Table 3.1 SUMMARY OF RAINFALL DATA

(Unit : mm)

No.	Code No.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
1	9637000	100	90	152	214	101	24	14	11	16	32	63	105	900
2	9637002	124	84	123	136	56	18	14	10	14	41	46	107	772
3	9637011	122	106	140	144	60	17	14	10	19	40	68	87	835
4	9637012	112	118	148	169	76	26	24	26	24	58	91	116	1,004
5	9637015	115	95	132	127	65	18	17	17	21	43	70	101	830
6	9637017	90	108	156	192	53	5	1	3	10	22	40	56	738
7	9637020	210	185	346	557	298	117	104	100	119	154	225	239	2,704
8	9637025	133	110	182	354	182	23	18	13	27	58	111	98	1,305
9	9637041	185	154	244	321	149	45	43	36	46	90	134	192	1,669
10	9637045	184	170	321	622	350	101	73	83	112	188	276	217	2,693
11	9637046	149	135	255	506	307	101	83	79	92	143	195	191	2,298
12	9637047	125	120	179	248	104	16	10	7	21	48	85	106	1,091
13	9637048	88	78	139	234	119	27	14	18	22	104	81	99	1,054
14	9637049	142	131	177	277	103	24	13	14	29	59	103	104	1,187
15	9637051	121	99	151	220	67	20	13	3	17	36	70	99	885
16	9637052	98	86	109	183	61	14	12	6	11	28	56	100	752
17	9637053	166	173	250	304	124	48	68	46	80	100	186	230	1,661
18	9637054	98	84	131	215	50	6	10	3	10	27	63	68	777
19	9637062	92	114	160	247	119	26	37	21	45	47	94	132	1,101
20	9637069	102	68	101	185	78	12	32	9	24	14	60	121	768
21	9637070	118	80	123	141	63	11	10	6	12	26	66	117	730
22	9637076	116	80	130	179	94	19	15	8	13	33	72	123	877
23	9638000	78	66	103	236	184	43	31	29	28	50	84	108	1,031
24	9638001	78	83	131	174	80	16	13	15	28	60	70	82	847
25	9638002	66	83	152	221	112	24	15	14	27	68	101	74	972
26	9638003	72	79	175	263	116	21	13	14	24	55	108	113	1,069
27	9638005	92	82	139	186	130	23	23	20	35	68	104	99	1,019
28	9638008	101	84	154	196	99	22	12	19	38	61	92	95	970
29	9638010	99	83	136	208	101	18	15	21	30	60	93	91	956
30	9638013	88	105	151	186	100	14	9	16	24	58	80	84	919
31	9638017	104	90	150	199	94	20	13	17	25	61	88	91	952
32	9638018	60	59	85	156	124	25	27	16	31	69	99	143	915
33	9638019	97	113	119	178	85	13	8	12	14	100	105	218	1,083

(Unit : mm)

No.	Code No.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
34	9638020	70	55	83	189	171	39	29	29	24	59	83	117	951
35	9638022	116	92	151	223	99	21	14	15	36	60	97	94	1,010
36	9638023	77	67	123	274	176	40	31	23	34	70	110	115	1,135
37	9638027	57	69	150	223	127	28	24	17	27	68	94	105	992
38	9638028	117	89	190	205	98	34	19	15	49	100	133	119	1,074
39	9638031	109	79	130	194	117	26	13	15	41	34	67	112	887
40	9638033	85	69	141	164	103	28	10	21	31	36	122	105	920
41	9638034	81	56	131	162	96	21	10	15	30	59	105	94	867
42	9638035	88	45	108	168	104	39	32	22	31	63	61	157	883
43	9638036	92	64	141	218	119	17	13	16	19	59	84	105	957
44	9638038	94	62	167	219	124	28	13	8	31	80	107	110	1,005
45	9737000	129	121	206	258	112	28	13	9	20	33	84	100	1,117
46	9737005	159	158	286	429	189	42	24	17	32	46	120	143	1,632
47	9737006	216	187	311	312	160	62	63	63	67	101	172	218	1,940
48	9737008	117	88	192	262	172	31	12	19	16	27	62	60	1,052
49	9737009	162	139	263	330	166	25	25	28	125	73	106	157	1,580
50	9737011	154	158	234	329	137	24	12	8	11	27	86	133	1,326
51	9737013	171	160	213	318	117	35	20	8	23	41	111	174	1,400
52	9737014	142	132	214	247	102	23	16	25	37	54	88	114	1,218
53	9737015	175	152	281	368	146	33	24	41	80	165	295	264	2,075
54	9737016	119	137	167	258	58	9	8	7	22	47	92	127	1,052
55	9737017	176	174	426	300	147	52	56	40	56	121	131	221	1,958
56	9737019	128	147	236	362	133	50	29	31	27	40	87	122	1,319
57	9737021	114	94	144	182	84	21	10	7	12	31	54	120	952
58	9737024	275	189	309	370	139	44	58	76	130	235	327	378	2,513
59	9737025	171	183	226	300	127	25	17	5	29	39	103	168	1,495
60	9737026	208	168	260	331	128	53	36	32	45	96	140	214	1,736
61	9737027	114	113	187	241	107	36	31	13	26	51	89	84	1,077
62	9737028	168	164	281	384	179	70	73	91	95	139	207	219	2,043
63	9738002	94	88	156	214	100	21	11	13	21	58	104	97	915
64	9738008	116	102	155	217	61	25	8	19	23	81	92	113	973
65	9738009	74	68	117	157	89	16	7	11	21	65	92	91	818
66	9738014	79	93	157	311	143	28	49	21	71	67	205	94	1,348

Table 3.2 MONTHLY AVERAGE RAINFALL IN THE RUVU RIVER BASIN

(Unit : mm)

Code No.	Name of Station	Area	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
9637000	Morogoro Agri. Station	978	100	90	152	214	101	24	14	11	16	32	63	105	921
9637020	Tegetero Mission	420	210	185	346	557	298	117	104	100	119	154	225	239	2,654
9637047	Hobwe	426	125	120	179	248	104	16	10	7	21	48	85	106	1,069
9638005	Lugoba Mission	939	92	82	139	186	130	23	23	20	35	68	104	99	1,000
9638008	Athina Sisal Estate	988	101	84	154	196	99	22	12	19	38	61	92	95	973
9638020	Bagamoyo Salt Works	701	70	55	83	189	171	39	29	29	24	59	83	117	949
9638022	Kikondeni Sisal Estate	699	116	92	151	223	99	21	14	15	36	60	97	94	1,018
9638023	Chambezi Coast Agri. Company	293	77	67	123	274	176	40	31	23	34	70	110	115	1,140
9638033	Ubena Zomozi	1,127	85	69	141	164	103	28	10	21	31	36	122	105	915
9638034	Chalinze Catholic Mission	916	81	56	131	162	96	21	10	15	30	59	105	94	860
9638038	Ruvu National Service Farm	1,463	94	62	167	219	124	28	13	8	31	80	107	110	1,043
9737000	Duthumi Estate	1,042	129	121	206	258	112	28	13	9	20	33	84	100	1,114
9737008	Kisaki	1,563	117	88	192	262	172	31	12	19	16	27	62	60	1,060
9737011	Kikeo Mission	1,077	154	158	234	329	137	24	12	8	11	27	86	133	1,313
9737014	Mvuha	980	142	132	214	247	102	23	16	25	37	54	88	114	1,195
9737026	Kibungo	785	208	168	260	331	128	53	36	32	45	96	140	214	1,712
9738002	Maneromango Upper School	1,141	94	88	156	214	100	21	11	13	21	58	104	97	977
9738008	Kidunda Village	1,276	116	102	155	217	61	25	8	19	23	81	92	113	1,012
9738009	Ng'hesse	1,159	74	68	117	157	89	16	7	11	21	65	92	91	809
	Total Average	17,974	111	96	170	231	118	28	16	18	29	58	97	109	1,081

Table 3.3 MONTHLY AVERAGE RAINFALL IN UNIT BASIN

(Unit : mm)

Unit Basin No.	Area	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
1	1,342	153	139	226	306	132	26	10	11	14	28	83	120	1,248
2	1,437	122	95	197	269	167	30	12	18	16	27	65	68	1,081
3	1,124	127	115	199	264	106	28	12	14	23	39	87	99	1,115
4	1,023	194	171	275	385	186	71	58	55	70	108	162	203	1,959
5	1,316	157	141	221	259	107	32	24	27	37	66	101	140	1,336
6	1,857	120	93	146	242	72	22	8	18	24	76	90	107	1,047
7	526	116	109	175	248	111	25	17	14	24	46	82	114	1,084
8	1,387	96	86	155	195	104	28	14	15	28	42	90	107	951
9	943	99	86	137	195	97	20	14	18	32	63	95	95	954
10	511	90	80	140	202	96	20	10	13	22	59	98	95	890
11	672	102	82	139	196	95	20	12	16	33	64	95	95	951
12	924	89	78	149	207	105	22	11	11	26	63	101	100	918
13	899	86	65	149	170	102	26	10	13	37	59	105	106	931
14	700	80	66	162	198	124	27	13	8	35	76	106	113	957
15	885	85	66	147	164	104	26	11	14	37	57	111	106	936
16	171	82	71	162	206	123	26	13	8	32	73	105	111	953
17	885	89	77	139	180	128	25	21	18	34	66	145	100	1,032
18	287	84	71	117	186	146	30	26	22	31	67	129	105	1,019
19	497	85	66	144	247	160	35	27	15	38	82	107	119	1,090
20	324	72	55	82	185	169	39	30	28	24	63	83	117	941
21	263	73	55	84	193	172	40	31	27	25	65	82	118	956

Table 3.4 MONTHLY AVERAGE RAINFALL IN THE CATCHMENT AREA OF THE HYDROLOGICAL STATIONS

(Unit : mm)

Station Code.	Area (km2)	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
1H2	12,488	123	108	185	249	117	29	16	19	28	55	94	111	1,132
1H3	6,697	143	127	215	288	137	34	20	22	29	52	95	120	1,291
1H5	420	207	182	338	540	287	111	99	95	113	148	217	234	2,620
1H8	15,190	117	101	179	240	116	28	15	18	28	57	96	110	1,099
1H10	5,870	149	132	225	300	146	36	22	23	30	49	95	122	1,342
1HA1A	2,840	101	88	154	206	103	24	13	16	28	48	89	103	970
1HA5	1,646	103	91	159	215	107	26	15	16	25	41	86	108	986
1HA15	2,370	102	89	155	209	105	25	14	16	27	45	88	105	974
1HB1	963	121	96	197	269	168	30	12	18	16	27	65	68	1,080
1HB2	101	131	128	190	265	111	61	54	52	62	82	85	112	1,333
1HC2	251	166	146	270	432	229	89	79	76	91	119	174	187	2,057

Table 3.5 LIST OF HYDROLOGICAL STATIONS IN THE RUVU RIVER BASIN

Scr. No.	River Name	Station Code	Name	Location Latitude	Location Longitude	Altitude (m)	Catchment Area(km2)	Obsevation Period Established	Obsevation Period Closed
1	Ruvu	1H2 *	Ruvu Sisal Estate	6° 48' S	38° 39' E	27	12,488.0	Aug.1950	Jun.1959
2	Ruvu	1H3 *	Kidunda	7° 16' S	38° 18' E	76	6697.0	Aug.1951	Oct.1963
3	Ruvu	1H5 *	Kibungo	7° 01' S	37° 48' E	473	420.0	Oct.1952	Cont.
4	Ruvu	1H8 *	Ruvu Bridge	6° 41' S	38° 41' E	15	15,190.0	Nov.1958	Cont.
5	Ruvu	1H10*	Mikula	7° 18' S	38° 10' E	80	5870.0	Nov.1965	Cont.
6	Ngerengere	1HA1A*	Utari Bridge	7° 02' S	38° 22' E	90	2840.0	Oct.1950	Cont.
7	Ngerengere	1HA3	Kingolwira	6° 45' S	37° 48' E	425	690.0	Sep.1950	Oct.1963
8	Ngerengere	1HA4	Kilimanjero	6° 46' S	37° 42' E	457	630.0	Apr.1953	Oct.1959
9	Ngerengere	1HA5*	Kiluwa	6° 44' S	38° 06' E	198	1646.0	Nov.1953	Aug.1967
10	Ngerengere	1HA6	Kihonda	6° 47' S	37° 39' E	466	461.0	Sep.1950	Oct.1963
11	Mlali	1HA7	Mlali	6° 58' S	37° 32' E	518	18.1	Oct.1953	Oct.1963
12	Morogoro	1HA8	Morogoro	6° 51' S	37° 40' E	543	23.3	Mar.1954	Cont.
13	Ngerengere	1HA9	Konga	6° 54' S	37° 37' E	530	20.5	Apr.1954	Mar.1960
14	Ngerengere	1HA9A	Konga	6° 54' S	37° 37' E	530	20.5	Nov.1962	Cont.
15	Ngerengere	1HA10	Mgera	6° 56' S	37° 34' E	518	15.4	Apr.1954	Oct.1963
16	Ngerengere	1HA15*	Mgude	6° 48' S	38° 09' E	95	2370.0	Oct.1968	Dec.1975
17	Msoro	1HB1*	Kisaki	7° 28' S	37° 42' E	152	963.0	Nov.1950	Dec.1962
18	Mgeta	1HB2*	Mgeta	7° 02' S	37° 34' E	975	101.0	Jun.1954	Cont.
19	Mgeta	1HB3	Bunduki	7° 02' S	37° 37' E	1,220	46.0	Jun.1954	1962
20	Mgeta	1HB4	Luhuela	7° 01' S	37° 38' E	1,493	5.0	Dec.1954	1963
21	Mvuha	1HC2*	Mvuha	7° 12' S	37° 51' E	274	251.0	Apr.1954	Cont.

Note * : Stations selected for the Study

Table 3.6 SUMMARY OF RIVER DISCHARGE (1/2)

(Unit : discharge ; m3/s, runoff ; mm, Rainfall ; mm)

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
1H2	Catchment Area		12,488 km2		Data Period 1950 to 1959								
Mean	49.1	79.8	58.8	194.5	239.4	96.0	38.3	22.4	18.2	17.2	36.6	46.6	74.7
Mean Max.	107.4	156.3	144.8	265.0	286.9	187.3	54.8	33.8	35.7	35.3	79.5	110.9	124.8
Mean Min.	23.0	24.6	25.1	86.1	158.0	48.0	27.5	16.1	12.9	10.6	14.4	20.3	38.9
Ab. Max.	282.8	293.0	222.2	307.1	365.7	290.0	107.9	55.6	86.5	73.6	232.1	232.1	365.7
Ab. Min.	7.0	6.1	5.7	47.2	42.3	20.3	19.3	12.3	8.0	6.1	7.5	4.8	4.8
Runoff	10.5	15.5	12.6	40.4	51.3	19.9	8.2	4.8	3.8	3.7	7.6	10.0	188.8
Rainfall	123.0	108.4	184.8	248.6	117.1	29.0	16.1	19.1	27.9	54.9	93.9	111.4	1,131.5
Runoff C.	8.6%	14.3%	6.8%	16.2%	43.8%	68.7%	51.0%	25.1%	13.5%	6.7%	8.1%	9.0%	16.7%
1H3	Catchment Area		6,697 km2		Data Period 1951 to 1969								
Mean	52.6	40.7	63.2	176.1	131.2	43.6	27.5	20.2	17.0	18.1	49.8	54.1	57.8
Mean Max.	124.2	88.1	156.2	308.6	291.4	78.4	38.5	30.6	31.7	36.0	140.1	138.2	121.8
Mean Min.	24.5	22.1	26.7	71.1	49.9	29.9	21.9	16.3	12.8	12.6	19.0	23.8	27.5
Ab. Max.	563.7	259.0	428.0	624.0	544.4	193.8	69.6	76.3	93.4	81.8	699.0	627.4	699.0
Ab. Min.	0.4	3.4	2.0	18.3	22.6	13.2	9.8	7.1	6.3	5.6	5.6	2.4	0.4
Runoff	21.0	14.7	25.3	68.2	52.5	16.9	11.0	8.1	6.6	7.2	19.3	21.6	272.4
Rainfall	143.1	126.9	215.5	287.7	136.7	34.4	20.2	22.2	29.3	52.3	95.0	119.6	1,290.8
Runoff C.	14.7%	11.6%	11.7%	23.7%	38.4%	49.1%	54.5%	36.3%	22.4%	13.8%	20.3%	18.1%	21.1%
1H5	Catchment Area		420 km2		Data Period 1952 to 1992								
Mean	17.8	14.0	19.2	40.7	34.5	17.7	11.7	8.7	8.4	10.3	18.8	20.1	18.5
Mean Max.	51.5	34.4	53.1	103.8	82.3	39.2	27.8	21.6	33.2	41.4	70.0	62.6	51.7
Mean Min.	9.0	7.6	8.3	17.5	19.0	10.5	7.2	5.6	4.7	4.6	6.4	8.4	9.1
Ab. Max.	207.7	91.3	136.6	257.0	170.8	126.8	82.2	73.0	127.1	247.9	291.9	205.4	291.9
Ab. Min.	2.1	1.8	1.8	4.7	6.7	4.4	3.8	3.4	2.8	2.1	0.7	1.4	0.7
Runoff	113.2	80.4	122.3	251.0	220.3	109.3	74.9	55.7	51.9	65.5	116.2	128.3	1,388.6
Rainfall	207.4	182.4	337.7	540.2	286.8	111.4	98.6	94.8	113.1	148.4	217.3	233.5	2,620.0
Runoff C.	54.6%	44.1%	36.2%	46.5%	76.8%	98.1%	76.0%	58.8%	45.8%	44.1%	53.5%	54.9%	53.0%
1H8	Catchment Area		15,190 km2		Data Period 1958 to 1992								
Mean	57.7	39.8	57.7	163.4	161.4	60.0	28.3	19.8	16.5	15.8	47.6	65.1	61.1
Mean Max.	106.7	66.2	118.0	287.6	283.0	112.9	39.4	27.3	25.9	29.9	101.6	124.9	110.3
Mean Min.	28.2	24.6	28.1	82.9	77.0	33.4	21.2	15.6	12.2	10.7	19.5	33.8	32.3
Ab. Max.	540.4	137.2	341.2	800.9	694.5	643.8	80.7	65.5	86.6	163.7	533.1	505.3	800.9
Ab. Min.	3.0	6.2	6.2	8.5	21.6	7.3	10.1	8.3	7.7	6.0	6.0	3.7	3.0
Runoff	10.2	6.3	10.2	27.9	28.5	10.2	5.0	3.5	2.8	2.8	8.1	11.5	126.8
Rainfall	117.3	101.0	179.3	239.9	116.1	28.3	15.3	17.8	28.1	57.0	96.2	110.0	1,099.4
Runoff C.	8.7%	6.3%	5.7%	11.6%	24.5%	36.2%	32.5%	19.5%	10.0%	4.9%	8.4%	10.4%	11.5%
1H8	with Culvert												
Mean	59.5	39.8	58.4	183.0	179.1	61.6	28.3	19.8	16.5	15.8	51.3	68.6	65.1
Mean Max.	113.5	66.2	124.8	345.0	339.2	121.1	39.4	27.3	25.9	29.9	113.4	141.9	124.0
Mean Min.	28.2	24.6	28.1	86.6	77.0	33.4	21.3	15.6	12.2	10.7	19.6	33.8	32.6
Ab. Max.	675.9	137.2	398.1	1,093.7	960.5	851.6	80.7	65.5	86.6	163.7	665.8	627.1	1,093.7
Ab. Min.	3.0	6.3	6.3	8.5	21.6	7.3	10.1	8.3	7.7	6.0	6.0	3.7	3.0
Runoff	10.5	6.3	10.3	31.2	31.6	10.5	5.0	3.5	2.8	2.8	8.8	12.1	135.2
Rainfall	117.3	101.0	179.3	239.9	116.1	28.3	15.3	17.8	28.1	57.0	96.2	110.0	1,099.4
Runoff C.	9.0%	6.2%	5.7%	13.0%	27.2%	37.1%	32.6%	19.6%	9.9%	4.9%	9.1%	11.0%	12.3%
1H10	Catchment Area		5,870 km2		Data Period 1966 to 1991								
Mean	41.6	39.5	61.4	131.4	118.5	42.6	24.0	17.7	17.8	16.1	32.7	58.5	50.2
Mean Max.	97.0	73.6	141.2	252.9	261.1	74.4	37.3	28.0	36.0	36.3	100.6	141.3	106.6
Mean Min.	21.3	22.9	22.8	48.6	53.5	27.8	18.5	13.8	12.2	10.2	13.3	24.2	24.1
Ab. Max.	280.1	326.4	486.7	877.2	708.6	190.9	89.9	86.6	119.1	72.8	422.8	592.0	877.2
Ab. Min.	2.1	2.0	5.2	6.8	29.9	17.7	12.2	9.1	6.6	5.1	5.8	5.5	2.0
Runoff	19.0	16.3	28.0	58.0	54.1	18.8	11.0	8.1	7.9	7.4	14.4	26.7	269.5
Rainfall	148.8	131.8	225.4	300.0	145.7	36.1	21.9	23.0	30.2	49.3	95.3	121.6	1,341.7
Runoff C.	12.8%	12.3%	12.4%	19.3%	37.1%	52.1%	50.1%	35.2%	26.0%	14.9%	15.1%	22.0%	20.1%

Table 3.6 SUMMARY OF RIVER DISCHARGE (2/2)

(Unit : discharge ; m3/s, runoff ; mm, Rainfall ; mm)

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
1HA1A	Catchment Area		2,840 km2		Data Period 1950 to 1992								
Mean	3.9	3.0	3.2	12.2	13.4	3.9	1.8	1.0	0.8	0.8	3.6	4.3	4.3
Mean Max.	10.7	7.8	11.7	27.5	28.6	7.7	3.4	1.9	1.6	3.2	8.4	10.9	10.3
Mean Min.	1.2	0.9	0.9	3.3	5.3	2.0	1.0	0.5	0.4	0.3	1.1	1.8	1.6
Ab. Max.	55.3	39.1	62.6	62.0	61.4	28.6	14.4	9.9	16.0	36.9	51.3	62.3	62.6
Ab. Min.	0.0	0.0	0.0	0.1	0.7	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Runoff	3.7	2.5	3.0	11.2	12.6	3.5	1.7	1.0	0.7	0.8	3.3	4.1	48.1
Rainfall	101.1	87.7	153.8	206.5	103.3	24.3	13.4	16.2	28.0	47.8	89.0	103.3	970.3
Runoff C.	3.6%	2.9%	2.0%	5.4%	12.2%	14.6%	13.0%	6.0%	2.5%	1.6%	3.7%	3.9%	5.0%
1HA5	Catchment Area		1,646 km2		Data Period 1953 to 1970								
Mean	3.9	2.7	3.4	11.7	9.3	3.3	1.8	1.2	1.1	1.2	3.6	3.5	3.9
Mean Max.	11.9	8.8	11.1	26.9	21.5	7.1	4.0	2.6	2.3	6.0	8.6	8.1	9.9
Mean Min.	1.4	1.0	1.1	4.0	3.6	1.7	1.0	0.7	0.6	0.4	1.4	1.6	1.5
Ab. Max.	50.5	25.2	41.8	53.8	49.0	19.2	17.3	13.4	17.9	48.6	52.0	23.9	53.8
Ab. Min.	0.1	0.1	0.1	0.1	1.2	0.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0
Runoff	6.3	4.0	5.5	18.4	15.1	5.3	2.9	1.9	1.8	1.9	5.7	5.7	74.4
Rainfall	103.0	91.2	158.5	214.6	106.8	25.9	14.6	15.9	25.2	41.4	86.1	107.7	985.6
Runoff C.	6.2%	4.4%	3.5%	8.6%	14.1%	20.3%	19.7%	11.9%	7.0%	4.6%	6.6%	5.3%	7.5%
1HA15	Catchment Area		2,370 km2		Data Period 1968 to 1992								
Mean	4.3	3.1	5.6	13.9	13.7	3.6	1.3	0.9	0.7	2.0	3.8	3.7	4.7
Mean Max.	16.2	10.0	21.4	43.9	52.0	6.9	2.3	1.4	1.6	12.0	15.3	11.5	16.2
Mean Min.	1.2	1.2	2.0	3.9	3.8	1.8	0.9	0.6	0.4	0.3	1.1	1.3	1.5
Ab. Max.	57.3	34.5	86.3	108.6	155.8	17.3	5.1	3.5	4.6	124.4	67.5	70.8	155.8
Ab. Min.	0.0	0.1	0.0	0.0	1.3	0.7	0.4	0.4	0.1	0.0	0.0	0.0	0.0
Runoff	4.9	3.2	6.3	15.2	15.4	3.9	1.5	1.0	0.8	2.2	4.2	4.2	62.9
Rainfall	101.5	88.7	155.3	209.0	104.6	25.0	13.9	16.1	26.9	45.1	88.0	105.0	974.3
Runoff C.	4.8%	3.6%	4.1%	7.3%	14.8%	15.6%	11.0%	6.3%	3.0%	4.9%	4.8%	4.0%	6.5%
1HB1	Catchment Area		963 km2		Data Period 1953 to 1963								
Mean	6.2	7.0	8.5	17.1	12.6	4.9	3.5	2.5	2.3	2.3	4.5	4.5	6.3
Mean Max.	20.9	17.8	21.7	37.7	29.8	8.4	5.5	3.7	5.7	4.1	9.4	11.6	14.7
Mean Min.	2.9	3.4	3.8	7.3	6.2	3.8	2.8	2.1	1.9	1.5	2.9	2.6	3.4
Ab. Max.	36.3	31.4	34.0	50.8	48.7	19.0	15.2	9.6	27.6	14.0	38.2	31.3	50.8
Ab. Min.	0.3	1.1	1.3	2.6	1.3	1.1	0.9	0.9	0.8	0.8	1.1	0.9	0.3
Runoff	17.4	17.5	23.6	46.0	35.0	13.3	9.7	7.1	6.3	6.4	12.1	12.4	207.2
Rainfall	120.8	95.6	196.7	269.1	168.4	30.5	11.9	17.7	15.7	27.4	64.5	67.8	1,080.0
Runoff C.	14.4%	18.3%	12.0%	17.1%	20.8%	43.6%	81.5%	40.0%	40.1%	23.3%	18.8%	18.3%	19.2%
1HB2	Catchment Area		101 km2		Data Period 1959 to 1992								
Mean	2.5	2.3	2.8	5.0	3.8	2.0	1.5	1.2	1.2	1.5	2.7	2.9	2.5
Mean Max.	10.6	6.3	7.9	12.8	10.4	2.9	1.9	1.8	3.4	5.5	9.9	9.5	6.9
Mean Min.	1.6	1.4	1.6	2.5	2.3	1.6	1.3	1.1	0.9	0.9	1.2	1.6	1.5
Ab. Max.	71.4	22.3	27.3	35.6	45.4	8.6	4.0	5.7	15.3	41.0	37.4	37.4	71.4
Ab. Min.	0.2	0.2	0.2	0.9	0.9	0.4	0.3	0.1	0.1	0.1	0.1	0.3	0.1
Runoff	65.4	54.9	73.1	128.9	101.3	52.4	40.2	32.9	30.9	41.1	70.5	76.4	768.5
Rainfall	131.1	127.7	190.4	265.0	110.9	61.3	54.2	52.1	62.2	81.6	84.9	111.6	1,333.0
Runoff C.	49.9%	43.0%	38.4%	48.7%	91.3%	85.5%	74.1%	63.1%	49.6%	50.3%	83.0%	68.4%	57.6%
1HC2	Catchment Area		251 km2		Data Period 1954 to 1992								
Mean	8.7	7.6	12.6	23.3	13.0	5.5	4.3	3.8	4.4	6.1	10.1	8.7	9.0
Mean Max.	52.5	32.3	62.8	102.7	50.0	15.2	13.9	14.6	19.0	33.5	55.9	50.2	41.9
Mean Min.	2.9	3.1	3.6	6.4	5.0	3.5	2.8	2.3	2.3	2.3	2.6	2.7	3.3
Ab. Max.	204.7	111.3	289.3	296.7	216.3	100.0	141.5	122.3	101.3	196.3	310.5	288.8	310.5
Ab. Min.	0.0	0.0	0.0	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Runoff	92.4	73.2	134.7	240.8	138.8	56.9	46.1	40.3	45.0	65.4	104.2	92.5	1,131.4
Rainfall	165.9	145.9	270.1	432.2	229.4	89.1	78.8	75.8	90.5	118.7	173.8	186.8	2,057.2
Runoff C.	55.7%	50.2%	49.9%	55.7%	60.5%	63.8%	58.4%	53.2%	49.7%	55.1%	59.9%	49.5%	55.0%

