permeable and capable of supplying oxygen to the root zone, and they also have high moisture and fertilizer holding capacities. The ratio of coarse soils to the geographical area is used as an index to evaluate the productivity of the soil in this categorization.

(c) Land Use

The cultivated area in the related districts of the Sharda canal command amounts to about 2.4 million ha or 70% of the geographical area. While, the alkalinity and salinity affected area is estimated to be 98 thousand ha or 4% of the geographical area. To prevent the cultivated area from degrading, the area with higher ratio of cultivated area in related district will be given high priority for development. Then, the ratio of the cultivated area to the geographical area is taken as an index of the categorization of the Study area.

The result of categorization of salinity/alkalinity affected condition is as shown in Table I.3.

1.2 Categorization from Socio-Economic Conditions

(1) Farm Economy Condition

(a) Farm Income

Although the main crops in the Study area are wheat, paddy and sugar cane, the cropping patterns differ much with locations. In Hardoi and Rae Bareli districts, wheat cultivation prevails, with the ratio of 5 to 10 times of wheat cropping areas to paddy cropping areas. Whereas, in Pilibhit, Shahjahanpur, Lucknow and Unnao districts, paddy cropping area is much greater, by about 2 times. Sugar cane cultivation which requires annual irrigation is much practiced in Pilibhit, Shahjahanpur, Kheri and the northern part of Hardoi district. Since cropping systems are closely related to farm income, the gross income of these three main crops is used to evaluate farm economic conditions.

(b) Farm holdings

The average operational holding in the Study area is less than 1 ha, except in Pilibhit and Kheri Districts which are located upstream of the Hardoi Branch. Marginal operational holdings of less than 1 ha tended to increase in all districts during the 5 years from 1980/81 to 1985/86, at rates of 2% to 12%. The average holding and rate of increase of marginal operational holdings are used as another index for evaluation of farm economic conditions.

(2) Agricultural Support Service Conditions

(a) Fertilizer Storage and Fertilizer Use

The fertilizer supply service is an important agricultural support service. To evaluate the present development condition of this service, the capacity of the fertilizer storage provided in the area and fertilizer use actually introduced are employed.

(3) Social Infrastructure Development Conditions

(a) Rural electrification

Rural electrification is evaluated by use of the rate of electrified villages to the total numbers of villages.

(b) Rural water supply facility development conditions

The development condition of rural water supply facilities is evaluated by the numbers of wells and taps.

The results of categorization of socio-economic conditions is as shown in Table I.4.

2. Selection of the Representative Areas

2.1 Selection Criteria for Representative Area

(1) Selection procedure

The priority ranking for selection of the representative areas is determined by means of a scoring system on the basis of the results of the categorization, as shown below.

(a) to determine the parameters for selection on the basis of the categorization of the Study area,

(b) to calculate the scores for respective parameters and to determine the priority ranking according to the calculation formula with weighting to each parameter

(c) To check the items such as CAD work progress, environmental impacts through a screening method

(d) to select the representative area on the canal system basis with a view to making possible efficient water management

(2) Selection Criteria

Development of the representative areas is aimed to sufficiently and effectively promote the Sharda Canal CAD Project. Therefore, the basic factors that the representative areas to be selected should meet as a model development are established as follows:

(a) Strong development wish in terms of development strategy of the Government of India and Uttar Pradesh State Government and farmers

(b) No existence of on-going works of CAD program

(c) Representative model area for implementation of Sharda Canal CAD Project

(d) Area requiring modernization of the existing irrigation facilities to ensure efficient operation and maintenance

(e) No adverse environmental effect upon implementation

(f) Urgency of the development

(g) High economic effect of the development

(h) Strong development impact with a view of social and economic aspects

The above-mentioned basic factors are duly taken into account the scores of parameters to be used in determination of priority ranking. The relationship between the basic factors and selection parameters is shown in the matrix in Table I.5, together with the scores thus determined.

(3) Scoring method of priority ranking

The priority ranking for selection of the representative areas is determined by the following calculation formula:

Formula for scoring:

$$PR = 50\%TS + 50\%SE$$

where, PR : Total marks for selection
TS : Marks for technical aspects
These marks are determined for irrigation condition, poor drainage condition and alkalinity/salinity condition
SE : Marks for socio-economic aspects

(a) parameters and marks of technical aspects

i) Irrigation condition

$$TSi = 35\%AI + 35\%FC + 15\%GC + 15\%DG$$

where, TSi : Total marks to be determined from irrigation conditions
AI : Actual irrigation rate
FC : Facilities condition
GC : Irrigation rate by government canals
DG : Dependency of ground water in irrigation

ii) Poor drainage condition

$$TSd = 35\%DI + 35\%PD + 30\%DC$$

where, TSd : Total marks to be determined from poor drainage condition
DI : Drainability index
PD : Poor drainage area rate
DC : Drainage canal density

iii) Salinity and alkalinity condition

$$TSs = 60\%SA + 20\%CS + 20\%CA$$

where, TSs : Total marks to be determined from salinity/alkalinity condition
SA : Salt affected soil rate
CS : Coarse soil rate
CA : Cultivated area rate

(b) Parameters and marks for socio-economic aspects

$$SE = 40\%FE + 30\%AS + 30\%SI$$

where, SE : Total marks to be determined from socio-economic aspect
FE : Farm economy index
AS : Agricultural support service condition
SI : Social infrastructure development condition

The result of the evaluation are shown in Table I.1 to Table I.4. The priority ranking for selection is as shown in Table I.6, and the locations of the priority areas of the respective categories are as shown in Fig. I.2 to Fig. I.4.

(4) Screening by parameters

(a) Progress of OFD works

The OFD works of Sharda Canal Command are being executed. The progress of OFD works in the respective blocks in the Study area as of September 1990 is as shown in Table I.7. In accordance with the result of the Minutes of Meeting of the Steering Committee held on October 16, 1990, the on-going areas of OFD works are excluded from selection of the representative areas through the screening procedure.

(b) Adverse environmental effect upon implementation

The adverse environmental effects upon implementation are preliminarily assessed in terms of the physical, ecological and human activity aspects.

The prediction of effects of the influence of the physical condition is related to the impacts of drainage, and the water quality of the marshy areas and their surroundings. The marshy areas and their surroundings which are located far from the main drainage streams and topographically depressed are difficult to sufficiently drain and are, therefore, susceptible to expansion of water logging and water contamination with introduction of advanced irrigation farming.

The impacts of the ecological aspect is assessed with respect to the effect on the ground water regime. The parameter used in the ground water regime is the recovery of the ground water tables. The ground water tables of post monsoon in the driest year 1987 in some areas did not recover up to the levels of the preceding pre-monsoon. To avoid an adverse effect on the ground water regime in extremely less recovered areas, groundwater development in such areas as conjunctive use will be avoided.

No significant adverse effect on human activity is predicted under the present Study.

The result of the prediction of the above effects is shown in Table I.8

2.2 Selection of Representative Areas

Based on the results of the priority ranking, the representative area in terms of the canal system is determined as shown in Table I.9. Consequently, the following areas with the total CCA of 57,301 ha are selected as the representative areas, of which locations are as shown in Fig. I.5.

1) Representative area for improvement of irrigation condition

District	:	Lucknow
Block	:	Sarojini Nagar
Canal system	:	Lucknow Branch Amausi Distributary
CCA	:	14,862 ha

2) Representative area for improvement of poor drainage condition

District	:	Hardoi
Block	:	Sursa
Canal system	:	Hardoi Branch Badaicha Distributary
CCA	:	17,313 ha

3) Representative area for salinity and alkalinity affected area

District	:	Unnao
Block	:	Purwa
Canal system	:	Purwa Branch Purwa Distributary
CCA	:	12,252 ha

The general features of the selected 3 representative areas are described below:

(1) Sarojini Nagar (Lucknow District)

Sarojini Nagar is located in the downstream reaches of the Lucknow Branch and is irrigated by the Amausi Distributary. The CCA is 14,862 ha, of which 21% is annually irrigated by the Sharda irrigation system. On the other hand, tubewells for irrigation which are densely distributed in this area shows high dependency of irrigation on ground water as a supplemental irrigation water source. The total length of irrigation canals amounts to 105 km of which 42% has reduced functions due to insufficient O/M and require rehabilitation.

Major drainage rivers of this area are the Sai River which flows along the western edge of this area and tributaries of the Gomti River which flow along the eastern edge. The distance to the major drainage rivers is comparatively far in this area, which is one of the constraints for development of proper drainage in conjunction with the high midland percentage (74%) of this area. Poor drainage and waterlogging/marshy land occupies 4.1% of the midland, where drainage improvement is insufficient due to the above-mentioned constraints. The cultivated area rate in this area is 48% which is relatively low among other areas in the Hardoi Branch Command Area. 35% of the cultivated area has alkaline soil most of which pH is 8.5 to 9.0, and 25% of the cultivated area has coarse textured soil which has fine porosity and high water/nutrient holding capacity. Alkalinity or salinity problems in this area are not very serious due to these soil characteristics.

Wheat cultivation is predominant in this area and the cropping system and farming practices largely depend on upland crop cultivation as a consequence. Sugarcane is also extensively cultivated here and farmers' income is about average for the Hardoi Branch Command.

(2) Sursa (Hardoi District)

This area is located in the middle part of the Hardoi Branch Command and is irrigated by the Hardoi Branch (direct) and Badaicha Distributary. CCA of this area is 17,313 ha and the annual irrigation rate to C.C.A is 43%. The Sharda Canal System irrigate relatively low percentage of CCA with 94 km irrigation canals in total. On the other hand, ground water is not utilized for irrigation very much. Judging from these, it can be said that farming in this area largely depends on rainfall, which results in low irrigation sufficiency of 61% in Kharif and 18% in Rabi.

The main drainage river of this area is the Sai River and 86% of the total area is located in the mid-land where drainage improvement is relatively difficult comparing with upland and lowland. Drainage canal density is high (133 m/ha), but waterlogging and marshy land still occupies 3.1% of the total area, which means that present drainage system does not function well.

The cultivated area rate of this area is 61%, of which 30.4% has alkaline soil. Alkaline soil consists of 13.2% strong alkaline (over pH9.0) and 17.2% alkaline (pH8.5-pH9.0) soil. Coarse textured soil is less distributed (14.5%) in the area. Judging from the above-mentioned conditions, drainage improvement is a high priority in this area so as to prevent farmland from deterioration. The major crop is paddy and sugarcane cultivation is rare. Farmers' income is relatively low in the Hardoi Branch Command.

(3) Purwa (Unnao District)

This area lies in the middle part of the Purwa Branch Command irrigated by the Purwa Branch (direct) and the Purwa distributary. CCA of this area is 12,252 ha of which 49% is annually irrigated by the Sharda Canal. Consequently dependency on ground water is low. The total length of the irrigation canal is 97 km of which 22% has reduced functions and requires rehabilitation.

The main drainage river of this area is the Loni River. The percentage of midland is high (88%). Waterlogging or marshy land occupies 2.7% of the total area and the drainage

canal density is medium (67 m/ha) in the Hardoi Branch Command which shows that the drainage improvement has not been done properly.

The cultivated area rate of this area is 60% of which 39% has alkaline soil, and half of alkaline soil shows strong alkalinity (pH over 9.0).

Though the cultivated area of wheat and paddy is almost the same, it is taken as the paddy area in the Hardoi Branch Command. Farmers' income levels are low and the land holding size is small.

In addition to the above-mentioned three selected areas, Sataon area with a CCA of about 8,000 ha under District Rae Bareli was included as a representative CAD area for improvement of irrigation condition according to the result of discussion in the Steering Committee of the Study held on December 27, 1990.

The field works of Stage II and agricultural planning was carried out for those four Representative CAD areas.

TABLES

Table I.1 Priority Ranking for Selection of Representative Area by Irrigation

Sl. No.	Name of Block	Name of District	1. Irrigation Rate (A) Proposed Irrigation Area(ha)	(B) Actual Irrigation Area(ha)	(C)=(B/A) Irrigation Rate (%)	Mark (AI)	2. Canal Condition (D) Canal Length(km)	(E) Loss Functioned Canal(km)	(F)=(E/D) Rate (%)	Mark (FC)	3. Irrigation Rate by Government Canal (G) Percentage	Mark (GC)	4. Irrigation by Groundwater (H) Geographical Area (ha)	Number of Tubewell (I) Government Tubewell	(J) Private Tubewell	(K)=(I+J) Total	(L)=(H/K) Dependance of Groundwater (ha/no)	Mark (DG)	Weighted Mark	Ranking
1	Purenpur	Pilibhit	12,600	7,740	44.0	80	214.50	0.00	0.0	20	15.9	100	121,574	0	2,563	2,563	47	100	65	7
2	Banda	Shahjhanpur	902	1,024	114.6	20	9.10	0.00	0.0	20	4.7	100	46,891	27	1,699	1,726	27	100	44	26
3	Powayan	Shahjhanpur	574	874	152.1	20	5.94	0.00	0.0	20	4.7	100	30,601	82	1,315	1,397	22	100	44	26
4	Sindhauli	Shahjhanpur	10,610	14,140	133.3	20	105.22	0.00	0.0	20	34.6	80	29,168	48	213	261	112	60	35	42
5	Bhawalkhera	Shahjhanpur	8,077	6,971	86.3	40	85.25	0.00	0.0	20	41.7	60	31,928	24	281	305	105	60	39	36
6	Paigawan	Kheri	6,568	7,819	119.0	20	71.25	9.23	13.0	20	25.3	80	47,370	142	902	1,044	45	100	41	35
7	Pihani	Hardoi	9,894	10,260	104.7	20	105.00	55.56	52.9	100	38.8	80	33,685	48	231	279	121	60	63	8
8	Todarpur	Hardoi	8,064	9,741	120.8	20	96.00	0.00	0.0	20	29.2	80	30,621	22	124	146	210	20	29	47
9	Shahabad	Hardoi	1,129	1,544	136.8	20	10.00	0.00	0.0	20	11.6	100	34,673	85	260	345	101	60	38	39
10	Harivawan	Hardoi	7,494	8,092	108.0	20	71.00	17.62	24.8	40	53.3	60	29,035	38	181	219	133	60	39	36
11	Tadiyawan	Hardoi	8,964	7,506	83.7	40	94.00	40.64	43.2	80	41.6	60	31,235	33	114	147	212	20	54	15
12	Bawan	Hardoi	7,148	6,681	93.5	40	81.00	0.00	0.0	20	31.2	80	32,827	36	266	302	109	60	42	30
13	Sandi	Hardoi	736	302	41.0	80	5.00	0.00	0.0	20	1.8	100	31,575	29	99	128	247	20	53	16
14	Abirauni	Hardoi	10,305	7,119	69.1	60	113.00	8.45	7.5	20	42.3	60	37,708	36	155	191	197	40	45	28
15	Surra	Hardoi	12,172	8,212	67.5	60	145.21	0.00	0.0	20	37.8	80	33,628	28	101	129	261	20	43	28
16	Bilgram	Hardoi	6,559	2,349	35.8	80	47.60	0.00	0.0	20	30.7	80	33,839	32	326	358	95	80	59	19
17	Kothawan	Hardoi	8,264	5,740	69.5	60	82.00	0.00	0.0	20	48.3	60	29,485	29	190	219	135	60	46	24
18	Kachhona	Hardoi	9,612	4,028	41.9	80	93.00	0.00	0.0	20	47.3	60	24,864	1	113	114	218	20	47	23
19	Madhoganj	Hardoi	5,395	3,294	61.1	60	72.52	7.85	10.8	20	23.7	80	28,916	28	301	329	88	80	52	17
20	Malawan	Hardoi	2,814	2,592	92.1	40	35.83	1.60	4.5	20	49.7	60	31,069	8	111	119	261	20	33	44
21	Sandila	Hardoi	9,520	8,491	89.2	40	111.70	0.00	0.0	20	42.1	60	31,262	1	357	358	88	80	42	30
22	Beholar	Hardoi	6,422	5,819	90.6	40	110.50	0.00	0.0	20	47.1	60	27,842	1	200	201	139	60	39	36
23	Bharawan	Hardoi	7,764	6,911	89.0	40	108.00	0.00	0.0	20	24.6	80	23,140	21	556	577	40	100	48	22
24	Mal	Lucknow	7,673	4,720	61.5	60	83.00	0.00	0.0	20	39.5	80	25,382	57	1,902	1,959	13	100	55	11
25	Malihabad	Lucknow	6,315	5,521	87.4	40	78.34	2.40	3.1	20	41.6	60	22,594	24	1,215	1,239	18	100	45	25
26	Kakori	Lucknow	6,415	6,111	95.3	40	89.92	38.75	43.1	80	41.8	60	38,435	34	2,413	2,447	16	100	66	6
27	Sarojini Nagar	Lucknow	11,839	6,040	51.0	60	169.88	70.74	41.6	80	47.9	60	35,903	29	2,110	2,139	17	100	73	4
28	Mohanlalganj	Lucknow	10,626	4,871	45.8	80	138.05	42.78	31.0	60	55.0	60	34,652	19	1,761	1,780	19	100	73	4
29	Gosainganj	Lucknow	2,133	787	36.9	80	27.15	15.52	57.2	100	73.5	40	25,701	18	1,427	1,445	18	100	84	2
30	Auras	Unnao	7,045	10,410	147.8	20	143.66	6.30	4.4	20	75.7	40	23,428	5	217	222	106	60	29	47
31	Geniumradabad	Unnao	7,072	3,698	52.3	60	93.74	2.27	2.4	20	38.0	80	27,990	8	245	253	111	60	49	18
32	Bangarmau	Unnao	4,798	3,458	72.1	60	56.10	0.00	0.0	20	38.8	80	27,996	25	217	242	116	60	49	18
33	Fatehpur Chaurasi	Unnao	4,014	4,901	122.1	20	53.00	0.00	0.0	20	34.4	80	32,177	10	176	186	173	40	32	46
34	Hasanganj	Unnao	11,206	10,593	92.9	40	225.23	5.20	2.3	20	74.2	40	27,331	7	236	243	112	60	36	41
35	Mayarani	Unnao	9,962	9,151	91.9	40	191.35	1.90	1.0	20	69.8	40	25,683	8	151	159	162	40	33	44
36	Safipur	Unnao	5,273	5,476	103.8	20	70.60	0.00	0.0	20	52.2	60	27,803	8	277	285	98	80	35	42
37	Newabganj	Unnao	8,584	6,311	73.5	60	169.10	4.00	2.4	20	50.5	60	33,483	14	436	450	74	80	49	18
38	Bichhiya	Unnao	12,701	14,250	112.2	20	204.00	2.38	1.2	20	85.2	20	33,242	2	237	239	139	60	26	49
39	Sikandarpur Sirsi	Unnao	4,229	3,847	91.0	40	59.90	0.00	0.0	20	30.0	80	34,889	10	308	318	110	60	42	30
40	Sikandarpur Khas	Unnao	4,465	2,731	61.2	60	51.10	1.26	2.5	20	35.9	80	28,895	7	620	627	46	100	55	11
41	Asoha	Unnao	8,129	5,491	67.5	60	118.88	10.16	8.5	20	60.9	40	23,527	24	938	962	24	100	49	18
42	Purwa	Unnao	9,012	8,960	99.4	40	149.47	32.88	22.0	40	75.7	40	33,881	1	155	156	217	20	37	40
43	Hilauli	Unnao	9,245	2,527	27.3	80	79.12	29.20	36.9	60	33.0	80	25,556	12	535	547	47	100	76	3
44	Bighapur	Unnao	9,024	6,994	77.5	40	112.11	10.33	9.2	20	68.4	40	26,939	7	912	919	29	100	42	30
45	Sumerpur	Unnao	5,135	7,346	143.1	20	97.16	0.00	0.0	20	49.2	60	25,550	1	100	101	253	20	26	44
46	Sataon	Raebareli	3,970	680	17.1	100	45.66	26.19	56.1	100	29.6	80	26,745	9	1,963	1,972	14	100	97	1
47	Khiron	Raebareli	7,896	4,758	60.3	60	111.43	2.88	2.6	20	37.4	80	33,204	23	3,002	3,025	8	100	55	11
48	Lalganj	Raebareli	5,993	4,126	68.8	60	85.87	0.00	0.0	20	22.3	80	22,276	37	1,972	2,009	11	100	55	11
49	Sareni	Raebareli	7,797	2,415	31.0	80	84.73	0.00	0.0	20	33.3	80	25,511	16	1,842	1,858	14	100	62	9
50	Dalmau	Raebareli	1,817	1,554	85.5	40	63.60	0.00	0.0	20	69.8	40	26,476	59	2,789	2,848	9	100	42	30
	Total/Average		359,055	284,906	79.3		4,726.56	446.08	9.4		41.8		1,598,278	1,273	38,814	40,087	40			

RATING	Irrigation Rate(%)	Mark(AI)	Rate(%)	Mark(FC)	Percentage(%)	Mark(GC)	Dependancy(ha/no)	Mark(WE)
	>100	20	>50	100	100 - 80	20	>200	20
	100 - 75	40	40 - 50	80	80 - 60	40	150 - 200	40
	75 - 50	60	30 - 40	60	60 - 40	60	100 - 150	60
	50 - 25	80	20 - 30	40	40 - 20	80	50 - 100	80
	25 - 0	100	20 >	20	20 - 0	100	50 >	100

