APPENDIX

Table A-1 LIST OF MINOR IRRIGATION SCHEMES MAINTAINED BY DID
IN 1979 FOR THE STATE OF PERLIS

No.	Name of Scheme	Irri. Area (ha) Main	Off	Type of Scheme/1	Total Cost (M$10³) Const./2	O&M
1.	Ban Seberang Ramai	405	–	G	187.5	11.3
2.	Ban Bukit Tok Poh	26	–	G	27.1	1.0
3.	Ban Wang Bintong	202	–	G	149.1	8.0
4.	Sungai Siran	405	–	G	140.7	4.6
5.	Taliair Pdg. Melangit	202	–	G	164.3	4.9
6.	Taliair Kg. Belukar	101	–	G	7.9	1.3
7.	Taliair Kbg. Badak	41	–	G	8.5	5.3
8.	Taliair Batu Pahat	16	–	G	4.3	2.0
9.	Sungai Santan	809	–	G	410.7	18.2
10.	Kampung Tok Daboi	28	–	G	6.7	0.5
11.	Alor Sena	81	–	G	16.0	1.0
12.	Taliair Bukit Tau	81	–	G	4.7	1.0
13.	Alur Buruh	202	–	G	41.2	3.1
14.	Sungai Repoh	809	–	G	245.2	13.0
15.	Taliair Pdg. Siding	405	–	G	133.0	5.5
16.	Taliair Kuala Tunggang	405	–	G	149.9	6.0
17.	Alur Melaka	41	–	G	30.5	4.5
18.	Taliair Pdg. Telela	41	–	G	8.5	3.5
19.	Titi Tinggi	81	–	G	18.6	0.7
20.	Kok Kelang	324	–	G	33.6	3.3
21.	Kegunaan Air Hujan	2661	–	G	–	60.3
	Total	7366	–		1788.0	159.0

Remarks; /1: G = Gravity, P = Pumping, C = Control Drainage

   /2: Total construction cost as on 31.12.1979

Table A-2 LIST OF MINOR IRRIGATION SCHEME MAINTAINED BY DID
IN 1979 FOR THE STATE OF KEDAH (1/2)

No.	Name of Scheme	Irri. Area (ha)		Type of Scheme/1	Total Cost (M$10³)	
		Main	Off		Const./2	O&M
Main Land						
1.	Sidam Kanan	453	453	P	649.6	76.5
2.	Sidam Kiri	219	219	P	396.0	37.2
3.	Pulai	239	239	P	338.4	39.6
4.	Pekula	1781	1781	P	1699.5	252.3
5.	Kampung Binjal	172	–	G	125.1	–
6.	Bendang Raja Janing	138	57	G	104.5	7.5
7.	Sungai Gelam	155	155	G	51.9	12.1
8.	Kampung Iboi	186	186	G	116.9	8.2
9.	Kampung Tawar	40	40	G	41.8	7.9
10.	Simpang Empat	28	28	G	69.5	5.0
11.	Ulu Bakai	75	75	G	78.3	13.2
12.	Kampung Parit	192	192	G	44.9	11.6
13.	Serdang Batu 16	33	33	G	72.1	3.9
14.	Kg. Ulu/Kilang Batu	47	47	G	34.2	3.8
15.	Sungai Seluang	134	134	G	96.9	9.0
16.	Ulu Mahang	61	61	G	104.2	4.2
17.	Bendang Sena	38	38	G	69.7	3.8
18.	Tanjung Sik	91	91	G	136.0	15.5
19.	Ban Merbok	1530	–	C	1336.9	67.0
20.	Kota Bukit Meriam	1453	–	C	275.0	53.3
21.	Bandar Bahru	971	971	P	1906.8	141.8
22.	Kampung Badang	75	75	G	117.8	6.7
23.	Jemerli	121	–	G	467.3	5.4
24.	Otak Kerbau	197	197	G	488.7	18.3
25.	Lembah Bata	243	–	G	480.5	12.4
26.	Kampung Ruat	26	26	G	62.3	3.2
27.	Singkir Darat/Laut/ Pdg. Chetti/Sg. Pei	291	146	G	721.2	13.1
28.	Kulim	153	153	G	415.6	19.5
29.	Terat Batu	26	26	P	62.1	11.1
30.	Kampung Luar	97	97	G	322.9	5.8
31.	Selarong Panjang	40	40	G	84.6	0.9
32.	Kerja-Kerja Kecil	32	32	G	6.7	–
33.	Bakar Bata, Yan	40	40	G	139.9	–
34.	Sungai Kok	36	36	G	128.6	–
35.	Ulu Sedim (Siputeh)	79	79	G	162.6	17.9
36.	Serdang Batu 18	65	65	G	173.3	12.5
37.	Merbau Pulas	95	95	P	287.0	26.1
38.	Pinang Tunggal	279	279	P	759.2	43.2
39.	Paya Rawa	304	111	G	286.8	–
40.	Lembah Bata II	931	–	G	1687.5	–
41.	Sungai Taka	97	40	P	57.3	19.7
	Sub-Total	11263	6337		14660.1	989.2

Table A-3 LIST OF MINOR IRRIGATION SCHEME MAINTAINED BY DID
IN 1979 FOR THE STATE OF KEDAH (2/2)

No.	Name of Scheme	Irri. Area (ha) Main	Off	Type of Scheme/1	Total Cost (M\$10³) Const./2	O&M
Pulau Langkawi						
42.	Pulau Tuba	41	–	C	–	–
43.	Temoyong	134	–	C	–	–
44.	Kedawang	310	–	C	–	–
45.	Kampung Paya	91	–	G	–	–
46.	Masirat	237	59	G	–	–
47.	Kampung Kok	20	–	G	–	–
48.	Padang Saga	439	23	G	–	–
49.	Padang Gaong	808	40	G+P	–	–
50.	Sungai Menghulu	83	–	G	–	–
51.	Kuah	82	–	C	–	–
52.	Kampung Ewa	87	–	C	–	–
53.	Air Hangat	232	–	G	–	–
	Sub-Total	2564	122		1021.2	24.8
	Total for Kedah	13827	6459		15681.3	1014.0

Remarks; /1: G = Gravity, P = Pumping, C = Control Drainage

/2: Total construction cost as on 31.12.1979

Source; DID (Ref.   ). Data on schemes in Pulau Langkawi are
obtained from Ref.

Table A-4 LIST OF MINOR IRRIGATION SCHEMES MAINTAINED BY DID
IN 1979 FOR THE STATE OF PENANG

| No. | Name of Scheme | Irri. Area (ha) | | Type of Scheme/1 | Total Cost (M$10^3) | |
		Main	Off		Const./2	O&M
1.	Sungai Muda	7115	7115	P	4331.0	612.5
2.	Pinang Tunggal	1496	1496	P	1497.0	196.2
3.	Sungai Jarak	789	789	P+G	1575.2	110.8
4.	Tasek Glugor	221	221	P	500.1	49.6
5.	Jarak Tengah	105	105	P	125.8	21.9
6.	Sungai Kulim	3663	3663	G	2608.9	321.9
7.	Macang Bubok	136	136	G	156.0	24.3
8.	Juru	244	159	P	733.9	45.0
9.	Sungai Renjau	20	20	G	16.7	10.2
10.	Kuala Tasek	18	18	P	46.2	9.7
11.	Tasek Junjong	195	195	G	73.3	51.5
12.	Sungai Pinang	601	–	G	569.8	41.4
13.	Sungai Burong	525	202	G	426.9	42.2
14.	Permatang Damar Laut	64	64	G	62.8	6.1
15.	Sungai Acheh	1563	1563	P	517.1	0
	Total	16755	15746		13240.7	1543.3

Remarks; /1: G = Gravity, P = Pumping, C = Control Drainage

/2: Total construction cost as on 31.12.1979

Table A-5 LIST OF MINOR IRRIGATION SCHEMES MAINTAINED BY DID
IN 1979 FOR THE STATE OF PERAK (1/2)

| No. | Name of Scheme | Irri. Area (ha) | | Type of | Total Cost (M$10^3) | |
		Main	Off	Scheme/1	Const./2	O&M
1.	Sg. Segar	144	144	G	55.4	37.6
2.	Jelai Serta Tambahan	278	278	G	254.3	16.5
3.	Batu Kurau	662	662	G	268.1	23.8
4.	Jemerang Star	191	191	G	235.2	11.4
5.	Sg. Rambutan	76	76	G	114.8	6.4
6.	Sg. Damak	22	22	G	92.8	3.2
7.	Sg. Acheh	1582	1582	G+P	3649.5	95.6
8.	Sg. Bedarah	101	101	P	181.3	16.3
9.	Sg. Nor	128	128	G+P	310.2	21.1
10.	Sg. Garok	74	74	G	102.3	3.6
11.	Air Kuning	132	132	G	212.2	9.3
12.	Kg. Medan/Batu Tiga	62	62	P	188.5	15.6
13.	Gua Petai	33	33	G	55.8	3.2
14.	Bukit Torak/Lubok Sengga	95	95	G	276.2	4.0
15.	Pengkalan Alor	119	119	G	90.9	13.2
16.	Sg. Lang	79	79	G	27.6	7.1
17.	Saiong	211	211	G	166.3	22.7
18.	Chepias	111	111	G	138.2	10.7
19.	Kota Lama Kiri	112	112	G	570.7	12.9
20.	Padang Rengas	115	115	G	-	17.0
21.	Kenas	30	30	G	128.0	4.5
22.	Lenggong	181	181	G	207.2	27.3
23.	Sumpitan	182	182	G	13.9	11.0
24.	Talang	111	111	G	139.0	12.5
25.	Padang Kunyit	65	65	G	126.1	6.4
26.	Krunei	41	41	G	40.9	17.0
27.	Padang Setang	49	49	G	151.9	7.8
28.	Kroh Ulu	37	37	G	25.2	4.1
29.	Senggang	52	52	G	64.4	5.4
30.	Berhala	52	52	G	199.6	10.4
31.	Kampong Ngor	31	31	G	39.0	3.9
32.	Lempor	117	117	G	501.7	13.9
33.	Jalong	24	24	G	54.0	0.9
34.	Bongor	38	38	G	49.7	4.6
35.	Bukit Gantang	981	981	G	1804.5	79.1
36.	Jebong	169	169	G	104.4	20.8
37.	Sg. Simpul Kiri	38	38	G	173.2	8.3
38.	Trosor	24	24	G	-	1.1
39.	Beluru	243	243	G	741.6	20.1
40.	Seberang Perak Per. I & Tambahan	2371	2371	P	4122.0	286.2
41.	Bota/Lambor	848	848	P	1446.3	163.6
42.	Bukit Tunggal	1079	1079	P	3019.2	218.8
43.	Kuala Dal	26	26	G	71.1	5.8
44.	Seterus	81	81	G	160.1	6.5
45.	Ketior	49	49	G	252.2	8.2
46.	Sauk	49	49	G	127.1	9.5
47.	Ujib	51	51	G	132.0	10.7

Table A-6 LIST OF MINOR IRRIGATION SCHEMES MAINTAINED BY DID
IN 1979 FOR THE STATE OF PERAK (2/2)

| No. | Name of Scheme | Irri. Area (ha) | | Type of Scheme/1 | Total Cost (M$10³) | |
		Main	Off		Const./2	O&M
48.	Jeliang	49	49	G	68.7	1.3
49.	Parit	105	101	G+P	133.0	42.5
50.	Bruas & Bruas Tambahan	283	207	G	572.2	4.3
51.	Dendang 'A'	90	85	G	12.8	2.4
52.	Dendang 'B'	194	162	G	61.9	3.2
53.	Seberang Perak Per. IV	4877	4877	G	22355.7	197.0
54.	Senin	202	202	P	547.2	60.6
55.	Lambor Kiri	202	202	P	590.1	63.0
56.	Changkat Jong	1869	1869	G	1165.2	138.7
57.	Ulu Kuang	73	73	G	153.2	1.2
58.	Ulu Chemor	26	26	G	86.9	4.6
59.	Sg. Jernang	6	–	G	118.3	0.8
60.	Kampong Padang	28	28	P	140.0	18.2
61.	Sg. Chop	26	26	G	114.5	7.2
62.	Sg. Tuntong	202	–	C	151.4	2.2
	Total	19578	19253		47155.7	1866.8

Remarks; /1: G = Gravity, P = Pumping, C = Control Drainage

/2: Total construction cost as on 31.12.1979

Table A-7 LIST OF MINOR IRRIGATION SCHEMES MAINTAINED BY DID
IN 1979 FOR THE STATE OF SELANGOR

No.	Name of Scheme	Irri. Area (ha)		Type of Scheme/1	Total Cost (M$10^3)	
		Main	Off		Const./2	O&M
1.	Sg. Buloh	89	89	G	99.9	3.5
2.	U. Sel. Batu 30	30	30	G	95.2	4.0
3.	Kalong Tengah	69	69	G	120.7	5.0
4.	Kuang	76	76	G	17.2	16.8
5.	Jln. Enam Kaki	62	62	G	88.1	7.1
6.	Dusun Tua	88	88	G	86.9	12.5
7.	U. Lgt. Batu 19$\frac{3}{4}$	20	20	G	9.6	6.5
8.	Kuala Lui	11	11	G	25.9	5.0
9.	Sesapan Batu Minangkabau	190	170	G	328.1	25.0
10.	Beranang II	23	23	G	10.8	6.0
11.	Bukit Kepong	57	40	G	152.6	9.4
12.	Paya Lebar	27	27	G	21.8	2.5
13.	Sg. Rinching Hilir	68	68	G	135.0	17.0
14.	Kuala Pajam	37	37	G	79.4	3.0
15.	Sg. Air Hitam	26	26	G	37.8	6.0
16.	Sg. Merab	33	20	G	33.9	2.6
	Total	906	856		1342.9	131.9

Remarks; /1: G = Gravity, P = Pumping, C = Control Drainage

/2: Total construction cost as on 31.12.1979

Table A-8 LIST OF MINOR IRRIGATION SCHEMES MAINTAINED BY DID
IN 1979 FOR THE STATE OF NEGERI SEMBILAN (1/4)

