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REPUBLIC OF KENYA
MINISTRY OF WATER DEVELOPMENT

THE STUDY
ON
THE NATIONAL WATER MASTER PLAN

DATA BOOK
(DB.6)
PROJECT SHEET
FOR
URBAN WATER SUPPLY

JULY 1992

JAPAN INTERNATIONAL COOPERATION AGENCY

LIST OF REPORTS

EXECUTIVE SUMMARY

MAIN REPORT

1. Vol.1 Water Resources Development and Use Plan towards 2010
2. Vol.2 Master Action Plan towards 2000
Part 1 : National Water Master Action Plan
3. Vol.3 Master Action Plan towards 2000
Part 2 : Action Plan by Province/District

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2. B Hydrology
3. C Groundwater Resources
4. D Domestic and Industrial Water Supply
5. E Agriculture and Irrigation
6. F Livestock, Wildlife and Fishery
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DATABOOK

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4. DB.4 Topographic Survey Data
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6. DB.6 Project Sheet for Urban Water Supply

PREFACE

Interpretation of Report

The original objective of this NWMP Study is to propose a nationwide framework for orderly planning and development of water resources in the country. The Study also deals with the formulation of individual development schemes. However, it should be noted that the plans formulated in this Study remain at a national level and do not provide complete details at local level. Further details should be examined in subsequent studies on each river basin, district, and project basis which are separately recommended in this Study.

Administrative Division of Districts

In this Study, the original 41 districts were considered and various statistical data, particularly socio-economic information, were collected for these districts. During the progress of the Study, six districts were detached from the original ones and established as new districts. In the report, the data on these new districts are grouped together with the corresponding original districts as shown below.

	<u>Original Districts</u>	<u>New Districts</u>	<u>Data included in:</u>
1.	Machakos	Makueni	Machakos/Makueni
2.	Kisii	Nyamira	Kisii/Nyamira
3.	Kakamega	Vihiga	Kakamega/Vihiga
4.	Meru	Tharaka-Nithi	Meru/Tharaka-Nithi
5.	Kericho	Bomet	Kericho/Bomet
6.	South Nyanza	Migori	South Nyanza/Migori

(Note: The last three Districts were established very recently.
The report refers only to the names of the original 41 districts.)

The administrative boundary map used in this Study is the latest complete map set covering the whole country (41 Districts, 233 Divisions and 976 Locations), prepared in 1986 by the Survey of Kenya, Ministry of Land and Housing.

Data and Information

The data and information contained in the report represent those collected in the 1990-1991 period from various documents and reports made available mostly from central government offices in Nairobi and/or those analyzed in this Study based on the collected data. Some of them may be different from those kept in files at some agencies and regional offices. Such discrepancies if any should be collated and adjusted as required in further detailed studies of the relevant development projects.

Development Cost

The cost and benefit estimate was based on the 1991 price level, and expressed in US\$ equivalent according to the exchange rate of US\$1 = KShs25.2 prevailing at that time. The same exchange rate was used in calculating the development cost in K£/KShs currency.

NOTES

The data and information contained in this databook are those used for preliminary cost estimate of the urban water supply schemes. The information is not complete for all items (due to lack of data) and may in some cases be different from some of existing data (in case different data was used). It is presumed that these deficiencies in data will not give critical relevance to preliminary cost estimate of a nation-wide master plan study level. Nevertheless, the gaps in information should be supplemented and/or collected in subsequent stages.

1. Geographic information (Lines 6 to 11):

- Mostly extracted from 1/50,000 topographic map.

2. Existing facilities (Lines 13 to 17):

- Data extracted from either of the following:

- (a) Rural Infrastructure Inventory Survey by MOPND
- (b) Socioeconomic survey conducted under this Study
- (c) Answers from District Water Engineers to questionnaires issued under this Study

However, the information is still incomplete in many schemes due to unavailability of clear information.

3. Future development plan (Lines 29 to 33):

- Plans by MOWD and NWCPD are listed if they exist.
- In case of no existing plans, preliminary plans proposed by this Study were listed. The plans are very tentative only for preliminary cost estimate and subject to further elaboration through comparison of other alternative plans.

4. Cost estimate (Lines 35 to 54)

- Very preliminary cost estimate based on empirical cost formulae. The purpose of estimate is to grasp an overall development cost of water supply sector covering the whole country. The cost of each scheme should be examined on a more detail basis in each project.

5. Location Map

- Location of water intake and route of pipeline shown on figures are indicative only.

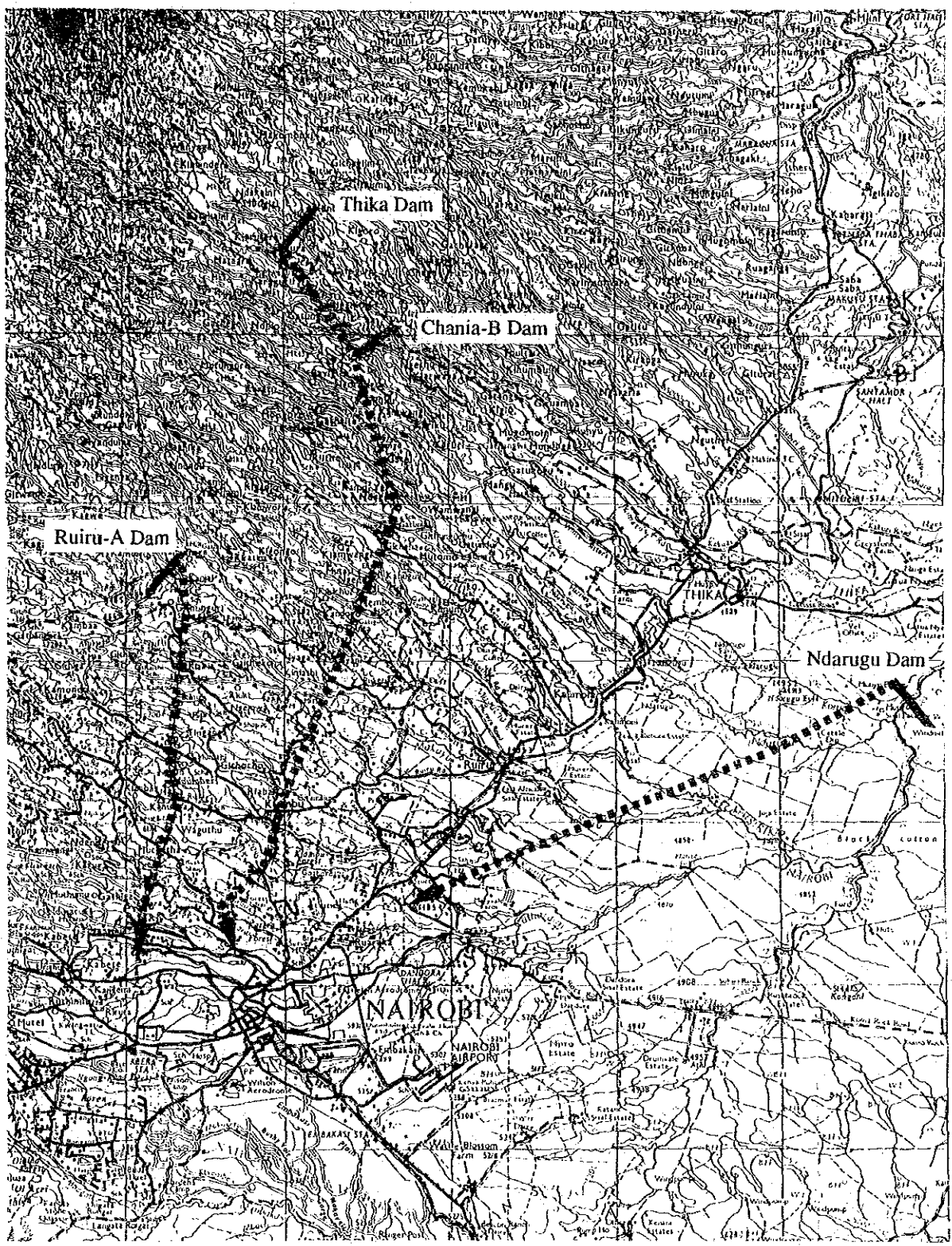
LIST OF PROJECT SHEETS

Code No.	District		Location		Urban Name	Page
	Code	Name	Code	Name	Name	
U- 1	110	Nairobi	110.0	Nairobi	Nairobi	1
U- 2	210	Kiambu	211.1	Kiambaa	Karuri	3
U- 3			211.4	Kiambu Municipality	Kiambu	5
U- 4			212.1	Ngenda	Gatundu & Ngenda	7
U- 5			213.1	Limuru	Limuru	9
U- 6			214.1	Ruiru	Ruiru	11
U- 7			214.4	Thika Municipality	Thika	13
U- 8			215.1	Githunguri	Githunguri	15
U- 9			216.6	Kikuyu	Kikuyu	17
U- 10	220	Kirinyaga	221.1	Tebere	Wanguru	19
U- 11			222.2	Kiine	Sagana	21
U- 12			222.3	Inoi	Kerugoya	23
U- 13			223.2	Kabare	Kutus	25
U- 14	230	Murang'a	231.4	Muruka	Kandara	27
U- 15			232.3	Nginda	Maragua	29
U- 16			233.4	Iyego	Kangema	31
U- 17			234.3	Mbiri	Murang'a	33
U- 18			235.1	Makuyu	Makuyu	35
U- 19	240	Nyandarua	241.3	Oi Kalou	Oi Kalou	37
U- 20	250	Nyeri	254.2	Konyu	Karatina	39
U- 21			256.1	Karima	Othaya	41
U- 22			257.0	Nyeri Municipality	Nyciri	43
U- 23	310	Kilifi	311.2	Mariakani	Mariakani	45
U- 24			313.2	Tezo	Kilifi	47
U- 25			314.3	Gede	Watamu	49
U- 26			314.4	Malindi Town	Malindi	51
U- 27	320	Kwale	321.1	Shimba North	Kwale	53
U- 28			323.1	Kinango South	Kinango	55
U- 29			324.1	Msambweni	Msambweni	57
U- 30	330	Lamu	331.0	Witu	Witu	59
U- 31			333.2	Lamu Town	Lamu	61
U- 32	340	Mombasa	340.0	Mombasa	Mombasa	63
U- 33	350	Taita-Taveta	352.4	Voi	Voi	65
U- 34			353.2	Werugha	Wundanyi	67
U- 35	360	Tana River	362.3	Bura	Bura & Madogo	69
U- 36			363.3	Zabaki	Hola	71
U- 37			364.1	Bilisa	Garsen	73
U- 38	410	Embu	411.8	Kangaari South	Runyenjes	75
U- 39			412.1	Nthawa	Siakago	77
U- 40			413.7	Embu Municipality	Embu	79
U- 41	420	Isiolo	421.1	Central	Isiolo	81
U- 42			421.2	Oldonyonyiro	Oi Doinyo Ng'iro	83
U- 43	430	Kitui	431.4	Changwithya	Kitui	85
U- 44			433.2	Mutomo	Mutomo	87
U- 45			434.4	Mwingi	Mwingi	89
U- 46	440	Machakos/Makueni	441.1	Muvuti	Machakos	91
U- 47	440		441.2	Mitaboni	Mitaboni	93
U- 48	440		442.3	Settlement Area	Athi River	95
U- 49	440		444.3	Kiteta	Uaani/Tawa	97
U- 50	440		445.1	Kangundo	Kangundo	99
U- 51	440		447.4	Kilungu	Nunguni	101
U- 52	440		448.3	Nzau	Emali	103

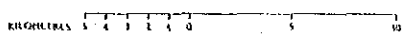
Code No.	District		Location		Urban Name	Page
	Code	Name	Code	Name	Name	
U- 53	440		449.4	Mtito Andei	Mtito Andei&Kibwezi	105
U- 54	450	Marsabit	452.2	Kargi	Kargi	107
U- 55	450		454.1	Mountain	Marsabit	109
U- 56	450		455.2	Sololo	Sololo	111
U- 57	450		456.1	Moyale	Moyale	113
U- 58	460	Meru	461.4	Ntima	Meru	115
U- 59	460		463.1	Nkucne	Nkubu	117
U- 60	460		464.1	Chogoria	Chogoria	119
U- 61	460		464.3	Karingani	Chuka	121
U- 62	460		467.2	Maua	Maua	123
U- 63	510	Garissa	513.1	Madogashe	Mudo Gashe	125
U- 64	510		515.2	Ijara	Ijara	127
U- 65	510		515.3	Kotile	Kotile	129
U- 66	510		515.4	Masalani	Masalani	131
U- 67	510		519.1	Sankuri	Garissa	133
U- 68	520	Mandera	521.1	Mandera	Mandera	135
U- 69	520		523.1	Elwak	Elwak	137
U- 70	520		524.2	Rhamu	Rhamu	139
U- 71	530	Wajir	532.4	Wajir Township	Wajir	141
U- 72	530		536.2	Buna	Buna	143
U- 73	530		537.2	Bute	Bute	145
U- 74	610	Kisii/Nyamira	611.2	Eranga	Manga	147
U- 75	610		611.5	East Kitutu	Keroka	149
U- 76	610		615.0	Kisii Municipality	Kisii	151
U- 77	610		617.1	Majoge Chache	Ogembo	153
U- 78	620	Kisumu	622.1	West Kisumu	Maseno	155
U- 79	620		622.3	East Kisumu	Kisumu & + Kiboswa	157
U- 80	620		623.2	South East Kano	Ahero	159
U- 81	620		625.2	Muhoroni	Muhoroni	161
U- 82	630	Siaya	633.2	East Gem	Yala	163
U- 83	630		634.1	East Alego	Siaya	165
U- 84	630		635.4	North Agenya	Ukwala	167
U- 85	640	South Nyanza	641.1	Kanyada West	Homa Bay	169
U- 86	640		644.3	Suna East	Migori	171
U- 87	640		648.1	Central Karachuonyo	Kendu Bay	173
U- 88	710	Kajiado	711.1	Odomongi	Oloitokitok	175
U- 89	710		712.1	Ngong	Ngong	177
U- 90	710		713.1	Ildamat	Kajiado	179
U- 91	710		713.5	Namanga	Namanga	181
U- 92	710		714.1	Magadi	Magadi	183
U- 93	720	Kericho	723.1	Kepletudo	Sotik	185
U- 94	720		725.5	Kericho Township	Kericho	187
U- 95	720		726.1	Kipketion	Kipkelion	189
U- 96	720		727.1	Londiani	Londiani	191
U- 97	730	Laikipia	731.5	Nanyuki	Nanyuki	193
U- 98	730		733.9	Nyahururu Township	Nyahururu	195
U- 99	740	Nakuru	743.2	Gilgil	Gilgil	197
U- 100	740		744.1	Naivasha	Naivasha	199
U- 101	740		746.1	Njoro	Njoro	201
U- 102	740		747.3	El Burgon	El BURGON	203
U- 103	740		747.5	Molo South	Molo	205
U- 104	740		749.0	Nakuru Municipality	Nakuru	207
U- 105	750	Narok	752.1	Lower Melili	Narok	209
U- 106	750		752.5	Keekonyoike	Nairagie Ngare	211
U- 107	760	Trans Nzoia	762.3	Kitale	Kitale	213