Table 3.7 RESULT OF PROBABILITY ANALYSIS ON THE DISCHARGE DATA

(1) Annual Mean Discharge

(Unit : m3/sec)

Return	Stream Gauging Station											
Period	1H2	1H3	1H5	1H8	1H8*	1H10	1HA1A	1HA5	1HA15**	1HB1	1HB2	1HC2
1/500	41.09	6.96	9.65	23.40	22.97	31.65	1.68	0.67	-	3.19	0.52	0.62
1/200	43.08	11.04	10.32	25.23	24.85	32.16	1.75	0.89	-	3.45	0.71	0.92
1/100	44.89	14.53	10.90	26.94	26.63	32.65	1.82	1.08	-	3.68	0.86	1.21
1/50	47.04	18.49	11.58	29.05	28.84	33.29	1.91	1.30	-	3.95	1.04	1.58
1/40	47.82	19.88	11.82	29.84	29.66	33.53	1.95	1.38	-	4.04	1.10	1.72
1/30	48.91	21.78	12.15	30.95	30.84	33.88	2.01	1.50	-	4.18	1.18	1.92
1/25	49.66	23.04	12.38	31.72	31.80	34.13	2.05	1.57	-	4.27	1.23	2.06
1/20	50.65	24.68	12.67	32.75	32.75	34.47	2.10	1.67	-	4.39	1.30	2.25
1/10	54.29	30.47	13.72	36.66	36.94	35.80	2.33	2.02	-	4.82	1.55	2.99
1/5	59.34	37.85	15.10	42.36	43.12	37.88	2.71	2.49	-	5.41	1.85	4.11
1/4	61.46	40.77	15.65	44.85	45.83	38.83	2.89	2.69	-	5.65	1.97	4.62
1/3	64.78	45.14	16.50	48.83	50.22	40.41	3.21	2.98	-	6.02	2.15	5.45
1/2	71.33	53.21	18.11	57.05	59.35	43.87	3.94	3.54	-	6.73	2.47	7.23

Note * : with culvert

**: Data not available

(2) Annual Minimum Discharge

(Unit : m3/sec)

Return	Stream Gauging Station											
Period	1H2	1H3	1H5	1H8	1H8*	1H10	1HA1A	1HA5	1HA15	1HB1	1HB2	1HC2
1/500	3.856	0.000	0.452	2.079	2.079	0.568	0.00000	0.00015	0.00000	0.000	0.000	0.000
1/200	4.002	0.052	0.677	2.684	2.684	1.203	0.00000	0.00028	0.00001	0.018	0.000	0.000
1/100	4.145	0.366	0.870	3.189	3.189	1.748	0.00000	0.00046	0.00002	0.109	0.000	0.000
1/50	4.329	0.763	1.089	3.747	3.747	2.367	0.00000	0.00079	0.00005	0.212	0.035	0.000
1/40	4.400	0.913	1.165	3.939	3.939	2.584	0.00000	0.00095	0.00006	0.247	0.050	0.000
1/30	4.502	1.128	1.271	4.200	4.200	2.882	0.00001	0.00121	0.00009	0.297	0.071	0.020
1/25	4.574	1.278	1.341	4.372	4.372	3.080	0.00001	0.00143	0.00012	0.329	0.085	0.036
1/20	4.671	1.480	1.432	4.593	4.593	3.338	0.00001	0.00176	0.00016	0.371	0.105	0.058
1/10	5.056	2.268	1.754	5.356	5.356	4.248	0.00006	0.00361	0.00047	0.520	0.182	0.157
1/5	5.656	3.460	2.165	6.294	6.294	5.415	0.00030	0.00860	0.00167	0.707	0.298	0.341
1/4	5.931	3.994	2.328	6.655	6.655	5.877	0.00056	0.01195	0.00272	0.781	0.349	0.438
1/3	6.387	4.866	2.573	7.185	7.185	6.571	0.00139	0.01933	0.00551	0.891	0.433	0.613
1/2	7.381	6.725	3.026	8.133	8.133	7.855	0.00696	0.04519	0.01925	1.093	0.612	1.060

(3) Annual Maximum Discharge

(Unit : m3/sec)

Return	Stream Gauging Station											
Period	1H2	1H3	1H5	1H8	1H8*	1H10	1HA1A	1HA5	1HA15	1HB1	1HB2	1HC2
1/500	499	1,524	406	1,218	1,958	1,519	90	75	297	73	95	649
1/200	463	1,329	366	1,071	1,667	1,275	83	70	256	69	83	544
1/100	437	1,187	335	962	1,457	1,105	78	67	225	66	74	471
1/50	411	1,048	305	854	1,257	946	72	63	196	62	66	402
1/40	402	1,005	295	820	1,194	898	70	62	186	61	63	380
1/30	391	949	282	775	1,114	836	68	60	174	59	59	354
1/25	385	914	274	747	1,059	799	66	59	167	58	57	337
1/20	376	871	264	712	1,004	753	64	58	158	57	54	317
1/10	350	739	232	604	819	618	57	53	130	53	46	257
1/5	322	605	197	492	637	490	49	48	101	49	37	199
1/4	313	561	186	454	577	450	46	46	92	47	34	181
1/3	300	502	170	403	500	399	42	43	80	45	30	157
1/2	280	413	144	323	383	324	35	38	61	41	24	123

Table 3.8 SUMMARY OF ESTIMATED DISCHARGE AT PROPOSED DAM SITE

(Unit : m3/sec)

Proposed Dam Site	Catchment Area(km2)	Mean Discharge for 40 years (1950 - 1989)												
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Rudete	246.8	2.51	5.23	9.68	6.30	2.40	1.32	0.88	0.79	0.90	1.48	2.01	3.03	3.04
(Specific Q m3/s/km2)		(0.010)	(0.021)	(0.039)	(0.026)	(0.010)	(0.005)	(0.004)	(0.003)	(0.004)	(0.006)	(0.008)	(0.012)	(0.012)
Ngerengere	2809.3	3.34	2.45	3.34	13.60	14.60	4.84	2.19	1.03	0.67	0.68	2.32	3.31	4.36
(Specific Q m3/s/km2)		0.001	0.001	0.001	0.005	0.005	0.002	0.001	0.000	0.000	0.000	0.001	0.001	0.002
Mkombezi	602.9	0.59	0.68	1.21	2.79	3.27	1.65	0.91	0.37	0.21	0.41	0.67	0.77	1.13
(Specific Q m3/s/km2)		(0.001)	(0.001)	(0.002)	(0.005)	(0.005)	(0.003)	(0.002)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)
Mgeta	938.7	11.03	13.59	22.18	39.62	24.56	9.68	5.42	3.64	3.23	3.54	6.07	8.96	12.63
(Specific Q m3/s/km2)		(0.012)	(0.014)	(0.024)	(0.042)	(0.026)	(0.010)	(0.006)	(0.004)	(0.003)	(0.004)	(0.006)	(0.010)	(0.013)
Kidunda	5760.9	35.76	39.17	61.17	132.40	108.02	64.14	40.85	27.29	20.53	18.02	27.02	39.70	51.17
(Specific Q m3/s/km2)		(0.006)	(0.007)	(0.011)	(0.023)	(0.019)	(0.011)	(0.007)	(0.005)	(0.004)	(0.003)	(0.005)	(0.007)	(0.009)

Table 3.9 PEAK FLOOD DISCHARGE AT PROPOSED DAM SITE

(Unit : m3/sec)

Proposed Dam Site	Catchment Area(km2)	Return Period					
		1/5	1/10	1/20	1/50	1/100	1/200
Rudete	246.8	54.22	70.42	94.05	121.13	143.93	196.83
(Specific Q m3/s/km2)		(0.220)	(0.285)	(0.381)	(0.491)	(0.583)	(0.798)
Ngerengere	2809.3	48.47	56.24	63.06	71.21	76.95	82.42
(Specific Q m3/s/km2)		(0.017)	(0.020)	(0.022)	(0.025)	(0.027)	(0.029)
Mkombezi	602.9	13.39	17.90	22.65	29.29	34.59	40.25
(Specific Q m3/s/km2)		(0.022)	(0.030)	(0.038)	(0.049)	(0.057)	(0.067)
Mgeta	938.7	136.31	184.09	257.37	345.19	421.53	525.54
(Specific Q m3/s/km2)		(0.145)	(0.196)	(0.274)	(0.368)	(0.449)	(0.560)
Kidunda	5760.9	481.28	606.65	739.10	928.33	1084.04	1251.30
(Specific Q m3/s/km2)		(0.084)	(0.105)	(0.128)	(0.161)	(0.188)	(0.217)

Table 3.10 SUMMARY OF SEDIMENT YIELD

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
1H8	Catchment Area		15,190 km2		Data Period 1958 to 1992								
													(Unit : ton/day)
Mean	14,135	7,017	13,016	54,643	51,719	13,854	4,016	2,409	1,976	1,887	13,313	17,543	16,294
Mean Max.	32,114	13,880	33,571	114,899	108,316	34,691	6,456	3,870	3,869	5,000	34,334	42,328	36,111
Mean Min.	4,738	3,535	4,383	21,576	17,391	5,081	2,629	1,702	1,202	1,008	3,703	6,825	6,148
													(Unit : m3/km2)
Mean	16.03	7.19	14.76	59.95	58.64	15.2	4.55	2.73	2.17	2.14	14.61	19.89	217.85
Mean Max.	36.41	14.21	38.06	126.07	122.81	38.06	7.32	4.39	4.25	5.67	37.67	47.99	
Mean Min.	5.37	3.62	4.97	23.67	19.72	5.58	2.98	1.93	1.32	1.14	4.06	7.74	
1H10	Catchment Area		5,870 km2		Data Period 1966 to 1991								
													(Unit : ton/day)
Mean	8,137	7,818	14,155	36,532	30,826	7,854	3,672	2,485	2,607	2,266	6,452	13,502	11,359
Mean Max.	23,516	17,359	38,739	79,855	83,247	16,216	6,516	4,603	6,600	6,306	26,376	40,242	29,131
Mean Min.	3,332	3,723	3,597	9,917	10,302	4,394	2,599	1,777	1,552	1,235	1,781	4,084	4,024
													(Unit : m3/km2)
Mean	23.87	20.72	41.53	103.73	90.44	22.3	10.77	7.29	7.4	6.65	18.32	39.61	392.64
Mean Max.	68.99	46	113.66	226.73	244.24	46.04	19.12	13.51	18.74	18.5	74.89	118.07	
Mean Min.	9.78	9.87	10.55	28.16	30.22	12.48	7.62	5.21	4.41	3.62	5.06	11.98	

Table 4.1 MAIN FEATURES OF DAR ES SALAAM WATER SUPPLY SYSTEM

Main Facilities	Name of Schemes		
	Upper Ruvu	Lower Ruvu	Mtoni
- Water Source	Ruvu River	Ruvu River	Kizinga River
Intake:	210,000 m^3/day	386,000 m^3/day	unknown
- Raw Water Pumping Station	98,500 m^3/day H=70.2 m	191,000 m^3/day H=24 m	unknown
- Treatment plant	82,000 m^3/day	182,000 m^3/day	9,000 m^3/day
- Clean Water Pumping Station	98,500 m^3/day H=152.4 m	182,000 m^3/day H=108 m	unknown
- Transmission Main	Steel d=512 n 750*51km FRP d=900*21km	PC d=1350*55km	nil
- Booster station	98,500 m^3/day H=152.4 m	nil	nil
- Service reservoir	Kibaha 6,900m^3 Kimara 6,900 m^3*2	University 22,700 m^3*2	nil

Table 4.2 MUNICIPAL WATER CONSUMPTION RECORDS IN DAR ES SALAAM WATER SUPPLY SYSTEM

	1990*	1992
Production	296,330 m3/day	295,000 m3/day
Supply to the distribution network	193,400 m3/day	200,000 m3/day
Total consumption	125,727 m3/day	130,000 m3/day
Domestic consumption	111,056 m3/day	114,000 m3/day
Industrial consumption	4,120 m3/day	
Commercial consumption	5,697 m3/day	16,000 m3/day
Institutional consumption	4,854 m3/day	
Distribution leakage	67,673 m3/day	70,000 m3/day

*; Source: The Study on Rehabilitation of Dar Es Salaam Water Supply in the United Republic of Tanzania, JICA, 1991 and Urban Sector Engineering Project, Infrastructure Rehabilitation, Part 1, Volume 1, PMO, 1992

Table 4.3 WATER DEMAND IN DAR ES SALAAM WATER SUPPLY SYSTEM IN YEAR 1990

Sectoral demand	Service Area		Total
	Area covered by distribution system of the DSM city	Area along transmission mains*	
- Domestic demand	129,282	10,464	139,746
- Industrial demand	4,612	15,639	20,251
- Commercial demand	6,282	2,183	8,465
- Institution and other demand	5,355	4,053	9,408
- Agricultural demand	0	8,500	8,500
- Leakage & wastage	78,363	42,506	120,869
(Ratio)	(35%)	(51%)	
Total demand	223,894	83,345	

Note

*: Based on the data collected through the field survey.

Table 4.4 WATER DEMAND IN AREA COVERED BY DISTRIBUTION NETWORK OF DAR ES SALAAM CITY

Year	1990	1995	2000	2005	2010	2015	2020
I. Total Population served (thousand persons)	1,358	1,726	2,194	2,784	3,518	4,416	5,491
(Increase ratio of population in %)		(4.91)	(4.92)	(4.88)	(4.79)	(4.65)	(4.45)
II. Population by type of connections of water supply							
(1-1) Population by House Connection	435	502	579	667	766	873	986
- Per capita demand (lpcd)	204.0	236.5	274.2	300.0	300.0	300.0	300.0
(1-2) Population by yard connection/stand pipe	923	1,224	1,615	2,117	2,752	3,543	4,505
- Per capita demand (lpcd)	44.0	48.1	52.6	57.5	62.9	68.7	75.1
III. Sectoral Water Demand							
(1) Domestic demand (m3/day)	129,282	177,533	243,711	321,938	402,793	505,420	634,215
(2) Industrial demand (m3/day)	4,612	5,347	6,198	6,677	7,193	7,749	8,348
(3) Commercial demand (m3/day)	6,282	7,283	8,442	9,095	9,798	10,555	11,371
(4) Institutional and other demand (m3/day)	5,355	6,208	7,197	7,753	8,352	8,998	9,693
(5) Leakage (m3/day)	78,363	105,737	66,387	86,366	107,034	133,181	165,907
(Leakage ratio in %)	(35)	(35)	(20)	(20)	(20)	(20)	(20)
Daily average demand (m3/day)	223,893	302,107	331,936	431,828	535,170	665,903	829,533
Daily maximum demand (m3/day)	279,867	377,634	414,919	539,785	668,963	832,378	1,036,917

Table 4.5 WATER DEMAND IN AREA ALONG THE TRUNK TRANSMISSION MAINS

Year	1990	1995	2000	2005	2010	2015	2020
- Population served (persons)	109	127	153	185	221	263	312
(Increase ratio of population in %)		(3.10)	(3.80)	(3.87)	(3.62)	(3.54)	(3.48)
- Per capita demand (lpcd)	96.0	105.0	114.7	125.5	137.2	150.0	163.9
(1) Domestic demand (m3/day)	10,464	13,329	17,557	23,209	30,312	39,439	51,152
(2) Industrial demand (m3/day)	15,639	18,130	21,018	22,642	24,392	26,277	28,308
(3) Commercial demand (m3/day)	2,183	2,531	2,934	3,161	3,405	3,668	3,951
(4) Institutional demand (m3/day)	3,225	3,739	4,334	4,669	5,030	5,419	5,837
(5) Agricultural demand (m3/day)	8,500	8,500	8,500	8,500	8,500	8,500	8,500
(6) Leakage (m3/day)	41,644	30,819	23,289	26,649	30,702	35,701	41,892
(Leakage ratio in %)	(51)	(40)	(30)	(30)	(30)	(30)	(30)
Daily average demand (m3/day)	81,655	77,048	77,631	88,829	102,341	119,003	139,640
Daily maximum demand (m3/day)	102,069	96,310	97,039	111,037	127,926	148,753	174,550

Table 4.6 TOTAL DEMAND IN SERVICE AREA OF THE DAR ES SALAAM WATER SUPPLY SYSTEM

	Year	1990	1995	2000	2005	2010	2015	2020
I.	Mean daily water demand							
	(1) Area in the distribution network of DSM (m3/day)	223,893	302,107	331,936	431,828	535,170	665,903	829,533
	(2) Areas along transmission mains (m3/day)	81,655	77,048	77,631	88,829	102,341	119,003	139,640
	Total (in m3/day)	305,548	379,155	409,567	520,658	637,511	784,905	969,173
	Total (in m3/sec)	3.54	4.39	4.74	6.03	7.38	9.08	11.22
II.	Maximum daily Water demand							
	(1) Area in the distribution network of DSM (m3/day)	279,867	377,634	414,919	539,785	668,963	832,378	1,036,917
	(2) Areas along transmission mains (m3/day)	102,069	96,310	97,039	111,037	127,926	148,753	174,550
	Total (in m3/day)	381,935	473,944	511,959	650,822	796,889	981,132	1,211,467
	Total (in m3/sec)	4.42	5.49	5.93	7.53	9.22	11.36	14.02

Table 5.1 EXISTING /PROPOSED/ABANDONED AGRICULTURAL PROJECTS/FARMS IN THE RUVU RIVER BASIN

Serial No.	Project Title	Ownership	Present Status	Potential Project/Farm Area (ha)	Developed/ Cultivated Area (ha)	Irrigation Area (ha)			Water Right (lit./sec.)	Remarks
						Proposed	Designed	Existing		
Lower Ruvu River Basin										
1	NAFCO	Public	Existing	3,200	3,200	725	725	145	21.83	Data of irrigation area in 1989
2	J.K.T Ruvu (Ruvu National Service Rice Irrigation Project)	Public	Existing	2,370	24	200	200	24	894.22 -	
3	Ruvu Secondary School	Public	Existing	12	5	-	-	-	-	Farm for Training to Students
4	Mr. Mabruk Farm	Private	Proposed	390	-	-	-	-	-	
5	P.A.C Masuguru Farm	P.A.C	Existing	400	30	-	-	-	-	
6	Mzizima Farm	Private	Existing	1,640	30	200	-	-	-	
7	Mr. Mtawale	Private	Proposed	50	-	-	-	-	-	
8	Kigongoni Prison Farm	Public	Existing	650	650	450	20	20	-	
9	Bagamoyo Irrigation Development Project	Public	Existing	2,500	8	1,000 -	100 -	8 -	84.96 -	Phase 1 : Experimental Farm of 8 hectares
10	Makurunge Farm	Public	Abandoned	150	-	-	-	-	-	
11	Matushita Farm	Private	Abandoned	400	-	-	-	-	-	
12	Geneta Farm	Private	Proposed	4,000	-	-	-	-	-	
13	SIAFCO	Private	Proposed	200	-	-	-	-	-	
14	FARUHI	Private	Abandoned	230	-	-	-	-	-	
15	SAZI Farm	Private	Proposed	500	-	20	-	-	-	
16	Kitonga Village Irrigation	Village	Proposed	2,400	2,400	2,400	-	-	-	Small scale low lift pumping irri.
17	Mama Mhando	Private	Existing	150	100	-	-	-	-	
Upper Ruvu Basin										
18	Mlali Irrigation Project	Public	Existing	400	60	400	0	-	-	Siltation problem is severe.
19	Mgeta Rural	Public	Existing	2,000	2,000	2,000	2000	-	-	
20	Mgeta Plain	Public	Existing	-	-	-	-	-	-	

Table 5.2 REGISTERED WATER RIGHTS IN THE RUVU RIVER BASIN

Reg. No.	Grantee	Region	Water Sources	Amount (m3/sec)	Purpose	Remarks
Irrigation / Livestock						
609	Chhtlar Shivramvyas & VKB	Bagayomo	Ruvu River	0.0033	Dom./Irr.	
798	Chow Hsien	Bagayomo	Ruvu River	0.0033	Dom./Irr.	
966	JWT Holloway	Bagamoyo	Ruvu River	0.1710	Dom./Liv./Irr/Ind.	
1012	H.kumbruch	Bagayomo	Ruvu River	0.1133		
1023	Ruvu Valley Sugar Co., Ltd.	Bagamoyo	Ruvu River	0.4319	Dom./Irr/Ind.	
1024	Ruvu Valley Sugar Co., Ltd.	Bagayomo	Msumbiji River	0.2903	Irr./Dom./Liv.	
1025	George Stylianos	Morogoro	Ngerengere River	0.0005	Irr./Liv.	
1036	Director National Service	Bagayomo	Ruvu River	0.8496		
1417	P.S. Ministry of Agriculture	Morogoro	Kikundi River	0.0071	Dom./Irr.	
1418	P.S. Ministry of Agriculture	Morogoro	Kikundi River	0.0142	Dom./Irr.	
1419	P.S.Agriculture	Morogoro	Mlali River	0.0071	Dom./Irr.	
1487	NACO Ltd.	Morogoro	Ngerengere River	0.0068	Dom./Liv.	
2877	Bagamoyo District Council	Bagamoyo	Ruvu River	0.0037	Dom./Liv.	
2897	Director Production Kilimo	Bagamoyo	Ruvu River	0.0184		
2900	Director Production Kilimo	Bagamoyo	Msua River	0.0034	Dom./Liv.	
3297	Morogoro Native Authority Council	Morogoro	Nyambuywa River	0.0142	Dom./Irr.	
3299	Morogoro Native Authority Council	Morogoro	Mzinga River	0.0142	Dom./Irr.	
3301	Morogoro Native Authority Council	Morogoro	Mgera River	0.2832	All Purpose	
3302	Morogoro Native Authority Council	Morogoro	Ngadangi River	0.0028	Dom./Irr.	
3333	Edward Seitz	Morogoro	Mgeta River	0.1427	Dom./Irr.	
3335	Fatehai K. Ramji	Morogoro	Karoka River	0.0016	Dom./Irr.	
3338	Tom Henshaw	Morogoro	un-named stream	0.0001	Dom./Irr.	
3502	Provincial Agriculture Officer	Morogoro	Morogoro River	0.0142		
3503	Provincial Agriculture Officer	Morogoro	Morogoro River	0.2131		
3507	Commissioner of Prisons	Morogoro	Ngerengere River	0.0040	Dom./Liv.	
3513	Commissioner of Prisons	Morogoro	Ngerengere River	0.0034	Dom./Ind./Liv.	
3528	Morogoro Town Council	Morogoro	Kirakala River	0.0001	Irrigation	
3550	Fazal Kassani Mills Ltd.	Morogoro	Ngerengere River	0.0355	Dom./Irr.	
3562	The Procura, the Holy Fathers	Morogoro	Mgeta River	0.0053	Dom./Irr.	
3564	The Procura, the Holy Fathers	Morogoro	Bigwa River	0.0033	Dom./irr.	
3571	The Procura, the Holy Fathers	Morogoro	Spring Near Mgeta River	0.0014	Dom./Irr.	
3581	Morogoro District Council	Morogoro	Mlali River	0.1416	Irrigation	
3623	Morogoro Native Authority Council	Morogoro	Mzinga/Mindu River	0.0284	Dom./Irr.	
3962	Edward Seitz	Morogoro	Mgeta River	0.1427	Dom./Irr.	
4449	DDD. Bagamoyo	Bagayomo	Ruvu River	0.0850		
4553	Deocese of Morogoro	Morogoro	Mgololo River	0.0013	Ind./Irr.	
4570	The Procura, the Holy Fathers	Morogoro	Tangeni River	0.0006		4570 + another right
4602	Taj Mohamed	Morogoro	Mgera River	0.0079	Dom./Ind./Liv.	
4700	Director Sugarcane Breeding Sta. Kibaha	Kibaha	Ruvu River	0.5675	Dom./Irr/Ind.	
4805	United Farming Co.,Ltd.	Kibaha	Ruvu River	0.8942	Dom./Irr.	
4828	Bigwa Folk Dev. Colledge	Morogoro	Mgolole River	0.0050	Dom./Irr./Liv.	
4855	G.Sambetakis	Morogoro	Well near Ngere. River	0.0001	Dom./Irr.	
4859	A.N.C. Mazibabu	Morogoro	Ngemgere River	0.0167	Irrigation	Expired Mar.'92
4868	Wilson M.Karuwesa	Morogoro	Lukuyu River	0.0123	Dom./Irr./Liv.	Expired Mar.'92
4883	Registar SUA	Morogoro	Ngemgere River	0.0007	Irrigation	
	TOTAL			4.5667		

Ministry of Water, Energy and Minerals

Table 5.3 DATA ON LIVESTOCK IN BAGAMOYO DISTRICT

(1) LIVESTOCK RAISING

Unit: Head

Animals	1984	1985	1986	1987	1988	1989	1990
Cattle	55714	57385	59107	60880	62706	64587	66525
Goat	10028	10329	10639	10958	11287	11626	11975
Sheep	2844	2929	3017	3118	3201	3297	3396
Chicken	87555	90182	92887	95674	98544	101500	104545
Geese	5118	5267	5425	5588	5756	5930	6108
Guene	193	199	205	211	217	224	231
Turkey	15	16	17	18	19	20	21
Pig	769	792	816	840	865	874	900
Rabbit	63	65	67	69	71	73	75
Donkey	27	28	29	30	31	32	33

Source: D.A.D.O. Bagamoyo, 1992

(2) LIVESTOCK PRODUCTION

Products	Unit	1984	1985	1986	1987	1988
Beef	kg	19990	314818	193156	192801	175640
Goat meat	kg	274	480	1914	509	614
Mutton	kg	15	-	-	-	-
Pork	kg	105	2314	4498	1580	-
Eggs	No.	204299	33431	151207	226001	192842
Butter	kg	1050	-	9550	3350	4750
Milk	kg	107857	409676	207951	271967	268242
Chicken	kg	11457	11609	11341	4719	6769
Cattle skin*		1980	913	1773	2601	2876
Goats skin*		-	480	12	48	46
Sheep skin*		15	-	-	-	-

Note: * Piece.

Source: Agriculture and Livestock Dev.D.C.O. Bagamoyo 1992.

(3) CONSUMPTION OF ANIMAL PRODUCTS PER CAPITA PER YEAR

Products	Unit	1984	1985	1986	1987	1988
Beef	kg	0.2	1.8	1.12	1.12	1.02
Goat	kg	0.003	0.003	0.01	0.003	0.004
Chicken	kg	0.067	0.068	0.07	0.03	0.04
Pork	kg	-	0.013	0.03	0.01	0.001
Eggs	kg	2	0.19	1.5	1.3	1.12
Milk	kg	1.2	1.5	1.21	1.6	1.7
Butter	kg	0.007	0.009	0.01	0.02	0.03

Source: Agriculture and Livestock Dev. D.C.O. Bagamoyo 1992.

Table 5.4 DATA ON LIVESTOCK IN BAGAMOYO AND KIBAHA DISTRICTS

(1) LIVESTOCK GRAZING

District/Village	Cattle	Goats	Sheep	Chicken
Bagamoyo				
Ruvu Darajani	1486	289	275	1414
Vigwaza	934	10	-	1396
Visezi	2342	117	12	1451
Kibaha				
Mlandizi	38	1	-	2768
Vikuruti	32	-	-	1134
Mbwawa	-	32	-	2627
Miswe	-	19	-	2058
Kwala	2962	176	47	1250
Mwanabwito	215	31	7	344
Ruvu Mjuu	-	15	-	765
1984 Livestock Census.	8009	690	341	15207
As of 1993.	9996	841	426	18991

Source: Regional Commissioner's Office, Coast Region 1992

Table 5.5 DATA ON LIVESTOCK IN MOROGORO DISTRICT

(1) LIVESTOCK GRAZING

Ward	Cattle	Goats	Sheep	Pig	Rabbits
Kisaki		1112	195	180	58
Mangazi		26		18	120
Singisa		193	2	100	
Mzinga		3614	144		
Kingolwira	2604	854	247	320	282
Mikese	262	355	37	206	100
Tegetero	6	1750	1028		5
Kinole		371	35		18
Kiroka		518	48		15
Mkuyuni		921	63		
Mzunbe		424	30		
Melela	4368	1375	380	10	90
Mlali	788	8		190	56
Doma		442	23		
Kidugalo	2111	316	77	100	9
Tununguo	1280	137	105	106	6
Ngerengere		90	5	90	
Kibogwa		4689	153	70	
Kubungo		801	144		
Kisemu		1351	197	25	
Lundi		1313	34	35	
Mtonbozi		1929	140		
Tawa		1707	5		
Bunduki		1312	1406	1060	764
Kikeo		1657	117	905	908
Langali		2061	314	2446	1092
Tchenzewa		1272	271	2068	
Kasanga		1764	159		35
Kolero		1770	171		10
Mvuha		681	506		7
Total	11419	34813	6036	7929	3575

Source: D.A.D.O.Morogoro Rural 1984.

