Annexure - 4.1
(Para 4.4)

Statewise/Projectwise irrigated Area, Water Used and O&M Costs under: (A) National Water Management Project (NWMP) and (B) other than NWMP

Explanatory Note to the Annexure - 4.1(A) on Irrigation Water Use and O&M Cost in as Sub-projects included under National Water Management Project (NWMP).

1 The World Bank assisted National Water Management Project (NWMP) aims at higher production in canal irrigated surface system, through predictable, reliable and equitable distribution of water. In the studies carried out for seasonwise water use and operation and maintenance cost in connection with the work of Committee on Pricing of Irrigation water, available data of 85 sub-projects belonging to 8 major states included under N.W.M.P. has been used. These states are Andhra Pradesh (10 sub-projects), Bihar (2 sub-projects,) Karnataka (20 sub-projects), Tamil Nadu (16 sub-projects), Madhya Pradesh (21 sub-projects), Kerala (6 sub-projects), Orissa (8 sub-projects) and Uttar Pradesh (2sub-projects).

2 To work out operational plan of a sub-project, in most of the cases ten year data of rainfall, evaporation, available storage/runoff and actual crop pattern was used to estimate water requirement by Modified Penman Method. In most of the project water releases at the canal head and actual area irrigated were given for about 10 years period of which latest 3 to 5 years were taken for the current study. The corresponding actual data on operation and maintenance cost provided in the project reports have been used, wherever available. To have an idea of the seasonwise irrigation requirement at plant level (potential evapo-transpiration – effective rainfall) the corresponding data of PET and rainfall furnished in the sub-project reports were used. In 2 or 3 projects like Hathua in Bihar, Sharda in U.P. and Mahanadi Stage-I in Orissa, where actual water use figures were not available in the project reports, these were estimated in relation to annual water yield. In a few cases where actual O&M cost were not supplied these were estimated on the basis of available norms. The details are given in Annexure 4.1 (A). For other than NWMP details ire given in Annexure 4.1 (B)

Annexure - 4.1(A)
Abstract

Table - 4.1
(Para 4.7)

N.W.M.P. SUB-PROJECTS
STATBWISE OPERATION AMD MAINTENANCE COSTS (QtN COSTS) PER HECTARE OF IRRIGATED AREA/TH. M^3 OF WATER USED

SI. No.	State	No. of NWMP sub-projects considered	Weighted average O&M cost/ha. in Rs.	Weighted average O&M cost/Th. M^3 of wateruse in Rs.
1	Andhra Pradesh	10	76	8
2	Bihar	2	29	5
3	Karnataka	20	146	12
4	Kerala	6	74	8
5	Madhya Pradesh	21	150	19
6	Orissa	8	91	11
7	Tamil Nadu	6	81	6
8	Uttar Pradesh	2	175	16

Source: Sub-project reports received under National Water Management Project (NWMP) in Ministry of Water Resources, New Delhil. Sea Annexure-4.1 (A) for details.

Figures relate to the period between 1980-92,

Annexure—4-1(A)
(Para 4.7)

Statewise/Projectwise irrigated Area, Water used and 0 & M Costs under National Water Management Project (N.W.M.P)
K =Kharlf (16/6 to 15/10) R= Rabi (16/10 to 15/3). H =Hot Weather (16/3 to 15/6). T=Total

Sl No.	Name of the State/Project	Average area actually irrigated(ha)				Average water actually used (ha. m)				Annual water used per hectare ($1000M^3$)	Annual O&M Cost	
											Total Rupees Lakh	Rupees per100/per hectare
		K	R	H	T	K	R	H	T			
1	2	3	4	5	6	7	8	9	10	11	12	13
A	ANDHRA PRADESN											
1	Rajolibanda	9739	10017	.	19756	13594	9180		22774	11 .55	17.7	7.7/89
2	Thandava	12880	324	-	13204	4600	2700	-	7300	6.00	9.1	I2.0/72
3	K.C. Canal	10251	4835	-	15086	15890	5080	.	20970	14.00	15.7	7.5/103
4	Nytavaran	-	3182	-	3182		5720	-	5720	16.00	15.17	30.0/480
5	Tungabhadra LLC	14935	25712	-	40647	24400	22800	-	47200	11.60	48.1	10.0/114
6	Nizam Sagar	81612	40978	-	122590	58500	33800	-	92300	7.50	46.0	5.0/38
7	Dindi	2555	785	.	3340	4500	1983	.	6283	19.00	8.1	12.9/245
8	Musi	219	4112	-	4331	830	5310	-	6140	14.00	6.68	11.0/154
10	Upper Pannar	371	1228	-	1599	902	2116	-	3018	19.00	1.97	6.5/124
B	BIHAR											
1	Hathua Branch Canal	77600	46233	.	123833	11302	23163	.	61468	5.00	35.4	5.8/29
2	Ouaraon Branch Canal	36435	21797	-	58232	24200	20000	-	44200	8.00	7.0	4.0/12
C	KARNATAKA											
1	Vanivlas aagar	-	11112	-	11112	-	8520	-	8520	7.67	17.6	20.6/15
2	Bhadra	87797	76779	-	164576	101800	100300	-	202100	12.00	243.7	12.1/14
3	Tungabhadra LBC (54^{th} Dy)	3990	6872	4154	15016	5219	9358	2775	17352	11.00	20.8	12.0/13

Sl No.	Name of the State/Project	Average area actually irrigated(ha)				Average water actually used (ha. m)				Annual water used per hectare ($1000M^3$)	Annual O&M Cost	
											Total Rupees Lakh	Rupees per100/per hectare
4	Narconahally	4800		-	4800	4802	-	-	4802	10.00	7.7	16.0/16
5	Chandran Pally	-	3024	-	3024	-	2491	-	2491	8.23	4.8	19.3/15'
6	Dharaa	4760		-	4760	2732	-	-	2732	5.74	7.6	27.8/16
7	Tungabhadra RBNLC	14935	-	-	14935	9275	-	-	9275	6.20	24.0	25.8/16
8	Kanva	796	1293	-	2089	400	1300	-	1700	8.00	3.1	18.0/14
9	Naldala	603	-	-	603	538	-	.	538	8.90	0.4	8.0/71
10	Naragal	550	-	-	550	526	-	-	526	9.60	0.5	10.0/96 '
11	Mavanhally	140	1253	-	1393	100	990	-	1090	7.40	2.7	26.0/19
12	Araahankar	793	378	-	1171		310	-	600	5.10	1.2	20.0/10
13	Wagaribonanhally	1824	1978	-	3802	1900	2600	-	4500	11.80	3.6	8.0/94
14	Tungabadhra RBLLC(Begewady Dy)_	4204	3985	"	8189			.	7874	9.6	13.1	16.6/15
15	Kanaka Nala	164	948	57	1169	135	380	150	665	5.7	2.6	39.9/22
16	Tunga Anicut	9042	2708		11750	24430	18210		42640	36.3	19.2	4.5/16
17	Gondi Canals	4269	2819	-	7088	7200	6800	-	14000	20.0	4.9	3.5/70
18	Shanti Sagar Canala	1928	1689	- -	3617	2182	2445		4627	13.0	4.0	8.7/113
19	Anjana Pura taaarvoir	6153		-	6153	8260	-	-	8260	13.0	7.4	9.0/111
20	Ahbaligola	2602	-	-	2602	4470	-	-	4470	17.0	4.1	9.0/153
D	KERALA											
1	Neyyar	5000	8228		13228	8000	11600		19600	15.0	30.6	15.0/225
2	Nalapuzha	20553	20553		41106	6000	28800		34800	9.0	13.3	4.0/36
3	Pothundy	4685	4685		9370	1550	3120		4070	5.0	5.0	11.0/55
4	Nangalam	2986	2986	-	5972	326	252		578	2.0	2.1	35.0/70
5	Vazhani	•	3650	•	3650		2520		2520	7.0	2.7	11.0/77
6	Pecchi	"	12050	"	12050	•	14930	•	14930	12.0	9.9	7.0/84

Sl No.	Name of the State/Project	Average area actually irrigated(ha)				Average water actually used (ha. m)				Annual water used per hectare ($1000M^3$)	Annual O&M Cost	
											Total Rupees Lakh	Rupees per100/per hectare
E	MADHYA PRADESH											
1	Chandrakechar	991	1364	-	2355	700	1600		2300	10.0	8.3	36.0/360
2	Bila	278	7206	•	7484	600	3200	-	3800	5.0	6.0	15.0/75
3	Barna	-	32535		32535	.	29059		29059	8.9	42.0	14.5/129
4	C h i I I a r		3002	-	3002	-	1400		1400	5.0	8.3	56.0/280
5	Samarat Ashok Sagar(Halali)	•	21671	"	21671	•	14925	4	14925	6.9	16.0	10.7/74
6	Moruan	-	1546	-	1546		1000	.	1000	6. 0	1.3	13.0/78
7	Kethan	17	2205	-	2222	100	700		800	4. 0	1.5	19.0/76
8	Gagan	459	137	-	596	900	300	-	1200	20.0	0.4	3.0/60
9	Sukta	184	3425	-	3609	76	600	-	676	2.0	9.5	134.0/265
10	Saroda	6049	-	-	6049	400	-	-	400	0.7	3.6	90.0/63
11	Kunda	145	270	2	417	100	200	-	300	7.0	0.9	30.0/210
12	Ratapani	10	1372	-	1382	-	1000	-	1000	7.0	0.9	8.7/61
13	Sakalda	358	760	20	1138	133	658	22	813	7.0	1.0	12.0/84
14	Segwal	265	304	28	561	200	500	2	702	13.0	1.0	14.0/182
15	Sonkhadi	-	631	-	631	-	355	-	355	5.5	3.0	86.0/473
16	Kharung	41462	1788	-	43200	13200	1900	-	15100	3.0	68.0	17.0/51
17	Gangutpara	7526	156	•	1682	700	200	-	900	5.0	2.1	23.0/115
18	Aoda	-	6680	-	6680	-	2600	-	2600	4.0	4.5	17.0/68
19	Mota	-	1808	-	1808	-	1400	-	1400	8.0	2.0	14.0/112
20	Paronch	134	765	-	899	60	700	-	760	8.5	1.3	13.2/112
21	Tawa	6847	145333	•	152180		•	•	149997	9.8	256.0	17.1/168
F	OR1SSA											
1	Hahanadi Delta Stage-1	169660	84428	-	254088		-	*	163400		209.0	13.0/83
2	Mahanadi Delta Stage-II	81241	24722	-	105963		-	-	127061		179.0	14.0/168

Sl No.	Name of the State/Project	Average area actually irrigated(ha)				Average water actually used (ha. m)				Annual water used per hectare ($1000M^3$)	Annual O&M Cost	
											Total Rupees Lakh	Rupees per100/per hectare
3	Salandi	73635	15851	.	89486	•	-	.	70376	7.9	65.8	9.4/74
4	Rushibulya	61282	1986	-	63268		-	-	31496	5.0	79.9	25.0/125
5	Oerjang	5951	2864	-	8815		-	-	3701	4.2	8.2	22.2/93
6	Salia	8443	3546	-	11989	-	•	-	4700	3.9	11.8	25.0/98
7	Dhanei	3830	1420	-	5250	2200	450	-	2650	5.0	11.3	42.0/210
8	Hirakud	157568	110995	.	268563	.	.	.	268108	9.9	173.0	4.5/64
G	TAMIL NADU											
1	Sathanur		9110		9110		17150		17150	18.8	16.8	9.8/184
2	Kodayar	20404	23803	-	44207	19100	32500	-	51600	11.7	27.9	5.4//63
3	Thambaraparani	21729	34847		56576	28300	30000	-	58300	10.3	48.1	8.3/85
4	Cumbum Valley	5865	6044		11909	5000	3700	-	8700	7.0		
5	Amaravathy	1883	2678		4561	12200	16300	-	28500	62.5	2.0	0.7/44
6	Marudhanadi	.	976	.	976	.	1331	.	1331	13.6	-	
7	Sethiathope	13196	4156	-	17352	6145	6145	-	12290	7.0	4.7	4.0/28
8	Patar Anicut	.	15820	.	15820	.	16610		16610	10.0		-
9	Patar PorandalarRes. System	843	4514	_	5359	825	3900		4725	9.0		
10	Parambikular Aliyar Project	10338	2575	-	12913	14756	5407		20160	15.6		
11	Tilavukkal		2418	-	2418		1715		1715	7. 1		
12	Krishnagiri	740	3861	-	4601	786	6717		7503	16.0	10.6	14.0/224
13	Tholudur System	-	10865	-	10865	-	6430	-	6430	6.0		
14	Thirukoilur Anicut	-	102695	-	10269	-	8350	-	8350	8.0		
15	Gadana Ramanadi System	4209	5356	-	9565	4850	5350	-	10200	11.0		
16	Manjalar		1609		1609		2320		2320	14.0		
H	UTTAR PRADESH											
1	Sharda Canal system	314000	301000	-	615000	258500	479500	-	738000	12.0	1155.0	16.0/192

Sl No.	Name of the State/Project	Average area actually irrigated(ha)				Average water actually used (ha. m)				Annual water used per hectare ($1000M^3$)	Annual O&M Cost	
											Total Rupees Lakh	Rupees per100/per hectare
2	Lower Ganga Canal System	147000	177000	-	324000	-	-	-	-	-	492.0	

SOURCE .

Detailed Reports/Summary Reports i.n respect of sub-projects under National Water Management Project received from various state Govts. in . Uater Management cell, Ministry of Water Resources, Govt. of India, New Delhi.

Note :

1. The figures of average irrigated area average water use have been arrived at by taking the average of last 3-5 years at date as available in a period from 1980-1992.

2. O&M cost for Bihar works out low because only a part of distribution system is covered. 0&M cost of head works and main canals not included.

3. There are some discrepancies in 0&M cost/ha in respect of some projects in a state, which nay be due to-incorrect reporting/size of the project/age of the project.

Annexure - 4.1(B)
Abstract

Table – 4.2
(Para 4.7)

MAJOR & MEDIUM PROJECTS (OTHER THAN NWMP)

STATEWISE OPERATION AMD MAINTENANCE (O&M) COSTS PER HECTARE OF IRRIGATED AREA/TH. M^3 0F WATER USED

SI. No.	State _	No. of projets other than NWMP sub-projects	Weighted average O&M cost/ ha. in Rs.	Weighted average O&M cost/Th. M^3 of water use in Rs.	Remarks
1	Andhra Pradesh	5 .	164*	13*	
2	Haryana	2	146	27	
3	Karnataka	1	160	17	
4	Maharashtra	9	226	24	
5	Orissa	4	113	14	
6	Rajasthan	13	72	10	
7	Uttar Pradesh	14	189 .	23	
8	West Bengal	3	241	48	

Source:

Data received from the State Governments for Pricing Committee in response to letter from the planning commission, 1992

* The O&M cost of projects in Andhra Pradesh in the above abstract works out much higher than O&M cost of projects included under NWMP.Under NWMP only completed projects are included, whereas in the above list Nagarjunasagar & Sriram Sagar Projects are included, where distribution system are still incomplete. Partly irrigated area have to bear the full cost of head works as well as completed main canal system.

Annexure- 4.1 B
(Para 4.7)

STATEWISE/PROJECTWISE IRRIGATED AREA WATER USE AND O&M COSTS OF MAJOR & MEDIUM PROJECTS • OTHER THAN NWMP

K = Kharif (16/6 to 15/10), R = Rabi (16/10 to 15/3), N = Net Weather (16/3 to 15/4). T = Total

Sl. No.	Name of the State/Project	Average area actually Irrigated in last 3 to 5 year ending 1991-92				Average water actually used in last 3 to 5 years ending 1991-92				Annual water use per ha. (1000 N^5)	Annual O & M Cost	
											Total, Rupees Lakhs	Rupees par 1000N^5/par ha.
		K	R	N	T	K	R	N	T			
1	2	3	4	5	6	7	8	9	10	11	12	13
A	AHDHRA PRADESH											
1	Tungabhadra HLC	64142	32879		97021	58245	29123		87368	9.0	230.0	26.4/238
2.	Nagarjuna Sagar	325433	452089		777522	590368	429520	-	1019888	13.2	1020.0	10.0/132
3	Lakanapur	161	868		1029	215	617	-	832	8.3	3.0	36.1/300
4.	Shriram Sagar	77344	70797		148141	136814	114045	-	250859	16.9	450.0	18.0/304
5.	Vamasdhara	44201			44201			-	22278	5.1	50.0	22.7/116
B	HARYANA											
1.	Western Yamuna Canal System	353400	483800		837200	294976	191546		486522	5.8	1901.0	39 .1/227
2.	Bhakhra System	515000	615400		1130400	304000	264000		568000	5.0	976.0	17.2/86
C	KARNATAKA											
1.	Ghataprabha	66253	54751		121004			-	113200	9.3	193.0	17.0/158
D	MAHARASTRA											

Sl. No.	Name of the State/Project	Average area actually Irrigated in last 3 to 5 year ending 1991-92				Average water actually used in last 3 to 5 years ending 1991-92				Annual water use per ha. (1000 N^5)	Annual O & M Cost	
											Total, Rupees Lakhs	Rupees par $1000N^5$/par ha.
1 .	Bagh	22730	-	3610	26340				18267	6.9	43.8	24.0/166
2.	Asolimiendha	9420		187	9607				4300	4.5	15.9	37.0/167
3.	Darana Gangpur	15707	14060	•	29767				35100	11.8	106.8	30.4/359
4.	Nazare	350	1667	157	2174				1050	4.8	4.2	40.0/192
5.	Manar	140	4317	2137	6694				12133	18.1		
6.	Bhojpur	523	930	-	1453				967	6.7	5.5	56.4/378
7.	Katapurna	80	1967	690	2737				4000	14.6	11.1	27.6/406
8.	Subkhana	-	567		567				333	5.9	4.7	140.0/826
9	Nirguna	507	1040	133	1689				2700	16.0	6.9	25.4/406
10	Radha Naghri	16330	2850	100	19280				21467	11.1	13.2	6.2/69
E	ORISSA										'	
1	Salki	19890	865		20755				22381	10.8	27.6	12.4/134
2	Daha	4689	607		5296				5037	9.5	7.6	15.0/143
3	Pitamahal	2574	403		2977				2011	6.7	3.6	17.7/119
4	Gohira	8951	3816		12767				3433	2.7	8.7	25.5/69
F	RAJASTHAN											
1	Alnia	27	6094		6121				3379	5.5	14.9	44.1/243
2	Chambal	34662	202105	-	236767	28506	126691		155197	6.6	277.4	17.9/118
3	Gudha Dam	1423	7289		8712				9363	10.7	16.6	17.7/189

Sl. No.	Name of the State/Project	Average area actually Irrigated in last 3 to 5 year ending 1991-92				Average water actually used in last 3 to 5 years ending 1991-92				Annual water use per ha. (1000 N^5)	Annual O & M Cost	
											Total, Rupees Lakhs	Rupees par $1000N^5$/par ha.
4	Jakham	158	12384	-	12542	-	-		13232	10.6	11.0	8.3/88
5	Badgapn		1761	-	1761	-			741	4.2	5.5	74.3/312
6	Orai	-	4278	-	4278				3280	7.7	7.3	22.2/171
7	Basi Irrigation Project	41	2103	-	2144	42	1996		2038	9.5	8.1	39.7/377
8	Somkagdar Irrigation Project	634	1561	-	2195	663	2782	-	3445	23.4	44.4	42.0/983
9	Morel	49	9834	-	9883	-	-	-	3401	3.2	27.8	49.0/157
10	Indira Gandhi Nahar Project	205183	256670		461853		-	-	403352	8.8	225.8	6.0/53
11	Bhakhra Irrigation System	152587	192250	-	344837	108719	79510	-	188229	5.5	215.8	12.0/66
12	Gang Canal	124467	193073		317540	105096	81813	_	186909	5.9	145.4	8.0/47
13	Jawai Project	.	20869	.	20869		8521	-	8521	4.3	28.9	49.6/21S
G	UTTAR PRADESH											
1	Narainpur Pump Canal	33886	22334		56220				34443	6. 1	105.5	30.6/187
2	Gandak Canal	78229	98243		176542	80017	79473	.	150490	8.5	331 .0	22.0/187
3	Zanania Pump Canal	20320	19739		40059	-	- - -	.	14595	3.6	75.1	51.4/185
4	Belan Canal	28895	28179		57074	-	.	-	33615	5.9	107.0	31.8/188
5	Sarda Sahayak	369999	459633		829632	437800	448000	-	885800	10.7	1555.0	17.5/187
6	Chandra Prabha Canal System	-	•		17518	-	-	-	6533	3.7	32.2	49.3/182
7	Bhopauli Pump Canal	-	-		23270	-	-	-	14 108	6.1	43.2	30.6/187
8	Yamuna Pump Canal	8276	9918		18194	4788	4521	-	9309	5.1	31.1	33.4/170

Sl. No.	Name of the State/Project	Average area actually Irrigated in last 3 to 5 year ending 1991-92				Average water actually used in last 3 to 5 years ending 1991-92				Annual water use per ha. (1000 N^5)	Annual O & M Cost	
											Total, Rupees Lakhs	Rupees par 1000N^5/par ha.
9	Ghaghar canal System	50067	8433		58500	25122	2166	-	27288	4.7	117.7	43.3/204
10	Tones Pump Canal	9890	10573		20463	6096	3775	-	9871	4.8	26.8	27.1/13C
11	Batwa Canal System	7027	168640		175667		-	-	82460	4.7	354.1	42.9/202
12	Govind Sagar Jamni Bund	-	35067		35067		9112	-	91 12	2.6	82.1	90.2/235
13	Ranipur Canal System		10667		10667		1273	-	1273	1.2	19.3	152.0/182
14	Dhasan Canal System	-	37333		37333	.	8826	.	8826	2.4	68.2	77.2/18$
N	WEST BENGAL											
1	Midnapor Canal Project	31189		8466	39655	7145	.	4644	1 1789	3.0	66.5	56.4/169
?	Kangsabati Res Project	273375	18509	14208	306092	-	-	-	131077	4.3	-	
3	Nayurakshi Res. Project	219914	6102	18832	2 244848	66826	5214	14319	86359	3.5	533.0	61 .7/216
4	Damodar Valley Barrage	31 1088	17265	38856	367209	165162	10799	51834	227795	6.2	970.0	42.6/264

ANNEXURE - 4.2

(Para 4.13 & 4.14)

Broad details of items of different cateqories of maintenance for irrigation projects.

1 An irrigation project, whether big or small, consists of some or all of the following components:

i) A storage work which may be a dam, built in earth masonry or concrete.

ii) Canal (s) taking off from the head regulator(s) located in the body of the dam or from downstream diversion weirs, and extending over a length decided by topographic factors and also by availability of water in the storage/diversion work. Canal (s) has/have to cross natural drainage and communications lines, for which C.D. works in masonry and/or concrete are provided. There are other structures such as standing wave flumes (SWF) for measurement of discharges and cross regulators and escapes for regulating flow of water.

iii) Branches, distributaries and minors and sub-minors taking off from the upstream canal (s) and running up to a natural drainage, usually the same river from which water has been captured for storage. At the . off-take of each such channel a gated or ungated control is provided. Further more many structures such as bridges, falls, outlets etc. are provided in the channels.

iv) Field channels taking off from distributary, minor and sub minor and extending to the last farm gate of the field proposed to be irrigated from the system.

v) A communication system like telegraph, or telephone or radio-telephone provided for facilitating quick communication of messages for system management.

vi) Colonies with residential and non-residential buildings provided to house the various Govt. functionaries operating the irrigation system and their offices.

1.2 It is to be noted here that except the field channels (item iv) all the components are constructed by the Govt. at Government cost, in land belonging to the Government. While practices vary from state to state, their construction is carried out either by the Government or the farmers and their maintenance cost is ultimately to be j borne by the farmers.

2 Preventive Maintenance

2.1 The earthen embankment, whether provided for a dam or a canal may not, perhaps, need much preventive maintenance. While electrical and electro-mechanical equipment installed for sluice gates, radial gates etc., would need preventive maintenance in the form of painting, lubrication of moving parts etc.

3 Operative Maintenance

3.1 Earthwork gets damaged because of erosion due to action of natural force like rain, cyclone, wind etc. and also by human actions. Embankment develops cracks. Rats and crabs make holes in the embankment. Animals coming for drinking water also cause damages. The earthwork also suffers from settlement, deshaping etc. Stone pitching provided on the slopes and banks gets disturbed.

3.2 All such damages have to be repaired and the work has to be restored to the original shape as designed. Leaks are developed on downstream slopes of water retaining embankments. They have to be attended to by treating the leakage locally and also locating the source of leakage and plugging it. Cement pointing provided at the joints in the stone masonry gets damaged due to leaching of cement and other processes of aging. They have to be provided with fresh pointing periodically. Water collected in the drainage galleries has to be pumped out continuously. Instruments provided in the dam body to monitor behaviour have to be read periodically and readings analysed by experts.

3.3 Damages take place due to erosive action of water flowing over spillways. They have to be periodically inspected after every monsoon and repaired where necessary. Sometimes, erosion takes place in the spillway channel and retrogression sets in. This has to be arrested by providing remedial measures, so as to prevent progress of the retrogression up to the main body of the dam.

3.4 Canals get silted up because of some unfavourable hydraulic conditions. Silt has to be removed to restore the carrying capacity of the canals. Behaviour of the chemnel has to be analysed from hydraulic considerations and attempts have to - be made to remove the main causes inducing such silting.

3.5 Weeds need to be checked and removed both from and within the canal section, and from outside borrow pits. Growth of shrubs within the section and on the outside slopes also needs to be checked and removed.

3.6 Rubber seals, and stem rods of gates, suffer damages due to wear and tear. Stems rods get bent while rubber seals crack or get raptured. These have to be replaced so as to prevent further damages.

3.7 The residential and non-residential housing complex for the operating staff also needs annual M&R. Similarly, the communication equipment, whether it is canal telegraph, telegram or radio telegram has its own drill of maintenance.

4 Special Repairs

4.1 Snapping of a regulator gate, or washing out of an embankment due to piping fault/failure or due to extraordinary high rains, earthquakes, land-slides etc. and remedial work of drainage, grouting and blanket.

4.2 For example a totally new gate may have to be installed in place of a damaged gate, or a totally new C.D. work may be constructed in place of one which is washed out. The spillway capacity may need to be augmented.

Annexure 4.3
(Para 4.17)

Norns for O&M adopted in respect of irrigation Projects in Uttar Pradesh

The question of working expenses to be provided in the projects framed from time to time has been examined and it has been decided that the per acre basis which is in use at present should be replaced by a method in which working expenses for various components of the projects are determined separately.

1. Head Works:

The following table may be used for calculating the working expenses of the Head Works. (Figures as % of construction cost of work)

Present day cost of works	Storage reservoirs on rock foundation	Weirs & Barrages in boulder reach	Weirs and Barrages in Plains	Other Head-Works
1	2	3	4	5
Above Rs. 1000 lacs	0.14	0.40	0.20	0.12
Rs.500 lacs to 1000 lacs	0.17	0.45	0.25	0.15
Rs.200 lacs to 500 lacs	0.19	0.50	0.30	0.20
Rs. 50 lacs to 200 lacs	0.25	0.60	0.40	0.25
Rs. 10 lacs to 50 lacs	0.28	0.65	0.45	0.28
Below Rs. 10 lacs	0.35	0.75	0.50	0.35

Marginal adjustment should be made in the charges so that the works with higher cost should not have less provision than those with lower cost.

The amount as given above may be increased by 20% to account for Superientending Engineer and Chief Engineer reserve and special repairs.

For establishment charges a provision of Rs.250/- per mile of channels (allowing only one mile for 3 miles of drains shall be adopted

Rs. 10/- per acre of proposed annual Irrigation should be adopted for special Revenue Establishement and 4% of the gross revenue from water rates for collection charges.

* *Extracts of letter No.2381/1.D. dated June 1964 of Chief Engineer, Irrigation Department, U.P.*

SI. No.	Name of buildings	Present cost of construction	Amount of annual repairs	Remarks
1	2	3	4	*5*
1	Office building, Residential buildings Hospitals shops, out house etc.		1% of capital crop	
2	Power house, Water Tower, Township etc.		1.5% of capital crop	

O-Miscellaneous

Provision has been made for the following items of work under this head.

i. Maintenance of grounds and gardens,

ii. Workcharge establishment

iii. Maintenance of Power House

iv. Maintenance of Water Works

v. Sanitation

vi. Protection of forests

vii. Demarcation of boundry

viii. Survey of river

ix. Jungle clearance

x. Antimalaria measures

xi. Railway crossings

xii. Any other works found necessary depending on work to work.

2. New Headworks

Similarly for these works, complete details of items, quantities and rates have been worked out with due consideration to local river conditions and compared to provisions on old works. The overall cost of maintenance of each head works has been kept within a certain percentage of its capital cost;, the percentage decreasing with the magnitude and capital cost of the work and varying within a small margin on the basis of local conditions of the work.

3. Pumped Canal

Complete details of items and rates have been worked out by the Superienteding Engineers for each individual work. Provisions against various sub-heads have been made for such items as –

C-Works

(i) Repairs to pump house

(ii) Repairs to intake channels

(iii) Repairs to masonary works in intake channels

(iv) Repairs to arched aqua-duct

(v) Any other training works

K-Buildings. Same as for Head works given before

Q- Equipment

(i) Maintenance of pumps and motors

O- Miscellaneous

(i) Workcharge establishment

(ii) Maintenance of Grounds and any other items found necessary.