Index	Weighting(%)
AI	35
FC	35
GC	15
WE	15

Table I.2 Priority Ranking for Selection of Representative Area by Drainage

Sl. No.	Name of Block	Name of District	1. Drainability Index (A) Geographical Area (ha)	(B) Midland Area (ha)	(C)=(B/A) Percentage (%)	(D) Mark (DI)	2. Poor Drainage Area Rate (E) Midland Area (ha)	(F) Waterlogged/ Marshy Area (ha)	(G)=(F/E) Percentage (%)	(H) Mark (PD)	3. Drainage Canal Density (I) Waterlogged/ Marshy Area (ha)	(J) Canal Length (km)	(K)=(J/I) Density (m/ha)	(L) Mark (DC)	Weighted Mark	Ranking
1	Puranpur	Pilibhit	121,574	75,599	62.2	40	75,599	794	1.1	40	794	38.3	48.2	40	40	50
2	Banda	Shahjahanpur	46,891	32,162	68.6	40	32,162	154	0.5	20	154	72.0	467.5	100	54	36
3	Powayan	Shahjahanpur	30,601	20,453	66.8	40	20,453	162	0.8	20	162	23.8	146.9	100	54	36
4	Sindhauli	Shahjahanpur	29,168	18,254	62.6	40	18,254	266	1.5	40	266	34.2	128.6	100	61	23
5	Bhawalkhera	Shahjahanpur	31,928	22,027	69.0	40	22,027	386	1.8	40	386	20.3	52.6	60	47	47
6	Paigawan	Kheri	47,370	34,100	72.0	60	34,100	504	1.5	40	504	21.7	42.3	40	46	48
7	Pihani	Hardoi	35,685	26,861	75.8	60	26,861	350	1.4	40	350	41.2	117.7	100	67	9
8	Tolaipur	Hardoi	30,621	21,467	70.1	60	21,467	305	1.4	40	305	54.2	177.7	100	67	9
9	Shahabad	Hardoi	34,673	25,006	72.1	60	25,006	614	2.5	60	614	0.0	0.0	20	46	49
10	Harpalpur	Hardoi	29,035	22,582	77.8	60	22,582	656	2.9	60	656	22.8	34.8	40	53	34
11	Tadiyawan	Hardoi	31,255	23,369	74.8	60	23,369	462	2.0	40	462	53.3	115.4	100	67	9
12	Bawan	Hardoi	32,827	25,904	78.9	60	25,904	502	1.9	40	502	46.9	93.4	80	60	27
13	Saodi	Hardoi	31,576	17,869	56.6	20	17,869	1,185	6.6	100	1,185	0.0	0.0	20	48	44
14	Ahirauri	Hardoi	37,703	30,426	80.7	80	30,426	111	0.4	20	111	38.0	342.3	100	66	19
15	Sursa	Hardoi	33,628	28,777	85.6	80	28,777	897	3.1	80	897	119.1	132.8	100	87	1
16	Bilgram	Hardoi	33,839	23,085	68.2	40	23,085	1,192	5.2	100	1,192	6.3	5.3	20	54	34
17	Kothawan	Hardoi	29,485	19,453	66.0	40	19,453	557	2.9	60	557	52.0	93.4	80	61	23
18	Kachhona	Hardoi	24,864	21,688	87.2	80	21,688	1,518	7.0	100	1,518	31.7	20.9	20	66	19
19	Madhoganj	Hardoi	28,916	20,293	70.2	60	20,293	549	2.7	60	549	24.1	43.9	40	53	38
20	Malawan	Hardoi	31,069	23,897	76.9	60	23,897	417	1.7	40	417	65.9	158.0	100	67	9
21	Sandila	Hardoi	31,362	23,076	73.6	60	23,076	1,895	8.2	100	1,895	43.1	22.7	20	60	27
22	Behdar	Hardoi	27,842	21,620	77.7	60	21,620	1,788	8.3	100	1,788	68.4	38.3	40	67	9
23	Bharawan	Hardoi	23,140	17,506	75.7	60	17,506	1,155	6.6	100	1,155	32.9	28.5	40	67	9
24	Mal	Lucknow	25,382	21,364	84.2	80	21,364	245	1.1	40	245	36.4	148.6	100	73	4
25	Malihabad	Lucknow	21,092	13,780	65.3	40	13,780	539	3.9	80	539	33.1	61.4	60	61	23
26	Kakori	Lucknow	22,594	18,048	79.9	60	18,048	646	3.6	80	646	29.1	45.0	40	60	27
27	Sarojini Nagar	Lucknow	38,435	28,356	73.8	60	28,356	1,150	4.1	100	1,150	21.5	18.7	20	60	27
28	Mohanlalganj	Lucknow	35,900	28,429	79.2	60	28,429	201	0.7	20	201	15.2	75.6	80	53	38
29	Gosaiganj	Lucknow	34,652	25,672	74.1	60	25,672	805	3.1	80	805	0.0	0.0	20	53	38
30	Auras	Unnao	25,701	21,795	84.8	80	21,795	809	3.7	80	809	82.5	102.0	100	87	1
31	Ganjmuradabad	Unnao	23,428	17,895	76.4	60	17,895	663	3.7	80	663	40.6	61.2	60	67	9
32	Bangarmau	Unnao	27,990	21,026	75.1	60	21,026	1,302	6.2	100	1,302	26.1	20.0	20	60	27
33	Fatehpur Chaurasi	Unnao	27,996	21,154	75.6	60	21,154	772	3.6	80	772	35.2	45.6	40	60	27
34	Hasanganj	Unnao	32,177	27,845	86.5	80	27,845	524	1.9	40	524	54.2	103.4	100	73	4
35	Mevasanj	Unnao	27,331	23,713	86.8	80	23,713	843	3.6	80	843	46.6	55.3	60	73	4
36	Safipur	Unnao	25,683	13,023	50.7	20	13,023	1,791	13.8	100	1,791	26.4	14.7	20	48	44
37	Newabganj	Unnao	27,803	22,511	81.0	80	22,511	714	3.2	80	714	63.9	89.5	80	80	3
38	Bichhiya	Unnao	33,483	31,162	93.1	100	31,162	972	3.1	80	972	47.3	48.7	40	72	7
39	Sikandarpur Sirsi	Unnao	33,242	18,867	56.8	20	18,867	726	3.8	80	726	79.7	109.8	100	69	8
40	Sikandarpur Khas	Unnao	24,869	12,129	24.8	20	12,129	647	5.3	100	647	29.6	45.7	40	55	33
41	Asoha	Unnao	28,893	20,296	70.2	60	20,296	1,081	5.3	100	1,081	29.1	26.9	40	67	9
42	Purwa	Unnao	23,527	20,808	88.4	80	20,808	554	2.7	60	554	37.0	66.8	60	66	19
43	Hilauli	Unnao	33,881	29,054	85.8	80	29,054	819	2.8	60	819	20.2	24.7	20	52	43
44	Bighapur	Unnao	25,556	16,725	65.4	40	16,725	189	1.1	40	189	30.5	161.4	100	61	23
45	Sumerpur	Unnao	26,939	15,734	58.4	20	15,734	377	2.4	60	377	52.3	138.7	100	62	22
46	Sataon	Raebareli	25,550	19,782	77.4	60	19,782	85	0.4	20	85	42.2	496.5	100	60	27
47	Khiron	Raebareli	23,204	17,746	76.5	60	17,746	647	3.6	80	647	14.9	23.0	20	53	38
48	Lalganj	Raebareli	22,276	13,236	59.4	20	13,236	71	0.5	20	71	14.2	200.0	100	48	44
49	Sareni	Raebareli	25,511	17,733	69.5	40	17,733	30	0.2	20	30	6.4	213.3	100	54	34
50	Dalmau	Raebareli	26,476	18,791	71.0	60	18,791	286	1.5	40	286	84.6	295.8	100	67	9
Total/Average			1,592,626	1,150,149	72.2		1,150,149	33,905	2.9		33,905	1,909	56.3			

Percentage(%)	Mark(DI)
100-90	100
90-80	80
80-70	60
70-60	40
60>	20

Percentage(%)	Mark(PD)
>4	100
3 - 4	80
2 - 3	60
1 - 2	40
1>	20

Density(m/ha)	Mark(DC)
100 m/ha <	100
75 - 100	80
50 - 75	60
25 - 50	40
25>	20

Index Weightage(%)	
DI	35
PD	35
DC	30

Table I.3 Priority Ranking for Selection of Representative Area by Alkalinity

Sl. No.	Name of Block	Name of District	1. Salt Affected Soil						2. Coarse Soil Rate				3. Cultivated Area Rate		Weighted Mark	Ranking
			(A) Cultivated Area (ha)	(B) Extremely Alkaline pH 9.0< (ha)	(C) Moderate Alkaline pH 9.0-8.5 (ha)	(D)=(B/A) Percentage (%)	(E)=(C/A) Percentage (%)	(F)=(D*2+E) Rate	Mark (SA)	(G) Geographical Area (ha)	(H) Coarse Soil (ha)	(I)=(H/G) Percentage (%)	(J) Mark (CS)	(K)=(A/G) Percentage (%)	(L) Mark (CA)		
1	Purwapur	Pilibhit	73,065	1,181	22,065	1.6	30.2	33	60	121,574	28,691	23.6	60	60.1	60	60	23
2	Banda	Shahjahanpur	28,653	923	11,016	2.4	28.5	33	60	46,891	12,004	25.6	60	82.4	100	68	10
3	Powayan	Shahjahanpur	24,680	575	4,829	2.3	19.6	24	40	30,601	8,629	28.2	60	80.7	100	56	27
4	Sindhauli	Shahjahanpur	23,464	508	5,608	2.2	23.9	28	40	29,168	8,838	30.3	80	80.4	100	60	23
5	Bhawalkhera	Shahjahanpur	24,380	752	6,217	3.1	25.5	32	60	31,928	8,493	26.6	60	76.4	80	64	15
6	Paseawan	Kheri	36,632	1,067	10,184	2.9	27.8	34	60	47,370	19,138	40.4	100	77.3	80	72	8
7	Pihani	Hardoi	24,066	545	6,184	2.3	25.7	30	60	33,685	8,421	25.0	60	71.4	80	64	15
8	Todarpur	Hardoi	21,589	349	5,585	1.6	25.9	29	40	30,621	8,176	26.7	60	70.5	80	52	34
9	Shahabad	Hardoi	25,859	696	6,181	2.7	23.9	29	40	34,673	7,906	22.3	60	74.6	80	52	34
10	Harpalpur	Hardoi	17,691	993	3,662	5.6	20.7	32	60	29,035	6,098	21.0	60	60.9	60	60	23
11	Tadiyawan	Hardoi	20,004	636	3,342	3.2	16.7	23	40	31,235	6,434	20.6	60	64.0	60	48	37
12	Sawai	Hardoi	23,472	658	6,220	2.8	26.5	32	60	32,827	6,570	20.0	60	71.5	80	64	15
13	Sandi	Hardoi	21,878	1,288	1,488	5.9	6.8	19	20	31,576	12,251	38.8	80	69.3	60	40	45
14	Ahirauri	Hardoi	25,316	886	6,202	3.5	24.5	32	60	37,705	7,277	19.3	40	67.1	60	56	27
15	Sursa	Hardoi	20,349	674	6,427	3.3	31.6	38	60	33,628	4,876	14.5	40	60.5	60	56	27
16	Sitapur	Hardoi	21,651	1,164	2,923	5.4	13.5	24	40	33,839	9,712	28.7	60	64.0	60	48	37
17	Kothawan	Hardoi	19,757	699	1,853	3.5	9.4	16	20	29,485	8,551	29.0	60	67.0	60	36	48
18	Kachhona	Hardoi	13,422	1,611	5,342	12.0	39.8	64	100	24,864	3,680	14.8	40	54.0	40	76	4
19	Mallawan	Hardoi	9,676	450	1,664	4.7	17.2	27	40	28,916	6,766	23.4	60	33.5	20	40	45
20	Malawan	Hardoi	21,089	1,067	6,419	5.1	30.4	41	80	31,069	7,022	22.6	60	67.8	60	72	8
21	Sandila	Hardoi	16,735	1,507	6,539	9.0	39.1	57	100	31,362	7,558	24.1	60	53.4	40	80	2
22	Behdar	Hardoi	16,312	1,681	4,422	10.3	27.1	48	80	27,842	6,097	21.9	60	58.6	40	68	10
23	Bharawan	Hardoi	14,455	588	2,602	4.1	18.0	26	40	23,140	5,229	22.6	60	62.5	60	48	37
24	Mal	Lucknow	17,625	431	4,801	2.4	27.2	32	60	25,382	3,172	12.5	40	69.4	60	56	27
25	Malihabad	Lucknow	14,753	1,444	3,187	9.8	21.6	41	80	21,092	6,897	32.7	80	69.9	60	76	4
26	Kakori	Lucknow	14,460	973	2,386	6.7	16.5	30	40	22,594	3,954	17.5	40	64.0	60	44	41
27	Sarojini Nagar	Lucknow	18,382	2,428	3,158	13.2	17.2	44	80	38,435	9,647	25.1	60	47.8	20	64	15
28	Mohanlalganj	Lucknow	21,137	3,406	2,307	16.1	10.9	43	80	35,903	5,494	15.3	40	59.0	40	64	15
29	Gosiganj	Lucknow	17,653	4,176	205	23.7	1.2	48	80	34,652	7,381	21.3	60	50.9	40	68	10
30	Auras	Unnao	14,572	1,606	4,255	11.0	29.2	51	100	25,701	4,395	17.1	40	56.7	40	76	4
31	Ganjmuradabad	Unnao	16,091	739	1,995	4.6	12.4	22	40	23,426	4,639	19.8	40	68.7	60	44	41
32	Bangarmau	Unnao	18,517	1,105	2,930	6.0	15.8	28	40	27,990	5,206	18.6	40	66.2	60	44	41
33	Fatehpur Chaurasi	Unnao	19,545	666	2,427	3.4	12.4	19	20	27,996	8,091	28.9	60	69.8	60	36	48
34	Hasanganj	Unnao	20,916	1,580	4,261	7.6	20.4	35	60	32,177	3,925	12.2	40	65.0	60	56	27
35	Mavaiganj	Unnao	17,778	2,797	2,201	15.7	12.4	44	80	27,331	4,045	14.8	40	65.0	60	68	10
36	Safipur	Unnao	15,084	1,605	2,453	10.6	16.3	38	60	25,680	10,787	42.0	100	58.7	40	64	15
37	Nawabganj	Unnao	18,054	3,255	1,330	18.0	7.4	43	80	27,803	4,949	17.8	40	64.9	60	68	10
38	Bichhiya	Unnao	18,709	5,205	5,065	27.8	27.1	83	100	33,483	4,118	12.3	40	55.9	40	76	4
39	Sikandarpur Sirsi	Unnao	21,120	1,378	2,116	6.5	10.0	23	40	33,242	14,028	42.2	100	63.5	60	56	27
40	Sikandarpur Khas	Unnao	21,212	1,184	954	5.6	4.7	13	20	34,889	15,805	45.3	100	60.8	60	44	44
41	Asoha	Unnao	17,880	4,014	3,166	22.5	17.7	63	100	28,893	8,523	29.5	60	61.9	60	84	1
42	Purwa	Unnao	14,190	2,423	3,074	17.1	21.7	56	100	23,527	3,317	14.1	40	60.3	60	80	2
43	Hilauli	Unnao	19,892	2,879	2,426	14.5	12.2	41	80	33,881	5,760	17.0	40	58.7	40	64	15
44	Bighapur	Unnao	16,465	2,481	1,248	15.1	7.6	38	60	25,556	7,897	30.9	80	64.4	60	64	15
45	Sumerpur	Unnao	16,991	1,537	629	9.0	3.7	22	40	26,959	10,856	40.3	100	63.1	60	56	27
46	Sataon	Raebareli	18,067	1,486	1,089	8.2	6.0	22	40	25,559	6,490	25.4	60	70.7	80	52	34
47	Khiero	Raebareli	14,917	1,812	1,422	12.1	9.5	34	60	23,204	5,059	21.8	60	64.3	60	60	23
48	Lalganj	Raebareli	13,523	646	744	4.8	5.5	15	20	22,276	7,507	33.7	80	60.7	60	40	45
49	Sarenl	Raebareli	13,592	483	1,264	3.6	9.3	16	20	25,511	7,168	28.1	60	53.3	40	32	50
50	Dalmau	Raebareli	17,592	1,303	2,192	7.4	12.5	27	40	26,476	7,254	27.4	60	66.4	60	48	37
	Total/Average		1,022,951	73,540	199,661	7.2	19.5	34		1,592,626	394,782	38.6		64.2			
				Mark 100	Mark 50												

Rate	Mark(SA)
> 50	100
40 - 50	80
30 - 40	60
20 - 30	40
20 >	20

Percentage	Mark(CS)
40 <	100
40-30	80
30-20	60
20-10	40
10 >	20

Percentage(%)	Mark(CA)
80 <	100
70 - 80	80
60 - 70	60
50 - 60	40
50 >	20

Index	Weightage(%)
SA	60
CS	20
CA	20

Table I.4 Priority Ranking for Selection of Representative Area by Socio-Economic(1/2)

Sl. No.	Name of Block	Name of District	1. Farm Economy Index																2. Agricultural Support System Development Index						
			A. Farm Income Index								B. Operational Holding Index								A. Consumption of Fertilizer		B. Storage Capacity				
			Paddy(Rs.1,500/ton)		Wheat(Rs.1,660/ton)		Sugarcane(Rs.195/ton)		Crop Income (Rs./ha)	Mark (FI)	i) Average Holdings Size		ii) Marginal Farmer Increasing				Weighted Mark (OH)	Weighted Mark (FE)	Average 1984-88 (Kg/ha)	Mark (CF)	Storage Capacity (ton)	Cultivated Area (ha)	Unit Capacity (Kg/ha)	Mark (SC)	Weighted Mark (AS)
			Cropped Area (ha)	Yield (ton/ha)	Cropped Area (ha)	Yield (ton/ha)	Cropped Area (ha)	Yield (ton/ha)			Holding Size (ha)	Mark (AH)	1980-81 (1,000 pcs.)	1985-86 (1,000 pcs.)	Increasing (%)	Mark (MF)									
1	Pursaur	Pilibhit	38,971	2.9	45,711	2.1	14,108	67.8	5,120	20	1.17	20	104	116	112	100	60	40	101.23	20	1,030	73,065	14.1	100	60
2	Banda	Shahjahanpur	23,670	2.5	28,779	2.3	2,563	53.8	4,075	40	0.98	60	242	246	102	20	40	40	91.57	40	2,100	38,653	54.3	60	50
3	Powayan	Shahjahanpur	12,019	2.5	16,781	2.3	2,065	53.8	4,202	40	0.98	60	242	246	102	20	40	40	152.67	20	1,250	24,680	50.6	60	40
4	Sindhauli	Shahjahanpur	11,471	2.5	13,981	2.3	1,974	53.8	4,231	40	0.98	60	242	246	102	20	40	40	46.70	80	1,250	23,464	53.3	60	70
5	Rosa Jalalpur	Shahjahanpur	9,017	2.5	12,170	2.3	4,680	53.8	4,904	40	0.98	60	242	246	102	20	40	40	117.03	20	900	24,380	36.9	80	50
6	Paigawan	Kheri	7,923	2.1	15,672	1.8	6,786	48.3	4,359	40	1.02	40	257	260	113	100	70	55	68.03	60	850	36,632	23.2	100	80
7	Bihapi	Hardoi	4,366	1.7	11,948	1.8	4,050	43.1	3,886	60	0.95	60	299	307	103	20	40	50	44.43	80	1,300	24,066	54.0	60	70
8	Todarpur	Hardoi	5,703	1.7	12,742	1.8	3,215	43.1	3,613	60	0.95	60	299	307	103	20	40	50	52.53	60	1,200	21,589	55.6	60	60
9	Shahabad	Hardoi	2,490	1.7	13,991	1.8	2,934	43.1	3,685	60	0.95	60	299	307	103	20	40	50	63.60	60	1,200	25,859	46.4	80	70
10	Harivansh	Hardoi	2,689	1.7	9,098	1.8	2,160	43.1	3,676	60	0.95	60	299	307	103	20	40	50	57.10	60	1,100	17,691	62.2	60	60
11	Tadiyawan	Hardoi	2,391	1.7	10,434	1.8	1,501	43.1	3,457	60	0.95	60	299	307	103	20	40	50	62.50	60	1,000	20,004	50.0	80	70
12	Bawan	Hardoi	2,833	1.7	12,972	1.8	1,987	43.1	3,475	60	0.95	60	299	307	103	20	40	50	33.17	80	1,200	23,472	51.1	60	70
13	Sandi	Hardoi	1,254	1.7	11,525	1.8	375	43.1	3,088	60	0.95	60	299	307	103	20	40	50	42.67	80	1,200	21,878	54.8	60	70
14	Ahirauri	Hardoi	2,355	1.7	13,652	1.8	1,588	43.1	3,379	60	0.95	60	299	307	103	20	40	50	24.30	100	1,300	25,316	51.4	60	80
15	Sursa	Hardoi	2,176	1.7	13,406	1.8	1,146	43.1	3,273	60	0.95	60	299	307	103	20	40	50	48.67	80	1,400	20,340	68.8	60	70
16	Bilgram	Hardoi	3,645	1.7	11,862	1.8	524	43.1	3,051	60	0.95	60	299	307	103	20	40	50	52.37	60	1,100	21,651	50.8	60	60
17	Kothawan	Hardoi	1,716	1.7	10,683	1.8	231	43.1	3,020	60	0.95	60	299	307	103	20	40	50	31.43	80	1,100	19,757	55.7	60	70
18	Kachhona	Hardoi	938	1.7	9,673	1.8	258	43.1	3,069	60	0.95	60	299	307	103	20	40	50	43.60	80	1,200	13,422	89.4	40	60
19	Madhoganj	Hardoi	1,223	1.7	11,858	1.8	702	43.1	3,203	60	0.95	60	299	307	103	20	40	50	39.40	80	1,300	9,676	134.4	20	50
20	Malawan	Hardoi	3,532	1.7	10,005	1.8	152	43.1	2,950	80	0.95	60	299	307	103	20	40	60	79.50	80	1,100	21,089	52.2	60	70
21	Sandila	Hardoi	3,060	1.7	10,783	1.8	212	43.1	2,968	80	0.95	60	299	307	103	20	40	60	69.97	60	900	16,735	53.8	60	60
22	Bohder	Hardoi	1,383	1.7	11,229	1.8	337	43.1	3,071	60	0.95	60	299	307	103	20	40	50	44.30	80	900	16,312	55.2	60	70
23	Bharawan	Hardoi	1,015	1.7	8,507	1.8	483	43.1	3,184	60	0.95	60	299	307	103	20	40	50	54.90	60	1,000	14,455	69.2	60	60
24	Mal	Lucknow	4,198	1.6	7,537	1.9	27	47.1	2,898	80	0.94	60	118	120	102	20	40	60	84.27	40	1,200	17,625	68.1	60	50
25	Malihabad	Lucknow	2,587	1.6	6,110	1.9	14	47.1	2,939	80	0.94	60	118	120	102	20	40	60	103.55	20	900	14,753	61.0	60	40
26	Kakori	Lucknow	2,892	1.6	6,910	1.9	34	47.1	2,957	80	0.94	60	118	120	102	20	40	60	87.94	40	700	14,469	48.4	80	60
27	Sarojini Nagar	Lucknow	5,625	1.6	12,996	1.9	89	47.1	2,945	80	0.94	60	118	120	102	20	40	60	55.75	60	300	18,387	16.3	100	80
28	Mohanlalganj	Lucknow	4,159	1.6	12,705	1.9	104	47.1	3,003	60	0.94	60	118	120	102	20	40	50	83.61	40	1,000	21,187	47.2	80	60
29	Gosiganj	Lucknow	5,770	1.6	9,987	1.9	204	47.1	2,952	80	0.94	60	118	120	102	20	40	60	147.50	20	1,400	17,653	79.3	40	30
30	Auras	Unnao	6,461	1.2	7,764	1.8	123	46.0	2,500	80	0.85	80	247	264	107	60	70	75	71.57	60	500	14,572	20.6	100	80
31	Ganimurabad	Unnao	3,258	1.2	9,147	1.8	371	46.0	2,845	80	0.85	80	247	264	107	60	70	75	33.67	80	100	16,091	6.2	100	90
32	Bangarmau	Unnao	3,287	1.2	9,140	1.8	233	46.0	2,781	80	0.85	80	247	264	107	60	70	75	90.47	40	100	18,517	5.4	100	70
33	Fatehpur Chaurasi	Unnao	4,484	1.2	10,795	1.8	256	46.0	2,736	80	0.85	80	247	264	107	60	70	75	65.87	60	200	19,565	10.2	100	80
34	Hasanganj	Unnao	6,814	1.2	10,759	1.8	150	46.0	2,578	80	0.85	80	247	264	107	60	70	75	41.60	80	100	20,916	4.8	100	90
35	Mayawati	Unnao	5,393	1.2	9,881	1.8	278	46.0	2,677	80	0.85	80	247	264	107	60	70	75	61.10	60	500	17,778	28.1	80	70
36	Safipur	Unnao	4,539	1.2	9,461	1.8	323	46.0	2,736	80	0.85	80	247	264	107	60	70	75	98.13	40	100	15,084	6.6	100	70
37	Newabganj	Unnao	5,590	1.2	9,038	1.8	44	46.0	2,552	80	0.85	80	247	264	107	60	70	75	65.20	60	300	18,054	16.6	100	90
38	Bighhiya	Unnao	12,799	1.2	11,391	1.8	46	46.0	2,371	80	0.85	80	247	264	107	60	70	75	56.43	60	600	18,709	32.1	80	70
39	Sikandarpur Sirsal	Unnao	3,085	1.2	9,907	1.8	27	46.0	2,719	80	0.85	80	247	264	107	60	70	75	111.43	20	300	21,129	14.2	100	60
40	Sikandarpur Khas	Unnao	4,871	1.2	11,010	1.8	100	46.0	2,660	80	0.85	80	247	264	107	60	70	75	39.00	80	600	21,212	28.3	80	80
41	Asoha	Unnao	6,419	1.2	9,165	1.8	71	46.0	2,526	80	0.85	80	247	264	107	60	70	75	46.20	80	600	17,880	33.6	80	80
42	Purwa	Unnao	8,744	1.2	9,229	1.8	303	46.0	2,511	80	0.85	80	247	264	107	60	70	75	56.40	60	300	14,190	21.1	100	80
43	Hilauli	Unnao	6,342	1.2	7,916	1.8	124	46.0	2,512	80	0.85	80	247	264	107	60	70	75	42.83	80	300	19,892	15.1	100	90
44	Bighaur	Unnao	6,532	1.2	8,350	1.8	326	46.0	2,396	80	0.85	80	247	264	107	60	70	75	59.40	60	300	16,455	18.2	100	80
45	Sumerpur	Unnao	6,707	1.2	8,711	1.8	398	46.0	2,623	80	0.85	80	247	264	107	60	70	75	51.30	60	300	16,991	17.7	100	80
46	Sareni	Raebareli	2,450	1.5	8,410	1.8	351	41.3	2,973	80	0.76	100	288	315	109	80	90	85	59.57	60	1,500	17,592	85.3	40	50
47	Khiroy	Raebareli	3,065	1.5	8,200	1.8	300	41.3	2,913	80	0.76	100	288	315	109	80	90	85	54.00	60	1,500	18,067	83.0	40	50
48	Lalganj	Raebareli	1,896	1.5	7,679	1.8	195	41.3	2,938	80	0.76	100	288	315	109	80	90	85	95.73	40	1,500	14,917	100.6	20	30
49	Sarani	Raebareli	2,607	1.5	7,289	1.8	696	41.3	3,112	60	0.76	100	288	315	109	80	90	75	51.03	60	1,500	13,523	110.9	20	40
50	Dalmau	Raebareli	5,390	1.5	9,148	1.8	480	41.3	2,872	80	0.76	100	288	315	109	80	90	85	61.87	60	2,000	13,592	147.1	20	40
Total/Average			281,714		575,737		59,691						12,512	13,128	105						45,280	1,022,951	44.4		