No.	Name of Scheme	Irri. Area (ha)		Type of	Total Cost (M$10^3)	
		Main	Off	Scheme/1	Const./2	O&M
1.	Sri Menanti (KP)	142	81	G	69.1	10.3
2.	Terachi Batu 14 (KP)	117	42	G	108.1	6.9
3.	Solok Bangkong (R)	20	20	G	24.6	2.9
4.	Ulu Spri (R)	74	74	G	127.3	6.3
5.	Tiga Nenek (R)	85	71	G	255.7	6.5
6.	Sg. Batu/Sg. Lalah (R)	28	28	G	55.9	3.4
7.	Repah (T)	23	23	G	13.8	3.3
8.	Tampin Tengah (T)	25	25	G	26.2	5.3
9.	Rantau Pening/Kg. Solok (S)	38	36	G	133.1	5.9
10.	Inas (KP)	178	178	G	31.8	5.3
11.	Pantai (S)	49	49	G	98.3	2.5
12.	Ulu Gadong (R)	28	28	G	68.5	1.6
13.	Kg. Daching (S)	142	81	G	34.7	8.7
14.	Labu Batu 10 (S)	228	228	G	483.9	13.8
15.	Ampang Jeram (KP)	146	146	G	81.8	31.7
16.	Mampong (R)	64	64	G	92.4	5.7
17.	Kuala Klawang (J)	113	113	G	389.2	18.7
18.	Kombok (S)	45	20	G	17.6	3.1
19.	Sg. Muar I & II (KP)	567	567	G	2033.4	51.9
20.	Ulu Repah (T)	28	28	G	15.9	2.3
21.	Manin Dalam (S)	38	34	G	68.1	3.1
22.	Sg. Kelawang (J)	99	95	G	37.8	10.0
23.	Penajis (R)	83	83	G	457.2	8.5
24.	Kuala Nuri (KP)	114	61	G	251.8	4.6
25.	Batang Benar (S)	36	-	G	12.1	-
26.	Labu Batu 9 (S)	24	20	G	33.2	3.1
27.	Gunong Pasir (KP)	77	40	G	15.4	10.7
28.	Sg. Pilah (KP)	49	40	G	55.2	3.2
29.	Peraku (KP)	95	-	G	83.4	6.3
30.	Ulu Gemencheh (T)	48	48	G	29.4	6.2
31.	Tanjong Ipoh (KP)	340	340	G	1375.5	27.7
32.	Padang Bianas (KP)	146	154	G	137.5	7.3
33.	Durian Gasing (J)	93	36	G	191.1	11.4
34.	Sg. Dua (T)	115	115	G	379.4	11.9
35.	Kendong (R)	61	20	G	45.8	0
36.	Ulu Kelawang (J)	81	81	G	183.4	25.1
37.	Terachi Batu 17 (KP)	146	71	G	45.0	11.7
38.	Legong Jlir (R)	331	331	G	289.4	-
39.	Kg. Jimah (PD)	81	69	G	91.4	6.5
40.	Ampang Serong (R)	95	73	G	172.6	7.3

Remarks; /1: G = Gravity, P = Pumping, C = Control Drainage,
I = Inundation

/2: Total construction cost as on 31.12.1979

| No. | Name of Scheme | Irri. Area (ha) | | Type of Scheme/1 | Total Cost (M$$10^3$$) | |
		Main	Off		Const./2	O&M
41.	Ampang Limau (R)	131	40	G	300.7	–
42.	Sungai Raya (PD)	259	247	G	495.5	16.4
43.	Kuala Jempol Stage I (KP)	283	–	G	277.0	17.8
44.	Chembong (R)	172	121	G	190.0	–
45.	Peradong (J)	65	65	G	85.5	6.0
46.	Kg. Ulu Parit (KP)	57	8	G	19.9	5.2
47.	Kuala Jempol Stage II (KP)	184	–	G	290.8	14.3
48.	Kg. Chegor (KP)	24	–	G	23.9	2.9
49.	Ulu Giang (R)	30	30	G	60.5	3.0
50.	Sg. Tarum (S)	71	40	G	79.8	9.0
51.	Ulu Jelebu (J)	45	45	G	165.8	6.9
52.	Chelogeh (S)	90	–	G	59.9	5.6
53.	Kg. Londah (T)	194	194	P	293.6	17.7
54.	Galau I - V (KP)	93	40	G	131.3	6.0
55.	Kg. Jelawai (T)	61	61	G	399.3	7.1
56.	Air Panas (R)	20	20	G	68.8	0.7
57.	Triang Ilir (J)	364	227	G	887.1	19.9
58.	Sg. Jerang (J)	129	125	G	165.8	6.9
59.	Batang Penar (S)	34	–	G	85.8	2.8
60.	Kg. Pilin (R)	235	81	G	250.6	12.9
61.	Serting Ilir (KP)	174	81	G	174.3	14.9
62.	Kayu Ara (S)	24	–	G	56.9	–
63.	Ulu Pilah/Gacong (KP)	113	40	G	234.0	14.3
64.	Tanjong Juan (KP)	36	20	G	55.0	3.0
65.	Ulus Inas (KP)	59	28	G	94.1	3.1
66.	Ulu Beranang Stage II (S)	22	–	G	36.4	3.1
67.	Kg. Tanggai I & II (KP)	133	61	G	188.9	6.4
68.	Juasseh Ilir (KP)	34	30	G	64.6	3.1
69.	Lenggeng (S)	401	340	G	505.6	25.9
70.	Sg. Layang (R)	251	142	G	380.9	12.8
71.	Kg. Bangkahulu (T)	81	81	G	152.6	23.2
72.	Kg. Jijan (S)	93	77	G	163.3	8.2
73.	Kg. Miku (R)	42	42	G	52.8	1.0
74.	Gemencheh Lama (T)	49	49	G	115.5	23.2
75.	Linggi (PD)	65	57	G	94.3	8.1
76.	Cheriau (KP)	22	4	G	58.0	2.6
77.	Ulu Chembong (R)	24	24	G	88.5	3.3
78.	Ulu Kundor (R)	57	57	G	139.4	6.4
79.	Ulu Jempol I - V (KP)	526	607	G	800.6	29.2
80.	Selaru (KP)	22	20	G	60.2	4.3

Remarks; /1: G = Gravity, P = Pumping, C = Control Drainage

/2: Total construction cost as on 31.12.1979

No.	Name of Scheme	Irri. Area (ha)		Type of Scheme/1	Total Cost (M$10³)	
		Main	Off		Const./2	O&M
81.	Ulu Bendol (KP)	42	8	G	69.3	5.1
82.	Siliau (S)	57	--	G	81.7	--
83.	Pelangai I, II & III (KP)	81	61	G	160.7	9.8
84.	Buyau (KP)	24	8	G	50.5	3.1
85.	Labu Hilir (S)	73	32	G	30.1	3.2
86.	Kg. Gating (R)	20	20	G	49.6	1.0
87.	Ulu Chengkau (R)	34	--	G	63.1	2.8
88.	Kg. Lada (R)	20	--	G	22.4	1.0
89.	Ulu Gadong (R)	40	28	G	68.5	1.6
90.	Gargu (J)	24	24	G	54.4	2.9
91.	Sg. Relai (J)	20	20	G	39.1	3.6
92.	Kg. Pondoi (T)	27	27	G	49.1	0.9
93.	Sg. Salak/Sg. Jerneh (T)	57	57	G	134.9	7.0
94.	Keru (T)	86	40	G	229.7	11.1
95.	Kg. Sogoh (S)	34	16	G	53.3	5.2
96.	Kg. Lambar (S)	30	28	G	56.1	2.6
97.	Renal (J)	34	34	G	69.2	10.0
98.	Spri (J)	42	42	G	97.9	6.5
99.	Nuri I & II (KP)	49	32	G	107.9	2.2
100.	Tumang I & II (KP)	28	16	G	69.0	2.9
101.	Anak Air Tontong (R)	33	33	G	41.8	2.6
102.	Semerbok (R)	20	20	G	112.4	8.5
103.	Ibor (R)	61	28	G	53.2	3.0
104.	Senama (R)	49	--	G	94.1	5.7
105.	Batang Rokan (T)	61	20	G	138.2	6.3
106.	Kg. Gamin (KP)	24	--	G	17.6	2.2
107.	Kg. Kering I (S)	49	49	G	59.2	3.9
108.	Labu Batu 7½ (S)	20	--	G	73.5	2.7
109.	Ulu Simin (R)	53	--	G	99.9	5.8
110.	Kg. Petasseh (J)	81	77	G	243.4	19.1
111.	Kg. Gelang (J)	73	73	G	119.7	5.8
112.	Belangkan (S)	24	--	G	48.7	3.0
113.	Pilin Tengah (R)	38	--	G	107.8	3.0
114.	Ulu Ghalib (KP)	12	12	G	7.4	0.4
115.	Sg. Lui (KP)	21	--	G	107.1	2.0
116.	Bayai Pindah (KP)	24	--	G	78.1	1.6
117.	Ulu Bemban (KP)	22	--	G	64.6	1.3
118.	Kg. Bemban (S)	20	16	G	75.1	--
119.	Kg. Puom (J)	8	8	G	0	--
120.	Ulu Padang Besar (R)	34	--	G	101.4	3.7

Remarks;   /1:   G = Gravity, P = Pumping, C = Control Drainage

/2:   Total construction cost as on 31.12.1979

Table A-11 LIST OF MINOR IRRIGATION SCHEMES MAINTAINED BY DID IN 1979 FOR THE STATE OF NEGERI SEMBILAN (4/4)

No.	Name of Scheme	Irri. Area (ha) Main	Off	Type of Scheme/1	Total Cost (M$10³) Const./2	O&M
121.	Kg. Gebok (S)	16	12	G	62.5	2.9
122.	Golai (S)	12	12	G	17.7	2.7
123.	Kg. Junjun (S)	18	18	G	60.0	2.6
124.	Sawah Rajah (R)	20	8	G	57.2	5.3
125.	Tampin Kanan (PD)	15	–	G	26.1	2.8
126.	Batang Nyamor	34	–	G	99.1	–
127.	Pulau Mampat (R)	40	40	P	204.5	–
128.	Bongek (R)	67	7	G	144.7	8.1
129.	Kg. Cuai (R)	20	3	G	77.0	2.6
130.	Pilin Tengah (R)	38	11	G	107.8	3.0
131.	Air Mawang	32	8	G	61.2	1.5
132.	Ulu Melang (KP)	18	–	G	82.4	4.6
133.	Rembang Panas (KP)	57	28	G	215.0	3.1
134.	Sg. Talan Panjang (KP)	12	–	G	62.6	2.2
135.	Kepis (KP)	24	12	G	95.5	1.5
136.	Juasseh Tengah (KP)	24	16	G	31.3	3.1
137.	Majau (KP)	24	16	G	44.2	2.2
138.	Merual Jerneh (KP)	12	–	G	31.3	1.8
139.	Kg. Yu (KP)	20	8	G	104.7	2.6
140.	Kg. Betong (KP)	32	16	G	53.2	1.7
141.	Air Baning (J)	61	61	G	207.7	1.2
142.	Kg. Lakai (J)	34	24	G	88.4	2.1
143.	Gadong (R)	40	6	G	81.5	3.0
144.	Kg. Kering II (J)	78	–	G	152.8	1.5
145.	Lekong Kerpal (J)	20	–	G	27.7	1.8
146.	Kg. Kemin (J)	24	24	G	86.0	3.6
147.	Anak Air Kata (KP)	37	16	G	83.2	0.4
148.	Kg. Kancong (S)	24	–	G	175.7	–
	Total	11463	7892		21704.2	948.9

Remarks; /1: G = Gravity, P = Pumping, C = Control Drainage

/2: Total construction cost as on 31.12.1979

Table A-12 LIST OF MINOR IRRIGATION SCHEMES MAINTAINED BY DID
IN 1979 FOR THE STATE OF MELAKA (1/2)

No.	Name of Scheme	Irri. Area (ha) Main	Off	Type of Scheme/1	Total Cost (M$10^3) Const./2	O&M
1.	Tanjong Minyak	1133	–	G+P	760.8	36.9
2.	Bachang	595	142	G+P	164.5	58.4
3.	Parit China	461	–	G+P	264.3	25.3
4.	Duyong	688	–	G+P	264.3	55.9
5.	Sungai Putat	344	–	G	86.2	19.1
6.	Durian Tunggal	72	–	C	13.4	3.1
7.	Batu Berendam	413	–	G	14.0	7.8
8.	Sungai Udang	84	–	G	12.5	6.3
9.	Tangga Batu	324	–	G	122.1	12.4
10.	Paya Rumput Sungai Udang	32	–	G	54.8	3.5
11.	Paya Rumpur Alor Gajah	59	–	G	123.1	3.5
12.	Sempang Ampat	188	–	G	157.5	14.8
13.	Sungai Siput	279	279	G	566.2	22.4
14.	Padang Sebang I & II	295	247	G	429.0	23.2
15.	Melaka Pindah	510	510	G	573.4	45.2
16.	Rembia	49	49	G	120.8	3.8
17.	Kuala Sungga	20	20	G	67.9	1.6
18.	Sungai Baru Ilir	374	–	G	190.8	33.3
19.	Durian Daun	62	–	G	79.5	4.9
20.	Masjid Tanah	177	–	G	36.8	13.9
21.	Solok Jementang	57	–	G	26.2	4.5
22.	Air Paabas	73	40	G	187.2	5.7
23.	Solok Kemus	24	–	G	38.7	1.9
24.	Kemuning	97	97	G	153.6	10.1
25.	Air Hitam Lendu	34	–	G	30.3	4.9
26.	Parit Melana	26	26	G	47.5	2.1
27.	Solok Melaka Pindah	24	–	G	49.0	1.9
28.	Melekek	22	–	G	27.9	1.7
29.	Sungai Buluh	20	–	G	40.4	1.6
30.	Cerana Puteh	24	24	G	26.4	1.9
31.	Solok Duku	49	–	G	86.5	3.9
32.	Masjid Tanah Kampong Lekok	32	–	G	75.6	2.7
33.	Ramuan China Kecil	69	–	G	145.3	5.4
34.	Masjid Tanah Pekan	11	–	G	11.0	0.8
35.	Jasin I & II	705	705	G	686.6	52.3
36.	Chohong	202	99	G	277.3	15.4
37.	Chabau	17	17	G	50.9	1.1
38.	Sempang Asahan	101	20	G	30.8	6.1
39.	Lembah Nyalas	81	–	G	99.0	4.9
40.	Selandar I & II	142	142	G	259.3	10.3

