan
	2. Sadat Nagar Disty.	whole	9,570	Pihani
	3. Jajupara Mr.	whole	18,490	Pihani
	4. Bandrha Mr.	whole	5,830	Pihani
	5. Raigan Mr.	whole	5,830	Pihani
	6. Abdulla Nagar Mr.	whole	7,640	Pihani
	7. Pandrwa Disty.	whole	7,270	Pihani, Hariyawan
	8. Peng Disty.	whole	14,690	Hariyawan, Tadiyawan
	9. Sihona Disty.	whole	16,600	Tadiyawan, Ahilauli
	10. Sakin Disty.	whole	14,050	Tadiyawan, Ahilauli
	11. Mandwa Mr.	whole	4,930	Pasgawan
	12. Nayagaon Mr.	whole	2,820	Pasgawan
	13. Ambari Mr.	whole	4,080	Pasgawan, Pihani
	14. Kakori Disty.	whole	30,750	Malihabad, Kakori
	15. Chilouli Mr.	whole	3,000	Kakori
	16. Khashmaura Mr.	whole	2,000	Kakori
	17. Lal Nagar Mr.	whole	2,400	Kakori
	18. Mohan Disty.	24,020 m to tail end	10,620	Sarojininagar
	19. Unch Gaon Mr.	whole	5,200	Hasanganj
	20. Ain Mr.	whole	4,800	Sarojininagar
	21. Tirwa Mr.	whole	2,600	Sarojininagar
	22. Ramdaspur Mr.	whole	3,400	Sarojininagar
	23. Saidpur Mr.	whole	3,400	Sarojininagar
	24. Chunati Mr.	whole	2,800	Sarojininagar
	25. Bhaukapur Mr.	whole	2,900	Sarojininagar
	26. Khaudedeva Mr.	whole	7,300	Sarojininagar
	27. Beti Mr.	whole	2,000	Sarojininagar
	28. Pyarepur Mr.	whole	12,200	Sarojininagar
	29. Amausi Disty.	2,605 m to tail end	6,700	Mohanlalganj
	30. Dehwa Mr.	4,830 m to tail end	3,795	Sarojininagar, Mohanlalganj
	31. Bhadesuwa Mr.	5,200 m to tail end	2,520	Mohanlalganj
	32. Manoharpur Mr.	1,000 m to tail end	1,000	Mohanlalganj
	33. Meerampur Mr.	1,180 m to tail end	1,700	Mohanlalganj
	34. Debaria Mr.	whole	800	Mohanlalganj
	35. Bhajmanmau Mr.	whole	1,800	Mohanlalganj
	36. Akbarpur Mr.	whole	1,500	Mohanlalganj
	37. Gehru Mr.	9,850 m to tail end	9,800	Sarojininagar
	38. Banthra Khera Mr.	whole	4,260	Sarojininagar
	39. Sakoorpur Mr.	2,500 m to tail end	500	Sarojininagar
	40. Gosainganj Disty.	7,230 m to tail end	3,650	Sarojininagar, Gosainganj
	41. Ahmamau Mr.	1,840 m to tail end	1,840	Sarojininagar
	42. Sithauli Disty.	7,080 m to tail end	2,520	Gosainganj
	43. Datikar Mr.	whole	2,000	Gosainganj
	44. Bakkas Mr.	whole	4,500	Gosainganj
	45. Nigohi Disty.	whole	12,500	Mohanlalganj
	46. Sirsa Mr.	whole	5,450	Mohanlalganj, Hariyawan

Table F.5 Irrigation Canals Less Functioned(2/2)

Name of Canal	Canal Reaches	Length(m)	Name of Block Concerned
47. Katauli Mr.	whole	3,000	Kakori
48. Karora Mr.	whole	4,200	Mohanlalganj, Gosainganj
49. Keoli Mr.	whole	4,040	Mohanlalganj, Gosainganj
50. Nagram Disty	whole	4,690	Mohanlalganj
III Asiwan Branch Canal			
1. Maurawan Disty.	65,110 m to tail end	3,090	Sataon
2. Lakhanpura Mr.	Whole	11,200	Hilauli, Nawabganj
3. Narichak Disty.	Whole	19,000	Hilauli, Sataon
4. Kunsa Mr.	Whole	3,200	Hilauli
5. Bankat Mr.	Whole	7,700	Hilauli, Sataon
6. Bhitargaon Mr.	Whole	2,000	Hilauli
7. Unai Mr.	Whole	3,200	Sataon
8. Bandar Mr.	Whole	3,000	Sataon
9. Sataon Mr.	Whole	2,000	Sataon
10. Korihar Mr.	Whole	3,000	Sataon
11. Hajipur Mr.	Whole	2,000	Sataon
IV Purwa Branch Canal			
1. Taura Disty.	6,780 m to tail end	8,820	Asoha
2. Ratausia Disty.	6,660 m to tail end	7,560	Purwa, Asoha
3. Purwa Disty.	5,040 m to tail end	19,820	Kheero, Purwa
4. Raipur Disty.	9,130 m to tail end	1,770	Bichhiya
V Unnao Branch Canal			
1. Moghalpur Mr.	3,140 m to tail end	1,260	Sikhandarpur Khan
2. Pandri Disty.	7,590 m to tail end	7,810	Bichhiya, Purwa
3. Sipatpur Mr.	8,830 m to tail end	2,520	Purwa
4. Patan Disty.	11,070 m to tail end	10,330	Bighapur
Total		446,085	

Source : Irrigation Department, U.P.

Table. F.6 Irrigation Canal Condition by Block

Si. No.	Name of Block	Name of District	(A) Canal Length(km)	(B) Less Functioned Canal(km)	(C)=(B/A) Ratio (%)
1.	Puranpur	Pilibhit	214.50	0.00	0.00
2.	Banda	Shahajhanpur	9.10	0.00	0.00
3.	Puwayan	Shahajhanpur	5.94	0.00	0.00
4.	Sindhauli	Shahajhanpur	105.22	0.00	0.00
5.	Bhawalkhera	Shahajhanpur	85.25	0.00	0.00
6.	Pasgawan	Kheri	71.25	9.23	12.95
7.	Pihani	Hardoi	105.00	55.56	52.91
8.	Todarpur	Hardoi	96.00	0.00	0.00
9.	Shahabad	Hardoi	10.00	0.00	0.00
10.	Hariyawan	Hardoi	71.00	17.62	24.82
11.	Tadiyawan	Hardoi	94.00	40.64	43.23
12.	Bawan	Hardoi	81.00	0.00	0.00
13.	Sandi	Hardoi	5.00	0.00	0.00
14.	Ahirauri	Hardoi	113.00	8.45	7.48
15.	Sursa	Hardoi	145.21	0.00	0.00
16.	Bilgram	Hardoi	47.60	0.00	0.00
17.	Kothawan	Hardoi	82.00	0.00	0.00
18.	Kachhona	Hardoi	93.00	0.00	0.00
19.	Madhoganj	Hardoi	72.52	7.85	10.82
20.	Malawan	Hardoi	35.83	1.60	4.47
21.	Sandila	Hardoi	111.70	0.00	0.00
22.	Behdar	Hardoi	110.30	0.00	0.00
23.	Bharawan	Hardoi	108.00	0.00	0.00
24.	Mal	Lucknow	83.00	0.00	0.00
25.	Malihabad	Lucknow	78.34	2.40	3.06
26.	Kakori	Lucknow	89.92	38.75	43.09
27.	Sarojini Nagar	Lucknow	169.88	70.74	41.64
28.	Mohanlalganj	Lucknow	138.05	42.78	30.98
29.	Gosaiganj	Lucknow	27.15	15.52	57.17
30.	Auras	Unnao	143.66	6.30	4.39
31.	Ganjmuradabad	Unnao	93.74	2.27	2.42
32.	Bangarmau	Unnao	56.10	0.00	0.00
33.	Fatehpur Chaurasi	Unnao	53.00	0.00	0.00
34.	Hasanganj	Unnao	226.23	5.20	2.30
35.	Mayaganj	Unnao	191.35	1.90	0.99
36.	Safirpur	Unnao	70.60	0.00	0.00
37.	Nawabganj	Unnao	169.10	4.00	2.37
38.	Bichhiya	Unnao	204.00	2.38	1.17
39.	Sikandarpur Sirosi	Unnao	59.90	0.00	0.00
40.	Sikandarpur Khan	Unnao	51.10	1.26	2.47
41.	Asoha	Unnao	118.88	10.16	8.55
42.	Purwa	Unnao	149.47	32.88	22.00
43.	Hilauli	Unnao	79.12	29.20	36.91
44.	Bighapur	Unnao	112.11	10.33	9.21
45.	Sumerpur	Unnao	97.16	0.00	0.00
46.	Sataon	Raebareli	46.66	26.19	56.14
47.	Kheero	Raebareli	111.43	2.88	2.58
48.	Lalganj	Raebareli	85.87	0.00	0.00
49.	Sareni	Raebareli	84.73	0.00	0.00
50.	Dalmau	Raebareli	63.60	0.00	0.00
Total/Average			4,726.56	446.08	9.44

Source : Irrigation Department, U.P.

Table F.7 Irrigated Area of Related Districts in Sharda Command

Name of District	Geographical Area(ha) (1)	Net Irriga-ted Area(ha) (2)	Gross Irriga-ted Area(ha) (3)	Gross Sown Area(ha) (4)	Percentage(%) (2)/(1) (5)
NAINITAL	68,522	40,735	58,755	90,072	59.4
PILIBHIT	309,372	146,474	275,820	339,238	47.3
BAREILLY	260,465	191,633	98,029	289,662	73.6
SHAHJAHANPUR	396,539	370,828	334,751	269,508	93.5
KHERI	364,632	188,232	245,720	373,607	51.6
HARDOI	598,817	243,403	299,971	511,233	40.6
BARABANKI	30,074	12,650	17,805	23,300	42.1
SITAPUR	567,154	159,081	191,732	514,330	28.0
LUCKNOW	215,841	131,092	38,290	149,662	60.7
UNNAO	458,519	203,917	246,080	405,495	44.5
RAEBARELI	149,762	91,533	25,565	116,997	61.1
TOTAL	3,419,697	1,779,578	1,832,518	3,083,104	52.0

Source : Statistic Diary 1988 & 89, U.P.

Table F.8 Irrigation Ratio in Related Blocks in Hardoi Branch Command

(1984-89 Average)

Sl. No.	Name of Block	Name of District	Irrigation Ratio			Irrigation Rate by Governemnt Canal
			Proposed Irrigation Area(ha)	Actual Irrigation Area(ha)	Irrigation Rate (%)	Percentage (%)
1.	Puranpur	Pilibhit	17,600	7,740	44.0	15.9
2.	Banda	Shahajhanpur	902	1,034	114.6	4.7
3.	Puwayan	Shahajhanpur	574	874	152.1	4.7
4.	Sindhauli	Shahajhanpur	10,610	14,140	133.3	34.6
5.	Bhawalkhera	Shahajhanpur	8,077	6,971	86.3	41.7
6.	Pasgawan	Kheri	6,568	7,819	119.0	25.3
7.	Pihani	Hardoi	9,894	10,360	104.7	38.8
8.	Todarpur	Hardoi	8,064	9,741	120.8	29.2
9.	Shahabad	Hardoi	1,129	1,544	136.8	11.6
10.	Hariyawan	Hardoi	7,494	8,002	106.8	53.3
11.	Tadiyawan	Hardoi	8,964	7,506	83.7	41.6
12.	Bawan	Hardoi	7,148	6,681	93.5	31.2
13.	Sandi	Hardoi	736	302	41.0	1.8
14.	Ahirauri	Hardoi	10,305	7,119	69.1	42.3
15.	Sursa	Hardoi	12,172	8,212	67.5	37.8
16.	Bilgram	Hardoi	6,559	2,349	35.8	30.7
17.	Kothawan	Hardoi	8,264	5,740	69.5	48.3
18.	Kachhona	Hardoi	9,612	4,028	41.9	47.3
19.	Madhoganj	Hardoi	5,395	3,294	61.1	23.7
20.	Malawan	Hardoi	2,814	2,592	92.1	49.7
21.	Sandila	Hardoi	9,520	8,491	89.2	42.1
22.	Behdar	Hardoi	6,422	5,819	90.6	47.1
23.	Bharawan	Hardoi	7,764	6,911	89.0	24.6
24.	Mal	Lucknow	7,673	4,720	61.5	39.5
25.	Malihabad	Lucknow	6,315	5,521	87.4	41.6
26.	Kakori	Lucknow	6,415	6,111	95.3	41.8
27.	Sarojini Nagar	Lucknow	11,839	6,040	51.0	47.9
28.	Mohanlalganj	Lucknow	10,626	4,871	45.8	55.0
29.	Gosaiganj	Lucknow	2,133	787	36.9	73.5
30.	Auras	Unnao	7,045	10,410	147.8	75.7
31.	Ganjmuradabad	Unnao	7,072	3,698	52.3	38.0
32.	Bangarmau	Unnao	4,798	3,458	72.1	38.8
33.	Fatehpur Chaurasi	Unnao	4,014	4,901	122.1	34.4
34.	Hasanganj	Unnao	11,306	10,503	92.9	74.2
35.	Mayaganj	Unnao	9,962	9,151	91.9	69.8
36.	Safirpur	Unnao	5,273	5,476	103.8	52.2
37.	Nawabganj	Unnao	8,584	6,311	73.5	50.5
38.	Bichhiya	Unnao	12,701	14,250	112.2	85.2
39.	Sikandarpur Sirosi	Unnao	4,229	3,847	91.0	30.0
40.	Sikandarpur Khan	Unnao	4,465	2,731	61.2	35.9
41.	Asoha	Unnao	8,129	5,491	67.5	60.9
42.	Purwa	Unnao	9,012	8,960	99.4	75.7
43.	Hilauli	Unnao	9,245	2,527	27.3	33.0
44.	Bighapur	Unnao	9,024	6,994	77.5	68.4
45.	Sumerpur	Unnao	5,135	7,346	143.1	49.2
46.	Sataon	Raebareli	3,970	680	17.1	29.6
47.	Kheero	Raebareli	7,896	4,758	60.3	37.4
48.	Lalganj	Raebareli	5,993	4,126	68.8	22.3
49.	Sareni	Raebareli	7,797	2,415	31.0	33.3
50.	Dalmau	Raebareli	1,817	1,554	85.5	69.8
Total/Average			359,055	284,906	79.3	41.8

Source : Irrigation Department, U.P.

