Table A7.5 - 7 INIT CROP WATER REQUIREMENT OF UPLAND CROPS 1/2

Item	Unit	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Maha Total	Mar	Apr	May	Jun	Jul	Aug	Sept	Yala Total	Annual total
Basic Data for Calculation																		
1 ETo	mm/d	5.4	4.7	4.7	5.1	5.7	6.2	5.7		6.2	5.7	5.6	5.4	6.0	6.2	6.0		
2 Effective rainfall	mm/m	75	75	75	25	33	70	67	420	70	67	48	21	15	20	39	280	980
3 Field application effeciency	%	60%																
4 Operation efficiency	%	68%																
A Chilli	Area :	1,000 ha																
1 Crop coefficient																		
Kc-1			0.65	0.75	0.99	1.00	0.99				0.66	0.90	1.00	1.00	0.98			
Kc-2				0.66	0.90	1.00	1.00	0.98			0.65	0.75	0.99	1.00	0.99			
Average		0.00	0.33	0.71	0.95	1.00	1.00	0.49		0.00	0.66	0.83	1.00	1.00	0.99	0.00		
2 Days of irrigation	days		15	30	30	30	30	15	150		30	30	30	30	30		150	
3 ET crop (ETo x Kc)	mm/m	0	23	99	145	171	185	42	665	0	112	139	161	180	183	0	775	
4 Area factor (Fa)	mm		0.25	1.00	1.00	1.00	1.00	0.25			0.75	1.00	1.00	1.00	0.75			
5 ET crop net (ETo x Kc x Fa)	mm/m	0	6	99	145	171	185	10	616	0	84	139	161	180	137	0	701	
6 Land preparation	mm																	
7 Sub-total (= (5)+(6))	mm	0	6	99	145	171	185	10	616	0	84	139	161	180	137	0	701	
8 Effective rainfall	mm	0	38	75	25	33	70	33	274	0	67	48	21	15	20	0	171	445
9 Net requirement (= (7)-(8))	mm	0	0	25	119	138	115	0	397	0	17	90	140	165	117	0	530	923
10 Farm requirement	mm	0	0	42	199	230	192	0	662	0	29	151	234	276	195	0	884	1,545
11 Diversion requirement	mm	0	0	61	292	339	282	0	974	0	42	221	344	405	287	0	1,300	2,273
12 Diversion requirement	MCM	0.0	0.0	0.6	2.9	3.4	2.8	0.0	9.7	0.0	0.4	2.2	3.4	4.1	2.9	0.0	13.0	22.7
(Expected Return flow)																		
R/flow other than percolation	mm	0	0	15.6	74.8	86.7	72.1	0	249	0	10.9	56.7	88	104	73.5	0	332.7	582.0
(80 % of Operation losses)	MCM	0.0	0.0	0.2	0.7	0.9	0.7	0.0	2.5	0.0	0.1	0.6	0.9	1.0	0.7	0.0	3.3	5.8
																		(269)
B Pulses	Area :	1,000 ha																
1 Crop coefficient																		
Kc-1				0.61	1.03							0.61	1.03					
Kc-2				0.50	0.87	1.05						0.50	0.87	1.05				
Average		0.00	0.00	0.56	0.95	0.53	0.00	0.00		0.00	0.00	0.56	0.95	0.53	0.00	0.00		
2 Days of irrigation	days			30	30	15			75			30	30	15			75	
3 ET crop (ETo x Kc)	mm	0	0	78	145	45	0	0	268	0	0	93	154	47	0	0		
4 Area factor (Fa)	mm			0.75	1.00	0.25						0.75	1.00	0.25				
5 ET crop net (ETo x Kc x Fa)	mm	0	0	59	145	11		0	215	0	0	70	154	12	0	0		
6 Land preparation	mm																	
7 Sub-total (= (5)+(6))	mm	0	0	59	145	11	0	0	215	0	0	70	154	12	0	0	236	451
8 Effective rainfall	mm	0	0	75	25	16	0	0	116	0	0	48	21	7	0	0	77	193
9 Net requirement (= (7)-(8))	mm	0	0	0	120	0	0	0	120	0	0	22	133	4	0	0	159	279
10 Farm requirement	mm	0	0	0	200	0	0	0	200	0	0	36	222	7	0	0	265	465
11 Diversion requirement	mm	0	0	0	294	0	0	0	294	0	0	53	326	11	0	0	390	684
12 Diversion requirement	MCM	0.0	0.0	0.0	2.9	0.0	0.0	0.0	2.9	0.0	0.0	0.5	3.3	0.1	0.0	0.0	3.9	6.8
(Expected Return flow)																		
R/flow other than percolation	mm	0	0	0	75.3	0	0	0	75	0	0	13.6	83.5	2.8	0	0	99.8	175.1
(80 % of Operation losses)	MCM	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.8	0.0	0.0	0.1	0.8	0.0	0.0	0.0	1.0	1.8
																		(269)
C Big Onion	Area :	1,000 ha																
1 Crop coefficient																		
Kc-1				0.48	0.76	0.95						0.48	0.76	0.95				
Kc-2				0.45	0.59	0.89	0.95					0.45	0.59	0.89	0.95			
Average		0.00	0.00	0.47	0.68	0.92	0.48	0.00		0.00	0.00	0.47	0.68	0.92	0.48	0.00		
2 Days of irrigation	days			30	30	30	10		100			30	30	30	10		100	
3 ET crop (ETo x Kc)	mm	0	0	66	103	157	29	0	356	0	0	78	109	166	29	0		
4 Area factor (Fa)	mm			0.75	1.00	0.92	0.17					0.75	1.00	0.92	0.17			
5 ET crop net (ETo x Kc x Fa)	mm	0	0	49	103	144		0	297	0	0	59	109	152	5	0		
6 Land preparation	mm																	
7 Sub-total (= (5)+(6))	mm	0	0	49	103	144	0	0	297	0	0	59	109	152	5	0	325	
8 Effective rainfall	mm	0	0	75	25	33	23	0	156	0	0	48	21	15	7	0	91	247
9 Net requirement (= (7)-(8))	mm	0	0	0	78	111	0	0	189	0	0	10	88	137	0	0	236	425
10 Farm requirement	mm	0	0	0	130	186	0	0	315	0	0	17	147	229	0	0	393	709
11 Diversion requirement	mm	0	0	0	191	273	0	0	464	0	0	25	217	336	0	0	578	1,042
12 Diversion requirement	MCM	0.0	0.0	0.0	1.9	2.7	0.0	0.0	4.6	0.0	0.0	0.3	2.2	3.4	0.0	0.0	5.8	10.4
(Expected Return flow)																		
R/flow other than percolation	mm	0	0	0	48.9	69.9	0	0	119	0	0	6.46	55.5	86	0	0	148.0	266.7
(80 % of Operation losses)	MCM	0.0	0.0	0.0	0.5	0.7	0.0	0.0	1.2	0.0	0.0	0.1	0.6	0.9	0.0	0.0	1.5	2.7
																		(269)

Table A7.5 - 7 INIT CROP WATER REQUIREMENT OF UPLAND CROPS 2/2

Item	Unit	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Maha Total	Mar	Apr	May	Jun	Jul	Aug	Sept	Yala Total	Annual total
D Red Onion	Area :	1,000 ha																
1 Crop coefficient																		
Kc-1				0.48	0.76	0.95						0.48	0.76	0.95				
Kc-2				0.45	0.59	0.89						0.45	0.59	0.89				
Average		0.00	0.00	0.47	0.68	0.92	0.00	0.00		0.00	0.00	0.47	0.68	0.92	0.00	0.00		
2 Days of irrigation	days			30	30	30			90			30	30	30			90	
3 ET crop (ETo x Kc)	mm	0	0	66	103	157	0	0	326	0	0	78	109	166	0	0		
4 Area factor (Fa)	mm			0.75	1.00	0.75						0.75	1.00	0.75				
5 ET crop net (ETo x Kc x Fa)	mm	0	0	49	103	118		0	270	0	0	59	109	124	0	0		
6 Land preparation	mm																	
7 Sub-total (= (5)+(6))	mm	0	0	49	103	118	0	0	270	0	0	59	109	124	0	0	292	
8 Effective rainfall	mm	0	0	75	25	33	0	0	133	0	0	48	21	15	0	0	84	217
9 Net requirement (= (7)-(8))	mm	0	0	0	78	85	0	0	163	0	0	10	88	110	0	0	208	371
10 Farm requirement	mm	0	0	0	130	142	0	0	272	0	0	17	147	183	0	0	347	619
11 Diversion requirement	mm	0	0	0	191	209	0	0	400	0	0	25	217	268	0	0	510	910
12 Diversion requirement	MCM	0.0	0.0	0.0	1.9	2.1	0.0	0.0	4.0	0.0	0.0	0.3	2.2	2.7	0.0	0.0	5.1	9.1
(Expected Return flow)																		
R/flow other than percolation	mm	0	0	0	48.9	53.5	0	0	102	0	0	6.46	55.5	68.7	0	0	130.7	233.0
(80 % of Operation losses)	MCM	0.0	0.0	0.0	0.5	0.5	0.0	0.0	1.0	0.0	0.0	0.1	0.6	0.7	0.0	0.0	1.3	2.3
																		(26%)
E Vegetables	Area :	1,000 ha																
1 Crop coefficient																		
Kc-1			0.45	0.61	0.89	0.89						0.48	0.79	0.90	0.88			
Kc-2				0.48	0.79	0.90	0.88					0.45	0.61	0.89	0.89			
Average		0.00	0.23	0.55	0.84	0.90	0.44	0.00		0.00	0.00	0.47	0.70	0.90	0.89	0.00		
2 Days of irrigation	days		15	30	30	30	15		120			30	30	30	30		120	
3 ET crop (ETo x Kc)	mm	0	16	77	129	153	41	0	415	0	0	78	113	161	165	0		
4 Area factor (Fa)	mm		0.25	1.00	1.00	1.00	0.25					0.75	1.00	1.00	0.75			
5 ET crop net (ETo x Kc x Fa)	mm	0	4	77	129	153		0	362	0	0	59	113	161	123	0		
6 Land preparation	mm																	
7 Sub-total (= (5)+(6))	mm	0	4	77	129	153	0	0	362	0	0	59	113	161	123	0	457	
8 Effective rainfall	mm	0	38	75	25	33	35	0	205	0	0	48	21	15	20	0	104	309
9 Net requirement (= (7)-(8))	mm	0	0	2	103	120	0	0	226	0	0	10	93	146	103	0	352	578
10 Farm requirement	mm	0	0	4	172	200	0	0	376	0	0	17	154	244	172	0	587	963
11 Diversion requirement	mm	0	0	6	253	295	0	0	553	0	0	25	227	359	253	0	864	1,417
12 Diversion requirement	MCM	0.0	0.0	0.1	2.5	2.9	0.0	0.0	5.5	0.0	0.0	0.3	2.3	3.6	2.5	0.0	8.6	14.2
(Expected Return flow)																		
R/flow other than percolation	mm	0	0	1.47	64.7	75.4	0	0	142	0	0	6.46	58	91.9	64.7	0	221.1	362.7
(80 % of Operation losses)	MCM	0.0	0.0	0.0	0.6	0.8	0.0	0.0	1.4	0.0	0.0	0.1	0.6	0.9	0.6	0.0	2.2	3.6
																		(26%)
F Sunflower	Area :	1,000 ha																
1 Crop coefficient																		
Kc-1			0.46	0.79	1.05	1.00				0.45	0.58	0.98	1.02					
Kc-2			0.45	0.58	0.98	1.02					0.46	0.79	1.05	1.00				
Average		0.00	0.46	0.69	1.02	1.01	0.00	0.00		0.23	0.52	0.89	1.04	0.50	0.00	0.00		
2 Days of irrigation	days		30	30	30	30			120	15	30	30	30	15			120	
3 ET crop (ETo x Kc)	mm	0	64	97	155	173	0	0	489	21	89	149	168	45	0	0		
4 Area factor (Fa)	mm		0.75	1.00	1.00	0.75				0.25	1.00	1.00	1.00	0.25				
5 ET crop net (ETo x Kc x Fa)	mm	0	48	97	155	130		0	430	5	89	149	168	11	0	0		
6 Land preparation	mm																	
7 Sub-total (= (5)+(6))	mm	0	48	97	155	130	0	0	430	5	89	149	168	11	0	0	422	851
8 Effective rainfall	mm	0	75	75	25	33	0	0	208	35	67	48	21	7	0	0	178	386
9 Net requirement (= (7)-(8))	mm	0	0	22	130	97	0	0	249	0	22	100	147	4	0	0	273	522
10 Farm requirement	mm	0	0	37	216	161	0	0	415	0	37	167	245	7	0	0	455	870
11 Diversion requirement	mm	0	0	54	318	237	0	0	610	0	54	246	360	10	0	0	670	1,279
12 Diversion requirement	MCM	0.0	0.0	0.5	3.2	2.4	0.0	0.0	6.1	0.0	0.5	2.5	3.6	0.1	0.0	0.0	6.7	12.8
(Expected Return flow)																		
R/flow other than percolation	mm	0	0	13.9	81.5	60.7	0	0	156	0	13.9	63	92.1	2.45	0	0	171.5	327.5
(80 % of Operation losses)	MCM	0.0	0.0	0.1	0.8	0.6	0.0	0.0	1.6	0.0	0.1	0.6	0.9	0.0	0.0	0.0	1.7	3.3
																		(26%)

Table A7.5 - 8 UNIT CROP WATER REQUIREMENT OF PERENNIAL CROPS

Item	Unit	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Annual total
Basic Data for Calculation														
1 ETo	mm/day	5.4	4.7	4.7	5.1	5.7	6.2	5.7	5.6	5.4	6.0	6.2	6.0	
2 Effective rainfall	mm/m	75	75	75	25	33	70	66.7	48.3	20.9	14.7	20.3	38.8	563
3 Field application effeciency	%	60%												
4 Operation efficiency	%	68%												
A Banana	Area :	1,000 ha												
1 Crop coefficient														
Kc-1		0.80	0.75	0.70	0.70	0.75	0.90	1.05	1.05	1.05	1.00	1.00	1.00	
Kc-2		1.00	0.80	0.75	0.70	0.70	0.75	0.90	1.05	1.05	1.05	1.00	1.00	
Kc-3		1.00	1.00	0.80	0.75	0.70	0.70	0.75	0.90	1.05	1.05	1.05	1.00	
Average		0.93	0.85	0.75	0.72	0.72	0.78	0.90	1.00	1.05	1.03	1.02	1.00	
2 Days of irrigation	days	30	30	30	30	30	30	30	30	30	30	30	30	
3 ET crop (ETo x Kc)	mm	151	120	106	110	123	146	154	168	170	186	189	180	
4 Area factor (Fa)	mm	0.80	0.80	0.80	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.80	
5 ET crop net (ETo x Kc x Fa)	mm	121	96	85	110	123	146	154	168	170	186	189	144	
6 Land preparation	mm													
7 Sub-total (= (5)+(6))	mm	121	96	85	110	123	146	154	168	170	186	189	144	1,690
8 Effective rainfall	mm	75	75	75	25	33	70	67	48	21	15	20	39	563
9 Net requirement (= (7)-(8))	mm	46	21	10	84	90	76	87	120	149	171	169	105	1,128
10 Farm requirement	mm	77	35	17	140	150	126	145	200	249	286	281	175	1,880
11 Diversion requirement	mm	113	51	25	206	220	185	214	293	366	420	414	258	2,765
12 Diversion requirement	MCM	1.1	0.5	0.2	2.1	2.2	1.9	2.1	2.9	3.7	4.2	4.1	2.6	27.6
(Expected Return flow)														
R/flow other than percolation	mm	29	13	6	53	56	47	55	75	94	107	106	66	708
(80 % of Operation losses)	MCM	0.3	0.1	0.1	0.5	0.6	0.5	0.5	0.8	0.9	1.1	1.1	0.7	7.1 (26%)
B Sugar Cane	Area :	1,000 ha												
1 Crop coefficient														
Kc-1		1.05	1.05	1.05	1.05	1.05	1.05	0.80	0.60	0.55	0.80	0.95	1.05	
Kc-2		1.05	1.05	1.05	1.05	1.05	1.05	1.05	0.80	0.60	0.55	0.80	0.95	
Kc-3		0.95	1.05	1.05	1.05	1.05	1.05	1.05	1.05	0.80	0.60	0.55	0.80	
Kc-4		0.80	0.95	1.05	1.05	1.05	1.05	1.05	1.05	1.05	0.80	0.60	0.55	
Kc-5		0.55	0.80	0.95	1.05	1.05	1.05	1.05	1.05	1.05	1.05	0.80	0.60	
Kc-6		0.60	0.55	0.80	0.95	1.05	1.05	1.05	1.05	1.05	1.05	1.05	0.80	
Kc-7		0.80	0.60	0.55	0.80	0.95	1.05	1.05	1.05	1.05	1.05	1.05	1.05	
Average		0.84	0.93	1.01	1.04	1.04	1.05	1.03	0.97	0.88	0.84	0.83	0.83	
2 Days of irrigation	days	30	30	30	30	30	30	30	30	30	30	30	30	
3 ET crop (ETo x Kc)	mm	135	131	142	159	178	195	176	163	142	152	154	149	
4 Area factor (Fa)	mm	0.80	0.80	0.80	1.00	1.00	1.00	1.00	1.00	0.80	0.80	0.80	0.80	
5 ET crop net (ETo x Kc x Fa)	mm	108	105	113	159	178	195	176	163	114	121	123	119	
6 Land preparation	mm													
7 Sub-total (= (5)+(6))	mm	108	105	113	159	178	195	176	163	114	121	123	119	1,676
8 Effective rainfall	mm	75	75	75	25	33	70	67	48	21	15	20	39	563
9 Net requirement (= (7)-(8))	mm	33	30	39	134	145	125	109	115	93	107	103	81	1,113
10 Farm requirement	mm	55	50	65	223	242	209	182	191	155	178	172	134	1,856
11 Diversion requirement	mm	81	73	95	328	356	307	268	281	228	261	252	197	2,729
12 Diversion requirement	MCM	0.8	0.7	1.0	3.3	3.6	3.1	2.7	2.8	2.3	2.6	2.5	2.0	27.3
(Expected Return flow)														
R/flow other than percolation	mm	21	19	24	84	91	79	69	72	58	67	65	51	699
(80 % of Operation losses)	MCM	0.2	0.2	0.2	0.8	0.9	0.8	0.7	0.7	0.6	0.7	0.6	0.5	7.0 (26%)

Table A7.5 - 9 WATER REQUIREMENTAND RETURN FLOW OF SEVANAGALA SUGAR INDUSTRIES AREA

(Unit : MCM)

Item	Area (ha)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
A Water Requirement of the Area (Entire development stage)														
1 Irrigation														
- Sugarcane	2,020	0.00	4.63	4.63	3.81	0.00	3.00	3.00	3.00	3.00	3.81	0.00	0.00	28.86
- Paddy	730	3.73	3.73	0.00	0.00	3.92	3.92	3.92	3.92	0.00	3.73	0.00	0.00	26.88
Sub-total (1)	2,750	3.73	8.36	4.63	3.81	3.92	6.92	6.92	6.92	3.00	7.55	0.00	0.00	55.75
2 Others														
- Factory		0.00	0.00	0.00	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.00	0.00	1.99
- Domestic in factory area		0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.43
- Settlers		0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	1.18
- Other needs		0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	1.69
Sub-total (2)		0.28	0.28	0.28	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.28	0.28	5.30
Total		4.01	8.63	4.90	4.37	4.48	7.48	7.48	7.48	3.56	8.11	0.28	0.28	61.04
(m3/sec)		(1.50)	(3.57)	(1.83)	(1.69)	(1.67)	(2.88)	(2.79)	(2.79)	(1.37)	(3.03)	(0.11)	(0.10)	(1.94)

Note:

1 Total cane area = 5,000 acre or 2,020 ha
2 Total padddy area = 1,815 acre or 733 ha
3 No irrigation due to rainfall : May, Nov, Dec, Jan
4 Irrigation supply of sugarcane is terminated one month before harvesting.
5 Harvesting period of sugarcane : May to October
6 Water duty of paddy : Yala season; 7 acre-ft/acre, Maha; 5 acre-ft/acre

Source: Attached data of "Letter of Water Issue Request by Sugar Cooperation in 1987; "Water Requiremnt Sevanagala Sugar Project", Research and Development Division of SLSC (Sri Lanka Sugar Corporation), 1981

B RETURN FLOW														
1 Sugar cane	2,020	0.00	1.20	1.20	0.99	0.00	0.78	0.78	0.78	0.78	0.99	0.00	0.00	7.50
2 Paddy (LHG)	730	1.98	1.98	0.00	0.00	2.08	2.08	2.08	2.08	0.00	1.98	0.00	0.00	14.25
Total	2,750	1.98	3.18	1.20	0.99	2.08	2.86	2.86	2.86	0.78	2.97	0.00	0.00	21.75

Assumptions:

1 No return flow is espected from other demand
2 Return flow is estimated by the ratio using for MEA area
3 Paddy field are located on LHG soils
4 Return flow ratio for the paddy field including both percolation and operation loss is 0.53
5 Return flow ratio for the operation loss is 0.26

Table A7.5 - 10 WATER REQUIREMENTS ESTIMATED BY ADB AND RETURN FLOW OF RIGHT BANK AREA

A Water requrement of ADB'sAppraisal

1 Unit diversion water requirement (Unit: mm)

Crop	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Year
- paddy in Maha	179	286	286	412	459	175							1,797
- paddy in Yala							168	467	469	556	318	0	1,978
- sugarcane	143	97	96	230	332	293	114	133	200	319	289	315	2,561
- subsidary crops	0	0	51	212	0	0	27	61	229	354	0	0	934

2 Diversion irrigation water requirements of right bank area (Unit: MCM)

Crop	Area (ha)	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Year
- paddy in Mal	10,900	19.5	31.2	31.2	44.9	50.0	19.1							195.9
- paddy in Yal:	9,700							16.3	45.3	45.5	53.9	30.8	0.0	191.9
- sugarcane	500	0.7	0.5	0.5	1.2	1.7	1.5	0.6	0.7	1.0	1.6	1.4	1.6	12.8
- subsidary cro	500	0.0	0.0	0.3	1.1	0.0	0.0	0.1	0.3	1.1	1.8	0.0	0.0	4.7
Sub-total		20.2	31.7	31.9	47.1	51.7	20.5	17.0	46.3	47.6	57.3	32.3	1.6	405.2
(m3/s)		7.6	11.8	11.9	17.6	19.3	7.7	6.3	17.3	17.8	21.4	12.1	0.6	

3 Industrial demand, etc (Unit: MCM)

	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	30.0

TOTAL (Unit: MCM)

	22.7	34.2	34.4	49.6	54.2	23.0	19.5	48.8	50.1	59.8	34.8	4.1	435.2
(m3/s)	8.5	12.8	12.8	18.5	20.2	8.6	7.3	18.2	18.7	22.3	13.0	1.5	

Note: Irrigation efficiency is taken at 52.5 % for both paddy and upland crops (75 % of appricatiion and 70 % of conveyance efficiencies)

Source; Appraisal Report of Walawe Irrigation Improvement Project, ADB,1984

B Return Flow 60 % of irrigatoin supply for the area of 4,700 ha (Areas of E'pitiya and C'wewa)

1 Diversion req't	4700	11.01	16.55	16.67	24.04	26.26	11.16	9.45	23.63	24.29	28.97	16.86	1.97	210.88
2 Return flow		6.61	9.93	10.00	14.43	15.75	6.70	5.67	14.18	14.58	17.38	10.11	1.18	126.53

Soil	Area	Rate of return flow (JICA)	(Ref. to TAble A5.4-6)		
REB	2300	0.74	1702		
INT	900	0.66	594		
LHG	1500	0.53	795		
Total	4700		3091	Ave.	0.6577
				say	0.6

Table A7.5-11 **RETURN FLOW TO THE WALAWE RIVER 1/2**

(Unit : MCM)