Table 5.6 WOOD CONSUMPTION IN THE RUVU RIVER BASIN

Year	Charcorl (bags)	Firewood (M3)	Logs (M3)	Withies (M3)	Poles (Unit)
Bagamoyo District					
85/86	326458	2121	1043	364	106
86/87	471423	1311	1385	242	254
87/88	311257	2223	341	172	150
88/89	244276	4107	14458		735
89/90	101391	1338	599	267	346
90/91	207789	1900	953		537
91/92	161605	2868	287	135	792
Average	260600	2267	2724	236	417
Kibaha District					
85/86	16412	1873	19	1741	2752
86/87	60310	1622	39	1444	1615
87/88	62484	2175	48	420	2875
88/89	46874	2298	53	618	1454
89/90	16265	1887		570	2006
90/91	10037	983	38	235	1064
91/92	7563	167	28	246	1744
Average	31421	1572	37	753	1930
Kisarawe District					
85/86	279623	19403	506	6364	92301
86/87	205082	16705	340	2144	29581
87/88	282309	13158	811	5160	27327
88/89	201000	8500	405	27200	21350
89/90	242000	9500	230	35000	24000
90/91	251000	8000	165	30000	28000
91/92	181772	16433	435	21190	41280
Average	234684	13100	413	18151	37691
Morogoro Rural District					
85/86	46287	12564	1853	unknowr	941
86/87	52106	5685	2297		2075
87/88	20654	2695	2005		1244
88/89	34165	1549	1595		953
89/90	71361	1463	1769		1051
90/91	31435	2510	1155		490
91/92	19227	1404	1585		500
Average	39319	3981	1751		1036

Source: District Forest Office.

Table 5.7 SUMMARY TABLE OF AGRICULTURAL PROJECT

Project Title	Location	Project Type	Potential Area (ha)	Project Area (ha)	Project Description
Bagamoyo Irrigation Development Project	Lower Ruvu	Extension	1,100	1,100	The project area comprises Bagamoyo Irrigation Development Project (BIDP) area of 1,000 ha and a private farm area of 100 ha BIDP is under phased development as follows; - Phase 1 Experimental Farm of 8ha (existing) - Phase 2 Pilot Farm of 100ha (under construction) - Phase 3 Full development of 1,000 ha by gravity irrigation (proposed) As the irrigation water resources, construction of large scale reservoir(s) is required for dry season.
Low-lift Pump Irrigation Project	Lower Ruvu	New Development	2,400	50 Pilot Farm	The project is requested by farmers. Irrigation will be done by small scale and removable type pumps utilizing existing ponds as a water resource. Equipment will be managed by farmers' group. As a trial, pilot farm of 50 ha will be a proper size of the project.
Makurunge Irrigation Project	Lower Ruvu	Rehabilitation	150	150	Reconstruction of the abandoned pump irrigation scheme. At present the area is cultivated by farmers from Makurunge village under rainfed condition.
Ruvu National Youth Irrigation Project	Lower Ruvu	Rehabilitation	800	200	Rehabilitation of the existing pump irrigation scheme of 24 ha and construction of remaining area of 176 ha The project is operated by National Youth Service.
Kidunda Irrigation Project	Middle Ruvu	New Development	26,500	15,600	Proposed project area is located in the floodplain of the Ruvu river. At present almost no agricultural activities in the area. Construction of Kidunda dam is necessary for this project.
Ngerengere Irrigation Project	Middle Ruvu	New Development	3,500	3,500	Proposed project area is located in the floodplain of the Ruvu river. At present no agricultural activities in the area. Construction of Ngerengere dam is necessary for this project.
Uluguru Mountains East Project	Upper Ruvu Uluguru Mountains	Rehabilitation and Development	16,000	16,000	Project component - Watershed management - Rehabilitation of trunk rural road (Morogoro-Kisaki) - Construction of agricultural marketing facilities especially for fruits
Mgeta Plain Irrigation Project	Mgeta Plain	New Development	25,000	7,000	Both banks of the Mgeta River are the potential area. However, existence of Selous Game Reserve limits the development of the right bank. Construction of Mgeta dam is necessary for this Project.
Mgeta Plain Mvuha Irrigation Project	Mgeta Plain	New Development	5,000	5,000	The potential area is estimated on the basis of the information from farmers. Basic data for development are not available. Farmers have a strong intention of irrigating for their field under rainfed condition.
Mlali Irrigation Project	Vicinity of Morogoro Uluguru Mountains	Rehabilitation	800	400	This project has a high priority in the FAO's study and in the Regional office. The project has suffered from serious sedimentation at the weir site. Irrigation facilities are also deteriorated. In addition to the existing area of 150 ha, an area of 250 ha is proposed to be extended.
Uluguru Mountains West Project	Uluguru Mountains West side slope	Rehabilitation and Development	2,000	2,000	Project component - Watershed management: Afforestation - Rehabilitation and improvement of existing traditional irrigation system for erosion control - Improvement of trunk rural road (approx. 42 km) The area is the Vegetable Zone for Dar Es Salaam and Morogoro city.

Table 5.8 LIST OF UNIT DIRECT CONSTRUCTION COST AND MATERIAL COST

(Unit : TSHs)

Item		Unit	Unit Price
Irrigation Works			
Excavation of Large Canal	: Common	m^3	411
Excavation of Small Canal	: Common	m^3	411
Embankment	: Excavated Materia	m^3	589
	: Borrowed Material	m^3	1,116
Backfill		m^3	1,116
Concrete	: Reinforced	m^3	23,588
	: Lining	m^3	16,000
	: Plain	m^3	22,463
Concrete Form		m^2	5,106
Reinforcement Bar		ton	218,000
Wet Stone Masonry		m^3	
Concrete Pipe	: D=600	m	22,229
	: D=800	m	28,200
	: D=1000	m	31,400
Land Leveling		ha	180,000
Road Works			
Rural Roads			
Rehabilitation of gravel road	: Easy	m	14,000
	: Medium	m	16,000
	: Heavy	m	18,000
Upgrading earth road to gravel	: Easy	m	20,000
	: Medium	m	23,000
	: Heavy	m	26,000
Periodic maintenance of gravel road	: Easy	m	16,000
	: Medium	m	18,000
	: Heavy	m	20,000
Bridge (cost per metre)	: Easy	m	14,000
	: Medium	m	18,000
	: Heavy	m	22,000
Trunk Roads		m	
Upgrading surface dress to asphalt concrete	: Easy	m	170,000
	: Medium	m	200,000
	: Heavy	m	240,000
Upgrading gravel to surface dress	: Easy	m	270,000
	: Medium	m	300,000
	: Heavy	m	330,000
Bridge (cost per metre)	: Easy	m	18,000
	: Medium	m	22,000
	: Heavy	m	28,000

Table 5.9 SUMMARY OF CONSTRUCTION COST OF IRRIGATION PROJECT

	Bagamoyo Irrigation Development	Low-lift Pump Irrigation	Makurunge Irrigation	Ruvu National Youth Irrigation	Kidunda Irrigation	Ngerengere Irrigation	Uluguru Mountain East	Mlali Irrigation	Mgeta Plain Irrigation	Mgeta Plain Mvuha Irrigation	Uluguru Mountain West
1 Construction Cost											
1.1 Preparatory Works	59,350	2,478	8,917	18,141	870,978	128,527	207,823	25,253	393,561	185,757	138,320
1.2 Irrigation & Drainage	297,040	0	11,158	96,574	4,910,300	611,693	0	95,857	2,334,011	848,009	0
1.3 On-farm Development	587,370	30,060	90,180	120,240	9,405,770	1,472,940	633,064	195,390	4,208,400	2,104,200	1,202,400
1.4 Land Development	175,860	9,000	27,000	36,000	2,816,100	441,000	0	45,000	1,260,000	630,000	0
1.5 Other Major Works	126,720	10,500	50,000	110,000	287,385	44,900	3,523,400	168,808	68,800	132,930	1,564,000
1.5.1 Intake Facilities	17,220				287,385	44,900		4,680	68,800	34,450	
1.5.2 Intake Weir	109,500							164,128		98,480	
1.5.3 Access Road Impro.							2,893,400				1,564,000
1.5.4 Fruit Packing, etc.							630,000				
1.5.5 Pump House			50,000	100,000							
1.5.6 Other Works		10,500		10,000							
Sub-Total of Item 1	1,246,340	52,038	187,255	380,954	18,290,532	2,699,060	4,364,287	530,308	8,264,771	3,900,895	2,904,720
1.6 Overhead, Profit	124,634	5,204	18,726	38,095	1,829,053	269,906	436,429	53,031	826,477	390,090	290,472
1.7 Tax											
Total of Item 1	1,370,974	57,242	205,981	419,050	20,119,586	2,968,966	4,800,716	583,338	9,091,248	4,290,985	3,195,192
2 Land Acquisition, Resettlement and Compensation	27,419	1,145	4,120	8,381	402,392	59,379	96,014	11,667	181,825	85,820	63,904
3 O & M Equipment	34,274	0	5,150	10,476	502,990	74,224	120,018	14,583	227,281	107,275	79,880
4 Administration	34,274	1,431	5,150	10,476	502,990	74,224	120,018	14,583	227,281	107,275	79,880
5 Physical Contingency	146,694	5,982	22,040	44,838	2,152,796	317,679	513,677	62,417	972,764	459,135	341,886
Total of Item 1 to 5	1,613,636	65,799	242,439	493,222	23,680,752	3,494,473	5,650,443	686,589	10,700,399	5,050,489	3,760,741
6 Engineering Services	154,577	6,297	23,224	47,248	2,268,483	334,751	541,281	65,771	1,025,038	483,809	360,258
Grand Total (1000 TShs)	1,768,213	72,096	265,664	540,470	25,949,236	3,829,224	6,191,723	752,361	11,725,438	5,534,298	4,120,999
Grand Total (1000 US$)	3,844	157	578	1,175	56,411	8,324	13,460	1,636	25,490	12,031	8,959

Table 5.10 CALCULATION OF INCREMENTAL BENEFIT BY PROJECT

Project Title	Without Project Condition			With Project Condition			Incremental Production	Market Price by Crops	Incremental Benefit*
	Planted Area (ha)	Yield (ton/ha)	Production (ton)	Planted Area (ha)	Yield (ton/ha)	Production (ton)	(ton)	(TShs/kg)	(1,000 TShs)
Lower Ruvu									
1 Bagamoyo Irrigation Development									
Paddy	108	4.5	486	1,500	4.5	6,750	6,264	190	238,032
Maize		-		217	3.6	781	781	42	9,843
								Total 1	**247,875**
2 Low-lift Pump Irrigation									
Paddy	20	1.2	24	70	3.8	266	242	190	9,196
Maize	30	1.2	36	10	3.6	36	0	42	0
								Total 2	**9,196**
3 Makurunge Irrigation									
Paddy		-		200	3.8	760	760	190	28,880
Maize		-		30	3.6	108	108	42	1,361
								Total 3	**30,241**
4 Ruvu National Youth Irrigation									
Paddy		-		300	3.8	1,140	1,140	190	43,320
Maize		-		40	3.6	144	144	42	1,814
								Total 4	**45,134**
Middle Ruvu									
5 Kidunda Irrigation									
Paddy	0	-		18,770	3.8	71,326	71,326	190	2,710,388
Maize	0	-		6,260	3.6	22,536	22,536	42	283,954
								Total 5	**2,994,342**
6 Ngerengere Irrigation									
Paddy	0	-		2,940	3.8	11,172	11,172	190	424,536
Maize	0	-		980	3.6	3,528	3,528	42	44,453
								Total 6	**468,989**
Upper Ruvu									
7 Uluguru Mountain East			65,600			65,600		140	2,755,200
								Total 7	**524,800**
8 Mlali Irrigation									
Paddy		1.8	0	400	3.8	1,520	1,520	190	57,760
Maize	60	1.4	84	240	3.6	864	780	42	9,828
									67,588
9 Mgeta Plain Irrigation									
Paddy		1.8	0	2,800	3.8	10,640	10,640	190	404,320
Maize		1.4	0	5,600	3.6	20,160	20,160	42	254,016
Cotton		1.6	0	2,800	2.4	6,720	6,720	70	141,120
								Total 9	**799,456**
10 Mgeta Plain Mvuha Irrigation									
Paddy		1.8	0	1,400	3.8	5,320	5,320	190	202,160
Maize		1.4	0	2,800	3.6	10,080	10,080	42	127,008
Cotton		1.6	0	1,400	2.4	3,360	3,360	70	70,560
								Total 10	**399,728**
11 Uluguru Mountain West			148,675			148,675	0	40	1,189,400
								Total 11	**1,189,400**

Incremental Benefit is calculated deducting production cost, transportation cost, etc.

Table 5.11 WEIGHT OF ASPECTS / FACTORS

Conformity with National Policy					Socio-economic aspect	
Long Term National Plan					**Population Served**	
1. Attaining self-sufficiency	◎	2 ○	1 ×	0	Estimated population in the area	
2. Increasing agricultural diversification	◎	2 ○	1 ×	0	more than 20,000	5
3. Providing raw materials for industry	◎	2 ○	1 ×	0	more than 15,000	4
4. Production for Export	◎	2 ○	1 ×	0	more than 10,000	3
5. Deriving from livestock resources	◎	2 ○	1 ×	0	more than 5,000	2
Full Score		10			less than 5,000	1
National Irrigation Policy					Estimated population density (no./km2)	
1. Economic viability	◎	2 ○	1 ×	0	more than 200	5
2. State farm considered ending	No state farm exist in the				more than 150	4
3. State farm to investor or	Study Area.				more than 100	3
smallholder's organization					more than 50	2
4. New project to private sector	◎	2 ○	1 ×	0	50 to 0	1
5. Support to smallholder	◎	2 ○	1 ×	0	**Full Score**	10
6. Strong request by farmer's group	◎	2 ○	1 ×	0	**Accessibility**	
7. Independency from Gov. interventions	◎	2 ○	1 ×	0	Distance from national trunk road (km)	
Full Score		10			Less than 5km	10
Project Ranking by ISID	Ranking top 10 %			10	5 - 10 km	8
	Ranking top 30 %			8	10 - 20 km	6
	Ranking top 60 %			6	20 - 50 km	4
	Ranking top 80 %			4	50 -100 km	2
	Others			2	more than 100km	1
Full Score	10				**Full Score**	10
Sub-Total 1	30				**Sub-Total 2**	20

Technical Aspect		Estimated Cost and Benefit	
Water Resources		**Total construction cost (million Tshs)**	
Stable water resources without condition	10	less than 500	5
Stable water resources with one condition	8	1,000 - 500	3
Stable water resources with two conditions	6	more than 1,000	1
Unstable water resources	4	**Full Score**	5
Full Score	10	**Cost per hectares (1,000 Tshs/ha)**	
Water Quality		less than 1,380	5
Suitable	3	1,380 - 2,300	3
Partly unsuitable	2	more than 2,300	1
Unsuitable	0	**Full Score**	5
Full Score	3	**Benefit per hectares (1,000 Tshs/ha)**	
Soil Condition		more than 10,000	5
Suitable	3	10,000 - 5,000	3
Unsuitable	0	less than 5,000	1
Full Score	3	**Full Score**	5
Easiness of project implementation		**B/C Ratio**	
On-going	4	more than 5	15
Existing	3	3 - 5	10
Planing Stage	2	Less than 3	5
Abandoned	1	**Full Score**	15
Full Score	4		
		Sub-Total	30
Sub-Total	20		
TOTAL SCORE =	**Sub-total (1+ 2 + 3 + 4)**	=	100

Table 5.12 PRIORITY OF AGRICULTURAL PROJECT IN THE RUVU BASIN

	Item \ Project Title	1. Bagamoyo Irrigation Development Project	2. Pilot Farm Low-lift of Pump Irrigation Project	3. Existing Pump Irrigation Schemes Rehabilitation Project		4. Middle Ruvu Irrigation Project		5. Uluguru Mountain East Project	6. Mlali Irrigation Project	7. Mgeta Plain Irrigation Development Project		8. Uluguru Mountain West Project
		Lower Ruvu Valley				Middle Ruvu Valley		Upper Ruvu Valley				
			Low-lift Pump Irrigation Project	Makurunge Irrigation Project	Ruvu National Youth Irrigation Project	Kidunda Irrigation Project	Ngerengere Irrigation Project			Mgeta Plain Irrigation Project	Mgeta Plain Mvuha Irrigation Project	(Mgeta traditional irrigation)
General Feature of the Project	*Project Description*											
	Potential Area in Gross (ha)	1,000	2,400	150	800	26,500	3,500	16,000	800	25,000	5,000	2,000
	Proposed Project Size in Net (ha)	1,100 including area of private farm	50 5 nos. of pilot schemes	150	200	15,600	2,450	Potential area for the Area is estimated based on cultivation and production records	400	7,000	Potential area is estimated based on villager's information	2,000 Data from district office
	Present Status	Pilot farm of 100ha is under Construction	Small-scale irrigation by manpower	Abandoned	Farm exists but no irrigation since 1978	African Cultivation	African Cultivation	Existing "Fruit (Orange) Zone" Existing Area = 2,624 ha	Existing but no irrigation area because of siltation at weir site	Rainfed farming	Rainfed farming	Existing "Vegetable Zone" for Morogoro and DSM
	Prospective Project Component	Irrigation and Drainage system - Main Irrigation : 12 km - Secondary : 10 km - Drainage : 12 km Heightening of Lower Ruvu NUWA intake will be required for gravity irrigation.	Pilot farm construction : 100ha - 5 canals (0.5 km each) - Supply of Low-lift pumps - Construction of workshops - Training programmes to farmers	- Reconstruction of Pumping house - Re-excavation of canals Irrigation canal : 2 km	- 2 pumping stations - Rehabilitation of existing canal system for 24 ha - Construction of new canal system for 176 ha - Supply of machinery - Rehabilitation of Godown	Irrigation & Drainage Canals Main Irrigation : 51 km Secondary : 122 km Drainage : 124 km	Irrigation and Drainage canals - Main Irrigation : 11 km - Secondary : 17 km - Drainage : 14 km Construction of basic social infrastructures	Soil conservation : 16,000 ha Improvement of trunk rural road Bigwa - Mkuyuni : 37 km Storage godowns : 1 Sorting and packing facilities : 1	Irrigation and Drainage canals - Main Irrigation : 2 km - Secondary : 10 km - Drainage : 9 km - Intake Weir : L=50 m - Intake Facility	Irrigation and Drainage canals - Main Irrigation : 40 km - Secondary : 65 km - Drainage : 50 km Rehabilitation of rural road - Morogoro - Kisaki : 140 km	Irrigation and Drainage canals - Irrigation canals Main & Secondary : 53km - Drainage canals : 28km Intake Weir : 1 no. Rehabilitation of rural road - Mvuha - site : 15 km	Soil erosion control : 2,000 ha Rehabilitation of rural road Mlali - Langali : 15 km Langali - Nyandira : 5 km Improvement of irrigation canals 68 systems : 170 km Domestic piped water supply
Conformity with Government Policy	**Long Term National Plan**											
	1. Attaining self-sufficiency	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎
	2. Increasing agricultural diversification	○	○	○	○	○	○	◎	○	○	○	◎
	3. Providing raw materials for industry	X	X	X	X	○	○	◎	○	○	○	○
	4. Production for Export	X	X	X	X	○	○	◎	X	X	X	◎
	5. Deriving from livestock resources	X	X	X	X	○	○	X	X	X	X	X
	National Irrigation Policy											
	1. Economic viability											
	2. State farm considered ending	-	-	-	-	-	-	-	-	-	-	-
	3. State farm to investor or smallholder's organization	-	-	-	-	-	-	-	-	-	-	-
	4. New project to private sector	X	X	X	X	◎	◎	X	○	○	X	X
	5. Support to smallholder	◎	◎	◎	X	○	X	◎	◎	○	◎	◎
	6. Strong request by farmer's group	◎	◎	○	X	X	X	○	◎	○	◎	◎
	7. Independency from Gov. interventions	○	○	○	X	◎	◎	○	○	○	○	○
	Project Ranking by ISID	No.1 out of 9 projects in Coast Region	Newly Identified Not yet included in the ranking	No.5 out of 9 projects	No.9 out of 9 projects	Newly Identified	Newly Identified	Newly Identified	No.5 out of 16 projects in Morogoro Region	Newly Identified	Newly Identified	No.3 out of 16 projects in Morogoro Region
	Weighted Sub-Total Score	*18*	*12*	*13*	*5*	*15*	*14*	*16*	*18*	*12*	*13*	*20*
Socio-economic Aspect	**Population Served**											
	Estimated population in the area	22,900	25,000	1,700	National Youth Service	5,200	5,200	45,000	12,200	29,500	8,100	32,600
	Estimated population density (no./km2)	280	150	30		15	15	140	150	70	100	100
	Accessibility											
	Distance from national trunk road (km)	*9.5*	*10*	*10 (from Bagamoyo)*	*0.1*	*90*	*70*	*40*	*8 (3km form old trunk)*	*110*	*95*	*30*
	Road condition in the Area	Accessibility is hard in the low-lying area for 2.5 km in flood season.	Access road is hardly passable in rainy season.	Road from BIDP to site is not passable in rainy season. The Ruvu river crossing by a ferry is required.	The project area is located besides the Morogoro - DSM Highway	Secondary rural roads connect the project area to a trunk road. Condition is seriously bad in rainy season	Secondary rural roads connect the project area to a trunk road. Condition is seriously bad in rainy season.	Major rural road "Morogoro - Kisaki" passes through the area. However, bad road condition is a serious constraint of the area.	Accessibility of this project is rather good.	Condition of the "Mkuyuni - Mvuha" section is serious in rainy season. Mngazi to Kisaki is not passable in rainy season.	Access road from Mvuha to the project area is not passable in rainy season.	Road in mountainous section of "Mlali - Nyandira" is seriously damaged. Section from Langali to Nyandira is not passable by a jeep.
	Weighted Sub-Total Score	18	17	10	10	5	5	12	15	9	7	12
Technical Aspect	**Water Resources**	**The Ruvu river** on following conditions - Construction of Dam(s) - Improvement of Lower NUWA intake weir or construction of new weir	**The Ruvu river** on following condition - Construction of Dam(s) for the whole potential area	**The Ruvu river** on following condition - Construction of Dam(s) for the whole potential area	**The Ruvu river** on following condition - Construction of Dam(s) for the whole potential area	**The Ruvu river** on following condition - Construction of Kidunda Dam	**The Ruvu river** on following condition - Construction of Ngerengere Dam	Mainly depend on Rainfall	**The Mlali river**	**The Mgeta river** on following condition - Construction of Mgeta Dam	**The Mvuha river** Hydrological data on the river is not available. Further study will be inevitable.	**The Mgeta river and small seasonal rivers and streams**
	Water Quality	Suitable for Irrigation	Water quality of the Mkombezi river is not suitable.	Suitable for Irrigation	Suitable for Irrigation	Suitable for Irrigation	Suitable for Irrigation	Suitable for Irrigation	Suitable for Irrigation	Suitable for Irrigation	Suitable for Irrigation	Suitable for Irrigation
	Soil Condition	Suitable for Paddy	Suitable for Paddy	Suitable for Paddy	Suitable for Paddy	No data on suitability for cultivation	No data on suitability for cultivation	Suitable for most crops	Suitable for most crops	Suitable for most crops except north part of Gombo	Suitable for most crops	Suitable for most crops
	Easiness of project implementation	On-going	Preliminary plan	**Abandoned**	**Abandoned** (no farming)	Preliminary plan	Preliminary plan	Existing	Existing	Preliminary plan	Preliminary plan	Existing
	Weighted Sub-Total Score	16	15	15	15	15	15	13	17	16	14	15
Economic Aspect	**Estimated Cost and Benefit**											
	Total construction cost (million Tshs)	1,768	72	265	540	25,949	3,829	6,192	752	11,725	5,534	4,120
	Cost per hectares (1,000 Tshs/ha)	1,630	1,442	1,771	2,702	1,658	1,563	2,360	1,881	1,675	1,581	2,060
	Benefit per hectares (Tshs/ha)	6,854	5,518	6,048	6,770	5,740	5,743	6,000	5,069	3,073	3,073	17,841
	B/C Ratio	4.20	3.83	3.42	2.51	3.46	3.67	2.54	2.69	1.83	1.94	8.66
	Weighted Sub-Total Score	19	21	21	12	17	17	12	14	12	14	26
Evaluation	**Total Score**	71	65	59	42	52	51	53	64	49	48	73
	Comments											
	Priority	A*	A	B	C	B	B	B	A	C	C	A

Note ; ◎ Fitted ○ Partly Fitted X Unfitted Priority A : Top Priority , A* : Top Priority with conditions , B : Priority , C : Low Priority

Table 6.1 RESULTS OF FLOOD ROUTINE ANALYSIS AT LOWER RUVU FLOODPLAIN

Section No.	Chainage (km)	Lowest River Bed EL(m)	High Water Channel		Water Level in m				
			Bank EL(m)	Mean EL(m)	635m3/s EL(m)	820m3/s EL(m)	1005m3/s EL(m)	1255m3/s EL(m)	1460m3/s EL(m)
0	0.00	-3.70	3.00	3.00	2.30	2.30	2.30	2.30	2.30
1	15.20	-7.70	1.90	1.75	2.77	2.97	3.15	3.38	3.55
2	23.80	-2.59	1.48	2.60	3.12	3.34	3.54	3.78	3.96
Ferry	25.50	-4.90			3.22	3.49	3.64	3.88	4.06
	25.51	-4.90			3.31	3.61	3.84	4.32	4.74
2C	26.30	-2.85	1.70	2.50	3.35	3.64	3.88	4.35	4.76
3	31.90	-4.32	3.30	3.54	3.97	4.25	4.48	4.82	5.13
4	42.50	-0.83	6.67	7.21	6.57	6.79	6.96	7.14	7.27
5	51.20	2.16	9.50	8.04	8.80	9.01	9.18	9.39	9.54
6	61.70	4.82	12.70	11.40	12.02	12.21	12.38	12.58	12.72
7	70.30	9.41	15.41	13.90	14.50	14.66	14.80	14.99	15.12
Bridge	79.72	10.65			17.58	17.78	17.94	18.14	18.29
	79.73	10.65			18.50	19.35	19.61	19.77	19.99
8	80.60	11.14	17.84	16.90	18.54	19.37	19.63	19.80	20.01
9	94.20	16.31	21.00	19.80	21.13	21.39	21.63	21.89	22.10
10	107.10	20.52	25.30	23.60	24.85	25.02	25.18	25.38	25.53
10A	113.20	22.04	27.22	25.50	26.49	26.68	26.84	27.03	27.17
R/W	113.30	20.38			27.25	27.25	27.25	27.25	27.25
	113.31	20.38			27.36	27.73	28.10	28.20	28.31
11	115.60	22.27	27.80	26.00	27.48	27.84	28.19	28.31	28.43
12	126.30	26.12	31.38	29.60	30.33	30.49	30.64	30.80	30.93
13	134.70	28.49	32.51	32.70	33.13	33.31	33.45	33.65	33.79
14	142.80	31.47	36.36	35.40	36.00	36.23	36.41	36.62	36.78
16	156.30	35.90	39.90	41.15	41.71	41.94	42.13	42.37	42.54

Table 6.2 SUMMARY OF FLOOD CONTROL FACILITIES FOR IRRIGATION PROJECTS

No.	Name of Scheme	Construction of Flood Dyke				Construction of Drainage Outlets (Sluices)			
		Length of Dyke (km)	Excavation & Stripping (m3)	Embankment (m3)	Slope Protection Sodding (m2)	No. of Sluices	Concrete* (m3)	Flap Gates 1500 x 1500 mm	Slide Gates 1500 x 1500 mm
1	Bagamoyo	13.5	90,000	250,000	140,000	8	1,000	16	16
2	Low-lift Pump P/S	11.5	71,000	173,000	73,000	2	250	4	4
3	Makurunge	3.5	23,000	61,000	25,000	1	125	2	2
4	Ruvu National Youth	6.0	20,000	68,000	36,000	2	250	2	2
5	Kidunda	28.5	180,000	500,000	210,000	15	1,875	30	30
6	Mgeta	48.0	310,000	845,000	360,000	10	1,250	20	20

Note ; reinforced concrete with strength of 210 kgf/cm2, and reinforcement bar and forms per concrete 1 m3 are assumed at 100 kg and 3.5 m2, respectively.