Remarks; /1: G = Gravity, P = Pumping, C = Control Drainage

/2: Total construction cost as on 31.12.1979

Table A-13 LIST OF MINOR IRRIGATION SCHEMES MAINTAINED BY DID
IN 1979 FOR THE STATE OF MELAKA (2/2)

No.	Name of Scheme	Irri. Area (ha)		Type of Scheme/1	Total Cost (M$10³)	
		Main	Off		Const./2	O&M
41.	Kemengkang	24	24	G	42.4	1.5
42.	Umbai/Serkam	162	—	C	75.1	12.8
43.	Lubok Buaya	47	—	G	91.8	2.8
44.	Merlimau	158	—	P	24.3	9.6
45.	Telok Rimba	243	142	P	220.6	16.5
46.	Air Panas	202	—	G	226.0	14.2
47.	Bukit Senggeh	24	24	G	46.1	1.5
48.	Nyalas Gapis	40	—	G	45.8	2.5
49.	Sempang Rim	16	16	G	49.7	1.0
50.	Tambak Merlang	34	34	G	62.7	2.1
51.	Parit Keliling	40	40	G	124.2	2.7
	Total	8959	2697		7195.9	601.7

Remarks; /1: G = Gravity, P = Pumping, C = Control Drainage

/2: Total construction cost as on 31.12.1979

Table A-14 LIST OF MINOR IRRIGATION SCHEMES MAINTAINED BY DID
IN 1979 FOR THE STATE OF JOHOR

| No. | Name of Scheme | Irri. Area (ha) | | Type of | Total Cost (M10^3) | |
		Main	Off	Scheme/1	Const./2	O&M
1.	Padang Endau	846	846	G	454.8	50.0
2.	Kahang	304	304	G	531.0	26.9
3.	Telok Rimba	325	325	G	469.0	32.8
4.	Pulau Penarek	144	144	G	328.2	22.4
5.	Lukut	104	-	G	69.9	8.3
6.	Sungai Balang	308	308	G	321.5	31.6
7.	Ulu Benut	176	176	G	160.9	10.0
8.	Tenang	130	130	G	48.3	6.7
9.	Tangkak	87	87	G	147.8	10.5
10.	Jementah	127	127	G	20.3	9.0
11.	Kesang Tasek	146	146	P	101.9	27.8
12.	Sagil	142	142	P	73.9	18.7
13.	Kesang Gate	32	32	P	65.8	12.9
14.	Dengku	26	26	G	37.2	6.8
15.	Serom No. 1	32	32	P	54.7	5.9
16.	Kurnia Sakti	40	40	P	54.7	20.4
17.	Ring	405	405	G	2892.1	43.8
18.	Kebun Bahru	243	243	G	66.5	11.8
19.	Sabak Sena	24	24	P	40.4	8.0
20.	Juasseh	49	49	G	100.1	4.0
21.	Telok Bakong	44	44	P	89.4	7.9
	Total	3734	3630		6128.4	376.3

Remarks; /1: G = Gravity, P = Pumping, C = Control Drainage

/2: Total construction cost as on 31.12.1979

Table A-15 LIST OF MINOR IRRIGATION SCHEMES MAINTAINED BY DID
IN 1979 FOR THE STATE OF PAHANG (1/8)

No.	Name of Scheme	Irri. Area (ha)		Type of Scheme/1	Total Cost (M$10³)	
		Main	Off		Const./2	O&M
1.	Paya Ampang	47	--	C	148.5	3.4
2.	Paya Nyokyak	22	--	C	15.9	0.3
3.	Paya Rhu	24	--	C	99.3	1.1
4.	Paya Sepat	99	--	C	80.3	1.2
5.	Paya Ubai	49	--	C	24.7	1.4
6.	Paya Soi	182	--	C	77.9	1.4
7.	Paya Bongor	67	--	G	25.2	1.5
8.	Paya Sri Damai	70	--	C	65.6	1.0
9.	Paya Kubang Karah	117	--	C	27.2	1.5
10.	Paya Rambutan	71	--	G	98.1	1.1
11.	Paya Pinang	73	--	P	181.5	10.9
12.	Paya Beruas	142	--	P	24.3	1.4
13.	Paya Ganchong	364	--	P	2854.2	13.8
14.	Paya Gunting	18	--	P	15.1	0.4
15.	Paya Gemayah	23	--	P	10.9	0.5
16.	Paya Kg. Melayu	28	--	P	3.8	0.6
17.	Paya Kg. Wau/Betong	26	--	P	44.3	1.2
18.	Paya Lubok	221	--	P	113.3	1.1
19.	Paya Pulau Jawa	69	--	P	87.0	1.5
20.	Paya Padang	18	--	P	3.3	0.4
21.	Paya Serandu	202	--	P	60.5	15.0
22.	Paya Salong	166	--	P	19.7	1.2
23.	Paya Sejabon	25	--	P	11.9	0.5
24.	Paya Tebat	171	--	P	78.4	1.3
25.	Paya Mambang	328	--	P	270.9	1.6
26.	Paya Kinchir	22	--	P	36.1	0.4
27.	Paya Pasir Panjang	162	--	P	52.9	1.2
28.	Paya Sg. Duri	55	--	P	37.6	0.8
29.	Paya Tg. Pulai	93	--	P	34.8	1.2
30.	Paya Pelak	271	--	P	44.5	1.3
31.	Paya Belimbing	70	--	P	65.1	1.5
32.	Paya Sepayang	254	--	P+G	529.9	7.1
33.	Paya Ketam	153	--	P+G	236.3	1.5
34.	Paya Permatang Pauh	121	--	P+G	406.0	35.9
35.	Paya Pahang Tua	1366	--	P+G	2106.1	28.9
36.	Paya Temai Hilir	125	--	P+G	63.9	7.1
37.	Paya Wah	38	--	C	7.1	0.7
38.	Paya Menchali/Gading	95	--	C	44.0	1.2
39.	Paya Pulau Rumput	45	--	C	71.2	0.7
40.	Paya Kemap	121	--	G	689.7	4.6

Remarks; /1: G = Gravity, P = Pumping, C = Control Drainage,
I = Inundation

/2: Total construction cost as on 31.12.1979

Table A-16 LIST OF MINOR IRRIGATION SCHEMES MAINTAINED BY DID
IN 1979 FOR THE STATE OF PAHANG (2/8)

No.	Name of Scheme	Irri. Area (ha) Main	Off	Type of Scheme/1	Total Cost (M$10^3) Const./2	O&M
41.	Paya Beluru	71	–	P	24.3	–
42.	P. Angut (Pamar Aur) MK. Jenderak	107	–	C	38.5	2.4
43.	P. Ara MK. Kerdau	4	–	I	3.2	0.0(
44.	P. Angut Ulu MK. Jenderak	49	–	C	27.9	1.1
45.	P. Alor Lintah MK. Chenor	47	–	I	42.2	1.1
46.	P. Bintang MK. Sanggang	160	–	C	44.9	3.6
47.	P. Bintang Ulu MK./Sanggang	6	–	I	15.1	0.1
48.	P. Besar MK. Besar	115	–	C	14.9	2.6
49.	P. Busut Jin MK. Perak	30	–	C	32.5	0.7
50.	P. Batu Bor MK. Bera	117	–	C	48.0	2.7
51.	P. Bangau Parit MK. Bangsu	22	–	C	0.9	0.5
52.	P. Berhala Kapas MK. Lebak	30	–	C	22.6	6.4
53.	P. Belimbing MK. Bt. Segumpal	105	–	C	2.9	2.4
54.	P. Biut MK. Jenderak	73	–	C	9.4	2.0
55.	P. Batu Gajah MK. Chenor	28	–	C	29.8	0.9
56.	P. Besar Lipat Kajang MK. Lipat Kajang	28	–	C	32.8	0.6
57.	P. Banir MK. Songsang	28	–	C	37.4	0.6
58.	P. Besar Mengkarak MK. Triang	20	–	C	32.5	0.5
59.	P. Bangau MK. Bangau	22	–	C	21.1	0.5
60.	P. Besar Lebak MK. Lebak	51	–	C	30.9	1.2
61.	P. Batu MK. Perak	16	–	C	12.2	0.4
62.	P. Besar Bohor MK. Bera	138	–	C	85.5	3.1
63.	P. Badok MK. Sanggang	53	–	C	13.6	2.1
64.	P. Baroh MK. Perak	47	–	C	15.1	2.1
65.	P. Belenggu MK. Perak	24	–	C	23.6	1.5
66.	P. Baharu (Lama) MK. Perak	24	–	G	11.0	0.5
67.	P. Baharu Ulu (Stage I) MK. Chenor	65	–	G	60.0	0.6
68.	P. Beringin MK. Lebak	14	–	I	7.5	0.3
69.	P. Batu Hampar MK. Mentakab	28	–	I	19.1	0.6
70.	P. Bakoh MK. Kerdau	10	–	I	5.7	0.2
71.	P. Cik Ali MK. Triang	32	–	C	14.3	2.3
72.	P. Chempaka MK. Semantan	71	–	C	134.4	1.6
73.	P. Caruk Murun MK. Chenor	32	–	I	22.1	0.7
74.	P. Chendor MK. Triang	40	–	I	9.2	0.9
75.	P. Chukang Paku MK. Semantan	21	–	C	25.0	–

Remarks; /1: G = Gravity, P = Pumping, C = Control Drainage,
I = Inundation

/2: Total construction cost as on 31.12.1979

Table A-17 LIST OF MINOR IRRIGATION SCHEMES MAINTAINED BY DID IN 1979 FOR THE STATE OF PAHANG (3/8)

No.	Name of Schemes	Irri. Area (ha) Main	Off	Type of Scheme/1	Total Cost (M$10³) Const./2	O&M
76.	P. Darat Sanggang MK. Sanggang	196	--	C	14.3	4.5
77.	P. Darat Sir Ulu & Kuala MK. Kerdau	73	-	C	19.5	2.6
78.	P. Dehilir MK. Sanggang	11	-	C	17.9	1.2
79.	P. Dedalu MK. Sanggang	61	-	C	14.6	1.4
80.	P. Dalam MK. Sanggang	42	-	C	13.0	1.7
81.	P. Embon MK. Bt. Segumpal	98	-	C	63.3	2.2
82.	P. Guai & Merbau MK. Triang	156	--	C	3.7	3.5
83.	P. Gantok MK. Songsang	77	--	C	4.1	1.7
84.	P. Gumai MK. Bt. Segumpal	121	-	C	61.7	7.6
85.	P. Geduai MK. Jenderak	13	-	I	35.1	-
86.	P. Gunung MK. Jenderak	57	--	C	47.0	1.4
87.	P. Gertak Keladan MK. Perak	23	-	I	6.2	0.5
88.	P. Gajah Mati MK. Jenderak	16	-	I	4.8	0.4
89.	P. Gajah Mati MK. Mentakab	20	-	I	5.3	0.5
90.	P. Imam Sulong MK. Triang	9	-	I	1.9	0.2
91.	P. Jelutong MK. Kertau	38	-	C	1.7	0.9
92.	P. Jerangan MK. Semantan	27	-	G	88.3	0.6
93.	P. Jaapan Keladi MK. Jendarak	10	-	I	5.0	0.2
94.	P. Kilang MK. Triang	140	-	C	5.3	4.9
95.	P. Kanalau MK. Bangau	49	-	C	2.7	1.1
96.	P. Ketam MK. Kerdau	111	--	C	32.5	8.1
97.	P. Kering MK. Kertau	24	-	I	1.4	0.6
98.	P. Kertau MK. Kertau	85	-	C	23.8	6.6
99.	P. Kerayong MK. Triang	28	-	C	4.0	0.6
100.	P. Krot MK. Chenor	148	-	C	67.8	3.4
101.	P. Ketapi MK. Kerdau	32	-	C	10.7	0.7
102.	P. Kelibang MK Kerdau	40	-	C	30.9	2.4
103.	P. Kuin MK. Lebak	30	--	C	47.8	0.7
104.	P. Kuala Triang MK. Triang	24	-	C	52.5	2.2
105.	P. Kepong MK. Semantan	101	--	C	51.7	2.3
106.	P. Kening Seberang MK. Bera	14	--	C	5.9	0.4
107.	P. Keladan MK. Songsang	32	-	C	24.0	0.7
108.	P. Kindang MK. Jenderak	34	-	C	11.3	0.8
109.	P. Karai MK. Bera	14	-	I	8.0	0.3
110.	P. Kubu MK. Songsang	8	-	I	10.0	0.2
111.	P. Lebak MK. Lebak	63	-	C	28.0	1.4
112.	P. Lipat Kajang MK. Lipat Kajang	81	--	C	14.9	1.8