Area	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Total
(Alternative - DFR-1)	(Irrigation demand of the Right bank is 405 MCM/year)												
1 Kiriibanwewa block													
- Percolation	0.82	1.00	0.78	0.78	0.10	0.41	1.02	0.78	0.78	0.59	0.00	0.00	7.06
- Operation	1.61	1.41	1.02	1.54	0.44	1.02	2.22	1.38	1.65	1.48	0.32	0.17	14.25
Sub-total-1	2.43	2.41	1.80	2.32	0.54	1.43	3.24	2.16	2.43	2.07	0.32	0.17	21.31
2 Beddewawe Branch Left													
- Percolation	0.84	0.95	0.70	0.70	0.09	0.42	1.01	0.70	0.70	0.53	0.00	0.00	6.64
- Operation	0.77	0.67	0.49	0.82	0.35	0.56	1.09	0.71	0.84	0.80	0.25	0.14	7.50
Sub-total-2	1.61	1.62	1.19	1.52	0.44	0.98	2.10	1.41	1.54	1.33	0.25	0.14	14.14
3 Beddewawe Branch Right													
- Percolation	0.59	0.74	0.59	0.59	0.07	0.30	0.74	0.59	0.59	0.45	0.00	0.00	5.25
- Operation	1.31	1.16	0.89	1.61	0.84	1.16	2.01	1.38	1.54	1.47	0.55	0.36	14.29
Sub-total-3	1.90	1.90	1.48	2.20	0.91	1.46	2.75	1.97	2.13	1.92	0.55	0.36	19.54
Total 1,2,3	5.93	5.94	4.47	6.04	1.89	3.87	8.09	5.53	6.11	5.31	1.12	0.68	54.98
4 Sugar area	2.97	0.00	0.00	1.98	3.18	1.20	0.99	2.08	2.86	2.86	2.86	0.78	21.76
5 Right bank of MEA (Irri. Demand of 405 MCM/yr)	6.61	9.93	10.00	14.43	15.75	6.70	5.67	14.18	14.58	17.38	10.11	1.18	126.52
Total (1 - 5) (U/S Anicut)	15.51	15.87	14.47	22.45	20.82	11.77	14.75	21.79	23.55	25.55	14.09	2.64	203.26
6 Kalatota	5.97	5.52	3.69	3.99	0.44	3.13	6.96	3.96	4.34	3.10	0.00	0.00	41.10
7 Lidiyagama scheme	8.59	9.19	7.05	7.92	0.91	4.59	11.20	7.57	8.07	6.26	0.00	0.00	71.35
Total (1 - 7)	30.07	30.58	25.21	34.36	22.17	19.49	32.91	33.32	35.96	34.91	14.09	2.64	315.71

Table A7.5-11 **RETURN FLOW TO THE WALAWE RIVER 2/2**

(Unit : MCM)

Area	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Total
(Alternative - DFR-2)	(Irrigation demand of the Right bank is 346MCM/year)												
1 Kiriibanwewa block													
- Percolation	0.82	1.00	0.78	0.78	0.10	0.41	1.02	0.78	0.78	0.59	0.00	0.00	7.06
- Operation	1.61	1.41	1.02	1.54	0.44	1.02	2.22	1.38	1.65	1.48	0.32	0.17	14.25
Sub-total-1	2.43	2.41	1.80	2.32	0.54	1.43	3.24	2.16	2.43	2.07	0.32	0.17	21.31
2 Beddewawe Branch Left													
- Percolation	0.84	0.95	0.70	0.70	0.09	0.42	1.01	0.70	0.70	0.53	0.00	0.00	6.64
- Operation	0.77	0.67	0.49	0.82	0.35	0.56	1.09	0.71	0.84	0.80	0.25	0.14	7.50
Sub-total-2	1.61	1.62	1.19	1.52	0.44	0.98	2.10	1.41	1.54	1.33	0.25	0.14	14.14
3 Beddewawe Branch Right													
- Percolation	0.59	0.74	0.59	0.59	0.07	0.30	0.74	0.59	0.59	0.45	0.00	0.00	5.25
- Operation	1.31	1.16	0.89	1.61	0.84	1.16	2.01	1.38	1.54	1.47	0.55	0.36	14.29
Sub-total-3	1.90	1.90	1.48	2.20	0.91	1.46	2.75	1.97	2.13	1.92	0.55	0.36	19.54
Total 1,2,3	5.93	5.94	4.47	6.04	1.89	3.87	8.09	5.53	6.11	5.31	1.12	0.68	54.98
4 Sugar area	2.97	0.00	0.00	1.98	3.18	1.20	0.99	2.08	2.86	2.86	2.86	0.78	21.76
5 Right bank of MEA (Irri. Demand of 346 MCM/yr, MMP's estimate)	18.09	18.46	13.53	12.56	6.01	10.50	13.38	12.39	10.96	9.37	4.61	5.92	135.78
Total (1 - 5) (U/S Anicut)	26.99	24.40	18.00	20.58	11.08	15.57	22.46	20.00	19.93	17.54	8.59	7.38	212.52
6 Kalatota	5.97	5.52	3.69	3.99	0.44	3.13	6.96	3.96	4.34	3.10	0.00	0.00	41.10
7 Lidiyagama scheme	8.59	9.19	7.05	7.92	0.91	4.59	11.20	7.57	8.07	6.26	0.00	0.00	71.35
Total (1 - 7)	41.55	39.11	28.74	32.49	12.43	23.29	40.62	31.53	32.34	26.90	8.59	7.38	324.97

Fig. A7.5 - 12 IRRIGATION WATER REQUIREMENT AND RETURN FLOW OF KALTOTA SCHEME

Item	Unit	Sep	Maha Paddy: Oct	Nov	Dec	Jan	Feb	Yala Paddy: Mar	Apr	May	Jun	Jul	Aug	Annual total
Basic Data for Calculation														
1 ETo	mm/day	5.8	5.0	4.2	4.2	4.6	5.1	5.6	5.1	5.4	5.3	6.0	6.1	
2 Effective rainfall at M060	mm/m	56	185	225	112	62	46	117	201	76	0	55	34	1169
3 Field application effeciency	%	100%												
4 Operation efficiency	%	68%												
A Paddy on RBE (Moderate drain) soi	Area :	870 ha												
	Percolation rate :		10 mm/day for growing period (15 mm/day for land preparation period)											
1 Crop coefficient														
Kc-1				1.01	1.15	1.17			1.00	1.07	1.20	1.14		
Kc-2				1.00	1.07	1.20	1.14			1.01	1.15	1.17		
Kc-3														
Average			0.00	1.01	1.11	1.19	1.14	0.00	1.00	1.04	1.18	1.16		
2 Days of irrigation	days		30	30	30	30	15	15	30	30	30	30	0	
3 ET crop (ETo x Kc)	mm	0	0	127	140	164	87	0	153	168	187	208	0	
4 Area factor (Fa)	mm		0.00	0.75	1.00	1.00	0.25	0.00	0.25	1.00	1.00	0.75		
5 ET crop net (ETo x Kc x Fa)	mm	0	0	95	140	164	22	0	38	168	187	156	0	
6 Land preparation	mm		783	392				392	783					
7 Percolation	mm		0	225	300	300	38	0	75	300	300	225	0	
8 Sub-total (= (5)+(6)+(7))	mm	0	783	712	440	464	59	392	896	468	487	381	0	
9 Effective rainfall	mm	0	185	225	112	62	23	59	201	76	0	55	0	998
10 Net requirement (= (8)-(9))	mm	0	598	487	328	402	36	334	695	392	487	326	0	4,085
11 Farm requirement	mm	0	598	487	328	402	36	334	695	392	487	326	0	4,085
12 Diversion requirement	mm	0	880	716	482	590	53	490	1022	577	716	479	0	6,007
13 Diversion requirement	MCM	0.00	7.66	6.23	4.19	5.14	0.46	4.27	8.90	5.02	6.23	4.17	0.00	52.26
14 Diversion requirement	m3/s	0.00	2.95	2.40	1.62	1.98	0.36	3.29	3.43	1.94	2.40	1.61	0.00	1.83
(Expected Return Flow)		<<90 % of Percolation Loss>>												
1 Percolation in land preparation	mm		450	225				225	450					1,350
2 Percolation in growing stage	mm	0	0	225	300	300	38	0	75	300	300	225	0	1,763
3 Total	mm	0	450	450	300	300	38	225	525	300	300	225	0	3,113
4 Return flow (0.9 x (3))	mm	0	405	405	270	270	34	203	473	270	270	203	0	2,801
	MCM	0.00	3.52	3.52	2.35	2.35	0.29	1.76	4.11	2.35	2.35	1.76	0.00	24.4 (47%)
5 R/flow other than percolation	mm	0	282	229	154	189	17	157	327	185	229	153	0	1,922
(80 % of Operation losses)	MCM	0.00	2.45	1.99	1.34	1.64	0.15	1.37	2.85	1.61	1.99	1.33	0.00	16.72 (32%)
Total of return flow		0.00	5.97	5.52	3.69	3.99	0.44	3.13	6.96	3.96	4.34	3.10	0.00	41.09

Note:
For the estimate of the irrigation water requirement of the area, same crop calender as applied for the study area is used.
Rainfall data of M060 station is used for estimate of effective raonfall

Fig. A7.5 - 13 **IRRIGATION REQUIREMENT OF RIDIYAGAMA SCHEME**

Area: Both banks of Ridiyagama Scheme

Total area : 6,210 ha Right bank of 2710 ha and Left bank of 3440 ha (Unit : MCM)

Item	Area (ha)	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Annual total
(Basic Data for Calculation)														
1 Unit Irri. Demand														
1 Paddy (LHG)	1000	0.00	5.54	4.97	3.60	4.69	0.49	3.13	7.49	4.25	4.88	3.92	0.00	42.96
2 Paddy (RBE-Mod drain)	1000	0.00	9.95	8.83	5.81	6.89	0.76	5.34	12.45	6.46	7.09	5.57	0.00	69.16
3 Paddy (RBE-Well drain)	1000	0.00	16.57	15.45	10.22	11.30	1.31	8.65	20.17	10.87	11.50	8.88	0.00	114.93
4 Chilli	1000	0.00	0.00	0.00	0.61	2.92	3.39	2.82	0.42	2.21	3.44	4.05	2.87	22.73
5 Big Onion	1000	0.00	0.00	0.00	0.00	1.91	2.73	0.00	0.00	0.25	2.17	3.36	0.00	10.42
6 Red Onion	1000	0.00	0.00	0.00	0.00	1.91	2.09	0.00	0.00	0.25	2.17	2.68	0.00	9.10
7 Pulses	1000	0.00	0.00	0.00	0.00	2.94	0.00	0.00	0.00	0.53	3.26	0.11	0.00	6.84
8 Vegetables	1000	0.00	0.00	0.00	0.06	2.53	2.95	0.00	0.00	0.25	2.27	3.59	2.53	14.17
9 Sunflower	1000	0.00	0.00	0.00	0.54	3.18	2.37	0.00	0.54	2.46	3.60	0.10	0.00	12.79
10 Sugar Cane	1000	1.97	0.81	0.73	0.95	3.28	3.56	3.07	2.68	2.81	2.28	2.61	2.52	27.29
11 Banana	1000	2.58	1.13	0.51	0.25	2.06	2.20	1.85	2.14	2.93	3.66	4.20	4.14	27.65
12 Cassava	1000	1.25	0.00	0.00	0.00	1.25	1.29	0.56	0.46	0.88	1.47	1.85	1.78	10.80
2 Expected Return Flow from Paddy Fields (90% of percolation rate)														
(From percolation)														
1 Paddy (LHG)	1000	0.00	1.35	1.69	1.35	1.35	0.17	0.68	1.69	1.35	1.35	1.01	0.00	11.98
2 Paddy (RBE-Mod drain)	1000	0.00	4.05	4.05	2.70	2.70	0.34	2.03	4.73	2.70	2.70	2.03	0.00	28.01
3 Paddy (RBE-Well drain)	1000	0.00	8.10	8.10	5.40	5.40	0.68	4.05	9.45	5.40	5.40	4.05	0.00	56.02
(Other than percolation)														
1 Paddy (LHG)	1000	0.00	1.42	1.27	0.92	1.20	0.12	0.80	1.92	1.09	1.25	1.00	0.00	11.00
2 Paddy (RBE-Mod drain)	1000	0.00	2.55	2.26	1.49	1.76	0.20	1.37	3.19	1.65	1.82	1.43	0.00	17.70
3 Paddy (RBE-Well drain)	1000	0.00	4.24	3.95	2.62	2.89	0.34	2.21	5.16	2.78	2.94	2.27	0.00	29.42
(Calculation) Assumption: 100 % of the area is covered by LHG soils														
1 Irrigation Demand of the Area														
1 Paddy (LHG)	6210	0.00	34.40	30.86	22.36	29.10	3.02	19.45	46.54	26.40	30.33	24.34	0.00	266.80
2 Paddy (RBE-Mod drain)	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3 Paddy (RBE-Well drain)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4 Chilli		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5 Big Onion		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6 Red Onion		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7 Pulses		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8 Vegetables		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9 Sunflower		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10 Sugar Cane		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11 Banana		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12 Cassava		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total-1	6210	0.00	34.40	30.86	22.36	29.10	3.02	19.45	46.54	26.40	30.33	24.34	0.00	266.80
2 Expected Return Flow from Paddy Fields														
(From percolation)														
1 Paddy (LHG)	6210	0.00	8.38	10.48	8.38	8.38	1.05	4.19	10.48	8.38	8.38	6.29	0.00	74.40
2 Paddy (RBE-Mod drain)	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3 Paddy (RBE-Well drain)	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sub-total	6210	0.00	8.38	10.48	8.38	8.38	1.05	4.19	10.48	8.38	8.38	6.29	0.00 0	74.40
(From other than percolation)														
1 Paddy (LHG)	6210	0.00	8.81	7.90	5.72	7.45	0.77	4.98	11.91	6.76	7.77	6.23	0.00	68.30
2 Paddy (RBE-Mod drain)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3 Paddy (RBE-Well drain)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sub-total		0.00	8.81	7.90	5.72	7.45	0.77	4.98	11.91	6.76	7.77	6.23	0.00	68.30
4 Estimated return flow to the Walawe river (assuming 50 % of the area)														
TO WALAWE river		0.00	8.59	9.19	7.05	7.92	0.91	4.59	11.20	7.57	8.07	6.26	0.00	71.35
3 Other water demand 18000 m3/day in in future (1997) Source: Irrigation Department of M/LIMD														
(days of month)		(30)	(31)	(30)	(31)	(31)	(28)	(31)	(30)	(31)	(30)	(31)	(31)	(365)
		0.54	0.56	0.54	0.56	0.56	0.50	0.56	0.54	0.56	0.54	0.56	0.56	6.57
4 Total Water Demand of the Scheme		0.54	34.95	31.40	22.91	29.65	3.53	20.01	47.08	26.96	30.87	24.90	0.56	273.37

Table A7.5-14 IRRIGATION WATER REQUIREMENT OF RIGHT BANK AREA ESTIMATED BY MMP IN AUG-1992

(Unit : MCM)

Item	Area (ha)	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Annual total
WATER REQUIRED FROM UDA WALAWE RESERVOIR														(Unit : MCM)
A Embilipitiya Block														
1 Volume req'd at block head		2.99	9.64	8.21	8.04	11.50	3.72	6.11	9.51	9.68	10.15	8.92	3.05	91.51
2 Vol. from r -flow & local run.		0.64	1.99	2.02	1.50	1.44	0.66	1.11	1.44	1.35	1.22	1.04	0.51	14.92
3 Balance req'd from main canal		2.35	7.65	6.19	6.54	10.06	3.05	4.99	8.07	8.33	8.93	7.88	2.55	76.59
4 Vol. lost in canal, pond, etc		0.12	0.40	0.32	0.34	0.53	0.16	0.26	0.42	0.44	0.47	0.41	0.13	4.00
		0.12												
5 Vol. needed from the reservoir		2.47	8.05	6.51	6.88	10.59	3.21	5.25	8.49	8.77	9.40	8.29	2.68	80.59
B Chandrikawewa Block														
1 Volume req'd at block head		3.64	11.51	9.80	9.60	13.55	4.35	7.63	11.91	12.05	12.49	11.11	3.79	111.42
2 Vol. from r -flow & local run.		1.63	4.92	5.17	3.57	2.88	1.59	2.89	3.49	3.11	2.56	2.17	1.20	35.19
3 Balance req'd from main canal		2.01	6.59	4.63	6.02	10.66	2.76	4.74	8.43	8.93	9.93	8.94	2.60	76.24
4 Vol. lost in canal, pond, etc		0.21	0.69	0.49	0.63	1.12	0.29	0.50	0.88	0.94	1.04	0.94	0.27	8.00
5 Vol. needed from the reservoir		2.22	7.28	5.11	6.66	11.78	3.05	5.24	9.31	9.87	10.97	9.88	2.87	84.24
C Murawasihena Block														
1 Volume req'd at block head		2.91	9.58	7.78	7.62	10.97	3.06	4.69	7.68	8.21	9.36	8.45	3.60	83.90
2 Vol. from r -flow & local run.		0.76	2.33	2.26	1.79	1.92	0.74	1.09	1.50	1.51	1.54	1.36	0.72	17.52
3 Balance req'd from main canal		2.16	7.25	5.52	5.83	9.05	2.32	3.60	6.18	6.70	7.81	7.08	2.88	66.38
4 Vol. lost in canal, pond, etc		0.39	1.31	1.00	1.05	1.64	0.42	0.65	1.12	1.21	1.41	1.28	0.52	12.00
5 Vol. needed from the reservoir		2.55	8.56	6.52	6.88	10.69	2.73	4.25	7.29	7.91	9.23	8.36	3.41	78.38
D Binkama Block														
1 Volume req'd at block head		2.07	9.10	6.84	7.12	10.53	2.51	4.79	8.48	8.93	10.31	8.88	2.72	82.29
2 Vol. from r -flow & local run.		1.42	4.54	4.59	3.23	2.76	1.36	2.48	3.09	2.83	2.54	2.13	1.14	32.11
3 Balance req'd from main canal		0.65	4.57	2.25	3.88	7.77	1.16	2.31	5.39	6.10	7.77	6.75	1.58	50.18
4 Vol. lost in canal, pond, etc		0.12	0.82	0.40	0.70	1.39	0.21	0.41	0.97	1.09	1.39	1.21	0.28	9.00
5 Vol. needed from the reservoir		0.76	5.38	2.65	4.58	9.17	1.36	2.73	6.36	7.19	9.16	7.96	1.86	59.17
E Angunukolapelessa Block														
1 Volume req'd at block head		2.81	11.62	9.37	9.30	13.26	3.18	5.56	9.73	10.32	12.03	10.48	3.65	101.29
2 Vol. from r -flow & local run.		2.53	8.63	8.23	6.61	7.11	2.56	4.29	6.13	6.12	6.36	5.44	2.43	66.43
3 Balance req'd from main canal		0.28	2.99	1.14	2.68	6.15	0.62	1.27	3.60	4.19	5.66	5.04	1.22	34.85
4 Vol. lost in canal, pond, etc		0.07	0.77	0.29	0.69	1.59	0.16	0.33	0.93	1.08	1.46	1.30	0.32	9.00
5 Vol. needed from the reservoir		0.35	3.76	1.44	3.37	7.74	0.78	1.60	4.53	5.28	7.13	6.34	1.54	43.85
Total vol. needed from Uda Walawe Reservoir		8.35	33.04	22.23	28.37	49.96	11.14	19.06	35.99	39.02	45.89	40.84	12.35	346.24
Reference														
ADB's Estimste in 1984		1.6	20.2	31.7	31.9	47.1	51.7	20.5	17	46.3	47.6	57.3	32.3	405.2
Balance (MMP-ADB)		6.8	12.8	-9.5	-3.5	2.9	-40.6	-1.4	19.0	-7.3	-1.7	-16.5	-19.9	-59.0

Fig. A7.5 - 15 RETURN FLOW FROM THE RIGHT BANK AREA ESTIMATED BY MMP IN AUG-1992

(Unit : MCM)

Item	Area (ha)	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Annual total
(Entiring Walawe Ganga above Liyangastota)														
A Embilipitiya Block														
1 Return flow leaving each block	2.579	7.949	8.092	6.012	5.752	2.657	4.452	5.745	5.393	4.884	4.159	2.024	59.70	
2 Portion used in other block	0	0	0	0	0	0	0	0	0	0	0	0	0.00	
3 Volume lost from main canal	0.123	0.4	0.323	0.341	0.525	0.159	0.261	0.421	0.435	0.466	0.411	0.133	4.00	
4 Balance leaving project area	2.702	8.348	8.415	6.353	6.278	2.816	4.713	6.166	5.828	5.35	4.571	2.157	63.70	
5 Entiring above Liyangastota 100%	2.702	8.348	8.415	6.353	6.278	2.816	4.713	6.166	5.828	5.35	4.571	2.157	63.70	
B Chandrikawewa Block														
1 Return flow leaving each block	3.813	11.49	12.07	8.336	6.73	3.705	6.738	8.132	7.266	5.975	5.055	2.794	82.11	
2 Portion used in other block	0	0	0	0	0	0	0	0	0	0	0	0	0.00	
3 Volume lost from main canal	0.211	0.692	0.486	0.632	1.12	0.29	0.498	0.885	0.938	1.043	0.939	0.273	8.00	
4 Balance leaving project area	4.024	12.18	12.56	8.968	7.85	3.994	7.235	9.017	8.204	7.018	5.994	3.067	90.11	
5 Entiring above Liyangastota 80%	3.219	9.743	10.05	7.175	6.28	3.195	5.788	7.214	6.564	5.614	4.795	2.453	72.09	
Total vol.		5.921	18.09	18.46	13.53	12.56	6.012	10.5	13.38	12.39	10.96	9.366	4.61	135.78

Table A7.5-16 **DESIGN RAINFALL FOR DRAINAGE SYSTEM**

1. Daily Maximum Rainfalls

(Unit : mm/day)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Max
(Sugar Research Institute, SRI, at Uda Walawe)													
1981	43.1	13.0	83.8	37.6	34.5	10.2	0.0	0.0	14.5	46.7	136.1	33.0	136.1
1982	28.5	25.2	70.0	66.3	73.2	9.4	5.3	80.5	7.2	63.8	100.3	38.4	100.3
1983	0.0	0.0	32.5	32.0	58.2	0.5	20.3	77.9	14.7	110.5	71.9	99.6	110.5
1984	36.1	36.1	143.5	68.6	43.4	10.0	19.3	0.0	74.4	53.4	77.0	47.8	143.5
1985	48.9	33.4	38.8	36.7	37.4	21.8	21.8	4.6	52.0	62.2	48.9	58.3	62.2
1986	52.0	141.5	51.0	33.9	23.7	0.7	2.5	18.6	47.5	55.1	32.8	18.0	141.5
1987	10.9	9.5	49.6	46.5	17.4	1.5	0.0	21.4	19.0	67.8	90.5	80.6	90.5
1988	15.5	68.4	81.0	52.3	36.0	22.9	9.3	16.6	17.4	80.0	65.1	51.2	81.0
1989	19.5	24.7	72.5	45.3	30.2	8.1	30.1	13.6	57.1	56.2	56.0	24.0	72.5
1990	53.9	37.3	61.8	35.1	32.9	3.9	22.9	2.8	2.9	71.5	67.8	81.9	81.9
Max	53.9	141.5	143.5	68.6	73.2	22.9	30.1	80.5	74.4	110.5	136.1	99.6	143.5
Min	0.0	0.0	32.5	32.0	17.4	0.5	0.0	0.0	2.9	46.7	32.8	18.0	62.2
Ave	30.8	38.9	68.5	45.4	38.7	8.9	13.2	23.6	30.7	66.7	74.6	53.3	102.0
(Agricultural Research Station, ARS , at Angunakolapelessa)													
1985	9.0	38.4	31.1	17.0	10.2	44.4	1.0	34.8	16.5	33.4	23.0	18.0	44.4
1986	44.5	13.7	84.2	67.1	8.5	10.7	1.9	28.0	55.4	12.1	17.0	23.2	84.2
1987	19.5	1.1	28.0	35.0	10.0	17.6	0.0	13.7	62.5	33.3	112.5	21.0	112.5
1988	17.0	26.8	34.0	76.6	15.6	54.8	8.5	14.4	35.3	10.2			76.6
1989	83.9	10.2	23.0	38.4	7.5	10.2	33.9	35.2	22.7	39.2	12.6	6.4	83.9
1990	38.1	1.8	14.3	26.0	42.4	29.4	7.8	1.4	9.5	81.8	37.0	84.5	84.5
Max	83.9	38.4	84.2	76.6	42.4	54.8	33.9	35.2	62.5	81.8	112.5	84.5	112.5
Min	9.0	1.1	14.3	17.0	7.5	10.2	0.0	1.4	9.5	10.2	12.6	6.4	44.4
Ave	35.3	15.3	35.8	43.4	15.7	27.9	8.9	21.3	33.7	35.0	40.4	30.6	81.0

2. Probable Rainfalls (estimated by Gumbel method)

Return Period (year)	Probable Rainfall (mm)		
	SRI	ARS	Average
5	131.8	105.5	118.7
10	154.1	123.3	138.7
25	182.3	145.8	164.1
50	203.2	162.6	182.9

Taking into account the rainfall distribution pattern of the Study area, average values of SRI and ARS are adopted as the design rainfall for drainge system in the area.