Table F.9 Irrigation Area of Hardoi Branch Command for Past 5 Years (1/2)

Canal Name	C.C.A. (ha)	Proposed Irrigaion Area(ha)			1985-1986			1986-1987			1987-1988		
		Kharif	Rabi	Total	Kharif	Rabi	Total	Kharif	Rabi	Total	Kharif	Rabi	Total
HARDOI BRANCH CANAL													
0 Miles to 23 Miles	34,173	10,252	8,543	18,795	3,202	4,012	7,214	4,120	3,240	7,360	4,047	3,509	7,556
23 Miles to 53 Miles	54,704	13,129	13,675	26,804	16,572	11,959	28,531	18,967	15,893	34,860	12,100	8,635	20,735
53 Miles to 99 Miles	78,681	18,884	19,670	38,554	14,684	18,256	32,940	16,867	18,408	35,275	13,225	17,949	31,174
99 Miles to Tail	70,881	17,012	17,720	34,732	11,089	14,571	25,660	12,477	16,080	28,557	9,350	15,567	24,917
TOTAL	238,439	59,277	59,608	118,885	45,547	48,798	94,345	52,431	53,621	106,052	38,722	45,660	84,382
LUCKNOW BRANCH CANAL													
0 Miles to 72 Miles	112,201	26,928	28,050	54,978	19,623	27,475	47,098	19,623	27,475	47,098	15,856	24,881	40,737
72 Miles to Tail	97,570	23,418	24,392	47,810	17,640	20,805	38,445	19,329	19,171	38,500	12,223	18,603	30,826
TOTAL	209,771	50,346	52,442	102,788	37,263	48,280	85,543	38,952	46,646	85,598	28,079	43,484	71,563
SANDILA BRANCH													
0 Miles to Tail	71,672	17,201	17,918	35,119	8,498	18,015	26,513	9,458	18,049	27,507	7,893	16,320	24,213
ASHIVAN BRANCH CANAL													
0 Miles to Tail	85,511	20,542	21,378	41,920	12,656	17,236	29,892	13,789	16,788	30,577	8,245	16,295	24,540
PURWA BARNCH CANAL													
0 Miles to 30 Miles	41,927	10,062	10,482	20,544	10,988	9,940	20,928	10,604	10,529	21,133	6,809	10,687	17,496
30 Miles to Tail	32,638	7,832	8,161	15,993	7,491	9,628	17,119	7,275	7,791	15,066	3,539	6,322	9,861
TOTAL	74,565	17,894	18,643	36,537	18,479	19,568	38,047	17,879	18,320	36,199	10,348	17,009	27,357
UNNAO BRANCH CANAL													
0 Miles to 33 Miles	46,349	11,124	11,587	22,711	8,597	10,611	19,208	9,333	9,625	18,958	4,522	10,547	15,069
33 Miles to Tail	31,465	7,533	7,866	15,399	3,700	4,908	8,608	4,196	5,336	9,532	1,863	4,164	6,027
TOTAL	77,814	18,657	19,453	38,110	12,297	15,519	27,816	13,529	14,961	28,490	6,385	14,711	21,096
GRAND TOTAL	757,772	183,917	189,442	373,359	134,740	167,416	302,156	146,038	168,385	314,423	99,672	153,479	253,151

Table F.9 Irrigation Area of Hardoi Branch Command for Past 5 Years (2/2)

Canal Name	C.C.A. (ha)	1988-1989			1989-1990			AVERAGE		
		Kharif	Rabi	Total	Kharif	Rabi	Total	Kharif	Rabi	Total
HARDOI BRANCH CANAL										
0 Miles to 23 Miles	34,173	4,208	4,020	8,228	4,423	3,920	8,343	4,000	3,740	7,740
23 Miles to 53 Miles	54,704	10,350	18,962	29,312	12,104	7,753	19,857	14,019	12,640	26,659
53 Miles to 99 Miles	78,681	17,958	18,987	36,945	15,687	17,758	33,445	15,684	18,272	33,956
99 Miles to Tail	70,881	12,929	15,978	28,907	11,358	14,782	26,140	11,441	15,396	26,836
TOTAL	238,439	45,445	57,947	103,392	43,572	44,213	87,785	45,143	50,048	95,191
LUCKNOW BRANCH CANAL										
0 Miles to 72 Miles	112,201	20,815	27,068	47,883	18,917	26,257	45,174	18,967	26,631	45,598
72 Miles to Tail	97,570	20,901	18,713	39,614	16,496	18,509	35,005	17,318	19,160	36,478
TOTAL	209,771	41,716	45,781	87,497	35,413	44,766	80,179	36,285	45,791	82,076
SANDILA BRANCH										
0 Miles to Tail	71,672	9,889	18,074	27,963	8,444	18,103	26,547	8,836	17,712	26,549
ASHIVAN BRANCH CANAL										
0 Miles to Tail	85,511	14,156	15,942	30,098	9,951	16,667	26,618	11,759	16,586	28,345
PURWA BARNCH CANAL										
0 Miles to 30 Miles	41,927	11,534	9,863	21,397	8,803	9,942	18,745	9,748	10,192	19,940
30 Miles to Tail	32,638	6,507	8,287	14,794	4,618	8,308	12,926	5,886	8,067	13,953
TOTAL	74,565	18,041	18,150	36,191	13,421	18,250	31,671	15,634	18,259	33,893
UNNAO BRANCH CANAL										
0 Miles to 33 Miles	46,349	9,363	10,627	19,990	6,460	9,341	15,801	7,655	10,150	17,805
33 Miles to Tail	31,465	4,432	5,158	9,590	2,817	4,073	6,890	3,402	4,728	8,129
TOTAL	77,814	13,795	15,785	29,580	9,277	13,414	22,691	11,057	14,878	25,935
GRAND TOTAL	757,772	143,042	171,679	314,721	120,078	155,413	275,491	128,714	163,274	291,988

Data Source :
Irrigation Department,
U.P.

Table F.10 Unit Water Supply Depth at Respective Sections of Hardoi Branch System (1/2) : Kharif Cropping Season

Canal Name	C.C.A. (ha)	Kharif P.I.A. (ha)	1986-Kharif				1987-Kharif				1988-Kharif				1989-Kharif			
			Supplied	Actual Irrigation		Unit Water	Supplied	Actual Irrigation		Unit Water	Supplied	Actual Irrigation		Unit Water	Supplied	Actual Irrigation		Unit Water
			Volume (10^6 m3)	Area (ha)	Ratio (%)	Depth (m/ha)	Volume (10^6 m3)	Area (ha)	Ratio (%)	Depth (m/ha)	Volume (10^6 m3)	Area (ha)	Ratio (%)	Depth (m/ha)	Volume (10^6 m3)	Area (ha)	Ratio (%)	Depth (m/ha)
SHARDA RIVER			16,611				11,553				17,057				12,581			
SHARDE MAIN CANAL			4,399				4,597				4,545				4,170			
HARDOI BRANCH CANAL																		
at Head	757,772	183,917	2,242	146,038	79	1.54	2,366	99,672	54	2.37	2,444	143,042	78	1.71	2,168	120,078	65	1.81
at 23 Miles	723,599	173,665	1,893	141,918	82	1.33	2,154	95,625	55	2.25	2,121	138,834	80	1.53	2,004	115,655	67	1.73
at 53 Miles	668,895	160,536	1,682	122,951	77	1.37	1,803	83,525	52	2.16	1,734	128,484	80	1.35	1,565	103,551	65	1.51
Lucknow Branch Canal (55 Miles)																		
at 99 Miles	308,771	74,105	664	57,674	78	1.15	639	34,328	46	1.86	646	58,921	80	1.10	656	44,007	59	1.49
Asiwan Branch Canal																		
at Tail	152,379	36,551	252	31,408	86	0.80	250	16,733	46	1.49	284	31,836	87	0.89	272	22,698	62	1.20
Purwa & Unnao Branch Canal																		
LUCKNOW BRANCH CANAL																		
at Head	281,443	67,547	724	48,410	72	1.50	779	35,972	53	2.17	746	51,605	76	1.45	674	43,857	65	1.54
Sandila Branch Canal(50 Miles)																		
at 72 Miles	97,570	23,418	301	19,329	83	1.56	221	12,223	52	1.81	270	20,901	89	1.29	231	16,496	70	1.40
SANDILA BRANCH CANAL																		
at Head	71,672	17,201	156	9,458	55	1.65	165	7,893	46	2.09	152	9,889	57	1.54	141	8,444	49	1.67
ASIWAN BRANCH CANAL																		
at Head	85,511	20,542	129	13,789	67	0.94	119	8,245	40	1.44	141	14,156	69	1.00	114	9,951	48	1.15
PURWA BARNCH CANAL																		
at Head	74,565	17,894	153	17,879	100	0.86	153	10,348	58	1.48	190	18,041	101	1.05	177	13,421	75	1.32
at 30 Miles	32,638	7,832	78	7,275	93	1.07	80	3,539	45	2.26	96	6,507	83	1.48	92	4,618	59	1.99
UNNAO BRANCH CANAL																		
at Head	77,814	18,657	99	13,529	73	0.73	97	6,385	34	1.52	94	13,795	74	0.68	95	9,277	50	1.02
at 33 Miles	31,465	7,533	25	4,196	56	0.60	19	1,863	25	1.02	12	4,432	59	0.27	10	2,817	37	0.35

Data Source : Irrigation Department, UP

Table F.10 Unit Water Supply Depth at Respective Sections of Hardoi Branch System (2/2) : Rabi Cropping Season

Canal Name	C.C.A. (ha)	Rabi P.I.A. (ha)	1986/87 Rabi				1987/88-Rabi				1988/89-Rabi				1989/90-Rabi			
			Supplied Volume (10^6 m3)	Actual Irrigation Area (ha)	Ratio (%)	Unit Water Depth (m/ha)	Supplied Volume (10^6 m3)	Actual Irrigation Area (ha)	Ratio (%)	Unit Water Depth (m/ha)	Supplied Volume (10^6 m3)	Actual Irrigation Area (ha)	Ratio (%)	Unit Water Depth (m/ha)	Supplied Volume (10^6 m3)	Actual Irrigation Area (ha)	Ratio (%)	Unit Water Depth (m/ha)
SHARDA RIVER			3,537				2,663				3,242				3,316			
SHARDE MAIN CANAL			3,358				2,599				3,021				3,031			
HARDOI BRANCH CANAL																		
at Head	757,772	189,442	1,673	168,385	89	0.99	1,488	153,479	81	0.97	1,582	171,679	91	0.92	1,580	155,413	82	1.02
at 23 Miles	723,599	180,899	1,466	165,145	91	0.89	1,249	149,970	83	0.83	1,475	167,659	93	0.88	1,528	151,493	84	1.01
at 53 Miles	668,895	167,224	1,328	149,252	89	0.89	1,026	141,335	85	0.73	1,175	148,697	89	0.79	1,209	143,740	86	0.84
Lucknow Branch Canal (55 Miles)																		
at 99 Miles	308,771	77,194	548	66,149	86	0.83	399	63,582	82	0.63	469	65,855	85	0.71	*	66,089	86	
Asiwan Branch Canal																		
at Tail	152,379	38,096	272	33,281	87	0.82	195	31,720	83	0.61	259	33,935	89	0.76	250	31,664	83	0.79
Purwa & Unnao Branch Canal																		
LUCKNOW BRANCH CANAL																		
at Head	281,443	70,360	529	64,695	92	0.82	420	59,804	85	0.70	464	63,855	91	0.73	522	62,869	89	0.83
Sandila Branch Canal(50 Miles)																		
at 72 Miles	97,570	24,392	170	19,171	79	0.89	131	18,603	76	0.70	185	18,713	77	0.99	190	18,509	76	1.03
SANDILA BRANCH CANAL																		
at Head	71,672	17,918	110	18,049	101	0.61	83	16,320	91	0.51	116	18,074	101	0.64	128	18,103	101	0.71
ASIWAN BRANCH CANAL																		
at Head	85,511	21,378	109	16,788	79	0.65	71	16,295	76	0.44	82	15,942	75	0.51	131	16,667	78	0.79
PURWA BARNCH CANAL																		
at Head	74,565	18,643	164	18,320	98	0.90	125	17,009	91	0.73	167	18,150	97	0.92	152	18,250	98	0.83
at 30 Miles	32,638	8,161	87	7,791	95	1.12	71	6,322	77	1.12	100	8,287	102	1.21	69	8,308	102	0.83
UNNAO BRANCH CANAL																		
at Head	77,814	19,453	108	14,961	77	0.72	70	14,711	76	0.48	92	15,785	81	0.58	98	13,414	69	0.73
at 33 Miles	31,465	7,866	37	5,336	68	0.69	11	4,164	53	0.26	15	5,158	66	0.29	17	4,073	52	0.42

Remarks : * Accurate data is not available.