Crop Income(Rs/ha)	Mark(FI)
>5,000	20
4,000 - 5,000	40
3,000 - 4,000	60
2,000 - 3,000	80
<2,000	100

Holding Size(ha)	Mark(AH)
>1.1	20
1.0-1.1	40
0.9-1.0	60
0.8-0.9	80
0.7-0.8	100

Increasing(%)	Mark(MF)
>110	100
108-110	80
106-108	60
104-106	40
<104	20

Index	Weighting(%)
AH	50
MF	50

Index	Weighting(%)
AH	50
FI	50

Fertilizer(Kg/ha)	Mark(CF)
>100	20
75-100	40
50-75	60
25-50	80
0-25	100

Unit Capacity(Kg/ha)	Mark(SC)
>100	20
75-100	40
50-75	60
25-50	80
0-25	100

Index	Weighting(%)
CF	50
SC	50

Table I.4 Priority Ranking for Selection of Representative Area by Socio-Economic(2/2)

Sl. No.	Name of Block	Name of District	1. Social Infrastructure Index										Weighted Mark	Ranking
			A. Electrified Village				B. Water Supply Facility							
								Water Supply Facility						
			Total Village (nos.)	Electrified Village (nos.)	Percentage (%)	Mark (EV)	Population	Wells (nos.)	Taps (nos.)	Total	Density (Person/nos.)	Mark (WS)	Weighted Mark (SI)		
1	Purwapur	Pilibhit	388	227	59	60	219,936	0	9	9	24,437	100	80	58	27
2	Pawda	Shahjahanpur	189	61	32	80	107,723	40	0	40	2,693	60	70	52	42
3	Pawayan	Shahjahanpur	172	70	41	80	82,025	137	0	137	599	20	50	43	50
4	Sindhauli	Shahjahanpur	169	62	37	80	94,111	64	0	64	1,470	40	60	55	36
5	Bhawalkhera	Shahjahanpur	162	54	33	80	117,948	130	0	130	907	20	50	46	48
6	Pargawan	Kheri	221	106	46	80	141,501	202	0	202	701	20	50	61	21
7	Pihani	Hardoi	125	38	30	80	112,687	122	0	122	924	20	50	56	31
8	Todarpur	Hardoi	114	38	33	80	101,513	111	0	111	915	20	50	53	39
9	Shahabad	Hardoi	151	64	42	80	104,489	139	0	139	752	20	50	56	31
10	Harpalpur	Hardoi	91	40	44	80	116,184	86	0	86	1,351	40	60	56	31
11	Tadiyawan	Hardoi	88	47	53	60	107,709	87	0	87	1,238	40	50	56	31
12	Bawan	Hardoi	134	44	33	80	126,861	122	0	122	1,040	40	60	59	23
13	Sandi	Hardoi	96	49	51	60	93,891	89	0	89	1,055	40	50	56	31
14	Ahirori	Hardoi	96	44	46	80	131,916	93	0	93	1,418	40	60	62	20
15	Sursa	Hardoi	83	36	43	80	121,676	82	0	82	1,484	40	60	59	23
16	Bilgram	Hardoi	122	52	39	80	110,861	113	0	113	981	20	50	53	40
17	Kothawan	Hardoi	86	43	50	80	101,848	86	0	86	1,184	40	60	59	23
18	Kachhona	Hardoi	46	36	78	40	91,690	46	0	46	1,993	40	40	50	44
19	Madhavganj	Hardoi	100	58	58	60	105,875	98	0	98	1,080	40	50	50	44
20	Malawan	Hardoi	97	25	26	80	106,829	97	0	97	1,101	40	60	65	19
21	Sandila	Hardoi	97	45	46	80	105,912	95	0	95	1,115	40	60	60	22
22	Baldar	Hardoi	90	38	42	80	105,585	90	0	90	1,173	40	60	59	23
23	Bhagawan	Hardoi	82	65	79	40	77,563	72	0	72	1,077	40	40	50	44
24	Mal	Lucknow	87	47	54	60	93,904	87	0	87	1,079	40	50	54	38
25	Malihabad	Lucknow	100	86	86	40	100,226	98	0	98	1,023	40	40	48	47
26	Kakori	Lucknow	101	67	66	60	99,583	81	0	81	1,229	40	50	57	29
27	Sarojini Nagar	Lucknow	106	93	88	40	169,036	90	0	90	1,878	40	40	60	22
28	Mohanlalganj	Lucknow	113	67	59	60	135,837	112	0	112	1,213	40	50	53	39
29	Gosaiganj	Lucknow	117	74	63	60	109,550	114	0	114	961	20	40	45	49
30	Auras	Unnao	91	30	33	80	97,925	93	1	93	1,058	40	60	72	7
31	Ganjmuradabad	Unnao	85	27	32	80	90,731	72	1	73	1,243	40	60	75	2
32	Bangarmau	Unnao	78	48	62	60	93,246	66	1	67	1,392	40	50	66	15
33	Pachpour	Unnao	105	49	47	80	93,286	92	1	93	1,003	40	60	72	7
34	Hasanganj	Unnao	142	21	15	100	106,534	135	0	135	789	20	60	75	2
35	Mavaganj	Unnao	135	50	37	80	102,609	132	0	132	777	20	50	66	15
36	Safipur	Unnao	109	37	34	80	94,454	88	1	89	1,061	40	60	69	11
37	Nawabganj	Unnao	120	47	39	80	105,703	115	1	116	911	20	50	69	11
38	Bighhiya	Unnao	94	50	60	60	114,906	67	0	67	1,715	40	50	66	15
39	Nikandarpur Sirsi	Unnao	79	39	49	80	107,942	74	0	74	1,459	40	60	66	15
40	Sikandarpurchau	Unnao	111	27	24	100	124,121	92	3	95	1,307	40	70	75	2
41	Asoha	Unnao	118	28	24	100	97,562	93	0	93	1,049	40	70	75	2
42	Purwa	Unnao	100	35	35	80	85,986	11	0	11	7,817	100	90	81	1
43	Hilauli	Unnao	67	31	46	80	104,557	64	1	65	1,609	40	60	75	2
44	Bishanpur	Unnao	118	22	19	100	95,841	115	0	115	833	20	60	72	7
45	Sumerpur	Unnao	114	35	31	80	100,964	133	1	134	753	20	50	69	11
46	Sareni	Raebareli	70	69	99	40	98,739	0	12	12	8,228	100	70	70	10
47	Khiro	Raebareli	94	93	99	40	94,656	0	26	26	3,641	80	60	67	14
48	Lalganj	Raebareli	89	88	99	40	93,704	0	67	67	1,399	40	40	55	36
49	Sarani	Raebareli	153	144	94	40	112,754	0	124	124	909	20	30	51	43
50	Dalmau	Raebareli	124	123	99	40	94,830	16	58	74	1,281	40	40	58	27
Total/Average			5,827	2,869	49		5,395,419	4,236	307	4,537	1,189				

Percentage(%)	Mark(EV)
> 100	20
100 - 75	40
75 - 50	60
50 - 25	80
25>	100

Density(P./nos.)	Mark(WS)
>4,000	100
3,000-4,000	80
2,000-3,000	60
1,000-2,000	40
1,000>	20

Index	Weighting(%)
EV	50
WS	50

Index	Weighting(%)
PE	40
AS	30
SI	30

Table I.5 Relation between Basic Factors and Selection Parameters by Matrix

Description	Selection Criteria								Weighting				
	1	2	3	4	5	6	7	8	Irri.	Drain	Soil	Socio	Each item
I. SELECTION PARAMETERS													
A Natural Conditions													
1. Irrigation Condition	X		X						50				100
1) Irrigation Rate						X	X	X					35
2) Canal Conditions				X		X	X						35
3) Irrigation Rate by Government Canal						X							15
4) Dependancy on Ground Water Irrigation						X							15
2. Poor Drainage Condition	X		X							50			100
1) Drainability							X	X					35
2) Poor Drainage Area Rate						X	X						35
3) Drainage Canal Rate						X	X						30
3. Salinity/Alkalinity Affected Condition	X										50		100
1) Alkalinity						X	X	X					60
2) Soil Texture							X	X					20
3) Land Use							X						20
B Socio-Economy Conditions									50	50	50	100	
1. Farm Economy Conditions	X											40	100
1) Farm Income						X	X	X					50
2) Farm Holding						X	X	X					50
2. Agricultural Support Serviece Condition	X											30	100
1) Fertilizer Storage								X					50
2) Fertilizer Use								X					50
3. Social Infrastructure Development Condition	X											30	100
1) Rural Electrification								X					50
2) Rural Water Supply Facility								X					50
Development Conditions													
Total									100	100	100		
II. SCREENING													
1. Progress of CAD Works		X											
2. Adverse Environmental Effects					X								

Remarks : x : item concerned

Selection Criteria

1. Strong development wish of Central and State Government and farmers
2. Non-existence of on-going works of CAD program
3. Representing a model for implementaion of Sharda CAD Project
4. Area requiring modernization of existing irrigation facilities
5. No adverse environmental effect upon implementation
6. Urgency of the development
7. High economic effect of the development
8. Strong development impact from viewpoint of social and economic aspects

Table I.6 Priority Area for Selection of Representative Area

Sl. No.	Name of Block	Name of District	Weighted Mark				Final Mark					
			Irrigation	Drain	Soil	Socio-economy	Irrigation Mark	Irrigation Ranking	Drain Mark	Drain Ranking	Soil(Alkalinity) Mark	Soil(Alkalinity) Ranking
1.	Puranpur	Pilibhit	65	40	60	58	61.5	9	49.0	47	59.0	27
2.	Banda	Shahajhanpur	44	54	68	52	48.0	40	53.0	40	60.0	23
3.	Puwayan	Shahajhanpur	44	54	56	43	43.5	48	48.5	49	49.5	44
4.	Sindhauli	Shahajhanpur	35	61	60	55	45.0	47	58.0	34	57.5	31
5.	Bhawalkhera	Shahajhanpur	39	47	64	46	42.5	49	46.5	50	55.0	34
6.	Pasgawan	Kheri	41	46	72	61	51.0	29	53.5	38	66.5	11
7.	Pihani	Hardoi	63	67	64	56	59.5	12	61.5	23	60.0	23
8.	Todarpur	Hardoi	29	67	52	53	41.0	50	60.0	25	52.5	40
9.	Shahabad	Hardoi	38	46	52	56	47.0	44	51.0	46	54.0	37
10.	Hariyawan	Hardoi	39	53	60	56	47.5	42	54.5	36	58.0	30
11.	Tadiyawan	Hardoi	54	67	48	56	55.0	20	61.5	23	52.0	41
12.	Bawan	Hardoi	42	60	64	59	50.5	33	59.5	30	61.5	20
13.	Sandi	Hardoi	53	48	40	56	54.5	22	52.0	43	48.0	46
14.	Ahirauri	Hardoi	43	66	56	62	52.5	25	64.0	17	59.0	27
15.	Sursa	Hardoi	43	87	56	59	51.0	29	73.0	5	57.5	31
16.	Bilgram	Hardoi	59	54	48	53	56.0	18	53.5	38	50.5	42
17.	Kothawan	Hardoi	46	61	36	59	52.5	25	60.0	23	47.5	47
18.	Kachhona	Hardoi	47	66	76	50	48.5	39	58.0	34	63.0	15
19.	Madhoganj	Hardoi	52	53	40	50	51.0	29	51.5	44	45.0	49
20.	Malawan	Hardoi	33	67	72	63	48.0	40	65.0	14	67.5	9
21.	Sandila	Hardoi	42	60	80	60	51.0	29	60.0	25	70.0	5
22.	Behdar	Hardoi	39	67	68	59	49.0	37	63.0	20	63.5	14
23.	Bharawan	Hardoi	48	67	48	50	49.0	37	58.5	31	49.0	45
24.	Mal	Lucknow	55	73	56	54	54.5	22	63.5	18	55.0	34
25.	Malihabad	Lucknow	45	61	76	48	46.5	45	54.5	36	62.0	18
26.	Kakori	Lucknow	66	60	44	57	61.5	9	58.5	31	50.5	42
27.	Sarojini Nagar	Lucknow	73	60	64	60	66.5	3	60.0	25	62.0	18
28.	Mohanlalganj	Lucknow	73	53	64	53	63.0	6	53.0	40	58.5	29
29.	Gosaiganj	Lucknow	84	53	68	45	64.5	5	49.0	47	56.5	33
30.	Auras	Unnao	29	87	76	72	50.5	33	79.5	1	74.0	3
31.	Ganjmuradabad	Unnao	49	67	44	75	62.0	7	71.0	6	59.5	25
32.	Bangarmau	Unnao	49	60	44	66	57.5	15	63.0	20	55.0	34
33.	Fatehpur Chaurasi	Unnao	32	60	36	72	52.0	27	66.0	12	54.0	37
34.	Hasanganj	Unnao	36	73	56	75	55.5	19	74.0	3	65.5	13
35.	Mayaganj	Unnao	33	73	68	66	49.5	36	69.5	8	67.0	10
36.	Safirpur	Unnao	35	48	64	69	52.0	27	58.5	31	66.5	11
37.	Nawabganj	Unnao	49	80	68	69	59.0	13	74.5	2	68.5	7
38.	Bichhiya	Unnao	26	72	76	66	46.0	46	69.0	9	71.0	4
39.	Sikandarpur Sirosi	Unnao	42	69	56	66	54.0	24	67.5	10	61.0	21
40.	Sikandarpur Khan	Unnao	55	55	44	75	65.0	4	65.0	14	59.5	25
41.	Asoha	Unnao	49	67	84	75	62.0	7	71.0	6	79.5	2
42.	Purwa	Unnao	37	66	80	81	59.0	13	73.5	4	80.5	1
43.	Hilauli	Unnao	76	52	64	75	75.5	2	63.5	18	69.5	6
44.	Bighapur	Unnao	42	61	64	72	57.0	16	66.5	11	68.0	8
45.	Sumerpur	Unnao	26	62	56	69	47.5	42	65.5	13	62.5	17
46.	Sataon	Raebareli	97	60	52	70	83.5	1	65.0	14	61.0	20
47.	Khcero	Raebareli	55	53	60	67	61.0	11	60.0	25	63.5	14
48.	Lalganj	Raebareli	55	48	40	55	55.0	20	51.5	44	47.5	47
49.	Sareni	Raebareli	62	54	32	51	56.5	17	52.5	42	41.5	50
50.	Dalmau	Raebareli	42	67	48	58	50.0	35	62.5	22	53.0	39
							50		50		50	
							50		50		50	

Table I.7 Progress of On-Farm Works Under CAD Program in Hardoi Command Area

Sl. No.	Name of Block	Name of District	Progress of OFD Works under CAD Program
1.	Puranpur	Pilibhit	Under Implementation
2.	Banda	Shahajhanpur	No Progress
3.	Puwayan	Shahajhanpur	No Progress
4.	Sindhauli	Shahajhanpur	Under Implementation
5.	Bhawalkhera	Shahajhanpur	Under Implementation
6.	Pasgawan	Kheri	No Progress
7.	Pihani	Hardoi	No Progress
8.	Todarpur	Hardoi	Under Implementation
9.	Shahabad	Hardoi	Under Implementation
10.	Hariyawan	Hardoi	No Progress
11.	Tadiyawan	Hardoi	No Progress
12.	Bawan	Hardoi	No Progress
13.	Sandi	Hardoi	No Progress
14.	Ahirauri	Hardoi	No Progress
15.	Sursa	Hardoi	No Progress
16.	Bilgram	Hardoi	No Progress
17.	Kothawan	Hardoi	No Progress
18.	Kachhona	Hardoi	No Progress
19.	Madhoganj	Hardoi	No Progress
20.	Malawan	Hardoi	No Progress
21.	Sandila	Hardoi	No Progress
22.	Behdar	Hardoi	No Progress
23.	Bharawan	Hardoi	No Progress
24.	Mal	Lucknow	No Progress
25.	Malihabad	Lucknow	No Progress
26.	Kakori	Lucknow	No Progress
27.	Sarojini Nagar	Lucknow	No Progress
28.	Mohanlalganj	Lucknow	No Progress
29.	Gosaiganj	Lucknow	No Progress
30.	Auras	Unnao	No Progress
31.	Ganjmuradabad	Unnao	No Progress
32.	Bangarmau	Unnao	No Progress
33.	Fatehpur Chaurasi	Unnao	No Progress
34.	Hasanganj	Unnao	No Progress
35.	Mayaganj	Unnao	No Progress
36.	Safirpur	Unnao	No Progress
37.	Nawabganj	Unnao	No Progress
38.	Bichhiya	Unnao	No Progress
39.	Sikandarpur Sirosi	Unnao	No Progress
40.	Sikandarpur Khan	Unnao	No Progress
41.	Asoha	Unnao	No Progress
42.	Purwa	Unnao	No Progress
43.	Hilauli	Unnao	No Progress
44.	Bighapur	Unnao	No Progress
45.	Sumerpur	Unnao	No Progress
46.	Sataon	Raebarcli	No Progress
47.	Kheero	Raebarcli	No Progress
48.	Lalganj	Raebareli	No Progress
49.	Sareni	Raebareli	No Progress
50.	Dalmau	Raebarcli	No Progress

Table I.8 Prediction of Environmental Adverse Effects on Implementation

Si No.	Name of Block	Namm of District	Phisycal Aspect Drainage Condition	Ecological Aspect Ground water regime	Human Activity Aspect Employment structure
1.	Puranpur	Pilibhit	-	-	-
2.	Banda	Shahajhanpur	-	-	-
3.	Puwayan	Shahajhanpur	-	-	-
4.	Sindhauli	Shahajhanpur	-	-	-
5.	Bhawalkhera	Shahajhanpur	-	-	-
6.	Pasgawan	Kheri	-	SA	-
7.	Pihani	Hardoi	-	-	-
8.	Todarpur	Hardoi	-	-	-
9.	Shahabad	Hardoi	-	EA	-
10.	Hariyawan	Hardoi	-	-	-
11.	Tadiyawan	Hardoi	-	-	-
12.	Bawan	Hardoi	-	-	-
13.	Sandi	Hardoi	-	-	-
14.	Ahirauri	Hardoi	-	-	-
15.	Sursa	Hardoi	-	-	-
16.	Bilgram	Hardoi	-	-	-
17.	Kothawan	Hardoi	-	-	-
18.	Kachhona	Hardoi	-	-	-
19.	Madhoganj	Hardoi	-	-	-
20.	Malawan	Hardoi	-	-	-
21.	Sandila	Hardoi	-	-	-
22.	Behdar	Hardoi	-	-	-
23.	Bharawan	Hardoi	-	-	-
24.	Mal	Lucknow	-	-	-
25.	Malihabad	Lucknow	-	-	-
26.	Kakori	Lucknow	-	-	-
27.	Sarojini Nagar	Lucknow	-	-	-
28.	Mohanlalganj	Lucknow	-	-	-
29.	Gosaiganj	Lucknow	-	-	-
30.	Auras	Unnao	-	-	-
31.	Ganjmuradabad	Unnao	-	-	-
32.	Bangarmau	Unnao	-	-	-
33.	Fatehpur Chaurasi	Unnao	-	-	-
34.	Hasanganj	Unnao	SA	-	-
35.	Mayaganj	Unnao	SA	-	-
36.	Safirpur	Unnao	-	-	-
37.	Nawabganj	Unnao	EA	-	-
38.	Bichhiya	Unnao	-	-	-
39.	Sikandarpur Sirosi	Unnao	-	-	-
40.	Sikandarpur Khan	Unnao	-	-	-
41.	Asoha	Unnao	EA	-	-
42.	Purwa	Unnao	SA	SA	-
43.	Hilauli	Unnao	SA	EA	-
44.	Bighapur	Unnao	-	-	-
45.	Sumerpur	Unnao	-	-	-
46.	Sataon	Raebareli	-	EA	-
47.	Kheero	Raebareli	-	-	-
48.	Lalganj	Raebareli	-	-	-
49.	Sareni	Raebareli	-	-	-
50.	Dalmau	Raebareli	-	-	-