Table A7.5-17 **ESTIMTE OF DRAINAGE REQUIREMENT**

1 Formula

$$Q = (A * Rn * c * 10000) / (3600 * T * 1000)$$

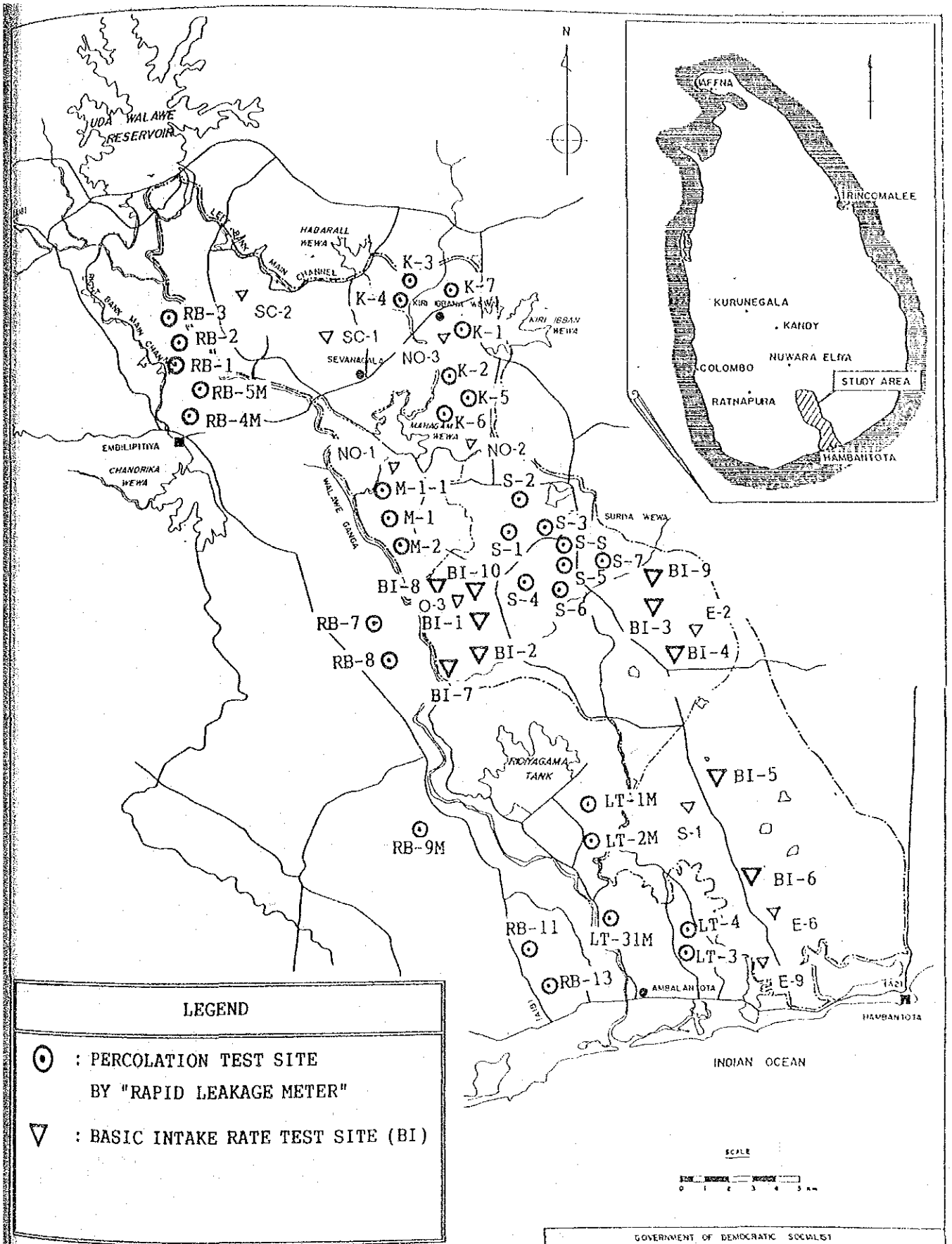
where,

- Q : Amount of drainage (cu-m/sec)
- A : Catchment area (ha)
- Rn : Probable daily rainfall, return period of 5 years (118.7 mm)
- c : Runoff coefficient
- T : Design time for drainage (hr)

2 Calculatin of Unit Drainage Requirements

Land use	A (ha)	Rn (mm/day)	c	T (hour)	Q (lit/s/ha)
Paddy field	1.0	118.7	0.6	48	4.12
Upland field, forest, etc	1.0	118.7	0.5	24	6.87

FIGURES



LEGEND

⊙ : PERCOLATION TEST SITE BY "RAPID LEAKAGE METER"

▽ : BASIC INTAKE RATE TEST SITE (BI)

Fig. A7.5-1 LOCATION OF IRRIGATION FIELD TEST SITES

GOVERNMENT OF DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
MINISTRY OF LANDS, IRRIGATION AND MAHAWELI DEVELOPMENT

THE FEASIBILITY STUDY ON WALAWE IRRIGATION UPGRADING AND EXTENSION PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

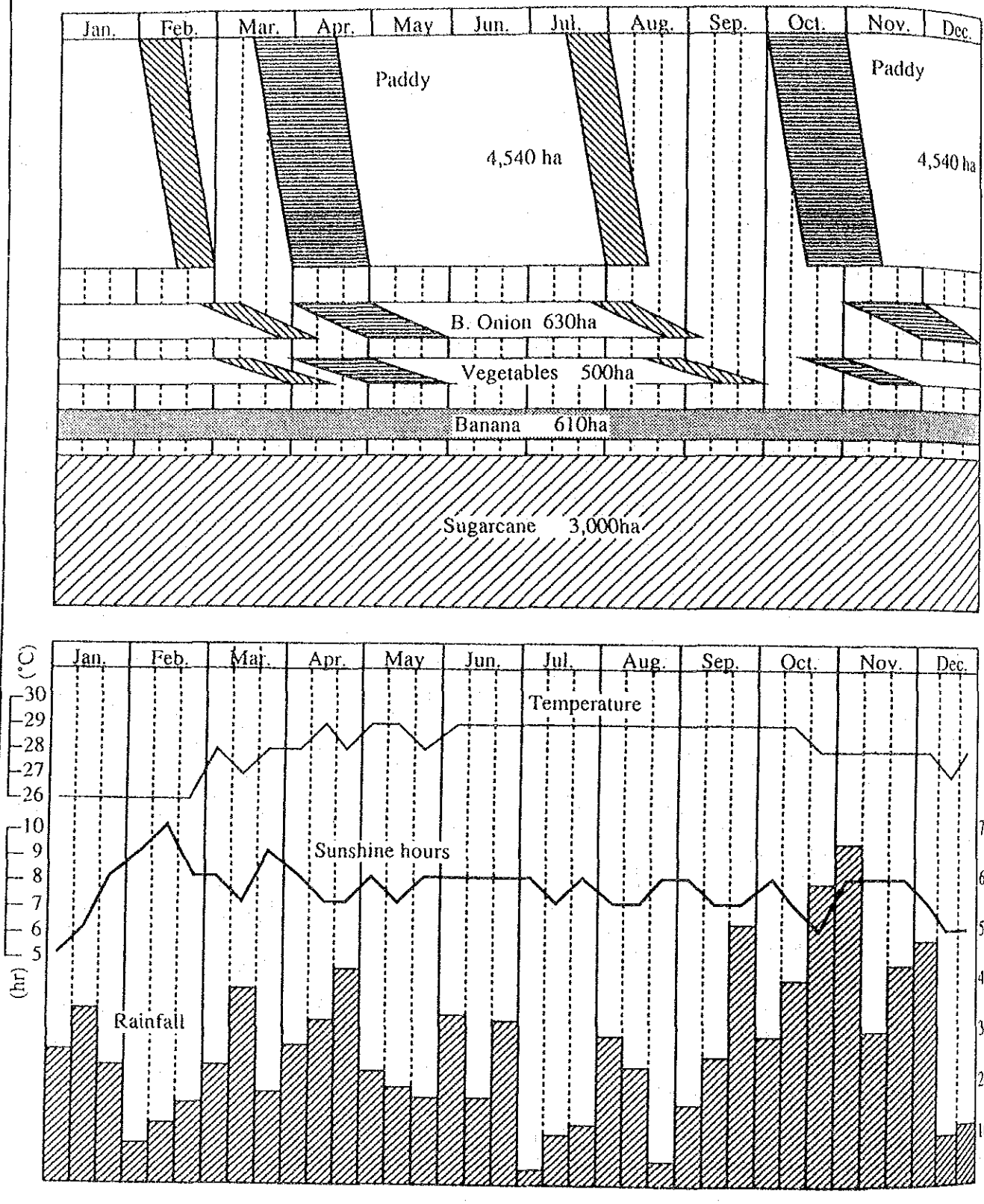


Fig. A7.5-2 PROPOSED CROPPING PATTERN

GOVERNMENT OF DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
MINISTRY OF LANDS, IRRIGATION AND MAHAWELI DEVELOPMENT
THE FEASIBILITY STUDY ON WALAWE IRRIGATION UPGRADING AND EXTENSION PROJECT
JAPAN INTERNATIONAL COOPERATION AGENCY

ANNEX 7-6 PRELIMINARY DESIGN OF IRRIGATION AND DRAINAGE FACILITIES

Contents

List of Tables

List of Figures

ANNEX 7-6 PRELIMINARY DESIGN OF IRRIGATION AND DRAINAGE FACILITIES

7.6.1 Rehabilitation and improvement work of the existing irrigation and drainage facilities

(1) Design considerations

Following basic concept for rehabilitation and improvement work for the Old area is formulated through the assessment of the existing irrigation and drainage facilities as described in Annex 7-1 :

- Objective facilities of the work is the existing irrigation canals and related structures under the management of MASL. The facilities are damaged and collapsed considerably due to deterioration and mal-design. Improvement and upgrading works of these facilities is required not only to improve and upgrade the existing facilities but also to extend irrigation area in the Extension area through saving the water consumption in the Old area. It is noted that the saving of water consumption of the existing irrigation area will also be realized thought the improvement work and enhancement of water management.

- No improvement plan for the existing drainage facilities is planned since no serious drainage problems has occurred in the area due to existence of the Uda Walawe reservoir, steep slope and rather higher location of the irrigation area than river.

- No work is planned for irrigation and drainage facility in the Sevanagala sugar area since the facilities were constructed recently (existing facilities were completed in 1986) by sugar cooperation and these facilities are well maintained by them.

(2) Water management plan

Improvement plan of the existing related structures are planned based on the following water management plan aiming at that irrigation water is distributed to each farmers plot equitably.

(i) Main, Branch and Distributary canals are run at a scheduled demand discharges in accordance with the crop water requirement. Discharge and design water level in the canals will be varied seasonally. For sustaining equable distribution of the irrigation water for the whole irrigation area, a turnout with a proportional weir or equivalent device, an adjustment gate and a discharge measuring device is needed.

(ii) Within commanding area of F-canal, intermittent and/or rotational irrigation supply method is introduced. Off-take of farm turnout is controlled by on-off operation of the inlet of a division box and groove for check plate.

(3) Improvement plan of canals

Most of the small scale canals such as D and F-canals are much deteriorated due to less maintenance of the canal sections and erosion by water flows especially at the bend portion of the canals. This has occurred by excess flow of irrigation water and high water velocity in the canals, and mal-design of irrigation facilities. To sustain the proper water distribution, and to save the conveyance losses in the canals and financial burdens for maintenance cost, a concrete

lined canal is planned for D and F canals. Extension of canal length is also planned to irrigate whole farm plot from field canals through farm turnouts.

Regarding the main and branch canals, improvement work for canals is planned by mean of heightening of canal banks for 14 km in total, and side slope protection at the eroded portion, especially at the outer bend of the curve portion and up and downstream portion of the structures. Assessment of flow capacity for the existing LBMC and BBC (refer to Annex 7-4) indicates that some stretches of both canals are required heightening of canal bank for extension of irrigation area. Required length of the bank heightening work is estimated at about 8 km for LBMC and 6 km for BBC. Regarding the BBC, end stretch of about 2 km is required for re-construction to convey irrigation water with appropriate water level to the irrigation extension area which is located at the end of the canal.

Improvement plan of the canals are summarized as below and its breakdown is tabulated in Table A7.6-1.

Item	Length (km)
Extension of canal length	30.3
Protection work of eroded portion	10.2
Canal lining	132.2
Heightening of canal bank	14.0
Total	186.7

(4) Improvement plan of related structures

According to the inventory list and report on conditions of the existing related structures on the existing irrigation canals prepared by MEA for the study area, two-third (2/3) of the related structures in the area are required to repair and replace as follows:

Canal	No repair Needed	Repair Needed	Replace Needed	Total
LBMC	16	26	24	66
Branch canals	25	60	2	87
D-canals	118	205	110	433
F-canals	581	450	626	1,657
Total	740	741	762	2,,243

The main constraints of the present conditions of the structures obtained through assessments of flow capacity of canals and inventory list are summarized as follow:

(i) Less flow capacity of aqueduct on LBMC for crossing the Mau river for extension of irrigation area.

(ii) Numbers of the existing farm turnout is much less than that of farm plots of about 2,900 in the existing irrigation area. It is counted that the numbers of the existing farm turnout is only 840 nos. It is necessary to provide additional farm turnout of 2,060 nos

(iii) About 1,000 numbers of drops exist in the area, especially on F-canals due to steep slope of the area. Two-third of drops are damaged seriously and needed to repair and replace.

(iv) Whole gates on structures are collapsed and deteriorated in many cases. Supply of new gates for the all gated structures are needed since the gates are installed in 1960-70s.

According to the above conditions and water management plan, proposed major improvement work are designed as follow and its details are shown in Table A7.6-1.

(i) Construction of measuring devices at or near turnouts on major canals, where water head is available (44 nos)

(ii) Modification of the intakes of the turnouts to sustain the proportional intake according to the canal discharge in parent canals

(iii) Replacement of all gates on the existing gated structures (197 nos)

(iv) Construction of additional farm turnouts for providing whole farm plots.(about 2300 nos.)

(v) Replacement and additional construction of drops and culverts (about 750 nos)

(vi) Additional construction of footpath bridges and bathing steps on major canals (about 80 nos)

(vii) Repair of aqueduct on LBMC for crossing the Mau river.(1 no)

7.6.2 Proposed irrigation facilities in the irrigation extension area

(1) General

The irrigation extension areas, covering 6,380 ha in net, comprise the areas of 1,040 ha in the Old area and 5,340 ha in the Extension area. The irrigation extension area in the Old area is located at the western end of the existing Beddewewa branch canal.

The irrigation extension area in the Extension area extends over the valleys and is broadly divided into two irrigation blocks (north and south areas) as shown in DWG-8 in Volume IV. The valley bottoms are planned to be used for the paddy fields and higher parts are for the upland crops. Irrigation area by crops is 2,760 ha of paddy and 3,620 ha of upland crops including 2,620 ha of sugar cane.

(2) Design considerations

Introduction of tank cascade system

The basic concept of the irrigation system in the irrigation extension area is to introduce a tank cascade system. The system aims at high irrigation efficiency with rather low level water management in the end users. The system will realize re-use of return flows and function as

buffer pond for upland irrigation. Existing tanks scattered in the area are fully utilized and incorporated in the proposed irrigation system (refer to Fig. A7.6-1).

Due to the existence of the tanks in the valleys, drainage water to out side of the project area could be minimized except flood time. This means that effect of drainage to the out side area such as commanding area of Liyangastota irrigation scheme and Karagan lagoon is minimized by the tanks. Existing natural streams are fully utilized as main drainage canal.

Water management plan

Water management plan is considered as below aiming at that irrigation water is distributed to each benefited farmers equitably.

(i) Main, Branch and Distributary canals are run at a scheduled demand discharges in accordance with the crop water requirement. Discharge and design water level in the canals will be varied seasonally.

(ii) Within commanding area of F-canal, intermittent and/or rotational irrigation supply method is introduced. Off-take of farm turnout is controlled by on-off operation of the inlet of a division box and groove for check plate.

Irrigation method of upland crop field applied for the project is surface irrigation system based on the field irrigation test result as presented in Annex 7-5. Flood irrigation system is to be applied for the paddy field. Day-time irrigation (12-14 hours per day) is applied for the upland irrigation and 24-hours continuous irrigation hour is planned for paddy fields.

Canal alignment

Alignment of irrigation canals are made taking into consideration the tank system based on the available topographic maps as shown in DWG 9 in Volume IV. Contour canal is basically applied to avoid deep cut and high embankment taking into account the result of geological survey, and to minimize construction cost. According to the result of survey, hard rocks extend over along ridge line with rather shallow overburden.

Left Bank Main Canal (LBMC) is extended from the existing end point at Suriyawewa for about 25 km along water shed line (refer to DWG-9). Canal route is selected to avoid deep cut and high embankment. taking into account the existence of the foundation condition.

Farm pond for upland crop irrigation is planned at the beginning point of D-canals to regulate canal flow in the night. Double canal system, namely canals mainly for paddy field and upland field is planned taking into account the location of the tanks and commanding area as shown in DWG 9 in Volume IV.

(3) Main features of tanks

As mentioned in the above, tanks will play important roles in the irrigation system. Main functions of tanks proposed for the project are summarized as below.

(i) Collection of return flow from the upstream fields, mainly from paddy fields.(low tank). Low tanks are located in valley bottoms and the existing tanks are fully utilized as low tanks.

(ii) Regulation of night flow of major canals to irrigate upland crops, which is located at the beginning of D-canals mainly for upland crops (high tank). The tanks are

located at top-end part of the upland field area and formulated by using a depressions at the most upstream part of the valleys.

(iii) Provision of domestic water to settlers and livestocks. It is considered that low land tank is used only for inhabitants to avoid damages of bunds and irrigation area. High tanks and tanks on LBMC, which will be created by level crossing work, could be used for livestock purpose.

(iv) Buffer for emergency supply with periodic release during severe drought time as Yala 1992.

(v) Reduce of out flow of excess water to the out side of area and temporary storage of flood flow in the rainy season (not main function, but important for environmental conservation).

Volume of low tank is decided to collect return flow yielded in the upstream paddy area and topographic condition. Assuming that paddy field on LHG soils will yield return flow of about 60 m^3/day/ha and the commanding area of tank is about 400 ha (6,000 ha / 15 tanks), daily return flow volume from the upstream area is calculated at 24,000 m^3. Since storage volume of the existing tanks is estimated at about 100,000 m^3 in an average, the most of the existing tanks have 4-days volume of return flow and will be utilized without heightening of bunds.

Volume of high tank is estimated based on the assumption that the commanding area of one tank is 240 ha in an average (commanding area of two d-canals), peak daily irrigation water demand of upland of 140 m^3/day/ha (banana), and regulation volume is for one night (12 hours). Estimated volume required for a tank is of about 34,000 m^3. Assuming average water depth of tank is 2 m deep, required area of the tank is about 2 ha.

It is noted that one small scale anicuts (pick-up structure) for collecting drainage water is planned on the Aliolu river in the Suriyawewa block. No anicut of new tank is planned for the Kiriibanwawe block since all of the water to be re-used will be collected by the Mahagama tank area.

(4) Proposed works

For successful agricultural development through irrigation development, construction of the following irrigation facilities is proposed:

- Construction of irrigation canals of 362 km in total as broken down below:

Canal	Nos.	Length (km)
Extension of LBMC	1	25
Branch canals	8	35
Distributary canals	171	302
Total	180	362

- Construction of related structures including (1,626 nos. in total) consisting of :
  - cross drain of 25 nos.
  - culvert of 44 nos,

- turnouts on main canals of 25 nos., branch canals of 172, and distributary canals of 580
- spillway of 15 nos.
- regulators or check structures of 15 nos.
- bridges of 15 nos, and footpath bridges of 67
- drops of 545 nos.
- bathing steps of 94 nos,
- one small scale intake weir on drainage canals for catching the return flow

- Rehabilitation of the existing village tanks of 15 nos., construction of low tanks of 4 nos.and high tanks of 28 nos.

More detailed description of the proposed project works is tabulated in Table A7.6-2 and A7.6-3, and main features of irrigation canals are shown in Table A7.6-4. Typical cross sections of irrigation canals as well as irrigation diagram are presented in Figs. A7.6-2 and A7.6-3. Plan and profile of extension route of LBMC is presented in DWG-10 in Volume IV.

7.6.3 Proposed drainage facilities in the irrigation extension area

(1) Basic plan

The drainage plan is formulated based on the available topographic maps and rainfall data in the area. The unit drainage requirement is estimated based on the one-day rainfall with return period of five years as presented in Annex. 7-5.

Drainage block in the irrigation extension area is broadly divided into three drainage areas, namely irrigation extension area in the Suriyawewa block, northern and southern part of the Extension areas as shown in DWG-11 in Volume IV. Excess water from irrigation extension area in the Suriyawewa block will be drained to the Walawe river directly through several natural streams. The excess water from the northern part of the Extension area will be evacuated to the main canal from Ridiyagama tank of the Liyangastota scheme since there is no alternative route of main drainage canal. Because of no cancellation of the existing tanks in the extension area, it is considered that the inflow discharge to the canal will not be changed. The excess water from southern part of the extension area will be flow into the Karagan lagoon, which is formulated as back marsh of the sea. As same topographic condition as that of northern part, there is no alternative plan of main canal.

(2) Drainage system

The proposed drainage canal layout is made in accordance with the above drainage plan and proposed irrigation canal layout. The most important item is full utilization of the existing natural drains. The layout plan of the drainage canal and proposed drainage diagram are shown in DWG-11.

(3) Proposed works

As a result of the layout, the main, secondary and turnout drains of about 254 km in total are planned for the project. Out the total, about 50 km of the existing drain could be utilized with re-shaping and expanding their flow capacity. Breakdown and main features of the drainage canals are tabulated in Tables A7.6-2, A7.6-3, and A7.6-5.

7.6.4 Proposed road network in the irrigation extension area

Road along the canal will have dual functions of (i) inspection and maintenance road, and (ii) farm road for agricultural activities, especially for transportation of sugar cane to the factory. Because of no existence of canals, no farm road along the canal exist. Farm roads along full stretch of proposed canals and connection road with trunk road of 406 km in total are proposed.

Width of roads along main and branch canals are planned to be 6 m in total with 4.5 m effective width as shown in Fig. A7.6-2 The road pavement is planned to be made by gravel for main and branch canal. No pavement is planned for roads along minor canals.