Data Source : Irrigation Department, UP

Table F.11 Estimate of Conveyance Efficiency of Hardoi Branch

Description	Unit	1986	1987	1988	1989	Average
KHARIF CROPPING						
1.Actual Supply Volume						
1a. Hardoi at head	MCM	2,242	2,366	2,444	2,168	2,305
1b. Sum of S.V.of 4 Branches	MCM	1,105	1,148	1,171	1,060	1,121
2.Actual irri.area						
2a. Hardoi at head	ha	146,038	99,672	143,042	120,078	127,208
2b. Sum of A.I.A.of 4 Branches	ha	93,607	60,950	97,597	76,506	82,165
2c. Area directly supplied from Hardoi Branch,A1 (2a-2b)	ha	52,431	38,722	45,445	43,572	45,043
3.Water losses and water use by A1, (1a-1b)	MCM	1,137	1,218	1,273	1,108	1,184
4.Water use by A1						
4a. Unit water use *	m	0.84	1.48	0.91	1.16	1.10
4b. Water use by A1 (2c x 4a)	MCM	441	573	414	507	495
5.Estimated water loss (3-4b)	MCM	696	645	859	601	689
6.Conveyance loss (6/1a)x100	%	31	27	35	28	30
RABI CROPPING						
1.Actual Supply Volume						
1a. Hardoi at head	MCM	1,673	1,488	1,582	1,580	1,581
1b. Sum of S.V.of 4 Branches	MCM	910	686	805	903	826
2.Actual irri.area						
2a. Hardoi at head	ha	168,385	153,479	171,679	155,413	162,239
2b. Sum of A.I.A.of 4 Branches	ha	114,764	107,819	113,732	111,200	111,879
2c. Area directly supplied from Hardoi Branch,A1 (2a-2b)	ha	53,621	45,660	57,947	44,213	50,360
3.Water losses and water use by A1, (1a-1b)	MCM	763	802	777	677	755
4.Water use by A1						
4a. Unit water use _1	m	0.76	0.55	0.67	0.78	0.69
4b. Water use by A1 (2c x 4a)	MCM	405	251	390	346	348
5.Estimated water loss (3-4b)	MCM	358	551	387	331	407
6.Conveyance loss (6/1a)x100	%	21	37	24	21	26

Note : A.I.A. : Actual Irrigation Area
S.V. : Supply Volume
_1 : Average unit water use of 3 command areas of Asiwan, Purwa, and Unnao Branch

Table F.12 General Features of Irrigation Canal System in Sarojini Nagar Area

	Canal Name	Canal Length (km)	Nos. of Outlet (Nos.)	C.C.A. (ha)	Design Discharge (cusec)	Proposed Irrigation Area(ha)		Structures							
						Kharif	Rabi	Regula-tor	Fall	Bridge			Turnout	Syphon	Others
										D.R.B	V.R.B	Foot Path			
LUCKNOW BRANCH CANAL															
1	Amausi Disty.	34.8	142	4,827	125.0	1,158	1,207	0	1	0	25	0	12	2	9
2	Gehru Disty.	19.95	72	3,357	39.5	806	839	0	1	1	33	0	5	0	10
3	Banthra Mr.	4.26	17	409	3.6	98	102	0	0	0	0	0	0	0	0
4	Rahimabad Mr.	4.2	17	437	3.0	105	109	0	1	3	0	0	1	0	3
5	Sahadat Khera Mr.	1.8	7	212	1.5	51	53	0	0	1	1	1	0	0	0
6	Khotara Mr.	2.94	8	402	7.0	96	101	0	0	0	1	0	1	0	1
7	Bakauli Mr.	1.175	4	290	1.5	70	73	0	0	0	1	0	0	0	0
8	Mati Mr.	4.2	13	525	7.0	126	131	0	1	0	2	1	2	1	0
9	Raisingh Khera Mr.	0.8	3	151	2.0	36	38	0	0	0	1	0	0	0	0
10	Alinagar Mr.	3.8	14	338	3.5	81	85	0	0	0	4	0	0	0	0
11	Bhadswa Mr.	7.7	32	886	8.0	213	222	0	0	1	6	0	0	1	2
12	Rani Khera Mr.	3.4	13	505	3.3	121	126	0	0	0	0	0	0	0	0
13	Dehwa Mr.	6.4	26	962	7.0	231	241	0	0	2	3	0	0	0	0
14	Govindpur Mr.	3.2	15	373	9.0	90	93	0	0	0	0	0	0	0	0
15	Bhasinda Mr.	0.8	5	138	2.0	33	35	0	0	0	0	1	0	1	1
16	Gautam Khera Mr.	1.2	7	169	1.3	41	42	0	1	0	2	0	0	0	0
17	Manoharpur Mr.	2	10	151	3.0	36	38	0	0	1	5	0	1	0	0
18	Meerampur Mr.	2.8	12	317	2.0	76	79	0	0	0	5	0	0	0	1
19	Davalia Mr.	0.8	2	26	1.0	6	7	0	1	0	2	0	0	0	0
20	Bhajmanmau Mr.	1.8	11	248	1.8	60	62	0	0	0	2	0	0	0	0
21	Akbarpur Mr.	1.5	4	139	1.6	33	35	0	0	0	1	0	0	0	0
	TOTAL	109.5	434	14,862		3,567	3,716	0	6	9	94	3	22	5	27

Source : Divisional Office II, Circle VI, Irrigation Department, U.P.
Longitudinal profile and kulaba-wise data are referred to.

TableF.13 General Features of Irrigation Canal System in Sataon Area

Canal Name	Canal Length (km)	Nos. of Outlet (Nos.)	C.C.A. (ha)	Design Discharge (cusec)	Proposed Irrigation Area(ha)		Structures							
					Kharif	Rabi	Regula-tor	Fall	Bridge D.R.B	Bridge V.R.B	Bridge Foot Path	Turnout	Cross Drain	Others
ASIWAN BRANCH CANAL														
1. Maurawan Disty. *1	28.60	82	5,655	34.00	1,357	1,414	0	2	3	6	0	6	0	0
2. Narichak Disty.	19.00	41	3,102	17.00	744	776	0	2	1	12	0	0	0	0
3. Kunsa Mr.	1.00	- *2	240	3.00	58	60	0	0	0	0	0	0	0	0
4. Lotna Mr.	0.50	- *2	150	5.00	36	38	0	0	0	0	0	0	0	0
5. Bankat Mr.	2.50	21	805	4.00	193	201	0	0	1	2	1	0	0	0
6. Bhatargaon Mr.	2.20	8	612	4.00	147	153	0	0	0	0	0	0	0	0
7. Unai Mr.	3.20	16	583	5.00	140	146	0	0	2	2	1	0	0	0
8. Bardar Mr.	3.50	7	229	5.00	55	57	0	0	0	0	0	0	0	0
9. Sataon Mr.	2.00	11	608	5.00	146	152	0	2	0	2	0	0	0	0
10. Korihar Mr.	3.00	12	487	5.00	117	122	0	1	1	1	0	0	0	0
11. Hajipur Mr.	2.00	14	403		97	101	0	0	0	4	0	0	0	0
TOTAL	67.50	212	12,874		3,090	3,219	0	7	8	29	2	6	0	0

Source : Irrigation Division Unnao, Cirvle VI, Irrigation Department, U.P.
Longitudinal profile and kulaba-wise data are referred to.

Remarks : 1* : Data of the Maurawan Disty is below M.28-0-600.
2* : No Kulabas are provided due to newly constructed canals.

Table F.14 General Features of Irrigation Canal System in Sursa Area

	Canal Name	Canal Length (km)	Nos. of Outlet (Nos.)	C.C.A. (ha)	Design Discharge (cusec)	Proposed Irrigation Area(ha)		Structures							
						Kharif	Rabi	Regula-tor	Fall	Bridge			Turnout	Cross Drain	Others
										D.R.B	V.R.B	Foot Path			
HARDOI BRANCH CANAL															
1	Bhadaicha Disty.	34.78	116	7,135	124.00	1,712	1,784	1	3	2	18	2	6	0	3
2	Kamrauli Mr.	7.84	29	1,225	8.56	294	306	0	1	0	4	0	0	1	2
3	Sikandarpur Mr.	8.34	30	1,825	12.70	438	456	0	0	0	5	0	0	1	1
4	Isauli Mr.	3.82	13	261	3.00	63	65	0	1	0	2	0	0	0	1
5	Sursa Mr.	7.8	24	1,123	9.00	270	281	0	4	0	5	1	1	0	0
6	Udra Mr.	2.76	4	195	2.40	47	49	0	3	0	1	0	0	0	0
7	Barha Mr.	5.49	17	1,194	7.75	287	299	0	0	0	6	0	0	2	0
8	Khajurahra Mr.	10.2	29	1,435	15.00	344	359	0	3	0	6	0	1	0	3
9	Tikari Mr.	3.52	20	755	5.50	181	189	0	0	0	2	0	0	0	0
10	Pachkohra Mr.	2.41	9	523	2.52	126	131	0	0	1	1	0	0	0	2
11	Marsa Disty.	7.5	20	1,085	12.40	260	271	0	0	0	5	0	0	3	0
12	Salkupur Mr.	3.4	7	350	2.70	84	88	0	0	0	4	0	0	0	0
13	Sauntera\Mr.	1.8	5	207	1.60	50	52	0	0	0	3	0	0	1	0
	TOTAL	99.66	323	17,313		4,155	4,328	1	15	3	62	3	8	8	12

Source : Sharda Canal Hardoi Division, Circel VI, Irrigation Department, U.P.
Longitudinal profile and kulaba-wise data are referred to.

Table F.15 General Features of Irrigation Canal System in Purwa Area

Canal Name	Canal Length (km)	Nos. of Outlet (Nos.)	C.C.A. (ha)	Design Discharge (cusec)	Proposed Irrigation Area(ha)		Structures							
					Kharif	Rabi	Regulator	Fall	Bridge			Turnout	Cross Drain	Others
									D.R.B	V.R.B	Foot Path			
PURWA BRANCH CANAL														
1. Purwa Disty.	22.87	72	3,145	57.00	755	786	1	2	0	14	1	5	6	1
2. Bhopatpur Mr.	1.70	8	398	3.44	96	100	0	0	0	1	1	0	1	0
3. Bhadnang Mr.	2.33	8	310	4.20	74	78	0	0	0	3	0	0	0	0
4. Bangaon Mr.	7.26	29	803	6.40	193	201	0	0	0	2	1	0	7	2
5. Badi Khera Mr.	2.60	8	204	1.80	49	51	0	0	0	2	0	0	0	0
6. Tupra Mr.	1.80	8	203	1.90	49	51	0	0	0	4	0	0	0	0
7. Pinjra Mr.	1.60	8	239	1.25	57	60	0	0	1	1	0	0	0	0
8. Chimyani Mr.	8.60	29	1,602	7.00	384	400	0	0	0	0	0	0	0	0
9. Simremau Mr.	4.52	20	584	3.40	140	146	0	2	0	0	0	0	3	1
10. Tikar Disty.	12.40	43	1,976	15.75	474	494	0	1	0	7	2	1	1	0
11. Ahamdabad Mr.	1.63	8	378	2.50	91	94	0	0	0	2	0	0	0	0
12. Panhan Mr.	6.58	21	1,376	6.56	330	344	0	0	0	5	3	0	1	1
13. Tiwaria Mr.	3.23	10	527	3.40	126	132	0	1	0	0	0	0	2	0
14. Pakra Mr.	4.26	18	509	5.00	122	127	0	1	0	3	0	0	0	0
TOTAL	81.38	290	12,252		2,941	3,063	1	7	1	44	8	6	21	5

Source : Sharda Canal Unnao Division, Circle VI, Irrigation Department, U.P.
Longitudinal profile and kulaba-wise data are referred to.

TableF.16 General Features of Lift Irrigation Schemes along the Sai River

Sl. No.	Name of Pump Canal	Discharge of Pump (cusec)	Power (H.P.)	Designed Discharge (cusec)	Actual Irrigation Area 89/90 Rabi (ha)	Actual Irrigation Area 90 Kharif (ha)	Actual Discharge 89/90 Rabi (cusec hr)	Actual Discharge 90 Kharif (cusec hr)	Actual Volume per ha 89/90 Rabi (cusec hr/ha)	Actual Volume per ha 90 Kharif (cusec hr/ha)	Remarks
LUCKNOW DISTRICT											
1	Latif Nagar	1 x 5	1 x 45	5	72	65	9,020	7,310	125	112	
2	Kallan Khera	1 x 2.5	1 x 20	3	35	35	3,050	3,093	87	88	
3	Barauliya	1 x 3	1 x 75	13	4	30	282	2,652	71	88	
4	Shekhpur	2 x 2.5	2 x 20	5	61	26	4,025	2,163	66	83	
5	Nibahari	1 x 5	1 x 45	5	59	35	6,725	4,805	114	137	
6	Bani North	2 x 5	2 x 45	13	142	118	11,948	9,113	84	77	
		1 x 2.5	1 x 20								
7	Bani South	2 x 2.5	2 x 20	5	23	25	2,113	2,863	92	115	
8	Sandana	2 x 2.5	2 x 20	10	51	53	4,805	5,495	94	104	
RAE BARELI DISTRICT											
9	Chastaur	1 x 5	1 x 40	5	81	28	3,290	780	41	28	
10	Sohaliya	1 x 10	1 x 70	10	78	71	13,620	12,730	175	179	
11	Chauhania	1 x 10	1 x 70	10	58	121	5,150	9,430	89	78	
12	Dariba	1 x 5	1 x 40	15	96	67	13,570	10,400	141	155	
		1 x 10	1 x 90								
13	Akbarpur	1 x 5	1 x 40	5	55	75	6,030	7,375	110	98	
14	Raghunathpur	1 x 5	1 x 40	5	51	26	5,710	2,880	112	111	
15	Jijouliya	1 x 10	1 x 100	10	101	105	12,160	8,400	120	80	
		2 x 2.5	2 x 2.5								
16	Phagupur	1 x 10	1 x 100	10	87	115	5,980	8,490	69	74	
	Total:			85	681	686	53,900	44,729	79	65	

Source : Minor Lift Canal Division, Irrigation Department, U.P.