Remarks; /1: G = Gravity, P = Puming, C = Control Drainage, I = Inundation

/2: Total construction cost as on 31.12.1979

No.	Name of Scheme	Irri. Area (ha) Main	Off	Type of Scheme/1	Total Cost (M$10³) Const./2	O&M
113.	P. Lanting MK. Chenor	179	–	C	104.2	5.0
114.	P. Luas MK. Jenderak	101	–	C	4.4	4.1
115.	P. Lompat MK. Songsang	40	–	C	18.3	0.9
116.	P. Ladang MK. Chenor	189	–	I	41.0	4.3
117.	P. Lanjut MK. Lipat Kajang	40	–	C	10.4	0.9
118.	P. Lubok MK. Chenor	30	–	I	48.8	0.7
119.	P. Luas & P. Kg. Batu MK. Perak	291	–	C	168.1	6.6
120.	P. Lubok Lian MK. Bera	38	–	I	19.2	0.9
121.	P. Lubok Kanah MK Bangau	53	–	C	411	1.2
122.	P. Lang MK. Triang	546	–	I	541.8	14.0
123.	P. Machang Gelap MK. Chenor	121	–	C	25.1	2.8
124.	P. Mentakab MK. Mentakab	72	–	C	19.5	1.7
125.	P. Mengkuang MK. Songsang	154	–	C	97.2	7.0
126.	P. Nyak Besar MK. Kertau	219	–	C	35.8	5.8
127.	Paya Nyak Kecil MK. Kertau	97	–	C	23.5	2.5
128.	P. Ngawin MK. Chenor	72	–	C	2.9	1.6
129.	P. Nawar MK. Jenderak	25	–	C	33.7	0.6
130.	P. Nakoh Mk. Chenor	73	–	I	75.0	1.7
131.	P. Pulau Nawar MK. Bera	35	–	C	11.1	1.5
132.	P. Puyu MK. Lebar	18	–	C	0.7	0.4
133.	P. Pamah Songsang MK. Songsang	117	–	C	12.1	2.7
134.	P. Persagi MK. Chenor	117	–	C	98.0	3.2
135.	P. Padang MK. Triang	158	–	C	20.0	3.6
136.	P. Perak MK. Mentakab	36	–	C	50.6	0.8
137.	P. Perak MK. Lipat Kajang	43	–	C	21.7	1.4
138.	P. Puchang MK. Bera	170	–	C	33.3	3.9
139.	P. Pamun & Sebelah MK. Bera	30	–	C	43.4	1.6
140.	P. Pamah Bintang MK. Songsang	172	–	I	21.3	3.8
141.	P. Pelong MK. Jenderak	26	–	C	46.3	0.6
142.	P. Pulau Chengal MK. Jenderak	38	–	I	33.4	1.0
143.	P. Peijing MK. Chenor	178	–	C	58.8	4.7
144.	P. Putat MK. Bera	28	–	C	34.0	1.5
145.	P. Paku MK. Bt. Segumpal	45	–	C	14.8	1.0
146.	P/Pauh MK. Jenderak	5	–	I	9.9	0.1
147.	P. Rumput MK. Triang	40	–	C	15.8	0.9
148.	P. Rambai MK. Jenderak	22	–	I	26.1	0.7

Remarks; /1: G = Gravity, P = Pumping, C = Control Drainage
I = Inundation

/2: Total construction cost as on 31.12.1979

Table A-19 LIST OF MINOR IRRIGATION SCHEMES MAINTAINED BY DID
IN 1979 FOR THE STATE OF PAHANG (5/8)

No.	Name of Scheme	Irri. Area (ha)		Type of Scheme/1	Total Cost (M$10³)	
		Main	Off		Const./2	O&M
149.	P. Rantau Panjang MK. Semantan	65	–	C	60.9	1.5
150.	P. Rantau Panjang MK. Bt.	32	–	C	20.0	0.7
151.	P. Sungai Rabit MK. Perak	178	–	C	126.9	4.0
152.	P. Siak MK. Perak	93	–	C	4.1	2.1
153.	P. Sebelah MK. Sanggang	27	–	C	4.2	1.0
154.	P. Sultanate Land MK. Chenor	40	–	C	33.9	0.9
155.	P/Sungai Leng MK. Chenor	219	–	I	102.2	5.0
156.	P. Sok MK. Jenderak	150	–	C	125.5	3.4
157.	P. Serdang MK. Mentakab	8	–	I	6.2	–
158.	P. Sekoh MK. Jenderak	36	–	I	39.1	1.6
159.	P. Sungai Chengal MK. Perak	67	–	C	326.2	20.8
160.	P. Sungai Tuang MK. Triang	190	–	C	58.7	4.3
161.	P. Selindang MK. Bera	130	–	C	52.7	3.9
162.	P. Songsang MK. Songsang	23	–	I	3.5	0.5
163.	P. Sungai Buluh MK. Mentakab	20	–	I	1.8	0.5
164.	P. Sentang MK. Kertau	14	–	I	7.5	0.3
165.	P. Songsang MK. Perak	8	–	I	2.9	0.2
166.	P. Sesap. MK. Mentakab	6	–	I	4.8	1.6
167.	P. Telok Era MK. Bangau	93	–	I	6.3	3.8
168.	P. Telok Sentang MK. Sanggang	44	–	C	28.3	1.5
169.	P. Tenggoh MK. Perak	38	–	C	14.7	0.9
170.	P. Teratai MK. Lebak	18	–	C	12.7	0.4
171.	P. Taram MK. Kerdau	202	–	C	72.9	8.1
172.	P. Tok Apas MK. Sanggang	30	–	C	23.5	0.7
173.	P. Tok Langit MK. Triang	4	–	I	4.1	0.09
174.	P. Terlang MK. Perak	8	–	C	0.7	0.2
175.	P. Tedong MK. Semantan	72	–	C	47.3	1.6
176.	P. Terjun MK. Sanggang	47	–	C	10.1	1.5
177.	P. Tenggang MK. Triang	38	–	C	4.6	0.9
178.	P. Tetapa MK. Triang	61	–	C	48.5	1.4
179.	P. Teringging MK. Jenderak	44	–	C	74.0	1.0
180.	P. Tanjong Bt. MK. Chenor	31	–	I	44.6	0.7
181.	P. Teris MK. Semantan	105	–	I	75.6	2.4
182.	P. Ting & Besar Kertau MK. Kertau	73	–	C	25.9	1.7
183.	P. Tanjung Keladan MK. Bera	34	–	I	16.7	0.8
184.	P. Tambang MK. Songsang	14	–	I	7.4	0.3

Remarks; /1: G = Gravity, P = Pumping, C = Control Drainage,
I = Inundation

/2: Total construction cost as on 31.12.1979

Table A-20 LIST OF MINOR IRRIGATION SCHEMES MAINTAINED BY DID
IN 1979 FOR THE STATE OF PAHANG (6/8)

No.	Name of Scheme	Irri. Area (ha) Main	Off	Type of Scheme/1	Total Cost (M$10³) Const./2	O&M
185.	P. Tebing Tinggi MK. Lebak	5	–	I	3.8	1.1
186.	P. Tebing Tinggi MK. Bera	10	–	I	3.8	0.2
187.	Paya Tengah	25	–	G	57.3	4.7
188.	Paya Som	38	–	G	15.0	2.8
189.	Paya Kg. Baru	111	–	G	48.7	7.5
190.	Paya Lata Kasah	78	–	G	35.2	5.6
191.	Paya Labuk Payong	16	–	G	7.7	0.4
192.	Paya Kangsar	182	–	P	1097.4	62.1
193.	Paya Gintong	81	–	P	242.3	33.1
194.	Paya Terpai	81	–	C	77.2	0.5
195.	Paya Betong	69	–	C	39.9	0.3
196.	Paya Ulu Cheka	81	–	C	110.0	0.6
197.	Paya Kool	40	–	C	8.0	0.1
198.	Paya Nyong	14	–	I	17.5	0.0(
199.	Paya Jerangsang	57	–	I	42.2	0.2
200.	Paya Bt. Dinding	20	–	I	23.3	0.2
201.	Paya Johor	18	–	G	45.3	–
202.	Paya Ulu Retang	21	–	P	125.3	0.9
203.	Paya Chebong	52	–	P	19.1	–
204.	Paya Kuala Atok	36	16	G+C	80.1	4.5
205.	Paya K. Merang	31	28	G+C	142.8	4.9
206.	Paya Temalir	12	10	G+C	83.4	5.6
207.	Paya Tat	24	24	G+C	175.7	9.3
208.	Paya Chenua	109	81	G+C	881.3	2.9
209.	Paya Renggol	30	24	P	50.3	4.4
210.	Paya Atok I & II	65	53	G	110.3	8.1
211.	Paya Ulu Temau	27	27	G	3.9	0.4
212.	Paya Ajai	36	28	G	33.5	7.0
213.	Paya Gali Hilir	38	32	P	88.0	7.7
214.	Paya Sungai Pasu	32	32	G	56.6	6.5
215.	Paya Ulu Gali	202	142	G	229.0	10.2
216.	Paya Tersang	49	49	G	114.2	5.0
217.	Paya Kenong	57	40	G	138.6	6.9
218.	Paya Cherlang	22	12	G+C	9.7	–
219.	Paya K/Keloi/Yul	32	24	G+C	76.1	4.5
220.	Paya Pamah Bedu	36	32	G+C	44.3	4.4
221.	Paya Ulu Lepar	24	20	G+C	8.5	–
222.	Paya Tg. Putus	34	24	P+C	63.4	6.9
223.	Paya Ulu Atok	28	12	G+C	53.5	4.7
224.	Paya Dong/During Sebatang	159	159	P	122.4	18.5
225.	Paya Gali Tengah	199	142	P	183.3	21.1

Remarks; /1: G = Gravity, P = Pumping, C = Control Drainage,
I = Inundation

/2: Total construction cost as on 31.12.1979

Table A-21 LIST OF MINOR IRRIGATION SCHEMES MAINTAINED BY DID
IN 1979 FOR THE STATE OF PAHANG (7/8)

No.	Name of Scheme	Irri. Area (ha) Main	Off	Type of Scheme/1	Total Cost (M$10³) Const./2	O&M
226.	Paya Batu Talam	104	101	G	37.4	9.3
227.	Paya Sain	22	8	P	38.3	0.3
228.	Paya Kekabu	18	8	G	9.9	3.9
229.	Paya Chin	6	4	G	10.8	–
230.	Paya Temunga	5	5	G+C	6.2	1.2
231.	Paya Sengkela	20	20	P+C	45.7	5.9
232.	Paya Bukit Gambut	10	4	G+C	5.5	–
233.	Paya Ulu Sempalit	45	–	I	20.9	–
234.	Paya Sg. Tikam	20	20	G+C	29.9	0.9
235.	Paya Meledu	15	15	G+C	51.4	0.6
236.	Paya Mentinue	7	–	G+C	35.2	0.4
237.	Paya Lalloh/Sasak	101	32	G	36.5	10.1
238.	Paya Terpuai	75	8	G	165.7	5.8
239.	Paya Chematu	20	12	G	14.6	0.5
240.	Paya Cherba	20	12	G	17.4	0.7
241.	Paya Kasikin	23	–	G+C	36.5	–
242.	Paya Lallang	43	20	G+C	80.4	3.3
243.	Paya Ulu Lallang	37	14	G+C	90.8	4.9
244.	Paya Tampin/Kemahang	23	12	G+C	129.4	6.4
245.	Paya Perangkap	21	18	G+C	52.2	5.5
246.	Paya Kadok	39	20	G+C	28.4	4.4
247.	Paya Keng	21	14	G+C	42.4	4.2
248.	Paya Sepan	15	8	G+C	18.7	3.0
249.	Paya Aur Gading	12	4	G	10.2	–
250.	Paya Teka	78	24	G+C	83.9	5.9
251.	Paya Pagar Sasak	40	16	P	76.1	0.5
252.	Paya Teris	80	14	G+C	64.3	7.8
253.	Paya Relai	16	12	G+C	38.2	1.6
254.	Paya Bandar	28	16	G+C	84.8	2.1
255.	Paya Pudu	14	6	G+C	14.3	2.8
256.	Paya Lanar	30	12	G+C	38.3	0.5
257.	Paya Peling Hilir	26	12	G+C	–	0.8
258.	Paya Bapong	14	–	G+C	–	0.3
259.	Paya Janda Baik	101	81	G	48.2	6.3
260.	Paya Lengkong	53	40	G+P	120.9	4.0
261.	Paya Keruntung	20	16	G	34.9	0.5
262.	Paya Cheringging	40	40	G	23.3	3.0
263.	Paya Sum-Sum	53	40	G	68.5	–
264.	Paya Ulu Semie	81	16	G	167.5	3.1
265.	Paya Simpang Pelanggi	40	32	G	76.8	5.6
266.	Paya Pelanggi	81	81	G	83.0	5.6

Remarks; /1: G = Gravity, P = Pumping, C = Control Drainage,
               I = Inundation

         /2: Total construction cost as on 31.12.1979

Table A-22 LIST OF MINOR IRRIGATION SCHEMES MAINTAINED BY DID
IN 1979 FOR THE STATE OF PAHANG (8/8)

| No. | Name of Scheme | Irri. Area (ha) | | Type of | Total Cost (M$10³) | |
		Main	Off	Scheme/1	Const./2	O&M
267.	Paya Seratus Tujuh	81	69	G	56.2	5.6
268.	Paya Melan	42	32	G	108.2	--
269.	Paya Lurau	16	--	G	4.1	--
270.	Paya Sempa	7	--	I	8.0	0.2
271.	Paya Karak Setia	12	--	I	13.7	0.2
272.	Paya Pelantar	7	--	I	6.4	0.1
273.	Paya Ponsoon	12	--	G	9.0	--
	Total	19302	1929		21048.9	844.3

Remarks; /1: G = Gravity, P = Pumping, C = Control Drainage,
I = Inundation

/2: Total construction cost as on 31.12.1979

Table A-23 LIST OF MINOR IRRIGATION SCHEMES MAINTAINED BY DID
IN 1979 FOR THE STATE OF TRENGGANU

| No. | Name of Scheme | Irri. Area (ha) | | Type of | Total Cost (M$10³) | |
		Main	Off	Scheme/1	Const./2	O&M
1.	Pulau Musang	1778	1238	P	1369.1	143.2
2.	Nerus	2444	1821	P	3895.5	236.5
3.	Paya Kemat	39	–	P	14.8	4.1
4.	Paya Diman	122	–	G	47.7	6.2
5.	Sungai Serai	89	–	G	25.9	0.6
6.	Sg. Telabak	128	–	G	13.3	5.1
7.	Paya Dusun	25	–	G	25.3	2.9
8.	Lubok Pandan	64	–	G	17.8	0.9
9.	Air Puteh	134	109	G	164.4	2.8
10.	Padang Ipoh	182	162	P	231.2	32.2
11.	Paya Dadong	57	49	P	61.9	17.7
12.	Bintang	61	45	G	107.6	4.9
13.	Kuala Telemong	69	57	P	79.2	1.6
14.	Paya Delong	40	32	P	46.2	8.6
15.	Kuala Akob	73	40	P	77.7	11.0
16.	Paya Rapat	113	81	P	131.6	8.2
17.	Gaung	202	182	P	240.1	18.4
18.	Peroh	51	–	G	80.8	8.6
19.	Batu Rakit	1995	138	C	692.6	39.6
20.	Bukit Tumboh	243	–	C	12.0	1.7
21.	Banggol Pauh	80	–	C	31.0	0.5
22.	Gelong Gabus	148	–	C	4.0	1.0
23.	Rhusila	86	–	C	11.6	0.5
24.	Sungai Ibai	364	–	C	143.0	5.7
25.	Chendering	32	–	C	12.7	3.8
26.	Batangan	85	–	C	58.0	0.7
27.	Setiu	1335	728	G	1281.9	28.4
28.	Bukit Julong	24	–	G	16.3	0.5
29.	Shular	17	–	G	11.0	–
30.	Cheniah	62	–	G	41.9	–
31.	Kandis	4	–	G	4.1	–
32.	Kempian	68	–	G	27.5	–
33.	Bukit Putra	81	–	G	80.8	4.1
34.	Matang	81	81	P	186.1	26.6
35.	Langgar	202	202	P	348.5	31.5
36.	Tapah	81	81	P	180.7	12.2
37.	Baroh Masin	20	10	G	23.2	1.7
38.	Batu Putih	81	81	P	147.8	7.2
39.	Paya Paman	202	202	P	449.6	18.1
40.	Pelagat	618	263	P	1399.1	58.5
41.	Bukit Peroh	162	162	P	246.2	7.5
	Total	11742	5764		12050.7	763.4