7.6.5 Proposed on-farm and land reclamation works in the irrigation extension area

(1) Design considerations

According to the MASL and the "Technical Guide Line for Irrigation Works" of Irrigation Dept. of M/LIMD, the size adopted for farm in the Irrigation and Agricultural settlement project is about 1.0 ha (2.5 acs) in total. The settlers under the project will also be allotted 1.0 ha in total. The settlers will have both paddy and upland fields and proportion of them will be decided from consideration of available family labour and satisfactory level of farm income. Since irrigation area of paddy field and upland field will be divided completely according to the soil conditions, LHG soils for paddy and RBE for upland field, each farmer will have more than two farms plots. Taking the above condition into consideration and furrow length of 60-100 m in an average, farm plot size is decided at 0.2 ha with about 70 m long and about 30 m wide as shown in Fig. A7.6-4.

The irrigation and drainage facilities in the on-farm level consist of field canal and drain, these related structures, and farm road along the canals. Following the technical guide line of Irrigation Department , commanding area of field canal is set at about 10 ha in an average, and about 50 farm plots will be commanded by the field canal.

Land reclamation work is required for 5,240 ha in total as follow since most of the lands are used as chena and remains as shrub land at present:

(Unit : ha in net)

Present land use	Proposed land use with project	
	Paddy	upland
Upland	380	-
Chena	800	-
Shrub	1,230	2,780
Homestead	-	50
Total reclamation area	**2,410**	**2,830**

The reclamation work consists of (i) bush and forest clearing including grubbing of roots of trees, (ii) land levelling for paddy fields and land grading for upland fields, and (iii) initial ploughing for both fields. It is planned that construction of levees for paddy plot and furrow for upland irrigation is to be made by settlers themselves.

(2) Proposed works

Following works are proposed under the project:

- Construction of minor canals within the on-farm development including construction of field canals (191 km each for irrigation and drainage field canals), roads and related structures (6,380 ha)

- Reclamation of farm lands of 5,240 ha in total comprising 2,410 ha of the paddy and 2,830 ha of upland fields.

TABLES

Table A7.6 - 1 **REHABILITATION PLAN FOR THE EXISTING CANALS AND RELATED STRUCTURES (1/2)**

Item	Unit	LBMC	B-canal	D-canal	F-canal	Total	Remarks
A Existing irrigation canals and structures		(Source : Inventory list of Uda Walawe Special Area, MEA-MASL)					
(Canal)							
1 Nos of canal	nos.	1	2	41	187	231	Yodo-Ela canal is dealt as B-canal
2 Length	km	30.3	20.0	42.7	59.2	152.244	
(Structures)							
1 Bathing step	nos.	0	9	1	2	12	249 nos. of the existing structures
2 Culvert	nos.	0	3	19	15	37	will not be used in future.
3 Drop	nos.	0	1	148	880	1,029	
4 Cross drain	nos.	7	8	15	19	49	
5 Farm turnout	nos.	0	11	148	681	840	
6 Field turnout	nos.	0	32	99	56	187	
7 Distributary t-out	nos.	28	13	0	0	41	
8 Foot bridge	nos.	4	2	3	1	10	
9 Car bridge	nos.	13	6	0	2	21	
10 Spillway	nos.	3	1	0	1	5	
11 Regulator	nos.	3	1	0	0	4	
12 Measuring device	nos.	0	0	0	0	0	
13 B-canal turnout	nos.	1	0	0	0	1	
14 Control gate of tank	nos.	1	0	0	0	1	
15 Siphon	nos.	1	0	0	0	1	
16 Aqueduct	nos.	1	0	0	0	1	
17 Tank	nos.	4	0	0	0	4	
Total - 1		66	87	433	1,657	2,243	
B Rehabilitation plan for the existing irrigation canal network							
(Canal)							
1 Extension of canal length	km	0.0	0.0	2.5	27.8	30.3	
2 Riprap of eroded portion at outer bend	km	9.0	1.1	0.0	0.0	10.1	
3 Canal lining	km	0.0	0.0	45.2	87.0	132.2	
4 Bank heightening	km	8.0	6.0	0.0	0.0	14.0	
(Total Required Nos. of Structures)							
1 Bathing step	2 nos./canal	10	9	66	0	85	
2 Culvert	2 nos./canal	0	4	66	374	444	
3 Drop	nos./canal	0	1	150	880	1,031	
4 Cross drain	nos./canal	7	8	20	22	57	
5 Farm turnout	nos./canal	0	0	0	2,900	2,900	
6 Field turnout	nos./canal	0	0	187	0	187	
7 Distributary t-out	nos./canal	28	13			41	
8 Foot bridge	nos./canal	4	4	3	3	14	
9 Car bridge	nos./canal	13	6	1	2	22	
10 Spillway	1 no./canal	3	1	0	1	5	
11 Regulator	nos./canal	3	1	0	0	4	
12 Measuring device	nos./canal	1	2	41	0	44	
13 B-canal turnout	nos.	1	0	0	0	1	
14 Control gate of tank	nos.	1	0	0	0	1	
15 Siphon	nos.	1	0	0	0	1	
16 Aqueduct	nos.	1	0	0	0	1	
17 Tank	nos.	4	0	0	0	4	
Total		77	49	534	4,182	4,842	

Table A7.6 - 1 **REHABILITATION PLAN FOR THE EXISTING CANALS AND RELATED STRUCTURES (2/2)**

Item	Unit	LBMC	B-canal	D-canal	F-canal	Total	Remarks
(Structures to be constructed Newly)							
1 Bathing step	nos.	10	0	65	0	75	
2 Culvert	nos.	0	1	47	359	407	
3 Drop	nos.	0	0	2	0	2	
4 Cross drain	nos.	0	0	5	3	8	
5 Farm turnout	nos.	0	0	0	2,219	2,219	
6 Field turnout	nos.	0	0	88	0	88	
7 Distributary t-out	nos.	0	0	0	0	0	
8 Foot bridge	nos.	0	2	0	2	4	
9 Car bridge	nos.	0	0	1	0	1	
10 Spillway	nos.	0	0	0	0	0	
11 Regulator	nos.	0	0	0	0	0	
12 Measuring device	nos.	1	2	41	0	44	
13 B-canal turnout	nos.	0	0	0	0	0	
14 Control gate of tank	nos.	0	0	0	0	0	
15 Siphon	nos.	0	0	0	0	0	
16 Aqueduct	nos.	0	0	0	0	0	
17 Tank	nos.	0	0	0	0	0	
Total		11	5	249	2,583	2,848	
(Structures to be Repaired)							
1 Bathing step	nos.	0	1	0	0	1	Minor repair such as supply of riplap to the d/s portopn and
2 Culvert	nos.	0	0	4	3	7	plastering
3 Drop	nos.	0	1	61	364	426	
4 Cross drain	nos.	2	4	3	6	15	
5 Farm turnout	nos.	0	6	71	47	124	
6 Field turnout	nos.	0	31	66	29	126	Gates are to be replaced completely
7 Distributary t-out	nos.	8	12	0	0	20	Gates are to be replaced completely
8 Foot bridge	nos.	4	1	0	0	5	
9 Car bridge	nos.	0	3	0	1	4	
10 Spillway	nos.	3	0	0	0	3	
11 Regulator	nos.	3	1			4	Gates are to be replaced completely
12 Measuring device	nos.	0				0	
13 B-canal turnout	nos.	0				0	Gates are to be replaced completely
14 Control gate of tank	nos.	1				1	
15 Siphon	nos.	1				1	
16 Aqueduct	nos.	1				1	
17 Tank	nos.	4				4	
Total		27	60	205	450	742	
(Structures to be Replaced)							
1 Bathing step	nos.					0	
2 Culvert	nos.		2	3		5	
3 Drop	nos.			39	268	307	
4 Cross drain	nos.			2	4	6	
5 Farm turnout	nos.			40	333	373	
6 Field turnout	nos.			26	20	46	Gates are to be replaced completely
7 Distributary t-out	nos.					0	Gates are to be replaced completely
8 Foot bridge	nos.					0	
9 Car bridge	nos.					0	
10 Spillway	nos.				1	1	
11 Regulator	nos.					0	
12 Measuring device	nos.					0	
13 B-canal turnout	nos.					0	
14 Control gate of tank	nos.					0	
15 Siphon	nos.					0	
16 Aqueduct	nos.					0	
17 Tank	nos.					0	
Total		0	2	110	626	738	

Table A7.6 - 2

PRINCIPAL FEATURES OF PROPOSED EXTENSION WORKS FOR IRRIGATION AND DRAINAGE FACILITIES

Canal	L (km)	Related structures																Road		Field canals	
		C/D (nos)	CV (nos)	B-T/O (nos)	D-T/O (nos)	F-T/O (nos)	FM-T/O (nos)	S/W (nos)	RG (nos)	BR (nos)	FB (nos)	DP (nos)	B/S (nos)	HT (nos)	LT (nos)	RT (nos)	D/A (nos)	RD-1 (km)	RD-2 (km)	FC (km)	FD (km)
1 SURIYA BLOCK																					
(1) Branch Canal	9.7			3	1	0	0	3	3	1	4	0	4	0	0	0	1	9.7			
(2) Distributary canal (PD-C)	25.1		32		16	38	440	0	0	0	10	45	10	0	1	0	0		25.1		
(3) Distributary canal (UD-C)	16.8		12		12	55	600	0	0	0	0	29	0	6	0	0	0		16.8		
(4) Drainage canal	15.0									1	0		0				0		15.0		
Total-1	66.6	0	44	3	29	93	1,040	3	3	2	14	74	14	6	1	0	1	9.7	56.9	31.2	31.2
2 NORTH BLOCK																					
(1) Extension of LBMC	19.4	9	0	0	0	0	0	3	3	4	15	0	15	0	0	0		19.4			
(2) Branch Canal	9.3	10		10	0	0	0	3	3	1	2	0	5	0	0	0	0	9.3			
(3) Distributary canal (PD-C)	67.8				35	105	1,140	0	0	0	14	124	27	0	3	4	0		67.8		
(4) Distributary canal (UD-C)	61.9				32	160	1,740	0	0	0	0	111	0	12	0	0	0				
(5) Drainage canal	48.6									2	0		0				0		48.6		
Total-2	207.0	19	0	10	67	265	2,880	6	6	7	31	235	47	12	3	4	0	28.7	116.4	86.4	86.4
3 SOUTH BLOCK																					
(1) Extension of LBMC	5.6	6	0	0	0	0	0	1	1	1	5	0	5	0	0	0		5.6			
(2) Branch Canal	16.1			12	0	0	0	5	5	2	6	0	6	0	0	0		16.1			
(3) PD-C	63.3				44	107	1,180	0	0	2	11	110	22	0	0	11			63.3		
(4) UD-C	67.5				32	115	1,280	0	0	0	0	126	0	10	0	0			67.5		
(5) Drainage canal	42.0									1	0		0						42.0		
Total-3	194.5	6	0	12	76	222	2,460	6	6	6	22	236	33	10	0	11	0	21.7	172.8	73.8	73.8
TOTAL	468.1	25	44	25	172	580	6,380	15	15	15	67	545	94	28	4	15	1	60.1	346.1	191.4	191.4

C/D Cross Drain
CV Culvert
B-T/O Turnout on Branch Canal
D-T/O Turnout on Distributary canals
F-T/O Field Turnout
FM-T/O Farm Turnout
S/W Spillway
RG Regulator
BR Bridge
FB Foot path bridge
DP Drop
PD-C Distributary canal mainly for paddy fields (lower canal)
B/S Bathing step
HT High Tank (farm pond for upland irrigaiton)
LT Low Tank (collection facilities of retrunflow)
RT Tank to be utilized with repair/ upgrading
D/A Drainage anicut to collect return flows
UD-C Distributary canal mainly for upland fields (higher canal)
RD-1 Road of 4.5 m wide
RD-2 Road of 2.1 m wide
FC Field canal
FD Field drain

Table A7.6-3 **BREAKDOWN OF PROPOSED EXTENSION WORKS FOR IRRIGATION AND DRAINAGE FACILITIES** 1/5

Canal			Related structures																Road		Field canals	
Canal	L (m)	Canal Type	C/D (nos)	CV (nos)	B-T/O (nos)	D-T/O (nos)	F-T/O (nos)	FM-T/O (nos)	S/W (nos)	RG (nos)	BR (nos)	FB (nos)	DP (nos)	B/S (nos)	HT (nos)	LT (nos)	RT (nos)	D/A (nos)	RD-1 (km)	RD-2 (km)	FC (km)	FD (km)
1 SURIYA BLOCK																						
(1) Branch Canal																						
0.6	C-1-4											1		1					0.6			
0.7	C-1-5																		0.7			
3.3	C-1-6			1	0	0	0	1	1	0	1	0	1	0	0	0			3.3		0.0	0.0
2.5	C-2-1			1				1	1	1	1		1						2.5			
1.1	C-2-3							1	1		1		1						1.1			
1.5	C-2-6			1	1													1	1.5			
S-total	9.7			3	1	0	0	3	3	1	4	0	4	0	0	0	1		9.7	0.0	0.0	0.0
(2) Distributary canal (PD-C)																						
0.5	C-1-1		2		1	1	9	0	0	0	0	1	0	0	0	0			0.0	0.5	0.3	0.3
3.6	C-1-2		8		4	4	59	0	0		1	5	1	0	1	0			0.0	3.6	1.8	1.8
10.4	C-1-3		14		7	12	150	0	0		4	19	4	0	0	0			0.0	10.4	4.5	4.5
10.6	C-1-5		8		4	21	222	0	0		5	20	5	0	0	0			0.0	10.6	6.7	6.7
S-total	25.1		32		16	38	440	0	0	0	10	45	10	0	1	0	0		0.0	25.1	13.2	13.2
(3) Distributary canal (UD-C)																						
1.1	C-1-1		1		1	1	15	0	0			2		1	0	0			0.0	1.1	0.5	0.5
2.2	C-1-2		3		3	7	72	0	0			3		0	0	0			0.0	2.2	2.2	2.2
9.9	C-1-3		6		6	30	328	0	0			17		4	0	0			0.0	9.9	9.8	9.8
2.1	C-1-4		1		1	7	78	0	0			4		0	0	0			0.0	2.1	2.3	2.3
1.5	C-1-5		1		1	10	107	0	0			3		1	0	0			0.0	1.5	3.2	3.2
S-total	16.8		12		12	55	600	0	0	0	0	29	0	6	0	0	0		0.0	16.8	18.0	18.0
(4) Drainage canal																						
1.1	D-2		0	0	0	0	0	0	0	0		0	0	0	0	0			0.0	1.1	0.0	0.0
3.2	D-3		0	0	0	0	0	0	0	0		0	0	0	0	0			0.0	3.2	0.0	0.0
7.9	D-5		0	0	0	0	0	0	0	1		0	0	0	0	0			0.0	7.9	0.0	0.0
2.8	D-6		0	0	0	0	0	0	0	0		0	0	0	0	0			0.0	2.8	0.0	0.0
S-total	15.0									1	0		0					0	0.0	15.0		

Table A7.6-3 **BREAKDOWN OF PROPOSED EXTENSION WORKS FOR IRRIGATION AND DRAINAGE FACILITIES** 2/5

Canal			Related structures																Road		Field canals	
Canal	L (m)	Canal Type	C/D (nos)	CV (nos)	B-T/O (nos)	D-T/O (nos)	F-T/O (nos)	FM-T/O (nos)	S/W (nos)	RG (nos)	BR (nos)	FB (nos)	DP (nos)	B/S (nos)	HT (nos)	LT (nos)	RT (nos)	D/A (nos)	RD-1 (km)	RD-2 (km)	FC (km)	FD (km)
Total-1	66.6		0	44	3	29	93	1,040	3	3	2	14	74	14	6	1	0	1	9.7	56.9	31.2	31.2
2 NORTH BLOCK																						
(1) Extension of LBMC																						
5.9 M-8			3	0	0	0	0	0	1	1	1	6	0	6	0	0	0		5.9		0.0	0.0
0.4 M-7			1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0.4		0.0	0.0
6.0 M-6			2	0	0	0	0	0	1	1	1	4	0	4	0	0	0		6.0		0.0	0.0
7.1 M-5			3	0	0	0	0	0	1	1	2	5	0	5	0	0	0		7.1		0.0	0.0
S-total	19.4		9	0	0	0	0	0	3	3	4	15	0	15	0	0	0		19.4		0.0	0.0
(2) Branch Canal																						
0.8 C-1-4			1		1									0					0.8			
0.4 C-1-5			1		1									0					0.4			
0.8 C-1-6			1		1				1	1				0					0.8			
3.9 C-1-7			4		4	0	0	0	2	2	1	1	0	2	0	0	0		3.9		0.0	0.0
1.5 C-2-1			1		1						0	1		1					1.5			
0.8 C-2-2			1		1									1					0.8			
1.1 C-2-3			1		1									1					1.1			
S-total	9.3		10		10	0	0	0	3	3	1	2	0	5	0	0	0	0	9.3	0.0	0.0	0.0
(3) Distributary canal (PD-C)																						
1.8 C-1-1						3	3	16	0	0	0	0	3	0	0	0	0		0.0	1.8	0.5	0.5
13.3 C-1-2						9	17	185	0	0	0	3	23	5	0	0	2		0.0	13.3	5.6	5.6
9.7 C-1-3						7	12	146	0	0	0	1	16	3	0	2	0		0.0	9.7	4.4	4.4
11.9 C-1-4						6	17	203	0	0	0	3	22	5	0	0	1		0.0	11.9	6.1	6.1
22.9 C-1-5						8	39	410	0	0	0	5	44	10	0	1	1		0.0	22.9	12.3	12.3
8.2 C-1-6						2	17	180	0	0	0	2	16	4	0	0	0		0.0	8.2	5.4	5.4
S-total	67.8					35	105	1,140	0	0	0	14	124	27	0	3	4	0	0.0	67.8	34.2	34.2

Table A7.6-3 **BREAKDOWN OF PROPOSED EXTENSION WORKS FOR IRRIGATION AND DRAINAGE FACILITIES** 3/5

Canal			Related structures																Road		Field canals	
Canal	L (m)	Canal Type	C/D (nos)	CV (nos)	B-T/O (nos)	D-T/O (nos)	F-T/O (nos)	FM-T/O (nos)	S/W (nos)	RG (nos)	BR (nos)	FB (nos)	DP (nos)	B/S (nos)	HT (nos)	LT (nos)	RT (nos)	D/A (nos)	RD-1 (km)	RD-2 (km)	FC (km)	FD (km)
(4) Distributary canal (UD-C)																						
	0.8	C-1-1				1	2	20	0	0	0	0	1	0	1	0	0		0.0		0.6	0.6
	18.4	C-1-2				14	38	441	0	0	0	0	30	0	6	0	0		0.0		13.2	13.2
	15.9	C-1-3				8	37	412	0	0	0	0	30	0	2	0	0		0.0		12.4	12.4
	20.6	C-1-4				7	57	604	0	0	0	0	38	0	3	0	0		0.0		18.1	18.1
	6.2	C-1-5				2	26	263	0	0	0	0	12	0	0	0	0		0.0		7.9	7.9
S-total	61.9					32	160	1,740	0	0	0	0	111	0	12	0	0	0	0.0	0.0	52.2	52.2
(5) Drainage canal																						
	0.9	D-2									0			0					0.0	0.9		
	6.6	D-3									0			0					0.0	6.6		
	2.5	D-4									0			0					0.0	2.5		
	17.1	D-5									1			0					0.0	17.1		
	7.5	D-6									1			0					0.0	7.5		
	5.1	D-7									0			0					0.0	5.1		
	1.2	D-8									0			0					0.0	1.2		
	4.9	D-9									0			0					0.0	4.9		
	2.8	D-10									0			0					0.0	2.8		
S-total	48.6										2	0		0				0	0.0	48.6		
Total-2	207.0		19	0	10	67	265	2,880	6	6	7	31	235	47	12	3	4	0	28.7	116.4	86.4	86.4
3 SOUTH BLOCK																						
(1) Extension of LBMC																						
	2.6	M-1	3	0	0	0	0	0	1	1	1	2	0	2	0	0	0		2.6		0.0	0.0
	1.1	M-2	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0		1.1		0.0	0.0
	1.5	M-3	1	0	0	0	0	0	0	0	0	2	0	2	0	0	0		1.5		0.0	0.0
	0.5	M-5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0.5		0.0	0.0
S-total	5.6		6	0	0	0	0	0	1	1	1	5	0	5	0	0	0		5.6	0.0	0.0	0.0

Table A7.6-3 **BREAKDOWN OF PROPOSED EXTENSION WORKS FOR IRRIGATION AND DRAINAGE FACILITIES** 4/5

Canal			Related structures															Road		Field canals	
Canal	L (m)	Canal Type	C/D (nos)	CV (nos)	B-T/O (nos)	D-T/O (nos)	F-T/O (nos)	FM-T/O (nos)	S/W (nos)	RG (nos)	BR (nos)	FB (nos)	DP (nos)	B/S (nos)	HT (nos)	LT (nos)	RT (nos)	D/A (nos)	RD-1 (km)	RD-2 (km)	FC (km)	FD (km)
(2) Branch Canal																						
2.4 C-1-3					1	0	0	0	0	0	1	1	0	1	0	0	0		2.4		0.0	0.0
1.2 C-1-5					1	0	0	0	0	0	0	0	0	0	0	0	0		1.2		0.0	0.0
3.1 C-1-6					2	0	0	0	2	2	0	1	0	1	0	0	0		3.1		0.0	0.0
5.9 C-1-7					3	0	0	0	1	1	1	2	0	2	0	0	0		5.9		0.0	0.0
1.3 C-2-1					2	0	0	0	1	1	0	0	0	0	0	0	0		1.3		0.0	0.0
1.3 C-2-3					1	0	0	0	0	0	0	1	0	1	0	0	0		1.3		0.0	0.0
0.9 C-2-6					2	0	0	0	1	1	0	1	0	1	0	0	0		0.9		0.0	0.0
S-total	16.1				12	0	0	0	5	5	2	6	0	6	0	0	0		16.1	0.0	0.0	0.0
(3) Distributary canal (PD-C)																						
2.7 C-1-1					4	4	25	0	0	0	0	4	0	0	0	0	0		0.0	2.7	0.8	0.8
8.2 C-1-2					9	9	84	0	0	0	1	13	2	0	0	2	0		0.0	8.2	2.5	2.5
7.6 C-1-3					8	11	139	0	0	0	1	11	2	0	0	3	0		0.0	7.6	4.2	4.2
13.4 C-1-4					8	23	276	0	0	1	3	24	5	0	0	1	0		0.0	13.4	8.3	8.3
26.0 C-1-5					11	47	519	0	0	1	6	49	12	0	0	3	0		0.0	26.0	15.6	15.6
1.4 C-1-6					1	5	52	0	0	0	0	2	0	0	0	1	0		0.0	1.4	1.6	1.6
0.9 C-2-1					1	2	20	0	0	0	0	1	0	0	0	0	0		0.0	0.9	0.6	0.6
1.5 C-2-3					1	3	30	0	0	0	0	3	1	0	0	0	0		0.0	1.5	0.9	0.9
1.6 C-2-4					1	3	35	0	0	0	0	3	0	0	0	1	0		0.0	1.6	1.1	1.1
S-total	63.3				44	107	1,180	0	0	2	11	110	22	0	0	11	0		0.0	63.3	35.4	35.4
(4) Distributary canal (UD-C)																						
11.1 C-1-1					6	6	77	0	0	0		20		3	0	0	0		0.0	11.1	2.3	2.3
20.7 C-1-2					14	30	359	0	0	0		37		2	0	0	0		0.0	20.7	10.8	10.8
19.2 C-1-3					7	30	346	0	0	0		37		3	0	0	0		0.0	19.2	10.4	10.4
3.5 C-1-4					2	15	153	0	0	0		7		2	0	0	0		0.0	3.5	4.6	4.6
13.0 C-1-5					3	34	345	0	0	0		25		0	0	0	0		0.0	13.0	10.4	10.4
S-total	67.5				32	115	1,280	0	0	0	0	126	0	10	0	0	0		0.0	67.5	38.4	38.4