II. MAIN CANALS & BRANCHES

The rates for various sub-heads are analysed below :-

D- Regulators. :- Similarity between falls and regulators taken into account to analyse the cost of annual Repairs of Regulators. The analysis of rates was worked out in details for Falls under various discharge categories of Main Canals & Branches & extra cost provided as the regulators have regulation arrangements which require repairs, painting and part renewal and replacement yearly.

The following table gives the rates provided for each Regulator in various categories of Main canals & Branches:

PROVISIONS	Above 5000	Cusees	Between -5000	2000 Cuscees	Between 2000	500-cusecs
	Ganga canal and old systern in west earn area & Bundelkhand area.	Sarda canal and works in eastern area	Ganga canal new & old systems in western area	Sarda canal & new works in eastern area & Bundelkhand	Ganga canal & old system in western area	Sarda canal & oth new Works in eastern area
Amount of maintenance of falls	320.00	265.00	240.00	200.00	180.00	150.00

as per analysis						
20% Extra on account of Regulation arrangements.	64.00	53.00	48.00	40.00	36.00	30.00
Total :	384.00	318.00	288.00	240.00	216.00	180.00
Say Rs.	385.00	320.00	290.00	240.00	215.00	180.00

E. Falls- Analysis for maintenance of falls on various categoreis of Main canals and Branches.

SI	Item of work	Average rate	Above 5000 cusces		Between 2000-5000 cuscecs		Below 2000 cusecs	
			Qty .	Amount	Qty .	Amount	Qty	Amount
1.	Brick work in repair to fall crest & retaining walls etc.	12/-% Cft.	5 cft	6.00	3 Cft	4.00	2 Cft	2.0
2.	Plaster & Pointing	12/-% sft	200 sft	24.00	150 sft	30.00	125 sft	15.00
3.	Repair to pitching and grouting etc	10/-% sft	400 Sft	40.00	300 sft	30.00	200 sft	20.00
4.	Relaying pitching in tauls	35/-% Cft	500 Cft	175.00	375 Cft	133.00	300 cft	105.00
5.	Miscellanous repairs to gauge and dumping of boulders in scour holes etc.	L.S		20.00	.	16.00		8.00
	For sarda sysem & works in Eastern Area.	Total		Rs. 265/-		Rs. 200/-		Rs.150/-
	In Ganga canal and old systems in Western areas which are much older and hence require greater maintenance 20% extra has been provided. These are also applicable to Bundelkhand area due to bad soil conditions	Extra total Rs.20%		53/-		40/-		30/-
		Total		318		240		180
		Say		320		240		180

F. River and hill torrent works: The details of items quantities and rates for repairs of these works have been worked out separately for each work and provided in the normal estimates.

F. Other X - Drainage Works

Analysis of rates for Annual Repairs of other X – Drainage Works such as drainage syphones and inlets on various categories of Main canal and Branches are as follows :-

SI No.	Item of work	Rate and Unit	Above 5000 cusecs		Between 2000-5000		Between 500-2000 cusecs	
			Qty.	Amt.	Qty.	Amount	Qty.	Amount
1.	Brick work in repairs to piers, wings, parapets etc.	120% cft	10 cft	12.00	7 Cft	8.00	5 Cft	6.00
2.	Plaster & pointing	12/-% Sft	150 Sft	18.00	100 Sft	12.00	75 Sft.	9.00
3.	Earth work	13/-% cft	2000 cft	26.00	1500Cft	20.00	1000	13.00
4 .	Relaying pitching	35/-% cft	200 cft	70. 00	175 cft	60.00	150 Cft	53. 00
5 .	Repairs to pitching	10/ % Sft	400 sft	40.00	300 sft	30.00	200 sft	20.00
6.	Clearance	L. s		25.00		20.00		15.00
For sarda canal and works in Eastern area		Total say		191.00 190/-		150.00 150/-		115.00 115/-
Ganga Canal and old add systems in western area		20% total say		38/- 228.00 225.00		30/- 80.00 80.OOl		28/- 138.00 140.00
For works in Budnelkhand area lesser rates as compared to Sarda system have been provided as the works of this type are of smaller magnitude in these regions		total	R s. 180.00		R S.140.O0		Rs.100.00	

Bridges:

Analysis of rate for annual repairs of Bridges on various categories of Main Canal & Branches.

(i) For Sarda Canal System and works in Eastern area								
SI	Item of work	Rate and Unit	Above 5000 Cusecs		Between 2000-5000 cusec		Between 500-2000 cuse c	
			Qty.	Amount	Qty.	Amount	Qty.	Amount
1	Brick work in repairs to parapets and floor etc	120/-% cft .	20 cft	24. 00	15 cft	18.00	5 Cft	6. 00
2.	Corner repair	(2.1 1/2 1each)	4 Nos	8.00	4 Nos.	6.0	4 NOS	4 . 00
3.	Plaster or pointing	12/-% sft	400 sft	48.00	300 sft	36.0	200 sft	24.00
4.	Repair to pitching and	10/- % sft	400 sft	40. 00	300 sft	30.0	175 sft	18.00

	greating etc.							
5.	Repairs to Kankar metalling in roadway	40/ -% Cft	170 cft	68.00	100 cft	40.0	70 cft	28.00
6.	Earth work on ramps	13/-%Cft	4000	52.00	3000	39.0	2500	32.50
7.	Site clearance etc	L S		5.00		5.0		3.00
Total				245.00		174.00		115.00
			Say	245.00		175.00	say	115.00

(ii) For Ganga Canal & old works in Western Area

Sl.	Item of work	Rate & Unit	Discharge above 5000 Cusecs		Between 2000-5000 Cusecs		Between 500 2000 cusecs	
			Qty	Amount	Qty	Amount	Qty	Amount
1	2	3	4	5	6	7	8	9
1	Brick work in repairs to wings, floor etc	120 per 100 cft	30 cft	36 .O0	20 cft	24.00	15 cft	18.00
2.	Corner Repairs	(Rs 2/- 1 1/2 and 1/-each.)	4 NOS	800	4 NOS	6. 00	4 Nos	4. 00
3.	Plaster or Pointing	12/ - % sft .	600 sft	72.00	500 sft	60.00	350 sft	42.00
4.	Repairs to pitching and grounting etc.	10/ -% sf t	500 sft	50.00	350 sft	35.00	200 sft	20.00
5.	Repairs to Kanker Detailing on roadway	40/ - % *c*ft	170 cft	68.00	125 cft	50.00	70 Cft	28.00
6 .	Earthwork on ramps	13/ - 1000 cft	4000 cft	52.00	3000 cft	39.00	2500 cft	33.00
7.	Site clearance	L. S		10.00		10.00		5.00
	Total			296.00		224.00		150.00
		Say		295.00		225.00		150.00
(iii)	For works in Bundelkhend Area							
1	Brickworks in repairing to wings floor etc.	120/ -% cft	30 cft	36.00 cft	20 cft	24.00	15 cft	18.00
2.	Corner Repairs	Rs.2/- 1 1/2 & Rs.1/ each	4 NOS	8.00	4 Nos	6.00	4 Nos	4.00
3.	Plaster or Pointing	12/ -% sft .	500 sft	60.00	450 sft	54.00	300 sft	36.00

Sl.	Item of work	Rate & Unit	Discharge above 5000 Cusecs		Between 2000-5000 Cusecs		Between 500 2000 cusecs	
			Qty	Amount	Qty	Amount	Qty	Amount
1	2	3	4	5	6	7	8	9
4.	Repairs to pitching	10/ -% sft	400 sft	40.00	300 sft	30.00	150 sft	15.00
5.	Repairs to Kankar metalling on roadway	40/ -% cft	170 cf t	68.00	125 cft	50.00	70 cft	28.00
6.	Earthwork on ramps	13/- 1000cft	4000 Cft	52.00	3000 cft	39.00	2500 Cft	33.00
7.	Site clearance			10.00		10.00		5. 00
	Total			274.00		213.00		39.00
		Say (Rs.)		275.00		215.00		40.00
8.	Escapes:	Analysis of rate for Annual repairs to Escapes/mile including masonry works for discharges above and below 2000 cusces.						

Sl. No.	Item of works	Rate & Unitt	Above 2000 cusecs		Below 2000 cusecs	
			Qty	Amount	Qty	Amount
1.	Earthwork in clearing the theks in escape bed and cutting terms etc including dressing	14/- 1000 cft	20,000 cft	280.00	15,000 cft	210.00
2.	Dressing &repairs to service Road	3/-ft. mile	12 ft mile	36.00	12 ft mile	36.00
3.	Jungle Clearance	Rs. 15/- to 20 per mile	1 mile	20.00	1 mile	15.00
4.	Nasonary work average one work in 2 miles			116.00		90.00
	Total			450.00		351.00
		Say Rs.		450.00	Say Rs.	350.00

J. Mills:

(2) Mills on Ganga canal and old System in western areas

Sl. No	Item of Works	Rate & Unit	Quantity	Amount	Remark
1.	Earthwork in Apron etc.	13/- 1000 cft	2000 cft	26.00	
2.	Brickworks in repair to walls and roof parapets etc	120/- %	25 cft	30.00	
3.	Plaster or pointing	12 % ft.	200 sft	24.00	
4.	White wsahing	1/-% sft	3000 sft	30.00	
5.	Brickworks in Repairs to masonry channels	120 % cft	30 cft	60.00	
6.	Plaster and pointing in mill chanels	12% sft	200 sft	24.00	
7.	Earthwork in repairs of bank etc of mill channels	13 % cft	100 cft	13.00	
8.	Repair and replacement of sluice arrangements	30/-each	2 Nos	60.00	
9.	Repairs to floors.	40/-% sft	100 /- sft.	40.00	
10.	Painting gates and repairs to regulators for mill channel	1 Nos.	70/- each	70.00	
	Total	Say Rs.		377.00 375.00	only

Sl.No.	Items of work	Rate & Unit	Quantity	Amount	Remark
MILLS IN TARAI / AND BHABAR AREA					
1.	Earthwork in Apron etc.	13/- % cft	500 cft	7.00	
2.	Brickwork in repair to walls and roof parapets etc.	120/- % cft	5 cft	6.00	
3.	Plaster or pointing	12/-%sft	50 sft.	6.00	
4.	White washing	1/-%sft	1000 sft	10.00	
5.	A.R. to Mill channel	1 No	30.00 each	30.00	
6.	Repairs to floors	40/-% sft	25 sft.	10.00	
7.	Renewal and replacement of sluice arrangement	15/-per No.	1 No	15.00	
8.	Repairs to regulator for mill channel	15/- each	1 No	15.00	
	Total		Rs.	99.00	
		say Rs.		100/-	

K- BUILDING: Same basis as per head works

L- EARTHWORK: Analysis of rates for annual repair to 11 M.C. & Branches under sub-head L-Earthwork

(iv) Sarda Canal and New Works in Eastern Area

Sl. No	Items of work	Unit & rate	Discharge above 5000 cusecs		between 2000-5000 cusesus		between 500-2000 cusecs	
			Qty	Amount	QTY	Amount	QTY	Amount
1.	Earthwork with / dressing in repairs to service road and banks	13/-1000 cft. etc.	25000 cft	325.00	20000 cft	260.00	15000 cft	195
2.	Scrapping leveling & dressing service road	3/-per	25 ft.m	75.00	24 ftm	72.00	22 ft.m	66/-
3.	Jungle clearance	Rs.20 to 30.00 per mile	1 mile	30.00	1 mile	25.00	1 mile	20/-
4.	Dressing and aligning daula	10/- miles	1 mile	10.00	1 mile	10.00	1 mile	10/-
5.	Lopping of branches and other small items	10/-	1 mile	10.00	1 mile	10.00	1 mile	10/-
			Say Rs.	448.00 450.00	say	377.00 375.00	say	301/- Rs.300/-

Higher Rates as below have been provided for old system constructed in last century and Sarda Main Canal

Discharge Category (Above 5000 Cusecs)

Sl. No.	Items of work	Rate & Unit	Ganga QTY	Canal Amount	QTY	Amt	Aty	Amt
1.	Earthwork in repair to banks and service raod with dressing	13/- 1000cft	35000 cft	455.00	30000 cft	390.00	50000	900.00
2.	Scrapping leveling & dressing service road	3/-ft, mile	25 ft miles	75.00	25ft miles	75.00		100.00
3.	Jungle clearance	Rs. 20 to 30 per mile	1 mile	30.00	1 mile	25.00		
4.	Dressing and aligning daula etc.	Rs. 10 to 25 per mile	1 mile	20.00	1 mile	10.00	1 mile	25.00
	Total			600.00		505.00		1,500.00

DISCHARGE CATEGORY II (BETWEEN 200-5000 CUSECS)

Sl. No	Items of work	Rate &Unit	Ganga Agra Cannal& canal		EasternYamuna canal	
			Qty	Amount	Qty	Amount
1.	Earthwork in repair to banks and service road with dressing	13/- 1000cft	22000cft	286.00	30,000	390.00
2.	Scrappig levelling & dressing service road	3/-ft, mile	25 mile	75.00	25 mile	75.00
3.	Jungle clearance	Rs.20 to 30per mile	1 mile	20.00	1 mile	25.00
4.	Dressing and aligning daula etc.	10 to 30 per mile	1 mile	10.00	1 mile	10.00
5.	Lopping off branches and other petty items	L.S.		10.00		5.00
		say		401.00 400.00		505.00 500.00

DISCHARGE CATEGORY III (BETWEEN 500-2000 CD8EC8)
EASTBR1I YAMUNA CANAL

QUANTITY AMOUNT

1	Earthwork in repairs to banks and service rood	I3/-1000Cft	22,000sCft	286.00
2.	Scrappig levelling & dressing service road	3/- ft,mile	25 ftmile	75.00
3.	Jungle clearance	Rs. 20 to 30 mile	1 mile	20.00
4.	Lopping Off branches and other petty items	L.S.		10.00
			Total	400.00
			say	400.00

M. Plantation:-

SI. No.	Item of work	Rate & Unit	Qty	Amt	Remark
1.	Replacement and planting new one (cost of plants including carriage.)	11/2 each	20 trees per mile	30.00	
2.	Preparing Thanwaleas	21/ 4/ -each	20 Nos.	45.00	
3.	Plantation Bolder 1 for 5 miles.	50/- mile	1/5 No.	10.00	
4.	Watering arrangements	15/- mile	1 mile	15.00	
			Rs.100/-per mile		

GARDENS

SI. No.	Item of Work	Rate & Unit	Quantity	Amount	Remark
1.	Replacing plants and planting new ones.	1 1/2 -each	10	15.00	
2.	Repairing thanwalas	2 l/4/-each	10 Nos.	22.50	
3.	Making Kiaries etc.	l/-each	10 NOS.	10.00	
4.	Removing Jungles and Shrubs.	5/-Acre	1 Acre	5.00	
				52.50	
			say Rs.	50/-per per	acre

O-MISCELLANEOUS

A rate of Rs. 25/- per mile for work in Western and Bundelkhand area and Rs. 20/- mile for Sarda Canal and works in Eastern area has been provided. This item includes painting mile and furlong stones, correcting boundary stones, painting gauges and correcting and repairing outlets and other small misc. Items.

		Ganga Canal & old work in western area including Bundeikhand		Sarda Canal and new works in Eastern areas	
Item of work	Rate	Qty	Amount	Qty	Amount
Painting mile and furlong stones	3.00 mile	1 mile	3.00	1 mile	3.00
Paintaing gauges	8/ rft	Average 6' per mile	3.00 stones	6 ft/mile	3.00
Correcting boundary stones	4/- each	Average 4/- per mile	1.00	4 stones per mile	1.00
Correcting and repairing outlets	L.S	1 mile	15.00	L.S.	10.00
Other small items	L.S.		3.00	L.S.	3.00
		Total	Rs. 25.00		Rs.20.00

III Distributeries and Minors

K - Building :- As provided for I-Headworks

L – Earthwork :-Analysis of rates for L- Earthwork(Annual Repairs) for various categories for Distributarious and minors.

(2) Sarda Canal and works in Eastern Area

Sl. No.	Item of work	Rate Unit	200-500 Cusecs		20-500 Cusecs		Below 20 cusecs	
			Qty	Amount	Qty	Amount	Qty	Amount
1.	Earthwork with dressing including silt clearance	12/- 1000 cft	20000 cft	240.00	15000 cft	180.00	12000 cft	144.00
2.	Jungle clearance	Rs. 10 to 20 per mile	1 mile	20.00	1 mile	15.00	1 mile	10.00

3.	Scrapping and dressing &leveling ,service road and riding basnk	3/-ft mile	12 ft mile	36.00	12 mile	36.00	5ft mile	15.00
4.	Bern scrapping	3 ft mile	6ft mile	18.00	4 ftM	12.00	3 ft M	
5.	Nasonary works	Rs 3 to 25 per work	Average one work per mile	25.00	1 work	20.00	1 work	15.00
6.	Miscellaneous	L.S.		10.00		10.00		10.00
Total		Say Rs.		349.00		273.00		203.00
Sarda Canal & New works in Eastern Area				350.00/ mile		270.00 /mile		200.00 /mile

Higher Rates as analysis below have been provided on old systems.

For Discharge Range Between 200-500 Cusecs

Sl. No	Item of Work	Rate & Unit	Eastern Yamuna Canal		Ganga Canal & Agra Canal System		Lower Ganga Canal System	
			Qty	Amount	Qty	Amount	Qty	Amount
1.	Earthwork with dressing including slit clearance	12/-1000	30000	360.00	23000 cft.	276.00	22000 cft.	264.00
2.	Jungle clearance	Rs. 10 to 120/- mile	1 mile	20.00	1 mile	20.00	1 mile	20.00
3.	Scrapping, levelling & dressing service mile roads & widening bank-	Rs.3/ ft. mile	ft	36.00	12'mile	36.00	12 'M	36.00
4.	Berm scrapping	Rs. 3/- ft. mile	6 mile	18.00	6 mile	18.00	6' mile	18.00

5.	Masonary works	(Average work per mile) Rs. 25 to 60/- perwork	1 No	60.00	1 No.	40.00	1 No.	5.
6.	Miscellaneous	L.S.		10.00		10.00		10.00
	Total			504.00		400.00		373.00
			Say Rs.	500.00	Say Rs.	400.00	Say Rs.	375.00

III FOR DISCHARGE RANGE BETWEEN 20-2000 CUSECS

SL. No.	ITEMS OF WORK	RATE UNIT	SASTERN CANAL YAMUNA SYSTEM		GANGA CANAL AND AGRA CANAL		LOWER GANGA CANAL SYSTEMS	
			QTY	AMOUNT	QTY	AMOUNT	QTY	AMOUNT
1.	Earthwork with dressing including site clearance	12/- Th cft	21000 cft	252.00	16500 cft	198.00	15500 cft	186.00
2.	Jungle clearance	Rs.10/- To 20 mile	1 mile	15.00	1 miles	15.00	1 mile	15.00
3.	Scrapping, leveling & dressing service road.	3/-ft mile	12' mile	36.00	12' Mile	36.00	12' Mile	36.00
4.	Berm scrapping	3/-ft.M	4' M	12.00	4'Mile	12.00	4"M	12.00
5.	Masonry works	Rs. 20 to 1 No. 50 per work	1 No.	50.00	1 No.	30.00	1 No.	24.00
6.	Miscellaneous	L.S.		10.00		10.00	QTY	10.00
		Total	Say Rs.	375.00		301.00 300.00	15500 cft	283.00 280.00

IV FOR DISCHARGE RANGE BELOW 20 CUSECS

SL. NO	ITEM OF WORK	RATE UNIT	EASTERN YAMUNA CANAL SYSTEM		GANGA CANAL AND AGRA CANAL		LOWER GANGA CANAL SYSTEMS	
			QTY	AMOUNT	QTY	AMOUNT	QTY	AMOUNT
1.	Earthwork with dressing including site	12/- 1000 cft	16500 cft	198.00	13000 cft	156.00	13000 cft	156.00

	clearance							
2.	Jungle clearance	10/-M	1 mile	10.00	1 mile	10.00	1 mile	10.00
3.	Scrapping, levelling & dressing service road.	3/- ft mile	5' Av. mile	15.00	5' M	15.00	5' M	15.00
4.	Berm scrapping	3/- ft.m	3'M	9.00	3'M	9.00	3' M	9.00
5.	Masonry works	Rs. 20 to 40 per work	1 No.	40.00	1 No.	25.00	1 No.	20.00
6.	Miscellaneous	L.S.		10.00		10.00		10.00
		Total		282.00		225.00		220.00
		say	Rs.	280.00		225.00		220.00

For HILL Channels

SL. No.	Item of work	Rates & Unit	20-200	CUSES	BELOW 20	CUSECS
1.	Repair to Masonry works to Head regulator.	50 to 100/-	1.No.	80.00	1 No.	50.00
2.	Repair to regulator plants of rivers and streams.	25 to 50/- each	1 No.	35.00	1 No.	25.00
3.	Painting mile stones and gauges.	Rs.10/- mile	1 mile	10.00	1 Mile	10.00
4.	Repair to outlets	Rs. 10/-each	Rs. 10/- each	20.00	2 nos	20.00
5.	Clearance of Minor slips	Rs.20/- Th Cft.	11,000 cft.	220.00	8000 cft	160.00
6.	Clearance of channels	L.S.		7.00		7.00
7.	Seasonal regulation	48/-P.M.	1 No. for 4 months for 1 1/2	128.00	1 No. for 44 months for 1 1/2 miles	128.00
	Total :-		Rs.	500.00		400.00

				mile		per mile

H-Escapes for III Distributeries

SL. NO.	ITEMS OF WORK	QUALITY	RATES	AMOUNT
1.	Earthwork in escape clearance with dressing and cutting berm etc.	12,000	12/-1000 cft	144.00
2.	Dressing & repairing service road	Rs. 3/-ft. mile	1 mile	15.00
3.	Jungle clearance	Rs. 15/-mile	1 mile	15.00
4.	Masonary work repairs	Rs. 50/- work mile	1 mile	15.00
			TOTAL	Rs.199.00
			say Rs. 200/- per mile	

V DRAINS

Analysis of rate for annual repairs to one mile length of drains

Sl. No.	Items of Work	Rate & Unit	Quantity	Amount	Remarks
1.	Earthwork in drains clearance partially dressed.	11/-1000 cft.	8,000 cft.	88.00	This amount is just sufficient to keep the drains in ordinary working condition.
2.	Removing theks & obstructions	16.00 per mile	1 mile	16.00 have to be increased	Provision will substantially if the public demand for comp lete clearance of all drains each year is met
3.	Repair to Masonry works	15.00	1 No.	15.00	
			Total	119.00	
			Say Rs.	120/-	

Annexure - 4.4
(Para 4.17)

JAYAKWADI- MODEL ON OPERATION AND MAINTENANCE COST REQUIRED FOR IRRIGATION PROJECTS (Maharashtra)

1 Irrigation projects constructed are the real assets of the state. For sustained return from heavy investments made in these projects, their proper maintenance is necessary. Class of maintenance of these schemes is dependent on the funds made available and the efficiency desired of the system in operation. As in the case of machines, adequate maintenance at the right time would prolong the life of the Irrigation system by preventing their early deterioration.

2 With the increasing investments on Irrigation projects at a rapid rate larger share for their operation & maintenance is evidently called for. With increasing sophistication in the schemes being taken up, cost of maintenance in also on the higher side because of timely and higher standards of maintenance required e.g. Head works with large radial gates, c.c. lined canals etc. For better control over systems, operation leading to safety and better efficiency, use of more sophisticated methods is also necessary e.g. wireless communication system. This has also necessitated higher allocation of funds towards operation and maintenance. Again as we now have to tackle technically more complex problems in project construction, may be concerning dam fundations on different soil conditions in case of canals, it is but to be expected that our initial investments as also the yearly maintenance costs are going to be higher.

3 Hence in consideration of the above various factors and in view of the escalation in costs with the passage of time periodic review of financial provisions to be made towards O&M of Irrigation projects is warranted. Government of Maharashtra has been conducting studies regarding O&M costs for Irrigation Projects. Based on these studies norms for O&M have been fixed from time to time in respect of Major, medium and minor projects. In the year 1985 such norms fixed for World Bank assisted projects was Rr.87/Ha. of potential creation (exclusive of establishment)

4 Government of Maharashtra has conducted study regarding O&M cost on various major projects like Jayakwadi, Mula etc. and on medium projects like Kharbhanda, Mahasangvi etc. Based on these studies and further considering the recommendation made by the Central Committee set-up by the Ministry of Water Resources of Government of India for studying and recommending on the financial requirements for proper maintenance and management of irrigation projects, the revised norms for O&M are being finalised.

As for example the O&M cost study made in respect of Jayakwadi project is presented herewith.

Note on requirement for operation and maintenance for Jayakwadi project

The actual expenditure incurred on 0&M for last one decade *on* Jayakwadi project is as follows:

Year	C.C.A. (Ha)	I.C.A. (Ha)	M&R expenditure in Rs. lakhs	Rate for works portion in Rs./ha. I.C. A.	Remarks
1	2	3	4	5	6
1981-82	90,350	69,500	33.67	48	
1982-83	90,350	69,500	38.56	55	
1983-84	1,03,909	79,930	44.50	56	
1984-85	1,26,009	96,930	80.20	83	
1985-86	2,16,580	1,66,600	93/36	56	
1986-87	2,16,580	1,66,600	94.93	57	
1987-88	2,16,580	1,66,600	152.27	91	
1988-89	2,17,880	1,67,600	174.18	104	
1989-90	2,20,480	1,69,600	211.39	125	
1990-91	2,27,552	1,83,000	253.60	138	

The grants for works portion has been observed to one inadequate as a number of items of maintenance and repairs have to be deferred for want of funds and only critical items are attended to.

2.0 The soil classification of Jayakwadi command is as under:

Shallow soils 15.98%

Medium soils 30.35%

Deep soils 53.67%

Total : 100.00%

Thus, it will be seen that the command consists predominantly of deep soils, most of which are black cotton soils, derived from disintegration of basalt of Deccan trap origin having montmordinite minerals. These minerals impart property of shrinkage and swelling with changes in moisture content. This peculier property presents difficulties in maintenance and repairs of earth, work, lining and structures in this area. Experience has shown that the grants provided so far are inadequate for proper maintenance of the system. The subsequent paras give it their realistic requirements of funds for proper maintenance of the system. The

present grants are observed to be inadequate probably due to the fact that In addition to the canal system passing through black cotton soils, it has also been lined with P.C.C. slabs of thin insitu concrete.

3.0 The maintenance of the Jayakwadi project system like many other Major Irrigation systems comprises of following major components.

(A) Maintenance to Main Canal and branches

i. Repairs to side lining

ii. Repairs to bad lining

iii. Service Road

iv. Grass and shrubs removal on banks .

v. Silt removal in canals

vi. Maintenance to structures

vii. Debris removal in deep cuts

viii. Repairs of slips

(B) Maintenance of distributories and Minors,

i. Earth work and shrubs removal including clearance of Tyffa (Pankanis)

ii. Service Roads

iii. Repairs to structures

iv. Silt removal

v. Maintenance of water courses upto first Division box.

(C) Maintenance of Colonies and Inspection Bunglows

(D) Maintenance of Telephone and Wireless Communication

(E) Maintenance of Head works

Paithan Left Bank Canal having a command area (I.C.A.) of 1,41,000 hectares has been considered for computation of realistic requirements of proper maintenance of Irrigation system including colonies and other ancilliary works. The requirements for proper maintenance of head works is attributable to both paithan Left Bank Canals right bank canals having an irrigable area of 1,83,000 hectares. Paithan Left Bank Canal is 208 kms. long having bedwidth of 15.80 M. in head reaches and F.S.D. of 4.10 M. The total length of branch canals is 105 kms. Thus the total length of Main canal and Branch is 313 kms.

4.0 Maintenance of Main Canal and Branches

4.1 Repairs to side lining

It appears that normally life of cement concrete lining will not exceed 50 years if the specifications as prescribed in C.B.I.P's Manual on canal lining are rigidly adhered to However, even assuming life as 100 years with very good maintenance, at least 1% Lining will have to be replaced every year. In addition to this the slabs get disturbed and have to be reset. In addition, pointing will have to be redone every year for about 3% of the area. It nay be mentioned that the world Bank Experts have mentioned a life of only 20 years for such lining.

The cost of repairs to side lining per km. works out as under :

i) Replacement = 1%

$$\frac{1}{100} \times 1000 \times 2.24 \times (4.25 + 2.90) - 160.16 \ M^2$$

@ Rs. 44.35 per M^2 = Rs. 7103.10

ii) Pointing 5%

= 3160.16 = 480.48 M^2

@ Rs. 6.95/M^2 = Rs.3,339.35

Total cost per km. = Rs.10,442.45

Cost for 313 kms. = Rs.32,68,487/-

4.2 Repairs to Bed lining

Since the life is assumed to be 100 years for computation, 1% bed lining will have to be replaced every year.

Quantity per km. = $1000 \times \left(\frac{10}{2} + 3.90 \times \frac{1}{10} \right) = 69.5 M^2$

Cost @ Rs.51.70 per M^2 = Rs.3,593.15/km.

Cost for 313 kms. = Rs. 11,24,655/-

4.3 Service Road

It is assumed that 7.5 cms of Murum/Sand will have to be spread only on the service road as present service road is mostly in black cotton soils.