NOTE
EA : Extremely affected
SA : Slightly affected

Table I.9 Overall Selection of Representative Area

No	Block Name	District Name	Priority	Overall Marking	Related Branch	Related Distr'y & Minor	Selection
	IRRIGATION						
1	Sataon	Raebareli	1st	83.5	Lower end of Asiwan	Maurawan Dy.	not recommended from environmental aspect
2	Hulauli	Unnao	1st	75.5	Lower end of Asiwan	Maurawan Dy.	not recommended from environmental aspect
3	Sarojini Nagar	Lucknow	1st	66.5	Lower end of Lucknow	Amausi Dy.	to be selected
4	Sikandarpur Khan	Unnao	1st	65.0	Upper part of Unnao	Mrs.	not recommended due to small size of related irrigation canals
	DRAINAGE						
1	Auras	Unnao	1st	79.5	Middle part of Lucknow	Auras Dy.& Mrs.	not recommended due to small size of related irrigation canals
2	Nawabganj	Unnao	1st	74.5	Middle part of Asiwan	Bhauli Dy.& Mrs	not recommended due to small size of related irrigation canals
3	Hasanganj	Unnao	1st	74.0	Middle part of Asiwan	Hasanganj Dy.& Mrs	not recommended due to small size of related irrigation canals
4	Purwa	Unnao	1st	73.5	Middle part of Purwa	Tikar Dy.& Mrs	given priority for Alkalinity/Salinity
5	Sursa	Hardoi	1st	73.0	Middle part of Hardoi	Bhadaya Dy.	to be selected
6	Ganjmulabad	Unnao	1st	71.0	Middle part of Hardoi	Mrs	not recommended due to small size of related irrigation canals
7	Asoha	Unnao	1st	71.0	Middle part of Asiwan	Asoha Dy.& Mrs	given priority for Alkalinity/Salinity
	SALINITY/ALKALINITY						
1	Purwa	Unnao	1st	80.5	Middle part of Purwa	Tikar Dy. & Mrs	to be selected
2	Asoha	Unnao	1st	79.5	Middle part of Asiwan	Asoha Dy.& Mrs	not recommended from environmental aspect
3	Auras	Unnao	1st	74.0	Middle part of Lucknow	Auras Dy.& Mr.	lower priority than the above
4	Bichhiya	Unnao	1st	71.0	Upper part of Purwa	Raipur Dy. & Mrs	lower priority than the above
5	Sandila	Hardoi	1st	70.0	Middle part of Sandila	Sandila Dy.& Mrs	lower priority than the above

FIGURES

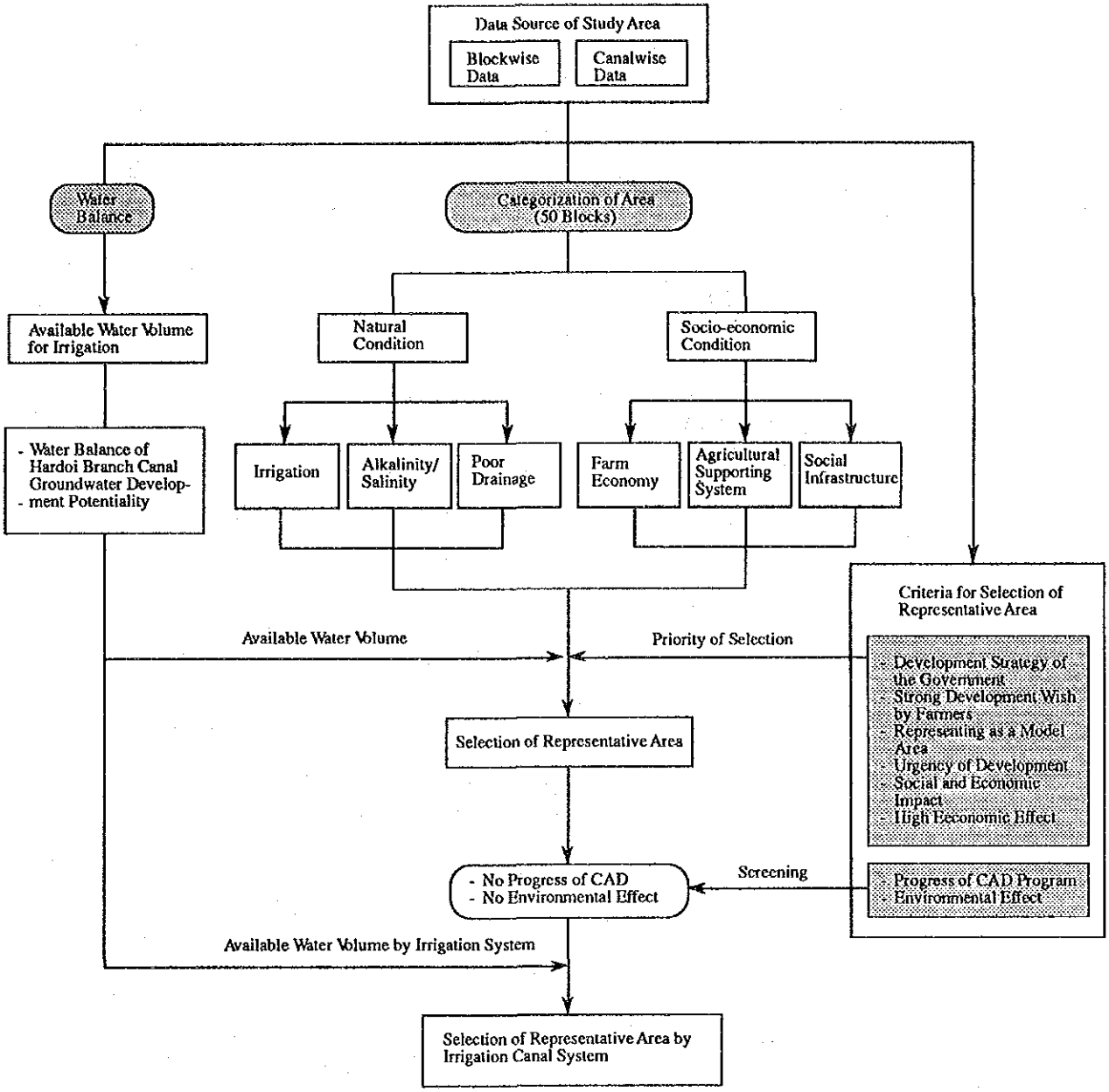

Fig. I.1 Work Flow Chart of Selection of Representative Areas

INDIA
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JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. I.2 Priority Area of Selection of Representative Area (Irrigation)

INDIA

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

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. I.3 Priority Area of Selection of Representative Area (Drainage)

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FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT
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Fig. I.4 Priority Area of Selection of Representative Area (Alkalinity/Salinity)

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Fig. I.5 Priority Area of Selection of Representative Area

INDIA
FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT
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ANNEX-J

IMPLEMENTATION PLAN AND PROJECT COST

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

ANNEX-J
PROJECT IMPLEMENTATION PLAN AND PROJECT COST

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ANNEX-J PROJECT IMPLEMENTATION PLAN AND PROJECT COST

1. Project Implementation

1.1 Principal Approach to Project Implementation

The development plan of the Project herein formulated includes various schemes for improvement/establishment of agricultural infrastructures in the command area as well as reinforcement/activation of farmers' association and agricultural supporting functions. These development components consist of the following work items :

I. Improvement/establishment of irrigation and drainage systems

This will consist of the following components;

- Modernization of existing irrigation canal systems
- Provision of adequate drainage system
- On-farm development woks
- Development of groundwater for conjunctive use

II. Water and Agro-management

The main components of this item will include the following to attain the intensive development of irrigated agriculture.

- Operation and maintenance of irrigation system from the offtaking to minor canals up to outlets
- Establishment of water users' association and introduction of osrabandi system in the command
- provision of agricultural extension services and activation/formation of farmers' agro-management societies

III. Training, Adaptive Research,and Monitoring and Evaluation

The main components of this group will include the following:

- Training of Project staff, farmers including women farmers

- Surface water and groundwater management in the schemes of conjunctive use
- Setting up and operation of adaptive trial farms
- Input and output monitoring of sub-project areas

The implementation of these development components will be arranged so as to effectively realize the development objectives and to ensure the development effects to the other areas in the Sharda Canal CAD project. The following principal approach is adopted in implementation plan :

(1) Early establishment of farmers' association

Framers participation to the project is prerequisite in attaining the efficient water management within outlet command. Prior to the commencement of the construction works, the water user' association is established in every outlet command so that the farmers can participate in the project works from the planning stage.

(2) Harmonized sequence of implementation of the Representative Areas

The implementation of construction works of the Representative Areas will be executed with the following concept:

(a) Survey, planning and design will be carried out with employment of technical firms to effectively execute a large amount of those works with the limited time.

(b) Modernization of irrigation and drainage systems will be executed on the basis of the job order to Irrigation Department.

(c) On-farm development will be executed stagewise according to the progress of the design works.

(d) Groundwater development will first be commenced from pilot demonstration farm, and then tubewell construction will follow on the basis of the result of pilot farm operation.

(3) Operation, maintenance water management of irrigation system

After completion of modernization works and on-farm works, the operation, maintenance and water management of the minor canal system will be carried out by the CADA. In order to effectively execute the water delivery to the every outlet command, osrabandi system will be introduced initially in the every outlet command under the guidance of the CADA.

(4) Agro-management

Immediately after the completion of the improvement of canal system and on-farm works, extension services will be provided by the CADA staff with cooperation of the existing governmental organization concerned.

(5) Training

Training will be provided by CADA during the Project operation period to the farmers including female farmers, canal inspector, CADA staff.

(6) Monitoring and evaluation of irrigated farm

At the final stage, the monitoring and evaluation of agricultural productivity under irrigated farm, conjunctive use of the surface water and groundwater, agro-economic impact will be executed.

1.2 Implementation Schedule

The implementation schedule of the Project is shown in Fig. J.1. It includes the preparatory works, construction works, research works, guidance services and monitoring and evaluation. The preparatory works include the establishment of farmers association, survey, design, tendering and project mobilization for implementation, and it will last 22 months in the initial stage. The construction works will last 50 months for the modernization works of the main irrigation and drainage systems and on-farm development works. All the work will be completed in the 6th year.

The topographic survey and subsequent designing work of on-farm works will be continued and the tendering will follow the completion of the design. The design will be completed in the 4th year.

Establishment of the farmers association in the command will also be commenced in the first year with the guidance from the CADA so as to ensure actual participation of the farmers from the planning stage of the on-farm development works. Introduction of the osrabandi will be promoted for the area where the on-farm works have been completed.

Modernization works of irrigation and drainage systems will be started in the second year after selection of the contractors through competitive bidding, and be completed in the last 6th year. All of the work in the respective representative areas will be concurrently commenced.

On-farm development works will be implemented with stage wise construction along with the progress of the design works. The result of the design will be brought into the construction step by step. The work will be commenced in the second year and all of the work will be completed in the last 5th year.

Wireless communication system will be established in the 4th year after site investigation and manufacturing and the monitoring and evaluation of the water management of the Sharda canal system will be commenced thereafter.

The groundwater development will first be commenced from the pilot farm construction of the tubewell and pipe drain schemes in the Purwa and Sursa areas together with observation and evaluation of the investigation results. Then the construction of the tubewells will be executed in the 4th year.

The adaptive trial farms will be established in the second year so as to utilize the result of the investigation in the actual water and farm management in the completed areas of the on-farm development.

The survey and design works will be carried out by the survey and design firms under the supervision of the CADA to utilize the limited time. All the construction works will be executed by the contractor(s) through competitive bidding. On-farm development works for lining canals will be executed by the contractors selected through competitive bidding, whereas earth canals will be executed by the farmers associations concerned for the command areas of on-farm works on the contract basis with CADA. The modernization of irrigation and drainage systems will be executed by the supervision of the CADA or with the job contract with Irrigation Department which is presently conducting O & M of those systems.

1.3 Organization of Project Implementation

Implementation of the Projects as a model development will be managed basically in accordance with the present organization of the CADA.

Implementation of the Project will need the multi-disciplinary working team. The fundamental components of the Project have to be directly performed by the CADA. Some other components will be carried out by the concerned departments and the CADA will prepare the implementation programme and its budget for implementation, and coordinate and monitor the progress of the works in accordance with the present governmental practice rules.

From the view point of the above, in order to effectively implement the Project, the organization structure of the Project is proposed as shown in Fig. J.2 and it will consist of the following :

The CADA will be headed by the Commissioner/Administrator under the direct supervision of the Uttar Pradesh State Agricultural Production Commissioner. The Commissioner /Administrator will be assisted by a full-time Project Manager who will be responsible for construction, operation, maintenance and extension services of the project activities and will be assisted by the following divisions.

(1) Administration and Accounting Division

This will undertake all administrative, financial,and regal services, i.e., accounting, treasury, personnel, records, other general services.

(2) Construction Division

This Division will consist of the following Sub-divisions which will be directly responsible for construction works of the Project at the respective Representative Areas.

(a) Irrigation and Drainage Modernization Sub-division
- to carry out survey,planning and design
- to supervise the modernization works of irrigation and drainage systems

The staff of this Sub-division have to be arranged from the present working staff of the Irrigation Department.

(b) Canal Maintenance Sub-division

- to provide the maintenance services for the minor canal facilities in the command of the concerned minor canals in coordinating with the operation and maintenance offices concerned of Irrigation Department or in contract with them

The staff of this Sub-division have to be arranged from the presently working staff of the operation and maintenance offices concerned of Irrigation Department

(c) Water Supply Sub-division

- to organize farmers' associations and provide guidance in introduction of osrabandi system
- to carry out water management down from the offtaking structures of minor canals

The staff of this Sub-division have to be strengthened by introduction of the engineering staff from operation and maintenance offices concerned in the Irrigation Department

(3) Land and Water Management Division

This Division will consist of the following Sub-divisions:

(a) Soil Survey Sub-division

- to carry out soil survey
- to carry out the guidance in soil management

The staff of this Sub-division is arranged from the presently working staff of CADA.

(b) On-farm Development Sub-division

- to carry out survey,planning and design
- to supervise on-farm development works

The staff of this Sub-division will be strengthened by transferring technical staff of Sub-divisional offices under the Irrigation Department

(c) Groundwater Sub-division

- to carry out investigation planning, design and construction supervision of groundwater development in coordination with Groundwater Department, UP.

(d) On-farm Work Maintenance Sub-division

- to carry out the guidance in maintenance works of on-farm works to water users association

(4) Agro-management Division

This Division will consist of the following Sub-divisions to provide intensive agricultural supporting services to farmers' associations.

(a) Crop Loan Sub-division
(b) Farm Input Sub-division
(c) Marketing and Storage Sub-division
(d) Agro-Processing Sub-division

The staff of these Sub-divisions have to be arranged from the Departments of Agriculture Cooperative and other related departments.

(5) Training, Action Research, Monitoring and Evaluation Division

Main Division will consist of the following Sub-divisions:

- Extension Sub-division
- Adaptive Research and Trial Farm Sub-division
- Monitoring and Evaluation Sub-division

The function of this unit will be to carry out planning and implementation of:

(i) training of farmers and CADA staff,

(ii) adaptive trial,

(iii) monitoring and evaluation of groundwater development pilot farm for conjunctive use

(iv) monitoring and evaluation of agricultural productivity with the Project.

The staff of this Division have to be arranged from the Department of Agriculture, Groundwater Department and the works are carried out in cooperation with the concerned departments.

2. Project Cost

2.1 Basic Conditions

The costs of implementation of the Project are estimated on the basis of the following conditions:

1) The exchange rate used in the cost estimate is shown as follows:

US$ 1.0 = Rs.25.90

2) The main construction works will be carried out by contractor(s) selected through competitive bidding.

3) The unit price of the works are divided into foreign currency portion and local currency portion. Local currency portion is estimated with reference to the current market prices in the early 1991, the cost data obtained from similar on-going works around the Project area and price rate fixed by the government agencies concerned. Foreign currency portion of materials and equipment to be imported is estimated on the basis of CIF Calcutta.

The classification of local currency portion and foreign currency portion is carried out by the following basis:

Local currency portion
- Land acquisition cost
- Labor force
- Reinforcement bars (Local Currency Portion)
- Structural steel (Local Currency Portion)
- Fuel and lubricants (Local Currency Portion)

- Wooden materials
- Concrete aggregates
- Cement
- Brick
- Pumping equipment
- Supporting equipment
- Inland transportation
- Administration expenses
- Expenses and fees of engineering services by local consultant

Foreign currency

- Reinforcement bars (Foreign Currency Portion)
- Structural steel (Foreign Currency Portion)
- Fuel and lubricants (Foreign Currency Portion)
- Wireless communication equipment
- Depreciation of construction equipment and machinery
- Contractors' general expenses and profit of the contractors
- Expenses and fees of engineering services by foreign consultants

5) Physical contingency of the cost estimate is 10% of the construction cost. Price contingency applied is : 7% per annum for the local currency portion and 3% per annum for the foreign currency portion.

2.2 Estimate of Project Cost

The project cost consists of direct construction cost, procurement cost of supporting equipment, land acquisition cost, engineering services and administration cost, and contingencies. The total cost is estimated to be Rs. 3, 351 million, consisting of the foreign currency portion of Rs. 571 million and the local currency portion of Rs. 2,780 million as summarized below. The breakdown is shown in Table J.1.

Project Cost

Unit: Rs. million

	Description	Foreign Currency	Local Currency	Total
A.	Wireless Communication System	58.9	6.5	65.4
B.	Representative Areas			
	B-1 Sarojini Nagar Area			
	1. Main system	31.5	148.0	179.5
	2. On-farm development works	33.3	149.0	182.3
	3. Land acquisition	0.0	5.3	5.3
	Sub-total (B-1)	64.8	302.3	367.1
	B-2 Sataon Area			
	1. Main system	32.1	363.1	355.2
	2. On-farm development works	28.9	131.1	160.0
	3. Land acquisition	0.0	7.4	7.4
	Sub-total (B-2)	61.0	461.6	522.6
	B-3 Sursa Area			
	1. Main system	51.4	258.2	309.6
	2. On-farm development works	38.9	180.5	219.4
	3. Land acquisition	0.0	8.6	8.6
	Sub-total (B-3)	90.3	447.3	537.7
	B-4 Purwa Area			
	1. Main system	39.8	155.3	195.1
	2. On-farm development works	27.5	124.8	152.3
	3. Land acquisition	0.0	3.0	3.0
	Sub-total (B-4)	67.3	283.1	350.4
	Sub-Total (B)	283.4	1,494.3	1,777.6
C.	Procurement of Supporting Equipment	0.0	8.4	8.4
D.	Administration Cost	0.0	148.7	148.7
E.	Engineering Service	103.8	118.6	222.4
F.	Contingencies			
	1. Physical	44.6	177.7	222.3
	2. Price	80.3	825.9	906.2
	Total	571.0	2,780.1	3,351.1

2.3 Breakdown of Project Cost

(1) Direct Construction Cost

Direct construction cost is estimated for the individual item by unit cost basis as mentioned in the following sub-section 2.5. The breakdowns of each representative areas are shown in Tables J.2 to J.5.

(2) Land Acquisition Cost

Land acquisition cost for four(4) representative areas is Rs. 24 million for the new minor canals parallel to distributary canals and new drainage canal systems. The breakdown is shown in Table J.6.

(3) Supporting Equipment

Supporting equipment would be procured for the operation and maintenance works of the canals and related structures, extension works by the staff of CADA and experimental research. The breakdown is shown in Table J.7.

(4) Administration Cost

Administration cost comprises the costs of the operation and maintenance for the main irrigation and drainage system by the Irrigation Department, and on-farm development works along with the extension work, operation of the adaptive trial farm and experimental research by the CADA. The breakdown is shown in Table J.8.

(5) Engineering Service Cost

Engineering services by foreign consultant would be required for the detailed design, farm guidance and construction supervision Some special equipment such as vehicle, motorcycle, computer etc., would be also required for the smooth operation. The required man-months of consultant engineers including local consultants are 410 M/M for the detailed design and farm guidance and 1,424 M/M for the construction supervision and farm guidance. The breakdown of the engineering service cost and required man-month are shown in Tables J.9 and J.10.

2.4 Annual Disbursement Schedule

The annual disbursement is worked out according to the implementation schedule as shown below. The breakdown of total cost is as shown in Table J.11 and breakdown of each Representative Area is shown in Table J.12.

Annual Disbursement Schedule

Unit: Million Rs.

Year	Foreign Currency	Local Currency	Total
1993	13.8	66.2	80.0
1994	37.5	171.4	208.9
1995	100.6	514.7	615.3
1996	206.6	750.6	967.2
1997	124.4	741.1	865.5
1998	88.2	526.1	614.3

2.5 Unit Cost Analysis

Construction cost is worked out by use of detailed unit cost. Each unit cost is composed of the basic unit cost such as labour and construction materials and working rate and/or construction machinery. Basic cost of labour and materials surveyed are shown in Table J.13. Hourly operation cost of machinery is also worked out based on the CIF prices of the major construction machinery and equipment, and their depreciation costs, operation and maintenance costs. According to these costs, unit cost is calculated, whose summary is shown in Table J.14.

2.6 Annual Operation and Maintenance Cost

Operation and maintenance costs at the full operation stage of the Project are estimated at Rs. 39.1 million, comprising the operation and maintenance of the Project facilities. The breakdown of annual maintenance cost is as shown in Table J.15.

2.7 Cost of Replacement of Project Facilities

Pumping equipment of irrigation, metal works of irrigation canal related structures and supporting equipment are periodically to be replaced. The economic life and the replacement cost used in the estimate are shown in Table J.16.