Table A7.6-3 **BREAKDOWN OF PROPOSED EXTENSION WORKS FOR IRRIGATION AND DRAINAGE FACILITIES** 5/5

Canal			Related structures																Road		Field canals	
Canal	L (m)	Canal Type	C/D (nos)	CV (nos)	B-T/O (nos)	D-T/O (nos)	F-T/O (nos)	FM-T/O (nos)	S/W (nos)	RG (nos)	BR (nos)	FB (nos)	DP (nos)	B/S (nos)	HT (nos)	LT (nos)	RT (nos)	D/A (nos)	RD-1 (km)	RD-2 (km)	FC (km)	FD (km)
(5) Drainage canal																						
	0.6	D-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0.0	0.6	0.0	0.0
	2.6	D-2	0	0	0	0	0	0	0	0	0		0	0	0	0	0		0.0	2.6	0.0	0.0
	5.2	D-3	0	0	0	0	0	0	0	0	0		0	0	0	0	0		0.0	5.2	0.0	0.0
	6.9	D-4	0	0	0	0	0	0	0	0	0		0	0	0	0	0		0.0	6.9	0.0	0.0
	11.8	D-5	0	0	0	0	0	0	0	0	1		0	0	0	0	0		0.0	11.8	0.0	0.0
	5.3	D-6	0	0	0	0	0	0	0	0	0		0	0	0	0	0		0.0	5.3	0.0	0.0
	2.6	D-7	0	0	0	0	0	0	0	0	0		0	0	0	0	0		0.0	2.6	0.0	0.0
	1.2	D-8	0	0	0	0	0	0	0	0	0		0	0	0	0	0		0.0	1.2	0.0	0.0
	1.4	D-9	0	0	0	0	0	0	0	0	0		0	0	0	0	0		0.0	1.4	0.0	0.0
	2.8	D-10	0	0	0	0	0	0	0	0	0		0	0	0	0	0		0.0	2.8	0.0	0.0
	1.6	D-11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0.0	1.6	0.0	0.0
S-total	42.0										1	0		0					0.0	42.0		
Total-3	194.5		6	0	12	76	222	2,460	6	6	6	22	236	33	10	0	11	0	21.7	172.8	73.8	73.8
TOTAL	468.1		25	44	25	172	580	6,380	15	15	15	67	545	94	28	4	15	1	60.1	346.1	191.4	191.4

C/D	Cross Drain	S/W	Spillway	B/S	Bathing step		
CV	Culvert	RG	Regulator	HT	High Tank (farm pond for upland irrigaiton)	RD-1	Road of 4.5 m wide
B-T/O	Turnout on Branch Canal	BR	Bridge	LT	Low Tank (collection facilities of retrunflow)	RD-2	Road of 2.1 m wide
D-T/O	Turnout on Distributary canals	FB	Foot path bridge	RT	Tank to be utilized with repair/ upgrading	FC	Field canal
F-T/O	Field Turnout	DP	Drop	D/A	Drainage anicut to collect return flows	FD	Field drain
FM-T/O	Farm Turnout	PD-C	Distributary canal mainly for paddy fields (lower canal)			UD-C	Distributary canal mainly for upland fields (higher cana

Table A7.6 - 4 MAIN FEATURES OF IRRIGATION CANALS IN IRRIGATION EXTENSION AREA 1/6

No	Canal	Section	Length (km)	Irrigation Area Paddy (ha)	Upland (ha)	Total (ha)	Design Discharge (l /sec)
1 Left Bank Main Canal (LBMC)							
		M-1	5.4	2,320	3,020	5,340	10,733
		M-2	0.5	2,221	3,020	5,241	10,534
		M-3	0.4	2,095	2,565	4,660	9,367
		M-4	1.8	1,774	2,192	3,966	7,972
		M-5	0.8	1,579	2,135	3,714	7,465
		M-6	3.4	1,551	2,078	3,629	7,294
		M-7	2.3	1,460	1,697	3,157	6,346
		M-8	1.7	1,369	1,647	3,016	6,062
		M-9	1.9	1,315	1,647	2,962	5,954
		M-10	0.8	1,315	1,591	2,906	5,841
		M-11	0.5	1,227	1,411	2,638	5,302
		M-12	0.5	1,180	1,411	2,591	5,208
		M-13	0.5	794	759	1,553	3,122
		M-14	1.0	511	631	1,142	2,295
		M-15	1.1	481	616	1,097	2,205
		M-16	1.7	407	370	777	1,562
		M-17	1.0	318	338	656	1,319
		Total	25.0				
2 Branch cnals							
	B-1	B1-1	1.1	126	455	581	1,168
		B1-2	1.5	126	364	490	985
		B1-3	0.8	66	144	210	422
		B1-4	0.8	0	65	65	131
		(total)	4.2				
	B-2	B2-1	0.8	91	381	472	949
		B2-2	0.8	62	260	322	647
		B2-3	0.8	43	181	224	450
		B2-4	0.4	0	97	97	195
		(total)	2.4				
	B-3	B3-1	1.0	88	180	268	539
		B3-2	1.3	0	54	54	109
		(total)	2.3				
	B-4	B4-1	0.2	386	652	1,038	2,086
		B4-2	0.7	366	614	980	1,970
		B4-3	1.3	247	346	593	1,192
		B4-4	0.7	147	238	385	774
		B4-5	1.2	0	85	85	171
		(total)	4.1				

Table A7.6 - 4 **MAIN FEATURES OF IRRIGATION CANALS IN IRRIGATION EXTENSION AREA** 2/6

No	Canal	Section	Length (km)	Irrigation Area Paddy (ha)	Upland (ha)	Total (ha)	Design Discharge (l /sec)
	B-5	B5-1	1.8	111	209	320	643
		B5-2	2.4	0	25	25	50
		(total)	4.2				
	B-6	B6-1	0.6	192	214	406	816
		B6-2	1.1	149	170	319	641
		B6-3	1.5	75	107	182	366
		(total)	3.2				
	B-7	B7-1	3.0	126	124	250	503
		B7-2	1.6	111	90	201	404
		(total)	4.6				
	BBC	B50-1	2.5	162	186	348	710
		B50-2	0.7	37	47	84	168
		B50-3	0.6	32	0	32	92
		B51	2.4	65	100	165	318
		B52-1	1.1	213	314	527	1,024
		B52-2	1.5	64	68	132	273
		B52-3	1.1	32	162	194	303
		(total)	9.9				
	Total of branch canal		34.9				
3	Distributary canals for paddy fields						
1	PD1		5.2	99	0	99	333
2	PD2-1		3.6	50	0	50	168
3	PD2-2		3.5	63	0	63	212
4	PD3-1		0.3	15	0	15	50
5	PD3-2		0.5	20	0	20	67
6	PD4-1		1.1	27	0	27	91
7	PD4-2		2.0	33	0	33	111
8	PD5-1		2.6	41	0	41	138
9	PD5-2		2.7	25	0	25	84
10	PD6-1		0.9	12	0	12	40
11	PD6-2		0.6	10	0	10	34
12	PD7-1		2.2	50	0	50	168
13	PD7-2		2.3	49	0	49	165
14	PD8-1		2.6	60	0	60	202
15	PD8-2		1.1	14	0	14	47
16	PD9-1		2.2	14	0	14	47
17	PD9-2		1.3	14	0	14	47
18	PD10-1		4.3	92	0	92	309
19	PD10-2		3.0	81	0	81	272
20	PD11-1		1.0	10	0	10	34

Table A7.6 - 4 MAIN FEATURES OF IRRIGATION CANALS IN IRRIGATION EXTENSION AREA 3/6

No	Canal	Section	Length (km)	Irrigation Area			Design Discharge (l/sec)
				Paddy (ha)	Upland (ha)	Total (ha)	
21	PD11-2		1.8	19	0	19	64
22	PD12-1		1.0	9	0	9	30
23	PD12-2		0.9	10	0	10	34
24	PD13-1		0.5	7	0	7	24
25	PD13-2		1.8	36	0	36	121
26	PD14		2.2	39	0	39	131
27	PD15-1		1.4	21	0	21	71
28	PD15-2		0.9	26	0	26	87
29	PD16		0.7	5	0	5	17
30	PD17-1		0.6	4	0	4	13
31	PD17-2		3.7	50	0	50	168
32	PD18-1		2.2	27	0	27	91
33	PD18-2		2.1	20	0	20	67
34	PD19-1		2.5	42	0	42	141
35	PD19-2		2.5	46	0	46	155
36	PD20		1.6	16	0	16	60
37	PD21-1		0.2	7	0	7	26
38	PD21-2		0.9	13	0	13	49
39	PD22		1.5	30	0	30	113
40	PD23-1		1.6	35	0	35	132
41	PD23-2		0.9	20	0	20	76
42	PD24-1		0.7	10	0	10	38
43	PD24-2		0.7	9	0	9	34
44	PD25-1		1.4	52	0	52	197
45	PD25-2		2.0	48	0	48	181
46	PD26-1		1.6	45	0	45	170
47	PD26-2		0.9	21	0	21	79
48	PD27-1		3.1	44	0	44	166
49	PD27-2		4.6	56	0	56	212
50	PD28-1		2.3	56	0	56	212
51	PD28-2		2.6	29	0	29	110
52	PD29-1		0.8	20	0	20	76
53	PD29-2		2.0	71	0	71	268
54	PD30-1		1.3	16	0	16	60
55	PD30-2		1.2	19	0	19	72
56	PD31-1		1.2	12	0	12	45
57	PD31-2		0.8	5	0	5	19
58	PD32-1		2.3	46	0	46	174
59	PD32-2		2.1	45	0	45	170
60	PD33-1		0.7	5	0	5	19
61	PD33-2		1.1	8	0	8	30
62	PD34-1		2.2	52	0	52	197
63	PD34-2		1.8	23	0	23	87
64	PD35-1		0.5	20	0	20	76
65	PD35-2		2.1	35	0	35	132
66	PD36-1		1.8	10	0	10	38
67	PD36-2		0.6	5	0	5	19
68	PD37-1		0.4	14	0	14	53
69	PD37-2		1.2	29	0	29	110

Table A7.6 - 4 MAIN FEATURES OF IRRIGATION CANALS IN IRRIGATION EXTENSION AREA 4/6

No	Canal	Section	Length (km)	Irrigation Area Paddy (ha)	Upland (ha)	Total (ha)	Design Discharge (l /sec)
70	PD38-1		0.6	10	0	10	38
71	PD38-2		2.1	51	0	51	193
72	PD39-1		2.5	35	0	35	132
73	PD39-2		0.5	8	0	8	30
74	PD40-1		1.6	41	0	41	155
75	PD40-2		0.9	27	0	27	102
76	PD41-1		0.7	10	0	10	38
77	PD41-2		1.3	10	0	10	38
78	PD42-1		1.2	29	0	29	110
79	PD42-2		1.2	33	0	33	125
80	PD50-1		2.1	14	0	14	40
81	PD50-2		3.5	51	0	51	147
82	PD51-1		3.9	42	0	42	121
83	PD51-2		3.1	20	0	20	58
84	PD51-3		0.4	15	0	15	43
85	PD51-4		0.4	16	0	16	46
86	PD52-1		0.7	14	0	14	40
87	PD52-2		1.2	18	0	18	52
88	PD53-1		0.4	20	0	20	58
89	PD53-2		1.0	17	0	17	49
90	PD54-1		0.7	23	0	23	66
91	PD54-2		1.2	41	0	41	118
92	PD55-1		2.0	88	0	88	254
93	PD55-2		1.5	29	0	29	84
94	PD56-1		2.5	23	0	23	66
95	PD56-2		0.5	9	0	9	26
4	**Distributary canals for upland fields**						
1	UD1		4.8	0	91	91	117
2	UD2-1		0.4	0	30	30	39
3	UD2-2		0.5	0	35	35	45
4	UD3-1		3.1	0	88	88	114
5	UD3-2		3.6	0	132	132	170
6	UD4-1		1.8	0	89	89	115
7	UD4-2		2.6	0	131	131	169
8	UD5-1		0.8	0	20	20	26
9	UD5-2		5.2	0	59	59	76
10	UD6-1		0.9	0	32	32	41
11	UD6-2		1.3	0	25	25	32
12	UD7		0.8	0	57	57	74
13	UD8-1		2.0	0	39	39	50
14	UD8-2		3.8	0	44	44	57
15	UD9		2.4	0	97	97	125
16	UD10		0.6	0	38	38	49
17	UD11-1		1.9	0	34	34	44
18	UD11-2		1.0	0	45	45	58
19	UD12-1		1.4	0	30	30	39
20	UD12-2		2.0	0	54	54	70
21	UD13-1		1.5	0	52	52	67

Table A7.6 - 4 MAIN FEATURES OF IRRIGATION CANALS IN IRRIGATION EXTENSION AREA 5/6

No	Canal	Section	Length (km)	Irrigation Area			Design Discharge (l /sec)
				Paddy (ha)	Upland (ha)	Total (ha)	
22	UD13-2		4.8	0	101	101	130
23	UD14		0.7	0	29	29	37
24	UD15-1		1.2	0	22	22	28
25	UD15-2		1.9	0	34	34	44
26	UD16		1.6	0	54	54	70
27	UD17		0.8	0	21	21	27
28	UD18-1		1.0	0	28	28	36
29	UD18-2		1.8	0	44	44	57
30	UD19-1		2.0	0	47	47	61
31	UD19-2		1.6	0	84	84	108
32	UD20		2.1	0	54	54	70
33	UD21-1*		1.2	0	14	14	18
34	UD21-2		2.5	0	24	24	30
35	UD22-1		2.3	0	15	15	19
36	UD22-2		5.6	0	122	122	154
37	UD23-1		2.8	0	53	53	67
38	UD23-2		4.7	0	55	55	69
39	UD24-1		2.1	0	80	80	101
40	UD24-2		2.0	0	110	110	139
41	UD25		2.0	0	48	48	60
42	UD26		1.1	0	15	15	19
43	UD27-1		3.3	0	45	45	57
44	UD27-2		1.8	0	49	49	62
45	UD28-1		0.1	0	15	15	19
46	UD28-2		0.2	0	10	10	13
47	UD29-1		0.8	0	15	15	19
48	UD29-2		5.0	0	113	113	142
49	UD30-1		1.6	0	47	47	59
50	UD30-2		2.0	0	22	22	28
51	UD31-1		1.4	0	36	36	45
52	UD31-2		1.2	0	28	28	35
53	UD31-3		1.7	0	26	26	33
54	UD32-1		1.1	0	20	20	25
55	UD32-2		1.1	0	24	24	30
56	UD33-1		1.5	0	26	26	33
57	UD33-2		2.0	0	37	37	47
58	UD34-1		1.5	0	73	73	92
59	UD34-2		1.2	0	34	34	43
60	UD35-1		0.7	0	8	8	10
61	UD35-2		1.3	0	26	26	33
62	UD36-1		1.2	0	20	20	25
63	UD36-2		3.0	0	49	49	62
64	UD37		1.7	0	21	21	26
65	UD50-1		1.5	0	56	56	73
66	UD50-2		2.3	0	44	44	57
67	UD51-1		2.2	0	61	61	79
68	UD51-2		2.1	0	78	78	101
69	UD52-1		1.1	0	15	15	20
70	UD52-2		0.8	0	32	32	42

Table A7.6 - 4 **MAIN FEATURES OF IRRIGATION CANALS IN IRRIGATION EXTENSION AREA** 6/6

No	Canal	Section	Length (km)	Irrigation Area Paddy (ha)	Upland (ha)	Total (ha)	Design Discharge (l /sec)
71	UD53-1		1.3	0	48	48	62
72	UD53-2		0.5	0	20	20	26
73	UD54-1		1.8	0	64	64	83
74	UD54-2		0.9	0	20	20	26
75	UD55-1		1.5	0	107	107	139
76	UD55-2		0.8	0	55	55	72

Table A7.6 - 5 MAIN FEATURES OF DRAINAGE CANALS IN IRRIGATION EXTENSION AREA 1/2

No	Canal	Length (km)	Drainage Area			Design Discharge (m3/s)
			Paddy (ha)	Upland/Others (ha)	Total (ha)	
1	DR1-1	0.6	14	13	195	1.48664
2	DR1-2	0.7	12	21	185	1.46466
3	DR1-3	2.5	115	78	185	5.23191
4	DR2-1	2	35	77	210	2.11589
5	DR2-2	0.5	5	21		7.51267
6	DR3-1	3.3	105	188	130	2.61726
7	DR3-2	0.9	31	35		2.98543
8	DR4	3	44	125	80	1.58963
9	DR5	1.6	42	78	85	1.29285
10	DR6	0.7	51	75	10	6.66198
11	DR7	3.2	66	135	65	1.64592
12	DR8	1	38	85		9.04841
13	DR9	1.8	45	68	35	0.89301
14	DR10	2.6	76	83	30	9.94142
15	DR11-1	0.7	4	15	110	0.87523
16	DR11-2	0.8	5	18	180	1.38086
17	DR11-3	0.9	9	19	50	2.7672
18	DR12	1.3	25	55	220	1.99225
19	DR13	0.9	23	26	35	5.27328
20	DR14	2.2	28	38	215	1.85347
21	DR15	1.6	22	105	105	1.53334
22	DR16-1	1.3	10	53	55	0.78316
23	DR16-2	1.6	10	47	43	0.6595
24	DR17	0.4	22	58	48	9.47895
25	DR18	0.9	10	34	25	9.92548
26	DR19	0.8	12	36	30	0.50286
27	DR20	1.1	31	56	10	11.00948
28	DR21	1.2	45	36	46	11.75822
29	DR22	0.5	35	45	40	12.48637
30	DR23-1	2.1	48	125	145	2.05266
31	DR23-2	1.1	8	65	35	0.71996
32	DR23-3	0.6	7	55	15	0.50974
33	DR24	0.4	25	30	35	3.83191
34	DR25	1.2	26	56	25	0.66359
35	DR26	0.5	20	43	55	5.25116
36	DR27	0.9	15	32	10	0.35034
37	DR28	1.2	48	64	45	6.54809
38	DR29-1	1.6	21	15	155	1.25442
39	DR29-2	0.9	8	18	170	1.32452
40	DR29-3	0.6	16	16	20	2.89218
41	DR29-4	1.5	17	25	95	0.89444
42	DR29-5	0.2	5	15		3.91027
43	DR30	1.2	65	35	51	4.76889
44	DR31-1	0.8	22	54	25	0.63337
45	DR31-2	1.8	101	134	68	2.43723
46	DR32	1.4	74	54	45	8.19113
47	DR33	4.2	128	106	115	2.04563
48	DR34	1.6	71	68	45	11.30559
49	DR35-1	0.8	5	18	20	0.28166

Table A7.6- 5 **MAIN FEATURES OF DRAINAGE CANALS IN IRRIGATION EXTENSION AREA** 2/2

No	Canal	Length (km)	Drainage Area			Design Discharge (m3/s)
			Paddy (ha)	Upland/Others (ha)	Total (ha)	
50	DR35-2	0.8	15	23	60	0.63201
51	DR35-3	0.6	21	27	30	1.39178
52	DR35-4	1.1	24	15	46	1.90973
53	DR36	2.4	95	95	85	3.53773
54	DR37	1.5	36	65	25	0.76662
55	DR38	0.3	10	35	30	16.09769
56	DR39-1	1	30	63	43	0.85182
57	DR39-2	0.6	8	32	24	1.2695
58	DR39-3	1.1	22	40	52	0.72268
59	DR39-4	1	10	11	10	2.17765
60	DR40	1	15	20	30	0.4053
61	DR41	0.9	48	24		2.94559
62	DR42-1	0.6		15	15	0.2061
63	DR42-2	0.8		20	35	0.37785
64	DR42-3	0.3		25	30	0.9618
65	DR42-4	0.8	24	6	80	1.6515
66	DR43	1.4	28	42	150	6.03149
67	DR44	1.2	50	44	90	7.15807
68	DR45	2.3	60	55	65	1.0716
69	DR46	0.9	40	45	20	16.70904
70	DR47	0.7	25	35	18	25.40582
71	DR48	0.9	36	27	130	26.63273
72	DR49	2	101	68	130	1.77638
73	DR501	1.2	72	227	56	2.24085
74	DR502	2	31	116	65	1.37119
75	DR51	1.1	46	3	20	0.34753
76	DR52	1	42	27	45	0.66768
77	DR53	1	40	20	40	0.577
78	DR54	4.2	110	172	35	1.87529
79	DR55	1.7	75	57	115	1.49064
80	DR56	2.8	138	198	210	3.37152
81	DR57	1.2	30	53	20	0.62511

FIGURES

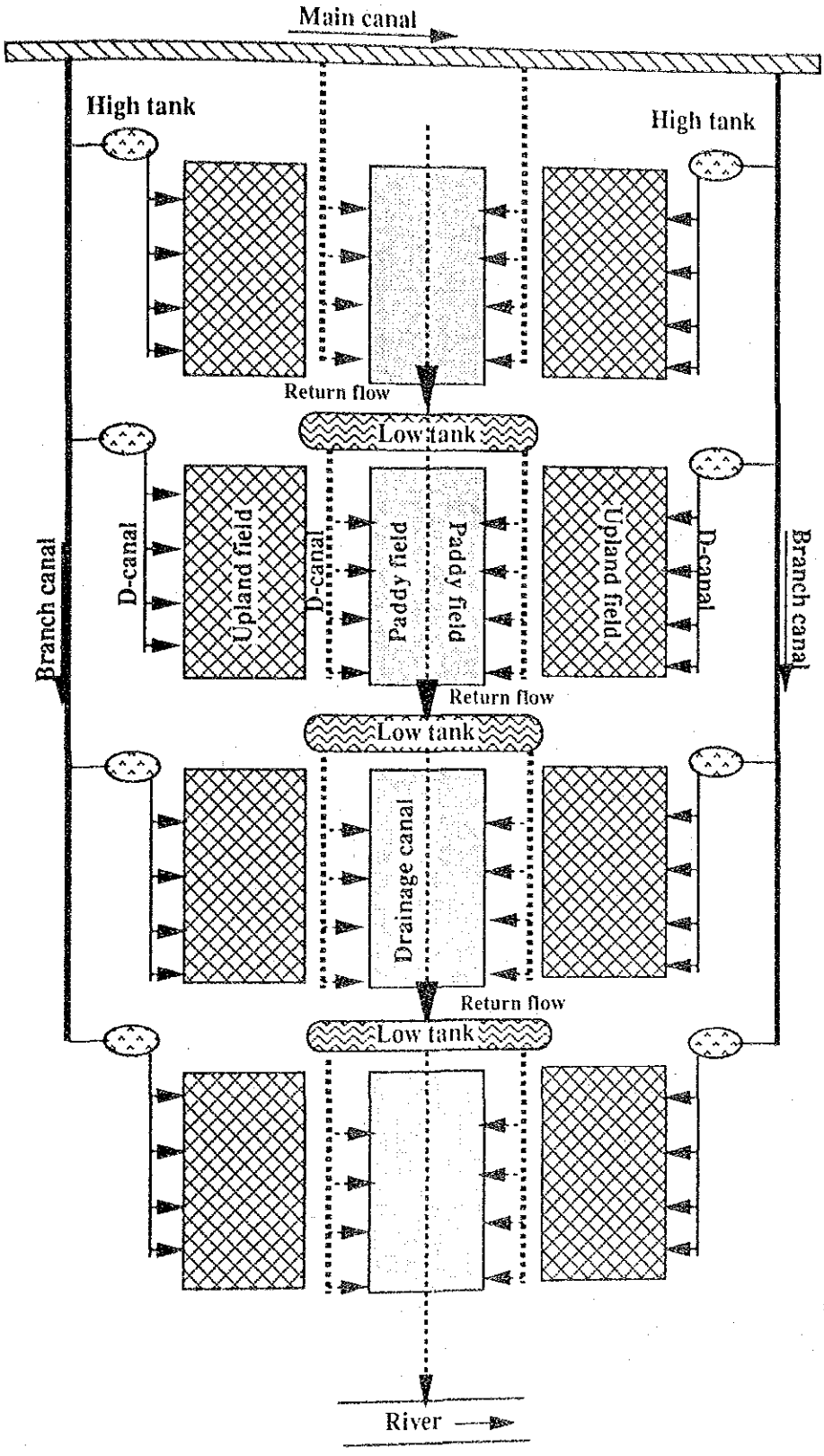


Fig. A7.6-1 SCHEMATIC LAYOUT OF TANK CASCADE SYSTEM

GOVERNMENT OF DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
MINISTRY OF LANDS, IRRIGATION AND MAHAWELI DEVELOPMENT