Code No.	District		Location		Urban Name	Page
	Code	Name	Code	Name	Name	
U- 108	760		762.4	Kiminini	Kiminini/Saboti+Spr.Kita	215
U- 109	760		763.5	Endebess	Endebess/Kwanza	217
U- 110	770	Uasin Gishu	772.5	Eldoret Municipality	Eldoret	219
U- 111	770		774.6	Otare	Burnt Forest	221
U- 112	810	Uasin Gishu	812.5	Kabarnet Mosop	Kabarnet	223
U- 113	810		814.3	Maji Mazuri	Maji Mazuri	225
U- 114	810		814.5	Eldama Ravine	Eldama Ravine	227
U- 115	810		815.1	Lembus Soi	Mogotio	229
U- 116	820	Elgeyo-Marakwet	822.4	Kiptuilong	Iten+Tambach	231
U- 117	830	Nandi	831.3	Chemelil	Nandi Hills	233
U- 118	830		832.2	Chemundu	Kapsabet+Baraton	235
U- 119	840	Samburu	841.4	Maralal	Maralal	237
U- 120	840		842.4	Wamba	Wamba	239
U- 121	840		843.6	Eibarta	Baragoi	241
U- 122	850	Turkana	853.5	Lodwar	Lodwar	243
U- 123	860	West Pokot	861.1	Kapenguria	Kapenguria/Makutano	245
U- 124	910	Bungoma	912.4	Musikoma	Bungoma	247
U- 125	910		913.1	Kimilili	Kimilili	249
U- 126	910		914.2	Webuye	Webuye	251
U- 127	920	Busia	921.5	South Teso	Busia	253
U- 128	930	Kakamega/Vihiga	931.3	West Bunyore	Luanda	255
U- 129	930		932.5	Central Maragoli	Vihiga+Majengo	257
U- 130	930		933.1	Shamakhokho	Kaimosi	259
U- 131	930		934.3	West Isukha	Khayega	261
U- 132	930		935.4	Kakamega Municipality	Kakamega	263
U- 133	930		939.2	Central Marama	Butcre	265
U- 134	930		93A.4	Central Wang'a	Mumias	267
U- 135	310	Kilifi	314.6	Magarini	Mamburui	269
U- 136	320	Kwale	324.5	Lungalunga	Lungalunga	271
U- 137	350	Taita-Taveta	351.1	Taveta	Taveta	273
U- 138	420	Isiolo	422.1	Garbatula	Garbatula	275
U- 139	420		423.1	Merti	Merti	277
U- 140	440	Machakos/Makueni	445.2	Matungulu	Tala	279
U- 141	440		448.1	Makueni	Wote	281
U- 142	450	Marsabit	451.1	North Horr	North Horr	283
U- 143	450		453.1	Korr	Korr	285
U- 144	610	Kisii/Nyamira	612.2	East Mugirango	Nyamira + Kebirigo	287
U- 145	630	Siaya	632.4	West Sakwa	Bondo	289
U- 146	640	South Nyanza	646.3	Bukira East	Kehancha + Tarang'anya	291
U- 147	640		646.8	Bugembe West	Nyabikaye	293
U- 148	640		647.4	Central Kasipul	Oyugis	295
U- 149	640		649.4	South Sakwa	Awendo/Sare	297
U- 150	730	Laikipia	733.4	Rumuruti	Rumuruti	299
U- 151	750	Narok	754.4	Uasin Gishu East	Kilgoris	301
U- 152	750		755.1	Siria East	Lolkorian	303
U- 153	770	Uasin Gishu	771.2	Moi's Bridge	Moi's Bridge	305
U- 154	770		772.4	Turbo West	Turbo	307
U- 155	810	Baringo	816.2	Marigat	Marigat	309
U- 156	910	Bungoma	911.4	Malakisi	Mawalie + Malakisi	311
U- 157	910		916.1	Cheptais	Chaptais	313
U- 158	920	Busia	922.2	Central Bukhayo	Nambale	315

a	b	c	d	e	f	g	h	i
2	National Water Master Plan							
3	URBAN WATER SUPPLY							
4	Code No.	U-1	Rate		Jul-92			25.2
5	-----							
6	Name of Urban:	Nairobi	LGL Notice No:					
7	Organization:							
8	Per Capita GRDP in 1988 (guess):							
9	District:	Nairobi	Locataion :	110 Nairobi				
10	Map (1/50,000) :	148/4	Coordinates(UTM) X:	258,705		Y:	(143,242)	
11	Sub-basin Code:	3BA	Elevation (El. m):					
12	-----							
13	Existing Facilities	Chaania R.+Sasumua Dam+Ruiru Dam+Kikuyu Spring						
14	Raw Water Source:							
15	Raw Water System:	H (m)=	L (m)=					
16	Treatment:	Capacity (m3/d)		178,110				
17	Distribution System:							
18	-----							
19			1990	2000	2010			
20	-----							
21	Projected Population	(no)	1,413,100	2,260,500	3,465,400			
22	Residential Demand	(m3/d)	175,048	286,236	448,336			
23	Non-residential Demand	(m3/d)	29,286	46,848	71,819			
24	Livestock Demand	(m3/d)	192	257	345			
25	Industrial Demand	(m3/d)	128,300	218,953	281,668			
26	Total Demand	(m3/d)	332,826	552,294	802,168			
27	Area served (estimated net)	(ha)	10,553	16,881	25,879			
28	-----							
29	Future Development Plan							
30	Raw Water Source:	Thika Dam, Ndarugu, Ruiru-A, Chania-B		River No:				
31	Raw Water System:	H (m)=	150	L (m)=	165,000			
32	Treatment:							
33	Distribution System:							
34	-----							
35	Incremental Capital Cost		1990	2000	2010		Total	
36	Incremental Capacity	(m3/d)	154,715.8	219,468.1	249,874.3		624,058.1	
37	Source Works	(US\$'000)	464.4	603.6	665.3		1,733.3	
38	Pump Cost	(US\$'000)	1,150.0	750.0	850.0		2,750.0	
39	Raw Water Main	(US\$'000)	66,119.9	84,841.0	93,316.5		244,277.3	
40	Treatment	(US\$'000)	15,742.3	22,330.9	25,424.7		63,497.9	
41	Storage	(US\$'000)	6,663.1	9,451.8	10,761.3		26,876.1	
42	Distribution	(US\$'000)	84,423.7	50,626.7	71,985.1		207,035.4	
43	Miscellaneous (20%)	(US\$'000)	34,912.7	33,720.8	40,600.6		109,234.0	
44	Admi. & Engineering	(US\$'000)	20,947.6	20,232.5	24,360.3		65,540.4	
45	Contingency	(US\$'000)	46,084.7	44,511.4	53,592.7		144,188.9	
46	Total Cost	(US\$'000)	276,508.3	267,068.6	321,556.4		865,133.4	
47	Cost per Capita	(US\$/c)	195.7	315.2	266.9			
48	Cost per ha	(US\$/ha)	26,202.0	42,202.0	35,735.9			
49	Cost per m3	(US\$/m3)	1.8	1.2	1.3		1.4	
50	-----							
51	Present Value of Water at DF=10 %		1990	2000	2010		Total	
52	Direct O & M Costs	(US\$'000)	13,825.4	13,353.4	16,077.8			
53	Capital Costs	(US\$'000)	28,480.4	27,508.1	33,120.3			
54	Total Annual Cost	(US\$'000)	42,305.8	40,861.5	49,198.1			
55	Unit Cost per m3	(US\$/m3)	0.7	0.5	0.5			
56	-----							
57	Remarks:	Thika dam is on-going. After Thika dam, Ndarugu dam (or alternatively Munyu dam).						
58		Ruiru-A dam and Chania-B dam will be required to meet the increasing demand.						
59		Source works cost above does not include the cost of dams, which should be added (see Sectoral Report M).						
60		Pipelije length: 50km (Thika Dam) + 36km (Ndarugu Dam)+ 35km (Ruiru-A Dam)+ 44km (Chania-B Dam)						
61		Although three dams are necessary to supply water to Nairobi, supply to urban centres along the pipelines						
62		such as Kiambu, Gatundu, Ngenda and Kikuyu could be considered if the supply capacities allow.						
63	-----							



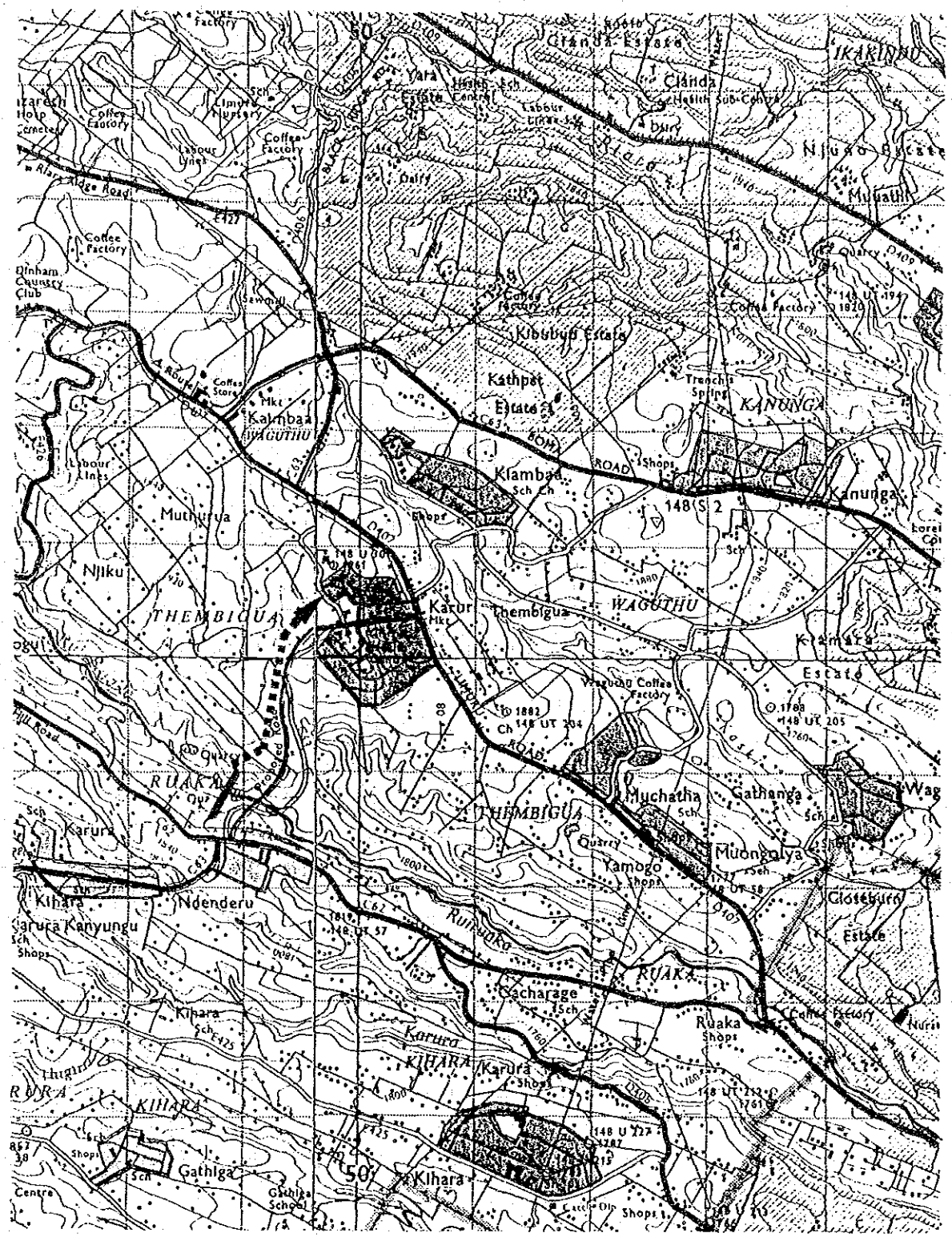
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THE STUDY
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JAPAN INTERNATIONAL COOPERATION AGENCY

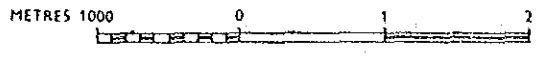
a	b	c	d	e	f	g	h	i
2					National Water Master Plan			
3			URBAN WATER SUPPLY					Feb-92
4	Code No. 210		U-2			Rate		25.2
5	-----							
6	Name of Urban:		Karuri		LGL Notice No:			
7	Organization:							
8	Per Capita GRDP in 1988 (guess):							
9	District:		Kiambu	Location :	211.1 Kiambaa			
10	Map (1/50,000) :		148/2	Coordinates(UTM) X:	250,489		Y:	(129,708)
11	Sub-basin Code:		3BA	Elevation (El. m):				
12	-----							
13	Existing Facilities							
14	Raw Water Source:		Boreholes			River No		
15	Raw Water System:		H (m)=	L (m)=				
16	Treatment:			Capacity (m3/d)				
17	Distribution System:							
18	-----							
19					1990	2000	2010	
20	-----							
21	Projected Population		(no)		16,200	31,700	46,400	
22	Residential Demand		(m3/d)		2,007	4,014	6,003	
23	Non-residential Demand		(m3/d)		336	656	960	
24	Livestock Demand		(m3/d)		22	42	64	
25	Industrial Demand		(m3/d)		189	358	530	
26	Total Demand		(m3/d)		2,554	5,070	7,557	
27	Area Served (estimated net)		(ha)		121	237	347	
28	-----							
29	Future Development Plan							
30	Raw Water Source:		Kiambaa Dam (Rui Ruaka R.)			River No:		
31	Raw Water System:		H (m)=	170 L (m)=	2,200			
32	Treatment:							
33	Distribution System:							
34	-----							
35	Incremental Capital Cost				1990	2000	2010	Total
36	Incremental Capacity		(m3/d)		2,553.8	2,516.2	2,487.0	7,557.0
37	Source Works		(US\$'000)		21.4	21.1	21.0	63.5
38	Pump Cost		(US\$'000)		10.4	10.4	10.4	31.2
39	Raw Water Main		(US\$'000)		126.7	126.3	125.9	378.9
40	Treatment		(US\$'000)		693.5	688.6	684.7	2,066.7
41	Storage		(US\$'000)		116.2	115.5	114.9	346.5
42	Distribution		(US\$'000)		967.8	926.0	878.2	2,772.1
43	Miscellaneous (20%)		(US\$'000)		387.2	377.6	367.0	1,131.8
44	Admi. & Engineering		(US\$'000)		232.3	226.5	220.2	679.1
45	Contingency		(US\$'000)		511.1	498.4	484.5	1,494.0
46	Total Cost		(US\$'000)		3,066.7	2,990.4	2,906.8	8,963.8
47	Cost per Capita		(US\$/c)		189.3	192.9	197.7	
48	Cost per ha		(US\$/ha)		25,348.5	25,834.1	26,478.3	
49	Cost per m3		(US\$/m3)		1.2	1.2	1.2	1.2
50	-----							
51	Present Value of Water at DF=10 %				1990	2000	2010	Total
52	Direct O & M Costs		(US\$'000)		153.3	149.5	145.3	
53	Capital Costs		(US\$'000)		315.9	308.0	299.4	
54	Total Annual Cost		(US\$'000)		469.2	457.5	444.7	
55	Unit Cost per m3		(US\$/m3)		0.5	0.5	0.5	
56	-----							
57	Remarks:	Source works cost does not include the cost of Kiambaa dam, which should be added separately						
58		(see Sectoral Report M).						
59								
60								
61								
62								
63	-----							

Fig.



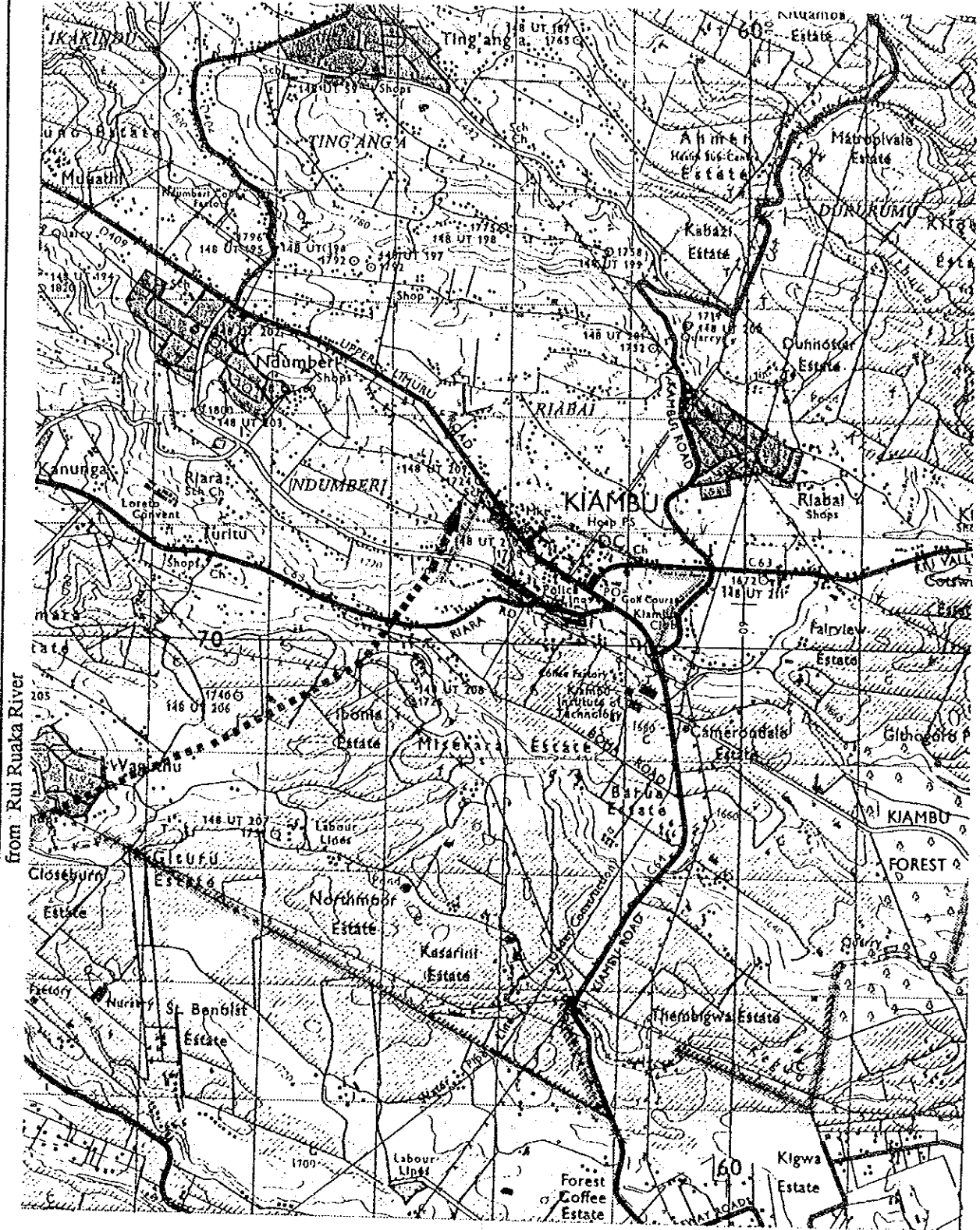
U- 2 Karuri

U 211.1 143/2 3BA



THE STUDY
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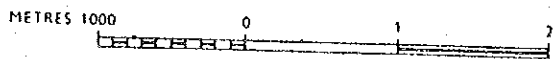
a	b	c	d	e	f	g	h	i
2					National Water Master Plan			
3			URBAN WATER SUPPLY					Jul-92
4	Code No. 210		U-3			Rate		25.2
5	-----							
6	Name of Urban:		Kiambu		LGL Notice No:			
7	Organization:							
8	Per Capita GRDP in 1988 (guess):							
9	District:		Kiambu	Locataion :	211.4 Kiambu Municipality			
10	Map (1/50,000) :		148/2	Coordinates(UTM) X:	259,347		Y:	(129,097)
11	Sub-basin Code:		3BA	Elevation (El. m):				
12	-----							
13	Existing Facilities							
14	Raw Water Source:		Bore holes + NCC P/L			River No		
15	Raw Water System:		H (m)=	L (m)=		Borcholes		
16	Treatment:		Capacity (m3/d)			550		
17	Distribution System:							
18	-----							
19					1990	2000	2010	
20	-----							
21	Projected Population		(no)		4,500	10,400	16,600	
22	Residential Demand		(m3/d)		557	1,317	2,148	
23	Non-residential Demand		(m3/d)		93	214	344	
24	Livestock Demand		(m3/d)		6	14	23	
25	Industrial Demand		(m3/d)		933	1,667	2,288	
26	Total Demand		(m3/d)		1,589	3,212	4,803	
27	Area served (estimated net)		(ha)		34	78	124	
28	-----							
29	Future Development Plan							
30	Raw Water Source:		Kiambaa Dam (Rui Ruaka r.)			River No:		
31	Raw Water System:		H (m)=	0 L (m)=		12,100		
32	Treatment:							
33	Distribution System:							
34	-----							
35	Incremental Capital Cost				1990	2000	2010	Total
36	Incremental Capacity		(m3/d)		1,039.4	1,622.5	1,590.7	4,252.6
37	Source Works		(US\$'000)		10.9	15.2	15.0	41.1
38	Pump Cost		(US\$'000)		0.0	0.0	0.0	0.0
39	Raw Water Main		(US\$'000)		576.9	628.3	625.8	1,831.0
40	Treatment		(US\$'000)		435.7	552.5	546.9	1,535.1
41	Storage		(US\$'000)		75.0	94.5	93.5	139.6
42	Distribution		(US\$'000)		268.8	352.5	370.4	991.7
43	Miscellaneous (20%)		(US\$'000)		273.5	328.6	330.3	932.4
44	Admi. & Engineering		(US\$'000)		164.1	197.2	198.2	559.4
45	Contingency		(US\$'000)		361.0	433.8	436.0	1,230.8
46	Total Cost		(US\$'000)		2,165.9	2,602.5	2,616.1	7,384.5
47	Cost per Capita		(US\$/c)		481.3	441.1	421.9	
48	Cost per ha		(US\$/ha)		64,450.5	59,066.4	56,501.2	
49	Cost per m3		(US\$/m3)		2.1	1.6	1.6	1.7
50	-----							
51	Present Value of Water at DF=10 %				1990	2000	2010	Total
52	Direct O & M Costs		(US\$'000)		108.3	130.1	130.8	
53	Capital Costs		(US\$'000)		223.1	268.1	269.5	
54	Total Annual Cost		(US\$'000)		331.4	398.2	400.3	
55	Unit Cost per m3		(US\$/m3)		0.9	0.7	0.7	
56	-----							
57	Remarks:	Source works cost does not include the cost of Kiambaa dam, which should be added separately						
58		(see Sectoral Report M).						
59								
60								
61								
62								
63	-----							