Remarks; /1: G = Gravity, P = Pumping, C = Control Drainage

/2: Total construction cost as on 31.12. 1979

Table A-24 LIST OF MINOR IRRIGATION SCHEMES MAINTAINED BY DID
IN 1979 FOR THE STATE OF KELANTAN (1/2)

| No. | Name of Scheme | Irri. Area (ha) | | Type of | Total Cost (M$10^3) | |
		Main	Off	Scheme/1	Const./2	O&M
1.	Repek	453	–	P	175.9	82.6
2.	Jubakar	498	–	G	57.6	29.2
3.	Padang Lindong	253	–	G	10.4	3.2
4.	Batu Balai	138	–	G	No. Record	3.9
5.	Danan	24	–	G	121.5	2.2
6.	Ulu Sat	506	121	G	375.4	34.4
7.	Pertok	32	–	G	39.0	4.5
8.	Putat	28	28	G	39.9	0.4
9.	Sg. Galang	81	7	G	5.4	0.7
10.	Lubok Bongor	53	53	G	83.0	0.6
11.	Bdg. Nyior	81	–	P	24.4	7.0
12.	Sungai Pinang	202	142	P	125.6	49.2
13.	Jegor	12	–	P	35.1	2.0
14.	Berohang	20	–	P	37.4	2.3
15.	Kalor	35	35	P	21.2	3.0
16.	Kubang Sawa	61	40	P	29.0	6.0
17.	Telosang Rasau	405	–	P+G	2458.5	35.0
18.	Sg. Bagan	971	24	P+G	1142.6	17.6
19.	Hilir Sat I	526	–	P+G	500.0	13.0
20.	Wakaf Bata	81	–	P+G	20.0	7.0
21.	Gading Galoh	405	–	P+G	50.0	10.0
22.	Jakar Panyit	40	–	P+G	20.0	1.0
23.	Kg. Ulu Sat	81	–	P+G	20.0	2.0
24.	Buluh Duri	324	–	P+G	40.0	8.0
25.	Durian Jadar	40	–	P+G	20.0	1.0
26.	Pangkal Dering	40	–	P+G	20.0	1.0
27.	Lepan Jenok	40	–	P+G	20.0	1.0
28.	Pasir Tumboh	28	–	P+G	14.0	0.7
29.	Bdg. Pulai	121	–	P+G	25.0	3.0
30.	Dalam Kelat	89	–	P+G	20.0	2.2
31.	Bdg. Kenor	81	–	P+G	20.0	2.0
32.	Bdg. Batu Balai	61	–	P+G	25.0	1.5
33.	Sg. Petai	101	–	P+G	25.0	2.5
34.	Lepan Tupai	101	–	P+G	25.0	2.5
35.	Baroh Kelong	202	–	P+G	30.0	5.0
36.	Alor Golok	65	–	P+G	20.0	1.6
37.	Rantau Panjang	769	–	P+G	5300.0	19.0
38.	Limau Purut	49	–	P+G	20.0	1.2
39.	Bdg. Tabeh	40	–	P+G	20.0	1.0
40.	Bdg. Liku	81	–	P+G	25.0	2.0

Remarks; /1: G = Gravity, P = Pumping, C = Control Drainage

/2: Total construction cost as on 31.12.1979

Table A-25 LIST OF MINOR IRRIGATION SCHEMES MAINTAINED BY DID
IN 1979 FOR THE STATE OF KELANTAN (2/2)

| No. | Name of Scheme | Irri. Area (ha) | | Type of | Total Cost (M$10^3) | |
		Main	Off	Scheme/1	Const./2	O&M
41.	Bukit Langsat	28	—	P+G	10.0	0.7
42.	Bdg. Legeh	61	—	P+G	15.0	1.5
43.	Bdg. Juluk	121	—	P+G	25.0	3.0
44.	Bukit Durian	121	—	P+G	25.0	3.0
45.	Bdg. Charimu	49	—	P+G	20.0	1.2
46.	Gunong	12	—	P+G	8.0	0.3
47.	Bdg. Pasir	40	—	P+G	15.0	1.0
48.	Tok Ajal	20	—	P+G	10.0	0.5
49.	Jeram	20	—	P+G	10.0	0.5
50.	Bdg. Pauh	101	—	P+G	25.0	2.5
51.	Gual Derahim	24	—	G	7.0	0.6
52.	Tok Che Ngah	324	—	G	25.0	8.0
53.	Bdg. Gading	111	—	G	15.0	2.8
54.	Kg. Air China	40	—	G	10.0	1.0
55.	Gunong Lama	16	—	G	5.0	0.4
56.	Bambang Batu 9	18	—	G	4.0	0.5
57.	Jedok	40	—	G	7.0	1.0
58.	Alor Jejulok	12	—	G	2.0	0.4
59.	Tanjung Pauh	20	—	P	8.0	2.0
60.	Jerimbung	55	—	P	10.0	4.7
61.	Kuala Balah	49	—	P	10.0	4.2
62.	Bukit Jering	55	—	P	97.0	4.7
63.	Chicha	30	—	P	15.0	2.6
64.	Pasir Hor	69	—	P	65.0	6.0
65.	Bdg. Tugalan	121	—	G	20.0	3.0
66.	Permatang Sungkai	32	—	G	20.0	0.8
67.	Bdg. Buaya	40	—	G	10.0	1.0
68.	Bdg. Kamal	24	—	G	6.0	0.6
69.	Gong Serai Hilir	81	—	G	10.0	2.0
70.	Gong Serai Bt. Awang	202	—	G	20.0	5.0
71.	Bt. Awang	28	—	G	3.0	0.7
	Total	9182	450		11592.9	439.2

Remarks; /1: G = Gravity, P = Pumping, C = Control Drainage

/2: Total construction cost as on 31.12.1979

Table B-1 LIST OF PUMPING STATIONS MAINTAINED BY DID IN 1977 (1/6)

State	Name of Scheme	No. of Units	Pump				Engine			Year Installed
			Type	Discharge Dia. (inches)	Capacity (cusecs)	Total Head (ft)	Type	R.P.M	H.P	
Muda Project	1. Daerah Perlis	3	A	14	9.0	8	D	1500	19.6	1972
	2.	3	A	11	4.5	8	D	1500	8.8	1972
	3.	2	A	18	15	5	D	-	-	1976
	4. Daerah Kubang Pasu	1	A	11	5	8	D	1500	9.8	1973
	5.	3	A	14	10	8	D	2000	25.5	1974
	6.	3	A	11	5	8	D	1500	9.8	1975
	7.	2	A	11	5	8	D	1500	9.8	1975
	8.	1	A	16	15	8.5	D	2000	30	1976
	9. Daerah Pendang	3	A	16	3 x 20	4	D	2250	72	1972
	10.	3	A	14	3 x 15	1.5	D	1800	38	1972
	11.	1	A	12	5	4	D	1760	10	1973
	12.	2	A	12	2 x 5	4	D	1760	10	1973
	13.	2	A	12	2 x 5	4	D	1760	10	1973
	14.	2	A	12	2 x 5	2	D	1760	10	1973
	15.	3	A	16	3 x 20	3	D	2250	65	1973
	16.	1	A	14	5	1	D	1760	10	1973
	17.	3	A	16	3 x 20	3	D	2250	65	1973
	18.	3	A	24	3 x 40	3	D	2800	80	1973
	19.	3	A	14	3 x 10	11	D	2000	30	1973
	20.	3	A	14	3 x 10	8	D	2000	30	1973
	21. Daerah Wan Mat Saman	3	A	11	5	4	D	1500	9.8	1973
	22.	3	A	14	10	4	D	2000	25.5	1973
	23.	3	A	30	65	3	D	2250	112.0	1973
	24.	3	A	14	10	4	D	1800	23.5	1973
	25.	3	A	14	20	2	D	1800	35.3	1973
	26.	3	A	16	20	3	D	2250	72.0	1973
	27.	3	A	16	12.5	13	D	2200	26	1972
	28.	3	A	14	10	8	D	1800	23.5	1973

Remarks; (1) Type of Pump: A = Axial flow, M = Mixed flow, C = Centrifugal, S = Submersible

(2) Type of Engine: D = Diesel, E = Electric

Table B-2 LIST OF PUMPING STATIONS MAINTAINED BY DID IN 1977 (2/6)

State	Name of Scheme	No. of Units	Pump Type	Pump Discharge Dia. (inches)	Pump Capacity (cusecs)	Pump Total Head (ft)	Engine Type	Engine R.P.M	Engine H.P	Year Installed
Kedah	1. Pekula	3	S	36	45	14	E	725	120	1967
	2. Sidam Kanan	3	A	16	10	14.5	D	1730	31.4	1970
	3. Sidam Kiri	3	A	16	6	15.5	D	1440	276	1970
	4. Pulai	3	A	16	8	11	D	1400	18.4	1970
	5. Bandar Bahru II	3	A	24	25	11	D	2300	145	1973
	6. Pekula Booster	2	A	8	5	5	D	1500	9.9	1972
	7. Pumph House	1	–	8	5	5	D	2000	12.8	–
	8. Terat Batu	2	–	6	25	19.5	D	1500	32.25	1974
P. Pinang	1. Sungai Muda (Muda River)	3	A	38	100	13	E	365	160	1957
	2. Kubang Semang	2	A	16	12.5	4	E	945	17.5	1963
	3. Kuala Tassek	1	A	12	5	6	D	1800	15	1963
	4. Sungai Renjau	1	A	12	5	6	D	1800	15	1964
	5. Pinang Tunggal	2	A	50	135	15	E	292	350	1964
	6. Kreh Booster	2	A	36	70	11	E	415	125	1966
	7. Sungai Muda	1	A	50	200	12.5	E	327	495	1967
	8. Padang Cempedak	2	A	30	50	11	E	415	100	1967
	9. Pinang Tunggal Tali-air Timur Booster	2	A	14	10	10	E	960	20	1967
	10. Pokok Sena	2	A	18	15	5	E	720	20	1967
	11. Jarak Tengah (Barat)	1	A	12	5	6	D	1500	18	1967
	12. Tassek Glugor (Air Melintas)	2	A	16	15	10	D	1500	38	1969
	13. Tassek Glugor (Kg. Tok Bedu)	2	A	12	5	11	D	1500	10	1970
	14. Jarak Tengah	1	A	12	5	6	D	1500	18	1970

State	Name of Scheme	No. of Units	Pump				Engine			Year Installed
			Type	Discharge Dia. (inches)	Capacity (cusecs)	Total Head (ft)	Type	R.P.M	H.P	
P. Pinang	15. Kubang Semang Perinkat II – Permatang Rawa	2	M	12	7.5	5	D	1500	24.5	1971
	16. Juru Padi Area	2	A	16	15	9	D	1500	43	1972
	17. Prai Kompleks	4	C	64	150	6.6	E	1470	220	1973
	18. Bagan Serai Kompleks	4	C	64	150	6.6	E	1470	220	1973
	19. Guar Teok Syed	1	A	12	3.98	8	D	1500	10	1973
Perak	1. Seberang Perak Peringkat I termasuk Tambahan (Trans Perak Stage 1 & Extension)	3	A	30	55	11	D	1800	120	1962
	2.	4	A	24	30	10	D	1650	71.5	1974
	3. Bota/Lambor	1	A	20	20	12	D	750	62	1963
	4.	2	A	23.6	30	12	D	750	98	1963
	5.	1	A	24	30	12	D	1800	144	1975
	6. Bukit Tunggal	1	A	23.6	30	12	D	750	98	1964
	7.	2	A	20	20	12	D	750	62	1964
	8.	1	A	24	30	12	D	1800	144	1975
	9. Kampung Tgh. Parit	1	C	12	5	17	D	1450	33	1970
	10. Kampung Padang	1	A	12	5	15	D	1750	33	1967
	11.	1	A	12	5	15	D	1750	33	1966
	12. Berhala	1	A	12	5	18	D	1580	33	1965
	13. Sg. Bedarah	2	A	16	10	22	D	1750	50	1966
	14. Sg. Nor	2	A	12	6	14	D	1800	19	1969
	15. Senin	3	A	16	10	17	D	1600	33	1971
	16. Lambor Kiri	2	A	16	10	13	D	1600	33	1972
	17.	1	A	16	10	13	D	1800	33	–
	18. Pengairan Krian	4	A	48	180	14	L	368	500	1975

Table B-4   LIST OF PUMPING STATIONS MAINTAINED BY DID IN 1977 (4/6)