THE FEASIBILITY STUDY ON WALAWE IRRIGATION UPGRADING AND EXTENSION PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

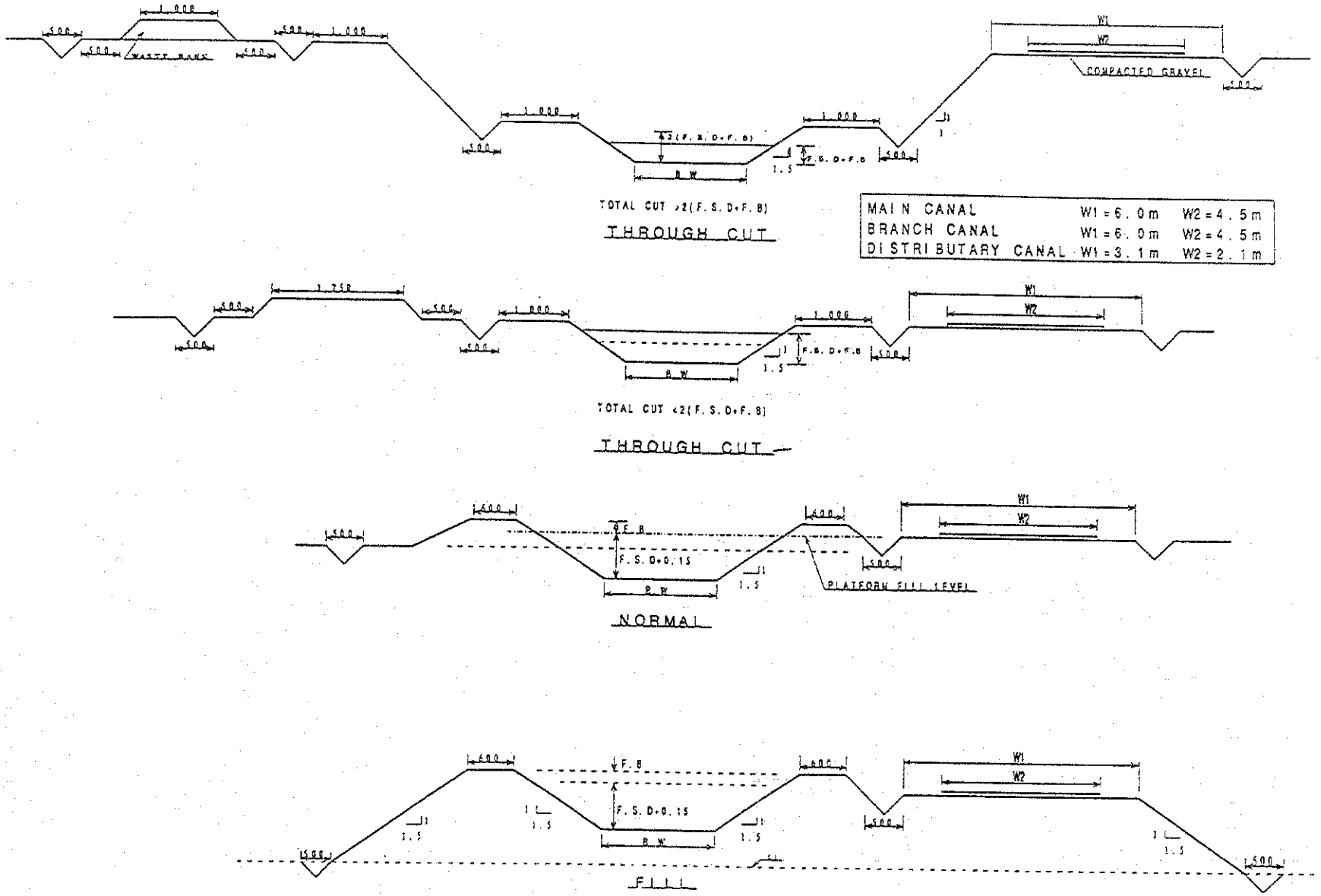
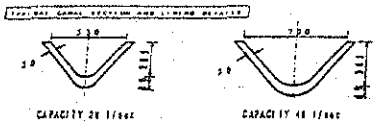
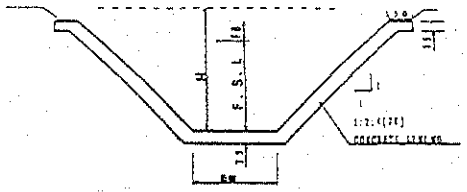


Fig. A7.6-2 TYPICAL CROSS SECTIONS OF CANALS AND ROADS (1/3)

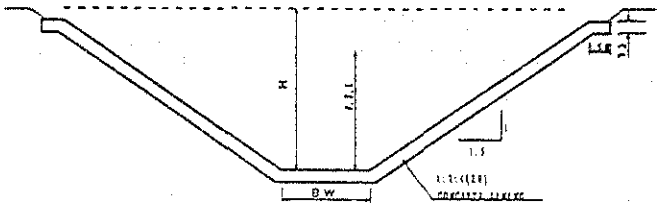


FIELD CANAL



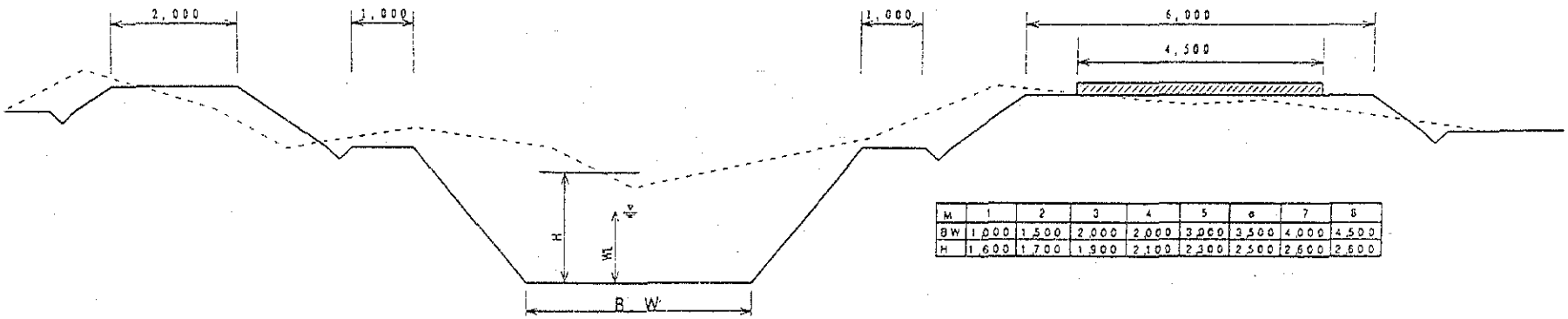
TYPE C-1 CANAL

C-1	1	2	3	4	5	6	7
BW	300	300	300	300	300	600	600
H	300	350	400	450	550	600	750



TYPE C-2 CANAL

C-2	1	2	3	4	5	6	7	8	9
BW	600	600	600	600	600	600	600	600	600
H	800	850	900	1,000	1,100	1,150	1,200	1,300	1,400



MAIN CANAL

M	1	2	3	4	5	6	7	8
BW	1,000	1,500	2,000	2,000	3,000	3,500	4,000	4,500
H	1,600	1,700	1,900	2,100	2,300	2,500	2,600	2,600

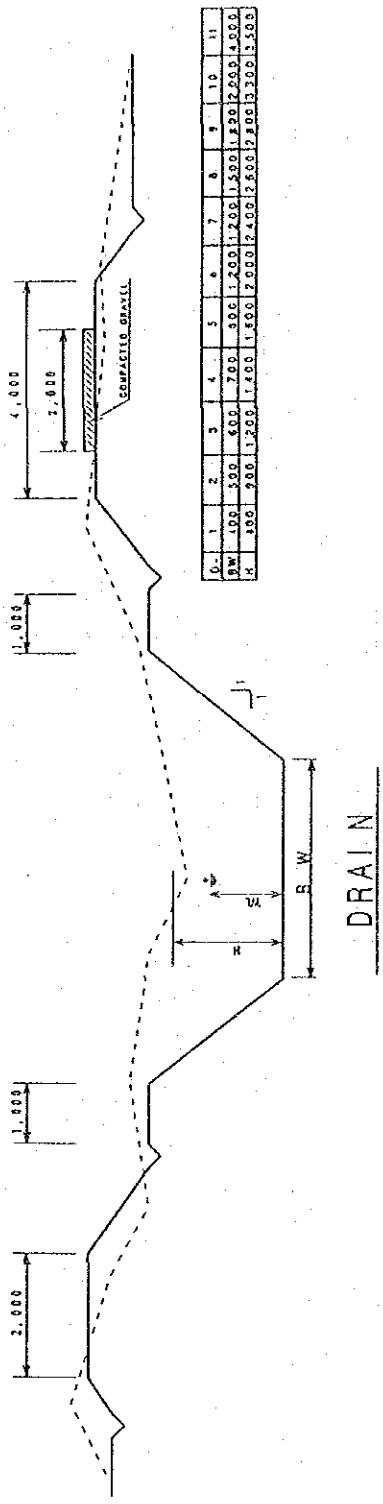
TYPICAL CANAL SECTION AND LINING DETAILES

GOVERNMENT OF DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
MINISTRY OF LANDS, IRRIGATION AND MAHAWELI DEVELOPMENT

THE FEASIBILITY STUDY ON
WALAWE IRRIGATION UPGRADING AND
EXTENSION PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. A7.6-2 TYPICAL CROSS SECTIONS OF CANALS AND ROADS (2/3)



	1	2	3	4	5	6	7	8	9	10	11
BW	400	500	600	700	800	1,200	1,200	1,500	1,800	2,000	4,000
H	800	900	1,200	1,400	1,600	2,000	2,400	2,800	3,600	3,300	3,500

Fig. A7.6-2 TYPICAL CROSS SECTIONS OF CANALS AND ROADS (3/3)

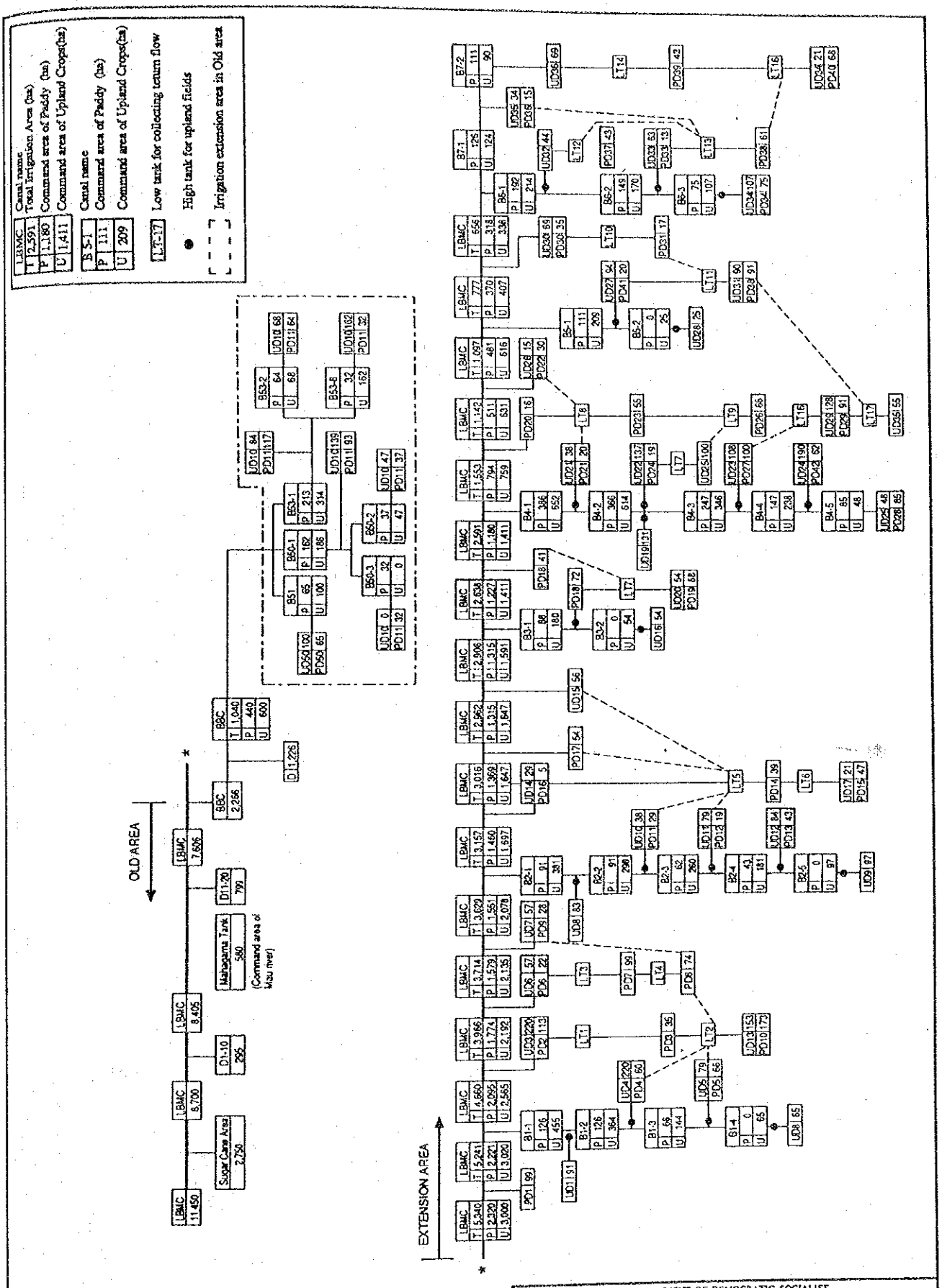


Fig. A7.6-3 IRRIGATION DIAGRAM

GOVERNMENT OF DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
MINISTRY OF LANDS, IRRIGATION AND MAHAWELI DEVELOPMENT

THE FEASIBILITY STUDY ON
WALAWE IRRIGATION UPGRADING AND
EXTENSION PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

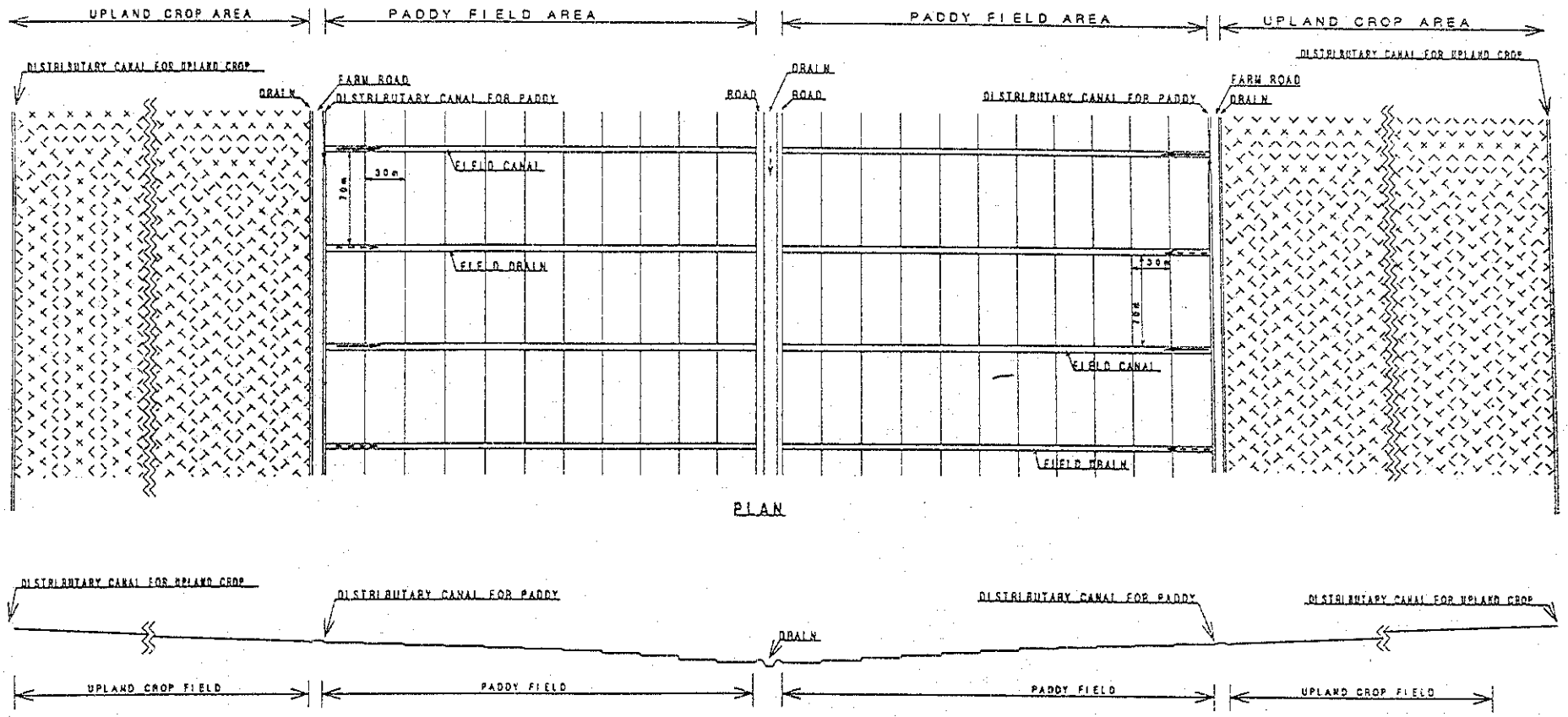


Fig. A7.6 - 4

GOVERNMENT OF DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
MINISTRY OF LANDS, IRRIGATION AND MAHAWELI DEVELOPMENT

THE FEASIBILITY STUDY ON WALAWE IRRIGATION UPGRADING AND EXTENSION PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. A7.6-4 PROPOSED FARM PLOT LAYOUT

ANNEX 7-7 RURAL INFRASTRUCTURE DEVELOPMENT PLAN

Contents

List of Tables

List of Figures

ANNEX 7-7 RURAL INFRASTRUCTURE DEVELOPMENT PLAN

7.7.1 Basic considerations

(1) Provision level of rural infrastructure

Provision required level of rural infrastructure is determined based on the study on the present situation of the rural infrastructure in the Study area and by referring to "Settlement Criteria" applied by MASL and provision levels of rural infrastructure in the similar development project under MASL as tabulated in Tables A7.7-1 and A7.7-2. According to the criteria, the minimum required facilities and services for the settlement scheme consists of : (i) education facilities, (ii) health and medical care facilities, (iii) postal service facilities, (iv) drinking water supply facilities, (v) road network, (vi) electricity supply, and (vii) administration facilities for project management. Among them, in view of the serious drinking water problem in the extension area, provision of rural water supply for settlers and cattle would be a important item.

It is considered that the main rural road system should be provided to serve for the transport of agricultural inputs and produce, and subsistence goods. It will activate human movement and promote regional development including post harvest facilities and processing facilities for agricultural products. From this view, improvement and construction of main rural roads would be urgently needed. The existing road from Suriyawewa to Mirijjawila on the A2 main road is in poor condition. This road should be the main rural road of the extension area in future and needs pavement to turn it to an all weather road. Another paved main rural road would be needed to connect Suriyawewa with Padalangala across the Walawe river. By this road the 1,040 ha of new development area lying in the west of Suriyawewa will have communication means.

(2) Objective area and village alignment

Based on the study results on the situation of the existing facilities, it is judged that the existing infrastructure in the Old area has been developed and satisfied the minimum required provision level. It is planned that development of rural infrastructure for Extension area is to be devoted under the project since there is no substantial infrastructure in the area.

It is estimated that about 50,000 persons or 9,000 families are expected to live permanently in the Extension area at full development stage of irrigation development of about 5,400 ha under the project. Future population in the area is estimated based on the assumptions that (i) each settlers will be allotted one ha of farm land, (ii) non-farm families (about 20 % of farm families) will be settled additionally, and (iii) an average family size is to be about 5 persons.

The settlement areas will be established in groups of inhabitants by their farming level and social activities so that the social and technical services can be rendered more effectively and efficiently. Under the condition, the project will provide Hamlet as alimentary settlements, and the Village Center will be set as cores of the primary activity sphere. Moreover, the Area Center will be established in the center of the secondary sphere.

The settlement areas are planned to be located at the area of unsuitable lands for irrigation farming so far as the aerial conditions can allow as shown in Fig. A7.7-1. About 9,000 settled families in the project area will be accommodated in 22 settlement areas. The settlements areas are arranged in a hierarchy consisting of three types of settlement; (i) Hamlets, each having about 250 farm households with appropriate social and community facilities, (ii) village centers and (iii) area center. Facilities of a village center services for three to four Hamlets, and area center provide highest service facilities for the settlers in the area as core of the settlement

services. Required space of the settlement areas is estimated based on the nos. of families, unit plot size of homestead of 0.2 ha/family and firewood forest area of 0.1 ha/family. Starter houses will be provided by the project . Principal features of settlement areas are summarized below.

Item	Hamlet	Village/C.	Area/C.	Total
1. Land				
Cultivation area (ha)	3,750	540	1,050	5,340
Village area (ha)	820	130	250	1,200
Fire wood forest (ha)	475	60	135	670
2. Village				
Villages (nos)	18	2	2	22
3. Population				
Farm families *person)	3,750	540	1,050	5,340
Non-Farm families (do.)	2,710	390	760	3,860
Population (do.)	34,900	5,000	9,800	49,700

7.7.2 Development plan

(1) General

The scale and grade of facilities are decided by referring to the facility design applied for similar project in the country based on the consideration that the project will provide the minimum required facilities and services for the settlement scheme. Based on the above considerations, following facility plan for rural infrastructure development is established and details of proposed facility plan are tabulated in Tables A7.7-3 and A7.7-4:

(Unit : nos.)

Item	Hamlet	Village/C.	Area/C.	Total
1. Settlement area	18	2	2	22
2. Education facilities	18	4	6	28
3. Health & medical care	8	2	2	12
4. Postal service facilities	0	2	2	4
5. Drinking water supply	18	2	2	22
6. Road (km)				
Village roads	93	14	12	119
Main farm road				31
7. Electricity supply	0	2	2	4
8. Telecommunication facility	0	2	2	4
9. Administration office	18	2	2	22
10. Agro extension facilities	0	2	4	6

Project work proposed are ; (i) construction of buildings for 28 schools, (ii) construction of buildings for 12 medical and health care center, (iii) construction of buildings for 4 post service facilities, (iv) construction of 23 drinking water supply systems, (v) construction of rural roads of 141 km long, (vi) construction of buildings for 22 project administration offices, (vii) construction of buildings for 6 agro-extension facilities, (viii) construction of buildings of one development center and provision of equipment, (ix) land preparation work for settlement area of 1,200 ha, and (x) provision of networks of electric supply and telecommunication.

(2) Education facilities

School buildings of 28 nos. in total are planned to be constructed under the project. Buildings consist of (i) 22 nos. of primary schools for each hamlet, (ii) 4 nos. of junior schools in village centers and area centers, and (iii) 2 nos. of senior schools in area centers. Average number of pupil of one primary school is estimated at about 150 and junior and senior school of 600 and 800, respectively. Land spaces required for primary schools is 1 ha, for junior school of 2 ha, and for senior school of 2.5 ha. Each school has class rooms, practice rooms and a teachers room as shown in Table A7.7-4.