Table 7.1 MAIN FEATURES OF 23 DAM SITES IDENTIFIED BY THE PREVIOUS STUDY

No.	Name of Dam Site	Catchment Area	Dam Height	Hydrological Feature			Storage Efficiency of Reservoir				Requirement of New Access road		
				Annual rainfall	Runoff Coefficient	Inflow Rate	Annual Inflow Volume	Reservoir Storage Capacity	Dam Embank. Volume	Storage Efficiency	Improve. of Existing road	New road Construct.	Total
		(km2)	(m)	(mm)	(%)	(mm/year/km2)	(Mill. m3/year)	(Mill. m3)	(Thous. m3)		(km)	(km)	
		(1)		(2)	(3)	(2)x(3)/100	(4)x(1)/1000	(6)	(7)	(6)/(7)	(9)	(10)	(9)+(10)
1	Mgeta	914	21	1,220	35	427	390	57	405	0.14	121	10	131
2	Rudete	249	20	1,150	33	383	95	13	421	0.03	121	12	133
3	Msoro	899	5	1,080	19	205	184	13	230	0.06	125	8	133
4	M/LB/R1	54	20	1,110	55	611	33	5	380	0.01	116	6	122
5	Mngazi	223	20	1,110	50	555	124	13	278	0.04	110	4	114
6	Bwakira	75	20	1,110	55	611	46	9	278	0.03	102	2	104
7	Dutumi	114	20	1,110	45	500	57	4	464	0.01	95	3	98
8	Ngerengere	2,701	17	970	5	49	131	84	340	0.25	59	3	62
9	Ruvu-Mgeta	3,672	21	1,340	20	268	984	1,665	1,542	1.08	85	4	89
10	Mkulazi	352	16	1,050	10	105	37	62	221	0.28	85	17	102
11	LB/R1	47	9	940	6	56	3	6	192	0.03	40	2	42
12	Msus	526	15	930	6	56	29	37	439	0.08	0	12	12
13	Mbiki (Major)	492	15	940	6	56	28	26	508	0.05	6	1	7
14	Mbiki (Minor)	91	14	940	6	56	5	11	351	0.03	13	1	14
15	Mkombezi	588	18	1,030	6	62	36	47	257	0.18	26	3	29
16	Msigwe	205	17	1,020	6	61	13	39	802	0.05	31	0	31
17	RB/R1	210	14	890	5	45	9	19	141	0.14	54	18	72
18	RB/R2	129	10	890	5	45	6	7	256	0.03	43	9	52
19	RB/R3	67	8	890	5	45	3	6	112	0.05	54	5	59
20	Banda	311	12	920	5	46	14	13	134	0.09	25	3	28
21	Mlandisi	78	17	950	5	48	4	9	229	0.04	7	1	8
22	Mbwawa	184	27	1,090	5	55	10	46	496	0.09	11	4	15
23	Chombe	189	15	1,090	5	55	10	12	164	0.07	30	2	32

Note

4 dam sites, the Mgeta (No.1), Negerengere (No.8), Ruvu-Mgeta (NO.9) and Mkombezi (No.15) are selected by the French study as the promising dam sites in the Ruvu river basin.

Table 7.2 RESULTS OF OVERALL ASSESSMENT OF 23 DAM SITES IDENTIFIED BY THE PREVIOUS STUDY

No.	Items of Rating					Overall Rating
	(1) Name of Dam Site	(2) Geological Condition	(3) Hydrological Condition	(4) Storage Efficiency	(5) Accessib-ility	
1	Mgeta	B	B	C	C	B
2	Rudete	A	D	D	C	B
3	Msoro	A	C	D	C	A
4	*M/LB/R1*	B	E	D	C	C
5	Mngagi	B	C	D	B	C
6	Bwakira	B	E	D	B	D
7	Dutumi	B	D	D	B	E
8	Ngerengere	A	C	C	A	A
9	Kidunda	C	A	A	B	B
10	Mkulazi	C	E	C	D	E
11	LB/R1	B	E	D	A	D
12	Msus	C	E	D	C	E
13	Mbiki (Major)	C	E	D	A	E
14	Mbiki (Minor)	A	E	D	A	D
15	Mkombezi	A	E	C	A	D
16	Msigwe	A	E	D	A	D
17	RB/R1	A	E	C	D	D
18	RB/R2	B	E	D	C	E
19	RB/R3	A	E	D	A	D
20	Banda	B	E	D	A	E
21	Malandisi	A	E	D	A	D
22	Mbwawa	B	E	D	A	E
23	Chmbe	B	E	D	A	E

Note

Rating standard applied

(1). Geological condition
- A : No geological problem identified
- B : Possibility of existence of major fault at dam site or thick alluvial deposit at dam site
- C : Possibility of existence of limestone at dam and reservoir area

(2) Hydrological Condition
- A : IR>200 and IV>450
- B : IR<200 and IV>450
- C : 100<IV<450
- D : 50<IV<100
- E : IV<50

where,
- IR : Inflow rate
- IV : Annual Inflow volume

(3) Storage efficiency
- A : SE>1.0
- B : 0.5<SE<1.0
- C : 0.1<SE<0.5
- D : SE<0.1

Where,
SE : Storage efficiency

(4) Accessibility
- A : Ln<5.5 and Li<60
- B : Ln<5.5 and Li>60
- C : 5.5<Ln<15
- D : Ln>15

where,
- Ln : Length of new access road required (km)
- Li : Length of existing access road improved (km)

Table 8.1 WATER BALANCE BY DEVELOPMENT SCENARIO

(Unit : m3/sec)

	Component of Water Balance	Scenario-1 Dam Name	Scenario-1 Outflow	Scenario-2 Dam Name	Scenario-2 Outflow
1	Regulated Outflow from upstream dam(s)	(1)Kidunda	28.16	(1)Ngerengere	1.81
				(2)Mgeta	7.11
		Total-1	28.16	Total-1	8.92
2	95 % Dependable Discharge Yielded in Area not Covered by Upstream Dam(s)	(1)U.R.I.S.	9.06	(1)U.R.I.S.	9.06
		(2)Kidunda	-8.60	(2)Ngerengere	-0.02
				(3)Mgeta	-1.38
		Total-2	0.46	Total-2	7.66
3	River Maintenance Flow for Downstream Reach of U.R.I.S.	(1)River flow*	4.12	(1)River flow*	4.12
		(2)Irrigation	1.00	(2)Irrigation	1.00
		Total-3	5.12	Total-3	5.12
4	Water Demand in Year 2020		11.23		11.23
5	Water Balance (Available (Discharge for New Irrigation Development)		12.27		0.23

Note

1. U.R.I.S. means existing upper Ruvu intake site.
2. The water balance is made on the basis of annual mean discharge data.
3. *; the required minimum river maintenance flow is the minimum mean monthly discharge at the existing gauging station 1H8.
4. Development Scenarios

   Senario-1 : (Kidunda dam)

   Senario-2 : (Mgeta dam) + (Ngerengere dam)

Table 8.2 BREAKDOWN OF CONSTRUCTION COST FOR KIDUNDA DAM (1/2)

Item No.	Work	Unit	Quantity	Foreign Currency (US$)		Local Currency (US$)		Total (US$)	
				Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
I	Direct Construction Cost								
1.	Preparatory Works (General)	L.S.			5,451,000		1,450,000		6,901,000
2.	Permanent Access Road								
	2.1 Improvement of existing rural road	km	90	70000.00	6,300,000	30000.00	2,700,000	100,000.00	9,000,000
	2.2 Construction of new access road	km	10	105000.00	1,050,000	45000.00	450,000	150,000.00	1,500,000
	(Subtotal-2)				7,350,000		3,150,000		10,500,000
3.	Diversion Tunnel and Intake Tunnel								
	3.1 Excavation at tunnel portals,common	m3	70,000	3.40	238,000	0.90	63,000	4.30	301,000
	3.2 Excavation at tunnel portals,rock	m3	210,000	11.50	2,415,000	2.70	567,000	14.20	2,982,000
	3.3 Tunnel excavation	m3	16,000	59.50	952,000	20.00	320,000	79.50	1,272,000
	3.4 Steel support	ton	62	1173.00	72,726	117.00	7,254	1,290.00	79,980
	3.5 Concrete for tunnel lining	m3	4,100	111.20	455,920	55.90	229,190	167.10	685,110
	3.6 Plug concrete	m3	4,000	85.60	342,400	43.00	172,000	128.60	514,400
	3.7 Reinforcement bar	ton	120	528.90	63,468	137.70	16,524	666.60	79,992
	3.8 Backfill grouting	m3	550	90.60	49,830	23.20	12,760	113.80	62,590
	3.9 Others(5 %)	L.S.			229,467		69,386		298,854
	(Subtotal-3)				4,818,811		1,457,114		6,275,926
4.	Main Dam								
	4.1 Excavation,common	m3	22,000	3.40	74,800	0.90	19,800	4.30	94,600
	4.2 Excavation,rock	m3	67,000	11.50	770,500	2.70	180,900	14.20	951,400
	4.3 Embankment,core	m3	240,000	7.10	1,704,000	1.80	432,000	8.90	2,136,000
	4.4 Embankment,filter	m3	110,000	34.80	3,828,000	16.10	1,771,000	50.90	5,599,000
	4.5 Embankment,rock	m3	420,000	12.60	5,292,000	3.00	1,260,000	15.60	6,552,000
	4.6 Blanket grouting	m	8,900	76.50	680,850	23.00	204,700	99.50	885,550
	4.7 Curtain grouting	m	38,000	96.50	3,667,000	27.00	1,026,000	123.50	4,693,000
	4.8 Crest road	m	4,400	70.00	308,000	30.00	132,000	100.00	440,000
	4.9 1 Measuring apparatus(1%)	L.S.			163,252		50,264		213,516
	4.10 Others(5 %)	L.S.			824,420		253,833		1,078,253
	(Subtotal-4)				17,312,822		5,330,497		22,643,319
5.	Spillway								
	5.1 Excavation,common	m3	65,000	3.40	221,000	0.90	58,500	4.30	279,500
	5.2 Excavation,rock	m3	195,000	11.50	2,242,500	0.70	136,500	12.20	2,379,000
	5.3 Concrete,gravity dam	m3	19,000	107.00	2,033,000	52.00	988,000	159.00	3,021,000
	5.4 Reinforcement bar	ton	790	503.80	398,002	137.70	108,783	641.50	506,785
	5.5 Anchor bar	m	670	11.40	7,638	1.90	1,273	13.30	8,911
	5.6 Spillway bridge	m	52	12600.00	655,200	5400.00	280,800	18,000.00	936,000
	5.7 Others(5 %)	L.S.			277,867		78,693		356,560
	(Subtotal-5)				5,835,207		1,652,549		7,487,756

(Continued)

Table 8.2 BREAKDOWN OF CONSTRUCTION COST FOR KIDUNDA DAM (2/2)

Item No.	Work	Unit	Quantity	Foreign Currency (US$)		Local Currency (US$)		Total (US$)	
				Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
6.	Architectural Buildings								
	6.1 Control house	m2	200	540.00	108,000	360.00	72,000	900.00	180,000
	6.2 Valve house	m2	50	540.00	27,000	360.00	18,000	900.00	45,000
	6.3 Gate house	m2	30	540.00	16,200	360.00	10,800	900.00	27,000
	(Subtotal-6)				151,200		100,800		252,000
7.	Metal Work								
	7.1 Diversion gates	ton	52	5830.00	303,160	650.00	33,800	6,480.00	336,960
	7.2 Spillway gate(radial)	ton	300	8330.00	2,499,000	930.00	279,000	9,260.00	2,778,000
	7.3 Intake gate	ton	9	7500.00	67,500	830.00	7,470	8,330.00	74,970
	7.4 Outlet facilities	ton	50	15750.00	787,500	1750.00	87,500	17,500.00	875,000
	7.5 Steel pipes(inc. penstock for hydropower)	ton	146	3300.00	481,800	370.00	54,020	3,670.00	535,820
	(Subtotal-7)				4,138,960		461,790		4,600,750
8.	Powerhouse and Generating Equipment	L.S.			14,908,000		2,352,000		17,260,000
	Total of Direct Construction Cost (I)				59,966,000		15,954,750		75,920,750
II	Land Aquisition and Compensation	L.S.			0		2,120,000		2,120,000
III	Administration Expenses	L.S.			0		759,000		759,000
IV	Engineering Services (Detailed design and supervision)	L.S.			7,744,000		1,367,000		9,111,000
	Total(I to IV)				67,710,000		20,200,750		87,910,750
V	Physical Contengency (15%)	L.S.			10,156,000		3,030,000		13,186,000
	Grand Total				77,866,000		23,230,750		101,096,750

Table 8.3 BREAKDOWN OF CONSTRUCTION COST FOR MGETA DAM (1/2)

Item No.	Work	Unit	Quantity	Foreign Currency (US$)		Local Currency (US$)		Total (US$)	
				Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
I	Direct Construction Cost								
1.	Preparatory Works (General)	L.S.			5,959,000		1,775,000		7,734,000
2.	Permanent Access Road								
	2.1 Improvement of existing rural road	km	130	70000.00	9,100,000	30000.00	3,900,000	100000.00	13,000,000
	2.2 Construction of new access road	km	12	105000.00	1,260,000	45000.00	540,000	150000.00	1,800,000
	(Subtotal-2)				10,360,000		4,440,000		14,800,000
3.	Diversion Tunnel and Intake Tunnel								
	3.1 Excavation at tunnel portals,common	m3	11,000	3.40	37,400	0.90	9,900	4.30	47,300
	3.2 Excavation at tunnel portals,rock	m3	32,000	11.50	368,000	2.70	86,400	14.20	454,400
	3.3 Tunnel excavation	m3	15,000	59.50	892,500	20.00	300,000	79.50	1,192,500
	3.4 Steel support	ton	78	1173.00	91,494	117.00	9,126	1290.00	100,620
	3.5 Concrete for tunnel lining	m3	4,600	111.20	511,520	55.90	257,140	167.10	768,660
	3.6 Plug concrete	m3	4,900	85.60	419,440	43.00	210,700	128.60	630,140
	3.7 Reinforcement bar	ton	140	528.90	74,046	137.70	19,278	666.60	93,324
	3.8 Backfill grouting	m3	620	90.60	56,172	23.20	14,384	113.80	70,556
	3.9 Others(5 %)	L.S.			122,529		45,346		167,875
	(Subtotal-3)				2,573,101		952,274		3,525,375
4.	Main Dam								
	4.1 Excavation,common	m3	28,000	3.40	95,200	0.90	25,200	4.30	120,400
	4.2 Excavation,rock	m3	82,000	11.50	943,000	2.70	221,400	14.20	1,164,400
	4.3 Embankment,core	m3	420,000	7.10	2,982,000	1.80	756,000	8.90	3,738,000
	4.4 Embankment,filter	m3	180,000	34.80	6,264,000	16.10	2,898,000	50.90	9,162,000
	4.5 Embankment,rock	m3	1,500,000	12.60	18,900,000	3.00	4,500,000	15.60	23,400,000
	4.6 Blanket grouting	m	4,800	76.50	367,200	23.00	110,400	99.50	477,600
	4.7 Curtain grouting	m	12,000	96.50	1,158,000	27.00	324,000	123.50	1,482,000
	4.8 Crest road	m	800	70.00	56,000	30.00	24,000	100.00	80,000
	4.9 Measuring apparatus(1%)	L.S.			307,654		88,590		396,244
	4.10 Others(5 %)	L.S.			1,553,653		447,380		2,001,032
	(Subtotal-4)				32,626,707		9,394,970		42,021,676
5.	Spillway								
	5.1 Excavation,common	m3	50,000	3.40	170,000	0.90	45,000	4.30	215,000
	5.2 Excavation,rock	m3	150,000	11.50	1,725,000	2.70	405,000	14.20	2,130,000
	5.3 Concrete	m3	10,000	98.50	985,000	49.80	498,000	148.30	1,483,000
	5.4 Reinforcement bar	ton	435	503.80	219,153	137.70	59,900	641.50	279,053
	5.5 Anchor bar	m	400	11.40	4,560	1.90	760	13.30	5,320
	5.6 Spillway bridge	m	20	12600.00	252,000	5400.00	108,000	18000.00	360,000
	5.7 Others(5 %)	L.S.			167,786		55,833		223,619
	(Subtotal-5)				3,523,499		1,172,492		4,695,991

(Continued)

Table 8.3 BREAKDOWN OF CONSTRUCTION COST FOR MGETA DAM (2/2)

Item No.	Work	Unit	Quantity	Foreign Currency (US$)		Local Currency (US$)		Total (US$)	
				Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
6.	Architectural Buildings								
	6.1 Control house	m2	200	540.00	108,000	360.00	72,000	900.00	180,000
	6.2 Valve house	m2	50	540.00	27,000	360.00	18,000	900.00	45,000
	6.3 Gate house	m2	30	540.00	16,200	360.00	10,800	900.00	27,000
	(Subtotal-6)				151,200		100,800		252,000
7.	Metal Work								
	7.1 Diversion gates	ton	32	8330.00	266,560	930.00	29,760	9260.00	296,320
	7.2 Spillway gate(radial)	ton	112	7500.00	840,000	830.00	92,960	8330.00	932,960
	7.3 Intake gate	ton	10	8330.00	83,300	930.00	9,300	9260.00	92,600
	7.4 Outlet facilities	ton	19	15750.00	299,250	1750.00	33,250	17500.00	332,500
	7.5 Steel pipes(inc. penstock for hydropower)	ton	87	5830.00	507,210	650.00	56,550	6480.00	563,760
	(Subtotal-7)				1,996,320		221,820		2,218,140
8.	Powerhouse and Generating Equipment	L.S.			8,356,000		1,464,000		9,820,000
	Total of Direct Construction Cost (I)				65,545,826		19,521,356		85,067,182
II	Land Aquisition and Compensation	L.S.			0		50,000		50,000
III	Administration Expenses	L.S.			0		851,000		851,000
IV	Engineering Services (Detailed design and supervision)	L.S.			8,677,000		1,531,000		10,208,000
	Total(I to IV)				74,222,826		21,953,356		96,176,182
V	Physical Contengency (15%)	L.S.			11,133,000		3,293,000		14,426,000
	Grand Total				85,355,826		25,246,356		110,602,182

Table 8.4 BREAKDOWN OF CONSTRUCTION COST FOR NGERENGERE DAM (1/2)

Item No.	Work	Unit	Quantity	Foreign Currency (US$)		Local Currency (US$)		Total (US$)	
				Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
I	Direct Construction Cost								
1.	Preparatory Works (General)	L.S.			4,837,000		1,467,000		6,304,000
2.	Permanent Access Road								
	2.1 Improvement of existing rural road	km	60	70000.00	4,200,000	30000.00	1,800,000	100000.00	6,000,000
	2.2 Construction of new access road	km	3	105000.00	315,000	45000.00	135,000	150000.00	450,000
	(Subtotal-2)				4,515,000		1,935,000		6,450,000
3.	Diversion Tunnel and Intake Tunnel								
	3.1 Excavation at tunnel portals,common	m3	5,000	3.40	17,000	0.90	4,500	4.30	21,500
	3.2 Excavation at tunnel portals,rock	m3	14,000	11.50	161,000	2.70	37,800	14.20	198,800
	3.3 Tunnel excavation	m3	6,400	59.50	380,800	20.00	128,000	79.50	508,800
	3.4 Steel support	ton	45	1173.00	52,785	117.00	5,265	1290.00	58,050
	3.5 Concrete for tunnel lining	m3	2,800	111.20	311,360	55.90	156,520	167.10	467,880
	3.6 Plug concrete	m3	1,300	85.60	111,280	43.00	55,900	128.60	167,180
	3.7 Reinforcement bar	ton	80	528.90	42,312	137.70	11,016	666.60	53,328
	3.8 Backfill grouting	m3	390	90.60	35,334	23.20	9,048	113.80	44,382
	3.9 Others(5 %)	L.S.			55,594		20,402		75,996
	(Subtotal-3)				1,167,465		428,451		1,595,916
4.	Main Dam								
	4.1 Excavation,common	m3	58,000	3.40	197,200	0.90	52,200	4.30	249,400
	4.2 Excavation,rock	m3	172,000	11.50	1,978,000	2.70	464,400	14.20	2,442,400
	4.3 Embankment,core	m3	510,000	7.10	3,621,000	1.80	918,000	8.90	4,539,000
	4.4 Embankment,filter	m3	220,000	34.80	7,656,000	16.10	3,542,000	50.90	11,198,000
	4.5 Embankment,rock	m3	1,500,000	12.60	18,900,000	3.00	4,500,000	15.60	23,400,000
	4.6 Blanket grouting	m	8,400	76.50	642,600	23.00	193,200	99.50	835,800
	4.7 Curtain grouting	m	24,000	96.50	2,316,000	27.00	648,000	123.50	2,964,000
	4.8 Crest road	m	2,000	70.00	140,000	30.00	60,000	100.00	200,000
	4.9 Measuring apparatus(1%)	L.S.			354,508		103,778		458,286
	4.10 Others(5 %)	L.S.			1,790,265		524,079		2,314,344
	(Subtotal-4)				37,595,573		11,005,657		48,601,230
5.	Spillway								
	5.1 Excavation,common	m3	13,000	3.40	44,200	0.90	11,700	4.30	55,900
	5.2 Excavation,rock	m3	38,000	11.50	437,000	2.70	102,600	14.20	539,600
	5.3 Concrete	m3	11,000	98.50	1,083,500	49.80	547,800	148.30	1,631,300
	5.4 Reinforcement bar	ton	430	503.80	216,634	137.70	59,211	641.50	275,845
	5.5 Anchor bar	m	670	11.40	7,638	1.90	1,273	13.30	8,911
	5.6 Spillway bridge	m	5	12600.00	63,000	5400.00	27,000	18000.00	90,000
	5.7 Others(5 %)	L.S.			92,599		37,479		130,078
	(Subtotal-5)				1,944,571		787,063		2,731,634

(Continued)

Table 8.4 BREAKDOWN OF CONSTRUCTION COST FOR NGERENGERE DAM (2/2)

Item No.	Work	Unit	Quantity	Foreign Currency (US$)		Local Currency (US$)		Total (US$)	
				Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
6.	Architectural Buildings								
	6.1 Control house	m2	200	540.00	108,000	360.00	72,000	900.00	180,000
	6.2 Valve house	m2	50	540.00	27,000	360.00	18,000	900.00	45,000
	6.3 Gate house	m2	30	540.00	16,200	360.00	10,800	900.00	27,000
	(Subtotal-6)				151,200		100,800		252,000
7.	Metal Work								
	7.1 Diversion gates	ton	6	5830.00	34,980	650.00	3,900	6480.00	38,880
	7.2 Spillway gate(radial)	ton	28	8330.00	233,240	930.00	26,040	9260.00	259,280
	7.3 Intake gate	ton	6	7500.00	45,000	830.00	4,980	8330.00	49,980
	7.4 Outlet facilities	ton	13	15750.00	204,750	1750.00	22,750	17500.00	227,500
	7.5 Steel pipes(inc. penstock for hydropower)	ton	26	3300.00	85,800	370.00	9,620	3670.00	95,420
	(Subtotal-7)				603,770		67,290		671,060
8.	Powerhouse and Generating Equipment	L.S.			2,392,000		348,000		2,740,000
	Total of Direct Construction Cost (I)				53,206,579		16,139,262		69,345,840
II	Land Aquisition and Compensation	L.S.			0		600,000		600,000
III	Administration Expenses	L.S.			0		693,000		693,000
IV	Engineering Services (Detailed design and supervision)	L.S.			7,073,000		1,248,000		8,321,000
	Total(I to IV)				60,279,579		18,680,262		78,959,840
V	Physical Contengency (15%)	L.S.			9,042,000		2,802,000		11,844,000
	Grand Total				69,321,579		21,482,262		90,803,840

Table 8.5 MAIN FEATURES OF WATER CONVEYANCE PROJECTS

No.	Description	Name of Water Conveyance Projects		
		New Lower Ruvu Project-1	New Lower Ruvu Project-2	Upper Ruvu Project
1	Intake capacity (m3/sec)	6.90	-	3.45
2	Capacity of Treatment Plants(m3/sec)	3.45	3.45	3.45
3	Diameter of Transmission Main (m)	1.90	-	1.35
4	Raw water pump (kw x units)			
	Capacity per unit	400	400	900
	Number of units	4	4	4
5	Booster pump (kw x units)			
	Capacity per unit	2,000	2,000	1,900
	Number of units	6	6	8

Table 8.6 CASH FLOW OF ECONOMIC COST AND BENEFIT OF WATER RESOURCE DEVELOPMENT FOR MUNICIPAL WATER SUPPLY TO DAR ES SALAAM

(Unit : 1000 x US$)

Year			Cash Flow of Economic Cost and Benefit for Water Supply Development						
			Economic Cost (C)			Economic Benefit (B)			Net Benefit
			Dam	Hydro.	Total	Water Supply	Hydro.	Total	(B-C)
-6	-2	1997	1,116	0	1,116	0	0	0	-1,116
-5	-1	1998	2,354	0	2,354	0	0	0	-2,354
-4	1	1999	14,502	0	14,502	0	0	0	-14,502
-3	2	2000	14,225	0	14,225	0	0	0	-14,225
-2	3	2001	5,443	6,129	11,572	0	1,658	1,658	-9,914
-1	4	2002	5,022	9,194	14,216	0	2,486	2,486	-11,730
1	5	2003	212	77	289	4,464	355	4,819	4,529
2	6	2004	212	77	289	5,202	355	5,557	5,268
3	7	2005	212	77	289	5,957	355	6,312	6,023
4	8	2006	212	77	289	6,722	355	7,077	6,788
5	9	2007	212	77	289	7,501	355	7,856	7,567
6	10	2008	212	77	289	8,298	355	8,653	8,364
7	11	2009	212	77	289	9,114	355	9,469	9,180
8	12	2010	212	77	289	9,954	355	10,309	10,019
9	13	2011	212	77	289	10,920	355	11,275	10,986
10	14	2012	212	77	289	11,907	355	12,262	11,973
11	15	2013	212	77	289	12,917	355	13,272	12,983
12	16	2014	212	77	289	13,955	355	14,310	14,021
13	17	2015	212	77	289	15,025	355	15,380	15,091
14	18	2016	212	77	289	16,218	355	16,573	16,283
15	19	2017	212	77	289	17,438	355	17,793	17,504
16	20	2018	212	77	289	18,690	355	19,045	18,756
17	21	2019	212	77	289	19,979	355	20,334	20,045
18		2020	212	77	289	21,307	355	21,662	21,373
19		2021	212	77	289	21,307	355	21,662	21,373
20		2022	212	77	289	21,307	355	21,662	21,373
21		2023	212	77	289	21,307	355	21,662	21,373
22		2024	212	77	289	21,307	355	21,662	21,373
23		2025	212	77	289	21,307	355	21,662	21,373
24		2026	212	77	289	21,307	355	21,662	21,373
25		2027	1,147	6,206	7,353	21,307	4,499	25,806	18,454
26		2028	1,614	9,270	10,885	21,307	355	21,662	10,778
27		2029	212	77	289	21,307	355	21,662	21,373
28		2030	212	77	289	21,307	355	21,662	21,373
29		2031	212	77	289	21,307	355	21,662	21,373
30		2032	212	77	289	21,307	355	21,662	21,373
31		2033	212	77	289	21,307	355	21,662	21,373
32		2034	212	77	289	21,307	355	21,662	21,373
33		2035	212	77	289	21,307	355	21,662	21,373
34		2036	212	77	289	21,307	355	21,662	21,373
35		2037	212	77	289	21,307	355	21,662	21,373
36		2038	212	77	289	21,307	355	21,662	21,373
37		2039	212	77	289	21,307	355	21,662	21,373
38		2040	212	77	289	21,307	355	21,662	21,373
39		2041	212	77	289	21,307	355	21,662	21,373
40		2042	212	77	289	21,307	355	21,662	21,373
41		2043	212	77	289	21,307	355	21,662	21,373
42		2044	212	77	289	21,307	355	21,662	21,373
43		2045	212	77	289	21,307	355	21,662	21,373
44		2046	212	77	289	21,307	355	21,662	21,373
45		2047	212	77	289	21,307	355	21,662	21,373
46		2048	212	77	289	21,307	355	21,662	21,373
47		2049	212	77	289	21,307	355	21,662	21,373
48		2050	212	77	289	21,307	355	21,662	21,373
49		2051	212	77	289	21,307	355	21,662	21,373
50		2052	212	77	289	21,307	355	21,662	21,373