TABLES

Table J.1 Project Cost

Unit: 1,000 Rs

Description	Amount		
	Foreign	Local	Total
A. Wireless Communication System			
A-1 HF Radio System	10,350	1,150	11,500
A-2 VHF Radio System	27,450	3,050	30,500
A-3 Data Processing Unit	21,060	2,340	23,400
Sub-Total (A)	58,860	6,540	65,400
B. Representative Areas			
B-1 Sarojini Nagar Study Area			
1) Irrigation System	4,145	63,138	67,283
2) Drainage System	20,035	38,045	58,079
3) Augumentation Facility	1,185	12,741	13,926
4) On-farm Facility	33,345	148,997	182,342
5) Improvement of Service Road	6,032	34,067	40,099
Sub-Total (B-1)	64,742	296,986	361,728
B-2 Sataon Study Area			
1) Irrigation System	10,701	227,665	238,366
2) Drainage System	13,484	21,949	35,433
3) Augumentation Facility	1,480	15,449	16,929
4) On-farm Facility	28,897	131,136	160,034
5) Improvement of Service Road	6,464	58,038	64,502
Sub-Total (B-2)	61,027	454,237	515,263
B-3 Sursa Study Area			
1) Irrigation System	3,904	96,125	100,029
2) Drainage System	35,078	62,641	97,719
3) Augumentation Facility	7,164	75,519	82,683
4) On-farm Facility	38,858	180,471	219,329
5) Improvement of Service Road	5,331	23,951	29,282
Sub-Total (B-3)	90,335	438,707	529,042
B-4 Purwa Study Area			
1) Irrigation System	2,101	58,746	60,847
2) Drainage System	32,865	50,733	83,598
3) Augumentation Facility	465	23,131	23,596
4) On-farm Facility	27,481	124,811	152,292
5) Improvement of Service Road	4,422	22,681	27,103
Sub-Total (B-4)	67,334	280,101	347,435
Sub-Total (B)	283,437	1,470,031	1,753,468
C. Procurement of Supporting Equipment	0	8,410	8,410
D. Land Acquisition	0	24,213	24,213
E. Administration Cost	0	148,700	148,700
F. Engineering Service	103,800	118,600	222,400
G. Contingency	124,873	1,003,597	1,128,470
Physical	44,610	177,649	222,259
Price	80,263	825,948	906,211
Total	570,970	2,780,091	3,351,061

Table J.2 Breakdown of Direct Construction Cost of Sarojini Nagar Area

Description		Unit	Unit Rate F/C	Unit Rate L/C	Quantity	Amount(1000Rs.) F/C	Amount(1000Rs.) L/C	Amount(1000Rs.) Total	Remarks
A. Irrigation System									
A-1 Improvement of Canal									
1) Excavation		m3	0	28	21,150	0	592	592	E-06
2) Embankment		m3	7	47	183,880	1,287	8,642	9,930	E-08
3) Brick Tile Lining		m2	0	206	180,040	0	37,088	37,088	C-22
4) Related Structures									
- Head Regulator	Type-C	no.	2,500	40,590	1	3	41	43	MST-05-2
- Offtaking Structure of Minor Canals		nos.	1,630	55,900	19	31	1,062	1,093	MST-03
- Outlet		nos.	250	4,150	292	73	1,212	1,285	MST-04
- Drainage Crossing	Type-A (14m)	no.	1,110	58,950	1	1	59	60	MST-06-1
	Type-B (7m)	nos.	430	31,510	2	1	63	64	MST-06
- Rehabilitation Work of Existing Facilities		L.S.			5%	5	122	127	
A-2 Construction of Parallel Canal along Amausi Disty.									
1) Striping		m2	11	3	155,800	1,714	467	2,181	E-02
2) Excavation		m3	19	3	39,340	747	118	865	E-03
3) Embankment		m3	7	47	23,100	162	1,086	1,247	E-08
4) Brick Tile Lining		m2	0	206	38,800	0	7,993	7,993	C-22
5) Related Structure									
- Offtaking Structure		nos.	1,630	55,900	10	16	559	575	MST-03
- Outlet		nos.	250	4,150	73	18	303	321	MST-04
- Bridge	Type-C(7.5 m)	nos.	5,080	197,800	2	10	396	406	MST-11
	Type-D(5m)	nos.	3,400	145,880	22	75	3,209	3,284	MST-12
- Drainage Crossing	Type-B(7m)	nos.	430	31,510	4	2	126	128	MST-06
Sub-total (A)						4,145	63,138	67,283	
B. Drainage System									
B-1 Main Drainage System									
1) Striping		m2	11	3	224,020	2,464	672	3,136	E-02
2) Excavation		m3	21	4	564,660	11,858	2,259	14,117	E-04
3) Embankment		m3	7	19	508,200	3,557	9,656	13,213	E-07
4) Related Structure									
- Bridge	Type-A (30m)	no.	24,500	880,540	0	0	0	0	MST-09
	Type-B (15m)	nos.	11,300	380,400	13	147	4,945	5,092	MST-10
	Type-C (7.5 m)	nos.	5,080	197,800	15	76	2,967	3,043	MST-11
	Type-D (5m)	nos.	3,400	145,880	28	95	4,085	4,180	MST-12
E-2 Tertiary Drainage System									
1) Excavation		m3	0	28	289,810	0	8,115	8,115	E-06
2) Embankment		m3	7	19	260,830	1,826	4,956	6,782	E-07
3) Related Structure									
- Foot Path		nos.	50	1,760	222	11	391	402	MST-13
Sub-total (B)						20,035	38,045	58,079	
C. Augumentation Facility									
Pump Station at the Sai River									
1) Pump House		1 lot				1	53	54	MST-15
2) Intake & Outlet Strucure						430	2,886	3,316	MST-17
3) Pump Equipment and Power Supply System		1 lot				754	9,802	10,556	MST-16
Sub-total (C)						1,185	12,741	13,926	
D. On-farm Facility									
D-1 Watercourse									
1) Lining		km	30,310	420,570	294	8,911	123,648	132,559	OF-01
2) Earth Canal		km	10,000	60,000	159	1,590	9,540	11,130	OF-02
D-2 Field Drain		km	0	21,000	368	0	7,728	7,728	OF-04
D-3 Related Structure									
1) Turnout		nos.	0	280	2,082	0	583	583	OF-03
2) Road Crossing	Type-A	nos.	70	2,820	66	5	186	191	OF-06
	Type-B	nos.	20	300	694	14	208	222	OF-07
3) Transition		nos.	0	110	496	0	55	55	OF-09
4) Aqueduct	Type-A	nos.	20	4,320	79	2	341	343	OF-10
	Type-B	nos.	20	4,090	119	2	487	489	OF-10-1
5) Drop		nos.	10	1,480	231	2	342	344	OF-11
6) Drainage Culvert	Type-A	nos.	40	2,380	0	0	0	0	OF-05
	Type-B	nos.	20	1,380	956	19	1,319	1,338	OF-05-1
D-4 Farm Road		km	50,000	10,000	456	22,800	4,560	27,360	MST-08
Sub-total (D)						33,345	148,997	182,342	
E. Improvement of Service Road									
E-1 Distributary Canal		km	60,000	610,000	55	3,297	33,520	36,817	MST-07
E-2 Minor Canal		km	50,000	10,000	55	2,735	547	3,282	MST-08
Sub-total (E)						6,032	34,067	40,099	
Total						64,742	296,986	361,728	

Table J.3 Breakdown of Direct Construction Cost of Sataon Area (1/2)

Description		Unit	Unit Rate F/C	Unit Rate L/C	Quantity	Amount(1000Rs.) F/C	Amount(1000Rs.) L/C	Amount(1000Rs.) Total	Remarks
A. Irrigation System									
A-1 Improvement of Canal									
A-1-1 Asiwan Branch Canal									
- Head Regulator	Type-A	nos.	780	14,970	15	12	225	236	MST-05
	Type-B	nos.	1,450	26,270	2	3	53	55	MST-05-1
	Type-C	nos.	2,500	41,230	0	0	0	0	MST-05-2
A-1-2 Maurawan Disty. Canal from Head to M28-0-600									
1) Excavation		m3	0	28	19,730	0	552	552	E-06
2) Embankment		m3	7	47	98,660	691	4,637	5,328	E-08
3) Brick Tile Lining		m2	0	211	299,800	0	63,258	63,258	C-22
4) Related Structures									
- Head Regulator	Type-A	nos.	780	14,970	21	16	314	331	MST-05
	Type-B	nos.	1,450	26,270	0	0	0	0	MST-05-1
	Type-C	nos.	2,500	41,230	0	0	0	0	MST-05-2
- Outlet		nos.	420	4,220	1	0	4	5	MST-04
A-1-3 Maurawan Disty. Canal from M28-0-0 to Tail End									
1) Excavation		m3	0	28	10,860	0	304	304	E-06
2) Embankment		m3	7	47	54,310	380	2,553	2,933	E-08
3) Brick Tile Lining		m2	0	211	215,400	0	45,449	45,449	C-22
4) Related Structures									
- Head Regulator	Type-A	nos.	780	14,970	9	7	135	142	MST-05
	Type-B	nos.	1,450	26,270	0	0	0	0	MST-05-1
	Type-C	nos.	2,500	41,230	0	0	0	0	MST-05-2
- Offtaking Structure of Minor Canals		nos.	1,630	58,170	1	2	58	60	MST-03
- Outlet		nos.	420	4,220	183	77	772	849	MST-04
- Drainage Crossing	Type-A (14m)	no.	1,110	61,320	0	0	0	0	MST-06-1
	Type-B (7m)	no.	430	32,810	1	0	33	33	MST-06
- Rehabilitation Work of Existing Facilities		L.S.			5%	4	50	54	
Sub-total (A-1)						1,192	118,397	119,589	
A-2 Construction of Parallel Canal									
A-2-1 Asiwan Branch									
1) Striping		m2	11	3	30,600	337	92	428	E-02
2) Excavation		m3	19	3	101,000	1,919	303	2,222	E-03
3) Embankment		m3	7	47	218,000	1,526	10,246	11,772	E-08
4) Brick Tile Lining		m2	0	211	152,000	0	32,072	32,072	C-22
5) Related Structure									
- Head Regulator	Type-A	nos.	780	14,970	25	20	374	394	MST-05
	Type-B	nos.	1,450	26,270	0	0	0	0	MST-05-1
	Type-C	nos.	2,500	41,230	0	0	0	0	MST-05-2
- Offtaking Structure		nos.	1,630	58,170	17	28	989	1,017	MST-03
- Outlet		nos.	420	4,220	329	138	1,388	1,527	MST-04
- Bridge	Type-C(7.5 m)	nos.	5,080	204,560	21	107	4,296	4,402	MST-11
	Type-D(5m)	nos.	3,400	150,580	58	197	8,734	8,931	MST-12
- Drainage Crossing	Type-A(14m)	nos.	430	32,810	8	3	262	266	MST-06
	Type-B(7m)	nos.	1,110	61,320	13	14	797	812	MST-06-1
A-2-2 Maurawan Disty. from Head to M28-0-0									
1) Striping		m2	11	3	143,090	1,574	429	2,003	E-02
2) Excavation		m3	19	3	48,590	923	146	1,069	E-03
3) Embankment		m3	7	47	107,910	755	5,072	5,827	E-08
4) Brick Tile Lining		m2	0	211	98,060	0	20,691	20,691	C-22
5) Related Structure									
- Head Regulator	Type-A	nos.	780	14,970	10	8	150	158	MST-05
	Type-B	nos.	1,450	26,270	0	0	0	0	MST-05-1
	Type-C	nos.	2,500	41,230	0	0	0	0	MST-05-2
- Offtaking Structure		nos.	1,630	58,170	10	16	582	598	MST-03
- Outlet		nos.	420	4,220	159	67	671	738	MST-04
- Bridge	Type-C(7.5 m)	nos.	5,080	204,560	7	36	1,432	1,467	MST-11
	Type-D(5m)	nos.	3,400	150,580	26	88	3,915	4,003	MST-12
- Drainage Crossing	Type-A(14m)	nos.	430	32,810	5	2	164	166	MST-06
	Type-B(7m)	nos.	1,110	61,320	8	9	491	499	MST-06-1
A-2-3 Maurawan Disty. from M28-0-0 to Tail End									
1) Striping		m2	11	3	65,790	724	197	921	E-02
2) Excavation		m3	19	3	18,910	359	57	416	E-03
3) Embankment		m3	7	47	80,820	566	3,799	4,364	E-08
4) Brick Tile Lining		m2	0	211	41,050	0	8,662	8,662	C-22
5) Related Structure									
- Head Regulator	Type-A	nos.	780	14,970	4	3	60	63	MST-05
	Type-B	nos.	1,450	26,270	0	0	0	0	MST-05-1
	Type-C	nos.	2,500	41,230	0	0	0	0	MST-05-2
- Offtaking Structure		nos.	1,630	58,170	2	3	116	120	MST-03
- Outlet		nos.	420	4,220	46	19	194	213	MST-04
- Bridge	Type-C(7.5 m)	nos.	5,080	204,560	6	30	1,227	1,258	MST-11
	Type-D(5m)	nos.	3,400	150,580	10	34	1,506	1,540	MST-12
- Drainage Crossing	Type-A(14m)	nos.	430	32,810	1	0	33	33	MST-06
	Type-B(7m)	nos.	1,110	61,320	2	2	123	125	MST-06-1
Sub-total (A-2)						9,509	109,268	118,777	
Sub-total (A)						10,701	227,665	238,366	

Table J.3 Breakdown of Direct Construction Cost of Sataon Area (2/2)

Description		Unit	Unit Rate F/C	Unit Rate L/C	Quantity	Amount(1000Rs.) F/C	Amount(1000Rs.) L/C	Amount(1000Rs.) Total	Remarks
B. Drainage System									
B-1 Main Drainage System									
1) Striping		m2	11	3	102,130	1,123	306	1,430	E-02
2) Excavation		m3	21	4	426,400	8,954	1,706	10,660	E-04
3) Embankment		m3	7	19	383,760	2,686	7,291	9,978	E-07
4) Related Structure									
- Bridge	Type-A (30m)	no.	24,500	912,510	0	0	0	0	MST-09
	Type-B (15m)	nos.	11,300	393,710	10	113	3,937	4,050	MST-10
	Type-C (7.5 m)	nos.	5,080	204,560	10	51	2,046	2,096	MST-11
	Type-D (5m)	nos.	3,400	150,580	19	65	2,861	2,926	MST-12
B-2 Tertiary Drainage System									
1) Excavation		m3	0	28	76,460	0	2,141	2,141	E-06
2) Embankment		m3	7	19	68,820	482	1,308	1,789	E-07
3) Related Structure									
- Foot Path		nos.	50	1,830	193	10	353	363	MST-13
Sub-total (B)						13,484	21,949	35,433	
C. Augumentation Facility									
1) Pump House		lot			1	1	55	56	MST-15
2) Intake & Outlet Strucure		lot			1	430	2,954	3,384	MST-17
3) Pump Equipment and Power Supply System		lot			1	1,049	12,440	13,489	MST-16
Sub-total (C)						1,480	15,449	16,929	
D. On-farm Facility									
D-1 Watercourse									
1) Lining		km	30,310	429,010	255	7,729	109,398	117,127	OF-01
2) Earth Canal		km	10,000	60,000	138	1,380	8,280	9,660	OF-02
D-2 Field Drain		km	0	21,000	318	0	6,678	6,678	OF-04
D-3 Related Structure									
1) Turnout		nos.	0	290	658	0	191	191	OF-03
2) Road Crossing	Type-A	nos.	70	2,910	57	4	166	170	OF-06
	Type-B	nos.	20	300	601	12	180	192	OF-07
3) Transition		nos.	0	120	429	0	51	51	OF-09
4) Aqueduct	Type-A	nos.	20	4,490	69	1	310	311	OF-10
	Type-B	nos.	20	4,250	103	2	438	440	OF-10-1
5) Drop		nos.	10	1,540	200	2	308	310	OF-11
6) Drainage Culvert	Type-A	nos.	40	2,460	0	0	0	0	OF-05
	Type-B	nos.	20	1,430	830	17	1,187	1,204	OF-05-1
D-4 Farm Road	Type-A	km	50,000	10,000	395	19,750	3,950	23,700	MST-08
Sub-total (D)						28,897	131,136	160,034	
E. Improvement of Service Road									
E-1 Distributary Canal		km	60,000	630,000	91.82	5,509	57,847	63,356	MST-07
E-2 Minor Canal		km	50,000	10,000	19.10	955	191	1,146	MST-08
Sub-total (E)						6,464	58,038	64,502	
Total						61,027	454,237	515,263	

Table J.4 Breakdown of Direct Construction Cost of Sursa Area

Description		Unit	Unit Rate F/C	Unit Rate L/C	Quantity	Amount(1000Rs.) F/C	Amount(1000Rs.) L/C	Amount(1000Rs.) Total	Remarks
A. Irrigation System									
A-1 Improvement of Canal									
1) Excavation		m3	0	28	17,660	0	494	494	E-06
2) Embankment		m3	7	47	109,390	766	5,141	5,907	E-08
3) Brick Tile Lining		m2	0	218	227,330	0	49,558	49,558	C-22
4) Related Structures									
- Head Regulator	Type-A	no.	780	12,690	1	1	13	13	MST-05
	Type-B	no.	1,450	26,840	0	0	0	0	MST-05-1
	Type-C	no.	2,500	42,040	1	3	42	45	MST-05-2
- Offtaking Structure of Minor Canals		nos.	1,630	61,200	11	18	673	691	MST-03
- Outlet		nos.	420	4,370	269	113	1,176	1,289	MST-04
- Drainage Crossing	Type-A (14m)	no.	1,110	64,530	3	3	194	197	MST-06-1
	Type-B (7m)	nos.	430	34,580	3	1	104	105	MST-06
- Siphon		no.	33,790	354,510	1	34	355	388	MST-20
- Rehabilitation Work of Existing Facilities		L.S.			5%	9	128	136	
A-2 Construction of Parallel Canal									
1) Striping		m2	11	3	110,560	1,216	332	1,548	E-02
2) Excavation		m3	19	3	45,760	869	137	1,007	E-03
3) Embankment		m3	7	47	102,960	721	4,839	5,560	E-08
4) Brick Tile Lining		m2	0	218	127,720	0	27,843	27,843	C-22
5) Related Structure									
- Offtaking Structure		nos.	1,630	61,200	5	8	306	314	MST-03
- Outlet		nos.	420	4,370	117	49	511	560	MST-04
- Bridge	Type-C(7.5 m)	nos.	5,080	213,410	3	15	640	655	MST-11
	Type-D(5m)	nos.	3,400	156,720	23	78	3,605	3,683	MST-12
- Drainage Crossing	Type-A(14m)	nos.	430	34,580	1	0	35	35	MST-06
Sub-total (A)						3,904	96,125	100,029	
B. Drainage System									
B-1 Main Drainage System									
1) Striping		m2	11	3	259,450	2,854	778	3,632	E-02
2) Excavation		m3	21	4	873,760	18,349	3,495	21,844	E-04
3) Embankment		m3	7	19	816,380	5,715	15,511	21,226	E-07
4) Related Structure									
- Bridge	Type-A (30m)	no.	24,500	954,700	2	49	1,909	1,958	MST-09
	Type-B (15m)	nos.	11,300	411,220	20	226	8,224	8,450	MST-10
	Type-C (7.5 m)	nos.	5,080	213,410	29	147	6,189	6,336	MST-11
	Type-D (5m)	nos.	3,400	156,720	13	44	2,037	2,082	MST-12
B-2 Tertiary Drainage System									
1) Excavation		m3	0	28	337,600	0	9,453	9,453	E-06
2) Embankment		m3	7	19	303,850	2,127	5,773	7,900	E-07
3) Related Structure									
- Foot Path		nos.	50	1,920	262	13	503	516	MST-13
B-3 Sub-surface Drainage System along Hardoi Branch Canal									
1) Sub-surface Pipe		1 lot				5,523	8,386	13,909	MST-14
2) Pump House		1 lot				1	63	64	MST-15
3) Suction Pond		1 lot				1	59	61	MST-17
4) Equipment & Power Supply		1 lot				29	259	288	MST-16
Sub-total (B)						35,078	62,641	97,720	
C. Augumentation Facility									
Cruster Shallow Well									
1) Pump House		nos.	460	50,790	900	414	45,711	46,125	MST-18
2) Equipment and Boring with Casing		nos.	6,300	22,300	900	5,670	20,070	25,740	MST-21
3) Power Supply		set	1,200	10,820	900	1,080	9,738	10,818	MST-19
Sub-total (C)						7,164	75,519	82,683	
D. On-farm Facility									
D-1 Watercourse									
1) Lining		km	30,310	438,950	343	10,396	150,560	160,956	OF-01
2) Earth Canal		km	10,000	60,000	186	1,860	11,160	13,020	OF-02
D-2 Field Drain		km	0	21,000	428	0	8,988	8,988	OF-04
D-3 Related Structure									
1) Turnout		nos.	0	300	2,425	0	728	728	OF-03
2) Road Crossing	Type-A	nos.	70	3,030	77	5	233	239	OF-06
	Type-B	nos.	20	310	808	16	250	267	OF-07
3) Transition		nos.	0	120	577	0	69	69	OF-09
4) Aqueduct	Type-A	nos.	20	4,740	92	2	436	438	OF-10
	Type-B	nos.	20	4,490	139	3	624	627	OF-10-1
5) Drop		nos.	10	1,630	269	3	438	441	OF-11
6) Drainage Culvert	Type-A	nos.	40	2,590	0	0	0	0	OF-05
	Type-B	nos.	20	1,500	1,116	22	1,674	1,696	OF-05-1
D-4 Farm Road		km	50,000	10,000	531	26,550	5,310	31,860	MST-08
Sub-total (D)						38,858	180,471	219,329	
E. Improvement of Service Road									
E-1 Distributary Canal		km	60,000	670,000	35	2,087	23,303	25,389	MST-07
E-2 Minor Canal		km	50,000	10,000	65	3,244	649	3,893	MST-08
Sub-total (E)						5,331	23,951	29,282	
Total						90,335	438,707	529,042	