from Rui Ruaka River

U- 3 Kiambu

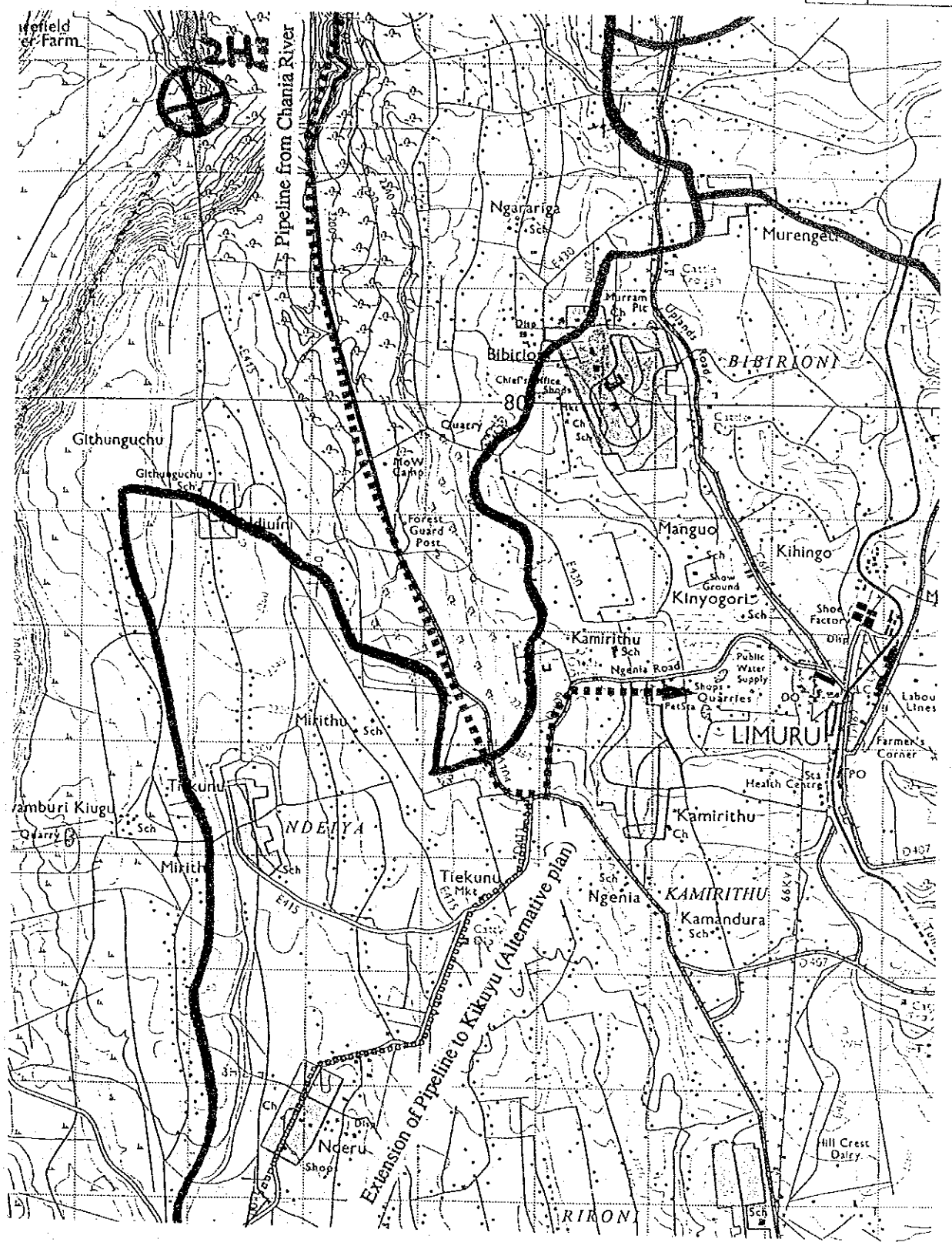
U 211.4 148/2 3BA



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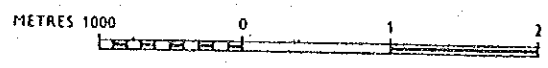
a	b	c	d	e	f	g	h	i
2	National Water Master Plan							
3	URBAN WATER SUPPLY							Feb-92
4	Code No. 210	U- 4				Rate		25.2
5	-----							
6	Name of Urban:	Gatundu & Ngenda		LGL Notice No:				
7	Organization:							
8	Per Capita GRDP in 1988 (guess):							
9	District:	Kiambu	Locataion :	212.1 Ngenda				
10	Map (1/50,000) :	148/2	Coordinates X:	36°54'		Y:	S 01°00'	
11	Sub-basin Code:	3BD	Elevation (El. m):					
12	-----							
13	Existing Facilities							
14	Raw Water Source:	Boreholes		L (m)=		River No		
15	Raw Water System:	H (m)=			Boreholes			
16	Treatment:	Capacity (m3/d)		433				
17	Distribution System:							
18	-----							
19				1990	2000	2010		
20	-----							
21	Projected Population	(no)		900	1,500	2,000		
22	Residential Demand	(m3/d)		111	190	259		
23	Non-residential Demand	(m3/d)		0	31	41		
24	Livestock Demand	(m3/d)		0	2	3		
25	Industrial Demand	(m3/d)		59	109	157		
26	Total Demand	(m3/d)		170	332	460		
27	Area Served (estimated net)	(ha)		7	11	15		
28	-----							
29	Future Development Plan							
30	Raw Water Source:	Thirika River		70 L (m)=		River No:		
31	Raw Water System:	H (m)=			3,200			
32	Treatment:							
33	Distribution System:							
34	-----							
35	Incremental Capital Cost			1990	2000	2010	Total	
36	Incremental Capacity	(m3/d)		0	0	26.75	26.8	
37	Source Works	(US\$'000)		0.0	0.0	0.7	0.7	
38	Pump Cost	(US\$'000)		0.0	0.0	1.9	1.9	
39	Raw Water Main	(US\$'000)		0.0	0.0	110.8	110.8	
40	Treatment	(US\$'000)		0.0	0.0	47.6	47.6	
41	Storage	(US\$'000)		0.0	0.0	7.2	7.2	
42	Distribution	(US\$'000)		0.0	0.0	29.9	29.9	
43	Miscellaneous (20%)	(US\$'000)		0.0	0.0	39.6	39.6	
44	Admi. & Engineering	(US\$'000)		0.0	0.0	23.8	23.8	
45	Contingency	(US\$'000)		0.0	0.0	52.3	52.3	
46	Total Cost	(US\$'000)		0.0	0.0	313.9	313.9	
47	Cost per Capita	(US\$/c)		0.0	0.0	627.7		
48	Cost per ha	(US\$/ha)		0.0	0.0	84,056.1		
49	Cost per m3	(US\$/m3)		0.0	0.0	11.7	11.7	
50	-----							
51	Present Value of Water at DF=10 %			1990	2000	2010	Total	
52	Direct O & M Costs	(US\$'000)		0.0	0.0	15.7		
53	Capital Costs	(US\$'000)		0.0	0.0	32.3		
54	Total Annual Cost	(US\$'000)		0.0	0.0	48.0		
55	Unit Cost per m3	(US\$/m3)		0.0	0.0	4.9		
56	-----							
57	Remarks:							
58								
59								
60								
61								
62								
63	-----							

a	b	c	d	e	f	g	h	i
2						National Water Master Plan		
3			URBAN WATER SUPPLY					Feb-92
4	Code No.	210	U- 5			Rate		25.2
5	-----							
6	Name of Urban:		Limuru			LGL Notice No:		
7	Organization:							
8	Per Capita GRDP in 1988 (guess):							
9	District:		Kiambu	Locataion :	213.1	Limuru		
10	Map (1/50,000):		148/1	Coordinates X:		36°38'	Y:	S 01°06'
11	Sub-basin Code:		3BA	Elevation (El. m):				
12	-----							
13	Existing Facilities							
14	Raw Water Source:		Boreholes			River No		
15	Raw Water System:		H (m)=	L (m)=				
16	Treatment:			Capacity (m3/d)		206		
17	Distribution System:							
18	-----							
19					1990	2000	2010	
20	-----							
21	Projected Population		(no)		1,600	3,200	4,600	
22	Residential Demand		(m3/d)		198	405	595	
23	Non-residential Demand		(m3/d)		33	65	95	
24	Livestock Demand		(m3/d)		2	4	6	
25	Industrial Demand		(m3/d)		698	1,225	1,641	
26	Total Demand		(m3/d)		931	1,699	2,337	
27	Area Served (estimated net)		(ha)		12	24	34	
28	-----							
29	Future Development Plan							
30	Raw Water Source:		Chania P/L			River No:		
31	Raw Water System:		H (m)=	360 L (m)=		59,700		
32	Treatment:							
33	Distribution System:							
34	-----							
35	Incremental Capital Cost				1990	2000	2010	Total
36	Incremental Capacity		(m3/d)		725.2	768.0	637.9	2,131.1
37	Source Works		(US\$'000)		100.3	8.7	7.6	116.6
38	Pump Cost		(US\$'000)		13.3	13.3	13.2	39.8
39	Raw Water Main		(US\$'000)		1,932.0	2,707.8	2,634.1	7,273.8
40	Treatment		(US\$'000)		356.7	368.4	331.7	1,056.8
41	Storage		(US\$'000)		61.4	63.4	57.0	181.9
42	Distribution		(US\$'000)		95.6	95.6	83.6	274.8
43	Miscellaneous (20%)		(US\$'000)		511.9	651.4	625.4	1,788.7
44	Admi. & Engineering		(US\$'000)		307.1	390.9	375.3	1,073.2
45	Contingency		(US\$'000)		675.6	859.9	825.6	2,361.1
46	Total Cost		(US\$'000)		4,053.9	5,159.4	4,953.4	14,166.8
47	Cost per Capita		(US\$/c)		2,533.7	3,224.6	3,538.2	
48	Cost per ha		(US\$/ha)		339,274.6	431,797.4	473,780.2	
49	Cost per m3		(US\$/m3)		5.6	6.7	7.8	6.6
50	-----							
51	Present Value of Water at DF=10 %				1990	2000	2010	Total
52	Direct O & M Costs		(US\$'000)		202.7	258.0	247.7	
53	Capital Costs		(US\$'000)		417.6	531.4	510.2	
54	Total Annual Cost		(US\$'000)		620.2	789.4	757.9	
55	Unit Cost per m3		(US\$/m3)		2.3	2.8	3.3	
56	-----							
57	Remarks:	Source works include the cost of a small dam to be constructed on the Chania river.						
58		Chania P/L will also supply water to rural areas along the pipeline up to Limuru.						
59		The P/L may be extended to Kikuyu town as an alternative to Kikuyu dam.						
60								
61								
62								
63	-----							