Quantity per km. is = 1000 x 0.075 x 5 = 375 M^3

Cost @ Rs.30.95 M^3 = 11,606.25/km

Cost for 313 kms. Rs.36,32,756/-

4.4 Shrubs removal

It is presumed that every year shrubs removal will be necessary on 25% of service road and 50% in Inspection path side.

i) Service Road $1000 \times \left(\frac{5.00}{4} \right) = 1250 M^2$

ii) I. P. Side $1000 \times \left(\frac{2.50}{2} \right) = 1250 M^2$

iii) Outside slope of banking about 30% length of main canal is in banking with average height of 5 m.

Quantity = 2 x 2.24 x 5 x 0.30 x 100 $= \frac{6720 M^2}{9220 M^2}$

Total quantity:

Assuming 30% length to be cleared every year the cost @ Rs.1.45/M^2 is

0.3 X 9920 X 1.45 = Rs.4,010.70/ km

Cost for 313 kms = Rs.12,55,349/-

4.6 Silt removal in canal

A depth of 30 cms of silt is assumed in 30% length of canal, as the canal is lined. The quantity per km is:

1000 x 0.3 x 10 X 0.30 = 900 M^3

The cost @ Rs. 8.30/M^3 = 7,470/km

Cost for 313 kms = 23,38,110/-

4.6 Maintenace of structures

There are 778 structures on Paithan Left Bank Canal and its branches. The break up is as under -

1	Cross Regulators and Escapes	43 Nos
2	Aquaducts	29 Nos
3	Other structures such as VRBs	617 Nos
4	Head Regulator	89 Nos
	Total	778 Nos

There are 129 gates of 50 M2 each for cross regulator. These gates will have to be painted every year. At the rate of Rs.31.55 per M^2 , the cost of painting is Rs. 1,577. 50 per gate. For average of 3 gates, per cross regulator, the the cost is Rs. 4,732.50 per cross regulator. In addition, the wireropes and rubber seals are to be replaced periodically and greasing is to be attended to.In addition the structure also will need some maintenance which may cost Rs. 2,500/-. Thus a cost of about Rs. 7,232.50 per cross regulator seems to be reasonable .

For aquaducts, in addition to maintenance of structure costing Rs.3,000/- the railing will have to be replaced wherever necessary and painted and wearing coat is to be applied, Greasing to bearings is to be attended to. A lumpsum amount of Rs.3,000/- per structure per aquaduct is proposed. For other structures, Rs.2,500/- per structure per annum is provided. The total amount required for maintenance of structures on Painthan Left Bank Canal and its branches will be as under :

1. C.R. & Escapes 43 X 7232.50	= Rs.3,10,997.50
2. Aquaducts 29 x 5500	= Rs.1,59,500.00
3. Other structures 706 x 2500	= Rs.17,65,000.00
Total	= Rs.22,35,497.50

4.7 Debris removal in deep cuts

About 10% of the length of canals is in cutting. It is observed that in every rainy season the debris from the spoil banks gets deposited in the canal. This is more serious in case of black cotton soils. The silt depositedn is to the extent of about 0.3 M.

Quantity = 0.10 x 313 x 1000-x 10 x 0.3 = 93,900 M^3

Cost = 9.00/M^3 - 93,900 x 9.00 = Rs. 8,45,100/-

4.8 Repairs to slips

It is observed that on an average one slip occurs for every five kms. of main canal and the cost of repairs to each slip is about Rs. 30,OOO/- including cost of toe wall, earth work and lining

Cost = $= \frac{208}{5}$ x 30,000 = Rs. 12,48,000/-

4.9 The cost of maintenance of main canal including branch canals works out as under for an irrigable area of 1,41,000 ha.

SI. No.	Item details	Total cost of 313 kms	Cost per ha. (I.C.A.) in Rs.
i)	Repairs to side lining	Rs.32,68,487	Rs.23.18
ii)	Repairs to bed lining	Rs.11,24, 656	Rs.7.97
iii)	Service Road	Rs.36,32,756	Rs.25.76
iv)	Shrubs removal	Rs.12,55,349	Rs.8.90
v)	Silt removal	Rs.23,38,110	Rs.16.58
vi)	Structures	Rs.22,35,497	Rs.15.85
vii)	Debris removal in cuts	Rs.8,43,100	Rs.5.09
Viii	Slips in earth works	Rs.12,48,000	Rs.8.85
		Total	Rs.113.05

5.0 Maintenance of Distributories/Minors

The total lenght of distributories and minors is 1611 kms, and the area covered is 1,41,000 ha. The cost of all items are worked out on this basis at current R.S.R.

5.1 Earth work and shrubs renoval including removal of Tyffa(Pankenis) .

Most of the minors run in black cotton soil and have low velcoties, the growth of Pankenis (Tyffa) is observed in about 20% length. The cost of removal is :-

1611 X 1000 X 0.2 X 1 M = 3,22,200 M^2

Cost @ Rs.1.45 per M^2 = Rs.4,67,190/-

Maintenance of earth work

Normally a labour can restor one Km. in about 15 days including repairs to breaches. Thus the cost per Km. works out to Rs. 375 per Km.

Cost = 1611 X 375 = Rs.6,04,125/-

Total cost = Rs.10,71,315/-

5.2 Service road (Maintenance)

Presently service road is provided only on l/3rd length murum of 7.5cms. is proposed

to be paid for maintenance. Quantity = 1611 x 1000 x l/3rd x. 075 x 3.75 = 1,51,031M^3

Cost = Rs.30.85 per M^3 Rs.46,74,409/-

5.3 The structures on distributories/minors are drops, outlets, V.R.Bs culverts etc. Assuming replacement of gates every 10 years the cost is Rs.10/- per ha. In addition, repairs to the V.R.Bs. falls etc. are to be provided for. The total cost can be assumed as Rs.15.00 per ha.

5.4 Silt removal

The minors mostly run in black cotton soil and the shape gets deteriorated very often. It is assumed that the silt will be deposited about 15 cms. In depth.

Quantity = 1611 x 1000 x 1.0 x .15 = 2,41,650 M^3

Cost = Rs.8.30 per M^3 = Rs.20,05,695/-

5.5 Maintenance of water courses upto 1st Division Box

As per the recent Government decision, water courses upto first Division Box are to be maintained by Government. The length of water courses is 1,41,000 meters and the cost works out to Rs. 7,05,000 at a rate of Rs. 5.00/- per meter.

5.6 The cost of maintenance of distributories/minor per ha. therefore works out as under :

Total Cost			Coat/ha
a)	Earth work, shrubs and Pankanis removal	Rs.10,71,315	Rs.7.60
b)	Service Road	Rs.45,74,409	Rs.33.05
c)	Structures	-	Rs.15.00
d)	Silt removal	Rs.20,05, 695	Rs.14.20
e)	Water courses	Rs.7,05,000	Rs.5.00
		Total	Rs.74.95

6.0 Colonies and Inspection Bunglovs

Presently, there are 49, Sectional Colonies with 23 buildings each. There are 10 Sub-Divisions with 19 buildings each and two Divisions with 40 buildings. Thus there are about 1391 buildings, costing about Rs. 391.78 lakhs. The maintenance cost of these buildings at 3% as per B & C. Department norms is Rs.11.75 lakhs, or Rs . 8.35/ha. In addition, to this, the cost of maintenance of eight inspection bunglows has to be considered. At each inspection bunglows, a Chowkidar, Khansara, Sweeper and Gardener has to be maintained.

Provision has also to be made for cooking arrangements and maintenance etc. A reasonable estimate of Rs.2.00 lakhs per Inspection Bunglow per year is made. The cost is, therefore, Rs.16,00,000 i.e. 11.35/ha for inspection Bunglows.

M & R to buildings	Rs.8.35 / ha
M & R to Inspection Bunglows	Rs.11.35 / ha
Total	Rs.19.70 / ha

7.0 Maintenance of Telephone & Wireless Communications. The actual rental cost of existing telephone lines is Rs.2,00,000/- per year. The salaries of Operators at six locations is about Rs.1,00,000/- per year. The cost per ha. therefore, works out to Rs.2.10/- per ha. Wireless communication has been recently provided for the entire command area. Wireless maintenance cost approximately works out to Rs.6/- per ha. Salary and wages of the Operators is Rs.21.55 , ha. The total cost, therefore, computed as follows :

Rental charges + Operator's Salary.	= Rs.2.10
Maintenance of Wireless	= Rs.6.00
Salary of Wireless Operators	= Rs.21.55
Total	= Rs.29.65 / ha

8.0 Maintenance of Head works

The maintenance of Dam is observed to be Rs. 20.10 / ha. and is considered to be reasonable. The details are shown in Annexure No. 1.

9.0 No provision is made for constructing and maintenance of catch water drains, Nalla Diversions, Plantation etc. The same is proposed to be got done by economising on other items. Presently, a lot of C.R.'T. and protected labour is working on Jayakwadi Project. It is felt that labour component of above mentioned work will be got done through them and hence no separate provision is made for the same.

10.0 CONCLUSION

The total requirement of maintenance and repairs, works out as under:

		Cost per ha. (ICA)	Cost per ha (CCA)
a)	M&R to Canals/branches.	Rs.113.05	Rs.86.95
b)	M&R to uistributories/minors	Rs.74.95	Rs.57.65
c)	Colonies and Inspection Bunglows.	Rs.19.70	Rs.15.15

d)	Telephone/Wireless Communication.	Rs.29.65	Rs.22.80
e)	Head works	Rs.20.10	Rs.15.45
	Total :	Rs.257.45	Rs.198.00
	Or say :	Rs. 260/-ha.	Rs.200/-ha.

NOTE : The above mentioned provision do not include following compenents :

1. Maintenance of completed drainage schemes. Rs. 3,000/- per km.)
2. Maintenance & clearance of natural nallas in the command area. (Rs. 25 /- ha.)
3. Special repairs (20% of M& R Grants.)

ANNEXURE – I

MAINTENANCE OF DAM & HEAD WORK

I)	EARTHEN DAM	TOTAL COST
	Following items are required to be attended every year.	(Rs. in lakhs)
1)	Maintenance of the wall including pitching, repairs to pitching out fall drains.	15.00
2)	Repairs and protective measures to U/S Bank.	
3)	Power consumption.	
4)	Repairs to parapet wall.	
5)	Manufacturing and replacing of guard stone.	
6)	Labour for watch and ward and vigilance during monsoon.	
7)	Maintenance of T&P and D/s road	
8)	Filling rain cuts on slope of earthen dam.	
9)	Replace to rips surface, drain, vertical drains.	
10)	Removing weeds bushes from the drains.	
II)	MASONRY DAM	
1)	Oil painting (on both sides) of redial and HR and stop log gates with anti corrosive paint.	
2)	Repairs to gates, replacing rubber seal etc.	
3)	Repairs and maintenance of goliat crane, V.T. Pump in sump well, generator.	10.00
4)	Maintenance of foundation gallery	
5)	Inspection of spill way bucket	
6)	Maintenance of instrumentation.	

7) Energy charges including maintenance of transformer.

Total : 15.00 + 10.00 = Rs.25.00 lakhs

Salary of staff = Rs.12.00 lakhs

Total= Rs.37.00 lakhs

Maintenance cost per hectare:

$$= \frac{37,00,000}{1,84,000} = \text{Rs.}20.10$$

ANNEXURE - II

MAINTENANCE OF IRRIGATION COLONIES & REST BOUSE MAINTENANCE INVOLVES FOLLOWING ITEMS

1 Maintenance of residential and non-residential buildings including internal roads.

2 Water supply and sanitary including repairing of ponds.1

3 Energy charges

4 Maintenance of Rest House.

5 Watch and ward of colony.

6 Miscellaneous purchase of materials.

Total Rs.10.00 lakhs

$$\text{Cost per hectares} = \frac{10,00,000}{46,400} = \text{Rs.}21.50$$

ANNEXURE – 4.5
(Para 4.17)

Extracts from the report of the N-G shah Committee (1985) Shoving Financial Norms as a percentage of the cost of various components of O&M as adopted by the committee for Irrigation Project.

5.13 It is needless to emphasise that the assets created by the Govt. should be adequately and timely maintained and repaired. In absence of adequate maintenance, the created facilities would become inefficient and their utility would gradually diminish. Efficient functional services (e.g. proper distribution of water under irri. projects) from such schemes cannot be provided. If the farmers are not supplied timely water, their confidence in irrigation systems would be shaken. Considering the issue in totality, improper repairs and maintenance would result in heavy losses. The M&R norms for irrigation schemes are adhoc and on hectarage basis.

In addition to M&R proper, the adhoc provision also includes expenditure on work-charged establishment. This also includes a portion of expenditure on divisional and sub-divisional temporary establishment. Out of the total funds provided, thus after incurring expenditure on establishment, the balance, amount is far too inadequate for actual maintenance and repairs. The Department of Administrative Reforms and Training (of the state) submitted a report to the Government in which the norms of irrigation sub-divisions after study of workload, and expenditure in temporary establishment were recommended. After accepting the recommendations, Govt. has fixed norms for staffing of a sub-division vide Govt. Resolution No. EST-1177-5-G dt.15.1.1980 (Appendix-VlII). According to. these norms, after adding a proportion of expenditure on the division, the establishment expenditure component of a sub-division with the existing pay structure comes to Rs.37 per hectare. The details are presented in statements 5.5 & 5.6. With upward revision of pay scales, , as the establishment expenditure would go on increasing, less and less money would be available for adequate maintenance. The Study Group, therefore, recommends that separate norms need to be established for M&R as well as establishment components instead of the existing systems of providing Lump sum grants on all inclusive basis. The establishment norms have been discussed in details in para 5.17.

5.14 The maintenance requirement of an earthen dam is different compared to a concrete or masonary dam for which this requirement is less. Similar approach applies to provisions needed for maintenance of lined and unlined canals. The repairs to canal roads also depend on the type of surface. The requirement of funds for upkeep of the colonies and other buildings constructed for maintenance staff of canals also would be different. The requirements of maintenance will also be different in case of canals

run for only one season and for those run for all the three season. In the present adhoc norms on hectares basis, none of the aspects like type of dam, whether the canals are lined or unlined, whether these are seasonal or perennial etc. are taken into consideration. Thus this system of fixing provisions for M&R is not rational and reasonable. Towards utilisation of irrigation potential already created it would greatly help if adequate provisions are made for M&R of irrigation schemes. It is, thus, essential that earmarking adequate provision for M&R is considered as an important element towards utilisation of irrigation potential.

5.15 The following aspects have also been taken into consideration in deciding the provisions needed for M&R of irrigation schemes.

1 A Committee appointed in 1982 by the Central Water Commission has recommended the following norms for the year 1982-83 in respect of flood control measures and drainage works.

a. For flood control embankments

For three years after completion of construction at Rs. 12000-17000 per km. (nearly 3% of total cost), and for succeeding years at Rs. 9000-12000 per km. (nearly 2% of total cost) . Lower appropriate rate may be considered for bunds upto 3 mts. in height. Suitable increase may be allowed in the above rates either at 10% per annum with reference to rates of 1982-83 or the actual increases in the rates.

b. For river training & bank protection works

At 5% of the cost of construction for first three years after completion, and at 3% thereafter.

2 In the Staff Appraisal Report for Gujarat Medium Irrigation Projects-II, May 1934, the World Bank has made the following suggestions for fixing M&R cost per hectares.

Type of works %age of coat of construction per year

Major civil works 0.5 to 1.0

Small pakka works & lined canals 1.5 to 2.0

Unlined canals 3.0 to 4.0

3 The following norms are suggested by the earst while Government of Bombay in its Circular NO. WST-1959-L/2, dated 28.12.1959.

SI No	Details	Annual repair cost as %age of total cost
1	Earthen bunds	0.75
2	Masonry aquaducts	0.50
3	Earthen water courses	0.75
4	Masonry works for water distribution systems like intakes, outlets etc.	0.50
5	Masonry dams	0.50
6	a) Buildings (permanent)	1.00
	b) Buildings (temporary)	2.50
7	Approach roads for. inspection	3.50
8	Telephone lines	5.00

5.16 Considering the above, M&R provision at 2% for earthen dams, canals, flood control embankments and similar works is considered reasonable. In case of masonry and concrete dams, cross drainage works on canals and lined works where the requirement of maintenance and repairs would be comparatively low, M&R provision at 1% should be adequate. The Buildings and Roads Department had fixed norms for M&R of roads- on kilometre basis depending on the types and surfaces of roads. Taking into consideration these norms, M&R provisions for roads on canals and those in canal command areas may also be decided. The R&B Department has also fixed norms for the buildings at 5% and 7.5% of their costs. If M&R grants on this scale are provided, they would be reasonable. Thus for M&R, the following norms are recommended .

Type of works	%age of total cost
Masonry dam, cross-drainage works & lining works	0.5
Earthen dams & unlined canals etc.	1.0
Approach roads & roads on canals	As per GR of 20.11.1979 of R&B Deptt
Buildings	As per GR of R&B Deptt. dtd. 5.11.1982.

Estimates of M&R cost per hectare based on the recommendations given above, has been worked out by considering the componentwise estimated costs in respect of Karjan and Sukhi Projects to serve as illustrations, and the likely costs are detailed in Table 5.1 below:

Table - 5.1

(Rs. in lakhs)

SI. No.	Details	Sukhi Projects		Karjan Project	
		Capital cost	M&R cost as per recommendation	Capital cost	M&R cost as per recommendation
	Type of works				
1	a. Masonry dam, lining work & canal structures	2222	11.1	8723	43.6
	b. Unlined canals & earthen dam	2210	22.1	1267	12.7
	c. Roads WBM surface (in Kms)	41.6	2.4	65 kms	3.65
	Katcha	29.0	0.3	60 kms	0.90
	d. Residential	250	12.5	465	23.25
2	Total M&R cost		48.40		84.10
3	Irrigation potential in hectares	20660			56000
4	Cost per hectare (in Rs.)	234			150

In case of Sukhi Project the type of main dam being earthen, the M&R expenditure is more than that for Karjan Project which has a concrete dam. The total M&R cost of both schemes being Rs.132.5 lakhs and the combined irrigation potential being 76,660 hectares, the average M&R expenditure comes to Rs.173 per hectare.

5.17 The extension wing of Agriculture Department performs (amongst others) the task of providing guidance to the farmers in respect of use of good seeds, use of pesticides, communicating results of researches and the measures the farmers should adopt for increasing agricultural production etc. In the command areas of projects, in addition to extension staff of Agriculture Department, the staff of Irri. Deptt. is also available for management of irrigation and M&R of works. Both have the common objective of bettenneht of agriculture in the area. The structure of Irrigation Department should also be organised on the lines of that of Agriculture Department and there would be better overall coordination with benefits to farmers if the jurisdiction of both the organisations are synchronised. This approach has been considered for Dantiwada Project and is appreciated by the World Bank also. It is necessary that similar organizational arrangements are made on other irrigation projects. It is recommended, thus, to have organisational structures based on common jurisdiction both for irrigation management and agriculture extension.

5.18 For facilitating introduction of warabandi system and volumetric method of supply, over and above the establishment available according to norms fixed by Irrigation Department vide Government Resolution of 15.1.1980, additional establishment is

found essential. This is justified in view of necessity of taking round the clock measurements of water levels, as predetermined on canal sections upstream of measuring devices such as flumes etc. which all involve additional work. According to present norms, there are 32 posts of section/beat Karkoons in each sub-division. In each section, one Karkoon looks after administrative work, two Karkoons look after M&R of canals and other five Karkoons handle water distribution. In this arrangement, there are five beats under each section and these five Karkoons carryout the work of water distribution within these beats. Each beat is of about 800 hact. size i.e. 8 sq.kms. (approx. 3 km. x 3 km.). Separate Karkoons for day and night working are not provided. For volumetric supplies of water, separate Karkoons for each shift will be necessary. While at present variations in canal flows and levels are tolerated, with volumetric supplies, the state of affairs has to be improved and variations will have to be controlled by proper management and constant flows and levels. To enable speedy movement of the operating staff for better controls, each beat will be able to take care of only 400 hectare area (4 sq. kms) , against 800 ha. at present. It appears that controlling an area of 2 kms. x 2 kms. under each beat would be possible. Thus under each sub-division, for efficient water distribution in three shifts, 120 Karkoons will be required for 40 beats. In addition to look after M&R as well as administrative work, considering the present norm of 3 Karkoons per section, 12 Karkoons will have to be provided in each sub-division. This will give a requirement of 132 Karkoons in each sub-division i.e. 100 more in comparison to the strength conforming to present norms. According to present norms, 24 posts of Chowkidars are provided under each sub-division 20 posts as beat Chowkidars for 20 beats and 4 posts for the four sectional charges. Considering one Chowkidar for every beat and additional four nos. for each of the section offices, the toal no. of Chowkidars required for 40 beats will be 44. By deducting the existing 24 posts, 20 additional posts of Chowkidars will be required per sub-division. With the existing pay structure for additional 100 beat Karkoons and 20 Chowkidars, the incremental annual expenditure of a sub- division, will be Rs.9.74 lakhs (statement 5.8), giving an additional expenditure of Rs.60 per hectare. This expenditure of Rs.60/- per hectare will be over and above the expenditure on establishment according to norms fixed vide Govt. Resolution dated 15.1.80 and is intended to make possible introduction of Warabandi and volumetric supplies of water by way of better management and operations of the systems. No doubt, there is some room for improvement in the structure proposed and to effect possible economy. In absence of any dependable data on this aspect, the Study Group would not like to make definite recommendation at this stage on this issue. Nevertheless it recommends sanctioning of additional expenditure of Rs.60 per ha. To cater to additional establishment needed for implementing warabandi and volumetric supply.

5.19 Recommendations for efficient water use in irrigation.

1 Supplying of water on volumetric basis

2 Upgrading standards of construction (modernization works, lining works etc.).

3 Undertaking command area infrastructure works (on-farm development works).

4 Introducing warabandi system.

5 Having two separate norms, one for establishment required for irrigation management, operation etc. and the other for M&R proper in place of the present adhoc single norm and providing funds for H&R accordingly.

APPENDIX – VIII

TRANSLATION

Fixing work load hours f6r set up of a sub division for irrigation management.

Government of Gujarat, Irrigation Department, Resolution No. EST-1177-5-G Sachivalaya, Gandhinagar. Dated 15-1-1980.

Ref.: i) Govt. letter No. EST-1065-G dt. 18.1.66

ii) G.R. No. EST-1175-13-G dt. 22.6.78.

RESOLUTION

After study of the set up for an irrigation management sub division, a report was submitted by the Administrative Reforms and Training Division of the Government. After careful consideration of 'various recommendations of the report in detail, Government is pleased to accept some of the recommendations. Norms are now fixed as under in accordance with the recommendations after making appropriate changes in the Govt. orders in reference to above.

i) Irrigation work load at the sub divisional level should be decided on the basis of area actually irrigated.

ii) If the maximum actual area irrigated (maximum utilisation) is more than 26000 acres in an old major project well established for more than 10 years, a sub division with 4 sections and 20 bits should be sanctioned till the maximum actual area irrigated reaches progressively 40,000 acres. A single bit must have a work load of 1300 acres. The provision of the sub divisional set up should be reviewed every five years on the basis of maximum actual area irrigated.

iii) One more section over and above the four sections said above should be sanctioned to look after maintenance of headworks, colonies, inspection bungalow, stores etc. and other general duties.

iv) 84 posts as per the statement attached should be sanctioned in a sub division. Post of a part time sweeper also should be sanctioned.

v) No appointment should be made on work-charged establisment for irrigation management. Drivers, Sweepers for colony and chowkidars of inspection bungalow should not be appointed on work-charged establishment but they should be appointed on temporary establishment. Total posts in a sub division should not be more than those prescribed under these norms even on converting work charged posts to temporary posts.

vi) Deputy Engineer-in-charge can distribute the work amongst the sanctioned staff under the advice of Executive Engineer.

vii) Sections and bits for medium irrigation schemes should be sanctioned on the lines of the norms of major schemes. A separate section should be sanctioned for each medium scheme even though the number of bits may not support this. Not more than four schemes will be in charge of a sub division. In a region with isolated medium irrigation schemes, one or two schemes may be kept with other (non-management) sub divisions by arranging suitable grouping.

viii) In case of new and developed schemes which have commenced for less than ten years the strength of the set up of the sub division will be linked with the percentage of the potential -created and this should be sanctioned accordingly for first five years.

Potential	
First year	50%
Second year	60%
Third year	70%
Fourth year	80%
Fifth year	100%

2. The above stated norms will be applicable hereafter for sub divisions in charge of irrigation management.

3 Necessary changes should be effected in the set up of the existing sub division for irrigation management in accordance with the norms laid down above. Appropriate proposals for changes in the existing establishment should be submitted by the Superintending Engineers to the Govt. with supporting details.

4 These orders are issued with concurrence of the – Financial Adviser dt. 27.9.79 on the file of this Deptt. of even No.

By order and in the name of the Governor of Gujarat.

Sd/-
P.D. Patel
Section Officer

STATEMENT

Accompaniment to Govt. Resolution of Irrigation Department No. EST-1177-5-G dt. 15-1-80.

Set up for a sub division for Irrigation Management.

SI. No.	Post	No.	Remarks
1	Deputy Executive Engr.	1	
2	Junior Engineer	1	For professional Br. of the sub division.
3	Supervisor	1	Section officers
4	Overseer	3	
5	Technical Assistant/ sub overseer	2	For helping section officers in M&R, original work and management.
6	Senior clerk	1	
7	Junior clerk	2	
8	Tracer	1	
9	Sectional bit clerk	32	1 per section for 4 section
			1 per bit for 20 bits
			2 per section for misc. work for 4 section.
10	Driver	1	If vehicle is allotted
11	Peon	2	
12	Chowkidar	1	For protection of office after office hours if necessary.
13	Sectional bit Chowkidar	24	4 for sections 20 for bits.
14	Chowkidar	12	For various activities like CR operation canal
		84	telephone etc.

Number of posts should be decreased in a sub-division with twelve or less bits and in a section with three or less bits.

Sd/-
P.D. Patel
Section Officer
Irrigation Department

STATEMENT - 5.5

Statement showing the yearly expenditure for th« staff of Divisional office

Sl. No.	Name of post	No.of posting	Pay Scale				
			Mini mum	Maxi mum	Avera ge	Total per year	
1	2	3	4	5	6	*7*	
1	Executive Engineer	1	1100	1600	1350	16200X1	= 16,200
2	Divisional Accountant	1	725	900	563	6756x1	= 6.756
3	Asstt. Supdt .(Dn .)	1	42l	800	613	7356x1	= 7,356
4	Dy. Accountant	1	330	560	545	5340x1	= 5,340
5	Store-keeper	*1*	330	560	445	5340x1	= 5,340
6	Draftsman	1	423	700	568	6816x1	= 6,816
7	Asstt. Engineer	3	550	900	725	8700x3	= 26,100
8	Asstt. Draftsman	1	300	560	470	5640x1	= 5,640
9	Tracer	*2*	260	400	330	3960x2	= 7,920
10	Sr. Clerk	4	330	560	445	5340x4	= 21,360
11	Jr. Clerk	7	260	400	330	3960x7	= 27,720
12	Typist	2	260	400	330	3960x2	= 7,920
13	Computer	1	260	400	330	3960x1	= 3,960
14	Peon/C' dar	5	*196*	232	214	2568x5	= 12,840
15	Driver	1	260	400	330	3960x1	= 3,960
		32					1,65,228
	Add for D.A. & A.D.A. (as per actual)						2,50,224
	Add medical charges a 2%						3,305
	Add leave encashment @ 1/24						6.885
	Add H.R.A. & C.L.A. @ 21%						98,371
	(As per actual)						5,24,013

STATEMENT - 5.6

Statement showing the yearly expenditure for the staff of sub-divisiona1

SI. No.	Name of post	No.of posting	Pay Scale				
			Mini mum	Maxi	Average	Total per	year
1	2	3	4	5	6	7	
1	Dy. Executive Engineer	1	900	1300	1100	13200x1 =	13200
2	Asstt. Engineer	1	550	800	725	8700x1 =	8700
3	Add. Astt. Engineer	1	425	700	568	6816x1 =	6816
4	Overseer	3	425	700	568	6816x3 =	20448
5	Tech. Asstt .	2	260	430	345	4140x2 =	8280
6	Sr. Clerk	1	330	560	445	5340x1 =	5340
7	Jr. Clerk	2	260	400	330	3960x2 =	7920
8	Tracer	1	260	400	330	3960x1 =	3960
9	Karkoon (incl. Section& *B*eat)	144	260	400	330	3960x144 =	570250
10	Driver	1	260	400	330	3960x1 =	3960
11	Peon/C'dar	3	196	232	214	2568x3 =	7704
12	Section Beat C'dar	128	196	232	214	2568x128=	328704
13	Chowkidar	12	196 .	232	214	2568x12 =	30816
							10,16,088

Expenditure of one Section	=	50,80,440/-
10,16,088 X 5 Nos.		
Add for D.A. & A.D.A.	=	17,81,100/-
Add Medical charges @ 2%	=	1,01,608/-
Add Leave Encashment @ 1/24	=	2,11,685/-
Add H.R.A. & C.L.A. @ 21%	=	10,66,892/-
	=	82,41,725/-
Expenditure of 5 Sub-dns.	=	82,41,725/-
Expenditure of 1 Division	=	5,24,013/-
		87,65,738/-

Acres for one Sub-Dn.	No. of Sub Dns	Total Acres
40,000	5	2,00,000

i.e. 80,000/- Hectare

Total expenditure for 5 sub divisions and one division = 87,65,738/

Expenditure for one Hectare comes to Rs..... 109.57

Say ....Rs. 110.00

STATEMENT 5.8

Probable expenditure on the establishment required in excess of that laid down by GR of 15-1-1980 of Irrigation Department due to introduction of Warabandhi on volumetric systems.