State	Name of Scheme	No. of Units	Pump Type	Discharge Dia. (inches)	Capacity (cusecs)	Total Head (ft)	Engine Type	Engine R.P.M	Engine H.P	Year Installed
Perak	19. Air Deras, Sg. Manik	3	A	16	10	17	D	1600	33	1975
	20. Kg. Medan/Batu Tiga	2	A	16	10	8	D	1600	33	1975
Selangor	1. Bagan Terap	3	M	32	55	20	D	750	250	1962
	2. Jaya Setia	3	A	24	28	6.1	D	1610	62	1967
Negeri Sembilan	1. Kampong Londah	3	A	16	10	14	D	1800	58	1964
	2. Kampong Bangkahulu	2	A	16	10	14	D	1800	58	1968
Melaka	1. Duyong	1	A	22	30	11.25	D	1000	56	1950
	2. Bachang	1	A	20	25	10.5	D	275	57	1950
	3. Telok Rimba	2	C	14	7	13.25	D	360	21	1955
	4. Merlimau	1	C	10	6	8	D	450	12	1947
Johor	1. Kesang Tasek	2	C	10	10	9	D	1500	12	1959
	2. Kesang Gate	1	C	10	5	30	D	1200	30	1962
	3. Sagil	1	C	10	5	10	D	1500	37	1962
	4. Pulau Penarik	2	C	12	9	30	D	1600	39.5	1963
	5. Serom No. 1	1	C	6	3	30	D	1250	32.5	1964
	6. Kurnia Sakti	1	A	12	5	17	D	1500	11.5	1965
	7. Telok Rimba	2	A	24	15	11	E	730	33	1965
Pahang	1. Paya Pinang, Kuantan	2	A	12	55	16	D	1200	22	1962
	2. Paya Permatang Pauh, Pekan	2	A	16	10	17	D	1200	39	1963
	3. Paya Pahang Tua, Pekan	4	A	22	25	13.5	D	1200	80	1964

Table B-5   LIST OF PUMPING STATIONS MAINTAINED BY DID IN 1977 (5/6)

State	Name of Scheme	No. of Units	Pump				Engine			Year Installed
			Type	Discharge Dia. (inches)	Capacity (cusecs)	Total Head (ft)	Type	R.P.M	H.P	
Pahang	4. Paya Sepayang, Rompin	3	M	16	5	19	D	2200	44.25	1973
	5. Paya Temai Hilir, Pekan	4	C	6	2	15	D	1500	15	–
	6. Paya Sg. Chengal, Temerloh	3	A	12	5	27	D	1600	34.5	1972
	7. Paya Gintong, Jerantut	3	A	16	5	36	D	1400	62	1965
	8. Paya Kangsar, Jerantut	4	C	12	7.5	50	D+E	1500	210	1972
	9. Paya Gali Hilir, Raub	2	A	12	5	14.5	D	1200	22	1965
	10. Paya Gali Tengah, Raub	2	C	6	1.5	15	D	1500	10	–
	11. Paya Tg. Putus, Raub	2	C	6	2	15	D	1500	15	–
	12. Paya Sain, Raub	2	C	6	2	15	D	1500	15	–
	13. Paya Lengkong, Bentong	2	C	6	1.5	15	D	1500	10	–
	14. Paya Ajai, Raub	2	C	6	2.5	15	D	1500	15	1975
	15. Paya Pagar Sasak, Lipis	1	C	6	2.3	12	D	1500	18	1976
	16. Paya Sengkala, Raub	1	C	6	2.3	10	D	1500	15	1976
	17. Paya Kertau, Temerloh	1	M	12	5	41	D	1400	42.5	1977
	Paya Sg. Lipis									
	18. Rumah Pam X	3	A	12	5	25	D	1560	40	1977
	19. Rumah Pam Y	3	A	12	5	25	D	1560	40	1977
	20. Rumah Pam Z	1	C	6	2	26	D	1500	12	1977
	21. Paya Ganchong, Pekan	2	C	16	12	16	D	1500	222	1977
	22. Paya Sengkela, Raub	2	C	6	2.5	17	D	1400	12.5	1977
Trengganu	1. Pulau Musang	3	M	28	30	20	D	600	136	1955
	2. Paya Kemat	1	A	7	4.5	15	D	1200	18	1955
	3. Paya Dadong	2	A	10	5	25	D	1500	52	1962
	4. Kuala Akob	1	A	16	5	42.5	D	1500	52	1964
	5. Paya Delong	2	A	10	5	14	D	1500	52	1964

Table B-6 LIST OF PUMPING STATIONS MAINTAINED BY DID IN 1977 (6/6)

State	Name of Scheme	No. of Units	Pump Type	Discharge Dia. (inches)	Capacity (cusecs)	Total Head (ft)	Engine Type	Engine R.P.M	H.P	Year Installed
Treng- ganu	6. Kuala Telemong	2	A	10	5	31	D	1500	52	1964
	7. Padang Ipoh	2	A	15	5	18	D	1250	38	1964
	8. Nerus	3	A	42	90	19	D	600	318	1964
	9. Paya Rapat	1	A	16	6	19.5	D	1500	52	1965
	10. Gaung	3	A	16	6	39.5	D	1500	52	1966
	11. Langgar	2	C	10	7	56	D	1500	188	1976
		2					E	1500	140	
	12. Matang	2	C	10	6	23	D	1500	89	1976
		2					E		75	
Kelantan	1. Salor	2	V	24	35	34	E	490	180	1951
	2. Salor Booster	1	C	12	5	7	E	715	7.5	1951
	3. Repek	1	C	24	20	26	D	600	113	1957
	4. Pasir Mas (Kasar)	3	A	30	50	34	E	590	275	1958
	5. Lemal	4	A	51	200	23.5	E	367	750	1967
	6. Kemubu	5	A	94.5	250	31.5	D	900	1150	1971
	7. Sik	2	A	12	4.5	6.85	D	1500	10	1972
	8. Kemasin	2	A	12	3	7	D	1520	6.7	1972
	9. Danan	2	A	12	4	33.9	D	1580	31.5	1972
	10. Gading	3	A	16	11	22.5	D	1465	43	1972
	11. Seligi	3	A	16	11	17.5	D	1360	43	1972
	12. Sungai Pinang	4	C	6	4	23.4	D	1450	17.5	1976
	13. Jerimbong	2	C	6	1	40	D	1500	10	1976
	14. Wakaf Bata	1	C	8	4	18	D	1200	12	-
	15. Bendang Nyior I	1	C	6	2	20	D	1200	17	1975
	16. Bendang Nyior II	1	C	6	2	20	D	1200	17	1975
	17. Pasir Hor	1	C	6	2	35	D	1500	21.5	-
	18. Cica I	1	C	4	1	40	D	2400	7	-
	19. Cica II	1	C	4	1	40	D	2400	7	-
	20. Kuala Balah	2	C	6	1	40	D	1500	10	-

PART 2
SABAH AND
SARAWAK

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1. INTRODUCTION

This Sectoral Report presents the projection of irrigation water demand for the years 1990 and 2000 based on the information and data collected in Malaysia from August to December 1981. Results of the Projection of irrigation water demand are used for subsequent water balance study for each river basin.

The role of irrigation in the States of Sabah and Sarawak has been devoted mostly to wet paddy, particularly for the double-cropping of paddy. Irrigation in these States is totally dependent on surface water sources because of the relatively high costs of groundwater development, and the high consumption of water in paddy production relative to the value of the crop. In this Sectoral Report irrigation water demand is projected only for irrigated paddy area.

Due to insufficiency of field measurement data such as evapotranspiration rate, percolation rate and irrigation efficiency, many assumptions are placed on the procedure of projection. Following the collection of such information in the future, necessary modifications shall be carried out.

2. IRRIGATION SCHEMES IN SABAH

2.1 History of Irrigation Development

In 1948, the Drainage and Irrigation Branch was set up in Agriculture Department of Sabah. In 1951, due to lack of supporting technical staff, it was amalgamated with PWD as one of its branches. However, drainage and irrigation works were undertaken independently by its own staff. In 1967, DID was established as a separate department of the State Ministry of Agriculture and Fisheries in order to accelerate the development of irrigated paddy areas. Prior to the formation of the State DID, about 10,600 ha of irrigated paddy area was implemented including the Papar (2,430 ha), Tuaran (1,340 ha) and numerous small irrigation schemes.

Since the formation of the State DID, more emphasis has been placed on the development of irrigation for paddy cultivation in the State in line with the State policy to attain self-sufficiency in rice as quickly as possible. Table 1 and Fig. 1 show the trend of increase for irrigated paddy areas. For the period of 1967 - 1980, the irrigated paddy area was doubled. New schemes such as the Tempasuk North (2,590 ha), Trusan Sapi (1,780 ha), Penampang (1,620 ha) and numerous small irrigation schemes were implemented during this period. Extensive improvement works for the Papar and Tuaran Schemes were also carried out. In 1980, irrigated paddy areas in the State reached 20,780 ha. This corresponds to about 62% of the total wet paddy area of 33,600 ha in the State. Irrigable areas for off-season paddy were 9,720 ha, or 49% of irrigated paddy area. List of irrigation schemes maintained by DID in 1979 is shown in Table 2.

2.2 Present Condition of Irrigation Schemes

2.2.1 Classification of schemes

In Sabah, there are 6 irrigation schemes with an area larger than 1,000 ha as shown in Table 3. Irrigation schemes (larger than 100 ha) maintained by DID are 25 in number comprizing 15 pumping and 10 gravity irrigation schemes as shown in Table 4. In addition, numerous small irrigation schemes (smaller than 100 ha) are in operation mainly in the Districts of Tuaran, Kota Belud, Kudat and Ranau.

2.2.2 Location of schemes

Distribution of irrigated paddy area is predominant in the west coast area of the State owing to good soil and topographic conditions as shown in Fig. 2. Irrigated paddy areas in this area (14,700 ha) share 70% of the total irrigation area in the State, comprizing 8,100 ha of double-cropped area and 6,600 ha of single-cropped area. The main irrigation schemes are the Tempasuk North, Tuaran, Penampang and Papar Schemes.

The interior area is the second rice bowl in the State. Most irrigation schemes in this area rely on gravity irrigation system diverting water from tributaries of the Padas River. The largest scheme in this area is the Bingkor Irrigation Scheme with an irrigable area of 2,000 ha.

In the interior area, double-cropping of paddy cultivation is scarcely performed due to socio-economic problems.

In the eastern half of the State of Sabah, the exis ing irrigated area is scarce. The Trusan Sapi Pumping Irrigation Scheme of 1,780 ha is the only irrigation scheme with an area of over 100 ha.

2.2.3 Present condition

All irrigation systems in Sabah rely on field-to-field irrigation. There are insufficient distribution canals in the existing schemes because of difficulty in land acquisition. Present canal density averages 14 m/ha varying from 2 to 53 m/ha as shown in Table 5. The length of existing irrigation canals total about 280 km. About 65% of them are lined by precast concrete slab.

Many irrigation schemes are suffering from their own problems and are waiting for improvement. A certain percentage of irrigable area in the Paper, Timbing Batu and other schemes receives poor water distribution. Drainage problems are found in many schemes such as the Tuaran, Kota Marudu, Tempasuk and Paper Schemes due to deficiency in effective drainage facilities. The major obstacles for the improvement is the reluctance of the farmers to give lands to provide right of way for a comprehensive system of secondary and tertiary canals and drains. In many pumping schemes, the pump operation has been disturbed due to siltation in the inlet channel and periodic desilting has to be carried out as part of the routine maintenance work.

In the Tambulian Laut Scheme, the main irrigation canal along the river had desappeared due to river bank erosion and portable pumps are still used for irrigation purpose. In the Kota Marudu Scheme, the diversion weir was destroyed by the flood in 1977 and a temporary intake by gabion was constructed.

Present conditions of representative irrigation schemes in the State of Sabah are explained hereunder.

Papar Irrigation Scheme

The Papar Irrigation Scheme of 2,430 ha is the largest and the oldest pumping irrigation scheme in Sabah. The construction of the Scheme was started in 1952 and completed in 1958 with finance from the Commonwealth Development Cooperation Funds. From 1970, improvement works were carried out in the pumping station and canals. The new pumping station has 5 units of diesel-driven pump with a capacity of 850 lit/s each. Another pumping station was completed in 1954, comprizing 3 pumps with a capacity of 567 lit/s each, and is now used for the supplemental purpose. A total of about 27 km of irrigation canals, mostly unlined, are being maintained. The canal density of the Scheme is about 11 m/ha which is insufficient for better performance of water management. About 30% of irrigation area is suffering from poor water distribution. The drainage system is

insufficient and improvement is necessary. After the completion of
the new pumping station, areas double-cropping with paddy were
increased to 1,620 ha, or to 67% of the whole irrigation area.
This is the highest percentage among schemes in the State of Sabah.

Trusan Sapi Irrigation Scheme

The Trusan Sapi Irrigation Scheme of 1,780 ha is being developed
in the tidal swamp area between Sandakan and Ranau as the first
sizeable irrigation scheme in the east coast of the State. The
coastal bund of 8 km, one tidal control structure and internal
drains of 22 km were completed by 1974. The pumping station
equipped with 5 diesel-driven pumps of 850 lit/s in capacity was
completed in 1976. Irrigation canals of 15 km are mostly lined by
precast concrete slab and are well maintained. The present canal
density is 30 m/ha. At present, off season paddy can be planted in
the area of 520, where drainage and irrigation facilities have been
provided. Extension of this scheme is under consideration.

Tuaran Irrigation Scheme

The Tuaran Irrigation Scheme with an irrigation area of 1,340 ha
was constructed from 1954 to 1957. From 1970 onwards, extensive
improvement works were carried out in the Pump House No. 1 area.
In addition, a new pumping station, concrete lined canals and
distribution control structures were constructed. After these
improvements, the irrigable area for double cropping paddy was
augmented to 1,010 ha, or 75% of the total irrigation area. The
No. 1 pumping station has 3 pumps with a capacity of 991 lit/s and
the No. 2 pumping station has 2 pumps with a capacity of 850 lit/s.
They are now well maintained. The irrigation canal density of this
scheme is about 16 m/ha. Due to the lack of comprehensive drainage
system, part of the irrigation areas are suffering from drainage
problems.