U- 5 Limuru

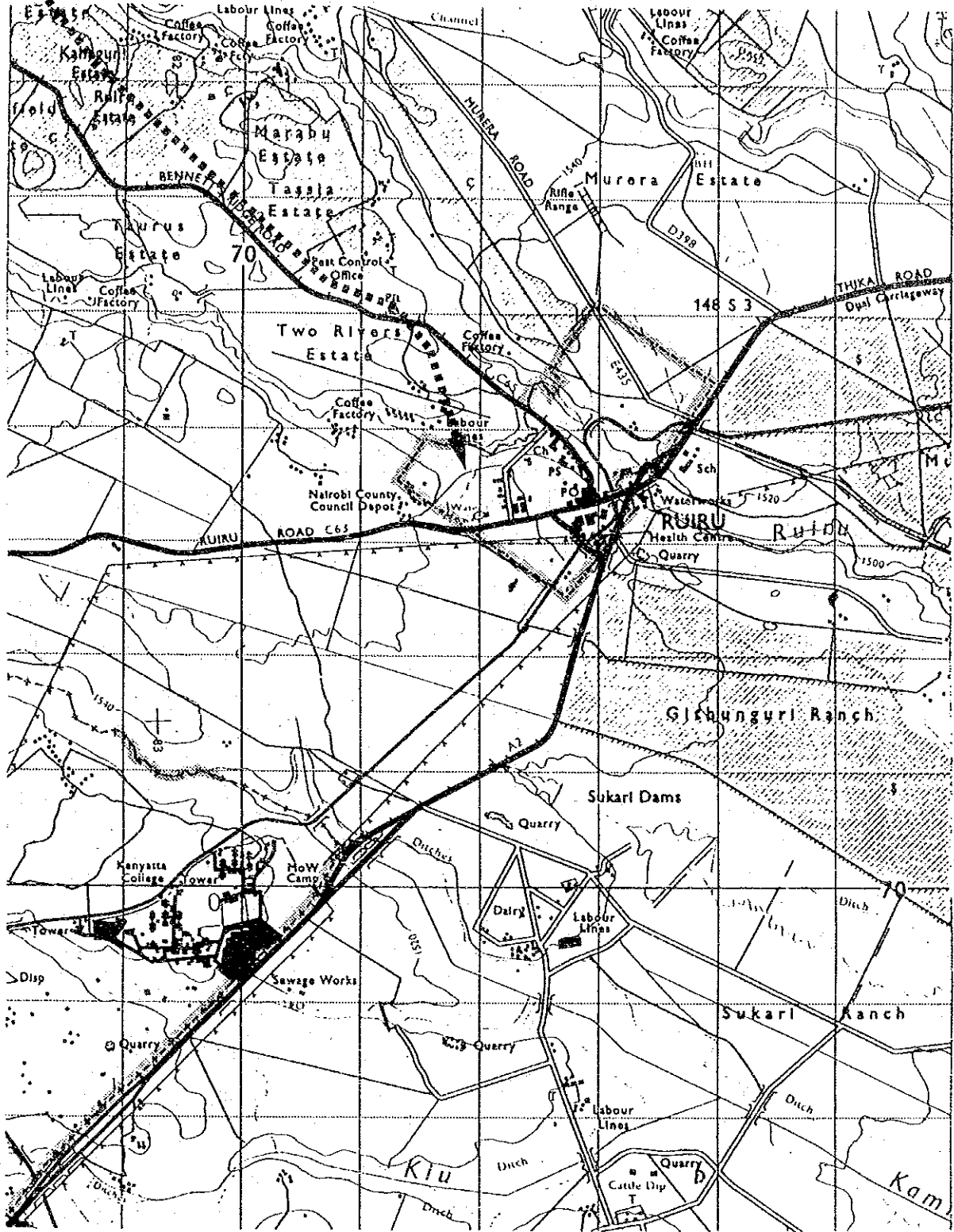
U 213.1 143/1 3BA



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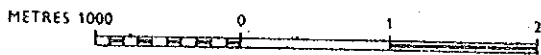
a	b	c	d	e	f	g	h	i	
2	National Water Master Plan								
3	URBAN WATER SUPPLY								
4	Code No. 210	U- 6				Rate		Jul-92 25.2	
5	-----								
6	Name of Urban:	Ruiru	LGL Notice No:						
7	Organization:								
8	Per Capita GRDP in 1988 (guess):								
9	District:	Kiambu	Locataion :	214.1	Ruiru				
10	Map (1/50,000) :	148/2	Coordinates X:		36°58'	Y:	S 01°09'		
11	Sub-basin Code:	3BC	Elevation (El. m):						
12	-----								
13	Existing Facilities								
14	Raw Water Source:	Ruiru River				River No			
15	Raw Water System:	H (m)=	L (m)=						
16	Treatment:	Capacity (m3/d)				393			
17	Distribution System:								
18	-----								
19				1990	2000	2010			
20	-----								
21	Projected Population		(no)	14,300	28,000	40,900			
22	Residential Demand		(m3/d)	1,771	3,546	5,291			
23	Non-residential Demand		(m3/d)	296	579	847			
24	Livestock Demand		(m3/d)	19	37	56			
25	Industrial Demand		(m3/d)	580	1,019	1,365			
26	Total Demand		(m3/d)	2,602	5,076	7,456			
27	Area served (estimated net)		(ha)	107	209	305			
28	-----								
29	Future Development Plan								
30	Raw Water Source:	Ruiru River				River No:			
31	Raw Water System:	H (m)=	L (m)=	7500					
32	Treatment:								
33	Distribution System:								
34	-----								
35	Incremental Capital Cost				1990	2000	2010	Total	
36	Incremental Capacity		(m3/d)	2209	2474	2380	7,063.0		
37	Source Works		(US\$'000)	19.2	20.9	20.3	60.3		
38	Pump Cost		(US\$'000)	0.0	0.0	0.0	0.0		
39	Raw Water Main		(US\$'000)	417.1	428.7	424.6	1,270.4		
40	Treatment		(US\$'000)	646.1	683.0	670.2	1,999.3		
41	Storage		(US\$'000)	109.1	114.6	112.8	336.5		
42	Distribution		(US\$'000)	854.3	818.5	770.7	2,443.5		
43	Miscellaneous (20%)		(US\$'000)	409.2	413.1	399.7	1,222.0		
44	Admi. & Engineering		(US\$'000)	245.5	247.9	239.8	733.2		
45	Contingency		(US\$'000)	540.1	545.3	527.6	1,613.1		
46	Total Cost		(US\$'000)	3,240.7	3,271.9	3,165.7	9,678.3		
47	Cost per Capita		(US\$/c)	226.6	238.8	245.4			
48	Cost per ha		(US\$/ha)	30,345.7	31,980.3	32,861.1			
49	Cost per m3		(US\$/m3)	1.5	1.3	1.3	1.4		
50	-----								
51	Present Value of Water at DF=10 %				1990	2000	2010	Total	
52	Direct O & M Costs		(US\$'000)	162.0	163.6	158.3			
53	Capital Costs		(US\$'000)	333.8	337.0	326.1			
54	Total Annual Cost		(US\$'000)	495.8	500.6	484.4			
55	Unit Cost per m3		(US\$/m3)	0.6	0.6	0.6			
56	-----								
57	Remarks: There is a plan to include Tatu Prison Training College and Githunguri Settlement Scheme in the supply and								
58	have a dam 7km from the town to meet the combined demand.								
59									
60									
61									
62									
63	-----								

from Ruiru River



U- 6 Ruiru

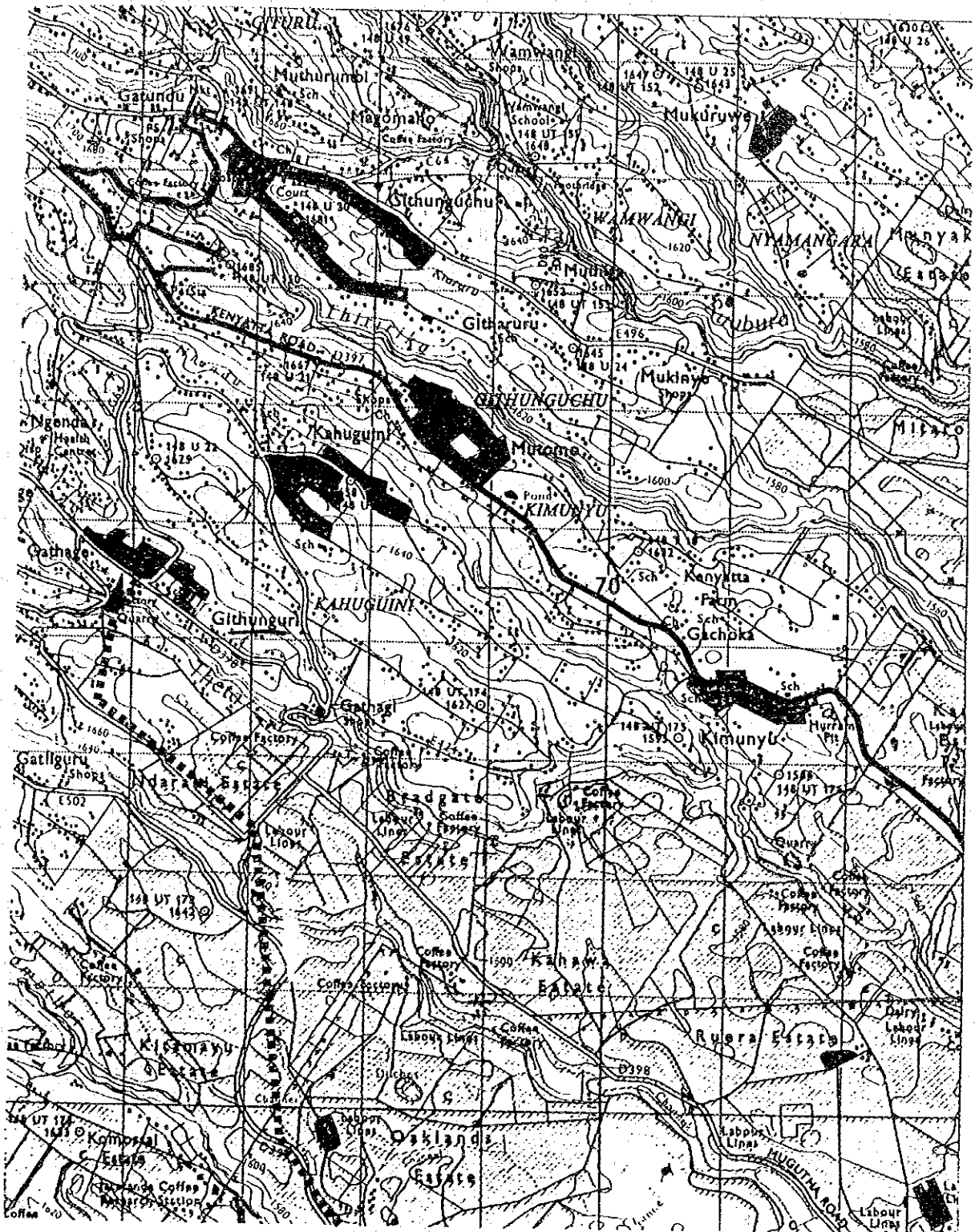
U 214.1 148/2 3BC



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a	b	c	d	e	f	g	h	i
2					National Water Master Plan			
3			URBAN WATER SUPPLY					Feb-92
4	Code No. 210		U- 7			Rate		25.2
5	-----							
6	Name of Urban:		Thika		LGL Notice No:			
7	Organization:							
8	Per Capita GRDP in 1988 (guess):							
9	District:		Kiambu	Locataion :	214.4	Thika Municipality		
10	Map (1/50,000) :		149/1	Coordinates X:		37°05'	Y:	S 01°04'
11	Sub-basin Code:		3CB	Elevation (El. m):				
12	-----							
13	Existing Facilities							
14	Raw Water Source:		Chania R.			River No		
15	Raw Water System:		H (m)=	L (m)=				
16	Treatment:			Capacity (m3/d)		11400		
17	Distribution System:							
18	-----							
19					1990	2000	2010	
20	-----							
21	Projected Population		(no)		59,000	135,500	217,500	
22	Residential Demand		(m3/d)		7,309	17,158	28,139	
23	Non-residential Demand		(m3/d)		1,223	2,806	4,506	
24	Livestock Demand		(m3/d)		80	180	299	
25	Industrial Demand		(m3/d)		2,522	4,593	6,472	
26	Total Demand		(m3/d)		11,134	24,737	39,416	
27	Area Served (estimated net)		(ha)		441	1,012	1,624	
28	-----							
29	Future Development Plan							
30	Raw Water Source:		Chania River (Lower)			River No:		
31	Raw Water System:		H (m)=	0.0 L (m)=		5500		
32	Treatment:							
33	Distribution System:							
34	-----							
35	Incremental Capital Cost				1990	2000	2010	Total
36	Incremental Capacity		(m3/d)		0	13336.6875	14679.375	28,016.1
37	Source Works		(US\$'000)		0.0	73.9	79.4	153.3
38	Pump Cost		(US\$'000)		0.0	0.0	0.0	0.0
39	Raw Water Main		(US\$'000)		0.0	549.7	572.9	1,122.6
40	Treatment		(US\$'000)		0.0	1,234.4	1,246.2	2,480.6
41	Storage		(US\$'000)		0.0	128.6	117.1	245.7
42	Distribution		(US\$'000)		0.0	4,570.4	4,899.0	9,469.4
43	Miscellaneous (20%)		(US\$'000)		0.0	1,311.4	1,382.9	2,694.3
44	Admi. & Engineering		(US\$'000)		0.0	786.8	829.7	1,616.6
45	Contingency		(US\$'000)		0.0	1,731.0	1,825.4	3,556.5
46	Total Cost		(US\$'000)		0.0	10,386.1	10,952.6	21,338.7
47	Cost per Capita		(US\$/c)		0.0	135.8	133.6	
48	Cost per ha		(US\$/ha)		0.0	18,179.9	17,885.6	
49	Cost per m3		(US\$/m3)		0.0	0.8	0.7	0.8
50	-----							
51	Present Value of Water at DF=10 %				1990	2000	2010	Total
52	Direct O & M Costs		(US\$'000)		0.0	519.3	547.6	
53	Capital Costs		(US\$'000)		0.0	1,069.8	1,128.1	
54	Total Annual Cost		(US\$'000)		0.0	1,589.1	1,675.7	
55	Unit Cost per m3		(US\$/m3)		0.0	0.3	0.3	
56	-----							
57	Remarks:							
58								
59								
60								
61								
62								
63	-----							

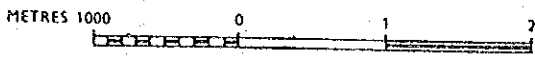
a	b	c	d	e	f	g	h	i
2	National Water Master Plan							
3	URBAN WATER SUPPLY							
4	Code No. 210		U- 8			Rate		Feb-92 25.2
5	-----							
6	Name of Urban:	Githunguri		LGL Notice No:				
7	Organization:							
8	Per Capita GRDP in 1988 (guess):							
9	District:	Kiambu	Locataion :	215.1 Githunguri				
10	Map (1/50,000):	148/2	Coordinates X:	36°46'		Y:	S 01°03'	
11	Sub-basin Code:	3BC	Elevation (El. m):					
12	-----							
13	Existing Facilities							
14	Raw Water Source:	Boreholes		L (m)=		River No		
15	Raw Water System:	H (m)=						
16	Treatment:			Capacity (m3/d)		157		
17	Distribution System:							
18	-----							
19				1990	2000	2010		
20	-----							
21	Projected Population	(no)		3,800	8,800	14,100		
22	Residential Demand	(m3/d)		471	1,114	1,824		
23	Non-residential Demand	(m3/d)		79	181	290		
24	Livestock Demand	(m3/d)		5	12	19		
25	Industrial Demand	(m3/d)		116	216	311		
26	Total Demand	(m3/d)		671	1,523	2,444		
27	Area Served (estimated net)	(ha)		28	66	105		
28	-----							
29	Future Development Plan							
30	Raw Water Source:	Ruiru river		L (m)=		River No:		
31	Raw Water System:	H (m)=		120		7,200		
32	Treatment:							
33	Distribution System:							
34	-----							
35	Incremental Capital Cost			1990	2000	2010	Total	
36	Incremental Capacity	(m3/d)		513.7	852.6	920.9	2,287.2	
37	Source Works	(US\$'000)		6.4	9.4	10.0	25.8	
38	Pump Cost	(US\$'000)		3.8	4.6	4.6	13.0	
39	Raw Water Main	(US\$'000)		308.4	332.0	336.2	976.7	
40	Treatment	(US\$'000)		292.9	390.6	407.6	1,091.1	
41	Storage	(US\$'000)		50.2	67.3	70.2	187.7	
42	Distribution	(US\$'000)		227.0	298.7	316.6	842.4	
43	Miscellaneous (20%)	(US\$'000)		177.8	220.5	229.1	627.3	
44	Admi. & Engineering	(US\$'000)		106.7	132.3	137.4	376.4	
45	Contingency	(US\$'000)		234.6	291.1	302.4	828.1	
46	Total Cost	(US\$'000)		1,407.8	1,746.5	1,814.2	4,968.5	
47	Cost per Capita	(US\$/c)		370.5	349.3	342.3		
48	Cost per ha	(US\$/ha)		49,609.6	46,772.9	45,835.0		
49	Cost per m3	(US\$/m3)		2.7	2.0	2.0	2.2	
50	-----							
51	Present Value of Water at DF=10 %			1990	2000	2010	Total	
52	Direct O & M Costs	(US\$'000)		70.4	87.3	90.7		
53	Capital Costs	(US\$'000)		145.0	179.9	186.9		
54	Total Annual Cost	(US\$'000)		215.4	267.2	277.6		
55	Unit Cost per m3	(US\$/m3)		1.1	0.9	0.8		
56	-----							
57	Remarks:	Alternatively, water can be supplied by a pipeline extended from Chania P/L						
58		(supply for higher lands incl. Limuru town).						
59								
60								
61								
62								
63	-----							