SI No	Post	Additional number in a Sub-division	Av. Basic pay for a year Rs.	Annual total expenditure Rs. lakh
1.	Sectional Beat clerk	100	3960	3.96
2.	Sectional Beat Chowkidar	20	2568	0.51
		Total		4.47
1.	Dearness Allowance and Additional D.A.			4.47
2.	Medical Allowance @ Rs . 30 per head			0.43
3.	Leave enxashment £ 1/24 of basic pay			0.37
		Total		9.74
	A sub division will lock after 16000 hectares			
	Additional expenditure per Ha.	= 974000 / 16000 = Rs.61.00 Say Rs.60/- hectare.		

Annexure -5.1
(Para 5.6)

Statement showing Area Irrigated. Demands Raised, Actual Collection and Accumulated Arrears of Irrigation Charges and OM costs in respect of Major and Medium Irrigation Sector during 1986-87 to 1990-91 in various states

(Area in lakh ha.)
(Amount in lakh Rs.)

State	Year	Area Irrigated	Demand Raised	Actual collection	Cost of collection	Arrears		Operation and Maintenance cost		Total
						Annual	cumulative	Estt.	Works	
1	2	3	4	5	6	7	8	9	10	11
1 BIHAR	1986-87	19.31	847	620	766	753	2971	1031	650	1681
	1987-88	17.13	1020	753	1075	722	3247	1624	1237	2861
	1988-89	19.63	750	678	1072	476	3414	1997	1525	3522
	1989-90	21.49	475	217	1418	371	3482	2591	1565	4156
	1990-91	21.08	1841	494	1136	1581	3882	3096	1550	4646
2 GUJARAT	1986-87	4.92	1009	1004	N.A	5	2444	N.A	N.A	1672
	1987-88	4.91	819	535	N.A	284	2728	N.A	N.A	1444
	1988-89	7.13	900	697	N.A	203	2920	N.A	N.A	2078
	1989-90	6.98	1110	765	N.A	346	3264	N.A	N.A	2400
	1990-91	7.00	1286	695	N.A	591	3856	N.A	N.A	2610
	1991-92	7.76	N.A	N.A	N.A	N.A	N.A	1032	1891	2923
3 HARYANA	1986-87	20.04			2%of			1296	1183	2479
	1987-88	18.81	1042	387	actual	655	1435	1585	1047	2632

	1988-89	19.58	1118	1284	collection i.e Commission paid To lambardar	(-)166	1268	1738	1002	2740
	1989-90	20.23	1179	1298		(-)118	1150	2133	934	3067
	1990-91	19.72	1168	1584		(-)416	1034	2311	1158	3469
4 MADHYA PRADESH	1986-87	17.17	2010	1353	200	657	5139	313	938	1251
	1987-88	15.59	2201	1365	204	836	5975	313	940	1253
	1988-89	15.88	2358	1796	253	562	6537	330	990	1320
	1989-90	15.97	2792	1264	231	1528	8065	363	1088	1451
5 MAHARASHTRA	1986-87		2056	1711		345	5919	728	1639	2367
	1987-88		1816	1515	N.A	301	6220	913	2160	3073
	1988-89		1851	1180		671	6891	2858	2349	S207
	1989-90		1953	1228		735	7910	3350	2710	6060
	1990-91		1900	1616		284	7175	N.A	N.A	N.A
6 ORISSA	1986-87	12.65[J]	925	383	N.A	542	N.A	N.A	N.A	M.A -
	1987-88	12.77	[952]	415	N.A	537	N.A	N.A	N.A	N.A
	1988-89	12.97	960	467	N.A	493	N.A	N.A	N.A	N.A
	1989-90	13.59	920	367	N.A	553	N.A	107	189	296[1]
	1990-91	13.71	921	417	N.A	504	N.A	121	215	336[1]
7 PUNJAB	1986-87	28.27	961	1057	29	NIL	NIL	1727	795	2522
	1987-88	28.44	1005	1210	30	NIL	NIL	2016	908	2924
	1988-89	29.00	907	1285	29	NIL	NIL	2280	847	3127
	1989-90	28.59	1077	1121	32	NIL	NIL	2995	991	3986
	1990-91	26.35	991	1044	30	NIL	NIL	2920	874	3794

9 RAJASTHAN[2]	1990-91	U.35	1609*	1023*	N.A	174	606	N.A	N.A	N.A
	1991-92	13.88	1619*	1141*	953	55	683	903	258	1161
9 TAMIL NADU	1985-86	10.80	304	N.A	N.A	N.A	N.A	N.A	N.A	N.A
	1986-87	11.37	380							
	1987-88	7.80	334							
	1988-89	8.91	340							
	1989-90	7.70	336							
10 UTTAR PRADESH	1986-87	57.53	6163	5946	10 to12%	207	N.A	857	3631	4488**
	1987-88	56.54	5822	4585	of the total	1237	N.A	4745	3992	8737**
	1988-89	60.03	6285	6484	revenue	(-)199	N.A	3197	5208	8405**
	1989-90	56.63	6429	6041	Collected	388	582	4739	5414	10158**
11 WEST BENGAL	1986-87	15.21	228	60	.	160	N.A	670	965	1635
	1987-88	15.20	233	78	-	155	N.A	700	915	1615
	1988-89	150.58	234	83	-	150	N.A	842	1057	1899
	1989-90	15.58	234	80	-	154	N.A	1104	1142	2246
	1990-91	17.00	264	75	500	189	N.A	1463	1308	2771

Source: Information furnished by the State Irrigation Departments of the Reporting States.

1 Relates to 4 major and 5 medium projects.

2 Relates to 5 major and 5 medium projects.

* Includes arrears also.

** Relates to canal irrigation system only.

NA Not available

Annexure – 6.1
(Para - 6.5)

GUIDELINES ISSUED* BY THE MINISTRY OF WATER RESOURCES FOR INVOLVING FARMERS IN WATER MANAGEMENT OF IRRIGATION SYSTEMS

1 Background

Irrigation facilities are created for supplying water to the farmers for raising crops so as to increase their agriculture production and cropping intensity through assured supply of water. The major and medium irrigation systems are planned, constructed, managed, maintained and operated by the Irrigation Departments, wherein certain procedures and rules are evolved and followed in respect of opening of canals, frequency of supply and distribution of water amongst farmers.

The scheduling of irrigation, time of supply and the number of doses to be given are hardly discussed with the users, except in some adhoc Committees set up at the Divisional or Sub-Divisional level.

Uptil now the Irrigation Acts initiated during the British period are being followed, wherein each individual farmer is expected to deal directly with the government except that some mutual cooperation is sought in case of water distribution under warabandi system being followed in the states of Punjab and Haryana.

The present system of water management does not provide for collective efforts in self governance by the users. The result is that there is no effort on the part of the farmers to maintain even the field channels which are constructed in their fields by the Government nor the sense of economical use of water if generating amongst the users.

There is an increasing and pressing demand from the States, that the field channels const ructed recently by the CADAS on behalf of the farmers shiould be maintained by the Departments or CADAs at the Go vernment cost as the farmers are not coming forward to maintain them. So far, we have constructed field channels in an area of about 9 million ha but by the end of 7th Plan the total coverage under field channels alone would be over 14 million ha.

The position of maintaining the irrigation canal systems upto the outlets is also not sat is factory due to lack of funds and as such additional responsibility of maintaining the field channels and field drai ns would not improve the situation and the Departments would also not be able to ,cope with the additional burden and responsibilities.

** Dated 30th April, 1987.*

Moreover, the present system of management - puts tremendous pressure on the Departments in maintaining the main system, planning of deliveries through the main canal/branches and also preparing the schedules for individual farmers. The result is that the supplies are made arbitrarily which neither benefit the farmers nor the crops.

2. Necessity of Involving Farmers in the Management and Maintenance. The research in agriculture, particularly in the field of agronomy in recent years has led to the evolution of hybrid and improved varieties having very high potential yields.However, these varieties are susceptible to water stress particularly at critical growth stages and therefore need very precise water management.

Accurate information is now available about the soil plant-water relationship particularly when to irrigate, how much to irrigate and how to irrigate for better water use and application efficiency. Introduction of irrigation particularly in public delivery systems envisages changes in cropping pattern, cropping sequence and farming habits so as to increase the irrigation as well as the cropping intensity by taking maximum advantage of the natural precipitation, irrigation and ground water.

Irrigation is a community subject and unless all the farmers in a given area adapt themselves to a certain common approach in selecting varieties of crops, sowing time and cropping, sequence, the water deliveries would not match exactly with the crop water requirements for getting higher yields. The maintenance of field channels and field drains is also very important to get full quantity of water released from the outlets and also to remove excess water from the fields through drains so as to maintain the health of the soils.

The present method of undertaking the responsibility of supplying water to individual farmers by the Irrigation departments or by CADAs is not able to improve the water supplies or achieve economic as well as optimum utilization of the irrigation potential.

In this context, it is necessary to think some alternative arrangements which would improve the water deliveries for optimal production per unit volume of water.

The necessity of involving farmers in water management has been recognised by the planners over the past few years. This is based on the assumption that water distribution costs would get reduced, the maintenance of the irrigation systems at micro level would be achieved, the beneficiaries would have sense of owning the system which would motivate economic use of the water, he effectiveness of the system would improve, reliability of assured water supply made known to the beneficiaries would also motivate them to go for appropriate inputs leading to higher productivity. The distribution of water will be equitable and schedules of supply could be more effective. It is, therefore, felt that farmers participation would ultimately give stability to the operation and maintenance of the irrigation system.

Experiences Aoroad

Some studies have been carried out by FAO/Ford Foundation in organising the farmers and entrusting them with the task of water management and maintenance of the system. The promising ones are the experiments carried out in Philippines and Sri Lanka. In both these countries, an effort was made to induct "Catalysts" or "Organisers" in the command area. The "Catalysts" were qualified professionals and had been trained in irrigation systems, irrigated farming cooperation, organising farmers and building confidence in them to take up active part in planning, designing and' execution of the systems in the first instance and managing the water delivery and maintenance of the system in the second phase. The Organisers started with simple tasks which could be undertaken by groups of farmers through their organized actions such as recruiting members for the associations, repairing the damaged structures, etc. The farmers' associations were then built up and water distribution procedures formulated. It came to the notice through these experiments that the farmers, if approached, in well conceived manner with their interests clearly understood, they respond with resources and initiative. It was also noticed that promotion of improved water management would proceed better and provide better results, if not focused only on water management exclusively, but rather, if associated with agriculture and other social activities, whenever the members desired so. Experience in other countries including USA and Mexico have also shown that for obtaining optimum returns from irrigation investments, the management of water should be with the farmers/ beneficiaries.

Experiences in India

In India, also there are quite a large number of cases where farmers associations, ither formal or informal, have been successfully managing the irrigation systems and distributing waters to all the farmers in the respective commands. These associations have been able to economise the use of water, increase productivity and create a sense of reliability and assurance in all the farmers in getting the water on time and in adequate quantity for various crops. Some of these cases are described below.

4.1 ‘PHAD' System

‘Phad' system is the management of irrigation by a group of beneficiaries. For over 200 years such a system of irrigation management has been practised on small irrigation works in North-Western parts of Maharashtra. The irrigation system comprising of low diversion weir and distribution net work is managed, operated and maintained by the beneficiaries themselves, through 'Phad' system. The Government only framed guidelines as to how the implementation by the beneficiaries was to be done and how accounts should be maintained.

4.2 Mohini Water Cooperative Society.

With the conventional water distribution, the farmers at the tailends are the sufferers. On the other hand, the farmers in the head reaches use more water than required by the crop and thus not only waste the costly water but also spoil their valuable lands in the long run. To find answer to this menace, the farmers of Kakrapar Irrigation project in Gujarat have formed water cooperative society named as Mohini Water Cooperative Society. The water is sold to the cooperatives in bulk and water rates are levied on basis of volume of water measured at the supply point. The responsibility of eguitable and efficient distribution of the water amongst the farmers vests in the cooperative society.

4.3 Sinchai Panchayats in Tawa Project (MP)

Sinchai Panchayats have been set up in number of irrigation divisions in the command area of Tawa Project of Madhya Pradesh. These panchayats are entrusted with the responsibility of orderly management and distribution of irrigation water. Successful operation of the water distribution through warabandi/osrabandi is also a major responsibility entrusted to these panchayats.

In addition, there are cases of irrigation cooperative societies in Kolhapur, Satara, Sangali and Ahmednagar districts of Maharashtra ; informal farmers groups distributing water equitably in the delta areas of Tamil Nadu and also farmers groups distributing water in old Vijaynagaram canals in Karnataka.

The above examples indicate that the farmers in India have necessary skills. Ability and capacity to manage irrigation economically for maximising the agricultural production from the available water resources. It is felt that, if the farmers are trained in water measurement, water accounting and budgeting as well as modern on- farm water management practices, they would be able to manage the distribution in a more economic manner.

5. Objectives of Farmers Participation in Water Management

1. To initiate participation of farmers (who are the users of water supplied from the system) in water management, irrigation scheduling, distribution and maintenance of system at micro level so as to:

    a) Improve irrigation as well as water use efficiency for optimal production per unit volume of water.

    b) To make best use of natural precipitation and ground water in conjunction with the canal water for increasing irrigation and cropping intensity in the commands.

2. To develop sense of economy in water use amongst the users.

3. To facilitate the users to have a choice in selecting crops, cropping sequence, timing of water supply and period as well as frequency depending upon the soils, climate and other infrastructure facilities available in the commands suet as road, markets cold storage etc., so as to maximise the incomes and profits.

4. To delineate responsibility in water distribution and maintenance of system between the users and the Departments for attaining high service-able standards of the system.

5. To promote incentive to the farmers by way of less water charges to those v ho use water efficiently.

6. To entrust collective and community responsibility on the farmers to collect water charges and payment to Governments .

7. To improve and sophisticate deliveries precisely as per crop needs by the Departments at the supply points of the minors and thus reduce operation loses.

8. To create healthy atmosphere between the Managers and users in the entire operation

6. Area of Operation of Farmers Associations and Methodology

The Associations will function efficiently , if the number of farmers is less as this would have better cohesion and interaction amongst the farmers. The area of operation should also be continuous and connected for measuring the water deliveries and maintaining water accounts. However, large number of farmers can t>e accommodated under one Association if the structure is built in two tiers viz. (i) outlet committees and (ii) association at the minor level.

Every outlet should have a Committee *of* five members out of which two should be from head reach, two members from tail reach and one from weaker section. One farmer should be elected as outlet Leader who would be the Member of the Managing Committee of the Associations at the minor level.

It is necessary to form association at the minor level and not at the village level, as the source of getting water being same in case of minors, there would be common interest developed amongst the members to act together. The Committee or association at the village level would have vested interests and therefore may not be functional. The area of operation should be chosen in such a way that the managerial expenses in -the long run would be less and with this point of view an area of 1000 ha appears to be reasonable as the annual burden of managerial expenses would not be more than Rs.100 per ha.

6.1 Selection of Minor

The selection of a minor for pilot project in initiatingthe farmers participation could be done as under :

1. The command area is compact and where the construction of minor and the field channels and lining is completed. The condition of the micro system is reasonably good though not very upto date.
2. There is a head regulator with gated control with measuring devices atleast at the minor and preferably at the outlets.
3. The minor as a whole is receiving water without difficulty from the main system and the utilization level is over 50%. Such prospective areas may be identified and the response from the farmers in initiating associations should be assessed by a fairly senior level officer through discussions with the farmers for final selection.

6.2 Methodology

Once the minor or group of the minors are selected, the irrigation staff should be asked to conduct detailed survey regarding .

1. Discharging capacity of minor, area planned to be irrigated and actually irrigated.
2. Quantity of water released during past few years and the area irrigated per thousand cubic meter of water seasonwise.
3. Actual seepage and transit loses in the minor as well as field channels so as to work out the net water which can be delivered to the farm vis-a-vis the water released from the head regulator of the minor.
4. Work out allocation of water for the selected minors in different seasons and also the water allocation per ha seasonwise.

The CAD or extension staff at the field level should visit the area and hold discussions with the individual fanners or the groups of farmers at the outlet level or in case of bigger outlets, group of farmers of branches of field channels separately and explain the advantages in forming an association and take over the water management below the minor level. The staff should be apprised of the exact benefits the farmers would get in this process by way of increase in irrigation, increase in production, saving in water charges, future prospects and thereby gains through organising inputs, transport, marketing and processing industries.

Once the farmers are appraised of the benefits in working together as well as taking over management; outlet committee should be formed and the election of the outlet Leaders should be carried out in the presence of representatives from the Departments such as patwaris or Canal Inspectors and the Extension workers.

A meeting of all the Outlet Leaders/Members of Managing Committees should then be organised and the collective and community advantages should be discussed with them by a senior level officer.

The responsibilities and the duties of the association in respect of water distribution, maintenance should be explained. The technical help that would be rendered by the Department and the legal backup to the association should also be mentioned.

After the Committee resolves to form an association, the same should be vetted by a general meeting involving all the farmers in the command and thereafter action may be taken to register the association under the Registration of Cooperative Societies Act or under the Registered Societies Act.

Initially one Canal Inspector or Patwari may be deputed to the association to work as Manager with one or two Assistants to be paid by the association. The canal Inspector or Patwari will later on be replaced by a Manager appointed by the association.

6.3 Membership

The provisions under the Registered Societies Act or Registered Cooperative Societies Act may be different in different States but in order to cover the interests of all the farmers in water management, following minimum provisions need to be made in the model laws or by-laws:

1. All the farmers in the command should be eligible to be members of the Outlet Committee and also the Association at the minor level. Every farmer will have only one vote in sleeting the outlet leader, passing resolution in the general meetings of outlet committees or the association.
2. If the 2/3rd of farmers become members of the association, the rules in respect of water distribution/deliveries and management of water at the farm level as resolved by the Association should be binding on the farmers who are not embers. The non members however, shall not be deprived of getting water as per allocations and rules framed by the Association.

The Patwari or Canal Inspector may be ex-officio Member of the Outlet Committee and the Junior Engineer or equivalent CAD Officer may be ex-officio Member of the farmers associations at the minor level. These ex-officio Members will not have voting right in electing the office bearers or the Chairman, etc. or in passing different resolutions but may guide the Members of the Committee regarding the allocation of water, general procedure for water distribution, provisions in the irrigation act or canal rules and other legal matters. They will also provide information about the actual availability of water before each season and the

approximate area that could be irrigated from the authorised or allocable water- in the respective minor command.

The Managing Committee pf the Farmers Association will resolve disputes amongst Members in respect of water distribution, water turns, allocate water to individual outlets out of the allocable water for the minor as decided by the Department, undertake correspondence with the irrigation/CAD Departments in all connected matters, prepare water budget, decide the date of supply of water and the frequencies, doses etc. place indents and maintain water accounts as well as accounts, for the expenditure on maintenance and repairs. The Committee also would be responsible for levying taxes for maintenance and repairs of the system.

The Managing Committee may elect one Farmer to work as Chairman of the association and one as Vice-chairman and also may set up different working Committees for water distribution, maintenance and repairs, collection of water taxes, collection of contribution fo.r maintenance of field channels and field drains/ etc.

6.4 Duties and Responsibilities.

The duties and responsibilities of the farmers association could be worked out in stages, starting gradually from distribution of water as per the schedu les prepared by the Department in the first season for taki ng over the control of the entire minor in respect of operation, maintenance and supply of water on volumetric basis in three 6r four succeeding seasons.

6.4.1 First Season

(a) Distribution of water as per schedules prepared for different rotations of water supply warabandi by the Department.

(b) Measuring discharge of water at minor and outlets and maintaining water account i.e. total water delivered from the minor in the season. The water charges could be assessed as per the conventional area basis, but compared with the volumetric rates of supply, as agreed upon .

(c) Demonstrate and practise improved on-farm water management methods for improving field application efficiency in the individual farmers' fields.

(d) Maintain field channels and field drains through contributions from the members either in cash or by labour and maintain separate accounts of expenditure.

6.4.2 Second Season

a) Prepare schedules for water supply for the outlets.

b) Measure discharge of water at minor and outlets and maintain water accounts, i.e. water delivered at the head regulator of the minor and outlet, working out area

irrigated per thousand cubic metre of water and compare the water charges as per the areas irrigated with the volumetric rates as agreed upon.

c) Convince the farmers regarding minimising operational, deep percolation losses so as to reduce the cost of water.

d) Prepare fields for receiving irrigation as per the improved methods such as borders or furrows etc. Training and demonstrations for better application efficiency at the fields

e) Maintain field channels and field drains.

6.4.3 Third Season

(a) Prepare crop plans for the irrigation season giving crops and their area.

(b) Prepare layout of fields, adopt better on-farm water Management.

(c) Prepare indents for water for the season and rotation.

(d) Maintain water accounts and prepare bills for the individual farmers based on area basis, while remitting water taxes to Government on volumetric basis as per agreement.

(e) Maintain and repair field channels and field drains including lining and earthwork of the minor.

6.4.4 Fourth Season

(a) Educate farmers about water rates on volumetric basis or supply in terms of hectare cm and billing the farmers on volumetric basis as well as remittance of water charges to Government on volumetric basis.

(b) Maintain and repair the minor/distributory structures from the maintenancae grants to be received from State Government and maintain separate accounts.

(c) Maintain entire on-farm development works, i.e., field channels and field drains including structures and collect contributions from the farmers either in cash or labour.

(d) Prepare complete annual reports describing the water account, irrigation efficiency and water use efficiency, crops grown, production and value of crops.

6.4.5 Fifth Season

(a) Later on the association may expand their activities further, in respect of organising of inputs, i.e., seeds, fertilisers, pesticides needed for agriculture production and distribute the same to the individual farmers.

(b) The association may also procure Agricultural implements for the community and

hire them to the individuals.

(c) Organise transport, storages and marketing of the agriculture produce, with a view to increase the , profits margin of the growers.

(d) Once the association members decide common and uniform crops in the area; agro based industries for processing the agriculture production can also be initiated so as to avail more profits by the farmers.

7. Advantages to the Farmers

1. The farmers will have the privilege of owning and managing system themselves.

2. Choice for selecting suitable frequencies of water deliveries and doses as needed by the crops, so as to enable them growing suitable crops which would give them increased production and profits within the allocable water from the project.

3. Security and reliability in getting water as per agreement with the department.

4. Attaining a stable state of irrigation facilities as per agreement and thereby minimising the alterations or deterioration in the supply due to arbitration of the irrigation/ CAD staff, incentive for economic use of water, as more of the water is saved less would be the payments of water charges.

   (a) Possibility of increasing profits through organised transport, storage, marketing and processing.

   (b) Priority in getting irrigation water in case of shortage of water due to less replenishment in the system.

8. Duties and Responsibilities of the Department

1. The quantity of water , allocable to the Association in normal year based on the area of the minor on prorata basis will have to be worked -out and communicated to the farmers.

2. The discharge at the minor level will have to be maintained as per the indents placed by the Association for irrigation water.

3. Measuring the volume of water supplied to the Association and billing them in time.

4. Monitoring the working and performance of the Association through ex-officio members in the outlet committees and association so as to ensure equitable distribution of water to all the farmers.

5. Intervening, in case the agreements are violated or the water rights of the weaker section are not protected by the Association.

6. Accommodate choice of farmers in respect of water deliveries, period of flow, frequencies within general time schedules prepared for the project.
7. Maintain the system uptodate and ensure supplies at full capacity in the main system.
8. To provide incentives to farmers like lining of minors, field channels etc., for better supply of water.

8.1 Advantages to the Department

1. As the supply points are redcuced, the time and energy in settling disputes of the individual members in sharing water amongst individual farmers would be reduced .
2. More attention can be given to programming and water scheduling at the minor level. This will howeverinvolve additional responsibility regarding effecting supply precisely and punctually at the respective points, i.e. at the minor level.
3. As the sense of economy is built up in the users, the irrigation efficiencies would be higher thus the problem of under utilisation will be reduced.
4. The role of irrigation staff and the status of the field functionaries in the society will improve as in the new circumstances the irrigation staff would not be responsible for supplying water to the farmers but will have to work as judges or arbitrators in resolving conflicts and giving fair justice to all the farmers.

9. Incentive to the Farmers for Future Development and Improvements .

There is no necessity of updating or sophisticating the system i.e., lining of the minor or field channels before initiating the Association. If the system at present is workable and able to provide water to all the farmers with measuring devices at the minor and outlet level, so as to work out the volume of water release, it will be reasonably good for initiating such participation. The rates for volumetric supply can be worked out in the present circumstances in such a way that they are not more than the rates charged as per the area basis.

The Association can be assured that if they organise and take up the supply on volumetric basis and if their performance is good, the lining of minors and field channels would be taken up by the Department on priority, which will improve the availability of water furhter and also will reduce cost of water as more water will be made available to the farms after lining. The Association can also be assured about the improvements in control structures by providing level control or automatic gates which will further reduce the operation losses and ensure proper supply.

Such improvements can be considered as points for negotiations or bargaining with the farmers' associations and to provide incentive for better performance and economical use of water.

10. Training

The training of fanners, members of the managing committee and the managerial staff of the associations can be arranged in stages as follows :-

1. Reading gauges at minor, parshall flumes or V. Notches at the outlets, calculating dishcarge in litre/ sec as per the readymade tables showing gauge reading versus discharges.
2. Calculating quantity of water by multiplying dischargein litres with time in sees, i.e. MVper sec or thousand litres, unit.
3. Cost of water per thousand litres or thousand cubic metres as per the annual cost of the project.
4. Water rates on volumetric or bulk supply, water rates as per area basis as per the prevailing practices.
5. Crop water requirements with due adjustments at the field level, out Jet level and minor level, depending upon the seepage losses in the system.
6. Irrigation layout for preparing fields to receive water, methods of irrigation, improvement in application efficiency by controlling stream size and cut-off time.
7. Calculation of water used for irrigation in hacm and total quantity of water required and used per season.

10.1 Measurement of Water and Water Management at Field Level and Maintenance.

1. Cross-sections required for ensuring desired flows in the channels.
2. Relation of bed gradients and obstruction to flow due to structures, with the discharging capacities and thereby necessity of desilting and deweeding.
3. Earthwork for the field channels, minors and field drains, maintaining bed level, top of banks, consolidation and compaction of earth work as well as maintaining adequate heights *of.* banks and structures.
4. Energy dissipation at the fails and structures for maintenance of water cushion depths.
5. Maintenance of structures, i..e. cement pointing, plaster for masonry, pitching and lining etc.
6. Maintenance of gates and other parts of the control structures.

10.2 Water scheduling

1. Water allocation per ha in case of warabandi, supplies based on prorata basis as per

roasters and holdings.

2. Water required for irrigating one, ha with a given delta in hacm and thus calculating time of supply from the outlet for standard discharge of 28 litres per second at the outlet. Working out time required for flow through the outlets as per the actual irrigated area.
3. Roastering of rotation of outlets on minor depending upon the capacity of the minor.
4. Preparation of water schedules for individual fanners, outlets and minors.
5. Water budgeting for the season and water accounts at the end of the season.

10.3 Other Aspects

1. Rights, duties and responsibilities of every individual members of the Association.
2. Duties and responsibilities, of the .outlet Leaders, Members of the Managing Committee, Chairman and Vice-Chairman as well as Professional Managers and Staff employed by the Association.
3. Business rules for Executive Committee, General Body of the outlet Committee meetings of general body of the Association. Recording proceedings of the meeting.
4. Points and subjects to be discussed during the meetings and procedures for passing resolutions and recommendations .
5. Mode of correspondence with the Department. Presentation of water budget, water account regarding maintenance of accounts of expenditure.

11 Monitoring

The Farmers' Association is a new experiment and in order to build up the association on proper lines and establish good traditions which will provide guidelines to other organisations likely to come up in future; timely and acurate monitoring of the farmers associations should be done by the Junior Engineer or equivalent officer and that of all the Outlet Committees should be done by the Patwaris or Canal Inspectors. The points for monitoring are;

1. Timely conducting meetings of outlet Committee or Associations, i.e., one before each season for preparing crop plan, water budget, negotiations with Departments, placing indents, etc.
2. Accuracy and precision in measuring discharges and maintaining water accounts.
3. Maintenance of expenditure.
4. Ability of the association for giving equal justice to all the beneficiaries and their performance in this respect.

5. Billing the individual farmers for water taxes and collecting the dues from the members and remittance to the Government in time.

6. Preparation of annual reports regarding irrigation efficiency, water use efficiency, area of irrigation, production, value of crops and economy in water use.

7. Higher level officers should also pay visits to the association offices and area during their normal visits and assess the working of the association, its ability to function and capability of giving equal justice to all the members. More critical examination and close water needs to be carried out to see that the association is not used by influencial farmers to exploit the water Resource at the cost of the weaker section.

Adminstration and higher level officers should pay visits to these associations and guide them in improving their performance, working so as to achieve the objectives fully. It is also necessary to post capable and efficient officers in such areas so as to guide farmers in building up associations, explain them the benefits and establish good traditions.

It also would be necessary to impress upon the field functionaries that the participation of the farmers is sought not to hand over the responsibility of water distribution and water accounting, etc., to the farmers but the main objective is to involve them in the entire functioning and working as partners and thus improve the irrigation efficiency and production from irrigation agriculture.

Sources: Farmer's participation in irrigation water management, CAD Division, Ministry of Water Resources (August, 1991).