Table F.17 Actual Irrigation Area in Sarojini Nagar Area

(Unit : ha)

Canal Name	C.C.A.	Kharif Cropping									Rabi Cropping							
		P.I.A.	85	86	87	88	89	90	Average		P.I.A.	85-86	86-87	87-88	88-89	89-90	Average	
LUCKNOW BRANCH CANAL																		
1. Amausi Disty.	4,827	1,134	917	932	413	926	595	777	760	67%	1,182	1,015	881	857	946	843	908	77%
2. Gehru Disty.	3,357	624	144	112	68	269	102	201	150	24%	650	160	207	255	231	187	208	32%
3. Banthra Mr.	409	108	0	0	0	2	0	0	0	0%	112	0	17	5	10	0	7	6%
4. Rahimabad Mr.	437	105	57	39	25	73	45	58	50	47%	109	86	28	76	70	73	67	61%
5. Sahadat Khera Mr.	212	51	17	18	4	24	6	8	13	26%	53	31	25	24	26	19	25	47%
6. Khotara Mr.	402	96	22	22	12	33	18	25	22	23%	101	38	34	37	34	37	36	36%
7. Bakauli Mr.	290	70	3	2	1	2	0	2	2	3%	73	8	6	7	4	7	6	9%
8. Mati Mr.	525	126	99	102	79	109	122	140	108	86%	132	78	38	71	87	92	73	56%
9. Raisingh Khera Mr.	151	36	1	0	14	25	25	33	17	46%	38	34	28	34	22	45	33	86%
10. Alinagar Mr.	338	81	0	2	0	3	4	4	2	3%	85	20	18	25	14	15	18	22%
11. Bhadswa Mr.	886	212	63	59	17	71	41	83	56	26%	221	133	106	121	132	125	123	56%
12. Rani Khera Mr.	505	121	54	61	8	66	25	39	42	35%	126	89	54	73	52	35	61	48%
13. Dehwa Mr.	962	231	55	66	17	59	32	28	43	18%	241	113	82	81	70	45	78	32%
14. Govindpur Mr.	373	90	34	37	5	57	7	19	27	29%	94	80	10	75	50	79	59	63%
15. Bhasinda Mr.	138	33	7	8	2	5	0	0	4	11%	35	22	17	22	30	15	21	61%
16. Gautam Khera Mr.	169	41	11	17	0	9	6	14	9	23%	42	31	10	11	19	2	15	35%
17. Manoharpur Mr.	151	33	30	36	3	32	7	26	22	67%	35	27	28	19	29	18	24	70%
18. Meerampur Mr.	317	44	23	22	2	20	2	13	14	31%	46	53	22	8	38	6	26	56%
19. Davalia Mr.	26	6	2	4	0	2	0	2	2	26%	7	6	6	6	6	3	6	85%
20. Bhajmanmau Mr.	248	67	0	0	0	0	0	0	0	0%	70	28	13	0	39	0	16	23%
21. Akbarpur Mr.	139	33	0	6	0	1	0	0	1	3%	35	18	7	0	33	0	12	33%
TOTAL	14,862	3,342	1,539	1,544	670	1,788	1,041	1,471	1,342	40%	3,482	2,067	1,638	1,808	1,945	1,645	1,821	52%

Source : Divisional Office II, Circle VI, Irrigation Department, U.P.
Kulaba-wise data are referred to.

Remarks : PIA : Proposed Irrigation Area

Table F.18 Actual Irrigation Area in Sataon Area

Canal Name	C.C.A.	Kharif Cropping (ha)									Rabi Cropping (ha)							
		P.I.A.	85	86	87	88	89	90	Average		P.I.A.	85-86	86-87	87-88	88-89	89-90	Average	
ASHIWAN BRANCH CANAL																		
1. Maurawan Disty.	5,655	867	227	218	40	66	11	24	98	11%	903	310	327	142	14	24	163	18%
2. Narichak Disty.	3,102	744	77	60	24	36	3	12	35	5%	776	80	62	53	2	20	44	6%
3. Kunsa Mr.	240	58	6	6	2	0	0	0	2	4%	60	27	25	2	0	4	12	19%
4. Lotna Mr.	150	36	2	3	1	0	0	0	1	3%	38	6	23	3	0	1	7	18%
5. Bankat Mr.	805	193	180	143	55	49	13	24	78	40%	201	185	146	28	0	49	81	40%
6. Bhatargaon Mr.	612	147	6	3	2	0	0	0	2	1%	153	14	12	4	0	1	6	4%
7. Unai Mr.	583	139	17	8	1	1	2	1	5	4%	145	64	21	2	0	17	21	14%
8. Bardar Mr.	229	55	29	25	3	2	0	1	10	18%	58	52	30	0	0	14	19	33%
9. Sataon Mr.	608	147	45	48	4	18	2	13	22	15%	153	63	57	5	0	28	31	20%
10. Korihar Mr.	487	117	23	15	0	0	0	0	6	5%	122	55	20	0	0	2	15	13%
11. Hajipur Mr.	403	96	4	1	0	0	0	0	1	1%	100	23	5	0	1	0	6	6%
TOTAL	12,874	2,599	616	529	132	173	30	76	259	10%	2,707	879	728	238	17	160	404	15%

Source : Irrigation Division Unnao, Cirvle VI, Irrigation Department, U.P.
Kulaba-wise data are referred to.

Remarks : PIA : Proposed Irrigation Area

Table F.19 Actual Irrigation Area in Sursa Area

Canal Name	C.C.A.	Kharif Cropping (ha)									Rabi Cropping (ha)							
		P.I.A.	85	86	87	88	89	90	Average		P.I.A.	85-86	86-87	87-88	88-89	89-90	Average	
HARDOI BRANCH CANAL																		
1. Bhadaicha Disty.	7,135	1,643	827	1,027	751	1,120	908	1,116	958	58%	1,711	1,643	1,712	1,499	1,600	1,651	1,621	95%
2. Kamrauli Mr.	1,225	294	123	178	146	194	144	164	158	54%	306	299	301	313	292	250	291	95%
3. Sikandarpur Mr.	1,825	418	77	104	100	136	93	76	98	23%	435	269	246	280	253	234	256	59%
4. Isauli Mr.	261	63	2	45	6	12	4	1	12	19%	65	68	49	59	67	45	58	88%
5. Sursa Mr.	1,123	270	24	59	45	105	44	54	55	20%	281	178	224	194	235	157	198	70%
6. Udra Mr.	195	47	4	11	7	12	6	4	7	16%	49	40	51	45	47	39	44	91%
7. Barha Mr.	1,194	325	52	59	36	85	43	43	53	16%	339	256	255	240	204	207	232	69%
8. Khajurahra Mr.	1,435	353	96	98	91	169	148	134	123	35%	367	337	311	367	389	366	354	96%
9. Tikari Mr.	755	186	23	17	31	61	38	31	34	18%	194	116	127	134	172	129	136	70%
10. Pachkohra Mr.	523	125	14	25	39	32	34	24	28	22%	131	80	106	62	91	92	86	66%
11. Marsa Disty.	1,085	260	735	924	846	906	791	866	845	324%	271	855	1,076	1,189	1,138	1,099	1,071	395%
12. Salkupur Mr.	350	84	154	188	163	123	198	207	172	205%	88	219	254	366	277	253	274	313%
13. Sauntera Mr.	207	50	62	66	45	36	57	52	53	107%	52	110	126	174	117	144	134	259%
TOTAL	17,313	4,117	2,193	2,801	2,306	2,991	2,508	2,772	2,595	63%	4,288		4,838	4,922	4,882	4,666	4,827	113%

Source : Sharda Canal Hardoi Division, Circel VI, Irrigation Department, U.P.
Kulaba-wise data are referred to.
Remarks : PIA : Proposed Irrigation Area

Table F.20 Actual Irrigation Area in Purwa Area

Canal Name	C.C.A.	Kharif Cropping (ha)									Rabi Cropping (ha)							
		P.I.A.	85	86	87	88	89	90	Average		P.I.A.	85-86	86-87	87-88	88-89	89-90	Average	
PURWA BRANCH CANAL																		
1. Purwa Disty.	3,145	755	478	518	323	528	318	510	446	59%	786	585	648	605	568	574	596	76%
2. Bhopatpur Mr.	398	96	27	32	13	34	11	24	24	25%	100	36	98	62	52	46	59	59%
3. Bhadnang Mr.	310	74	66	127	50	74	41	113	79	106%	78	72	83	76	65	92	78	100%
4. Ba Isauli Mr.	803	193	19	21	14	38	18	21	22	11%	201	36	115	125	99	94	94	47%
5. Badi Khera Mr.	204	49	85	101	76	106	90	126	97	199%	51	122	125	124	94	111	115	226%
6. Tu Udra Mr.	203	49	39	35	22	60	14	36	34	70%	51	35	66	59	69	55	57	112%
7. Pinjra Mr.	239	57	2	7	0	4	0	5	3	5%	60	33	41	24	28	28	31	52%
8. Chimyani Mr.	1,602	384	531	288	139	482	351	552	391	102%	400	452	290	376	391	502	402	100%
9. Sir Tikari Mr.	584	140	92	85	25	109	61	109	80	57%	146	132	126	133	142	146	136	93%
10. Tikar Disty.	1,976	474	805	761	589	825	673	795	741	156%	494	689	677	630	625	658	656	133%
11. Ahamdabad Mr.	378	91	184	190	126	192	165	202	177	195%	94	136	111	141	137	117	128	136%
12. Ranhan Mr.	1,376	330	373	447	256	427	364	470	390	118%	344	369	363	361	342	367	360	105%
13. Tiwaria Mr.	527	126	167	178	40	78	70	134	111	88%	132	184	179	142	124	141	154	117%
14. Pakra Mr.	509	122	330	343	226	351	285	354	315	258%	127	241	243	249	217	239	238	187%
TOTAL	12,252	2,941	3,198	3,133	1,899	3,308	2,461	3,451	2,908	99%	3,063	3,122	3,165	3,107	2,953	3,170	3,103	101%

Source : Sharda Canal Unnao Division, Circle VI, Irrigation Department, U.P.
Kulaba-wise data are referred to.

Remarks : PIA : Proposed Irrigation Area

Table F.21 Source -wise Irrigated Area in Sarojini Nagar Area (1/2)

Year : 1989/90
Unit : ha

*1		Cultivated Area		Total *2			Source-wise Irrigated Area							
No.	Village Nmae	Geographical Area	Total	w/o Double Crope Area	Irrigated Area		By Canal		By Tubewell		By Dug We		By Others	
					Area	%	Area	%	Area	%	Area	%	Area	%
A. SAROJINI NAGAR BLOCK (LUCKNOW DISTRICT)														
1.	Khandey Dev	521	546	403	267	66%	13	5%	254	95%	0	0%	0	0%
2.	Khasarwara	176	152	117	83	71%	0	0%	77	93%	0	0%	6	7%
9.	Paharpur	180	167	125	81	65%	0	0%	44	54%	35	43%	2	2%
10.	Banthra Sikandarpur	696	615	468	280	60%	0	0%	280	100%	0	0%	0	0%
11.	Bono	181	188	137	101	74%	0	0%	80	79%	0	0%	21	21%
22.	Saray Shahzadi	250	172	156	108	69%	0	0%	79	73%	0	0%	29	27%
1.	Ahmadpur	121	98	68	49	72%	0	0%	49	100%	0	0%	0	0%
2.	Asraf Nagar	255	186	139	92	66%	0	0%	92	100%	0	0%	0	0%
4.	Amausi	1,645	846	647	359	55%	281	78%	2	1%	25	7%	51	14%
5.	Anaura	324	240	179	93	52%	7	8%	84	90%	0	0%	2	2%
7.	Andhpur Dev	260	201	168	117	70%	0	0%	117	100%	0	0%	0	0%
8.	Alinagar Sunhara	499	306	216	132	61%	11	8%	119	90%	0	0%	2	2%
9.	Ali Nagar Khurd	126	39	32	22	69%	0	0%	22	100%	0	0%	0	0%
11.	Aurawan	241	298	149	109	73%	0	0%	109	100%	0	0%	0	0%
13.	Kurauni	719	489	331	269	81%	0	0%	269	100%	0	0%	0	0%
14.	Kishunpur Koariya	149	98	86	27	31%	0	0%	0	0%	17	63%	10	37%
17.	Khatola	464	102	58	58	100%	0	0%	58	100%	0	0%	0	0%
20.	Gauri	337	282	171	157	92%	129	82%	28	18%	0	0%	0	0%
21.	Gahru	619	329	216	212	98%	173	82%	38	18%	1	0%	0	0%
23.	Chandrwal	239	215	136	89	65%	57	64%	32	36%	0	0%	0	0%
24.	Jahmabad	43	47	33	13	39%	0	0%	13	100%	0	0%	0	0%
25.	Jatikhera	558	436	372	332	89%	317	95%	15	5%	0	0%	0	0%
26.	Dhavapur	111	73	59	48	81%	0	0%	44	92%	0	0%	4	8%
27.	Natkur	661	696	455	367	81%	188	51%	171	47%	0	0%	8	2%
28.	Numagar Bhadausa	321	244	219	150	68%	0	0%	150	100%	0	0%	0	0%
29.	Newan	512	411	276	232	84%	6	3%	155	67%	0	0%	71	31%
31.	Parvar Parchim	910	582	410	280	68%	44	16%	190	68%	0	0%	46	16%
32.	Parvar Purab	515	340	220	167	76%	40	24%	127	76%	0	0%	0	0%
35.	Farukhabad Chillava	341	122	96	55	57%	0	0%	55	100%	0	0%	0	0%
36.	Bijnaur	752	531	375	232	62%	13	6%	210	91%	1	0%	8	3%
39.	Behtava	115	86	66	27	41%	15	56%	12	44%	0	0%	0	0%
40.	Behsa	395	16	5	5	100%	0	0%	5	100%	0	0%	0	0%
41.	Bibipur	289	197	135	110	81%	0	0%	99	90%	0	0%	11	10%
42.	Bhagukhera	170	121	82	68	83%	68	100%	0	0%	0	0%	0	0%
44.	Mati	1,187	769	373	289	77%	165	57%	124	43%	0	0%	0	0%
46.	Makhdumpur Khaithi	349	210	172	122	71%	118	97%	4	3%	0	0%	0	0%
47.	Memaura	360	264	170	146	86%	0	0%	146	100%	0	0%	0	0%
50.	Miranpur Pinvat	301	172	128	111	87%	1	1%	110	99%	0	0%	0	0%
51.	Ratauli	165	126	103	90	87%	34	38%	49	54%	0	0%	7	8%
52.	Rahimabad	381	310	231	163	71%	74	45%	89	55%	0	0%	0	0%
53.	Rasulpur Idauria	130	29	18	9	50%	0	0%	9	100%	0	0%	0	0%
55.	Shahpur Majhgawan	130	111	71	63	89%	14	22%	49	78%	0	0%	0	0%
58.	Saraiya	154	353	323	293	91%	153	52%	127	43%	0	0%	13	4%
	Sub-Total	16,852	11,815	8,394	6,077	72%	1,921	32%	3,786	62%	79	1%	291	5%
B. MOHANLAL GANJ BLOCK (LUCKNOW DISTIRCT)														
1.	Uttar Gaon	540	560	353	225	64%	0	0%	156	69%	35	16%	34	15%
9.	Bhasanda	493	367	287	200	70%	140	70%	60	30%	0	0%	0	0%
13.	Bhilampur	97	66	60	45	75%	40	89%	5	11%	0	0%	0	0%
14.	Paraspur Thatha	343	157	125	73	58%	0	0%	73	100%	0	0%	0	0%
18.	Jabrauli	1,000	606	456	400	88%	300	75%	100	25%	0	0%	0	0%
22.	Sirs	522	443	327	258	79%	0	0%	258	100%	0	0%	0	0%
24.	Bhaundri	682	717	513	433	84%	206	48%	227	52%	0	0%	0	0%
25.	Gautamkhera	216	82	63	38	60%	0	0%	37	97%	1	3%	0	0%
28.	Govindpur	650	414	314	205	65%	120	59%	85	41%	0	0%	0	0%
37.	Dayalpur	730	620	501	211	42%	85	40%	89	42%	3	1%	34	16%
39.	Rati	434	378	333	236	71%	0	0%	236	100%	0	0%	0	0%