from Ruiru River

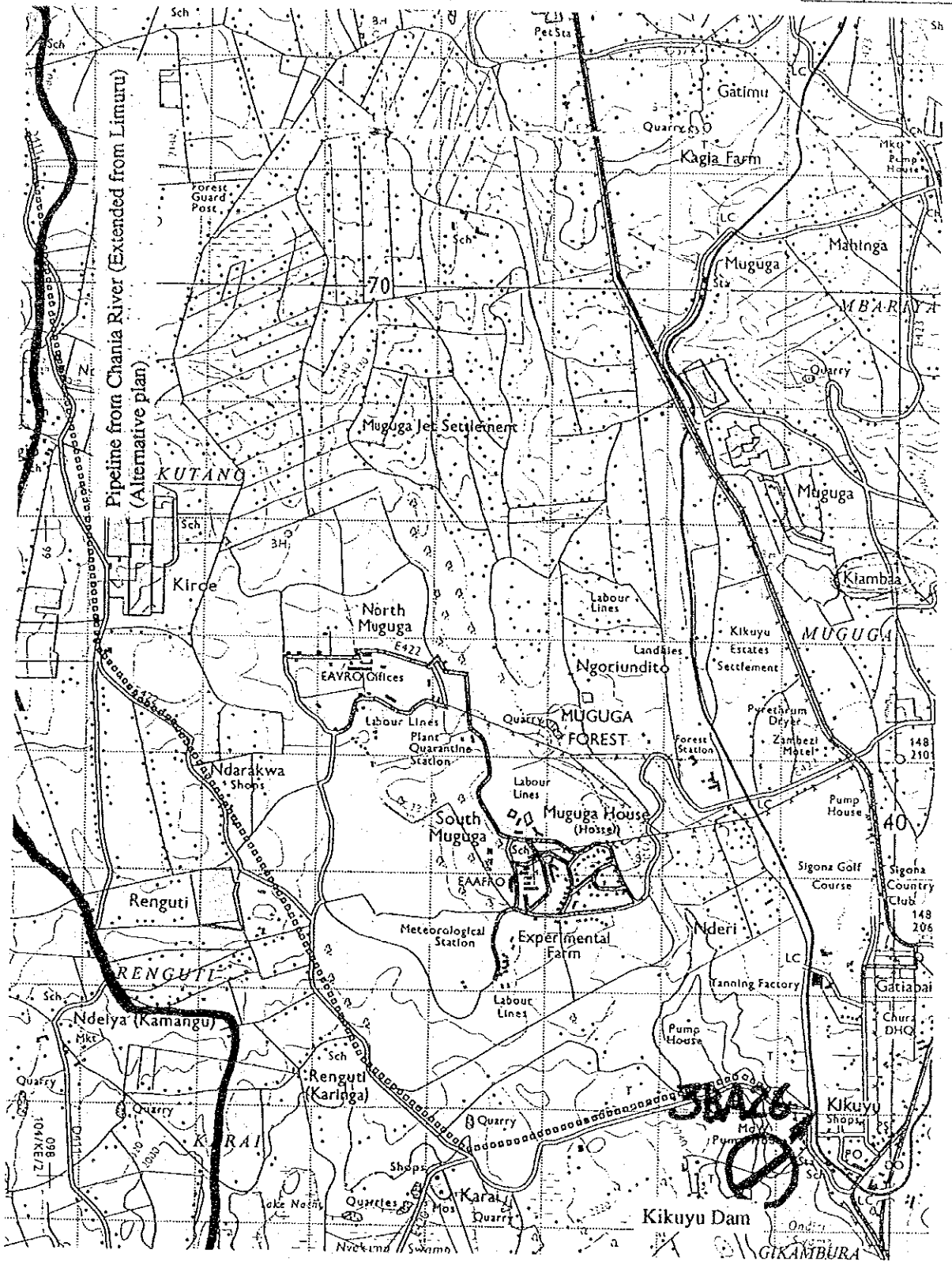
U- 8 Githunguri

U 215.1 148/2 3BC



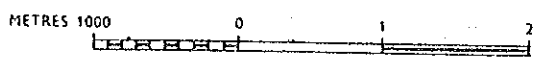
THE STUDY
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a	b	c	d	e	f	g	h	i	
2	National Water Master Plan								
3	URBAN WATER SUPPLY							Feb-92	
4	Code No. 210		U- 9			Rate		25.2	
5	-----								
6	Name of Urban:		Kikuyu		LGL Notice No:				
7	Organization:								
8	Per Capita GRDP in 1988 (guess):					216.6 Kikuyu			
9	District:		Kiambu		Locataion :				
10	Map (1/50,000) :		148/1		Coordinates X:	36°39'	Y:	S 01°14'	
11	Sub-basin Code:		3BA		Elevation (El. m):				
12	-----								
13	Existing Facilities								
14	Raw Water Source:		Boreholes				River No		
15	Raw Water System:		H (m)=		L (m)=				
16	Treatment:				Capacity (m3/d)		1270		
17	Distribution System:								
18	-----								
19						1990	2000	2010	
20	-----								
21	Projected Population		(no)			6,100	14,100	22,500	
22	Residential Demand		(m3/d)			756	1,785	2,911	
23	Non-residential Demand		(m3/d)			126	290	466	
24	Livestock Demand		(m3/d)			8	19	31	
25	Industrial Demand		(m3/d)			3,671	5,987	7,159	
26	Total Demand		(m3/d)			4,561	8,081	10,567	
27	Area Served (estimated net)		(ha)			46	105	168	
28	-----								
29	Future Development Plan								
30	Raw Water Source:		Kikuyu Dam				River No:		
31	Raw Water System:		H (m)=		0 L (m)=		440		
32	Treatment:								
33	Distribution System:								
34	-----								
35	Incremental Capital Cost					1990	2000	2010	Total
36	Incremental Capacity		(m3/d)			3,290.6	3,520.8	2,485.5	9,296.9
37	Source Works		(US\$'000)			25.9	27.2	21.0	74.0
38	Pump Cost		(US\$'000)			0.0	0.0	0.0	0.0
39	Raw Water Main		(US\$'000)			27.1	27.6	25.2	79.8
40	Treatment		(US\$'000)			780.9	805.1	684.5	2,270.5
41	Storage		(US\$'000)			141.7	151.6	114.9	408.2
42	Distribution		(US\$'000)			364.4	477.9	501.8	1,344.2
43	Miscellaneous (20%)		(US\$'000)			268.0	297.9	269.5	835.4
44	Admi. & Engineering		(US\$'000)			160.8	178.7	161.7	501.2
45	Contingency		(US\$'000)			353.8	393.2	355.7	1,102.7
46	Total Cost		(US\$'000)			2,122.6	2,359.3	2,134.2	6,616.1
47	Cost per Capita		(US\$/c)			348.0	294.9	254.1	
48	Cost per ha		(US\$/ha)			46,594.5	39,490.3	34,021.2	
49	Cost per m3		(US\$/m3)			0.6	0.7	0.9	0.7
50	-----								
51	Present Value of Water at DF=10 %					1990	2000	2010	Total
52	Direct O & M Costs		(US\$'000)			106.1	118.0	106.7	
53	Capital Costs		(US\$'000)			218.6	243.0	219.8	
54	Total Annual Cost		(US\$'000)			324.8	361.0	326.5	
55	Unit Cost per m3		(US\$/m3)			0.3	0.3	0.4	
56	-----								
57	Remarks:	Source works cost does not include the cost of Kikuyu dam, which should be added separately							
58		(see Sectoral Report M)							
59									
60									
61									
62									
63	-----								



U- 9 Kikuyu

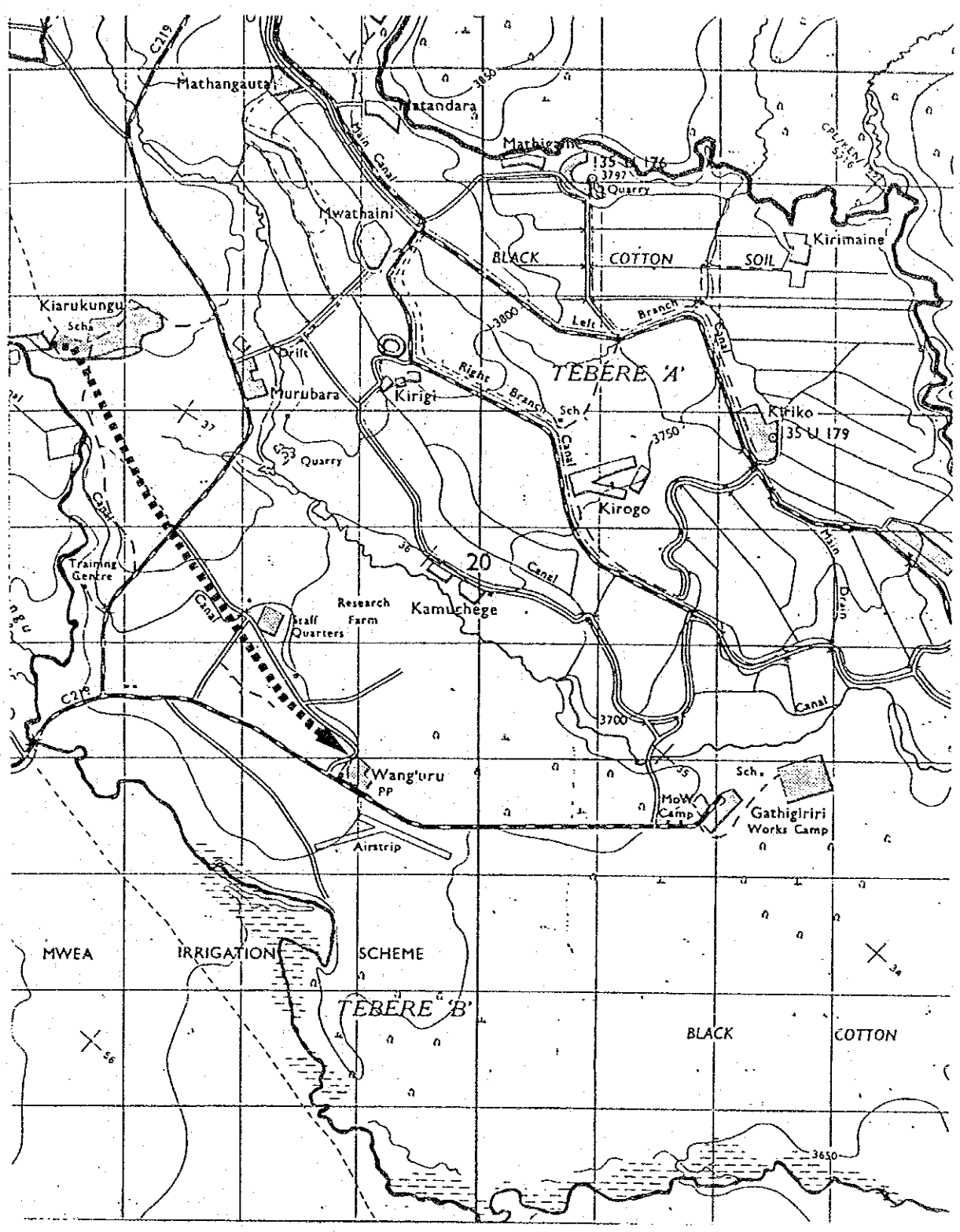
U 216.6 148/1 3BA



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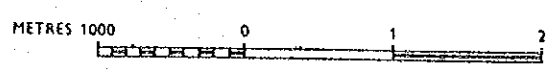
a	b	c	d	e	f	g	h	i
2					National Water Master Plan			
3			URBAN WATER SUPPLY					Feb-92
4	Code No.	220	U- 10			Rate		25.2
5	-----							
6	Name of Urban:		Wanguru		LGL Notice No:			
7	Organization:							
8	Per Capita GRDP in 1988 (guess):							
9	District:		Kirinyaga	Locataion :	221.1	Tebere		
10	Map (1/50,000) :		135/2	Coordinates X:		37°23'	Y:	S 00°40'
11	Sub-basin Code:		4DA	Elevation (El. m):				
12	-----							
13	Existing Facilities							
14	Raw Water Source:		N.I.B canal			River No		
15	Raw Water System:		H (m)=		L (m)=			
16	Treatment:			Capacity (m3/d)		208		
17	Distribution System:							
18	-----							
19					1990	2000	2010	
20	-----							
21	Projected Population			(no)	700	1,100	1,500	
22	Residential Demand			(m3/d)	87	139	194	
23	Non-residential Demand			(m3/d)	0	22	29	
24	Livestock Demand			(m3/d)	0	2	3	
25	Industrial Demand			(m3/d)	94	178	264	
26	Total Demand			(m3/d)	181	341	490	
27	Area Served (estimated net)			(ha)	5	8	11	
28	-----							
29	Future Development Plan							
30	Raw Water Source:		Thiba River			River No:		
31	Raw Water System:		H (m)=		L (m)=	5,000		
32	Treatment:							
33	Distribution System:							
34	-----							
35	Incremental Capital Cost				1990	2000	2010	Total
36	Incremental Capacity		(m3/d)	0.0	133.3	148.8	282.1	
37	Source Works		(US\$'000)	0.0	2.3	2.5	4.9	
38	Pump Cost		(US\$'000)	0.0	0.0	0.0	0.0	
39	Raw Water Main		(US\$'000)	0.0	187.6	189.1	376.7	
40	Treatment		(US\$'000)	0.0	130.6	139.7	270.3	
41	Storage		(US\$'000)	0.0	21.5	23.1	44.6	
42	Distribution		(US\$'000)	0.0	23.9	23.9	47.8	
43	Miscellaneous (20%)		(US\$'000)	0.0	73.2	75.7	148.9	
44	Admi. & Engineering (10%)		(US\$'000)	0.0	43.9	45.4	89.3	
45	Contingency (20%)		(US\$'000)	0.0	96.6	99.9	196.5	
46	Total Cost		(US\$'000)	0.0	579.6	599.3	1,178.9	
47	Cost per Capita		(US\$/c)	0.0	1,449.0	1,498.3		
48	Cost per ha		(US\$/ha)	0.0	194,031.1	200,625.6		
49	Cost per m3		(US\$/m3)	0.0	4.3	4.0	4.2	
50	-----							
51	Present Value of Water at DF=10 %				1990	2000	2010	
52	Direct O & M Costs		(US\$'000)	0.0	29.0	30.0		
53	Capital Costs		(US\$'000)	0.0	59.7	61.7		
54	Total Annual Cost		(US\$'000)	0.0	88.7	91.7		
55	Unit Cost per m3		(US\$/m3)	0.0	1.8	1.7		
56	-----							
57	Remarks:							
58								
59								
60								
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62								
63	-----							

Fig.



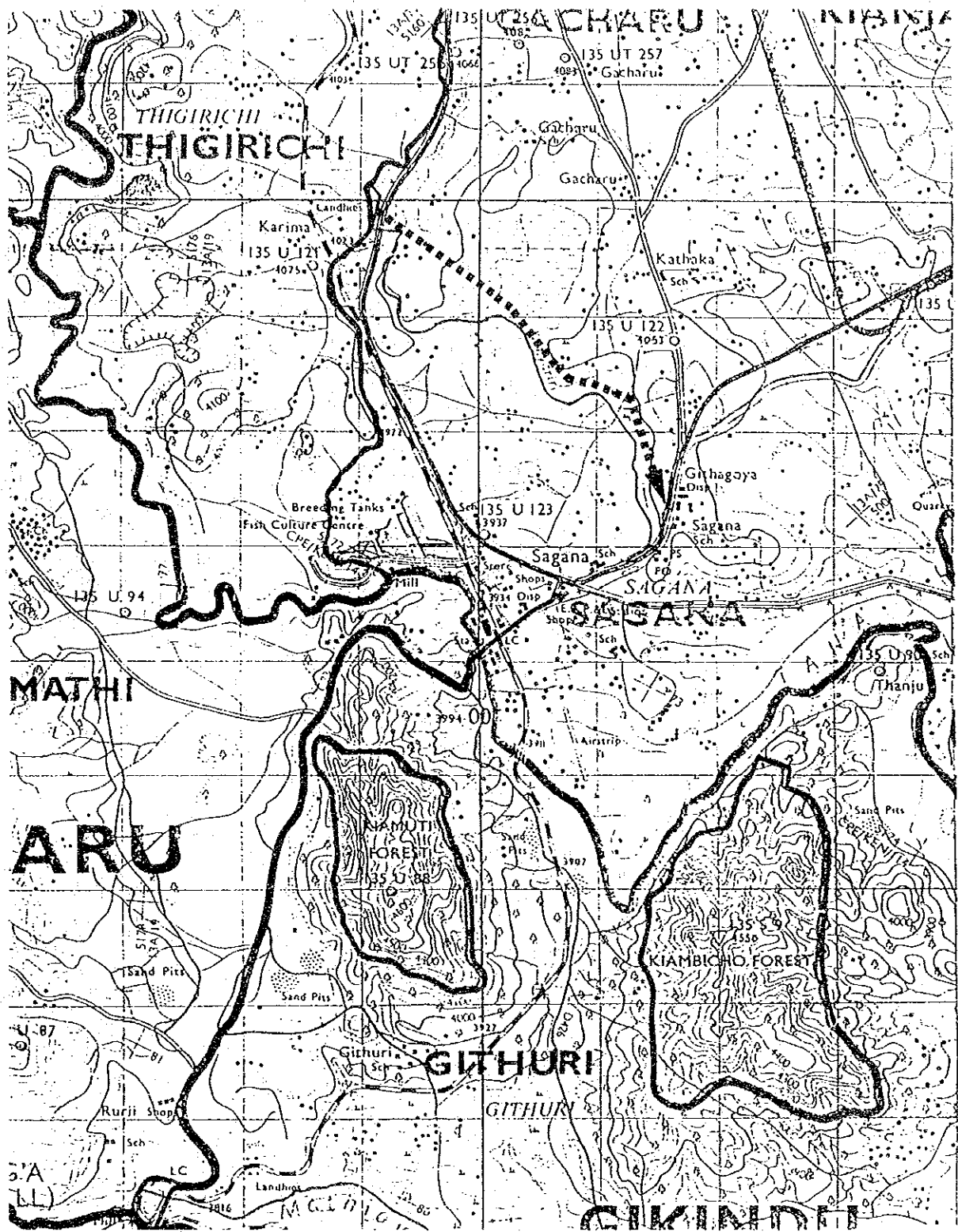
U- 10 Wanguru

U 221.1 135/2 4DA



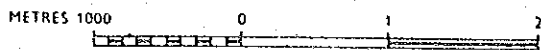
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a	b	c	d	e	f	g	h	i
2						National Water Master Plan		
3			URBAN WATER SUPPLY					Feb-92
4	Code No.	220	U- 11			Rate		25.2
5	-----							
6	Name of Urban:		Sagana		LGL Notice No:			
7	Organization:							
8	Per Capita GRDP in 1988 (guess):				222.2	Kiine		
9	District:		Kirinyaga	Locataion :				
10	Map (1/50,000) :		135/1	Coordinates X:		37°13'	Y:	S 00°39'
11	Sub-basin Code:		4BC	Elevation (El. m):				
12	-----							
13	Existing Facilities							
14	Raw Water Source:		Ragati River			River No		
15	Raw Water System:		H (m)=	L (m)=				
16	Treatment:			Capacity (m3/d)		297		
17	Distribution System:							
18	-----							
19					1990	2000	2010	
20	-----							
21	Projected Population		(no)		2,900	6,800	11,100	
22	Residential Demand		(m3/d)		359	861	1,436	
23	Non-residential Demand		(m3/d)		60	140	230	
24	Livestock Demand		(m3/d)		5	12	20	
25	Industrial Demand		(m3/d)		94	178	264	
26	Total Demand		(m3/d)		518	1,191	1,950	
27	Area Served (estimated net)		(ha)		22	51	83	
28	-----							
29	Future Development Plan							
30	Raw Water Source:		Ragati River			River No:		
31	Raw Water System:		H (m)=	L (m)=		4,100		
32	Treatment:							
33	Distribution System:							
34	-----							
35	Incremental Capital Cost				1990	2000	2010	Total
36	Incremental Capacity		(m3/d)		221.2	672.8	759.0	1,653.1
37	Source Works		(US\$'000)		3.4	7.9	8.6	19.9
38	Pump Cost		(US\$'000)		0.0	0.0	0.0	0.0
39	Raw Water Main		(US\$'000)		160.2	182.3	185.6	528.1
40	Treatment		(US\$'000)		177.9	341.9	366.0	885.7
41	Storage		(US\$'000)		29.8	58.8	63.0	151.7
42	Distribution		(US\$'000)		173.3	233.0	256.9	663.2
43	Miscellaneous (20%)		(US\$'000)		108.9	164.8	176.0	449.7
44	Admi. & Engineering		(US\$'000)		65.4	98.9	105.6	269.8
45	Contingency		(US\$'000)		143.8	217.5	232.4	593.6
46	Total Cost		(US\$'000)		862.6	1,305.0	1,394.1	3,561.8
47	Cost per Capita		(US\$/c)		297.5	334.6	324.2	
48	Cost per ha		(US\$/ha)		39,831.2	44,806.9	43,414.4	
49	Cost per m3		(US\$/m3)		3.9	1.9	1.8	2.2
50	-----							
51	Present Value of Water at DF=10 %				1990	2000	2010	Total
52	Direct O & M Costs		(US\$'000)		43.1	65.3	69.7	
53	Capital Costs		(US\$'000)		88.9	134.4	143.6	
54	Total Annual Cost		(US\$'000)		132.0	199.7	213.3	
55	Unit Cost per m3		(US\$/m3)		1.6	0.8	0.8	
56	-----							
57	Remarks:							
58								
59								
60								
61								
62								
63	-----							