Annexure- 6.2
(Pare 6.5)

Statewise/Projectwise status of Water Users Association/Societies

SI No	State	Name of Project	Name of Association	Year of Registration	Name of minor/out let covered by Association	No. of Farmers covered by Association	Area Covered by Association in hectare (ha)	Function being Performed by Association
1	2	3	4	5	6	7	8	9
1	Andhra Pradesh	Sriramsagar	600 Pipe Committees formed					To distribute water within out-let command
		Nagarjunasagar Right Command	196 Pipe Committees formed					-do-
		Nagarjunasagar Left Commend	Formation of 600 Pipe Committees Government of Andhra Pradesh					- do-
2.	Assam	Sukla	2 Chak Samities formed					-do-
3	Bihar	Gandak	Out let level committees			630	223.718	-do-
4.	Gujarat	Shetrunji	Shri Hendha Juth Irrigation Co-operative Society	1981-82	Right Bank Canal (R.B.C.) No. 3,4, 5,6	137	496	-do-

1	2	3	4	5	6	7	8	9
		Shetrunji	Shri Ghodha Kuda Irrigation Co-operative Society	1981-82	Left Bank Canal (L.B.C.) No. 16, 17, 18, 18A	108	717	-do-
		Shetrunji	Shri Arnitimba Irrigation Co-operative Society	1985-86	Right Bank Canal Distributary-2	41	1362	- do -
		Shetrunji	Shri Bhutuya Irrigation Co-operative Society	1988-89	Minor No. 1 Canal Distributary-2	39	133	-do-
		Machhu-1	Shri Amitiba Irrigation Co-operative Society	1982-83	Distributary-10,12	220	787	-do-
		Machhu-1	Panch Dwarka Irrigation Co-operative Society	1986-87	Distributary-5	214	640	-do-
		Machhu-1	Shri Rasik Gadh Irrigation Co-operative Society	1988-89	Distributary-1, 2	20	196	-do-
		Machhu-1	Shri Lalpur Irrigation Co-operative Society	1988-89	Distributary-2	15	257	- do-
		Machhu-1	Shri Jodhpur Irrigation Co-operative Society	1988-89	Distributary-1,2	13	368	-do-
		Machhu-1	Rajawadla Irrigation Co-	1988-89	Distributary-3	15	468	-do-

1	2	3	4	5	6	7	8	9
			operative Society					
		Machhu-1	Chardrapur Irrigation Co-operative Society	1988-89	Distributary-3	20	472	-do-
		Mahi - Kadana	Bhalej - Kadana Irrigation Co-operative Society	1986-87	Sardarpur sub-minor	50	446	-do-
		Mahi - Kadana	Mogri -Irrigation Coop Society	1984-85	Mogri minor Hadgud sub-minor	28	1400	-do-
		Mahi – Kadana	Navil Irrigation Coop. Society	1985-86	Mogri -minor	34	200	-do-
		Mahi - Kadana	Ajarpura Irrigation Co-operative Society	1984-85	Boiavi Distrbutary Set I,II kasor sub-minor	36	641	-do-
		Mahi - Kadana	Jahaj Irrigation Cooperative Society	1986-87	Virsad sub-minor	37	549	-do-
		Panam	Shardapur Panam Irrigation Co-operative Society	1984-85	32 main Canal 22 Sub - minor	47	362	-do-
		Panam	Valavav Panam Irrigation Co-operative Society	1986-87	32/R Distributary	76	536	-do-
		Dharoi	Dharoi Irrigation Co-operative Society	1982- 83	2170-SRP	57	358	-do-
		Dharoi	Unit a Irrigation Cooperative	1983-84	Minor M&I Branch Canal	97	2732	-do-

1	2	3	4	5	6	7	8	9
		Dharoi	Rangur Irrigation cooperative Society	1983-84	SM-2L minor	61	852	-do-
		Watrak	Ja1arnkhan Hathi-khantnaat Huyada Irri. Coop. Society	1986-87	Minor-159	87	287	-do-
		Ukai – Kakrapar	Mohini Cooperative, Society	1978-79	3L,4L,IR&2 of Bhestan mi nor	225	487	-do-
		Ukai -Kakrapar	Saras Water Cooperative Society	1986-87	Orma sub-minor & 2K sub- minor	261	458	-do-
		Ukai -Kakrapar	Vanskui	1983-84	Vanskui Distributray Champawadi minor Vanskui minor	290 145	411	-do-
		Ukai -Kakrapar	Mathuka Sahakari Mandi	1983-84	Hathuka sub minor	145	174	-do-
		Ukai -Kakrapar	Rayama Sahakari Handli	1981-82		140	452	-do-
		Ukai -Kakrapar	Pardi-1dris Sahakari Mandli	1982-83	Piludra minor	141	685	-do-
		Ukai -Kakrapar	Sydta Sahakar iMandli	1982-83	1-LYWadoly Distributary SydIa Sub -minor 1-1 Sub - minor	119	294	-do-
		Ukai -Kakrapar	Muland Sahakri Mandli	1988-89	3 L Sub-minor Klathodra & 2R., Wadoly Distributary	316	572	-do-
		Ukai -Kakrapar	Salaj Water Cooperative Society	1985-86,	4L 3L & 4L Minor Amalsadi. branch	214	214	-do-
		Ukai –Kakrapar	Sardar Katwach Mater Cooperative society	1982-83	Desad minor	227	321	-do-
		Ukai -Kakrapar	Davadha Water Cooperative	1983-84	35 Devda Minor 1L	515	880	-do-

1	2	3	4	5	6	7	8	9
			Society		sub-Minor Devadh Mr. IR Devadh Minor			
		Ukai -Kakrapar	Sania Water Cooperative Society	1983-84	3R Sub- Minor 4R Sub-Mınor , II Bhestan Minor	210	46S	-do-
		Ukai -Kakrapar	Sania Water Cooperative Society	1983-84	Bhestan 81 sub- Minor	322	927	-do-
		Ukai -Kakrapar	Ladvi Ovian Water Coop society	1988-89	Sania Sub- IR Sub Minor 1L Sub Minor	208	495	-do-
		Ukai -Kakrapar	Vanz Water Cooperative Society	1982-83	Vanz Minor 6 R Sub Minor; 1 R Sub Minor 1L/WC Talanpur Minor	127	849	-do-
		Ukai -Kakrapar	Gangpur Water Coop Society	1986-87	4L W/C Kereli Minor	106	86	-do-
		Ukai -Kakrapar	Mangrol Water Cooperative Socla	1981-82	Dy. Dol 9+ R10 of Kanwa Dy DO. of Asta Minor	220	383	-do-
		Ukai -Kakrapar	Shera Water Coop Society	1988-89	Nansot Branch	105	250	-do-
		Ukai -Kakrapar	Digas Water Cooperative Society	1988-89	Digas Minor Kanwwa Dy Mangrol Dy.	350	642	-do-

1	2	3	4	5	6	7	8	9
5.	Haryana	Jui Canal JLN Canal Gurgaon Canal RLI Canal	151 Numbers of Farmers Association have been formed as de tailed below: Jui Canal (151 Numebers) JNL Canal (37 Number) Gurgaon Canal (67 Number) and RLI (32 Number)					Major functions of these association are maintenance of field channeIs and distribution of available water.
6.	Himachel Pradesh	Giri	Giri Sinchai Salahakar Simiti	Distributary No. 3 of Right Bank Canal		409	380	
7.	Karnataka	MaIaprabha & Ghataprabha	Water users asso-ciation at outlet level (about 10 numbers)			379	456	
8.	Kerala	2031 outlet level Beneficiary Farmers Association comprising an area of 75109 hectare were registered as on 31.3.1991. The projective details of						

1	2	3	4	5	6	7	8	9
		these association are as under .						
		Malampuazha Mangalam Pothundy Gayathri Wa1ayar Peechi Chalakkudy Cheerakuzhy Vazhani Neyyar	444 64 126 130 8 310 504 32 97 316		between 1985-91 -do- -do- -do- -do- -do- - do- -do- - do-			The function now allotted to the association is to ensure proper distrition of water to the farners of the Ayacut area adopting scientific methods
9	Madhya Pradesh	Mahanadi	Irrigation Panchayat (736 numbers)				183000	Distribution of water among the members, collection of irrigation fees and conf1ict resolution etc.
		Tawa	Sinchai Panchaynt					-do-

1	2	3	4	5	6	7	8	9
10	Maharashtra	Mula	Shri Datta Coop Water Management Society	1989 - 90	Chanda Teh. Newasa Distt. Ahmednagar	400	495	Distribution of water at farm level
		Jayakwadi	Shri Changadeo canal Water Distribution Management Coop. Society Ltd.		Changatapuri Tal , Paithan Dist ,Aurangabad	211	225	-do-
		Bhima	Sidheshwar canal Water distribution Management Coop. Society Ltd.		Patas TaI Daund Dist . Pune	15	IS0	-do-
		Khadakwasala	Saha jeevan Water Services Coop Society Ltd.		Ranzani Tat .Madha Dist Solapur	I5	154	-do-
		Girna			Kasoda/ Adoan outlet	46	196	-do-
		Krishna			Minor Mo.7 of DRBC/7	239	229	-do-
11	Tamil Nadu	1. Cauvery Command						
		Paminiyar	a) A-60 Kardapari Chanar Channel	1990-91				To demand required

1	2	3	4	5	6	7	8	9
			Farmers Council					quantity of
			b) A-20 Nanthrayan Channel Farners Councial	1990-91	-	500	496.03	Water from Government to distribure Water to its Members to reaolve con-flict and supply inputa to members etc.
.	.	Kuduvauar	A-4O, Kudiraseva Kanar Channel Farmers Council	1990-91	-	150	193.125	
		Harichandrandh	A-26 Awbothi rajan Channe1 Farners Council	1990-91	-	100	57.145	
		Vennar	A -39 Rajendran Channel Famers Council	1990-91	-	510	604.415	-do-
	Tamil Nadu	Cauvery	a) A-9, A, Kenaka dingalar Channe Farwers Council	1990-91	-	285	258.375	-do-
			b) A-60,A Kandepari ChanneI Farmers Council	1990-91		325	253.605	-do-
			c)A-18 Veerakan Vaikal Farmers Council	1990-91	-	119	101 .400	-do-

1	2	3	4	5	6	7	8	9
			d) A- ZO. Triuvaipadi Vaika Farmers Council	1990-91	-	115	104.610	-do-
			e) 6-0ssi Voikel Farmers Council	1990-91	-	851	1194.020	-do-
			f) Thruchinnapuran Farmers Council	1990-91	-	32	44.370	-do-
			g) Nothrayan	1990-91	-		56.000	-do-
			h) old Muratha	1990-91		739	1103.285	-do-
			i) A- 9 Malayappa Nallur Farmers Council	1990-91		170	134.000	-do-
			j) A-29, Nanja Voikal Farmers Council	1990-91		215	500.00	-do-
			k) Sali pperi Water Society of VaIap par Mahilacheri Channel			122	130.000	-do-
		2. Lower Bhawni Command:						

1	2	3	4	5	6	7	8	9
			a) M - 6 ,Farmers Council	1988-89		1650	625 .890	To demand required quantity of water from Government to distribute water to its members to resolve supply of inputs to members etc.
			b) L-14 Farmerss council	1989-90		1280	1275.230	
			c) L-3 Farmers Council	1991-92		2170	2170.050	
			d)M1 Farmers Council	1990-91		2900	2892.650	
			e) N-13 Farmers Council	1991-92		1650	1645.020	
		3 . Sathanur Reservoir command						
			a) 5 R Distribitary Farmers Council	1989		738	438.120	-do-
			b) 4R Distributary Farmers Council	1990		759	762.300	-do-
			d) 6R Distributary Farners Council	1990		377	285.725	-do-
		4. Parambikulaam Aliyar Project:						
			a) Alagumalai Kulathu Palayam	1990	Kulathu palayam Distributer	64	142.130	To deaiand required

1	2	3	4	5	6	7	8	9
			Branch Canal Rotational irrigation Farmers Association					quantity of water from Government to distribute water to its members,
			6) 92000 Distributary Rational Irrigation Farmers Association	1990	Distributary of P.M.C.	42	73.370	to resoIve conf1icts and supply of inputs to members
			c) 2(R) Field both ie Sadayapa1am Distributary Rational Water Supply Aaaociation (RWS)	1990	2(R) Field both ie SadayapaIam Distributary in P. K. Palayam Br. Canal			
			d) 9R Br. Distributary Kamalapatty Rational Water Supply Asaociation	1990	Distrbutary 1,6,440 of Kamalapatty	40	69.050	
			e) Sadayapalam Distributary RWS Association	1990	31 Nerku SodyapaIayaai Distributary	33	79.640	
			f) 6L Sluice Kattur Distributary RUS Association	1990	Sluice No.6L at 49 16,200 of Kattur Distributary at 6.500 in P.M.			

1	2	3	4	5	6	7	8	9
		5. Periyar Vaigai Command:	a) PD . 8 Farmers Council	1990-91	-	2241	1465.500	To demand required quantity of water from Government to distribute water to it members to, resolve conflict and supply of, inputs to members etc.
			b) PD. 7 Farmers Council	1990-91		1544	993.870	
			c) PD. 5 Farmers Council	1990-91		29	48.250	
			d) PD. 11 Farmers Council	1990-91		3252	1742.88	
			e) PD - 10 Farmers Council	1990-91		329	202.84	
			f) TM.5 Farmers Council	1990-91		1 171	495.62	
			g) P S - 4 Farmers Council	1990-91		2968	1572.505	
			h) PS -2 Farmers Council	1990 -91		1676	999.215	
12.	Uttar Pradesh	Sarda Sahyak	Basrahiya Water User Cooperative Society	1987	5 outlets on Amethi Distributary	310	274	Society purchase water on volumetric basis and supplies to, the farmers on area basis

Source: Farmers Participation in Irrigation Water Management, Ministry *of* Water Resource (August ,1991).

Annexure - 6.3
(Para 6.6)

Legislative Provisions in different State for Constitution of Users Groups and their involvement in Water Management

The usefulness of water users association variously described as irrigation panchayats, water committees, cultivators cooperatives pipe committees has been recognised and given effect to in different state irrigation statutes. It was felt that these institutions could play an effective role in the construction, repair and maintenance of small and minor irrigation works such as tubewells, field channels and watercourses, the distribution of water for irrigation among cultivators, the collection of water charges etc. requisition of labour in emergency, settlement of disputes and the protection of irrigation works from encroachment and damage. A survey of the statues of Irrigation/CADA of a few states reveal the following status.

Madhya Pradesh

Under the Madhya Pradesh Irrigation Act, 1931 Irrigation panchayat may be established for every village. The collector has the discretion to establish an irrigation panchayat for a mahal chak in which the permanent holders and occupiers of land have entered into an agreement which comprises a compulsorily assessed area.

The panchayat is to consist, of one sarpanch and two or more members elected by the permanent holders and occupier of land under agreement of compulsorily assessed among themselves. The election is subject to the approval of the collector who can nominate one member to the panchayat. The collector cam also dismiss any member by giving reasons in writing and dissolve any panchayat subject to appeal to the Commissioner. The officially stated purposes of formation of Irrigation Panchayats are: (a) distribution of water (b) collection of irrigation fees and remittance to the treasury (c) assisting official in resolving disputes, (d) repair and maintenance of water courses and (e) punishment of irrigation water offenders.

Uttar Pradesh

In Uttar Pradesh under, the Uttar Pradesh Kshetra Samitis and Zila Parishads Adhiniyam, one of the function of the Kshetra Samitis is the construction, repair and maintenance of minor irrigation works lying wholly within their jurisdiction and supply of water from th>em and from other sources subiert to financial limits fixed by the state Government. Likewise is the function of the Zila Parishad for construction and maintenance of minor irrigation works lying wholly within district.

The Uttar Pradesh Panchyat Raj Act, 1947 empowers the state Government to require any Gaon Panchayat to construct, repair or maintain any small irrigation project and regulate the supply of water therefrom for irrigation purpose. The Act also provides that the Gaon Panchayat will have control over all water ways other than canals (as defined under the Northern India Canal and Drainage Act) situated within their jurisdiction and not being under the control of the state Government.

The Northern India Canal and Drainage Act as applicable to Uttar Pradesh was amended in 1963 to provide for the active cooperation of the Gaon Sabhas in che construction of watercourses and field channels.

Under the Act, the Division Canal Officer "(D.C.O.) is required to prepare schemes for the construction of water courses and transmit them to the Gaon Sabhas and Block Development Officers concerned, for their comments. Within three days of the receipt, the scheme is to be affixed by the Gaonsaba on its notice board and within twelve days thereafter, the scheme is required to be considered at its meeting and its decision is to be communicated to the D.C.O. On receipt of the decision of the Gaon Sabha, the D.C.O. can call upon the Gaon Sabha by notice in writing to implement the scheme within a specified time limit.

On receipt of the aforesaid notice, the Gaonsabha will give notice to persons on whose lands the Water courses are proposed to be constructed, either to gift or surrender lands in its favour for implementation of the scheme. If lands are not transferred in the above manner, the Gaon Sabha may either purchase the land or move the state Government to acquire it or if the land is required for a limited period only, apply to the requisitioning authority under section 6 of the Uttar Pradesh Rural Development (Requisitioning of Land) Act, 1948 to requistion of land. Such land acquired or requisitioned will be used for the construction of water courses. As regards the actual construction, the Goansabhas may give the beneficiaries the option of construction within a specified time and in case of thier failure to do so they themselves can construct.

The Act vests powers of inspection of the D.C.O. in respect of water courses constructed by the Gaon Sabha. The D.C.O. will approve such construction if the Gaonsabha has complied within the, scheme pre-passed by him. If not, he can call upon the Gaonsabha by a written order to remove and remedy all the defects in the construction. The Act further empowers the state Government to construct water courses on its own when the Gaonsabha fails to implement 3; the Scheme. All the watercourses and all work carried out by the State Government in connection with the implementation of the scheme will vest in the Gaon Sabha. For the purpose of recovering the cost of land for water courses, the government has been empowered to charge a levy at the rate of one rupee per annum per hectare. Similarly to recover the cost of construction a levy of Rs.1.50 per annum per ha is permissible.

The command Area Development Authority in Uttar Pradesh came into being under the Uttar Pradesh Commend Area Development Act, 1976. The authority has 14 members. There are district committees under the Chairmanship of the Collector for preparation of land development plan and execution. At the lowest level is the Chak Sabha a general body of the outlet beneficiaries responsible for on-farm development and maintenance.

With regards to the Chak Sabha and ChaK Samiti relevant provision of the Act are:

The members of the Chak Sabha, at a specially convened meeting called by the Assistant Soil Conservation Inspector, will elect members of chak samiti by show of hands. The Chak Samiti comprises five members of whom one will be a member of the Scheduled Caste (preferably small or marginal) one tailender, one a middle reach farmer (marginal or small) and two from among farmers in general.

Out of the five elected members, the Chak Sabha will elect one Chairman for the Samiti and one Secretary cum Treasurer. Among other qualifications, the Secretary is required to be a matriculate, having working knowledge of arithmetic.

The Chak Sabha are to meet not less than once a year between June 15-30 for the annual meeting.

The chak Samiti will have a tenure of three years, after which fresh election for another Chak Samiti will be held.

Their powers include.

(i) execution of works of construction and maintenance given by the BSA (Bhumi Sanrakshan Adhikari) ;

(ii) getting works executed on behalf of members and recovering costs;

(iii) arbitration and settlement of disputes;

(iv) levying fines for unauthorised irrigation, etc;

(v) levy fees on members of the Sabha as may be prescribed by the Government to implement warabandi etc.

Duties include meeting at specific intervals, assisting Government in construction/ maintenance, keeping the irrigation network in good repair maintaining accounts and the like.

Bihar

In Bihar under the provision of the Bihar Irrigation and Field Channel Act 1965, the duty to construct field channels lie mainly on the Grampanchayat. It provides that if it appears expedient to the Collector on the report of an officer of irrigation department that with a view to utilising the irrigation potential created by an irrigation work or watercourse, field channels should be constructed in any area which is within the local limit of any Grampanchayat he may give a notice in prescribed form to the panchayat samiti concerned, containing the exact location of the sluice or outlets on the irrigation work or water course and specifying the area of irrigable land to be served by the same and direct the panchayat samiti concerned to get field channels constructed within six months from the date of the notice. The panchayat samiti is thereafter empowered to direct the executive committee of the panchayat concerned to get such field channels constructed within specified time, which shall not be more than four months from the date of the issue of such direction. The executive committee is then required to serve on all the beneficiaries notices in the prescribed form directing them to construct such field channels at the cost within a specified period which shall not be more than two month from the date of notice and the beneficiary to construct the channel. The executive committee itself, on application made to it, shall construct the channels within specified time allowed by the panchayat samiti on the funds being provided by the latter. If the executive committee also fails to construct, the panchayat samiti itself shall construct the channels. If within a period of six months from the date of service of notice about the construction of field channels they are not constructed by the beneficiaries or the executive committee of the Grampanchayat or the panchyat samiti, the Collector may get them constructed through the engineering staff of the Government. For the purposes of the construction the panchayat samiti as well as its executive committee have power to acquire lands. The panchyat samiti has also a duty to see that the channels are maintained by its executive committee.

Kerala

Under the Travencore Cochin Irrigation Act: 1956 the local panchayats have been entrusted with the work of construction repair and maintenance of all petty works. These works include all irrigation works useful for the drainage or protection to an extent of area not more than five acres. For financing itself, the panchayat has been empowered by the Act, with the prior permission of the stats Government, to levy annual cess on area it benefited by petty irrigation work constructed, repaired or maintained wholly or partly at its cost. The cess has to be fixed on an acreage Basis ensuring not more than three percent return on this capital expenditure incurred by the panchayat. A further ceiling of rupees three and fifty paise per acre has also been fixed by the Act. The rate fixed by the panchayat has been made final under the Act.

The Kerala Command Area Development Act 1986.

Section 17 of the Act deals with association of farmers and committees. 3 level associations/ committees have been stipulated.

(i) Beneficiary Farmers' Association

Farmers benefited by one or more pipe outlets may form an association, which may be registered under the Societies Registration Act. The functions of the associations include construction, maintenance, repair and up keep of the irrigation system under the pipe outlet, implementation of warabandi, regulation and control of water supply for irrigation by volumetric -measurement, prevention of , unauthorised and unlawful use of water etc. The exact constitution of committee is not specified in the Act.

(ii) Canal Committee

The Command Area Development Authority may constitute a canal committee for each branch canal consisting of members drawn from irrigation department, agriculture department, cooperation department, presidents of each of the beneficiary farmers' association for the pipe outlets of the canal, representative from the credit agency and other members not exceeding five. The committee's function includes equitable distribution of water, uniform agricultural practices in branch canal and to coordinate the functions of the beneficiary farmers association.

(iii) Project Committee

The Government may constitute a project committee consisting of members from irrigation department agricultural department, cooperative department, one representative each of the canal committees, MLA and MP representing the project area and other members not exceeding five. The committees function include coordination of the function of the canal committee and ensuring equitable supply of water to different area etc.

Andhra Pradesh

Under the Andhra Pradesh Irrigation Utilisation and Command Area Development Act 1984, there is provision for a pipe committee for each pipe outlet consisting of a President, the chief executive, and members elected by the land holders under the pipe out-let in a single sitting as decided by the Irrigation Officer, either by show of hand or secret ballot. The pipe committee will consist of five to seven member representing all zones. Zones are contiguous sub units of a chak or chacks.

The main functions of the pipe committee are: -

i. (i) Construction, repair maintenance of irrigation system under the pipe at the cost and expense of land holders and recover the cost in such a Banner as prescribed as arrears to land revenue.

ii. (ii) To enforce warabandi.

iii. (iii) To regulate water supply by volumetric method as prescribed by Irrigaton Officer.

iv. (iv) To prevent unauthorised irrigation.

v. (v) To supervise and prevent water waste and damage to the system.

vi. (vi) To perform such other function as prescribed for water regulation and improved farm practices.

vii. (vii) As regards settlement of disputes, the pipe committee shall, after receiving complaint, issue notice to the concerned parties. If it cannot reach a compromise, it can refer matters to the Irrigation Officer.

Maharashtra

The Maharashtra Irrigation Act, 1976, which was enacted with a view to unifying and amending the law relating to irrigation in the state of Maharashtra, envisages the formation of water committees. Earlier the Model Irrigation Bill 1976, formulated by the Central Government and recommended for adaption by the State Government has introduced the concept of water committees with varied powers in the administration of irrigation works.

The Maharashtra Act regulates supply of water from irrigation works in three ways: -

- Supply of water on volumetric basis
- Supply of water under irrigation agreements.
- Supply of water under scheme.

The formation of waters committees is contemplated under the following situations.

viii. (i) Volumetric Supply of water

Volumetric supply of water is regulated under the Act, from a canal which is provided with a device for measuring water and where the holders or occupiers of not less than 51 percent of the lands or not less than 51 % of the holders or occupiers of the land, consent in writing to the canal officer to receive supply of water and to form a water committee of all such holders or occupiers for distribution of such water. On receipt of such written consent the canal officer will sanction supply of water on volumetric basis and direct the holders and occupiers

of land to form the committee within a period specified in the orders. If they fail to form the committee, the canal officer will form one after consultation with the beneficiaries.

Composition of Water Committee

The Committee will consist of five persons one of whom will be a Sectional Officer or his nominee and the remaining four to be appointed by the beneficiaries from amongst themselves. The Act mandates the section officer or his nominee to give technical or other guidance and assistance to the committee and guide it in its deliberations with a view to securing proper appointment and distribution of water to beneficiaries.

The Committee may regulate its own procedure for the transaction of its business.

Function

The functions of the committee are: -

i. to measure and receive the quantity of water at measuring device and to ensure proper apportionment and distribution among its members;

ix. to receive and enquire into complaints regarding distribution of water and take immediate steps to rectify them.

x. to prevent unauthorised use or waste of water.

xi. to assist: the canal officer in discharging his duties and in detecting unauthorised use of water.

xii. to ensure that only sactioned crops are brought under irrigation.

Any beneficiary aggrieved by the decision of the committee may appeal to the Executive Engineer within 30 days of such decision. -

(ii) Supply of Water under Scheme

In situation where the Appropriate Authority is of the opinion that a canal is likely to irrigate lands not exceeding 200 hectares (500 acres) in area and with a view to providing supply of water more economically in the public interest, the Authority may, by notification, in the official Gazette, prepare a draft scheme for supply of water from such canal to such lands.

The Act makes it mandatory to provide for entrusting the management of the canal and distribution of water therefrom to the Water Committee. The draft scheme is to contain details regarding.

i. The area

xiii. Survey number of lands to be included and the names of landholders and occupiers.

xiv. The period of water supply to the lands.

xv. Crops permitted to be grown

xvi. Water rate

xvii. Finances payable by the Appropriate Authority to the water committee.

The draft scheme is to be finalised after hearing from the affected land holders and occupiers.

On the finalisation and publication of the scheme in the official gazette and village Taluka and district headquarters where the lands are situated, the Appropriate Authority shall appoint a water committee to execute the scheme, subject to the superintendence, direction and control of the canal officer.

The composition of the committee is similar to the one in respect of one set up for supply of water on volumetric basis.

The duration of the committee is two years . The Appointing Authority is empowered on terminate the appointment of all or any member of the committee at any time by a written order without assigning any reasons.

Functions of the Committee

i. To manage the canal and ensure proper distribution of water to the lands included in scheme.

xviii. To decide the crops to be grown in accordance with the scheme.

xix. To carry out day to day maintenance and repairs of the canal.

xx. To maintain the irrigation system of the canal beyond the outlet in a fit state for the supply of water.

xxi. To assist the canal officer in the detection and prevention of encroachments on the canal lands and on the canal lands; prevention of damage to the canal and for repairs to the canal.

xxii. To impose penalty not exceeding Rs.200/- for unauthorised use of water or use of water out of turn or for growing crops in violation of the provision of the scheme.

xxiii. To maintain accounts of its finances

Any person aggrieved by the decision of the Committee may appeal to the canal officer within 45 days.

The Appropriate Authority is empowered to call for records of the water committee's decisions within a period of two years to examine the legality or propriety of its actions. Consequently the Authority may uphold, annul modify or [j] reverse the committee's order after giving a fair hearing to persons likely to be affected by its decision.

(iii) Supply of Water from Second Class Irrigation Works

The Act defines 'Second Class Irrigation Works' to mean, canals, channels, streams, rivers, wells, tubwells, artesian wells, pipes, artificial or natural reservoirs and bhandaras which have been declared under the Bombay Irrigation Act, 1987 as Second Class Irrigation Works before the commencement of the Act.

The Act makes it mandatory for the constitution of a Water Committee for each village in Which a Second Class Irrigation work is situated for the regulation of water supply.

The Committee is to consist of five members of whom one will be Talathi and the remaining four members to be nominated by the canal officer not below the rank of a Superintending Engineer, from the irrigators who has a right to take water as provided in the irrigation Record of rights. The members hold office for two years and are liable to be terminated without assigning any reasons.

Functions

i. The Committee shall assist the canal officer in detecting and preventing encroachment on lands pertaining to such irrigation work, prevent damage to such work and report to the canal officer any willful damage caused there to,

xxiv. Shall be responsible for the distribution of water according to regulations made with the approval of the state Government or any authorised officers,

xxv. To decide the crops to be grown in phad and other system,

xxvi. To ensure that land holders and occupiers, who are eligible to carry out repairs to such irrigation work do their duty.

xxvii. To report to the canal officer the names of those who fail to carry out their duties stated in (iv).

xxviii. To levy fine not exceeding Rs.200/- for unauthorised use of water or for any out of turn or irregular methods adopted for irrigation.