Table F. 21 Source -wise Irrigated Area in Sarojini Nagar Area (2/2)

*1		Cultivated Area		Total *2			Source-wise Irrigated Area							
No.	Village Nmae	Geographi-	Total	w/o Double	Irrigated Area		By Canal		By Tubewell		By Dug We		By Others	
		cal Area		Crope Area	Area	%	Area	%	Area	%	Area	%	Area	%
40.	Raghunath Khera	285	213	201	181	90%	0	0%	176	97%	0	0%	5	3%
41.	Sesandi	754	676	293	216	74%	116	54%	100	46%	0	0%	0	0%
42.	Sulsamau	538	537	437	330	76%	0	0%	330	100%	0	0%	0	0%
43.	Kusmaura	416	402	265	150	57%	72	48%	78	52%	0	0%	0	0%
44.	Kodra Raipur	339	328	269	200	74%	150	75%	50	25%	0	0%	0	0%
45.	Madarikhera	90	46	44	24	55%	0	0%	23	96%	0	0%	1	4%
46.	Mangaiyya	439	385	337	143	42%	0	0%	143	100%	0	0%	0	0%
47.	Meenapur	287	257	195	122	63%	6	5%	108	89%	0	0%	8	7%
48.	Meranpur	216	163	128	100	78%	75	75%	25	25%	0	0%	0	0%
50.	Akbarpur Baniganj	201	174	147	90	61%	0	0%	90	100%	0	0%	0	0%
52.	Virsinghpur	313	259	208	65	31%	22	34%	27	42%	0	0%	16	25%
53.	Barualia	423	346	286	200	70%	160	80%	40	20%	0	0%	0	0%
54.	Bhajmarmau	86	75	65	39	60%	0	0%	39	100%	0	0%	0	0%
55.	Bhadeswa	643	462	371	297	80%	96	32%	184	62%	0	0%	17	6%
56.	Dewaria Mansava	403	348	257	187	73%	2	1%	185	99%	0	0%	0	0%
57.	Dhanuwa Saand	444	397	283	214	76%	135	63%	79	37%	0	0%	0	0%
80.	Dehava	370	208	93	56	60%	53	95%	3	5%	0	0%	0	0%
103.	Gaura	1,055	584	384	300	78%	250	83%	50	17%	0	0%	0	0%
	Sub-Total	13,009	10,270	7,595	5,238	69%	2,028	39%	3,056	58%	39	1%	115	2%
C. ASOHA BLOCK (UNNAO DISTRICT)														
65.	Vilaura	324	267	218	124	57%	0	0%	112	90%	0	0%	12	10%
67.	Chopai	533	506	311	165	53%	0	0%	110	67%	0	0%	55	33%
68.	Chilauli	218	224	143	92	64%	0	0%	82	89%	0	0%	10	11%
69.	Darehta Achli	89	94	72	33	46%	0	0%	33	100%	0	0%	0	0%
70.	Darehta Mehant	73	69	56	36	64%	0	0%	36	100%	0	0%	0	0%
71.	Dundiathar	162	159	111	83	75%	0	0%	81	98%	0	0%	2	2%
72.	Gyanpur	139	130	108	71	66%	0	0%	71	100%	0	0%	0	0%
74.	Gomapur	170	164	133	72	54%	0	0%	54	75%	0	0%	18	25%
75.	Gondwa	103	94	74	41	55%	0	0%	39	95%	0	0%	2	5%
79.	Keelpur	70	69	58	41	71%	0	0%	39	95%	0	0%	2	5%
80.	Lachipur	159	152	132	93	70%	0	0%	93	100%	0	0%	0	0%
81.	Majhria	142	120	88	61	69%	0	0%	61	100%	0	0%	0	0%
82.	Gaddipur	65	65	39	16	41%	0	0%	16	100%	0	0%	0	0%
83.	Makhdumpur	41	41	31	25	81%	0	0%	25	100%	0	0%	0	0%
86.	Neemtheekar	164	138	138	86	62%	0	0%	86	100%	0	0%	0	0%
87.	Paharpur	164	200	143	102	71%	0	0%	102	100%	0	0%	0	0%
88.	Pardamanpur	63	72	48	22	46%	0	0%	22	100%	0	0%	0	0%
92.	Ograpur	209	210	168	109	65%	0	0%	109	100%	0	0%	0	0%
	Sub-Total	2,888	2,774	2,071	1,272	61%	0	0%	1,171	92%	0	0%	101	8%
D. NAWAB GANJ BLOCK (UNNAO DISTRICT)														
16.	Tenduva Hirankuddi	198	218	187	114	61%	99	87%	10	9%	0	0%	5	4%
23.	Paraura	103	104	93	66	71%	0	0%	66	100%	0	0%	0	0%
30.	Balahaomau	242	262	226	154	68%	0	0%	114	74%	0	0%	40	26%
32.	Benduva	33	66	45	22	49%	19	86%	3	14%	0	0%	0	0%
59.	Shekhpur	163	256	196	174	89%	133	76%	24	14%	0	0%	17	10%
	Sub-Total	739	906	747	530	71%	251	47%	217	41%	0	0%	62	12%
	Grand-Total	33,488	25,765	18,807	13,117	70%	4,200	32%	8,230	63%	118	1%	569	4%

Remarks : *1 : Milan Khasra No.
*2 : Total irrigated area dose not include the double cropped area.

Table F.22 Source -wise Irrigated Area in Sataon Area

Year : 1989/90
Unit : ha

*1		Cultivated Area		Total *2		Source-wise Irrigated Area							
No.	Village Nmae	Geographi-cal Area	Total	w/o Double Crope Area	Irrigated Area		By Canal		By Tubewell		By Dug Well		By Others	
					Area	%	Area	%	Area	%	Area	%	Area	%
A. SATAON BLOCK (RAE BARELI DISTRICT)														
5.	Unai Paharpur	386	322	254	195	77%	0	0%	195	100%	0	0%	0	0%
6.	Konsa	2,870	3,990	2,335	1,437	62%	0	0%	1,437	100%	0	0%	0	0%
7.	Konhar	1,536	1,433	1,095	735	67%	0	0%	735	100%	0	0%	0	0%
10.	Khusharoopur	106	121	92	61	66%	0	0%	61	100%	0	0%	0	0%
11.	Garhi Dula Rai	208	155	122	94	77%	0	0%	94	100%	0	0%	0	0%
13.	Gajipur Gambhipur	80	68	62	39	63%	0	0%	39	100%	0	0%	0	0%
14.	Gauri Sataon	76	60	50	25	50%	0	0%	25	100%	0	0%	0	0%
15.	Chaknasirpur	16	17	13	5	38%	0	0%	5	100%	0	0%	0	0%
16.	Chandawal	117	127	93	69	74%	0	0%	69	100%	0	0%	0	0%
29.	Damapur	198	211	157	101	64%	0	0%	101	100%	0	0%	0	0%
33.	Nirashapur	130	148	110	81	74%	0	0%	81	100%	0	0%	0	0%
38.	Purai	797	592	434	297	68%	0	0%	297	100%	0	0%	0	0%
45.	Bardar	1,028	883	734	380	52%	0	0%	380	100%	0	0%	0	0%
46.	Bankai	114	76	65	29	45%	0	0%	29	100%	0	0%	0	0%
47.	Manpur	118	143	100	57	57%	0	0%	57	100%	0	0%	0	0%
48.	Malikmau Chaubara	395	282	210	147	70%	0	0%	147	100%	0	0%	0	0%
50.	Raula	202	192	125	89	71%	0	0%	89	100%	0	0%	0	0%
56.	Shekhapur	123	124	93	71	76%	0	0%	70	99%	0	0%	1	1%
58.	Sataon	1,180	1,027	800	588	74%	0	0%	588	100%	0	0%	0	0%
68.	Usepur	65	80	55	47	85%	0	0%	36	77%	0	0%	11	23%
69.	Hajipur	783	879	657	353	54%	0	0%	353	100%	0	0%	0	0%
70.	Hardhaurpur	72	55	45	29	64%	0	0%	29	100%	0	0%	0	0%
	Sub-Total	10,600	10,985	7,701	4,929	64%	0	0%	4,917	100%	0	0%	12	0%
B. KHEERO BLOCK (RAE BARELI DISTRICT)														
27.	Chandeman	172	171	141	92	65%	0	0%	92	100%	0	0%	0	0%
45.	Nawgawan	122	123	86	67	78%	0	0%	67	100%	0	0%	0	0%
47.	Paho	866	632	504	329	65%	35	11%	279	85%	0	0%	15	5%
52.	Baraula	195	192	145	102	70%	0	0%	99	97%	0	0%	3	3%
57.	Bashigawan	224	122	106	60	57%	0	0%	60	100%	0	0%	0	0%
60.	Bhitargaon	1,318	1,174	866	578	67%	0	0%	563	97%	0	0%	15	3%
72.	Rampur Majara	139	165	124	89	72%	0	0%	84	94%	0	0%	5	6%
	Sub-Total	3,036	2,579	1,972	1,317	67%	35	3%	1,244	94%	0	0%	38	3%
C. HILAULI BLOCK (UNNAO DISTRICT)														
1.	Ahesa	636	588	367	325	89%	228	70%	64	20%	0	0%	33	10%
2.	Akohari	2,584	870	721	659	91%	570	86%	89	14%	0	0%	0	0%
8.	Bisara	496	357	298	261	88%	124	48%	132	51%	0	0%	5	2%
11.	Gulariha	2,768	975	955	686	72%	259	38%	68	10%	10	1%	349	51%
13.	Indaura	241	202	142	124	87%	33	27%	51	41%	0	0%	40	32%
14.	Jaisinghkhera	272	183	136	100	74%	0	0%	97	97%	0	0%	3	3%
19.	Lotna	526	390	265	232	88%	0	0%	232	100%	0	0%	0	0%
23.	Mavai	2,708	845	771	422	55%	258	61%	87	21%	0	0%	77	18%
25.	Nari Chak	521	411	370	331	89%	0	0%	255	77%	0	0%	76	23%
50.	Chipipur	53	39	31	23	74%	0	0%	23	100%	0	0%	0	0%
56.	Galibpur	361	301	267	171	64%	117	68%	43	25%	0	0%	11	6%
60.	Khanpur	211	223	155	110	71%	0	0%	110	100%	0	0%	0	0%
65.	Rajwada	515	512	409	213	52%	0	0%	100	47%	0	0%	113	53%
66.	Sarai Mubarak	235	195	153	125	82%	0	0%	125	100%	0	0%	0	0%
	Sub-Total	12,127	6,091	5,040	3,782	75%	1,589	42%	1,476	39%	10	0%	707	19%
	Grand-Total	25,763	19,655	14,713	10,028	68%	1,624	16%	7,637	76%	10	0%	757	8%

Remarks : *1 : Milan Khasra No.
*2 : Total irrigated area dose not include the double cropped area.