U- 11 Sagana

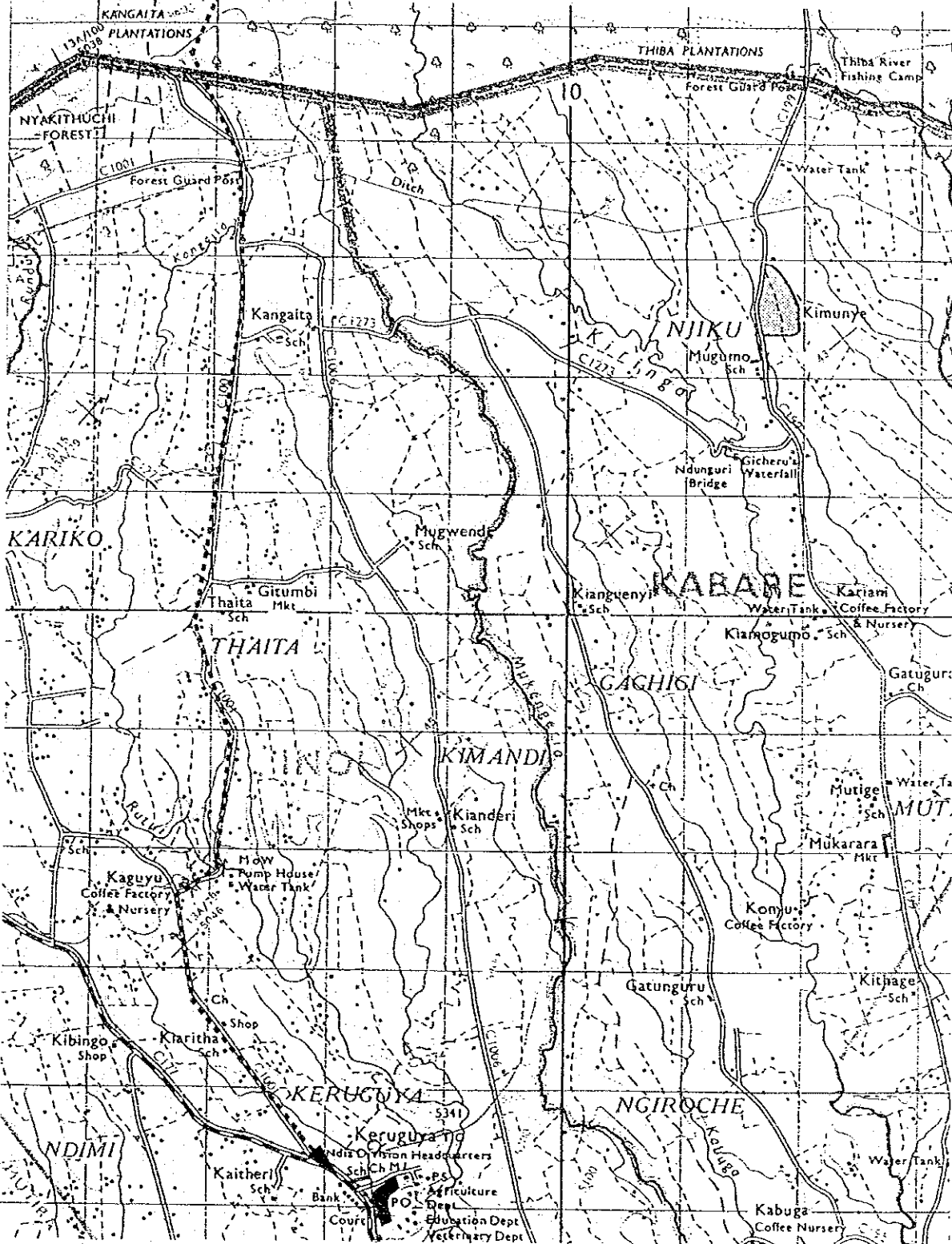
U 222.2 135/1 4BC



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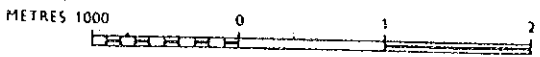
a	b	c	d	e	f	g	h	i	
2						National Water Master Plan			
3			URBAN WATER SUPPLY					Jul-92	
4	Code No.	220	U- 12			Rate		25.2	
5	-----								
6	Name of Urban:		Kerugoya			LGL Notice No:			
7	Organization:								
8	Per Capita GRDP in 1988 (guess):					222.3 Inoi			
9	District:		Kirinyaga	Locataion :					
10	Map (1/50,000):		121/4	Coordinates X:		37°17'	Y:	S 00°29'	
11	Sub-basin Code:		4DA	Elevation (El. m):					
12	-----								
13	Existing Facilities								
14	Raw Water Source:		Rutu River			River No			
15	Raw Water System:		H (m)=		L (m)=				
16	Treatment:			Capacity (m3/d)		1085			
17	Distribution System:								
18	-----								
19						1990	2000	2010	
20	-----								
21	Projected Population		(no)			8,900	20,700	34,100	
22	Residential Demand		(m3/d)			1,102	2,621	4,412	
23	Non-residential Demand		(m3/d)			184	428	706	
24	Livestock Demand		(m3/d)			15	36	61	
25	Industrial Demand		(m3/d)			94	178	264	
26	Total Demand		(m3/d)			1,395	3,263	5,443	
27	Area Served (estimated net)		(ha)			66	155	255	
28	-----								
29	Future Development Plan								
30	Raw Water Source:		Kiringa River			River No:			
31	Raw Water System:		H (m)=		L (m)=		10,000		
32	Treatment:								
33	Distribution System:								
34	-----								
35	Incremental Capital Cost					1990	2000	2010	Total
36	Incremental Capacity		(m3/d)			310.5	1,867.7	2,179.6	4,357.7
37	Source Works		(US\$'000)			4.4	16.9	19.0	40.3
38	Pump Cost		(US\$'000)			0.0	0.0	0.0	0.0
39	Raw Water Main		(US\$'000)			403.8	535.3	554.4	1,493.5
40	Treatment		(US\$'000)			218.0	593.9	641.8	1,453.7
41	Storage		(US\$'000)			36.9	101.1	108.5	246.5
42	Distribution		(US\$'000)			531.7	705.0	800.6	2,037.3
43	Miscellaneous (20%)		(US\$'000)			239.0	390.4	424.9	1,054.3
44	Admi. & Engineering		(US\$'000)			143.4	234.3	254.9	632.6
45	Contingency		(US\$'000)			315.4	515.4	560.8	1,391.6
46	Total Cost		(US\$'000)			1,892.6	3,092.2	3,364.9	8,349.7
47	Cost per Capita		(US\$/c)			212.7	262.0	251.1	
48	Cost per ha		(US\$/ha)			28,475.8	35,089.9	33,624.8	
49	Cost per m3		(US\$/m3)			6.1	1.7	1.5	1.9
50	-----								
51	Present Value of Water at DF=10 %					1990	2000	2010	Total
52	Direct O & M Costs		(US\$'000)			94.6	154.6	168.2	
53	Capital Costs		(US\$'000)			194.9	318.5	346.6	
54	Total Annual Cost		(US\$'000)			289.6	473.1	514.8	
55	Unit Cost per m3		(US\$/m3)			2.6	0.7	0.6	
56	-----								
57	Remarks:								
58									
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63	-----								

from Kiringa River



U- 12 Kerugoya

U 222.3 135/2 4DA

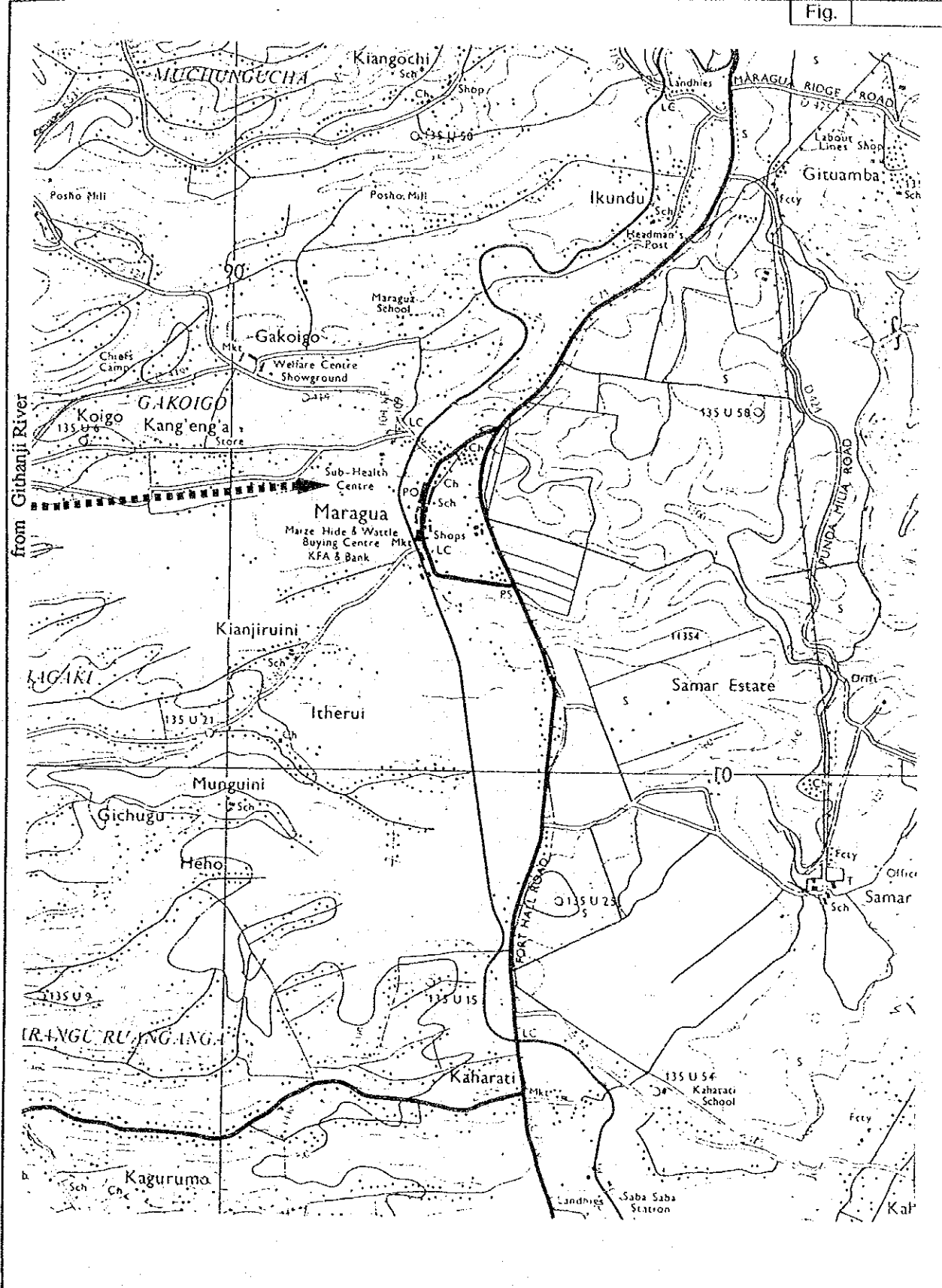


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a	b	c	d	e	f	g	h	i
2						National Water Master Plan		
3			URBAN WATER SUPPLY					Feb-92
4	Code No. 220		U- 13			Rate		25.2
5	-----							
6	Name of Urban:		Kutus		LGL Notice No:			
7	Organization:							
8	Per Capita GRDP in 1988 (guess):							
9	District:		Kirinyaga	Locataion :		223.2 Kabare		
10	Map (1/50,000) :		135/2	Coordinates X:		37°20'	Y:	S 00°33'
11	Sub-basin Code:		4DA	Elevation (El. m):				
12	-----							
13	Existing Facilities							
14	Raw Water Source:		Thiba R.			River No		
15	Raw Water System:		H (m)=	L (m)=				
16	Treatment:			Capacity (m3/d)		905		
17	Distribution System:							
18	-----							
19					1990	2000	2010	
20	-----							
21	Projected Population		(no)		6,300	14,400	23,500	
22	Residential Demand		(m3/d)		780	1,823	3,040	
23	Non-residential Demand		(m3/d)		131	297	485	
24	Livestock Demand		(m3/d)		11	25	42	
25	Industrial Demand		(m3/d)		3	5	8	
26	Total Demand		(m3/d)		925	2,150	3,575	
27	Area Served (estimated net)		(ha)		47	108	175	
28	-----							
29	Future Development Plan							
30	Raw Water Source:		Thiba River			River No:		
31	Raw Water System:		H (m)=	L (m)=		3,300		
32	Treatment:							
33	Distribution System:							
34	-----							
35	Incremental Capital Cost				1990	2000	2010	Total
36	Incremental Capacity		(m3/d)		20.4	1,245.4	1,424.9	2,690.7
37	Source Works		(US\$'000)		0.6	12.5	13.8	26.9
38	Pump Cost		(US\$'000)		0.0	0.0	0.0	0.0
39	Raw Water Main		(US\$'000)		113.3	162.6	166.9	442.8
40	Treatment		(US\$'000)		40.1	480.5	516.2	1,036.8
41	Storage		(US\$'000)		6.0	82.6	88.5	177.1
42	Distribution		(US\$'000)		376.4	483.9	543.7	1,404.0
43	Miscellaneous (20%)		(US\$'000)		107.3	244.4	265.8	617.5
44	Admi. & Engineering		(US\$'000)		64.4	146.7	159.5	370.5
45	Contingency		(US\$'000)		141.6	322.6	350.9	815.1
46	Total Cost		(US\$'000)		849.5	1,935.8	2,105.3	4,890.7
47	Cost per Capita		(US\$/c)		134.8	239.0	231.4	
48	Cost per ha		(US\$/ha)		18,056.9	32,002.3	30,979.1	
49	Cost per m3		(US\$/m3)		41.6	1.6	1.5	1.8
50	-----							
51	Present Value of Water at DF=10 %				1990	2000	2010	Total
52	Direct O & M Costs		(US\$'000)		42.5	96.8	105.3	
53	Capital Costs		(US\$'000)		87.5	199.4	216.8	
54	Total Annual Cost		(US\$'000)		130.0	296.2	322.1	
55	Unit Cost per m3		(US\$/m3)		17.4	0.7	0.6	
56	-----							
57	Remarks:							
58								
59								
60								
61								
62								
63	-----							

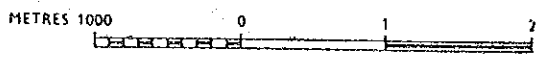
a	b	c	d	e	f	g	h	i	
2	National Water Master Plan								
3	URBAN WATER SUPPLY							Feb-92	
4	Code No. 230		U- 14			Rate		25.2	
5	-----								
6	Name of Urban:		Kandara		LGL Notice No:				
7	Organization:								
8	Per Capita GRDP in 1988 (guess):					231.4 Muruka			
9	District:		Murang'a	Locataion :					
10	Map (1/50,000):		135/3	Coordinates X:		37°00'	Y:	S 00°53'	
11	Sub-basin Code:		4CC	Elevation (El. m):					
12	-----								
13	Existing Facilities								
14	Raw Water Source:		Thika River			River No			
15	Raw Water System:		H (m)=	L (m)=					
16	Treatment:			Capacity (m3/d)		200			
17	Distribution System:								
18	-----								
19						1990	2000	2010	
20	-----								
21	Projected Population		(no)			700	1,300	1,800	
22	Residential Demand		(m3/d)			87	165	233	
23	Non-residential Demand		(m3/d)			15	26	37	
24	Livestock Demand		(m3/d)			1	2	2	
25	Industrial Demand		(m3/d)			0	0	0	
26	Total Demand		(m3/d)			103	193	272	
27	Area Served (estimated net)		(ha)			5	10	13	
28	-----								
29	Future Development Plan								
30	Raw Water Source:		Thika River				River No:		
31	Raw Water System:		H (m)=	0 L (m)=			4,700		
32	Treatment:								
33	Distribution System:								
34	-----								
35	Incremental Capital Cost					1990	2000	2010	Total
36	Incremental Capacity		(m3/d)			0.0	0.0	71.9	71.9
37	Source Works		(US\$'000)			0.0	0.0	1.5	1.5
38	Pump Cost		(US\$'000)			0.0	0.0	0.0	0.0
39	Raw Water Main		(US\$'000)			0.0	0.0	169.7	169.7
40	Treatment		(US\$'000)			0.0	0.0	89.0	89.0
41	Storage		(US\$'000)			0.0	0.0	14.2	14.2
42	Distribution		(US\$'000)			0.0	0.0	29.9	29.9
43	Miscellaneous (20%)		(US\$'000)			0.0	0.0	60.9	60.9
44	Admi. & Engineering		(US\$'000)			0.0	0.0	36.5	36.5
45	Contingency		(US\$'000)			0.0	0.0	80.3	80.3
46	Total Cost		(US\$'000)			0.0	0.0	482.1	482.1
47	Cost per Capita		(US\$/c)			0.0	0.0	964.1	
48	Cost per ha		(US\$/ha)			0.0	0.0	129,098.5	
49	Cost per m3		(US\$/m3)			0.0	0.0	6.7	6.7
50	-----								
51	Present Value of Water at DF=10 %					1990	2000	2010	Total
52	Direct O & M Costs		(US\$'000)			0.0	0.0	24.1	
53	Capital Costs		(US\$'000)			0.0	0.0	49.7	
54	Total Annual Cost		(US\$'000)			0.0	0.0	73.8	
55	Unit Cost per m3		(US\$/m3)			0.0	0.0	2.8	
56	-----								
57	Remarks:								
58									
59									
60									
61									
62									
63	-----								