An aggrieved person may file an appeal within 30 days to the Superintendent.

Legislative gaps and difficulties

The survey of relevant legal provision shows that not all state irrigation acts provide for people's participation in irrigation management. For example, the Northern India Canal and Drainage Act 1873, (as applicable to Punjab and Haryana), the Bengal Irrigation Act 1876, the Bombay Irrigation Act 1979, as applicable to the state of Gujarat (all of preindependence vintage), Rajasthan Irrigation and Drainage Act 1954, Orissa Irrigation Act, and Mysore Irrigation Act 1965, do not contain any provision for association of beneficiaries in the management and administration of irrigation works. This is a serious gap in state legislation.

However, even those state legislation surveyed earlier provide for people's participation only in small community irrigation systems. Water Committees, Irrigation Panchayats, Water Cooperatives, Pipe Committees etc. exist for a mahal, chak, village or outlet command. These users' associations are required to function under the active control of the officials of the irrigation department. The legislative bureaucracy would still direct the beneficiaries about their tasks. The Acts provide for detailed structural frame work with composition, powers and duties of these associations including the power of the bureaucracy to terminate the membership of beneficiaries. There is, therefore, a need to place greater confidence in elected associations or panchayats as a better agent of social change.

The participation of the farmers in the irrigation management depends on the attitude of the administrators towards the target group and their skill and ability to involve the latter in the successful achievement of the objectives of irrigation. The administrators have to adopt a development and motivational attitude towards their clientage group.

Consequently all state irrigation acts must be amended to incorporate provisions for the formation of water users associations not just in small irrigation works but also in big irrigation projects. Now with large state managed irrigation systems and the establishment of Command Area Development Authorities (CADA) for several major and medium irrigation projects, there is a need to legally legitimise the operation of water users associations in these projects for irrigation management of at least minor/outlet commands right from project planning stage. The concept of irrigation management by the users within an outlet/minor command must be widened to include on-farm development works, construction and maintenance of water courses and field channels, equitable water distribution, construction and maintenance of field drains to counter problems of water logging and salinity and protection of irrigation works.

The concept of partnership between the irrigation bureaucracy and the beneficiaries should be given effect to in the statutes. The adoption of this concept would do away with provisions of the present statutes which give controlling and paternalistic powers to the department. Instead

the laws should have enabling provisions conferring adequate autonomy to these associations to decide on their composition, duties, powers, working procedures and sanctions for non-compliance.

It needs to be emphasized that legislation is only one of the means for initiating social change. For laws to be successful as initiators of social changes, the target group for whose benefit the laws create institutions for achieving their participation, must be made aware of the existence of such laws and the rules made there under. A great onous lies on the irrigation development administrators to enlist the active and willing cooperation of the farmers whose destiny the irrigation development plans are to change. Suitable attitudinal changes in the department are also called for.

Source: Farmers Participation in Irrigation Water Management, CAD, Division, Ministry of Water Resources (August, 1991).

Annexure - 6.4
(Para - 6.8)

Govt.of Maharashtra, Irrigation Department's circular containing guidelines in respect of formation of Outlet Committees/Water Users' Organisations.

GOVERNMENT OF MAHARASHTRA Irrigation Department Government Circular Mo. CME 1091/(122/90)-IM(R) Mantralaya, Bombay - 400 032 Dated the 21st March 1991.

READ

1) Public Works Department Government Resolution No.3647/36-11 dt. 30th May 1947.
2) Public Works Department Government Resolution No. 3647/36-11 dt. 17th May 1951.
3) Irrigation & Power Department No. CHE 2968/110319-1 (4) dt. 21st September 1968.
4) Irrigation & Power Department No. CME 1080/6332 (1619)-IMG-3 dt. 9th January 1981.
5) Irrigation & Power Department No. CME 1080/14368 (1653)-IMG-3 dt. 19th January 1981.
6) Irrigation Department No. CME 1081/(1902)-Management-3 dt. 17th March 1982.
7) Irrigation Department No. CME 108I/(1902)-Management-3 dt. 7th January 1983.
8) Irrigation Department Ho. CME 1088/(88/88) -I (R) dt. 16th November 1988.
9) Irrigation Department No. CME 1090/(122/90)-IM(R) dt. 1st November 1990

PREAMBLE

Maharashtra Minor Irrigation Project has been undertaken by the Irrigation Department of Government of Maharashtra with the assistance from USAID. Guidelines in respect of formation of Outlet Committees and Water Management through water User's associations has already been issued vide above reference. The question of issuing such guidelines in entire minor irrigation sector was also under consideration of Government for some time.

2. Government in Irrigation Department issued instructions from time to time regarding formation of Canal Advisory Committees/Water Panchayat Committees vide

i. PWD GR. No. 3647/36-11, dt. 30th May 1947

xxix. PWD GR. No. 3647/36-11, dt. 17th May 1951

xxx. I&PD No. CME 2968/110319-1 (4) , dt. 21st September 1968

xxxi. I&PD No. CME 1080/6332 (1619)-IMG-3, dt. 9th January 1981

xxxii. I&PD No. CME 1080/14368(1653) IMG-3, dt. 19th June 1981

xxxiii. ID No. CME 1081/(19 02) Management-3, dt. 17th March 1982

xxxiv. ID No. CME 1081/(1902) Management-3, dt. 7th January 1983

xxxv. ID No. CME 1088/(88/88)-I(R), dt. 16th November 1988

xxxvi. ID No. CME 1090/(122/90)-IM(R), dt. 1st November 1990

3. Government in Irrigation Department had further circulated some draft rules for outlet committees for comments vide letter No. CDA 1083/1574/1137/CADA(I & Agri) dated 28-3-85.

4. Government had also circulated vide letter No. IDB 1085/630/IR dated 26-7-88 a copy of draft agreement proposed to be entered into by Government with the W.U. Associations for taking over the irrigation management of a particular minor/distributory receiving water on volumetric basis. The Revised Draft Agreement copy for Minor Irrigation Schemes is enclosed herewith. The Government of Maharashtra have recently issued the Circular mentioning the guidelines for water Users Organisations on 90 new Minor Irrigation Schemes and 12 existing Minor Irrigation Schemes for Maharashtra Minor Irrigation Project undertaken by the Irrigation Department of Government of Maharashtra with the assistance of USAID vide Circular No. CME 1090/(122/90)-IM(R) dt. 1-11-1990.

After taking into consideration all the studies done so far and the practices laid down hereinbefore, Government has now resolved that participatory management approach will be intensified for obtaining optimum benefits from all the minor irrigation projects. For this purpose all the beneficiaries under respective Minor Irrigation Schemes will be actively involved in decision making process of canal water releases and scheduling, optimum water utilisation, operation, maintenance and management of the irrigation system through the formation of Outlet Committees (OC) at individual outlet levels and water Users Association (WUA) at the Minor Irrigation Scheme level for ultimately taking over the irrigation management and operation and maintenance of the irrigation system. The above objective cannot be achieved over-night. A systematic progress has to be evolved for the formation of outlet committees and to form association (WUA) to ultimately take over the entire irrigation management from Government of Maharashtra/Irrigation Department and utilising water on volumetric basis.

To achieve the above objectives, guidelines as per enclosures are notified for the formation of effective Water Users Organisation, in a phased manner for all the new minor irrigation schemes in the State.

Phase I : Initiate development . of an organizational structure, as an interim measure, until the management is taken over by the WUA and

Phase II: Handing over the complete management of the irrigation system with the development of organizational structure of WUA.

These guidelines are, however, being notified for general guidance only. The rules of business are to be framed by the respective Water Users' Organizations/Associations as per their convenience/ local practices but within the broad guidelines notified herein.

By order and in the name of the Governor of Maharashtra.

N.D. VADNERE,
Deputy Secretary to the Government of Maharashtra,

Accompaniment to Maharashtra Government Circular, Irrigation Department No. CME-1090/(122/90)-IM(R), dated 21-3-1991.

Guiding Principles for Formation of Water Users Associations.

Annexure - A

Outlet Committees (OCS)

1. Objectives: To carry out irrigation management within the chak/outlet command.

2. Formations and Membership

Outlet committee will' be a committee representing all the irrigation under a chak. Five irrigators will be elected every two years from all the irrigators, to work as members of outlet committee, who will in turn elect one Chairman from themselves.

For getting elected as member of the outlet committee, the irrigator must not be a defaulter. An a irrigator can contest for only one outlet committee even though he may possess and in more than one outlet within the command of same M.I.S.

Every beneficiary in the outlet command of the M.I. Scheme, shall have right to become the member of the OC in order to derive the full irrigation benefits provided he is not a defaulter but he will cease to remain as a member of the OC if he sells his land in the command.

3. Business year, Jurisdiction and Tenure

Business year for the outlet committee will be from July 1 to June 30. The electons for outlet committee shall take place not later than second fortnight of June. The jusisdiction of an outlet committee will be the command area under the outlet and its tenure will be upto two years maximum (Depending upon the agro climatic zone the period may be modified in individual cases).

4. Function of the Committee

i. To frame the rules and procedures for proper functioning of the outlet committee,

ii. To give concurrence to the proposed planning/layout of Water Course (WC) and Field Channels (PCS) after suggesting the modification if necessary, and to assist the department in the execution of or undertake these works.

iii. To take over from the department and mainting /repair the distribution system below outlet.

iv. To maintain the records pertaining to irrigation, total water received in the rotation including duration, areas under each crop grown, chak maps, etc. - for that outlet.

v. To collect all water applications and to submit them alongwith the information regarding scheduling of water release to the ID/Management Committee.

vi. To assist in following/implementing the irrigation schedule of the outlet and ensuring the completion of rotation in assigned time.

vii. To prevent unauthorised use of water, waste of water and to report the cases of default to the ID/Management Committee

viii. To monitor the inflow from the chak outlet and in case the design flow is not received, the fact to be brought to the notice of the ID/Management Committee for immediate rectification of the fault.

ix. To liaison with ID/Management Committee on matters of irrigation schedule, water releases, unauthorised use of water etc.

x. To assist the ID/MC in collection of water charges from the irrigation promptly.

xi. To resolve all disputes reg, water use, distribution, conveyance, etc. and seek ID/MC assistance if required to resolve the dispute.

Accompaniment to Maharastra Government Circular, irrigation Department No. CME 1090/(122/90) IM (R), dated 21-3-1951.

ANNBXURE 'B'

MODEL STRUCTURE FOR WATER USERS ASSOCIATION (Phase - I)

1. Tank Management Committee (TMC)

i. Objective: Irrigation management of the M.I.S. till such time that Water Users Association is formed.

ii. Formation and Membership

The tank Management Committee will consist of :

i. Five members, elected from group of eligible irrigators, out of which 2 each will be from Tail and Middle outlets and one from head outlet. The classification of outlets as tail, middle and head will be done by concerned E.E. well in advance.

ii. The concerned Section Officer (JE) will be an ex-officio member of TMC. He will participate in the committee proceedings but will not have voting right.

iii. All the eligible irrigatior in the command of M.I.S. will have the right to vote to elect the members of the Tank Management Committee. E.E. or his nominee shall convene a meeting of all the eligible irrigators with a notice of not less than 15 days, mentioning the date, time and place thereof for holding the elections of candidates for TMC. The election shall be made by majority of voters. The election officer incharge of conducting the election shall notify the results of such election on the same day and communicate the same to concerned officers/agencies.

iv. The tenure of each member will be for a period of 2 years or until WUA is formed. The Section Officer shall ensure that the office bearers i.e. Chairman and Secretary are elected by the elected members TMC within 7 days of holding the General Body Election.

c) Business Year and Jurisdiction

The business year of the Tank Management Committee will be from July l of each year. The election for members of Tank Management Committee will be held not later than second fortnight of April each year (Depending upon the agro climatic zone, the period may be modified in individual case. The activities of Tank Management Committee will extend over the entire command area served, by the M.I. tank.

d) Functions of Tank Management Committee

The functions will be as follows:

i. To decide all the matters pertaining to release of water from the tank, the rotation period, Irrigation Scheduling (Pali-Patrak) discharge to be released in different minors etc. as far as its jurisdiction is concerned. The Tank Management Committee shall collect the water applications from outlet committees/irrigators and present them to canal inspect section officer, after duly completing them.

xxxvii. To decide the crop pattern for each season for the command of M.I. Scheme, their respective areas taking into consideration the advice from ID and AD on the likely availability of water, crop water requirement of different crops, date of planting and harvesting etc.

xxxviii. To frame the rules in relation to performing the various functions of the Tank Management Committee.

xxxix. To allocate water outletwise in every season, and to ensure no unauthorised use of water and to prevent the Waste of water.

xl. To coordinate the working and operation of outlet committees and to keep liaison with them. To assist ID in holding panchnamas etc. in accordance with the rules against those who commit such offences as are mentioned in. iv) above.

xli. To settle mutually the complaints arising in connection with the (i), (ii), (iii), (iv), (v) above and to communicate in writing their disposal together with the complainants acceptance of such disposal, to concerned Government Officers.

e) Tank Advisory Committee and Linkage of Irrigation Department with Tank Mangement Committee

The Irrigation Department Officers shall provide all possible assistance for smooth functioning of the TMCs and nurture them till they are able to form Water Users Association (WUA). For this purpose a Tank Advisory Committee (TAG) consisting of TMC, SDO (ID) SMD (AD) and AO representative shall be formed which shall meet at least quarterly or if required by TMC earlier too. The TAG shall provide required information and advice/assistance to TMC optimum irrigation management.

Illustrative Role of ID Officers :

i. SDO to notify the classification of outlets as tail, middle and head prior to the first irrigation water release.

xlii. The SDO shall notify the list of eligible irrigation of the MIS not later than 15 days prior to issuance of notice for holding election.

xliii. SDO to convene meetings of all eligible irrigators for electing members of TMC per Section 1b (iii).

xliv. JE shall establish good working relationship with irrigators and motivate them to form outlet committees.

xlv. The concerned Section Officer (JE) shall work as ex~ officio member of the Tank Management Committee and shall attend all the meetings of Tank Management Committee but shall not have voting right in the meetings of the Tank Management Committee.

xlvi. If in the opinion of the Sectional Officer the decision of the water management Committee is likely to cause injustice to any 07; the irrigators or is against the laid down policy of Government then Committee will seek decision from the Executive Engineer concerned. The decision of the Executive Engineer in such cases shall be final.

Accompaniment to Government Circular irrigation Department No.
CME 1090/(122/90) - IM(R), Dated 21.3.1991.

ANNEXURE - C

GUIDING PRINCIPLES OP WATER ASSOCIATION (WUA)
Phase II

1. FORMATION OF WUA

The WUA can be formed for a particular M.I. tank when a majority of the irrigators resolve to associate themselves to form WUA for improved irrigation management. However, the ID shall agree to deliver water on volumetric basis only when occupiers of not less than 51% of the lands or not less than 51% of the holders or the occupiers of the lands from that particular M.I. scheme or its minor canal show their consent to take water on payment on volumetric basis. Any eligible irrigator can become a member of WUA. All the members of the WUA General body, will elect a Management Committee from themselves to manage the affairs of the WUA.

If there are more than one village in the command of a M.I. Schemes. then separate water users organisations (WUA) can be formed for each village which will then constitute a single WUA at the MIS level to deal with all the matters of the particular MIS with I.D. A D and all other allied Government of Maharashtra Departments/Institutions. However, care will have to be taken to see that formation of such separate WUOs is practicable from the point of view of distribution of water among the different WUOs. No WUO will be formed if the area served by the WUO is less than 20% of the total command or 100 ha. whichever is smaller.

2. OBJECTIVES

The main objectives of the WUA/WUO shall be as follows:

i. To receive the allocated quantity of water at the measuring device and to arrange its distribution among members for irrigation purpose and to make payment thereof.

xlvii. To ensure equity in allocation and distribution of water.

xlviii. To facilitate dissemination, among the members, the information/latest technology to be provided by GOM/AD regarding the proper and suitable cropping pattern that can be adopted and their requirement of water, seeds, fertilizers and all other necessary inputs.

xlix. To carry out day to day maintenance and repairs of the . . entire distribution system including all water courses/field channels under the jurisdiction of the - WUA/WUO .

l. To resolve complaints, if any regarding internal distribution of water, to impose penalties for unauthorised user of water if any.

3. BUSINESS YEAR AND JURISDICTION

The business year of the WUA will be from July 1 of each year. The election for the vacant posts of members of Management Committee shall be held not latter than the second fortnight, of June each year.

The jurisdiction of the WUA will extend over the entire command area served by M.I. Tank.

4. MANAGEMENT COMMITTEE (MC)

The number of members of the Management Committee of the WUA will depend on the total number of outlet committee (say 1/3 to 1/5) .The minimum number of the members of management Committee being five and maximum limited to seven. The Chairman of outlet committee shall not be eligible to contest for the Management Committee of the WUA/WUO. A member will cease to be a member of management committee for two years if he loses his status as bonafide irrigator. The members of the MC will elect, by majority vote, as soon as the election of members are over, one Chairman and Secretary from themselves. The tenure of Chairman and Secretary of MC will be for two years. The tenure of each member of the Management Committee will also be two years. About half of the members shall retire in rotation each year for the purpose of filling such vacancies. In the first year of formation of this WUA about half the number of members in the order of percentage of votes secured for two years and the rest for one year.

5. FUNCTIONS OF THE MANAGEMENT COMMITTEE (MC)

The functions of the managing committee will be as follows:

i. To decide all the policy matters of the WUA from time to time and to frame rules to perform all functions of the Management Committee.

li. To enter into an agreement with GOM/Irrigation Department, for securing irrigation water c volumetric basis.

lii. To decide the crop pattern for each season for the 4c % command of the M.I. Scheme and their respective areas taking into consideration the likely availability of water, crop water requirement of different crops, dates of planting and harvesting etc.

liii. To decide the period of irrigation to be allocated to each outlet, the rotation period and the discharges to be let in the distribution system.

liv. To allocate water outlet wise in every season.

lv. To maintain the entire distribution system in good working condition.

lvi. To keep liaison with the outlet committees and with any other committees/groups /individuals for meeting the objections.

lvii. To decide the service charges, over and above the water rates fixed by GOM/ID to be charged from members/non-members of the society and also to share the profit amongst members.

lviii. To frame rules of business of the WUA for carrying out all the executive functions as and when required.

lix. To perform any or all functions in furtherance to the objective of the WUA.

lx. To receive grants from GOM/ID for the maintenance and special repairs of the distribution system and execute such works also.

Accompaniment to Government Circular/ Irrigation Department NO.
CME 1090/(122/90)-IM(R), dated 21/3/1991.

ANNEXURE 'D'

BROAD PRINCIPLES TO BE INCORPORATED IN THE AGREEMENT BETWEEN IRRIGATION DEPARTMENT AND WATER USERS ASSOCIATIONS

i. The right, to utilize all the water in M.I. Tank (excluding bonafide reservation for Non Irrigation use from time to time).

lxi. The WUA shall receive water for irrigation purposes only on volumetric basis as per the schedule prepared by WUA.

lxii. The WUA will distribute the water among members and non members.

lxiii. The WUA will decide the cropping pattern for adoption in the command.

lxiv. The WUA will pay the charges for water to Government at prescribed volumetric rates by the prescribed dates. The WUA shall charge the water rates as prescribed. GOM/ID in addition, may also collect service charges (to be determined by WUA) over and above the water rates from the members/non members.

lxv. The WUA shall maintain the entire distribution system. The WUA will get annual grants for this purpose from Government at the rates prescribed by GOM/ID from time to time. (to be spelled out clearly in the Agreement.)

lxvi. The GOM/ID shall maintain the M.I. Tank head sluice and measuring devices, meteorological laboratory, etc. in good condition and shall provide all relevant information on meteorological date water availability, etc. to WUA.

lxvii. GOM/ID shall release water for irrigation as per schedule prepared by WUA.

lxviii. GOM/ID shall provide additional grants for all special repairs of distribution system including structures to WUA.

lxix. All disputes, if any between WUA and GOM/ID shall be settled by a committee consisting of one nominee from ID and WUA each and third member who would be an Executive engineer (other than the concerned E.E.) nominated by the concerned Superintending Engineer. The decision of the committee shall be binding on ID and WUA.

lxx. GOM/ID shall provide necessary technical advice whenever required by WUA free of cost and shall also provide service of technical personnel when desired by WUA on cost sharing basis.

lxxi. GOM/ID shall provide at cost, all scarce materials and T & P to WUA for repairs as and when needed.

lxxii. At least 50% of the beneficiaries in the command should receive water.

lxxiii. If their are indication of water level rising to within 3m from ground in any chak, such chaks may be excluded from supply of irrigation water.

3)	Annexure D Broad principle No. 10.	All disputes, if any between WUA and GOM/ID shall be settled by a committee consisting of one nominee from ID and WUA each and third member who would be an Executive Engineer (Other than the concerned Executive Engineers) nominated by the concerned Superiintending Engineer. The decision of the committee shall be binding on ID and WUA.	All disputes, if any between WUA and local officers shall be settled by Ex. Engineer, Regional Minor Irrigation Cell (RMI). The decision of the said Executive Engineer shall be binding on I.D. and WUA.

Accompaniment with Government of Maharashtra, Irrigation Department's Circular No, CME 1090/(122/90)/IM(R), dated 21.3.19tl.

Subject: Agreement of Water Users Associations, (WUA) with the Government for utilising water in the State Minor Irrigation Projects.

Date:

Draft of the Agreement to be executed between .....……

Co-operative Water Users' Association (WUA) and the GOM (ID) for water utilisation of the .....M.I. Project, Ta..... Dist. ...…..……. for irrigation management of the said Executive Engineer, ... Irrigation Division, Dist. ..... (Of I.D.) And on behalf of the ..... Co-operative Water Users' Association (Register No. .....) the Chairman of the said WUA are executive the agreement at .....on dated.....

As per this agreement, the area under command of the canal of the Irrigation Department's' ……...Minor Irrigation Project is being handed over to above WUA for the period of the agreement for irrigation management purpose. (A copy of the map showing the said command area is attached herewith.) However, the right of ownership on such canals/minors/sub minors inclusive of all structures handed over to the WUA for irrigation management, the land acquised by the Govt, for it and also all other works executed in the said area the- cost of Govt. will remain with the Govt. For the above purpose, the conditions laid down as under in this agreement: are accepted by both the parties. These conditions may be modified if both the parties accord their consent to it.

1. Intention of the Agreement :

The Main objective of the Govt. behind this agreement is to promote the beneficiaries' participation in irrigation management so as to achieve the appreciable increase in crop production by optimum utilisation of the available water in the Minor Irrigation Tank. The rules in respect of WUA and main objective will be as under: -

i. Out of total lands under the c-anal/minor/sub-minor of concerned M.I. Project, minimum 51% of the lands hall be in the jurisdiction o f the WUA or minimum 51% of the holders or the occupiers of the lands from that particular. M.I. scheme shall the members of the WUA. The Govt. desires this percentage to be increased by minimum 4 to 5 percent within next five years.

lxxiv. The WUA shall receive the water from the Govt. on volumetric basis and shall distribute it amongst the members and non members according to their area under crops and to gain the profit by effecting economical use, of water.

lxxv. The WUA shall maintain the field channels, minors and sub-minors under its jurisdiction.

lxxvi. The WUA shall import knowledge of the modern techniques in water management to the beneficiaries of concerned M.I. Project so that the water is used economically and appropriate methods of water applications are adopted.

Govt. will not have any objection, if the WUA desires to incorporate any other objective without compromising any of the above referred objective. Government concurrence will be obligatory in such cases failing which these provisions in the WUA's regulations would stand automatically cancelled. Provision to this effect should be made in Rules and Regulations of the societies.

2. Water Right

(a) The right to utilise all the water in M.I. Tank (excluding bonafide reservation for non-irrigation use from time to time) will be given to WUA. However the Govt. will not be responsible for short receipt or water in reservoir in some years.

(b) If quota- for Kharif Season is not utilsed either partly or fully then the same (balance quota) water will not be made available for next rabi or Hot Weather Season. The WUA will have right to use all yearly water received in M.I. Tank (Depending upon rainfall) during the same Irrigation year. It is expected that this water is used in Rabi and Hot Weather season as per the projected Planning. In practice, however, considering the situation in the Command Area, there will not be any objection for utilising the quantity of water saved during Rabi in Hot Weather Season. However, the water rate will be charged as per the quantity used in respective seasons and the Government will not be responsible for the increased loss of water by, evaporation due to such diversion of quantity of water from Rabi to Hot Weather Season..

(c) Any member who sells his land in the jurisdiction of WUA will automatically cease to be a member and the new owner of the land will be eligible to become a •ember of the WUA.

(d) For every season the WUA shall publish, It? days before commencement of the season, the rotation schedule of canal and shall give it to the Canal Officer concerned. The WUA shall formulate the policy of receiving water and distributing it amongst its members for each rotation and shall inform accordingly in advance to the concerned Canal Officer. The concerned Canal Officer will make arrangement of release of water from the dam as per this rotation schedule. The Executive Engineer, Irrigation Department will inform WUA the name and designation of the concerned Canal Officer within 10 days after execution of this agreement. The water account will be maintained jointly by WUA and Canal Officer. The WUA will not normally get water release beyond committee rotation schedule. However, the concerned canal officer will modify the rotation schedule. However, on certain occasions (like heavy rainfall) it may not be possible to inform 10

days in advance. Under such circumstance, on the receipt of information, it will be the responsibility of the concerned Canal Officer to stop or release the supply of water from the dam. Head Regulatory used for release of water to WUA will be controlled by the Government.

(e) All the landholders in the jurisdiction of the WUA will have the right to become a member of the WUA. Every member will have right to take water in each season. If some members do not utilize or partly utilise their quota, the WUA will have the right to re-allocate the same amongst other members.

Government will not impose any restrictions on cropping pattern and the members of the WUA are free to adopt their own cropping pattern. However, in order to avoid water logging, Govt. will have the right to restrict area under Sugar Cane on each outlet. The WUA shall take care to see that the water table in the command of WUA's jurisdiction remains at a depth of 3 mts. or more from Ground level, For this purpose, the assistance from D.I.R.D., Pune, for monitoring underground water table can be sought by WUA with advance intimation to them.

(f) use of water for Irrigation purpose only The water will be supplied to the Society only for the Irrigation purpose.

If water is required for processing agricultural products, the WUA will have to separately demand water for it and will have to take specific sanction for the same.

If the area within the jurisdiction WUA and within its geographical limits (including the rea that can not be irrigated by flow irrigation), becomes suitable for irrigation and is included by WUA in its jurisdiction after agreement then the water can be used in this extra area as an incentive for utilising the available irrigation potential. However, Such water sanction will not be more than 5% of the available water.

3. Water rate and assessment

The water supplied on volumetric basis for irrigation will be charged as per the prevailing water rates and water cess fixed by the Government. Presently, following year wise water rates have been fixed by the Government:-

Water rates/Royalty charges to be assessed for supply of water from canal on volumetric basis, (per'000'cubic meters)

TABLE NO. I

Sr No.	Place	Season	1st year from 1-7-90	2nd year from 1-7-91	3rd year from 1-7-92	4th year from 1-7-93	5th year from 1-7-94
1	2	3	4	5	6	7	8
l.	At the	Kharif	12	14	16	18	20

head of the	Rabi	18	21	24	27	30
	Hot Weather	36	42	48	54	60

The above water rates are review able every two years after the execution of this agreement and modifications agreeable to both parties can be effected.

4. Rights of Member

Every landowner or occupier of the land in the jurisdiction of the WUA will have the right to become a member of the Association. However, the names of such persons must be on the 7/12 extract. Every member will have to place his water demand to the WUA in the prescribed form and it is obligatory for the WUA to review all such demands of the members and to inform them the decision taken in the specific period. It will be the right of each member to receive water in each rotation and in each season as per the policy laid down by the WUA and as per the season wise quota fixed for the WUA. Under no circumstance the number of members actually taming water or the area actually Irrigated shall be less than 51%. If this percentage falls below 51%, Govt may step the supply of water.

The water rates to be charged to the members of the WUA is to be decided by the WUA itself. The WUA may charge at different rates to the non-member and WUA will have right to collect such water charges from them. However, this rates shall not be more than 130% of the rate applied to members of the Association.

5. Recovery of the Water charges

The sanctioned quota of water on volumetric basis will be supplied to WUA at the head of the canal. At the end of each season the water so supplied will be charged as per the rates mentioned in Para 3 (Table No. I) And will be sent to the WUA on the dates shown below in Table No. II (Please see Sr.No.I)

Statement showing assessment and recovery of water charge

TABLE NO. II

Sr No.	Description	Kharif season	Rabi season	Hot weather
1.	Date of presentation of bill by Govt to WUA	30 Nov.	15 March	15 August
2.	Date of payment of the bill by WUA to Govt.	1 Feb.	1 May	15 Oct.
3.	The last date of payment of bill without 10% surcharge.	30 April	31 July	31 Dec.

Date payment of the bill is shown in Sr.No.2 of the above table (1st February, 1st May and 15th October). If payment is made within the specified period, the association will be given 5% discount: on the amount of the bill. However, if the amount of the bill is not paid within the due dates as shown in Sr.No.3 of above table, 10% surcharge will have to be paid by WUA on the amount of the bill. The Govt will have right to stop the water supply if WUA has not paid the water charges in the given time limit.