Table J.5 Breakdown of Direct Construction Cost of Purwa Area

Description		Unit	Unit Rate F/C	Unit Rate L/C	Quantity	Amount(1000Rs.) F/C	Amount(1000Rs.) L/C	Amount(1000Rs.) Total	Remarks
A. Irrigation System									
A-1 Improvement of Canal									
1) Excavation		m3	0	28	11,780	0	330	330	E-06
2) Embankment		m3	7	47	102,810	720	4,832	5,552	E-08
3) Brick Tile Lining		m2	0	211	175,180	0	36,963	36,963	C-22
4) Related Structures									
- Head Regulator	Type-A	nos.	780	14,970	3	2	45	47	MST-05
	Type-B	nos.	1,450	26,270	1	1	26	28	MST-05-1
	Type-C	nos.	2,500	41,230	0	0	0	0	MST-05-2
- Offtaking Structure of Minor Canals		nos.	1,630	58,170	10	16	582	598	MST-03
- Outlet		nos.	420	4,220	234	98	987	1,086	MST-04
- Drainage Crossing	Type-A (14m)	no.	1,110	61,320	0	0	0	0	MST-06-1
	Type-B (7m)	nos.	430	32,810	1	0	33	33	MST-06
- Rehabilitation Work of Existing Facilities		L.S.			5%	6	84	90	
A-2 Construction of Parallel Canal along Disty. Canals									
1) Striping		m2	11	3	49,340	543	148	691	E-02
2) Excavation		m3	19	3	17,360	330	52	382	E-03
3) Embankment		m3	7	47	39,360	276	1,850	2,125	E-08
4) Brick Tile Lining		m2	0	211	42,600	0	8,989	8,989	C-22
5) Related Structure									
- Offtaking Structure		nos.	1,630	58,170	8	13	465	478	MST-03
- Outlet		nos.	420	4,220	57	24	241	264	MST-04
- Bridge	Type-C(7.5 m)	nos.	5,080	204,560	2	10	409	419	MST-11
	Type-D(5m)	nos.	3,400	150,580	18	61	2,710	2,772	MST-12
- Drainage Crossing	Type-A(14m)	nos.	430	32,810	0	0	0	0	MST-06
Sub-total (A)						2,101	58,746	60,847	
B. Drainage System									
B-1 Main Drainage System									
1) Striping		m2	11	3	75,270	828	226	1,054	E-02
2) Excavation		m3	21	4	1,072,680	22,526	4,291	26,817	E-04
3) Embankment		m3	7	19	965,420	6,758	18,343	25,101	E-07
4) Related Structure									
- Bridge	Type-A (30m)	no.	24,500	912,510	2	49	1,825	1,874	MST-09
	Type-B (15m)	nos.	11,300	393,710	13	147	5,118	5,265	MST-10
	Type-C (7.5 m)	nos.	5,080	204,560	16	81	3,273	3,354	MST-11
	Type-D (5m)	nos.	3,400	150,580	36	122	5,421	5,543	MST-12
B-2 Tertiary Drainage System									
1) Excavation		m3	0	28	238,910	0	6,689	6,689	E-06
2) Embankment		m3	7	19	215,020	1,505	4,085	5,591	E-07
3) Related Structure									
- Foot Path		nos.	50	1,830	184	9	337	346	MST-13
B-3 Sub-surface Drainage System									
1) Sub-surface Pipe		ha	20980	28,110	40	839	1,124	1,964	MST-14
Sub-total (B)						32,865	50,733	83,598	
C. Augumentation Facility									
Shallow Well with Strainer									
1) Pump House		nos.	460	48,190	280	129	13,493	13,622	MST-18
2) Boring & Equipment		set	0	23,600	280	0	6,608	6,608	MST-20
3) Power Supply		set	1,200	10,820	280	336	3,030	3,366	MST-19
Sub-total (C)						465	23,131	23,596	
D. On-farm Facility									
D-1 Watercourse									
1) Lining		km	30,310	429,010	242	7,335	103,820	111,155	OF-01
2) Earth Canal		km	10,000	60,000	131	1,310	7,860	9,170	OF-02
D-2 Field Drain		km	0	21,000	303	0	6,363	6,363	OF-04
D-3 Related Structure									
1) Turnout		nos.	0	290	1,716	0	498	498	OF-03
2) Road Crossing	Type-A	nos.	70	2,910	54	4	157	161	OF-06
	Type-B	nos.	20	300	572	11	172	183	OF-07
3) Transition		nos.	0	120	409	0	49	49	OF-09
4) Aqueduct	Type-A	nos.	20	4,490	65	1	292	293	OF-10
	Type-B	nos.	20	4,250	98	2	417	418	OF-10-1
5) Drop		nos.	10	1,540	191	2	294	296	OF-11
6) Drainage Culvert	Type-A	nos.	40	2,460	0	0	0	0	OF-05
	Type-B	nos.	20	1,430	790	16	1,130	1,146	OF-05-1
D-4 Farm Road	Type-A	km	50,000	10,000	376	18,800	3,760	22,560	MST-08
Sub-total (D)						27,481	124,811	152,292	
E. Improvement of Service Road									
E-1 Distributary Canal		km	60,000	630,000	35.27	2,116	22,220	24,336	MST-07
E-2 Minor Canal		km	50,000	10,000	46.11	2,306	461	2,767	MST-08
Sub-total (E)						4,422	22,681	27,103	
Total						67,334	280,101	347,435	

Table J.6 Land Acquisition Cost

Area	Work Item	Unit Rate of Land /1 (Rs./m2)	Quantity (1,000m2)	Amount (1,000Rs.)
1. Sarojini Nagar	Irrigation Facility	4.50	156	702
	Drainage Facility	3.00	1,518	4,554
2. Sataon	Irrigation Facility	5.76	497	2,863
	Drainage Facility	4.08	1,117	4,557
3. Sursa	Irrigation Facility	5.60	111	622
	Drainage Facility	4.40	1,808	7,955
4. Purwa	Irrigation Facility	4.00	49	196
	Drainage Facility	2.00	1,382	2,764
Total			6,638	24,213

Remarks /1 : Unit rate of land is collected from the Tehsil concerned.

Table J.7 List of Supporting Equipment

Item		Unit Price (1,000 Rs)	Required Number	Amount (1,000 Rs)
I. Equipment for O & M Works				
1 Vehicle	small jeep, 4WD	300.0	16	4,800
2 Motorcycle	350 cc	10.0	24	240
Sub-total (I)				5,040
II. Equipment for Training				
1 Audio-visual Equipemnt				
- Sound System		150.0	4	600
- Overhead Projectors		35.0	4	140
- Slide Projector		35.0	4	140
- Screen		10.0	4	40
2 Printing Equipment				
- Photocopy Machine		200.0	4	800
3 Office Equipment				
- Air Condition		50.0	4	200
Sub-total (II)				1,920
III. Equipment for Experimental Research			L.S.	1,450
Total				8,410

Table J.8 Administration Cost

Item	Required Number	Required M/M	Monthly Rate(Rs.)	Amount (1,000 Rs.)
A-1 Main System (Irrigation Department)				
1) O & M Staff				
- Executive Engineer	4	12	15,000	720
- Assistant Executive Engine	4	12	12,000	576
- Junior Engineer	14	12	9,000	1,512
- Other staff	L.S.			1,000
- Labour	L.S.			200
- Driver	8	12	6,000	576
2) Equipment operation cost	4	12	15,000	720
3) Office operation cost	4	12	15,000	720
4) Miscellaneous	L.S.			76
Sub-total (A-1)				6,100
A-2 On-farm Works and Farm Management Works				
1) O & M Staff				
- Executive Engineer	4	12	15,000	720
- Assistant Executive Engineer	4	12	12,000	576
- Junior Engineer	8	12	9,000	864
- Soil Conservation Officer	8	12	6,000	576
- Extension Worker	100	12	6,000	7,200
- Water Management Staff	100	12	6,000	7,200
- Driver	8	12	6,000	576
- Labor	L.S.			500
2) Equipment operation cost	4	12	15,000	720
3) Office operation cost	4	12	15,000	720
4) Miscellaneous	L.S.			48
Sub-total (A-2)				19,700
Total				25,800

Table J. 9 Required Man-Months of Consultant Engineer

Specialist	Man-Month		
	Foreign Consultant	Local Consultant	Total
I. Detailed Design (4 years)			
1. Project Director	4	-	4
2. Chief Engineer	48	-	48
3. Design Engineer for Main System	12	36	48
4. Design Engineer for On-farm System	16	192	208
5. Geology/Geo-hydrologist	6	-	6
6. Agronomist	6	18	24
7. Water Management Expert	6	6	12
8. Extension Expert	12	18	30
9. Chief Surveyor	6	-	6
10. Specialist as Required	12	12	24
Sub-total (I)	128	282	410
II. Construction Supervision and Farm Guidance (5 years)			
1. Project Director	5	-	5
2. Chief Engineer	60	-	60
3. Construction Engineer for Main System	12	144	156
4. Construction Engineer for On-farm System	24	240	264
5. Groundwater Specialist	12	96	108
6. Agronomist	24	240	264
7. Water Management Expert	24	240	264
8. Extension Expert	24	240	264
9. Specialist as Required	15	24	39
Sub-total (II)	200	1,224	1,424
Total	328	1,506	1,834

Table J.10 Cost of Engineering Service

Unit : 1,000 Rs.

Description	Foreign Currency	Local Currency	Total
I. Detailed Design			
1. Remuneration (Foreign 128 M/M)	30,700	-	30,700
2. Remuneration (Local 282 M/M)	-	2,800	2,800
3. Direct Cost	9,200	900	10,100
4. Special Equipment			
- Vehicle	-	4,000	4,000
- Motorcycle	-	200	200
- Photocopy Machine	-	300	300
- Personnel Computer with Printer	600	-	600
5. Cost of Survey Works for On-farm Design	-	90,000	90,000
Sub-total (I)	40,500	98,200	138,700
II. Construction Supervision			
1. Remuneration (Foreign 200 M/M)	48,200	-	48,200
2. Remuneration (Local 1.224 M/M)	-	12,200	12,200
3. Direct Cost	14,500	3,700	18,200
4. Special Equipment			
- Vehicle	-	4,000	4,000
- Motorcycle	-	200	200
- Photocopy Machine	-	300	300
- Personnel Computer with Printer	600	-	600
Sub-total (II)	63,300	20,400	83,700
Total	103,800	118,600	222,400

Table J.11 Annual Disbursement Schedule

Unit: Million Rs.

Description		Amount			1993			1994			1995		
		Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
A. Direct Construction Cost													
1) Irrigation System		20.9	445.7	466.5	0.0	0.0	0.0	0.8	17.8	18.7	4.2	89.1	93.3
2) Drainage System		101.5	173.4	274.8	0.0	0.0	0.0	4.1	6.9	11.0	20.3	34.7	55.0
3) Augumentation Facility		10.3	126.8	137.1	0.0	0.0	0.0	0.0	0.0	0.0	1.7	21.1	22.9
4) On-farm Facility		128.6	585.4	714.0	0.0	0.0	0.0	5.1	23.4	28.6	25.7	117.1	142.8
5) Improvement of Service Road		22.2	138.7	161.0	0.0	0.0	0.0	0.9	5.5	6.4	4.4	27.7	32.2
6) Wireless Communication System		58.9	6.5	65.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sub-total (A)		342.3	1,476.6	1,818.9	0.0	0.0	0.0	10.9	53.7	64.7	56.3	289.8	346.1
B. Procurement of Supporting Equipment		0.0	8.4	8.4	0.0	4.2	4.2	0.0	4.2	4.2	0.0	0.0	0.0
C. Land Acquisition		0.0	24.2	24.2	0.0	0.0	0.0	0.0	12.1	12.1	0.0	12.1	12.1
D. Administration Cost		0.0	148.7	148.7	0.0	19.7	19.7	0.0	25.8	25.8	0.0	25.8	25.8
E. Engineering Service		103.8	118.6	222.4	11.8	28.6	40.5	20.3	31.4	51.6	24.9	29.3	54.2
Sub-total (A - E)		446.1	1,776.5	2,222.6	11.8	52.5	64.4	31.2	127.2	158.4	81.2	357.0	438.2
F. Contingency													
Physical Contingency	10%	44.6	177.6	222.3	1.2	5.3	6.4	3.1	12.7	15.8	8.1	35.7	43.8
Price Contingency													
F/C	3%	80.3	825.9	906.2	0.8	8.4	9.2	3.2	31.5	34.7	11.2	122.0	133.3
L/C	7%												
TOTAL		571.0	2,780.1	3,351.1	13.8	66.2	80.0	37.5	171.4	208.9	100.6	514.7	615.3

Description		1996			1997			1998		
		Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
A. Direct Construction Cost										
1) Irrigation System		5.8	124.8	130.6	5.8	124.8	130.6	4.2	89.1	93.3
2) Drainage System		28.4	48.5	77.0	28.4	48.5	77.0	20.3	34.7	55.0
3) Augumentation Facility		5.1	63.4	68.6	3.4	42.3	45.7	0.0	0.0	0.0
4) On-farm Facility		36.0	163.9	199.9	36.0	163.9	199.9	25.7	117.1	142.8
5) Improvement of Service Road		6.2	38.8	45.1	6.2	38.8	45.1	4.4	27.7	32.2
6) Wireless Communication System		58.9	6.5	65.4	0.0	0.0	0.0	0.0	0.0	0.0
Sub-total (A)		140.5	446.1	586.5	79.9	418.4	498.3	54.6	268.6	323.3
B. Procurement of Supporting Equipment		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C. Land Acquisition		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D. Administration Cost		0.0	25.8	25.8	0.0	25.8	25.8	0.0	25.8	25.8
E. Engineering Service		21.5	21.1	42.6	14.8	4.8	19.5	10.6	3.4	14.0
Sub-total (A - E)		162.0	493.0	655.0	94.7	448.9	543.6	65.2	297.8	363.0
F. Contingency										
Physical Contingency	10%	16.2	49.3	65.5	9.5	44.9	54.4	6.5	29.8	36.3
Price Contingency										
F/C	3%	28.4	218.3	246.7	20.2	247.3	267.5	16.5	198.5	214.9
L/C	7%									
TOTAL		206.6	760.6	967.2	124.4	741.1	865.5	88.2	526.1	614.3

Table J.12 Breakdown of Annual Disbursement Schedule (1/2)

Unit: Rs million

Description	Amount			1993			1994			1995			1996			1997			1998		
	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
I. Sarojini Nagar Area																					
I-A Direct Construction Cost																					
1) Irrigation System	4.1	63.1	67.3	0.0	0.0	0.0	0.2	2.5	2.7	0.8	12.6	13.5	1.2	17.7	18.8	1.2	17.7	18.8	0.8	12.6	13.5
2) Drainage System	20.0	38.0	58.1	0.0	0.0	0.0	0.8	1.5	2.3	4.0	7.6	11.6	5.6	10.7	16.3	5.6	10.7	16.3	4.0	7.6	11.6
3) Augumentaion Facility	1.2	12.7	13.9	0.0	0.0	0.0	0.0	0.0	0.0	0.2	2.1	2.3	0.6	6.4	7.0	0.4	4.2	4.6	0.0	0.0	0.0
4) On-farm Facility	33.3	149.0	182.3	0.0	0.0	0.0	1.3	6.0	7.3	6.7	29.8	36.5	9.3	41.7	51.1	9.3	41.7	51.1	6.7	29.8	36.5
5) Improvement of Serveice Road	6.0	34.1	40.1	0.0	0.0	0.0	0.2	1.4	1.6	1.2	6.8	8.0	1.7	9.5	11.2	1.7	9.5	11.2	1.2	6.8	8.0
6) Wireless Communication System	15.3	1.7	17.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.3	1.7	17.0	0.0	0.0	0.0	0.0	0.0	0.0
Sub-Total (I-1)	80.0	298.7	378.7	0.0	0.0	0.0	2.5	11.4	13.9	12.9	59.0	71.9	33.7	87.7	121.3	18.2	83.8	102.0	12.7	56.8	69.6
I-B Procurement of Supporting Equipment	0.0	2.2	2.2	0.0	1.1	1.1	0.0	1.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I-C Land Acquisition	0.0	5.3	5.3	0.0	0.0	0.0	0.0	2.6	2.6	0.0	2.6	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I-D Administration Cost	0.0	38.6	38.6	0.0	5.1	5.1	0.0	6.7	6.7	0.0	6.7	6.7	0.0	6.7	6.7	0.0	6.7	6.7	0.0	6.7	6.7
I-E Engineering Service	26.9	30.8	57.7	3.1	7.4	10.5	5.3	8.1	13.4	6.5	7.6	14.1	5.6	5.5	11.1	3.8	1.2	5.1	2.7	0.9	3.6
Sub-Total	106.9	375.4	482.4	3.1	13.6	16.7	7.8	29.9	37.7	19.4	75.9	95.3	39.2	99.8	139.1	22.0	91.8	113.8	15.4	64.4	79.9
I-F Contingency																					
Physical Contingency	10.7	37.5	48.2	0.3	1.4	1.7	0.8	3.0	3.8	1.9	7.6	9.5	3.9	10.0	13.9	2.2	9.2	11.4	1.5	6.4	8.0
Price Contingency	19.2	173.2	192.4	0.2	2.2	2.4	0.8	7.4	8.2	2.7	25.9	28.6	6.9	44.2	51.1	4.7	50.5	55.2	3.9	42.9	46.8
Total	136.8	586.2	723.0	3.6	17.2	20.7	9.4	40.3	49.7	24.0	109.4	133.4	50.0	154.0	204.0	28.9	151.5	180.4	20.9	113.8	134.7
II. Sataon Area																					
II-A Direct Construction Cost																					
1) Irrigation System	10.7	227.7	238.4	0.0	0.0	0.0	0.4	9.1	9.5	2.1	45.5	47.7	3.0	63.7	66.7	3.0	63.7	66.7	2.1	45.5	47.7
2) Drainage System	13.5	21.9	35.4	0.0	0.0	0.0	0.5	0.9	1.4	2.7	4.4	7.1	3.8	6.1	9.9	3.8	6.1	9.9	2.7	4.4	7.1
3) Augumentaion Facility	1.5	15.4	16.9	0.0	0.0	0.0	0.0	0.0	0.0	0.2	2.6	2.8	0.7	7.7	8.5	0.5	5.1	5.6	0.0	0.0	0.0
4) On-farm Facility	28.9	131.1	160.0	0.0	0.0	0.0	1.2	5.2	6.4	5.8	26.2	32.0	8.1	36.7	44.8	8.1	36.7	44.8	5.8	26.2	32.0
5) Improvement of Serveice Road	6.5	58.0	64.5	0.0	0.0	0.0	0.3	2.3	2.6	1.3	11.6	12.9	1.8	16.3	18.1	1.8	16.3	18.1	1.3	11.6	12.9
6) Wireless Communication System	13.2	1.5	14.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.2	1.5	14.7	0.0	0.0	0.0	0.0	0.0	0.0
Sub-Total (I-A)	74.3	455.7	530.0	0.0	0.0	0.0	2.4	17.6	19.9	12.2	90.3	102.5	30.6	132.1	162.7	17.2	128.0	145.2	11.9	87.8	99.7
II-B Procurement of Supporting Equipment	0.0	1.9	1.9	0.0	0.9	0.9	0.0	0.9	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
II-C Land Acquisition	0.0	7.4	7.4	0.0	0.0	0.0	0.0	3.7	3.7	0.0	3.7	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
II-D Administration Cost	0.0	33.4	33.4	0.0	4.4	4.4	0.0	5.8	5.8	0.0	5.8	5.8	0.0	5.8	5.8	0.0	5.8	5.8	0.0	5.8	5.8
II-E Engineering Service	23.3	26.6	50.0	2.7	6.4	9.1	4.6	7.0	11.6	5.6	6.6	12.2	4.8	4.7	9.6	3.3	1.1	4.4	2.4	0.8	3.1
Sub-Total	97.6	525.1	622.6	2.7	11.8	14.5	6.9	35.0	42.0	17.7	106.4	124.2	35.5	142.6	178.1	20.5	134.9	155.4	14.3	94.3	108.6
II-F Contingency																					
Physical Contingency	9.8	52.5	62.3	0.3	1.2	1.4	0.7	3.5	4.2	1.8	10.6	12.4	3.5	14.3	17.8	2.0	13.5	15.5	1.4	9.4	10.9
Price Contingency	17.5	247.2	264.8	0.2	1.9	2.1	0.7	8.7	9.4	2.5	36.4	38.8	6.2	63.1	69.4	4.4	74.3	78.7	3.6	62.8	66.5
Total	124.9	824.8	949.7	3.1	14.9	18.0	8.3	47.2	55.6	22.0	153.5	175.4	45.2	220.0	265.2	26.9	222.7	249.6	19.3	166.6	185.9

Table J.12 Breakdown of Annual Disbursement Schedule (2/2)

Unit: Rs million

Description	Amount			1993			1994			1995			1996			1997			1998		
	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
III. Sursa Area																					
III-A Direct Construction Cost																					
1) Irrigation System	3.9	96.1	100.0	0.0	0.0	0.0	0.2	3.8	4.0	0.8	19.2	20.0	1.1	26.9	28.0	1.1	26.9	28.0	0.8	19.2	20.0
2) Drainage System	35.1	62.6	97.7	0.0	0.0	0.0	1.4	2.5	3.9	7.0	12.5	19.5	9.8	17.5	27.4	9.8	17.5	27.4	7.0	12.5	19.5
3) Augumentaion Facility	7.2	75.5	82.7	0.0	0.0	0.0	0.0	0.0	0.0	1.2	12.6	13.8	3.6	37.8	41.3	2.4	25.2	27.6	0.0	0.0	0.0
4) On-farm Facility	38.9	180.5	219.3	0.0	0.0	0.0	1.6	7.2	8.8	7.8	36.1	43.9	10.9	50.5	61.4	10.9	50.5	61.4	7.8	36.1	43.9
5) Improvement of Serveice Road	5.3	24.0	29.3	0.0	0.0	0.0	0.2	1.0	1.2	1.1	4.8	5.9	1.5	6.7	8.2	1.5	6.7	8.2	1.1	4.8	5.9
6) Wireless Communication System	17.8	2.0	19.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.8	2.0	19.8	0.0	0.0	0.0	0.0	0.0	0.0
Sub-Total (I-A)	108.1	440.7	548.8	0.0	0.0	0.0	3.3	14.5	17.9	17.8	85.2	103.1	44.7	141.4	186.1	25.7	126.9	152.5	16.6	72.6	89.3
III-B Procurement of Supporting Equipment	0.0	2.5	2.5	0.0	1.3	1.3	0.0	1.3	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
III-C Land Acquisition	0.0	8.6	8.6	0.0	0.0	0.0	0.0	4.3	4.3	0.0	4.3	4.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
III-D Administration Cost	0.0	44.9	44.9	0.0	6.0	6.0	0.0	7.8	7.8	0.0	7.8	7.8	0.0	7.8	7.8	0.0	7.8	7.8	0.0	7.8	7.8
III-E Engineering Service	31.4	35.8	67.2	3.6	8.7	12.2	6.1	9.5	15.6	7.5	8.9	16.4	6.5	6.4	12.9	4.5	1.4	5.9	3.2	1.0	4.2
Sub-Total	139.5	532.6	672.0	3.6	15.9	19.4	9.4	37.4	46.8	25.3	106.2	131.5	51.2	155.6	206.8	30.1	136.1	166.2	19.8	81.5	101.3
III-F Contingency																					
Physical Contingency	13.9	53.3	67.2	0.4	1.6	1.9	0.9	3.7	4.7	2.5	10.6	13.2	5.1	15.6	20.7	3.0	13.6	16.6	2.0	8.1	10.1
Price Contingency	25.1	246.2	271.3	0.2	2.5	2.8	1.0	9.2	10.2	3.5	36.3	39.8	9.0	68.9	77.9	6.4	75.0	81.4	5.0	54.3	59.3
Total	178.5	832.0	1,010.6	4.2	20.0	24.2	11.4	50.3	61.7	31.4	153.1	184.5	65.2	240.1	305.3	39.6	224.7	264.3	26.8	143.9	170.7
IV. Purwa Area																					
VI-A Direct Construction Cost																					
1) Irrigation System	2.1	58.7	60.8	0.0	0.0	0.0	0.1	2.3	2.4	0.4	11.7	12.2	0.6	16.4	17.0	0.6	16.4	17.0	0.4	11.7	12.2
2) Drainage System	32.9	50.7	83.6	0.0	0.0	0.0	1.3	2.0	3.3	6.6	10.1	16.7	9.2	14.2	23.4	9.2	14.2	23.4	6.6	10.1	16.7
3) Augumentaion Facility	0.5	23.1	23.6	0.0	0.0	0.0	0.0	0.0	0.0	0.1	3.9	3.9	0.2	11.6	11.8	0.2	7.7	7.9	0.0	0.0	0.0
4) On-farm Facility	27.5	124.8	152.3	0.0	0.0	0.0	1.1	5.0	6.1	5.5	25.0	30.5	7.7	34.9	42.6	7.7	34.9	42.6	5.5	25.0	30.5
5) Improvement of Serveice Road	4.4	22.7	27.1	0.0	0.0	0.0	0.2	0.9	1.1	0.9	4.5	5.4	1.2	6.4	7.6	1.2	6.4	7.6	0.9	4.5	5.4
6) Wireless Communication System	12.6	1.4	14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.6	1.4	14.0	0.0	0.0	0.0	0.0	0.0	0.0
Sub-Total (I-A)	79.9	281.5	361.4	0.0	0.0	0.0	2.7	10.3	13.0	13.5	55.2	68.7	31.5	84.9	116.5	18.9	79.7	98.5	13.4	51.4	64.8
VI-B Procurement of Supporting Equipment	0.0	1.8	1.8	0.0	0.9	0.9	0.0	0.9	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
VI-C Land Acquisition	0.0	3.0	3.0	0.0	0.0	0.0	0.0	1.5	1.5	0.0	1.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
VI-D Administration Cost	0.0	31.8	31.8	0.0	4.2	4.2	0.0	5.5	5.5	0.0	5.5	5.5	0.0	5.5	5.5	0.0	5.5	5.5	0.0	5.5	5.5
VI-E Engineering Service	22.2	25.4	47.6	2.5	6.1	8.6	4.3	6.7	11.0	5.3	6.3	11.6	4.6	4.5	9.1	3.2	1.0	4.2	2.3	0.7	3.0
Sub-Total	102.1	343.4	445.5	2.5	11.2	13.8	7.0	24.9	31.9	18.8	68.5	87.3	36.1	94.9	131.1	22.0	86.2	108.2	15.6	57.6	73.3
VI-F Contingency																					
Physical Contingency	10.2	34.3	44.6	0.3	1.1	1.4	0.7	2.5	3.2	1.9	6.9	8.7	3.6	9.5	13.1	2.2	8.6	10.8	1.6	5.8	7.3
Price Contingency	18.5	159.3	177.8	0.2	1.8	2.0	0.7	6.2	6.9	2.6	23.4	26.0	6.3	42.0	48.4	4.7	47.5	52.2	4.0	38.4	42.4
Total	130.8	537.1	667.8	2.9	14.1	17.1	8.4	33.5	41.9	23.2	98.8	122.0	46.1	146.5	192.6	28.9	142.3	171.2	21.1	101.8	123.0