a	b	c	d	e	f	g	h	i	
2	National Water Master Plan								
3	URBAN WATER SUPPLY							Feb-92	
4	Code No. 230		U- 15			Rate		25.2	
5	-----								
6	Name of Urban:		Maragua		LGL Notice No:				
7	Organization:								
8	Per Capita GRDP in 1988 (guess):								
9	District:		Murang'a	Locataion :		232.7 Nginda			
10	Map (1/50,000) :		135/3	Coordinates X:		37°08'	Y:	S 00°46'	
11	Sub-basin Code:		4BF	Elevation (El. m):					
12	-----								
13	Existing Facilities								
14	Raw Water Source:		Boreholes			River No			
15	Raw Water System:		H (m)=	L (m)=					
16	Treatment:			Capacity (m3/d)		66			
17	Distribution System:								
18	-----								
19						1990	2000	2010	
20	-----								
21	Projected Population		(no)			35,500	64,200	91,200	
22	Residential Demand		(m3/d)			4,398	8,129	11,799	
23	Non-residential Demand		(m3/d)			736	1,330	1,889	
24	Livestock Demand		(m3/d)			49	86	125	
25	Industrial Demand		(m3/d)			0	0	0	
26	Total Demand		(m3/d)			5,183	9,545	13,813	
27	Area Served (estimated net)		(ha)			265	479	681	
28	-----								
29	Future Development Plan								
30	Raw Water Source:		Githanji river				River No:		
31	Raw Water System:		H (m)=	0 L (m)=			3,300		
32	Treatment:								
33	Distribution System:								
34	-----								
35	Incremental Capital Cost					1990	2000	2010	Total
36	Incremental Capacity		(m3/d)			5,116.6	4,362.8	4,267.7	13,747.0
37	Source Works		(US\$'000)			36.0	32.0	31.4	99.4
38	Pump Cost		(US\$'000)			0.0	0.0	0.0	0.0
39	Raw Water Main		(US\$'000)			231.3	220.2	218.7	670.2
40	Treatment		(US\$'000)			942.4	883.4	875.2	2,701.0
41	Storage		(US\$'000)			220.4	187.9	183.8	592.0
42	Distribution		(US\$'000)			2,120.9	1,714.6	1,613.1	5,448.6
43	Miscellaneous (20%)		(US\$'000)			710.2	607.6	584.4	1,902.2
44	Admi. & Engineering		(US\$'000)			426.1	364.6	350.7	1,141.3
45	Contingency		(US\$'000)			937.5	802.0	771.5	2,511.0
46	Total Cost		(US\$'000)			5,624.7	4,812.2	4,628.8	15,065.8
47	Cost per Capita		(US\$/c)			158.4	167.7	171.4	
48	Cost per ha		(US\$/ha)			21,216.4	22,452.3	22,956.6	
49	Cost per m3		(US\$/m3)			1.1	1.1	1.1	1.1
50	-----								
51	Present Value of Water at DF=10 %					1990	2000	2010	Total
52	Direct O & M Costs		(US\$'000)			281.2	240.6	231.4	
53	Capital Costs		(US\$'000)			579.3	495.7	476.8	
54	Total Annual Cost		(US\$'000)			860.6	736.3	708.2	
55	Unit Cost per m3		(US\$/m3)			0.5	0.5	0.5	
56	-----								
57	Remarks:	Alternatively, water abstraction from Maragua river by pumping, in case runoff in Githanji river							
58		is not sufficient.							
59									
60									
61									
62									
63	-----								



U- 15 Maragua

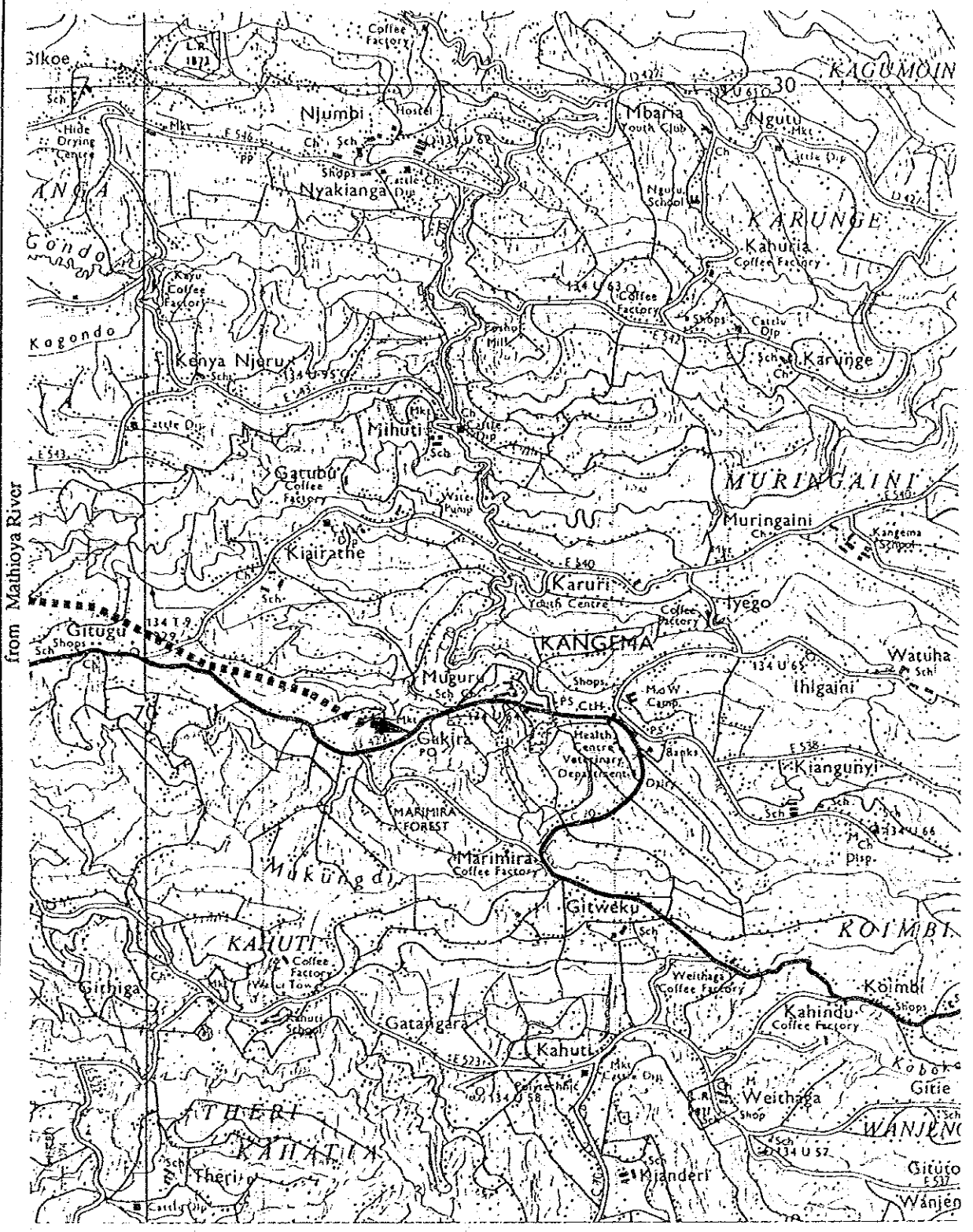
U 232.3 135/3 4BF



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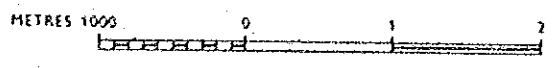
a	b	c	d	e	f	g	h	i
2					National Water Master Plan			
3			URBAN WATER SUPPLY					Feb-92
4	Code No. 230		U- 16			Rate		25.2
5	-----							
6	Name of Urban:		Kangema		LGL Notice No:			
7	Organization:							
8	Per Capita GRDP in 1988 (guess):				233.4	Iyego		
9	District:		Murang'a	Locataion :				
10	Map (1/50,000):		134/2	Coordinates X:		36°58'	Y:	S 00°40'
11	Sub-basin Code:		4BD	Elevation (El. m):				
12	-----							
13	Existing Facilities							
14	Raw Water Source:		River (Local)			River No		
15	Raw Water System:		H (m)=	L (m)=				
16	Treatment:			Capacity (m3/d)		350		
17	Distribution System:							
18	-----							
19					1990	2000	2010	
20	-----							
21	Projected Population		(no)		1,500	2,800	3,900	
22	Residential Demand		(m3/d)		186	355	505	
23	Non-residential Demand		(m3/d)		31	56	80	
24	Livestock Demand		(m3/d)		2	4	5	
25	Industrial Demand		(m3/d)		0	0	0	
26	Total Demand		(m3/d)		219	415	590	
27	Area Served (estimated net)		(ha)		11	21	29	
28	-----							
29	Future Development Plan							
30	Raw Water Source:		Mathioya River			River No:		
31	Raw Water System:		H (m)=	80 L (m)=		4,500		
32	Treatment:							
33	Distribution System:							
34	-----							
35	Incremental Capital Cost				1990	2000	2010	Total
36	Incremental Capacity		(m3/d)		0.0	64.5	175.0	239.6
37	Source Works		(US\$'000)		0.0	1.4	2.9	4.2
38	Pump Cost		(US\$'000)		0.0	2.3	2.4	4.7
39	Raw Water Main		(US\$'000)		0.0	161.6	172.4	334.0
40	Treatment		(US\$'000)		0.0	83.2	154.3	237.5
41	Storage		(US\$'000)		0.0	13.2	25.7	38.9
42	Distribution		(US\$'000)		0.0	77.7	65.7	143.4
43	Miscellaneous (20%)		(US\$'000)		0.0	67.9	84.7	152.5
44	Admi. & Engineering		(US\$'000)		0.0	40.7	50.8	91.5
45	Contingency		(US\$'000)		0.0	89.6	111.8	201.3
46	Total Cost		(US\$'000)		0.0	537.6	670.5	1,208.1
47	Cost per Capita		(US\$/c)		0.0	413.5	609.6	
48	Cost per ha		(US\$/ha)		0.0	55,373.0	81,622.9	
49	Cost per m3		(US\$/m3)		0.0	8.3	3.8	5.0
50	-----							
51	Present Value of Water at DF=10 %				1990	2000	2010	Total
52	Direct O & M Costs		(US\$'000)		0.0	26.9	33.5	
53	Capital Costs		(US\$'000)		0.0	55.4	69.1	
54	Total Annual Cost		(US\$'000)		0.0	82.2	102.6	
55	Unit Cost per m3		(US\$/m3)		0.0	3.5	1.6	
56	-----							
57	Remarks:							
58								
59								
60								
61								
62								
63	-----							

Fig.



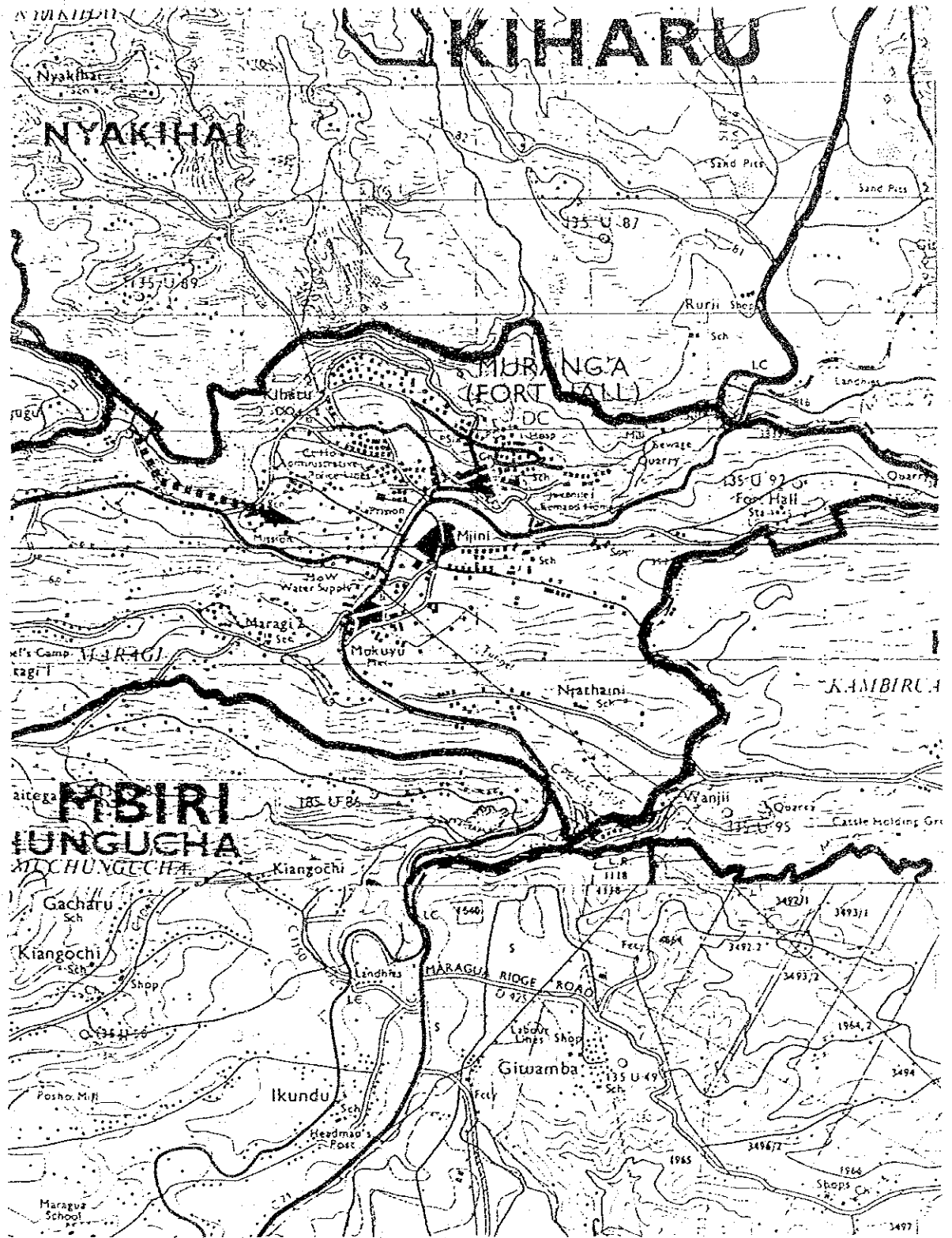
U- 16 Kangema

U 233.4 134/2 43D



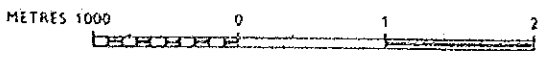
THE STUDY
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a	b	c	d	e	f	g	h	i
2						National Water Master Plan		
3			URBAN WATER SUPPLY					Feb-92
4	Code No.	230	U- 17			Rate		25.2
5	-----							
6	Name of Urban:		Murang'a		LGL Notice No:			
7	Organization:							
8	Per Capita GRDP in 1988 (guess):							
9	District:		Murang'a	Location :	234.3	Mbiri		
10	Map (1/50,000) :		135/1	Coordinates X:		37°07'	Y:	S 00°43'
11	Sub-basin Code:		4BD	Elevation (El. m):				
12	-----							
13	Existing Facilities							
14	Raw Water Source:		River (Local)			River No		
15	Raw Water System:		H (m)=	L (m)=				
16	Treatment:			Capacity (m3/d)		3000		
17	Distribution System:							
18	-----							
19					1990	2000	2010	
20	-----							
21	Projected Population		(no)		21,700	45,300	70,100	
22	Residential Demand		(m3/d)		2,688	5,736	9,069	
23	Non-residential Demand		(m3/d)		450	938	1,451	
24	Livestock Demand		(m3/d)		30	61	96	
25	Industrial Demand		(m3/d)		673	1,257	1,833	
26	Total Demand		(m3/d)		3,841	7,992	12,449	
27	Area Served (estimated net)		(ha)		162	338	524	
28	-----							
29	Future Development Plan							
30	Raw Water Source:		Maragua river			River No:		
31	Raw Water System:		H (m)=	70	L (m)=		1,800	
32	Treatment:							
33	Distribution System:							
34	-----							
35	Incremental Capital Cost				1990	2000	2010	Total
36	Incremental Capacity		(m3/d)		841.1	4,151.0	4,457.1	9,449.2
37	Source Works		(US\$'000)		9.3	30.8	32.5	72.6
38	Pump Cost		(US\$'000)		2.8	8.0	8.4	19.2
39	Raw Water Main		(US\$'000)		82.8	118.3	120.9	322.0
40	Treatment		(US\$'000)		387.6	865.0	891.3	2,143.9
41	Storage		(US\$'000)		66.8	178.8	192.0	437.5
42	Distribution		(US\$'000)		1,296.4	1,409.9	1,481.6	4,188.0
43	Miscellaneous (20%)		(US\$'000)		369.2	522.2	545.3	1,436.6
44	Admi. & Engineering		(US\$'000)		221.5	313.3	327.2	862.0
45	Contingency		(US\$'000)		487.3	689.3	719.8	1,896.4
46	Total Cost		(US\$'000)		2,923.7	4,135.6	4,318.9	11,378.2
47	Cost per Capita		(US\$/c)		134.7	175.2	174.2	
48	Cost per ha		(US\$/ha)		18,041.5	23,465.1	23,319.7	
49	Cost per m3		(US\$/m3)		3.5	1.0	1.0	1.2
50	-----							
51	Present Value of Water at DF=10 %				1990	2000	2010	Total
52	Direct O & M Costs		(US\$'000)		146.2	206.8	215.9	
53	Capital Costs		(US\$'000)		301.1	426.0	444.8	
54	Total Annual Cost		(US\$'000)		447.3	632.7	660.8	
55	Unit Cost per m3		(US\$/m3)		1.5	0.4	0.4	
56	-----							
57	Remarks:							
58								
59								
60								
61								
62								
63	-----							