IRR=			14.30%
NPV at Rd=8 %	45,635	103,525	57,890
Annual Value at Rd=8 %	662	1,502	840
B/C			2.27

Rd : Discount Rate

Table 8.7 CASH FLOW OF ECONOMIC COST AND BENEFIT FOR WHOLE IRRIGATION PROJECTS IN DEVELOPMENT SCENARIO-1

(Unit : 1000 x US$)

Year			Cash Flow of Economic Cost and Benefit for the Whole Irrigation Projects					
			Economic Cost (C)			Economic Benefit (B)		Net Benefit
			Dam	Irrigation	Total	Irrigation	Total	(B-C)
-6	-2	1997	864	0	864	0	0	-864
-5	-1	1998	1,821	134	1,955	0	0	-1,955
-4	1	1999	11,218	457	11,675	0	0	-11,675
-3	2	2000	11,004	1,089	12,093	0	0	-12,093
-2	3	2001	4,211	2,458	6,669	0	0	-6,669
-1	4	2002	3,885	4,399	8,284	0	0	-8,284
1	5	2003	164	2,953	3,118	539	539	-2,579
2	6	2004	164	3,102	3,266	539	539	-2,727
3	7	2005	164	4,497	4,662	539	539	-4,123
4	8	2006	164	3,469	3,634	1,039	1,039	-2,595
5	9	2007	164	1,222	1,386	1,514	1,514	128
6	10	2008	164	4,366	4,530	2,004	2,004	-2,526
7	11	2009	164	3,055	3,219	2,004	2,004	-1,215
8	12	2010	164	3,727	3,892	2,480	2,480	-1,412
9	13	2011	164	3,520	3,684	2,955	2,955	-729
10	14	2012	164	6,729	6,894	3,738	3,738	-3,156
11	15	2013	164	5,429	5,594	4,055	4,055	-1,539
12	16	2014	164	3,158	3,323	4,857	4,857	1,534
13	17	2015	164	246	411	5,332	5,332	4,921
14	18	2016	164	246	411	5,866	5,866	5,455
15	19	2017	164	307	472	5,866	5,866	5,394
16	20	2018	164	445	610	5,866	5,866	5,256
17	21	2019	164	2,915	3,080	5,866	5,866	2,786
18		2020	164	261	426	6,029	6,029	5,603
19		2021	164	261	426	6,029	6,029	5,603
20		2022	164	261	426	6,029	6,029	5,603
21		2023	164	261	426	6,029	6,029	5,603
22		2024	164	261	426	6,029	6,029	5,603
23		2025	164	261	426	6,029	6,029	5,603
24		2026	164	261	426	6,029	6,029	5,603
25		2027	888	261	1,149	6,029	6,029	4,880
26		2028	1,249	261	1,510	6,029	6,029	4,519
27		2029	164	84	248	6,029	6,029	5,781
28		2030	164	261	426	6,029	6,029	5,603
29		2031	164	261	426	6,029	6,029	5,603
30		2032	164	261	426	6,029	6,029	5,603
31		2033	164	261	426	6,029	6,029	5,603
32		2034	164	261	426	6,029	6,029	5,603
33		2035	164	261	426	6,029	6,029	5,603
34		2036	164	261	426	6,029	6,029	5,603
35		2037	164	261	426	6,029	6,029	5,603
36		2038	164	261	426	6,029	6,029	5,603
37		2039	164	261	426	6,029	6,029	5,603
38		2040	164	261	426	6,029	6,029	5,603
39		2041	164	261	426	6,029	6,029	5,603
40		2042	164	261	426	6,029	6,029	5,603
41		2043	164	261	426	6,029	6,029	5,603
42		2044	164	261	426	6,029	6,029	5,603
43		2045	164	261	426	6,029	6,029	5,603
44		2046	164	261	426	6,029	6,029	5,603
45		2047	164	261	426	6,029	6,029	5,603
46		2048	164	261	426	6,029	6,029	5,603
47		2049	164	261	426	6,029	6,029	5,603
48		2050	164	261	426	6,029	6,029	5,603
49		2051	164	261	426	6,029	6,029	5,603
50		2052	164	261	426	6,029	6,029	5,603

IRR=			4.16%
NPV at Rd=8 %	50,303	26,277	-24,026
Annual Value at Rd=8 %	730	381	-349
B/C			0.52

Rd : Discount Rate

Table 8.8 CASH FLOW OF ECONOMIC COST AND BENEFIT FOR WHOLE WATER RESOURCES DEVELOPMENT IN DEVELOPMENT SCENARIO-1 (DEVELOPMENT OF KIDUNDA DAM PROJECT AND IRRIGATION PROJECTS)

(Unit : 1000 x US$)

Year			Cash Flow of Economic Cost and Benefit for Water Resources Development						
			Total Economic Cost (C)			Total Economic Benefit (B)			Net Benefit
			W. S.	Irrigation	Total	W. S.	Irrigation	Total	(B-C)
-6	-2	1997	1,116	864	1,980	0	0	0	-1,980
-5	-1	1998	2,354	1,955	4,309	0	0	0	-4,309
-4	1	1999	14,502	11,675	26,177	0	0	0	-26,177
-3	2	2000	14,225	12,093	26,318	0	0	0	-26,318
-2	3	2001	11,572	6,669	18,241	1,658	0	1,658	-16,583
-1	4	2002	14,216	8,284	22,500	2,486	0	2,486	-20,014
1	5	2003	289	3,118	3,407	4,819	539	5,358	1,951
2	6	2004	289	3,266	3,555	5,557	539	6,096	2,541
3	7	2005	289	4,662	4,951	6,312	539	6,851	1,900
4	8	2006	289	3,634	3,923	7,077	1,039	8,116	4,193
5	9	2007	289	1,386	1,675	7,856	1,514	9,370	7,695
6	10	2008	289	4,530	4,820	8,653	2,004	10,657	5,837
7	11	2009	289	3,219	3,508	9,469	2,004	11,473	7,965
8	12	2010	289	3,892	4,181	10,309	2,480	12,789	8,608
9	13	2011	289	3,684	3,973	11,275	2,955	14,230	10,257
10	14	2012	289	6,894	7,183	12,262	3,738	16,000	8,817
11	15	2013	289	5,594	5,883	13,272	4,055	17,327	11,444
12	16	2014	289	3,323	3,612	14,310	4,857	19,167	15,555
13	17	2015	289	411	700	15,380	5,332	20,712	20,012
14	18	2016	289	411	700	16,573	5,866	22,439	21,739
15	19	2017	289	472	761	17,793	5,866	23,659	22,899
16	20	2018	289	610	899	19,045	5,866	24,911	24,013
17	21	2019	289	3,080	3,369	20,334	5,866	26,200	22,831
18		2020	289	426	715	21,662	6,029	27,691	26,977
19		2021	289	426	715	21,662	6,029	27,691	26,977
20		2022	289	426	715	21,662	6,029	27,691	26,977
21		2023	289	426	715	21,662	6,029	27,691	26,977
22		2024	289	426	715	21,662	6,029	27,691	26,977
23		2025	289	426	715	21,662	6,029	27,691	26,977
24		2026	289	426	715	21,662	6,029	27,691	26,977
25		2027	7,353	1,149	8,502	25,806	6,029	31,835	23,334
26		2028	10,885	1,510	12,395	21,662	6,029	27,691	15,297
27		2029	289	248	537	21,662	6,029	27,691	27,154
28		2030	289	426	715	21,662	6,029	27,691	26,977
29		2031	289	426	715	21,662	6,029	27,691	26,977
30		2032	289	426	715	21,662	6,029	27,691	26,977
31		2033	289	426	715	21,662	6,029	27,691	26,977
32		2034	289	426	715	21,662	6,029	27,691	26,977
33		2035	289	426	715	21,662	6,029	27,691	26,977
34		2036	289	426	715	21,662	6,029	27,691	26,977
35		2037	289	426	715	21,662	6,029	27,691	26,977
36		2038	289	426	715	21,662	6,029	27,691	26,977
37		2039	289	426	715	21,662	6,029	27,691	26,977
38		2040	289	426	715	21,662	6,029	27,691	26,977
39		2041	289	426	715	21,662	6,029	27,691	26,977
40		2042	289	426	715	21,662	6,029	27,691	26,977
41		2043	289	426	715	21,662	6,029	27,691	26,977
42		2044	289	426	715	21,662	6,029	27,691	26,977
43		2045	289	426	715	21,662	6,029	27,691	26,977
44		2046	289	426	715	21,662	6,029	27,691	26,977
45		2047	289	426	715	21,662	6,029	27,691	26,977
46		2048	289	426	715	21,662	6,029	27,691	26,977
47		2049	289	426	715	21,662	6,029	27,691	26,977
48		2050	289	426	715	21,662	6,029	27,691	26,977
49		2051	289	426	715	21,662	6,029	27,691	26,977
50		2052	289	426	715	21,662	6,029	27,691	26,977

IRR=			10.16%
NPV at Rd=8 %	95,938	129,802	33,864
Annual Value at Rd=8 %	1,392	1,884	491
B/C			1.35

Rd : Discount Rate

Table 8.9 BREAKDOWN OF CONSTRUCTION COST FOR NEW LOWER RUVU SCHEME-1 (1/2)

Item No.	Work	Unit	Quantity	Foreign Currency (US$)		Local Currency (US$)		Total (US$)	
				Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
I	Direct Construction Cost								
1.	Preparatory Works (General)	L.S.			11,860,000		2,727,000		14,587,000
2.	Permanent Access Road								
	2.1 Improvement of existing rural road	km	0	0.00	0	0.00	0	0.00	0
	2.2 Construction of new access road	km	5	105000.00	525,000	45000.00	225,000	150000.00	750,000
	(Subtotal-2)				525,000		225,000		750,000
3.	New Lower Ruvu Intake Weir								
	3.1 Excavation,common	m3	9,300	3.00	27,900	0.60	5,580	3.60	33,480
	3.2 Steel sheet pile	m2	290	150.00	43,500	15.00	4,350	165.00	47,850
	3.3 Concrete pile	m	990	67.30	66,627	34.00	33,660	101.30	100,287
	3.4 Concrete	m3	1,200	107.00	128,400	52.00	62,400	159.00	190,800
	3.5 Reinforcement bar	ton	6	503.80	3,023	137.70	826	641.50	3,849
	3.6 Intake gate	ton	32	7500.00	240,000	830.00	26,560	8330.00	266,560
	3.7 Others(5 %)	L.S.			25,472		6,669		32,141
	(Subtotal-3)				534,922		140,045		674,967
4.	Water supply Facilities								
	4.1 Excavation,common	m3	75,000	3.00	225,000	0.60	45,000	3.60	270,000
	4.2 Embankment	m3	113,000	7.10	802,300	1.80	203,400	8.90	1,005,700
	4.3 Concrete in raw water pump station	m3	860	165.10	141,986	84.80	72,928	249.90	214,914
	4.4 Concrete in clarifires and filters	m3	8,600	165.10	1,419,860	84.80	729,280	249.90	2,149,140
	4.5 Concrete in treated water pumping sta.	m3	440	165.10	72,644	84.80	37,312	249.90	109,956
	4.6 Building works in water chamber	L.S.			145,800		97,200		243,000
	4.7 Building works in treated water chamber	L.S.			842,400		561,600		1,404,000
	4.8 Other building works (admi.,chemi.,storage)	L.S.			1,474,200		982,800		2,457,000
	4.9 Reinforcement bar	ton	600	503.80	302,280	137.70	82,620	641.50	384,900
	4.10 Prestressed concrete pipe,1ntake main,1350mm dia.	m	500	440.00	220,000	110.00	55,000	550.00	275,000
	4.11 Others(5 %)	L.S.			282,324		143,357		425,681
	(Subtotal-4)				5,928,794		3,010,497		8,939,291
5.	Metal and Electrical Works for Water Treatment Facilities								
	5.1 Raw water pumps (400kw x 4 units)	L.S.			964,800		107,200		1,072,000
	5.2 Water treatment facilities(inline mixing)	L.S.			30,690,000		3,410,000		34,100,000
	5.3 Booster pumps (2000kw x 6 units)	L.S.			7,236,000		804,000		8,040,000
	5.4 Others(5 %)	L.S.			1,944,540		216,060		2,160,600
	(Subtotal-5)				40,835,340		4,537,260		45,372,600

(Continued)

Table 8.9 BREAKDOWN OF CONSTRUCTION COST FOR NEW LOWER RUVU SCHEME-1 (2/2)

Item No.	Work	Unit	Quantity	Foreign Currency (US$)		Local Currency (US$)		Total (US$)	
				Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
6.	New Transmission Main								
	6.1 Excavation	m3	970,000	3.00	2,910,000	0.60	582,000	3.60	3,492,000
	6.2 Backfill,sand	m3	420,000	19.00	7,980,000	5.70	2,394,000	24.70	10,374,000
	6.3 Backfill,random	m3	400,000	2.10	840,000	0.60	240,000	2.70	1,080,000
	6.4 Slab concrete	m3	6,100	69.00	420,900	35.50	216,550	104.50	637,450
	6.5 Reinforcement bar	ton	61	503.80	30,732	137.70	8,400	641.50	39,132
	6.6 Prestressed concrete pipe,1900mm dia.	m	55,000	888.00	48,840,000	222.00	12,210,000	1110.00	61,050,000
	6.7 Others(5 %)	L.S.			3,051,082		782,547		3,833,629
	(Subtotal-6)				64,072,713		16,433,497		80,506,211
7.	Extension of University Reservoir								
	7.1 Excavation	m3	18,000	3.00	54,000	0.60	10,800	3.60	64,800
	7.2 Concrete	m3	46,000	107.00	4,922,000	52.00	2,392,000	159.00	7,314,000
	7.3 Reinforcement bar	ton	2,800	503.80	1,410,640	137.70	385,560	641.50	1,796,200
	7.4 Others(5 %)	L.S.			319,332		139,418		458,750
	(Subtotal-7)				6,705,972		2,927,778		9,633,750
	Total of Direct Construction Cost (I)				130,462,741		30,001,077		160,463,818
II	Land Aquisition and Compensation	L.S.			0		20,000		20,000
III	Administration Expenses	L.S.			0		1,605,000		1,605,000
IV	Engineering Services (Detailed design and supervision)	L.S.			16,367,000		2,888,000		19,255,000
	Total(I to IV)				146,829,741		34,514,077		181,343,818
V	Physical Contengency (15%)	L.S.			22,024,000		5,177,000		27,201,000
	Grand Total				168,853,741		39,691,077		208,544,818

Table 8.10 BREAKDOWN OF CONSTRUCTION COST FOR NEW LOWER RUVU SCHEME-2 (1/2)

Item No.	Work	Unit	Quantity	Foreign Currency (US$)		Local Currency (US$)		Total (US$)	
				Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
I	Direct Construction Cost								
1.	Preparatory Works (General)	L.S.			5,347,000		1,048,000		6,395,000
2.	Permanent Access Road								
	2.1 Improvement of existing rural road	km	0	0.00	0	0.00	0	0.00	0
	2.2 Construction of new access road	km	0	105000.00	0	45000.00	0	150000.00	0
	(Subtotal-2)				0		0		0
3.	New Lower Ruvu Intake Weir								
	3.1 Excavation,common	m3	0	3.00	0	0.60	0	3.60	0
	3.2 Steel sheet pile	m2	0	150.00	0	15.00	0	165.00	0
	3.3 Concrete pile	m	0	67.30	0	34.00	0	101.30	0
	3.4 Concrete	m3	0	107.00	0	52.00	0	159.00	0
	3.5 Reinforcement bar	ton	0	503.80	0	137.70	0	641.50	0
	3.6 Intake gate	ton	0	7500.00	0	830.00	0	8330.00	0
	3.7 Others(5 %)	L.S.			0		0		0
	(Subtotal-3)				0		0		0
4.	Water supply Facilities								
	4.1 Excavation,common	m3	75,000	3.00	225,000	0.60	45,000	3.60	270,000
	4.2 Embankment	m3	113,000	7.10	802,300	1.80	203,400	8.90	1,005,700
	4.3 Concrete in raw water pump station	m3	860	165.10	141,986	84.80	72,928	249.90	214,914
	4.4 Concrete in clarifires and filters	m3	8,600	165.10	1,419,860	84.80	729,280	249.90	2,149,140
	4.5 Concrete in treated water pumping sta.	m3	440	165.10	72,644	84.80	37,312	249.90	109,956
	4.6 Building works in water chamber	L.S.			145,800		97,200		243,000
	4.7 Building works in treated water chamber	L.S.			842,400		561,600		1,404,000
	4.8 Other building works (admi.,chemi.,storage)	L.S.			1,474,200		982,800		2,457,000
	4.9 Reinforcement bar	ton	600	503.80	302,280	137.70	82,620	641.50	384,900
	4.10 Prestressed concrete pipe,1ntake main,1350mm dia.	m	500	440.00	220,000	110.00	55,000	550.00	275,000
	4.11 Others(5 %)	L.S.			282,324		143,357		425,681
	(Subtotal-4)				5,928,794		3,010,497		8,939,291
5.	Metal and Electrical Works for Water Treatment Facilities								
	5.1 Raw water pumps (400kw x 4 units)	L.S.			964,800		107,200		1,072,000
	5.2 Water treatment facilities(inline mixing)	L.S.			30,690,000		3,410,000		34,100,000
	5.3 Booster pumps (2000kw x 6 units)	L.S.			7,236,000		804,000		8,040,000
	5.4 Others(5 %)	L.S.			1,944,540		216,060		2,160,600
	(Subtotal-5)				40,835,340		4,537,260		45,372,600

(Continued)

Table 8.10 BREAKDOWN OF CONSTRUCTION COST FOR NEW LOWER RUVU SCHEME-2 (2/2)

Item No.	Work	Unit	Quantity	Foreign Currency (US$)		Local Currency (US$)		Total (US$)	
				Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
6.	New Transmission Main								
	6.1 Excavation	m3	0	3.00	0	0.60	0	3.60	0
	6.2 Backfill,sand	m3	0	19.00	0	5.70	0	24.70	0
	6.3 Backfill,random	m3	0	2.10	0	0.60	0	2.70	0
	6.4 Slab concrete	m3	0	69.00	0	35.50	0	104.50	0
	6.5 Reinforcement bar	ton	0	503.80	0	137.70	0	641.50	0
	6.6 Prestressed concrete pipe,1900mm dia.	m	0	888.00	0	222.00	0	1110.00	0
	6.7 Others(5 %)	L.S.			0		0		0
	(Subtotal-6)				0		0		0
7.	Extension of University Reservoir								
	7.1 Excavation	m3	18,000	3.00	54,000	0.60	10,800	3.60	64,800
	7.2 Concrete	m3	46,000	107.00	4,922,000	52.00	2,392,000	159.00	7,314,000
	7.3 Reinforcement bar	ton	2,800	503.80	1,410,640	137.70	385,560	641.50	1,796,200
	7.4 Others(5 %)	L.S.			319,332		139,418		458,750
	(Subtotal-7)				6,705,972		2,927,778		9,633,750
	Total of Direct Construction Cost (I)				58,817,106		11,523,535		70,340,641
II	Land Aquisition and Compensation	L.S.			0		0		0
III	Administration Expenses	L.S.			0		703,000		703,000
IV	Engineering Services (Detailed design and supervision)	L.S.			7,175,000		1,266,000		8,441,000
	Total(I to IV)				65,992,106		13,492,535		79,484,641
V	Physical Contengency (15%)	L.S.			9,899,000		2,024,000		11,923,000
	Grand Total				75,891,106		15,516,535		91,407,641

Table 8.11 BREAKDOWN OF CONSTRUCTION COST FOR NEW UPPER RUVU SCHEME (1/2)

Item No.	Work	Unit	Quantity	Foreign Currency (US$)		Local Currency (US$)		Total (US$)	
				Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
I	Direct Construction Cost								
1.	Preparatory Works (General)	L.S.			9,190,000		1,999,000		11,189,000
2.	Permanent Access Road								
	2.1 Improvement of existing rural road	km	0	0.00	0	0.00	0	0.00	0
	2.2 Construction of new access road	km	5	105000.00	525,000	45000.00	225,000	150000.00	750,000
	(Subtotal-2)				525,000		225,000		750,000
3.	New Lower Ruvu Intake Weir								
	3.1 Excavation,common	m3	6,200	3.00	18,600	0.60	3,720	3.60	22,320
	3.2 Steel sheet pile	m2	190	150.00	28,500	15.00	2,850	165.00	31,350
	3.3 Concrete pile	m	660	67.30	44,418	34.00	22,440	101.30	66,858
	3.4 Concrete	m3	790	107.00	84,530	52.00	41,080	159.00	125,610
	3.5 Reinforcement bar	ton	4	503.80	2,015	137.70	551	641.50	2,566
	3.6 Intake gate	ton	21	7500.00	157,500	830.00	17,430	8330.00	174,930
	3.7 Others(5 %)	L.S.			16,778		4,404		21,182
	(Subtotal-3)				352,341		92,474		444,816
4.	Water supply Facilities								
	4.1 Excavation,common	m3	75,000	3.00	225,000	0.60	45,000	3.60	270,000
	4.2 Embankment	m3	113,000	7.10	802,300	1.80	203,400	8.90	1,005,700
	4.3 Concrete in raw water pump station	m3	860	165.10	141,986	84.80	72,928	249.90	214,914
	4.4 Concrete in clarifires and filters	m3	8,600	165.10	1,419,860	84.80	729,280	249.90	2,149,140
	4.5 Concrete in treated water pumping sta.	m3	440	165.10	72,644	84.80	37,312	249.90	109,956
	4.6 Building works in water chamber	L.S.			145,800		97,200		243,000
	4.7 Building works in treated water chamber	L.S.			842,400		561,600		1,404,000
	4.8 Other building works (admi.,chemi.,storage)	L.S.			1,474,200		982,800		2,457,000
	4.9 Reinforcement bar	ton	600	503.80	302,280	137.70	82,620	641.50	384,900
	4.10 Prestressed concrete pipe,intake main,1350mm dia.	m	6,000	440.00	2,640,000	110.00	660,000	550.00	3,300,000
	4.11 Others(5 %)	L.S.			403,324		173,607		576,931
	(Subtotal-4)				8,469,794		3,645,747		12,115,541
5.	Metal and Electrical Works for Water Treatment Facilities								
	5.1 Raw water pumps (900kw x 4 units)	L.S.			2,170,800		241,200		2,412,000
	5.2 Water treatment facilities(inline mixing)	L.S.			30,690,000		3,410,000		34,100,000
	5.3 Booster pumps (1900kw x 8 units)	L.S.			9,165,600		1,018,400		10,184,000
	5.4 Others(5 %)	L.S.			2,101,320		233,480		2,334,800
	(Subtotal-5)				44,127,720		4,903,080		49,030,800

(Continued)

Table 8.11 BREAKDOWN OF CONSTRUCTION COST FOR NEW UPPER RUVU SCHEME (2/2)

Item No.	Work	Unit	Quantity	Foreign Currency (US$)		Local Currency (US$)		Total (US$)	
				Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
6.	New Transmission Main								
	6.1 Excavation	m3	630,000	3.00	1,890,000	0.60	378,000	3.60	2,268,000
	6.2 Backfill,sand	m3	260,000	19.00	4,940,000	5.70	1,482,000	24.70	6,422,000
	6.3 Backfill,random	m3	300,000	2.10	630,000	0.60	180,000	2.70	810,000
	6.4 Slab concrete	m3	4,200	69.00	289,800	35.50	149,100	104.50	438,900
	6.5 Reinforcement bar	ton	42	503.80	21,160	137.70	5,783	641.50	26,943
	6.6 Prestressed concrete pipe,1350mm dia.	m	51,000	440.00	22,440,000	110.00	5,610,000	550.00	28,050,000
	6.7 Others(5 %)	L.S.			1,510,548		390,244		1,900,792
	(Subtotal-6)				31,721,508		8,195,128		39,916,635
7.	Extension of University Reservoir								
	7.1 Excavation	m3	18,000	3.00	54,000	0.60	10,800	3.60	64,800
	7.2 Concrete	m3	46,000	107.00	4,922,000	52.00	2,392,000	159.00	7,314,000
	7.3 Reinforcement bar	ton	2,800	503.80	1,410,640	137.70	385,560	641.50	1,796,200
	7.4 Others(5 %)	L.S.			319,332		139,418		458,750
	(Subtotal-7)				6,705,972		2,927,778		9,633,750
	Total of Direct Construction Cost (I)				101,092,334		21,988,207		123,080,541
II	Land Aquisition and Compensation	L.S.			0		20,000		20,000
III	Administration Expenses	L.S.			0		1,231,000		1,231,000
IV	Engineering Services (Detailed design and supervision)	L.S.			12,554,000		2,215,000		14,769,000
	Total(I to IV)				113,646,334		25,454,207		139,100,541
V	Physical Contengency (15%)	L.S.			17,047,000		3,818,000		20,865,000
	Grand Total				130,693,334		29,272,207		159,965,541

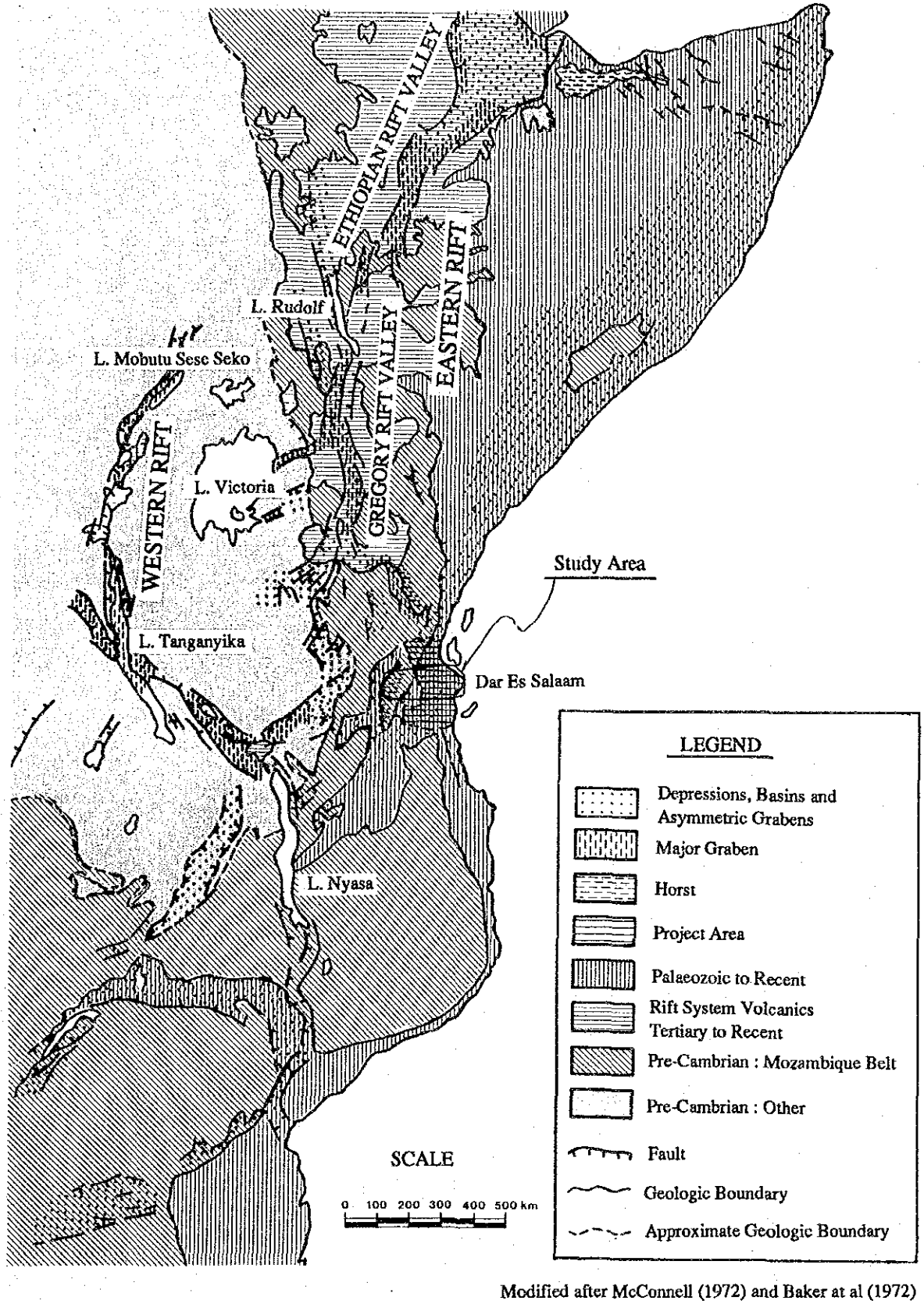
Table 8.12 RESULT OF ENVIRONMENTAL SCREENING