Table F.23 Source-wise Irrigated Area in Sursa Area (1/2)

Year : 1989/90
Unit : ha

*1		Cultivated Area		Total *2		Source-wise Irrigated Area							
No. Village Nmae	Geographi-cal Area	Total	w/o Double Crop Area	Irrigated Area		By Canal		By Tubewell		By Dug Well		By Others	
				Area	%	Area	%	Area	%	Area	%	Area	%
A. SURSA BLOCK (HARDOI DISTRICT)													
1. Aharamau	298	274	274	249	91%	249	100%	0	0%	0	0%	0	0%
2. Andharra	693	302	302	158	52%	43	27%	0	0%	115	73%	0	0%
3. Umrapur	541	405	405	133	33%	0	0%	0	0%	133	100%	0	0%
4. Ainchhamau	451	248	248	243	98%	243	100%	0	0%	0	0%	0	0%
5. Odra Pachlai	1,062	691	691	518	75%	481	93%	0	0%	32	6%	5	1%
6. Adgapur	346	269	269	142	53%	36	25%	0	0%	104	73%	2	1%
7. Kamrauli	249	128	128	77	60%	62	81%	0	0%	15	19%	0	0%
8. Tikari	270	205	205	140	68%	22	16%	14	10%	88	63%	16	11%
9. Ghinni Tusaura	378	210	210	136	65%	31	23%	0	0%	77	57%	28	21%
10. Turtipur	794	510	510	356	70%	66	19%	277	78%	8	2%	5	1%
11. Tundwal	706	442	442	339	77%	304	90%	0	0%	35	10%	0	0%
12. Dahigawan	219	263	263	145	55%	110	76%	0	0%	35	24%	0	0%
13. Dalelpur	427	211	211	160	76%	114	71%	0	0%	45	28%	1	1%
14. Newada	150	143	143	105	73%	20	19%	0	0%	85	81%	0	0%
17. Daheti Salkupur	381	282	282	214	76%	214	100%	0	0%	0	0%	0	0%
18. Barauwa	278	275	275	158	57%	30	19%	0	0%	128	81%	0	0%
19. Baharaiya	271	245	245	115	47%	0	0%	0	0%	115	100%	0	0%
21. Bikapur	634	364	366	233	64%	83	36%	0	0%	149	64%	1	0%
22. Bosara	461	263	293	169	58%	162	96%	0	0%	4	2%	3	2%
23. Bhataura	138	138	138	88	64%	0	0%	0	0%	88	100%	0	0%
24. Bhithha	124	34	34	31	91%	31	100%	0	0%	0	0%	0	0%
25. Marsa	907	630	830	423	51%	406	96%	0	0%	7	2%	10	2%
26. Meoni	814	610	610	476	78%	243	51%	0	0%	233	49%	0	0%
27. Mahurakalan	365	296	296	240	81%	130	54%	0	0%	103	43%	7	3%
31. Sarsaima	328	272	272	169	62%	0	0%	162	96%	0	0%	7	4%
32. Sontera	927	638	642	452	70%	338	75%	111	25%	0	0%	3	1%
33. Hosiyapur	562	358	358	253	71%	177	70%	54	21%	0	0%	22	9%
36. Dholiya	256	246	246	169	69%	92	54%	77	46%	0	0%	0	0%
37. Deoria	128	128	128	78	61%	18	23%	60	77%	0	0%	0	0%
38. Nanamau	37	26	26	10	38%	0	0%	10	100%	0	0%	0	0%
39. Faridapur	110	122	122	81	66%	0	0%	81	100%	0	0%	0	0%
40. Asauli	381	382	382	271	71%	57	21%	214	79%	0	0%	0	0%
41. Odranevaliya	470	528	528	342	65%	107	31%	235	69%	0	0%	0	0%
42. Kasrawan	682	611	691	410	59%	57	14%	353	86%	0	0%	0	0%
43. Khajurahara	2,132	2,235	2,235	1,463	65%	886	61%	577	39%	0	0%	0	0%
44. Jura	708	502	502	364	73%	215	59%	140	38%	7	2%	2	1%
45. Bhadaicha	863	756	756	507	67%	262	52%	245	48%	0	0%	0	0%
46. Malihamau	753	112	112	88	79%	66	75%	22	25%	0	0%	0	0%
47. Madhopur	180	178	178	122	69%	27	22%	93	76%	0	0%	2	2%
48. Sursa	257	247	247	187	76%	70	37%	117	63%	0	0%	0	0%
49. Akhanapur	135	130	130	68	52%	34	50%	33	49%	1	1%	0	0%
50. Kauthaliya	168	165	165	121	73%	101	83%	20	17%	0	0%	0	0%
51. Gurra	27	31	31	16	52%	0	0%	16	100%	0	0%	0	0%
52. Ghamoiya	65	41	41	17	41%	15	88%	0	0%	0	0%	2	12%
53. Peng	368	403	403	227	56%	175	77%	48	21%	2	1%	2	1%
54. Madhiya	48	35	35	26	74%	0	0%	26	100%	0	0%	0	0%
55. Sahabuddinpur	646	476	476	280	59%	140	50%	107	38%	7	3%	26	9%
56. Sarra	590	579	579	443	77%	403	91%	37	8%	0	0%	3	1%
57. Sathra	518	593	593	357	60%	186	52%	161	45%	0	0%	10	3%
58. Sikandarpur	165	126	126	88	70%	44	50%	44	50%	0	0%	0	0%
59. Kahermau	150	153	153	94	61%	0	0%	92	98%	2	2%	0	0%
61. Gangapur	333	235	235	112	48%	10	9%	86	77%	4	4%	12	11%
62. Ghosar	279	219	219	116	53%	0	0%	116	100%	0	0%	0	0%
63. Pachkohra	331	332	332	229	69%	57	25%	169	74%	3	1%	0	0%
64. Bannapur	683	428	528	254	48%	39	15%	205	81%	9	4%	1	0%
65. Bahloli	195	165	165	80	48%	11	14%	68	85%	0	0%	1	1%
66. Bhawanipur	133	132	132	76	58%	44	58%	32	42%	0	0%	0	0%
67. Bhilawan	324	226	227	144	63%	0	0%	84	58%	44	31%	16	11%
68. Mainamau	430	489	489	374	76%	230	61%	138	37%	6	2%	0	0%
69. Mehuna Maheshpur	274	321	321	188	59%	51	27%	136	72%	0	0%	1	1%
70. Lalpur	576	652	652	365	56%	37	10%	321	88%	1	0%	6	2%

Table F.23 Source-wise Irrigated Area in Sursa Area (2/2)

*1		Cultivated Area		Total *2		Source-wise Irrigated Area							
No. Village Nmae	Geographi-	Total	w/o Double	Irrigated Area		By Canal		By Tubewell		By Dug Well		By Others	
	cal Area		Crop Area	Area	%	Area	%	Area	%	Area	%	Area	%
71. Schramau	44	47	44	25	57%	0	0%	25	100%	0	0%	0	0%
72. Saraiya	150	182	183	101	55%	0	0%	93	92%	0	0%	8	8%
73. Singhwamau	340	366	366	265	72%	188	71%	64	24%	0	0%	13	5%
74. Sohariya	853	592	592	459	78%	247	54%	200	44%	0	0%	12	3%
75. Haraha	217	180	180	107	59%	18	17%	88	82%	1	1%	0	0%
76. Hathiai	157	160	160	98	61%	66	67%	32	33%	0	0%	0	0%
77. Matuwa	269	240	240	127	53%	0	0%	127	100%	0	0%	0	0%
78. Abdulpur	168	135	135	61	45%	0	0%	61	100%	0	0%	0	0%
79. Tashkhera	123	125	125	74	59%	6	8%	64	86%	1	1%	3	4%
80. Barbatapur	48	41	41	35	85%	0	0%	35	100%	0	0%	0	0%
81. Rajepur	131	94	94	58	62%	16	28%	42	72%	0	0%	0	0%
83. Kairmair	177	169	169	48	28%	0	0%	41	85%	0	0%	7	15%
Sub-Total	28,846	23,041	23,456	15,147	65%	7,570	50%	5,653	37%	1,687	11%	237	2%
B. AHIRORI BLOCK (HARDOI DISTRICT)													
18. Karahi	275	374	223	181	81%	138	76%	37	20%	0	0%	6	3%
20. Khajurmai	329	382	259	179	69%	54	30%	125	70%	0	0%	0	0%
34. Jarera	47	49	36	18	50%	0	0%	18	100%	0	0%	0	0%
37. Danmandi	132	131	91	64	70%	0	0%	64	100%	0	0%	0	0%
50. Punniyan	315	280	223	200	90%	200	100%	0	0%	0	0%	0	0%
51. Faridapur	802	854	577	382	66%	111	29%	242	63%	8	2%	21	5%
60. Vallopur	760	981	666	404	61%	176	44%	221	55%	0	0%	7	2%
61. Pipona	354	424	277	178	64%	0	0%	172	97%	1	1%	5	3%
62. Vaispur	59	70	46	36	78%	0	0%	36	100%	0	0%	0	0%
63. Dadudpur	125	132	86	50	58%	0	0%	50	100%	0	0%	0	0%
65. Bamhna Khera	110	104	79	51	65%	6	12%	42	82%	0	0%	3	6%
74. Anuwan	115	127	97	86	89%	45	52%	41	48%	0	0%	0	0%
Sub-Total	3,423	3,908	2,660	1,829	69%	730	40%	1,048	57%	9	0%	42	2%
Grand-Total	32,269	26,949	26,116	16,976	65%	8,300	49%	6,701	39%	1,696	10%	279	2%

Remarks : *1 : Milan Khasra No.
*2 : Total irrigated area dose not include the double cropped area.

Table F. 24 Source -wise Irrigated Area in Purwa Area (1/2)

Year : 1989/90
Unit : ha

*1		Cultivated Area		Total *2		Source-wise Irrigated Area							
No.	Village Nmae	Geographi-cal Area	Total	w/o Double Crop Area	Irrigated Area		By Canal		By Tubewell		By Dug Well		By Others	
					Area	%	Area	%	Area	%	Area	%	Area	%
A. PURWA BLOCK (UNNAO DISTRICT)														
1.	Beval Mansa Khera	308	220	155	147	95%	147	100%	0	0%	0	0%	0	0%
2.	Bhatmau	230	252	168	161	96%	161	100%	0	0%	0	0%	0	0%
3.	Chamiyani	1,075	1,225	825	589	71%	449	76%	100	17%	0	0%	40	7%
4.	Gara Kola	171	206	144	129	90%	127	98%	0	0%	0	0%	2	2%
5.	Jatanpur	96	101	73	56	77%	56	100%	0	0%	0	0%	0	0%
6.	Kishan Khera	151	214	119	118	99%	118	100%	0	0%	0	0%	0	0%
7.	Lakhmade Mau	328	367	238	235	99%	233	99%	0	0%	2	1%	0	0%
8.	Maharamau	289	354	178	175	98%	175	100%	0	0%	0	0%	0	0%
9.	Majgawan Sewak	113	108	79	52	66%	31	60%	17	33%	0	0%	4	8%
10.	Muraita	246	261	162	143	88%	106	74%	18	13%	0	0%	19	13%
11.	Rasupur	128	159	111	59	53%	40	68%	19	32%	0	0%	0	0%
12.	Sijnisehra Mau	262	200	151	114	75%	53	46%	49	43%	0	0%	12	11%
13.	Tiwaria	150	139	96	95	99%	86	91%	4	4%	0	0%	5	5%
14.	Salethu	345	413	282	254	90%	254	100%	0	0%	0	0%	0	0%
16.	Barwat	163	128	105	68	65%	0	0%	68	100%	0	0%	0	0%
35.	Achal Khera	145	104	104	100	96%	100	100%	0	0%	0	0%	0	0%
36.	Seer Sahab Lal	11	13	10	10	100%	10	100%	0	0%	0	0%	0	0%
37.	Ahamadabad Grunt	78	75	70	58	83%	58	100%	0	0%	0	0%	0	0%
38.	Atawa	55	40	40	36	90%	36	100%	0	0%	0	0%	0	0%
39.	Badey Khera	190	136	130	130	100%	130	100%	0	0%	0	0%	0	0%
40.	Banigaon	754	602	547	509	93%	509	100%	0	0%	0	0%	0	0%
41.	Bhadnag	575	316	299	285	95%	285	100%	0	0%	0	0%	0	0%
42.	Bishnu Khera	362	303	259	258	100%	258	100%	0	0%	0	0%	0	0%
43.	Chak Jamalpur	104	103	103	77	75%	77	100%	0	0%	0	0%	0	0%
44.	Dhirjeekhera	93	117	76	56	74%	56	100%	0	0%	0	0%	0	0%
46.	Fatehganj	160	105	88	67	76%	0	0%	61	91%	0	0%	6	9%
48.	Gangdaspur	100	65	65	58	89%	58	100%	0	0%	0	0%	0	0%
49.	Himmatpur Khera	185	180	139	113	81%	0	0%	113	100%	0	0%	0	0%
50.	Kasroar	556	273	245	235	96%	225	96%	7	3%	0	0%	3	1%
53.	Newada	171	194	135	95	70%	95	100%	0	0%	0	0%	0	0%
54.	Kasba Pachhim	418	330	257	211	82%	137	65%	43	20%	4	2%	27	13%
55.	Patti Sukhnandan	109	92	65	62	95%	52	84%	8	13%	0	0%	2	3%
56.	Kasba Ramahimat	458	376	257	229	89%	229	100%	0	0%	0	0%	0	0%
57.	Kasba Bhawanipur	362	340	219	209	95%	209	100%	0	0%	0	0%	0	0%
58.	Chandigarhi	127	133	74	70	95%	70	100%	0	0%	0	0%	0	0%
60.	Kalyanpur	59	55	28	28	100%	28	100%	0	0%	0	0%	0	0%
61.	Bharthi Higari	57	45	29	28	97%	28	100%	0	0%	0	0%	0	0%
62.	Seer Kaley Khan	21	28	18	18	100%	18	100%	0	0%	0	0%	0	0%
63.	Ramuamarpur	358	258	188	178	95%	138	78%	40	22%	0	0%	0	0%
64.	Semari Mau	142	40	40	10	25%	10	100%	0	0%	0	0%	0	0%
65.	Suee Khera	194	150	97	81	84%	40	49%	24	30%	0	0%	17	21%
66.	Tikar Kalan	307	213	213	212	100%	212	100%	0	0%	0	0%	0	0%
67.	Tikar Khurd	206	137	137	127	93%	127	100%	0	0%	0	0%	0	0%
68.	Tirpurapur	1,059	534	534	501	94%	427	85%	53	11%	0	0%	21	4%
69.	Tusroar	221	254	173	148	86%	124	84%	15	10%	0	0%	9	6%
70.	Bachhoalia	39	38	27	19	70%	4	21%	12	63%	0	0%	3	16%
72.	Asehru	291	276	227	209	92%	178	85%	31	15%	0	0%	0	0%
75.	Bhupatipur	491	421	313	184	59%	68	37%	36	20%	0	0%	80	43%
76.	Shankar Chak	16	20	11	9	82%	5	56%	1	11%	0	0%	3	33%
77.	Basnoha	135	125	105	68	65%	59	87%	0	0%	0	0%	9	13%
78.	Chhulamau	169	154	106	80	75%	0	0%	75	94%	0	0%	5	6%
79.	Dela	82	100	64	51	80%	51	100%	0	0%	0	0%	0	0%
81.	Asgarganj	49	23	19	17	89%	16	94%	0	0%	0	0%	1	6%
82.	Muhiuddeenpur	471	314	251	164	65%	137	84%	13	8%	0	0%	14	9%
83.	Bhataumau	105	98	61	54	89%	53	98%	1	2%	0	0%	0	0%
84.	Bhitoilee	177	108	99	76	77%	76	100%	0	0%	0	0%	0	0%
85.	Chandrasena	144	112	103	80	78%	73	91%	0	0%	0	0%	7	9%
86.	Darehata	372	357	182	171	94%	155	91%	16	9%	0	0%	0	0%
87.	Himmatpur	85	61	54	31	57%	13	42%	8	26%	0	0%	10	32%
88.	Koadra	284	174	151	93	62%	0	0%	29	31%	2	2%	62	67%
89.	Muraita	237	172	144	98	68%	15	15%	69	70%	0	0%	14	14%