U- 17 Murang'a

U 234.3 135/1 4bd

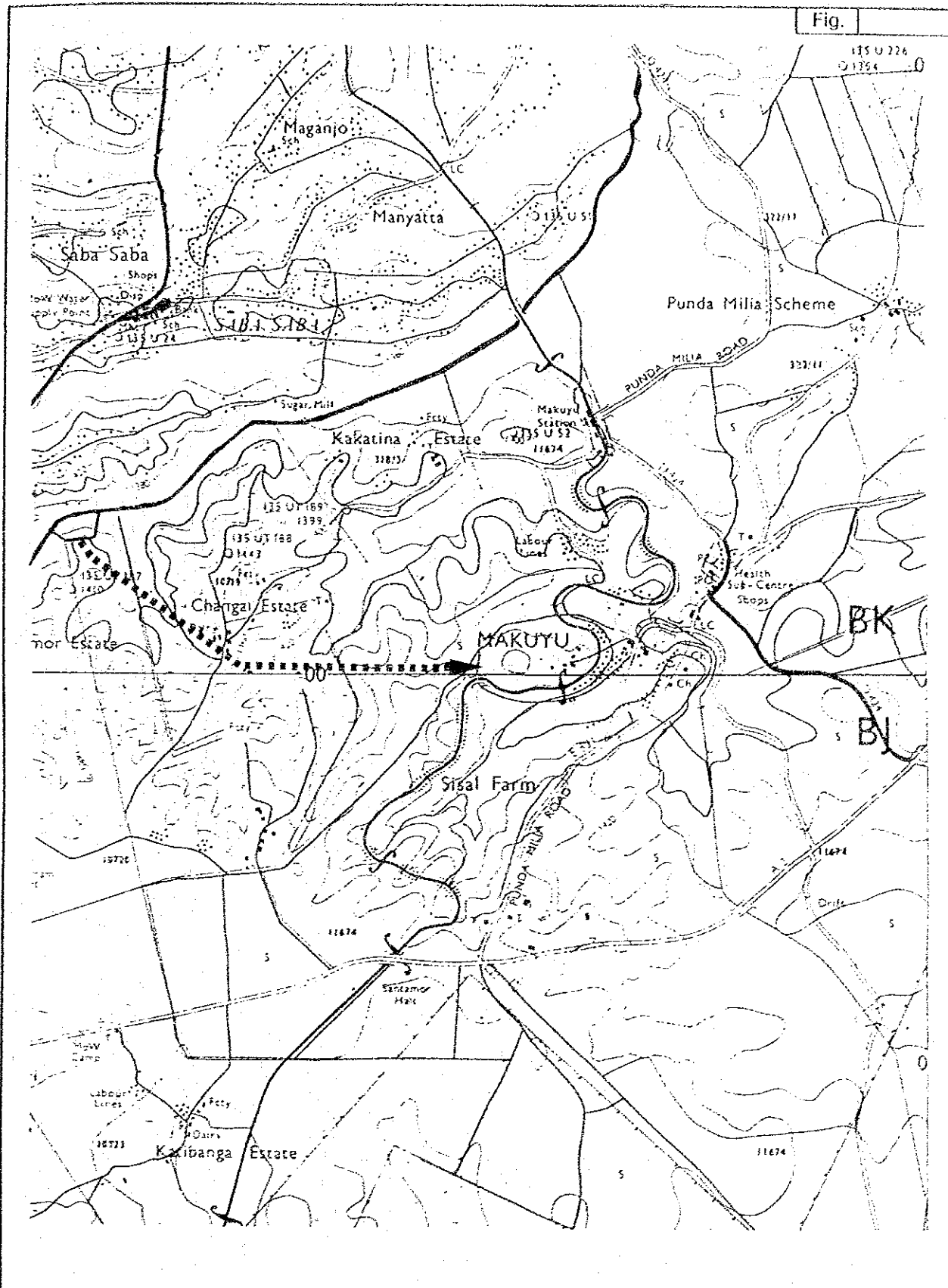


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a	b	c	d	e	f	g	h	i
2	National Water Master Plan							
3	URBAN WATER SUPPLY							
4	Code No. 230		U- 18			Rate		Feb-92 25.2
5	-----							
6	Name of Urban:		Makuyu		LGL Notice No:			
7	Organization:							
8	Per Capita GRDP in 1988 (guess):							
9	District:		Murang'a	Locataion :	235.1	Makuyu		
10	Map (1/50,000):		135/3	Coordinates X:		37°11'	Y:	S 00°53'
11	Sub-basin Code:		4BF	Elevation (El. m):				
12	-----							
13	Existing Facilities							
14	Raw Water Source:		River (Local)			River No		
15	Raw Water System:		H (m)=	L (m)=				
16	Treatment:			Capacity (m3/d)				
17	Distribution System:							
18	-----							
19					1990	2000	2010	
20	-----							
21	Projected Population		(no)		5,100	10,700	16,500	
22	Residential Demand		(m3/d)		632	1,355	2,135	
23	Non-residential Demand		(m3/d)		106	220	341	
24	Livestock Demand		(m3/d)		7	14	23	
25	Industrial Demand		(m3/d)		0	0	0	
26	Total Demand		(m3/d)		745	1,589	2,499	
27	Area Served (estimated net)		(ha)		38	80	123	
28	-----							
29	Future Development Plan							
30	Raw Water Source:		Motoho river:			River No:		
31	Raw Water System:		H (m)=	80	L (m)=	4,700		
32	Treatment:							
33	Distribution System:							
34	-----							
35	Incremental Capital Cost				1990	2000	2010	Total
36	Incremental Capacity		(m3/d)		744.8	844.1	909.8	2,498.7
37	Source Works		(US\$'000)		8.5	9.3	9.9	27.7
38	Pump Cost		(US\$'000)		2.7	3.4	3.4	9.5
39	Raw Water Main		(US\$'000)		212.2	216.4	219.0	647.6
40	Treatment		(US\$'000)		362.1	388.4	404.9	1,155.4
41	Storage		(US\$'000)		62.5	66.9	69.8	199.0
42	Distribution		(US\$'000)		304.7	334.6	346.5	985.8
43	Miscellaneous (20%)		(US\$'000)		190.5	203.8	210.7	605.0
44	Admi. & Engineering		(US\$'000)		114.3	122.3	126.4	363.0
45	Contingency		(US\$'000)		251.4	269.0	278.1	798.6
46	Total Cost:		(US\$'000)		1,508.7	1,614.1	1,668.7	4,791.5
47	Cost per Capita		(US\$/c)		295.8	288.2	287.7	
48	Cost per ha		(US\$/ha)		39,611.8	38,595.6	38,526.6	
49	Cost per m3		(US\$/m3)		2.0	1.9	1.8	1.9
50	-----							
51	Present Value of Water at DF=10 %				1990	2000	2010	Total
52	Direct O & M Costs		(US\$'000)		75.4	80.7	83.4	
53	Capital Costs		(US\$'000)		155.4	166.3	171.9	
54	Total Annual Cost:		(US\$'000)		230.8	247.0	255.3	
55	Unit Cost per m3		(US\$/m3)		0.8	0.8	0.8	
56	-----							
57	Remarks:							
58								
59								
60								
61								
62								
63	-----							

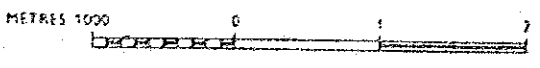
Fig.

135 U 224
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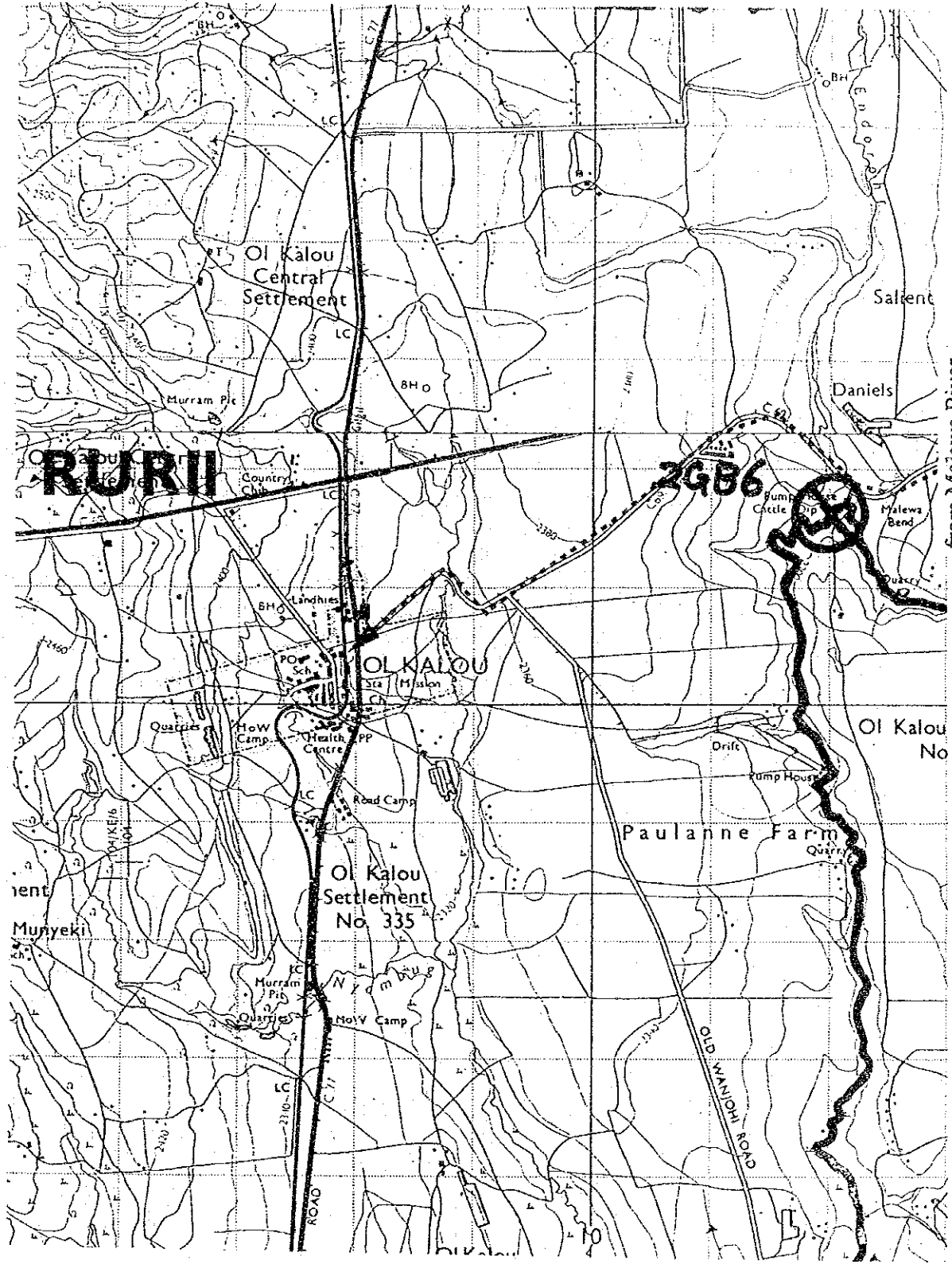
U- 18 Makuyu

U 235.1 135/3 4BF



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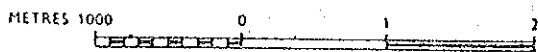
a	b	c	d	e	f	g	h	i
2						National Water Master Plan		
3			URBAN WATER SUPPLY					Jul-92
4	Code No. 240		U- 19			Rte		25.2
5	-----							
6	Name of Urban:		Ol Kalou		LGL Notice No:			
7	Organization:							
8	Per Capita GRDP in 1988 (guess):							
9	District:		Nyandarua	Locataion :	241.3	Ol Kalou		
10	Map (1/50,000) :		119/4	Coordinates X:		36°22'	Y:	S 00°16'
11	Sub-basin Code:		2GB	Elevation (El. m):				
12	-----							
13	Existing Facilities							
14	Raw Water Source:		Boreholes			River No		
15	Raw Water System:		H (m)=	L (m)=				
16	Treatment:			Capacity (m3/d)		1215		
17	Distribution System:							
18	-----							
19					1990	2000	2010	
20	-----							
21	Projected Population		(no)		9,700	24,800	37,900	
22	Residential Demand		(m3/d)		1,202	3,140	4,903	
23	Non-residential Demand		(m3/d)		201	514	784	
24	Livestock Demand		(m3/d)		51	132	211	
25	Industrial Demand		(m3/d)		286	530	764	
26	Total Demand		(m3/d)		1,740	4,316	6,662	
27	Area Served (estimated net)		(ha)		72	185	283	
28	-----							
29	Future Development Plan							
30	Raw Water Source:		Malewa River			River No:		
31	Raw Water System:		H (m)=	0 L (m)=		16,000		
32	Treatment:							
33	Distribution System:							
34	-----							
35	Incremental Capital Cost				1990	2000	2010	Total
36	Incremental Capacity		(m3/d)		524.6	2,576.7	2,346.0	5,447.3
37	Source Works		(US\$'000)		6.5	21.5	20.1	48.1
38	Pump Cost		(US\$'000)		0.0	0.0	0.0	0.0
39	Raw Water Main		(US\$'000)		687.2	923.7	902.7	2,513.7
40	Treatment		(US\$'000)		296.5	696.5	665.5	1,658.5
41	Storage		(US\$'000)		50.8	116.6	112.1	279.5
42	Distribution		(US\$'000)		579.5	902.1	782.6	2,264.3
43	Miscellaneous (20%)		(US\$'000)		324.1	532.1	496.6	1,352.8
44	Admi. & Engineering		(US\$'000)		194.5	319.3	298.0	811.7
45	Contingency		(US\$'000)		427.8	702.4	655.5	1,785.7
46	Total Cost		(US\$'000)		2,567.0	4,214.2	3,933.1	10,714.3
47	Cost per Capita		(US\$/c)		264.6	279.1	300.2	
48	Cost per ha		(US\$/ha)		35,437.0	37,371.1	40,203.0	
49	Cost per m3		(US\$/m3)		4.9	1.6	1.7	2.0
50	-----							
51	Present Value of Water at DF=10 %				1990	2000	2010	Total
52	Direct O & M Costs		(US\$'000)		128.4	210.7	196.7	
53	Capital Costs		(US\$'000)		264.4	434.1	405.1	
54	Total Annual Cost		(US\$'000)		392.8	644.8	601.8	
55	Unit Cost per m3		(US\$/m3)		2.1	0.7	0.7	
56	-----							
57	Remarks:							
58								
59								
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61								
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from Maiewa River

U- 19 Ol Kalou

U 241.3 119/4 2GB



THE STUDY
ON
THE NATIONAL WATER MASTER PLAN
JAPAN INTERNATIONAL COOPERATION AGENCY

a	b	c	d	e	f	g	h	i
2					National Water Master Plan			
3			URBAN WATER SUPPLY					Feb-92
4	Code No. 250		U- 20			Rate		25.2
5	-----							
6	Name of Urban:		Karatina		LGL Notice No:			
7	Organization:							
8	Per Capita GRDP in 1988 (guess):							
9	District:		Nyeri	Location :	254.2	Konyu		
10	Map (1/50,000) :		121/3	Coordinates X:		37°08'	Y:	S 00°28'
11	Sub-basin Code:		4BA	Elevation (El. m):				
12	-----							
13	Existing Facilities							
14	Raw Water Source:		Ragati R.			River No		
15	Raw Water System:		H (m)=	L (m)=				
16	Treatment:			Capacity (m3/d)		1800		
17	Distribution System:							
18	-----							
19					1990	2000	2010	
20	-----							
21	Projected Population		(no)		5,400	12,200	20,700	
22	Residential Demand		(m3/d)		669	1,545	2,678	
23	Non-residential Demand		(m3/d)		112	252	428	
24	Livestock Demand		(m3/d)		9	22	40	
25	Industrial Demand		(m3/d)		185	333	460	
26	Total Demand		(m3/d)		975	2,152	3,606	
27	Area Served (estimated net)		(ha)		40	91	155	
28	-----							
29	Future Development Plan							
30	Raw Water Source:		Ragati River			River No:		
31	Raw Water System:		H (m)=	0 L (m)=		6,900		
32	Treatment:							
33	Distribution System:							
34	-----							
35	Incremental Capital Cost				1990	2000	2010	Total
36	Incremental Capacity		(m3/d)		0.0	351.8	1,454.2	1,806.1
37	Source Works		(US\$'000)		0.0	4.8	14.0	18.9
38	Pump Cost		(US\$'000)		0.0	0.0	0.0	0.0
39	Raw Water Main		(US\$'000)		0.0	282.4	350.4	632.8
40	Treatment		(US\$'000)		0.0	234.7	521.8	756.5
41	Storage		(US\$'000)		0.0	39.9	89.4	129.4
42	Distribution		(US\$'000)		0.0	406.3	507.8	914.1
43	Miscellaneous (20%)		(US\$'000)		0.0	193.6	296.7	490.3
44	Admi. & Engineering		(US\$'000)		0.0	116.2	178.0	294.2
45	Contingency		(US\$'000)		0.0	255.6	391.6	647.2
46	Total Cost		(US\$'000)		0.0	1,533.5	2,349.8	3,883.3
47	Cost per Capita		(US\$/c)		0.0	225.5	276.4	
48	Cost per ha		(US\$/ha)		0.0	30,198.4	37,017.1	
49	Cost per m3		(US\$/m3)		0.0	4.4	1.6	2.2
50	-----							
51	Present Value of Water at DF=10 %				1990	2000	2010	Total
52	Direct O & M Costs		(US\$'000)		0.0	76.7	117.5	
53	Capital Costs		(US\$'000)		0.0	158.0	242.0	
54	Total Annual Cost		(US\$'000)		0.0	234.6	359.5	
55	Unit Cost per m3		(US\$/m3)		0.0	1.8	0.7	
56	-----							
57	Remarks:							
58								
59								
60								
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63	-----							