6. Maintenance and Repairs of Minor/Sub-Minor/Distributaries

a) Minor/Sub-Minor/Distributaries and all structures within the jurisdiction of the WUA will be jointly inspected before water supply but after the execution of agreement and accordingly the necessary improvements and repairs will be carried out at the Govt. cost for effecting proper water supply. After repairs joint inspection will be carried out again to ensure that the system is in a position to carry expected discharges.

b) It will be a responsibility of the WUA to maintain and repair minor-sub minor/ distributaries and structures on it within their -Jurisdiction. The maintenance grant at the rate at Rs. ("X") will be given by the Govt to WUA. ("X"-Hers the expenditure incurred by the Govt. every year as per the norms decided for maintenance and repairs is to be inserted). After every 2 years a review shall be taken regarding such grant. Generally the following items are including in maintenance work: -

1. Silt-removal from distributaries/sub-minor and proper up keep thereof.
2. Maintenance of inspection path and service roads in proper order.
3. Removal of grass, shrubs and bushes.
4. Maintenance of structures.
5. "Maintenance of Head Regulator and outlet gates etc.

(Note: In case of inadequate maintenance/Govt. will have the right to stop the water supply within 15 days pre intimation or to carry out the repair works on behalf of WUA and to recover its cost from WUA).

7. Maintenance and repairs to field channels and field drains

a) After executing the agreement and before commencing the water supply, the field channels, field drains and all structures within the jurisdiction of WUA, will be jointly inspected and as decided during the inspection, the necessary improvements and repairs will be carried out by Govt. cost. After repairs are carried out, another joint inspection shall be again carried out to ensure that the system has the capacity to carry designed discharges.

b) Regular Maintenance of the field channel and field drains inclusive of al structures

within the jurisdiction of WUA will be the responsibility of the WUA. Government will not sanction any grant for this work. The Government will have the right to stop the water supply if proper maintenance is not done. Generally, the following items are included in the maintenance work:

i. Removal of silt from field channels and field drains.

ii. Maintenance of Inspection path and service road in good conditions.

iii. Removal of grass shrubs and bushes

iv. Maintenance of structures in good conditions.

v. Maintenance of outlet gates etc. in good condition.

(Note: in case of improper maintenance by the WUA, the Govt will have full right either to stop water supply or to carry out the repair of works on behalf of WUA to recover the same from the WUA).

8. Special Incentive

In order to achieve effectively the objective like optimum utilisation of available water, check on unauthorised irrigation, Extending irrigation to as much area as possible, the WUA will be given following special subsidy.

If the water co-operative Societies as per the Government rules and are not availing any management subsidy under any other scheme, then they will be given financial assistance to the extent of 20% of the water charges on payment of their water charges as stated above in earlier paragraph. This financial assistance will not be in the form of reimbursement of expenditure but will be given outright from the water charges.

9. Irrigated on percolation

No separate water rates will be charged for use of water percolating through minor/sub-minor/drains within the command of the WUA. However, the WUA will not have any right on the water due to percolation through main canal and flow in the main nalla.

10. Rights of the Government Officers

The concerned canal officer has the right to inspect the position of water supplies to the WUA, and has the right, to inspect the area under the jurisdiction of the WUA and to inspect at any time or to verify whether the agreement is implemented properly or otherwise. The working of the WUA and record thereof will be inspected from time to time by the concerned canal officer. It will be the responsibility of the WUA to comply with points brought out in such inspection.

11. All disputes in respect of various provisions made in this agreement will be resolved by a committee comprising nominee from Irrigation Department and WUA each and the Executive Engineer of RMI Cell. The decision of the Committee shall be binding on I.D. and WUA.

12. The time limit of this agreement will remain inforce for the five years. Further continuation will be decided with the consent of both the parties.

One representative of the Government will be on the working committee of WUA as a Ex-officio honorary member.

Executive Engineer
Irrigation Division

Chairman

Society (WUA)

Annexure - 6.5
(Para 6.9)

Programme of Transferring the entire operation & maintenance of tube wells to beneficiaries through Panchayat Samities in West Bengal.

A. Selection of Sites

Under West Bengal Minor Irrigation Project with IDA Assistance (Credit No. 1691-IN) installations of 1200 high capacity Deep Tubewells (HDTW), 500 Medium Capacity Deep Tubewells (MDTW), 2940 Low Capacity Deep Tubewells (LDTW), 5400 Shallow Tubewells (STW) and 10,000 Open Dugwells (ODW) and modernization of 200 existing RLI Schemes are envisaged. Sites for these installations are selected by the District Site Selection Committee constituted for each District with following members:-

1	Savadhipati, Zilla parishad	Chairman.
2	Principal Agriculture Officer	Member.
3	Divisional Engineer (RE), WBSEB	Member.
4	Divisional Engineer (O&M) ,WBSEB	Member.
5	Sr. Geologist/Geologist of State	Member.
	Water Investigation Directorate	Member.
6	Executive Engineer of State	Member.
	Water Investigation Directorate	Member.
7	Executive Engineer (A-M)	Member.
8	Executive Engineer (A-I)	Member.

(In case of RLI, Executive Engineer (A-I) is member and the Executive Engineer (A-M) is the member-Convener.)

The following are the principal criteria for selection of sites: -

1. Expected command area should be: -
    a. 40-ha, for HDTW.
    b. 20-ha, for MDTW.
    c. 6-ha, for LDTW.
    d. 6-ha, for STW.

e. 0.4-ha, for ODW.

2. 80% of the land within the command area should be owned by small and marginal farmers in case of HDTW, MDTW,LDTW & STW and 100% of the land in the command area should be owned by small t marginal farmers in case of ODW.

3. Distance of 11 KV line should be within 1.5 Km. for HDTW, MDTW, LDTW & STW.

4. LDTW & STW should be located in such a manner as to form a cluster of 5 to 7 tubewells.

5. The local Panchayat Organization should be agreeable to take over the responsibility of operation and maintenance of LDTW and STW clusters.

6. The installation should be located in such places where desired yield is expected.

7. There should be no other source of irrigation.

8. Site should be located in areas where it is not possible to have irrigation installation through private enterprise.

In case of RLI Scheme, other criteria are as follows: -

(1) Expected command area should be 60 to 80-ha.

(2) 11 KV Line should be within 2.5 Km.

Proposals for these installations are received by the Asst. Engineer/Executive Engineers from the Garm Panchyat direct or through Panchyat Sanities. The Executive Engineer as Convenor of the District Site Selection Committee examines the technical feasibility of the proposals and places them before the District Site Selection Committee for selecting the sites in order of preference.

Transfer of Assets to Panchayat Sanitiess

It has been decided by Govt. of West Bengal that the low capacity deep tubewell and Shallow Tubewell clusters will be handed over to the Panchayat Sanities for operation 6 maintenance. The notification has been issued by the Agriculture (Minor Irrigation) Deptt, in consultation with Panchyat Deptt. Power Deptt. & Finance Deptt. The LDTW & STW clusters are to be handed over to the respective Panchayat Samities as and when the clusters are energised. The Panchayat Samities will take up the responsibility of operation & maintenance of the clusters through beneficiary committee constituted in the manner prescribed in the notification. The Panchayat Samities have been authorized to realize water rates from the beneficiaries to recover the operation & maintenace cost in full and also to generate some surplus for attending major

repair works in future Detailed guidelines for constitution of the beneficiaries committees, duties and responsibilities of Panchayat Samiti, procedure for maintenance of accounts and registered etc. have been given in the notification issued for this purpose. A copy of the notification is enclosed Upto 31/5/92, 286-LDW and 424-STW have already been handed over to different Panchayat Samities and by these installations an irrigation potential of about 8520 ha. (Gross) has been created. It has been seen that installation under management of Panchayat Samities are working satisfactorily and it has been possible to make these installation self-sustaining in respect of operation & maintenance and there has not been any burden on State exchequer on this account.

Methodology for charging water rates at present are varying from place to place. Some Panchayat Samities are charging on crop basis, some on area basis and some on hourly basis. Water rates being charged are higher than the Govt. rates but much lower than the market rates being charged from the privately owned installation.

Government of West Bengal
Department of Agriculture
Minor irrigation wing
M.I.-I Branch

NOTIFICATION

No. 28-M.I.-I/3E-7/88, dated Calcutta, the 5th Jan., 1991. - In exercise of the powers conferred by Section 110 of the West Bengal Panchayat Act, 1973 (West Bengal) Act XLI of 1973), the Governor is pleased hereby to place, Low Capacity Deep Tubewells (LDTW) i.e. Shallow Tubewells fitted with submersible Pumpsets and shallow Tubewells (STW) fitted with centrifugal pump sets, installed and energised on cluster beisis (each cluster having 5 to 7 well points) under the West Bengal Minor Irrigation Project with IDA assistance (Credit NO.1619-IN) as stated in the Annexure-A under the control and management of the Panchayat Samities for subsequent operation & maintenance in the following manner :-

1. Transfer of Assets

a) As soon as the tubewe.lls of a cluster are energised , the concerned Executive Engineer or on his behalf the concerned Assistant Engineer shall prepare a detailed inventory of assets in a cluster and hand over the assets to the Panchayat Samiti.

b) The inventory should comprise the following particulars in respect of each tubewells of the cluster: -

i) Location of Well Point - Mouja, J.L.No., Plot No.

ii) Tubewell Particulars: -

a. Length of 150 mm Housing pipes in meters.

b. Length of 80 mm blank pipe in meters.

c. Length of 80 mm Strainers in meters.

d. Total Assembly Depth below ground Level in meters.

e. Date of Lowering.

f. Date of Development & Yield Test.

g. Discharge as per Yield Test.

iii) Pump set particulars

i. Type of Pump set.
ii. Horse Power.
iii. Motor Power.
iv. Motor No.
v. Column Assembly Length in meters.
vi. Accessories –

iv) Pump Controller Particulars.

v) Pump House Particulars (give details of door & Windows

vi) Other electrical accessories: Light point with Switch Plug point with Switch

vii) Details of earthing

viii) Date of energisation

ix) Denomination No. of cluster.

c) Copies of the report of handing over and taking over shall be submitted by the Executive Engineer to the Chief Engineer, West Bengal Minor Irrigation Project and to the Divisional Engineer (O&M), W.B.S.E.B. as per form at Annexure B.

d) The Panchayat Samiti shall take over the assets and arrange operation & maintenance of the tubewells through a Beneficiary Committee to be constituted by the Panchayat Samiti for each cluster.

e) The Beneficiary Committee will have the following members

i. One beneficiary from each tubewell. (To be selected by the Sabhapati Panchyat Samiti in consultation with Krishi, Sech 0 Samabaya Sathayee Samiti)

ii. One representative of the Fanchayat Samiti

iii. One representative of the Gram Panchayat.

Total no. of members shall be 7 to 9. One of the beneficiary members shall be selected by the Sabhapati, Panchayat Samiti, to act as Hony. Secretary of the Beneficiary Committee. Hony. Secretary shall convene meetings and carry out managerial functions with the help of other members in accordance within decisions taken by the Beneficiary Committee and as per guiding and directions of the Panchayat Samiti. Directions of the Panchayat Samiti shall be binding on the Committee. Sabhapati Panchyat Samiti shall have the power to re-constitute the Committee and/or change the Honorary Secretary as and when necessary. The Beneficiary committee shall ensure watch and ward of the asset and proper operation & Maintenance of the tube-ells under the cluster (along with other assets) or which the Beneficiary Committee has been formed.

2. In exercise of the power conferred by Sub-section (3) of section 114 of the West Bengal Panchyat Act, 1973 (West Bengal Act XLI 1973), the Governor is further pleased hereby to direct that a Panchayat Samiti shall exercise, perform and discharge following powers, function and duties in connection with operation and maintenance of LDTW and STW cluster, as have been placed under the control and management of the Panchayat Samities by the Executive Engineer of Agricultural Engineering Directorate:

Powers functions and duties

a) Panchayat Samiti shall fix or refix the command area of each tubewell in consultation with the concerned Assistant Engineer of the Agricultural Engineering Directorate.

b) Panchayat Samiti shall effect Watch & Ward of the assets through the- Beneficiary Committee.

c) Panchayat Samiti shall ensure operation and maintenance of the tubewells through the Beneficiary Committee.

d) Panchayat Samiti shall be authorised to pay nominal charges if necessary for operation of the installation through the beneficiary committee and to take up any repair of assest and shall be entitled to incur expenditure on this account. In case of major repair, Panchayat Samiti may seek help from Agricultural Engineering Directorate, which shall undertake such repairs against payment of cost of spares and other materials.

f) Panchayat Samiti shall have the power to fix water rates to meet the operation and maintenance cost, and to collect the water rate against proper receipt provided that the Panchayat Samiti before finally fixing the water rate on the basis of comma area, energy charge and other operational and maintenance cost, shall obtain prior approval of the State Govt., by submitting the proposal to the Chief Engineer, West Bengal Minor Irrigation project, 5 mustaque Ahaed Street, Calcutta - 700000, who on vetting the proposal if considered acceptable, shall forward it to the Panchayat Deptt. for approval.

g) Panchayat Samiti shall pay the energy charges to West Bengal State Electricity Board. The West Bengal State Electricity Board, through its Group Supplies, will raise seasonal

bills to the Executive Officer, Panchayat Samiti, on receipt of official intimation from the concerned Executive Engineer in regard to handing over of tubewell to the Panchayat Samiti and submission of application by the Panchayat Samiti to the W.B.S.E.B. for change of name of consumer, provided that the Security deposit paid by the Agricultural Engineering Directorate at the time of energisation shall remain even after changing of name of consumer and it shall not be necessary for the Panchayat Samiti to pay fresh security deposit to the W.B.S.E.B.

i) Panchayat Samiti may exercise its powers, perform its function and discharge its duties with the help of the respective Beneficiary Committees.

3. In exercise of the power conferred by Section 212 of the West Bengal Panchayat Act. 1973 (West Bengal Act XLI of 1973), the Governor is further pleased to give the following directions for the guidance of the Panchayat Samities in discharge of their functions:

Directions

a) Report & Returns

i. Punchayat Samiti shall, after every crops season, furnish a report of area irrigated, revenue collected and expenditure incurred for each of the clusters to the concerned Executes (AI).

Registers

i. Panchayat Samiti shall maintain a clusterwise register to enter details of repair and maintenance undertaken.

ii. Panchayat Samiti shall cause maintenance, by Beneficiary Committee, of a field irrigation register showing daily hours of operation of each tubewell and area irrigated by the tubewell.

iii. Panchayat Samiti shall maintain a separate subsidiary cash register showing receipt of revenue and expenditure on operation & maintenance of tubewells.

iv. Panchayat Samiti shall cause maintenance, by the Beneficiary Committee, of a cash book for each cluster showing revenue collected and expenditure incurred for maintenance and operation of tubewells.

c) Audit of Accounts

All accounts of the Panchyat Samiti in this regard shall be audited by an auditor appointed by the State Government under section 186 of Bengal Panchayat Act. 1973.

d) Monitoring & Evaluation

i. Performance of Panchayat Samiti in respect of operation & maintenance of the tubewells shall be supervised and monitored by the AED for a 3-year transition period after which the handling over of the assets to Panchayat Saraities on permanent basis or otherwise shall be considered.

This notification issues with the concurrence of the Department of Panchayat, the Department of Finance and the Deptt. or Power.

5. The Accountant General, West Bengal is being informed.

By order of the Governor
D.M. Kanwar
Secretary to the Govt. of West Bengal

Calcutta
the 15 January, 1991

Annexure - 6.5 (Continued)

Attachment

FORMAT FOR HANDING COVER LDTW/8TW CLUSTERS

In pursuance of Notification No. …….. dt. ……. of the Department of Agricultural (MI Wing) the Light Duty Tubewells (160 mm x 80 mm) fitted with submersible pump and motor/Shallow Tubewells (80 mm) fitted with Centrifugal Pump and motor (Strike out whichever is not applicable)- in a cluster of ..... nos tubewells, the details of which are noted below of .....Cluster (Denom No..... in ..... Mouja (J.L.No.....) under ..... Block in the District of ..... installed under the West Bengal Minor Irrigation Project are hereby handed over to the Sebhapati..... Panchayat Samiti by the undersigned on behalf of Governor of West Bengal on this day the.....

Particulars of tubewells

SI. No.	Name of Mouja	Pin Point J.L.No.	Sites Plot No.	Tubewell Particulars			Total Assembly Deptt.	Date of Lower-ing	Discharge on Yield Test	Motor No.	No. of Column pipes
				150mm Housing	80mm Blank	80mm Strainer					
1	2	3	4	5	6	7	8	9	10	11	12
1.											
2.											
3.											
4.											

in addition to above, the following structures/ accessories are constructed/ installed in each of the tubewells.

Civil - Pump House

Electrical	Domestic Main Switch
	Light Point with Switch
	Plug Point with Switch
	Pump Controller
	Motor Accessories
	Earthing

N.B.: - Payment for installations of tubewells buildings etc.and payment to W.B.S.E.B. for Service connection has been made by the Department of Agricultural (M.I. Wing).

RUNNING CHARGES AND ENERGY BILLS ARE TO BE BORNE BY THE PANCHAYAT SAMITI.

Handed over the above assets

To the E.O. ..... Panchayat Samiti

Executive Engineer (A-I)/Assistant Engineer (A-I)

Taken over the assets from

the Executive Engineer (A-I).....

Assistant Engineer (A-I).....

E.O.....Panchayat Samiti.

Name of the District	Name of the Panchayat Samiti	Description of LDTW/STW	Remarks
1	2	3	4

ANNEXURE- 7.1

(Para.7.12)

Implication of Rationalisation of Water Rates: An illustrative exercise for selected States

1. The CWC in its paper entitled "An Overview of water rates for Surface irrigation" (Oct.91) gives data on depth of irrigation, gross area irrigated, and the prevailing water rate per acre for selected major crops, in respect of major and medium irrigation projects. The data relate to Gujarat, Karnataka, Madhya Pradesh, Orissa, Punjab and Uttar Pradesh. They are summarised in Table-1.

2. The irrigation depths are based on data for a selected number of projects in each state. The paper gives the list of projects from which this information is taken. The irrigation allowance soems to be expressed in terms of water released at the he-ad of the canal system. The estimates relate to crop categories, without any attempt at distinguishing seasons or regions.

3. Given the per hectare water rate and the depths of irrigation water supplied in respect of each crop, the implied rate per hacm of water supplied to each of the selected crop is easily estimated. These, summarised in Table-2, show that in Orissa, the ID crops generally bear higher rate per hacm than paddy or sugarcane. In Orissa, the highest per -hacm rates are charged on wheat, sugarcane and pulses.

4. We have calculated the simple average of the per hacm rates for coarse cereals, pulses and oil seeds. The ratio of this rate to the rate per hacm for each of the crops implied in the existing per hectare rates is used to rework the per hectare rates so that, al 1 crops pay the same rate per hacm as the selected ID crops. As an alternative, we have also worked out the rates on the basis of equalising with reference to the highest prevailing rate per hacm. The results are shown in Table-3.

5. Given the gross irrigated area under each crop, and the corresponding rates per hacm, the likely total revenues with existing and revised rates are estimated. These are set out in Table-4.

6. The above exercise does not differentiate between a given crop grown in different seasons and regions. These factors have a significant bearing on irrigation requirements and therefore the extent of rate revisions and resultant revenues. For instance in Gujarat, paddy is mostly grown in southern parts and in Uttar Pradesh in the east where the rainfall is relatively higher than the State average. Similarly the depth of irrigation for ID crops grown in Rabi and summer will be very different from that in Kharif. This is also true for paddy and cotton. For this reason, the results of this exercise should be considered no more than illustrative.

Table-1: Basic data on Irrigation needs, irrigated area, and water rates under major and medium projects in selected states.

Crop	Gujarat			Karnataka			Madhya Pradesh			Orissa			Punjab			Uttar Pradesh		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Paddy	91	110	82 .4	78	87	431	100	59	4.70	85	40	1012	123	48	635	87	98	789
Coarse cereals	18	40	67.8	30	19	271	15	3 7*	0.31	4 1	21	16	20	30	89	26	68	289
Wheat	75	10	144.2	83	54	45	63	62*	668.00	38	32	38	51	29	1138	52	98	319
Pulses	23	10	16.7	29	37	35	49	42	182.00	25	11	77	16	24	34	42	66	304
Sugar Cane	278	830*	36.2	251	370	112	169	297	39.00	1 22	100	26	160	68*	31	172	168	594
Oil Seeds	60	100	157.9	30	59	205	24	54	58.00	69	26	55	44	32	52	1 7	68	119
Cot ton	107	100	150.3	96	99	82	40	59	34.00				59	33	218	59	35	9

1. Irrigation depth in cm.

2. Water rate on major and medium works (Rs. per ha.) as reported in CWC (1991). Those marked * which have been correct on the basis of CWC(1988).

3. Gross Irrigated area (000 ha.

Source: CWC, 1991.

Table-2: - Implicit Water rate per hacm (Rs.)

Crop	Gujarat	Karnataka	M.P.	Orissa	Punjab	U.P.
Paddy	1.21	1.12	0.59	0.47	0.39	1.13
Coarse cereals	2.22	1.63	2.46	0.50	1.50	2.62
Wheat	1.47	0.65	1.00	0.84	0.57	1.88
Pulses	2.61	1.28	0.86	0.74	1.50	1.57
Sugar Cane	2.98	1.44	1.76	0.82	0.42	0.98
Oil Seeds	1.67	1.97	2.25	0.38	0.73	4.00
Cotton	0.93	1.03	1.50		0.56	0.59
Avg. for Coarse cereals, pulses and oil seeds	12.20	1.60	1.90	0.63	1.20	2.70

Computed from Table-1.

Table-3: Adjusted water rate (Rs. per ha) when per ha cm are equalized

Crop	Gujarat		Karnataka		M		Orissa		Punjab		U.P	
	a	b	a	b	a	b	a	b	a	b	a	b
Paddy	200	270	125	153	190	246	54	74	148	184	235	347
Coarse Cereals	40	54	48	59	29	37	26	35	24	30	70	104
Wheat	165	222	133	164	118	152	24	32	61	76	140	209
Pulses	51	69	46	57	93	120	16	12	19	24	113	168
Sugarcane	610	830	400	506	321	415	78	102	194	243	464	686
Oil Seeds	132	178	48	59	46	59	43	57	53	66	46	68
Cotton	237	320	99	189	75	97			71	88	159	237

a. rates per hacm equalised with reference to the average per hacm for coarse used, pulses and oil seeds as estimated in Table 2.

b. rate per ha era equalised with reference to the highest per hacm rate as estimated in Table 2.

Table-4: - Estimated revenue with existing and rationalised rates

(Rs. in Million)

	Gujarat	Karnataka	M.P.	Orissa	Punjab	U.P.
1. Existing Rates	89.5	116.2	104.3	47.5	77.9	254.2
2. Revised Rates	(a) 122.5	137.3	203.6	61.1	190.4	564.7
	(b) 165.6	175.6	344.3	83.3	236.9	829.2
3. (2)/ 1X 100	a) 137.0	118.0	195.0	129.0	244.0	222.0
	(b) 185.0	151.0	330.0	175.0	304.0	326.0

Annexure - 7.2
(Para - 7.11, 7.12 t 7.19)

STRUCTURE OF WATER RATES ON A SEASON - HA BASIS - ILLUSTRATIVE EXAMPLES

1. The Committee, under Chapter-7 'Implementation' have suggested that in Phase I, the existing system of pricing from a highly differentiated crop-area based assessment should be changed to one comprising a basic area rate and a variable season-ha rate. For determining the season-ha rate, the relevant considerations are: -

i. Irrigation requirements for crops in various cropping seasons;

ii. The relative value of water during different cropping seasons.

2. Irrigation requirements

Irrigation requirements of any crop would broadly depend upon the following factors: -

i) Potential Evapotranspiration (PET): This is computed for reference crop in different months depending upon various meteorological factors such as temp, wind velocity, sum shine hours, relative humidity etc.

ii) Consumptive use co-efficient; The coefficient is dependent on the type of crop and the stage of crop growth. This is to be multiplied with PET to get the evapotranspiration (Consumptive) needs of the relevant crop.

iii) Effective Rainfall: This is dependent on various factors like intensity of rainfall, topography, soil, initial moisture content of the soil, depth of ground water etc. Monthly effective rainfall is generally estimated by multiplying a factor to the average monthly rainfall. This factor varies with intensity of rainfall.

iv) Duration of Crop Period: Total irrigation requirements would also depend on the duration of the crop. In general water requirements for biseasonal crop would be more than seasonal crop and water requirements for perennial crop would be more than bi-seasonal/perennial crop.

v) Non Consumptive Use: This is mainly relevant in case of paddy, where substantial quantity of water is required for field preparation, transplantation and percolation losses in the field.

3. Relative value of Water in Different cropping seasons:

The value of delivered water during different cropping season is not the same. The need for storing water for use beyond rainy season entails evaporation losses from the reservoir and considerable cost for creating necessary storage. This factor has to be duly accounted, for pricing water in different cropping seasons.

4. Grouping of crops for simplification and proper enforce-Bent of rate structure:

The existing multiplicity of water rates for large number of crops in each season makes the task of measurement of cropped area arduous and expensive. There is also scope for under-reporting of higher rated crops. Irrigation water requirements would broadly depend on 5 factors (Para 2 above) out of which two major factors namely PET & effective rainfall would be broadly the same for all drops in a particular agro-climatic region. The other major factor, namely non-consumption use is relevant only to paddy crop. The duration of the crop can be accounted for by treating bi-seasonal as two crops and perennial as three or more crops related to relevant cropping seasons. The only other factor is the consumptive use co-efficient which varies with type of crop and the stage of crop growth. Since our purpose is not to work out crop water requirement but the structures of relative rates which reflects relative water requirements and yet is relatively simple to administer, it is in order to assume that the crop-factor is broadly be same for all non paddy crops during each cropping season. This would lead to grouping of all crops during a cropping season into two broad categories namely paddy and other crops. If necessary 'other crops' can be divided into two or more groups depending upon the importance of a particular crop in .1 cropping season. As already discussed above, biseasonal/perennial crops can be treated as two or three (or more depending upon the duration) crops over the relevant cropping seasons.

5. Suggested methodology for working out relative structure of season ha rate for various crop/group of crops

The following steps are involved: -

(i) Depending upon category of projects & agro-climatic regions, group projects as recommended in Para 3.32 ol the Report,

(ii) Broadly classify the crops into paddy and One/two other groups depending upon their importance in each season.

(iii) Work out area under different crop/group of crops assuming total annual irrigated area (Biseasonal to be counted as two crops & perennial, three or more crops depending upon duration) as 100 ha. .

(iv) Work out the relative irrigation requirements of each crop/group of crops by season as per procedure outlined above. If water requirement for any group of crops in a particular season is found to be very low, a minimum of one/two watering of 75 mm in the field may be assumed to take into account periodic break in rainfall even though on monthly basis the rainfall may be sufficient to meet the crop water requirement. Apply necessary efficiency factor (for delivery of water from outlet to crop root zone) to arrive at the irrigation water requirement at the outlet level. Calculate the total seasonal irrigation requirement for each group.

(v) Assume an average rate of recovery of Rs. 100/ham of water delivered at the outlet/group of farmers level. Convert the average ham-rate to seasonal ham-rate by applying necessary weightage to use of water during various seasons.

(vi) Multiplying seasonal ham-rate by the depth of seasonal water requirement would give the relative seasonal fate for crops/group of crops for a unit of overall cost recovery.

Chargeable rates:

Following procedure is involved:

(i) Estimate the capital cost of each group of projects (Para 3.27 to 3.29 of the Report).

(ii) Estimate O&M cost as per norms fixed by the State for different category of projects (Para 4.9 & 4.10 of the Report)

(iii) Add depreciation and interest charge (on capital cost) to O&M cost to estimate total recoverable charges. In the first phase, interest charges of only 1% on capital cost is to be realised. Deduct recoveries from non agricultural users to arrive at recoveries to be made from irrigation charges.

(iv) Deduct the amount recoverable by basic water rate on the irrigable commanded area, to arrive at the recoveries (R) to be effected through varying season-ha rate.

(v) Estimate irrigated area in the reference year by groups. To find out the amount (Rl) which can be realised through relative water rates. Multiply the area by repective water rates as worked out under Para 5 (vi) above

(vi) Work out the multiplication factor (R/R1) to be applied to rate structure by dividing the total desired recovery (R) through season-ha rate by the amount (Rl) as worked out above.

(vii) The above multiplying factor (R/R1) is to be applied to the relative rates worked out for various crops/group of crops in each season in accordance to Para 5 (vi) above to obtain actual chargeable season -ha rate.

(viii) The rates for biseasonal/perennial crops can be estimated by adding rates for relevant seasons.

Note:- The actual irrigated area would fluctuate from year to year depending upon (i) The availability of water (ii) Water use efficiency (iii) Change in cropping pattern. As such actual recoveries may differ from the planned recovery.

7. Periodic Rate Revision:

For periodical rate revisions, it would be enough to revise calculations given in Para 6 above, if the seasonal grouping of various crops are not changed.