Table F. 24 Source -wise Irrigated Area in Purwa Area (2/2)

*1		Cultivated Area		Total *2			Source-wise Irrigated Area							
No.	Village Nmae	Geographi-cal Area	Total	w/o Double Crop Area	Irrigated Area		By Canal		By Tubewell		By Dug Well		By Others	
					Area	%	Area	%	Area	%	Area	%	Area	%
90.	Naya Gaon	150	120	106	72	68%	29	40%	40	56%	0	0%	3	4%
91.	Pinjra	334	208	186	113	61%	38	34%	30	27%	6	5%	39	35%
92.	Toapra	248	318	162	159	98%	150	94%	9	6%	0	0%	0	0%
93.	Jamburpur	260	250	207	96	46%	30	31%	38	40%	0	0%	28	29%
94.	Baijuwamau	176	172	145	122	84%	60	49%	60	49%	0	0%	2	2%
95.	Ghinakhera	123	122	80	60	75%	0	0%	60	100%	0	0%	0	0%
96.	Mamrejpur	454	538	320	308	96%	285	93%	23	7%	0	0%	0	0%
97.	Pakra buzurg	458	475	326	300	92%	243	81%	57	19%	0	0%	0	0%
98.	Panhan	92	139	73	69	95%	67	97%	2	3%	0	0%	0	0%
99.	Purandarpur	198	148	117	76	65%	53	70%	23	30%	0	0%	0	0%
100.	Raghunathpur	146	176	107	98	92%	98	100%	0	0%	0	0%	0	0%
101.	Ramakhera	66	60	49	40	82%	38	95%	2	5%	0	0%	0	0%
102.	Rawatpur	145	170	112	101	90%	41	41%	60	59%	0	0%	0	0%
103.	Turkaha	118	156	88	41	47%	41	100%	0	0%	0	0%	0	0%
104.	Afsari	151	131	131	72	55%	62	86%	10	14%	0	0%	0	0%
105.	Adhauli	173	170	121	48	40%	37	77%	11	23%	0	0%	0	0%
109.	Kathar	145	157	116	73	63%	65	89%	0	0%	2	3%	6	8%
	Sub-Total	18,276	16,021	11,888	9,846	83%	8,022	81%	1,355	14%	16	0%	453	5%
B. SUMELPUR BLOCK (UNNAO DISTRICT)														
4	Khijauli	216	175	142	121	85%	121	100%	0	0%	0	0%	0	0%
7	Pakra Khurd	451	601	311	305	98%	305	100%	0	0%	0	0%	0	0%
8	Seraiyan	149	128	84	77	92%	75	97%	2	3%	0	0%	0	0%
	Sub-Total	816	904	537	503	94%	501	100%	2	0%	0	0%	0	0%
C. HILAULI BLOCK (UNNAO DISTRICT)														
15.	Jera	518	338	271	181	67%	0	0%	121	67%	0	0%	60	33%
28.	Patewla Daasi	204	138	133	108	81%	0	0%	108	100%	0	0%	0	0%
	Sub-Total	722	476	404	289	72%	0	0%	229	79%	0	0%	60	21%
D. KHEERO BLOCK (RAE BARELI DISTRICT)														
7.	Aindhi	384	283	244	132	54%	90	68%	0	0%	0	0%	0	0%
32.	Jari	407	285	258	177	69%	26	15%	116	66%	0	0%	35	20%
79.	Sheopuri	223	184	161	88	55%	71	81%	0	0%	0	0%	11	13%
	Sub-Total	1,014	752	663	397	60%	187	47%	116	29%	0	0%	46	12%
	Grand-Total	20,828	18,153	13,492	11,035	82%	8,710	79%	1,702	15%	16	0%	559	5%

Remarks : *1 : Milan Khasra No.
*2 : Total irrigated area dose not include the double cropped area.

Table F.25 O & M Staff of Irrigation System in the Project Area

Staff	Unnao Div. Sharda Canal		Irrigation Div. Unnao		Divisional Office-II		Sharda Canal Hardoi Div.	
	D.O.	S.D.O	D.O.	S.D.O	D.O.	S.D.O	D.O.	S.D.O
Executive Engineer	1	-	1	-	1	-	1	-
Deputy Revenue Officer	1	-	0	-	1	-	1	-
Assistant Engineer	4	1	5	1	4	1	5	1
Junior Engineer	16	3	17	4	14	3	20	5
Divisional Office Staff								
Account Section								
Div. accountant	1	-	1	-	1	-	1	-
Accountant clerk	4	-	5	-	4	-	5	-
Establishment Section								
Head clerk	1	-	1	-	1	-	1	-
Clerk	8	-	4	-	14	-	21	-
Revenue Section								
Head Munchi	1	-	1	-	1	-	1	-
Revenue Munchi	4	-	1	-	6	-	12	-
Technical Section								
Computor	1	-	0	-	-	-	1	-
Draftman	2	-	2	-	3	-	3	-
Trace	3	-	0	-	1	-	2	-
Field Staff								
Signaler	1	-	1	-	6	1	6	-
Sub-divisional Office Staff								
Camp clerk	4	1	4	2	-	2	-	
Ziledar	4	1	4	1	3	1	5	1
Head Munchi	1	-	1	0	-	-	-	1
Revenue Munchi	4	-	4	1	-	1	-	1
Munchi	8	1	8	1	-	-	-	3
Amin	22	6	19	4	12	4	28	6
Patrol	90	18	67	14	49	17	120	7
4th class worker	92	15	70	14	63	16	121	10
Total	273	46	216	42	184	46	354	35

Source : I.W.C. VI and each Divisional Office
Note: D.O. : Divisional Office
S.D.O. : Sub-divisional Office

Table F.26 Irrigation Water Requirement and Diversion Requirement of Sarojini Nagar Area (1/6)

Input data of Sarojini Nagar Area of Sharda Canal CAD Project
Summary of Crop and Basic Assumption

No.	Crop	Application Efficiency	Percolation Loss Code	Land prepartion Code	Pre-irrigation Code	Growing Stages
1	1 Paddy-nursery	0.90	1	1	0	2
2	2 Paddy	0.90	1	1	0	6
3	3 Pulses	0.75	0	0	1	7
4	4 Oilseeds	0.75	0	0	1	7
5	5 Wheat	0.75	0	0	1	7
6	6 Vegetables(Potatoes)	0.75	0	0	1	7
7	7 Forage crops	0.75	0	0	1	9

No.	Crop	Crop Coefficient (by growing stage)								
1	1 Paddy-nursery	1.00	1.00							
2	2 Paddy	1.10	1.14	1.17	1.20	1.20	1.15			
3	3 Pulses	0.35	0.40	0.80	1.08	1.10	1.03	0.55		
4	4 Oilseeds	0.20	0.53	1.12	1.17	1.17	1.16	0.70		
5	5 Wheat	0.48	0.58	1.10	1.18	1.18	1.16	0.92		
6	6 Vegetables(Potatoes)	0.37	0.42	0.90	1.05	1.12	1.08	0.74		
7	7 Forage crops	0.50	0.80	0.85	0.90	0.93	0.95	0.95	0.95	0.95

Remark; 1 growing stage = 15 days
RB1<=RAIN<RB2 : EFFR1=AA1*RAIN-BB1 RB2<=RAIN : EFFR1=AA2*RAIN+BB2
RB1= 0.00 RB2= 200.00 AA1= 0.79 BB1= 0.00 AA2= 0.22 BB2= 114.00
Land preparation for paddy starts OSTAGE(S) BEFORE TRANSPLANTING

Summary of crop and basic assumption
in Sarojini Nagar Sub-Project Kharif Season

No.	Crop	Cultiva. Area(ha)	Date of Water Issue	Land Preparation Period (stages)
1	1 Paddy-nursery	3.	5/16	2
2	2 Paddy	68.	6/16	2
3	3 Pulses	22.	6/ 1	1
4	4 Oilseeds	10.	6/ 1	1
	Total Project Area	100.		

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Potential ET (mm)	77.0	108.0	172.0	235.0	267.0	231.0	149.0	162.0	138.0	131.0	89.0	63.0
Conveyance Efficiency	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72
Return Flow Factor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Unit:mm

Code	1	2	3	4	5	6	7	8	9	10
Land Preparation	180.	0.	0.	0.	0.	0.	0.	0.	0.	0.
Percoration Losses	60.	90.	0.	0.	0.	0.	0.	0.	0.	0.
Pre-irrigation	50.	60.	0.	0.	0.	0.	0.	0.	0.	0.

Rainfall Data for Sarojini Nagar Sub-Project Kharif Season
Rainfall for Lucknow area (Amausi Distributary Command)

Unit:mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1981	2	1	19	0	2	73	332	119	239	0	30	8	825
1982	27	24	38	2	0	96	130	272	147	17	0	13	766
1983	28	0	0	7	72	196	104	108	203	57	0	9	784
1984	2	14	0	0	0	179	169	123	81	9	0	0	577
1985	28	0	0	0	0	46	211	186	509	242	0	0	1222
1986	0	0	23	1	10	129	217	118	67	11	0	45	621
1987	11	8	0	0	26	0	88	82	132	53	0	14	414
1988	0	14	8	9	0	89	492	482	47	72	0	18	1231
1989	34	10	0	0	0	59	244	142	204	24	6	0	723
1990	0	24	0	0	0	53	408	143	188	7	0	19	842
Ave.	13	9	8	1	11	92	239	177	181	49	3	12	800

Table F.26 Irrigation Water Requirement and Diversion Requirement of Sarojini Nagar Area (2/6)

Sample Intermediate Output in 1981

Crop : 1 Paddy-nursery
Land Preparation Requirement : 180. mm
Percolation Losses : 60. mm
Pre-irrigation : 0. mm
Growing Stages : 2 stages
Date of Water Issue : 5/16

Unit:mm

I t e m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crop Coefficient	0.00	0.00	0.00	0.00	0.17	0.67	0.17	0.00	0.00	0.00	0.00	0.00
Potential ET	77.0	108.0	172.0	235.0	267.0	231.0	149.0	162.0	138.0	131.0	89.0	63.0
Crop ET	0.0	0.0	0.0	0.0	44.5	154.0	24.8	0.0	0.0	0.0	0.0	0.0
Rainfall	2.0	1.0	19.0	0.0	2.0	73.0	332.0	119.0	239.0	0.0	30.0	8.0
Effective Rainfall	0.0	0.0	0.0	0.0	0.3	38.3	31.0	0.0	0.0	0.0	0.0	0.0
Land Preparation	0.0	0.0	0.0	0.0	60.0	120.0	0.0	0.0	0.0	0.0	0.0	0.0
Percoration Loss	0.0	0.0	0.0	0.0	10.0	40.0	10.0	0.0	0.0	0.0	0.0	0.0
Farm Water Req.	0.0	0.0	0.0	0.0	114.2	275.7	3.9	0.0	0.0	0.0	0.0	0.0
Overall Efficiency	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Diversion Water Req.	0.0	0.0	0.0	0.0	176.3	425.5	6.0	0.0	0.0	0.0	0.0	0.0

Sample Intermediate Output in 1981

Crop : 2 Paddy
Land Preparation Requirement : 180. mm
Percolation Losses : 60. mm
Pre-irrigation : 0. mm
Growing Stages : 6 stages
Date of Water Issue : 6/16

Unit:mm

I t e m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crop Coefficient	0.00	0.00	0.00	0.00	0.00	0.18	0.94	1.18	0.98	0.19	0.00	0.00
Potential ET	77.0	108.0	172.0	235.0	267.0	231.0	149.0	162.0	138.0	131.0	89.0	63.0
Crop ET	0.0	0.0	0.0	0.0	0.0	42.4	140.3	191.2	135.7	25.1	0.0	0.0
Rainfall	2.0	1.0	19.0	0.0	2.0	73.0	332.0	119.0	239.0	0.0	30.0	8.0
Effective Rainfall	0.0	0.0	0.0	0.0	0.0	9.6	154.8	93.5	138.0	0.0	0.0	0.0
Land Preparation	0.0	0.0	0.0	0.0	0.0	60.0	120.0	0.0	0.0	0.0	0.0	0.0
Percoration Loss	0.0	0.0	0.0	0.0	0.0	10.0	50.0	60.0	50.0	10.0	0.0	0.0
Farm Water Req.	0.0	0.0	0.0	0.0	0.0	102.8	155.5	157.6	47.7	35.1	0.0	0.0
Overall Efficiency	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Diversion Water Req.	0.0	0.0	0.0	0.0	0.0	158.6	240.0	243.2	73.6	54.2	0.0	0.0