Tempasuk North Irrigation Scheme

The Tempasuk North Irrigation Scheme is the largest gravity irriga-
tion schemes in the State with a total irrigation area of 2,590 ha,
of which 1,050 ha are being double cropped. The intake structure
on the Tempasuk river has 4-cell gates without diversion weir on
the river. Most of the irrigation canals are earth canals. The
present canal density is only 5 m/ha. The necessity to increase
the canal density is recognized by DID, but due to difficulty in
land acquisition, the construction of distribution canals is still
not possible. The drainage canal system is still insufficient.

2.3 Future Irrigation Development

According to information from MOA, development of three major irriga-
tion projects, i.e. the Lembah Bengkoka, Lower Labuk and Kinabatangan
Irrigation Projects, is under consideration in addition to irrigation
development for minor areas.

Lembah Bengkoka Project

The Lembah Bengkoka Project (1,200 ha) is a pumping irrigation
project. The Pitas Hilir Sub-project of 710 ha is under construction
as one of the sub-project of the National Small Scale Irrigation
Project financed by World Bank. In this Study, this Project is
regarded as a minor irrigation scheme because the irrigable area is
not large.

Lower Labuk Project

The Lower Labuk Project (5,830 ha) is identified along the middle
to lower reaches of the Labuk River as shown in Fig. 2. A part of
the lower Labuk area has already been developed as the Trusan Sapi
Irrigation Scheme of 1,780 ha. Detailed investigations for the
remaining areas are not carried out yet. Development of the whole
Lower Labuk Project is expected to be completed by the year 2000.

Kinabatangan River Basin Development Project

The Kinabatangan River Basin Development Project is located in the
eastern half of Sabah. The project area is mainly confined to the
lower part of the Kinabatangan River Basin, where the folding
situation forms a major constraint for development. The pre-
feasibility study on the development of the Kinabatangan River Basin
was carried out by JICA during 1981-82 (Ref. 1). In this study,
agricultural development for 44,000 ha of paddy field and a con-
struction of a multipurpose dam were proposed.

In order to make a definite plan for development of this Basin,
further investigations are indispensable. In the present Study,
it is assumed that this project will be implemented from the year
2000 onward.

Minor irrigation areas will be increased from the present 20,780 ha
to 33,520 ha in 2000. In line with the strategy by MOA, no rainfed paddy
area will remain by 2000. Projected paddy areas by basin in 1990 and
2000 are summarized in Table 6.

3. IRRIGATION SCHEMES IN SARAWAK

3.1 History of Irrigation Development

In the State of Sarawak, the history of irrigation development is relatively short. The construction of positive irrigation facilities to the wet paddy area was initiated after establishment of the State DID in 1967. The Paya Selanyau (Stage I) Irrigation Scheme of 120 ha, being supplied by the gravity system with a small reservoir, was completed in 1970 as the first positive irrigation scheme in the State. During the last decade, the irrigated paddy area was augmented steadily in spite of many constraints in development of irrigation in this State, as mentioned later. In 1980, irrigation areas maintained by DID are 6,030 ha in total. Areas double-cropped with paddy are about 1,640 ha. List of irrigation schemes maintained by DID in 1979 is shown in Table 7.

3.2 Present Condition of Irrigation Scheme

3.2.1 Classification of schemes

In Sarawak, there exists three types of irrigation scheme, i.e. control drainage, gravity and pumping. The control drainage scheme is a relatively inexpensive system built on flat gradient flood plains. Rainwater is stored as needed on the fields and in the drains by a system of bunds, drains, controls and gates. Excess water is drained out during low tide. Sea water intrusion is prevented by the bunds and closed gates during high tide. Total water management is not as good as in a pumping or gravity scheme and only one wet-season paddy is normally grown. This is the predominant type of irrigation scheme in the State of Sarawak. The pumping irrigation scheme is the next common type in the State. It can serve both the wet- and dry-season paddy.

In 1980, 28 irrigation schemes are maintained by DID comprizing 17 control drainage schemes (4,460 ha in total), 10 pumping irrigation schemes (2,060 ha in total) and a gravity irrigation scheme of 120 ha. Most of existing scheme has a service area of less than 500 ha in size as shown in Table 2.

3.2.2 Location of schemes

Irrigation schemes in the State of Sarawak are scattered extensively in all Divisions as shown in Fig. 3. Most of the control drainage schemes exist along rivers in the flood plain or near the coast. Positive irrigation schemes are generally located along the upstream stretch of the river where sea water intrusion does not reach. Irrigation areas are located mainly in the western half of the State, i.e. 6 schemes in the First Division, 10 schemes in the Second Division, and 9 schemes in the Third, Sixth and Seventh Divisions. In the eastern half of the State, there are only 8 schemes, i.e. 6 schemes in the Fourth Division and 2 schemes in the Fifth Division.

3.2.3 Present condition

Compared with the other states in Malaysia, many physical constraints on irrigation development are found in the whole of the State of Sarawak. The scheme sites are usually isolated and many of them inaccessible except for the river course. Due to difficulties in transportation, effective control and supervision of works are not always possible. The transportation of plant and equipment has to depend entirely on the availability of suitable loading crafts which are in short supply. Most of the schemes are either in or partly in peat soils of varying depths. Numerous difficulties were encountered in the implementation of irrigation schemes due to poor soil conditions. Rivers in the flood plain are usually affected by sea water intrusion. There is no economic water source for irrigation except direct rainfall for paddy areas located in the area concerned.

All positive irrigation area in Sarawak rely on field-to-field irrigation. There are insufficient distribution canals in the existing schemes. Present canal density for irrigation schemes averages 25 varying from 7 to 80 m/ha as shown in Table 8. Present conditions of the representative irrigation schemes in the State of Sarawak are explained hereunder.

Tanjong Bijat Control Drainage Scheme

The Tanjong Bijat Control Drainage Scheme (1,214 ha) is the largest and oldest control drainage scheme in the State. It is located 15 km northeast of Sriaman, the capital of the Second Division, and it is accessible only by river. Land improvement works at Tanjong Bijat were first carried out during the Japanese occupation (1942 to 1946) by the provision of bunds, drains and drainage control structures. However, such facilities have badly deteriorated due to lack of maintenance. Later on, the reconstruction of control drainage facilities and the extension of paddy area by the opening of jungle areas were implemented. All works were completed by 1974. At present, there exists irrigation canals (8 km), drainage canals (25 km), perimeter bunds (19 km) and drainage control facilities. In 1977, off-season cropping, i.e. maize and soy bean, was introduced in the scheme area. It resulted in the necessity for improvement and up-grading of drainage facilities in order to drain out excess water as fast as possible for off-season cropping. This rehabilitation will be carried out during the 4MP and 5MP periods.

Paya Selanyau (Stage II) Irrigation Scheme

The Paya Selanyau (Stage II) Irrigation Scheme (324 ha) adjacent to the Stage I area is located 40 km southwest of Miri, the capital of the Fourth Division, Sarawak. This is the largest pumping irrigation scheme in the State. Construction of the facilities was completed in 1979. The pumping station consists of 3 pumps with a capacity of 142 lit/s each. Due to siltation, flow capacity in the inlet channel has been remarkably reduced. Furthermore, sea water intrusion reaches the inlet of the pumping station during high tide. A tidal barrage will be necessary. Part of the concrete-lined main canal has sunk due to poor soil conditions. The present canal density of the scheme is 34 m/ha which is the highest in Sarawak.

3.3 Future Irrigation Development

According to information from MOA, development of six major irrigation projects, i.e. Limbang Valley, Samarahan, Sadong Krang, Kalaka Saribas, Batang Lupor and Binatang Barat Irrigation Projects, is under consideration in addition to irrigation development for minor areas.

Limbang Valley Project

The Limbang Valley Project is located in North-east Sarawak bordering Brunei. The project area is mainly confined to the lower part of the Limbang River Basin, where the flooding situation forms a major constraint for development.

The prefeasibility study on the development of the Basin was carried out in 1980 (Ref. 2). In this study, agricultural development for annual and perennial crops for about 20,000 ha and construction of a flood control dam (multipurpose dam) were proposed. Of these, the proposed irrigated paddy project of 8,600 ha (net area) shall consist of 7 sub-areas, i.e. 4 sub-areas (6,400 ha in total) on the left bank of the Limbang River and 3 sub-areas (2,200 ha in total) on the right bank. Areas on the left bank will be served by gravity irrigation system from the proposed dam. On the other hand, areas on the right bank rely on pumping due to unsuitable topography for gravity system.

Among these areas, R21 area (792 ha in net) on the right bank is proposed to be implemented as a pilot area under 4MP and detailed planning is presently being carried out. The feasibility study for the dam and the irrigation and drainage network for the remaining areas will be performed during 4MP. The major components of the R21 project consist of the following:

(a) a flood protection levee in order to protect the area against a 1 in 10-year flood in the period in which the dam is still not in operation, and

(b) a pumping station together with irrigation and drainage network necessary for double cropping of paddy.

The whole Limbang Valley Project is expected to be completed by 2000.

Samarahan River Basin Development Project

The Samarahan River Basin is located in the east of Kuching, which is one of the most densely populated river basin in Sarawak. The objective of the project is to improve the existing good agricultural land of 12,140 ha (net area) by providing drainage, irrigation and flood control facilities so that agricultural production of the river basin area can be increased. In 1977, the pre-feasibility study for the purpose to make plan for improved paddy cultivation in the area was undertaken by the UK Ministry of Overseas Development (Ref. 3). In this study, a total area of 6,000 ha was recommended

for immediate implementation. In the Samarahan River Basin, sources of irrigation water are limited to the minor rivers because of the salinity of the water in the main river and its major tributaries in the Basin. In the pre-feasibility study, the total irrigable area by river water was preliminarily estimated at about 1,600 ha in this basin based on the availability of water source including proposed diversion from a tributary of the Sadong River. The remaining paddy area will be irrigated by control drainage system.

Under 4MP, it is intended to complete the Lower Samarahan Project which is a sub-project area within the whole Samarahan River Basin Project. The Lower Samarahan Project covers 1,530 ha (net area) and is to be developed for main-season paddy and off-season annual crop cultivation. The major project works consist of the following components.

(a)   about 35 km of river levee and 6 tidal control gates to protect the area from saline water flooding,

(b)   internal control drainage facilities, and

(c)   a system of farm road.

Preparatory works for the feasibility study on the Samarahan River Basin Project are in progress. The whole project is expected to be implemented by 2000.

Sadong Krang Project

The Sadong Krang Project (4,050 ha in net) is located in the flood plain of the Sadong River Basin which is contiguous to river basin on the east of the Samarahan River Basin. The pre-feasibility study of the project was undertaken concurrently with the study for the Samarahan Project (Ref. 3). The water source for irrigation in the basin is abundant throughout the off-season. In the Sadong River Basin, severe flooding frequently occurs and, except for limited area, the agricultural potential of this area can only be realized by controlling the floods.

Under 4MP, the Sungai Kuala Area totalling 514 ha (net area) is proposed for implementation as a pilot project for the whole project area. This area will be developed for one crop of paddy and one off-season annual crop such as maize or soy bean. The main project components consist of:

(a)   a perimeter bund enclosing the project area to protect the area from annual freshwater flooding,

(b)   2 tidal control gates for effective drainage of the area, and

(c)   internal drains together with control drainage facilities.

The whole of the Sadong Krang Project is expected to be completed by 2000.

Batang Lupor and Binatang Barat Projects

The Batang Lupor Project (4,000 ha) is located in the delta of the Lupor River in the Second Division. On the other hand, the Binatang Barat Project (4,000 ha) is located in the flood plain of the Rajang River in the Sixth Division. The possibility of development for both areas was described in "the Padi Area Identification Report" prepared by the Padi Production Unit, Sarawak, in 1974 (Ref. 4). Detailed investigation and planning are not yet carried out.

Kalaka Saribas Project

The Kalaka Saribas Project area is located in the Districts of Kalaka and Saribas in the Second Division as shown in Fig. 3. The potential area for agricultural development is about 65,000 ha. The pre-feasibility study on this project will be carried out during 4MP.

Minor irrigation areas will be increased from present 6,030 ha to 21,300 ha in 1990 and 38,600 ha in 2000. Some 3,600 ha of rainfed paddy area will remain by 2000 according to information from MOA. Projected paddy areas in 1990 and 2000 are summarized in Table 9.

4. IRRIGATION WATER DEMAND

4.1 General

The role of irrigation in the State of Sabah and Sarawak has been devoted mostly to wet paddy particularly for the double-cropping of paddy. At present, there are only two irrigation schemes for upland crops, both in Sabah, viz. the Kundasang scheme covering 340 ha of vegetable farms and the Bundu Tuhan Scheme covering 220 ha also for vegetable farms. Irrigation system of these schemes supplies water not only for irrigation but for domestic purpose (Ref. 5). In addition, the Lagud Sebrang Irrigation Scheme is under construction near Tenom town aiming at irrigating soyabean, maize and other upland crops by sprinkler and furrow irrigation systems (Ref. 6). Since the irrigation water demand of these schemes is very small (less than 1×10^6 m^3/y), they are excluded from the calculation of irrigation water demand in this Study.

Hence, projection of irrigation water demand is carried out only for paddy based on the recommended cropping schedule and irrigated paddy area projected in the Sectoral Report Vol. 5 as shown in Table 3 and 4.

4.2 Climatic Zone in Sabah and Sarawak

Calculation of irrigation water demand and succeeding water balance study will be carried out by basin established for the study purpose. Among many meteorological factors, rainfall distribution influences foremost on the required amount of irrigation for each basin.

In order to simplify the calculation, the States of Sabah and Sarawak are divided into 7 and 6 climatic zones respectively based on the annual isohyet, monthly distribution of rainfall and the location of irrigation areas. Figure 4 shows the boundary of climatic zones together with the basin boundary.

For each zone, a rainfall station and an evaporation station are selected as a representative station in the zone as shown in Table 10. An average monthly rainfall and monthly pan evaporation for each selected station are summarized in Table 11 for Sabah and in Table 12 for Sarawak. The monthly rainfall for 20 years from 1960 to 1979 for each selected rainfall station are shown in Tables 13 to 25.