Project Name	Environmental Element							EIA
	a	b	c	d	e	f	g	
(1) Kidunda Dam Project	+	+	+	+	+	-	+	Y
(2) Mgeta Dam Project	-	+	+	+	+	-	+	Y
(3) Ngerengere Dam Project	+	+	+	+	+	-	+	Y
(3) Lower Ruvu Schemes-1 and -2	-	-	-	-	+	-	-	N
(4) Upper Ruvu Scheme	-	-	-	-	+	-	-	N
(6) Bagamoyo Irrigation Development	-	+	+	-	+	-	-	N
(7) Low-lift Pump Irrigation Project	-	+	+	-	+	-	-	N
(8) Makurunge Irrigation Project	-	+	+	-	+	-	-	N
(9) Ruvu National Youth Irrigation Project	-	+	+	-	+	-	-	N
(10) Kidunda Irrigation Project	+	+	+	-	+	-	+	Y
(11) Ngerengere Irrigation Project	+	+	-	-	+	-	+	Y
(12) Uluguru Mountain East Project	-	-	-	+	-	-	-	N
(13) Mgeta Plain Mvuha Irrigation Project	+	+	-	-	+	-	+	Y
(14) Mgeta Plain Irrigation Project	+	+	+	+	+	-	+	Y
(15) Mlali Irrigation Project	-	+	-	-	+	-	-	N
(16) Uluguru Mountain West Project	-	-	-	+	-	-	-	N

Notes
- + : Negative impact
- - : No or very small influence
- Y : EIA is necessary
- N : EIA is unnecessary

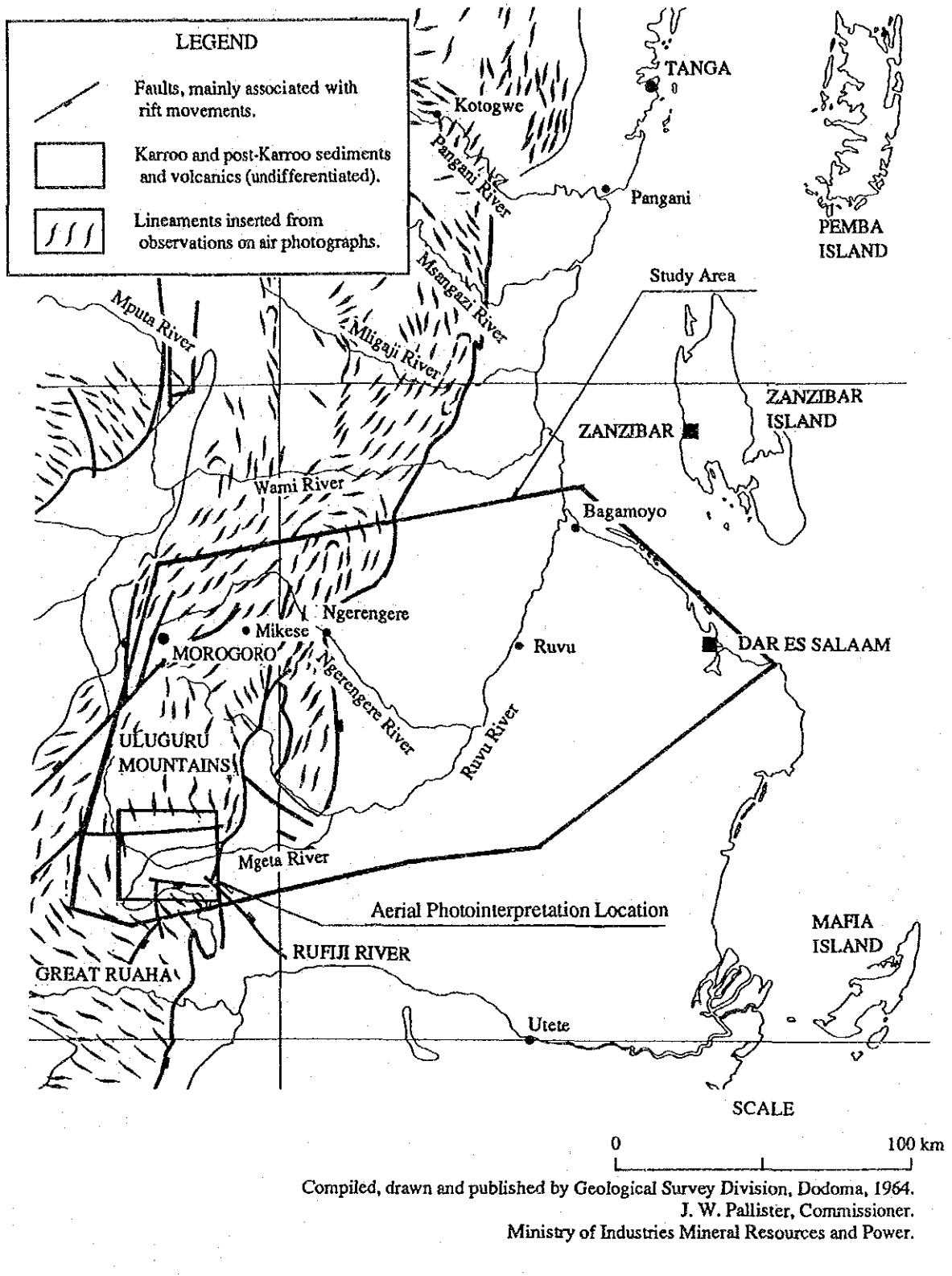
Environmental Element
- a. : Resettlement of Inhabitants
- b. : Public Health and Hygienic Conditions
- c. : Geographic and Geological Conditions
- d. : Soil Erosion
- e. : Surface Water
- f. : Ground Water
- g. : Animals and Vegetation
- EIA : Environmental Impact Assessment

Figures



Modified after McConnell (1972) and Baker at al (1972)

Fig. 2.1 REGIONAL SETTING AND EAST AFRICA RIFT SYSTEM



Compiled, drawn and published by Geological Survey Division, Dodoma, 1964.
J. W. Pallister, Commissioner.
Ministry of Industries Mineral Resources and Power.