Sample Intermediate Output in 1981

Crop : 3 Pulses
Land Preparation Requirement : 0. mm
Percolation Losses : 0. mm
Pre-irrigation : 50. mm
Growing Stages : 7 stages
Date of Water Issue : 6/ 1

Unit:mm

I t e m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crop Coefficient	0.00	0.00	0.00	0.00	0.00	0.28	0.77	1.08	0.53	0.00	0.00	0.00
Potential ET	77.0	108.0	172.0	235.0	267.0	231.0	149.0	162.0	138.0	131.0	89.0	63.0
Crop ET	0.0	0.0	0.0	0.0	0.0	63.5	114.7	174.6	73.5	0.0	0.0	0.0
Rainfall	2.0	1.0	19.0	0.0	2.0	73.0	332.0	119.0	239.0	0.0	30.0	8.0
Effective Rainfall	0.0	0.0	0.0	0.0	0.0	38.3	216.1	92.9	103.3	0.0	0.0	0.0
Pre-irrigation	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0
Percoration Loss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farm Water Req.	0.0	0.0	0.0	0.0	0.0	75.2	0.0	81.7	0.0	0.0	0.0	0.0
Overall Efficiency	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54
Diversion Water Req.	0.0	0.0	0.0	0.0	0.0	139.3	0.0	151.3	0.0	0.0	0.0	0.0

Table F.26 Irrigation Water Requirement and Diversion Requirement of Sarojini Nagar Area (3/6)

Sample Intermediate Output in 1981

Crop	: 4	Oilseeds
Land Preparation Requirement	: 0.	mm
Percolation Losses	: 0.	mm
Pre-irrigation	: 50.	mm
Growing Stages	: 7	stages
Date of Water Issue	: 6/ 1	

Unit:mm

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crop Coefficient	0.00	0.00	0.00	0.00	0.00	0.23	0.99	1.17	0.64	0.00	0.00	0.00
Potential ET	77.0	108.0	172.0	235.0	267.0	231.0	149.0	162.0	138.0	131.0	89.0	63.0
Crop ET	0.0	0.0	0.0	0.0	0.0	53.7	146.8	189.1	88.3	0.0	0.0	0.0
Rainfall	2.0	1.0	19.0	0.0	2.0	73.0	332.0	119.0	239.0	0.0	30.0	8.0
Effective Rainfall	0.0	0.0	0.0	0.0	0.0	37.3	233.2	95.2	109.4	0.0	0.0	0.0
Pre-irrigation	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0
Percoration Loss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farm Water Req.	0.0	0.0	0.0	0.0	0.0	66.5	0.0	93.9	0.0	0.0	0.0	0.0
Overall Efficiency	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54
Diversion Water Req.	0.0	0.0	0.0	0.0	0.0	123.1	0.0	174.0	0.0	0.0	0.0	0.0

Sample Intermediate Output in 1981
Summary of Water Demand for Each Crop
Unit Diversion Water Requirement

Unit:mm

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Paddy-nursery	0.	0.	0.	0.	176.	426.	6.	0.	0.	0.	0.	0.
2 Paddy	0.	0.	0.	0.	0.	159.	240.	243.	74.	54.	0.	0.
3 Pulses	0.	0.	0.	0.	0.	139.	0.	151.	0.	0.	0.	0.
4 Oilseeds	0.	0.	0.	0.	0.	123.	0.	174.	0.	0.	0.	0.

Sample Intermediate Output in 1981
Summary of Water Demand for Each Crop
Diversion Water Requirement

Unit:x1000 m3

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1 Paddy-nursery	0.	0.	0.	0.	6.	14.	0.	0.	0.	0.	0.	0.
2 Paddy	0.	0.	0.	0.	0.	108.	163.	165.	50.	37.	0.	0.
3 Pulses	0.	0.	0.	0.	0.	31.	0.	33.	0.	0.	0.	0.
4 Oilseeds	0.	0.	0.	0.	0.	12.	0.	17.	0.	0.	0.	0.
Total	0.	0.	0.	0.	6.	165.	163.	216.	50.	37.	0.	0.

Diversion Water Requirement for Sarojini Nagar Sub-Project Kharif Season
(Total Area : 100. ha)

Unit:x1000 m3

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1981	0.	0.	0.	0.	6.	165.	163.	216.	50.	37.	0.	0.	638.
1982	0.	0.	0.	0.	6.	155.	257.	82.	101.	35.	0.	0.	636.
1983	0.	0.	0.	0.	6.	110.	286.	230.	57.	29.	0.	0.	717.
1984	0.	0.	0.	0.	6.	118.	215.	211.	163.	36.	0.	0.	748.
1985	0.	0.	0.	0.	6.	178.	187.	132.	0.	8.	0.	0.	510.
1986	0.	0.	0.	0.	6.	140.	185.	217.	176.	35.	0.	0.	760.
1987	0.	0.	0.	0.	6.	200.	303.	263.	115.	30.	0.	0.	916.
1988	0.	0.	0.	0.	6.	158.	133.	35.	196.	27.	0.	0.	554.
1989	0.	0.	0.	0.	6.	172.	180.	187.	57.	34.	0.	0.	635.
1990	0.	0.	0.	0.	6.	174.	149.	186.	66.	36.	0.	0.	617.
Ave.	0.	0.	0.	0.	6.	157.	206.	176.	98.	30.	0.	0.	673.

Table F.26 Irrigation Water Requirement and Diversion Requirement of Sarojini Nagar Area (4/6)

Summary of crop and basic assumption
in Sarojini Nagar Sub-Project Area Rabi Season

No.	Crop	Cultiva. Area(ha)	Date of Water Issue	Land Preparation Period (stages)
5	5 Wheat	68.	11/ 1	2
3	3 Pulses	15.	10/16	1
4	4 Oilseeds	5.	10/16	1
6	6 Vegetables(Potatoes)	6.	10/16	1
7	7 Forage crops	6.	10/16	1
	Total Project Area	100.		

Sample Intermediate Output in 1981

Crop	:	5 Wheat
Land Preparation Requirement	:	0. mm
Percolation Losses	:	0. mm
Pre-irrigation	:	50. mm
Growing Stages	:	7 stages
Date of Water Issue	:	11/ 1

Unit:mm

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crop Coefficient	1.16	0.89	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.84
Potential ET	77.0	108.0	172.0	235.0	267.0	231.0	149.0	162.0	138.0	131.0	89.0	63.0
Crop ET	89.6	96.1	26.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.8	52.7
Rainfall	2.0	1.0	19.0	0.0	2.0	73.0	332.0	119.0	239.0	0.0	30.0	8.0
Effective Rainfall	1.6	0.7	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.8	5.4
Pre-irrigation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	16.7
Percoration Loss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farm Water Req.	88.0	95.4	24.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	47.4	64.0
Overall Efficiency	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54
Diversion Water Req.	163.0	176.7	46.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	87.7	118.5

Sample Intermediate Output in 1981

Crop	:	3 Pulses
Land Preparation Requirement	:	0. mm
Percolation Losses	:	0. mm
Pre-irrigation	:	50. mm
Growing Stages	:	7 stages
Date of Water Issue	:	10/16

Unit:mm

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crop Coefficient	0.93	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.49	1.02
Potential ET	77.0	108.0	172.0	235.0	267.0	231.0	149.0	162.0	138.0	131.0	89.0	63.0
Crop ET	71.4	14.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.5	43.4	63.9
Rainfall	2.0	1.0	19.0	0.0	2.0	73.0	332.0	119.0	239.0	0.0	30.0	8.0
Effective Rainfall	1.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.8	5.2
Pre-irrigation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	25.0	0.0
Percoration Loss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farm Water Req.	70.0	14.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.5	49.6	58.7
Overall Efficiency	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54
Diversion Water Req.	129.6	27.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	67.5	91.9	108.7

Table F.26 Irrigation Water Requirement and Diversion Requirement of Sarojini Nagar Area (5/6)

Sample Intermediate Output in 1981

Crop : 4 Oilseeds
Land Preparation Requirement : 0. mm
Percolation Losses : 0. mm
Pre-irrigation : 50. mm
Growing Stages : 7 stages
Date of Water Issue : 10/16

Unit:mm

I t e m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crop Coefficient	1.05	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.59	1.16
Potential ET	77.0	108.0	172.0	235.0	267.0	231.0	149.0	162.0	138.0	131.0	89.0	63.0
Crop ET	80.7	18.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.6	53.0	72.9
Rainfall	2.0	1.0	19.0	0.0	2.0	73.0	332.0	119.0	239.0	0.0	30.0	8.0
Effective Rainfall	1.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.5	5.5
Pre-irrigation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	25.0	0.0
Percoration Loss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farm Water Req.	79.2	18.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31.5	58.4	67.5
Overall Efficiency	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54
Diversion Water Req.	146.6	34.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	58.4	108.2	124.9

Sample Intermediate Output in 1981

Crop : 6 Vegetables(Potatoes)
Land Preparation Requirement : 0. mm
Percolation Losses : 0. mm
Pre-irrigation : 50. mm
Growing Stages : 7 stages
Date of Water Issue : 10/16

Unit:mm

I t e m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crop Coefficient	1.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.53	1.03
Potential ET	77.0	108.0	172.0	235.0	267.0	231.0	149.0	162.0	138.0	131.0	89.0	63.0
Crop ET	77.4	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.1	46.9	64.9
Rainfall	2.0	1.0	19.0	0.0	2.0	73.0	332.0	119.0	239.0	0.0	30.0	8.0
Effective Rainfall	1.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.1	5.3
Pre-irrigation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	25.0	0.0
Percoration Loss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farm Water Req.	75.9	19.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.1	52.9	59.6
Overall Efficiency	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54
Diversion Water Req.	140.6	36.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	68.7	98.0	110.4

Sample Intermediate Output in 1981

Crop : 7 Forage crops
Land Preparation Requirement : 0. mm
Percolation Losses : 0. mm
Pre-irrigation : 50. mm
Growing Stages : 9 stages
Date of Water Issue : 10/16

Unit:mm

I t e m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crop Coefficient	0.94	0.95	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.74	0.89
Potential ET	77.0	108.0	172.0	235.0	267.0	231.0	149.0	162.0	138.0	131.0	89.0	63.0
Crop ET	72.8	102.6	40.8	0.0	0.0	0.0	0.0	0.0	0.0	16.4	65.6	56.4
Rainfall	2.0	1.0	19.0	0.0	2.0	73.0	332.0	119.0	239.0	0.0	30.0	8.0
Effective Rainfall	1.5	0.8	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.5	5.0
Pre-irrigation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	25.0	0.0
Percoration Loss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Farm Water Req.	71.3	101.8	38.3	0.0	0.0	0.0	0.0	0.0	0.0	41.4	70.2	51.4
Overall Efficiency	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54
Diversion Water Req.	132.0	188.4	70.9	0.0	0.0	0.0	0.0	0.0	0.0	76.6	129.9	95.1

Table F.26 Irrigation Water Requirement and Diversion Requirement of Sarojini Nagar Area (6/6)

Sample Intermediate Output in 1981

Summary of Water Demand for Each Crop

Unit Diversion Water Requirement

Unit:mm

C r o p	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5 Wheat	163.	177.	46.	0.	0.	0.	0.	0.	0.	0.	88.	119.
3 Pulses	130.	27.	0.	0.	0.	0.	0.	0.	0.	68.	92.	109.
4 Oilseeds	147.	35.	0.	0.	0.	0.	0.	0.	0.	58.	108.	125.
6 Vegetables(Potatoes)	141.	37.	0.	0.	0.	0.	0.	0.	0.	69.	98.	110.
7 Forage crops	132.	188.	71.	0.	0.	0.	0.	0.	0.	77.	130.	95.

Sample Intermediate Output in 1981

Summary of Water Demand for Each Crop

Diversion Water Requirement

Unit:x1000 m3

C r o p	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5 Wheat	111.	120.	31.	0.	0.	0.	0.	0.	0.	0.	60.	81.
3 Pulses	19.	4.	0.	0.	0.	0.	0.	0.	0.	10.	14.	16.
4 Oilseeds	7.	2.	0.	0.	0.	0.	0.	0.	0.	3.	5.	6.
6 Vegetables(Potatoes)	8.	2.	0.	0.	0.	0.	0.	0.	0.	4.	6.	7.
7 Forage crops	8.	11.	4.	0.	0.	0.	0.	0.	0.	5.	8.	6.
T o t a l	154.	140.	36.	0.	0.	0.	0.	0.	0.	22.	93.	115.

Diversion Water Requirement for Sarojini Nagar Sub-Project Area Rabi Season
(Total Area : 100. ha)

Unit:x1000 m3

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1981	154.	140.	36.	0.	0.	0.	0.	0.	0.	22.	93.	115.	559.
1982	123.	120.	34.	0.	0.	0.	0.	0.	0.	20.	115.	110.	522.
1983	122.	141.	38.	0.	0.	0.	0.	0.	0.	18.	115.	114.	547.
1984	154.	128.	38.	0.	0.	0.	0.	0.	0.	21.	115.	125.	581.
1985	122.	141.	38.	0.	0.	0.	0.	0.	0.	5.	115.	125.	546.
1986	157.	141.	35.	0.	0.	0.	0.	0.	0.	21.	115.	74.	543.
1987	142.	133.	38.	0.	0.	0.	0.	0.	0.	18.	115.	109.	555.
1988	157.	128.	37.	0.	0.	0.	0.	0.	0.	17.	115.	104.	557.
1989	115.	131.	38.	0.	0.	0.	0.	0.	0.	20.	110.	125.	540.
1990	157.	120.	38.	0.	0.	0.	0.	0.	0.	21.	115.	103.	553.
Ave.	140.	132.	37.	0.	0.	0.	0.	0.	0.	18.	112.	111.	550.