4.3 Irrigation Water Demand

4.3.1 Procedure for calculation

Procedure for calculation of irrigation water demand for paddy is shown in the following equation.

$$FC = ET + PL \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$
$$CWR = PS + FC \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2)$$
$$IWD = (CWR - RE)/IE \dots\dots\dots\dots\dots\dots\dots (3)$$

where, FC : Field crop requirement
       CWR: Crop water requirement
       IWD: Irrigation water demand
       ET : Evapotranspiration
       PL : Percolation rate
       PS : Presaturation
       RE : Effective rainfall
       IE : Overall irrigation efficiency

Details of calculation and background of assumptions for each component in the above equation are described in the succeeding section. The cropping schedule by climatic zone applied to the calculation is as shown in Fig. 5 which is recommended in the Sectoral Report Vol. 10 Agriculture.

4.3.2 Evapotranspiration

Evapotranspiration, or consumptive use, from the paddy field varies seasonally correlating with the growing stages of paddy and meteorological factors. In general, evapotranspiration can be calculated by the equation below with reasonable accuracy if data on ET/EW ratio measured in the field are available.

$$ET = EW \times (ET/EW \ Ratio) \ \ldots\ldots\ldots\ldots\ldots \ (4)$$

where,

    ET: Evapotranspiration rate in the paddy field

    EW: Evapotration rate in the paddy field (90% of Pan evaporation)

    ET/EW ratio: Determined based on previous research.

Several seasonal measurement records on evapotranspiration of paddy are available in Malaysia. Among them, Sugimoto's work which was carried out in the Muda area (Ref. 7) is the most useful for the estimation of evapotranspiration in this study because of its elaborated method. In addition, Yashima has carried out research on evapotranspiration of paddy in the Muda Irrigation Scheme (Refs.8 and 9). They measured evapotranspiration (ET) and evaporation (EW) by using tanks placed inside the paddy field, and calculated the ET/EW ratio.

Figure 6 shows that such ET/EW ratio correlating with time after transplanting. A smooth convex curve can be drawn on the graph as shown in the above figure. It has been recognized that ET/EW ratio is applicable to quite a wide area (Ref. 10). Hence this curve obtained in the Muda area is applied not only in Peninsular Malaysia but also in the States of Sabah and Sarawak as well. Based on the curve presented, monthly average figure is proposed for simplifying the calculation of evapotranspiration. The recommended monthly figure is presented below.

Month after Transplanting	ET/EW Ratio
1	1.1
2	1.4
3	1.4
4	1.1

The evaporation rate in the paddy field is assumed to be 90% of the Class A pan evaporation.

4.3.3 Presaturation requirement

In general, presaturation of paddy fields can be defined as the supply of water, either by irrigation or rainfall, to a group of farms so as to wet the ground to saturation and to provide a water layer to facilitate ploughing and the preparation of nursery beds (Ref. 11).

Presaturation requirement during the staggering period in the cropping schedule is calculated by the following formula (Ref. 11) which was developed specially for field-to-field irrigation in Malaysia, taking into account the evaporation and percolation losses during the presaturation period.

$$q = (L - Eu)(1 - e^{-m}) + Eu \ldots\ldots\ldots\ldots (5)$$

where,

- q : Presaturation requirement (cm/d)
- L : Total loss from the saturated surface (cm/d)
- Eu: Evaporation loss from the unsaturated soil surface (cm/d)
- e : 2.718
- m : $T(L - Eu)/F$
- T : Presaturation period (staggering period in days)
- F : Total depth of water in the field (m)

Assuming that Eu and F in the above equation are to be 0.4 cm/d and 15 cm respectively, the presentation requirement during the staggering period for each cropping schedule are calculated. In addition, requirement for replenishment against evaporation and percolation losses up to transplanting time are also considered as presaturation requirement in this Study.

4.3.4 Percolation rate

Information on percolation rate measured on paddy field are scarce. The percolation rate measured in the Muda Irrigation Scheme was below 1 mm/d and the Feasibility study by MADA employed a figure of 1 mm/d as the expected percolation loss. In general, percolation rate after puddling works becomes below 1 - 2 mm/d in clayey soils or on condition that groundwater table is very high.

The percolation rate assumed in the previous reports is generally 2 mm/d for major projects. On the other hand, minor schemes are mostly scattered in relatively elevated areas and their soils are generally more permeable than major project areas. In this study, the following percolation rates are assumed in the case that percolation rate is not available in the previous reports.

Major irrigation project = 2 mm/d

Minor irrigation project = 3 mm/d

4.3.5 Effective rainfall

Since there is no standardized method for the calculation of effective rainfall in Malaysia, comparative studies are first carried out. Effective rainfall for the two representative irrigation projects in Sabah and Sarawak, i.e. the Penampang Irrigation Scheme (Kota Kinabalu Station) and the Samarahan irrigation project (Kuching Rainfall Station) is calculated for 20 years from 1960 to 1979 by using the daily balance method with the following assumptions.

(1) Maximum storage depth in the paddy field is 15 cm.

(2) During the irrigation period, the water layer on the ground is maintained at 10 cm, hence a net storage space of 5 cm is available.

(3) Rainfall less than 5 mm/d is ineffective.

(4) Rainfall over the maximum storage depth is ineffective.

(5) Daily decreasing depth by evapotranspiration and percolation is assumed as follows:

	Main	Off
Penampang Irrigation Project	7 mm/d	8 mm/d
Samarahan Irrigation Project	5 mm/d	7 mm/d

Results of calculation are summed up into monthly figures and plotted on the graphs against actual monthly rainfall as shown on Figs. 7 and 8. Both figures show that effectiveness of monthly rainfall is higher than 60% in most cases, when actual monthly rainfall is less than 200 mm. However, effectiveness tends to decrease gradually with the increase in monthly rainfall over 200 mm.

In calculating effective rainfall by the daily balance method, it is assumed that ideal water control is to be conducted throughout the paddy cultivation. Any rainfall cannot be considered as effective if the amount of irrigation supply is not reduced after the rainfall. The actual effective rainfall should, therefore, be less than the amount calculated by the above daily balance method. Taking practical conditions into account, recommendable effectiveness line of monthly rainfall is recommended as shown in Figs. 7 and 8 by the inclined solid line.

In other words, the following calculation basis is recommended in the present study.

Actual Monthly Rainfall (R)	Effective Rainfall (RE)
R $\leqq$ 200 mm/month	RE = 0.6 x R
R > 200 mm/month	RE = (R − 200) x 0.3 + 120

The monthly effective rainfall for each zone is estimated based on the above equation. Results of calculation are shown in Tables 26 to 38.

4.3.6 Irrigation efficiency

Field measurement data on irrigation efficiency are scarce in Malaysia. Since most irrigation schemes except pumping scheme have no accurate discharge measuring devices, the estimation of irrigation efficiency is not an easy task. In the Kemubu Irrigation Project, the largest pumping scheme in Malaysia, conveyance efficiency of its canal system was measured at 85% and the overall irrigation efficiency was estimated at 30 − 40% (Ref. 12). This low efficiency is mainly due to heavy operational losses under field-to-field flooding conditions.

The overall irrigation efficiency employed in the previous prefeasibility studies on the Samarahan River Basin and Limbang Valley Development Projects is 65% for early stage of the Project and 76.5% as a target value as shown in Table 39. However, it seems to be difficult to achieve under the present water management technology by farmers in Sabah and Sarawak. In view of the small size of holding in Malaysia, even with increase in canal density (30 − 35 m/ha) by the tertiary development program, certain amount of irrigation water should be allowed as distribution loss.

In this study, overall irrigation efficiency is assumed to be 50% in 1980 and 55% in 1990 and 2000 for both major and minor irrigation projects, which is the same figure as employed in Part 1 (for Peninsular Malaysia) of this Sectoral Report.

4.3.7 Result of calculation

(1) Crop water requirement

Based on the cropping pattern presented in Fig. 5 and calculation methodology aforementioned, crop water requirements are first calculated as shown in Tables 40 to 44.

(2) Irrigation water demand

Irrigation water demand for the years 1980, 1990 and 2000 is calculated for each river basin on monthly basis applying monthly effective rainfall estimated for 20 years from 1960 to 1970 and projected irrigation areas. Results of calculation in a form of volume (10^6 m^3) are shown in Tables 45 to 95.

The annual average irrigation water demand is 372×10^6 m^3 in 1980, 569×10^6 m^3 in 1990 and 639×10^6 m^3 in 2000 for the State of Sabah and 14×10^6 m^3 in 1980, 196×10^6 m^3 in 1990 and 482×10^6 m^3 in 2000 for the State of Sarawak as shown in Tables 96 and 97. The average irrigation water demand by basin are shown in Table 98 for Sabah and Table 99 for Sarawak.

5. NET IRRIGATION WATER WITHDRAWAL

5.1 Return Flow

Irrigation water demand comprises many kinds of orrigation losses which are unavoidable in process of conveyance and distribution of irrigation water to paddy fields. A certain percentage of irrigation losses such as conveyance, application, percolation and operational losses is considered to return to the river through drainage networks or underground permeable layer. Such return flow has never been measured in Malaysia and there is no evaluation basis for it.

For the basin-wide water demand and supply balance study, the amount of return flow should be considered as an usable water source. Since there is no evaluation basis for the return flow in Malaysia, it is assumed that 20% of diverted water for irrigation schemes locating upstream of the water balance study point (see Sectoral Report Vol. 16) may return to the river with little time lag, which is the same basis generally used in Japan based on long-term experience in water balance study.

5.2 Net Irrigation Water Withdrawal

In the present study, the net irrigation water withdrawal by irrigation schemes locating upstream of the water balance study point can be expressed as:

$$NIWW = IWD - RF = 0.8 \times IWD$$

where, NIWW: Net irrigation water withdrawal
IWD : Irrigation water demand
RF : Return flow (= 20% of IWD)

The net irrigation water withdrawal is calculated for each basin based on the area of irrigation schemes located upstream of the water balance study point, unit irrigation water requirement and the above relationship. Based on the distribution of irrigation area, the ratio of NIWW to IWD for minor irrigation schemes can be calculated as shown in Table 98. For major irrigation schemes, return flow is not considered because the project area is located upstream of the water balance study point. Table 99 shows NIWW calculated by basin for the State of Sabah. In Sarawak, NIWW is the same as IWD because all positive irrigation areas are located in the effective catchment area, or upstream of the water balance study point. The result of calculation of NIWW will be adopted to the succeeding water balance study together with water withdrawals by D&I water demand.

6. PLANNING MATERIALS

Planninf materials such as investment cost, O&M cost and manpower requirement necessary for irrigation development are prepared in this Chapter. Results of estimation of each item are used for succeeding project evaluation to be presented in the Main and State Reports of the Study.

6.1 Investment Cost

6.1.1 Unit construction cost

Construction cost for irrigation development varies widely depending on the location and topography of the project area, component of development, type of irrigation system and so on. In this study, standardized unit construction costs are assumed for projection of future development cost based on the previous studies.

Construction cost is estimated in the four categories, i.e. (1) direct construction cost, (2) engineering service & administration, (3) land acquisition, and (4) physical contingency. Engineering service and administration costs are assumed to be 10% of the direct cost. Physical contingency is assumed to be 30% of the total of the above (1) to (3).

In order to update (as of end 1980) the project cost estimate presented in the previous study reports, the following rates of the past price escalation are assumed as mentioned in the Sectoral Report Vol. 17.

Foreign currency portion:		8% per annum
Local currency portion :	1976 to 1978	0%
	1979 and 1980	27% per annum

Unit construction cost for major irrigation project as of end 1980 is estimated based on the previous study reports as shown in Table 100. The original cost estimate for irrigation development of the Kinabatangan River Basin (Ref. 1) is converted to the cost as of end 1980.

The average cost of the Kinabatangan and Limbang Valley Projects of M$12,421 per ha is almost the same as the unit construction cost for vergin land development (M$12,300/ha) assumed in Part 1 of this Sectoral Report. Construction costs for irrigation development in Sabah and Sarawak seem to be higher than that in Peninsular Malaysia. Direct comparison of construction cost for projects among Sabah, Sarawak and Peninsular Malaysia is not easy because available data on project cost estimation are not sufficient and project component and characteristics of each project are quite different. In the present Study, unit construction cost for irrigation development in Sabah and Sarawak is assumed to be the same as that in Peninsular Malaysia. Contingency of 30% to the direct construction cost assumed will be cover the difference in unit cost by locality.

In the case of control drainage schemes, unit construction cost (direct cost) is assumed to be M$3,000 per ha based on the actual cost of recently constructed schemes in Sarawak and estimated cost for the Lower Samarahan Project.

The unit construction cost including physical contingency (30% to total direct cost) by type of irrigation development are assumed as shown below.

Type of Development	Unit Const. Cost (M$/ha)
Rainfed to double cropping paddy	14,800
Single cropping to double cropping paddy	8,000
Virgin land to double cropping paddy	16,000
Tertiary development	7,100
Control drainage scheme	4,000

6.1.2 Investment cost

Estimation of investment cost for irrigation development is carried out based on the assumed type and area of irrigation development and the unit construction cost mentioned above.

Type of irrigation development is assumed as shown in Table 101. Based on information obtained from DID and our estimation, the development area of irrigation schemes by type by Malaysia Plan is projected as shown in Table 102 for major schemes in Sabah and Sarawak and in Tables 103 to 105 for minor schemes in both States.

Results of calculation of investment cost are summarized in Table 106 for major schemes and Tables 107 to 109 for minor schemes. Total investment costs up to the year 2000 amount to about M$298 x 10^6 for Sabah and M$826 x 10^6 for Sarawak.

6.2 O&M Cost

In order to evaluate irrigation projects in Sabah and Sarawak, the annual O&M cost is assumed to be 1.5% of the development cost, which is the same figure as assumed in Part 1 of this Study.

6.3 Manpower Requirement

For estimating the manpower requirement up to the year 2000, available information was first collected from DID. Based on the classification of manpower shown in Table 110, number of posts in State DIDs are counted as shown in Table 111. Existing manpower seems to be not enough to operate and manage irrigation projects well. For better O&M for irrigation project, increase in number of manpower is necessary.

Calculation standard for manpower requirement for irrigation development is assumed as shown in Table 112, which is the same figure as assumed in Part 1 of the Study. Result of estimation of manpower requirement by Malaysia Plan in Sabah and Sarawak is summarized in Table 113.

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