Table J.13 Unit Cost of Labour and Construction Materials

No.	Item	Unit	Cost (Rs.)	Componebt F (%)	Componebt L (%)	Unit Price F (Rs.)	Unit Price L (Rs.)	Remarks
A. Labour								
1.	Foreman	man-day	100	0%	100%	0	100	L-01
2.	Skilled Labour	man-day	55	0%	100%	0	55	L-02
3.	Common Labour	man-day	35	0%	100%	0	35	L-03
4.	Mason	man-day	60	0%	100%	0	60	L-04
5.	Carpenter	man-day	50	0%	100%	0	50	L-05
6.	Black Smith	man-day	50	0%	100%	0	50	L-06
7.	Painter	man-day	60	0%	100%	0	60	L-07
8.	Bar bender	man-day	65	0%	100%	0	65	L-08
9.	Welder	man-day	65	0%	100%	0	65	L-09
10.	Mechanic	man-day	90	0%	100%	0	90	L-10
11.	Electrician	man-day	70	0%	100%	0	70	L-11
12.	Plumber	man-day	65	0%	100%	0	65	L-12
13.	Driver	man-day	60	0%	100%	0	60	L-13
14.	Operator	man-day	70	0%	100%	0	70	L-14
15.	Assistant Operator	man-day	55	0%	100%	0	55	L-15
16.	Heavy Machine Mechanic	man-day	90	0%	100%	0	90	L-16
B. Construction Materials								
1.	Sand	m3	250	0%	100%	0	250	M-01
2.	Coarse Gravel	m3	380	0%	100%	0	380	M-02
3.	Boulder	m3	550	0%	100%	0	550	M-03
4.	Portrand Cement	ton	1,965	0%	100%	0	1,965	M-04
5.	Brick	1,000 nos.	900	0%	100%	0	900	M-05
6.	Brick Tile	1,000 nos	1,200	0%	100%	0	1,200	M-34
7.	Timber	m3	10,600	0%	100%	0	10,600	M-06
8.	Plywood	m2	165	0%	100%	0	165	M-07
9.	Reinforced iron bar	ton	10,200	10%	90%	1,020	9,180	M-08
10.	Structural Steel	kg	12	10%	90%	1	11	M-09
11.	R.C.C pipe, Dia 100 mm	m	56	0%	100%	0	56	M-10
12.	R.C.C pipe, Dia 150 mm	m	67	0%	100%	0	67	M-11
13.	R.C.C pipe, Dia 200 mm	m	91	0%	100%	0	91	M-12
14.	R.C.C pipe, Dia 250 mm	m	99	0%	100%	0	99	M-13
15.	R.C.C pipe, Dia 300 mm	m	148	0%	100%	0	148	M-14
16.	R.C.C pipe, Dia 300 mm	m	163	0%	100%	0	163	M-14-1
17.	R.C.C pipe, Dia 400 mm	m	188	0%	100%	0	188	M-15
18.	R.C.C pipe, Dia 450 mm	m	225	0%	100%	0	225	M-16
19.	R.C.C pipe, Dia 500 mm	m	259	0%	100%	0	259	M-17
20.	R.C.C pipe, Dia 600 mm	m	362	0%	100%	0	362	M-18
21.	R.C.C pipe, Dia 700 mm	m	432	0%	100%	0	432	M-19
22.	R.C.C pipe, Dia 800 mm	m	579	0%	100%	0	579	M-20
23.	R.C.C pipe, Dia 900 mm	m	720	0%	100%	0	720	M-21
24.	R.C.C pipe, Dia 1,000 mm	m	877	0%	100%	0	877	M-22
25.	R.C.C pipe, Dia 1,100 mm	m	1,023	0%	100%	0	1,023	M-23
26.	R.C.C pipe, Dia 1,200 mm	m	1,183	0%	100%	0	1,183	M-24
27.	P.V.C. pipe, Dia. 20 mm	m	6	20%	80%	1	5	M-25
28.	P.V.C. pipe, Dia. 50 mm	m	24	20%	80%	5	19	M-26
29.	P.V.C. pipe, Dia. 100 mm	m	66	20%	80%	13	53	M-27
30.	P.V.C. pipe, Dia. 150 mm	m	208	20%	80%	42	166	M-28
31.	P.V.C. pipe, Dia. 200 mm	m	346	20%	80%	69	277	M-29
32.	Fuel	lit.	13	40%	60%	5	8	M-30
33.	Diesel	lit.	6	40%	60%	2	3	M-31
34.	Kerosine	lit.	4	40%	60%	2	3	M-32
35.	Lubricant	lit.	31	40%	60%	12	18	M-33

Source : JICA survey in the early 1991

Table J.14 List of Unit Prices of Major Work Items

Unit : Rs.

Work Item	Unit	Foreign Currency	Local Currency	Total	Remarks
1. EARTH WORKS					
- Clearing and grubbing	m2	0	1	1	E-01
- Stripping of top soil	m3	11	3	14	E-02
- Excavation of irrigation canals(machine)	m3	19	3	22	E-03
- Excavation in drains by machine	m3	21	4	25	E-04
- Excavation in natural rivers	m3	30	4	34	E-05
- Excavation(manpower)	m3	0	28	28	E-06
- Embankment with excavated material	m3	7	19	26	E-07
- Embankment with borrowed material	m3	7	47	54	E-08
- Backfill for structures	m3	7	19	26	E-09
- Embankment for Road	m3	54	12	66	E-10
2. CONCRETE WORKS					
- Concrete, Type-A (1:1.5:3)	m3	50	1903	1,953	C-01
- Concrete, Type-B(1:2:4)	m3	50	1715	1,765	C-02
- Concrete, Type-C(1:3:6)	m3	50	1382	1,432	C-03
- Concrete, Type-D(1:4:8)	m3	50	1361	1,411	C-03-1
- Formwork	m2	0	289	289	C-04
- Reinforcement steel	ton	1308	12760	14,068	C-05
- Structural steel	ton	1594	15335	16,929	C-05-1
3. BRICK WORKS					
- Brick masonry	m3	0	1155	1,155	B-01
- Brick Pitching	m3	0	1188	1,188	B-02
- Plastering	m2	0	47	47	B-03
- Removal of Brickwork	m3	0	254	254	B-04
- Dry Brick Pitching	m3	0	775	775	B-05
- Ruled Pointing	m2	0	21	21	B-06
- Brick Lining/one tile with plaster with top	m2	0	200	200	C-22
4. PIPE WORKS					
- Precast concrete pipe, 200 mm dia.	m	0	163	163	C-06
- Precast concrete pipe, 250 mm dia.	m	0	180	180	C-07
- Precast concrete pipe, 300mm dia.	m	0	247	247	C-08
- Precast concrete pipe, 350mm dia.	m	0	266	266	C-08-1
- Precast concrete pipe, 400 mm dia.	m	0	298	298	C-09
- Precast concrete pipe, 500 mm dia.	m	34	396	430	C-10
- Precast concrete pipe, 600 mm.dia.	m	34	542	576	C-11
- Precast concrete pipe, 700 mm dia.	m	34	642	676	C-12
- Present concrete pipe, 800 mm dia.	m	34	837	871	C-13
- Precast concrete pipe, 900 mm dia.	m	34	1025	1,059	C-14
- Precast concrete pipe, 1000 mm dia.	m	34	1219	1,253	C-15
- Precast concrete pipe, 1100 mm.dia.	m	34	1433	1,467	C-16
- Precast concrete pipe, 1200 mm dia.	m	34	1634	1,668	C-17
- Precast concrete unit for outlet	nos	277	1,134	1,411	C-20
5. OTHERS					
- Installation of PVC 50mm	m	7	30	37	C-23
- Installation of PVC 100mm	m	20	81	101	C-24

Remarks : Above unit prices are worked out based on the prices in Lucknow city. The unit prices of the representative areas are calculated in consideration of the transportation cost of the construction materials.

Table J. 15 Annual Operation and Maintenance Cost

Unit : 1,000 Rs

Description	O & M Cost
I. Sarojini Nagar Area	
A. Main system	
1 Irrigation Facility	
- Canal	1,300
- Augumentation Facility	700
2 Drainage Facility	1,200
3 Service Road	800
B. On-farm system	3,600
Total	7,600
II. Sataon Area	
A. Main system	
1 Irrigation Facility	
- Canal	4,800
- Augumentation Facility	800
2 Drainage Facility	700
3 Service Road	1,300
B. On-farm system	3,200
Total	10,800
III. Sursa Area	
A. Main system	
1 Irrigation Facility	
- Canal	2,000
- Augumentation Facility	4,100
2 Drainage Facility	2,000
3 Service Road	600
B. On-farm system	4,400
Total	13,100
IV. Purwa Area	
A. Main system	
1 Irrigation Facility	
- Canal	1,200
- Augumentation Facility	1,200
2 Drainage Facility	1,700
3 Service Road	500
B. On-farm system	3,000
Total	7,600
Total	39,100

Table J.16 Replacement Cost

Item	Useful Life (year)	Replacement Cost (Rs. 1,000)
I. Sarojini Nagar Area		
1. Irrigation System		
- Pumping equipment	20	10,560
- Gate	10	20
2. Supporting Equipment	10	2,180
II. Sataon Area		
1. Irrigation System		
- Pumping equipment	20	13,500
- Gate	10	250
2. Supporting Equipment	10	1,890
III. Sursa Area		
1. Irrigation System		
- Pumping equipment	10	36,170
- Gate	10	20
2. Supporting Equipment	10	2,540
IV. Purwa Area		
1. Irrigation System		
- Pumping equipment	10	9,980
- Gate	10	30
2. Supporting Equipment	10	1,800

FIGURES

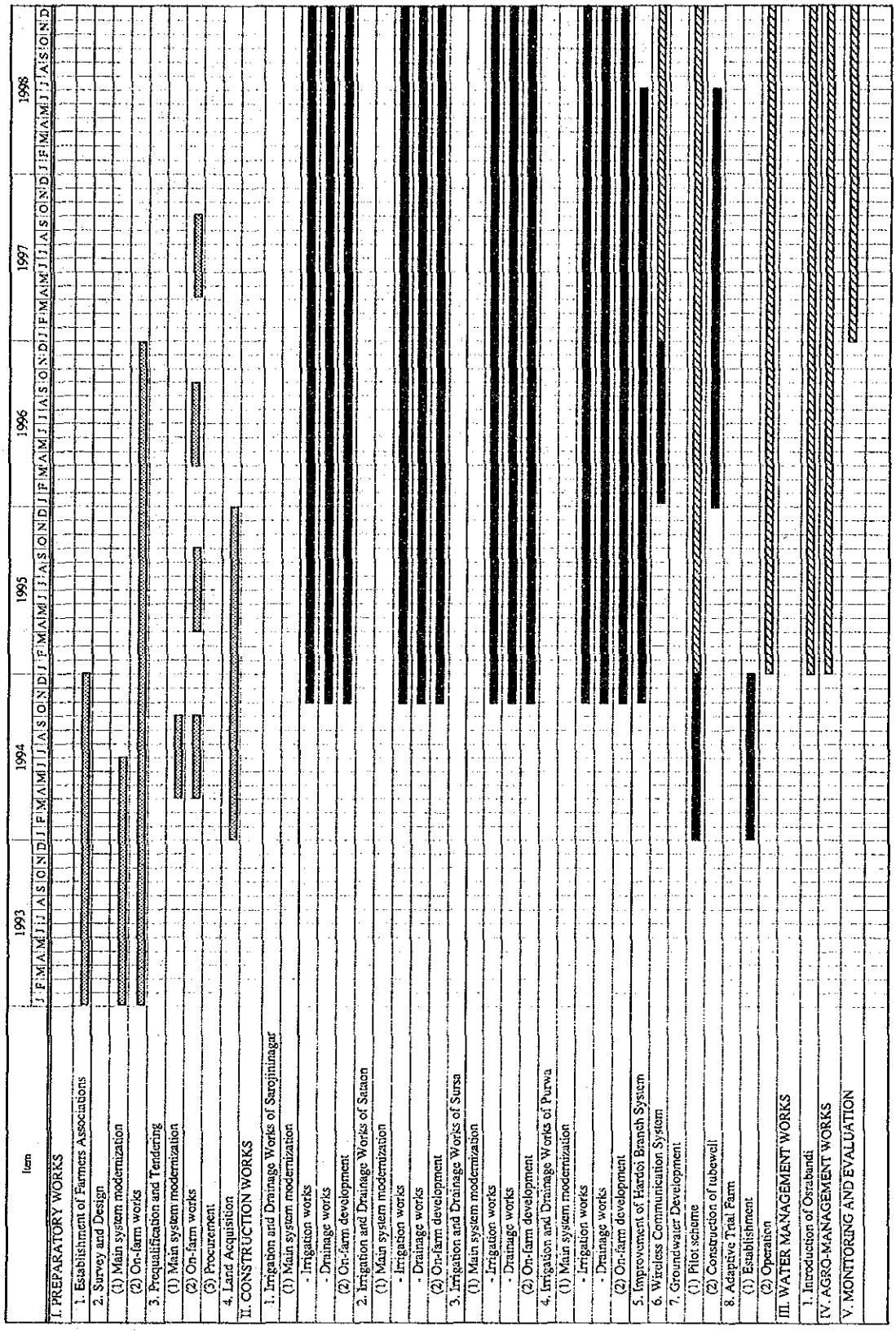

Fig. J.1 Project Implementation Schedule

INDIA
FEASIBILITY STUDY ON IRRIGATION AND DRAINAGE DEVELOPMENT OF SHARDA CANAL CAD PROJECT
JAPAN INTERNATIONAL COOPERATION AGENCY

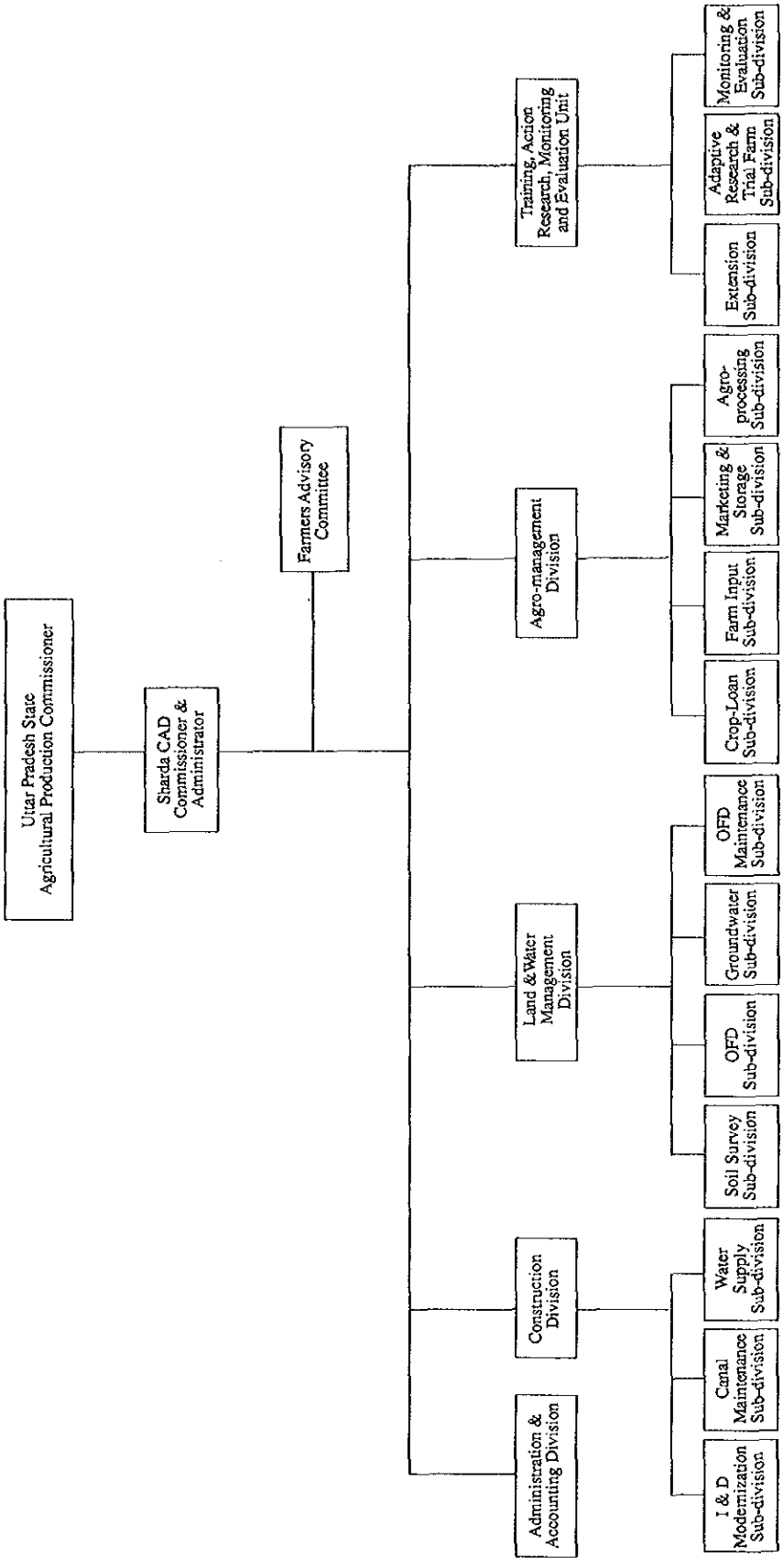

Fig. J.2 Organization Chart of Project Implementation

INDIA

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

JAPAN INTERNATIONAL COOPERATION AGENCY

ANNEX-K

PROJECT EVALUATION

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

ANNEX - K
PROJECT EVALUATION

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ANNEX K. PROJECT EVALUATION

1. General

The project is to be evaluated through an assessment of its feasibility in view of economic and financial aspects. The economic feasibility is evaluated by calculating the internal rate of return. A sensitivity analysis is also made to elucidate an economic viability of the project against the changes in the benefit and project cost.

Financial evaluation is carried out by analysing the effect of the project on the farm economy for a typical type of farmers and by preparing the repayment schedule of the project capital cost.

2. Economic Evaluation

2.1 Basic Assumption

The economic evaluation is made on the following basic assumptions;

(1) The economic useful life of the project is 50 years.
(2) All prices are expressed in constant 1990 prices.
(3) The exchange rate of US$1.00=Rs.25.9 is applied.

2.2 Economic Factors

Traffic and trade restrictions introduce a distortion in the price relationship between trade goods and non-trade goods. In order to evaluate the project costs and benefits with respect to world market prices, a standard conversion factor of 0.8 is applied to the price of non-traded goods and services.

From the viewpoint of international economy, the transfer of payment such as contract tax, duty, subsidy and interest are considered as a domestic monetary movement without direct productivity. These transfer payment are excluded from the project cost.

Economic prices of traded agricultural output (cereals and pulses) and farm inputs (urea, triple super phosphate (TSP) and potassium chloride (KCl)) are estimated on the basis of IBRD projection of world market prices for 1995 in constant 1985 terms. The domestic

cost elements such as transport, handling and processing down to the farm gate level were multiplied by the standard conversion factor (0.8).

The shadow price of 0.667 is applied for unskilled labors considering the present employment situation.

Economic prices of cereals and pulses, and inputs are shown in Table K.1.

2.3 Economic Benefits

The project benefit is born as a result of irrigation and drainage development as well as agricultural extension works. Present cultivated area is expected to increase productivity while currently fallow land due to water logging or alkalinity problem recovers its fertility. Non-irrigated area within CCA will also be expected to increase productivity as a result of introduction of better farming practice through extension works.

Expected benefit is defined as the difference of primary profit from crop production between future with project and without project conditions. Crop budget in future under with project condition is estimated irrespective of holding sizes, based on the proposed farming practices. On the other hand, crop budget under without project condition is estimated by holding sizes, assuming that the present farming practices will not change in future under the condition. The results of crop budgets are summarized in Table K.2. It may be a conservative assumption considering that further exploitation of groundwater will result in the increase of production cost as well as in the decrease of water yield, and thereby in the decrease of net benefit. The incremental benefit is expected to increase year by year and reach the full benefit in certain years after the completion of irrigation and drainage facilities. The build-up period to the full benefit is assumed to be 5 years.