Fig. 2.2 GEOLOGICAL STRUCTURE AROUND THE STUDY AREA

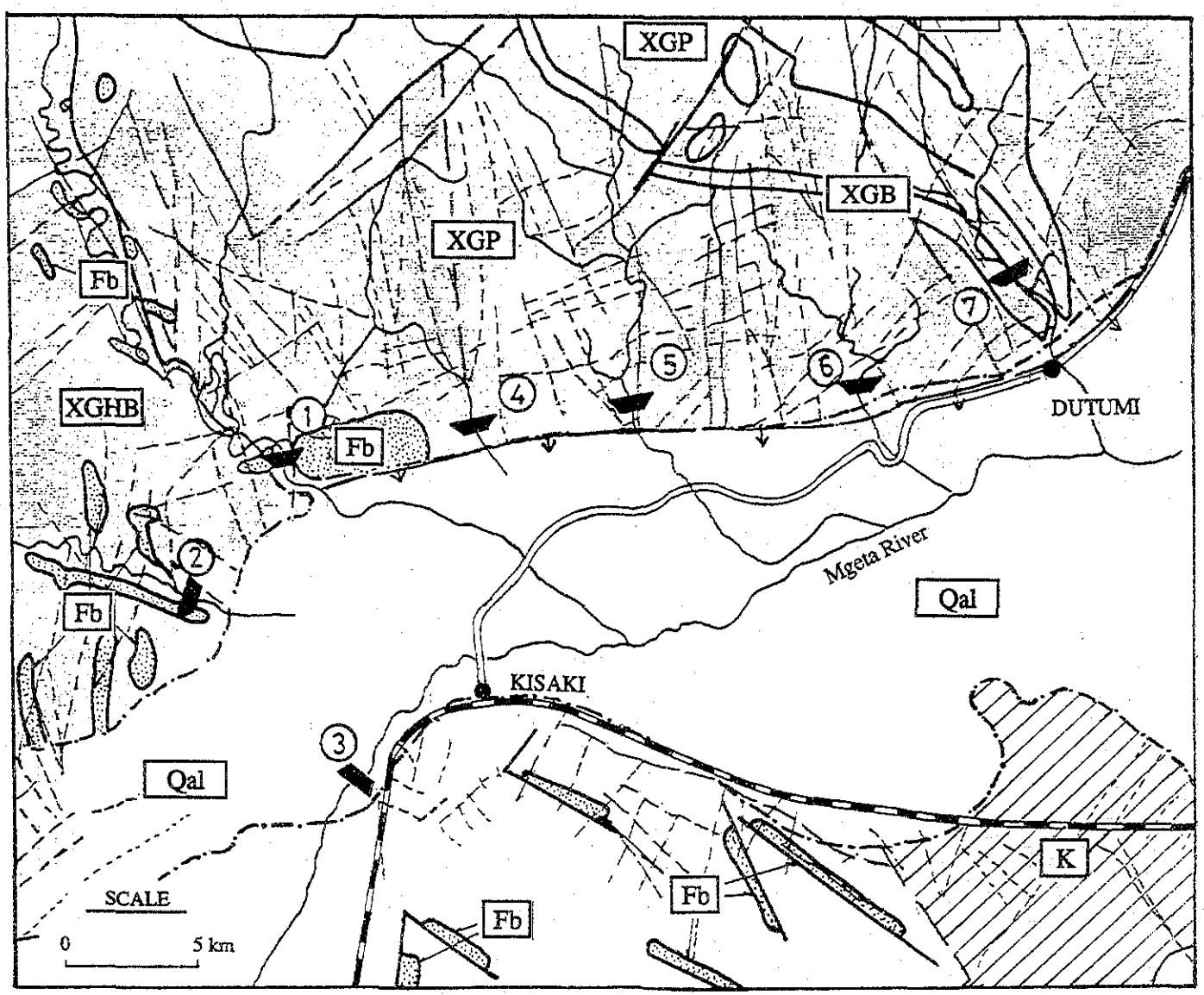


Fig. 2.3 AIR PHOTO LINEAMENT IN LOWER REACH OF THE MGETA RIVER

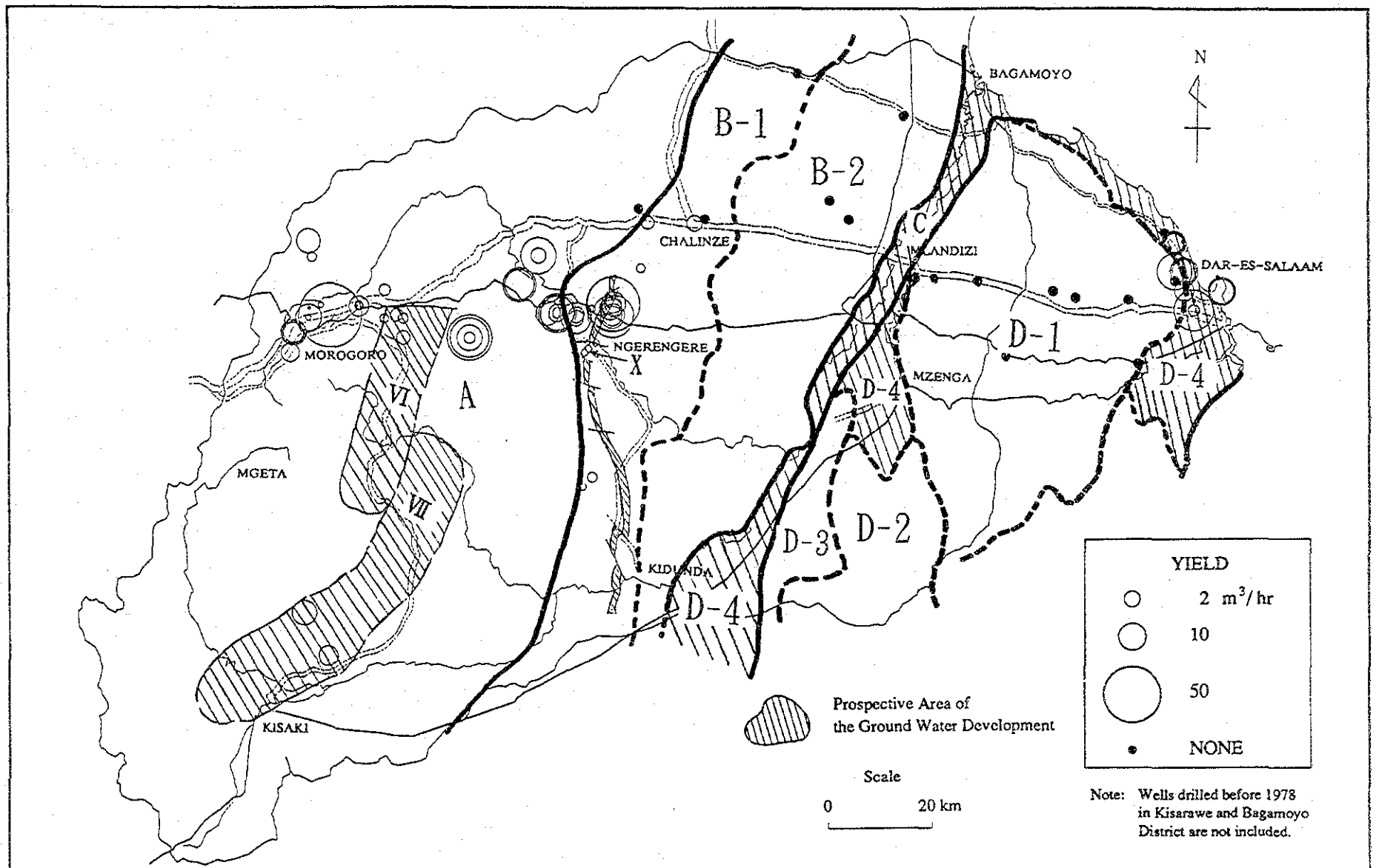


Fig. 2.4 LOCATION OF PROSPECTIVE AREA FOR GROUND WATER DEVELOPMENT

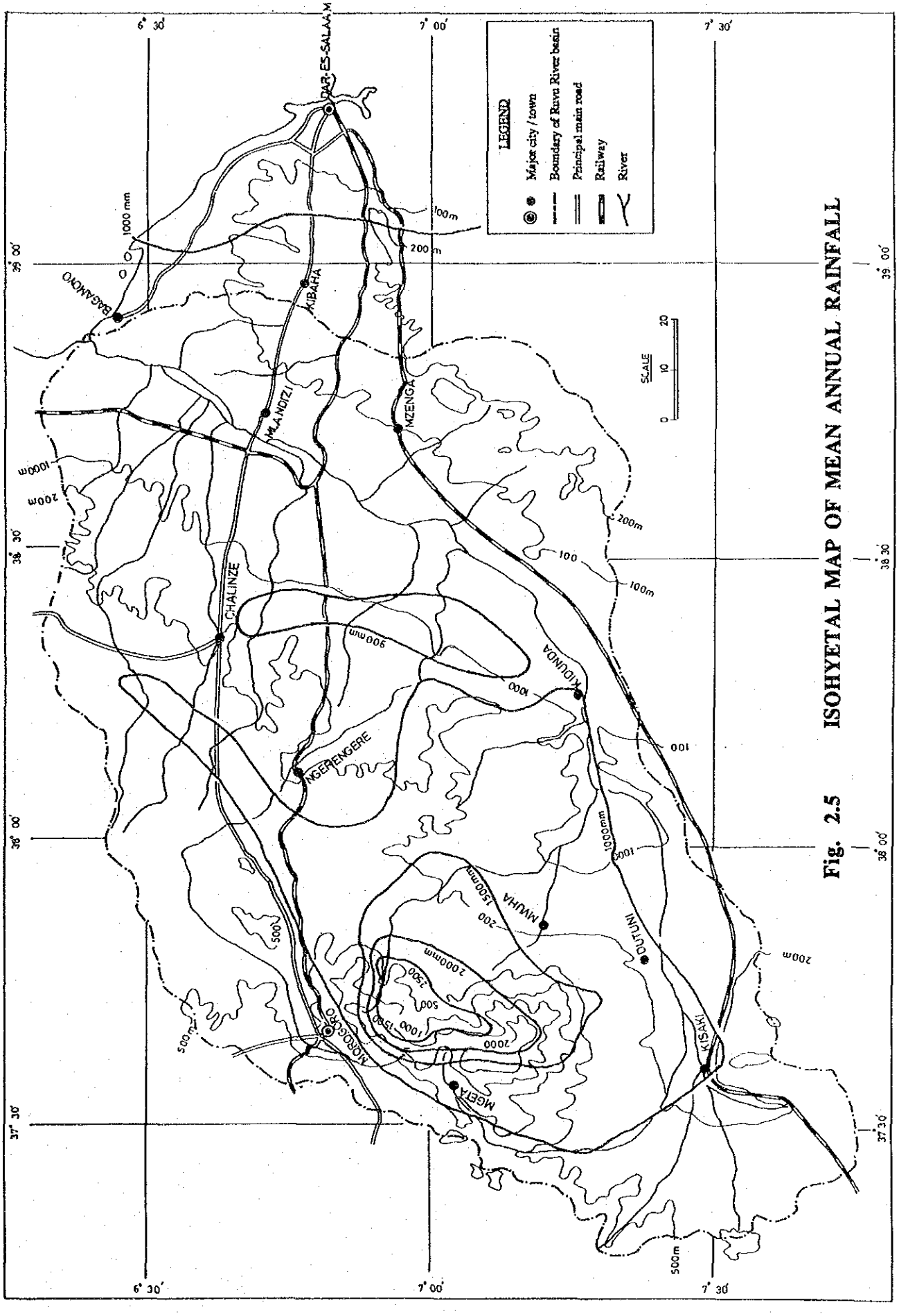


Fig. 2.5 ISOHYETAL MAP OF MEAN ANNUAL RAINFALL

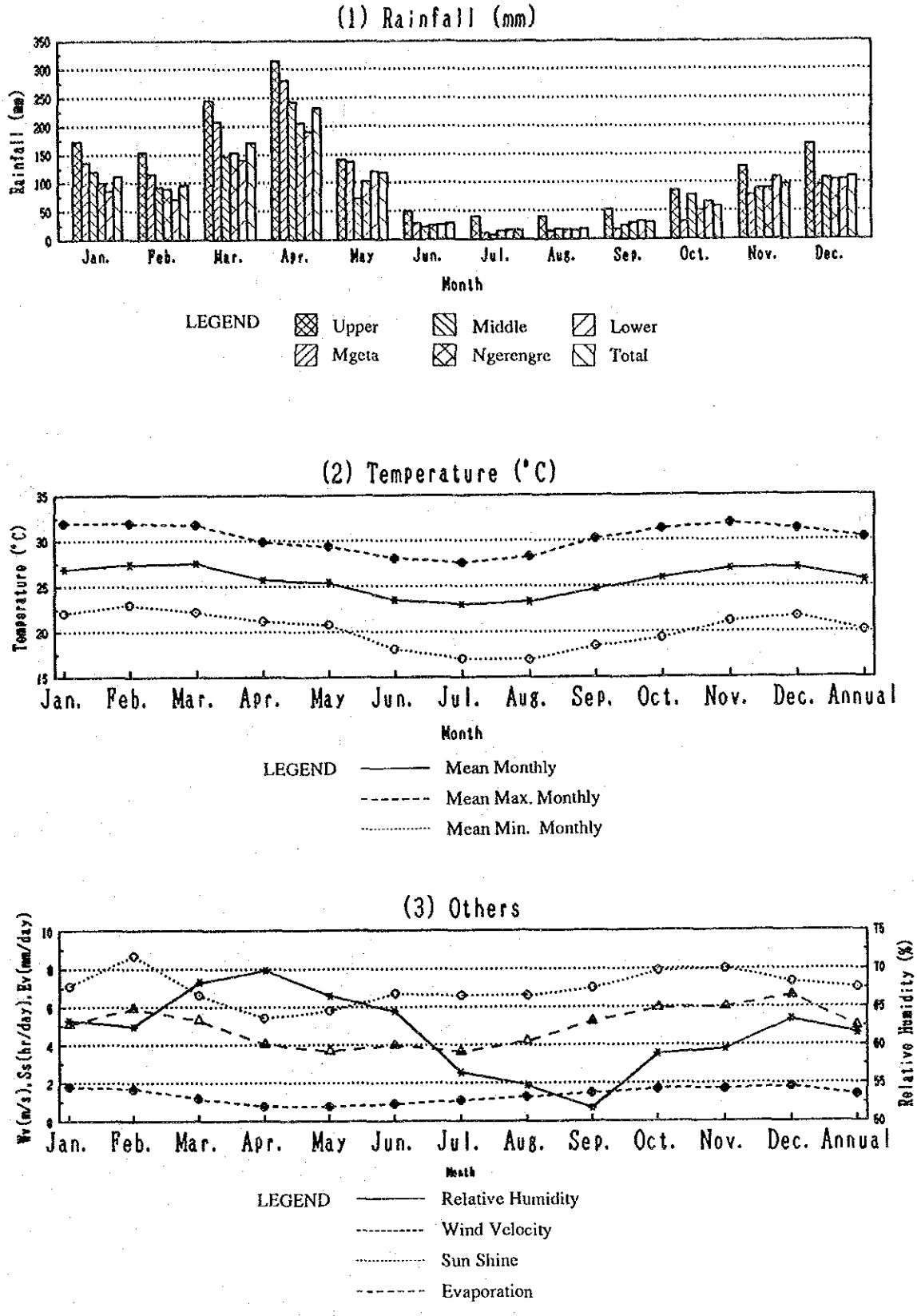


Fig. 2.6 SEASONAL CLIMATE PATTERN BY REGION

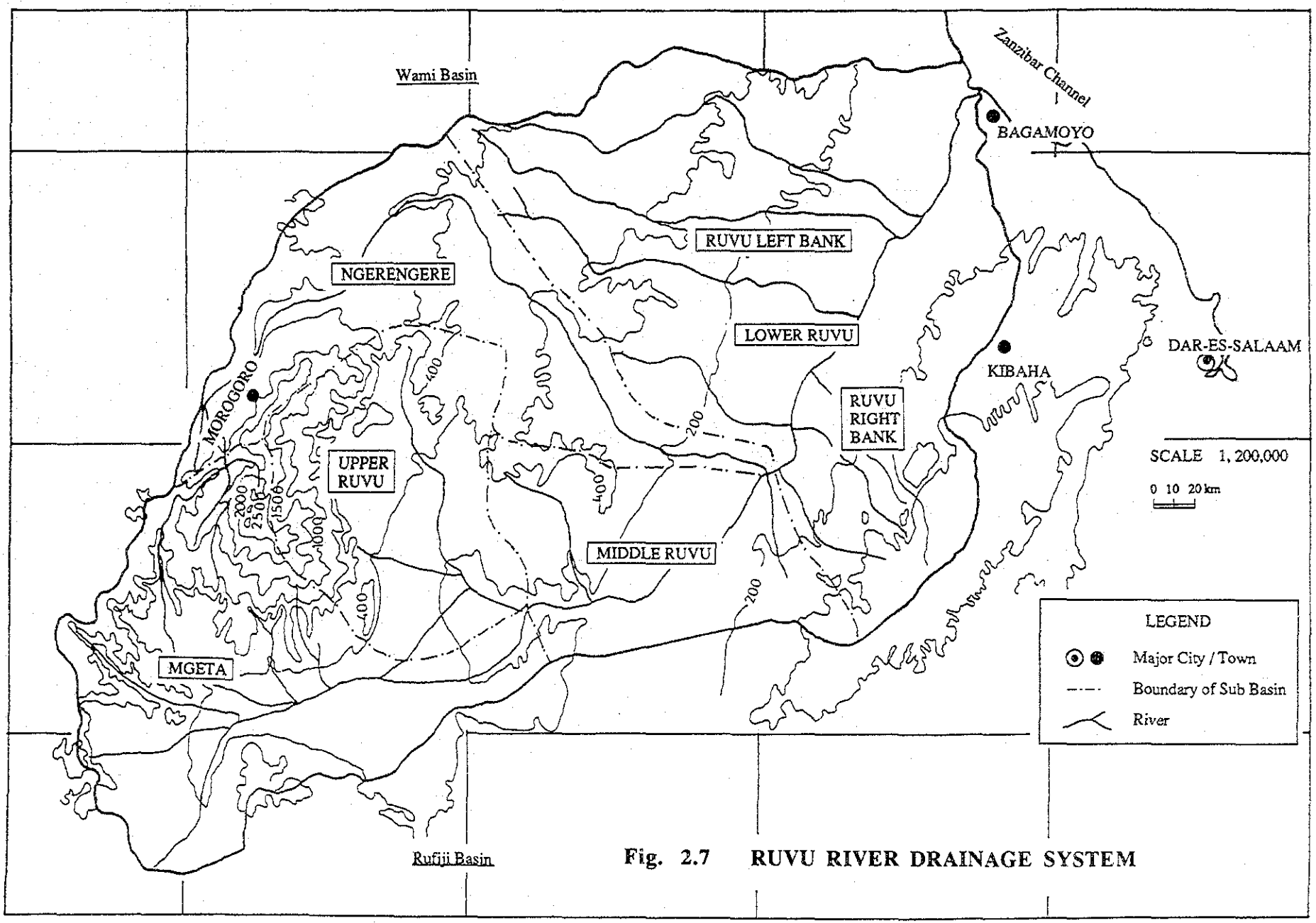


Fig. 2.7 RUVU RIVER DRAINAGE SYSTEM

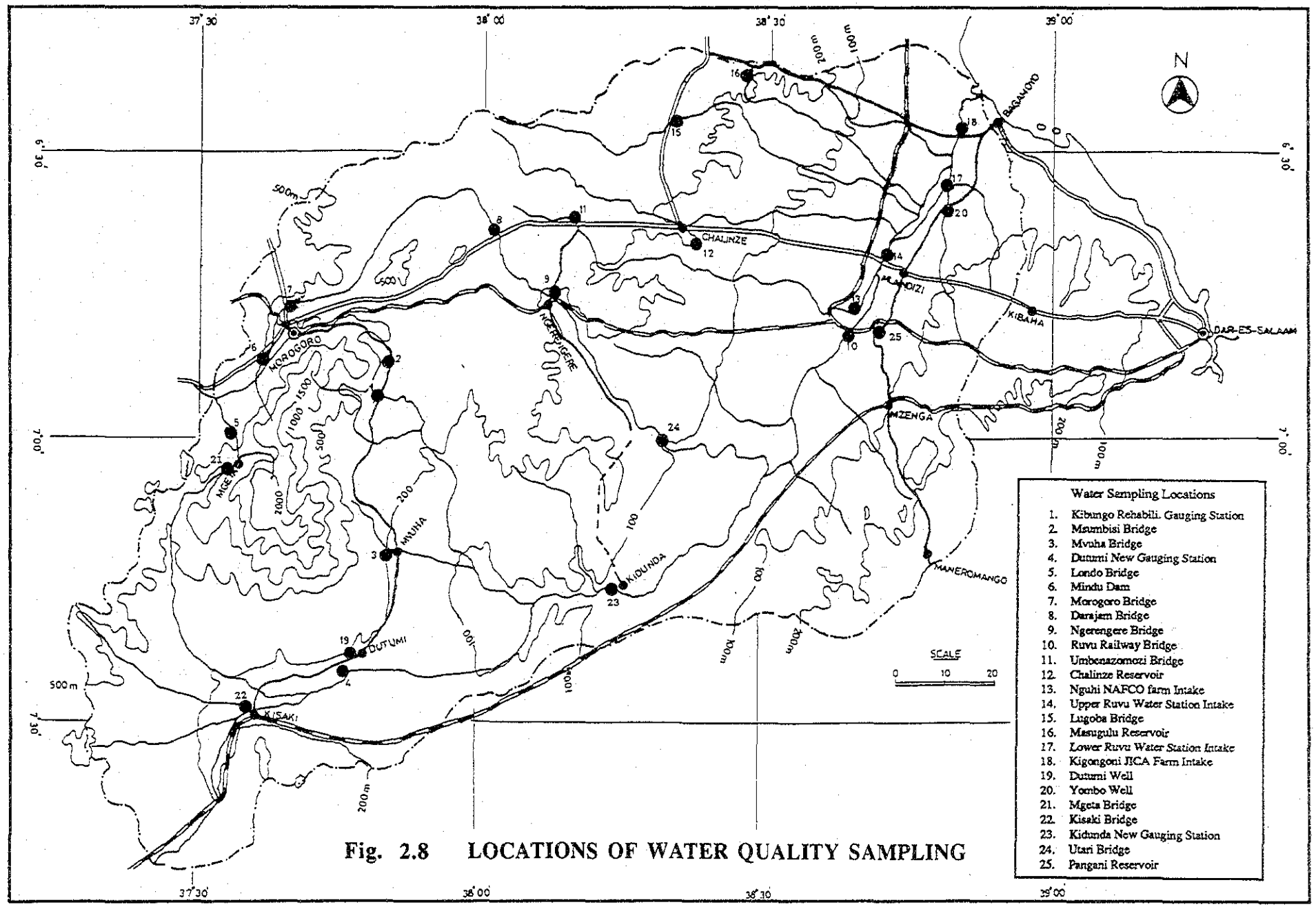


Fig. 2.8 LOCATIONS OF WATER QUALITY SAMPLING

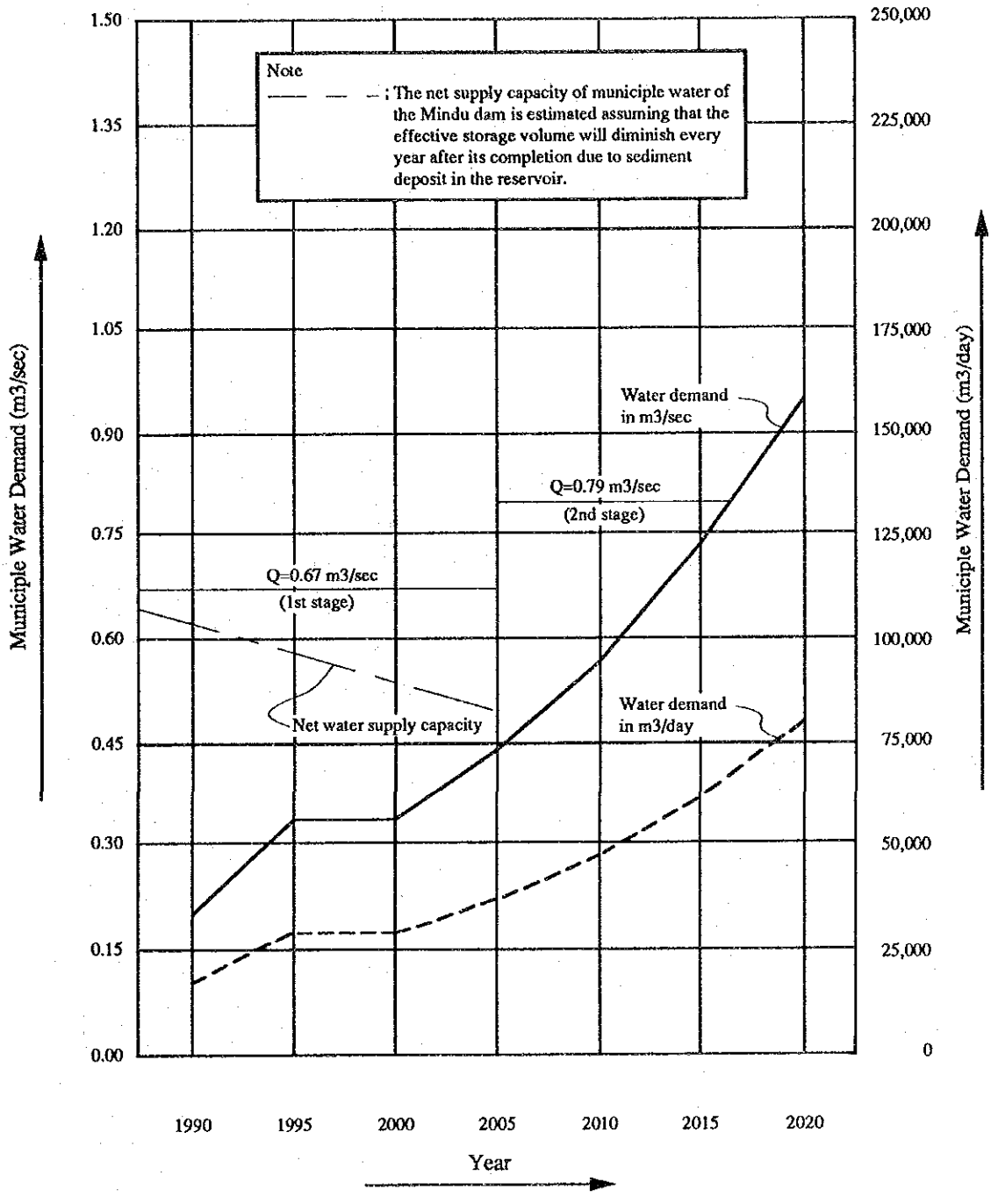


Fig. 2.9 MUNICIPAL WATER DEMAND AND WATER SUPPLY FOR MOROGORO MUNICIPALITY

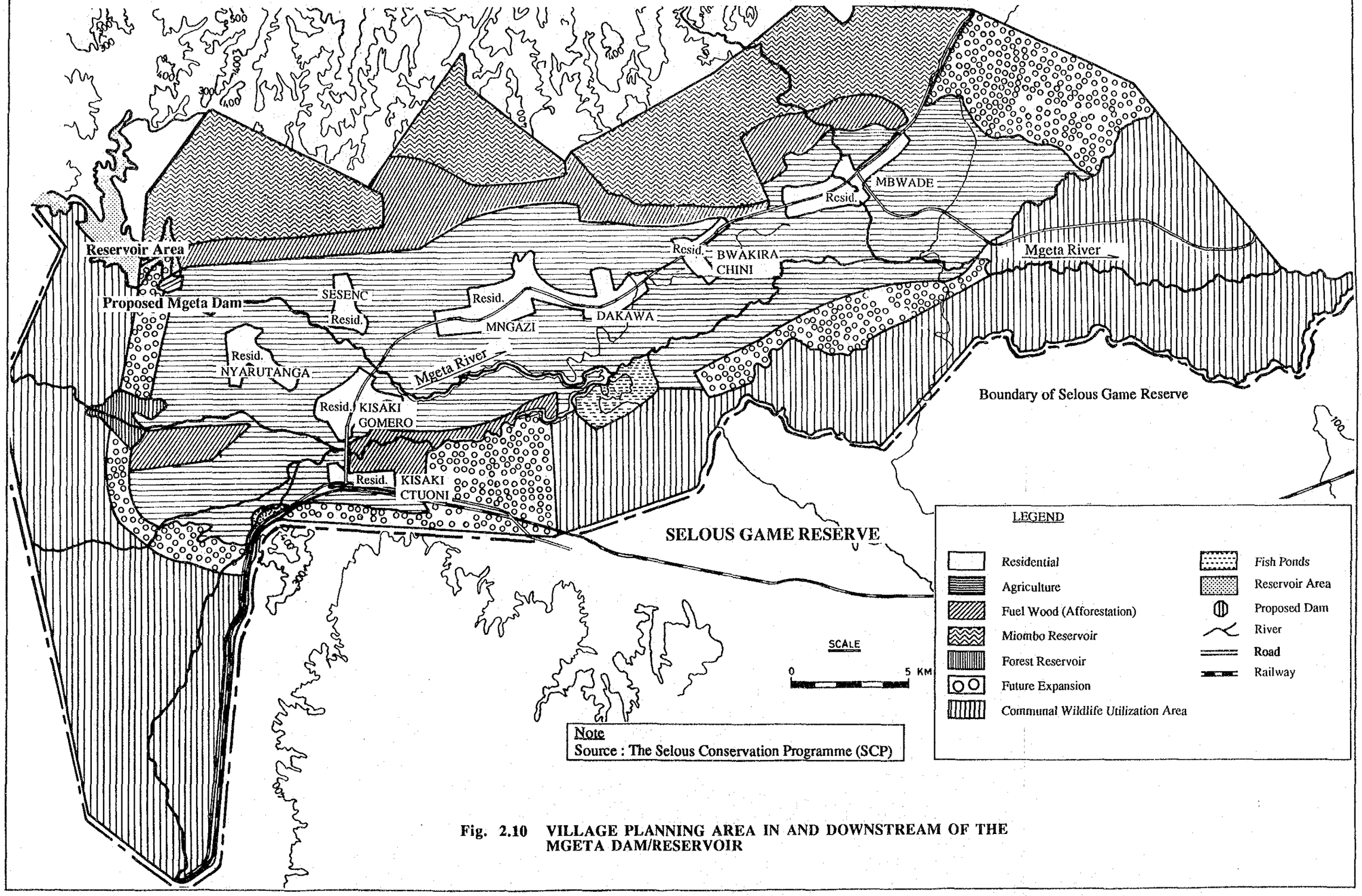


Fig. 2.10 VILLAGE PLANNING AREA IN AND DOWNSTREAM OF THE MGETA DAM/RESERVOIR

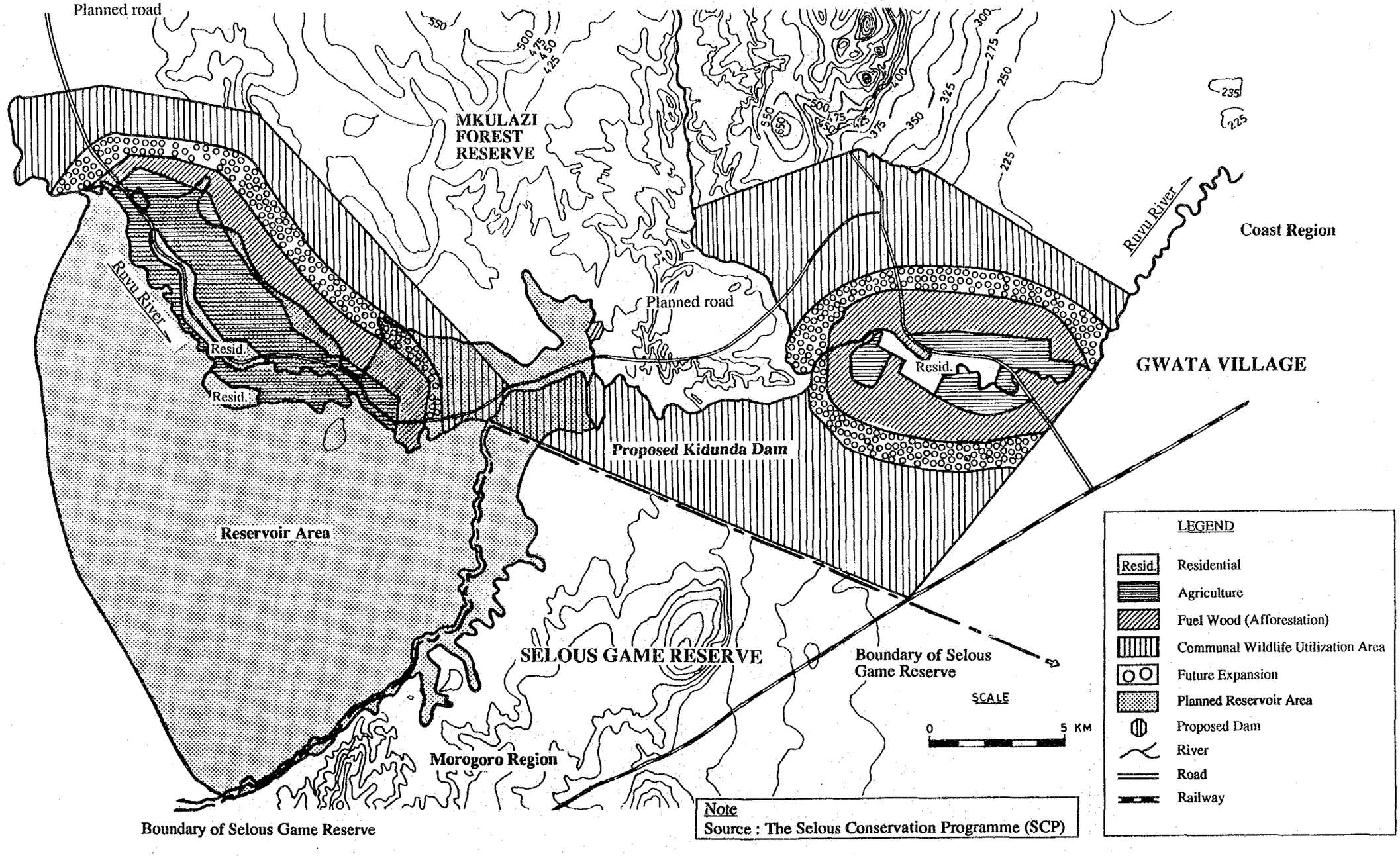


Fig. 2.11 VILLAGE PLANNING AREA IN AND AROUND THE KIDUNDA DAM/RESERVOIR

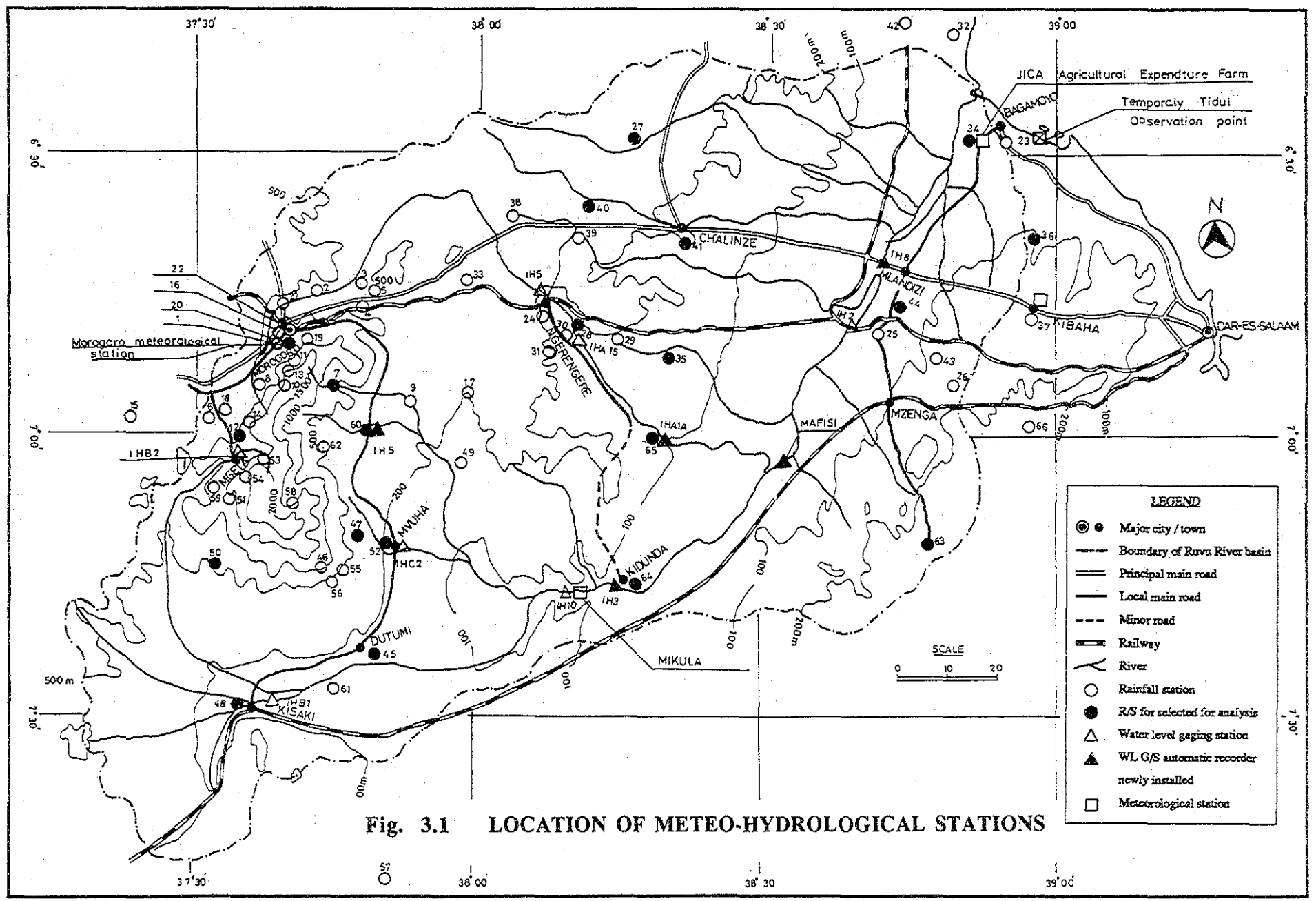


Fig. 3.1 LOCATION OF METEO-HYDROLOGICAL STATIONS

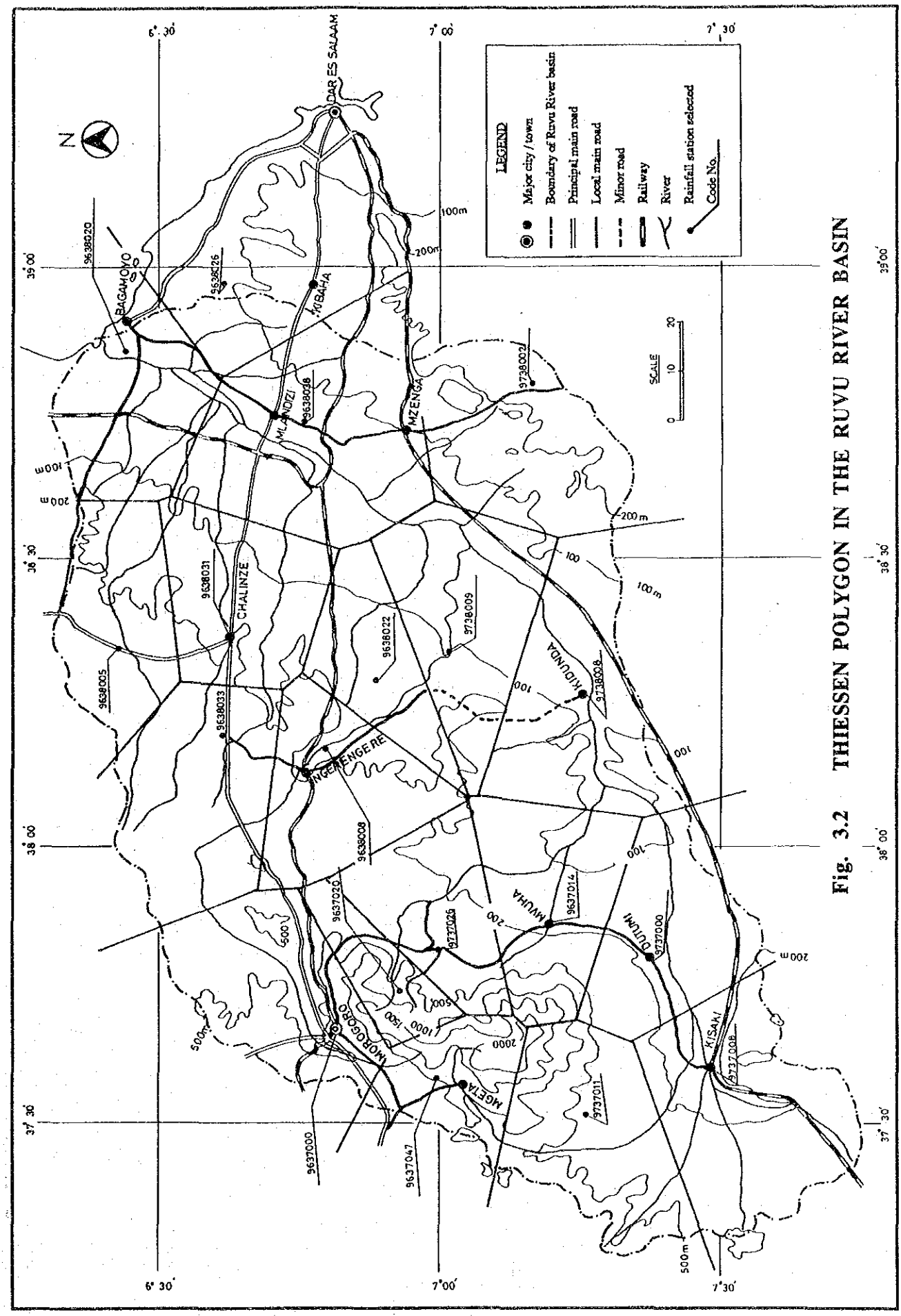


Fig. 3.2 THIESSEN POLYGON IN THE RUVU RIVER BASIN

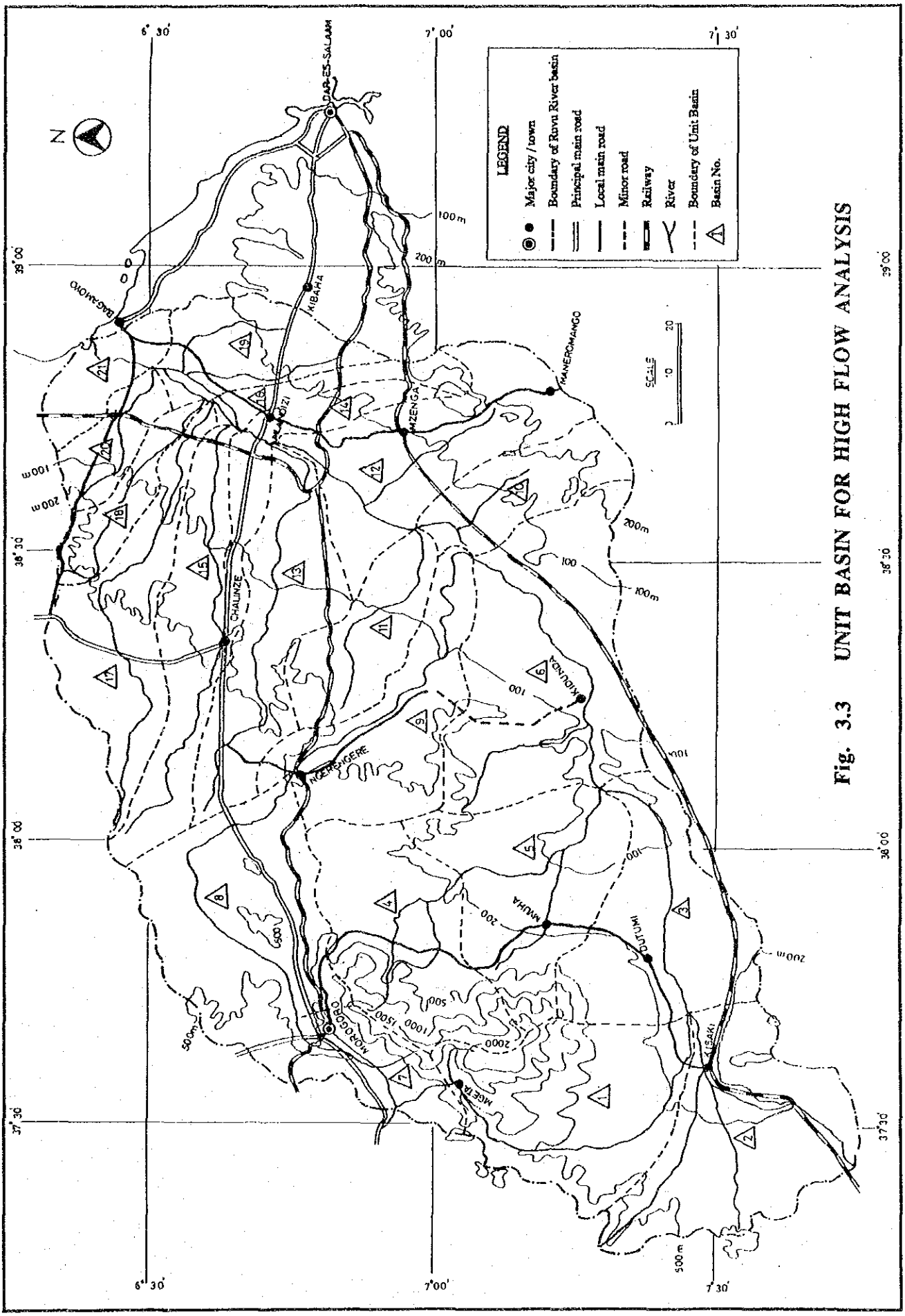
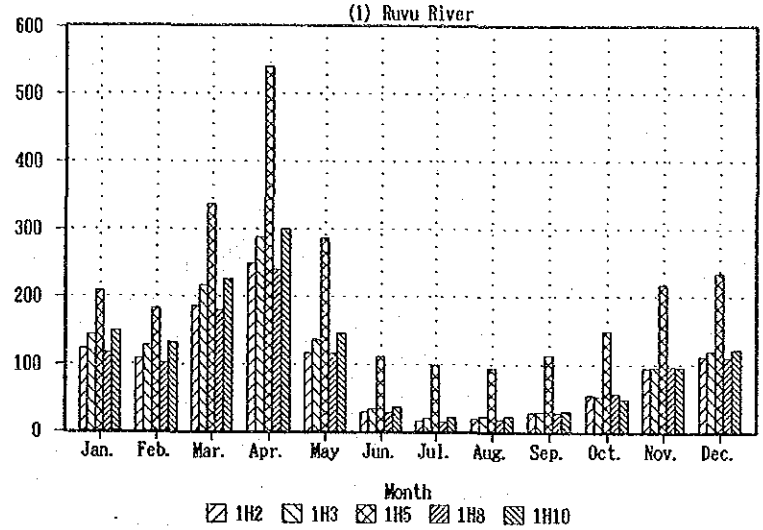