(3) Health and medical care facilities

10 nos. of unit (Gramodaya) health center as a primary medical treatment unit and 2 nos. of sub-divisional health center at the area centers are planned. At the former center, one public health nurse is stationed. One doctor and two or three nurses are stationed at the latter center. Spaces of building of each unit and sub-divisional center are 50 and 250 m^2. Main features of the facilities are tabulated in Table A7.7-4.

(4) Water supply

Drinking water supply facilities are planned for all settlers through provision of communal taps in the settlement area. Total numbers of taps planned are 270 sites. Because no ground water aquifer is expected in the area, water in the canals and tanks are water source of the supply systems. Clarification facilities are planned for two systems of area centers. It is considered that bathing,washing, etc. will be made in the canal and tanks at the bathing steps.

(5) Public service buildings

Construction of 20 "unit service centers" and 2 "block offices" is planned for management of the project. Unit service centers are located at each hamlet and village center and block offices are at the area centers. Main functions of unit service center are extension services of farmings and water management and maintenance of the project facilities in field level. Block office is areal center of the extension services and water management and maintenance. Block office will also be utilized for management of construction and settlement program prior to the project operation.

Office spaces of unit service center and block office are 180 m^2 and 640 m^2, respectively. Block office consists of rooms for block office manager, engineers, agricultural officers, administration, meeting, store, kitchen and toilet.

Other building for public services such as post office, bank and telephone office will also be constructed in the area center. Project will provide for lands and water supply facilities for these buildings. No construction work for these buildings are planned. Two post box at the village centers and two sub-post offices at area centers are constructed to convenient of settlers.

(6) Road network

The road network conforms to the irrigation and drainage layout, because village roads will function as operation and maintenance roads as well. Three categories of roads are planned as follow:

Categories	Main features
Hamlet roads	Gravel, Effective width 4.5 meters
Market roads	Paved, Effective width 4.5 meters
Main roads	Paved, Effective width 6.0 meters

(i) Main road

Main road will mainly function to connect the major villages in the area and the surrounding major cities and towns. The road will be used for transporting daily goods, farm input and output to and from areas. The construction of the main road is planned to connect the existing road running through the northern-most of the extension area and the national road passing through the southern-most of the area.

The main road of 30.5 km have an effective width of 6 m to allow two units of heavy farm machines or heavy trucks to pass each other. This main road is paved with asphalt. One bridge with about 90 m long is proposed on the main road for crossing over the Walawe river to connect both left and right banks of the area. Basic dimensions of the proposed bridge on the Walawe river is illustrated in Fig. A7.7-4.

(ii) Market road

Market roads of 87 km in total connect between village center and the area center. The effective width is 4.5 m so that farm machines such as tractors and trucks will be able to pass. The road surface is paved with asphalt. Hamlet roads of 24 km in total connect between hamlets and cultivation areas. The road has effective width of 4.5 m and the surface is paved with gravel.

(iii) Hamlet road

Hamlet road connects between Hamlet and cultivation area. The road has effective width of 4.5 m and the surface will be paved with gravel.

The proposed road network as well as these typical cross sections are shown in Figs.A7.7-2 and A7.7-3. Plan and profile of main road is presented in Drawings in Volume IV.

(7) Collection and shipping facilities, and pola

Four collection and shipping centers and two polas (public market) are planned for marketing of agricultural products of the project. Collection and shipping center has building space of about 450 m^2 consisting of warehouse and administration building. Facilities for pola are concrete yard with shelter of 350 m^2 and administration building. Land spaces of each collection and shipping center and pola are 1,000 m^2 and 10,000 m^2.

(8) Development center

A development center is planned at Suriyawewa, which is located in the center of the left bank area with land space of 20,000 m^2. The development center aims to sustain training activities for both project management staff and settlers. The center provides faculties of the meeting room, job training facilities for young men and women, library, audio visual equipment, broadcasting facilities, demonstration facilities for food processing, dormitory, warehouse, and water treatment facility.

At the development center, various training activities and events will be performed in future. In particular, training of farmers for crop diversification and water management, as well as use of organic fertilizer and natural pesticide are the important aspects.

Building space is estimated at about 1,200 m^2. The center has a rooms for agricultural extension work, community development work and common use section as shown in Volume IV. Since the center provides various training activities and events, some equipment such as audio-visual equipment, laboratory equipment, and food processing facilities are provided.

(9) Other facilities

Electricity supply

Electricity supply is to be available for the village center and area center, especially activities of public service agencies and agro-industries. Electricity supply system is expanded to village centers and area centers, especially for activities of public service agencies. Actual work for the extension of power supply line will be made by CEB.

Telecommunication system

Telecommunication system is also expanded to village centers and area centers by extension of available telephone line. Public phones will be available at the sub-post office.

Commercial facilities

In Hamlet, small stores will be constructed for the daily necessities of villagers such as bakeries, groceries and drug stores. More space will be allocated for those of village and area centers to reflect the high level commercial activities thereabout. No facility is planned with assumption that these facilities will be constructed by private sector.

TABLES

Table A7.7-1 SETTLEMENT CRITERIA

Description	Hamlet	Village C.	Area C.	Township
1 Population				
1 Farm famulies	200-250	800-1,000	1,600-3,000	
2 Non-farm families	50-60	200-300	400-600	
3 Total of families	250-300	1,000-1,300	2,000-3,600	
4 Population	1,300-1,700			
2 Education facilities				
1 Primary school	***			
2 Junior school		***		
3 Senior secondary school			***	
4 Senior school			***	
5 Central college				***
3 Health and medical care facilities				
1 Gramodaya health center	***			
2 Sub-divisional health center		***		
3 Divisional health center			***	
4 Hospital				***
4 Postal service				
1 Post box	***			
2 Sub post office		***		
3 Post office			***	***
5 Drinking water supply				
1 Individual well	***	***		
2 Pipe water			***	***
6 Roads				
1 Hamlet roads	***	***		
2 Market roads		***	***	
3 Main roads		***	***	***
7 Electricity supply		***	***	***
8 Administrations				
1 Unit service center	***	***		
2 Block office		***	***	

Source: Planing and Monitoring Unit, MASL

***: Required to provide

Townshp in and around the Study area is Embilipitiya on Right bank.

Table A7.7-2 PROVISION LEVEL OF RURAL INFRASTRUCTURE IN MASL'S AREA

Description	Unit	Irrigation scheme			
		System-B	System-C	System-G	System-H
1 General features					
(1) Gross project area	ha	121,000	46,500	12,800	58,800
(2) Net irrigation area	ha	47,400	22,200	3,300	25,200
(3) Settlement area	ha	16,000	8,000	1,900	6,900
2 Rural infrastructure					
(1) Pre-school	nos.	55	36	29	75
(2) Primary school	nos.	45	41	10	16
(3) Junior school	nos.	9	16	10	43
(4) Senior school	nos.	6	2	4	28
(5) Sunday school	nos.	39	31	23	69
(6) Religious center	nos.	50	45	23	113
(7) Development ceter	nos.	1	1	0	2
(8) Hospital	nos.	3	2	1	4
(9) Sub divisional health center	nos.	3	7	2	5
(10) Gramodaya health center	nos.	14	29	10	40
(11) Volunteer health center	nos.	285	0	0	0
(12) Co-operatives	nos.	43	31	18	59
(13) Unit service center	nos.	55	64	15	51
(14) Post/ Sub-post office	nos.	18	18	10	9
(15) Peoples bank	nos.	2	1	1	6
(16) Bank of Ceylon	nos.	1	2	1	8
(17) Rural bank	nos.	0	2	2	7
(18) Police station	nos.	2	2	1	7

Source: Accelerated Mahaweli Programme

Table A7.7-3 PRINCIPAL FEATURES OF PROPOSED RURAL INFRASTRUCTURE

Description	Unit	NORTH BLOCK				SOUTH BLOCK				Total of Extension Area				Suriyawewa Block	TOTAL
		Block-1		Block-2		Block-3		Block-4							
		Hamlet	Area/C	Hamlet	Village/C	Hamlet	Area/C	Hamlet	Village/C	Hamlet	Village/C	Area/C	Total		
1. Land															
Cultivation area	ha	1,200	600	700	240	1,050	450	800	300	3,750	540	1,050	5,340	1,040	6,380
Village area	ha	270	140	150	60	220	110	180	70	820	130	250	1,200		1,200
Fire wood	ha	155	75	90	30	130	60	100	30	475	60	135	670		670
2. Village															
Village	nos	5	1	4	1	5	1	4	1	18	2	2	22		22
3. Populatin															
Farm families	family	1,200	600	700	240	1,050	450	800	300	3,750	540	1,050	5,340		5,340
Non-farm families	family	870	400	500	170	760	360	580	220	2,710	390	760	3,860		3,860
Popolation	man	11,200	5,400	6,500	2,200	9,780	4,400	7,420	2,600	34,900	5,000	9,800	49,700		49,700
4. Education facilities															
Primary school	nos	5	1	4	1	5	1	4	1	18	2	2	22		22
Junir school	nos	0	1	0	1	0	1	0	1	0	2	2	4		4
Senir secondly school	nos	0	1	0	0	0	1	0	0	0	0	2	2		2
5. Health & medical care facilities															
Gramodaya health center	nos	2	0	2	1	2	0	2	1	8	2	0	10		10
Sub-divisional health center	nos	0	1	0	0	0	1	0	0	0	0	2	2		2
6. Postal service															
Post box	nos	0	0	0	1	0	0	0	1	0	2	0	2		2
Sub-post office	nos	0	1	0	0	0	1	0	0	0	0	2	2		2
7. Drinking water supply															
Intake facility	nos	5	1	4	1	5	1	4	1	18	2	2	22	1	23
Clarification facility	nos	0	1	0	0	0	1	0	0	0	0	2	2	1	3
Conveyance facility	nos	5	1	4	1	5	1	4	1	18	2	2	22	1	23
Communial tap	nos	58	34	34	13	50	26	38	16	180	29	60	269		269
8. Road															
Hamlet road	m	7,000	0	0	0	11,000	0	6,000	0	24,000	0	0	24,000		24,000
Market road	m	3,800	0	3,500	5,500	4,000	0	5,500	4,500	16,800	10,000	0	26,800		26,800
Internal road	m	13,500	7,000	7,500	3,000	11,000	5,500	9,000	3,500	41,000	6,500	12,500	60,000		60,000
Main road	m	0	11,100	0	0	0	11,500	0	0	0	0	22,600	22,600	7,900	30,500
Brideg *	nos	0	0	0	0	0	0	0	0	0	0	0	0	1	1
9. Electrification															
Transmission line (11kv)	m	0	3,000	0	3,000	0	4,000	0	4,000	0	7,000	7,000	14,000		14,000
Low voltage distribution work	nos	0	1	0	1	0	1	0	1	0	2	2	4		4
10. Telecommunication system															
Trunk cable	m	0	4,000	0	5,500	0	4,000	0	4,500	0	10,000	8,000	18,000		18,000
Internal line	m	0	1,500	0	500	0	1,500	0	500	0	1,000	3,000	4,000		4,000
Central exchange	nos	0	0	0	0	0	1	0	0	0	0	1	1		1
11. Administration office															
Unit service center	nos	5	0	4	1	5	0	4	1	18	2	0	20		20
Block office	nos	0	1	0	0	0	1	0	0	0	0	2	2		2
12. Agro-extension facilities															
Collection $ shipping	nos	0	1	0	1	0	1	0	1	0	2	2	4		4
Pola	nos	0	1	0	0	0	1	0	0	0	0	2	2		2
13. Development center	nos													1	1

Table A7.7-4 **PRINCIPAL FEATURES OF RURAL INFRASTRUCTURE**

1 Education Facility

Item	Unit	Primary School	Junir School	Senir School
(1) Site	(sq.m)	10,000	20,000	25,000
(2) Building	(sq.m)	350	650	900
1) Pupils	(nos.)	150	600	800
2) Teachers	(nos.)	4	8	10
3) Class Room	(nos.)	2	6	8
4) Practice Room	(nos.)	1	2	2
5) Staff Room	(nos.)	1	1	1

2 Health & Medical Care

Item	Unit	Gramodaya H'th Center	Sub-Divi'al H'th Center
(1) Site	(sq.m)	200	1,000
(2) Building	(sq.m)	50	250
1) Doctor	(nos.)	-	1
2) Nurse	(nos.)	-	2
3) Mid Wife	(nos.)	-	1
4) Health Nurse	(nos.)	1	2
5) Surgery	(nos.)	1	1
6) Delivery Room	(nos.)	-	1
7) Inspection Room	(nos.)	-	1
8) Office	(nos.)	-	1
9) Dressing Room	(nos.)	-	1
10) Store	(nos.)	1	1
11) Dispensary	(nos.)	-	1
12) Waiting Hall	(nos.)	1	1
13) Waiting Lobby	(nos.)	-	1

3 Postal

Item Item	Unit	Post-box	Sub-post Office
(1) Site	(sq.m)	5	500
(2) Building	(sq.m)	-	180
1) Post Office	(nos.)	-	1
2) Bed room	(nos.)	-	1
3) Sitting room	(nos.)	-	1
4) Dining room	(nos.)	-	1
5) Kitchen	(nos.)	-	1
6) Post box	(nos.)	1	1

Table A7.7-4 PRINCIPAL FEATURES OF RURAL INFRASTRUCTURE

4 Administrative Office

Item Item	Unit	Unit Service Center	Block Office
(1) Site	(sq.m)	1,000	5,000
(2) Building	(sq.m)	180	640
1) DRPM Romm	(nos.)	-	1
2) Irri. Engineer Room	(nos.)	-	1
3) Agri. Room	(nos.)	-	1
4) Officers' room	(nos.)	1	2
5) Meeting Room	(nos.)	1	2
6) Office	(nos.)	-	1
7) Store	(nos.)	-	4
8) Kitchen	(nos.)	-	1
9) Toilet	(nos.)	1	1

5 Development Center

Item	Unit	Quantity	Area(sq.m)
(1) Site	(sq.m)	20,000	
(2) Building	(sq.m)	1,200	
(3) Agricultural Extension Section			
1) Chief's Office	(nos.)	1	30
2) Specialist Office	(nos.)	1	30
3) General Office	(nos.)	1	20
4) Document Room	(nos.)	1	30
5) Class Room	(nos.)	3	90
6) Agricultural Science Room	(nos.)	1	90
7) Sience Laboratory	(nos.)	1	50
8) Kitchen	(nos.)	1	10
9) Storage	(nos.)	1	15
10) Toilet	(nos.)	1	15
(4) Community Development Section			
1) Chief's Office	(nos.)	1	30
2) Specialist Office	(nos.)	1	30
3) General Office	(nos.)	1	20
4) Document Room	(nos.)	1	30
5) Reception Room	(nos.)	2	30
6) Home Science Room	(nos.)	1	60
7) Class Room	(nos.)	3	90
8) Storage	(nos.)	2	30
9) Kitchen	(nos.)	1	10
10) Toilet	(nos.)	1	30
(5) Common Use Section			
1) Training Room	(nos.)	1	120
2) Work shop	(nos.)	1	120
3) Meeting Room	(nos.)	2	160
4) Library Room	(nos.)	1	60
(6) Equipment			
1) Audio-visual aids	(L.S)	1	
2) Agricultural Science	(L.S)	1	
3) Sience Laboratory	(L.S)	1	
4) Home Science	(L.S)	1	
5) Work shop	(L.S)	1	
6) Broad casting facilities	(L.S)	1	
7) Demo. facilities	(L.S)	1	

Table A7.7-4 **PRINCIPAL FEATURES OF RURAL INFRASTRUCTURE**

6 Agro Extension Facility

Item	Unit	Collecting & Shipping	Pola
(1) Site	(sq.m)	1,000	10,000
(2) Building	(sq.m)	450	350
1) Office	(nos.)	1	1
2) Storage	(nos.)	1	-
3) Open Building for Market	(nos.)	-	1
4) Car Parking Lot	(nos.)	1	1
5) Toilets	(nos.)	1	1

7 Rural Water Supply

Item	Unit	Hamlet	Villege Center	Area Center	Divelopment Center
(1) Population	(nos.)	2,000	2,500	5,000	7,000
(2) Intake	(nos.)	1	1	1	1
(3) Sand Filter	(nos.)	1	1	1	1
(4) Disinfection	(nos.)	-	-	1	1
(5) Distribution Tank	(nos.)	-	-	1	1

FIGURES

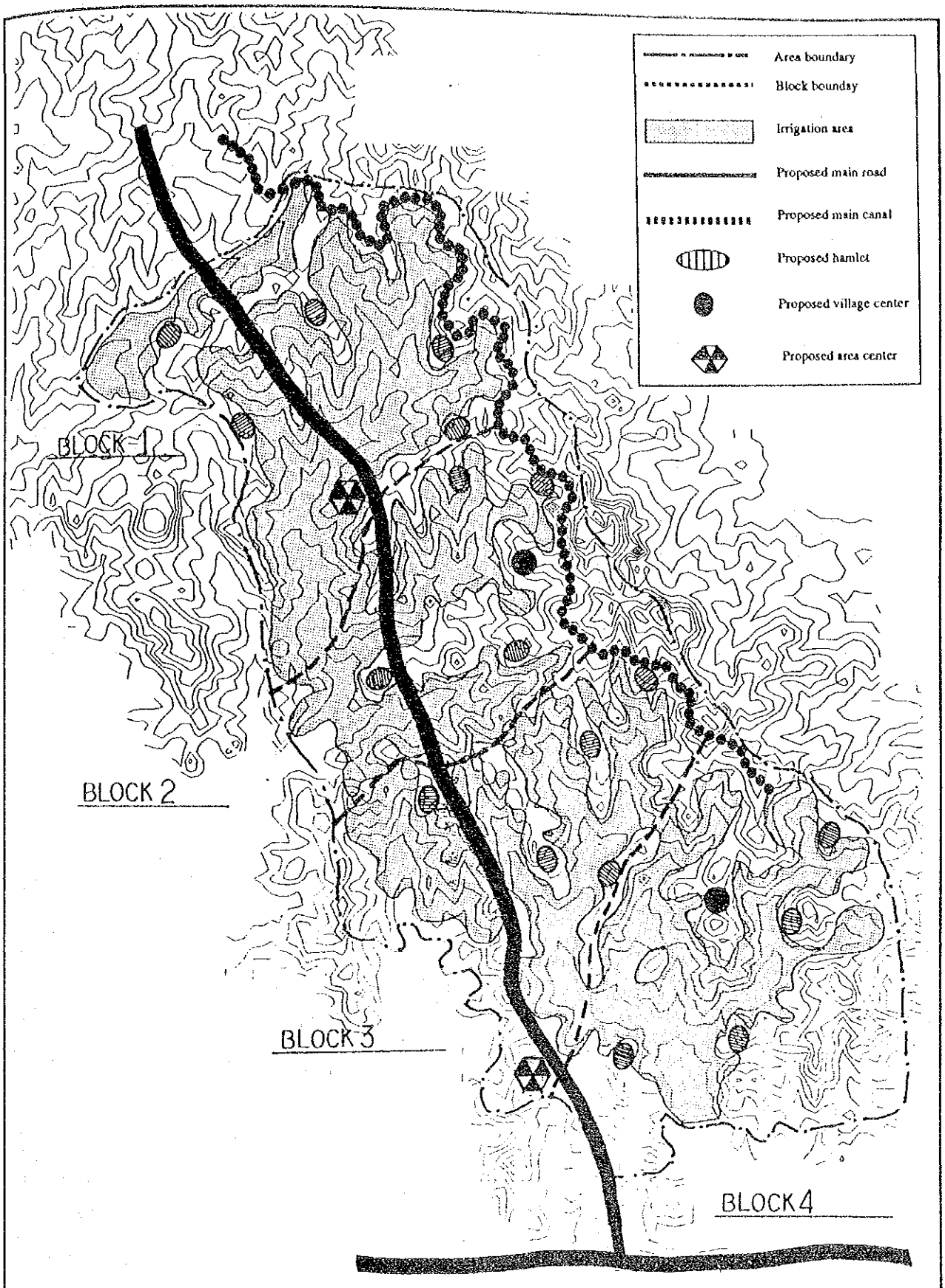


Fig. A7.7-1 VILLAGE LAYOUT PLAN IN THE EXTENSION AREA

GOVERNMENT OF DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
MINISTRY OF LANDS, IRRIGATION AND MAHAWELI DEVELOPMENT

THE FEASIBILITY STUDY ON WALAWE IRRIGATION UPGRADING AND EXTENSION PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

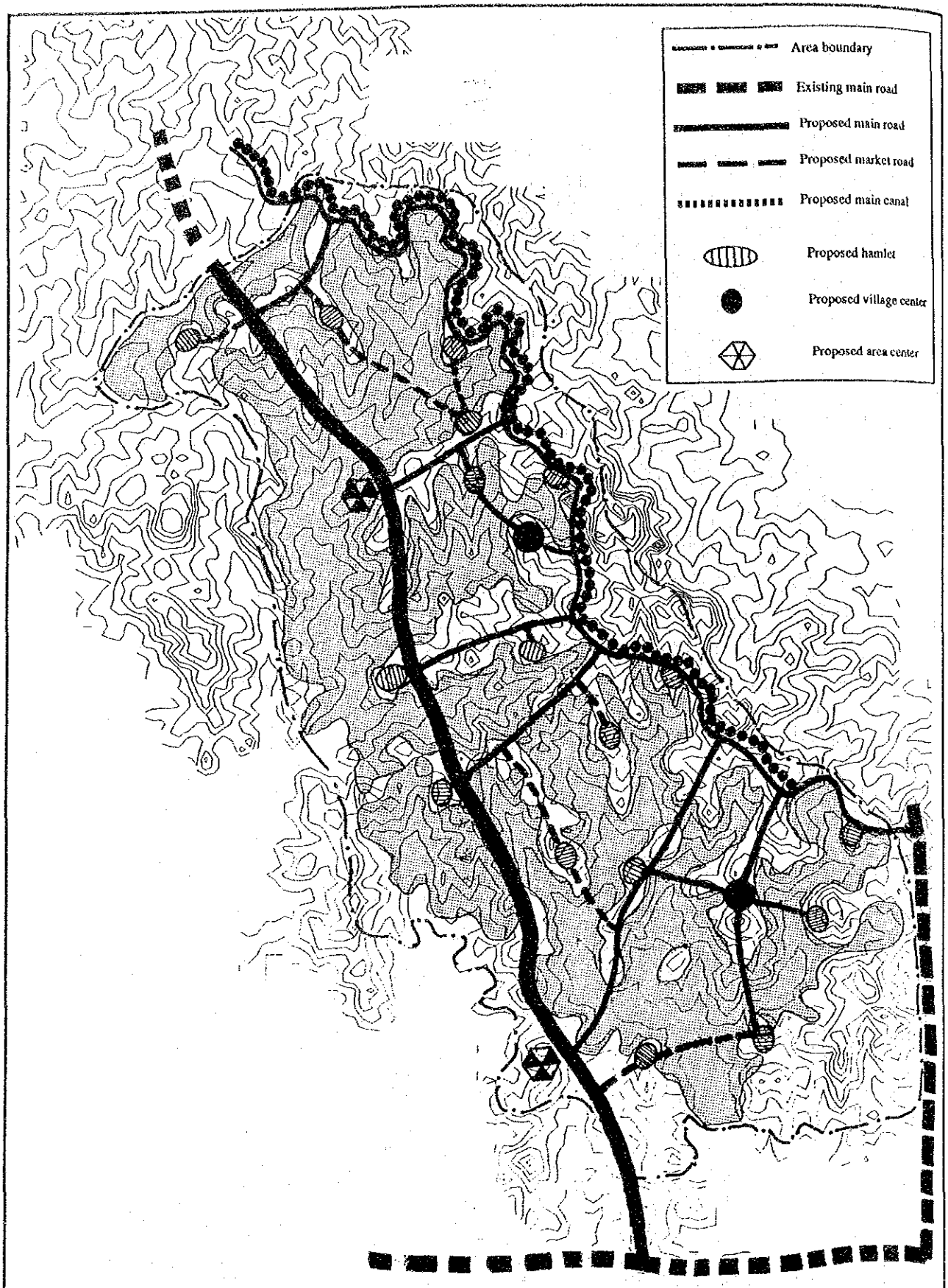


Fig. A7.7-2 PROPOSED ROAD NETWORK IN THE EXTENSION AREA

GOVERNMENT OF DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
MINISTRY OF LANDS, IRRIGATION AND MAHAWELI DEVELOPMENT