As mentioned in the previous chapter, the area-wise development for the project is planned to be carried out as follows:

Accumulated Development Areas

Unit: ha

Construction year	Sarojini Nagar	Sataon	Sursa	Purwa
1	0	0	0	0
2	594	515	693	490
3	3,566	3,090	4,156	2,940
4	7,727	6,695	9,004	6,371
5	11,888	10,300	13,852	9,802
6	14,862	12,874	17,313	12,252

As a result, irrigation and drainage benefit is expected to be born from the 3rd construction year. The annual incremental benefit at the full development stage is estimated at Rs.488.5 million (refer to Tables K.3) as shown below:

Unit: Rs.million

Condition	Sarojini Nagar	Sataon	Sursa	Purwa	Total
With Project					
Kharif	105.4	89.5	116.1	86.8	397.8
Rabi	127.1	107.9	139.8	105.8	480.6
Perennial	-	-	2.9	-	2.9
Total (A)	232.4	197.4	258.8	192.6	881.3
Without Project					
Kharif	39.4	25.5	45.5	35.0	145.4
Rabi	54.9	56.1	94.9	36.3	242.2
Perennial	-	-	5.2	-	5.2
Total (B)	94.3	81.7	145.6	71.3	392.8
Incremental (A) - (B)	138.2	115.8	113.2	121.3	488.5

2.4 Economic Costs

The economic project cost is estimated based on the financial project cost, taking account of transfer payment and standard conversion factor for non-traded goods within the financial construction cost. The economic project costs is estimated at Rs.2,124.4 million for four Representative Areas (refer to Table K.4), being broken down into the following:

Economic Cost for Initial Investment

Unit: Rs.10^6

Description	Sarojini Nagar	Sataon	Sursa	Purwa	Total
1. Direct Construction Cost	320.3	444.2	463.1	307.4	1,535.1
2. Procurement of Supporting Equipment	1.5	1.3	1.7	1.2	5.8
3. Land Acquisition	4.2	5.9	5.7	2.4	19.4
4. Administration Cost	38.6	33.4	44.9	31.8	148.7
5. Engineering Services	57.7	50.0	67.2	47.5	222.4
Sub-total	422.3	534.8	583.8	390.4	1,931.3
6. Contingency	42.2	53.5	58.4	39.0	193.1
Total	464.5	588.3	642.2	429.4	2,124.4

The total annual economic operation and maintenance cost at the full development stage is estimated at Rs.33.4 million in total, as shown below:

Annual Economic O&M Cost

Unit: Rs.1,000

Description	Sarojini Nagar	Sataon	Sursa	Purwa	Total
1. Main system					
a. Irrigation Facility					
- Canal	1,060	3,930	1,640	980	7,610
- Augmentation Facilities	670	760	3,930	1,150	6,510
b. Drainage Facilities	1,050	610	1,760	1,490	4,910
c. Service Roads	680	1,100	510	420	2,710
2. On-farm system	2,950	2,620	3,600	2,460	11,630
Total	6,410	9,020	11,440	6,500	33,370

Some equipment of the irrigation and drainage system are replaced at certain intervals of periods. Useful life and costs of those equipment are as shown below:

Useful Life and Replacement Costs

Description	Sarojini Nagar		Sataon		Sursa		Purwa	
	Useful life	Cost (Rs.10^3)	Useful life	Cost (Rs.10^3)	Useful life	Cost (Rs.10^3)	Useful life	Cost (Rs.10^3)
1. Irrigation system								
a. pumping equipment	20	10,348	20	13,230	10	28,936	10	7,984
b. Gate	10	16	10	200	10	16	10	24
2. Supporting equipment	10	1,744	10	1,512	10	2,032	10	1,440

2.5 Economic Evaluation

The economic internal rate of return for the project is calculated based on the economic cost and benefit and the project implementation schedule. The results are as shown on Table K.5 and summarized below:

Sarojini Nagar	19.2%
Sataon	13.7%
Sursa	12.0%
Purwa	18.4%
Overall	15.5%

The results show that the project is economically feasible with an internal rate of return of 15.5% for the overall area, ranging from 19.2% for the Sarojini Nagar area to 12.0% for the Sursa area.

2.6 Sensitivity Analysis

A sensitivity analysis is carried out to evaluate the soundness of the project against possible adverse changes in the future for the following cases; (i) reduction of project benefit by 10% due to unexpected decrease in forecast prices, (ii) project cost overrun by 10% and (iii) combination by cases (i) and (ii). The result is presented below:

Unit: %

Description	Sarojini Nagar	Sataon	Sursa	Purwa	Overall
1. Case (i)	17.7	12.5	10.8	16.9	14.1
2. Case (ii)	17.9	12.7	11.0	17.1	14.4
3. Case (iii)	16.4	11.5	9.9	15.7	13.1

The result of sensitivity analysis indicates that the economic viability of the project is rather insensitive to the possible adverse changes.

3. Financial Analysis

A financial analysis of the project is made by the analysis of the typical farm budgets and assessment for repayment of the project construction cost.

3.1 Farm Budget Analysis

In order to evaluate the project feasibility from farmer's household economy, typical farm budgets of marginal farmers are prepared for the future with and without conditions as shown below (refer to Table K.6):

Unit: Rupees

Area	With Project			Without Project			Incremental Benefit
	Kharif	Rabi	Total	Kharif	Rabi	Total	
Sarojini Nagar (0.58ha)	3,195	3,099	6,294	2,082	2,065	4,147	2,147
Sataon (0.58ha)	3,118	3,001	6,119	910	1,868	2,778	3,341
Sursa (0.53ha)	2,839	2,679	5,518	1,627	2,028	3,655	1,863
Purwa (0.56ha)	3,119	2,818	5,937	2,090	1,785	3,875	2,062

As seen from the above table, the income of marginal farmers is expected to increase by 50% to 120%. Their economic situations are sure to be improved.

3.2 Capacity to Pay

After the implementation of the project, operation and maintenance cost of the irrigation and drainage systems as well as of on-farm facilities is shouldered to beneficial farmers. Those costs are estimated as shown below:

Annual Financial O&M Costs

Description	Sarojini Nagar		Sataon		Sursa		Purwa	
	Total ($Rs.10^3$)	Per ha (Rs.)	Total ($Rs.10^3$)	Per ha (Rs.)	Total ($Rs.10^3$)	Per ha (Rs.)	Total ($Rs.10^3$)	Per ha (Rs.)
1. Main System	4,000	276	7,600	590	8,700	502	4,600	375
2. On-farm facilities	3,600	242	3,200	249	4,400	254	3,000	245
Total	7,600	518	10,800	839	13,100	756	7,600	620

O&M costs for the main system will have to be paid as water charge while those for on-farm facilities are recovered as labor force.

On the other hand, incremental benefit of a farmer is estimated at Rs.3,500 to Rs.5,760 per ha. Water charges which farmers will have to shoulder are only 15% at maximum, which proves that farmers could pay water charge easily.

3.3 Repayment

Fund requirement for construction of the project is estimated at Rs.3,351 million. Based on the estimated fund requirement, a cash flow statement is prepared under an assumption of the following conditions:

(a) 80% of fund requirement is financed by the international organization with loan service fee of 2.5% per annum and a repayment period of 30 years including a grace period of 10 years.

(b) Remaining local currency is financed by the budget allocation of the Government with no interest and no repayment.

The cash flow statement is shown in Table K.7.

The project brings about a great improvement in farm budget and gives an incentive to the farmers in the project area. The government should subsidize about Rs.1.6 million to Rs.230.5 million including loan repayment, loan service fee and a part of O&M cost annually for the project during the repayment of 30 years.

4. Socio-economic Impact

The following socio-economic impacts are expected through the implementation of the project.

(1) Increase of crop production

The project bring about considerable increase of crop production. As shown in ANNEX E AGRICULTURE, expected incremental production of crops are: 59,000 tons for paddy, 38,000 tons for wheat, 10,200 tons for oilseeds, 19,000 tons for pulses, 39,000 tons for potatoes, etc. Considerable production increase of oilseeds and pulses will induce agro-processing industry which will contribute to the diversification of economic activity.

(2) Alleviation of poverty and improvement of nutritious status

Upon attainment of reliable irrigation water supply and introduction of new farming technology with new cropping patterns, productivity of crops remarkably increases, which leads to improvement of nutritious status of people. Even marginal farmer having six family members with 0.4 ha of cultivable land is able to attain self-sufficiency in cereals in calorie basis. Pulses and oilseed crops are also harvested more, which results in the improvement of nutritious status of family.

(3) Employment opportunity

During the construction stage, about 10.3 million man-days, equivalent to Rs.361.0 million of employment opportunity is generated. Laborers are recruited from adjacent villages. This employment opportunity are sure to stimulate economic activity in rural area. Also are expected employment opportunity for agricultural laborer through production increase.

(4) Women's development

As a part of training programme, women are educated to learn how to read and write. Once get educated, they have another incentive to learn more. They are expected to play a vital role in agriculture production through agricultural extension programme.

(5) Brick making industry

The project requires vast amount of bricks for canal lining, structural material and road pavements. The required amount of bricks are usually produced near the construction sites. Brick factories produce more bricks as required, which generates other employment opportunities.

(6) Environment

Ground water table in Sarojini Nagar and Sataon Areas has been lowered in recent years. Augmentation of canal water is only a possible way to avoid further deterioration of ground water condition.

Inundation of water in Purwa Area has been a very serious concern from the view point not only of agricultural production but also of the environment of human life. Proposed drainage plan improves present agriculture productivity, and early drainage reduces current problem of higher rate of water-born diseases.

5. Project Justification

Internal rate of return (IRR) of the project in respective Representative Areas shows different value ranging from 12.0% for Sursa to 19.2% for Sarojini Nagar. The IRR of overall project shows 15.5%.

The project in the Sarojini Nagar area shows the highest IRR of 19.2% among four Representative Areas. Augmentation of irrigation water supply will increase irrigation area and reduce further deterioration of groundwater level. The project will also contribute to equitable distribution of water through on-farm development and thereby to equitable development which is one of the objectives of State Development Plan.

The project in the Sataon area shows IRR of 13.7%. The project include canal improvement of Asiwan branch canal, whose benefit will be expected to be born from other

areas commanded by the branch when on-farm development works will be carried out. If this cost is allocated proportionally to beneficial command areas, the IRR would further be increased. The same effect as Sarojini Nagar area will be expected with regards to even distribution of canal water and preventing the deterioration of ground water level.

The project in the Sursa area shows the lowest IRR of 12.0%, reflecting relatively better yield level of crops under the present condition. Irrigation water supply by canal will be reduced from present over supply condition to the proposed volume determined by the Roster, which may reduce benefit to the area but contribute to the augmentation of irrigation water volume to downstream area. Drainage improvement will increase Kharif cropping area drastically. Even distribution of water and improvement of nutritious status of farmers are expected from the project.

The project in the Purwa area shows the IRR of 18.4%, following Sarojini Nagar area. Drainage improvement will bring about the increase of cropped area as well as yield increase through the improvement of soil condition. Traffic condition will also be improved, and occurrence of water born diseases will be reduced through the reduction of inundation area and duration.

The IRR of the overall project shows 15.5%. The results of financial analysis reveals the improvement of farm income with repayability of water charge. Considering this IRR and positive socio-economic impacts as mentioned above, in light with the objectives of the State Five-Year Development Plan, all projects can be justified.

TABLES

Table K.1 Derivation of Economic Farmgate Prices in 1995

for Major Crops

ITEM	Unit	Commodity					
		Wheat	Paddy	Maize	Sorghum	Groundnut	Sugarcane
World Market Price 1995 1/	US$	160	263	98	93	371	173
Quality Adjustment	%	100	75	100	100	100	100
World Market Price, Adjusted	US$	160	198	98	93	371	173
Ocean Freight & Insurance 2/	US$					51	0
Domestic Border Price	US$	160	198	98	93	422	173
Exchange Rate	Rs/US$	25.90	25.90	25.90	25.90	25.90	25.90
Domestic Border Price	Rs	4,138	5,116	2,550	2,415	10,938	4,473
Domestic Handling & Transport 3/	Rs	400	400	400	400	400	400
Wholesale Price	Rs	4,538	5,516	2,950	2,815	11,338	4,873
Processing 3/	Rs	0	-169	0	0	-200	-95
Processing Ratio	%	0	67	0	0	40	7
Sales of By-products	Rs		70			3,281	
Transport from Farmgate 3/	Rs	-80	-80	-80	-80	-80	-80
Economic Farmgate Price	Rs	4,458	3,572	2,870	2,735	7,657	414
Financial Farmgate Price	Rs	2,310	1,880	1,880	1,880	5,150	310
Conversion Factor		1.930	1.900	1.526	1.455	1.487	1.337

Remarks: 1/ From "Commodity Price Forecasts --December 1990 (IBRD, Economic Analysis and Projections Department) commodity prices projected for 1995 in current US Dollars have been deflated by the MUV index to obtain price projections in constant prices of 1990:

Wheat: Canadian No.1, Western Red Spring, FOB Thunder Bay
Paddy: Rice: Thai, milled, 5% broken, FOB Bankok
Maize: US No.2, Yellow, FOB Gulf ports;
Sorghum US No.2, Milo Yellow, FOB Gulf ports

2/ With India on the margin of self-sufficiency in foodgrains, it is assumed that, depending on the size of the annual harvests, exports or imports will occur in the short- and medium-term, and international transport costs have therefore been omitted.

3/ Adjusted with Standard Conversion Factor of 0.8

for Fertilizer

ITEM	Unit	Fertilizer			
		UREA	TSP	DAP	KCl
Projected 1995 world market price 1/	US$	111	98	125	62
International shipping/handling charge	US$	42	42	44	39
CIF price at Calcutta	US$	153	140	170	102
Exchange Rate	Rs/US$	25.90	25.90	25.90	25.90
Value equivalent to Rs./ton	Rs	3,969	3,633	4,390	2,630
Domestic transport/handling to wholesale point	Rs	400	400	400	400
Price at Lucknow	Rs	4,369	4,033	4,790	3,030
Transport/handling to farmgate 2/	Rs	80	80	80	80
Farmgate economic price	Rs	4,449	4,113	4,870	3,110
Price per ton of nutrient	Rs	9,671	8,569		5,184
		N	P2O5		K2O

Remarks: 1/ From "Commodity Price Forecasts --December 1990 (IBRD, Economic Analysis and Projections Department) commodity prices projected for 1995 in current US Dollars have been deflated by the MUV index to obtain price projections in constant prices of 1990:

2/ Adjusted with Standard Conversion Factor of 0.8

Table K.2 Economic Benefit per ha under With and Without - Project Conditions

Unit : Rs

Holding Size Classes	Cropping Season	Sarojini Nagar Distribution by Size	Sarojini Nagar Gross Benefit	Sarojini Nagar Production Cost	Sarojini Nagar Net Benefit	Sataon Distribution by Size	Sataon Gross Benefit	Sataon Production Cost	Sataon Net Benefit	Sursa Distribution by Size	Sursa Gross Benefit	Sursa Production Cost	Sursa Net Benefit	Purwa Distribution by Size	Purwa Gross Benefit	Purwa Production Cost	Purwa Net Benefit
With-Project Condition																	
	Kharif		9,962	2,873	7,089		9,962	3,007	6,955		9,565	2,697	6,868		9,908	2,823	7,085
	Rabi		11,047	2,497	8,550		10,394	2,506	7,889		10,019	2,363	7,657		10,394	2,252	8,143
	Perennial										12,420	5,686	6,734				
	Total		21,008	5,369	15,639		20,356	5,513	14,843		19,405	5,075	14,330		20,302	5,074	15,228
Without-Project Condition																	
Marginal	Kharif		6,522	2,544	3,978		6,775	3,738	3,037		6,931	2,530	4,401		7,865	3,023	4,842
	Rabi		7,479	2,015	5,464		8,350	2,613	5,737		9,213	2,542	6,671		7,255	1,914	5,341
	Perennial										10,764	5,251	5,513				
	Total	35.0%	14,001	4,559	9,442	41.0%	15,125	6,351	8,774	29.0%	15,806	5,084	10,722	35.0%	15,120	4,937	10,183
Small	Kharif		7,279	2,766	4,513		6,228	3,599	2,629		7,001	2,246	4,755		8,126	1,651	6,475
	Rabi		9,094	2,141	6,953		8,281	2,268	6,013		9,805	2,325	7,480		7,288	1,829	5,459
	Perennial										10,764	4,965	5,799				
	Total	30.0%	16,373	4,907	11,466	26.0%	14,509	5,867	8,642	26.0%	16,427	4,597	11,830	27.0%	15,414	3,480	11,934
Semi-medium	Kharif		6,150	2,300	3,850		8,839	3,550	5,289		7,457	2,601	4,856		7,423	2,900	4,523
	Rabi		7,989	2,515	5,474		10,064	2,491	7,573		9,613	2,226	7,387		7,001	1,859	5,142
	Perennial										10,764	5,513	5,251				
	Total	23.0%	14,139	4,815	9,324	21.0%	18,903	6,041	12,862	26.0%	16,671	4,870	11,801	23.0%	14,424	4,759	9,665
Medium	Kharif		7,453	2,215	5,238		7,131	3,224	3,907		6,304	1,817	4,487		7,783	2,498	5,285
	Rabi		8,677	2,964	5,713		8,737	2,672	6,065		9,202	2,120	7,082		7,654	1,920	5,734
	Perennial										10,764	5,751	5,013				
	Total	12.0%	16,130	5,179	10,951	12.0%	15,868	5,896	9,972	19.0%	15,212	4,056	11,156	15.0%	15,437	4,418	11,019
Total Weighted	Kharif		6,775	2,515	4,260		7,109	3,601	3,508		6,967	2,339	4,628		7,822	2,546	5,276
	Rabi		8,225	2,282	5,943		8,738	2,505	6,234		9,469	2,323	7,146		7,265	1,879	5,386
	Perennial										10,764	5,340	5,424				
	Total		15,000	4,797	10,203		15,847	6,105	9,742		16,080	4,706	11,373		15,087	4,425	10,662
Incremental																	
	Kharif		3,186	358	2,829		2,853	-594	3,446		2,598	358	2,240		2,086	277	1,809
	Rabi		2,822	215	2,607		1,656	1	1,655		550	40	511		3,129	372	2,757
	Perennial		0	0	0		0	0	0		1,656	346	1,310		0	0	0
	Total		6,009	573	5,436		4,509	-593	5,101		3,325	369	2,956		5,215	649	4,566

Table K.3 Breakdown of the Expected Project Benefit

Area	Cropping Season	Project Area (ha)	With Project Condition				Without Project Condition				Incremental Benefit (Rs.million)
			Cultivated Area (ha)	Gross Income (Rs.million)	Production Cost (Rs.million)	Primary Profit (Rs.million)	Cultivated Area (ha)	Gross Income (Rs.million)	Production Cost (Rs.million)	Primary Profit (Rs.million)	
1 Sarojini Nagar	Kharif	14,862	14,862	148.1	42.7	105.4	9,237	62.6	23.2	39.4	66.0
	Rabi		14,862	164.2	37.1	127.1	9,275	76.3	21.4	54.9	72.1
	Annual			312.2	79.8	232.4		138.9	44.6	94.3	138.2
2 Sataon	Kharif	12,874	12,874	128.2	38.7	89.5	7,274	51.7	26.2	25.5	64.0
	Rabi		12,874	142.2	34.3	107.9	9,006	78.7	22.6	56.1	51.8
	Annual			270.5	73.0	197.4		130.4	48.7	81.7	115.8
3 Sursa	Kharif	17,313	16,880	161.7	45.6	116.1	9,834	68.5	23.0	45.5	70.6
	Rabi		16,880	180.1	40.3	139.8	13,280	125.7	30.9	94.9	44.9
	Perennial		433	5.4	2.5	2.9	960	10.3	5.1	5.2	-2.3
	Annual			347.2	88.3	258.8		204.6	59.0	145.6	113.2
4 Purwa	Kharif	12,252	12,252	121.4	34.6	86.8	6,638	51.9	16.9	35.0	51.8
	Rabi		12,252	135.3	29.5	105.8	6,735	48.9	12.7	36.3	69.5
	Annual			256.7	64.1	192.6		100.9	29.6	71.3	121.3
Total		57,301	57,301	1186.6	305.3	881.3	32,983	574.7	181.9	392.8	488.5

Table K.4 Annual Economic Disbursement Schedule

Unit: Rs.1,000

	Description	Amount	1993	1994	1995	1996	1997	1998
I	Sarojini Nagar Study Area							
	I-1 Direct Construction Cost	320,346	0	11,619	60,303	104,581	85,749	58,094
	I-2 Procurement of Supporting Equipment	1,496	748	748	0	0	0	0
	I-3 Land Acquisition	4,205	0	2,102	2,102	0	0	0
	I-4 Administration Cost	38,568	5,110	6,692	6,692	6,692	6,692	6,692
	I-5 Engineering Service	57,683	10,492	13,387	14,059	11,061	5,065	3,618
	Sub-Total	422,298	16,350	34,548	83,156	122,334	97,506	68,404
	I-6 Physical Contingency	42,230	1,635	3,455	8,316	12,233	9,751	6,840
	Total	464,528	17,985	38,003	91,472	134,567	107,257	75,244
II	Sataon Study Area							
	II-1 Direct Construction Cost	444,197	0	16,542	85,418	138,316	121,210	82,711
	II-2 Procurement of Supporting Equipment	1,296	648	648	0	0	0	0
	II-3 Land Acquisition	5,936	0	2,968	2,968	0	0	0
	II-4 Administration Cost	33,409	4,426	5,797	5,797	5,797	5,797	5,797
	II-5 Engineering Service	49,967	9,089	11,596	12,178	9,582	4,388	3,134
	Sub-Total	534,805	14,163	37,551	106,361	153,694	131,394	91,642
	II-6 Physical Contingency	53,481	1,416	3,755	10,636	15,369	13,139	9,164
	Total	588,286	15,579	41,306	116,997	169,064	144,534	100,806
III	Sursa Study Area							
	III-1 Direct Construction Cost	463,072	0	14,886	86,357	159,343	128,054	74,432
	III-2 Procurement of Supporting Equipment	1,743	871	871	0	0	0	0
	III-3 Land Acquisition	6,862	0	3,431	3,431	0	0	0
	III-4 Administration Cost	44,928	5,952	7,795	7,795	7,795	7,795	7,795
	III-5 Engineering Service	67,196	12,223	15,595	16,378	12,885	5,901	4,215
	Sub-Total	583,801	19,046	42,578	113,961	180,024	141,750	86,442
	I-6 Physical Contingency	58,380	1,905	4,258	11,396	18,002	14,175	8,644
	Total	642,182	20,951	46,836	125,357	198,026	155,925	95,086
IV	Purwa Study Area							
	VI-1 Direct Construction Cost	307,439	0	10,933	58,067	100,438	83,334	54,667
	VI-2 Procurement of Supporting Equipment	1,233	617	617	0	0	0	0
	VI-3 Land Acquisition	2,368	0	1,184	1,184	0	0	0
	VI-4 Administration Cost	31,795	4,212	5,517	5,517	5,517	5,517	5,517
	VI-5 Engineering Service	47,553	8,650	11,036	11,590	9,119	4,176	2,983
	Sub-Total	390,388	13,479	29,286	76,358	115,073	93,026	63,166
	I-6 Physical Contingency	39,039	1,348	2,929	7,636	11,507	9,303	6,317
	Total	429,427	14,827	32,215	83,993	126,580	102,329	69,483
TOTAL PROJECT COST								
A.	Direct Construction Cost	1,535,054	0	53,980	290,145	502,678	418,347	269,904
B.	Procurement of Supporting Equipment	5,768	2,884	2,884	0	0	0	0
C.	Land Acquisition	19,371	0	9,685	9,685	0	0	0
D.	Administration Cost	148,700	19,700	25,800	25,800	25,800	25,800	25,800
E.	Engineering Service	222,400	40,454	51,614	54,205	42,647	19,530	13,950
	Sub-total	1,931,293	63,038	143,964	379,835	571,125	463,677	309,654
F.	Contingency	193,129	6,304	14,397	37,984	57,112	46,368	30,965
	TOTAL	2,124,422	69,342	158,360	417,819	628,237	510,045	340,619