8. Illustrative examples to work out water rates on a season -ha basis.

8.1 The examples worked out are purely for purpose of illustrating the methodology. Any inaccuracy in assumptions, data or arithmetical calculations do not affect the methodology itself. Following broad assumptions have been made in the examples solely for the purpose of illustrating the methodology of calculations and nay be quite different for working out actual rate structure.

i) For categorisation of projects, all the projects in the entire state have been assumed to belong to one category. In actual practice groupings would have to be done keeping specific situation in view (Para 7.12 of the Report).

ii) Following grouping of crops has been assumed. Kharif - Paddy, others (Crops); Rabi - Paddy/Wheat, others; Summer - Others. The rates for biseasonals/perennials can be derived by adding up corresponding seasonal rates of 'Other Crops'. As explained earlier, these grouping of crops may meet general requirements. However, if desired different groupings can be considered to meet the demands of a particular situation, but the number of groups should not exceed two or three in each cropping season.

iii) Average PET and effective rainfall data for the entire state has been taken from Table - 2.

iv) Effective rainfall has been assumed, as 80% of average monthly rainfall or consumptive need which— ever is less. This is only an assumption and may vary in different agro-climatic regions.

v) Where during a season, irrigation requirement for a particular crop/group of crop, works out to less than 75 mm in the field, a minimum of 75 mm has been assumed, to account for minimum crop water requirements during break in rainfall. The minimum requirements which may vary in different agro-climatic regions, is only applicable for crops grown during rainy season (s)

vi) Field application efficiency from outlet to root zone of crops has been assumed as 90% in case of paddy and 70% for other crops.

vii) The relative rate structure has been worked out on the basis of average recovery of Rs. 100/ham of water delivered at the outlet for the entire year. This can be easily converted to seasonal group specific rates simply by multiplying by a factor (R/R1) depending upon the desired amount of recovery as explained in Para 6 above.

viii) To take into account the relative cost of water in different cropping season, weightage of Kharif Rabi: Summer has been assumed as 3:1.5:2. Any other desired weightage can be considered depending upon the specific situation.

8.2 Explanatory notea to calculations in the illustrative example

Line 1 Cropping Pattern:- Average cropping pattern in percentage for various states has been worked out on the basis of project reports furnished under World Bank assisted

'National Water Management Project (NWMP) ' or informations specially supplied by the States.

Line 2 Depth of water required at the outlet:- This has been worked out as under:

(Consumptive Water requirements of crop/group of crops + Non consumptive water requirements -effective rainfall) x Application efficiency at the outlet.

The above calculations have been done on monthly basis and added up appropriately to obtain seasonal water requirements. As stated under Para 8.1 (v) above, if the quantity within the bracket for the entire crop season works out to be less than 75 ma then a minimum irrigation water requirement of 75 mm has been assumed.

Line 3 Volume of water required at the outlet: This is obtained by multiplying area given in line '1' with respective depth of water worked out in line '2'. By Adding water requirements of crops/group of crops during a season, we get seasonal water requirements. Annual water requirements (WA) would be WA = WK+WR+WH

Line 4 Average cost of water has been assumed as Rs. 100 per ham. By multiplying this average cost with total water (WA) we obtain the total value of water (V) delivered at the outlet. The weighted value of water for use during different seasons can be calculated as given below:

(aK.WK) + (aR.WR) + (aS.WH) = V

Where ak : aR : as are weightage given to use of water during Kharif, Rabi; & Summer seasons respectively. In the illustrative examples this has been assumed as 1:1.5:2.

a Wk + 1.5 a WR + 2a. WR =V

The values of 'a', '1.5 a' and '2a' have been estimated from the above equation, which gives the weighted value of water during Kharif, Rabi & Summer seasons against the average annual value of Rs. 100 per nan.

Line 5 Structure of water rates on a season ha basis:

a) At average rate: By multiplying' the average rate (vide line '4' above) with seasonal water requirements of various crops/group of crops (vide line '3' above).

b) At weighted rates: By multiplying weighted rate (vide line '4' above) with seasonal water requirements of various crops/group of crops (vide line '3' above).

The details are given in the following tables enclosed.

Table – 1 Statewise PET/Rainfall Data

Table – 2 Statewise / Monthwise Average PET-Effective Rainfall

Table – 3 Structure of Water Rates on season – ha basis-illustrations.

(A) Andhra Pradesh

(B) Bihar

(C) Gujarat

(D) Haryana

(E) Karnataka

(F) Madhya Pradesh

(G) Maharashtra

(H) Orissa

(I) Punjab

(J) Rajasthan

(K) Tamil Nadu

(L) Uttar Pradesh

(M) West Bengal

Annexure 7.2
(Para 7.11 & 7.12)

TABLE – 1
STATEWISE PET/RAINFALL DATA

SL No.	NAME OF THE STATE	AGIO- CLIMATIC ZONES	SUB-ZONES	PET/RAINFALL IN MM JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	Andhra Predesh	10	2	121/5	137/5	181/6	182/24	187/66	158/68	141/94	138/102	127/135	116/123	105/58	104/18
			3	115/4	131/6	179/9	190/24	209/39	177/113	132/212	127/169	118/197	122/82	110/19	105/7
			4	108/7	127/9	175/12	193/21	215/28	174/150	127/273	122/218	115/194	120/76	102/21	93/7
		11	2	100/10	114/18	160/13	166/18	199/49	138/117	122/152	123/163	115/182	119/232	1 08/89	97/14
			3	113/4	125/8	168/10	178/15	199/48	176/98	134/173	137/142	123/152	117/188	110/89	195/20
			4	113/29	123/8	163/9	171/21	185/47	170/48	155/82	153/117	142/117	120/257	105/331	105/112
Average PET/ BOX Rainfall				112/8	126/7	171/8	180/16	199/37	166/79	135/131	133/121	123/130	119/128	107/81	102/24
Average PET				104	119	163	164	162	87	4	12	-	-	26	78
Effective rainfall															
2	Bihar	4	4	5O/14	70/14	125/11	168/15	201/46	159/170	123/303	116/301	110/211	112/56	71/7	48/2
			5	55/6	77/11	132/30	168/27	179/75	134/256	117/345	113/250	109/41	112/41	74/5	52/1
			6	64/16	90/13	150/9	195/11	220/31	167/141	124/247	113/253	114/207	117/68	81/11	60/4
		7	3	76/19	97/23	154/19	187/20	196/57	155/193	115/335	109/333	104/228	110/92	86/13	70/4
			4	70/20	89/28	138/22	170/23	192/43	145/188	108/338	102/333	102/225	108/75	80/75	63/4
Average PET/ 80%			-	63/12	85/14	140/15	178/15	198/40	152/152	117/251	111/235	108/146	112/53	78/8	59/2
Average PET minus Effective rainfall				51	71	125	163	158					59	70	57

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
3	Gujarat	13	1	-	-	-	-	-	-	-	-	-	-	-	-
			2	99/2	130/1	165/1	193/2	220/8	166/163	119/393	113/228	124/183	143/33	113/88	97/1
			3	90/2	106/1	154/4	187/1	237/3	191/105	124/297	115/224	127/166	137/20	102/7	85/4
			4	87/2	105/2	161/3	196/1	241/5	208/73	143/292	122/208	136/134	139/151	99/3	76/2
			5	93/2	110/5	163/3	209/1	266/6	226/30	168/163	154/88	160/46	158/8	108/2	82/1
			6	108/2	122/2	176/2	208/3	242/6	202/70	150/210	138/125	140/79	151/16	122/5	103/2
			7	115/1	124/2	168/1	181/2	183/6	160/112	123/256	114/123	128/70	149/18	126/5	113/2
Average PET/80% Rainfall				99/1	116/2	165/2	196/1	232/5	192/74	138/215	126/133	136/90	146/33	112/4	93/2
Average PET minus Effective rainfall				98	114	163	195	227	118	-	-	46	113	108	91
*	Haryana	6	1	41/64	63/44	115/39	161/17	213/16	216/62	157/341	133/338	133/182	104/72	60/7	40/22
			2	46/22	69/24	119/22	165/8	216/15	223/44	166/223	142/208	140/126	110/23	64/4	44/15
			3	42/11	64/9	113/16	158/7	209/20	227/38	203/140	171/133	151/87	111/8	59/4	39/12
Average PET/ 80% Rainfall				43/26	65/21	116/21	161/9	213/14	222/38	175/188	149/181	141/105	108/27	61/4	41/13
Average PET minus Effective rainfall				17	44	95	152	199	184	-	-	36	81	57	28

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
5	Karnataka	10	1	122/4	136//4	180/8	189/28	202/50	159/101	135/162	132/128	123/157	127/96	115/32	. 112/7
			2	121/6	137/5	181/6	182/24	187/66	158/68	141/94	138/102	127/135	116/123	105/58	104/18
			5	126/6	135/7	171/12	160/56	155/121	127/74	117/110	119/106	119/117	112/171	105/76	112/21
		12	1	120/4	126/3	162/4	167/9	164/50	121/605	105/625	106/480	109/304	123/91	116/27	117/8
			2	142/18	141/20	165/42	151/114	140/253	111/583	113/566	119/325	121/218	119/282	117/152	129/46
			4	96/14	101/12	134/24	127/83	122/132	96/407	88/849	92/515	94/235	92/205	86/94	89/36
Average PET/ Rainfall		80%		121/7	129/7	166/13	163/42	162/89	129/245	117/321	118/221	116/155	115/129	107/59	111/18
Average PET Effective rainfall		minus		114	122	153	121	73	118	.	.			48	93
6	Kerala	12	2	142/18	141/20	165/42	151/114	140/253	111/583	113/566	119/325	121/218	119/282	117/152	129/46
			3	166/4	162/8	192/25	163/75	151/174	108/382	100/568	112/314	123/156	115/219	122/100	149/31
			4	96/14	101/12	134/24	127/83	122/131	96/407	88/849	92/515	94/235	92/205	86/94	89/36
Average PET/ Rainfall		80%		135/10	135/11	164/24	147/91	138/149	105/366	100/529	108/308	113/162	109/188	108/92	122/30
Average PET Effective rainfall		minus		125	124	140	56							16	92

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
7	Madhya Pradesh	7	1	84/12	104/21	152/22	180/19	210/25	164/194	112/401	108/371	108/226	114/67	89/12	76/8
			2	73/18	94/21	141/16	173/18	205/44	170/249	112/421	104/393	106/259	111/72	81/11	66/5
		8	5	84/8	104/10	147/15	167/30	180/47	137/181	102/397	102/313	100/241	106/80	87/15	77/11
			2	59/29	81/21	129/8	163/2	209/5	193/85	127/334	111/346	119/137	114/16	71/17	53/4
			3	66/24	84/15	125/33	153/12	186/8	159/148	102/456	95/433	101/217	101/45	73/5	59/22
			4	71/23	91/19	139/19	169/8	204/21	172/131	109/351	102/350	109/205	114/35	80/15	64/11
			5	80/18	100/8	152/10	185/4	229/9	187/108	113/372	102/374	113/211	122/30	90/15	75/10
			6	79/11	98/7	141/18	166/9	197/13	159/141	103/326	95/275	101/230	108/48	83/18	71/13
			7	80/15	96/13	140/13	166/7	202/10	166/142	106/430	98/440	106/251	116/26	85/12	73/16
			8.	63/16	84/6	134/7	173/3	224/8	212/71	133/305	111/318	121/169	116/26	74/8	57/7
		9	1	102/3	117/2	163/5	180/16	194/40	135/291	103/484	101/235	102/266	118/89	104/29	97/7
			3	94/9	114/4	166/6	200/5	253/11	198/118	130/239	119/241	122/187	129/31	98/25	84/8
Average PET/ BOX Rainfall				78/12	97/10	144/11	173/9	208/16	171/12	113/30	104/27	109/17	114/38	85/12	71/8

								4	0	3	3			
Average PET minus Effective rainfall			66	87	133	164	182	47				76	73	63
8 Maharashtra	7	1	84/12	104/21	152/22	180/19	210/25	164/19	112/40	108/37	108/22	114/67	89/12	76/8
								4	1	1	6			
	9	1	102/3	117/2	163/5	180/16	194/40	135/29	103/48	101/23	102/26	118/89	104/29	97/7
								1	4	5	6			
		2	112/4	127/2	172/4	191/15	211/31	155/96	130/14	125/11	121/14	132/71	115/27	106/7
									6	0	9			
		3	94/9	114/4	166/6	200/5	253/11	198/11	130/23	119/24	122/18	129/31	98/25	84/8
								8	9	1	7			
		4	112/10	133/8	182/20	206/16	252/16	199/18	126/30	117/25	118/20	125/40	106/14	99/17
	12							3	0	1	3			
		1	120/4	126/3	162/4	167/9	164/50	121/60	105/62	106/48	109/30	123/91	116/27	117/8
								5	5	0	4			
Average PET/ 80% Rainfall			104/6	120/5	166/8	187/11	214/23	162/19	118/29	113/22	113/17	124/52	105/18	97/7
								8	3	5	8			
Average PET minus Effective rainfall			98	115	158	176	191					72	87	90

1	2 3		4	5	6	7	8	9	10	11	12	13	14	15	16
9	Orissa	7	1	84/12	104/21	152/22	180/19	210/25	164/194	112/401	108/371	108/226	114/67	89/12	76/8
			2	73/18	94/21	141/16	173/18	209/44	170/249	112/421	104/393	106/259	111/72	81/11	66/5
			5	84/8	104/10	147/85	167/30	180/47	137/181	102/377	102/313	100/241	106/80	87/15	77/11
		11	1	92/14	112/27	162/24	180/31	230/74	141/205	119/317	118/313	113/257	117/185	99/56	86/6
			2	100/10	114/18	160/13	166/18	199/49	138/117	122/152	123/163	115/182	119/232	108/89	97/14
	Average PET/ 80X Rainfall			87/10	106/16	152/14	173/19	206/38	150/151	113/267	111/248	108/186	113/102	93/29	80/7
	Average PET Minus Effective rainfall			77	90	138	154	168	.	.	.	.	11	64	73
10	Punjab	6	1	41/64	63/44	115/39	161/17	213/16	216/62	157/341	133/338	133/182	104/72	60/7	40/22
			2	46/22	69/24	119/22	165/8	216/15	223/44	166/223	142/200	140/126	110/23	64/4	44/15
			3	42/11	64/9	113/16	158/7	209/20	227/38	203/140	171/133	151/87	111/8	59/4	39/12
	Average PET/ 80% Rainfall			43/26	65/21	116/21	161/9	213/14	222/38	175/188	149/181	141/105	108/27	61/4	41/13
	Average PET Minus Effective rainfall			17	44	95	152	199	184	.	-	36	81	57	28
11	Rajas than	6	3	42/11	64/9	113/16	156/7	209/20	227/38	203/140	171/133	151/87	111/8	59/4	39/12

	6	9	62/8	80/4	111/5	ioF/4	225/10	210/68	139/277	121/256	133/122	122/15	75/6	58/4
		10	62/«	81/0	126/6	158/0	195/7	154/89	96/206	84/206	99/129	107/0	70/0	57/13
		11	-/5	-/5	-/5	-/2	-/16	-/100	-/590	-/600	-/231	-/17	-/5	-/3
		12	59/4	79/3	125/8	159/3	204/8	178/64	120/173	102/207	115/112	112/12	71/3	55/4
		13	6S/7	87/8	141/6	185/3	250/15	236/47	159/184	127/204	143/91	126/12	76/4	59/5
		14	-/11	-/a	-/10	-/3	-/18	-/49	-/217	-/295	-/153	-/37	-/4	-/8
	9	3	94/9	114/4	166/6	200/5	253/11	198/118	130/239	119/241	122/187	129/31	98/25	84/8
	14	1	68/4	89/5	146/6	188/3	251/10	258/24	199/99	168/110	165/44	133/6	8O/2	63/4
Aver ate PET/ 80% Rainfall			65/5	85/5	135/6	174/3	227/10	209/53	149/189	127/200	133/103	120/12	76/5	59/5
Average PET minus Effective rainfall			60	80	129	171	217	156	-		30	108	71	54

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
12	TamilNadu	10	5	126/6	135/57	171/12	160/56	155/121	127/74	117/110	119/106	119/117	112/171	105/76	112/21
			6	125/30	132/12	168/19	158/64	168/81	167/47	165/58	160/87	150/102	123/184	104/147	113/69
		11	4	113/29	123/8	163/9	171/21	185/47	170/48	153/82	153/117	142/117	120/257	105/331	105/112
			5	-/71	-/20	-/22	-/36	-/43	•/28	-/48	-/86	-/81	-/252	-/418	-/261
			6	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-
		12	2	142/18	141/20	165/42	151/114	140/253	111/583	113/566	119/325	121/218	119/282	117/152	129/46
			4	96/14	101/12	134/24	127/83	122/131	96/407	88/849<	92/515	94/235	92/205	86/94	19/36
	Average PET/80% Rainfall			120/22	126/11	160/17	153/50	154/90	134/158	128/228	129/165	125/116	113/180	103/162	110/73
	Average PET/minus Effective Rainfall			98	115	143	103	64	-	-	-	-	-	-	-
13	Uttar Pradesh	1	4	-78	-/68	-/71	-/48	-/58	-/137	-/366	-/360	-/195	•/49	-/15	-/37
		4	1	52/21	75/16	133/11	177/8	209/30	181/159	131/341	118/329	119/224	114/64	70/4	49/6
			2	62/18	92/12	154/10	199/5	239/19	195/92	130/293	115/300	120/186	122/55	80/8	58/5
			3	-/-	-/-	-/-	-/-	-/-	-/-	•/•	-/-	-/•	-/-	-/•	-/-
		5	1	57/21	78/13	134/9	176/4	211/17	196/91	130/299	117/308	121/183	115/61	71/2	50/6
			2	48/32	69/23	121/17	165/7	210/14	204/77	143/303	127/318	129/171	107/40	62/3	42/12
			3	54/15	78/14	135/9	177/6	223/11	211/59	144/218	124/249	132/151	119/31	72/4	51/7
		8	1	59/18	83/9	139/8	176/3	221/8	206/76	140/279	120/321	130/170	122/45	T6/7	33/8
	Average PET/ 80% Rainfall			55/23	79/18	136/19	178/9	219/18	199/79	136/MO	120/250	126/146	117/39	72/5	51/9
	"Average PET Minus Effect! Rainfall			32	61	117	169	201	120	.	.	-	.	67	42

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
14	West Bengal	2	1	31/16	41/23	69/46	87/90	83/171	71/493	71/710	71/558	63/378	61/113	42/20	31/5
			5	51/16	71/30	113/74	133/192	132/361	116/588	121/605	114/532	105/429	98/164	71/23	52/7
		3	1	63/11	84/13	139/19	174/38	188/118	129/256	118/311	110/254	107/244	112/122	77/14	61/1
			2	74/9	94/17	149/25	179/41	208/89	138/217	117/259	113/290	109/261	114/117	87/22	69/3
			3	75/15	95/18	151/27	175/48	108/101	128/280	113/312	108/319	105/279	112/133	89/20	70/3
			4	-/16	-/18	-/23	-/31	-/79	-/224	-/285	-/289	-/225	-/110	-/15	-/2
		7	4	70/20	89/28	138/22	170/23	192/43	145/188	108/338	102/333	102/225	108/75	80/15	63/4
Average PET/ 80% Rainfall				61/12	79/17	127/27	153/53	152/110	121/257	108/322	103/294	99/233	101/95	74/15	58/3
Average PET minus Effective Rainfall				49	62	100	100	42	-	-	-	-	6	59	55

• Effective rainfall has been taken equal to 60% rainfall or average PET whichever is less

Source: - Agro-climatical regional planning Unit, Ahmedabad

i) Zones & sub-zones ACIP - Agro climatic zones: Profiles and Issues working paper - 2, July 1989.

ii) Rainfall data 1901-1970

iii) PET data as synthesed from PPSR No. 136, February 1971 of IMD' Pune

Annexure 7.2

(Para 7.19)

Table – 3(A)

Structure of water rates on season - ha basis

Andhra Pradesh

Sl.No.	Item Details	Unit	Kharif			Rabi			Hot Weather		Grand Total	Remarks
			Paddy	Others	Total	Paddy	others	Total	others	Total		
1	Cropping pattern (%of gross irrigated)	Ha	35	36	71	S	21	26	3	3	100	
2	Depth of water required at the outlet	M	0.76	0.14	-	0.44	0.61	-	0.45	-		
3	Volume of water required at the outlet	Ham	26.6	5.0	31.6	2.2	12.8	15.0	1.4	1.4	48.0	
4	Cost of water at different rates in the ratio of K:R:S:: 1:1.5:2	Rs./ham			84			126		168		
5	Irrigation water rates											
	a) At average rates	Rs. /ha	76	14		44	61		45			
	b) At weightedtial rates	Rs./ha	64	12		55	77		76			

Table – 3(B)

Bihar

Sl.No.	Item Details	Unit	Kharif			Rabi			Hot Weather		Grand Total	Remarks
			Paddy	Others	Total	Paddy	others	Total	others	Total		
1	Cropping pattern (%of gross irrigated)	Ha	58	7	65	25	5	30	5	5	100	
2	Depth of water required at the outlet	M	0.65	0.15	-	0.40	0.30		0.40			
3	Volume of water required at the outlet	Ham	37.7	1.1	38.8	10	1.5	11.5	2.0	2.0	52.3	
4	Cost of water at different rates in the ratio of K:R:S:: 1:1.5:2	Rs./ham			87			131	-	174		
5	Irrigation water rates											
	a) At average rates	Rs. /ha	65	15	-	40	30	-	40			
	b) At weightedtial rates	Rs./ha	57	13	-	52	39		70			

Table – 3(C)

Gujarat

Sl. No.	Item Details	Unit	Kharif			Rabi			Hot Weather			Grand Total	Remarks
			Paddy	Others	Total	Paddy	others	Total	Paddy	others	Total		
1	Cropping pattern (%of gross irrigated)	Ha	19	22	41	1	38	39	2	18	290	100	
2	Depth of water required at the outlet	M	0.90	0.15	-	1.05	0.50		1.20	0.60			
3	Volume of water required at the outlet	Ham	17.1	3.3	20.4	1.1	19.0	20.1	2.4	10.8	13.2	53.7	
4	Cost of water at different rates in the ratio of K:R:S:: 1:1.5:2	Rs./ham			70			105	-		140		
5	Irrigation water rates												
	a) At average rates	Rs. /ha	90	15		105	50		120	60			
	b) At weightedtial rates	Rs./ha	63	11		110	53		168	84			

Table – 3(D)

Haryana

Sl. No.	Item Details	Unit	Kharif			Rabi			Hot Weather		Grand Total	Remarks
			Paddy	Others	Total	Paddy	others	Total	others	Total		
1	Cropping pattern (%of gross irrigated)	Ha	8	34	42	23	33	56	2	2	100	
2	Depth of water required at the outlet	M	0.90	0.15	-	0.25	0.25		0.40			
3	Volume of water required at the outlet	Ham	7.2	5.1	12.3	5.8	8.3	14.1	0.8	0.8	27.2	
4	Cost of water at different rates in the ratio of K:R:S:: 1:1.5:2	Rs./ham			78			117	-	156		
5	Irrigation water rates											
	a) At average rates	Rs. /ha	90	15		25	25		40			
	b) At weightedtial rates	Rs./ha	70	12		29	29		62			

Table – 3(E)

Karnataka

Sl. No.	Item Details	Unit	Kharif			Rabi			Hot Weather			Grand Total	Remarks
			Paddy	Others	Total	Paddy	others	Total	Paddy	others	Total		
1	Cropping pattern (%of gross irrigated)	Ha	18	33	51	11	29	40		9	9	100	
2	Depth of water required at the outlet	M	0.63	0.30		0.97	0.60			0.35			
3	Volume of water required at the outlet	Ham	11.34	9.9	21.24	10.67	17.4	28.07		3.15	3.15	52.46	
4	Cost of water at different rates in the ratio of K:R:S:: 1:1.5:2	Rs./ham			75			113	-		150		
5	Irrigation water rates												
	a) At average rates	Rs. /ha	63	30		97	60			35			
	b) At weightedtial rates	Rs./ha	47	23		110	68			53			

Table – 3(F)

Madhya Pradesh

Sl.No.	Item Details	Unit	Kharif			Rabi			Hot Weather		Grand Total	Remarks
			Paddy	Others	Total	Paddy	others	Total	others	Total		
1	Cropping pattern (%of gross irrigated)	Ha	25	9	34	43	21	64	2	2	100	
2	Depth of water required at the outlet	M	0.67	0.14		0.42	0.35		0.45			
3	Volume of water required at the outlet	Ham	16.80	1.26	18.06	18.06	7.35	25.41	0.90	0.90	44.37	
4	Cost of water at different rates in the ratio of K:R:S:: 1:1.5:2	Rs./ham			76			114	-	152		
5	Irrigation water rates											
	a) At average rates	Rs. /ha	67	14		42	35		45			
	b) At weightedtial rates	Rs./ha	51	11		48	40		68			

Table – 3(G)

Maharashtra

Sl.No.	Item Details	Unit	Kharif			Rabi			Hot Weather		Grand Total	Remarks
			Paddy	Others	Total	Paddy	others	Total	others	Total		
1	Cropping pattern (%of gross irrigated)	Ha	10	39	49	11	21	32	19	19	100	
2	Depth of water required at the outlet	M	0.63	0.17		0.53	0.35		0.70			
3	Volume of water required at the outlet	Ham	6.30	6.6	12.9	5.81	7.4	13.2	13.3	13.3	39.4	
4	Cost of water at different rates in the ratio of K:R:S:: 1:1.5:2	Rs./ham			66			99	-	132		
5	Irrigation water rates											
	a) At average rates	Rs. /ha	63	17		53	35		70			
	b) At weightedtial rates	Rs./ha	42	11		52	35		92			

Table – 3(H)

Orissa

Sl.No.	Item Details	Unit	Kharif			Rabi			Hot Weather		Grand Total	Remarks
			Paddy	Others	Total	Paddy	others	Total	others	Total		
1	Cropping pattern (%of gross irrigated)	Ha	70	0.4	70.4	26	3.3	29.3	0.3	0.3	100	
2	Depth of water required at the outlet	M	0.63	0.11	-	0.89	0.40		0.40	0.40		
3	Volume of water required at the outlet	Ham	44.1	0.04	44.14	23.1	1.32	24.42	0.12	0.12	68.68	
4	Cost of water at different rates in the ratio of K:R:S:: 1:1.5:2	Rs./ham			85			128	-	170		
5	Irrigation water rates											
	a) At average rates	Rs. /ha	63	11		89	40		40			
	b) At weightedtial rates	Rs./ha	54	9		114	51		68			

Table – 3(I)

Punjab

Sl.No.	Item Details	Unit	Kharif			Rabi			Hot Weather		Grand Total	Remarks
			Paddy	Others	Total	Paddy	others	Total	others	Total		
1	Cropping pattern (%of gross irrigated)	Ha	17	33	50	21	28	49	1	1	100	
2	Depth of water required at the outlet	M	0.90	0.15	-	0.25	0.25		0.50			
3	Volume of water required at the outlet	Ham	15.3	5.0	20.3	5.3	7.0	12.3	0.50	0.5	33.1	
4	Cost of water at different rates in the ratio of K:R:S:: 1:1.5:2	Rs./ham			83			125		166		
5	Irrigation water rates											
	a) At average rates	Rs. /ha	90	15		25	25		50			
	b) At weightedtial rates	Rs./ha	75	12		31	31		83			

Table – 3(j)

Rajasthan

Sl.No.	Item Details	Unit	Kharif			Rabi			Hot Weather		Grand Total	Remarks
			Paddy	Others	Total	Paddy	others	Total	others	Total		
1	Cropping pattern (%of gross irrigated)	Ha	1.1	30.30	31.4	36.0	32.3	68.3	0.3	0.3	100	
2	Depth of water required at the outlet	M	0.84	0.11	-	0.42	0.30		0.56			
3	Volume of water required at the outlet	Ham	0.9	3.3	4.2	15.1	9.7	24.8	0.2	0.2	29.2	
4	Cost of water at different rates in the ratio of K:R:S:: 1:1.5:2	Rs./ham			70			105		140		
5	Irrigation water rates											
	a) At average rates	Rs. /ha	84	11		42	30		56			
	b) At weightedtial rates	Rs./ha	59	8		44	32		78			

Table – 3(K)

Uttar Pradesh

Sl.No.	Item Details	Unit	Kharif			Rabi			Hot Weather		Grand Total	Remarks
			Paddy	Others	Total	Paddy	others	Total	others	Total		
1	Cropping pattern (%of gross irrigated)	Ha	31	17	48	33	13	46	6	6	100	
2	Depth of water required at the outlet	M	0.77	0.11	-	0.33	0.27		0.50			
3	Volume of water required at the outlet	Ham	23.87	1.87	25.74	10.89	3.51	14	3.0	3.0	43.14	
4	Cost of water at different rates in the ratio of K:R:S:: 1:1.5:2	Rs./ham			81			122		162		
5	Irrigation water rates											
	a) At average rates	Rs. /ha	77	11		33	27		50			
	b) At weightedtial rates	Rs./ha	62	9		40	33		81			

Table – 3(L)

West bengal

Sl.No.	Item Details	Unit	Kharif			Rabi			Hot Weather		Grand Total	Remarks
			Paddy	Others	Total	Paddy	others	Total	others	Total		
1	Cropping pattern (%of gross irrigated)	Ha	88.2	0.10	88.3	7.0	4.6	4.6	0.1	0.1	100	
2	Depth of water required at the outlet	M	0.63	0.11	-	0.86	0.34		0.20			
3	Volume of water required at the outlet	Ham	55.57	0.01	55.58	6.02	1.56	7.58	0.02	0.02	63.18	
4	Cost of water at different rates in the ratio of K:R:S:: 1:1.5:2	Rs./ham			94			141		188		
5	Irrigation water rates											
	a) At average rates	Rs. /ha	63	11		86	34		20			
	b) At weightedtial rates	Rs./ha	59	10		121	48		38			

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