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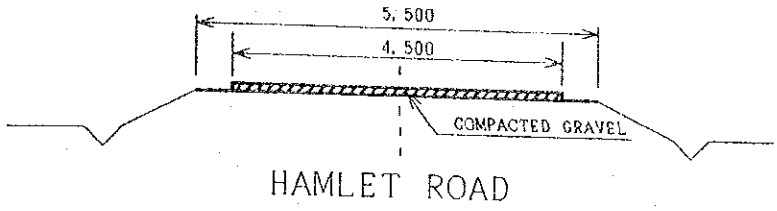
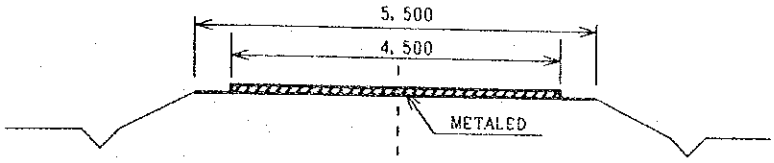
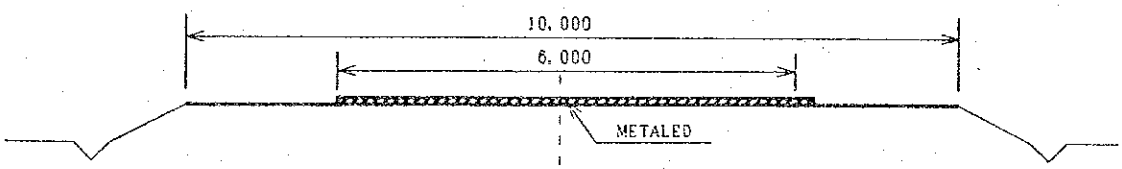
JAPAN INTERNATIONAL COOPERATION AGENCY



HAMLET ROAD



MARKET ROAD



MAIN ROAD

Fig. A7.7-3 TYPICAL CROSS SECTION OF PROPOSED RURAL ROADS

GOVERNMENT OF DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
MINISTRY OF LANDS, IRRIGATION AND MAHAWELI DEVELOPMENT

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JAPAN INTERNATIONAL COOPERATION AGENCY

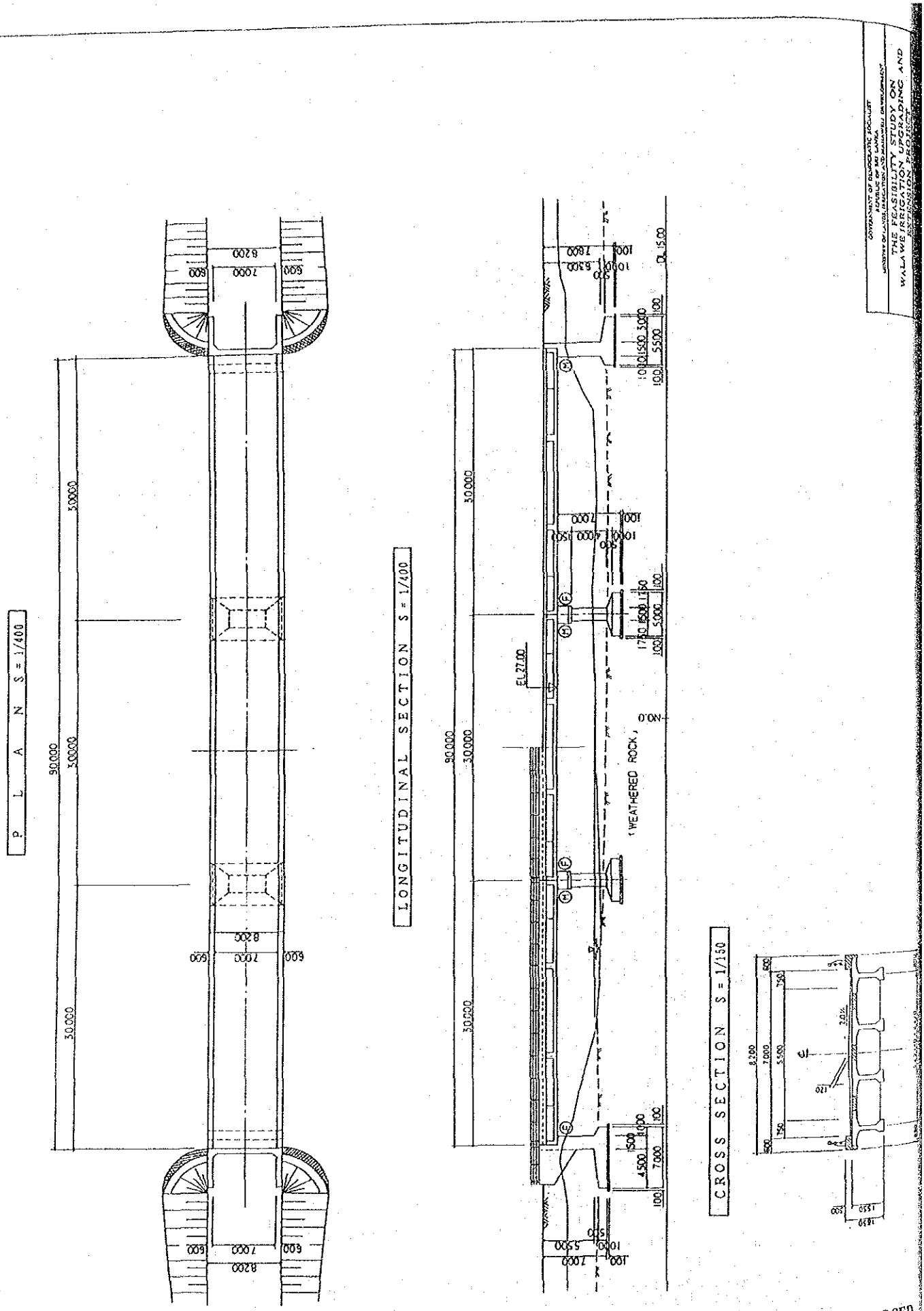

Fig. A7.7-4 MAIN FEATURES OF PROPOSED BRIDGE ON THE WALAWE RIVER

ANNEX 7-8 PRELIMINARY DESIGN OF THE TIMBOLKETIYA DIVERSION SCHEME

Contents

List of Tables

List of Figures

ANNEX 7-8 PRELIMINARY DESIGN OF THE TIMBOLKETIYA DIVERSION SCHEME

7.8.1 Background

The water resources available for the Walawe Development Scheme are the Walawe river and its tributaries. There are three major tributaries downstream of the Uda Walawe reservoir, namely the Hulanda and the Timbolketiya rivers on the right bank, and the Mau river on the left bank. The Hulanda and the Mau rivers have already been developed and included in the irrigation system of the Walawe development scheme. Only the Timbolketiya river has not been used directly. Is was considered formerly that river flow of the Timbolketiya was needed to satisfy the downstream water users such as the Liyangastota anicut scheme. However, as a result of extensive reclamation of paddy fields on both banks of the Walawe river, return flow from the paddy fields appears in the Walawe river and its volume is quite plenty.

Results of the water balance study indicated that;

- In the case of "with Samanalawewa reservoir and without development of the Timbolketiya river", shortages of water occur at the Uda Walawe reservoir in four years out of 20 years for the proposed cropping pattern. This satisfies the 80 % dependability of water supply.

- In the case of "with Samanalawewa reservoir and with development of the Timbolketiya river", shortages occur in two years out of 20 years. This result shows that the Timbolketiya diversion plan is rather effective for stabilizing the water supply to the Walawe area.

In order to augment the water resources for the Walawe development scheme, a plan is studied that the Timbolketiya is linked with Right Bank Main Canal (RBMC) and a part of the Timbolketiya flow is used for the Right Bank area. It is expected that the commensurate amount of water could be stored in the Uda Walawe reservoir and more reliable water could be supplied from the reservoir.

7.8.2 Basic conditions and considerations

(1) Related river condition

The Timbolketiya river is a right tributary of the Walawe river, joining with the main stream at 4 km downstream from the Uda Walawe dam, and has catchment area of 269 sq-km at the gauging station at Timbolketiya (Station No. 1807). Average annual runoff of the river at the station is estimated at 124 MCM. According to the "Engineering Survey Map", gradient of the river bed is estimated at about 1/600. The river has two major tributaries, the Rakwana (CA= 200 km^2) and Andolu rivers (CA= 69 km^2). They join at just upstream of the Timbolketiya bridge on route A-18 as shown in Fig.A7.8-1.

Probable peak flood discharges of the Timbolketiya, Rakwana and Andolu rivers with return period of 50 years, design flood of the diversion weir, are estimated at 300 m^3/sec, 225 m^3/sec and 75 m^3/sec, respectively. The peak flood discharges are estimated based on daily rainfall of 179 mm/day with return period of 50 years and by unit hydrograph method.

According to the geological investigations results along the rivers, there is certain possibility to place weir body directly on the fresh or weathered bedrocks. These bedrocks are available at rather shallow place, deeper than 4 m from the original ground surface.

Most of the riverine land below elevation of 240 ft along main stream and both tributaries are glass land except small patch of irrigated paddy area, which is located at about 1 km upstream on the left bank of the Rakwana river from the confluence. No permanent house is also found out in the riverine area except near the bridge.

(2) Intake discharge from the Timbolketiya river

River flow having 80 % reliability discharge is planned to divert. Annual amount of diversion water is estimated at 77 MCM (about 60 % of annual runoff) as shown in Table A7.8-1. The diversion discharges to RBMC are ranged between 1 and 4 m^3/s, and its average is of 2.5 m^3/s. The design diversion discharge is thus set at 4 m3/s.

(3) Condition of RBMC

Supply point of the water from the Timbolketiya is planned at just downstream point of Timbolketiya siphon (4 km point of RBMC) taking into account the locations of the river and canal, and to avoid excess inflow of sediment and diverted water into the siphon. According to the design drawing prepared for the rehabilitation works for the Right bank area prepared by MMP and CECB under "Walawe Irrigation Improvement Project", the design water level of According to the design drawings of "Walawe Irrigation Improvement Project (1986), design water level of RBMC at the outlet of the siphon (reduced distance of 4325 m from the Uda Walawe reservoir) is at EL. 72.06 m (about 236 ft) at the discharge of 22 m^3/s. Crest elevation of the diversion weir, when gravity diversion system is planned, is required to be higher than El. 73.2 m (240 ft). It is noteworthy that there is no drop structure on RBMC in the downstream stretch of about 10 km from the siphon down to the crossing point with A-18 road.

(4) Diversion site on the Timbolketiya river

Result of the discharge measurement made in July 1992 by the Team for both tributaries indicates that the Rakwana river has about three times of base flow discharge than that of the Andolu river (refer to Table A7.8-2). This means that the diversion plan should include the river flow of the Rakwana river. There is no suitable site for the diversion weir for gravity system on the Timbolketiya main stream within reasonable length of the weir. According to the "Engineering Survey Map", width of the river valley at El. 73.2 m (240 ft) contour line between the bridge on A-18 and the siphon on RBMC is about 400-500 m.

In addition to the above, there is other difficult condition to construct diversion weir with crest elevation of higher than 240 ft in the downstream stretch of the bridge. Top slab elevation of the bridge of A-18 on the Timbolketiya river was surveyed by MEA's surveyor. As a result, the slab elevation is measured at El.74.193 m (243 ft).

7.8.3 Alternative facility plans

(1) Alternative diversion plans

Considering the conditions and limitations of the river and RBMC, three alternative diversion plans are prepared. Two plans (Alternative-1 and -2) are gravity intake plan by mean of construction of diversion weir which have crest elevation of higher than the design water level of RBMC (236 ft), and the other is lifting plan (Alternative-3) by installing pumps and low weir as follow (Refer to Fig.A7.8-1):

- Alternative -1 : Construction of two diversion weirs on both the Rakwana and Andolu rivers. Diverted water of the Rakwana river is conveyed to the other weir site on the Andolu river through supply canal of about 1.1 km, then both river flows are diverted by the weir on the Andolu river. Length of link channel from the weir to RBMC is estimated at about 3.2 km. Total length of the canals is thus estimated at 4.3 km. Width of river sections at elevation of 240 ft are 45 m for the Rakwana river site and 110 m for the Andolu river site. Heights from river bed to elevation of 240 ft are 8 m for the Rakwana river site and 9 m for the Andolu river site.

- Alternative -2 : Construction of one diversion weir at the confluence of Rakwana and Andolu rivers. Length of link canals to RBMC of 2.3 km is rather shorter than that of Alternative-1. Width of river section at 240 ft is 175 m and height from river bed to 240 ft line is about 9 m.

- Alternative -3 : Construction of pump station and low diversion weir on the river at just upstream stretch of the siphon on the Timbolketiya river. Lifting plan by installing pump is planned to avoid artificial inundation to the upper stretch of the river and to save the construction cost of link canal to the RBMC. Lifting height of pumps will be about 14 m with construction of weir having crest elevation of about 220 ft. Width of river section at 220 ft is 170 m and weir height from river bed to 220 ft line is about 4 m. Canal length to RBMC is 0.4 km.

(2) Preliminary design of gravity intake plans

Movable type diversion weir is selected based on the considerations of; (i) water depth at the weir site between present river bed level and required intake water level (or crest of weir) is about 8 - 9 m, (ii) design water levels of weirs are just below the river bank level, and (ii) backwater effect to the upstream stretch of the weirs to be avoided as much as possible to conserve riverine conditions.

Selection of the movable weir type is made through comparative study on (i) girder type roller gate and (ii) rubber tube weir. Comparison is made for structural features, operation and maintenance, durability, and construction cost as below.

(i) Structural features	In case of roller type gate, piers and foundation slab need greater strength owing heavier weight of the gate leaf compare with rubber tube weir. In case of rubber tube weir, neither pier nor strengthened foundation is required because of lighter weight than roller gate.
(ii) Operation and maintenance	Power requirement roller gate is bigger than that of rubber gate due to the difference of weight. Roller gate requires power at opening of gate, but rubber gate requires at closing the gate. For the view point of safety operation for flood, rubber weir has advantage than roller gate. Periodic derusting and painting is required for the roller gate but no such maintenance work is required for rubber gate.
(iii) Durability	Durability or useful life is almost same to both types spanning over 30 years if maintenance work is well done.

(iv) construction cost

Including the cost for the related civil works and power supply system, the construction cost of weir is roughly estimated as below.

(Unit : Rs. Million)

Gate type	Alt-1	Alt-2
Roller gate	282.8	221.9
Rubber tube weir	247.8	183.1

Based on the above comparative study, rubber tube weir is selected for the scheme. Main features of diversion weirs are illustrated in Fig. A7.8-2.

(3) Preliminary design of pump plan

Pump plan consists of two major diversion facilities, pump station and low diversion weir. Diversion weir is planned to sustain the stable intake condition for the suction of pump equipment. Fixed type weir is planned taking into account the low height of weir and wide width of valley. Height of the weir is planned to be 2.4 m taking into account the suitable suction condition of pumps. Main features of diversion weirs are illustrated in Fig. A7.8-3.

Three units of pumps with capacity of 78 m^3/min/unit and 14 m lifting height are planned to be installed at the pump station taking into account the intake discharge of 3.9 m^3/s and its seasonal variation, and maintenance of pump units. Volute mixed flow type with diameter of 800 mm is selected based on the design discharge and required lifting height.

(4) Construction cost of Alternative plans

Based on the design of the diversion structures and canals, construction cost of three alternative plans are roughly estimated as summarized below.

(Unit : Rs. million)

Item	Alt - 1	Alt -2	Alt -3
Diversion weir	247.8	183.1	38.7
pump station	-	-	165.3
Link canal to RBMC	23.0	14.3	2.3
Total	270.8	197.4	206.3

7.8.4 Conclusion and recommendation

As a result of the study, Alternative 2, construction of one diversion weir at the confluence of Rakwana and Andolu rivers, is the most economical and suitable plan among three alternative plans. This plan could divert river waters by gravity. However, it is considered that the implementation of the plan is to be suspended till the project management of the left bank area will be reached at full development scale or additional water demand will occur in the outside of the basin

It is recommended that a comprehensive study on development plan of the Timbolketiya river is to be executed based on the monitoring data of return flows available at the Liyangastota anicut at the full development stage of the left bank area and water management of the irrigation area in the upstream stretch of the anicut.

TABLES

Table A7.8-1 INTAKE PLAN OF THE TIMBOLKETIYA RIVER FOR RBMC

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Max	Min	Ave
A. Discharge in m3/s																
1 Average runoff	3.7	2.8	3.8	4.7	4.4	3.2	2.7	2.5	3.3	5.4	6.1	4.4	47.0	6.1	2.5	3.9
2 Diversion to RBMC	0.9	2.0	2.6	3.3	2.8	2.2	1.7	1.9	2.2	3.2	3.9	2.7	29.5	3.9	0.9	2.5
3 D80 discharge	0.9	2.0	2.6	3.3	2.8	2.2	1.7	1.9	2.2	3.2	3.9	2.7	29.5	3.9	0.9	2.5
4 D90 discharge	0.9	1.9	2.5	3.1	2.4	2.0	1.5	1.7	1.8	3.1	3.5	2.4	26.6	3.5	0.9	2.2
B. Amount in MCM																
1 Average runoff	9.9	6.8	10.2	12.2	11.8	8.3	7.2	6.7	8.6	14.5	15.8	11.8	123.7	15.8	6.7	10.3
2 Diversion to RBMC	2.5	4.8	6.9	8.6	7.5	5.8	4.6	5.2	5.7	8.5	10.2	7.1	77.4	10.2	2.5	6.5
3 D80 discharge	2.5	4.8	6.9	8.6	7.5	5.8	4.6	5.2	5.7	8.5	10.2	7.1	77.4	10.2	2.5	6.5
4 D90 discharge	2.3	4.5	6.6	8	6.4	5.2	3.9	4.6	4.7	8.2	9.1	6.3	69.8	9.1	2.3	5.8

Note;

1 Monthly discharge having 80 % reliability is planned to be intaked for RBMC.

2 Design intake capacity of the diversion structure is to be 4 m3/s.

3 Additional irrigation water of 77 MCM per year will be developed by this development.

4 Some intake weir is requred even for pump plan to divert water since amount of intake water is rather large compare with average river flow. In case of drought, most of river flow is to be diverted to RBMC.

5 D80, D90: 80 % , 90 % reliable flow estimated by Gumbel Method based on the extended river flow prepared in Phase I.

Table A7.8-2 DISCHARGE MEASUREMENT OF RIVER FLOWS

Discharge measurement was made for the Timbolketiya river at 4 sites in July 1992. Measuring sites are; (i) Timbolketiya river, just downstream stretch of the Bridge of A-18 road on the Timbolketiya (T-1 site), (ii) Andolu river (A-1), and (iii) two sites on the Rakwana river (R-1 and R-2).

The measurement of flow velocity was made by employing current meter and flow areas were measured by tape and staff gauge with 1 m interval.

Results of the measurement is summarized as below.

Site	River	Discharge(m3/s)
T-1	Timbolketiya (main stream)	2.09
R-1	Rakwana (tributary)	1.55
R-2	Rakwana (tributary)	1.66
A-1	Andolu (tributary)	0.56

As seen in the above table, the Timbolketiya river has a base flow of about 2 m3/s at the bridge site comprising about 1.5 m3/s of the Rakwana river and about 0.5 m3/s of the Andolu river. The Rakwana river (right hand tributary) has about 3 times of discharge than the Andolu river.

At the same time, measurement was also made for the Mau river on the left bank. There was no significant discharge in the river at the crossing point between the river and LBMC; the discharge was measured at less than 10 lit/s.

FIGURES

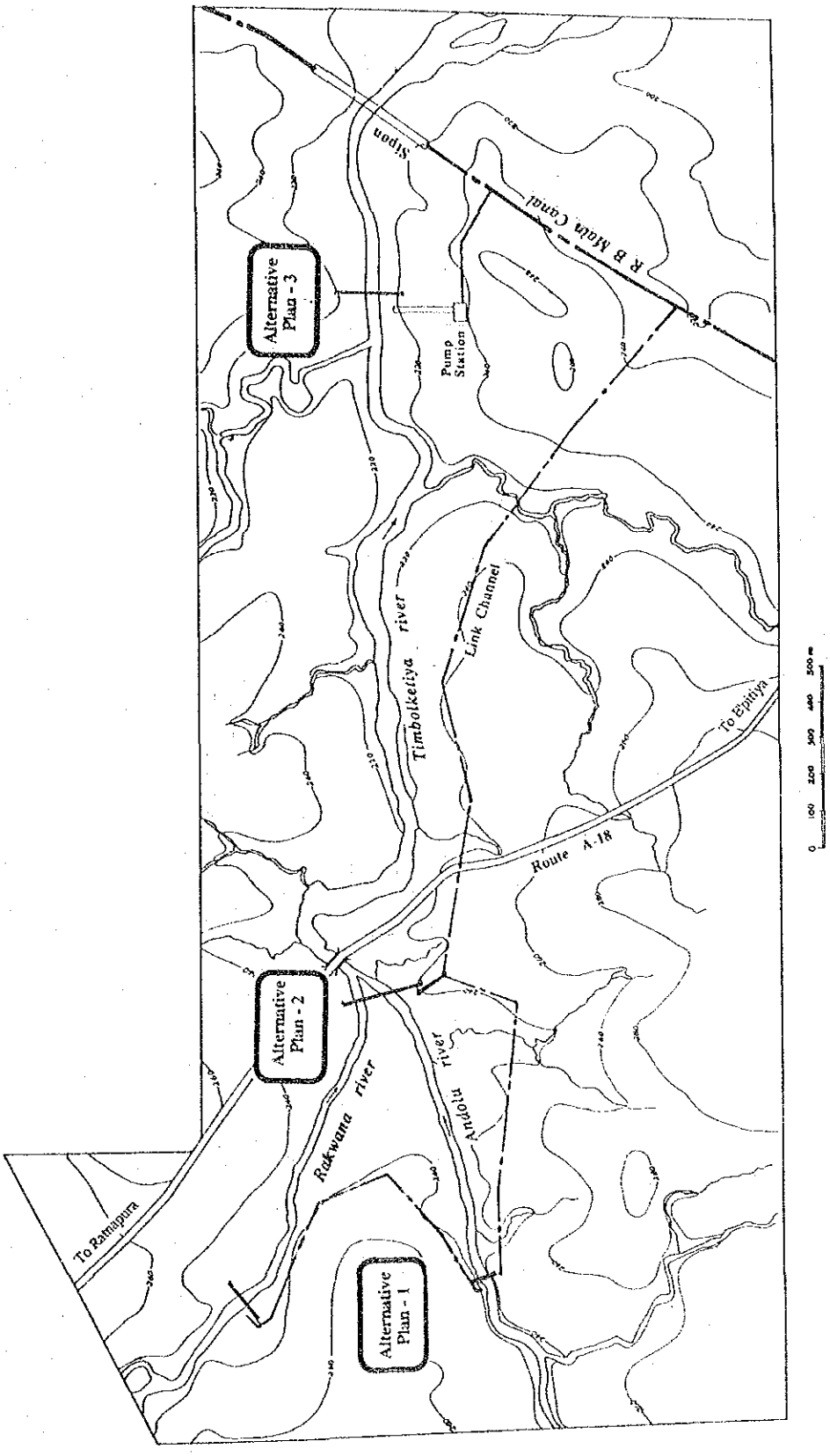

Fig. A7.8-1 ALTERNATIVE FACILITY PLANS ON THE TIMBOLKETIYA RIVER

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