Fig. 3.3 UNIT BASIN FOR HIGH FLOW ANALYSIS



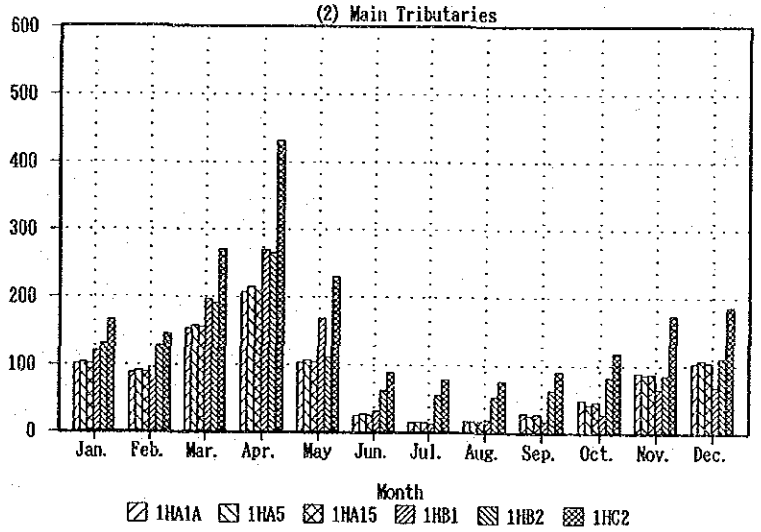
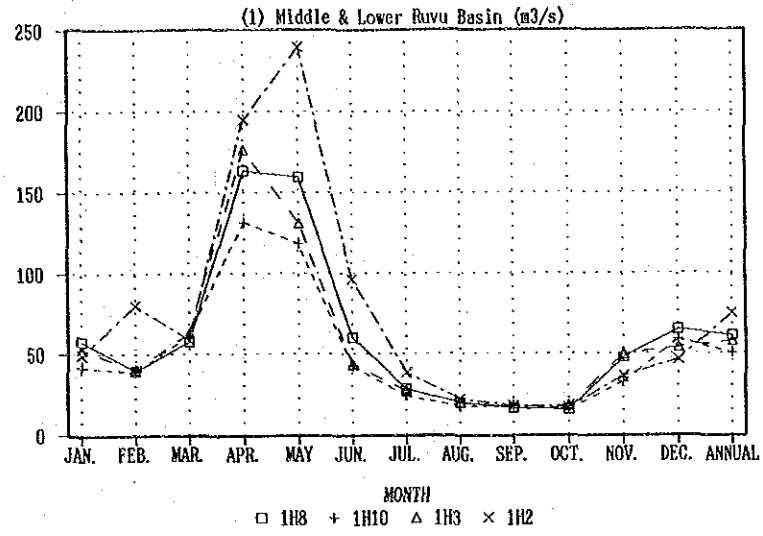
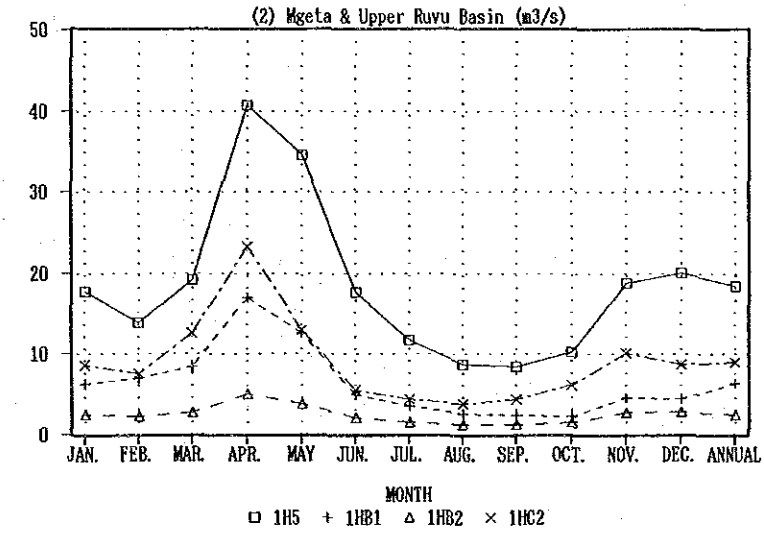


Fig. 3.4 MONTHLY RAINFALL PATTERN IN THE HYDROLOGICAL STATIONS





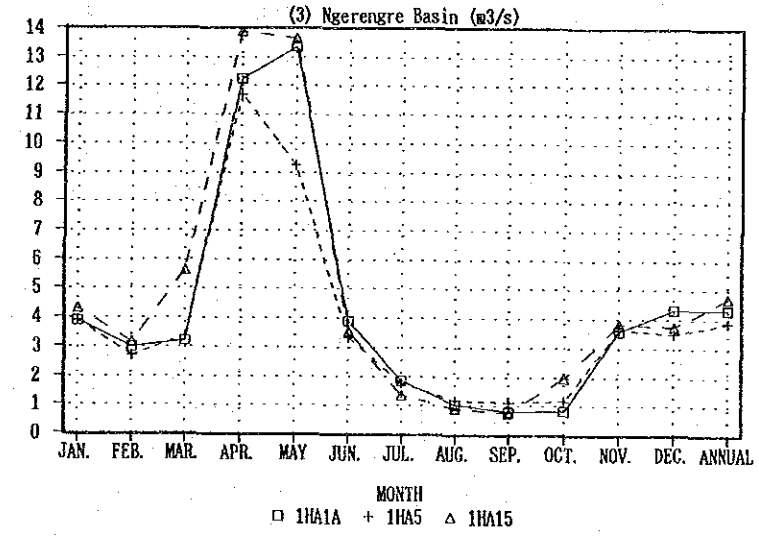
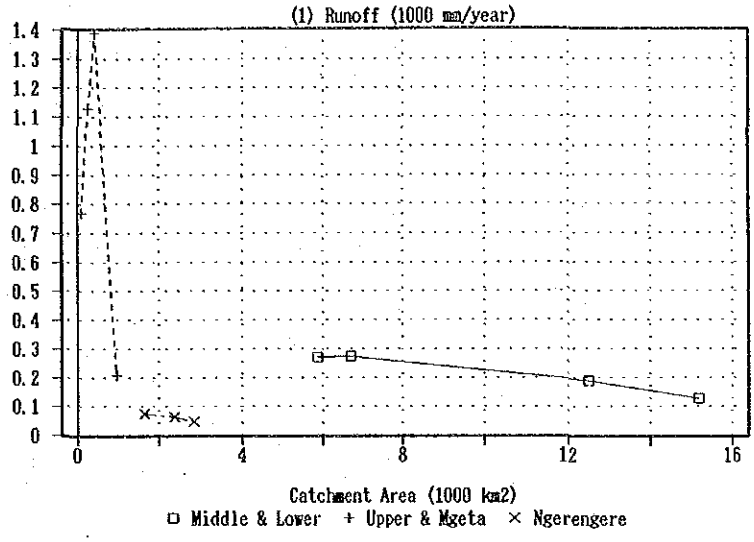


Fig. 3.5 SUMMARY OF RIVER DISCHARGE



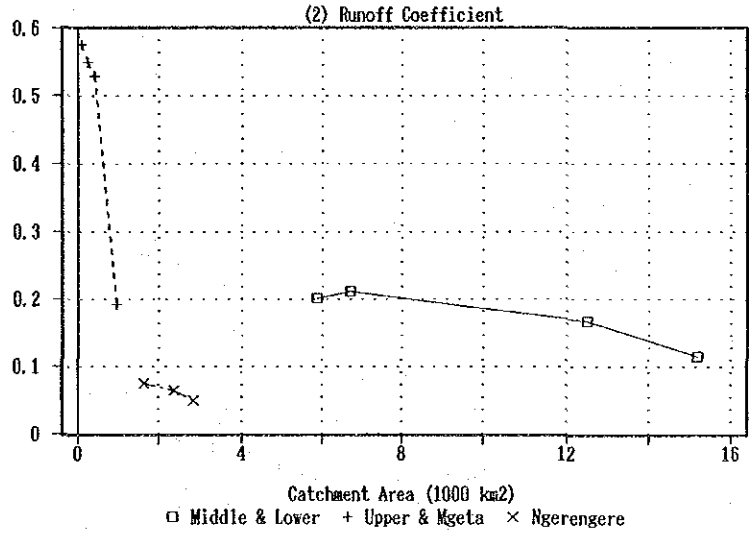


Fig. 3.6 CATCHMENT AREA AND RUNOFF COEFFICIENT

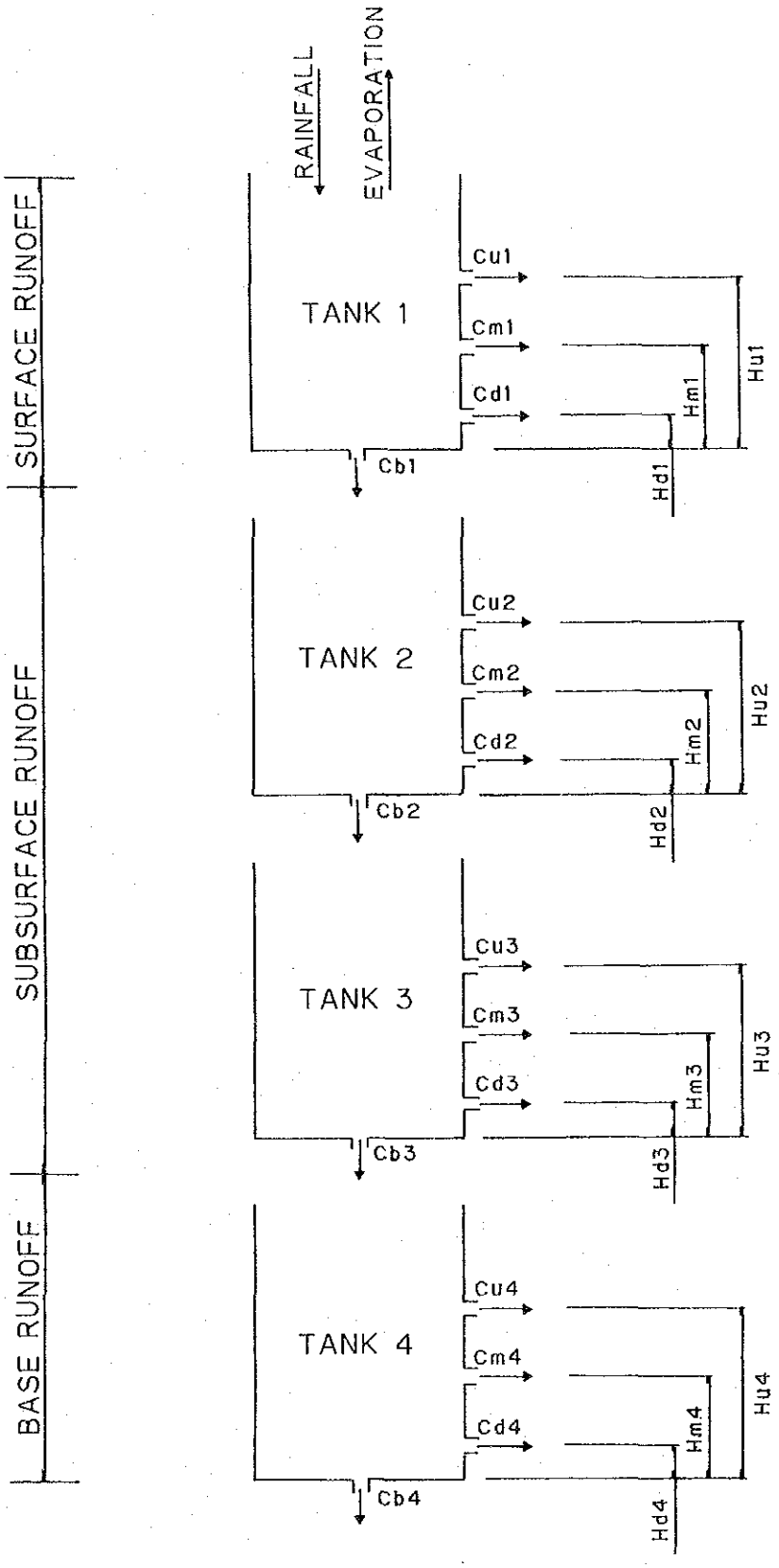


Fig. 3.7 LOW FLOW ANALYSIS MODEL (TANK MODEL)

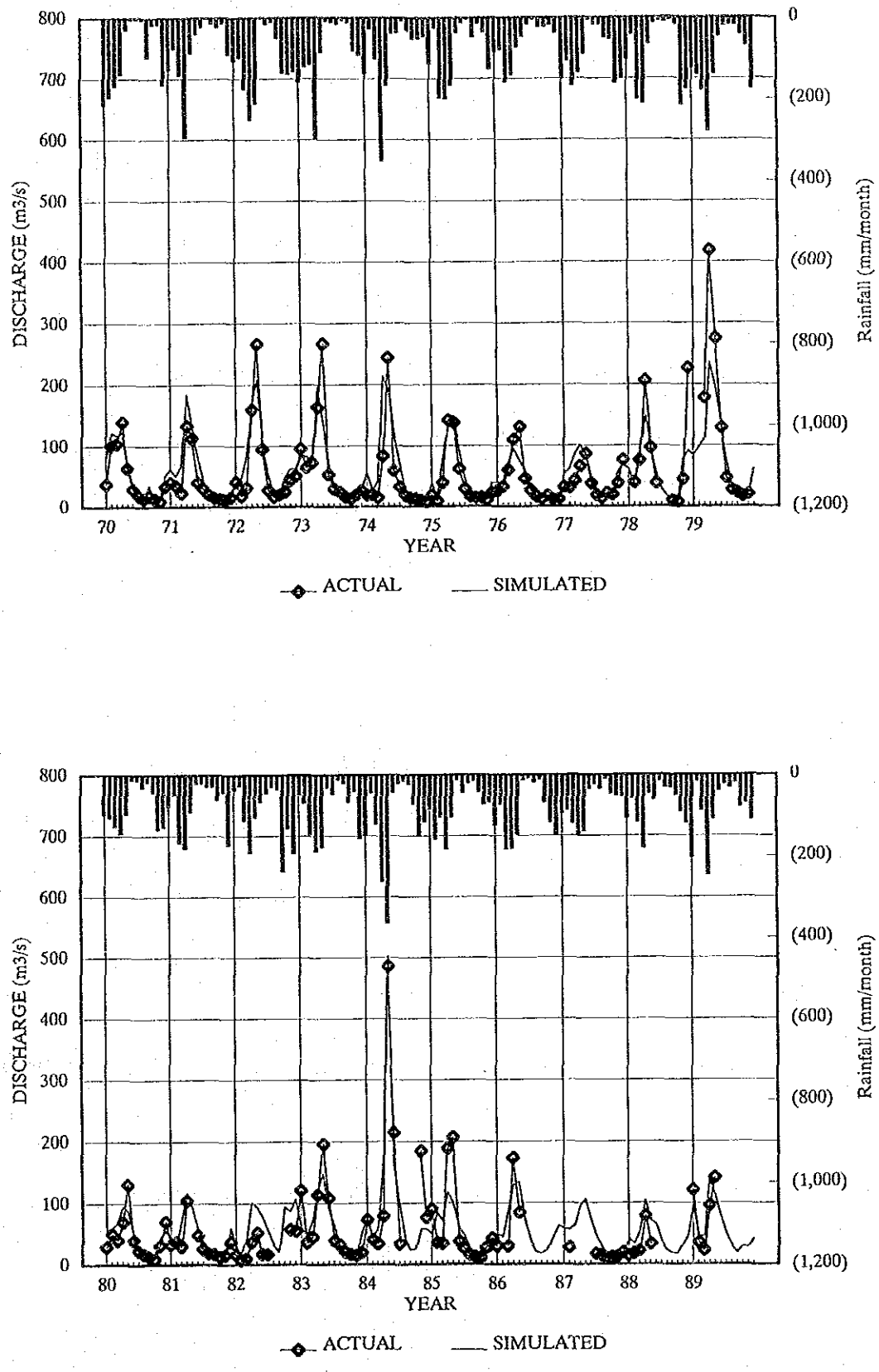


Fig. 3.8 RESULT OF LOW FLOW ANALYSIS AT 1H8

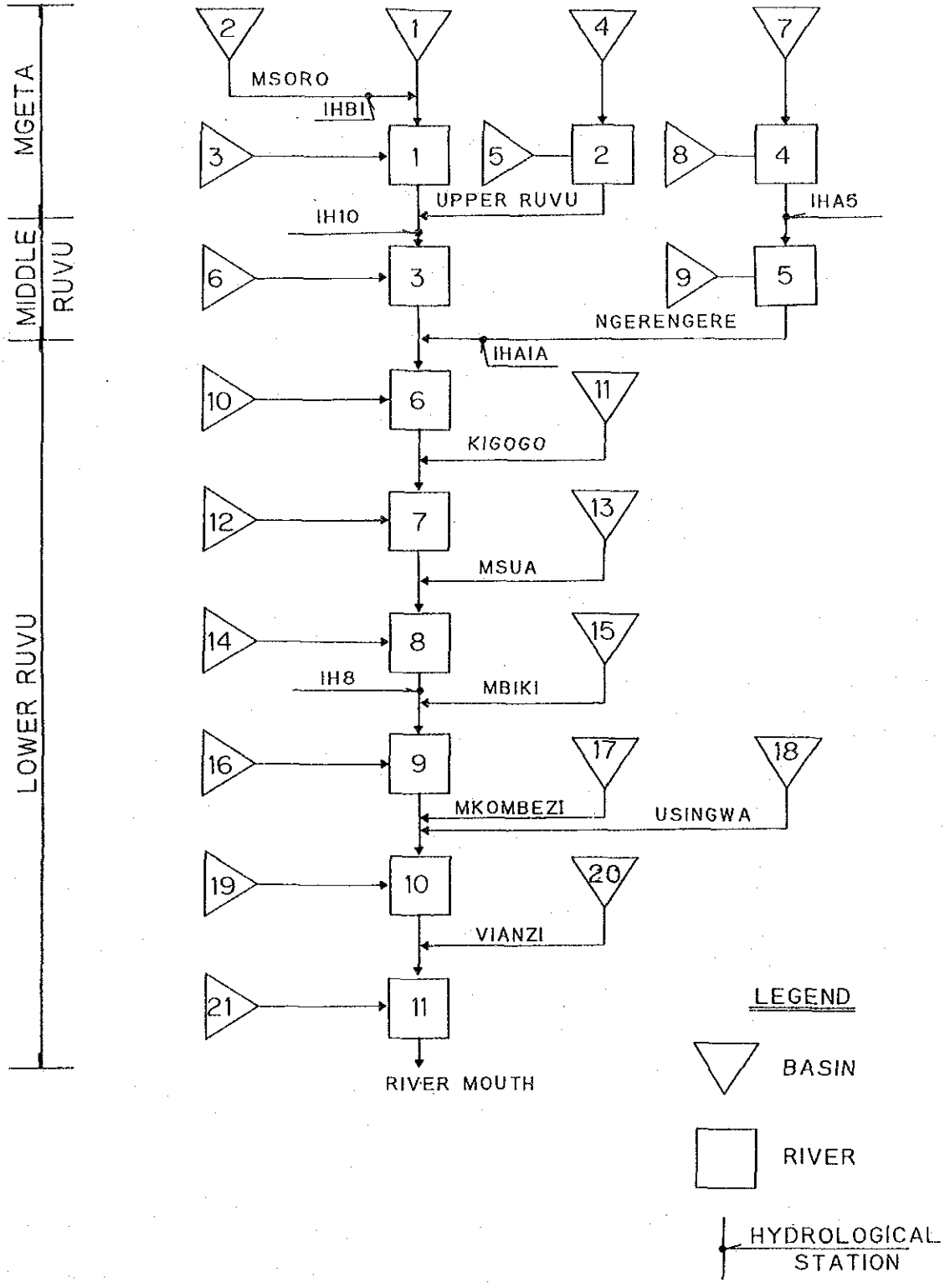
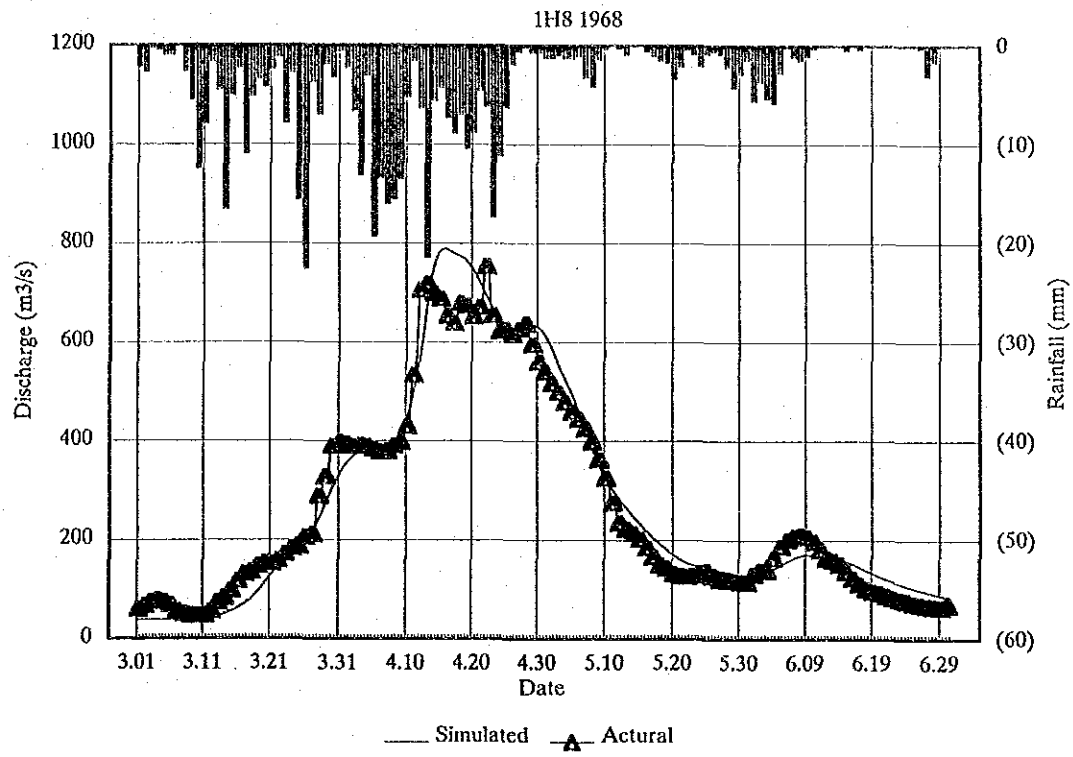


Fig. 3.9 HIGH FLOW ANALYSIS MODEL



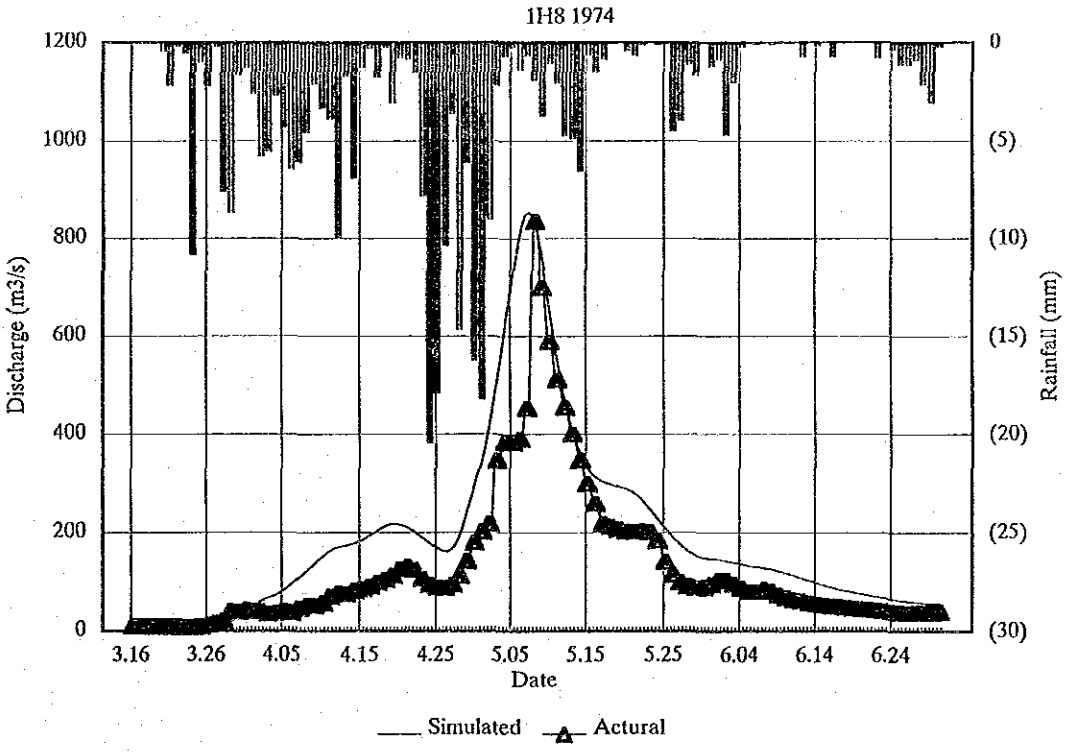
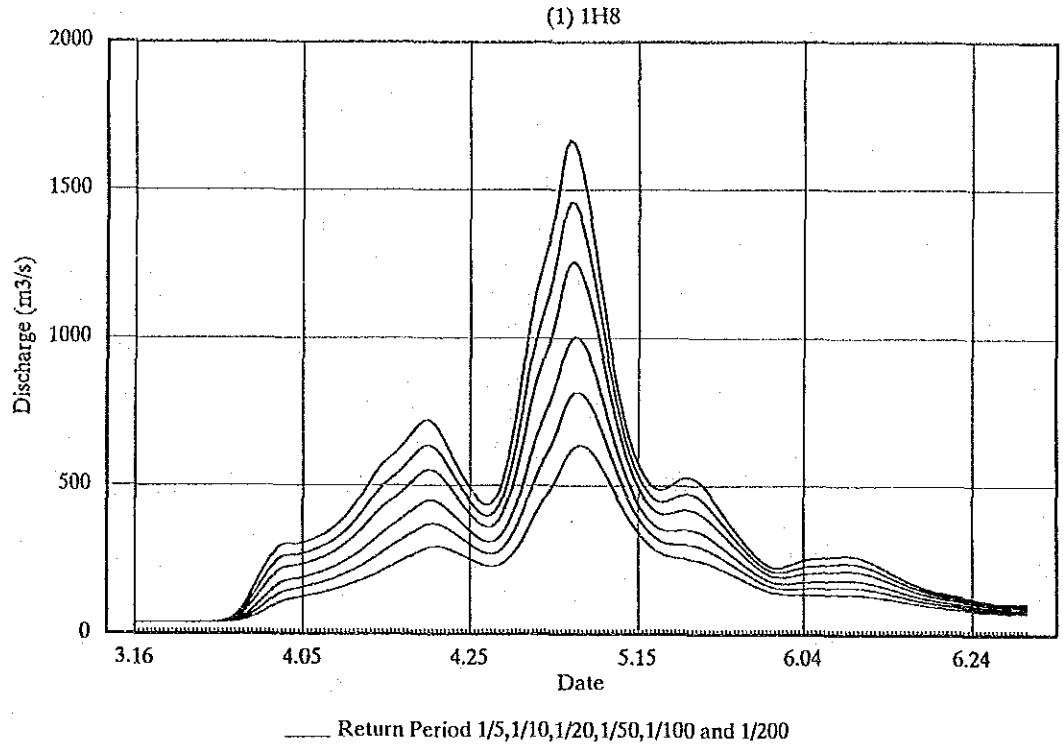


Fig. 3.10 RESULT OF HIGH FLOW ANALYSIS AT 1H8



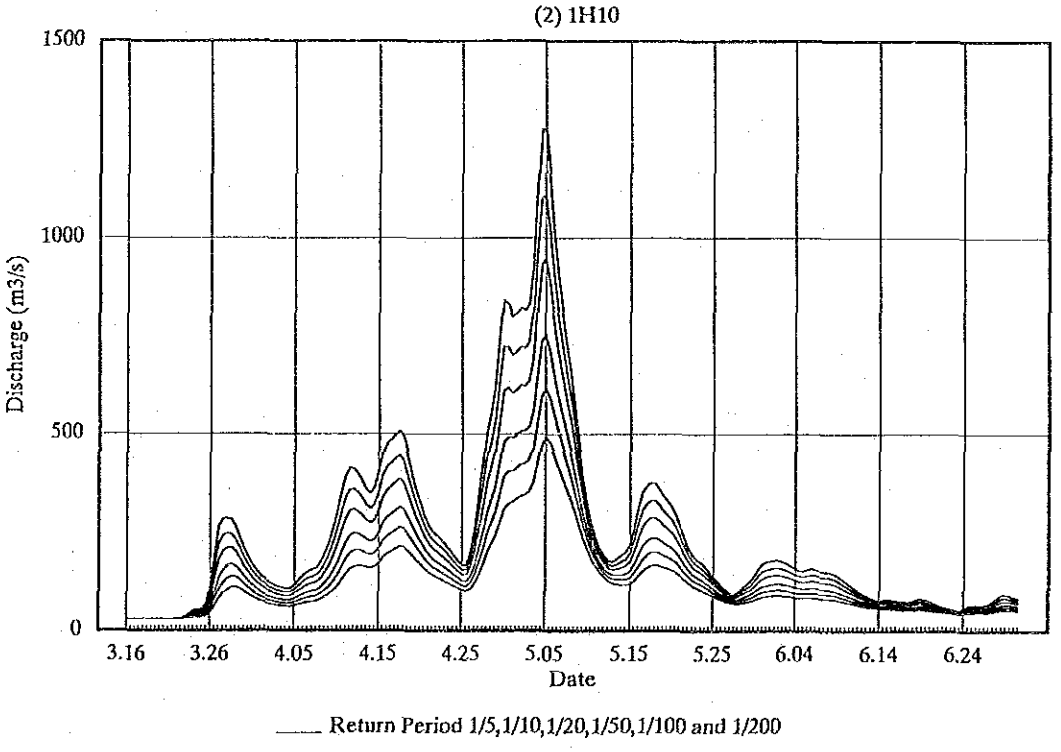


Fig. 3.11 PROPOSED FLOOD PATTERN